Q*bert's QUBES

MYLSTAR

INSTRUCTION MANUAL

Q*BERT'S QUBES (GAME GV-119)
INSTRUCTION MANUAL

TABLE OF CONTENTS

"WARNING: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction 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
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ATTACHED TO AND A PART OF Q*BERTS QUBES (GAME GV-119)

INSTRUCTION MANUAL

1. PLEASE MAKE THE FOLLOWING CHANGES/DELETIONS/ADDITIONS TO YOUR Q*BERTS QUBES INSTRUCTION MANUAL:

PAGE 9　　　C. FUSES

　DELETE:　F6 KNOCKER, +30V DC, 1 AMP SLO-BLO

　ADD:　F12 INPUT LINE 115V AC, 8 AMP SLO-BLO, EL-26

PAGE 13　　LOGIC BOARD ASSY.(A1), PARTS LIST

　CHANGE:　Q1 CHANGED TO MPS-U45, XO-306

　DELETE:　C33, Q2 AND R32

　ADD:　C53, CAPACITOR, 10UF, 25V TANT, XO-127

PAGE 15　　LOGIC BOARD ASSY.(A1), PARTS LIST

　ADD:　C14-15, ROM 3, 2764 8K x 8 EPROM, XO-489

PAGE 17　　LOGIC BOARD ASSY.(A1), SCHEMATIC DIAGRAM, SHEET 1 OF 3

　DELETE:　LEGEND "KNOCKER" AT Q2, AND REMOVE R32, Q2, C33 AND OUTPUT LEAD "A1P1-6"

　CHANGE:　INPUT FOR Q1 NOW COMES FROM A8-15(OP35)

　CHANGE:　R31 CHANGED TO 15K, 5%, ¼W, XO-22

　ADD:　C53 AT BASE OF Q1 (MPS-U45) TO GROUND
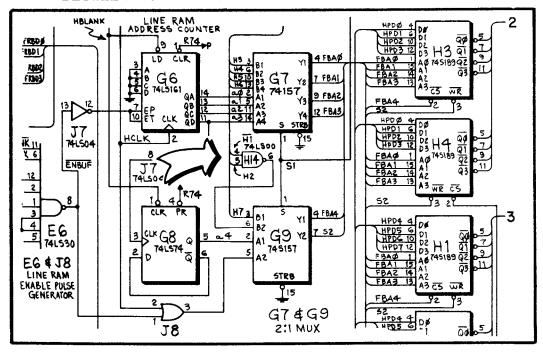
　ADD:　WIRE FROM A8-12 TO PINS 26 OF K4, K5, K6 AND K7-8

PAGE 20　　LOGIC BOARD ASSY.(A1), SCHEMATIC DIAGRAM, SHEET 2 OF 3

　CHANGE:　PLEASE CORRECT THE PORTION OF THE CIRCUITRY AS SHOWN BELOW INCORPORATING THE ADDITION OF THE H14 CIRCUITRY BETWEEN G7 AND G9.

PAGE 21   LOGIC BOARD ASSY.(A1), SCHEMATIC DIAGRAM, SHEET 3 OF 3
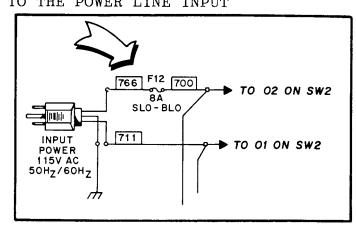
   CHANGE: REMOVE (+5V) FROM K4-26, K5-26, K6-26 AND K7-8,-26, TIE
             THESE POINTS TOGETHER AND CONNECT VIA (JUMPER) TO A8-12

PAGES 30-31-32   PRIMARY POWER/FILTER BOARD/INTERCONNECTION DIAGRAM
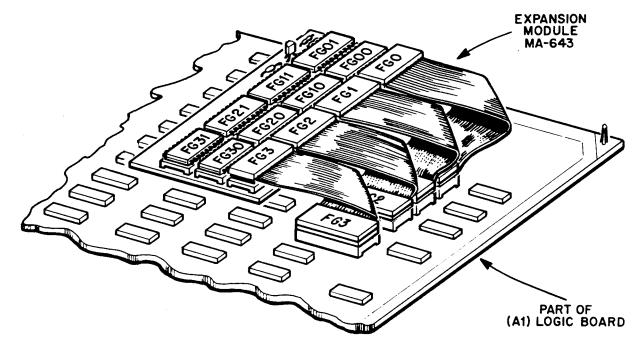
   DELETE: REMOVE THE KNOCKER/FUSE/JACK ASSY. BETWEEN A7J1-1 AND
             A7J1-2.

   ADD: PARTIAL SCHEMATIC DIAGRAM BELOW INDICATES ADDITION OF
             F12 TO THE POWER LINE INPUT

2.   THE FOREGROUND OBJECT ROM (EXPANSION MODULE, MA-643) CONSISTS
     OF FOUR SERIES PAIRED 2764'S WHICH HAVE THE SUM EQUIVALENT OF
     DOUBLING THE MEMORY CAPACITY REQUIRED FOR THE Q*BERTS QUBES
     (GAME GV-119).   THE LOGIC PROM KIT UTILIZED IS PK-119.   SOUND
     PROM KIT USED IN THIS GAME IS PKS-119.   SEE FIGURE 1. FOR
     LOCATION OF THE EXPANSION MODULE AND FIGURE 2. FOR THE SCHEMATIC
     DIAGRAM.   THIS CIRCUIT MODIFICATION REPLACES THE K4, K5, K6 AND
     K7-8 PORTION OF LOGIC BOARD ASSY.(A1), SCHEMATIC DIAGRAM BOTTOM
   OF PAGE 21, SHEET 3 OF 3.
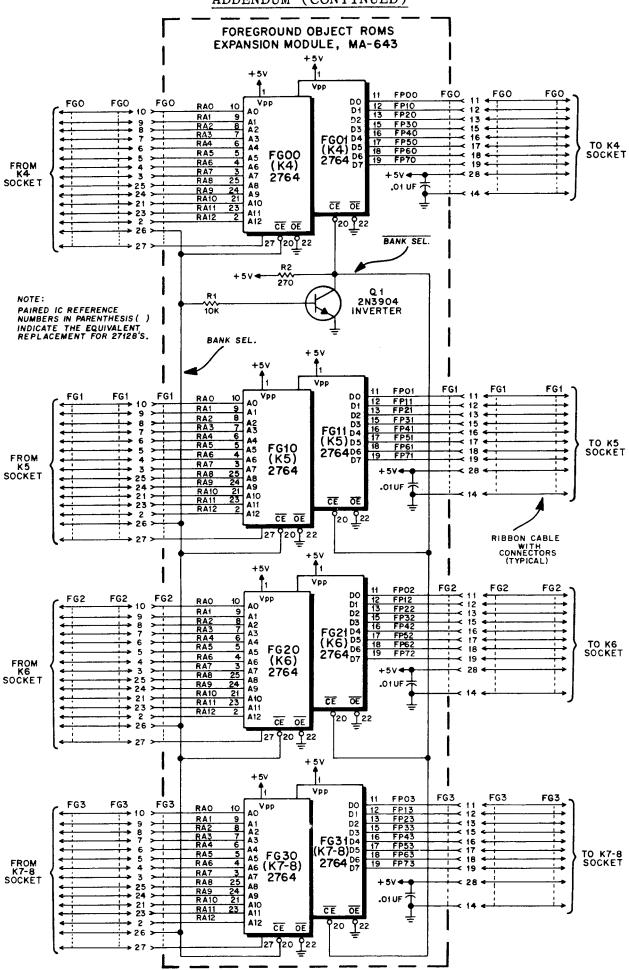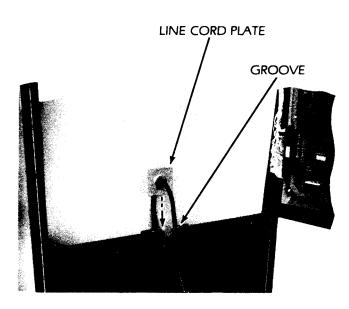

FIGURE 1.

FIGURE 2.

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.

LINE CORD PLATE

GROOVE

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!!
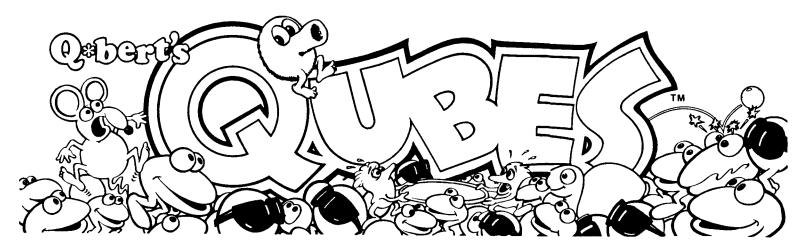
C. CONTROL PANEL REMOVAL

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.

