

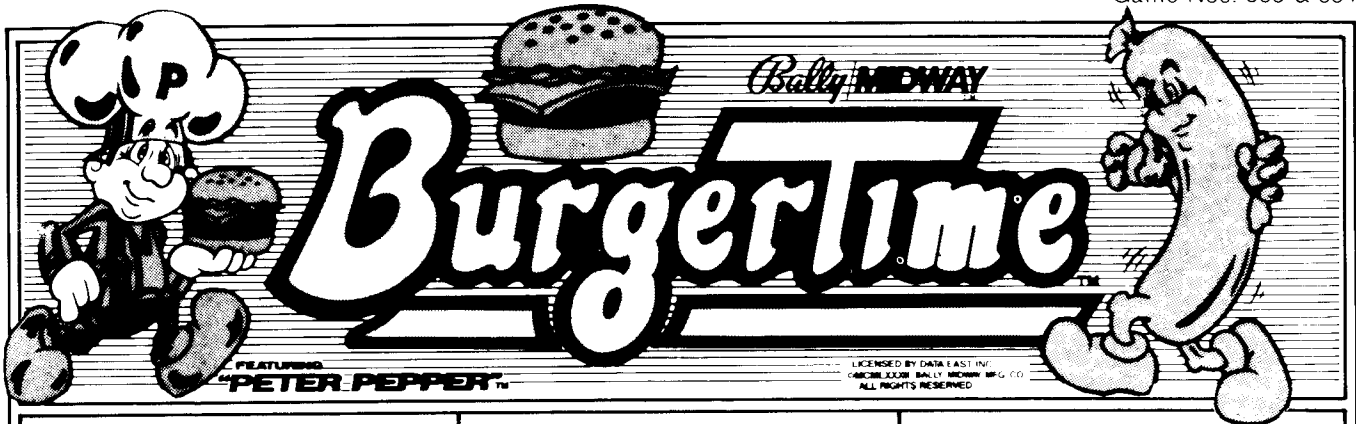
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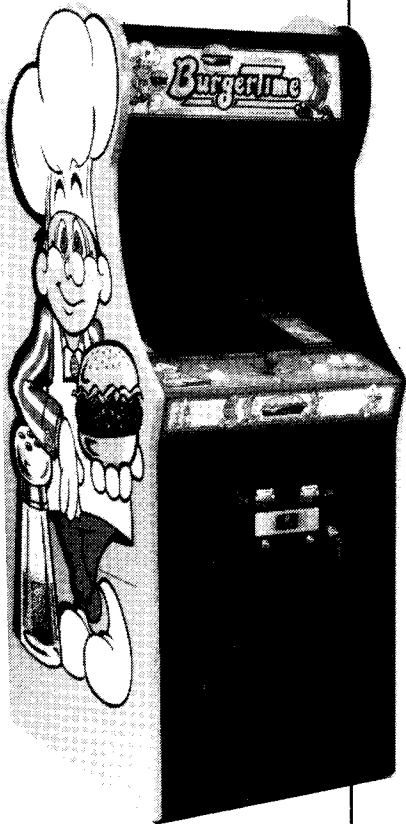
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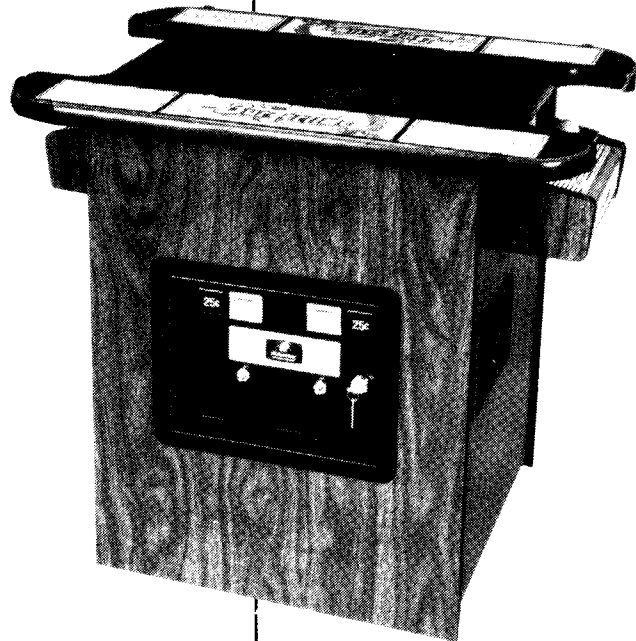
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Parts & Operating Manual



NO. 333 UPRIGHT



NO. 334 COCKTAIL

Bally

MIDWAY MFG. CO.

10750 W. Grand Avenue
Franklin Park, Illinois 60131
U.S.A.



Phone: (312) 451-1360

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Telex No.: 72-1596

WARNING

THIS GAME MUST BE GROUNDED. FAILURE TO DO SO MAY RESULT IN DESTRUCTION TO ELECTRONIC COMPONENTS.

WARNING: This equipment generates, uses, and can radiate radio frequency energy and if not 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.

ELECTRICAL BULLETIN: FOR ALL APPARATUS COVERED BY THE CANADIAN STANDARDS ASSOCIATION (CSA) STANDARD C22.2 NO. 1, WHICH EMPLOYS A SUPPLY CORD TERMINATED WITH A POLARIZED 2-PRONG ATTACHMENT PLUG.

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BurgerTime

IMPORTANT NOTE

DO NOT plug in your new game yet. Before you do anything to your game, we recommend that you read SECTIONS I and II of this manual completely. It will not take more than a few minutes and it may be very helpful.

I. Introduction

BURGER TIME is a one or a two player game. There are two models: the "UPRIGHT" and "COCKTAIL TABLE". When the two player mode is selected on the Upright model, the players take turns at the controls to guide their CHEF through the game course. If you have purchased the Cocktail Table model of this game, the rules of play are the same. The only **difference** is that in the two player mode of the Cocktail Table game, the picture flips to face you when it's your turn.

When playing this game, you are the CHEF's controlling force. It is up to you to direct him through the maze of ladders and platforms to build his Burgers. Your job is to give him guidance while building his Burgers and to keep him away from his pursuers.

These pursuers are very sneaky and, if given half a chance, will try to corner your CHEF at the end of one of the platforms or to trap him on one of the ladders he has to use to get from one level of platforms to another.

The CHEF's pursuers have no defense mechanisms of any kind. But they **CANNOT** be **PERMANENTLY**

eliminated either. As soon as your CHEF puts one pursuer out of commission, another appears somewhere on the screen at the edge of one of the platforms.

However, in an emergency, your CHEF can slow these pursuers down for short periods of time. This is accomplished by having him throw PEPPER on them. When hit by the PEPPER, his pursuers will be disabled for several seconds. When they are disabled like this, the CHEF can walk right over them and not be caught.

As your skill level increases, the number and direction of pursuers coming at your CHEF at any one time and the speed with which they move, is gradually increased; plus, their pursuit patterns become more and more devious while their overall accuracy is highly improved.

Bonus CHEF's are awarded to you periodically throughout the game as you reach or pass certain preselected point values. Each task or event that your CHEF can perform or cause to happen has an assigned point value as listed in Figure 1-1.

Major Features

Your BURGER TIME game is equipped with a very detailed self-diagnostic package.

It also comes with a new improved Power Chassis designed to help reduce electrical interference with other equipment.

Game Objective

The object of the game is to **HAVE FUN** and survive as long as possible while constantly improving your skills and building as many Burgers as you can. As you do this, each following rack of the game will have more pursuers, more difficult mazes, and will in general be harder to complete.

OBJECT DESCRIPTION	POINT VALUE
1. ALL BURGER PARTS	50 POINTS PER LEVEL DROPPED
2. BURGER PART + 1 PURSUER	500 POINTS PER DROP
3. BURGER PART + 2 PURSUERS	1000 POINTS PER DROP
4. BURGER PART + 3 PURSUERS	1500 POINTS PER DROP
5. BURGER PART + 4 PURSUERS	2000 POINTS PER DROP
6. ICE CREAM CONE	500 POINTS + ONE PEPPER
7. COFFEE CUP	1000 POINTS + ONE PEPPER
8. FRENCH FRIES	1500 POINTS + ONE PEPPER
9. FLATTENED HOT DOG	100 POINTS
10. FLATTENED PICKLE	200 POINTS
11. FLATTENED EGG	300 POINTS

Figure 1-1 Assigned Point Values

II. Location and Setup

INSPECTION:

1. Remove the game from its shipping crate.
2. Inspect the entire outside of it for any signs of damage.
 - Any scratches?, dents?, cracks?
 - Any broken controls?
 - Any broken glass or plastic?
 - Just look it over closely and make a note of any signs of damage.
3. Remove the shipping cleats from the bottom of the cabinet.
 - UPRIGHT MODELS ONLY:** In order to help prevent easy theft of your game, you may wish to remove the Caster Wheel Assemblies from the bottom of your cabinet at this time.
4. Install the four levelers, one at each corner of the cabinet.
 - Level the cabinet.
5. Open the cabinet and inspect the inside of the game for any signs of damage. See Figure 2-1.
 - Also check to make sure all plug-in connectors on the wire harness are firmly seated.

NOTE: ALL connectors or plugs are keyed so they will only go together when all pins are properly lined up.

- Replug any connectors found unplugged. DO NOT FORCE PLUGS ONTO CONNECTORS. DO NOT FORCE PLUGS TOGETHER. If it won't go on easily, assuming the keys are lined up, it either does not belong there or is damaged.
- Make sure all printed circuit boards (P.C.B.'s) are firmly seated in their connectors. See Figure 2-1. These connectors are also keyed. The P.C.B.'s will only go into them one way without being damaged.

- Note the location of the game's serial number. See Figure 2-1.
- Check all major subassemblies to be sure they are mounted securely. These are called out in Figure 2-1.
 - Power supply.
 - Control panel(s).
 - T.V. monitor.
 - Other P.C.B.'s and/or P.C.B. rack, etc.
 - Power Chassis assembly.
- 6. Make a note of any problems that can't be easily corrected.
- 7. Call your distributor and/or service man about your problem list.

INSTALLATION

1. Location requirements:

- Power:**
 - Domestic 110 V @ 60 Hz
 - Foreign 200 V to 240 V @ 50 Hz
- Temperature:** 32° to 100° F (0° to 38° C)
- Humidity:** Not over 95% relative
- Space required:**
 - Upright 25" x 33" (63 x 84cm)
 - Cocktail 32" x 22" (81 x 55cm)
- Game height:**
 - Upright 70" (175cm)
 - Cocktail 29" (73cm)

2. Voltage Selection:

Your game is designed to work properly on the line voltage where you are located. Check your line voltage with a meter to determine what its value is. Then check the power input wires to the main power supply transformer on your game to be sure they are connected to taps which correspond to your line voltage value.

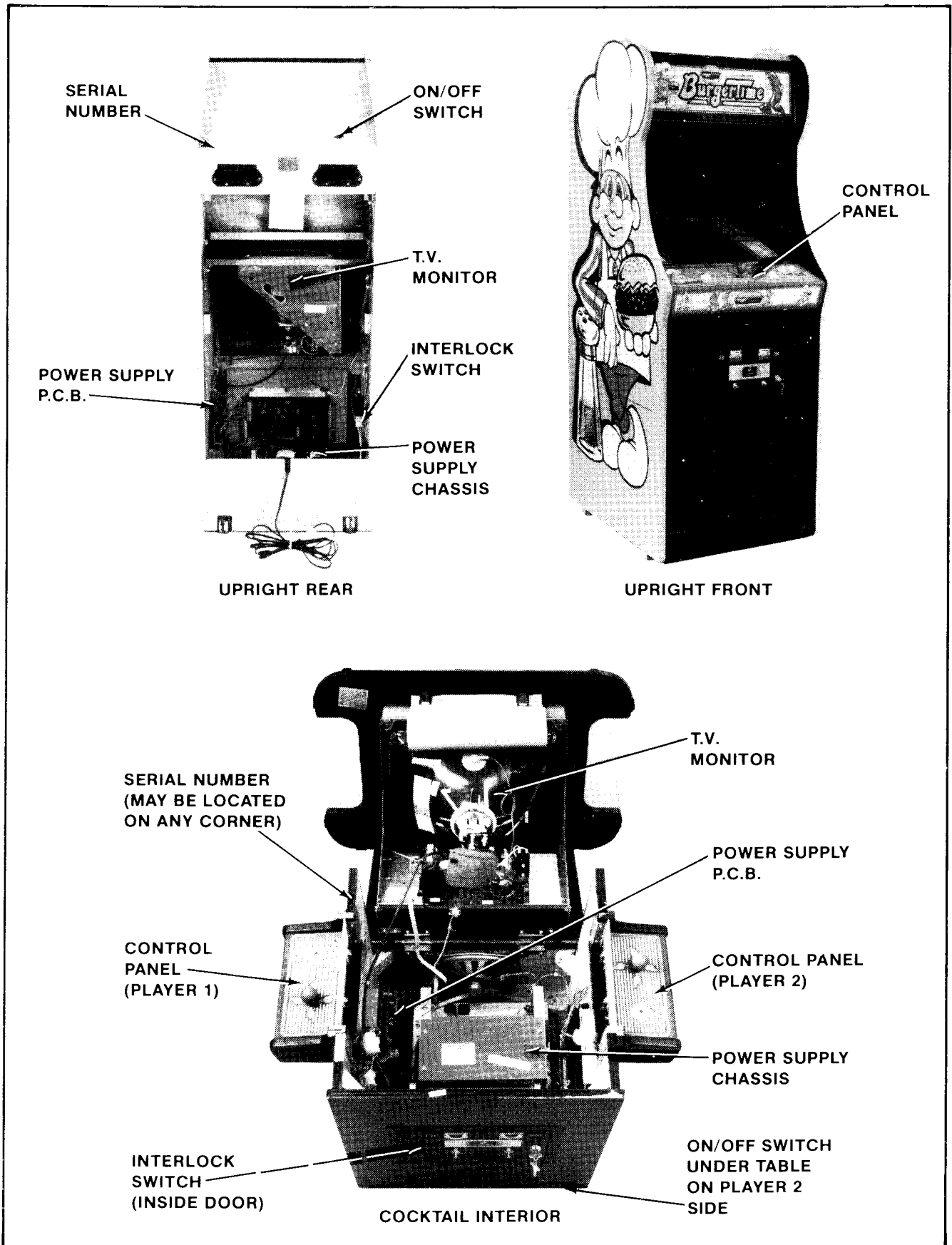


Figure 2-1 Location of Serial No., Interlock Switch, On/Off Switch, & Major Sub Assys.

If the power input wires to the main power supply transformer are not connected to taps which correspond to your local line voltage, move them to the proper taps.

If the line voltage in your area falls outside the upper or lower limits of the range of inputs covered by the main power supply transformer, **DO NOT PLUG YOUR GAME IN** until you have talked with your distributor and/or service man and obtained a solution to this problem. Otherwise you could damage your game.

3. Interlock and power ON/OFF switches: See Figure 2-1.

- To help prevent the possibility of getting an electric shock while working inside the game cabinet, interlock switches have been installed at each cabinet access door (this **DOES NOT** include the coin door in the Upright models).
- When any access door is opened, the interlock switch installed there turns off all power to the game.
- Check each interlock switch for proper operation.

After checking the line voltage in your area and determining that the input wires to the main power supply transformer of your game are connected properly — or — after obtaining a solution to your over or under voltage problem from your distributor and/or your service man, plug the game into your A.C. wall outlet.

The game ON/OFF switches for both models are located as shown in Figure 2-1. Turn the game on and allow it to warm up a few minutes.

Slowly open each access door to the game (this **does not** include the coin door on the Upright models).

As the door is opened approximately 1" (2.54cm) the power to the game should go off (the T.V. monitor, all the lights, and all sounds will stop).

If this does not happen, check the interlock switch by this door to see if it has broken loose from its mounting or if it is stuck in the "ON" position.

If the switch is found to be bad, turn the game off, unplug it, and replace the interlock switch.

When done, plug the game back into the wall outlet, close the access door, and turn the game back on.

After the game has warmed up, repeat the above interlock switch test.

When the interlock switch is working properly and turns the power to the game off, power may be restored to the game with the access door(s) open. Take hold of the interlock switch plunger and **gently** pull it out to its fully extended position. **THIS IS TO BE USED ONLY FOR SERVICING THE GAME.** See Figure 2-2.

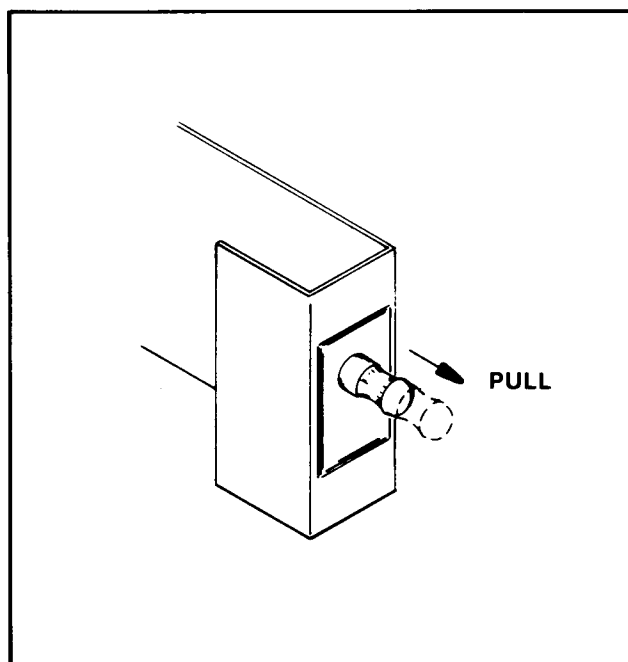


Figure 2-2 Interlock Switch Operation

SELF-TEST

Your new game will Self-Test itself to see if it has any bad parts. The information it receives while testing itself will be shown on the T.V. monitor. Some information can also be heard through the game's speaker system. See the GAME OPERATION section for a more detailed description of this function.

When there is a bad result according to the Self-Test, call your distributor and/or service man to have the trouble fixed unless it is something you can do yourself (such as replace a bad RAM or ROM chip).

NOTE: In order for the two SELF-TEST SWITCHES on the bracket located inside the cabinet at the right hand edge of the coin door frame to function properly, DIP SWITCHES 5 and 6 of SW-1 (at locations 15D on the SOUND I/O BOARD) MUST BE IN THE "OFF" POSITION.

GAME VOLUME ADJUSTMENT CONTROL

See Figure 2-3.

The game volume control pot is located on the Sound I/O board. The other board is the CPU board. There is only one pot. For adjustment, it may be reached through the rear access door on the Upright models. On the Cocktail Table model, you will have to open the table top to reach it.

To make the sounds louder, turn the pot clockwise as you face it (↻).

To make the sounds **less** loud, turn the pot counter-clockwise as you face it (↺).

OPTION SWITCH SETTINGS

To change the option switch settings, you **DO NOT** have to take the Sound I/O board out of the game. They can be easily reached through the rear access door on the Upright models. On the Cocktail Table model, you do have to open the table top to reach them.

When changing any options, **ALWAYS** put the game into the Self-Test mode, make your changes, check the results on the monitor screen, take the game out of the Self-Test mode, and play the game to be sure the switches have worked properly and that no switches were accidentally moved that were not meant to be. (These switches are small and this can happen.)

The option switch settings and what they will make the game do are shown in Figure 2-4. See Figure 2-3 for option switch locations.

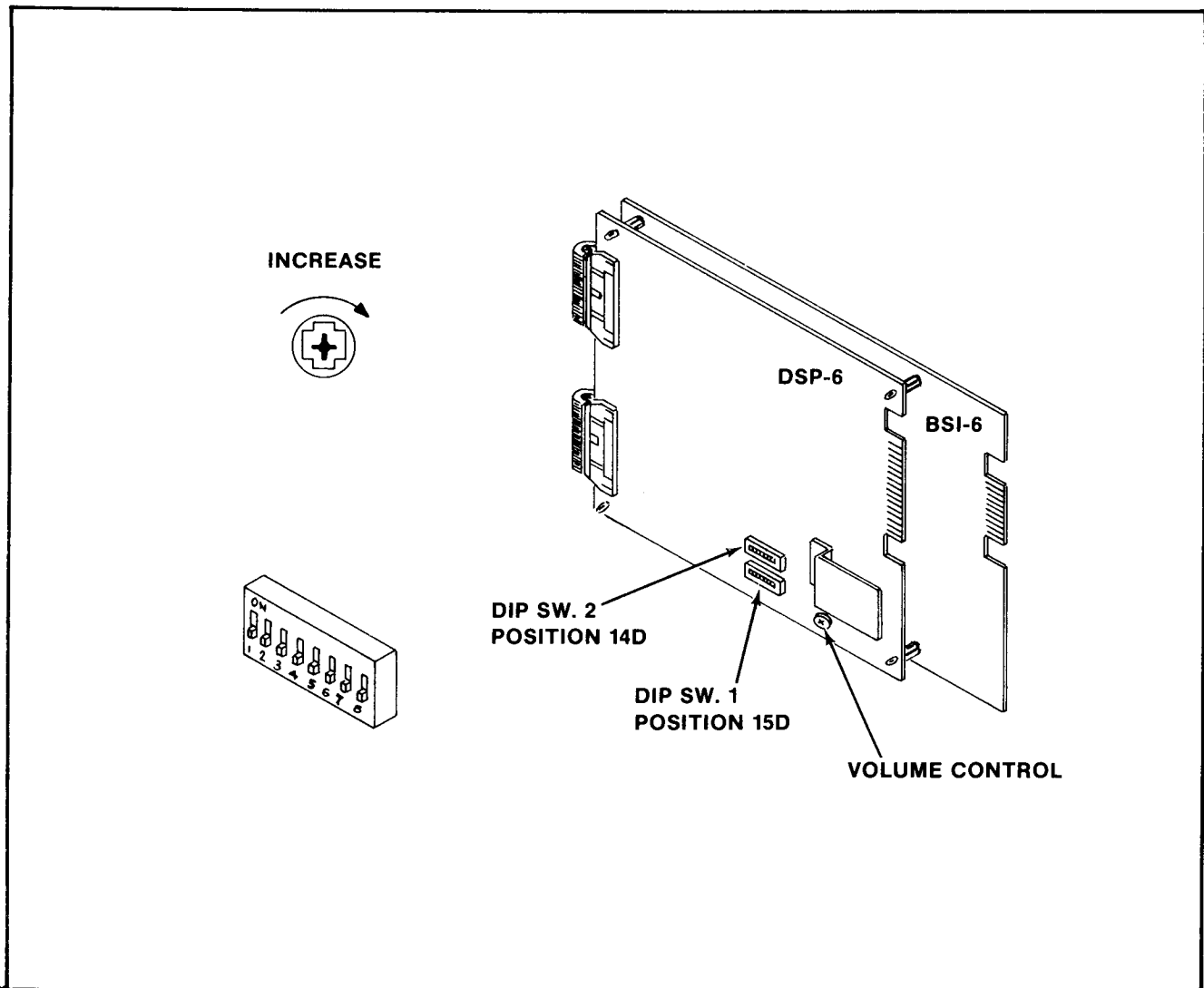


Figure 2-3 Location of Volume Control & Option Switches

BURGER TIME									
OPTION SWITCH SETTINGS									
DIP SWITCH 15D (SW1)									
COINS PER CREDIT									
COIN SWITCHES NO. 1 AND NO. 2		SW#1	SW#2	SW#3	SW#4	SW#5	SW#6	SW#7	SW#8
*1 - COIN	1 - CREDIT	OFF	OFF						
1 - COIN	2 - CREDITS	ON	OFF						
1 - COIN	3 - CREDITS	OFF	ON						
2 - COINS	1 - CREDIT	ON	ON						
TEST CREDIT BUTTON		SW#1	SW#2	SW#3	SW#4	SW#5	SW#6	SW#7	SW#8
*1 - COIN	1 - CREDIT			OFF	OFF				
1 - COIN	2 - CREDITS			ON	OFF				
1 - COIN	3 - CREDITS			OFF	ON				
2 - COINS	1 - CREDIT			ON	ON				
DIAGNOSTICS									
		SW#1	SW#2	SW#3	SW#4	SW#5	SW#6	SW#7	SW#8
*GAME MODE						OFF	OFF		
NORMAL TEST PROCEDURE						ON	OFF		
CROSS HATCH ONLY						OFF	ON		
SOUND I/O BOARD TEST ONLY						ON	ON		
CABINET DESIGN									
		SW#1	SW#2	SW#3	SW#4	SW#5	SW#6	SW#7	SW#8
UPRIGHT CONTROL PANEL								ON	
COCKTAIL CONTROL PANELS								OFF	
UPRIGHT SCREEN									ON
COCKTAIL SCREEN									OFF
DIP SWITCH 14D (SW2)									
NUMBER OF CHEFS PER GAME									
		SW#1	SW#2	SW#3	SW#4	SW#5	SW#6	SW#7	SW#8
*3 CHEFS		OFF					OFF	OFF	OFF
5 CHEFS		ON							
BONUS CHEFS AWARDED EVERY									
		SW#1	SW#2	SW#3	SW#4	SW#5	SW#6	SW#7	SW#8
10,000 POINTS			OFF	OFF			OFF	OFF	OFF
15,000 POINTS			ON	OFF					
*20,000 POINTS			OFF	ON					
30,000 POINTS			ON	ON					
DIFFICULTY LEVEL OF PLAY									
		SW#1	SW#2	SW#3	SW#4	SW#5	SW#6	SW#7	SW#8
*EASY - 4 PURSUERS					OFF		OFF	OFF	OFF
HARD - 6 PURSUERS					ON				
RACK BONUS									
		SW#1	SW#2	SW#3	SW#4	SW#5	SW#6	SW#7	SW#8
*BONUS PEPPER AWARDED AT END OF EACH RACK						ON	OFF	OFF	OFF
NO BONUS PEPPER AWARDED AT END OF EACH RACK						OFF			

*INDICATES FACTORY RECOMMENDED SETTINGS.

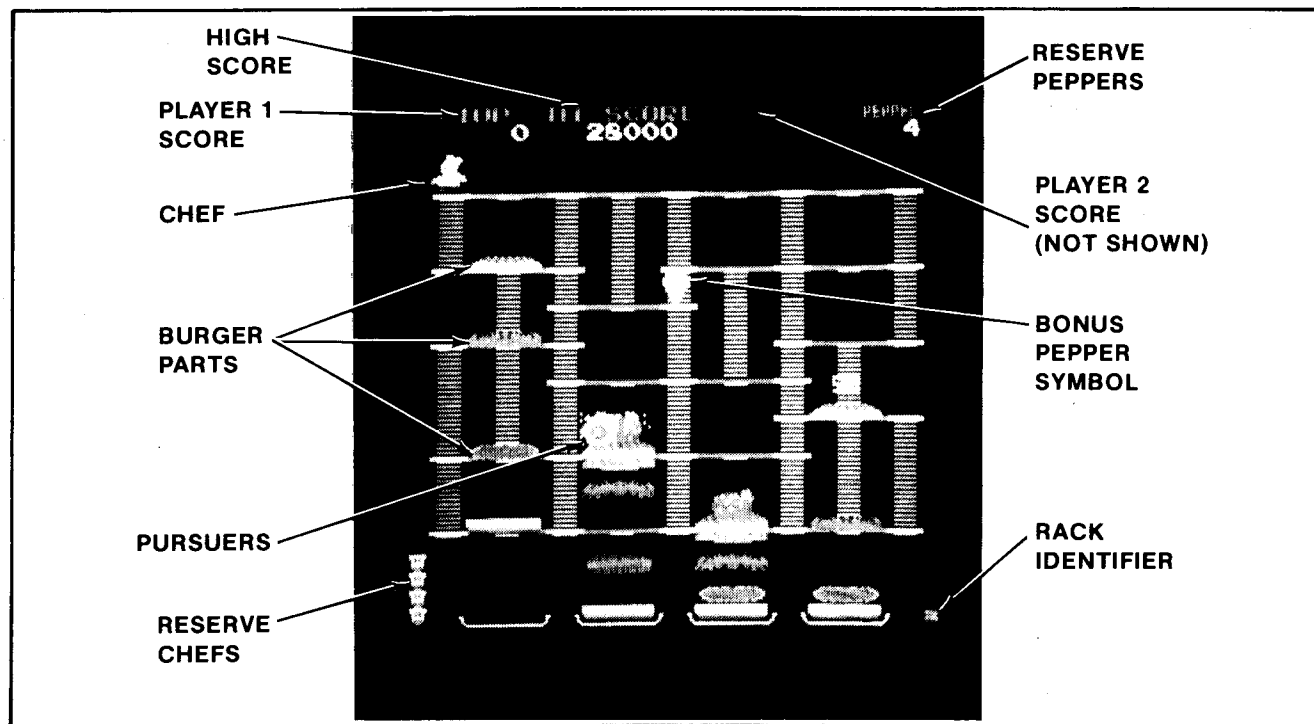
PART NO. M051-00333-A010

Figure 2-4 Option Switch Settings

III. Game Operation

BURGER TIME is a one or a two player game with a color T.V. monitor. The game gives a display which has all the parts shown below.

The game has five possible modes of operation: ATTRACT, READY-TO-PLAY, PLAY, HIGH SCORE/INITIAL, and SELF-TEST.



SELF-TEST MODE

The Self-Test mode is a special mode for checking the game switches and computer functions. It is the easiest and best way to check for proper operation of the entire game.

NOTE: Putting the game into Self-Test will cause it to erase any CREDITS it has on it from its memory.

You may begin a Self-Test at any time after the power to the game is on by sliding the TOP Self-Test switch to the "ON" position and activating the "TILT SWITCH". (The "SELF-TEST" Switch(es) are **ONLY READ** by the game's computer for instructions **AFTER** the "TILT SWITCH" has been activated or when the game is powered up.) Now that the game is in the Self-Test mode, it will react as follows:

1. First, you will see a moving multicolored pattern appear on the screen.
2. Immediately following this, a rightside up test display is shown on the monitor screen. Pushing the CREDIT BUTTON after each display is completed will cause the game to step through each of its 11 different Self-Tests. The game will remain in this Self-Test mode until you set the TOP Self-Test switch back to the "OFF" position and activate the

"TILT SWITCH". These test displays are shown on the following page.

3. If a bad ROM or RAM chip is found by the game's internal check system during the Self-Test, the game indicates this to you by showing the P.C. Board location code of the bad chip(s) in place of the letters "OK".
4. To check your game function switches and buttons (coin counter switches, PEPPER Button, 1 PLAYER and 2 PLAYER buttons, etc.): activate each one while the game is in the "SW TEST" section of the complete Self-Test mode. You should see a different square filled with light for each activation. If you do not see it, the switch/button is either not working, miswired, or disconnected. Check it out thoroughly.
5. **SOUND I/O BOARD TEST ONLY:**
To check "SOUND" (the game has 16 different sounds), slide the TOP and the BOTTOM Self-Test switches to the "ON" position and activate the "TILT SWITCH". (The "SELF-TEST" Switch(es) are **ONLY READ** by the game's computer for instructions **AFTER** the "TILT SWITCH" has been activated or when the game is powered up.) Now

**SELF-TEST DISPLAY
AND BOARD LOCATION COORDINATES**

MAPPING OK or (incorrect address bit)

RAM TEST OK or (a number and a letter, i.e. 1L, 3H, etc.)

MIX TEST (if error, one or more characters will be out of sync)

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8

FOREGROUND CHARACTER DISPLAY — (screen is filled with different parts of foreground objects) — If error has occurred, pictures will be distorted

CROSS HATCH PATTERN DISPLAYED

SOUND	PSG1	PSG2	END
	CHECK 01, 02, 03,	04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 15, 16	

ROM TEST OK or (a number and a letter, i.e. 4D, 5B, etc.)

SW TEST — (ACTIVATE ALL OF GAME'S INPUT SWITCHES — IF GOOD THEY WILL LIGHT A SQUARE)

DIP TEST 00001011 01010000 (INDICATES WHICH OPTION SWITCHES ARE TURNED "ON" AND WHICH ARE TURNED "OFF" — 1="ON" & 0="OFF".)

BACKGROUND CHARACTER DISPLAY — (SHOWS ALL BACKGROUND MAZE CONFIGURATIONS)

TILT TEST

that the game is in the Self-Test mode, it will react as follows:

It will give the same screen display it did when the sounds were checked as part of the complete Self-Test procedure. The game will automatically check all 16 sounds.

Pushing the CREDIT BUTTON after each display is completed will cause the game to step through each of its SOUND P.C. BOARD Self-Tests. The game will remain in this Self-Test mode until you set the TOP and the BOTTOM Self-Test switches back to the "OFF" position and activating the "TILT SWITCH". These text displays are shown below.

6. If you wish to produce **ONLY** a CROSS HATCH test pattern on the monitor screen for further use, slide the BOTTOM Self-Test switch to the "ON" position and activate the TILT SWITCH. The TOP Self-Test switch should REMAIN IN THE "OFF" POSITION.

7. When finished with the Self-Test mode, slide the BOTTOM Self-Test switch back to the "OFF" position and activate the TILT SWITCH.

8. Normal game functions will now return to the monitor screen.

SOUND	PSG1	PSG2	END
	CHECK 01, 02, 03,	04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 15, 16	

ROM TEST OK or (a number and a letter, i.e. 4D, 5B, etc.)

SW TEST — (ACTIVATE ALL OF GAME'S INPUT SWITCHES — IF GOOD THEY WILL LIGHT A SQUARE)

DIP TEST 00001011 01010000 (INDICATES WHICH OPTION SWITCHES ARE TURNED "ON" AND WHICH ARE TURNED "OFF" — 1="ON" & 0="OFF".)

