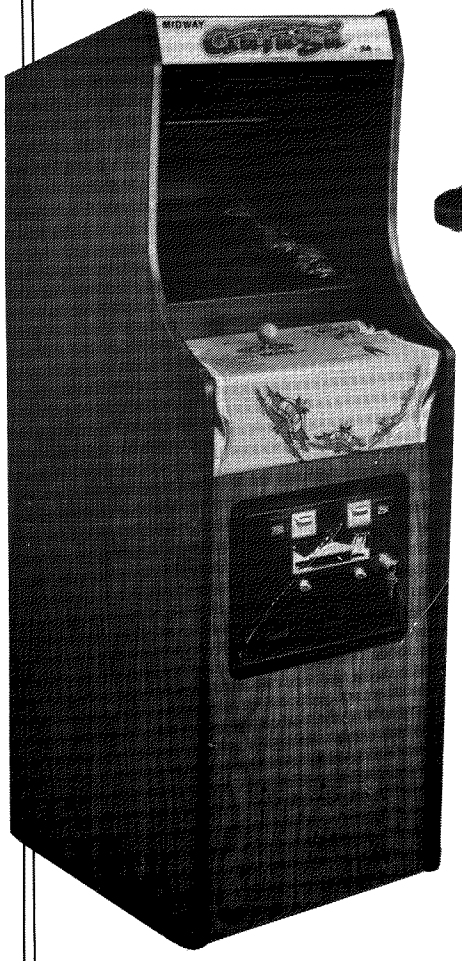
MIDWAYS

Galaga

Parts and Operating Manual



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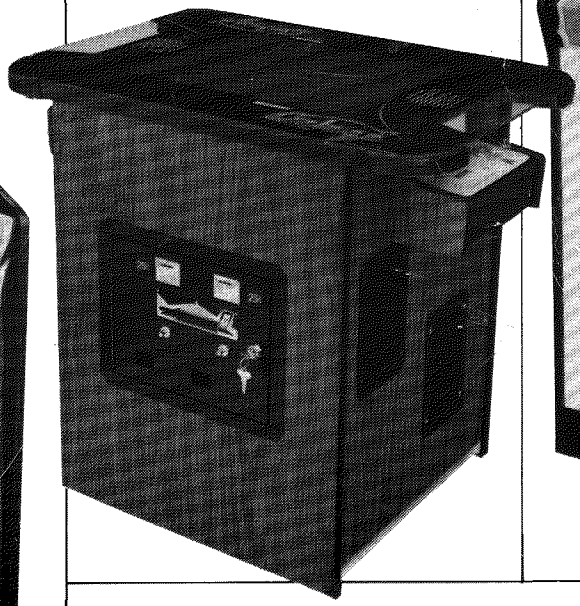

No. 510 COCKTAIL

No. 508 UPRIGHT

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

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I Introduction

Galaga

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.

Introduction

GALAGA 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 space to defend your planet against the on-coming hordes of invaders. Your mission is to destroy as many of the enemy ships as possible.

These invaders arrive in convoys. They will attack you while swerving back and forth across the screen, dropping bombs all the while. Certain of the enemy ships can put out a tractor beam and capture your space fighter. That fighter changes color from white to red and stays with that particular enemy ship for the rest of the game. You can get it back by destroying the enemy ship that captured it while they are both attacking your current fighter. If you do this, the rescued ship changes color again from red back to white, and links up with your current fighter. This doubles your fire power.

As your skill level increases, the number of attackers coming at you at any one time and the speed with which the enemy ships attack is gradually increased, plus their attack patterns become more and more complex.

Bonus ships are awarded to you periodically throughout the game as you reach or pass certain preselected point values. Each enemy ship has an assigned point value.

Major New Features

Two major new features of your GALAGA game are: 1) The player is given the chance to double his fire power at certain points throughout the game, and 2) The game has a rapid fire (automatic firing) option whereby the player just holds the FIRE button down and his space fighter continues to fire at the GALAGAS in bursts of two missiles each.

To double his fire power, the player must let one of his space fighters be captured by one of the GALAGA command ships and then rescue it. The GALAGA command ships **MUST BE SHOT TWICE** to destroy them. When shot once, they change color from green to blue. When shot again, they explode. The rescued fighter then links up with the one that rescued it and they now work as a team — both moving together and firing at the same time.

Game Objective

The object of the game is to survive as long as possible while destroying as many attacking ships as you can. As you do this, each following convoy of attackers will be harder to destroy.

II Location and Setup

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

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

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

     Power supply.

     Control panel(s).

     T.V. monitor.

     Other P.C.B.'s and/or P.C.B. rack, etc.

     Power supply filter assembly.

     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 33" (63 x 84 cm)
Mini	20" x 24" (50 x 60 cm)
Cocktail	32" x 22" (81 x 55 cm)

   Game height:

Upright	70" (175 cm)
Mini	59" (148 cm)
Cocktail	29" (73 cm)

2. **Voltage Selections:**

   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 1.
   - To help prevent the possibility of getting an electric shock while working inside the game cabinet, interlock switches have been installed at each cabinet access door (this **DOES NOT** include the coin door in the Upright and Mini models).

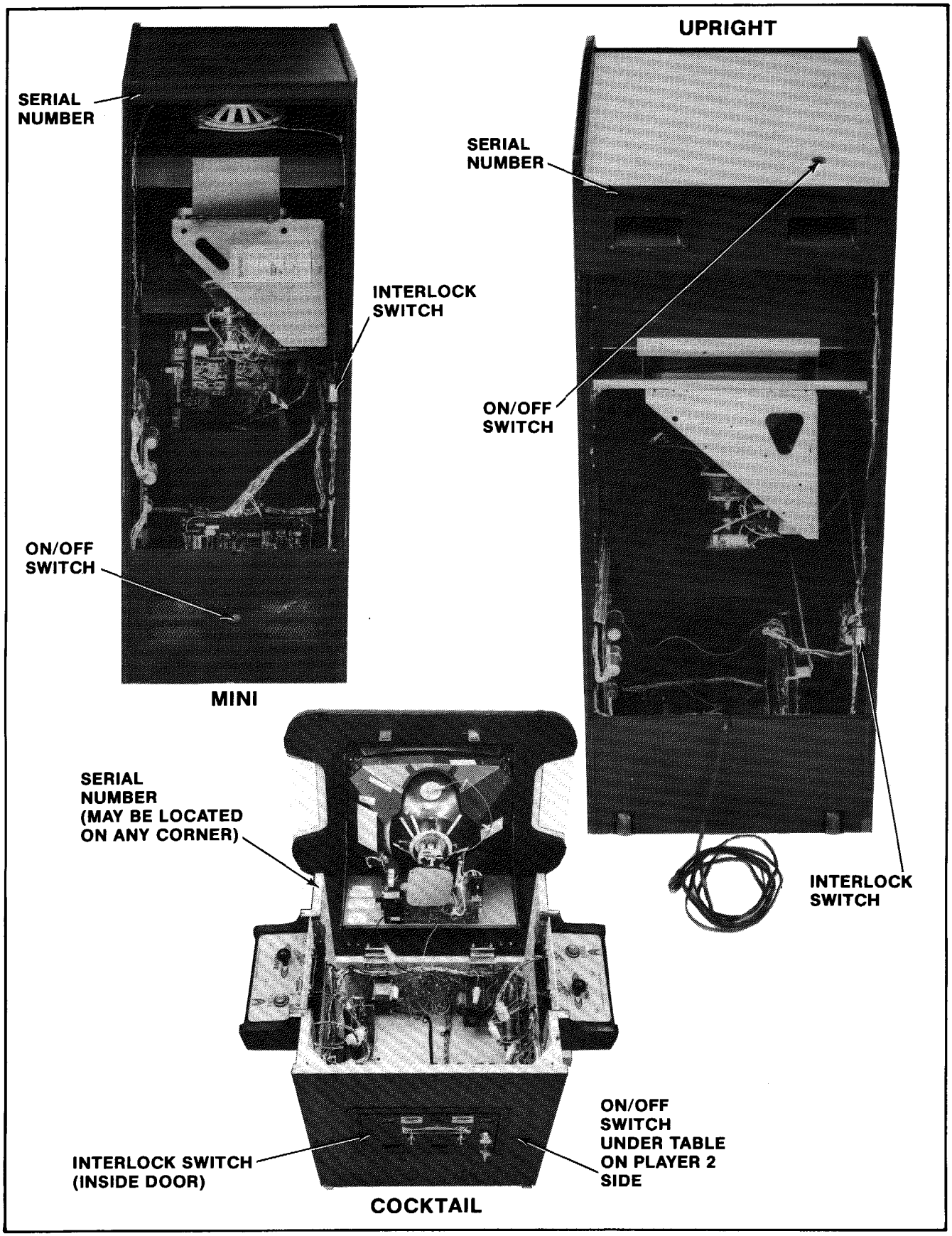


Figure 1. Location of serial number, interlock switch and ON/OFF switch.

- When any access door is opened, the interlock switch installed there turns off all power to the game.
- Check each interlock switch for proper operation.

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

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

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

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

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

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

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

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

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

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 2.

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 counterclockwise as you face it (←).

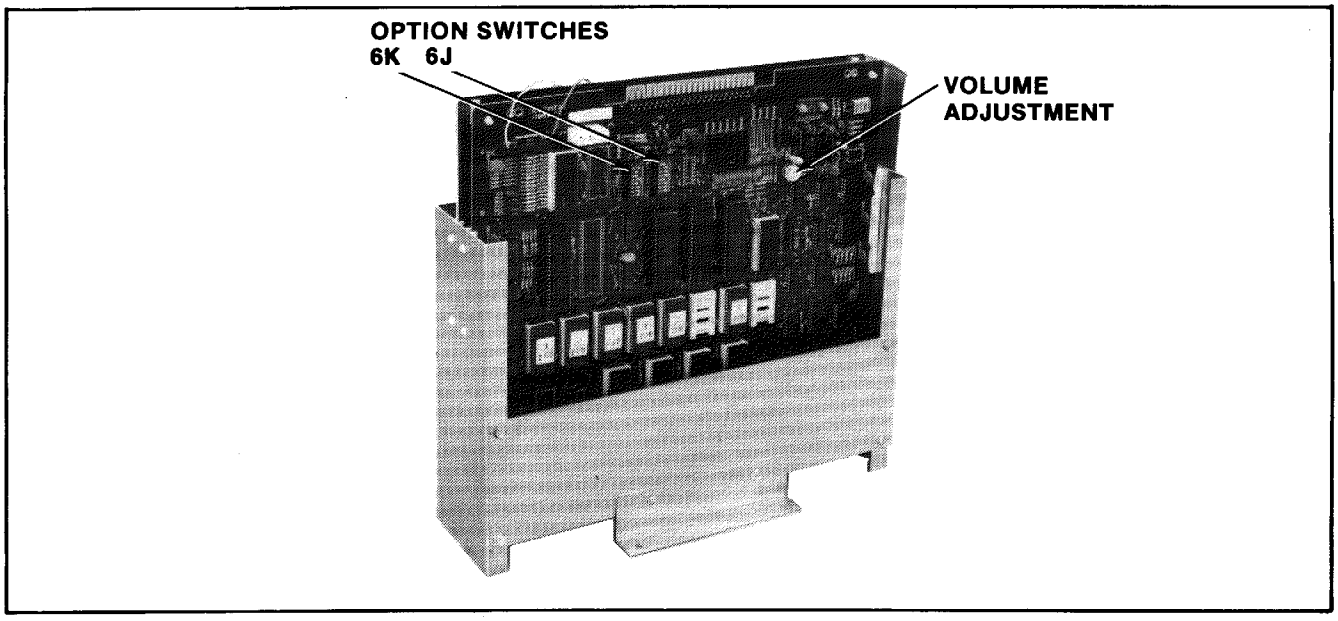


Figure 2. Location of volume control and option switch

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 perform the Self-Test and play the game to be sure the switches have worked properly and that no switches were accidentally moved that were not meant to be. (These switches are small and this can happen.)

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

ELIMINATING THE RAPID (AUTOMATIC) FIRE FEATURE

If you do not desire the RAPID (AUTOMATIC) FIRE FEATURE on your game, it can be simply and easily eliminated. See the following procedure.

