FEBRUARY, 1982
Game Nos. 550, 555, & 557

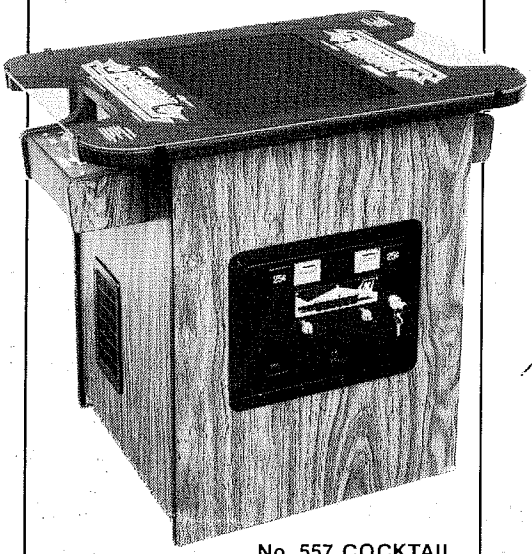
MIDWAYS

# BOSCONIAN

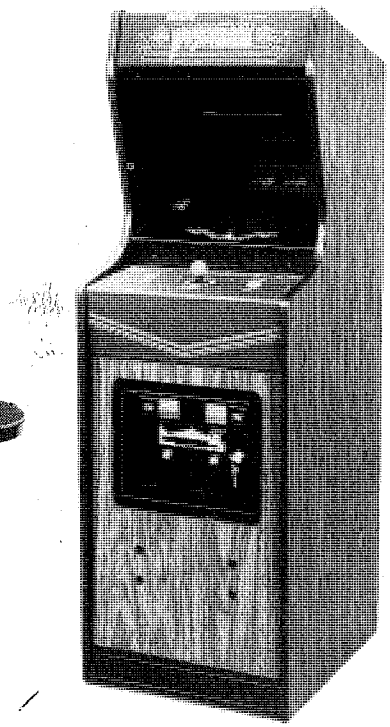
LICENSED FROM NAMCO LTD.

## Parts and Operating Manual

No. 550 UPRIGHT



No. 557 COCKTAIL



No. 555 MINI


MIDWAY MFG. CO.
A BALLY COMPANY
10750 W. GRAND AVENUE
FRANKLIN PARK, ILLINOIS 60131
USA

Phone: (312) 451-1360 Cable Address: MIDCO Telex No.: 72-1596



Form No. 0550-00300-0000

**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.

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

CAUTION: TO PREVENT ELECTRIC SHOCK DO NOT USE THIS (POLARIZED) PLUG WITH AN EXTENSION CORD, RECEPTACLE OR OTHER OUTLET UNLESS THE BLADES CAN BE FULLY INSERTED TO PREVENT BLADE EXPOSURE.

ATTENTION: POUR PREVENIR CHOCS ELECTRIQUES NE PAS UTILISER CETTE FICHE POLARISEE AVEC UN PROLONGATEUR. UNE PRISE DE COURANT OU UNE AUTRE SORTIE DE COURANT, SAUF SI LES LAMES PEUVENT ETRE INSEREES A FOND SANS EN LAISSER AUCUNE PARTIE A DECOUVERT.




Printed In U.S.A.

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**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

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

When playing this game, you are the pilot of a space fighter stationed in deep space to defend your solar system against the on-coming BOSCONIAN conquerors and their space station worlds. Your mission is to destroy as many of the enemy ships and space stations as possible.

These invaders arrive in convoys. They will attack you and attempt to run into you while flying back and forth across the screen. They will engage your fighter either singly or in ATTACK FORMATIONS to defend their space station worlds from you. The BOSCONIAN space station worlds have several defences of their own to hinder you. They keep the areas around them filled with Cosmo-Mines, eject Space Mines when you approach, fire Missiles, and through a mysterious power, are able to attract Asteroids and keep them floating in their immediate vicinity.

Your space fighter is provided with a long range scanner which can pick up and track the BOSCONIAN home space station worlds and the Attack Formations they send out to destroy you. However, your scanner's sensitivity does not enable it to pick up and track single BOSCONIAN Ships, Missiles, Space Mines of any type, or Asteroids.

As your skill level increases, the number and direction of attackers coming at you at any one time and the speed with which they attack, is gradually increased; plus, their attack patterns become more and more complex while their aim gets better.

Bonus ships are awarded to you periodically throughout the game as you reach or pass certain preselected point values. Each enemy Ship, Missile, etc. has an assigned point value as listed in Figure 1.

# Major New Features

Your BOSCONIAN game has several new features among which is the ability of your space fighter to fire both forward and backward at the same time, giving you greatly increased fire power, and the option to start a new game at the same level that your last fighter was destroyed.

# Game Objective

The object of the game is to **HAVE FUN** and survive as long as possible while constantly improving your skills and destroying as many of the enemy as you can. As you do this, each following convoy of attackers will be harder to destroy.

| OBJECT DESTROYED | POINT VALUE |
|---|---|
| ASTEROID | 10 POINTS |
| COSMO-MINE | 20 POINTS |
| I-TYPE MISSILE | 50 POINTS |
| P-TYPE MISSILE | 60 POINTS |
| E-TYPE MISSILE | 70 POINTS |
| SPY SHIP | MYSTERY |
| CANNON ON ENEMY BASE SPACE STATION | 200 POINTS |
| ENTIRE ENEMY BASE SPACE STATION | 1500 POINTS |
| ENTIRE I-TYPE MISSILE ATTACK FORMATION | 500 POINTS |
| ENTIRE P-TYPE MISSILE ATTACK FORMATION | 1000 POINTS |
| ENTIRE E-TYPE MISSILE ATTACK FORMATION | 1500 POINTS |

**Figure 1 Assigned point values**

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**Figure 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.
   - Also check to make sure all plug-in connectors on the wire harness are firmly seated.

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

   - Replug any connectors found unplugged. DO NOT FORCE PLUGS ONTO CONNECTORS. DO NOT FORCE PLUGS TOGETHER. If it won't go on easily, assuming the keys are lined up, it either does not belong there or is damaged.
   - Make sure all printed circuit boards (P.C.B.'s) are firmly seated in their connectors. See Figure 2. 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.
   - Check all major subassemblies to be sure they are mounted securely. These are called out in Figures 2 & 3.
     Power supply.
     Control panel(s).
     T.V. monitor.
     Other P.C.B.'s and/or P.C.B. rack, etc.
     Transformer board 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 29" (63 x 73cm)
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.

- 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.
- Check each interlock switch for proper operation.

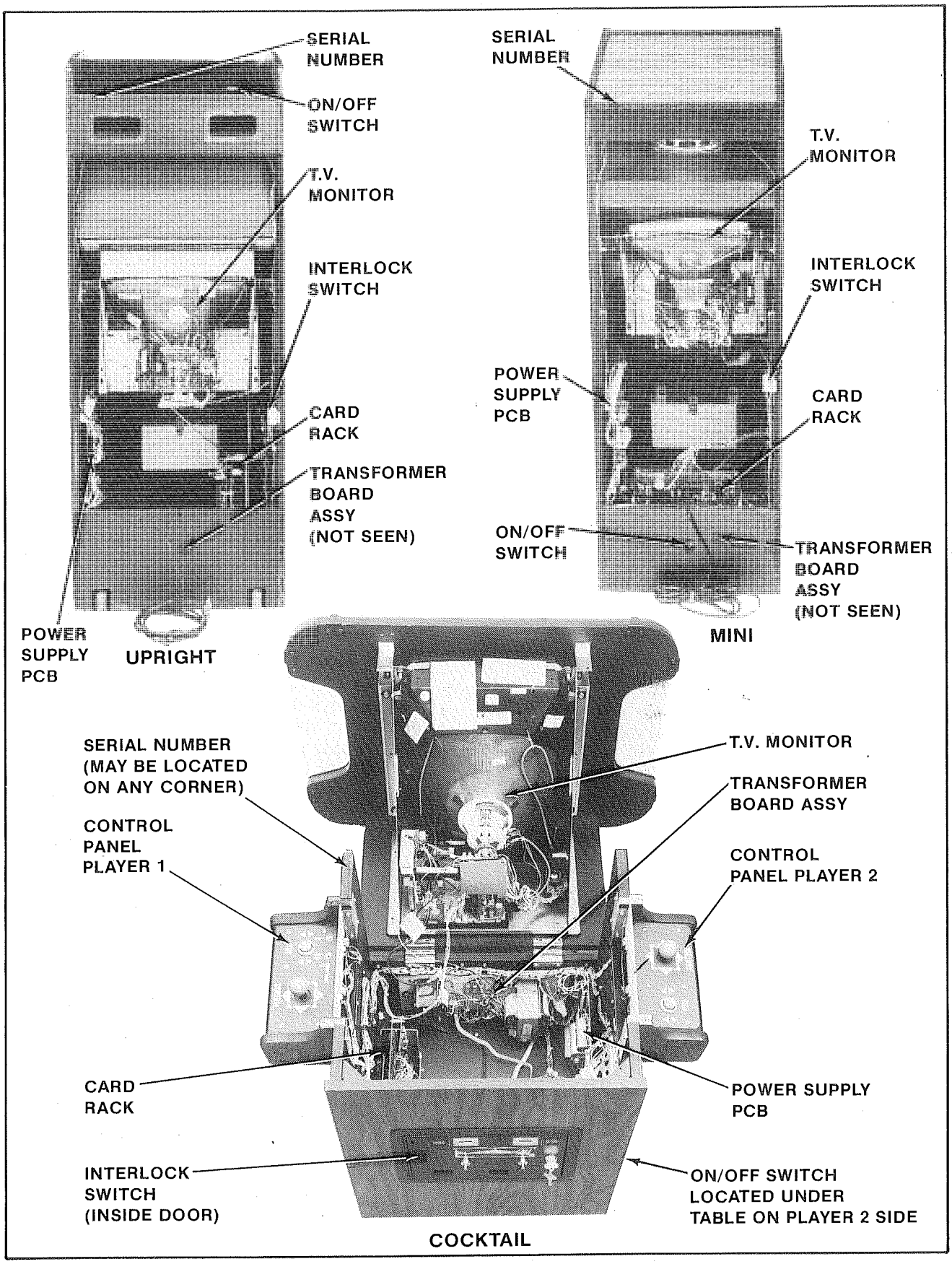



Figure 2 Location of serial number, interlock switch, on/off switch & major subassemblies

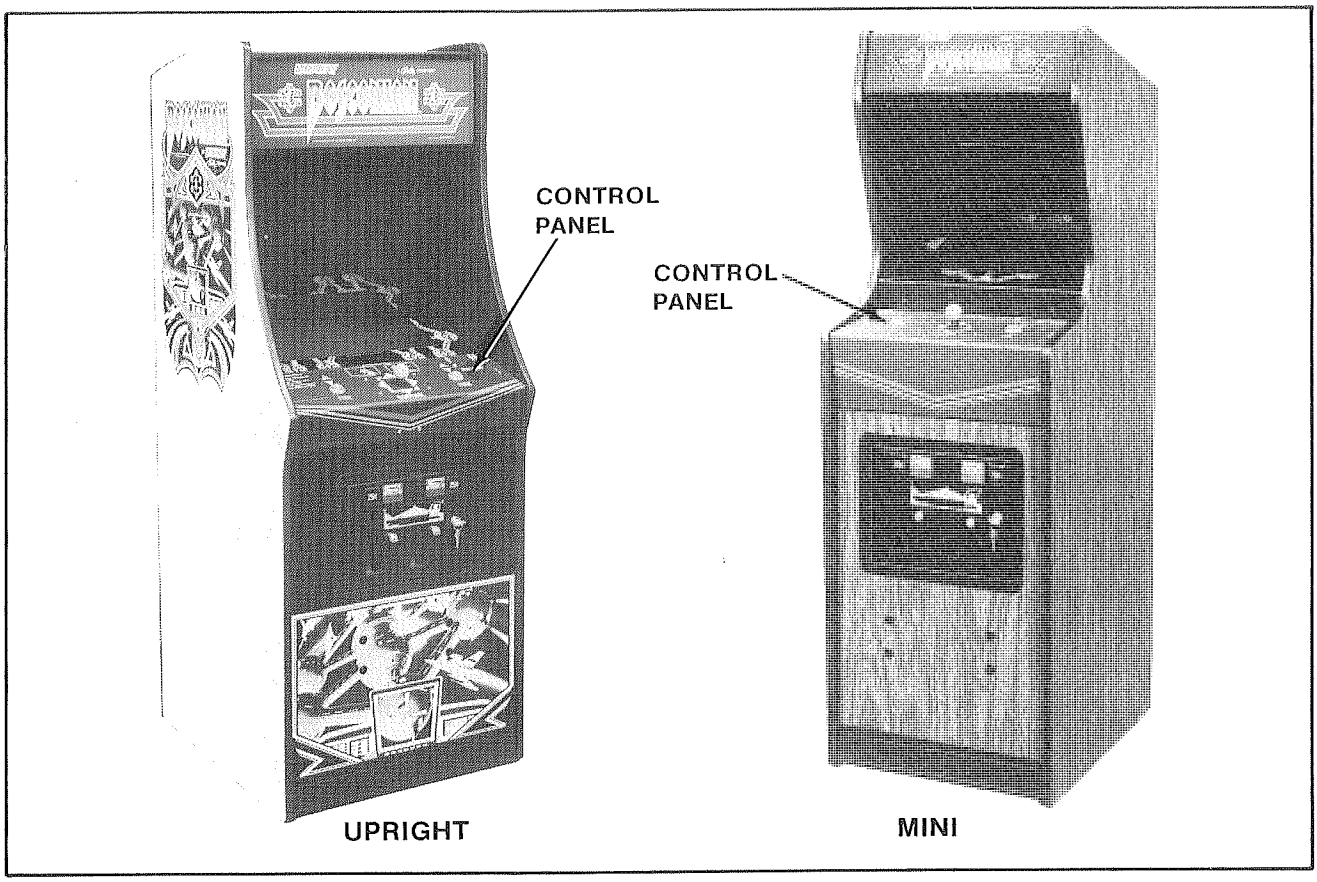



**Figure 3 Major subassemblies (cont. from FIG. 2)**

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. 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 4.

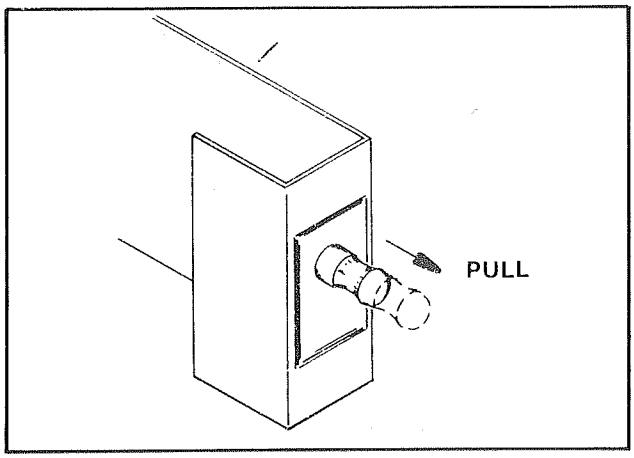



**Figure 4 Interlock switch operation**

## SELF-TEST

Your new game will Self-Test itself to see if it has any bad parts. The information it receives while testing itself will be shown on the T.V. monitor. Some information can also be heard through the games speaker system. See the GAME OPERATION section for a more detailed description of this function.

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

## GAME VOLUME ADJUSTMENT CONTROL. See Figure 5.

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

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

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

## OPTION SWITCH SETTINGS

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

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

The option switch settings and what they will make the game do are shown in Figure 6. See Figure 5 for option switch locations.

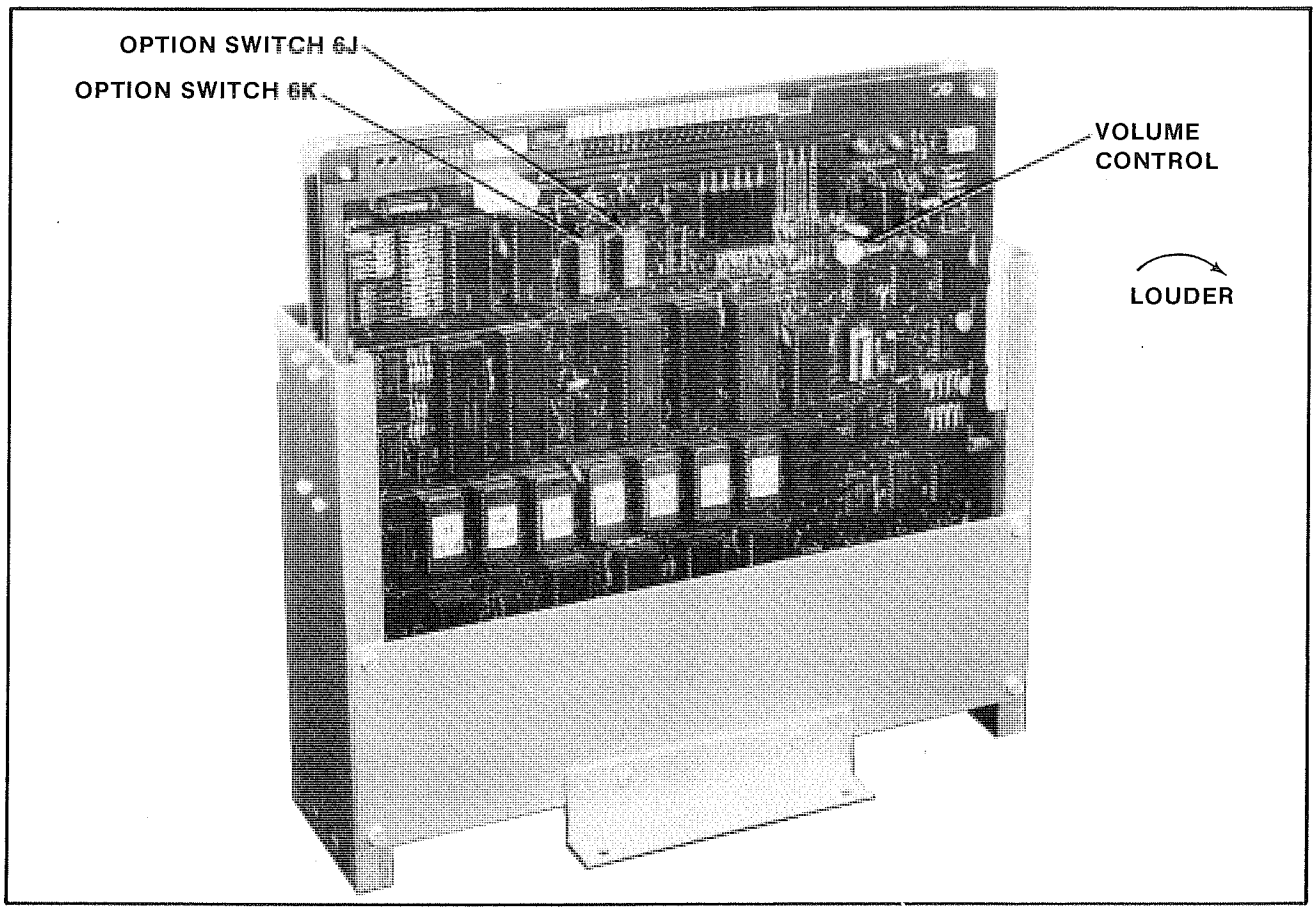



**Figure 5 Location of option switches and volume control**

## BOSCONIAN

## OPTION SWITCH SETTINGS

### DIP SWITCH 6J

| | SW#1 | SW#2 | SW#3 | SW#4 | SW#5 | SW#6 | SW#7 | SW#8 |
|---|---|---|---|---|---|---|---|---|
| **1 PLAYER GAME**<br>PRESS THE 1 PLAYER START BUTTON<br>1, 2, 3, or 5 FIGHTERS | OFF | | | | | | NOT USED | |
| **2 PLAYER GAME**<br>PRESS THE 2 PLAYER START BUTTON<br>1, 2, 3, OR 5 FIGHTERS **EACH** | | | | | | | | |
| **1 PLAYER GAME**<br>PRESS THE 1 PLAYER START BUTTON<br>1, 2, 3, OR 5 FIGHTERS | ON | | | | | | NOT USED | |
| **1 PLAYER GAME**<br>**WITH 3, 5, 7, OR 11 FIGHTERS**<br>PRESS THE **2 PLAYER** START BUTTON | | | | | | | | |

### DIFFICULTY LEVEL SETTINGS — "B" IS THE EASIEST AND "C" IS THE MOST DIFFICULT

| | SW#1 | SW#2 | SW#3 | SW#4 | SW#5 | SW#6 | SW#7 | SW#8 |
|---|---|---|---|---|---|---|---|---|
| RANK "A" — STANDARD LEVEL OF DIFFICULTY | | OFF | OFF | | | | NOT USED | |
| RANK "B" — EASIEST LEVEL OF DIFFICULTY | | OFF | ON | | | | | |
| RANK "C" — HARDEST LEVEL OF DIFFICULTY | | ON | OFF | | | | NOT USED | |
| RANK "AUTO" — (MEASURES PLAYERS SKILL LEVEL) | | ON | ON | | | | | |
| **NO** GAME CONTINUATION FEATURE.<br>PLAYER(S) MAY CONTINUE GAME FROM PRESENT ROUND AFTER LAST SHIP HAS BEEN DESTROYED.<br>**THIS COSTS ADDITIONAL CREDITS.**<br>PLAYER(S) SCORE(S) ARE RETURNED TO **ZERO — "O".** | | | | ON<br>OFF | | | NOT USED | |
| GAME PROVIDES SOUND IN **ATTRACT MODE**<br>GAME **DOES NOT** PROVIDE SOUND IN **ATTRACT MODE** | | | | | ON<br>OFF | | NOT USED | |
| FREEZE VIDEO<br>(MONITOR PRESENTATION STOPS MOVING)<br>MONITOR OPERATES NORMALLY | | | | | | ON<br>OFF | NOT USED | |

### COIN COUNTER

| | SW#1 | SW#2 | SW#3 | SW#4 | SW#5 | SW#6 | SW#7 | SW#8 |
|---|---|---|---|---|---|---|---|---|
| ONE WAY | | | | | | | NOT USED | ON |
| TWO WAY | | | | | | | | OFF |

**NOTE:** SWITCH NUMBER 6J-7 IS NOT USED AND SHOULD **ALWAYS** REMAIN IN THE **"OFF"** POSITION.

**Figure 6 Option switch settings**

## BOSCONIAN

## OPTION SWITCH SETTINGS

### DIP SWITCH 6K

### COINS PER CREDIT

| | | SW#1 | SW#2 | SW#3 | SW#4 | SW#5 | SW#6 | SW#7 | SW#8 |
|---|---|---|---|---|---|---|---|---|---|
| FREE PLAY | | ON | ON | ON | | | | | |
| 4 COINS | 1 CREDIT | OFF | ON | ON | | | | | |
| 3 COINS | 1 CREDIT | ON | OFF | ON | | | | | |
| 2 COINS | 1 CREDIT | OFF | OFF | ON | | | | | |
| 2 COINS | 3 CREDITS | ON | ON | OFF | | | | | |
| 1 COIN | 3 CREDITS | OFF | ON | OFF | | | | | |
| 1 COIN | 2 CREDITS | ON | OFF | OFF | | | | | |
| 1 COIN | 1 CREDIT | OFF | OFF | OFF | | | | | |

### BONUS SHIPS AWARDED AT THE FOLLOWING POINT VALUES:

| BEGAN WITH 1, 2 OR 3 FIGHTERS | | BEGAN WITH 5 FIGHTERS | | SW#1 | SW#2 | SW#3 | SW#4 | SW#5 | SW#6 | SW#7 | SW#8 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1st SHIP | 20000 | 1st SHIP | 30000 | | | | | | | | |
| 2nd SHIP | 70000 | 2nd SHIP | 120000 | | | | ON | ON | OFF | | |
| AND EVERY | 70000 | | | | | | | | | | |
| 1st SHIP | 15000 | 1st SHIP | 20000 | | | | | | | | |
| 2nd SHIP | 50000 | 2nd SHIP | 70000 | | | | ON | OFF | ON | | |
| AND EVERY | 50000 | | | | | | | | | | |
| 1st SHIP | 15000 | 1st SHIP | 30000 | | | | | | | | |
| 2nd SHIP | 50000 | 2nd SHIP | 100000 | | | | ON | OFF | OFF | | |
| | | AND EVERY | 100000 | | | | | | | | |
| 1st SHIP | 10000 | 1st SHIP | 15000 | | | | | | | | |
| 2nd SHIP | 50000 | 2nd SHIP | 70000 | | | | OFF | ON | ON | | |
| AND EVERY | 50000 | | | | | | | | | | |
| 1st SHIP | 30000 | 1st SHIP | 30000 | | | | | | | | |
| 2nd SHIP | 100000 | 2nd SHIP | 80000 | | | | OFF | ON | OFF | | |
| AND EVERY | 100000 | AND EVERY | 80000 | | | | | | | | |
| 1st SHIP | 15000 | 1st SHIP | 20000 | | | | | | | | |
| 2nd SHIP | 70000 | 2nd SHIP | 100000 | | | | OFF | OFF | ON | | |
| AND EVERY | 70000 | | | | | | | | | | |
| 1st SHIP | 20000 | 1st SHIP | 30000 | | | | | | | | |
| 2nd SHIP | 70000 | 2nd SHIP | 120000 | | | | OFF | OFF | OFF | | |
| | | AND EVERY | 120000 | | | | | | | | |
| NO BONUS SHIPS GIVEN WITH THIS SETTING | | | | | | | ON | ON | ON | | |

### DETERMINES NUMBER OF SPACE FIGHTERS PLAYER BEGINS GAME WITH:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 SPACE FIGHTER | | | | | | | ON | ON | |
| 2 SPACE FIGHTERS | | | | | | | OFF | ON | |
| 3 SPACE FIGHTERS | | | | | | | ON | OFF | |
| 5 SPACE FIGHTERS | | | | | | | OFF | OFF | |

**Figure 6 Option switch settings (cont'd.)**

# Game Operation

BOSCONIAN 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 7.

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

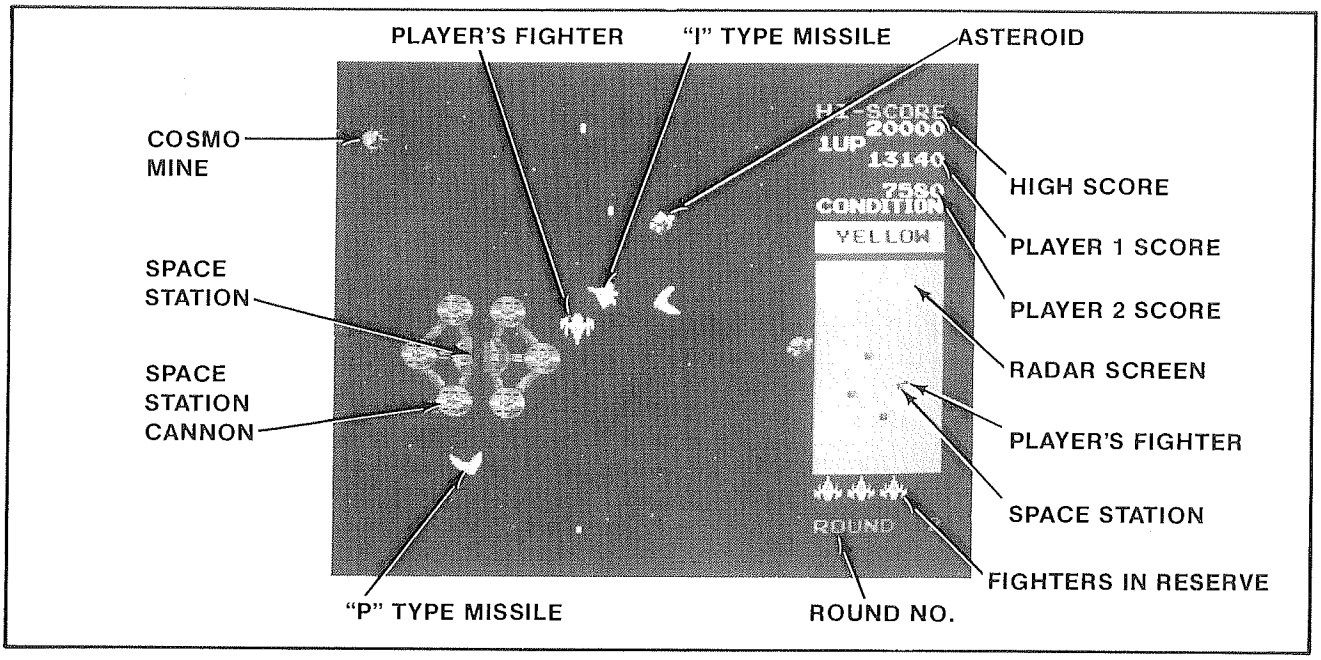



**Figure 7 Identification of "on screen" graphics during play**

## SELF-TEST MODE

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

**NOTE:** Putting the game into Self-Test will cause it to **erase** any CREDITS shown at the lower left corner of the screen from its memory.

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. Test switch is located inside coin door under coin meter. When this is done, the game will react as follows:

1. First, you will see a moving multicolored pattern appear on the screen.
2. Immediately following this, a rightside up test display is shown on the monitor screen. This will remain until you set the Self-Test switch back to the "OFF" position. This test display is shown below.

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

RAM OK or (a number and a letter, i.e. 1L, 3H, etc.)
ROM OK or (a number, i.e. 0, 2, etc.)
UPRIGHT or (TABLE)
*1 COIN *1 CREDIT
*3 SHIPS
RANK *A (B, C, AUTO)
SOUND 00 (01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19)
1ST BONUS *20000 PTS
2ND BONUS *70000 PTS
*AND EVERY 70000 PTS

* = switch selectable

| DISPLAY | DESCRIPTION |
|---|---|
| RAM OK | All RAMs are good. |
| RAM 1L | RAM located on CPU PC board at position 2N is bad. |
| RAM 1H | RAM located on CPU PC board at position 2N is bad. |
| RAM 2L | RAM located on CPU PC board at position 2N is bad. |
| RAM 2H | RAM located on CPU PC board at position 2N is bad. |
| RAM 3L | RAM located on Video PC board at position 1E is bad. |
| RAM 3H | RAM located on Video PC board at position 1E is bad. |
| RAM 4L | RAM located on Video PC board at position 1E is bad. |
| RAM 4H | RAM located on Video PC board at position 1E is bad. |
| RAM 5L | RAM located on Video PC board at position 1H is bad. |
| RAM 5H | RAM located on Video PC board at position 1H is bad. |
| RAM 6L | RAM located on Video PC board at position 1H is bad. |
| RAM 6H | RAM located on Video PC board at position 1H is bad. |
| ROM OK | All ROMs are good. |
| ROM 0 | ROM located on CPU PC board at position 3N is bad. |
| ROM 1 | ROM located on CPU PC board at position 3M is bad. |
| ROM 2 | ROM located on CPU PC board at position 3L is bad. |
| ROM 3 | ROM located on CPU PC board at position 3K is bad. |
| ROM 4 | ROM located on CPU PC board at position 3J is bad. |
| ROM 5 | ROM located on CPU PC board at position 3H is bad. |
| ROM 6 | ROM located on CPU PC board at position 3E is bad. |

3. If a bad ROM or RAM chip is found by the game's internal check system during the Self-Test, the game indicates this to you by showing the location code of the bad chip(s) in place of the letters "OK". The above table translates the chip location codes into actual positions on either the Video or the CPU P.C. Boards.

4. "RANK" is a difficulty setting, with "RANK B" being the **least** difficult level of play and "RANK C" being the **most** difficult level of play. "RANK AUTO"; at this setting the game measures the player's skill level and progressively gets harder as the player gets better. See the "OPTION SWITCH SETTINGS" table.

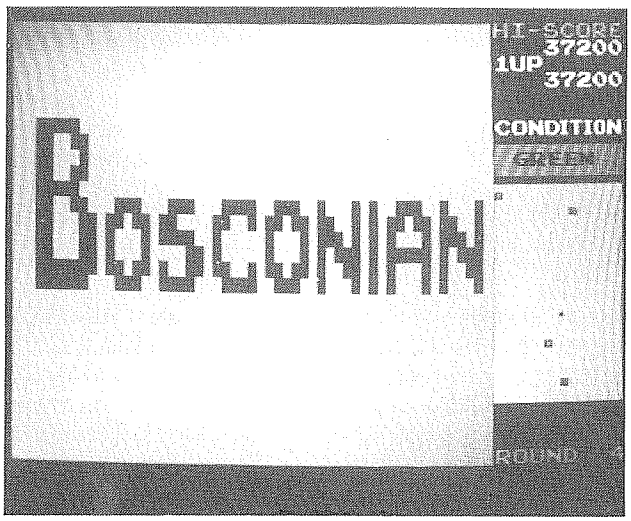
5. To check "SOUND" (the game has 20 different sounds):
   a) Move the controller to the right momentarily and release it — "SOUND" number changes from "00" to "01" and you hear sound "01".
   b) Press any button or activate the coin switches and sound "01" will change to sound "02" and it is heard.
   c) Repeat Step 2 with a different button or switch, etc. and — "SOUND 02" changes to "SOUND 03" and it is heard — and so on.

6. To check your game function switches and buttons (coin counter switches, FIRE button, 1 PLAYER and 2 PLAYER buttons): activate each one while the game is in the Self-Test mode. You should hear a different game sound for each activation. If you do not hear it, the switch/button is either not working, miswired, or disconnected. Check it out thoroughly.

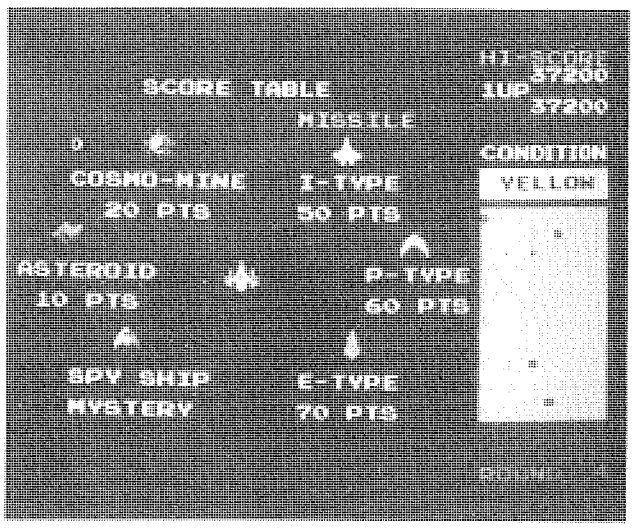
7. When finished with the Self-Test mode, slide the Self-Test switch back to the "OFF" position.
   - A cross hatch pattern appears on the monitor screen for about 2 seconds.
   - If you wish to keep this test pattern on the monitor screen for further use, slide Self-Test switch back to the "ON" position **after** the cross hatch appears and **before** it disappears.
   - When finished with the cross hatch pattern, set the Self-Test switch to the "OFF" position.
   - Normal game functions will now return to the monitor screen.

## ATTRACT MODE

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

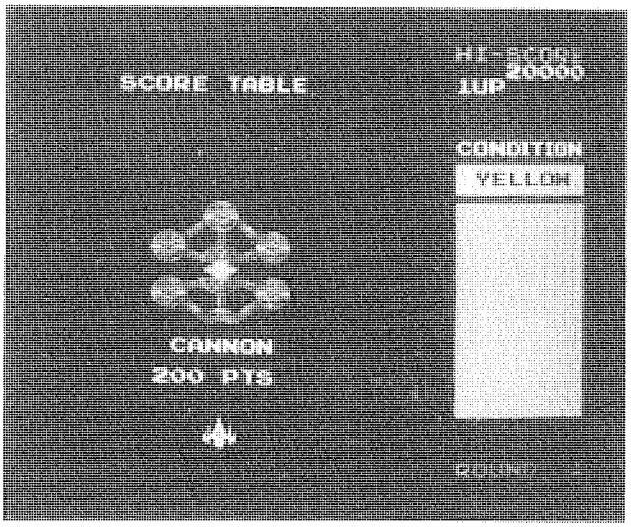



**DISPLAY 1**

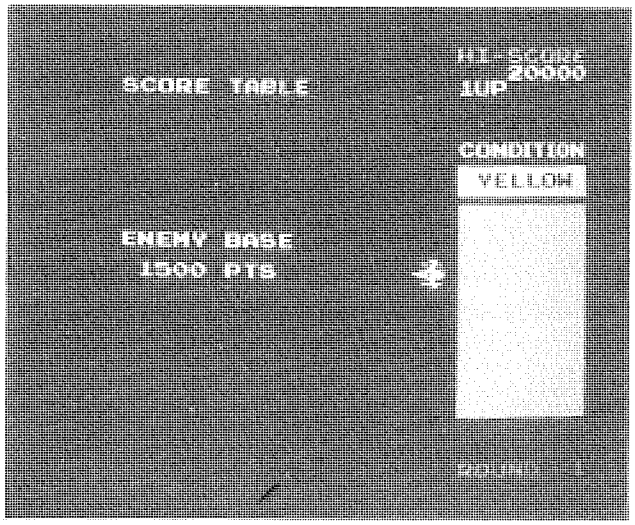



**DISPLAY 2**

   - The above display and the one that follows give the point values assigned to the different things that can be destroyed by your space fighter.



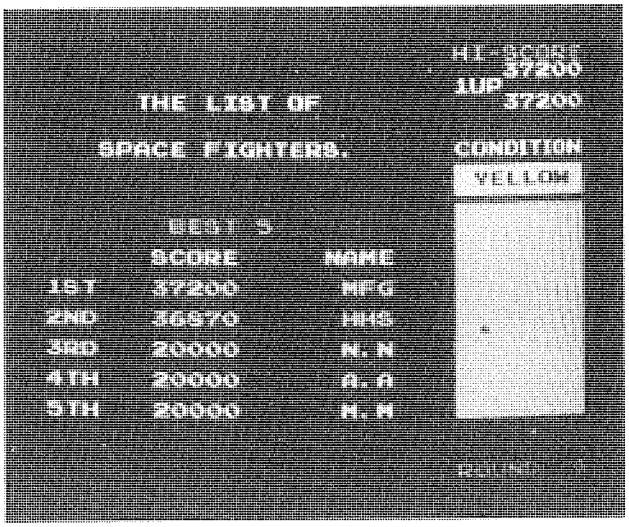

**DISPLAY 3a**




**DISPLAY 3b**

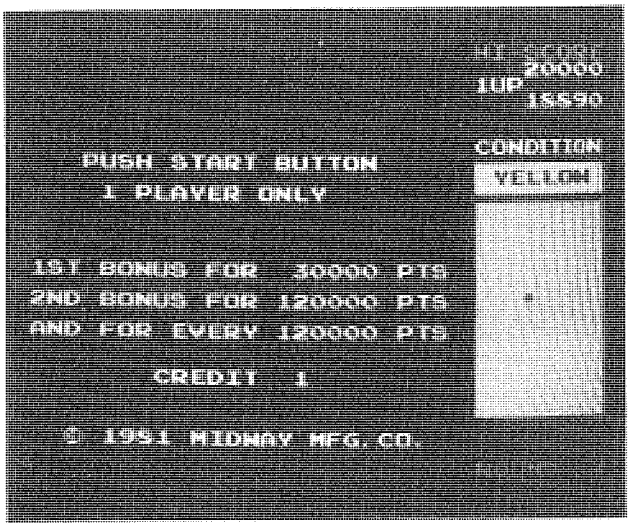
   - The fourth display in the attract mode sequence shows simulated game play.

   - The next display in the series lists the five highest scoring individuals, "THE LIST OF SPACE FIGHTERS", that have played the game to date.




DISPLAY 5

- No matter where the game is in the Attract mode sequence, it will immediately go to the following display as soon as a game has been paid for. It will hold this display on the monitor screen until the "1 PLAYER" or the "2 PLAYER" start button is pushed.




## READY-TO-PLAY MODE

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

## PLAY MODE

1. The Play mode begins when either the "1 PLAYER" or the "2 PLAYER" start button is pressed. "PLAYER ONE" — "READY" is displayed **centered** on the screen.
2. The Play mode ends when all of your space fighters have been destroyed. When this happens, "GAME OVER" is written across the center of the monitor screen.
3. The game is made up of convoys of invading aliens. You, as defender, try to destroy as many convoys as you can. They are hard, tricky fighters. Your task will not be easy! Just remember that when shooting at the space station hub to take out the whole station, the missile launching doors MUST be at least part way open in order for your shots to be able to destroy the entire space station. Or, if you destroy all six Cannons on the space station rim, the entire space station will go up with the destruction of the sixth Cannon.
4. The convoys are displayed one at a time on the long range scanner to the right of the screen. They are made up of BOSCONIAN Space Station worlds which are surrounded by Cosmo-Mines and Asteroids. These space stations send out three different types of missiles to try to blow you out of space. They are: "I-TYPE", which are purple in color; "P-TYPE", which are silver-blue in color; and "E-TYPE", which are red in color.

   The longer you are in a particular "ROUND" (ROUND 1, ROUND 2, etc.), the more missiles the enemy space stations will send out after you. (What "ROUND" you're in is indicated at the lower right hand corner of the screen.)

   You **MUST** destroy every BOSCONIAN space station world in a particular "ROUND" to advance to the next one.

