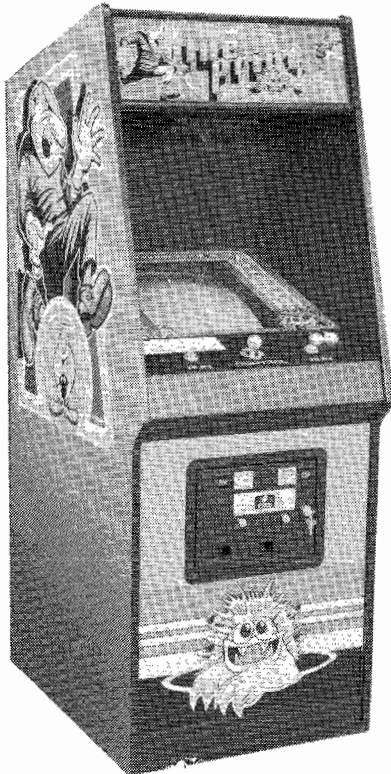
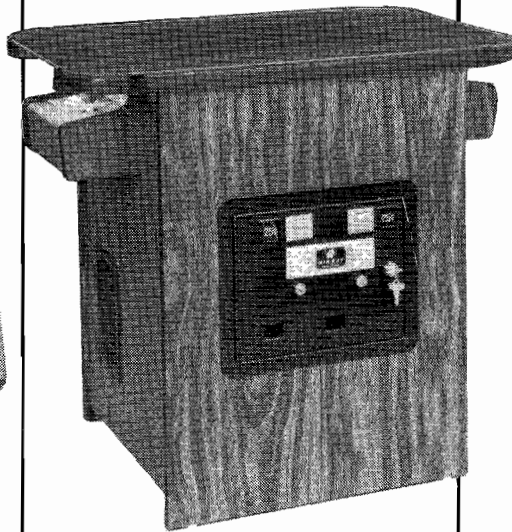




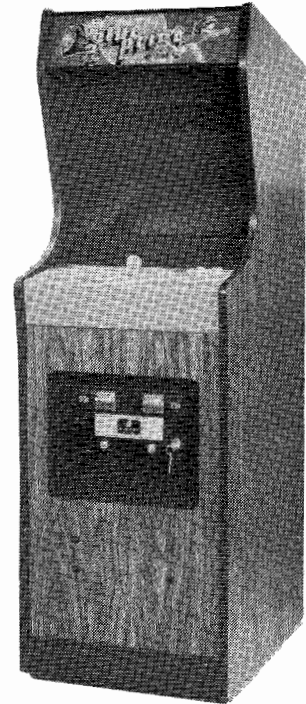
Parts & Operating Manual



NO. 300 UPRIGHT



NO. 302 COCKTAIL



NO. 301 MINI

Bally

MIDWAY MFG. CO.

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



Phone: (312) 451-1360

Cable Address: MIDCO

Telex No.: 72-1596

WARNING

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

WARNING: This equipment Generates, Uses and can Radiate Radio Frequency Energy and if not installed and used in accordance with the Instructions Manual, may cause interference to Radio Communications. As temporarily permitted by Regulation it has not been tested for compliance to Subpart J or Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference. Operation of this equipment in a Residential Area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

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.

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Blueprint

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

BLUEPRINT 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 guide J.J. 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 must direct J.J. through the maze he is in. This is done with the control stick. J.J. is searching for the parts to build the Ammo Machine on the BLUEPRINT at the bottom of the screen which will enable him to save his girl friend from the ogre that is chasing her across the top of the screen.

Each part of this Ammo Machine is contained in one of the houses in the maze. Two of the houses contain bombs. Also, any house that J.J. has removed a part of the Ammo Machine from will contain a bomb if he goes back into it for any reason.

If J.J. goes into a house and comes out with a part for the Ammo Machine, he must tow it down to the BLUEPRINT and place this part over the corre-

sponding section of the BLUEPRINT. This done, he can head back into the maze and go looking for another part to the Ammo Machine.

If J.J. goes into a house and comes out with a bomb, he must make his way to the Bomb Pit located at the lower right hand corner of the screen and throw it in **BEFORE** it goes off. If he fails, you lose one man.

Once the Ammo Machine is built, J.J. must push the Start Button for it located at the lower left hand corner of the screen. Once this is done, the Ammo Machine will start firing at the ogre chasing J.J.'s girl friend across the top of the screen. You can move the Ammo Machine back and forth across the bottom of the screen at this time with the control stick. It does not move up and down on the screen.

