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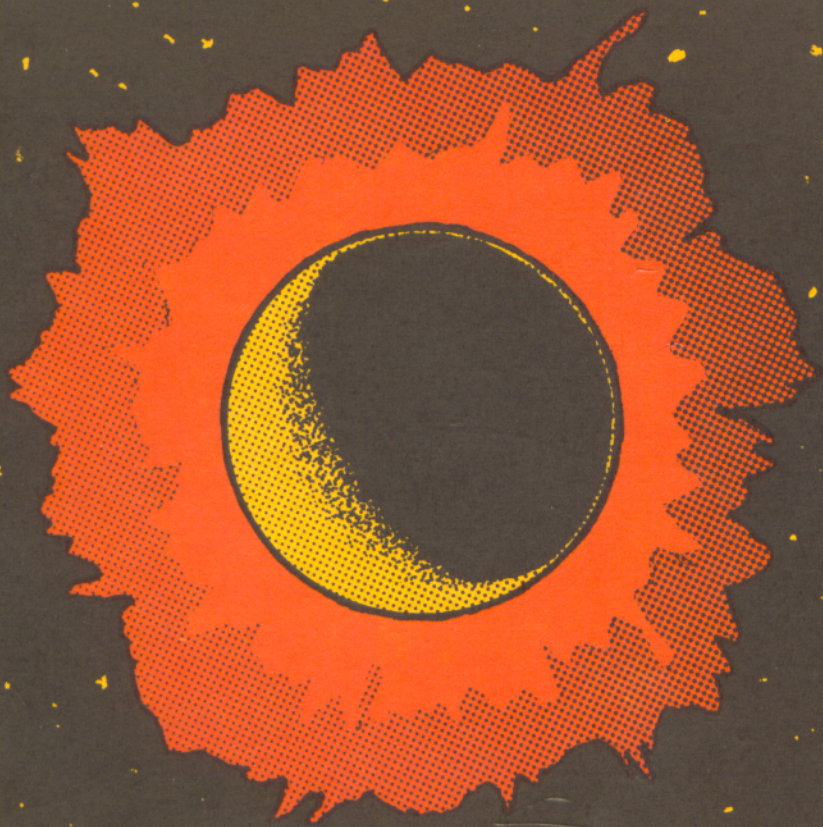

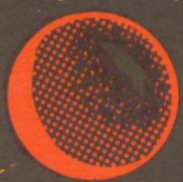

# MAD PLANETS

## Instruction Manual

# MAD PLANETS (GAME GV-102)
## INSTRUCTION MANUAL
## (PRELIMINARY)

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**WELLS GARDNER MONITOR,**
**SERVICE AND OPERATION MANUAL (Attached)**


"WARNING: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference."

**NOTICE**

**WARRANTY INFORMATION IS LOCATED ON THE INSIDE BACK COVER.**


**FOR SERVICE, CALL TOLL FREE: 1-800-323-9121; (ILLINOIS) 1-800-942-1620**

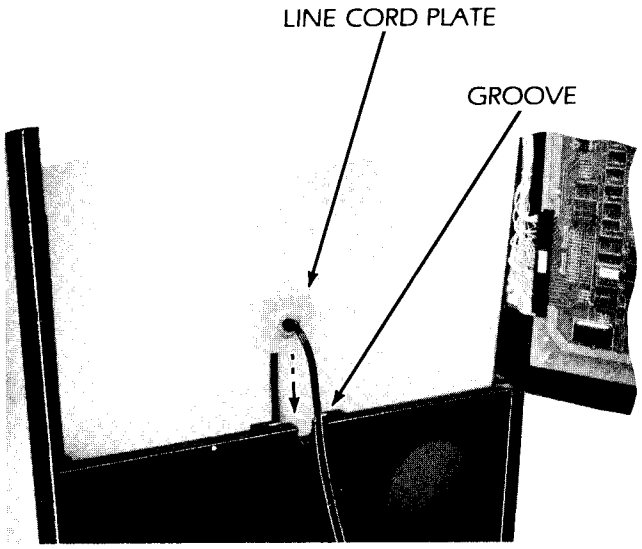
# I. INSTALLATION

**MAD PLANETS**
**(GAME GV-102)**

# I. INSTALLATION

## A. SET—UP

1. Carefully inspect the exterior of the game for any damage which might have occurred during shipment.
2. Unlock and open the rear cabinet door.
3. Check that all plug in connectors are seated firmly. The connectors are keyed so they will only go in one way.
4. Remove the binding strap from the line cord, and install the line cord plate in the groove provided (see photo).
5. Cabinet levelers (2) are stored within the cash box for shipping purposes. Install and adjust as necessary.




## B. CHECK-OUT

1. Check that all cables are free of moving parts.
2. Check for any loose wires.
3. Check for loose solder or foreign matter on switches and power supply assemblies.
4. Be certain all fuses are seated firmly.
5. Be sure transformer wiring corresponds to the supply voltage.
6. Refer to section VI to make all the necessary game adjustments.
7. Reassemble the game.
8. Plug the line cord into a properly grounded 3-wire receptacle ONLY!!

## C. CONTROL PANEL REMOVAL

1. Unplug the game.
2. Unlock and open the coin chute door.
3. Reach in through the coin chute door and remove the wing nut and flat washer from each of the two carriage bolts which secure the control panel to the game. Remove the carriage bolts.
4. Pull the control panel back, grasp it at the front edge as far back as it will go (approximately ¼").
5. Raise the front of the control panel approximately one inch above its supports and lift the entire assembly high enough to disconnect plug A9J2/A9P2.
6. Remove the entire control panel assembly from the game.
7. The Joystick and leaf-switches are now accessible for removal or cleaning.

## D. MONITOR REMOVAL

1. Unplug the game.
2. Perform the control panel assembly removal procedure (Section C).
3. Remove the outside shield, glass and monitor mask and put them aside in a secure place.
4. Unlock and open the rear cabinet door.
5. NOTE: The color monitor contains HIGH VOLTAGES delivering LETHAL quantities of energy. Do not attempt to service the monitor until you have shorted the anode plug on the picture tube to ground.
6. Disconnect the video plug A17J1, the monitor power supply plug A12J3/A12P3 and the ground wire from the monitor chassis.
7. From the rear of the game, remove the one nut and one washer from each of the four carriage bolts used to secure the monitor to the platform.
8. Remove the monitor from the rear of the game, being careful to clear all cables from the CRT neck.
9. For reassembly, reverse the above procedure.

# II. INITIALIZATION

## TURN GAME ON

Immediately, the coin chute lamps and the speaker marquee lamp will turn on.

## AFTER A TEN SECOND DELAY

A. The attract mode appears on the screen.

B. The playing field cycles through the following:

1. High Game to Date screen
2. Instruction Set
3. Game Play Cycle

# III. GAME OPERATION

## A. GAME START

1. Insert coins into coin chute.
   a. Coin chute tune is played.
   b. Total credits are displayed on screen.
2. Press one or two player button to start game.
   a. Demonstration scene displayed on screen.
   b. Total Credits are decreased by one.
   c. Game initializes.

## B. FIRST PLAYER

1. The first player's score displays a zero.
2. The other player's display will be blank.

## C. SECOND PLAYER

1. Additional player is indicated by the words "PLAYER 2" and a zero in the second player's display.

## D. SHIPS/EXTRA SHIPS

1. Each player will begin with three ships (dependent on Option/Parameter settings).
2. Extra ships are earned by achieving certain score levels (dependent on Option/Parameter settings).

# IV. GAME PLAY AND SCORING
## HOW TO PLAY

The control panel consists of one or two player select buttons, a joystick with fire buttons and one rotary dial for rotating the ship. The players ship is moved vertically, horizontally or diagonally by the joystick. The ship can be rotated 360 degrees by the rotary dial. The fire buttons are located on the joystick, two on the front and one as a trigger style.

**APPROACHING PLANETS** — These planets first appear far in another galaxy and rapidly approach the players ship. They do not have moons orbiting around them. The player is awarded 100 points for destroying an Approaching Planet.

**ATTACKING PLANET** — A planet that has three to six moons orbiting around it. An attacking Planet seeks out and tries to destroy the players ship by colliding with the ship or releasing moons into space. An Attacking Planet cannot be destroyed until all of the orbiting moons have been destroyed (see MAD PLANET). An Attacking Planet scores 1 point when hit.

**ORBITING MOON** — These are moons that are in orbit around the Attacking Planet. Destroying an Orbiting Moon awards 10 points.

**MAD MOON** — Any moon that leaves its original orbit around the planet and is free floating in space. These orange moons must be avoided or destroyed. Destroying a Mad Moon scores 100 points and is eliminated from the planet that released it. If the Mad Moon escapes the player and moves off the screen, it is replaced in its original orbit around the Attacking Planet.

**MAD PLANET** — Commencing with the destruction of all of the Orbiting Moons, an Attacking Planet transposes into a Mad Planet. A Mad Planet must be destroyed quickly as its vengeful quest to destroy the ship causes its movement to quicken rapidly. Mad Planets score 200, 300 or 500 points, dependent on its size.

**COMETS** — Comets first appear in the beginning of the third round and continue throughout the game. They travel indiscriminately around the planets and are deadly to the players ship. It must be avoided or destroyed. The first Comet destroyed awards 100 points. Every Comet destroyed in succession increments its value by 100 points up to 1000 points awarded for the tenth and all following Comets. However, if a Comet is allowed to leave the screen at any time during the round, the Comet values start over at 100 points and repeat the scoring sequence. This scoring sequence repeats at the beginning of each new round.

**HUMANS** — Humans first appear in the first Bonus Period (see BONUS PERIOD) and all subsequent rounds thereafter. Humans are picked up by the players ship by touching them with the ship. Points awarded for picking up Humans advances for each wave of game play. Starting with the second wave, Humans award 300 points each. This increments by 100 points for each subsequent wave to a maximum of 1000 points per Human in the ninth wave and remains at 1000 points for the remainder of the game. During a Bonus Period, all Humans score 200 points (see BONUS PERIOD).

**BONUS PERIOD** — A Bonus Period is achieved at the end of each wave (see ROUND PROGRESSION). During the Bonus Period only the players ship, Humans and Comets appear on the screen. The Player must pick up Humans to gain bonus points and avoid being hit by the Comet. The period ends when either the players ship is destroyed by a Comet, the Comet is allowed to leave the screen or ten Comets have been destroyed. Each Comet appearing (up to ten) must be destroyed for the Bonus Period to continue. Comets score 100 points for the first one destroyed and increment by 100 points for each subsequent Comet that is eliminated. All Humans score 200 points during the Bonus Period.

**PERFECT ROUND** — A Perfect Round is achieved by destroying all of the planets in a round while they are Approaching Planets. They must not be allowed to form into Attacking Planets and the players ship must not be destroyed. A Perfect Round awards the total number of Attacking Planets allowed to appear on the screen at one time for that round times 2000.

### GAME PLAY

Game play is initiated when either the one player or two player buttons are pressed. As the round begins, Approaching Planets from a distant galaxy begin to approach the players ship. The player has the option of destroying the planets as they are approaching him. Successfully destroying all Approaching Planets in a round awards bonus points for a Perfect Round. When a planet is allowed to reach the players ships orbit, it reveals a group of moons orbiting around it. This becomes an Attacking Planet. An Attacking Planet cannot be destroyed until the player has destroyed all of

# IV. GAME PLAY AND SCORING

its Orbiting Moons. Once all of the Orbiting Moons game been destroyed, the planet transposes into the Mad Planet destine to destroy the players ship. The Mad Planet must be destroyed quickly as it travels faster and faster the longer it remains in orbit.

Each round has a predetermined number of planets per round and a predetermined number of Attacking Planets to fight at one time (see ROUND PROGRESSIONS). Once an Attacking Planet is destroyed, another planet approaches. If not destroyed, it also will become an Attacking Planet. This cycle continues until there are no longer any planets to destroy in that round. Once all the planets have been destroyed, the game advances to the next round.

In defense to the players attack, the Attacking Planet will release one of its Orbiting Moons into space in an attempt to destroy the players ship. This orange moon must be avoided or destroyed. If the Mad Moon is allowed to leave the screen without being destroyed, it is replaced in its original orbit around the Attacking Planet that released it.

The Bonus Period appears at the end of each wave. During this time, the player must pick up Humans while trying to destroy as many Comets as possible. The period ends when either the players ship is destroyed by a Comet, the Comet is allowed to leave the screen or ten Comets have been destroyed (see BONUS PERIOD).

## ROUND PROGRESSIONS

| ROUND # | NUMBER OF ATTACKING PLANETS | TOTAL NUMBER OF PLANETS IN ROUND | HUMAN POINTS | PERFECT ROUND BONUS | WAVE |
|---|---|---|---|---|---|
| 1 | 2 | 5 | — | 4000 | 1 |
| 2 | 3 | 6 | — | 6000 | |
| 3 | 4 | 7 | — | 8000 | |
| BONUS PERIOD | | | 200 | | |
| 4 | 2 | 8 | 300 | 4000 | 2 |
| 5 | 3 | 9 | 300 | 6000 | |
| 6 | 4 | 10 | 300 | 8000 | |
| BONUS PERIOD | | | 200 | | |
| 7 | 2 | 11 | 400 | 4000 | 3 |
| 8 | 3 | 12 | 400 | 6000 | |
| 9 | 4 | 13 | 400 | 8000 | |
| BONUS PERIOD | | | 200 | | |
| 10 | 2 | 14 | 500 | 4000 | 4 |
| 11 | 3 | 15 | 500 | 6000 | |
| 12 | 4 | 16 | 500 | 8000 | |
| BONUS PERIOD | | | 200 | | |
| 13 | 2 | 17 | 600 | 4000 | 5 |
| 14 | 3 | 18 | 600 | 6000 | |
| 15 | 4 | 19 | 600 | 8000 | |
| 16 | 5 | 20 | 600 | 10,000 | |
| BONUS PERIOD | | | 200 | | |
| 17 | 2 | 20 | 700 | 4000 | 6 |
| 18 | 3 | 20 | 700 | 6000 | |
| 19 | 4 | 20 | 700 | 8000 | |
| 20 | 5 | 20 | 700 | 10,000 | |
| BONUS PERIOD | | | 200 | | |
| 21 | 2 | 20 | 800 | 4000 | 7 |
| 22 | 3 | 20 | 800 | 6000 | |
| 23 | 4 | 20 | 800 | 8000 | |
| 24 | 5 | 20 | 800 | 10,000 | |
| BONUS PERIOD | | | 200 | | |
| 25 | 2 | 20 | 900 | 4000 | 8 |
| 26 | 3 | 20 | 900 | 6000 | |
| 27 | 4 | 20 | 900 | 8000 | |
| 28 | 5 | 20 | 900 | 10,000 | |
| BONUS PERIOD | | | 200 | | |
| 29 | 2 | 20 | 1000 | 4000 | 9 |
| 30 | 3 | 20 | 1000 | 6000 | |
| 31 | 4 | 20 | 1000 | 8000 | |
| 32 | 5 | 20 | 1000 | 10,000 | |
| BONUS PERIOD | | | 200 | | |

ROUNDS 29 THROUGH 32 ARE REPEATED FOR ROUNDS 33 THROUGH 99

# V. SOUND

The Sound Board installed in this game has been programmed for sound only. The switch bank on the Sound Board is not used and the switch positions have no effect on the sound.

# VI. GAME ADJUSTMENTS/OPTIONS

## A. CONTROL BOARD SWITCH ADJUSTMENTS

**SWITCH 1 — DEMONSTRATION MODE***

| | |
|---|---|
| ON | DEMO MODE |
| OFF | NORMAL PLAY |

**SWITCH 2 — ATTRACT PLAY**

| | |
|---|---|
| ON | NO SOUND |
| OFF | SOUND |

**SWITCHES 3 & 4 — CREDITS/COINS**

| 3 | 4 | |
|---|---|---|
| ON | ON | FREE PLAY |
| OFF | ON | 1/2 |
| ON | OFF | 2/1 |
| OFF | OFF | 1/1 |

**SWITCH 5 — SHIPS**

| | |
|---|---|
| ON | 5 |
| OFF | 3 |

**SWITCH 6 — FREE SHIPS**

| | |
|---|---|
| ON | EVERY 12,000 POINTS |
| OFF | EVERY 10,000 POINTS |

**SWITCHES 7 & 8 — DIFFICULTY CONTROL**

| 7 | 8 | |
|---|---|---|
| ON | ON | VERY HARD |
| OFF | ON | HARD |
| ON | OFF | EASY |
| OFF | OFF | STANDARD |

*IN THE DEMONSTRATION MODE THE PLAYER CAN SELECT ANY ROUND BY ROTATING THE ROTARY DIAL. EXTRA SHIPS ARE OBTAINED BY DEPRESSING THE ONE PLAYER START BUTTON. GAME PLAY IS INITIATED BY DEPRESSING THE TWO PLAYER START BUTTON.

## B. SOUND ADJUSTMENTS

The audio output is controlled by the potentiometer mounted on the service panel assembly (located inside the coin mechanism door).

Turning the potentiometer counter-clockwise will decrease the volume. Turning it clockwise will increase the volume.

IMPORTANT: Each of the potentiometers installed on the Sound board have been factory adjusted. The potentiometer settings should never be changed when performing the recommended calibration procedure.

