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KRUULL



Instruction Manual

 **Gottlieb**

KRULL (GAME GV-105) INSTRUCTION MANUAL

TABLE OF CONTENTS

SEC.		PAGE
I.	INSTALLATION	1
II.	INITIALIZATION	3
III.	GAME OPERATION	3
IV.	GAME PLAY AND SCORING	4
V.	SOUND/SPEECH	6
VI.	GAME ADJUSTMENTS/OPTIONS	6
VII.	BOOKKEEPING AND SELF TEST	7
VIII.	GENERAL INFORMATION	9
IX.	THEORY OF OPERATION	11
X.	WRING AND SCHEMATIC DIAGRAMS	12
XI.	PARTS INFORMATION	33

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

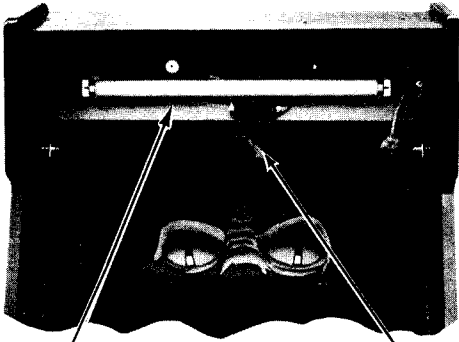
WARNING: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart 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.

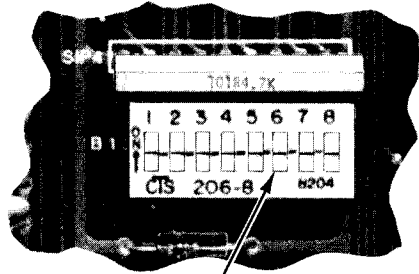
FOR SERVICE, CALL TOLL FREE: 1-800-323-9121; (ILLINOIS) 1-800-942-1620

I. INSTALLATION

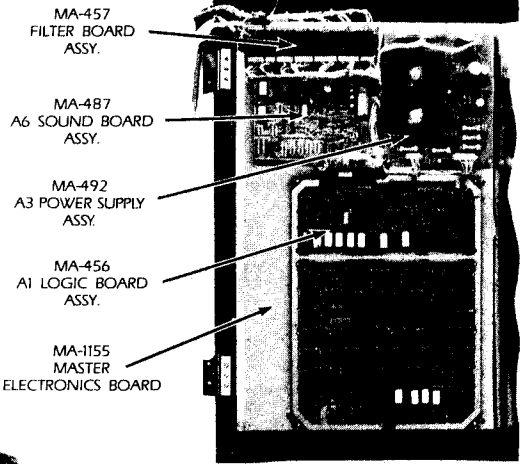


MA-376
ILLUMINATION
ASSY.

MA-459
SPEAKER
ASSY.



GAME ADJUSTMENT
SWITCHES
(PART OF A1 LOGIC BOARD)



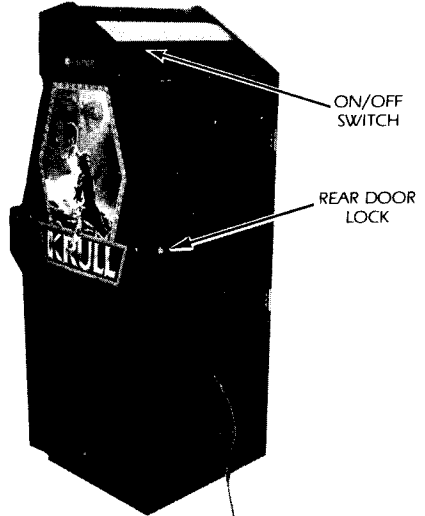
MA-457
FILTER BOARD
ASSY.

MA-487
A6 SOUND BOARD
ASSY.

MA-492
A3 POWER SUPPLY
ASSY.

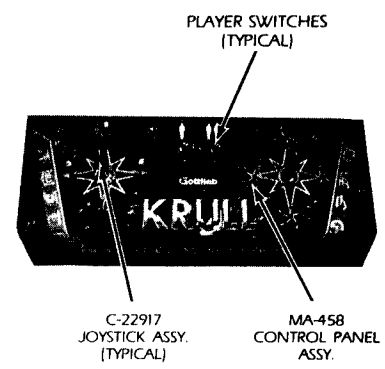
MA-456
A1 LOGIC BOARD
ASSY.

MA-1155
MASTER
ELECTRONICS BOARD



ON/OFF
SWITCH

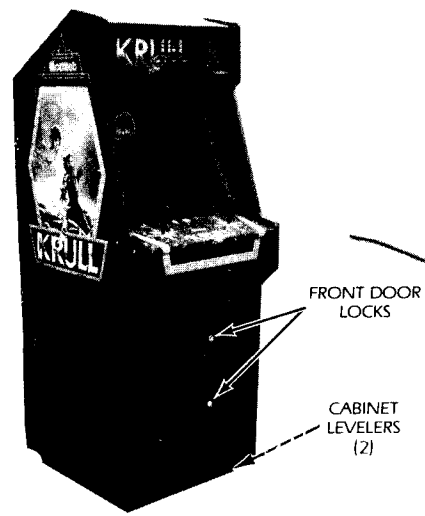
REAR DOOR
LOCK



PLAYER SWITCHES
(TYPICAL)

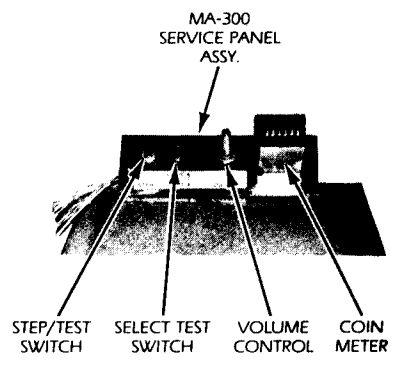
C-22917
JOYSTICK ASSY.
(TYPICAL)

MA-458
CONTROL PANEL
ASSY.



FRONT DOOR
LOCKS

CABINET
LEVELERS
(2)



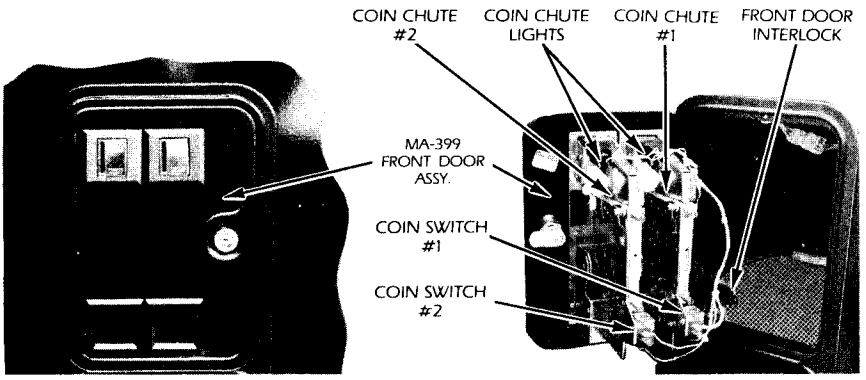
MA-300
SERVICE PANEL
ASSY.

STEP/TEST
SWITCH

SELECT TEST
SWITCH

VOLUME
CONTROL

COIN
METER



COIN CHUTE
#2

COIN CHUTE
LIGHTS

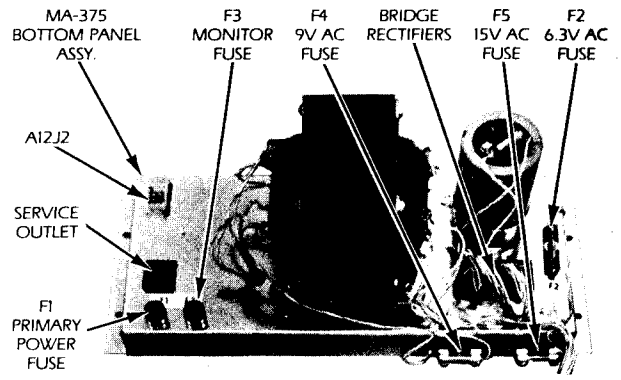
COIN CHUTE
#1

FRONT DOOR
INTERLOCK

MA-399
FRONT DOOR
ASSY.

COIN SWITCH
#1

COIN SWITCH
#2



MA-375
BOTTOM PANEL
ASSY.

F3
MONITOR
FUUSE

F4
9V AC
FUUSE

BRIDGE
RECTIFIERS

F5
15V AC
FUUSE

F2
6.3V AC
FUUSE

A12J2

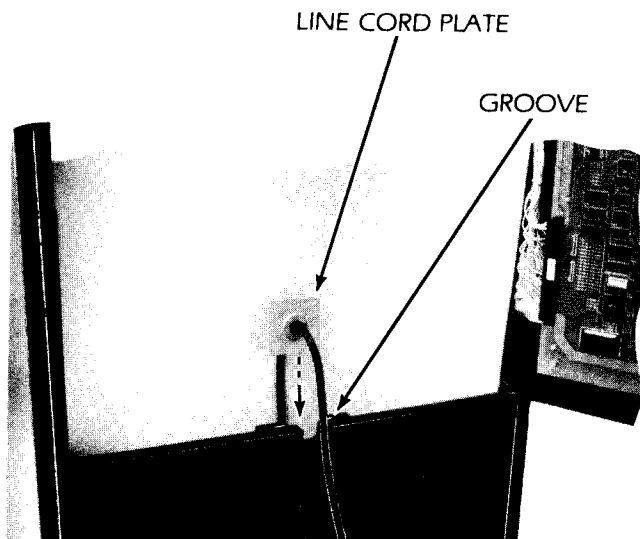
SERVICE
OUTLET

F1
PRIMARY
POWER
FUUSE

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. Unlatch the control panel latch at the top center of the panel. Note where the latch strike plate is located. Remove the carriage bolts.
4. Pull the control panel back, grasp it at the front edge as far back as it will go (approximately 1/4").
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's and leaf-switches are now accessible for removal or cleaning.
8. For reassembly, reverse the above procedure.

D. MONITOR REMOVAL

1. Unplug the game.
2. Perform the control panel assembly removal procedure (Section C).
3. Unlock and open the rear cabinet door.
4. 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.
5. Disconnect the video plug A17J1, the monitor power supply plug A12J3/A12P3 and the ground wire from the monitor chassis.
6. 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.
7. Remove the monitor from the rear of the game, being careful to clear all cables from the CRT neck.
8. For reassembly, reverse the above procedure.

I. INSTALLATION, II. INITIALIZATION, III. GAME OPERATION

I. INSTALLATION

E. SPEAKER ASSEMBLY AND MARQUEE REMOVAL

1. Unplug the game.
2. Unlock and open the back door.
3. Unplug the A15-J1/P1 connector.
4. Unlatch the two latches on the rear of the Speaker Assembly Panel located inside the back door above the monitor.
5. On the front of the game, pull down on the lower molding under the marquee. The Speaker Assembly will lower to allow removal of the marquee.
6. Remove the marquee by lifting it upward out of its track. The Speaker Assembly and Illumination Assembly are now accessible for servicing.
7. Tilt the front of the Speaker Assembly downward while lifting the center upward.

Pull the assembly straight out to remove. Be careful not to pinch the Speaker Assembly cable.

8. For reassembly, reverse the above procedure. When replacing the marquee:
 - a. Tilt the front of the Speaker Assembly downward.
 - b. Place the bottom of the marquee in the lower molding track on the front of the assembly.
 - c. Apply slight pressure with your thumbs to the lower left and right corners of the marquee.
 - d. Slowly raise the Speaker Assembly until the top of the marquee is in place in the upper track in the top molding.
 - e. Be certain to reconnect the A15-J1/P1 connector and relatch the rear assembly latches.

II. INITIALIZATION

TURN GAME ON

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

- B. The playing field cycles through the following:

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

AFTER A TEN SECOND DELAY

- A. The attract mode appears on the screen.

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. Total Credits are decreased by one.
 - b. 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 "COLWYN 2" and a zero in the second player's display.

D. COLWYN'S/EXTRA COLWYN'S

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

IV. GAME PLAY AND SCORING

HOW TO PLAY

CONTROL PANEL

The left joystick controls the movement of the player character, Colwyn. He can be moved in any one of eight directions. The right joystick controls the movement of the player's weapon, the glaive. It can be thrown in any one of eight directions. Four glaives can be in flight at one time and will return to Colwyn with a boomerang-type action. The one and two player select buttons are also located on the panel.

Krull consists of five subgames: (1) The Mountain Game, (2) The Swamp Game, (3) The Fortress Game, (4) The Hexagon Game and (5) The Beast Game. The player must accomplish a task in each of the five games with eight levels of difficulty in each. All eight levels can be reached in one task based on the time spent performing that task (amount of time spent on that subgame). The total number of lethal characters on the screen at one time increases as the levels increase.

"FROM THE SKY WILL COME THE BLACK FORTRESS. FROM THE FORTRESS WILL COME THE SLAYERS, TO DEVOUR THE PLANET OF KRULL. THEN SHALL A GIRL OF ANCIENT NAME BECOME QUEEN, AND THE KING SHE CHOOSES SHALL RULE THE PLANET."

The planet Krull is threatened by the Beast. His army of Slayers has brought terror to the land. Colwyn must stop this terror and save the land and its people. On the day Colwyn is to wed the Princess Lyssa, the Slayers, army of the Beast, kidnap her to become the Beast's bride. Colwyn must reach the Black Fortress and reclaim his Princess. He who marries the Princess shall be king. The Beast must not be allowed to rule the planet.

A prophet acquaints Colwyn with the magical properties of the glaive, a five-bladed sword, which Colwyn must acquire. To accomplish this task, he must climb the mountain and collect the five individual blades of the glaive in order to assemble the weapon. The blade is picked up by touching Colwyn to the blade. Boulders are fatal and must be avoided. The weapon joystick is not

utilized in this subgame. The player is awarded 1000 points for each blade picked up. Points are also awarded for placing Colwyn in a dangerous position in front of one or more boulders.

During his travels to discover the Black Fortress, Colwyn comes upon an army of eight men that he befriends and recruits to help him in his quest to destroy the Beast so that Krull can be safe from his evil.

With no intentions of losing his newly acquired bride without bloodshed, the Beast orders an army of Slayers to stop Colwyn and his friends. Forging through the quicksand-riddled swamps, Slayers materialize from the soil and Colwyn prepares for battle. In the second subgame, Colwyn must save as many friends as possible while killing all of the Slayers. The friends are saved by touching them and the Slayers are destroyed by the glaive. The Slayers themselves and their spears must be avoided. The game begins with eight friends. The number of friends saved is the number of friends carried over into future subgames. The friends can eliminate the Slayers with hand-to-hand combat but can also be destroyed themselves. Receiving three blows either by hand-to-hand or by the Slayer's spear is fatal to the friends. The subgame ends when there are no longer any friends to save and all of the Slayers have been eliminated. Avoid quicksand, as it slows Colwyn's attack. Each friend saved awards 1000 points (maximum 8000 points) and 100 points for each Slayer the player eliminates.

After days of travel, Colwyn and his men have found the Black Fortress in the Iron Desert where many dangers await them. While attempting to lead his men through the dangerous narrow passageways that lead to the Fortress, Slayers materialize once again in a second attempt to stop Colwyn's struggle. In this third subgame, Colwyn must pick up all of his friends and deposit them safely into the hexagon while again combating the Slayers. The total number of friends in this subgame is equal to the total number of friends saved in Subgame 2. This subgame concludes

IV. GAME PLAY AND SCORING

when all of the friends have been delivered to the hexagon. The player is awarded 1000 points for each friend delivered to the hexagon, 100 points for each Slayer he destroys and 100 points for each Slayer remaining when the last friend is delivered to the hexagon.

Victorious in battle, Colwyn must now attempt to release his friends from the hexagon. Unlike entry, exiting the hexagon is a struggle deservant of its own merit. Once again Colwyn must call upon the power of the glaive. Release of his friends is accomplished by throwing the glaive at the front wall while it is black only. Any glaive striking the wall while it is not black will stick in the wall until the wall becomes black. The Slayers, of course, attempt to stop Colwyn's efforts. In his own attempt for survival, Colwyn must fight them off and avoid their spears. The subgame ends when the last black wall is broken through and the friends have escaped. The player is awarded 100 points for each Slayer he puts an end to, 100 points for each Slayer remaining when the friends are set free and 1000 points for the first black wall destroyed, 2000 points for the second, 3000

points for the third and 4000 points for the fourth.

