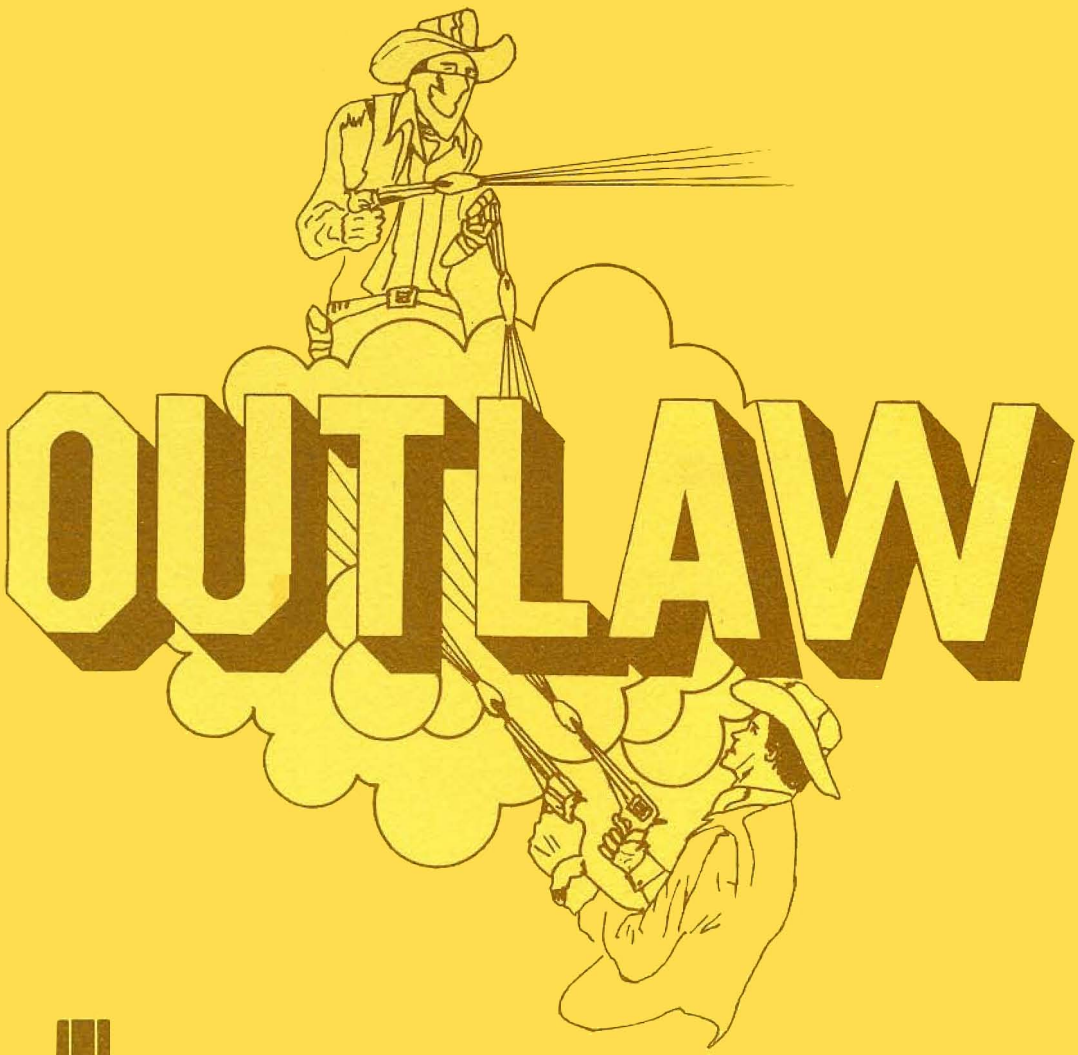
TM-040

OPERATION MAINTENANCE SERVICE MANUAL



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(b) Such products are returned prepaid to Seller's plant; and

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I. INTRODUCTION

1.1 PHYSICAL DESCRIPTION OF GAME

Atari's "Outlaw" is a one-player video action game packaged in its own distinctively-styled cabinet. The upright cabinet rests directly on the floor and the player stands in front. (Drawing number A003218 in Section VII of this manual shows an external view of the game.) A 23-inch black and white TV monitor surrounded by attractive color graphics is mounted at the top front of the cabinet. Alongside the TV screen, in the upper right corner, there is a back-lighted rectangular section with printed player instruction.

The player-operated controls are located just below the TV screen. They consist of a push-button start switch, two added difficulty push-button switches, and a pistol (attached to the cabinet by a 2½-foot-long cable). The pistol rests in a holster-like receptacle in the front panel; during play it is drawn and fired by the player.

Two identical coin mechanisms are located below the player-operated controls. They accept quarters only, and are connected in parallel so that either one can initiate play. (The Outlaw game features an owner/operator-adjustable option that permits on-site game structuring for either one or two plays per quarter.) The cash box is located behind the coin mechanism access door.

A speaker is located below the coin mechanism, near the bottom of the cabinet. During play it produces the sound of footsteps and gunfire.

1.2 BRIEF DESCRIPTION OF PLAY

In the Outlaw game the player tries to shoot the outlaw before the outlaw shoots him. The outlaw is a human-shaped image that suddenly appears at some random location on the TV screen (either on the right or left) and starts running toward the center of the screen. After a run of variable length, the outlaw stops, turns toward the player, sinks down into a crouching position, and fires at the player. The speaker produces footstep sounds while the outlaw is running and gunfire sounds when he fires. Also a white muzzle blast flash appears at the outlaw's gun hand when he fires.

The player must leave the pistol in the holster until the outlaw image appears on the screen. The player then draws the pistol from the holster and aims it at the outlaw. The player pulling the trigger causes a white impact spot to appear on the screen. Its location corresponds to the point at which the player had been aiming the pistol at the moment he pulled the trigger.

Whenever the impact spot covers or even touches any part of the outlaw image, the outlaw falls, and then disappears. One point is then scored for the player. But if the outlaw gets to shoot before the player can hit him, a point is scored for the outlaw. The player must return the pistol to the holster before a new outlaw image will appear on the screen.

During play, the TV screen displays a numerical count of player and outlaw scores, and may also display other written information from time to time. Play ends when the player achieves a maximum score or when an internally-set game timer has elapsed. There are no restrictions on the number of shots fired by the player or on the number of outlaws. The full game sequence and the owner/operator options for game structuring are described in Section III of this manual.

II. SPECIFICATIONS

2.1 GENERAL

Cabinet Dimensions:	Height 56¼ inches, Width 31½ inches, Depth 27½ inches.
TV Monitor:	Ball Brothers Model TG23, 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.

2.2 ELECTRICAL

Power Requirement:	Uses conventional wall outlet providing 60-cycle AC (60-Hz, single-phase) at 110 volts; power consumption rated at about 100 watts.
Fusing:	All fuses located inside cabinet; TV monitor has two 1-amp fuses and remainder of game is protected by a 2-amp slow-blow fuse.
Power Interrupt Switch:	This is a safety switch located inside the cabinet. To protect the person who collects coins, the switch interrupts AC power to the game whenever the rear panel access door is unlocked and opened.

2.3 ENVIRONMENTAL

Operating and Storage Temperature Range:	from 32°F to 120°F (ambient temp.)
Relative Humidity:	from 0% to 80% without condensation

2.4 OWNER/OPERATOR OPTIONS FOR STRUCTURING OF PLAY

- Choice of 1 or 2 plays per quarter
- Choice of bonus game or not
- Three choices of skill level for bonus game
- Three choices of score criteria for player's "achievement" display
- Length of game time: (Adjustable from approximately 1 minute to approximately 3 minutes)

2.5 ACCESSORIES AVAILABLE ON SEPARATE ORDER

Video Probe:	order from ATARI
Universal Test Fixture for Outlaw game:	order from ATARI, catalog no. TF101

III. THEORY OF OPERATION

3.1 FUNCTIONAL DESCRIPTION OF GAME

The simplified block diagram in Figure 3-1 shows the major functional parts of the Outlaw game and how they are interconnected. In the muzzle end of the pistol contains a narrow-beam-width optical lens that focuses light onto an optical detector circuit located inside the pistol. This optical detector responds to light coming either from the TV screen or from a light-emitting diode (LED) mounted inside the pistol's holster receptacle on the front panel, but does not respond to the surrounding room lighting. The optical detector's output signal connects to the main electronic control circuitry via the pistol cable.

A "feedback" control loop is formed during play: from electronic control circuitry to TV monitor circuitry to TV screen to player's pistol (via light emitted from the screen) and back to electronic control circuitry (via the pistol cable). This closed loop provides a means for the electronic control circuitry to sense the player's aim point on the TV screen when he squeezes the pistol trigger. The electronic control circuitry then checks for coincidence (or lack thereof) of the optical detector's output (just after pistol trigger switch closure) with the time occurrence of the video signal producing the outlaw's image on the TV screen. This is how the electronic control circuitry decides whether or not a player's shot has hit the outlaw.

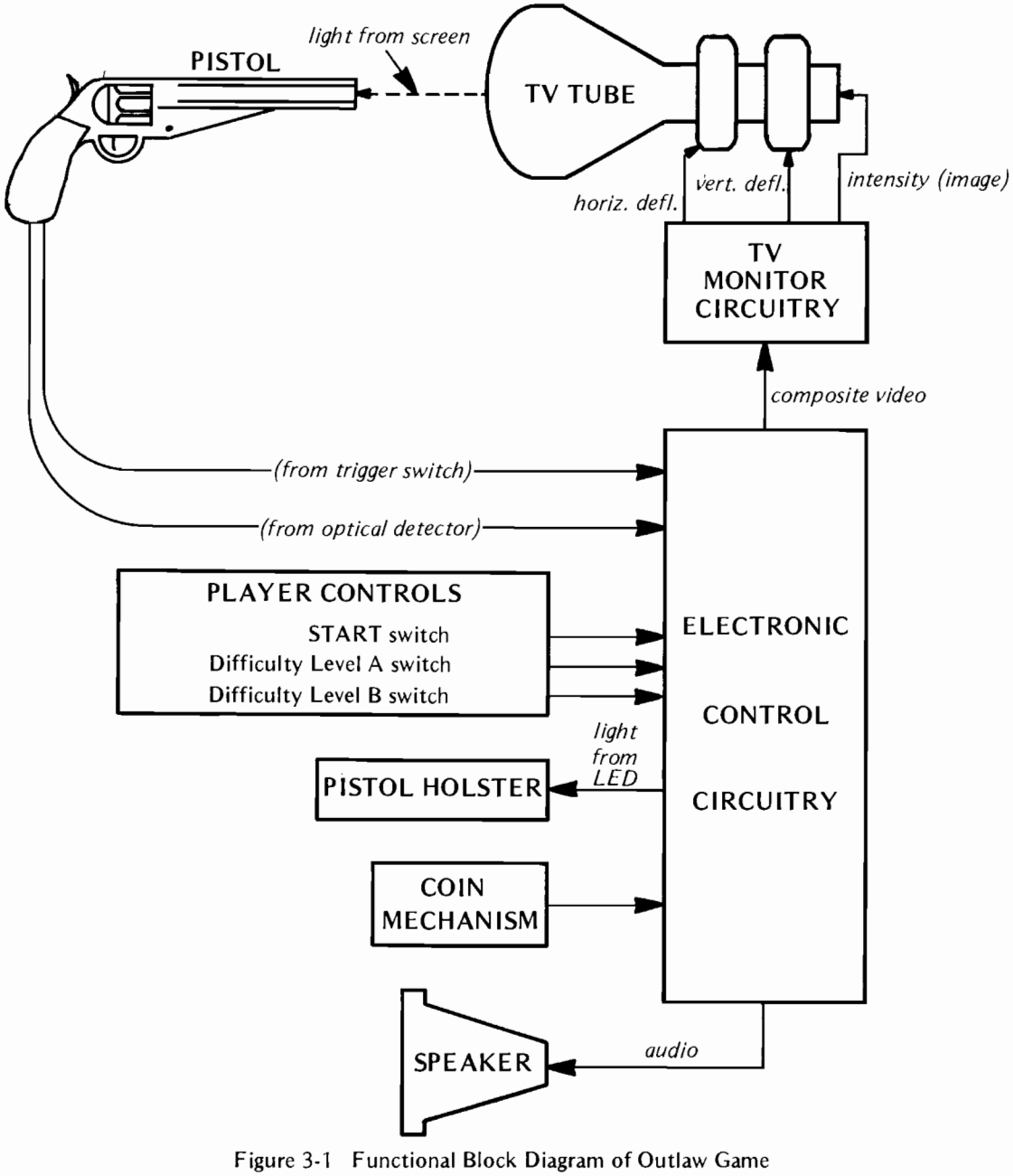


Figure 3-1 Functional Block Diagram of Outlaw Game

3.2 GENERAL INFORMATION

The general information about the Outlaw game given in this sub-section 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 Outlaw 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 Ball Brothers Research Corp. 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 signal is constructed to produce only three video levels (black, medium white, and white) instead of the more or less continuous shades of gray seen on a home TV screen. The horizontal scan lines on the 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 that causes the monitor to produce only 256 horizontal scans, without interlace, from top to bottom of the screen, rather than the home TV's 525 lines with interlace.

The upper and lower portions of the screen are divided up into several regions called windows, and the outlaw's image is not allowed to appear in these parts of the screen. Figure 3-2 shows the locations of these windows and assigns a letter designation to each of them. Normally the window portions of the screen are kept dark (black video level), but at certain times during play one or more windows can light up (white video level).

The back illumination provided by a lighted window attracts the player's attention and enables one to read the printing which has been silk-screened onto the clear vacuform placed over the monitor's TV screen. The printing in front of a window is not readily noticeable when the window is dark. Figure 3-2 also shows the printing on the vacuform.

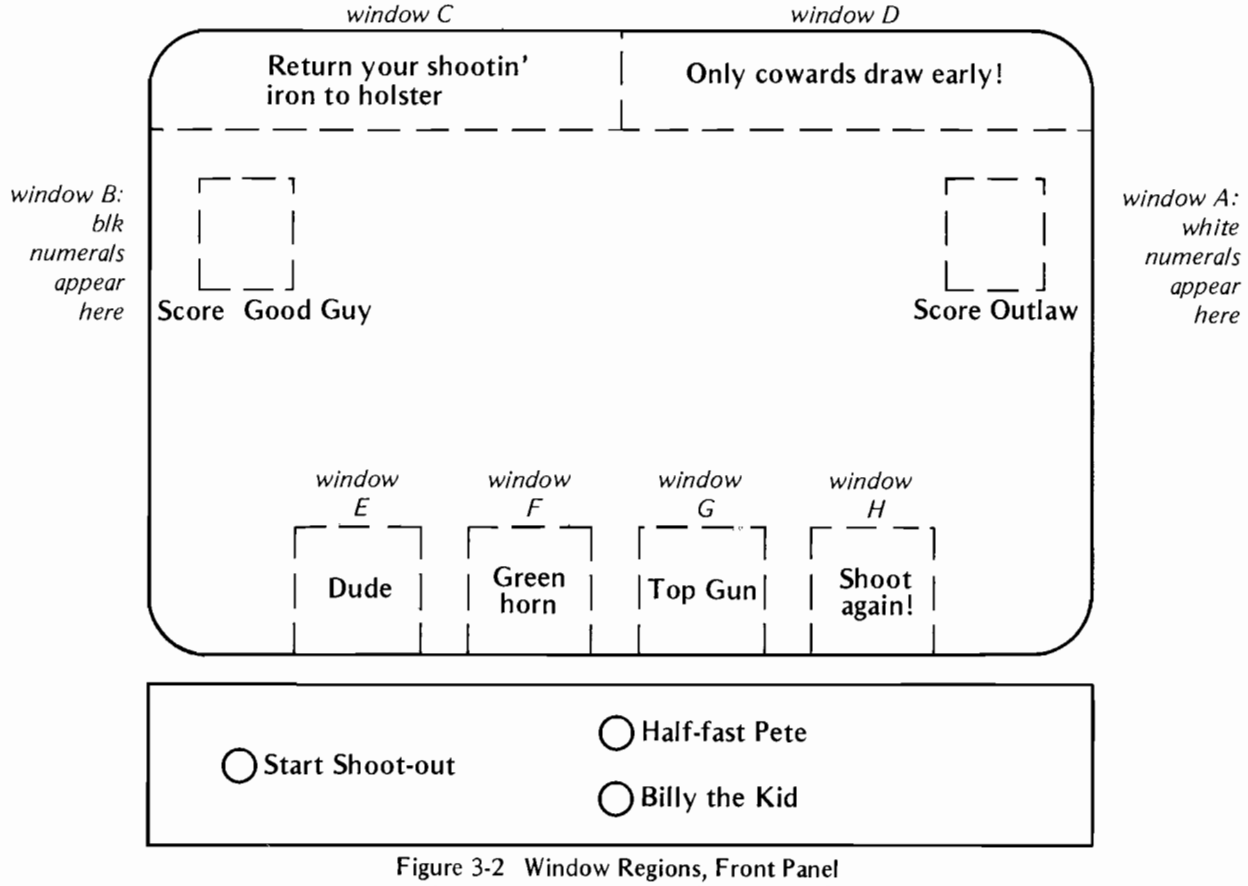


Figure 3-2 Window Regions, Front Panel and Control Panel Artwork (not to scale)

During play the number of hits made by the player and by the outlaw are indicated by numerals which will appear in the two score regions on the TV screen (shown as "Score Good Guy" and "Score Outlaw" in Figure 3-2). Numerals of the player's score will be white video level (against a medium white background); those of the outlaw's score will be black video level, also against a medium white background.

3.3 GAME SEQUENCE

3.3.1 **OPERATING MODES**: During use the Outlaw 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 play ends (either by the player achieving a perfect score or by the game timer elapsing), at which point the game reverts back to attract mode.

3.3.2 **ATTRACT MODE**: During this mode the outlaw's image appears on the TV screen, runs, stops, turns, goes into a crouch, fires and then disappears. (There is no fall motion, however.) The outlaw's image is at a black video level, the background is medium white, and when he fires, the muzzle flash of his pistol is at white video level. After a few moments a new outlaw appears in a different location on the screen, and the outlaw motion is repeated.

This cycle of outlaw appearance, motion, and disappearance continues as long as the game remains in the attract mode. However, during this mode no sound is produced by the speaker, removal of the pistol from the holster and/or squeezing the trigger produces no response (i.e., the pistol is inoperative), and no front panel push buttons are lit (and depressing them produces no response). Any player and/or outlaw scores left over from the most recent play mode continue to be displayed on the TV screen, and speed of the outlaw's crouch and fire motion continues over from the most recent previous play mode. (A player can increase the speed of the crouch and fire motion by pressing the front panel added difficulty switches during play mode.)

A special feature of the Outlaw game is that the speaker will produce a loud, continuous sound should the pistol cable become broken or disconnected. This sound serves as an alarm to attract the game attendant. This feature is in operation as soon as the game is energized, and remains in effect whether the game is in the attract or play mode.

3.3.3 **PLAY MODE**: A player causes the game to change over from the attract mode to play mode when he deposits a coin and it clears the coin mechanism. Signals from the coin mechanism go to the electronic control circuitry, which produces the following responses:

(a) Outlaw images stop appearing on the TV screen.
(b) A credit signal is sent to the front panel start push-button switch, causing the switch to light up and the words "Start shoot-out" to become visible.

To continue the game sequence, the player must now depress the start button. After doing this, the game timer starts counting down, and the electronic control circuitry checks whether or not the pistol is resting in its front panel holster. If the pistol is not fully seated in the holster, window C will begin flashing by switching between black to white video level. Illumination in this window attracts the player's attention and the words "Return your shootin' iron to holster" become visible. In order to have the game sequence continue, the player must now seat the pistol fully in the holster.

After the start button has been depressed, and after the pistol is sensed to be resting in the holster, the electronic control circuitry initiates an outlaw motion sequence. An outlaw image appears in a random location on the screen (either at right or left), and the image starts running toward the center of the screen. The speaker produces footstep sounds while the outlaw is running.

If the player draws the pistol out of the holster before the outlaw image has stopped running, the electronic control circuitry produces the following responses:

(a) Window D will begin flashing and its illumination makes the words "Only cowards draw early" become visible.
(b) The outlaw image will stop running. The outlaw then continues with his normal motion sequence — turn, crouch, and fire.

If the player waits until the outlaw image has stopped running before drawing the pistol, window D remains dark. The Outlaw game features a "Cowards Shoot First" owner/operator option for structuring the play. A player can be prevented from achieving a perfect game if window D has been illuminated even once during his game sequence, (see paragraph 3.3.4).