   There are also special Attack Formations made up of five missiles each which will appear continuously throughout the game. If they are completely destroyed, bonus points will be awarded as follows:

| OBJECT DESTROYED | BONUS POINT VALUE |
|---|---|
| ENTIRE I-TYPE MISSILE ATTACK FORMATION | 500 POINTS |
| ENTIRE P-TYPE MISSILE ATTACK FORMATION | 1000 POINTS |
| ENTIRE E-TYPE MISSILE ATTACK FORMATION | 1500 POINTS |

The Rounds in which the different Attack Formations will appear are as follows:

| ROUND NUMBER | VEHICLE TYPE |
|---|---|
| 1 | I |
| 2 | P |
| 3 | I |
| 4 | P |
| 5 | P |
| 6 | E |
| 7 | E |
| 8 | P |
| 9 | E |
| 10 | E |
| 11 | P |
| 12 | I |
| 13 | P |
| 14 | E |
| 15 | E |
| 16 | E |
| 17 | E |

ROUND 18 AND BEYOND — REPEATS VEHICLE SEQUENCE FOUND FROM ROUND 12 THROUGH 17.

These Attack Formations are lead by one missile that is the same shape as the other four but is a slightly different color. If you shoot this "lead — or — control missile", the Attack Formation will break up and go in different directions.

When you destroy the last space station of a convoy, the screen gives the following display **centered** on the monitor screen:

**PLAYER ONE**
**READY**

The number of the next ROUND is displayed in the lower right corner of the screen, the next convoy of BOSCONIAN space station worlds appears in the long range scanner at the right side of the monitor screen, your space fighter appears at the center of the screen, and play begins.

As you destroy more convoys, the attacks on you become faster, are in a more rapid succession, and follow trickier flight patterns. For instance, they will try to trap you in a cross fire, or with your back to a mine field, etc. You've really got to watch them closely.

When the enemy happens to destroy one of your fighters, assuming you have at least one reserve fighter left, the words "PLAYER ONE" — "READY" appear **centered** on the monitor screen BEFORE play begins again.

When the enemy destroys your **last** fighter, the words "GAME OVER" are displayed **centered** on the monitor screen. (AT THIS POINT, SEVERAL DIFFERENT THINGS CAN HAPPEN DEPENDING ON WHETHER THE **"GAME CONTINUATION FEATURE"** HAS BEEN SELECTED.)

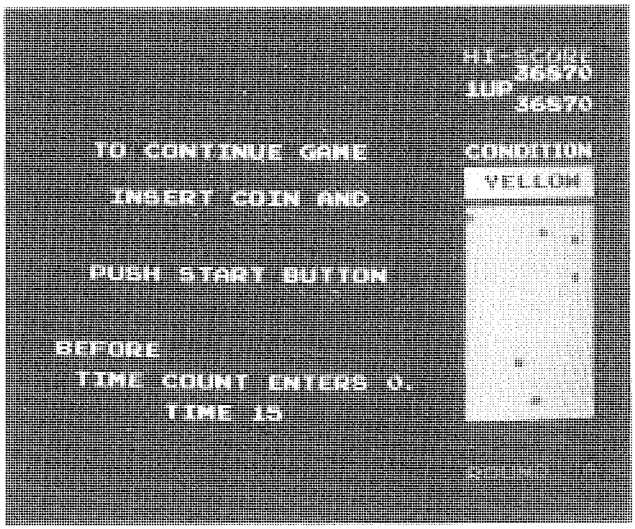
"GAME CONTINUATION FEATURE" HAS **NOT** BEEN SELECTED:

If your score was the highest one of the five best scores, the game will tell you this by putting the following display on the screen.

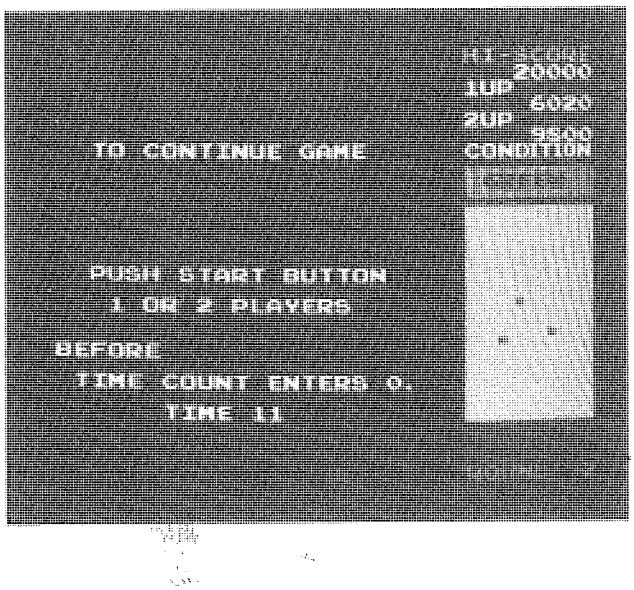

After this display, the game will go into the High Score/Initial mode immediately. If your score was not the highest of the day, but was still one of the "BEST 5", the game will go directly to the High Score/Initial mode presentation. If your score is not high enough to cause the game to go into the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

"GAME CONTINUATION FEATURE" **HAS BEEN** SELECTED:

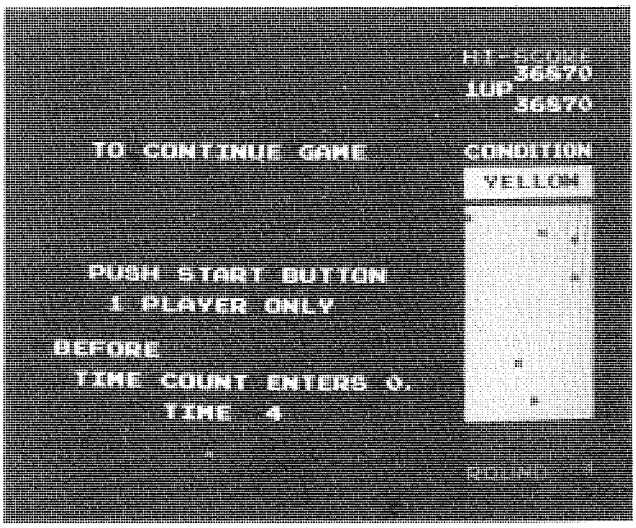
The game will act in the same manner as stated above **EXCEPT IN THE CASE WHERE** your score is not high enough to cause the game to go into the High Score/Initial mode and there are no more credits left in its memory. In this case, it will give the following display **centered** on the monitor screen:




If there are at least enough credits left in the game's memory for a **TWO** PLAYER GAME, the above message is modified to read this way:




If there are ONLY enough credits left in the game's memory for a **ONE** PLAYER GAME, the above message is modified to read as follows:



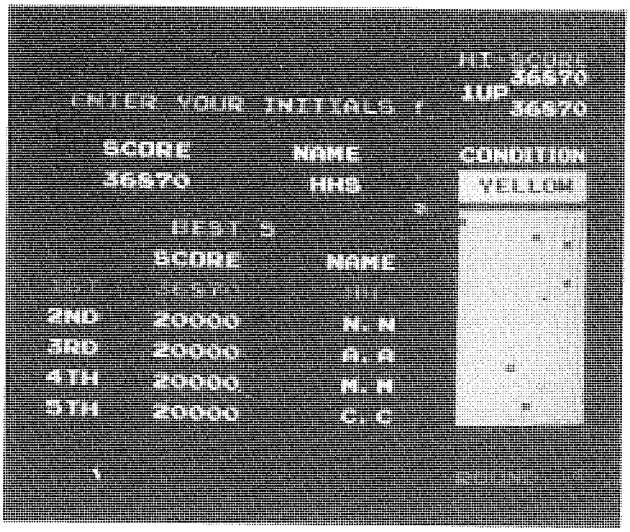

If you decide to exercise any of the above options BEFORE the 15 second time limit runs out, your score will be set BACK to ZERO "0", the ROUND number that you were in when your last space fighter was destroyed will REMAIN THE SAME, and play will begin in the same sequence as it has for all previous games.

If you **do not** decide to exercise any of the above options BEFORE the 15 second time limit runs out, 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).

Also, if you do decide to play another game AFTER the 15 second GAME CONTINUATION time limit has run out, you will be starting at ROUND 1 again with your score at ZERO "0".

### HIGH SCORE/INITIAL MODE

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




When in the High Score/Initial mode, there are three "A" 's under the top "NAME" heading on the screen. The first "A" is red and flashing on and off. The other two "A" 's are white. Farther down the screen under the "BEST 5" heading, your score has been entered in bright green and the space for your initials is blank. All other scores are white.

By moving the controller stick to the right, the flashing letter can be made to sequence forward through the alphabet: "A", "B", "C", "D", etc. By moving the controller stick to the left, the flashing letter can be made to sequence backward through the alphabet: "Z", "Y", "X", "W", etc.

When you reach your initial, release the controller and push the FIRE button. Your initial is frozen in place and appears in the blank space opposite your score at the same time. If you do not wish to put your initials opposite your score, just press the FIRE button three times. Three "A" 's will appear opposite your score.

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

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

## TWO PLAYER OPERATION

The Upright, 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 the enemy blows up your space fighter. At this point, the game will do one of several things depending on whether or not the destroyed fighter was your last or if you still have others remaining in reserve.

### FIGHTER DESTROYED — FIGHTERS REMAINING IN RESERVE

- The attack stops.
- Next, the "ROUND" changes to the "ROUND" number the other player is in, it displays "PLAYER ___" — "READY" while what's left of the other player's convoy appears on the long range scanner at the right of the screen.
- Play begins for the other player.

### FIGHTER DESTROYED — NO FIGHERS REMAINING IN RESERVE

- Game displays "GAME OVER".
- Next, if your score was the highest one of the five best scores, the game will tell you this by putting the congratulatory display on the screen. After this display, it will go into the High Score/Initial mode immediately. If your score was not the highest of the day, but was still one of the "BEST 5", the game will go directly to the High Score/Initial mode presentation.
- After this, the "ROUND" changes to the "ROUND" number the other player is in, the game will display "PLAYER ___" — "READY" while what's left of the other player's convoy appears on the long range scanner at the right of the screen and play 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 display "PLAYER ___" — "READY" while what's left of the other player's convoy appears on the long range scanner at the right of the screen and play begins for the other player.

# III. Maintenance and Repair

Your BOSCONIAN 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 CAN NOT 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 8.

1. **UPRIGHT MODEL:**
   As viewed from the back, facing the cabinet, with the rear access door removed; the fuses are located on the Mech. Panel and the Power Supply Board.
2. **MINI MODEL:**
   As viewed from the back, facing the cabinet, with the rear access door removed; the fuses are located on the Mech. Panel and the Power Supply 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 Mech. Panel and the Power Supply 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 monitor manufacturer) and/or the T.V. Troubleshooting Section of this manual for information on these fuses.

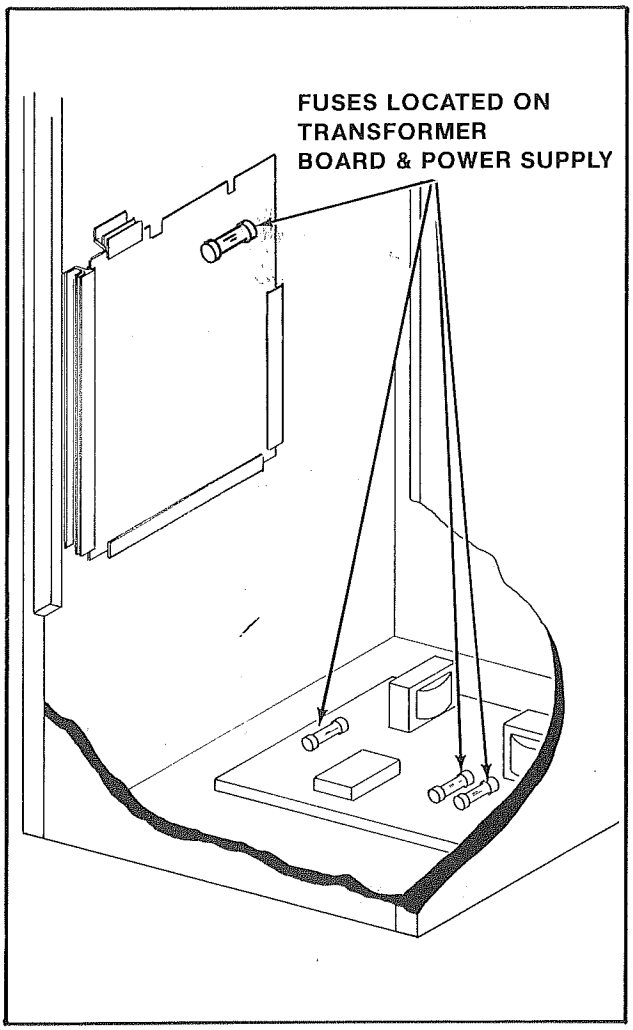



**Figure 8 Location of fuses**

## OPENING THE CONTROL PANEL. See Figure 9.

### 1. UPRIGHT MODEL:

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

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

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

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

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

- To remove the control panel:

  Raise it up and tilt it toward you until you can see the cable behind it.

  Cradling the control panel between yourself and the cabinet, disconnect it from its cabling.

  The control panel is now free and can be removed.

- To reinstall the control panel, reverse this procedure.

### 2. MINI MODEL:

- 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.

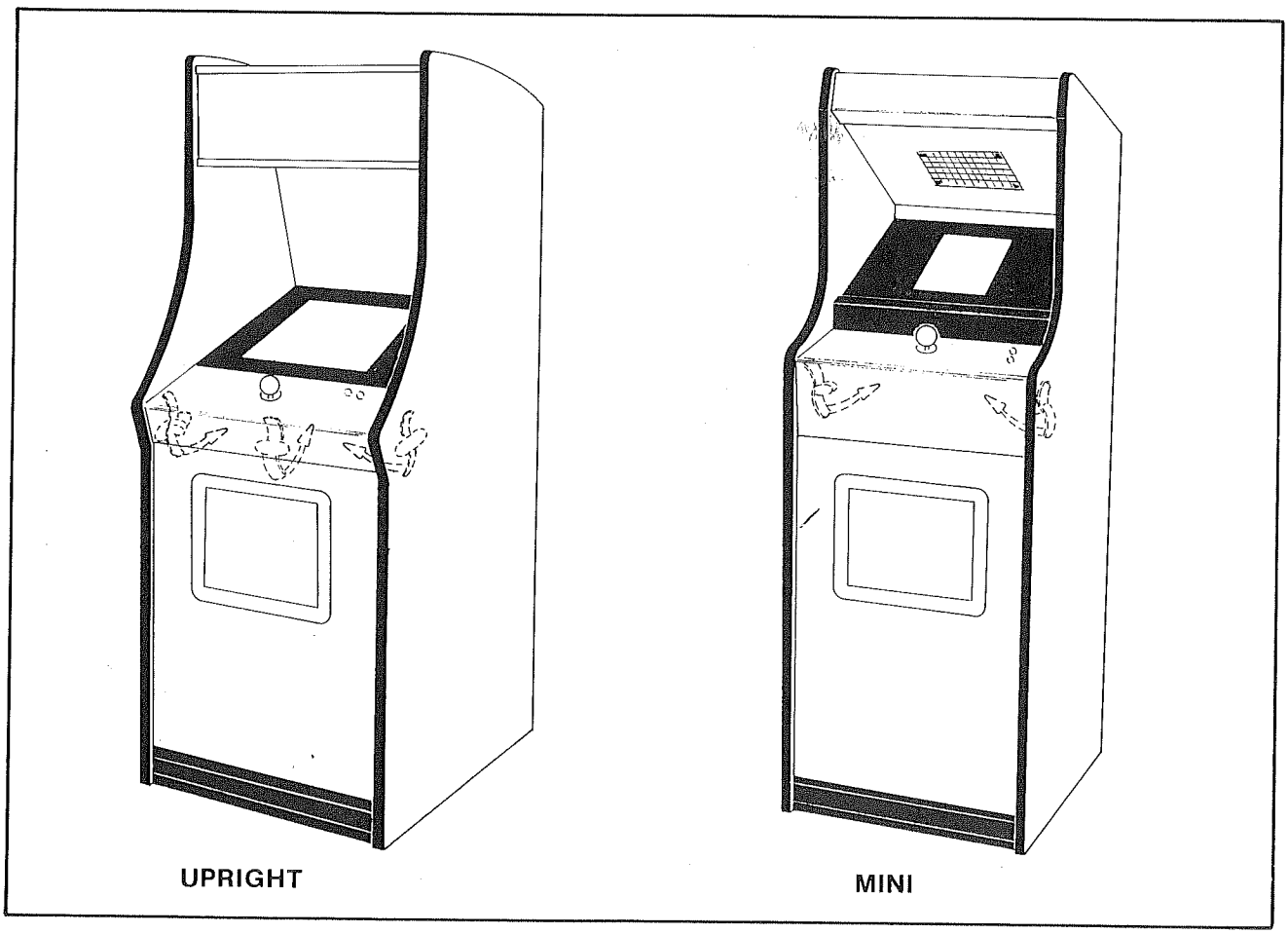



**Figure 9 Removing control panel — Upright & Mini games**

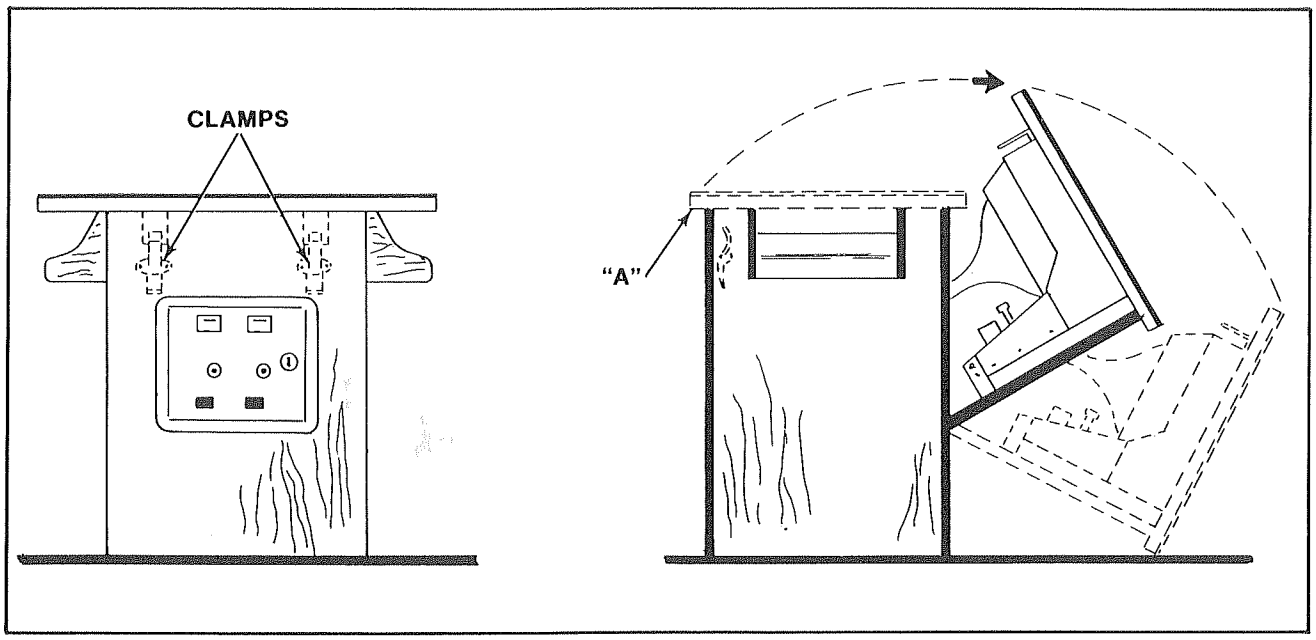



**Figure 10 Opening the Cocktail game**

### 3. COCKTAIL TABLE MODEL:

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

  Turn power to the game off.

  Open the coin box door and release the two latches indicated in Figure 10.

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

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

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

**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 11.

- To remove the contol 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.

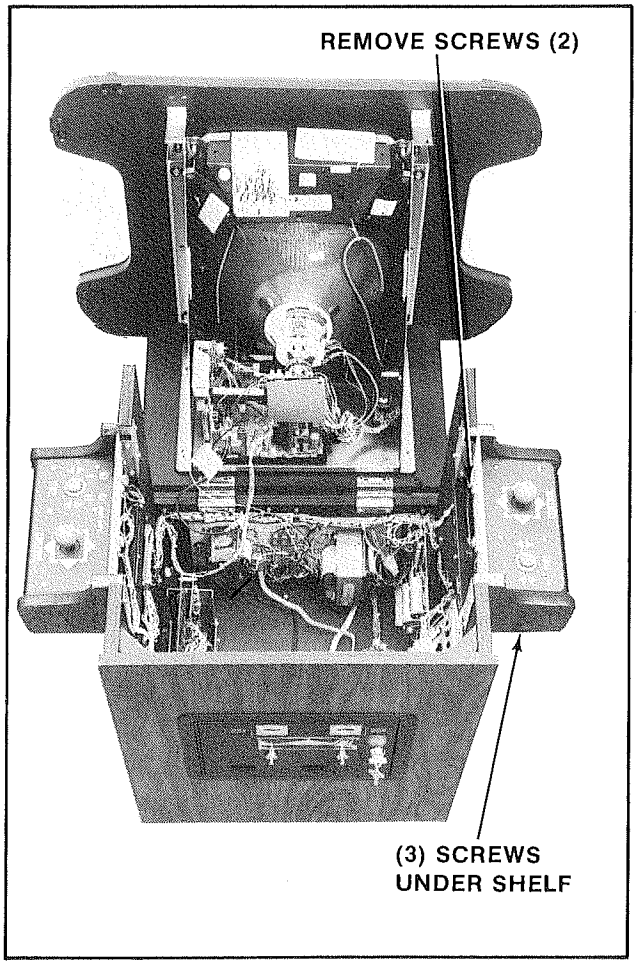



**Figure 11 Removing control panel — Cocktail game**

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

**1. UPRIGHT MODEL:** See Figure 12.

**NOTE:** To do this, the latches which secure the control panel MUST be released. The control panel need not be removed. See the "UPRIGHT MODEL" procedure.

- Turn the power to the game off and remove the rear access door.
- Remove the screws from the glass support bracket and lift it out the back of the cabinet.
- Grasp the main-display-glass in the top center, lift up slightly and pull it out the rear of the cabinet.
- Loosen the screws which secure the T.V. bezel-glass-clamps in place.
  Move the clamps to the side and the bezel glass may be removed.
  Remove the above mentioned screws and the bezel with four bezel-glass-clamps may be removed.
- To reinstall the T.V. bezel assembly and the main-display-glass, reverse this procedure.

**2. MINI MODEL:** See Figure 13.

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

- Turn the power off to the game and remove the control panel.
- Remove the screws which secure the glass clamping plate.
- 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.

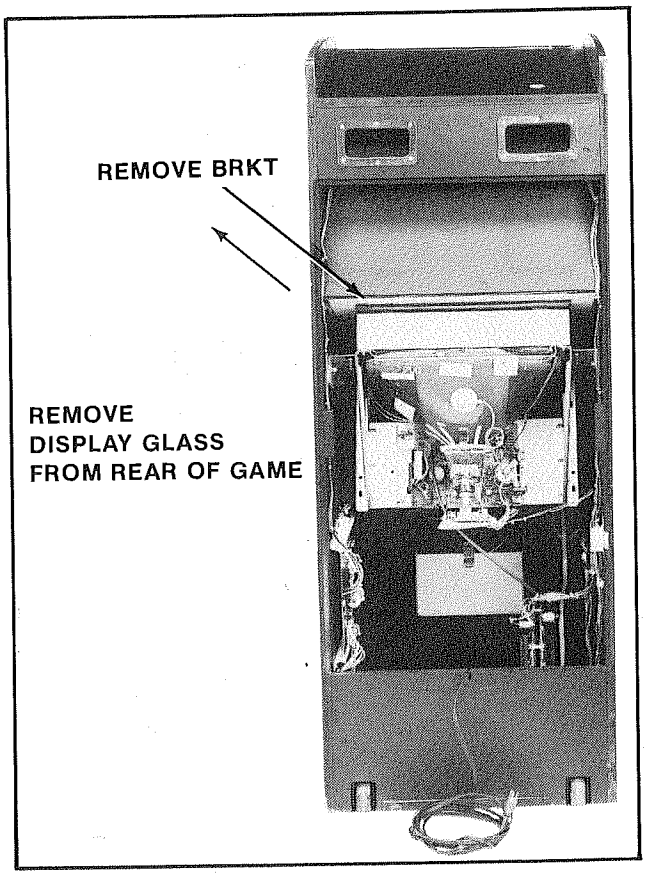



**Figure 12 Removing display glass—Upright game**

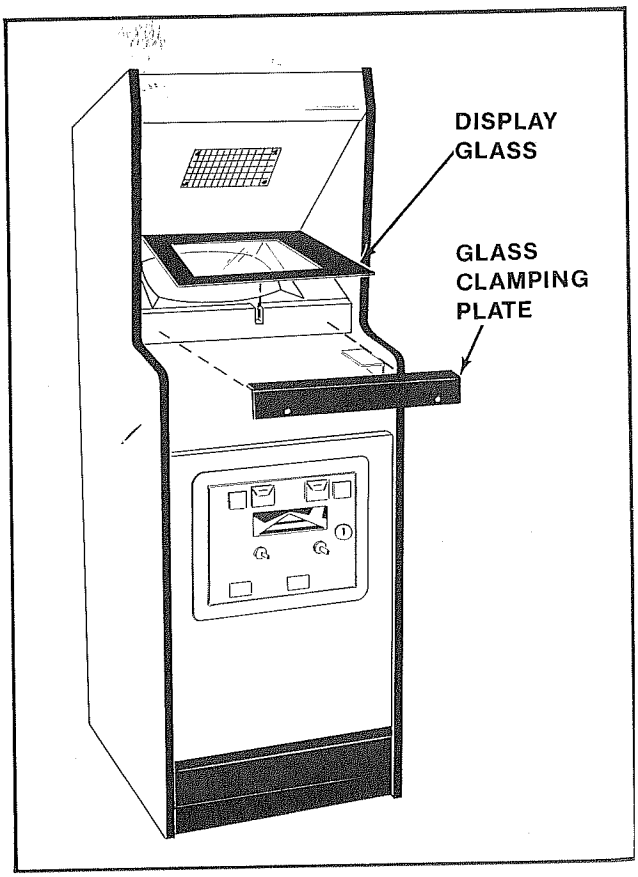



**Figure 13 Removing display glass — Mini game**

3. **COCKTAIL TABLE MODEL:** See Figure 14.

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

- Remove the screws which secure the table top glass clamps in place.
- Remove the table top glass.
- Lift out the T.V. bezel assembly.
- To reinstall the T.V. bezel assembly and the table top glass, reverse this procedure.

## 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 15.

- 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 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 channels will be loose.

  The monitor mounting channels slide on top of and against two metal guides mounted to the cabinet's right and left sides. The monitor is removed by sliding it out the back of the cabinet. See Figure 15.

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

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

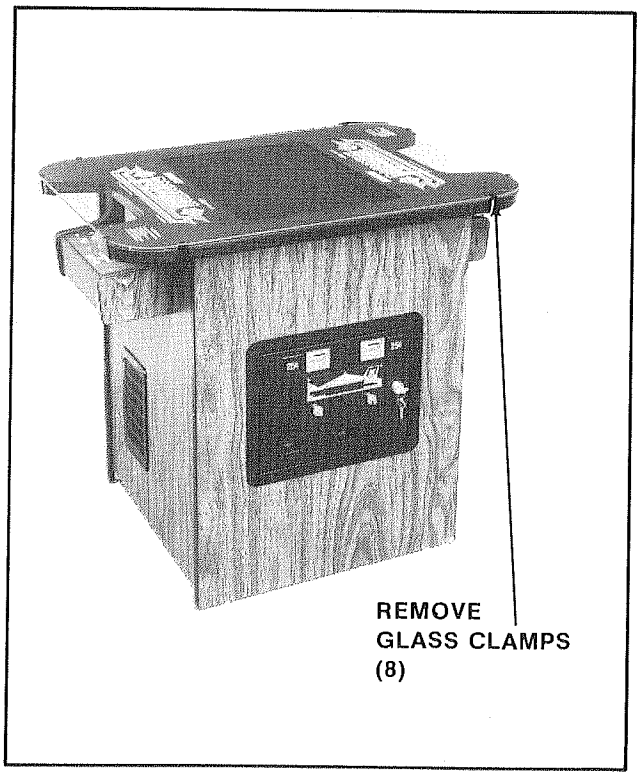



Figure 14 Removing top glass — Cocktail game

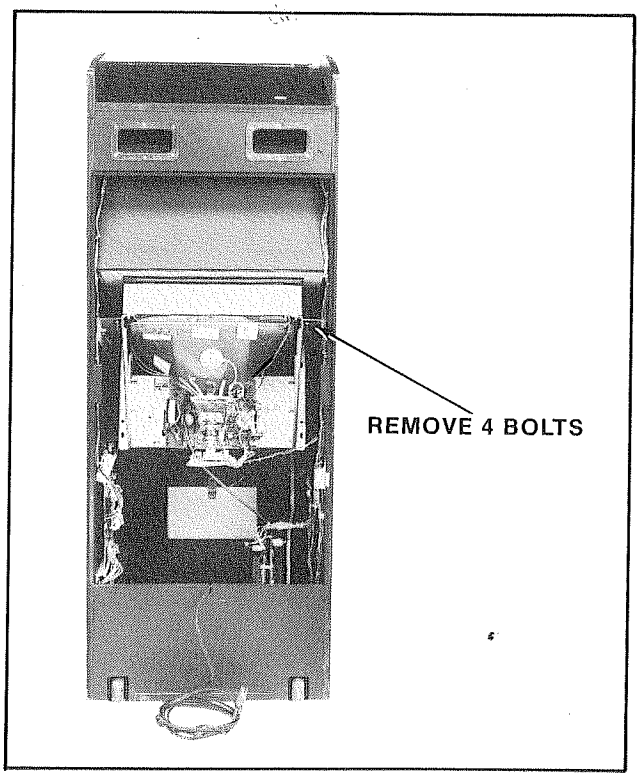



Figure 15 Replacing monitor — Upright game

2. **MINI MODEL:** See Figure 16.

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 nuts, the T.V. monitor will be loose.

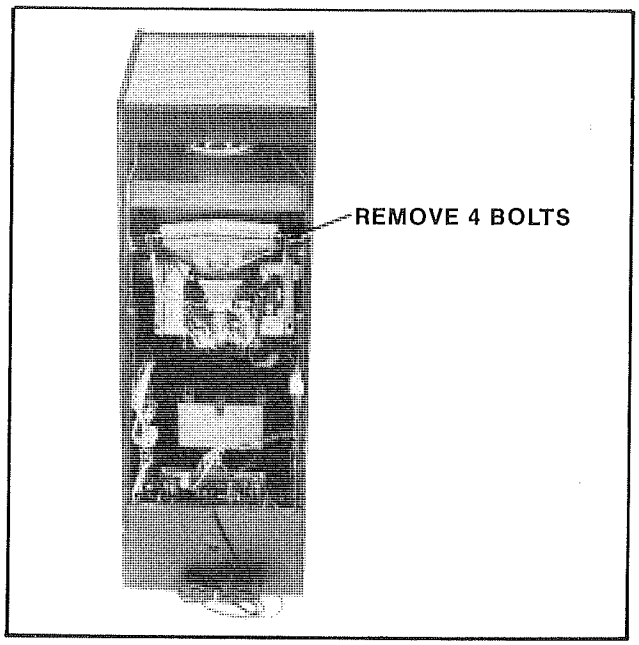



**Figure 16 Replacing monitor — Mini game**

**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 as shown in Figure 16.

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 18.

Turn power off to the game.

Open the coin box door and release the two latches indicated in Figure 17.

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

- Once the latches are released, unhook them from their latch plates.
- Grasp the table top at "A" and open it as indicated in Figure 17.

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

- Remove the screws which hold the table top glass clamps in place.
- Remove the table top glass.
- Lift out the T.V. bezel assembly.

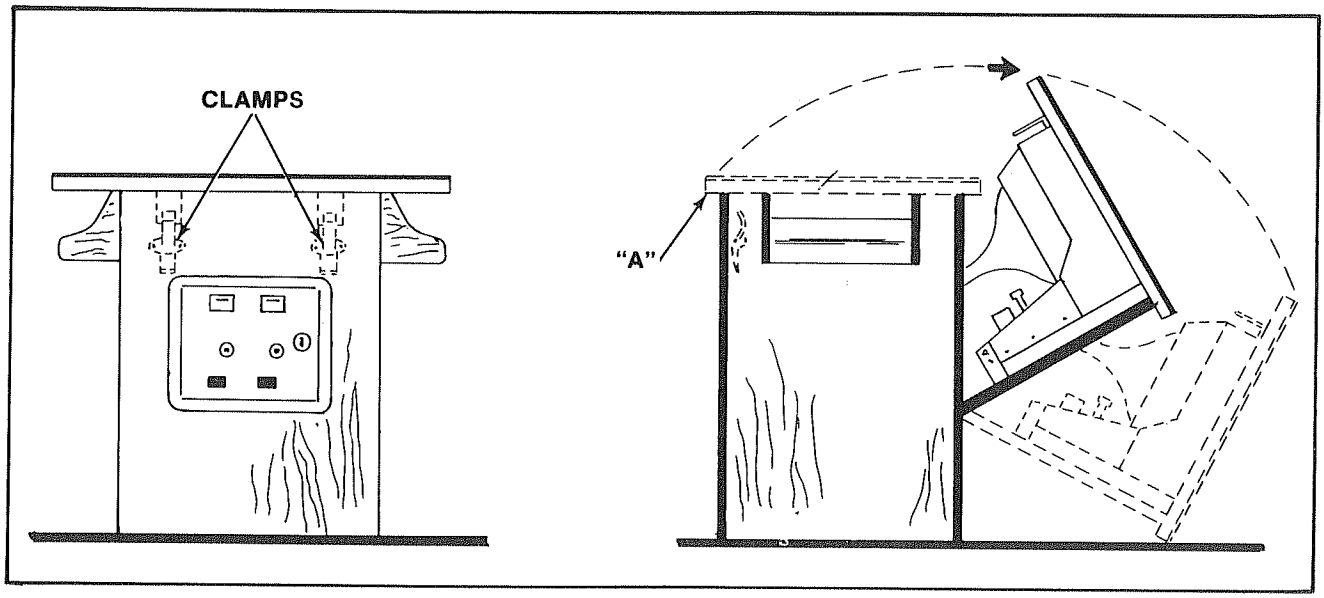



**Figure 17 Opening the Cocktail game**

- 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" by the door hinge(s). See Figure 18.
- Close the Cocktail Table top 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 18.
- Pry up the end of each monitor mounting bracket with a screwdriver or similar tool until you can grasp them both.
- Lift the T.V. monitor straight up and out of the table top being VERY CAREFUL not to bump the neck of the picture tube.
- To reinstall the T.V. monitor, reverse this procedure.
- Be sure to check the clearance of the "L" brackets BEFORE setting the monitor into the table top.
- After replacing the T.V. monitor, be sure to run the game Self-Test.

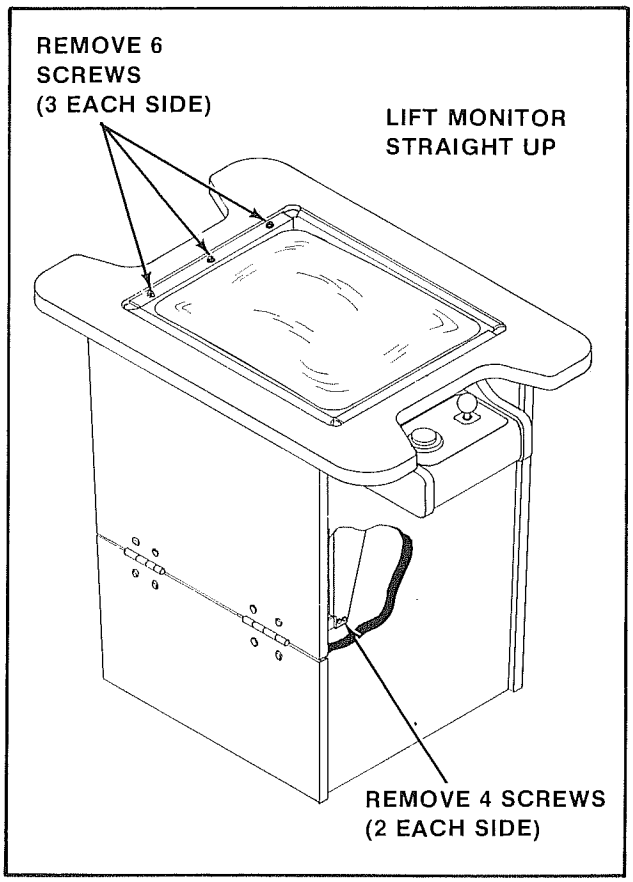



**Figure 18 Replacing monitor — Cocktail game**

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

1. **UPRIGHT MODEL:** See Figure 19.
   - Turn the power to the game off.
   - Unlock and open the rear access door.
   - Disconnect the video board from all its cabling.
   - Disconnect the CPU board from all its cabling.
   - Slide the P.C.B. clamps to one side, remove the P.C.B.'s from the card rack and take them out the back of the cabinet.
   - Disconnect the power supply board from all its cabling, remove the P.C.B. supports indicated in Figure 19, and slide it out the back of the cabinet.
   - To reinstall the above P.C.B.'s, reverse this procedure.

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

2. **MINI MODEL:** See Figure 19.
   - Turn the power off to the game.
   - Unlock and open the rear access door.
   - Disconnect the video board from all its cabling.
   - Disconnect the CPU board from all its cabling.
   - Slide the P.C.B. clamps to one side, remove the P.C.B.'s from the card rack and take them out the back of the cabinet.
   - Disconnect the power supply board from all its cabling, remove the P.C.B. supports indicated in Figure 19, and slide it out the back of the cabinet.
   - To reinstall the above P.C.B.'s, reverse this procedure.
3. **COCKTAIL TABLE MODEL:** See Figure 19.
   - Turn the power off to the game.
   - Open the cabinet:
     Open the coin box door and release the two latches indicated in Figure 17.

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

     Once they're released, unhook them from their latch plates.
   - Grasp the table top at "A" and open it as indicated in Figure 17.

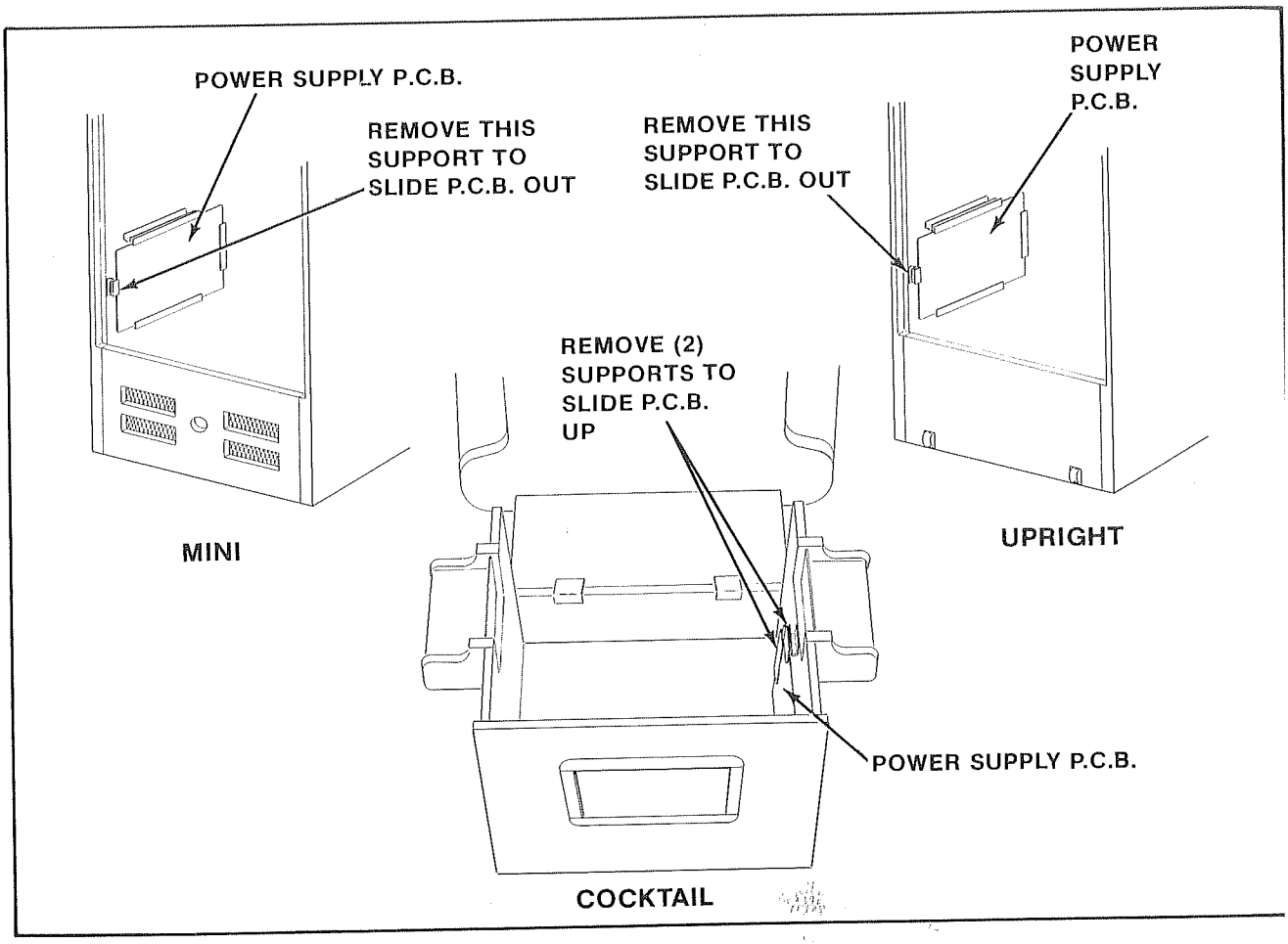



**Figure 19 Power supply replacement**

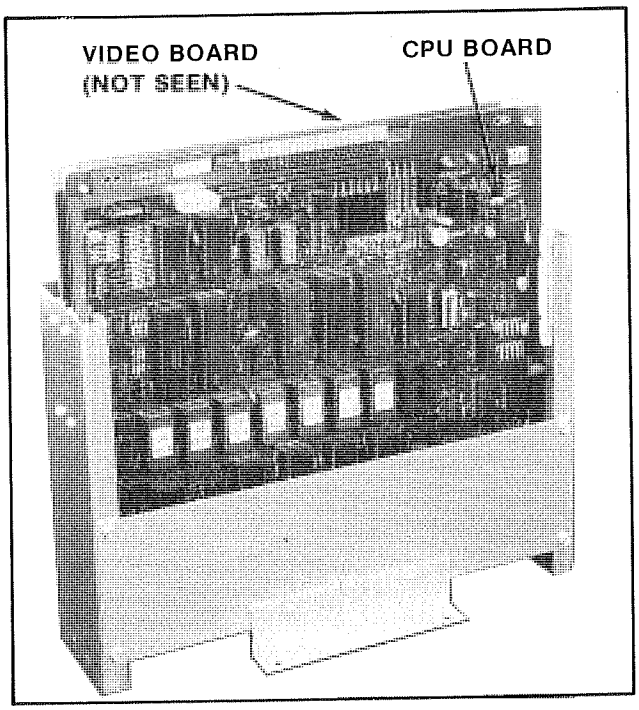



**Figure 20 Removing Video & CPU boards from card rack**

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

- To remove the power supply board. See Figure 19.
  Disconnect it from all its cabling.
  Remove the two smallest P.C.B. supports.
  Once these are removed, the power supply can be lifted out the top of the cabinet.
  To reinstall the power supply board, reverse this procedure.