HOW TO PLAY

The object of the Q*Bert's Qubes game is to rotate a cube so that the colors of all three sides match the corresponding colors of the target cube: When a cube is rotated so that its colors match the target cube the cube turns to a green outline cube. The player must get five outline cubes in a row, up-down, across, or diagonally. Getting the required number of tic-tac-toes completes the round, and the screen advances to the next round, with Q*Bert starting back on the top cube. At the beginning of each level there will be a short demonstration to let the player know how many tic-tac-toes are required to complete the round in the new level. Each level consists of four rounds.

The game play starts with the player-controlled Q*Bert character appearing at the top of the playfield. The joystick will move Q*Bert from cube to cube by hopping in any of four diagonal directions. Q*Bert can move anywhere on the playfield but jumping off will kill him. Each time Q*Bert jumps off a cube that is not a green outline cube the cube will rotate in the direction that Q*Bert jumped. In early levels once a cube has matched the target cube it will no longer rotate, in later levels they will be able to turn.

Q*Bert will have to avoid touching the purple ball and the Meltniks. These deadly objects drop randomly onto the second from the top level and bounce downwards. The Meltniks will either fall off the bottom, or, melt if they land on a cube whose top matches its character color. The purple ball will stop at the bottom and hatch into Rat-a-tat-tat, the rat which chases Q*Bert. To destroy the rat Q*Bert must time his jump so that the rat will land on a cube that is rotating. The rat will fall off the cube and points are awarded. The number of points awarded decreases each time the rat is killed, however, it is reset to the maximum number of points at the start of each new round and each time after Q*Bert dies.

The turtle Sheldon appears in every round, the green ball begins appearing in round three, and the Shoobops begin appearing in level 3. The green characters or objects are safe to hop on and will award points. All other objects are deadly to touch. Hopping Q*Bert onto Sheldon awards 100

points and slows all the characters down to a crawl for a few seconds except Q*Bert. Hopping Q*Bert onto the green ball awards 100 points and freezes all the characters on the screen for a few seconds, but Q*Bert will still be able to move and rotate cubes. The middle of level 3 the Shoobops begin appearing. They will drop onto the second level from the top and hop randomly downward. As they hop off a cube it will rotate in the direction that they hop. Hopping Q*Bert onto either of the Shoobops will award 100 points.

All characters and objects appear at random time intervals throughout the game. As the levels increase they will appear with increasing frequency and increased speed, however they will always be slower than Q*Bert.

During level 3 the play action increases with difficulty by increasing the number of colors to six. Each side will have its own unique color. At level 4 the number of tic-tac-toes required increases to 2 making completing the round more difficult. Level 5 requires 3 tic-tac-toes. Level 6 requires only 1 tic-tac-toe but at this point the green outline cubes are free to rotate back to regular cubes.

Bonus points are awarded at the end of each round based on the number of cubes that match the target cube. The points awarded per cube increase as the game progresses. There is a timer that counts down throughout the level, until reaching 15, where it then stops. The quicker the player completes a level the more time left on the timer. The remaining time is how long the player will get to play the bonus round which appears after each level. During the bonus round the cube will rotate in the direction the joystick is moved but Q*Bert will remain on the same cube until it matches the target cube. Then Q*Bert will advance to the next cube. When time runs out points are awarded 100 points for the first cube, 200 points for the second, 300 for the third, etc.

When the difficulty level is set on hard two additional characters appear starting at level 2. The purple guys appear at the bottom and right side of the screen. They do not chase Q*Bert but move randomly on the sides and fronts of the cubes to get in Q*Berts way.

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IV. GAME PLAY AND SCORING

ROUND PROGRESSIONS

	ROUND	# T-T-T NEEDED	CUBES LOCK	CHARACTERS ON SCREEN	ROUND COMPLETION BONUS
LEVEL 1	1	1	Yes	Rat-a-tat-tat, Meltniks, Sheldon	200
	2	1	Yes	Rat-a-tat-tat, Meltniks, Sheldon	200
	3	1	Yes	Rat-a-tat-tat, Meltniks, Sheldon	200
	4	1	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon	200
LEVEL 2	1	1	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon	200
	2	1	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon	225
	3	1	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon	250
	4	1	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon	275
LEVEL 3	1	1	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon	300
	2	1	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon	325
	3	1	Yes	Rat-a-tat-tat, Green Ball, Sheldon, Shoobops	350
	4	1	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon, Shoobops	375
LEVEL 4	1	2	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon, Shoobops	400
	2	2	Yes	Rat-a-tat-tat, Green Ball, Sheldon, Shoobops	425
	3	2	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon, Shoobops	450
	4	2	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon, Shoobops	475
LEVEL 5	1	3	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon, Shoobops	500
	2	3	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon, Shoobops	525
	3	3	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon, Shoobops	550
	4	3	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon, Shoobops	575
LEVEL 6	1	1	No	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon	600
	2	1	No	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon, Shoobops	625
	3	1	No	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon	650
	4	1	No	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon, Shoobops	675
LEVEL 7	1	2	No	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon	700
	2	2	No	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon, Shoobops	725
	3	2	No	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon	750
	4	2	No	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon, Shoobops	775
LEVEL 8	1	3	No	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon	800
	2	3	No	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon	825
	3	3	No	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon	850
	4	3	No	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon	875
LEVEL 9	1	4	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon, Shoobops	900
	2	4	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon, Shoobops	925
	3	4	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon, Shoobops	950
	4	4	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon, Shoobops	975
LEVEL 10	1	3	No	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon	900
	2	3	No	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon	925
	3	3	No	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon	950
	4	3	No	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon	975
LEVEL 11	1	3	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon, Shoobops	900
	2	3	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon, Shoobops	925
	3	3	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon, Shoobops	950
	4	3	Yes	Rat-a-tat-tat, Green Ball, Meltniks, Sheldon, Shoobops	975

After level 11 the game keeps cycling through level 9-11.

SCORING

- Killing Rat-a-tat-tat is worth
    500 points the first time
    400 points the second time
    300 points the third time
    200 points the third time
    100 points the third time
    10 points each time after

- Resets to 500 each round or after each death

- Hopping onto Shoobops
    Scores 100 points each

- Hopping onto Green Ball
    Scores 100 points and freezes
    all characters but Q*Bert

- Hopping onto Sheldon
    Scores 100 points and slows down
    all characters but Q*Bert

- Hopping onto a cube
    Scores 5 points

- Changing cube to correct color
    Scores 100 points

- Bonus round points are
    100 points for first cube
    200 points for second cube
    300 points for third cube
    400
      "
      "
      "

    25000 points for twenty-fifth cube

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V. SOUND/SPEECH

ATTRACT MODE

SPEECH	OCCURENCE
"HELLO, I'M TURNED ON"	When game is powered up.

GAME MODE

SPEECH	OCCURENCE
(Garbled Nonsense Speech)	When "Q*Bert" is killed. When the characters "Shoobops" or the Purple guys are present.
"BYE, BYE"	When player has finished entering his initials on high score table.

VI. GAME ADJUSTMENTS/OPTIONS

A. CONTROL BOARD SWITCH ADJUSTMENTS

SWITCH 1 _____ **ATTRACT MODE**
OFF ....SOUND
ON ....NO SOUND

SWITCHES				COIN/CREDITS	
2	3	4	5	RIGHT SLOT	LEFT SLOT
OFF	OFF	OFF	OFF	1/1	1/1
OFF	OFF	OFF	ON	2/1	1/2
OFF	OFF	ON	OFF	2/1	1/3
OFF	OFF	ON	ON	2/1	2/1
OFF	ON	OFF	OFF	2/1	1/1
OFF	ON	OFF	ON	3/1	1/1
OFF	ON	ON	OFF	4/1	1/1
OFF	ON	ON	ON	FREE	FREE

SWITCH 6 _____ **1ST EXTRA MAN**
OFF ....10,000 POINTS
ON ....15,000 POINTS

SWITCH 7 _____ **EACH ADDITIONAL MAN**
OFF .... 20,000 POINTS
ON .... 25,000 POINTS

SWITCH 8 _____ **DIFFICULTY CONTROL**
OFF .... NORMAL
ON ..... (PURPLE GUYS COME IN STARTING AT LEVEL 2) ..... HARD

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/Speech 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 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 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. SOUND/SPEECH TEST

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

4. BOOKEEPING

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 player button on the control panel to perform that function.

DISPLAY SCORE COUNTS — A table is shown with categories of score values 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 player 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 — Sames 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 HIGH SCORE — Pressing either player button will reset the Supreme Noser table (all-time high scores).

VII. BOOKKEEPING AND SELF TEST

5. 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.

6. SWITCH TEST

Pressing any player button, coin switch or moving the joystick in any direction will display a corresponding action.

VIII. GENERAL INFORMATION

A. PRINTED CIRCUIT BOARDS ARE DESIGNATED AS FOLLOWS:

A1   Logic Board Assy.

