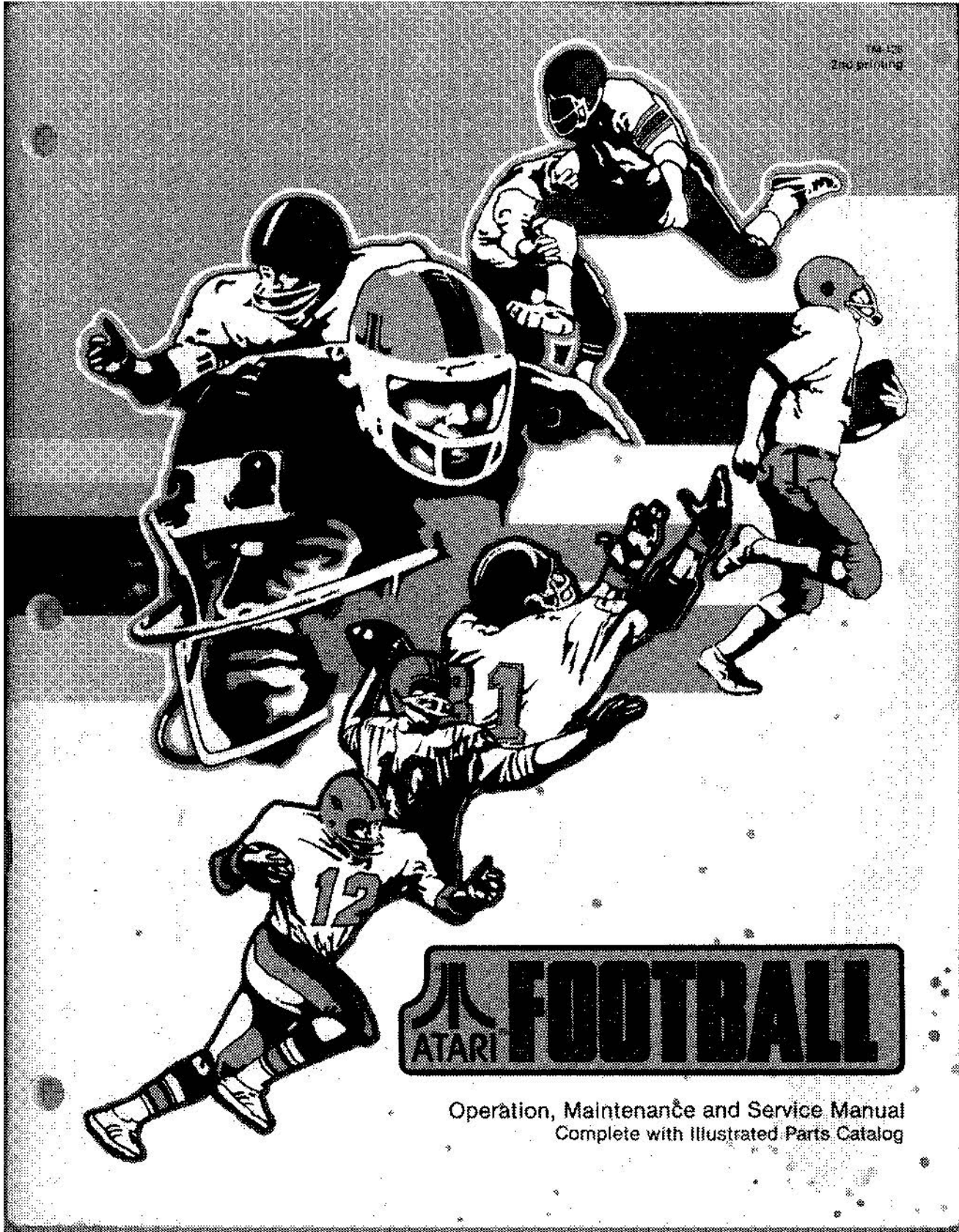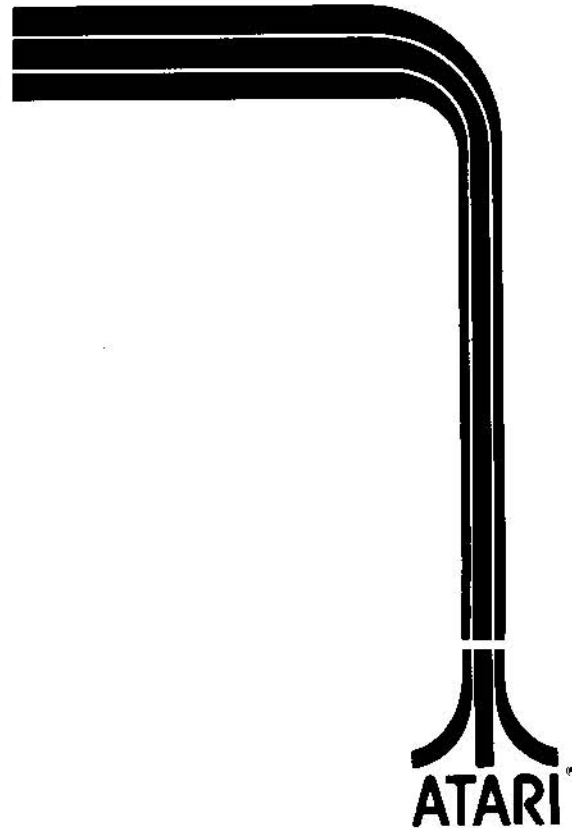# ATARI FOOTBALL

Operation, Maintenance and Service Manual
Complete with Illustrated Parts Catalog

FOOTBALL

Operation, Maintenance and Service Manual

Complete with Illustrated Parts Catalog

ATARI

A Warner Communications Company

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS

LIST OF TABLES

LIST OF APPENDICES

LOCATION SETUP

A. INTRODUCTION

Football is a two-player game developed by Atari, Inc. The game is packaged in a cocktail cabinet, graphically illustrated with football plays and action figures. The 19-inch TV monitor displays the different football plays while in the attract mode, enhancing the attraction for passing potential players.

Player-operated controls are mounted on either side of the screen (end zones) which allows proper player orientation (opposing teams) during the play mode. This is illustrated in Figure 1-1. The player controls consist of a Play/Pass LED pushbutton switch and a Player Track Ball. The ball smoothly rolls at the shove from the palm of your hand; this moves either your defensive or offensive man any place on the screen within the goal and boundary lines.

FOOTBALL

TOP VIEW OF CABINET

(PLAYER ONE)

PLAYER TWO
DIRECTION
TOWARD
GOAL LINE

PLAYFIELD

PLAYER ONE
DIRECTION
TOWARD
GOAL LINE

PLAY/PASS
PUSHBUTTON

PLAY SELECT
DISPLAY

TRACK BALL
PLAYER
CONTROL

(PLAYER TWO)
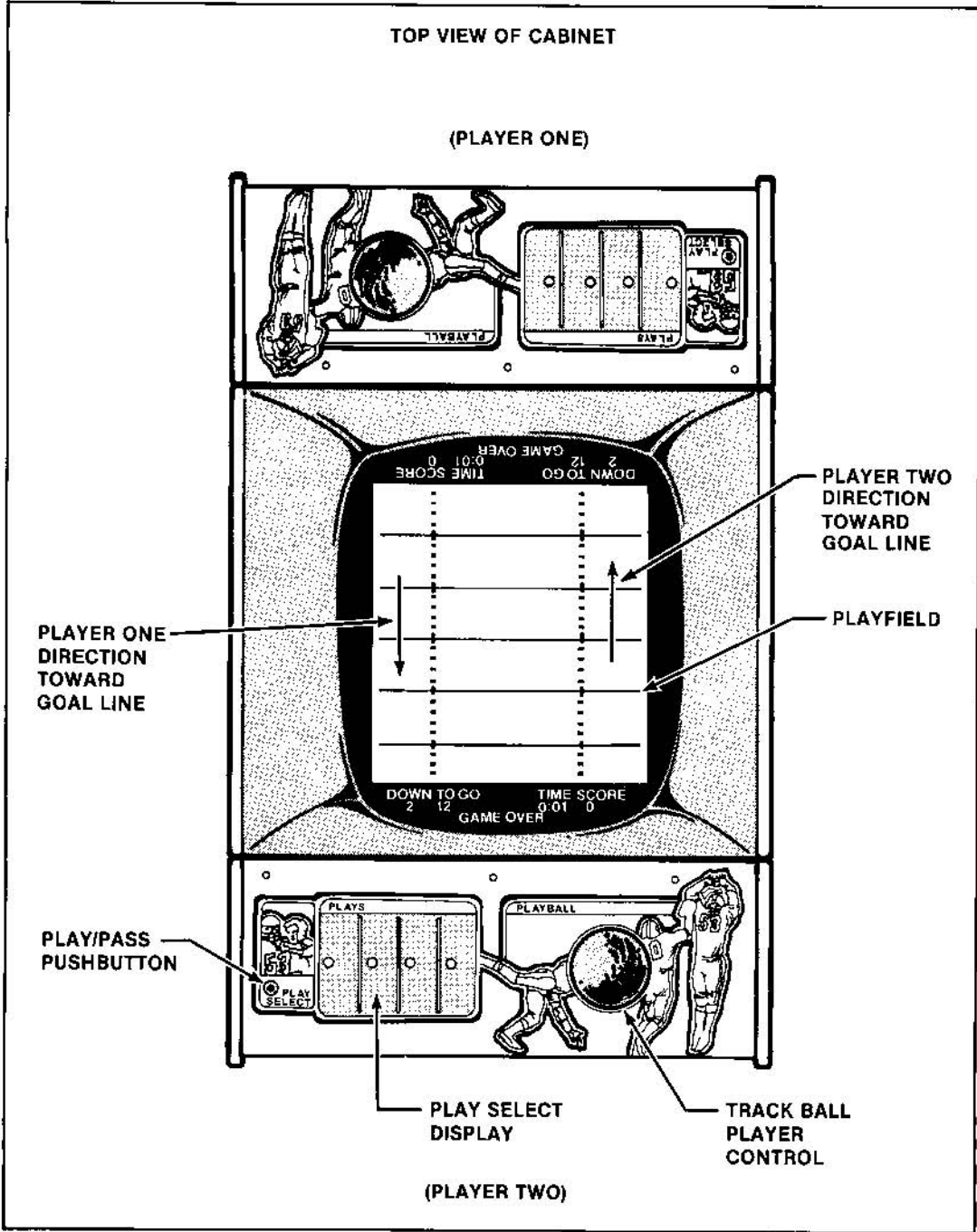
Figure 1-1   Football Control Panel
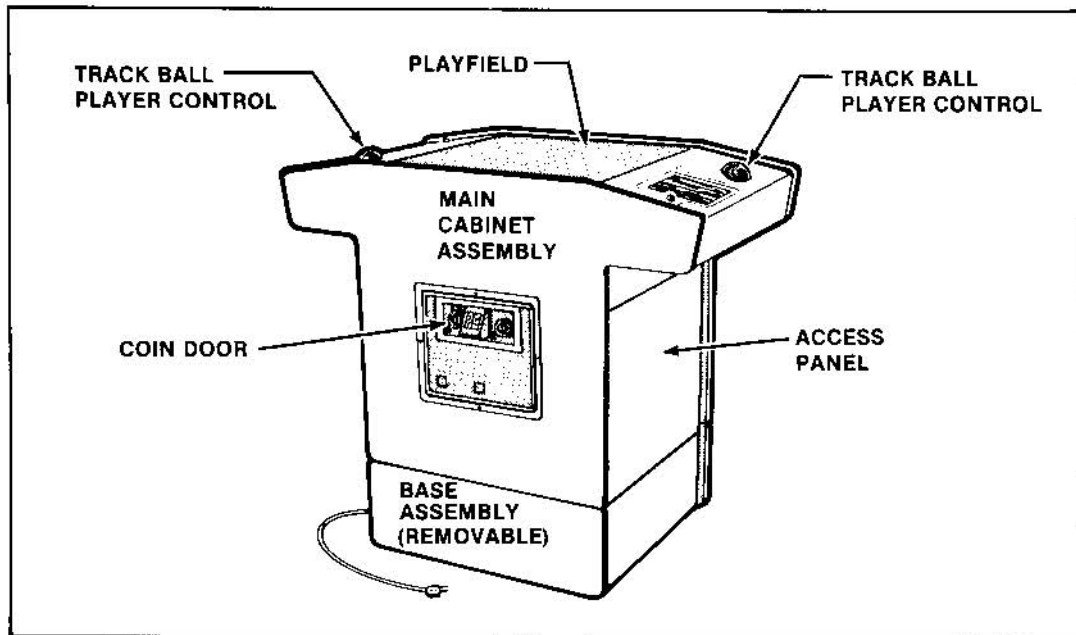
Figure 1-2   Football Cabinet Assembly

The coin mechanism on the front mid-portion of the game cabinet, below the table top as illustrated in Figure 1-1, initiates the play, when a coin or coins are deposited. The cash box is located behind a locked access door. The Football cabinet is shipped to you with an optional wood base as illustrated in Figure 1-2. This base is initially mounted at the factory for shipping convenience.

The Football game is another unique concept developed by Atari, which provides the illusion of realism, the realism of action as the players scrimmage and battle for the goal line. The competitive participation of the two opposing players increases as they put their spirit into the track ball.

The object of your Atari Football game is for the offensive player (displayed as O's) to score a touchdown at the goal line. This goal line is at the end zone away from the offensive player. The offensive player in possession of the ball must travel or run in the forward direction regardless of which control panel is being used.

The defensive player (displayed as X's) must keep the offense from reaching the goal line. The offensive player has the ability to scheme and maneuver his plays by selecting one of the four plays available at his or her con-

trol panel (2 pass plays and 2 running plays—see Chapter 2). The defense must out-guess the offensive opponent to either gain possession of the ball or block the opponent's path to the goal line. When the defense gains possession of the ball the X's change to O's and vice versa. The interchange continues as the offense tries to score and the defense attempts to stop the offense and regain possession of the ball.

B. GAME INSPECTION

Your new Football 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.

LINE VOLTAGE	VOLTAGE-SELECTION CONNECTOR WIRE COLOR
95 VAC	BLACK
110 VAC	ORANGE (installed at factory)
210 VAC	GREEN
220 VAC	RED
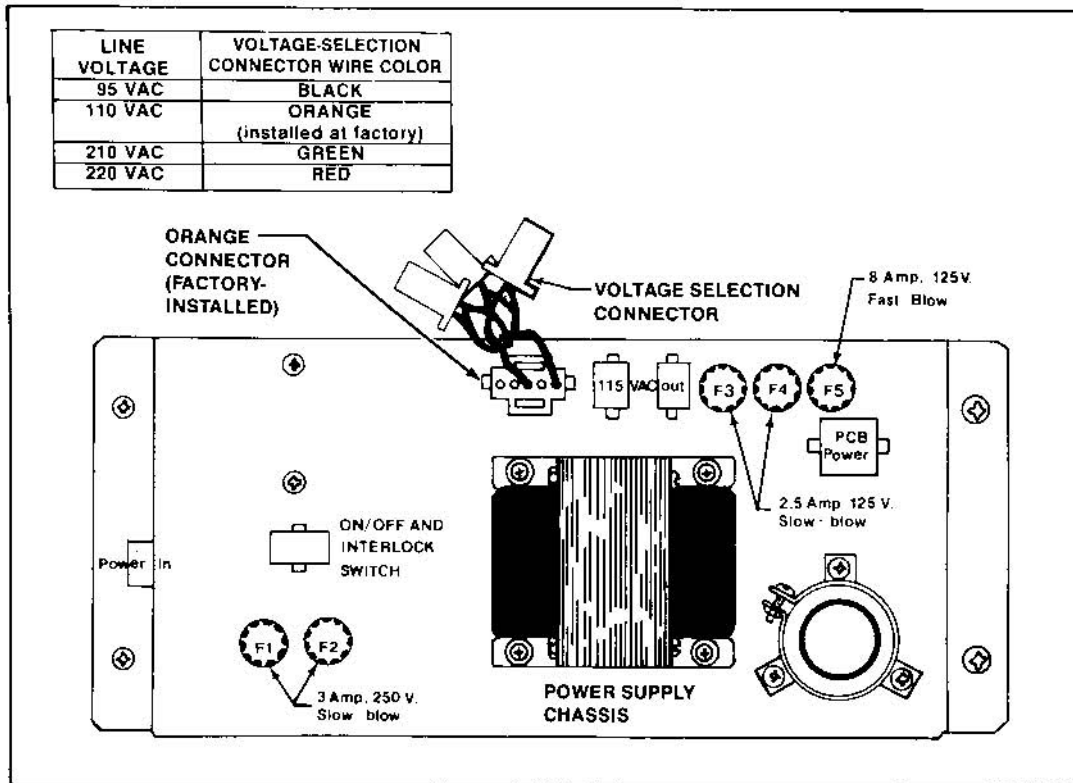
Figure 1-4 Voltage-Selection Connectors

Table 1-1 Installation Requirements

POWER REQUIREMENTS
  Power Supply   110 VAC @ 60 Hz
                                  220 VAC @ 50 Hz

TEMPERATURE RANGE
  On Location and in Storage   No lower than 0 degrees Celsius
                                  (32 degrees Fahrenheit)

HUMIDITY RANGE
  Relative Humidity   No more than 95%

LOCATION SPACE REQUIREMENTS *
  Height: 39.25 Inches (99.7 Centimeters)
  Width: 44.00 Inches (111.8 Centimeters)
  Depth: 25.25 Inches (64.14 Centimeters)

TV MONITOR   19-Inch Black and White

*See Figure 1-5

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. (See Figure 1-6). One is located behind the 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.

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).

44" (111.8 CENTIMETERS)

39.25" (99.7 CENTIMETERS)

25.25" (64.14 CENTIMETERS)
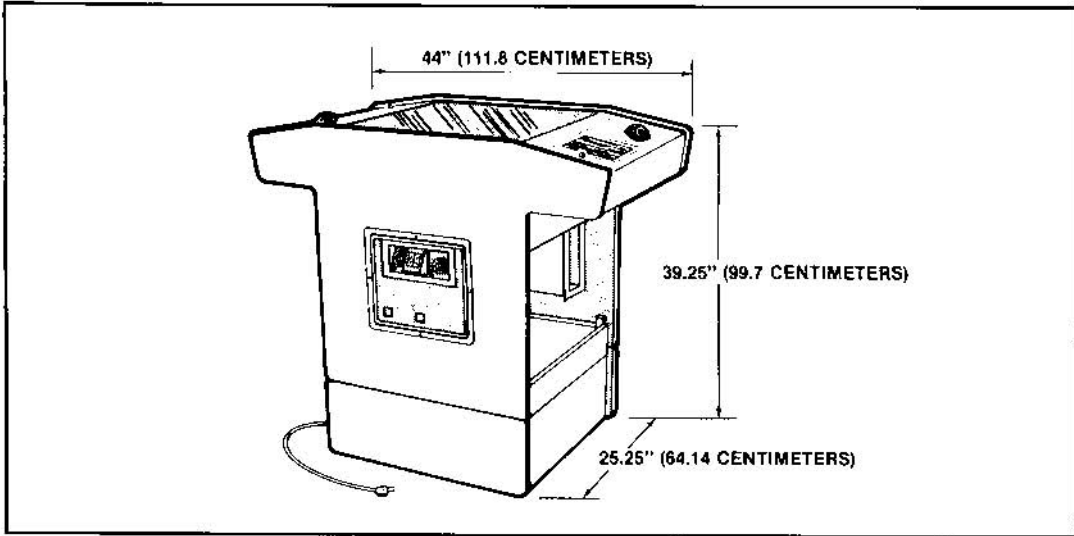
Figure 1-5   Location Set-up Requirements

INTERLOCK SWITCH

POWER ON/OFF SWITCH

NOTE:
WHEN TROUBLESHOOTING WITH THE
DOOR(S) OPEN, YOU MUST PULL INTERLOCK
PLUNGER OUT WITH THUMB AND FOREFINGER
AS INDICATED BY DIRECTION OF ARROW.
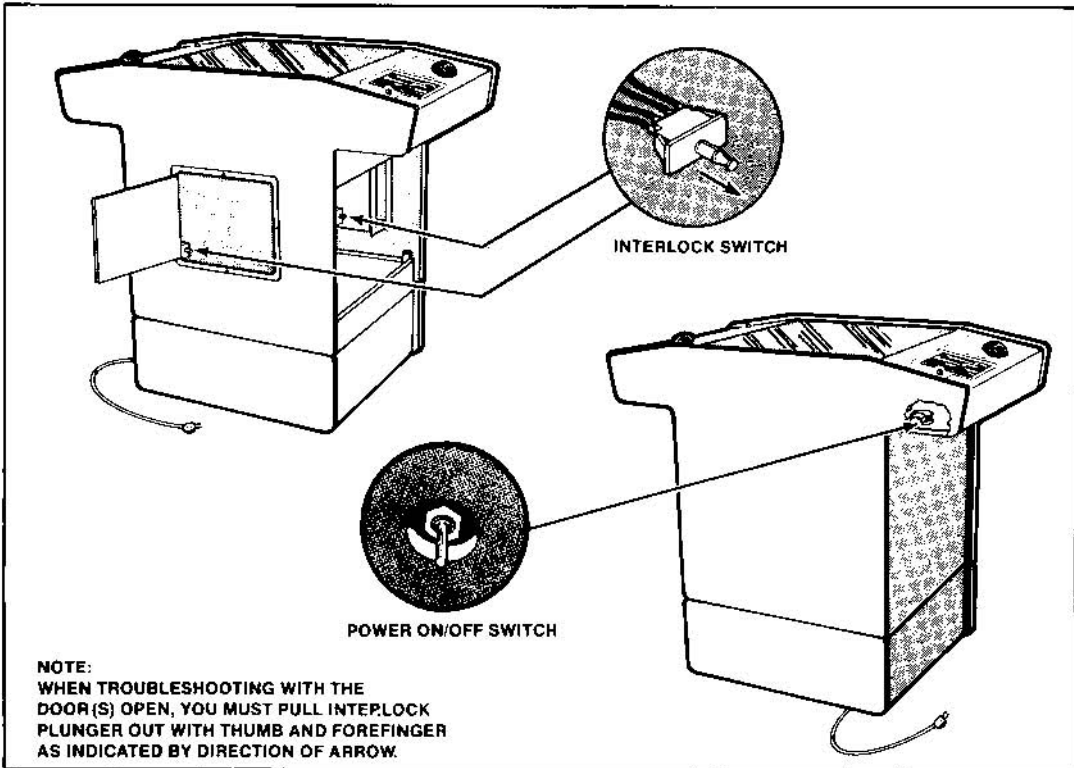
Figure 1-6   Location of Interlock and Power On/Off Switches

1-6   FOOTBALL
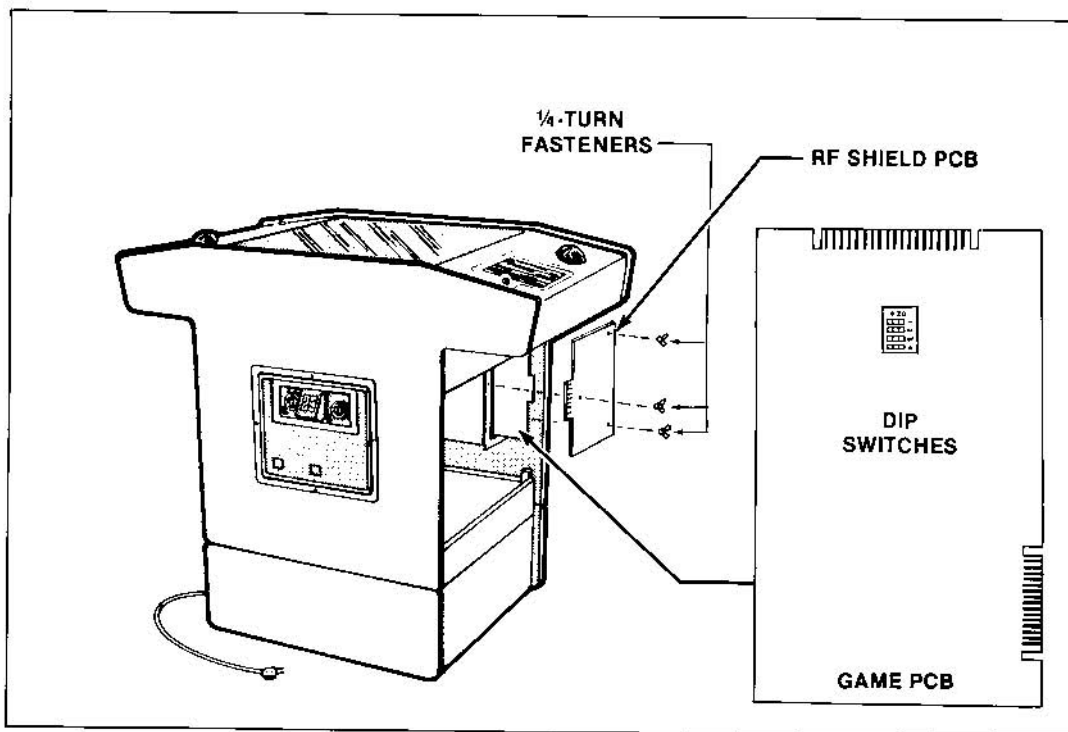
Figure 1-7 Option DIP Switches and Game PCB Location and Removal

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.

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

Table 1-2 Option Settings

OPTION	Switch Settings on 4 Toggle DIP Switch (located at position K10 on the Game PCB)				RESULT
	1	2	3	4	
Coin Length	ON ON ON OFF OFF ON OFF OFF		NOT USED		(A) 2½ Minutes Coin (B) 2 Minutes Coin (C) 2½ Minutes Coin (D) 3 Minutes Coin

Table 1-3 Self-Test

Instruction	Result if Test Passes	Result if Test Fails
1. **PRELIMINARY** Set volume level potentiometers (located on a bracket immediately behind and to the right of the coin door) to ½ volume.	Not Applicable	Not Applicable
2. **RAM AND ROM TEST** Set Self-test slide switch (located above the volume potentiometer immediately behind and to the right of the coin door, to the "on" position).	TV monitor displays ROM OK RAM OK as illustrated below. This means the RAM and ROM were checked, and both tested correctly.	If the RAM does not check correctly, the screen will display the message **BAD RAM** If the ROM is at fault, **BAD RAM** appears on the screen. There are three ROMs in Football (Program ROMS 1, 2, 3). ---NOTE--- The self test stops only when the self test switch is set to "off". To start again set it to "on". No scrollfield motion.
3. **SCROLLFIELD TEST** Press the "Play Select" pushbutton switch on either control panel.	Scrollfield scrolls in the direction towards the player, regardless of which play select switch was pressed. ---NOTE--- When both play select switches are pressed simultaneously, the scrollfield will freeze in position.	
4. **TRAK BALL™ TEST** Roll the Trak Ball™ in random motion and observe TV monitor screen. Either player's Trak Ball will do. Player should move	An "X" or "O" character will move around within the entire area of the scrollfield. It is irrelevant to the test which Trak Ball controls the X or the O.	"X" or "O" character (or both) not displayed.
5. **AUDIO TEST** Press each switch, success fully and hold it on (play select, enter, option, etc.)	Crowd sound intensifies as each switch held on.	No crowd sound (indicates logic or entry malfunction). Crowd sound does not intensify (indicates possibility that switch is bad). See next test.
6. **SWITCH AND LAMP TEST** Press all the following switches: Slam, Coin switches (2), Play Select Switch	Each pressed switch generates an audible "Beep" — one beep when pressed and a second beep when released. All LEDs dark, all lamps lighted. Back-lighted play select board lamps are lighted.	No beep sound. Either some or all lamps are out.
7. **OPTION SWITCH TEST** The option switches 1 and 2 have a special test feature. The four combinations of switches are labeled A, B, C, and D and are displayed on the screen.	The active option switch setting is displayed below the ROM OK at the top of the screen. For example, the first switch setting is "A". Therefore the following is displayed: **ROM OK** **A**	No switch setting display or display incorrectly matching the actual setting.

GAME PLAY
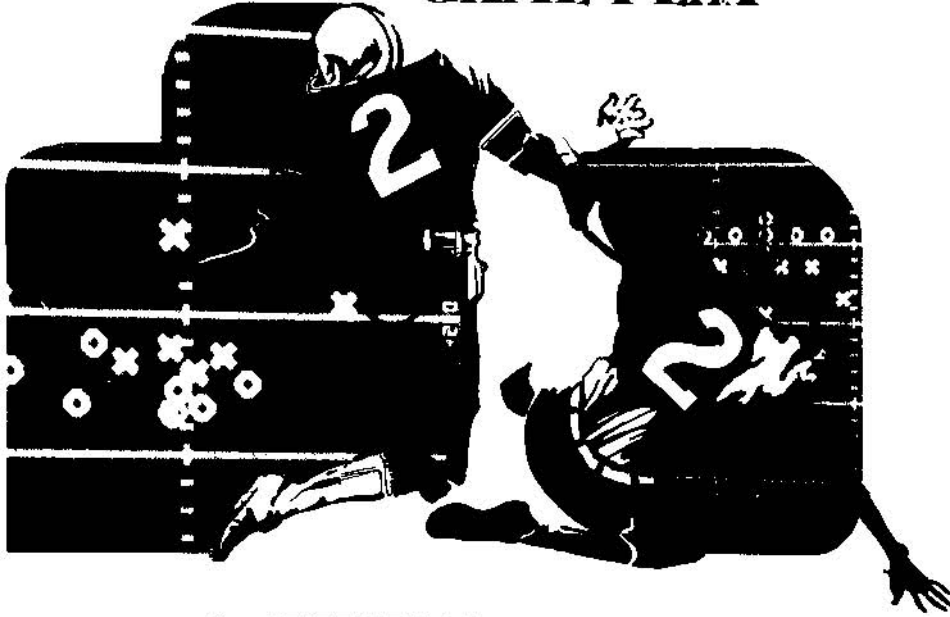
A. INTRODUCTION

The Atari Football game has three different modes of operation. These modes are listed below:

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

READY-TO-PLAY—coins accepted

PLAY— initiated one second after pressing the Play-Select button.

FOOTBALL

B. PLAYER CONTROL PANEL

(See Figure 2-1)

The Atari Football game consists of two player control panels (a control panel is illustrated in Figure 2-1). These two control panels are operated simultaneously by opponents. Each control panel is capable of operating either the offense or the defense, depending on game conditions. The player control panel consists of a trackball, a Play Select board and a dual function LED pushbutton (its primary function is as a Play Select switch and secondary function as a Press-to-Pass switch). When the Play Select switch is active, the LED flashes. When the play has been selected, and after one second, the Play Select LED will go off, changing the switch function to a Press-to-Pass.

The Play Select Board
(See Figure 2-2)

The Play Select display board illustrates four offensive and four defensive plays, two of which are running plays and two passing plays. The upper, which is the offensive set of plays, is back-lighted by three incandescent lamps. The defensive, at the lower portion of the display board, is also back-lighted by three incandescent lamps. Prior to selecting any of the four plays, whether offensive or defensive, the four LED lamps are dark. Pressing the Play Select pushbutton switch lights a random LED. The player may now make his selection by stepping the LED from play to play (left to right) at any time he wishes, prior to the time required for scrimmage by continuing to press the Play Select switch. On the next play, the LEDs start dark until the Play Select pushbutton switch is pressed once more.

The next item of importance at the player control panel is the trackball. The trackball is the actual manual control for either the pass receiver or the quarterback if you're the offensive player, or the safety if you're the defensive player. This trackball control is operated by rolling it in any direction, 360 degrees, with the palm of the hand. It positions the offensive man with the ball or defensive safety at any position in the scrolling playfield by moving him at a rate proportional to the roll of the ball. The only time the trackball is active is during the Play mode and the only time that the Play Select pushbutton switch is active, is during the Ready-to-Play and the Play mode. During any other mode other than the aforementioned, these controls are totally inactive. Therefore, everything remains inoperative until credits are provided.

C. ATTRACT MODE

(See Figure 2-3)

The Attract mode begins when AC power is applied to the game and the power on/off switch is turned to "on". (The power on/off switch is located on the underside of the game cabinet's table top, as illustrated in Figure 1-4.) While in the Attract mode, the TV monitor displays random play. For example, it randomly selects a play such as the Sweep running play. This selection is indicated by the LED at the Play Select display board when the red LED lights in at the Sweep play. Then, regardless of whether the player is offense or defense, the play continues and is played out until the man is tackled, goes out of bounds, makes a touchdown, or his pass is intercepted by a defensive player. He returns to a huddle. Then while in the Attract mode the screen displays the next play (the Keeper, the Bomb, and so on). Regardless of the control panel, the Xs indicate the defensive players and the Os indicate the offensive players. A better understanding and explanation of the players and plays will be discussed in the following paragraphs under the Play Mode section.

D. READY-TO-PLAY MODE

(See Figure 2-4)

The Ready-to-Play mode is initiated immediately after the coins are accepted by the coin mechanism. After the coins are accepted, the Play Select pushbutton switch becomes active. The screen then changes from its current Attract mode display to the huddle (offense and defense). The game is in the player's hands, and the audio is now active.

Actually, this mode exists at each huddle regardless of the score or of offense or defense conditions. Whenever the game goes into a huddle, for both offense and defense, we are in the Ready-to-Play mode. In this mode, the coin message is no longer displayed in the scoreboard display field. Instead, the scoreboard indicates whether you are the offense or defense. The scoreboard indicates a zero score when first placed into the Ready-to-Play mode, and the down number and yards to go. Time begins to tick off, and the score, down, and yards-to-go change according to the game conditions. The game is now redy to be played. The Play Select pushbutton switch is activated and flashes.

The game circuitry accepts coins at any time. Each coin adds time selected by the operator to the game-timer (up to a maximum of 99 minutes and 59 seconds). If coins

PLAY SELECT
BOARD DISPLAYS
ILLUSTRATIONS OF PLAY
(OFFENSE AND DEFENSE).

