

STEEPLECHASE

Operation · Maintenance · Service Manual



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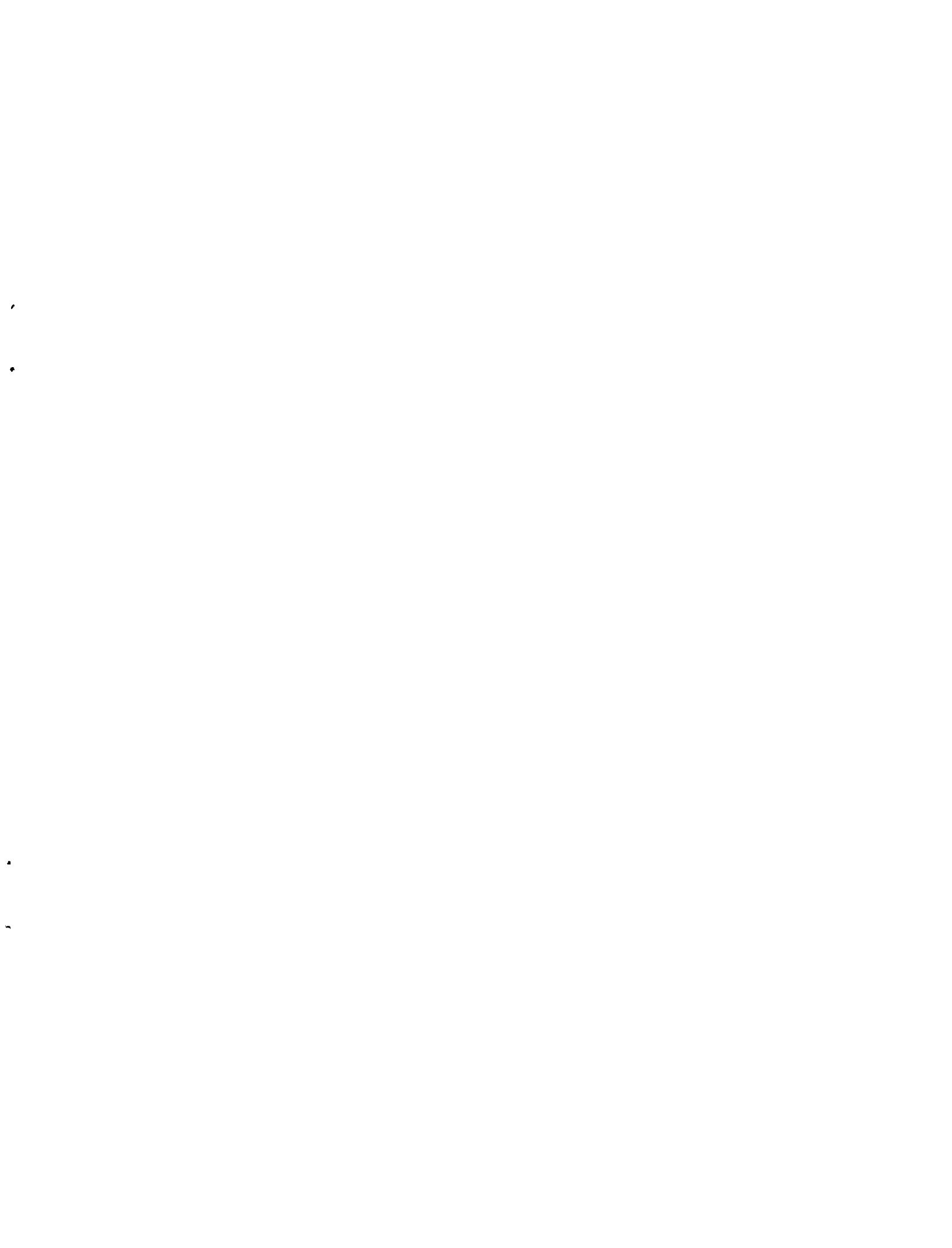
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I. Introduction

1.1 PHYSICAL DESCRIPTION

Atari's Steeplechase is a horse race video action game designed for up to six players. The game is packaged in its own distinctively-styled upright cabinet that rests directly on the floor. (Drawing number A003249 in Section VII of this manual shows an external view of the game.) A 23-inch black and white TV monitor is mounted at the top front of the cabinet and players stand in front, facing the TV screen. Six horizontal strips of transparent material, each of a different color, are affixed to the plexiglass panel in front of the TV screen. Each strip covers one player's race track on the screen; when the game is energized, each strip filters the light coming from images underneath that strip. To players looking at the screen, the result of this filtering is that no two horses are of the same color.

The player-operated controls are located on a horizontal flat panel, beneath the TV monitor. The controls consist of a "START" push-button switch and six back-lighted player push-button switches, one for each player. Figure 1-1 shows the graphics on this panel.

Two identical coin mechanisms are located below the player-operated controls. They accept quarters only, and are connected so that either one can initiate play. The Steeplechase game features an owner/operator-adjustable option that permits on-site game structuring for six players per coin, or for two players for one coin, four players for two coins, six players for three coins. The cash box is located behind the coin mechanism access door. A speaker mounted inside the cabinet, to the left of the coin mechanism, will produce a variety of game sounds during play.

1.2 BRIEF DESCRIPTION OF PLAY

In the Steeplechase game a player tries to jockey his horse to the finish line ahead of all other horses. At the beginning of play on the left side of the TV screen a separate horse image appears for each player, along with a seventh pace horse at the bottom. The race begins when the start button is depressed, and ends when one of the horses reaches the finish line located near the right side of the screen. During a race the horse images gallop across the screen, moving from left to right, and have to jump over a string of fence picket obstacles that appear at various points along the racetrack.

These pickets also move across the TV screen, but from right to left toward the horses. There is a separate string of pickets for each horse, but all pickets move at the same rate and corresponding pickets along the track line up one beneath the other (from the top of the screen on down). The sketch in Figure 1-2 shows a typical picture appearing on the screen partway through a race.

In order to advance toward the finish line, a player has to make his horse jump over all pickets after the first one. He does this by depressing his front panel push button whenever he wants the horse to jump. But anytime a horse strikes a picket- either because the player failed to depress the button before the horse reached the picket, or because he depressed the button too soon and the horse landed back down on the track without having jumped over the picket that horse momentarily falls, drops back a short distance, and then gets up and starts galloping again.

The spacing between successive pickets is irregular; this makes the game more challenging because it prevents a player from advancing a horse merely by depressing the button at a regular rate. Other aspects of the game's operation provide additional challenge as the horses approach the finish line: pickets are made to move at faster and faster rates, the jump of the leading player's horse becomes shorter, and players get less visual warning of approaching pickets.

Along with the video action just described, the following sounds produced by the speaker during play add to the game excitement: a bugle call as soon as the first coin is deposited, the starter's gunshot when the start button is depressed, hoofbeats and crowd noise throughout the race, and loud "cracking" sounds whenever any horse strikes a picket.

When the race is over, the image on the TV screen of the winning horse begins to blink. It continues to blink until another play sequence is initiated (by a player depositing a coin).

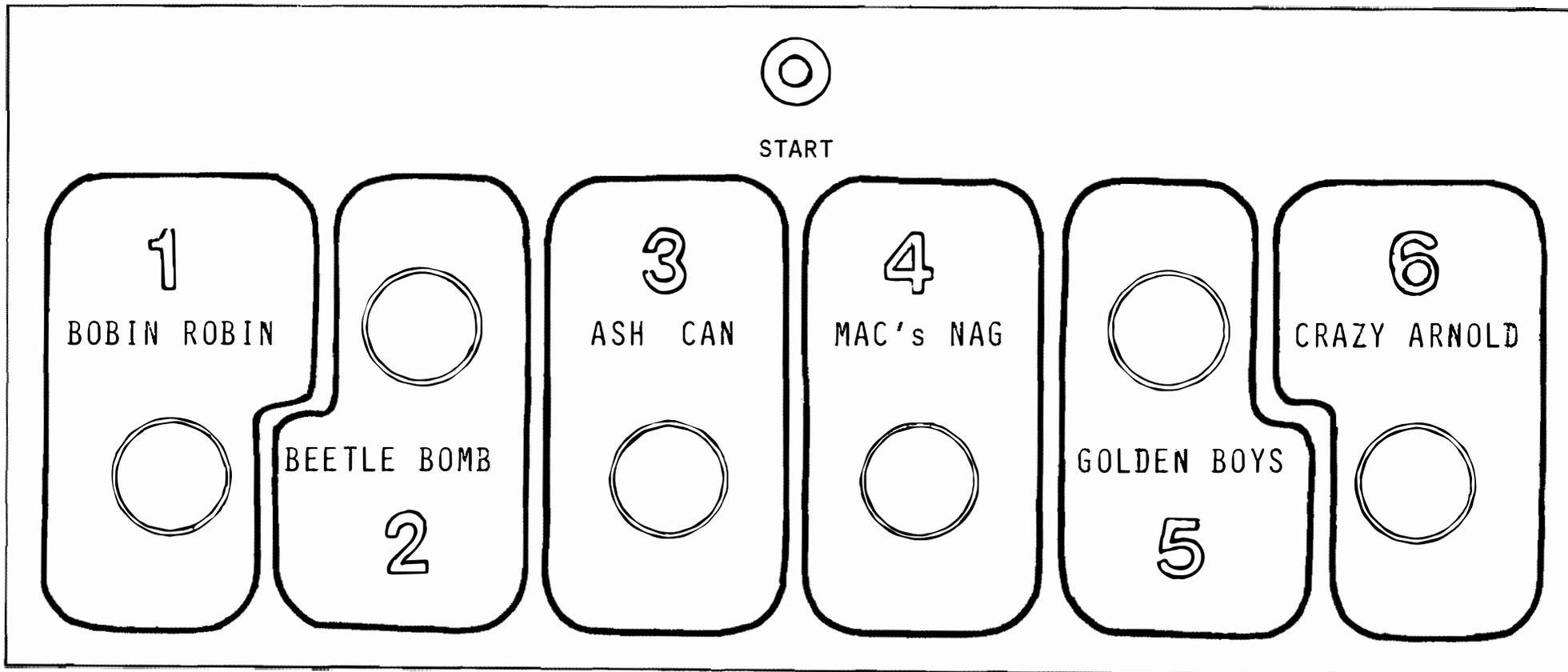


Figure 1-1 Graphics on Player Control Panel (not shown to scale)

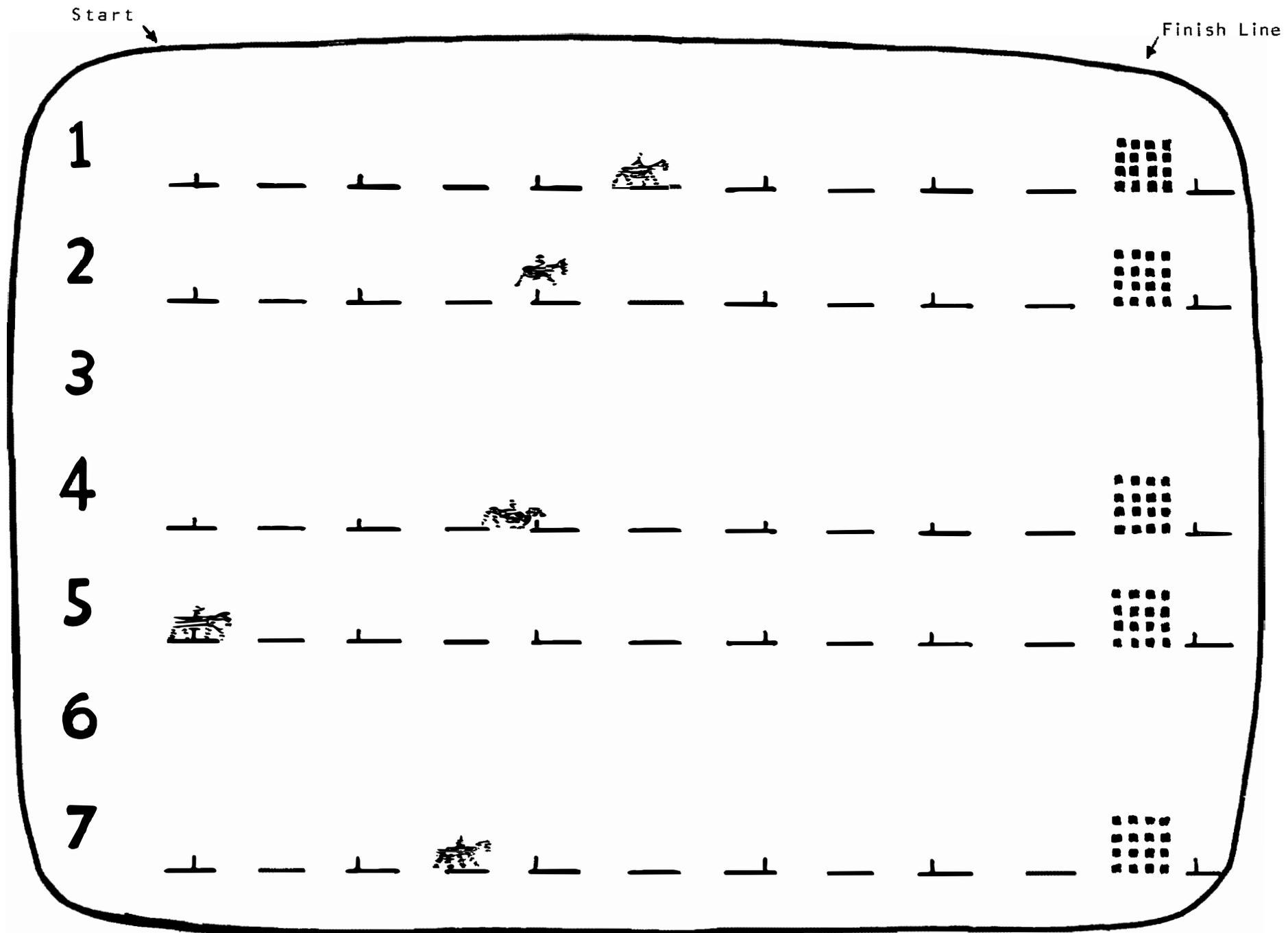


Figure 1-2 Typical Picture Partway Through a Race, with 3 Players (not drawn to scale)
 Horse #5 Not Being Jumped

II. Specifications

GENERAL

Cabinet Dimensions: Height 66 ¼ inches, Width 31 ½ inches, Depth 31 inches when set up for operation and 26 inches when set up for transit. (For setup instructions, see Section 4.1.3 in this manual.)

Cabinet Weight: 305 lbs.

TV Monitor: Motorola Model XM701, black and white, with 23-inch screen

Coin Mechanisms: Two identical mechanisms (connected in parallel); accept quarters only

Cash Box: Removable, located behind locked access door to coin mechanism assembly

Power Cord: Approximately 6 ft. long, extending from rear of cabinet and having grounded three-prong plug for conventional wall outlets

ELECTRICAL

Power Requirement: Uses conventional wall outlet providing 60-cycle AC (60-Hz, single-phase) at 110 volts; power consumption rated at 72 watts

Fusing: All fuses located inside cabinet; TV monitor has two 1-amp fuses and remainder of game is protected by one 1 ¼-amp. slow-blow fuse

Power Interrupt Switches: These are safety switches located inside the cabinet. They cause the AC power to the game to be interrupted whenever either the upper or the lower rear panel service access door is unlocked and opened.

ENVIRONMENTAL

Operating and Storage Temperature Range: from 32° F to 120° F (ambient temperature)

Relative Humidity: from 0% to 80% without condensation

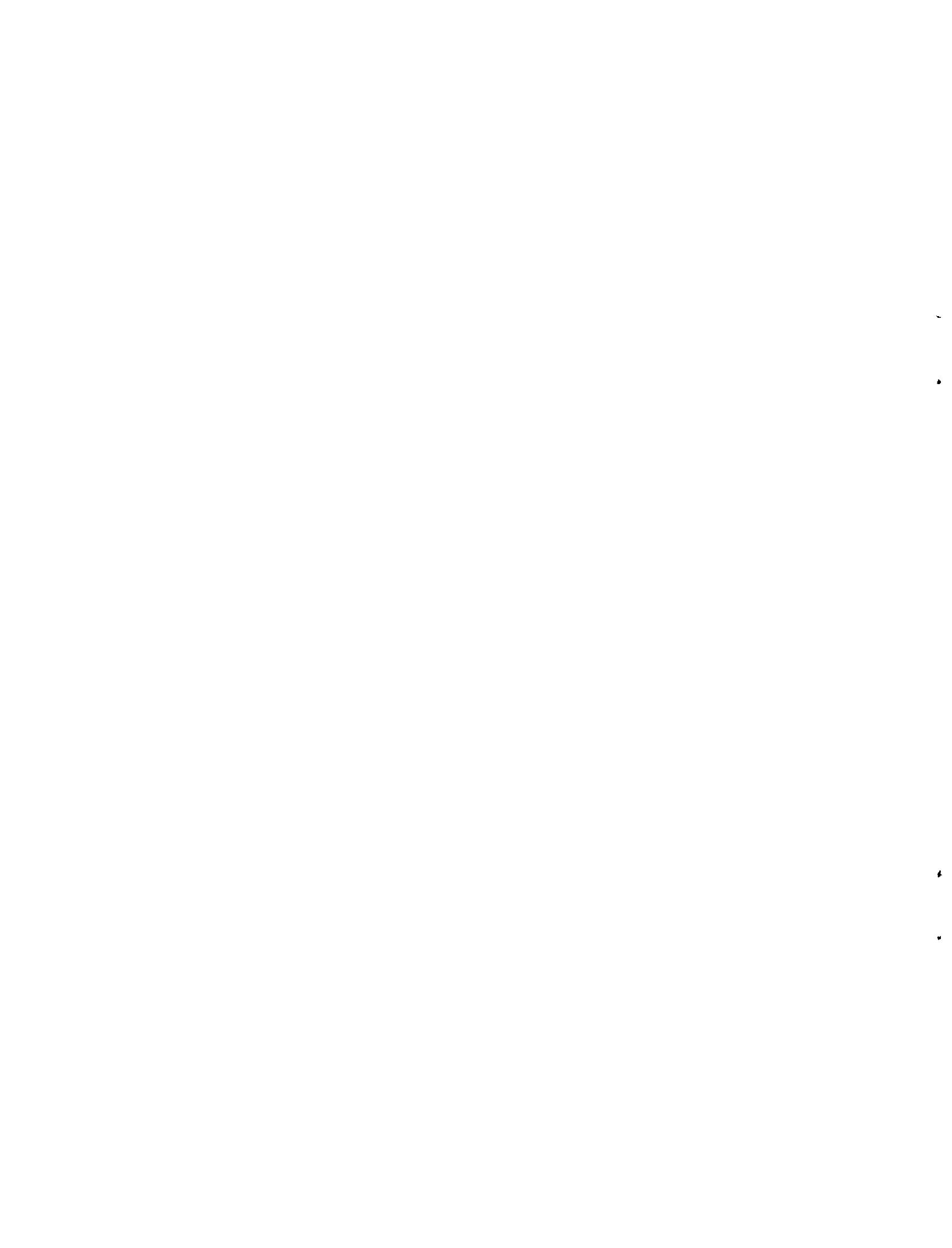
OWNER/OPERATOR OPTIONS FOR STRUCTURING OF PLAY

- Choice of 6 players per coin or 2 players per coin
- 2-minute game time or 90-second game time

ACCESSORIES AVAILABLE ON SEPARATE ORDER

Video Probe: order from ATARI

Universal Test Fixture for Steeplechase game: order from ATARI, catalog no. TF101



III. Theory of Operation

3.1 MAJOR FUNCTIONAL PARTS

The simplified block diagram in Figure 3-1 shows the major functional parts of the Steeplechase game and how they are interconnected. Note that the speaker is separate from the TV monitor.

3.2 GENERAL INFORMATION

The general information about the Steeplechase game given in this paragraph provides a background for understanding the Installation Instructions in Section IV of this manual, and the descriptions of game operation in paragraphs 3.3 and 3.4.

3.2.1 ENERGIZING THE GAME: The Steeplechase game does not have an external "power on" switch. Instead the game is energized as soon as the power cord is plugged into an active AC wall outlet. This outlet must provide the AC power listed in the Specifications (Section II of this manual).

3.2.2 TV MONITOR: The TV Monitor is a self-contained transistorized television monitor supplied to ATARI by Motorola. Because the composite video signal supplied to the monitor by the game's electronic control circuitry differs in certain important respects from the signal derived from commercial TV broadcasts, the monitor does not produce any sound and the picture appearing on its screen is unlike that of a home TV set. The game's sound is produced by a speaker mounted separately from the monitor and driven directly by the game's electronic control circuitry. (The separate "audio" and composite video connections shown in Figure 3-1 point out this difference.)

3.2.3 PICTURE ON TV SCREEN: The game's composite video is constructed to produce only one video level (white) instead of the more or less continuous shades of gray (between the extremes of black and white) seen on a home TV set. The horizontal "scan lines" on the game TV screen will be more noticeable than those on a home TV set. (This is explained by the fact that the composite video contains synchronization information which causes the TV monitor to produce only 272 horizontal scans, without interlace, from top to bottom of the screen, rather than the home TV's 525 lines with interlace.)

The game's TV screen is divided up into seven horizontal strips of equal height, with only one horse image moving along each strip, as shown in Figure 1-2. Horse images are white video level and the background is black video level.

The numerals "1" thru "7" are silk-screened on the acetate overlays placed on the TV screen. Rectangular-shaped "windows" of white video level provide backlighting to identify the number of each horse participating in a race.

3.3 GAME SEQUENCE

3.3.1 OPERATING MODES: During use the Steeplechase game can be described as operating in either of two modes, attract or play. Plugging the power cord into an active AC outlet energizes the game and it starts out in the attract mode. It remains in the attract mode until a player deposits a coin and the coin clears the coin mechanism, at which point signals derived from the coin mechanism cause the game to go into the play mode. The game remains in this mode until the horserace ends (by either a player horse or the pace horse reaching the finish line), at which point the game reverts back to the attract mode.

3.3.2 ATTRACT MODE: During the attract mode motionless horse images appear on the TV screen. Just after the game is energized they will be in random positions along their respective racetracks, and after completion of a play mode they will be retaining the positions held at the final moment of the race just completed. If one of the player horse images is touching the finish line, that horse and its portion of the racetrack will be blinking. If the pace horse image is touching the finish line, the closest player horse (or horses, when two or more are tied for second place behind the pace horse) will be blinking. The racetrack for each horse image consists of a solid line without pickets and a checkered finish line at the right-hand side.

If the game is structured for 6 players/coin, images of all six horses and of the seventh pace horse will appear on the TV screen. If structured for 2 players/coin, images of the pace horse and one of the following combinations of player horses will appear on the screen: horses #1 and #4, or horses #1, #2, #4 and #5, or all six horses.

During the attract mode none of the push button switches on the player control panel is lighted, depressing the start button or any player push button produces no response from the game, and no sound is produced by the speaker.