## C. MONITOR ADJUSTMENTS

Normally, few if any adjustments are required for proper monitor operation. However, after any major repairs to the monitor chassis refer to the attached monitor manual.

# VII. BOOKKEEPING AND SELF TEST

## POWER UP

Upon power up, this game will check ROM's 0 through ROM 4 and RAM's 0, 1 and 2 for integrity. If any of the ROM's check sums are incorrect, the screen will display a warning and display the defective ROM(s). If any of the RAM's are defective, the screen will display the message "DEFECTIVE RAM." These messages will stay on the screen until both the one player and two player start buttons are depressed simultaneously. In such a case, the game may not perform properly. When both the ROM's and RAM's check good, no message is displayed.

After the memory test sequence, the screen will display "PRESS FIRE FOR START OF NEW DAY, CLEAR ULTRA SCORES," for ten seconds. If the fire button is pressed during this time, the computer recognizes a new day (see USAGE TABLE) and resets the Ultra High Score table. If the button is not pressed during this time, the computer assumes continuation of the same day and the Ultra Scores are retained. NOTE: There are two high score tables: The Ultra High Score table (daily high scores), and the Galactic Hall of Fame table (all time high scores). The Galactic Hall of Fame table can be reset during Self Test 3.

## SELF TEST

The battery back-up bookkeeping functions of this game are contained in Self Test steps 3 and 4. These are in addition to the electro-mechanical coin counter located inside the front door panel. Every time a coin is inserted into a coin slot, the counter is energized, incrementing the count.

The self-test consists of six functions which may be used to identify problems in the video system and to change program parameters.

The self-test mode is entered by setting the self-test toggle switch located inside the cash door to "TEST". A selection of available tests is displayed on the monitor. To return to the GAME mode at any time, the operator needs only to set the toggle switch back to "GAME".

Selection of tests is done with the push button switch labled "SELECT". Upon entering the test mode, a flashing arrow points to the first test selection. Momentarily depressing the "SELECT" button will advance through each selection one by one.

When the arrow is pointing to the desired test, the operator may begin that test by pressing the "SELECT" button and holding it down until the test appears on the screen.

Once a test has been selected, the operator can return to the selection list by holding down the select switch until it re-appears. The seven tests are as follows:

### 1. MONITOR ADJUSTMENT

Three patterns can be displayed on the screen for adjusting monitor color, brightness, contrast and convergence. The patterns are: Color scale, a gray scale, and a dot pattern. By momentarily pressing the select switch, the operator may cycle through the three patterns.

### 2. DIP SWITCHES

A functional description of the eight Dip Switches located on the Logic Board Assy. is displayed. Changing any switch will cause an immediate update of the description displayed on the screen.

### 3. BOOKKEEPING

Selecting this test will display a menu of four functions. Pushing the SELECT button momentarily will move an arrow on the screen. When the arrow points to the desired function, press either start button on the control panel to perform that function.

DISPLAY SCORE COUNTS — A table is shown with 20 categories of score values by thousands (K) and a count associated with each category. The count represents the number of plays in which the score at the end of the game fell into that category. In addition, a high score, low score, and average is shown along with the total number of plays on which the average is based. To clear the table, press either start button and return to the menu by holding down SELECT.

# VII. BOOKKEEPING AND SELF TEST

DISPLAY TIME COUNTS — Same as above except each category represents play times in minutes. The high, low, and average are given in minutes and seconds.
DISPLAY ROUND COUNTS — Same as above except each category represents the round in which the games ended.

Note: Each of these tables is independent of the others. Any table may be cleared without affecting the others in any way.
RESET HALL OF FAME — Pressing either start button will reset the Hall of Fame table (all time high scores).
CLEAR COIN COUNT — The number to the right of COINS COLLECTED is set to zero. The hardware coin counter is not affected. This number will always be the number of coins collected since the last time the count was cleared.

## 4. USAGE TABLE

This table is an extension of the bookkeeping sections vital statistics. It shows the performance of this machine from the standpoint of how busy this machine was servicing customers (or how much idle time there was). Since the machines usage depends heavily upon the time of day, the percentage of usage (50% for 30 minutes busy, 30 minutes idle) is based on an hourly basis. If the machine was being played most of the time during the hour, it may show a figure close to 99%.

The table gives the previous one weeks usage data. The column displaying -1 shows yesterdays data, the column displaying -2 shows the day before, etc. Only 16 hours of data can be displayed on the table for one day. If the machine is kept on for more than 16 hours, the overflowed data will be automatically placed under the next days data.

When a power interruption is detected during an hour, an asterisk sign is attached next to the percentage value indicating the particular hour may have actually been much longer.

This machine has no internal clock to keep track of the exact time or day. It can only keep track of how much time has passed like a stopwatch. In order for this machine to distinguish between a power up of a new day from a power up of a middle-of-the-day servicing, an operators input is required. To tell the machine that a power up is the beginning of the day, the operator must press the fire button within ten seconds of the power up. This practice ensures the usage tables data to be tabulated by the day of the week, and at the same time clears todays high scores (Ultra Scores). See POWER UP for this sequence.

## 5. MEMORY

For each RAM memory chip: An OK or an NG (no good) appears signaling that the chip is good or bad respectively.

For each ROM memory chip: the same OK or NG applies in addition to the respective check sums being displayed. If you have a suspect ROM, refer to your distributor for the correct check sum number.

## 6. SWITCHES

A colored square is displayed for each player button. Pressing a button causes the appropriate square to change color.
For each coin mechanism, a digit is displayed (initially 0). Inserting a coin into a coin chute will increment the appropriate value without affecting the coin meter.

Moving the joystick will display its direction of movement by the fire buttons colored square. The rotary dial input is also tested for both rotations.

## 7. SOUND TEST

After selecting this test a count will appear on the screen representing the various sounds that are produced by the game. There will be 20 different sounds produced and the screen count will repeat to 01. Pressing either Start button will suppress all sound output and speed up the count so a particular sound can be sought out and checked.

Note: The count on the screen represents the binary signal code that will be sent to the A6 Sound board through the six sound input lines on the A6J1 connector. When executing the Sound Test sequence, there will be no sounds produced on counts 16 and 22 thru 41. There are no sounds assigned to these numbers.

# VIII. GENERAL INFORMATION

## A. PRINTED CIRCUIT BOARDS ARE DESIGNATED AS FOLLOWS:

A1 Logic Board Assy.

A2 Interface Assy.

A3 Power Supply Assy.

A6 Sound Board Assy.

A8 Filter Board

## B. WIRE COLORS ARE SHOWN AS NUMBERS:

| | |
|---|---|
| 0 Black | 5 Green |
| 1 Brown | 6 Blue |
| 2 Red | 7 Purple |
| 3 Orange | 8 Slate |
| 4 Yellow | 9 White |

For example, 688 is a BLUE- SLATE-SLATE striped wire.

## C. FUSES

BOTTOM PANEL

| | | |
|---|---|---|
| F1 | Primary Power | 4 Amp SLO-BLO |
| F2 | 6.3 VAC | 3 Amp SLO-BLO |
| F3 | Monitor | 2 Amp SLO-BLO |
| F4 | 9 VAC | 10 Amp SLO-BLO |
| F5 | 15 VAC | 1 Amp SLO-BLO |

POWER SUPPLY ASSY. (A3)

| | | | |
|---|---|---|---|
| F11 | +5VDC Source | | 5 Amp SLO-BLO |
| F21 | Sound Board Assy. | +30VDC | 2 Amp SLO-BLO |
| F31 | Sound Board Assy. | +12VDC | ¼ Amp SLO-BLO |
| F32 | Sound Board Assy. | -12VDC | ¼ Amp SLO-BLO |
| F41 | Coin Meter | +20VDC | 1 Amp SLO-BLO |

# VIII. GENERAL INFORMATION

## POWER SUPPLY SPECIFICATIONS

| LOCATION | VOLTAGE | PROTECTION |
|---|---|---|
| Logic Board Assy. | +5VDC | Voltage adjustable. 6Amps over-voltage protection and fused for over-current protection. |
| Sound Board | +30VDC | 2 Amps fused for over-current protection. The reference for this circuit is a 1N5363 + 30VDC Zener controlling the base of an emitter follower pass transistor. |
| Sound Board | +12VDC<br>-12VDC | 100 milliamps fused for over-current protection. The plus and minus 12 volts supplies are the 7812 and 7912 IC regulators respectively. |
| Coin Meter | +20VDC | Full wave rectified unfiltered voltage, fused for over-current protection. |
| Coin Chute Lights | +4.5VDC | Full wave rectified unfiltered voltage, fused for over-current protection. |
| Monitor and Marquee | 100VAC or<br>115VAC, 60HZ | Isolated, fused AC voltage. |

# IX. THEORY OF OPERATION

## INTRODUCTION

The character based graphics system designated GG-III has two main subdivisions. The first subdivision is the Central Processor Unit (CPU) which has three partitions:

a. Microprocessors
b. Memory
c. Input and Output ports (I/O)

The Intel 8088 microprocessor is used and 32K bytes of memory is reserved for programming space and has 5 input ports and 5 output ports. The second subdivision is the video state machine which generates and controls the video signal to the monitor. The state machine has three partitions:

a. System Clock (CLK)
b. Foreground generator (FGND)
c. Background generator (BGND)

The system clock is driven by a 20MHZ crystal, divided down for a 5MHZ dot clock.

All inputs and outputs including the video control and general purpose I/O are memory-mapped, (i.e. everything within the system can be addressed in a single segment of 64K addresses as memory).

The video control unit is divided into an "object-oriented" foreground driver and "character-oriented" background driver. The screen resolution is 256 pixels horizontally, and 240 lines vertically for both foreground and background. The CPU communicates with the foreground driver and background driver by writing data into the designated memory areas in a certain format. The foreground is designed to display moving objects on the screen with a minimum overhead to the processor. The game programs will only have to specify the vertical and horizontal position and the object select number to the foreground driver. The background video supplements the foreground with relatively static figures on the screen. The CPU specifies all the character positions on the screen with desired "character " patterns.

A 5MHZ system clock drives a 9 bit horizontal dot counter and an 8 bit vertical line counter. The horizontal counter counts from 0 to 255 during active scan line and 256 to 317 during horizontal blanking time. When the horizontal counter reaches 317, the horizontal counter resets to 0. At the beginning of the horizontal blanking time (horizontal counter = 256) it increments the vertical counter. The vertical counter counts from 0 to 239 during active vertical scan time and 240 to 255 during vertical blanking time.

The battery backup system supports two battery RAM's that store all of the bookkeeping functions. The battery is maintained at a +3.6V reference by a trickle charge supplied on the logic board regulated by a current limiting resistor. If the AC power to the game is interrupted, the battery allows the RAM's to store the data contained in the Distrubutors table and the Options/Parameters screen.

# X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

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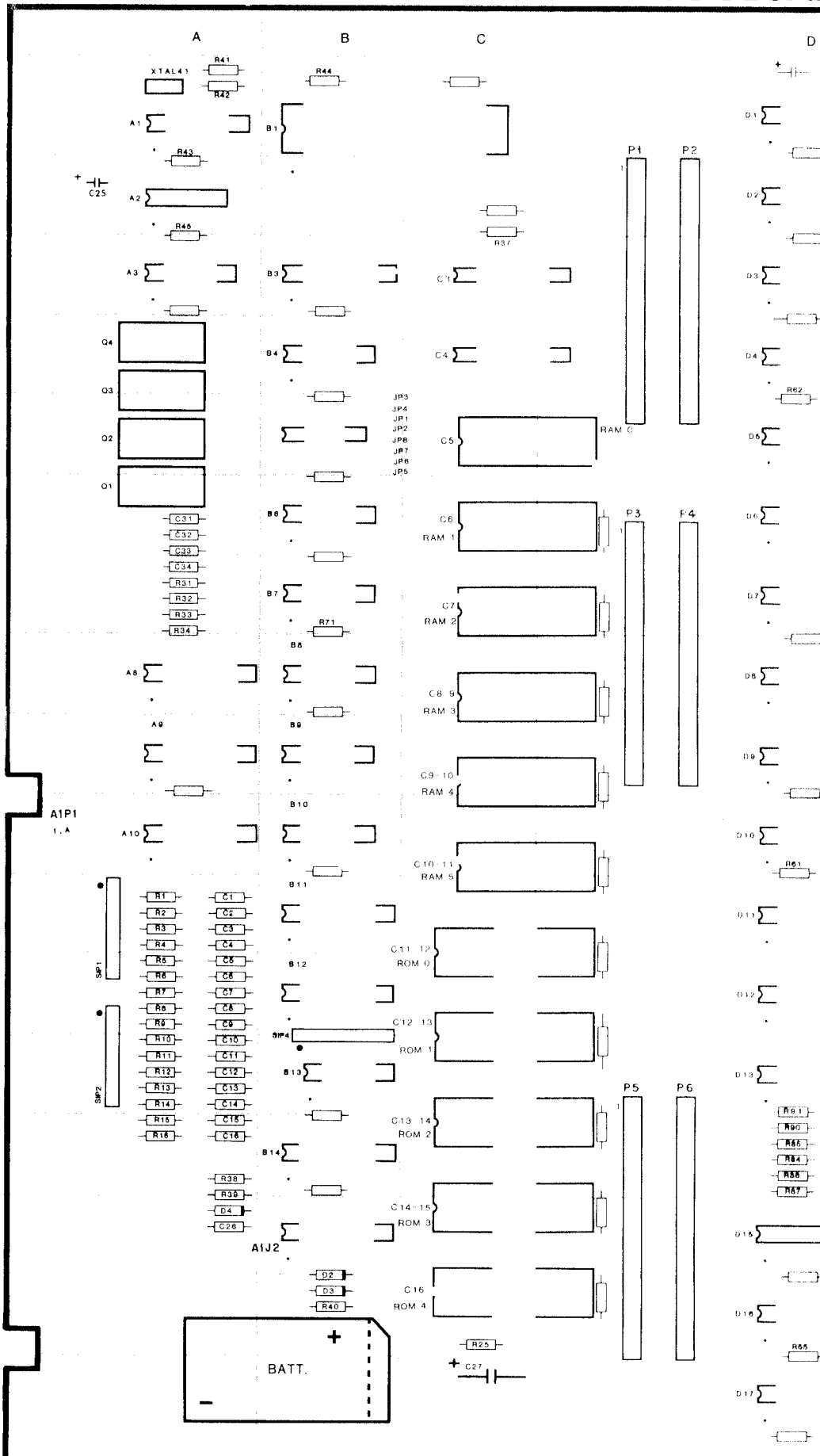
# LOGIC BOARD ASSY. (A1), PARTS LIST