1. Turn the power off to the game.

Figure 3. 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 PRESS THE 1 PLAYER START BUTTON 2, 3, 4, OR 5 FIGHTERS	OFF						NOT USED	
2 PLAYER GAME PRESS THE 2 PLAYER START BUTTON 2, 3, 4, OR 5 FIGHTERS **EACH**								
1 PLAYER GAME PRESS THE 1 PLAYER START BUTTON 2, 3, 4, OR 5 FIGHTERS	ON						NOT USED	
1 PLAYER GAME WITH 5, 7, 9, OR 11 FIGHTERS PRESS THE **2 PLAYER** START BUTTON								
DIFFICULTY LEVEL SETTINGS — "A" IS THE EASIEST AND "D" IS THE MOST DIFFICULT								
	SW#1	**SW#2**	**SW#3**	**SW#4**	**SW#5**	**SW#6**	**SW#7**	**SW#8**
RANK "A" - EASIEST LEVEL OF PLAY		OFF	OFF				NOT USED	
RANK "B" - 2ND LEVEL OF DIFFICULTY		ON	ON					
RANK "C" - 3RD LEVEL OF DIFFICULTY		OFF	ON				NOT USED	
RANK "D" - MOST DIFFICULT LEVEL OF PLAY		ON	OFF					
	SW#1	**SW#2**	**SW#3**	**SW#4**	**SW#5**	**SW#6**	**SW#7**	**SW#8**
GAME PROVIDES SOUND IN **ATTRACT MODE**				ON			NOT USED	
GAME **DOES NOT** PROVIDE SOUND IN **ATTRACT MODE**				OFF				
FREEZE VIDEO (MONITOR PRESENTATION STOPS MOVING)					ON		NOT USED	
MONITOR OPERATES NORMALLY					OFF			
AUTOMATIC RACK ADVANCE						ON	NOT USED	
NORMAL OPERATION						OFF		
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

2. UPRIGHT and MINI models:
   Unlock and open the rear access door.

   COCTAIL TABLE model:
   If you have this model, you will need to open the table top to reach the necessary terminal board. (See the appropriate opening procedure in the "MAINTENANCE AND REPAIR" section of this manual.)

3. Move the plug in the Rapid Fire P.C. Board from position "A"-RAPID, to position "B"-MANUAL.

4. To close the game, reverse the opening procedure.

5. Turn the power back on, run the game Self-Test, and play one game to make sure everything is working properly.

Figure 3. Option switch settings (Continued)

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	ON	ON	OFF					
3 COINS	1 CREDIT	ON	OFF	ON					
2 COINS	1 CREDIT	ON	OFF	OFF					
2 COINS	3 CREDITS	OFF	ON	ON					
1 COIN	3 CREDITS	OFF	ON	OFF					
1 COIN	2 CREDITS	OFF	OFF	ON					
1 COIN	1 CREDIT	OFF	OFF	OFF					

BONUS SHIPS AWARDED AT THE FOLLOWING POINT VALUES:

BEGAN WITH 2, 3 OR 4 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	60000	2nd SHIP	100000				ON	ON	OFF		
AND EVERY	60000	AND EVERY	100000								
1st SHIP	20000	1st SHIP	30000								
2nd SHIP	70000	2nd SHIP	120000				ON	OFF	ON		
AND EVERY	70000	AND EVERY	120000								
1st SHIP	20000	1st SHIP	30000								
2nd SHIP	80000	2nd SHIP	150000				ON	OFF	OFF		
AND EVERY	80000	AND EVERY	150000								
1st SHIP	30000	1st SHIP	30000								
2nd SHIP	100000	2nd SHIP	100000				OFF	ON	ON		
AND EVERY	100000										
1st SHIP	30000	1st SHIP	30000								
2nd SHIP	120000	2nd SHIP	120000				OFF	ON	OFF		
AND EVERY	120000										
1st SHIP	20000	1st SHIP	30000								
2nd SHIP	60000	2nd SHIP	150000				OFF	OFF	ON		
1st SHIP	30000	ONE SHIP	30000								
2nd SHIP	80000	ONLY					OFF	OFF	OFF		
NO BONUS SHIPS GIVEN WITH THIS SETTING							ON	ON	ON		

DETERMINES NUMBER OF SPACE FIGHTERS PLAYER BEGINS GAME WITH:

								SW#7	SW#8
2 SPACE FIGHTERS								ON	ON
3 SPACE FIGHTERS								ON	OFF
4 SPACE FIGHTERS								OFF	ON
5 SPACE FIGHTERS								OFF	OFF

Game Operation

GALAGA is a one or a two player game with a color T.V. monitor.

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

SELF-TEST MODE

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

NOTE: Putting the game into Self-Test will cause it to erase any CREDITS 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, there is an explosion sound (same as when your fighter is hit).
2. Immediately following this, you see an upside down test display which lasts for about 1/2 second. (By pushing both the "1 PLAYER" and the "2 PLAYER" buttons at the same time, the picture will turn upside down and stay that way until you release the buttons.)
3. And last, 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.

RAM OK or (a number and a letter i.e. 1L, 3H, etc.
ROM OK or (a number i.e. 01 21, etc.)
UPRIGHT or (TABLE)
*1 COIN *1 CREDIT
*3 SHIPS
RANK *A (B,C,D)
SOUND 00 (01,02,03,04,05,06,07,08,09,10,11,12, 13,14,15,16,17)
1ST BONUS *20000 PTS
2ND BONUS *70000 PTS
*AND EVERY 70000 PTS

* = switch selectable

Figure 4a. Self test display

4. If a bad ROM or RAM chip is found by the games 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":

DISPLAY	DESCRIPTION
RAM OK	All RAMs are good
RAM OL	RAM located on Video PC board at position 1K is bad.
RAM OH	RAM located on Video PC board at position 1K is bad.
RAM 1L	RAM located on Video PC board at position 1K is bad.
RAM 1H	RAM located on Video PC board at position 1K is bad.
RAM 2L	RAM located on Video PC board at position 3E is bad.
RAM 2H	RAM located on Video PC board at position 3F is bad.
RAM 3L	RAM located on Video PC board at position 3K is bad.
RAM 3H	RAM located on Video PC board at position 3L is bad.
RAM 4L	RAM located on Video PC board at position 3H is bad.
RAM 4H	RAM located on Video PC board at position 3J is bad.
ROM OK	All ROMs are good.
ROM 01	ROM located on CPU PC board at position 3N is bad.
ROM 02	ROM located on CPU PC board at position 3M is bad.
ROM 03	ROM located on CPU PC board at position 3L is bad.
ROM 04	ROM located on CPU PC board at position 3K is bad.
ROM 11	ROM located on CPU PC board at position 3J is bad.
ROM 21	ROM located on CPU PC board at position 3E is bad.

Figure 4b. Board location coordinates (Self test display)

5. "RANK" is a difficulty setting, with "RANK A" being the **least** difficult level of play and "RANK D" being the **most** difficult level of play. See the "OPTION SWITCH SETTINGS" table.

6. To check "SOUND" (the game has 18 different sounds):
   a) Move the controller to the right momentarily and release it — "SOUND" number changes from "00" to "01".
   b) Press any game play button or activate the coin switches and sound "01" is heard.
   c) Repeat Step 6. a) — "SOUND 01" changes to "SOUND 02".
   d) Repeat Step 6. b) — and "SOUND 02" is heard.

7. 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 the same sound during each activation. If you do not hear it, the switch/button is either not working, miswired, or disconnected. Check it out thoroughly.

8. 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 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 games 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 games memory.
   - After the High Score/Initial mode when there are no more credits left in its memory.

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.

PLAY MODE

1. The Play mode begins when either the "1 PLAYER" or the "2 PLAYER" start button is pressed. "PLAYER 1", "STAGE 1" 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 alien space ships. You, as defender, try to destroy as many convoys as you can.

4. The convoys are displayed one at a time at the top of the screen. They are made up of GALAGA COMMAND SHIPS, RED GALAGAS, and BLUE GALAGAS. These ships fly onto the screen from different angles, going by your position (giving you an opportunity to shoot them down) and then take up their positions in the convoy formation at the top of the screen.

   In the first STAGE, the enemy ships do not drop bombs on you as they fly onto the screen and go by your position. However, they will in later stages.

   After the convoy (or what's left of it after you've finished shooting at them as they fly onto the screen and head for their respective spots in the convoy formation) finishes forming up at the top of the screen, enemy ships will begin peeling off and diving at your fighter. They weave back and forth across the screen dropping bombs all the while.

   The GALAGA COMMAND SHIPS can put out a tractor beam and capture your fighter. When this happens, that fighter changes color from white to red and stays with that particular enemy COMMAND SHIP for the rest of the game. You can get your fighter back by destroying the GALAGA COMMAND SHIP that captured it while they are both attacking your current fighter. The GALAGA COMMAND SHIPS **MUST BE SHOT TWICE** to destroy them. When shot once, they change color from green to blue. When shot again, they explode. If, however, you mistakenly shoot the captured fighter, it will be destroyed. At that time, if the captured fighter is in a stand-by position in the convoy formation — 500 points will be added to your score; if the captured fighter is attacking — 1000 points will be added to your score.

   The RED and BLUE GALAGAS will explode as soon as they are hit by one of your shots.

There are also special attack squadrons made up of three ships each which will appear from STAGE 4 on. If they are completely destroyed, bonus points will be awarded as follows:

STAGES 4-6	1000 BONUS POINTS
STAGES 8-10	2000 BONUS POINTS
STAGES 12-14	3000 BONUS POINTS

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

"STAGE "
(And the number of the next stage.)

The only exception to this would be when the next STAGE is a CHALLENGING STAGE. The first CHALLENGING STAGE comes at the end of the 2nd STAGE. After this, they come at the end of every third STAGE. When you destroy the last ship of the 2nd, 6th, 10th, 14th, 18th, etc. convoys, you will see this display **centered** on the monitor screen:

"CHALLENGING STAGE"

A CHALLENGING STAGE is made up of 40 enemy ships that fly by your fighter in 5 groups of 8 ships each while describing varying patterns. They do not drop any bombs and the object is to shoot down as many of them as you can. When you shoot down one COMPLETE formation of 8 enemy ships, bonus points (between 1000 and 3000 depending on the STAGE) are added to your score. If you can destroy all 40 GALAGAS, you will be awarded a SPECIAL BONUS OF 10000 POINTS for that particular CHALLENGING STAGE. When you destroy all 40 GALAGAS, you will see this display **centered** on the monitor screen:

"PERFECT !" ———— flashes
"NUMBER OF HITS 40"
"SPECIAL BONUS 10000 PTS"

Otherwise, after each CHALLENGING STAGE is over, the game gives this display **centered** on the monitor screen:

NUMBER OF HITS __ __
BONUS __ __ __ __
(The BONUS is 100 times the NUMBER OF HITS.)

The next display the game always gives is shown below and is **centered** on the monitor screen.

"STAGE "
(And the number of the next stage.)

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 in one corner of the screen, etc. You've really got to watch them closely. If they can't bomb you, they'll ram you in the rear. That's one of their favorite tricks, to fly in a circle and come up behind you.

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

When the enemy destroys or captures your **last** fighter, the words "GAME OVER" are displayed **centered** on the monitor screen. The next thing the game does is to display your "RESULTS" statistics. See the following sample display.

1 UP	**HIGH SCORE**	***2 UP**
000000	000000	000000

RESULTS
SHOTS FIRED ___
NUMBER OF HITS ___
HIT-MISS RATIO __._%

stage markers ⟶ ▯▯

*ONLY SHOWN IF THE LAST GAME WAS A TWO PLAYER GAME.

If your score was high enough to become one of the five best scores, the game will go into the High Score/Initial mode immediately after the Results mode. 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).

When in the High Score/Initial mode, there are three "A"'s under the top "NAME" heading on the screen. The first "A" is yellow and flashing on and off. The other two "A"'s are white. Farther down the screen under the "TOP 5" heading, your score has been entered in bright yellow 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, 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 and the remainder of the enemy convoy flies off the top of the screen in formation.
- Next, "PLAYER " - "STAGE " is displayed (whenever a new convoy is going to come onto the screen) otherwise it just displays "PLAYER " - "READY" while what's left of the previously formed convoy flies onto the top of the screen.
- Play begins for the other player.

FIGHTER DESTROYED OR CAPTURED — NO FIGHTERS REMAINING IN RESERVE

- Game displays "PLAYER " - "GAME OVER".
- Next, it goes to the "RESULTS" mode.
- After the "RESULTS" mode, if your score was high enough, it goes to the "HIGH SCORE/ INITIAL" MODE.

  After this mode, the game will display "PLAYER " - "STAGE " (whenever a new convoy is going to come onto the screen) otherwise it just displays "PLAYER " - "READY" while what's left of the previously formed convoy flies onto the top 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 " - "STAGE " (whenever a new convoy is going to come onto the screen) otherwise it just displays "PLAYER " - "READY" while what's left of the previously formed convoy flies onto the top of the screen and play begins for the other player.

III Maintenance and Repair

Maintenance and Repair

Your GALAGA 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

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 the monitor manufacturer) and/or the T.V. Troubleshooting Section of this manual for information on these fuses.

OPENING THE CONTROL PANEL.

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 in the center of the front 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.**
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.**

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 5.

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 5.

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.

- **To remove the control panel(s):**

  Disconnect it from its cabling.

  The control panel is now free and can be removed.