3.3.3 GAME SEQUENCE IN PLAY MODE: A player causes the game to change over from the attract to play mode when depositing a coin that clears the coin mechanism. Signals from the coin mechanism go to the electronic control circuitry and produce the following responses:

- (a) If the game is structured for 6 players/coin: all seven horse images move back to the start position and remain motionless, and all six player push buttons light up. If structured for 2 players/coin: the #7 pace horse and player horses #1 and #4 move back to the starting position and remain motionless; any other player horse images, racetracks, and finish lines disappear; and player push buttons #1 and #4 light up,

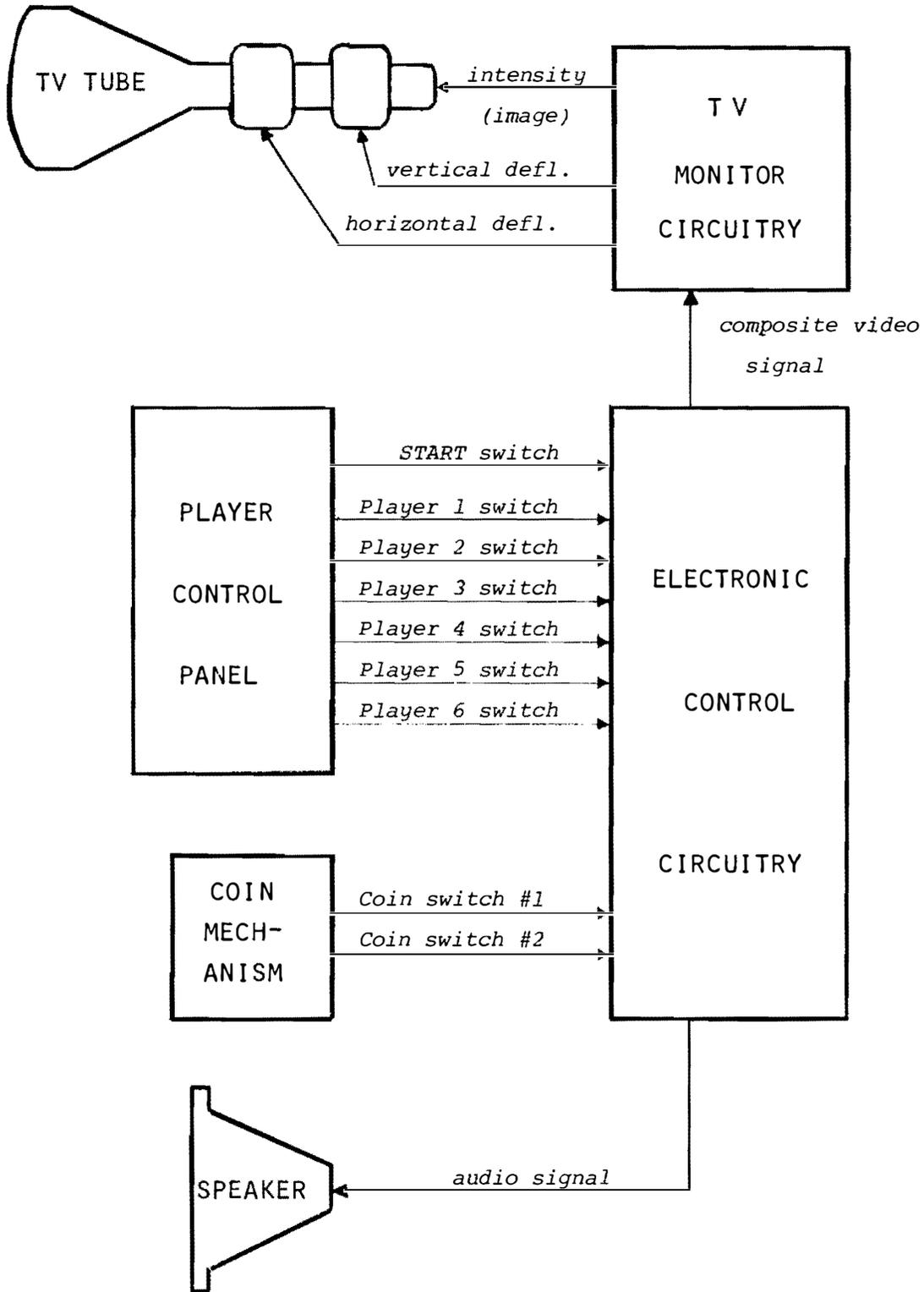


Figure 3-1 Simplified Block Diagram of Steeplechase Game

- (b) The speaker produces the bugle call sound, then goes silent.

If the game is structured for 2 players/coin, additional coins must be deposited in order for more than two players to participate in a race. Depositing a second coin causes horses #2 and #5 to appear at the start position, and those two push buttons to light up. The deposit of a third coin likewise causes the remaining two horses, #3 and #6, to appear on the TV screen and those buttons to light up.

To continue the game sequence, a player must next depress the start push button. A signal from the start switch goes to the electronic control circuitry and produces the following responses:

- (a) The racetracks for the pace horse and for each player horse immediately change from a solid line to a broken line,
- (b) The speaker immediately produces the sound of the starter's gunshot,
- (c) Pickets appear to the right of the checkered finish lines and begin to move toward the horses,
- (d) The horse images begin to gallop,
- (e) Each lighted player push button will cause its horse to go into a jump position when the button is depressed,
- (f) The speaker will begin to produce hoofbeat sounds continuously and background crowd roar sounds at random times.

Just before each picket reaches the #7 pace horse, the electronic control circuitry causes that horse to jump over the picket. Because of this automatic response the pace horse's advance toward the finish line is uninterrupted. But jumping of player horses is under control of the push buttons. In order to advance a horse toward the finish line, each player must manually depress the push button just before each picket (except those closest to the start position) reaches his horse. As long as a player can cause a horse to successfully jump over every picket, that horse's rate of advance toward the finish line will be double that of the pace horse.

If a player causes a horse to jump too soon, the horse image will descend too soon and will fall onto the picket. Or an approaching picket may strike a player's horse before the player has managed to push the button. Any horse striking a picket goes into a fall position momentarily, drops back a short distance, and then gets up and resumes galloping.

Any time a horse strikes a picket (except the one closest to the start position), the speaker produces a cracking sound. This sound will be louder if two horses strike pickets simultaneously, and still louder if three or more strike pickets at the same time.

Because a push button produces no response while the horse image is either in the jump or fall position, players are prevented from lengthening a horse's jump and from forcing a horse to get up from a fall.

The electronic control circuitry senses each time the lead player horse has advanced over another one-eighth part of the racetrack, and produces the following responses:

- (a) The speed of the picket movement toward the horses is increased somewhat,
- (b) The length of the lead horse's jump is decreased somewhat,
- (c) A whistle sound is produced by the speaker.

The accumulative effect of these incremental changes is especially noticeable as the lead player horse approaches closer and closer to the finish line.

The race ends when either the pace horse or one of the player horses reaches the finish line, and at that moment the game reverts back to attract mode. The leading player horse(s) will continue to blink during this mode, the horse images will retain their locations along the racetrack, and the speaker ceases to produce sound. The design of the electronic control circuitry includes features which prevent ties for first place, whether between player horses or between the pace horse and player horses.

3.3.4 OWNER/OPERATOR OPTIONS: The Steeplechase game has two option features which allow the owner/operator to alter the game structuring. The two-position switch S1 mounted on the printed circuit board will structure the game for 6 players/coin when in its "A" position, and for 2 players/coin when in its "AP"* position. Para. 4.3.1 in Section IV of this manual gives the procedure for adjusting this switch.

A jumpering point formed by two traces on the PCB artwork provides the means for adjusting the time required for the pace horse to reach the finish line. The elapsed time per play is maximum when the pace horse wins the race. If the jumpering point is not soldered, the maximum elapsed time per play will be 90 seconds. If soldered, the time will be two minutes. Para. 4.3.2 gives the procedure for making this game time adjustment.

*Note: in future production runs, this "AP" position will instead be labeled "2/4/6" on the board.

3.4 DETAILED TECHNICAL DESCRIPTION OF OPERATION

3.4.1 GENERAL INFORMATION: This subsection gives a component-level technical description of the game's electronic circuitry. Drawing number 003750 is a two-sheet schematic diagram of the circuitry on the printed circuit board, and drawing number A003750 is the PCB assembly drawing showing the locations of the components called out on the schematic. The position of each integrated circuit device is identified by a column letter designation (A through P), and by a row number designation (1 through 9). Drawing number 003266 is a schematic of the harness wiring inside the game cabinet. These drawings and a schematic diagram of the TV monitor's circuitry are included in Section VII of this manual.

On the PCB schematic the symbol *P* (appearing at various inputs to logic gates and other integrated circuits) indicates a connection to +5 volts through a pull-up resistor.

In the subsections that follow, the portions of the circuitry being described can be located on the PCB schematic by finding the intersection of the zone letters (A, B, C or D) and the zone numbers (1 through 8). For example, the designation sheet 1, zone A 8 refers to the extreme lower left corner of sheet 1 of the schematic.

3.4.2 CLOCK SIGNALS (SHEET 2, ZONES D 6, 7, 8): The output from a 12-MHz crystal-controlled oscillator at L4 pin 1 is divided by 2 at flip-flop K1 pin 2. The 6-MHz CLOCK signal produced at K1 pin 5 is then used as the main system clock. From every 384 CLOCK pulses applied at K1 pin 11, the configuration formed by flip-flop K1 and gate K2 passes a partial string of 255 consecutive clock pulses in each horizontal line at K2 pin 10. By additional gating at M1 pins 10, 2, 4 and 12, the HCLOCK 1 through HCLOCK 4 signals are generated. Their relationship to other timing signals associated with the horizontal scan lines seen on the TV screen is shown in the timing diagram of Figure 3-2. The HCLOCK 1 through HCLOCK 4 signals are used to clock the horse motion counters (see para. 3.4.7).

3.4.3 GENERATION OF HORIZONTAL SYNCHRONIZATION INFORMATION (SHEET 2, ZONES C 6, 7, 8 and D 6, 7, 8): Flip-flop H2 (with output at pin 5) and type-9316 counters H1 and F1 comprise a horizontal sync chain which divides the CLOCK signal by 384. The timing relationships between the HBLANK, HSYNC, FINISH LINE and HRESET signals produced in this chain are shown in Figure 3-2. The HSYNC signal at J2 pin 10 is the basis for the horizontal synchronization information sent to the TV monitor, and the HBLANK signal at H2 pin 9 is the basis for the horizontal component of the video blanking information to the monitor.

3.4.4 GENERATION OF VERTICAL SYNCHRONIZATION INFORMATION (SHEET 2, ZONES B 6, 7, 8 and C 6, 7, 8): Flip-flop C2 and type-9316 counters C3 and D3 comprise a vertical sync chain which divides the HSYNC signal by 272. The circuit configuration formed by transistor Q5 and flip-flop E2 detects power failures and produces a correct start-up sequence on the vertical sync chain after power is applied. The VSYNC signal at J2 pin 13 is the basis for the vertical synchronization information sent to the TV monitor. The VBLANK signal at E3 pin 5 is the basis for the vertical component of the video blanking information to the monitor. The timing relationships between VSYNC and VBLANK, and with certain other timing signals, is shown in Figure 3-3. A total of 272 HSYNC pulses are generated, and thus 272 horizontal scan lines appear on the TV screen, between successive VSYNC signals.

3.4.5 GENERATION OF RACETRACK INFORMATION (SHEET 2, ZONES B 6, 7, 8): Flip-flop C2 and type-9316 counters A2 and B2 comprise the racetrack horizontal motion counter. The BUFFERED CLOCK signal, which is derived directly from the system clock at L1 pin 12 (in zone D7), provides the clocking. The counter normally advances to a count of 384, but occasionally it is forced to 383 instead. The 383 count is regulated by the TRACK CLOCK signal at D2 pin 6, a signal derived from the type-9316 counter in location P5. This counter acts as a variable-rate pulse generator that is programmed by the A, A, B and C signals (applied at P5 pins 6, 5, 4 and 3) to divide by an increasingly smaller number. The A, A, B and C signals come from the leader detection circuit (see para. 3.4.8) and represent the position of the leading player's horse along the racetrack. As the leading horse gets closer and closer to the finish line, counter P5 goes through its cycle at a faster and faster rate and the broken-line racetrack is made to move faster and faster from right to left across the TV screen.

3.4.6 GENERATION OF PICKET INFORMATION (SHEET 2, ZONES A 7 and 8): The picket information on the TV screen is derived from the PICKET LINE signal produced at B1 pin 15. The type-9316 device in location B1 is configured to act as a programmable one-shot that is triggered at regular intervals along the racetrack by the signal coming from D1 pin 8. But B1's output at pin 15 times out after the random length of time determined by its position along the racetrack and a random number coming from A1 pin 8. The shift register device in location A1 circulates the random number until the picket is off the TV screen, at which time another random number is loaded from F4 pin 3 so that the new pickets follow a random pattern. This design insures that the spacing between successive pickets on the screen will be irregular. The shift

register device in location C1 insures that no pickets are present when a new play mode begins. Then an additional "1" is circulated in the register as each new picket appears, until all six bits are ones, meaning that all pickets are on the screen.

3.4.7 HORSE HORIZONTAL MOTION COUNTERS

(SHEET 2 ZONES A, B, C, D 4 AND 5): A total of seven horse motion counters are provided, one for the pace horse and one for each of the player horses. For example, the type-9316 devices in locations N2 and P2 form the counter for player horse #1. The counters are driven by the HCLOCK 1 through HCLOCK 4 signals derived from the main system clock (see para. 3.4.2). Each horizontal motion counter can be programmed to divide by either 256 or 255 or 254. If a motion counter counts 255 pulses, the horse image on the TV screen does not move along the racetrack because the HCLOCK 1 through HCLOCK 4 signals have exactly 255 pulses per horizontal scan line on the TV screen.

Now consider a specific motion counter for one of the player horses, say horse #1. If the REV 1 signal, applied at K2 pin 6 and N2 pin 4, is high, then the motion counter will divide by 254. This will cause horse #1 to move to the left (drop back) on the screen. But if REV 1 is low and the FW 1 signal, applied at K2 pin 5, is high, then the motion counter divides by 256. This will cause the horse to move to the right (advance towards the finish line). The other motion counters operate in a similar fashion. Note: The Atari motion circuit is protected by U.S. patent no. 3,793,483.

The REV signals are generated by the Jump and Fall Circuitry (see para. 3.4.9). An individual REV signal (REV 1, REV 2, etc.) is high only on one or two horizontal scan lines per frame on the TV screen, depending on the frequency of the TRACK CLOCK signal, and only when the horse is falling.

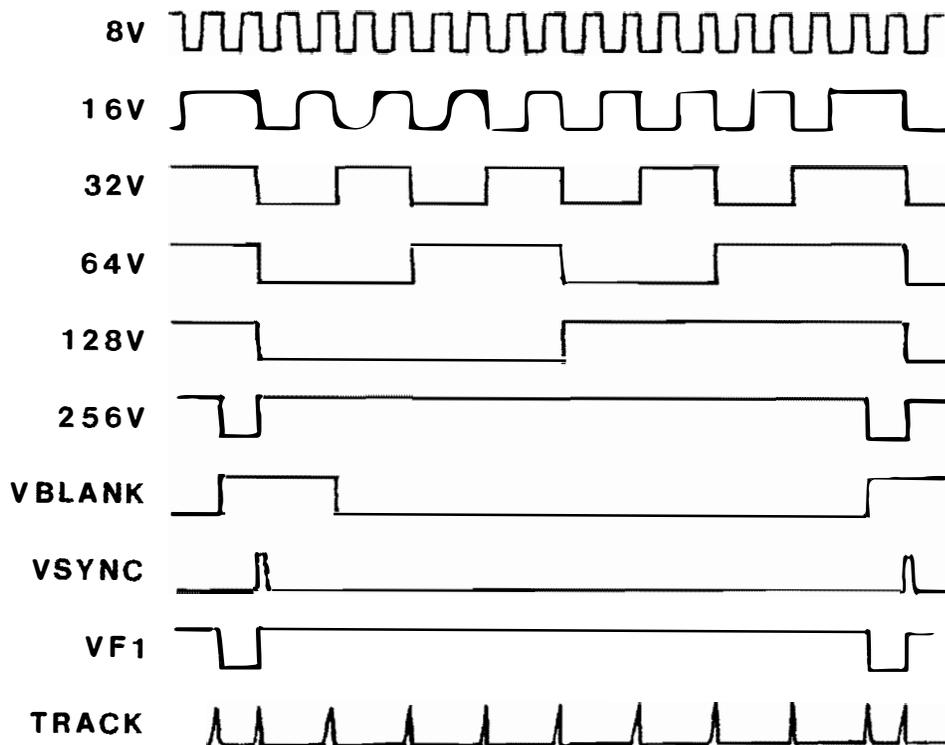


Figure 3-3 Timing Diagram of Signals Associated with Vertical Picture Frame

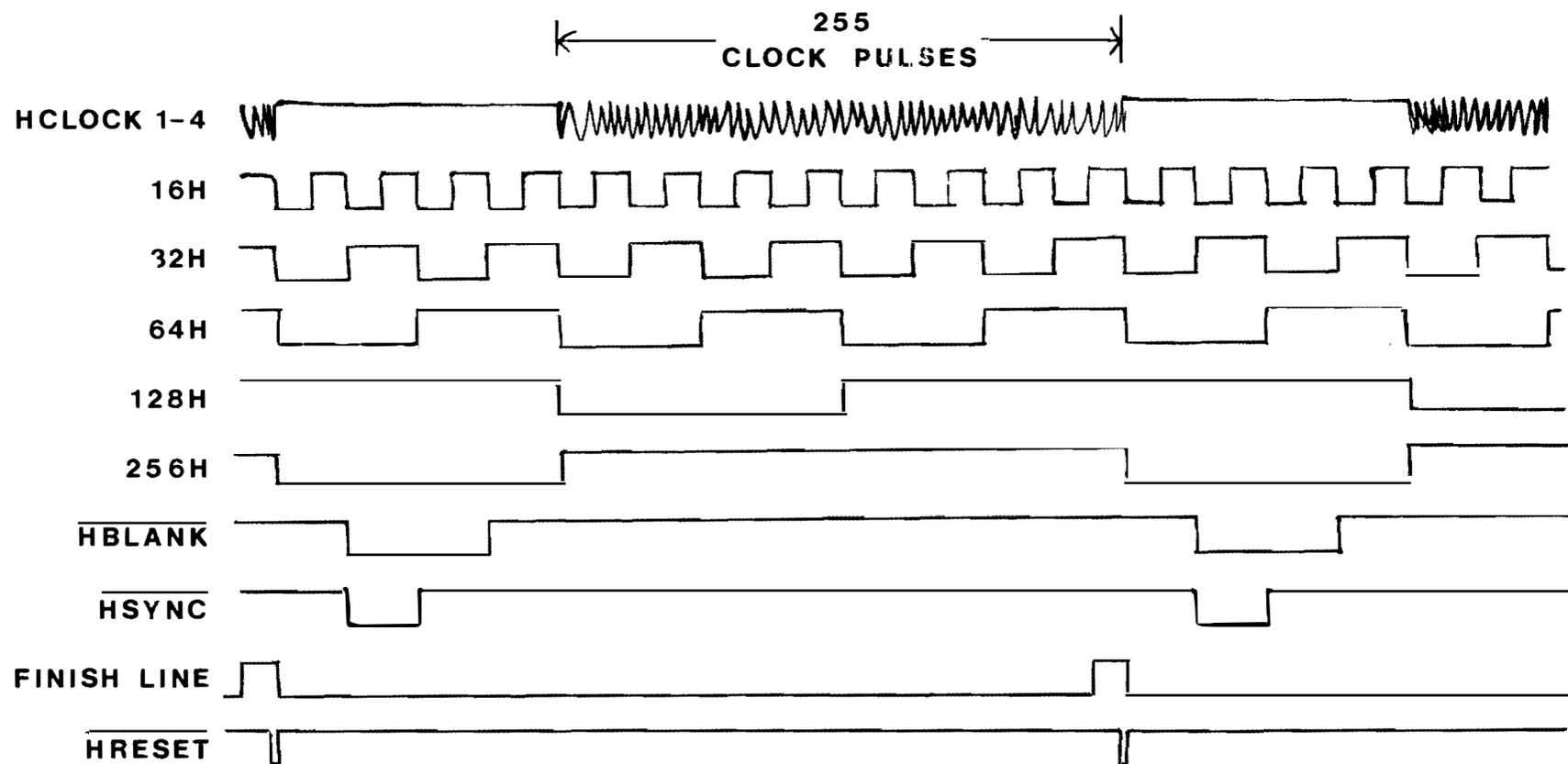


Figure 3-2 Timing Diagram of Signals Associated with Each Horizontal Scan Line

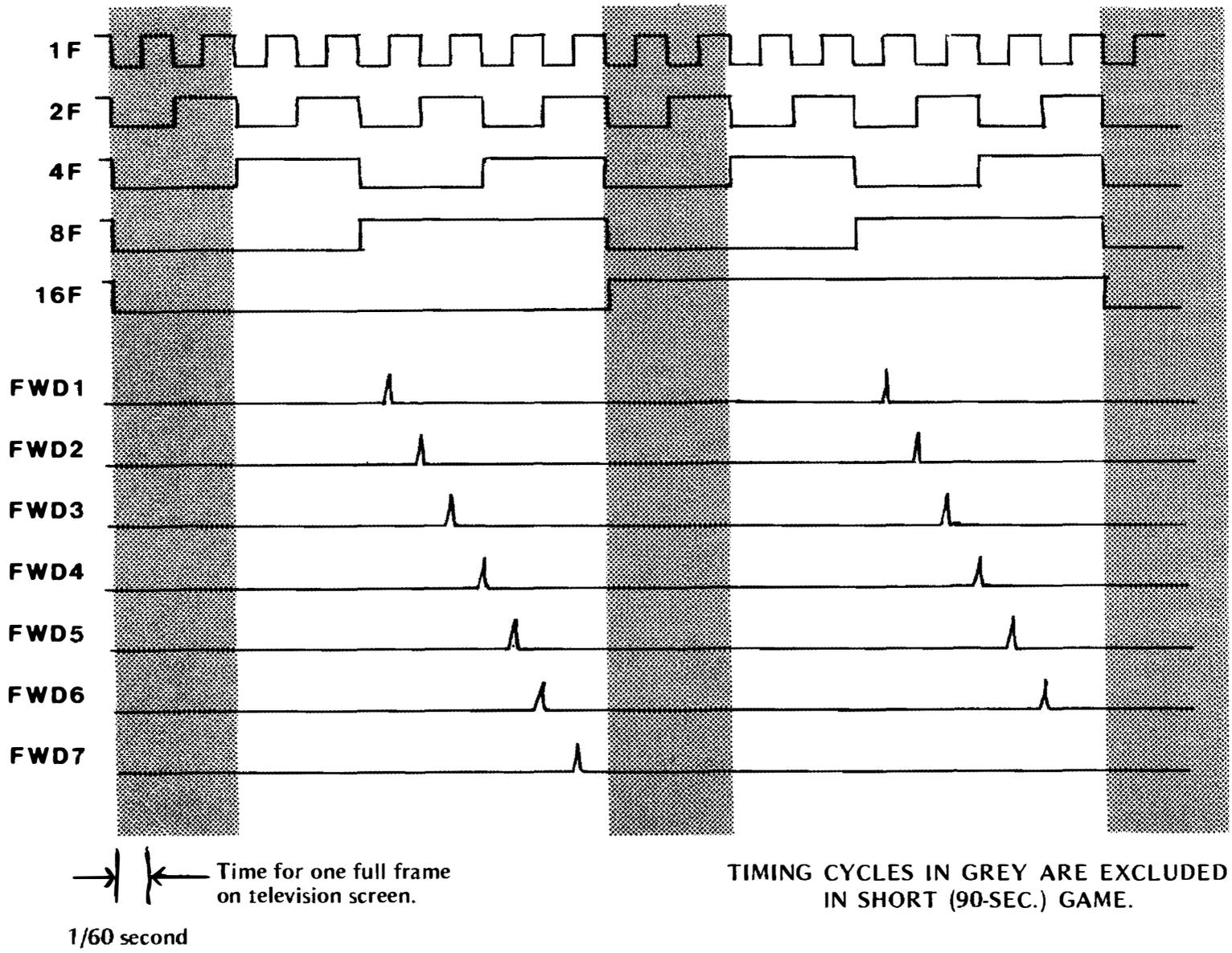


Figure 3-4 Timing Diagram of Signals FWD 1 Through FWD 7

The LEAD 7 signal at pin 5 of flip-flop E1 is high if horse #7, the pace horse, is in the lead. However, the LEAD 7 signal does not affect the lead information just described, and does not cause the racetrack to speed up.