- To remove the video and CPU boards. See Figure 20.
  Disconnect the video board from all its cabling
  Disconnect the CPU board from all its cabling
  Slide the P.C.B. clamps to one side, remove the P.C.B.'s from the card rack and lift them out the top of the cabinet.
  To reinstall the video and CPU boards, reverse this procedure.

## OPENING THE ATTRACTION PANEL

**1. UPRIGHT MODEL:** See Figure 21.

- 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 21.

  Remove the top bracket and slide up the attraction panel. This exposes the attraction panel fluorescent light tube and its mounting bracket assembly. See Figure 21.

  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 22.

  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. See Figure 23.

  Be sure the power is off to the game.

  Disconnect it from its power cable.

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

  To reinstall the fluorescent tube mounting bracket assembly, reverse this procedure.
- Replacing the speaker. See Figure 24.

  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.

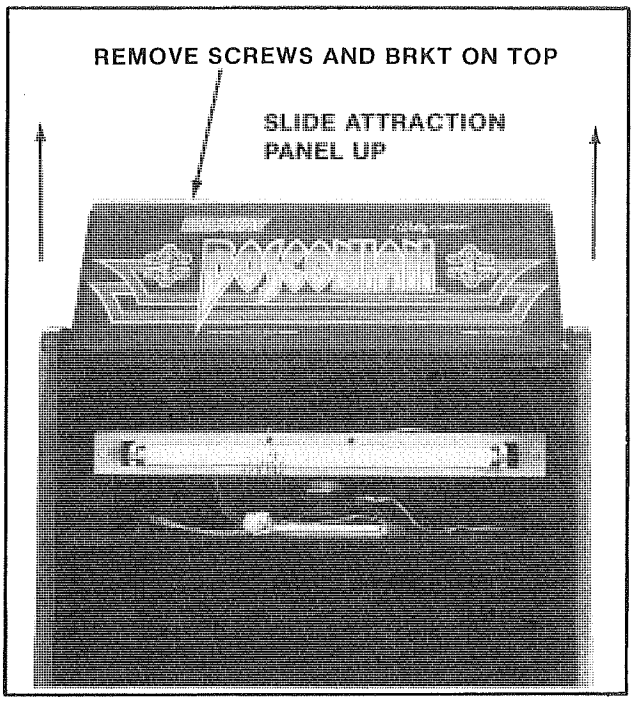



**Figure 21 Opening the attraction panel — Upright game**

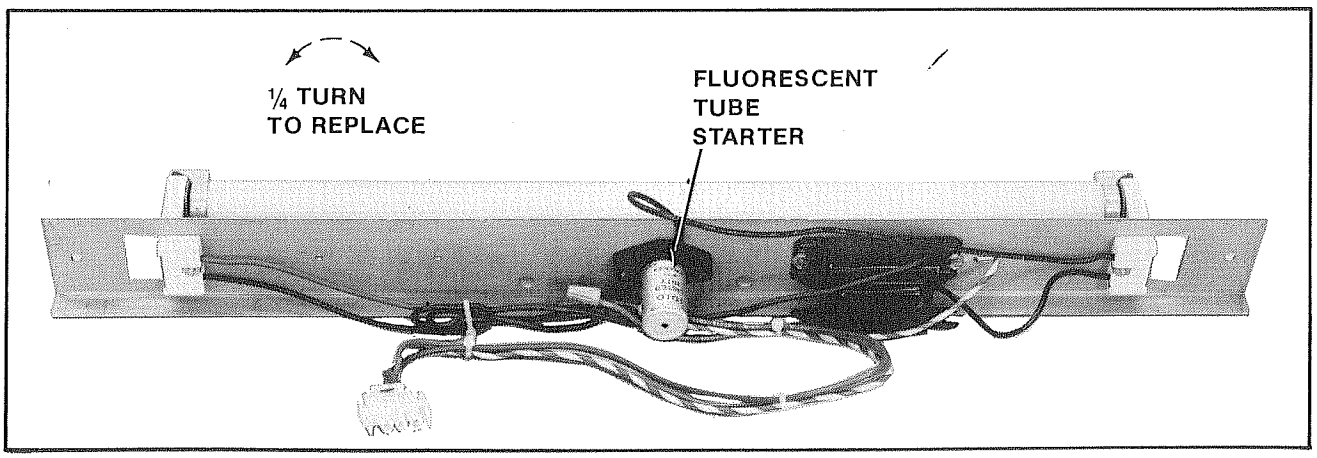



**Figure 22 Replacing fluorescent starter — Upright game**

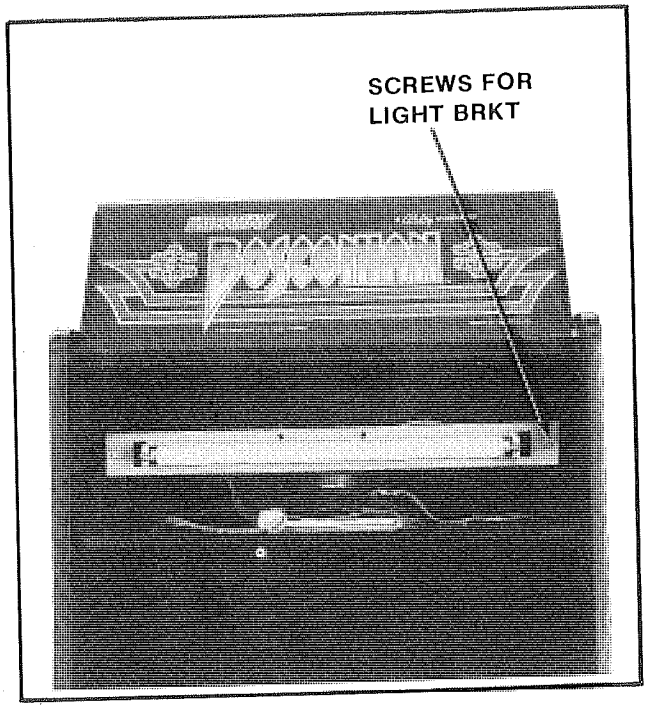



**Figure 23 Replacing fluorescent tube mounting bracket — Upright game**

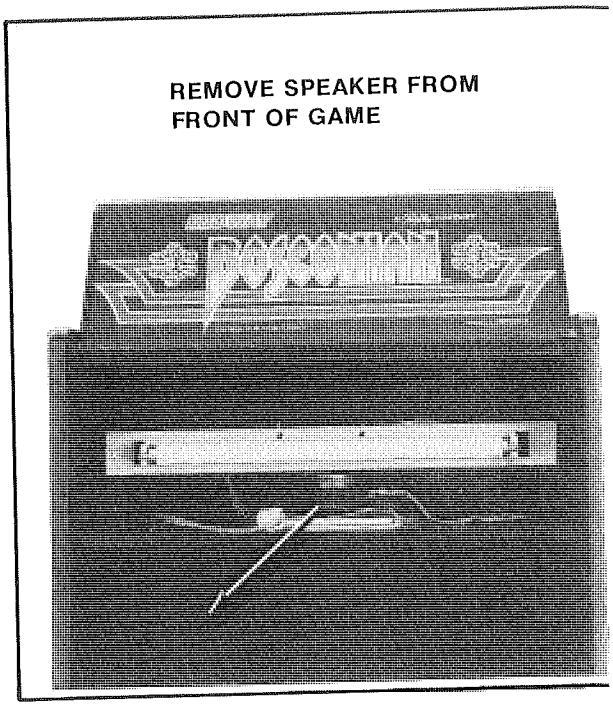



**Figure 24 Replacing speaker — Upright game**


**Figure 25 Opening the attraction panel — Mini game**

2. **MINI MODEL:** See Figure 25.
   - Turn the power off to the game.
   - Remove the screws from the top and bottom the formed attraction panel.
   - Remove the formed attraction panel by pull it straight away from the cabinet. This expo the attraction panel light bulbs and th mounting board.
   - To service the light bulbs and their mount board:

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

     Mark the burnt out bulbs and turn the powe the game back off again.

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

     The new bulbs are gently pushed into empty sockets.

     To completely replace the light bulb moun board:

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

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

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

     To reinstall the above removed items, rev this procedure.

- To replace the speaker. See Figure 26.
  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

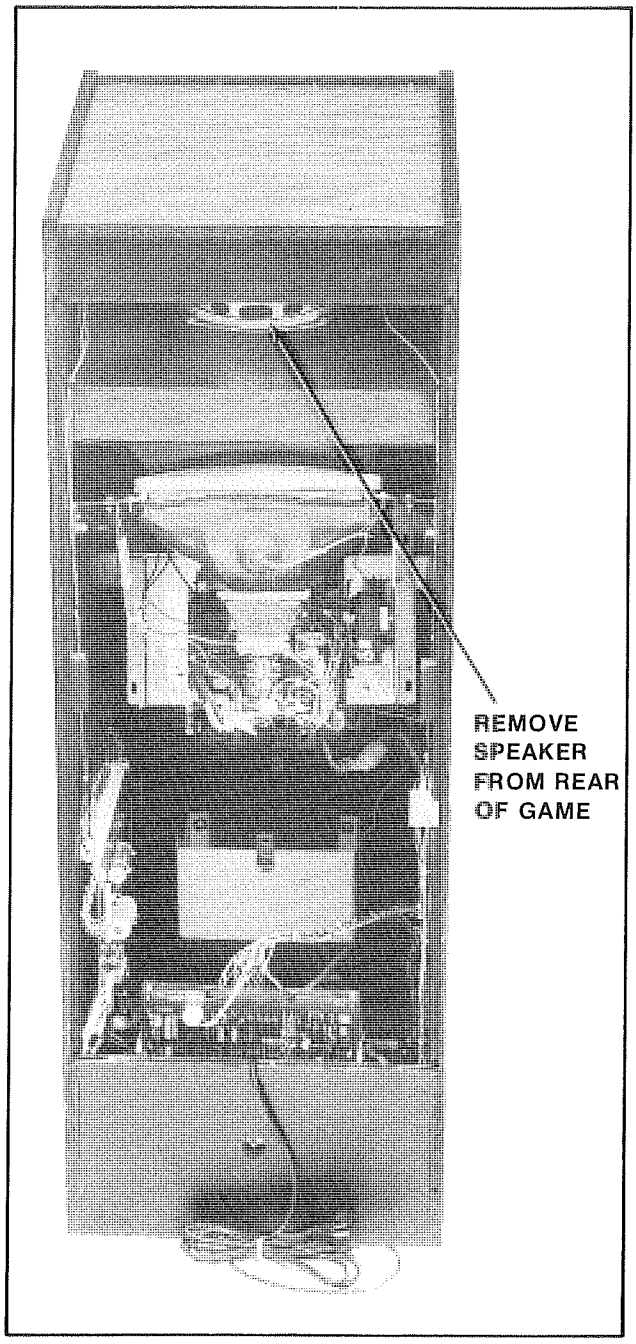



**Figure 26 Replacing speaker — Mini game**

## 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 27.
   - 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.
4. Clean the magnet of all foreign particles. See Figure 28.
   - 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.

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 29.
   - 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.

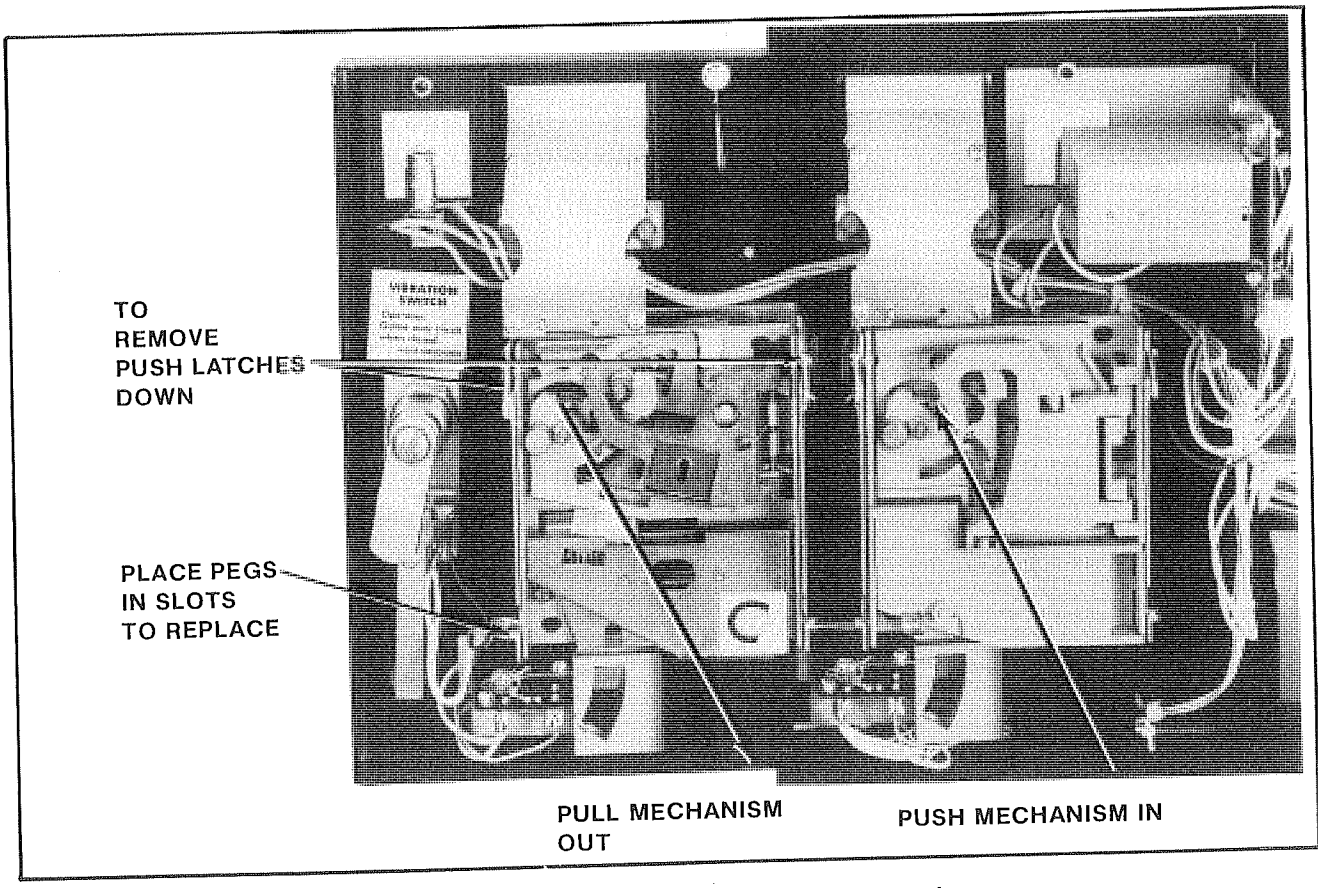



**Figure 27 Removing and replacing coin acceptors**

8. Check the coin chute for obstructions such as: paper, gum, etc.
9. Reinstall the coin acceptor to the coin door. See Figure 27.
   - 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.

## 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 27.
   - 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.

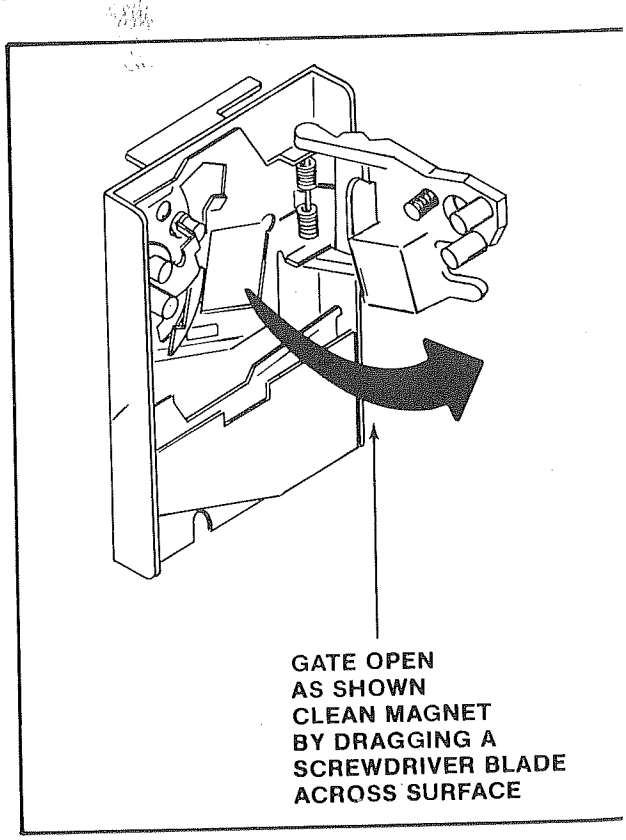



**Figure 28 Opening the metal coin acceptor**

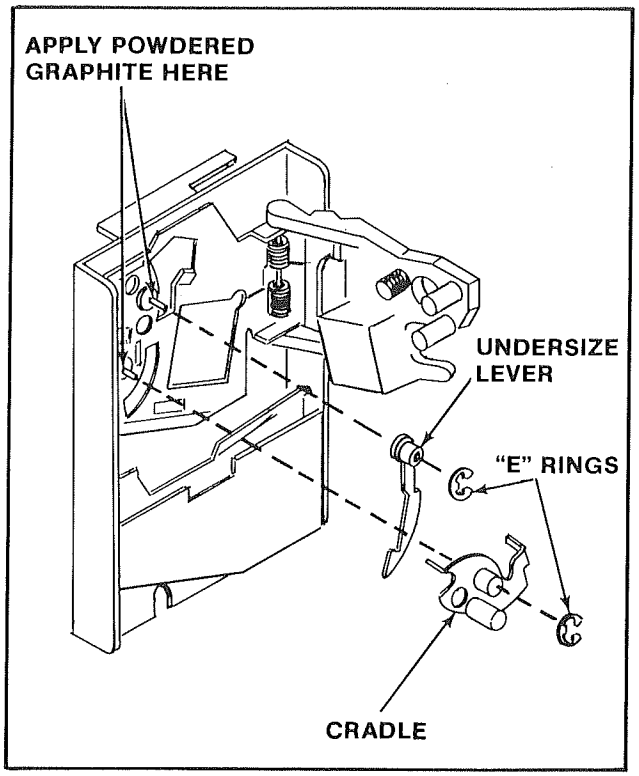



Figure 29 Lubricating the metal coin acceptor

4. Squeeze the two pins indicated in Figure 30 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 27.
   - 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 31 for instructions on how to set the plastic coin acceptor mechanisms to either accept or reject Canadian quarters.

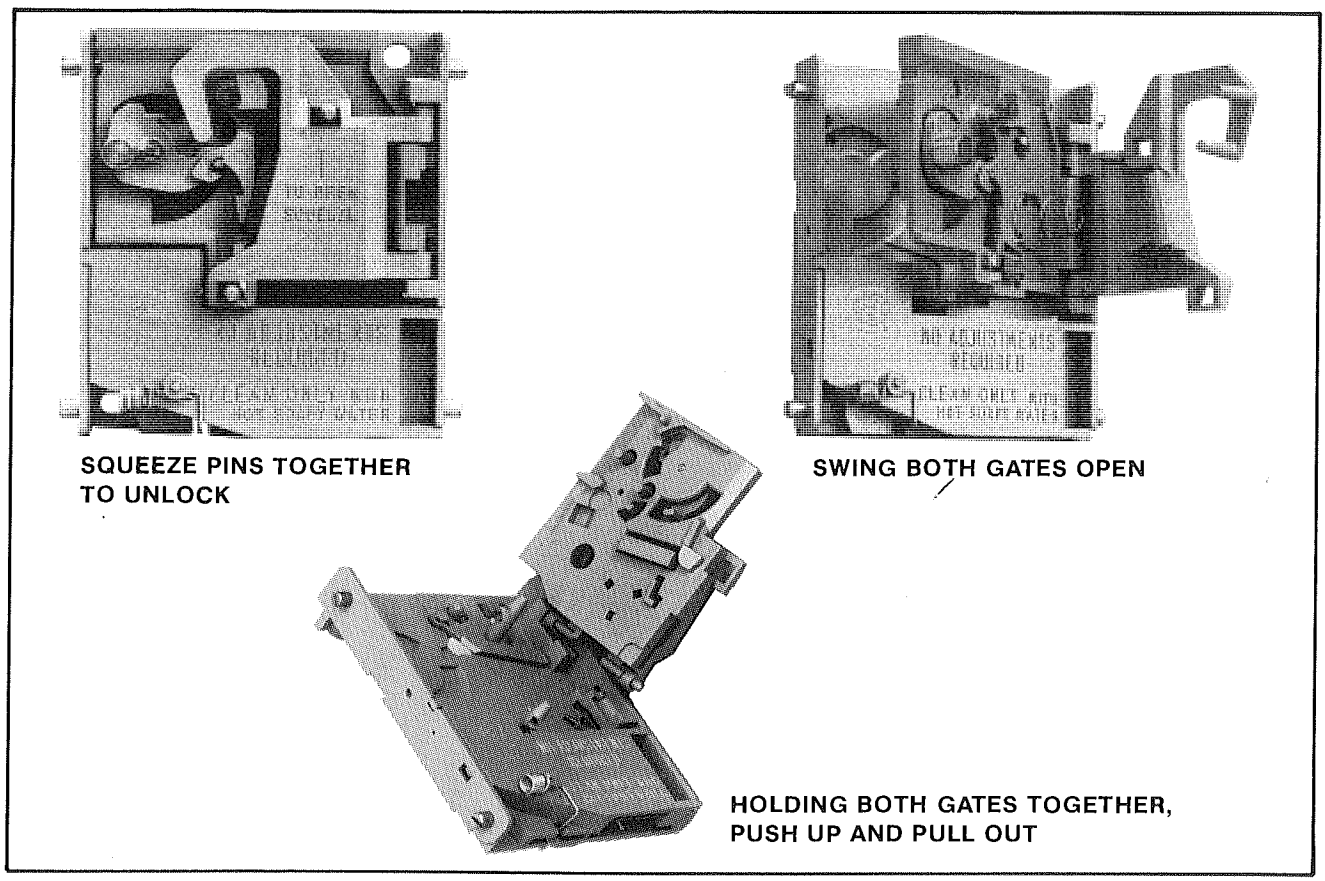
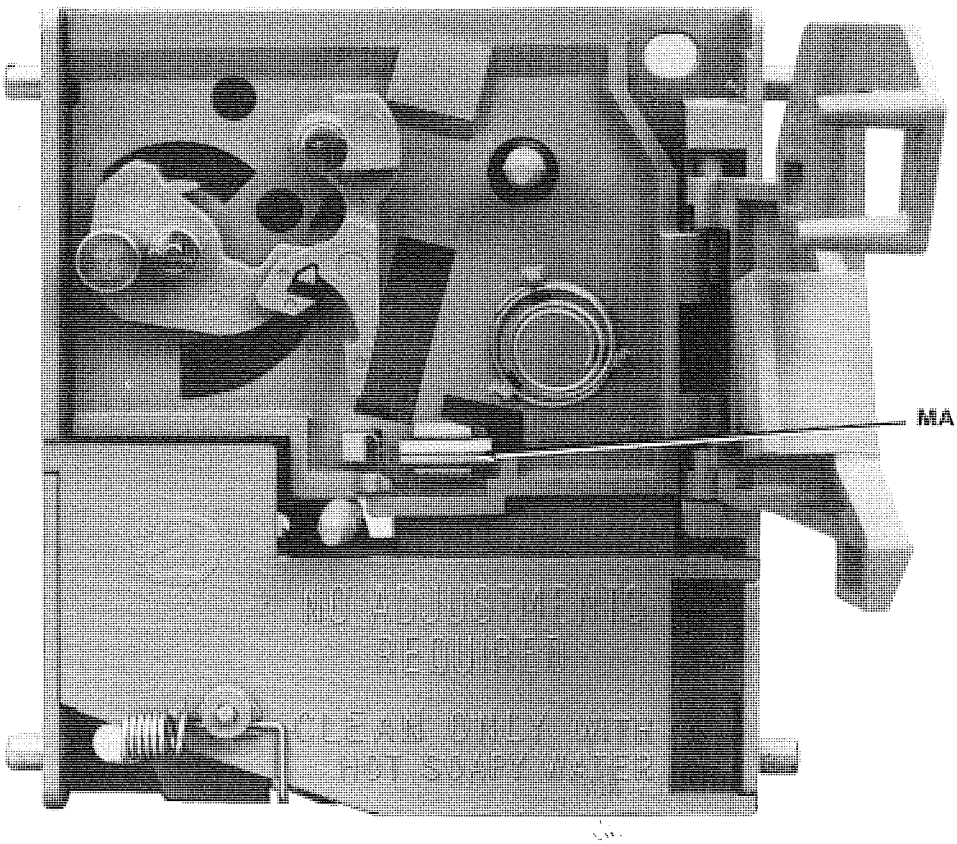



Figure 30 Opening the plastic coin acceptor




ACCEPTOR CAN BE SET TO ACCEPT U.S. QUARTERS ONLY OR BOTH U.S. AND CANADIAN QUARTERS.

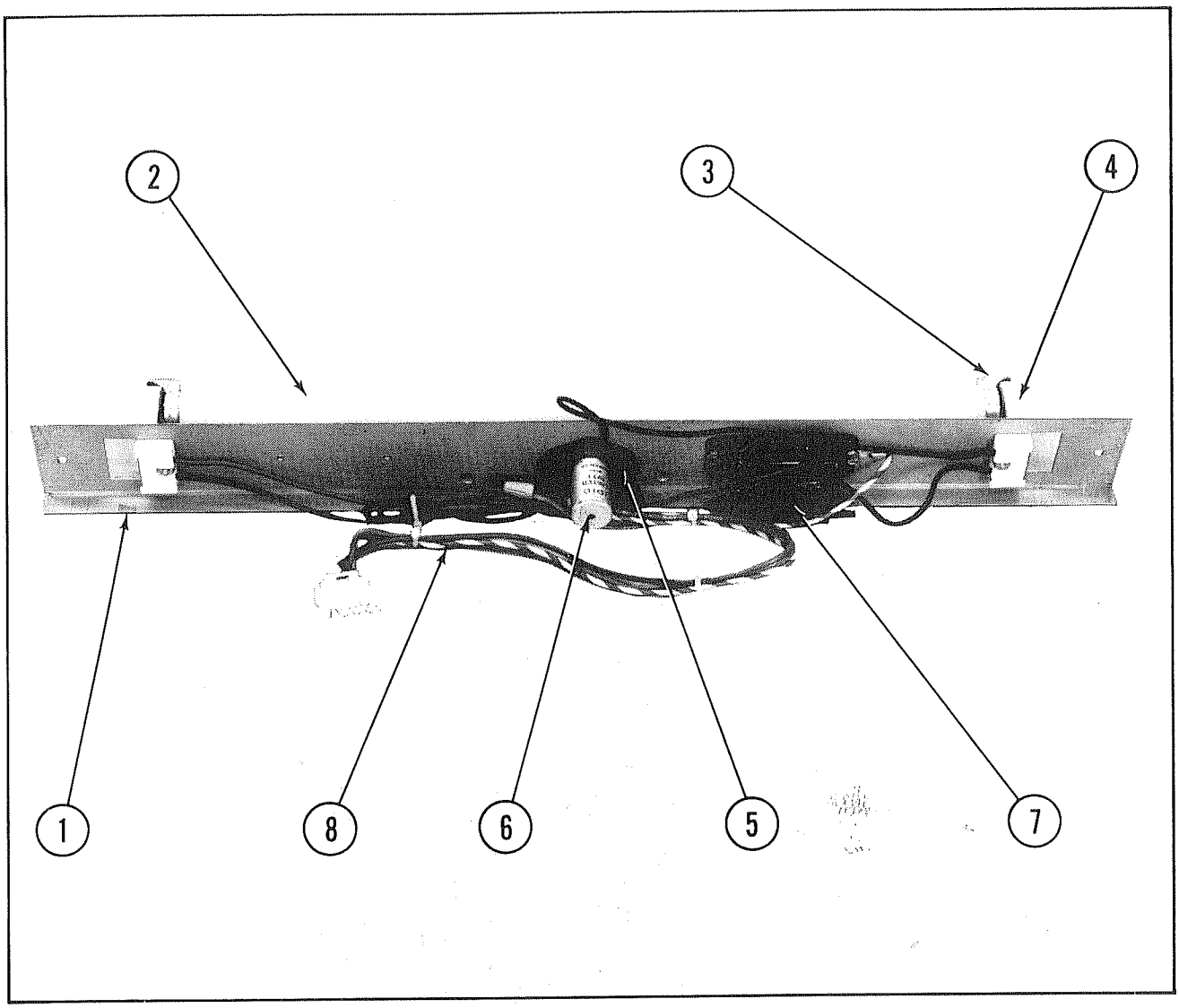
SLIDE MAGNET TO EXTREME RIGHT (AS SHOWN) TO ACCEPT BOTH U.S. AND CANADIAN QUARTERS.

TO ACCEPT U.S. QUARTERS ONLY, SLIDE MAGNET TO EXTREME LEFT.

**Figure 31 Changing the plastic coin acceptor to accept American or Canadian quarters**

# IV Illustrated Parts Breakdown

## NO. 550 — BOSCONIAN UPRIGHT — HEADER FLUORESCENT FIXTURE ASSY.

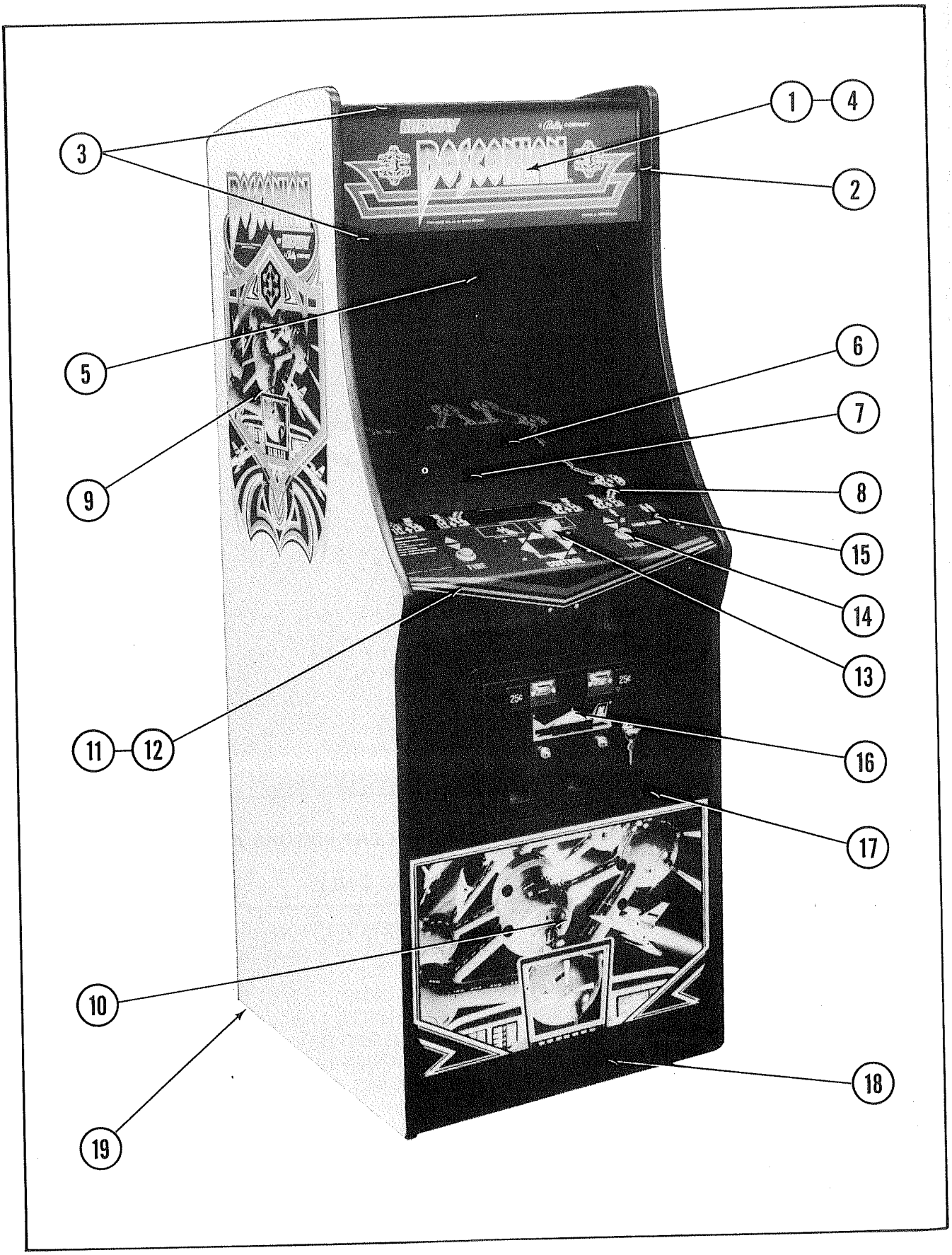



## NO. 550— BOSCONIAN UPRIGHT — HEADER FLUORESCENT FIXTURE ASSY. — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

| ITEM | PART NO. | DESCRIPTION |
|---|---|---|
| 1 | 0508-00103-0000 | FLUORESCENT BRKT. |
| 2 | 0017-00003-0043 | 18" COOL WHITE FLUOR. LAMP |
| 3 | 0017-00021-0005 | FLUORESCENT LOCKS (2 REQ'D.) |
| 4 | 0017-00031-0036 | FLUORESCENT SOCKET (2 REQ'D.) |
| 5 | 0017-00003-0412 | FLUOR. STARTER HOLDER W/WIRE 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 | FLUOR. STARTER |
| 7 | 0017-00003-0026 | BALLAST |
| | 0017-00101-0598 | #8-32 x 5/16 SLT. HEX HD. SCR. (4 REQ'D.) |
| 8 | A508-00017-0000 | FLUORESCENT CABLE ASSY. |
| | A961-00042-0000 | LINE FILTER ASSY. — NOT SHOWN |

## NO. 550— BOSCONIAN UPRIGHT — FRONT

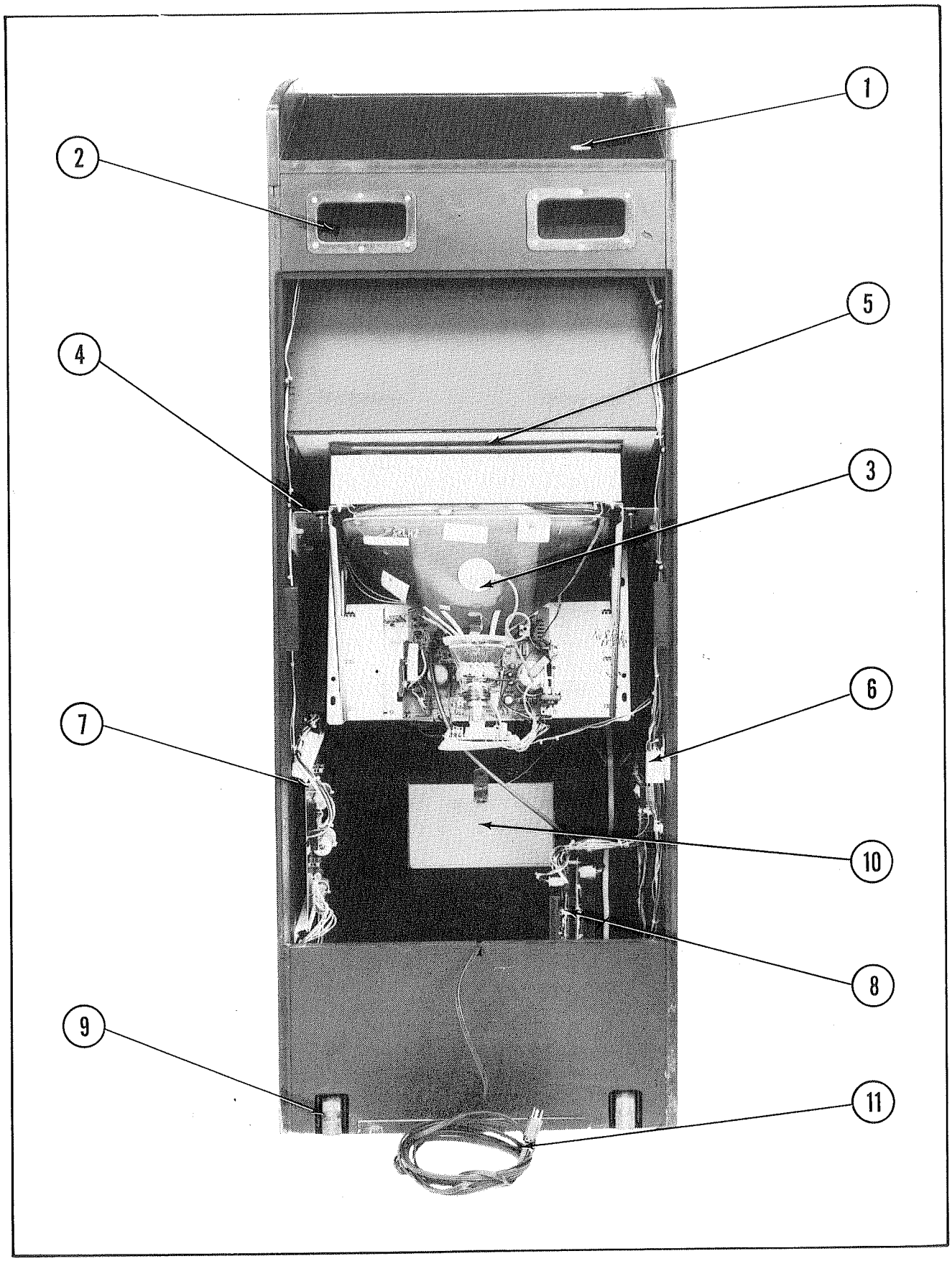


## NO. 550— BOSCONIAN UPRIGHT — FRONT — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

| ITEM | PART NO. | DESCRIPTION |
|---|---|---|
| 1 | 0550-00901-00XF | DECORATIVE HEADER PLEXI — 23" x 8-15/16" x 3/16" |
| 2 | 0537-00903-0057 | GLASS CHANNEL — 7-5/8" LG. (2 REQ'D.) |
| 3 | 0508-00104-00XF | UPPER/LOWER HEADER RETAINER (2 REQ'D.) |
| | 0017-00101-0138 | #8 x 5/8 TORX TAMPER RESISTANT BLK. SCR. (6 REQ'D) |
| | 0017-00009-0522 | LONG ARM KEY T-20 (FOR ABOVE SCREW) |
| 4 | A508-00007-0000 | HEADER FLUORESCENT LIGHT ASSY. |
| 5 | 0017-00009-0393 | SPEAKER GRILLE — BLACK W/SLOTS |
| | 0017-00003-0259 | 6" x 9" SPEAKER 8 OHM, 7W. |
| | 0017-00101-0136 | #8-32 x 1-1/4 CARRIAGE BOLT (4 REQ'D.) |
| | 0017-00103-0061 | #8-32 HEX NUT W/SEMS (4 REQ'D.) |
| 6 | 0508-00900-0000 | 19" T.V. BEZEL |
| 7 | 0508-00905-0000 | T.V. PLEXI-GLASS (GRAYLITE #31) — 17-3/8" x 13-1/4" x 1/8" |
| | 0508-00901-0000 | PLEXI-GLASS CLIPS (4 REQ'D.) |
| | 0017-00101-0017 | #6 x 1/2 SLT. HEX HD. BLK. SCR. (4 REQ'D.) |
| 8 | 0550-00900-00XF | MAIN VIEWING GLASS — 23" x 21-1/8" x 3/16" |
| | 0508-00108-0000 | GLASS STOP BRKT. — CABINET REAR |
| | 0017-00101-0027 | #8 x 3/4 SLT. HEX HD. M.S. (3 REQ'D.) |
| 9 | 0550-00903-0000 | DECAL — SIDE |
| 10 | 0550-00904-0000 | DECAL — FRONT |
| 11 | A550-00009-0000 | STRIKE TO CONTROL PANEL ASSY. |
| | 0508-00115-0000 | CENTER CONTROL SHELF LOCK BRKT. |
| | 0961-00115-00XF | STRIKE (2 REQ'D.) |
| | 0017-00101-0620 | #8-32 x 1/2 CARRIAGE BOLT (10 REQ'D.) |
| | 0017-00103-0061 | #8-32 HEX NUT W/SEMS (12 REQ'D.) |
| | 0017-00009-0033 | LATCH CLAMP (3 REQ'D.) |
| | 0017-00101-0141 | #8 x 11/16 UNSLOT. HEX HD. M.S. (6 REQ'D.) |
| | 0550-00101-0100 | CONTROL SHELF MTG. BRKT. — RIGHT |
| | 0550-00101-0200 | CONTROL SHELF MTG. BRKT. — LEFT |
| | 0555-00901-0000 | LOCATING PIN (4 REQ'D.) |
| 12 | 0550-00902-0000 | CONTROL SHELF OVERLAY — DECORATIVE |
| 13 | A557-00006-0000 | CONTROL ASSY. |
| 14 | 0017-00042-0256 | PUSH BUTTON ASSY. — RED (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.) |
| 15 | 0017-00032-0051 | SMALL RED PUSH BUTTON SWITCH (2 REQ'D.) |
| 16 | A090-00300-07BK | U.S.A. 25¢ DOUBLE COIN DOOR ASSY. |
| 17 | 0090-00002-04BK | LARGE BLACK DOUBLE COIN DOOR FRAME |
| | 0017-00101-0121 | #6-32 x 5/16 PHIL. TRS. HD. SCR. (3 REQ'D.) (MOUNTS COIN DOOR TO FRAME) |
| 18 | 0935-00906-0100 | KICK PLATE — 23 " LG. |
| 19 | 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. 550 — BOSCONIAN UPRIGHT — REAR ACCESS