- **To reinstall the control panel, reverse this procedure.**

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

1. **UPRIGHT MODEL:**

   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:**

   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.

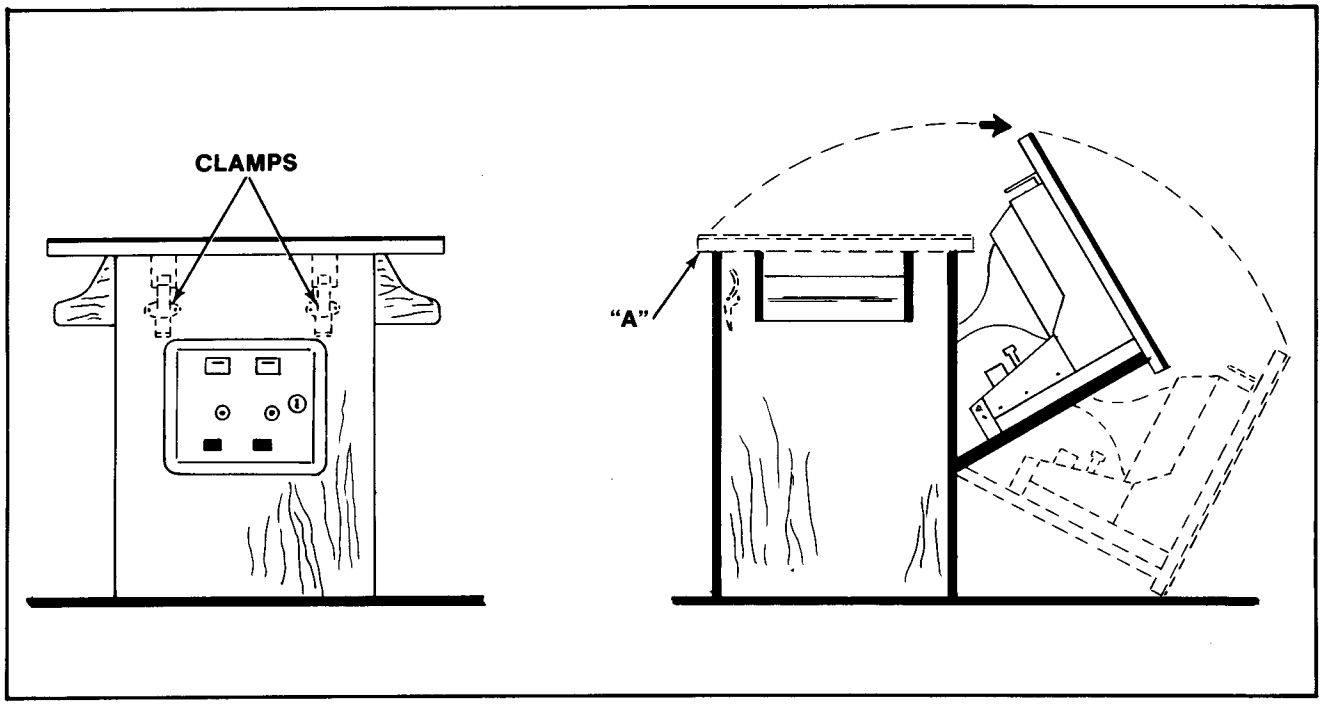


Figure 5. Opening Cocktail game

- 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.

3. **COCKTAIL TABLE MODEL:**

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 6

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

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

With the removal of only four bolts, the T.V. monitor and its mounting channels will be loose.

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

To reinstall the T.V. monitor, be sure to run the game Self-Test.

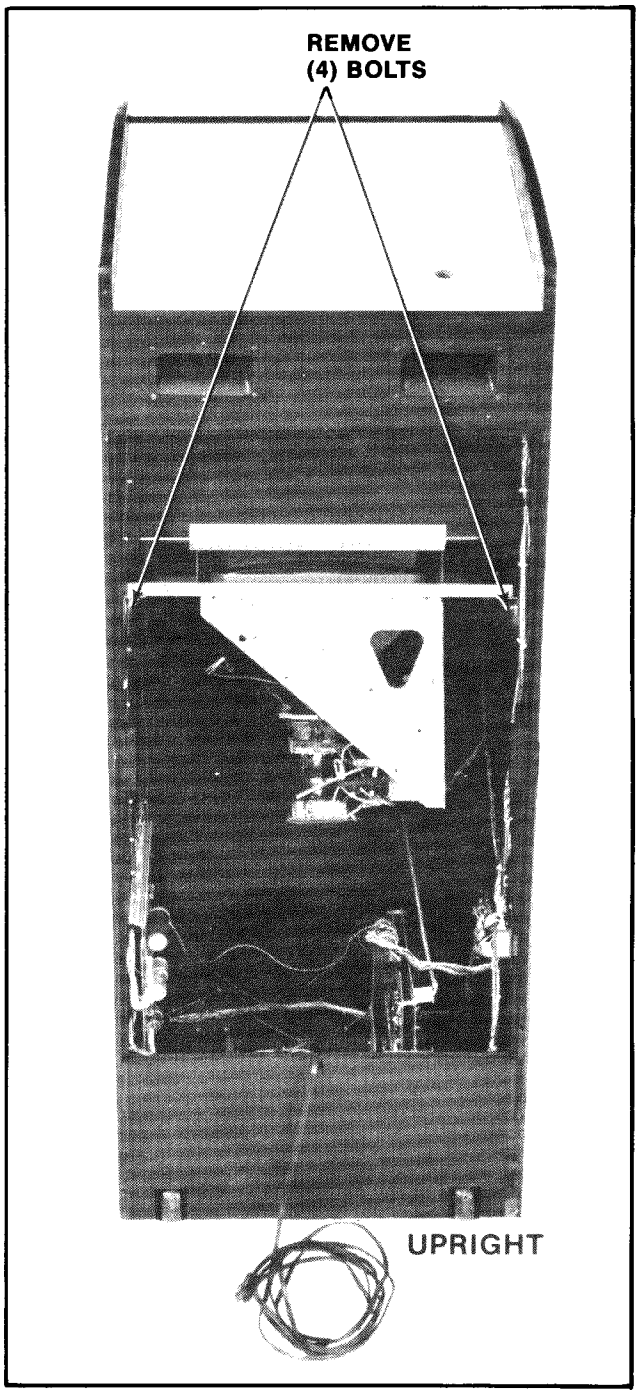


Figure 6. Removing monitor from Upright game

2. **MINI MODEL** SEE FIGURE 7

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.

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.

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 8

Turn power off to the game.

Open the coin box door and release the two latches indicated in Figure 5.

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 5.

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

- Remove the screws which hold the table top glass clamps in place.
- Remove the table top glass.
- Lift out the T.V. bezel assembly.
- Completely disconnect the T.V. monitor from all its cabling. DON'T FORGET THE CHASSIS GROUND WIRE.
- Remove the screws holding the T.V. monitor chassis to the "L" by the door hinge(s).
- 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.
- 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.

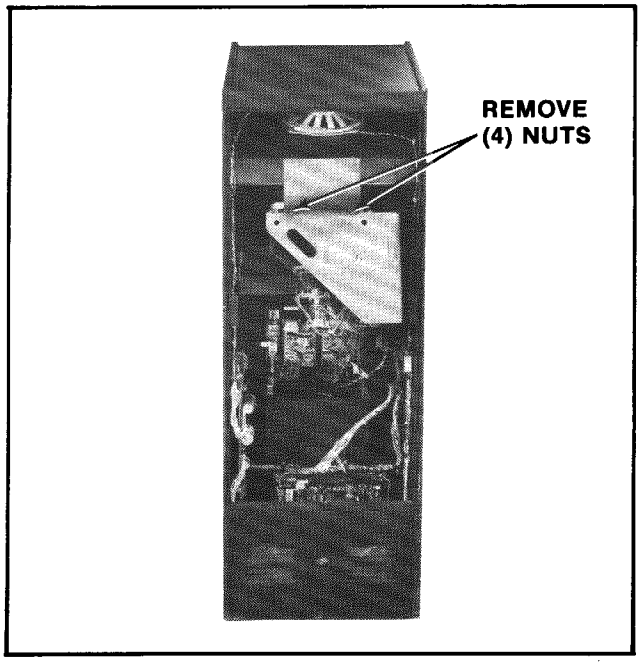


Figure 7. Removing monitor from Mini game

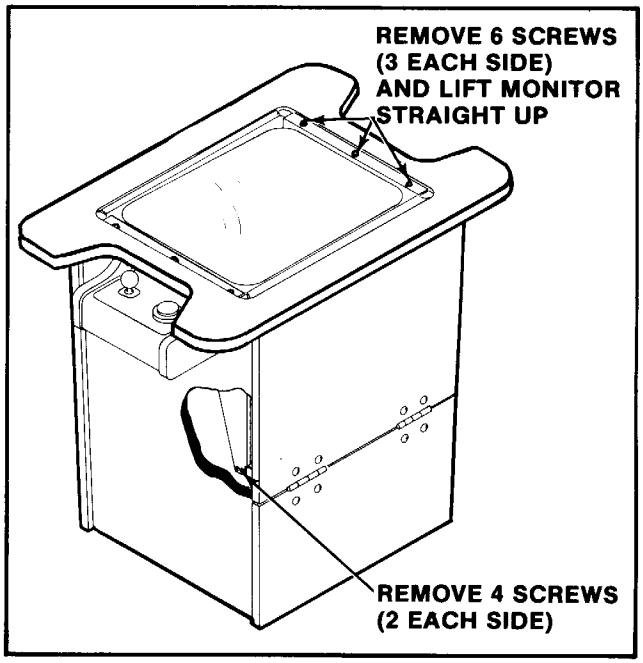


Figure 8. Removing monitor from Cocktail game

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

1. **UPRIGHT MODEL.** SEE FIGURE 9
   - 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 10, and slide it out the back of the cabinet.
   - To reinstall the above P.C.B.'s, reverse this procedure.

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

2. **MINI MODEL.** SEE FIGURE 9
   - 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 9, 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 9.
   - Turn the power off to the game.
   - Open the cabinet:
     Open the coin box door and release the two latches indicated in Figure 5.

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 5.

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

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

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

   - Replacing the fluorescent tube starter.
     Be sure the power to the game has been turned off.

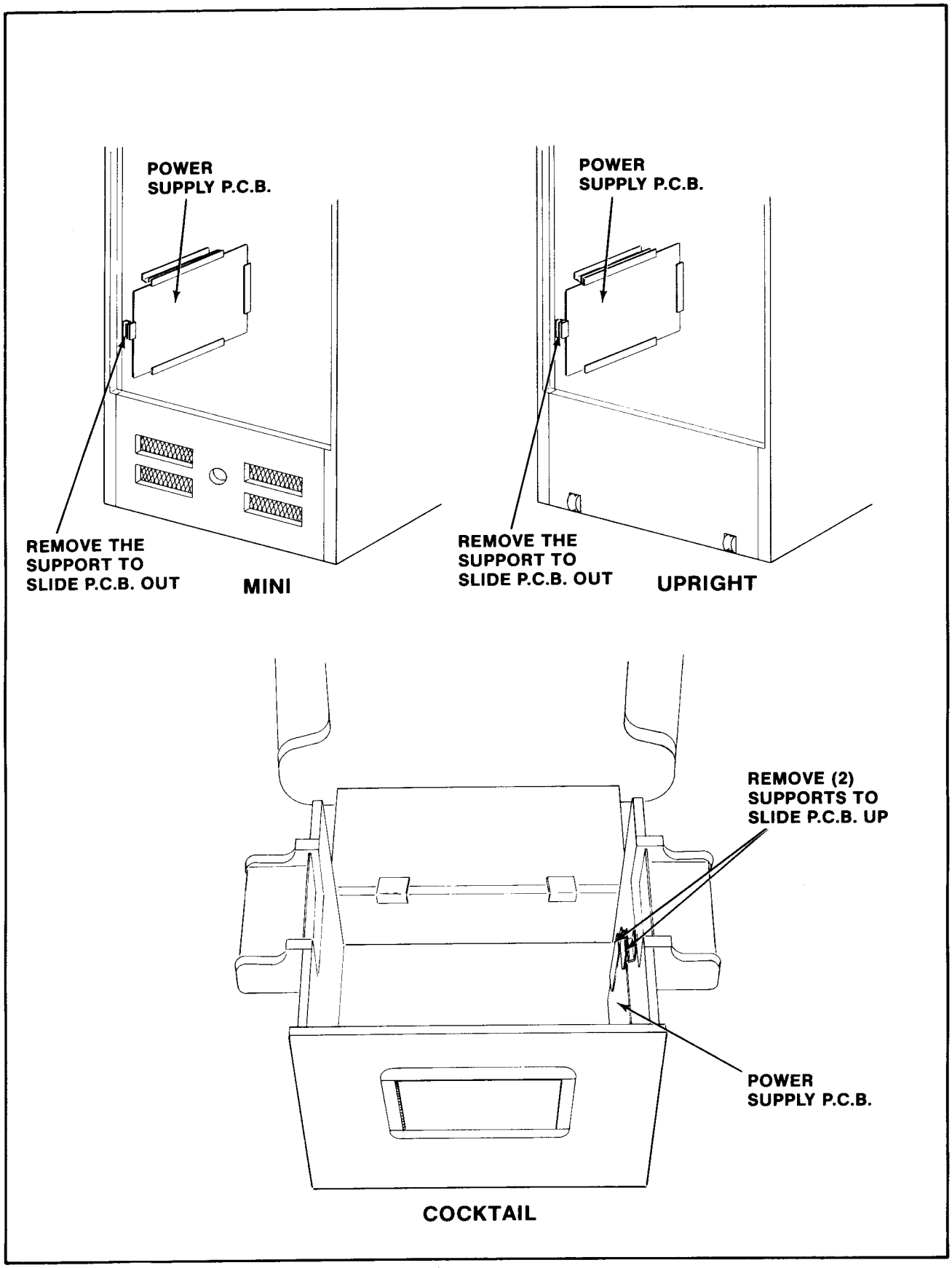


Figure 9. P.C.B. replacement

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

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

- Replacement of the fluorescent tube mounting bracket assembly.