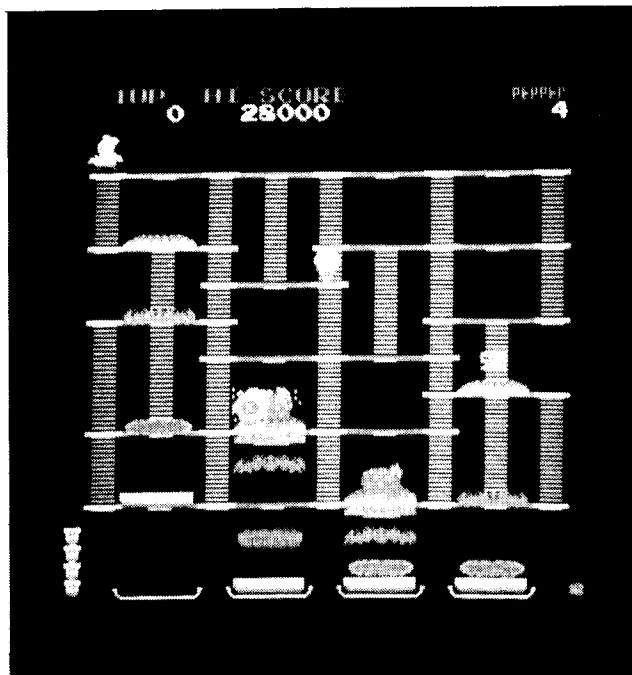
BACKGROUND CHARACTER DISPLAY — (SHOWS ALL BACKGROUND MAZE CONFIGURATIONS)

TILT TEST

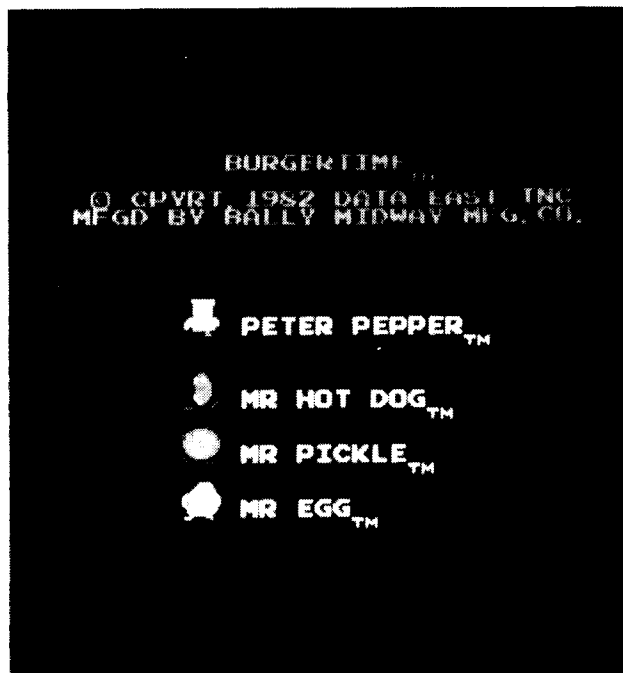
ATTRACT MODE

1. The Attract mode starts:

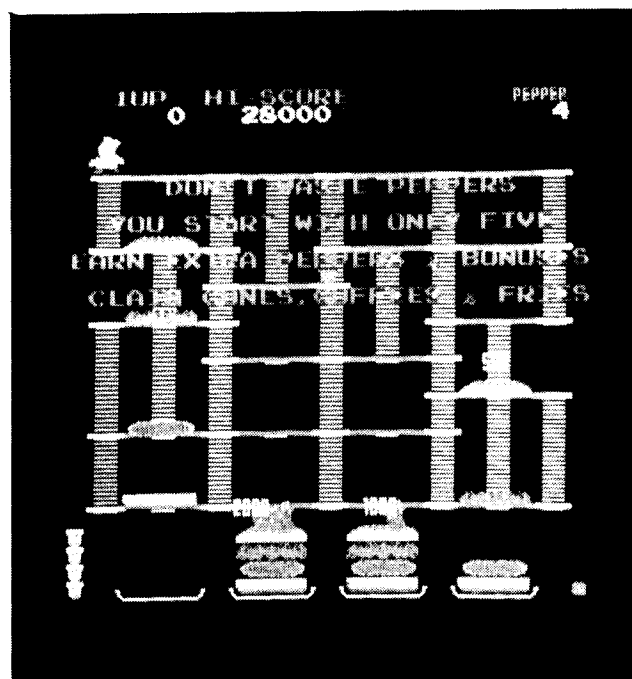
- Just after power has been turned on to the game. (Self-Test switch is in the "OFF" position.)
 - After a Self-Test has been completed. (Performing a Self-Test sets the credits in the game's memory to zero "0".)
- After a play has been finished, the score was not high enough to put the game into the High Score/Initial mode, and there are no more credits left in the game's memory.
 - After the High Score/Initial mode when there are no more credits left in its memory.
 - In the Attract mode, the game will give the following displays **centered** on the monitor screen:



Attract Mode Display 1



Attract Mode Display 3



Attract Mode Display 2



Attract Mode Display 4



Attract Mode Display 5

- No matter where the game is in the Attract mode sequence, it will immediately go to the following display as soon as a game has been paid for. It will add the words "PUSH START BUTTON" and "CREDIT _____" to the bottom of this display and the Point Value display in the Attract mode sequence. These words will remain at the bottom of these displays in the Attract mode sequence until the "1 PLAYER" start button is pushed.



Ready To Play Mode

READY-TO-PLAY MODE

1. The Ready-To-Play mode starts when enough coins have been accepted for a 1 or a 2 player game.
2. The Ready-To-Play mode ends when either the "1 PLAYER" or the "2 PLAYER" push button is pressed.
3. In the Ready-To-Play mode, the game will give the above modified displays **centered** on the monitor screen.
4. If no START button is pressed, the displays will remain modified indefinitely as shown above.

PLAY MODE

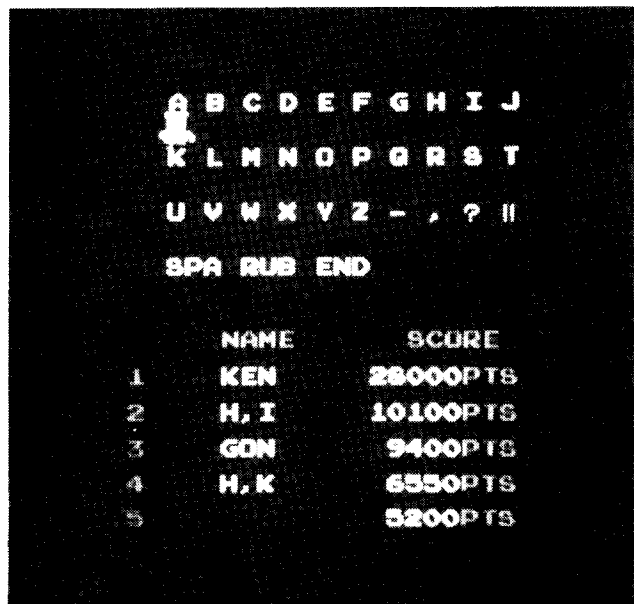
1. The Play mode begins when the "1 PLAYER" or the "2 PLAYER" start button is pressed. "GAME START" is displayed **centered** on the screen.
2. The Play mode ends when all of your CHEFS have been caught. When this happens, "GAME OVER" is written across the center of the monitor screen.
3. When playing this game, you are the CHEF's controlling force. It is up to you to direct him through the maze of ladders and platforms to build his Burgers. Your job is to give him guidance while building his Burgers and to keep him away from his pursuers (Eggs, Hot Dogs, and Pickles).
4. These pursuers are very sneaky and, if given half a chance, will try to corner your CHEF at the end of one of the platforms or to trap him on one of the ladders he must use to get from one level of platforms to another.
5. The CHEF'S pursuers have no defense mechanisms of any kind. But they **CANNOT** be **PERMANENTLY** eliminated either. As soon as your CHEF puts one pursuer out of commission, another appears somewhere on the screen at the edge of one of the platforms.
6. However, in an emergency, your CHEF can slow these pursuers down for short periods of time. This is accomplished by having him throw PEPPER on them. When hit by the PEPPER, his pursuers will be disabled for several seconds. When they are disabled like this, the CHEF can walk right over them and not be caught.
7. As your skill level increases, the number and direction of pursuers coming at your CHEF at any one time and the speed with which they move, is gradually increased; plus, their pursuit patterns become more and more devious while their overall accuracy is highly improved.
8. Bonus CHEFS are awarded to you periodically throughout the game as you reach or pass certain preselected point values.

9. Bonus Peppers are awarded to you each time you make your CHEF run over the randomly appearing pictures of the Ice Cream Cone, the Coffee Cup, or the Fries. In addition to the bonus Peppers this obtains for you, you are also awarded bonus points each time you run over one of the above items with your CHEF.
10. When you complete the last Burger of a Rack, the screen is cleared, the next Rack appears, the number of the Rack is displayed in the lower right corner of the screen, your CHEF appears at the bottom center of the screen, and play begins anew.
11. When the pursuers happen to catch one of your CHEFS, assuming you have at least one remaining in reserve, the words "GAME START" appear **centered** on the monitor screen BEFORE play begins again.
12. When the pursuers catch your **LAST** CHEF, the words "GAME OVER" are displayed **centered** on the monitor screen. (AT THIS POINT, SEVERAL DIFFERENT THINGS CAN HAPPEN.)

If your score was one of the TOP 5, the game will go directly to the High Score/Initial mode presentation. If your score is not high enough to cause the game to go into the High Score/Initial mode, it will either go to the Attract mode (if there are no more credits left in its memory) or into the Ready-To-Play mode (if there are still credits left in its memory).

HIGH SCORE/INITIAL MODE

In the High Score/Initial mode the game gives a display which looks like the following:



High Score/Initial Mode

When in the High Score/Initial mode, all the letters of the alphabet are displayed in a field above the rankings list.

By moving the controller stick left, right, up, or down, you can position the CHEF under your initials one at a time. When you have him positioned properly for one of your initials, push the Pepper Button and the CHEF will take that initial down and put it in front of your score. Continue the procedure for your remaining initials.

If you do not wish to put your initials opposite your score, just press the Pepper button three times. Three "A"'s will be positioned opposite your score.

After the High Score/Initial mode, the game will either go to the Attract mode (if there are no more credits left in its memory) or into the Ready-To-Play mode (if there are still credits left in its memory).

Most of the above holds true in the "2 PLAYER" mode also. But there are a few minor differences.

TWO PLAYER OPERATION

The Upright and Cocktail Table models both have two player operation.

In the two player mode, the rules of play are the same as in the single player mode. There are some additional rules, however.

1. In the Upright model, the players must take turns at the controls.
2. In the Cocktail Table model, each player has his own set of individual controls. The picture will flip to face you when it is your turn. (When it is not your turn, your set of controls will have **NO** effect on the game.)
3. Your turn lasts until the pursuers catch your CHEF. At this point, the game will do one of several things depending on whether or not the caught CHEF was your last or if you still have others remaining in reserve.

CHEF CAUGHT — OTHERS REMAINING IN RESERVE

- The GAME stops.
- Next, the Rack changes to the Rack number the other player is in, it displays "PLAYER ___" — "GAME START" while what's left of the other player's Rack and his CHEF appears on the screen.
- Play then begins for the other player.

CHEF CAUGHT — NO OTHERS REMAINING IN RESERVE

- Game displays "PLAYER ___" — "GAME OVER".
- After this, "PLAYER ___" — "GAME START" is displayed, the other player's Rack and his CHEF appear on the monitor screen and game play begins for the other player.

- After the last player has finished his game, if either or both of the scores were high enough, it goes to the "HIGH SCORE/INITIAL" mode. The player(s) that attained the high score(s) **MUST REMEMBER WHAT THEIR OWN SCORE WAS!!** If both players qualified, the one with the **LOWEST** score enters his/her initials **FIRST**. The one with the **HIGHEST** score enters his/her initials **LAST**.
- If your score(s) were **NOT** high enough to cause the game to go into the "HIGH SCORE/INITIAL" mode, the game will either go to the Attract mode (if there are no more credits left in its memory) or into the Ready-To-Play mode (if there are still credits left in its memory).

IV. Maintenance and Repair

Your **NEW** game needs certain types of maintenance to keep it in good working order. **CLEAN**, well **MAINTAINED** games **attract players** and **EARN MORE PROFITS**.

The most important thing for you to remember is to run the Self-Test **EVERY TIME** you collect money from the coin box. **JUST LOOKING** at your game **WILL NOT** tell you if all its controls and inside parts are working correctly. The Self-Test will inform you whether or not your game is working the way it should.

The second most important thing you should remember is to clean the outside of the game and coin acceptor mechanisms on a regular basis.

CLEANING

The outside of the game cabinet plus the metal can be cleaned with any non-abrasive household cleaner. However, the front of the T.V. monitor tube and **both sides** of all other glass and plastic on or in the game **MUST** be cleaned with anti-static cleaner **ONLY** (available from your distributor — order PART NO. 0017-00008-0098 — an 8 oz. spray bottle). For cleaning the coin acceptors: hot soapy water may be used on the plastic ones and any household cleanser may be used on the metal ones. If you wish, special coin machine cleaners that leave no residue may be purchased from your distributor.

DO NOT dry-wipe any of the plastic panels. This is because any dust that was on them can scratch their surfaces. If this has happened, anyone looking through this type of damaged plastic would feel he was looking at the game through a fog. This fogging damage **CANNOT** be repaired or reversed. The **ONLY** solution is to **replace** the damaged piece of plastic.

FUSE REPLACEMENT

This game contains several fuses located as shown in Figure 4-1.

1. UPRIGHT MODEL:

As viewed from the back, facing the cabinet, with the rear access door removed; the fuses are located on the Power Chassis and Power Supply Board Assemblies.

2. COCKTAIL TABLE MODEL:

As viewed from the coin door side of the cabinet, with the monitor tilted open to one side; the fuses are located on the Power Chassis and the Power Supply Board Assemblies.

Replace fuses **ONLY** with the type and size listed in the Illustrated Parts Breakdown Section of this manual.

See the T.V. Monitor Manual (available on request from your distributor or the monitor manufacturer) and/or the T.V. Troubleshooting Section of this manual for information on these fuses.

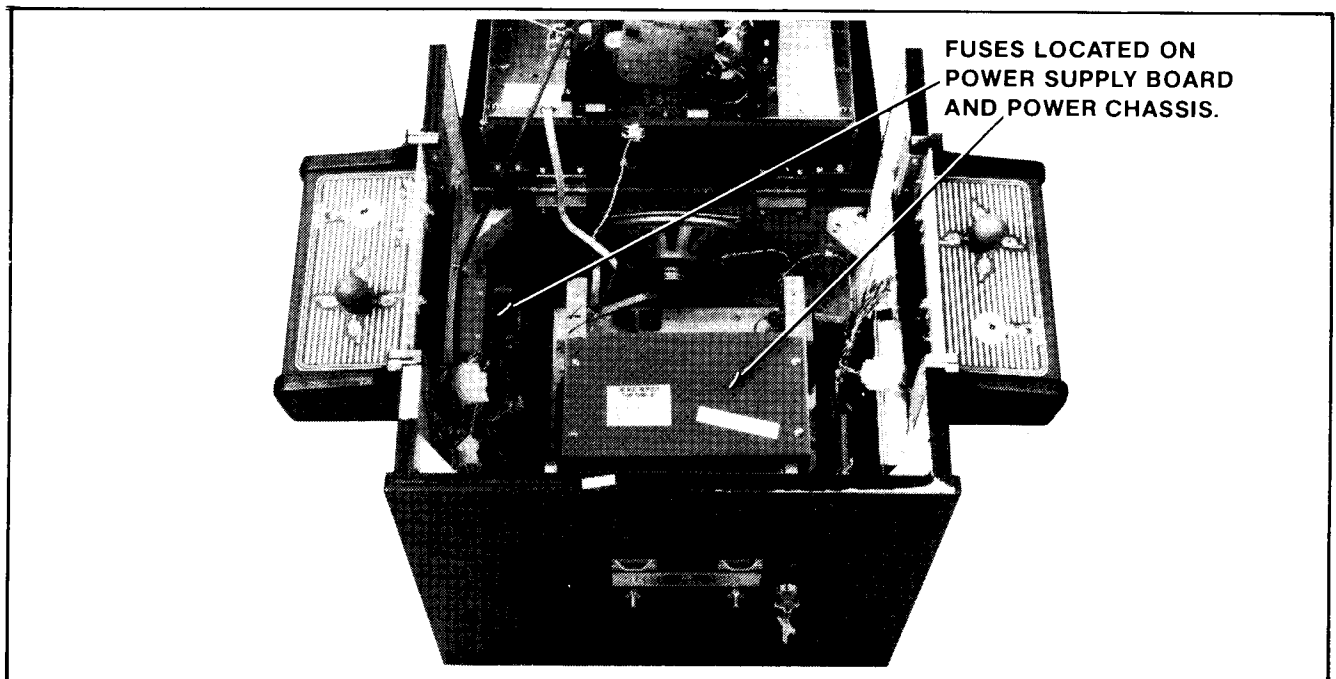


Figure 4-1 Location of Fuses

OPENING THE CONTROL PANEL

1. UPRIGHT MODEL: See Figure 4-2.

- The control panel is held in place by three latches, one on the left side, one on the right side, and one on the front center.

They are spring loaded to provide constant positive pressure on their latch plates.

They can be reached through the coin door **AFTER turning power to the game off.**

To release the latches, lift up and toward the center of the control panel.

Once they are released, unhook them from their latch plates.

- To remove the control panel:
Raise it up and tilt it toward you until you can see the cable behind it.
Cradling the control panel between yourself and the cabinet, disconnect it from its cabling.
The control panel is now free and can be removed.
- To reinstall the control panel, reverse this procedure.

2. COCKTAIL TABLE MODEL: See Figure 4-3.

- Each control panel is held in place by several screws, two on the inside of the cabinet and three

along the outside bottom edge of the control panel.

Turn power to the game off.

Open the coin box door and release the two latches indicated in Figure 4-4.

CAUTION: The right hand latch is very close to the HIGH VOLTAGE on the monitor.

Once they're released, unhook them from their latch plates.

Grasp the table top at "A" and open it as indicated in Figure 4-4.

CAUTION: Due to the weight of the monitor, EXTREME CARE MUST be taken when opening the cabinet.

Remove the screws which secure the control panel in place. See Figure 4-3.

- To remove the control panel(s):
Disconnect it from its cabling.
The control panel is now free and can be removed.
- To reinstall the control panel, reverse this procedure.

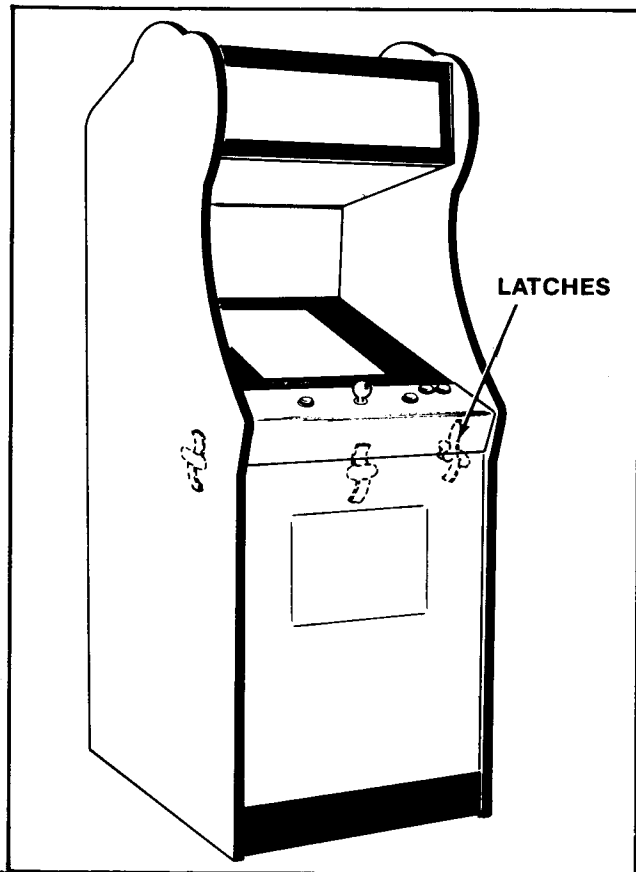


Figure 4-2 Opening the Control Panel — Upright

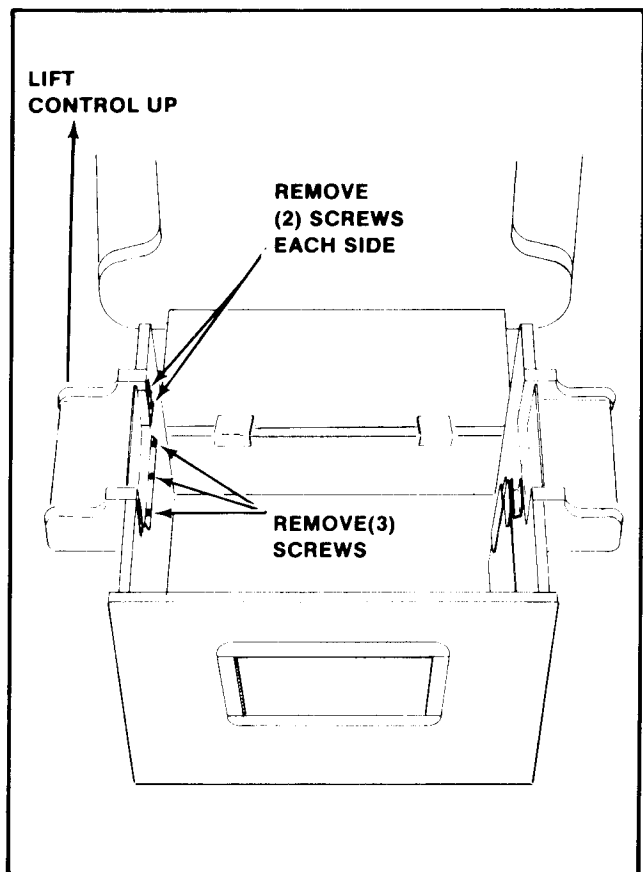


Figure 4-3 Removing the Control Panel — Cocktail

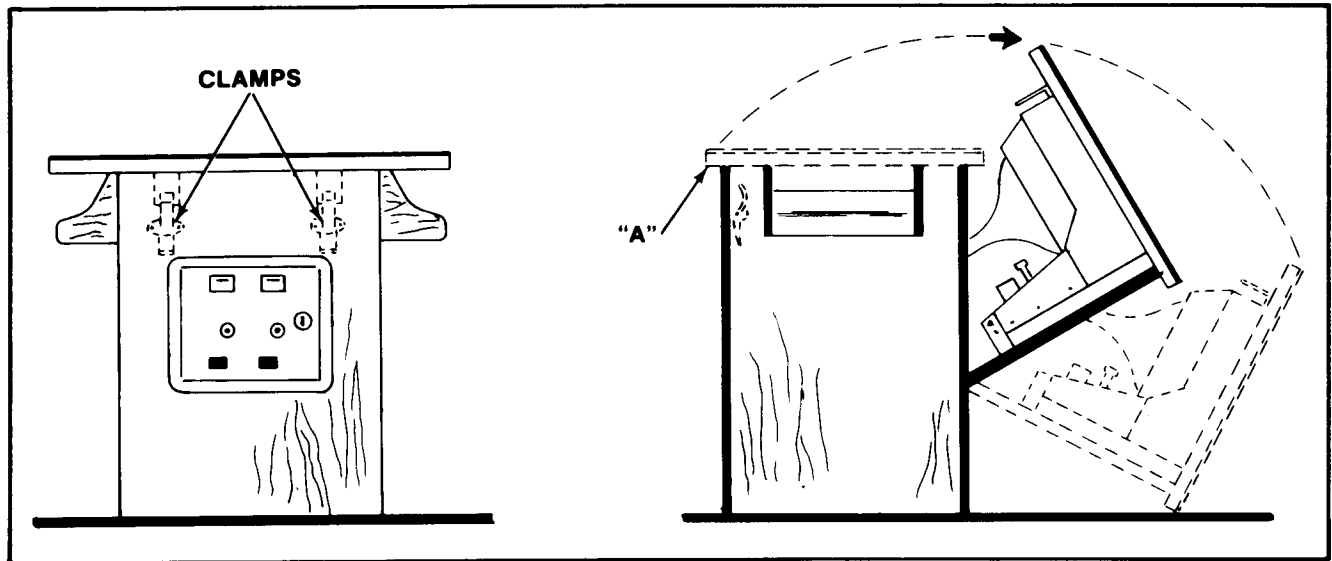


Figure 4-4 Opening the Cocktail Game

REMOVAL OF THE MAIN-DISPLAY-GLASS AND/OR THE T.V. BEZEL ASSEMBLY

1. UPRIGHT MODEL: See Figure 4-5.

NOTE: In order to do this, the control panel **MUST** be removed first. See the "UPRIGHT MODEL" procedure.

- Turn the power to the game off and remove the control panel. This frees the main-display-glass so it can be lifted up.
- By putting your finger in the hole in the middle of the main-display-glass support, you can lift it up and out.
- Loosen the screws which secure the T.V. bezel-glass-clamps in place.
Move the clamps to the side and the bezel glass may be removed.
Remove the above mentioned screws and the bezel with four bezel-glass-clamps may be removed.
- To reinstall the T.V. bezel assembly and the main-display-glass, reverse this procedure.

2. COCKTAIL TABLE MODEL: See Figure 4-6.

NOTE: This may be done with the table top in the open or the closed position. If you decide to open the table top, **TURN THE POWER TO THE GAME OFF FIRST.**

- Remove the screws which secure the table top glass clamps in place.
- Remove the table top glass.
- Loosen the screws which secure the T.V. bezel-glass-clamps in place.

Move the clamps to the side and the bezel glass may be removed.

Remove the screws which secure the bezel assembly to the table top and the bezel with four bezel-glass-clamps may be removed.

- To reinstall the T.V. bezel and the table top glass, reverse this procedure.

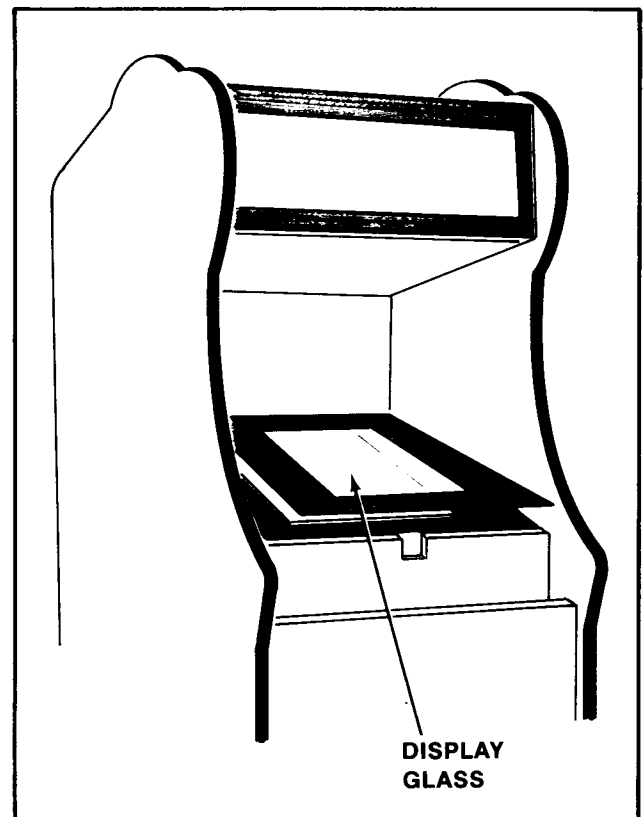


Figure 4-5 Removing the Main Display Glass & T.V. Bezel — Upright

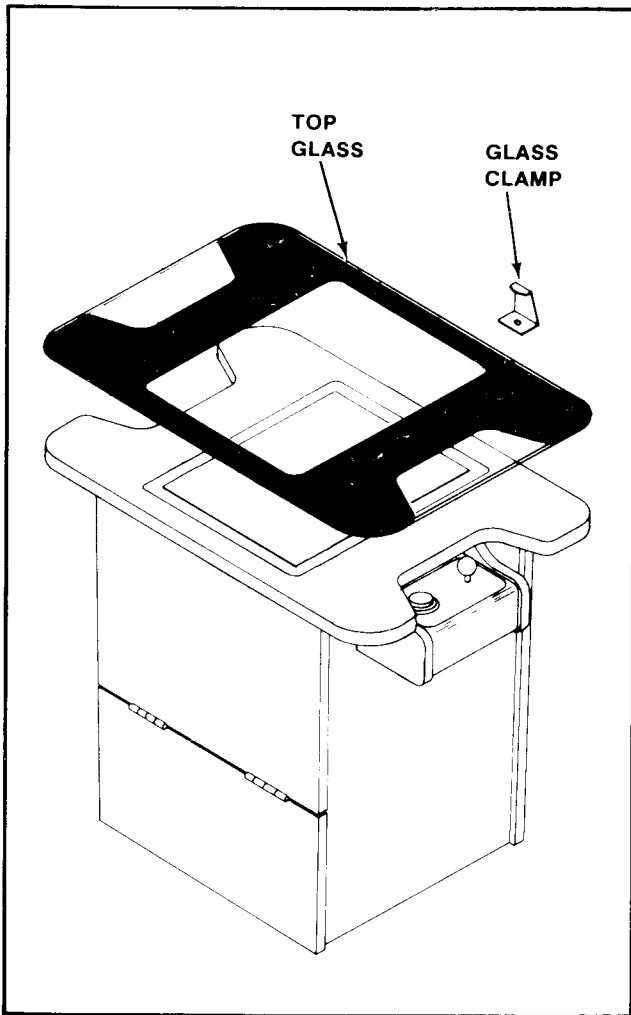


Figure 4-6 Removing the Top Glass & T.V. Bezel — Cocktail

T.V. MONITOR REPLACEMENT

CAUTION: High voltages may exist in any television unit, even with the power disconnected. Use **EXTREME CAUTION** and do not touch electrical parts or the T.V. yoke area with your hands or with metal objects held in your hands!

In addition, **BE SURE TO USE HEAVY GLOVES** when handling the monitor. You could cut your hands on the metal T.V. chassis without such protection.

DANGER: The T.V. monitor **DOES NOT** contain an isolation transformer on its chassis (it is mounted instead on the floor of the cabinet). When servicing the monitor on a test bench, **YOU MUST ISOLATE THE MONITOR FROM AC VOLTAGE WITH AN ISOLATION TRANSFORMER.**

1. **UPRIGHT MODEL:** See Figure 4-7.

- Turn power off to the game.
- Open the rear access door.
- Completely disconnect the T.V. monitor from all its cabling. **DON'T FORGET THE CHASSIS GROUND WIRE.**

Before removing the T.V. monitor, the main-display-glass **MUST** be removed. See above "Upright Model" procedure.

With the removal of only four bolts, the T.V. monitor will be loose.

The monitor mounting channels slide on top of and against two metal guides mounted to the cabinet's right and left sides. The monitor is removed by sliding it out the back of the cabinet. See Figure 4-7.

To reinstall the T.V. monitor, reverse this procedure.

After replacing the T.V. monitor, be sure to run the game Self-Test.

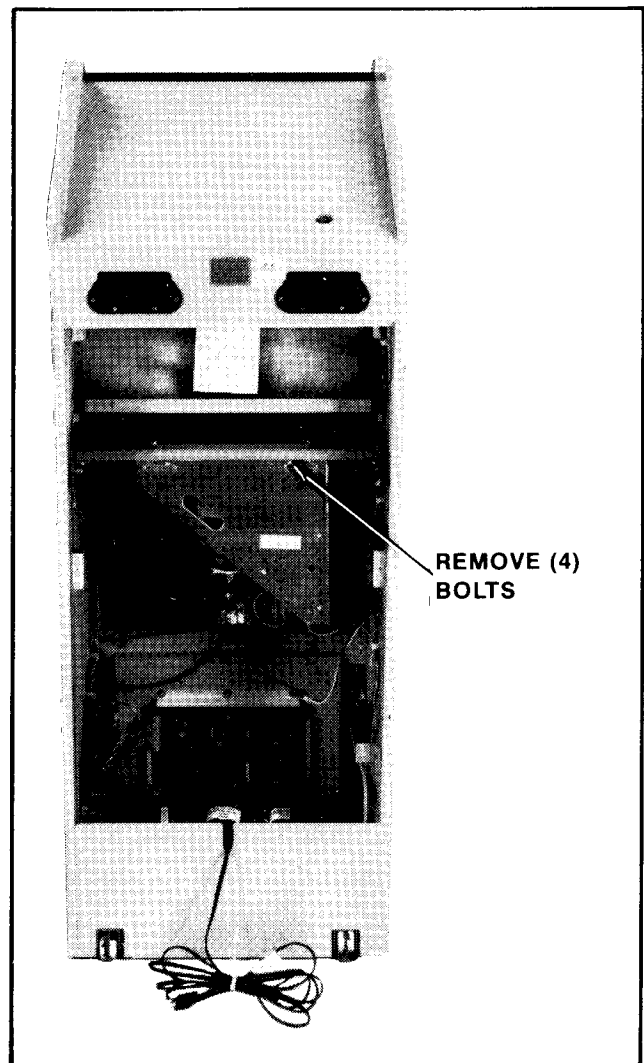


Figure 4-7 Removing the Monitor — Upright

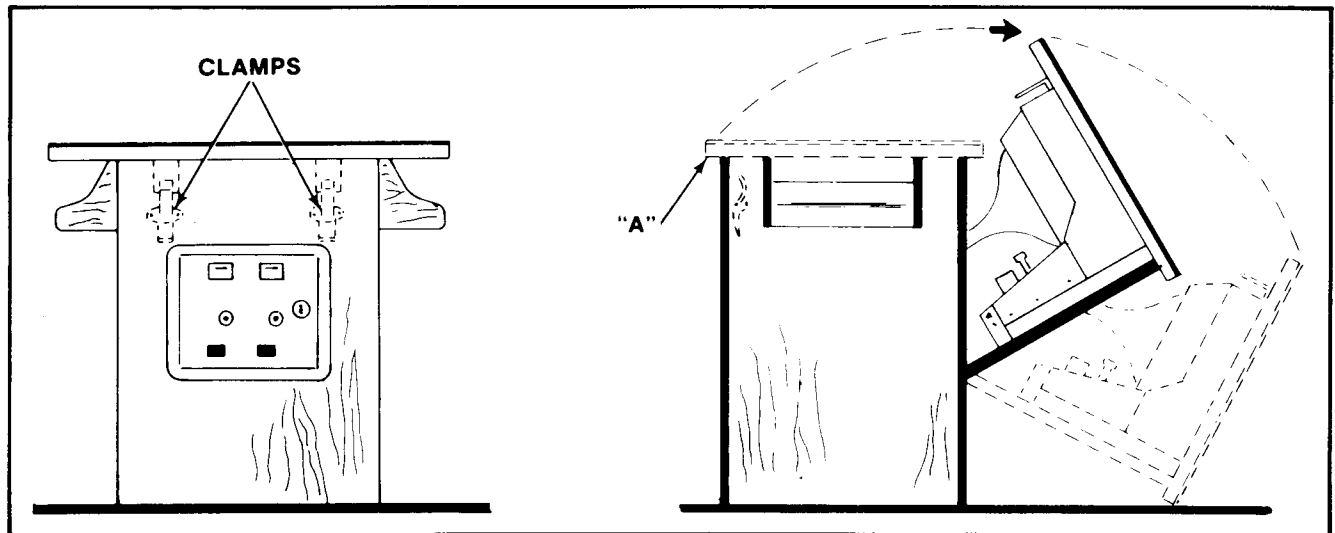


Figure 4-8 Opening the Cocktail Game

2. COCKTAIL TABLE MODEL: See Figure 4-9.

- Turn power off to the game.
- Open the coin box door and release the two latches indicated in Figure 4-8.

CAUTION: The right hand latch is very close to the **HIGH VOLTAGE** on the monitor.

- Once the latches are released, unhook them from their latch plates.
- Grasp the table top at "A" and open it as indicated in Figure 4-8.

CAUTION: Due to the weight of the monitor, **EXTREME CARE MUST** be taken when opening the cabinet.

- Remove the screws which hold the table top glass clamps in place.
- Remove the table top glass.
- Lift out the T.V. bezel assembly.
- Completely disconnect the T.V. monitor from all its cabling. **DON'T FORGET THE CHASSIS GROUND WIRE.**
- Remove the screws holding the T.V. monitor chassis to the "L" brackets by the door hinge(s). See Figure 4-9.
- Close the Cocktail Table and re-latch it.
- Remove the screws which secure the T.V. monitor mounting brackets to the edges of the slot cut in the table top. See Figure 4-9.
- Pry up the end of each monitor mounting bracket with a screwdriver or similar tool until you can grasp them both.

- Lift the T.V. monitor straight up and out of the table top being **VERY CAREFUL** not to bump the neck of the picture tube.
- To reinstall the T.V. monitor, reverse this procedure.
Be sure to check the clearance of the "L" brackets **BEFORE** setting the monitor into the table top.
- After replacing the T.V. monitor, be sure to run the game Self-Test.

