

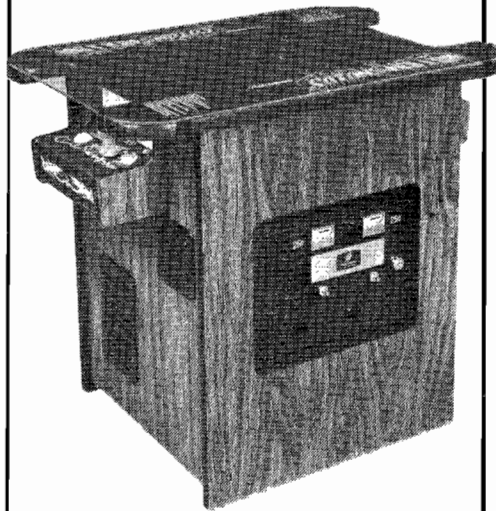
# Bally/Midway's



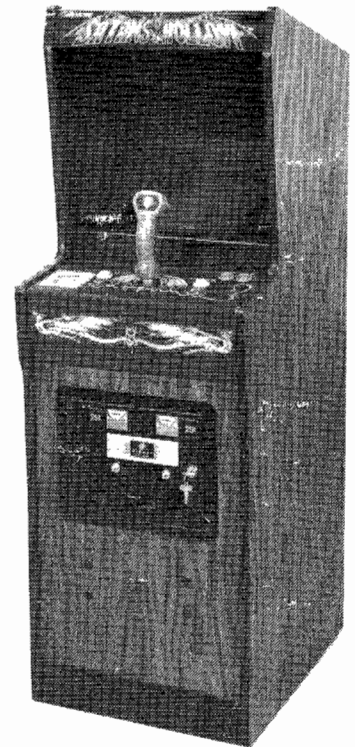
## Parts & Operating Manual



NO. 941 UPRIGHT



NO. 942 COCKTAIL



NO. 943 MINI

# Bally

MIDWAY MFG. CO.

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



Phone: (312) 451-1360

Cable Address: MIDCO

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 installed and used in accordance with the Instructions Manual, may cause interference to Radio Communications. As temporarily permitted by Regulation it has not been tested for compliance to Subpart J or Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference. 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.

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# Satan's Hollow

## 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

SATAN'S HOLLOW is a one or a two player game. There are three models: the "UPRIGHT", "MINI", and "COCKTAIL TABLE". The Upright and Mini models have been designed for either **RIGHT** or **LEFT** hand use. When the two player mode is selected on the Upright or Mini model, the players take turns at the controls to take their Rocket Launcher 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, the Rocket Launcher is under **YOUR** control. **YOU** make it move back and forth across the screen to launch Rockets that will eliminate your attackers. These attackers are displayed in groups, called "racks", across the top of the screen. The first rack is made up of a small number of attackers. The second rack is made up of a larger number of these attackers. And intermixed with the racks of attackers is a rack with only a single fire-breathing Devil's head.

The attackers and the Devil's Head will try to wipe out your Rocket Launcher. If they do, you lose one player. In emergencies, you have a Shield which goes all

around your Rocket Launcher for a short period of time. It is activated by pushing the Shield Button on the control console. **BUT BE CAREFUL!!** This consumes a lot of power and will only last a **VERY SHORT TIME!**

Each attacker eliminated will cause a Bridge Section to appear at the lower left corner of the screen **EXCEPT:** when there is already a Bridge Section there or when you have a Bridge Section in tow under your Rocket Launcher. Pick these Sections up with your Rocket Launcher and move them over to build a Bridge across the gorge at the right side of the screen leading into the land of SATAN.

When you complete your Bridge into the land of SATAN, you can cross it and do battle with him. If you win you will be rewarded by increased fire power for your Rocket Launcher. If SATAN defeats you, you lose one player.

As your skill level increases, the number of attackers is increased and the speed that the fire-breathing Devil's Head moves is increased also.

Bonus Rocket Launchers are awarded to you periodically throughout the game as you reach or pass certain preselected point values. Each attacker has an assigned point value as listed in Figure 1-1.

## Major Features

There are several major features in your SATAN'S HOLLOW game: 1) a complete and easy-to-use diagnostic package featuring: 2) A complete ROM/RAM check with bad chip location information read-out on the monitor screen; 3) The capability to check each of the game's different sounds **INDIVIDUALLY**; 4) Provision for checking each control and switch **SEPARATELY**; 5) A full function Bookkeeping mode; 6) An entire options list that can be set from the front console with **NO NEED** to crawl inside the back of the cabinet and look for tiny switches located on P.C. boards; 7) A sound system test; 8) A "PRE-SET" category that returns **ALL** information in the Bookkeeping mode to zero and all operator selected options back to factory recommended settings; and 9) The game is equipped with a rechargeable battery so that it won't forget where it was the night before at closing — even if you turn it off. It will "remember" this information for up to two weeks.

## Game Objective

The object of the game is to **HAVE FUN** while constantly improving your skills as you play, eliminating as many attackers as possible each time to get the highest score.

DESCRIPTION	POINTS AWARDED
SATAN	1000
LUCIFER	1000
OLD NICK	500
BEELZEBUB	250
EGG THROWER	225
BRIDGE BOMBER	225
GARGOYLE	120

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.
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. 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 Figures 2-1 & 2-2.
    - Power supply.
    - Control panel(s).
    - T.V. monitor.
    - Other P.C.B.'s and/or P.C.B. rack, etc.
    - Power supply and filter 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 32" (63 x 81cm)
  - Mini 20" x 24" (50 x 60cm)
  - Cocktail 32" x 22" (81 x 55cm)
- Game height:**
  - Upright 70" (175cm)
  - Mini 61" (153cm)
  - 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.

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 and Mini models).
- When any access door is opened, the interlock switch installed there turns off all power to the game.

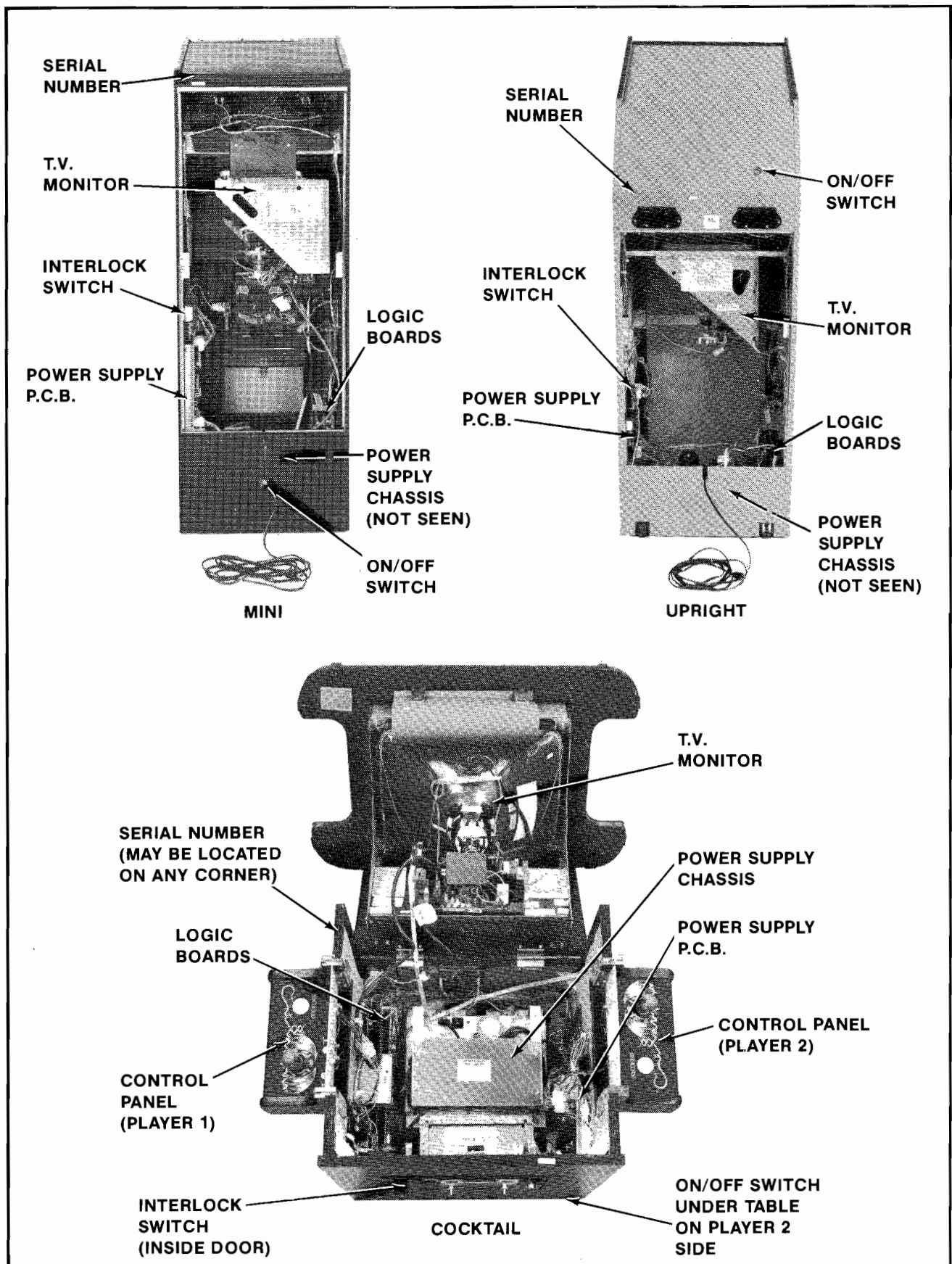


Figure 2-1 Location of Serial No., Interlock Switch, On/Off Switch and Major Sub-Assys.



Figure 2-2 Major Sub-Assys. (Cont. from Fig. 2-1)

- 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 all 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 and Mini 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 2-3.

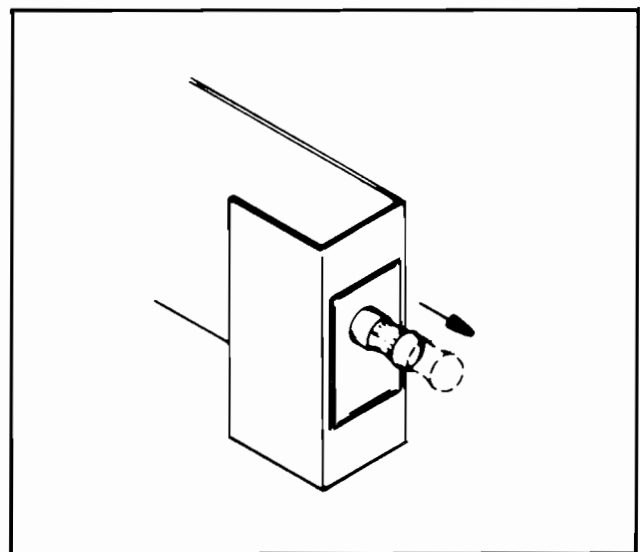


Figure 2-3 Interlock Switch Operation

## 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. 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).

## GAME VOLUME ADJUSTMENT CONTROL:

See Figure 2-4.

The game volume control pot is located just inside the cabinet on the right side of the coin door frame. There is only one pot. For adjustment, it may be reached through the coin door on **ALL** models.

To make the sounds louder, turn the pots clockwise as you face them ( ↻ ).

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

## OPTION SETTINGS:

To change the most common option settings, you **DO NOT** have to take the game apart or go into the cabinet and hunt for tiny switches on P.C. boards. These most common options can be changed from the main console of the game while it is in the Self-Test mode. The Self-Test switch is located just inside the cabinet on the right side of the coin door frame as you face it.

When changing any options, **ALWAYS** perform the Self-Test and play the game to be sure the ones selected are working properly. Of course, when you must change one of the switches that is located on one of the game's P.C. boards, it is also recom-

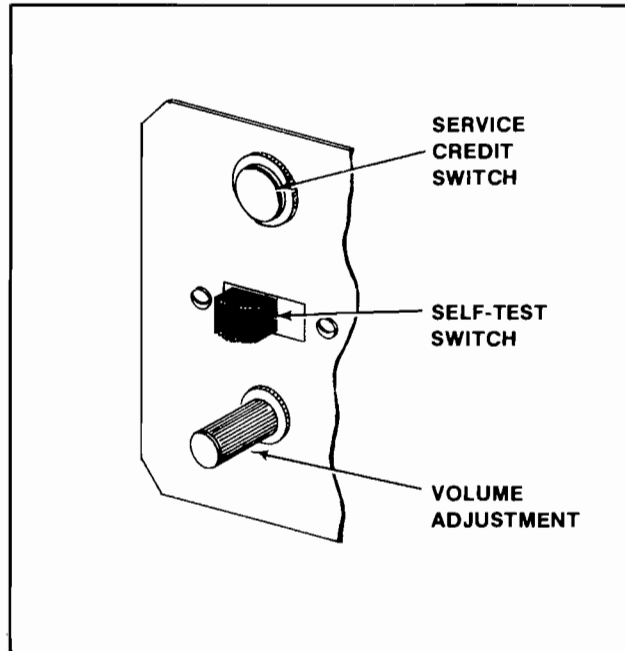


Figure 2-4 Location of Volume Control

mended that you perform the Self-Test 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 P.C. Board option switch settings, and what they will make the game do are shown in Figure 2-6. These switches are MAINLY INTENDED for use by a technician who is checking and/or performing tests on the game. See Figure 2-5 for option switch locations.

**NOTE:** In order to set the option switches located on the game's P.C. Boards, these Boards need not be removed from their card rack.

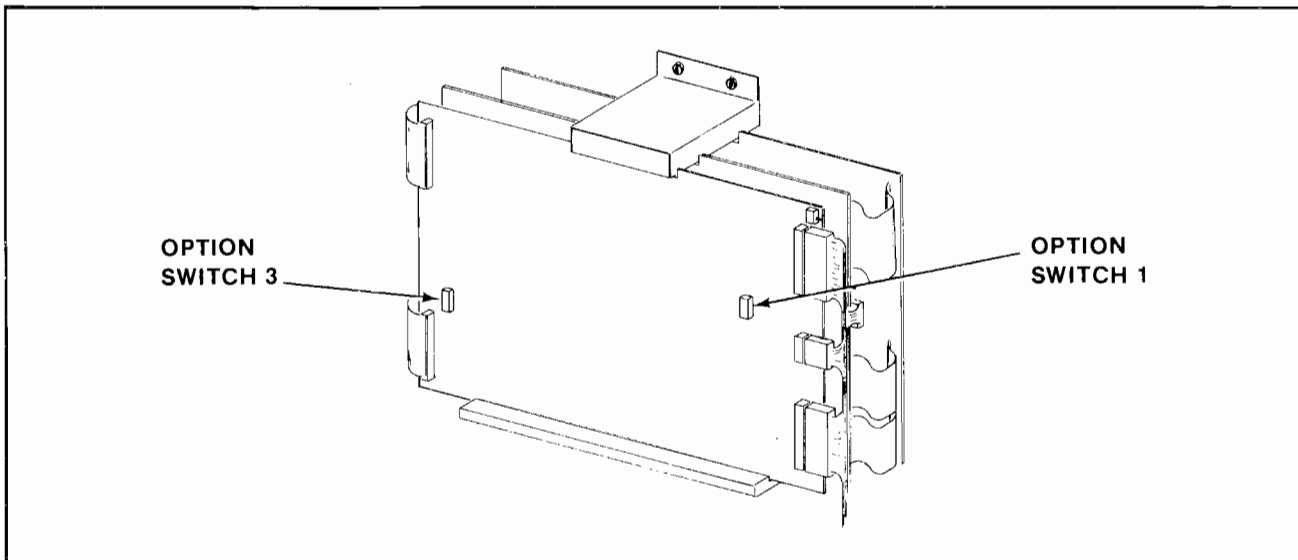


Figure 2-5 Option Switch Locations

SATAN'S HOLLOW	
OPTION SWITCH SETTINGS	
<b>SWITCH NO. 1 — AT B3 — LOCATED ON SOUND I/O P.C. BOARD</b>	
2 COIN METERS ***1 COIN METER	SW#1 SW#2 SW#3 SW#4 SW#5 SW#6 SW#7 SW#8 SW#9 SW#10 ON NOT NOT NOT NOT NOT NOT NOT NOT OFF USED USED USED USED USED USED USED USED
MINI/UPRIGHT COCKTAIL TABLE	ON OFF
FREEZE VIDEO ***NORMAL OPERATION	ON OFF
<b>SWITCH NO. 3 — AT D14 — LOCATED ON SOUND I/O P. C. BOARD</b>	
***NORMAL OPERATION SOUND I/O DIAGNOSTIC MODE	SW#1 SW#2 SW#3 SW#4 OFF ** ** ** ON
*** NORMAL OPERATION RAM/ROM TEST INDICATES TEST RESULTS VIA YELLOW LED ON SOUND I/O BOARD: <b>FAST FLASH = BAD ROM</b> <b>SLOW FLASH = BAD RAM</b>	OFF ON
***NORMAL OPERATION OSCILLATOR TEST	OFF ON
***NORMAL OPERATION FILTER TEST	OFF ON
** NO EFFECT IF SW#1 OF SWITCH NO. 3 IS IN THE "OFF" POSITION. ***INDICATES FACTORY RECOMMENDED SETTINGS.	<b>PART NO.</b> <b>M051-00941-A011</b>

THE REMAINDER OF SATAN'S HOLLOW'S MOST COMMON OPTION SETTINGS ARE CONDUCTED DURING THE **MACHINE SETUP** PORTION OF THE SELF-TEST MODE AND WILL BE COVERED IN DETAIL IN THAT SECTION OF THIS MANUAL.

Figure 2-6 Option Switch Settings



# III. Game Operation

SATAN'S HOLLOW 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 in Figure 3-1.

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

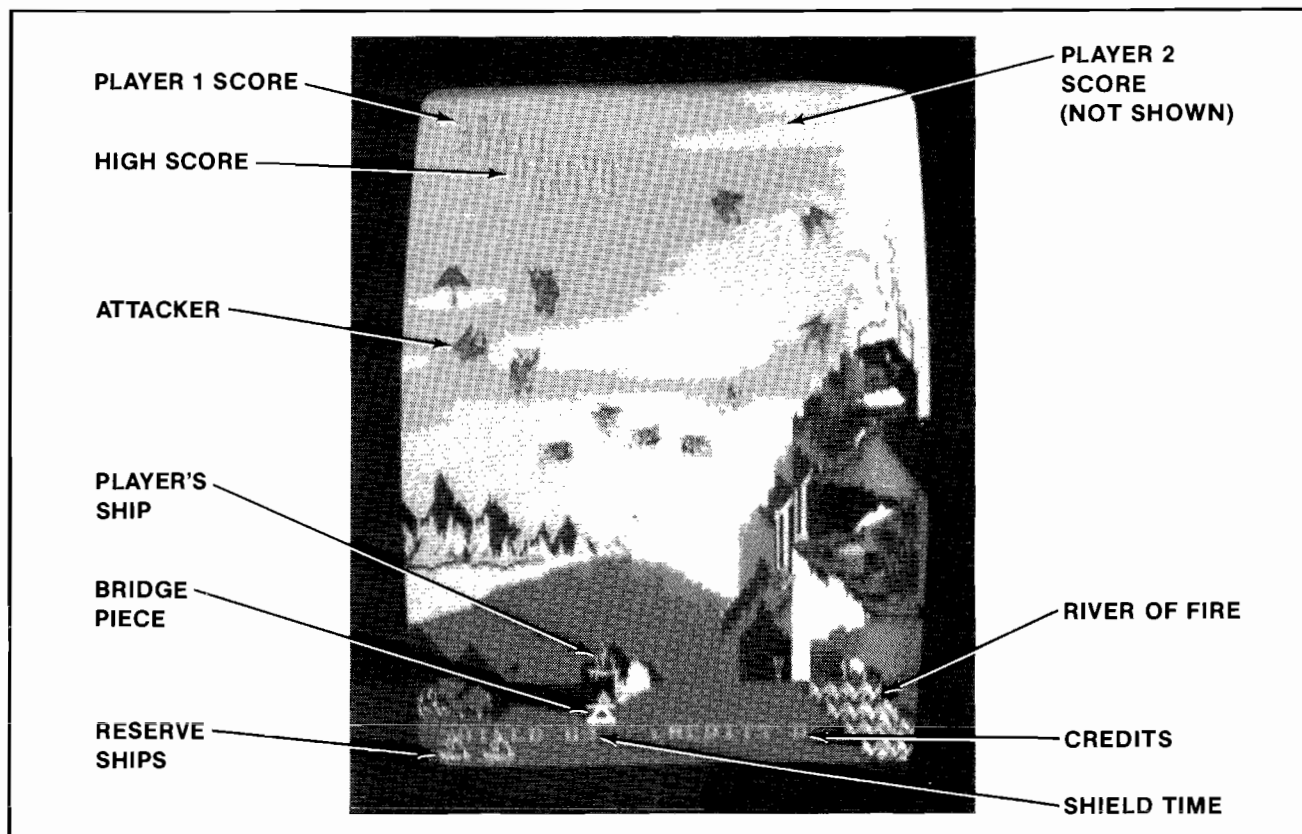


Figure 3-1 Identification of "On-Screen" Graphics During Play

## SELF-TEST MODE

The Self-Test mode is a special mode for checking game play statistics as well as 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 NOT** cause the game to erase any CREDITS it has in its memory when the Self-Test mode is entered.

You may begin a Self-Test at any time by sliding the Self-Test switch to the "ON" position after the power to the game is on (the Self-Test switch is located just inside the cabinet on the right side of the coin door frame as you face it). When this is done, the game will react as follows:

1. If the game is in the Attract mode when the Self-Test switch is moved to the "ON" position, it will finish the sequence and then go into the Self-Test

mode. This is illustrated by the display of the Self-Test Mode Menu on the monitor screen.

2. If the game is in the Ready-To-Play mode or the Play mode when the Self-Test switch is slid to the "ON" position, it **WILL NOT** go into the Self-Test mode until **AFTER** the player's last Missile Launcher has been destroyed (the game **MUST** be over). At this point, the game will go into the Self-Test mode. Again, this is illustrated by the display of the Self-Test Mode Menu on the monitor screen.
3. The fastest way to enter the Self-Test mode is to slide the Self-Test switch to the "ON" position and then activate the "TILT" switch located on the back side of the coin door just below the lock mechanism. The game will then **IMMEDIATELY** go into the Self-Test mode.

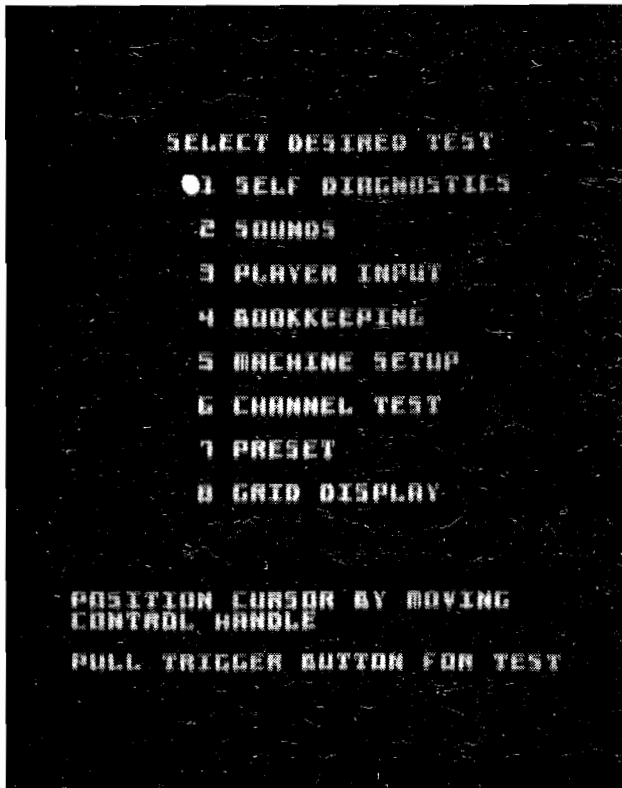


Figure 3-2 Self-Test — Menu

The Self-Test mode has eight (8) major categories as illustrated by Figure 3-2.

1. It is easy to select what category you want to enter. By moving the control stick left or right the Cursor at the left of the screen can be moved UP or DOWN until it is in front of the category you want to test. Release the control stick at this time.
2. After the Cursor has been positioned, depress either "SHIELD" Button on the console and the monitor screen will display the test category you have selected.

**NOTE:** There is one exception to this. If you position the Cursor in front of the "PRE-SET" category on the Self-Test Mode Menu, when you press the "SHIELD" Button on the console — EVERYTHING, I repeat — **EVERYTHING** — including **ALL** information in the "BOOKKEEPING" mode, and **ALL operator selected options**, will be set back to zero ("0") and to the factory recommended settings — **respectively**.

- Once you are **IN** one of the Self-Test mode categories, FOLLOW THE **ON-SCREEN INSTRUCTIONS TO COMPLETE THE TEST**.
3. The next group of Figures show the **CORRECT** screen presentation for **EACH** category of the Self-Test mode.

During the SELF DIAGNOSTICS section of the Self-Test mode, you will **first** see a cross hatch pattern on the screen for about 1/2 second. **Second**, you will see a lot of different colored bars shown on the monitor screen. These bars will be UNpainted one at a time from the top down. **Third**, you will see the screen painted Red, Blue, and Green in bars from the top down. **Fourth**, all the different colored bars you saw "**Second**" are displayed again. And **fifth**, the different colored bars are replaced by this message: "**HIT SHIELD BUTTON TO EXIT**". If the Shield Button is not hit, the test will repeat itself. This feature was designed into the game to enable over-night testing for an intermittent hardware problem.

If the SELF DIAGNOSTICS find one or more bad ROM or RAM chips: instead of going through what is described above, the game will give you a written message as to which parts are bad. This message includes their I.D.'s and their P.C. Board locations.

During the SOUNDS section of the Self-Test mode, the game will give a display which looks like that shown in Figure 3-2a.

- In this category, each of the game's separate sounds can be checked individually in any order — or — you can tell the game to check them all in order — 3 through 23.

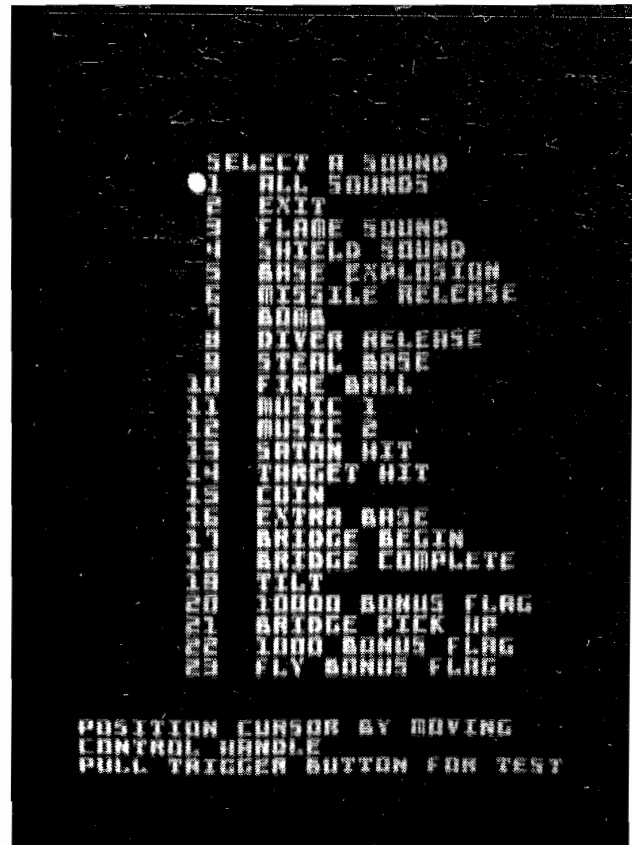


Figure 3-2a Self-Test — Sounds



During the PLAYER INPUT section of the Self-Test mode, the game will give a display which looks like that shown in Figure 3-2b.

- In this category, each of the game's player operated controls — including the coin switches on the back side of the coin door — may be checked individually. A game sound will be heard as each switch/control is actuated. If no game sound is heard, that switch/control is either not working, miswired, or disconnected. Check it out thoroughly.

As the Player Input Switches and Devices are activated, the Switch or Device activated is spelled out in the space indicated.

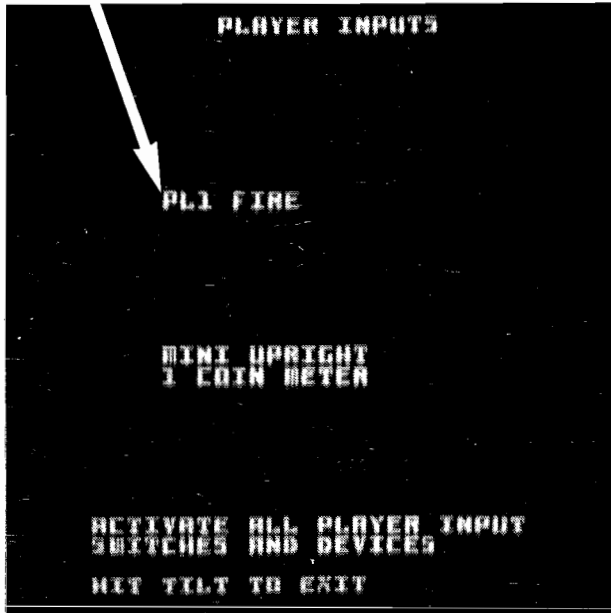


Figure 3-2b Self-Test — Player Inputs

During the BOOKKEEPING section of the Self-Test mode, the game will give a display which looks like that shown in Figure 3-2c.

- In this category a basic bookkeeping function is performed. And with the selection of the "TIME REPORT" and the "SCORE REPORT", detailed breakdowns of game times and scores may be obtained.

In the TIME REPORT and SCORE REPORT sections of the BOOKKEEPING mode, the game will give displays which look like those shown in Figures 3-2d and 3-2e respectively.

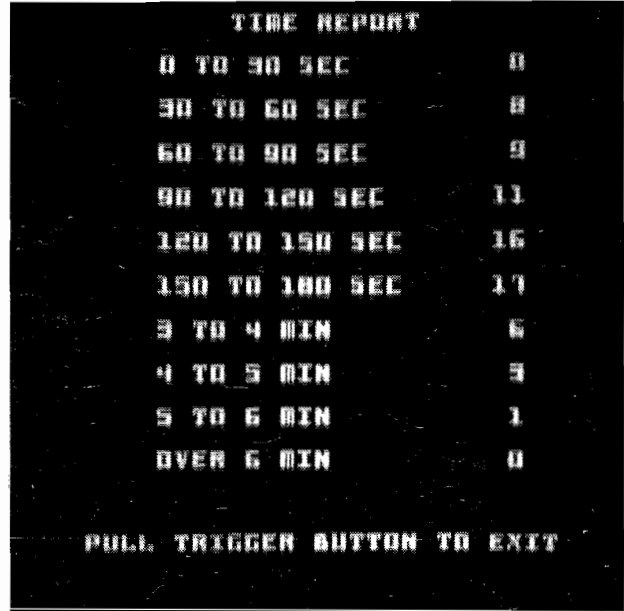


Figure 3-2d Self-Test — Time Report

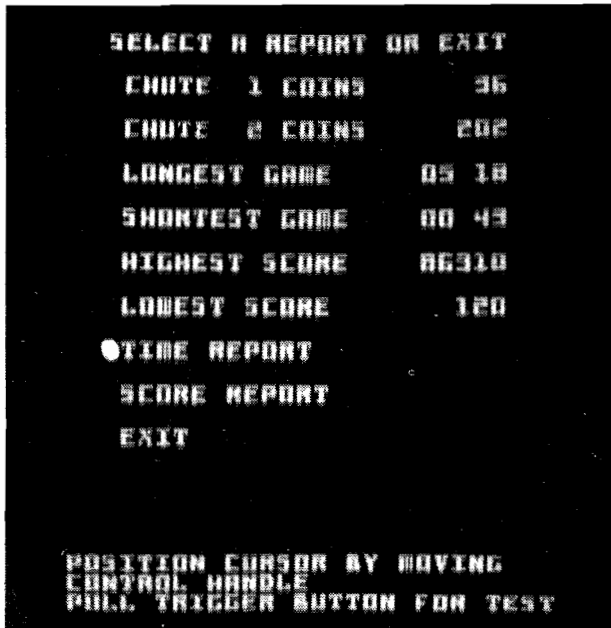


Figure 3-2c Self-Test — Bookkeeping

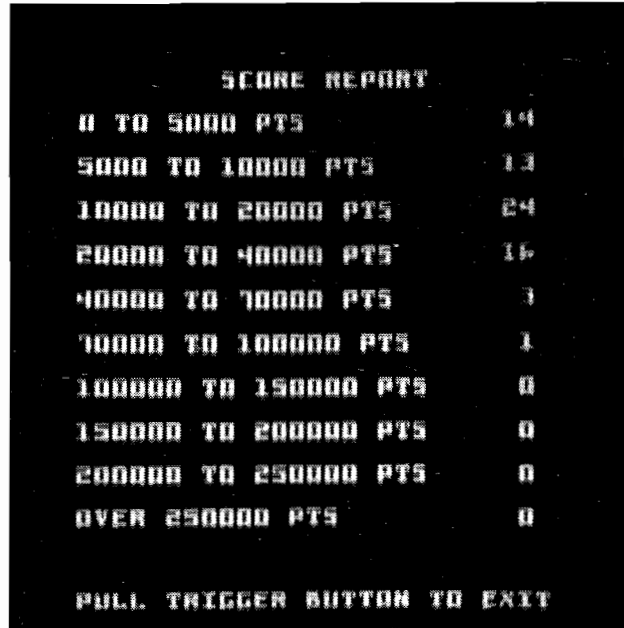
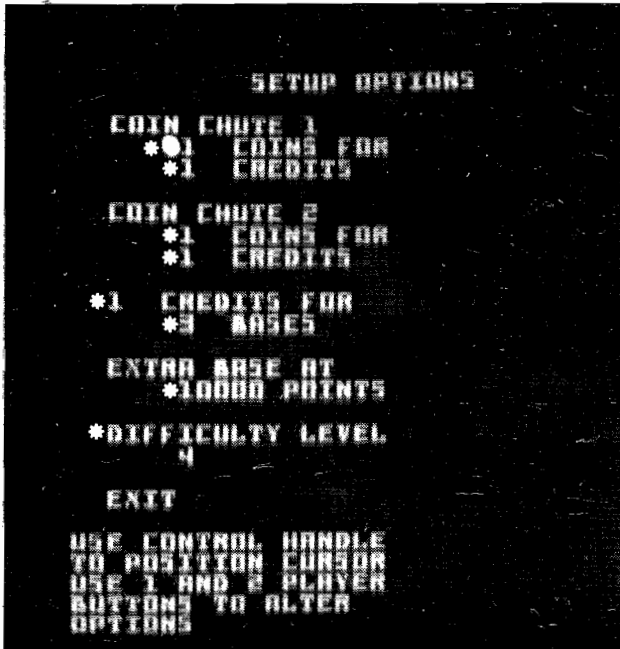


Figure 3-2e Self-Test — Score Report

During the SETUP OPTIONS section of the Self-Test mode, the game will give a display which looks like that shown in Figure 3-2f.

- In this category, all common game options may be changed from the control console: coins per credit, credits per base, bonus base(s) awarded at, difficulty level --, and so on.



\* = Factory recommended settings.

Figure 3-2f Self-Test — Set-Up Options

**DIFFICULTY LEVEL EXPLANATION:**

The Difficulty Level setting has a range of 1 to 9. With 1 being the easiest level of play and 9 being the most difficult level of play. We recommend that a setting of 4 be used as a beginning point.

Game play can then be made **MORE** difficult or **LESS** difficult, according to the skill levels attained by the players in your area.

**CHANNEL TEST:**

During the CHANNEL TEST section of the Self-Test mode, the game will give a display which looks like that shown in Figure 3-2g.

- In this category, the game conducts a test of its SOUND SYSTEM.

Once you enter the CHANNEL TEST section of the Self-Test mode, the game automatically tests Channels 1 through 6 giving a tone for each one as it checks it. After the 6th Channel is tested, the game automatically repeats the test until the "SHIELD" button is hit. It then goes back to the Self-Test Mode Menu.

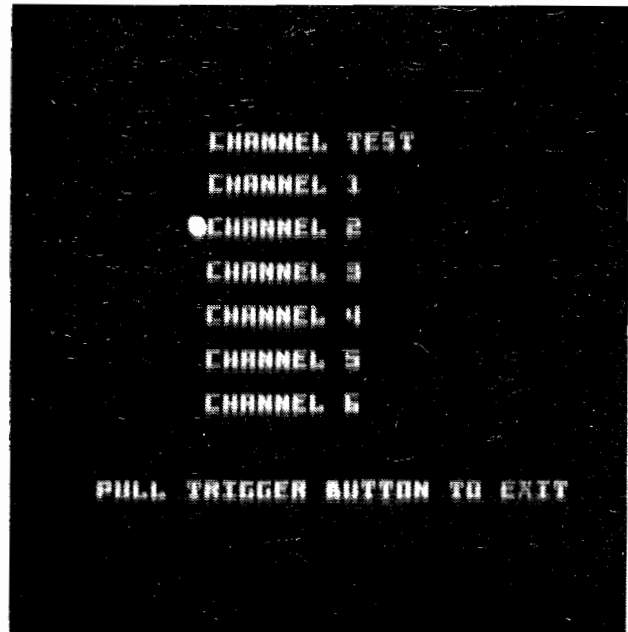


Figure 3-2g Self-Test — Channel Test

During the GRID DISPLAY section of the Self-Test mode, the game shows a white cross hatch pattern on the monitor screen. This is for alignment and/or test purposes. This pattern will remain on the monitor screen until the SHIELD Button is hit. The game will then go back to the Self-Test Mode Menu.

To leave the Self-Test mode, simply slide the Self-Test switch to the "OFF" position at **ANY** time. The game will then run through the ROM/RAM test display after which normal game functions will return to the monitor screen.

**RACK ADVANCE:**

The game can be made to advance through the various racks by beginning a game **and THEN** sliding the Self-Test switch to the "ON" position. After this has been done, each time you depress the ONE PLAYER BUTTON the game will advance one rack.

When you reach the desired rack, slide the Self-Test switch to the "OFF" position. (If you leave the Self-Test switch in the "ON" position, the game will go into the Self-Test mode when you are finished playing the rack you "advanced" to.)

**CROSS HATCH PATTERN:**

A cross hatch pattern is shown on the screen when power is first turned on to the game, when the TILT Switch is actuated, and during the "SELF DIAGNOSTIC" portion of the Self-Test mode, and during the "GRID DISPLAY" portion of the Self-Test mode.

This pattern may be kept on the screen for adjustment purposes as described earlier.

When you are finished using the cross hatch pattern, simply hit the SHIELD Button to return to the Self-Test Mode Menu.

### HARDWARE MASTER RESET SWITCH:

There are two of these little red switches, one on the Sound I/O Board and one on the CPU Board, located as shown in Figure 3-3.

The function of each of these switches — when pressed — is to make the game think it has **JUST**

been turned on. They set up an “initial power-up” condition.

We **DO NOT** recommend that you indiscriminately press **EITHER** of these switches. They should **ONLY** be used if there is a major problem encountered while testing the P.C. Boards.