A3   Power Supply Assy.

A6   Sound/Speech 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
F6	Knocker	+30VDC	1 Amp SLO-BLO

POWER SUPPLY ASSY. (A3)

F11	+5VDC Source		5 Amp SLO-BLO
F21	Sound/Speech Assy.	+30VDC	1½ Amp SLO-BLO
F31	Sound/Speech Assy.	+12VDC	¼ Amp SLO-BLO
F32	Sound/Speech 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/Speech Board	+30VDC	1.5Amps 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/Speech 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 Distrubutors table and the Options/Parameters screen.
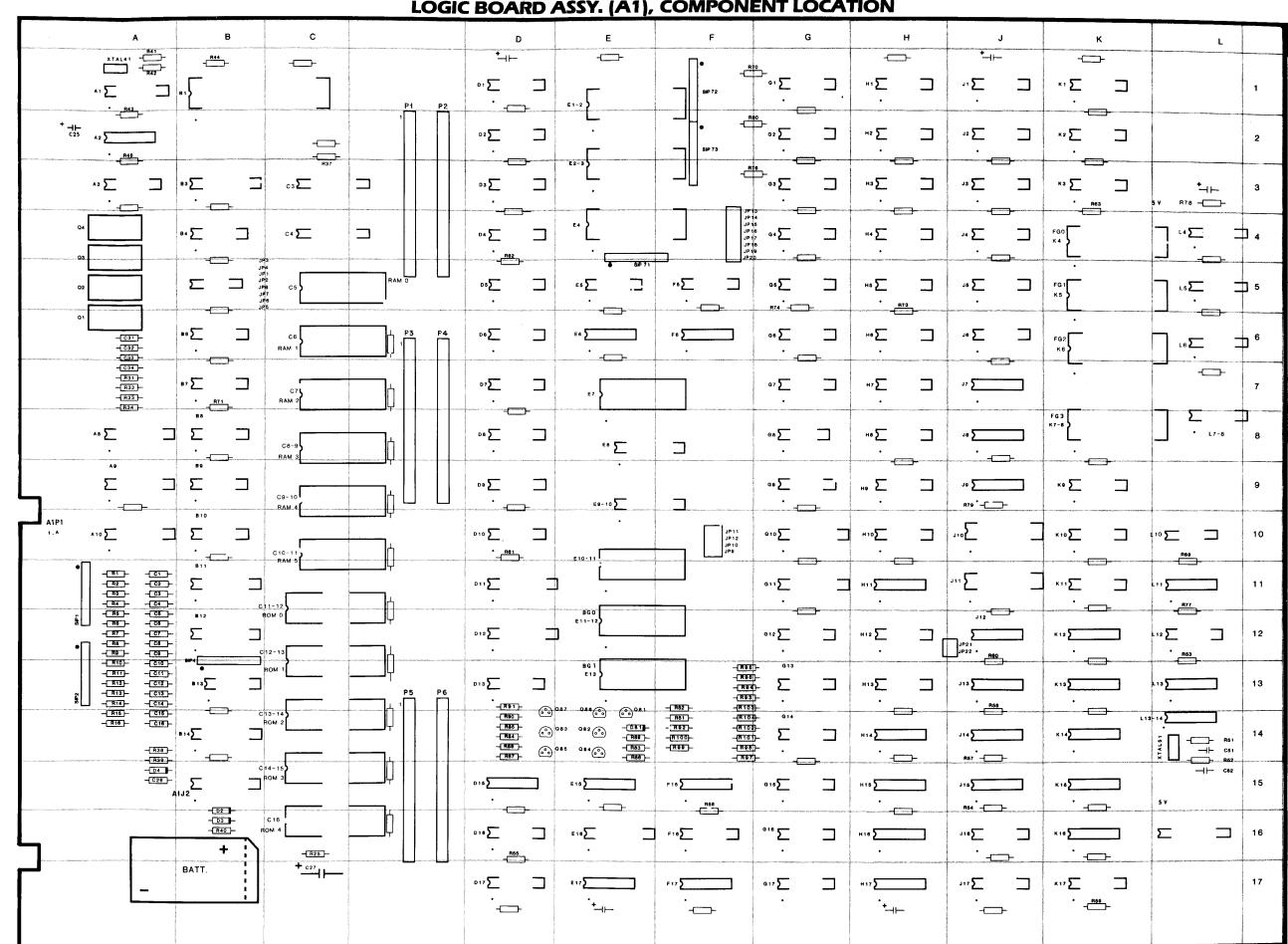
X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

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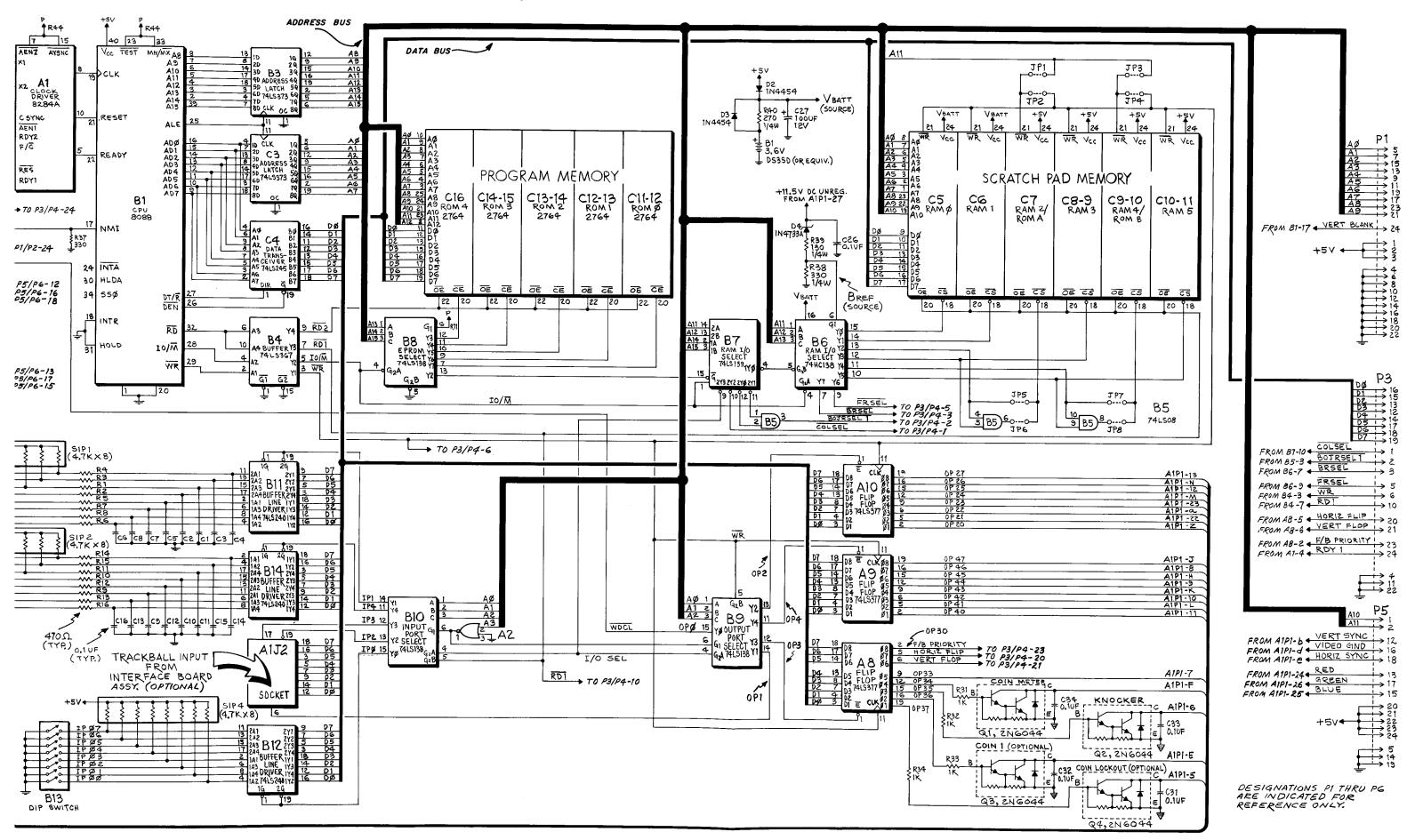
LOGIC BOARD ASSY. (A1), PARTS LIST