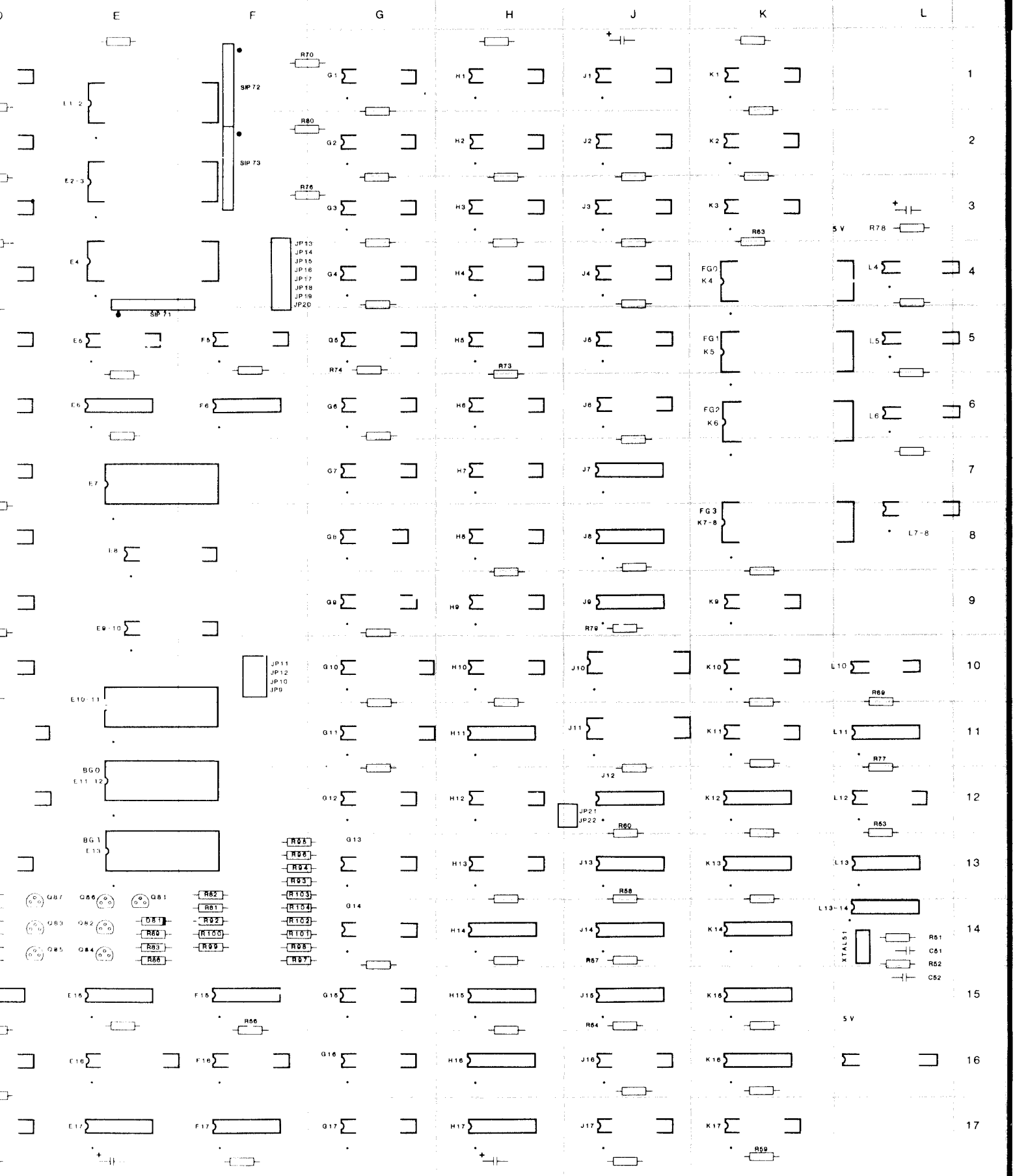
### MISCELLANEOUS ELECTRONIC COMPONENTS

| REFERENCE | DESCRIPTION | PART NO. |
|---|---|---|
| Bat. 1 | Battery, 3.6V | XO-458 |
| C1-C16 | Capacitor, 0.1 UF 50V AX. CR. +80%-20% | XO-230 |
| C25 | Capacitor, 100 UF, 25V EL-AX | XO-212 |
| C26 | Capacitor, 0.1 UF, 50V AX. CR. +80%-20% | XO-230 |
| C27 | Capacitor, 100 UF, 25V EL-AX | XO-212 |
| C31-34 | Capacitor, 0.1 UF, 50V AX. CR. +80%-20% | XO-230 |
| C51 | Capacitor, 100 PF, 100V CMD 5% | XO-198 |
| C52 | Capacitor, 0.1 UF, 100V CMD 5% | XO-196 |
| ALL UNMARKED CAPACITORS | .01 UF, 50V AX. CR. +80%-20% | XO-229 |
| ALL POLARIZED UNMARKED CAPACITORS | 10 UF, 25V AX. TANT. 10% | XO-127 |
| D2 | Diode, 1N4454 | XO-275 |
| D4 | Diode, 1N4733A | XO-274 |
| D81 | Diode, 1N4148 | XO-261 |
| Q1-Q4 | Transistor, 2N6044 | XO-120 |
| Q81-Q87 | Transistor, MPSA70 | XO-309 |
| R1-R16 | Resistor, 470 OHM, 5% ¼W | XO-35 |
| R37, R38 | Resistor, 330 OHM, 5% ¼W | XO-34 |
| R39 | Resistor, 130 OHM, 5% ¼W | XO-172 |
| R40 | Resistor, 270 OHM, 5% ¼W | XO-68 |
| R41, R42 | Resistor, 510 OHM, 5% ¼W | XO-25 |
| R43 | Resistor, 130 OHM, 5% ¼W | XO-172 |
| R44, R45 | Resistor, 1K OHM, 5% ¼W | XO-5 |
| R51, R52 | Resistor, 330 OHM, 5% ¼W | XO-34 |
| R53, R54, R56 | Resistor, 1K OHM, 5% ¼W | XO-5 |
| R57, R58 | Resistor, 560 OHM, 5% ¼W | XO-36 |
| R59-R61 | Resistor, 1K OHM, 5% ¼W | XO-5 |
| R63, R64 | Resistor, 1K OHM, 5% ¼W | XO-5 |
| R70 | Resistor, 1K OHM, 5% ¼W | XO-5 |
| R73, R74 | Resistor, 1K OHM, 5% ¼W | XO-5 |
| R76-R80 | Resistor, 1K OHM, 5% ¼W | XO-5 |
| R81 | Resistor, 820 OHM, 5% ¼W | XO-174 |
| R82 | Resistor, 100 OHM, 5% ¼W | XO-28 |
| R83, R84 | Resistor, 15 OHM, 5% ¼W | XO-171 |
| R85 | Resistor, 180 OHM, 5% ¼W | XO-24 |
| R86, R87 | Resistor, 15 OHM, 5% ¼W | XO-171 |
| R88 | Resistor, 180 OHM, 5% ¼W | XO-24 |
| R89, R90 | Resistor, 15 OHM, 5% ¼W | XO-171 |
| R91 | Resistor, 180 OHM, 5% ¼W | XO-24 |
| R92 | Resistor, 1K OHM, 5% ¼W | XO-5 |
| R93 | Resistor, 2K OHM, 5% ¼W | XO-14 |
| R94 | Resistor, 1K OHM, 5% ¼W | XO-5 |
| R95 | Resistor, 470 OHM, 5% ¼W | XO-35 |
| R96 | Resistor, 240 OHM, 5% ¼W | XO-173 |
| R97 | Resistor, 2K OHM, 5% ¼W | XO-14 |
| R98 | Resistor, 1K OHM, 5% ¼W | XO-5 |
| R99 | Resistor, 470 OHM, 5% ¼W | XO-35 |
| R100 | Resistor, 240 OHM, 5% ¼W | XO-173 |
| R101 | Resistor, 2K OHM, 5% ¼W | XO-14 |
| R102 | Resistor, 1K OHM, 5% ¼W | XO-5 |
| R103 | Resistor, 470 OHM, 5% ¼W | XO-35 |
| R104 | Resistor, 240 OHM, 5% ¼W | XO-173 |
| SIP 1, SIP 2, SIP 4 | Resistor, Dip, 4.7K, 9 Pin | XO-492 |
| SIP 71, SIP 72, SIP 73 | Resistor, Dip, 1K, 9 Pin | XO-493 |
| X-TAL 1 | Crystal, 15 MHZ | XO-482 |
| XTAL 51 | Crystal 20 MHZ | XO-494 |
| | Dip Switch | XO-505 |
| | 20 Pin Dip Socket | XO-491 |
| | 22 Pin Dip Socket | XO-467 |
| | 24 Pin Dip Socket | XO-529 |
| | 28 Pin Dip Socket | XO-536 |
| | 40 Pin Dip Socket | XO-530 |