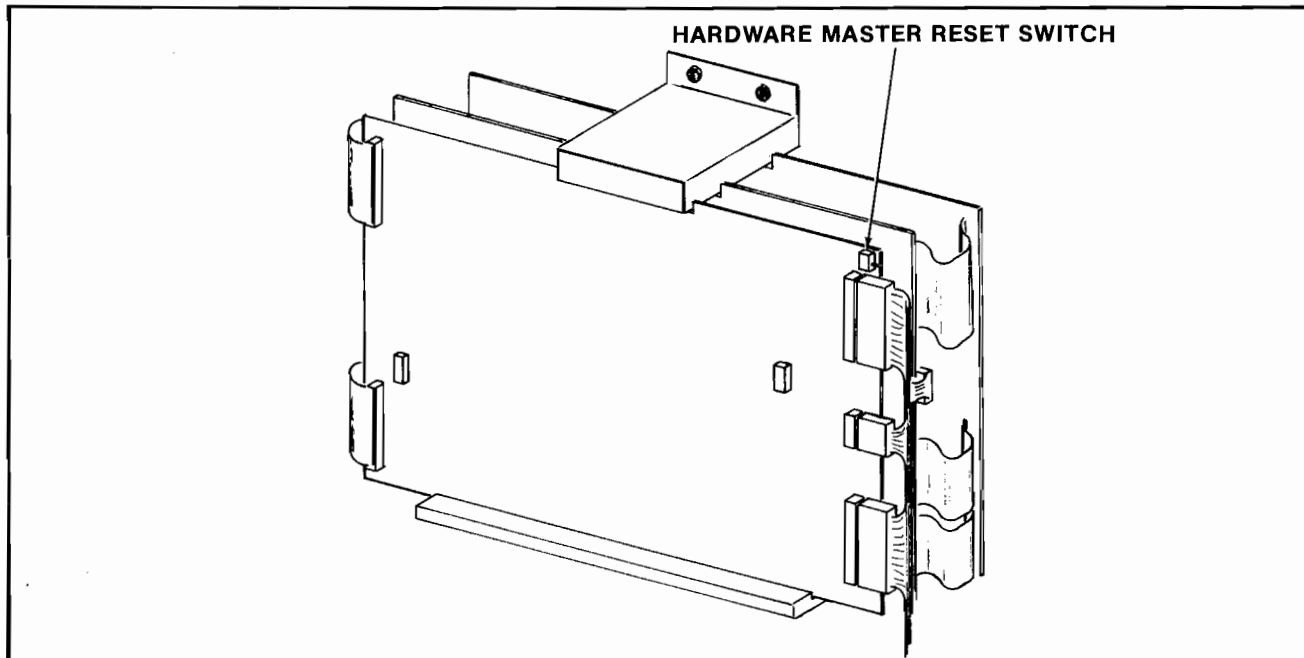
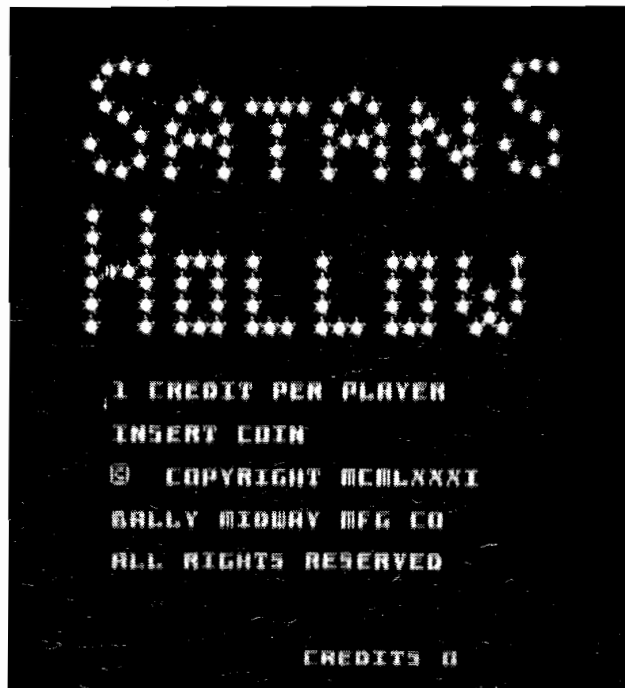


Figure 3-3 Location of Hardware Master Reset Switch

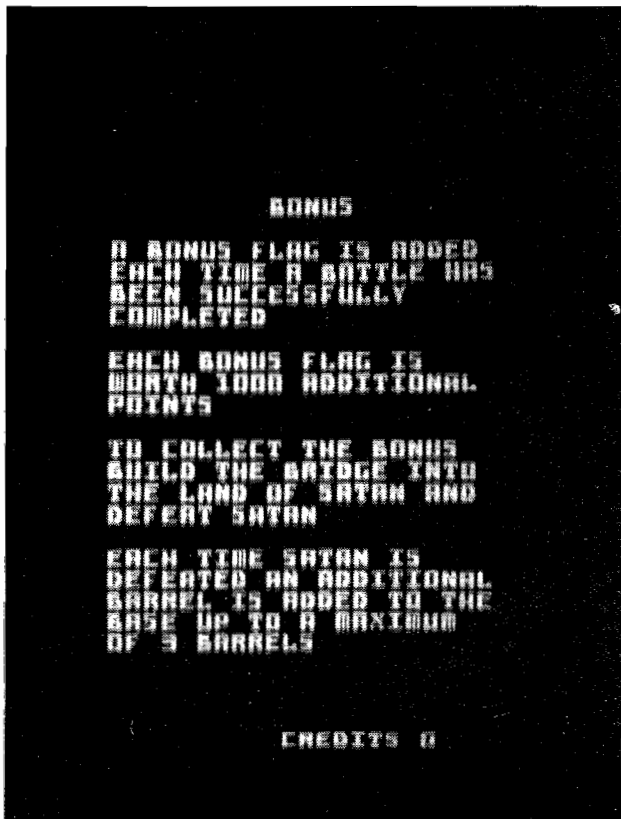
### ATTRACT MODE

1. The Attract mode starts:

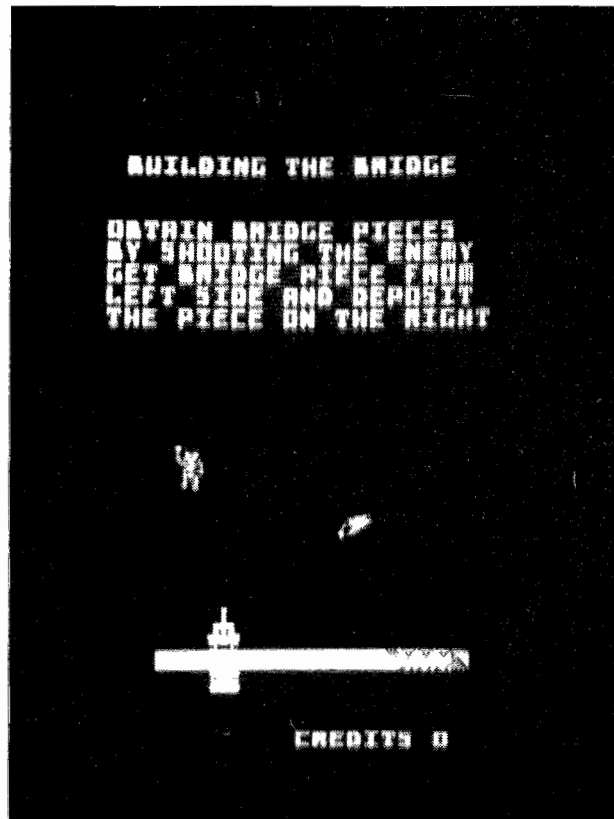
- Just after power has been turned on to the game. (Self-Test switch is in the “OFF” position.)
- After a Self-Test has been completed and there are no more credits left in the game’s memory.
- After a play has been finished, the score was not high enough to put the game into the High Score/Initial mode, 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:
- 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 hold this display on the monitor screen until the “1 PLAYER” or the “2 PLAYER” start button is pushed.



Attract Mode Display 1



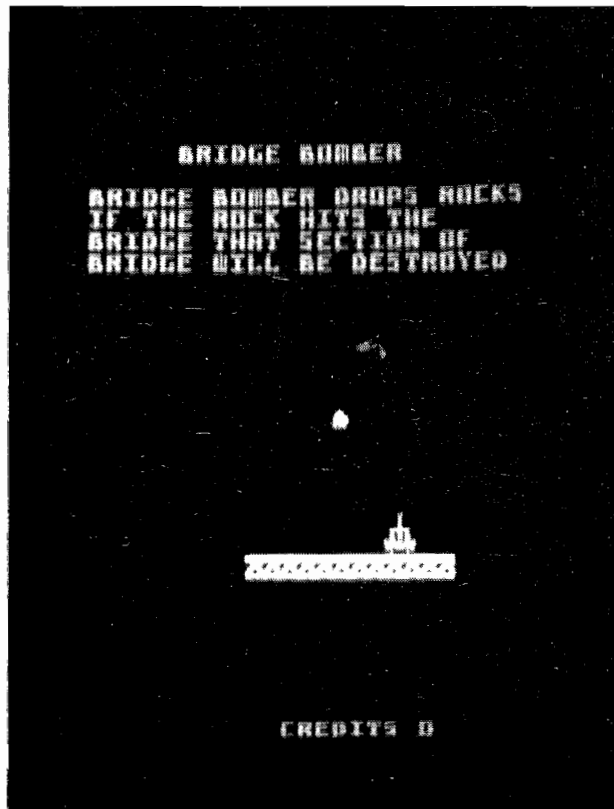
Attract Mode Display 2



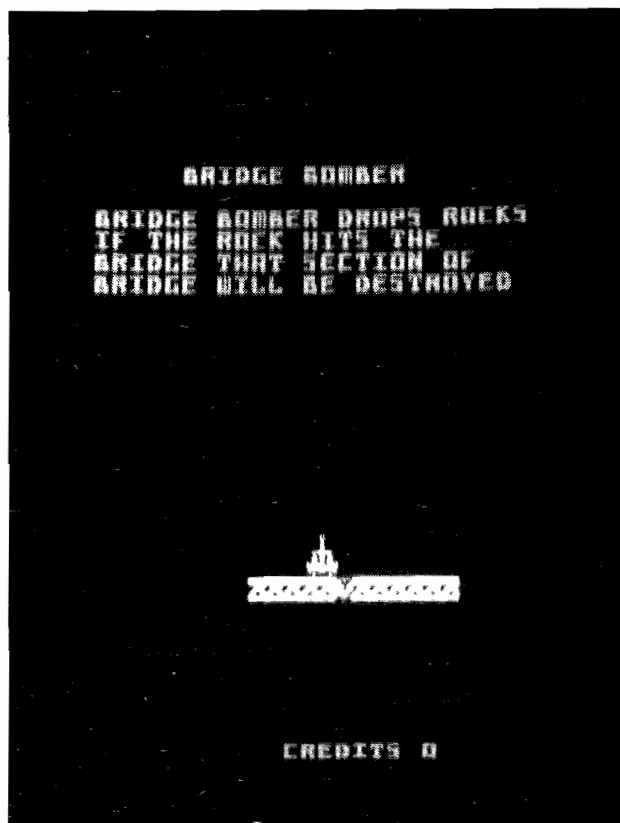
Attract Mode Display 4



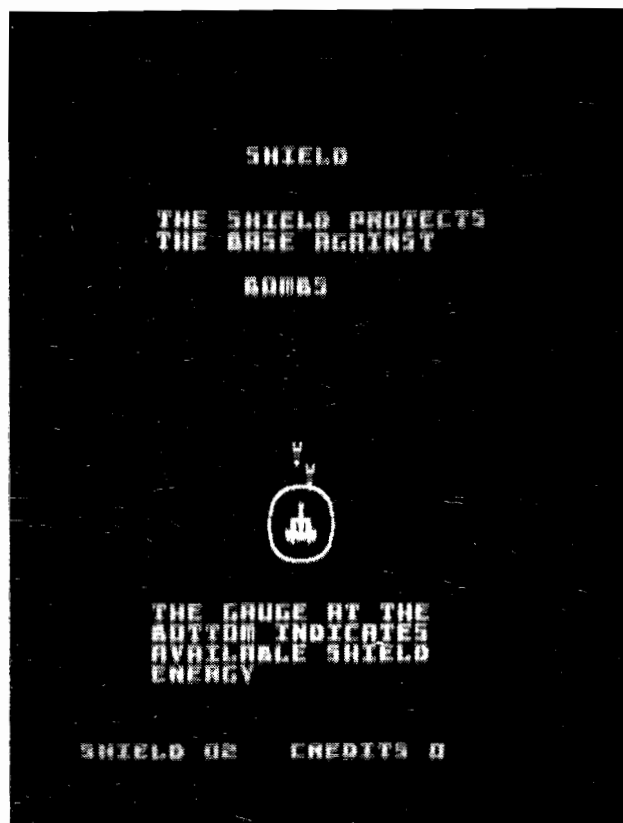
Attract Mode Display 3



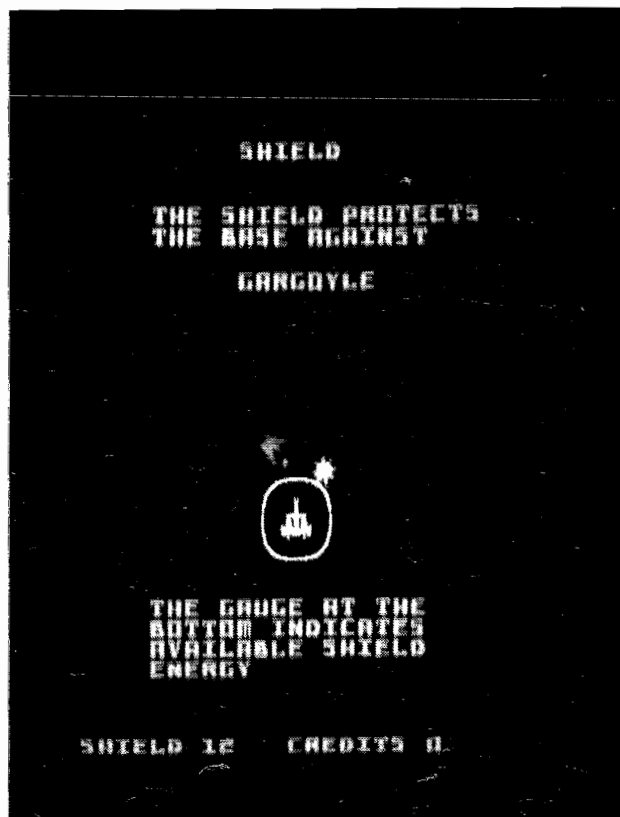
Attract Mode Display 5



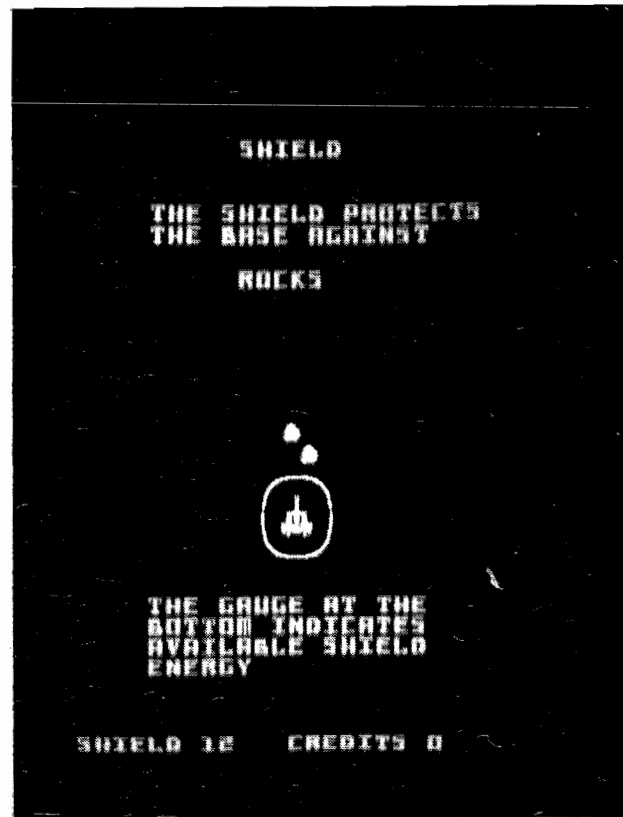
Attract Mode Display 6



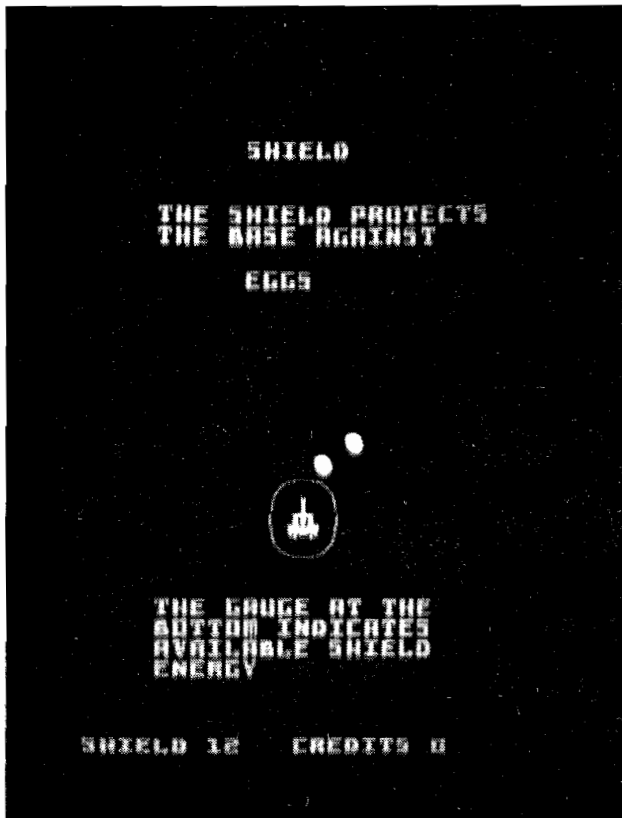
Attract Mode Display 8



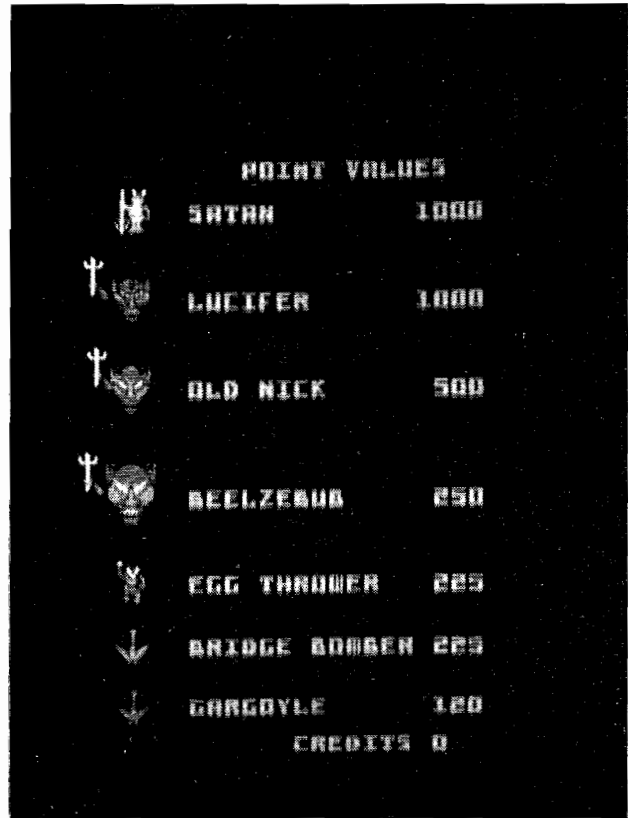
Attract Mode Display 7



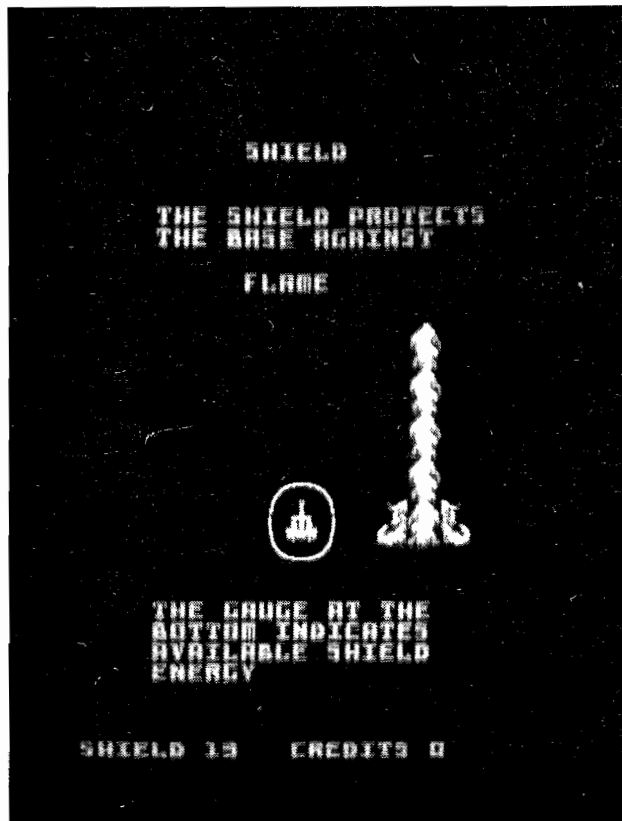
Attract Mode Display 9



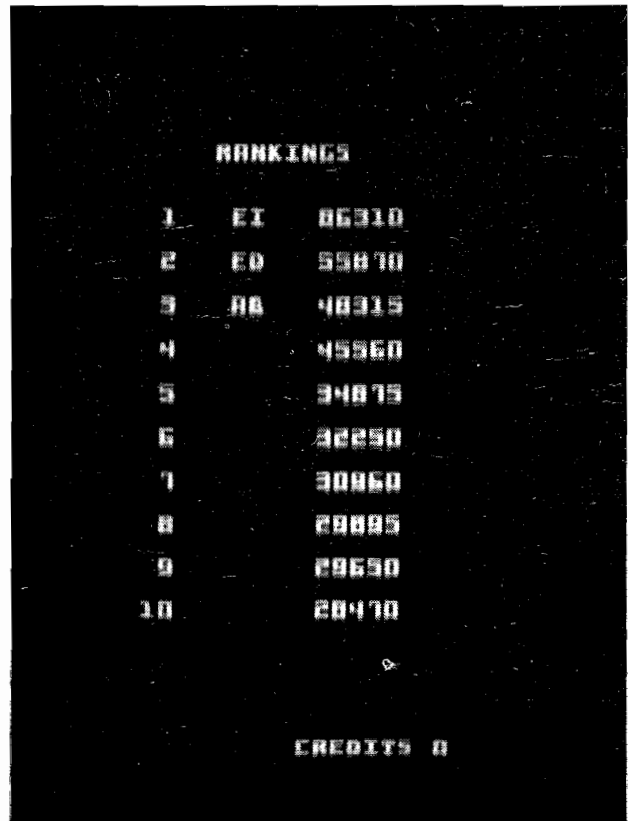
Attract Mode Display 10



Attract Mode Display 12



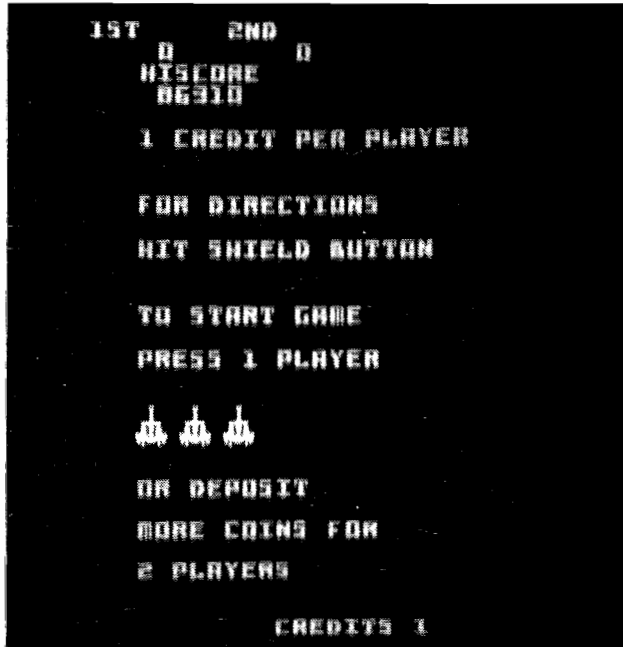
Attract Mode Display 11



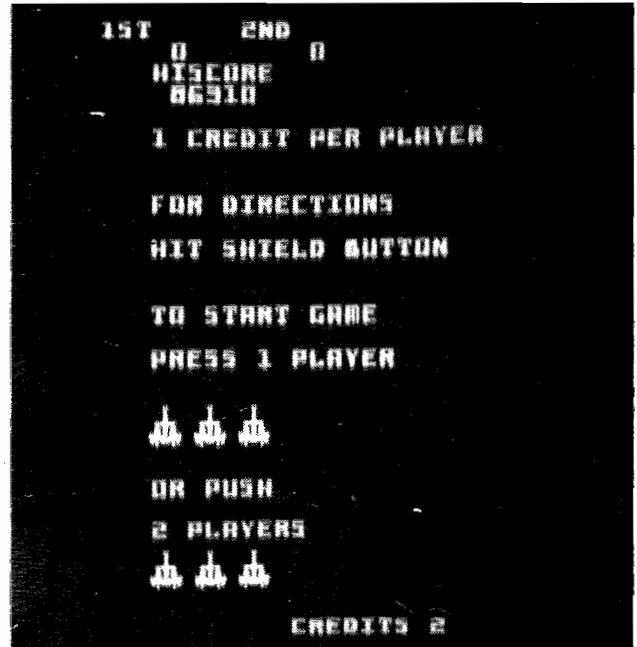
Attract Mode Display 13

## READY-TO-PLAY

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 following displays **centered** on the monitor screen.
4. If no START button is pressed, the game will hold the following "Instruction Message" display on the screen indefinitely.



Ready to Play Mode Display 1



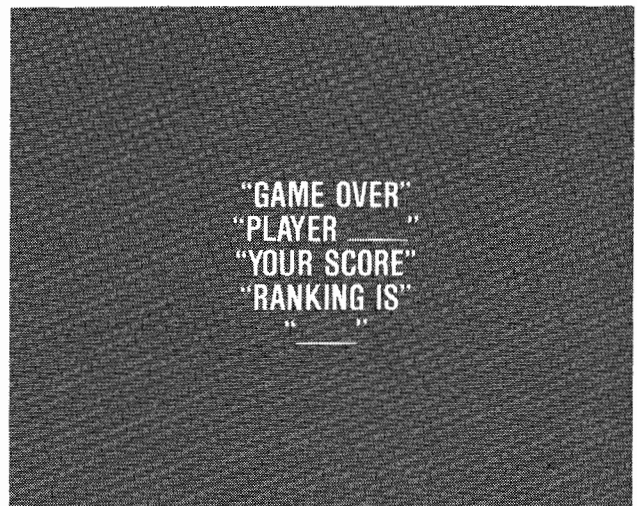
Ready to Play Mode Display 2

## PLAY MODE

1. The Play mode begins when either the "1 PLAYER" or the "2 PLAYER" start button is pressed. When this happens, the following is displayed **centered** on the monitor screen.
2. The Play mode ends when you have no more Missile Launchers left to fire at your attackers. When this happens, the following is displayed **centered** on the monitor screen.



Play Mode Display #1



Play Mode Display #2

3. The game is made up of attackers displayed across the monitor screen in phases called "racks". These attackers will try to destroy your Missile Launcher. What form the attackers will come in depends on what rack you are in.

The racks are made up of different kinds of attackers and varying numbers of each type. The higher the rack number, the greater are the numbers of certain types of attackers present. In the earlier racks the attackers are easier to overcome than in the more advanced ones. A list of the various attackers and what they do follows.

**GARGOYLE:** This is a green, fire-breathing, bird-like creature. It will drop bombs on, and/or dive at your Missile Launcher. If your Missile Launcher is hit by either, it will be destroyed.

**BRIDGE BOMBER:** This is a red, fire breathing, bird-like creature. It carries large rocks that it will try to drop on your Missile Launcher and/or the Bridge you're building. Failing this, it will try to crash into your Missile Launcher. If it is hit by a rock or crashed into by a Bridge Bomber, your Missile Launcher will be destroyed.

If your Bridge is hit by a rock, the section(s) that were hit will be knocked out. You then have to replace it (them) **BEFORE** you can continue work on the completion of the rest of your Bridge.

**EGG THROWER:** This is a green devil-like creature. It carries large explosive Eggs which it will throw at your Missile Launcher to try to destroy it. It will also try to crash into your Missile Launcher if it hasn't been hit by one of the exploding and burning Eggs.

When these Eggs hit the ground, they explode and burn quite fiercely for several seconds each. You can move your Missile Launcher through the fire(s) they cause **ONLY** if it's SHIELD is up. Otherwise it would be destroyed.

ALL OF THE ABOVE ARE THOROUGHLY NASTY — you really have to keep an eye on them! Among the other sneaky things they do, they will try to **STEAL** your **RESERVE** Missile Launchers. But, if you shoot the one that is carrying off your reserve Missile Launcher **BEFORE** it reaches the top of the screen and disappears, you will get this particular stolen Missile Launcher back. Don't relax your guard though, because they will keep trying to steal them.

If the Missile Launcher you are currently using is destroyed in the attempt to save the one that was stolen **BEFORE** it reaches the top of the screen and disappears, that stolen Missile Launcher will be returned to you.

**LUCIFER, OLD NICK, and BEELZEBUB:** These are all red devil's head characters. LUCIFER is the smallest in size. The others are each slightly larger than the previous figure — respectively. LUCIFER

appears 1st. If you can't hit him with a missile and he doesn't barbecue you, OLD NICK appears next (he's slightly larger in size presenting a bigger target) and will try to destroy your Missile Launcher in the same way. If you survive his attempts on you, BEELZEBUB will appear in his turn — and so on.

If, by some miracle, you manage to escape "barbecue time" but were unable to destroy any of the devil's head characters, the next rack of green attackers (GARGOYLES, EGG THROWERS, etc.) will appear after the last devil's head character disappears.

4. **MISSILE LAUNCHER SHIELD:** Your MISSILE LAUNCHER is equipped with a SHIELD that can protect it from **ANYTHING** in the game that is capable of destroying it. However, this SHIELD only lasts for a **VERY SHORT TIME** if it is used continuously (about 1 second). So use it sparingly! As soon as you release the SHIELD Button, it begins to recharge at a rate roughly equal to the speed it discharges at when you use it.

**MISSILE LAUNCHER DESTROYED:** Whenever you lose a Missile Launcher, assuming you have one in reserve to replace it with, the replacement will have **ONE LESS** Missile Launcher Barrel than your previous one had down to a **MINIMUM** of one. You will **ALWAYS** have **AT LEAST** one Missile Launcher Barrel on your Missile Launcher at all times.

5. **GAME PLAY:** This is a short description of the object of the game, how to play it, and what happens when you do.

**OBJECT OF THE GAME:** Is to destroy your attackers while at the same time preventing them from destroying you. When any attacker is destroyed, a Bridge Section will appear at the lower left hand corner of the screen.

You can pick up this Bridge Section with your Missile Launcher and place it at the edge of the Devil's Gorge (eventually building a bridge completely across it, allowing you to enter **SATAN'S HOLLOW**).

No matter how many attackers you destroy, another Bridge Section **WILL NOT** appear until **AFTER** the current one is in place over the Devil's Gorge.

**END OF A RACK — LAST ATTACKER DESTROYED:** When the last attacker of any rack is destroyed, the action stops and a green bird flies to the castle with a white flag.

**BATTLE WITH SATAN:** Once you complete the construction of your Bridge across the Devil's Gorge, you can cross it and enter SATAN'S HOLLOW. If you defeat SATAN, you gain an additional Missile Launcher Barrel (more fire power). The maximum number of Missile Launcher Barrels allowed is 3 per Missile Launcher. No matter how



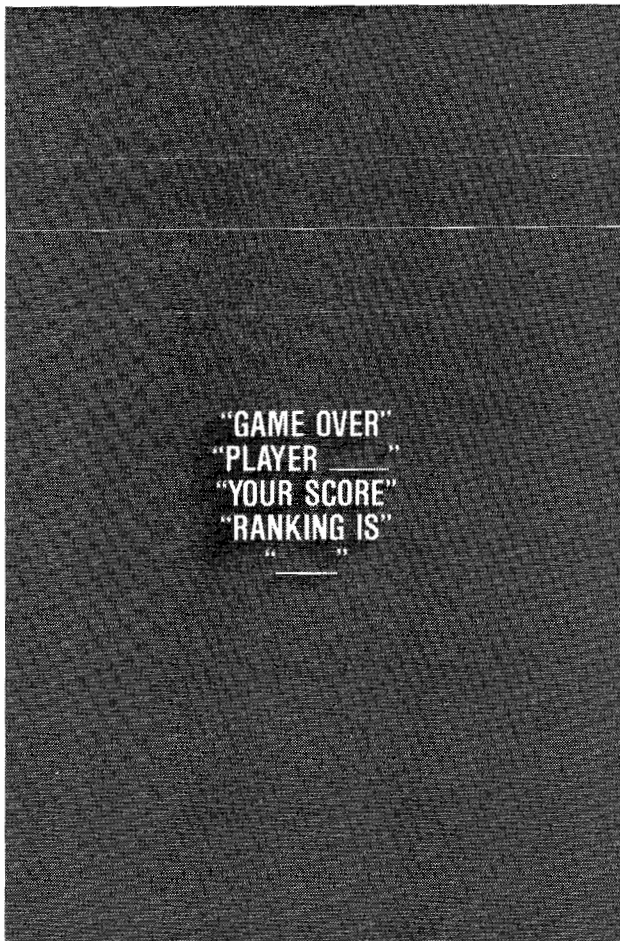
many times you do battle with, and defeat SATAN, you **CANNOT** obtain more than 3 Missile Launcher Barrels on your current Missile Launcher.

Once you've received your 3rd Missile Launcher Barrel, your additional incentive to build another Bridge is that whenever you cross into SATAN'S HOLLOW, do battle with him, and defeat him, you are awarded BONUS POINTS for each flag on the castle. (As mentioned elsewhere, you earn one flag for each complete rack of attackers you destroy.)

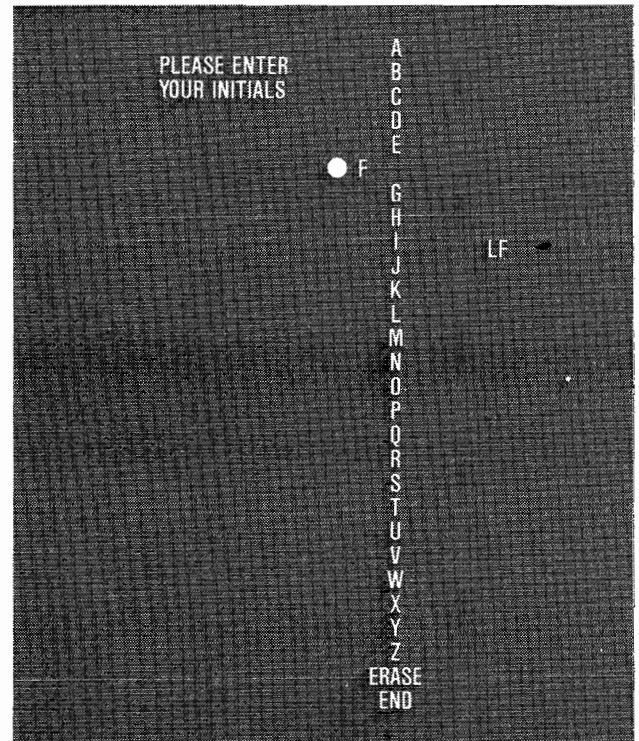
As you improve your skills and become better and better at the game, advancing into the more difficult racks, you will see more and more of the BRIDGE BOMBERS and EGG THROWERS per rack.

Regardless of how it happens, when one of your Missile Launchers is destroyed, assuming you have at least one more remaining in reserve, your new Missile Launcher will appear in the bottom center of the monitor screen and play begins anew.

When your **LAST** Missile Launcher is destroyed, the words below are displayed **centered** on the monitor screen.



If your score was high enough to become one of the ten best scores, the game will go into the High Score/Initial mode immediately after the above display. 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). In the High Score/Initial mode the game gives a display which looks like the following:



By moving the control stick to the right, you can make the cursor move down the alphabet: "A", "B", "C", "D", etc. By moving the control stick to the left, you can make the cursor move up the alphabet: "Z", "Y", "X", "W", etc.

When you reach your initial, center the control stick and pull the trigger. Your initial is printed out on the screen. If you do not wish to put your initials opposite your score, just pull the trigger two times. Two "A"'s will appear on the screen. Or — you can push either the 1 or 2 PLAYER button to leave this mode immediately.

**NOTE:** If you make a mistake, you can erase the wrong letter by positioning the cursor opposite the "ERASE" word at the bottom of the line of alphabet characters and pressing the trigger. Then simply go back and print out the correct letter.

When you've printed out your last initial, move the cursor opposite the "END" word and pull the trigger to tell the game you are through printing out your initials. The game will then give the following RANKINGS display showing your score opposite your ranking and your initials.

RANKINGS		
1	ET	86310
2	ED	55870
3	RB	48315
4		45560
5		34875
6		32250
7		30860
8		29895
9		28650
10		28470

CREDITS 0

**NOTE:** If you don't tell the game you are through printing out your initials as instructed above, the game will automatically go into the RANKINGS display after a short wait.

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).

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

## TWO PLAYER OPERATION

The Upright, Mini, and Cocktail Table models all 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.

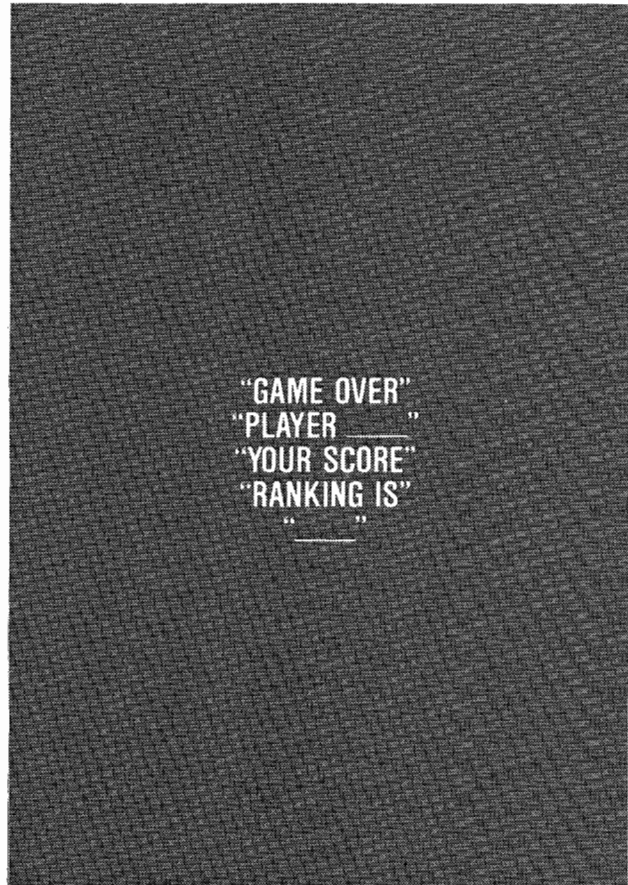
1. In the Upright and Mini models, the players must take turns at the controls.
2. In the Cocktail Table model, each player has his own set of individual controls. The picture will flip to face you when it is your turn. (When it is not your turn, your set of controls will have **NO** effect on the game.)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

### DESTROYED MISSILE LAUNCHER — OTHERS REMAINING IN RESERVE

- The game stops and "PLAYER \_\_\_\_ UP" is displayed on the monitor screen.
- Next, the other player's Missile Launcher and attackers appear on the screen and game play begins for the other player.

### DESTROYED MISSILE LAUNCHER — NO OTHERS REMAINING IN RESERVE

- Game displays:



centered on the monitor screen.

- After the above display, if your score was high enough, it goes to the "HIGH SCORE/INITIAL" mode.

After this mode, "PLAYER \_\_\_\_ UP" and the other player's Missile Launcher and attackers appear on the monitor screen. Play then begins for the other player.

If your score was **NOT** high enough to cause the game to go into the "HIGH SCORE/INITIAL" mode, the game will just display "PLAYER \_\_\_\_ UP", the other player's Missile Launcher and attackers on the monitor screen. Play then begins for the other player.

# 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**. 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 Supply Chassis and Power Supply P.C. Board.

### 2. MINI MODEL:

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

### 3. 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 Supply Chassis and the Power Supply P.C. Board.

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.

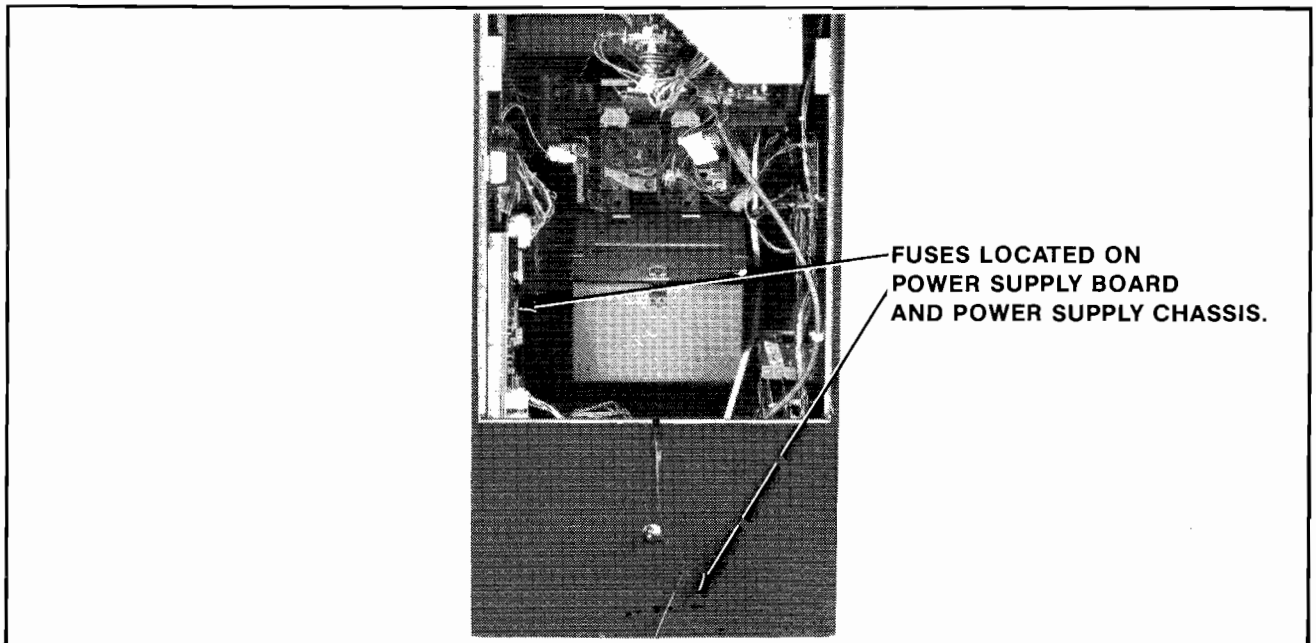


Figure 4-1 Location of Fuses

## OPENING THE CONTROL PANEL

### 1. UPRIGHT MODEL: See Figure 4-2.

- The control panel is held in place by two latches, one on the left side and one on the right side of the cabinet.  
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 front 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. MINI MODEL: See Figure 4-2.