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

**LOGIC BOARD ASSY. (A1), SCHEMATIC DIAGRAM, SHEET 1 OF 3**
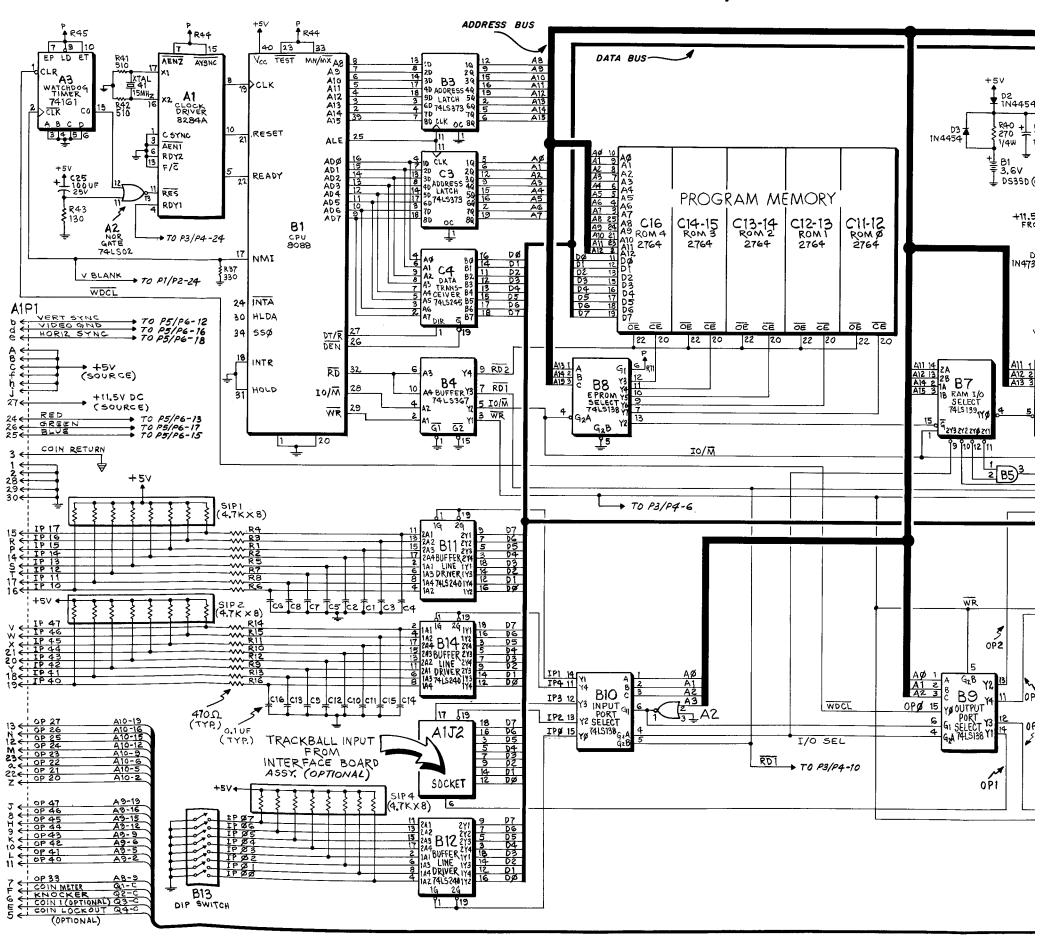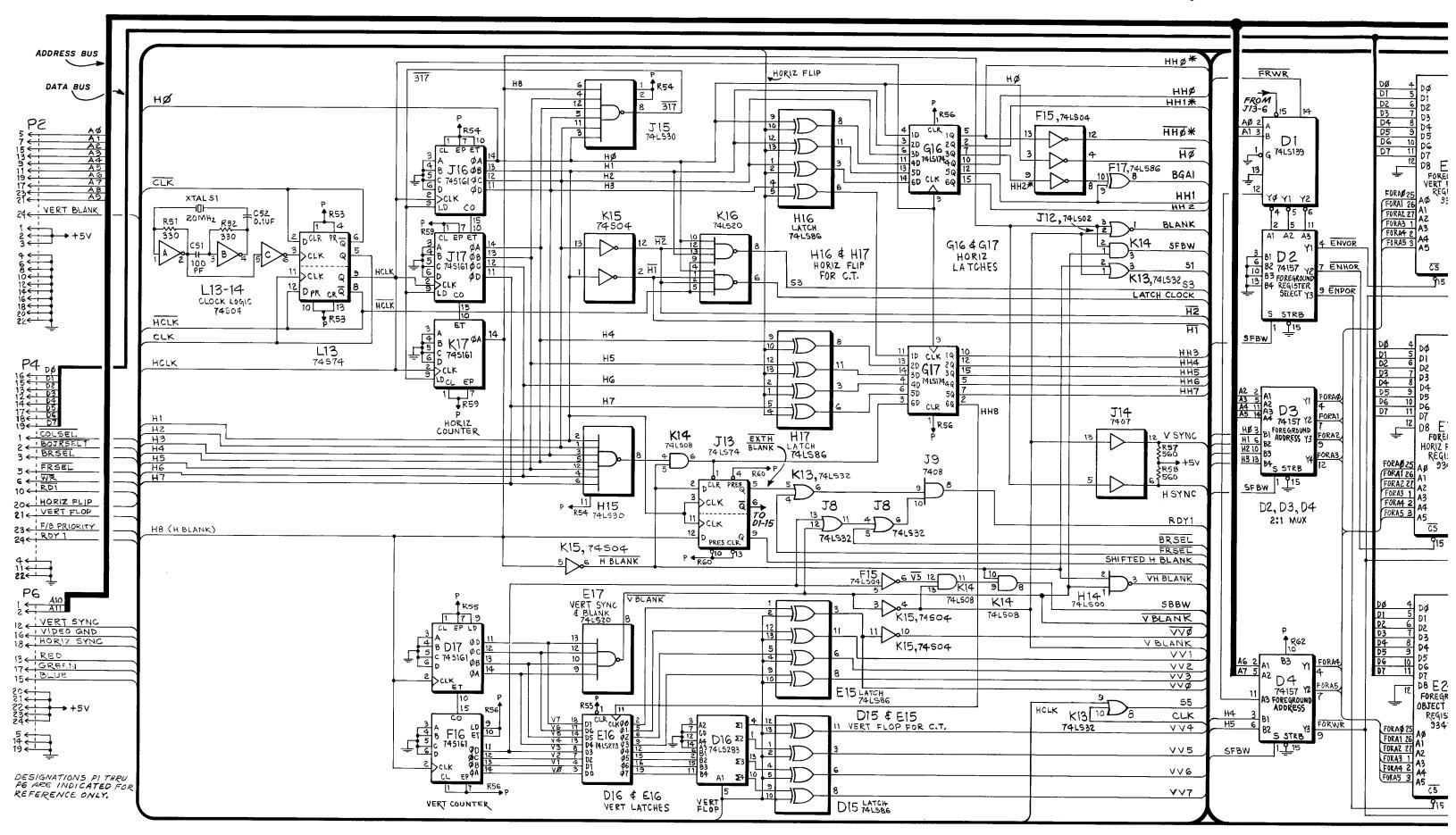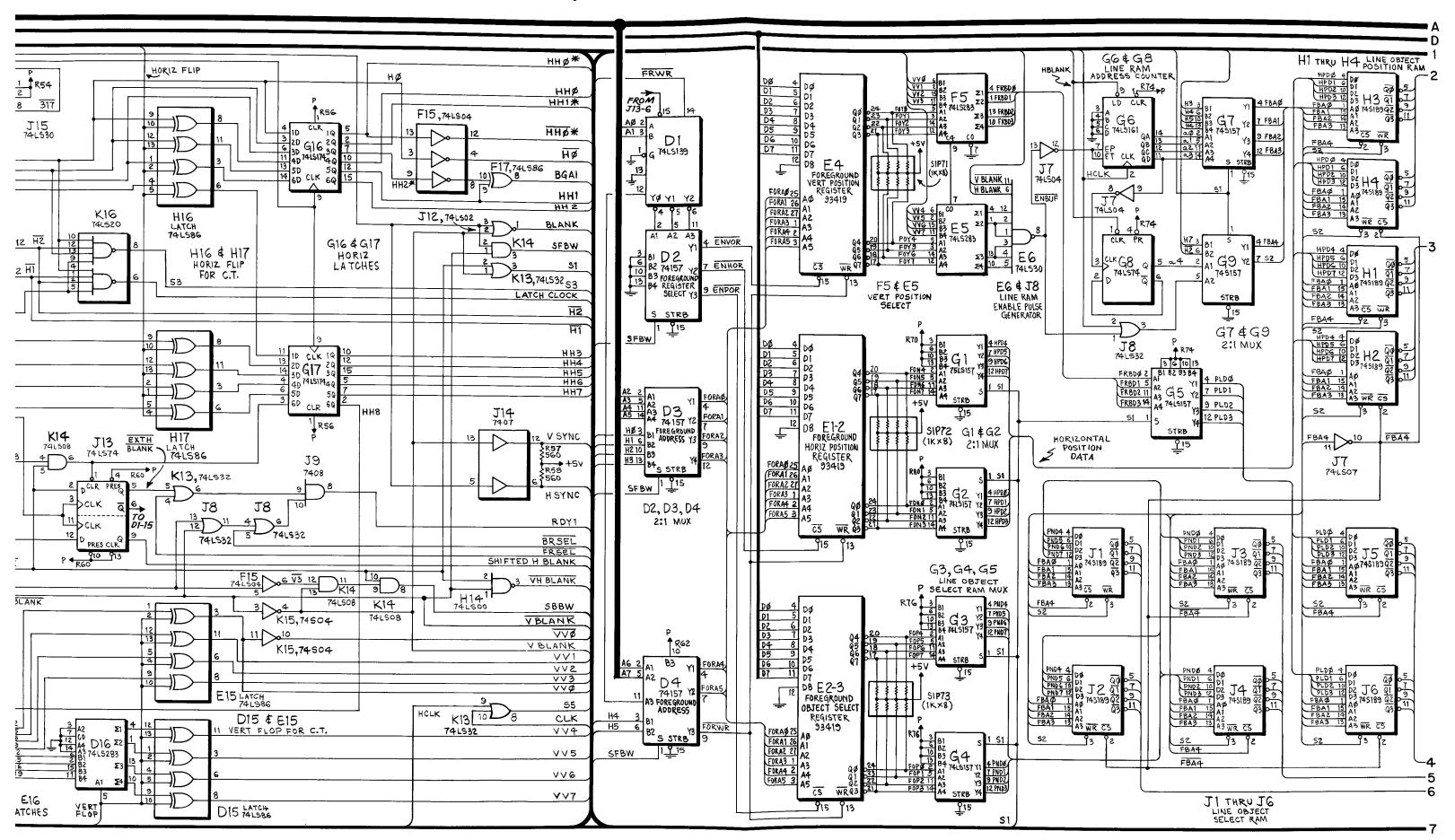
LOGIC BOARD ASSY. (A1), PARTS LIST (CONT.)