—TRACKBALL
CONTROLS

• USE PALM
OF HAND TO
MOVE PLAYERS
360° ROTATION

• OFFENSIVE
• QUARTERBACK
AND RECEIVER

• DEFENSIVE
SAFETY

SWEEP   KEEPER   BOMB   DOWN & OUT

FLASHES WHEN ACTIVE AS
PLAY SELECT FUNCTION

DARK WHEN ACTIVE AS
PRESS TO PASS FUNCTION
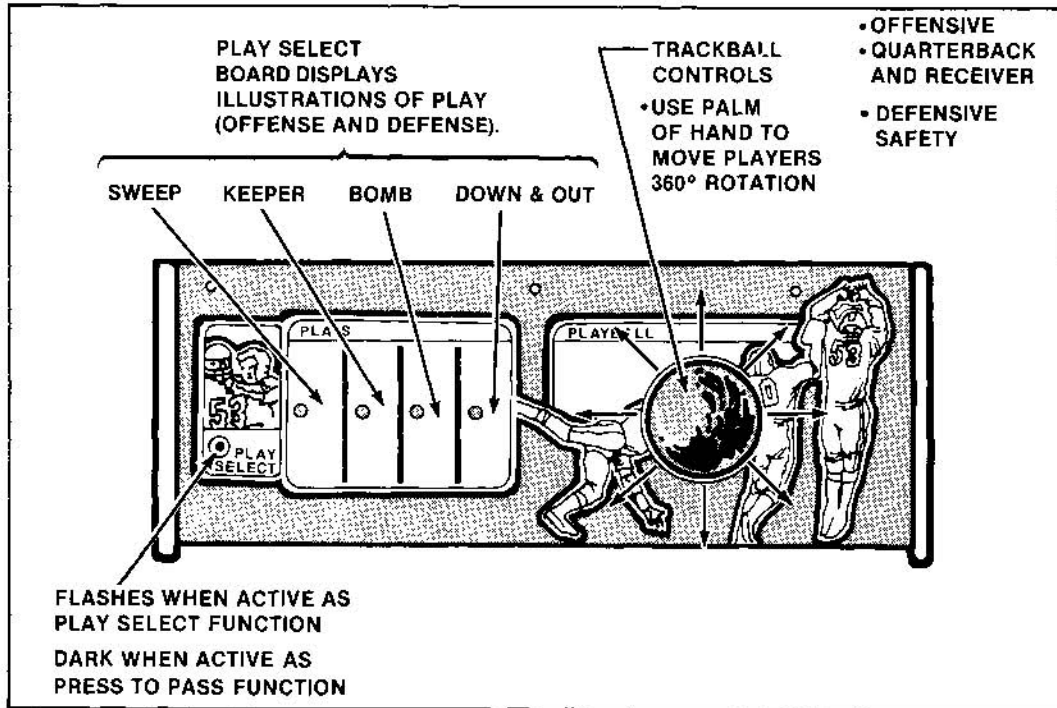
Figure 2-1   Player Control Panel

PLAYS

OFFENSE

LEDS

SWEEP   KEEPER   BOMB   DOWN
AND OUT

BACK
ILLUMINATED BY
INCANDESCENT
LAMPS

DEFENSE
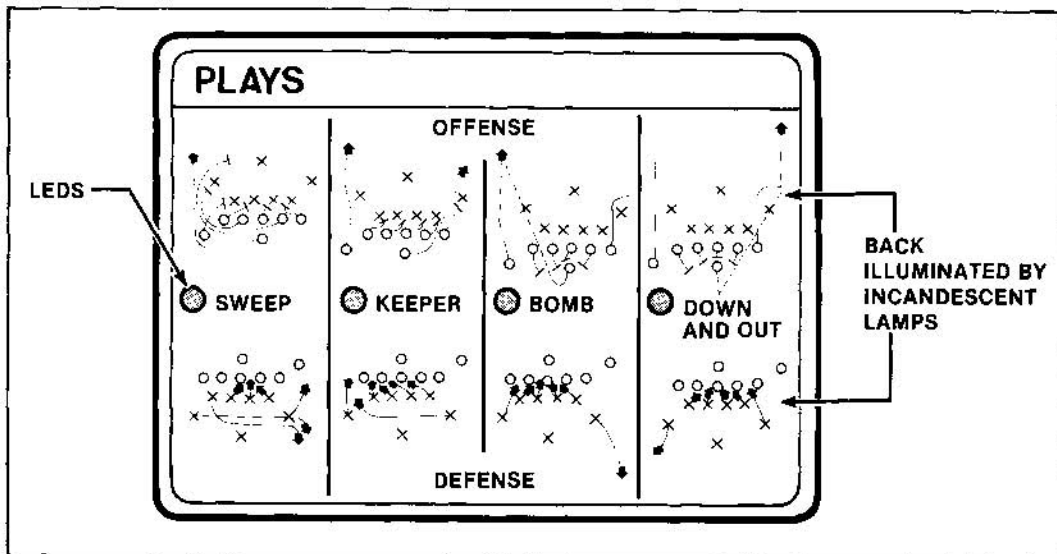
Figure 2-2   Play Select Board Display

Figure 2-3   Attract Mode

TRACKBALL
INACTIVE

DEFENSE
HUDDLE

BALL

OFFENSE
HUDDLE

TRACKBALL
INACTIVE

LED FLASHES UNTIL THE
PLAY SELECT SWITCH IS
PRESSED, THEN IT GOES
DARK

REPEATED PRESSING
OF SWITCH STEPS
LED PLAY INDICATOR
FROM LEFT TO RIGHT

LEDS ARE DARK UNTIL
THE PLAY SELECT
SWITCH IS PRESSED.
THEN THE PLAY LED
INDICATOR HOLDS ON
SELECTION.

Figure 2-4   Ready-to-Play Mode

are added in the Attract mode, the scores are reset and the game enters Ready-to-Play mode as described above. If coins are added during a game, the timer is extended with no other effect. (The operator option can be set so that the deposit of each coin adds 1½, 2, 2½, or 3 minutes to game time.)

E. PLAY MODE

After the Ready-to-Play mode is displayed as discussed in the previous subsection, the players, offensive or defensive, may select a game by pressing the Play Select pushbutton switch. Immediately after pressing the Play Select switch the players are set to the line of scrimmage.

NOTE: Even after your opponent has his men at the line of scrimmage, you may continue to select plays, providing that you do not pause for longer than ten seconds. Waiting longer would award you a 5 yard penalty for delay of game.

Plays

Four plays are available to either opponent. These plays are the following:

● Sweep
● Keeper
● Bomb
● Down-and-Out

The first two plays are running plays, the last two are passing plays.

Offensive Running Plays

The Sweep Play
(See Figure 2-5)

First, we'll discuss the running plays, beginning with the Sweep. The offense has seven players; a center (1), quarterback (2), wingback (3), and two guards (4, 5) to the left and right of the center. Outside of that there are two tackles to either side (6, 7). In this version of the video Atari Football, the center hikes the ball to the quarterback, the quarterback is controlled by the player. (The man with the ball is always controlled by the trackball control at the control panel.) After the center has hiked the ball to the quarterback, the quarterback should run to the left side of the field and the center then proceeds to rush toward the tackle. All tackles and guards rush the line, blocking the defense from the quarterback as he rushes beyond the wingback. The wingback covers the quarterback all the way down to the end zone.

The Keeper Play
(See Figure 2-6)

The Keeper is an offensive play where the center hikes the ball to the quarterback; the wingback, at the wide end

of the field, begins to run deep. Immediately after the quarterback receives the ball from the hike, he rushes between the tackle and the guard or between the guard and the center and then into the field. The remaining men proceed to block for him.

Offensive Passing Plays

The Bomb Play
(See Figure 2-7)

The offensive Bomb play is a long-distance passing play. The bomb is received at all times by the wingback, who always runs his pattern to the left side of the playing field. When the center hikes the ball to the quarterback, the player must operate the trackball so that the quarterback immediately drops back into his pocket. At the same time, the offensive line guards him from the defensive line. After the ball is hiked, the end player on the right runs a fake "down and out" pattern, and the wingback goes out deep down the left side of the field. At the appropriate time, the player must press the "Press to Pass" button to pass the ball to his receiver. If the wing back is too deep the ball will not reach the receiver. There is also the chance that a defensive player is in the immediate vicinity of the receiver and that the ball will be intercepted or knocked down for an incomplete.
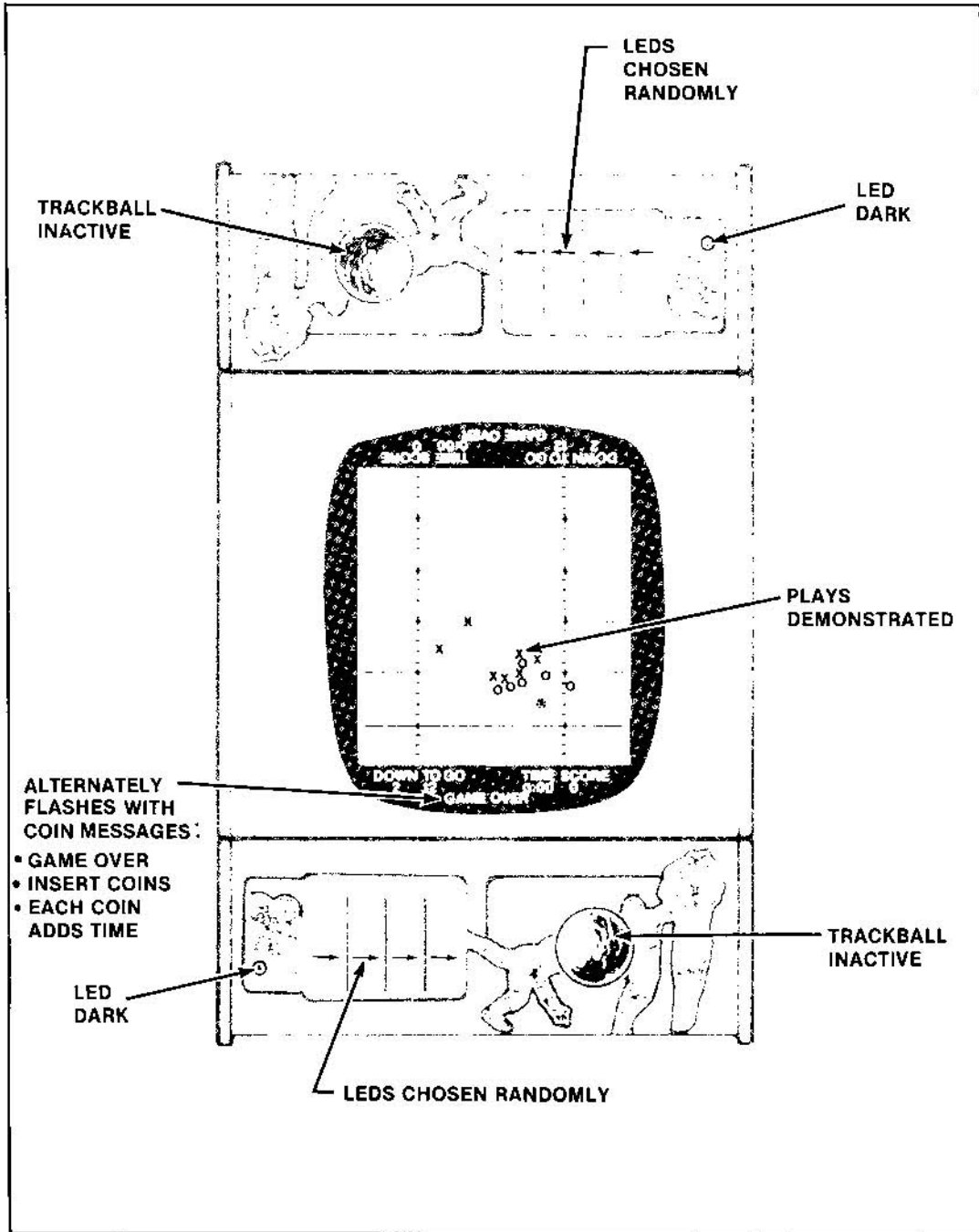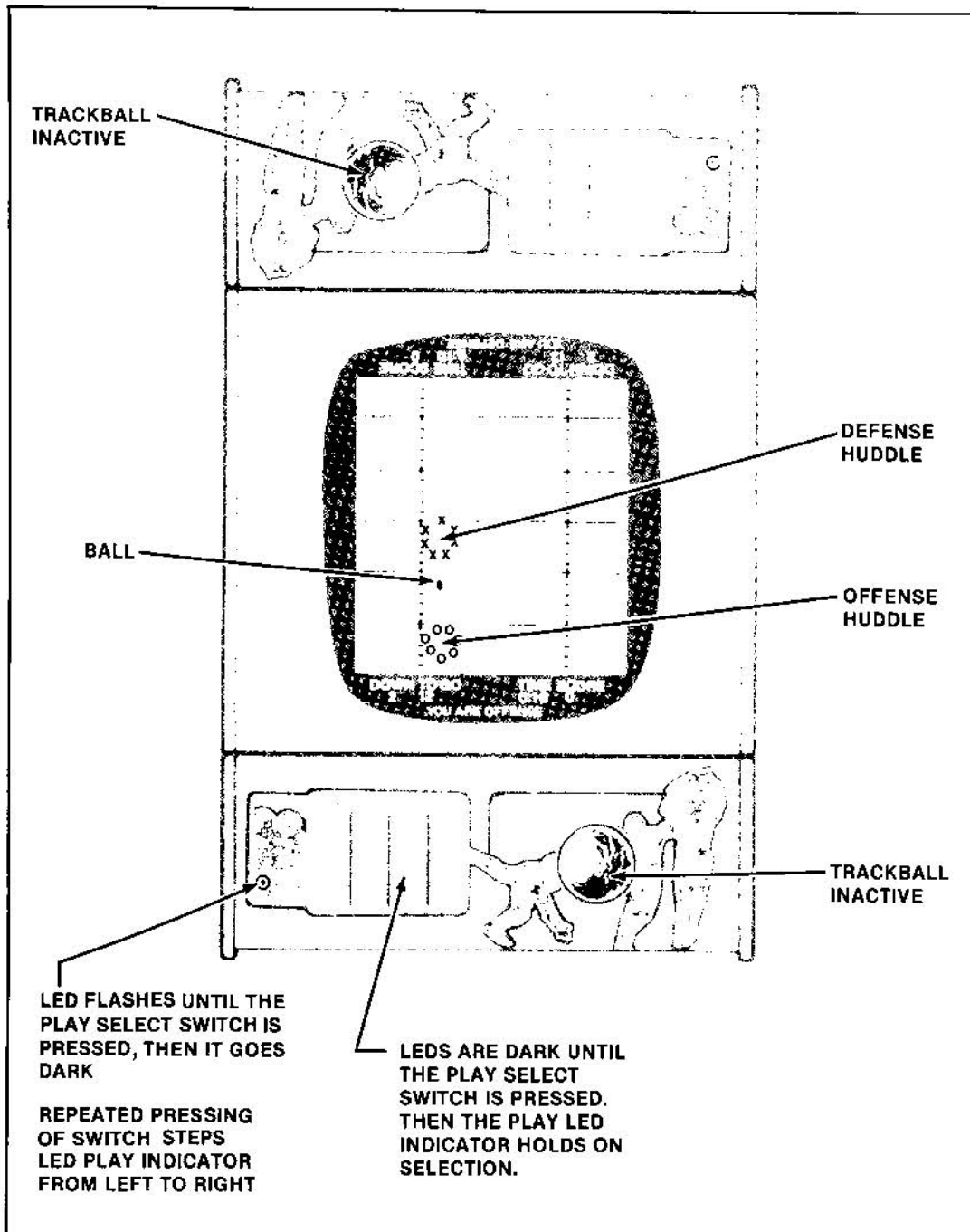
The Down and Out Play
(See Figure 2-8)

The Down and Out is a short-distance passing play. All offensive action in this play is identical to the Bomb except that when the ball is passed, it goes to the tight end who runs a quick down and out pattern to the right side of the field. This is a short-pass play, and if the player waits too long before passing the ball, it will result in an incomplete pass. Again, as in the Bomb play, if there is a defensive player in the immediate vicinity of the receiver, a pass attempt may result in an interception.

Defensive Running Plays

The Sweep
(See Figure 2-9)

In the defensive Sweep play, we once again have seven players. These players are indicated by Xs. We have four Xs which are on the line: the two center Xs are guards (1, 2), and the other two outer Xs are tackles (3, 4). In the next row, you have two men on either end off of the line of scrimmage and these two men are your linebacks (5, 6). The last man in the back of your field is your safety (7).

In the defensive mode, if you are the defensive player, this safety is the only player who may be operated by the trackball.
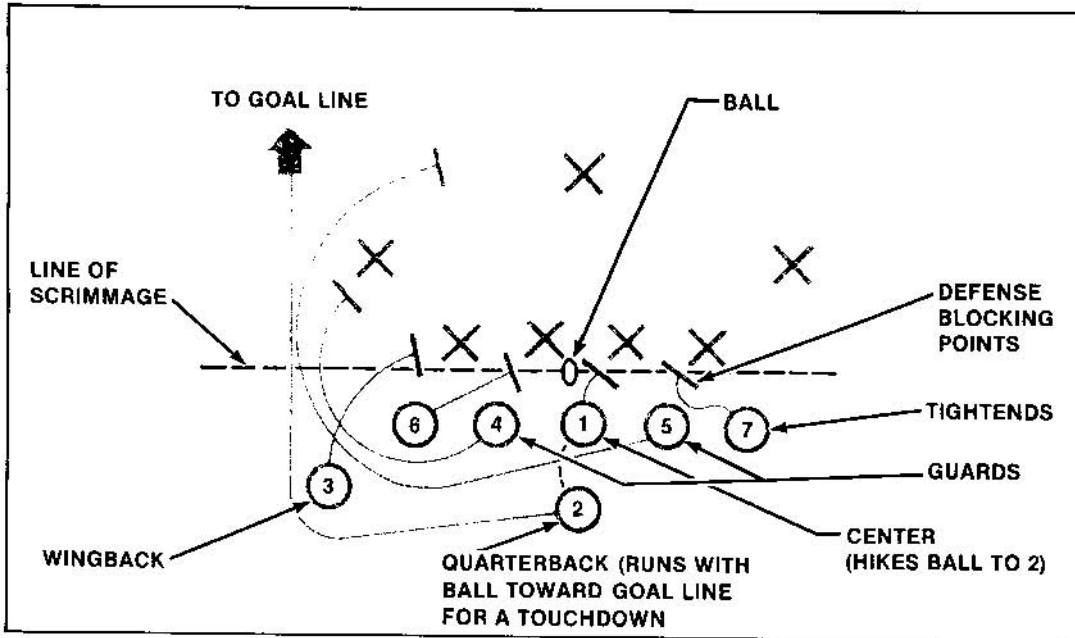
Figure 2-5   THE SWEEP An Offensive Running Play

In the figure: TO GOAL LINE, BALL, LINE OF SCRIMMAGE, DEFENSE BLOCKING POINTS, TIGHTENDS, GUARDS, CENTER (HIKES BALL TO 2), WINGBACK, QUARTERBACK (RUNS WITH BALL TOWARD GOAL LINE FOR A TOUCHDOWN
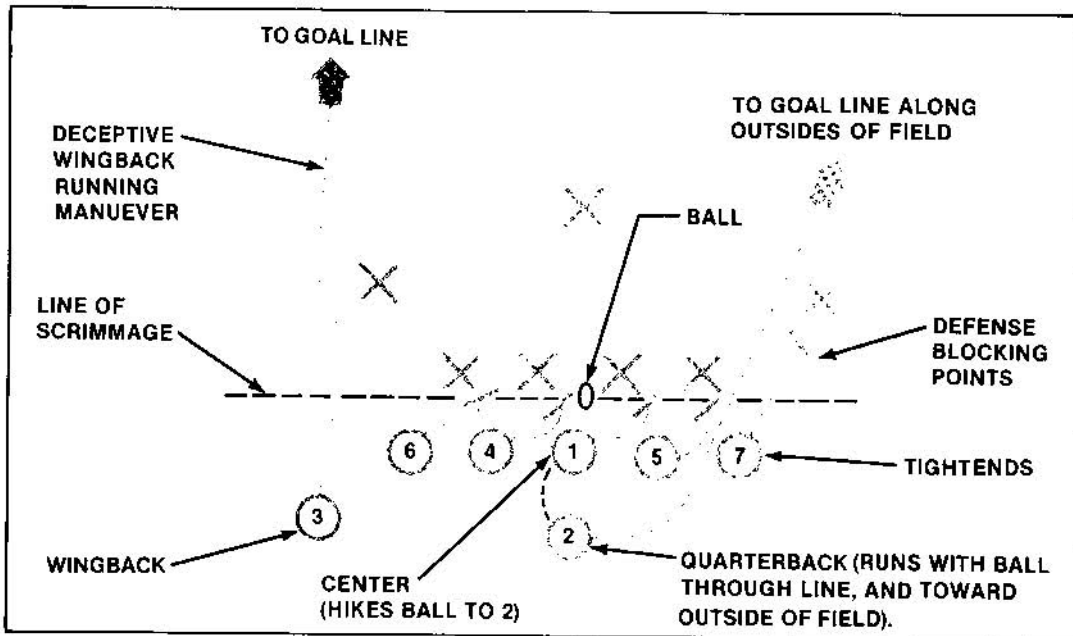
Figure 2-6   THE KEEPER An Offensive Running Play

In the figure: TO GOAL LINE, DECEPTIVE WINGBACK RUNNING MANUEVER, TO GOAL LINE ALONG OUTSIDES OF FIELD, BALL, LINE OF SCRIMMAGE, DEFENSE BLOCKING POINTS, TIGHTENDS, WINGBACK, CENTER (HIKES BALL TO 2), QUARTERBACK (RUNS WITH BALL THROUGH LINE, AND TOWARD OUTSIDE OF FIELD).

Figure 2-7 THE BOMB An Offensive Passing Play

Figure 2-8 THE DOWN & OUT An Offensive Passing Play

2-8 FOOTBALL

In the Sweep defensive illustration, Figure 2-9, we see that both guards and the right tackle rush toward a single point on the line—toward the quarterback. The left tackle goes a short distance back, rushes right and then all the way back again. At this point, the left linebacker follows him through and the right linebacker goes around the wingback of the offensive team, trying to get around the offensive line of scrimmage. Meanwhile, the player has complete control of the safety.

The Keeper Play
(See Figure 2-10)

The Keeper defensive play shows that the front line rushes the offensive line to the left. The left linebacker rushes past the line, around it, and the right linebacker follows him up. Meanwhile, the safety remains behind, controlled by the player.

The Bomb Play
(See Figure 2-11)

In the Bomb defense strategy, once again we have the line being rushed by the defensive line together with the left side linebacker. The right side linebacker drops back into his own secondary, and automatically follows the offensive wingback, and defends against any attempted pass to the wingback. The safety is again in the hands of the player.

The Down and Out Play
(See Figure 2-12)

During the Down and Out strategy, the line rushes together with the wide side linebacker. The short side linebacker drops back into his secondary and defends against the pass to the offensive player running the down and out pattern. Once again, the safety is controlled by the player.

The Four Goal Deterrents

The four goal deterrents are the intercept, incomplete, tackle, and out-of-bounds. These conditions are displayed at the lower part of your scoreboard display field.

The incomplete pass (see Figure 2-13) occurs in a passing situation, when the quarterback pauses too long to pass it to the receiver down the field. It may also occur if the ball passes near a defensive player as it comes "down" to the receiver. This condition resets the game into a huddle at the initial scrimmage line and stops the clock.

The out-of-bounds (see Figure 2-14) occurs when the offensive player, while running in the direction of the goal line, goes off, onto, and past either side boundary; this stops the play, and the clock.

The tackle (see Figure 2-15) is the condition on the screen where the defensive player (X) physically touches the offensive player (O). Once again, at the point of being tackled, the player could gain or lose, depending on which side of the scrimmage line the player may have been tackled. Occasionally he may be tackled in his own end zone and the defense scores 2 points.

Note here that a pass can only occur when the quarterback is behind his line of scrimmage. If the quarterback decides to run the ball beyond the line of scrimmage, the ball can no longer be passed, and the Press-to-Pass pushbutton becomes inoperative.

The most deterrent type of goal-stopping, clock-stopping situation is the intercept. The intercept (see Figure 2-16) is the condition where the quarterback passes to the receiver and a defensive player between the ball and receiver intercepts the ball by actually touching it, as seen on the video screen. The intercept immediately turns the ball over to the opponent, reversing the offensive and defensive situations, and gives that yardage to the new offense. The defense and offense both leave the playfield and return in reversed order (defense to offense and vice versa).

When the defense intercepts the ball, the defense then becomes the offense at the same yardage as the point of interception.

Time Penalty

A player is penalized five yards for not selecting his next play within ten seconds before lining up at the line of scrimmage or before pressing the game select button. Therefore, it is important that you reach your decision prior to ten seconds after your opponent does.

The Touchdown
(See Figure 2-17)

An offensive player scores when he reaches his goal line and makes a touchdown; the offensive players score 6-points for a passing touchdown and 7-points for a running touchdown. This touchdown occurs when the offensive player (O) carries the ball and actually makes contact with the last yardage line at his end zone. This end zone is opposite to the offensive player. Therefore, the offensive player's goal line is toward his opponent. The screen proceeds to scroll in either direction, providing a full view of the field as the offensive player executes his plays. The active players are kept at approximately center screen.
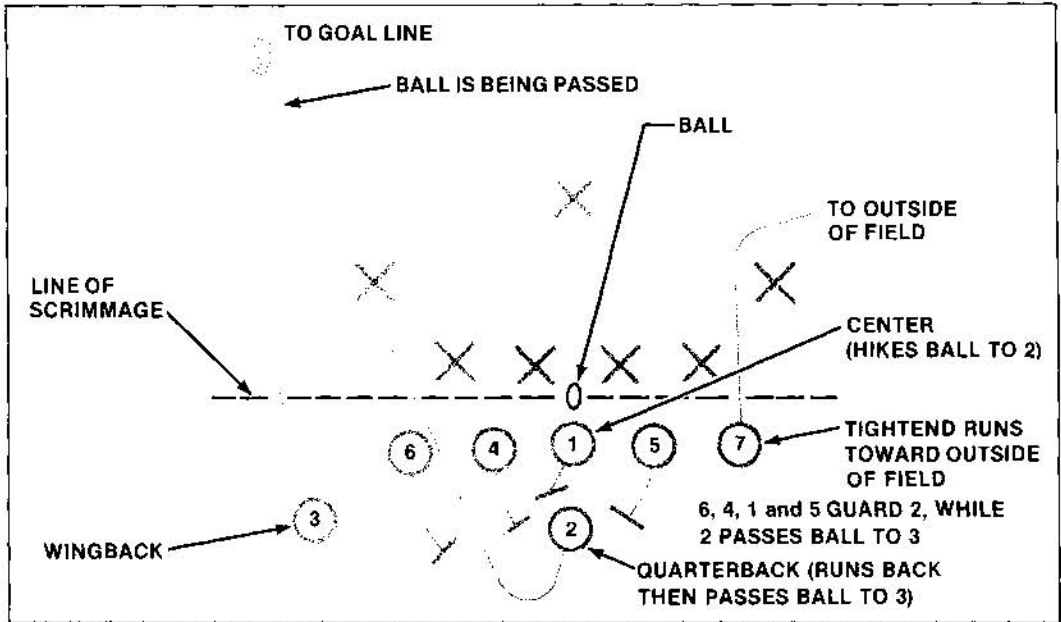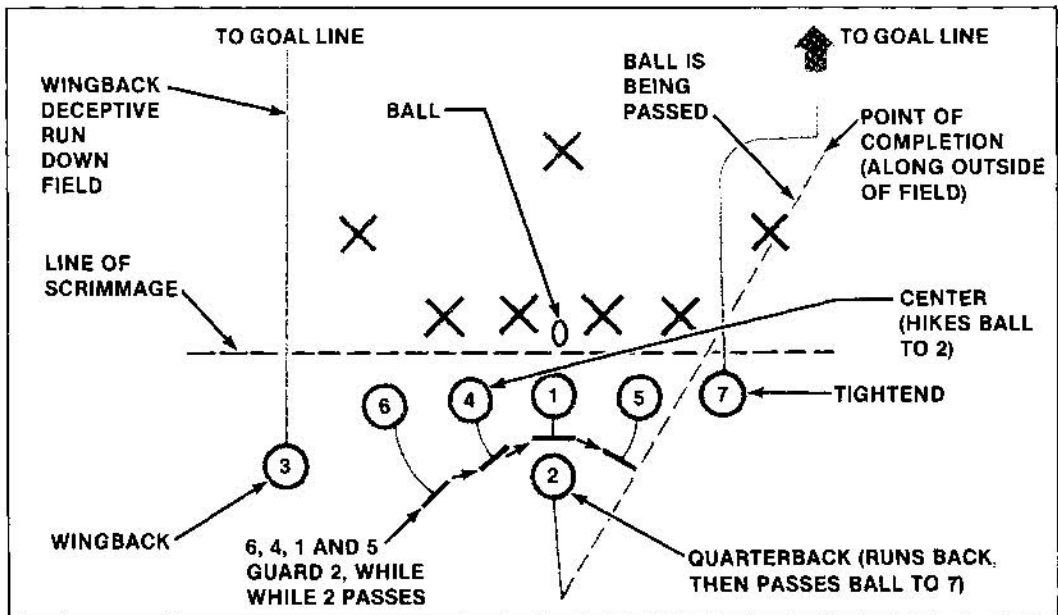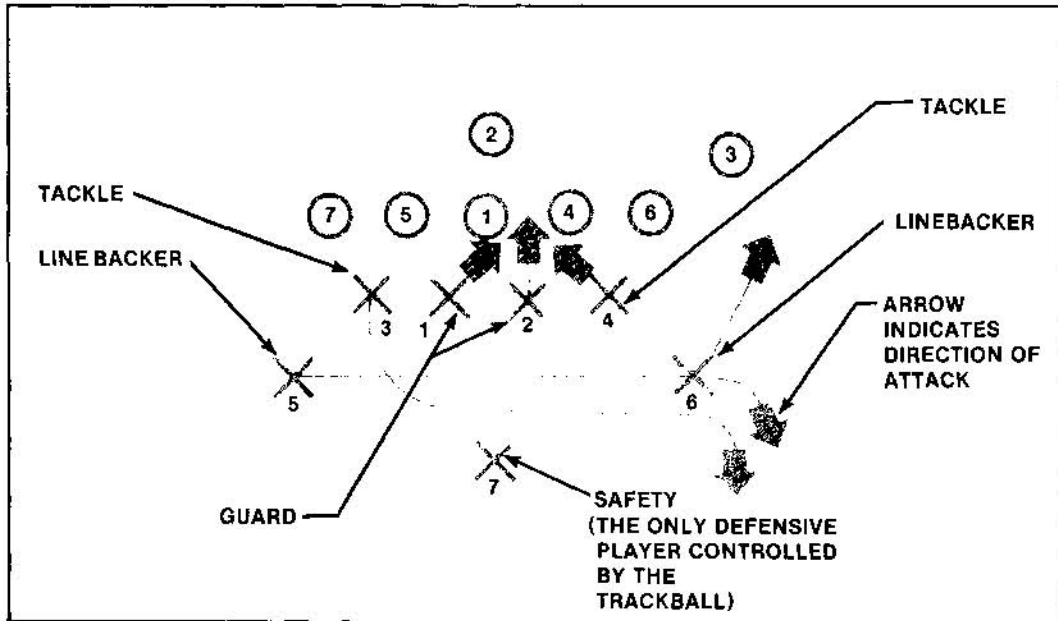
Figure 2-9   THE SWEEP A Defense
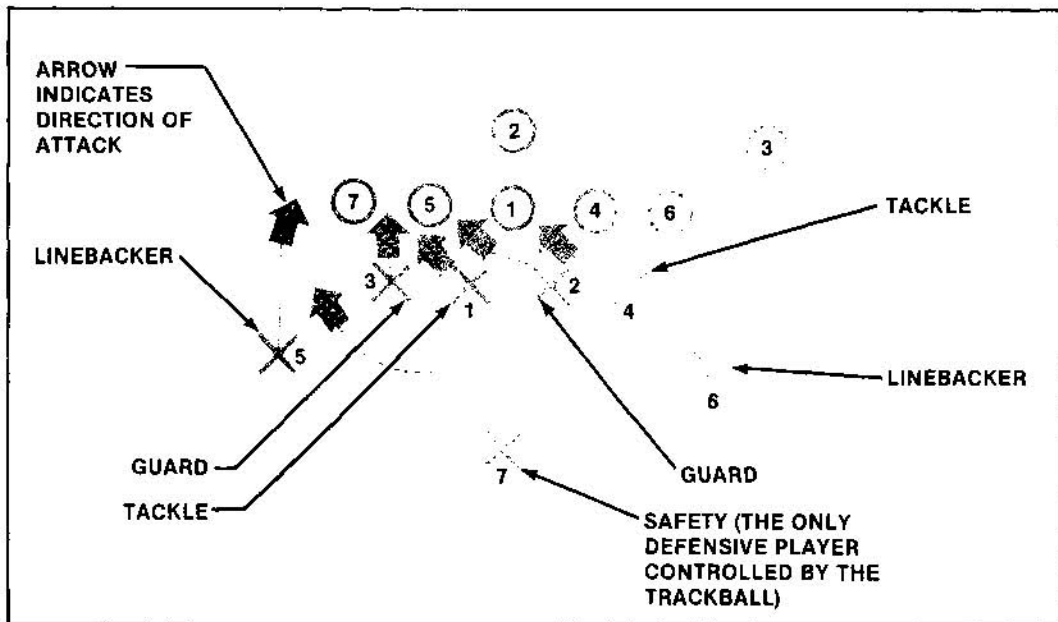
Figure 2-10   THE KEEPER A Defense
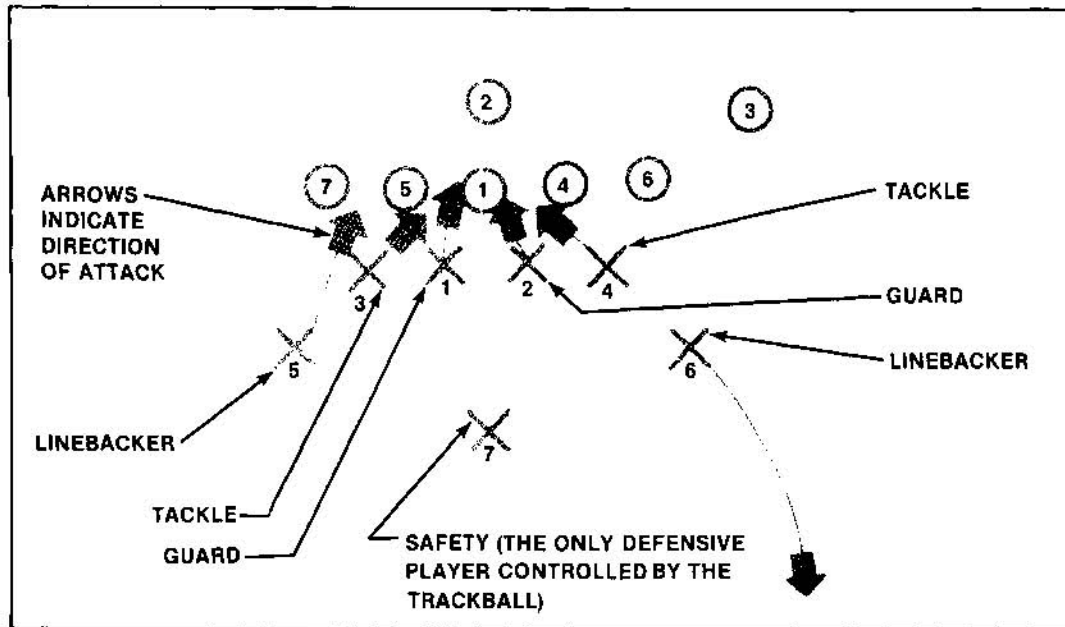
Figure 2-11 THE BOMB A Defense
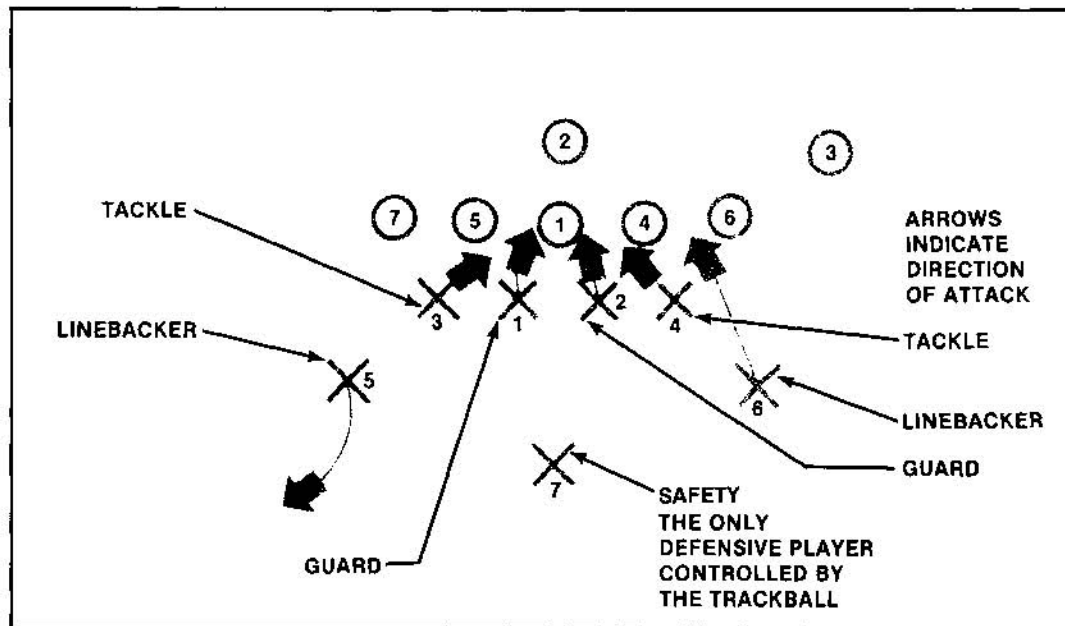
Figure 2-12 THE DOWN & OUT A Defense

OFFENSE SELECTOR
DOWN AND OUT

TRACKBALL
INACTIVE

LED
DARK

QUARTERBACK

BALL STOPS

RECEIVER

DOWN TO GO   TIME SCORE
2   12   0:10 0
INCOMPLETE

TRACKBALL
INACTIVE

LED
DARK

ASSUMED: DEFENSE
SELECTED BOMB

Figure 2-13 Incomplete

OFFENSE
SELECTED
BOMB

LED
DARK

TRACKBALL
INACTIVE

RECEIVER
OUT OF
BOUNDS
(TOUCHING SIDE
BOUNDARY LINE)

DOWN MARKER

DOWN TO GO   TIME SCORE
2   12   0:10 0
OUT OF BOUNDS

TRACKBALL
INACTIVE

LED
DARK

ASSUMED: DEFENSE
SELECTED BOMB

Figure 2-14   Out of Bounds

Figure 2-15 Tackled Offense
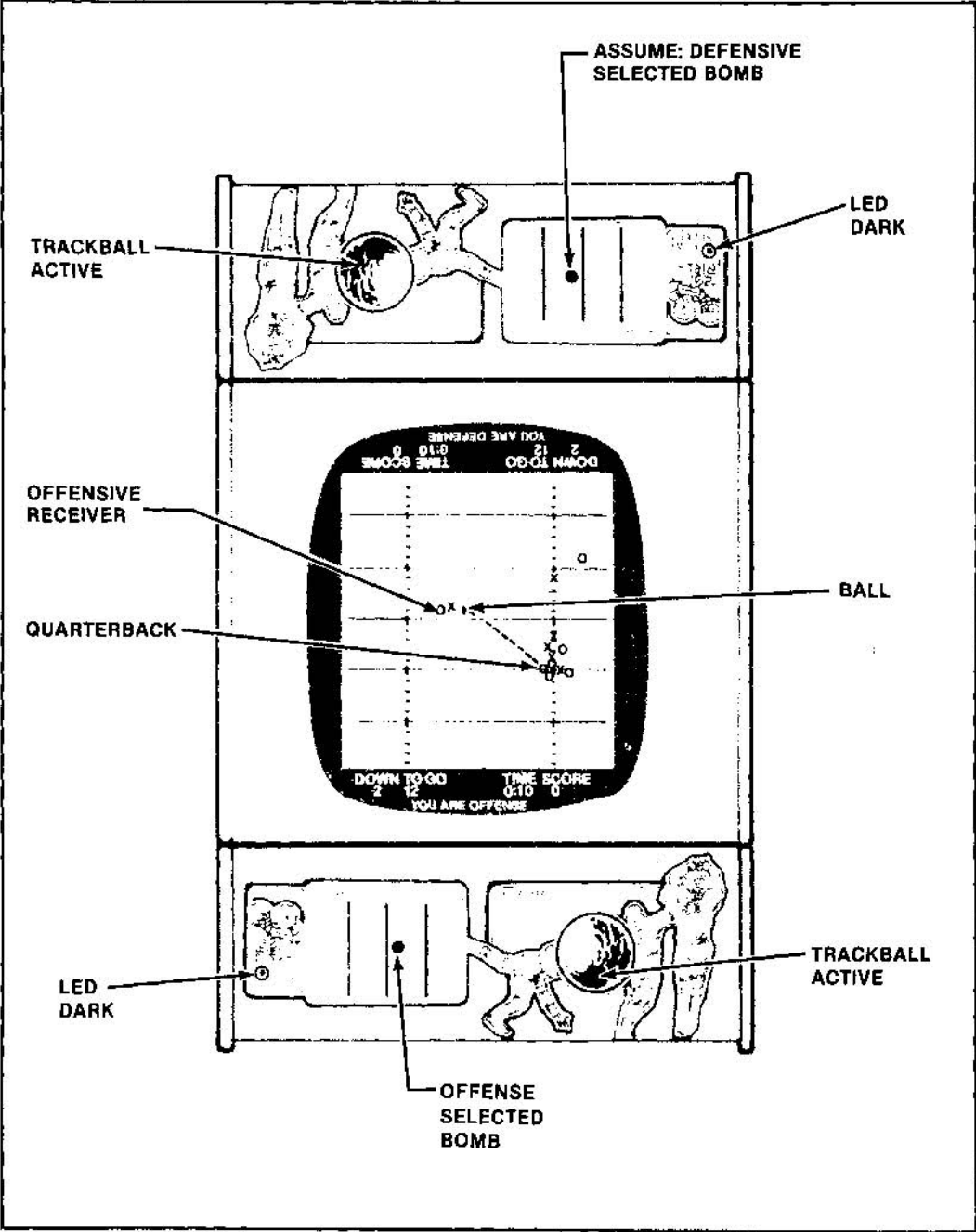
2-14 FOOTBALL

Figure 2-16 The Intercept

The Downs

In Atari Football, the offensive player is set up to control four consecutive offensive plays (described as downs). If in executing those four downs, the offense is able to gain 10 or more yards he automatically receives a "first down", giving him another 4 consecutive offensive plays. If a first down is not obtained in 4 plays, the defense will get the ball.