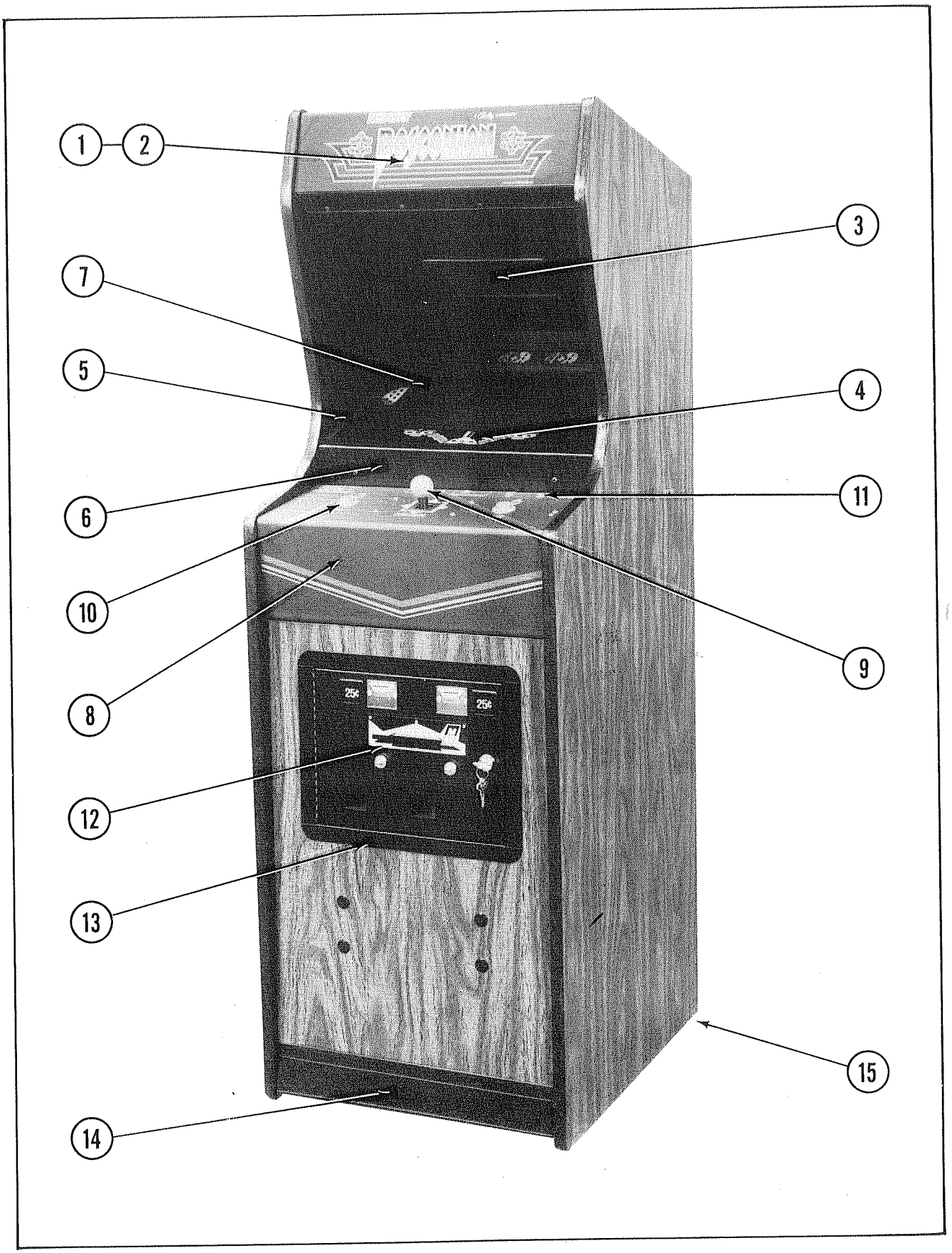


## NO. 550 — BOSCONIAN UPRIGHT — REAR ACCESS — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

| ITEM | PART NO. | DESCRIPTION |
|---|---|---|
| 1 | A088-00013-0000 | ON-OFF SWITCH & BRKT. ASSY. |
| 2 | 0894-00916-0000 | RECESSED HAND LIFT (2 REQ'D.) |
| | 0017-00101-0141 | #8 x 11/16 UNSLOT. HEX HD. SCREW (12 REQ'D.) |
| 3 | 0017-00003-0339 | ELECTROHOME — 19" COLOR DUAL SYNC HORIZ. MTG. MONITOR (OR) |
| 3 | 0017-00003-0418 | WELLS-GARDNER — 19" COLOR DUAL SYNC HORIZ. MTG. MONITOR |
| 4 | 0550-00100-0000 | MONITOR RAIL (2 REQ'D.) |
| | 0017-00102-0006 | 1/4-20 x 3/4 SQR. NECK 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.) |
| | 0017-00101-0141 | #8 x 11/16 UNSLOT, HEX HD. M.S. (8 REQ'D.) |
| | 0555-00901-0000 | LOCATING PIN (4 REQ'D.) |
| 5 | 0508-00900-0000 | T.V. BEZEL |
| 6 | A088-00015-0000 | INTERLOCK SWITCH & BRKT. ASSY. |
| 7 | A082-90420-B000 | 5V/4A POWER SUPPLY P.C. ASSY. |
| | 0624-00902-0100 | P.C. SUPPORT BRKT. — 12" LG. (2 REQ'D.) |
| | 0624-00902-0300 | P.C. SUPPORT BRKT. — 2-1/2" LG. |
| | 0624-00902-0500 | P.C. SUPPORT BRKT. — 6-1/2" LG. |
| | 0017-00101-0141 | #8 x 11/16 UNSLOT. HEX HD. M.S. (10 REQ'D.) |
| | 0017-00104-0037 | #8 FLAT WASHER (10 REQ'D.) |
| 8 | A550-00017-0000 | CARD RACK W/P.C. BOARDS ASSY. |
| 9 | 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.) |
| 10 | 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 RND. HD. BOLT BLK. (4 REQ'D.) |
| | 0017-00104-0014 | 7/8" DISH WASHER (4 REQ'D.) |
| | 0017-00103-0018 | 1/4-20 HEX NUT (4 REQ'D.) |
| 11 | A866-00049-0000 | LINE CORD ASSY. |
| | | **ADDITIONAL PARTS LIST** |
| | A550-00013-0000 | TRANSFORMER BOARD ASSY. |
| | A097-00008-0000 | BACK DOOR LOCK ASSY. |
| | 0017-00009-0490 | 5-5/8" SQR. VENT GRILLE (4 REQ'D.) |
| | 3010-03003-0000 | GROUNDING CLIP |
| | A508-00024-0000 | VIDEO SIGNAL CABLE ASSY. |
| | A508-00034-0000 | AUDIO ADAPTER CABLE ASSY. |
| | A508-00035-0000 | VIDEO SIGNAL ADAPTER CABLE ASSY. |
| | A550-00011-0000 | CONTROL SHELF CABLE ASSY. |
| | A550-00016-0000 | MASTER CABLE ASSY. |
| | A508-00026-0000 | COIN DOOR CABLE ASSY. |
| | A508-00014-0000 | HIGH VOLTAGE CABLE ASSY. |
| | A508-00015-0000 | LOW VOLTAGE CABLE ASSY. |
| | A082-91410-A000 | RAPID FIRE P.C. BOARD ASSY. |
| | 0017-00101-0018 | #6 x 3/4 SLOT HEX HD. SCREW (4 REQ'D.) |
| | 0508-00106-0000 | T.V. BEZEL MTG. BRKT. (2 REQ'D.) |
| | 0508-00108-0000 | MAIN VIEWING GLASS STOP BRKT. |
| | 0017-00101-0027 | #8 x 3/4 SLT. HEX HD. M.S. (3 REQ'D.) |

## NO. 555 — BOSCONIAN MINI — FRONT

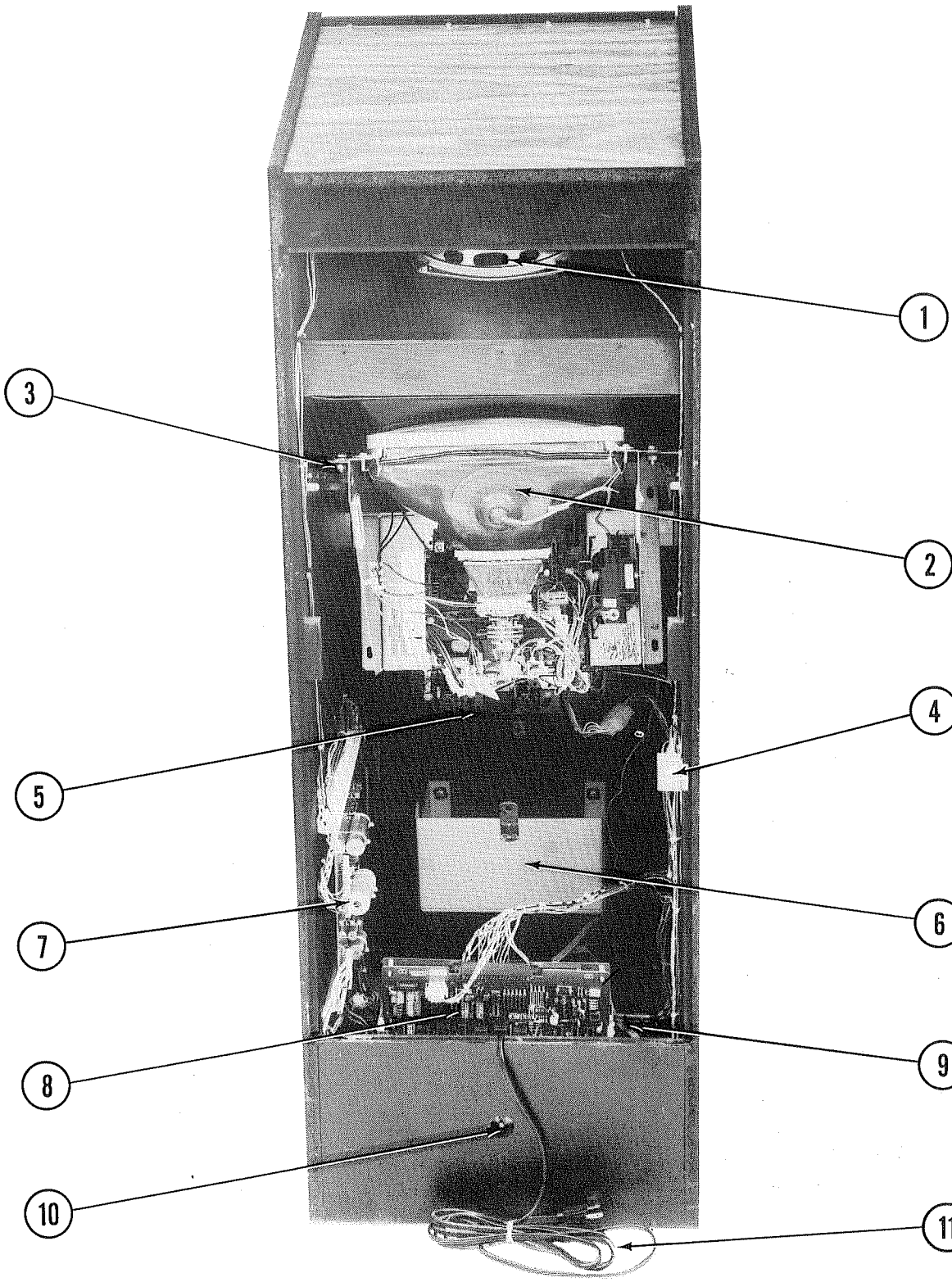


## NO. 555 — BOSCONIAN MINI — FRONT — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

| ITEM | PART NO. | DESCRIPTION |
|---|---|---|
| 1 | 0555-00900-00XF | HEADER DISPLAY PANEL |
| | 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) |
| 2 | A555-00007-0000 | INSERT DISPLAY ASSY. |
| | 0017-00031-0030 | WEDGE BASE LIGHT SOCKET (5 REQ'D.) |
| | 0017-00003-0219 | #194 LAMP 14V., .27A. (5 REQ'D.) |
| | A514-00015-0000 | INSERT DISPLAY CABLE ASSY. |
| 3 | 0017-00009-0393 | BLACK SPEAKER GRILLE W/SLOTS |
| | 0017-00003-0259 | 6" x 9" SPEAKER — 8 OHM, 7W. |
| | 0017-00101-0127 | #8-32 x 1-1/2 CARRIAGE BOLT (4 REQ'D.) |
| | 0017-00103-0061 | #8-32 HEX NUT W/SEMS (4 REQ'D.) |
| 4 | 0555-00902-00XF | MAIN GLASS — 17-13/16" x 14-13/16" x 3/16" |
| 5 | 0537-00903-0056 | GLASS CHANNEL — 14-1/2" LG. (2 REQ'D.) |
| 6 | A555-00016-0000 | GLASS CLAMPING PLATE ASSY. |
| | 0017-00101-0138 | #8 x 5/8 TORX TAMPER RESISTANT SCR. (2 REQ'D.) |
| 7 | A555-00005-0000 | T.V. BEZEL ASSY. |
| | 0931-00903-0000 | T.V. BEZEL |
| | 0934-00905-0000 | PLEXI-GLASS (TINTED) |
| | A961-00026-0000 | BEZEL MTG. BRKT. ASSY. |
| 8 | A555-00015-0000 | OVERLAY/CONTROL PLATE ASSY. |
| | 0555-00102-0000 | CONTROL SHELF PLATE |
| | 0555-00903-0000 | CONTROL SHELF DECORATIVE OVERLAY |
| | 0017-00101-0620 | #8-32 x 1/2 CARRIAGE BOLT (8 REQ'D.) |
| | 0017-00103-0061 | #8-32 HEX NUT W/SEMS (8 REQ'D.) |
| | A555-00013-0000 | CONTROL SHELF CABLE ASSY. |
| | 0555-00101-0100 | CONTROL SHELF MTG. BRKT. — RIGHT |
| | 0555-00101-0200 | CONTROL SHELF MTG. BRKT. — LEFT |
| | 0555-00901-0000 | LOCATING PIN (4 REQ'D.) |
| | 0961-00115-00XF | STRIKE (2 REQ'D.) |
| | 0017-00009-0033 | LATCH CLAMP (2 REQ'D.) |
| | 0017-00101-0141 | #8 x 11/16 UNSLOT. HEX HD. M.S. (8 REQ'D.) |
| 9 | A557-00006-0000 | CONTROL ASSEMBLY |
| 10 | 0017-00042-0256 | PUSH BUTTON ASSY. — RED (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.) |
| 11 | 0017-00032-0051 | SMALL RED SWITCH BUTTON W/HARDWARE (2 REQ'D.) |
| 12 | A090-00300-07BK | U.S.A. 25¢ DOUBLE COIN DOOR ASSY. |
| 13 | 0090-00002-04BK | LARGE BLACK DOUBLE COIN DOOR FRAME |
| | 0017-00101-0121 | #6-32 x 5/16 PHIL. TRS. HD. SCR. (3 REQ'D.) (MOUNTS COIN DOOR TO FRAME) |
| | A508-00026-0000 | COIN DOOR CABLE ASSY. |
| 14 | 0935-00906-0400 | KICK PLATE — 17-15/16" LG. |
| 15 | 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. 555 — BOSCONIAN MINI — REAR ACCESS

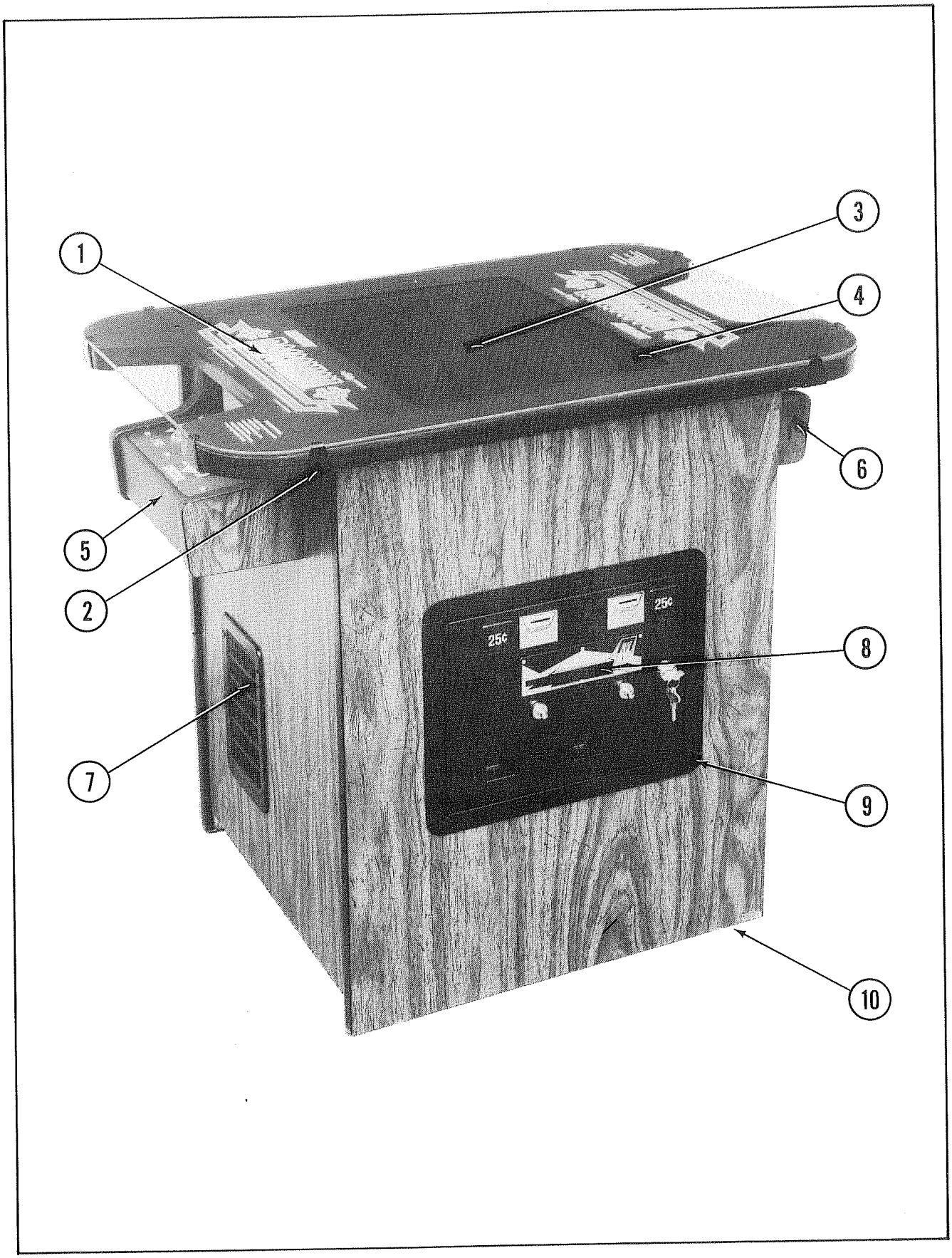


## NO. 555 — BOSCONIAN MINI — REAR ACCESS — PARTS LIST

*ORDER BY PART NUMBER* ***ONLY***

| ITEM | PART NO. | DESCRIPTION |
|---|---|---|
| 1 | 0017-00003-0259 | 6" x 9" SPEAKER 8 OHM, 7W. |
| 2 | 0017-00003-0340 | ELECTROHOME — 13" COLOR DUAL SYNC HORIZ. MTG. MONITOR (OR) |
| 2 | 0017-00003-0396 | WELLS-GARDNER — 13" COLOR DUAL SYNC HORIZ. MTG. MONITOR |
| 3 | A926-00012-00XF | T.V. MTG. BRKT. ASSY. |
| | 0017-00101-0141 | #8 x 11/16 UNSLOT. HEX HD. M.S. (2 REQ'D.) |
| | 0555-00100-0000 | MONITOR MTG. BRKT. (2 REQ'D.) |
| | 0017-00102-0066 | 1/4-20 x 3/4 UNSLOT. HEX 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.) |
| 4 | A088-00015-0000 | INTERLOCK SWITCH & BRKT. ASSY. |
| 5 | A090-00300-07BK | DOUBLE ENTRY 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 |
| | 0950-00101-0000 | COIN DEFLECTOR (2 REQ'D.) |
| | 0950-00900-0000 | LARGE PLASTIC COIN BOX |
| | 0017-00101-0142 | 1/4-20 x 1-3/8 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.) |
| 7 | A082-90420-B000 | 5V/4A POWER SUPPLY P.C. ASSY. |
| | 0624-00902-0100 | P.C. SUPPORT BRKT. — 12" LG. (2 REQ'D.) |
| | 0624-00902-0300 | P.C. SUPPORT BRKT. — 2-1/2" LG. |
| | 0624-00902-0500 | P.C. SUPPORT BRKT. — 6-1/2" LG. |
| | 0017-00101-0141 | #8 x 11/16 UNSLOT. HEX HD. M.S. (10 REQ'D.) |
| | 0017-00104-0037 | #8 FLAT WASHER (10 REQ'D.) |
| 8 | A550-00017-0000 | CARD RACK W/P.C. BOARDS ASSY. |
| 9 | A555-00009-0000 | TRANSFORMER BOARD ASSY. |
| 10 | A088-00013-0000 | ON/OFF SWITCH & BRKT. ASSY. |
| 11 | A866-00049-0000 | LINE CORD ASSY. |
| | | **ADDITIONAL PARTS LIST** |
| | A097-00008-0000 | BACK DOOR LOCK ASSY. |
| | 0017-00009-0490 | 5-5/8" SQR. VENT GRILL — BACK DOOR (4 REQ'D.) |
| | A514-00011-0000 | HIGH VOLTAGE CABLE ASSY. |
| | A555-00011-0000 | LOW VOLTAGE CABLE ASSY. |
| | A555-00012-0000 | MASTER CABLE ASSY. |
| | A508-00034-0000 | AUDIO ADAPTER CABLE ASSY. |
| | A508-00035-0000 | MONITOR SIGNAL ADAPTER CABLE ASSY. |
| | A508-00024-0000 | VIDEO SIGNAL CABLE ASSY. |
| | 3010-03003-0000 | GROUND CLIP |
| | A082-91410-A000 | RAPID FIRE P.C. BOARD ASSY. |
| | 0017-00101-0018 | #6 x 3/4 SLOT. HEX HD. SCREW (4 REQ'D.) |

## NO. 557 — BOSCONIAN COCKTAIL — FRONT

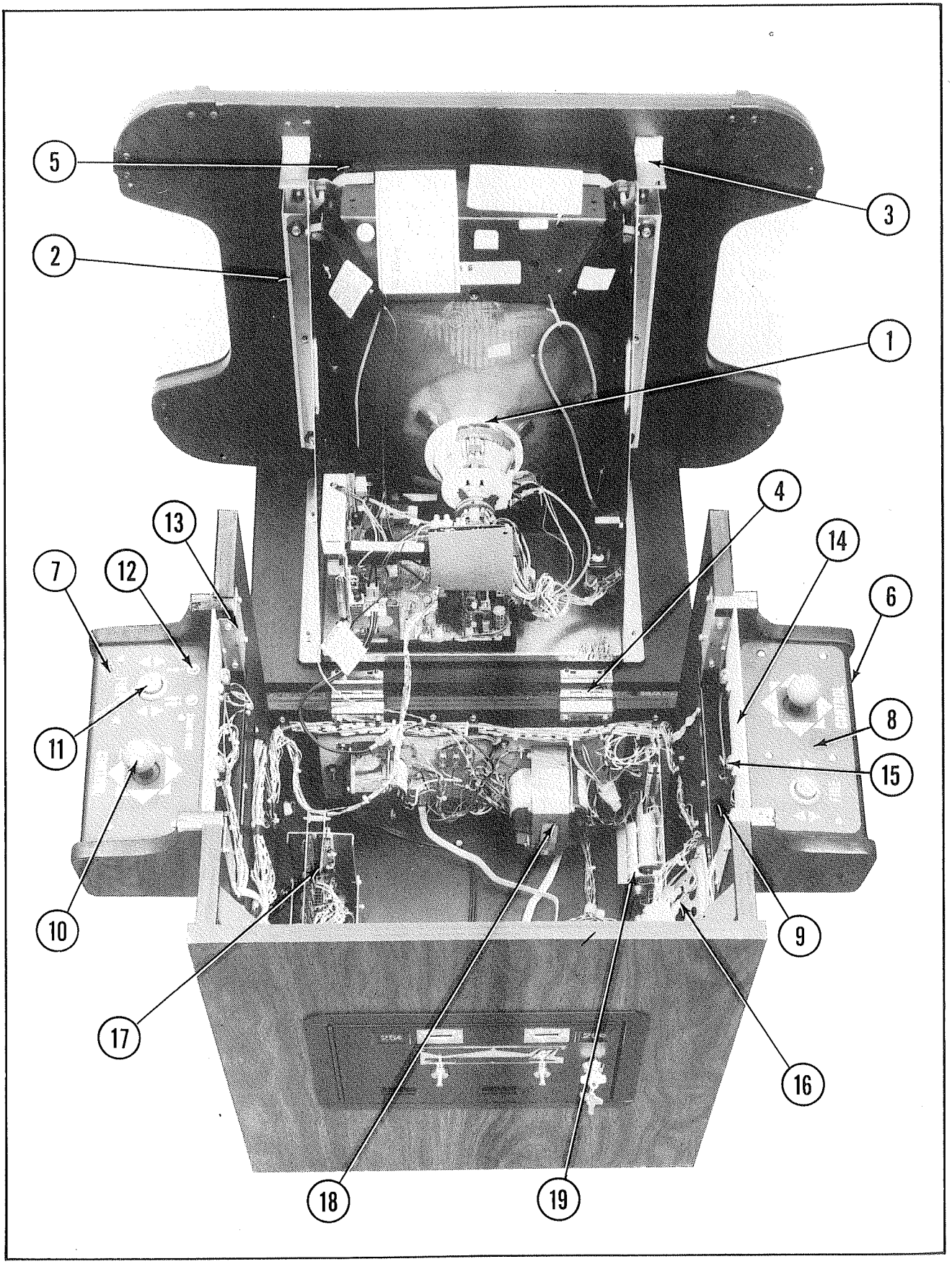


## NO. 555 — BOSCONIAN COCKTAIL — FRONT — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

| ITEM | PART NO. | DESCRIPTION |
|---|---|---|
| 1 | 0017-00009-0499 | COVER GLASS — 32" x 22" x1/4" |
| | 0557-00903-0000 | ARTWORK UNDERLAY |
| 2 | 0775-00104-00XF | GLASS CLIPS (8 REQ'D.) |
| | 0017-00101-0117 | #8 x 5/8 PHIL. TRS. HD. SCR. (16 REQ'D.) |
| 3 | 0508-00905-0000 | T.V. PLEXI-GLASS (GRAYLITE #31) — 17-3/8" x 13-1/4" x 1/8" |
| | 0508-00901-0000 | PLEXI-GLASS MTG. CLIPS (4 REQ'D.) |
| | 0017-00101-0017 | #6 x 1/2 SLT. HEX HD. SCR. (4 REQ'D.) |
| 4 | 0557-00900-0000 | T.V. BEZEL |
| 5 | A557-00007-0100 | CONTROL SHELF ASSY. — PLAYER #1 |
| 6 | A557-00007-0200 | CONTROL SHELF ASSY. — PLAYER #2 |
| 7 | 0017-00009-0393 | BLACK SPEAKER GRILLE W/SLOTS (3 REQ'D.) |
| | 0017-00003-0187 | 6" x 9" SPEAKER 8 OHM, 9W. |
| | 0017-00101-0136 | #8-32 x 1-1/4 CARRIAGE BOLT (12 REQ'D.) |
| | 0017-00103-0061 | #8-32 HEX NUT W/SEMS (12 REQ'D.) |
| 8 | A090-00300-07BK | U.S.A. 25¢ DOUBLE COIN DOOR ASSY. |
| 9 | 0090-00002-02BK | LARGE BLACK DOUBLE COIN DOOR FRAME |
| | 0017-00101-0121 | #6-32 x 5/16 PHIL. TRS. HD. SCR. (3 REQ'D.) (MOUNTS COIN DOOR TO FRAME) |
| 10 | 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. 557 — BOSCONIAN COCKTAIL — INTERIOR ACCESS



## NO. 555 — BOSCONIAN COCKTAIL — INTERIOR ACCESS — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

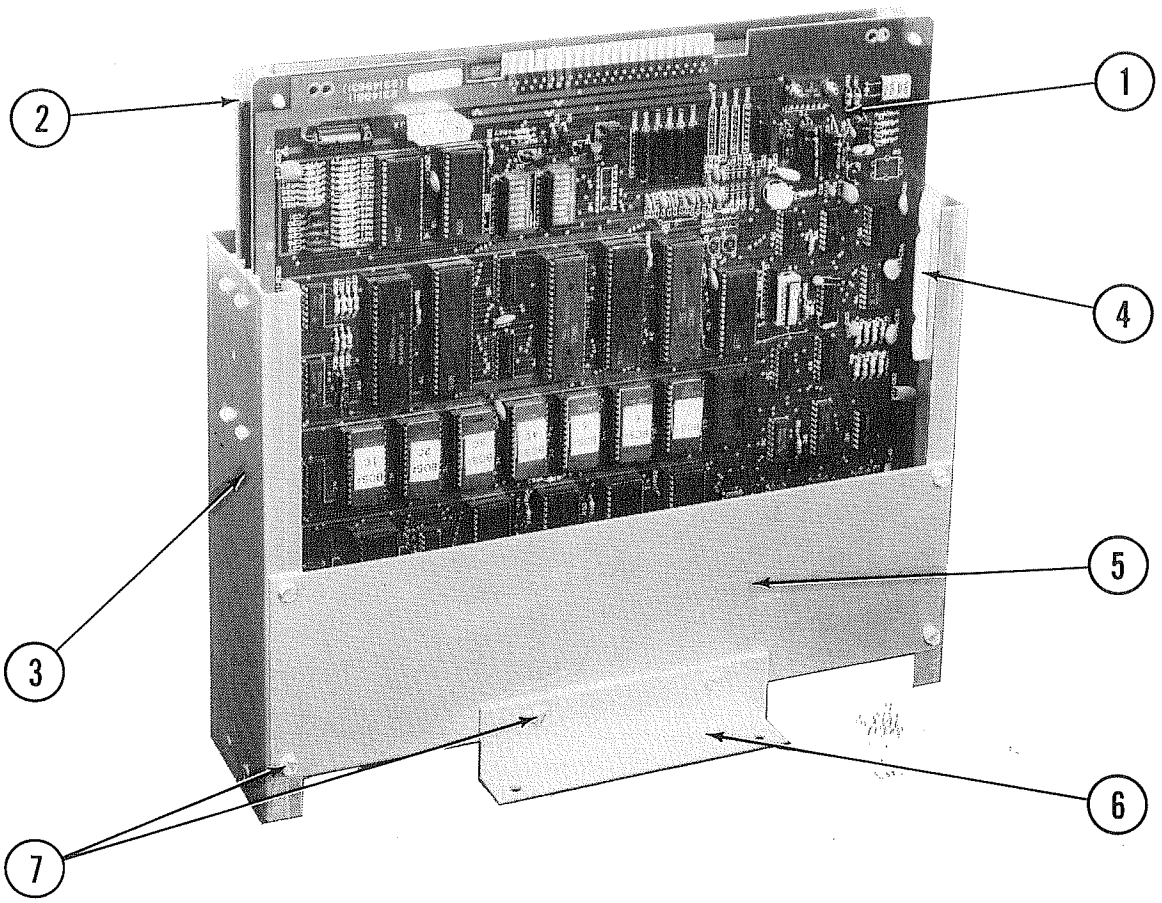
| ITEM | PART NO. | DESCRIPTION |
|---|---|---|
| 1 | 0017-00003-0428 | WELLS-GARDNER — 19" COLOR DUAL SYNC VERT. MTG. MONITOR |
| 2 | A557-00004-00XF | MONITOR MTG. BRKT. ASSY. (2 REQ'D.) |
| | 0017-00101-0642 | #8-32 x 1-1/2 CARRIAGE BOLT (4 REQ'D.) |
| | 0017-00104-0031 | #8 FLAT WASHER (4 REQ'D.) |
| | 0017-00103-0061 | #8-32 HEX NUT W/SEMS (4 REQ'D.) |
| | 0017-00102-0002 | 1/4-20 x 1/2 SLT. HEX HD. BOLT (6 REQ'D.) |
| | 0017-00102-0052 | 1/4-20 x 1" UNSLT. HEX FLAT HD. BOLT (6 REQ'D.) |
| | 0017-00104-0014 | 7/8" DISH WASHER (8 REQ'D.) |
| 3 | 0921-00107-00XF | STRIKE (2 REQ'D.) |
| | 0017-00101-0769 | #10 x 3/4 SLT. HEX HD. M.S. (4 REQ'D.) |
| | 0017-00009-0033 | LATCH CLAMP (2 REQ'D.) — NOT SEEN |
| | 0017-00101-0141 | #8 x 11/16 UNSLOT HEX HD. SCREW (4 REQ'D.) |
| 4 | 0017-00009-0514 | 2-1/2" HINGE (2 REQ'D.) |
| | 0017-00101-0628 | #8-32 x 3/4 CARRIAGE BOLT (4 REQ'D.) |
| | 0017-00101-0639 | #8-32 x 1-1/4 CARRIAGE BOLT (4 REQ'D.) |
| | 0017-00103-0061 | #8-32 HEX NUT W/SEMS (4 REQ'D.) |
| 5 | 0557-00900-0000 | T.V. BEZEL |
| 6 | 0557-00102-00XF | CONTROL PANEL (2 REQ'D.) |
| 7 | 0557-00902-0100 | DECORATIVE OVERLAY — PLAYER #1 |
| 8 | 0557-00902-0200 | DECORATIVE OVERLAY — PLAYER #2 |
| | 0017-00101-0620 | #8-32 x 1/2 CARRIAGE BOLT (8 REQ'D.) |
| | 0017-00103-0061 | #8-32 HEX NUT W/SEMS (8 REQ'D.) |
| | 0017-00101-0341 | #6 x 1/4 PHIL. TRS. HD. SCR. (10 REQ'D.) |
| 9 | 0510-00101-00XF | BOTTOM PAN (2 REQ'D.) |
| 10 | A557-00006-0000 | CONTROL ASSY. (2 REQ'D.) |
| | A557-00014-0100 | CONTROL SHELF CABLE ASSY. — PLAYER #1 |
| | A557-00014-0200 | CONTROL SHELF CABLE ASSY. — PLAYER #2 |
| 11 | 0017-00042-0256 | RED PUSH BUTTON ASSY. (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.) |
| 12 | 0017-00032-0051 | SMALL RED BUTTON SWITCH W/HARDWARE (2 REQ'D.) — PLAYER #1 PANEL ONLY |
| 13 | 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.) |
| 14 | 0930-00904-0000 | LIGHT SHIELD (2 REQ'D.) |
| 15 | 0017-00031-0044 | WEDGE BASE LAMP SOCKET (4 REQ'D.) |
| | 0017-00003-0219 | #194 LAMP 14V., .27A. (4 REQ'D.) |
| | 0017-00101-0555 | #6-32 x 5/16 SLT. HEX HD. M.S. (4 REQ'D.) |
| 16 | 0017-00003-0187 | 6" x 9" SPEAKER 8 OHM, 9W. |
| 17 | A550-00017-0000 | CARD RACK W/P.C. BOARDS ASSY. |
| 18 | A557-00010-0000 | TRANSFORMER BOARD ASSY. |
| 19 | A082-90420-B000 | 5V/4A. POWER SUPPLY P.C. ASSY. |
| | 0624-00902-0100 | P.C. SUPPORT BRKT. — 12" LG. |
| | 0624-00902-0300 | P. C. SUPPORT BRKT. — 2-1/2" 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. M.S. (14 REQ'D.) |
| | 0017-00104-0031 | #8 FLAT WASHER (14 REQ'D.) |

## NO. 555 — BOSCONIAN COCKTAIL — INTERIOR ACCESS — PARTS LIST (Continued)

*ORDER BY PART NUMBER* ***ONLY***

| ITEM | PART NO. | DESCRIPTION |
|---|---|---|
| | | **ADDITIONAL PARTS LIST** |
| | 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.) |
| | A082-91410-A000 | RAPID FIRE P.C. BOARD ASSY. |
| | 0017-00101-0018 | #6 x 3/4 SLOT. HEX HD. SCREW (4 REQ'D.) |
| | A088-00013-0000 | ON-OFF SWITCH & BRKT. ASSY. |
| | A927-00019-0000 | COIN BOX ASSY. |
| | 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 WASHER (4 REQ'D.) |
| | 0017-00103-0061 | #8-32 HEX NUT W/SEMS (4 REQ'D.) |
| | A088-00014-0000 | INTERLOCK SWITCH & BRKT. ASSY. |
| | 0927-00907-0000 | HIGH VOLTAGE SHIELD — FORMED |
| | A557-00013-0000 | MASTER CABLE ASSY. |
| | A510-00011-0000 | HIGH VOLTAGE CABLE ASSY. |
| | A557-00012-0000 | LOW VOLTAGE CABLE ASSY. |
| | A508-00026-0000 | COIN COOR CABLE ASSY. |
| | A510-00014-0000 | VIDEO SIGNAL CABLE ASSY. |
| | A508-00034-0000 | AUDIO SIGNAL ADAPTER CABLE ASSY. |
| | A508-00035-0000 | VIDEO SIGNAL ADAPTER CABLE |
| | A927-00005-0000 | HIGH BASE LEG KIT ASSY. — OPTIONAL |
| | A866-00049-0000 | LINE CORD ASSY. |