- The control panel is held in place by two latches, one on the right side, and one on the left side of the cabinet.  
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.

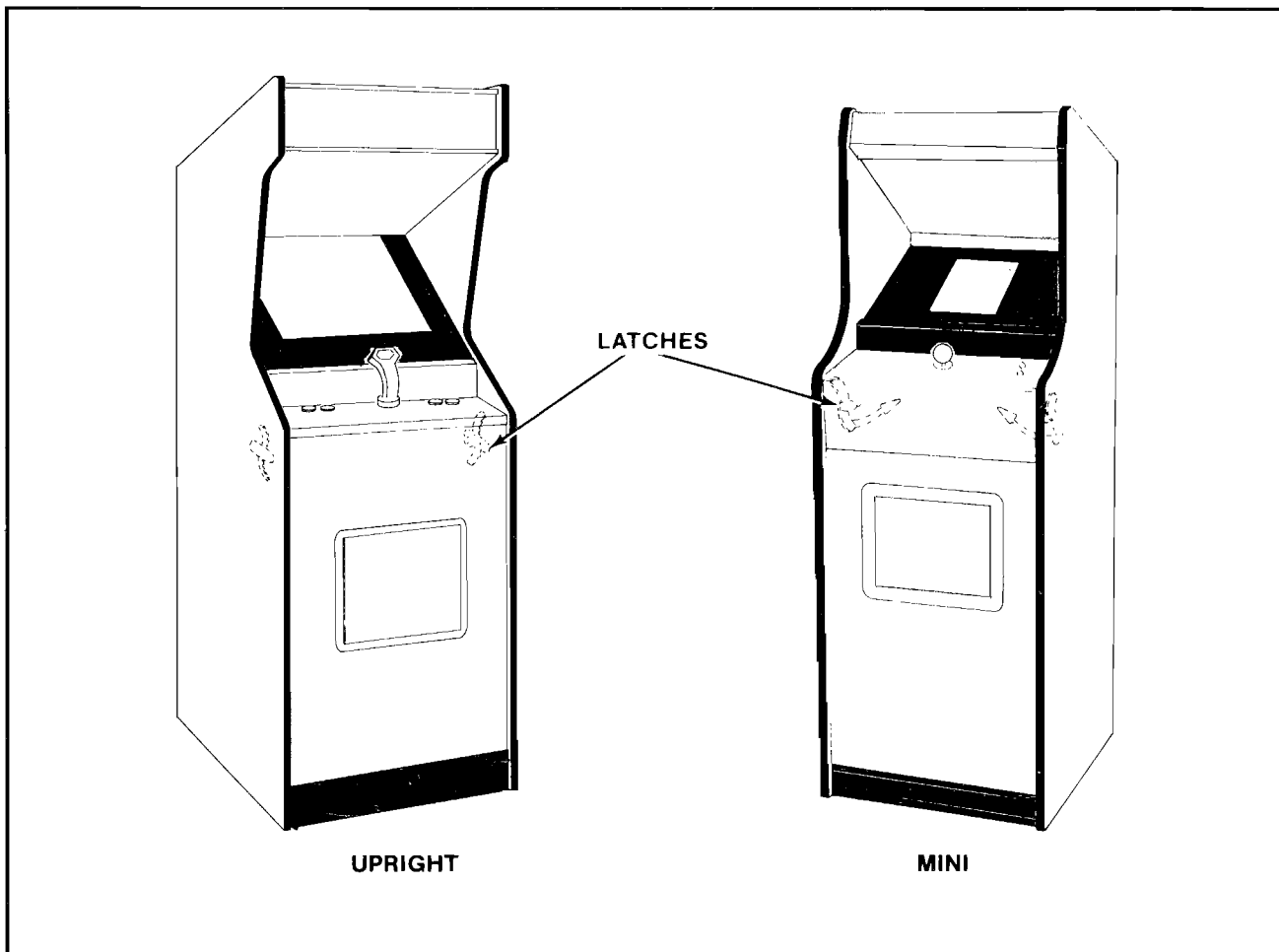


Figure 4-2 Opening the Control Panel — Upright & Mini

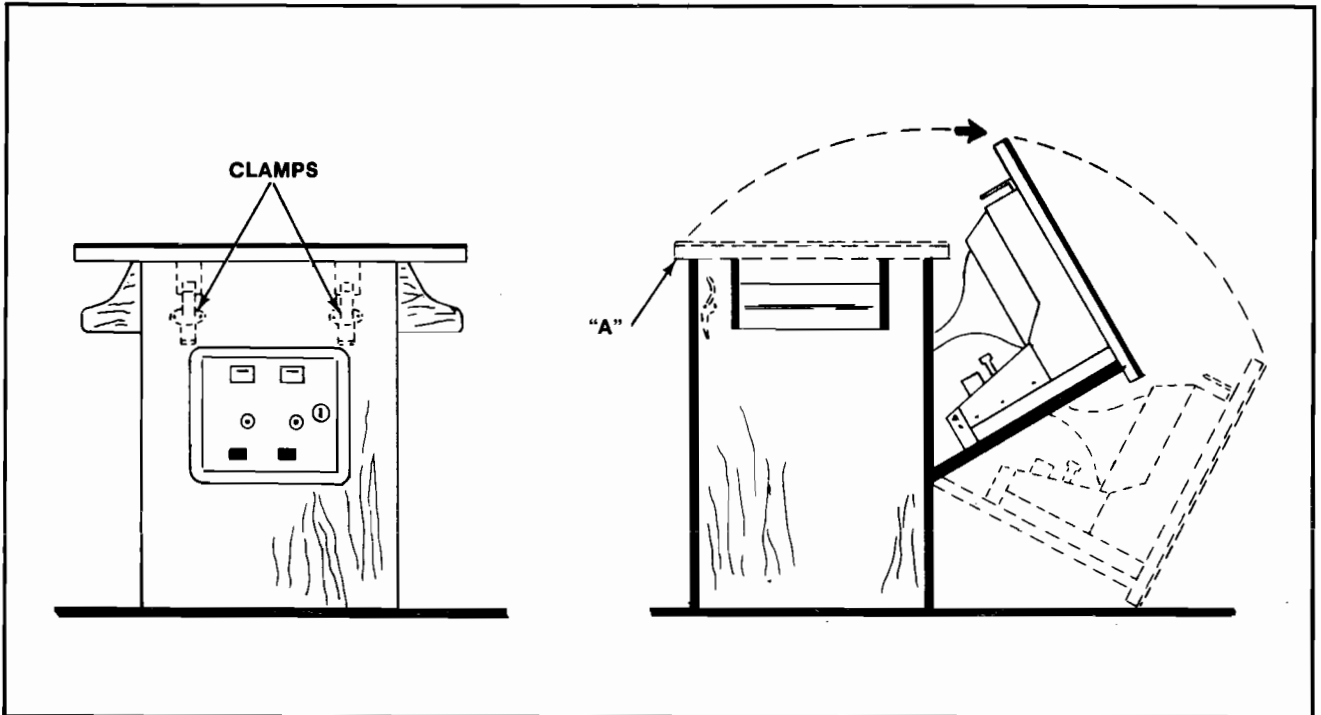


Figure 4-3 Opening the Cocktail Game

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

- Each control panel is held in place by several screws, four on the inside of the cabinet and three along the inside 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 4-3.

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

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

Grasp the table top at "A" and open it as indicated in Figure 4-3.

**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 4-4.

- 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.

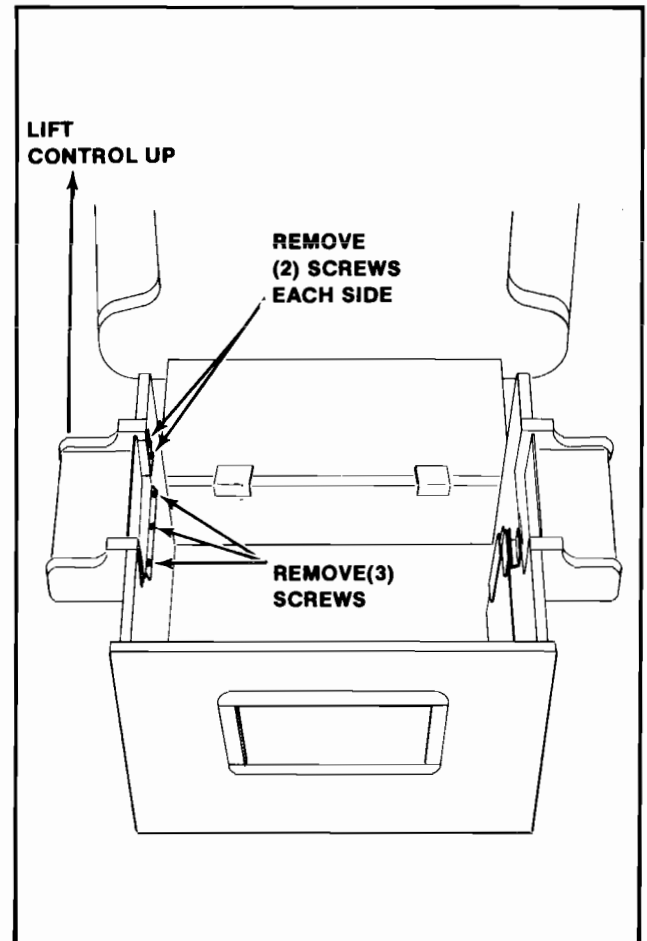


Figure 4-4 Removing the Control Panel — Cocktail

## 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 gets the control panel stick out of the way so the main-display-glass can be removed.
- Remove the screws securing the main-display-glass retainer and the main-display-glass in place as shown in Figure 4-5 and lift out the main-display-glass.
- Remove the screws which secure the T.V. bezel assembly in place.
- The T.V. bezel assembly is now free and can be slid out of the cabinet.
- To reinstall the T.V. bezel assembly and the main-display-glass, reverse this procedure.

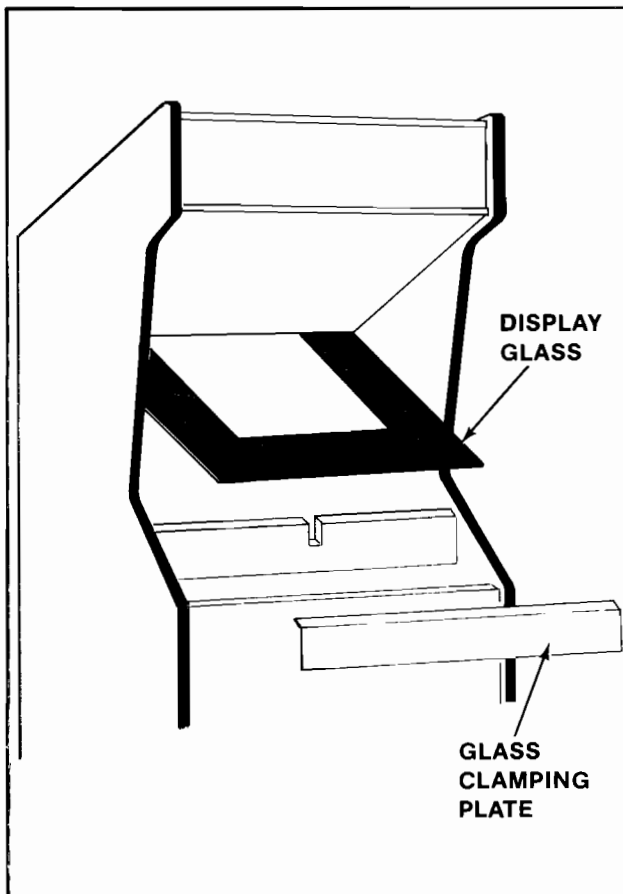


Figure 4-5 Removing the Main Display Glass & T.V. Bezel — Upright

### 2. MINI MODEL: See Figure 4-6.

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

- Turn the power off to the game and remove the control panel.
- Remove the screws which secure the glass clamping plate. See Figure 4-6.
- Lift out the glass clamping plate. 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.
- Remove the screws which secure the T.V. bezel assembly and lift it out.

**NOTE:** Use the hole in the center of the main-display-glass support to grasp it.

- Reverse this procedure to reinstall the T.V. bezel assembly and the main-display-glass.

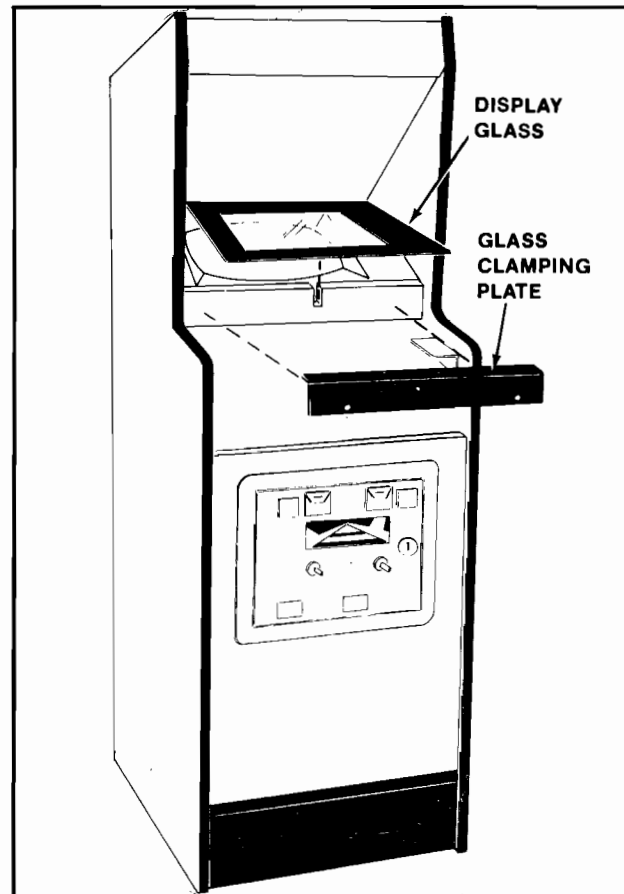


Figure 4-6 Removing the Main Display Glass & T.V. Bezel — Mini



### 3. COCKTAIL TABLE MODEL: See Figure 4-7.

**NOTE:** This may be done with the table top in the closed or the open 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 assembly and the table top glass, reverse this procedure.

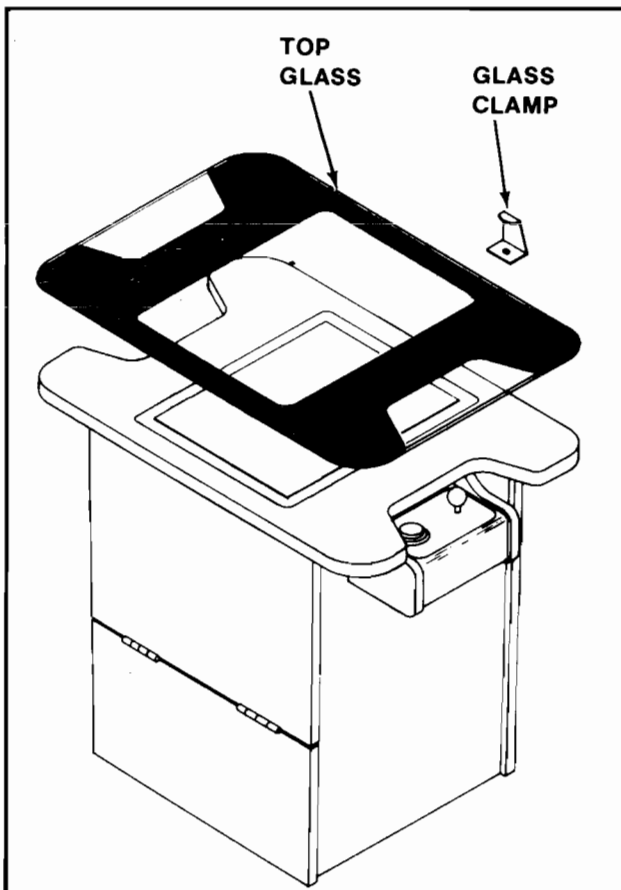


Figure 4-7 Removing the Top Glass & T.V. Bezel  
— Mini

## 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 4-8.

- 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 and bezel must be removed. See above "Upright Model" procedure.
- With the removal of only four bolts, the T.V. monitor and its mounting bracket will be loose.
- The monitor mounting bracket slides 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.
- To reinstall the T.V. monitor, reverse this procedure.
- After replacing the T.V. monitor, be sure to run the game Self-Test.

### 2. MINI MODEL: See Figure 4-9.

- Turn the 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 and bezel **MUST** be removed. See above "Mini Model" procedure.
- With the removal of only four bolts, the T.V. monitor will be loose.

**CAUTION:** **BE SURE** to support the T.V. monitor from the rear while removing the four bolts so it will not fall out of the cabinet.

- The monitor is removed by supporting it and pulling straight back. (BE CAREFUL not to hit monitor on its rear support bracket.)
- To reinstall the T.V. monitor, reverse this procedure.
- After replacing the T.V. monitor, be sure to run the game Self-Test.

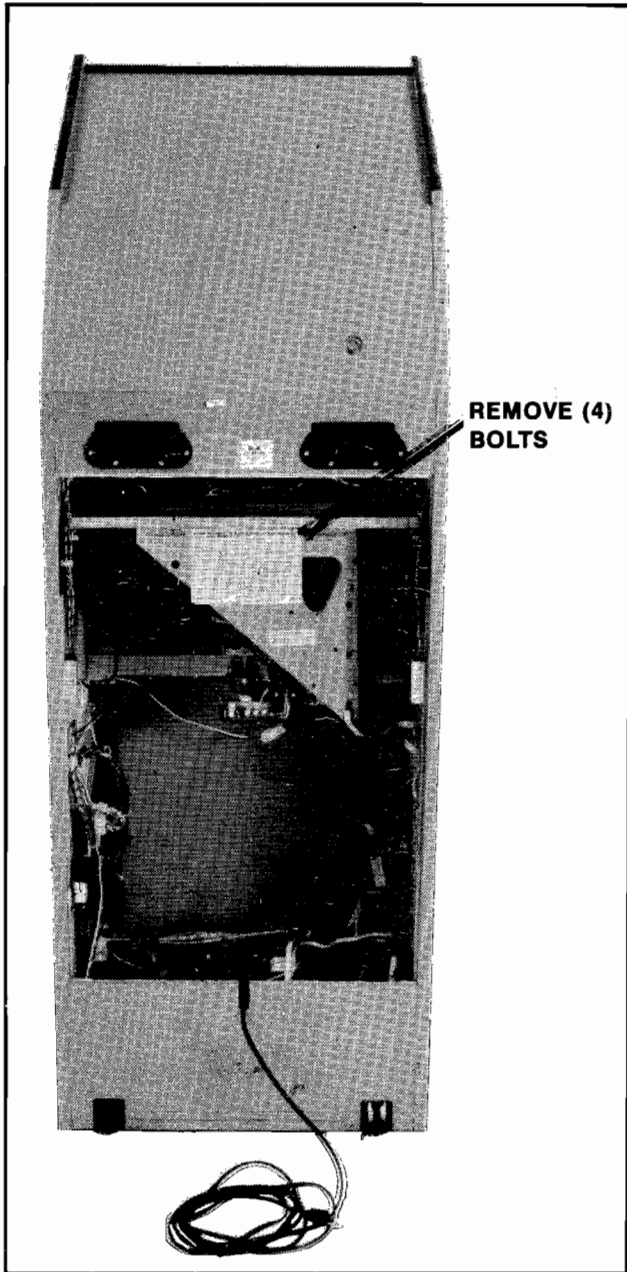
**3. COCKTAIL TABLE MODEL:** See Figure 4-11.

- Turn the power off to the game.
- Open the coin box door and release the two latches indicated in Figure 4-10.

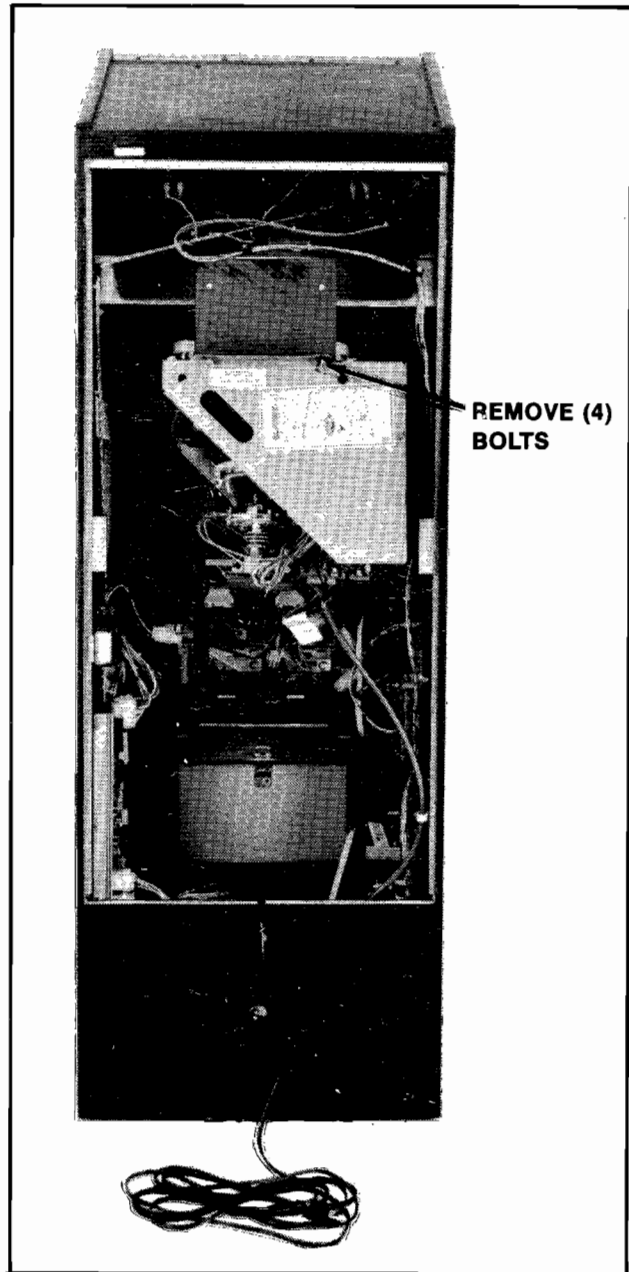
**CAUTION: The right hand latch is very close to the HIGH VOLTAGE on the monitor. BE CAREFUL!!**

- Once the latches are released, unhook them from their latch plates.
- Grasp the table top at "A" and open it as indicated in Figure 4-10.

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



**Figure 4-8 Removing the Monitor — Upright**



**Figure 4-9 Removing the Monitor — Mini**



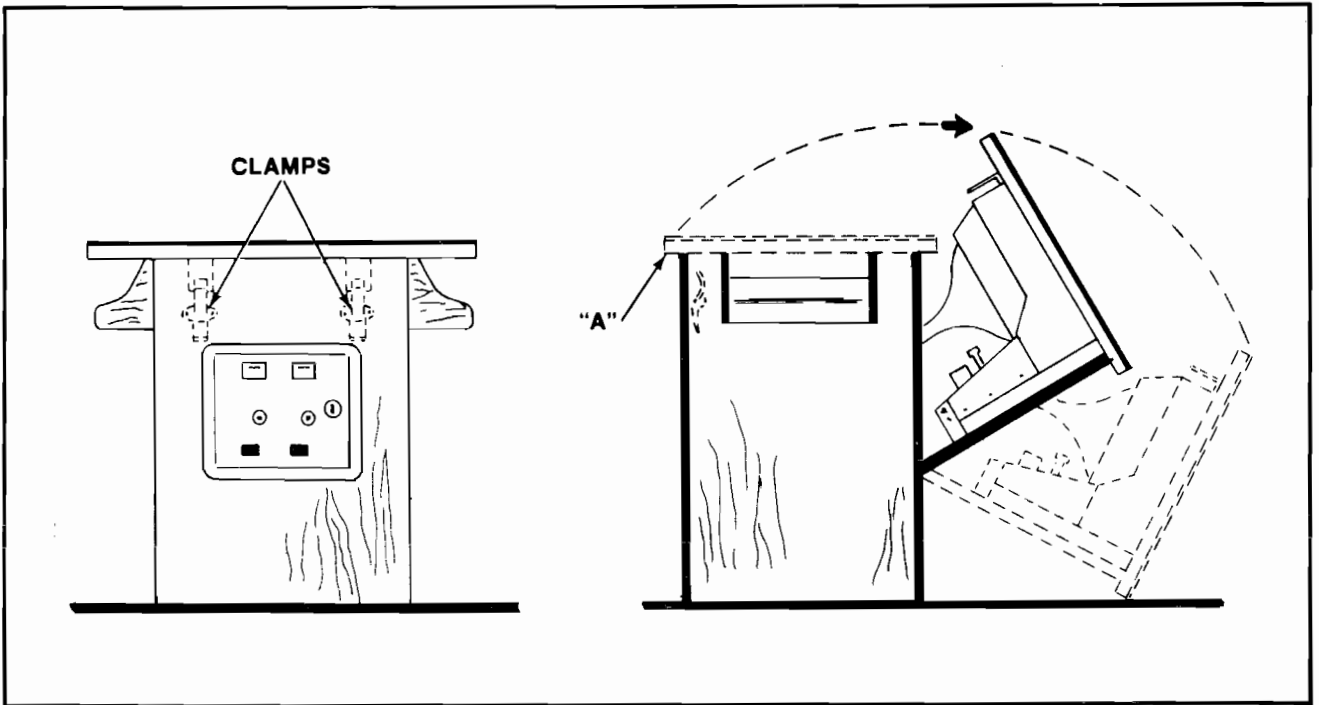


Figure 4-10 Opening the Cocktail Game

- 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 4-11.
- 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 4-11.
- 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 assembly, 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.

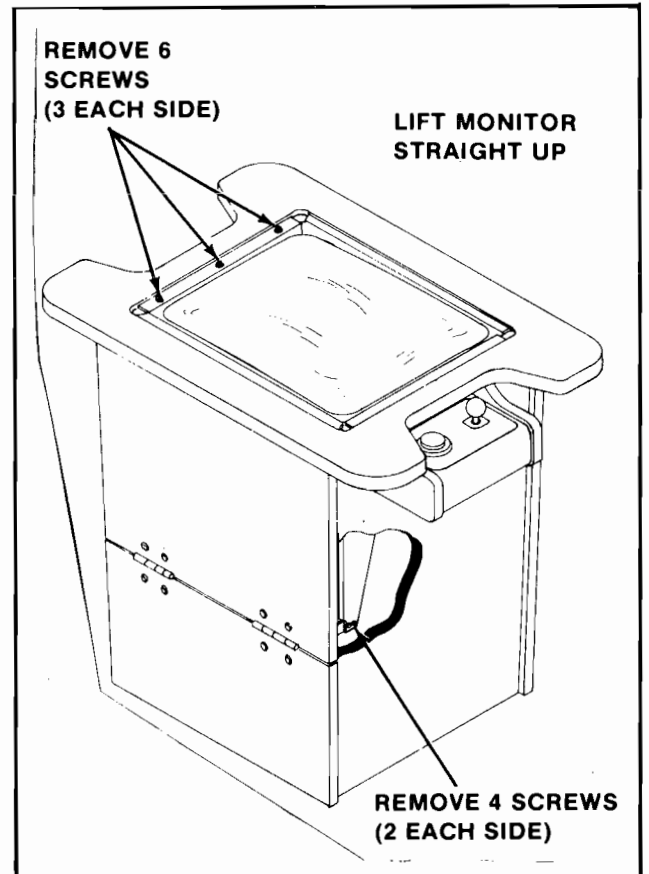


Figure 4-11 Removing the Monitor — Cocktail

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

1. UPRIGHT MODEL: See Figure 4-12.

- Turn the power to the game off.
- Unlock and open the rear access door.
- Disconnect all cabling from the P.C. boards and lift them out of their card rack..
- Disconnect the linear power supply board from all its cabling, remove the P.C.B. supports indicated in Figure 4-12, and slide the linear power supply board 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.**

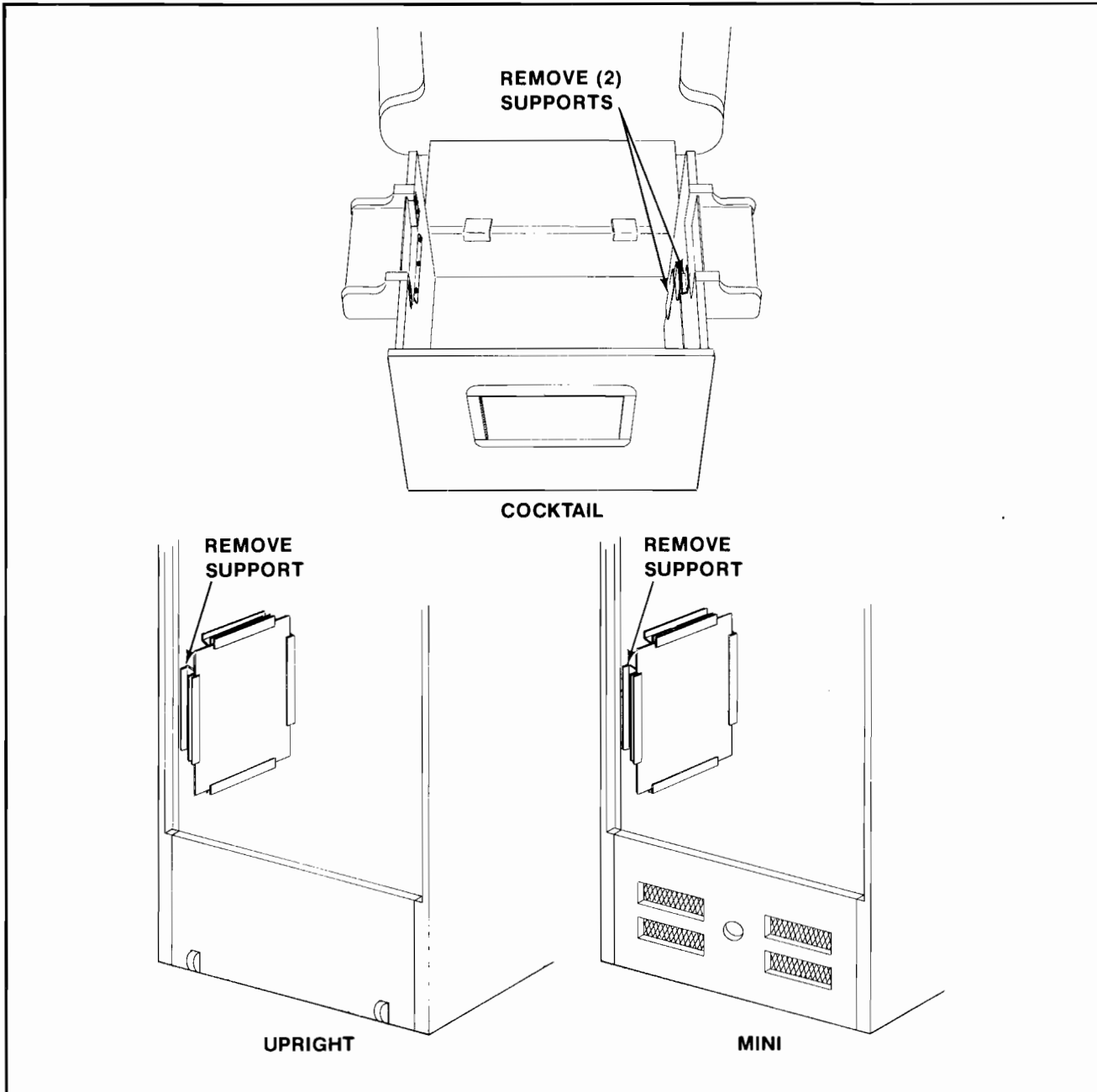


Figure 4-12 Removing P.C.B.'s

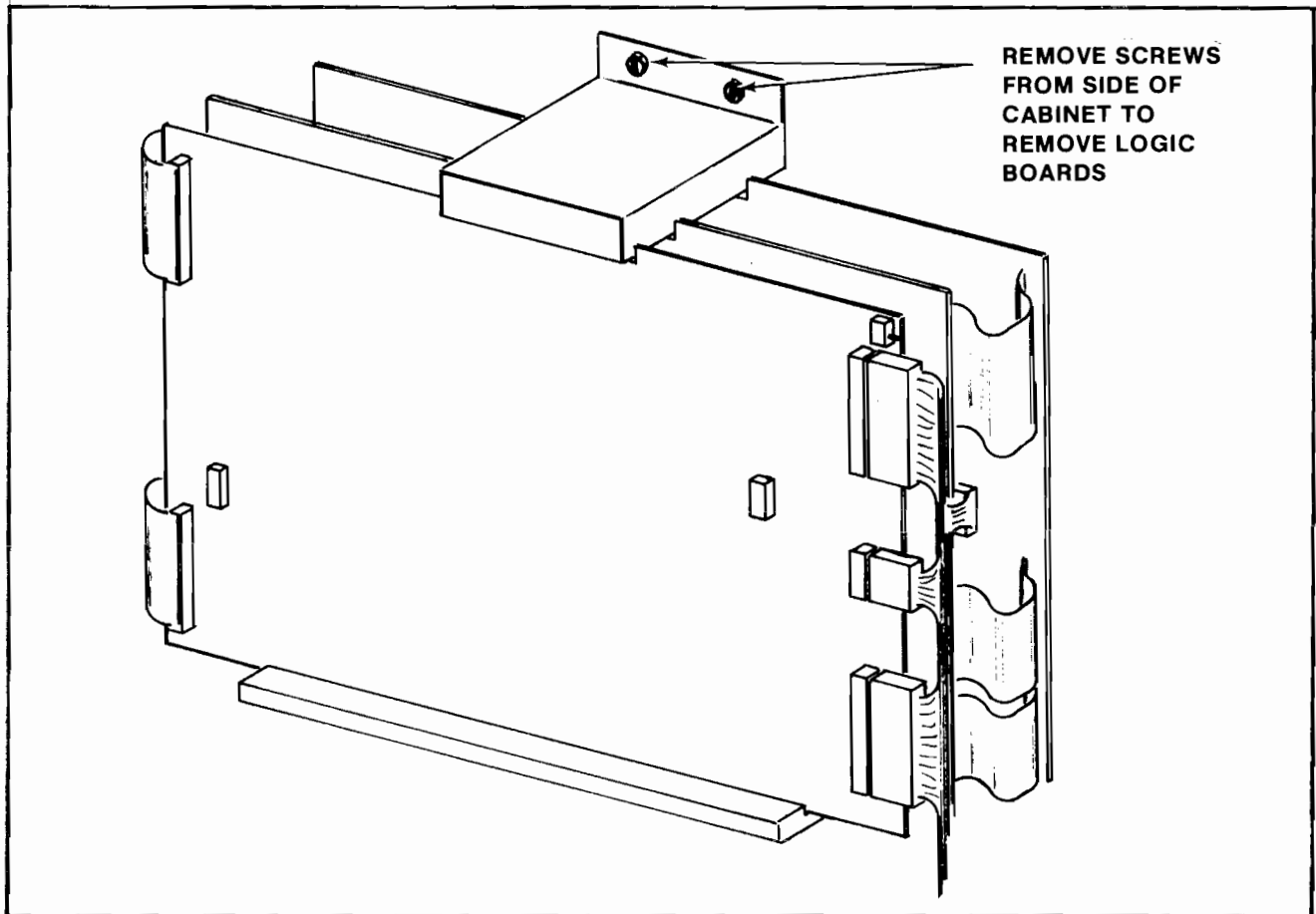


Figure 4-13 Removing P.C.B.'s from Card Rack

**2. MINI MODEL:** See Figure 4-12.

- Turn the power off to the game.
- Unlock and open the rear access door.
- Disconnect all cabling from the P.C. boards and lift them out of their card rack.
- Disconnect the linear power supply board from all its cabling, remove the P.C.B. supports indicated in Figure 4-12, and slide the linear power supply board out the back of the cabinet.
- To reinstall the above P.C.B.'s, reverse this procedure.

**3. COCKTAIL TABLE MODEL:** See Figure 4-12.

- Turn the power off to the game.
- Open the cabinet:  
Open the coin box door and release the two latches indicated in Figure 4-10.

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

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

- Grasp the table top at "A" and open it as indicated in Figure 4-10.

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

- To remove the linear power supply board. See Figure 4-12.  
Disconnect it from all its cabling.  
Remove the two smallest P.C.B. supports.  
Once these are removed, the linear power supply can be lifted out the top of the cabinet.  
To reinstall the linear power supply board, reverse this procedure.
- To remove the P.C. boards from the card rack. See Figure 4-13.  
Disconnect them from ALL their cabling.  
The P.C. boards are now free and can be slid from their rack.
- To reinstall the P.C. boards, reverse this procedure.

## OPENING THE ATTRACTION PANEL

### 1. UPRIGHT MODEL: See Figure 4-14.

- 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.) See Figure 4-14.

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 4-15.

**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 of 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.
- 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.

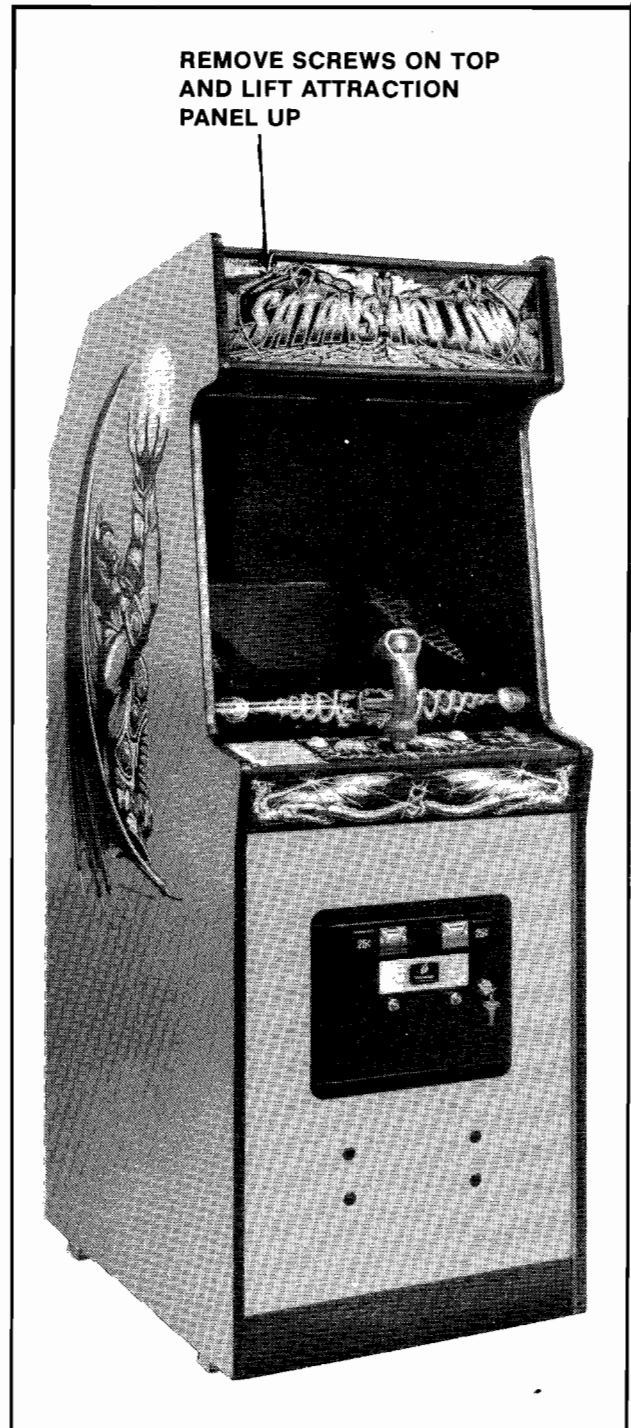


Figure 4-14 Opening the Attraction Panel — Upright

### 2. MINI MODEL. See Figure 4-16.

- Turn the power off to the game.**
- Remove the screws which secure the top bracket in place. (They are on its top side.) See Figure 4-16.
- Remove the top bracket and slide up the attraction panel. This exposes the attraction panel light bulbs and their mounting board.