On the screen there are two small quarter-inch markers on the outside of either sideline (see Figure 2-18), ten yards deep into the defensive field from scrimmage. These two markers represent the point ten yards downfield from the line of scrimmage which the offensive team must pass to gain another first down.

The number of downs to go for the ten-yard marker is displayed in the left-hand corner of either player's scoreboard. For example, the first and ten (1 and 10)

means that it is the first down and ten yards to go for another first down. On the fourth down, assuming that the line of scrimmage is two yards from the first down marker, the scoreboard would read down 4 and two yards to go (4 and 2). If the quarterback had received the ball and been tackled twenty-five yards from the first down marker, on the third down play, it would be displayed as 4 and 25 on the scoreboard at the end of the play.

Note here that if the ball were to be intercepted, it would automatically go to the defense no matter how many downs for the offense. The two yardage markers are automatically reset each time the offense reaches or passes them.

Defensive strategy here is to make sure that the offense doesn't get his first down and ten, giving him more chances to score.

DEFENSE
SELECTED
BOMB

TRACKBALL
INACTIVE

TOUCH DOWN

TIME SCORE
0:10 0
DOWN TO GO
2   12

TOUCHDOWN
PLAYER
TOUCHES
GOAL LINE

GOAL LINE

DOWN TO GO
2   12
TIME SCORE
0:10 0
TOUCH DOWN

TRACKBALL
INACTIVE

ASSUMED: DEFENSE
SELECTED BOMB
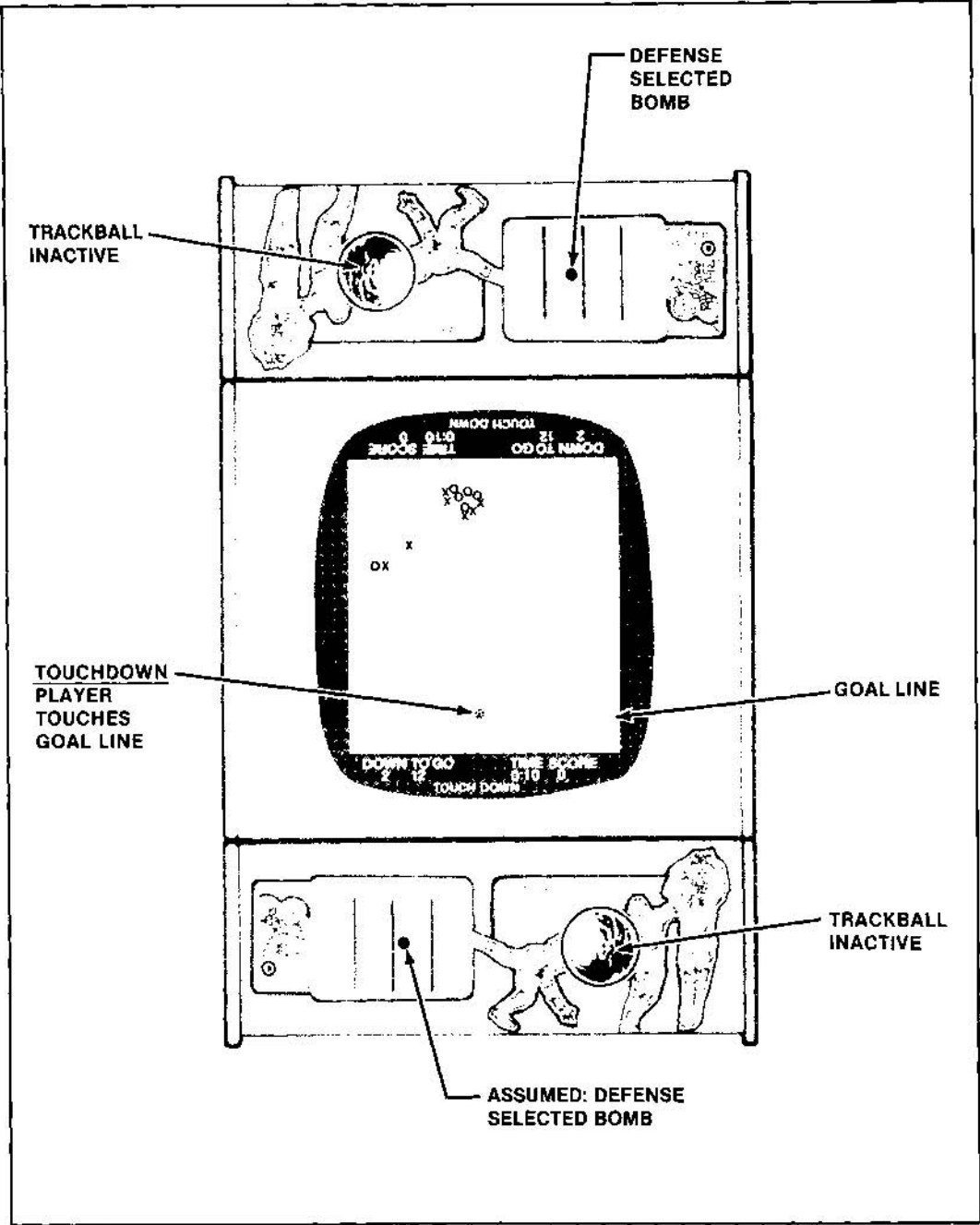
Figure 2-17   Touchdown
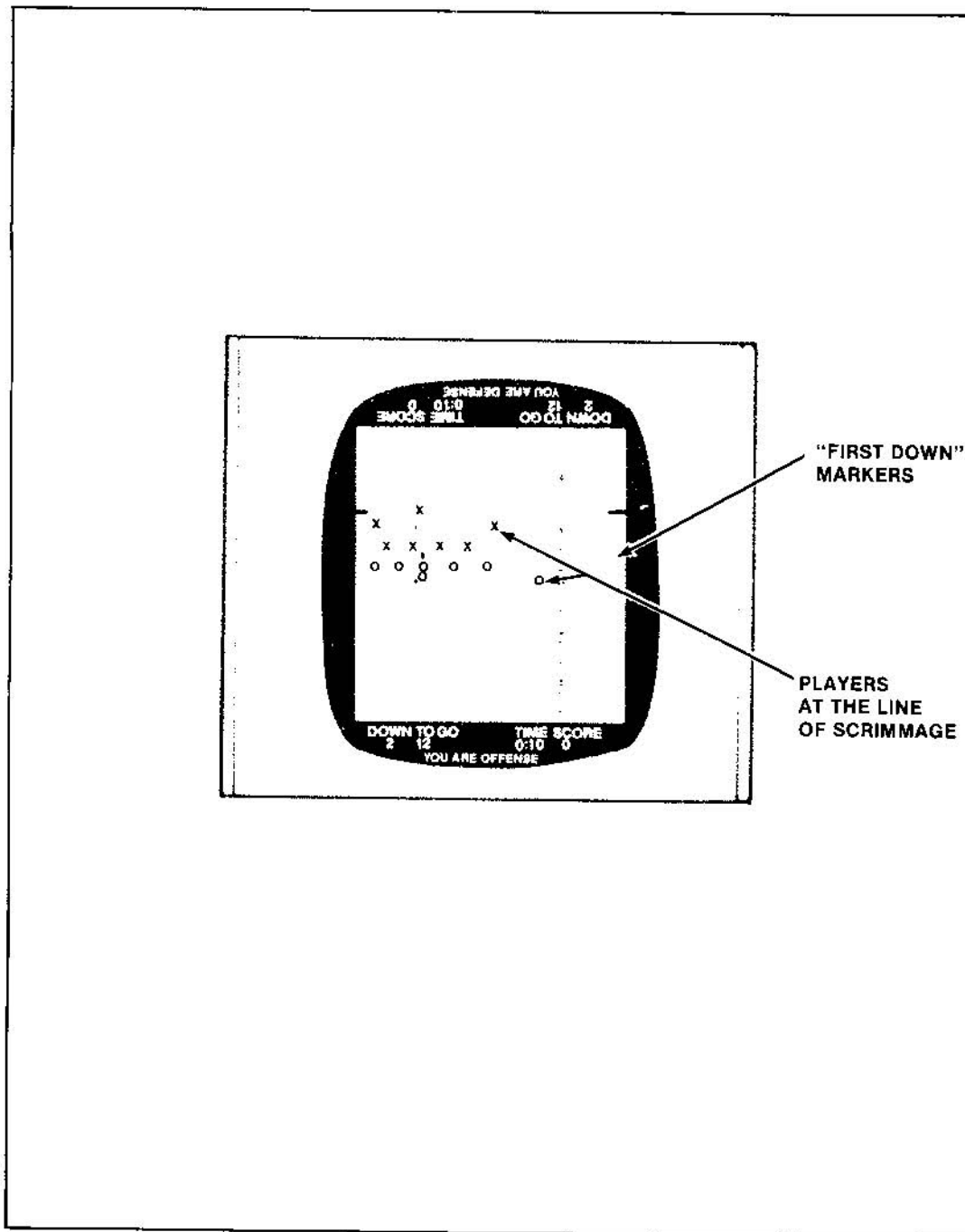
Figure 2-18   Down Location

2-18 FOOTBALL

THEORY OF OPERATION

A. GENERAL INFORMATION

This chapter provides a general overview of the theory of operation of the Football 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 Football 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.

The Football 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.
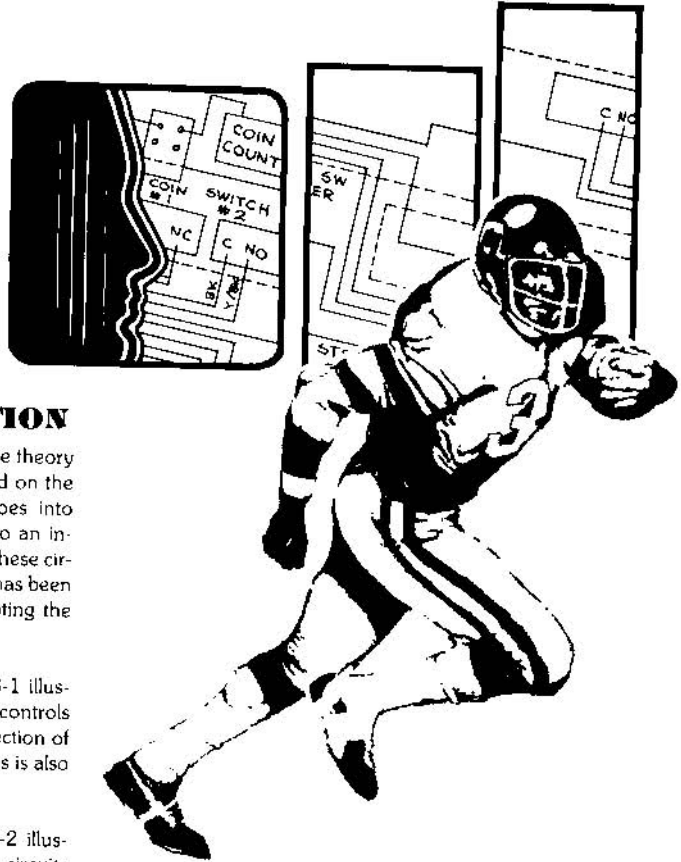
FOOTBALL
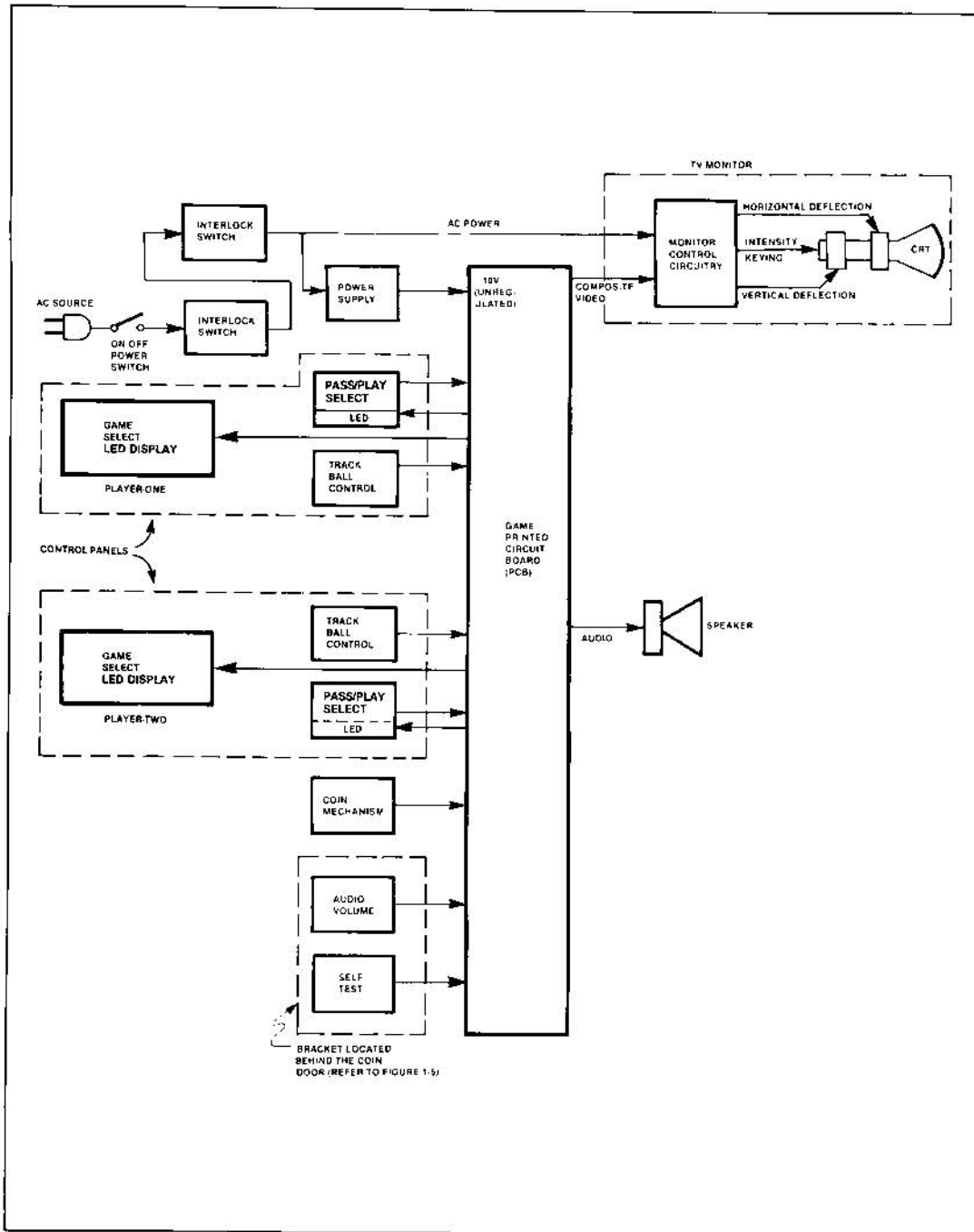
Figure 3-1 Football Game Block Diagram

3-2 FOOTBALL

Figure 3-2   Football PCB Block Diagram

The functional operation of the Football 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 25 VAC to pins W, 19, X, and 20 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. The 25 VAC input is rectified through diodes CR1 and CR2 filtered by capacitor C62 and supplied as unregulated +18 volts to the TDA 1004 audio amplifier. This +18 volts is also regulated by a three-terminal device 7812 to develop +12 volts DC.

C. MICROPROCESSOR CIRCUITRY

The heart of the Football 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 C2)

2. Gated address buffers (B1 and C1)

3. Data buffers (E2)

4. ROM memory (P1, N1 and M1) for -02 version or PROM memory as listed in the PCB assembly parts list for the -01 version (refer to Illustrated Parts Catalog, Chapter 5).

5. RAM memory (M2, N2 for working RAM)

6. Address decoding circuitry (B3, E3, C7 and miscellaneous gates)

7. Watchdog reset counter (A4 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 ABS 0 - BUS 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," "bomb play" 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.
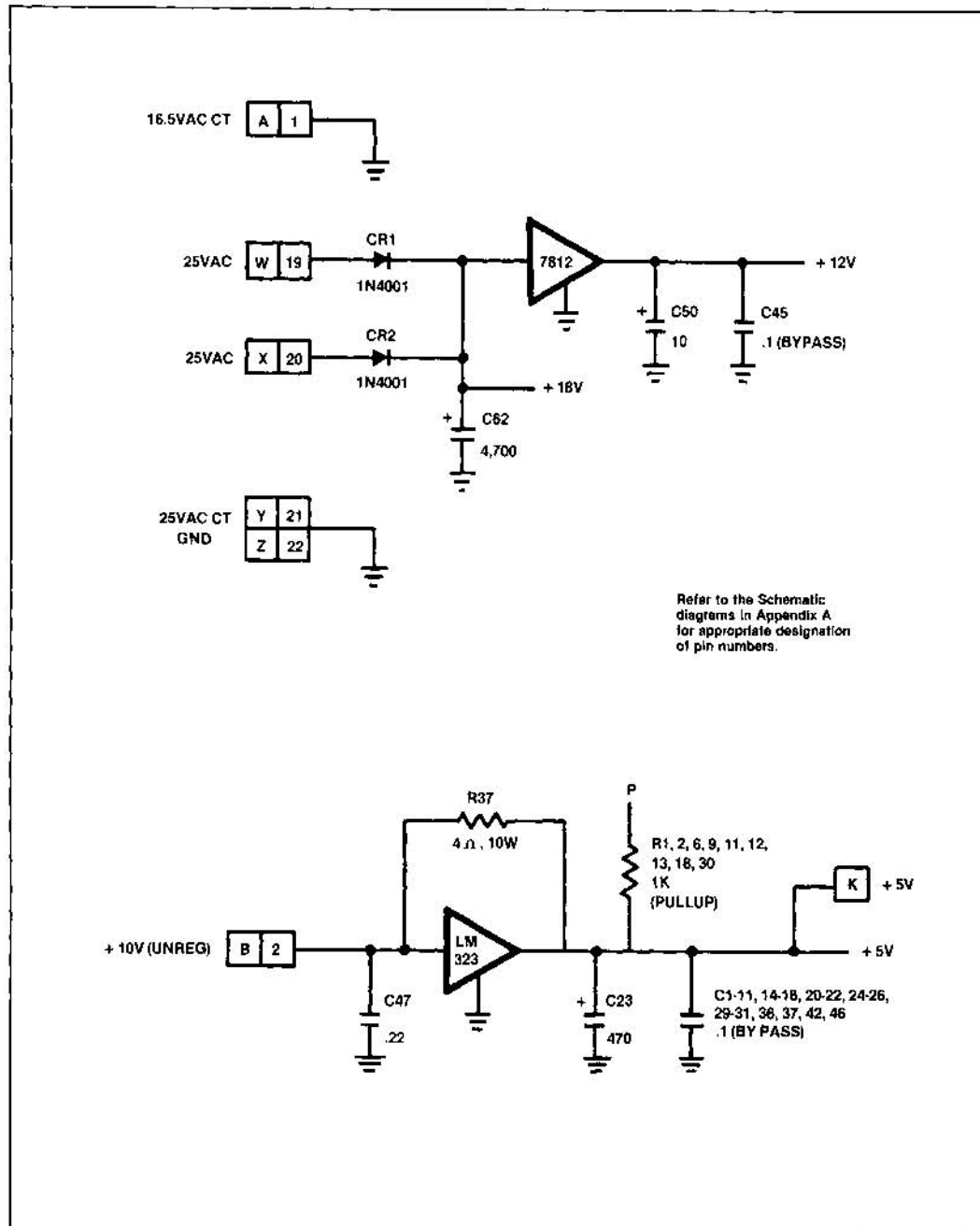
Figure 3-3 On-Board Power Supply Schematic Diagram
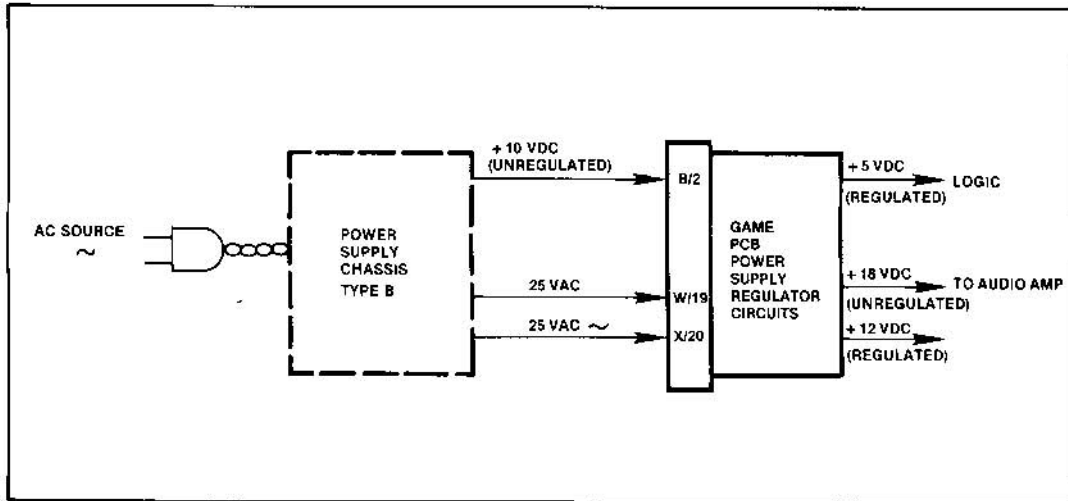
Figure 3-4   Power Supply Simplified Block Diagram

Φ 0 Clock Driver

The basic operating frequency of the microprocessor is established by its Φ0 input (on pin 37 of the MPU device). The Football 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 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 P5 to produce the Φ0 clock input. See Figure 3-8, Φ0 Clock Driver Signal.

Watchdog RESET (See Figure 3-5)

The reset counter in the microprocessor control circuitry consists of a 4-bit decade counter, A4. The Q_D output of this counter is the RESET signal to the MPU. Counter A4 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 WATCHDOG 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 WATCHDOG 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 N4 and several discrete components. The output of this oscillator is 12 MHz. Examination of this signal with an oscilloscope (at pin 2 of N4) should show the period (or cycle time) to be approximately 83 nanoseconds (.083 microseconds). See Figure 3-9.

This base frequency is then divided down by binary counters P5, P6, N6; it provides the various horizontal synchronization frequencies (1H through 256H). The final output of this horizontal counter chain is 256H (at pin 13 of N6). 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 BLANK and H SYNC timing pulses at flip-flop N5. See Figure 3-11, Horizontal Sync Timing Diagram for the relative timing of these waveforms.

Table 3-1 MPU Input/Output Signal Descriptions

Signal	Description/Function	Signal	Description/Function
D0-D7	These eight lines are bi-directional data bus lines.	$\overline{RESET}$	When low, this input line resets the MPU on either a "power-up condition" or a Q_3 output of the watchdog counter. During the reset sequence prior to RESET going high, the contents of two locations (FFFC, FFFD) in memory are loaded into the MPU program counter to point the start of a reset routine.
A0-A15	These sixteen lines are unidirectional MPU address lines to supporting memory (i.e., ROMs, RAMs) and I/O.		
$\overline{IRQ}$	This input, when low, indicates an interrupt to the MPU. After the MPU concludes its current instruction it will proceed to the IRQ sequence.		
R/$\overline{W}$	This output is the read and write signal line, which indicates the direction of data transfers on MPU data bus.	$\Phi 0$	Clock input
		$\Phi 1, \Phi 2$	Two-phase, non-overlapping MPU clock outputs.

Table 3-2 Atari Programmed Memory Map

Address	Function
6800-7FFF	PROGRAM
5000	WATCHDOG
4000-4003	INPUT PORTS
3000	INTERRUPT ACKNOWLEDGE
2000-2003	OUTPUT PORTS
1000-13BF	SCROLLFIELD
13C0-13FF	MOTION OBJECT PARAMETERS
03A0-03FF	PLAYFIELD—PLAYER 2
0200-025F	PLAYFIELD—PLAYER 1
0000-01FF	WORKING RAM

INPUT/OUTPUT PORTS	D7	D6	D5	D4	D3	D2	D1	D0
2000 (OUT 0)	SCROLLFIELD OFFSET (8 BITS)							
2001 (OUT 1)	SPARE					KICKER	HIT	WHISTLE
2002 (OUT 2)	ATTRACT	COIN CNTR		NOISE AMPLITUDE				
2003 (OUT 3)	SPARE				LED CATHODES (4 BITS)			
4000 (IN0) = 0	COIN 1	END SCREEN	SLAM	SELECT 1	TRACKBALL DIRECTION			
					PL1HD	PL1VD	PL2HD	PL2VD
4000 (CTRLD) = 1	TRACK-BALL VERT 1				TRACK-BALL HORIZ. 1			
4002 (IN2) = 0	COIN 2	TEST	SPARE	SELECT 2	OPTION SW			
					4	3	2	1
4002 (CTRLD) = 1	TRACK-BALL VERT 2				TRACK-BALL HORIZ. 2			

	MOTION OBJECT PARAMETERS
13C0	MOTION OBJECT 1 PICTURE #
13C1	MOTION OBJECT 1 VERTICAL POSITION
13E0	MOTION OBJECT 1 HORIZONTAL POSITION
13E1	SPARE
13C2	MOTION OBJECT 2 PICTURE #
13C3	MOTION OBJECT 2 VERTICAL POSITION
13E2	MOTION OBJECT 2 HORIZONTAL POSITION
13E3	SPARE
13DE	MOTION OBJECT 16 PICTURE #
13DF	MOTION OBJECT 16 VERTICAL POSITION
13FE	MOTION OBJECT 16 HORIZONTAL POSITION
13FF	SPARE
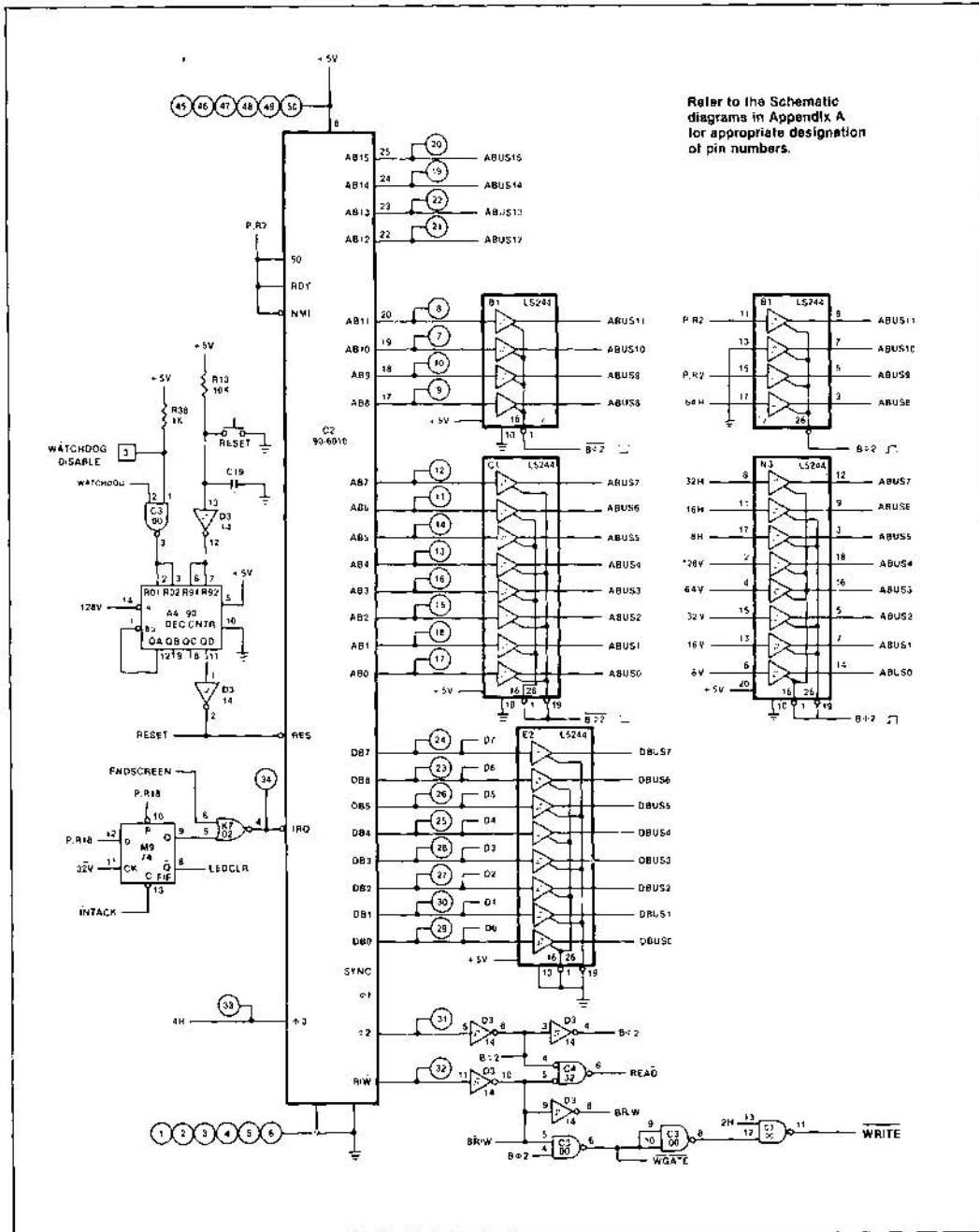
Figure 3-5   Microprocessor Schematic Diagram
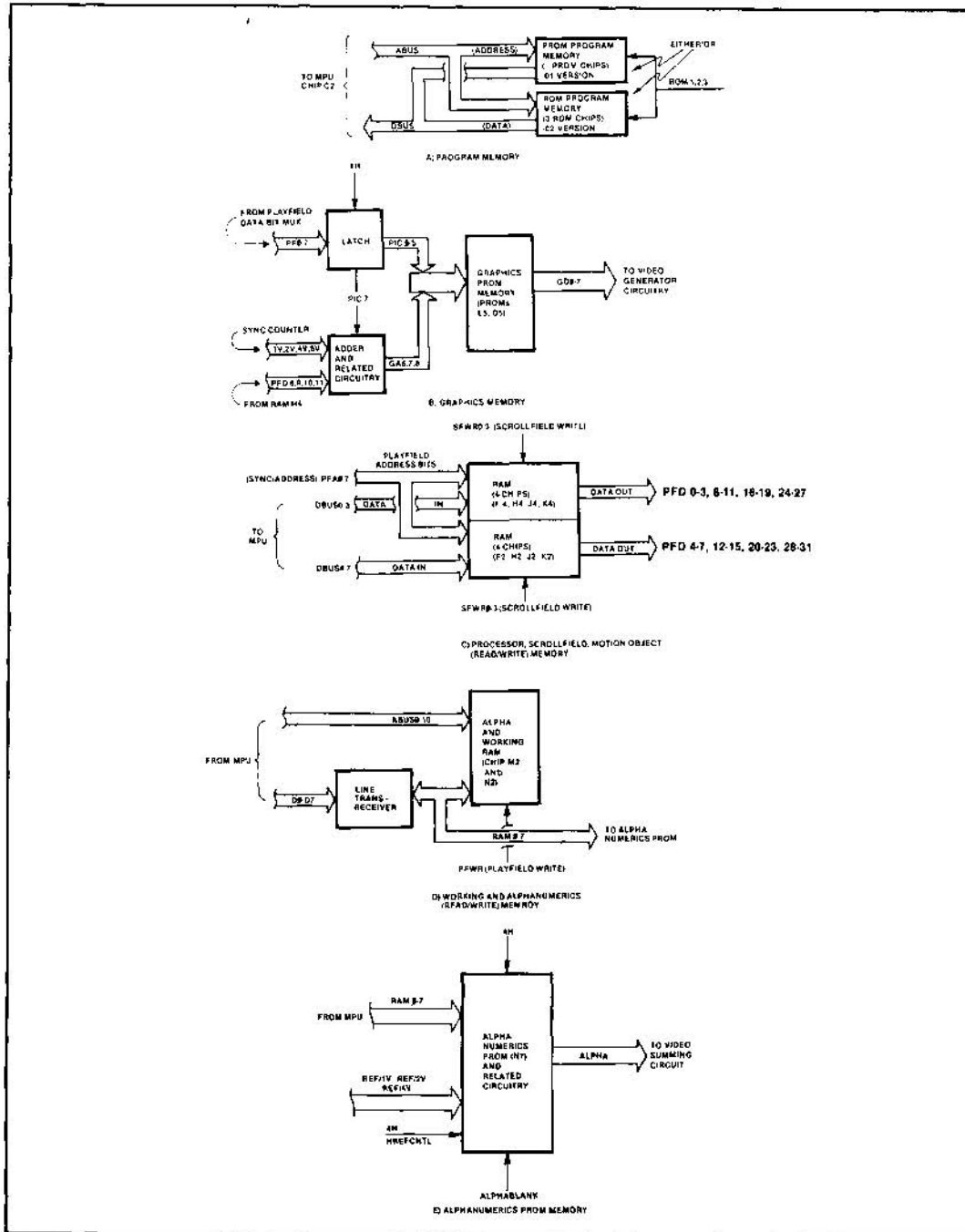
Figure 3-6 Memory Block Diagram
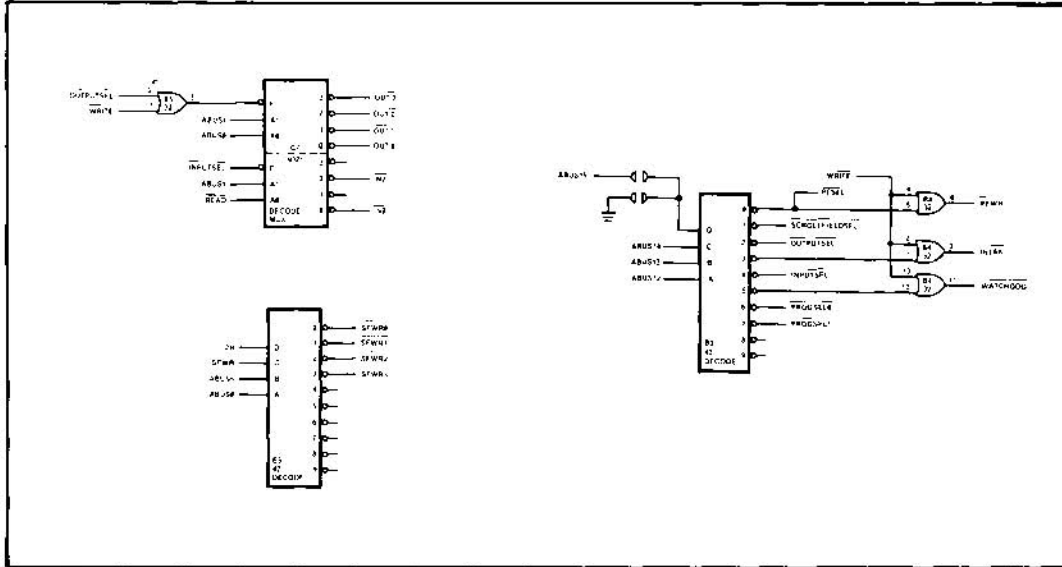
Figure 3-7 Address Decoding
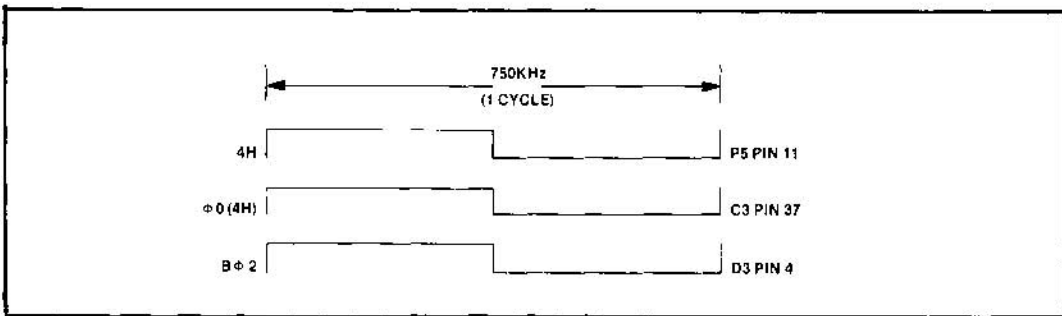
Figure 3-8 Φ0 Clock Driver Signal