If the player now squeezes the pistol trigger while pointing the pistol at the upper or lower window regions of the TV screen or elsewhere off the screen, there is no response from the game. But if the player points the pistol at the outlaw's region of the screen and squeezes the trigger, the electronic control circuitry senses the aim point and produces the following responses:

(a) The sound of a gunshot comes from the speaker.
(b) An "impact spot" will briefly appear on the screen at the player's point of aim (this spot being at white video level).
(c) If the player's impact spot covers or even touches any part of the outlaw image, then the outlaw will briefly go into a "fall" motion and then disappear; if not hit,

the outlaw will continue with the motion sequence undisturbed.

There is no limit on the number of shots the player can now fire, but in order to score a point, one must succeed in hitting the outlaw. If the player has not hit the outlaw by the time the outlaw fires, a point is scored for the latter.

As soon as a point is scored for anyone, one of the screen's numerical display areas (windows A or B) changes to show the new accumulated score. After scoring, the electronic control circuitry then causes window C to begin flashing, and player must return the pistol to the holster in order for the game sequence to continue, so that a new outlaw will appear on the screen.

The foregoing game sequence is repeated many times – outlaw appears, player draws pistol from holster, shoots at outlaw, a point is scored (either for player or for outlaw), and player returns pistol to holster. The sequence ends when either the game timer elapses or when the player's score reaches a "bonus game level" – (provided that game play has been structured by the owner/operator options to allow a bonus game, paragraph 3.3.4.

If the player wishes to make shooting the outlaw more difficult, anytime after depressing the start button he can increase the speed of the crouch and fire portion of the outlaw's motion sequence. The player does this by depressing either of the two front panel added difficulty switches. Depressing the upper switch causes it to light up (showing the words "Half-fast Pete" for medium difficulty), and the crouch and fire speeds are increased to a faster medium speed. Depressing the lower switch causes the latter to light up (showing the words "Billy the Kid" for greatest difficulty), and speed is the fastest. After a player depresses either of these switches, the increased speed continues for the remainder of the game time on this play. Speed of the crouch and fire portions of the outlaw motion sequence is restored back to its normal speed at the beginning of a subsequent new play mode.

Windows E, F, or G become illuminated as soon as the player achieves the minimum scores set by the player skill level owner/operator option (see paragraph 3.3.4). Window H becomes illuminated if the player meets the bonus game conditions set up by the owner/operator options. In a bonus game the play mode begins without a coin having to be deposited in the coin mechanism by the player.

3.3.4 **OWNER/OPERATOR OPTIONS**: The Outlaw game features a number of options which the owner/operator can adjust at the game site in order to structure the game play, that is, to change some of the rules or to alter the timing of the game sequence. The game time option consists of a potentiometer which can be manually adjusted to either increase or decrease the game time within the maximum and minimum limits listed in the Specifications. The remaining options are set by selecting either "open" (off) or "closed" (on) positions in a eight-pole DIP (dual in-line package) bit switch located on the PCB. Table 3-1 lists the eight poles and their effects on game operation. Section IV of this manual gives instructions for making these adjustments.

3.4 DETAILED TECHNICAL DESCRIPTION OF OPERATION

3.4.1 **GENERAL INFORMATION**: This paragraph gives a component-level technical description of the game's electronic circuitry. Drawing number 003213 is a schematic diagram of the circuitry located on the printed circuit board, and drawing number 003244 is a schematic of the harness wiring. These drawings are included in Section VII of this manual, along with a schematic diagram of the TV monitor's circuitry.

The locations of components called out on the PCB schematic are shown on the PCB assembly drawing (number A003213). Each integrated circuit location is identified by a column letter designation (A through N) and by a row number designation (1 through 8).

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.

3.4.2 **GAME POWER SUPPLY (REGIONS HH 1 AND 2, FF 1 AND 2)**: The LM309 amplifier circuit provides the front panel's +5 volts via pin 5 of the PCB edge connector and the wiring harness (see harness schematic, drawing number 003244). The basic 5 V supply is regulated by the LM309 (Region HH 2) on the printed circuit board. This supply connects to the start switch, the coin mechanism's coil and switch contacts, and to the anodes of the light-emitting diodes (LEDs) that backlight the added difficulty switches.

The half-wave circuit connected to terminal 20/X provides three supply voltages: -12 V, unregulated +18 V, and +5 V. The -12 volts is sent (via pin 1 of connector J1) to the optical detector circuitry located inside the pistol. The unregulated +18 volts is sent two places: (a) through series resistors R29 and R30 to pin 10 of the PCB edge connector, and after that via the harness to the anode of the LED mounted inside the pistol holster on the front panel, and (b) to the audio output circuit (Region GG 2 of PCB schematic). Here the +18 volts is connected in a small voltage divider used at the LM380 to keep maximum voltage below 22 volts, as specified for the LM380 (at maximum line voltage of 130 VAC). The +5 volts is used for the logic V_{cc} as a reference for the -12 volt output.

3.4.3 **COIN AND GAME CIRCUITRY (REGIONS BB 5 AND 6)**: The coin circuitry provides for: (a) either one or two plays per coin (under control of owner/operator option switch S8 connected to pin 10 of flip-flop H7), and (b) a free game (bonus game) if the player exceeds a certain skill

DESCRIPTION OF OPTION	SWITCH SETTING	EFFECT ON GAME OPERATION
Bonus Game	S1 off	Bonus game allowed
	S1 on	Bonus game not allowed
Bonus Game – at Unconditional Skill Level	S2 off	No effect on game operation
	S2 on	Any player score meets requirement for bonus game
Bonus Game – at Player Skill Level F	S3 off	No effect on game operation
	S3 on	Skill level F ("Greenhorn") meets requirement for bonus game (provided outlaw has no score)
Bonus Game – at Player Skill Level G	S4 off	No effect on game operation
	S4 on	Skill level G ("Top Gun") meets requirement for bonus game (provided outlaw has no score)
Player Skill Level – Minimum Scores	S5 off and S6 off	Windows E, F, G do not light up, regardless of player's score
	S5 on and S6 off	Player's score of 6 lights up window E, 12 lights up F, and 16 lights up G
	S5 off and S6 on	Player's score of 14 lights up window E, 24 lights up F, and 34 lights up G
	S5 on and S6 on	Player's score of 16 lights up window E, 26 lights up F, and 36 lights up G
Cowards Shoot First	S7 off	If anytime during play the player draws the pistol before the outlaw stops running, the player is prevented from achieving a bonus game (regardless of score)
	S7 on	Drawing the pistol before the outlaw stops running has no effect on achieving a bonus game
Number of plays per coin	S8 off	Two plays per coin
	S8 on	One play per coin

Table 3-1 Switch Settings for Owner/Operator Options

threshold score (under control of owner/operator option switch S1 connected to pin 13 of gate J7).

The basic game latch is formed by transistors Q13, Q14, and Q15. This latch is activated for game ($\overline{\text{ATTRACT}}$) when it is set by gate F7, pin 3, via diode D10. The transistor latch can use slowdown capacitors internally so that it cannot be set by electrostatic sparking (such as that produced when rubbing feet on a rug), thus giving erroneous free games. In fact, should electrostatic sparking occur, the ANT (antenna) connection to the base of Q14 resets the game, thereby terminating play. The antenna is a length of wire approximately one foot long. One end connects to pin 13 of the PCB edge connector, but the other end is intentionally left hanging loose. An electric current induced in the wire during static discharge is transmitted to the latch at the base of Q14.

The contacts from the coin switches, connecting to the PCB at edge connector pins 12 and 16, are tied to the set and reset inputs of the latch formed by gates H8, pins 11 and 13. This latch debounces the signal received from the coin switches when a coin passes through the coin mechanism. The output signal from this latch (at H8 pin 10) is further conditioned through connection to two flip-flops (F8 pin 10 and F8 pin 13), in order to place the coin mechanism signal in phase with the system logic. While a coin is passing through the coin mechanism, these two flip-flops reset to binary 00 state. As soon as the coin has passed through, the reset is lifted, and when the function "32V" (at flip-flop clock inputs F8, pins 9 and 12) comes down, the first flip-flop (F8 pin 3) clocks to binary 1 state. At the next "32V" falling function, the first flip-flop clocks back to binary 0 (at F8 pin 3), and the second flip-flop clocks to binary 1 state (at F8 pin 5). Gate F7 decodes this condition of the flip-flop outputs, and its output (at F7 pin 3) goes down. At the third "32V" function, the second flip-flop clocks back to binary 0 (at F8 pin 5), where it remains. The momentary down signal at gate F7 pin 3 ($\overline{\text{COIN}}$) sets the game latch (Q13, Q14, Q15). It also sets other flip-flops at L3 pin 5, H7 pin 13, H7 pin 1. If the free game switch S1 is in the "on" position, the momentary down signal at gate F7 pin 3 also sets flip-flop J7 pin 13.

After the game latch is set, the flip-flop in location J7 (region AA 5 of the schematic) is released to operate, because the game latch's output "Q" applied at J7, pin 1, comes up. The normally-closed front panel start push-button switch is now permitted to operate the "D" input of flip-flop J7 (pin 2). A prior condition at gate K7 pin 12 is ATTRACT or game off.

The type-555 device in location J8 is a timer that, after being set, runs down in the time established by the RC-network formed by C9, R21 and R22. The signal that reaches the timer from flip-flop J7, pin 6, is negative to its reset input. NOTE: Resistor R22 is a potentiometer (Trimpot) that can be manually adjusted to increase or decrease the player's game time, as described in paragraph 3.3.4 under the game time owner/operator option. The signal at the timer's logic-level output pin (J8 pin 3) is named $\overline{\text{ATTRACT}}$. As soon as this signal comes on, the input $\overline{\text{START}}$ signal is gated off through the connection back to gate K7 pin 12.

When a "true" level is present at the credit output, the front panel start switch is illuminated. The credit lamp drive circuit is formed by gate H8 pin 6, Q11, and Q12; the collector of Q12 connects to pin 7 of the PCB edge connector. Termination of credit occurs when the game is reset from pin 6 of flip-flop H7. The time run down of the $\overline{\text{ATTRACT}}$ signal clocks flip-flop H7; the condition present on the "D" input (H7 pin 12) at this time determines whether credit is available. If at rundown of ATTRACT this "D" input is "up," then credit will be terminated. A high player score requires both gate E7 inputs (pins 5 and 6) to be down. If switch S8 (the number-of-plays-per-coin option), connected to pin 10 of flip-flop H7, is in the closed or on position, a "down" condition is assured at input pin 6 of gate E7. This will be "true" if either input to gate K7 (output at pin 8) is down.

If switch S1 (bonus game option) had been in the open or off position, a low is assured at pin 8 of flip-flop J7. If switch S1 had been in the closed or on position, then high is assured at J7 pin 8, and the pin 6 output of gate L5 then controls gate K7 pin 8. The K7 pin 8 output will be high only if both K7 inputs are up.

At output pin 5, the flip-flop L3 is initially low, and goes high only when the "ACP" input (clocked at L3 pin 9) is high. The ACP signal (produced in region EE 8 of schematic) goes high only after the player's score reaches the level set in the bonus game – player skill level options (switches S2, S3, S4). See paragraph 3.3.4. Besides the input from L3 pin 5, another condition on gate L5 is the PERFECT SCORE signal (at pin 4 of L5). This signal (produced in region FF 7 of schematic) is high only if switch S2 is closed, player has never been shot (no outlaw score), and – provided that switch S7, the "Cowards Shoot First" option, is in the "off" position – if the player has never drawn the pistol before the outlaw stopped running.

If switch S8 (number of plays per coin option) is in the open or off position, a constant high is forced at pin 10 of flip-flop H7 and the player receives two plays per coin. The connection of the $\overline{\text{COIN}}$ signal to pin 13 of H7 assures that pin 6 of gate E7 remains high after the pulse on the $\overline{\text{COIN}}$ output (pin 3 of gate F7) has passed.

Pin 6 of gate E7 goes down at the first interrogation by the ATTRACT signal coming up – the end of game. But at that time only the "up" is clocked through, and the game flip-flop is not reset. If the game flip-flop is not reset, then a new depression of the start switch will initiate a new game.

For a bonus game to be possible, switch S1 (connected to pin 13 of flip-flop H7) has to be in the closed or on

position so that the $\overline{\text{COIN}}$ can set a high onto pin 8 of flip-flop J7. If this high is still present at the end of the game (when the game timer has run down), then a bonus game results.

3.4.4 SYNCHRONIZATION INFORMATION FOR TV MONITOR (REGIONS GG, HH 5, 6, 7 AND 8 ON PCB SCHEMATIC): The output of a 14-MHz crystal oscillator (N2 pin 4) is divided by flip-flop D3 to form the CLOCK signal (D3 pin 9). The CLOCK then drives a divide-down configuration (two type 9300 ICs and flip-flop F3), and after two gating stages and flip-flop D3, the H RESET signal is generated (D3 pin 6). The H RESET sets the horizontal blanking latch at M2 pin 12 and drives a second divide-down configuration (two type-9300 ICs and flip-flop L3). After a gating stage and flip-flop H2, the V RESET signal is generated (H2 pin 6). The V RESET sets the vertical blanking latch at M2 pin 2. The output of the horizontal blanking latch (M2 pin 10) connects to the "P" input (pin 10) of flip-flop H2, and its output (H2 pin 8) becomes H SYNC (the horizontal synchronization timing). The output of the vertical blanking latch (M2 pin 4) is gated with signals from the vertical divide-down configuration, and after gating and one inversion, becomes V SYNC (the vertical synchronization timing), C3 pin 12.

The complements of these two signals are combined in gate C6, and this gate's output at C6 pin 8 becomes COMP SYNC (composite synchronization). This COMP SYNC is one of the input signals to the circuitry that constructs the composite video signal sent to the TV monitor. See paragraph 3.4.5.

The time interval between successive H SYNC pulses is approximately 64 microseconds, and between successive V SYNC pulses is approximately 16.7 milliseconds. The V SYNC does not have serrations, and its width is equal to 4 horizontal lines.

3.4.5 VIDEO AND COMPOSITE VIDEO FOR TV MONITOR (REGIONS EE 4, 5 AND 6): The video or picture information for the TV monitor is present at the pin-12 output of gate K8. Signal construction is for three intensity levels: black, medium white and white. (The white level appears intensely white whether written on a black or on a medium white background.) The open collector outputs of two gates (K8 pin 12 and K8 pin 2) provide this video capability. The operation of these two gates is similar to that of the simplified circuit shown in Figure 3-4. Here VIDEO will be at black level if gate A is down (zero volts), and will be at medium white level if gate B is down (+2.5 volts). VIDEO will be at white level if gates A and B are both up (+5 volts).

Blanking is used during both vertical and horizontal synchronization. Vertical blanking is constructed in latch M2 (outputs at pins 1 and 4), and horizontal blanking in latch M2 (outputs at pins 10 and 13). The V and H blanking are ORed to form $\overline{\text{COMP BLANK}}$ at gate L1, pin 3.

The $\overline{\text{COMP BLANK}}$ signal forces a plus level at both inputs (pins 12 and 13) of gate E3, thus forcing black video level and deleting all other signals. When $\overline{\text{COMP BLANK}}$ is "off," background (medium white video level) and black are routed through E4 (at pin 8) and K8 (at pin 2). The voltage switching levels at the video point (K8 pin 12) are then between ground and +2.5 volts; this would be a video signal with blanking.

By means of additional resistor matrixing (R15, R17, R18), the synchronization information is added and a composite video signal is formed at the junction of resistors R15, R17 and R18. This signal is coupled through capacitor C10 to PCB edge connector pin 8, and then on via the harness to the TV monitor. When synchronization information is present, the video point (K8 pin 12) is already shorted to ground level by the blanking; therefore there is no synchronization interference to this output. Without synchronization information (when there is an open collector condition at K8 pin 4), the voltage swing at the composite video point or the junction of resistors R15, R17 and R18 would be as follows: from +5 volts (white video level) to +2.5 volts (black video level), with the middle level at +3.75 volts (medium white video level). Resistor R18 thus adjusts the amount of sync that is added below blanking; 30% of the total swing is the value with the given resistors. Figure 3-5 summarizes the waveform voltage levels present at the composite video point.

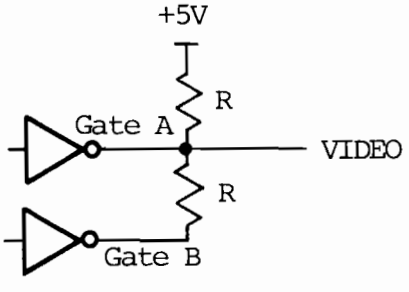


Figure 3-4 Simplified Video Circuit

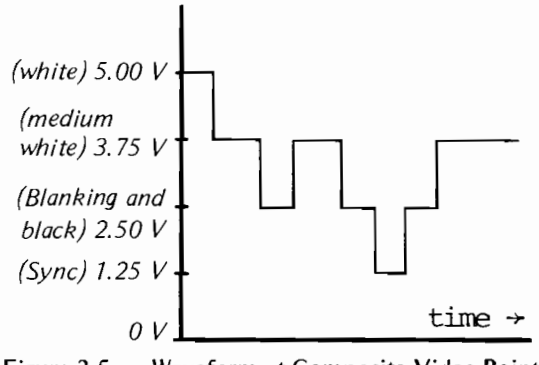


Figure 3-5 Waveform at Composite Video Point, (Junction of Resistors R15, R17, R18)

3.4.6 GENERATION OF SOUND (REGIONS GG, HH 3 AND 4): The basic sounds generated are: the player's gunshot, the outlaw's gunshot and the outlaw's footsteps while running. Transistor Q3, connected as a diode in avalanche (Zener breakdown) mode, is the noise source. The noise signal is then filtered by the 0.01 microfarad capacitor C35 before preamplification by transistor Q4, and the output of Q4 is coupled via C28 to the pin 3 input of a type-741 operational amplifier. Two 1N914 diodes, D12 and D15, connected in the feedback loop of this amplifier limit output at pin 6 to ±0.7 volt. When these diodes are not conducting, the 741 amplifier's gain is very high. Thus the noise input is conditioned to be a digital on/off type of signal. This is done in order to simplify subsequent gain control of the noise signal. With this type of conditioning, different frequencies cannot coexist as they would in a truly analog noise signal. This is acceptable here as long as frequency content of the noise is controlled. Pre-filter capacitor C27, R43, and C31 provide this control. The voltage at pin 3 (the "+ input") of the 741 amplifier is set to about 0.5 volt, so that the amplifier's output can be fed directly to the bases of transistors Q1 and Q2.

Q1 is the gunshot transistor. The input signal to its base is chopped, but Q1 has no output unless a positive voltage is present at its collector. This voltage comes from capacitor C30. When a gunshot is fired, Q1 is made conductive for one picture field. This is in response to the signal FLASH applied at the base of transistor Q5, and capacitor C30 charges quickly. But the discharge is slower, and the noise trails off slowly (as C30 discharges through R60).

When the outlaw fires, there is also a signal at the base of Q1, but at the same time transistor Q5 switches in R60 and C30 as a filter to change the gun noise. The outlaw's gun noise is continuous for about one second as he fires.

For the footsteps sound, noise is switched to occur only when the outlaw is running. The noise signal is routed through transistor Q2 and then input pin 1 of gate H6. The signal at gate H6 output pin 12 is filtered by the RC-network R99 and C33.

Both the gunshot signal (from Q1) and the footsteps signal (from gate H6) are coupled via capacitor C49 to the pin 2 input of a type-LM380 amplifier. The output of this amplifier (at pin 8) couples through capacitor C50 and – via pin 21 of the PCB edge connector and the wiring harness – causes the speaker to produce the game sounds. The potentiometer R65 connected to C49 is a manually-adjustable Trimpot that can be used to control speaker volume; see paragraph 5.4 in Section V of this manual for adjustment instructions. The connection from transistor Q7 also controls the audio amplifier by turning it on or off. The Q7 base connection through R67 from the ATTRACT signal prevents generation of sound when the game is in the attract mode. The connection through R105 generates a loud screech alarm if the gun is removed by vandalism (regardless of whether the game is in the attract or play mode).

3.4.7 PISTOL CONTROLS (REGION FF 2 AND 3): Gates B3 (output at pin 13) and A7 (output at pin 12) form the pistol trigger latch; it is used to debounce the signals received from the pistol via PCB edge connector pins 4 and 6, and the pistol cable. When the trigger is "off" (as long as the player is not squeezing the trigger), the two-stage counter formed by flip-flops A4 is in the binary 00 state. The player squeezing the trigger sets the trigger latch, which then releases the trigger counter. Pulses on the V BLANK signal clock into the counter and it counts through as follows: 00 to 01 and then to 10. It remains at the last level until the next trigger squeeze sequence.