Now inside the Black Fortress, Colwyn secedes from his friends in order to rescue the Princess Lyssa. He finds her in a large cave carefully guarded by the Beast. He knows that the only way to reclaim his bride and conserve the planet is to forge into battle with the Beast. In the fifth subgame, the player moves Colwyn towards the Princess in order to reach her. As he progresses, the Beast attempts to stop him by throwing fireballs at him. The fireballs must be avoided or destroyed by the glaive. If not destroyed, the fireballs will ricochet off of the walls. Destroying a fireball awards the player 100 points multiplied by the number of fireballs in flight. The Beast is momentarily stunned when hit with a glaive and awards the player 100 points. The Beast cannot be destroyed and the player must avoid touching him. When Colwyn reaches the Princess, his friends, following the pandemonium of the battle, appear and chase the Beast off, awarding 1000 points per friend. The total number of friends in this subgame is equal to the total number of friends saved in Subgame 2.



KRULL

V. SOUND, VI. GAME ADJUSTMENTS / OPTIONS

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.

Note: The Sound Board and sound ROM's installed in this game are not compatible with the Sound Board or sound ROM's used on any other game.

VI. GAME ADJUSTMENTS / OPTIONS

A. CONTROL BOARD SWITCH ADJUSTMENTS

SWITCH 1 _____ **LIVES PER GAME**
 OFF 3 LIVES
 ON 5 LIVES

SWITCH 2 _____ **ATTRACT PLAY**
 OFF SOUND
 ON NO SOUND

SWITCHES
3 **4** _____ **COIN/CREDITS**
 OFF OFF 1/1
 ON OFF 1/2
 OFF ON 2/1
 ON ON FREE PLAY

SWITCH 5 _____ **HEXAGON CONTROL**
 OFF ROVING
 ON STATIONARY

SWITCH 6 _____ **DIFFICULTY CONTROL**
 OFF NORMAL
 ON HARD

SWITCHES
7 **8** _____ **EXTRA LIVES**

		FIRST EXTRA LIFE	EACH ADDITIONAL LIFE
OFF	OFF	30,000 POINTS	EVERY 50,000 POINTS
OFF	ON	40,000 POINTS	EVERY 50,000 POINTS
ON	OFF	30,000 POINTS	EVERY 30,000 POINTS
ON	ON	50,000 POINTS	EVERY 75,000 POINTS

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

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 labeled "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 six tests are as follows:

1. MONITOR ADJUSTMENT

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

2. MEMORY TEST

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

Check sums are displayed for each ROM memory chip. If you have a suspect ROM, refer to your distributor for the correct check sum number.

3. 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.

4. 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.

DISPLAY TIME COUNTS — Same as above except each category represents play times in seconds. 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 are independent of the others. Any table may be cleared without affecting the others in any way.

RESET KRULL ELITE — Pressing either start button will reset the Krull Elite table (all time high scores).

Note: There are two high score tables. The Daily Heroes high score table is reset on power up.

5. SWITCH TEST

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

VII. BOOKKEEPING AND SELF TEST

chute will increment the appropriate value without affecting the coin meter.

Moving the MOVE joystick will display its direction of movement in the upper right corner of the screen. Moving the FIRE joystick will display its direction of movement directly under the MOVE joystick display.

6. 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 28 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 through 21 and 32 through 39. There are no sounds assigned to these numbers. These number assignments are subject to change.

VIII. GENERAL INFORMATION

A. PRINTED CIRCUIT BOARDS ARE DESIGNATED AS FOLLOWS:

- A1 Logic Board 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	6 ¼ Amp SLO-BLO
F21	Sound Board Assy. +16VDC	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. 6 Amps over-voltage protection and fused for over-current protection.
Sound Board	+16VDC	2 Amps fused for over-current protection. The reference for this circuit is a 1N4745A +16VDC Zener controlling the base of an emitter follower pass transistor.
Sound Board	+12VDC -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 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 Distributors table and the Options/Parameters screen.

X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

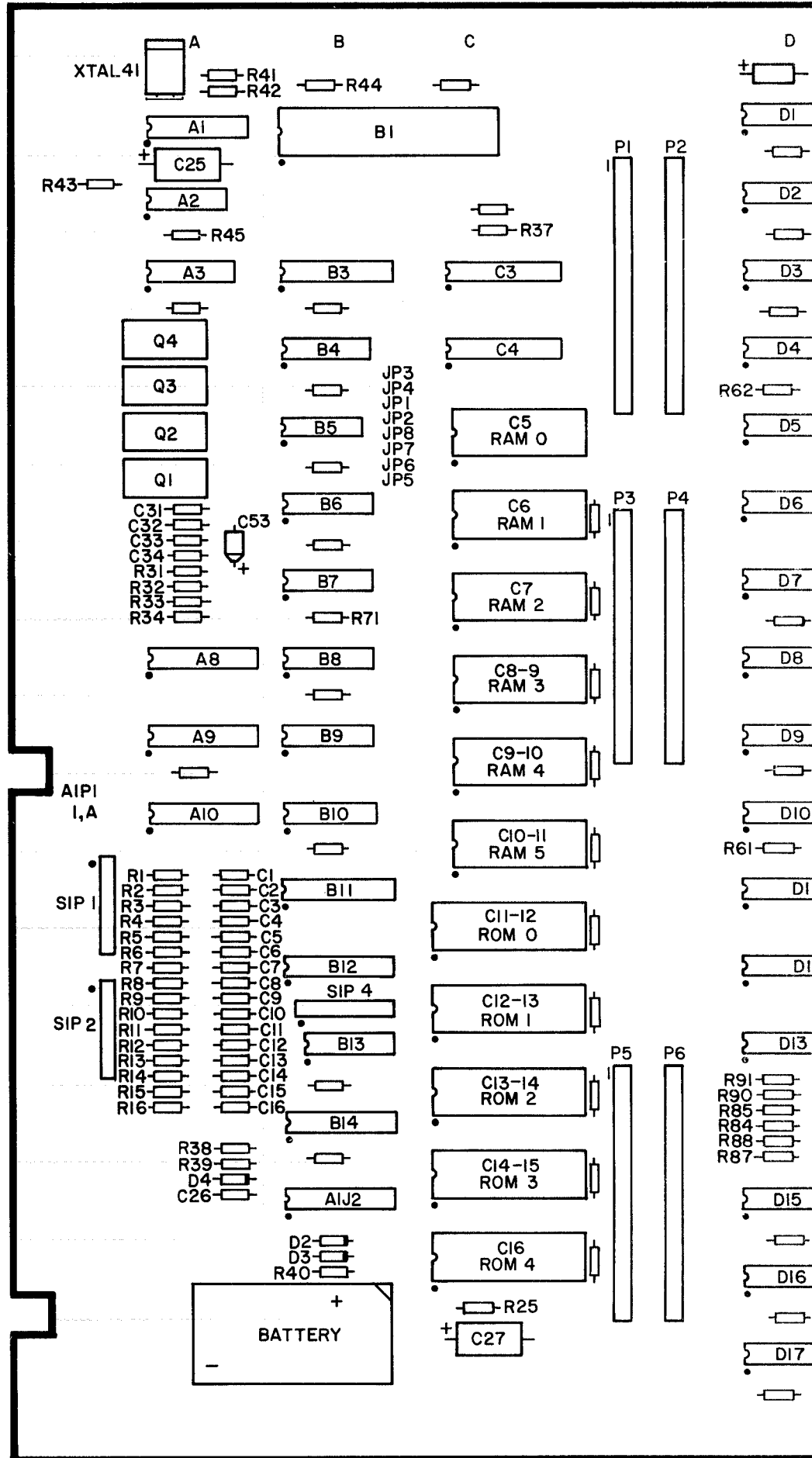
TABLE OF CONTENTS

	PAGE
LOGIC BOARD ASSY. (A1)	
COMPONENT LOCATION AND PARTS LIST	13
SCHEMATIC DIAGRAM (SHEET 1 OF 3)	16
SCHEMATIC DIAGRAM (SHEET 2 OF 3)	18
SCHEMATIC DIAGRAM (SHEET 3 OF 3)	21
POWER SUPPLY ASSY. (A3)	
COMPONENT LOCATION AND PARTS LIST	24
SCHEMATIC DIAGRAM	25
SOUND BOARD ASSY. (A6)	
COMPONENT LOCATION AND PARTS LIST	27
SCHEMATIC DIAGRAM	28
PRIMARY POWER/FILTER BOARD/ INTERCONNECTION DIAGRAM	30

**LOGIC BOARD ASSY. (A1),
PARTS LIST**

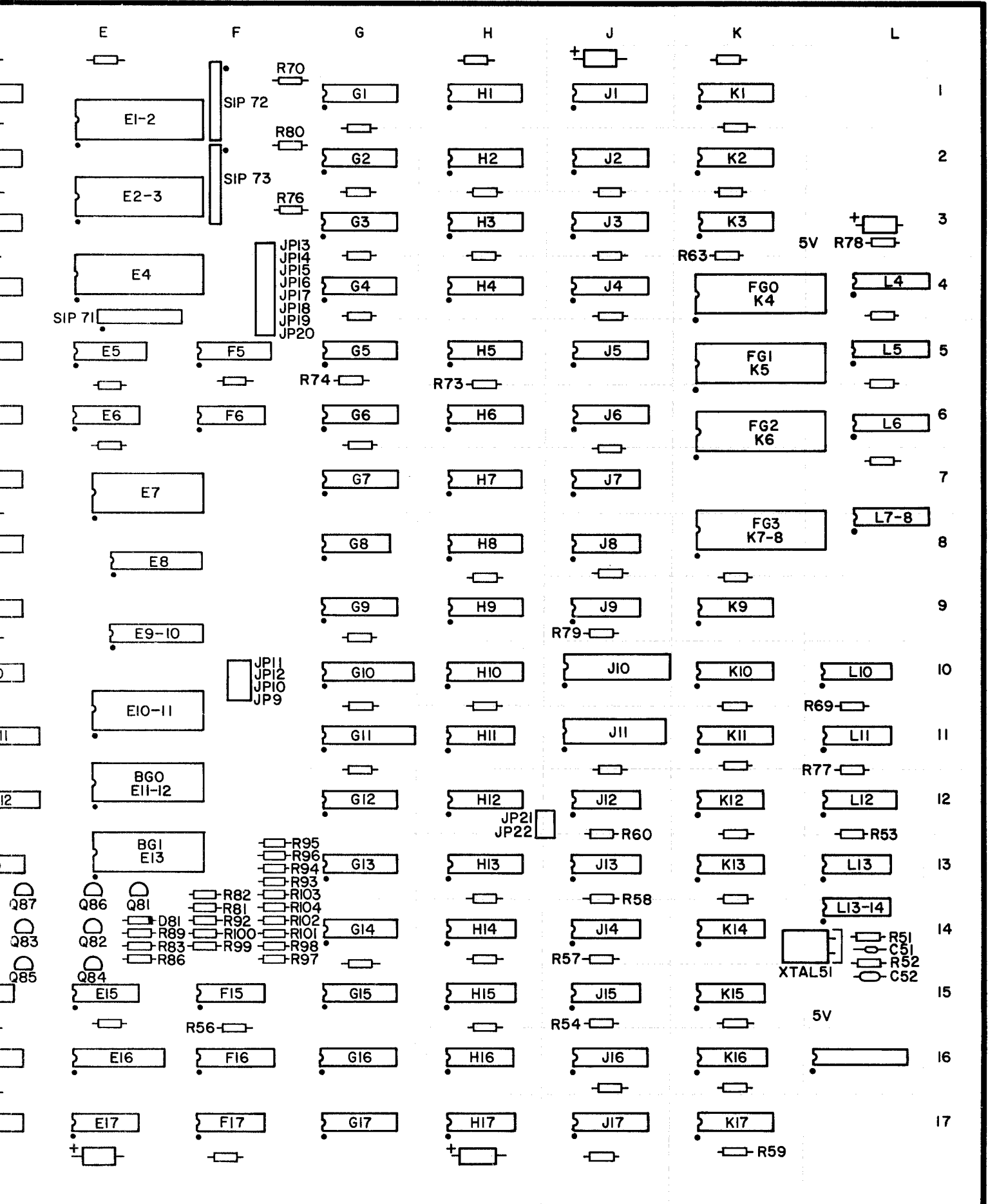
**MISCELLANEOUS ELECTRONIC
COMPONENTS**

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
C53	Capacitor, 10 UF, 25V AX TANT 10%	XO-127
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	Transistor, MPS-U45	XO-306
Q2-Q4	Transistor, 2N6044	XO-120
Q81-Q87	Transistor, MPSA70	XO-309
R1-R16	Resistor, 470 OHM, 5% 1/4W	XO-35
R25	Resistor, 1K OHM, 5% 1/4W	XO-5
R31	Resistor, 10K OHM, 5% 1/4W	XO-18
R32-R34	Resistor, 1K OHM, 5% 1/4W	XO-5
R37, R38	Resistor, 330 OHM, 5% 1/4W	XO-34
R39	Resistor, 130 OHM, 5% 1/4W	XO-172
R40	Resistor, 270 OHM, 5% 1/4W	XO-68
R41, R42	Resistor, 510 OHM, 5% 1/4W	XO-25
R43	Resistor, 130 OHM, 5% 1/4W	XO-172
R44, R45	Resistor, 1K OHM, 5% 1/4W	XO-5
R51, R52	Resistor, 330 OHM, 5% 1/4W	XO-34
R53, R54, R56	Resistor, 1K OHM, 5% 1/4W	XO-5
R57, R58	Resistor, 560 OHM, 5% 1/4W	XO-36
R59-R61	Resistor, 1K OHM, 5% 1/4W	XO-5
R63, R64	Resistor, 1K OHM, 5% 1/4W	XO-5
R70	Resistor, 1K OHM, 5% 1/4W	XO-5
R73, R74	Resistor, 1K OHM, 5% 1/4W	XO-5
R76-R80	Resistor, 1K OHM, 5% 1/4W	XO-5
R81	Resistor, 820 OHM, 5% 1/4W	XO-174
R82	Resistor, 100 OHM, 5% 1/4W	XO-28
R83, R84	Resistor, 15 OHM, 5% 1/4W	XO-171
R85	Resistor, 180 OHM, 5% 1/4W	XO-24
R86, R87	Resistor, 15 OHM, 5% 1/4W	XO-171
R88	Resistor, 180 OHM, 5% 1/4W	XO-24
R89, R90	Resistor, 15 OHM, 5% 1/4W	XO-171
R91	Resistor, 180 OHM, 5% 1/4W	XO-24
R92	Resistor, 1K OHM, 5% 1/4W	XO-5
R93	Resistor, 2K OHM, 5% 1/4W	XO-14
R94	Resistor, 1K OHM, 5% 1/4W	XO-5
R95	Resistor, 470 OHM, 5% 1/4W	XO-35
R96	Resistor, 240 OHM, 5% 1/4W	XO-173
R97	Resistor, 2K OHM, 5% 1/4W	XO-14
R98	Resistor, 1K OHM, 5% 1/4W	XO-5
R99	Resistor, 470 OHM, 5% 1/4W	XO-35
R100	Resistor, 240 OHM, 5% 1/4W	XO-173
R101	Resistor, 2K OHM, 5% 1/4W	XO-14
R102	Resistor, 1K OHM, 5% 1/4W	XO-5
R103	Resistor, 470 OHM, 5% 1/4W	XO-35
R104	Resistor, 240 OHM, 5% 1/4W	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 41	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