The H SYNC signal is used to clock two stages of vertical sync counters M5 and M6. 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 M6) 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 (L5) whose output data is latched by latch L6. 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. See Figure 3-12, Vertical Sync Timing Diagram, for the relative timing of these waveforms.
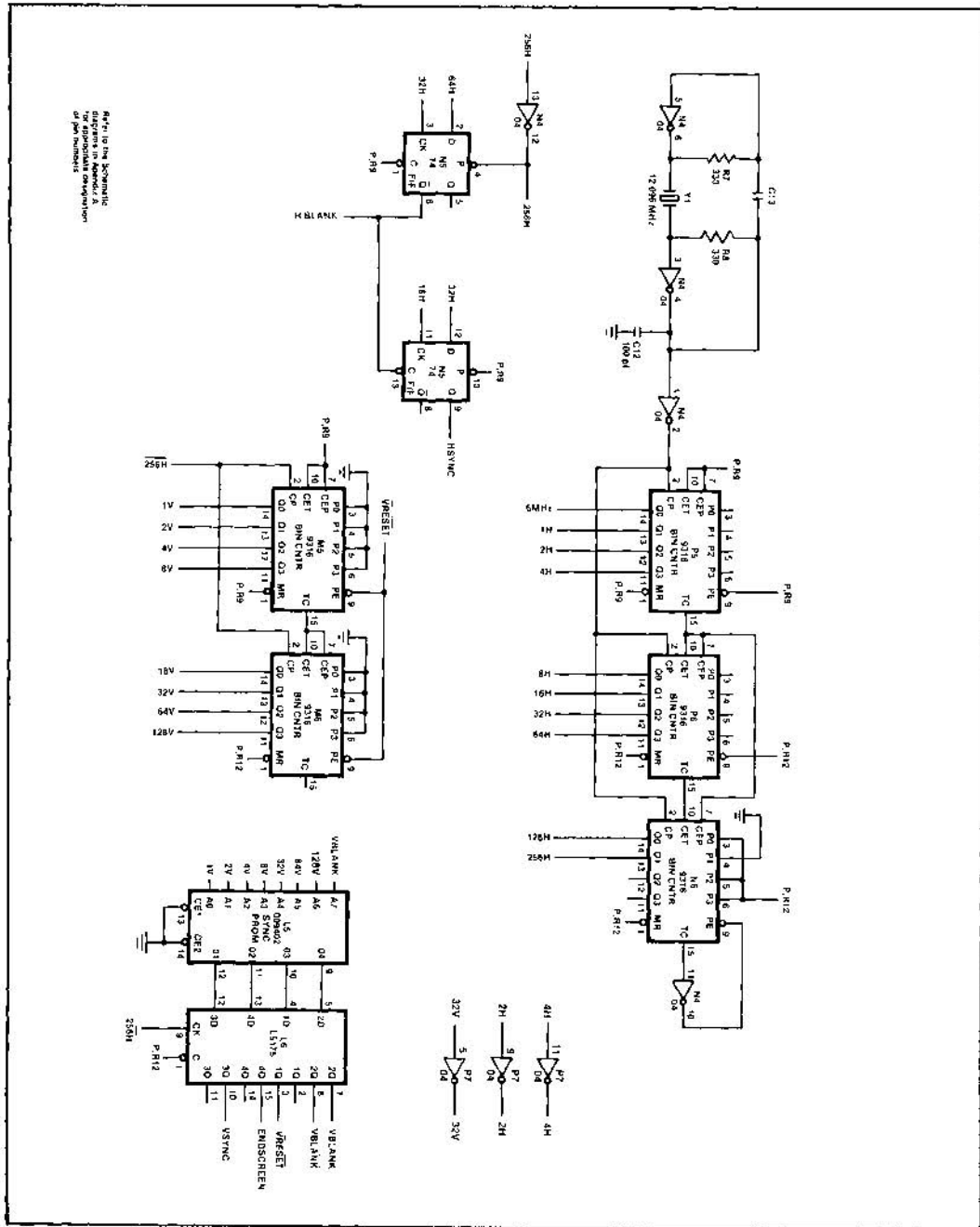
Figure 3-9 Sync Generator Schematic Diagram
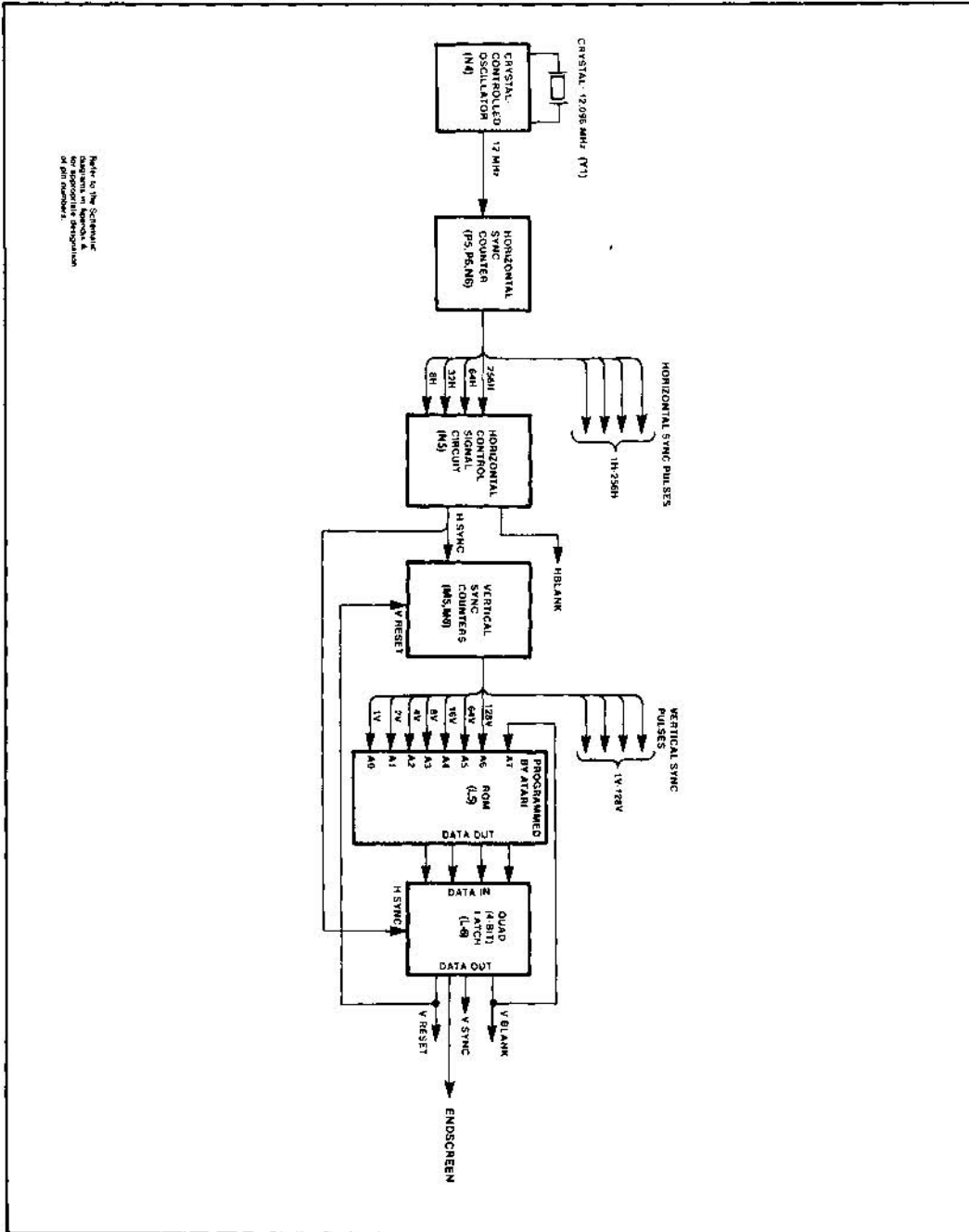
Figure 3-10   Simplified Diagram of Crystal-Controlled Oscillator and TV Sync Circuitry
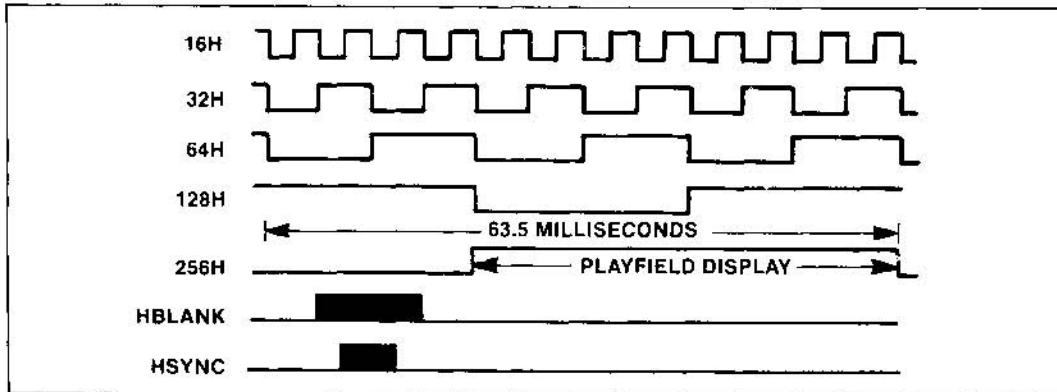
Figure 3-11 Horizontal Sync Timing Diagram
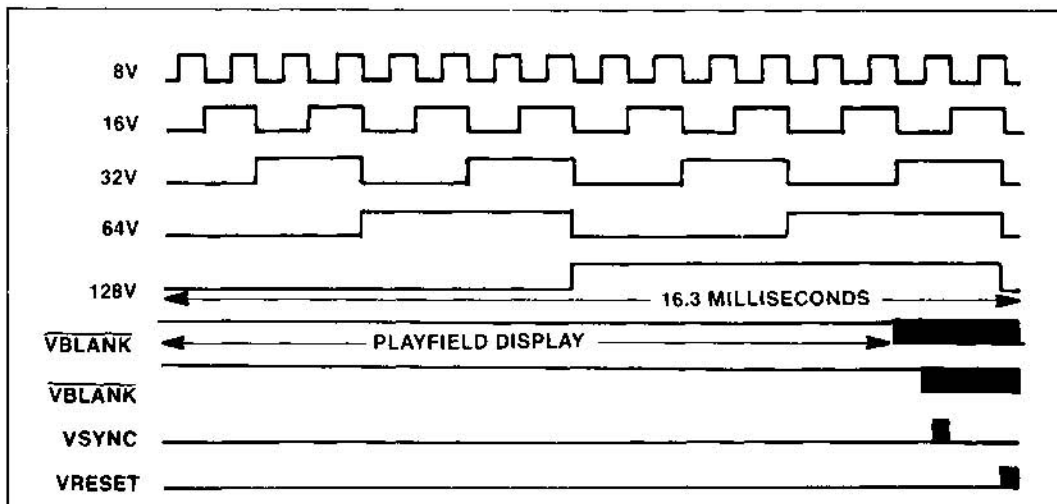
Figure 3-12 Vertical Sync Timing Diagram

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 GENERATOR

(See Figure 3-13 and 3-14)

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

Figure 3-11 Horizontal Sync Timing Diagram
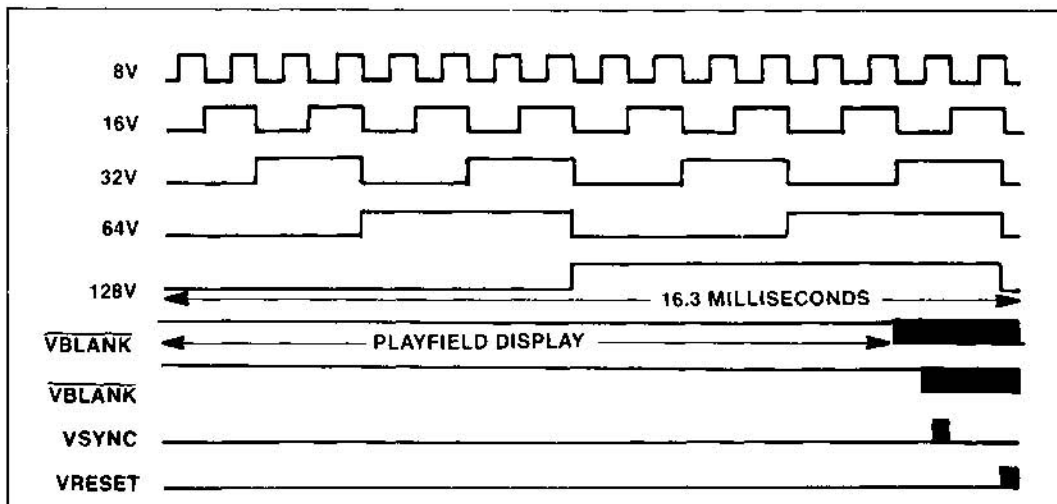
Figure 3-12 Vertical Sync Timing Diagram

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 GENERATOR

(See Figure 3-13 and 3-14)

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 N7 (See Figure 3-14) which is accessed by addressing the data from the RAM (M2, N2). The microprocessor loads the alphanumeric location bits into the RAM. The RAM outputs (RAM 0-7) are then temporarily latched by latch M7 at the rising edge of the 4H clock. The latch output bits then address the alphanumerics PROM N7 (at address inputs A4-A9) and address one of the 64 different pictures stored in it. The vertical reflect signals (REFL4V, REFL2V, REFL1V) and the horizontal reflect control signal (HREFL.CNTL) and sync signal 4H determine which of the 8 lines of the character is currently being addressed.

The reflect signals determine the alphanumeric image rotation which is displayed at either end of the TV monitor screen facing the player.

The 4-bit parallel output of alphanumeric PROM N7 is then converted into serial data by shift register P8 and summed into the video output circuitry. Shift register P8 is gated by NAND gate N9, which is controlled by the ALPHABLANK window signal.

F. SCROLLFIELD GENERATOR

(See Figure 3-15 and 3-16)

The scrollfield generator generates the scrolling playfield video. The video is actually generated by the data stored in the graphics PROM comprised of PROM devices C5 and D5. See Figure 3-15. This PROM video information is addressed by data from the playfield display RAM.

The method by which the MPU writes the appropriate scrollfield data to each RAM location and then the horizontal and vertical timing signals read this data out for actual video generation is known as "cycle sharing". The circuitry that controls this "cycle sharing" technique selects one of 3 sets of addressing information to address the display RAM.

This circuitry functions as follows:

1. When buffered MPU clock B02 is high, the MPU address bus (A0-A15) addresses various playfield display RAM locations, and writes appropriate scrollfield picture codes into them via the MPU data bus (D0-D7).
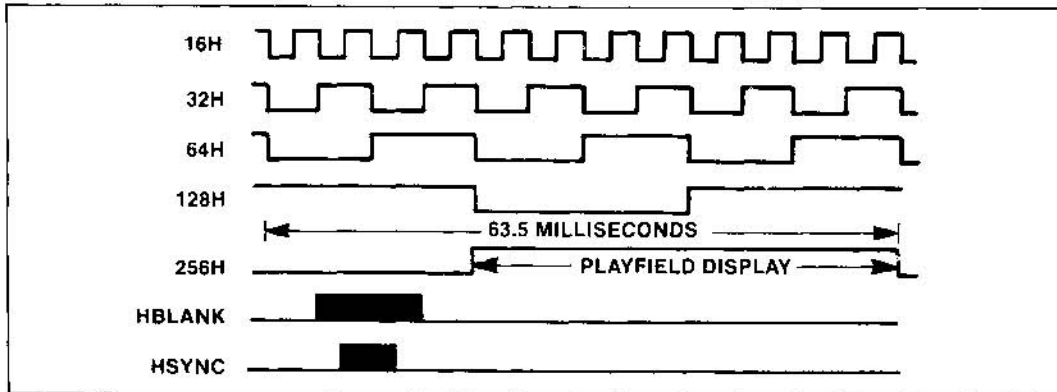
2. When B02 is low and $\overline{256H}$ is low, horizontal sync signals (8H, 16H, 32H, 64H) are enabled to address the RAM. This is used for motion object display.

3. When B02 is low and $\overline{256H}$ is high the vertical sync signals (16V, 32V, 64V, 128V), the shifted horizontal sync signals (SFH4, SFH5, SFH6, SFH7) address the playfield. These shifter signals are the result of adding the top 5 bits of the scroll latch, F7, to the horizontal sync functions. They provide a "coarse", 8 bits at a time, horizontal shift of the scrollfield.

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 PROMs C5 (LSB), D5 (MSB). The output of the PROMs is then converted to serial video information by shift register A6.

The serial video is then displayed 0 to 7 bit times by variable delay circuit shift register J8 and multiplexer H8. This circuit provides the "fine" horizontal shift of the scrollfield.
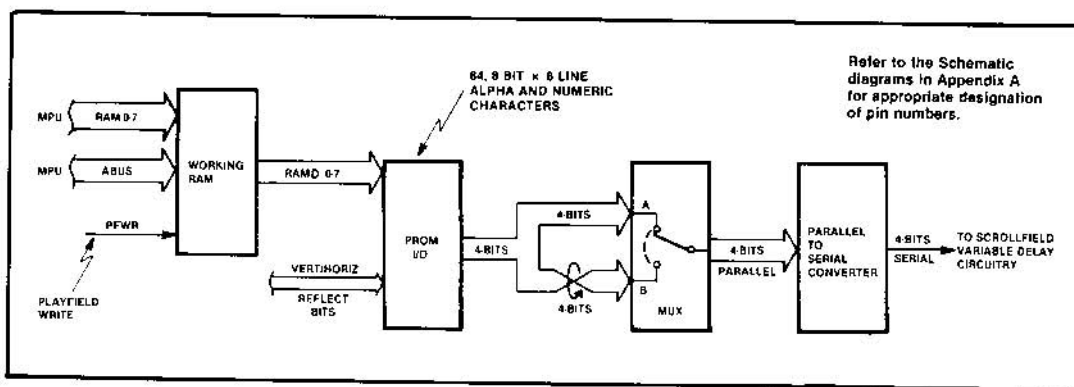
Figure 3-13   Alphanumerics Generator Block Diagram
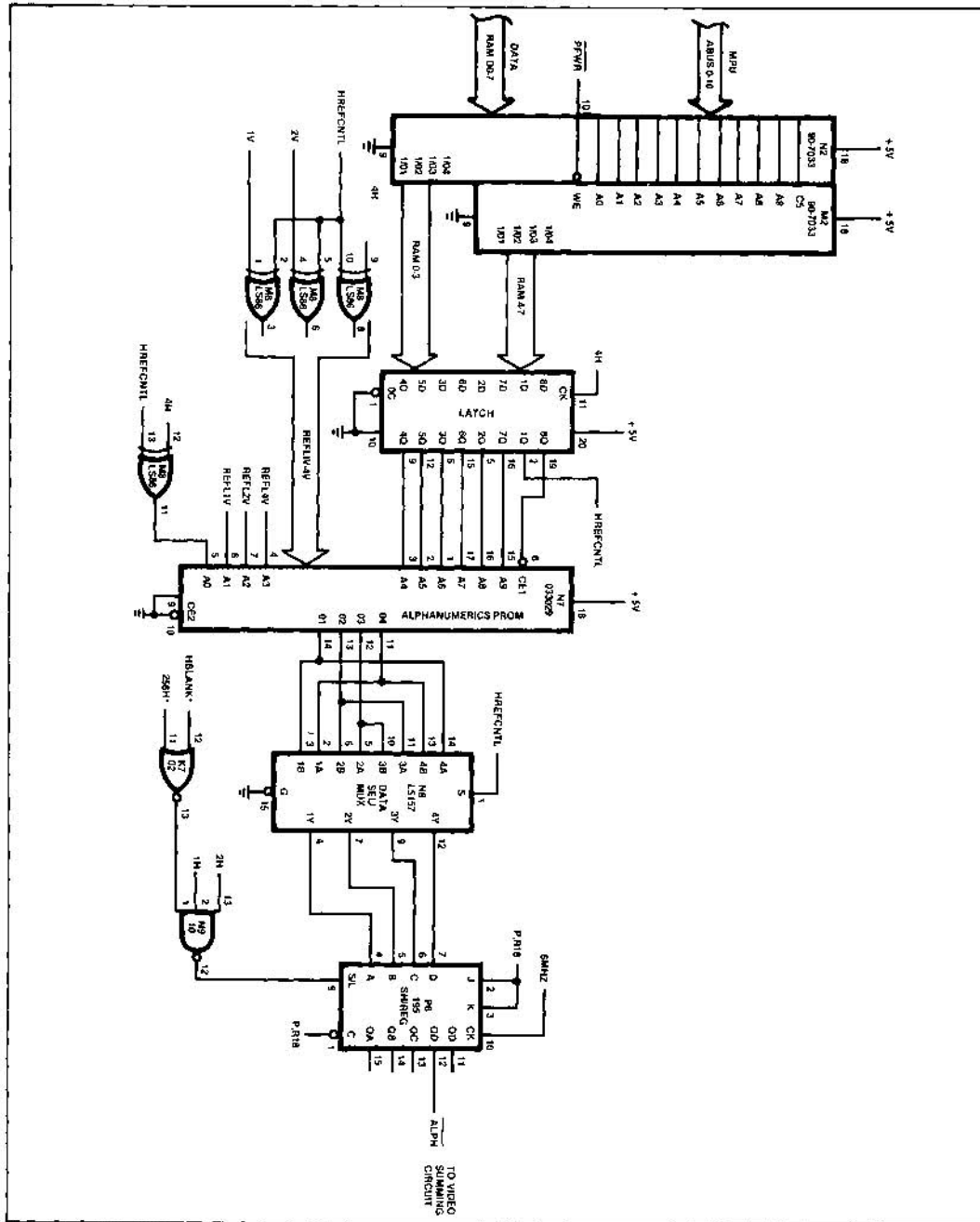
Figure 3-14 Alphanumerics Generator Simplified Schematic Diagram

Refer to the Schematic
diagrams in Appendix A
for appropriate designation
of pin numbers.
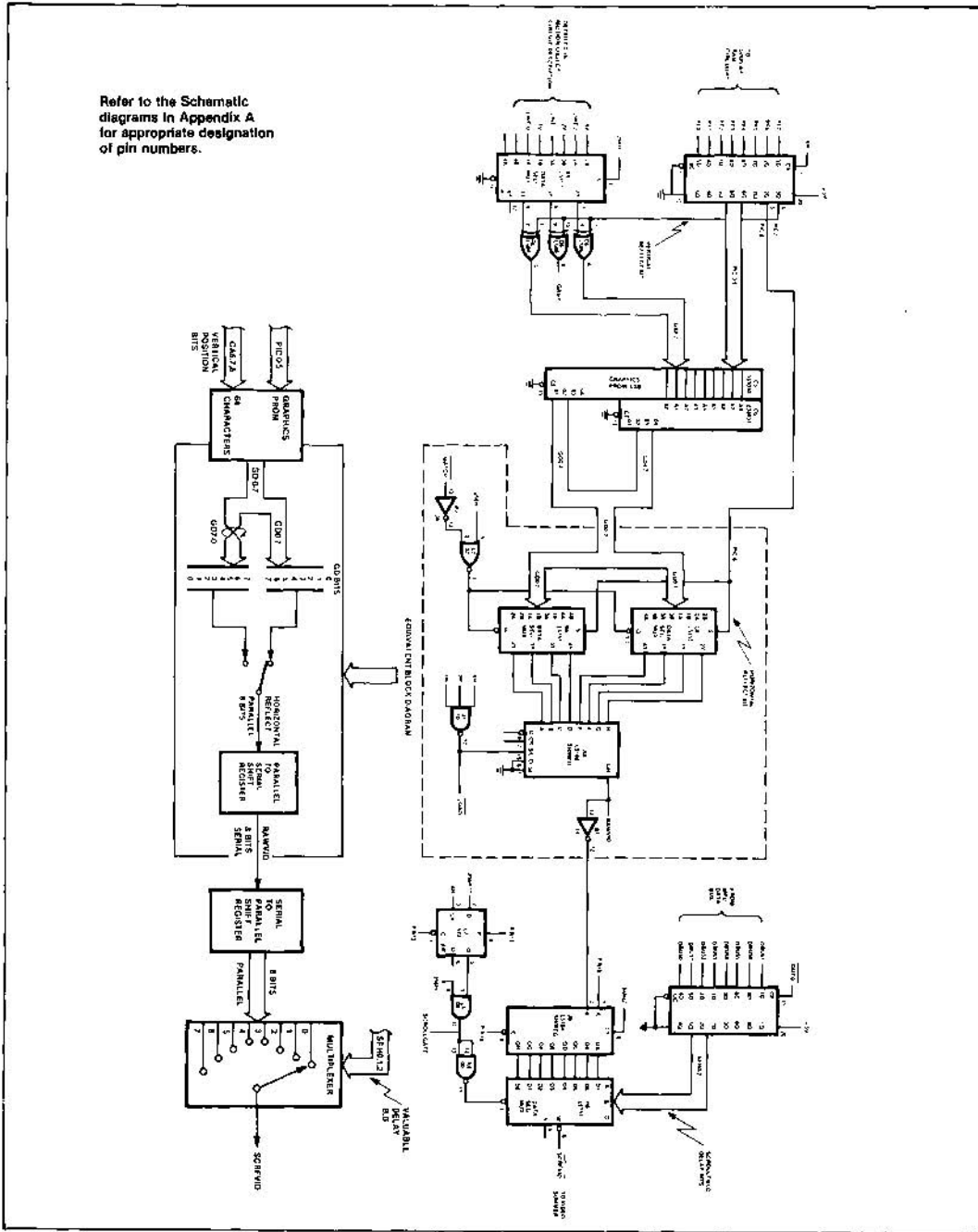
Figure 3-15 Scrollfield Generator Block Diagram and Simplified Schematic
Diagram
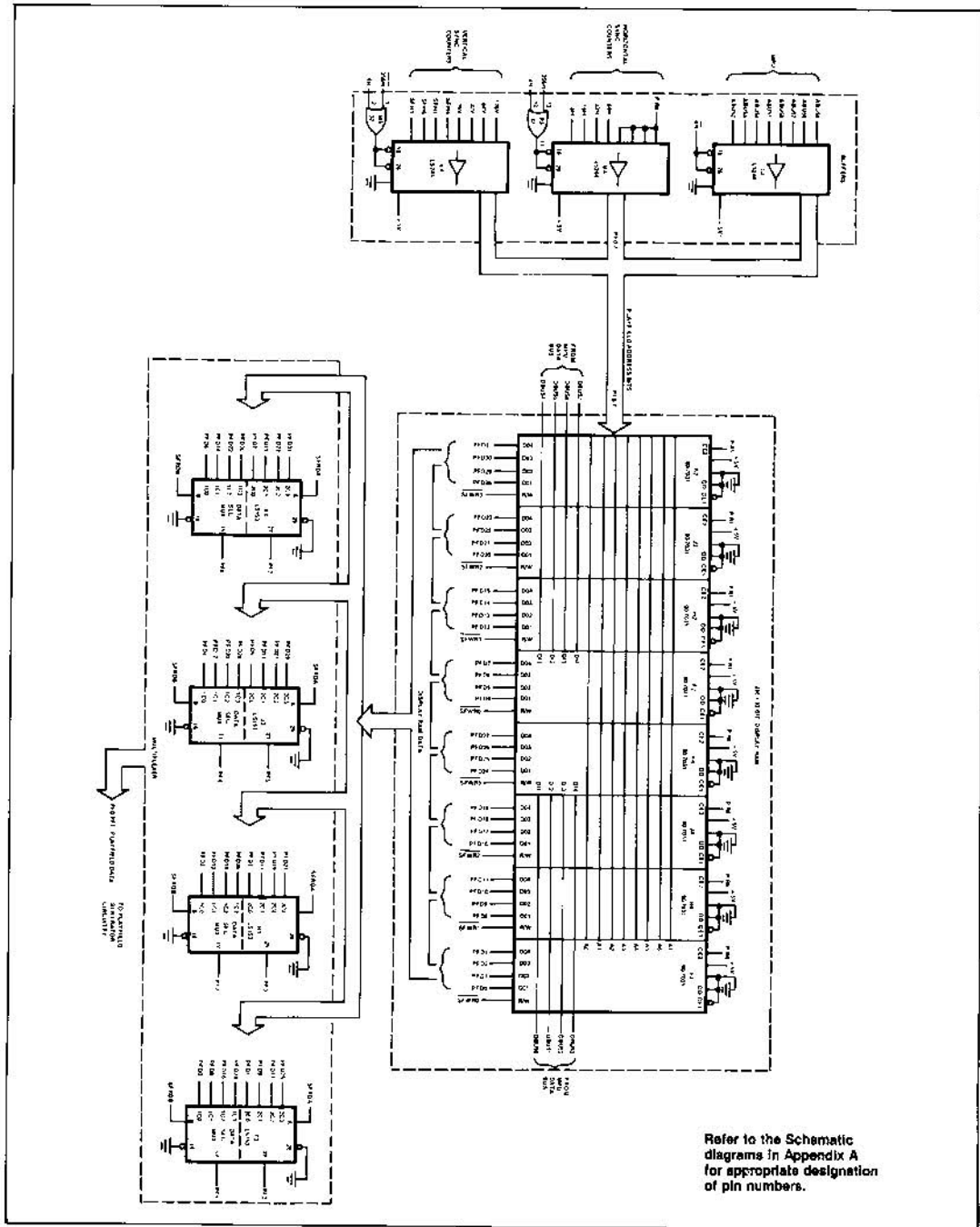
Figure 3-16   Display RAM Simplified Schematic Diagram

Refer to the Schematic
diagrams in Appendix A
for appropriate designation
of pin numbers.

G. MOTION OBJECT GENERATOR

(See Figure 3-17)

The motion object generator produces characters such as the football and the Xs and Os. These motion objects are generated by the same circuitry found in the scrollfield generator (see Figure 3-15), while the actual graphics are permanently stored in PROMs C5 and D5 (see Figure 3-17). This circuitry is used for motion objects when 256H is low, and for scrollfield when 256H is high. The RAWVID signal from the parallel to serial shift register A6 is connected to OR gate K3. This gate ORs the raw video (RAWVID) from the scrollfield circuitry and the data out (DO) from the RAM K6 which   was cleared while the information on that line was being read out. The procedure is as follows for each motion object:

1. The horizontal position is latched at J5. It is used to set counters K5 and J6 to the desired start position.

2. The vertical line number is effectively subtracted from the vertical position by adders F5. The H5 produces a match signal if the object is visible on this scan line. It also produces the LINE 0, LINE 1 and LINE 2 signals which select one of eight scan lines with an object.

3. The LINExx signals, together with the picture code, PIC 0-5, are used by the graphics circuitry to produce the RAMVID as previously discussed.

4. The 8-bits of RAMVID are ORed with any existing data in RAM (K6) from previous objects and placed in the RAM at the address latched in J5, and the next seven serial addresses.

These steps are repeated for each of the 16 motion objects during the time 256H is low. The HCLR signal then resets the K5 and J6 counters. The data is read out of the RAM as MVID while 256H is high. The location is read and its contents are sent to the video circuit. The RAM is cleared by output of AND gate L8 prior to the next data line.