As your skill level increases, the ogre runs faster, the bomb fuses are shorter, a maze monster will appear (which can cause you to lose one man if you touch him), and so on. In general, each maze will be harder to complete than the one before.

A bonus man is awarded to you as you reach or pass a certain preselected point value. Each part of the Ammo Machine, the bombs, etc., have an assigned point value as listed in Figure 1-1.

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 ogres as you can. As you do this, each succeeding rack will be harder to complete.

OBJECT DESCRIPTION	POINT VALUE
EACH PART OF AMMO MACHINE	1000 POINTS
BOMB	50 POINTS
WEIRD WILLIE (BACK TO BOMB DISPOSAL PIT)	100 POINTS
OGRE	VARIABLE 25 TO 1000 POINTS

Figure 1-1 Assigned Point Values

II. Location and Setup

INSPECTION:

1. Remove the game from its shipping crate.
2. Inspect the entire outside of it for any signs of damage.
 - Any scratches?, dents?, cracks?
 - Any broken controls?
 - Any broken glass or plastic?
 - Just look it over closely and make a note of any signs of damage.
3. Remove the shipping cleats from the bottom of the cabinet.
4. Install the four levelers, one at each corner of the cabinet.
 - Level the cabinet.
5. Open the cabinet and inspect the inside of the game for any signs of damage. See Figure 2-1.
 - Also check to make sure all plug-in connectors on the wire harness are firmly seated.

NOTE: ALL connectors or plugs are keyed so they will only go together when all pins are properly lined up.
 - Replug any connectors found unplugged. **DO NOT FORCE PLUGS ONTO CONNECTORS. DO NOT FORCE PLUGS TOGETHER.** If it won't go on easily, assuming the keys are lined up, it either does not belong there or is damaged.
 - Make sure all printed circuit boards (P.C.B.'s) are firmly seated in their connectors. These connectors are also keyed. The P.C.B.'s will only go into them one way without being damaged.
 - Note the location of the game's serial number. See Figure 2-1.
 - Check all major subassemblies to be sure they are mounted securely. These are called out in Figures 2-1 & 2-2.
 - Power supply.
 - Control panel(s).
 - T.V. monitor.
 - Other P.C.B.'s and/or P.C.B. rack, etc.
 - Power supply 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 35" (63cm x 88cm)
 - Mini 20" x 24" (50cm x 60cm)
 - Cocktail 32" x 22" (81cm x 55cm)
- Game height:**
 - Upright 68" (170cm)
 - Mini 61" (153cm)
 - Cocktail 29" (73cm)