Flip-flop B7 and type-9316 counter H3 form the frame counter. The VF1 signal, which goes high only once per frame on the TV screen, provides the clocking at H3 pin 2. The frame counter's output signals, 4F, 2F and 1F, are applied to a 4-to-10 demultiplexer device in location J3. The outputs from J3 are gated to produce the FWD1 through FWD6 and the $\overline{\text{FWD7}}$ signals for the horizontal motion counters just described. The time relationships between the frame counter's outputs and the FWD1 through FWD7 signals are shown in Figure 3-4.

On the schematic note the jumpering point drawn between ground and the junction of resistor R9 and H3 pin 5. With the jumpering point connected, the frame counter has a maximum count of 32 (two-minute game). With the jumpering point not connected, the maximum count is 24 (90-second game). This feature comprises the 2-minute/90-second owner/operator game time option.

Figure 3-4 shows that each horse is allowed to move forward on a different frame on the TV screen. When structuring is for a 90-second game, each player horse can move forward once every 12 frames, and when structuring is for a 2-minute game, once every 16 frames. But player horses can drop back on any frame.

Figure 3-4 also shows that the FWD1 through FWD6 signals are generated twice as often as the $\overline{\text{FWD7}}$ signal. This means that the #7 pace horse can advance toward the finish line only half as often as player horses can. However, the pace horse never drops back, that is, never strikes a picket. This is why a REV7 signal is not necessary.

The terminal count signals TC1 through TC7 from the motion counters go to the horse video circuitry (para. 3.4.10) and indicate when to start showing horse video.

3.4.8 LEADER DETECTION CIRCUIT (SHEET 2 ZONES C 2, 3 AND D 2, 3): The $\overline{\text{TC1}}$ through $\overline{\text{TC6}}$ signals, ORed together in gate P6, and the $\overline{\text{VRESET}}$ signal, which occurs on the last horizontal scan line of each frame on the TV screen, are gated at H4 pin 3 to produce a clocking signal. This signal causes certain information to be gated into latches N7, N6 and A4. The very last TC pulse on this last scan line leaves the following information in these latches for the next entire frame: which horse is in the lead (the LEAD 1 through LEAD 6 signals), and where the lead horse is located (A, A, B and C signals). If horses are tied, both LEAD signals will be high. The lead information is used to make the lead player horse's jump shorter than the

jump of the other horses, and to blink the winner at the end of the race. The location information is used to speed up the race track and the gallop rate as the leader progresses.

3.4.9 JUMP AND FALL CIRCUITRY (SHEET 1 ZONES C,D, 5 THROUGH 8 and B 7,8; SHEET 2 ZONE D 1): To cause a horse to jump, the player has to depress the corresponding front panel push button. Doing this produces a signal whose edge sets a flip-flop: for horse #1 this occurs at L8 pin 3. The flip-flop's output at L8 pin 6 then causes a type-9316 counter, which is configured as a programmable one-shot, to start timing on the next cycle of the 1/2 TRACK CLOCK signal. The length of its timing is determined by whether that horse (#1) or the pace horse (#7) is in the lead. Since the 1/2 TRACK CLOCK signal is proportional to the speed of the track, this one-shot controls the distance of the jump with respect to the track, regardless of the track speed. When the type-9316 counter reaches terminal count, the TC signal at L6 pin 15 is used to disable further counting until a load or a master reset command occurs. Note that with this configuration a jump cannot be initiated if the game is in the attract mode, or if the horse is already jumping or falling.

The hit detection circuitry (on sheet 2 zone D 1) initiates the fall sequence. The coincidence of horses and pickets is detected at gate F2 pin 12, and a signal is produced whenever a horse strikes a picket. Gating at F2 pin 8 disables any hits during the first one-eighth part of the race-track. The HIT TRIGGER generated at A4 pin 5 is decoded into six separate signals $\overline{\text{HIT1}}$ through $\overline{\text{HIT6}}$ by the demultiplexer device in location N5. This decoding is possible because the vertical sync information contained in the 32V, 64V and 128V signals determines which horse hit a picket when the HIT TRIGGER signal is present.

The signals $\overline{\text{HIT1}}$ through $\overline{\text{HIT6}}$ go to the master reset inputs at the jump/fall one-shots and to the fall flags (on sheet 1). For example, the $\overline{\text{HIT1}}$ signal goes to its one-shot at L6 pin 1, and to the fall flag L5 at pin 4, which has the signal FALL1 at L5 pin 5. The one-shot L6 then counts for 15 cycles of the 1/2 TRACK CLOCK signal, until the terminal count signal at L6 pin 15 resets the fall flag at L5 pin 13 and completes the timing cycle. To move the horse backwards, the REV1 signal is generated on every other cycle of the 1/2 TRACK CLOCK signal.

In a separate pace horse jump circuit (sheet 2 zone A 4,5), gate K4 senses when a picket is within a one-half horse length in front of the pace horse and produces a signal at K4 pin 13. This signal forces flip-flop J4 into a jump condition and the signal JUMP 7 is produced until the picket is behind the pace horse. No fall circuitry is required for the pace horse because the pace horse cannot hit a picket.

3.4.10 HORSE VIDEO (SHEET 2 ZONES A THROUGH D 1,2,3): Two read-only memories (ROMs) in locations C4 and D4 have been programmed with a total of six horse figures: one jumping, one falling and four different running figures. The choice of which figure is to be read out from each ROM is under control of the signals applied to the ROM's A5, A6, and A7 address inputs.

The gallop rate signals X1 through X4 generated by the IC device in location F7 are proportional to the 1/2 TRACK CLOCK signal. To produce the GALLOP A and GALLOP B signals, the X3 and X4 signals are added to the vertical sync chain's 64V and 32V signals, respectively. The GALLOP A and GALLOP B signals are then combined with a composite JUMP signal from H5 pin 15 and a composite FALL signal from J5 pin 15, respectively, to produce the signals that will select the horse figure to be read out from the ROMs (refer to Figure 3-5).

During horizontal blanking the data from the ROMs for the current line of video are loaded into the shift registers in locations C5 and D5. When a composite TC signal is received from P8 pin 14, the shift registers are enabled to shift the video out. The video is gated with an enable signal which only allows the enabled horses to be displayed, and the composite HORSES signals appears at F3 pin 12.

3.4.11 OTHER VIDEO CIRCUITRY (SHEET 2 ZONE A,B 1 AND 2): The racetrack portion of the composite video is produced at A3 pin 6 by the gating of the TRACK signal, coming from C3 pin 15 in the vertical sync chain, and the two signals T1 and T2 coming from the racetrack motion counter (A2 pins 14 and 13). This is the portion of the video that produces the dotted line effect on the TV screen.

The finish line portion of the composite video is produced at A3 pin 11 by gating the FINISH LINE signal, coming from B4 pin 6 in the horizontal sync chain, with the exclusive OR of signals 2H and 2V. This produces the checkered effect on the TV screen.

The pickets are produced by gating the PICKET LINE signal, coming from B1 pin 15, with the vertical sync chain's 16V, 8V, and 4V signals. This produces the PICKET signal at B3 pin 6 and also the stubby picket seen on the TV screen.

The above signals are ORed together at B3 pin 10 and then gated with a signal coming from F5 pin 15. This signal from F5 has components which come from N8 pin 14 and causes the winning horse to blink, includes the VBLANK, HBLANK and 16V (the space between horses) from C6 pin 8, and enables only those horses which have received credit. The video signal produced at B4 pin 8 is then mixed with the composite sync signal produced at E4 pin 10. The signal resulting at the junction of resistors R10 and R11 is sent to the TV monitor as the composite video output.

3.4.12 COIN CIRCUITRY (SHEET 1 ZONE A,B 4 AND 5):

The signals coming from the coin switches are debounced and verified to have a length of at least 20 milliseconds by the analog circuitry connected between the edge connector pins (N and 13) and the amplifiers, J9 pin 14 and J9 pin 13. The outputs from these amplifiers is then combined to produce the COIN signal at J8 pin 11. This signal sets the credit latch formed by the two amplifiers with outputs at J9 pin 1 and J9 pin 2. Transistor Q4's circuit provides the credit latch with static charge sensing. By comparing the diode D2's drop voltage at J9 pin 5 to the resistor divider voltage at J9 pin 4, the credit latch also has power fault (power on) reset. At the end of the game the signal produced at D7 pin 3 resets the credit latch.

Comp JUMP*	Comp FALL*	GALLOP A	GALLOP B	3 MSB of ROM Address			FIGURE
				A7	A6	A5	
1	0	X	X	1	0	0	Jumping Horse
0	1	X	X	1	0	1	Falling Horse
0	0	0	0	0	1	0	Running Horse #3
0	0	0	1	0	0	0	Running Horse #1
0	0	1	0	0	1	1	Running Horse #4
0	0	1	1	0	0	1	Running Horse #2
				1	1	0	(unprogrammed)
				1	1	1	(unprogrammed)

*Comp JUMP and Comp FALL are mutually exclusive, i.e. cannot both be "1."

Figure 3-5 Address Coding for ROMs

The game is structured for 6 players/coin when switch S1 is in the "A" position; this forces the 4PLAY signal at F6 pin 6 and the 6PLAY signal at F6 pin 8 to always be high. Deposit of the first coin will then cause all three GAME RESET signals to occur, resetting all horses to the start line, and will cause the BUG TRIG (bugle trigger) signal to initiate the bugle sound sequence. Also the coin counter driver is triggered, and all front panel push buttons are lit.

A player depressing the start button causes the ATTRACT signal to be produced at F8 pin 6.

The game is structured for 2 players/coin when switch S1 is in the 2/4/6 position. Deposit of the first coin will set the credit latch, and the signal Q at H8 pin 2 will go high. Q going high causes the coin counter F6 to be incremented, the BUG TRIG signal to be generated, and the GAME RESET 1 signal forces horses #1 and #4 back to the start line.

Deposit of a second coin will clock the 4PLAY signal to high and the GAME RESET 1 and GAME RESET 2 signals will be produced. Deposit of a third coin will clock the 6PLAY signal to a high, and all three GAME RESET signals will be produced. The bugle call sound is produced only after the first coin is deposited. As each additional coin is deposited, the next two horses will appear on the TV screen and those jump push buttons will light up. As in the 6 players/coin structuring, a player depressing the start button starts the race; however, in 2 players/coin structuring, additional players can join the race after it has started by depositing more coins. Note: If additional players are added after the game starts, all horses except the pace horse will be reset to the start position.

3.4.13 BUGLE SOUND CIRCUIT (SHEET 1 ZONE D 3 AND 4): The bugle sound circuit consists of time value counter B8, the note sequencer formed by C7 and B7, the ROM in location C8, and frequency synthesizer D8. The bugle sound sequence begins when the BUG TRIG signal resets the note sequencer at C7 pin 3 and via the gate input D7 pin 12. Information from the note sequencer then addresses the ROM. This information includes the frequency of the present note (signals BUG1 through BUG4) and the time value of the next note (BUG6 through BUG8). The frequency data go to frequency synthesizer D8 and the time value data to time value counter B8. Counter B8 first makes the note sound for the proper amount of time, then increments the note sequencer C7 and B7, and after that loads new time value data. The BUG8 signal produced at C8 pin 9 signifies the end of the sequence.

3.4.14 OTHER SOUND CIRCUITS (SHEET 1 ZONES B,C,D 1 THROUGH 4): The junction of resistors R87, R90, R89, R88 and R74 forms a summing point for the sound signals for the bugle, constant background crowd roar, gunshot and fall, whistle and trot (gallop sound) circuits.

Transistor Q9 is a current-starved, zener-biased noise generator. Its output is buffered by amplifier C10, and the signal NOISE appears at C10 pin 1. A variable attenuation circuit involving Q8 and the signals C* and \bar{Q} feeds a changing-amplitude noise signal into an active band-pass filter formed by amplifier C10. The output at C10 pin 7 adds the crowd roar sound heard in the background during play.

To produce the gunshot and fall sounds, transistor Q6 charges capacitor C46 at the start of the game play and each time a horse strikes a picket and falls. This decaying voltage controls the gain of the saturating amplifier stage Q7, which produces a burst of noise (a "bang") each time the circuit is triggered. The output is band-pass filtered before the sound summing point.

The whistle sound is produced by a type-556 timer device in location F9. Half of this IC is connected as a long time constant one-shot. It is triggered each time the leading horse completes an additional one-eighth of the race. The signal C* coming from F8 pin 8 provides the triggering. The second half of IC F9 forms a VC● (voltage controlled oscillator) which is driven by the one-shot's timing capacitor voltage and is gated by the one-shot pulse. The signal WHISTLE is produced each time this circuit is triggered.

The type-9312 device in location E7 produces the gallop sound by making a 3-out-of-4 pulse sequence based on timing of the gallop rate signals X1, X2 and X3.

3.4.15 AUDIO OUTPUT STAGE (SHEET 1 ZONE B 2 AND 3): The sound signals described in paragraphs 3.4.13 and 3.4.14 are mixed by operational amplifier C10; the output at pin 10 is coupled to a type-LM380 audio power amplifier in location B9. The output at B9 pin 8 is coupled to the speaker. The signal Q controls transistor Q10 so that Q10 turns on power amplifier B9 at the start of the game, and disables it one second after the game ends.

IV. Installation Instructions

4.1 UNPACKING INSTRUCTIONS

4.1.1 EXAMINATION FOR SHIPPING DAMAGE: Before shipment from the factory, components and sub-assemblies of each game are carefully checked for proper operation. However, during shipment some adjustments may have changed or parts may have been damaged. Upon initial removal of the game from the shipping container, examine the exterior of the cabinet; then open the rear panel access doors and also examine the interior. Any shipping damage such as a dented, cracked or broken cabinet, sub-assemblies broken loose, etc., should be reported immediately to the shipper and to Atari, Inc.

4.1.2 MECHANICAL INSPECTION: Once it has been determined that the game has been received in good condition, next carefully inspect the interior parts and verify the following:

- (a) All slip-on and plug-in connectors are firmly seated (particularly the PCB edge connector)
- (b) The fuses are all seated in their holders
- (c) No loose foreign objects are present (especially metal objects which could cause electrical short circuits)
- (d) No harness wires have become disconnected or pulled loose. Be sure *all* major assemblies have been checked... the TV monitor, the printed circuit board, the push-button switches and lamps on the front panel, the speaker assembly, the coin mechanism, and the interlock switches activated by the rear panel access doors.

Do not go on to the remaining paragraphs in this section until the above material inspection has been thoroughly performed.

4.1.3 SETTING UP CABINET AT GAME SITE: The upper portion of the cabinet containing the TV monitor is attached to the main portion of the cabinet with runners. For transit and for carrying the game through narrow doorways, the upper portion may have been slid forward on the runners until its back side is flush with the back side of the main portion of the cabinet and then bolted in that position. Also the control panel assembly (item 11 on drawing number A003249 included in Section VII of this manual), would be unbolted and removed whenever the upper portion of the cabinet is in its forward "transit" position.

After delivery to the game site, the upper portion of the cabinet and the control panel assembly must be bolted down in the positions shown on drawing A004274, prior to energizing and using the game. We strongly suggest assembling the Steeplechase game in the room where it will be located. Otherwise, in the assembled mode, it may not fit through certain doorways. To assemble the game, follow these two steps:

Step 1) Open the lower rear door for access. Loosen (don't remove completely) both hex-head bolts (one on each side underneath the top portion's wooden base). Slide top portion of cabinet back to its rear limit on the runners and retighten the two bolts.

Step 2) Remove the control panel packaged in bubble wrap from the cabinet interior. Locate the small bag taped to control panel. It contains eight carriage bolts- 5 with hex nuts for the panel's *bottom* half, and 3 with wing nuts for the panel's *top* half. Attach the control panel with these bolts to the cabinet. Then join the 12-position Molex connector to the harness. Close and lock the lower rear access door.

4.2 ENERGIZING THE GAME

4.2.1 APPLICATION OF AC POWER: Close the rear panel access doors, making sure that they are completely shut at the bottom, and remove the locking key. Plug the power cord into an AC outlet providing the AC power listed in the Specifications (Section II of this manual). The wall outlet must accept a three-prong plug and the receptacle must be connected to a good earth ground. After the power cord has been plugged in, the proper response from the game is that images appear on the TV screen.

If there is no response from the game, unplug the power cord and check the AC wall outlet. A simple, safe way to check for presence of AC power at the wall outlet is to plug in an appliance known to be working properly, such as a table lamp, radio, or an electric clock. If the wall outlet passes the check, then presume that the trouble is with the game and refer to Section VI of this manual. (*CAUTION: No trouble-shooting steps should be attempted inside the cabinet by anyone not familiar with safety measures and repair procedures on electrical equipment.*)

Do not go on to the remaining paragraphs in this section until the proper response described above has been observed.

4.2.2. CHECK ON OPERATION OF INTERLOCK

SWITCHES: The interlock switches are safety switches connected to the AC power circuit. They are mounted inside the cabinet, one in the upper portion of the cabinet, near the bottom edge of the rear panel access door, and the other in a similar position in the lower, main portion of the cabinet. At the factory these switches are mechanically adjusted so that the upper switch will automatically transfer to its "off" position (switch contacts open) whenever the upper rear panel access door is opened, and likewise the lower switch will automatically transfer to "off" whenever the lower rear panel access door is opened. While an access door is closed, the corresponding interlock switch is adjusted to be in the "on" position (switch contacts closed). With

this arrangement, only while *both* access doors are closed is the AC power allowed to reach the game's power supply, meaning that the game can operate.

After application of AC power per paragraph 4.2.1 above, correct operation of the interlock switches can be checked in two steps, as follows:

Step 1) Unlock and open the upper rear panel access door. The correct response is that by the time the edge of the door has moved about 2 to 3 inches away from the cabinet, the TV screen should go dark, verifying that the interlock switch has automatically transferred to "off." While opening the access door, do not insert fingers inside the cabinet, and do not allow foreign objects to fall inside. If images are still present on the TV screen even after the door has been opened, immediately close and lock the door, and unplug the power cord from the wall outlet. Then refer to Section VI of this manual to replace and/or adjust the interlock switch. If the correct response was obtained, then close and lock the access door.

Step 2) Unlock and open the lower rear panel access door. The correct response is the same as described in Step 1 above. If the correct response is obtained, then close and lock this access door also.

Do not go on to the remaining paragraphs in this section until the operation of both interlock switches has been checked and found to be correct.

4.3 GAME STRUCTURING

Before putting the game into operation at the game site, the game structuring should be defined by the owner/operator. The term *game structuring* refers to the game rules and the maximum length of the overall elapsed game time per play. Para. 3.4.7 of Section III in this manual covers the owner/operator options provided in this game and describes their effect on game structuring.

Adjustment of the 6-players-per-coin/2-players-per-coin option consists of manually changing the position of a two-position switch mounted on the printed circuit board inside the cabinet. Adjustment of the 2-minute/90-second game time option consists of soldering or unsoldering two adjacent points on the surface of the printed circuit board.

Before performing either adjustment, the game should be de-energized or not operating. Further, it is also recommended that the power cord be unplugged beforehand.

Unlock and open the lower rear panel access door; doing this should cause the interlock switch to de-energize the game, as described in para. 4.2.2. If the interlock switch fails to de-energize the game, then immediately close and lock the door, unplug the power cord, and refer to Section

VI of this manual to adjust and/or replace the switch.

While being careful to avoid touching any parts of your body against the TV chassis components or other wiring connections inside the cabinet, find the printed circuit board.

4.3.1 ADJUSTMENT OF 6-PLAYERS-PER-COIN/2-PLAYERS-PER-COIN OPTION: On the PCB find the switch mounted near the board's lower edge, approximately halfway from each end of the board. The location of this switch is shown on drawing number A003750. Note the letters "AP"* and "A" engraved on the board's surface, alongside the switch.

To structure the game for 6 players/coin, manually slide the switch stud toward the letter "A" as far as it will go. To structure the game for 2 players/coin, manually slide the switch stud toward the letters "AP"* as far as it will go.

After doing this, make sure that no foreign objects have been dropped inside the cabinet, and then close and lock the access door.

4.3.2 ADJUSTMENT OF 2-MINUTE/90-SECOND GAME TIME OPTION: Remove the PCB from inside the cabinet by unplugging its edge connector and sliding the board all the way out of its guides. Then find the two PC traces which comprise the jumpering point located between the IC devices in board positions H3 and J3 (see Figure 4-1). If these two stripes are left *not* connected, the maximum elapsed game time per play will be 90 seconds; if they *are* connected by soldering, the maximum elapsed game time per play will be 2 minutes.

CAUTION: Be careful not to apply excessive heat when touching a soldering iron to the traces. Excessive heat can damage the traces, causing them to peel up from the surface of the board. A 40-watt iron with a small tip designed for IC work is recommended for this task.

After the adjustment has been made, by either soldering or unsoldering the jumpering point, replace the PCB inside the cabinet. Make sure that the PCB edge connector is plugged in securely and in the correct orientation. Also make sure that no foreign objects have been dropped inside the cabinet. Then close and lock the access door.

*Note: in future production runs, this "AP" position instead will be labeled "2/4/6" on the board.

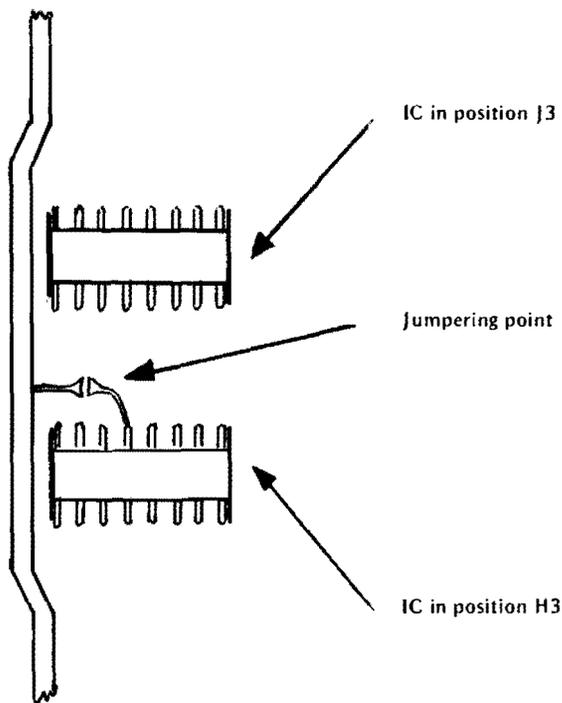


Figure 4-1 Location of Jumpering Point on PCB

4.4 FUNCTIONAL CHECK OF GAME OPERATION

The following procedure provides a simple check that can be quickly performed at the game site, and that does not require external test equipment. If at any point during this procedure the game's response is observed to be other than the response called for herein, assume the game is not operating correctly and refer to Section VI of this manual. If all responses are as described here, then all major parts of the game can be assumed to be functioning correctly.