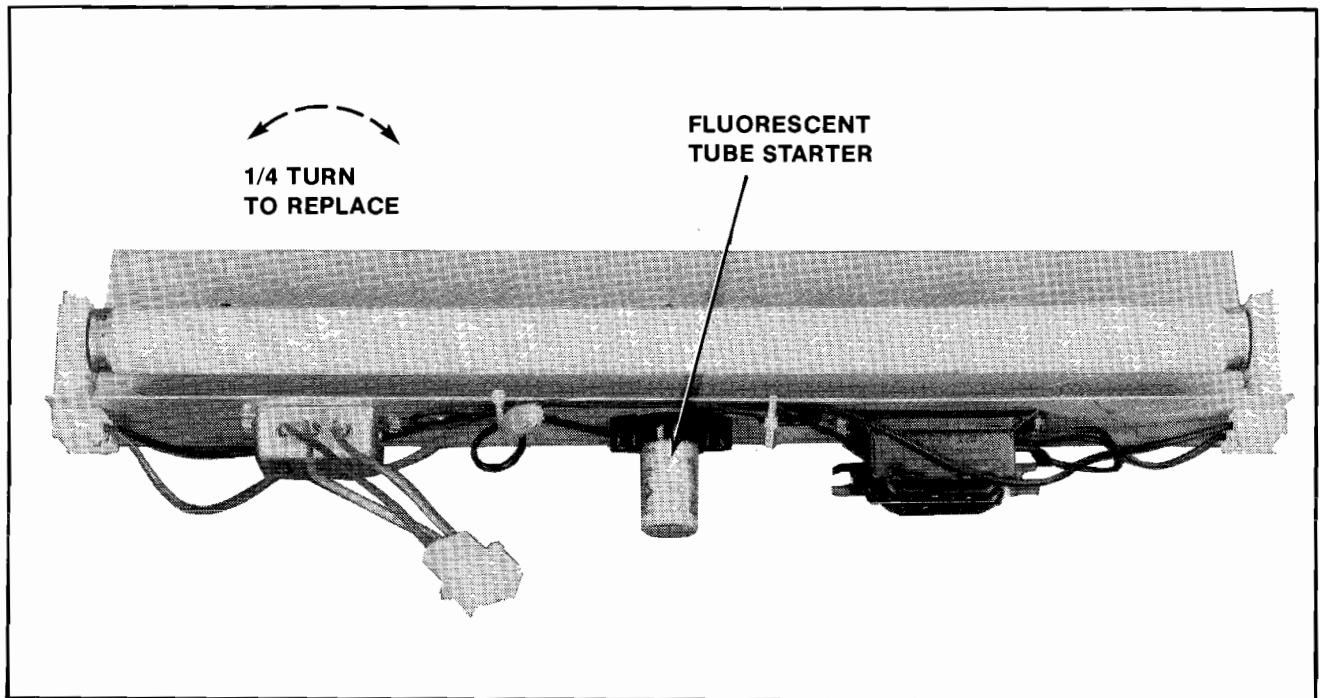


Figure 4-15 Replacing Fluorescent Tube Starter

- To service the light bulbs and their mounting board:

Turn the power to the game back on so you can see which bulbs are burnt out.

Mark the burnt out bulbs and **turn the power to the game back off again.**

To replace the burnt out bulbs, grasp them gently and pull straight out.

The new bulbs are gently pushed into the empty sockets.

To completely replace the light bulb mounting board:

Open the cabinet rear access door and unplug the mounting board from its power cable.

Remove the screws that hold the mounting board to the cabinet.

Gently slide the mounting board out the front of the cabinet being careful not to catch its cable on anything.

To reinstall the above removed items, reverse this procedure.

- To replace the speaker.

**Be sure the power is off to the game.**

Disconnect the speaker from its cabling.

Remove the nuts and bolts securing the speaker.

Slide the speaker out through the rear access door.

To reinstall the speaker, simply reverse this procedure.

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

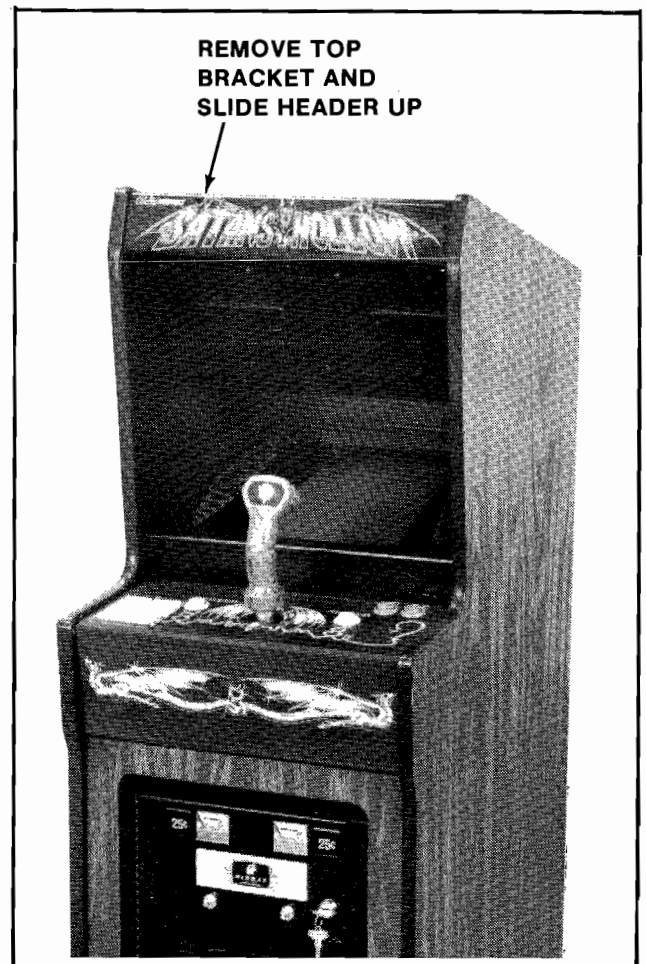


Figure 4-16 Opening the Attraction Panel — Mini

## SERVICING THE CONTROL PANEL BLACK LIGHT (UPRIGHT MODEL ONLY)

1. Be sure the power is off to the game.
2. Remove the control panel as described previously. This exposes the bottom row of screws which secure the control panel support bracket and the black light protector in place. See Figure 4-17.
3. Remove all the screws which secure the above items in place and set them aside.
  - The black light tube may be replaced at this time by reaching through the space where the light protector was before you removed it.

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

4. Replacing the black light tube starter. See Figure 4-15.
  - Remove the black light tube.
  - Remove the screws which secure the black light tube mounting bracket to the cabinet. See Figure 4-18.
 

The mounting bracket is now loose and can be pulled out and slightly to one side until you can see the black light tube starter.
  - 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 black light tube starter, reverse this procedure.

5. The black light tube mounting bracket assembly may be replaced at this time by simply disconnecting it from its power cable and removing it from the game.
6. To reinstall any of the above removed items, simply reverse this procedure.

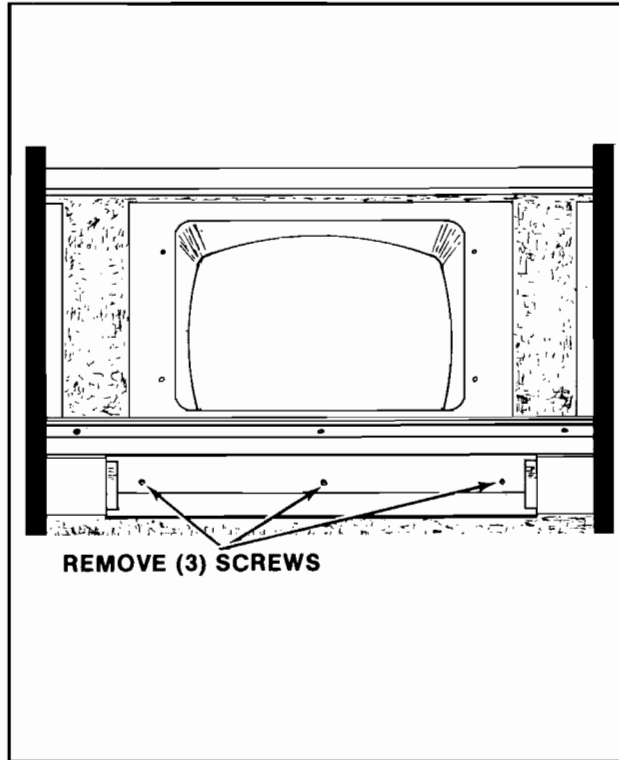


Figure 4-18 Removing Black Light Tube Mtg. Brkt. — Upright

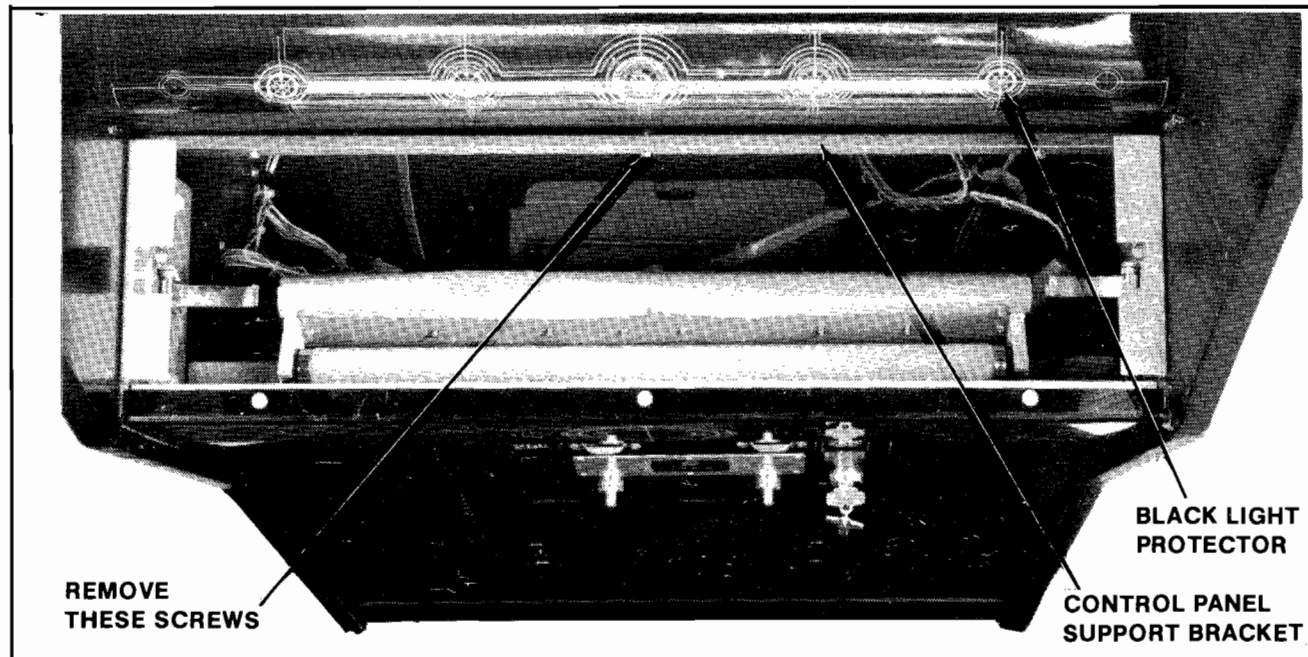
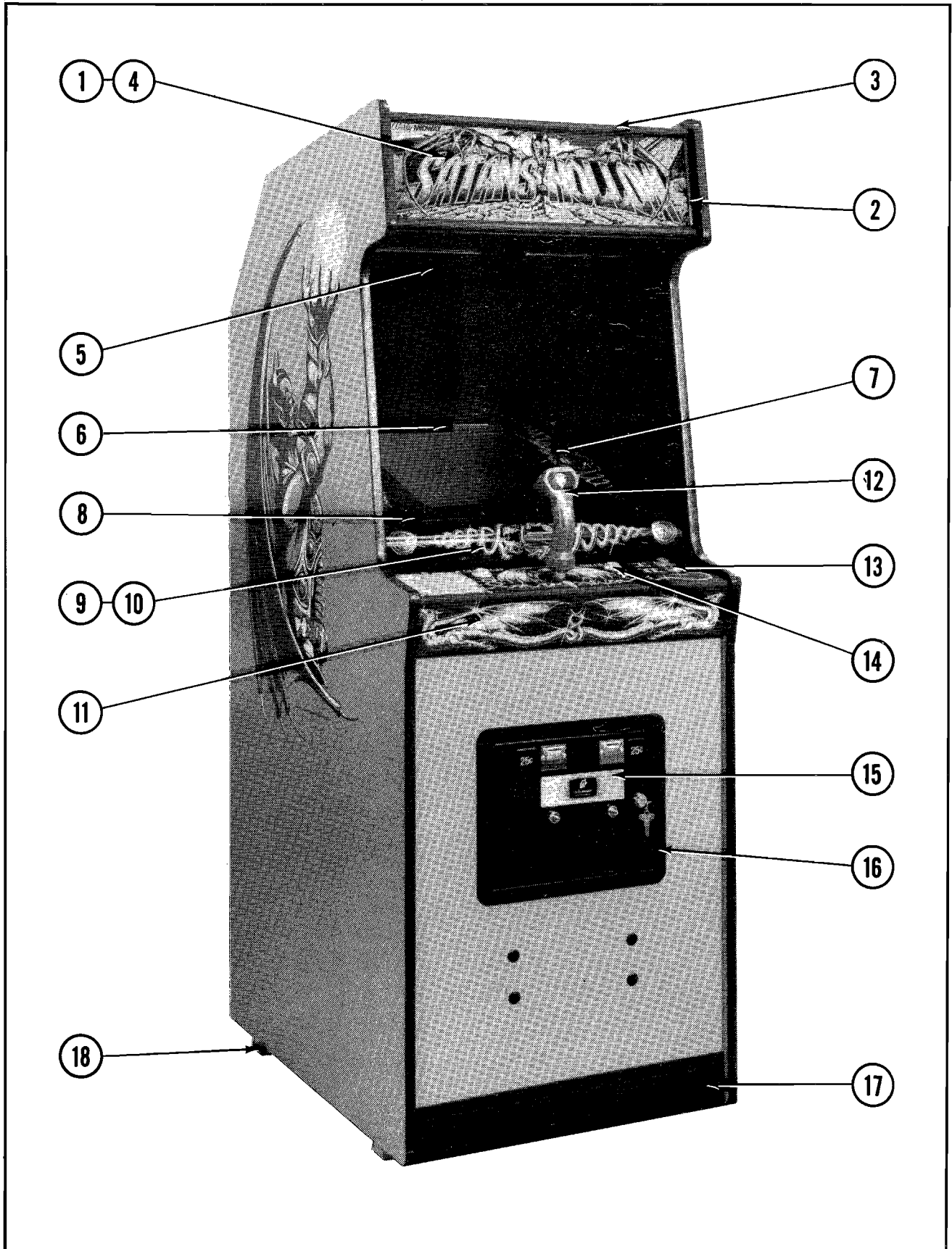


Figure 4-17 Servicing Control Panel Black Light — Upright

## **V Illustrated Parts Breakdown**

NO. 941 — SATAN'S HOLLOW — UPRIGHT — FRONT



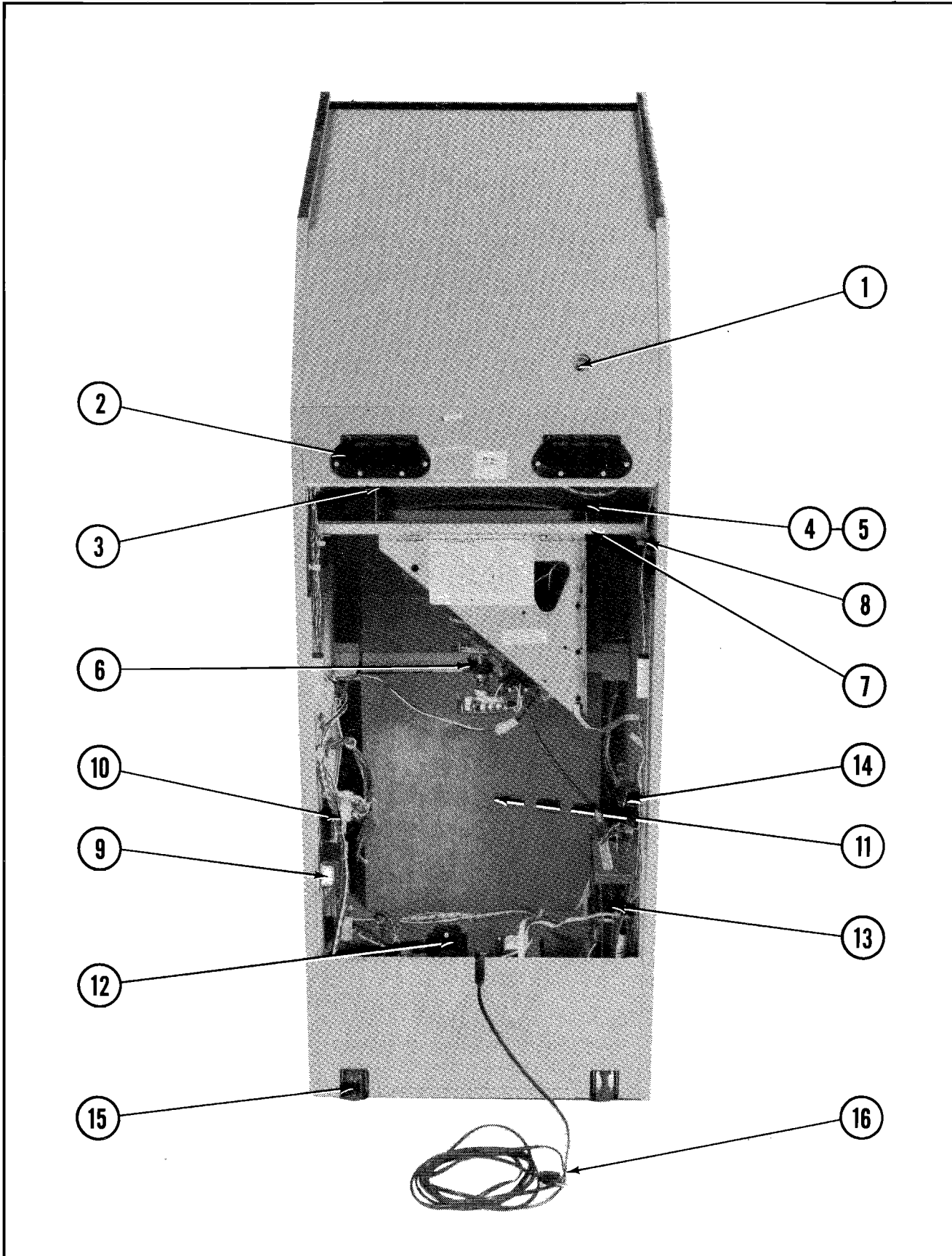


**NO. 941 — SATAN'S HOLLOW — UPRIGHT — FRONT — PARTS LIST**

*ORDER BY PART NUMBER ONLY*

<b>ITEM</b>	<b>PART NO.</b>	<b>DESCRIPTION</b>
1	0941-00902-00XF	DECORATIVE HEADER PLEXI
2	0537-00903-0063	GLASS CHANNEL — 6-3/8" LG. (2 REQ'D.)
3	0574-00903-0100	HEADER BRKT. RETAINER (2 REQ'D.)
	0017-00101-0138	#8 x 5/8 TORX TAMPER RESISTANT SCREW (8 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 (2 REQ'D.)
	0017-00003-0430	6" x 9" SPEAKER — 4 OHM, 10W. (2 REQ'D.)
	0017-00101-0127	#8-32 x 1-1/2 CARRIAGE BOLT (8 REQ'D.)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (8 REQ'D.)
6	0508-00900-0000	19" T.V. BEZEL
	0508-00901-0000	PLEXI-GLASS CLIPS (4 REQ'D.)
	0017-00101-0017	#6 x 1/2 SLT. HEX HD. BLACK SCREW (4 REQ'D.)
7	0941-00901-00XF	MAIN VIEWING GLASS
8	0941-00102-00XF	HOLD DOWN BRKT.
	0017-00101-0126	#10-32 x 3/4 BLK. BUTTON HD. SCR. (4 REQ'D.)
9	0941-00903-0000	LAMP PROTECTOR
	0017-00101-0088	#8 x 3/4 PHIL. FLAT HD. SCR. (3 REQ'D.)
10	A628-00009-0000	CONTROL SHELF LIGHT ASSY. — UPPER
	0628-00916-0000	MIDDLE FLUORESCENT REFLECTOR
11	0941-00900-0000	CONTROL SHELF OVERLAY — DECORATIVE
	0941-00101-0000	CONTROL SHELF PLATE
	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.)
	0982-00102-0000	STRIKE (2 REQ'D.)
	0017-00009-0534	BASSICK CLAMP (2 REQ'D.)
	0017-00101-0141	#8 x 11/16 UNSLOT. HEX HD. SCR. (12 REQ'D.)
12	A941-00021-0000	CONTROL ASSEMBLY
	A089-00020-0000	CONTROL GRIP CABLE ASSY. — 16"
	A941-00011-0000	CONTROL SHELF CABLE ASSY.
13	0017-00042-0256	PUSH BUTTON ASSY. — RED (2 REQ'D.)
14	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.)
15	A090-00300-11BK	U.S.A. 25¢ COIN DOOR ASSY.
	A982-00015-0000	COIN DOOR CABLE ASSY.
16	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)
17	0935-00906-0100	KICK PLATE — 23" LG.
18	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. 941 — SATAN'S HOLLOW — UPRIGHT — REAR ACCESS



**NO. 941 — SATAN'S HOLLOW — UPRIGHT — REAR ACCESS — PARTS LIST**

*ORDER BY PART NUMBER ONLY*

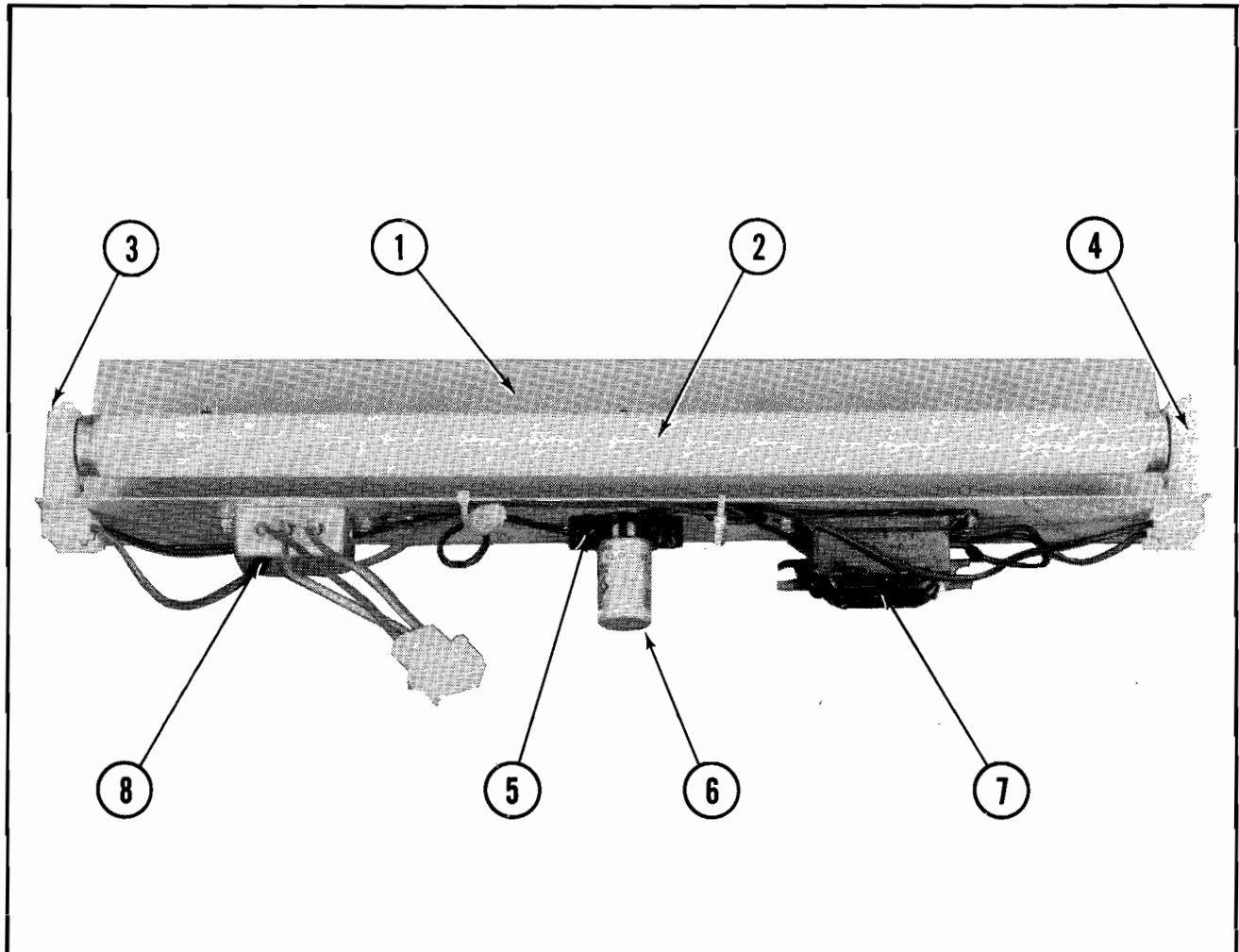
<b>ITEM</b>	<b>PART NO.</b>	<b>DESCRIPTION</b>
1	A088-00013-0000	ON-OFF SWITCH & BRKT. ASSY.
2	0894-00916-0000	PLASTIC PULL & VENT (2 REQ'D.)
	0017-00101-0141	#8 x 11/16 UNSLOT. HEX HD. M.S. (8 REQ'D.)
3	0941-00106-0000	MAIN VIEWING GLASS STOP BRKT.
	0017-00101-0027	#8 x 3/4 SLT. HEX HD. M.S. (3 REQ'D.)
4	0508-00900-0000	19" T.V. BEZEL
5	0508-00106-0000	BEZEL MTG. BRKT. (2 REQ'D.)
	0508-00901-0000	PLEXI-GLASS CLIPS (4 REQ'D.)
	0017-00101-0017	#6 x 1/2 SLT. HEX HD. BLACK SCREW (4 REQ'D.)
6	0017-00003-0339	ELECTROHOME — 19" COLOR DUAL SYNC HORIZ. MTG. MONITOR (OR)
6	0017-00003-0439	WELLS-GARDNER — 19" COLOR DUAL SYNC HORIZ. MTG. MONITOR
7	A508-00005-0000	MONITOR MTG. CHANNEL ASSY. (2 REQ'D.)
	0017-00102-0066	1/4-20 x 3/4 UNSLOT. HEX BOLT (4 REQ'D.)
	0017-00104-0014	7/8" DISH WASHER (4 REQ'D.)
8	0595-00104-0000	MONITOR RAIL (2 REQ'D.)
9	A088-00016-0000	INTERLOCK SWITCH & BRKT. ASSY.
10	A082-90412-D000	POWER SUPPLY P.C. BRD. ASSY.
	0624-00902-0500	P.C. SUPPORT BRKT. — 6-1/2" LG. (4 REQ'D.)
	0017-00101-0141	#8 x 11/16 UNSLOT. HEX HD. SCR. (8 REQ'D.)
	0017-00104-0037	#8 WASHER (8 REQ'D.)
11	A082-90910-E000	DUAL POWER AMP P.C. ASSY.
	0017-00042-0014	1/8" SNAP BUSHING (4 REQ'D.)
	0017-00101-0751	#5-40 x 1/4 PHIL. RND. HD. M.S. (4 REQ'D.)
12	A945-00020-0000	POWER CHASSIS ASSY. — 125VA., 115V.
13	A941-00004-0000	CARD RACK W/BOARDS ASSY.
	A084-90010-A941	C.P.U. P.C. BOARD ASSY.
	A084-90913-A941	SOUND P.C. BOARD ASSY.
	A084-91399-A941	VIDEO/GENERATOR P.C. BOARD ASSY.
	0017-00042-0208	1-1/8" P.C.B. SUPPORT (4 REQ'D.)
	0017-00042-0253	DUAL LKG. P.C.B. SPACER (4 REQ'D.)
	0017-00101-0085	#6 x 5/16 SLT. HEX HD. WD. SCR. (4 REQ'D.)
14	A950-00004-0000	COIN BOX ASSY.
	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.)
15	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.)
	0017-00100-0037	3/8" E-RING (2 REQ'D.)
16	A945-00019-0000	LINE CORD ASSY. — 115V.

**NO. 941 — SATAN'S HOLLOW — UPRIGHT — REAR ACCESS — PARTS LIST (Continued)**

*ORDER BY PART NUMBER ONLY*

ITEM	PART NO.	DESCRIPTION
<b>ADDITIONAL PARTS LIST</b>		
	A151-00098-0000	BACK DOOR LOCK ASSY.
	0017-00009-0490	5-5/8" SQR. VENT GRILL — BACK DOOR (4 REQ'D.)
	A515-00021-0000	MULTIFUNCTION SWITCH & BRKT. ASSY.
	A515-00020-0000	TEST SWITCH & BRKT. ASSY.
	A941-00015-0000	MASTER CABLE W/BRKT. ASSY.
	A941-00007-0000	HIGH VOLTAGE CABLE ASSY.
	A941-00008-0000	LOW VOLTAGE CABLE ASSY.
	A968-00029-0000	VIDEO SIGNAL CABLE ASSY.
	0017-00009-0513	1/8" T-HANDLE ALLEN KEY

NO. 941 — SATAN'S HOLLOW — UPRIGHT — HEADER FLUORESCENT LIGHT ASSY.

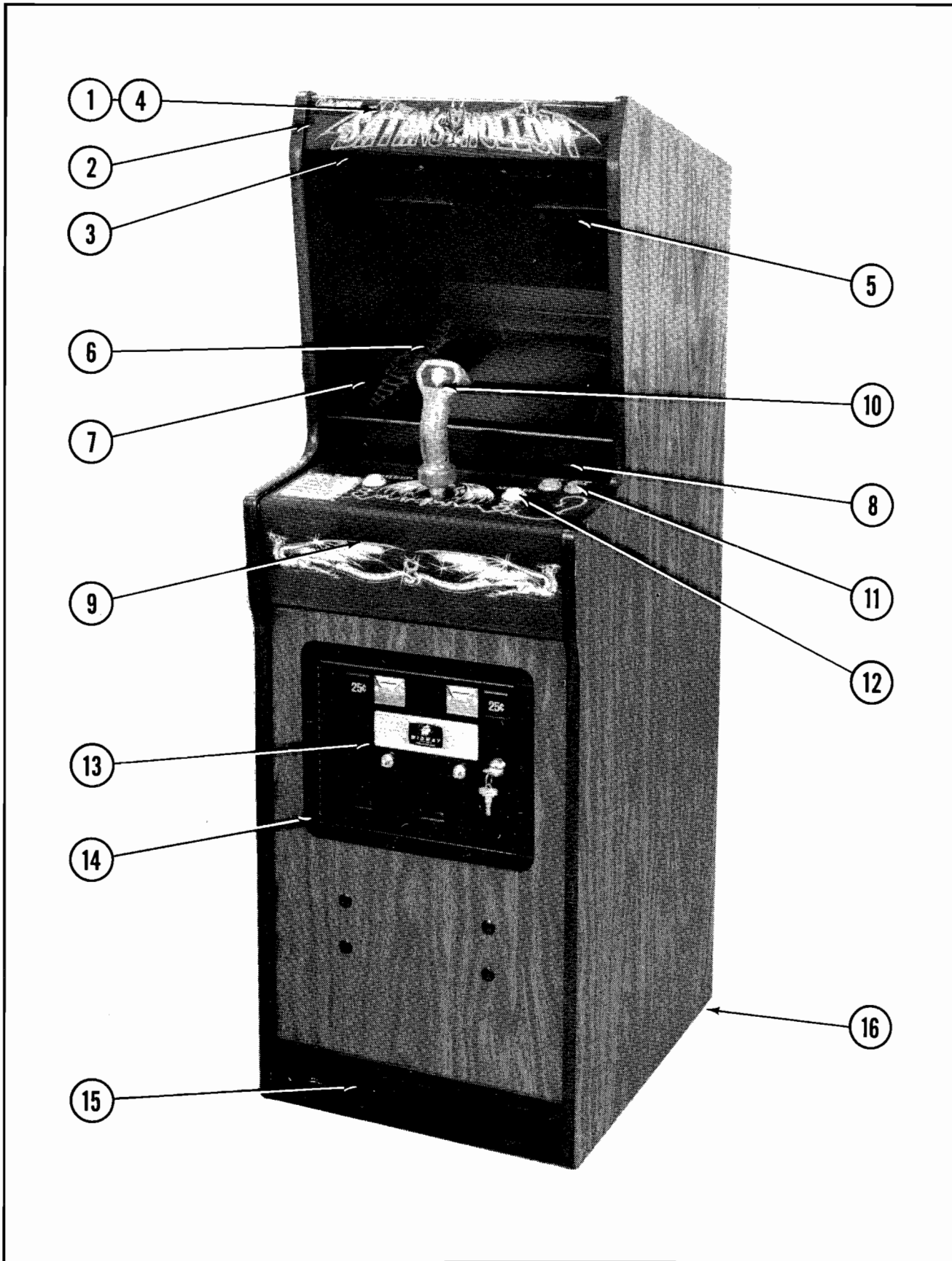


NO. 941 — SATAN'S HOLLOW — UPRIGHT — HEADER FLUORESCENT LIGHT ASSY. — PARTS LIST

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.

NO. 943 — SATAN'S HOLLOW — MINI — FRONT

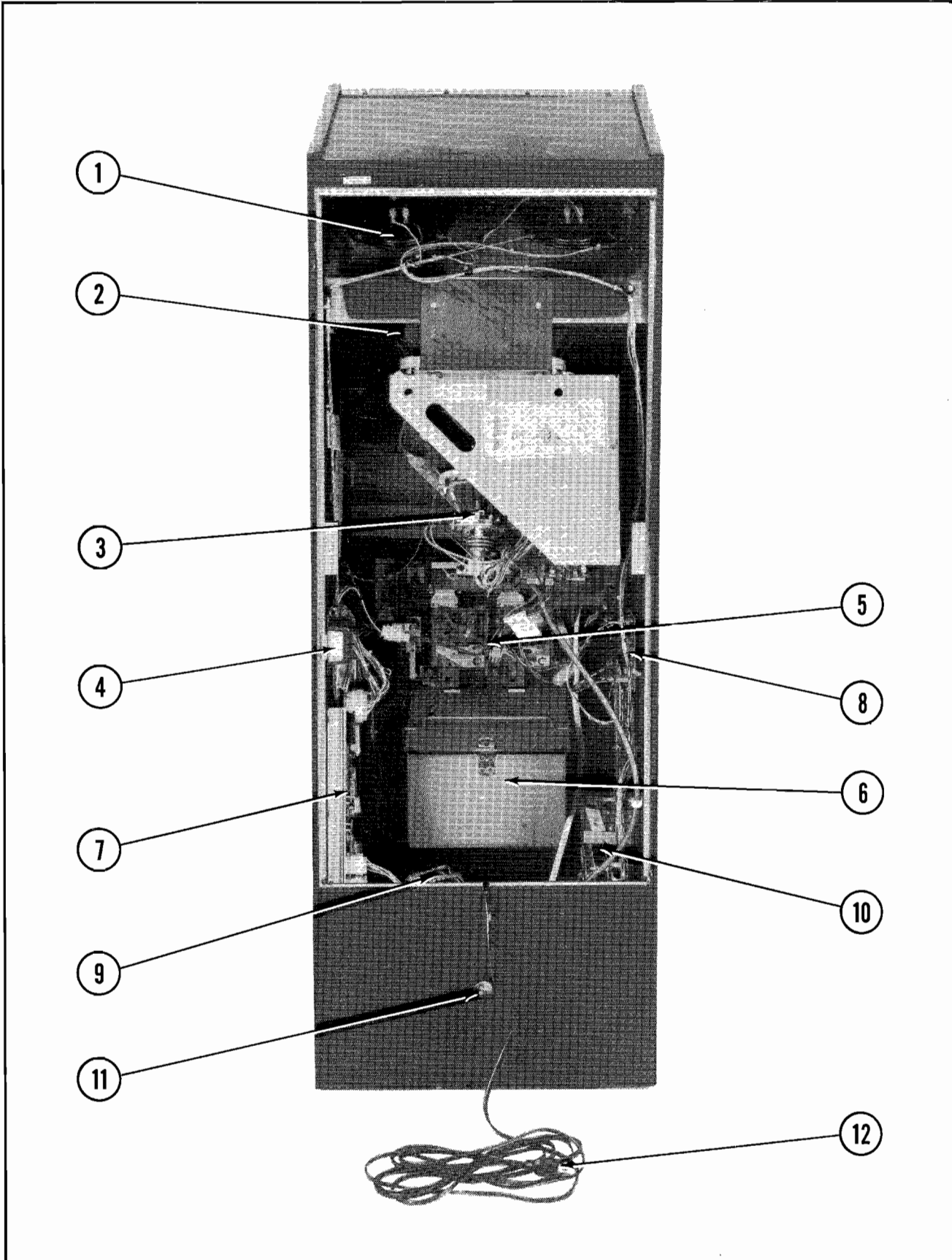


**NO. 943 — SATAN'S HOLLOW — MINI — FRONT -- PARTS LIST**

*ORDER BY PART NUMBER ONLY*

<b>ITEM</b>	<b>PART NO.</b>	<b>DESCRIPTION</b>
1	0943-00901-00XF	DECORATIVE HEADER
2	0537-00903-0062	GLASS CHANNEL — 3-7/8" LG. (2 REQ'D.)
3	0574-00100-00XF	HEADER BRKT. RETAINER (2 REQ'D.)
	0017-00101-0138	#8 x 5/8 TORX TAMPER RESISTANT SCREW (6 REQ'D.)
	0017-00009-0522	LONG ARM KEY T-20 (FOR ABOVE SCREW)
4	A926-00010-0000	INSERT DISPLAY ASSY.
	A514-00015-0000	INSERT CABLE ASSY.
	0017-00031-0030	WEDGE BASE LIGHT SOCKET (5 REQ'D.)
	0017-00003-0219	#194 WEDGE LAMP — 14V., .27A. (5 REQ'D.)
5	0017-00009-0393	BLACK SPEAKER GRILL W/SLOTS (2 REQ'D.)
	0017-00003-0430	6" x 9" SPEAKER — 4 OHM, 10W. (2 REQ'D.)
	0017-00101-0127	#8-32 x 1-1/2" CARRIAGE BOLT (8 REQ'D.)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (8 REQ'D.)
6	0943-00900-00XF	MAIN VIEWING GLASS
7	0537-00903-0056	GLASS CHANNEL — 14-1/2" LG. (2 REQ'D.)
8	A555-00016-0000	GLASS CLAMPING PLATE ASSY.
	0017-00101-0138	#8 x 5/8 TORX TAMPER RESISTANT SCREW (2 REQ'D.)
9	0943-00902-0000	DECORATIVE CONTROL SHELF OVERLAY
	A943-00015-0000	CONTROL SHELF WELD PLATE ASSY.
	0550-00101-0100	CONTROL SHELF MTG. BRKT. — RIGHT
	0550-00101-0200	CONTROL SHELF MTG. BRKT. — LEFT
	0555-00901-0000	PLASTIC LOCATING PIN (4 REQ'D.)
	0982-00102-0000	STRIKE (2 REQ'D.)
	0017-00009-0534	BASSICK CLAMP (2 REQ'D.)
	0017-00101-0141	#8 x 11/16 UNSLOT. HEX HD. SCR. (12 REQ'D.)
10	A941-00021-0000	CONTROL ASSEMBLY
	A089-00020-0000	CONTROL GRIP CABLE ASSY — 16"
	A943-00011-0000	CONTROL SHELF CABLE ASSY.
11	0017-00042-0256	PUSH BUTTON ASSY. — RED (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	LARGE COIN DOOR FRAME
	0017-00101-0121	#6-32 5/16 PHIL. TRS. HD. SCR. (3 REQ'D.)
15	0935-00906-0400	KICK PLATE — 17-15/16" 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. 943 — SATAN'S HOLLOW — MINI — REAR ACCESS