# TIC DIAGRAMS, PARTS LISTS

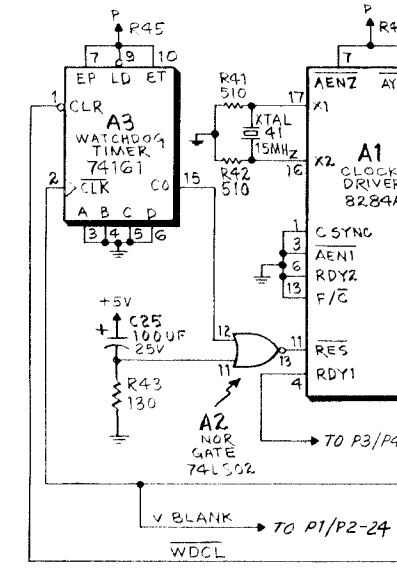
## RD ASSY. (A1), COMPONENT LOCATION

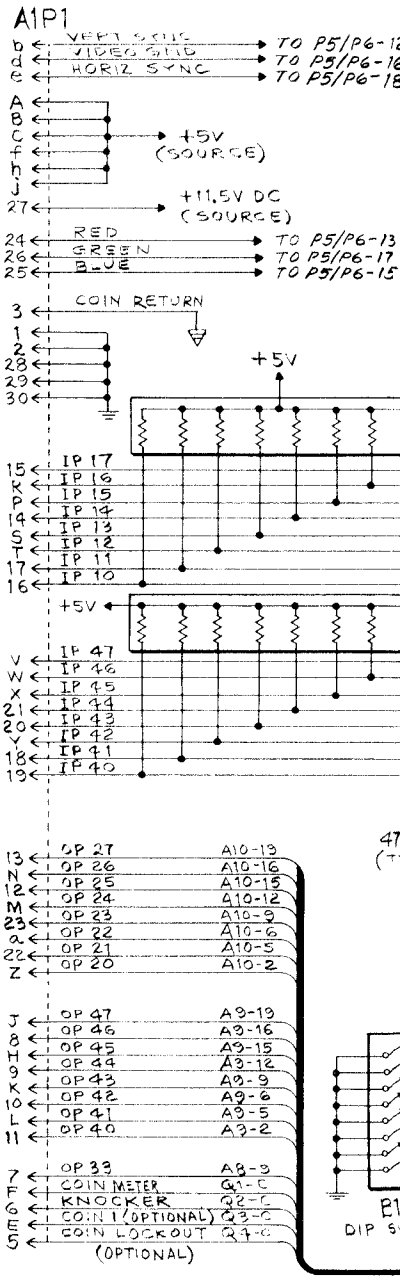


# LOGIC BOARD ASSY. (A1), PARTS LIST (CONT.)

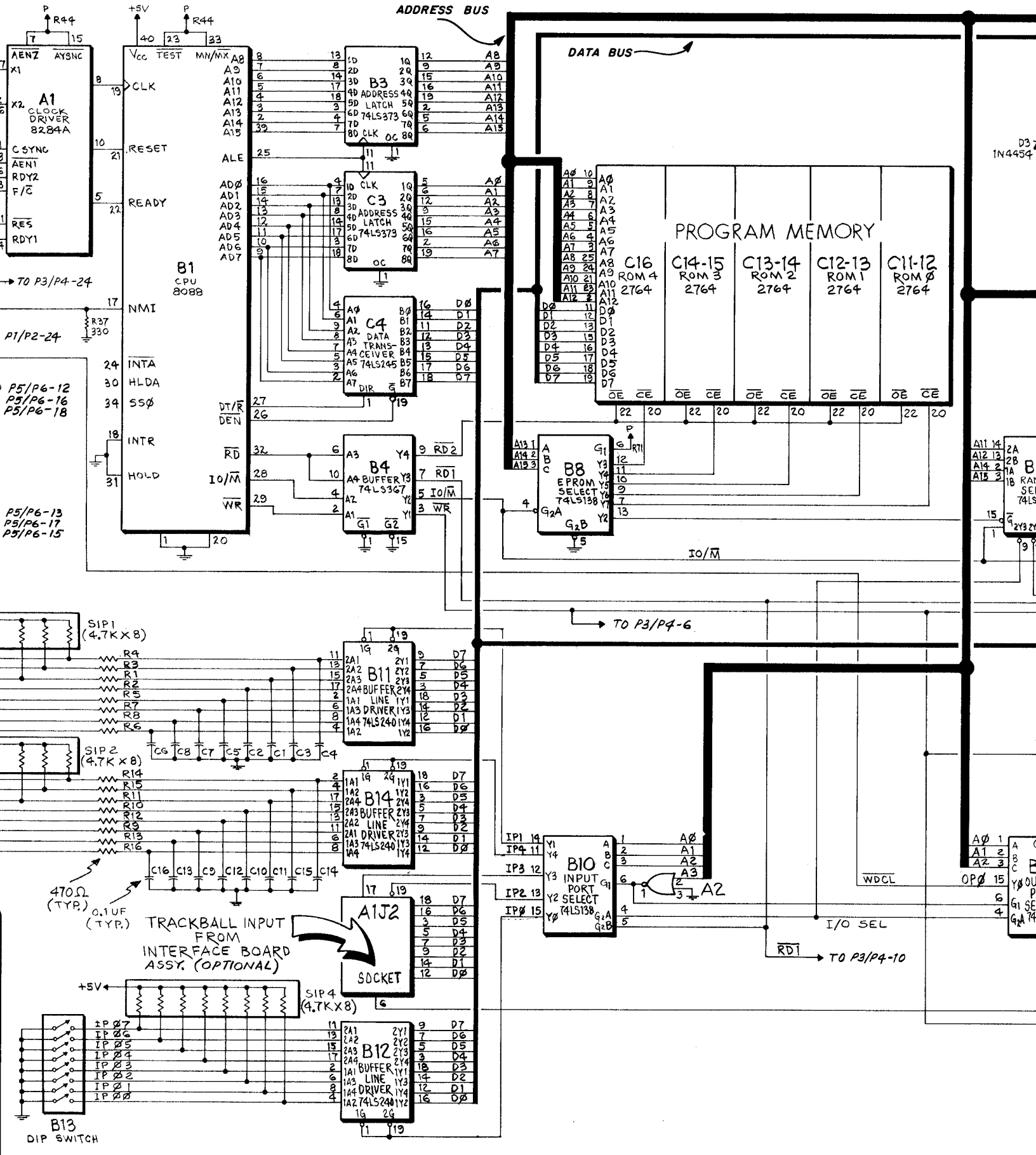
## INTEGRATED CIRCUITS

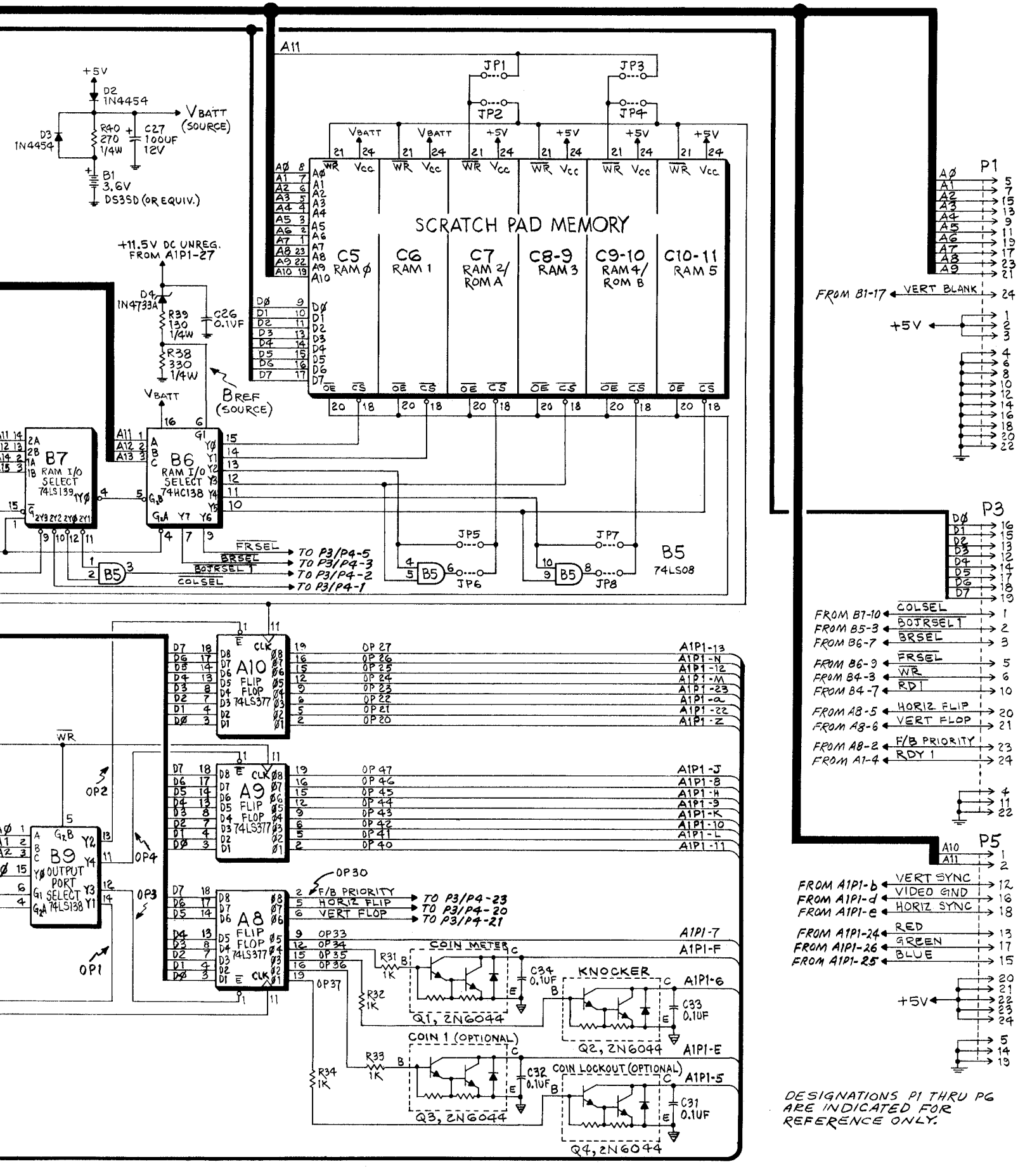
| REFERENCE | DESCRIPTION | PART NO. |
|---|---|---|
| | Logic Board Assy. | MA-378 |
| A1 | 8284 CLK Driver | XO-478 |
| A2 | 74LS02 Quad 2-input "NOR" gate | XO-428 |
| A3 | 74161 Synchronous 4-bit counter | XO-192 |
| A8, A9, A10 | 74LS377 Octal "D" Flip Flop | XO-97 |
| B1 | 8088 CPU | XO-490 |
| B3 | 74LS373 Octal D-type flip flop | XO-445 |
| B4 | 74LS367 Hex 3-state buffer | XO-444 |
| B5 | 74LS08 Quad 2-input "AND" gate | XO-86 |
| B6 | 74HC138 Decoder/demultiplexer | XO-190 |
| B7 | 74LS139 Dual 1 of 4 decoder | XO-419 |
| B8 | 74S138 1 of 8 decoder | XO-113 |
| B9, B10 | 74LS138 1 of 8 decoder | XO-437 |
| B11, B12, B14 | 74LS240 Octal Buffer/line driver | XO-91 |
| C3 | 74LS373 Octal D-type flip flop | XO-445 |
| C4 | 74LS245 Octal Bus transceiver | XO-79 |
| C5 | RAM Ø 6116LP-4 | XO-191 |
| C6 | RAM 1 6116LP-4 | XO-191 |
| C7 | RAM 2 2128-2 | XO-195 |
| C11-12 | ROM Ø 2764 8K x 8 EPROM | XO-489 |
| C12-13 | ROM 1 2764 8K x 8 EPROM | XO-489 |
| C13-14 | ROM 2 2764 8K x 8 EPROM | XO-489 |
| D1 | 74LS139 Dual 1 of 4 Decoder | XO-419 |
| D2, D3, D4, D5, D6, D7, D8, D9, | | |
| D10 | 74157 Quad 2-input multiplexer | XO-114 |
| D11 | 74LS374 Octal D-type flip flop | XO-96 |
| D12 | 74LS244 Octal buffer/line driver | XO-117 |
| D13 | 74LS157 Quad 2-input multiplexer | XO-390 |
| D15 | 74LS86 Quad 2-input exclusive "OR" gate | XO-435 |
| D16 | 74LS283 4-bit binary full adder | XO-95 |
| D17 | 74S161 Synchronous presettable binary counter | XO-488 |
| E1-2, E2-3, E4 | 93419 64 x 9 bipolar RAM | XO-99 |
| E5 | 74LS283 4-bit binary full adder | XO-95 |
| E6 | 74LS30 8-input "NAND" | XO-432 |
| E7 | 4801 1K x 8 RAM | XO-193 |
| E8, E9-10 | 74LS245 Octal Bus Transceiver | XO-79 |
| E10-11 | 4801 1K x 8 RAM | XO-193 |
| E11-12 | 2732A (BGØ) 4K x 8 EPROM | XO-485 |
| E13 | 2732A (BG1) 4K x 8 EPROM | XO-485 |
| E15 | 74LS86 Quad 2-input exclusive "OR" gate | XO-435 |
| E16 | 74LS273 8-bit register | XO-94 |
| E17 | 74LS20 Dual 4-input "NAND" gate | XO-430 |
| F5 | 74LS283 4-bit binary full adder | XO-95 |
| F6 | 74LS32 Quad 2-input "OR" gate | XO-433 |
| F15 | 74LS04 Hex inverter | XO-418 |
| F16 | 74S161 Synchronous presettable binary counter | XO-488 |
| F17 | 74LS86 Quad 2-input exclusive "OR" gate | XO-435 |
| G1, G2, G3, G4, G5 | 74LS157 Quad 2-input multiplexer | XO-390 |
| G6 | 74LS161 Synchronous presettable binary counter | XO-440 |
| G7 | 74157 Quad 2-input multiplexer | XO-114 |
| G8 | 74LS74 Dual D-type flip flop | XO-434 |
| G9 | 74S157 Quad 2-input multiplexer | XO-124 |
| G10 | 74LS245 Octal bus transceiver | XO-79 |
| G11 | 74LS374 Octal D-type flip flop | XO-96 |
| G12 | 74LS157 Quad 2-input multiplexer | XO-390 |
| G13, G14, G15 | 7489 64-bit RAM | XO-88 |
| G16, G17 | 74LS174 Hex D flip flop | XO-442 |
| H1, H2, H3, H4 | 74S189 64-bit RAM | XO-89 |
| H5, H6, | 74S161 Synchronous presettable binary counter | XO-488 |
| H7, H8, H9, H10 | 74LS157 Quad 2-input multiplexer | XO-390 |
| H11 | 74LS260 Dual 5-input "NOR" gate | XO-93 |
| H12 | 74LS298 Quad 2-port register | XO-118 |
| H13 | 74LS157 Quad 2-input multiplexer | XO-390 |
| H14 | 74LS00 Quad 2-input "NAND" gate | XO-427 |
| H15 | 74LS30 8 input "NAND" gate | XO-432 |
| H16, H17 | 74LS86 Dual 2-input exclusive "OR" gate | XO-435 |
| J1, J2, J3, J4, J5, J6 | 74S189 64-bit RAM | XO-89 |
| J7 | 74LS04 Hex inverter | XO-418 |
| J8 | 74LS32 Quad 2-input "OR" gate | XO-433 |
| J9 | 7408 Quad 2-input "AND" gate | XO-404 |
| J10, J11 | 93422 256 x 2 bipolar RAM | XO-100 |
| J12 | 74LS02 Quad 2-input "NOR" gate | XO-428 |
| J13 | 74LS74 Dual D-type flip flop | XO-434 |
| J14 | 7407 Hex buffer/driver | XO-384 |
| J15 | 74LS30 8 input "NAND" gate | XO-432 |
| J16, J17 | 74S161 Synchronous presettable binary counter | XO-488 |
| K1, K2, K3 | 74LS379 Quad D-type flip flop | XO-98 |
| K4 | FG0 2764-3 8K x 8 EPROM | XO-489 |
| K5 | FG1 2764-3 8K x 8 EPROM | XO-489 |
| K6 | FG2 2764-3 8K x 8 EPROM | XO-489 |
| K7-8 | FG3 2764-3 8K x 8 EPROM | XO-489 |
| K9, K10, K11 | 74LS157 Quad 2-input multiplexer | XO-390 |
| K12 | 74LS260 Dual 5-input "NOR" gate | XO-93 |
| K13 | 74LS32 Quad 2-input "OR" gate | XO-433 |
| K14 | 74LS08 Quad 2-input "AND" gate | XO-86 |
| K15 | 74LS04 Hex inverter | XO-418 |
| K16 | 74LS20 Dual 4-input "NAND" gate | XO-430 |
| K17 | 74S161 Synchronous presettable binary counter | XO-488 |
| L4, L5, L6, L7 | 74LS166 8-bit shift register | XO-391 |
| L10 | 74LS74 Dual flip flop | XO-434 |
| L11 | 74LS20 Dual 4-input "NAND" gate | XO-430 |
| L12 | 74LS161 Synchronous presettable binary counter | XO-440 |
| L13 | 74S74 Dual D-type pos. edge trig. flip flop (T. I. only) | XO-87 |
| L13-14 | 74S04 Hex inverter | XO-400 |



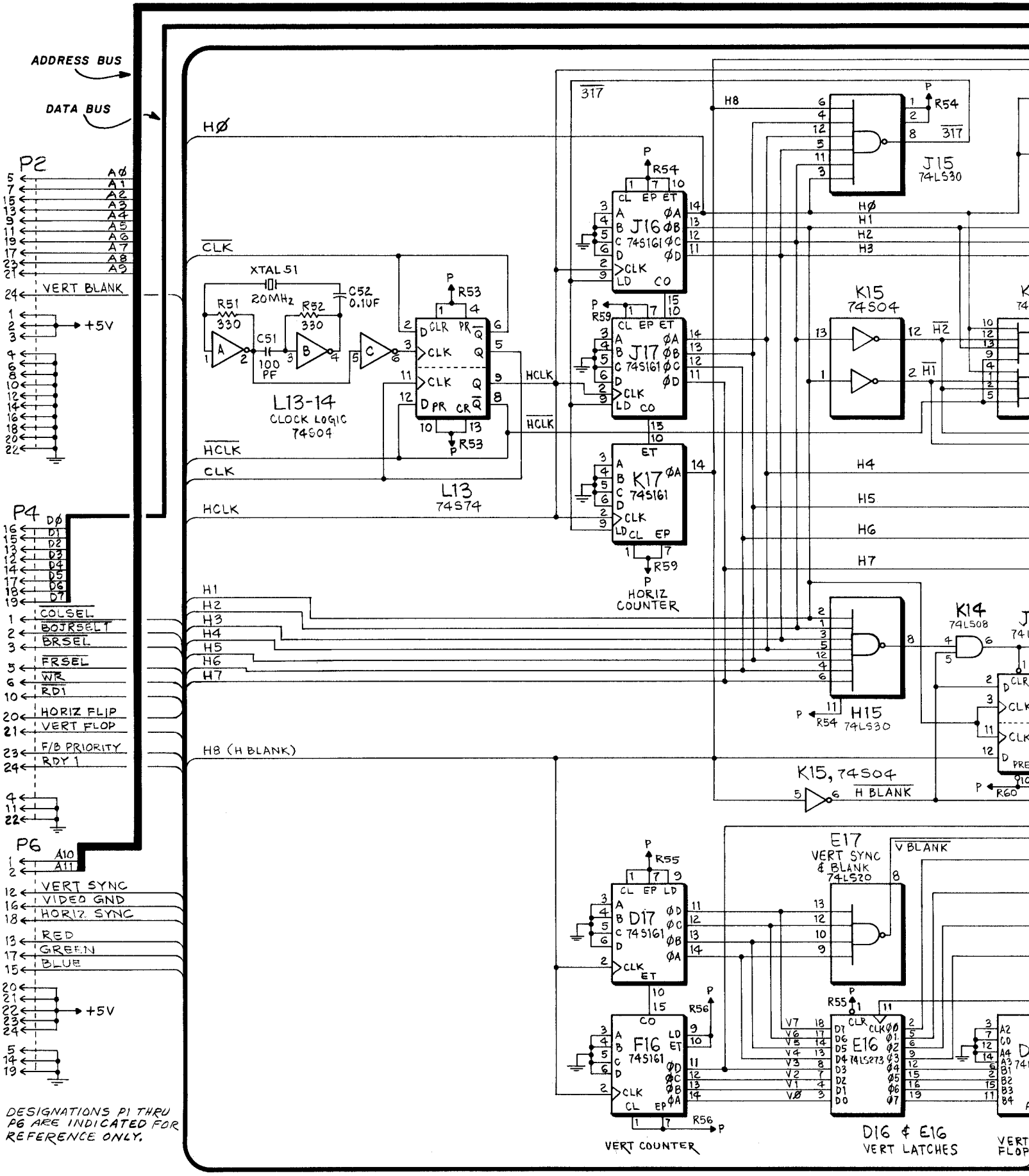



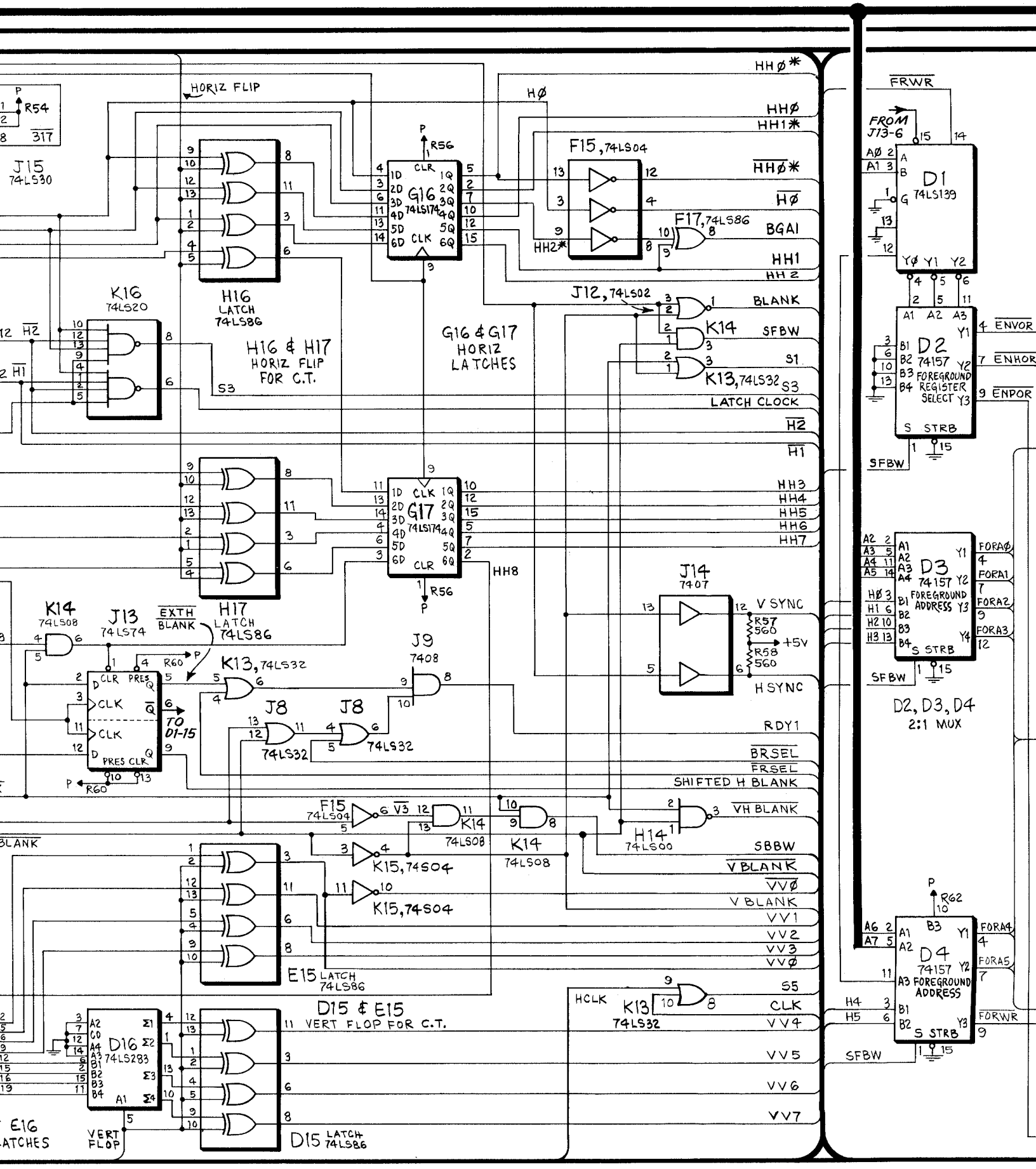
# X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