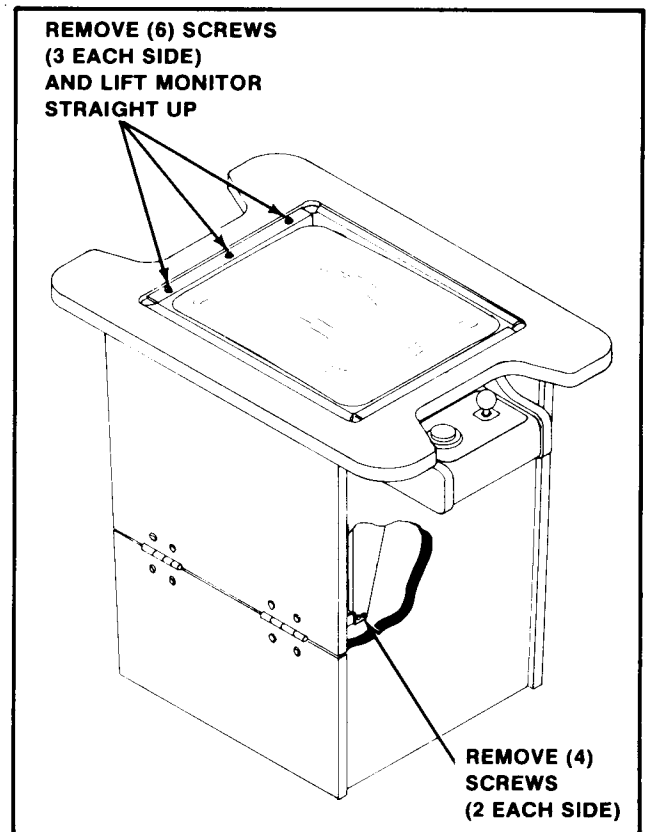


Figure 4-9 Removing the Monitor — Cocktail Game

PRINTED CIRCUIT BOARD (P.C.B.) REPLACEMENT

1. **UPRIGHT MODEL:** See Figure 4-10.

- Turn the power to the game off.
- Unlock and open the rear access door.
- Disconnect the Sound I/O board from all its cabling.
- Disconnect the CPU board from all its cabling.
- Slide the P.C.B. clamps to one side, remove the P.C.B.'s from the card rack and take them out the back of the cabinet.
- Disconnect the Power Supply board from all its cabling, remove the P.C.B. supports indicated in Figure 4-10, and slide it out the back of the cabinet.
- To reinstall the above P.C.B.'s, reverse this procedure.

NOTE: P.C.B.'s are all keyed and will ONLY fit into their connectors one way without forcing them. The plugs on the cable harness which connect it to the P.C.B.'s are also keyed and will ONLY go onto their connectors one way without forcing them.

2. **COCKTAIL TABLE MODEL:** See Figure 4-10.

- Turn the power off to the game.
- Open the cabinet:
Open the coin box door and release the two latches indicated in Figure 4-8.

CAUTION: The right hand latch is very close to the HIGH VOLTAGE on the monitor.

Once they're released, unhook them from their latch plates.

- Grasp the table top at "A" and open it as indicated in Figure 4-8.

CAUTION: Due to the weight of the monitor, EXTREME CARE MUST be taken when opening the cabinet.

- To remove the Power Supply Board. See Figure 4-10.
Disconnect it from all its cabling.
Remove the two smallest P.C.B. supports.
Once these are removed, the power supply can be lifted out the top of the cabinet.
To reinstall the power supply board, reverse this procedure.
- To remove the Sound I/O and CPU boards.
Disconnect the Sound I/O board from all its cabling.
Disconnect the CPU board from all its cabling.
Slide the P.C.B. clamps to one side, remove the P.C.B.'s from the card rack and lift them out the top of the cabinet.
To reinstall the Sound I/O and CPU boards, reverse this procedure.

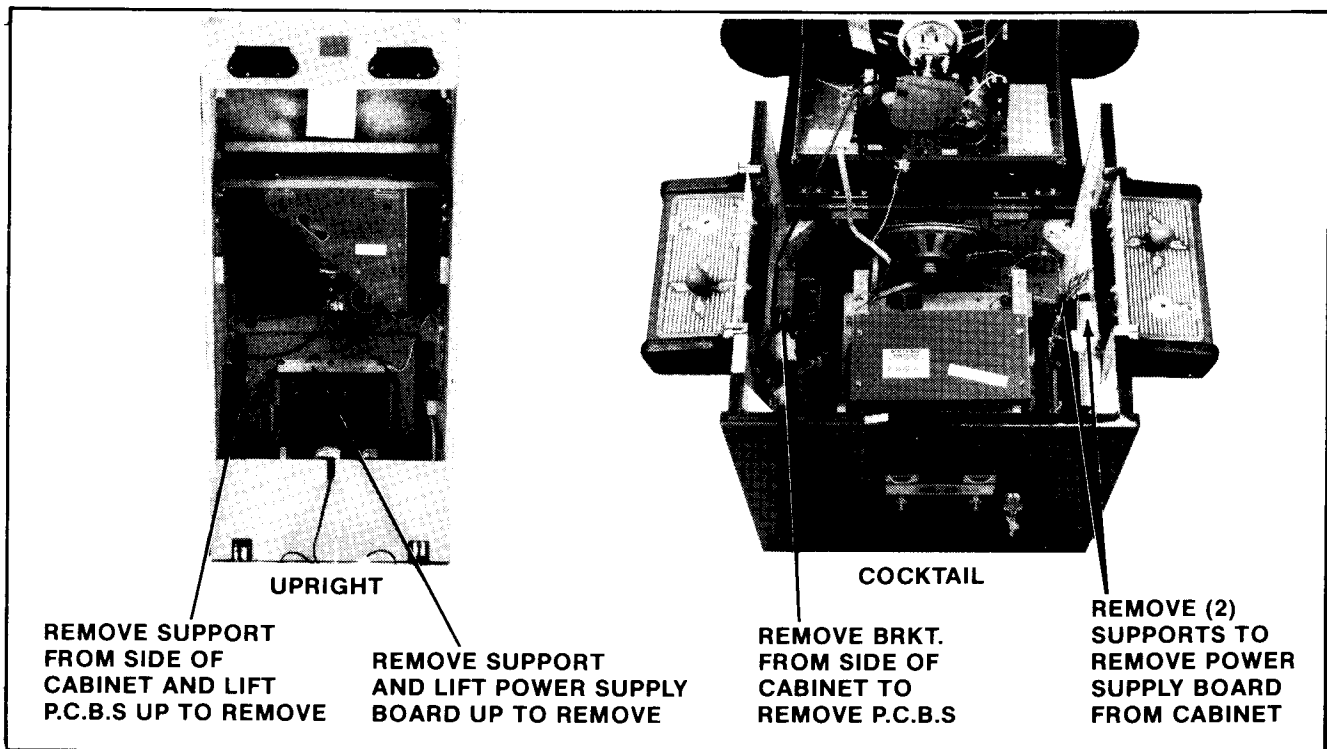


Figure 4-10 Removing P.C.B.s

OPENING THE ATTRACTION PANEL

1. **UPRIGHT MODEL:** See Figure 4-11.

- Turn the power to the game off.
- Opening the attraction panel:
 - Remove the screws which secure the top bracket in place. (They are on its top side.)
 - Remove the top bracket and slide up the attraction panel. This exposes the attraction panel fluorescent light tube and its mounting bracket assembly.
 - To reinstall the attraction panel, reverse this procedure.
- The fluorescent light tube may be replaced at this time. **BE CAREFUL NOT TO DROP IT.**

WARNING: If you drop a fluorescent tube and it breaks, IT WILL IMplode! Shattered glass can fly six (6) feet or more from the implosion. Use care when replacing any fluorescent tube.

- Replacing the fluorescent tube starter. See Figure 4-12.

Be sure the power to the game has been turned off.

Grasp the starter (it is on the back of the mounting bracket), give it a quarter turn, and remove it from its socket.

To replace the fluorescent light tube starter, reverse this procedure.

- Replacement of the fluorescent tube mounting bracket assembly.

Be sure the power is off to the game.

Disconnect it from its power cable.

Remove the screws at its right and left hand sides which secure it and gently slide it out the front of the cabinet, being careful not to catch its power cable on anything.

To reinstall the fluorescent tube mounting bracket assembly, reverse this procedure.

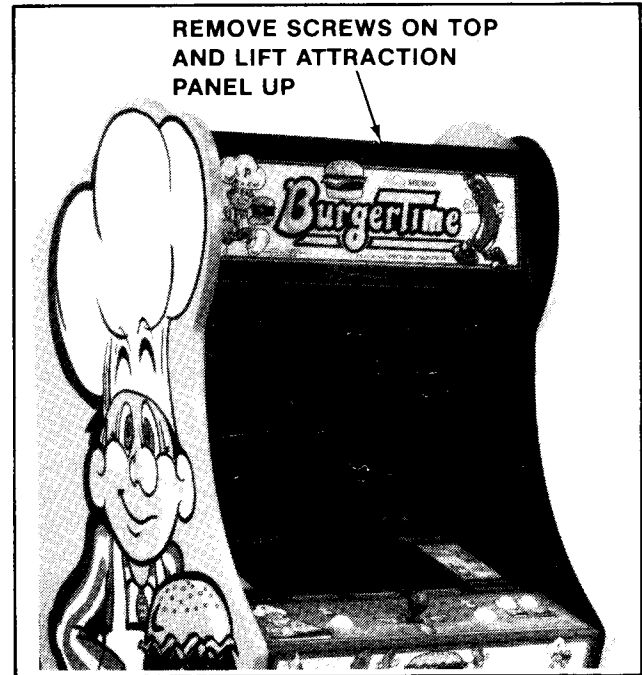


Figure 4-11 Opening the Attraction Panel — Upright

- Replacing the speaker.

Be sure the power is off to the game.

Remove the attraction panel and disconnect the speaker from its cabling.

Remove the nuts and bolts which secure the speaker and speaker grill in place and set them and the speaker grill aside.

Once the bolts which secure the speaker in place are removed, the speaker may be removed through the opening where the attraction panel was.

Reverse this procedure to reinstall the speaker.

2. **THE COCKTAIL TABLE MODEL HAS NO BACK-LIT ATTRACTION PANEL.**

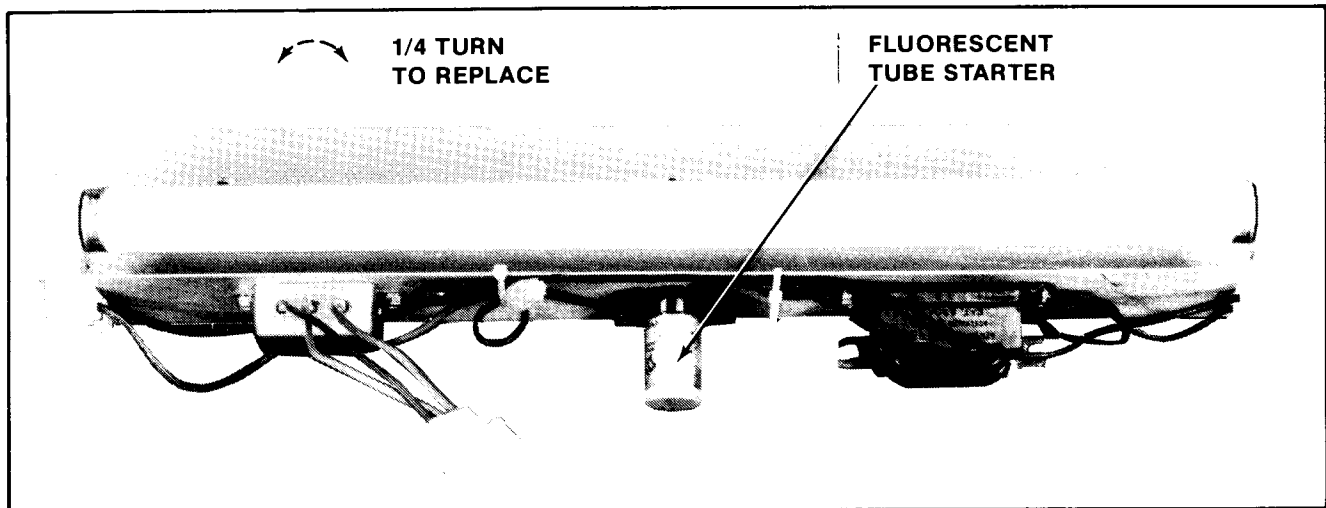
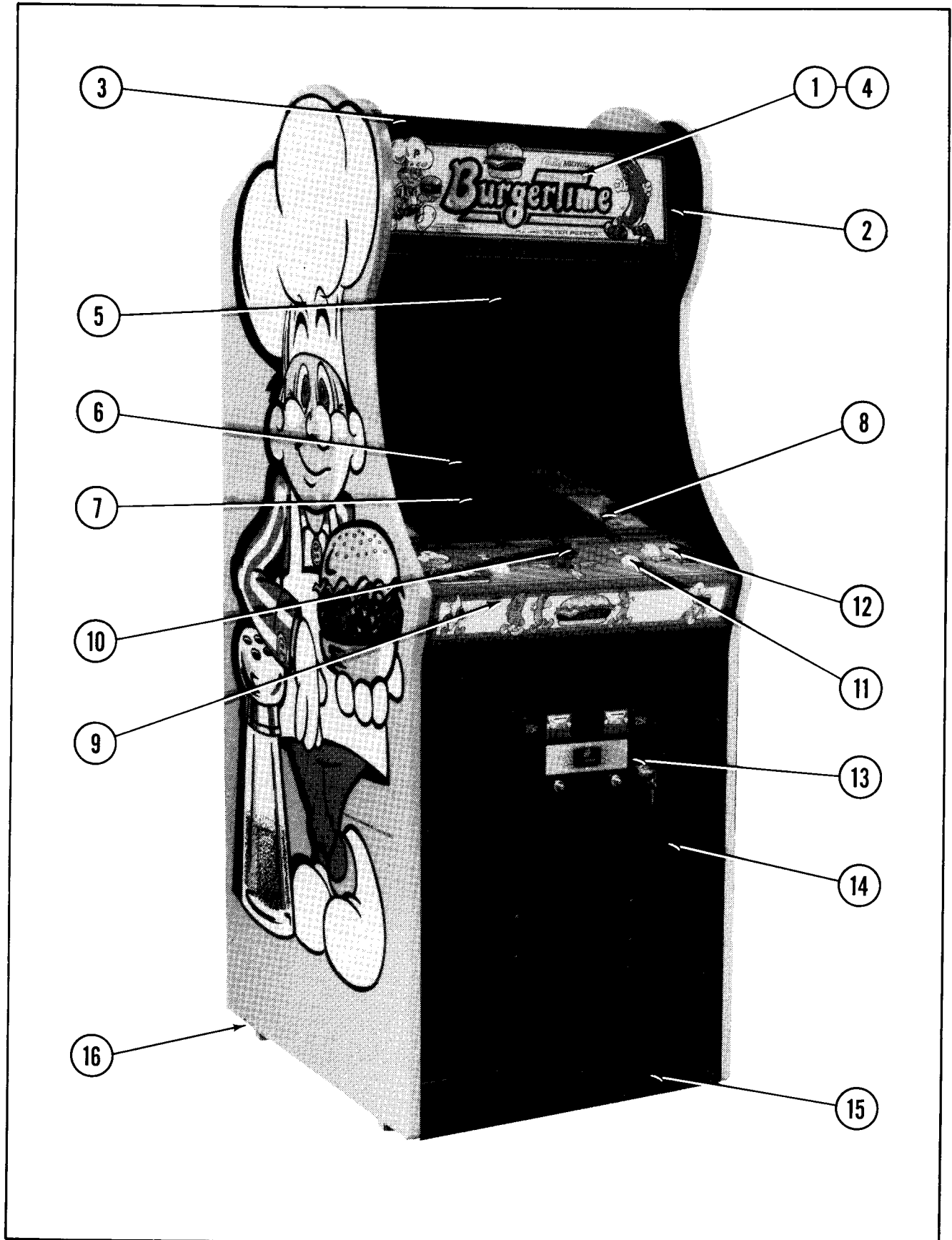


Figure 4-12 Replacing Fluorescent Tube Starter

V Illustrated Parts Breakdown

NO. 333 — BURGER TIME — UPRIGHT — FRONT

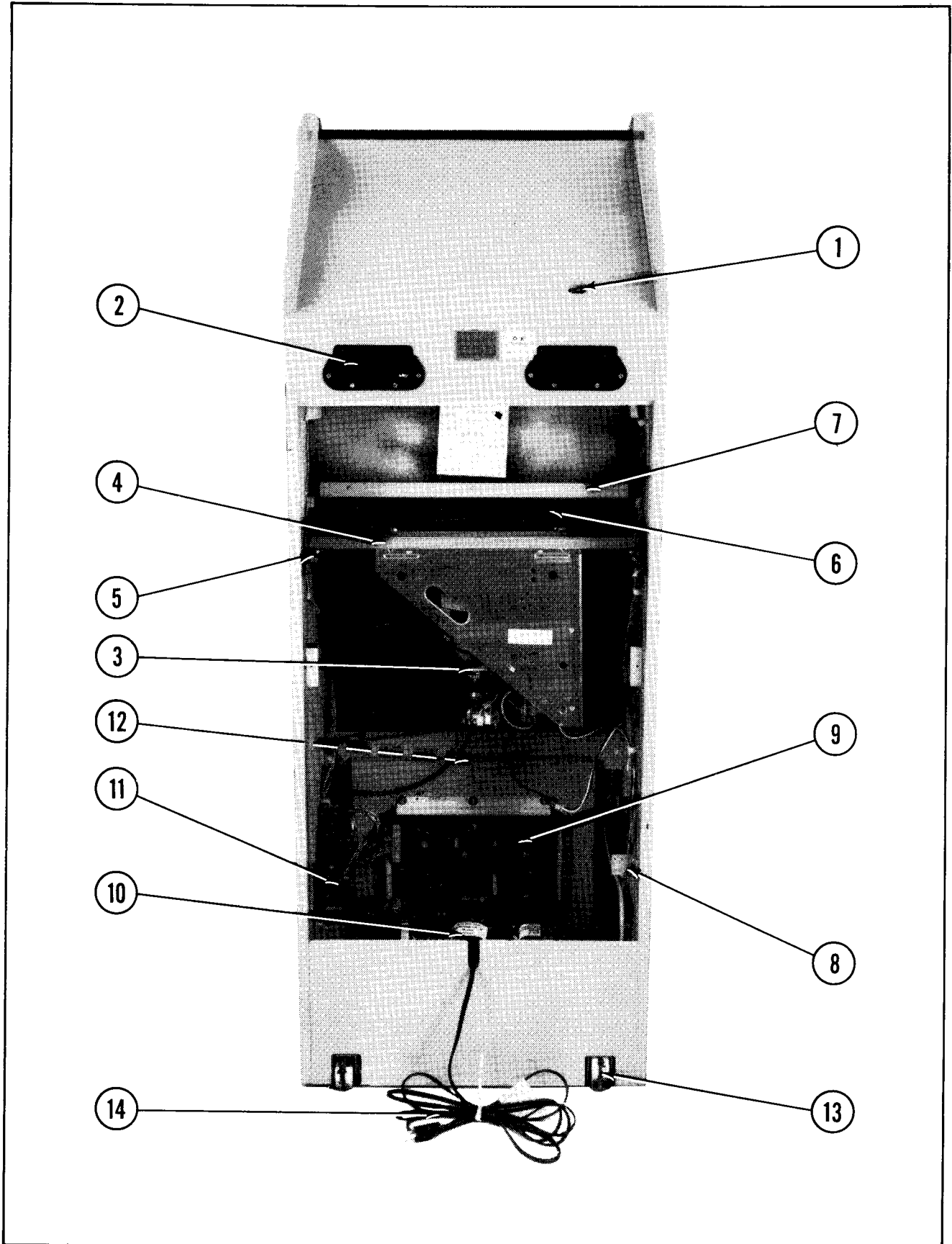


NO. 333 — BURGER TIME — UPRIGHT — FRONT — PARTS LIST

ORDER BY PART NUMBER ONLY

ITEM	PART NO.	DESCRIPTION
1	0333-00901-00XF	HEADER DISPLAY PLEXI
2	0537-00903-0057	GLASS CHANNEL — 7-5/8" LG. (2 REQ'D.)
3	0574-00903-0100	HEADER BRKT. RETAINER (2 REQ'D.)
	0017-00101-0138	#8 x 5/8 TORX TAMPER RESISTANT SCR. (6 REQ'D.)
	0017-00009-0522	LONG ARM KEY T-20 (FOR ABOVE SCREW)
4	A595-00011-0000	HEADER LIGHT ASSY.
5	0017-00009-0393	BLACK SPEAKER GRILL W/SLOTS
	0017-00003-0259	6" x 9" SPEAKER — 8 OHM, 7W.
	0017-00101-0127	#8-32 x 1-1/2 CARRIAGE BOLT (4 REQ'D.)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (4 REQ'D.)
6	0508-00900-0000	19" T.V. BEZEL
7	0333-00902-0000	DIFFUSER
	0508-00901-0000	PLEXI-GLASS CLIPS (4 REQ'D.)
	0017-00101-0017	#6 x 1/2 BLK. SLT. HEX HD. SCREW (4 REQ'D.)
8	0333-00900-00XF	MAIN VIEWING GLASS
	0508-00108-0000	GLASS STOP BRKT.
	0017-00101-0027	#8 x 3/4 SLT. HEX HD. M.S. (3 REQ'D.)
9	A316-00012-0000	CONTROL SHELF PLATE WELD ASSY. W/STRIKES
	0333-00903-0000	DECORATIVE CONTROL SHELF OVERLAY
	0941-00103-0100	CONTROL SHELF MTG. BRKT. — RIGHT
	0941-00103-0200	CONTROL SHELF MTG. BRKT. — LEFT
	0555-00901-0000	PLASTIC LOCATING PIN (4 REQ'D.)
	0017-00009-0534	BASSICK CLAMP (3 REQ'D.)
	0017-00101-0141	#8 x 11/16 UNSLOT. HEX HD. SCR. (10 REQ'D.)
	0316-00903-0000	CONTROL SHELF STRAP
10	A982-00017-0000	CONTROL ASSEMBLY
	A316-00005-0000	CONTROL SHELF CABLE ASSY.
11	0333-00904-0000	PUSH BUTTON ASSY. — WHITE (PRINTED) (2 REQ'D.)
12	0017-00042-0257	PUSH BUTTON ASSY. — YELLOW (2 REQ'D.)
	0017-00032-0093	PUSH BUTTON SWITCH W/HOLDER (4 REQ'D.)
	0017-00103-0054	5/8-11 PAL NUT (4 REQ'D.)
13	A090-00300-11BK	U.S.A. 25¢ DOUBLE COIN DOOR ASSY.
	A982-00015-0000	COIN DOOR CABLE ASSY.
14	0090-00002-04BK	BLACK LARGE COIN DOOR FRAME
	0017-00101-0121	#6-32 x 5/16 PHIL. TRS. HD. SCR. (3 REQ'D.) (MOUNTS COIN DOOR TO FRAME)
15	0935-00906-0100	KICK PLATE — 23" LG.
16	0017-00102-0048	3/8-16 x 2" LEG LEVELERS (4 REQ'D.)
	0017-00103-0026	3/8-16 LEG LEVELER HEX NUTS (4 REQ'D.)

NO. 333 — BURGER TIME — UPRIGHT — REAR ACCESS

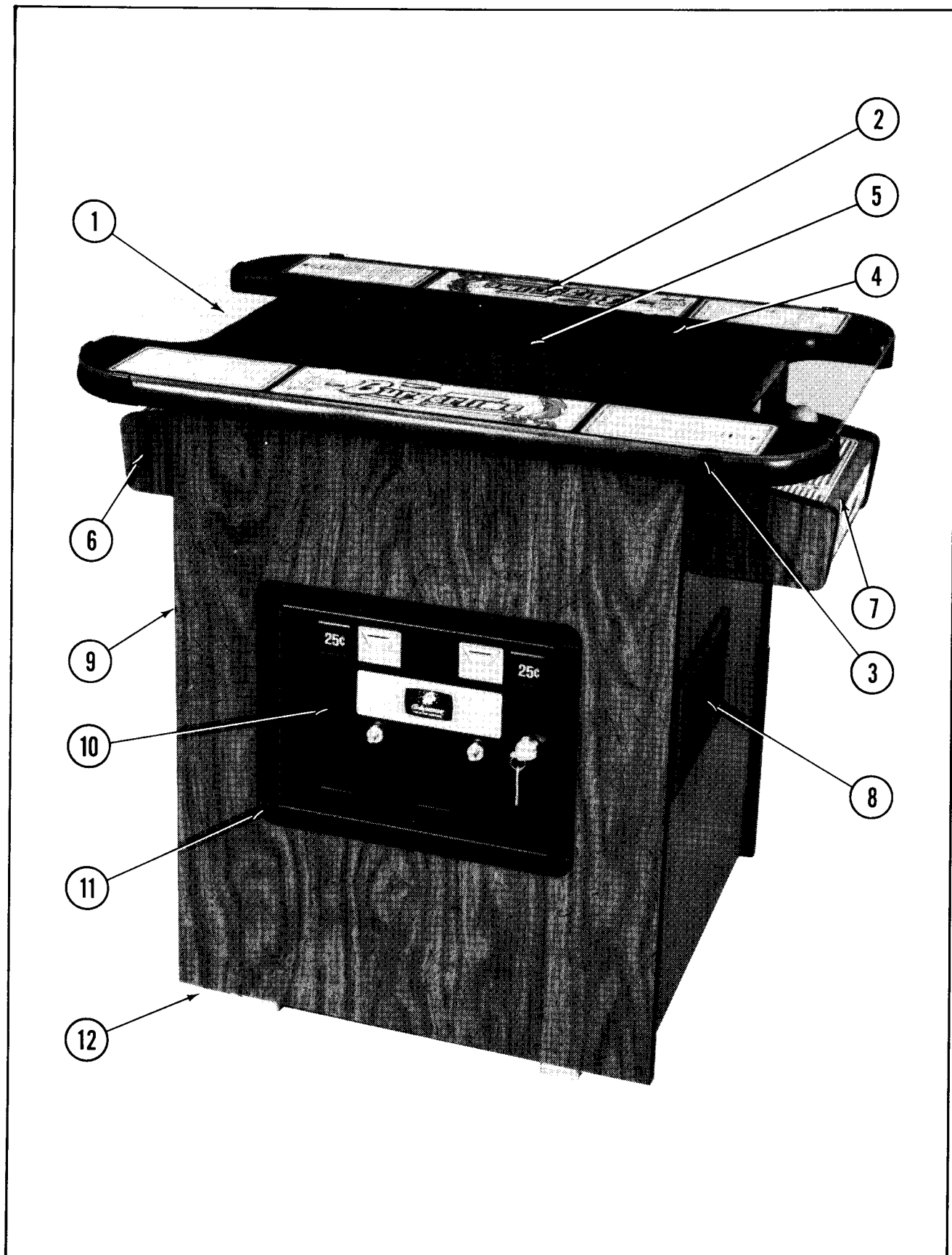


NO. 333 — BURGER TIME — UPRIGHT — REAR ACCESS — PARTS LIST

ORDER BY PART NUMBER ONLY

ITEM	PART NO.	DESCRIPTION
1	A945-00038-0000	ON-OFF SWITCH & PLATE ASSY.
2	0894-00916-0000	PLASTIC PULL & VENT (2 REQ'D.)
3	0017-00101-0141	#8 x 11/16 UNSLOT. HEX HD. M.S. (8 REQ'D.)
	0017-00003-0339	ELECTROHOME — 19" COLOR DUAL SYNC. HORIZ. MTG. MONITOR (OR)
3	0017-00003-0439	WELLS-GARDNER — 19" COLOR DUAL SYNC. HORIZ. MTG. MONITOR
4	A508-00005-0000	MONITOR MTG. CHANNEL ASSY. (2 REQ'D.)
	0017-00102-0066	1/4-20 x 3/4 UNSLOT. HEX HD. BOLT (4 REQ'D.)
5	0017-00104-0014	7/8" DISH WASHER (4 REQ'D.)
	0595-00104-0000	MONITOR RAIL (2 REQ'D.)
	0555-00901-0000	PLASTIC LOCATING PINS (4 REQ'D.)
6	0017-00101-0141	#8 x 11/16 UNSLOT. HEX HD. M.S. (8 REQ'D.)
	0508-00900-0000	19" T.V. BEZEL
7	0508-00108-0000	GLASS STOP BRKT.
8	0017-00101-0027	#8 x 3/4 SLT. HEX HD. M.S. (3 REQ'D.)
	A088-00016-0000	INTERLOCK SWITCH & SPRING BRKT. ASSY.
9	A082-90427-A000	POWER SUPPLY P.C. BOARD ASSY.
	0624-00902-0200	P.C. SUPPORT BRKT. — 10" LG. (2 REQ'D.)
	0624-00902-0400	P.C. SUPPORT BRKT. — 4" LG.
	0017-00101-0141	#8 x 11/16 UNSLOT. HEX HD. M.S. (11 REQ'D.)
	0017-00104-0037	#8 FLAT WASHER (11 REQ'D.)
10	A945-00036-0002	POWER CHASSIS ASSY. — 70VA., 115V.
11	A334-00010-0000	CARD RACK HOLDER W/BOARDS ASSY.
	A084-91440-D333	SOUND BRD. P.C. ASSY.
12	A084-91441-E333	CPU BRD. P.C. ASSY.
	A950-00004-0000	COIN BOX ASSY. (NOT SEEN)
	A950-00006-0000	COIN BOX CRADLE ASSY.
	0950-00105-0000	COIN BOX COVER
	0950-00104-0000	COIN BOX HANDLE
	0950-00101-0000	COIN DEFLECTOR (2 REQ'D.)
	0950-00900-0000	LARGE PLASTIC CASH BOX
	0017-00101-0142	1/4-20 x 1-3/8 BLACK RND. HD. BOLT (4 REQ'D.)
	0017-00104-0014	7/8" DISH WASHER (4 REQ'D.)
	0017-00103-0018	1/4-20 HEX NUT (4 REQ'D.)
13	A961-00007-0000	CASTER ASSY. (2 REQ'D.)
	0961-00109-0000	WHEEL BRKT. (2 REQ'D.)
	0017-00042-0255	PLASTIC WHEEL (2 REQ'D.)
	0894-00702-00XF	SHAFT (2 REQ'D.)
14	0017-00100-0037	3/8" E-RING (2 REQ'D.)
	A945-00019-0000	LINE CORD ASSY.
		ADDITIONAL PARTS LIST
	A334-00014-0000	CARD RACK SUB-ASSY.
	A151-00098-0000	BACK DOOR LOCK ASSY.
	0017-00009-0490	5-5/8" SQR. VENT GRILL (4 REQ'D.)
	A333-00012-0000	CREDIT SWITCH & BRKT. ASSY.
	0950-00103-0000	COIN BOX DIVIDER — OPTIONAL
	A333-00008-0000	MASTER CABLE W/BRKT. ASSY.
	A316-00009-0000	HIGH VOLTAGE CABLE ASSY.
	A316-00010-0000	LOW VOLTAGE CABLE ASSY.

NO. 334 — BURGER TIME — COCKTAIL — FRONT

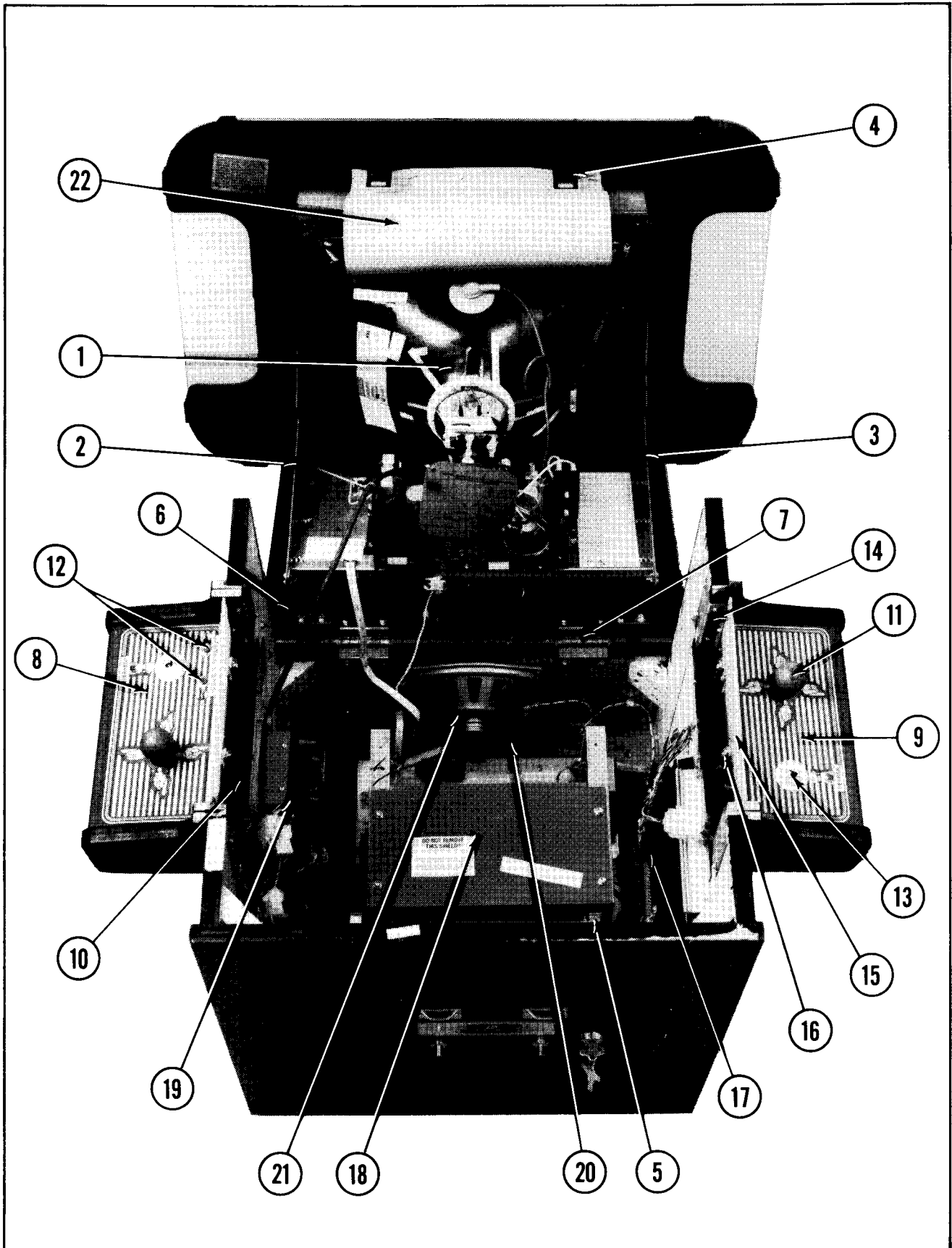


NO. 334 — BURGER TIME — COCKTAIL — FRONT — PARTS LIST

ORDER BY PART NUMBER ONLY

ITEM	PART NO.	DESCRIPTION
1	0017-00009-0499	COVER GLASS — 32" x 22" x 1/4"
2	0334-00900-0000	DECORATIVE ARTWORK UNDERLAY
3	0775-00104-00XF	GLASS CLIPS (8 REQ'D.)
	0017-00101-0117	#8 x 5/8 BLK. PHIL. TRS. HD. SCR. (8 REQ'D.)
4	0557-00900-0000	T.V. BEZEL
5	0333-00902-0000	DIFFUSER
	0508-00901-0000	PLEXI-GLASS CLIPS (4 REQ'D.)
	0017-00101-0017	#6 x 1/2 SLT. HEX HD. SCR. (4 REQ'D.)
6	A334-00004-0100	CONTROL SHELF ASSY. — PLAYER #1
7	A334-00004-0200	CONTROL SHELF ASSY. — PLAYER #2
8	0017-00009-0393	BLACK SPEAKER GRILL W/SLOTS (2 REQ'D.)
9	0017-00009-0482	SPEAKER GRILL (NOT SEEN)
	0017-00003-0187	6" x 9" SPEAKER — 8 OHM, 9W.
	0017-00101-0136	#8-32 x 1-1/4 CARRIAGE BOLT (8 REQ'D.)
	0017-00101-0127	#8-32 x 1-1/2 CARRIAGE BOLT (4 REQ'D.)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (12 REQ'D.)
10	A090-00300-11BK	U.S.A. 25¢ DOUBLE COIN DOOR ASSY.
	A982-00015-0000	COIN DOOR CABLE ASSY.
11	0090-00002-04BK	LARGE COIN DOOR FRAME
	0017-00101-0121	#6-32 x 5/16 PHIL. TRS. HD. SCR. (3 REQ'D.) (MOUNTS COIN DOOR TO FRAME)
	A927-00019-0000	COIN BOX ASSEMBLY
	A962-00004-0000	COIN BOX COVER ASSY.
	A962-00005-0000	COIN BOX SIDE CHANNEL ASSY. — SHORT
	0962-00101-0000	COIN BOX SIDE CHANNEL — SHORT
	0017-00101-0628	#8-32 x 3/4 CARRIAGE BOLT (4 REQ'D.)
	0017-00104-0022	#8 FLAT WASHER (4 REQ'D.)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (4 REQ'D.)
12	0017-00102-0048	3/8-16 x 2" LEG LEVELERS (4 REQ'D.)
	0017-00103-0026	3/8-16 LEG LEVELER HEX NUTS (4 REQ'D.)