After performing the adjustments described in paragraph 4.2, Energizing the Game, and paragraph 4.3, Game Structuring, the game should be operating in the attract mode, as per para. 3.3.2. The speaker should not be producing any sound. Observe the TV screen.

If the game has been structured for 6 players/coin, the images of all six player horses and of the seventh pace horse should be appearing on the screen. If the game has been structured for 2 players/coin, the images of the pace horse and one of the following combinations of player horses should be appearing on the screen: horses #1 and #4, or horses #1, #2, #4 and #5, or all six horses. None of the images will be moving and the horses will be at random positions along their respective tracks. For each of these horse images the racetrack will be a solid line rather than a

broken line, the checkered finish line will be visible, but no pickets will be visible.

Also if one of the player horse images is touching the finish line, that horse and its portion of the racetrack will be blinking. If the pace horse image is touching the finish line, the pace horse image will not blink but the closest player horse (or closest player horses when two or more are tied for second place behind the pace horse) will be blinking.

If the game has been structured for 6 players/coin, upon acceptance of a coin all seven horse images should move back to the start position and all six push buttons light up. No horse images should be blinking.

In addition to the visual responses described above, upon acceptance of the first coin the speaker should immediately produce the bugle call. But after the bugle call ends, the speaker should go silent.

Next depress the player push buttons, one at a time. Doing this should not produce any response from the game.

Next depress the "START" push button. Immediately the speaker should produce the sound of the starter's gunshot, and after that produce continuous hoofbeat sounds, constant background crowd roars, and certain other sounds throughout the play mode. On the TV screen the racetracks should immediately change from solid to broken lines, pickets should appear on the extreme right-hand edge of the screen and begin moving toward the horses, and the horses should begin galloping toward the finish line.

Watch the horse images as they encounter the pickets. The seventh pace horse should automatically jump over all pickets and continue to gallop on toward the finish line. Player horses should all begin to advance toward the finish line and gallop through the first picket. But as soon as any player horse strikes any picket after the first one, that horse should momentarily go into a fall position, drop back a short distance, get up and then resume galloping again. Whenever any player horse strikes a picket after the first one, the speaker should produce a cracking noise. Verify these responses for each of the seven horses.

Next check the operation of the player push buttons. If a button is depressed while the horse is in a fall position, there should be no response from the game. If a button is depressed while the horse is galloping, the horse should go into a jump position, remain there momentarily, then come back down onto the racetrack and resume galloping again. However, if the button is depressed a second time while the horse is still in the jump position, there should be no response from the game. Verify the correct response from each of the six player push buttons, one at a time.

Next choose one player horse and exercise the push button so that this horse jumps over pickets and moves out in front of all other player horses. Each time this lead horse covers another one-eighth part of the racetrack's total length, the speaker should produce a whistle sound. Also the speed of the picket movement should increase somewhat, and the length of the lead horse's jump should decrease somewhat, as each successive one-eighth part of racetrack length is covered. The accumulative effect of these incremental changes should be especially noticeable as the lead horse approaches closer and closer to the finish line. Continue to exercise the push button until either this horse or the pace horse reaches the finish line.

When a horse reaches the finish line, the race ends and the game should change over to the attract mode. The speaker should cease to produce sound and the lead player horse should begin to blink. Also all horse images should be motionless in gallop positions and in the places they held along the racetrack at the moment the race ended. Also the player push buttons should no longer be lit.

This completes the functional check of the usual game sequence. However, it is possible that a player may deposit an additional coin after a race has started. To check the game's response to this action, proceed as follows. Deposit a coin, depress the "START" button, and exercise one of the player push buttons until that horse is leading all other player horses. Then deposit an additional coin.

If the game has been structured for 2 players/coin, the game should respond by forcing all player horses back to the start position and by adding two more horses, and then by resuming the race. But the pace horse will be left undisturbed; this horse will not be forced back to start. Also the speed of picket movement will be restored to the slowest speed, but there will not be a new bugle call. If structured for 6 players/coin, the game should respond by forcing all player horses *and* the pace horse back to the start position. Also the speed of picket movement will be restored to the slowest speed and there will be a new bugle call. The "START" button need not be depressed again; the race will automatically begin all over again as soon as the bugle call ends.

V. Maintenance and Adjustments

5.1 ROUTINE MAINTENANCE

Due to its solid-state electronic circuitry, the Atari Steeplechase game should require very little periodic maintenance and only occasional adjustment.

5.1.1 CLEANING: Game cabinets and glass may be cleaned with any non-abrasive household cleaner. If desired, special coin machine cleaners which leave no residue can be obtained from distributors.

5.1.2 LUBRICATION: About once every three months lightly spray the rejector linkage portion of the coin acceptor inside the coin mechanism. Use WD-40® or similar lubricant, and *avoid* spraying the entire coin acceptor. Potentiometer shafts must *never* be lubricated in any way.

5.2 ADJUSTMENTS ON TV MONITOR

The TV monitor need be adjusted *only* when the picture is distorted, or if contrast or brightness seems out of adjustment. The light detector circuit inside the pistol produces its maximum output when the TV screen's brightness is at the maximum setting.

NOTE: Access to the TV monitor is possible only from inside the cabinet, and these adjustments are made while the game is energized. Therefore only those familiar with safety measures and repair procedures on electrical equipment should make these adjustments.

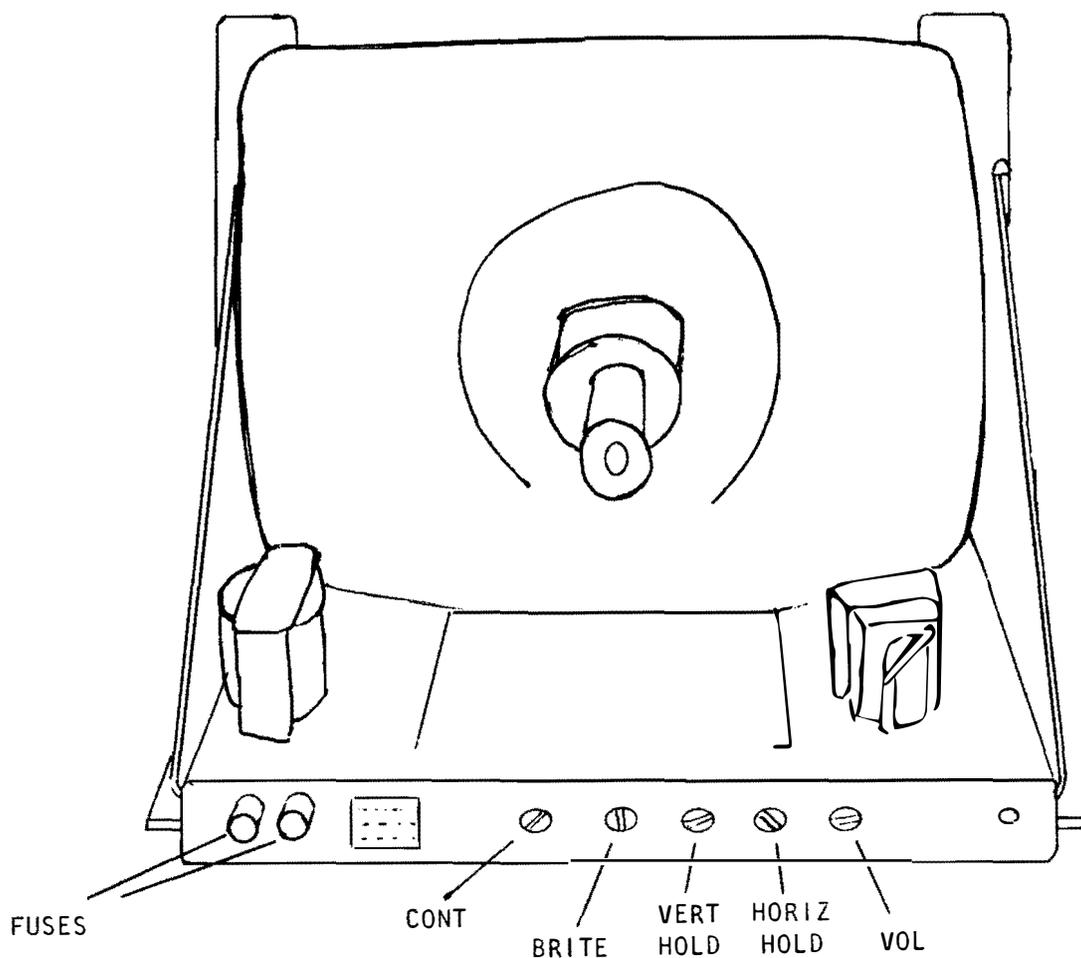


Figure 5-1 Location of Adjustments on TV Chassis

The TV monitor's adjustments function like those of a conventional commercial TV set, except that the volume adjustment has no effect. The Steeplechase game produces its sound in a speaker separate from the TV monitor. Figure 5-1 shows the location of these adjustments on the rear of the TV monitor chassis. The following are general guidelines to follow while making these adjustments:

- BRITE (Brightness)** This should be adjusted before the contrast. Adjust the brightness 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)** Adjust if the picture is slightly off-center horizontally, 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.

5.3 ADJUSTMENT OF SPEAKER VOLUME

The loudness of the sounds produced during game play can be adjusted with the potentiometer R98, as described in the circuit description of para. 3.4.15, Section III of this manual. The adjustment is done by manually moving the stud on top of the potentiometer body, as shown in Figure 5-2. This potentiometer is mounted on the printed circuit board inside the cabinet. Drawing number A003750, the PCB assembly drawing included in Section VII of this manual, shows this potentiometer in the lower right corner of the board.

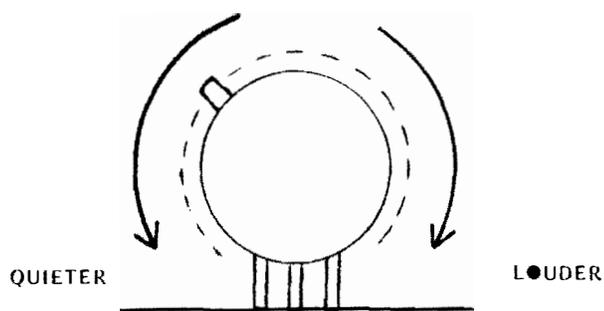


Figure 5-2 "SPEAKER VOLUME" Potentiometer

VI. Troubleshooting and Repairs

6.1 GENERAL PROCEDURE

This section describes troubleshooting procedures in detail sufficient for a person with moderate technical ability to understand. However, for those interested in gaining more information on video game technology, especially the electronics, we recommend reading the Video Game Operator's Handbook, manual no. TM-043. This book is available from Atari, Inc., attn. Customer Service Dept., 2175 Martin Avenue, Santa Clara, CA 95050, for \$5.00 each, or from your distributor.

6.1.1 IDENTIFYING THE TROUBLE AREA: The first troubleshooting step should be to note all observable trouble symptoms. Examples of symptoms are: depositing a coin produces no game response, no sound coming out of the speaker at any time, no picture on the TV screen. At the same time also note the game features that still work. A systematic way of checking game operation is to perform the functional check given in Section IV of this manual. Carefully train your eye to pick up all clues; by doing this an experienced troubleshooter can often spot the cause of a trouble even before he opens the cabinet.

Keeping these observations in mind, use the understanding of game operation gained from the Theory of Operation (Section III) and the schematic drawings (Section VII). Next narrow down the suspected cause of the trouble to a specific area or areas of the game: the coin mechanism, TV monitor, harness and front panel components (switches, lamps, LEDs, pistol assembly), electronics tray, printed circuit board, and power cord. Be careful not to overlook possible trouble areas that may seem too obvious: a power cord plug that has worked loose from the wall outlet and is no longer fully seated in the receptacle, or a rear panel access door that is not fully closed (thus causing the interrupt switch to block the AC power path to the game).

6.1.2 LOCATING THE TROUBLE CAUSE: Once a problem has been narrowed down to one or more areas, the next step is to perform various tests and measurements to isolate a specific cause of the trouble. Remember that sometimes a very complicated problem, such as erratic game operation, can be traced to a simple cause—the printed circuit board not being fully seated in its edge connector. Start with the most suspect area and trace backwards from the point where the trouble is first observable, using a process of elimination to eventually locate the faulty component, connection, etc. For example, if no sound is audible during game play, first check for a signal at the speaker leads. If no signal is present there, go back through the wiring harness connections to the printed circuit board. If there is still no signal, then systematically check back through the various components of the sound generation circuit.

Substitution of parts is a legitimate and easy way to isolate the cause. For instance, if the PCB is the suspected trouble area, remove it and substitute a known-to-be-good PCB. Then check for correct game operation. Similarly, to check the TV monitor, connect the game to a known-to-be-good monitor. The harness can often be checked by substitution also. Substitute both a known-to-be-good PCB and TV monitor. If the trouble still persists, the harness must be at fault.

While locating the trouble cause, use the technical descriptions in Section III as guides for correct circuit-level operation, and the schematic drawings of Section VII as roadmaps for tracing signal flow paths.

The test equipment for use in troubleshooting is discussed in paragraph 6.2.

6.1.3 CORRECTING THE TROUBLE CAUSE: In practice, the steps required to correct troubles can range from simple adjustments (fully seating the PCB in its edge connector, changing the setting on a potentiometer, adjusting the picture controls on the TV monitor) to repair of loose connections and replacement of defective parts. Extreme care should be exercised when removing integrated circuit devices and discrete components. Use a 40-watt soldering iron with a small tip designed especially for IC work. To remove an IC device, follow this procedure:

Remove all solder from *both* sides of the PCB, first melting it with the hot iron and then sucking up the molten solder with a Soldapull® solder sucker. After all the solder is gone, remove the IC device by gently prying up. Afterwards clean the area thoroughly, using an approved PCB cleaning solution to remove any traces of flux and dirt. Alcohol will do in a pinch, if necessary.

Insert the new IC device using an IC insertion tool, making sure that the reference notch is oriented correctly and that the device's leads are not bent during insertion into the board. Afterwards, be sure to solder each lead on *both* sides of the PCB, using as little solder as possible. After soldering, clean the area thoroughly to remove the flux.

Observe the same removal and insertion procedures when replacing discrete components. Trim the leads as close as possible and be sure to orient diodes and capacitors correctly.

6.1.4 VERIFYING CORRECT GAME OPERATION: After locating and correcting the cause of a trouble, re-energize the game and perform a final check on correct game operation. Doing this will verify that your troubleshooting was correct. If the game operation is still not correct, go back and double-check your work. Make sure that any replaced components were installed correctly. If

this was done properly, then start the troubleshooting steps over again. Keep in mind that there may be more than one trouble at a time, and that correcting one trouble can sometimes bring previously undetectable troubles to light.

This verification is especially important when the original trouble had been intermittent, that is, was not happening all the time.

6.2 TEST EQUIPMENT

Electronic troubleshooting of a video game essentially consists of checking for the presence of various signals and of examining their condition. A signal can be thought of as acting like a “messenger” that carries instructions from one unit or circuit to another. Many different types of signals are produced in a video game, and for this reason several unusual and perhaps unfamiliar types of test instruments are used during troubleshooting. Each instrument has its own set of advantages and disadvantages for examining a given type of signal, and both the depth of the intended troubleshooting capability and budget will determine what instruments will be needed. Some instruments are basic and essential, no matter what size of service facility, while other optional instruments are desirable because they make troubleshooting easier and quicker.

6.2.1 BASIC TEST EQUIPMENT:

(a) The Video Probe. This is a simple but invaluable instrument having two leads—a test-clip lead and a test-probe lead. During troubleshooting of video signals the test-clip lead is left connected to the game side of the video coupling capacitor. On the Steeplechase game this point is the junction of resistors R10 and R11 on the PCB.

When the test-probe lead is then connected to any video developmental signal, that signal will be coupled to the video signal going to the TV monitor and a video probe picture will appear on the TV screen. The shape and other characteristics of this picture will give information about the signal being probed. The video probe is suited for troubleshooting synchronization and image signals, but will not be useful for extremely fast signals (such as the clock) or for very slow analog or digital signals.

A video probe can be constructed in a few minutes from these common electrical components: a length of 20 AWG (American Wire Gauge) rubber-coated wire, a 4.7K-ohm, ¼-watt carbon resistor, and two test leads. For the leads, use a single Mouser test clip (Mouser #131C 301 or 302) attached to one end of the wire, and a test prod containing the resistor on the other.

To assemble the video probe, proceed as follows: Remove the cap from the test clip and strip 3/16 inch off

each end of the wire. Solder one end to the post in the test clip, thread the other end through the hole in the cap, and snap on the cap. Next unscrew the plastic body of the test prod from the point and trim both leads of the resistor to a 3/16-inch length. Solder one resistor lead to the inside of the point. Thread the other end of the wire through the hole in the body and solder it to the other resistor lead; screw the body back onto the point.

(b) The Logic Probe. This is a test instrument designed for fast verification of digital IC outputs. It is small, convenient to carry, easy to read, and relatively inexpensive. The logic probe derives its power from the system under test; it has two power leads, one for connection to ground and the other to +5 volts DC. When the logic probe’s tip is held against a digital signal point, three colored lamps in the tip will indicate the signal’s condition or state, as follows:

- The red lamp lit indicates a high or logic level 1 (for TTL components, this is +2.4 to +5 volts)
- The white lamp lit indicates a low or logic level 0 (for TTL components, this is 0 to +0.8 volt)
- The blue lamp lit indicates that the signal is changing states
- No lamps lit indicate the grey region between 0 and 1 (for TTL this is between +0.8 and +2.4 volts)

A circuit shorted to ground will illuminate the white lamp and an open circuit will illuminate the red lamp.

The logic probe is readily available from electronic supply sources; a commercial model found satisfactory is the Kurz-Kasch model LP 520.

(c) The Logic Pulser. This test instrument is similar in size and shape to the logic probe, and it also derives its power from the system under test. When the logic pulser’s tip is held against a digital signal point, the source and sink capabilities of the pulser override any IC output and the point is driven to the opposite logic level. If the point that the logic pulser is held against is low, pressing the switch on the side of the pulser will introduce a high pulse. Conversely, pulsing a high line will pull that line low momentarily.

During troubleshooting the logic pulser allows stimulation of in-circuit ICs with a shaped digital pulse. For example, a certain feature of the game may not be working and you suspect that a circuit is not receiving the necessary signal. Use the pulser to imitate that signal and if the circuit begins working, you have proved that the signal was in fact missing and you can begin tracking it down. This technique is very similar to jumping coils in electromechanical games such as pinball machines.

In addition to the regular “pulse” button, there is another switch mounted on the logic pulser. When this switch is set in the “rep” mode, the instrument pulses the digital signal point at a 5-Hz rate or 5 times per second.

This extremely low rate is slow enough to allow watching events initiated by the pulser. Counter outputs, for example, are more easily observed when the counter is pulsed or clocked at this rate.

The logic pulser is also readily available from electronic supply sources; a commercial model found satisfactory is the Kurz-Kasch model HL 583.

(d) Oscilloscope. The most versatile test instrument, and also the most expensive, is the oscilloscope. The high-speed TTL integrated circuits used in video games produce fast-rise-time signals. The oscilloscope should have a 50-MHz bandwidth, dual trace and dual time base capability. These latter features allow examination of both input and output signals simultaneously, so that precise timing relationships can be checked. The oscilloscope should also have provision for internal or external sync.

Of the newer, solid-state oscilloscopes, a satisfactory model is the Tektronix 465.

(e) VOM or Volt-Ohmmeter. This common measuring instrument is extremely useful in video game troubleshooting. It can be used to check line voltage, transformer secondary windings, continuity, resistance, power supply voltages, and to some extent used for measurements in the analog circuitry.

One commercial model found satisfactory is the Simpson 260.

6.2.2 OPTIONAL TEST EQUIPMENT:

(a) The Logic Comparator. This test instrument's main benefit is that it can be used to check the functioning of an integrated circuit device while the device is still in place on the printed circuit board. The logic comparator performs the check by comparing the suspect ICs functioning with that of an identical-type reference IC mounted in the instrument itself. Suppose that the functioning of a type-74193 device on the PCB is suspected to be defective. First insert a program card with a known-to-be-good 74193 into the logic comparator, and then clip the comparator test leads onto the leads of the suspect device. If there are any logic state differences between the reference IC and the suspect IC under test, then an LED on the logic comparator will light up to indicate which output is not functioning correctly. Once a defective IC has been located, it should be replaced.

Logic comparators are readily available from electronic supply sources.

(b) Atari Universal Test Fixture. In situations where a large number of video games are being serviced, investment in the Universal Test Fixture will be justified. This item of

test equipment forms a test station for troubleshooting printed circuit boards after they have been removed from the game cabinet. The Universal Test Fixture has a full set of controls for operating the game and also has its own TV monitor. The game's PCB is plugged into an edge connector mounted on the side of the Fixture; with this arrangement the PCB is positioned in a convenient way for connecting probes and other test instruments.

A Program Card inserted into a receptacle in the top of Fixture takes the place of the game's interconnect wires. The program card thus sets up the Fixture for each particular game; the game's name is clearly printed on the program card itself.

With the Universal Test Fixture the method of troubleshooting via substitution of known-to-be-good parts is made fast and convenient. For example, suppose that the TV picture in a game is completely broken up and you want to determine whether the game or monitor is causing the problem. Remove the PCB and plug it into the Fixture's edge connector, and also insert the correct program card for that game. If the picture on the Fixture's monitor is correct, then you know that the problem lies in the game's monitor.

6.3 SPECIFIC TROUBLESHOOTING INFORMATION

The following subparagraphs give additional troubleshooting information about certain areas of the Steeplechase game.

6.3.1 ANTENNA STATIC MODIFICATION: The antenna is a wire inside the cabinet, approximately one foot long, with one end connected to pin 12 of the PCB edge connector and the other end intentionally left not connected. The antenna's function is to prevent a player from getting free play sequences by inducing a static electric charge in the coin entrance plate or any other metal part of the game--provided that the wire has been cut to optimum length.

On the printed circuit board, pin 12 of the edge connector connects through adjustable potentiometer (Trimpot) R56 to ground. The potentiometer's wiper arm connects to the base of transistor Q4, which in turn can reset the credit latch. (The operation of the credit latch is described in Section 3.4 of Section III.) When a static discharge occurs, an electric current is induced in this wire and an impulse is transmitted to the credit latch circuit. This impulse resets the latch, turning off game credit and switching the game over to the attract mode. To test the static modification feature, touch the end of the antenna wire with your finger. The human body usually has enough capacitance to trigger the circuitry.

Sensitivity of the static modification feature may be adjusted with potentiometer R56, or by changing the length of the antenna wire, or through a combination of both of these. Drawing number A003750, the PCB assembly drawing included in Section VII of this manual, shows the location of this potentiometer near the edge connector end of the PCB. Lengthening the antenna wire increases sensitivity, so that a lesser charge will turn off game credit. Cutting the wire shorter decreases sensitivity, so that larger charge is required for triggering the circuit.

If there are problems with static charges accidentally shutting off the game, try cutting the wire shorter, in increments of $\frac{1}{2}$ inch at a time. Be aware, however, that if the antenna wire is cut too short, players may be able to get free play sequences by inducing a static charge in the game.