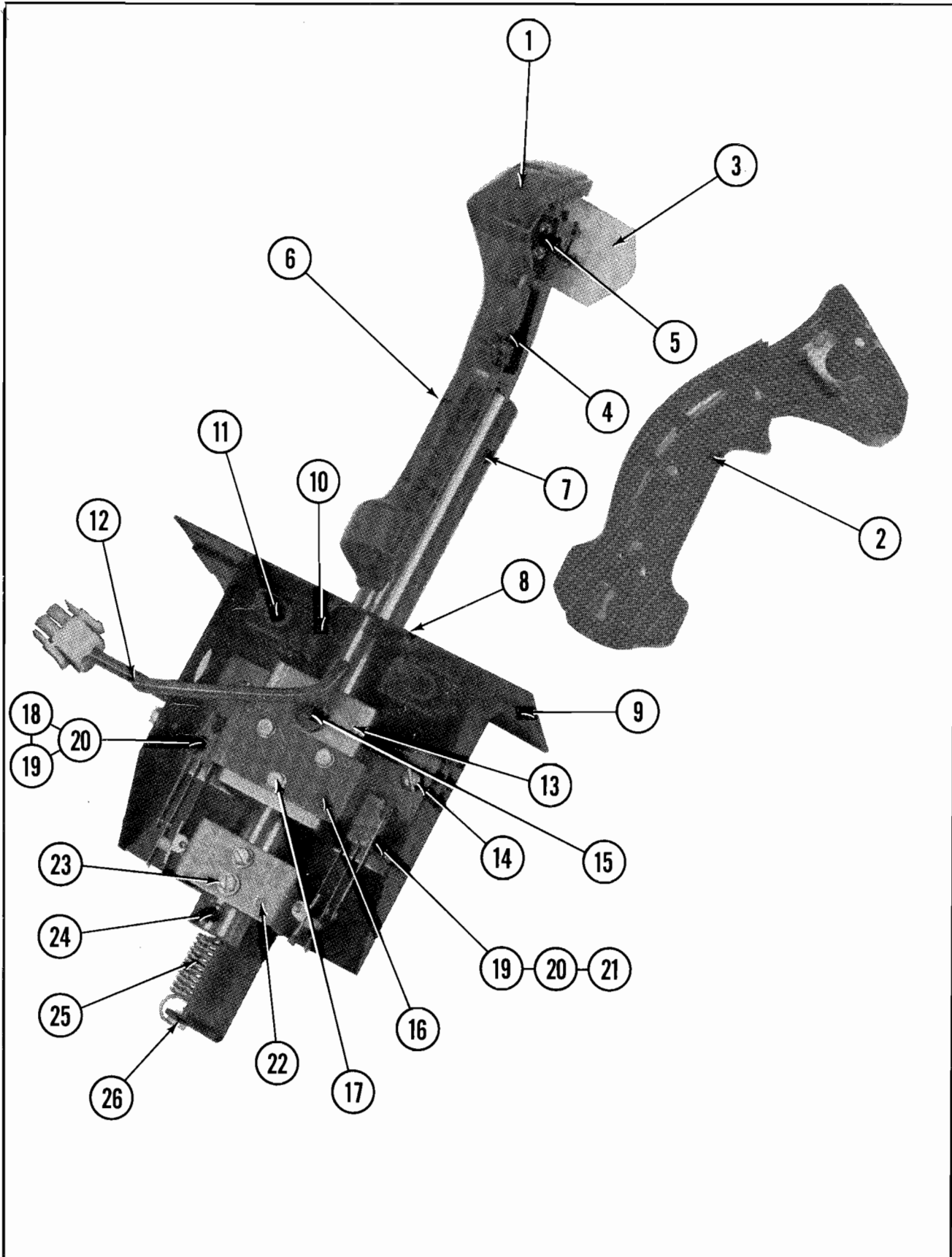


**NO. 943 — SATAN'S HOLLOW — MINI — REAR ACCESS — PARTS LIST**

*ORDER BY PART NUMBER ONLY*

ITEM	PART NO.	DESCRIPTION
1	0017-00003-0430	6" x 9" SPEAKER — 4 OHM, 10W. (2 REQ'D.)
2	0513-00900-0000	T.V. BEZEL
	A961-00026-0000	BEZEL MTG. BRKT. ASSY. (2 REQ'D.)
3	0017-00003-0340	ELECTROHOME — 13" COLOR DUAL SYNC HORIZ. MTG. MONITOR (OR)
3	0017-00003-0435	WELLS-GARDNER — 13" COLOR DUAL SYNC HORIZ. MTG. MONITOR
	A926-00012-00XF	T.V. MTG. BRKT. ASSY.
	0017-00102-0066	1/4-20 x 3/4 UNSLOT. HEX HD. BOLT (2 REQ'D.)
	0017-00104-0014	7/8" DISH WASHER (2 REQ'D.)
	0513-00101-0000	MONITOR MTG. BRKT.
4	A088-00016-0000	INTERLOCK SWITCH & BRKT. ASSY.
5	A090-00300-11BK	U.S.A. 25¢ DOUBLE COIN DOOR ASSY.
6	A950-00004-0000	COIN BOX ASSY.
	A950-00006-0000	COIN BOX CRADLE ASSY.
	0950-00105-0000	COIN BOX COVER
	0950-00104-0000	COIN BOX HANDLE
	0950-00900-0000	LARGE PLASTIC CASH BOX
	0017-00101-0142	1/4-20 x 1-3/8 BLACK RHD. 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.)
7	A082-90412-D000	POWER SUPPLY P.C. BRD. ASSY.
	0624-00902-0500	P.C. SUPPORT BRKT. — 6-1/2" LG. (4 REQ'D.)
	0017-00101-0141	#8 x 11/16 UNSLOT. HEX HD. SCR. (8 REQ'D.)
	0017-00104-0037	#8 WASHER (8 REQ'D.)
8	A082-90910-E000	DUAL POWER AMP P.C. ASSY.
	0017-00042-0014	1/8" SNAP BUSHING (4 REQ'D.)
	0017-00101-0751	#5-40 x 1/4 PHIL. RND. HD. M.S. (4 REQ'D.)
9	A945-00020-0000	POWER CHASSIS ASSY. — 125VA., 115V.
10	A941-00004-0000	CARD RACK W/BOARDS ASSY.
	A084-90010-A941	C.P.U. P.C. BOARD ASSY.
	A084-90913-A941	SOUND P.C. BOARD ASSY.
	A084-91399-A941	VIDEO/GENERATOR P.C. BOARD ASSY.
	0017-00042-0208	1-1/8" P.C.B. SUPPORT (4 REQ'D.)
	0017-00042-0253	DUAL LKG. P.C.B. SPACER (4 REQ'D.)
	0017-00101-0085	#6 x 5/16 SLT. HEX HD. WD. SCR. (4 REQ'D.)
11	A088-00013-0000	ON-OFF SWITCH & BRKT. ASSY.
12	A945-00019-0000	LINE CORD ASSY. — 115V.
<b>ADDITIONAL PARTS LIST</b>		
	A151-00098-0000	BACK DOOR LOCK ASSY.
	0017-00009-0490	5-5/8" SQR. VENT GRILL (4 REQ'D.)
	0926-00904-0000	PROTECTIVE BUBBLE — BACK DOOR
	0017-00101-0628	#8-32 x 3/4 CARRIAGE BOLT (10 REQ'D.)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (10 REQ'D.)
	A515-00020-0000	TEST SWITCH & BRKT. ASSY.
	A943-00014-0000	MASTER CABLE W/BRKT. ASSY.
	A943-00008-0000	HIGH VOLTAGE CABLE ASSY.
	A943-00009-0000	LOW VOLTAGE CABLE ASSY.
	A968-00029-0000	VIDEO SIGNAL CABLE ASSY.

NO. 941 & 943 — SATAN'S HOLLOW — UPRIGHT & MINI — CONTROL ASSY.

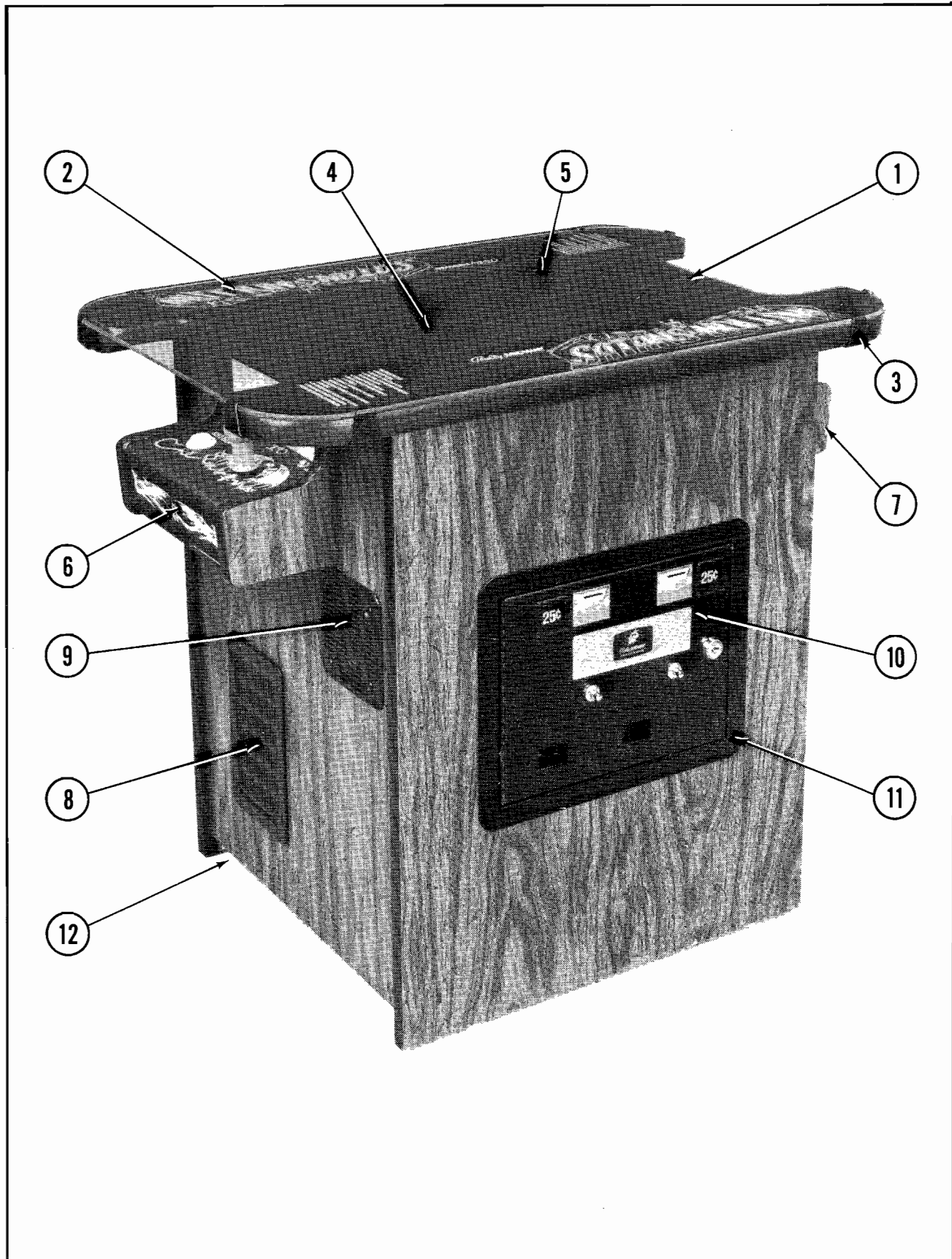


NO. 941 & 943— SATAN'S HOLLOW — UPRIGHT & MINI — CONTROL ASSY. — PARTS LIST

ORDER BY PART NUMBER **ONLY**

ITEM	PART NO.	DESCRIPTION
1	0873-00900-0200	CONTROL GRIP — LEFT
2	0873-00900-0100	CONTROL GRIP — RIGHT
3	0941-00904-0000	LENS
4	0628-00906-0000	TRIGGER
5	A628-00028-0000	CONTROL GRIP SWITCH ASSY.
	0020-00202-0000	SWITCH PLATE
	0017-00101-0528	#5-40 x 3/4 PHIL. RND. HD. M.S. (2 REQ'D.)
	0873-00123-00XF	SWITCH MTG. BRKT.
	0017-00101-0083	#4-20 x 3/8 PHIL. PAN HD. SCR. (2 REQ'D.)
6	0017-00101-0149	#10-32 x 3/8 TORX TAMPER RESISTANT BUTTON HD. SCREW (5 REQ'D.)
7	0941-00700-00XF	GRIP TUBING
8	0628-00904-0000	SLIDE
9	A941-00024-0000	CONTROL BRKT. & BEARING ASSY.
10	0941-00905-0000	BUMPER (2 REQ'D.)
	0941-00704-00XF	SPACER (2 REQ'D.)
11	0017-00101-0668	#10-32 x 1" HEX SOCKET HD. CAP SCR. (2 REQ'D.)
	0017-00104-0004	#10 SPLIT LOCK WASHER
12	A089-00020-0000	CONTROL GRIP CABLE ASSY. — 16" LG.
	0010-00266-0100	SPRING EXTENSION STRAIN RELIEF
	0017-00021-0299	2 PIN CONNECTOR
13	A941-00019-0000	BUSHING & BEARING BRKT. ASSY.
14	0017-00101-0646	#10-32 x 1/4 SLT. PAN HD. SCR. W/SEMS (4 REQ'D.)
15	0942-00702-00XF	PIVOT PIN
	0017-00100-0025	1/4" E-RING (2 REQ'D.)
16	0941-00108-0000	SWITCH BRKT.
17	0017-00101-0085	#6 x 5/16 SLT. HEX HD. SCR. (3 REQ'D.)
18	A941-00022-0100	ROLLER SWITCH ASSY. — LEFT
19	A941-00022-0200	ROLLER SWITCH ASSY. — RIGHT
20	0020-00202-0000	SWITCH PLATE (2 REQ'D.)
21	0017-00101-0527	#5-40 x 5/8 PHIL. RND. HD. SCR. (4 REQ'D.)
22	0941-00109-0000	SWITCH ACTUATOR
23	0017-00101-0598	#8-32 x 5/16 SLT. HEX HD. SCR. (2 REQ'D.)
24	0941-00703-00XF	SPRING PIN
	0017-00100-0018	3/16" E-RING
25	0010-00602-0000	EXTENSION SPRING
26	0017-00042-0316	SHOULDER WASHER
	0017-00101-0622	#8-32 x 1/2 HEX HD. SOCKET SCREW (LOCATED ON ITEM #7)

NO. 942 — SATAN'S HOLLOW — COCKTAIL — FRONT

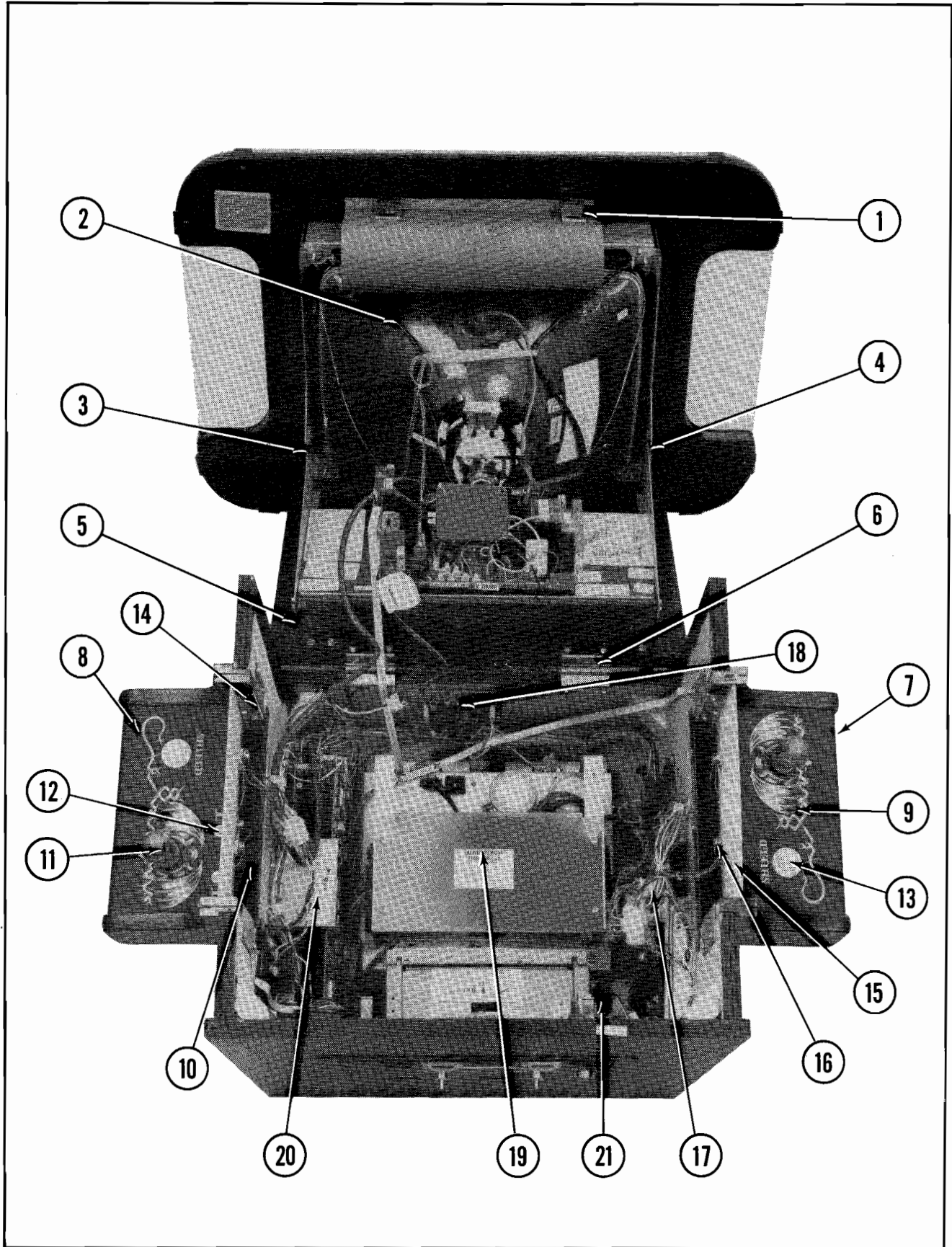


**NO. 942 — SATAN'S HOLLOW — COCKTAIL — FRONT — PARTS LIST**

*ORDER BY PART NUMBER ONLY*

<b>ITEM</b>	<b>PART NO.</b>	<b>DESCRIPTION</b>	
1	0017-00009-0499	COVER GLASS — 32" x 22" x 1/4"	
2	0942-00900-0000	ARTWORK UNDERLAY — DECORATIVE	
3	0775-00104-00XF	GLASS CLIPS (8 REQ'D.)	
4	0017-00101-0117	#8 x 5/8 PHIL. TRS. HD. SCREW (8 REQ'D.)	
	0530-00903-0000	ACRYLIC DIFFUSER	
	0508-00901-0000	PLEXI-GLASS CLIPS (4 REQ'D.)	
	0017-00101-0017	#6 x 1/2" SLT. HEX HD. BLK. SCREW (4 REQ'D.)	
5	0557-00900-0000	T.V. BEZEL	
6	A942-00004-0100	CONTROL SHELF ASSY. — PLAYER #1	
7	A942-00004-0200	CONTROL SHELF ASSY. — PLAYER #2	
8	0017-00009-0393	BLACK SPEAKER GRILL W/SLOTS (2 REQ'D.)	
9	0017-00009-0482	SMALL SPEAKER GRILL (2 REQ'D.)	
	0017-00003-0460	4" SQR. SPEAKER — 4 OHM, 10W. (2 REQ'D.)	
	0017-00101-0136	#8-32 x 1-1/4 CARRIAGE BOLT (16 REQ'D.)	
	0017-00103-0061	#8-32 HEX NUT W/SEMS (16 REQ'D.)	
	10	A090-00300-11BK	COIN DOOR ASSY. — U.S.A. 25¢
		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. 942 — SATAN'S HOLLOW — COCKTAIL — INTERIOR ACCESS



**NO. 942 — SATAN'S HOLLOW — COCKTAIL — INTERIOR ACCESS — PARTS LIST**

*ORDER BY PART NUMBER ONLY*

ITEM	PART NO.	DESCRIPTION
1	0610-00132-00ZN	STRIKE (2 REQ'D.)
	0017-00009-0534	BASSICK CLAMP (2 REQ'D.)
	0017-00101-0141	#8 x 11/16 UNSLOT. HEX HD. M.S. (8 REQ'D.)
2	0017-00003-0339	ELECTROHOME — 19" COLOR DUAL SYNC HORIZ. MTG. MONITOR (OR)
2	0017-00003-0439	WELLS-GARDNER — 19" COLOR DUAL SYNC HORIZ. MTG. MONITOR
3	A515-00019-0000	MONITOR SUPPORT ASSY. — LEFT
4	A515-00019-0100	MONITOR SUPPORT ASSY. — RIGHT
	0017-00101-0109	#8 x 5/16 UNSLOT. HEX HD. BOLT (6 REQ'D.)
	0942-00102-0000	POWER CHASSIS MTG. BRKT. (2 REQ'D.)
5	0927-00101-00XF	SUPPORT ANGLE (2 REQ'D.)
	0017-00101-0598	#8-32 x 5/16 SLT. HEX HD. M.S. (8 REQ'D.)
6	0017-00009-0514	2-1/2" HINGE (2 REQ'D.)
	0017-00101-0136	#8-32 x 1-1/4 CARRIAGE BOLT (8 REQ'D.)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (8 REQ'D.)
7	A942-00013-0000	CONTROL PANEL WELDMENT ASSY. (2 REQ'D.)
8	0942-00901-0100	DECORATIVE OVERLAY PLAYER #1
9	0942-00901-0200	DECORATIVE OVERLAY PLAYER #2
10	0510-00101-00XF	BOTTOM PAN (2 REQ'D.)
	0017-00101-0341	#6 x 1/4 PHIL. TRS. HD. SCR. (6 REQ'D.)
11	A942-00018-0000	CONTROL ASSY. (2 REQ'D.)
	A942-00005-0100	CONTROL SHELF CABLE ASSY. — PLAYER #1
	A942-00005-0200	CONTROL SHELF CABLE ASSY. — PLAYER #2
12	0017-00032-0051	SMALL RED BUTTON SWITCH ASSY. W/HARDWARE (2 REQ'D.)
13	0017-00042-0301	PUSH BUTTON ASSY. — YELLOW (2 REQ'D.)
	0017-00032-0093	PUSH BUTTON SWITCH W/HOLDER (2 REQ'D.)
	0017-00103-0054	5/8-11 PAL NUT (2 REQ'D.)
14	0930-00104-0000	CONTROL PANEL LOCATING BRKT. (4 REQ'D.)
	0017-00101-0025	#8 x 1/2 SLT. HEX HD. M.S. (16 REQ'D.)
15	0727-00901-0000	LIGHT SHIELD (2 REQ'D.)
16	0017-00031-0044	WEDGE BASE LAMP SOCKET (4 REQ'D.)
	0017-00003-0219	#194 WEDGE LAMP — 14V., .27A. (4 REQ'D.)
	0017-00101-0555	#6-32 x 5/16 SLT. HEX HD. M.S. (4 REQ'D.)
17	A082-90412-D000	POWER SUPPLY P.C. BRD. ASSY.
	0624-00902-0100	P.C. SUPPORT BRKT. — 12" LG.
	0624-00902-0500	P.C. SUPPORT BRKT. — 6-1/2" LG. (2 REQ'D.)
	0017-00101-0141	#8 x 11/16 UNSLOT. HEX HD. SCR. (7 REQ'D.)
	0017-00104-0037	#8 WASHER (7 REQ'D.)
18	A082-90910-E000	DUAL POWER AMP P.C. ASSY.
	0017-00042-0014	1/8" SNAP BUSHING (4 REQ'D.)
	0017-00101-0751	#5-40 x 1/4 PHIL. RND. HD. M.S. (4 REQ'D.)
19	A945-00020-0000	POWER CHASSIS ASSY. — 125VA., 115V.
20	A941-00004-0000	CARD RACK W/BOARDS ASSY.
	A084-90010-A941	C.P.U. P.C. BOARD ASSY.
	A084-90913-A941	SOUND P.C. BRD. ASSY.
	A084-91399-A941	VIDEO/GENERATOR P.C. BOARD ASSY.
	0017-00042-0208	1-1/8" P.C.B. SUPPORT (4 REQ'D.)
	0017-00042-0253	DUAL LKG. P.C.B. SUPPORT (4 REQ'D.)
	0017-00101-0085	#6 x 5/16 SLT. HEX HD. WD. SCR. (4 REQ'D.)

**NO. 942 — SATAN'S HOLLOW — COCKTAIL — INTERIOR ACCESS — PARTS LIST (Continued)**

*ORDER BY PART NUMBER ONLY*

ITEM	PART NO.	DESCRIPTION
21	A775-00013-0000	FAN ASSEMBLY
	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. M.S. (4 REQ'D.)
	<b>ADDITIONAL PARTS LIST</b>	
	A088-00014-0000	INTERLOCK SWITCH & BRKT. ASSY.
	A088-00013-0000	ON-OFF SWITCH & BRKT. ASSY.
	A942-00012-0000	MASTER CABLE W/BRKT. ASSY.
	A942-00009-0000	HIGH VOLTAGE CABLE ASSY.
	A942-00008-0000	LOW VOLTAGE CABLE ASSY.
	A580-00011-0000	VIDEO SIGNAL CABLE ASSY.
	0942-00902-0000	MONITOR SHIELD
	A927-00005-0000	HIGH BASE LEG KIT ASSY. — OPTIONAL

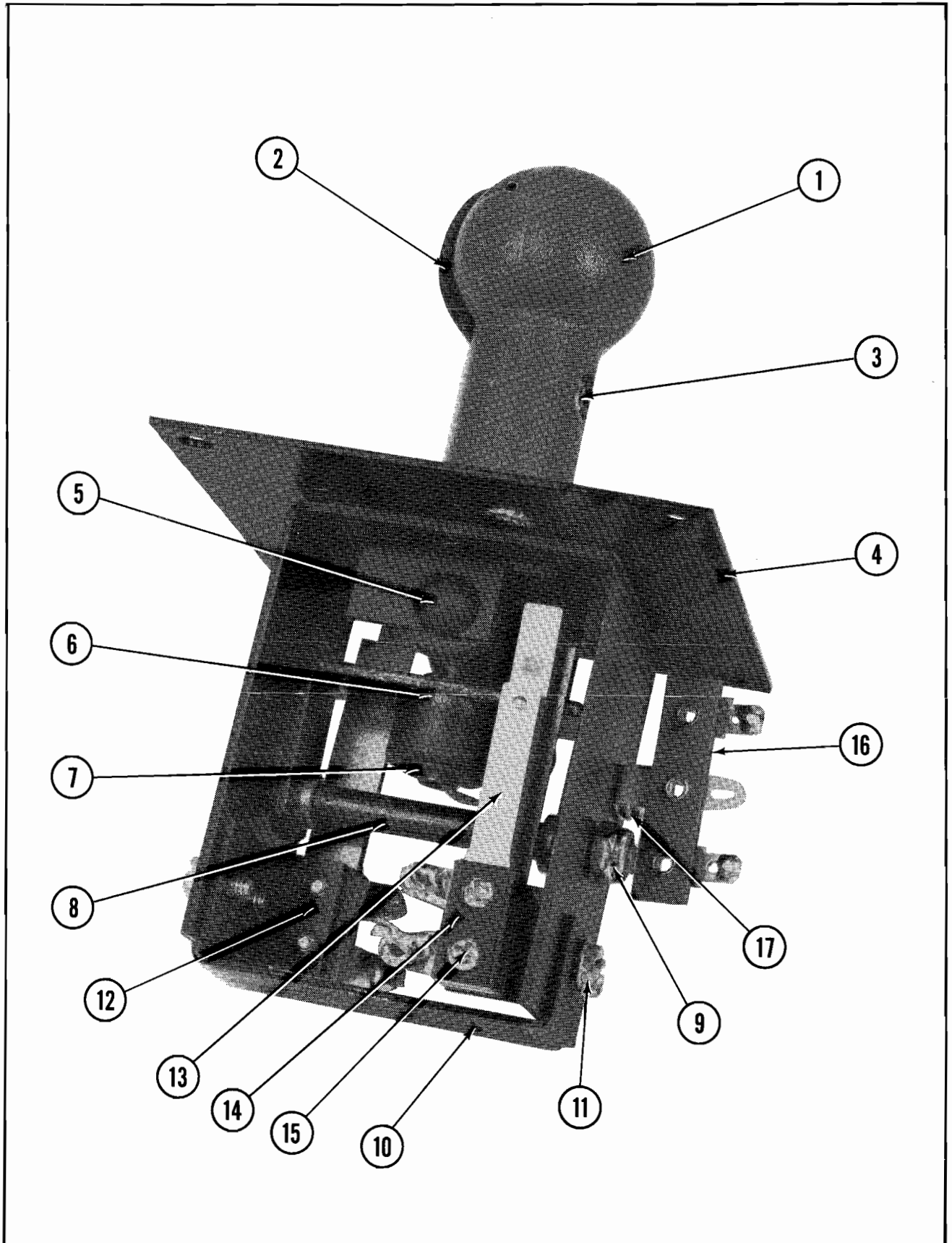
**NO. 942 — SATAN'S HOLLOW — COCKTAIL — CONTROL ASSY. — PARTS LIST**

*ORDER BY PART NUMBER ONLY*

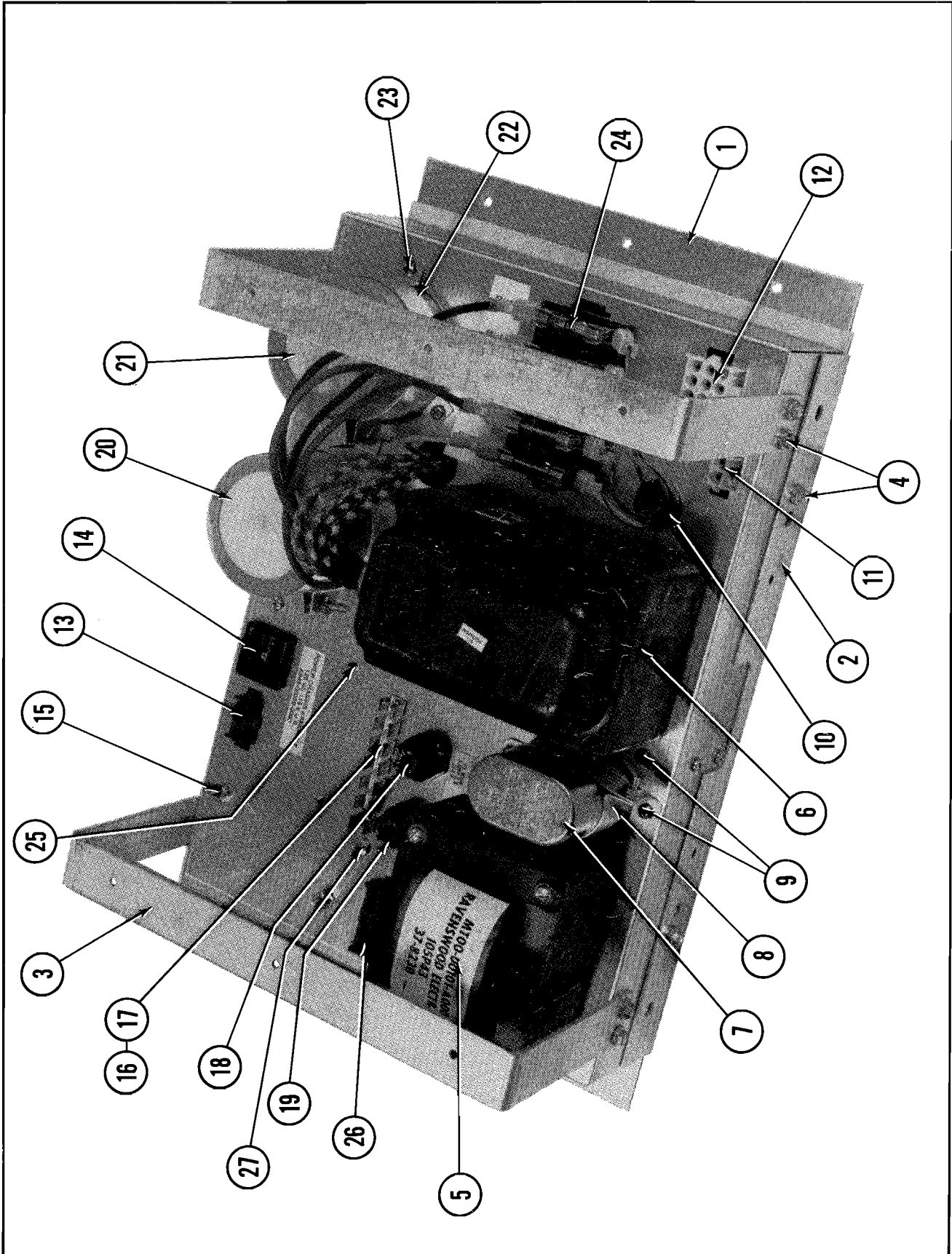
ITEM	PART NO.	DESCRIPTION
1	A727-00020-0000	KNOB & SWITCH ASSY.
	0010-00267-0000	COMPRESSION SPRING
	0017-00032-0103	PUSH BUTTON SWITCH — 115V., 1/2A.
	0017-00101-0786	#2 x 5/16 PHIL. RND. HD. SCREW
2	0727-00904-0000	TRIGGER
	0017-00007-0067	3/32 x 3/4 ROLL PIN
3	0017-00101-0148	#8-32 x 1/4 TAMPER RESISTANT TORX SCREW (2 REQ'D.)
4	A942-00017-00XF	CONTROL SWITCH BRKT. & TOP PLATE ASSY.
5	0017-00041-0616	RUBBER BUMPER (2 REQ'D.)
6	A942-00016-0000	BRKT. & BEARING ASSY.
7	0017-00100-0025	1/4" E-RING
8	0942-00701-00XF	SHAFT
9	0017-00103-0011	#10-32 LOCKING NUT
10	0508-00112-00XF	BRACE — MAIN BRKT.
11	0017-00101-0755	#6-32 x 5/16 SLT. PAN HD. M.S. (4 REQ'D.)
12	0852-00103-00XF	SWITCH BRKT. (2 REQ'D.)
13	A508-00022-0000	LEAF SWITCH ASSY. (2 REQ'D.)
14	0020-00202-0000	SWITCH PLATE (2 REQ'D.)
15	0017-00101-0527	#5-40 x 5/8 PHIL. RND. HD. M.S. (4 REQ'D.)
16	0017-00021-0634	2 POSITION TERMINAL STRIP
17	0017-00101-0555	#6-32 x 5/16 SLT. HEX HD. SCREW



NO. 942 — SATAN'S HOLLOW — COCKTAIL — CONTROL ASSY.



SATAN'S HOLLOW — POWER CHASSIS ASSY. — 125VA., 115V. — ALL VERSIONS

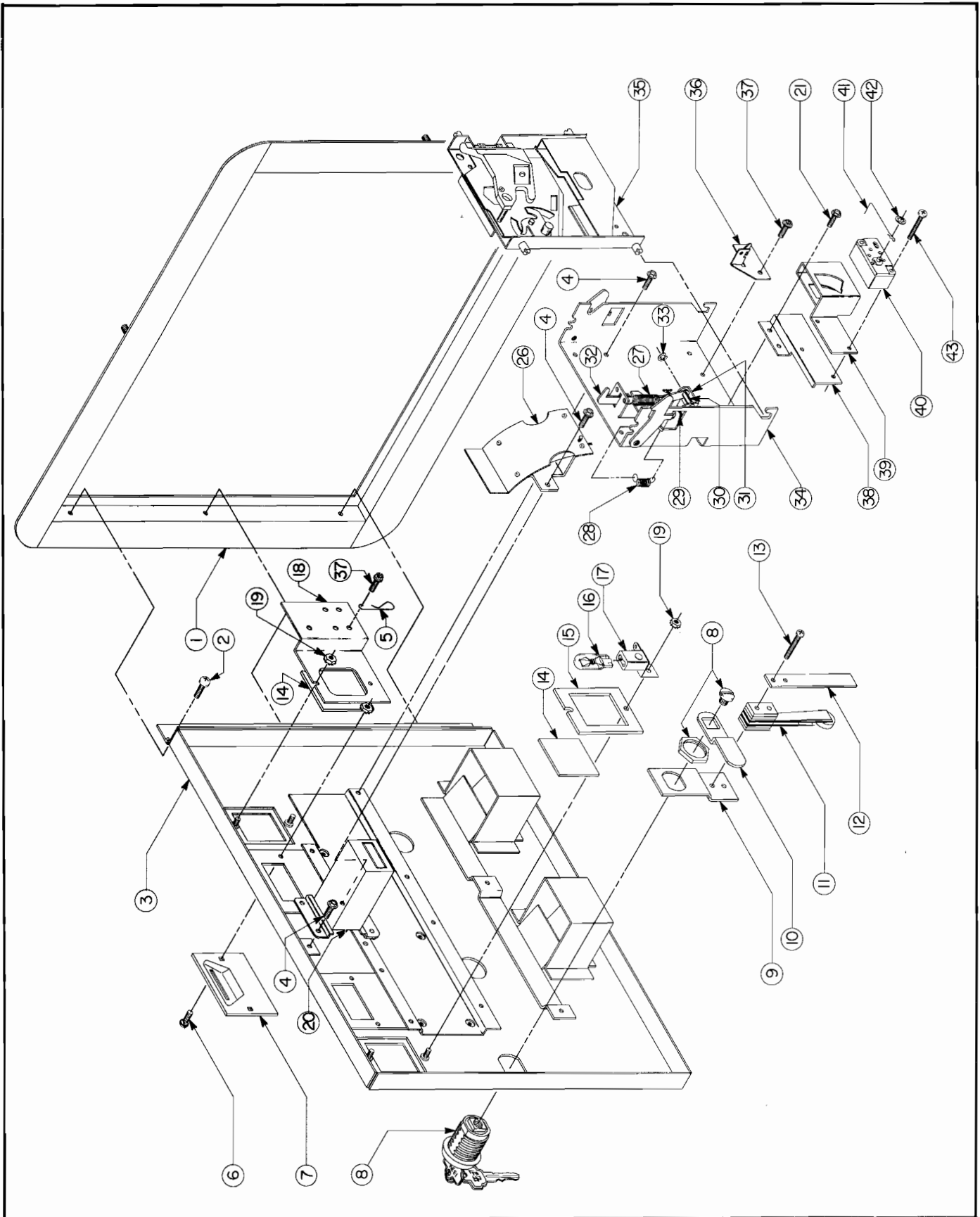


**SATAN'S HOLLOW — POWER CHASSIS ASSY. — 125VA., 115V. — ALL VERSIONS — PARTS LIST**

*ORDER BY PART NUMBER ONLY*

ITEM	PART NO.	DESCRIPTION
1	0945-00104-00XF	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	MT00-00099-A000	POWER TRANSFORMER ASSY. — 115V., 60 HZ.
	0017-00103-0084	#6-32 HEX NUT W/SEMS (4 REQ'D.)
7	0175-181T4-GXJK	CAPACITOR — 3.5 M.F., 440V.
8	0017-00009-0535	CLAMP
	0017-00101-0565	#6-32 x 7/16 SLT. PAN HD. SCR.
	0017-00103-0084	#6-32 HEX NUT W/SEMS
9	0017-00101-0067	#6 x 3/8 PHIL. PAN HD. SCR. (11 REQ'D.)
	0945-00103-00XF	PARTITION — LOCATED UNDER CHASSIS (NOT SEEN)
10	0945-00902-0000	SNAP BUSHING (3 REQ'D.)
11	0017-00021-0297	2 POSITION CONNECTOR
12	A945-00030-0100	CONNECTOR & CABLE ASSY. #1
13	A945-00030-0200	CONNECTOR & CABLE ASSY. #2
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 ASSEMBLY — 125V. — UNDER CHASSIS (NOT SEEN)
16	0017-00021-0510	TERMINAL STRIP
17	0017-00101-0140	#4-40 x 5/16 PHIL. PAN HD. SCR. (2 REQ'D.)
18	0017-00003-0263	SLO-BLO FUSE — 4A., 250V.
19	0017-00003-0005	FUSE — 2A., 250V.
	0017-00003-0444	QUICK CONN. FUSEHOLDER (2 REQ'D.) — FOR ABOVE FUSES
20	0945-00816-1902	CAPACITOR — 100,000 M.F.
21	0945-00816-1901	CAPACITOR — 55,000 M.F.
	0017-00104-0107	#10 FLAT WASHER (4 REQ'D.)
	0017-00103-0081	#10-32 HEX NUT W/SEMS (4 REQ'D.)
22	0017-00009-0422	CLAMP (2 REQ'D.)
	0017-00101-0758	#8-32 x 3/4 PHIL. RND. HD. SCREW (2 REQ'D.)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (2 REQ'D.)
23	0017-00101-0067	#6 x 3/8 PHIL. PAN HD. SCR. (6 REQ'D.)
24	0945-00904-0000	5 POSITION FUSE HOLDER
	0017-00003-0263	SLO-BLO FUSE — 4A., 250V.
	0017-00003-0217	SLO-BLO FUSE — 2.5A., 250V. (2 REQ'D.)
	0017-00003-0007	SLO-BLO FUSE — 3A., 250V. (2 REQ'D.)
	0945-00903-0000	FUSE HOLDER BARRIER
	A945-00022-0000	HEATSINK & DIODE ASSY.
	0017-00101-0067	#6 x 3/8 PHIL. PAN HD. SCR. (2 REQ'D.)
25	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)
26	A945-00030-0500	CONNECTOR & CABLE ASSY.
27	0017-00101-0660	#10-32 x 3/4 PAN HD. SCREW
	0017-00104-0107	#10 FLAT WASHER
	0017-00103-0081	#10-32 HEX NUT W/SEMS

FRONT DOOR ASSEMBLY — U.S.A. 25¢



**FRONT DOOR ASSEMBLY — U.S.A. 25¢**

*ORDER BY PART NUMBER ONLY*

ITEM	PART NO.	DESCRIPTION
1	0090-00002-02BK	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	0017-00101-0552	#6-32 x 1/4 CARRIAGE BOLT (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.)
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	0093-00155-00XF	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	0017-00007-0132	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)



# 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).

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## 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:

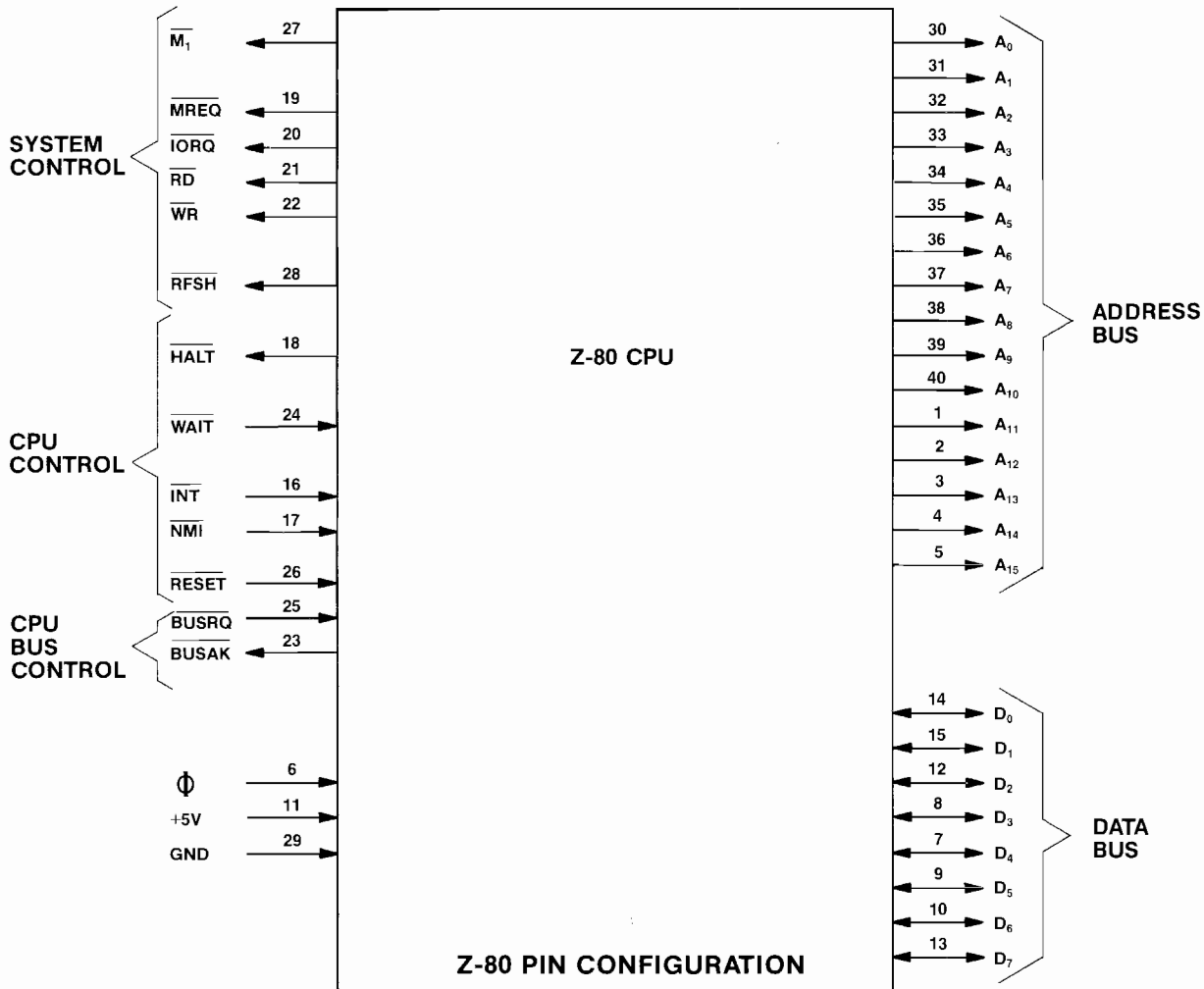
<b>Add</b>	Left or right shifts or rotates (arithmetic and logical)
<b>Subtract</b>	Increment
<b>Logical AND</b>	Decrement
<b>Logical OR</b>	Set bit
<b>Logical Exclusive OR</b>	Reset bit
<b>Compare</b>	Test bit

## 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.



**A<sub>0</sub>-A<sub>15</sub>****(Address Bus)**

Tri-state output, active high. A<sub>0</sub>-A<sub>15</sub> 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. A<sub>0</sub> is the least significant address bit. During refresh time, the lower 7 bits contain a valid refresh address.