NO. 334 — BURGER TIME — COCKTAIL — INTERIOR ACCESS



NO. 334 — BURGER TIME — COCKTAIL — INTERIOR ACCESS — PARTS LIST

ORDER BY PART NUMBER ONLY

ITEM	PART NO.	DESCRIPTION
1	0017-00003-0339	ELECTROHOME — 19" COLOR DUAL SYNC. HORIZ. MTG. MONITOR (OR)
1	0017-00003-0439	WELLS-GARDNER — 19" COLOR DUAL SYNC. HORIZ. MTG. MONITOR
2	A515-00019-0000	MONITOR SUPPORT ASSY. — LEFT
3	A515-00019-0100	MONITOR SUPPORT ASSY. — RIGHT
4	0017-00101-0109	#8 x 5/16 UNSLOT. HEX HD. BOLT (6 REQ'D.)
4	0610-00132-00ZN	STRIKE (2 REQ'D.)
5	0017-00009-0534	BASSICK CLAMP (2 REQ'D.)
5	0017-00101-0141	#8 x 11/16 UNSLOT. HEX HD. M.S. (8 REQ'D.)
6	0927-00101-00XF	SUPPORT ANGLE (2 REQ'D.)
6	0017-00101-0598	#8-32 x 5/16 SLT. HEX HD. SCREW (4 REQ'D.)
7	0017-00009-0514	2-1/2" HINGE (2 REQ'D.)
7	0017-00101-0136	#8-32 x 1-1/4 CARRIAGE BOLT (8 REQ'D.)
7	0017-00103-0061	#8-32 HEX NUT W/SEMS (8 REQ'D.)
8	0334-00901-0100	DECORATIVE OVERLAY PLAYER #1
9	0334-00901-0200	DECORATIVE OVERLAY PLAYER #2
9	A302-00015-0000	CONTROL PANEL WELDMENT ASSY. (2 REQ'D.)
10	0510-00101-00XF	BOTTOM PAN (2 REQ'D.)
10	0017-00101-0341	#6 x 1/4 PHIL. TRS. HD. SCR. (6 REQ'D.)
11	A982-00017-0000	CONTROL ASSY. (2 REQ'D.)
11	A334-00008-0100	CONTROL SHELF CABLE ASSY. — PLAYER #1
11	A334-00008-0200	CONTROL SHELF CABLE ASSY. — PLAYER #2
12	0017-00032-0051	SMALL RED BUTTON SWITCH ASSY. W/HARDWARE (2 REQ'D.)
13	0333-00904-0000	PUSH BUTTON ASSY. W/PRINTING (2 REQ'D.)
13	0017-00032-0093	PUSH BUTTON SWITCH W/HOLDER (2 REQ'D.)
13	0017-00103-0054	5/8-11 PAL NUT (2 REQ'D.)
14	0930-00104-0000	CONTROL PANEL LOCATING BRKT. (4 REQ'D.)
14	0017-00101-0025	#8 x 1/2 SLT. HEX HD. M.S. (16 REQ'D.)
15	0930-00904-0000	LIGHT SHIELD (2 REQ'D.)
16	0017-00031-0044	WEDGE BASE LAMP SOCKET (4 REQ'D.)
16	0017-00003-0219	#194 WEDGE LAMP — 14V., .27A. (4 REQ'D.)
16	0017-00101-0555	#6-32 x 5/16 SLT. HEX HD. M.S. (4 REQ'D.)
17	A082-90427-A000	POWER SUPPLY P.C. BOARD ASSY.
17	0624-00902-0400	P.C. SUPPORT BRKT. — 4" LG.
17	0624-00902-0200	P.C. SUPPORT BRKT. — 10" LG. (2 REQ'D.)
17	0017-00101-0141	#8 x 11/16 UNSLOT. HEX HD. M.S. (7 REQ'D.)
17	0017-00104-0037	#8 FLAT WASHER (7 REQ'D.)
18	A945-00036-0000	POWER CHASSIS ASSY. — 70VA., 115V.
18	0942-00102-0000	POWER CHASSIS MTG. BRKT. (2 REQ'D.)
19	A334-00010-0000	CARD RACK HOLDER W/BOARDS ASSY.
19	A084-91440-D333	SOUND BRD. P.C. ASSY.
19	A084-91441-E333	CPU BRD. P.C. ASSY.

NO. 334 — BURGER TIME — COCKTAIL — INTERIOR ACCESS — PARTS LIST (Continued)

ORDER BY PART NUMBER ONLY

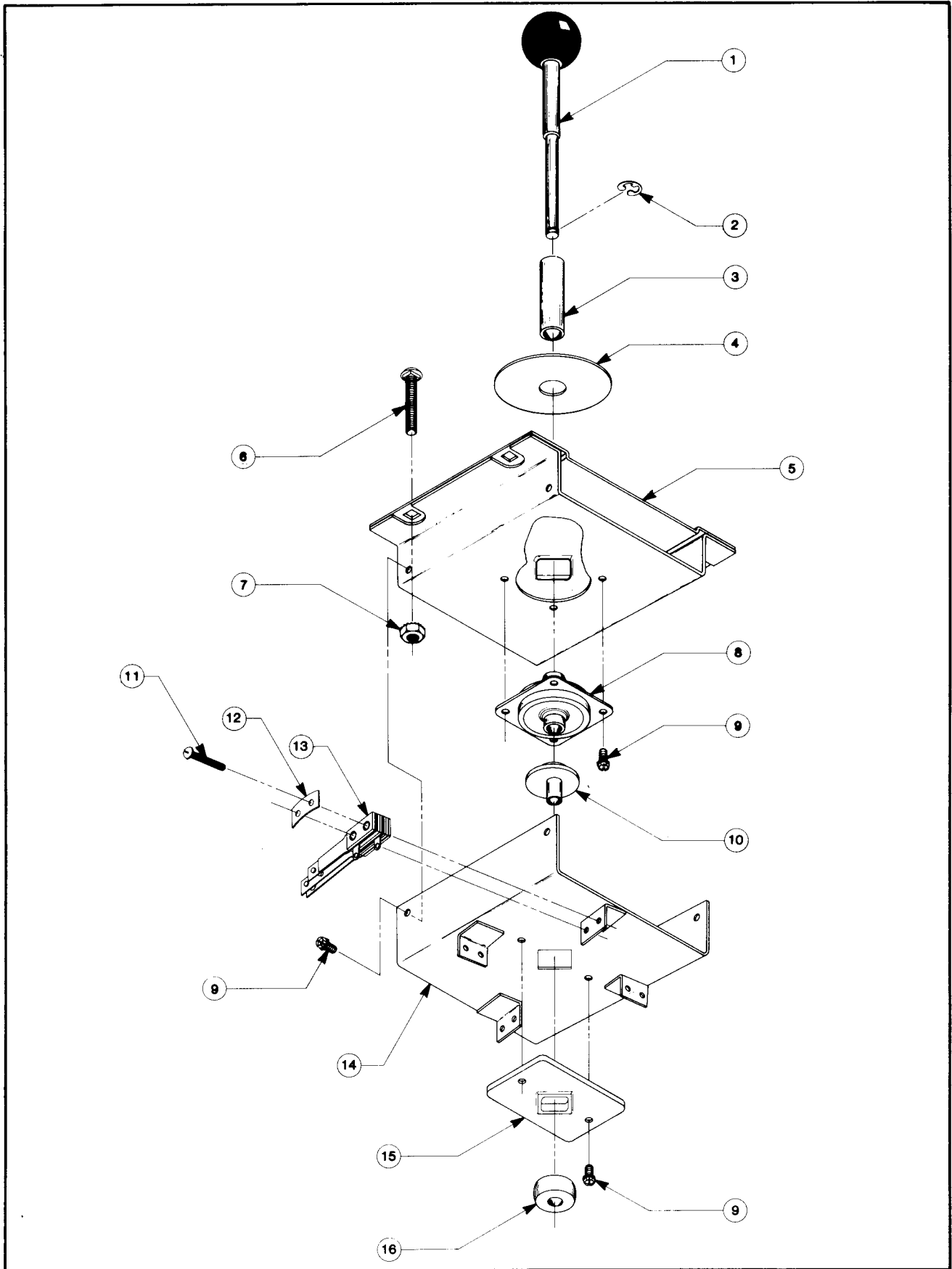
ITEM	PART NO.	DESCRIPTION
20	A775-00013-0000	FAN ASSY.
	0151-00081-0000	4" FAN
	0775-00110-00XF	FAN PLATE
	0749-00106-00XF	VENT SCREEN
	0017-00101-0347	#6-32 x 1/2" R.H.M.S. (4 REQ'D.)
	0017-00104-0009	#6 EXT. WASHER (4 REQ'D.)
	0017-00103-0005	#6-32 HEX NUT (4 REQ'D.)
	0017-00101-0026	#8 x 5/8 SLT. HEX HD. SCREW (4 REQ'D.)
21	0017-00003-0187	6" x 9" SPEAKER — 8 OHM, 9W.
22	0942-00902-0000	MONITOR SHIELD
ADDITIONAL PARTS LIST		
	A088-00014-0000	INTERLOCK SWITCH & BRKT. ASSY.
	A945-00038-0000	ON-OFF SWITCH & PLATE ASSY.
	A334-00005-0000	MASTER CABLE W/BRKT. ASSY.
	A317-00006-0000	HIGH VOLTAGE CABLE ASSY.
	A316-00010-0000	LOW VOLTAGE CABLE ASSY.
	0942-00902-0000	MONITOR SHIELD
	A927-00005-0000	HIGH BASE LEG KIT ASSY. — OPTIONAL
	A334-00014-0000	CARD RACK SUB-ASSY.

BURGER TIME — CONTROL ASSEMBLY — ALL VERSIONS — PARTS LIST

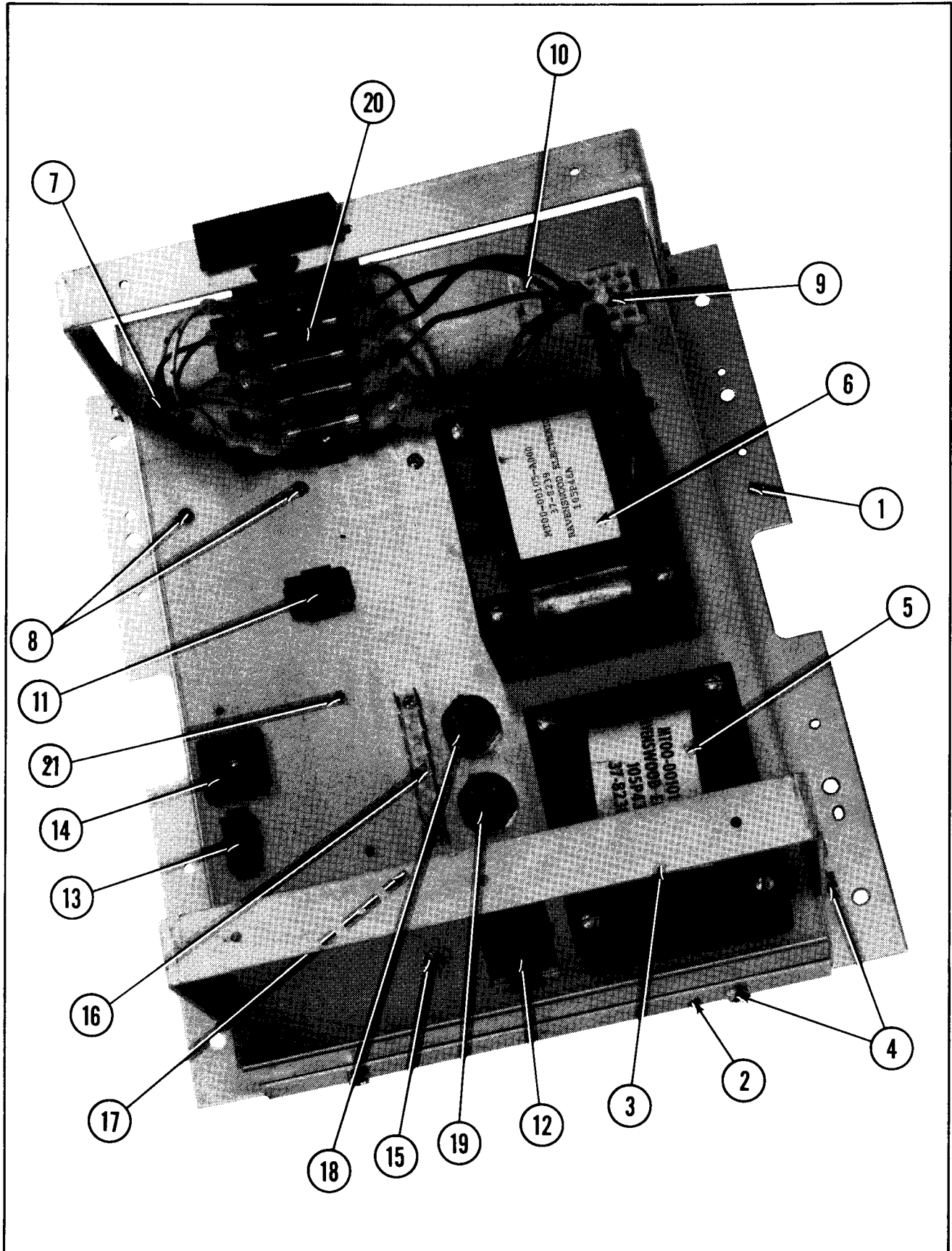
ORDER BY PART NUMBER ONLY

ITEM	PART NO.	DESCRIPTION
1	A932-00022-0000	BALL & SHAFT ASSEMBLY
2	0017-00100-0025	1/4 E-RING
3	0921-00702-0000	STOP SPACER
4	0921-00902-0000	SLIDE PLATE
5	A982-00019-0000	PIVOT PLATE WELD ASSY.
6	0017-00101-0637	#8-32 x 1" CARRIAGE BOLT (4 REQ'D.)
7	0017-00103-0061	#8-32 HEX NUT W/SEMS (4 REQ'D.)
8	0932-00902-0000	GROMMET
9	0017-00101-0598	#8-32 x 5/16 SLT. HEX HD. M.S. (10 REQ'D.)
10	0962-00904-0000	SLEEVE
11	0017-00101-0527	#5-40 x 5/8 SLT. RND. HD. SCR. (8 REQ'D.)
12	0020-00202-0000	SWITCH PLATE (4 REQ'D.)
13	A932-00009-0000	SWITCH ASSEMBLY (4 REQ'D.)
14	A932-00012-0000	STOP PLATE & SWITCH BRKT. ASSY.
15	0932-00905-0000	WEAR PLATE
16	0921-00700-0000	ACTUATOR

BURGER TIME — CONTROL ASSEMBLY — ALL VERSIONS



BURGER TIME — POWER CHASSIS ASSY. — 70VA, 115V. — ALL VERSIONS

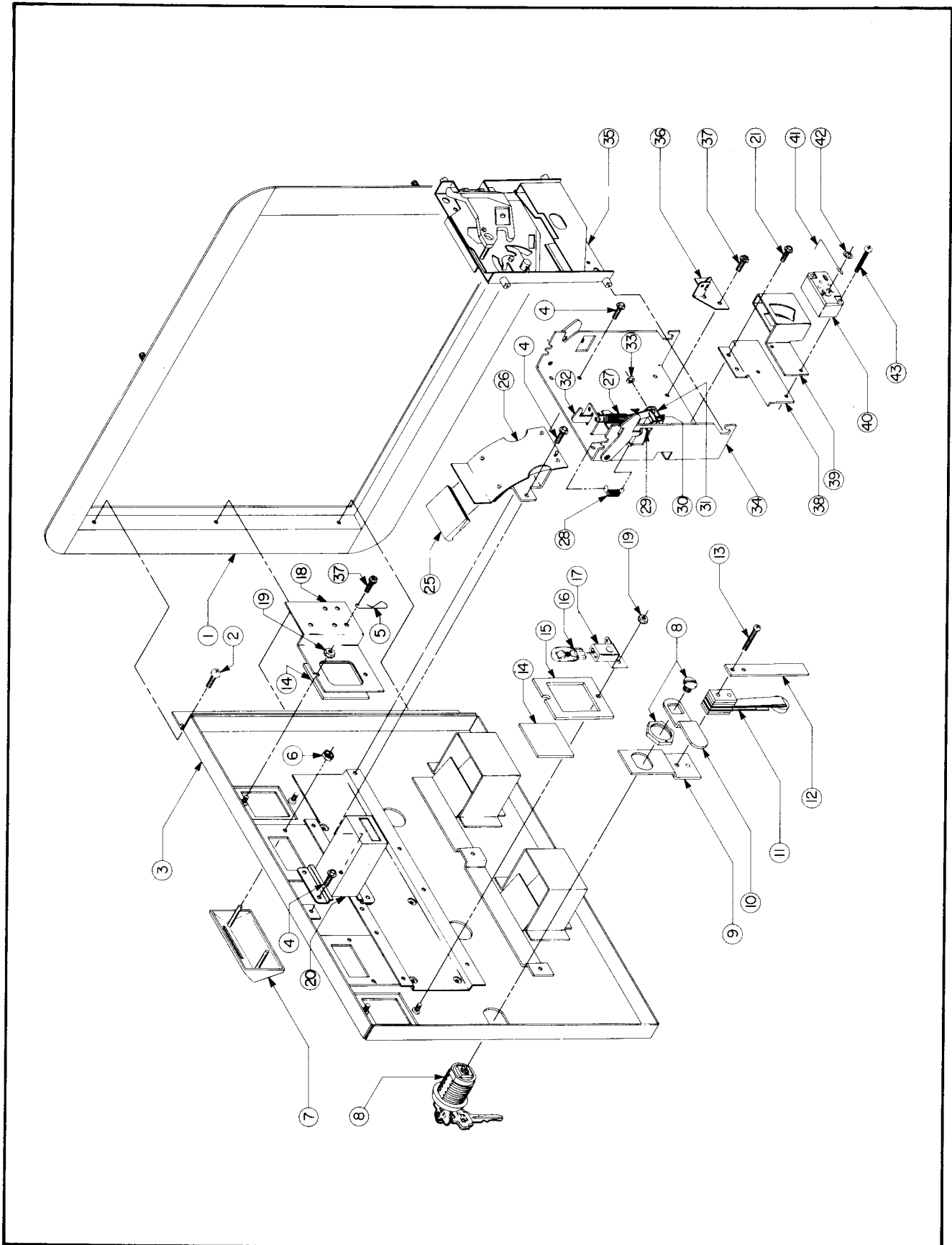


BURGER TIME — POWER CHASSIS ASSY. — 70VA, 115V. — ALL VERSIONS — PARTS LIST

ORDER BY PART NUMBER ONLY

ITEM	PART NO.	DESCRIPTION
1	0945-00108-00XF	CHASSIS
2	A945-00029-0000	MTG. PLATE & BARRIER ASSY.
3	0945-00107-01XF	STRAP (2 REQ'D.)
4	0017-00101-0123	#8 x 1/4 UNSLOT. HEX HD. SCR. (12 REQ'D.)
5	MT00-00101-A000	ISOLATION TRANSFORMER W/O SHIELD ASSY. — 115V., 50/60 HZ.
	0017-00103-0061	#8-32 HEX NUT W/SEMS (4 REQ'D.)
6	MT00-00105-A000	POWER TRANSFORMER W/O SHIELD — 70VA, 115V. (UPRIGHT ONLY)
6	MT00-00105-B000	POWER TRANSFORMER W/SHIELD — 70VA, 115V. (COCKTAIL ONLY)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (4 REQ'D.)
7	0945-00902-0000	SNAP BUSHING (3 REQ'D.)
8	0017-00101-0067	#6 x 3/8 PHIL. PAN HD. SCR. (11 REQ'D.)
	0945-00103-00XF	PARTITION — LOCATED UNDER CHASSIS (NOT SEEN)
9	A945-00030-0400	CONNECTOR & CABLE ASSY.
10	0017-00021-0297	2 POSITION CONNECTOR
11	A945-00030-0300	CONNECTOR & CABLE ASSY.
12	A945-00030-0500	CONNECTOR & CABLE ASSY.
13	A945-00030-0200	CONNECTOR & CABLE ASSY.
14	A945-00021-0000	CONVENIENCE OUTLET ASSY.
15	0017-00101-0573	#6-32 x 1/2 PHIL. RND. HD. SCR. (2 REQ'D.)
	0017-00103-0084	#6-32 HEX NUT W/SEMS (2 REQ'D.)
	A945-00025-0000	FILTER ASSY. — 125V. — UNDER CHASSIS (NOT SEEN)
16	0017-00021-0510	TERMINAL STRIP
	0017-00101-0140	#4-40 x 5/16 PHIL. PAN HD. SCR. (2 REQ'D.)
17	0017-00101-0660	#10-32 x 3/4 SLT. PAN HD. SCREW (NOT SEEN)
	0017-00104-0107	#10 FLAT WASHER
	0017-00103-0081	#10-32 HEX NUT W/SEMS
18	0017-00003-0263	SLO-BLO FUSE — 4A., 250V.
19	0017-00003-0005	FUSE — 2A., 250V.
	0017-00003-0444	FUSE HOLDER — QUICK CONN. (2 REQ'D.) — FOR ABOVE FUSES
20	0945-00904-0000	5 POSITION FUSE HOLDER
	0945-00908-0000	FUSE BLOCK INSULATOR
	0017-00003-0217	SLO-BLO FUSE — 2.5A., 250V. (2 REQ'D.)
	0017-00003-0007	SLO-BLO FUSE — 3A., 250V. (2 REQ'D.)
	0017-00003-0263	SLO-BLO FUSE — 4A., 250V.
	0945-00903-0000	FUSE HOLDER BARRIER
	0017-00101-0067	#6 x 3/8 PHIL. PAN HD. SCREW (2 REQ'D.)
21	0017-00101-0780	#6 x 1/2 PHIL. PAN HD. SCREW (2 REQ'D.)
	0017-00021-0629	5 POSITION TERMINAL STRIP (UNDER CHASSIS)
	A945-00019-0000	LINE CORD ASSY. — 115V. (NOT SHOWN)

FRONT DOOR ASSEMBLY — U.S.A. 25¢

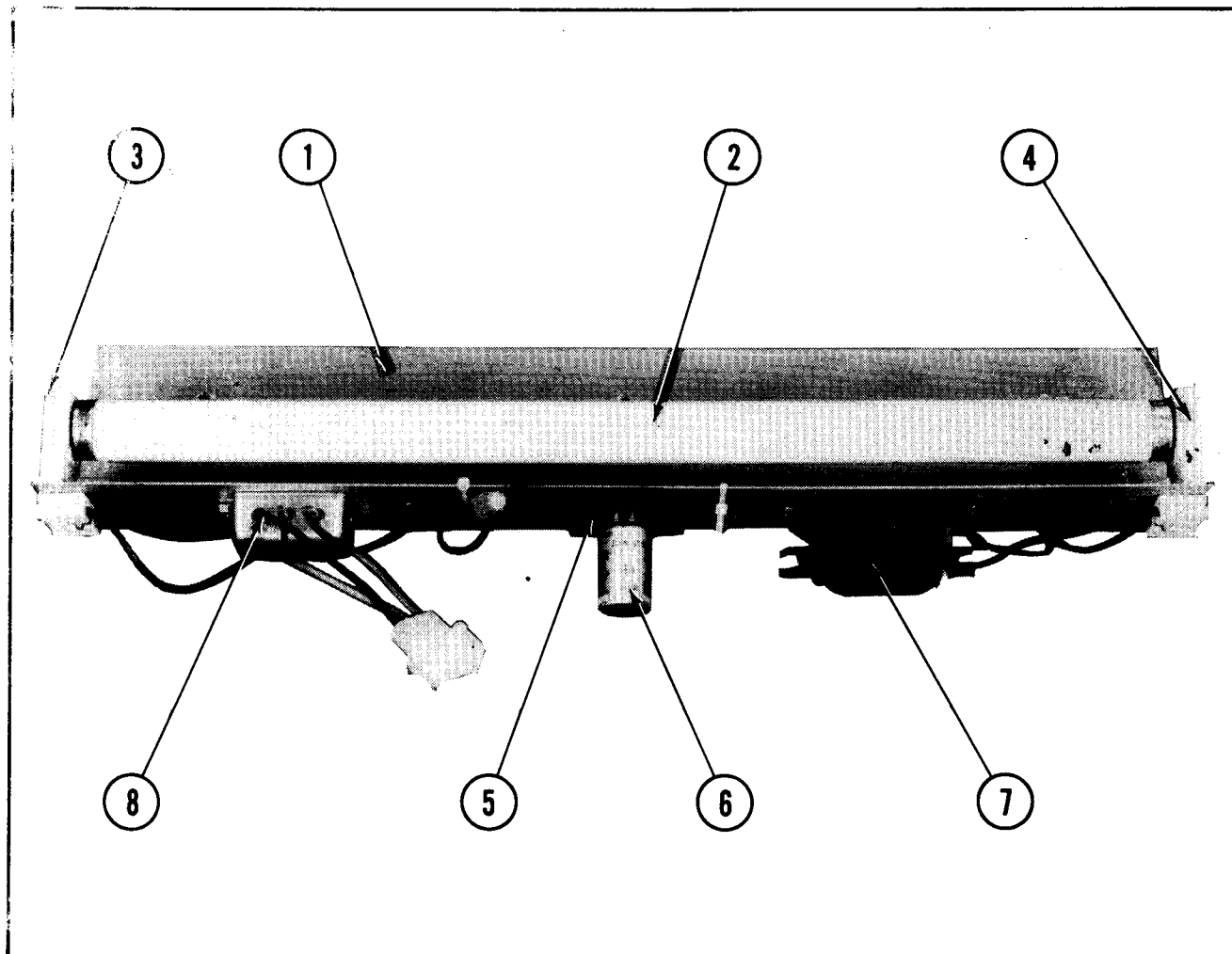


FRONT DOOR ASSEMBLY — U.S.A. 25¢ — PARTS LIST

ORDER BY PART NUMBER ONLY

ITEM	PART NO.	DESCRIPTION
1	0090-00002-04BK	DOUBLE ENTRY COIN DOOR FRAME
2	0017-00101-0121	#6-32 x 5/16 PHIL. TRS. HD. SCR. (3 REQ'D.)
3	A090-00073-02BK	DOUBLE ENTRY COIN DOOR W/DRESS PLATE
4	0017-00101-0123	#8 x 1/4 UNSLOT. HEX HD. SCREW (12 REQ'D.)
5	0017-00007-0019	KEY HOOK
6	0017-00103-0059	PUSH NUT (4 REQ'D.)
7	0090-00912-0000	COIN ENTRY PLATE — 25¢ (2 REQ'D.)
8	A097-00005-0000	DOOR LOCK & KEY W/SCREW & NUT (OR)
8	A097-00006-0000	DOOR LOCK & KEY W/SCREW & NUT
9	0090-00128-00XF	DOOR TILT SWITCH BRKT.
10	0017-00005-0041	DOOR CAM
11	A090-00095-0000	DOOR TILT SWITCH
12	0090-00126-03XF	SWITCH BACK-UP PLATE
13	0017-00101-0525	#5-40 x 9/16" PHIL. HD. M.S. (2 REQ'D.)
	A090-00096-0000	DOOR TILT SWITCH & BRKT. ASSY. (ITEMS 9 & 11 THRU 13)
14	0090-00903-9500	25¢ WINDOW (2 REQ'D.)
15	0090-00143-00XF	COIN PLEX RETAINER
16	0017-00003-0219	12 VOLT LAMP — G.E. #194 (2 REQ'D.)
17	0017-00031-0048	WEDGE SOCKET W/BRKT. (2 REQ'D.)
18	A090-00100-0000	BRKT. ASSY.
19	0017-00103-0084	#6-32 HEX NUT W/SEMS (4 REQ'D.)
20	A090-00089-0000	COIN METER W/DIODE
21	0017-00101-0124	#6 x 1/4 UNSLOT. HEX HD. SCR. (4 REQ'D.)
25	0090-00911-0000	INSULATOR (2 REQ'D.)
26	A090-00112-0000	COIN CHUTE & INSULATOR ASSY. (2 REQ'D.)
27	0010-00134-0000	SPRING
28	0010-00181-0000	SPRING
29	0017-00007-0083	1/8 x 1-5/8 ROLL PIN
30	0090-00129-00XF	PIVOT POST
31	0090-00167-00XF	PIVOT LEVER
32	0090-00182-00XF	REJECT LEVER
33	0017-00100-0018	E-RING
	A090-00088-0000	REJECT LEVER ASSY. (2 REQ'D.) (ITEMS 30 THRU 33)
34	A090-00105-0000	COIN ACCEPTOR FRAME ASSY. (2 REQ'D.)
35	0017-00005-0003	COIN ACCEPTOR W/STRING CUTTER (2 REQ'D.) (OR)
35	0017-00005-0211	COIN ACCEPTOR W/ANTI STRING DEVICE (2 REQ'D.) (OR)
35	0017-00005-0214	COIN ACCEPTOR W/STRING CUTTER (2 REQ'D.)
36	A090-00064-0000	ANTI-PENNY DEVICE
37	0017-00101-0099	#6 x 1/4 SLT. HEX HD. M.S. (2 REQ'D.)
38	0090-00162-00XF	COIN SWITCH MTG. BRKT.
39	0017-00005-0203	COIN SWITCH CHUTE
40	0017-00005-0195	COIN SWITCH
41	0010-00599-0000	COIN SWITCH WIRE
42	0017-00007-0015	PUSH-ON RING
	A090-00059-0400	COIN SWITCH & WIRE ASSY. (ITEMS 40 THRU 42)
43	0017-00101-0147	#4-40 x 3/4 PHIL. PAN. HD. M.S. (2 REQ'D.)
	A090-00077-0000	COIN GUIDE & SWITCH ASSY. (ITEMS 38 THRU 43)

NO. 333 — BURGER TIME — UPRIGHT — HEADER FLUORESCENT LIGHT ASSY.



NO. 333 — BURGER TIME — UPRIGHT — HEADER FLUORESCENT LIGHT ASSY. — PARTS LIST

ORDER BY PART NUMBER ONLY

ITEM	PART NO.	DESCRIPTION
1	0595-00105-0000	FLUORESCENT BRKT.
2	0017-00003-0043	18" COOL WHITE FLUORESCENT LAMP
3	0017-00003-0445	LAMP LOCKS (2 REQ'D.)
4	0017-00031-0036	FLUORESCENT SOCKET (2 REQ'D.)
5	0017-00003-0412	FLUORESCENT STARTER HOLDER W/LEADS
	0017-00101-0573	#6-32 x 1/2 PHIL. RND. HD. M.S. (4 REQ'D.)
	0017-00104-0009	#6 EXT. WASHER (4 REQ'D.)
6	0017-00003-0019	FLUORESCENT STARTER
7	0017-00003-0026	BALLAST
	0017-00101-0598	#8-32 x 5/16 SLT. HEX HD. SCR. (4 REQ'D.)
8	A961-00042-0000	LINE FILTER ASSY.

VI Technical Troubleshooting

Introduction

The most common problems occur in harness components such as the coin acceptor, player controls, interconnecting wiring, etc. The TV monitor and PCB computer cause their share of problems too, but not as much as the harness and its component parts. TV monitor troubleshooting will not be covered here because it is covered in that section of this manual.

As you already know, the PCB computer is a complex device with a number of different circuits. Some circuits remain basically the same among games, but overall there are a great many differences between them. PCB troubleshooting procedures, therefore, can be lengthy and will differ greatly among games. However, some basic Z-80 CPU information is involved in this section.

General Suggestions

The first step in any troubleshooting procedure is correctly identifying the malfunction's symptoms. This includes not only the circuits or features malfunctioning, but also those still operational. A carefully trained eye will pick up other clues as well. For instance, a game in which the computer functions fail completely just after money was collected may have a quarter shorting the PCB traces. Often, an experienced troubleshooter will be able to spot the cause of the problem even before opening the cabinet.

After all the clues are carefully considered, the possible malfunctioning areas can be narrowed down to one or two good suspects. Those areas can be examined by a process of elimination until the cause of the malfunction is discovered.

Harness Component Troubleshooting

Typical problems falling in this category are coin and credit problems, power problems and failure of individual features.

NO GAME CREDIT

For example, your prospective player inserts his quarter and is not awarded a game. The first item to check is if the quarter is returned. If the quarter is returned, the malfunction most certainly lies in the coin acceptor itself. First, use a set of test coins (both old and new) to ascertain that the player's coin is not undersize or underweight. If your test coins are also returned, coin acceptor servicing is indicated. Generally, the cause of this particular problem is a maladjusted magnet gate. Normally, this will mean slightly closing the magnet gate a little by turning the adjusting screw out a bit (see section on coin acceptor for more details).

If the quarter is not returned and there is no game credit, the cause of the malfunction may be in one of several areas. First try operating the coin return button; if the coin is returned, the problem is most likely in the magnet gate. Enlarge the gap according to the coin acceptor service procedures. If this does not cure the problem, remove the coin acceptor, clean it and perform the major adjustment procedure.

If the trapped coin is not returned when the wiper lever is actuated, you may have an acceptor jammed by a slug, gummed up with beer, a jammed coin chute, or mechanical failure of the acceptor mechanism. In this case, first check for the slug that will generally be trapped against the magnet. If so, simply remove the slug and test the acceptor. If the chute is blocked, remove the acceptor and remove the jammed coins. If there is actual failure of the acceptor, remove the unit and repair as indicated in the coin acceptor service procedures.

If the coin is making its way through the acceptor (that is, falling into the coin box), yet there is still no game credit, you either have a mechanical failure of the coin switch or electrical failure of the coin and credit circuits. The first place to begin is by checking the coin switch. Most of these switches are the make/break variety of micro switch, which is checked by testing for continuity between the NO, NC, and C terminals. When not actuated, the NC and C terminals should be continuous and the NO terminal open. When operated, the NO and C terminals should close and the NC should be open. If the coin switch checks out, examine the connections to the terminals to make sure there is good contact. If necessary, use the continuity tester and check from the terminal lug on the switch to the associated PCB trace. This will tell you if there is a continuous line all the way to the credit circuit.

If the coin switch wires do not check out, the problem is in the computer — most likely in the coin and credit circuitry.