IC DIAGRAMS, PARTS LISTS

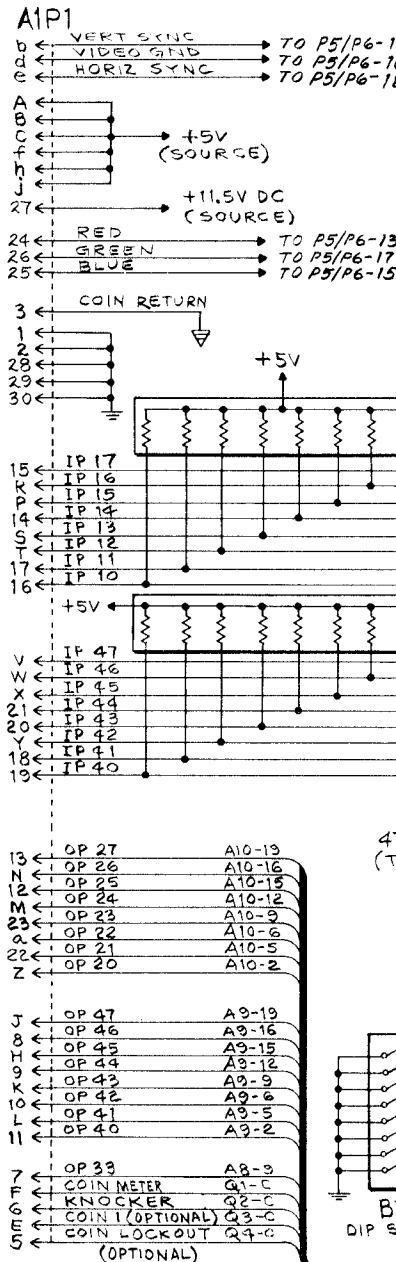
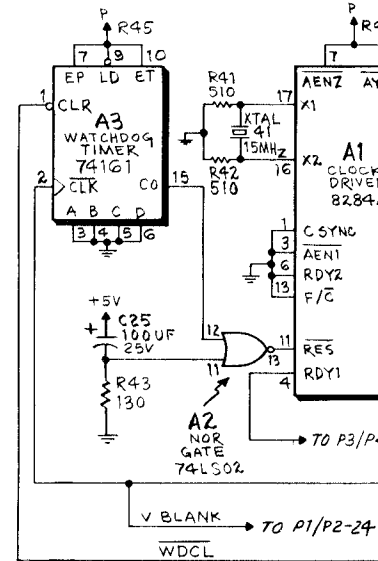
RD ASSY. (A1), COMPONENT LOCATION



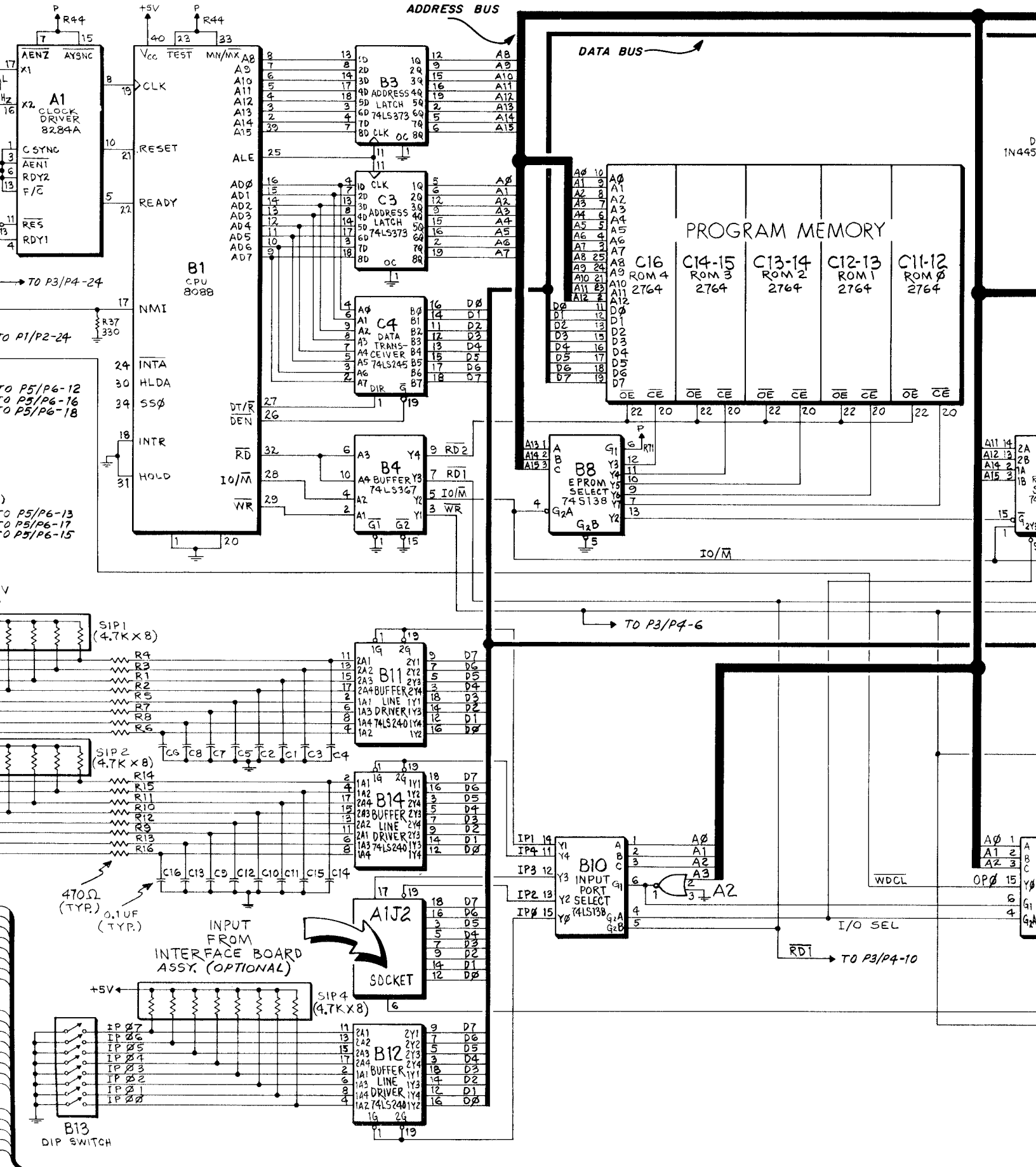
LOGIC BOARD ASSY. (A1), PARTS LIST (CONT.)

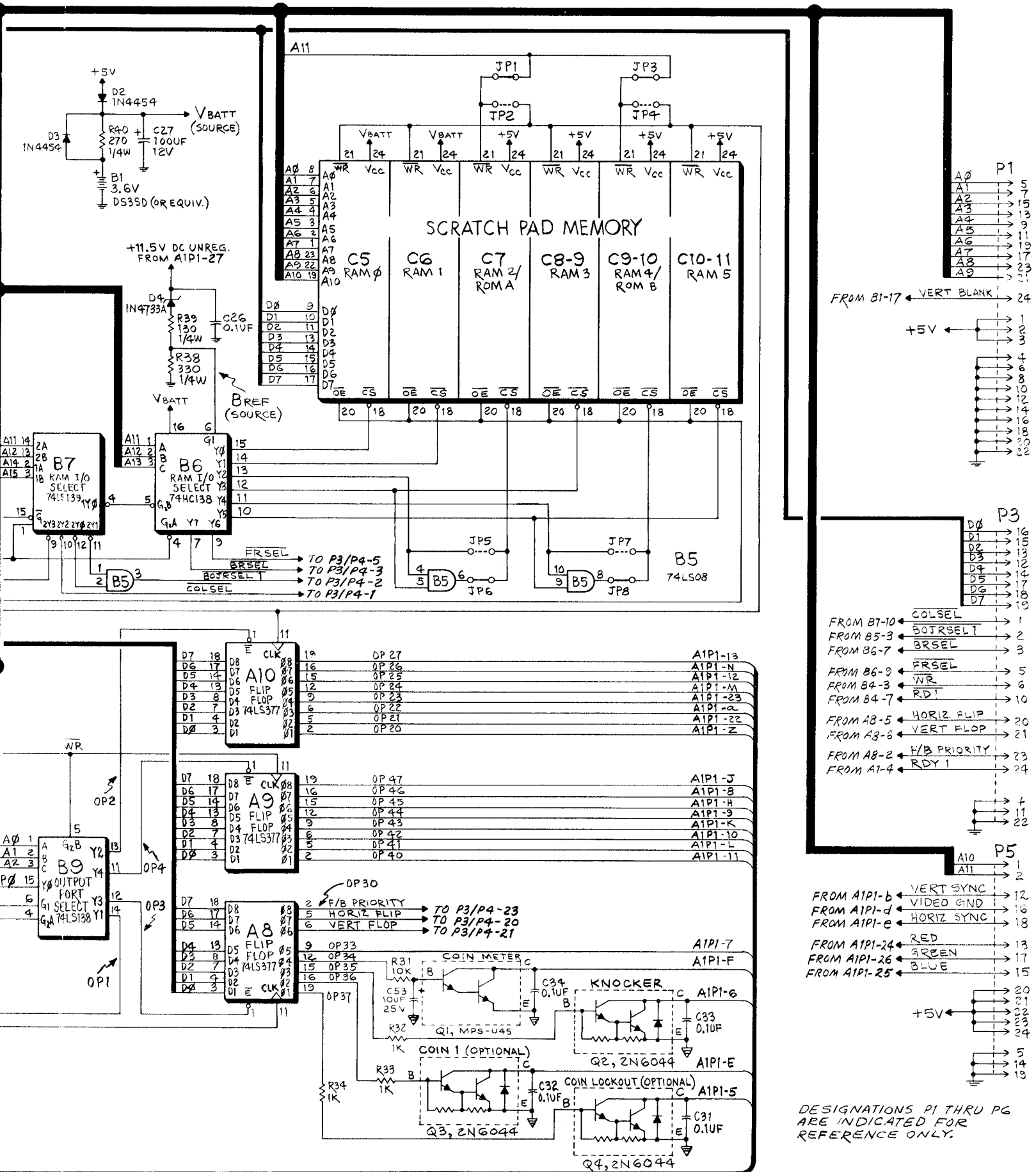
INTEGRATED CIRCUITS

REFERENCE	DESCRIPTION	PART NO.	REFERENCE	DESCRIPTION	PART NO.
	Logic Board Assy.	MA-456	G7	74157 Quad 2-input multiplexer	XO-114
A1	8284 CLK Driver	XO-478	G8	74LS74 Dual D-type flip flop	XO-434
A2	74LS02 Quad 2-input "NOR" gate	XO-428	G9	74S157 Quad 2-input multiplexer	XO-124
A3	74161 Synchronous 4-bit counter	XO-192	G10	74LS245 Octal bus transceiver	XO-79
A8, A9, A10	74LS377 Octal "D" Flip Flop	XO-97	G11	74LS374 Octal D-type flip flop	XO-96
B1	8088 CPU	XO-490	G12	74LS157 Quad 2-input multiplexer	XO-390
B3	74LS373 Octal D-type flip flop	XO-445	G13, G14, G15	7489 64-bit RAM	XO-88
B4	74LS367 Hex 3-state buffer	XO-444	G16, G17	74LS174 Hex D flip flop	XO-442
B5	74LS08 Quad 2-input "AND" gate	XO-86	H1, H2, H3, H4	74S189 64-bit RAM	XO-89
B6	74HC138 Decoder/demultiplexer	XO-190	H5, H6,	74S161 Synchronous presettable binary counter	XO-488
B7	74LS139 Dual 1 of 4 decoder	XO-419	H7, H8, H9, H10	74LS157 Quad 2-input multiplexer	XO-390
B8	74S138 1 of 8 decoder	XO-113	H11	74LS260 Dual 5-input "NOR" gate	XO-93
B9, B10	74LS138 1 of 8 decoder	XO-437	H12	74LS298 Quad 2-port register	XO-118
B11, B12, B14	74LS240 Octal Buffer/line driver	XO-91	H13	74LS157 Quad 2-input multiplexer	XO-390
C3	74LS373 Octal D-type flip flop	XO-445	H14	74LS00 Quad 2-input "NAND" gate	XO-427
C4	74LS245 Octal Bus transceiver	XO-79			
C5	RAM 0 6116LP-4	XO-191	H15	74LS30 8 input "NAND" gate	XO-432
C6	RAM 1 6116LP-4	XO-191	H16, H17	74LS86 Dual 2-input exclusive "OR" gate	XO-435
C7	ROM A 2732A 4K x 8 EPROM	XO-485			
C9-C10	ROM B 2732A 4K x 8 EPROM	XO-485	J1, J2, J3,	74S189 64-bit RAM	XO-89
C11-12	ROM 0 2764 8K x 8 EPROM	XO-489	J4, J5, J6	74LS04 Hex inverter	XO-418
C12-13	ROM 1 2764 8K x 8 EPROM	XO-489	J7	74LS32 Quad 2-input "OR" gate	XO-433
C13-14	ROM 2 2764 8K x 8 EPROM	XO-489	J8	7408 Quad 2-input "AND" gate	XO-404
C14-15	ROM 3 2764 8K x 8 EPROM	XO-489	J9	93422 256 x 2 bipolar RAM	XO-100
C16	ROM 4 2764 8K x 8 EPROM	XO-489	J10, J11	74LS02 Quad 2-input "NOR" gate	XO-428
D1	74LS139 Dual 1 of 4 Decoder	XO-419	J12	74LS74 Dual D-type flip flop	XO-434
D2, D3, D4, D5, D6, D7, D8, D9,			J13	7407 Hex buffer/driver	XO-384
D10	74157 Quad 2-input multiplexer	XO-114	J14	74LS30 8 input "NAND" gate	XO-432
D11	74LS374 Octal D-type flip flop	XO-96	J15	74S161 Synchronous presettable binary counter	XO-488
D12	74LS244 Octal buffer/line driver	XO-117	J16, J17	74LS379 Quad D-type flip flop	XO-98
D13	74LS157 Quad 2-input multiplexer	XO-390	K1, K2, K3	FG0 2764-3 8K x 8 EPROM	XO-489
D15	74LS86 Quad 2-input exclusive "OR" gate	XO-435	K4	FG1 2764-3 8K x 8 EPROM	XO-489
D16	74LS283 4-bit binary full adder	XO-95	K5	FG2 2764-3 8K x 8 EPROM	XO-489
D17	74S161 Synchronous presettable binary counter	XO-488	K6	FG3 2764-3 8K x 8 EPROM	XO-489
E1-2, E2-3, E4	93419 64 x 9 bipolar RAM	XO-99	K7-8	74LS157 Quad 2-input multiplexer	XO-390
E5	74LS283 4-bit binary full adder	XO-95	K9, K10, K11	74LS260 Dual 5-input "NOR" gate	XO-93
E6	74LS30 8-input "NAND" gate	XO-432	K12	74LS32 Quad 2-input "OR" gate	XO-433
E7	4801 1K x 8 RAM	XO-193	K13	74LS08 Quad 2-input "AND" gate	XO-86
E8, E9-10	74LS245 Octal Bus Transceiver	XO-79	K14	74S04 Hex inverter	XO-400
E10-11	4801 1K x 8 RAM	XO-193	K15	74LS20 Dual 4-input "NAND" gate	XO-430
E11-12	2128 (BG0) RAM	XO-195	K16	74S161 Synchronous presettable binary counter	XO-488
E13	2128 (BG1) RAM	XO-195	K17	74LS166 8-bit shift register	XO-391
E15	74LS86 Quad 2-input exclusive "OR" gate	XO-435	L4, L5, L6, L7-8	74LS74 Dual flip flop	XO-434
E16	74LS273 8-bit register	XO-94	L10	74LS20 Dual 4-input "NAND" gate	XO-430
E17	74LS20 Dual 4-input "NAND" gate	XO-430	L11	74LS161 Synchronous presettable binary counter	XO-440
F5	74LS283 4-bit binary full adder	XO-95	L12	74S74 Dual D-type pos. edge trig. flip flop (T. I. only)	XO-87
F6	74LS32 Quad 2-input "OR" gate	XO-433	L13	74S04 Hex inverter	XO-400
F15	74LS04 Hex inverter	XO-418	L13-14		
F16	74S161 Synchronous presettable binary counter	XO-488			
F17	74LS86 Quad 2-input exclusive "OR" gate	XO-435			
G1, G2, G3,	74LS157 Quad 2-input multiplexer	XO-390			
G4, G5	74LS161 Synchronous presettable binary counter	XO-440			
G6					