**D<sub>0</sub>-D<sub>7</sub>****(Data Bus)**

Tri-state input/output, active high. D<sub>0</sub>-D<sub>7</sub> constitute an 8-bit bidirectional data bus. The data bus is used for data exchanges with memory and I/O devices.

**M<sub>1</sub>****(Machine Cycle one)**

Output, active low. M<sub>1</sub> 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,  $\overline{M1}$  is generated as each op code byte is fetched. These two byte op-codes always begin with CBH, DDH, EDH or FDH.  $\overline{M1}$  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 M1 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 M<sub>1</sub> time while I/O operations never occur during M<sub>1</sub> 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 M<sub>1</sub> 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. 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 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.

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## MCR II SYSTEM P.C. BOARD JUMPER OPTIONS

VIDEO GENERATOR P.C. BOARD									
MANUFACTURER	EPROM NO.	JW#1	JW#2	JW#3	JW#4	JW#5	JW#6	JW#7	JW#8
MOTOROLA	68764	#	*	*	#	*	*	*	*
	68766	#	*	*	#	*	*	*	*
INTEL	2764	*	#	#	*	#	*	*	#
T. I.	2564	#	*	*	#	*	#	#	*
SUPER C.P.U. P.C. BOARD									
JUMPER OPTIONS FOR PROGRAM ROMS ONLY									
MANUFACTURER	EPROM NO.	JW#2	JW#4	JW#5	JW#6	JW#7	JW#18	JW#19	
MOTOROLA	68764	#	#	*	#	*	*	#	
	68766	#	#	*	#	*	*	#	
T. I.	2564	#	#	*	#	*	*	#	
INTEL	2764	*	*	#	*	#	#	*	
JUMPER OPTIONS FOR BACKGROUND ROMS ONLY									
MANUFACTURER	EPROM NO.	JW#10	JW#11	JW#12	JW#13	JW#14	JW#15	JW#16	JW#17
MOTOROLA	68764	*	#	*	#	*	#	#	*
	68766	*	#	*	#	*	#	#	*
T. I.	2564	*	#	*	#	*	#	#	*
INTEL	2764	#	*	#	*	#	*	*	#
SOUND I/O P. C. BOARD									
MANUFACTURER	EPROM NO.	JW#1	JW#2						
NUMEROUS MFR'S	2532	*	#						
NUMEROUS MFR'S	2732	#	*						

\* = CUT JUMPER WIRES WHERE THIS SYMBOL "\*" APPEARS.

# = LEAVE JUMPER WIRES IN WHERE THIS SYMBOL "#" APPEARS.

The above table illustrates the fact that the Video Generator P.C. Board used in the MCR II System has 8 jumper wires, the SUPER C.P.U. P.C. Board used in the MCR II System has 19 jumper wires, and the Sound I/O P.C. Board used in the MCR II System has 2 jumper wires.

All of the above Boards can be used with a variety of different **SETS of EPROM chips**. However, these EPROMS are not all made by the same manufacturer

and do have some internal differences. So, in order to make them function properly in their respective P.C. Boards, certain jumper wires on these Boards have to be cut.

The above table tells you which jumpers to cut (depending on which EPROM set you're going to use) by showing a "\*" under that jumper wire's number. If there is **NO** "\*" under a jumper wire's number, **THAT PARTICULAR JUMPER WIRE IS NOT TO BE CUT.**



# 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.

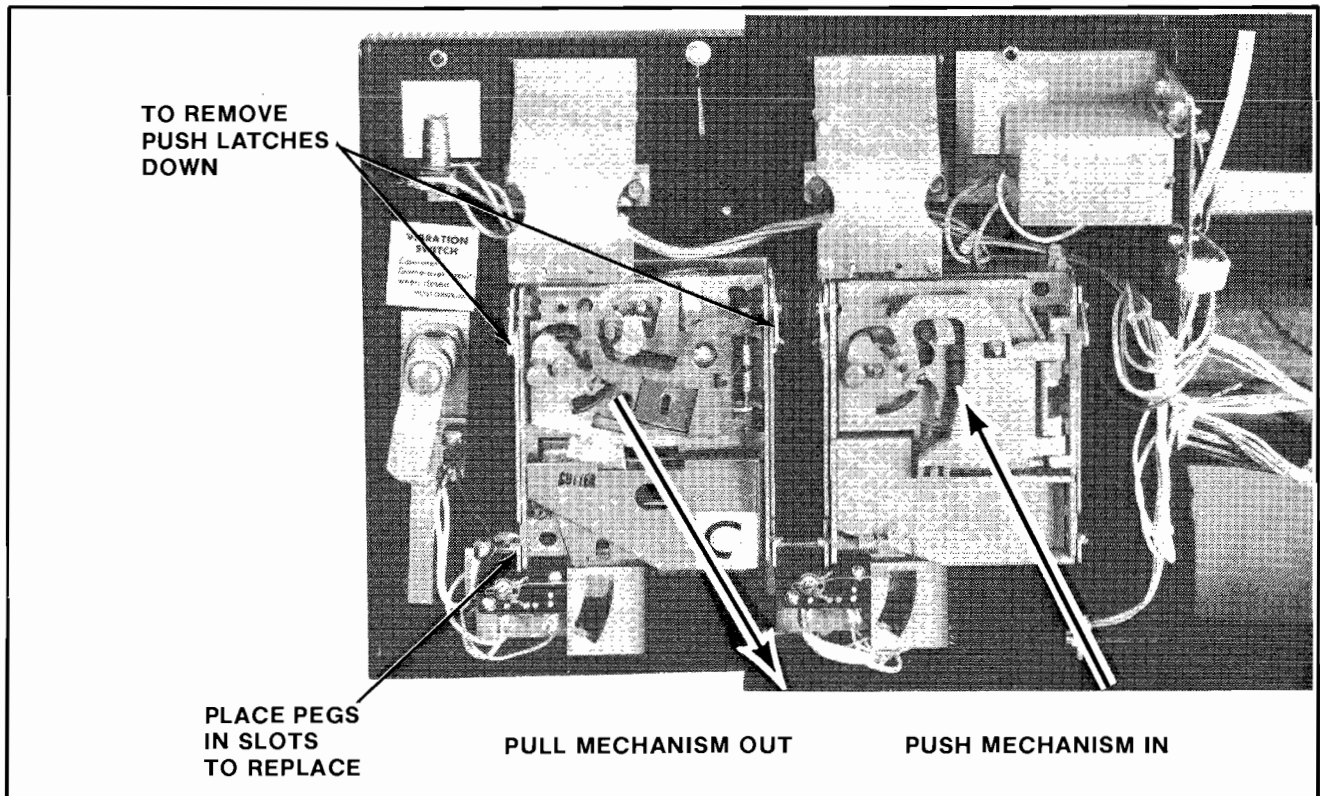


Figure 7-1 Removing and replacing coin acceptor

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.

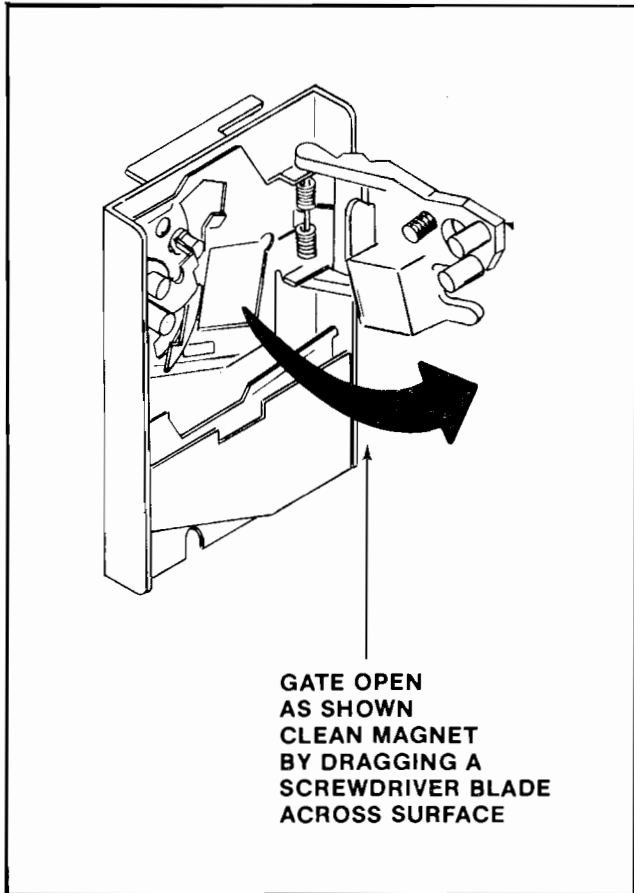


Figure 7-2 Cleaning the metal coin acceptor

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.

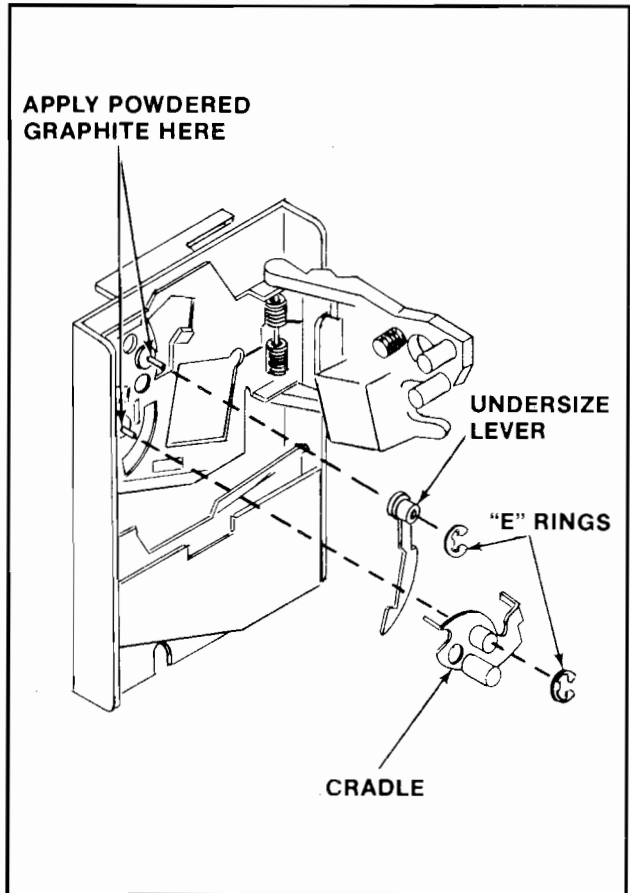


Figure 7-3 Lubricating the metal coin acceptor



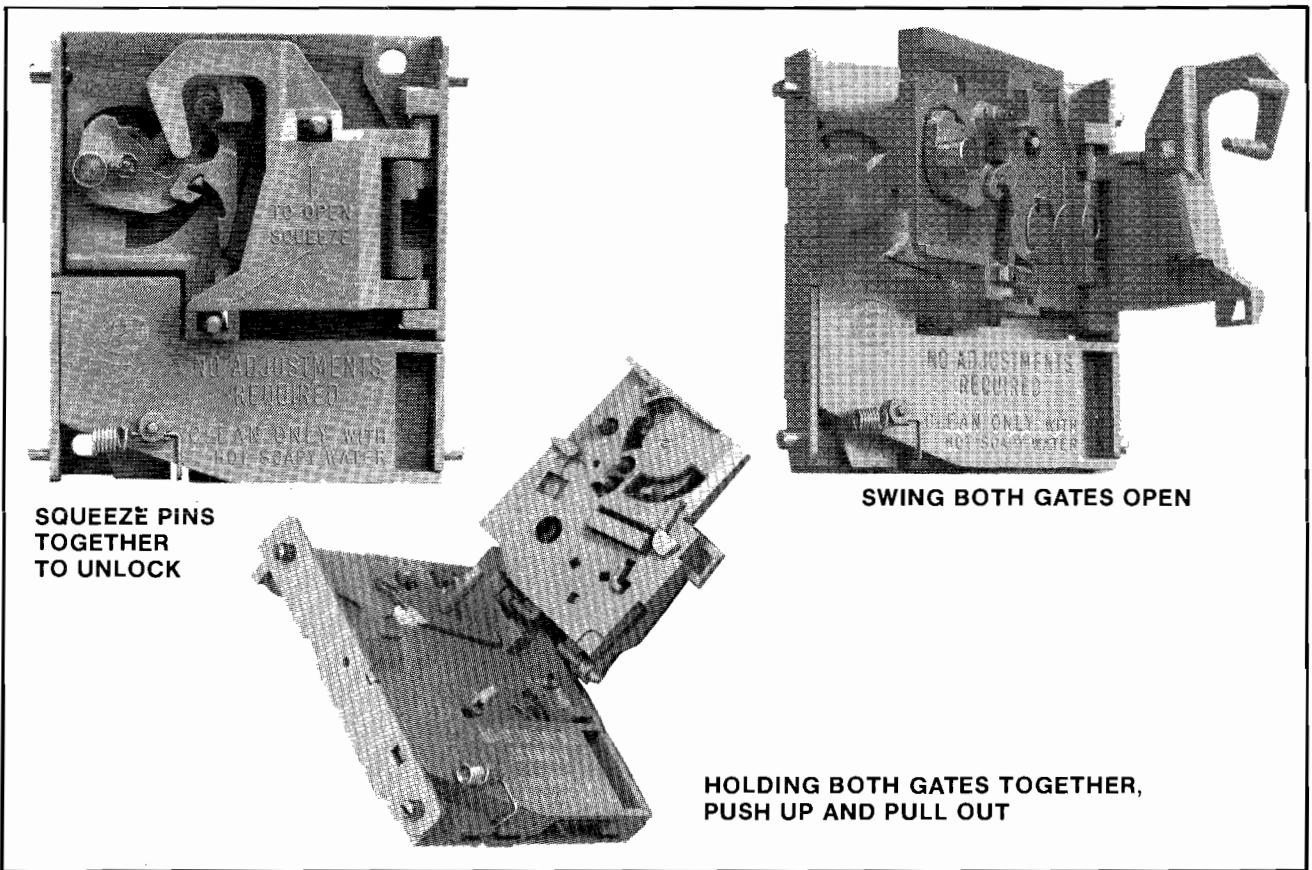


Figure 7-4 Opening the plastic coin acceptor

### 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.

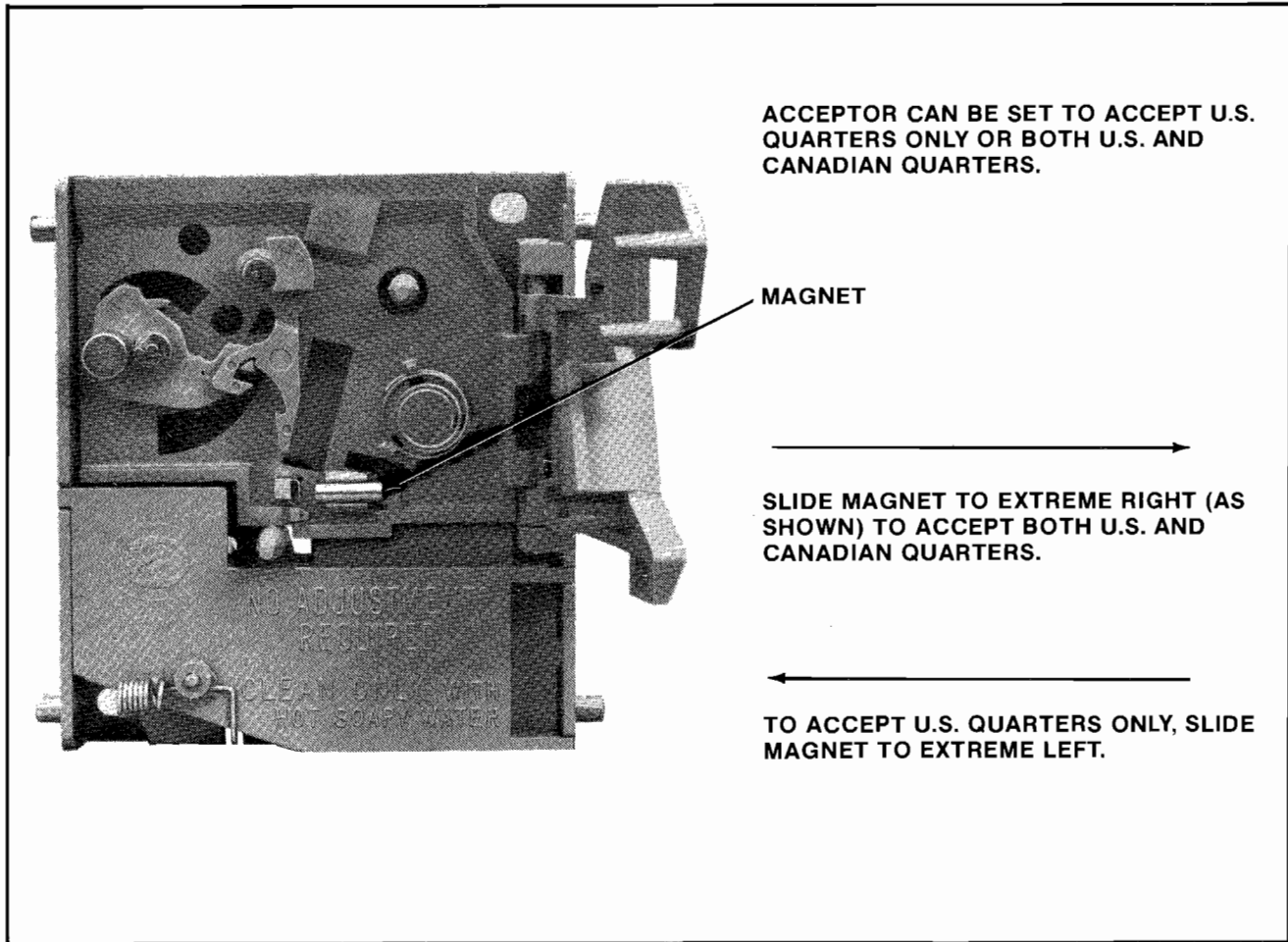


Figure 7-5 Changing the plastic coin acceptor to accept American or Canadian quarters.

**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 (arcng).

## 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.

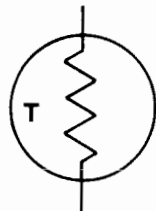
**24. Can't adjust purity or convergence:**

- 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.

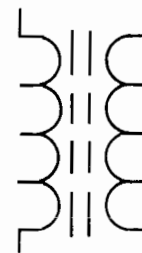
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## Guide To Schematic Symbols



**THERMISTOR**  
(POLARITY DOESN'T MATTER)



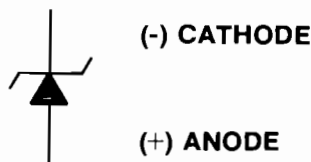
**IRON CORE TRANSFORMER**  
(SUCH AS A FLYBACK)



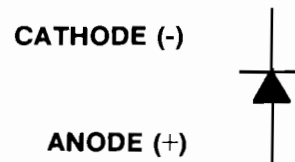
**INDUCTOR, COIL, CHOKE**  
(POLARITY DOESN'T MATTER)



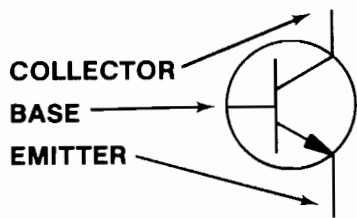
**FUSE**  
(POLARITY DOESN'T MATTER)



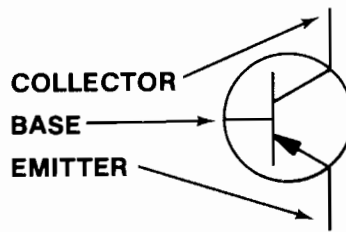
**ZENER DIODE**



**DIODE**



**NPN TRANSISTOR**



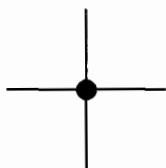
**PNP TRANSISTOR**



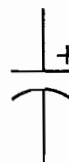
**VARIABLE RESISTOR, POT, CONTROL**  
(POLARITY DOESN'T MATTER)



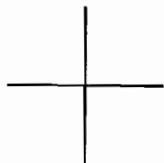
**RESISTOR**  
(POLARITY DOESN'T MATTER)



**LINES ARE CONNECTED**



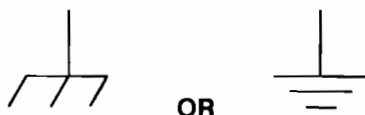
**ELECTROLYTIC CAPACITOR**



**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.

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## 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.

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# 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.



# 19" COLOR MONITOR SCHEMATIC DIAGRAM

## MODELS 19K4901, 19K4906, 19K4951, 19K4956

Power Supply Voltage and Symbols

Symbol	Voltage	Operating Circuit
	15V	Vert. Osc. Sync Blanking CRT Cut-Off
	130V	Horiz. Osc. Horz. Drive Horz. Output Vert. Output
	175V	Video Output

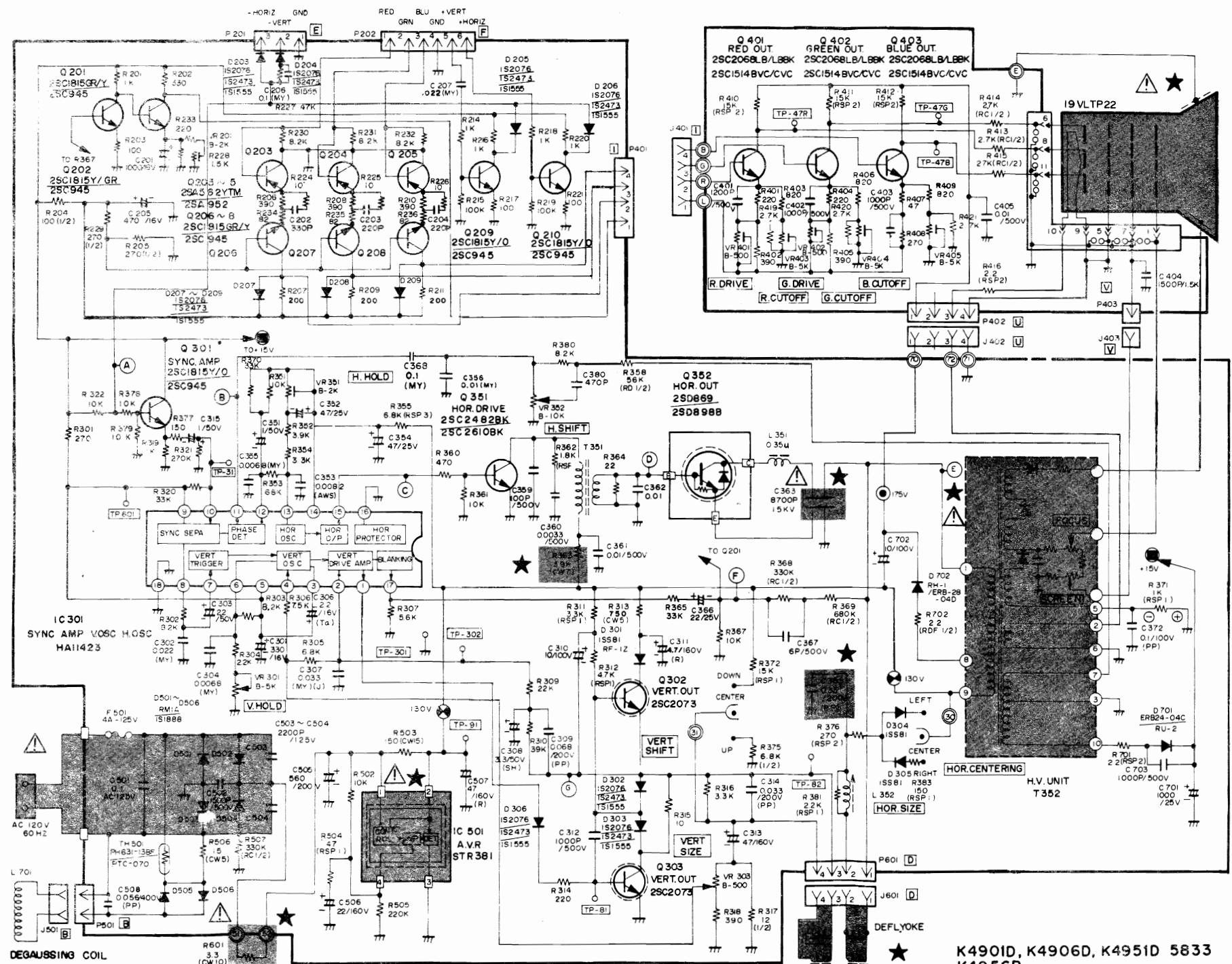
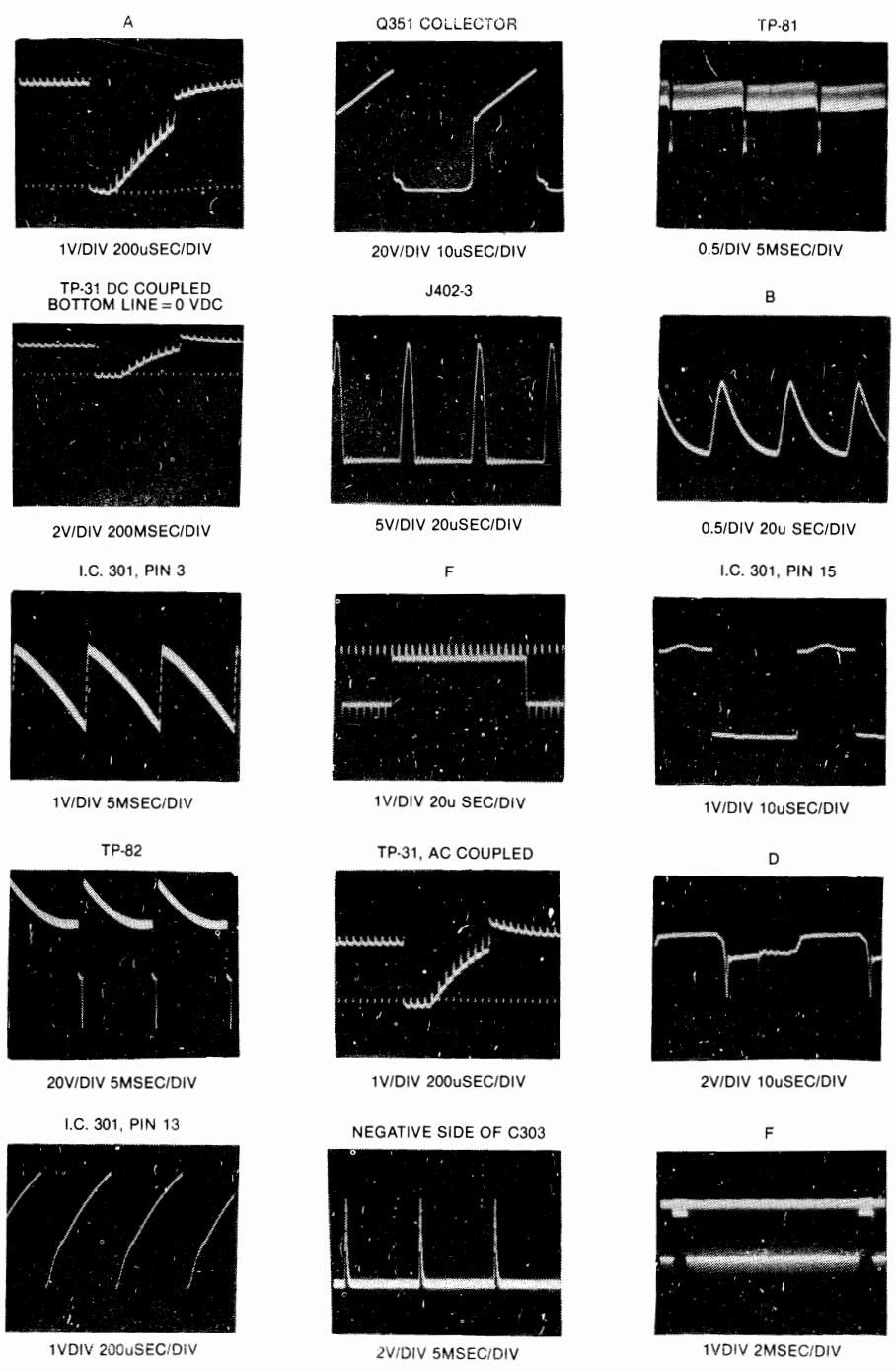
**SERVICE TECHNICIAN WARNING**  
**X-RAY RADIATION PRECAUTION:**  
 THIS PRODUCT CONTAINS CRITICAL ELECTRICAL AND MECHANICAL PARTS ESSENTIAL FOR X-RAY RADIATION PROTECTION.  
 FOR REPLACEMENT PURPOSES, USE ONLY TYPE PARTS SHOWN IN THE PARTS LIST.

**CAUTION: FOR CONTINUED SAFETY, REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER'S RECOMMENDED PARTS.**  
**AVERTISSEMENT: POUR MAINTENIR LE DEGRE DE SECURITE DE L'APPAREIL NE REMPLACER LES COMPOSANTS DONT LE FONCTIONNEMENT EST CRITIQUE POUR LA SECURITE QUE PAR DES PIECES RECOMMANDEES PAR LE FABRICANT.**

### OSCILLOSCOPE WAVEFORM PATTERN

The waveforms shown are as observed on the wide band oscilloscope with the monitor turned to a reasonably strong signal and a normal picture. The voltages shown on each waveform are the approximate peak amplitudes.

If the waveforms are observed on the oscilloscope with a poor high frequency response, the corner of the pulses will tend to be more rounded than those shown and the amplitude of any high frequency pulse will tend to be less.



K4901D, K4906D, K4951D 5833  
 K4956B

## REPLACEMENT PARTS LIST

This monitor contains circuits and components included specifically for safety purposes.

For continued protection no changes should be made to the original design, and components shown in shaded areas of schematic, or  $\Delta$   $\star$  on parts list should be replaced with exact factory replacement parts.

The use of substitute parts may create a shock, fire, radiation or other hazard. Service should be performed by qualified personnel only.

## MAIN BOARD

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
<b>RESISTORS</b>					
R201	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R369	203X5602-329	680K Ohm, 5%, 1/2W Comp.
R202	203X6500-523	30 Ohm, 5%, 1/4W Carbon	R370	203X6501-002	33K Ohm, 5%, 1/4W Carbon
R203	203X6500-405	100 Ohm, 5%, 1/4W Carbon	R371	203X9014-584	1K Ohm, 5%, 1W Metal Oxide
R204	203X6700-327	100 Ohm, 5%, 1/2W Carbon	R372	203X9101-119	12K Ohm, 5%, 1W Metal Oxide
R205	203X6700-421	270 Ohm, 5%, 1/2W Carbon	R375	203X6700-763	6.8K Ohm, 5%, 1/2W Carbon
R206	203X6500-540	390 Ohm, 5%, 1/4W Carbon	R376	203X9104-404	270 Ohm, 5%, 2W Metal Oxide
R207	340X2201-934	200 Ohm, 5%, 1/4W Carbon	R377	203X6500-447	150 Ohm, 5%, 1/4W Carbon
R208	203X6500-540	390 Ohm, 5%, 1/4W Carbon	R378	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R209	340X2201-934	200 Ohm, 5%, 1/4W Carbon	R379	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R210	203X6500-540	390 Ohm, 5%, 1/4W Carbon	R380	203X6500-865	8.2K Ohm, 5%, 1/4W Carbon
R211	340X2201-934	200 Ohm, 5%, 1/4W Carbon	R381	203X6500-724	2.2K Ohm, 5%, 1W Metal Oxide
R214	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R383	203X9014-387	150 Ohm, 5%, 1W Metal Oxide
R215	203X6501-126	100K Ohm, 5%, 1/4W Carbon	R502	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R216	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R503	204X1700-535	150 Ohm, 5%, 15W Metal Oxide
R217	203X6500-405	100 Ohm, 5%, 1/4W Carbon	R504	203X9014-267	47 Ohm, 5%, 1W Metal Oxide
R218	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R505	203X6501-209	2.2K Ohm, 5%, 1/4W Carbon
R219	203X6501-126	100K Ohm, 5%, 1/4W Carbon	R506	203X9104-105	15 Ohm, 5%, 2W Metal Oxide
R220	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R507	203X5602-185	330K Ohm, 5%, 1/2W Comp.
R221	203X6500-405	100 Ohm, 5%, 1/4W Carbon	$\Delta$ $\star$ R601	204X1625-058	3.3 Ohm, 5%, 10W WW
R222	203X6500-762	3.3 Ohm, 5%, 1/4W Carbon	R701	203X9105-141	2.2 Ohm, 5%, 2W Metal Oxide
R224	203X6500-169	10 Ohm, 5%, 1/4W Carbon	R702	203X6206-441	2.2 Ohm, 5%, 1/2W Carbon
R225	203X6500-169	10 Ohm, 5%, 1/4W Carbon	VR201	204X2070-072	2K Ohm-B Semi-Fixed
R226	203X6500-169	10 Ohm, 5%, 1/4W Carbon	VR301	204X2070-084	5K Ohm-B Semi-Fixed
R227	203X6501-044	47K Ohm, 5%, 1/4W Carbon	VR303	204X2070-055	500 Ohm-B Semi-Fixed
R228	203X6500-645	1K Ohm, 5%, 1/4W Carbon	VR351	204X2070-072	2K Ohm-B Semi-Fixed
R229	203X6700-421	270 Ohm, 5%, 1/2W Carbon	VR352	204X2070-072	2K Ohm-B Semi-Fixed
R230	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.	<b>CAPACITORS</b>		
R231	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.	C201	203X0014-088	1000 uF, 16V, Electrolytic
R232	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.	C202	202X7200-064	330 pF, 500V, Ceramic
R233	203X6500-468	180 Ohm, 5%, 1/4W Carbon	C203	202X7200-043	220 pF, 500V, Ceramic
R234	340X2820-934	82 Ohm, 5%, 1/4W Carbon	C204	202X7200-043	220 pF, 500V, Ceramic
R235	340X2820-934	82 Ohm, 5%, 1/4W Carbon	C205	203X0014-076	470 uF, 16V, Electrolytic
R236	340X2820-934	82 Ohm, 5%, 1/4W Carbon	C206	203X1810-149	0.1 uF, 125V Mylar
R301	203X6500-508	270 Ohm, 5%, 1/4W Carbon	C207	349X2232-109	.022 uF, 100V Mylar
R302	203X6500-863	8.2K Ohm, 5%, 1/4W Carbon	C301	203X0014-065	330 uF, 50V Electrolytic
R303	203X6500-863	8.2K Ohm, 5%, 1/4W Carbon	C302	203X1600-563	0.033 uF, 50V Mylar
R304	203X6500-724	2.2K Ohm, 5%, 1/4W Carbon	C303	203X0629-037	3.3 uF, 50V Electrolytic
R305	203X6500-842	6.8K Ohm, 5%, 1/4W Carbon	C304	203X1600-366	0.068 pF, 50V Mylar
R306	203X6003-201	7.5K Ohm, 2%, 1/4W Carbon	C306	203X0412-012	2.2 uF, 16V Tantal
R307	203X6500-825	5.6K Ohm, 5%, 1/4W Carbon	C307	203X1600-634	0.033 uF, 50V Mylar
R309	203X6500-965	22K Ohm, 5%, 1/4W Carbon	C308	203X0025-174	3.3 uF, 50V Electrolytic
R310	203X6500-988	39K Ohm, 5%, 1/4W Carbon	C309	203X1207-100	0.068 uF, 100V PP
R311	203X6500-762	3.3K Ohm, 5%, 1/4W Carbon	C310	203X0629-061	10 uF, 100V Electrolytic
R312	203X9014-741	4.7K Ohm, 5%, 1/4W Carbon	C311	203X0041-025	10 uF, 160V Electrolytic
R313	204X1450-537	1K Ohm, 5%, 5W Carbon	C312	202X7050-248	1000 pF, 500V Ceramic
R314	203X6500-481	220 Ohm, 5%, 1/4W Carbon	C313	203X0040-052	47 uF, 160V Electrolytic
R315	203X6500-169	10 Ohm, 5%, 1/4W Carbon	C314	203X1201-265	0.033 uF, 200V PP
R316	203X6500-762	3.3K Ohm, 5%, 1/4W Carbon	C315	203X0629-023	1 uF, 50V Electrolytic
R317	203X6700-107	12 Ohm, 5%, 1/2W Carbon	C352	203X0619-045	47 uF, 25V Electrolytic
R318	203X6500-540	390 Ohm, 5%, 1/4W Carbon	C353	203X1190-015	0.0082 pF, 50V Mylar-PP
R319	203X6500-645	1K Ohm, 5%, 1/4W Carbon	C354	203X0619-045	47 uF, 25V Electrolytic
R320	203X6501-002	33K Ohm, 5%, 1/4W Carbon	C355	203X1600-366	0.0068 pF, 50V Mylar
R321	203X6501-224	270K Ohm, 5%, 1/2W Carbon	C356	202X7050-483	0.01 uF, 500V Ceramic
R322	203X6500-886	10K Ohm, 5%, 1/4W Carbon	C359	202X8065-606	100 pF, 500V Ceramic
R351	203X6500-886	10K Ohm, 5%, 1/4W Carbon	C360	202X7050-366	0.0033 pF, 500V Ceramic
R352	203X6500-785	3.9K Ohm, 5%, 1/4W Carbon	C361	202X7050-483	0.01 uF, 500V Ceramic
R353	203X6501-086	68K Ohm, 5%, 1/4W Carbon	C362	202X7203-032	0.01 uF, 50V Ceramic
R354	203X6500-762	3.3K Ohm, 5%, 1/4W Carbon	$\Delta$ $\star$ C363	203X1270-911	8700 pF, 1.5 KV PP
R355	203X9205-143	6.8K Ohm, 5%, 3W Metal Oxide	$\star$ C365	203X1201-265	0.33 uF, 200V PP
R358	203X5601-878	56K Ohm, 5%, 1/2W Carbon	C366	203X0019-026	22 uF, 25V Electrolytic
R360	203X6500-561	470 Ohm, 5%, 1/4W Carbon	C367	202X8065-162	6 pF, 500V Ceramic
R361	203X6500-886	10K Ohm, 5%, 1/4W Carbon	C368	202X7203-032	0.01 uF, 50V Ceramic
R362	203X9014-645	1.8K Ohm, 5%, 1W Metal Oxide	C372	203X1207-125	0.1 uF, 100V PP
$\star$ R363	204X1527-751	3.9K Ohm, 5%, 7W Metal Oxide			
R364	203X6500-246	22 Ohm, 5%, 1/4W Carbon			
R365	203X6501-002	33K Ohm, 5%, 1/4W Carbon			
R367	203X6500-886	10K Ohm, 5%, 1/4W Carbon			
R368	203X5602-185	330K Ohm, 5%, 1/2W Comp.			