If you do get game credit when a coin is deposited, but the game will not start when the start switch is pressed, you may have a problem in the start switch, the interconnecting wiring or in the computer. First check the switch. If the switch is OK, proceed to check the wiring. Again, make sure you go from the terminal lug on the switch to the PCB trace. This way, you will check the terminal contact as well as PCB edge connector contact. If the wiring is continuous, proceed to check the PCB credit circuit. If not, check each section of the wiring, until the discontinuity is located. If the wiring is OK, the problem must lie in the computer.

Transformer and Line Voltage Problems

Your machine must have the correct line voltage to operate properly. If the line voltage drops too low, a circuit in the computer will disable game credit. The point at which the computer will fail to work will vary some from game to game, but no game will work on line voltage that drops below 105 VAC.

Low line voltage may have many causes. Line voltage normally fluctuates a certain amount during the day as the total usage varies. Peak usage times occur mainly at dawn or dusk, so if your machine's malfunction seems to be related to the time of day, this may be a factor. A large load connected to the same line as the game (such as a large air conditioner or other device with an exceptionally large motor) may drop the line voltage significantly when starting up. This drop can result in an intermittent credit problem. In addition, poor connections in the location wiring, plug, or line cord may also cause a significant drop in power. Cold solder joints in the game's harness, especially in areas like the transformer connections, interlock switch, or fuse block, may also produce the same results, although probably on a more permanent basis.

Sometimes location owners (especially in bars) replace light switches with dimmer rheostats, and the game is sometimes on the same line. Obviously, the voltage available to the game is going to drop dramatically when the dimmer is turned.

In any case, the way to check for correct line voltage is with your VOM. Set the VOM to 250 VAC and stick the probes in the wall receptacle. If it's OK here, check the transformer primary connections. If you do not get 117 VAC, examine the solder joints on the transformer, fuse block, and interlock switch. If you do get 117 VAC, the problem must be either in the transformer, harness connections, or in the PCB power supply.

If you suspect the transformer, check its secondaries with the VOM set to 50 VAC and correlate the readings with the legend on the side of the transformer. The transformer must also be correctly grounded, so check the ground potential as well, especially if there is a hum bar rolling up or down the TV screen.

HARNESS PROBLEMS

Other harness problems include blowing fuses and malfunctioning controls. The repeating blown-fuse problem can sometimes be quite exasperating to solve, for short circuits have the tendency to occur in areas almost impossible to find. First, try inserting a new fuse, as old fuses age and blow without cause. If the new one also blows, you definitely have a short.

The best way to approach this problem is by turning the power off and disconnecting devices that may be causing the problem, such as the TV, transformer, and PCB. Disconnect the devices by pulling off their connectors, but do not allow them to touch. If necessary, insulate them with small pieces of electrical tape. Then, connect your VOM across the terminals of the fuse block (all electrical power shut off), and set it to one of the resistance scales. This will save blowing a fuse each time you want to check the circuit.

If the VOM reveals that disconnecting the devices removed the short, reconnect the devices one by one until the short returns. The last device connected is the one that is at fault. If the VOM reads a short even after the devices are disconnected, the fault must lie in the harness itself, and only patient exploration will reveal its location. First, carefully examine all the wiring, looking for terminals that may be touching, metal objects such as coins shorting connections or burned insulation. If necessary, use the VOM to check each suspected wire.

MALFUNCTIONING CONTROLS

One of the most common problems here is a bad potentiometer. Typically, a bad pot will cause the image to jump as it reaches a certain point. The only cure for this one is to install a new pot.

If a feature that is operated by a switch (for example, joysticks, foot pedals, control panel buttons) does not operate at all, check the switch with a VOM or continuity tester to verify its operation. If the switch does not check out, replace it. If the switch is OK, you should suspect the input to the switch from the PCB. In this case, get out the harness and logic schematics and check to see what kind of input it is. In many cases, the input will be +5 VDC. If so, use the VOM to check its presence. Normally, the switch is used to pull a +5 VDC line LOW to GND or to pull a LOW line HIGH. If the PCB output is missing, check the wire length from the PCB. If you find the signal at the PCB trace, the wire length or connection is at fault. If not, begin exploring the PCB using the logic schematics.

A Glossary of Microprocessor Terms

MICROPROCESSOR — one or several microcircuits that perform the function of a computer's CPU. Sections of the circuit have arithmetic and comparative functions that perform computations and executive instructions.

CPU — central-processing unit. A computing system's "brain", whose arithmetic, control and logic elements direct functions and perform computations. The microprocessor section of a microcomputer is on one chip or several chips.

PROM — programmable read-only memory. User permanently sets binary on-off bits in each cell by selectively fusing or not fusing electrical links. Non-erasable. Used for low-volume applications.

EPROM — erasable, programmable, read-only memory. Can be erased by ultraviolet light bath, then reprogrammed. Frequently used during design and

development to get programs debugged, then replaced by ROM for mass production.

ROM — read-only memory. The program, or binary on-off bit pattern, is set into ROM during manufacture, usually as part of the last metal layer put onto the chip. Nonerasable. Typical ROM's contain up to 16,000 bits of data to serve as the microprocessor's basic instructions.

RAM — random-access memory. Stores binary bits as electrical charges in transistor memory cells. Can be read or modified through the CPU. Stores input instructions and results. Erased when power is turned off.

LSI — large scale integration. Formation of hundreds or thousands of so-called gate circuits on semiconductor chips. Very large scale integration (VLS) involves microcircuits with the greatest component density.

MOS — metal-oxide semiconductor. A layered construction technique for integrated circuits that achieves high component densities. Variations in MOS chip structures create circuits with speed and low-power requirements, or other advantages (static will damage a MOS chip).

Introduction to the Z-80 CPU

The term "microcomputer" has been used to describe virtually every type of small computing device designed within the last few years. This term has been applied to everything from simple "microprogrammed" controllers constructed out of TTL MSI up to low end minicomputers with a portion of the CPU constructed out of TTL LSI "bit slices." However, the major impact of the LSI technology within the last few years has been with MOS LSI. With this technology, it is possible to fabricate complete and very powerful computer systems with only a few MOS LSI components.

The Zilog Z-80 family of components can be configured with any type of standard semiconductor memory to generate computer systems with an extremely wide range of capabilities. For example, as few as two LSI circuits and three standard TTL MSI packages can be combined to form a simple controller. With additional memory and I/O devices a computer can be constructed with capabilities that only a minicomputer could previously deliver.

New products using the MOS LSI microcomputer are being developed at an extraordinary rate. The Zilog Z-80 component set has been designed to fit into this market through the following factors:

1. The Z-80 is fully software compatible with the popular 8080A CPU.
2. Existing designs can be easily converted to include the Z-80.
3. The Z-80 component set is at present superior in both software and hardware capabilities to any other microcomputer system on the market today.
4. For increased throughput the Z80A operating at a 4 MHz clock rate offers the user significant speed advantages.

Microcomputer systems are extremely simple to construct using Z-80 components. Any such system consists of three parts:

1. **CPU (Central Processing Unit)**
2. **Memory**
3. **Interface Circuits to peripheral devices**

The CPU is the heart of the system. Its function is to obtain instructions from the memory and perform the desired operations. The memory is used to contain instructions and in most cases data that is to be processed. For example, a typical instruction sequence may be to read data from a specific peripheral device, store it in a location in memory, check the parity and write it out to another peripheral device. Note that the Zilog component set includes the CPU and various general purpose I/O device controllers, while a wide range of memory devices may be used from any source. Thus, all required components can be connected together in a very simple manner with virtually no other external logic.

General Purpose Registers

There are two matched sets of general purpose registers, each set containing six 8-bit registers that may be used individually as 8-bit registers or as 16-bit register pairs by the programmer. One set is called BC, DE and HL while the complementary set is called BC', DE' and HL'. At any one time the programmer can select either set of registers to work with through a single exchange command for the entire set. In systems where fast interrupt response is required, one set of general purpose registers and an accumulator/flag register may be reserved for handling this very fast routine. Only a simple exchange command need be executed to go between the routines. This greatly reduces interrupt service time by eliminating the requirement for saving and retrieving register contents in the external stack during interrupt or subroutine processing. These general purpose registers are used for a wide range of applications by the programmer. They also simplify programming, especially in ROM based systems where little external read/write memory is available.

Arithmetic & Logic Unit (ALU)

The 8-bit arithmetic and logical instructions of the CPU are executed in the ALU. Internally the ALU communicates with the registers and the external

data bus on the internal data bus. The type of functions performed by the ALU include:

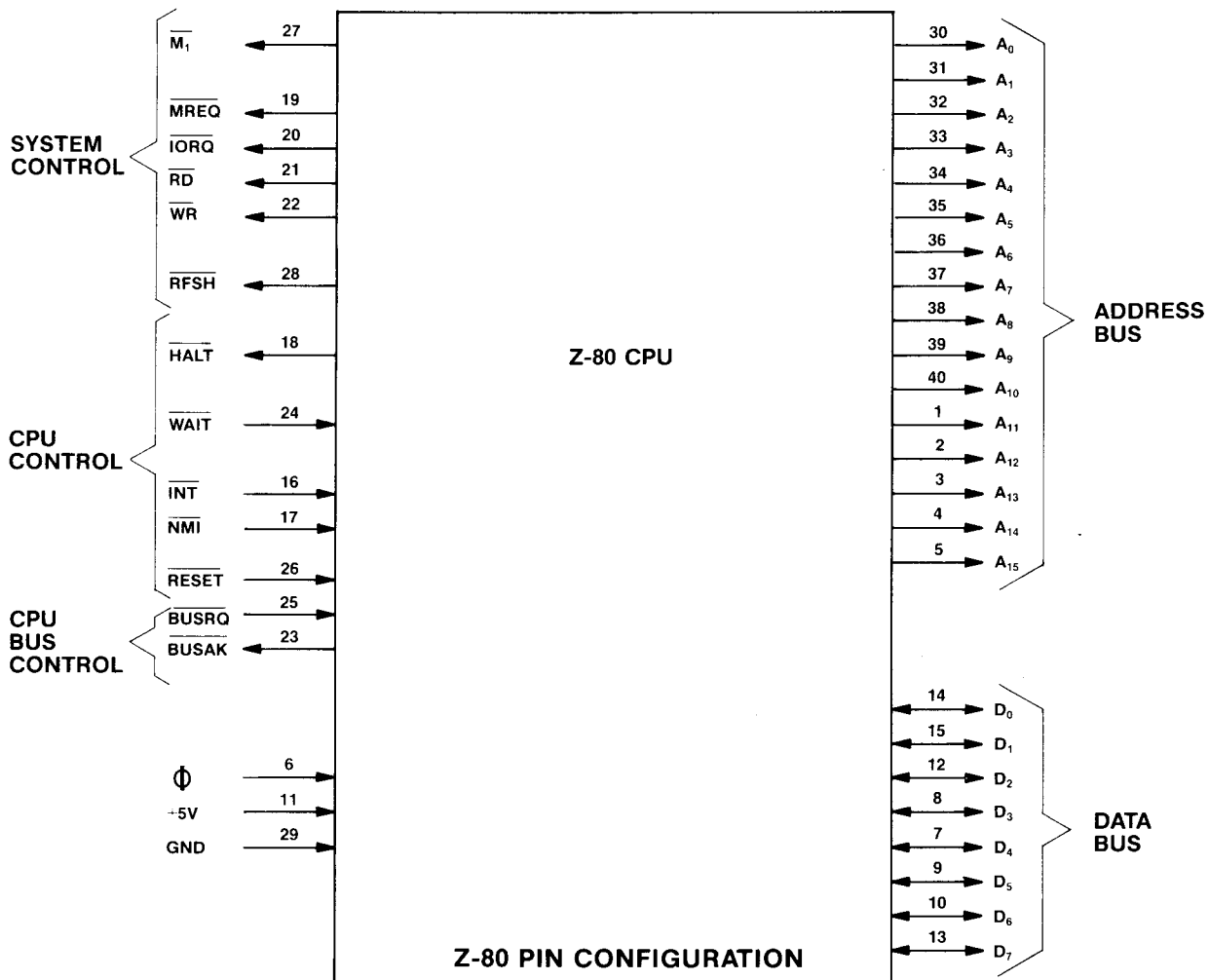
Add	Left or right shifts or rotates (arithmetic and logical)
Subtract	Increment
Logical AND	Decrement
Logical OR	Set bit
Logical Exclusive OR	Reset bit
Compare	Test bit

Instruction Register and CPU Control

As each instruction is fetched from memory, it is placed in the instruction register and decoded. The control sections performs this function and then generates and supplies all of the control signals necessary to read or write data from or to the registers, control the ALU and provide all required external control signals.

Z-80 CPU Pin Description

The Z-80 CPU is packaged in an industry standard 40 pin Dual In-Line Package. The I/O pins are shown in the below figure and the function of each is described.



A₀-A₁₅
(Address Bus)

Tri-state output, active high. A₀-A₁₅ constitute a 16-bit address bus. The address bus provides the address for memory (up to 64K bytes) data exchanges and for I/O device data exchanges. I/O addressing uses the 8 lower address bits to allow the user to directly select up to 256 input or 256 output ports. A₀ is the least significant address bit. During refresh time, the lower 7 bits contain a valid refresh address.

D₀-D₇
(Data Bus)

Tri-state input/output, active high. D₀-D₇ constitute an 8-bit bidirectional data bus. The data bus is used for data exchanges with memory and I/O devices.

M₁
(Machine Cycle one)

Output, active low. $\overline{M_1}$ indicates that the current machine cycle is the OP code fetch cycle of an instruction execution. Note that during execution of 2-byte op-codes, $\overline{M_1}$ is generated as each op code byte is fetched. These two byte op-codes always begin with CBH, DDH, EDH or FDH. $\overline{M_1}$ also occurs with \overline{IORQ} to indicate an interrupt acknowledge cycle.

MREQ
(Memory Request)

Tri-state output, active low. The memory request signal indicates that the address bus holds a valid address for a memory read or memory write operation.

IORQ
(Input/Output Request)

Tri-state output, active low. The \overline{IORQ} signal indicates that the lower half of the address bus holds a valid I/O address for a I/O read or write operation. An \overline{IORQ} signal is also generated with an $\overline{M_1}$ signal when an interrupt is being acknowledged to indicate that an interrupt response vector can be placed on the data bus. Interrupt Acknowledge operations occur during M₁ time while I/O operations never occur during M₁ time.

RD
(Memory Read)

Tri-state output, active low. \overline{RD} indicates that the CPU wants to read data from memory or an I/O device. The addressed I/O device or memory should use this signal to gate data onto the CPU data bus.

WR
(Memory Write)

Tri-state output, active low. \overline{WR} indicates that the CPU data bus holds valid data to be stored in the addressed memory or I/O device.

RFSH
(Refresh)

Output, active low. \overline{RFSH} indicates that the lower 7 bits of the address bus contain a refresh address for dynamic memories and the current MREQ signal should be used to do a refresh read to all dynamic memories.

HALT
(Halt state)

Output, active low. \overline{HALT} indicates that the CPU has executed a HALT software instruction and is awaiting either a non maskable or a maskable interrupt (with the mask enabled) before operation can resume. While halted, the CPU executes NOP's to maintain memory refresh activity.

WAIT
(Wait)

Input, active low. \overline{WAIT} indicates to the Z-80 CPU that the addressed memory or I/O devices are not ready for a data transfer. The CPU continues to enter wait states for as long as this signal is active. This signal allows memory or I/O devices of any speed to be synchronized to the CPU.

INT
(Interrupt Request)

Input, active low. The Interrupt Request signal is generated by I/O devices. A request will be honored at the end of the current instruction if the internal software controlled interrupt enable flip-flop (IFF) is enabled and if the \overline{BUSRQ} signal is not active. When the CPU accepts the interrupt, an acknowledge signal (\overline{IORQ} during M₁ time) is sent out at the beginning of the next instruction cycle. The CPU can respond to an interrupt in three different modes that are described in detail in section 5.4 (CPU Control Instructions).

NMI
(Non-Maskable Interrupt)

Input, negative edge triggered. The non maskable interrupt request line has a higher priority than \overline{INT} and is always recognized at the end of the current instruction, independent of the status of the interrupt enable flip-flop. \overline{NMI} automatically forces the Z-80 CPU to restart to location 0066H. The program counter is automatically saved in the external stack so that the user can return to the program that was interrupted. Note that continuous \overline{WAIT} cycles can prevent the current instruction from ending, and that a \overline{BUSRQ} will override a \overline{NMI} .

RESET

Input, active low. RESET forces the program counter to zero and initializes the CPU. The CPU initialization includes:

- 1) Disable the interrupt enable flip-flop

- 2) Set Register I = 00H
- 3) Set Register R = 00H
- 4) Set Interrupt Mode 0

During reset time, the address bus and data bus go to a high impedance state and all control output signals go to the inactive state.

BUSRQ

(Bus Request)

Input, active low. The bus request signal is used to request the CPU address bus, data bus and tri-state output control signals to go to a high impedance state so that other devices can control these buses. When BUSRQ is activated, the CPU will set these

buses to a high impedance state as soon as the current CPU machine cycle is terminated.

BUSAK

(Bus Acknowledge)

Output, active low. Bus acknowledge is used to indicate to the requesting device that the CPU address bus, data bus and tri-state control bus signals have been set to their high impedance state and the external device can now control these signals.

CLK

(Clock)

Single phase TTL level clock which requires only a 330 ohm pull-up resistor to +5 volts to meet all clock requirements.

VII. Coin Door Maintenance

SPECIAL NOTE: If you have any questions about the coin acceptors in your game(s), please feel free to contact their manufacturers. Each manufacturer's name is **PROMINENTLY** imprinted on every acceptor mechanism.

Metal mechanisms only:
COIN MECHANISMS, INC.
817 Industrial Drive
Elmhurst, IL 60126
Phone (312) 279-9150

Metal and Plastic mechanisms:
COINCO COIN ACCEPTORS, INC.
860 Eagle Drive
Bensenville, IL 60106
Phone (312) 766-6781

COIN DOOR MAINTENANCE

METAL COIN ACCEPTOR MECHANISMS

Periodically, the metal coin acceptor mechanism(s) must be removed from the coin door and cleaned.

1. **Make sure the power to the game is off.**
2. Unlock and open the coin door.

3. Remove the coin acceptor mechanism as shown in Figure 7-1.
 - Push down on the two spring loaded latches.
 - While holding the latches down, pull the top of the coin acceptor mechanism toward you.
 - Release the latches and lift out the coin acceptor mechanism.

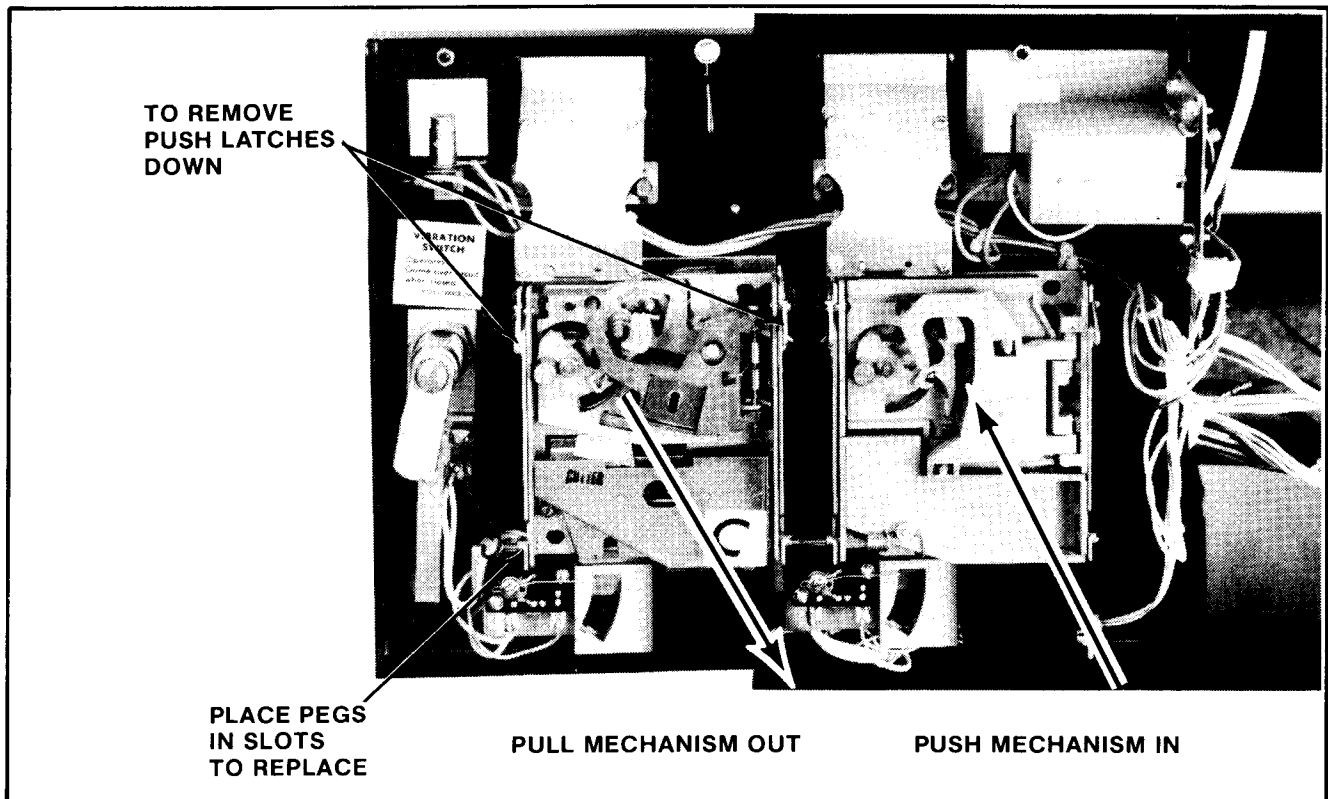


Figure 7-1 Removing and replacing coin acceptor

4. Clean the magnet of all foreign particles. See Figure 7-2.
 - This may be accomplished by swinging the gate open as shown in the above figure.
5. Remove the cradles and undersize levers and clean the bushings. (A pipe cleaner makes a good bushing cleaner.)
 - Also clean the pivot pin.
6. Whenever needed, the coin acceptor should be cleaned with hot water and cleanser in the following manner:
 - Place the coin acceptor in boiling water for about ten minutes.

CAUTION: BE CAREFUL NOT TO BURN YOURSELF.

- Next, use a brush and kitchen cleaner to remove all remaining foreign matter from the unit.
- Rinse the coin acceptor in clean boiling water.
- Dry the coin acceptor thoroughly by using filtered compressed air to blow it dry.

NOTE: The reason we recommend using boiling water is that it evaporates faster than cold water and speeds drying time.

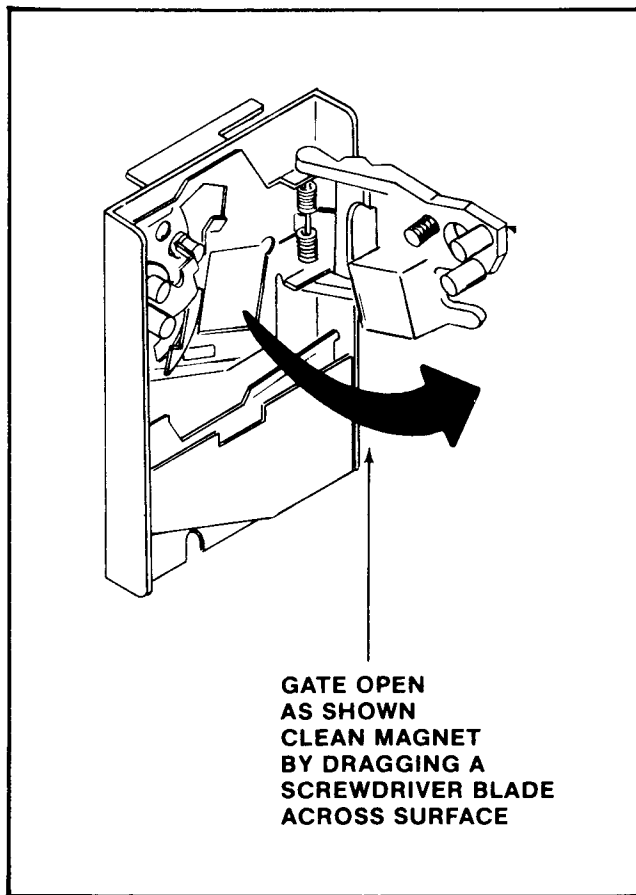


Figure 7-2 Cleaning the metal coin acceptor

7. To lubricate the coin acceptor:
 - Use **ONLY** powdered graphite and put it **ONLY** on the moving parts of the coin acceptor. These parts are called out in Figure 7-3.
 - Be extremely careful to keep the powdered graphite away from paths that are traveled by the coins.

**— WARNING —
DO NOT USE OIL
TO LUBRICATE THE
COIN ACCEPTOR.**

8. Check the coin chute for obstructions such as: paper, gum, etc.
9. Reinstall the coin acceptor to the coin door. See Figure 7-1.
 - Place the two pegs at the coin acceptor's base into their retaining slots.
 - Now push the top of the coin acceptor toward the coin door until it snaps in place and is held there by the two spring loaded latches.
10. Close and lock the coin door.

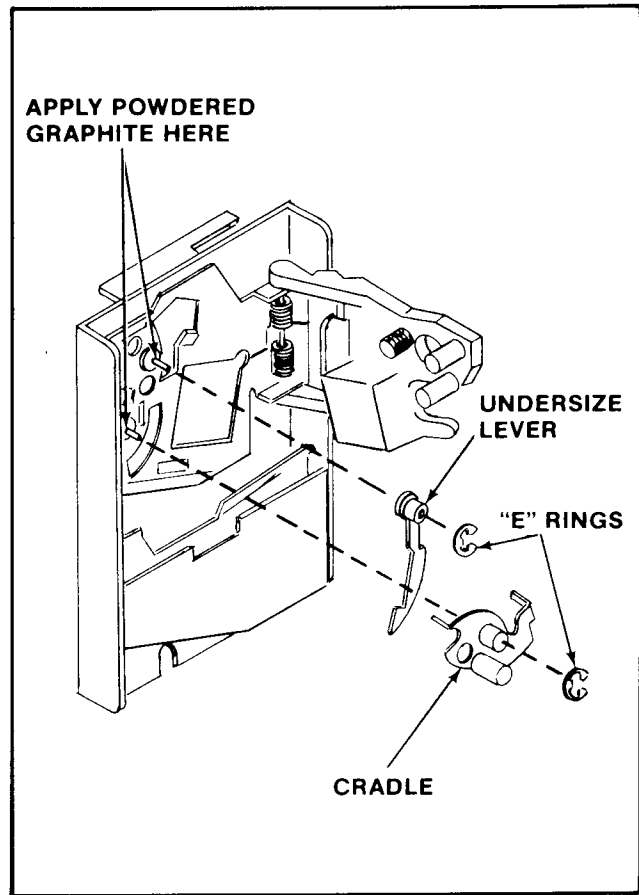


Figure 7-3 Lubricating the metal coin acceptor

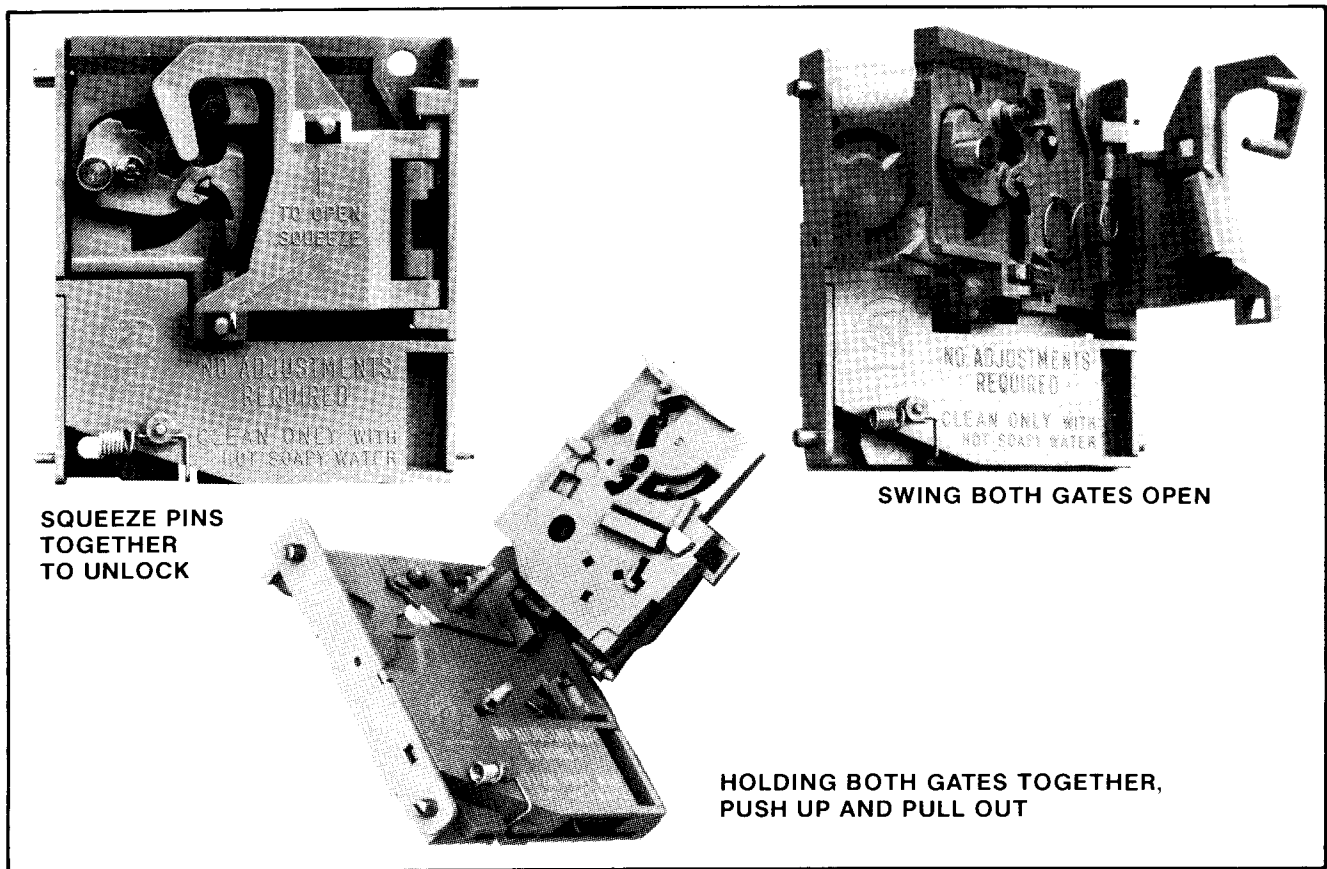


Figure 7-4 Opening the plastic coin acceptor

PLASTIC COIN ACCEPTOR MECHANISMS

The plastic coin acceptor mechanism(s) must be removed periodically from the coin door and cleaned.

1. **Make sure the power to the game is off.**
2. Unlock and open the coin door.
3. Remove the coin acceptor mechanism(s) as shown in Figure 7-1.
 - Push down on the two spring loaded latches.
 - While holding the latches down, pull the top of the acceptor mechanism toward you.
 - Release the latches and lift out the mechanism.
4. Squeeze the two pins indicated in Figure 7-4 together to open the mechanism and break it down into its three basic parts.
 - Clean the mechanism in hot soapy water. It never rusts.
 - Rinse the mechanism in clean hot water and allow it to dry.

Reassemble the mechanism (it never needs lubrication).

5. Check the coin chute for obstructions such as: paper, gum, etc.
6. Reinstall the coin acceptor to the coin door. See Figure 7-5.
 - Place the two pegs at the coin acceptor's base into their retaining slots.
 - Now push the top of the coin acceptor toward the coin door until it snaps in place and is held there by the two spring loaded latches.
7. Close and lock the coin door.

NOTE: See Figure 7-6 for instructions on how to set the plastic coin acceptor mechanisms to either accept or reject Canadian quarters.

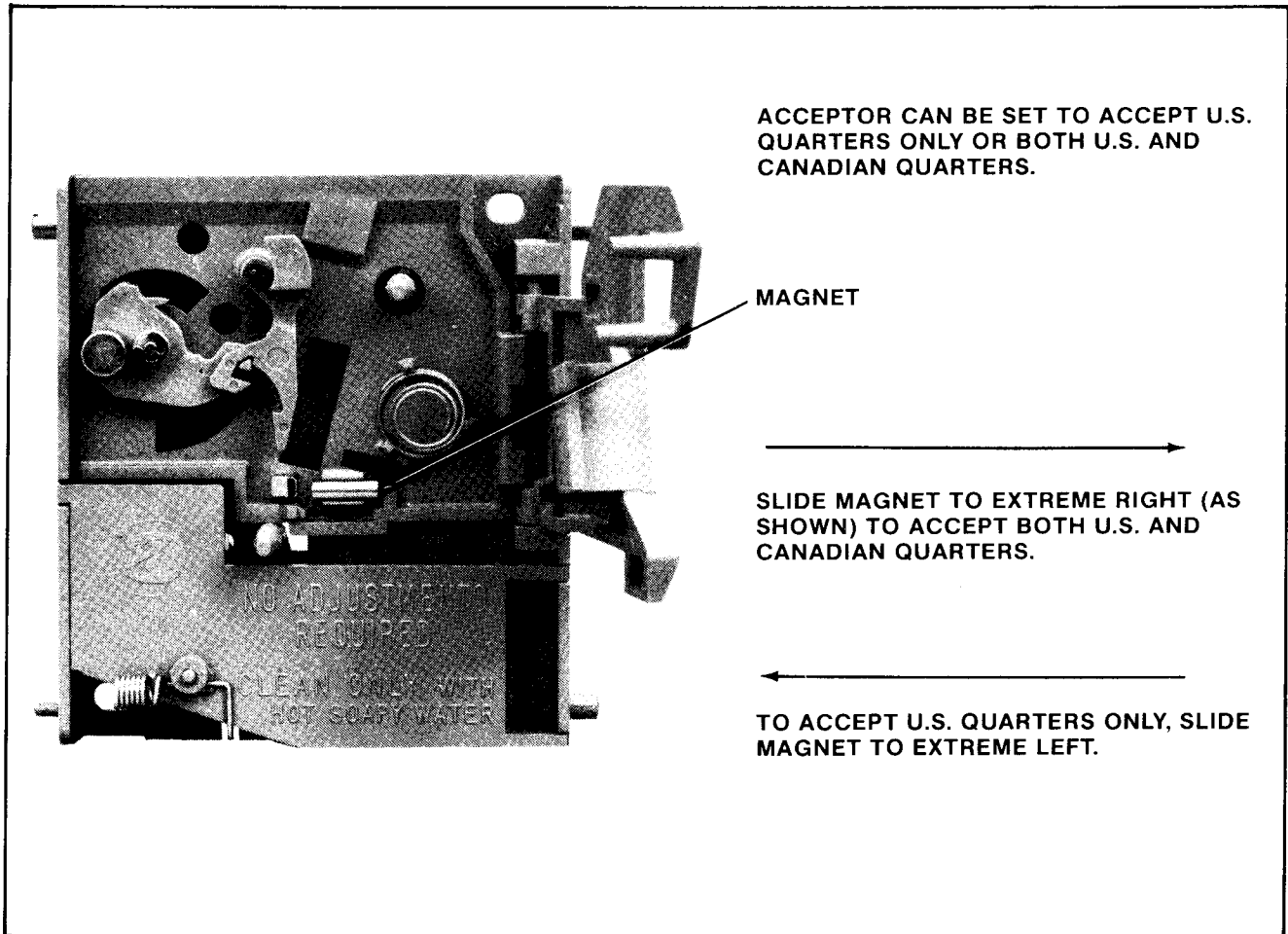


Figure 7-5 Changing the plastic coin acceptor to accept American or Canadian quarters.