  Be sure the power is off to the game.

  Disconnect it from its power cable.

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

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

- Replacing the speaker.

  Be sure the power is off to the game.

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

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

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

  Reverse this procedure to reinstall the speaker.

2. **MINI MODEL.**
   - **Turn the power off to the game.**
   - **Remove the screws from the top and bottom of the formed attraction panel.**
   - **Remove the formed attraction panel by pulling it straight away from the cabinet. This exposes the attraction panel light bulbs and their mounting board.**
   - **To service the light bulbs and their mounting board:**

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

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

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

     The new bulbs are gently pushed into the empty sockets.

   - To completely replace the light bulb mounting board:

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

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

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

     To reinstall the above removed items, reverse this procedure.

   - **To replace the speaker.**

     Be sure the power is off to the game.

     Disconnect the speaker from its cabling.

     Remove the nuts and bolts securing the speaker.

     Slide the speaker out through the rear access door.

     To reinstall the speaker, simply reverse this procedure.

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

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.
   - 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 10.
   - 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 the 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 11.
   - Be extremely careful to keep the powdered graphite away from paths that are traveled by the coins.

WARNING
DO NOT USE OIL TO LUBRICATE THE COIN ACCEPTOR.

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

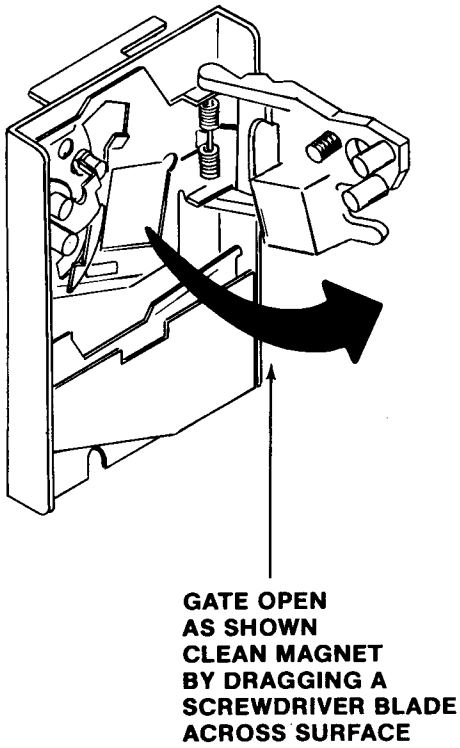


Figure 10. Opening the metal coin acceptor

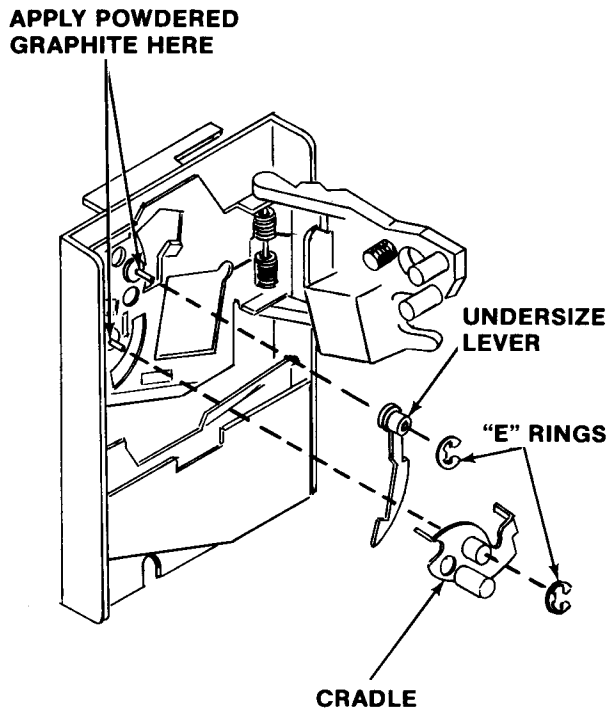


Figure 11. Lubricating the metal coin acceptor

PLASTIC COIN ACCEPTOR MECHANISMS

The plastic coin acceptor mechanismm(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).
   - Push down on the two spring loaded latches.
   - While holding the latches down, pull the top of the acceptor mechanism toward you.
   - Release the latches and lift out the mechanism.
4. Squeeze the two pins on the mechanisms together to open 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.
   - Place the two pegs at the coin acceptors 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 12 for instructions on how to set the plastic coin acceptor mechanisms to either accept or reject Canadian quarters.

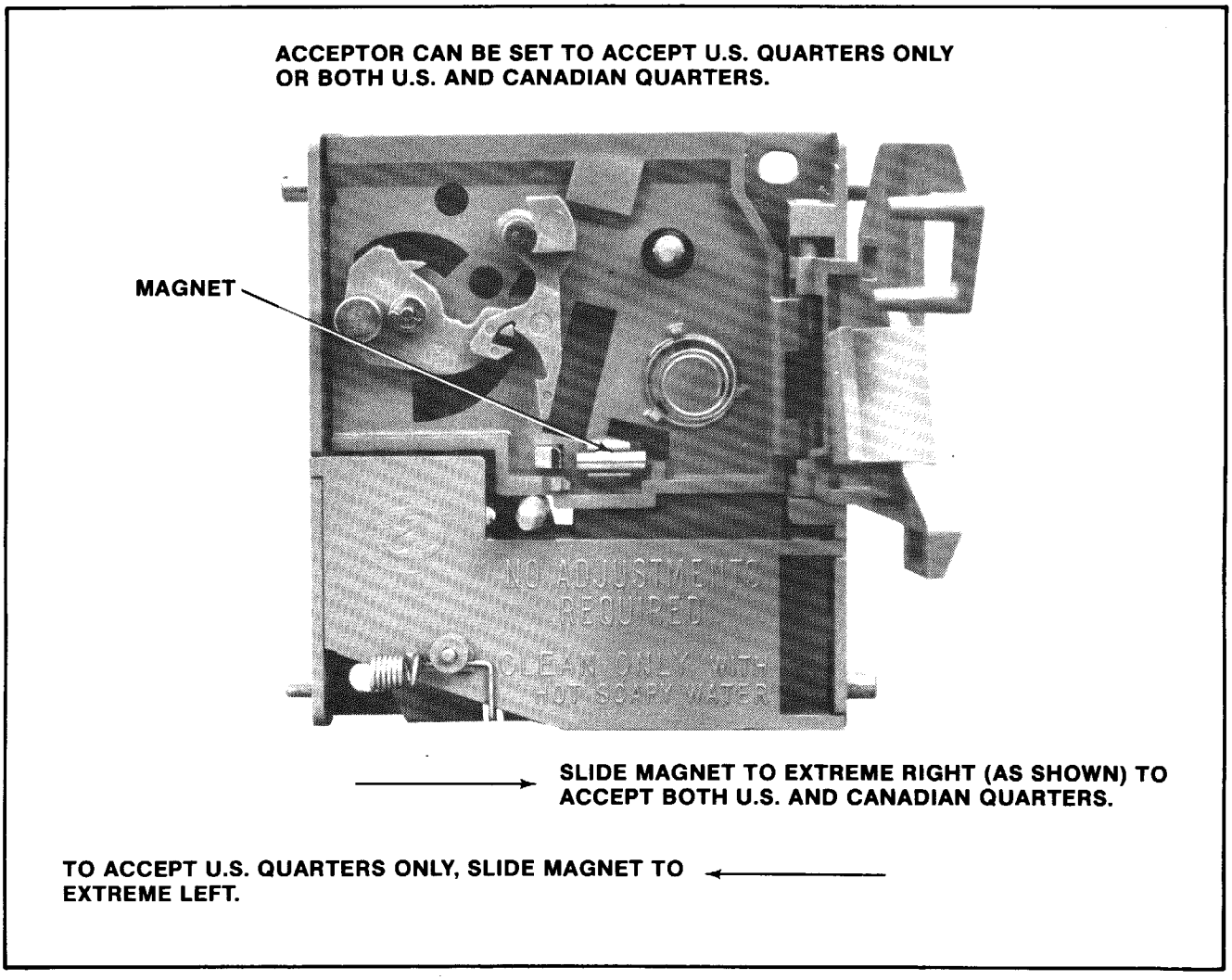
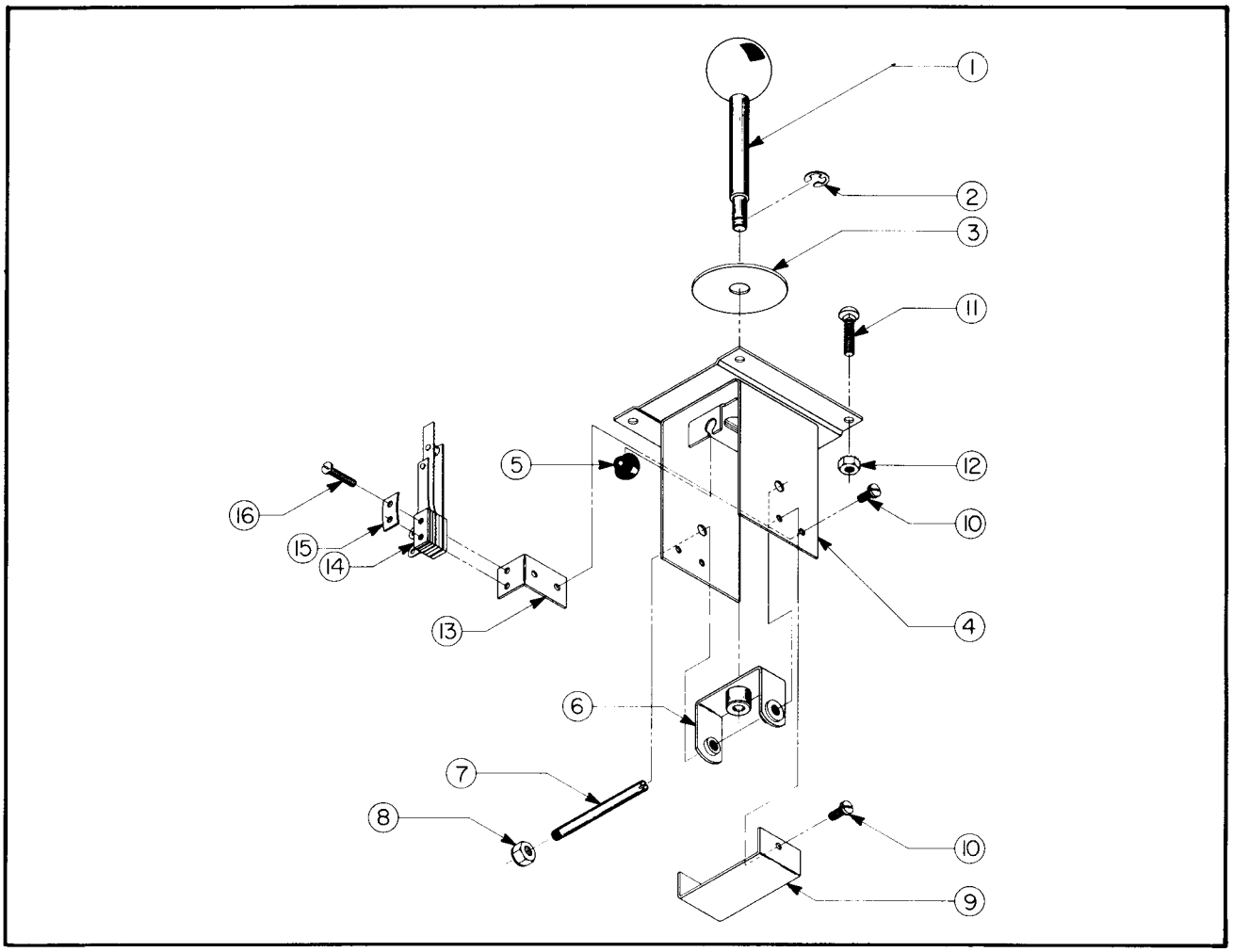