## BOSCONIAN — CARD RACK ASSY. W/BOARDS — ALL VERSIONS

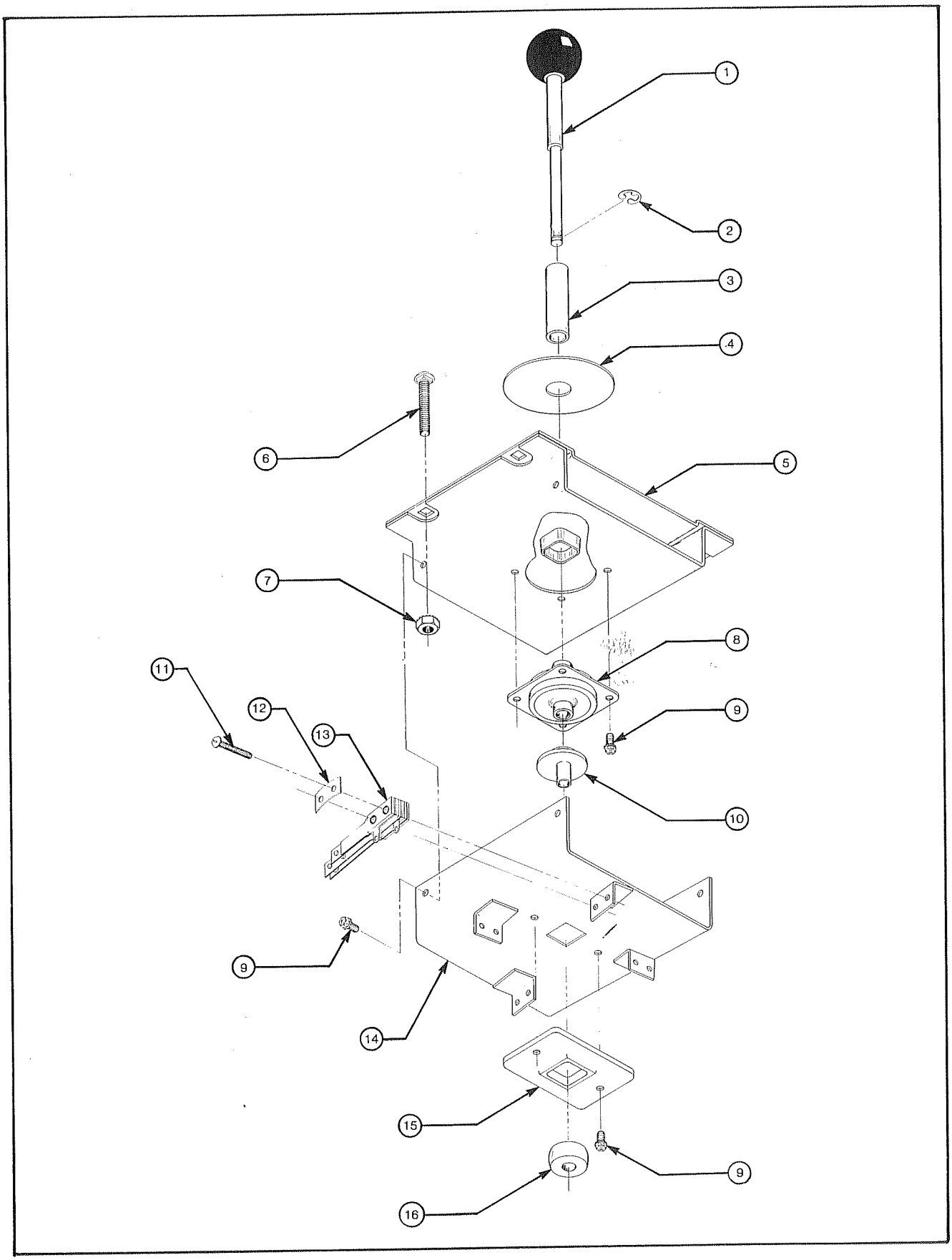



## BOSCONIAN — CARD RACK ASSY. W/BOARDS — ALL VERSIONS— PARTS LIST

*ORDER BY PART NUMBER* ***ONLY***

| ITEM | PART NO. | DESCRIPTION |
|---|---|---|
| 1 | A084-91412-B550 | CPU BOARD ASSY. |
| 2 | A084-91413-B550 | VIDEO BOARD ASSY. |
| 3 | A935-00015-0000 | HOLDER PLATE & STOP ASSY. (2 REQ'D.) |
| 4 | 0017-00009-0478 | NYLON GUIDE (4 REQ'D.) |
| 5 | 0935-00103-0000 | SIDE SUPPORT (2 REQ'D.) |
| 6 | 0935-00102-0000 | MOUNTING BRACKET (2 REQ'D.) |
| 7 | 0017-00101-0096 | #6 x 3/8 SLT. HEX HD. SCR. (14 REQ'D.) |
| | A084-91414-A550 | FILTER BOARD ASSY. — MOUNTS ON TO CPU BOARD — NOT SHOWN |
| | 0508-00116-0100 | P.C. SUPPORT BRKT. — RIGHT — NOT SHOWN |
| | 0508-00116-0200 | P.C. SUPPORT BRKT. — LEFT — NOT SHOWN |

## BOSCONIAN — CONTROL ASSEMBLY — ALL VERSIONS — PARTS LIST



## BOSCONIAN — CONTROL ASSEMBLY — ALL VERSIONS — PARTS LIST

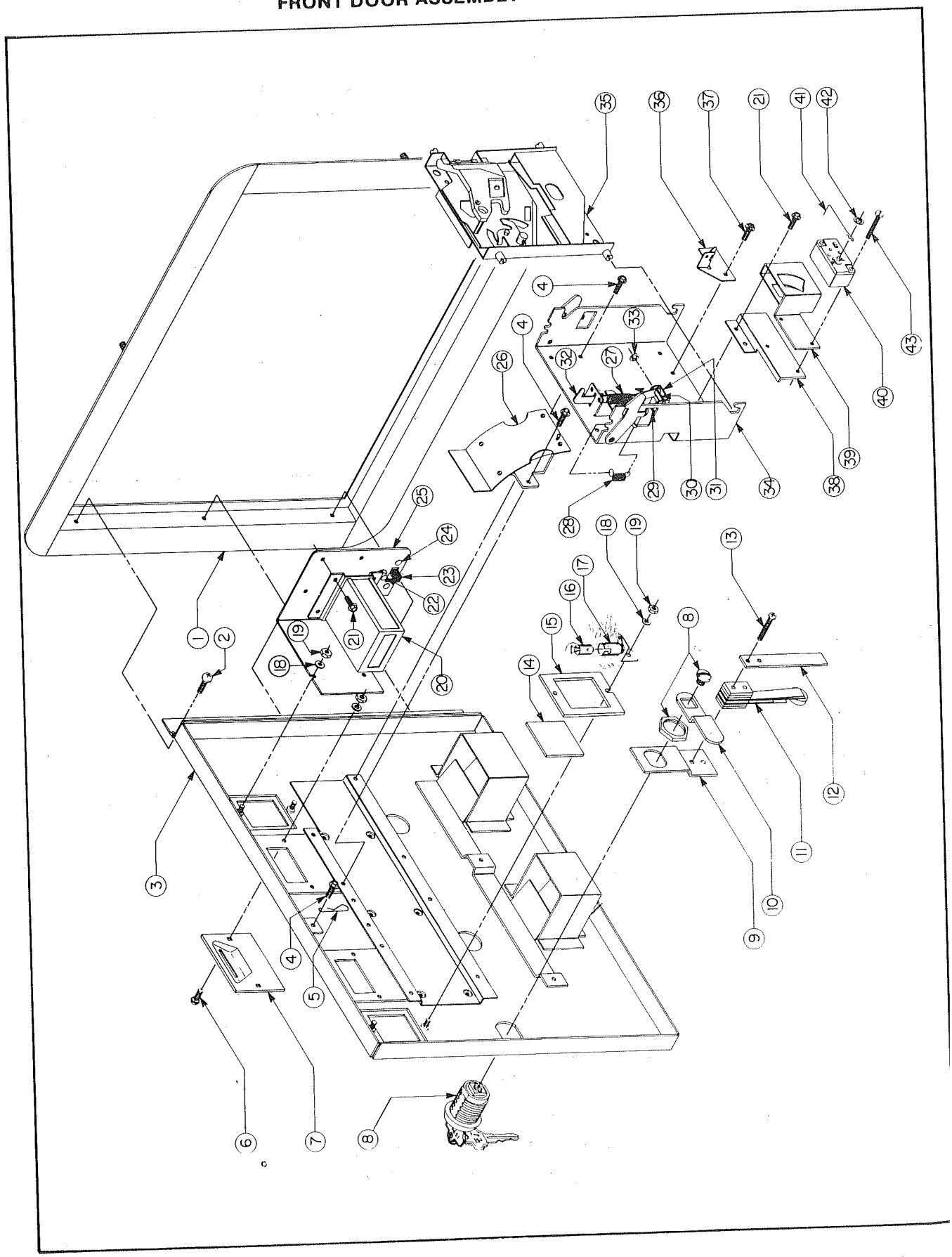
*ORDER BY PART NUMBER **ONLY***

| ITEM | PART NO. | DESCRIPTION |
|---|---|---|
| 1 | A932-00022-0000 | BALL & SHAFT ASSEMBLY |
| 2 | 0017-00100-0025 | 1/4" E-RING |
| 3 | 0921-00702-0000 | STOP SPACER |
| 4 | 0921-00902-0000 | SLIDE PLATE |
| 5 | A557-00005-0000 | SPOT WELD ASSEMBLY |
| 6 | 0017-00101-0637 | #8-32 x 1" CARRIAGE BOLT (4 REQ'D.) |
| 7 | 0017-00103-0061 | #8-32 HEX NUT W/SEMS (4 REQ'D.) |
| 8 | 0932-00902-0000 | GROMMET |
| 9 | 0017-00101-0598 | #8-32 x 5/16 SLT. HEX HD. M.S. (10 REQ'D.) |
| 10 | 0962-00904-0000 | SLEEVE |
| 11 | 0017-00101-0527 | #5-40 x 5/8 SLT. RND. HD. SCR. (8 REQ'D.) |
| 12 | 0020-00202-0000 | SWITCH PLATE (4 REQ'D.) |
| 13 | A932-00009-0000 | SWITCH ASSEMBLY (4 REQ'D.) |
| 14 | A921-00009-0000 | STOP PLATE & SWITCH BRKT. ASSY. |
| 15 | 0927-00908-0000 | WEAR PLATE |
| 16 | 0921-00700-0000 | ACTUATOR |

## BOSCONIAN — TRANSFORMER BOARD ASSY. — PARTS LIST (NO PHOTOGRAPH)

| ITEM | PART NO. | DESCRIPTION |
|---|---|---|
| | MT00-00082-0000 | TRANSFORMER — 115/115V. — UPRIGHT & MINI |
| | MT00-00087-0000 | POWER TRANSFORMER — 120/240V. — UPRIGHT & MINI |
| | MT00-00085-0000 | TRANSFORMER — 115V., 50HZ — COCKTAIL ONLY |
| | MT00-00091-0000 | SHIELDED TRANSFORMER — 115/220V. — COCKTAIL ONLY |
| | 0017-00101-0628 | #8-32 x 3/4 CARRIAGE BOLT (4 REQ'D.) |
| | 0017-00103-0008 | #8-32 HEX NUT (4 REQ'D.) |
| | 0017-00101-0141 | #8 x 11/16 UNSLOT. HEX HD. SCR. (15 REQ'D.) |
| | 0720-00001-0300 | 3 POSITION FUSE CLIP ASSY. — UPRIGHT & COCKTAIL |
| | 0720-00001-0200 | 2 POSITION FUSE CLIP ASSY. — MINI ONLY |
| | 0720-00001-0100 | 1 POSITION FUSE CLIP ASSY. |
| | 0017-00003-0004 | SLO-BLO FUSE — 2A., 250V. (2 REQ'D.) |
| | 0017-00003-0002 | SLO-BLO FUSE — 1/2 A., 250V. — COCKTAIL & UPRIGHT |
| | 0017-00003-0217 | SLO-BLO FUSE — 2-1/2A., 125V. |
| | A508-00037-0000 | 2 LEAD XFRMR BRD. FILTER ASSY. |
| | 3010-13106-0000 | TERMINAL STRIP |
| | 0017-00021-0370 | MALE CONNECTOR — 5 PAIR |
| | 3000-17246-0100 | GROUND STRAP — COCKTAIL |
| | 3000-17246-0500 | 5-1/2" GROUND STRAP — MINI |
| | 3000-17246-0700 | 20" GROUND STRAP — UPRIGHT & MINI |
| | 3000-17246-0800 | 23" GROUND STRAP — COCKTAIL |
| | 3000-17246-0900 | 48" GROUND STRAP — UPRIGHT |
| | 3000-17246-1000 | 36" GROUND STRAP — MINI & COCKTAIL |

## 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 (4 REQ'D.) |
| 5 | 0017-00007-0019 | KEY HOOK |
| 6 | 0017-00101-0552 | #6-32 x 1/4 CARRIAGE BOLT (4 REQ'D.) |
| 7 | 0090-00117-03XF | 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 | 0090-00126-01XF | 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. #1895 (2 REQ'D.) |
| 17 | 0017-00031-0048 | BAYONET SOCKET W/BRKT. (2 REQ'D.) |
| 18 | 0017-00104-0002 | #6 SPLIT LOCK WASHER (8 REQ'D.) |
| 19 | 0017-00103-0084 | #6-32 HEX NUT W/SEMS (4 REQ'D.) |
| 20 | A090-00057-0000 | COIN METER |
| 21 | 0017-00101-0124 | #6 x 1/4 UNSLOT. HEX HD. SCR. (8 REQ'D.) |
| 22 | 0017-00032-0051 | PUSH BUTTON SWITCH |
| 23 | 0017-00032-0007 | SLIDE SWITCH |
| 24 | 0017-00072-0034 | STEEL OVAL HD. RIVET |
| 25 | 0090-00173-0000 | COIN COUNTER MTG. BRKT. |
| | A090-00082-0000 | TEST SWITCH & BRKT. ASSY. (ITEMS 23 THRU 25) |
| 26 | A090-00087-0000 | COIN CHUTE & TOP 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 | A090-00085-0000 | 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 | 0017-00101-0698 | #4-40 x 3/4 SLT. RND. HD. M.S. (2 REQ'D.) |
| | A090-00077-0000 | COIN GUIDE & SWITCH ASSY. (ITEMS 38 THRU 43) |

# V Technical Troubleshooting

# 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. Nonerasable. Used for low-volume applications.

**EPROM** — erasable, programmable, read-only memory. Can be erased by ultraviolet light bath, then reprogrammed. Frequently used during design and development to get programs debugged, then replaced by ROM for mass production.

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

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

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

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

# Introduction to the Z-80 CPU

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

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

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

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

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

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

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

## General Purpose Registers

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

## Arithmetic & Logic Unit (ALU)

The 8-bit arithmetic and logical instructions of the CPU are executed in the ALU. Internally the ALU communicates with the registers and the external data bus on the internal data bus. The type of functions performed by the ALU include:

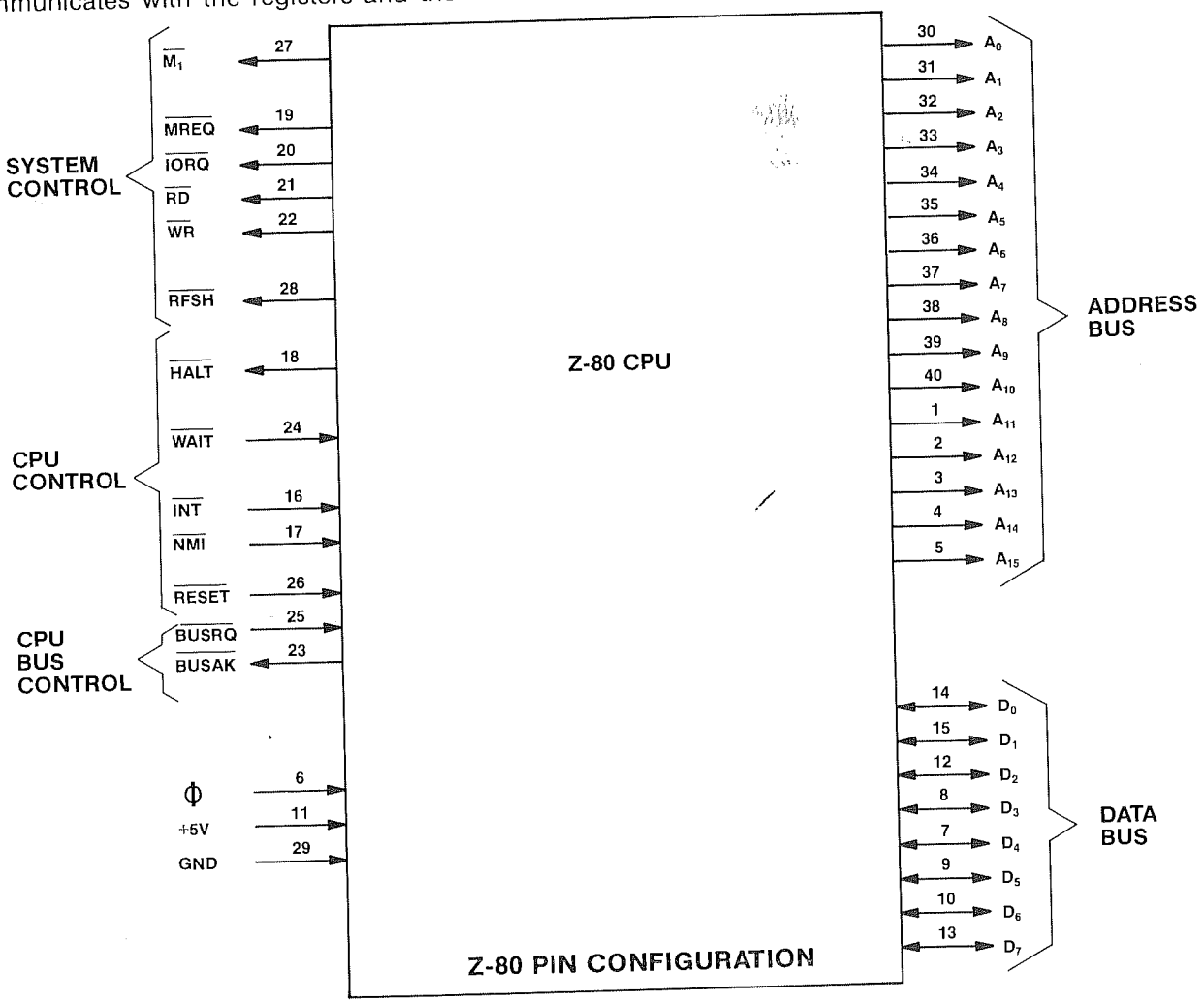
| | |
|---|---|
| **Add** | Left or right shifts or rotates (arithmetic and logical) |
| **Subtract** | Increment |
| **Logical AND** | Decrement |
| **Logical OR** | Set bit |
| **Logical Exlusive OR** | Reset bit |
| **Compare** | Test bit |

## Instruction Register and CPU Control

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

## Z-80 CPU Pin Description

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



**$A_0$-$A_{15}$**
**(Address Bus)**
Tri-state output, active high. $A_0$-$A_{15}$ 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. $A_0$ is the least significant address bit. During refresh time, the lower 7 bits contain a valid refresh address.

**$D_0$-$D_7$**
**(Data Bus)**
Tri-state input/output, active high. $D_0$-$D_7$ constitute an 8-bit bidirectional data bus. The data bus is used for data exchanges with memory and I/O devices.

**$M_1$**
**(Machine Cycle one)**
Output, active low. $\overline{M_1}$ indicates that the current machine cycle is the OP code fetch cycle of an instruction execution. Note that during execution of 2-byte op-codes, $\overline{M1}$ 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 $\overline{M1}$ 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 $M_1$ time while I/O operations never occur during $M_1$ 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 $M_1$ time) is sent out at the beginning of the next instruction cycle. The CPU can respond to an interrupt in three different modes that are described in detail in section 5.4 (CPU Control Instructions).

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

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

1) Disable the interrupt enable flip-flop

2) Set Register I = $00_H$

3) Set Register R = $00_H$

4) Set Interrupt Mode 0

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

**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**

# VI T.V. Monitor

# 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 heighth:**
   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 neckboard 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, visable retrace lines:**
    A. Broken neck board.
    B. Internal short circuit in the picture tube (arcing).

15. **Unsymmetrical picture or sides of picture:**
    A. Defective yoke.

16. **No brightness, power supply operating — No high voltage for the picture tube; check:**
    A. Horizontal oscillator.
    B. Horizontal amplifier and output.
    C. Flyback transformer (high voltage unit).

17. **No brightness, high voltage present; check:**
    A. Heater voltage to the tube at the neck board.
    B. Screen-grid voltage for the tube.
    C. Focus voltage.
    D. Grid to cathode picture tube bias.

18. **No high voltage; check:**
    A. For AC input to the "flyback".
    B. Horizontal deflection stages.
    C. Flyback transformer.
    D. Yoke.
    E. Power supply.

19. **No horizontal and vertical hold; check:**
    A. Sync transistors and circuit.
    B. Wires and jack from logic board to the monitor.

20. **Wavey 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.

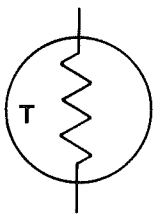
C. Metal foreign material is in picture tube shield.

D. Nearby equipment is electromagnetically interferring.

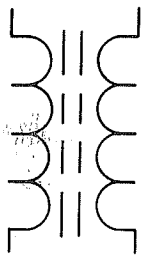
E. The poles of the earth are pulling off the purity.

F. Poor focus or width of picture.

# Guide To Schematic Symbols



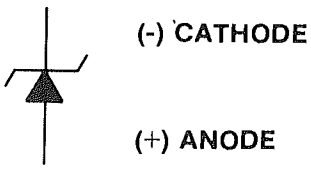

**THERMISTOR**
(POLARITY DOESN'T MATTER)



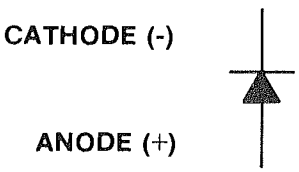
**IRON CORE TRANSFORMER**
(SUCH AS A FLYBACK)

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

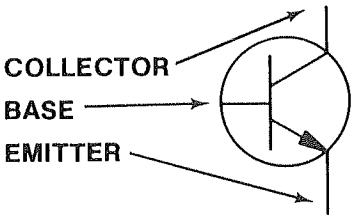
**FUSE**
(POLARITY DOESN'T MATTER)



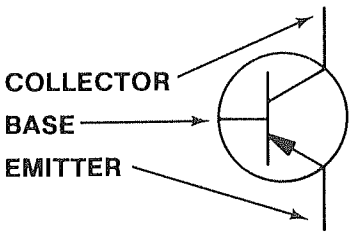

**ZENER DIODE**



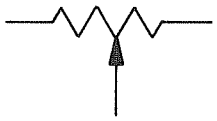

**DIODE**




**NPN TRANSISTOR**

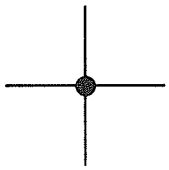



**PNP TRANSISTOR**



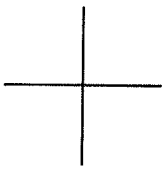
**VARIABLE RESISTOR, POT, CONTROL**
(POLARITY DOESN'T MATTER)

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

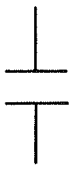


**LINES ARE CONNECTED**

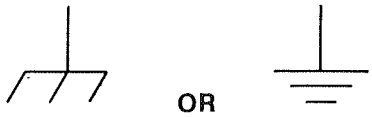

**ELECTROLYTIC CAPACITOR**



**LINES ARE NOT CONNECTED**



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



**OR**

**GROUND**

# Troubleshooting

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

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

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

**WARNING: That picture tube is a bomb!** When it breaks, first it implodes, then it explodes. Large pieces of glass have been known to fly in excess of 20 feet in all directions. **DO NOT** carry it by the long, thin neck. Discharge its voltage to ground by shorting the anode hole to ground. Use a plastic handled screwdriver, connect one end of a wire with an alligator clip at each end to chassis ground and the other end to the metal shaft of the screwdriver. Using ONE HAND ONLY (put the other in your pocket) and touching ONLY the plastic handle of the screwdriver **(DO NOT TOUCH THE METAL SHAFT)** stick the blade of the screwdriver into the anode hole. Be prepared for a fairly loud pop and a flash. The longer the monitor has been turned off, the smaller the pop and dimmer the flash. But **BE CAREFUL**, picture tubes will hold a very healthy charge for at least **a week** if not longer. Even after you've discharged it once, it may still carry a residual charge. It's better to be too careful than dead, which is why electronic equipment always carries stickers referring servicing to qualified personnel. Handle the side with the viewing screen against your chest when changing it. **ALWAYS** wear safety goggles when handling the picture tube.

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

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

**CAUTION:**

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

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

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

To test a transistor, one lead of the ohmmeter is placed on the base; and the other lead placed just on the emitter, then on the collector. A normal transistor will read either high resistance (infinite), or little resistance (400 to 900 ohms), depending on the polarity of this type transistor. Then the leads should be switched, one remaining on the base, and the other switched from the emitter to the collector. Now the opposite condition should result: the resistance should be infinite if it was lower when the other lead was on the base. Consistantly 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 oscilliscope. **BE CAREFUL:** Shorting their pins can easily destroy them.

Resistors are checked with an ohmeter 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 assmebled 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" or 19" color monitor uses transistors for its sync section. An Electrohome 13" or 19" color monitor uses an integrated circuit IC501 for its sync section. The idea is all the same. The output to the vertical amplifying transistors for all monitors must be a sawtooth wave form, sort of like a bunch of pyramids, racing to 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. Again, Wells Gardner uses transistors for the horizontal oscillator, and Electrohome uses the other side of IC501. Still, the effect is the same. 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 oscillators frequencies 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 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 the emitter on TR502 of the Wells Gardner monitors; or the emitter of X04 for the Electrohome monitor. Here are the voltages you should receive:

Wells Gardner = 127VDC
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 integratec 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 circuits work is displayed by this part. Actually, the output of other circuits is in the neck of the picture tube.

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

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

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

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

# Differences Between Monitors

The easiest way to identify the brand of monitor you are working with, assuming you can't find the brand name written on it anywhere, is to see if there are two circuit boards rising up from the chassis toward the picture tube neck. In other words, they stand up, or are perpendicular to the chassis, with a black plastic bracket holding them in place. This is a description of a Wells Gardner monitor. They use separate boards for main chunks of circuitry. Therefore, you have a "power board" (the power supply), an "interface board" (the interface section), and a "horizontal/vertical board" (for the deflection circuitry). Still, there are a few parts on the chassis, but most can be found on the board. An Electrohome monitor has no separate boards, except for the neck board, and just has a flat chassis.

Another good way to determine which monitor you have is to check the transistor call out numbers that are printed on the chassis next to the part. For instance, on the neck board, one of the color output transistors is TR401. If you look through the schematics or the parts lists, you will find TR401 in the Wells Gardner literature. On the other hand, the neck board transistor may say X101. X101 can be found in the Electrohome literature. So, all Wells Gardner transistor call outs begin with TR, and Electrohome transistor call outs start with an "X".

# Parts Interchangeability

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

1. You **CAN** swap the voltage regulator TR502 or X01 on any Wells Gardner or Electrohome 19 inch monitor. You **CAN NOT** swap the voltage regulator on the 13 inch Wells Gardner or Electrohome (G07-902) since the Electrohome uses an integrated circuit for the power supply.

2. You **CAN** swap any resistor between monitors that has the same resistance, wattage rating, and tolerance.

3. You **CAN** swap any capacitor between monitors that has the same capacitance, and voltage rating.

4. **PICTURE TUBES:**
   Due to the fact that "ELECTROHOME" is now (October, 1981) using a picture tube with an **internal shield,** these picture tubes can be used in EITHER "WELLS GARDNER" or "ELECTROHOME" monitors.
   However, a "WELLS GARDNER" picture tube can **ONLY** be used in a "WELLS GARDNER" monitor. It will not function properly if installed in an "ELECTROHOME" monitor. The picture purity will be off.

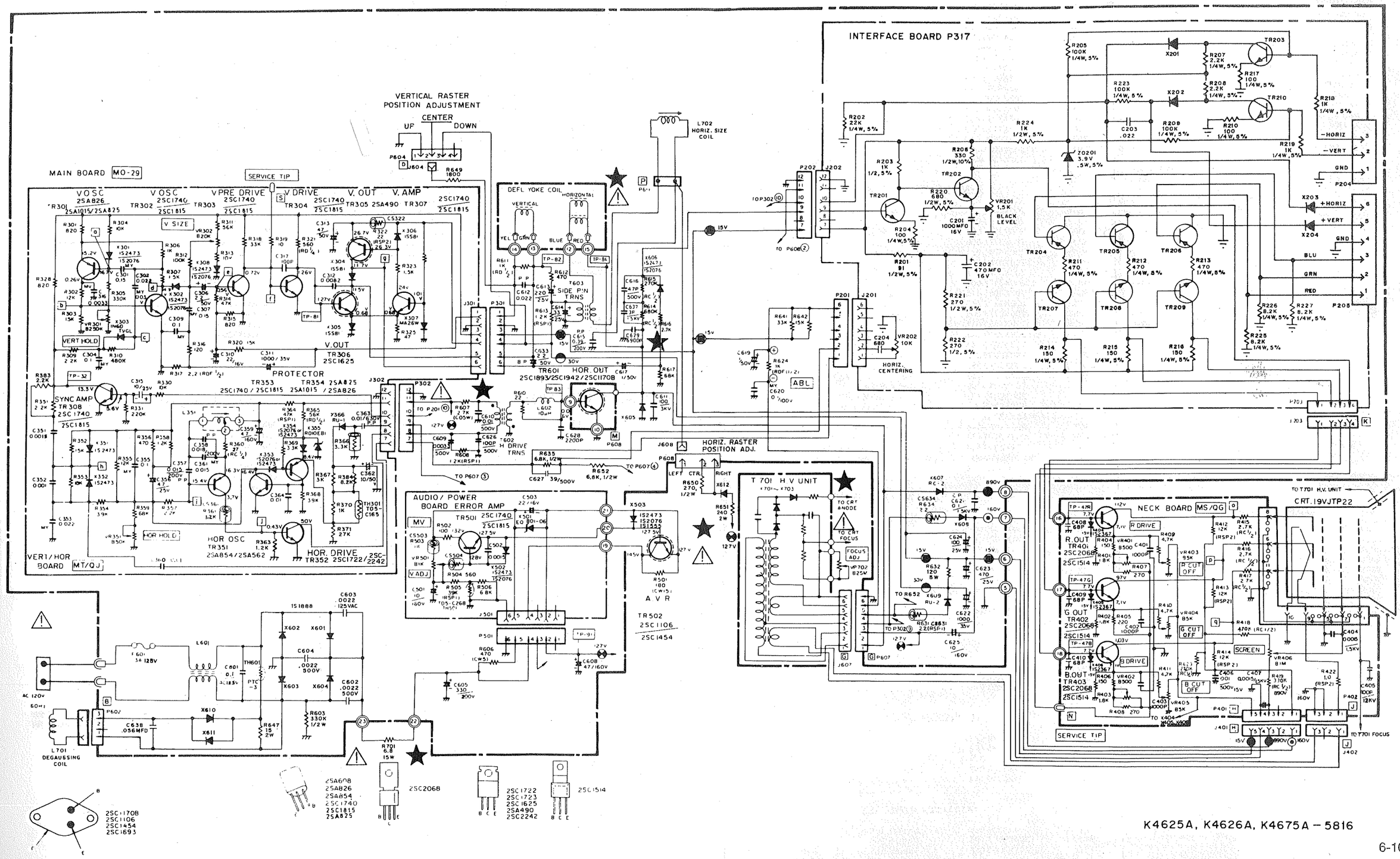
5. You **CAN NOT** change any part that is a **safety part**, one that is shaded in gray on the schematic; it **MUST** be **IDENTICAL** to the original. **To do otherwise IS DANGEROUS.** For instance, the 13 inch Electrohome (G07-904) monitor "flyback". looks identical to the 19 inch Electrohome (G07-904) 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.

# WELLS-GARDNER 19" COLOR MONITOR SCHEMATIC DIAGRAM

# M051-00087-A012




K4625A, K4626A, K4675A – 5816

# VERT/HOR BOARD (MT/QJ)

| Ref. No. | Part No. | Description |
|---|---|---|
| **RESISTORS** | | |
| R301 | 203X6500-628 | 820 Ohm, ± 5%, 1/8W Carbon |
| R302 | 203X6500-902 | 12k Ohm, ± 5%, 1/8W Carbon |
| R303 | 203X6500-927 | 15k Ohm, ± 5%, 1/8W Carbon |
| R304 | 203X6500-866 | 10k Ohm, ± 5%, 1/8W Carbon |
| R305 | 203X6501-241 | 330k Ohm, ± 5%, 1/8W Carbon |
| R306 | 203X6500-645 | 1k Ohm, ± 5%, 1/8W Carbon |
| R307 | 203X6500-689 | 1.5k Ohm, ± 5%, 1/8W Carbon |
| R309 | 203X6500-724 | 2.2k Ohm, ± 5%, 1/8W Carbon |
| R310 | 203X6501-285 | 470k Ohm, ± 5%, 1/8W Carbon |
| R311 | 203X6501-065 | 56k Ohm, ± 5%, 1/8W Carbon |
| R312 | 203X6501-126 | 100k Ohm, ± 5%, 1/8W Carbon |
| R313 | 203X6001-326 | 10k Ohm, ± 5%, 1/8W Carbon |
| R314 | 203X6501-044 | 47k Ohm, ± 5%, 1/8W Carbon |
| R315 | 203X6500-628 | 820 Ohm, ± 5%, 1/8W Carbon |
| R316 | 203X6500-420 | 120 Ohm, ± 5%, 1/8W Carbon |
| R317 | 203X6206-441 | 2.2 Ohm, ± 5%, 1/2W Carbon |
| R319 | 203X6500-169 | 100 Ohm, ± 5%, 1/8W Carbon |
| R320 | 203X6500-927 | 15k Ohm, ± 5%, 1/8W Carbon |
| R321 | 203X6700-509 | 560 Ohm, ± 5%, 1/2W Carbon |
| R322 | 203X9100-121 | 22 Ohm, ± 5%, 2W M |
| R323 | 203X6500-689 | 1.5K Ohm, ±5%, 1/8W Carbon |
| R324 | 203X6500-988 | 27k Ohm, ± 5%, 1/8W Carbon |
| R325 | 203X6500-326 | 47 Ohm, ± 5%, 1/8W Carbon |
| R328 | 203X6500-628 | 820 Ohm, ± 5%, 1/8W Carbon |
| R330 | 203X6500-886 | 10k Ohm, ± 5%, 1/8W Carbon |
| R331 | 203X6501-209 | 220k Ohm, ± 5%, 1/8W Carbon |
| R351 | 203X6500-724 | 2.2k Ohm, ± 5%, 1/8W Carbon |
| R352 | 203X6500-927 | 15k Ohm, ± 5%, 1/8W Carbon |
| R353 | 203X6500-944 | 18k Ohm, ± 5%, 1/8W Carbon |
| R354 | 203X6500-783 | 3.9k Ohm, ± 5%, 1/8W Carbon |
| R355 | 203X6500-902 | 12k Ohm, ± 5%, 1/8W Carbon |
| R356 | 203X6500-561 | 470 Ohm, ± 5%, 1/8W Carbon |
| R357 | 203X6500-724 | 2.2k Ohm, ± 5%, 1/8W Carbon |
| R358 | 203X6500-666 | 1.2k Ohm, ± 5%, 1/8W Carbon |
| R359 | 203X6501-088 | 68k Ohm, ± 5%, 1/8W Carbon |
| R360 | 203X5500-471 | 27 Ohm, ± 5%, 1/4W Comp. |
| R361 | 203X6000-998 | 1.2k Ohm, ± 5%, 1/8W Carbon |
| R363 | 203X6500-666 | 1.2k Ohm, ± 5%, 1/8W Carbon |
| R364 | 203X9014-988 | 47k Ohm, ± 5%, 1W M.O. |
| R365 | 203X6700-989 | 56k Ohm, ± 5%, 1/2W Carbon |
| R366 | 203X6001-148 | 3.3k Ohm, ± 5%, 1/8W Carbon |
| R367 | 340X2222-734 | 2.2k Ohm, ± 5%, 1/2W Carbon |
| R368 | 203X6500-785 | 3.9k Ohm, ± 5%, 1/8W Carbon |
| R369 | 203X6500-762 | 3.3k Ohm, ± 5%, 1/4W Carbon |
| R370 | 302X6100-961 | 1k Ohm, ± 5%, 1/4W Carbon |
| R371 | 203X6104-751 | 2.7k Ohm, ± 5%, 1/4W Carbon |
| VR301 | 204X2122-093 | Varistor, 250K Ohm, Vert. Hold |
| VR302 | 204X2114-065 | Varistor, 20K Ohm, Vert. Size |
| VR351 | 204X2114-059 | Varistor, 50K Ohm, Hor. Hold |
| **CAPACITORS** | | |
| C301 | 203X1100-928 | 0.15 uF, 50V, ± 10% Mylar |
| C302 | 203X1100-573 | 0.022 uF, 50V, ± 10% Mylar |
| C304 | 203X1100-858 | 0.1 uF, 50V, ± 10% Mylar |
| C306 | 203X0025-026 | 2.2 uF, 50V, Electrolytic |
| C307 | 203X1100-928 | 0.15 uF, 50V, ± 10% Mylar |
| C309 | 203X1100-858 | 0.1 uF, 50V, ± 10% Mylar |
| C310 | 203X0010-011 | 22 uF, 16V Electrolytic |
| C311 | 203X0020-099 | 1000 uF, 35V Electrolytic |
| C312 | 202X7000-469 | 0.0082 uF, 50V, ± 10% Ceramic |

| Ref. No. | Part No. | Description |
|---|---|---|
| **CAPACITORS (CONT.)** | | |
| C313 | 203X0025-087 | 47 uF, 50V Electrolytic |
| C315 | 203X0015-082 | 10 uF, 25V Electrolytic |
| C316 | 203X1100-220 | 3300 uF, 50V, ± 10% Mylar |
| C317 | 202X8000-616 | 100 pF, 50V, ± 10% Ceramic |
| C351 | 202X7000-281 | 1500 pF, 50V, ± 10% Ceramic |
| C352 | 202X7000-247 | 1000 pF, 50V, ± 10% Ceramic |
| C353 | 203X1100-573 | 0.022 uF, 50V, ± 10% Mylar |
| C355 | 203X1100-858 | 0.1 uF, 50V, ± 10% Mylar |
| C356 | 203X0015-105 | 4.7 uF, 25V Electrolytic |
| C357 | 203X1201-013 | 0.015uF, 200V ± 10% PP |
| C358 | 203X1201-034 | 0.018 uF, 200V, ± 10% PP |
| C359 | 203X0040-013 | 4.7 uF, 160V Electrolytic |
| C360 | 202X7000-482 | 0.01 uF, 50V, ± 10% Ceramic |
| C361 | 203X1100-509 | 0.015 uF, 50V, ± 10% Mylar |
| C362 | 203X0025-058 | 10 uF, 50V Electrolytic |
| C363 | 203X1205-487 | 0.01 uF, 630V, ± 10% PP |
| C364 | 202X7000-482 | 0.01 uF, 50V, ± 10% Ceramic |
| **SEMICONDUCTORS** | | |
| TR301 | 200X4082-614 | Transistor, 2SA826Q |
| TR302 | 200X3174-006 | Transistor, 2SC1740Q |
| TR303 | 200X3174-006 | Transistor, 2SA1740Q |
| TR304 | 200X3174-006 | Transistor, 2SC1740Q |
| TR305 | 200X4049-081 | Transistor, 2SA490YLBGLI |
| TR306 | 200X3162-538 | Transistor, 2SC1625YLBGLI |
| TR307 | 200X3174-014 | Transistor, 2SC1740R |
| TR308 | 200X3174-006 | Transistor, 2SC1740Q |
| TR351 | 200X4085-415 | Transistor, 2SA854Q |
| TR352 | 200X3172-208 | Transistor, 2SC1722BKS |
| TR353 | 200X3174-006 | Transistor, 2SC1740Q |
| TR354 | 200X4082-614 | Transistor, 2SA826Q |
| X301 | 201X2010-144 | Diode, (SI) IS2473-T72 |
| X302 | 201X2010-144 | Diode, (SI) IS2473-T72 |
| X303 | 200X8000-026 | Diode, (GE), IN60TVGL |
| X304 | 200X8010-165 | Diode (SI) ISS81 |
| X305 | 201X2010-165 | Diode (SI) ISS81 |
| X306 | 201X2010-165 | Diode (SI) ISS81 |
| X307 | 200X8010-102 | Diode (SI) MA26W |
| X308 | 200X8010-094 | Diode (SI) IS2473 |
| X351 | 201X2010-144 | Diode (SI) IS2473-T72 |
| X352 | 201X2010-144 | Diode (SI) IS2473-T72 |
| X353 | 201X2010-144 | Diode (SI) IS2473-T72 |
| X354 | 201X2010-144 | Diode (SI) IS2473-T72 |
| X355 | 200X8220-851 | Diode (Zener) RD10EBI |
| X366 | 200X8100-130 | Diode (HS) RU-1 0.3 US |
| **MISCELLANEOUS** | | |
| J301 | 204X9300-958 | Socket, 6 Pin |
| J302 | 204X9300-958 | Socket, 6 Pin |
| P301 | 204X9601-195 | Plug, 6 Pin |
| P302 | 204X9601-195 | Plug, 6 Pin |
| TH301 | 201X0000-534 | Thermistor |
| **TRANSFORMERS & COILS** | | |
| L351 | 201X5200-091 | Coil, Horiz. Osc. |

# POWER BOARD (MV)

| Ref. No. | Part No. | Description |
|---|---|---|
| **RESISTORS** | | |
| R501 | 204X1725-052 | 180 Ohm, ± 10%, 15W WW |
| R502 | 203X6000-608 | 100 Ohm, ± 5%, 1/8W Carbon |
| R503 | 203X6000-960 | 1k Ohm, ± 5%, 1/8W Carbon |
| R504 | 203X6000-879 | 560 Ohm, ± 5%, 1/8W Carbon |
| R505 | 203X9014-965 | 39k Ohm, ± 5%, 1W M.O. |
| R506 | 203X6500-842 | 6.8k Ohm, ± 5%, 1/8W Carbon |
| R551 | 203X6500-420 | 120 Ohm, ± 5%, 1/8W Carbon |
| VR501 | 204X2050-001 | Varistor Vert. Adj. |
| **CAPACITORS** | | |
| C501 | 203X0040-020 | 10 uF, 160V Electrolytic |
| C502 | 202X7000-281 | 1500 pF, 50V, ± 10% Ceramic |
| C503 | 203X0010-011 | 22 uF, 16V Electrolytic |
| C551 | 203X0005-046 | 220 uF, 10V Electrolytic |
| **SEMICONDUCTORS** | | |
| TR501 | 200X3174-006 | Transistor, 2SC1740Q |
| △★TR502 | 200X3145-404 | Transistor, 2SC1454 |
| TR551 | 200X3172-305 | Transistor, 2SC1723 |
| X501 | 201X2230-042 | Diode, (SI) Zener EQB01-06V |
| X502 | 201X2010-144 | Diode, (SI) IS2473-T72 |
| **MISCELLANEOUS** | | |
| J501 | 204X9300-958 | Socket, 6 Pin |
| P501 | 204X9601-195 | Plug, 6 Pin |
| TH501 | 201X0000-618 | Thermistor |