2. Voltage Selection:

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

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

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

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

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

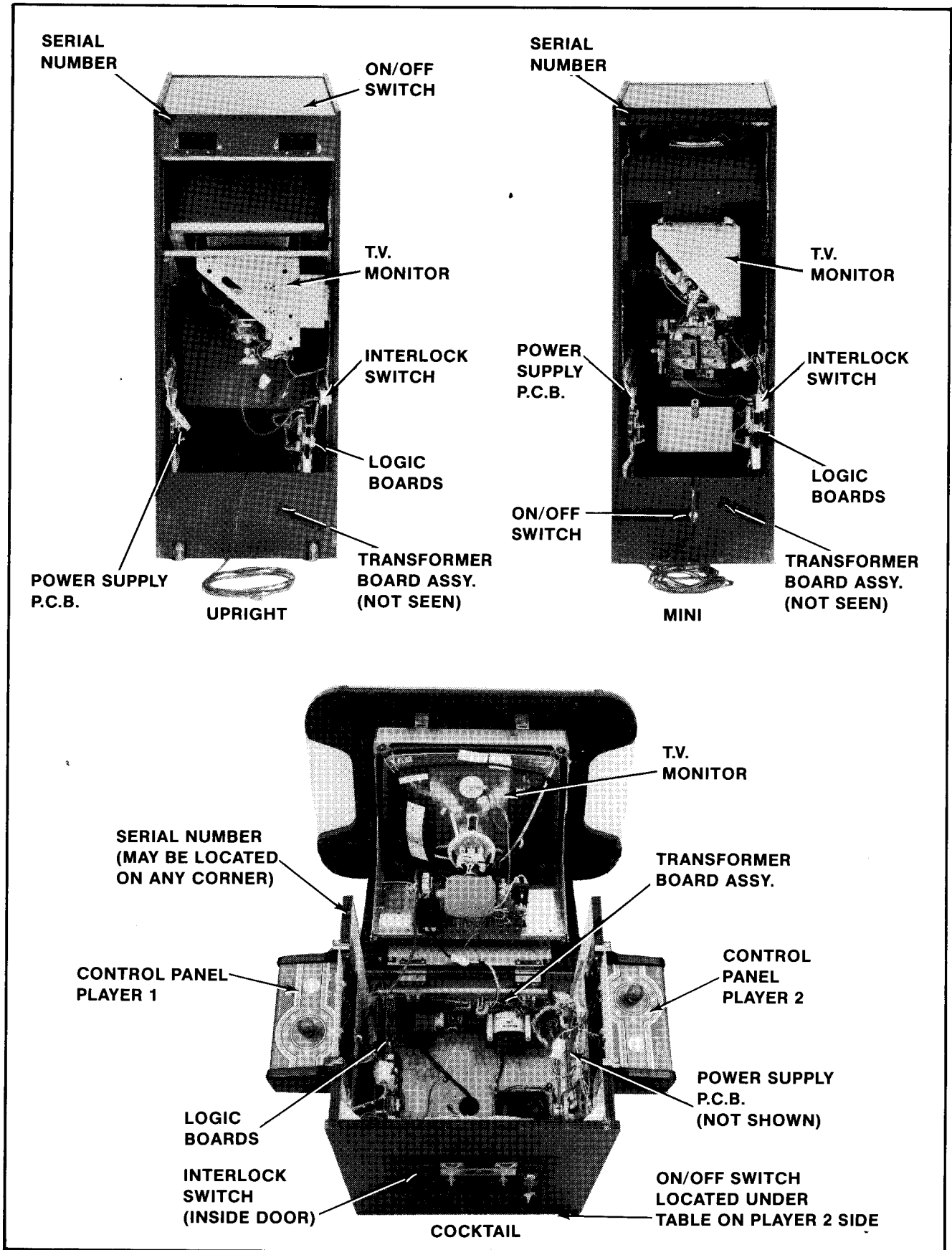


Figure 2-1 Location of Serial No., Interlock Switch, On/Off Switch, & Major Sub-Assemblies