The FLASH signal (at A4 pin 5) is "true" only when this counter is in its intermediate 01 state. The waveform of the FLASH signal is a pulse one picture field long. This same signal also enables a type-9602 Monostable Multivibrator (in location A3). The Monostable's output (at A3 pin 10) is named HIT ENABLE; this signal generates the video of the player's gun blast on the TV screen.

The output signal from the optical detector circuit mounted inside the pistol – see schematic on drawing number 001807 – arrives via the pistol cable on pin 2 of connector J1. This signal is named GNS and consists of negative-going pulses that start accurately but whose ends are stretched out.

The line counter formed by flip-flops A2 counts these pulses. This counter starts out in the binary 00 state, and the pulses of the GNS signal (applied at clock input pins 9 and 12 of A2) cause the counter to count through as follows: 00 to 01 to 11 and then to 10. It remains at 10 until reest by the $\overline{\text{V RESET}}$ signal at A2 pins 10 and 13. The line counter enables a type-9602 Monostable Multivibrator when the output at A2 pin 5 is at "1" (in other words, during the second "1" of counter states 01 and 11). However, because the FLASH signal is connected to the Monostable's reset input (A3 pin 3), the Monostable's output at A3 pin 6 only works during the flash field.

The output signal from the Monostable (at pin A3 pin 6) is put in synchronization with the clocked system timing by flip-flop L2, and the signal produced at L2 pin 5 is named BLAST RESET. The adjustable potentiometer or Trimpot R69 is labeled "AIM" on the printed circuit board artwork. It connects to the Monostable through RC-network R63 and C43 and has some influence on the Monostable's output timing. The result from this influence is that R69 adjusts the horizontal location of the pistol flash.

The BLAST RESET signals (L2 pins 5 and 6) connect to the blast motion V and H counters in region CC 7 and 8 of the schematic. These type-9316 counters generate

various V BLAST and H BLAST signals. BLAST RESET holds these counters in the "rest" mode (binary 000 state) until the Monostable (A3 pin 6) has run down. The counters are then released to count, and do so until the "carry" feedback (pin 9 of the type-9316 devices) terminates the count. This is at terminal count. The video blast structure is the decoded logic of this brief count (gates D7, E7 in region CC 6 of schematic).

3.4.8 GENERATION OF THE OUTLAW IMAGES (REGION BB 1, 2, AND 3): The outlaw images appearing on the TV screen come from an integrated circuit read-only memory (ROM) in position J4 on the printed circuit board. A total of 4096 binary information bits are stored in the ROM, with the bits organized into eight picture blocks as shown on sheet 2 of drawing number 003323 (see Section VII of this manual). Depicted on this drawing, reading from left to right in the upper row, are the turn image, the fall image, a tilt image (not used in this game), at the extreme right a crouch image, and in the lower row four running images. Note that each picture block is a rectangular matrix consisting of 512 cells, arranged 32 cells high by 16 cells wide. Each cell represents an individual binary information bit, with shaded cells standing for binary 1 bits and non-shaded cells standing for binary 0 bits.

The ROM, a bipolar type with a maximum access time of 70 nanoseconds, makes stored binary information bits available 8 bits at a time, at outputs D_0 through D_7 (J4 pins 7 through 10 and 14 through 17). These information bits are in the form of a parallel 8-bit byte. A byte is a generic term used to indicate a measurable group of consecutive binary digits.

The choice of which image gets read out of the ROM is under control of the lower three address inputs A_6, A_7, A_8 to the ROM (J4 pins 4, 5, and 6). The signals on these three inputs are produced by the multiplexer device in position H4 on the board. This multiplexer can be regarded as the equivalent of a 4-pole, 2-throw switch.

Sixteen cells extending across each of the 32 rows comprise the picture information bits needed during each horizontal line sweep across the TV screen. It takes 32 of these sweeps to produce one entire picture block on the TV screen, with the ROM presenting two 8-bit bytes during each sweep. The choice of which pair of bytes should be read out during a specific line sweep is under control of the upper five address inputs A_0 through A_4 to the ROM (J4 pins 1, 2, 21, 22, and 23).

As these parallel 8-bit bytes appear at the ROM's outputs, they are entered into an 8-bit bidirectional shift register formed by the type-74194 devices in positions J5 and K5. This shift register converts the image information from the ROM's parallel form into serial form. The type-7450 AND/OR Invert Gate in position H5 takes the two shift register outputs (at J5 pin 15 and at K5 pin 12) and produces a single output signal at H5 pin 6.

A signal produced in the badguy motion circuitry (region BB 7 of the schematic) and applied at the ROM's A_5 input (J4 pin 3) controls the sequence in which the ROM's two bytes per horizontal line sweep are read out. Other signals from this circuitry, named BAD GUY DIRECTION and $\overline{\text{BAD GUY DIRECTION}}$, connect to the type-7450 device in position H5 and, through gates F5, to the S_0,S_1 inputs of the shift register. These signals can cause image information to be transposed at readout and while passing through the shift register. The result of this transposition process is that outlaw images appearing on the TV screen can exhibit either the right-to-left orientation (for right-to-left motion), or else a transposed left-to-right orientation.

3.4.9 OUTLAW MOTION CONTROL (REGIONS AA, BB 7 AND 8): A gate in position D4 forms a randomization oscillator. Three of its inputs (D4 pins 2, 4 and 5) connect both to capacitor C29, which goes to ground, and to resistor R46, which goes to the gate's output at D4 pin 6. Noise drives these three common inputs, but a signal appears at the gate's output (D4 pin 6) only when the ACTION RESET signal is present (D4 pin 1). The type-9316 binary counter in position N3 is used as a vertical motion counter. During an outlaw/player shoot-out sequence, counter N3 is prevented from changing state. However, between shoot-out sequences its clock input (N3 pin 2) is driven by the RML signal coming through gate M5 pin 6 from the randomization oscillator. With this arrangement, the count in counter N3 is thus randomized by noise during action reset.

During action reset the randomization oscillator also drives the BAD GUY DIRECTION flip-flop (C4 pin 3) at megahertz rates, and the randomized direction is stored in this flip-flop, C4 pin 2. The two type-9316 binary counter devices in positions M7 and N7 are used as the horizontal motion counter. Horizontal walk direction is controlled at M7 pin 4 via gate M6, pin 1. The 1H signal derived from the main system clock drives the clock (pin 2) input of M7 and N7.

In region DD 4 of the schematic the "Q" output from the BAD GUY DIRECTION flip-flop (C4 pin 5) connects through gate M5 pin 2 to the clock input (pin 2) of a type-9316 binary counter in position J6. The changes of this flip-flop at megahertz rates during action reset accomplish the randomization of J6's initial count condition. When the ACTION RESET signal is not present at the D4 pin 1 input of the randomization oscillator, the "Q" output of the BAD GUY DIRECTION flip-flop is held at a steady state (either 0 or 1). Counter J6's clock input (J6 pin 2) is then under control of the WALK A signal (applied at M5 pin 1), since gate M5 is a type-7486 Exclusive OR device.

The WALK A signal originates at the pin 8 output of the type-7493 four-bit binary counter in position F4 (region DD 8 of schematic). During an outlaw walk

sequence on the TV screen this counter provides clock pulses (via WALK A) to drive counter J6. It also sends to the multiplexer in position H4 (region BB 4 of schematic) the two signals WALK A (at H4 pin 2) and WALK B (at H4 pin 5). The images read out this sequence from the ROM in position J4.

With this arrangement of gating clocking pulses through Exclusive OR gate M5, the time when counter J6 reaches its terminal count depends upon the random number that had been entered during action reset. If J6's initial count had been low, then the outlaw walks further across the screen before J6's terminal count is reached. If initial count had been high, then the outlaw's walk is short. Length of the minimum walk is controlled by making sure that the initial count number entered is less than the number decided by the gate H6 pin 6 connection to the counter's parallel enable input (J6 pin 9).

When counter J6 reaches its terminal count, the signal RANDOM HALT appears at its terminal count output (J6 pin 15). The RANDOM HALT signal stops the outlaw's horizontal motion via the Q input to multiplexer H4 and the signal STOP (at H4 pin 12).

3.4.10 OUTLAW SHOOT SEQUENCE (REGION DD 7 AND 8): After the walk portion of the outlaw's motion sequence is completed, either the stop/crouch/shoot portion or the fall portion take place. The RANDOM HALT signal comes up at the end of counter J6's countdown and connects to the clock input (pin 11) of flip-flop K6. This signal sets it, provided that the flip-flop has not already been set by the $\overline{\text{HOLSTER}}$ signal applied at the "preset" input, K6 pin 10. The $\overline{\text{HOLSTER}}$ signal is generated by flip-flop K6 (pin 6) when signals from circuitry inside the pistol indicate that the player has drawn the pistol from the holster prematurely. In other words, the outlaw image was still moving across the TV screen. In this way the stop/crouch/shoot can be forced to start sooner, rather than waiting for counter J6's countdown. Flip-flop K6's "Q" output (pin 9) is named DRAW.

The RANDOM HALT signal also connects through D1 and R9 to the trigger input (pin 2) of the type-555 timer in position L8. The timer's output (pin 3), after passing through two inversion gates, is named ACTION CLOCK, pin 8 of gate M8. The RANDOM HALT signal synchronizes this action clock oscillator formed by timer L8, so that action is synchronous with halt. This normally is the case, because counter J6 is advanced by pulses of the ACTION CLOCK signal; however, resynchronization is needed when a halt is forced by a player prematurely drawing the pistol from the holster.

The action sequence is as follows. At the start of the sequence (before the player draws the pistol from the holster), the signal $\overline{\text{DRAW}}$ (K6 pin 8) is high. This forces the type-74195 counter in position C7 (via gate A7 pin 10 and the counter's parallel enable input at pin 9) to parallel-load binary 1110* every leading edge of the signal ACTION CLOCK, C7 pin 10. The pin-8 output of F6, named HIT, is low during this time.

As soon as the player draws the pistol or the RANDOM HALT signal occurs, the signal $\overline{\text{DRAW}}$ goes low, releasing the type-74195 counter's parallel enable input. The counter then shifts left during each leading edge of the ACTION CLOCK signal, passing through its stop, crouch, and shoot binary states, and finally back to its walk state. Returning to its walk binary state causes an ACTION RESET signal to be generated through the path formed by gate B7 pin 6, C6 pin 6, and Monostable Multivibrator N6. This ACTION RESET pulse resets the DRAW flip-flop K6, resets the badguy horizontal motion counter (Region BB 7 and 8 of schematic), and randomizes all the appropriate counters.

Now suppose that the player has drawn the pistol and shot the outlaw. A signal passing through the path formed by gates B7 pin 6, H6 pin 8, F7 pin 11 and B4 pin 6 clears the normally-set "hit" latch F6 (except during the fall mode). The HIT signal at F6 pin 8 then goes high, forcing counter C7 to parallel-load during the next leading edge of the ACTION CLOCK signal. The data that is loaded puts the counter into its binary 1111 state, the code for the fall mode. The "hit" latch F6 is reset at the same time that binary 1111 is loaded into the counter, and the counter changes back to its binary 1110 state (the run mode) at the next leading edge of the ACTION CLOCK signal after the fall.

Note that the signal CROUCH at gate C6 pin 6 goes high during both of the counter's crouch and fire binary states. This signal applied at the ROM's input (H4 pin 6) causes the crouching image to appear on the TV screen during both the crouch and fire modes. The bad guy blanking flip-flop L6 (region DD 4 of schematic) is set when the pistol is still out of the holster and the HOLSTER signal at pin 13 of gate L5 is high. This allows the gate-L5 output at pin 11 to pass the ACTION RESET pulses. The BADGUY BLANK signal holds the ACTION RESET signal on, and causes the "Return shootin' iron to holster" message to be illuminated on the TV screen. After the player returns the pistol to the holster, BAD GUY BLANKING cancels after two pulses of the ACTION CLOCK signal.

3.4.11 ADDED DIFFICULTY SWITCHES (REGION DD 1, 2 AND 3): The normal slow speed in the stop/crouch/shoot sequence (described in paragraph 3.4.10) can be adjusted by means of the draw speed potentiometer R12. This pot is connected to the timer L8 action clock circuit (region DD 7 of schematic). Charging current for the timer circuit comes to R12 from a 100K-ohm resistor (R89) connected to +5 volts. But the ACTION CLOCK signal is speeded up whenever transistor Q16 or Q17 is conducting, because the transistors can provide additional charging current.

* the "run" command

When the game is first energized by plugging in the power cord, neither Q16 nor Q17 is conducting. The added difficulty latches formed by the type-74279 device in position N8 are reset by the START signal at the beginning of every new play mode. During play, the person depressing the medium added-difficulty push-button (labeled "Half-fast Pete") causes a momentary ground from the switch's contacts to be applied at PCB edge connector pin 6. This sets the medium latch (output at N8 pin 4). Transistor Q16 is then brought into conduction, increasing the current into potentiometer R12, via the signal named XXD. This additional charging current serves to speed up the timing of L8's ACTION CLOCK signal.

The player depressing the hard added-difficulty switch (labeled "Billy the Kid") causes a momentary ground at PCB edge connector pin 18, setting the hard latch (N8 pin 13). Transistor Q17 is then brought into conduction, and its charging current (via the signal names XFL which bypasses potentiometer R12) makes the speed of the ACTION CLOCK signal still faster. Potentiometer R12 is no longer effective when Q17 is conducting, and therefore the fastest speed is not adjustable. Note that whenever the hard latch (N8 pin 13) is set, it also automatically resets the medium latch via N8 pin 3. Either latch being set sends drive current via PCB edge connector pin 14 or 15 to the light-emitting diodes or LEDs on the front panel. Each LED, in turn, provides the switch's back-lighting after a push-button has been depressed. With this circuit configuration, during play one cannot return back to a lower difficulty level after having depressed an added-difficulty switch. The latches are reset at the beginning of every *new* game.

3.4.12 PISTOL-IN-HOLSTER DETECTION CIRCUITRY (REGION CC 3 AND 4): An LED mounted inside the holster on the front panel is aligned so that when lit, it shines directly into the pistol barrel, provided that the pistol is fully seated. This alignment is important, because the pistol's optical field of view is very narrow, and its optical detector circuit must respond whenever the LED flashes. The LED connects to the printed circuit board at edge connector pins 9 and 10. It is flashed only during the vertical blanking of the composite video signal. Thus outputs from the pistol's optical detector circuit at this time cannot be confused with the outputs caused by light coming from scan lines on the TV screen. The duration of LED flash time is equal to that of one horizontal synchronization period during horizontal line in V sync (a 0.015% duty cycle). With such a low duty cycle, the LED can withstand a peak current of 6 amperes, producing an intense light pulse.

The four signals applied to gate L4 (H SYNC, V SYNC, 1V and 2V) cause a 5-microsecond pulse at the output (L4 pin 8), and after further gating with the signal $\overline{16H}$, a 2.5-microsecond pulse appears at pin 2 of gate B3. This pulse drives transistor Q9, which then drives Q10, producing the current for pulsing the LED. Q10 is a power transistor chosen for supplying this high current. The 5-microsecond-wide pulse at gate L4's output (pin 8) also connects to the clock input (pin 3) of flip-flop K4. The output from the pistol's optical detector circuit -- named GNS -- connects to the flip-flop's "D" input (K6 pin 2). With this clocking signal, the flip-flop interrogates the GNS signal with a 2-microsecond delay, in order to give a margin against other delay in the pistol's optical detection.

3.4.13 PISTOL-IN-HOLSTER LOGIC (REGION DD4 OF SCHEMATIC): The pistol-in-holster information is stored in flip-flop K6 (pin 5). When the pistol is in its holster, the first pulse of the ACTION CLOCK signal causes this information to pass on to flip-flop L6 (pin 6). The second pulse causes the information to pass on to flip-flop L6 (pin 3). This signal, named $\overline{\text{BADGUY BLANK}}$, supplies voltage through resistor R4 to pin 2 of Monostable Multivibrator N6, whose output at pin 6 is named ACTION RESET. The pistol must be in the holster in order for outlaw motion to begin.

The flip-flop in position M4 (region HH5 of schematic) detects if the player draws the pistol from the holster before the outlaw stops running; its output at M4 pin 5 is named COWARDS SHOOT FIRST. If owner/operator option switch S7 is in the "off" ("open") position, the COWARDS SHOOT FIRST signal causes the "perfect-game" latch to reset (at J2 pin 11).

The $\overline{\text{ACTION RESET}}$ signal, brought on by the disappearance of the rundown voltage ($\overline{\text{BADGUY BLANK}}$) at N6 pin 2, resets the "draw" flip-flop at K6 pin 13. Because of this resetting, if the player draws the pistol while the outlaw is still running, the outlaw will stop and then crouch and fire.

3.4.14 PLAYER AND OUTLAW SCORE REGISTERS (REGIONS EE, FF 6, 7 AND 8): The two type-7490 counters in positions A1 and B2 form the player's score register, and two more type-7490 counters in positions C2 and D1 form the outlaw's score register. On the TV screen the player's score appears in white numerals on the left-hand side, and the outlaw's score in black numerals on the right-hand side. The HIT signal, generated at pin 8 of the "hit" latch F6 (region DD7 of schematic), comes on clocks into counter A1 (pin 14) each time the player shoots the outlaw. This increases the player's score by one point for each hit. A signal produced at the pin-8 output of gate B6 provides a pulse to pin 14 of counter C2 each time the outlaw shoots the player, increasing the outlaw's score. The START signal resets both registers back to zero at the beginning of each play mode.

If the outlaw wins the shoot-out, then the signal Q3, generated by counter C7 (region DD6 of schematic), will provide the pulse at pin 13 of gate B6. This gate couples through capacitor C40 and on through gate B6 pin 8 to the advance counter C2. Note that any pulse reaching this counter also resets the perfect score latch (at J2 pin 10).

Besides driving counter A1 of the player's score register, the HIT signal also forces an ACTION RESET signal (region DD5 and 6 of schematic). The ACTION RESET will prevent any score from reaching the outlaw score register.

The outputs of all four counters – A1, B2 and C2, D1 – connect to two type-74153 multiplexer devices in positions B1 and C1. The multiplexer outputs then connect to a type-7448 BCD to 7-segment decoder. The function of this multiplexer-decoder arrangement is to convert the score register data in binary code into numerical data in 7-segment code for display on the TV screen.

The remaining circuitry – the type-9312 devices in positions F1 and H1, flip-flops K1, gates J1, etc. – combines the 7-segment numerical data with the appropriate system clock signals so that the signals $\overline{\text{BLACK SCORE}}$ (K1 pin 5) and $\overline{\text{WHITE SCORE}}$ (K1 pin 9) can be gated into the composite video logic.

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 door 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. Don't forget to also examine the pistol which normally rests in the front panel holster.

4.1.2 MECHANICAL INSPECTION: Once you have determined that the game was 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 switches, lamps, etc. on the back side of the front panel, the speaker assembly, the coin mechanism, and the interlock switch activated by the rear panel access door.

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

4.2 ENERGIZING THE GAME

4.2.1 APPLICATION OF AC POWER: Close the rear panel access door, making sure that it is completely shut at the bottom, and remove the key from the lock. 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 the lamps behind the player instructions in the front panel's upper right corner should immediately light up; then the TV screen should also light up.

If there is no response at all 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 troubleshooting 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 SWITCH: The interlock switch is a safety switch mounted inside the cabinet, near the bottom edge of the rear panel access door. At the factory this switch is mechanically adjusted so that it will automatically transfer to its "off" position (switch contacts open) whenever the rear panel access door is opened. When the interlock switch is in its "off" position, the AC power leading to the game's power supply is interrupted. When the access door is closed, the interrupt switch is adjusted to be in the "on" position (switch contacts closed) and AC power is 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 switch can be checked as follows: unlock the rear panel access door and slowly open the 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 front panel lamps and 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 the front panel lamps and TV screen continue to be lighted up 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.

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

4.3 GAME STRUCTURING

Before putting the Outlaw 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 length of the overall elapsed game time per play. Game structuring is under control of the owner/operator options described in paragraph 3.3.4 of this manual.

The physical adjustments on switches S1 through S8 and on the game time potentiometer have to be performed inside the cabinet. These adjustments consist of manually

moving a stud on top of the potentiometer (Trimpot), and of manually setting the positions on the eight miniature switches. Table 3-1 summarizes the effects of the switch positions on game structuring.

While performing these adjustments the game should be de-energized or not operating. Further, it is recommended that the power cord be unplugged beforehand.

Unlock and open the rear panel access door; this should cause the interlock switch to de-energize the game, as described in paragraph 4.2.2. If the interlock switch should fail to de-energize the game, 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 the body against the TV chassis components or other wiring connections inside the cabinet, find the printed circuit board and examine its surface. If game time is to be changed, locate the potentiometer (the words "GAME TIMER" are engraved on the board's artwork, alongside the mounting terminals), and move it as shown in Figure 4-1.