6.3.2 TV MONITOR: The TV monitor is a self-contained unit housed in its own chassis. A trouble's cause may be narrowed down to the monitor—either by the substitution method using a known-to-be-good monitor, or by verifying presence of AC power to the monitor power supply and presence of the *correct* composite video signal. The entire monitor can then be removed from the game cabinet. Doing this facilitates troubleshooting steps, because all monitor components will then be accessible.

A schematic diagram of the monitor circuitry is included in Section VII of this manual. After disconnecting and removing the monitor from the game, standard TV troubleshooting techniques are adequate for locating causes of trouble. Additional servicing information is available from the monitor manufacturer (Motorola).

6.3.3 COIN MECHANISM: If a player inserts a coin and the game does not respond, first check the coin mechanism. If pressing the coin rejector button forces the rejector mechanism to return the coin, then examine the coin to make sure that it is genuine. If it is, then use a set of your own test coins (which should include both very new and very old, worn coins) to determine whether or not the player's coin is under-size or underweight. If your test coins are also returned, this indicates that servicing of the coin acceptor portion of the coin mechanism is called for. Generally the cause of this particular problem is an improperly adjusted magnet gate.

Inside the coin mechanism a magnet is used to test the metallic composition of the coin. Highly magnetic coins, such as those made of steel or iron, will be retained by the magnet and can be returned by actuating the wiper operating lever. Coins having comparatively high magnetic properties will be slowed down by the magnet, and will drop off the end of the rail short of the "accept" entrance and be returned. Coins having little or no magnetic properties, such as brass or zinc coins, will pass through the magnetic field so fast that they will overshoot the "accept" entrance and be returned.

A magnetic gate adjusted with too large a gap may pass both genuine and counterfeit coins. An adjustment with too small a gap can lead to rejection of some or even all coins. Over a period of time, the screw that adjusts the magnet gate has a tendency to work loose, resulting in a gradual narrowing of the gate. At first, only the thickest (i.e., newest) coins are rejected. As time passes, more and more coins are rejected until finally player complaints lead to the calling of the game repairman.

If pressing the coin rejector button does not cause the coin to be returned, and if the game still does not respond, then check the coin mechanism to see if the coin is jammed inside.

If you are certain that the coin is genuine, and that the coin passes through the coin mechanism and into the cash box, then the lack of game response is probably due to some kind of electrical trouble. Check for signals at the electrical contacts of the coin mechanism before moving on to the harness and other parts of the circuitry.

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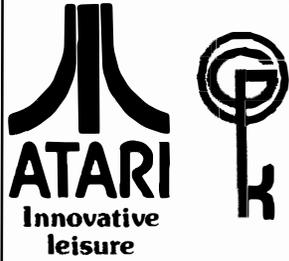


VII. Schematics, Drawings and Parts Lists

<i>Number</i>	<i>Title</i>
003249-01	Parts List, Top Assembly
A003249	Top Assembly
004274	Customer Assembly
004209-01	Parts List, Control Panel Assembly
A004209	Control Panel Assembly
003266	Harness Schematic
003766	Parts List, Electronics Tray Assembly
A003766	Electronics Tray Assembly
003750	PCB Schematic
003750	Parts List, PCB Assembly
A003750	PCB Assembly

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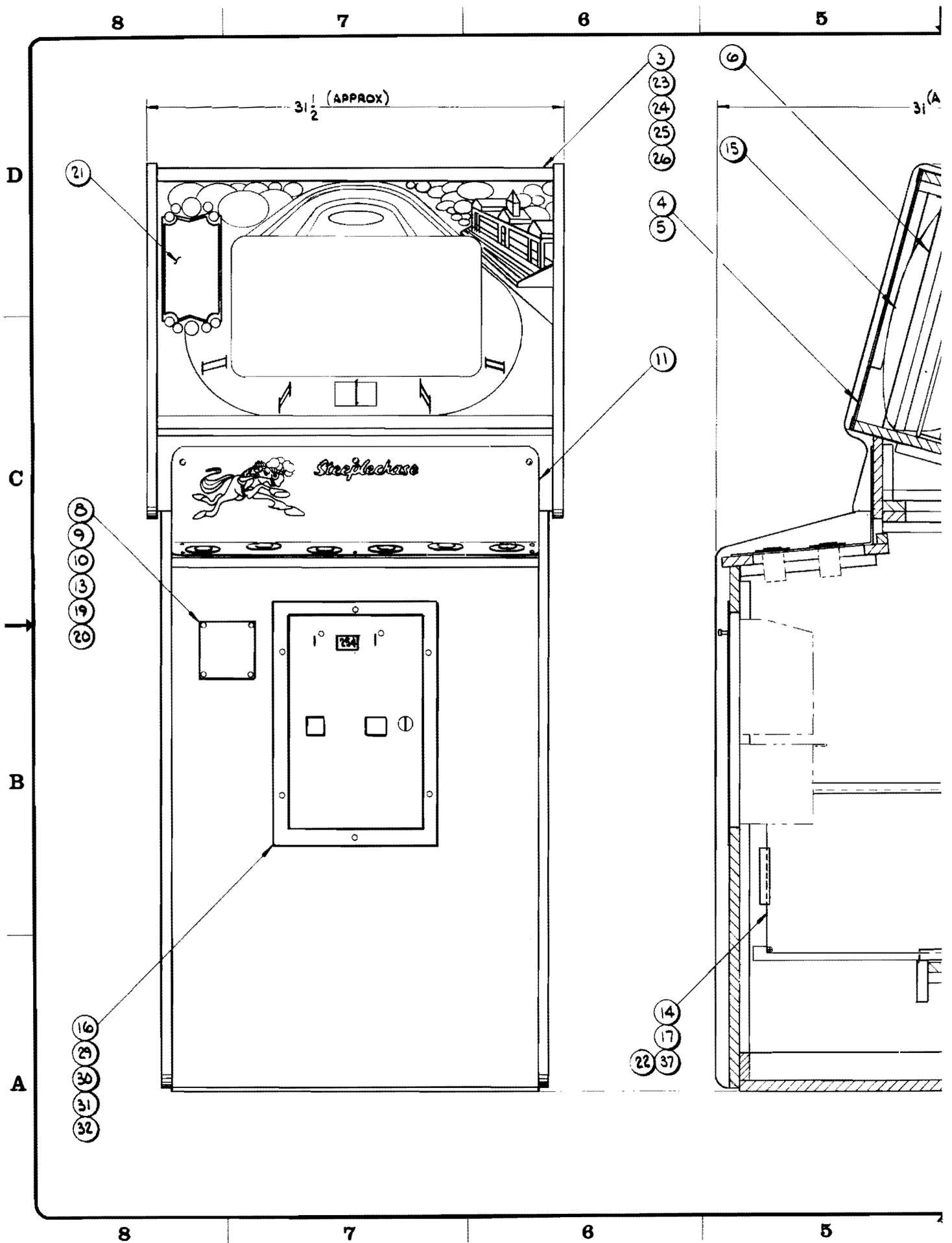


PARTS LIST SPECIFICATION Page 1 of 1

Drawn	
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Proj. Eng.	Elec. Eng
	REV. A

Rev.	Description	Date	Apprv.	Rev.	Description	Date	Apprv.
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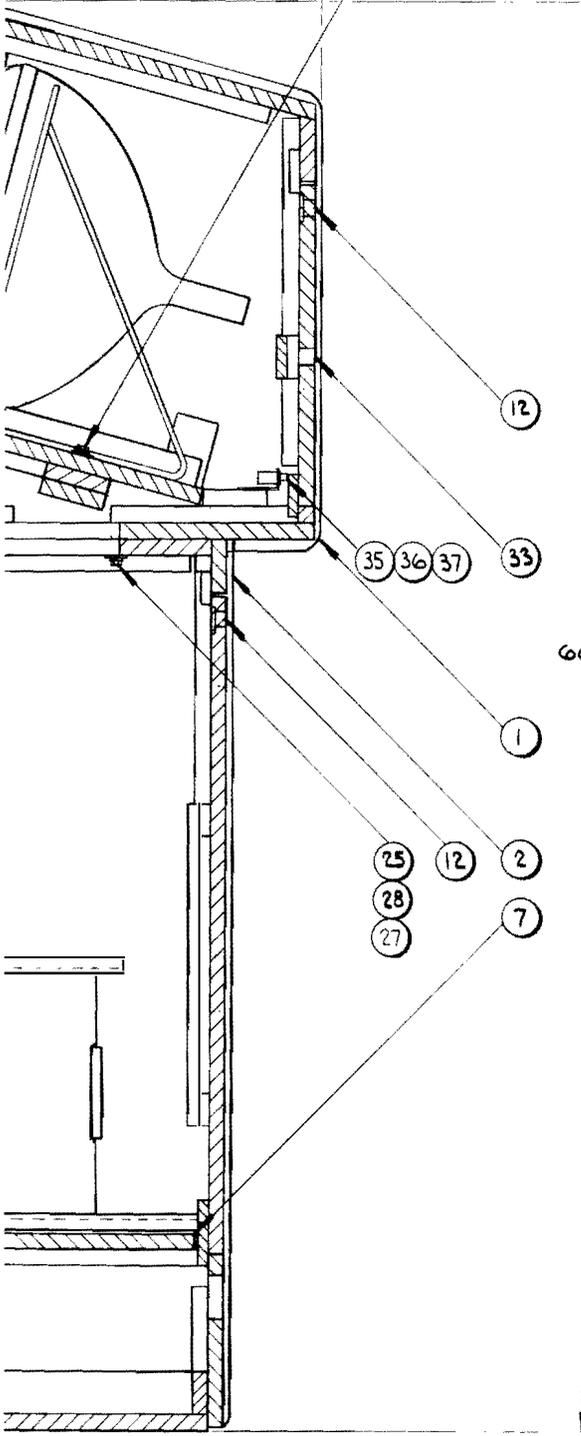
Item	Part Number	Qty.	DESCRIPTION
1	A003250	1	Assembly, Upper Cabinet
2	A003251	1	Assembly, Lower Cabinet
3	003761	1	Retainer, Plex
4	003762	1	Panel, Plex (Smoked)
5	003772	1	Silkscreen, Plex
6	003771	1	Bezel
7	A003766	1	Assembly, Electronics Tray
8	000869	1	Grill, Speaker
9	48-004	1	Speaker (5")
10	73-77002	4	Pop Rivet
11	A004209-01	1	Assembly, Control Panel
12	71-2114	2	Lock, Mechanical, Barrel Cart
13	73-7001	4	Cap, Mushroom
14	A003750	1	Assembly, PCB
15	A004210	1	Assembly, Monitor Shelf
16	A003637	1	Assembly, Cash Door
17	001141	1	Pad, Foam
18	004241	1	Silkscreen, Side Panel
19	72-6812	4	Screw, SM (#8 x 3/4)
20	75-018S	4	Washer, Flat (#8)
21	004242-X	1	Card, Instruction
22	75-016S	1	Washer, Flat (#6)
23	75-5520N	2	Bolt, Carriage (1/4-20 x 1 1/4)
24	75-015S	4	Washer, Flat (1/4)
25	75-045	6	Washer, Lock (1/4)
26	75-935	2	Nut, Wing (1/4-20)
27	72-5532	2	Bolt, Hex HD (1/4-20 x 2" Lg)
28	75-035S	2	Washer, Flat (Wide) (1/4")
29	75-5120B	6	Bolt Carriage (#10-24 x 1 1/4 Lg)
30	75-010S	6	Washer, Flat (#10)
31	75-040	6	Washer, Lock (#10)
32	75-911S	6	Nut, Hex (#10-24)
33	72-6824	4	Screw, SM (#8 x 1 1/2 Lg)
34	72-5540	2	Bolt, Hex HD (1/4-20 x 2 1/2 Lg)
35	68-001	Ref.	AC Power Interlock Switch
36	000268	Ref.	Bracket, Switch Mounting
37	72-6610	3	Screw, SM (#6 x 5/8 Lg)
38	003867-XX	1	Container, Shipping
39	TM-047	1	Tech Manual



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REVISIONS				
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A	PRODUCTION RELEASE	S	29 75	

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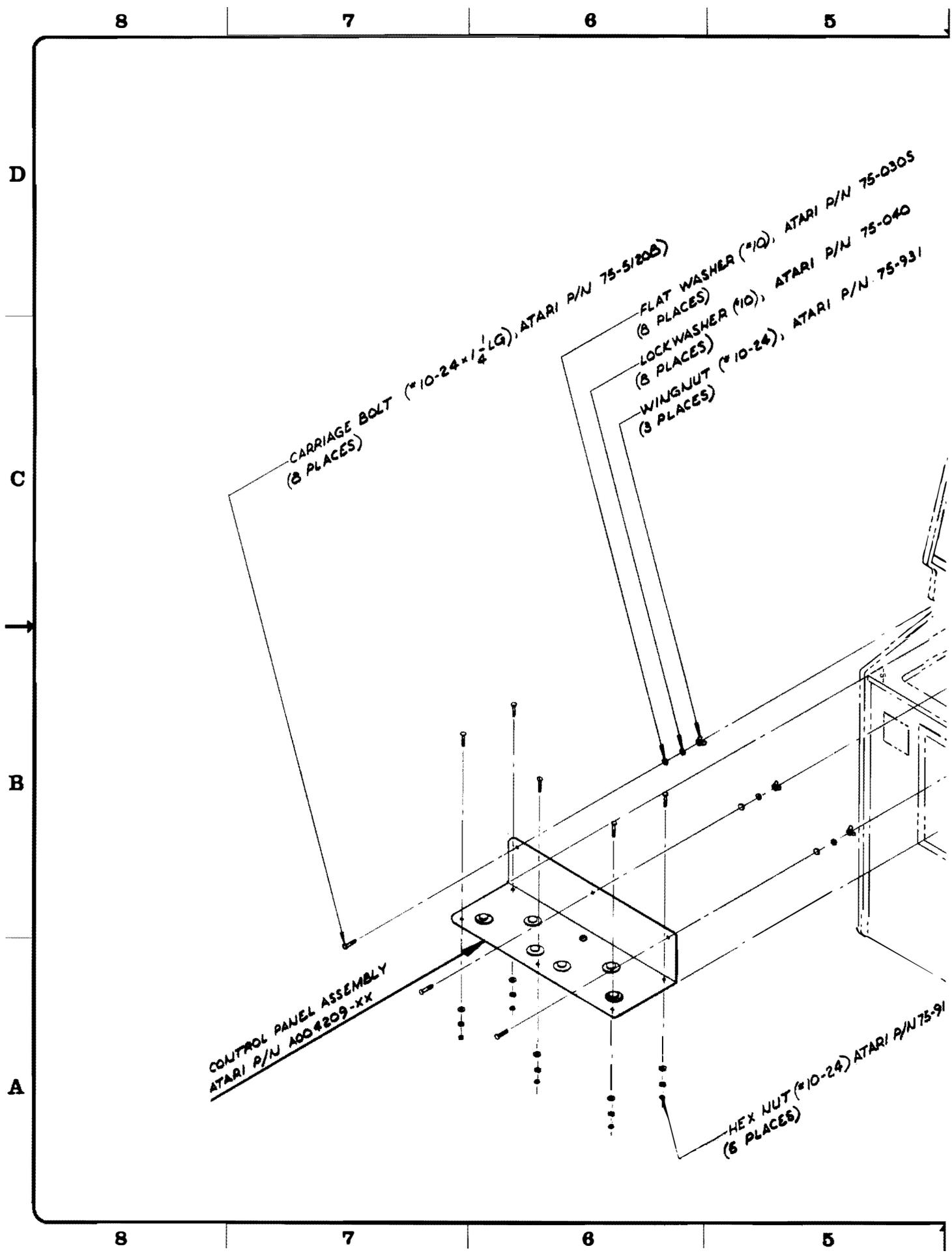
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FINAL	STEERLECHASE
NEXT ASSY	USED IN
APPLICATION	

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON	DESIGN ENGINEER	
FRACTIONS - 2/16	PURPOSE ENGINEER	TITLE: STEEPLCHASE TOP ASSEMBLY
ANGLES - 45°	EXHIBIT CONTROL	SIZE: D
SURFACE FINISH - 0.010	APPROVED:	DRAWING NO: A003249-XX
MATERIAL: SEE P/L003249		REV: A
		SCALE: 1" = 1"

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4 3 2 1

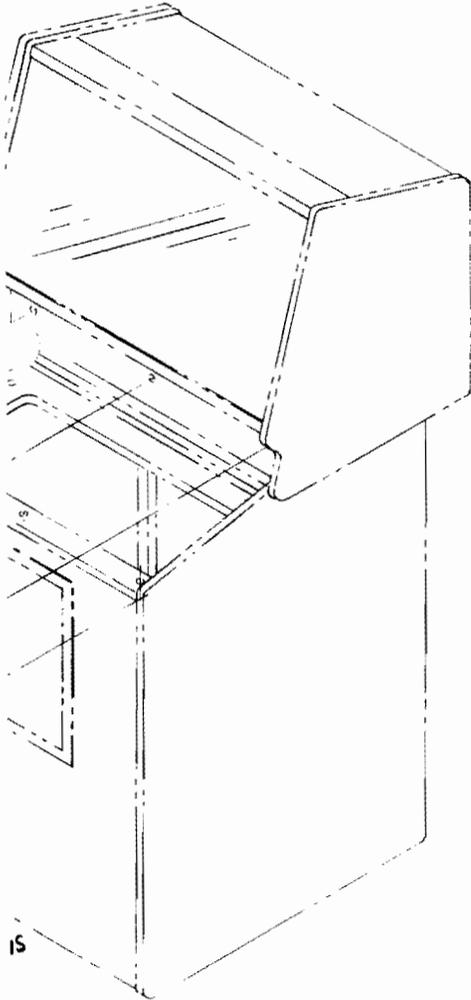
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SYM	DESCRIPTION	INITIALS AND DATE		
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A	PRODUCTION RELEASE	9.17.75		

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DRAWING NO. 004274
 SHEET 1 OF 1



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INTERPRET THIS DRAWING PER USASI 2145	DRAWN BY A. GREEN SEPT 15, 1975	 ATARI INCORPORATED 14600 Winchester Boulevard San Leandro, California 94603
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TO NEAREST 0.01	CHECKED	
FRACTIONS 1/16, 1/8, 1/4, 3/8, 1/2, 5/8, 3/4, 7/8	DESIGN ENGINEER	TITLE CUSTOMER ASSEMBLY STEEPLECHASE
ANGLES ±1° SURFACE FINISH	DRAWN ENGINEER	SIZE DRAWING NO. REV. D 004274 1 A
MATERIAL	DRAWING CONTROL	SCALE
APPROVED		SHEET 1 OF 1

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STEEPLECHASE



ASSEMBLY TITLE / DOMESTIC CONTROL PANEL ASSEMBLY P/L 004209-01

PARTS LIST SPECIFICATION Page 1 of 1

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Proj. Eng.	Elec. Eng.
	REV. C

Rev.	Description	Date	Apprv.	Rev.	Description	Date	Apprv.
A							
B	Rev per ECN 1639						
C	Rev per ECN 1661	9/25/75					

Item	Part Number	Qty.	DESCRIPTION
1	003763	1	Panel
2			
3	A004304-01	1	Assembly, Switch (Yellow)
4	A004304-02	1	Assembly, Switch (Red)
5	A004304-03	1	Assembly, Switch (Blue)
6	A004304-04	1	Assembly, Switch (Purple)
7	A004304-05	1	Assembly, Switch (Amber)
8	A004304-06		Assembly, Switch (Green)
9	003765-01	1	Harness
10	62-011	1	Switch Licon, Unlighted
11	001856	1	Bushing, Switch
12	75-5120B	8	Bolt, Carriage (#10-24 x 1 1/4 Lg)
13	75-030S	8	Washer, Flat (#10)
14	75-040	8	Washer, Lock (#10)
15	75-911S	5	Nut, Hex (#10-24).
16	75-931	3	Nut, Wing (#10-24)
17	80-003	1	Envelope (3 1/2 x 6 1/2)

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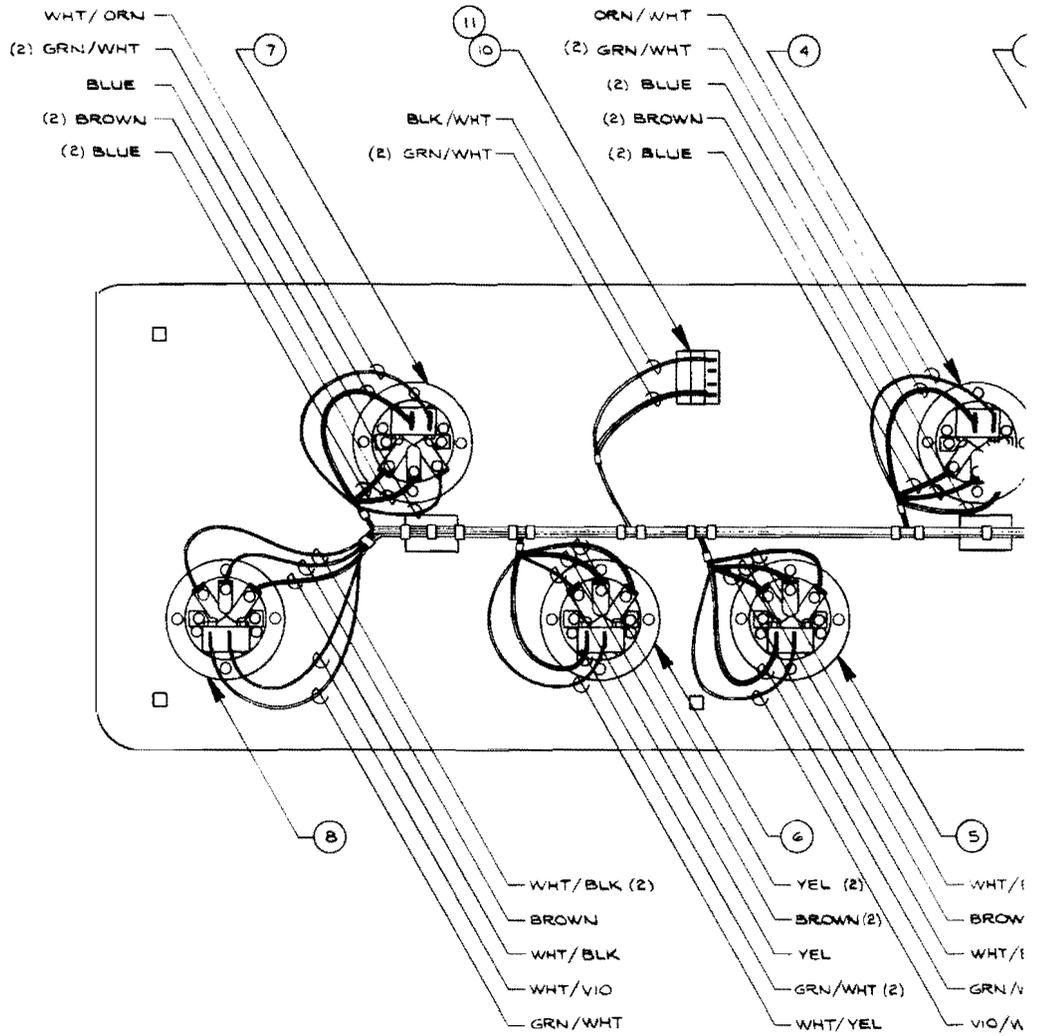
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BOTTOM VIEW