Figure 12. Changing the plastic coin acceptor for American or Canadian Quarters

IV Illustrated Parts Breakdown

GALAGA — CONTROL ASSEMBLY — ALL VERSIONS

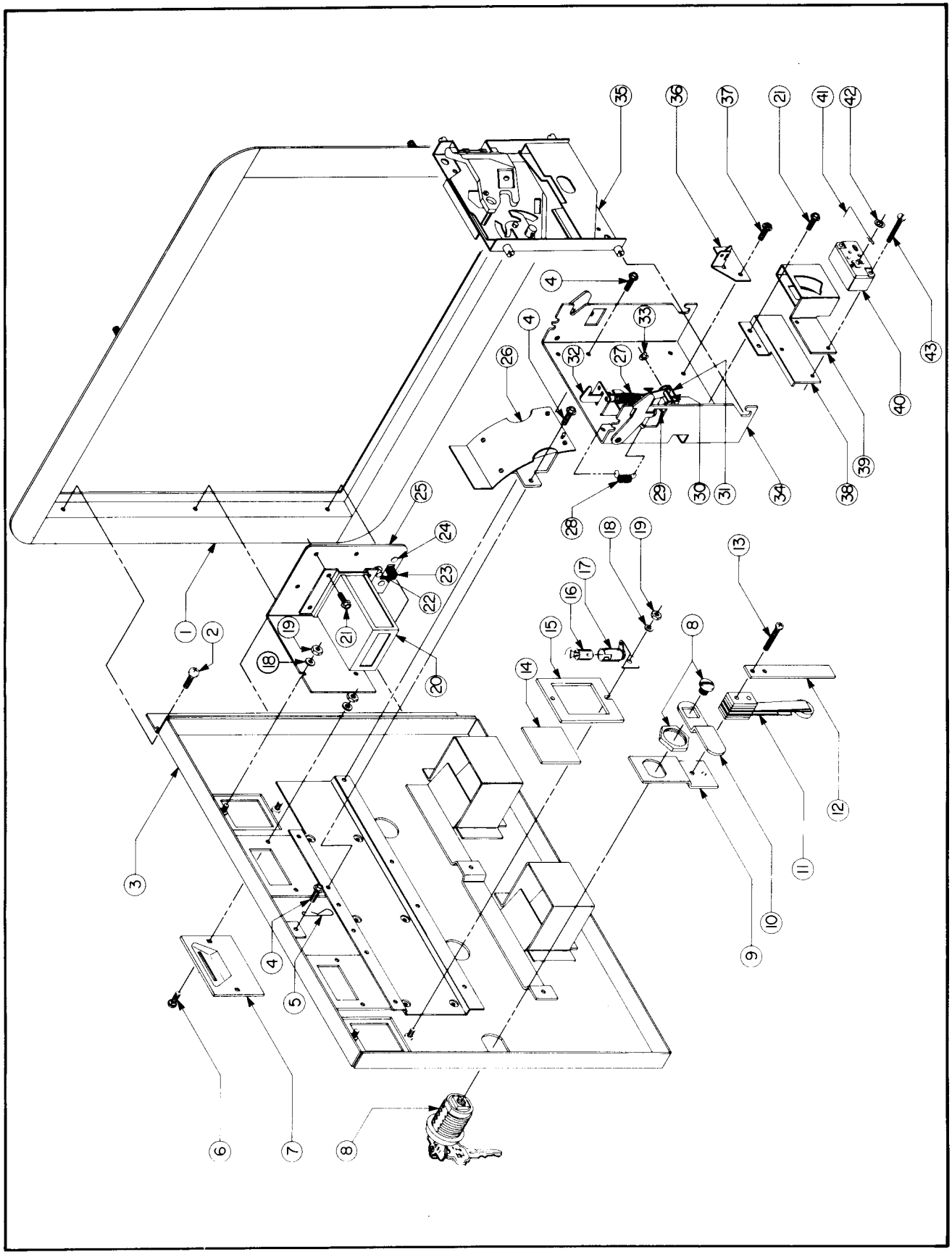


GALAGA — CONTROL ASSEMBLY — ALL VERSIONS

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
1	A866-00207-0000	MOLDED 1-3/8" DIA. BALL & SHAFT ASSY.
2	0017-00100-0025	1/4" E-RING
3	0852-00106-0000	FOLLOWER PLATE
4	A508-00021-00XF	TOP PLATE — MAIN CONTROL BRKT. ASSY.
5	0017-00041-0616	RUBBER BUMPER — 90 DUROMETER (2 REQ'D.)
6	A866-00027-0000	PIVOT BRKT. HUB & BEARING ASSY.
7	0852-00701-00XF	PIVOT PIN
8	0017-00103-0011	#10-32 LOCK NUT
9	0508-00112-00XF	BRACE — MAIN BRKT.
10	0017-00101-0755	#6-32 x 5/16 SLT. PAN HD. M.S. (4 REQ'D.)
11	0017-00101-0620	#8-32 x 1/2 RND. CARRIAGE BOLT (4 REQ'D.)
12	0017-00103-0061	#8-32 LOCK NUT W/SEMS (4 REQ'D.)
13	0852-00103-00XF	SWITCH BRKT. (2 REQ'D.)
14	A508-00022-0000	LEAF SWITCH ASSY. (2 REQ'D.)
15	0020-00202-0000	SWITCH PLATE (2 REQ'D.)
16	0017-00101-0737	#5-40 x 5/8 SLT. PAN HD. M.S. (4 REQ'D.)

FRONT DOOR ASSEMBLY — U.S.A. 25¢

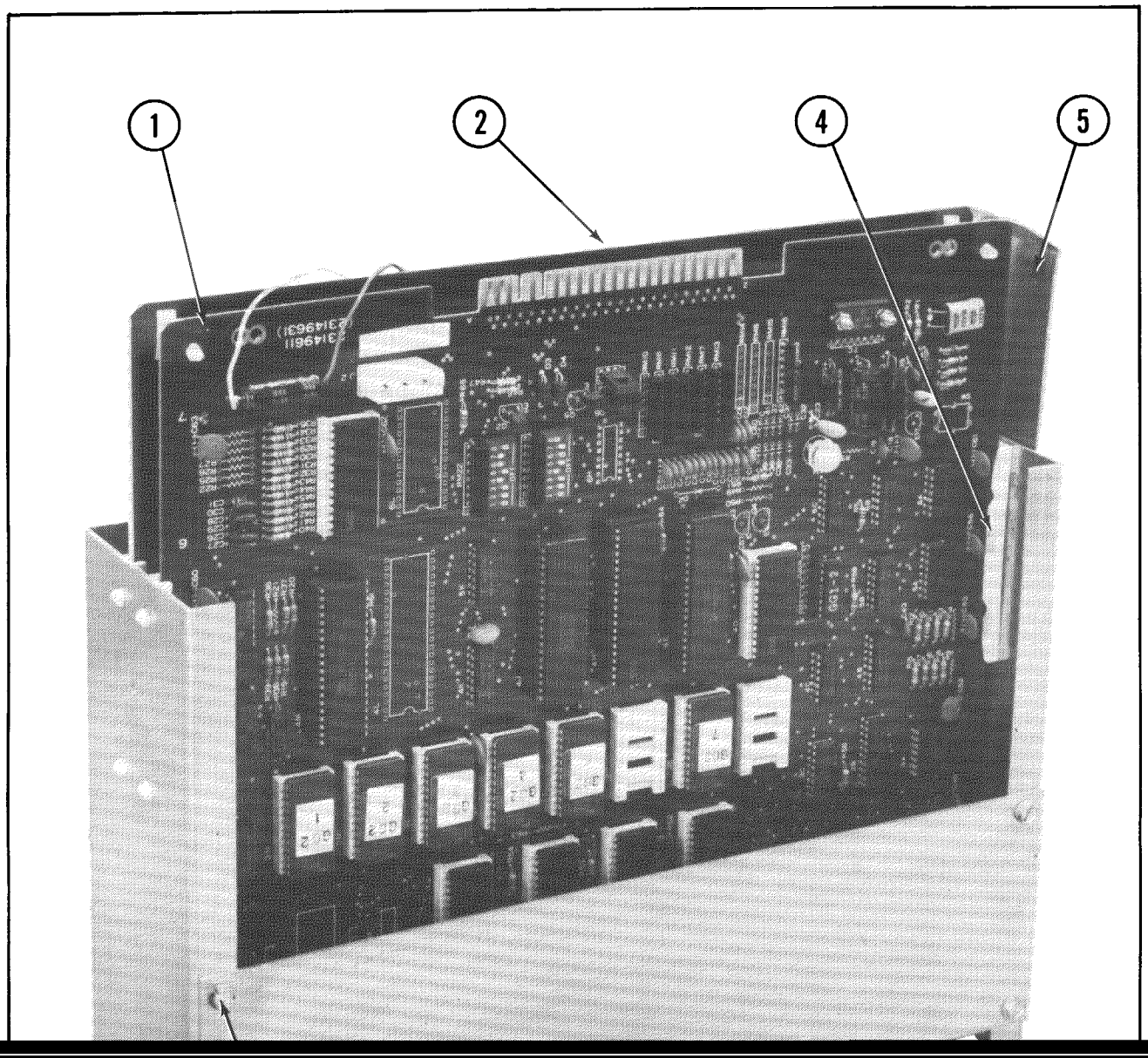


FRONT DOOR ASSEMBLY — U.S.A. 25¢

*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	A090-00071-0000	DOOR TILT SWITCH
12	0090-00126-01XF	SWITCH BACK-UP PLATE
13	0017-00101-0528	#5-40 x 3/4" PHIL. HD. M.S. (2 REQ'D.)
	A090-00004-0000	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	0017-00003-0052	12 VOLT LAMP — G.E. #1895 (2 REQ'D.)
17	0017-00031-0038	BAYONET SOCKET W/BRKT. (2 REQ'D.)
18	0017-00104-0002	#6 SPLIT LOCK WASHER (8 REQ'D.)
19	0017-00103-0087	#6-32 HEX NUT (8 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)