To change switch settings, locate the switch assembly (shown as item 84 on the PCB assembly drawing number A003213). Note that "1" thru "8" are engraved on the body of the switch assembly, and that the plus sign engraved on the switch body indicates the "on" (contacts closed) position of each switch. Placing the switches in the positions listed in Table 3-1 will produce the desired game structuring.

After making these physical adjustments, close and lock the rear panel access door, and energize the game.

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 4.3, Game Structuring, and paragraph 4.2, Energizing the Game, the game should be operating in the attract mode, as per paragraph 3.3.2. The speaker should not be producing any sound. Observe the TV screen. The outlaw's image should be repeating its cycle of appearance, motion, and disappearance over and over again. All the window regions of the screen (see Figure 3-2) should be dark. Next look at the front panel controls. No backlighting should be

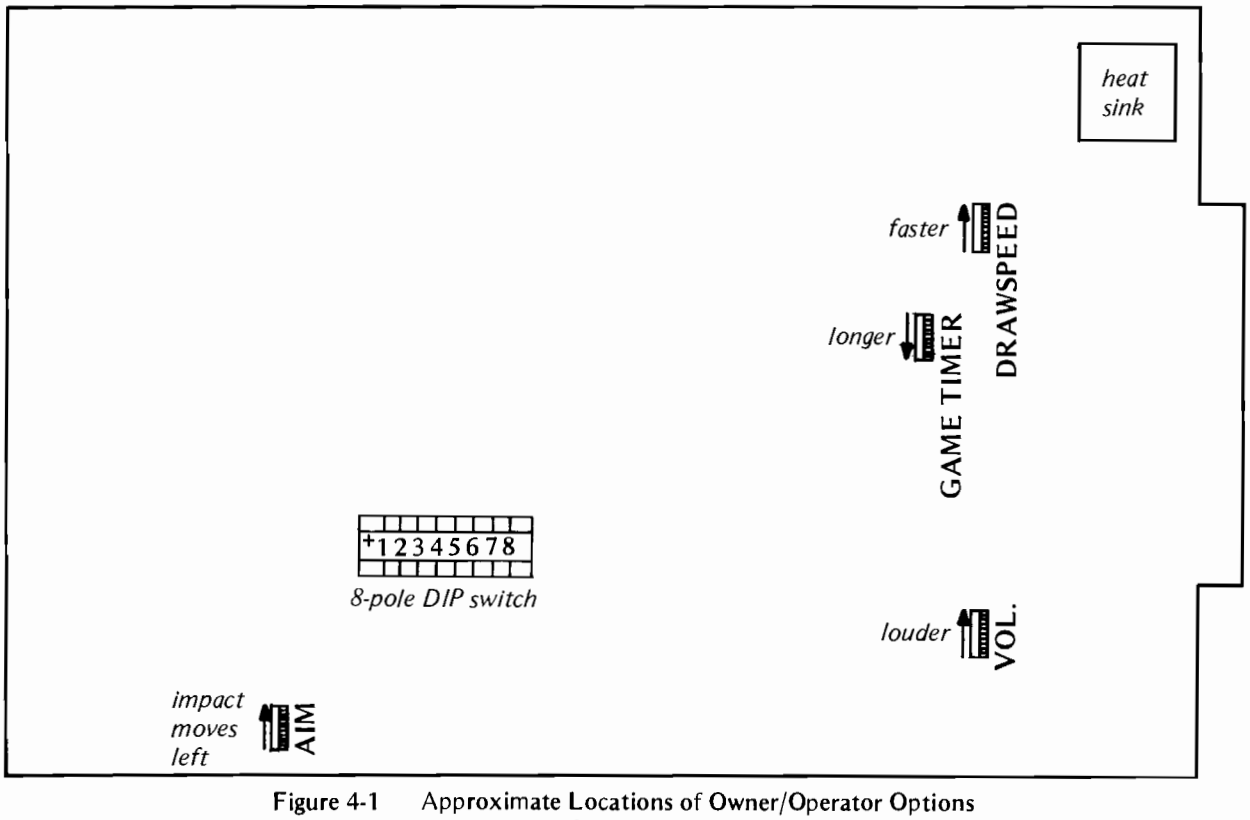


Figure 4-1 Approximate Locations of Owner/Operator Options on "Outlaw" PCB

visible behind the push-button switches ("Start Shoot-Out" and the two added-difficulty "Half-fast Pete" and "Billy the Kid" switches). Now remove the pistol from the holster and squeeze the trigger; neither of these actions should produce any response from the game.

Depress the coin rejector button on each of the two coin acceptors; make sure that the linkage is operating smoothly. Deposit a coin; no genuine coin should be rejected. Upon acceptance of a coin, the game should respond by changing over to the play mode.

The backlighting to the start button should now come on, making the words "Start shoot-out" visible. Outlaw images should continue to appear on the screen.

Remove the pistol from the holster and then depress the start switch. The outlaw image should disappear and no new images should appear. Also the upper left corner of the TV screen (window C) should begin flashing, making the words "Return shootin' iron to holster" visible, and the start switch should go dark.

Return pistol to holster, making sure that it is fully seated. The flashing on the TV screen should cease. After a few moments an outlaw image should appear and begin running, and the speaker should begin producing footstep sounds.

Draw the pistol from the holster, but do not squeeze the trigger. Observe the TV screen. After running a few steps, the image should stop and footstep sounds cease. Then the image turns, goes into the crouch position, and finally the outlaw fires. As he does so, the white muzzle flash of his pistol should appear on the screen, and the speaker should produce gunfire sounds. Also the black numeral *1* should appear in the right-hand "Outlaw's score" region of the TV screen (window B). See Figure 3-2. This shows that the outlaw has scored one point from this shoot-out.

After a few moments the outlaw image should disappear, the upper left corner of the screen "window C" should begin flashing, and "Return your shootin' iron to holster" becomes visible again. No new outlaw images should appear while the pistol remains out of the holster.

Replace pistol in holster; flashing on screen should stop, and after a few moments a new outlaw image should appear on the screen. Immediately draw the pistol, without waiting for the outlaw to stop running. As soon as the pistol is drawn, the image should stop running. The response is *incorrect* if the outlaw continues running after the pistol is drawn. Also, the top right corner of the screen (window D) should light up and the words "Only cowards draw early!" become visible. Do not squeeze the trigger, and allow the outlaw to win this shoot-out. After the outlaw fires, his score should advance to "2."

Replace pistol in holster. After a few moments a new outlaw image will appear. Observe the image and after it stops running, draw the pistol. Window D should remain dark. Point the pistol somewhere in the middle region of the screen but not at the outlaw image, and squeeze the trigger. Each time the trigger is squeezed, a white impact spot should appear at the pistol's aim point on the screen. Also the speaker should be producing a gunshot sound each time the trigger is squeezed. As long as the impact spots do not touch the outlaw image, the latter's motion continues unaffected. Allow the outlaw to again win the shoot-out and observe his score advance. Replace the pistol in the holster.

When a new outlaw image appears, draw the pistol and try to shoot the outlaw. A successful hit (the white impact spot covering or even touching any part of the image) should cause the outlaw to fall, and then disappear. In the left-hand "SCORE GOOD GUY" region of the screen the white numeral "1" should appear. Continue repeating shoot-outs, if necessary, until the outlaw has been "hit" once.

Next depress the upper added-difficulty switch; the switch should light up, making the words "Half-fast Pete" visible. Return the pistol to the holster. When the new outlaw image appears, leave the pistol in the holster and watch the image. In this shoot-out sequence, the speed of the crouch and fire portion of the outlaw's motion should be noticeably faster than in the previous shoot-out – before the switch had been depressed. Allow the outlaw to win the shoot-out.

Depress the lower added-difficulty switch; the switch should light up and the words "Billy the Kid" become visible. Also, the other added-difficulty switch should go dark. When the outlaw image appears, again leave the pistol in the holster. Now the speed of crouch and fire should be even faster than before.

After the above steps have been performed, allow the game time to elapse, namely the game timer should run down. This will be evident when the speaker ceases to produce any sounds. Then check the pistol to make sure that it is inoperative; draw the pistol from the holster and squeeze the trigger. There should be no response from the game.

If the game is structured for two plays per coin (switch S8 of owner/operator option in the "off" position), then the start switch should again light up, making the words "Start shoot-out" visible again. But if the game is structured for one play per coin (switch S8 in "on" position), the game will change over to the attract mode.

Observe the TV screen. The scores for both the player and the outlaw should remain showing. The speed of the outlaw's crouch and fire motion should still be at the fastest setting, and the outlaw should be repeating the cycle of appearance, motion, and disappearance over and over again.

Next initiate a new play sequence. If the game had been structured for only one play per coin, a new coin must now be deposited. Depress the start button; it should go dark and the "Billy the Kid" button should also go dark. Observe the outlaw image on the TV screen. The speed of the crouch and fire motion should be restored back to the normal or slowest speed.

For the remainder of this functional check, exercise the game through one or more play sequences and verify that game operation is in accordance with the game structuring defined by the owner/operator option switch settings. For example, keep shooting the outlaw so that the player's score will reach skill levels that call for windows E, F, and G to become illuminated, and that will earn a bonus game, causing window H to light up. Also check the structuring that prevents the earning of a bonus game if the player draws the pistol even once while the outlaw is running (switch S7).

V. MAINTENANCE AND ADJUSTMENTS

5.1 ROUTINE MAINTENANCE

Due to its solid-state electronic circuitry, the Atari Outlaw 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. Because during play the Outlaw game has a control link formed by the light path from the TV screen into the pistol, it is particularly important that both the plex panel immediately in front of the TV screen and the *lens* mounted in the muzzle end of the pistol be kept clean. The cleaner with brand name "Mirror Glaze" is especially recommended for this. Any gouges or very deep scratches in this area of the plex panel may require replacement of the plexiglass.

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 seem 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.*

The TV monitor's adjustments function like those of a conventional commercial TV set, except that the volume adjustment has no effect. The Outlaw 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:

BRT (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)--Contrast is factory-adjusted for optimum performance. Do not readjust unless required because of component replacement.

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

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

VERT SIZE (Vertical Size)--Adjust only if the picture is stretched out vertically from the center. Turning this knob will "compress" the image back to more normal proportions.

VERT LIN (Vertical Linearity)--This needs adjustment only if the proportions are not equal from top to bottom, that is, if the bottom half were compressed and the top half elongated, for example.

5.3 ADJUSTMENT OF AIM POINT

The bright impact spots appearing on the TV screen when players fire the pistol should be at the pistol's aim point, i.e., should be appearing at a point lining up with the pistol barrel. This aim point is controlled by potentiometer R69, as described in the circuit description of paragraph 3.4.7 of this manual.

The aim point adjustment need only be made if the impact spot is found to be noticeably off-line from the pistol barrel axis. The adjustment is done by manually moving the stud on top of the potentiometer in the direction shown in Figure 4-1. This potentiometer is mounted on the printed circuit board inside the cabinet; the work "AIM" is engraved in the board's artwork, alongside the mounting terminals.

The game must be energized and in the play mode in order to perform this adjustment. This procedure will be easier to perform if a second person is available to fire the pistol and to observe the impact spot on the TV screen, while the first person moves the stud.

5.4 ADJUSTMENT OF SPEAKER VOLUME

The loudness of the sounds produced during game play can be adjusted with the potentiometer R65, as described in the circuit description of paragraph 3.4.6, Section III of this manual.

The adjustment is done by manually moving the stud on top of the potentiometer body, as shown in Figure 4-1. This potentiometer is mounted on the printed circuit board inside the cabinet; the word "VOL." is engraved on the board's artwork, alongside the mounting terminals.

5.5 ADJUSTMENT OF DRAW SPEED

Speed of the outlaw's motion after he stops running can be adjusted with the potentiometer R12, as described in the circuit description of paragraph 3.4.11 in Section III of this manual. But this potentiometer will not influence outlaw motion when a player has depressed the most difficult ("Billy the Kid") switch on the front panel. That difficulty switch forces the fastest possible speed anyway.

The adjustment is done by manually moving the stud on top of the potentiometer body, as shown in Figure 4-1. This potentiometer is mounted on the printed circuit board inside the cabinet; the words "DRAWSPEED" are engraved on the board's artwork, alongside the mounting terminals.

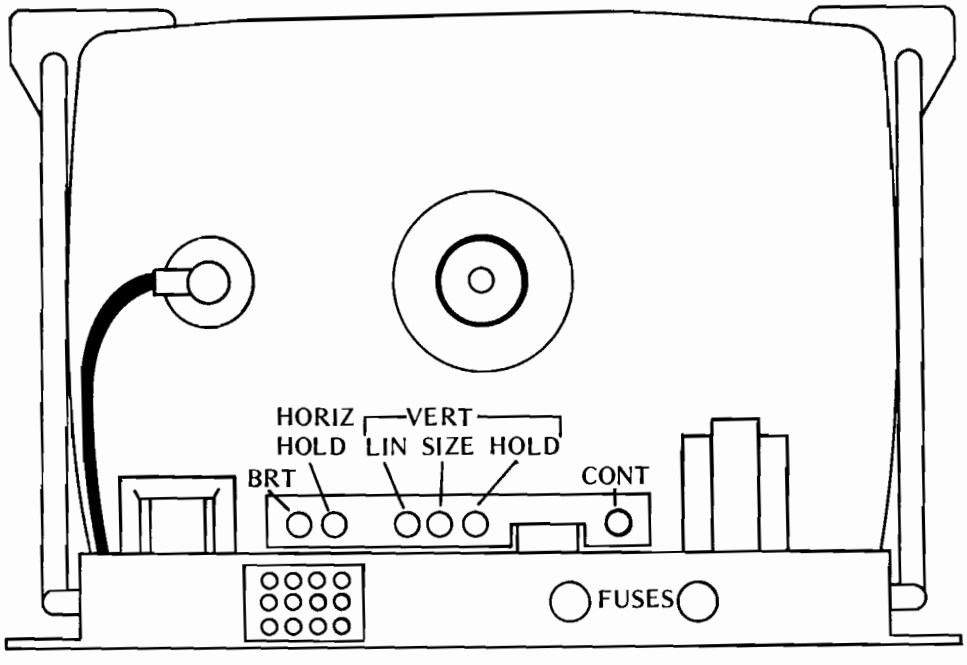


Figure 5-1 Location of Adjustments on Ball Bros. TV Chassis

VI. TROUBLESHOOTING AND REPAIR

6.1 GENERAL PROCEDURE

NOTE: 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 Soldapullt®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 Outlaw game this point is the junction of resistors R15, R17 and R18 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: 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 Outlaw game.

6.3.1 ANTENNA STATIC MODIFICATION: This subparagraph gives a procedure for modifying the antenna wire connected to pin 13 of the printed circuit board's edge connector. The antenna connects to the reset input of the credit latch, as described in paragraph 3.4.3 of Section III. This static modification feature is included in the credit latch circuit so that it will not be possible for a player to obtain bonus games by inducing a static charge in the coin entrance plate or any other metal part of the game – provided that the antenna has been cut to optimum length.

The antenna is a wire approximately one foot long, with one end intentionally left not connected. 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 body usually has enough capacitance to trigger the circuitry. Sensitivity of the static modification feature may be adjusted by changing the length of the antenna wire. Lengthening the wire increases sensitivity, so that a lesser charge will turn off game credit. Cutting the wire shorter decreases sensitivity, so that a 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 ½ inch at a time. Be aware, however, that if the antenna wire is cut too short, players may be able to obtain free game credit (bonus games) 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 (Ball Brothers Research Corp.).

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 undersize 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.

VII. Schematics, Drawings and Parts Lists

Number	*Title*
A003218	Parts List and Drawing Top Assembly
A003241	Parts List and Drawing Control Panel Assembly
A003235	Parts List and Drawing Pistol Assembly
003244	Schematic Harness
A003240	Parts List and Drawing Electronics Tray Assembly
003213	Schematic Printed Circuit Board
A003213	Parts List and Drawing PCB Assembly
(none)	Schematic Ball Brothers Model TG23 Monitor

OUTLAW

ATARI™ Innovative leisure

ASSEMBLY TITLE / TOP ASSEMBLY - OUTLAW **P/L** A003218

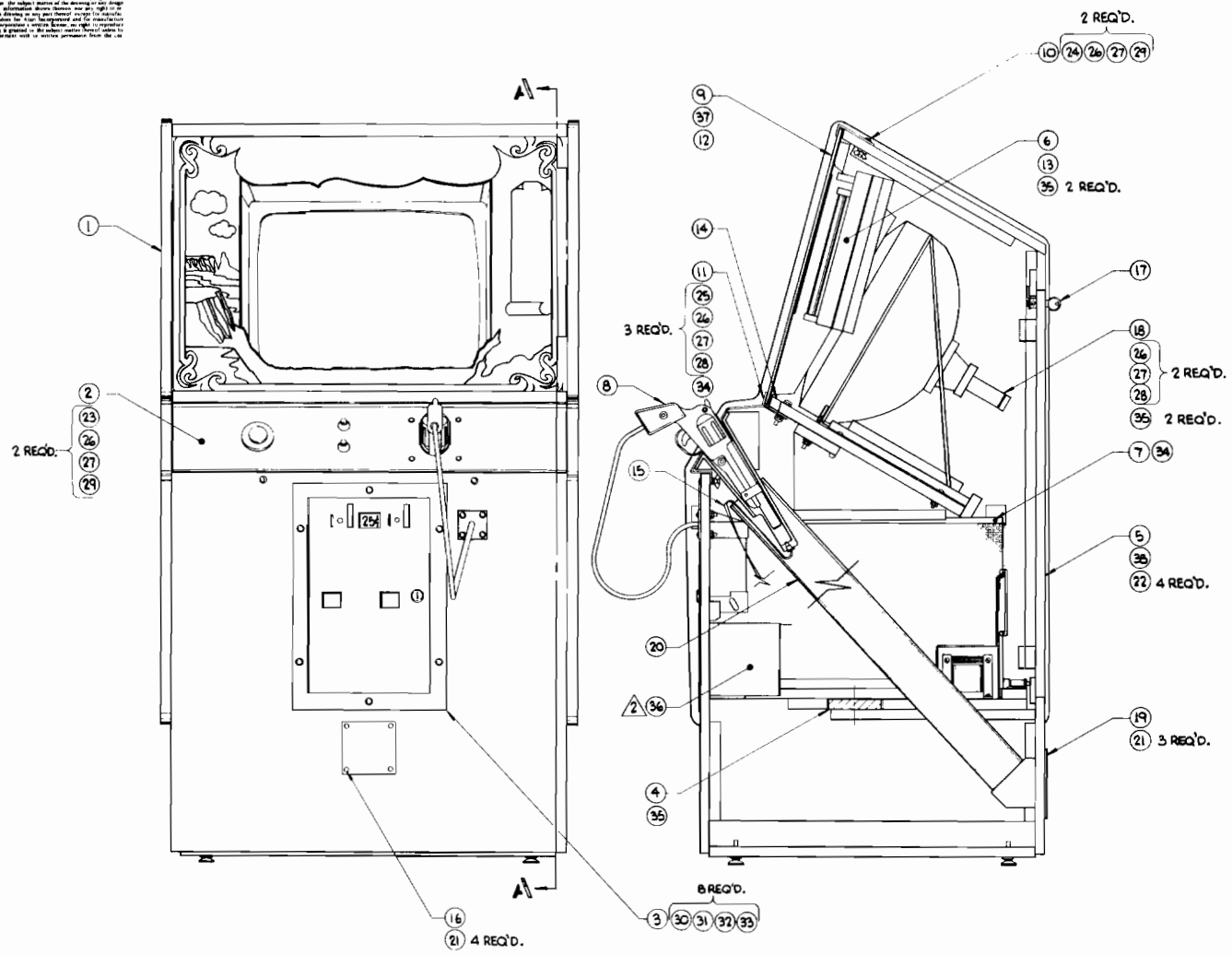
PARTS LIST SPECIFICATION Page 1 of 2

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

Rev.	Description	Date	Apprv.	Rev.	Description	Date	Apprv.
A	PROD REL	2/13/76					

Item	Part Number	Qty.	DESCRIPTION
1	A003219	1	Assembly, Cabinet
2	A003241	1	Assembly, Control Panel
3	A003637-08	1	Assembly, Cash Door
4	A003240	1	Assembly, Electronics Tray
5	A005151	1	Assembly, Rear Door
6	A005145	1	Assembly, 9" Fluorescent Light
7	A004286-06	1	Final Assembly, R.F. Shield Enclosure
8	A003235	1	Assembly, Pistol
9	002754-01	1	Panel, Glass
10	005148	1	Retainer, Top Plex
11	005147	1	Retainer, Bottom Plex
12	002755	1	Bezel
13	70-305	1	9" Fluorescent Tube
14	005153-01	1	Angled Cleat (20.00)
15	A003246-02	1	Holster LED Harness
16	000869	1	Grill, Speaker
17	71-2114	1	Lock, Mechanical Barrel Cartridge
18	A005168	1	Assembly, TV Tray
19	002230	1	Flange, Female
20	002228	1	Tube
21	73-77002	7	Pop Rivet
22	72-6616	4	Screw, SM, #6 x 1.00" Lg
23	75-5520B	2	Bolt, Carriage (¼-20 x 1¼ Lg) Black
24	75-5520N	2	Bolt, Carriage (¼-20 x 1¼ Lg) Nickle
25	72-5520	2	Screw, Machine, Hex Head, ¼-20
26	75-015S	9	Washer, Flat (¼)
27	75-045	9	Washer, Lock (¼)
28	75-915S	7	Nut, Machine, Hexagon ¼-20
29	75-935	2	Nut, Wing, ¼-20
30	75-5120B	8	Bolt, Carriage, 10-24 x 1¼ Lg, Black
31	75-010S	8	Washer, Flat, #10
32	75-040	8	Washer, Split-Lock, #10
33	75-911S	8	Nut, Hex, 10-24
34	72-6608	2	Screw, SM, #6 x ½" Lg
35	72-6820	5	Screw, SM, #8 x 1¼" Lg
36	005166-01	1	Numeral Card
37	005228-01	1	Instruction Panel
38	000527	2	Extrusion, Rubber
39	005213-01	2	Corrugated Tray
40	005213-02	1	Sleeve

Item	Part Number	Qty.	DESCRIPTION
41	005213-03	1	Foam Tray
42	005213-04	1	Left Foam Cap
43	005213-05	1	Right Foam Cap



NOTES:

1. A003218-01 ; DOMESTIC OUTLAW, A003218-02 ; INTERNATIONAL OUTLAW.
2. ITEM 36 ; NUMERAL CARD, SHOULD BE PLACED IN PLASTIC BAG AND SHIPPED INSIDE COIN BOX.