X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS





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

ADDRESS BUS
DATA BUS

P2
5 A0
7 A1
15 A2
13 A3
9 A4
11 A5
19 A6
17 A7
23 A8
21 A9

24 VERT BLANK
1 +5V
3
4
6
8
10
12
14
16
18
20
22

P4 D0
16 D1
15 D2
13 D3
12 D4
14 D5
17 D6
18 D7

1 COLSEL
2 BOJRSEL
3 BRSEL
5 FRSEL
6 WR
10 RD1
20 HORIZ FLIP
21 VERT FLOP
23 F/B PRIORITY
24 RDY 1

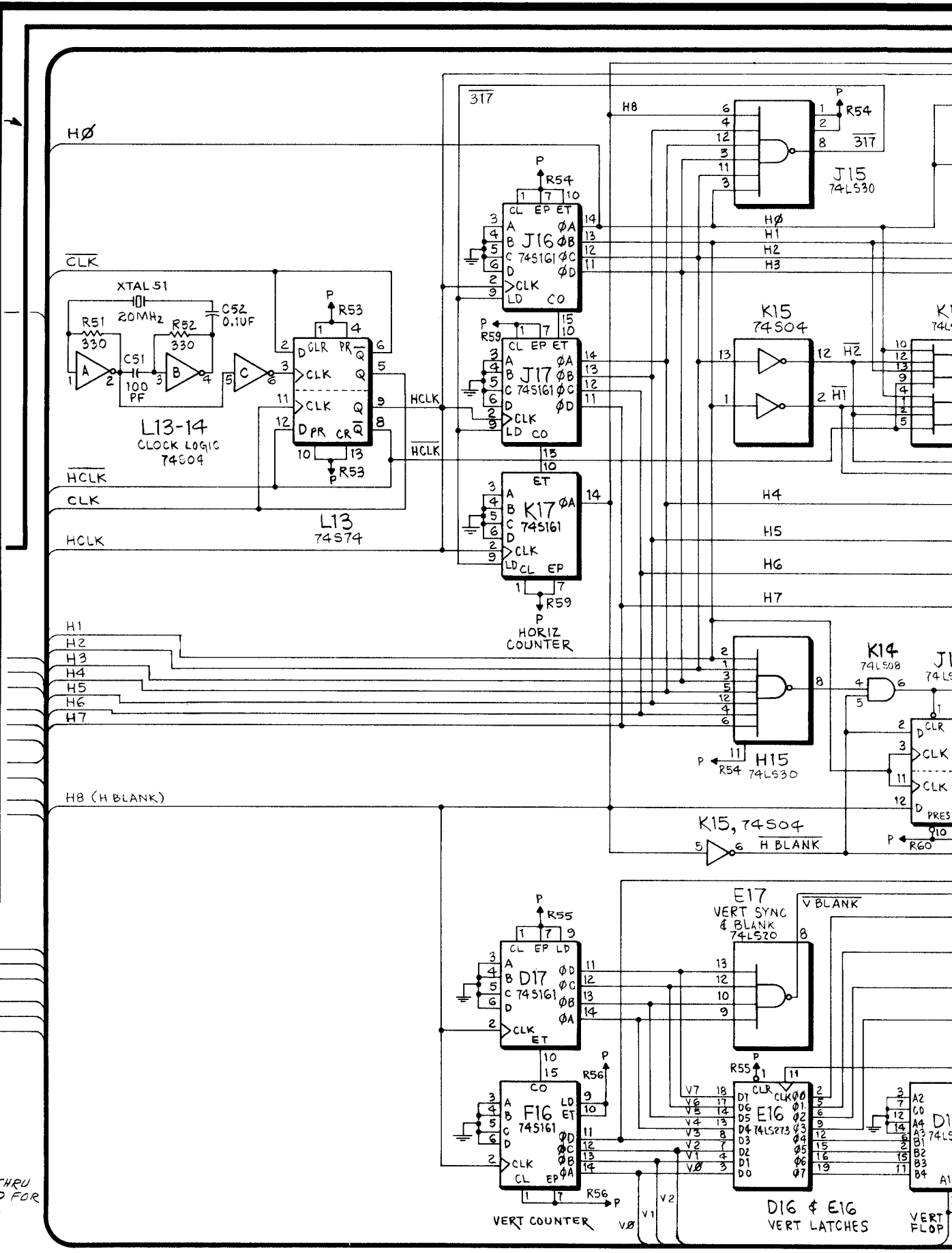
4
11
22

P6 A10
1 A11
2

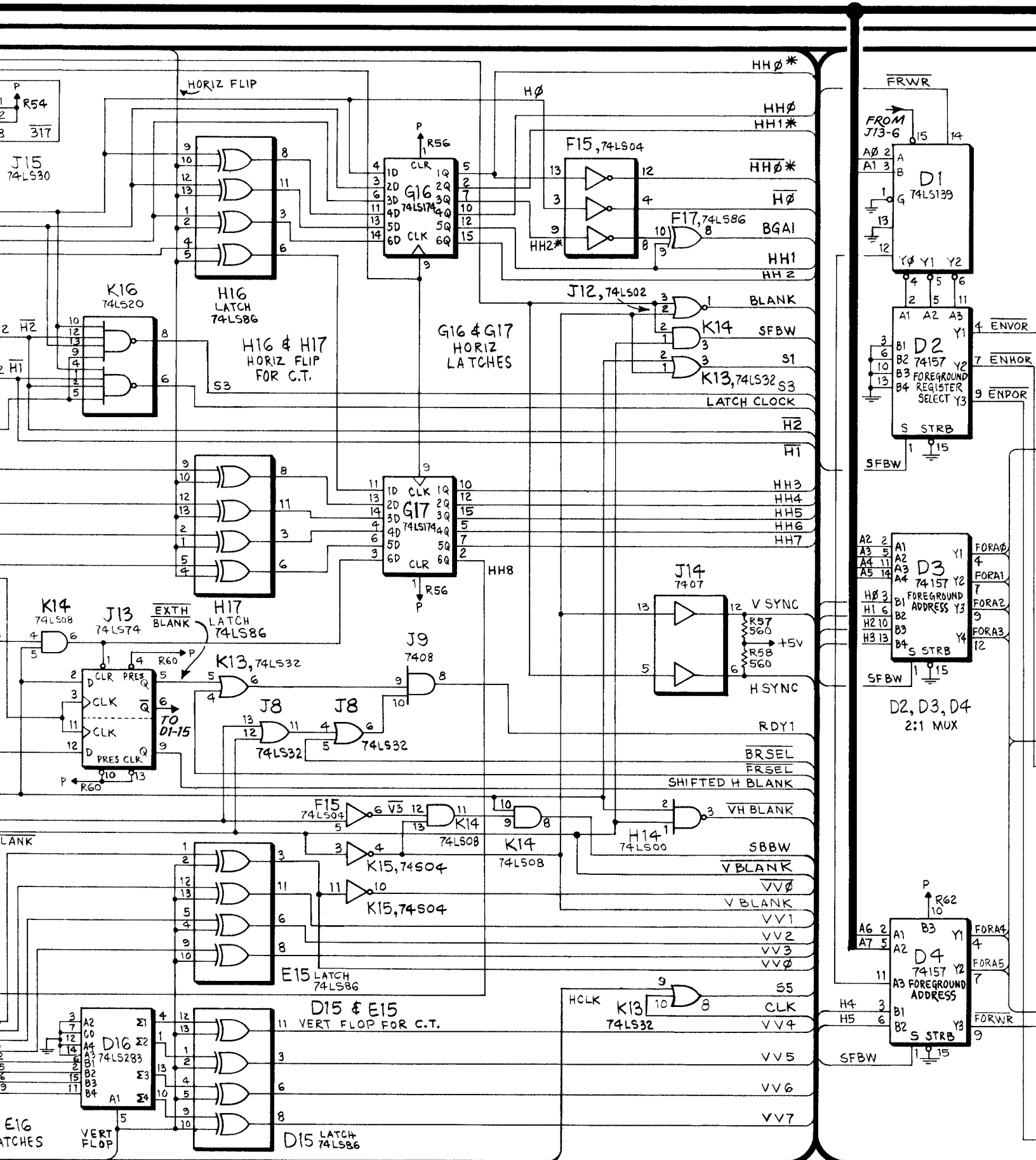
12 VERT SYNC
16 VIDEO GND
18 HORIZ SYNC
13 RED
17 GREEN
15 BLUE

20 +5V
21
22
23
24
5
14
19

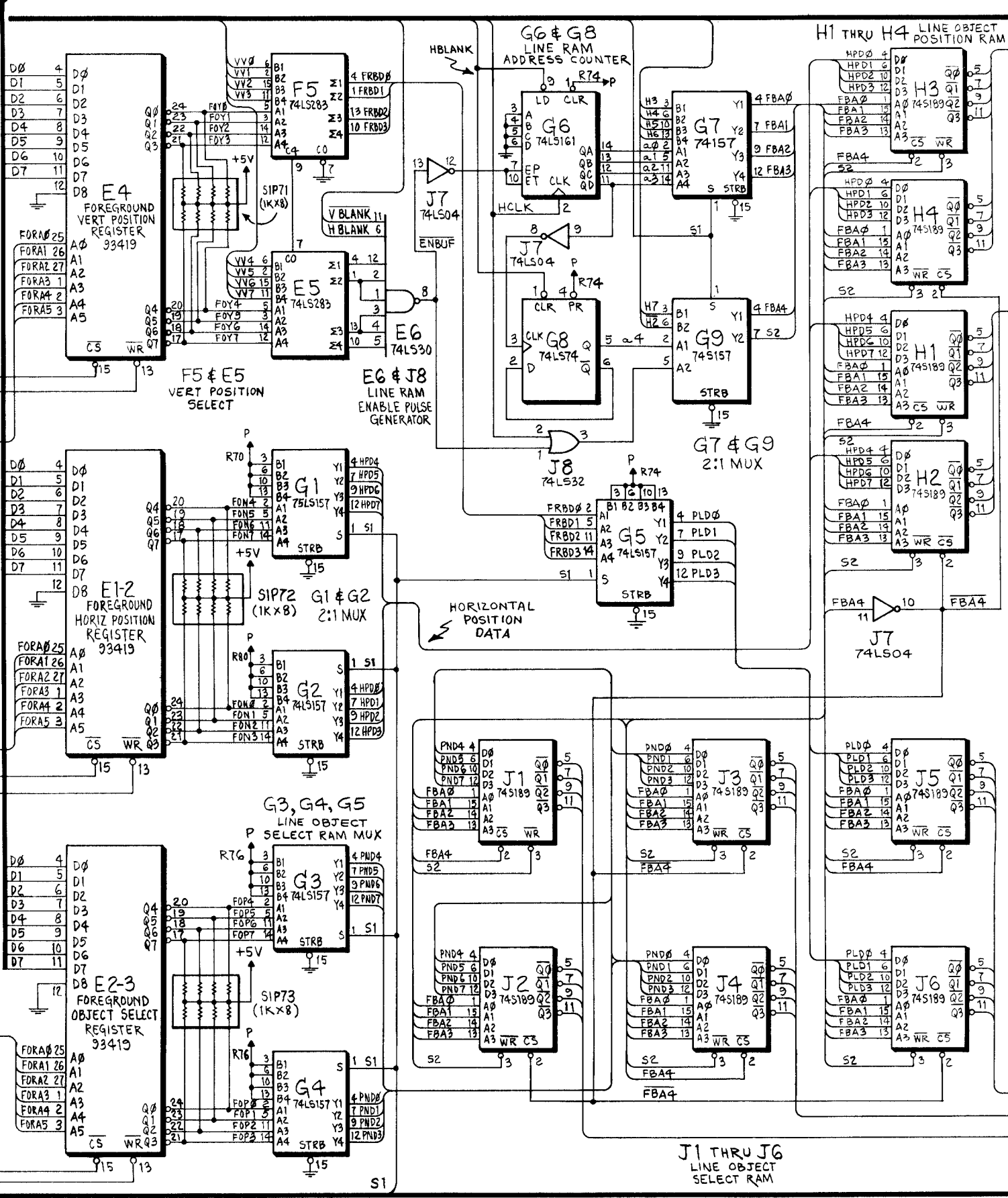
DESIGNATIONS P1 THRU P6 ARE INDICATED FOR REFERENCE ONLY.



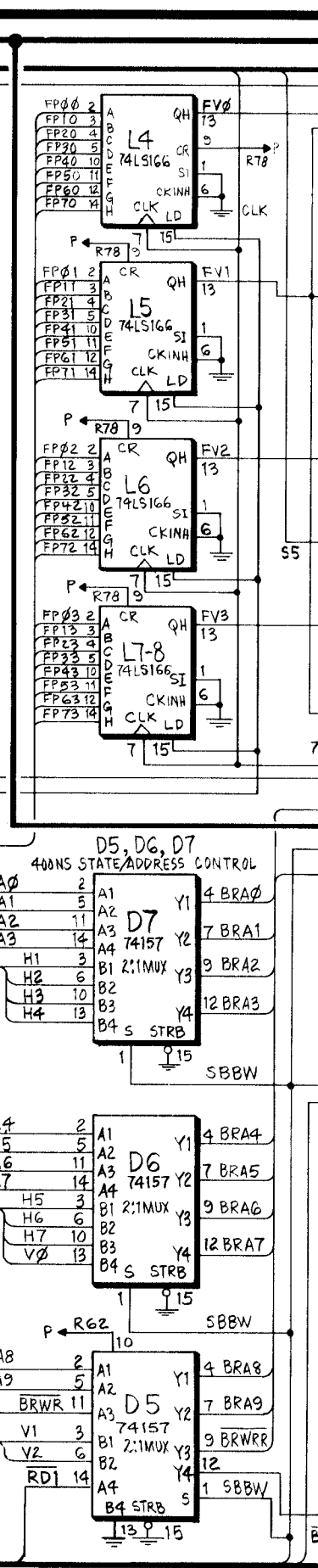
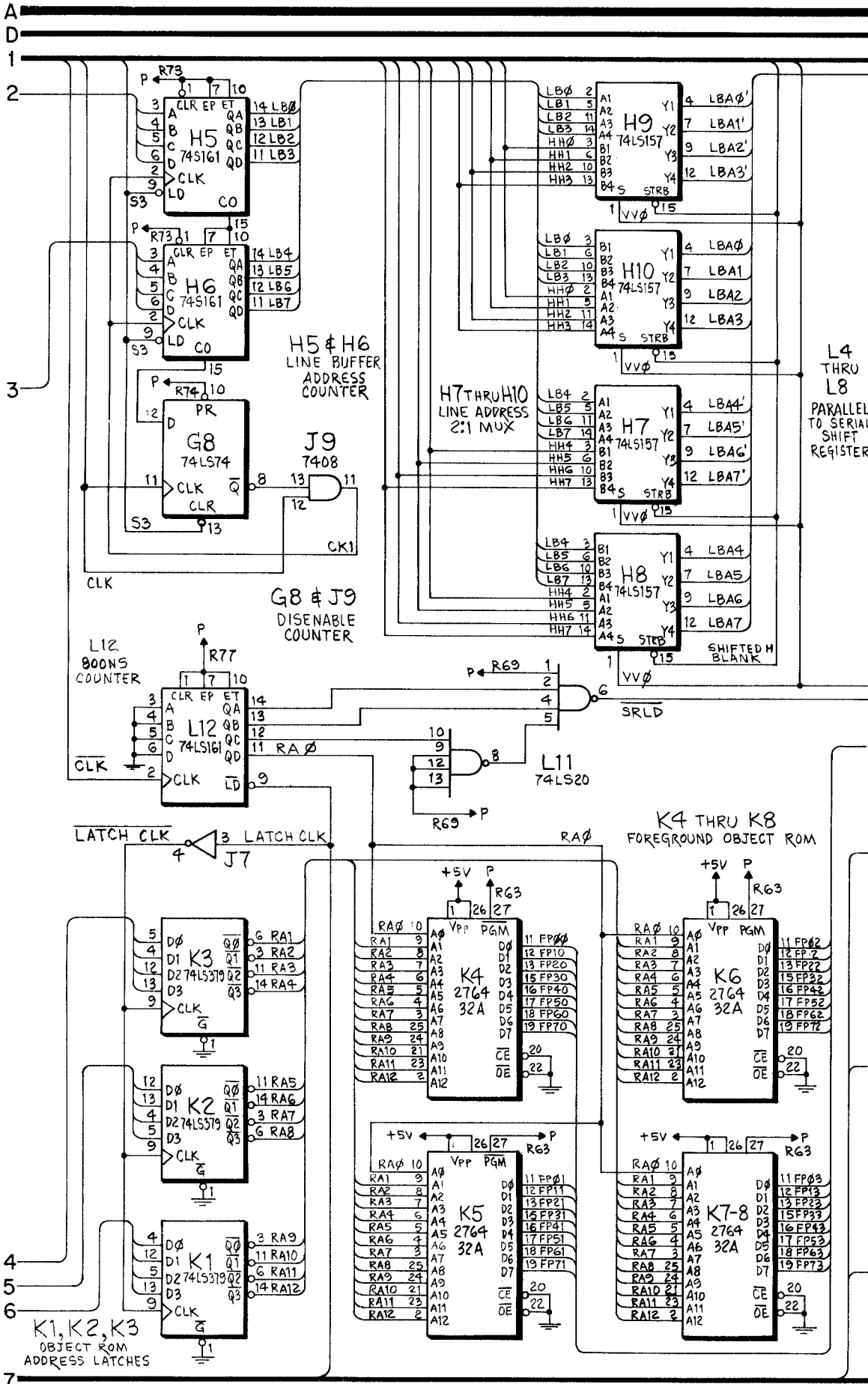
X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS



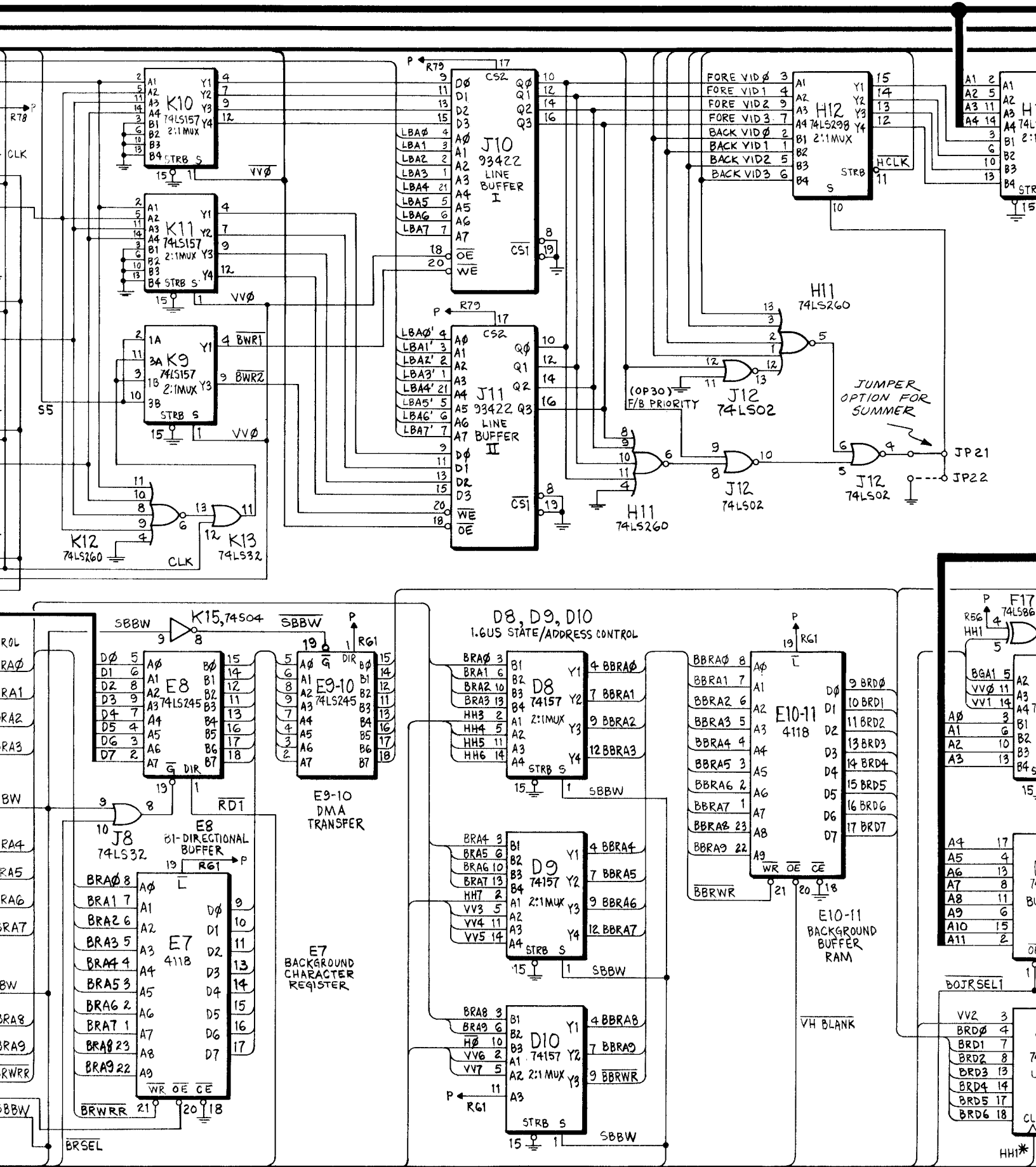
A
D
1
2
3
4
5
6
7



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

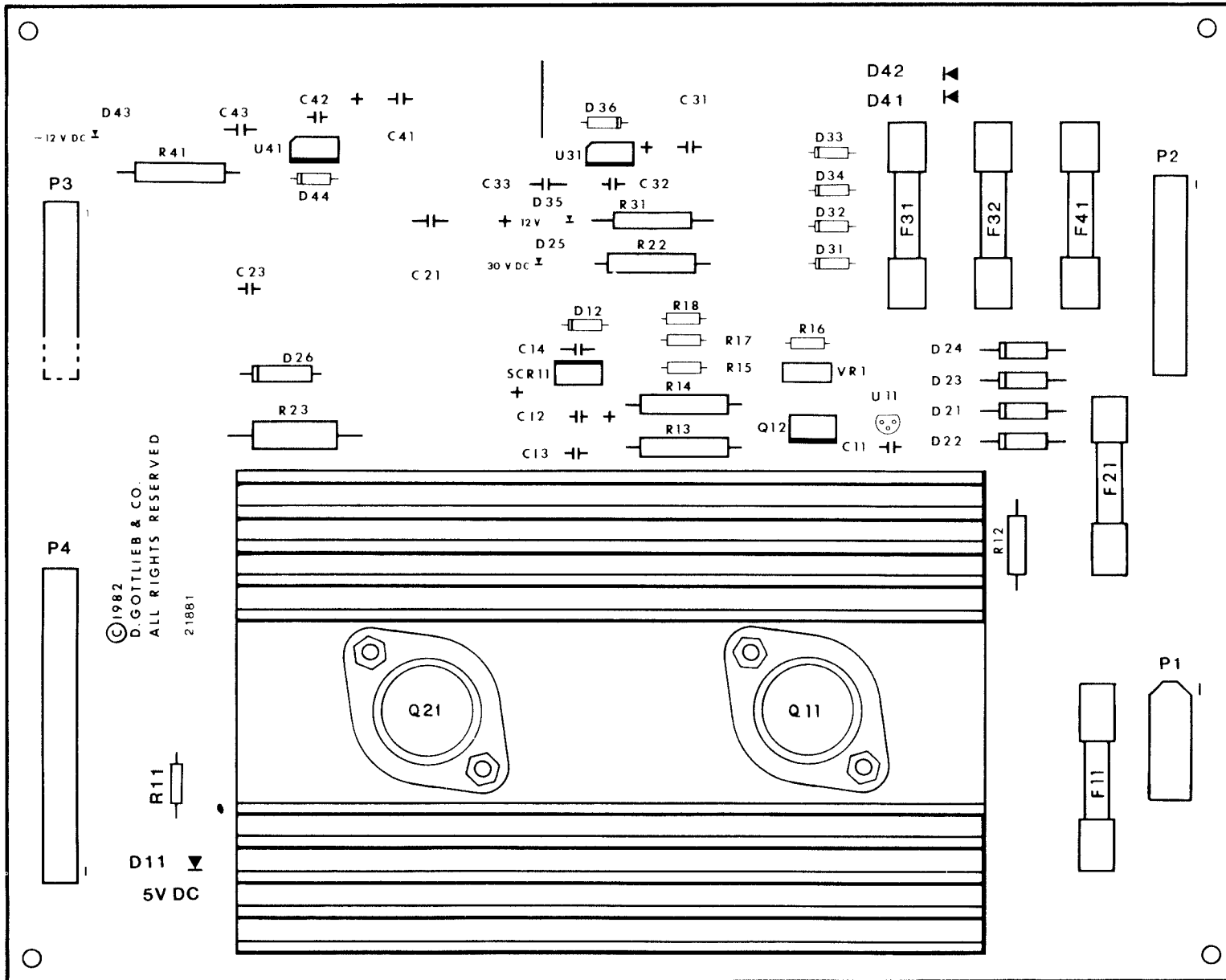


X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS



X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

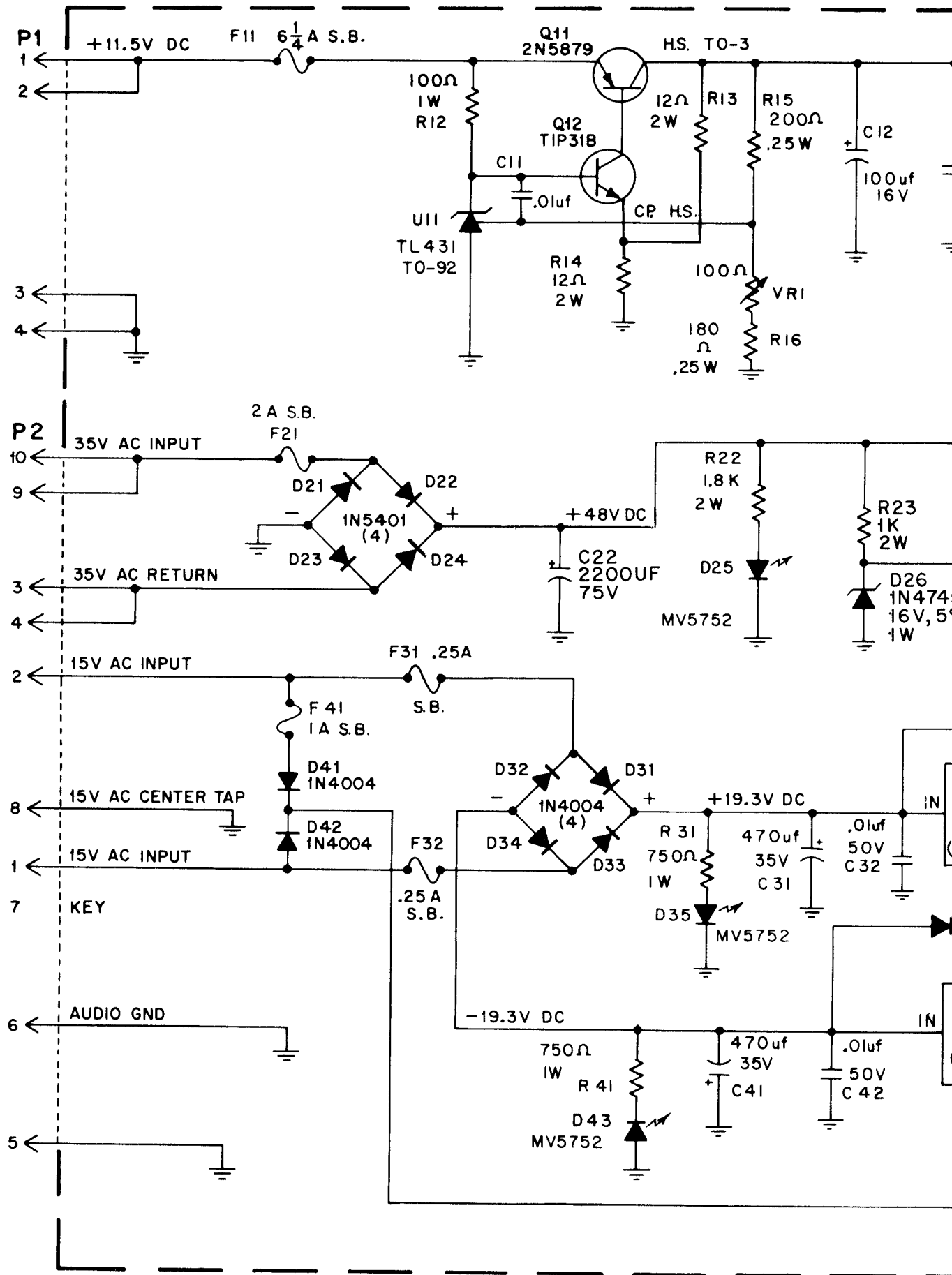
POWER SUPPLY ASSY. (A3), COMPONENT LOCATION



POWER SUPPLY ASSY. (A3), PARTS LIST

REFERENCE	DESCRIPTION	PART NO.	REFERENCE	DESCRIPTION	PART NO.
	Power Supply Assy.	MA-492	P2	Connector, 10 PIN	XO-531
C11, C32, C42	Capacitor, .01 mfd., 50V	XO-229	P3	Connector, 7 PIN	XO-526
C12	Capacitor, 100UF, 16V	XO-235	P4	Connector, 16 PIN	XO-372
C13, C23	Capacitor, 0.1UF, 100V	XO-234	Q11	Transistor, PNP, 2N5879	XO-323
C14, C33, C43	Capacitor, 0.2UF, 16V	XO-205	Q12	Transistor, NPN, TIP31B	XO-641
C21	Capacitor, 2200UF, 75V	XO-132	Q21	Transistor, NPN, 2N3055	XO-301
C31, C41	Capacitor, 470UF, 35V	XO-284	R11	Resistor, 470 OHM, 5% 1/2W	XO-55
D11, D25			R12	Resistor, 100 OHM, 5% 1W	XO-137
D35, D43	Diode, Light Emitting MV-5752	XO-270	R13, R14	Resistor, 12 OHM, 5% 2W	XO-138
D12	Diode, Zener, 5.6V, 5%, 1W, 1N4734A	XO-255	R15	Resistor, 200 OHM, 5% 1/4W	XO-143
D21-D24	Diode, 1N5401	XO-263	R16	Resistor, 180 OHM, 5% 1/4W	XO-24
D26	Diode, Zener, 16V, 5%, 1W, 1N4745A	XO-620	R17	Resistor, 100 OHM, 5% 1/4W	XO-28
D31-D34, D36			R18	Resistor, 20 OHM, 5% 1/4W	XO-29
D41, D42, D44	Diode, 1N4004	XO-254	R22	Resistor, 1.8KOHM, 5% 2W	XO-135
F11	Fuse, 6 1/4 AMP SLO-BLO	EL-8	R23	Resistor, 1KOHM, 5% 2W	XO-627
F21	Fuse, 2 AMP SLO-BLO	EL-7	R31, R41	Resistor, 750 OHM, 5% 1W	XO-136
F31, F32	Fuse, 1/4 AMP SLO-BLO	EL-5	SCR11	Silicon Controlled Rectifier	XO-131
F41	Fuse, 1 AMP SLO-BLO	EL-6	U11	Diode, Programmable Zener TL431	XO-272
P1	Connector, 4 PIN	PS-87	U31	Voltage Regulator -12V, LM 340T	XO-473
			U41	Voltage Regulator -12V, LM 320	XO-130
			VR1	Potentiometer, 100 OHM	XO-134

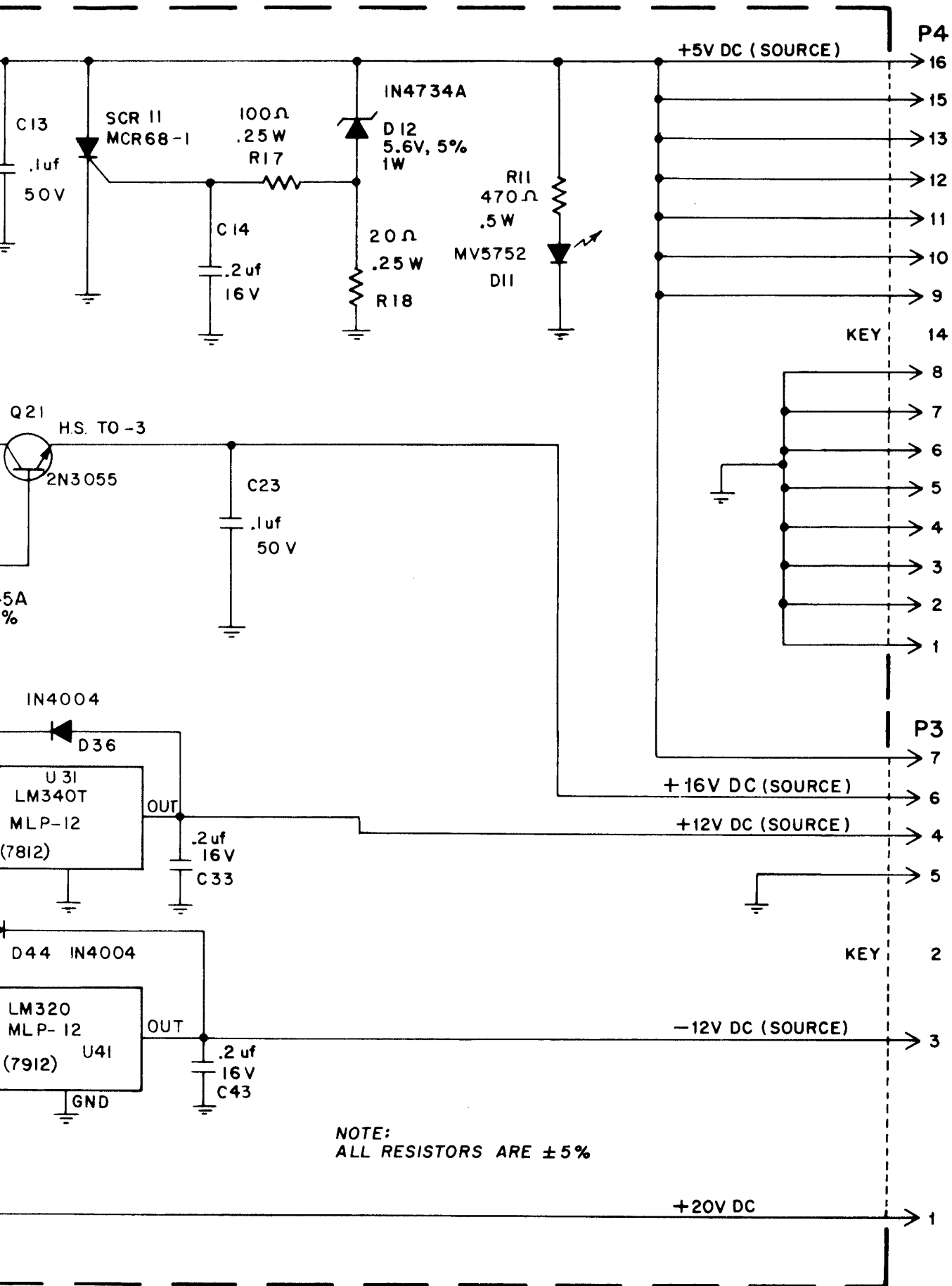
X. WIRING AND SCHEMATIC



RT NO.