## MAIN BOARD (CONT.)

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
<b>CAPACITORS (CONT.)</b>					
C380	202X7200-087	470 uF, 500V Ceramic	Q206	200X3181-523	Transistor (NPN) 2SC1815GR
$\Delta$ C501	203X1810-149	0.1 uF, 125V Mylar	Q207	200X3181-523	Transistor (NPN) 2SC1815GR
$\Delta$ C502	202X7050-282	1500 pF, 500V Ceramic	Q208	200X3181-523	Transistor (NPN) 2SC1815GR
$\Delta$ C503	202X7810-214	2200 pF, 125V Ceramic	Q209	200X3181-523	Transistor (NPN) 2SC1815GR
$\Delta$ C504	202X7810-214	2200 pF, 125V Ceramic	Q210	200X3181-523	Transistor (NPN) 2SC1815GR
C505	203X0220-075	560 uF, 200V Electrolytic	Q301	200X3181-523	Transistor (NPN) 2SC1815GR
C506	203X0040-034	22 uF, 160V Electrolytic	Q302	200X3207-306	Transistor (NPN) 2SC2073LBGL2
C507	203X0041-057	47 uF, 160V Electrolytic	Q303	200X3207-306	Transistor (NPN) 2SC2073LBGL2
C701	203X0019-092	1000 uF, 25V Electrolytic	Q351	200X3248-217	Transistor (NPN) 2SC2482BK
C702	203X0634-061	10 uF, 100V Electrolytic	Q352	200X4589-802	Transistor (NPN) 2SD898B
C703	202X7050-248	1000 pF, 500V Ceramic	IC301	200X2300-033	IC HA11423
			$\Delta$ $\star$ IC501	200X2600-183	IC STR381
<b>SEMICONDUCTORS</b>					
D203	201X2010-159	Diode, IS2076-27			
D204	201X2010-159	Diode, IS2076-27			
D205	201X2010-159	Diode, IS2076-27	L351	201X4710-134	Coil, (RF Choke)
D206	201X2010-159	Diode, IS2076-27	L352	201X5000-083	Coil, Horiz. Size
D207	201X2010-159	Diode, IS2076-27	L701	611X0004-007	Coil, Adg.
D208	201X2010-159	Diode, IS2076-27	T351	202X1300-080	Transformer, Hor. Drive
D209	201X2010-159	Diode, IS2076-27	$\Delta$ $\star$ T352	200X9720-301	HV-Unit M-11
D301	201X2010-165	Diode, ISS81			
D302	201X2010-159	Diode, IS2076-27			
D303	201X2010-159	Diode, IS2076-27	$\Delta$ F501	204X7120-073	Fuse, 4 Amp, 125V
D304	201X2120-009	Diode, RH-IV	J402	206X5008-632	Recep W Wire 3P-M-BG
D305	201X2120-009	Diode, RH-IV	P201	204X9600-466	Plug, PWB 3P-J
D306	201X2010-159	Diode, IS2076-27	P202	204X9601-477	Plug, PWB 6P-Q
$\Delta$ D501	201X3120-216	Diode, RM-1AV	P401	204X9600-298	Plug, PWB 4P-B
$\Delta$ D502	201X3120-216	Diode, RM-1AV	P501	204X9600-249	Plug, PWB 2P-B
$\Delta$ D503	201X3120-216	Diode, RM-1AV	P601	204X9600-304	Plug, PWB 4P-C
$\Delta$ D504	201X3120-216	Diode, RM-1AV	TH501	201X0100-112	Thermistor
D505	201X3120-216	Diode, RM-1AV			
D506	201X3120-216	Diode, RM-1AV			
D701	201X2130-234	Diode, RU-2V			
D702	201X2120-009	Diode, RH-1V			
Q201	200X3181-523	Transistor (NPN) 2SC1815GR			
Q202	200X3181-523	Transistor (NPN) 2SC1815GR			
Q203	200X4056-260	Transistor (PNP) 2SA562-Y-TM			
Q204	200X4056-260	Transistor (PNP) 2SA562-Y-TM			
Q205	200X4056-260	Transistor (PNP) 2SA562-Y-TM			

## SEMICONDUCTORS (CONT.)

## TRANSFORMERS & COILS

## MISCELLANEOUS

## FINAL ASSEMBLY PARTS

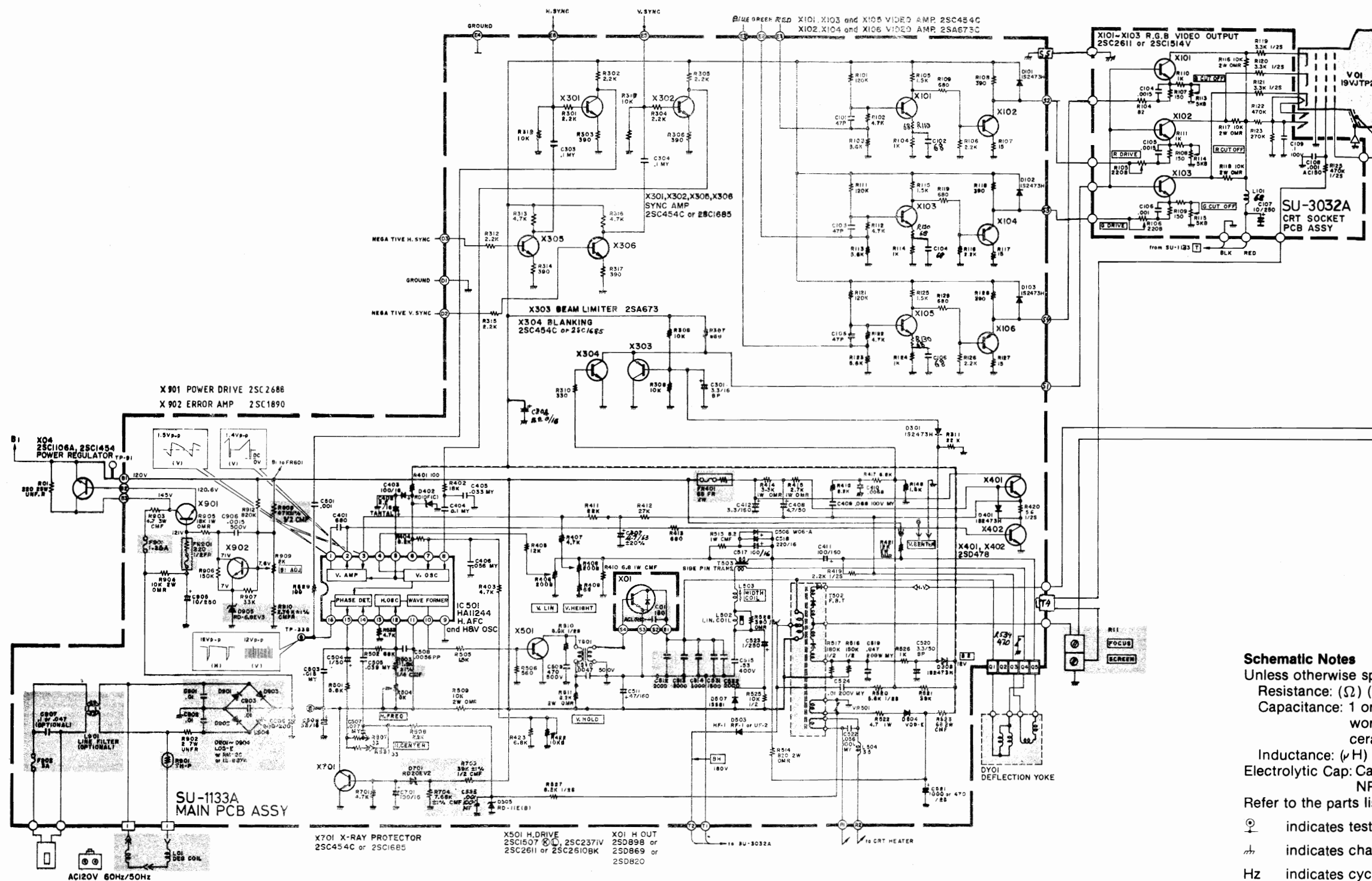
## NECK BOARD

## RESISTORS

R401	203X6000-729	220 Ohm, 5% 1/4W Carbon
R402	203X6500-540	390 Ohm, 5% 1/4W Carbon
R403	203X6000-661	820 Ohm, 5% 1/4W Carbon
R404	203X6000-729	220 Ohm, 5% 1/4W Carbon
R405	203X6500-540	390 Ohm, 5% 1/4W Carbon
R406	203X6000-661	820 Ohm, 5% 1/4W Carbon
R407	203X6000-729	470 Ohm, 5% 1/4W Carbon
R408	203X6000-998	270 Ohm, 5% 1/4W Carbon
R409	203X6000-661	820 Ohm, 5% 1/4W Carbon
R410	203X9104-824	15K Ohm, 5% 2W M.O. Forming
R411	203X9104-824	15K Ohm, 5% 2W M.O. Forming
R412	203X9104-824	15K Ohm, 5% 2W M.O. Forming
R413	203X6000-998	2.7K Ohm, 5% 1/2W Comp.
R414	203X6000-998	2.7K Ohm, 5% 1/2W Comp.
R415	203X6000-998	2.7K Ohm, 5% 1/2W Comp.
R416	203X9105-154	2.2 Ohm, 5% 2W Metal Oxide
R419	203X6500-741	2.7K Ohm, 5% 1/4W Carbon
R420	203X6500-741	2.7K Ohm, 5% 1/4W Carbon
R421	203X6500-741	2.7K Ohm, 5% 1/4W Carbon
VR401	204X2115-014	500 Ohm, -B Semi-Fixed
VR402	204X2115-014	500 Ohm, -B Semi-Fixed
VR403	204X2115-006	5K Ohm, -B Semi-Fixed
VR404	204X2115-006	5K Ohm, -B Semi-Fixed
VR405	204X2115-006	5K Ohm, -B Semi-Fixed

## CAPACITORS

C401
------



**Schematic Notes**  
 Unless otherwise specified  
 Resistance: (Ω) (K→KΩ, M→MΩ), 1/4 (W) carbon resistor  
 Capacitance: 1 or higher→ (pF), less than 1→ (μF)  
 working voltage → 50 (V)  
 ceramic capacitor  
 Inductance: (μH)  
 Electrolytic Cap: Capacitance Value (μF)/working voltage (V),  
 NP → non-polar (or bipolar) electrolytic cap.  
 Refer to the parts list for additional component information.

⊙ indicates test point connection  
 ⚡ indicates chassis ground unless otherwise specified  
 Hz indicates cycles per second

For **safety** purposes (and continuing reliability)  
 ⚠ replace all components marked with safety symbol with identical type.  
 NOTE: FR → fusible resistor

00-4147-04  
 G07-CB0

Parts identification on circuit boards:  
 e.g. SU1126A (R107 = R1107)  
 SU3030A (R113 = R3113)



## REPLACEMENT PARTS LIST - ELECTROHOME 19" MONITOR

Components identified by the  $\Delta$  symbol in the PARTS LIST and on the Schematic have special characteristics important to safety.

DO NOT degrade the safety of the set through improper servicing.

### Abbreviations for Resistors and Capacitors

#### Resistor

C R : Carbon Resistor  
 Comp. R : Composition Resistor  
 OM R : Oxide Metal Film Resistor  
 V R : Variable Resistor  
 MF R : Metal Film Resistor  
 CMF R : Coating Metal Film Resistor  
 UNF R : Nonflammable Resistor  
 F R : Fusible Resistor

#### Capacitor

C Cap. : Ceramic Capacitor  
 M Cap. : Mylar Capacitor  
 E Cap. : Electrolytic Capacitor  
 BP E Cap. : Bi-Polar (or Non-Polar) Electrolytic Capacitor  
 MM Cap. : Metalized Mylar Capacitor  
 PP Cap. : Polypropylene Capacitor  
 MPP Cap. : Metalized PP Capacitor  
 PS Cap. : Polystyrol Capacitor  
 Tan. Cap. : Tantal Capacitor

NOTE: When ordering replacement parts please specify the part number as shown in this list including part name, and model number. Complete information will help expedite the order.

Use of substitute replacement parts which do not have the same safety characteristics as specified, may create shock, fire or other hazards. For maximum reliability and performance, all parts should be replaced by those having identical specifications.

## SERVICE REPLACEMENT PARTS LIST

Symbol	Description	Part Number
	Main P.C.B. Ass'y	SU-1133A
	CRT Socket P.C.B. Ass'y	SU-3032A
	Purity Shield Ass'y	07-220083-03

### Outside of the P.C.B. Ass'y

Symbol	Description	Part Number
$\Delta$	Picture Tube 19"	17-7198-03
$\Delta$	Deflection Yoke	A29779-D = 21-141-01
$\Delta$	PC Magnet	A75034-B = 29-32-01
$\Delta$	Flyback Transf.	A29951-B
$\Delta$	HVR	A46600-A
R05	UNF Resistor 220 $\Omega$ , 25W K	QRF258K-221
C04	C Capacitor 150pF, AC1.5KV	QCZ0101-005
X01	Si. Transistor	2SD870
X02	Si. Transistor	2SC1106A
SC	Screw #8- $\frac{3}{8}$	31-610818-06
SC	Screw $\frac{1}{4}$ x $\frac{3}{4}$ Pix Tube Mtg. (4)	31-601418-12
WA	Pyramidal Lock Washer (4)	33-255-01
	Nut Retainer, Pix Tube Mtg. (4)	33-494-01
	Clip — P.C.B. Support Standoff	33-629-02
	Wire Terminal (Gnd. Strap)	33-670-010R-02
	Terminal Lug (Gnd.)	34-228-03
	Groundstrap Assy.	34-33-04
	Grounding Spring	34-574-02
	Wire Hook (Gnd. Strap)	35-212-03
	Purity Shield Holddown Clamp	35-3053-02
	Support Brkt. RH	35-2348-01
	Support Brkt. LH	35-3890-01
	Chassis Base	35-3890-02
	Yoke Wedge (3)	38-449-02
		39-1233-01

### Purity Shield Ass'y. Parts List

Symbol	Description	Part Number
D911, D912	Degaussing Coil	21-1007-30
	Rectifier 1 Amp 600V (2)	28-22-27
	Pin Terminal (2)	34-708-01
	Pin Terminal Housing	34-709-01
	Purity Shield (2 pcs.)	35-3847-01
	Purity Shield (2 pcs.)	35-3847-02
C911	Capacitor 100nF 10% 400V	48-171544-62
F921	Resistor, Wirewound 33 $\Omega$ , 4W	42-113301-03
	Fire Retardent Term. Strip 4 Lug	34-492-09

### CRT Socket P.C.B. Ass'y (SU-3032A) Parts List

#### Resistors

Symbol	Description	Part Number
R3105	V R 200	QVZ3234-022
R3106	V R 200	QVZ3234-022
R3113	V R 5K	QVZ3234-053
R3114	V R 5K	QVZ3234-053
R3115	V R 5K	QVZ3234-053
R3116	OM R 10K $\Omega$ 2W J	QVZ3234-053
R3117	OM R 10K $\Omega$ 2W J	QRG029J-103
R3118	OM R 10K $\Omega$ 2W J	QRG029J-103
R3119	Comp. R 3.3K $\Omega$ $\frac{1}{2}$ W K	QRG029J-103
R3120	Comp. R 3.3K $\Omega$ $\frac{1}{2}$ W K	QRZ0039-332
C3121	Comp. R 3.3K $\Omega$ $\frac{1}{2}$ W K	QRZ0039-332

#### Capacitors

Symbol	Description	Part Number
C3107	E Cap. 10uF 250V A	QEW53EA-106
C3108	C Cap. 1000pF DC1400V P	QCZ9001-102M

#### Coils

Symbol	Description	Part Number
L3101	Peaking Coil	QQL043K-101

**Semiconductors**

Symbol	Description	Part Number
X3101	Si. Transistor	2SC1514VC
X3102	Si. Transistor	2SC1514VC
X3103	Si. Transistor	2SC1514VC

**Miscellaneous**

Symbol	Description	Part Number
△	△CRT Socket	A76068

**Main PCB Ass'y (SU-1133A) Parts List****Resistors**

Symbol	Description	Part Number
R1406	V R 200Ω	QVZ3230-002
R1408	V R 200Ω	QVZ3230-002
R1410	CMF R 6.8Ω1W J	QRX019J-6R8
R1414	OM R 3.3KΩ1W J	QRG019J-332
R1415	OM R 2.7KΩ1W J	QRG019J-272
R1421	OM R 12KΩ2W J	QRG026J-123Z
R1422	V R 10KΩ	QVZ3230-014
△FR1401	△F R 68Ω2W K	QRH024K-680M
△R1503	△CMF R 11.8KΩ¼W +1%	QRV142F-1182
R1504	V R 5KΩ	QVZ3230-053
R1509	OM R 10KΩ2W J	QRG026J-103Z
R1512	OM R 8.2KΩ2W J	QRG026J-822Z
R1514	OM R 820Ω2W J	QRG026J-821Z
R1515	CMF R 8.2Ω1W J	QRX019J-8R2
R1522	CMF R 4.7Ω1W J	QRX019J-4R7
R1523	OM R 68Ω2W J	QRG026J-680Z
R1528	OM R 390Ω1W J	QRG019J-391
R1534	ZN R	ERZ-C05ZK471
VR1501	ZN R	ERZ-C05DK271
△R1703	△CMF R 39Ω½W +1%	QRV122F-3902
△R1704	△CMF R 7.68KΩ¼W +1%	QRV142F-7681
△R1901	△Posistor	A75414
R1902	UNF R 2Ω7W K	QRF076K-2R0
R1903	CMF R 4.7Ω3W J	QRX039J-4R7
R1904	OM R 10KΩ2W J	QRG026J-103Z
R1905	OM R 18KΩ1W J	QRG019J-183
△Q1908	△CMF R 47Ω½W +1%	QRV122F-470Z
△R1909	V R 2KΩ	QVP5A0B-023E
R1910	△CMF R 2.74KΩ¼W +1%	QRV142F-274I
△FR1901	△F R 220Ω½W K	QRH124K-221M

**Capacitors**

Symbol	Description	Part Number
C1301	BPE Cap. 3.3uF 50V A	QEN61HA-335Z
C1402	Tan. Cap. 2.2uF 16V K	QEE51CK-225B
C1407	E Cap. 4.7uF 6.3V A	QEW51JA-475
C1411	E Cap. 100uF 160V A	QEW52CA-107
C1412	E Cap. 3.3uF 160V A	QEW52CA-335
C1508	PP Cap. 5600uF 50V J	QFP31HJ-562
△C1512	△PP Cap. 2000pF DC1500V J	QFZ0082-202
△C1513	△PP Cap. 2000pF DC1500V J	QFZ0082-202
△C1514	△PP Cap. 2000pF DC1500V J	QFZ0082-202
C1515	PP Cap. 0.53uF DC1200V J	QFZ0067-534
C1520	BPE Cap. 3.3uF 50V A	QEN61HA-335Z
C1523	E Cap. 1uF 160V A	QEW62CA-105Z
C1524	M Cap. 0.1uF 200V K	QFM720K-104M
△C1531	△PP Cap. 2000pF DC1500V J	QFZ0082-202
△C1532	△PP Cap. 1500pF DC1500V J	QFZ0082-152
C1904	E Cap.	QEY0034-001
C1905	E Cap. 10uF 250V A	QEW52EA-106

**Coils****Symbol**

L1502  
L1503  
L1504

**Description**

Linarity Coil  
Width Coil  
Heater Choke

**Part Number**

A39835  
C30380-A  
C30445-A

**Transformers****Symbol**

T1501  
T1503

**Description**

Hor. Drive Transf.  
Side Pin Transf.

**Part Number**

A46022-BM  
C39050-A

**Semiconductors****Symbol**

IC1501

**Description**

IC

**Part Number**

HA11244

X1101

Si. Transistor

2SC1685(R)

X1102

Si. Transistor

2SA673(C)

X1103

Si. Transistor

2SC1685(R)

X1104

Si. Transistor

2SA673(C)

X1105

Si. Transistor

2SC1685(R)

X1106

Si. Transistor

2SA673(C)

X1301

Si. Transistor

2SC1685(R)

X1302

Si. Transistor

2SC1685(R)

X1303

Si. Transistor

2SA673(C)

X1304

Si. Transistor

2SC1685(R)

X1305

Si. Transistor

2SC1685(R)

X1401

Si. Transistor

2SD478

X1402

Si. Transistor

2SD478

X1501

Si. Transistor

2SC2610BK

X1901

Si. Transistor

2SC2688 (K.L.M.)

X1902

Si. Transistor

2SC1890A (E.F.)

D1101

Si. Diode

W06A

D1102

Si. Diode

W06A

D1103

Si. Diode

W06A

D1301

Si. Diode

1SZ473H

D1401

Si. Diode

1SZ473H

D1402

Zener Diode

RD10F(C)

D1503

Si. Diode

HF-1

D1504

Si. Diode

V09E

D1505

Zener Diode

RD11E(B)

D1506

Si. Diode

W06A

D1507

Si. Diode

1SS81

D1508

Si. Diode

1SZ473H

△D1701

△Zener Diode

RD20EV2

△D1901

△Si. Diode

1S1887A

△D1902

△Si. Diode

1S1887A

△D1903

△Si. Diode

1S1887A

△D1904

△Si. Diode

1S1887A

△D1905

△Zener Diode

RD6.8EV3

**Miscellaneous****Symbol**

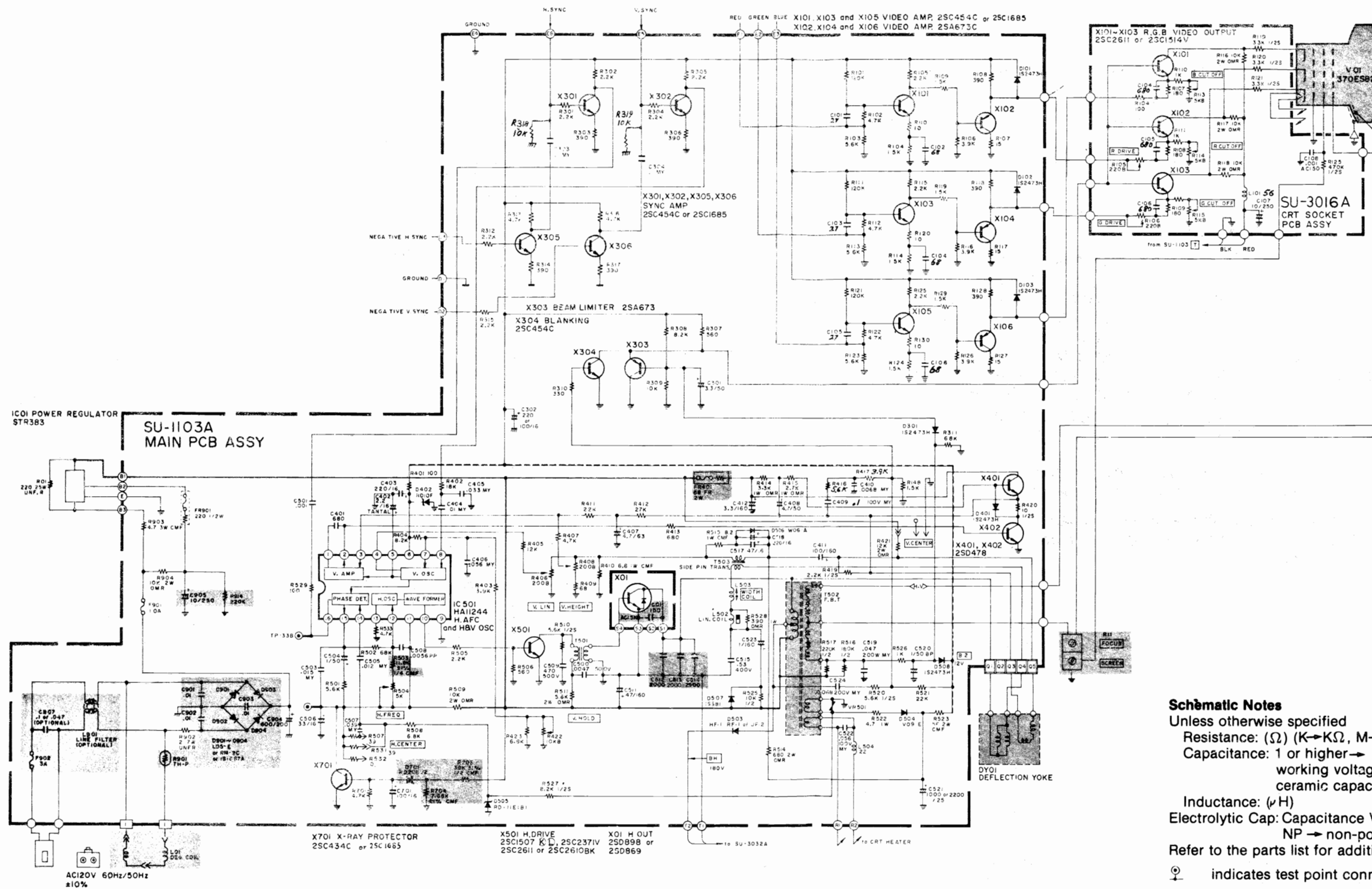
△F1901  
△F1902

**Description**

△Fuse 1.25A  
△UL Fuse 3A


**Part Number**

QMF53U1-1R25S  
QMF66U1-3R0S



**Schematic Notes**

- Unless otherwise specified
- Resistance: (Ω) (K→KΩ, M→MΩ), 1/4 (W) carbon resistor
- Capacitance: 1 or higher → (pF), less than 1 → (μF)
- working voltage → 50 (V)
- ceramic capacitor
- Inductance: (μH)
- Electrolytic Cap: Capacitance Value (μF)/working voltage (V), NP → non-polar (or bipolar) electrolytic cap.
- Refer to the parts list for additional component information.

- ⊙ indicates test point connection
- ⌚ indicates chassis ground unless otherwise specified
- Hz indicates cycles per second
- For **safety** purposes (and continuing reliability)
- ⚠ replace all components marked with safety symbol with identical type.
- NOTE: FR → fusible resistor (——)

G07-FBO  
00-4147-03

Parts identification on circuit boards:  
e.g. SU1126A (R107 = R1107)  
SU3030A (R113 = R3113)

## REPLACEMENT PARTS LIST - ELECTROHOME 13" MONITOR

Components identified by the  $\Delta$  symbol in the PARTS LIST and on the Schematic have special characteristics important to safety.

DO NOT degrade the safety of the set through improper servicing.

### Abbreviations for Resistors and Capacitors

Resistor		Capacitor	
C R	: Carbon Resistor	C Cap.	: Ceramic Capacitor
Comp. R	: Composition Resistor	M Cap.	: Mylar Capacitor
OM R	: Oxide Metal Film Resistor	E Cap.	: Electrolytic Capacitor
V R	: Variable Resistor	BP E Cap.	: Bi-Polar (or Non-Polar) Electrolytic Capacitor
MF R	: Metal Film Resistor	MM Cap.	: Metalized Mylar Capacitor
CMF R	: Coating Metal Film Resistor	PP Cap.	: Polypropylene Capacitor
UNF R	: Nonflammable Resistor	MPP Cap.	: Metalized PP Capacitor
F R	: Fusible Resistor	PS Cap.	: Polystyrol Capacitor
		Tan. Cap.	: Tantal Capacitor

NOTE: When ordering replacement parts please specify the part number as shown in this list including part name, and model number. Complete information will help expedite the order.

Use of substitute replacement parts which do not have the same safety characteristics as specified, may create shock, fire or other hazards. For maximum reliability and performance, all parts should be replaced by those having identical specifications.

Symbol	Description	Part Number
	Main P.C.B. Ass'y	SU-1103A
	CRT Socket P.C.B. Ass'y	SU-3016A
<b>Outside of the P.C.B. Ass'y</b>		
Symbol	Description	Part Number
$\Delta$ V01	$\Delta$ Picture Tube	370ESB22(E)
$\Delta$ DY01	$\Delta$ Deflection Yoke P.C. Magnet Wedge	C29123-V A76366-A C30006
	$\Delta$ Flyback Transf.	A19183-A
$\Delta$ R11	$\Delta$ Focus V R	A46606-A
$\Delta$ R05	UNF Resistor 220 $\Omega$ , 25W. K	QRF258K-221
$\Delta$ C04	$\Delta$ C Capacitor 150 pF, AC1.5KV	QCZ0101-005
X01	Si. Transistor	2SD869
IC01	IC Regulator	STR383
L01	Degaussing Coil	21-1007-31
	Degaussing Coil Pin Terminal (2)	34-708-01
	Degaussing Coil Pin Terminal Housing	34-709-01
	Groundstrap Ass'y.	34-697-04
	Groundstrap Wire Terminal	34-228-03
	Groundstrap Spring (2)	35-3560-01
BR	Support Bracket RH	35-3919-01
BR	Support Bracket LH	35-3919-02
SC	SCREW 10- $\frac{1}{2}$ Pix Tube Mtg. (4)	31-631018-08
WA	Pyramidal Lockwasher (4)	33-255-01
	Clip P.C.B. Support (2)	33-629-02
	Ground Lug	34-33-04
CH	Chassis Base	38-452-01

## Main P.C.B. Ass'y (SU-1103A) Parts List

### Resistors

Symbol	Description	Part Number
R1406	V R 200 $\Omega$	QVZ3230-022
R1408	V R 200 $\Omega$	QVZ3230-022
R1410	CMF R 6.8 $\Omega$ 1W J	QRX019J-6R8
R1414	OM R 3.3K $\Omega$ 1W J	QRG019J-332
R1415	OM R 2.7K $\Omega$ 1W J	QRG019J-272
R1421	OM R 12K $\Omega$ 2W J	QRG029J-123
R1422	V R 10K $\Omega$	QVZ3224-014H
$\Delta$ FR1401	$\Delta$ F R 68 $\Omega$ 2W K	QRH024K-680M
$\Delta$ R1503	$\Delta$ CMF R 11.8K $\Omega$ $\frac{1}{4}$ W +1%	QRV142F-1182
R1504	V R 5K $\Omega$	QVZ3230-053
R1509	OM R 10K $\Omega$ 2W J	QRG029J-103
R1511	OM R 5.6K $\Omega$ 2W J	QRG029J-562
R1514	OM R 680 $\Omega$ 2W J	QRG029J-681
R1515	CMF R 8.2 $\Omega$ 1W J	QRX019J-8R2
R1522	CMF R 4.7 $\Omega$ 1W J	QRX019J-4R7
R1523	OM R 56 $\Omega$ 2W J	ORG029J-560
R1528	OM R 390 $\Omega$ 1W J	ORG019J-391
R1534	ZN R	ERZ-C05ZK471
VR1501	ZN R	ERZ-C05DK271
$\Delta$ R1703	$\Delta$ CMF R 39K $\Omega$ $\frac{1}{2}$ W +1%	QRV122F-3902
$\Delta$ R1704	$\Delta$ CMF R 7.68K $\Omega$ $\frac{1}{4}$ W +1%	QRV142F-7681
$\Delta$ R1901	$\Delta$ Posistor	A75414
R1902	UNF R 2 $\Omega$ 7W K	QRF076K-2R0
R1903	CMF R 5.6 $\Omega$ 3W J	QRX039J-5R6
R1904	OM R 10K $\Omega$ 2W J	QRG026J-103Z
$\Delta$ FR1901	$\Delta$ F R 220 $\Omega$ $\frac{1}{2}$ W K	QRH124K-221M

### Capacitors

Symbol	Description	Part Number
C1402	Tan. Cap. 2.2uF 16V K	QEE51CK-225B
C1411	E Cap. 100uF 160V A	QEW52CA-107
C1412	E Cap. 3.3uF 160V A	QEW52CA-335
C1508	PP Cap. 5600pF 50V J	QFP31HJ-562
C1511	E Cap. 47uF 160V A	QEW52CA-476S
$\Delta$ C1512	$\Delta$ PP Cap. 2000pF DC1500V J	QFZ0082-202
$\Delta$ C1513	$\Delta$ PP Cap. 2000pF DC1500V J	QFZ0082-202
$\Delta$ C1514	$\Delta$ PP Cap. 2500pF DC1500V J	QFZ0082-252
C1515	PP Cap. 0.53uF DC1200V K	QFZ0067-534
C1520	BPE Cap. 1uF 50V A	QEN61HA-105Z
C1524	M Cap. 0.1uF 200V K	QFM72DK-682M
C1904	E Cap.	QEY0034-001
C1905	E Cap. 10uF 250V A	QEW52EA-106
$\Delta$ C1907	$\Delta$ MM Cap. 0.1uF AC150V Z	QFZ9008-104

### Coils

Symbol	Description	Part Number
L1501	Peaking Coil	A75360-6
L1502	Liniarty Coil	A39934
L1503	Width Coil	C30380-A
L1504	Heater Choke	C30333-A
L1901	Line Filter	A39475-J

### Transformers

Symbol	Description	Part Number
T1501	Hor. Drive Transf.	A46022-BM
T1503	Side Pin Transf.	C39050-A

<b>Semiconductors</b>		
<b>Symbol</b>	<b>Description</b>	<b>Part Number</b>
IC1501	I.C.	HA11244
X1101	Si. Transistor	2SC1685(R)
X1102	Si. Transistor	2SA673(C)
X1103	Si. Transistor	2SC1685(R)
X1104	Si. Transistor	2SA673(C)
X1105	Si. Transistor	2SC1685(R)
X1106	Si. Transistor	2SA673(C)
X1301	Si. Transistor	2SC1685(R)
X1302	Si. Transistor	2SC1685(R)
X1303	Si. Transistor	2SA673(C)
X1304	Si. Transistor	2SC1685(R)
X1305	Si. Transistor	2SC1685(R)
X1401	Si. Transistor	2SD478
X1402	Si. Transistor	2SD478
X1501	Si. Transistor	2SC2610BK
X1701	Si. Transistor	2SC1685(P-S)
D1101	Si. Diode	W06A
D1102	Si. Diode	W06A
D1103	Si. Diode	W06A
D1301	Si. Diode	1S2473H
D1401	Si. Diode	1S2473H
D1402	Zener Diode	RD10F(C)
D1503	Si. Diode	HF-1
D1504	Si. Diode	V09E
D1505	Zener Diode	RD11E(B)
D1506	Si. Diode	W06A
D1507	Si. Diode	1SS81
D1508	Si. Diode	1S2473H
△D1701	△Zener Diode	RD20EV2
△D1901	△Si. Diode	1S1887A
△D1902	△Si. Diode	1S1887A
△D1903	△Si. Diode	1S1887A
△D1904	△Si. Diode	1S1887A
<b>Miscellaneous</b>		
<b>Symbol</b>	<b>Description</b>	<b>Part Number</b>
△F1901	△Fuse 1A	QMF53U1-1R0S
△F1902	△UL Fuse 3A	QMF66U1-3R0S

## CRT Socket P.C.B. Ass'y (SU-3016A) Parts List

### Resistors

Symbol	Description	Part Number
R3105	V R 200Ω	QVZ3234-022
R3106	V R 200Ω	QVZ3234-022
R3113	V R 5KΩ	QVZ3234-053
R3114	V R 5KΩ	QVZ3234-053
R3115	V R 5KΩ	QVZ3234-053
R3116	OM R 10KΩ2W J	QRG029J-103
R3117	OM R 10KΩ2W J	QRG029J-103
R3118	OM R 10KΩ2W J	QRG029J-103
R3119	Comp. R 3.3KΩ½W K	QRZ0039-332
R3120	Comp. R 3.3KΩ½W K	QRZ0039-332
R3121	Comp. R 3.3KΩ½W K	QRZ0039-332

### Capacitors

Symbol	Description	Part Number
C3107	E Cap. 10uF 250V A	QEW52EA-106
C3108	C Cap. 1000pF DC1400V P	QCZ9001-102M

### Coils

Symbol	Description	Part Number
L3101	Peaking coil	QQL043K-101

### Semiconductors

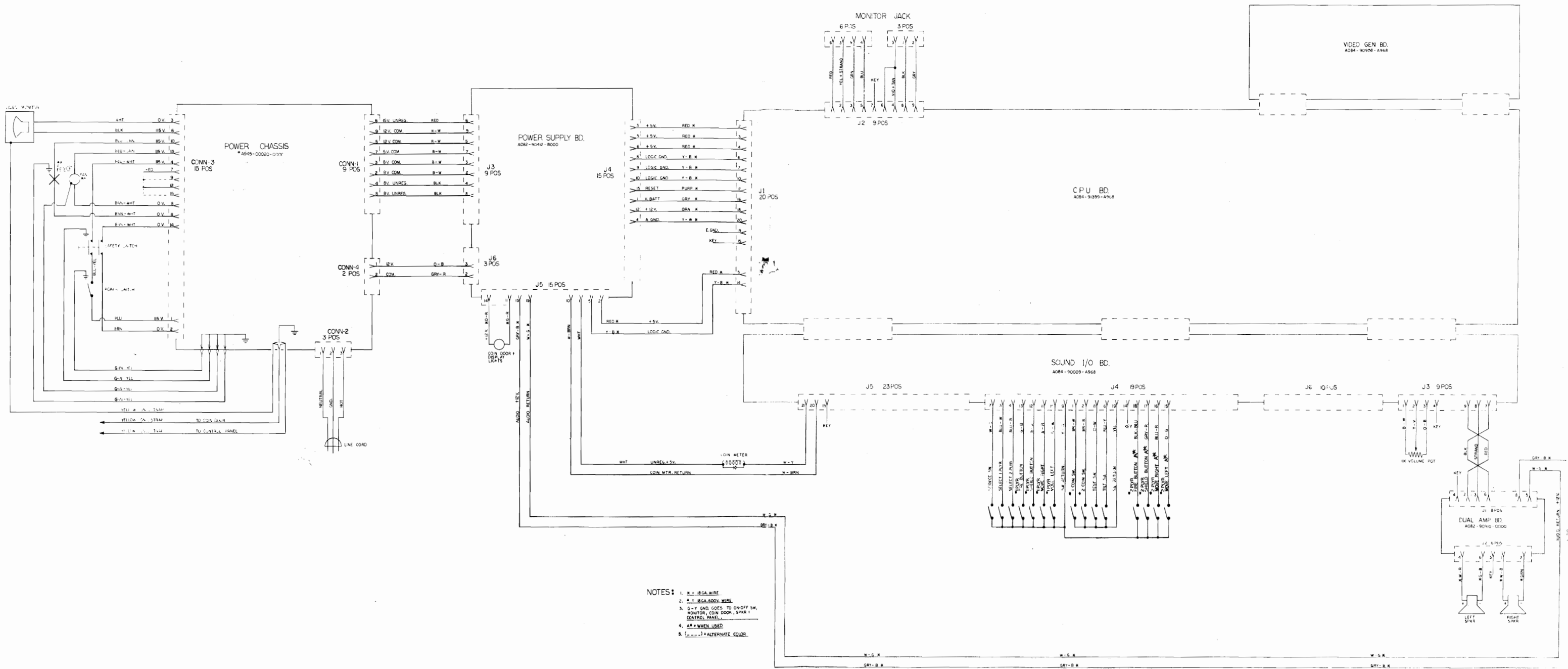
Symbol	Description	Part Number
X3101	Si. Transistor	2SC2611
X3102	Si. Transistor	2SC2611
X3103	Si. Transistor	2SC2611