REVISIONS				
LTR	SYM	DESCRIPTION	DATE	APPROVED
	A	PRODUCTION REL	2-23	

OUTSTANDING ECNs

NOTES UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
ANGLES ± 1°
SURFACE FINISH

DO NOT SCALE DRAWING

DRAWN BY DATE 2-23-76
CHECKED
ENGINEER
PROJECT ENGINEER
MANUFACTURER

MATERIAL SEE P/L A003218-01 OR A003218-02
FINISH

NEXT ASSY OUTLAW
APPLICATION

ATARI INCORPORATED
14600 Winchester Boulevard
Los Gatos California 95030

TITLE
TOP ASSEMBLY
OUTLAW

SIZE D | DRAWING NO A003218-XX | REV A
SCALE | SHEET 1 OF 1

A003218-XX
SHEET 1/1
REV A

OUTLAW

ATARI™ Innovative leisure

ASSEMBLY TITLE / ASSEMBLY, CONTROL PANEL **P/L** A003241

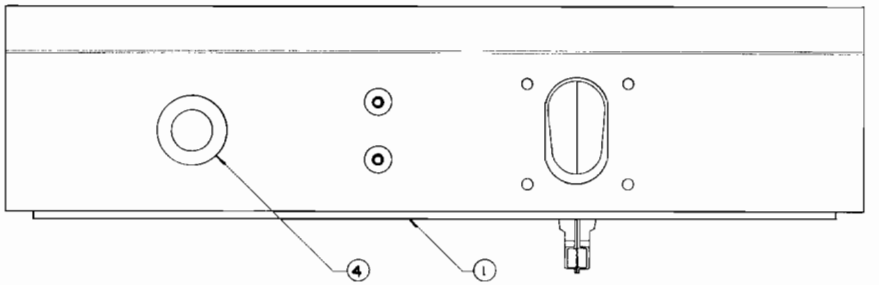
PARTS LIST SPECIFICATION Page 1 of 1

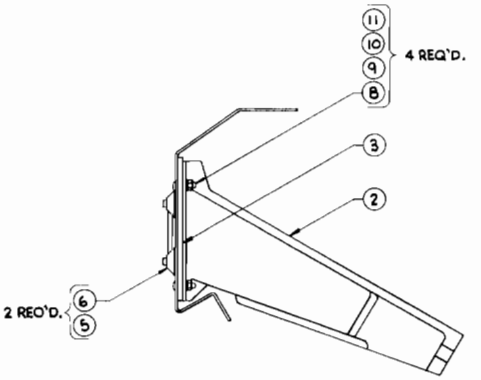
Drawn		
Checked	Mech. Eng.	
Proj. Eng.	Elec. Eng	REV. A

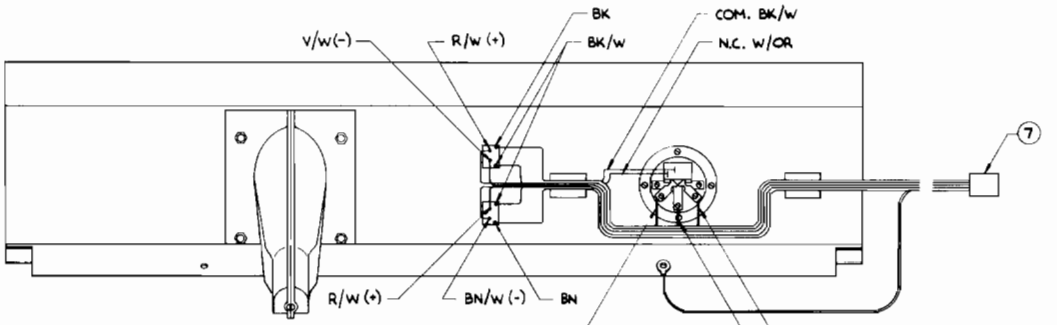
Rev.	Description	Date	Apprv.	Rev.	Description	Date	Apprv.
A		2-2-76					

Item	Part Number	Qty.	DESCRIPTION
1	003231	1	Panel, Cover
2	A005141	1	Assembly, Holster
3	005137	1	Plate, Holster
4	A003094-11	1	Switch Double Light
5	62-002C	2	Switch, Push Button, Led
6	001856	2	Bushing, Switch
7	A003246-01	1	Control Panel Harness Assembly
8	75-5112N	4	Bolt, Carriage 10-24 x 3/4 Lg.
9	75-010S	4	Washer, Flat, #10
10	75-040	4	Washer, Split-Lock, #10
11	75-911S	4	Nut, Hex #10-24

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE / APPROVED
	A	PRODUCTION REL	2-23







BACK VIEW

OUTSTANDING ECNs	

NOTES: UNLESS OTHERWISE SPECIFIED

A003218	OUTLAW
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON
ANGLES ±1° .XX ± .03 .XXX ± .010
SURFACE FINISH

DO NOT SCALE DRAWING

MATERIAL: SEE P/L A003241

FINISH

DRAWN BY: DATE: 2-23-76

CHECKED: Bruce K Lyon

ENGINEER

PROJECT ENGINEER

MFG. ENGINEER

ATARI INCORPORATED
14600 Winchester Boulevard
Los Gatos, California 95030

TITLE: ASSEMBLY, CONTROL PANEL

SIZE: D | DRAWING NO: A003241 | REV: A

SCALE | SHEET 1 OF 1

A003241 1/1 A

OUTLAW

ATARI
Innovative leisure

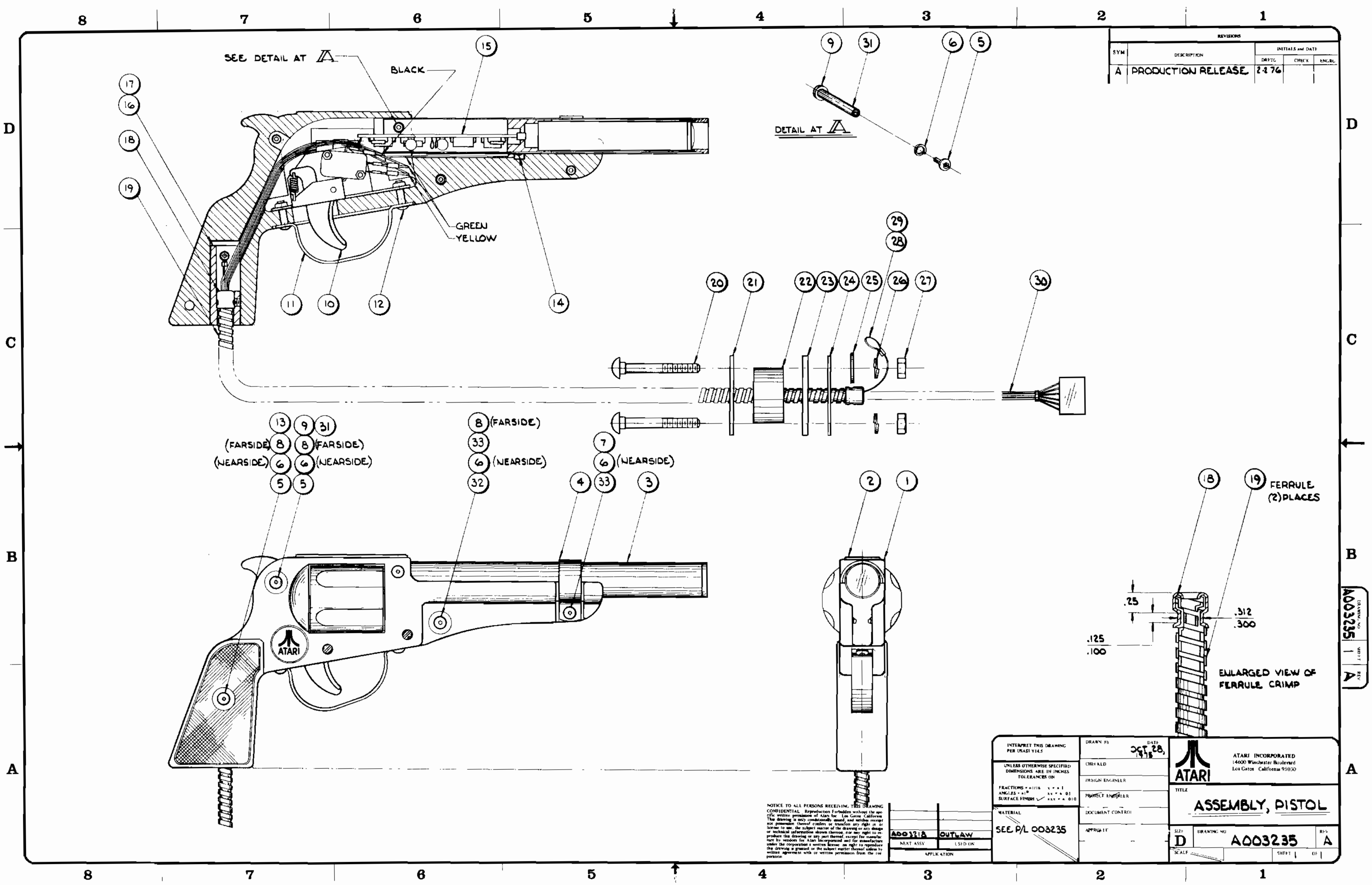
ASSEMBLY TITLE / ASSEMBLY, PISTOL	P/L 003235

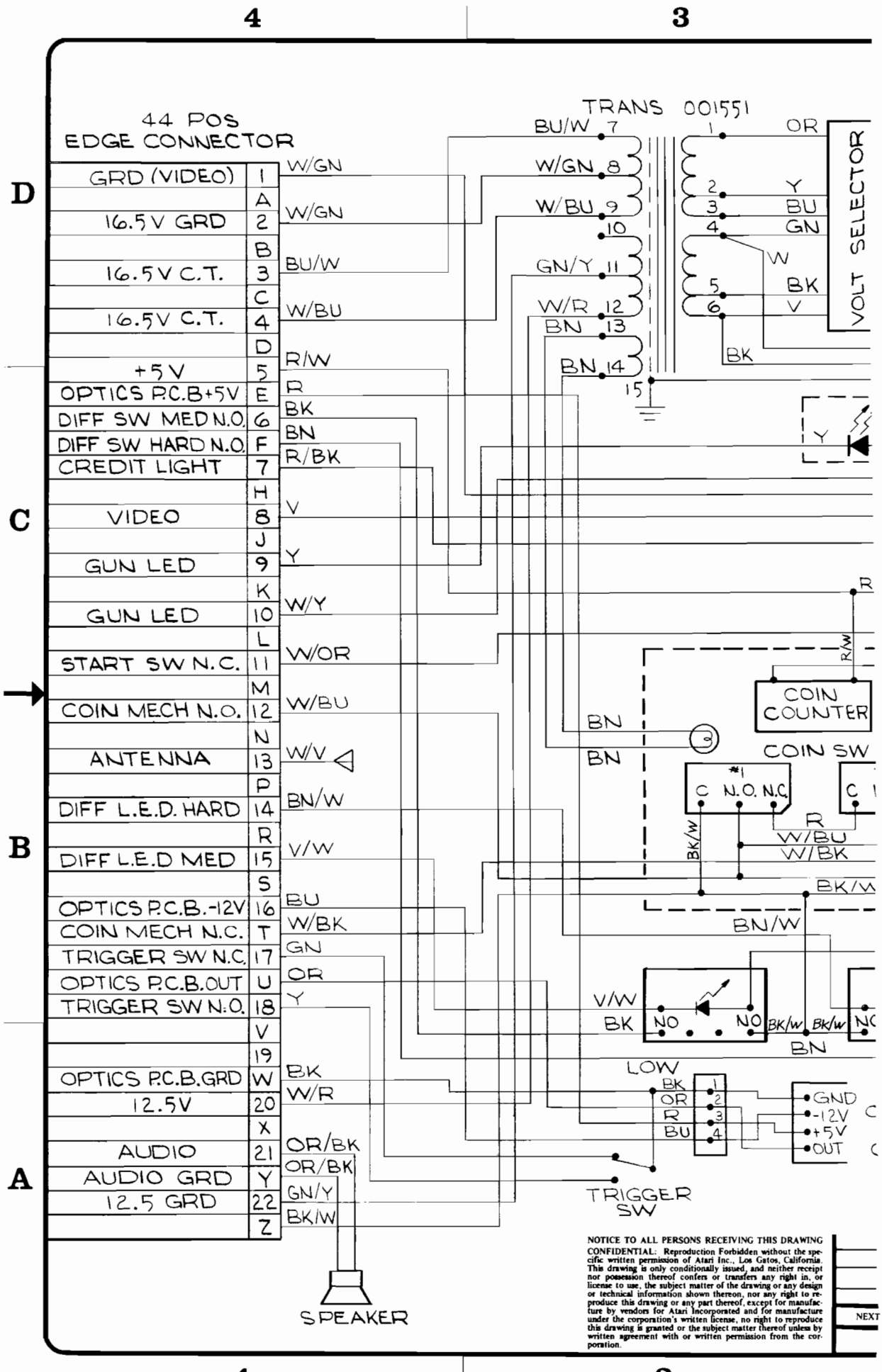
PARTS LIST SPECIFICATION — Page 1 of 1

Drawn Alan Green 5-6-75		
Checked 6/25/75	Mech. Eng.	
Proj. Eng.	Elec. Eng	REV. A
OUTLAW		

Rev.	Description	Date	Apprv.	Rev.	Description	Date	Apprv.
A	PROD REL	2/3/76					

Item.	Part Number	Qty.	DESCRIPTION
1	003236-01	1	Frame, Pistol (Left)
2	003236-02	1	Frame, Pistol (Right)
3	003237	1	Barrel, Pistol
4	003238	1	Strap, Pistol Barrel
5	82-8806	3	Screw, Button Hd (#8-32 x 3/8)
6	75-040	5	Washer, Lock, #10
7	82-303	1	Post (3/8 Lg)
8	75-020S	3	Washer, Flat, Narrow Pattern (#10)
9	82-306	2	Post (3/4 Lg)
10	A001850	1	Assembly, Trigger
11	001848	1	Guard, Trigger
12	82-8810	2	Screw, Button Hd (#8-32 x 5/8 Lg)
13	82-305	1	Post, 1"
14	72-1403S	1	Screw, Pan Hd (#4-40 x 3/16 Lg) Mach Scr
15	A005144	1	Assembly, Optics
16	001853	1	Adapter, Cable
17	75-4103	2	Screw, Set, Cup Point, Allen, Stl (#10-24 x 3/16 Lg)
18	82-701	2	Ferrule
19	78-2000109L	30"	Cable, Stripwound
20	75-5524N	4	Bolt, Stl Carriage (¼-20 x 1½ Lg)
21	001939	1	Plate, Cable
22	001941	1	Cable, Support
23	001942	1	Mount, Shock
24	001940	1	Clamp, Cable
25	75-025S	1	Washer, Flat (¼)
26	75-045	4	Washer, Lock (¼)
27	75-915S	4	Nut, Hex (¼-20)
28	59-002	33"	Cable, Aircraft, unlooped, 500 lbs Test
29	78-23111	2	Sleeve, Air Cord
30	003239	1	Assembly, Pistol Harness
31	78-28008	1	Tubing, Heat Shrink (3/4"Lg)
32	82-307	1	Post (¼ Lg)
33	82-8804	2	Screw, Button Hd (#8-32 x ¼ Lg)


REVISIONS
SYM | DESCRIPTION | INITIALS and DATE: DRFTG. CHECK ENGRG.
A | PRODUCTION RELEASE | 2-2-76
SEE DETAIL AT A
BLACK
GREEN
YELLOW
DETAIL AT A
(FARSIDE)
(NEARSIDE)
FERRULE (2) PLACES
.25
.312
.300
.125
.100
ENLARGED VIEW OF FERRULE CRIMP
ATARI
ATARI INCORPORATED
14600 Winchester Boulevard
Los Gatos California 95030
TITLE
ASSEMBLY, PISTOL
SIZE D
DRAWING NO A003235
REV A
SHEET 1
DRAWN BY
DATE OCT 28, 1975
MATERIAL
SEE P/L 003235
A003218
OUTLAW
NEXT ASSY
USED ON
APPLICATION
DRAWING NO A003235 SHEET 1 REV A