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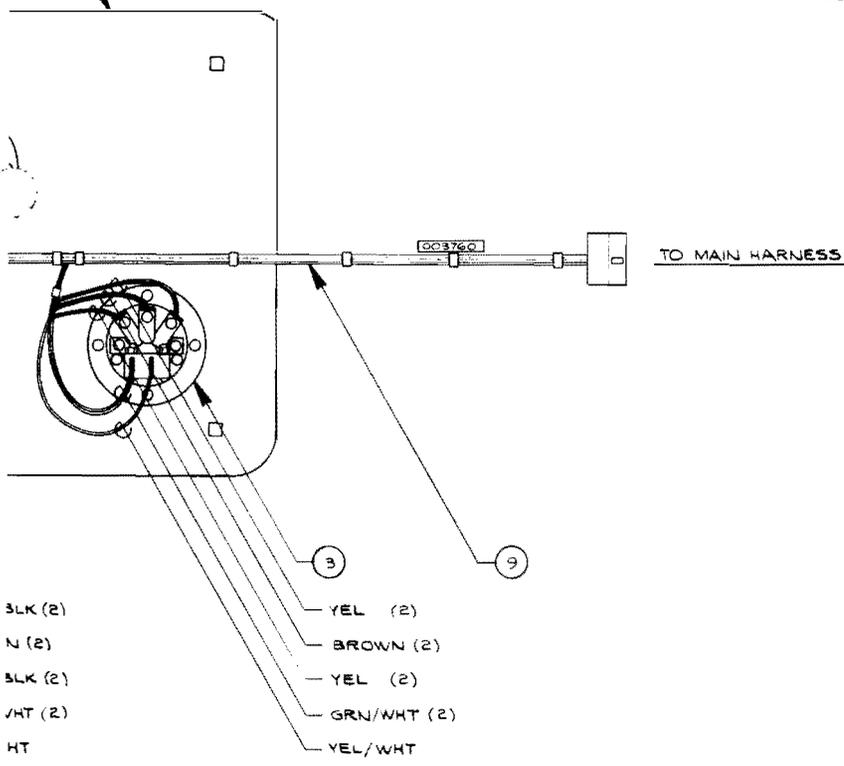
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REVISIONS				
SYM	DESCRIPTION	INITIALS and DATE		
		DRAFT	CHECK	ENGR
A	PRODUCTION RELEASE	9-2-75		
B	REV PER ECU 1639	9-17-75		
C	REV PER ECU 1661	9-25-75		

NOTES:

1. ITEM 12 TO ITEM 6 PACKAGED IN ITEM 17 ARE FOR MOUNTING THE CONTROL PANEL TO THE CABINET



P/L 004209-01, DOMESTIC VERSION
P/L 004209-02, INTERNATIONAL VERSION

D
C
B
A
DRAWING NO. A004209-XX
SCALE
REV C

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A003249	STEEPLECHASE
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APPLICATION	

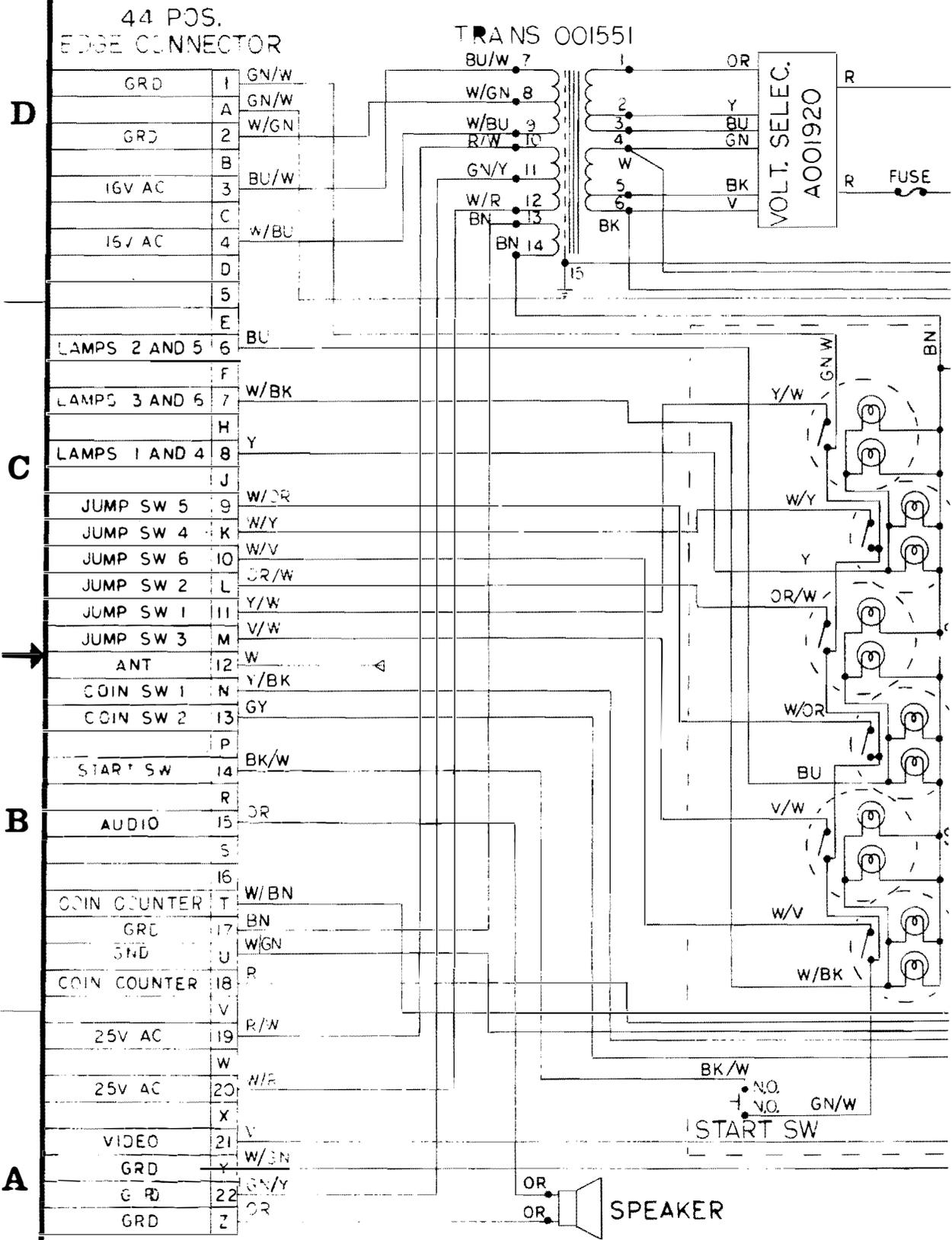
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ANGLES - 45° 90° 135° 180°	PROJECT ENGINEER		
MATERIAL	DOCUMENT CONTROL		TITLE ASSEMBLY - CONTROL PANEL, STEEPLECHASE
SEE P/L004209-XX	APPROVED		SIZE D
			DRAWING NO. A004209-XX
			REV C
			SCALE 1:1
			SHEET 1 OF 1

4

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1



44 PINS.
EDGE CONNECTOR

TRANS 001551

VOLT. SELEC.
A001920

D
C
B
A

GRD	1	GN/W
	A	GN/W
GRD	2	W/GN
	B	BU/W
16V AC	3	BU/W
	C	W/BU
15V AC	4	W/BU
	D	
	E	
LAMPS 2 AND 5	6	BU
	F	
LAMPS 3 AND 6	7	W/BK
	H	
LAMPS 1 AND 4	8	Y
	J	
JUMP SW 5	9	W/OR
JUMP SW 4	K	W/Y
JUMP SW 6	L	W/V
JUMP SW 2	M	OR/W
JUMP SW 1	N	Y/W
JUMP SW 3	M	V/W
ANT	12	W
COIN SW 1	N	Y/BK
COIN SW 2	13	GY
	P	
START SW	14	BK/W
	R	
AUDIO	15	OR
	S	
	16	
COIN COUNTER	T	W/BN
GRD	17	BN
3RD	U	W/GN
COIN COUNTER	18	R
	V	
25V AC	19	R/W
	W	
25V AC	20	N/A
	X	
VIDEO	21	V
GRD	Y	W/BN
GRD	22	GN/Y
GRD	Z	OR

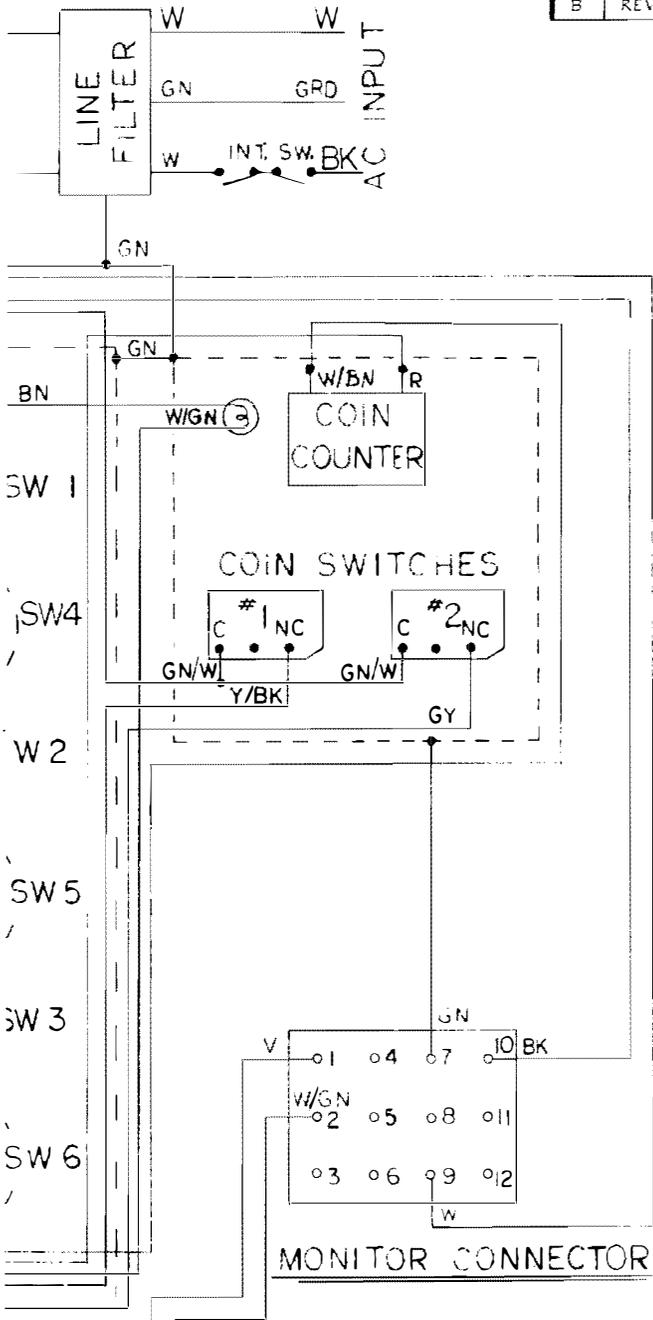
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NEXT A:

2

1

REVISIONS				
SYM	DESCRIPTION	INITIALS and DATE		
		DRETC	CHECK	ENGRG
A	PROD REL. 9-5-75		<i>ES</i>	<i>BRR</i>
B	REV PER ECN 1677		<i>10/6/75 ES</i>	<i>BRR</i>



D

C

B

DRAWING NO

SHEET

REV

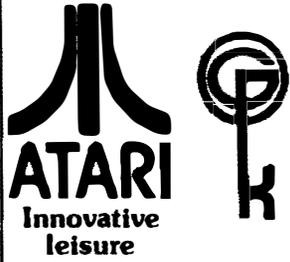
A

INTERPRET THIS DRAWING PER USASI Y14.5 UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: FRACTIONS = ±1/16 x = ±.1 ANGLES = ±1° xx = ±.03 SURFACE FINISH ✓ xxx = ±.010	DRAWN BY _____ DATE 8-7-75	ATARI INCORPORATED 14600 Winchester Boulevard Los Gatos, California 95030
	CHECKED _____ DESIGN ENGINEER _____ PROJECT ENGINEER _____ DOCUMENT CONTROL _____ APPROVED _____	
MATERIAL: _____	SIZE C	DRAWING NO 003266
APPLICATION _____	SCALE _____	REV B SHEET / OF /

2

1

STEEPLECHASE



ASSEMBLY TITLE / ELECTRONICS TRAY ASSEMBLY

P/L 003766

PARTS LIST SPECIFICATION

Page 1 of 1

Drawn	
Checked	Mech. Eng.
Proj. Eng.	Elec. Eng.
	REV. D

Rev.	Description	Date	Apprv.	Rev.	Description	Date	Apprv.
A		8-21-75					
B	Rev per ECN 1611	9-10-75					
C	Rev per ECN 1634	9-19-75					
D	Rev per ECN 1659,1662	9/25/75					

Item	Part Number	Qty.	DESCRIPTION
1	003757	1	Tray, Electronics
2	A003764	1	Harness
3	001551	1	Transformer
4	72-3201	1	Fuse Holder
5	46-201132	1	Fuse
6	90-3001	1	Filter, Power Line
7	68-001	2	A.C. Power Interlock Switch
8	000268	2	Bracket, Switch MTG
9	54-401	1	Power Cord, 8'
10	A001920	1	Harness, Voltage Selection
11	*A001921-01	1	Shorting Block, 95V
12	*A001921-02	1	Shorting Block, 110V
13	*A001921-03	1	Shorting Block, 220V H
14	*A001921-04	1	Shorting Block, 220V L
15	000622	1	Cover, Transformer
16	003100-04	1	Fuse Jumper Harness
17	72-6608	1	Screw, Sm, Pan Hd, Phil #6 x 1/2 Lg
18	72-6812	4	Screw, Sm, Pan Hd, Phil #8 x 3/4 Lg
19	000871	1	Label

* Install Shorting Block per Voltage Required

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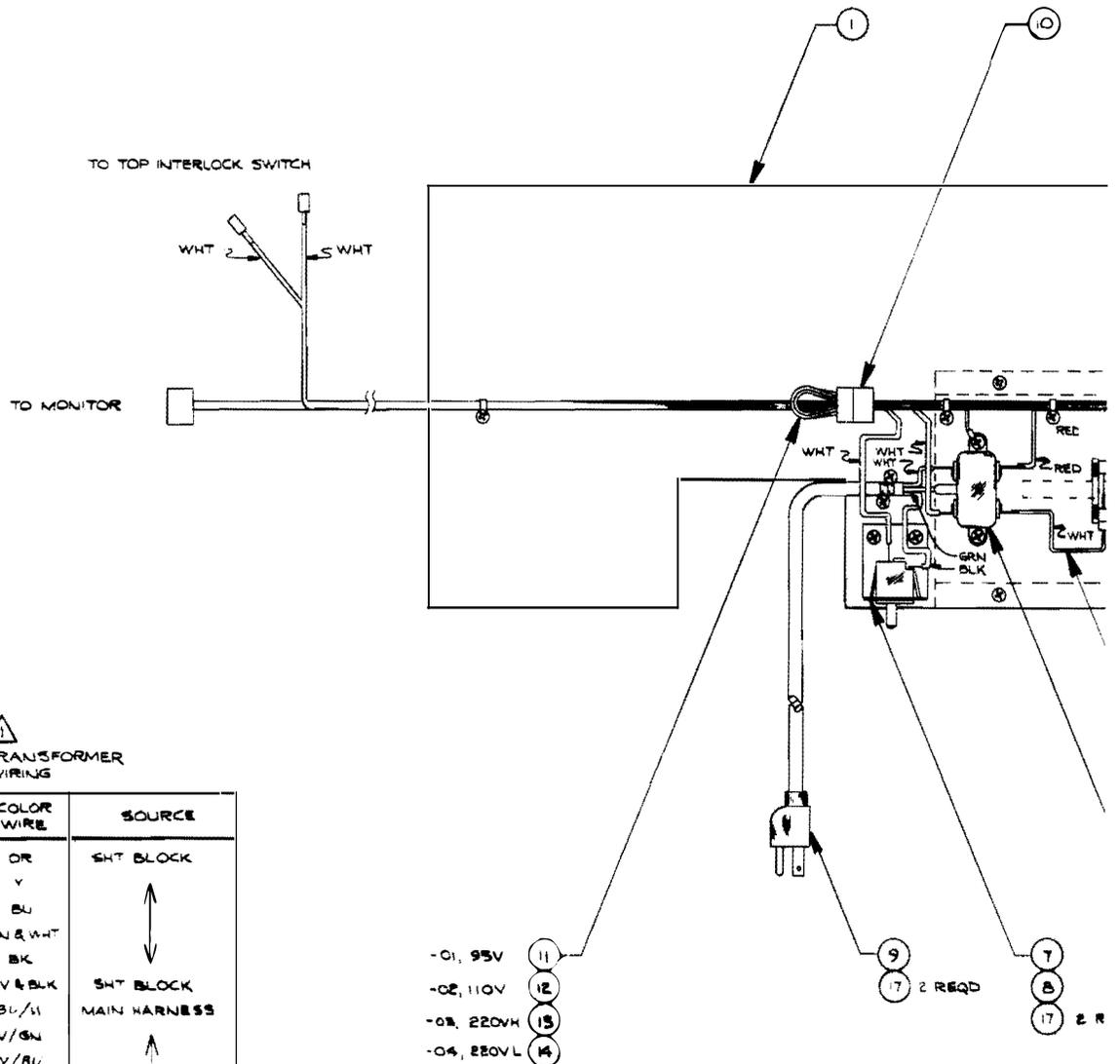
5

D

C

B

A



1
TRANSFORMER
WIRING

PIN NO.	COLOR WIRE	SOURCE
1	OR	SHT BLOCK
2	Y	
3	BU	
4	GN & WHT	
5	BK	SHT BLOCK
6	V & BLK	
7	BU/W	MAIN HARNESS
8	W/GRN	
9	W/BU	
10	R/W	
11	GN/Y	
12	W/R	
13	BN	
14	BN	
15	GN	MAIN HARNESS

SEE NOTE 1

SEE NOTE 1

NOTES:

- COMBINE GREEN WIRE FROM SHT BLOCK AND BK WIRE FROM MON AND V WIRE FROM SHT BLOCK AND W WIRE FROM MONITOR (PINK PASTON'S #187 AND ATTACH TO TRANSFORMER.
- USE ITEM 17, SM. PAN HD, PHIL #6 X 1/2 LG WITH HARNESS TIE DOWN

8

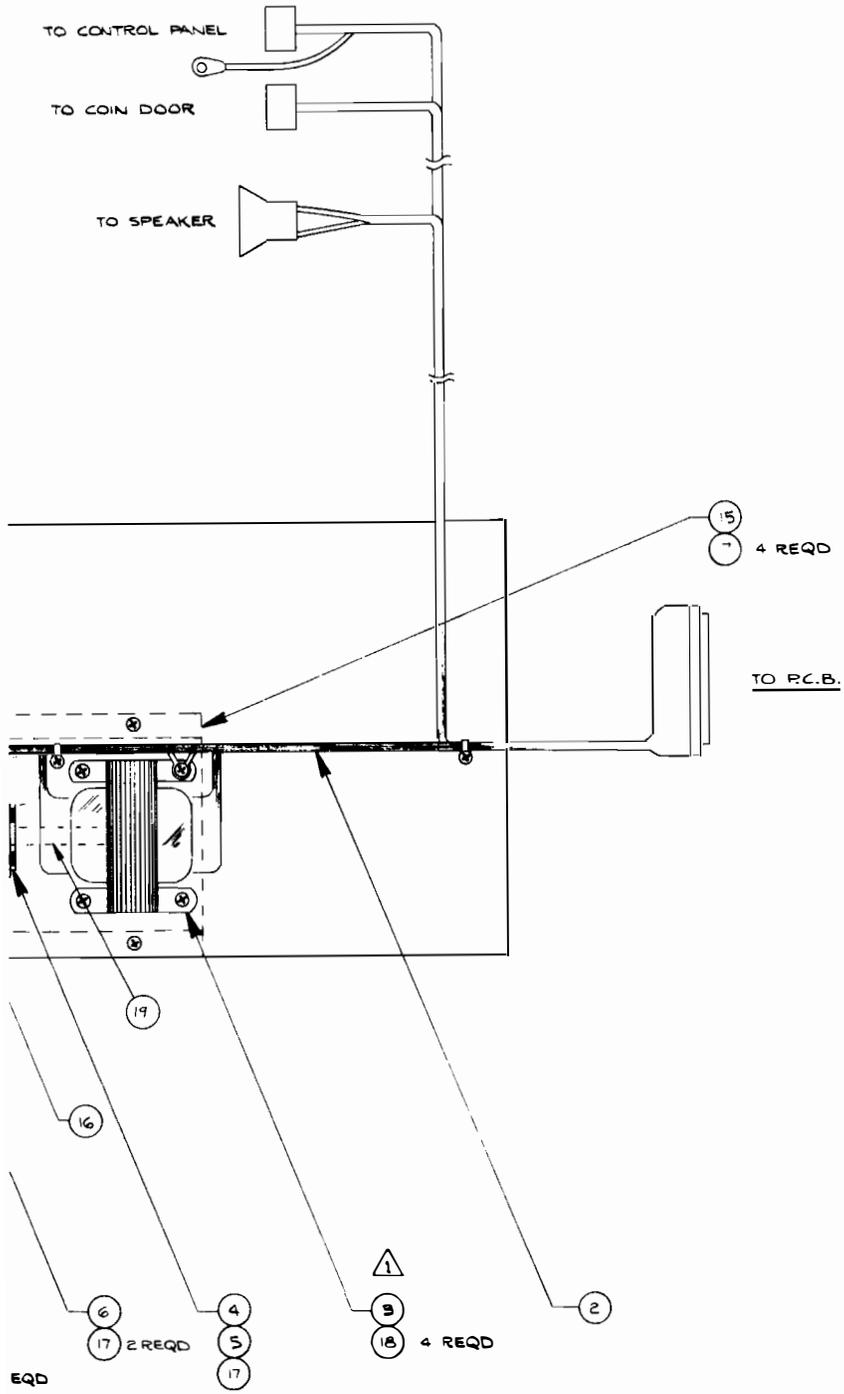
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4 3 2 1

REVISIONS				
SYM	DESCRIPTION	INITIALS and DATE		
		DRAFT	CHECK	ENGR
A	PRODUCTION RELEASE <i>M.S.</i>	8-19-75		
B	REV PER ECN 1611	9-10-75		
C	REV PER ECN 1634	9-16-75		
D	REV PER ECN 1659, 1662	9-25-75		



D

C

B

A

ATOR (PIN 9),
), WITH

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STEERLECHASE	
NEXT ASSY	USED ON
APPLICATION	

INTERPRET THIS DRAWING PER USASI Y14.5	DRAWN BY M. STEELE	DATE AUG 19, 75	<p>ATARI INCORPORATED 14600 Winchester Boulevard Los Gatos, California 95030</p>
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON	CHKD BY	DESIGN ENGINEER	
FRACTIONS ± 1/16 0 + .1	PROJECT ENGINEER	EXHIBIT CONTROL	TITLE STEERLECHASE - ELECTRONIC TRAY ASSEMBLY
ANGLES ± 1° 0 + .03	APPROVED		SIZ D
SURFACE FINISH ✓ 0.004 ± 0.010	SEE P/L 003766		DRAWING NO A003766
MATERIAL			REV D
			SCALE 1:2
			SHEET 1 OF 1