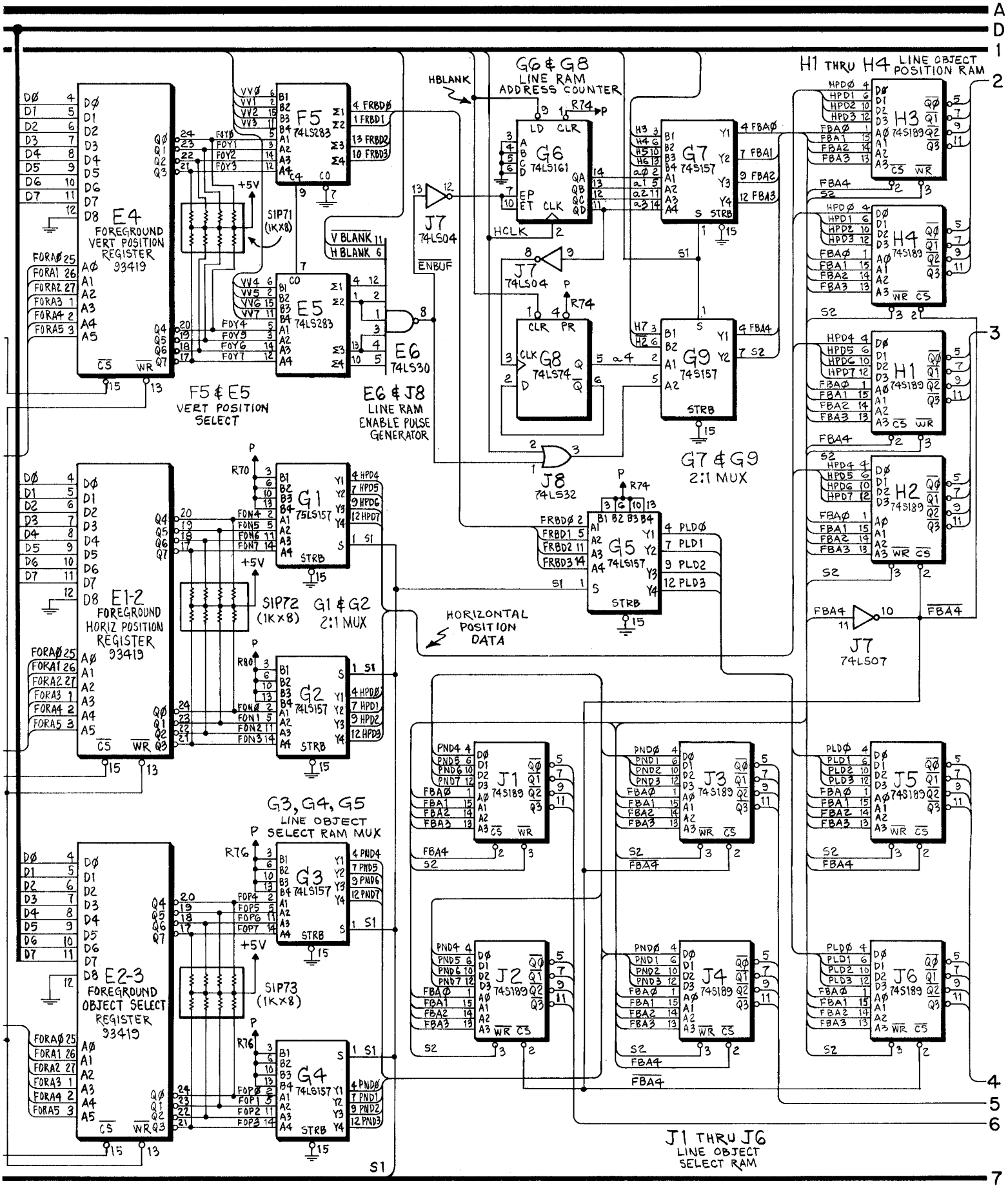




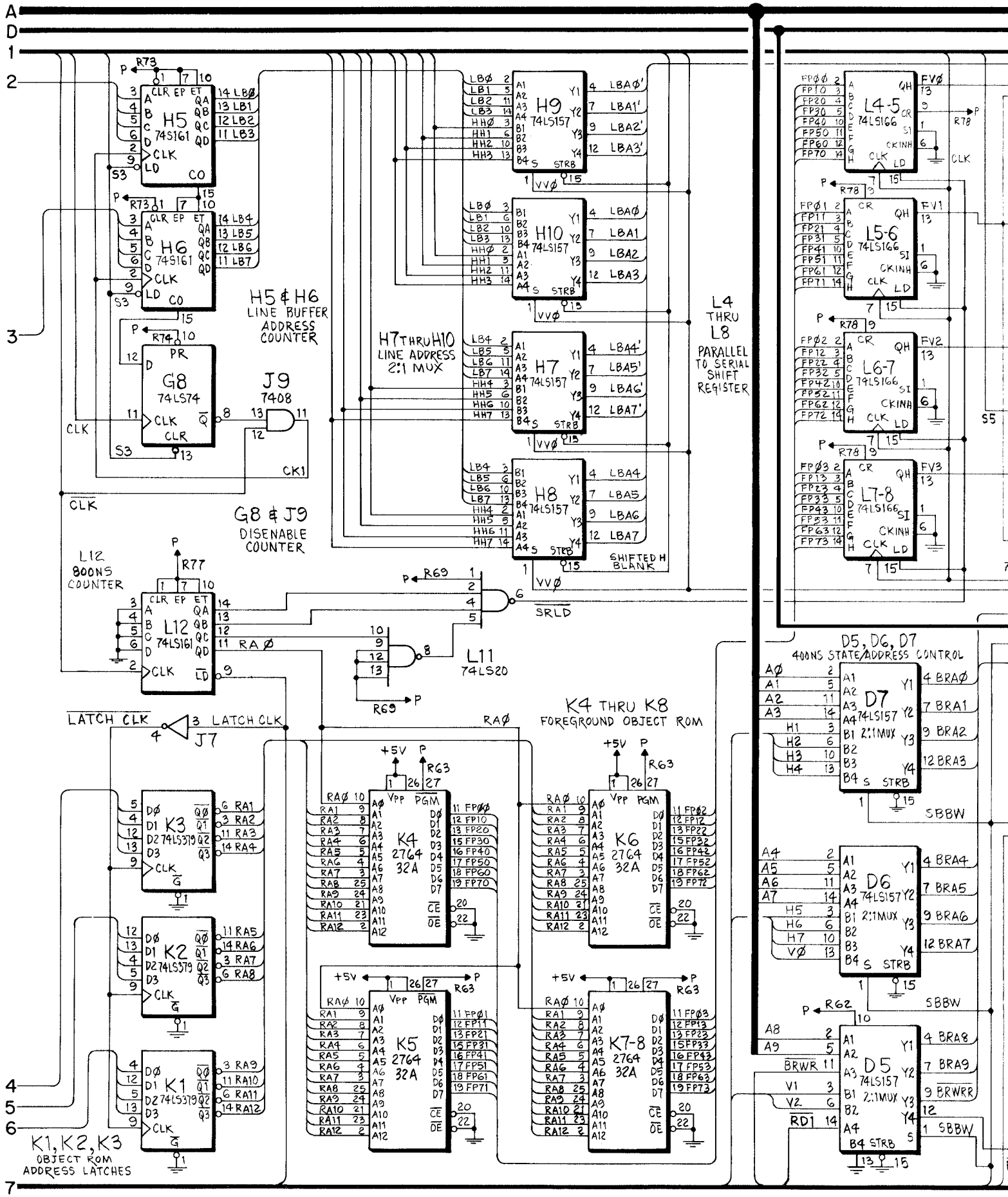

# LOGIC BOARD ASSY. (A1), SCHEMATIC DIAGRAM, SHEET 1 OF 3

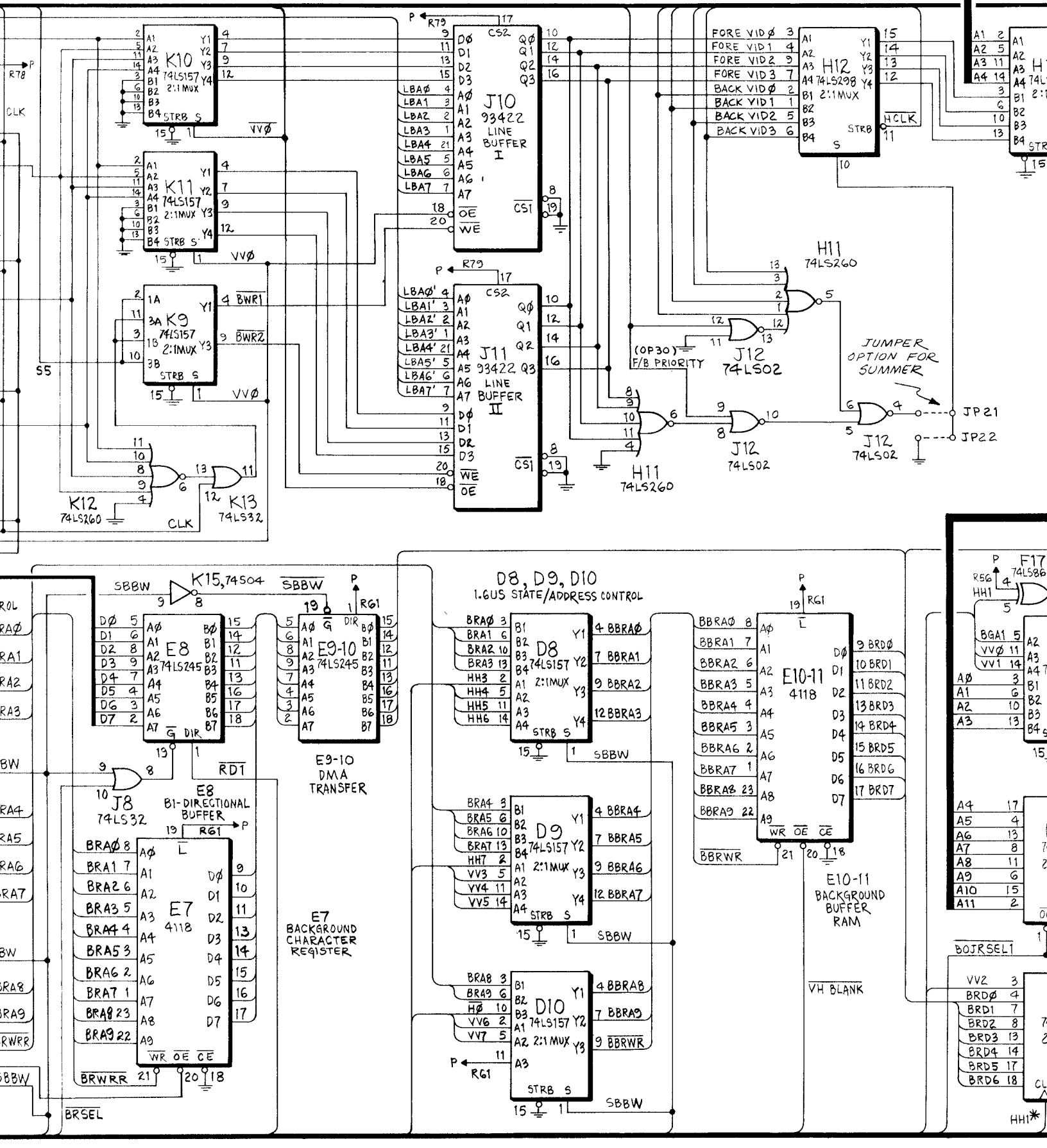

ADDRESS BUS
DATA BUS
P2
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
VERT BLANK
+5V
P4
D0
D1
D2
D3
D4
D5
D6
D7
COLSEL
BOJRSELT
BRSEL
FRSEL
WR
RD1
HORIZ FLIP
VERT FLOP
F/B PRIORITY
RDY 1
P6
A10
A11
VERT SYNC
VIDEO GND
HORIZ SYNC
RED
GREEN
BLUE
+5V
DESIGNATIONS P1 THRU P6 ARE INDICATED FOR REFERENCE ONLY.
HØ
CLK
XTAL 51
20MHz
C52 0.1UF
R51 330
R52 330
C51 100 PF
L13-14
CLOCK LOGIC
74S04
L13
74S74
HCLK
317
H8
J15
74LS30
J16
J17
74S161
K15
74S04
K17
HORIZ COUNTER
K14
74LS08
H15
74LS30
K15, 74S04
H BLANK
H1
H2
H3
H4
H5
H6
H7
H8 (H BLANK)
D17
F16
VERT COUNTER
E17
VERT SYNC & BLANK
74LS20
V BLANK
E16
74LS273
D16 & E16
VERT LATCHES

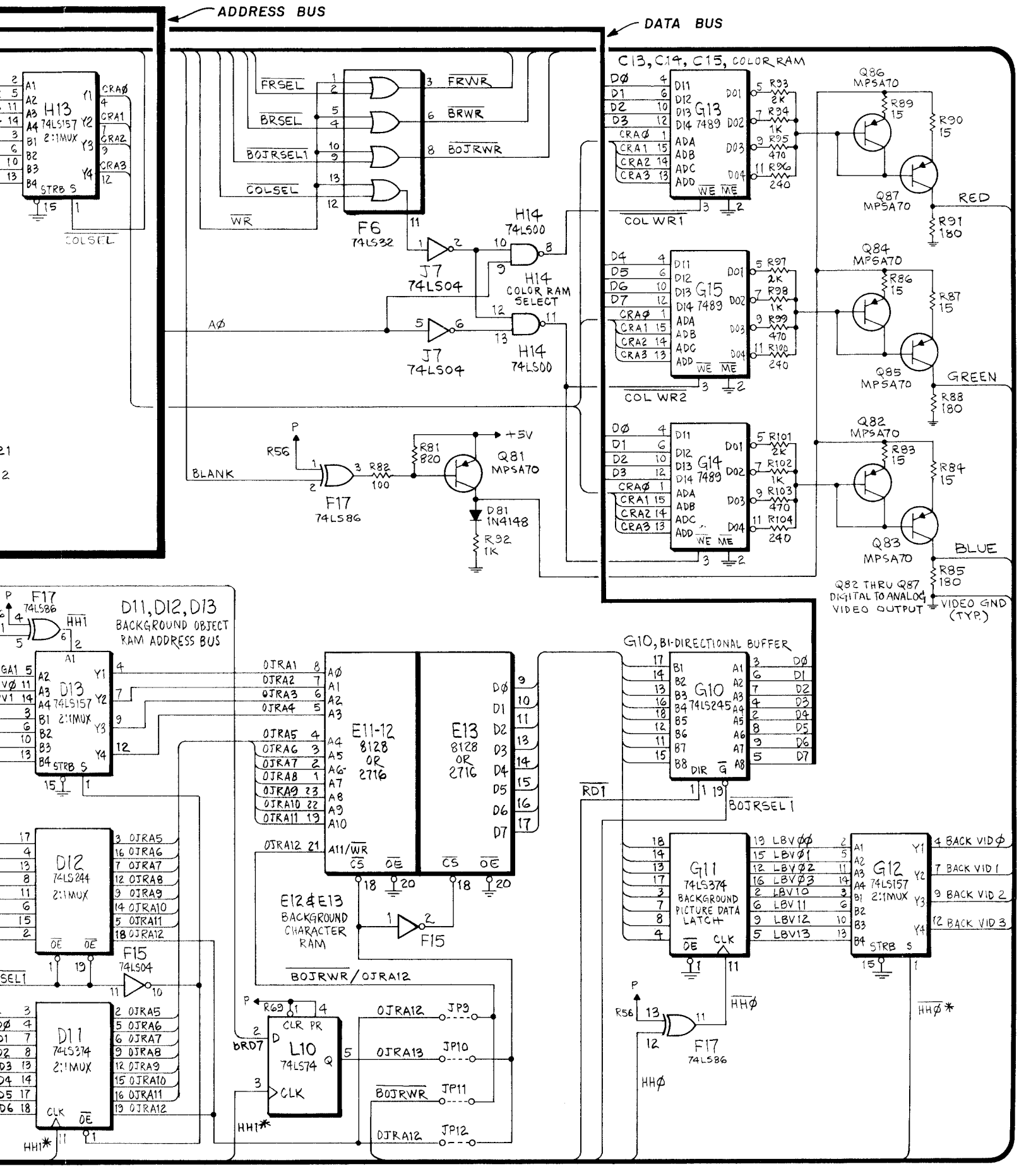

HORIZ FLIP
J15 74LS30
R54
317
H16 LATCH 74LS86
K16 74LS20
H16 & H17 HORIZ FLIP FOR C.T.
G16 & G17 HORIZ LATCHES
G16 74LS174
G17 74LS174
R56
F15, 74LS04
F17, 74LS86
J12, 74LS02
K14 74LS08
K13, 74LS32
HHØ*
HH1*
HHØ*
HØ
BGAI
HH1
HH2
BLANK
SFBW
S1
S3
LATCH CLOCK
H2
H1
HH3
HH4
HH5
HH6
HH7
HH8
J14 7407
V SYNC
R57 560
R58 560
+5V
H SYNC
K14 74LS08
J13 74LS74
EXTH BLANK
H17 LATCH 74LS86
R60
K13, 74LS32
J9 7408
J8
74LS32
TO D1-15
RDY1
BRSEL
FRSEL
SHIFTED H BLANK
F15 74LS04
K14 74LS08
K15, 74S04
H14 74LS00
VH BLANK
SBBW
V BLANK
VVØ
VV1
VV2
VV3
VVØ
E15 LATCH 74LS86
D15 & E15
11 VERT FLOP FOR C.T.
D16 74LS283
VERT FLOP
D15 LATCH 74LS86
E16 LATCHES
HCLK
K13 74LS32
S5
CLK
VV4
VV5
VV6
VV7
FRWR
FROM J13-6
D1 74LS139
D2 74157 FOREGROUND REGISTER SELECT
ENVOR
ENHOR
ENPOR
D3 74157 FOREGROUND ADDRESS
FORAØ
FORA1
FORA2
FORA3
D2, D3, D4 2:1 MUX
R62
D4 74157 FOREGROUND ADDRESS
FORA4
FORA5
FORWR
SFBW




**LOGIC BOARD ASSY. (A1), SCHEMATIC DIAGRAM, SHEET 2 OF 3**


H5 74S161
H6 74S161
H5 & H6 LINE BUFFER ADDRESS COUNTER
G8 74LS74
J9 7408
G8 & J9 DISENABLE COUNTER
H7 THRU H10 LINE ADDRESS 2:1 MUX
H9 74LS157
H10 74LS157
H7 74LS157
H8 74LS157
L4 THRU L8 PARALLEL TO SERIAL SHIFT REGISTER
L4-5 74LS166
L5-6 74LS166
L6-7 74LS166
L7-8 74LS166
SHIFTED H BLANK
L12 800NS COUNTER
L12 74LS161
L11 74LS20
SRLD
LATCH CLK
J7
K1, K2, K3 OBJECT ROM ADDRESS LATCHES
K4 THRU K8 FOREGROUND OBJECT ROM
K4 2764 32A
K5 2764 32A
K6 2764 32A
K7-8 2764 32A
D5, D6, D7 400NS STATE/ADDRESS CONTROL
D7 74LS157
D6 74LS157
D5 74LS157
SBBW
CLK
CK1
RA0