# NECK BOARD (MS/QG)

| Ref. No. | Part No. | Description |
|---|---|---|
| **RESISTORS** | | |
| R401 | 203X6500-709 | 1.8k Ohm ± 5% 1/8W Carbon |
| R402 | 203X6500-709 | 1.8k Ohm ± 5% 1/8W Carbon |
| R403 | 203X6500-709 | 1.8k Ohm ± 5% 1/8W Carbon |
| R404 | 203X6500-447 | 150 Ohm ± 5% 1/8W Carbon |
| R405 | 203X6500-481 | 220 Ohm ± 5% 1/8W Carbon |
| R406 | 203X6500-447 | 150 Ohm ± 5% 1/8W Carbon |
| R407 | 203X6500-508 | 270 Ohm ± 5% 1/8W Carbon |
| R408 | 203X6500-508 | 270 Ohm ± 5% 1/8W Carbon |
| R409 | 203X6500-800 | 4.7k Ohm ± 5% 1/8W Carbon |
| R410 | 203X6500-800 | 4.7k Ohm ± 5% 1/8W Carbon |
| R411 | 203X6500-800 | 4.7k Ohm ± 5% 1/8W Carbon |
| R412 | 203X9104-809 | 12k Ohm ± 5% 2.0W Metal Oxide |
| R413 | 203X9104-809 | 12k Ohm ± 5% 2.0W Metal Oxide |
| R414 | 203X9104-809 | 12k Ohm ± 5% 2.0W Metal Oxide |
| R415 | 203X5601-313 | 2.7k Ohm ± 10% 1/2W Comp. |
| R416 | 203X5601-313 | 2.7k Ohm ± 10% 1/2W Comp. |
| R417 | 203X5601-313 | 2.7k Ohm ± 10% 1/2W Comp. |
| R418 | 203X5602-254 | 470k Ohm ± 10% 1/2W Comp. |
| R419 | 203X5602-185 | 330k Ohm ± 10% 1/2W Comp. |
| R422 | 203X9105-117 | 1.0 Ohm ± 10% 2W Metal Oxide |
| R423 | 203X5102-155 | 270k Ohm ± 5% 1/4W Carbon |
| VR401 | 204X2115-014 | 500 Ohm Varistor R Drive |
| VR402 | 204X2115-014 | 500 Ohm Varistor B Drive |
| VR403 | 204X2115-006 | 5k Ohm Varistor R Cutoff |
| VR404 | 204X2115-006 | 5k Ohm Varistor G Cutoff |
| VR405 | 204X2115-006 | 5k Ohm Varistor B Cutoff |
| VR406 | 204X2000-025 | 1M Ohm Varistor Screen |
| **CAPACITORS** | | |
| C401 | 202X7000-247 | 1000 pF, 50V, 10% Ceramic |
| C402 | 202X7000-247 | 1000 pF, 50V, 10% Ceramic |

| Ref. No. | Part No. | Description |
|---|---|---|
| C403 | 202X7000-247 | 1000 pF, 50V, 10% Ceramic |
| C404 | 202X7110-019 | 1500 pF, 2kV ± 10% Ceramic |
| C405 | 202X7150-018 | 100 pF, 12kV, ± 10% Ceramic |
| C406 | 202X7050-483 | .01 uF, 500V, ± 10% Ceramic |
| C407 | 202X7110-019 | 1500 pF, 2kV ± 10% Ceramic |
| C408 | 202X8000-550 | 68 pF, 50V, ± 10% Ceramic |
| C409 | 202X8000-550 | 68 pF, 50V, ± 10% Ceramic |
| C410 | 202X8000-550 | 68 pF, 50V, ± 10% Ceramic |
| **SEMICONDUCTORS** | | |
| TR401 | 200X3206-800 | Transistor, 2SC2068, 2SC1514 (R output) |
| TR402 | 200X3206-800 | Transistor, 2SC2068, 2SC1514 (G output) |
| TR403 | 200X3206-800 | Transistor, 2SC2068, 2SC1514 (B output) |
| X404 | 201X2100-126 | Diode, IS2367 (protector) |
| X405 | 201X2100-126 | Diode, IS2367 (protector) |
| X406 | 201X2100-126 | Diode, IS2367 (protector) |
| **MISCELLANEOUS** | | |
| J401 | 206X5003-729 | Socket, 5 Pin |
| J402 | 206X5003-983 | Socket, 3 Pin |
| P401 | 204X9600-329 | Plug, 5 Pin |
| P402 | 204X9600-254 | Plug, 3 Pin |

## △★ 297X2000-072 HIGH VOLTAGE ASSEMBLY (T701)

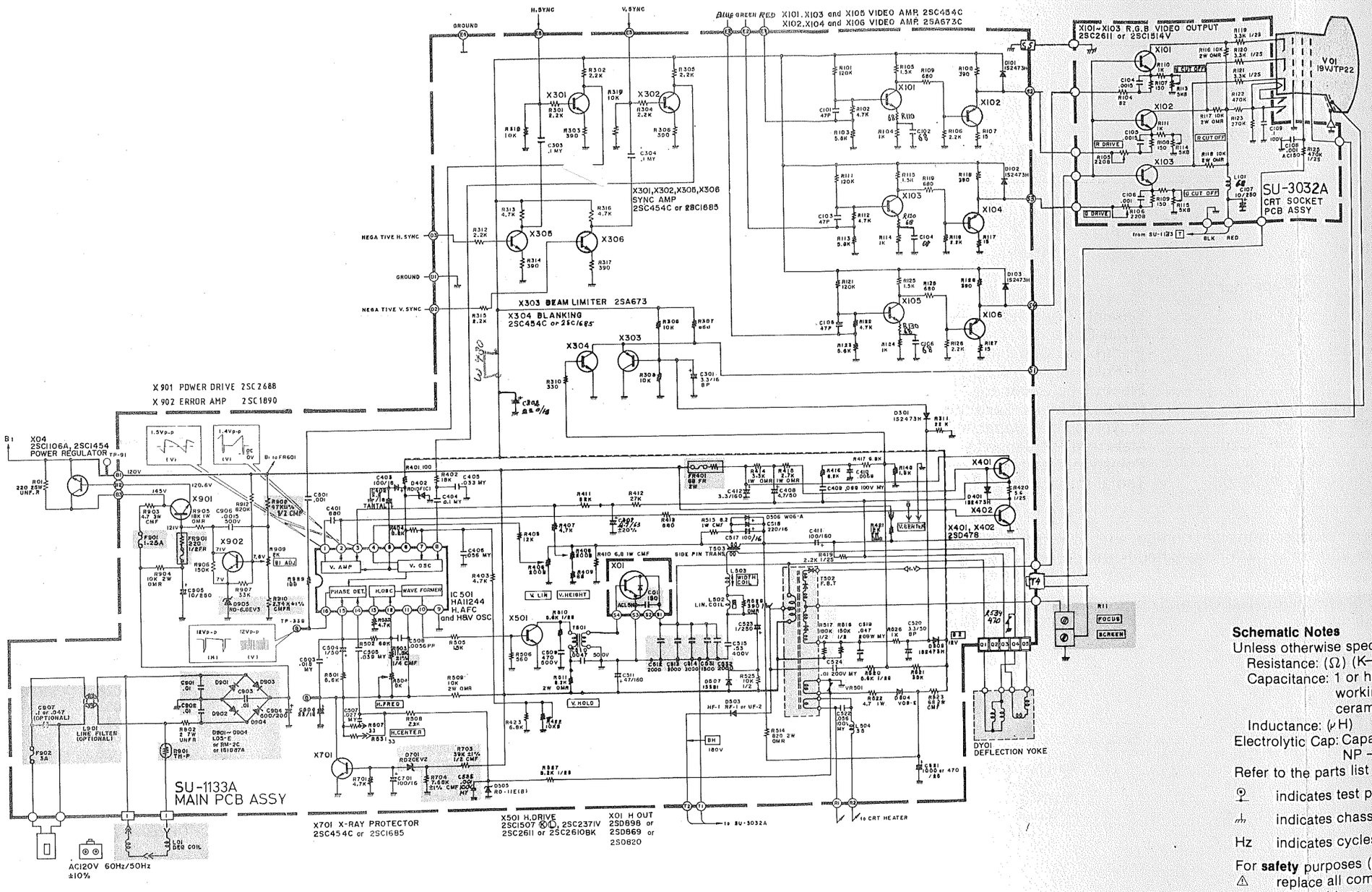
| | | |
|---|---|---|
| △★R701 | 204X1625-058 | 3.3 Ohm, ± 10% 10W WW Resistor |
| VR702 | 204X3901-125 | Focus Control |
| X701 | | Diode (SI HV) } |
| X702 | | Diode (SI HV) } Part of T701 |
| X703 | | Diode (SI HV) } |

## FINAL ASSEMBLY PARTS

| | |
|---|---|
| △★88X-0129-506 | 19VJTP22 Pix Tube |
| 38A5554-000 | Assy. Purity Shld/Degaussing |
| 205X9800-256 | Lateral/Purity Assembly |
| △★202X1110-810 | Yoke, Deflection |
| 208X2000-946 | CRT Socket |
| 297X2000-072 | HV Unit (T701) |
| 6A0397 | Plug, Line Cord |
| 9A2753-003 | Degaussing Coil (L701) |

# INTERFACE BOARD (P305)
## (MODEL 19K4606)

| Ref. No. | Part No. | Description |
|---|---|---|
| **RESISTORS** | | |
| R201 | 340X3910-934 | 91 Ohm, 5%, 1/2W Carbon |
| R203 | 340X3102-934 | 1k Ohm, 5%, 1/2W Carbon |
| R204 | 340X2101-934 | 100 Ohm, 5%, 1/4W Carbon |
| R206 | 340X3331-944 | 330 Ohm, 10%, 1/2W Carbon |
| R207 | 340X3102-934 | 1k Ohm, 5%, 1/2W Carbon |
| R208 | 340X3152-934 | 1.5k Ohm, 5%, 1/4W Carbon |
| R209 | 340X2101-934 | 100 Ohm, 5%, 1/4W Carbon |
| R210 | 340X3102-934 | 1k Ohm, 5%, 1/2W Carbon |
| R211 | 340X2331-934 | 330 Ohm, 5%, 1/4W Carbon |
| R212 | 340X2331-934 | 330 Ohm, 5%, 1/4W Carbon |
| R213 | 340X2331-934 | 330 Ohm, 5%, 1/4W Carbon |
| R214 | 340X2201-934 | 200 Ohm, 5%, 1/4W Carbon |
| R215 | 340X2201-934 | 200 Ohm, 5%, 1/4W Carbon |
| R216 | 340X2201-934 | 200 Ohm, 5%, 1/4W Carbon |
| VR201 | 40X0590-017 | 1.5k Ohm, Black Level Control |
| **CAPACITORS** | | |
| C201 | 45X0524-038 | 1000 uF, 16V Electrolytic |
| **SEMICONDUCTORS** | | |
| TR201 | 86X0121-001 | Transistor (NPN) |
| TR202 | 86X0121-001 | Transistor (NPN) |
| TR203 | 86X0121-001 | Transistor (NPN) |
| TR204 | 86X0066-001 | Transistor (PNP) |
| TR205 | 86X0066-001 | Transistor (PNP) |
| TR206 | 86X0066-001 | Transistor (PNP) |
| TR207 | 86X0121-001 | Transistor (NNP) |
| TR208 | 86X0121-001 | Transistor (NPN) |
| TR209 | 86X0121-001 | Transistor (NPN) |
| ZD201 | 66X0040-018 | Diode, Zener, 6.8v, 5%, 0.5W |
| ZD202 | 66X0040-019 | Diode, Zener, 3.9v, 5%, 0.5W |
| **MISCELLANEOUS** | | |
| J201 | 204X9300-958 | Socket, 6 Pin |
| J202 | 204X9300-958 | Socket, 6 Pin |
| J203 | 206X5019-207 | Socket, 4 Pin |
| P201 | 204X9601-195 | Plug, 6 Pin |
| P202 | 204X9601-195 | Plug, 6 Pin |
| P203 | 204X9600-845 | Plug, 4 Pin |
| P205 | 6A0393-006 | Plug, 6 Pin |




00-4147-04
G07-CB0

**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

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

# REPLACEMENT PARTS LIST - ELECTROHOME 19'' MONITOR

Components identified by the ⚠ 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 |
|---|---|---|
| | Picture Tube 19'' | 17-7198-03 |
| ⚠ | ⚠Deflection Yoke | A29779-D = 21-141-01 |
| | PC Magnet | A75034-B = 29-32-01 |
| ⚠ | ⚠Flyback Transf. | A29951-B |
| ⚠ | ⚠HVR | A46600-A |
| R05 | UNF Resistor 220Ω,25W K | QRF258K-221 |
| C04 | C Capacitor 150pF, AC1.5KV | QCZ0101-005 |
| X01 | Si. Transistor | 2SD870 |
| X02 | Si. Transistor | 2SC1106A |
| SC | Screw #8-⅜ | 31-610818-06 |
| SC | Screw ¼ x ¾ 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 | 33-629-02 |
| | Standoff | 33-670-010R-02 |
| | Wire Terminal (Gnd. Strap) | 34-228-03 |
| | Terminal Lug (Gnd.) | 34-33-04 |
| | Groundstrap Assy. | 34-574-02 |
| | Grounding Spring | 35-212-03 |
| | Wire Hook (Gnd. Strap) | 35-3053-02 |
| | Purity Shield Holddown Clamp | 35-2348-01 |
| | Support Brkt. RH | 35-3890-01 |
| | Support Brkt. LH | 35-3890-02 |
| | Chassis Base | 38-449-02 |
| | Yoke Wedge (3) | 39-1233-01 |

### Purity Shield Ass'y. Parts List

| Symbol | Description | Part Number |
|---|---|---|
| | Degaussing Coil | 21-1007-30 |
| D911, D912 | 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 |
| R921 | Resistor, Wirewound 33Ω, 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 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 |
| C3121 | Comp. R 3.3KΩ½W 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 | Description | Part Number |
|---|---|---|
| L1502 | Linarity Coil | A39835 |
| L1503 | Width Coil | C30380-A |
| L1504 | Heater Choke | C30445-A |

**Transformers**

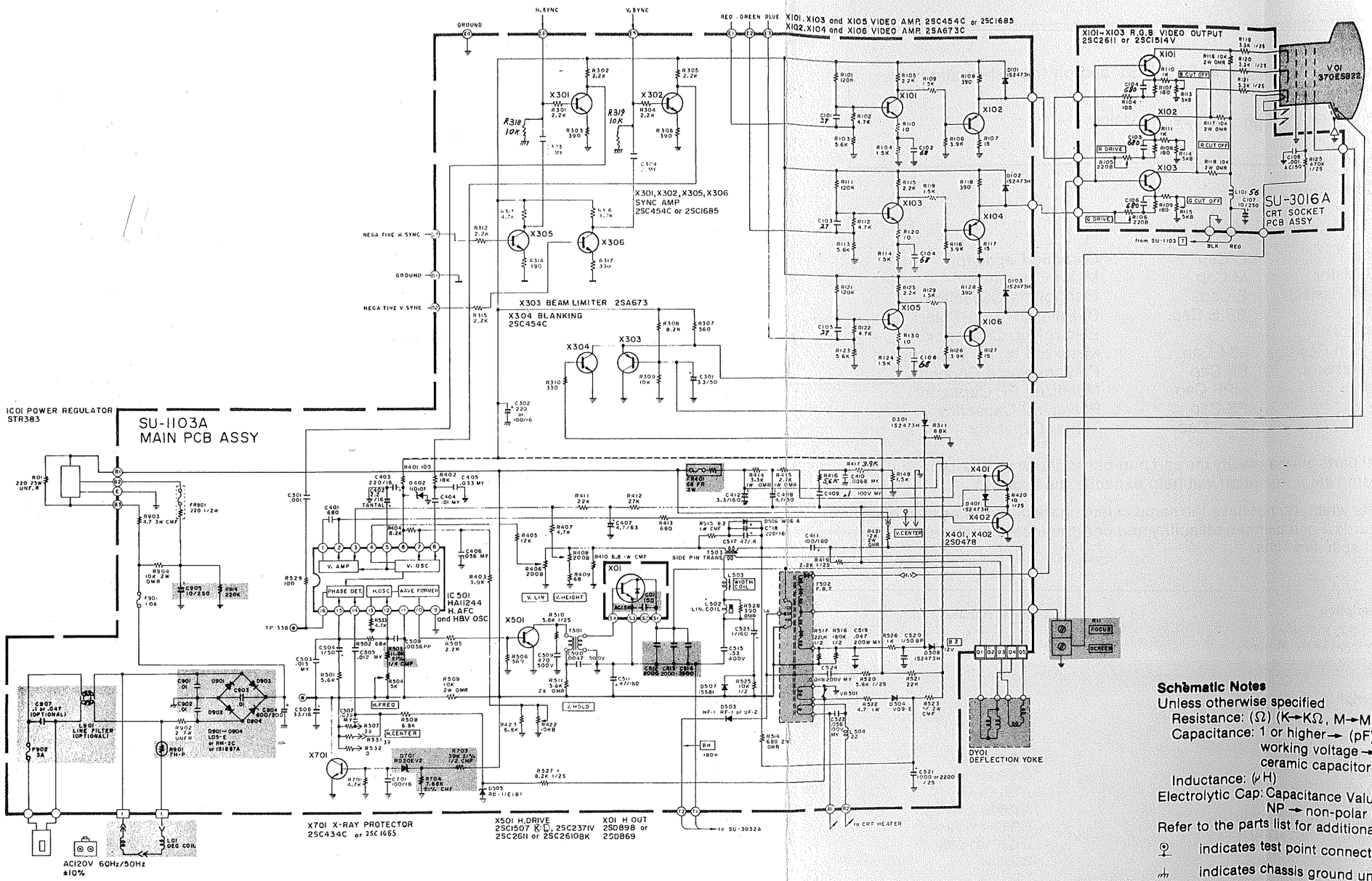
| Symbol | Description | Part Number |
|---|---|---|
| T1501 | Hor. Drive Transf. | A46022-BM |
| T1503 | Side Pin Transf. | C39050-A |

**Semiconductors**

| Symbol | Description | Part Number |
|---|---|---|
| IC1501 | IC | 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 | Description | Part Number |
|---|---|---|
| ⚠F1901 | ⚠Fuse 1.25A | QMF53U1-1R25S |
| ⚠F1902 | ⚠UL Fuse 3A | 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

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

G07-FBO
00-4147-03

# REPLACEMENT PARTS LIST - ELECTROHOME 13'' MONITOR

Components identified by the ⚠ 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 | | | |
| CMF R | : | Coating Metal Film Resistor | MM Cap. | : | Metalized Mylar Capacitor |
| UNF R | : | Nonflammable Resistor | PP Cap. | : | Polypropylene Capacitor |
| F R | : | Fusible Resistor | 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.

| Symbol | Description | Part Number |
|---|---|---|
| | Main P.C.B. Ass'y | SU-1103A |
| | CRT Socket P.C.B. Ass'y | SU-3016A |

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

| Symbol | Description | Part Number |
|---|---|---|
| ⚠V01 | ⚠Picture Tube | 370ESB22(E) |
| ⚠DY01 | ⚠Deflection Yoke | C29123-V |
| | PC Magnet | A76366-A |
| | Wedge | C30006 |
| | ⚠Flyback Transf. | A19183-A |
| ⚠R11 | ⚠Focus V R | A46606-A |
| ⚠R05 | UNF Resistor 220Ω, 25W. K | QRF258K-221 |
| ⚠C04 | ⚠C Capacitor 150 pF, AC1.5KV | QCZ0101-005 |
| X01 | Si. Transistor | 2SD869 |
| IC01 | IC Regulator | STR383 |
| L01 | Degausing Coil | 21-1007-31 |
| | Degausing Coil Pin Terminal (2) | 34-708-01 |
| | Degausing 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 10-½ 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 200Ω | QVZ3230-022 |
| R1408 | V R 200Ω | QVZ3230-022 |
| 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 | QRG029J-123 |
| R1422 | V R 10KΩ | QVZ3224-014H |
| ⚠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 | QRG029J-103 |
| R1511 | OM R 5.6KΩ2W J | QRG029J-562 |
| R1514 | OM R 680Ω2W J | QRG029J-681 |
| R1515 | CMF R 8.2Ω1W J | QRX019J-8R2 |
| R1522 | CMF R 4.7Ω1W J | QRX019J-4R7 |
| R1523 | OM R 56Ω2W J | ORG029J-560 |
| R1528 | OM R 390Ω1W J | ORG019J-391 |
| R1534 | ZN R | ERZ-C05ZK471 |
| VR1501 | ZN R | ERZ-C05DK271 |
| ⚠R1703 | ⚠CMF R 39KΩ½W +1% | QRV122F-3902 |
| ⚠R1704 | ⚠CMF R 7.68KΩ¼W +1% | QRV142F-7681 |
| ⚠R1901 | ⚠Posistor | A75414 |
| R1902 | UNF R 2Ω7W K | QRF076K-2R0 |
| R1903 | CMF R 5.6Ω3W J | QRX039J-5R6 |
| R1904 | OM R 10KΩ2W J | QRG026J-103Z |
| ⚠FR1901 | ⚠F R 220Ω½W 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 |
| ⚠C1512 | ⚠PP Cap. 2000pF DC1500V J | QFZ0082-202 |
| ⚠C1513 | ⚠PP Cap. 2000pF DC1500V J | QFZ0082-202 |
| ⚠C1514 | ⚠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 |
| ⚠C1907 | ⚠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 Chokė | C30333-A |
| L1901 | Line Filter | A39475-J |

**Transformers**

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

| Semiconductors<br>Symbol | Description | Part Number |
|---|---|---|
| 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 |

| Miscellaneous<br>Symbol | Description | Part Number |
|---|---|---|
| ⚠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**

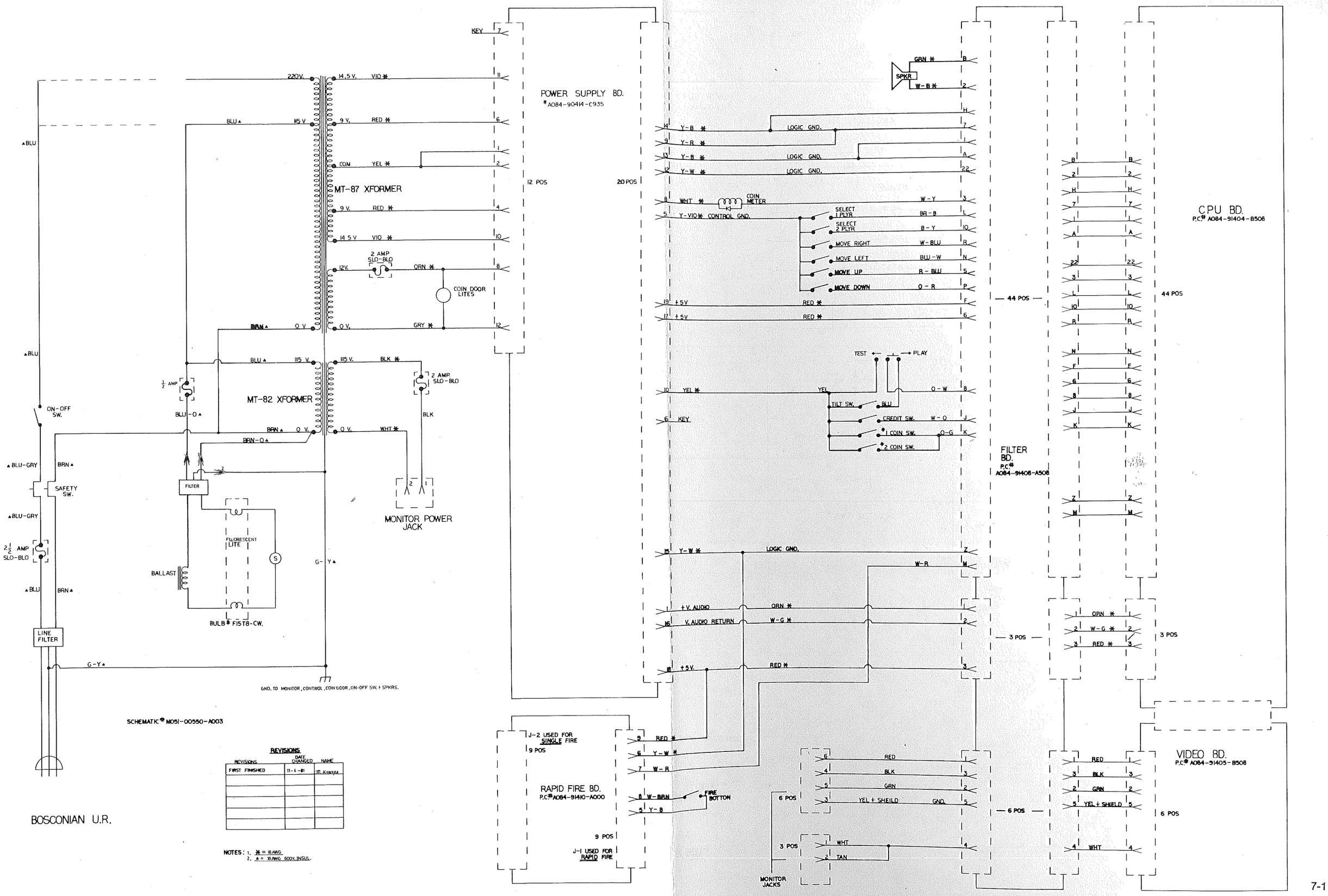
| Symbol | Description | Part Number |
|---|---|---|
| L3101 | Peaking coil | QQL043K-101 |

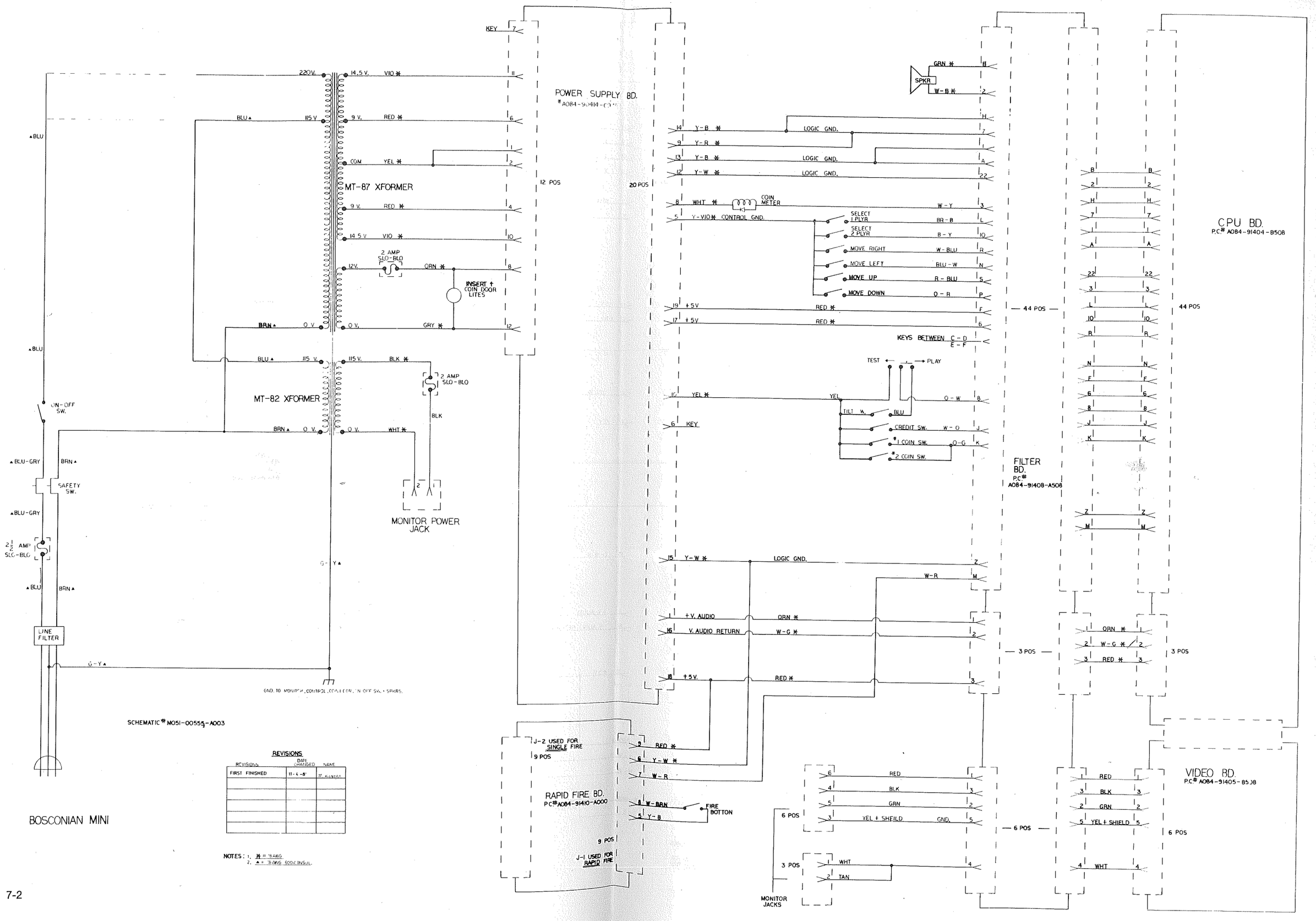
**Semiconductors**

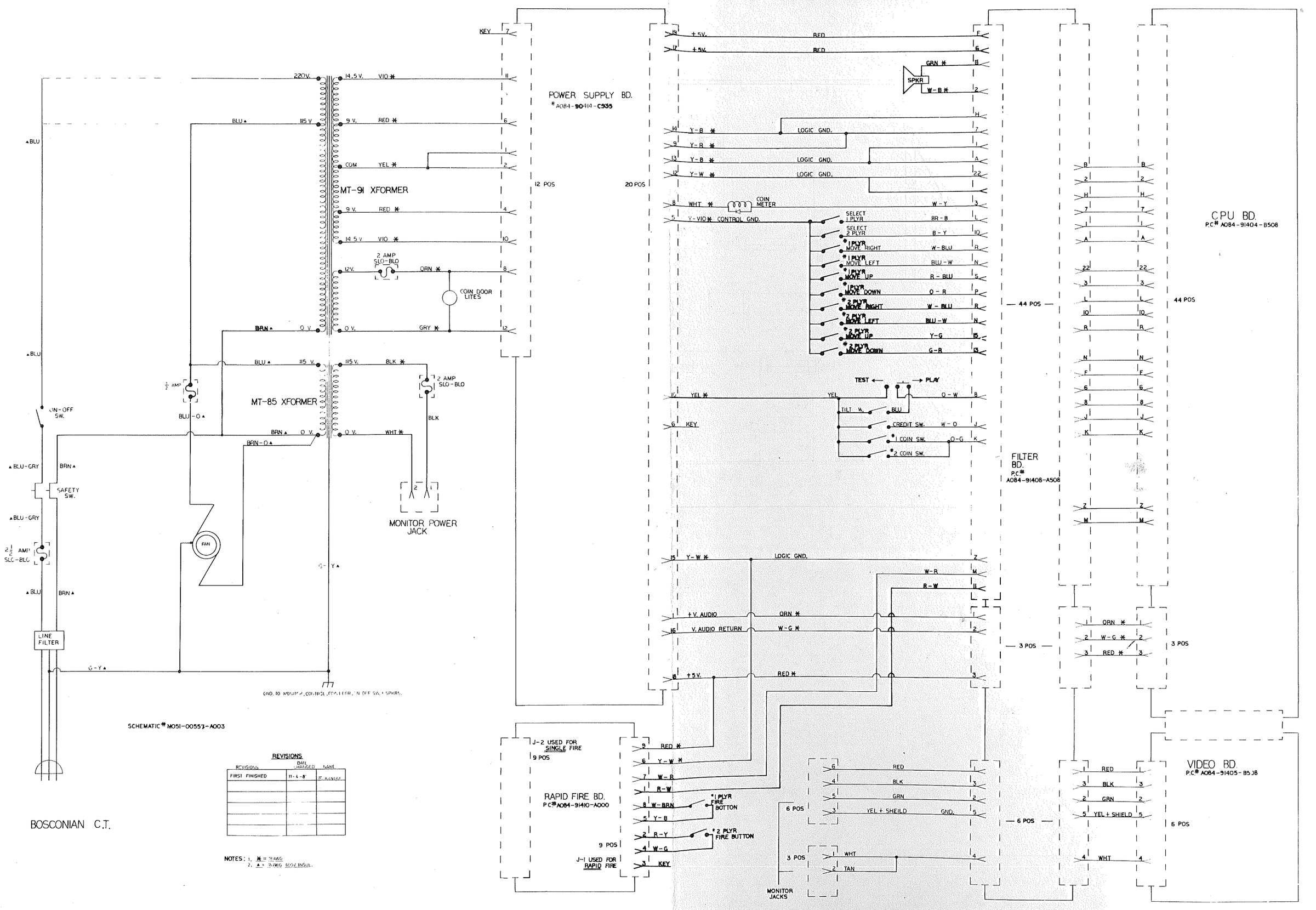
| Symbol | Description | Part Number |
|---|---|---|
| X3101 | Si. Transistor | 2SC2611 |
| X3102 | Si. Transistor | 2SC2611 |
| X3103 | Si. Transistor | 2SC2611 |

**Miscellaneous**

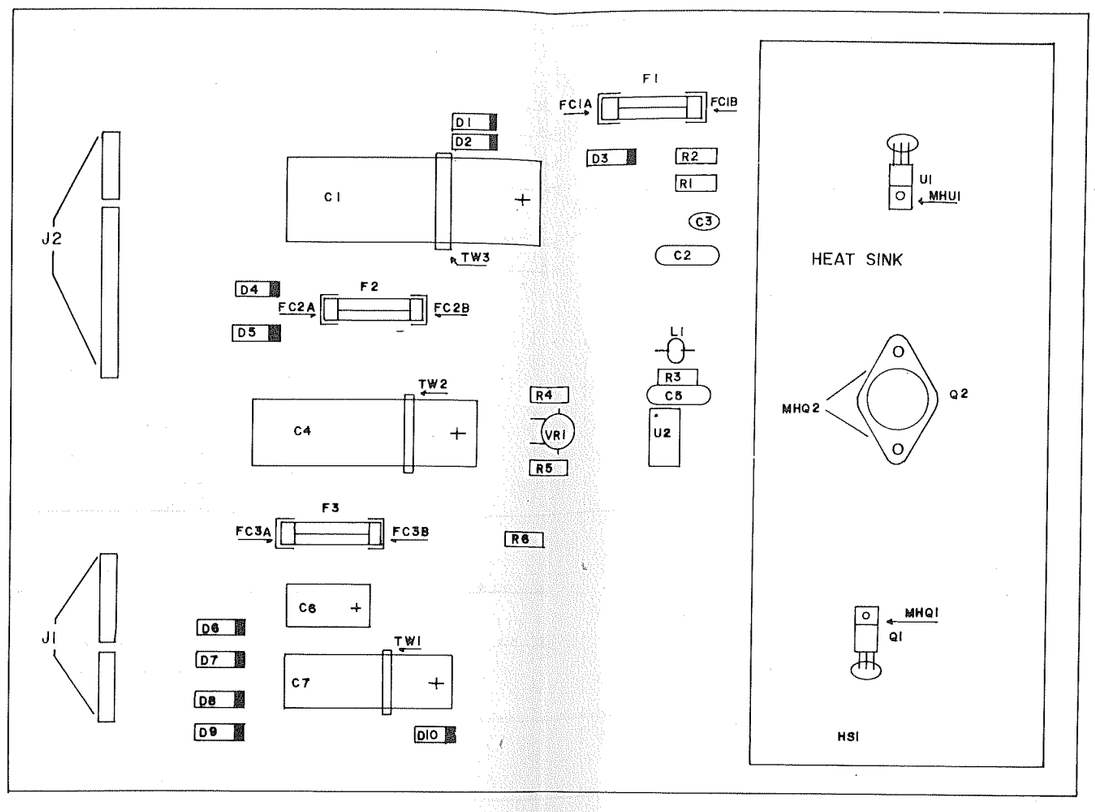
| Symbol | Description | Part Number |
|---|---|---|
| ⚠ | ⚠ CRT Socket | A75522 |


POWER SUPPLY BD.
#A084-90414-C935
12 POS
20 POS
KEY
220V.
14.5 V. VIO *
BLU ▲
115 V
9 V. RED *
COM YEL *
MT-87 XFORMER
9 V. RED *
14.5 V VIO *
12V. 2 AMP SLO-BLO ORN *
COIN DOOR LITES
BRN ▲ 0 V.
0 V. GRY *
BLU ▲ 115 V.
115 V. BLK *
2 AMP SLO-BLO
½ AMP
MT-82 XFORMER
BLU-0 ▲
BRN ▲ 0 V.
0 V. WHT *
BLK
BRN-0 ▲
ON-OFF SW.
▲BLU-GRY
BRN ▲
SAFETY SW.
FILTER
2½ AMP SLO-BLO
▲BLU
BRN ▲
LINE FILTER
BALLAST
FLUORESCENT LITE
S
G-Y ▲
BULB # F15T8-CW.
MONITOR POWER JACK
GND. TO MONITOR, CONTROL, COIN DOOR, ON-OFF SW. + SPKRS.
SCHEMATIC # M051-00550-A003
BOSCONIAN U.R.
REVISIONS
REVISIONS | DATE CHANGED | NAME
FIRST FINISHED | 11-4-81 | M. Konopa
NOTES: 1. * = 18 AWG.
2. ▲ = 18 AWG. 600V. INSUL.
SPKR
GRN *
W-B *
Y-B * LOGIC GND.
Y-R *
Y-B * LOGIC GND.
Y-W * LOGIC GND.
WHT * COIN METER
Y-VIO * CONTROL GND.
SELECT 1 PLYR
SELECT 2 PLYR
MOVE RIGHT
MOVE LEFT
MOVE UP
MOVE DOWN
W-Y
BR-B
B-Y
W-BLU
BLU-W
R-BLU
O-R
+5V RED *
+5V RED *
TEST
PLAY
YEL *
YEL
TILT SW.
BLU
CREDIT SW.
1 COIN SW.
2 COIN SW.
W-O
O-G
O-W
KEY
Y-W * LOGIC GND.
W-R
+V. AUDIO ORN *
V. AUDIO RETURN W-G *
+5V. RED *
J-2 USED FOR SINGLE FIRE
9 POS
RAPID FIRE BD.
P.C.#A084-91410-A000
9 POS
J-1 USED FOR RAPID FIRE
RED *
Y-W *
W-R
W-BRN
Y-B
FIRE BOTTON
6 POS
RED
BLK
GRN
YEL + SHIELD GND.
3 POS
WHT
TAN
MONITOR JACKS
FILTER BD.
P.C.#
A084-91408-A506
— 44 POS —
— 3 POS —
— 6 POS —
CPU BD.
P.C.# A084-91404-B508
44 POS
ORN *
W-G *
RED *
3 POS
VIDEO BD.
P.C.# A084-91405-B508
RED
BLK
GRN
YEL + SHIELD
WHT
6 POS


POWER SUPPLY BD.
* A084-90414-C*
12 POS
20 POS
KEY
220V.
14.5 V.
VIO *
BLU ▲
115 V.
9 V.
RED *
COM
YEL *
MT-87 XFORMER
9 V.
RED *
14.5 V.
VIO *
12V.
ORN *
2 AMP SLO-BLO
INSERT † COIN DOOR LITES
BRN ▲
0 V.
GRY *
BLU ▲
115 V.
BLK *
2 AMP SLO-BLO
MT-82 XFORMER
BLK
BRN ▲
0 V.
WHT *
ON-OFF SW.
▲BLU-GRY
SAFETY SW.
2½ AMP SLO-BLO
▲BLU
LINE FILTER
G-Y ▲
MONITOR POWER JACK
GND. TO MONITOR, CONTROL, COAX (COM.), ON OFF SW., + SPARE
SCHEMATIC * M051-00555-A003
BOSCONIAN MINI
REVISIONS
REVISIONS | DATE CHANGED | NAME
FIRST FINISHED | 11-4-81 | # SLEEGER
NOTES: 1. * = 18AWG
2. ▲ = 18AWG 600V INSUL.
SPKR
GRN *
W-B *
Y-B *
Y-R *
Y-W *
LOGIC GND.
WHT *
COIN METER
Y-VIO * CONTROL GND.
SELECT 1 PLYR
SELECT 2 PLYR
MOVE RIGHT
MOVE LEFT
MOVE UP
MOVE DOWN
+5V
RED *
KEYS BETWEEN C-D E-F
TEST
PLAY
YEL *
TILT
CREDIT SW.
*1 COIN SW.
*2 COIN SW.
FILTER BD.
P.C.* A084-91408-A508
44 POS
CPU BD.
P.C.* A084-91404-B508
+V. AUDIO
V. AUDIO RETURN
+5 V.
3 POS
VIDEO BD.
P.C.* A084-91405-B508
6 POS
RED
BLK
GRN
YEL + SHIELD
GND.
WHT
TAN
MONITOR JACKS
J-2 USED FOR SINGLE FIRE
9 POS
RAPID FIRE BD.
P.C.* A084-91410-A000
FIRE BOTTON
J-1 USED FOR RAPID FIRE