PLEASE NOTE:

THE INFORMATION CONTAINED IN THIS SECTION
IS TOLD IN AN EASY TO UNDERSTAND MANNER
AND IS INTENDED TO AID THOSE WITHOUT AN
ELECTRONICS DEGREE IN TROUBLESHOOTING AND
REPAIRING THEIR GAMES T.V. MONITOR.

IF YOU READ THROUGH THIS SECTION AND STILL
HAVE QUESTIONS, PLEASE CONTACT YOUR DISTRIBUTOR
OR MIDWAY MANUFACTURING COMPANY AT THE TOLL
FREE NUMBER PROVIDED WITH YOUR GAMES PAPERS.

**OUR STAFF AND OUR DISTRIBUTORS STAND READY
TO HELP YOU!**

THANK YOU

VIII T.V. Monitor Manual

Color T.V. Monitor

Introduction: (How to use this section of your manual.)

This section has been designed to simply familiarize you with one of the more mystical components in your game — the T.V. monitor. If you are an electronics technician who is quite knowledgeable on the subject, you may decide to just go to the schematics and start troubleshooting the defective monitor. But if you are like most people, a monitor is a T.V. set, and that means a complex doo-dad that means big buck repairs. This isn't necessarily so. This section of the manual will acquaint you with the monitor and could just help you repair it if you feel adventurous enough to give it a try. If you have any knowledge of electronics, especially the use of a voltmeter, the repairs you can make are astonishing. Just keep in mind that **ELECTRICITY CAN BE VERY DANGEROUS, SO BE CAREFUL!!**

If you want to understand how a monitor works, just read the "THEORY OF OPERATION" subsection. If you wish, you can follow along with the schematics. The information is presented in a very basic manner but more complete treatment of the subject can be found in the technical sections of bookstores.

If you want to attempt to repair your monitor, it would be a good idea to read this whole section beginning to end before starting. **Pay attention to all warnings**

and take them seriously. The more equipment you have the better, but a low cost Volt-Ohm-Milliameter can often, do the trick. Here are the steps to take:

1. Find the symptom that matches the problems your monitor has in the "SYSTEM — DIAGNOSIS" subsection. The diagnosis tells the circuit or area the problem may be in and possibly even the actual component causing it.
2. Once you have the circuit that is causing the trouble, read the "TROUBLESHOOTING" subsection to learn the procedure for finding the bad part.
3. Next, go to the schematic section and find the schematic that matches your monitor. It may be helpful to read the "DIFFERENCES BETWEEN MONITORS" subsection if you are unsure of which monitor you have. Use the schematic to see what parts are in the offending circuit.

That really is all there is to it. Just remember that there are some bizarre or rare symptoms not covered, or that a monitor may have two or more different problems that only a genius, the experienced, or an experienced genius can figure out. But be patient, follow safety precautions, and remember that there is also literature available from the monitor companies through your distributor or from Midway Manufacturing Company on request. (There is a toll free number on the back side of the front cover of this manual.)

Symptom Diagnosis

- 1. Insufficient width or height:**
 - A. Horizontal line (due to VERTICAL CIRCUIT DEFECT).
 - Bad yoke.
 - Bad vertical output section.
 - Open fusible resistor in vertical section.
 - Bad height control.
 - Bad flyback.
 - B. Vertical line (due to HORIZONTAL CIRCUIT DEFECT).
 - Bad yoke.
 - Open width coil.
 - Open part in horizontal output section.
- 2. Picture spread out too far or crushed in certain areas:**
 - A. Horizontal or vertical output transistor.
 - B. Bad component in output circuitry.
- 3. Line too close with black spacing:**
 - A. Problem in vertical section causing poor linearity.
- 4. Poor focus and convergence:**
 - A. Bad high voltage transformer ("flyback") or control.
 - B. Focus voltage wire not connected to neck-board terminal.
- 5. Colors missing; check:**
 - A. Interface color transistors.
 - B. Color output transistors.
 - C. Cracked printed circuit board.
 - D. Color circuits.
 - E. Video input jack.
- 6. Picture not bright enough:**
 - A. Weak emission from picture tube. (Turn horizontal sync off frequency and put brightness all the way up for about 15 minutes. Occasionally this cures the problem.)
- 7. Silvery effect in white areas; check:**
 - A. Beam current transistors.
 - B. Weak picture tube emission.
- 8. Too much brightness with retrace lines; check:**
 - A. Beam limiter transistors.
 - B. Brightness and/or color blanking control set too high.
- 9. Increasing brightness causes an increase in size and poor focus.**
 - A. Weak high voltage rectifier or regulation (high voltage unit).
- 10. Small picture and/or poor focus:**
 - A. Low B+ voltage (power supply trouble).
- 11. Vertical rolling:**
 - A. Vertical oscillator transistor, IC, or circuit.
 - B. No sync from logic board.
- 12. Horizontal line across center:**
 - A. Vertical output circuit is dead (see symptom No. 1. A.).
 - B. Vertical oscillator is not putting out the right wave form.
- 13. Picture bends:**
 - A. Horizontal sync needs adjusting.
 - B. Magnetic or electromagnetic interference.
- 14. Flashing picture, visible retrace lines:**
 - A. Broken neck board.
 - B. Internal short circuit in the picture tube (arcing).
- 15. Unsymmetrical picture or sides of picture:**
 - A. Defective yoke.
- 16. No brightness, power supply operating — No high voltage for the picture tube; check:**
 - A. Horizontal oscillator.
 - B. Horizontal amplifier and output.
 - C. Flyback transformer (high voltage unit).
- 17. No brightness, high voltage present; check:**
 - A. Heater voltage to the tube at the neck board.
 - B. Screen-grid voltage for the tube.
 - C. Focus voltage.
 - D. Grid to cathode picture tube bias.
- 18. No high voltage; check:**
 - A. For AC input to the "flyback".
 - B. Horizontal deflection stages.
 - C. Flyback transformer.
 - D. Yoke.
 - E. Power supply.
- 19. No horizontal and vertical hold; check:**
 - A. Sync transistors and circuit.
 - B. Wires and jack from logic board to the monitor.
- 20. Wavy picture — (power supply defect); check:**
 - A. Transistors, diodes, electrolytic capacitors in the power supply.

21. Moving bars in picture:

- A. Ground connector off between monitor and logic boards.
- B. Defect in the power supply (see wavy picture symptom).

22. Washed out picture (see picture not bright enough):

- A. Check video signal at the cathode pins with an oscilloscope. If there is about 80 volts peak to peak, the picture tube has weak emission.

23. Monitor won't turn on:

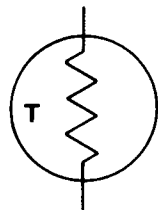
- A. Problem in the power supply: Check fuse, transistors, open fusible resistor.
- B. Shorted horizontal output transistor.

- C. Defective high voltage disabling circuit.
- D. Crack(s) somewhere on main chassis board.

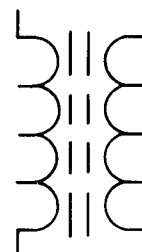
24. Can't adjust purity or convergence:

- A. Use a degausser to demagnetize the picture tube carefully following your degausser's instructions.
- B. Picture tube defective.
- C. Metal foreign material is in picture tube shield.
- D. Nearby equipment is electromagnetically interfering.
- E. The poles of the earth are pulling off the purity.
- F. Poor focus or width of picture.

Guide To Schematic Symbols



THERMISTOR
(POLARITY DOESN'T MATTER)



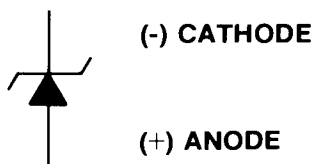
IRON CORE TRANSFORMER
(SUCH AS A FLYBACK)



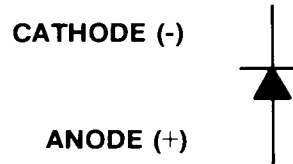
INDUCTOR, COIL, CHOKE
(POLARITY DOESN'T MATTER)



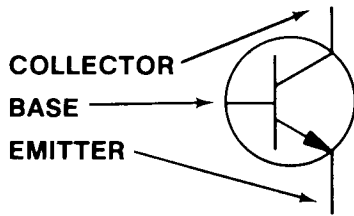
FUSE
(POLARITY DOESN'T MATTER)



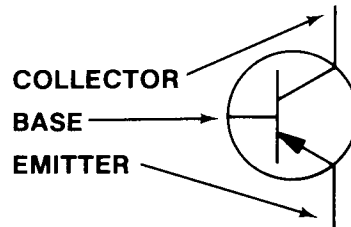
ZENER DIODE



DIODE



NPN TRANSISTOR



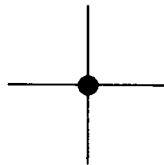
PNP TRANSISTOR



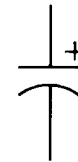
VARIABLE RESISTOR, POT, CONTROL
(POLARITY DOESN'T MATTER)



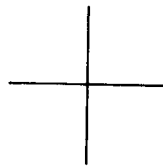
RESISTOR
(POLARITY DOESN'T MATTER)



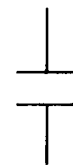
LINES ARE CONNECTED



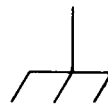
ELECTROLYTIC CAPACITOR



LINES ARE NOT CONNECTED



CAPACITOR
(POLARITY DOESN'T MATTER)



OR



GROUND

Troubleshooting

Troubleshooting monitors requires experience, patience, **and luck**. The first step is to match the symptom the monitor displays to the diagnosis next to it in the "SYMPTOM-DIAGNOSIS" subsection. This will pinpoint the circuit the problem is probably in, and often the parts to check. Next, the circuit should be visually inspected to see if there are any parts broken, burned, or if something is there that shouldn't be, like a loose screw, etc. Some parts go bad before others and should be checked first. In fact, following is the general order in which parts usually go bad:

1. Semiconductors (like transistors, diodes, and integrated circuits).
2. Fusible resistors.
3. Electrolytic capacitors.
4. Resistors.
5. Capacitors and coils.

Always remember that a monitor can bite like a snake. Even when it is turned off, capacitors hold voltage and will discharge it to you should you be touching chassis ground. The picture tube or CRT, itself, is a giant capacitor, so avoid the flyback anode plug hole. With the monitor on, the power supply circuit and/or the flyback, which puts out at least 18,000 volts, **CAN BE KILLERS!!** Avoid handling power transistors (usually output transistors), yoke terminals, and other high power components when the monitor is on.

WARNING: That picture tube is a bomb!

When it breaks, first it implodes, then it explodes. Large pieces of glass have been known to fly in excess of 20 feet in all directions. **DO NOT** carry it by the long, thin neck. Discharge its voltage to ground by shorting the anode hole to ground. Use a plastic handled screwdriver, connect one end of a wire with an alligator clip at each end to chassis ground and the other end to the metal shaft of the screwdriver. Using **ONE HAND ONLY** (put the other in your pocket) and touching **ONLY** the plastic handle of the screwdriver (**DO NOT TOUCH THE METAL SHAFT**) stick the blade of the screwdriver into the anode hole. Be prepared for a fairly loud pop and a flash. The longer the monitor has been turned off, the smaller the pop and dimmer the flash. But **BE CAREFUL**, picture tubes will hold a very

healthy charge for at least **a week** if not longer. Even after you've discharged it once, it may still carry a residual charge. It's better to be too careful than dead, which is why electronic equipment always carries stickers referring servicing to qualified personnel. Handle the side with the viewing screen against your chest when changing it. **ALWAYS** wear safety goggles when handling the picture tube.

To maintain the safety and performance of the monitor, always use exact replacement parts. For instance, the wrong components in the power supply can cause a fire, or the wrong color transistor may give a funny color to the picture. Service your monitor on a nonconductive firm table like wood, **NOT METAL**, and take off all of your jewelry just in case. With all this in mind, you are ready to begin troubleshooting.

Observe the picture carefully. Try to vary the appropriate control that would most likely affect your particular symptom. For example, if there is poor brightness or no picture, try turning up the brightness or contrast control. If the controls have no effect at all, chances are there is trouble with the control itself, the circuit it controls, or a nearby circuit that may be upsetting voltages. Go to the list of symptoms and determine with the schematic where the bad circuit is.

CAUTION:

Keep in mind that capacitors hold a charge as can the picture tube (for at least a week and usually longer), and could shock you.

First, check for obvious visual defects such as broken or frayed wires, solder where it is not supposed to be, missing components, burned components, or cracked printed circuit boards. If everything looks good up to this point, make sure that diodes, electrolytic capacitors, and transistors have their leads connected in the right polarity as shown on the schematic and the circuit board.

Turn on the power and measure the voltages at the leads of the active devices such as tubes, transistors, or integrated circuits. Any voltage that does not come within at least 10% to 15% of the voltage specified on the schematic indicates either a problem with that device or a component connected with it in the circuit. The next step is to use the ohmmeter to narrow down the field of possible offenders.

To test a transistor, one lead of the ohmmeter is placed on the base; and the other lead placed just on the emitter, then on the collector. A normal transistor will read either high resistance (infinite), or little resistance (400 to 900 ohms), depending on the polarity of this type transistor. Then the leads should be switched, one remaining on the base, and the other switched from the emitter to the collector. Now the opposite condition should result: the resistance should be infinite if it was lower when the other lead was on the base. Consistently infinite readings indicate an open, and a short is demonstrated by 0-30 ohms on most of these test readings. Finally, place one lead on the collector, then the other on the emitter. No matter which lead is used, there should be infinite resistance. Any lower reading, such as 50 ohms (which is typical on a bad transistor), indicates a short.

This all sounds pretty confusing, but a little experience on a good transistor will make you an expert in no time. Usually, the lowest ohmmeter setting is used for testing transistors. Once in a great while a transistor may check out good on this test, but may actually be "leaky" or break down only on higher voltages. If in doubt, change it. It is also wise to check the transistor out of the circuit just in case some component in the circuit is affecting the ohmmeter reading.

A diode is tested like a transistor except it only has two leads. Again, there should be high resistance one

way and little resistance the other. If it tests bad, take one lead out of the circuit in case some component is messing up the ohmmeter reading.

NOTE: DO NOT leave soldering equipment on the leads too long since all semiconductors, especially integrated circuits, are easily destroyed by heat.

Without special equipment, integrated circuits are checked by verifying the proper DC voltage on the pins and the correct AC wave form using an oscilloscope. **BE CAREFUL:** Shorting their pins can easily destroy them.

Resistors are checked with an ohmmeter and should usually be within ten percent of the value stated on them and on the schematic. You may have to desolder one lead from the printed circuit board. If you wreck the foil on the board, carefully solder a small wire over the break to reconnect the conductive foil.

Capacitors are tricky. Their resistance goes up when checked with an ohmmeter which shows a charging action. As they suck up current from the meter, the voltage goes up and so does the resistance. If you are sure a particular circuit is giving you a problem and everything else checks out O.K., Electrolytic capacitors are prime suspects. Substitute a new one and keep your fingers crossed.

Theory of Operation

To understand what goes on inside the monitor, large general groups of circuits will be examined instead of laboriously analyzing the branches and small circuits that make up these groups. This will help avoid confusion and aid in a basic, concrete, knowledge of what makes up a monitor.

THE POWER SUPPLY —

The AC going to the monitor from the game transformer is just like the voltage and current from your wall outlet. It jumps up and down going positive and negative sixty times a second. But a monitor needs nice, smooth DC; direct current, not alternating. So diodes chop up the AC and a big electrolytic capacitor filters it out to make it even smoother. Since the monitor is a big piece of electronic equipment, with many circuits demanding a lot of power from the power supply, there are also zener diodes and transistors to help maintain a nice, constant, smooth voltage so that the monitor circuits don't jump around. And this is what happens when you see a wavy picture. There is AC creeping

through the power supply, so it must be malfunctioning. If the voltage from the power supply is too low, the other circuits will be starved for power and you may see a small, wavy picture, or none at all.

Some circuits receive voltages that are higher than what the power supply should put out. But they come from the flyback transformer which will be discussed later.

THE INTERFACE SECTION OF THE CHASSIS —

The interface section of the chassis is fairly easy to identify. It is right by the place where the video jack(s) from the logic board(s) plug into. There are sets of transistors that receive the separate red, green, blue, and sync information from the cables that come from the logic boards. The circuits jack up the voltage and match impedances, or in other words, prepare the logic board outputs for the circuits that will really amplify them for the output devices such as the yoke in the case of the sync, or the picture tube that shows the colors.

An interesting aside is that our sync is composite negative sync. That means two things:

1. The sync is a negative going wave form.
2. There are two pulses going at different speeds over the same wire:
 - a. Vertical wave forms at 60 times per second (or Hertz) and
 - b. Horizontal wave forms at about 15,750 times per second (Hz).

The sync is amplified by a sync amplifier transistor and sent on its way to the oscillators. The sync or timing information will be explained along with the oscillator shortly.

The color information is sent via wires to the neck board where the main amplification occurs. This will also be discussed later.

VERTICAL AND HORIZONTAL DEFLECTION—

After the sync signal is amplified by the sync amp, it goes to two different sections, the vertical and horizontal circuits. Basically, the sync signals are for timing so the picture doesn't mess up since it is assembled like an orderly jigsaw puzzle, but so fast that you can't see the electron beams for each color painting the picture on the screen. This will all become clear soon. For now, we will follow the 60 cycle component of the sync as it goes on its journey to the deflection yoke.

The 60 cycle pulse goes to the vertical oscillator to make sure this circuit goes back and forth (or oscillates) at 60 times a second. Without this pulse keeping the circuit at the correct speed, it may get lazy and oscillate at 58 cycles or lower, or get ambitious and oscillate at 62 cycles or higher. At the wrong speed, the picture will start to roll up or down.

A Wells Gardner 13" (K4806) or 19" (K4906, K4956) color monitor uses an integrated circuit for its sync section. An Electrohome 13" or 19" color monitor uses an integrated circuit IC501 for its sync section. Wells Gardner uses HA11423 and Electrohome uses HA11244. **These ARE NOT interchangeable!** The idea is all the same. The output to the vertical amplifying transistors for all monitors must form a sawtooth wave form, sort of like a bunch of pyramids, racing through the yoke's vertical coils at 60 times a second.

Along the way to the output transistors, the 60 cycle pulse is shaped and amplified to do the job: the yoke magnetically pushes the electron beam to fill the screen out sideways looking at the screen with the greatest length going up and down. Or viewing the screen sitting like a home television set, the amplified vertical output fills the screen up and down. Watching a monitor like this, seeing only a horizontal line means a problem with the vertical coils of the yoke or anything from the vertical output section on back to the oscillator.

The horizontal section is very similar with a few exceptions. The horizontal wave shape is more like a square and has a frequency of 15,750 cycles a second. Both Wells Gardner and Electrohome use the other side of their respective integrated circuits for the horizontal circuitry. If the oscillator isn't going at the correct speed, the picture may move sideways, start to slant, or tear up with slanted thin figures. With both the vertical and horizontal of all monitors, there are variable resistors that change the speed of the oscillators up and down. This way you have controls that can make the correct frequencies to keep the electronic jigsaw puzzle nicely locked in place. If you're driving in a car and next to you someone else is driving their car at exactly the same speed, it will appear that they are not moving. And this is why the sync frequency and the oscillator's frequency must match, so the picture doesn't appear to move.

The correct wave form is shaped and amplified in the circuitry just like in the vertical section. But the horizontal output transistor is a large power transistor and not only serves to give current to the horizontal yoke windings, it also feeds the flyback transformer.

THE FLYBACK TRANSFORMER (OR HIGH VOLTAGE UNIT) —

The picture tube needs high voltage to light up, and the power supply can't meet this demand. The flyback transformer receives current alternating at about 15,750 times per second from the horizontal output transistor. The "flyback" jacks up its input voltage and puts out a higher voltage alternating at the same speed. But, in your "flyback" there are diodes that chop up the alternating voltage to make it a smooth DC output just like in the power supply. This is what goes through that thick red wire to your picture tube. **THIS AREA HAS ABOUT 18,000 VOLTS ON IT AND IT CAN KILL YOU!!**

The "flyback" may be dangerous, but it is also generous. It has extra output windings which give voltage to the heater pins of the picture tube, voltage for the vertical deflection circuits, and picture tube screen-grid voltage. So in a way, the high voltage "flyback" is like a second power supply.

COLOR CIRCUITS —

The color circuits are pretty straight forward. The signals go into the interface section where some amplification and impedance matching occurs. These circuits are pretty sparse and simple. Each color just has two transistors and a diode with some resistors and capacitors. From here, the AC color signal is sent by wires to the neck board.

The color output circuits are on the neck board. The color signals going to the transistors are controlled by two variable resistors called drive controls. There are only two, one for the red and one for the green.

The blue doesn't have one. In the emitter part of each transistor is another variable resistor that is the cut off control. These controls vary the amount of amplified AC signal that goes to the cathodes of the picture tube. The more signal, the more color. The bases of each of these transistors are connected together and are all connected to the blanking and beam limiting transistors which are in the interface section.

The beam limiter helps control the brightness level, and the blanking transistor rapidly turns the picture tube on and off so that retrace lines don't show up on the screen. By turning up the brightness on a good monitor, these four to six retrace lines can be seen slanting diagonally across the picture.

PROTECTION CIRCUIT —

To protect the high voltage section against voltages that are too high coming from the power supply which could cause X-rays to be emitted from the "flyback", a circuit senses the higher power supply voltage, and using a transistor, turns off the horizontal oscillator. Since the horizontal oscillator doesn't work, the horizontal output transistor has nothing to feed the "flyback" which in turn has nothing to feed the picture tube. The monitor will be silent, have no picture, and will appear to be off. **But don't be fooled.** There is still that excessive amount of voltage coming from the power supply. To find out, check at pin two of Wells Gardner's IC501 and emitter of X04 for the Electrohome monitor. Here are the voltages you should receive:

Wells Gardner = 130VDC
Electrohome = 120VDC

The best place to measure this voltage on an Electrohome monitor is at a pin marked B1 on the chassis. This is because a 13 inch color Electrohome monitor,

The G07-FB0 or G07-902, has an integrated circuit and very little else in the power supply. Still, there should be 120VDC at B1.

THE PICTURE TUBE (OR CRT) —

The picture tube or CRT is an output device. In other words, the end result of the circuit's work is displayed by this part. Actually, the output of other circuits is in the neck of the picture tube.

First, there is the heater. The heater boils off electrons from the cathodes so that they (the electrons) shoot up to the screen to excite the phosphors so that the three phosphors emit three colors of light.

The cathodes are next, and again they emit electrons to turn on the tube phosphors, making it glow. The cathode can arc or short to the heater resulting in no picture and a defective picture tube.

Next come the grids. The first grid is grounded. The following grid is the screen grid which receives about 300VDC depending on the brightness setting. The next grid closest to the picture tube screen is the focus grid which gets about one fifth the amount of voltage that is applied to the picture tube anode.

After jetting from the cathode through all these grids, the electrons speed through a mask, a sheet of material with tiny holes, and then excite the tiny dots of phosphor in the inside surface of the picture tube screen. The green electron gun (or cathode and circuitry) spits out electrons which head for the green phosphors only. The same goes for the red and blue guns. The way the phosphor light blends determines the color seen. Should these electron beams become too intense, they may burn the phosphor. With the monitor off, this can be seen as a dark permanent image of the video information on the tube screen.

Differences Between Monitors

The easiest way to identify the brand of monitor you are working with, assuming you can't find the brand name written on it anywhere, is to check the color of the suction cup type insulator that houses that dangerous anode plug on the CRT. Both monitors use a red wire but the Wells Gardner anode cup is BLACK while the Electrohome anode cup is LIGHT GRAY. Unfortunately, "call-out-numbers" for parts, circuit layout, and even circuit design are similar enough to confuse the average observer.

Let's say you have an Electrohome that isn't working. No problem. You can scavenge parts from an old broken up one that you may have around.

Now let's say you have a Wells Gardner that isn't working. **STOP!!** This could be a problem. There are 3

different types of Wells Gardner K4900 **SERIES** monitors in the games. Here are ways to identify them.

K4906 (1st TYPE) — This monitor's identifying tags have **BLACK** ink printed on a white background. There is **NO** Vertical Damping Control. (This Control would be next to the Vertical Hold Control but this area is jumpered with a small wire instead.)

K4906 (2nd TYPE) — This monitor's identifying tags have **RED** ink printed on a white background. There **IS** a Vertical Damping Control next to the Vertical Hold Control. The Damping Control provides a few more lines on the top of the monitor screen (monitor viewed as a normal T.V. would be) for any video game that may need these lines to fit the picture on the

screen. Moving the Control may distort the top part of your picture (or the side, depending on the game and how the monitor is mounted) so go ahead and move it if you are having this type of problem. To accommodate this new feature, there are a few circuit changes.

ONE MAJOR DIFFERENCE BETWEEN THESE TWO VERSIONS OF THE K4906 IS THE YOKE. They look the same but notice the part numbers:

K4906 **WITHOUT** the Damper Control: 2021111201

K4906 **WITH** the Damper Control: 2021111258

Since the companies like to change part numbers at the drop of a hat, the best thing to do is to request whatever part number is written on your yoke. If you should get the wrong yoke, the results will be:

Picture distortion.

Excessive brightness.

Too much or too little vertical picture size.

K4956 (3rd TYPE) — This monitor is identical to the K4906 **WITHOUT** the Damper Control **EXCEPT** the picture tube is vertically mounted and there is an additional small P.C. Board mounted on the monitor where the yoke plugs in. This monitor is used on some Cocktail Table games where the picture has to flip for the second player.

Generally speaking, some games flip the picture image via the logic board programming but this monitor is used in games that flip the picture image via generation of a small signal voltage which is sent to the extra P.C. Board on this monitor. This signal voltage causes relays on this extra P.C. Board to flip the picture by reversing the horizontal and vertical signals to the yoke pins.

What kind of problems can this extra P.C. Board cause? If the relays become defective, the picture won't flip. If the P.C. Board gets cracked you may have a horizontal line on the screen, a vertical line on the screen, or maybe just a dot in the center of the screen. Of course, the logic board could be defective and not sending the signal to flip the picture. In any case, some people feel that using relays is cheaper, simpler, and more reliable, so this is an advantage.

CONTROLS YOU MAY NOT TOUCH

Basically, on the Electrohome monitor, you can move any control you want **EXCEPT** for the B1 control. This sets the power supply voltage (ideally at 120 VDC) and is located right behind VERTICAL HOLD. The 13" Electrohome **DOES NOT** have this control. It may also be wise not to move the VERTICAL LINEARITY since this distorts the picture and is hard to reset perfectly. If you do move it, turn on the Cross Hatch Test Pattern of your game and try to get the squares to the point where they are equal in size by readjusting this Linearity Control.

On the Wells Gardner monitor, brightness is adjusted by the "BLACK LEVEL" Control which is right next to the Horizontal Frequency Control. Under the Focus Control is the "SCREEN" Control which you **DO NOT** touch. Yes, this control does adjust the brightness, but it is used to set the CRT bias and is adjusted at the factory. When Wells Gardner sets it, they mark the position with a black mark on the knob. If you move it, be sure to realign the mark and **THEN** set the BLACK LEVEL Control to the brightness you desire. So, other than the SCREEN control, you may adjust any of the controls.

Parts Interchangeability

Some parts can be interchanged on all of the monitors. Here are the rules:

1. You **CAN** swap any resistor between monitors that has the same resistance, wattage rating, and tolerance.
2. You **CAN** swap any capacitor between monitors that has the same capacitance and voltage rating.
3. You **CAN** swap many of the parts between the 19" and the 13" versions of each manufacturer's monitor. **BUT**, be certain to compare the manufacturers' part numbers to be positive the parts you want to interchange are identical. **BE SURE** you have read the section DIFFERENCES BETWEEN MONITORS which was covered earlier.
4. You **CANNOT** swap any picture tubes between monitors!! In the past you could, but Wells Gardner is now using a new monitor. When

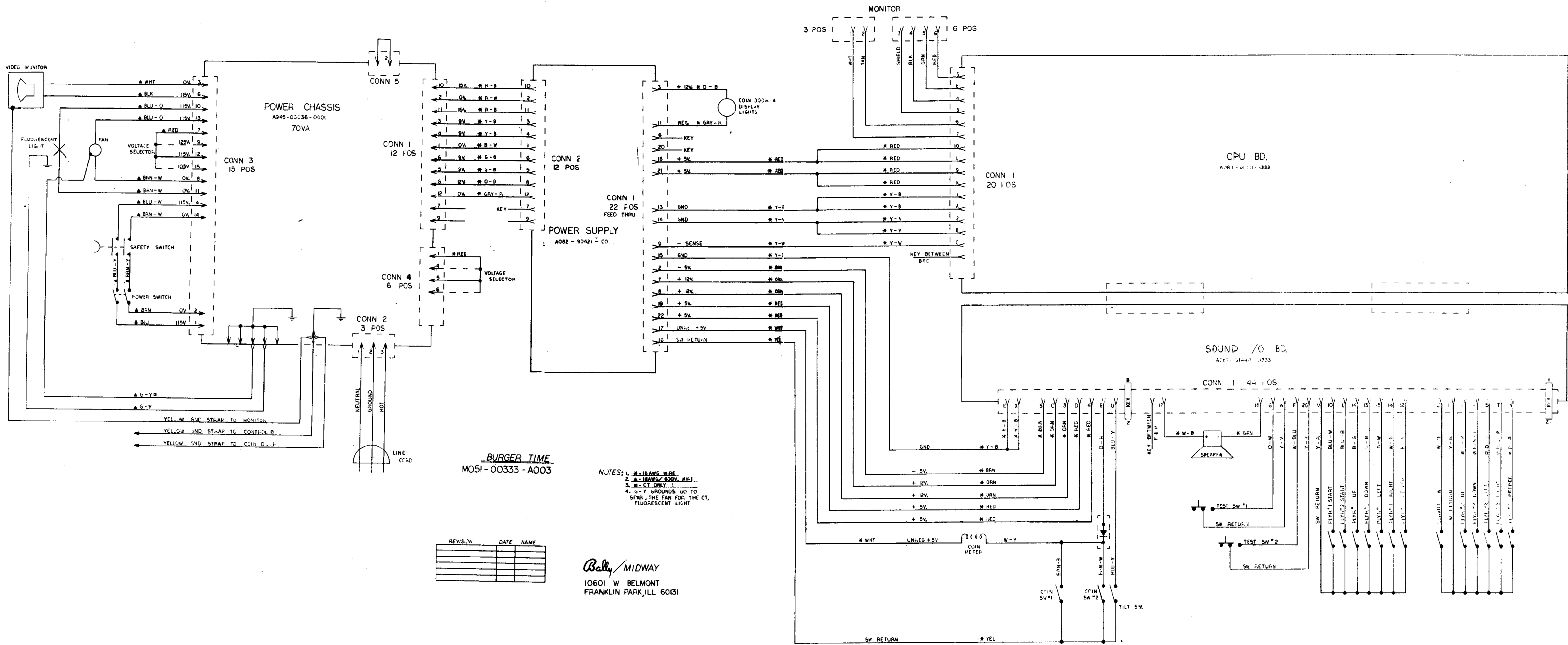
ordering a replacement picture tube, **ALWAYS SPECIFY THE PICTURE TUBE NUMBER!**

5. You **CANNOT** change any part that is a **safety part**, one that is shaded in gray on the schematic; it **MUST** be **IDENTICAL** to the original. **To do otherwise IS DANGEROUS.** For instance, the 13 inch Electrohome (G07-902) monitor "flyback" looks identical to the 19 inch Electrohome (G07-904) monitor "flyback". In fact, there is even a 19 inch Electrohome (G07-905) monitor (which is an obsolete model) with a similar looking "flyback". **NONE OF THESE ARE INTERCHANGEABLE!!**
6. You **CAN** change any of the parts between the G07-904 and G07-907. They're essentially the same monitor except that the G07-907 has a vertically mounted picture tube.

If there is any doubt about what parts can be swapped between each manufacturer's 19 inch and 13 inch models, compare the manufacturer's part number between each one. If they match up, they are the same part.