H. TRACKBALL CONTROL AND SWITCH INPUT CIRCUITRY

(See Figure 3-18)

The trackball control and switch input signals are multiplexed as illustrated in Figure 3-19. This multiplexing is accomplished by alternately selecting the mode of operation for the pre-settable counters D9, D10, H10, and H9. When the counter load signal (CTRLD) goes low, it reads the switch status by loading a preset count into the counter inputs (A, B, C, D) and then latching and outputting the data into schmidt device E10. When CTRLD goes high the trackball control signal toggles the counter either in a count up or a count down direction. The counter outputs then are gated via E10. Both trackball and switch signals are then sent to the microprocessor via the data bus (D0 - D7).
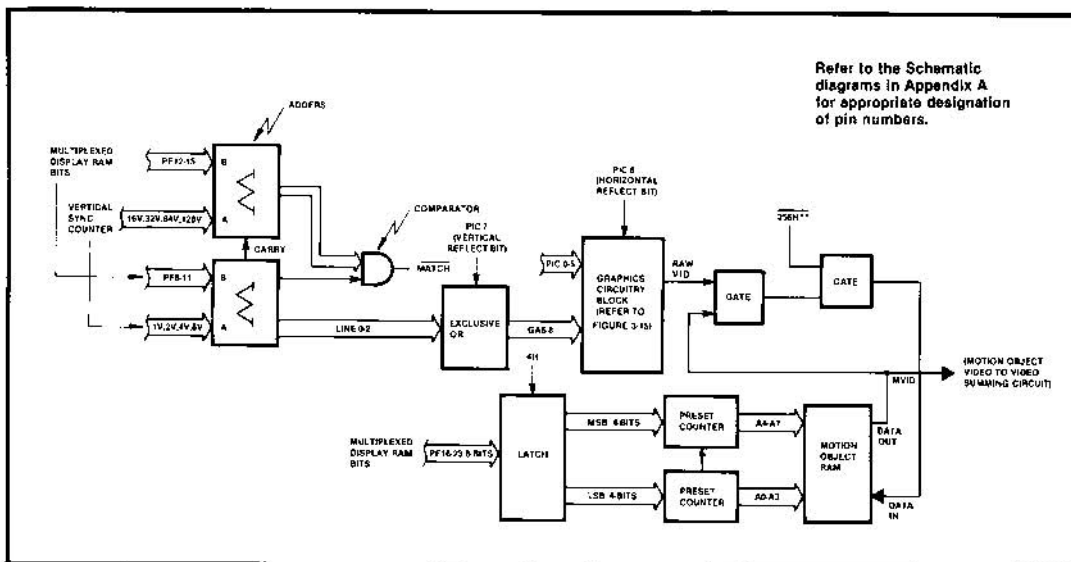
Figure 3-17   Motion Object Generator Block Diagram
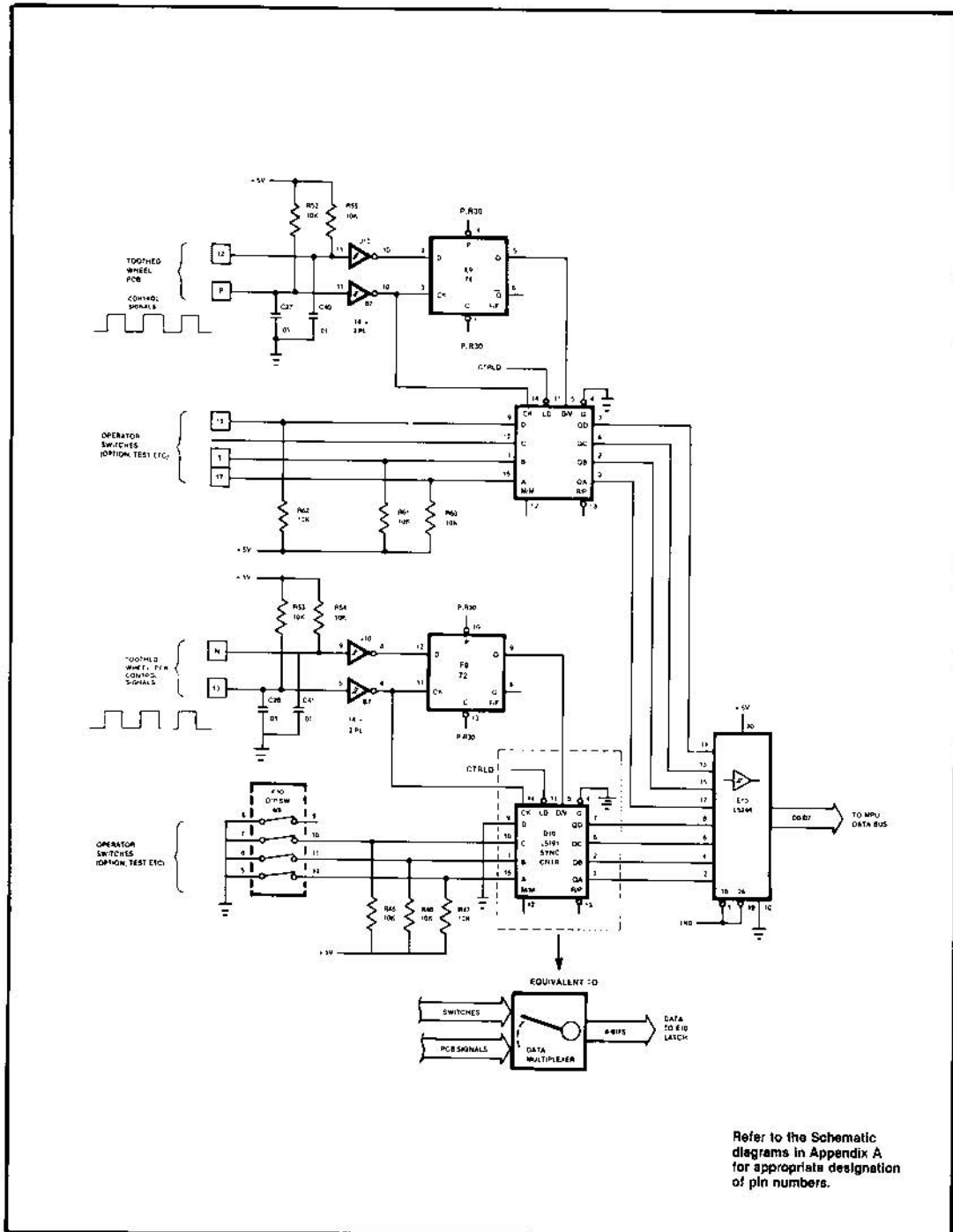
Figure 3-18 Trackball Control and Switch Input Simplified Schematic Diagram

J. VIDEO OUTPUT

(See Figure 3-19)

The video output circuit receives all the video signals (MVID, RAWVID, SCROLLGATE, SCRFVID, ALPHA, and related sync signals) and gates these signals logically summed at the Q1 emitter follower device (2N3643). The signal at the emitter of the transistor then becomes the composite video signal sent to the games TV display monitor.

K. AUDIO GENERATOR AND AMPLIFIER

(See Figure 3-20)

The audio generator produces the crowd whistle and ball sounds. The crowd sound is the result of the gated random noise generator composed of shift registers A8 and B8. The NOISE output of this generator is gated "on" each time the KICKER signal goes low. The KICKER signal is developed by the microprocessor via LATCH F8. The crowd sound volume is automatically controlled by the data bus bits DBUS 0-5. The noise (unfiltered crowd sound) is then filtered by the active band-pass filter circuit comprised of one-half of Op-Amp A9 (LM324). The other half of A9 is the audio mixer which sums the hit, whistle and the crowd sounds. The whistle sound is generated by VCO control bit 1Q of F8 which gates the VCO "on", therefore producing the whistle sound.

The output of the audio mixer A9 is then amplified by the TDA-1004 audio amplifier device. Potentiometer R75 controls the level of audio output.
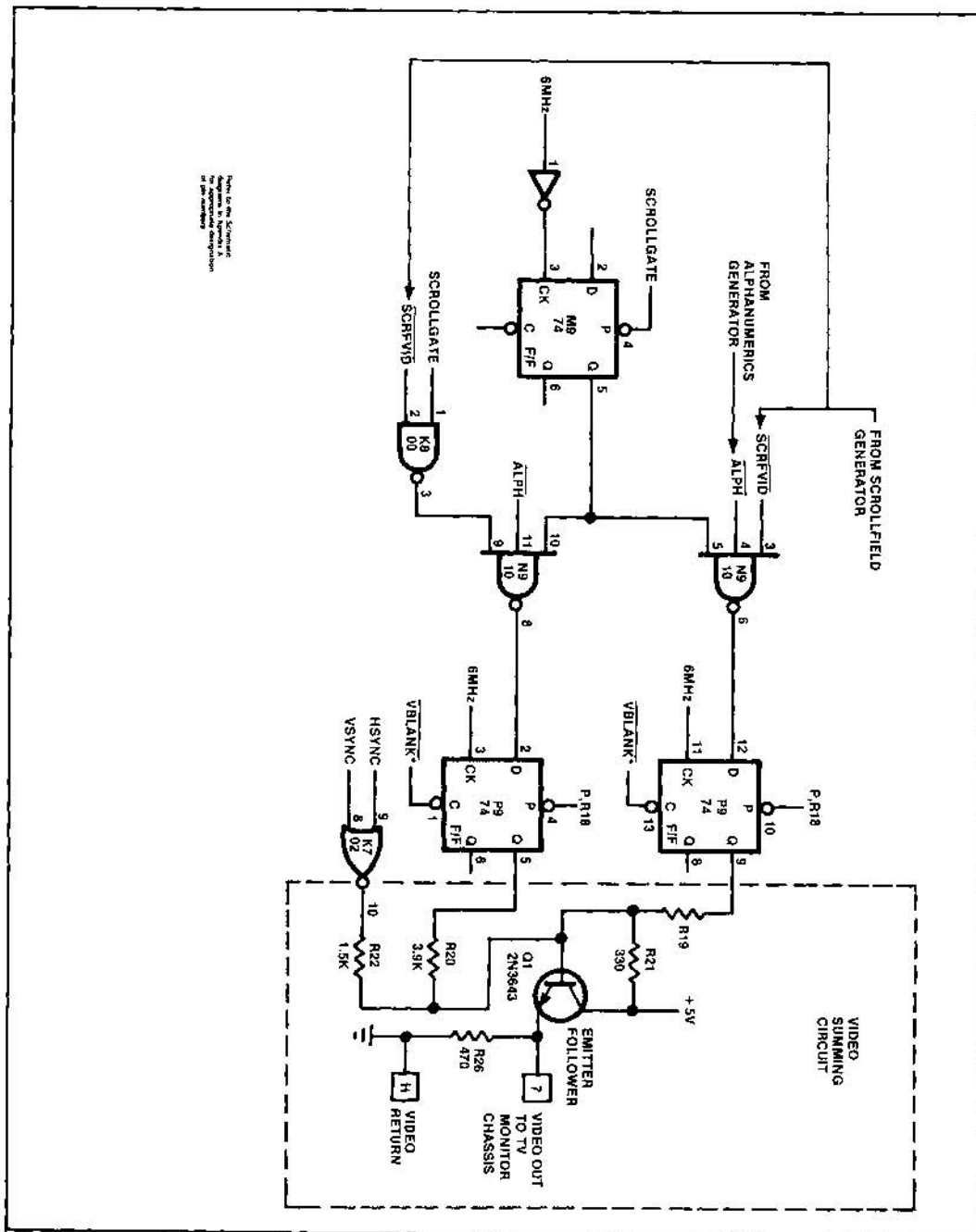
Figure 3-19   Video Circuit Simplified Schematic Diagram
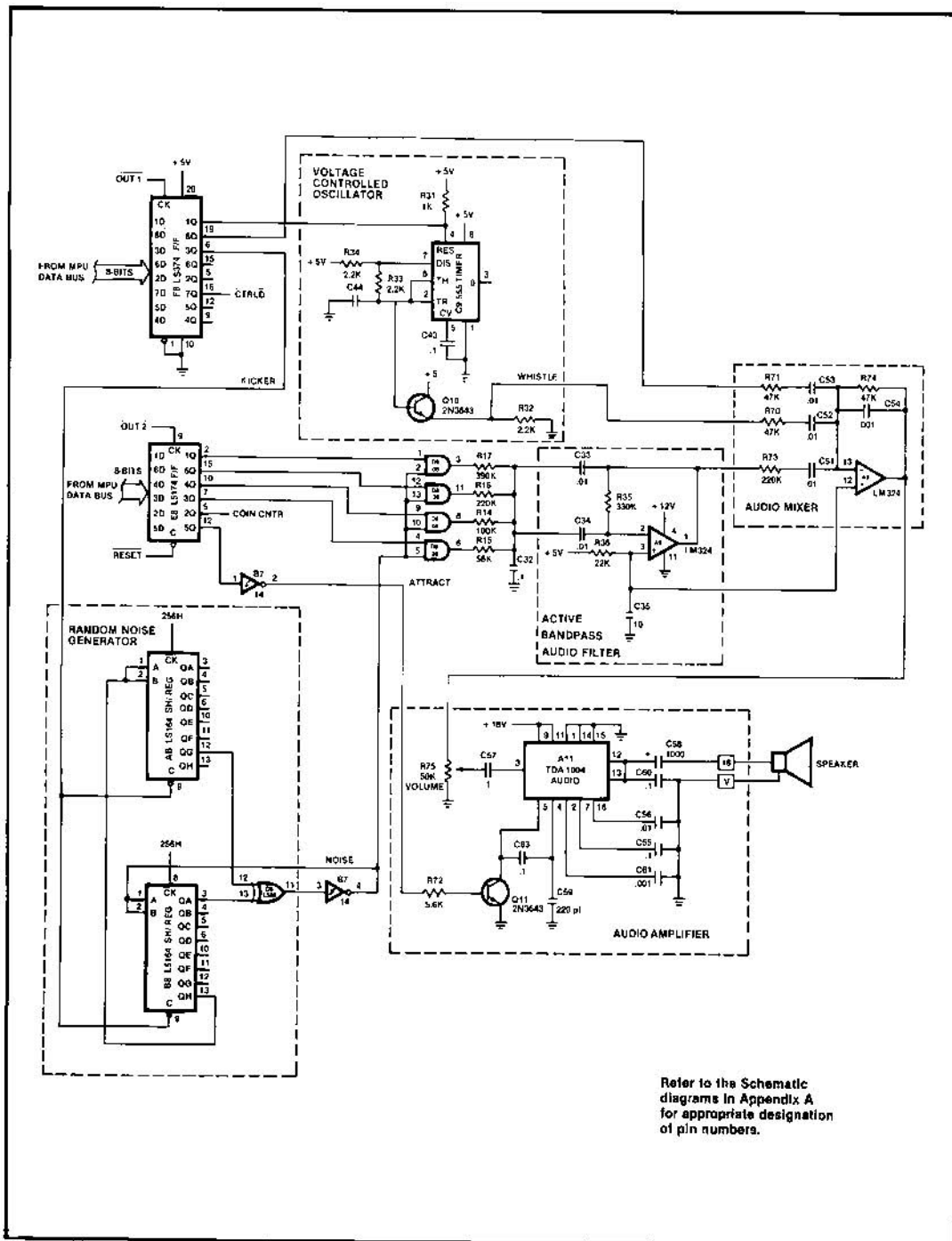
Figure 3-20 Audio Generator and Amplifier Simplified Schematic Diagram

MAINTENANCE AND ADJUSTMENTS

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.

FOOTBALL

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.
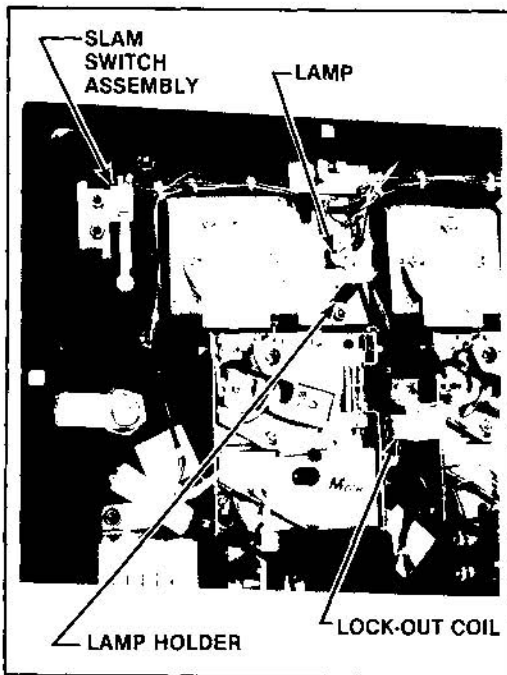
Figure 4-1 Coin Door Assembly
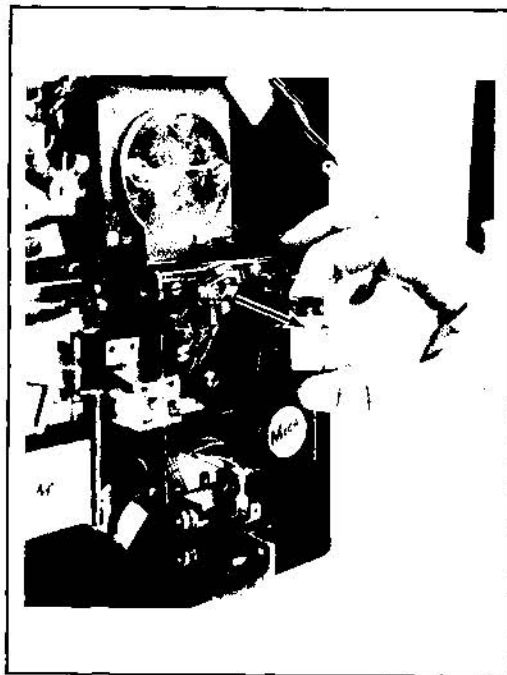
Figure 4-2 Hinging Open the Magnet Gate Assembly
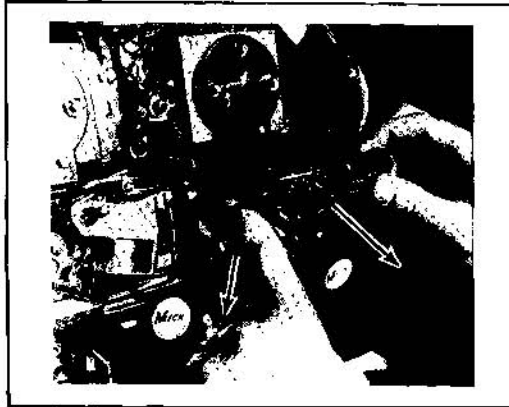
Figure 4-3 Removal of Coin Mechanism

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)
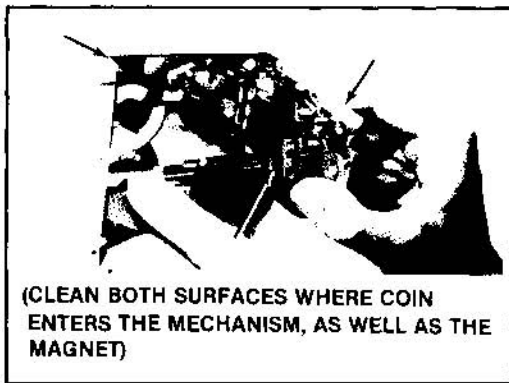
Figure 4-4 Surfaces to Clean Inside the Coin Mechanism

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.
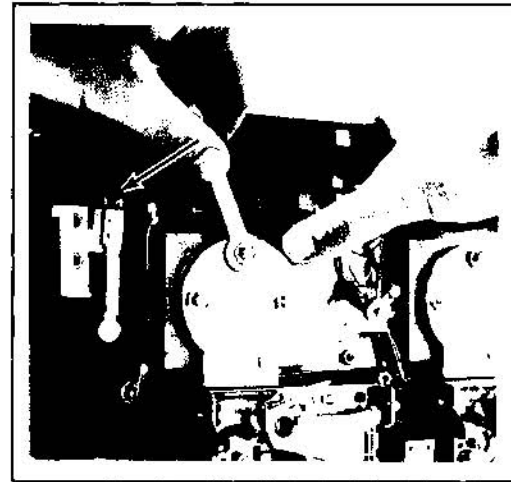
Figure 4-5 Removal of Plate Covering Rear of Coin Slot

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

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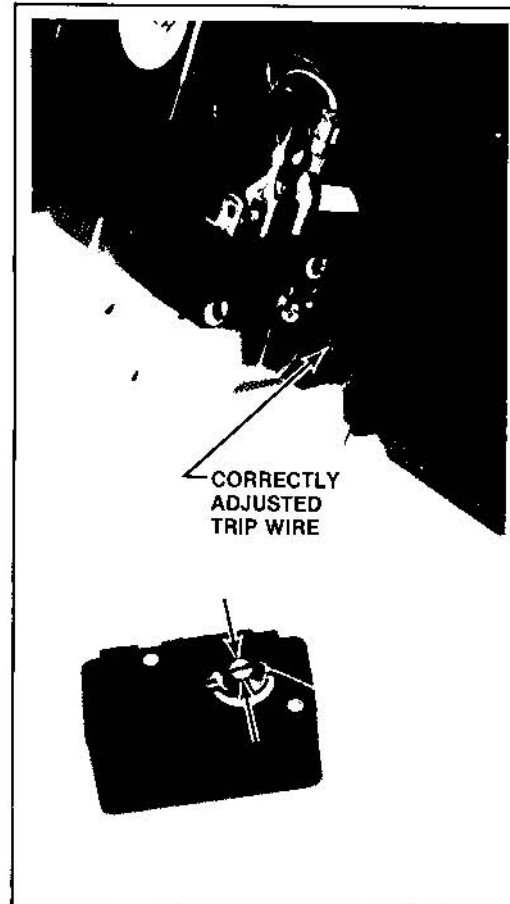
Figure 4-7   Detail View of Coin Switch and Trip Wire

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.

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

---CAUTION---

For best results be sure the game has been turned on for a while before making any TV monitor adjustments

---NOTE---

The TV monitor adjustments are accessible through the access door panel of the game cabinet. These adjustments have to be done while the game is energized. Therefore, only persons familiar with safety measures and repair procedures on electrical equipment should perform them.

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

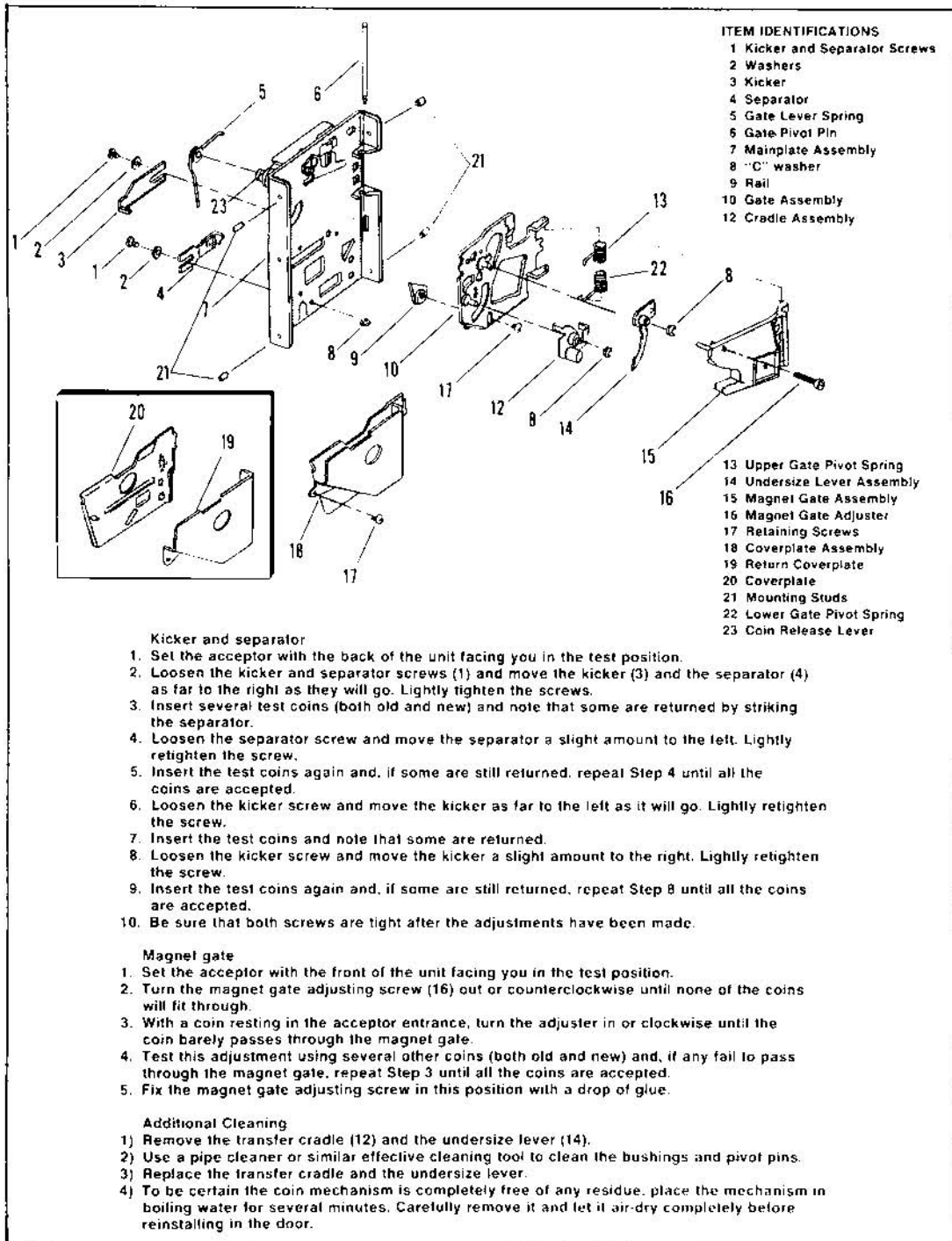The monitor's adjustments function like those of a conventional, home television set, except that the volume adjustment has no effect. Instead, the game produces its sound in circuits separate from the TV monitor. Figure 4-9 shows the location of the adjustments on both TV monitors used by Atari. Your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

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

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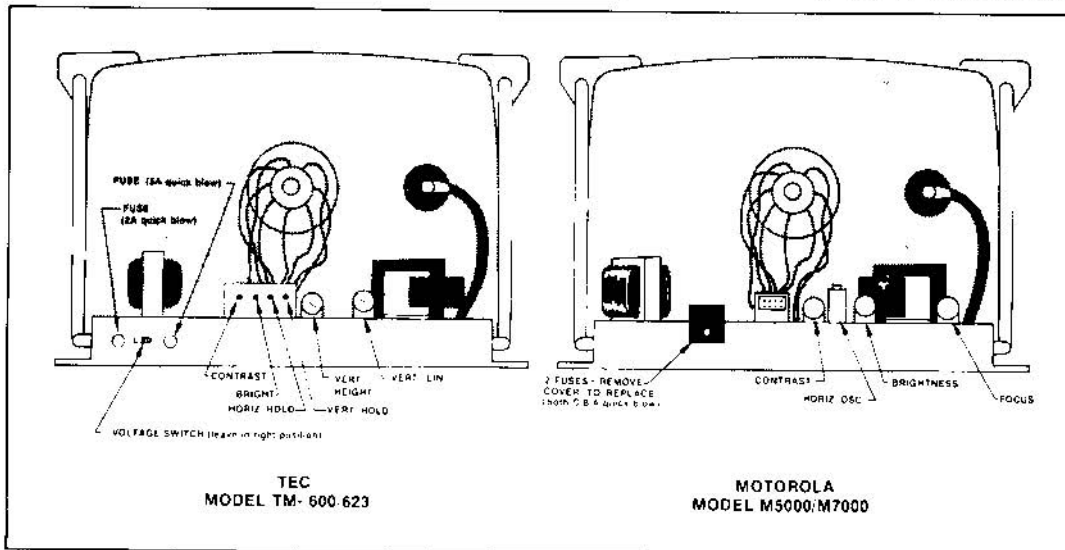
Figure 4-9 Locations of Adjustments on TV Chassis

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
Clip near power supply:
   (shown in harness schematic)
   2.5-amp Slo-Blo

E. CONTROL PANEL REMOVAL (See Figure 4-10)

Prior to replacing any removable component from the control panel, follow the steps outlined in Figure 4-10.

F. TV MONITOR REMOVAL (See Figure

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

G. TRACK BALL ASSEMBLY REMOVAL (See Figure 4-12)

Refer to paragraph E before replacing the track ball assembly.

H. PLAY SELECT BOARD ASSEMBLY REMOVAL (See Figure 4-13)

Refer to paragraph E before replacing the play select board assembly.

CONTROL PANEL REMOVAL

1. Unfasten and remove three allen-head screws from control panel.
2. Swing the control panel open.

Figure 4-10   Control Panel Removal

TV MONITOR REMOVAL

1. Remove control panel located to the right of the coin mechanism as illustrated in Figure 4-10.
2. Remove glass playfield shield.
3. Remove cardboard bezel.
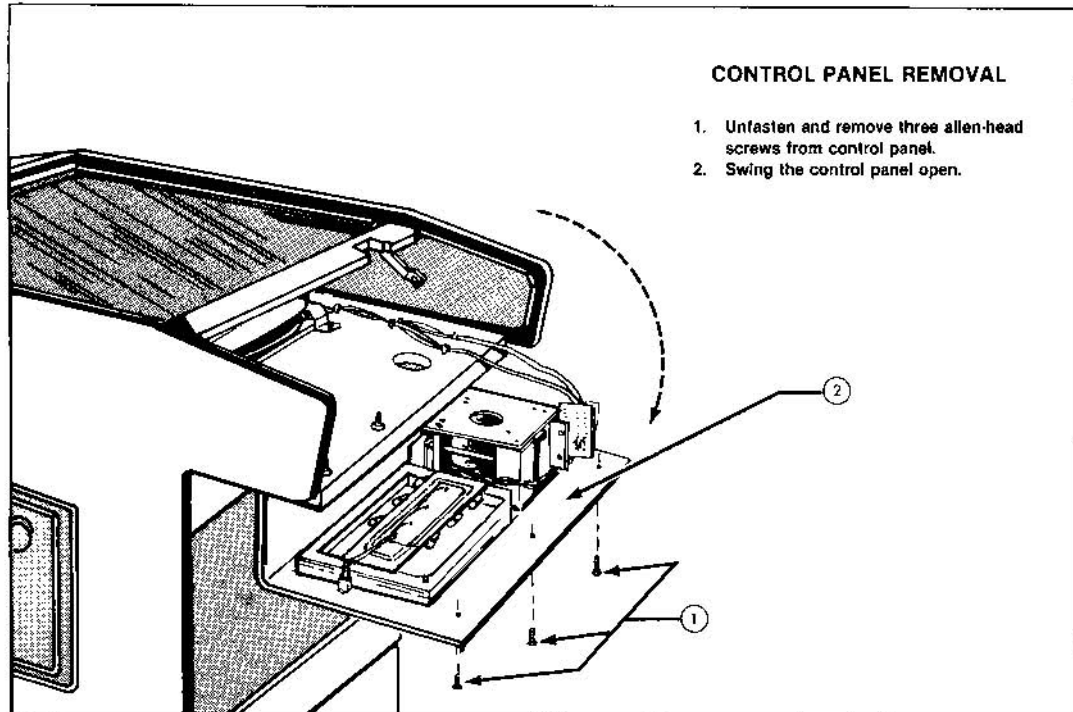4. Open access door.
5. Unplug control panel Molex connectors for both player control panels.
6. Unfasten and remove the two TV monitor carriage bolts.
7. Unplug TV monitor chassis connector.
8. Slide out TV monitor shelf assembly (the opened control panel is attached to the assembly).

Figure 4-11   T.V. Monitor Removal

TRACKBALL ASSEMBLY REMOVAL

1. Remove control panel as illustrated in Figure 4-10.
2. Unfasten and remove three (3) trackball 82° flathead countersink screws from assembly.
3. Remove the trackball assembly.

─── NOTE ───

Normally it is not necessary to remove the entire trackball assembly in order to remove a troublesome component. Therefore the remaining steps instruct on procedure for removing the more troublesome assemblies.

BALL REMOVAL

4. Unfasten and remove four (4) countersink machine screws from trackball assembly top plate.
5. Remove and/or replace the ball.

STEERING CONTROL PCB

6. Unfasten and remove two (2) pan head machine screws associated washers and hex nut from either of two steering PCB assemblies.
7. Remove troublesome PCB assembly.

Figure 4-12   Track Ball Assembly Removal

PLAY SELECT BOARD ASSEMBLY REMOVAL

1. Remove control panel as illustrated in Figure 4-10.
2. Unfasten and remove two pan head machine screws.
3. Unplug Molex connector.
4. Remove board.
5. Replace lamp if necessary.
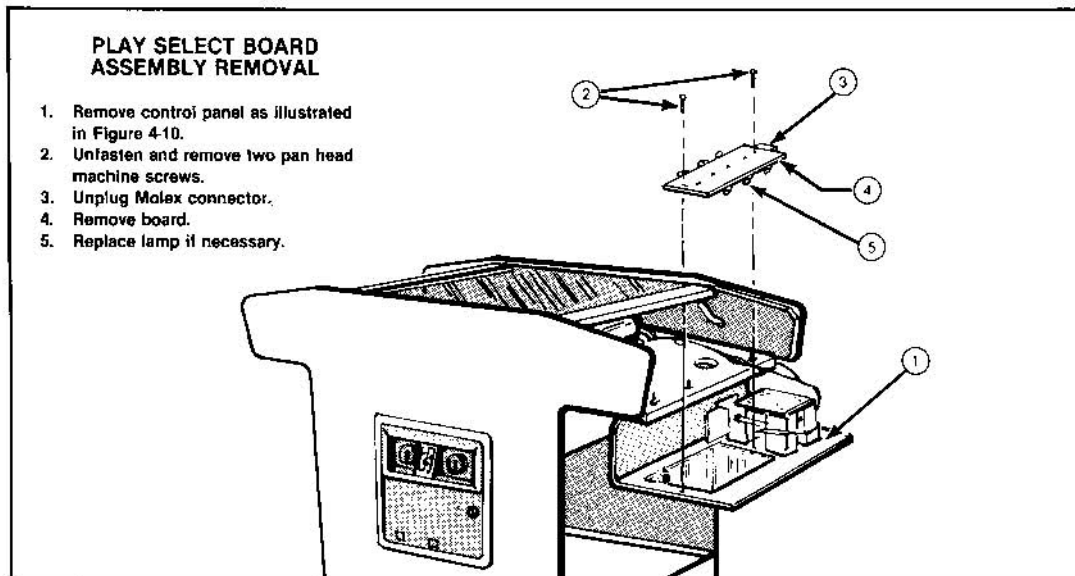
Figure 4-13 Play Select Board Assembly Removal

NORMALLY CLOSED
(N.C.) CONTACTS

CONTROL
PANEL

LED
SWITCH

TURN
COUNTERCLOCKWISE
TO REMOVE

LIGHT-EMITTING DIODE
(L.E.D.) CONTACTS

NORMALLY OPEN
(N.O.) CONTACTS

• Remove all wires from the suspected switch.
• Turn the switch counterclockwise while holding the cone-shaped nut on the outside of the game cabinet.
• Install a new switch using the reverse procedure.
• Reconnect the harness wires.

N.C.   N.C.