GALAGA — CARD RACK ASSY. W/BOARDS — ALL VERSIONS

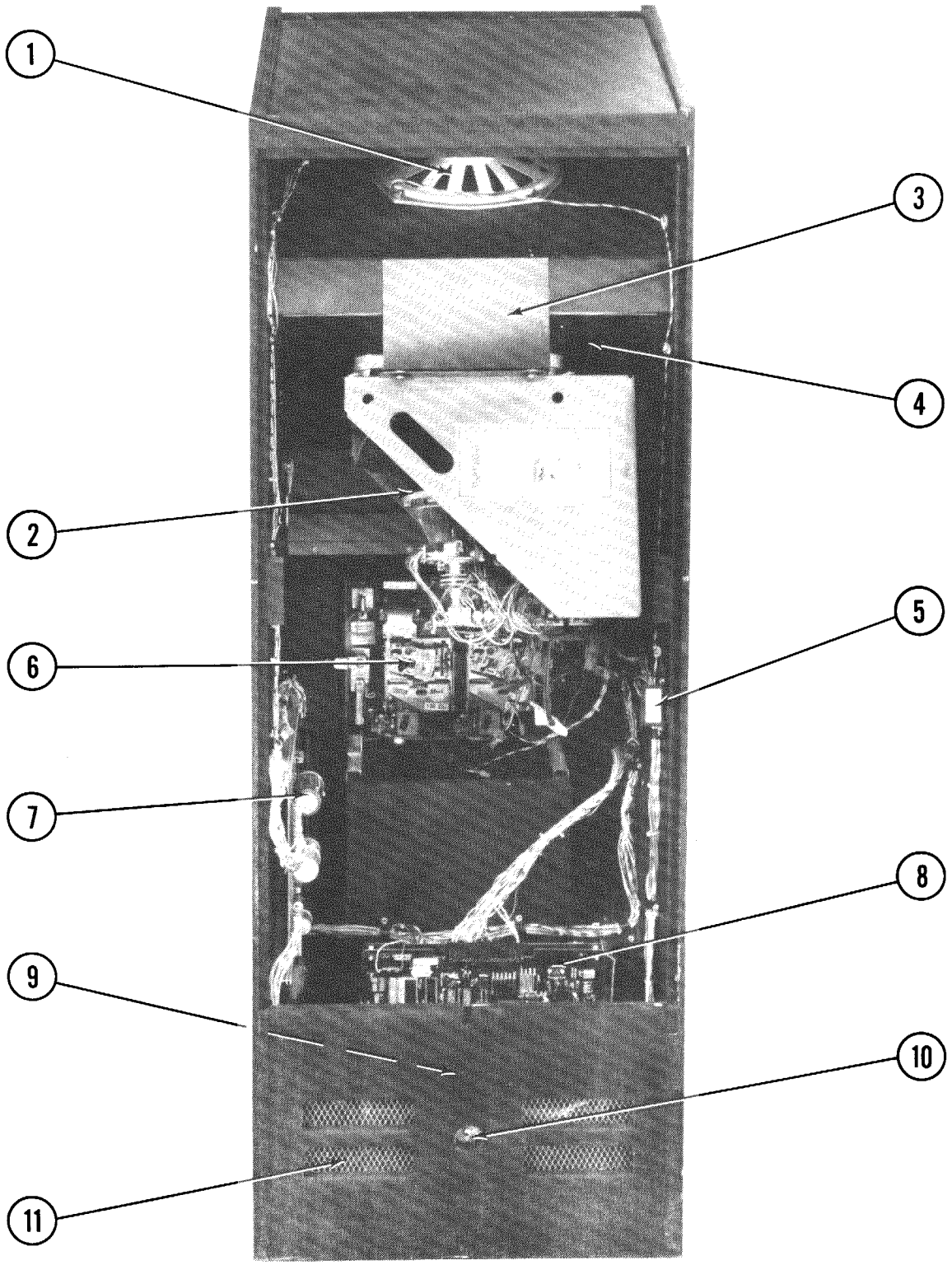


NO. 514 — GALAGA MINI — FRONT PARTS LIST

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
1	0514-00901-00XF	DISPLAY PANEL
	0017-00101-0138	#8 x 5/8 TORX TAMPER RESISTANT SCR. (8 REQ'D.)
	0017-00009-0522	LONG ARM KEY T-20 (FOR ABOVE SCREW)
2	A926-00010-0000	INSERT DISPLAY ASSY.
	0017-00031-0030	WEDGE BASE LIGHT SOCKET (5 REQ'D.)
	0017-00003-0219	#194 LAMP 14V., .27A. (5 REQ'D.)
3	0017-00009-0393	BLACK SPEAKER GRILL W/SLOTS
	0017-00003-0187	6" x 9" SPEAKER 8 OHM, 9W.
	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	0514-00900-00XF	FRONT GLASS — 17-13/16" x 14-13/16" x 3/16"
5	0905-00903-0100	GLASS EDGE CHANNEL — 14-1/2 LG. (2 REQ'D.)
6	A931-00012-0000	GLASS CLAMPING PLATE ASSY.
	0017-00101-0138	#8 x 5/8 TORX TAMPER RESISTANT SCREW (2 REQ'D.)
7	A514-00008-0000	CONTROL PLATE & OVERLAY ASSY.
	0514-00100-0000	CONTROL SHELF PLATE
	0514-00902-0000	DECORATIVE SHELF OVERLAY
	0017-00101-0620	#8-32 x 1/2 CARRIAGE BOLT (4 REQ'D.)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (4 REQ'D.)
	0514-00102-0100	CONTROL SHELF BRKT. SUPPORT — RIGHT
	0514-00102-0200	CONTROL SHELF B RKT. SUPPORT — LEFT
	0961-00115-00XF	STRIKE (2 REQ'D.)
	0017-00009-0033	BASSICK CLAMP (2 REQ'D.)
8	A508-00011-0000	CONTROL ASSY.
9	0017-00042-0256	PUSH BUTTON ASSY. — RED
	0017-00032-0093	PUSH BUTTON SWITCH W/HOLDER
	0017-00103-0054	5/8-11 PAL NUT
10	0017-00032-0051	SMALL RED SWITCH BUTTON W/HARDWARE (2 REQ'D.)
11	A090-00300-07BK	U.S.A. 25¢ COIN DOOR ASSY.
	0090-00002-02BK	LARGE COIN DOOR FRAME
	0017-00101-0121	#6-32 x 5/16 PHIL. TRS. HD. SCR. (3 REQ'D.) (MOUNTS COIN DOOR TO FRAME)
12	0017-00102-0048	3/8-16 x 2" LEG LEVELERS (4 REQ'D.)
	0017-00103-0026	3/8-16 LEG LEVELER NUTS (4 REQ'D.)
13	0935-00906-0400	KICK PLATE 17-15/16" LG. — NOT SHOWN

NO. 514 — GALAGA MINI — REAR ACCESS

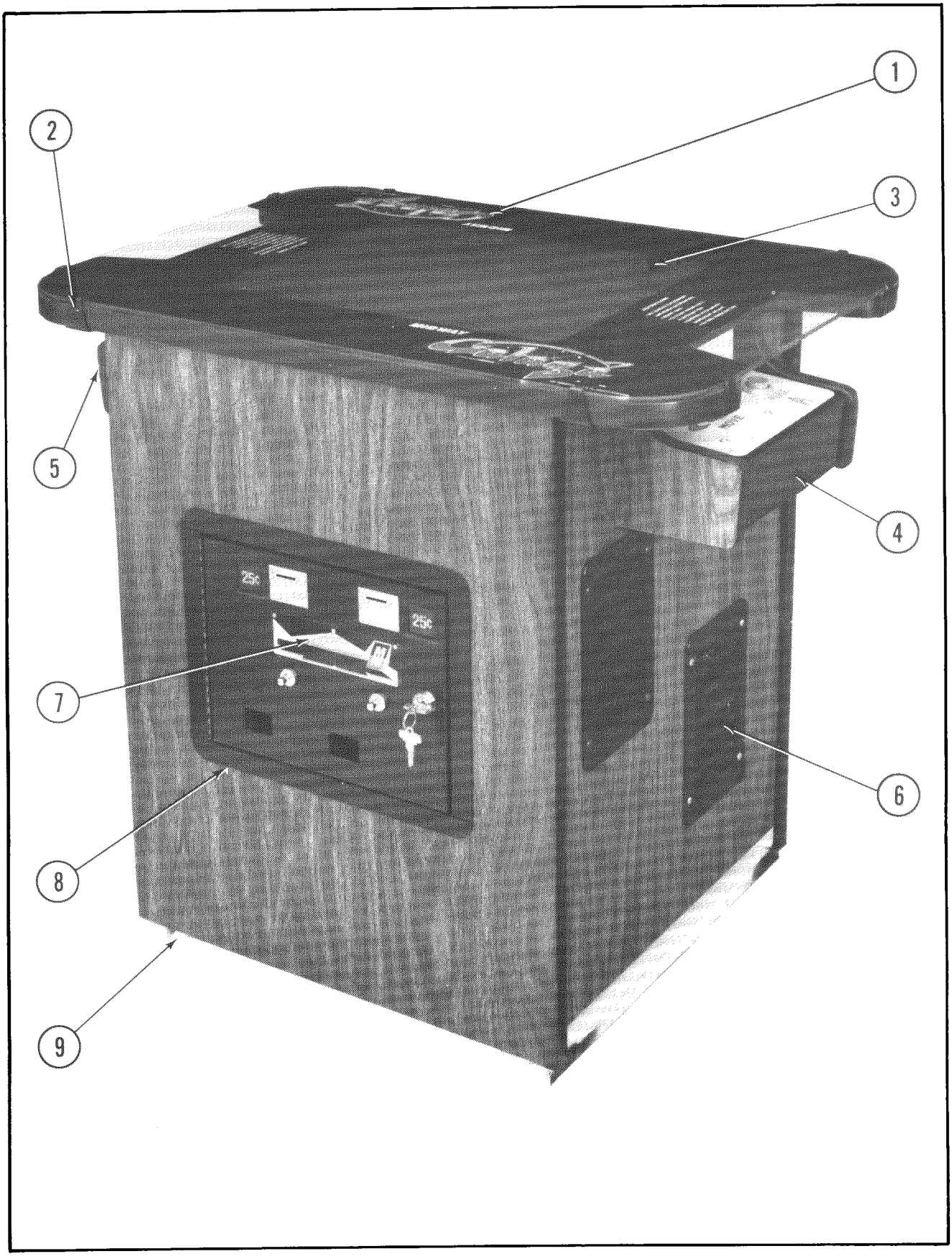


NO. 514 — GALAGA MINI — REAR ACCESS PARTS LIST

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
1	0017-00003-0187	6" x 9" SPEAKER 8 OHM, 9W.
2	0017-00003-0340	ELECTROHOME — 13" COLOR DUAL SYNC. HORIZ. MTG. MONITOR (OR)
2	0017-00003-0369	WELLS-GARDNER — 13" COLOR DUAL SYNC. HORIZ. MTG. MONITOR
3	A926-00012-00XF	T.V. MTG. BRKT. ASSY.
	0017-00102-0066	1/4-20 x 3/4 UNSLOT. HEX HD BOLT (2 REQ'D.)
	0017-00104-0014	7/8" DISH WASHER (2 REQ'D.)
4	A514-00004-0000	T.V. BEZEL ASSY.
	0513-00900-0000	T.V. BEZEL
	0934-00905-0000	PLEXI-GLASS (TINTED)
	A961-00026-0000	BEZEL MTG. BRKT. ASSY.
5	A151-00027-0000	INTERLOCK SWITCH ASSY.
6	A090-00300-07BK	DOUBLE ENTRY COIN DOOR ASSY.
7	A084-91414-C935	POWER SUPPLY ASSY.
	0624-00902-0100	P.C. SUPPORT BRKT. — 12" LG. (2 REQ'D.)
	0624-00902-0300	P.C. SUPPORT BRKT. — 2-1/2" LG. (2 REQ'D.)
	0017-00101-0025	#8 x 1/2 SLT. HEX HD. SCR. (10 REQ'D.)
	0017-00104-0037	#8 FLAT WASHER (10 REQ'D.)
8	A508-00019-0000	CARD RACK ASSY. W/BOARDS
9	A084-91408-B508	FILTER BOARD ASSY. — NOT SEEN
	A514-00010-0000	TRANSFORMER BOARD ASSY. — (NOT SEEN) (LOCATED ON CABINET BASE)
10	A088-00013-0000	ON-OFF SWITCH & BRKT. ASSY.
11	0017-00009-0490	5-5/8" SQ. VENT GRILL (4 REQ'D.)
		ADDITIONAL PARTS LIST
	A097-00008-0000	BACK DOOR LOCK ASSY.
	0926-00904-0000	PROTECTIVE BUBBLE — BACK DOOR
	0017-00101-0628	#8-32 x 3/4 CARRIAGE BOLT (10 REQ'D.)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (10 REQ'D.)
	A905-00028-0000	CASH BOX ASSY. W/HANDLE
	A961-00008-0000	CASH BOX COVER ASSY.
	A894-00024-0000	CASH BOX SIDE CHANNEL ASSY.
	0894-00121-0000	CASH BOX SIDE CHANNEL — LONG
	0017-00101-0628	#8-32 x 3/4 CARRIAGE BOLT (4 REQ'D.)
	0017-00104-0022	#8 FLAT WASHER (4 REQ'D.)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (4 REQ'D.)
	A508-00026-0000	COIN DOOR CABLE ASSY.
	A514-00011-0000	HIGH VOLTAGE CABLE ASSY.
	A514-00012-0000	LOW VOLTAGE CABLE ASSY.
	A514-00013-0000	MASTER CABLE ASSY.
	A514-00014-0000	CONTROL SHELF CABLE ASSY.
	A514-00015-0000	DISPLAY INSERT CABLE ASSY.
	A514-00024-0000	SIGNAL CABLE ASSY.
	A508-00034-0000	AUDIO ADAPTOR CABLE ASSY.
	A508-00035-0000	MONITOR SIGNAL ADAPTOR CABLE ASSY.
	A866-00049-0000	LINE CORD ASSY.
	A082-91109-A000	CREDIT MULT. BYPASS P.C. BRD.
	3000-17143-0000	GROUND STRAP
	A082-91410-A000	RAPID FIRE P.C. BRD. ASSY.