- 531
- 526
- 372
- 323
- 641
- 301
- 55
- 137
- 138
- 143
- 24
- 28
- 29
- 135
- 627
- 136
- 131
- 272
- 473
- 130
- 134

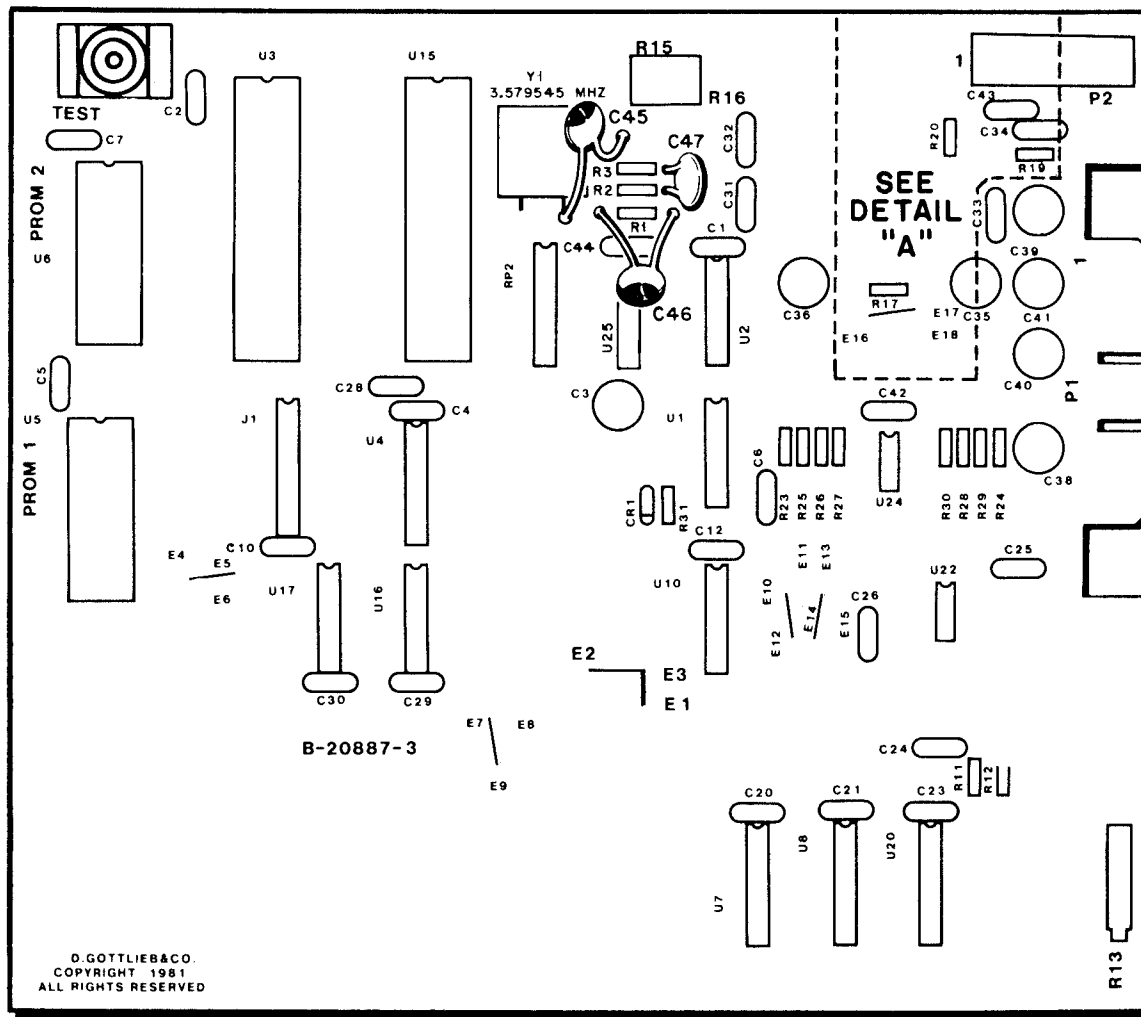
TIC DIAGRAMS, PARTS LISTS



POWER SUPPLY ASSY. (A3), SCHEMATIC DIAGRAM

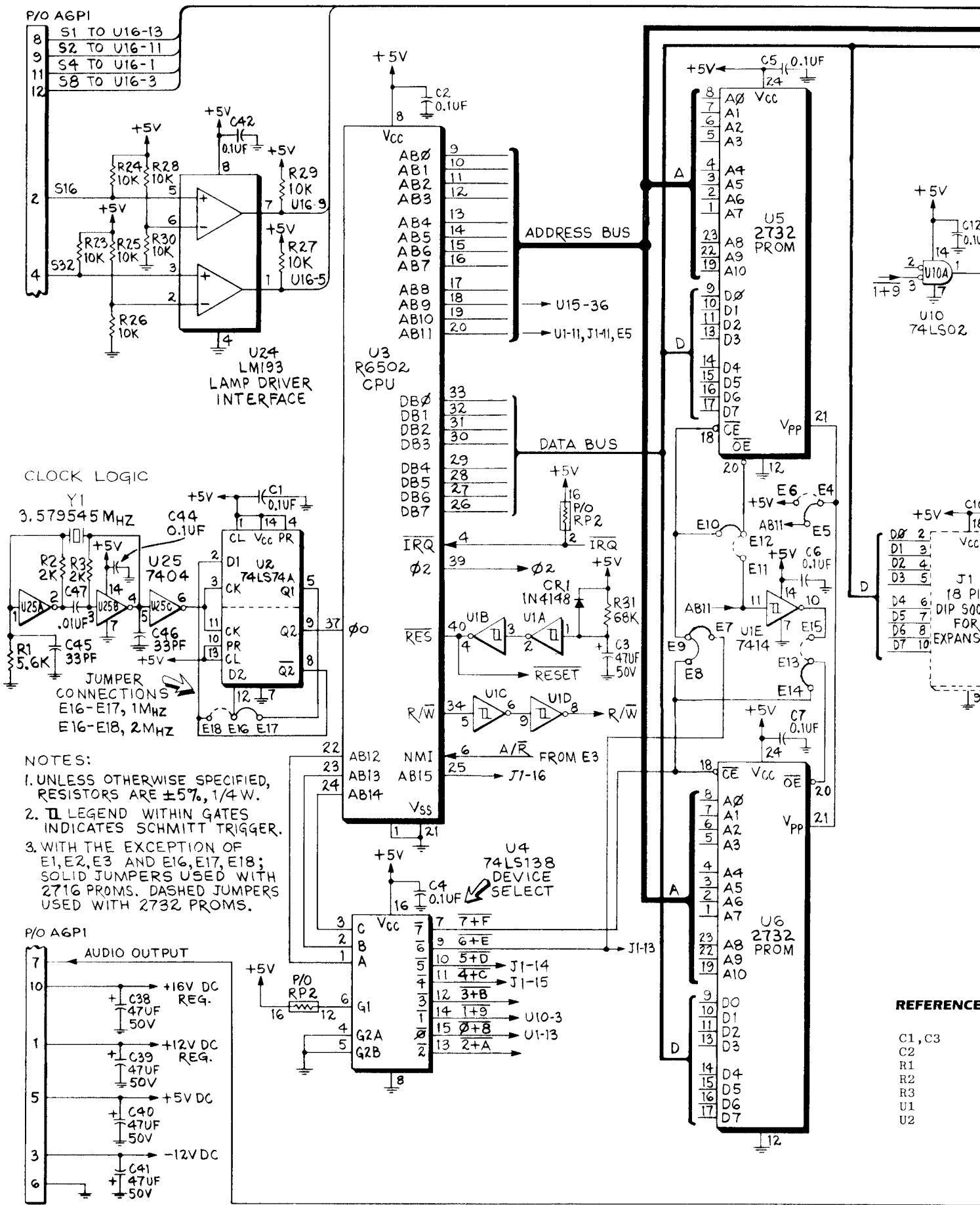
X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