INTEGRATED CIRCUITS

REFERENCE	DESCRIPTION	PART NO.	REFERENCE	DESCRIPTION	PART NO.
	Logic Board Assy.	MA-378	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	74LS157 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, B9, B10	74LS138 1 of 8 decoder	XO-437	H11	74LS260 Dual 5-input "NOR" gate	XO-93
B11, B12, B14	74LS240 Octal Buffer/line driver	XO-91	H12	74LS298 Quad 2-port register	XO-118
C3	74LS373 Octal D-type flip flop	XO-445	H13	74LS157 Quad 2-input multiplexer	XO-390
C4	74LS245 Octal Bus transceiver	XO-79	H14	74LS00 Quad 2-input "NAND" gate	XO-427
C5	RAM Ø 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	RAM 2 2128-2	XO-195	J1, J2, J3, J4, J5, J6,		
C8-9	RAM 3 2128-2	XO-195	J7	74S189 64-bit RAM	XO-89
C11-12	ROM Ø 2764 8K x 8 EPROM	XO-489	J7	74LS04 Hex inverter	XO-418
C12-13	ROM 1 2764 8K x 8 EPROM	XO-489	J8	74LS32 Quad 2-input "OR" gate	XO-433
C13-14	ROM 2 2764 8K x 8 EPROM	XO-489	J9	7408 Quad 2-input "AND" gate	XO-404
D1	74LS139 Dual 1 of 4 Decoder	XO-419	J10, J11	93422 256 x 2 bipolar RAM	XO-100
D2, D3, D4, D5, D6, D7, D8, D9,			J12	74LS02 Quad 2-input "NOR" gate	XO-428
D10	74157 Quad 2-input multiplexer	XO-114	J13	74LS74 Dual D-type flip flop	XO-434
D11	74LS374 Octal D-type flip flop	XO-96	J14	7407 Hex buffer/driver	XO-384
D12	74LS244 Octal buffer/line driver	XO-117	J15	74LS30 8 input "NAND" gate	XO-432
D13	74LS157 Quad 2-input multiplexer	XO-390	J16, J17	74S161 Synchronous presettable binary counter	XO-488
D15	74LS86 Quad 2-input exclusive "OR" gate	XO-435	K1, K2, K3	74LS379 Quad D-type flip flop	XO-98
D16	74LS283 4-bit binary full adder	XO-95	K4	FG0 2764-3 8K x 8 EPROM	XO-489
D17	74S161 Synchronous presettable binary counter	XO-488	K5	FG1 2764-3 8K x 8 EPROM	XO-489
E1-2, E2-3, E4	93419 64 x 9 bipolar RAM	XO-99	K6	FG2 2764-3 8K x 8 EPROM	XO-489
E5	74LS283 4-bit binary full adder	XO-95	K7-8	FG3 2764-3 8K x 8 EPROM	XO-489
E6	74LS30 8-input "NAND"	XO-432	K9, K10, K11	74LS157 Quad 2-input multiplexer	XO-390
E7	4801 1K x 8 RAM	XO-193	K12	74LS260 Dual 5-input "NOR" gate	XO-93
E8, E9-10	74LS245 Octal Bus Transceiver	XO-79	K13	74LS32 Quad 2-input "OR" gate	XO-433
E10-11	4801 1K x 8 RAM	XO-193	K14	74LS08 Quad 2-input "AND" gate	XO-86
E11-12	2732A (BGØ) 4K x 8 EPROM	XO-485	K15	74S04 Hex inverter	XO-400
E13	2732A (BG1) 4K x 8 EPROM	XO-485	K16	74LS20 Dual 4-input "NAND" gate	XO-430