NO. 510 — GALAGA COCKTAIL — FRONT

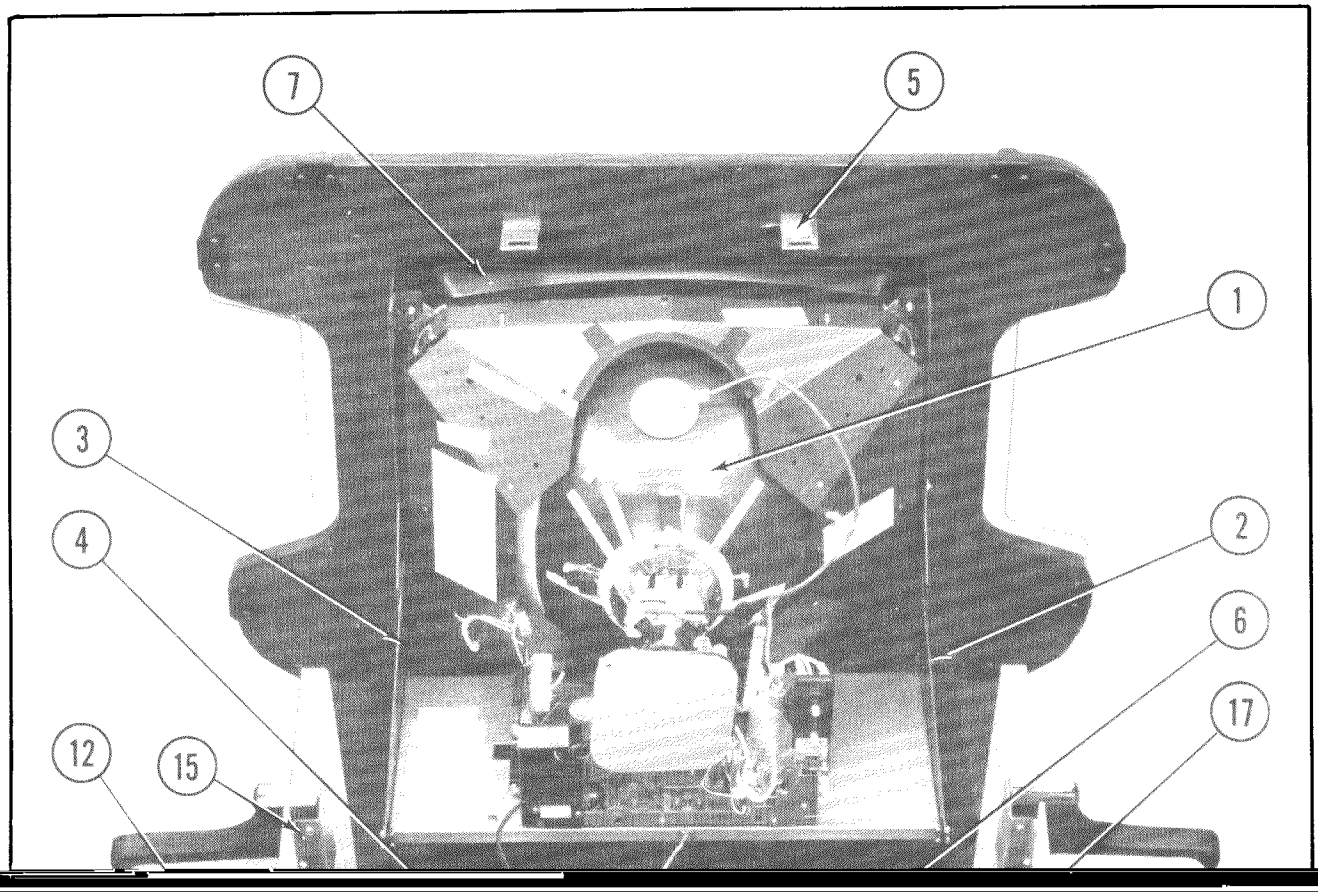


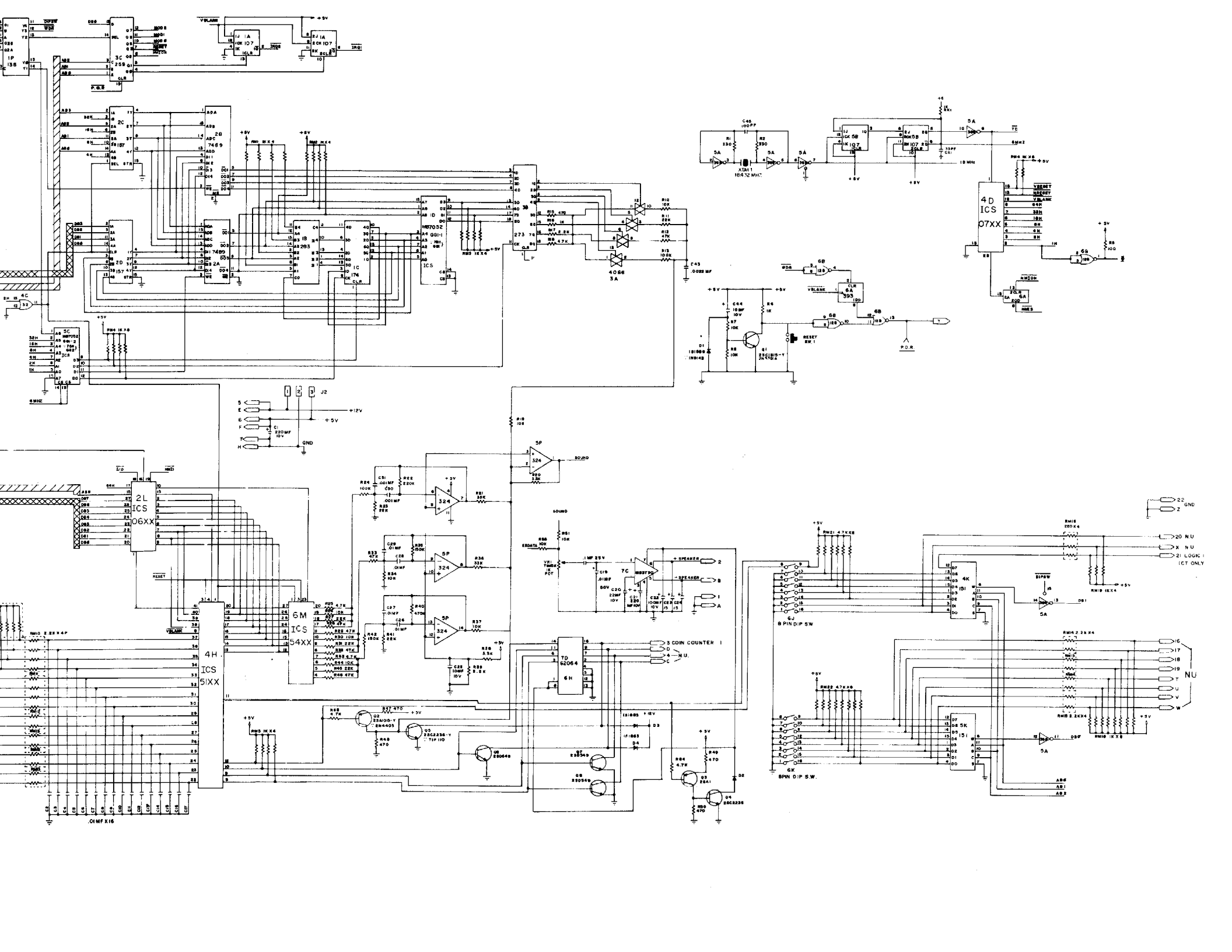
NO. 510 — GALAGA COCKTAIL — FRONT PARTS LIST

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
1	0510-00900-00XF	COVER GLASS — 32" x 22" x 1/4
2	0775-00104-00XF	GLASS CLIPS (8 REQ'D.)
	0017-00101-0117	#8 x 5/8 PHIL TRS. HD. SCR. (16 REQ'D.)
3	A927-00022-0000	T.V. BEZEL & PLEXI ASSY.
	0927-00903-0000	T.V. BEZEL
	0869-00907-0000	GREY PLEXI
4	A510-00006-0100	CONTROL SHELF ASSY. — PLAYER #2
5	A501-00006-0000	CONTROL SHELF ASSY. — PLAYER #1
6	0017-00009-0393	BLACK SPEAKER GRILL W/SLOTS (3 REQ'D.)
	0017-00003-0259	6" x 9" SPEAKER 8 OHM, 7W.
	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.)
7	A090-00300-06BK	DOUBLE ENTRY COIN DOOR ASSY.
8	0090-00002-02BK	LARGE COIN DOOR FRAME
	0017-00101-0121	#6-32 x 5/16 PHIL. TRS. HD. SCR. (3 REQ'D.) (MOUNTS COIN DOOR TO FRAME)
9	0017-00102-0048	3/8-16 x 2" LEG LEVELERS (4 REQ'D.)
	0017-00103-0026	3/8-16 LEG LEVELER NUTS (4 REQ'D.)
		NOT SHOWN LIST
	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.)
	A927-00008-0000	ON/OFF SWITCH ASSY.
	A151-00078-0000	INTERLOCK SWITCH ASSY.
	A775-00013-0000	FAN ASSY.
	0151-00081-0000	4" MUFFIN FAN
	0775-00110-00XF	FAN PLATE
	0749-00106-00XF	FAN 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. SCR. (4 REQ'D.)
	A866-00049-0000	LINE CORD ASSY.
	3000-17143-0000	GROUND STRAP
	0927-00907-0000	HIGH VOLTAGE SHIELD — FORMED

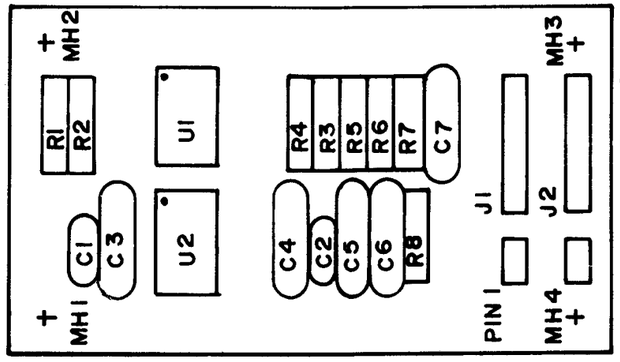
NO. 510 — GALAGA COCKTAIL — INTERIOR ACCESS





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

ASS'Y M051-00114-A001

PROJECT ENG: JERRY SZERSZEN

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

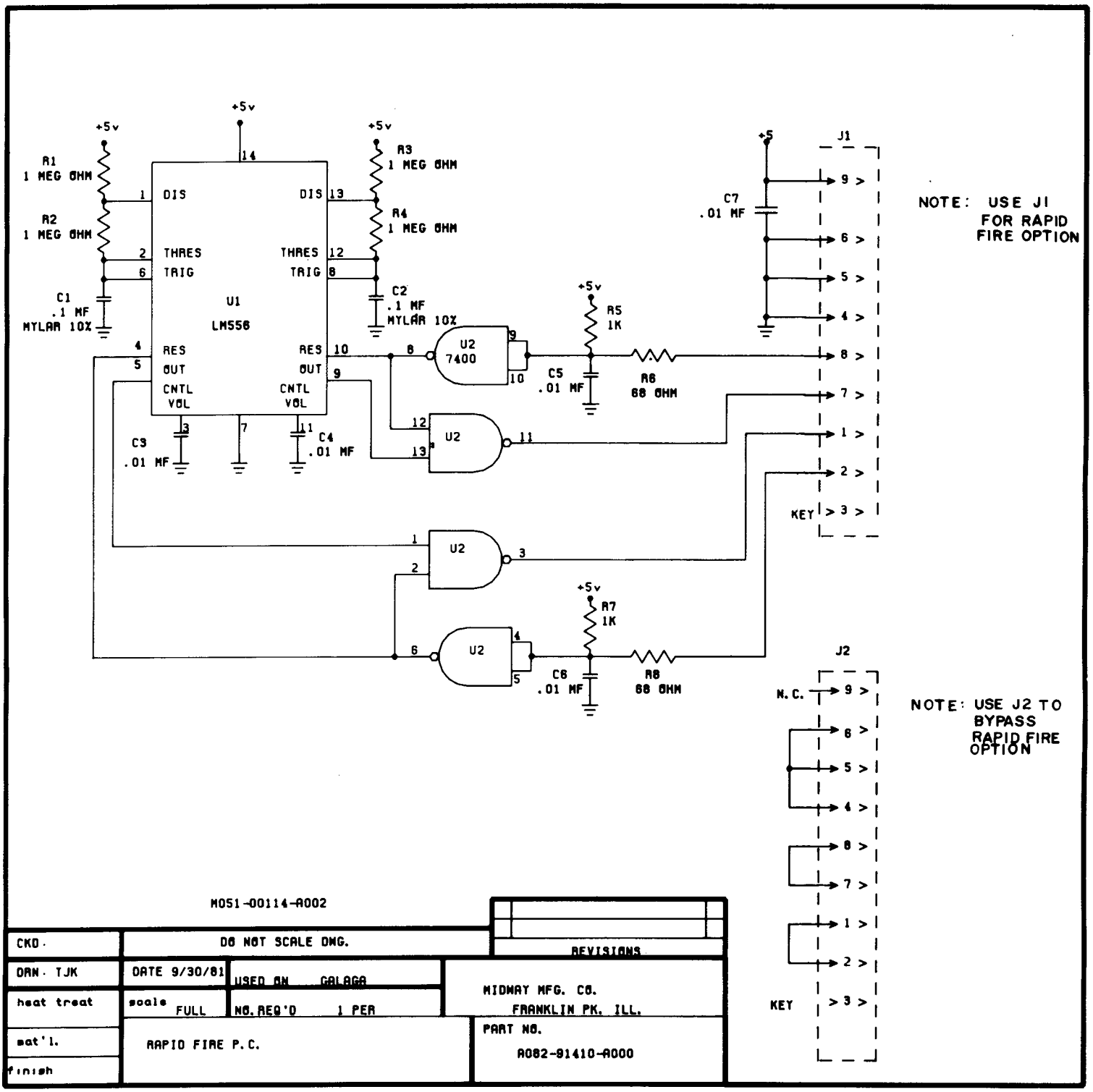
FIRST APPLICATION	GALAGA		
DRN. MM	DATE 09-30-81	SCALE FULL	
MECH CHK	MATL		
ELEC CHK	FINISH		

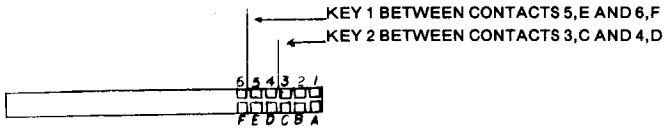
MIDWAY MFG. CO.
FRANKLIN PK., IL. 60131 A BALLY CO

RAPID FIRE P.C.