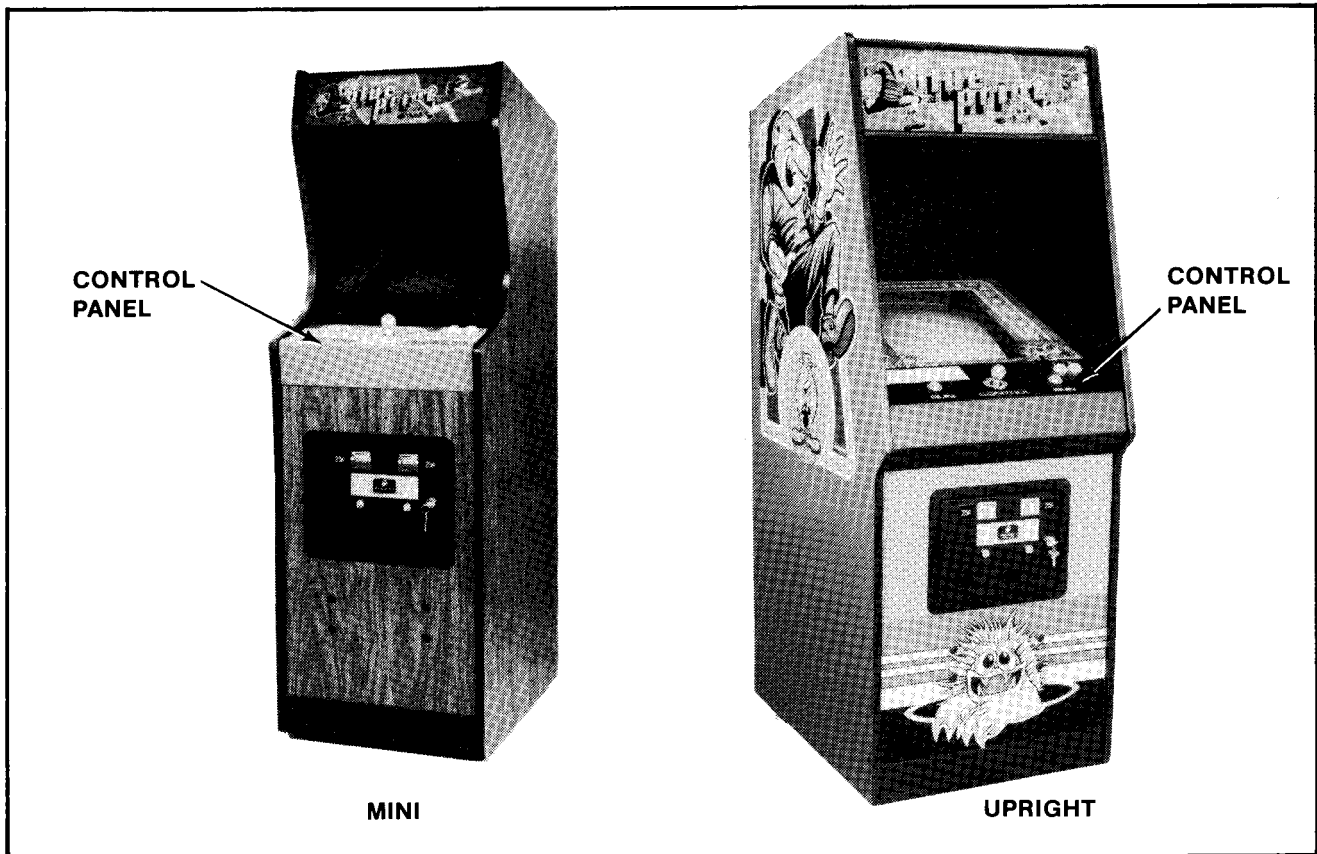


Figure 2-2 Major Sub-Assemblies (Cont. from Fig. 2-1)

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

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

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

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

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

If the switch is found to be bad, turn the game off, unplug it, and replace the interlock switch. When done, plug the game back into the wall outlet, close the access door, and turn the game back on.

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

When the interlock switch is working properly and turns the power to the game off, power may be restored to the game with the access door(s) open. Take hold of the interlock switch plunger and **gently** pull it out to its fully extended position. **THIS IS TO BE USED ONLY FOR SERVICING THE GAME.** See Figure 2-3.

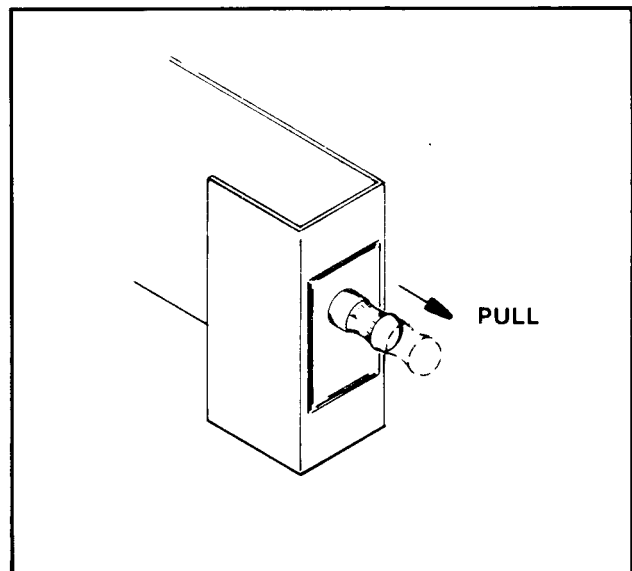


Figure 2-3 Interlock Switch Operation

SELF-TEST:

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

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

GAME VOLUME ADJUSTMENT CONTROL:

See Figure 2-4.

The game volume control pots (MASTER VOLUME and BACKGROUND VOLUME) are located on the MPU/SOUND board. The other board is the VIDEO board. There are two pots. For adjustment, they may be reached through the rear access door on the UPRIGHT and MINI models. On the COCKTAIL TABLE models, you will have to open the table top to reach them.

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

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

OPTION SWITCH SETTINGS:

To change the option switch settings, you **DO NOT** have to take the MPU 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 2-5. See Figure 2-4 for option switch locations.