Monitor schematics and parts lists for
Electrohome G07-CBO, G07-FB0
and Well Gardner 4901 omitted

IX Schematics and Wiring Diagrams

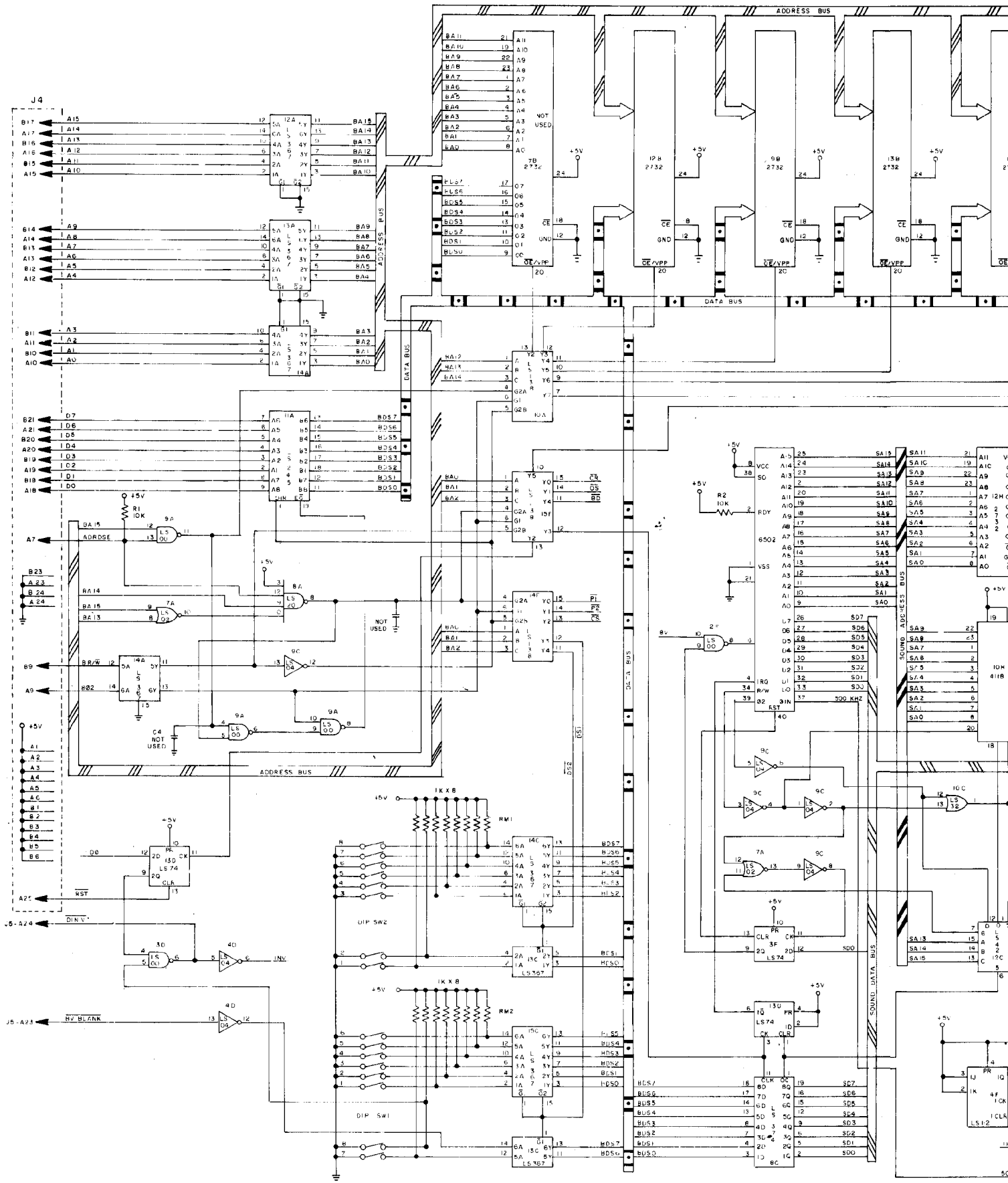


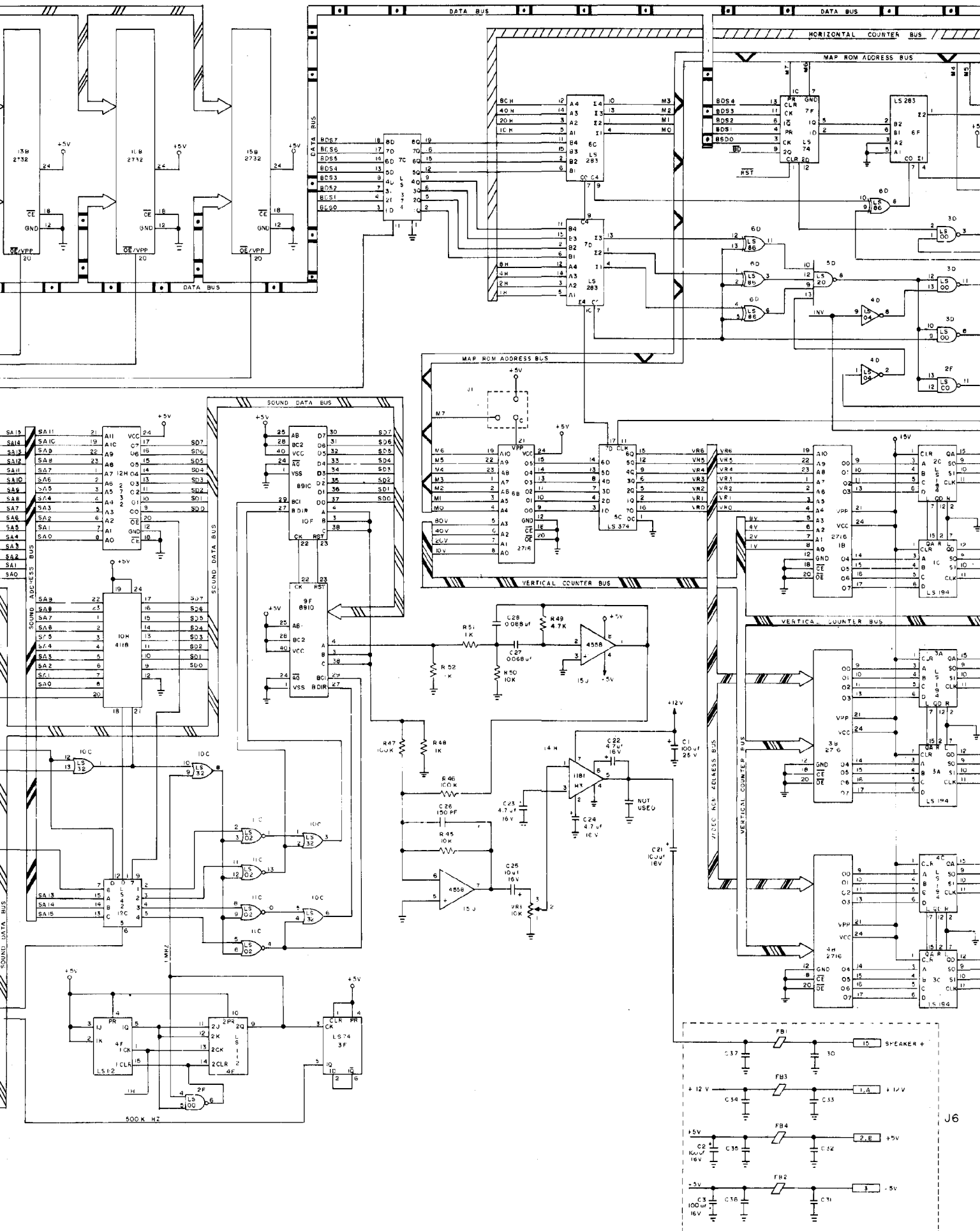
DESCRIPTION LIST

<u>DESIGNATION NO.</u>	<u>DESCRIPTION</u>	<u>DESIGNATION NO.</u>	<u>DESCRIPTION</u>
C1	100 uf 25 V	D1, D2	IN914B
C2, C3	100 uf 16 V	D5, D6	IN914B
C4 - C15	.01 uf CER.	D9 - D18	IN914B
C16 - C19	22 uf CER.		
C20	.01 uf CER.		
C21	100 uf 16 V	IC2A, IC3A	74LS194
C22 - C24	47 uf	" 4A - IC6A	74LS367
C25	10 uf	" 7A	74LS02
C26	150 pf CER.	" 8A	74LS20
C27, C28	.068 uf POLY.	" 9A	74LS00
C29	.01 uf CER.	" 10A	74LS138
C30 - C37	390 pf CER.	" 11A	74LS245
		" 12A - IC14A	74LS367
CP1 - CP26	.1 uf CER.	" 1B	2716 EPROM ABOO-1
CP27	.10 uf TANT.	" 3B	" " ABO1-1
		" 4B	" " ABO2-1
		" 6B	" " ABO3-1
		" 9B	2732 EPROM ABO4-1
R1, R2	10K ohm 1/4W 5% CARBON	" 10B	" " ABO5-1
R3, R4	1K " " " "	" 12B	" " ABO5A-1
R5	100 " " " "	" 13B	" " ABO6-1
R6	1K " " " "	" 15B	" " ABO7-1
R7	100 " " " "	" 1C - IC4C	74LS194
		" 5C	74LS374
R12	1K ohm 1/4W 5% CARBON	" 6C	74LS283
R13	100 " " " "	" 7C, 8C	74LS374
R14	1K " " " "	" 9C	74LS04
R15	100 " " " "	" 10C	74LS32
		" 11C	74LS02
R20	1K ohm 1/4W 5% CARBON	" 12C	74LS42
R21	100 " " " "	" 13C - 15C	74LS367
R22	1K " " " "		
R23	100 " " " "	" 2D	74LS57
R24	1K " " " "	" 3D	74LS00
R25	100 " " " "	" 4D	74LS04
R26	1K " " " "	" 5D	74LS20
R27	100 " " " "	" 6D	74LS86
R28	1K " " " "	" 7D	74LS283
R29	100 " " " "	" 13D	74LS74
R30	1K " " " "		
R31	100 " " " "	" 2F	74LS00
R32	100 " " " "	" 3F	74LS74
R33	1K " " " "	" 4F	74LS112
R34	1K " " " "	" 5F	74LS74
R35	100 " " " "	" 6F	74LS283
R36	33 " " " "	" 7F	74LS174
R37	1K " " " "	" 9F, 10F	8910 SOUND GEN.
R38, R39	33 ohm 1/4W 5% CARBON	" 12F	6502 CPU
R40, R41	5.1K " " " "	" 13F	7474
R42	1K " " " "	" 14F, 15F	74LS138
R43	33 " " " "	" 6H - 8H	74387
R44	1K " " " "		
R45	10K " " " "	" 10H	4118 RAM 2KX8
R46, R47	100K " " " "	" 12H	2732 EPROM AB14-1
R48	1K " " " "	" 13H	555 TIMER
R49	47K " " " "	" 14H	1181H3 AUDIO AMP
R50	10K " " " "	" 13J	555 TIMER
R51, R52	1K " " " "	" 15J	4558 OP. AMP
R53 - R56	82 " " " "		
RM1, RM2	1K ohm SIP 9-PIN		
VR1	POT 0-10K ohm	FB1 - FB4	FERRITE BEAD
		HSIC14H	HEAT SINK, AUDIO AMP
		ICS1B, 3B, 4B, 6B, 9B, 10B, 12B, 13B, 15B	24 PIN IC SOCKET
		ICS 9F, 10F, 12F	40 PIN IC SOCKET
		ICS 12H	24 PIN IC SOCKET
		J4, J5	50 PIN CONN.
			<u>MOUNTING HARDWARE</u>
		MHIC14H	(2) AUDIO AMP MTG. SCRW. 5-40X4 PHL PAN
		MHHSIC14H	MTG. HARDWARE - HEAT SINK
		-	(2) SCRW. 4-40X8 PHL PAN
		-	(4) WSH. 6 140-.312-.032 FL-D
		-	(2) NUT 4-40 HEX
		PCMHI - PCMHI4	P.C. SCRW. 6-32 X 6 PHL PAN
		SW1, SW2	SWITCH 8 POS. DIP
		A080-91440-D333	SOUND I/O BOARD

CROSS REFERENCE LIST

<u>DESCRIPTION</u>	<u>Q'ty</u>	<u>DESIGNATION NO.</u>	<u>PART NO.</u>
150pf CER.	1	C26	0333-00800-0010
390pf CER.	8	C30 - C37	0318-00800-0002
.01uf CER.	14	C4 - C15, C20, C29	0508-00800-0800
.068uf POLY.	2	C27, C28	0333-00800-0005
.1uf CER.	26	CP1 - CP26	0508-00800-0900
.10uf TANT.	1	CP 27	0333-00800-0011
10uf CER.	1	C25	0333-00800-0006
22uf CER.	4	C16 - C19	0333-00800-0007
47uf CER.	3	C22 - C24	0333-00800-0008
100uf 16V	3	C2, C3, C21	0333-00800-0003
100uf 25V	1	C1	0333-00900-0009
33ohm 1/4W 5%	4	R36, R38, R39, R43	0062-074B3-1XXX
82ohm 1/4W 5%	4	R53 - R56	
100ohm " "	12	R5, R7, R13, R15, R21, R23, R25, R27, R29, R31, R32, R35	0062-110B3-1XXX
1K " " "	19	R3, R4, R6, R12, R14, R20, R22, R24, R26, R28, R30, R33, R34, R37, R42, R44, R48, R51, R52	0062-179B3-1XXX
5.1K " " "	2	R40, R41	0062-213B3-1XXX
10K " " "	4	R1, R2, R45, R50	0062-227B3-1XXX
47K " " "	1	R49	0062-259B3-1XXX
100K " " "	2	R46, R47	0062-275B3-1XXX
1Kohm SIP 9-PIN	2	RM1, RM2	0508-00804-0200
0-10Kohm POT	1	VR1	0333-00804-0003
1N514B DIODE	14	D1, D2, D5, D6, D9 - D18	0300-00801-0001
555 TIMER	2	IC13H, 13J	0333-00803-0008
1181H3 AUDIO AMP	1	" 14H	0333-00803-0036
4118 RAM 2K X 8	1	" 10H	0550-00803-5400
2716 EPROM AB00-1	1	" 1B	0333-00803-0019
" " AB01-1	1	" 3B	0333-00803-0020
" " AB02-1	1	" 4B	0333-00803-0021
" " AB03-1	1	" 6B	0333-00803-0022
2732 EPROM AB04-1	1	" 9B	0333-00803-0023
" " AB05-1	1	" 10B	0333-00803-0024
" " AB05A-1	1	" 12B	0333-00803-0025
" " AB06-1	1	" 13B	0333-00803-0026
" " AB07-1	1	" 15B	0333-00803-0027
" " AB14-1	1	" 12H	0333-00803-0028
4558 OP. AMP	1	" 15J	0333-00803-0029
6502 CPU	1	" 12F	0333-00803-0030
7474	1	" 13F	0333-00803-0033
74157	1	" 2D	0333-00803-0031
74367	1	" 6H - 6H	0333-00803-0032
74LS00	3	" 9A, 3D, 2F	0300-00803-0027
74LS02	2	" 7A, 11C	0300-00803-0028
74LS04	2	" 9C, 4D	0300-00803-0029
74LS20	2	" 8A, 5D	0300-00803-0052
74LS32	1	" 10C	0300-00803-0031
74LS42	1	" 12C	0333-00803-0034
74LS74	3	" 13D, 3F, 5F	0300-00803-0032
74LS86	1	" 6D	0300-00803-0054
74LS112	1	" 4F	0333-00803-0007
74LS138	3	IC 10A, 14F, 15F	0300-00803-0033
74LS174	1	" 7F	0300-00803-0047
74LS194	6	" 2A, 3A, IC-4C	0333-00803-0003
74LS245	1	" 11A	0333-00803-0035
74LS283	3	" 6C, 7D, 6F	0300-00803-0045
74LS367	9	" 4A-6A, 12A-14A, 13C-15C	0300-00803-0039
74LS374	3	" 5C, 7C, 8C	0333-00803-0004
8910 SOUND GEN.	2	" 9F, 10F	0066-953AX-XXSX
HEAT SINK, AUDIO AMP	1	HSIC14H	0066-071XX-AXCX
24 PIN IC SOCKET	10	ICS 1B, 3B, 4B, 6B, 9B, 10B, 12B, 13B, 15B, 12H	0508-00804-0500
40 PIN IC SOCKET	3	ICS 9F, 10F, 12F	0508-00804-1800
EPROM LABEL AB00-1	1		M051-00333-A024
" " AB01-1	1		M051-00333-A025
" " AB02-1	1		M051-00333-A026
" " AB03-1	1		M051-00333-A027
" " AB04-1	1		M051-00333-A028
" " AB05-1	1		M051-00333-A029
" " AB05A-1	1		M051-00333-A030
" " AB06-1	1		M051-00333-A031
" " AB07-1	1		M051-00333-A032
" " AB14-1	1		M051-00333-A033
FERRITE BEAD	4	FB1 - FB4	0316-00804-0002
50 PIN CONN.	2	J4, J5	0300-00804-1104
<u>MOUNTING HARDWARE</u>			
AUDIO AMP MTG. SCRW. 5-40 X 4 PHL RND	2	MHC14H	0017-00101-0751
MTG. HARDWARE - HEAT SINK SCRW. 4-40 X 6 PHL PAN	2	MHHSIC14H	
WSH. 6 140-.312-032 FL-D	4	-	0017-00104-0088
NUT 4-40 HEX.	2	-	0017-00103-0002
P.C. SCRW. 6-32 X 6 PHL PAN	4	PCMH1 - PCMH4	0017-00101-0339
SWITCH 8 POS. DIP	2	SW1, SW2	0300-00804-0700
SOUND I/O BOARD	1	-	A080-91440-D333

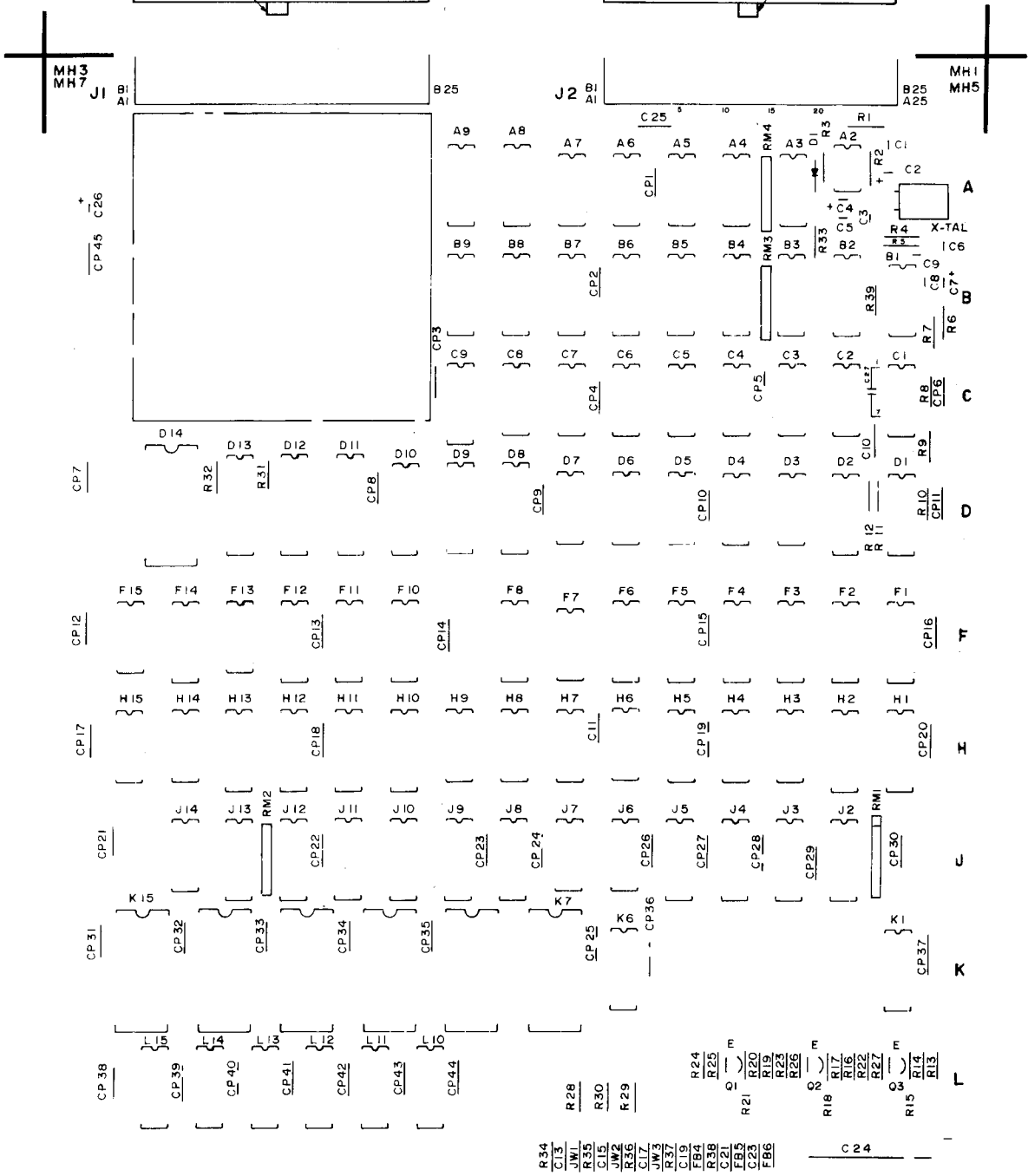
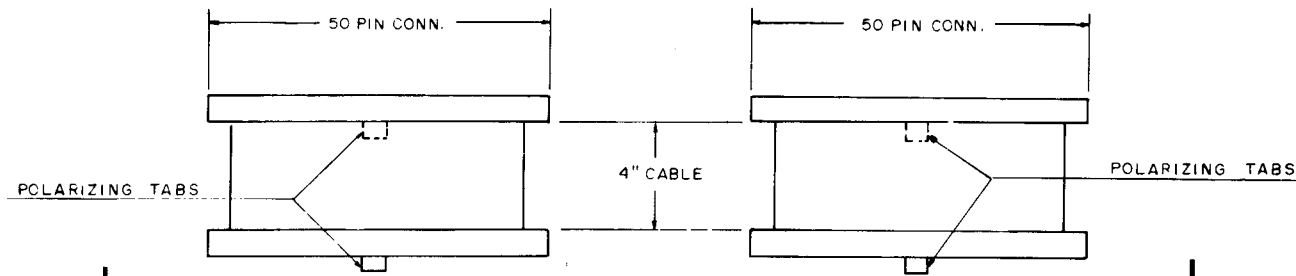




DESIGNATION LIST

<u>DESIGNATION NO.</u>	<u>DESCRIPTION</u>	<u>DESIGNATION NO.</u>	<u>DESCRIPTION</u>	<u>DESIGNATION NO.</u>	<u>DESCRIPTION</u>
C 1	0.1 μ f CER.	IC 2A	555	IC 9H	74 LS 86
C 2	22 μ f	3A	74 LS 86	10H	74 LS 367
C 3	0.01 μ f CER.	4A	74 LS 86	11H	74 LS 367
C 4	6.8 μ f	IC 5A	74 LS 86	12H	74 LS 367
C 5	1000 pf	6A	74 LS 86	13H	74 LS 283
C 6	0.1 μ f CER.	7A	74 LS 00	14H	74 LS 02
C 7	4.7 μ f	8A	74 LS 153	15H	74 LS 10
C 8	0.1 μ f CER.	9A	74 LS 153		
C 9	0.01 μ f CER.			IC 2J	74175
C 10	100 pf CER.			3J	2511-1
C 11	220 pf "	IC 1B	7404	4J	2511-1
C 18-C21	470 pf "	2B	74 LS 163	5J	2511-1
C 22, C23	390 pf "	3B	74 LS 163	6J	74 LS 00
C 24	100 μ f ELECT. 16V	4B	74163	7J	74 LS 00
C 25	33 pf CER.	5B	74 LS 163	8J	74 LS 174
C 26	100 μ f ELECT. 16V	6B	74 LS 163	9J	74 LS 175
C 27	0.01 μ f CER.	7B	74 LS 138	10J	74 LS 367
		8B	74 LS 153	11J	74 LS 367
		9B	74 LS 153	12J	74 LS 04
CPI-CP45	.1 μ f CER			13J	74 LS 74
		1C	74 LS 04	14J	74 LS 00
		2C	74 LS 04		
R 1	10 K 1/4 W 5%	3C	74 LS 00	IC 1K	74175
R 2	10 K 1/4 W 5%	4C	74 LS 20	6K	74 LS 157
R 3	47 K 1/4 W 5%	5C	74 LS 30	7K	2732 EPROM AB08-1
R 4	470 ohm 1/4 W 5%	6C	74 LS 74	9K	" " AB09-1
R 5	470 ohm 1/4 W 5%	7C	74 LS 74	10K	" " AB10-1
R 6	10 K 1/4 W 5%	8C	74 LS 32	12K	" " AB11-1
R 7	4.7 K 1/4 W 5%	9C	74 LS 153	13K	" " AB12-1
R 8	10 K 1/4 W 5%			15K	" " AB13-1
R 9	4.7 K 1/4 W 5%	1D	74 LS 157		
R 10	1 K 1/4 W 5%	2D	74 LS 174	10L	74 LS 194
R 11	1 K 1/4 W 5%	3D	74 LS 00	11L	74 LS 194
R 12	1 K 1/4 W 5%	4D	74 LS 10	12L	74 LS 194
R 13	1 K 1/4 W 5%	5D	74 LS 04	13L	74 LS 194
R 14	1.5 K 1/4 W 5%	6D	74 LS 00	14L	74 LS 194
R 15	3.3 K 1/4 W 5%	7D	74 LS 04	15L	74 LS 194
R 16	3.3 K 1/4 W 5%	8D	2114-2	FB4 FB6	FERRITE BEAD
R 17	1.5 K 1/4 W 5%	9D	2114-2	X-TAL	X-TAL 12 MHz
R 18	4.7 K 1/4 W 5%	10D	2114-2		
R 19	1.5 K 1/4 W 5%	11D	74 LS 374		
R 20	3.3 K 1/4 W 5%	12D	74 LS 374	CPU 7	CPU ASSY DATA EAST ML-10256-2
R 21	4.7 K 1/4 W 5%	13D	74 LS 374		
R 22	1 K 1/4 W 5%	14D	2016		
R 23	1 K 1/4 W 5%			J1	SKT 50 PIN MALE
R 24	22 ohm 1/4 W 5%			J2	SKT 50 PIN MALE
R 25	470 ohm 1/4 W 5%	IC 1F	74 LS 157	* JW1 - JW3 (SEE NOTE)	ZERO OHM RESISTORS
R 26	470 ohm 1/4 W 5%	2F	74 LS 157	PCMHI - PCMH4	MÉTAL STANDING SPACER
R 27	470 ohm 1/4 W 5%	3F	74 LS 163	PCMH5 - PCMH8	P.C. MTG. SCRWB
R 28	180 ohm 1/4 W 5%	4F	74 LS 163		6-32 X6 PHL RND
R 29	180 ohm 1/4 W 5%	5F	74 LS 112		
R 30	180 ohm 1/4 W 5%	6F	74 LS 04		
R 31	4.7 K 1/4 W 5%	7F	74 LS 10		
R 32	4.7 K 1/4 W 5%	8F	74 LS 367		
R 33	30 K 1/4 W 5%	10F	74 LS 367	A080-91441-E333	CPU/DATA PCB
R 34 - R38	2.2 K 1/4 W 5%	11F	74 LS 367		
R 39	82 ohm 1/4 W 5%	12F	74 LS 283		
		13F	74 LS 86		
RM1	1K SIP 9 PIN	14F	74 LS 138		
RM2 - RM4	82 OHM 8 PIN 4 POS SIP	15F	74 LS 00		
		IC 1H	7489		
		2H	7489		
		3H	74 LS 86		
		4H	74 LS 86		
		5H	74 LS 125		
Q 1	2N 3391A	6H	74 LS 04		
Q 2	2N 3391A	7H	74 LS 27		
Q 3	2N 3391A	8H	74 LS 00		

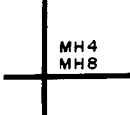
PROJECT ENG. J. SZERSZEN		USED ON BURGER TIME		Bally / MIDWAY MFG. CO. FRANKLIN PK. ILL.	
DO NOT SCALE DRAWING	HEAT TREAT	SCALE FULL	NO. REQ'D 1 PER		
DIM. TOLERANCES UNLESS SPECIFIED	DATE 7/26	ASS'Y DRAWING	PART NO.		
DESIGNED BY	DATE 12/6/82	CPU/DATA	M051-00333-E008		
CHECKED BY		A084-91441-E333			



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15 14 13 12 11 10 9 8 C.12 C.14 C.16 C.18 C.20 C.22 3 2 1

BURGER TIME CPU/DATA
A080-21441-E333
PAT. PENDING

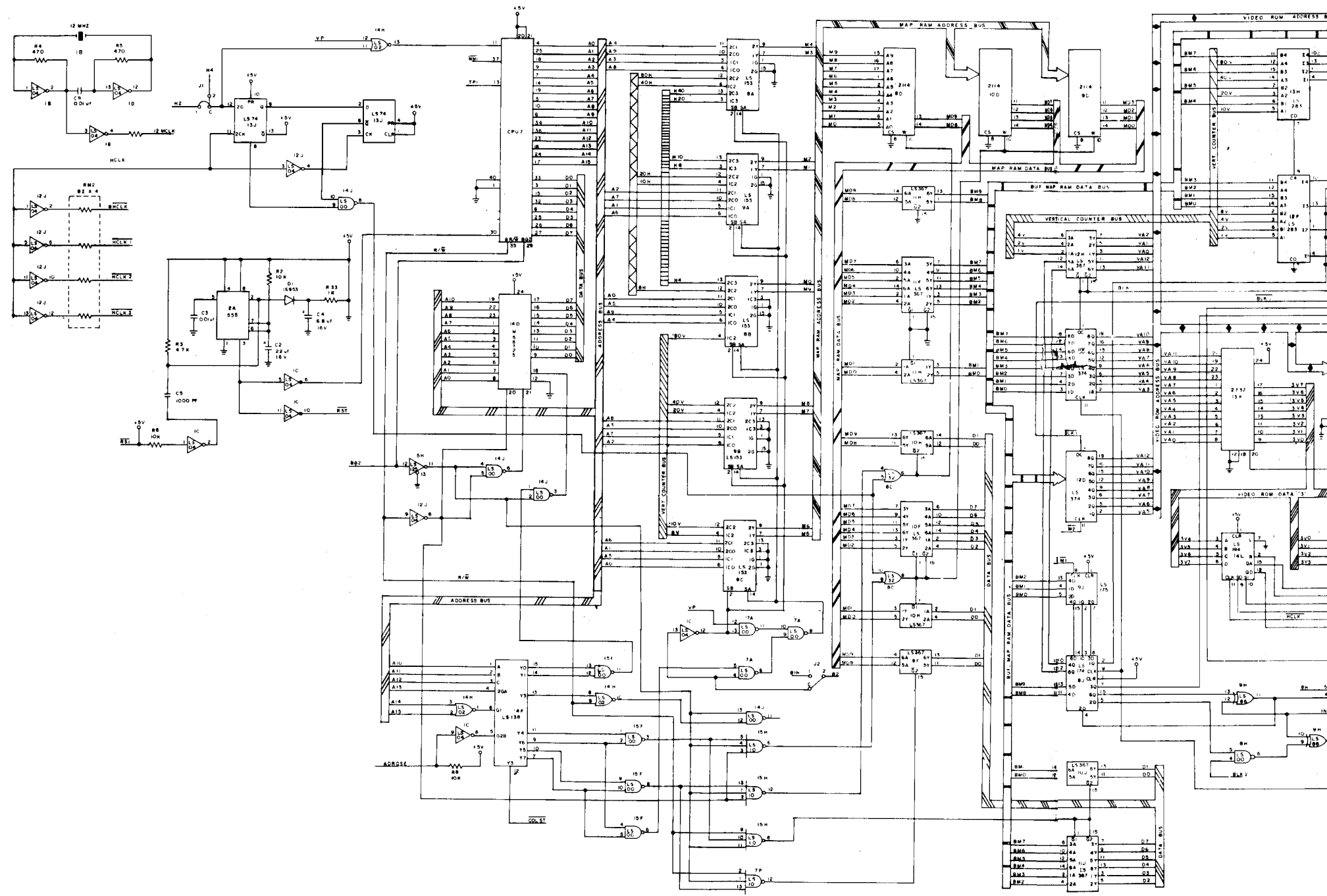


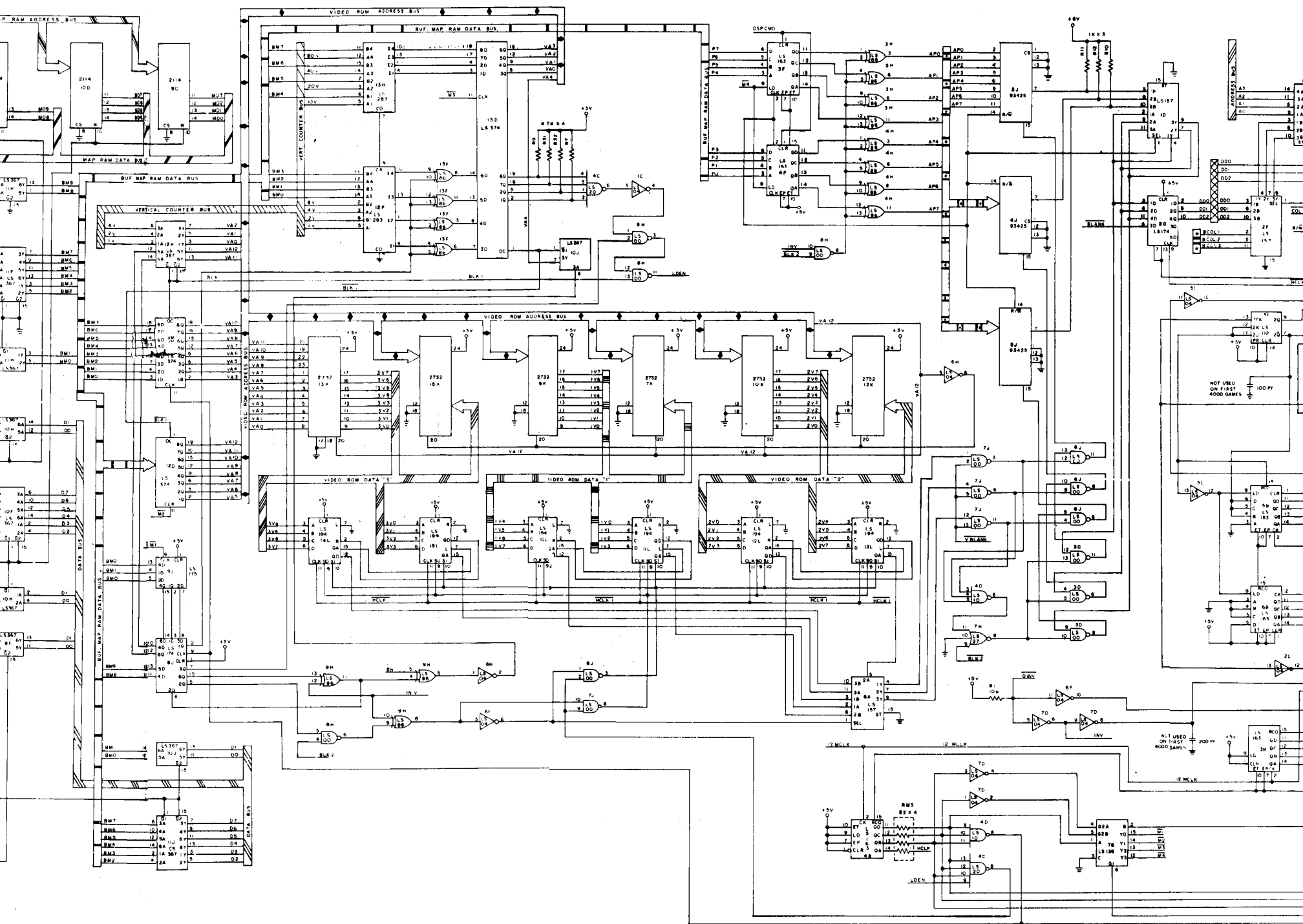
* NOTE :

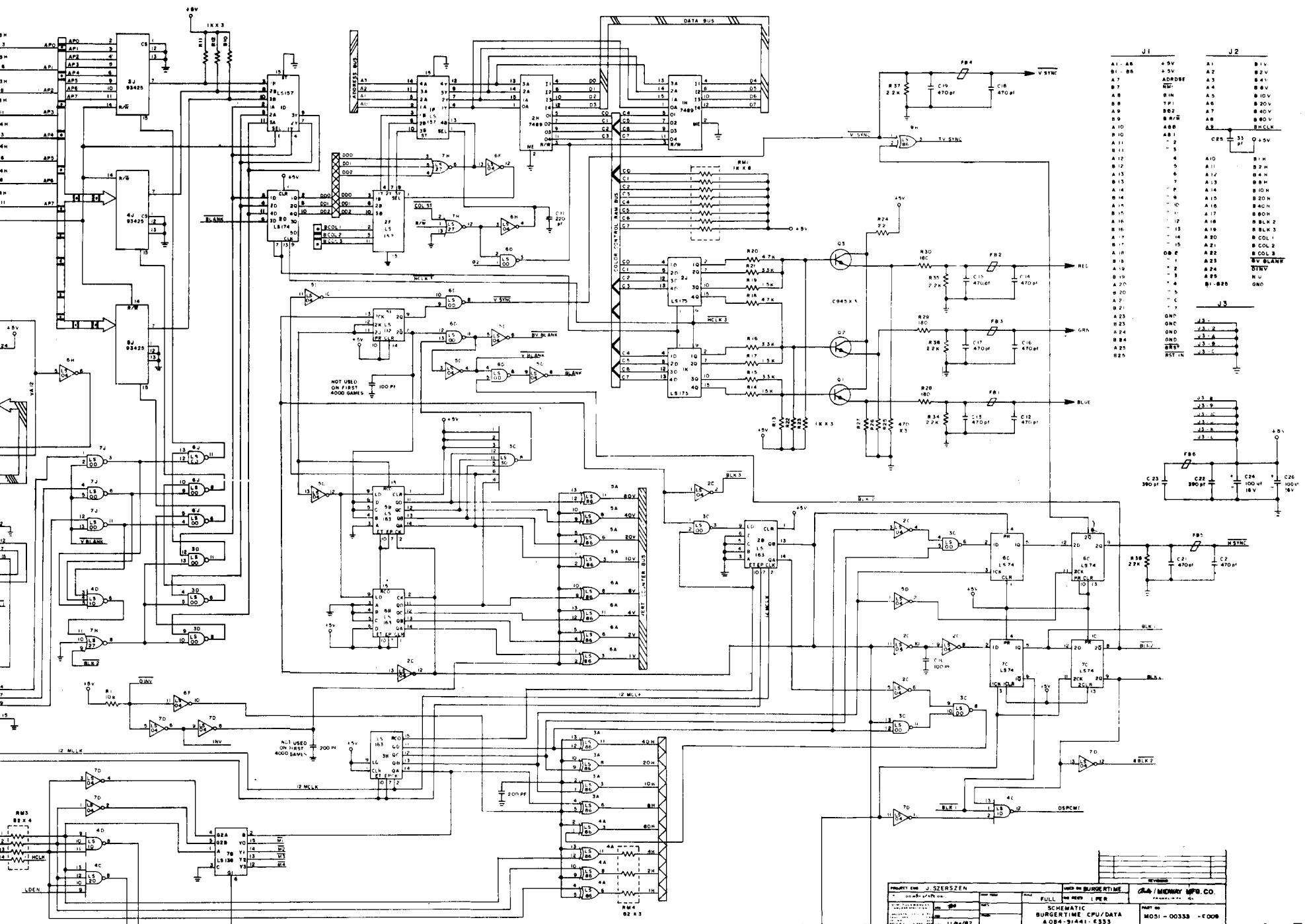
INSERT JW1 INTO FB1, JW2 INTO FB2, JW3 INTO FB3.