4 3 2 1

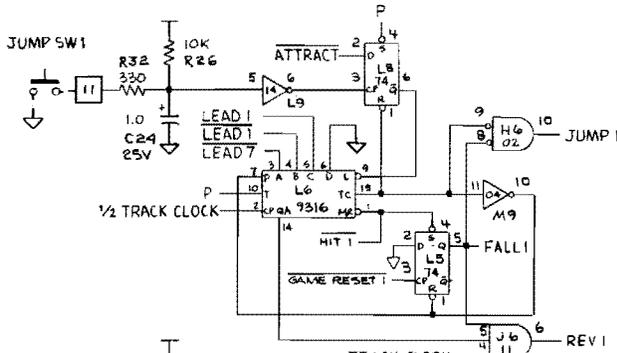
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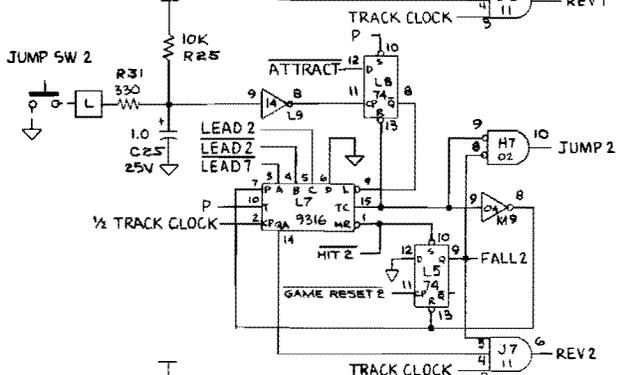
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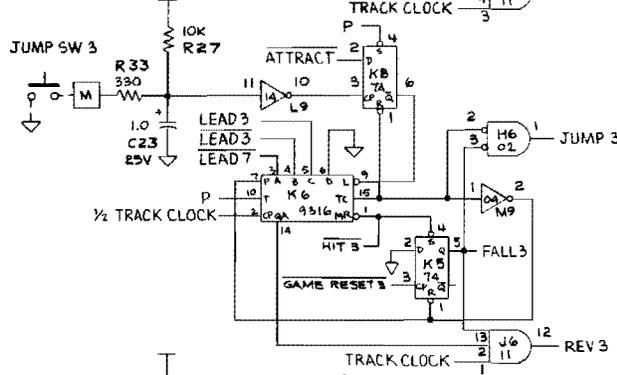
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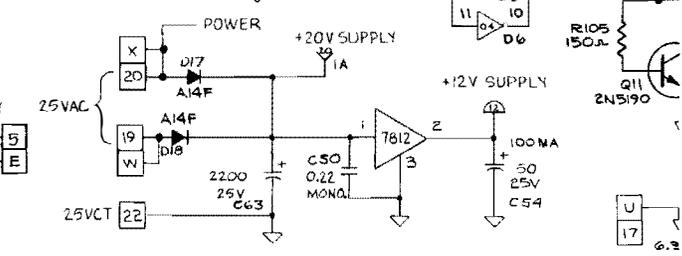
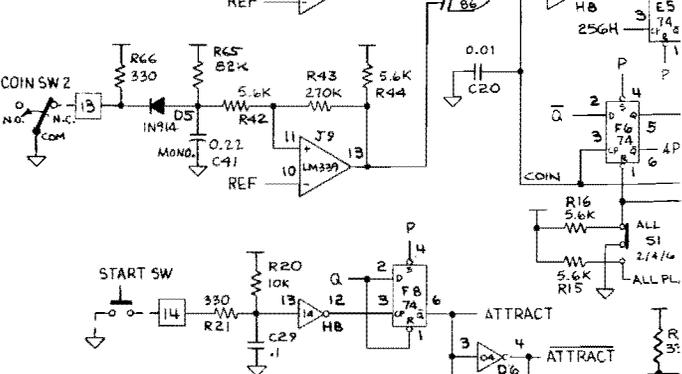
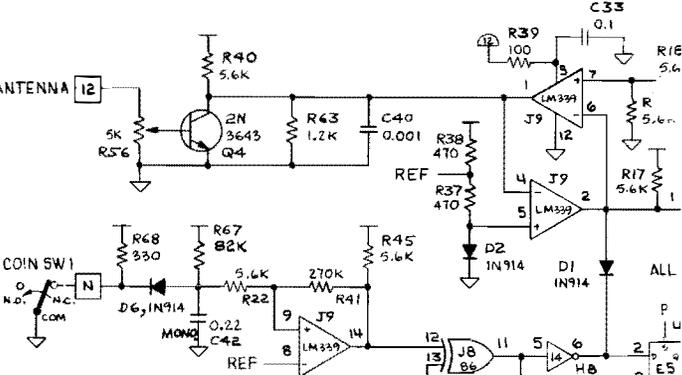
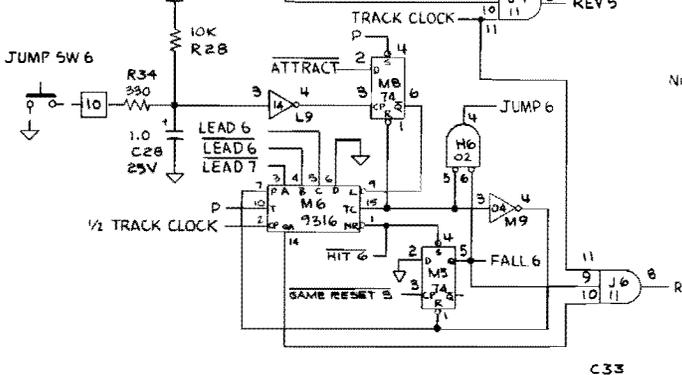
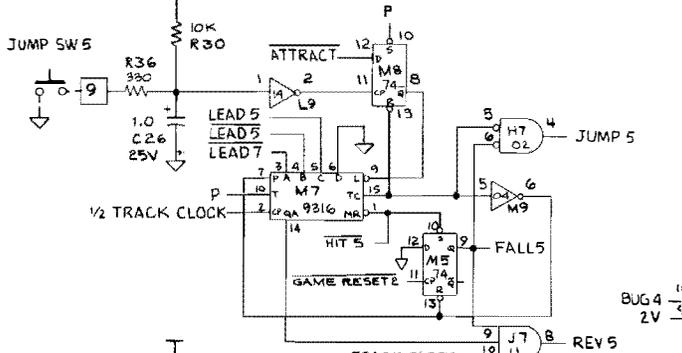
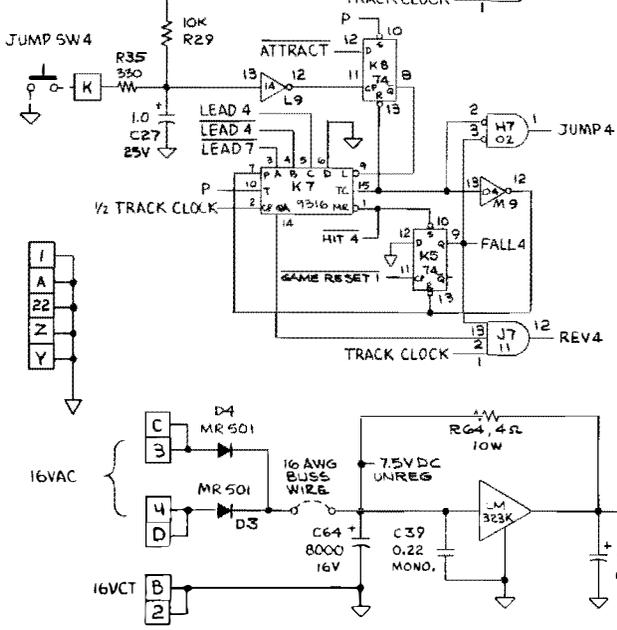
C



B



A



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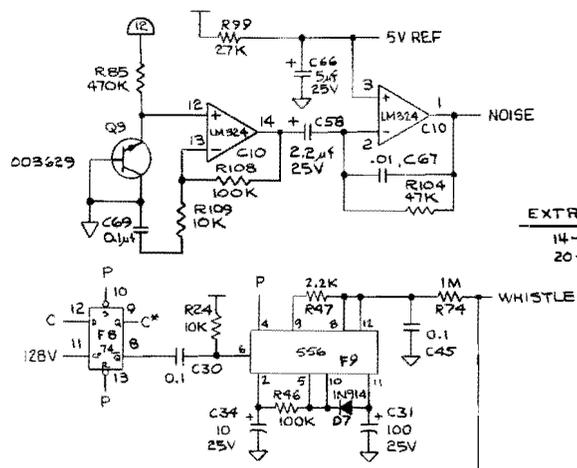
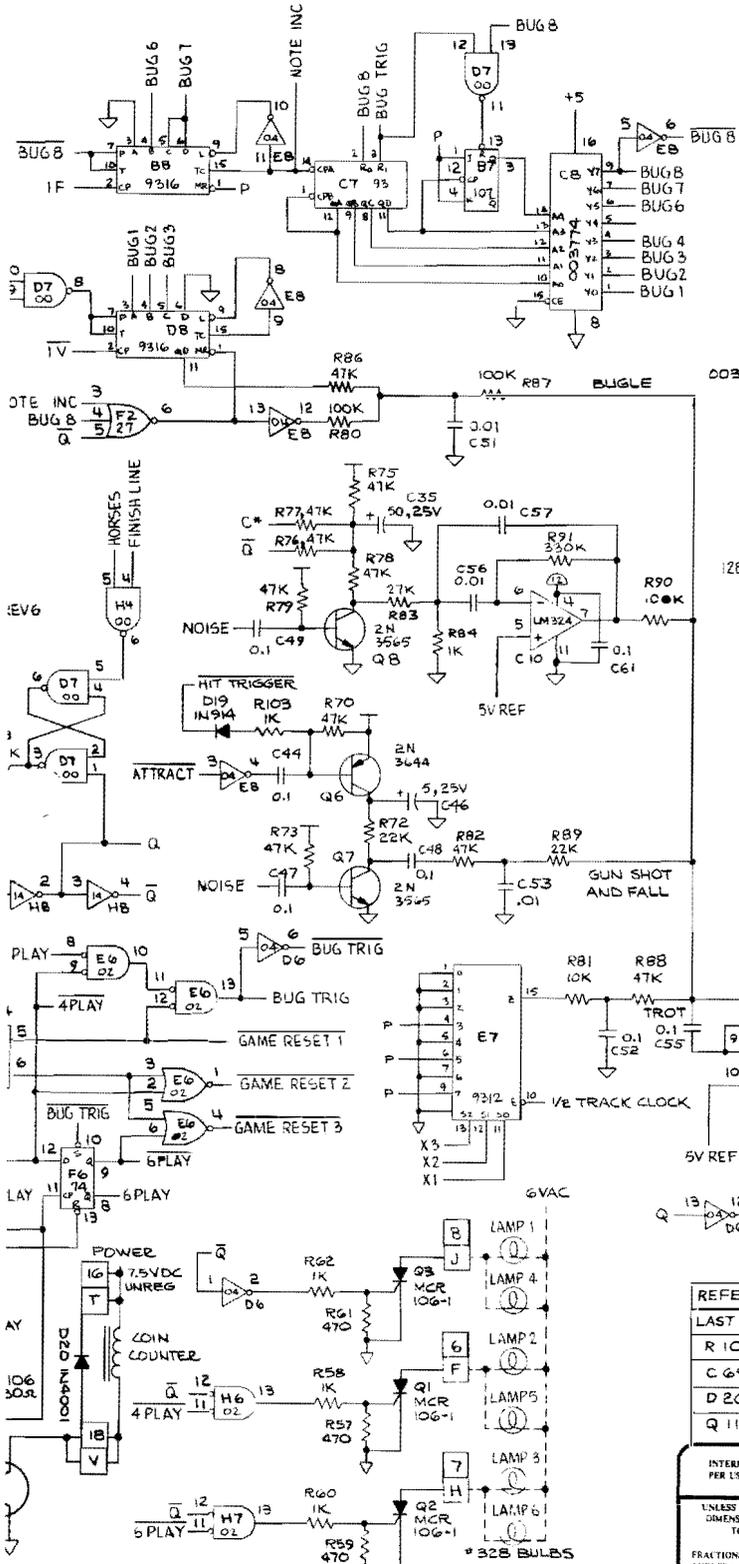
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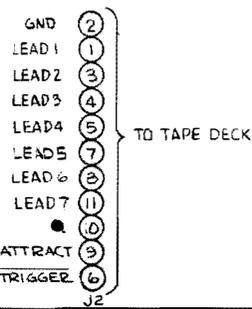
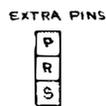
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REVISIONS			
SYM	DESCRIPTION	INITIALS and DATE	
		DRFTG	CHECK ENGRG
A	PRODUCTION RELEASE MS	BJE/75	
B	REVISED PER ECN 1606	7/4/75	
C	REV PER ECN 1615, 1630, 1633, 1657	9-17-75	
D	REV PER ECN 1680, 1681, 1773	11-4-75	



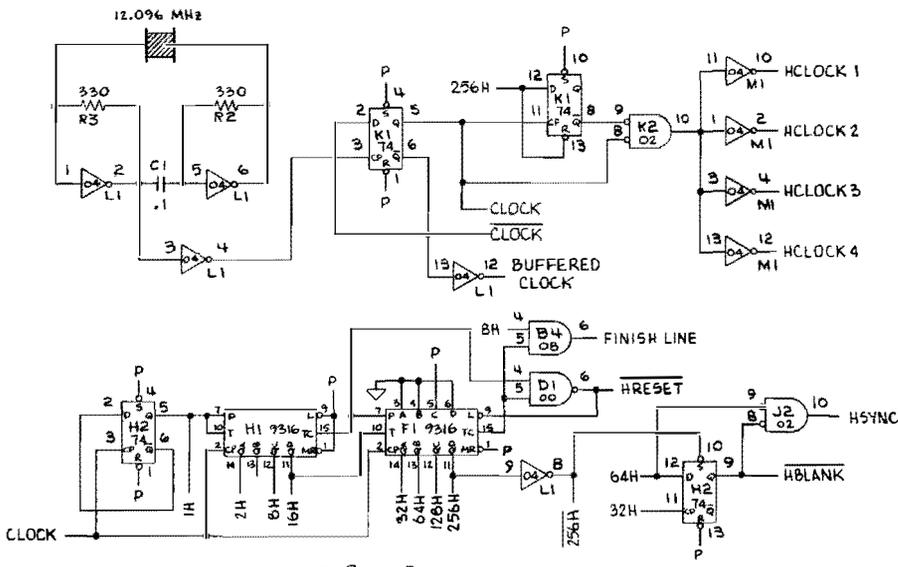
EXTRA GATES
14-HB
20-C6



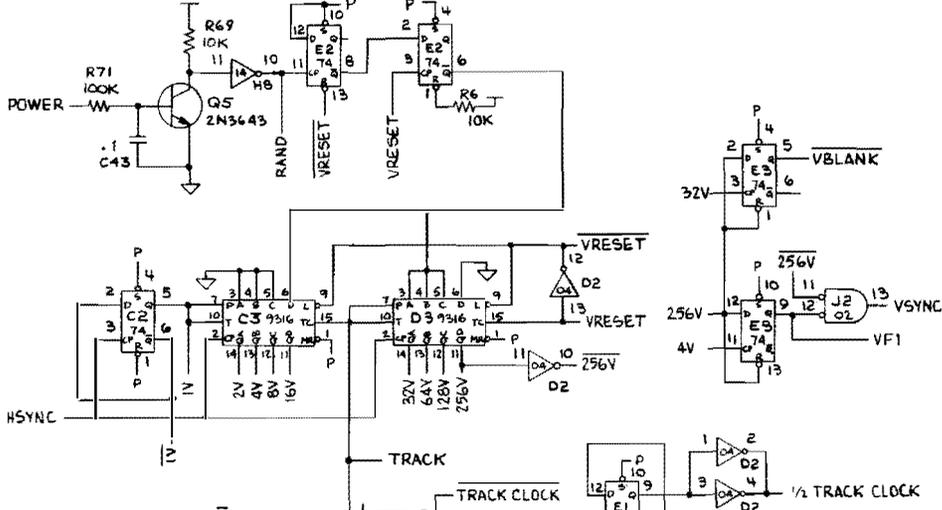
REFERENCE DESIGNATIONS	
LAST USED	NOT USED
R 109	R 48-54, 92-95, 101, 102
C 69	C 36, 38
D 20	D B-14
Q 11	

INTERPRET THIS DRAWING PER ISAS 1145	DRAWN BY	DATE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON	CHK'RS	
FRACTIONS = 1/16 1/8 1/4 3/8 1/2 5/8 3/4 7/8	DESIGN ENGINEER	
ANGLES = 10° 30° 45° 60° 90° 120° 150° 180°	PROJECT ENGINEER	
SURFACE FINISH = 125 250 500 1000 2000 4000 8000 16000 32000 64000 128000 256000 512000 1024000 2048000 4096000 8192000 16384000 32768000 65536000 131072000 262144000 524288000 1048576000 2097152000 4194304000 8388608000 16777216000 33554432000 67108864000 134217728000 268435456000 536870912000 1073741824000 2147483648000 4294967296000 8589934592000 17179869184000 34359738368000 68719476736000 137438953472000 274877906944000 549755813888000 1099511627776000 2199023255552000 4398046511104000 8796093022208000 17592186044416000 35184372088832000 70368744177664000 140737488355328000 281474976710656000 562949953421312000 1125899906842624000 2251799813685248000 4503599627370496000 9007199254740992000 18014398509481984000 36028797018963968000 72057594037927936000 144115188075855872000 288230376151711744000 576460752303423488000 1152921504606846976000 2305843009213693952000 4611686018427387904000 9223372036854775808000 18446744073709551616000 36893488147419103232000 73786976294838206464000 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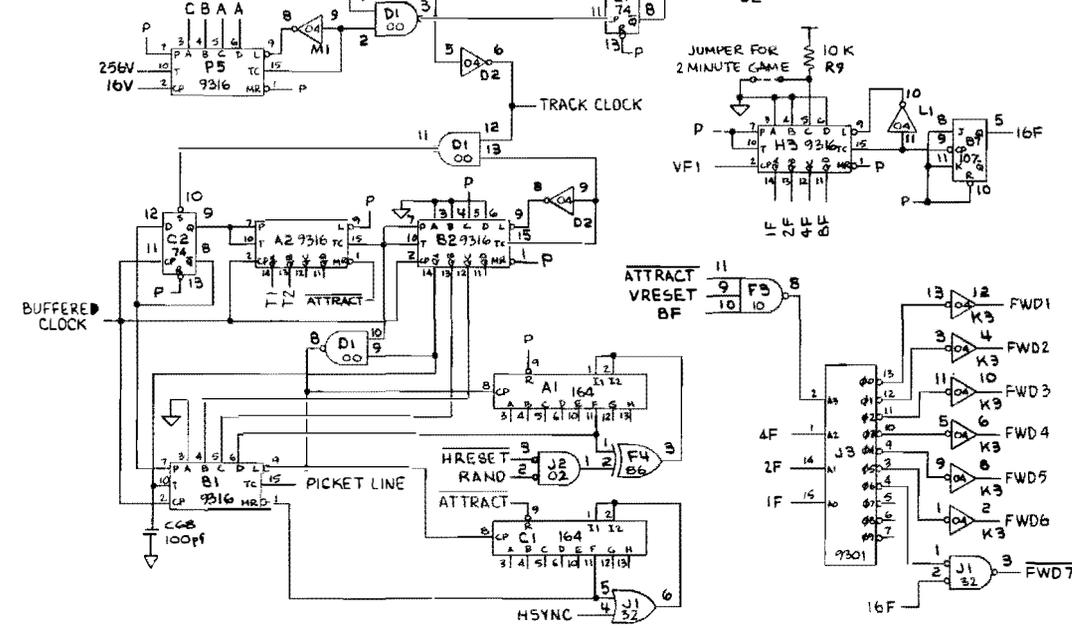
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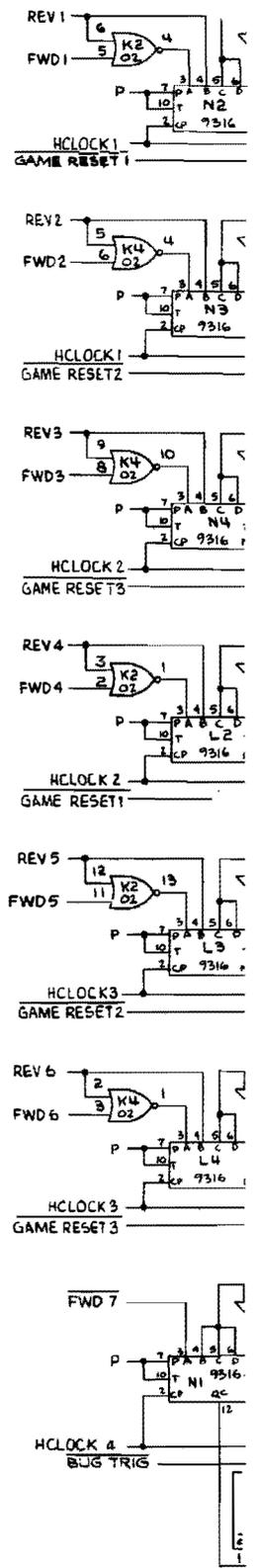
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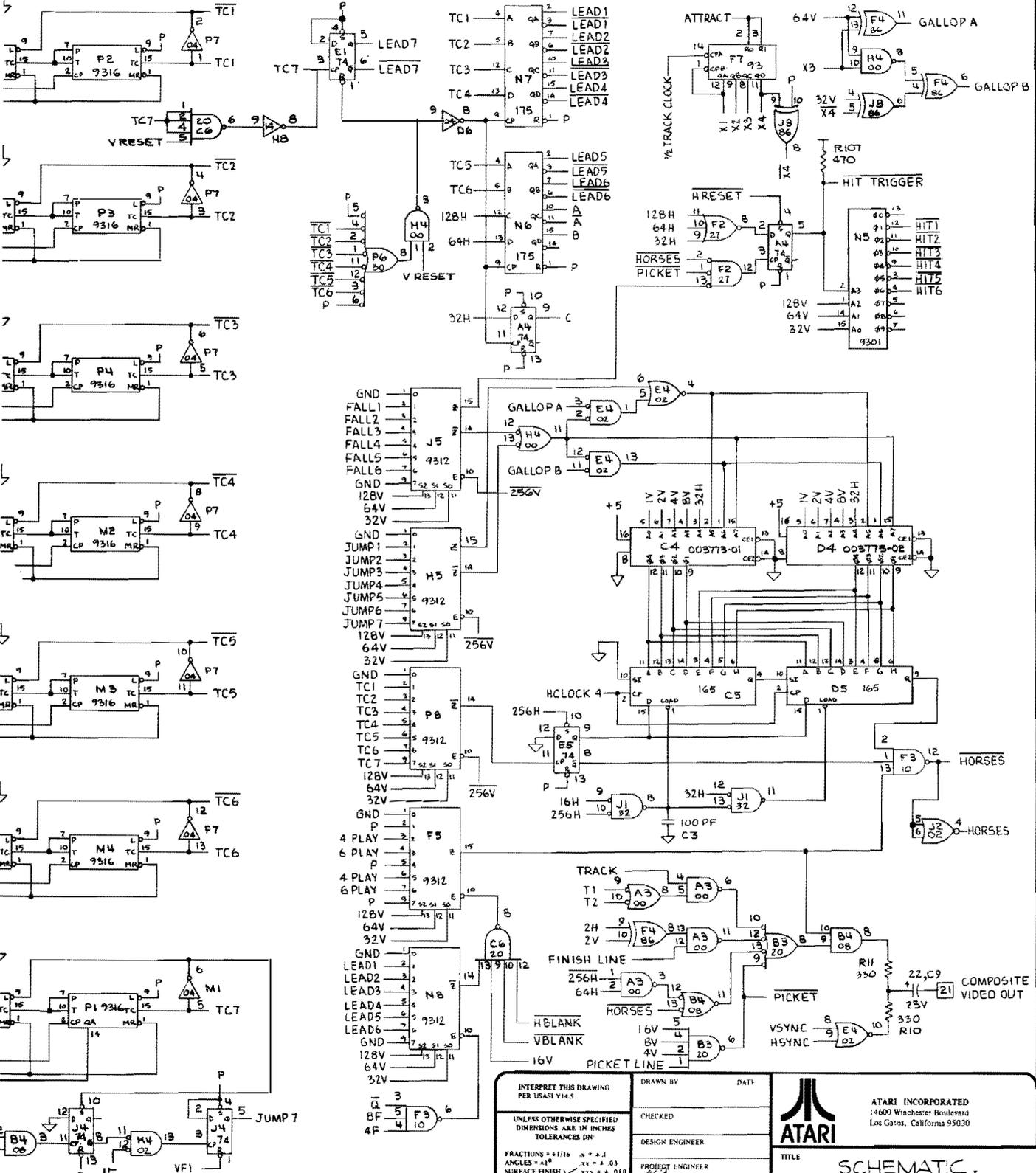


B



A





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INTERPRET THIS DRAWING PER USAS1 V14.5 UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES DN FRACTIONS = +1/16 - .001 ANGLES = ±1° SURFACE FINISH = .001 ± .010	DRAWN BY DATE	ATARI INCORPORATED 14600 Winchester Boulevard Los Gatos, California 95030
	CHECKED DESIGN ENGINEER PROJECT ENGINEER DOCUMENT CONTROL	
MATERIAL:	APPROVED:	SIZE D
NEXT ASSY USED ON APPLICATION	DRAWING NO 003750	RVS D
SCALE NONE	SHEET 2 OF 2	

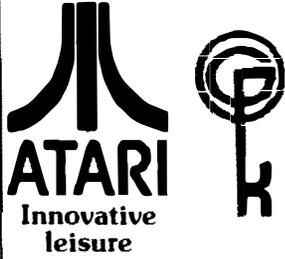
D

C

B

A

DRAWING NO
 SHEET
 REV



PARTS LIST SPECIFICATION

Drawn Dave Storie

Checked

Mech. Eng.