N.O.   N.O

DOUBLE-POLE SINGLE-THROW
(DPST) SWITCH WITH
INTERNAL LED
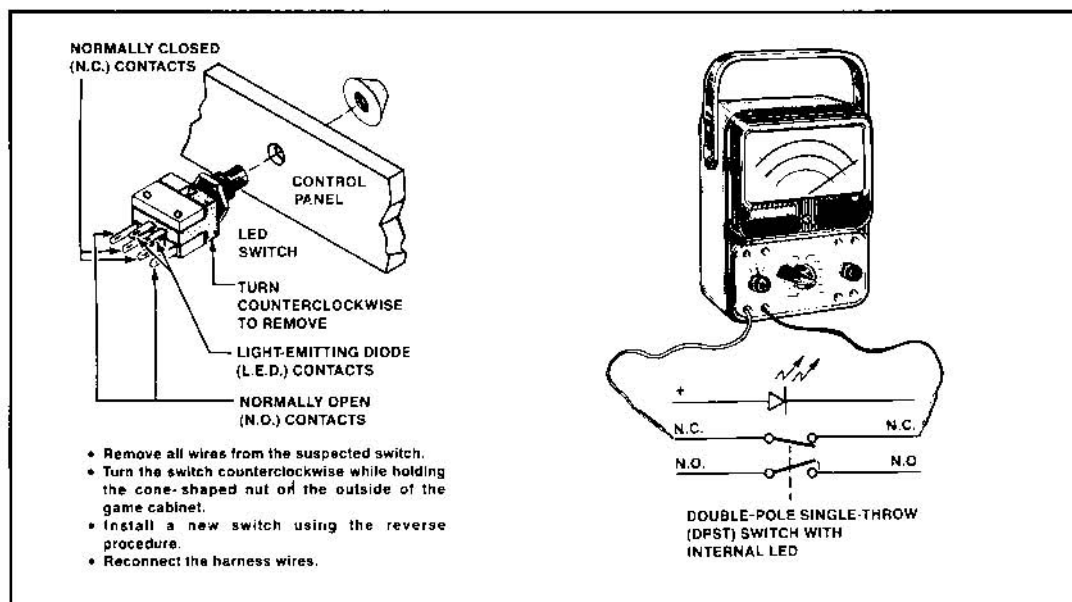
Figure 4-14   LED (LICON) Play Select Pass Switch Removal

J. LED (LICON) PLAY SELECT/PASS SWITCH REMOVAL (See Figure 4-14)

Refer to paragraph F before replacing the LED play select/pass pushbutton switch.

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 4-14 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 4-14.

K. BASE ASSEMBLY REMOVAL (See Figure 4-15)

The base assembly to the cabinet may be removed when desired. For example, by removing the cabinet base assembly, the playfield is lower, therefore facilitating the placement of lounge chairs near the player controls like with other Atari cocktail table games.
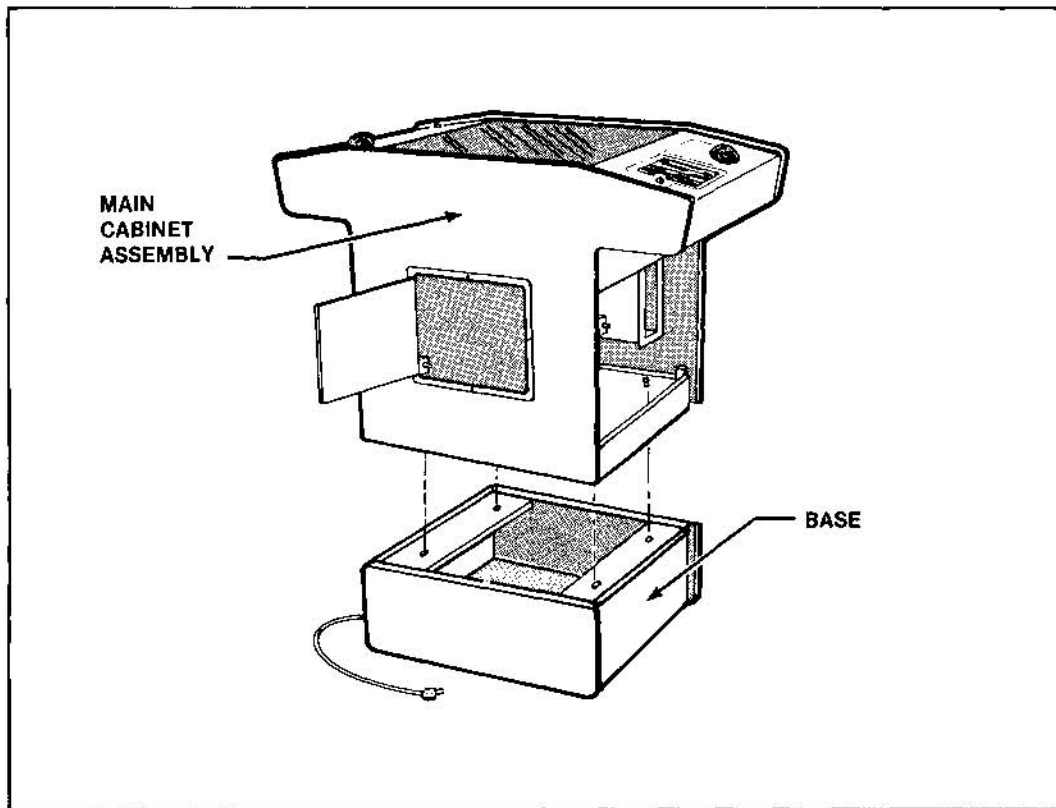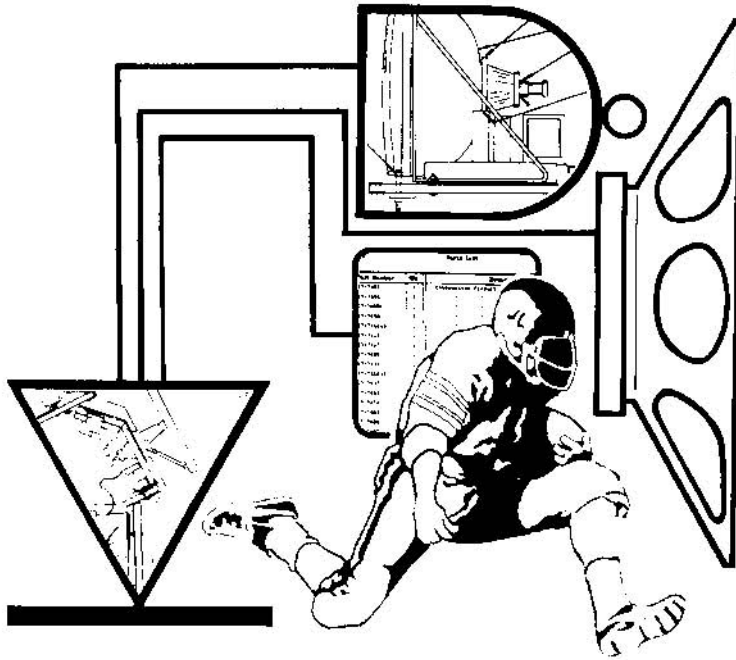

Figure 4-15   Base Assembly Removal

ILLUSTRATED PARTS CATALOG

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

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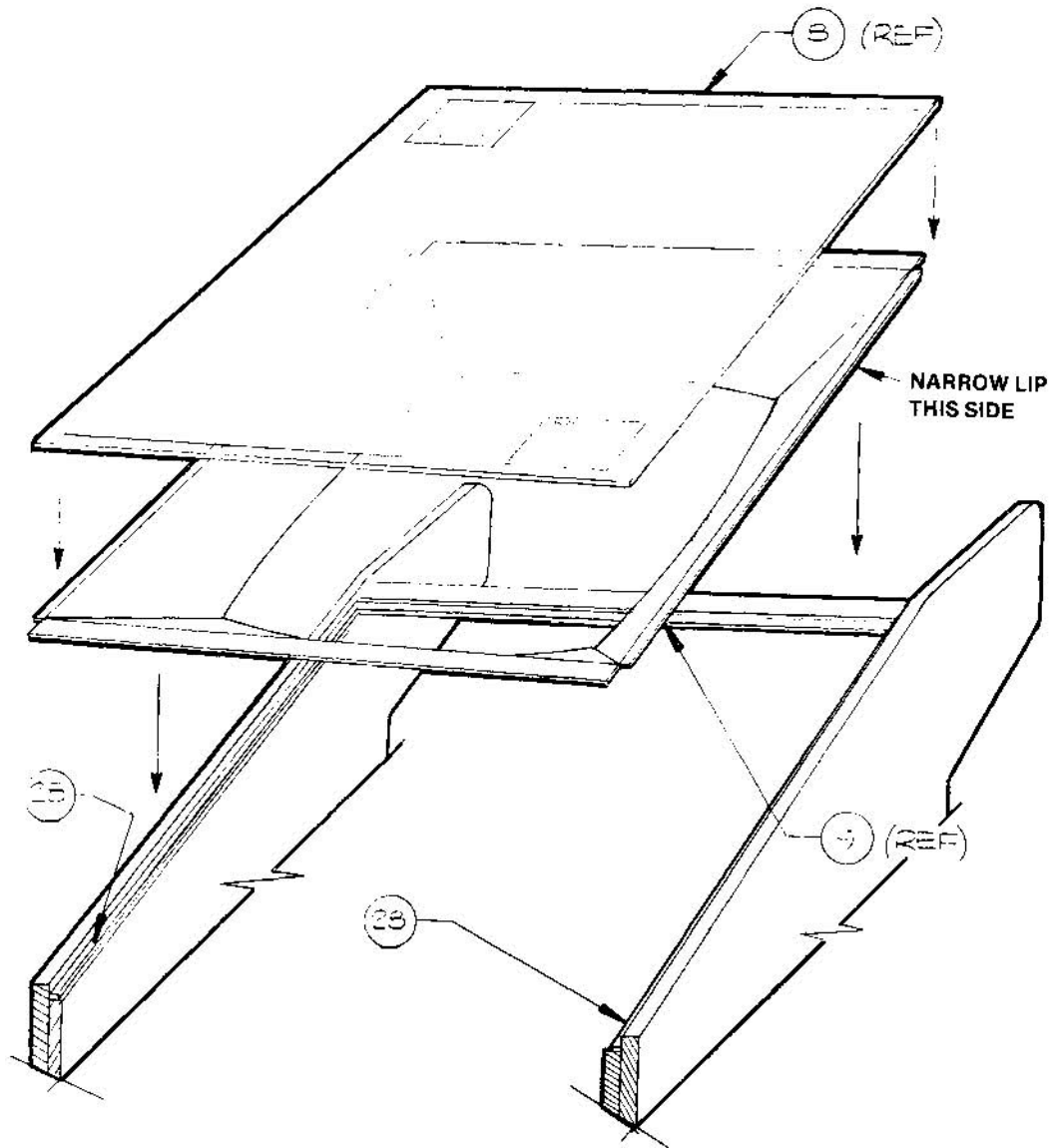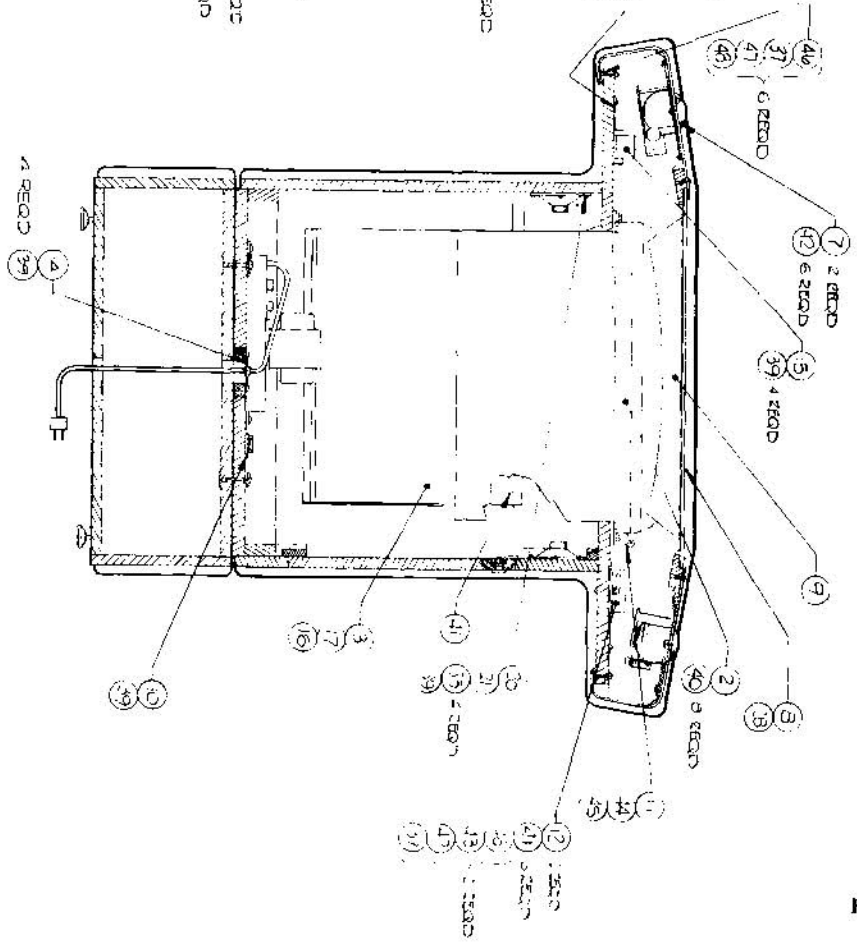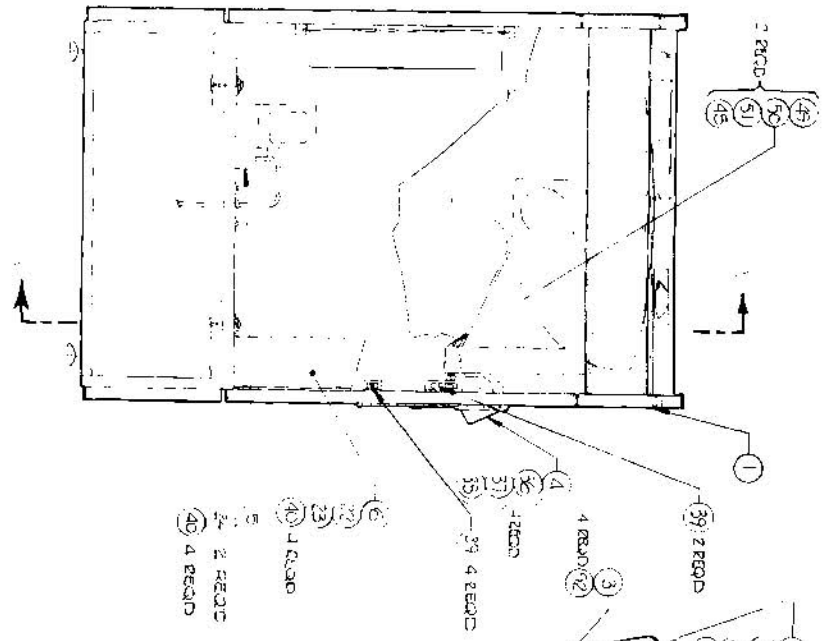
FOOTBALL

8 (REF)

NARROW LIP
THIS SIDE

25

28

9 (REF)

Figure 5-1   Football Final Assembly
A033580-01   D

5-2 FOOTBALL

THE FOLLOWING ITEMS ARE NOT SHOWN (19) (25) (26) (27)

SECTION A-A

FOOTBALL 5-3

ATARI®

Figure 5-1 Football Final Assembly
Parts List

Item	Part Number	Qty.	Description
1	A033529-01	1	Cabinet Assy. with Graphics
2	A033578-01	1	Assy., Monitor
3	A030867-01	1	Assy., R.F. Shield Enclosure
4	A009083-01	1	Coin Door Final Assy.
5	A007197-01	1	Power Supply Assy.
6	009549-01	1	Coin Door
7	A033582-01	2	Assy., Control Panel with Graphics
8	033588-01	1	Shield with Graphics
9	033477-01	1	Bezel with Graphics
10	46-2022502	1	Fuse, 2.5 AMP (Slow Blow)
11	033098-01	1	Stop
12	002728-01	2	Bracket, Panel, Mounting
13	004131-02	1	Fan Grill Mesh
14	A022016-01	1	Strain Relief Power Cord Assy.
15	007103-01	1	On-Off Switch Cover
16	A030978-01	1	Assy., Atari Football P.C.B.
17	A033254-01	1	Assy., R.F. P.C.B.
18	A033323-02	1	Main Harness and Component Assy.
19			
20	48-004	1	Speaker, 5"
21	000869-01	1	Speaker Grill
22	032570-01	1	Coin Box Enclosure
23	A009548-01	1	Assy., Coin Box Lid
24	46-202302	2	Fuse, 3 AMP (Slow Blow)
25	005233-01	1	Rear Door Seal
26	033613-01	1	Bag, Instruction Manual
27	TM-126	1	Tech Manual and IPC
28	78-13025	A/R	3M Sealer 5354
35	73-77015	4	Rivet, 3/16 × .68 (Black)
36	75-5516B	4	Bolt, Carr., ¼"-20 × 1.00 Lg (Black)
37	75-015S	12	Washer, Flat, ¼"
38	75-990505S	4	Nut, Lock, Shallow Pat., Nylon ¼"
39	72-6610S	23	Screw, S.M.P.H., Phil., #6 × 5/8" Lg.
40	72-6812S	8	Screw, S.M.P.H., Phil., #8 × 3/4" Lg.
41	72-6810S	6	Screw, S.M.P.H., Phil., #8 × 5/8" Lg.
42	82-8516	6	Screw, Mach., Allen, Button Hd., ¼-20 × 1.00 Lg.
43	75-935	2	Wingnut, Steel, ¼"-20
44	72-6012S	1	Screw, S.M.P.H., Phil., #10 × 3/4" Lg.
45	75-010S	3	Washer, Flat, #10 (Steel)
46	75-5520B	8	Carr. Bolt, ¼"-20 × 1.25" Lg. (Black)
47	75-045S	2	Washer, Splitlock, ¼"
48	75-915	6	Nut, Mach., Hex, ¼"-20
49	75-931	8	Wingnut, Steel, 10-24
50	75-5120B	2	Bolt, Carriage, 10-24 × 1.25 Lg.
51	75-040S	2	Washer, Splitlock #10
52	72-6608S	4	Screw, S.M.P.H., Phil., #6 × ½" Lg.

APPLY R.T.V SILICONE RUBBER (GE 108 OR
EQUIV) AS SHOWN, ON ONE SIDE.
LOCATION OF COPYRIGHT DECAL MAY
CHANGE AT THE DISCRETION OF MANUFAC-
TURING.

Figure 5-2   TV Monitor Assembly
A033578-01   D

FOOTBALL   5-5

Figure 5-2   TV Monitor Assembly
Parts List

Item	Part Number	Qty.	Description
1	A033065-01	1	Assy, Monitor Support
2	90-032	1	Monitor 23" Diagonal Black and White
3	005594-01	4	Monitor Tie-Down Brkt.
4	48-004	1	Speaker 5"
5	000869-01	1	Speaker Grill
6	73-77015	8	Rivet 3/16 × .68 (Black)
7	72-6610S	6	Screw SMPH #6 × 5/8" Lg.
8	72-6812S	8	Screw SMPH #8 × 3/4" Lg.
9	006313-03	1	Copyright Decal 1978
10	004131-02	1	Fan Grill, Mesh
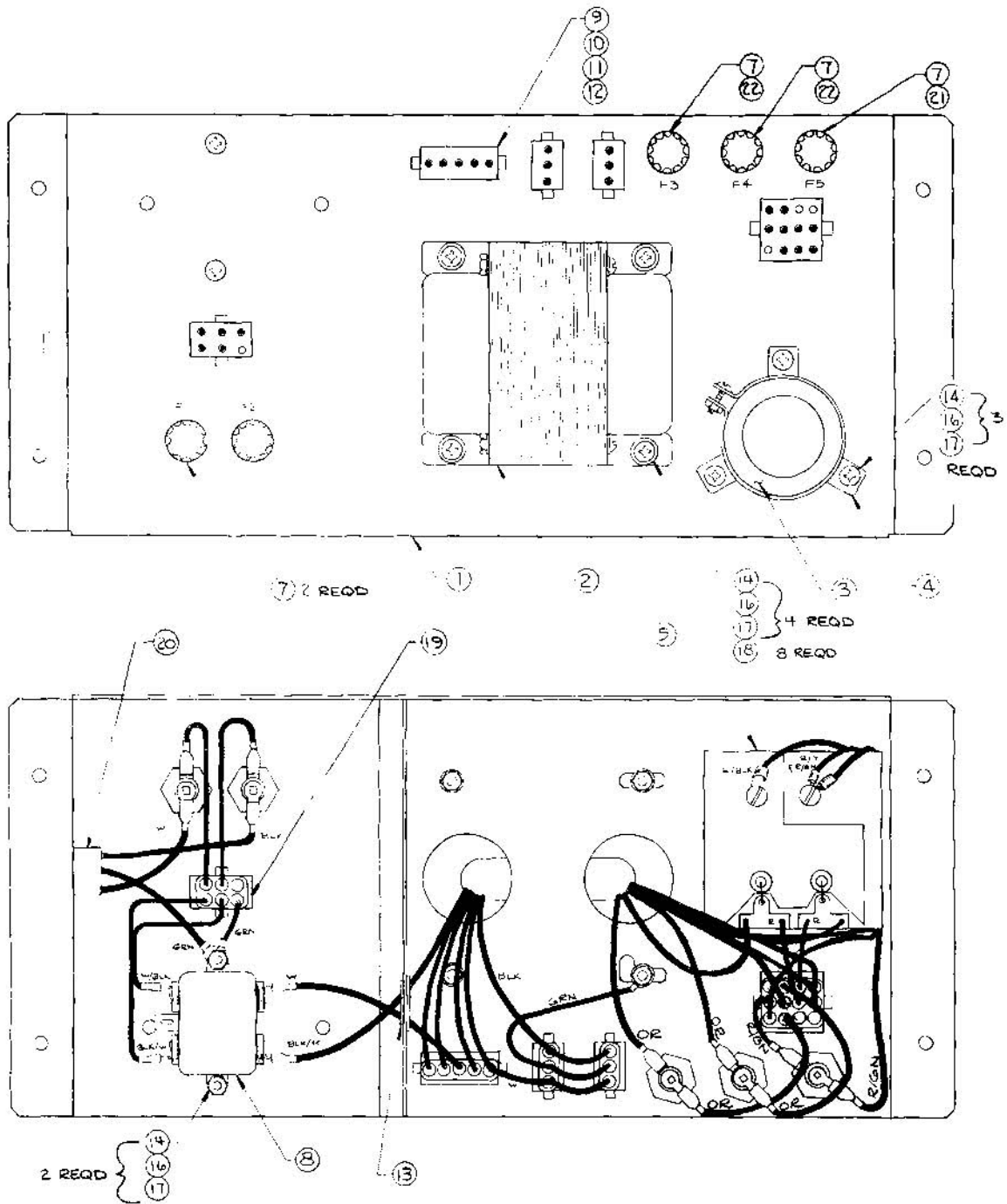
Figure 5-3 Type B Power Supply
A007197-01 D

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 $\times$ 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
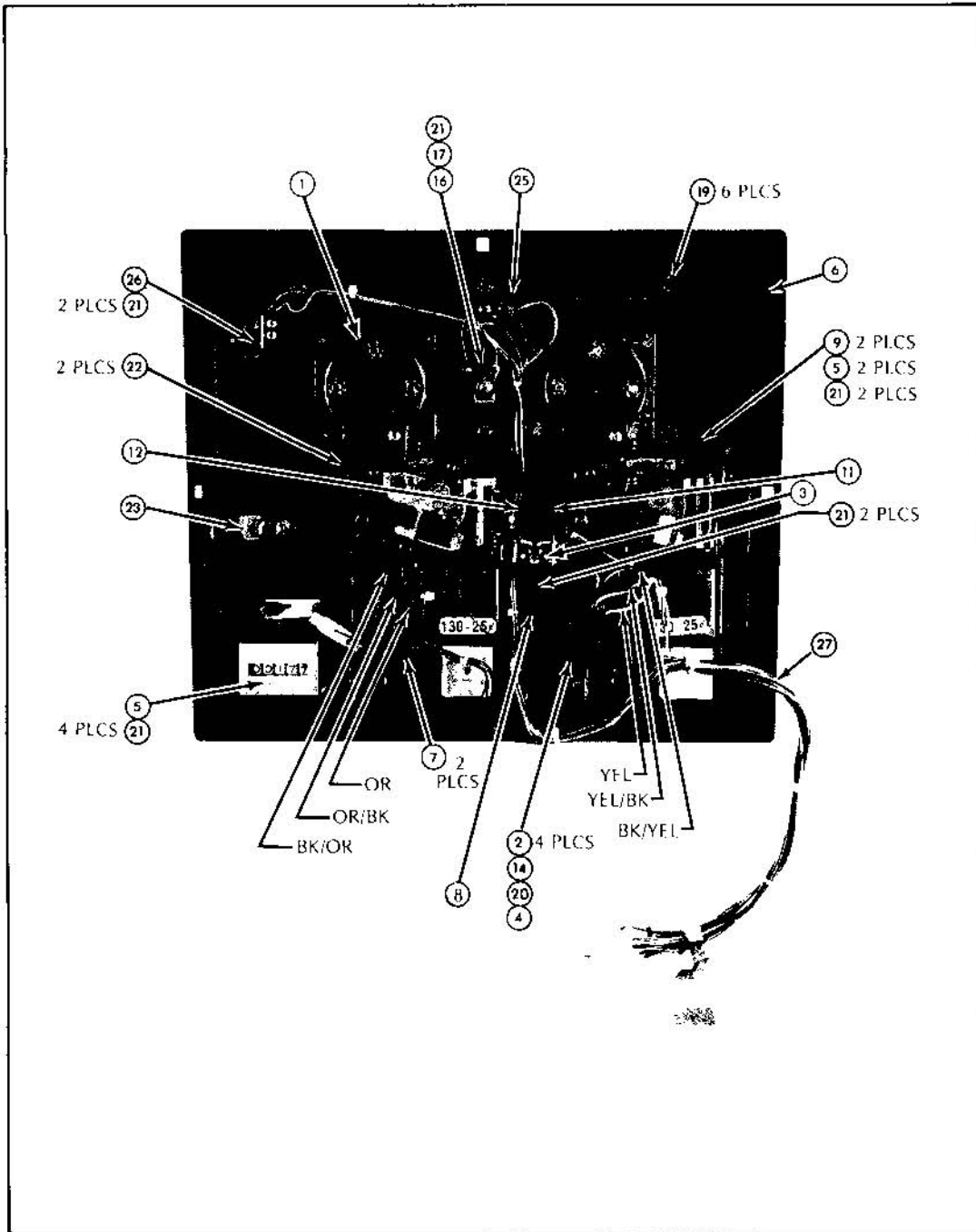
Figure 5-4 Coin Door Assembly   A009083-01   F

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

ATARI®
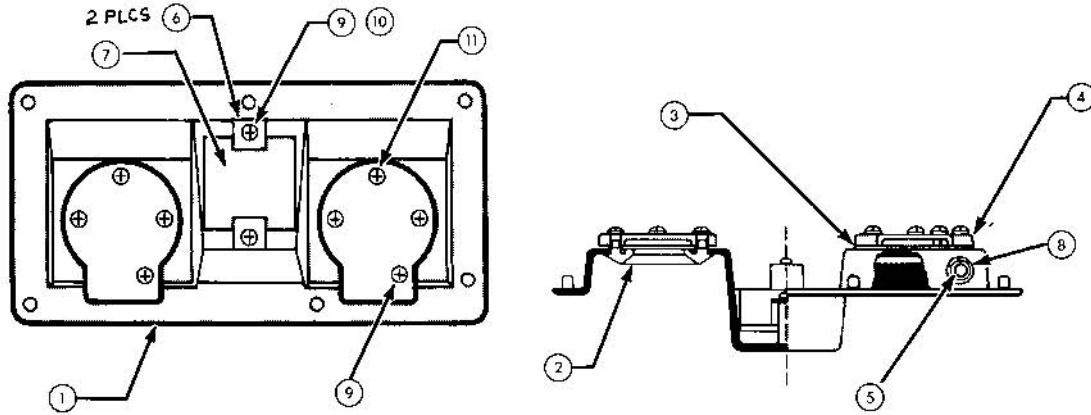
Item	Part Number	Qty.	Description
1	004328-01	1	Bezel
2	See below	2	Ring
3	004331-01	2	Coin Shield
4	004332-01	2	Primary Coin Chute
5	004327-01	2	Bearing, Scavenger Button
6	004329-01	2	Clamp, Price Plate
7	See Below	1	Price Plate
8	73-3009	2	Retaining "C" Ring, Truarc #5103-37
9	72-1604S	4	Mach. Scr., 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.

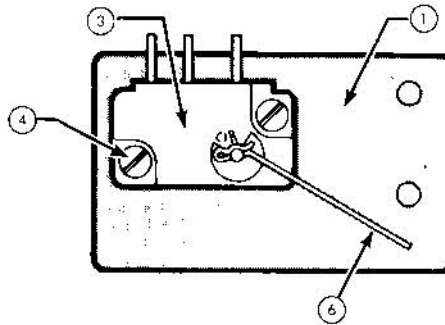Figure 5-5 Front Bezel Assembly
A007637-01 thru -07   D
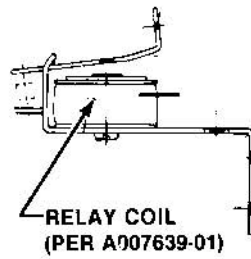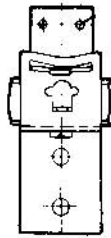
NOTES:

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

2. Manufacturer: Coin Mech, Inc.

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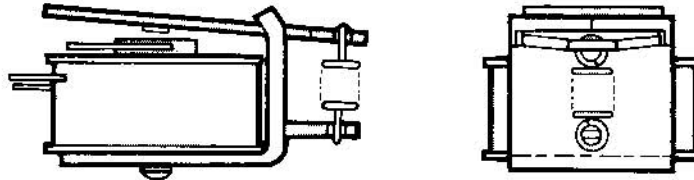
Figure 5-6   Coin Lockout Assembly
A030362-01   A

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 × ¾LG Roll-Tight Self-Tapping	2
5			
6	008824-01	Wireform, Cherry	1

Figure 5-7   Coin Switch Assembly
A007640-01   D
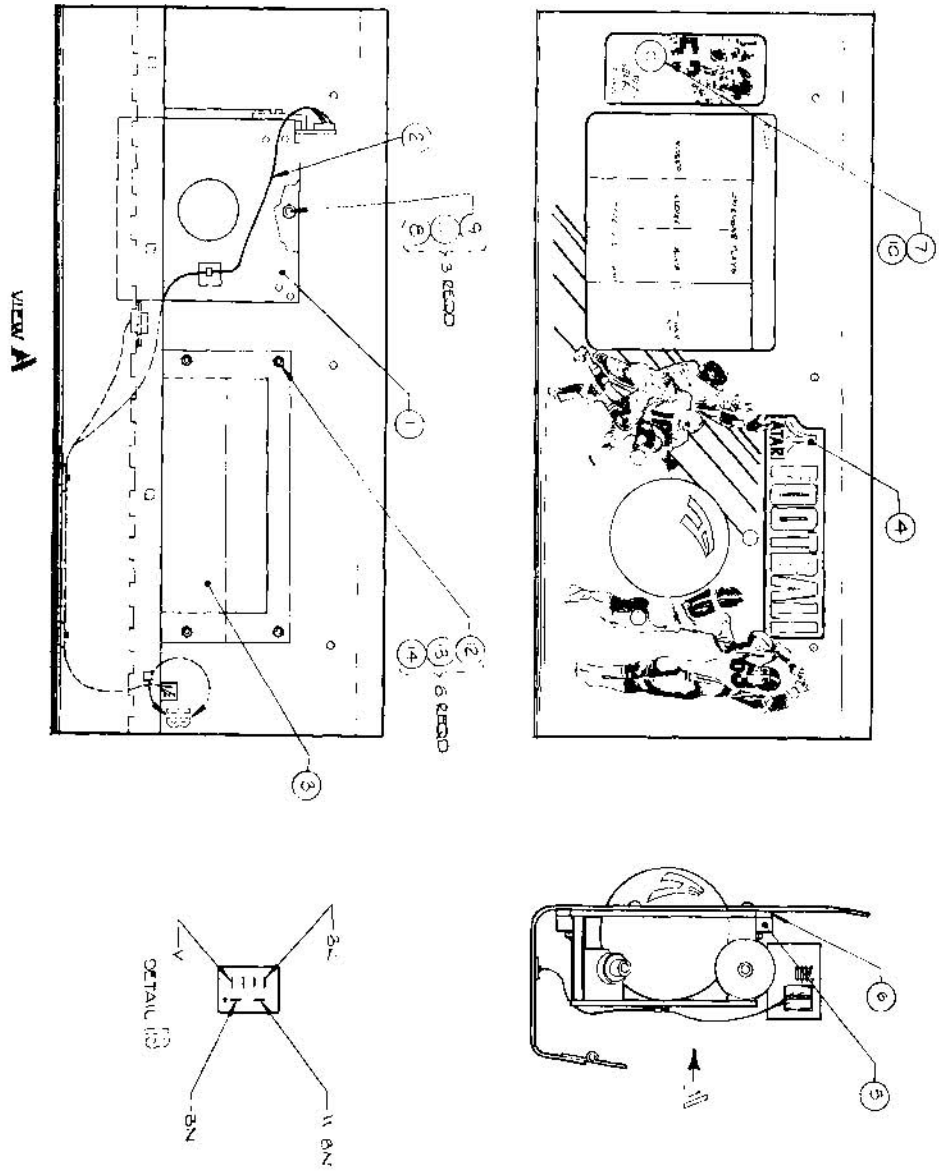
Figure 5-8   Control Panel Assembly
A033582-01   D

Figure 5-8   Control Panel Assembly
Parts List

Item	Part Number	Qty.	Description
1	A033360-01	1	Assy., Trackball
2	A033324-01	1	Assy., Control Harness
3	A033729-01	1	Assy., P.C.B.
4	033346-01	1	Control Panel with Graphics
5	033097-01	1	Support, Play Selection Panel
6	033345-01	1	Panel, Play Select with Graphics
7	001856-01	1	Bushing, Alum.
8	75-990505S	3	Nut, Hex, ¼-20 Nylon Locking
9	75-5512N	3	Bolt, Carriage, ¼-20 × 3/4" Lg.
10	62-002	1	LED Switch, Lighted
11	75-015S	3	Washer, Flat, ¼"
12	75-040S	6	Washer, Splitlock, #10
13	75-910S	6	Nut, Hex, #10-32
14	75-010S	6	Washer, Flat, #10
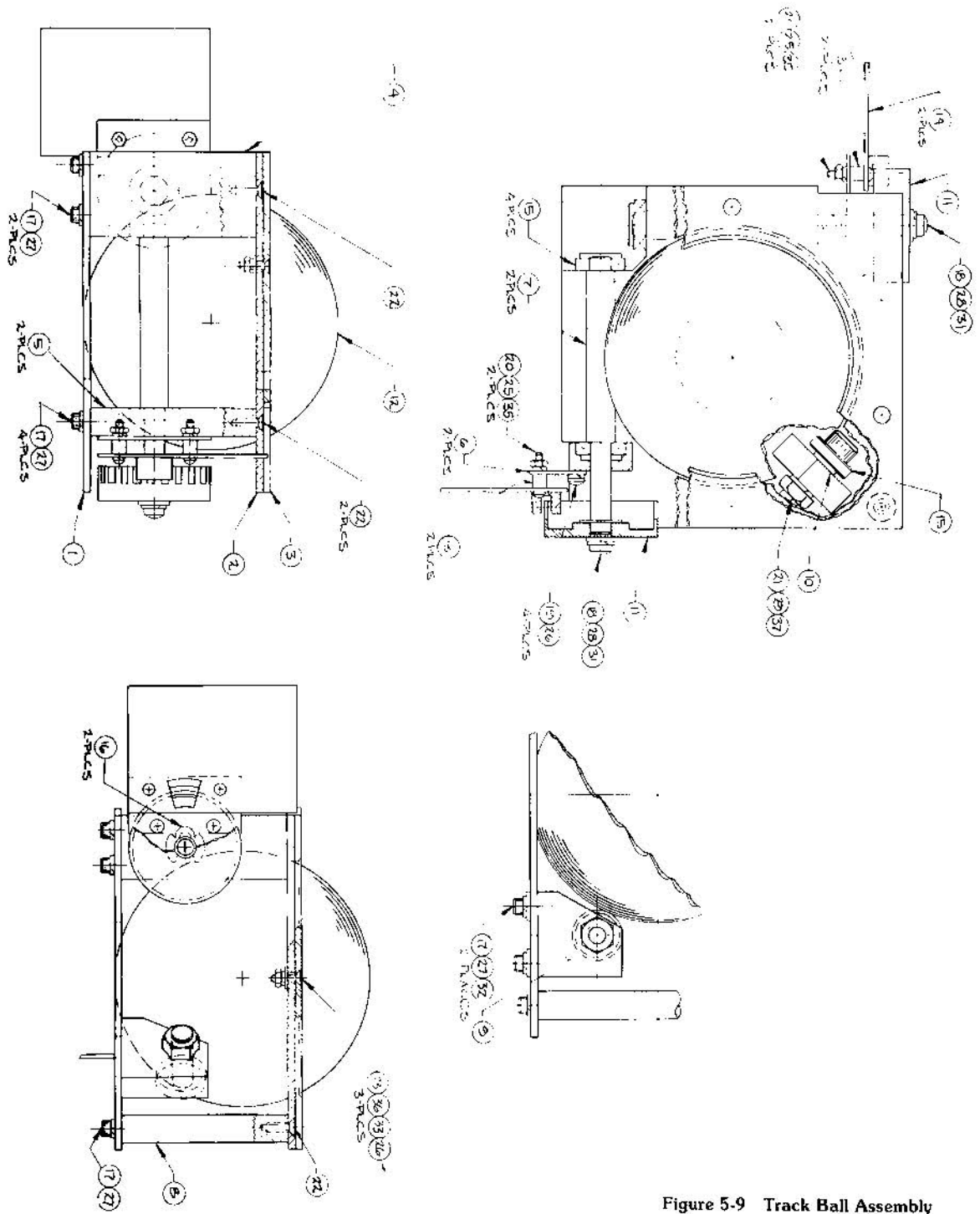
Figure 5-9   Track Ball Assembly
033360-01   D