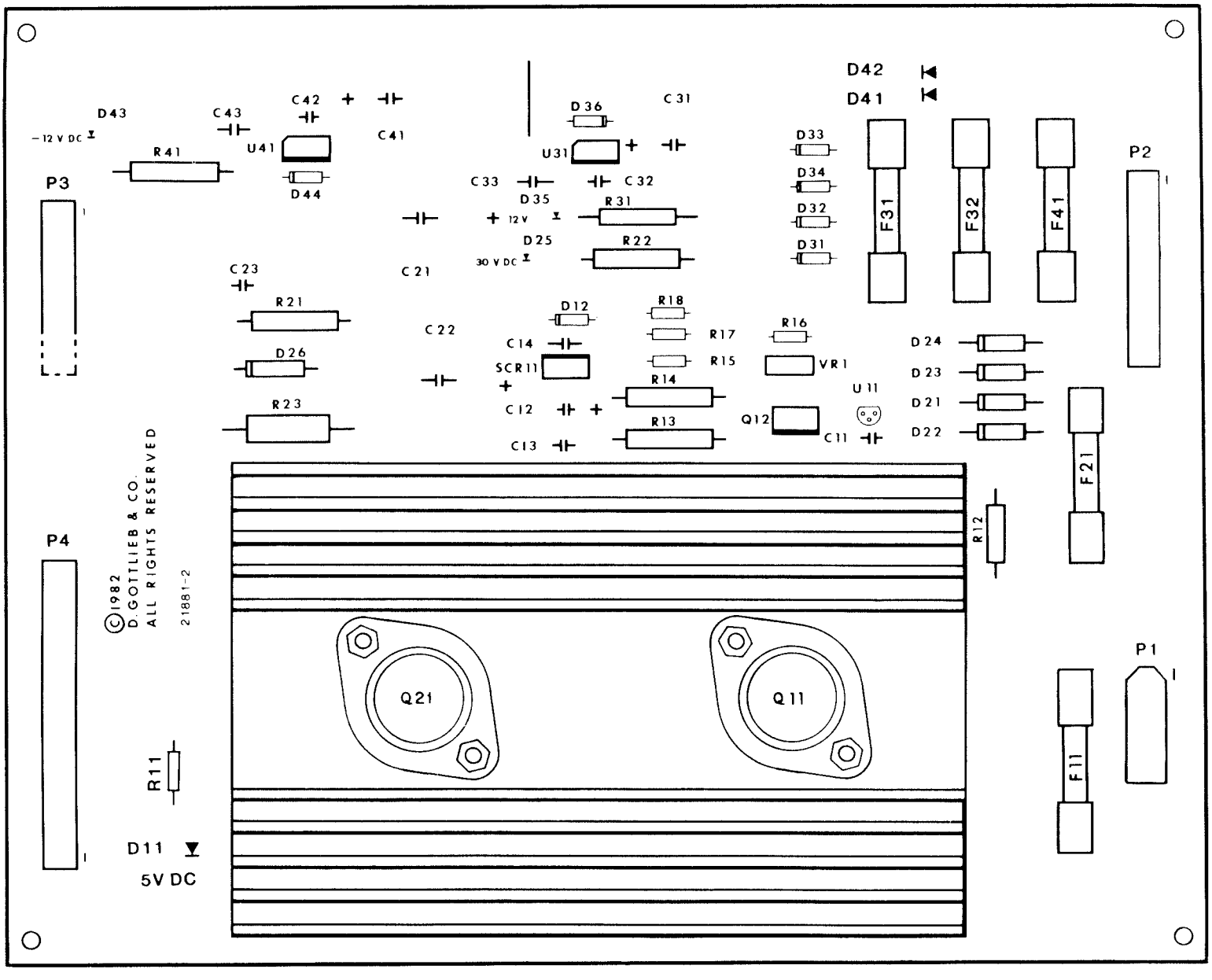

K10 74LS157 2:1MUX
K11 74LS157 2:1MUX
K9 74LS157 2:1MUX
K12 74LS260
K13 74LS32
J10 93422 LINE BUFFER I
J11 93422 LINE BUFFER II
H12 74LS298 2:1MUX
H11 74LS260
J12 74LS02
(OP30) F/B PRIORITY
JUMPER OPTION FOR SUMMER
JP21
JP22
FORE VID0
FORE VID1
FORE VID2
FORE VID3
BACK VID0
BACK VID1
BACK VID2
BACK VID3
HCLK
VV0
BWR1
BWR2
CLK
SS
K15, 74S04
E8 74LS245
E9-10 74LS245
E9-10 DMA TRANSFER
E8 BI-DIRECTIONAL BUFFER
J8 74LS32
RD1
E7 4118
E7 BACKGROUND CHARACTER REGISTER
BRSEL
D8, D9, D10
I.GUS STATE/ADDRESS CONTROL
D8 74LS157 2:1MUX
D9 74LS157 2:1MUX
D10 74LS157 2:1MUX
SBBW
RG1
E10-11 4118
E10-11 BACKGROUND BUFFER RAM
BBRWR
VH BLANK
F17 74LS86
BOJRSEL1




**LOGIC BOARD ASSY. (A1), SCHEMATIC DIAGRAM, SHEET 3 OF 3**

# X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

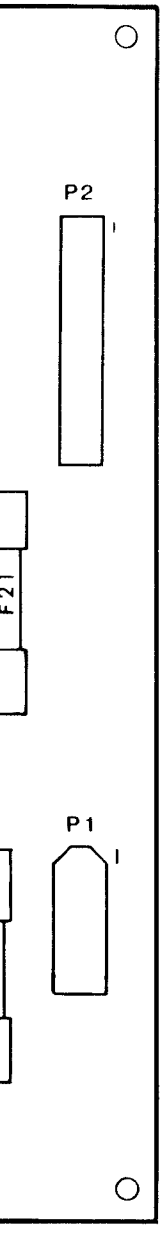
## POWER SUPPLY ASSY. (A3), COMPONENT LOCATION




## POWER SUPPLY ASSY. (A3), PARTS LIST

| REFERENCE | DESCRIPTION | PART NO. |
|---|---|---|
| | Power Supply Assy. | MA-430 |
| C11, C32, C42 | Capacitor, .01 mfd., 50V | XO-229 |
| C12 | Capacitor, 100UF, 16V | XO-235 |
| C13, C23 | Capacitor, 0.1UF, 100V | XO-234 |
| C14, C33, C43 | Capacitor, 0.2UF, 16V | XO-205 |
| C21, C22 | Capacitor, 2200UF, 75V | XO-132 |
| C31, C41 | Capacitor, 470UF, 35V | XO-284 |
| D11, D25 | | |
| D35, D43 | Diode, Light Emitting MV-5752 | XO-270 |
| D12 | Diode, Zener, 5.6V, 5%, 1W, 1N4734A | XO-255 |
| D21-D24 | Diode, 1N5401 | XO-263 |
| D26 | Diode, Zener, 30V, 5%, 5W, 1N5363B | XO-273 |
| D31-D34, D36 | | |
| D41, D42, D44 | Diode, 1N4004 | XO-254 |
| F11 | Fuse, 6¼ AMP SLO-BLO | EL-8 |
| F21 | Fuse, 2 AMP SLO-BLO | EL-7 |
| F31, F32 | Fuse, ¼ AMP SLO-BLO | EL-5 |
| F41 | Fuse, 1 AMP SLO-BLO | EL-6 |
| P1 | Connector, 4 PIN | PS-87 |

| REFERENCE | DESCRIPTION | PART NO. |
|---|---|---|
| P2 | Connector, 10 PIN | XO-531 |
| P3 | Connector, 7 PIN | XO-526 |
| P4 | Connector, 16 PIN | XO-372 |
| Q11 | Transistor, PNP, 2N5879 | XO-323 |
| Q12 | Transistor, NPN, T1P31B | XO-641 |
| Q21 | Transistor, NPN, 2N3055 | XO-301 |
| R11 | Resistor, 470 OHM, 5% ½W | XO-55 |
| R12 | Resistor, 100 OHM, 5% 1W | XO-137 |
| R13, R14 | Resistor, 12 OHM, 5% 2W | XO-138 |
| R15 | Resistor, 200 OHM, 5% ¼W | XO-143 |
| R16 | Resistor, 180 OHM, 5% ¼W | XO-24 |
| R17 | Resistor, 100 OHM, 5% ¼W | XO-28 |
| R18 | Resistor, 20 OHM, 5% ¼W | XO-29 |
| R21, R22 | Resistor, 1.8KOHM, 5% 2W | XO-135 |
| R23 | Resistor, 200 OHM, 5% 5W | XO-133 |
| R31, R41 | Resistor, 750 OHM, 5% 1W | XO-136 |
| SCR11 | Silicon Controlled Rectifier | XO-131 |
| U11 | Diode, Programmable Zener TL431 | XO-272 |
| U31 | Voltage Regulator +12V, LM 340T | XO-473 |
| U41 | Voltage Regulator -12V, LM 320 | XO-130 |
| VR1 | Potentiometer, 100 OHM | XO-134 |




T NO.

31
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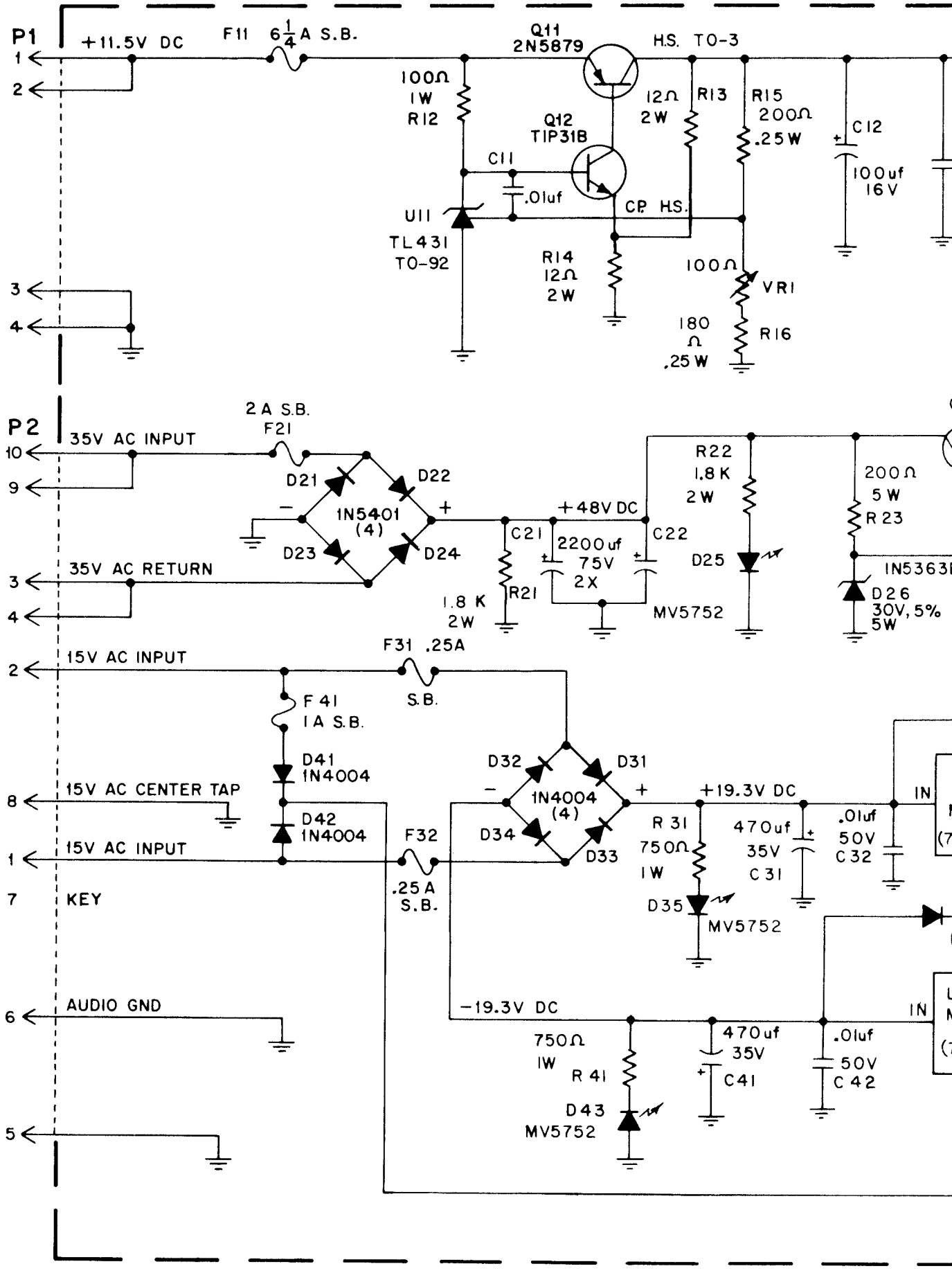
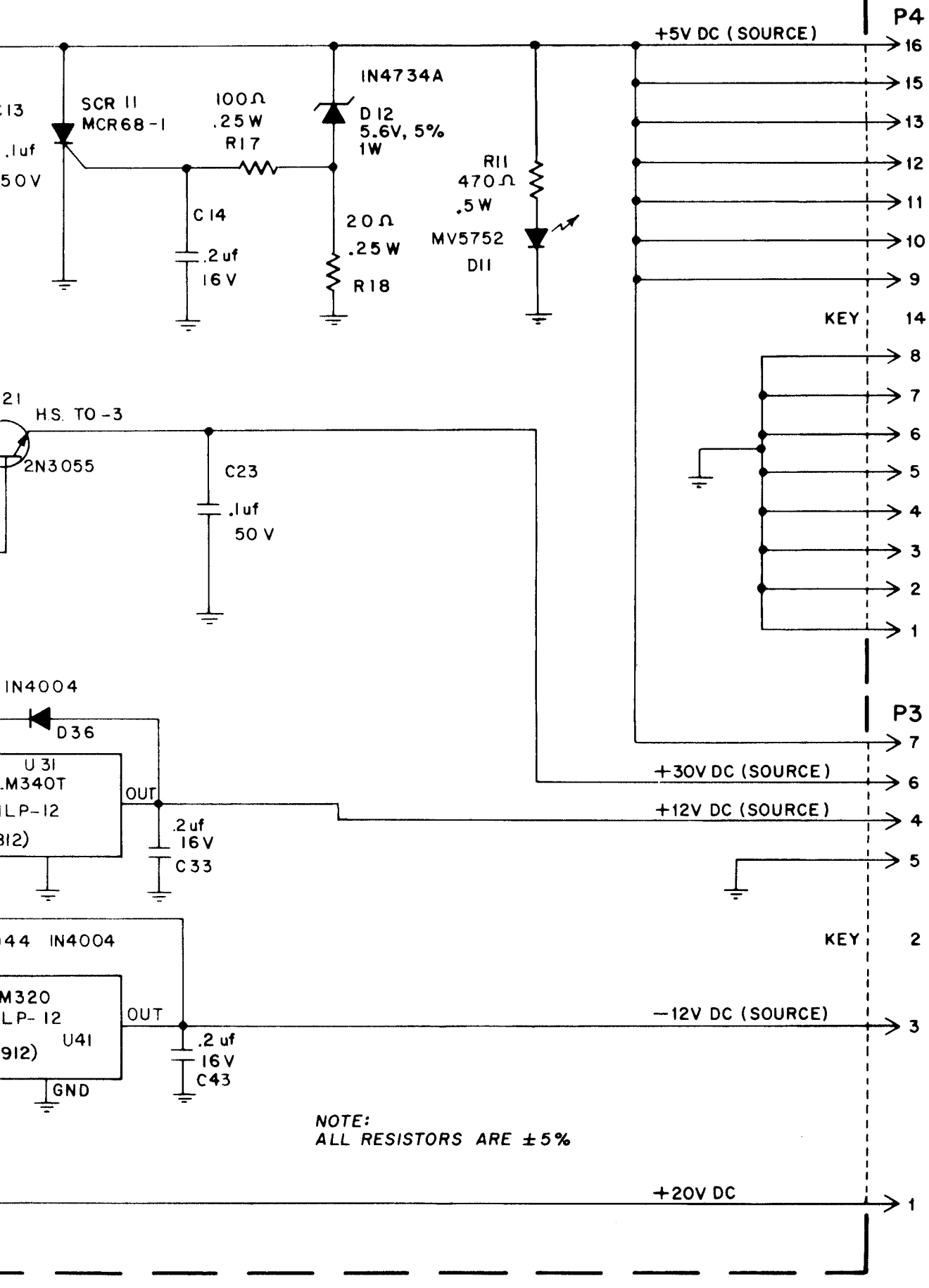
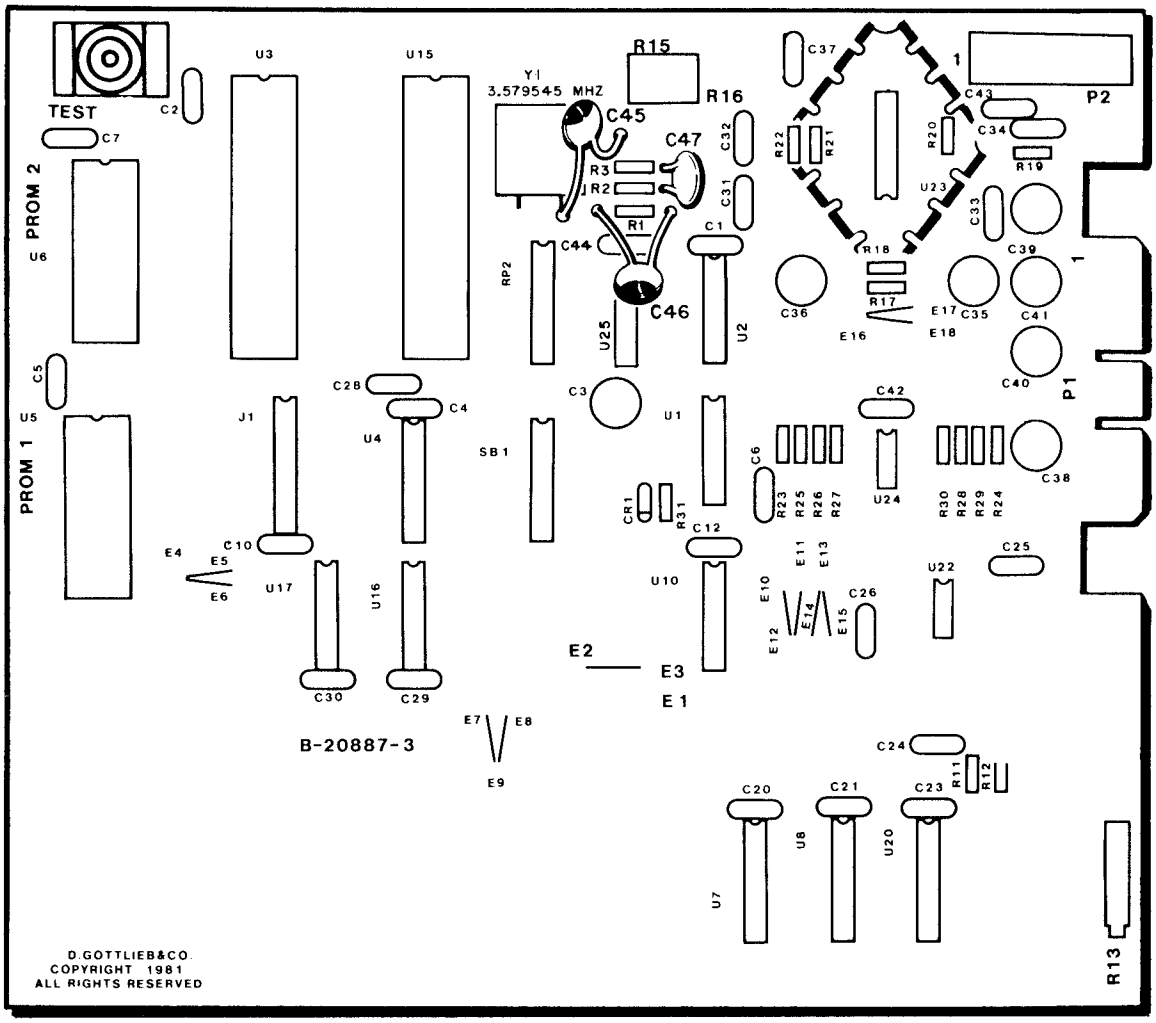