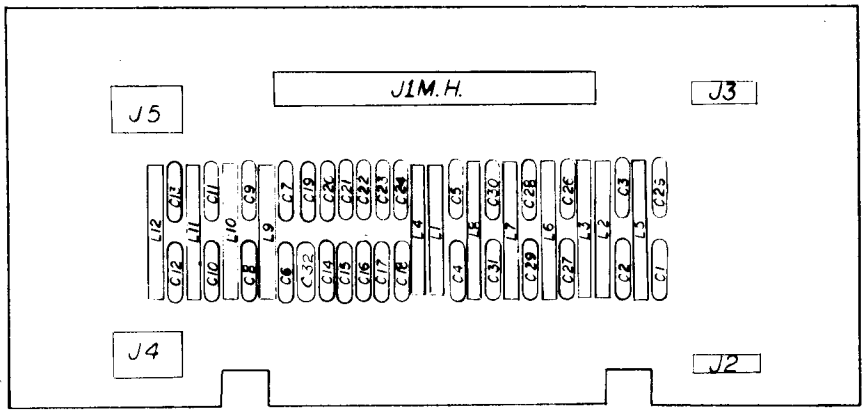
REVISIONS

PART NO
A-08-2-9-1-4-1-0-A-00-0


+5v
R1
1 MEG OHM
R2
1 MEG OHM
C1
.1 MF
MYLAR 10%
U1
LM556
DIS
THRES
TRIG
RES
OUT
CNTL
VOL
R3
1 MEG OHM
R4
1 MEG OHM
C2
.1 MF
MYLAR 10%
C3
.01 MF
C4
.01 MF
U2
7400
U2
R5
1K
C5
.01 MF
R6
68 OHM
C7
.01 MF
J1
KEY
NOTE: USE J1 FOR RAPID FIRE OPTION
R7
1K
C6
.01 MF
R8
68 OHM
J2
N.C.
KEY
NOTE: USE J2 TO BYPASS RAPID FIRE OPTION
M051-00114-A002
CKD.
DO NOT SCALE DWG.
REVISIONS
DRN. TJK
DATE 9/30/81
USED ON GALAGA
heat treat
scale FULL
NO. REQ'D 1 PER
MIDWAY MFG. CO.
FRANKLIN PK. ILL.
mat'l.
finish
RAPID FIRE P.C.
PART NO.
A082-91410-A000



DESIGNATION	DESCRIPTION
C1	.1MF AXCER
C2-C5	47 PF AXCER
C6, C7	470 PF AXCER
C8-C13	100 PF AXCER
C14-C32	.01 MF AXCER
L1-L4	CHOKE 10 UH W.W. MILLER
L5-L8	CHOKE 10 UH W.W.
L9-L12	CHOKE ENCAP 1C UH
J1	P.C. EDGE CONN.
J2, J3	3 PIN HEADER
J4,J5	6 PIN HEADER
J1 M.H.	2 EDGE CONN. KEY
	(2) 6-32 x 10 SLOT PAN SCREW
	(2) WSH 6 145-.250-.032
	(1) BRKT.-CONN. FIN.



DESCRIPTION	QUANTITY	DESIGNATION	PHANTOM NUMBER
47PF 50V AXCER	4	C2-C5	0508-00800-1800
100PF 50V AXCER	6	C8-C13	0508-00800-1600
470PF 50V AXCER	2	C6, C7	0508-00800-1700
.01MF 25V AXCER	19	C14-C32	0508-00800-1800
.1MF 50V AXCER	1	C1	0508-00800-0900
10 UH W.W. RF CHOKE MILLER	4	L1-L4	0067-021XX-XXAX
10 UH W.W. PF CHOKE	4	L5-L8	0508-00804-2000
10 UH ENCAP PF CHOKE	4	L9-L12	0508-00804-2100
PC EDGE CONN.	1	J1	0017-00021-0418

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 EDGE CON KEY	2	J1MH	0017-00021-0396
6-32 x 10 SLOT PAN SCREW	2	J1MH	0017-00101-0574
WSH 6 145-.250-.032	2	J1MH	0017-00104-0002
BRKT-CONN. FIN	1	J1MH	0866-0018-00XF

PROJECT ENGINEER L. DEKKER

ASSY. DWG M051-00508-B014

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

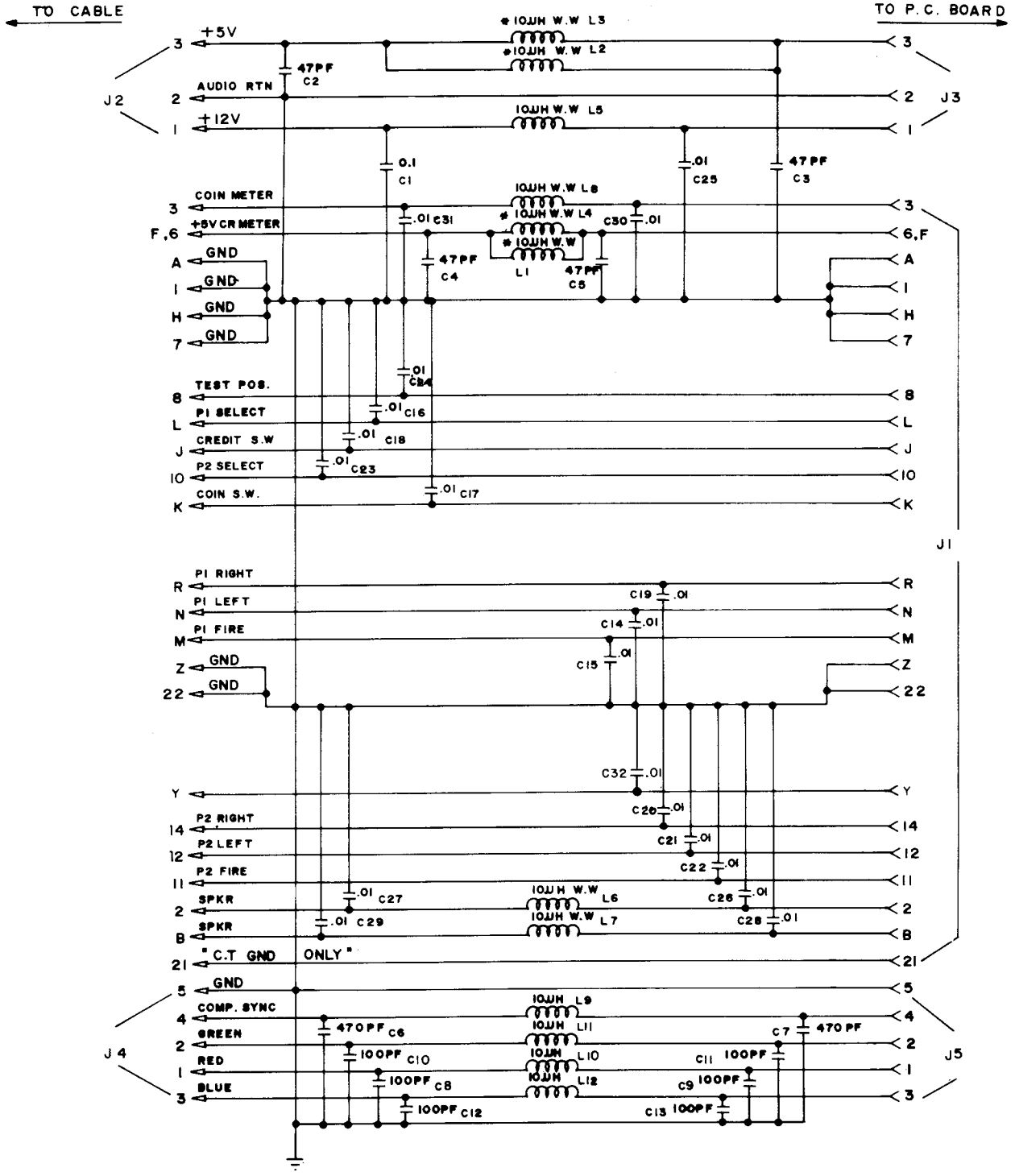
FIRST USED ON
DRN C.K.S. DATE 10-12-81 SCALE FULL
MECH CHK MAT'L
ELEC CHK FINISH

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

GALAGA FILTER PC

REVISIONS

PART NO. A-08-4-9-1-4-0-8-B-5-C-8



NOTE:
ALL .1 & .01 ARE MF
ALL CAPS AX. CER. UNLESS
NOTED OTHERWISE
* 1.5 AMP (MILLER TYPE)
INDUCTORS

SCHEM: 9081-00508-3015
THIS DWG IS CONFIDENTIAL & PROPERTY OF MIDWAY MFG. CO.

MIDWAY MFG. CO.
FRANKLIN PARK, ILL. 60131
A BALLY CO.

REVISIONS

PART NO. A084-91408-8508

GALAGA FILTER BOARD

PROJECT ENG: L. DEKKER

FIRST USED ON	GALAGA
DRWN	M.M.
DATE	10-12-81
SCALE	FULL
WEIGHT	
SHEET	1 OF 1
ELEC. CHK	
REVISION	

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

GALAGA LOGIC BOARD

CHIP NUMBER	FUNCTION
74LS00	Quad 2 Input Nand
74LS08	Quad 2 Input And
74LS10	Triple 3 Input Nand
74LS20	Dual 4 Input Nand
74LS32	Quad 2 Input Or
74LS86	Quad 2 Input Exclusive Or
74LS107	Dual "JK" Flip-Flop
74128	50 Ohm Line Driver
74LS138	3 to 8 Line Decoder
74LS139	Dual 2 to 4 Line Decoder
74LS151	8 Line to 1 Line Data Selector/Multiplexer
74LS153	Dual 4 to 1 Line Multiplexer
74LS157	Quad 2 to 1 Line Multiplexer
74LS158	Quad 2 to 1 Line Multiplexer (Inverting)
74LS161	4 Bit Binary Counter
74LS174	Hex "D" Flip-Flop
74S189	Ram 16 x 4
74LS245	Octal Buss Transceiver
74LS257	Quad Data Selector/Multiplexer
74LS259	8 Bit Addressable Latch
74LS273	Octal "D" Flip-Flop
74LS283	4 Bit Full Adder
74LS298	Quad 2 Input Multiplexer with Storage
74LS365	Hex Buss Driver
74LS367	Hex Buss Driver
74LS368	Hex Buss Driver (Inverting)
74LS377	Octal "D" Flip-Flop
74LS393	Dual 4 Bit Binary Counter
MB7052	Prom 256 X 4 (GG1-1 thru GG1-5)
MB2147	Ram 4K X 1
MB8147	Ram 4K X 1
UPD2114	Ram 1K X 4
MB8532	Eprom 4K X 8
HN462732	Eprom 4K X 8
Z80A or D780C-1	CPU (must use at location 4M)
D780C	CPU (may substitute Z80)
4066	Quad Bilateral Switch
MB3730	Audio Amplifier
LM324	Quad Operational Amplifier
02XX	Custom Data Buffer
04XX	Custom Address Buffer
00XX	Custom Address Generator
05XX	Custom Video Controller
07XX	Custom Horizontal and Vertical Sync. Generators
08XX	Custom Buss Transceivers
51XX	Custom I/O Ports
54XX	Custom Sound Generator
TMM2016	RAm 2K X 8
06XX	Custom Master Buss Controller
18.432	X-tal

ADDITIONAL DEVICES

CHIP NUMBER	FUNCTION	
2SC1815	Transistor	NPN
2N3391	Transistor	NPN
D998	Transistor	NPN
C2500	Transistor	NPN
TIP 110	Transistor	NPN
A733	Transistor	PNP
2N4403	Transistor	PNP
1N4004	Diode	
1N914B	Diode	