CROSS REFERENCE LIST

<u>DESCRIPTION</u>	<u>Q'ty</u>	<u>DESIGNATION NO.</u>	<u>PART NO.</u>
33 pf CER.	1	C 25	0300-00800-1400
100 pf "	1	C 10	0300-00800-0500
220 pf "	1	C 11	0550-00800-2000
390 pf "	2	C 22, 23	0316-00800-0002
470 pf "	4	C18 - C21	0550-00800-0200
1000 pf	1	C 5	0300-00800-0600
0.01 µf CER.	3	C 3, C9, C27	0508-00800-0800
0.1 µf CER.	48	C1, 6, 8, CPl - CP45	0508-00800-0900
4.7 µf	1	C 7	0333-00800-0002
6.8 µf	1	C 4	0333-00800-0001
22 µf	1	C 2	0333-00800-0004
100 µf ELECT 16V	2	C 24, C26	0333-00800-0003
22 ohm 1/4 W 5%	1	R 24	0062-063B3-1XXX
82 ohm 1/4 W 5%	1	R 39	0062-104B3-1XXX
180 ohm 1/4 W 5%	3	R 28, 29, 30	0062-127B3-1XXX
470 ohm 1/4 W 5%	5	R 4, 5, 25, 26, 27.	0062-156B3-1XXX
1 K 1/4 W 5%	6	R10, 11, 12, 13, 22, 23.	0062-179B3-1XXX
1.5 K 1/4 W 5%	3	R14, 17, 19.	0062-187B3-1XXX
2.2 K 1/4 W 5%	5	R 34 - R 38	0062-195B3-1XXX
3.3 K 1/4 W 5%	3	R15, 16, 20.	0062-203B3-1XXX
4.7 K 1/4 W 5%	6	R 7, 9, 18, 21, 31, 32.	0062-211B3-1XXX
10 K 1/4 W 5%	4	R1, 2, 6, 8.	0062-227B3-1XXX
30K 1/4 W 5%	1	R 33	0062-249B3-1XXX
47K 1/4 W 5%	1	R 3	0062-259B3-1XXX
1 K SIP 9 PIN	1	RM1	0508-00804-0200
82 OHM 8 PIN 4 POS SIP	3	RM2 - RM4	0333-00804-0004
DIODE IN 914 B	1	DI	0300-00801-0001
XSTR 2N3391A	3	GI, 2, 3	0300-00802-0003
74 LS 00	9	IC 7A, 3C, 3D, 6D, 15F, 8H, 6J, 7J, 14J.	0300-00803-0027
74 LS 02	1	14H	0300-00803-0028
7404	1	1 B	0333-00803-0012
74 LS 04	7	1 C, 2C, 5D, 7D, 6F, 6H, 12J.	0300-00803-0029
74 LS 10	3	4D, 7F, 15H.	0300-00803-0051
74 LS 20	1	4C	0300-00803-0052
74 LS 27	1	7H	0300-00803-0053
74 LS 30	1	5C	0333-00803-0011
74 LS 32	1	8C	0300-00803-0031
74 LS 74	3	6C, 7C, 13J.	0300-00803-0032
74 LS 86	8	3A, 4A, 5A, 6A, 13F, 3H, 4H, 9H.	0300-00803-0054
7489	2	1H, 2H.	0550-00803-3300
74 LS 112	1	5F	0333-00803-0007
74 LS 125	1	5H	0333-00803-0009
74 LS 138*	2	7B, 14F.	0300-00803-0033
74 LS 153	5	8A, 9A, 8B, 9B, 9C.	0333-00803-0006
74 LS 157	4	1D, 1F, 2F, 6K.	0300-00803-0050
74163	1	4B	0333-00803-0010
74 LS 163	6	2B, 3B, 5B, 6B, 3F, 4F.	0333-00803-0001
74 LS 174	2	2D, 8J.	0300-00803-0047
74175	2	2J, 1K.	0333-00803-0002
74 LS 175	1	9J	0300-00803-0035
74 LS 194	6	10L, 11L, 12L, 13L, 14L, 15L.	0333-00803-0003
74 LS 283	2	12F, 13H.	0300-00803-0045
74 LS 367	8	8F, 10F, 11F, 10H, 11H, 12H, 10J, 11J.	0300-00803-0039
74 LS 374	3	11D, 12D, 13D.	0333-00803-0004
2016 RAM 2K X 8	1	IC 14D	0508-00803-5400
2114-2 STAT RAM	3	IC 8D-IC10D	0550-00803-0300
2511-1 BP-RAM	3	" 3J-1C5J	0333-00803-0005
2732 EPROM AB08-1	1	" 7K	0333-00803-0013
" " AB09-1	1	" 9K	0333-00803-0014
" " AB10-1	1	" 10K	0333-00803-0015
" " AB11-1	1	" 12K	0333-00803-0016
" " AB12-1	1	" 13K	0333-00803-0017
" " AB13-1	1	" 15K	0333-00803-0018
555 TIMER	1	" 2A	0333-00803-0008
24 PIN IC SOCKET	6	ICS 7K, 9K, 10K, 12K, 13K, 15K	0508-00804-0500
EPROM LABEL AB08-1	1		M051-00333-A018
EPROM LABEL AB09-1	1		M051-00333-A019
EPROM LABEL AB10-1	1		M051-00333-A020
EPROM LABEL AB11-1	1		M051-00333-A021
EPROM LABEL AB12-1	1		M051-00333-A022
EPROM LABEL AB13-1	1		M051-00333-A023
FERRITE BEAD	3	FB4-FB6	0316-00804-0002
X-TAL 12 MHz	1	X-TAL	0333-00804-0001
SKT 50 PIN MALE	2	J1, 2.	0300-00804-1104
50 PIN CABLE ASSY TYPE B	2		0333-00804-0002
ZERO OHM RESISTORS	3	* JW1 - JW3 (SEE NOTE)	
CPU-7 ASSY DATA EAST ML-10256-2	1	CPU-7	0066-362BX-XAWX
METAL STAND-OFF CARD SPACER	4	PCMHI-4	0986-00701-00XF
PC MOUNTING SCREWS	4	PCMHS-8	0017-00101-0339
CPU/DATA PCB	1		A080-91441-E333







J1		J2	
A1	45V	A1	B1V
B1	45V	A2	B2V
A7	ADDR	A3	B4V
B7	RD	A4	B5V
A8	01N	A5	B0V
B8	TP1	A6	B20V
A9	RD	A7	B40V
B9	R/W	A8	B80V
A10	ADD	A9	BLK
B10	AB1	A10	BLK 2
A11	2	A11	BLK 3
B11	3	A12	B COL 1
A12	4	A13	B COL 2
B12	5	A14	B COL 3
A13	6	A15	B COL 4
B13	7	A16	B COL 5
A14	8	A17	B COL 6
B14	9	A18	B COL 7
A15	10	A19	B COL 8
B15	11	A20	B COL 9
A16	12	A21	B COL 10
B16	13	A22	B COL 11
A17	14	A23	B COL 12
B17	15	A24	STV
A18	16	A25	BLV
B18	17	B1	820
A19	18		
B19	19		
A20	20		
B20	21		
A21	22		
B21	23		
A22	24		
B22	25		
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A25	30		
B25	31		
A26	32		
B26	33		

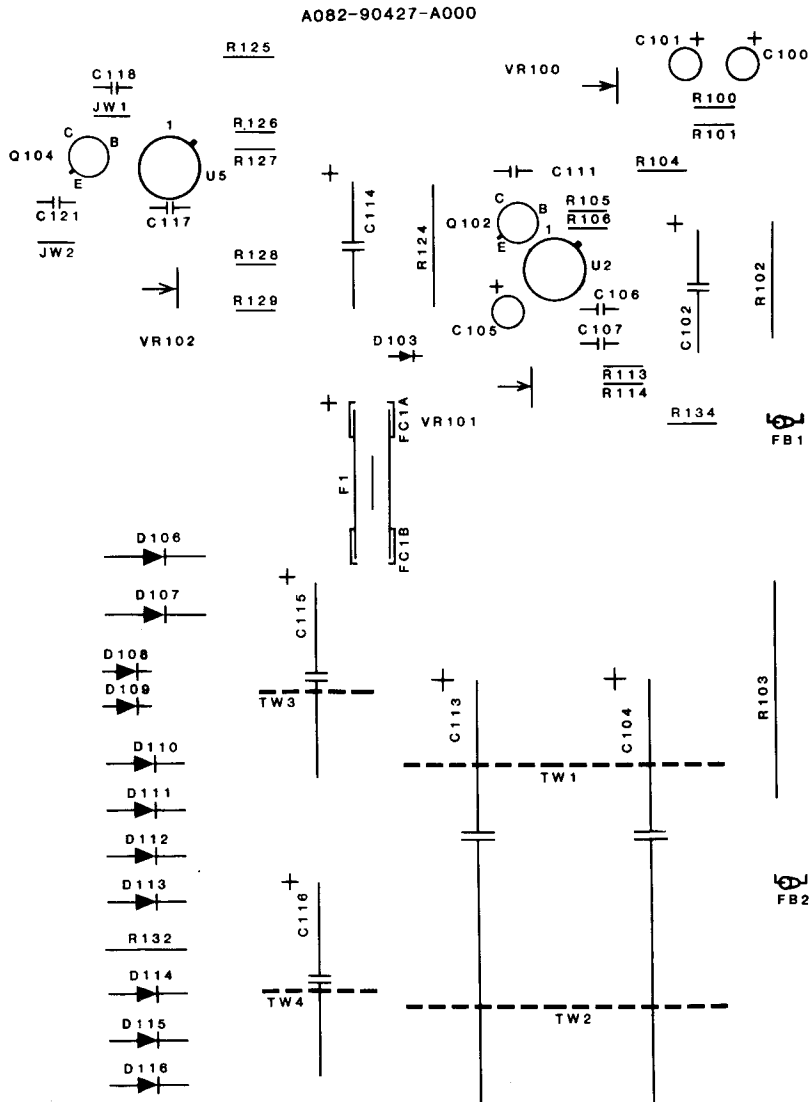
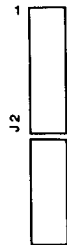
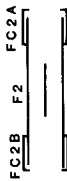
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J3-2	0V
J3-3	0V
J3-4	0V
J3-5	0V
J3-6	0V
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J3-8	0V
J3-9	0V
J3-10	0V
J3-11	0V
J3-12	0V
J3-13	0V
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J3-15	0V
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J3-84	0V
J3-85	0V
J3-86	0V
J3-87	0V
J3-88	0V
J3-89	0V
J3-90	0V
J3-91	0V
J3-92	0V
J3-93	0V
J3-94	0V
J3-95	0V
J3-96	0V
J3-97	0V
J3-98	0V
J3-99	0V
J3-100	0V

PROJECT ENG J. SZERSZEN
 DESIGNED BY BURGERTIME
 FULL AND REVISIONS PER
 SCHEMATIC BURGERTIME CPU/DATA
 684-91-41-633
 11/24/82
 PART NO
 MOSI-00333-0008

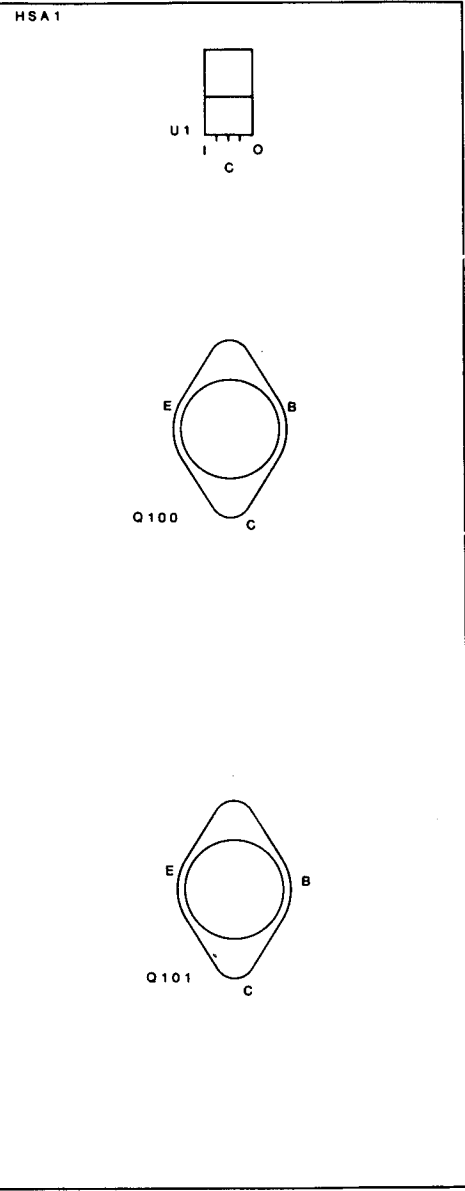
DESIGNATION LIST

<u>DESIGNATION</u>	<u>DESCRIPTION</u>	<u>DESIGNATION</u>	<u>DESCRIPTION</u>
C100	10 μ f RD TANT	D103	IN 4001
C101	0.47 μ f RD TANT 35 V	D106, 107	MR 750
C102	470 μ f AX. ELEC.	D108, 109	IN 4001
C104	25,000 μ f AX. ELEC.	D110 - D116	A15 F 50V 5A
C105	4.7 μ f RD TANT 35 V		
C106, 107	0.1 μ f	Q102, Q104	2N2905
C111	0.1 μ f		
C113	40,000 μ f AX. ELEC.	U2, U5	LM305
C114	470 μ f " " "		
C115	2200 μ f " " 25V	FBI, FB2	FERRITE BEAD
C116	4700 μ f " " "	FBMHI, FBMH2	FERRITE BEAD MTG HDRW. 2-20G SOLID WIRE
C117	47 pf		
C118	0.1 μ f		
C121	0.1 μ f		
R100	100 ohm 1/4 W 5% CRBN	HSA1	HEAT SINK ASSY.
R101	470 " " " "	MHSA	HEAT SINK ASSY MTG HDRW 2-4-40 X 10 SLT RND 4-WASHER, 4, 120-.250-018 2-4-40 HEX NUT THERMAL COMPOUND
R102	0.18 " 5W "		
R103	0.16 " 15W "		
R104	68 " 1/2 W " CRBN	F1	FUSE, 1/4A, SLO-BLO
R105	24 " 1/4 W " "	F2	FUSE, 1 AMP
R106	270 " " " "	F1, F2	FUSE CLIP W/STOP
R113	1.2 K " " " "	J1	2 POS. KK-156
R114	560 " " " "	J1, J2	5 " " "
R124	25 " 5W 10%	J1	13 " " "
R125	68 " 1/2 W 5% CRBN	J2	6 " " "
R126	10 " 1/4 W 5% "		
R127	1 K " " " "		
R128	6.2 K " " " "		
R129	1 K " " " "		
R132	150 " 2W 10%		
R134	68 " 1/2 W 5%		
VR100, 101, 102	100 ohm POT	JW1, JW2, JW3	JUMPER WIRE
		TW1-TW4	TIE WRAP
		LB1	TAG, FUSE 1/4A. SLO-BLO
		LB2	TAG, FUSE 1AMP
		LB3	TAG, PWR SPLY I. D.

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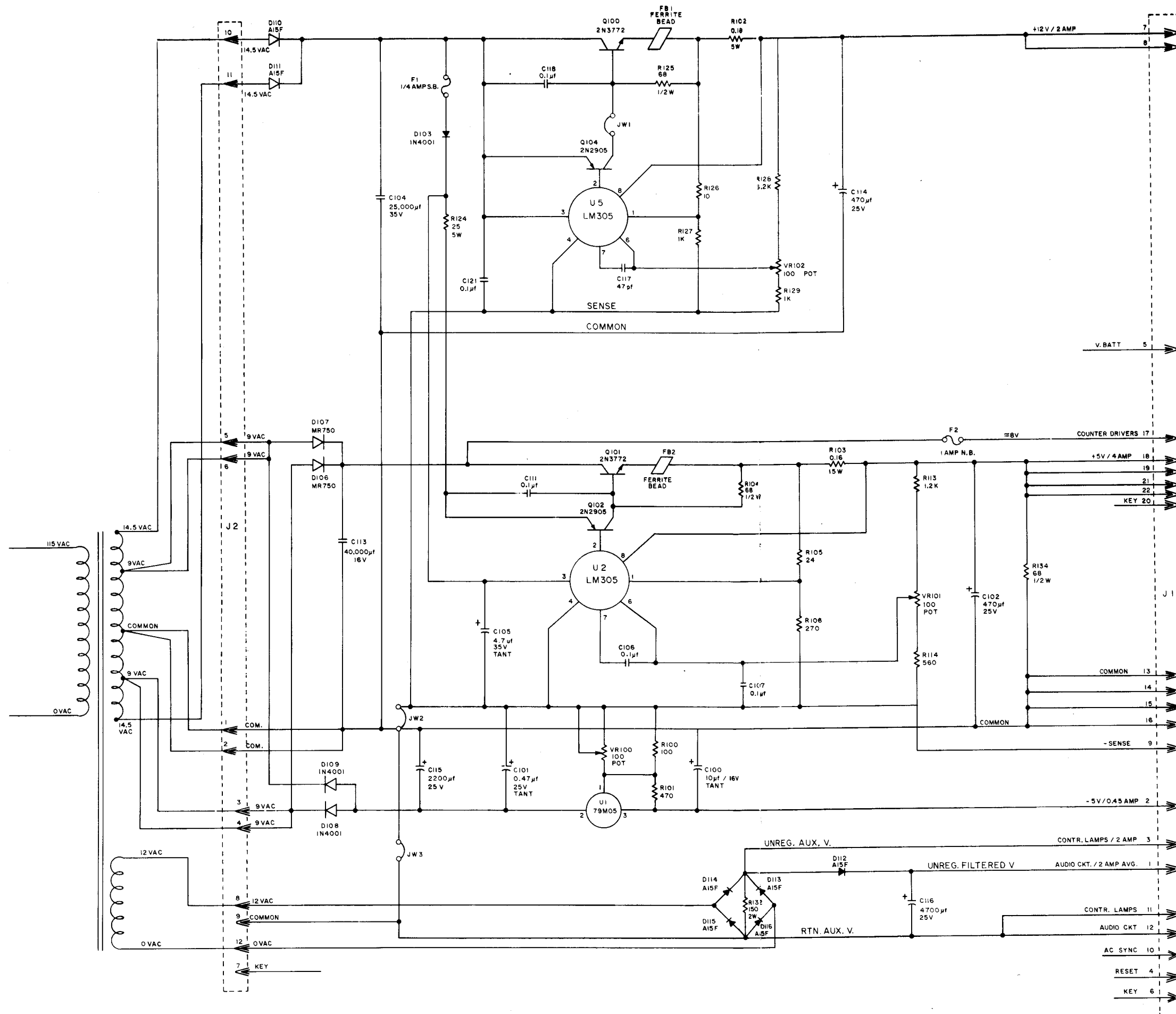
MEDIUM POWER SUPPLY 70VA



CROSS REFERENCE LIST

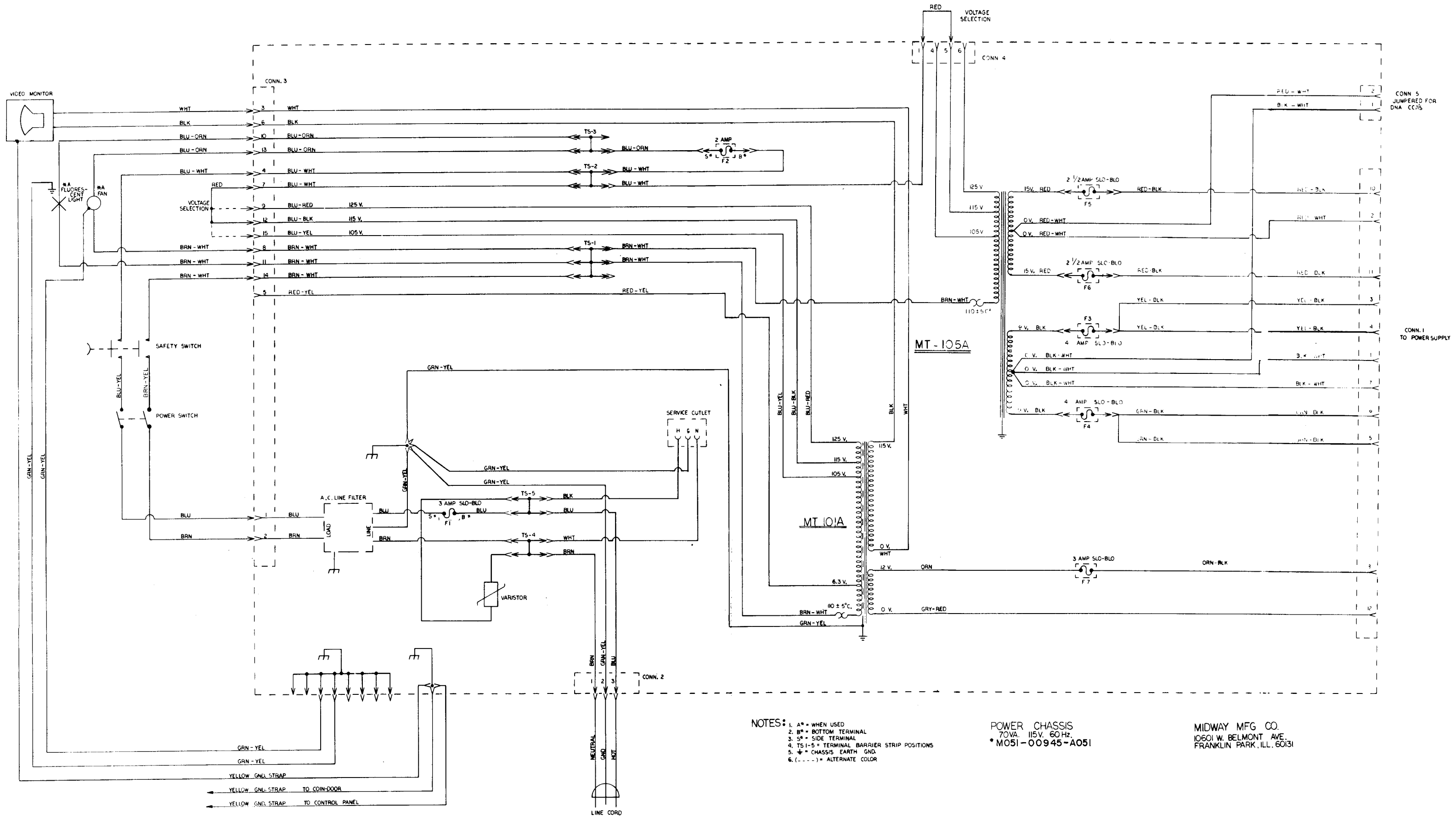
DESCRIPTION	QTY	DESIG. NOS.	PART NOS.	DESCRIPTION	QTY	DESIG. NOS.	PART NOS.
47 pf	1	C117	0945-00811-0100				
0.1 pf	5	C106, 107, 111, 118, 121	0945-00811-0200	2N 2905	2	Q102, 104	0945-00808-0300
0.47 pf RD TANT 35V	1	C101	0945-00816-1100				
4.7 pf " " "	1	C105	0945-00811-0400	LM 305	2	U2, U5	0945-00813-0100
10 pf " " "	1	C100	0945-00816-1000				
470 uf AX. ELEC.	2	C102, 114	0945-00816-0600	FERRITE BEAD	2	FB1, FB2	0017-00009-0225
2200 pf " " 25V	1	C115	0945-00816-1300	FERRITE MTG. HDRW.		FBMH1, FBMH2	
4700 uf " " "	1	C116	0945-00811-0700				
25,000 pf " " "	1	C104	0945-00816-1700	20 G SOLID WIRE	2	FBMH1, FBMH2	0017-00033-0139
40,000 pf " " "	1	C113	0945-00816-1800				
				HEAT SINK ASSY	1	HSA1	A945-00008-0100
0.16 ohm 15W 5%	1	R103	0945-00815-0100				
0.18 " 5W 5%	1	R102	0945-00815-0200	4-40 X 10 SLT RND	2	HSA1	0017-00101-0727
10 " 1/4W 5% CRBN	1	R126	0062-051B3-1XXX	WSH, 4, 120-.250-018	4	HSA1	0017-00104-0071
24 " " " "	1	R105	0062-065B3-1XXX	4-40 HEX NUT	2	HSA1	0017-00103-0002
25 " 5W 10%	1	R124	0945-00815-1000				
68 " 1/2W 5%	3	R104, 125, 134	0062-098D3-1XXX	FUSE, 1/4 A SLO-BLO	1	F1	0017-00003-0446
100 " 1/4W 5% CRBN	1	R100	0062-110B3-1XXX	FUSE, 1 AMP	1	F2	0017-00003-0001
150 " 2W 10%	1	R132	0945-00812-0200	FUSE CLIP W/STOP	4	F1, F2	0017-00071-0033
270 " 1/4W 5%	1	R106	0062-138B3-1XXX				
470 " " " "	1	R101	0062-156B3-1XXX	2 POS. KK-156 CONN.	1	J1	3000-16387-0200
560 " " " "	1	R114	0062-162B3-1XXX	5 " " " "	2	J1, J2	3000-16387-0500
1K " " " "	2	R127, 129	0062-179B3-1XXX	6 " " " "	1	J2	3000-16387-0600
1.2K " " " "	1	R113	0062-183B3-1XXX	13 " " " "	1	J1	3000-16387-1300
6.2K " " " "	1	R128	0062-217B3-1XXX				
				22 AWG 2 1/2 IN.	3	JW1, JW2, JW3	0151-00087-0000
100 ohm POT	3	VR 100, 101, 102	0945-00814-0000	TIE WRAP 7 5/8 IN.	2	TW3, TW4	0945-00814-0300
				TIE WRAP 10 3/4 IN.	2	TW1, TW2	0945-00814-0400
A 15F 50V 5A DIODE	7	D110 - D116	0945-00804-0200	TAG, FUSE 1/4 A. SLO-BLO	1	LB1	M051-00945-A020
				TAG, FUSE 1 AMP	1	LB2	M051-00945-A021
IN 4001	3	D103, 108, 109	0945-00804-0300	TAG, PWR SPLY 1D.	1	LB3	M051-00945-A022
MR 750	2	D106, 107	0945-00804-0800	70 VA PWR SPLY PC.	1	_____	A080-90421-C000
				HEAT SINK ASSY	1	_____	0017-00033-0139

PROJECT ENG J. JARON		USED ON BLUEPRINT		REVISIONS	
DO NOT SCALE DIMS		HEAT TREAT	SCALE FULL	NO REQ'D 1 PER	
DIM. TOLERANCES UNLESS OTHERWISE SPECIFIED		MATERIAL	ASSY DRWNG. MED PS. 70 VA (A082-90421-C000)		PART NO M051-00945-A031
DATE 12/2/82	DRAWN TJB	FINISH	A082-90427-A000		FRANKLIN PK ILL



REVISIONS		MIDWAY MFG. CO.	
NO.	DATE	REVISED BY	REASON

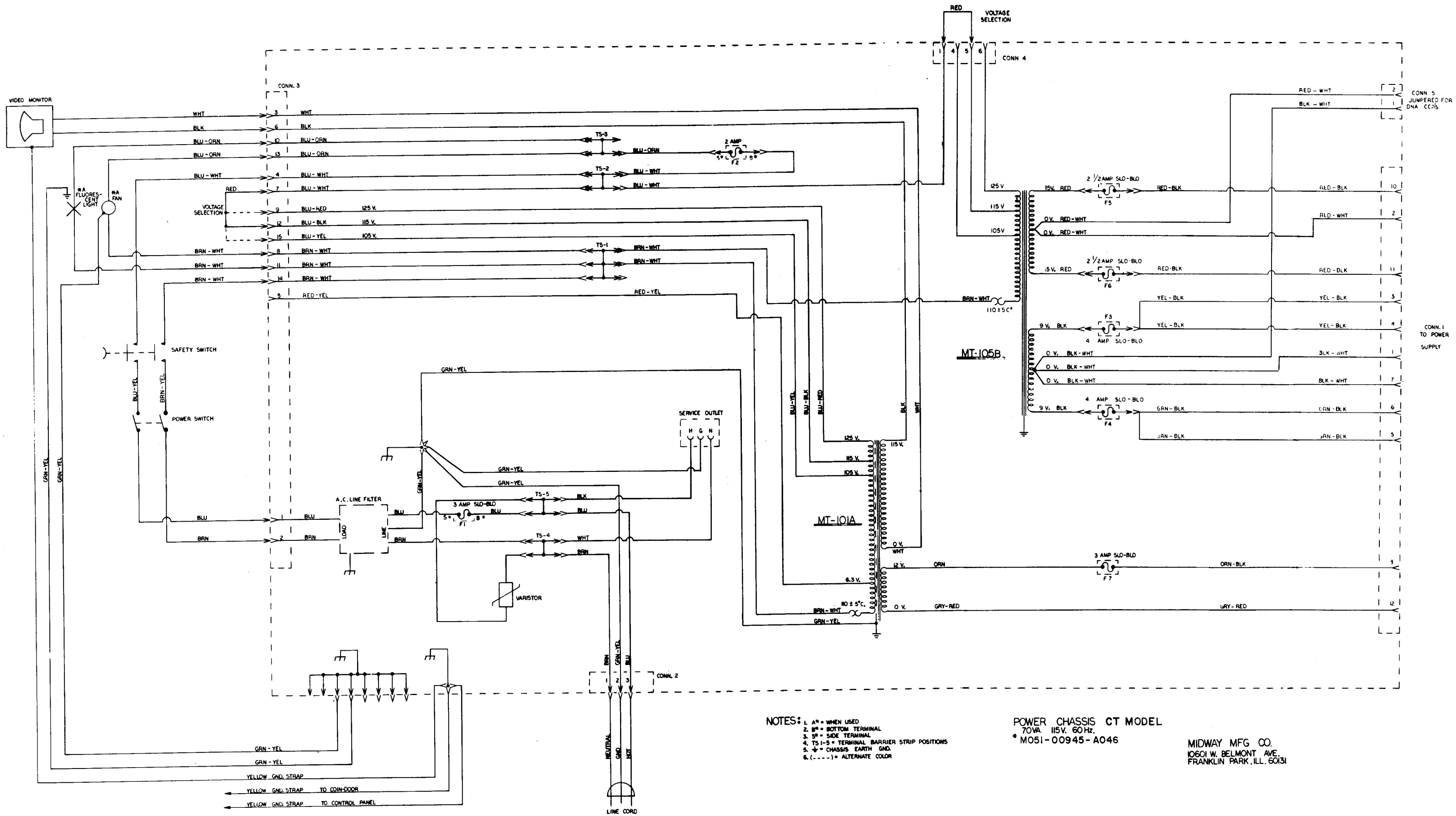
PROJECT ENG.	DESIGNED BY: J.S.	SCALE: 1/2" = 1"	DATE: 12/02/82
DRAWN BY: R.L.W.	CHECKED BY:		
MEDIUM PWR. SUPPLY 70 VA		PART NO. MO51-00945-A032	
A082-90421-C000			



NOTES: 1. A* = WHEN USED
 2. B* = BOTTOM TERMINAL
 3. S* = SIDE TERMINAL
 4. TS-1-5 = TERMINAL BARRIER STRIP POSITIONS
 5. * = CHASSIS EARTH GND.
 6. (---) = ALTERNATE COLOR

POWER CHASSIS
 70VA, 115V, 60Hz
 * M051-00945-A051

MIDWAY MFG CO.
 10601 W. BELMONT AVE.
 FRANKLIN PARK, ILL. 60131



NOTES: 1. A* = WHEN USED
 2. B* = BOTTOM TERMINAL
 3. S* = SIDE TERMINAL
 4. TS-1-5 = TERMINAL BARRIER STRIP POSITIONS
 5. ⚡ = CHASSIS EARTH GND.
 6. (---) = ALTERNATE COLOR

POWER CHASSIS CT MODEL
 70VA 115V. 60HZ.
 * MO51-00945-A046

MIDWAY MFG CO.
 10601 W. BELMONT AVE.
 FRANKLIN PARK, ILL. 60131

BURGER TIME CPU BOARD

Chip Number	Function	Chip Number	Function
74LS00	Quad 2 Input NAND	74LS174	Hex D Flip-Flop
74LS02	Quad 2 Input NOR	74LS175	Quad D Flip-Flop
74LS04	Hex Inverters	74LS194	4 Bit Universal Shift Register
74LS10	Triple 3 Input NAND	74LS283	4 Bit Binary Adder
74LS20	Dual 4 Input NAND	74LS367	Hex Bus Driver
74LS27	Triple 3 Input NOR	74LS374	Octal D Type Flip-Flop
74LS30	8 Input NAND	CPU 7	CPU & Bus Buffers
74LS32	Quad 2 Input OR	2732	4K x 8 EPROM
74LS74	Dual D Type Flip-Flop	MSM2128	2K x 8 RAM
74LS86	Quad 2 Input XOR	M58725	2K x 8 RAM
74LS89	16 x 4 RAM	2114	1K x 4 RAM
74LS112	Dual JK Type Flip-Flop	93425	256 x 1 RAM
74LS125	Quad Buffer — Tri State	HM2511	256 x 1 RAM
74LS138	3 to 8 Line Decoder	74S89	16 x 4 RAM
74LS153	Dual 4 to 1 Line Multiplexer	MB461	16 x 4 RAM
74LS157	Quad 2 to 1 Line Multiplexer	555	General Purpose Timer
74LS163	4 Bit Binary Counter — Synchronous Clear	12000	X-Tal 12MHZ

BURGER TIME SOUND BOARD

Chip Number	Function	Chip Number	Function
74LS00	Quad 2 Input NAND	74LS245	Octal Bus Transceiver
74LS02	Quad 2 Input NOR	74LS283	4 Bit Binary Adder
74LS04	Hex Inverters	74LS367	Hex Bus Driver — Tri State
74LS20	Dual 4 Input NAND	74LS374	Octal D Type Flip-Flop
74LS32	Quad 2 Input OR	6502	CPU
74LS42	BCD to Decimal Decoder	2732	4K x 8 EPROM
74LS74	Dual D Type Flip-Flop	2716	2K x 8 EPROM
74LS86	Quad 2 Input XOR	4118	1K x 8 RAM
74LS112	Dual JK Type Flip-Flop	MK4801	1K x 8 RAM
74LS138	3 to 8 Line Decoder	AY-3-8910	Sound Generator
74LS157	Quad 2 to 1 Line Multiplexer	555	General Purpose Timer
74LS174	Hex D Type Flip-Flop	1181	Audio Amplifier
74LS194	4 Bit Universal Shift Register	4558	Dual Operational Amplifiers