Figure 5-9   Track Ball Assembly
Parts List

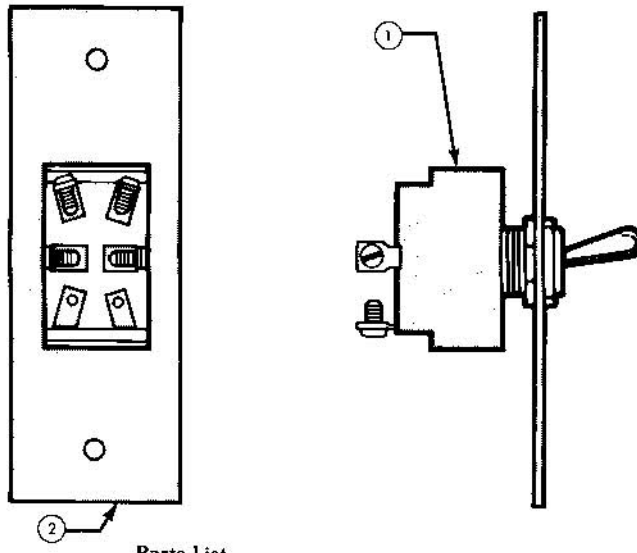| Item	Part Number	Qty.	Description
1	033355-01	1	Plate, Base
2	033356-01	1	Plate, Top
3	033357-01	1	Plate, Cover
4	033358-01	1	Post, Corner
5	033359-01	2	Post, End
6	033361-01	2	Bracket, PCB
7	033362-01	2	Shaft, Roller
8	033363-01	1	Stand Off
9	033364-01	1	Post, Adjustable
10	033365-01	1	Spacer
11	000616-01	2	Hub, Light
12	033366-01	1	Ball, 4½ Dia., Rubber
13	74-5404NN	4	Spacer, 1/8 I.D., ¼ O.D. × ¼ LG, Nylon
14	A009060-01	2	PCB Assy, Steering
15	76-13003	5	Bearing, Fafnir S3K or Equiv. (N.D.-R6)
16	73-3006	2	'E' Ring, Truarc #5144-37
17	72-8808	9	Screw, Mach, Cap, Hex Soc. Hd #8-32 × ½ LG
18	72-1006S	2	Screw, Mach, Pan Hd, X-Rec, #10-32 × 3/8 LG
19	72-1606S	4	Screw, Mach, Pan Hd, X-Rec, #6-32 × 3/8 LG
20	72-1410S	4	Screw, Mach, Pan Hd, X-Rec, #4-40 × 5/8 LG
21	72-8920S	1	Screw, Mach, Cap, Hex Soc. Hd, #3/8-16 × 1¼ LG
22	75-3806S	4	Screw, Mach, 82° Flat, C'Sunk Hd, X-Rec, #8-32 × 3/8 LG
23	75-3608S	3	Screw, Mach, 82° Flat, C'Sunk Hd, X-Rec, #6-32 × ½ LG
25	75-044S	4	Washer, Split Lock, Spring, #4
26	75-046S	4	Washer, Split Lock, Spring, #6
27	75-048S	9	Washer, Split Lock, Spring, #8
28	75-040S	2	Washer, Split Lock, Spring, #10
29	75-041S	1	Washer, Split Lock, Spring, 3/8
31	75-010S	2	Washer, Flat, Plain, #10
32	75-018S	2	Washer, Flat, Plain, #8
33	75-016S	3	Washer, Flat, Plain, #6
35	75-914S	4	Nut, Machine, Hex, Std. Pat., #4-40
36	75-916S	3	Nut, Machine, Hex, Std. Pat., #6-32
37	75-919S	1	Nut, Machine, Hex, Std. Pat., 3/8-16

3 POSITION AMP PLUG
AND PINS
1 BK
2 GN
3 W
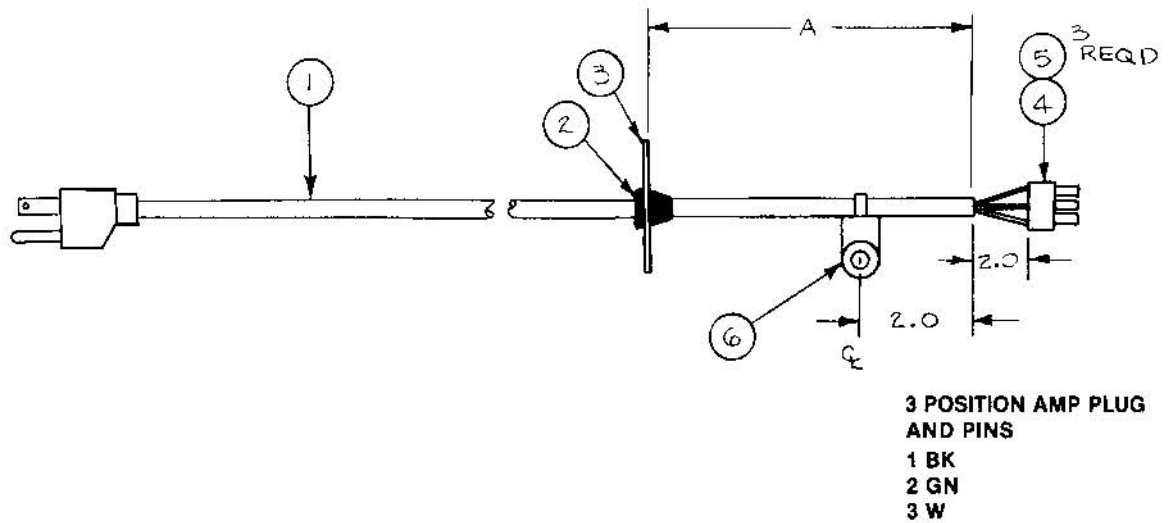
Parts List

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 5-10   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 5-11   On/Off Switch Assembly
A006449-01
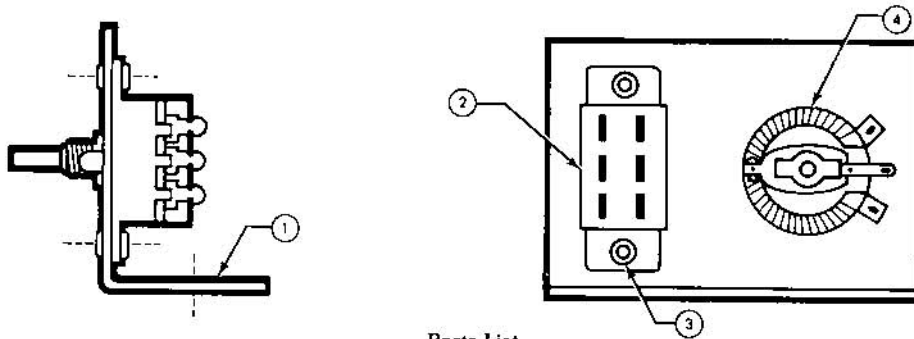
Parts List

Item	Part Number	Qty.	Description
1	030168-01	1	Bracket, Mounting
2	69-001	1	Switch, Test DPDT
3	73-77001	2	Pop Rivet, .125 DIA × .375 Lg
4	19-9032	1	Rheostat, Wire Wound (OHMITE MOD "E" #0110)

Figure 5-12   Self-Test Switch/Volume Bracket Assembly
A030169-01

CONTACTS

PLUNGER

*To lock switch in "on"
position, pull out plunger
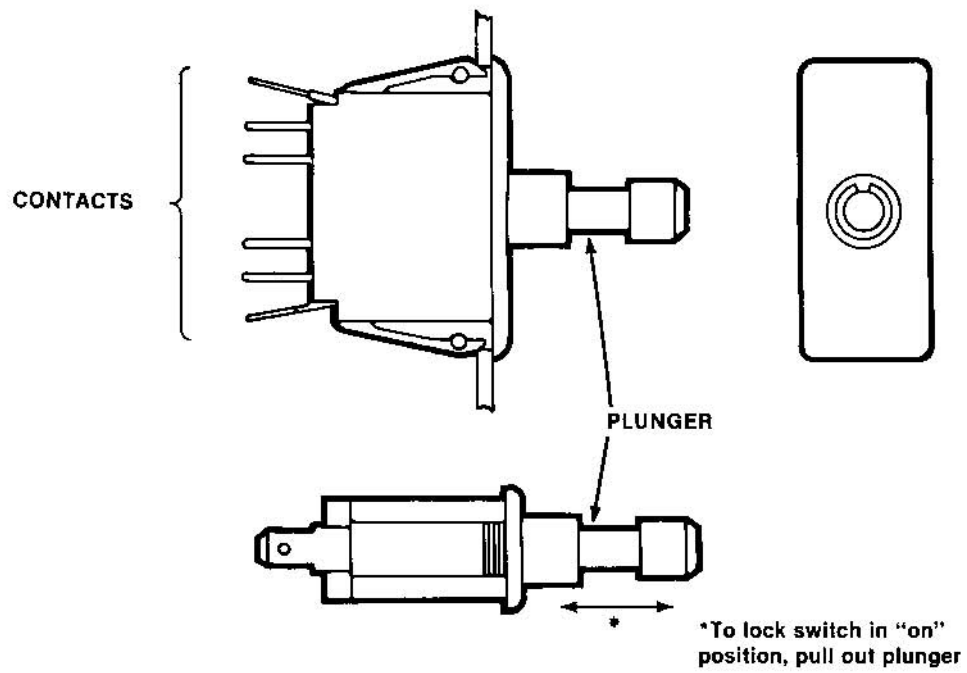
Figure 5-13   Interlock Switch Assembly
62-002

CONTACTS

PIN LAYOUT

RED LENS
PUSHBUTTON
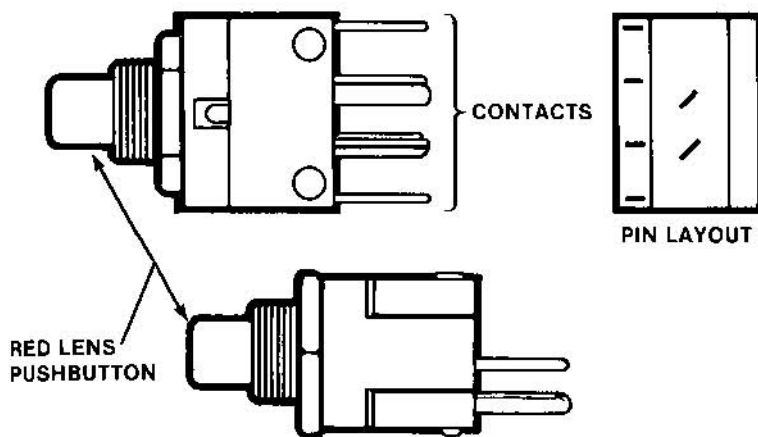
Figure 5-14   LED Pushbutton Switch Assembly (Red)
60-002
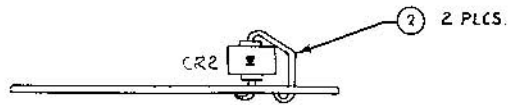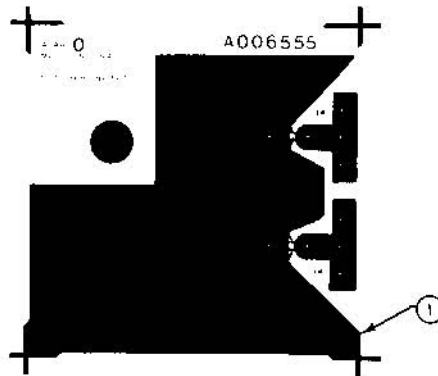
Parts List

Item	Part Number	Qty.	Description	
1	006556-01	1	P.C. Board	
2	31-MR750	2	Diode, MR750	CR1,CR2

Figure 5-15   Rectifier PCB Assembly
            A006555-01   C

5-20 FOOTBALL

**TRACES SHOWN ARE
ON OPPOSITE SIDE**

A033729
033730-01 [A]

FOOTBALL DISPLAY BD
ATARI © 78

CR1   CR2   CR3   CR4

③
6 PL

④

ASSEMBLY

[1]
[2]

CR1
[3]   [4]

CR2
[5]

CR3
[6]

CR4
[7]

SCHEMATIC
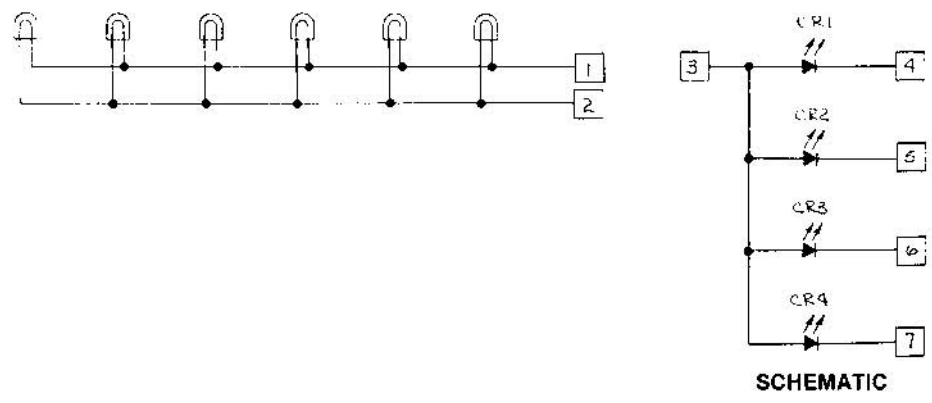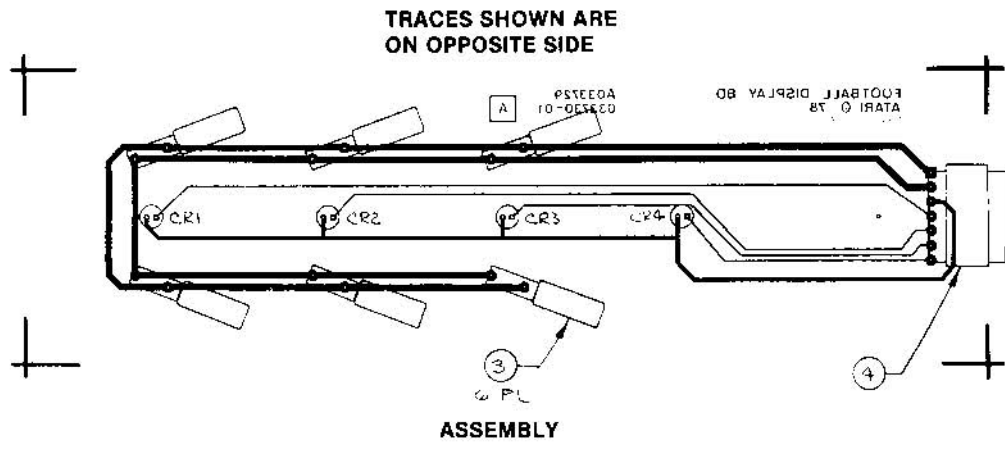
Parts List

Item	Part Number	Qty.	Description
1	033730-01	1	P.C. Board
2	38-MV5053	4	LED, MV5053 CR1-4
3	79-4312	6	Socket, Lamp, Miniature, Right Angle
4	79-58281	1	Header, 7 Pin, Right Angle

Figure 5-16   Play Select PCB Assembly
A033729-01   D
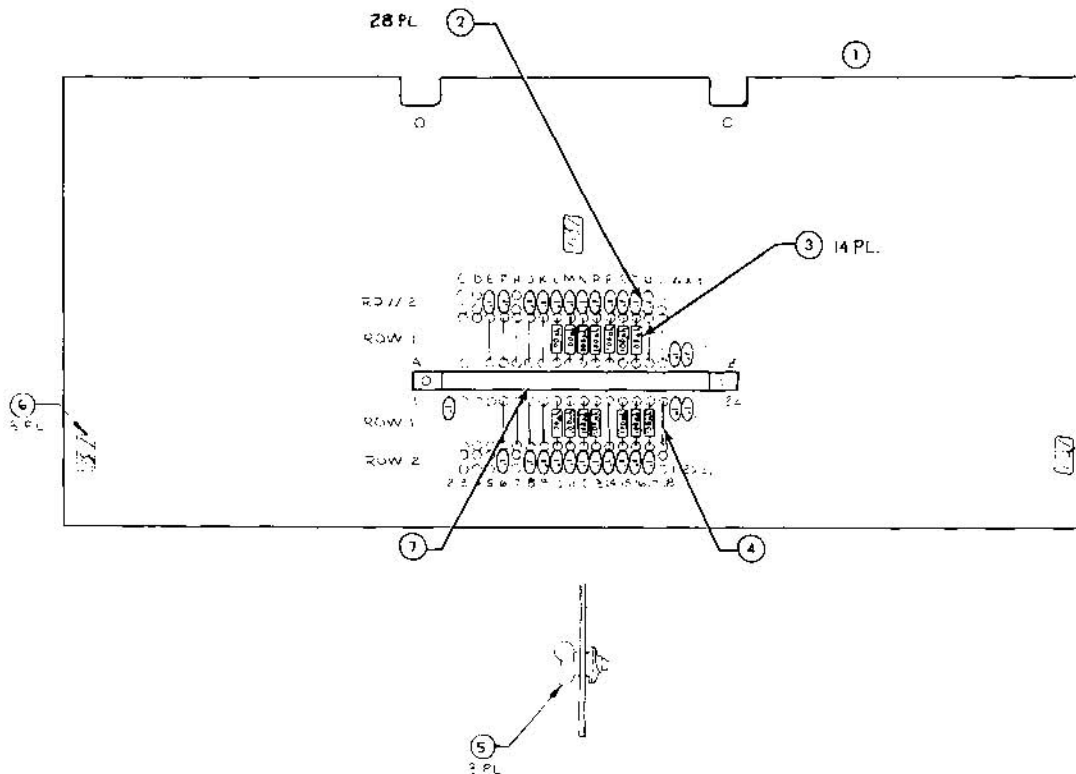
Parts List

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 5-17   RF Shield PCB Assembly
A033254-01
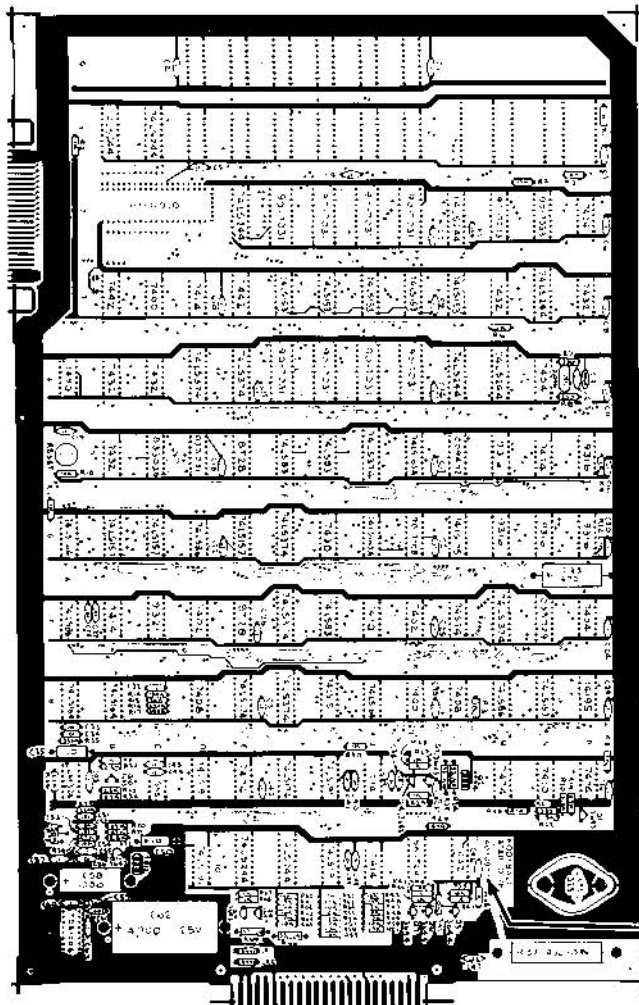
PROGRAM MEMORY CHART			
LOCATION	-01 (PROM)	-02 (ROM)	ALT CKTRY -01
C0			033728
D1	033020		033727
E0			033726
E1	033031		033725
F0			033724
F1	033022		033723
H0			033722
H1	033023		033721
J0			033720
J1	033024		033719
K0			033718
K1	033025		033717
M1		033026	
N1		033027	
P1		033028	

PERMANENT-MARK
"-01" OR "-02"
AFTER A030977
(-01 for PROM, -02
for ROM).

Figure 5-18   Football PCB Assembly
A030977-01, 02

FOOTBALL 5-23

Figure 5-18   Football PCB Assembly
Parts List
-01 Version

-01, -02 Versions

Item	Part Number	Qty.	Description	
1	030978-01	1	P.C. Board	
2	10-5101	3	Res., Carbon, 5%, ¼W, 100 Ohm	R3-5
3	10-5331	3	Res., Carbon, 5%, ¼W, 330 Ohm	R7, 8, 21
4	10-5471	2	Res., Carbon, 5%, ¼W, 470 Ohm	R23, 26
5	10-5102	19	Res., Carbon, 5%, ¼W, 1K Ohm	R1,2,6,9,11-13,18,27-31 38,40,43,44,67,68
6	10-5152	1	Res., Carbon, 5%, ¼W, 1.5K Ohm	R22
7	10-5222	4	Res., Carbon, 5%, ¼W, 2.2K Ohm	R19, 32-34
8	10-5392	1	Res., Carbon, 5%, ¼W, 3.9K Ohm	R20
9	10-5562	1	Res., Carbon, 5%, ¼W, 5.6K Ohm	R72
10	10-5103	25	Res., Carbon, 5%, ¼W, 10K Ohm	R10,39,41,42,45-65
11	10-5223	1	Res., Carbon, 5%, ¼W, 22K Ohm	R36
12	10-5473	3	Res., Carbon, 5%, ¼W, 47K Ohm	R70,71,74
13	10-5563	1	Res., Carbon, 5%, ¼W, 56K Ohm	R15
14	10-5104	1	Res., Carbon, 5%, ¼W, 100K Ohm	R14
15	10-5224	2	Res., Carbon, 5%, ¼W, 220K Ohm	R16,73
16	10-5334	1	Res., Carbon, 5%, ¼W, 330K Ohm	R35
17	10-5394	1	Res., Carbon, 5%, ¼W, 390K Ohm	R17
19	11-5330	4	Res., Carbon, 5%, ½W, 33 Ohm	R24,25,66,69
22	19-315503	1	Trimpot, 50K Ohm	R75
23	19-805W4P0	1	Res., Wirewound, 10W, 4 Ohm	R37
25	24-250106	2	Cap., Elec., 25V, 10 μf	C35,50
26	24-250108	1	Cap., Elec., 25V, 1000 μf	C58
27	24-250477	1	Cap., Elec., 25V, 470 μf	C23
28	24-250478	1	Cap., Elec., 25V, 4700 μf	C62
31	27-250102	2	Cap., Cer., 25V, .001 μf	C54,61
32	27-250103	14	Cap., Cer., 25V, .01 μf	C27,28,33,34,38-41,48,49,51-53,56
33	27-250104	39	Cap., Cer., 25V, .1 μf	C1-11,13-22,24-26,29 32,36,37,42-46, 55,57,60,63
34	27-250224	1	Cap., Cer., 25V, .22 μf	C47
36	28-101101	1	Cap., Mica, 100V, 100 pf	C12
37	28-101221	1	Cap., Mica, 100V, 220 pf	C59
41	31-1N4001	2	Diode, 1N4001	CR1,2
44	33-2N3644	3	Transistor, 2N3644	Q5-7
46	34-2N3643	7	Transistor, 2N3643	Q1,3,4,8-11
47	34-2N6044	1	Transistor, 2N6044	Q2
49	37-7400	2	Integrated Circuit, 7400	C3,K8
50	37-7402	2	Integrated Circuit, 7402	D7,K7
51	37-7404	3	Integrated Circuit, 7404	P2,N4,P7
52	37-7408	2	Integrated Circuit, 7408	D8,L8
53	37-7410	2	Integrated Circuit, 7410	J7,N9
54	37-7414	3	Integrated Circuit, 7414	D3,B7,J10
55	37-7430	1	Integrated Circuit, 7430	H6
56	37-7432	5	Integrated Circuit, 7432	M3,P3,B4,C4,B5
57	37-7442	3	Integrated Circuit, 7442	B3,E3,L10

Figure 5-19   Football PCB Assembly
Parts List
-01 Version

Item	Part Number	Qty.	Description	
58	37-7474	5	Integrated Circuit, 7474	N5,E9,J9,M9,P9
59	37-74S74	1	Integrated Circuit, 74S74	L7
60	37-74LS83	3	Integrated Circuit, 74LS83	F5,H5,H7
61	37-74LS86	3	Integrated Circuit, 74LS86	D6,A7,M8
62	37-7490	1	Integrated Circuit, 7490	A4
63	37-74LS151	1	Integrated Circuit, 74LS151	H8
64	37-74LS153	5	Integrated Circuit, 74LS153	F3,H3,J3,K3,L3
65	37-74LS157	4	Integrated Circuit, 74LS157	B6,C6,E6,N8
66	37-74LS163A	2	Integrated Circuit, 74LS163A	K5,J6
67	37-74LS164	3	Integrated Circuit, 74LS164	A8,B8,J8
68	37-74LS166	1	Integrated Circuit, 74LS166	A6
69	37-74LS174	2	Integrated Circuit, 74LS174	E8,F9
70	37-74LS175	1	Integrated Circuit, 74LS175	L6
71	37-74LS191	4	Integrated Circuit, 74LS191	D9,H9,D10,H10
72	37-74195	1	Integrated Circuit, 74195	P8
73	37-74LS244	9	Integrated Circuit, 74LS244	B1,C1,E2,L2,N3,L4,M4, E10,F10
74	37-74LS374	7	Integrated Circuit, 74LS374	D4,E4,J5,F6,F7,M7,F8
76	37-LM323K	1	Regulator LM323	
77	37-LM324	1	Op Amp LM324	A9
78	37-555	1	Timer 555	C9
79	37-TDA1004	1	Audio Amp TDA1004	A11
80	37-7812	1	Regulator 7812	
81	37-8T28	2	Integrated Circuit 8T28	E5,E7
82	37-9316	5	Integrated Circuit 9316	M5,P5,M6,N6,P6
83	37-9321	1	Integrated Circuit 9321	C7
86	62-001	1	Switch, SPST, Mom	
87	66-118PIT	1	Switch, SPST, X8, DIP	K10
88	72-1608C	2	Screw, Pan Hd., #6-32 × ½ Lg., Cres.	
89	75-016C	2	Washer, Flat, #6, Cres	
90	75-056	2	Washer, Lock, Int. Star, #6	
91	75-916C	2	Nut, Hex, #6-32, Cres.	
93	78-16005	1	Silpad (LM323)	
94	78-06001	1	Heatsink (LM323)	
95	009470-01	1	Heatsink (TDA1004)	
96	78-13016	AR	Cement (TDA1004 Heatsink)	
98	79-42040	1	Socket, 40-Pin, Med. Insertion	C2
100	90-102	1	Crystal, 12.096 MHz	Y1
102	90-6010	1	Microprocessor	C2
103	90-7008	1	RAM	K6
104	90-7031	8	RAM	F2,H2,J2,K2,F4,H4, J4,K4
105	90-7033	2	RAM	M2,N2
107	009402-01	1	PROM, Sync (82S129)	L5
108	033029-01	1	PROM, Alpha Numerics (82S137)	N7
109	033030-01	1	PROM, Graphics, LSB (82S131)	C5
110	033031-01	1	PROM, Graphics, MSB (82S131)	D5

APPENDIX A

Reference Drawings

List of Reference Drawings

C13

R7 330   R8 330

N4 5 6 O4

Y1 12.096 MHz

N4 3 4 O4

C12 100pf

N4 1 2 O4

P,R9

P5 9316 BIN CNTR
P0 P1 P2 P3 PE 3 4 5 6 9
CEP 7
CET 10
CP 2
Q0 Q1 Q2 Q3 MR 14 13 12 11 1
TC 15

P,R9

P,R9

6MHZ 1H 2H 4H

P,R12

P6 9316 BIN CNTR
P0 P1 P2 P3 PE 3 4 5 6 9
CEP 7
CET 10
CP 2
Q0 Q1 Q2 Q3 MR 14 13 12 11 1
TC 15

P,R12

8H 16H 32H 64H

N4 13 12 O4
256H   256H

64H 2 D
32H 3 CK
P 4
N5 74 F/F
Q 5
Q 6
C 1
P,R9

HBLANK

32H 12 D
16H 11 CK
P 10
N5 74 F/F
Q 9
Q 8
C 13

HSYNC

P,R9

VRESET

P,R9

M5 9316 BIN CNTR
P0 P1 P2 P3 PE 3 4 5 6 9
CEP 7
CET 10
CP 2
Q0 Q1 Q2 Q3 MR 14 13 12 11 1
TC 15

P,R9

M6 9316 BIN CNTR
P0 P1 P2 P3 PE 3 4 5 6 9
CEP 7
CET 10
CP 2
Q0 Q1 Q2 Q3 MR 14 13 12 11 1
TC 15

P,R12

256H   2V 4V 8V   16V 32V 64V 128V

R37 4Ω,10W

P

1K (PULLUP)

K +5V

+10V (UNREG) B 2

LM 323

+5V

C47 .22

C23 + 470

C1-11,14-18,20-22,24-26,
29-31,36,37,42,46
.1 (BYPASS)

A-2 FOOTBALL

P,R12

4H —[P7]— 4H
         O4

2H —[P7]— 2H
         O4

32V —[P7]— 32V
          O4

VBLANK ─ 15 A7   O4 9   5 2D   2Q 7 ─ VBLANK
128V ─ 1 A6   L5   O3 10   4 1D   2Q 6 ─ VBLANK
64V ─ 2 A5 03406-01   1Q 2
32V ─ 3 A4 SYNC PROM   1Q 3 ─ VRESET
8V ─ 4 A3   O2 11   13 4D   4Q 15 ─ ENDSCREEN
4V ─ 7 A2   L6   4Q 14
2V ─ 6 A1   LS175 O1 12 12 3D   3Q 10 ─ VSYNC
1V ─ 5 A0   F/F   3Q 11
      CE1 CE2   CK C
       13   14   9   1
                    P,R12

256H

16.5VAC CT [A|1]

25VAC [W|19] CR1   7812
        IN4001   + C50 C45   +12V
25VAC [X|20] CR2 |10 |.1 (BYPASS)
        IN4001
              — +18V
            + C62
            |4700

25VAC CT [Y|21]
GND   [Z|22]

LAST DES

C63
CR2
Q11
R75
Y1

SYNC, POWER

FOOTBALL A3

A4 FOOTBALL

FOR ALTERNATE CIRCUITRY TO -01,
SEE SHEET 3

MICROPROCESSOR, MEMORY

Figure 1 Football PCB Schematic Diagram
Sheet 2 of 6
030977-01, 02
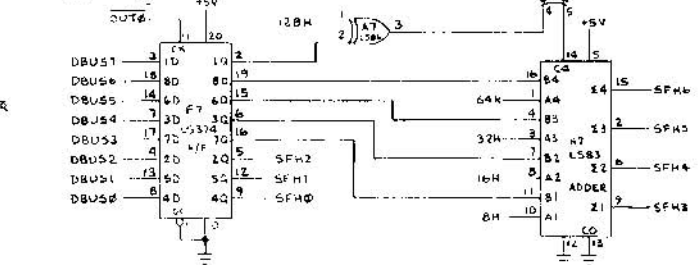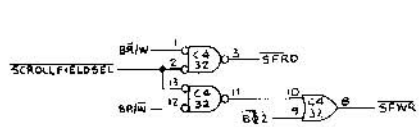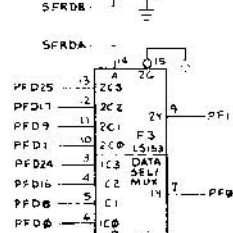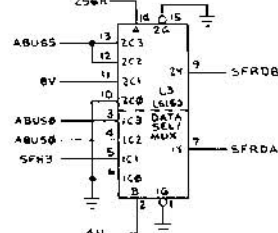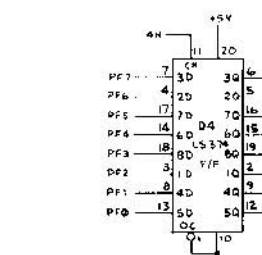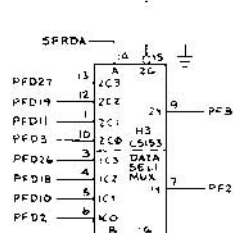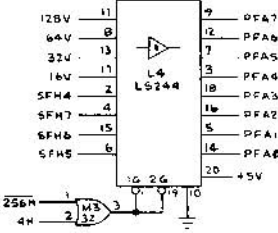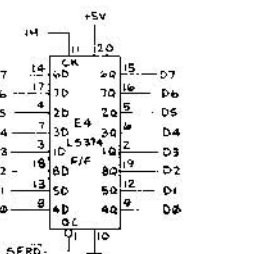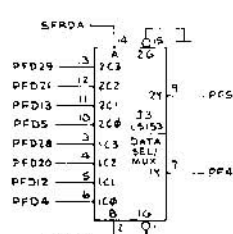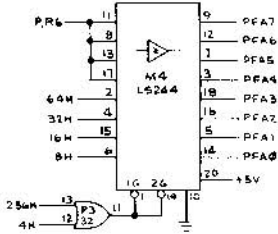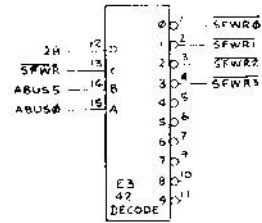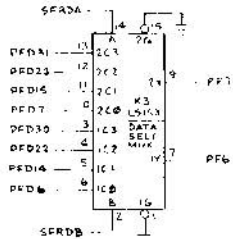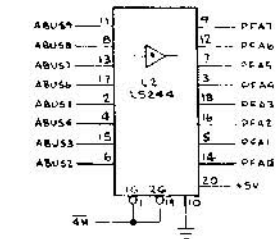
FOOTBALL A5
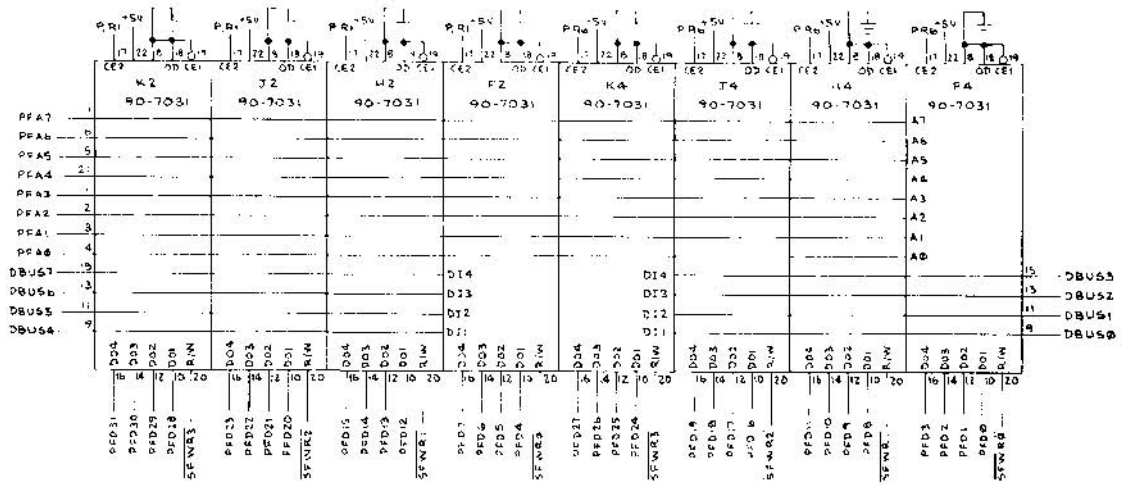
A6   FOOTBALL