E15	74LS86 Quad 2-input exclusive "OR" gate	XO-435	K17	74S161 Synchronous presettable binary counter	XO-488
E16	74LS273 8-bit register	XO-94	L4, L5, L6, L7	74LS166 8-bit shift register	XO-391
E17	74LS20 Dual 4-input "NAND" gate	XO-430	L10	74LS74 Dual flip flop	XO-434
F5	74LS283 4-bit binary full adder	XO-95	L11	74LS20 Dual 4-input "NAND" gate	XO-430
F6	74LS32 Quad 2-input "OR" gate	XO-433	L12	74LS161 Synchronous presettable binary counter	XO-440
F15	74LS04 Hex inverter	XO-418	L13	74S74 Dual D-type pos. edge trig. flip flop (T. I. only)	XO-87
F16	74S161 Synchronous presettable binary counter	XO-488	L13-14	74S04 Hex inverter	XO-400
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			
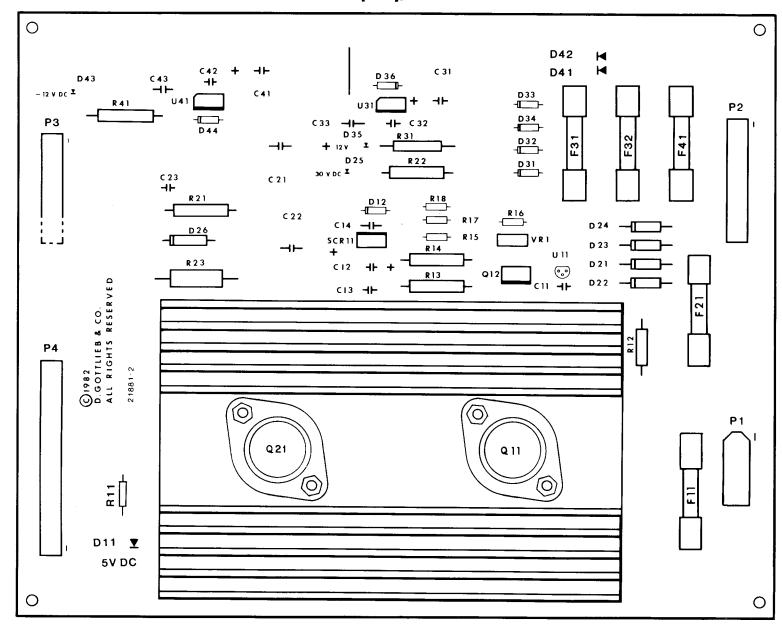
LOGIC BOARD ASSY. (A1), SCHEMATIC DIAGRAM, SHEET 2 OF 3
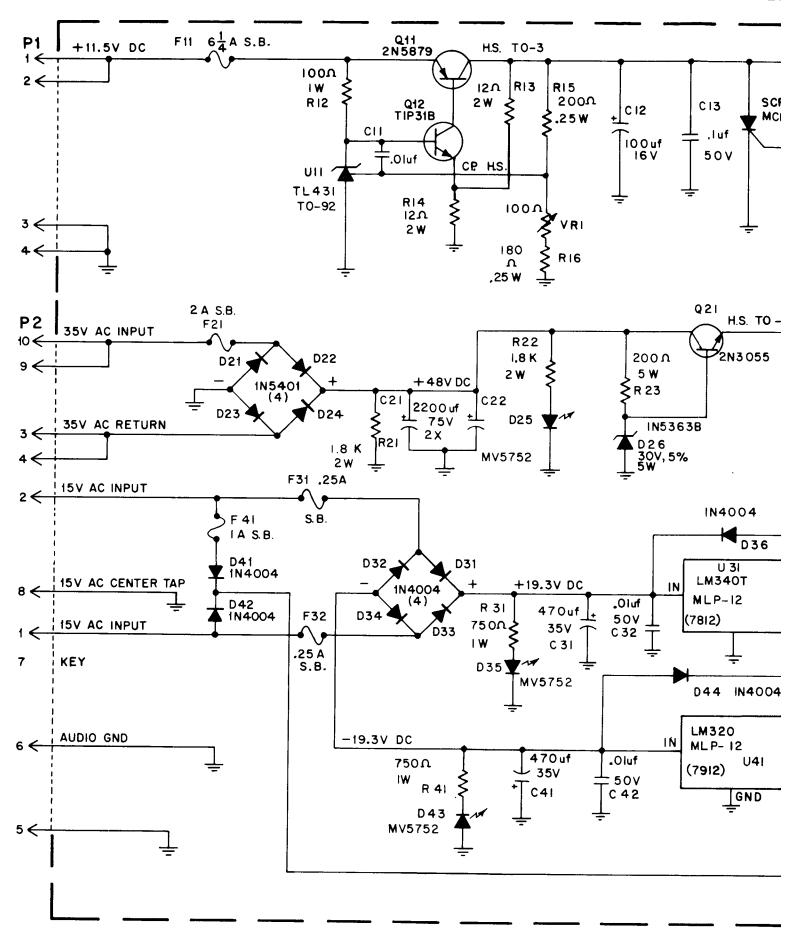
POWER SUPPLY ASSY. (A3), COMPONENT LOCATION
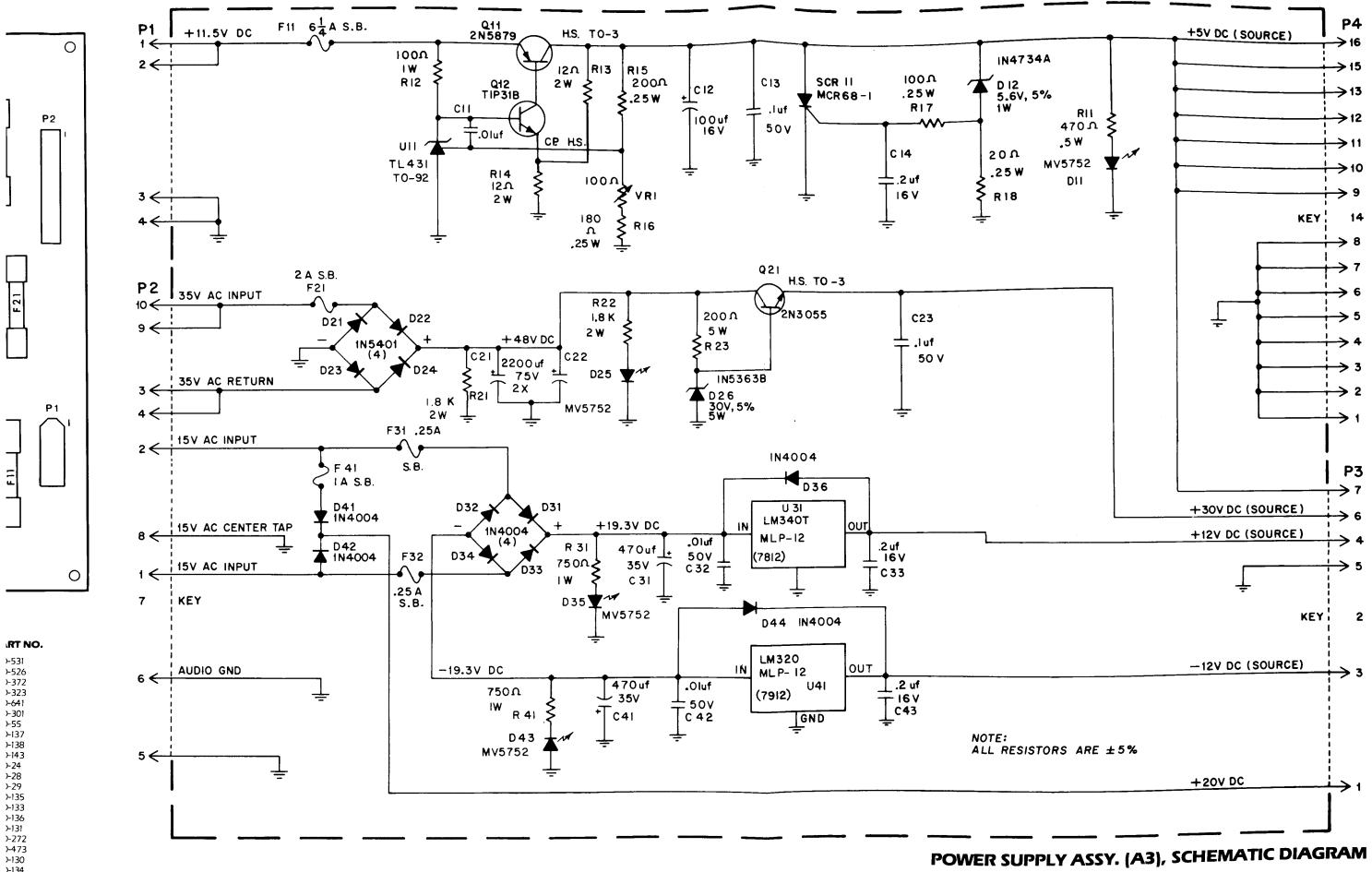
POWER SUPPLY ASSY. (A3), PARTS LIST
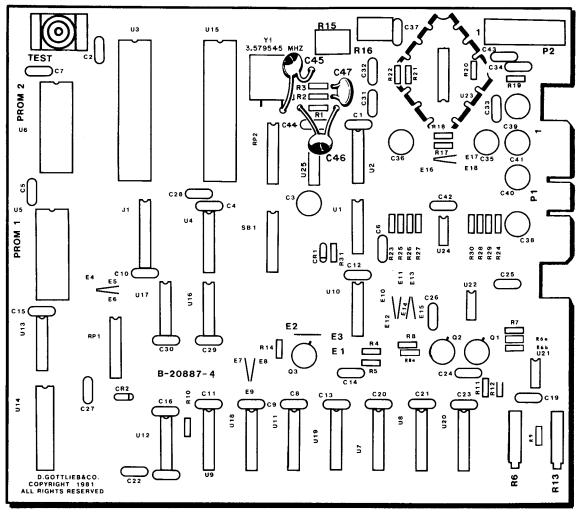
| REFERENCE	DESCRIPTION	PART NO.	REFERENCE	DESCRIPTION	PART NO.
	Power Supply Assy.	MA-430	P2	Connector, 10 PIN	XO-531
C11, C32, C42	Capacitor, .01 mfd , 50V	XO-229	P3	Connector, 7 PIN	XO-526
C12	Capacitor, 100UF, 16V	XO-235	P4	Connector, 16 PIN	XO-372
C13, C23	Capacitor, 0.1UF, 100V	XO-234	Q11	Transistor, PNP, 2N5879	XO-323
C14, C33, C43	Capacitor, 0.2UF, 16V	XO-205	Q12	Transistor, NPN, TIP31B	XO-641
C21, C22	Capacitor, 2200UF, 75V	XO-132	Q21	Transistor, NPN, 2N3055	XO-301
C31, C41	Capacitor, 470UF, 35V	XO-284	R11	Resistor, 470 OHM, 5% ½W	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% ¼W	XO-143
			R16	Resistor, 180 OHM, 5% ¼W	XO-24
D21-D24	Diode, 1N5401	XO-263	R17	Resistor, 100 OHM, 5% ¼W	XO-28
D26	Diode, Zener, 30V, 5%, 5W, 1N5363B	XO-273	R18	Resistor, 20 OHM, 5% ¼W	XO-29
			R21, R22	Resistor, 1.8KOHM, 5% 2W	XO-135
D31-D34, D36			R23	Resistor, 200 OHM, 5% 5W	XO-133
D41, D42, D44	Diode, 1N4004	XO-254	R31, R41	Resistor, 750 OHM, 5% 1W	XO-136
F11	Fuse, 6¼ AMP SLO-BLO	EL-8	SCR11	Silicon Controlled Rectifier	XO-131
F21	Fuse, 2 AMP SLO-BLO	EL-7	U11	Diode, Programmable Zener TL431	XO-272
F31, F32	Fuse, ¼ AMP SLO-BLO	EL-5	U31	Voltage Regulator -12V, LM 340T	XO-473
F41	Fuse, 1 AMP SLO-BLO	EL-6	U41	Voltage Regulator -12V, LM 320	XO-130
P1	Connector, 4 PIN	PS-87	VR1	Potentiometer, 100 OHM	XO-134