POWER SUPPLY BD.
# A084-90414-C935
12 POS
KEY
220V.
14.5 V. VIO *
115 V
9 V. RED *
COM YEL *
MT-91 XFORMER
9 V. RED *
14.5 V VIO *
12V. ORN *
2 AMP SLO-BLO
COIN DOOR LITES
0 V.
GRY *
BRN
BLU
BLK *
MT-85 XFORMER
2 AMP SLO-BLO
BLK
WHT *
BRN-O
BLU-O
ON-OFF SW.
BLU-GRY
SAFETY SW.
2 1/2 AMP SLO-BLO
FAN
G-Y
LINE FILTER
MONITOR POWER JACK
GND. TO MONITOR, COIN DOOR, CONTROLLER, ON OFF SW. + SPKRS.
SCHEMATIC # M051-00557-A003
BOSCONIAN C.T.
REVISIONS
REVISIONS
DATE CHANGED
NAME
FIRST FINISHED
11-6-81
NOTES: 1. * = 18 AWG
2. ▲ = 18 AWG 600V INSUL.
20 POS
+5V. RED
GRN *
SPKR
W-B *
Y-B *
Y-R *
Y-W *
LOGIC GND.
WHT *
COIN METER
Y-VIO * CONTROL GND.
SELECT 1 PLYR
SELECT 2 PLYR
1 PLYR MOVE RIGHT
1 PLYR MOVE LEFT
1 PLYR MOVE UP
1 PLYR MOVE DOWN
2 PLYR MOVE RIGHT
2 PLYR MOVE LEFT
2 PLYR MOVE UP
2 PLYR MOVE DOWN
W-Y
BR-B
B-Y
W-BLU
BLU-W
R-BLU
O-R
W-BLU
BLU-W
Y-G
G-R
TEST
PLAY
YEL *
O-W
TILT
BLU
CREDIT SW.
W-O
1 COIN SW.
O-G
2 COIN SW.
KEY
FILTER BD.
P.C.#
A084-91408-A508
44 POS
CPU BD.
P.C.# A084-91404-B508
3 POS
+V. AUDIO
V. AUDIO RETURN
ORN *
W-G *
RED *
W-R
R-W
J-2 USED FOR SINGLE FIRE
9 POS
RAPID FIRE BD.
P.C.#A084-91410-A000
J-1 USED FOR RAPID FIRE
1 PLYR FIRE BOTTON
2 PLYR FIRE BUTTON
R-Y
W-BRN
Y-B
W-G
6 POS
RED
BLK
GRN
YEL + SHEILD
GND.
3 POS
WHT
TAN
MONITOR JACKS
VIDEO BD.
P.C.# A084-91405-B508

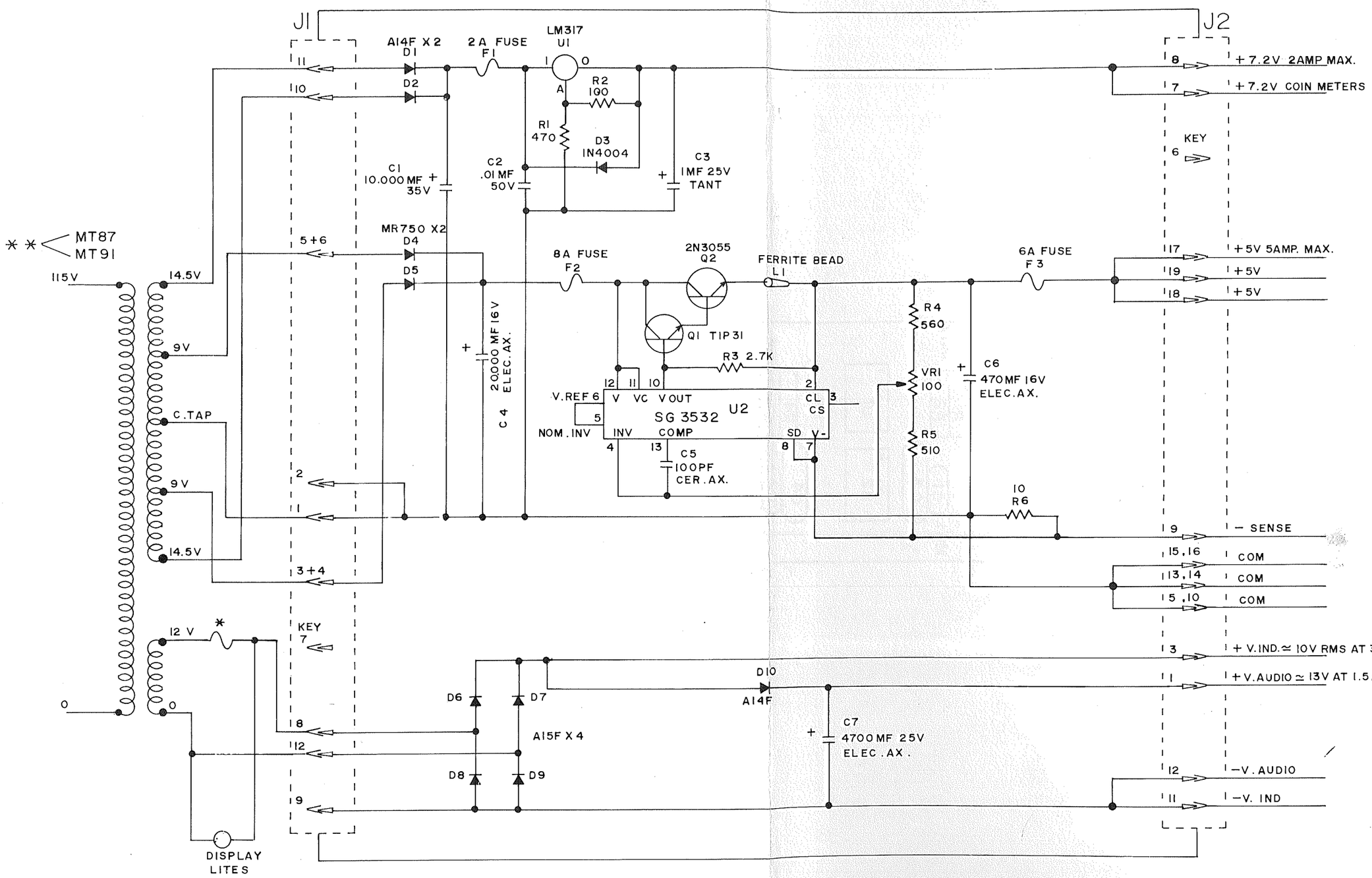
| DESIGNATION | DESCRIPTION |
|---|---|
| C1 | 10000 MF 35V AX. ELEC. |
| C2 | .01 MF 50V AX. CER. |
| C3 | 1MF 25V TANT. |
| C4 | 20000 MF 16V AX. ELEC. |
| C5 | 100 PF 50V AX. CER |
| C6 | 470 MF 16V AX. ELEC. |
| C7 | 4700 MF 25V " " |
| R1 | 470 OHM 1/4W 5% CRBN |
| R2 | 100 " " " " |
| R3 | 2.7K " " " " |
| R4 | 560 " " " " |
| R5 | 510 " " " " |
| R6 | 10 " " " " |
| VR1 | 100 OHM 1/4W CRBN. FLM. |
| D1, D2 | A14F |
| D3 | IN4004 |
| D4, D5 | MR750 |
| D6-D9 | A15F |
| D10 | A14F |
| Q1 | TIP31 |
| Q2 | 2N3055 |
| U1 | LM317 |
| U2 | 3532 |
| L1 | FERROXCUBE BEAD |
| HS1 | HEAT SINK |
| F1 | FUSE 2A |
| F2 | " 8A |
| F3 | " 6A |
| FC1A, FC1B, FC2A FC2B, FC3A, FC3B | FUSECLIP W/ STOP " " |
| J1 | CONN. KK.156 (RA)(5-PIN)(6-PIN) |
| J2 | " " (RA)(5-PIN)(13-PIN) |
| MHQ1 | MOUNTING HARDWARE Q1<br>(1) SCREW 4-40X10 SLT RND<br>(1) WSH.4 120-.250-018<br>(1) HEXNUT 4-40<br>(1) SHOULDER WSH. 974-302<br>THERMAL COMPOUD AS REQ.<br>(1) TO-220 INSULATOR RT-3.5 MICA |
| MHQ2 | MOUNTING HARDWARE Q2<br>(2) SCREW 4-40X10 SLT RND<br>(2) WSH 4 120-.250-018<br>(2) HEXNUT 4-40<br>(2) SHOULDER WSH. 974-302<br>THERMAL COMPOUD AS REQ.<br>(1) TO-3 RT-1.5 FILM |
| MHU1 | MOUNTING HARDWARE U1<br>(1) SCREW 4-40X10 SLT RND<br>(1) WSH 4 120-.250-018<br>(1) HEXNUT 4-40<br>(1) SHOULDER WSH. 974-302<br>THERMAL COMPOUD AS REQ<br>(1) TO-220 INSULATOR RT-3.5 MICA |
| TW1-TW3 | TIE WRAPS |




| DESCRIPTION | QTY | DESIGNATION | PART NUMBER |
|---|---|---|---|
| 100 PF 50v AX.CER. | 1 | C5 | **0508-00800-2100** |
| .01MF " " " | 1 | C2 | 0171-097H2-JXXX |
| 1MF 25v TANT. | 1 | C3 | 0935-00814-0100 |
| 470MF " AX.ELEC. | 1 | C6 | 0175-271EX-EXXX |
| 4700MF " " " | 1 | C7 | **0508-00800-2200** |
| 10000MF 35v AX.ELEC. | 1 | C1 | 0175-322GX-EXBX |
| 20000 16v MF " " | 1 | C4 | 0935-00814-0800 |
| 10 OHM 1/4w 5% CBN | 1 | R6 | 0062-051B3-1XXX |
| 100 " " " " | 1 | R2 | 0062-110B3-1XXX |
| 470 " " " " | 1 | R1 | 0062-156B3-1XXX |
| 510 " " " " | 1 | R5 | 0062-159B3-1XXX |
| 560 " " " " | 1 | R4 | 0062-162B3-1XXX |
| 2.7K " " " " | 1 | R3 | 0062-199B3-1XXX |
| 100 " " CBN FLM | 1 | VR1 | 0063-025AX-1DEX |
| 1N4004 | 1 | D3 | 0508-00801-0200 |
| A14F | 3 | D1,D2,D10 | 0064-168XX-XXGX |
| A15F | 4 | D6-D9 | 0064-169XX-XXGX |
| MR750 | 2 | D4,D5 | 0064-303XX-XXJX |
| TIP31 | 1 | Q1 | 0065-485XX-XXXX |
| 2N3055 | 1 | Q2 | 0935-00800-0000 |
| 3532 | 1 | U2 | 0066-044BX-XXXX |
| LM317 | 1 | U1 | 0935-00804-3600 |
| FERROXCUBE BEAD | 1 | L1 | 0017-00009-0225 |
| HEAT SINK | 1 | HS1 | 0068-045XX-ABDX |
| FUSE 2A | 1 | F1 | 0017-00003-0005 |
| FUSE 6A | 1 | F3 | 0017-00003-0008 |
| FUSE 8A | 1 | F2 | 0017-00003-0184 |
| FUSECLIP | 6 | FC1A,FC1B,FC2A, FC2B,FC3A,FC3B | 0017-00003-0214 |
| KK 156 (RA) (5) | 2 | J1,J2 | 3000-16387-0500 |
| KK 156 (RA) (6) | 1 | J1 | 3000-16387-0600 |
| KK 156 (RA) (13) | 1 | J2 | 3000-16387-1300 |
| SCREW 4-40x10 | 4 | MHU1,MHQ1,MHQ2 | 0017-00101-0727 |
| WSH 4 120-.250-018 | 4 | " " " | 0017-00104-0071 |
| HEXNUT 4-40 | 4 | " " " | 0017-00103-0002 |
| SHOULDER WSH | 4 | " " " | 0017-00042-0109 |
| THERMAL COMPOUND | AS REQ. | " " " | 0017-00009-0204 |
| TO-220,INSULATOR | 2 | MHU1,MHQ1 | 0017-00003-0205 |
| TO-3 INSULATOR | 1 | MHQ2 | 0017-00042-0108 |
| TIE WRAPS | 3 | TW1-TW3 | 0017-00042-0105 |
| **PCB** | 1 | | **A080-90414-C935** |

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

| | | | |
|---|---|---|---|
| DIM. TOLERANCES 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: RALLY-X | MIDWAY MFG. CO. FRANKLIN PK., IL 60131 A BALLY CO | |
| | DRN. MMM DATE 2/9/82 SCALE | | |
| | MECH CHK. MATL | ASSEMBLY DRWNG PWR. SUPP. A084-90414-C935 | REVISIONS |
| | FINISH | PART NO. M051-00935-C028 | |




NOTES:

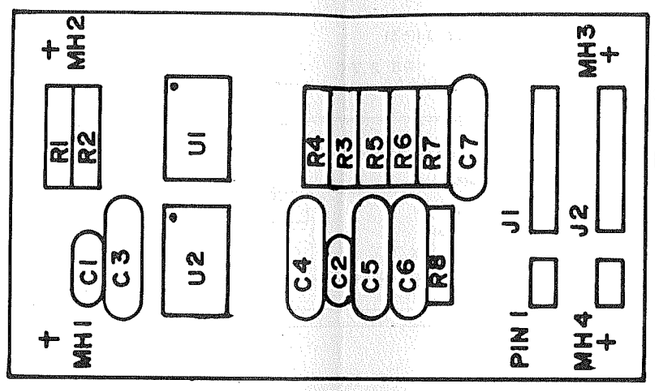
* 2AMP FUSE W/O DISPLAY LITES

** MT87 FOR UR.
MT91 FOR C.T.

| | | | | | |
|---|---|---|---|---|---|
| DO NOT SCALE DWG | | HEAT TREAT | SCALE FULL | USED ON RALLY-X | REVISIONS |
| DIM. TOLERANCES UNLESS SPECIFIED | DRN. M.M. | MAT'L | | NO. REQ'D 1 PER | MIDWAY MFG. CO. FRANKLIN PK. ILL. |
| CONCENTRICITY T I R .003<br>FRACTIONAL 1/64<br>DECIMAL .005<br>HOLE DIA. +.002 .000 | CKD. | FINISH | SCHEMATIC POWER SUPPLY A084-90414-C935 | | ART NO. M051-00935-C025 |
| | DATE 2-10-82 | | | | |

## DESIGNATION LIST

| DESIGNATION | DESCRIPTION |
|---|---|
| C1, C2 | .1MF 100V MYLAR |
| C3-C7 | .01MF 25V AX CER |
| R1-R4 | 1MEG OHM 1/4w 5% CRBN RES |
| R5 | 1K " " " " " |
| R6 | 68 " " " " " |
| R7 | 1K " " " " " |
| R8 | 68 " " " " " |
| U1 | LM556 |
| U2 | 7400 |
| J1, J2 | KK.156 VERT 2(6-PIN) 2(2-PIN) |
| MH1-MH4 | SNAP BUSHING 1/4" |



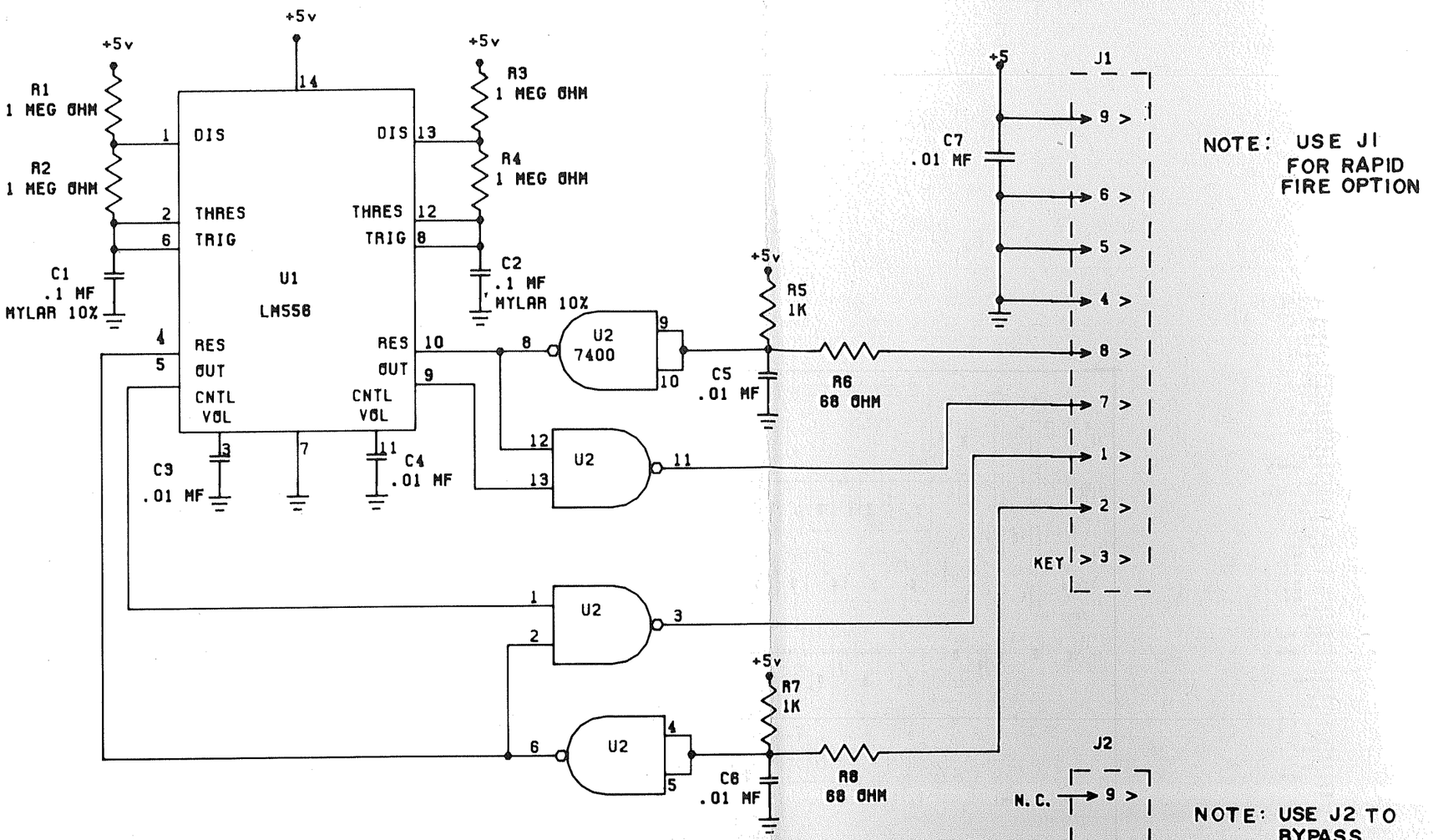

## CROSS REFERENCE LIST

| DESCRIPTION | QUANTITY | DESIGNATION | PART # |
|---|---|---|---|
| .01MF 25VAXCER | 5 | C3-C7 | 0508-00800-0800 |
| .1MF 100V 10% MYLAR | 2 | C1, C2 | 0508-00800-2300 |
| 68 OHM 1/4w 5% CRBN RES. | 2 | R6, R8 | 0062-09883-1XXX |
| 1K " " " " " | 2 | R5, R7 | 0062-17983-1XXX |
| 1MEG " " " " " | 4 | R1-R4 | 0062-32383-1XXX |
| LM556 | 1 | U1 | 0508-00803-5500 |
| 7400 | 1 | U2 | 0508-00803-5600 |
| KK.156 CON. (2-PIN) | 2 | J1, J2 | 3000-16335-0200 |
| (6-PIN) | 2 | J1, J2 | 3000-16335-0600 |
| MOUNTING HARDWARD SNAP BUSHING 1/4" | 4 | MH1-MH4 | 0017-00042-0014 |
| RAPID FIRE P.C | 1 | A080-91410-A000 | A080-91410-A000 |

PROJECT ENG: JERRY SZERSZEN



| | | | |
|---|---|---|---|
| DIM. TOLERANCES UNLESS OTHERWISE SPEC | GALAGA | | MIDWAY MFG. CO. FRANKLIN PK., IL. 60131 A BALLY CO. |
| CONCENTRICITY T I R .002 | DRWN MM | DATE 09-30-81 | SCALE FULL |
| FRACTIONAL ± 1/64 | MECH CHK | MATL | RAPID FIRE P.C. ASSEMBLY DRAWING A082-91410-A000 |
| DECIMAL ± 005 | ELEC CHK | FINISH | REVISIONS |
| HOLE DIA + 002 -- 000 | | | PART NO M05-1-0001-1:4-A-0001 |
| ANGLE ± 1/2° | | | |
| DO NOT SCALE DWG | | | |



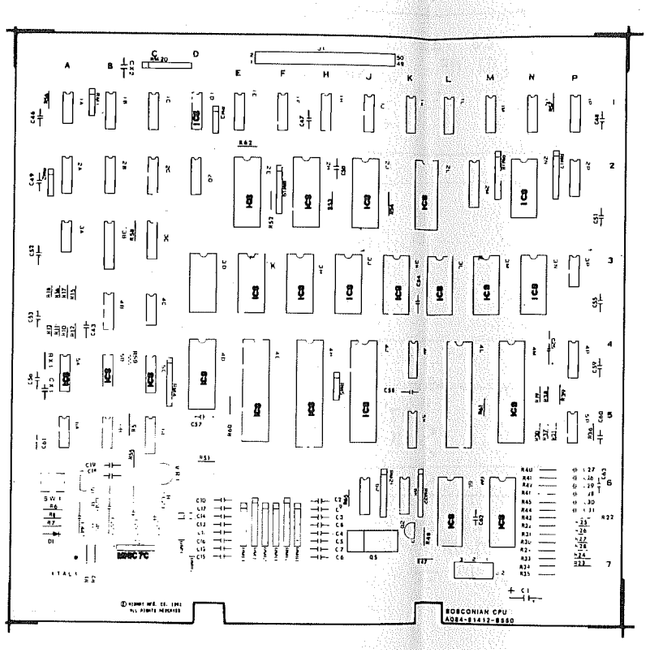

M051-00114-A002

| | | | |
|---|---|---|---|
| CKD. Y.S. | DO NOT SCALE DWG. | | REVISIONS |
| DRN. TJK | DATE 9/30/81 | USED ON GALAGA | MIDWAY MFG. CO. FRANKLIN PK. ILL. |
| heat treat | scale FULL | NO. REQ'D 1 PER | |
| mat'l. | RAPID FIRE P.C. | | PART NO. A082-91410-A000 |
| finish | | | |

# DESIGNATION LIST

| DESIGNATION | DESCRIPTION |
|---|---|
| C1 | 470 MF ELEC. |
| C2—C17 | .01 MF CER. |
| C18 | .1MF " |
| C19 | .01 MF " |
| C20 | 22 MF ELEC. |
| C21 | 220 MF " |
| C22 | 100 MF " |
| C23,C24 | .15 MF TANT. |
| C25 | 10 MF ELEC. |
| C26—C29 | .01 MF POLY. |
| C30,C31 | .001 MF " |
| C32—C42 | NOT USED |
| C43 | .0022 MF CER. |
| C44 | 10 MF ELEC. |
| C45 | 100 PF CER. |
| C46—C65 | .1 MF " |
| CX1 | NOT USED |
| CX2 | 100 PF CER. |
| | |
| R1,R2 | 330 OHM 1/4w 5% CRBN. |
| R3,R4 | NOT USED |
| R5 | 100 OHM 1/4w 5% CRBN. |
| R6 | 1K " " " " |
| R7,R8 | 10K " " " " |
| R9 | NOT USED |
| R10 | 10K OHM 1/4w 5% CRBN. |
| R11 | 22K " " " " |
| R12 | 47K " " " " |
| R13 | 100K " " " " |
| R14 | NOT USED |
| R15 | 470 OHM 1/4w 5% CRBN. |
| R16 | 1K " " " " |
| R17 | 2.2K " " " " |
| R18 | 4.7K " " " " |
| R19 | 10K " " " " |
| R20 | 3.3K " " " " |
| R21 | 33K " " " " |
| R22 | 220K " " " " |
| R23 | 22K " " " " |
| R24 | 100K " " " " |
| R25 | 4.7K " " " " |
| R26 | 10K " " " " |
| R27 | 22K " " " " |
| R28 | 47K " " " " |
| R29 | 4.7K " " " " |
| R30 | 10K " " " " |
| R31 | 22K " " " " |
| R32,R33 | 47K " " " " |
| R34 | 10K " " " " |
| R35 | 150K " " " " |
| R36 | 33K " " " " |
| R37 | 10K " " " " |
| R38 | 3.3K " " " " |
| R39 | 2.2K " " " " |
| R40 | 470K " " " " |
| R41 | 22K " " " " |
| R42 | 150K " " " " |
| R43 | 4.7K " " " " |
| R44 | 10K " " " " |
| R45 | 22K " " " " |
| R46 | 47K " " " " |
| R47,R48 | 470 " " " " |
| R49,R50 | NOT USED |
| R51 | 10K OHM 1/4w 5% CRBN. |
| R52—R54 | 1K " " " " |
| R55 | 10K " " " " |
| R56—R62 | 1K " " " " |
| R63,R64 | NOT USED |
| R65 | 4.7K OHM 1/4w 5% CRBN. |
| RX1 | 1K " " " " |
| | |
| RM1—RM5 | 1K OHM 5 PIN SIP. |
| RM4 | 1K " 9 PIN " |
| RM5 | 1K " 8 PIN " |
| RM6,RM7 | 1K " 9 PIN " |
| RM8 | NOT USED |
| RM9 | 1K OHM 8 PIN SIP. |
| RM10—RM13 | 2.2K " 8 PIN " |
| RM14,RM15 | NOT USED |
| RM16 | 220 OHM 8 PIN SIP. |
| RM17—RM20 | 2.2K " 9 PIN " |
| RM21,RM22 | 4.7K " " " |
| | |
| VR1 | 1K POT |

| DESIGNATION | DESCRIPTION |
|---|---|
| D1 | IN9148 |
| | |
| Q1 | 2N3391A |
| Q2 | 2N4403 |
| Q3,Q4 | NOT USED |
| Q5 | TIP 110 |
| | |
| IC 1A | 74LS107 |
| " 1B | 74LS283 |
| " 1C | 74LS174 |
| " 1D | FROM BS-1 |
| " 1E,1F,1H,1J,1K,1L,1M,1N | 74LS367 |
| " 1P | 74LS138 |
| " 2A,2B | 7489 |
| " 2C | 74LS157 |
| " 2D | 74LS158 |
| " 2E,2H,2J | 08XX CUSTOM IC |
| " 2L | 05XX " " |
| " 2M | 74LS245 |
| " 2N | STATIC RAM 2K X 8 |
| " 2P | 74LS258 |
| " 3A | 4066 CMOS |
| " 3B | 74LS273 |
| " 3C | 74LS259 |
| " 3D | NOT USED |
| " 3E | EPROM BS-G |
| " 3H | " BS-F |
| " 3J | " BS-E |
| " 3K | " BS-D |
| " 3L | " BS-C |
| " 3M | " BS-B |
| " 3N | " BS-A |
| " 3P | 74LS32 |
| " 4B | 74LS139 |
| " 4C | 74LS258 |
| " 4D | 07XX CUSTOM IC |
| " 4E | Z-80A |
| " 4H | 81XX CUSTOM IC |
| " 4J | Z-80A |
| " 4K | 74LS151 |
| " 4L | NOT USED |
| " 4M | Z-80A |
| " 4P | 74S139 |
| " 5A | 74LS366 |
| " 5B | 74107 |
| " 5C | FROM BS-2 |
| " 5K | 74LS151 |
| " 5P | LM324 |
| " 6A | 74LS393 |
| " 6B | 74128 |
| " 6C | 74LS109 |
| " 6L | 50XX CUSTOM IC |
| " 6M | 54XX " " |
| " 7C | M83730 |
| | |
| IC8 1D | 18 PIN SOCKET |
| " 2E, 2H, 2J, 2L | 28 PIN " |
| " 2N,3E,3H,3J,3K,3L,3M,3N | 24 PIN " |
| " 4D | 28 PIN " |
| " 4E | 40 PIN " |
| " 4H | 42 PIN " |
| " 4J,4M | 40 PIN " |
| " 5A | 16 PIN " |
| " 5B | 14 PIN " |
| " 6C | 16 PIN " |
| " 6L,6M | 28 PIN " |
| | |
| XTAL 1 | 18.432 MHZ CRYSTAL |
| SW 1 | AKC-8 PB SWITCH |
| DIP SW 6J,6K | 8 POS. DIP SWITCH |
| J1 | CONN. R.A.HEADER 50 PIN |
| J2 | CONN. P.C.B. HEADER 3 PIN |
| MHC7C | MOUNTING HARDWARE |
| | — (2) 4-40 HEX NUT |
| | — (2) 4-40 X 8 BLT PAN M.S. |
| | — (2) WSH 4 .125-250-032 FLT. ST |
| | — (2) WSH 4 .120-250-018 EXT. ST |
| P.C.B. | BOSCONIAN CPU BD. |

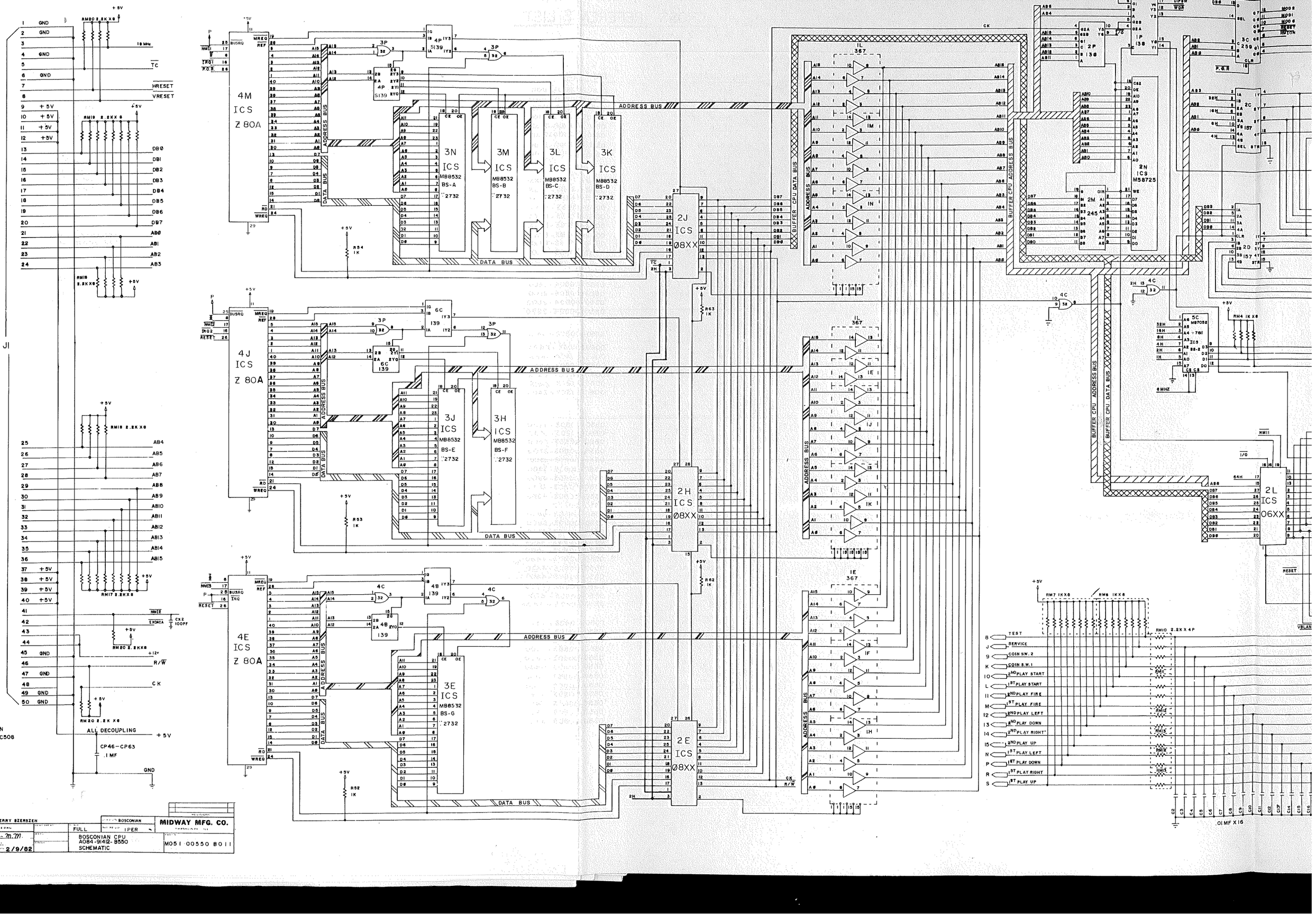



# CROSS REFERENCE LIST

| DESCRIPTION | QUAN | DESIGNATION | PART NO. |
|---|---|---|---|
| 100 PF CER. | 2 | C45,CX2 | 0550-00800-0900 |
| .001 MF POLY. | 2 | C30,C31 | 0550-00800-1100 |
| .0022 MF CER. | 1 | C43 | 0550-00800-0800 |
| .01 MF " | 17 | C2—C17,C19 | 0550-00800-0700 |
| .01 MF POLY. | 4 | C26—C29 | 0550-00800-1000 |
| .1 MF CER. | 19 | C18,C46—C63 | 0550-00800-0600 |
| .15 MF TANT. | 2 | C23,C24 | 0560-00800-1200 |
| 10 MF ELEC. | 2 | C25,C44 | 0560-00800-1700 |
| 22 MF " | 1 | C20 | 0550-00800-1800 |
| 100 MF " | 1 | C22 | 0650-00800-1500 |
| 220 MF " | 1 | C21 | 0550-00800-1400 |
| 470 MF " | 1 | C1 | 0550-00800-1300 |
| | | | |
| 100 OHM 1/4w 5% CRBN | 1 | R5 | 0062-11083-1XXX |
| 330 " " " " | 2 | R1,R2 | 0062-14493-1XXX |
| 470 " " " " | 3 | R15,R47,R48 | 0062-15883-1XXX |
| 1K " " " " | 13 | R6,R16,R62-R54,R56-R62, RX1 | 0062-17993-1XXX |
| 2.2K " " " " | 2 | R17,R39 | 0062-19893-1XXX |
| 3.3K " " " " | 2 | R20,R38 | 0062-20393-1XXX |
| 4.7K " " " " | 5 | R19,R25,R29,R43,R65 | 0062-21183-1XXX |
| 10K " " " " | 11 | R7,R8,R10,R11,R26,R30,R54, R37,R44,R51,R66 | 0062-22783-1XXX |
| 22K " " " " | 8 | R11,R23,R27,R31,R41,R45 | 0062-24393-1XXX |
| 33K " " " " | 2 | R21,R36 | 0062-25183-1XXX |
| 47K " " " " | 5 | R12,R28,R32,R33,R40 | 0062-25993-1XXX |
| 100K " " " " | 2 | R13,R24 | 0062-27583-1XXX |
| 150K " " " " | 2 | R35,R42 | 0062-28393-1XXX |
| 220K " " " " | 1 | R22 | 0062-29183-1XXX |
| 470K " " " " | 1 | R40 | 0062-30783-1XXX |
| | | | |
| 220 OHM 9 PIN | 1 | RM16 | 0550-00804-1800 |
| 1K " 5 PIN | 5 | RM1-RM5,RM9 | 0550-00804-1300 |
| 1K " 9 PIN | 3 | RM4,RM6,RM7 | 0550-00804-1500 |
| 2.2K " 8 PIN | 4 | RM10-RM13 | 0550-00804-1900 |
| 2.2K " 9 PIN | 4 | RM17-RM20 | 0550-00804-1600 |
| 4.7K " 9 PIN | 2 | RM21,RM22 | 0550-00804-1700 |
| | | | |
| 1K POT | 1 | VR1 | 0508-00804-1300 |
| | | | |
| IN9148 | 1 | D1 | 0550-00801-0100 |
| | | | |
| 2N3391A | 1 | Q1 | 0550-00802-0200 |
| 2N4403 | 1 | Q2 | 0550-00802-0100 |
| TIP110 | 1 | Q5 | 0550-00802-0300 |
| | | | |
| 08XX CUSTOM IC | 1 | IC2L | 0068-008CX-XAPX |
| 07XX " " | 1 | " 4D | 0068- 008CX-XAPX |
| 08XX " " | 3 | " 2E,2H,2J | 0068- 007CX-XAPX |
| 50XX " " | 1 | " 6L | 0068-012CX-XAPX |
| 51XX " " | 1 | " 4H | 0068-008CX-XAPX |
| 54XX " " | 1 | " 5M | 0068-009CX-XAPX |
| 74LS32 | 2 | " 3P,4C | 0550-00803-0500 |
| 7489 | 2 | " 2A,2B | 0550-00803-0300 |
| 74107 | 1 | " 5B | 0550-00803-7200 |
| 74LS107 | 1 | " 1A | 0550-00803-0600 |
| 74128 | 1 | " 6B | 0550-00803-0400 |
| 74LS138 | 2 | " 1P,2P | 0550-00803-0700 |
| 745139 | 1 | " 4P | 0550-00803-0900 |
| 74LS139 | 2 | " 4B,6C | 0550-00803-0800 |
| 74LS151 | 2 | " 4K,5K | 0550-00803-1000 |
| 74LS157 | 1 | " 2C | 0550-00803-1100 |
| 74LS158 | 1 | " 2D | 0550-00803-1800 |
| 74LS174 | 1 | " 1C | 0550-00803-1300 |
| 74LS245 | 1 | " 2M | 0550-00803-1400 |
| 74LS259 | 1 | " 3C | 0550-00803-1600 |
| 74LS273 | 1 | " 3B | 0550-00803-1600 |
| 74LS283 | 1 | " 1B | 0550-00803-1700 |
| 74LS367 | 8 | " 1E,1F,1H,1J,1K,1L,1M,1N | 0550-00803-1800 |
| 74LS368 | 1 | " 5A | 0550-00803-1900 |
| 74LS393 | 1 | " 6A | 0550-00803-2000 |
| LM324 | 1 | " 6P | 0550-00803-0200 |
| M83730 | 1 | " 7C | 0068-188XX-XX4X |
| 4066 CMOS | 1 | " 3A | 0508-00803-5300 |