ALTERNATE CIRCUITRY TO -01 MEMORY
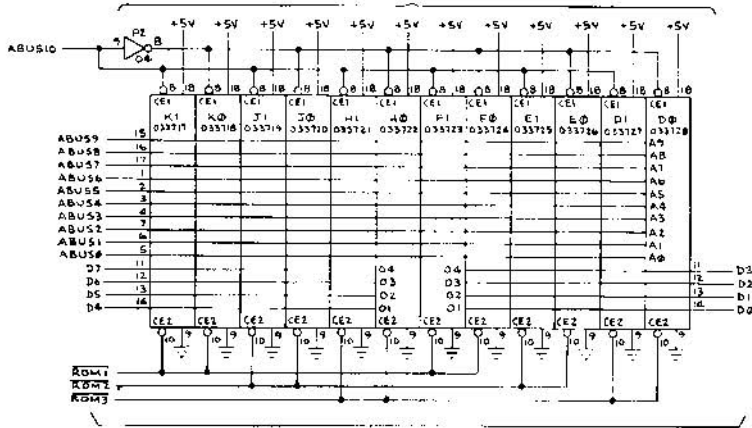
PLAYFIELD DISPLAY RAM

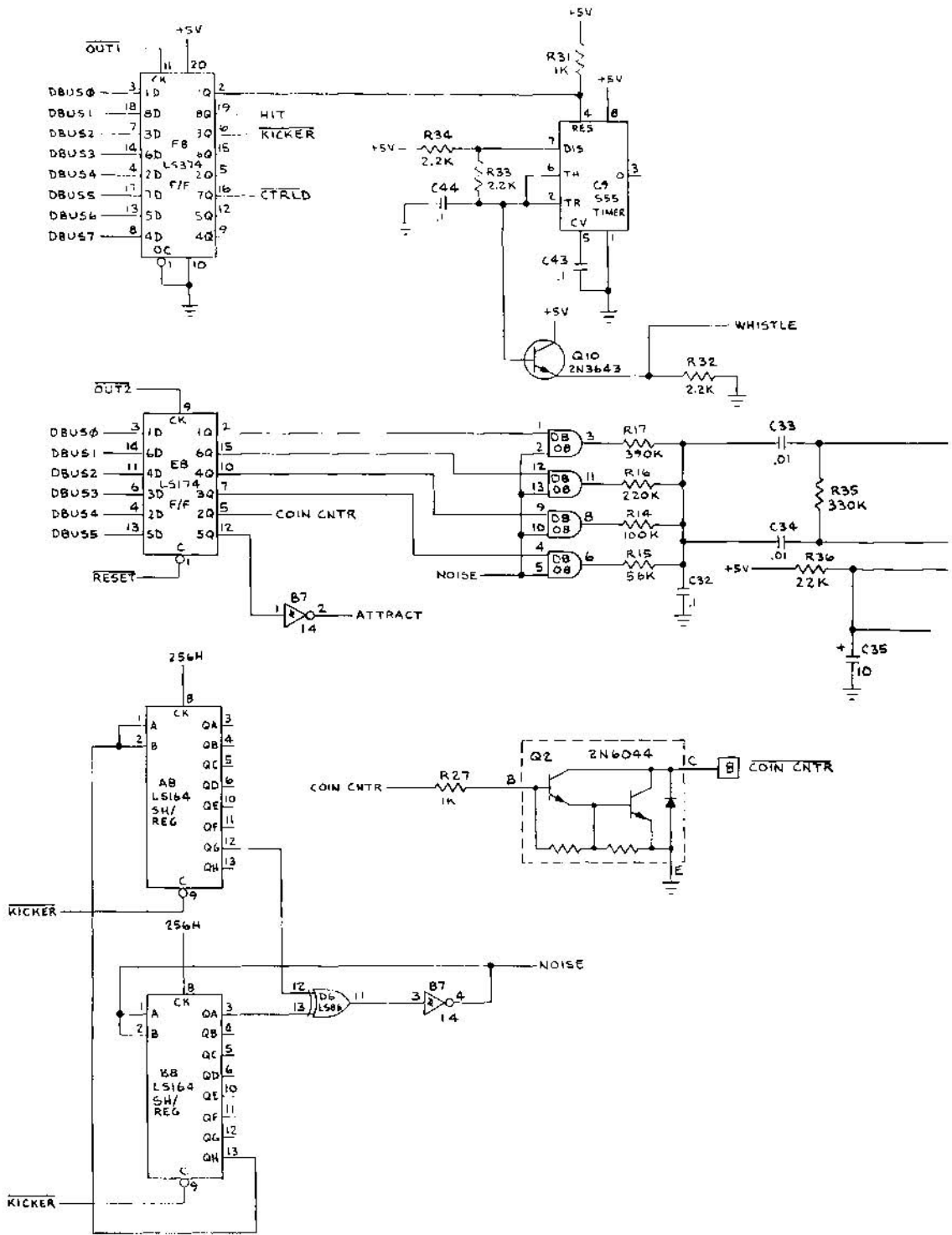Figure 1 Football PCB Schematic Diagram
Sheet 3 of 6
030977-01, 02

FOOTBALL A7

A8 FOOTBALL

GRAPHICS, VIDEO OUT
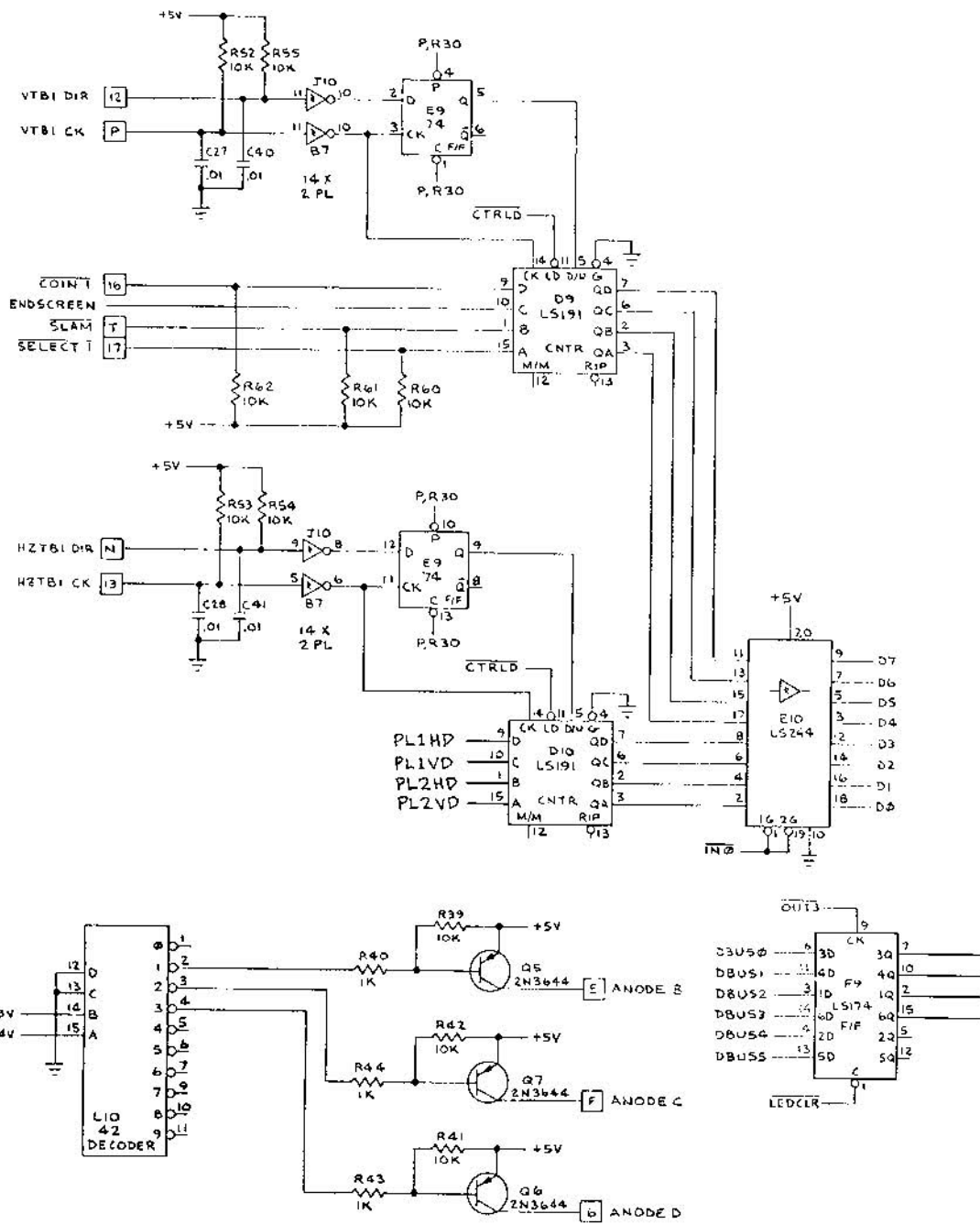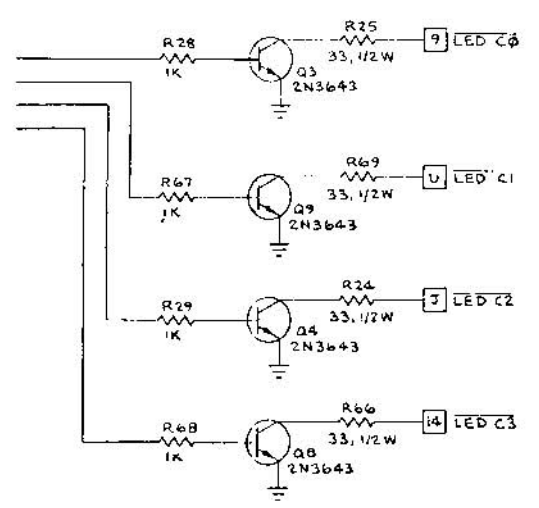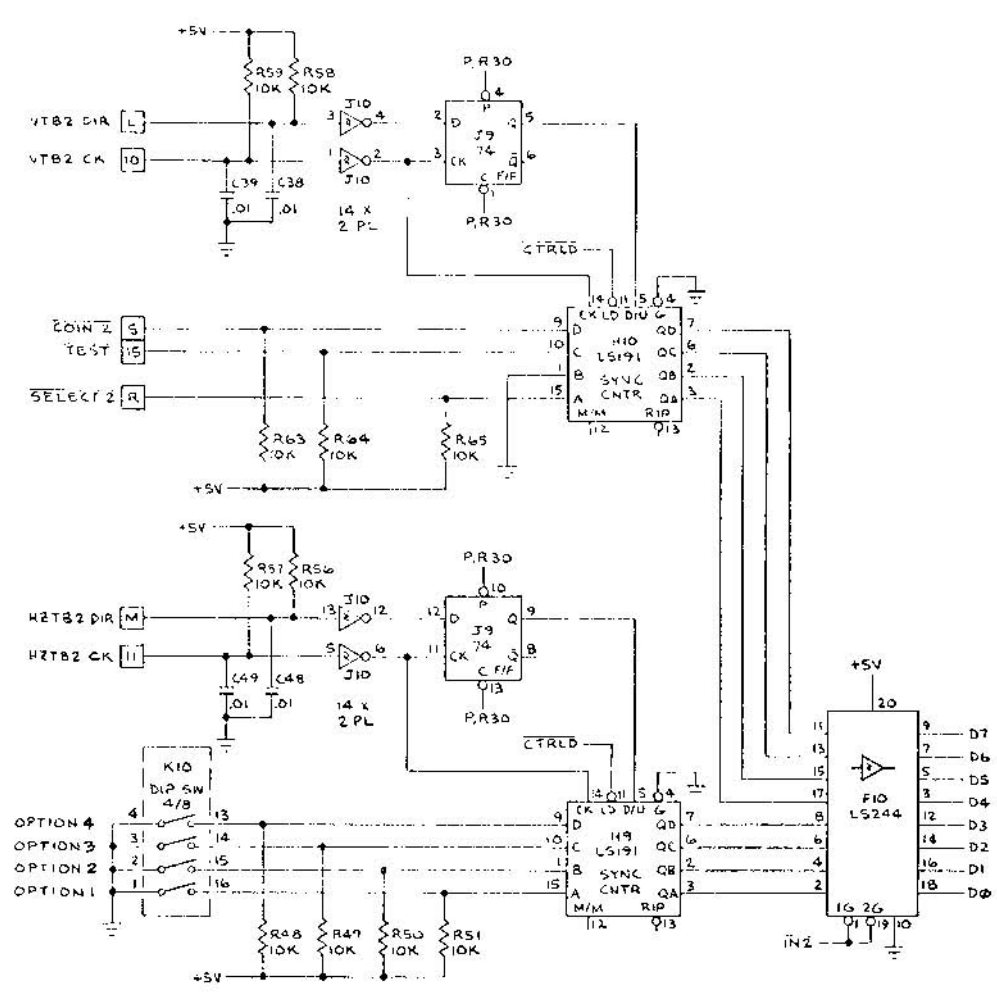
A10 FOOTBALL

INPUTS, OPTIONS, LED PINOUTS

Figure 1 Football PCB Schematic Diagram
Sheet 5 of 6
030977-01, 02

FOOTBALL A11
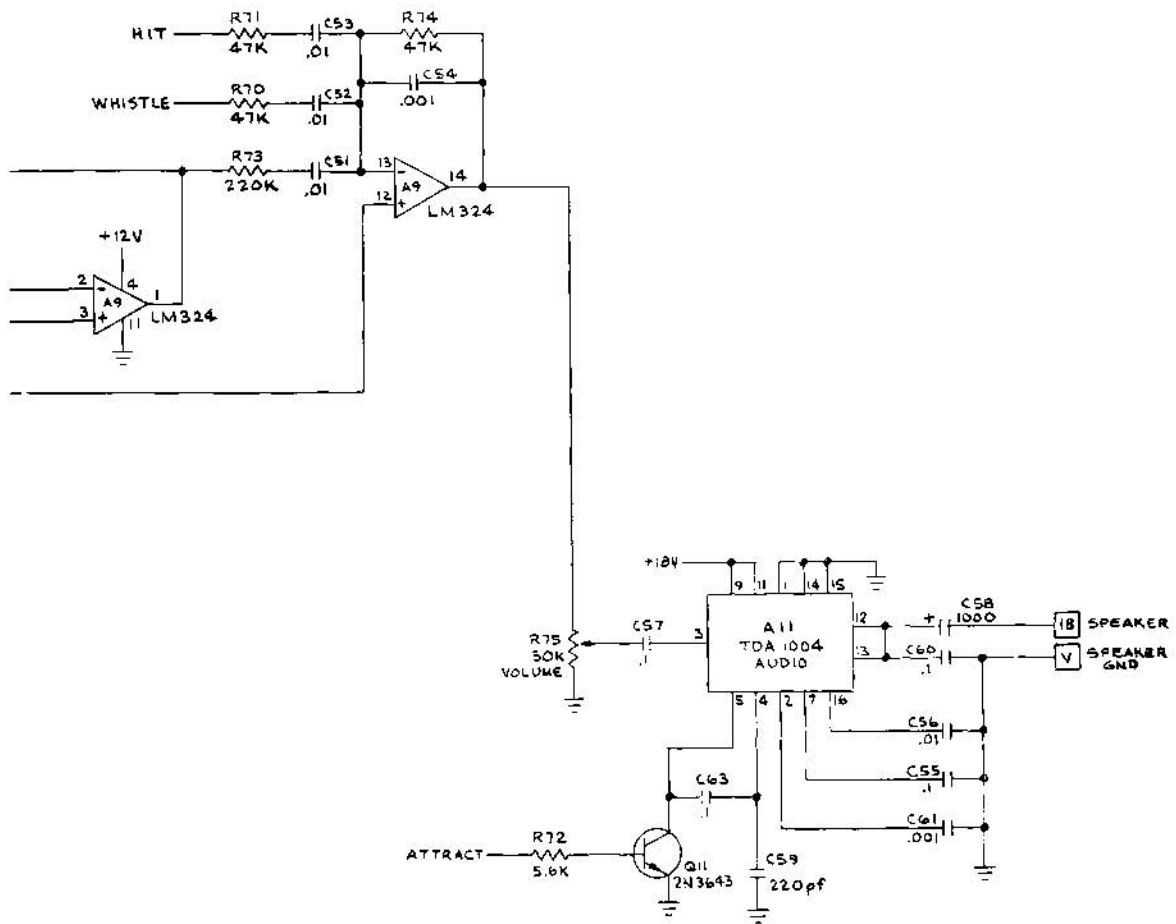
A12 FOOTBALL

AUDIO

Figure 1   Football PCB Schematic Diagram
Sheet 6 of 6
030977-01, 02
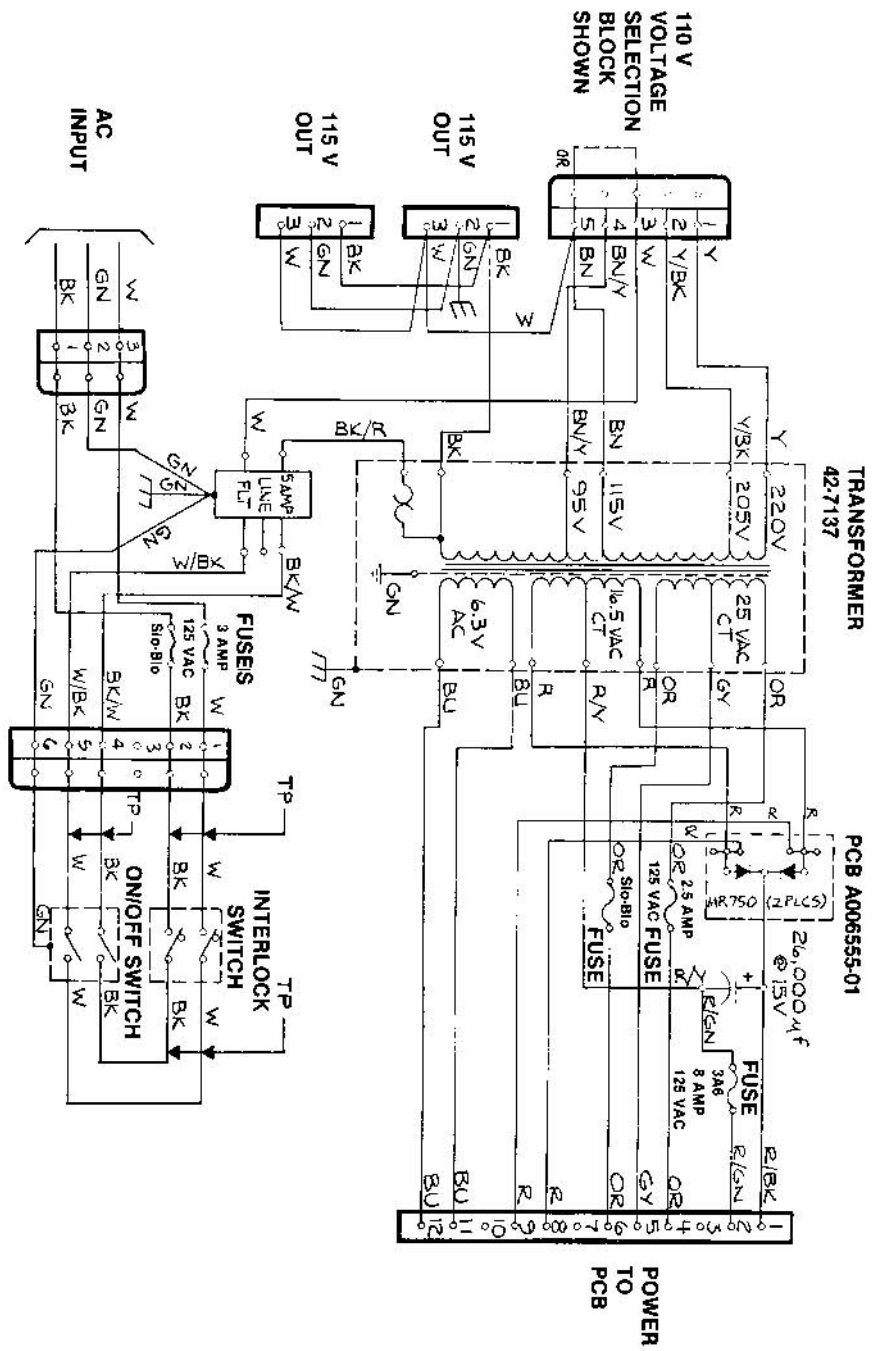
FOOTBALL A13

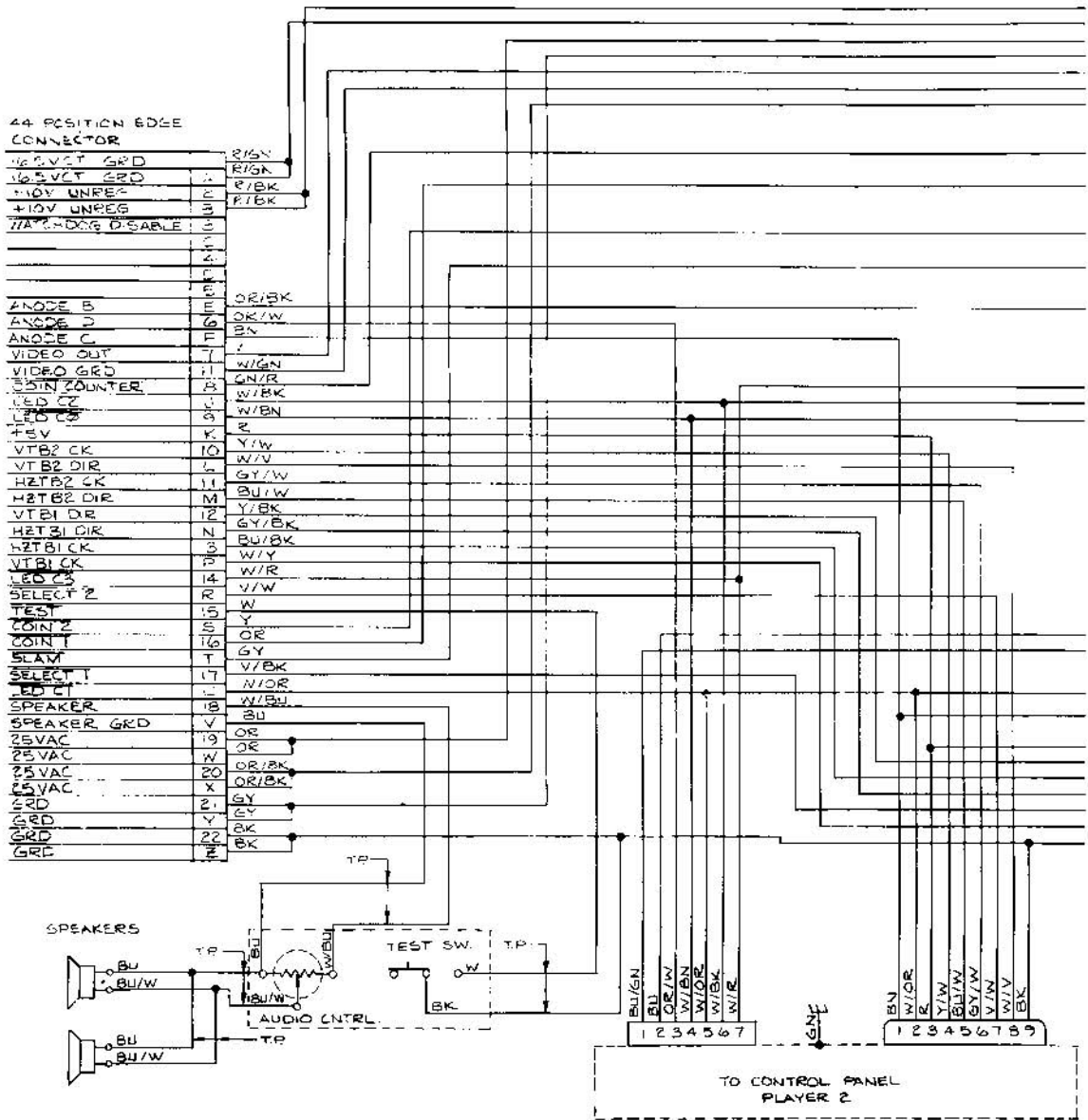Figure 2   Type B Power Supply Schematic Diagram
007197-01 C

A14 FOOTBALL
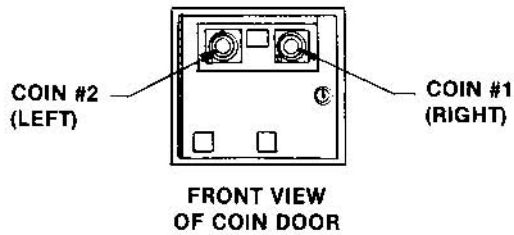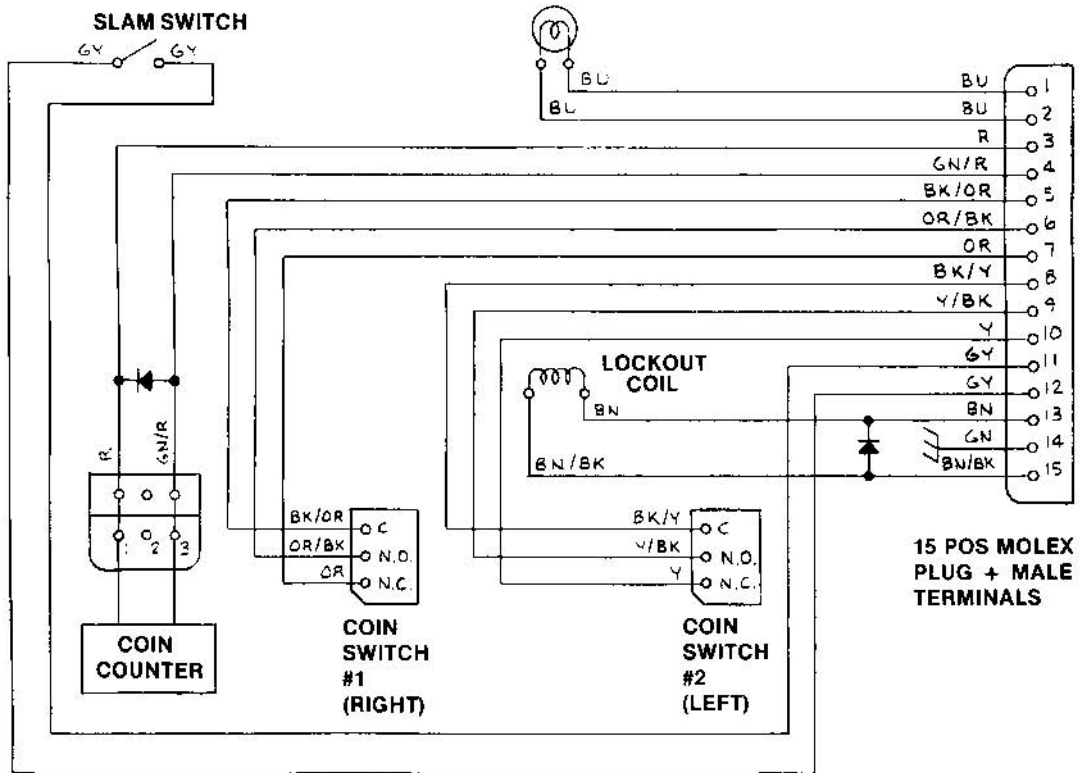
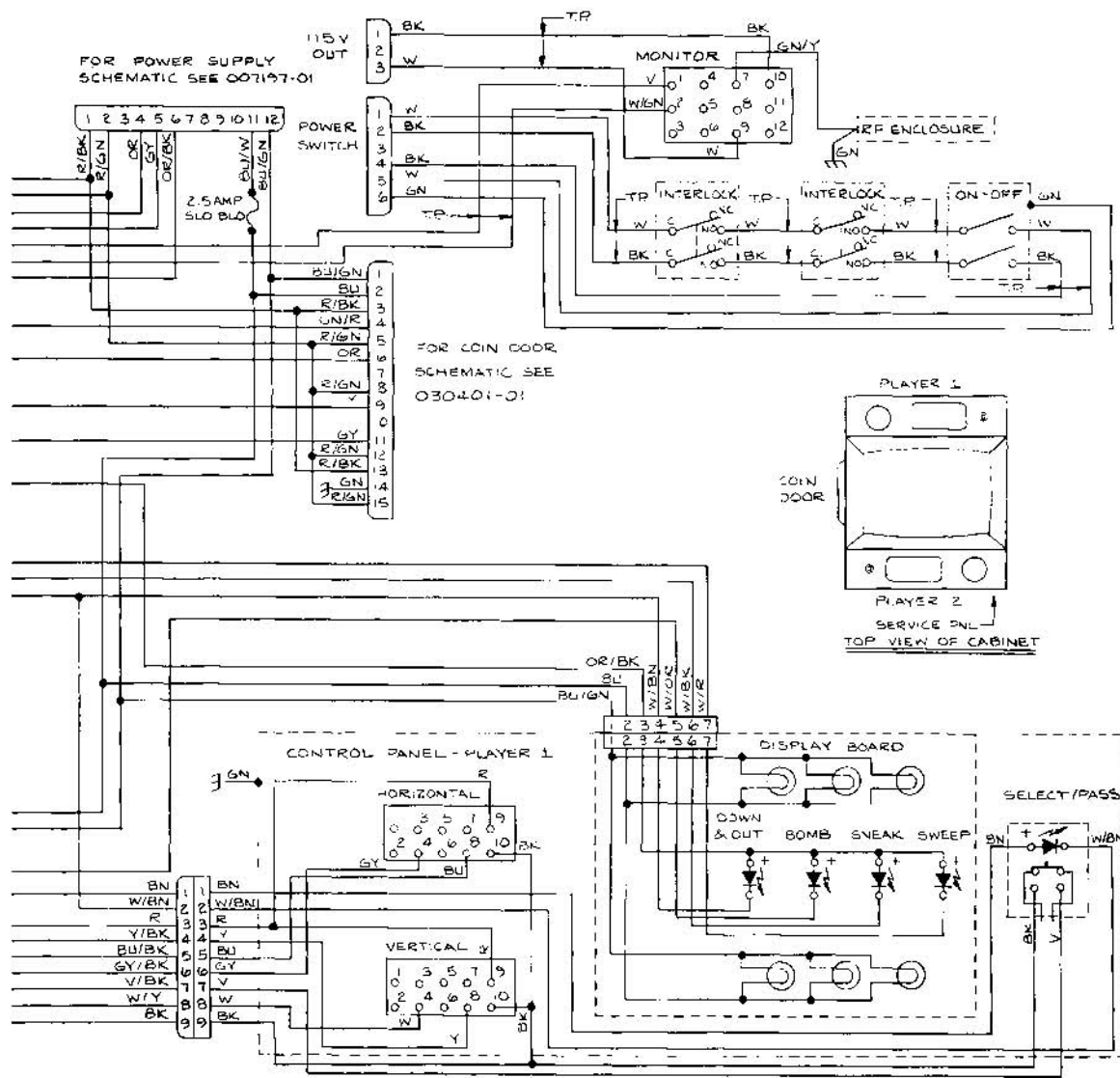**Figure 3 Coin Door Schematic Diagram**
030401 R

FOOTBALL A15

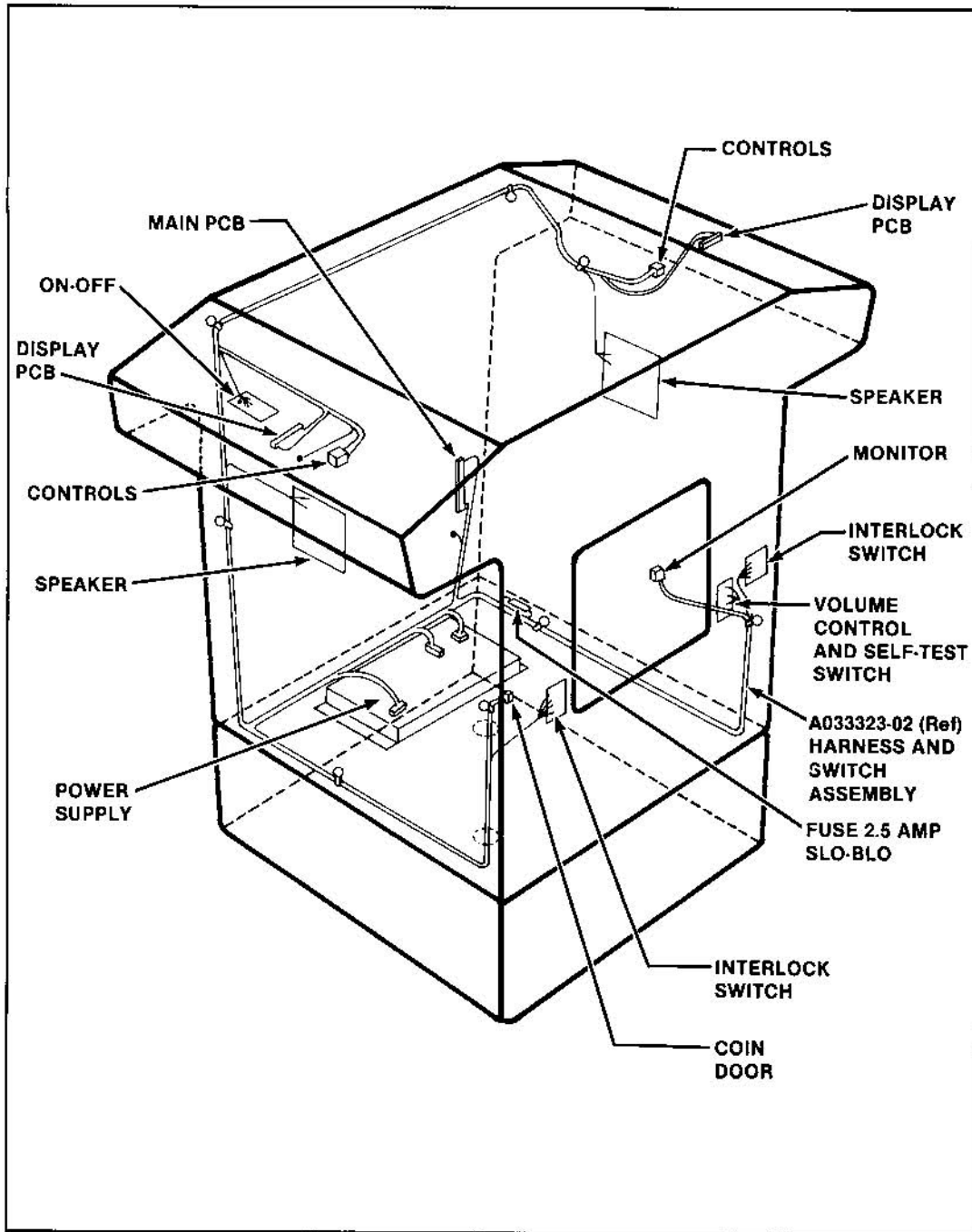Figure 4 Football Game Harness Schematic Diagram
033322-01

FOOTBALL A17

Figure 5   Football Game Harness Layout   A033580-01   A

A18   FOOTBALL