POWER SUPPLY ASSY. (A3), SCHEMATIC DIAGRAM
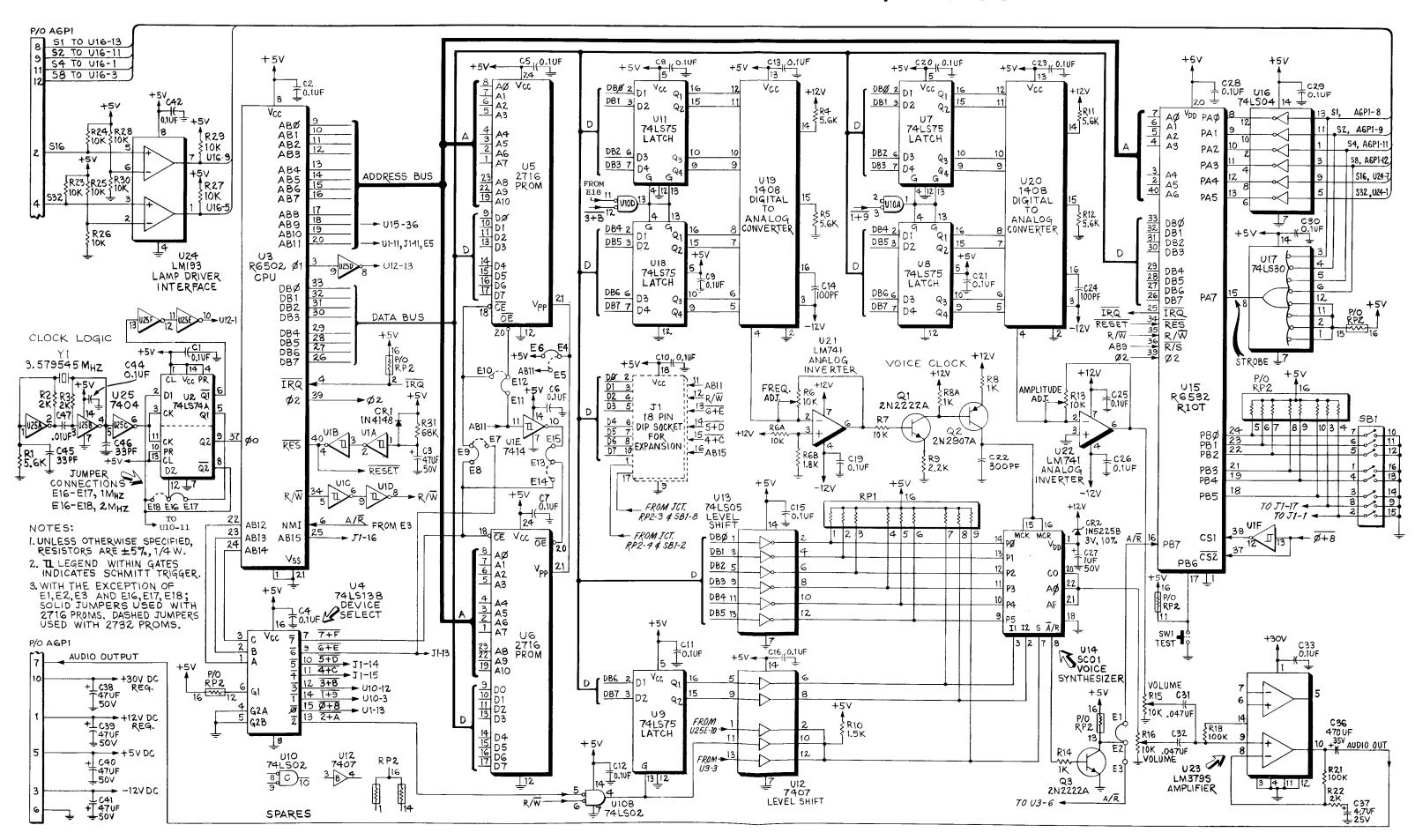
SOUND/SPEECH ASSY. (A6), COMPONENT LOCATION
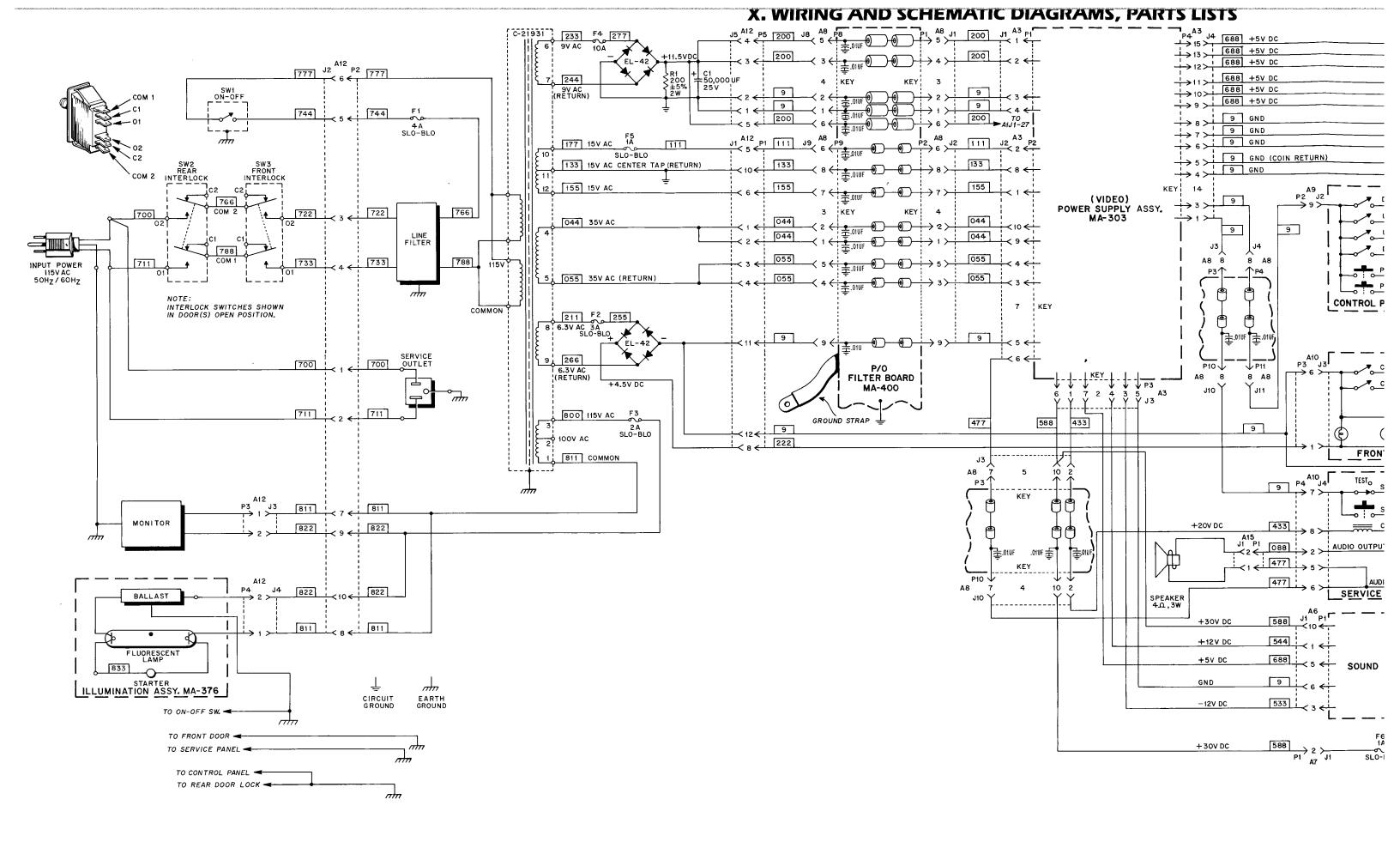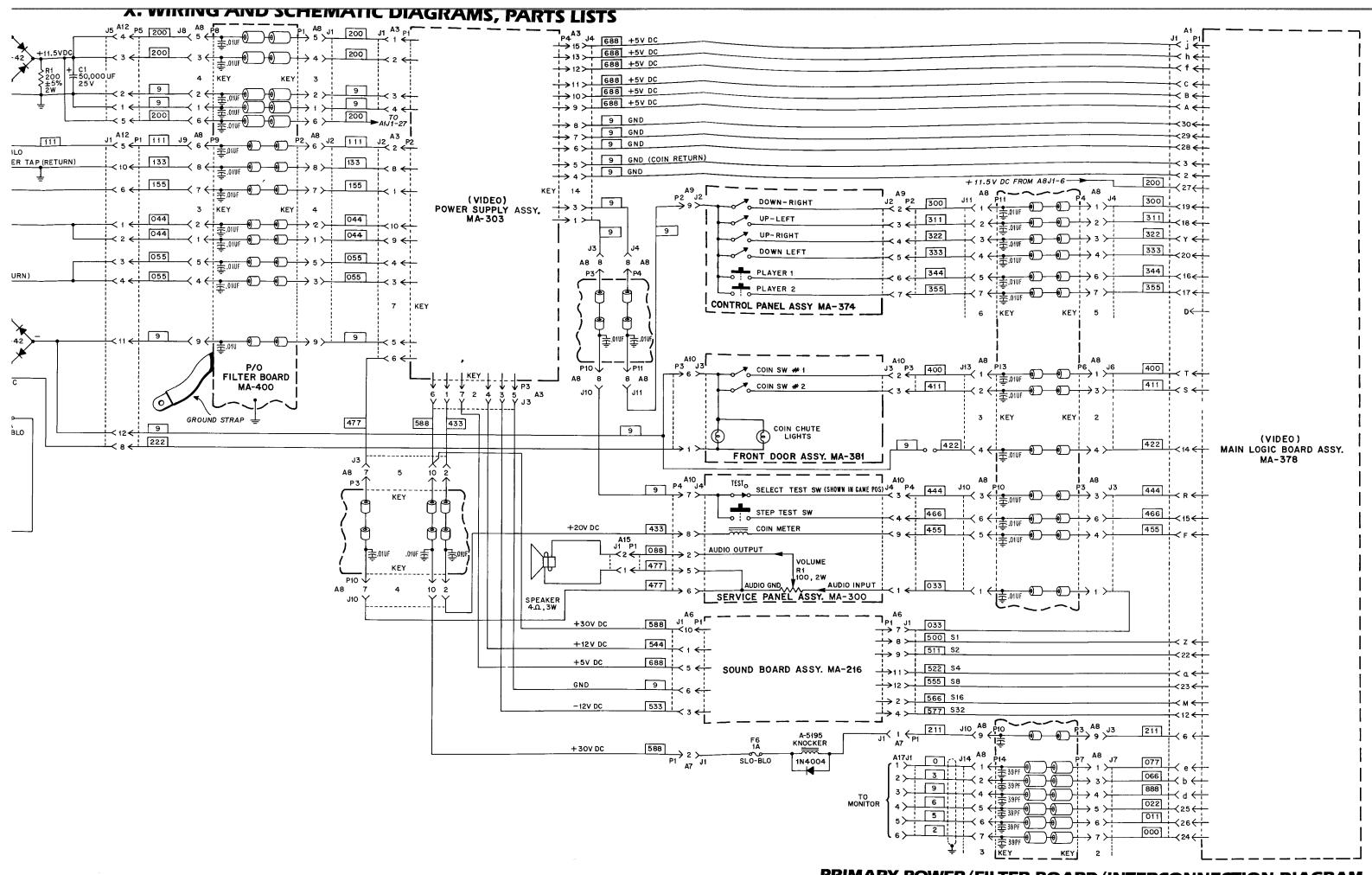
SOUND/SPEECH ASSY. (A6), PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER	REFERENCE	DESCRIPTION	PART NUMBER
	Sound/Speech Assembly	MA-216	R 15, R 16	Potentiometer, 10K ohm	XO-109
C 1, C2	Capacitor, 0.1UF, 25V	XO-248	R 18, R 21	Resistor, 100K ohm, 5%, ¼W	XO-45
C4, C 13			R22	Resistor, 2K ohm, 5%, ¼W	XO-14
C 15, C 16 , C 19			R31	Resistor, 68K ohm, 5%, ¼W	XO-189
C20, C21, C23			RP 1, RP2	Resistor, Dip	XO-168
C25, C26			SB 1	Switch, Dip	XO-505
C28-C30, C33			SW 1	Switch, Momentary Pushbutton	XO-515
C42, C44			U 1	IC, 74 14	XO-397
C31-C32	Capacitor, .047UF, 25V	XO-222	U2	IC, SN74LS74N	XO-434
C37	Capacitor, 4.7UF, 35V	XO-291	U3	CPU, R6502-13	XO-360
C3, C38-C41	Capacitor, 47UF, 50V	XO-210	U4	IC, SN74LS 138N	XO-437
C14, C24	Capacitor, 100PF	XO-223	U5, U6	EPROM, 2716	PR-53
C22	Capacitor, 300PF	XO-283	U7-U9, U 11, U 18	IC, SN74LS75	XO-394
C27	Capacitor, 1UF, 50V	XO-217	U 10	IC, SN74LS02N	XO-428
C36	Capacitor, 470UF, 35V	XO-284	U 12	IC, SN7407N	XO-384
C45, C46	Capacitor, 33PF	XO-277	U 13	IC, Inverter, SN74LS05N	XO-411
C47	Capacitor, .01 UF, 100V	XO-202	U 14	Voice Chip, SC01	XO468
CR 1	Diode, 1N4 148	XO-261	U 15	RRIOT, R6532-18	XO-361
CR2	Diode, Zener, 1N5225B	XO-269	U 16	IC, SN74LS04N	XO-418
Q 1, Q3	Transistor, NPN, 2N2222A	XO-320	U 17	IC, SN74LS30N	XO-432
Q2	Transistor, PNP, 2N2907A	XO-321	U 19, 20	Converter, PMI, 1408A-6P	XO-416
R 1, R4, R5 R 11, R 12	Resistor, 5.6K ohm, 5%, ¼W	XO-19	U21, U22	IC, LM74 1CP	XO-393
			U23	IC, LM379S	XO-395
R2, R3	Resistor, 2K ohm, 5%, ¼W	XO-14	U24	IC, Dual Comparitor, LM 193	XO-396
R6, R 13	Potentiometer, 10K	XO-108	U25	Inverter, 7404	XO-402
R6A, R7, R23-R30	Resistor, 10K ohm, 5%, ¼W	XO-18	Y 1	Crystal, 3.579545MHZ	XO-456
R8, R8A, R 14	Resistor, 1K ohm, 5%, ¼W	XO-5		Socket 22 Pin Dip	XO-467
R6B	Resistor, 1.8K ohm, 5%, ¼W	XO-37		Socket 24 Pin (2)	XO-529
R9	Resistor, 2.2K ohm, 5%, ¼W	XO-27		Socket 40 Pin (2)	XO-530
R 10	Resistor, 1.5K ohm, 5%, ¼W	XO-20			