4
3
44 POS
EDGE CONNECTOR
GRD (VIDEO) 1
A
16.5 V GRD 2
B
16.5 V C.T. 3
C
16.5 V C.T. 4
D
+5 V 5
OPTICS P.C.B+5V E
DIFF SW MED N.O. 6
DIFF SW HARD N.O. F
CREDIT LIGHT 7
H
VIDEO 8
J
GUN LED 9
K
GUN LED 10
L
START SW N.C. 11
M
COIN MECH N.O. 12
N
ANTENNA 13
P
DIFF L.E.D. HARD 14
R
DIFF L.E.D MED 15
S
OPTICS P.C.B.-12V 16
COIN MECH N.C. T
TRIGGER SW N.C. 17
OPTICS P.C.B.OUT U
TRIGGER SW N.O. 18
V
19
OPTICS P.C.B.GRD W
12.5V 20
X
AUDIO 21
AUDIO GRD Y
12.5 GRD 22
Z
W/GN
W/GN
BU/W
W/BU
R/W
R
BK
BN
R/BK
V
Y
W/Y
W/OR
W/BU
W/V
BN/W
V/W
BU
W/BK
GN
OR
Y
BK
W/R
OR/BK
OR/BK
GN/Y
BK/W
SPEAKER
TRANS 001551
BU/W 7
W/GN 8
W/BU 9
10
GN/Y 11
W/R 12
BN 13
BN 14
15
1 OR
2 Y
3 BU
4 GN
W
5 BK
6 V
BK
VOLT SELECTOR
Y
R
R/W
COIN COUNTER
BN
BN
COIN SW
*1
C N.O. N.C.
C
R
W/BU
W/BK
BK/W
BK/W
BN/W
V/W
BK
NO
NO
BK/w
BK/w
BN
LOW
BK 1
OR 2
R 3
BU 4
GND
-12V
+5V
OUT
TRIGGER SW
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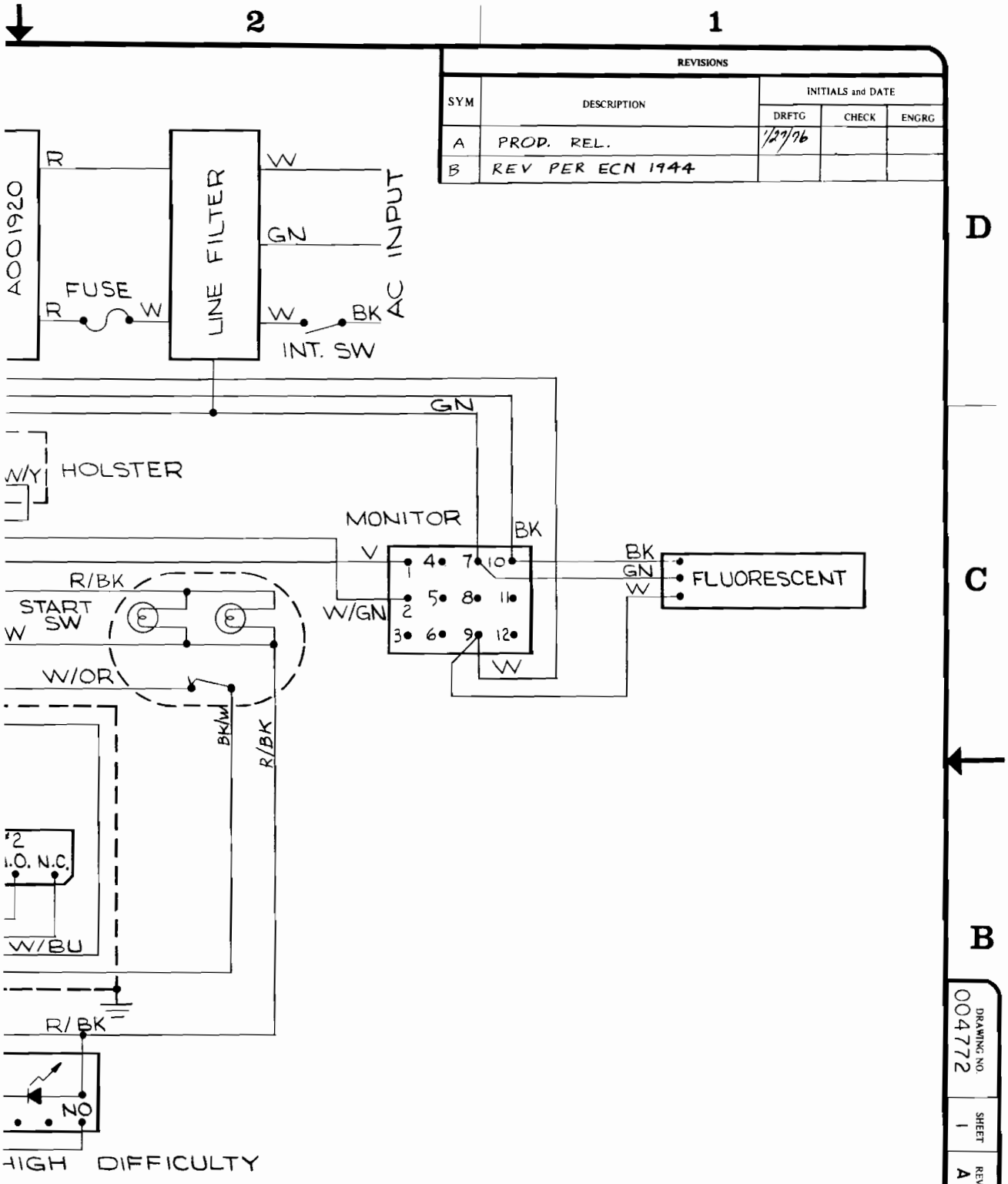
NEXT
4
3


2
1
REVISIONS
SYM
DESCRIPTION
INITIALS and DATE
DRFTG
CHECK
ENGRG
A
PROD. REL.
1/29/76
B
REV PER ECN 1944
D
C
B
A
A001920
R
FUSE
W
LINE FILTER
W
GN
W
BK
AC INPUT
INT. SW
GN
W/Y
HOLSTER
MONITOR
V
BK
R/BK
START SW
W
W/GN
W/OR
BK/W
R/BK
4
7
10
5
8
11
2
3
6
9
12
W
BK
GN
W
FLUORESCENT
N.O. N.C.
W/BU
R/BK
NO
HIGH DIFFICULTY
PTICS PC. B
ASSY
IRCUIT SIDE
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
MATERIAL:
ASSY
USED ON
APPLICATION
DRAWN BY
DATE
1-15-76
CHECKED
DESIGN ENGINEER
PROJECT ENGINEER
DOCUMENT CONTROL
APPROVED
ATARI
ATARI INCORPORATED
14600 Winchester Boulevard
Los Gatos, California 95030
TITLE
OUTLAW
HARNESS SCHEMATIC
SIZE
C
DRAWING NO.
003244
REV
A
SCALE
SHEET 1 OF 1
DRAWING NO.
004772
SHEET
1
REV
A

OUTLAW

ATARI™
Innovative leisure

ASSEMBLY TITLE / ASSEMBLY, ELECTRONICS TRAY **P/L** 003240

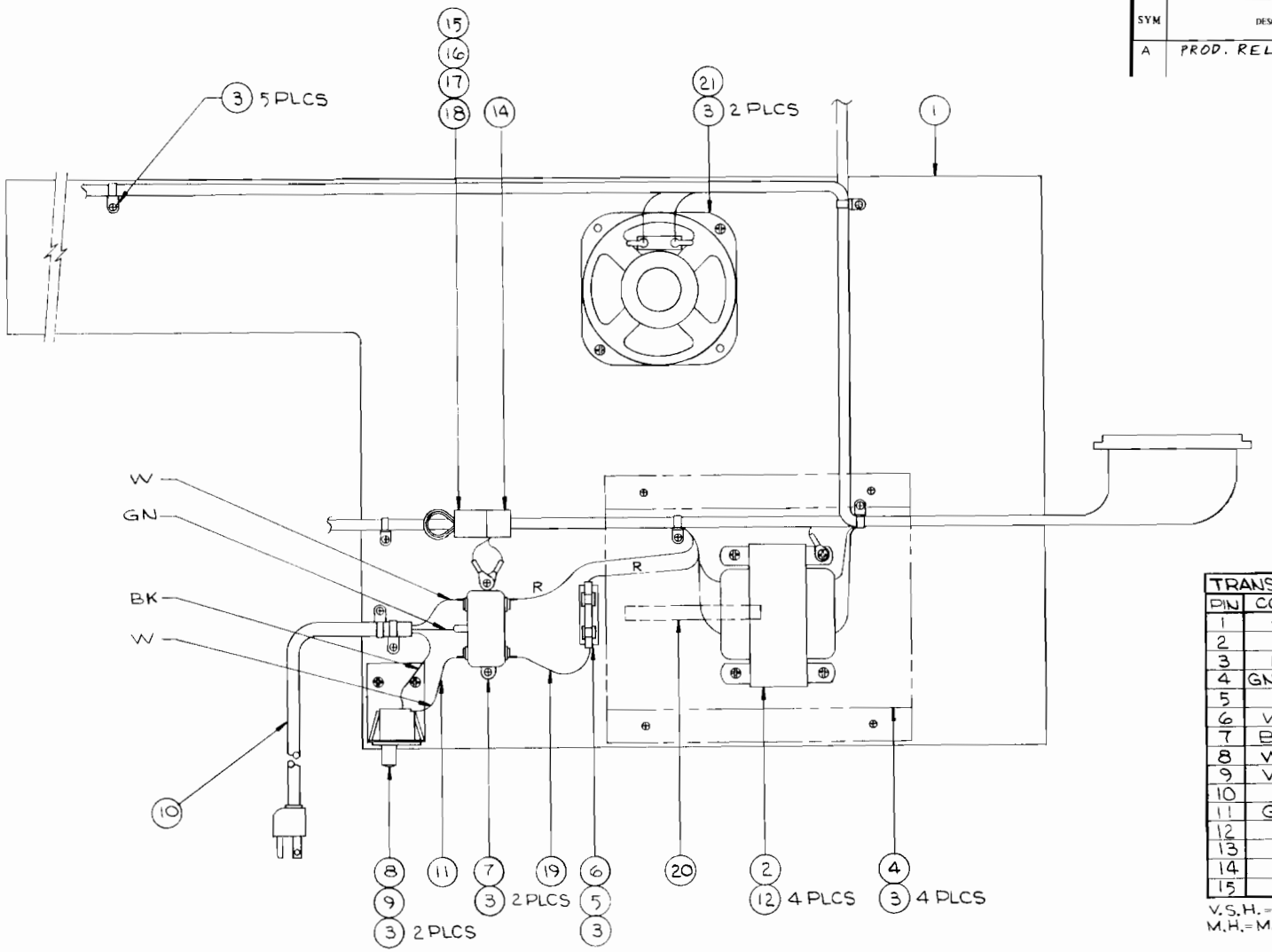
PARTS LIST SPECIFICATION Page 1 of 1

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

Rev.	Description	Date	Apprv.	Rev.	Description	Date	Apprv.
A	[illegible]	[illegible]					

Item	Part Number	Qty.	DESCRIPTION
1	003230	1	Tray, Electronics
2	001551	1	Transformer
3	72-6608		Screw, Sht. Metal, Pan Hd., Phil., #6 x ½ Lg.
4	000622	1	Cover, Transformer
5	79-3201	1	Fuse Holder
6	46-201201	1	Fuse, 2 Amp, Slo Blo
7	41-2001	1	Filter, Power Line
8	68-001	1	A.C. Power Interlock Switch
9	000268	1	Bracket, Switch Mtg.
10	A004244	1	Power Cord 8' Assembly
11	A002808-03	1	Interlock Switch Jumper
12	72-6812	4	Screw, SM, Pan Hd., Phil., #8 - 3/4 Lg.
13	A003245	1	Harness
14	A001920	1	Harness, Voltage Selection
15	A001921-01	A/R	Shorting Block, 95V
16	A001921-02	"	Shorting Block, 110V
17	A001921-03	"	Shorting Block, 220V H
18	A001921-04	"	Shorting Block, 220V L
19	A003100-04	1	Fuse Jumper Harness
20	000871	1	Label
21	48-002	1	Speaker, 4"

REVISIONS				
SYM	DESCRIPTION	INITIALS and DATE		
		DRFTG	CHECK	ENGRG
A	PROD. REL.	1/29/76		



TRANSFORMER WIRING		
PIN	COLOR	SOURCE
1	OR	V.S.H.
2	Y	V.S.H.
3	BU	V.S.H.
4	GN & WHT	V.S.H. & M.H.
5	BK	V.S.H.
6	V & BK	V.S.H. & M.H.
7	BU/W	M.H.
8	W/GN	M.H.
9	W/BU	M.H.
10	N/A	—
11	GN/Y	M.H.
12	W/R	M.H.
13	BN	M.H.
14	BN	M.H.
15	GN	M.H.

V.S.H. = VOLTAGE SELECTION HARNESS
M.H. = MAIN HARNESS

DRAWING NO A003240 | SHEET 1 | REV

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

MATERIAL: SEE P/L 003240

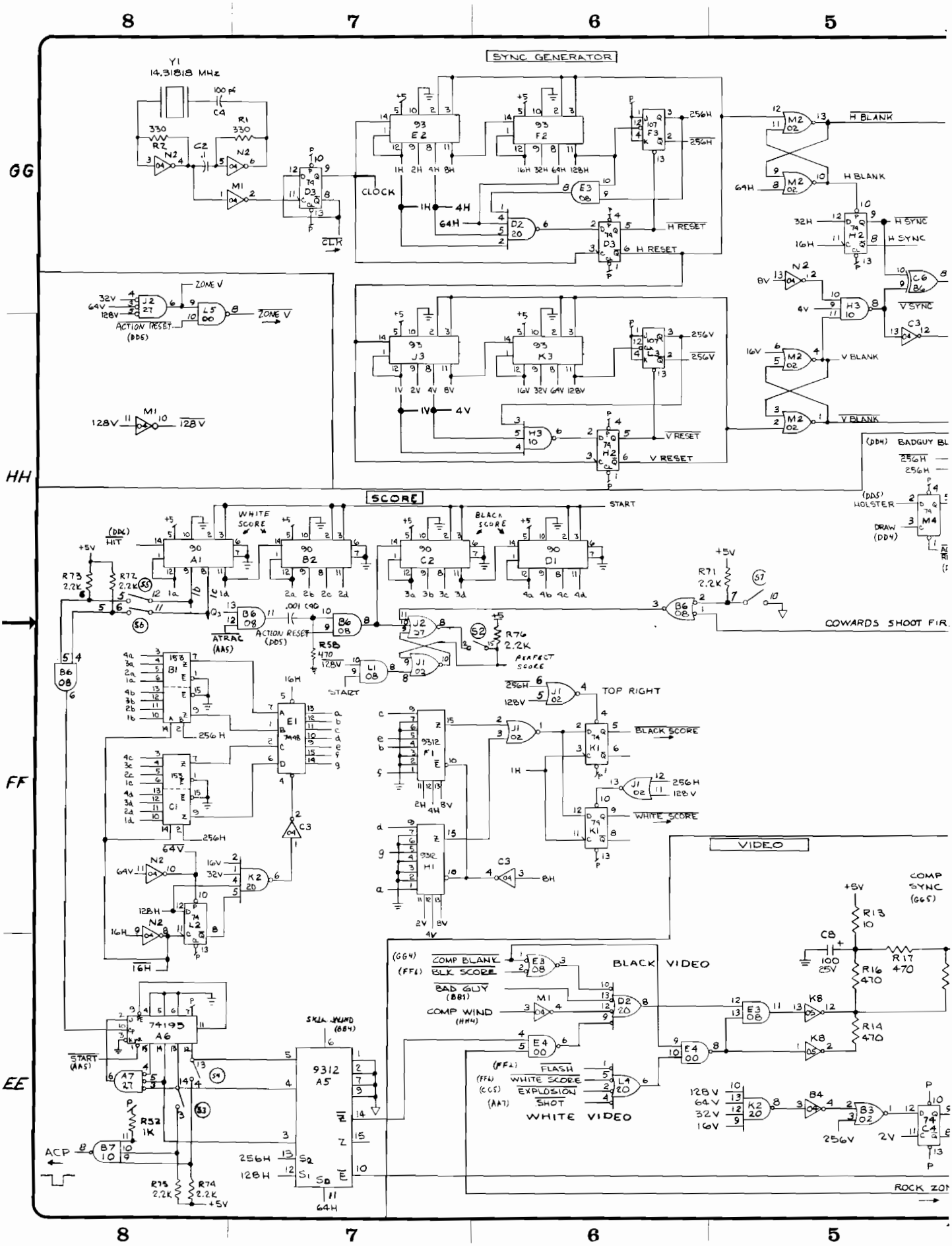
NEXT ASSY | USED ON
APPLICATION

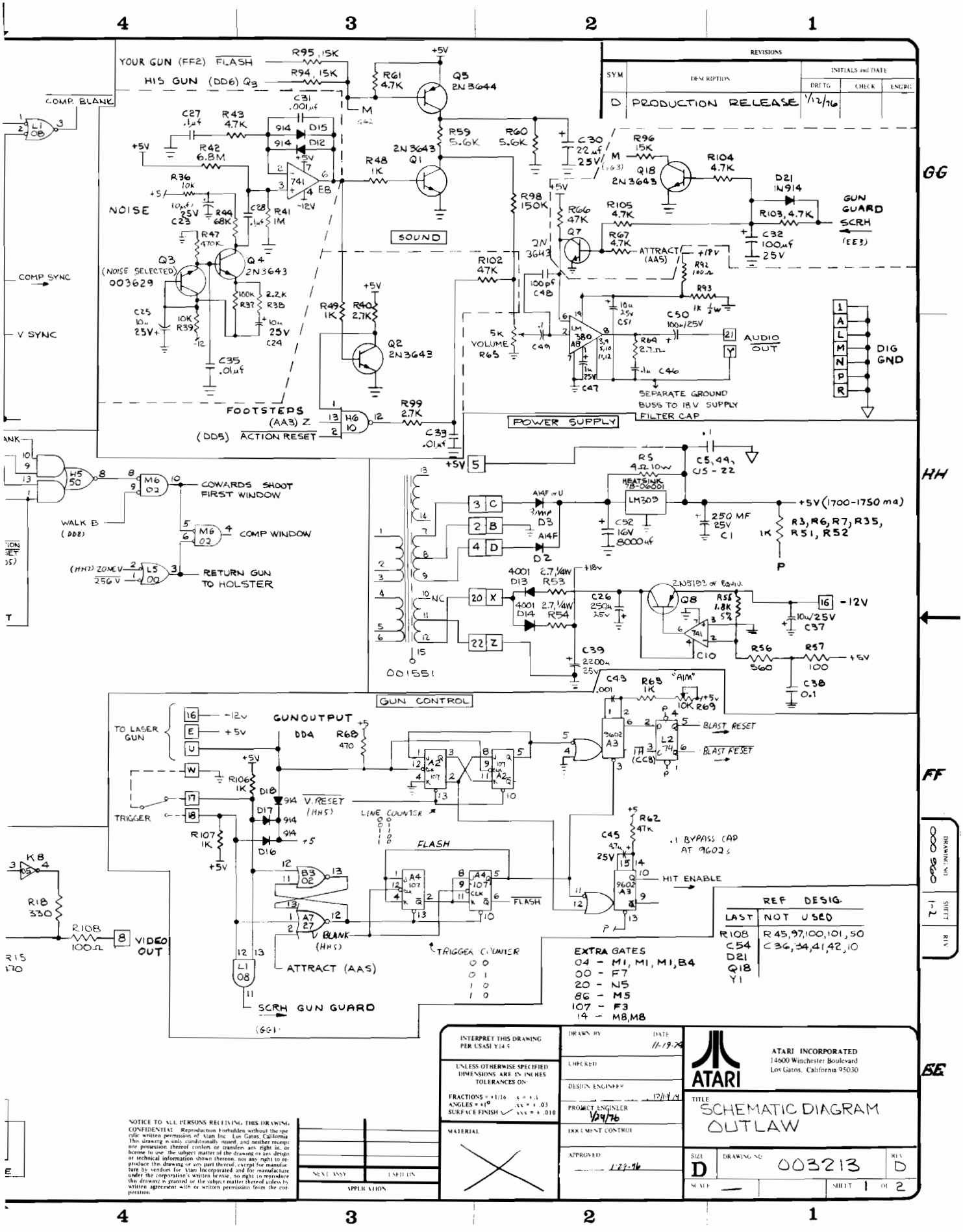
DRAWN BY — DATE 1-19-76
CHECKED
DESIGN ENGINEER
PROJECT ENGINEER
DOCUMENT CONTROL
APPROVED

ATARI INCORPORATED
14600 Winchester Boulevard
Los Gatos, California 95030

TITLE: OUTLAW ELECTRONICS TRAY ASSEMBLY

SIZE C | DRAWING NO A003240 | REV A
SCALE | SHEET | OF


8
7
6
5
GG
HH
FF
EE
SYNC GENERATOR
Y1
14.31818 MHz
CLOCK
H RESET
V RESET
H BLANK
V BLANK
H SYNC
V SYNC
ZONE V
ACTION RESET
(DD5)
128V
SCORE
WHITE SCORE
BLACK SCORE
START
ATRAC
(AA5)
ACTION RESET
(DD5)
PERFECT SCORE
COWARDS SHOOT FIR
TOP RIGHT
BLACK SCORE
WHITE SCORE
256H
128H
64H
16H
VIDEO
COMP BLANK
BLK SCORE
BAD GUY
(BB1)
COMP WIND
(HH4)
BLACK VIDEO
FLASH
WHITE SCORE
EXPLOSION
SHOT
WHITE VIDEO
COMP SYNC
(GG5)
ACP
ROCK ZON