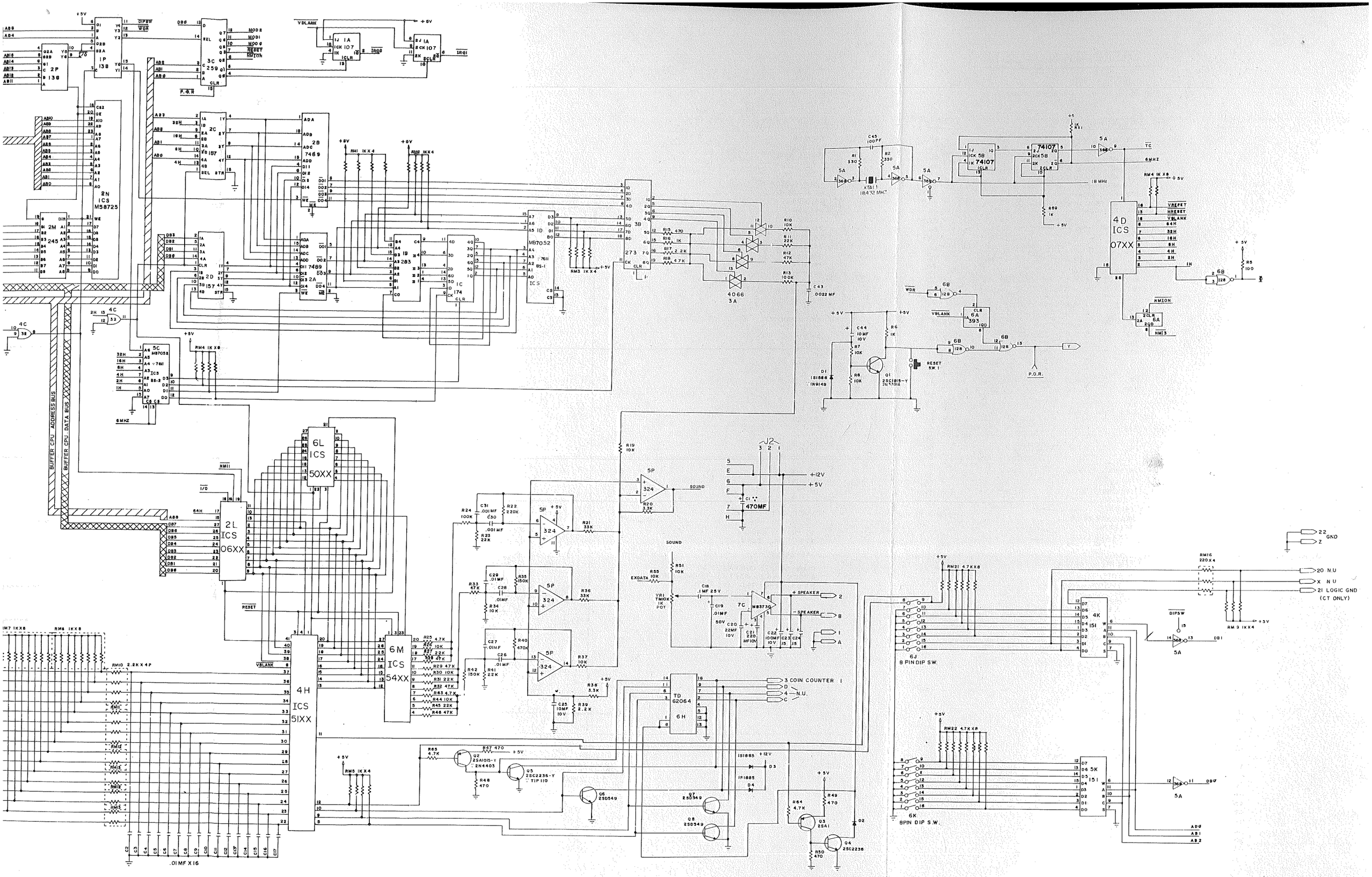
| DESCRIPTION | QUAN | DESIGNATION | PART NO. |
|---|---|---|---|
| PROM BS-1 | 1 | IC 1D | 0550-00803-3100 |
| " BS-2 | 1 | " 5C | 0550-00803-3200 |
| EPROM BS-A | 1 | " 3N | 0550-00803-2500 |
| " BS-B | 1 | " 3M | 0550-00803-2400 |
| " BS-C | 1 | " 3L | 0550-00803-2900 |
| " BS-D | 1 | " 3K | 0550-00803-2900 |
| " BS-E | 1 | " 3J | 0550-00803-2700 |
| " BS-F | 1 | " 3H | 0550-00803-2800 |
| " BS-G | 1 | " 3E | 0550-00803-2900 |
| STATIC RAM 2KX8 | 1 | " 2N | 0550-00803-3000 |
| Z-80A | 3 | " 4E,4J,4M | 0550-00803-2200 |
| | | | |
| 14 PIN SOCKET | 1 | IC8 5B | 0550-00804-0900 |
| 16 " " | 3 | " 1D,6A,6C | 0550-00804-0700 |
| 24 " " | 1 | " 2M,3E,3H,3J,3K,3L,3M,3N | 0550-00804-0400 |
| 28 " " | 7 | " 2E,2H,2J,2L,4D,6L,6M | 0550-00804-0500 |
| 40 " " | 3 | " 4E,4J,4M | 0550-00804-0600 |
| 42 " " | 1 | " 4H | 0550-00804-0700 |
| | | | |
| 18.432 MHZ CRYSTAL | 1 | XTAL1 | 0550-00804-1100 |
| AKC-8 PB SWITCH | 1 | SW1 | 0550-00804-1200 |
| 8 POS. DIP SWITCH | 2 | DIPSW1,DIPSW2 | 0550-00804-1400 |
| CONN. R.A. HEADER 50PIN | 1 | J1 | 0550-00804-0900 |
| CONN. PCB HEADER 3 PIN | 1 | J2 | 0017-00081-0443 |
| | | | |
| MOUNTING HARDWARE | | | |
| 4-40 HEX NUT | 2 | MHC7C | 0017-00102-0008 |
| 4-40X8 SLT PAN M.S. | 2 | " | 0017-00101-0810 |
| WSH 4 .125-250-032 FLT.ST | 2 | " | 0017-00104-0018 |
| WSH 4 .120-250-018 EXT. ST. | 2 | " | 0017-00104-0071 |
| | | | |
| BOSCONIAN CPU PC. | 1 | | A080-91412-8550 |

| | | | |
|---|---|---|---|
| PROJECT ENG: J. SZERSZEN | | USED ON BOSCONIAN | MIDWAY MFG. CO. FRANKLIN PK. ILL. |
| DO NOT SCALE DWG. | HEAT TREAT | SCALE FULL | NO REQ'D 1 PER. |
| DIM. TOLERANCES UNLESS SPECIFIED | MATL. | BOSCONIAN CPU BD. | PART NO. M051-00550-8010 |
| | FINISH | A084-91412-8550 ASS'Y DRWNG. | |
| | | | REVISIONS |




PARTS USED ON
A084-91404-C508
REV. B.5

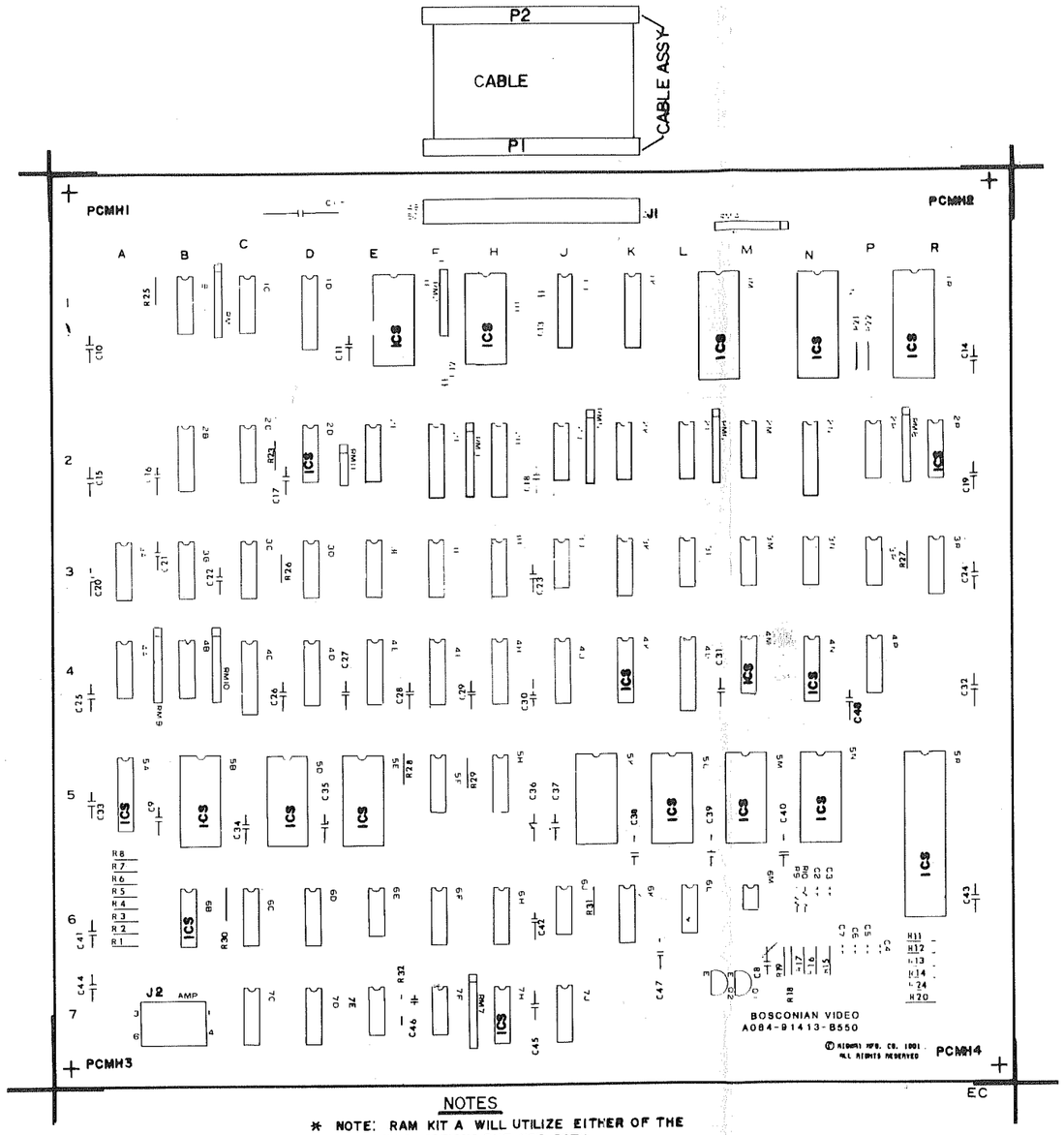
| | | | |
|---|---|---|---|
| PROJECT ENG: JERRY BZERSZEN | BOSCONIAN | MIDWAY MFG. CO. | |
| DO NOT SCALE DWG. | FULL | IPER | |
| UNLESS OTHERWISE SPECIFIED TOLERANCES | DRAWN m.m | BOSCONIAN CPU A084-91412-B550 SCHEMATIC | M051 00550 B011 |
| DATE 2/9/82 | | | |


BUFFER CPU ADDRESS BUS
BUFFER CPU DATA BUS
1P 138
2P 138
3C 259
1C 174
2C 157
2D 157
2A 157
3B 273
4C 32
2M 245
2N ICS M58725
5C MB7052
2B ADC 7489
3A 7489
4A 283
4B MB7052
1A 1J ICK 107
2A 1J ICK 107
74107
74LS393
4066 3A
TD 62064 6H
MB3730
2SA1015-Y 2N4403
2SC2235-Y TIP 110
2SD549
2SA1
2SC2236
1S1885
1N914B
XTAL1 18432 MHZ
RESET SW.1
P.O.R.
DIPSW
8 PIN DIP SW.
6K 8PIN DIP S.W.
2L ICS 06XX
4H ICS 51XX
6L ICS 50XX
6M ICS 54XX
4D ICS 07XX
6J ICS
SOUND
3 COIN COUNTER
N.U.
+12V
+5V
6MHZ
18 MHz
VBLANK
WDR
NMION
NMI3
VREPET
HREPET
20 N.U
X N.U
21 LOGIC GND (CT ONLY)
22 GND
.01MF X16

# DESIGNATION LIST

| DESIGNATION | DESCRIPTION |
|---|---|
| C 1 | 470 MF ELEC. |
| C 4 | .022 MF POLY. |
| C 5, C6 | .0047 MF " |
| C 7 | .001 MF 100V 10% POLY |
| C8, C9 | .001 MF 50V 10% CER. |
| C10—C45 | .1 MF CER. |
| C46 | 220 PF MICA |
| C47 | .001 MF 50V 10% CER. |
| C48 | 100 PF. CER. |
| R 1 | 220 OHM 1/4w 5% CRBN. |
| R 2 | 470 " " " " |
| R 3 | 220 " " " " |
| R 4 | 470 " " " " |
| R 5 | 1K " " " " |
| R 6 | 220 " " " " |
| R 7 | 470 " " " " |
| R 8 | 1K " " " " |
| R 11 | 10K " " " " |
| R12 | 22K " " " " |
| R13 | 47K " " " " |
| R14, R15 | 100K " " " " |
| R16 | 22K " " " " |
| R17 | 33K " " " " |
| R18 | 47K " " " " |
| R19 | 1K " " " " |
| R20 | 100 " " " " |
| R21—R31 | 1K " " " " |
| R32 | 330 " " " " |
| RM1—RM4 | 2.2 K OHM 9 PIN SIP. |
| RM5, RM6 | 1K " " " " |
| RM7 | 470 " " " " |
| RM8—RM10 | 1K " " " " |
| RM11 | 1K " 5 PIN " |
| Q1, Q2 | 2N3391A |
| IC 1B | 74LS259 |
| " 1C | 74LS138 |
| " 1D | 74LS377 |
| " 1E, 1H | PHAN. RAM 2K X 8 |
| " 1J, 1K | 74LS374 |
| " 1M | 06XX CUSTOM IC |
| " 1N | 50XX " " |
| " 1R | 07XX " " |
| ** " 2B | RAM KIT B OPTION 1 |
| " 2C | 74LS163 |
| " 2D | PROM BS-3 |
| " 2E | 7489 |
| " 2F, 2H | 74LS245 |
| " 2J, 2K, 2L, 2M | 74LS283 |
| " 2N | 74LS244 |
| " 2P | 74LS257 |
| " 2R | PROM BS-4 |
| ** " 3A, 3B | RAM KIT B OPTION 2 |
| " 3C, 3D, 3E, 3F | 74LS163 |
| " 3H | 74LS283 |
| " 3J | 74LS20 |
| " 3K | 74LS283 |
| " 3L, 3M | 74LS86 |
| " 3N | 74LS20 |
| " 3P | 74LS86 |
| " 3R | 74LS136 |
| " 4A | 74LS174 |
| " 4B | 74LS365 |
| " 4C | 74LS273 |
| * " 4D, 4E, 4F, 4H | RAM KIT A OPTION 2 |
| * " 4J | " " " " 1 |
| " 4K | 03XX CUSTOM IC |
| " 4L | 74LS377 |
| " 4M | PROM BS-5 |
| " 4N | 03XX CUSTOM IC |
| " 4P | 74LS368 |
| " 5A | PHAN. PAL BS-8 |
| " 5B | 05XX CUSTOM IC |
| " 5D | EPROM BS-P |
| " 5E | " BS-N |

| DESIGNATION | DESCRIPTION |
|---|---|
| IC 5F, 5H | 74LS174 |
| " 5K | NOT USED |
| " 5L | EPROM BS-L |
| " 5M | " BS-K |
| " 5N | " BS-J |
| " 5R | 52XX CUSTOM IC |
| " 6B | PROM BS-6 |
| " 6C, 6D | 74LS194 |
| " 6E | 74LS86 |
| " 6F, 6H | 74LS157 |
| " 6J | 74LS86 |
| " 6K | 74LS175 |
| " 6L | 74LS08 |
| " 7C | 74LS157 |
| " 7D | 74LS174 |
| " 7E | 74LS00 |
| " 7F | 74LS08 |
| " 7H | PROM BS-7 |
| " 7J | 74LS175 |
| ICS 1E | 24 PIN SOCKET |
| " 1H | " " " |
| " 1M | 28 PIN " |
| " 1N | " " " |
| " 1R | 16 PIN " |
| " 2D | " " " |
| " 2R | 18 PIN " |
| " 4K | 16 PIN " |
| " 4M | 18 PIN " |
| " 4N | 20 PIN " |
| " 5A | 24 PIN " |
| " 5B | " " " |
| " 5D | " " " |
| " 5E | " " " |
| " 5L | " " " |
| " 5M | " " " |
| " 5N | " " " |
| " 5R | 42 PIN " |
| " 6B | 16 PIN " |
| " 7H | " " " |
| PCMH1- PCMH4 | DUALLOCKING SPACERS |
| J1 | 50 PIN RT. ANGLE |
| J2 | 6 PIN MNL CONN. |
| CABLE ASSY | AS BELOW |
| P1, P2 | PLUG-SOCKET CONNECTOR 50-PIN |
| CABLE | RIBBON CABLE-.33FT 50-CONNECTOR |
| | 28 GA. STRND. RND. CONDUCTOR |
| A080-91413-B550 | BOSCONIAN P.C.B. |



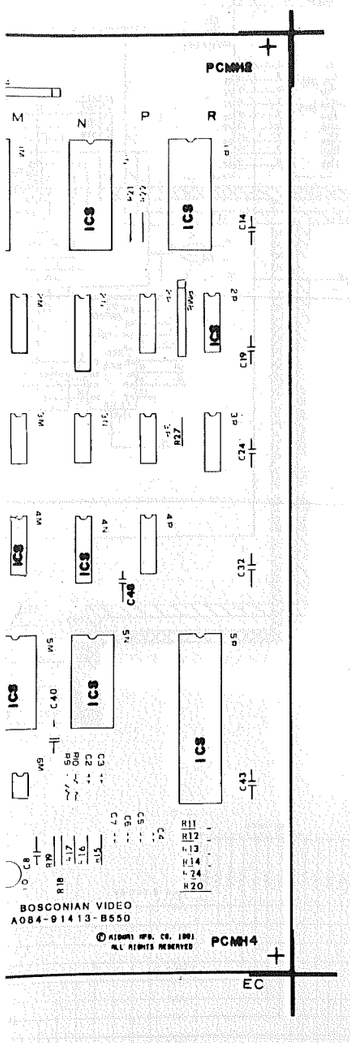

## NOTES

* NOTE: RAM KIT A WILL UTILIZE EITHER OF THE FOLLOWING OPTIONS BUT NOT BOTH;
OPTION 1—(1) 2148 LOC. 4J
OR
OPTION2—(4) 2147 LOC. 4D, 4E, 4F, 4H

** NOTE: RAM KIT B WILL UTILIZE EITHER OF THE FOLLOWING OPTIONS BUT NOT BOTH;
OPTION 1—(1) 2148 LOC. 2B
OR
OPTION2—(2) HM2511 LOC. 3A, 3B

EC

# CROSS REFERENCE LIST




| DESCRIPTION | QUAN. | DESIGNATION | PART NO. |
|---|---|---|---|
| 100 PF CER. | 1 | C48 | 0550-00800-0900 |
| 220 PF MICA. | 1 | C46 | 0550-00800-2000 |
| .001 MF 100V 10% POLY. | 1 | C7 | 0550-00800-2100 |
| .001 MF 50V 10% CER. | 3 | C8,C9,C47 | 0550-00800-2400 |
| .0047 MF POLY. | 2 | C5,C6 | 0550-00800-2200 |
| .022 MF " | 1 | C4 | 0550-00800-2300 |
| .1 MF CER. | 36 | C10—C45 | 0550-00800-2500 |
| 470 MF ELEC. | 1 | C1 | 0508-00800-1500 |
| | | | |
| 100 OHM 1/4w 5% CRBN | 1 | R20 | 0062-11083-1XXX |
| 220 " " " " | 3 | R1,R3,R6 | 0062-13383-1XXX |
| 330 " " " " | 1 | R32 | 0062-14483-1XXX |
| 470 " " " " | 3 | R2,R4,R7 | 0062-15683-1XXX |
| 1K " " " " | 14 | R5,R8,R19,R21—R31 | 0062-17983-1XXX |
| 10K " " " " | 1 | R11 | 0062-22783-1XXX |
| 22K " " " " | 2 | R12,R16 | 0062-24383-1XXX |
| 33K " " " " | 1 | R17 | 0062-25183-1XXX |
| 47K " " " " | 2 | R13,R18 | 0062-25983-1XXX |
| 100K " " " " | 2 | R14,R15 | 0062-27583-1XXX |
| | | | |
| 470 OHM 9 PIN SIP. | 1 | RM7 | 0550-00804-2400 |
| 1K " " " " | 5 | RM5,RM6,RM8—RM10 | 0550-00804-2100 |
| 1K " 5PIN " | 1 | RM11 | 0550-00804-2000 |
| 2.2K " 9PIN " | 4 | RM1—RM4 | 0550-00804-2200 |
| | | | |
| 2N3391A | 2 | Q1,Q2 | 0550-00802-0400 |
| | | | |
| 03XX CUSTOM IC | 2 | IC 4K,4N | 0066-010CX-XAPX |
| 05XX " " | 1 | " 5B | 0066-004CX-XAPX |
| 06XX " " | 1 | " 1M | 0066-005CX-XAPX |
| 07XX " " | 1 | " 1R | 0066-006CX-XAPX |
| 50XX " " | 1 | " 1N | 0066-012CX-XAPX |
| 52XX " " | 1 | " 5R | 0066-013CX-XAPX |
| | | | |
| 74LS00 | 1 | IC 7E | 0550-00803-3400 |
| 74LS08 | 2 | " 6L,7F | 0550-00803-3500 |
| 74LS20 | 2 | " 3J,3N | 0550-00803-3600 |
| 74LS86 | 5 | " 3L,3M,3P,6E,6J | 0550-00803-3700 |
| 7489 | 1 | " 2E | 0550-00803-3300 |
| 74LS138 | 2 | " 1C,3R | 0550-00803-3800 |
| 74LS157 | 3 | " 6F,6H,7C | 0550-00803-3900 |
| 74LS163 | 5 | " 2C,3C,3D,3E,3F | 0550-00803-7100 |
| 74LS174 | 4 | " 4A,5F,5H,7D | 0550-00803-4000 |
| 74LS175 | 2 | " 6K,7J | 0550-00803-7000 |
| 74LS194 | 2 | " 6C,6D | 0550-00803-6900 |
| 74LS244 | 1 | " 2N | 0550-00803-6800 |
| 74LS245 | 2 | " 2F,2H | 0550-00803-4100 |
| 74LS257 | 1 | " 2P | 0550-00803-4200 |
| 74LS259 | 1 | " 1B | 0550-00803-4300 |
| 74LS273 | 1 | " 4C | 0550-00803-4400 |
| 74LS283 | 6 | " 2J,2K,2L,2M,3H,3K | 0550-00803-4500 |
| 74LS365 | 1 | " 4B | 0550-00803-4600 |
| 74LS368 | 1 | " 4P | 0550-00803-4700 |
| 74LS374 | 2 | " 1J,1K | 0550-00803-6700 |
| 74LS377 | 2 | " 1D,4L | 0550-00803-4800 |
| | | | |
| PROM BS-3 | 1 | IC 2D | 0550-00803-5500 |
| " BS-4 | 1 | " 2R | 0550-00803-5600 |
| " BS-5 | 1 | " 4M | 0550-00803-5700 |
| " BS-6 | 1 | " 6B | 0550-00803-5800 |
| " BS-7 | 1 | " 7H | 0550-00803-5900 |
| PHAN. PAL BS-8 | 1 | " 5A | 0550-00803-6600 |
| EPROM BS-J | 1 | " 5N | 0550-00803-4900 |
| " BS-K | 1 | " 5M | 0550-00803-5000 |
| " BS-L | 1 | " 5L | 0550-00803-5100 |
| " BS-N | 1 | " 5E | 0550-00803-5200 |
| " BS-P | 1 | " 5D | 0550-00803-5300 |
| PHAN RAM 2K X8 | 2 | " 1E,1H | 0550-00803-5400 |

| DESCRIPTION | QUAN. | DESIGNATION | PART NO. |
|---|---|---|---|
| PHAN.RAM A OPTIONS | 1 | ——— | 0550-00803-6000 |
| * RAM KIT A OPTIONS 1 | 1 | IC 4J | 0550-00803-6200 |
| * " " " " 2 | 4 | " 4D,4E,4F,4H | 0550-00803-6300 |
| PHAN. RAM B OPTIONS | 1 | ——— | 0550-00803-6100 |
| ** RAM KIT B OPTIONS 1 | 1 | IC 2B | 0550-00803-6400 |
| ** " " " " 2 | 2 | " 3A,3B | 0550-00803-6500 |
| | | | |
| 16 PIN SOCKET | 5 | ICS-2D,2R,4M,6B,7H | 0508-00804-0700 |
| 18 PIN " | 2 | " 4K,4N | 0508-00804-0600 |
| 20PIN " | 1 | " 5A | 0550-00804-2300 |
| 24PIN " | 8 | " 1E,1H,5B,5D,5E,5L 5M,5N | 0508-00804-0500 |
| 28 PIN " | 3 | " 1M,1N,1R | 0508-00804-0400 |
| 42 PIN " | 1 | " 5R | 0508-00804-1900 |
| | | | |
| 6 PIN MNL CONN. | 1 | J2 | 0017-00021-0424 |
| 50 PIN RT. ANGLE CONN. | 1 | J1 | 0508-00804-0800 |
| DUAL LOCKING SPACERS | 4 | PCMH1—PCMH4 | 0017-00042-0253 |
| | | | |
| CABLE ASSY. | 1 | ——— | 0508-00804-2200 |
| 50-PIN PLUG-SOCKET CONNECTOR | 2 | P1,P2 | 0508-00804-0900 |
| RIBBON CABLE-.33FT | 1 | CABLE | 0017-00033-0346 |
| 50-CONDUCTOR 28 GA. STRND AND CONDUCTOR | | | |
| | | | |
| BOSCONIAN P.C.B | 1 | ——— | A080-91413-B550 |

| | | | | |
|---|---|---|---|---|
| PROJECT ENG: J. SEZERSZEN | | | USED ON BOSCONIAN | MIDWAY MFG. CO. FRANKLIN PK ILL |
| DO NOT SCALE DWG | HEAT TREAT | SCALE FULL | NO REQ'D 1 PER | REVISIONS |
| DIM. TOLERANCES UNLESS SPECIFIED | MATL | BOSCONIAN VIDEO A084-91413-B550 ASS'Y DRWNG. | | PART NO M05 1-00550-B012 |
| | FINISH | | | |
| | DATE 12/9/82 | | | |

BUFFER DATA BUS

6MHZ

3B MB8125 2147

3A MB8125 2147

2B MB8148 2148

1M ICS 06XX

1N ICS 50XX

5R ICS 52XX

5N BS-J ICS 2732

5M BS-K ICS 2732

5L BS-L ICS 2732

5K ICS 2732

+5V

R9 33K R10 10K R11 10K R12 22K R13 47K R14 100K

C2 .0047 C3 .01

555 6M

C4 .002 C5 .0047 C6 .0047 C7 .001 C8 .001

R15 100K R16 22K R17 33K R18 47K R19 1K C-7 .001

Q1 2N3391A Q2 2N3391A

HBLANK H

5D ICS BS-P 2732

5E ICS BS-N 2732

BUFFER DATA BUS

HCOUNT OBCLD CCLR 6MHZ

3E 163 3D 163

4D 4E 4F 4H MB8147 2147

4J MB8149 2149

DATA INCLK

6D 194 6C 194

7C 157

6J 8B

7F 08

3N 20

4B 368

RM9 1K RM10 1K +5V

4M MB7052 7611 BS-5 ICS

4N ICS 03XX

SHIFT I SHIFTO

HBLANK HH

7D 174

5A ICS BS-8 PAL.

6B ICS BS-6 MB7051 7603

5B ICS

4A 174

05XX

BUFFER DATA BUS

VSYNC HSYNC 256H STARCLR BLK I BLK O STAR

9MHZ

C9 .001

1R ICS

07XX

R21 1K R22 1K VRESET HRESET

2R MB7051 7603 BS-7 ICS

RM8 1K X 8P

FLIP 256H HBLANK FF 128H 64H HCOUNT

32H 16H 8H 4H 2H 1H

6L 08

7E 7400

4P 368

CMPSYNC

6MHZ

C48 100PF

C45 220P

R32 330

2H LD LO ZHH

+5V +5V 1K R24 100 R20

CMPSYNC

R1 220 R2 470 R3 220 R4 470 R5 1K R6 220 R7 470 R8 1K

BLUE GREEN RED

1 2 3 4 5 6

HBLANK

RM7 470X8

OBCLD CCLR SOCLD COLSET VPSET DSET

LO

HBLANK HH

3R 138

BS-7 ICS

STARCLR STAR POSI T POSI V SOWR

EXCS VCRAM DHRAM

1B 259

RESET BLK1 BLK0 FLIP

R/W ABS AB5 AB4

AB15 AB14 CK AB13 AB12 AB11

DB0 AB2 AB1 AB0

J1

1 GND
2 GND
3
4 GRN
5
6 GND
7
8
9 +5V
10 -5V
11 +5V
12 +5V
13 DB0
14 DB1
15 DB2
16 DB3
17 DB4
18 DB5
19 DB6
20 DB7
21 AB0
22 AB1
23 AB2
24 AB3
25 AB4
26 AB5
27 AB6
28 AB7
29 AB8
30 AB9
31 AB10
32 AB11
33 AB12
34 AB13
35 AB14
36 AB15
37 +5V
38 +5V
39 +5V
40 +5V
41 (NC)
42 (NC)
43
44
45 GND
46 R/W
47 GND
48 CK
49 GND
50 GND

RM4 2.2K X 8 · RM3 2.2K X 8 · RM2 2.2K X 8 · RM1 2.2K X 8 · RM4 2.2K X 8 · RM2 2.2K X 8 · RM4 2.2K X 8 · RM4 2.2K X 8 · +5V · (NC) · TC · HRESET · VRESET · C1 470 MF :6V · ALL DECOUPLING · CP4 – CP21 1MF · GND

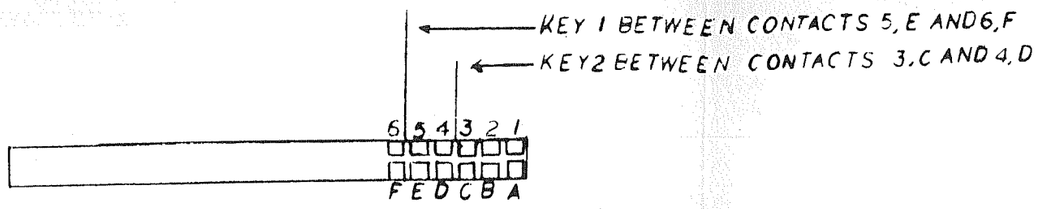
BUFFER DATA BUS · BUFFER ADDRESS BUS · DATA BUS A2 · DATA BUS A3

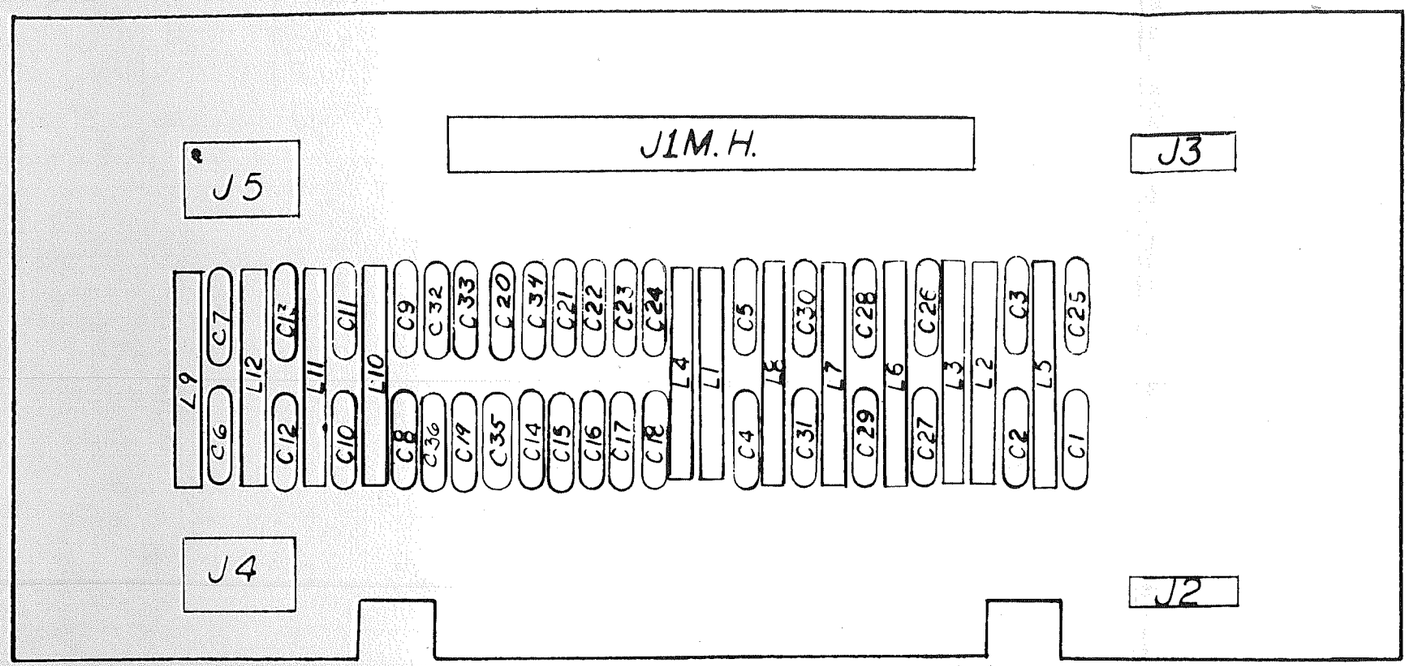
RM5 1K X 8 · RM6 1K X 8 · RM11 1K · RM9 1K · RM10 1K · R23 1K

374 · 283 · 245 · 2E 89 · 2D ICS BS-3 · 3A MB8125 · 3B MB8125 · 3C 163 · 3F 163 · 2C 163 · 377 · 2H 245 · 2K 283 · 2J 283 · 2L 283 · 3K 283 · 3H 283 · 2P 257 · 6K 175 · 4C 273 · 5F 174 · 5H 174 · 4K 03XX ICS · 4L 377 · 6H 157 · 6F 157 · 7C 157 · 5D ICS BS-P 2732 · 5E ICS BS-N 2732 · 1H M58725 20HP-2 · IE M58725 20HP-2 · 6D 194 · 6C 194 · 4M MB7052 BS-5 ICS

6MHZ · 8MHZ · 9MHZ · 10MHZ · 20CLK · COLSET · VPSET · FLIP · VCRAM · DHRAM · R/W · HBLANK H · HBLANK M · HBLANK N · SHIFT I · SHIFT O · LD · CK · CE CO WE · OE

| | | | |
|---|---|---|---|
| PROJECT ENG: J. SZERSZEN | | | MIDWAY MFG. CO. FRANKLIN PK. ILL. |
| DO NOT SCALE DWG | SHEET FULL | USED ON BOSCONIAN NO REQD 1 PER | |
| DIM TOLERANCES UNLESS SPECIFIED | SIZE | BOSCONIAN VIDEO A084-91413-8550 SCHEMATIC | PART NO. M051-00550 8013 |
| 2/9/82 | DRAWN | | |




| DESCRIPTION | QUANTITY | DESIGNATION | PHANTOM NUMBER |
|---|---|---|---|
| 3 PIN HEADER AMP 350429-1 | 2 | J2-J3 | 0017-00021-0443 |
| 6 PIN HEADER AMP 350431-1 | 2 | J4-J5 | 0017-0021-0424 |
| PC EDGECON KEY | 2 | JIMH | C017-00021-0396 |
| 6-32x10 SLOT PAN SCREW | 2 | JIMH | 0017-00101-0574 |
| WSH 6 145-.250-.032 | 2 | JIMH | 0017-00104-0002 |
| BRKT-CONN.FIN | 1 | JIMH | 0866-0016-00XF |

NUMBER
00-0500
00-0100
00-0200
00-0300
00-0400
XX-XXAX

04-0100

04-0200

21-0418

S DATED

PROJECT ENGINEER L. EEKER



DIM. TOLERANCES 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
DRN CKS | DATE 1-4-82 | SCALE FULL
MECH CHK | MAT'L
ELEC CHK | FINISH

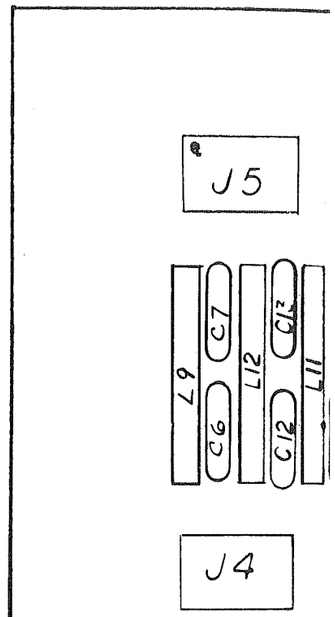
MIDWAY MFG. CO.
FRANKLIN PK., IL. 60131 A BALLY CO.

BOSCONIAN FILTER P.C.
ASSY. DRWNG.
A084-9141 4-A550

REVISIONS

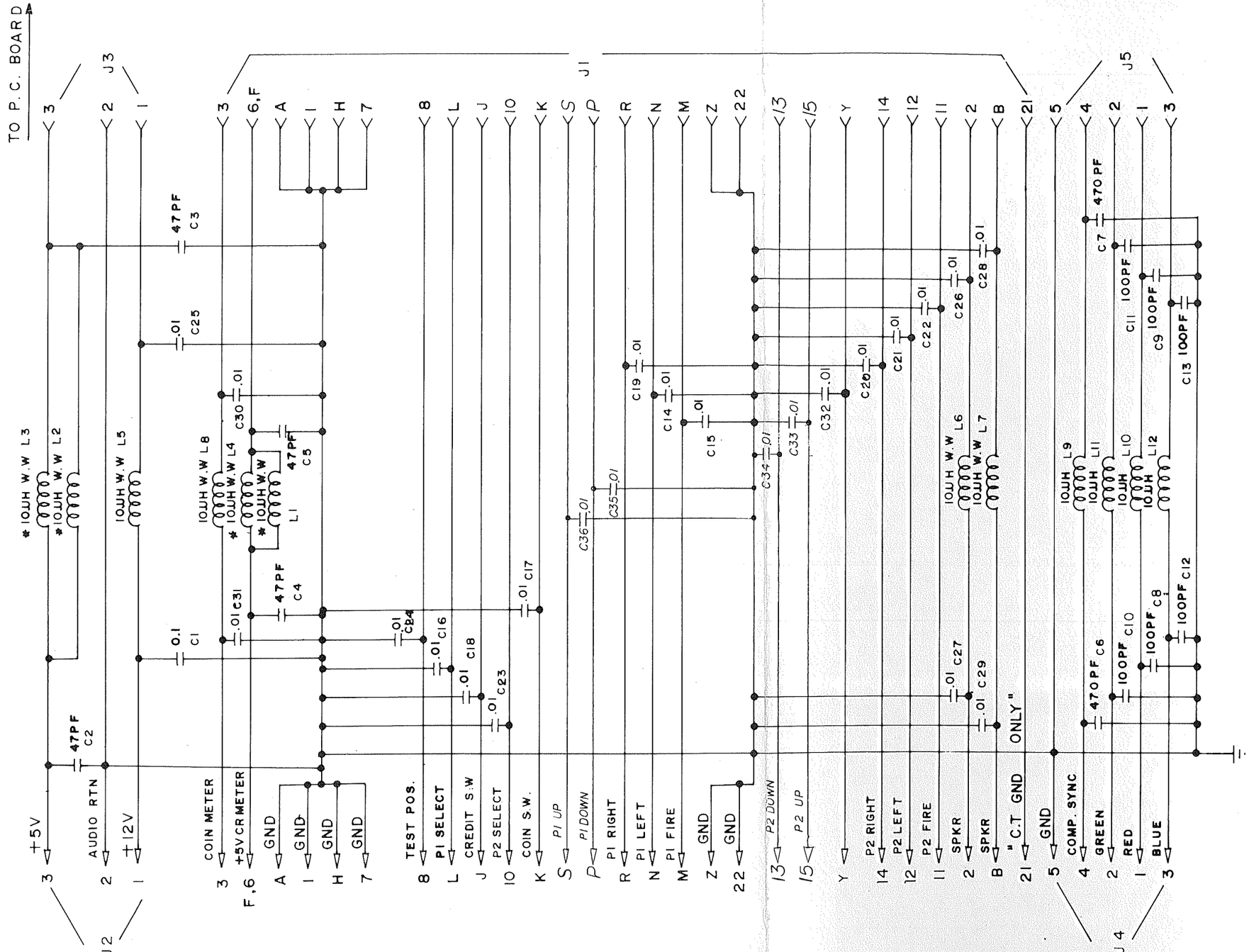
PART NO.
M-0-5-1-0-0-5-5-0-A-0-1-4

| DESIGNATION | DESCRIPTION |
|---|---|
| C1 | .1 MF AX CER |
| C2-C5 | 47 PF AX CER |
| C6, C7 | 470PF AX CER |
| C8-C13 | 100 PF AX CER |
| C14-C36 | .01 MF AX CER |
| L1-L4 | CHOKE 10 UH W.W. MILLER |
| L5-L8 | CHOKE 10 UH W.W. |
| L9-L12 | CHOKE ENCAP 10 UH |
| J1 | P.C. EDGE CONN |
| J2, J3 | 3 PIN HEADER |
| J4, J5 | 6 PIN HEADER |
| J1 M.H. | 2 EDGE CONN. KEY<br>(2) 6-32 x 10 SLOT PAN SCREW<br>(2) WSH 6 .145-.250-.032<br>(1) BRKT.-CONN. FIN. |




| DESCRIPTION | QUANTITY | DESIGNATION | PHANTOM NUMBER |
|---|---|---|---|
| 47 PF 50V AX CER | 4 | C2-C5 | 0550-00800-0500 |
| 100PF 50V AX CER | 6 | C8-C13. | 0550-00800-0100 |
| 470PF 50V AX CER | 2 | C6, C7 | 0550-00800-0200 |
| .01MF 50V AX CER | 23 | C14-C36 | 0550-00800-0300 |
| .1MF 50V AXCER | 1 | C1 | 0550-00800-0400 |
| 10 UH W.W. RF CHOKE MILLER | 4 | L1-L4 | 0067-021XX-XXAX |
| 10 UH W.W. RF CHOKE | 4 | L5-L8 | 0550-00804-0100 |
| 10 UH ENCAP RF CHOKE | 4 | L9-L12 | 0550-00804-0200 |
| PC EDGE CONN | 1 | J1 | C017-00021-0418 |

PLEASE DESTROY ALL PRINTS DATED PRIOR TO 1-4-82




NOTE:

ALL .1 + .01 ARE MF
ALL CAPS AX. CER. UNLESS NOTED OTHERWISE

* 1.5 AMP (MILLER TYPE) INDUCTORS

PROJECT ENG: L. DEKKER

THIS DWG IS CONFIDENTIAL & PROPERTY OF MIDWAY MFG. CO

| DIM. TOLERANCES UNLESS OTHERWISE SPEC | | | |
|---|---|---|---|
| CONCENTRICITY T.I.R. | .002 | BOSCONIAN | |
| FRACTIONAL | ± 1/64 | mm 12-22-8. | FULL |
| DECIMAL | ± .005 | | |
| HOLE DIA | +.002 -.000 | | |
| ANGLE | ± 1/2° | | |
| DO NOT SCALE DWG | | | |

MIDWAY MFG. CO.
FRANKLIN PK., IL 60131 A BALLY CO

BOSCONIAN
FILTER BOARD
A084-91[illegible]55

REVISIONS

PART NO
M051-00550-A015