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SOUND/SPEECH ASSY. (A6), SCHEMATIC DIAGRAM

PRIMARY POWER/FILTER BOARD/INTERCONNECTION DIAGRAM

XI. PARTS INFORMATION

TABLE OF CONTENTS

XI. PARTS INFORMATION

SPEAKER/MARQUEE ASSY.
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-377
7.	Cable Assy.	MA-318
8.	Speaker	EL-83
9.	Speaker Grill	B-20931
10.	Marquee, Lexan (Screen)	24083

CONTROL PANEL ASSY.

ITEM	DESCRIPTION	PART NO.
1.	Control Panel Assy.	MA-374
2.	Short Button (2)	A-21970
3.	Button Holder and Switch (2)	A-21971
4.	Joystick	C-22458
5.	Cable Assy.	MA-382
6.	Lexan Overlay	24082

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

BOTTOM PANEL ASSY.

ITEM	DESCRIPTION	PART NO.
1.	Bottom Panel Assy.	MA-375
2.	Transformer	C-21931
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-314
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 (INTERIOR)

ITEM	DESCRIPTION	PART NO.
1.	Vent Channel (1)	D-21754
2.	On-Off Switch	23799
3.	Switch Plate	A-22396
4.	Cable Assy. Master Electronics	MA-397
5.	Interconnect Cable	MA-398
6.	Back Door	D-21896
7.	Master Electronic Board	MA-394
8.	Rear Door Lock	MH-0
9.	Anchor Plate, Lock	MH-1
10.	Shield, Top	C-22632
11.	Shield, Bottom	C-22633
12.	Clip Bracket, Shield	B-22631
13.	Line Cord	B-15357
14.	Cover Plate, Line Cord	A-21955
15.	Cable Assy. High Voltage	MA-360
16.	Interlock Switch	EL-66
17.	Cover, Interlock Switch	A-21888
18.	Expansion Module	MA-643
19.	Fuse Holder	EL-78
20.	F12, 8 Amp, SLO-BLO	EL-26

CABINET PARTS (EXTERIOR)

ITEM	DESCRIPTION	PART NO.
1.	Top Glass	22464
2.	CRT Frame	24084
3.	Monitor Filter Glass	D-22465
4.	Monitor Mask	D-22463
5.	Monitor	C-22462
6.	Cable Assy., Front Door	MA-365
7.	Interlock Switch	EL-66
8.	Cover, Interlock Switch	A-21888
9.	3" Leg Adjuster (2)	MH-21
10.	Decal (Right)	24129
	Decal (Left)	24129
11.	Lexan Overlay (Screen)	24128