REVISIONS
SYM | DESCRIPTION | INITIALS and DATE | DRFTG | CHECK | ENGRG
D | PRODUCTION RELEASE | 1/12/76
YOUR GUN (FF2) FLASH
HIS GUN (DD6) Q3
R95, 15K
R94, 15K
R61 4.7K
Q5 2N3644
C31 .001µf
C27 .1µf
R43 4.7K
D15
D12
R42 6.8M
R36 10K
NOISE
C23 10µf 25V
R40 68K
C28 .1µf
R41 1M
741
R47 470K
Q3 (NOISE SELECTED) 003629
Q4 2N3643
100K R37
2.2K R38
C25 10µ 25V
10K R39
C29 10µ 25V
C35 .01µf
COMP BLANK
COMP SYNC
V SYNC
SOUND
R59 5.6K
R60 5.6K
C30 22µf 25V
2N3643 Q1
R48 1K
R98 150K
R96 15K
Q18 2N3643
R104 4.7K
D21 1N914
R103, 4.7K
GUN GUARD SCRN (EE3)
C32 100µf 25V
R66 47K
Q7 2N3643
R105 4.7K
R67 4.7K
ATTRACT (AA5)
+18V
R92 100Ω
R93 1K 1/2W
R102 47K
100pf C48
R49 1K
R40 2.7K
Q2 2N3643
5K VOLUME R65
C49 .1
LM 380 A8
C50 100µ/25V
R69 2.7Ω
C46 .1µ
C47 25V
AUDIO OUT
SEPARATE GROUND BUSS TO 18V SUPPLY FILTER CAP
DIG GND
FOOTSTEPS (AA3) Z
(DD5) ACTION RESET
H6 10
R99 2.7K
C39 .01µf
POWER SUPPLY
COWARDS SHOOT FIRST WINDOW
WALK B (DD8)
M6 02
COMP WINDOW
(HH7) ZOMEV 256V
L5 00
RETURN GUN TO HOLSTER
W5 50
R5 4.2Ω 10W
HEATSINK 78-06001
C5,44, C15 - 22
LM309
C52 16V 8000µf
250 MF 25V C1
+5V (1700-1750 ma)
R3, R6, R7, R35, R51, R52
D3 3AMP AI4F
D2 AI4F or U
4001 D13
4001 D14
2.7, 1/4W R53
2.7, 1/4W R54
C26 250µ 25V
2N5183 or Equiv.
Q8
R55 1.8K 5%
C10
C37 10µ/25V
R56 560
R57 100
C38 0.1
C39 2200µ 25V
C43 .001
R68 1K
"AIM" R69 10K
00155!
GUN CONTROL
TO LASER GUN
GUNOUTPUT DD4
R68 470
BLAST RESET
TRIGGER
R106 1K
D18
D17
D16
V. RESET (HH5)
LINE COUNTER
R107 1K
FLASH
R62 47K
C45 47µ 25V
.1 BYPASS CAP AT 9602's
HIT ENABLE
K8
R18 330
R108 100Ω
VIDEO OUT
BLANK (HH5)
TRIGGER COUNTER
ATTRACT (AAS)
SCRN GUN GUARD (GG1)
EXTRA GATES
04 - M1, M1, M1, B4
00 - F7
20 - N5
86 - M5
107 - F3
14 - M8, M8
REF DESIG.
LAST NOT USED
R108 | R45, 97, 100, 101, 50
C54 | C36, 34, 41, 42, 10
D21
Q18
Y1
DRAWING NO 003213
SHEET 1-2
REV
INTERPRET THIS DRAWING PER USASI Y14.5
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
FRACTIONS ± 1/16 XX ± .03
ANGLES ± 1° XXX ± .010
SURFACE FINISH
MATERIAL
NEXT ASSY
USED ON
APPLICATION
DRAWN BY
DATE 11-19-74
CHECKED
DESIGN ENGINEER 12/19/74
PROJECT ENGINEER 1/29/76
DOCUMENT CONTROL
APPROVED 1-29-76
ATARI INCORPORATED
14600 Winchester Boulevard
Los Gatos, California 95030
TITLE SCHEMATIC DIAGRAM OUTLAW
SIZE D
DRAWING NO 003213
REV D
SCALE —
SHEET 1 OF 2
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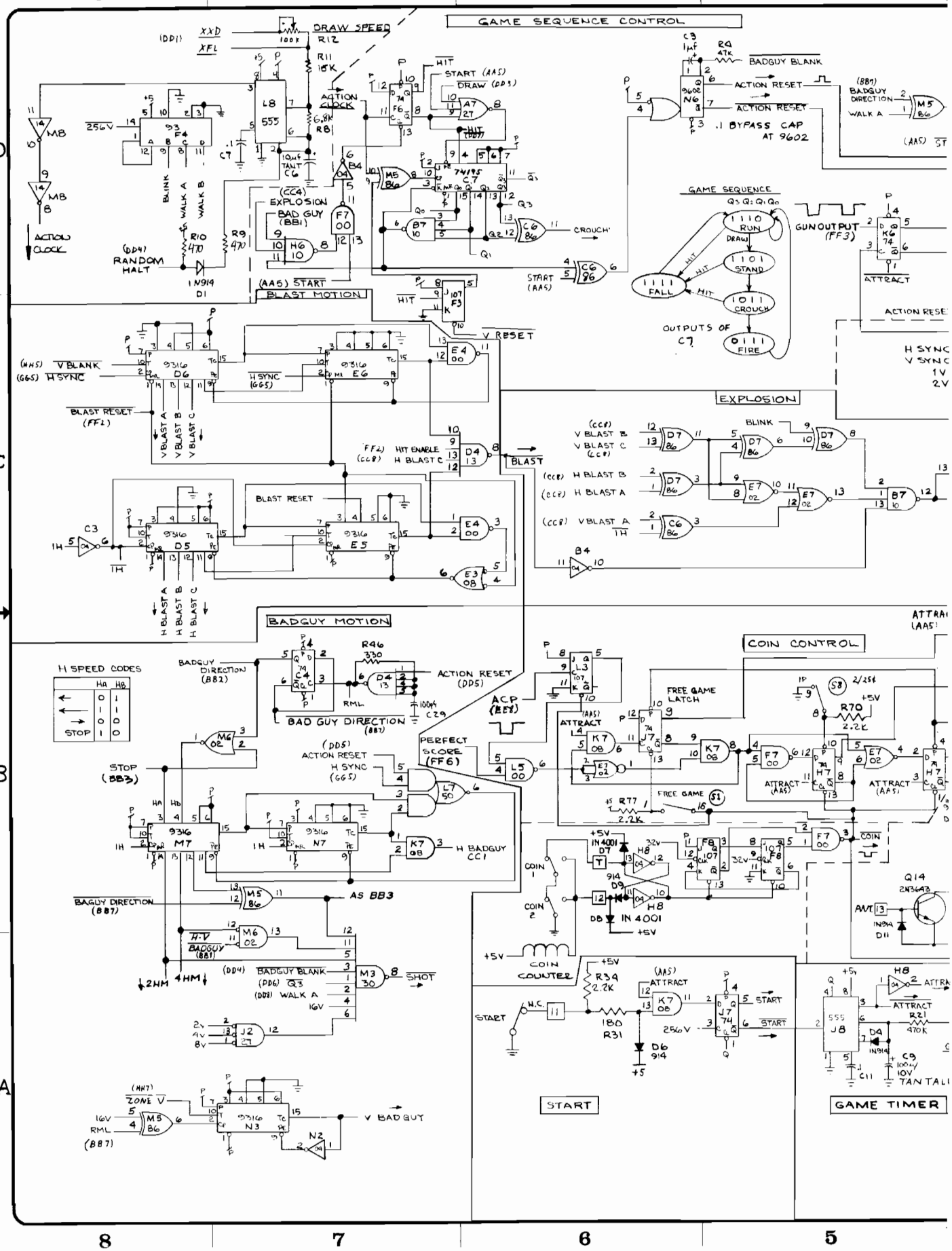
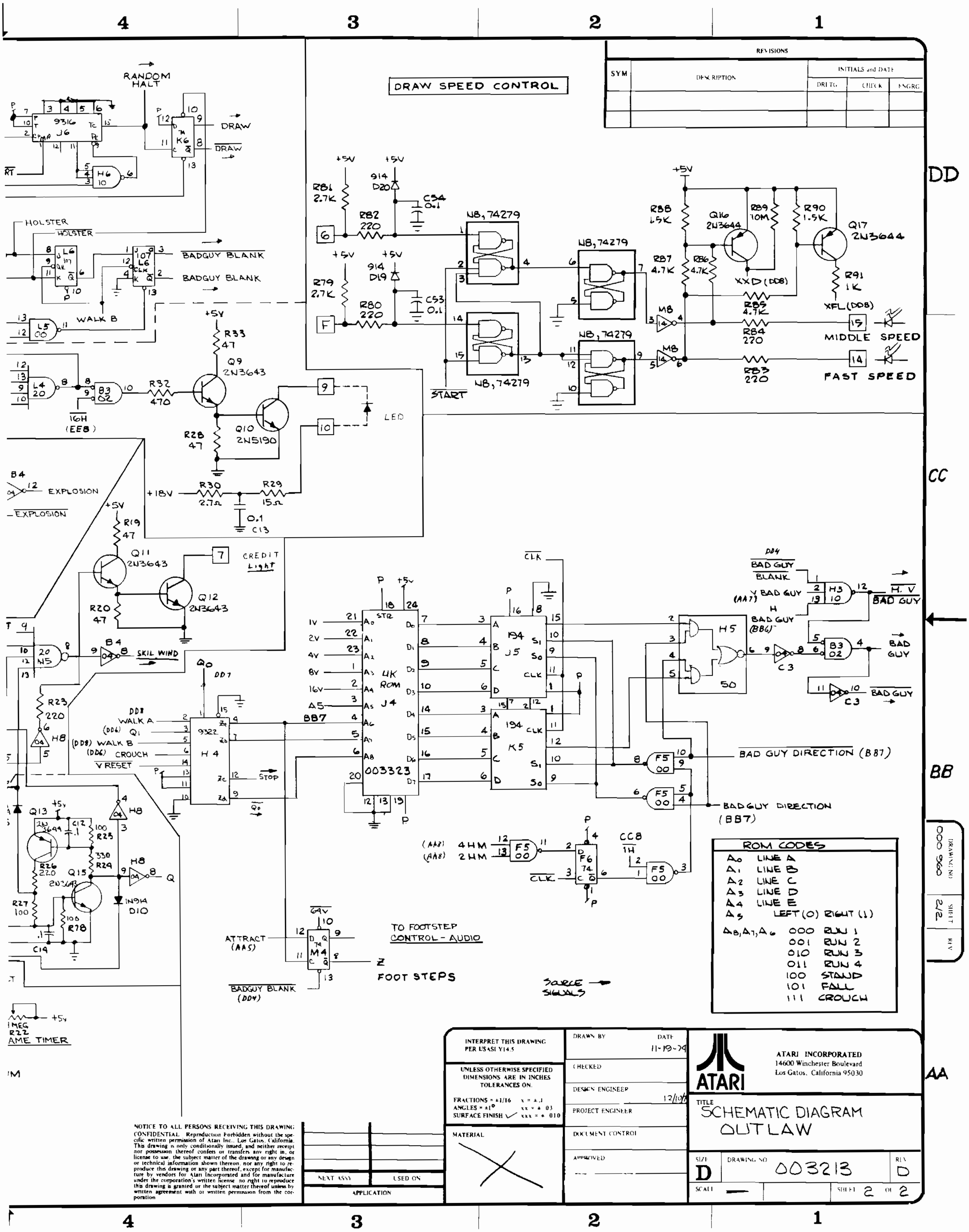

8
7
6
5
DD
CC
BB
AA
GAME SEQUENCE CONTROL
DRAW SPEED
R12
100K
R11
15K
R8
6.8K
ACTION CLOCK
C7
.1
10uF TANT C6
256V
BLINK
WALK A
WALK B
R10
470
R9
470
1N914
D1
RANDOM HALT
(DD4)
ACTION CLOCK
MB
(CC4) EXPLOSION
BAD GUY (BB1)
F7 00
H6 10
(AA5) START
BLAST MOTION
HIT
START (AA5)
DRAW (DD3)
A7 27
B7 10
74195 C7
Q3
Q2
Q1
Q0
C6 86
CROUCH
START (AA5)
BADGUY BLANK
ACTION RESET
ACTION RESET
.1 BYPASS CAP AT 9602
C3 1mF
R9 47K
9602 N6
(BB7) BADGUY DIRECTION
WALK A
M5 86
GAME SEQUENCE
Q3 Q2 Q1 Q0
1110 RUN
DRAW
1101 STAND
1111 FALL
1011 CROUCH
0111 FIRE
HIT
OUTPUTS OF C7
GUN OUTPUT (FF3)
K6 74
ATTRACT
H SYNC
V SYNC
1V
2V
V RESET
(HNS) VBLANK
(GGS) HSYNC
93L16 D6
93L16 E6
BLAST RESET (FF2)
V BLAST A
V BLAST B
V BLAST C
EXPLOSION
(CC8) V BLAST B
V BLAST C
(CC8) H BLAST B
(CC8) H BLAST A
(CC8) V BLAST A
BLINK
D7 86
E7 02
B7 10
C6 86
(FF2) HIT ENABLE
(CC8) H BLAST C
D4 13
E4 00
BLAST
B4 04
C3
1H
93L16 D5
93L16 E5
E3 08
H BLAST A
H BLAST B
H BLAST C
BADGUY MOTION
H SPEED CODES
HA HB
STOP 1 0
BADGUY DIRECTION (BB2)
R46 330
C4 74
D4 13
ACTION RESET (DD5)
RML
BAD GUY DIRECTION (BB7)
C29 100pF
STOP (BB3)
M6 02
PERFECT SCORE (FF6)
L7 50
L5 00
ACP (EE8)
L3 107
COIN CONTROL
FREE GAME LATCH
ATTRACT (AA5)
K7 08
J7 74
F7 00
H7
S8 2/25¢
R70 2.2K
+5V
FREE GAME
S1
R77 2.2K
93L16 M7
93L16 N7
1H
HA
HB
K7 08
H BADGUY CC1
AS BB3
BADGUY DIRECTION (BB7)
M5 86
H-V BADGUY (BB1)
M6 02
(DD4) BADGUY BLANK
(DD6) Q3
(DD8) WALK A
M3 30
SHOT
2HM
4HM
16V
2V
4V
8V
J2 27
COIN 1
COIN 2
+5V IN4001 D7
914 D9
DB IN 4001
H8 04
+5V
COIN COUNTER
COIN
Q14 2N3643
ANT
IN914 D11
R34 2.2K
180 R31
D6 914
H.C.
START
(AA5) ATTRACT
K7 08
J7 74
START
256V
555 J8
R21 470K
D4 IN914
C9 100uF 10V TANTALUM
C11
H8 04
ATTRACT
START
GAME TIMER
(HH7) ZONE V
93L16 N3
N2
V BADGUY
(BB7)


DRAW SPEED CONTROL
REVISIONS
SYM
DESCRIPTION
INITIALS and DATE
DRFTG
CHECK
ENGRG
RANDOM HALT
DRAW
HOLSTER
BADGUY BLANK
WALK B
START
MIDDLE SPEED
FAST SPEED
LED
EXPLOSION
CREDIT Light
SKIL WIND
WALK A
CROUCH
V RESET
STOP
BAD GUY DIRECTION (BB7)
BADGUY DIRECTION (BB7)
H. V BAD GUY
BAD GUY
ATTRACT (AA5)
TO FOOTSTEP CONTROL - AUDIO
FOOT STEPS
SOURCE SIGNALS
ROM CODES
A0 LINE A
A1 LINE B
A2 LINE C
A3 LINE D
A4 LINE E
A5 LEFT (0) RIGHT (1)
A8,A7,A6 000 RUN 1
001 RUN 2
010 RUN 3
011 RUN 4
100 STAND
101 FALL
111 CROUCH
4K ROM J4
003323
GAME TIMER
INTERPRET THIS DRAWING PER USASI Y14.5
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON:
FRACTIONS = ±1/16
ANGLES = ±1°
SURFACE FINISH
MATERIAL
DRAWN BY
DATE 11-19-79
CHECKED
DESIGN ENGINEER
PROJECT ENGINEER
DOCUMENT CONTROL
APPROVED
NEXT ASSY
USED ON
APPLICATION
ATARI
ATARI INCORPORATED
14600 Winchester Boulevard
Los Gatos, California 95030
TITLE
SCHEMATIC DIAGRAM
OUTLAW
SIZE D
DRAWING NO 003213
REV D
SHEET 2 OF 2
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ATARI
Innovative leisure

ASSEMBLY TITLE	OUTLAW P.C. BOARD ASSEMBLY	P/L 003213

PARTS LIST SPECIFICATION — Page 1 of 3

Drawn		
Checked	Mech. Eng.	
Proj. Eng.	Elec. Eng 1.20.76	REV. D

Rev.	Description	Date	Apprv.	Rev.	Description	Date	Apprv.
D	Prod. Rel.						

Item	Part Number	Qty.	DESCRIPTION
1	10-5100	1	Resistor, Carbon, 5%, ¼ W, 10 ohm R13
2	10-5101	6	" " " " 100 ohm R25,27,57,78,92,108
3	10-5102	12	" " " " 1K ohm R3,6,7,35,48,49 51,52,63,91,106,107
4	11-5102	1	Resistor, Carbon, 5%, ½ W, 1K ohm R93
5			
6	10-5103	2	Resistor, Carbon, 5%, ¼ W, 10K ohm R36,39
7	10-5104	1	" " " " 100K ohm R37
8	10-5105	1	" " " " 1Meg ohm R41
9	10-5152	2	" " " " 1.5K ohm R88, R90
10	10-5150	1	" " " " 15 ohm R29
11	10-5153	4	" " " " 15K ohm R94,95,96, 11
12	10-5181	1	" " " " 180 ohm R31
13	10-5182	1	" " " " 1.8K ohm R55
14	10-5221	6	" " " " 220 ohm R23,26,80,82,83,84
15	10-5222	10	" " " " 2.2K ohm R34,38,70,71,72, 73,74,75,76,77
16	10-52P7	4	" " " " 2.7 ohm R30,53,54,64
17	10-5272	4	" " " " 2.7K ohm R40,79,81,99
18	10-5331	5	" " " " 330 ohm R1,2,18,24,46
19	10-5562	2	" " " " 5.6K ohm R59,60
20	10-5470	4	" " " " 47 ohm R19,20,28,33
21	10-5471	9	" " " " 470 ohm R9,10,14,15,16,17, 32,58,68,
22	10-5472	9	" " " " 4.7K ohm R43,61,67,85,86, 87,103,104,105
23	10-5473	4	" " " " 47K ohm R4,62,66,102
24	10-5474	2	" " " " 470K ohm R21,47
25	10-5661	1	" " " " 560 ohm R56
26	10-5682	1	" " " " 6.8K ohm R8
27	10-5683	1	" " " " 68K ohm R44
28	10-5685	1	" " " " 6.8M ohm R42
29	19-808W4PO	1	Resistor, Wirewound, 10 W, 4 ohm R5
30	19-315502	1	Trimpot, 5K R65
31	19-315103	1	Trimpot, 10K R69
32	24-250105	2	Capacitor, Electrolytic, 1 uf, 25V C3,47
33	24-250475	1	" " 4.7 uf, 25V C45
34	24-250106	5	" " 10 uf, 25V C 23,24,25,37, 51
35	29-046	1	Capacitor, Tantalum, 10 uf, 20V C6
36	24-250107	3	Capacitor, Electrolytic, 100 uf, 25V C8,32,50