**POWER SUPPLY ASSY. (A3), SCHEMATIC DIAGRAM**

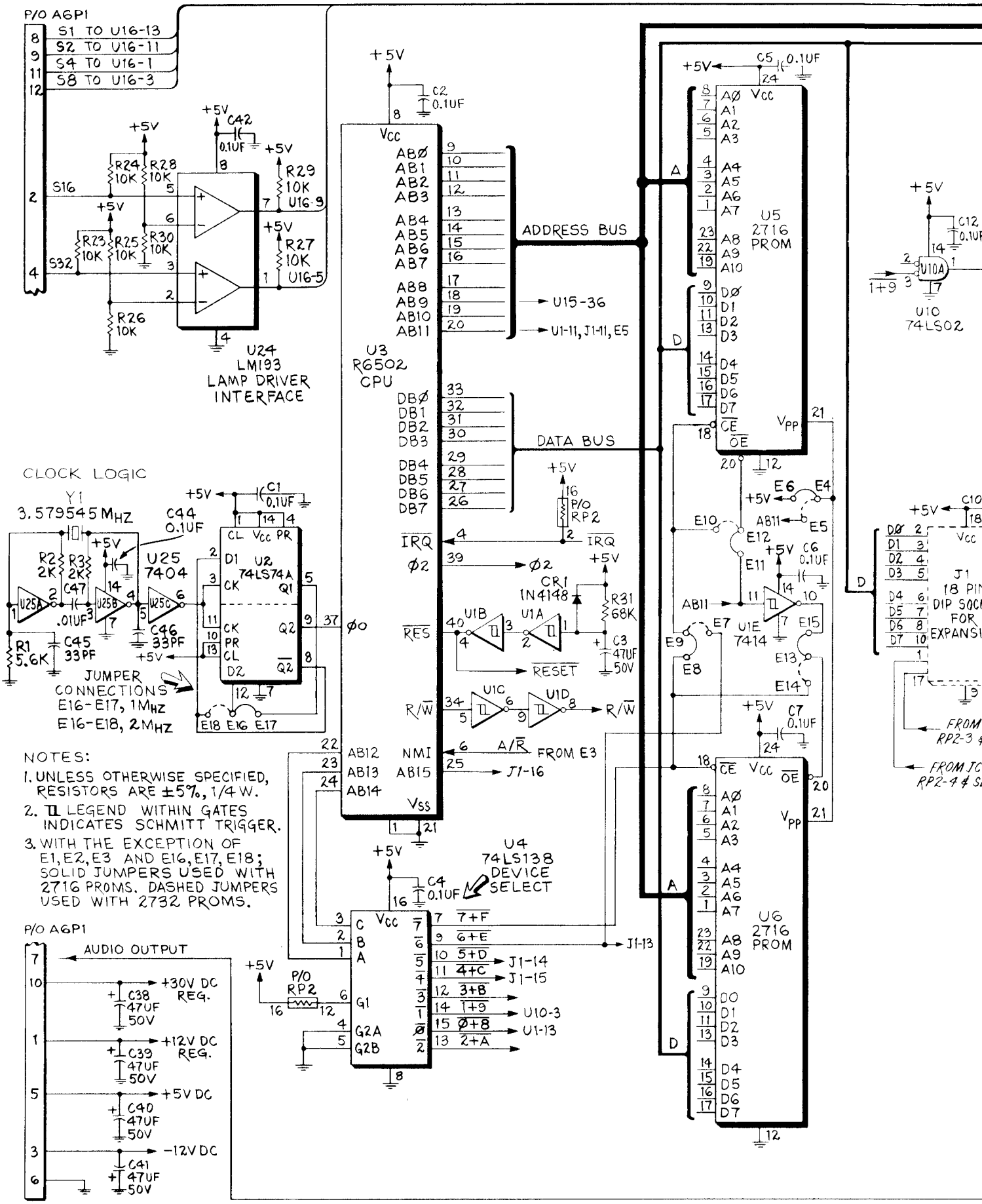
# X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

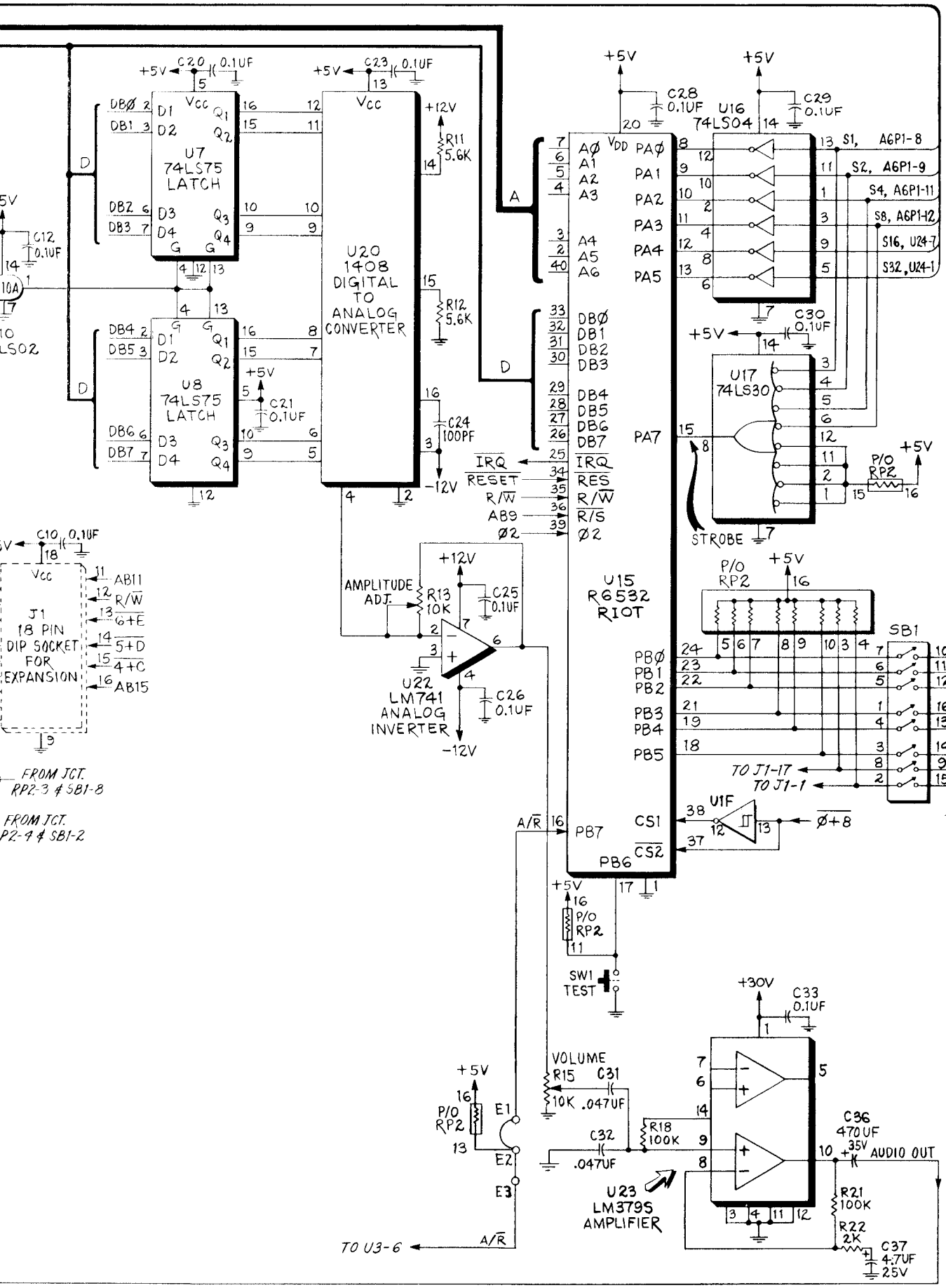
## SOUND BOARD ASSY. (A6), COMPONENT LOCATION



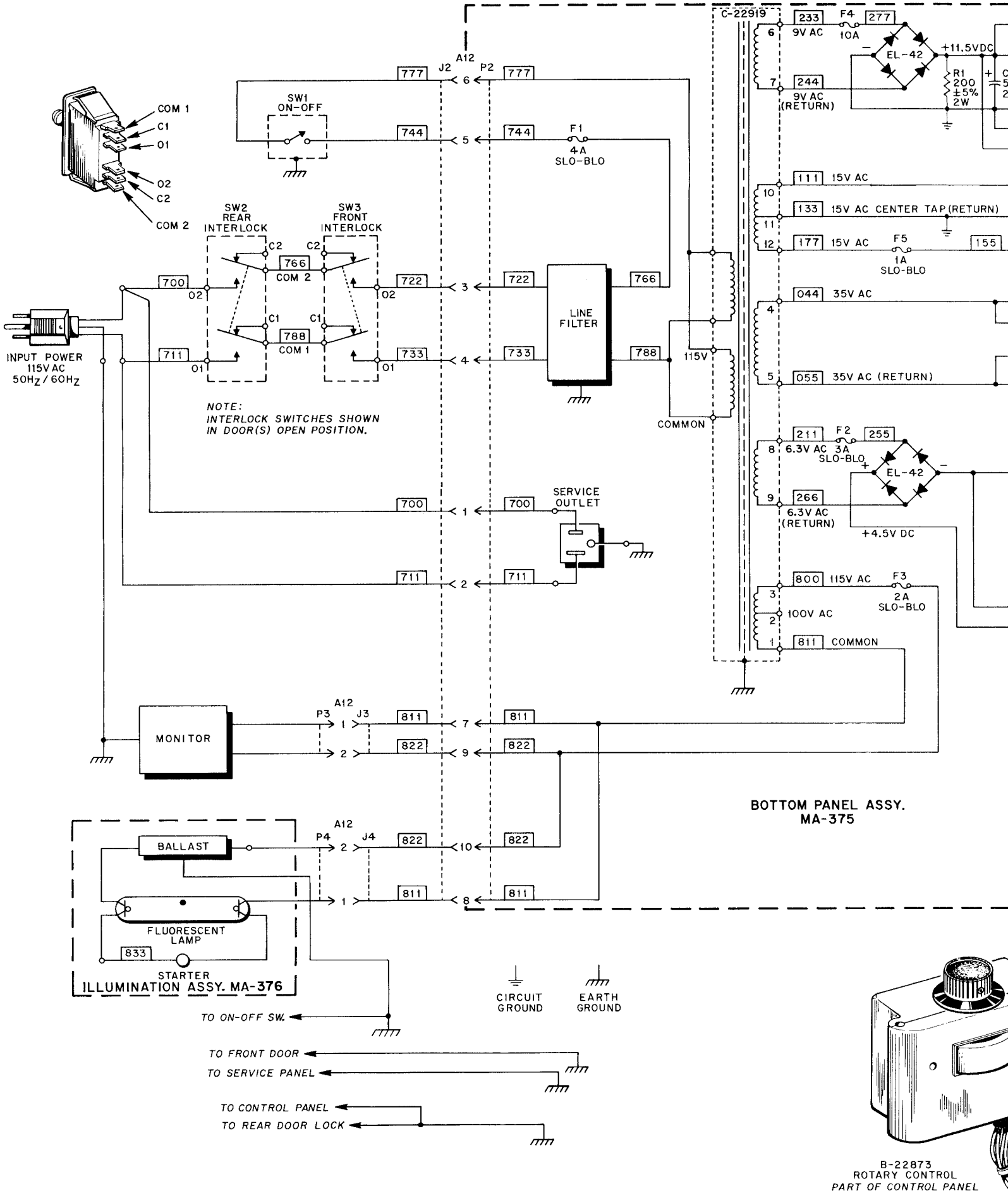

## SOUND BOARD ASSY. (A6), PARTS LIST

| REFERENCE | DESCRIPTION | PART NUMBER |
|---|---|---|
| | Sound Board Assembly | MA-309 |
| C1, C2<br>C4-C7, C10<br>C12, C20, C21<br>C23, C25, C26<br>C28, C29, C30<br>C33, C42, C44 | Capacitor, 0.1UF, 25V | XO-248 |
| C31, C32 | Capacitor, .047UF, 25V | XO-222 |
| C37 | Capacitor, 4.7UF, 35V | XO-291 |
| C3, C38-C41 | Capacitor, 47UF, 50V | XO-210 |
| C24 | Capacitor, 100PF | XO-223 |
| C36 | Capacitor, 470UF, 35V | XO-284 |
| C45, C46 | Capacitor, 33PF | XO-277 |
| C47 | Capacitor, .01UF, 100V | XO-202 |
| CR1 | Diode, 1N4148 | XO-261 |
| R1, R11, R12 | Resistor, 5.6K ohm, 5%, 1/4W | XO-19 |
| R2, R3 | Resistor, 2K ohm, 5%, 1/4W | XO-14 |
| R13 | Potentiometer, 10K ohm | XO-108 |
| R23-R30 | Resistor, 10K ohm, 5%, 1/4W | XO-18 |
| R15 | Potentiometer, 10K ohm | XO-109 |
| R18, R21 | Resistor, 100K ohm, 5%, 1/4W | XO-45 |
| R22 | Resistor, 2K ohm, 5%, 1/4W | XO-14 |
| R31 | Resistor, 68K ohm, 5%, 1/4W | XO-189 |
| RP2 | Resistor, DIP | XO-168 |
| SB1 | Switch, DIP | XO-505 |
| SW1 | Switch, Momentary Pushbutton | XO-515 |
| U1 | IC, 7414 | XO-397 |
| U2 | IC, SN74LS74N | XO-434 |
| U3 | CPU, R6502-13 | XO-360 |
| U4 | IC, SN74LS138N | XO-437 |
| U5, U6 | EPROM, 2716 | PR-53 |
| U7 | IC, SN74LS75 | XO-394 |
| U10 | IC, SN74LS02N | XO-428 |
| U15 | RRIOT, R6532-18 | XO-361 |
| U16 | IC, SN74LS04N | XO-418 |
| U17 | IC, SN74LS30N | XO-432 |
| U20 | Converter, PMI, 1408A-6P | XO-416 |
| U22 | IC, LM741CP | XO-393 |
| U23 | IC, LM379S | XO-395 |
| U24 | IC, Dual Comparitor, LM193 | XO-396 |
| U25 | Inverter, 7404 | XO-402 |
| Y1 | Crystal, 3.579545MHZ | XO-456 |
| | Socket, 22 Pin DIP | XO-467 |
| | Socket, 24 Pin (2) | XO-529 |
| | Socket, 40 Pin (2) | XO-530 |


P/O A6P1
S1 TO U16-13
S2 TO U16-11
S4 TO U16-1
S8 TO U16-3
U24
LM193
LAMP DRIVER
INTERFACE
U3
R6502
CPU
ADDRESS BUS
DATA BUS
U15-36
U1-11, J1-11, E5
U5
2716
PROM
U6
2716
PROM
U4
74LS138
DEVICE
SELECT
U10
74LS02
CLOCK LOGIC
Y1
3.579545 MHZ
U25
7404
U2
74LS74A
JUMPER
CONNECTIONS
E16-E17, 1MHZ
E16-E18, 2MHZ
CR1
IN4148
U1E
7414
RESET
IRQ
NOTES:
1. UNLESS OTHERWISE SPECIFIED, RESISTORS ARE ±5%, 1/4 W.
2. ⊓ LEGEND WITHIN GATES INDICATES SCHMITT TRIGGER.
3. WITH THE EXCEPTION OF E1, E2, E3 AND E16, E17, E18; SOLID JUMPERS USED WITH 2716 PROMS. DASHED JUMPERS USED WITH 2732 PROMS.
P/O A6P1
AUDIO OUTPUT
+30V DC REG.
+12V DC REG.
+5V DC
-12V DC