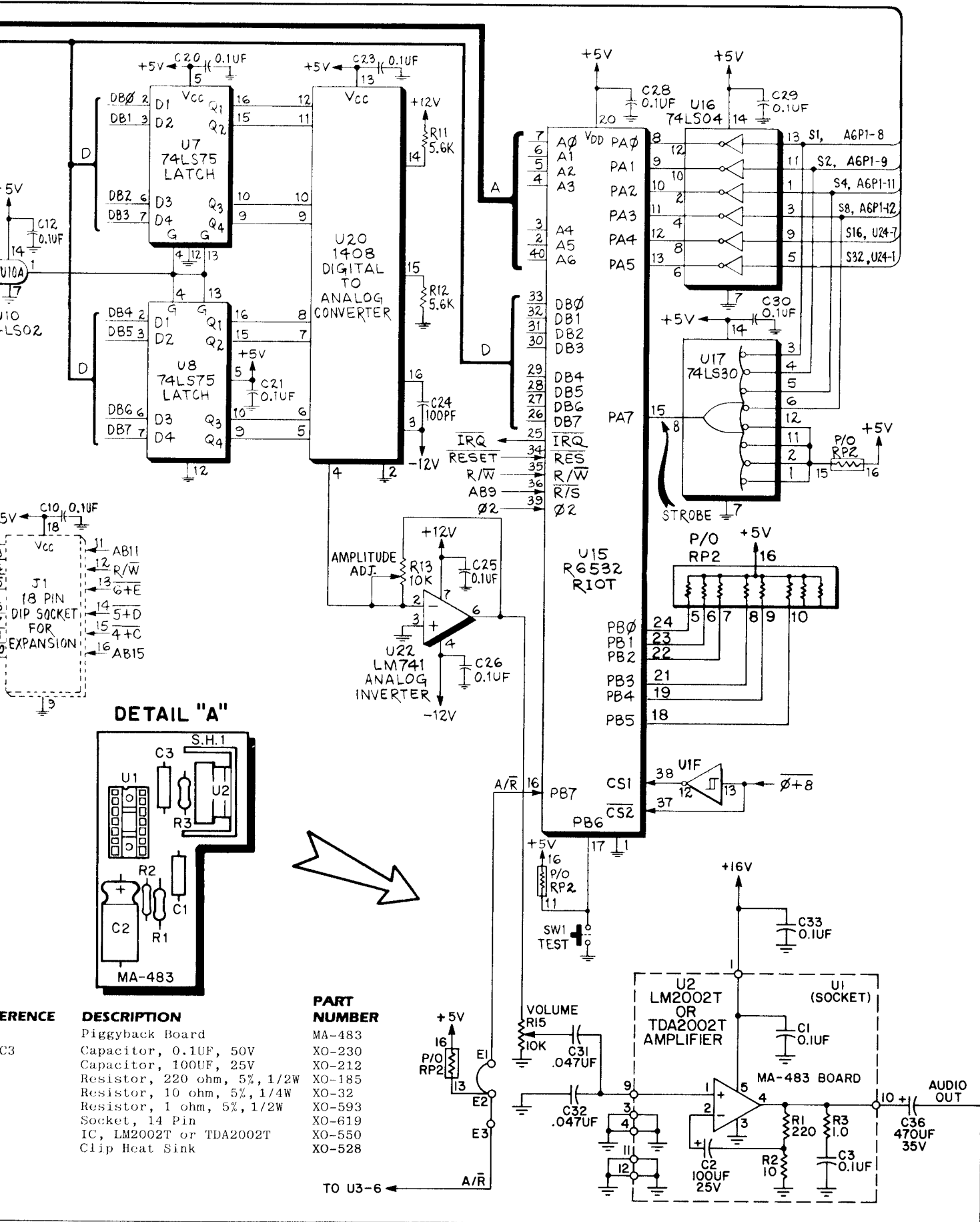
SOUND BOARD ASSY. (A6), COMPONENT LOCATION



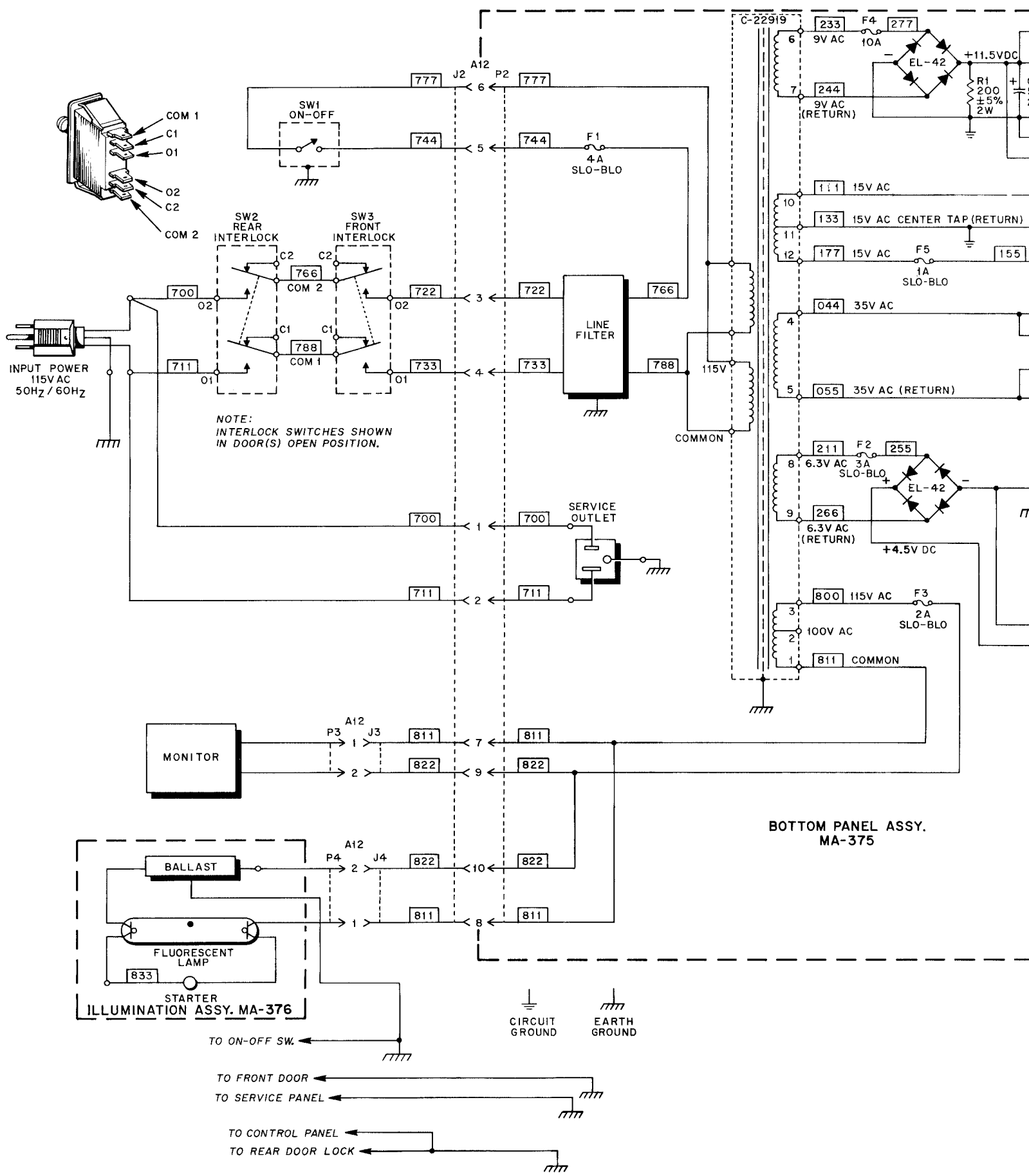
SOUND BOARD ASSY. (A6), PARTS LIST

REFERENCE	DESCRIPTION	PART NO.	REFERENCE	DESCRIPTION	PART NO.
C1, C2	Sound Board Assembly	MA-487	RP2	Resistor, DIP	XO-168
C4-C7, C10	Capacitor, 0.1UF, 25V	XO-248	SW1	Switch, Momentary Pushbutton	XO-515
C12, C20, C21			U1	IC, 7414	XO-397
C23, C25, C26			U2	IC, SN74LS74N	XO-434
C28, C29, C30			U3	CPU, R6502-13	XO-360
C33, C42, C44			U4	IC, SN74LS138N	XO-437
C31, C32	Capacitor, .047UF, 25V	XO-222	U5-U6	EPROM, 2732	XO-485
C37	Capacitor, 4.7UF, 35V	XO-291	U7	IC, SN74LS75	XO-394
C3, C38-C41	Capacitor, 47UF, 50V	XO-210	U10	IC, SN74LS02N	XO-428
C24	Capacitor, 100PF	XO-223	U15	RRIOT, R6532-18	XO-361
C36	Capacitor, 470UF, 35V	XO-284	U16	IC, SN74LS04N	XO-418
C45, C46	Capacitor, 33PF	XO-277	U17	IC, SN74LS30N	XO-432
C47	Capacitor, .01UF, 100V	XO-202	U20	Converter, PMI, 1408A-6P	XO-416
CR1	Diode, 1N4148	XO-261	U22	IC, LM741CP	XO-393
R1, R11, R12	Resistor, 5.6K ohm, 5%, 1/4W	XO-19	U24	IC, Dual Comparitor, LM193	XO-396
R2, R3	Resistor, 2K ohm, 5%, 1/4W	XO-14	U25	Inverter, 7404	XO-402
R13	Potentiometer, 10K ohm	XO-108	Y1	Crystal, 3.579545MHZ	XO-456
R15	Potentiometer, 10K ohm	XO-109		Socket, 22 Pin DIP	XO-467
R23-R30	Resistor, 10K ohm, 5%, 1/4W	XO-18		Socket, 24 Pin (2)	XO-529
R31	Resistor, 68K ohm, 5%, 1/4W	XO-189		Socket, 40 Pin (2)	XO-530

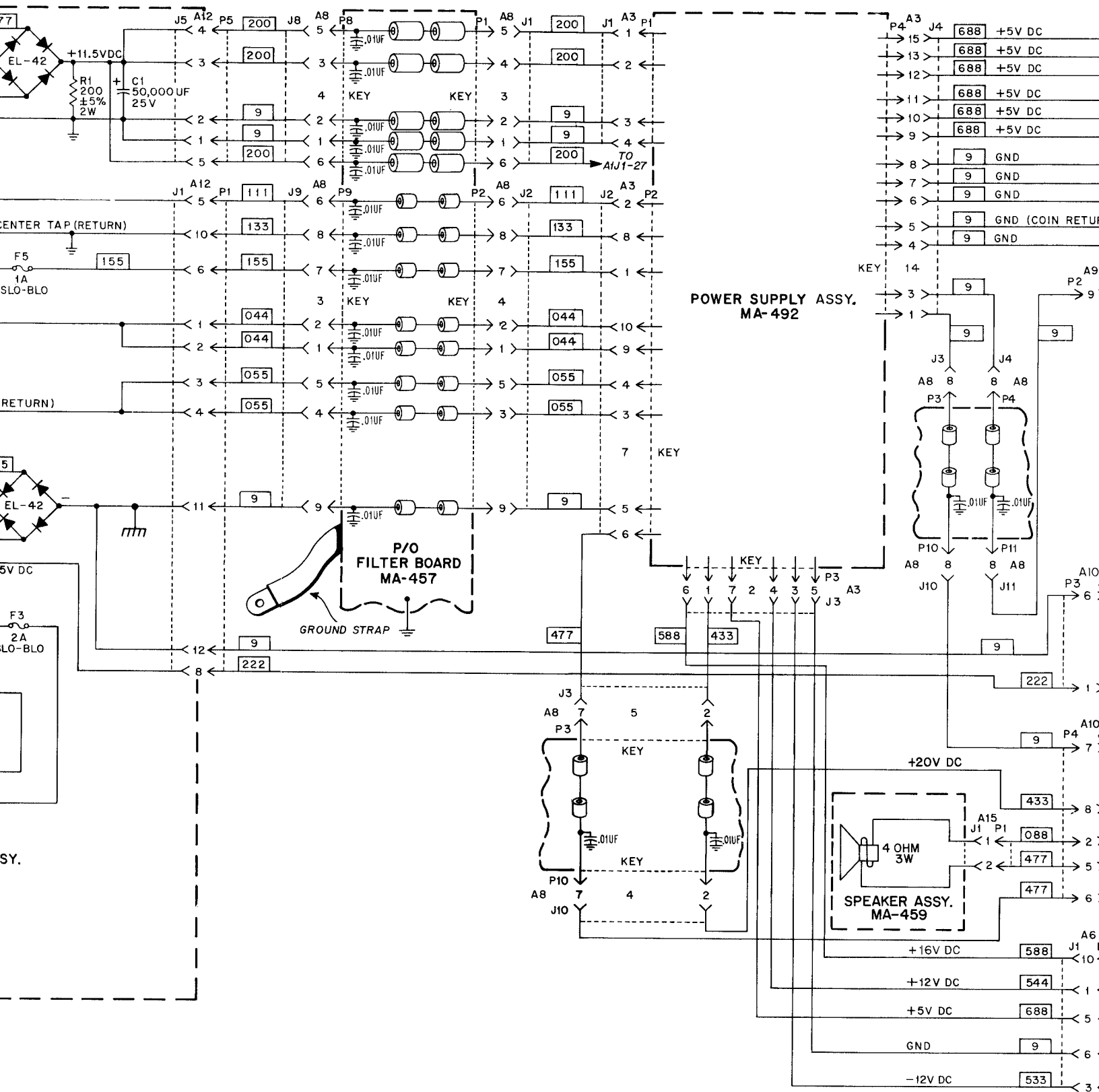


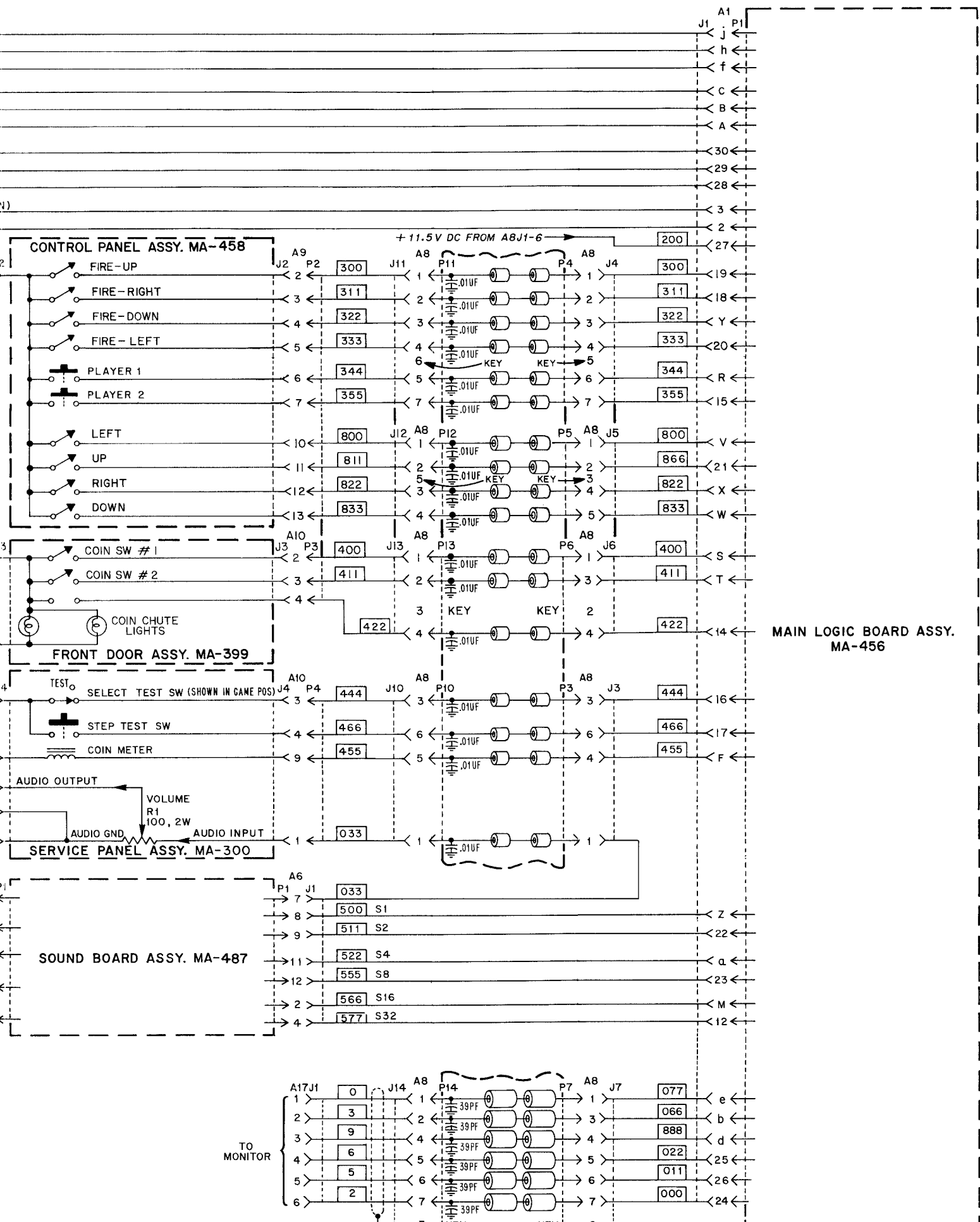


SOUND BOARD ASSY. (A6), SCHEMATIC DIAGRAM



X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS





PRIMARY POWER/FILTER BOARD/INTERCONNECTION DIAGRAM

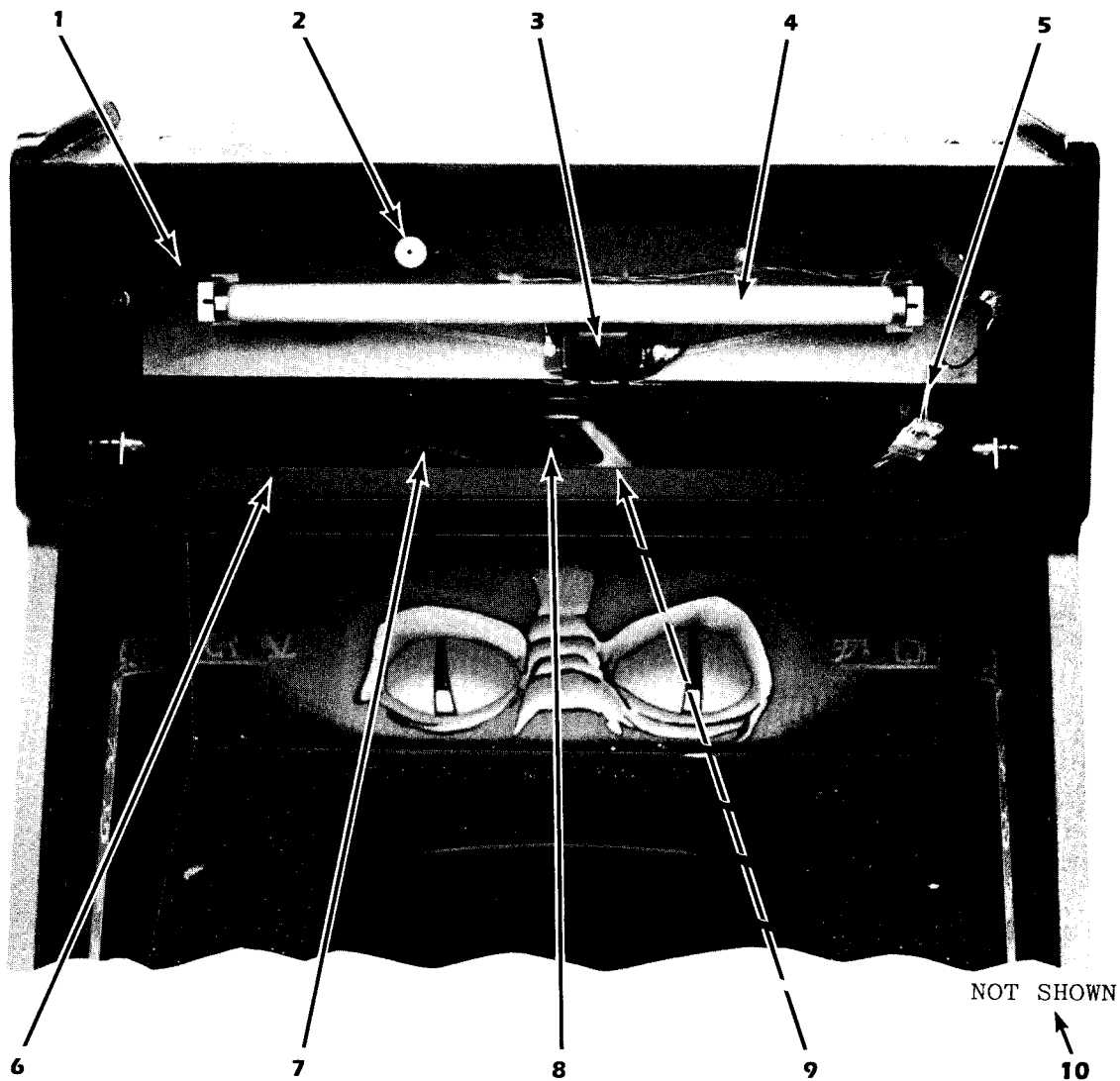
XI. PARTS INFORMATION

TABLE OF CONTENTS

	PAGE
SPEAKER/MARQUEE ASSY.	34
ILLUMINATION ASSY.	34
CONTROL PANEL ASSY.	35
SERVICE PANEL ASSY.	36
BOTTOM PANEL ASSY.	37
CABINET PARTS	38
CABINET PARTS	39

XI. PARTS INFORMATION

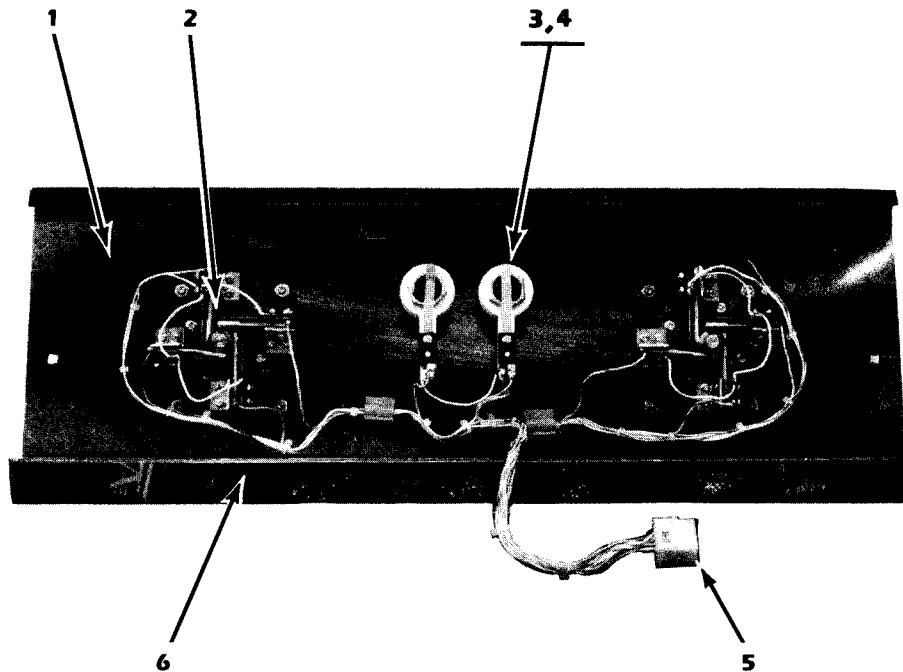
SPEAKER/MARQUEE ASSY. AND ILLUMINATION ASSY.