*

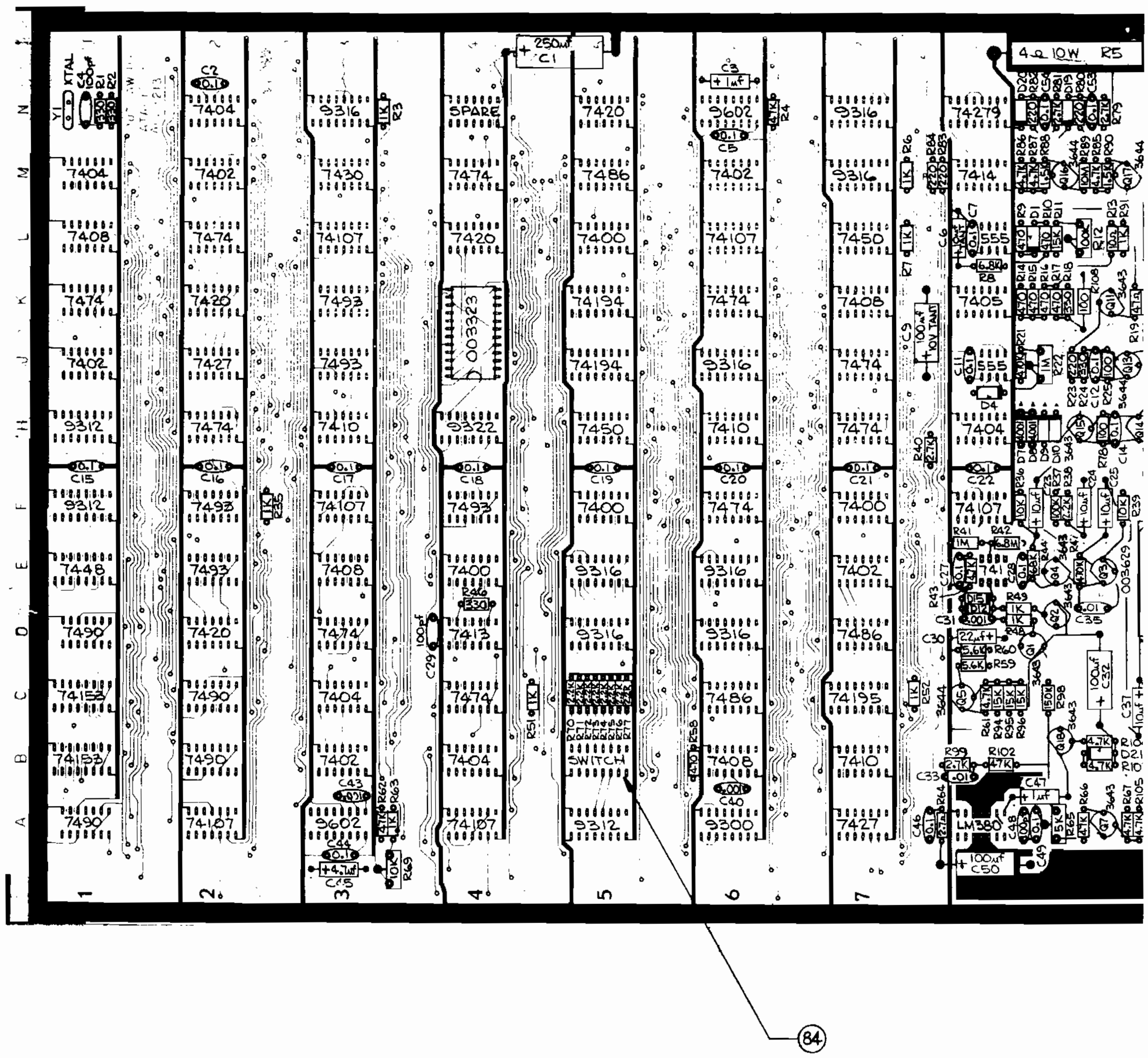
Item	Part Number	Qty.	DESCRIPTION
37	24-250257	2	Capacitor, Electrolytic, 250 uf, 25V C1,C26
38	24-250228	1	" " 2200uf, 25V C39
39	24-160808	1	" " 8000uf, 16V C52
40	27-120104	22	Capacitor, Ceramic Bypass, .1 uf, 12V C2,5,7,11,12,13, 14,15,16,17,18, 19,20,21,22,27, 28,38,44,49,53,54
41	27-250104	1	Capacitor, Ceramic Bypass, .1 uf, 25V C46
42	27-160103	2	" " Disc, .01 uf, 16V C33,35
43	27-101102	3	" " " .001uf, 100V C31,40,43
44	28-101101	3	Capacitor, Dipped Mica, 100 pf, 100V C4,29,48
45	31-A14F	2	Diode, A14F D2,3
46	31-1N914	15	Diode, 1N914 D1,4,5,6,9,10,11, 12,15,16,17,18, 19,20,21
47	31-1N4001	4	Diode, 1N4001 D7,8,13,14
48	33-2N3644	4	Transistor, 2N3644 Q5,13,16,17
49	33-2N5193	1	Transistor, 2N5193 Q8
50	34-2N3643	10	Transistor, 2N3643 Q1,2, ,4,7,9, 11,12,14,15,18
51	34-2N5190	1	Transistor, 2N5190 Q10
52	37-7400	4	Integrated Circuit, 7400 E4,F5,F7,L5
53	37-7402	5	" " 7402 B3,E7,J1,M2,M6
54	37-7404	5	" " 7404 B4,C3,H8,M1,N2
55	37-7405	1	" " 7405 K8
56	37-7408	4	" " 7408 B6,E3,K7,L1
57	37-7410	3	" " 7410 B7,H3,H6
58	37-7413	1	" " 7413 D4
59	37-7414	1	" " 7414 M8
60	37-7420	4	" " 7420 D2,K2,L4,N5
61	37-7427	2	" " 7427 A7,J2
62	37-7430	1	" " 7430 M3
63	37-7448	1	" " 7448 E1
64	37-7450	2	" " 7450 H5,L7
65	37-7474	10	" " 7474 C4,D3,F6,H2,H7, J7,K1,K6,L2,M4
66	37-7486	3	" " 7486 C6,D7,M5
67	37-7490	4	" " 7490 A1,B2,C2,D1
68	37-7493	5	" " 7493 E2,F2,F4,J3,K3
69	37-74107	6	" " 74107 A2,A4,F3,F8,L3,L6
70	37-74153	2	" " 74153 B1,C1
71	37-74194	2	" " 74194 J5,K5
72	37-74195	1	" " 74195 C7
73	37-74279	1	" " 74279 N8
74	37-9300	1	" " 9300 A6
75	37-9312	3	" " 9312 A5,F1,H1
76	37-9316	8	" " 9316 D5,D6,E5,E6,J6, M7,N3,N7
77	37-9322	1	" " 9322 H4
78	37-9602	2	" " 9602 A3,N6
79	37-555	2	" " 555 J8,L8
80	37-741	2	" " 741 E8, C9
81	37-LM309K	1	" " LM309K
82	37-LM380	1	" " LM380 A8
83	003323	1	ROM 8205 J4

Item	Part Number	Qty.	DESCRIPTION	
84	66-041P1T	1	Switch	B5
85	72-1412C	2	Screw, Mach., Pan Hd., Phil. 6-32 x 5/8"	
86	75-016	2	Washer, Flat, Regular, #6	
87	75-056	2	Washer, LOck, Internal Star, #6	
88	75-916C	2	Nut, Machine, Hex, #6	
89	78-06001	1	Heatsink	
90				
91	90-101	1	Crystal, 14.31818 Mhz	Y1
92	10-5154	1	Resistor, Carbon, 5%, ¼ W, 150K ohm	R98
93	19-315105	1	Trimpot, 1 Meg	R22
94	19-315104	1	Trimpot, 100K	R12
95	29-013	1	Capacitor, Tantalum, 100uf, 10V ±10%	C9
96	003629	1	Transistor, Noise	Q3
97	10-5106	1	Res, Carbon, 5%, ¼ W 10 Meg	R89
98	003214	1	P.C. Board	
99	78-16005	1	Sil-Pad	
100	24-250226	1	Capcitor, Elect. 22µf, 25V	C30

8 7 6 5

D

C

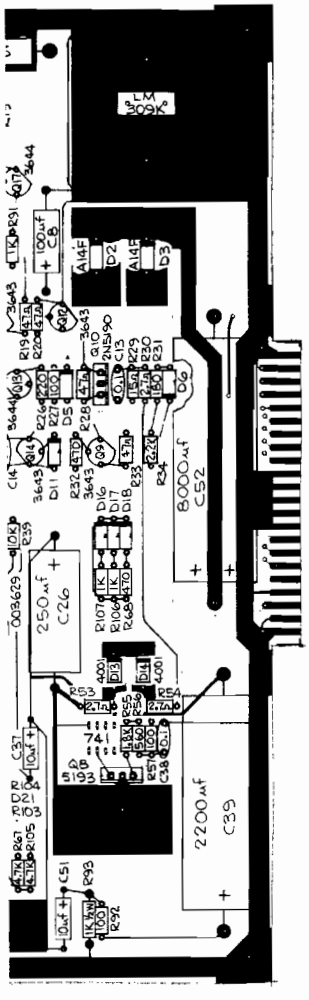


B

A

8 7 6 5

REVISIONS				
SYM	DESCRIPTION	INITIALS and DATE		
		DRFTG	CHECK	ENGRG
D	PRODUCTION RELEASE	1/12/76		



NOTE:
1. ALL UNMARKED DIODES ARE 1N914.

MODIFICATIONS TO 003214 REV D P.C. BOARDS:
1. CUT TRACE TO PIN 14 OF A1 ON COMP. SIDE OF BOARD.
2. JUMPER PIN 14 OF A1 TO PIN 9 OF F3.
3. CUT TRACE TO PIN 19 ON CIRCUIT SIDE OF BOARD.

DRAWING NO. | SHEET | REV

NEXT ASSY	USED ON
	OUTLAW
APPLICATION	

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

MATERIAL
SEE
P/L003213

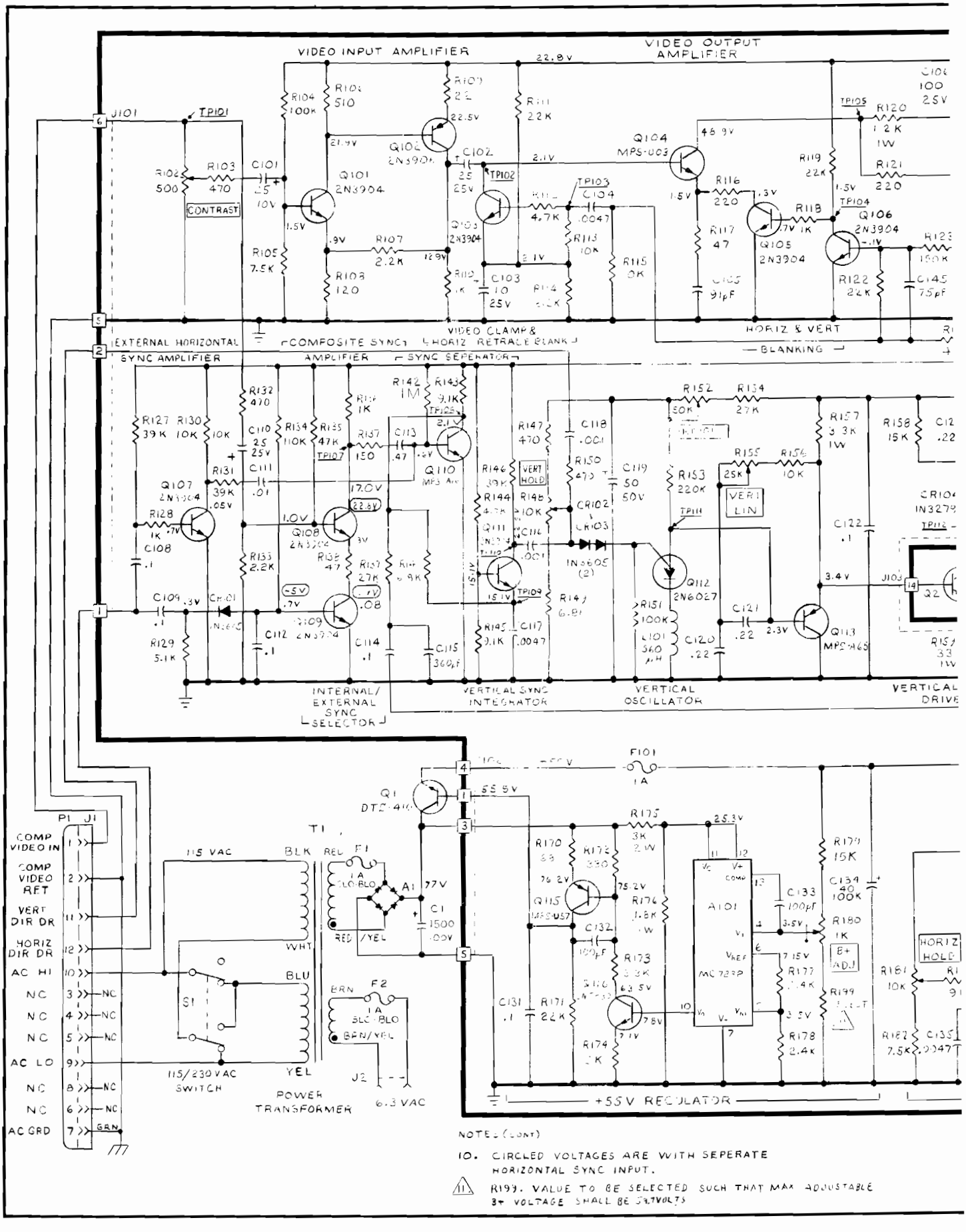
	DRAWN BY	DATE
		1/12/76
CHECKED		
DESIGN ENGINEER		
PROJECT ENGINEER		1/29/76
DOCUMENT CONTROL		
APPROVED		1-29-76

ATARI INCORPORATED
14600 Winchester Boulevard
Los Gatos, California 95030

TITLE ASSEMBLY, OUTLAW P.C.BD.

SIZE	DRAWING NO.	REV
D	A003213	D

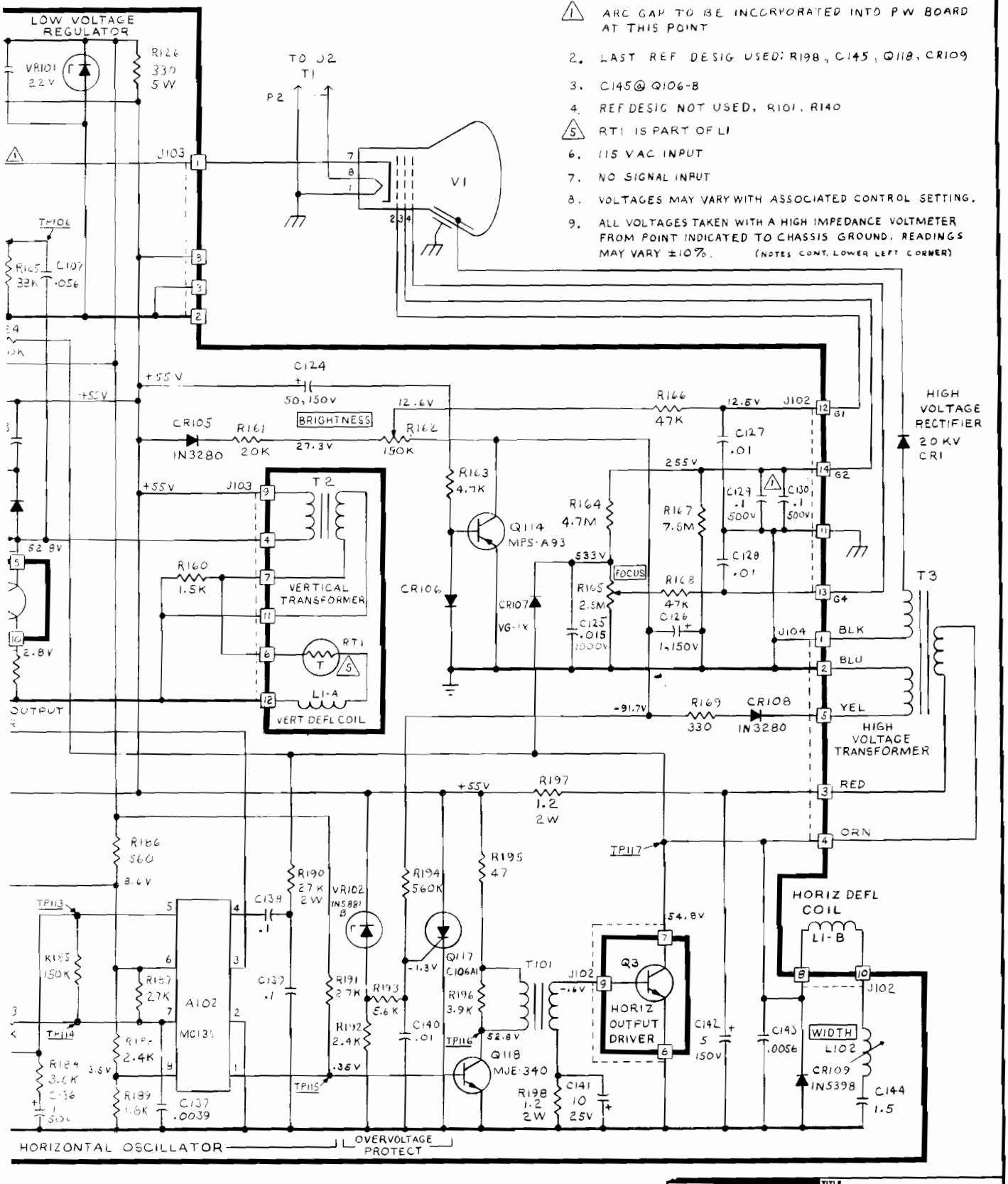
SCALE 1/1 SHEET 1 OF 1



NOTES: (CONT)

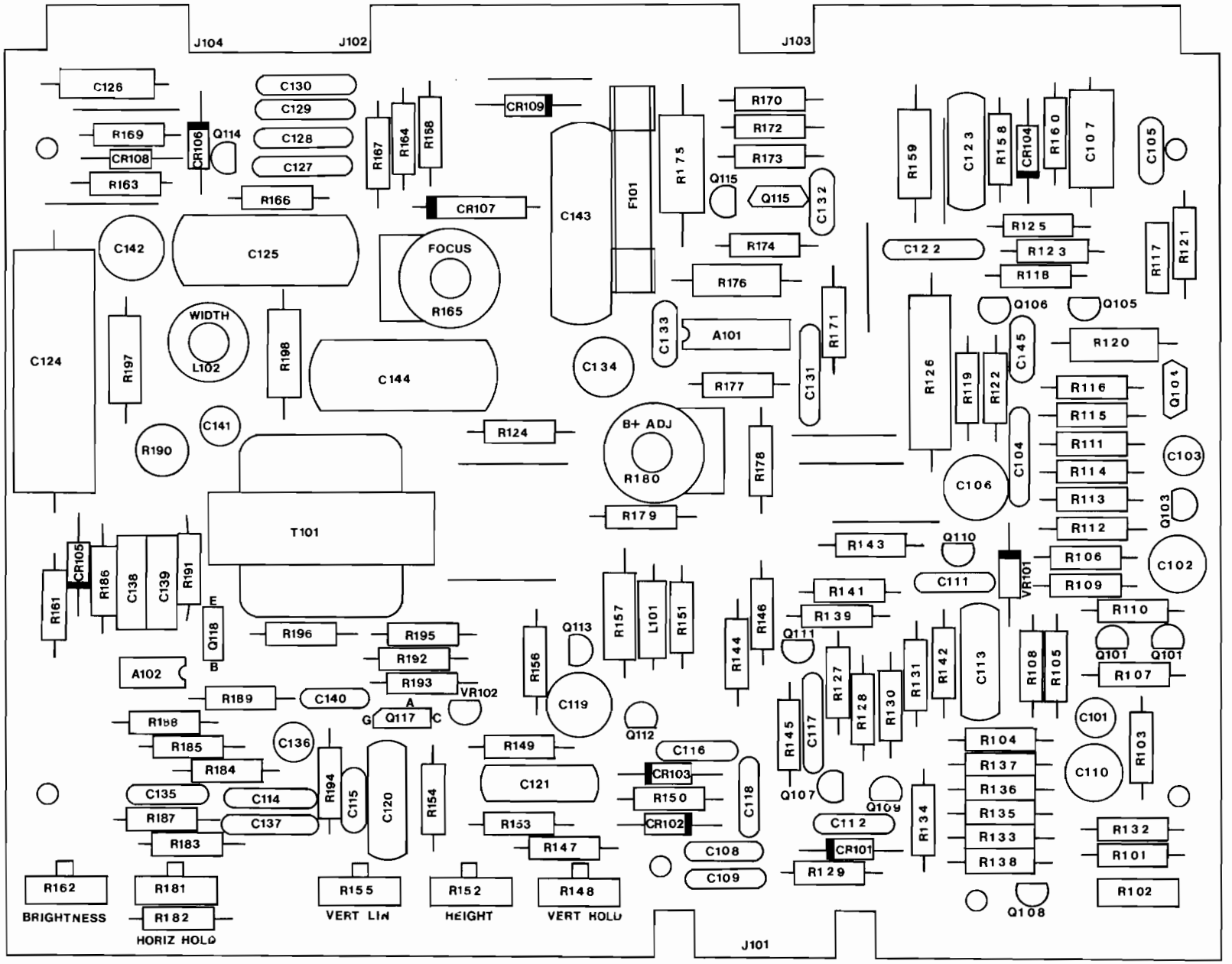
10. CIRCLED VOLTAGES ARE WITH SEPERATE HORIZONTAL SYNC INPUT.

⚠11. R199. VALUE TO BE SELECTED SUCH THAT MAX ADJUSTABLE B+ VOLTAGE SHALL BE 13.7VOLTS



1. ARC GAP TO BE INCORPORATED INTO P.W. BOARD AT THIS POINT
2. LAST REF DESIG USED: R198, C145, Q118, CR109
3. C145 @ Q106-B
4. REF DESIG NOT USED, R101, R140
5. RT1 IS PART OF L1
6. 115 VAC INPUT
7. NO SIGNAL INPUT
8. VOLTAGES MAY VARY WITH ASSOCIATED CONTROL SETTING.
9. ALL VOLTAGES TAKEN WITH A HIGH IMPEDANCE VOLTMETER FROM POINT INDICATED TO CHASSIS GROUND. READINGS MAY VARY ±10%. (NOTES CONT. LOWER LEFT CORNER)

Buel / MIRATEL	TITLE: SCHEMATIC, TG20 & 23		
SHEET 1 of 1	SIZE D	DRAWING NO. 1-024-0557	REV. E



STRAIGHT LINES ARE JUMPERS
BETWEEN TRACES

PRINTED WIRING ASSEMBLY, MODEL TG-20/23 MONITOR

Ball Brothers Research Corp.
Miratel Division
Saint Paul, Minnesota

Drawing Number
6-002-0615

TM-040

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leisure