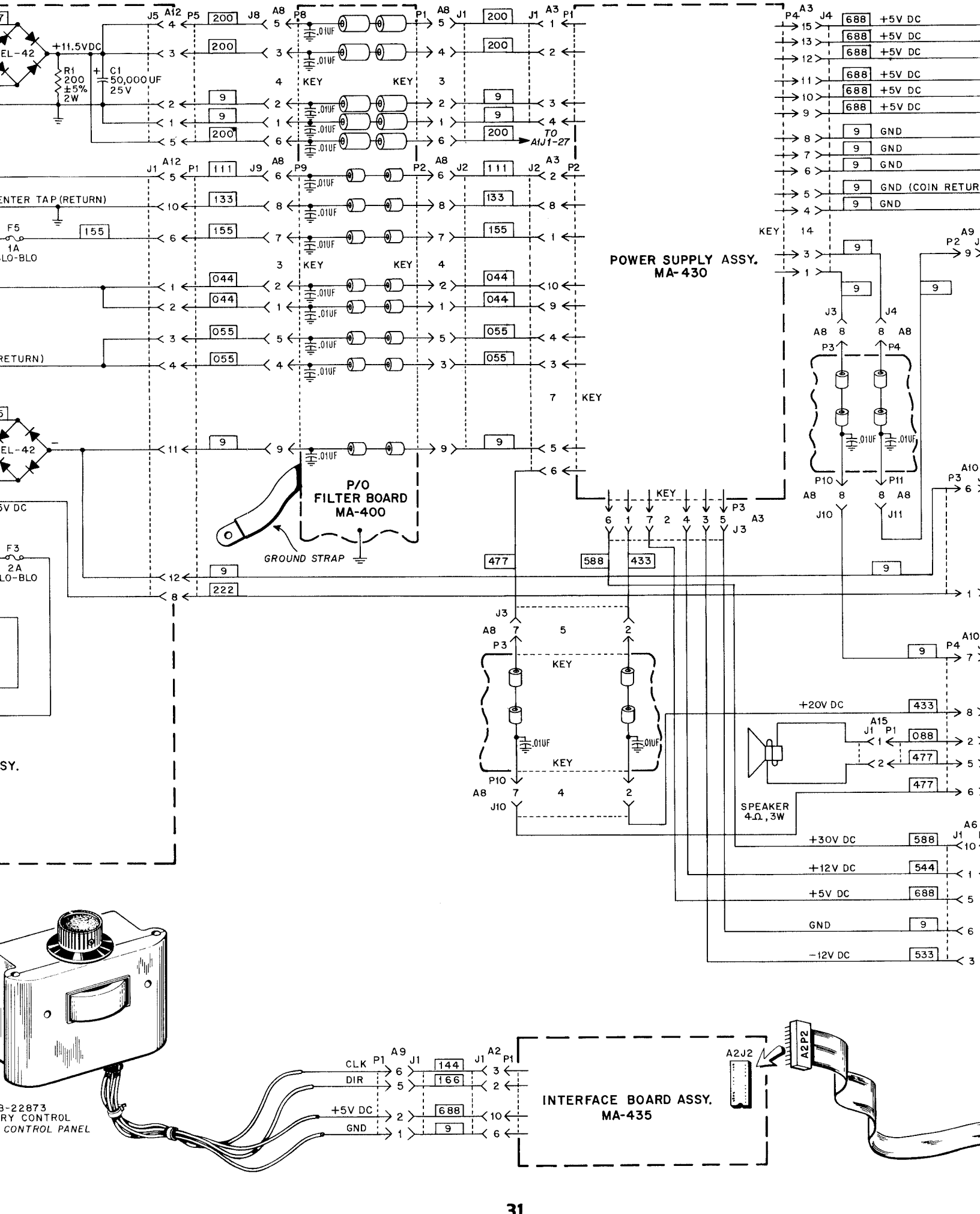

## SOUND BOARD ASSY. (A6), SCHEMATIC DIAGRAM

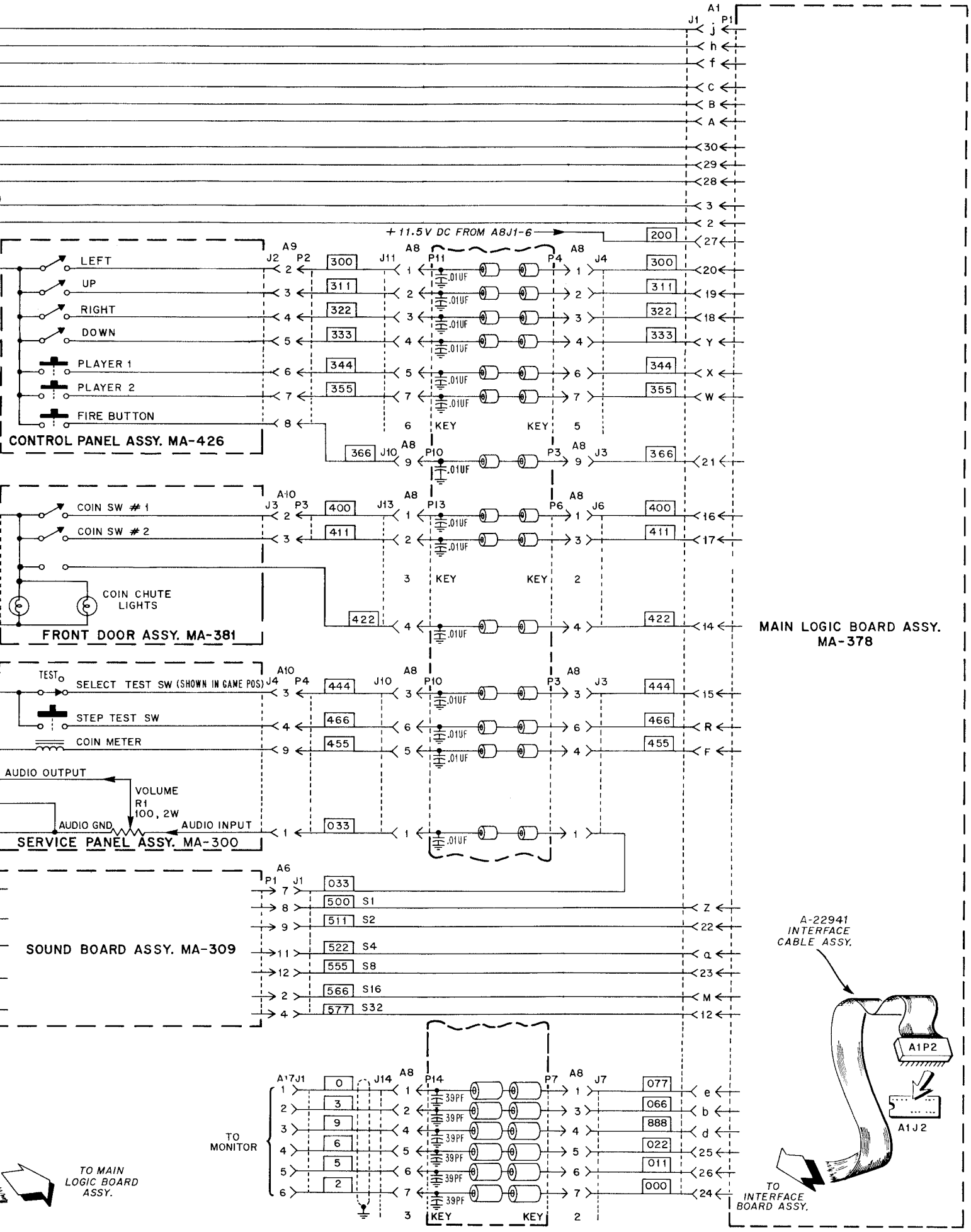




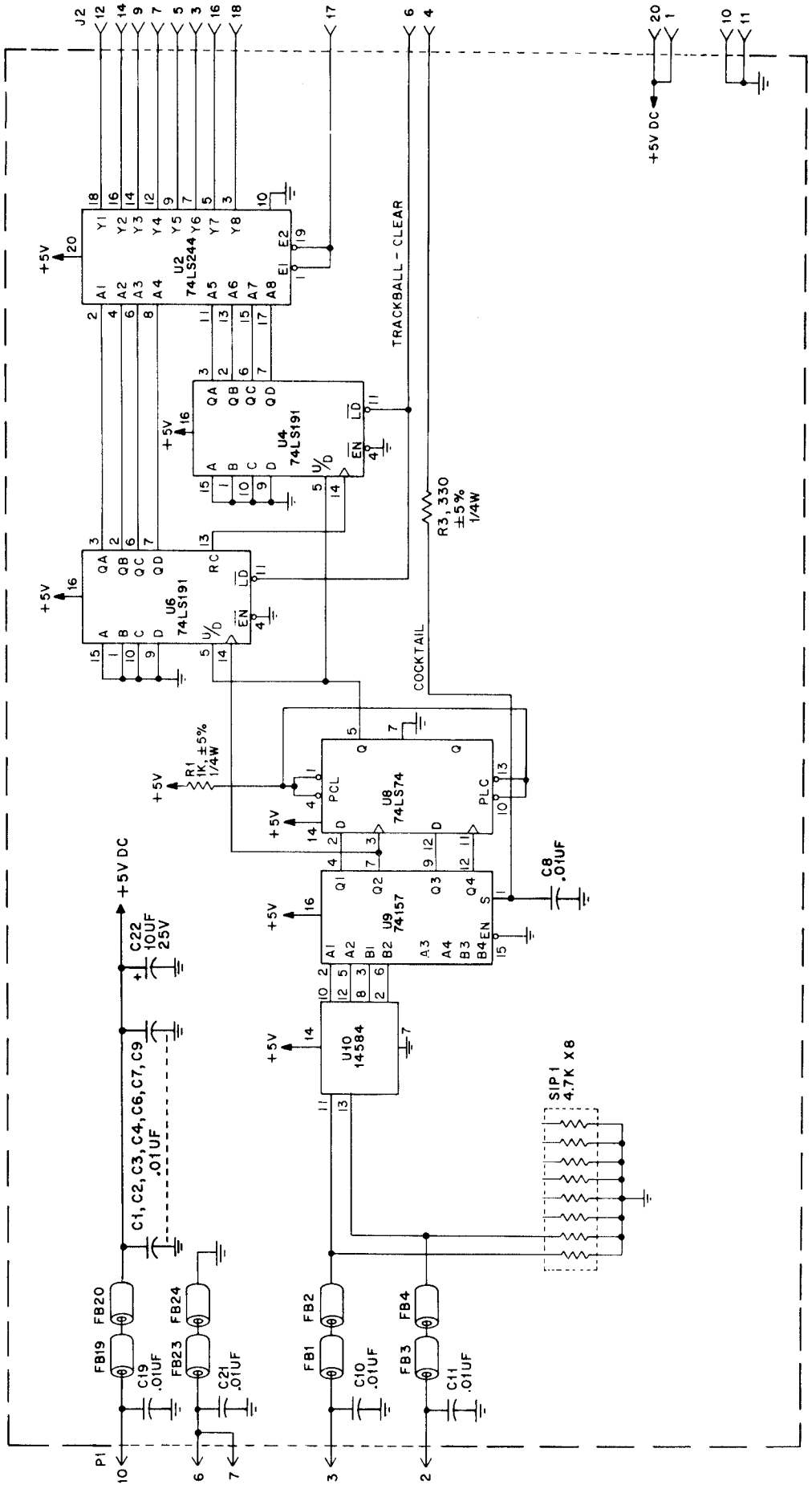

B-22873
ROTARY CONTROL
*PART OF CONTROL PANEL*

# X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS





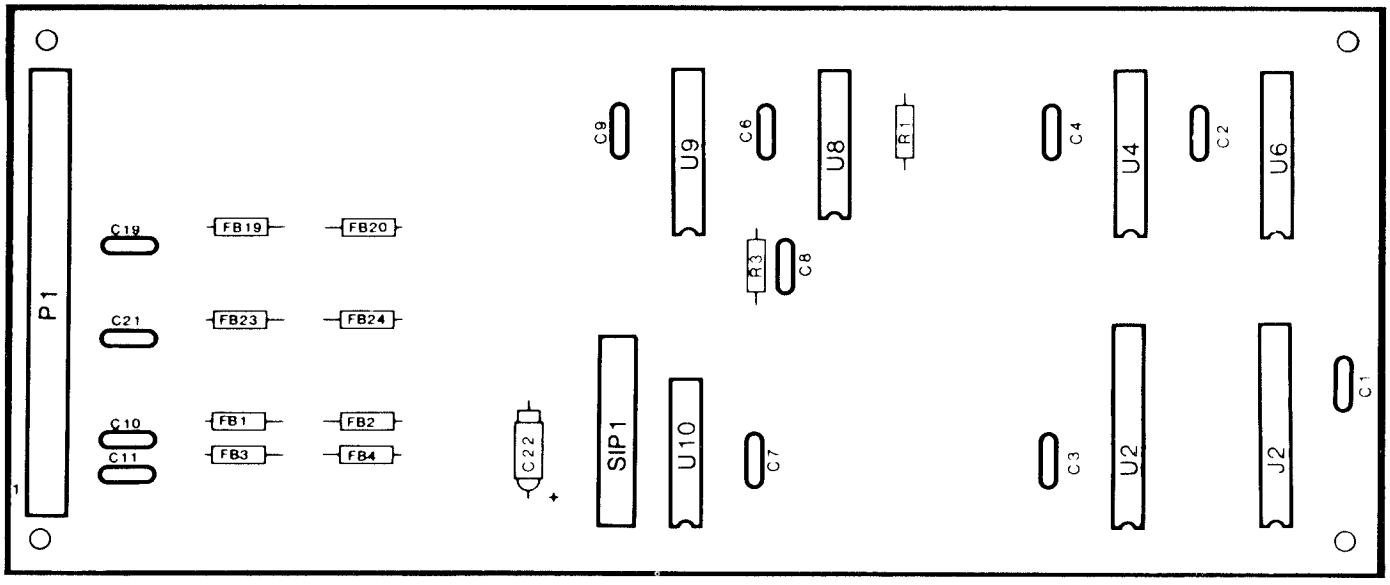

# PRIMARY POWER/INTERCONNECTION DIAGRAM




INTERFACE ASSY. (A2), SCHEMATIC DIAGRAM

# X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

## INTERFACE ASSY. (A2), COMPONENT LOCATION




## INTERFACE ASSY. (A2), PARTS LIST

| ITEM | DESCRIPTION | PART NO. |
|---|---|---|
| | Interface Board Assy. | MA-435 |
| C1-C4 | Capacitor, .01UF, 50V, AX. CM. | XO-229 |
| C6-C11 | | |
| C19, C21 | | |
| C22 | Capacitor, 10UF, 25V, AX. TANT | XO-127 |
| R1 | Resistor, 1K OHM, 5%, 1/4W | XO-5 |
| R3 | Resistor, 330 OHM, 5%, 1/4W | XO-34 |
| SIP 1 | Resistor, DIP, 4.7K, 9 Pin | XO-492 |
| FB1-FB4 | Ferrite Bead | XO-338 |
| FB19, FB20 | | |
| FB23, FB24 | | |
| J2 | Socket, DIP, 20 Pin | XO-491 |
| U2 | IC, 74LS244, Octal Buffer | XO-117 |
| U4, U6 | IC, 74LS191, Binary Counter | XO-116 |
| U8 | IC, 74LS74, Dual Flip-Flop | XO-434 |
| U9 | IC, 74157, 2-1 Multiplexer | XO-114 |
| U10 | IC, 14584, CMOS Inverter | XO-119 |
| P1 | Plug, 14 Pin | XO-145 |

# LIMITED WARRANTY

D. Gottlieb & Co. warrants to the initial purchaser of the D. Gottlieb & Co. machine that the items listed in the following schedule as installed and used in the original D. Gottlieb & Co. machine will for the applicable period set forth in the schedule, computed from the initial date of purchase from an authorized D. Gottlieb & Co. distributor, be free of defects in materials and workmanship:

## SCHEDULE

| GAME | ITEM | WARRANTY PERIOD |
|---|---|---|
| Pinball | All Electronic Printed circuit boards | 90 days |
| Pinball-Video | All Electronic Printed Circuit Boards | 90 days |
| | Card Cage | 90 days |
| | Television Monitor | 30 days |
| Video | All Electronic Printed Circuit Boards | 90 days |
| | Television Monitor | 30 days |

This Limited Warranty does not apply to any parts damaged in the course of handling or assembling by the customer or damage due to other than normal use or use in violation of instructions or reasonable practices, or further damaged in return shipment. This Limited Warranty is made only to the original customer, and is and shall be in lieu of all other warranties expressed or implied, and of all other obligations or liabilities on the part of D. Gottlieb & Co. and in no event shall D. Gottlieb & Co. be liable for any anticipated profits, consequential damages, loss of time, or other losses incurred by the customer in connection with the purchase or operation of D. Gottlieb & Co. machines or components thereof.

The registration card with each D. Gottlieb & Co. factory-wired machine must be filled in and returned to D. Gottlieb & Co. within ten days after date of purchase for this Limited Warranty to be effective. This Limited Warranty applies only to machines so registered.

THIS LIMITED WARRANTY IS IN LIEU OF ANY OTHER EXPRESS OR IMPLIED WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS, AND OF ANY OTHER OBLIGATION ON THE PART OF THE SELLER AND D. GOTTLIEB & CO.

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