ITEM	DESCRIPTION	PART NO.
1.	Illumination Assy.	MA-376
2.	Starter	EL-69
3.	Ballast (60 HZ)	EL-70
4.	Lamp, Fluorescent	LA-4
5.	Cable Assy.	MA-364
6.	Speaker Assy.	MA-459
7.	Cable Assy.	MA-318
8.	Speaker	EL-93
9.	Speaker Grill	B-20931
10.	Marquee, Lexan (Screen)	A-23044

XI. PARTS INFORMATION

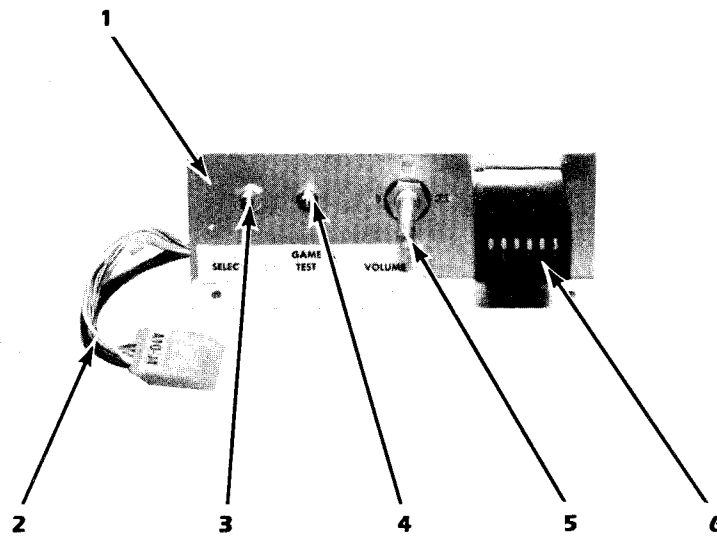
CONTROL PANEL ASSY.



ITEM	DESCRIPTION	PART NO.
1.	Control Panel Assy.	MA-458
2.	Joystick (2)	C-22917
3.	Short Button (2)	A-21970
4.	Button Holder and Switch (2)	A-21971
5.	Cable Assy.	MA-464
6.	Lexan Overlay	A-23045

XI. PARTS INFORMATION

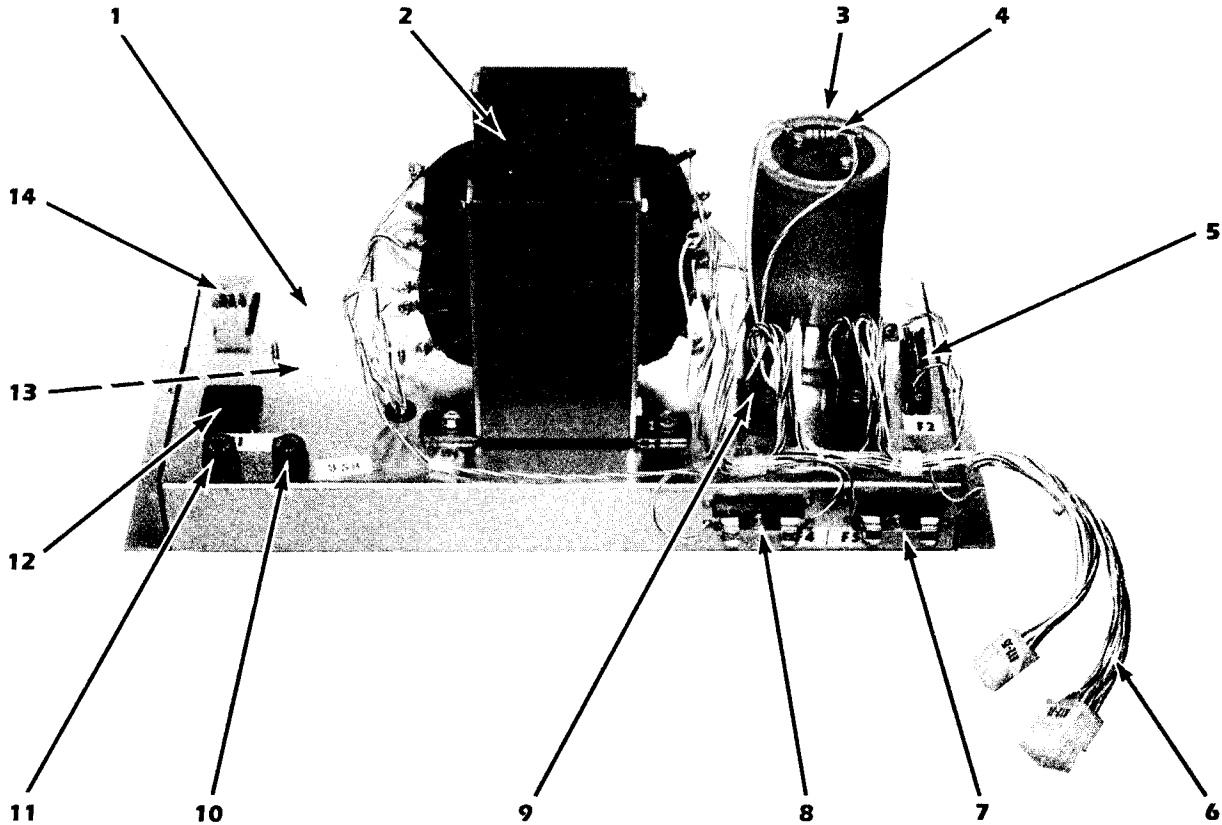
SERVICE PANEL ASSY.



ITEM	DESCRIPTION	PART NO.
1.	Service Panel Assy.	MA-300
2.	Cable Assy.	MA-316
3.	Switch (Push Button)	EL-57
4.	Switch (Toggle)	EL-85
5.	Volume Control	XO-104
6.	Coin Meter	EL-84

XI. PARTS INFORMATION

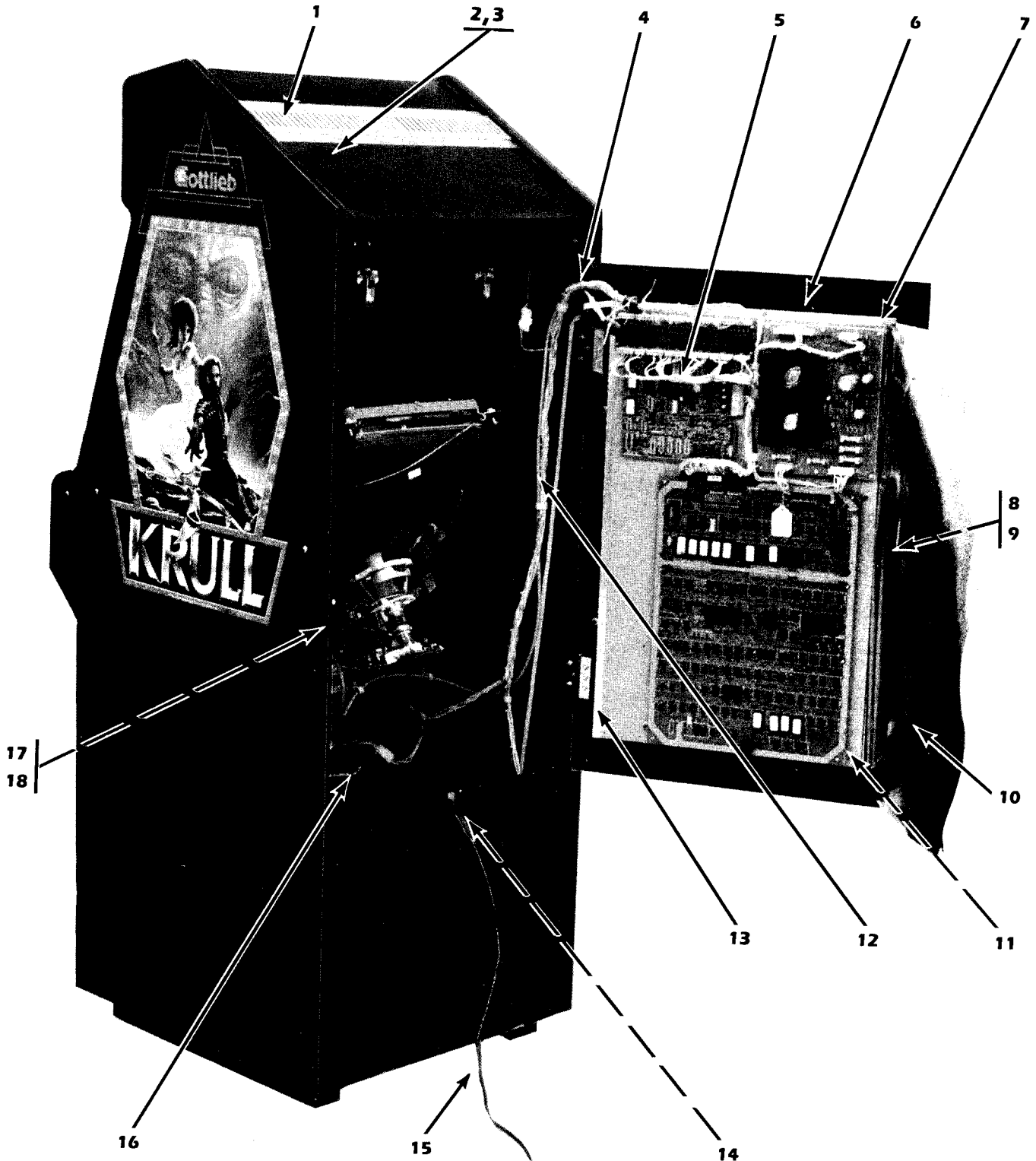
BOTTOM PANEL ASSY.



ITEM	DESCRIPTION	PART NO.
1.	Bottom Panel Assy.	MA-375
2.	Transformer	C-22919
3.	Capacitor, 50, 000UF, 25V	XO-141
4.	Resistor, 200 OHM, 5%, 2W	XO-142
5.	Fuse, 3 AMP, SLO-BLO	EL-9
6.	Cable Assy. (Secondary)	MA-476
7.	Fuse, 1 AMP, SLO-BLO	EL-6
8.	Fuse, 10 AMP	EL-23
9.	Bridge Rectifier (2)	EL-42
10.	Fuse, 2 AMP, SLO-BLO	EL-7
11.	Fuse, 4 AMP, SLO-BLO	EL-33
12.	Service Outlet	A-18133
13.	Line Filter	EL-50
14.	Cable Assy. (Primary)	MA-363

XI. PARTS INFORMATION

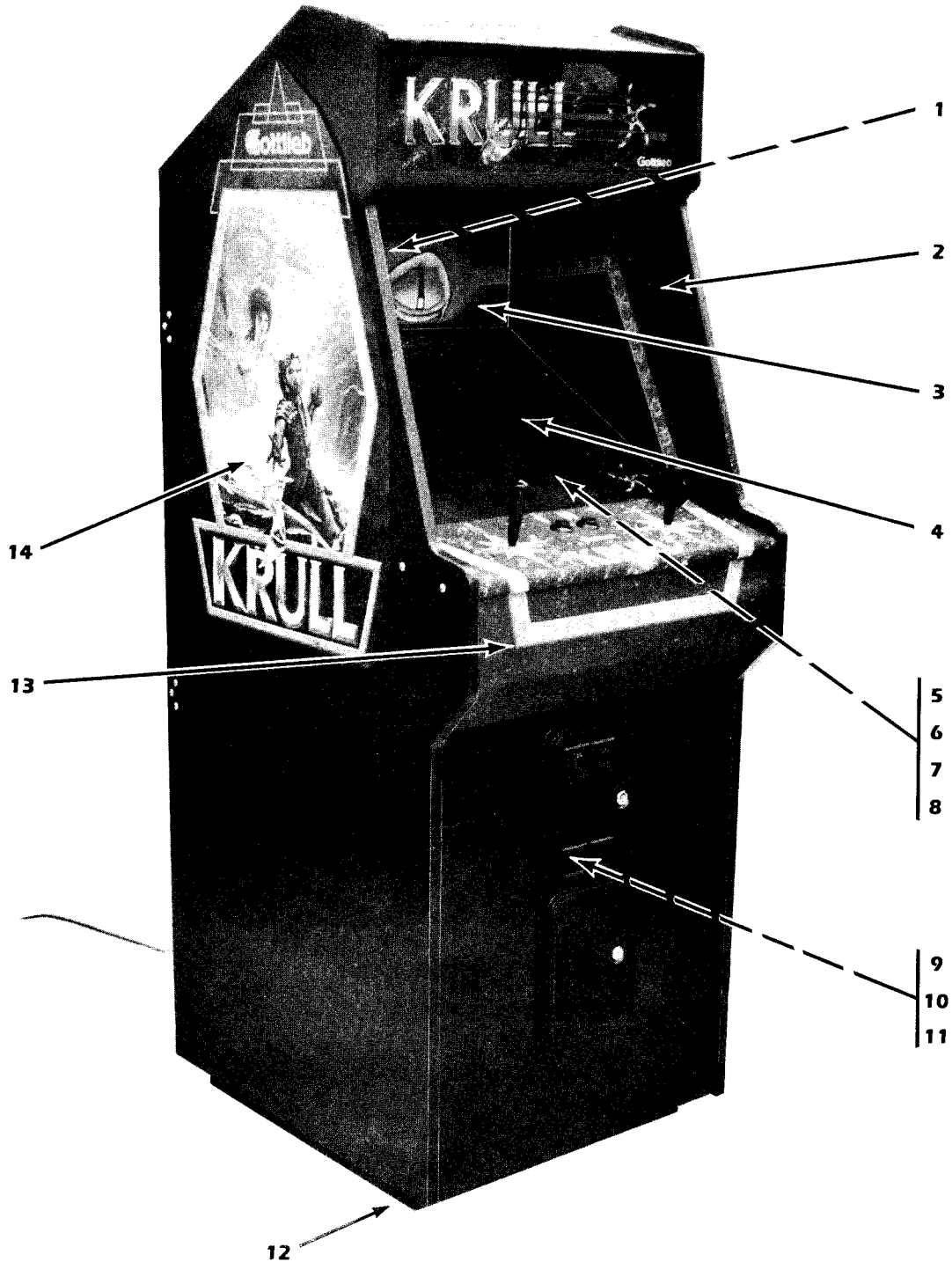
CABINET PARTS



ITEM	DESCRIPTION	PART NO.	ITEM	DESCRIPTION	PART NO.
1.	Vent Channel (2)	D-21754	10.	Shield, Top	D-22632
2.	On-Off Switch	EL-56	11.	Shield, Bottom	C-22633
3.	Switch Plate	A-22396	12.	Monitor Cable	A-22620
4.	Cable Assy. Master Electronics	MA-466	13.	Clip Bracket, Shield	B-22631
5.	Interconnect Cable	MA-465	14.	Cover Plate, Line Cord	A-21955
6.	Back Door	D-23073-3	15.	Line Cord	B-15357
7.	Master Electronic Board	MA-1155	16.	Cable Assy. High Voltage	MA-360
8.	Rear Door Lock	MH-0	17.	Interlock Switch	EL-66
9.	Anchor Plate, Lock	MH-1	18.	Cover, Interlock Switch	A-21888

XI. PARTS INFORMATION

CABINET PARTS



ITEM	DESCRIPTION	PART NO.	ITEM	DESCRIPTION	PART NO.
1.	Left Side CRT Decal	A-23068	8.	Monitor	C-22462-3
2.	Right Side CRT Decal	A-23069	9.	Cable Assy. Front Door	MA-369
3.	Rear Side CRT Decal	A-23070	10.	Interlock Switch	EL-66
4.	Top Glass	A-22464	11.	Cover, Interlock Switch	A-21888
5.	CRT Frame	A-23042	12.	3" Leg Adjuster (2)	MH-21
6.	Monitor Filter Glass	C-22849-1	13.	Lexan Overlay (Screen)	A-23043
7.	Monitor Mask	D-22463	14.	Side Decal (Left or Right)	D-21346

SERVICE NOTES

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

<u>GAME</u>	<u>ITEM</u>	<u>WARRANTY PERIOD</u>
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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