Proj. Eng.

Elec. Eng.

REV.
D

Rev.	Description	Date	Apprv.	Rev.	Description	Date	Apprv.
A							
C	Rev per ECN 1615,1630,1633	9-17-75					
D	Rev per ECNs 1681, 1683, & 1771	11/14/75					

Item	Part Number	Qty.	DESCRIPTION	
1	10-5101	1	Res. 100 ohm 1/4W	R39
2	10-5331	14	Res. 330 ohm 1/4W	R34, R32, R31, R33, R35, R21, R66, R68, R36, R2, R3, R11, R10, R106
3	10-5471	6	Res. 470 ohm 1/4W	R38, R37, R61, R57, R59, R107
4	10-5102	14	Res. 1K 1/4W	R103, R62, R58, R60, R4, R1, R12, R13, R14, R5, R7, R8, R84, R23
5	10-5122	1	Res. 1.2K 1/4W	R63
6	10-5222	1	Res. 2.2K 1/4W	R47
7	10-5562	10	Res. 5.6K 1/4W	R40, R17, R18, R19, R42, R44, R22, R45, R15, R16
8	10-5103	13	Res. 10K 1/4W	R28, R26, R25, R27, R29, R20, R30, R81, R24, R69, R6, R9, R109
9	10-5223	2	Res. 22K 1/4W	R72, R89
10	10-5273	2	Res. 27K 1/4W	R83, R99
11	10-5473	13	Res. 47K 1/4W	R86, R75, R76, R77, R79, R78, R73, R82, R70, R97, R96, R88, R104
12	10-5104	7	Res. 100K 1/4W	R80, R87, R90, R100, R46, R71, R108
13	10-5823	2	Res. 82K 1/4W	R65, R67
14	10-5274	2	Res. 270K 1/4W	R43, R41
15	10-5334	1	Res. 330K 1/4W	R91
16	10-5474	1	Res. 470K 1/4W	R85
17	10-5105	1	Res. 1M 1/4W	R74
18				
19				
20	17-54P0	1	Res. 4 ohm 10W	R64
21	19-315502	1	Trimpot 5K ohm	R56
22	19-315103	1	Trimpot 10K ohm	R98
23	24-250105	7	Cap. 1mf 25V	C28, C24, C25, C23, C26, C27, C60
24	24-250225	1	Cap. 2.2mf 25V	C58
25	24-250505	2	Cap. 5mf 25V	C46, C66

PARTS LIST SPECIFICATION

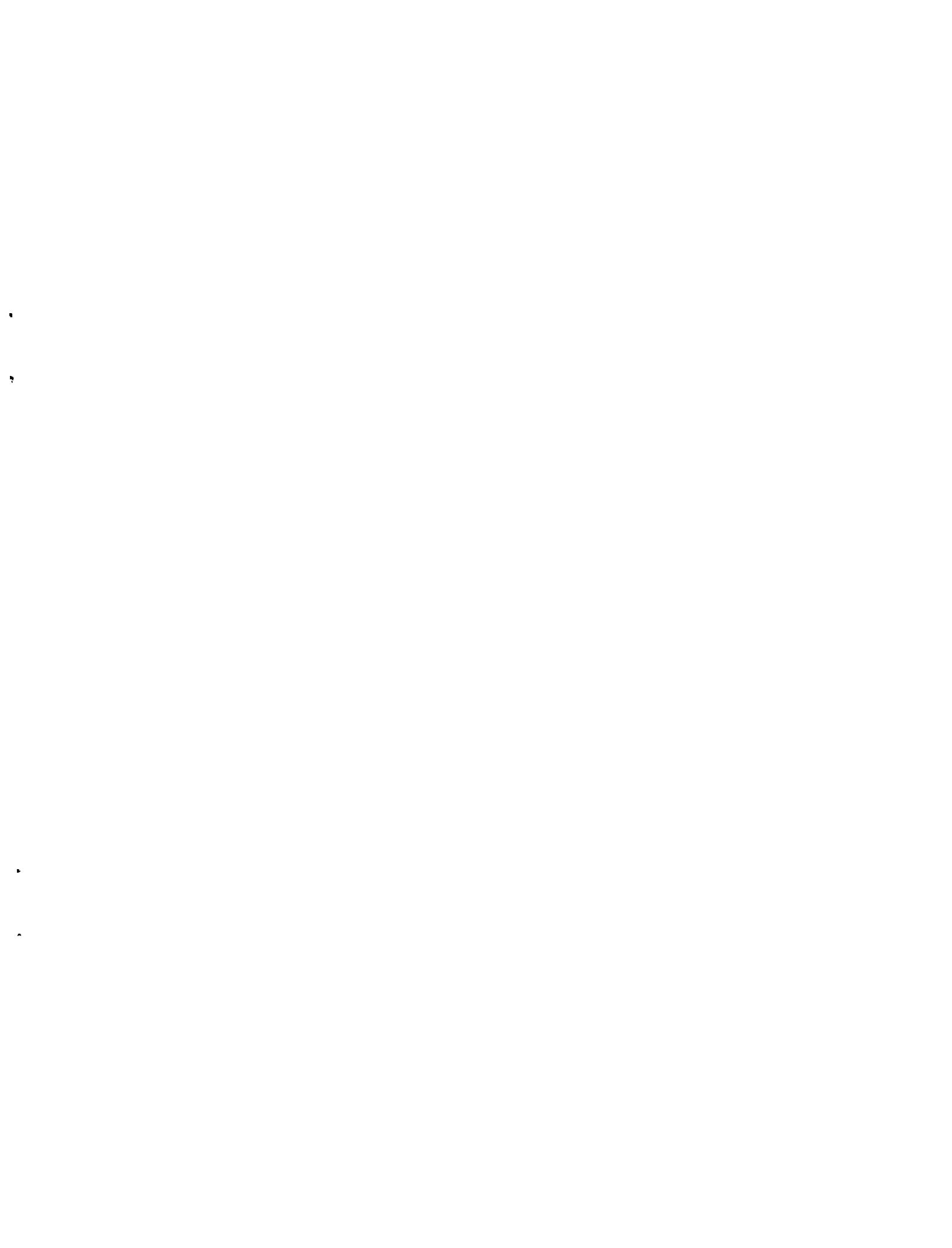
Page 2 of 3

Item	Part Number	Qty.	DESCRIPTION
26	24-250106	1	Cap. 10mf 25V C34
27	24-250226	2	Cap. 22mf 25V C62, C9
28	24-250506	2	Cap. 50mf 25V C54, C35
29	24-250107	1	Cap. 100mf 25V C31
30	24-250227	1	Cap. 220mf 25V C22
31	24-060257	1	Cap. 250mf 6V C12
32	24-250228	1	Cap. 2200mf 25V C63
33	24-160808	1	Cap. 8000mf 16V C64
34	27-250102	1	Cap. .001mf 25V C40
35	27-250103	6	Cap. .01mf 25V C20, C51, C57, C53, C56, C67
36	27-250104	34	Cap. .1mf 25V C33, C29, C49, C47, C48, C44, C61, C59, C55, C52, C30, C45, C65, C43, C1, C2, C5, C7, C10, C13, C15, C17, C9, C32, C4, C6, C8, C11, C14, C16, C18, C21, C37, C69
37			
38	27-011	4	Cap. Monolythic .22mf 25V C50 C39, C42, C41
39	28-250101	2	Cap. 100pf 25V C3, C68
40	31-1N914	8	Diode 1N914 D2, D1, D5, D6, D19, D16, D15, D7
41	31-1N4001	1	Diode 1N4001 D20
42	31-MR501	2	Diode MR501 D3, D4
43	003629	1	Transistor, Noise Source, (2N3643) Q9
44	34-2N3643	2	Transistor 2N3643 Q4, Q5
45	33-2N3644	1	Transistor 2N3644 Q6
46	34-2N3565	3	Transistor 2N3565 Q8, Q7, Q10
47	35-MCR106	3	SCR MCR106 Q1, Q2, Q3
48	37-7400	4	I.C. 7400 D1, A3, H4, D7
49	37-7402	7	I.C. 7402 E6, H7, E4, K4, J2, K2, H6
50	37-7404	8	I.C. 7404 D2, K3, D6, P7, E8, M1, L1, M9
51	37-7408	1	I.C. 7408 B4
52	37-7410	1	I.C. 7410 F3
53	37-7411	2	I.C. 7411 J6, J7
54	37-7414	2	I.C. 7414 H8, L9
55	37-7420	2	I.C. 7420 B3, C6
56	37-7427	1	I.C. 7427 F2
57	37-7430	1	I.C. 7430 P6
58	37-7432	1	I.C. 7432 J1
59	37-7474	17	I.C. 7474 K1, E1, H2, E2, C2, E3, A4, J4, E5, K5, L5, M5, F6, F8, K8, L8, M8
60	37-7486	2	I.C. 7486 F4, J8
61	37-7493	2	I.C. 7493 C7, F7
62	37-74107	1	I.C. 74107 B7
63	37-74164	2	I.C. 74164 C1, A1

PARTS LIST SPECIFICATION

Page 3 of 3

Item	Part Number	Qty.	DESCRIPTION
64	37-74165	2	I.C. 74165 C5, D5
65	37-74175	2	I.C. 74175 N6, N7
66	37-9301	2	I.C. 9301 J3, N5
67	37-9312	6	I.C. 9312 F5, H5, J5, E7, N8, P8
68	37-9316	31	I.C. 9316 P1, N1, H1, F1, B1, L2, M2, N2, P2, A2, B2, L3, M3, N3, P3, H3, C3, D3, P5, K6, L6, M6, K7, L7, M7, B8, D8, L4, M4, N4, P4
69	003774	1	ROM, Bugle C8
70	003773-01	1	ROM "A", Horse Video C4
71	003773-02	1	ROM "B", Horse Video D4
72	37-556	1	I.C. 556 F9
73	37-LM324	1	I.C. LM324 C10
74	37-LM339	1	I.C. LM339 J9
75	37-LM380	1	I.C. LM380 B9
76	37-7812	1	Regulator 12V 7812
77	37-LM323K	1	Regulator 5V LM323K
78	69-001	1	DPDT Slide Switch
79	78-06001	1	Heatsink
80	90-102	1	Crystal 12.096 MHZ
81	79-42116	3	16 Pin I.C. Socket
82	72-1610S	2	Screw, Mach, Pn Hd, Phil, 6-32 x 5/8" Lg
83	75-916S	2	Nut, Mach, Hex, 6-32
84	75-056	2	Lock Washer, Internal Star, #6
85	72-1408S	3	Screw, Mach, Pn Hd, Phil, 4-40 x 1/2" Lg
86	75-914S	3	Nut, Mach, Hex, 4-40
87	75-054	3	Lockwasher, Internal Star, #4
88	78-16005	1	Sil-Pad
89	003751	1	Circuit Board
90	57-216	A/R	Jumper, 16 Awg Buss Wire
91	10-5151	1	Resistor, 150 ohm, 1/4W R105
92	34-2N5190	1	Transistor, 2N5190 Q11
93	31-A14F	2	Diode, GE A14F D17,D18



4

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1

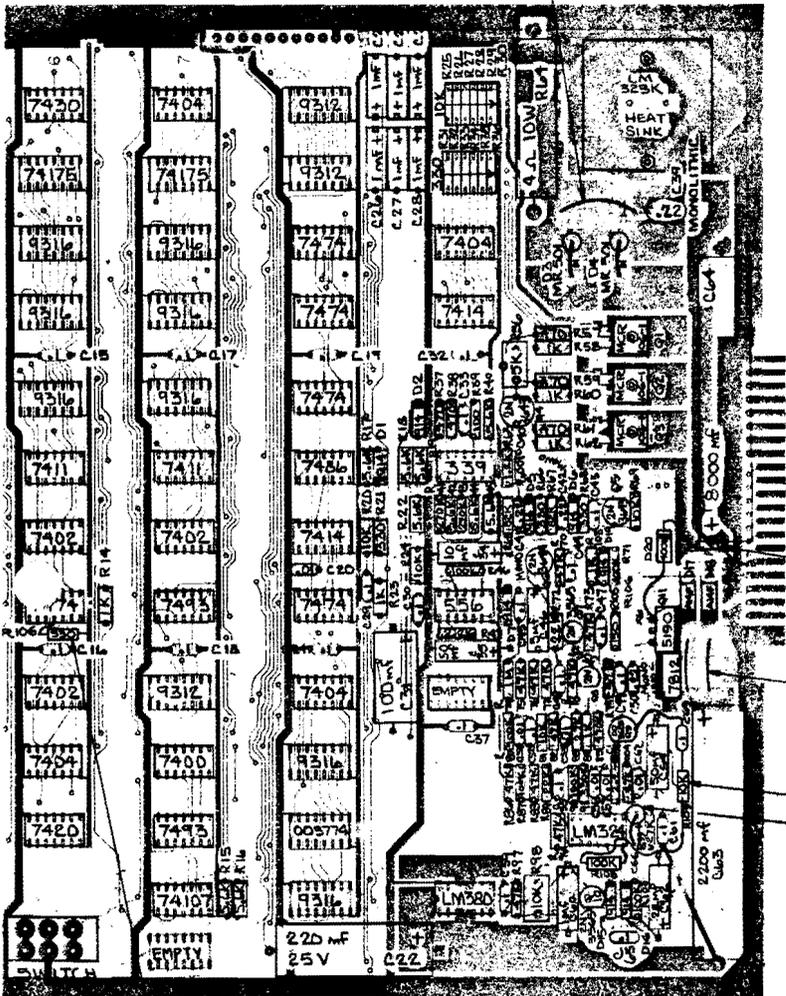
REVISIONS				
SYM	DESCRIPTION	INITIALS and DATE		
		DRAFTG	CHECK	ENCRG
A	PRODUCTION RELEASE M.S.	8/27/75	US	DK
B	REVISED PER ECN 1606	9/4/75	DK	DK
C	REV PER ECN 1615, 1630, 1633, 1657	9-17-75	DK	DK
D	REV PER ECN 1680, 1681, 1771	11-14-75	DK	DK

D

C

B

DRAWING NO.
SHEET
REV



NOTE 9

NOTE 10

NOTE 11

NOTE 4

NOTE 8

A DIODE, D20, IN4001, ANODE SIDE, FROM Q11 PIN 2 TO VE SIDE OF C64, 2000 μ F CAPACITOR, CATHODE SIDE. R POSITIVE SIDE OF C64 AND CATHODE SIDE OF D20 DGE CONNECTOR PIN 16 & T.

LL 22 AWG BUSS WIRE (2 PLACES) FROM CATHODE OF D17 & D18 TO POSITIVE SIDE OF C63.

ACE BETWEEN PIN 13 & 14 OF C10. ADD A 100K RES, R08 BETWEEN C10 PIN 13 & 14. A 10K RESISTOR, R109 AND A 0.1 μ F CERAMIC CAPACITOR, C69 21% FROM C10 PIN 13 TO BASE OF Q9, AS SHOWN.

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INTERPRET THE DRAWING PER LEASAT Y14.1	DRAWN BY	DATE	 ATARI INCORPORATED 14600 Winchester Boulevard Los Gatos, California 95030
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON:	CHECKED		
FRACTIONS - 1/16 1/8 1/4 1/2 3/4 1	DESIGN ENGINEER		TITLE STEEPLECHASE - ASSEMBLY DRWG.
ANGLES - 45° 90° 120° 135° 180°	PROJECT ENGINEER		
SURFACE FINISH - SEE A. 818	DOCUMENT CONTROL		SIZE D
MATERIAL: SEE P/L 003750	APPROVED		
			DRAWING NO. A003750
			REV D
			SCALE 1/1
			SHEET 1 OF 1

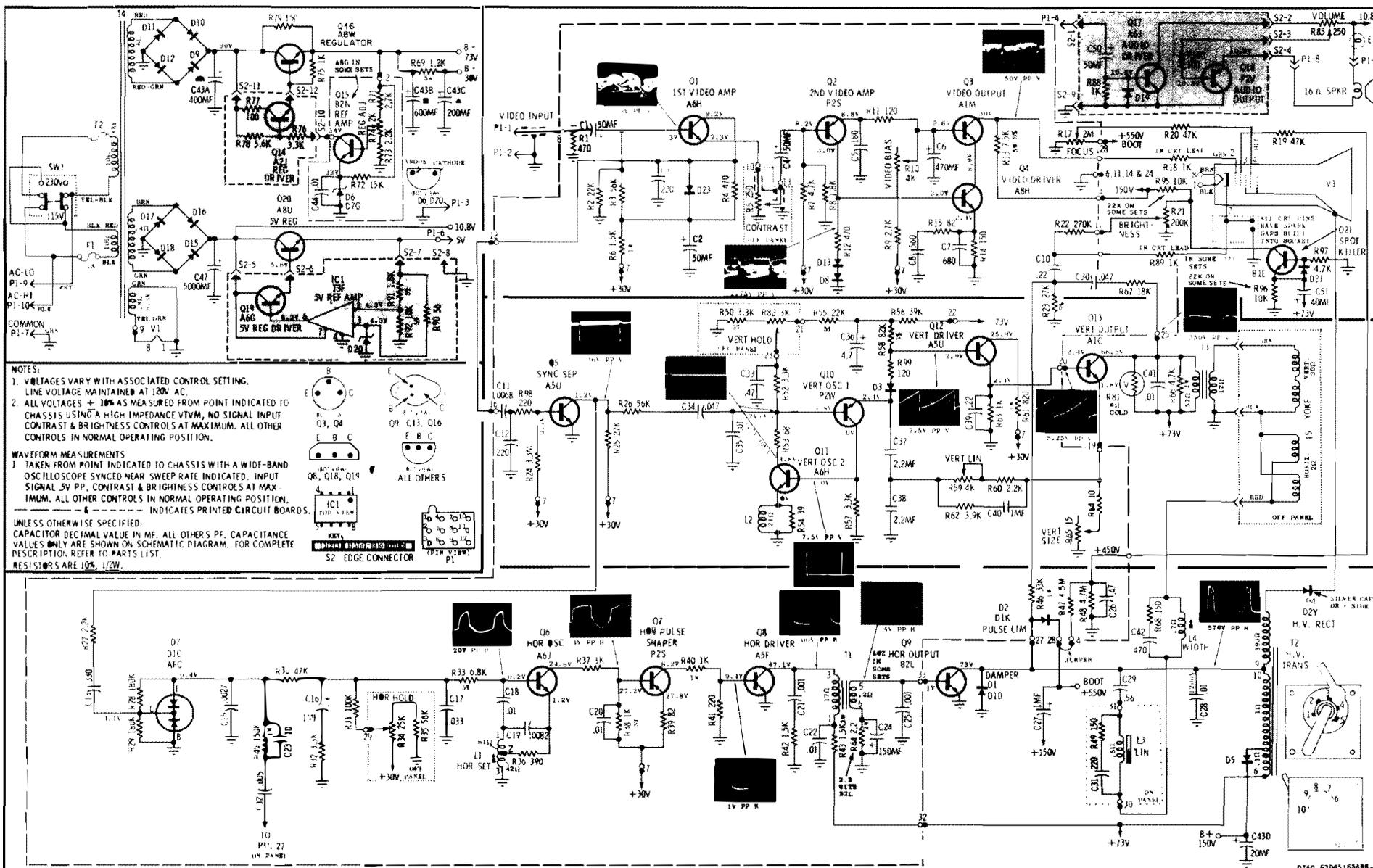
A

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2

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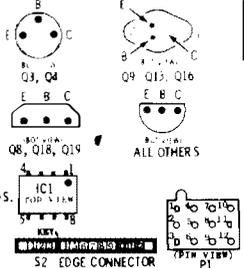
NOTES:

- VOLTAGES VARY WITH ASSOCIATED CONTROL SETTING. LINE VOLTAGE MAINTAINED AT 120V AC.
- ALL VOLTAGES $\pm 10\%$ AS MEASURED FROM POINT INDICATED TO CHASSIS USING A HIGH IMPEDANCE VTVM, NO SIGNAL INPUT. CONTRAST & BRIGHTNESS CONTROLS AT MAXIMUM. ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.

WAVEFORM MEASUREMENTS

- TAKEN FROM POINT INDICATED TO CHASSIS WITH A WIDE-BAND OSCILLOSCOPE SYNC'D NEAR SWEEP RATE INDICATED. INPUT SIGNAL 5V PP, CONTRAST & BRIGHTNESS CONTROLS AT MAXIMUM. ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.

UNLESS OTHERWISE SPECIFIED: CAPACITOR DECIMAL VALUE IN MF. ALL OTHERS PF. CAPACITANCE VALUES ONLY ARE SHOWN ON SCHEMATIC DIAGRAM. FOR COMPLETE DESCRIPTION REFER TO PARTS LIST. RESISTORS ARE 10%, 1/2W.



Motorola XM501/XM701 Monitor Schematic