### Miscellaneous

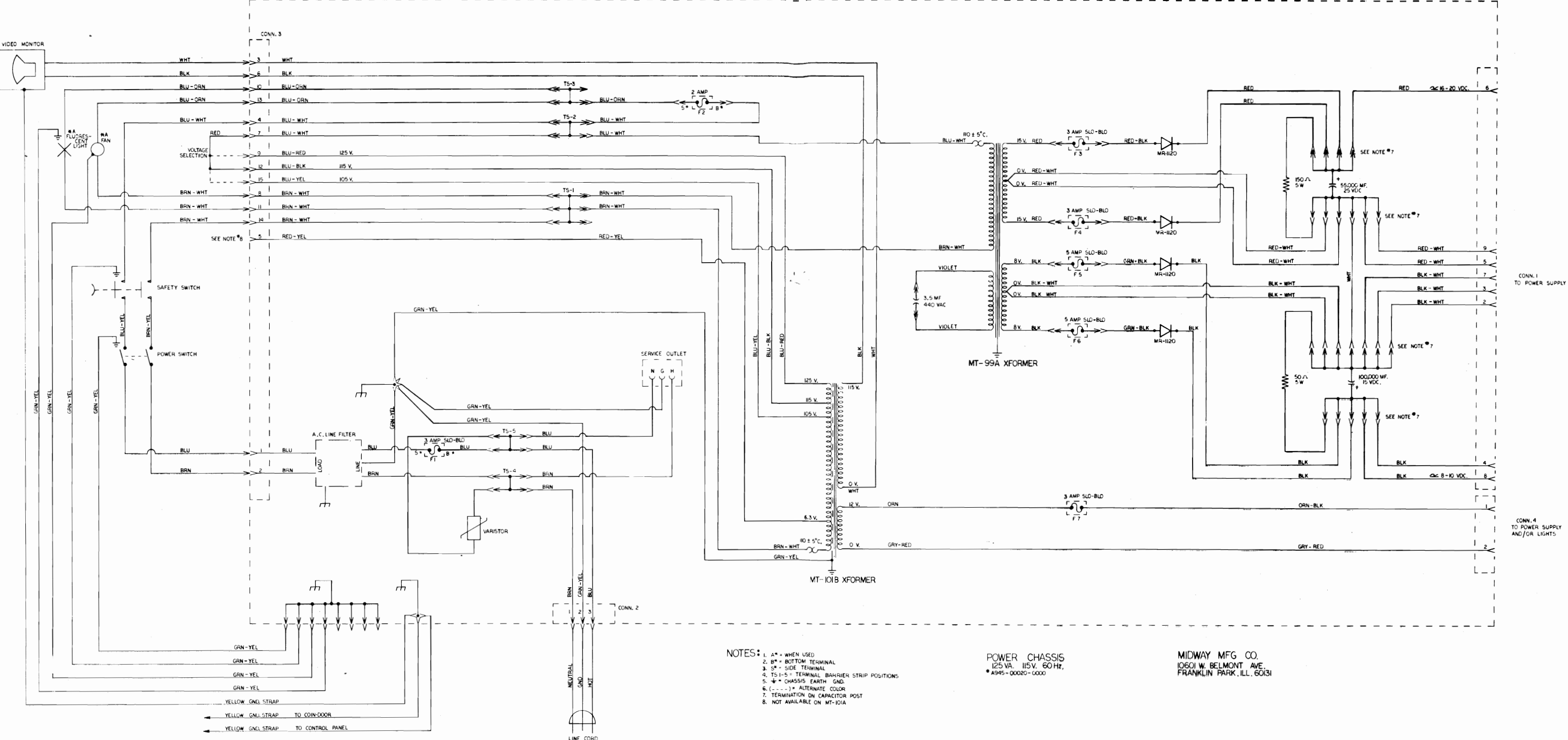
Symbol	Description	Part Number
△	△ CRT Socket	A75522

## **IX Schematics and Wiring Diagrams**





SATANS HOLLOW  
ALL MODELS  
MEWAY MFG. CO.  
10201 W. BELMONT AVE.  
FRANKLIN PARK, ILL. 60131

- NOTES:
1. A\* = WHEN USED
  2. B\* = BOTTOM TERMINAL
  3. S\* = SIDE TERMINAL
  4. TS1-S\* = TERMINAL BARRIER STRIP POSITIONS
  5. \* = CHASSIS EARTH GND.
  6. (---) = ALTERNATE COLOR
  7. TERMINATION ON CAPACITOR POST
  8. NOT AVAILABLE ON MT-101A

POWER CHASSIS  
125 VA, 115 V, 60 Hz,  
\*A945-00020-0000

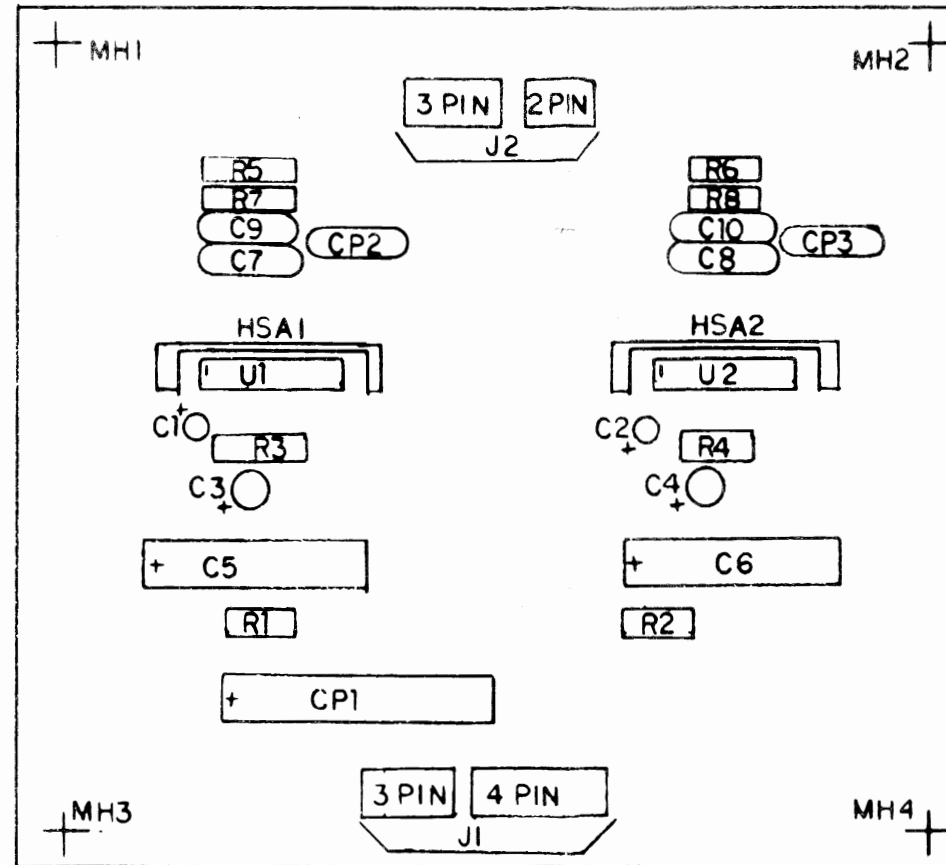
MIDWAY MFG CO.  
10601 W. BELMONT AVE.  
FRANKLIN PARK, ILL. 60131

### DESIGNATION LIST

DESIGNATION	DESCRIPTION
C1,C2	4.7mf 25v rd.tant.
C3,C4	22mf 6v " "
C5,C6	470mf 6v ax.elect.
C7-C10	.1mf 50v ax.cr.
CP1	220mf 25v ax.elect.
CP2,CP3	.1mf 50v ax.cr.
R1,R2	2.7K $\Omega$ 1/4w 5% CRBN.
R3,R4	27 $\Omega$ " " "
R5-R8	1 $\Omega$ 1/2w " "
U1,U2	MB3730
J1	3 PIN STRT.KKI56
	4 " " " "
J2	3 " " " "
	2 " " " "
HSA1,2	HEATSINK ASSY.
MH1-MH4	HEYCO BUSHING

### CROSS REFERENCE LIST

DESCRIPTION	QTY	DESIGNATION	PART NO
.1mf 50v ax.cr.	6	C7-C10, CP2,CP3	0986-00800-1100
4.7mf 25v rd.tant.	2	C1,C2	0986-00800-3100
22mf 6v " "	2	C3,C4	0986-00800-1600
220mf 25v ax.elect.	1	CP1	0986-00800-3200
470mf 6v " "	2	C5,C6	0986-00800-1700
1 $\Omega$ 1/2w 5%	4	R5-R8	0062-02603-1XXX
27 $\Omega$ 1/4w " "	2	R3,R4	0062-068B3-1XXX
2.7K " " "	2	R1,R2	0062-199B3-1XXX
MB3730	2	U1,U2	0066-188XX-XX4X
2 PIN STRT.KKI56	1	J2	3000-16367-0200
3 " " " "	2	J1,J2	3000-16367-0300
4 " " " "	1	J1	3000-16367-0400
HEATSINK ASSY.	2	HSA1, HSA2	A986-00010-E000
HEYCO BUSHING	4	MH1-MH4	0017-00042-0014
PC BOARD	1		A080-90910-E000

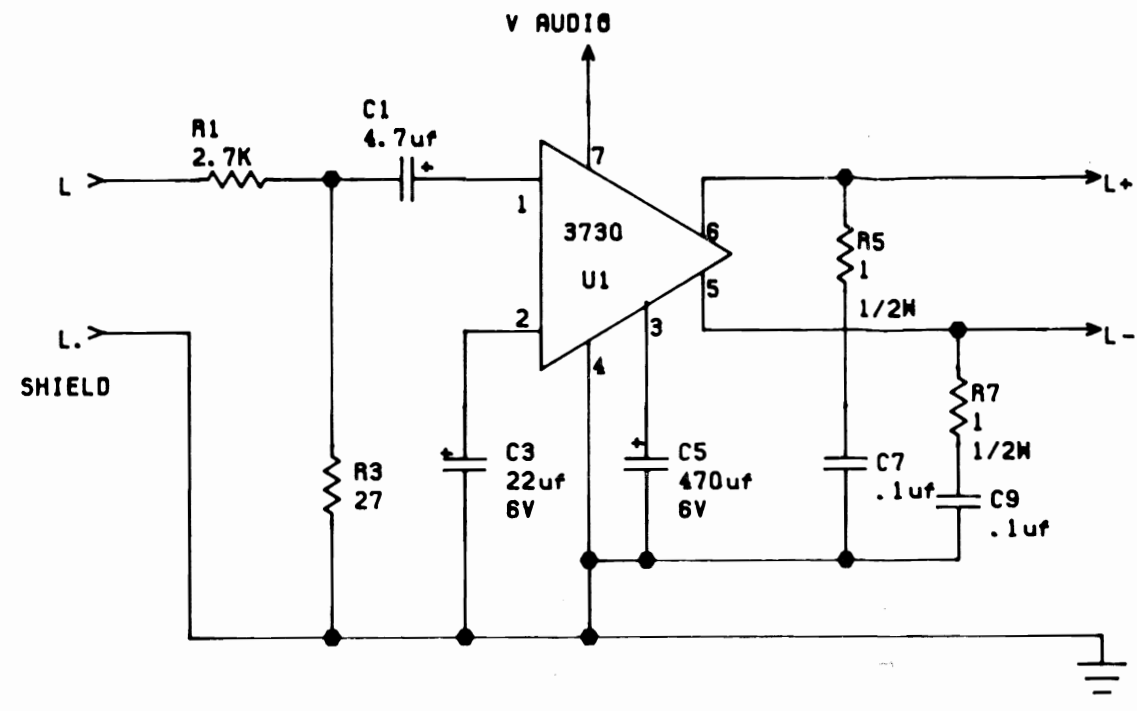


PROJECT ENG. C.MEDNICK

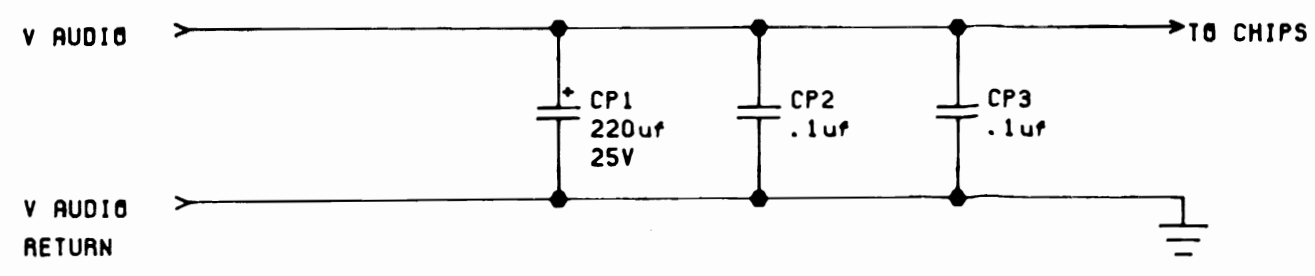
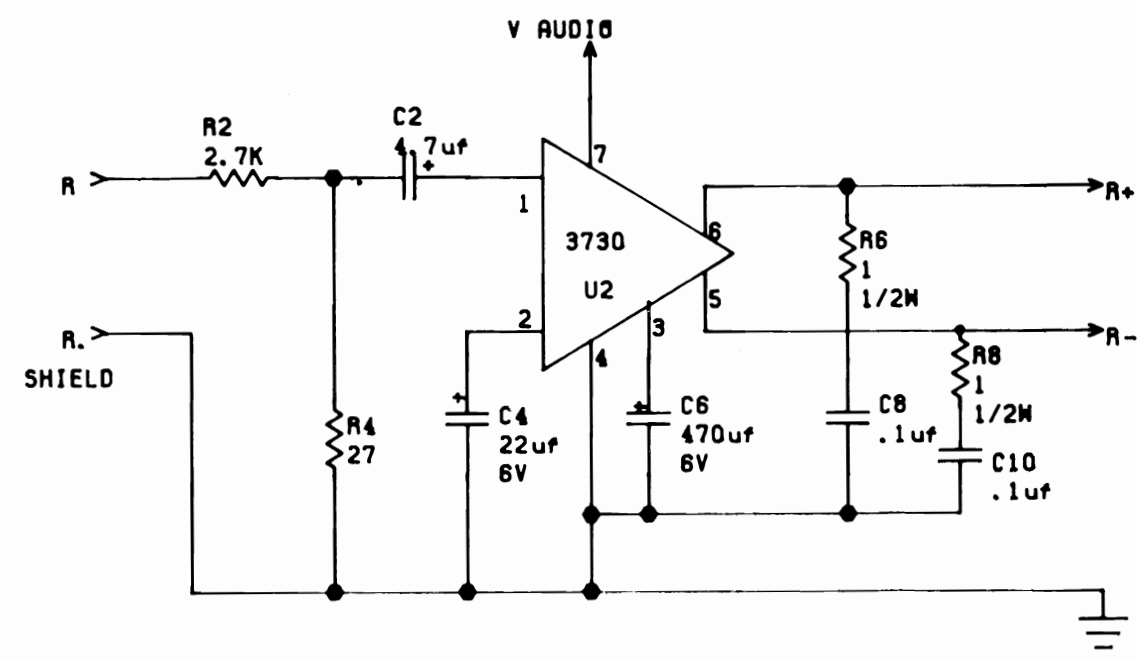
THIS DWG IS CONFIDENTIAL & PROPERTY OF MIDWAY MFG. CO.

<b>DIM. TOLERANCES</b> UNLESS OTHERWISE SPEC CONCENTRICITY T.I.R. .002 FRACTIONAL ± 1/64 DECIMAL ± .005 HOLE DIA. +.002 - .000 ANGLE ± 1/2° DO NOT SCALE DWG	FIRST USED ON TRON DPN TJK DATE 9-1-82 SCALE FULL MECH CHK MAT L ELEC CHK FINISH C. M. H.	<b>MIDWAY MFG. CO.</b> FRANKLIN PK., IL. 60131 A BALLY CO.	
	<b>DUAL PWR. AMP. ASSY</b> A080-90910-E000		<b>REVISIONS</b>
			PART NO <b>M051-00986-E010</b>

- J1**
- PIN 1 — N.C.
  - 2 — L. AUDIO
  - 3 — L. SHIELD
  - 4 — KEY
  - 5 — V AUDIO RETURN
  - 6 — R. AUDIO
  - 7 — R. SHIELD
  - 8 — V AUDIO



- J2**
- PIN 1 — R+
  - 2 — R-
  - 3 — KEY
  - 4 — L+
  - 5 — N.C.
  - 6 — L-

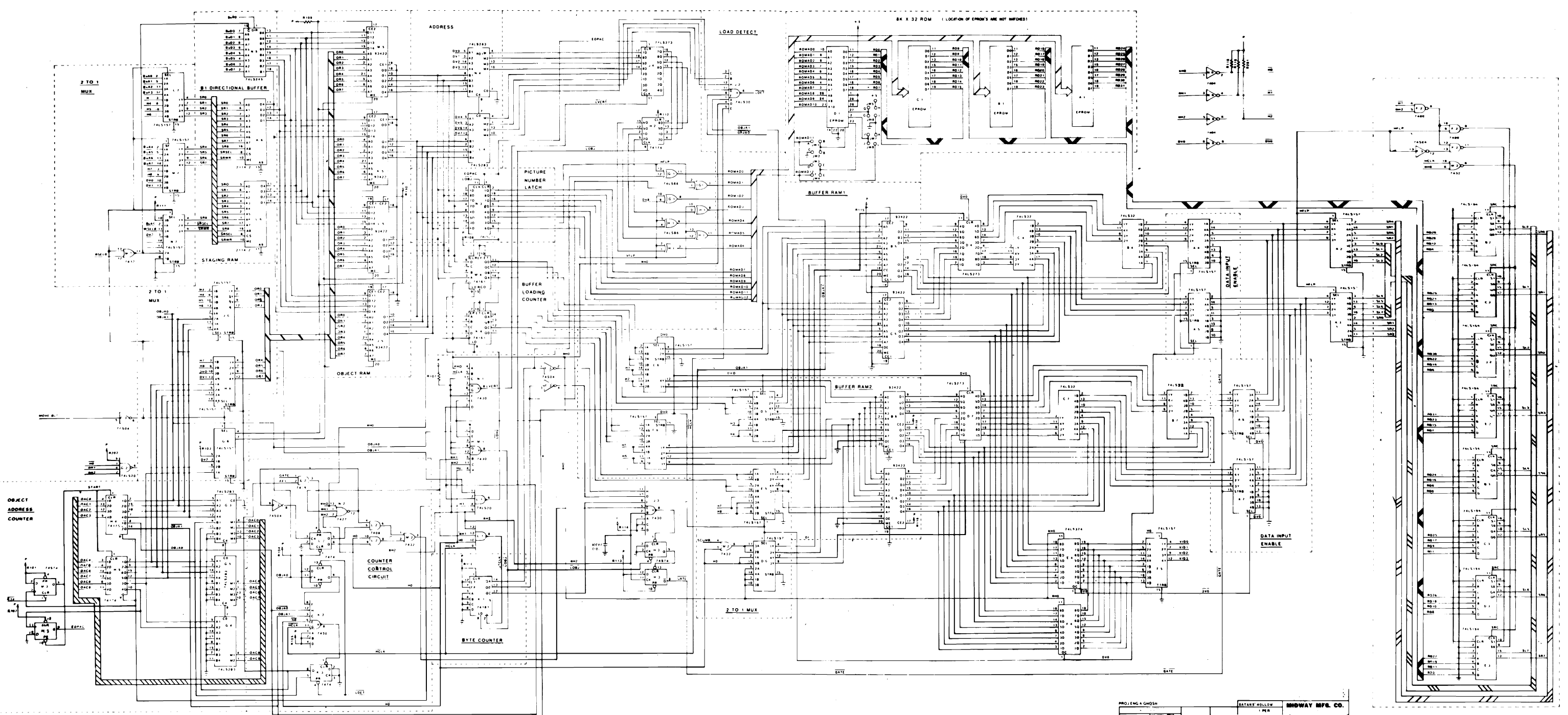


REVISIONS		<b>MIDWAY MFG. CO.</b>	
		FRANKLIN PK. ILL.	
USED ON TRON		PART NO	
NO. REQ'D		M051-00986-E011	
SCALE		SCHEMATIC, DUAL POWER AMP.	
NONE		A082-90910-E000	
HEAT TREAT		MATERIAL	
		FINISH	
DO NOT SCALE DWG.		DATE 9/1/82	
DIM TOLERANCES UNLESS SPECIFIED		DRN <i>SK</i>	
CONCENTRICITY ± .003		CKD.	
FRACTIONAL ± 1/64			
DECIMAL ± .005			
HOLE DIA + .002 - .000			





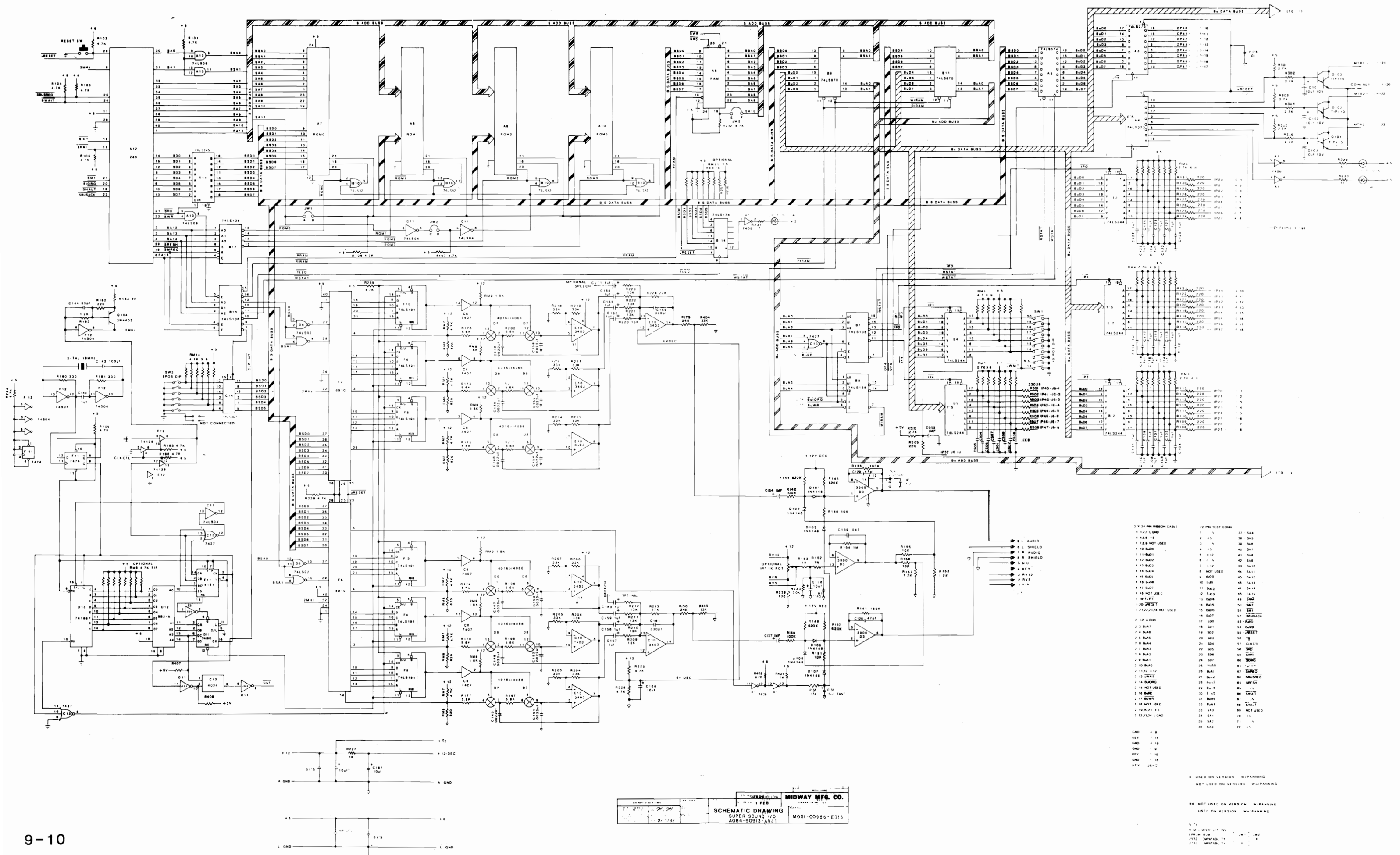




PROJ. ENG. & CHECK	DATE	BY	PER	REV.
	7/8/82			1/82
SCHEMATIC VIDEO GEN			MOSI-00986-6005	
A084-91399-A941				





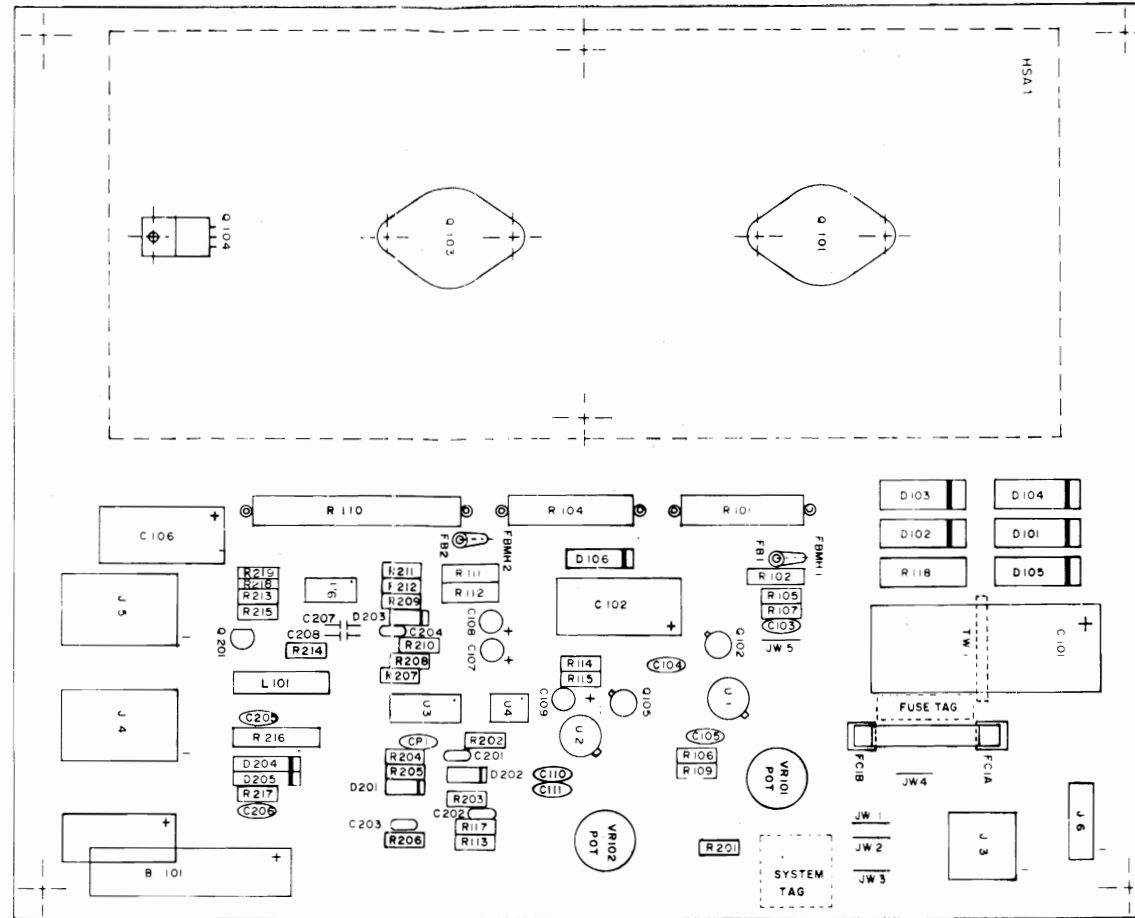


**MIDWAY MFG. CO.**  
 SCHEMATIC DRAWING  
 SUPER SOUND I/O  
 A084-90913-69A1  
 MO51-00986-E016

\* USED ON VERSION: WIPANNING  
 NOT USED ON VERSION: WIPANNING  
 \*\* NOT USED ON VERSION: WIPANNING  
 NOT USED ON VERSION: WIPANNING

CROSS REFERENCE LIST

DESIGNATION	DESCRIPTION	DESIGNATION	DESCRIPTION
C101	4700uf AX. ELECT.	R117	560ohm 1/4W 5%
C102	470uf AX. ELECT.	R118	150ohm 2W
C103	.1uf AX. CER.	R201	270ohm 1/4W 5%
C104	.1uf AX. CER.	R202	1.2K 1/4W 5%
C105	47pf AX. CER.	R203	1.1M 1/4W 5%
C106	470uf AX. ELECT.	R204	3.3M 1/4W 5%
C107	100uf RD. TANT.	R205	10M 1/4W 5%
C108	1uf RD. TANT.	R206	100K 1/4W 5%
C109	4.7uf RD. TANT.	R207	33K 1/4W 5%
C110	.1uf AX. CER.	R208	2M 1/4W 5%
C111	.1uf AX. CER.	R209	1M 1/4W 5%
C201	.01uf MYLAR	R210	1.2M 1/4W 5%
C202	.033uf MYLAR	R211	75K 1/4W 5%
C203	.01uf MYLAR	R212	75K 1/4W 5%
C204	.047uf MYLAR	R213	220K 1/4W 5%
C205	820pf AX. CER.	R214	3.9K 1/4W 5%
C206	.01uf AX. CER.	R215	1.2K 1/4W 5%
C207	0.082uf MYLAR	R216	82ohm 1W 10%
		R217	270ohm 1/4W 5%
		R218	110K 1/4W 5%
		R219	68ohm 1/2W 5%
		VR101,102	100ohm POT
CP1	.1uf AX. CER.	D101	A15F
		D102	A15F
		D103	A15F
		D104	A15F
		D105	A15F
		D106	1N4001
		D201	1N4148
		D202	1N4148
		D203	1N4148
		D204	1N4001
		D205	1N4001
R101	18ohm 5W W/RES. SPACER	Q102	2N2905
R102	68ohm 1/2W 5%	Q105	2N2905
R104	10ohm 5W W/RES. SPACER	Q201	2N4401
R105	27ohm 1/4W 5%	U1	LM305 REG.
R106	270ohm 1/4W 5%	U2	LM305 REG.
R107	6.2K 1/4W 5%	U3	LM3900
		U4	4N28
		U6	555
R109	1K 1/4W 5%	L101	22uH INDUCTOR
R110	16ohm 15W W/RES. SPACER	B101	BATTERY 3.6VDC 60DEG C
R111	6.8ohm 1/2W 5%	F1	3 RA S BLO FUSE
R112	68ohm 1/2W 5%	FC1A,1B	FUSE CLIP
R113	1.2K 1/4W 5%	FE1,2	FERRITE BEAD
R114	47ohm 1/4W 5%	TW1	TIE WRAP
R115	160ohm 1/4W 5%	J3	9PIN P.C. MOUNT CONN.(MALE)
		J4	15PIN P.C. MOUNT CONN.(FEMALE)
		J5	15PIN P.C. MOUNT CONN.(MALE)
		J6	3PIN P.C. MOUNT CONN.(MALE)
		LB1	FUSE TAG
		LB2	SYSTEM TAG
		HSA1	HEAT SINK ASS'Y 1
		MHSA1	MOUNTING HARD WARE(HEAT SINK) 2 SCREW 4 WASHER 2 HEXNUT
		JW1-5	JUMPER WIRE
		FBMH1,2	FERRITE BEAD MOUNTING HARD



PROJ. ENG.: L. DEKKER

USED ON: SATANS HOLLOW

MIDWAY MFG. CO.

FRANKLIN, PA. U.S.A.

DO NOT SCALE DRAWING

FULL NO. PER. PER.

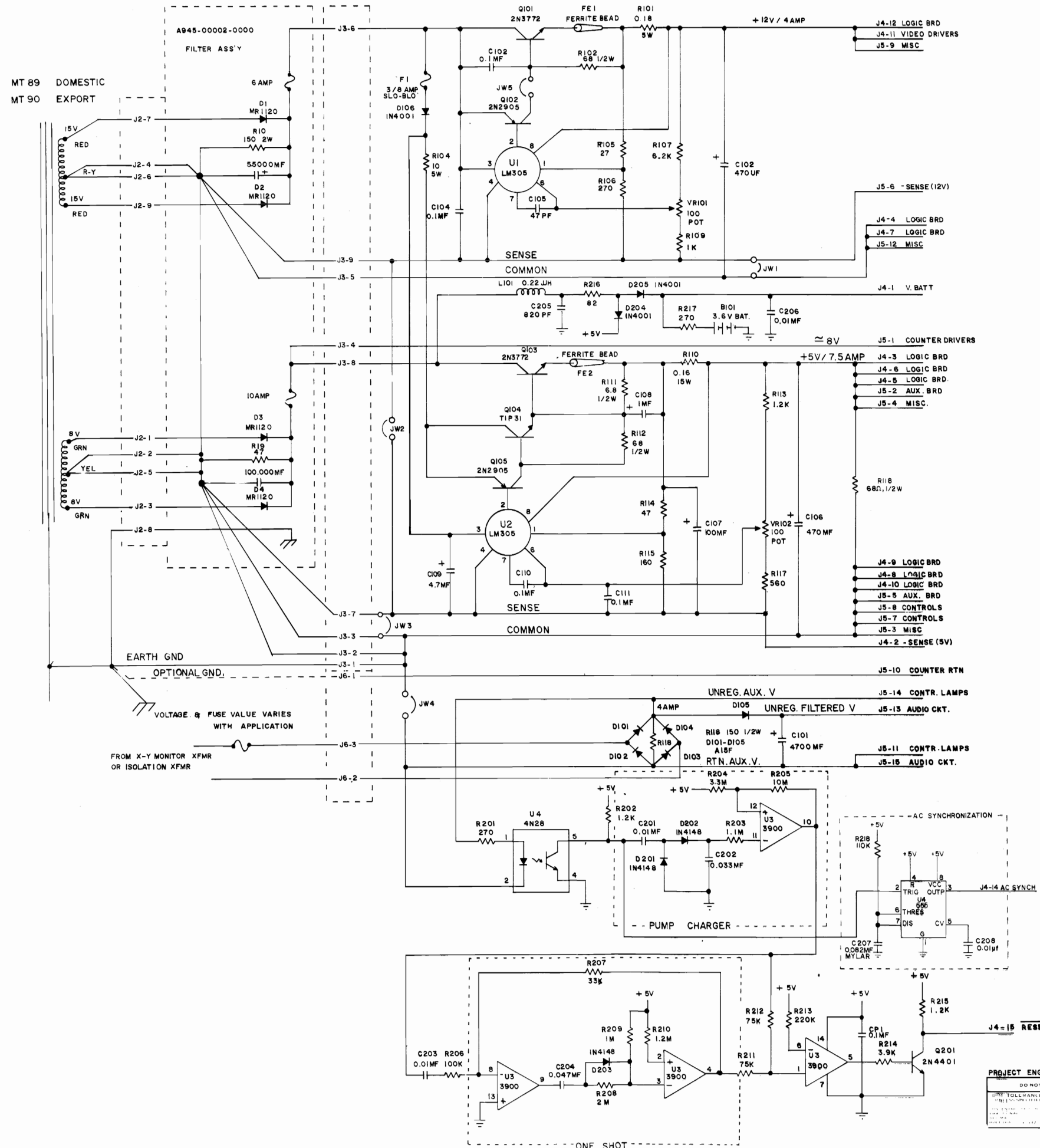
ASSEMBLY DRAWING I25VA PWRSPY

DATE: 5/14/82

A082-90412-0000

M051-00945-B006

DESCRIPTION	Q'ty	DESIGNATION	PART
47pf AX. CER.	1	C105	0945-00811-0100
820pf AX. CER.	1	C205	0945-00816-0400
.01uf AX. CER.	2	C206,208	0945-00816-0100
.01uf MYLAR	2	C201,203	0945-00816-0200
.033uf MYLAR	1	C202	0945-00816-0500
.047uf MYLAR	1	C204	0945-00816-0300
0.082uf AX. CER.	1	C207	0945-00816-1900
.1uf AX. CER.	5	C103,104,110,111	0945-00811-0200
		CP1	
1uf RAD. TANT.	1	C108	0945-00811-0300
4.7uf RAD. TANT.	1	C109	0945-00811-0400
100uf RAD. TANT.	1	C107	0945-00811-0500
470uf AX. ELECT.	2	C102,106	0945-00816-0600
4700uf AX. ELECT.	1	C101	0945-00811-0700
16ohm 15W 5%	1	R110	0945-00815-0100
18ohm 5W 5%	1	R101	0945-00815-0200
6.8ohm 1/2W 5%	1	R111	0062-04703-1XXX
10ohm 5W 5%	1	R104	0945-00812-0100
27ohm 1/4W 5%	1	R105	0062-068B3-1XXX
47ohm 1/4W 5%	1	R114	0062-086B3-1XXX
68ohm 1/2W 5%	3	R102,112,219	0062-098D3-1XXX
82ohm 1W 10%	1	R216	0062-104F5-1XXX
150ohm 2W 5%	1	R118	0945-00812-0200
160ohm 1/4W 5%	1	R115	0062-124B3-1XXX
270ohm 1/4W 5%	3	R106,201,217	0062-138B3-1XXX
560ohm 1/4W 5%	1	R117	0062-162B3-1XXX
1K 1/4W 5%	1	R109	0062-179B3-1XXX
1.2K 1/4W 5%	3	R113,202,215	0062-183B3-1XXX
3.9K 1/4W 5%	1	R214	0062-207B3-1XXX
6.2K 1/4W 5%	1	R107	0062-217B3-1XXX
33K 1/4W 5%	1	R207	0062-251B3-1XXX
75K 1/4W 5%	2	R211,212	0062-269B3-1XXX
100K 1/4W 5%	1	R206	0062-275B3-1XXX
110K 1/4W 5%	1	R218	0062-277B3-1XXX
220K 1/4W 5%	1	R213	0062-291B3-1XXX
1M 1/4W 5%	1	R209	0062-323B3-1XXX
1.1M 1/4W 5%	1	R203	0062-325B3-1XXX
1.2M 1/4W 5%	1	R210	0062-327B3-1XXX
2M 1/4W 5%	1	R205	0062-337B3-1XXX
3.3M 1/4W 5%	1	R204	0062-347B3-1XXX
10M 1/4W 5%	1	R205	0062-371B3-1XXX
100ohm POT	2	VR101,102	0945-00814-0000
LM305 REG.	2	U1,2	0945-00813-0100
555	1	U6	0229-00810-4500
LM3900	1	U3	0945-00813-0200
4N28	1	U4	0945-00813-0300
A15F RECTIFIER	5	D101-105	0945-00804-0200
1N4001	3	D106,204,205	0945-00804-0300
1N4148	3	D201-203	0945-00804-0500
2N2905	2	Q102,105	0945-00808-0300
2N4401	1	Q201	0945-00804-0400
BATTERY 3.6VDC 60DEG-C	1	B101	0017-00003-0377
FUSE 3/8A S-BLO	1	F1	0945-00808-0400
FUSE CLIP	2	FC1A,1B	0017-00003-0214
TIE WRAP	1	TW1	0945-00814-0300
FERRITE BEAD	2	FB1,2	0017-00009-0225
FERRITE MOUNTING HDW.	2	FBMH1,2	0017-00033-0139
22uH INDUCTOR	1	L101	0945-00814-0200
FUSE TAG	1	LB1	M051-00945-A004
SYSTEM TAG	1	LB2	M051-00945-A009
P.C.B.	1		A080-90412-U000
HEAT SINK ASS'Y	1	HSA1	A945-00008-0000
(SEE HS ASS'Y DRAWING "X" NOTE)			
4-40 X 10 SLT RND	2	MHSA1A,2A	0017-00101-0072
4-40 HEX NUT	2	MHSA1E,2E	0017-00103-0002
WSH 4-120-.250-018	4	MHSA1B,1D	0017-00104-0071
3PIN P.C. MOUNT CONN. (MALE)	1	J6	0017-00021-0443
9PIN P.C. MOUNT CONN. (MALE)	1	J3	0017-00021-0425
15PIN P.C. MOUNT CONN. (FEMALE)	1	J4	0017-00021-0441
15PIN P.C. MOUNT CONN. (MALE)	1	J5	0017-00021-0440
22 AWG T & R BARE 2.5"	5	JW1-5	0151-00087-0000



PROJECT ENG: L. DEKKER		DRAWN BY: SATANMOLLO		MIDWAY MFG. CO.	
DO NOT SCALE DRG		SCALE: FULL		FRANKLIN, ILL.	
DATE: 5/3/82		PART NO: A082-90412-0000		PART NO: M051-00945-0007	
TITLE: POWER SUPPLY I25VA W/CKT SUPORT		REV: 1		REV: 1	