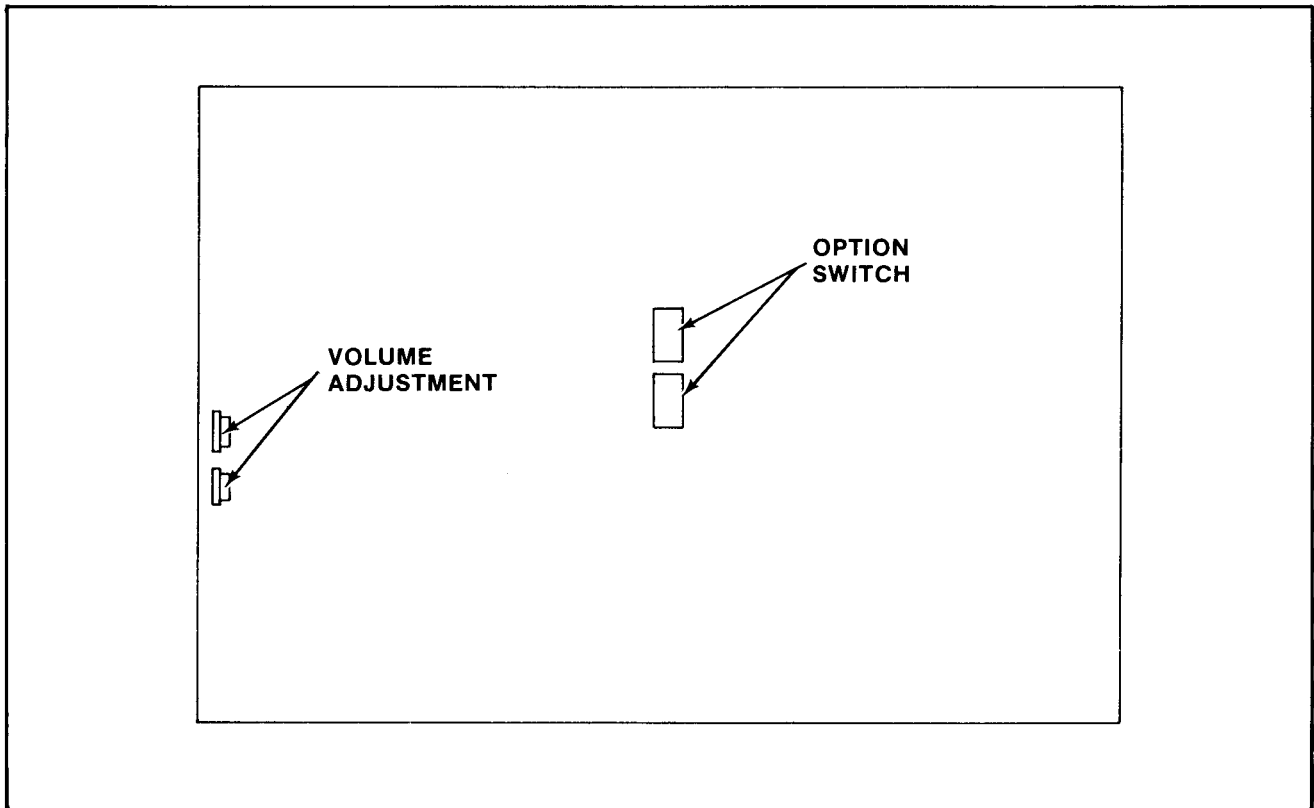


Figure 2-4 Game Volume Adjustment Control & Option Switch Location

BLUE PRINT								
OPTION SWITCH SETTINGS								
DIP SWITCH 1								
BONUS PLAYERS AWARDED: ONE MAN AT 20,000 POINTS *ONE MAN AT 30,000 POINTS ONE MAN AT 40,000 POINTS ONE MAN AT 50,000 POINTS	SW#1	SW#2	SW#3	SW#4	SW#5	SW#6	SW#7	SW#8
	NOT USED	ON	ON				NOT USED	NOT USED
		OFF	ON					
		ON	OFF					
	OFF	OFF						

NORMAL / FREE PLAY FREE PLAY *NORMAL PLAY				OFF				
				ON				

MAZE MONSTER: *APPEARS IN 2ND MAZE APPEARS IN 3RD MAZE					ON			
					OFF			

COINS PER CREDIT *1 COIN 1 CREDIT 2 COINS 1 CREDIT						ON		
						OFF		
DIP SWITCH 2								
PLAYERS PER CREDIT: 2 MEN PER CREDIT *3 MEN PER CREDIT 4 MEN PER CREDIT 5 MEN PER CREDIT	SW#1	SW#2	SW#3	SW#4	SW#5	SW#6	SW#7	SW#8
	ON	ON	NOT USED				NOT USED	NOT USED
	OFF	ON	USED				USED	USED
	ON	OFF						
	OFF	OFF						

CABINET STYLE UPRIGHT AND MINI MODELS COCKTAIL TABLE MODEL				ON				
				OFF				

DIFFICULT LEVEL SETTINGS LEVEL 1 *LEVEL 2 LEVEL 3 LEVEL 4					ON	ON		
					OFF	ON		
					ON	OFF		
					OFF	OFF		
*INDICATES FACTORY RECOMMENDED SETTINGS.					PART NO. M051-00300-A009 — REVISION B			

Figure 2-5 Option Switch Settings

III. Game Operation

BLUEPRINT is a one or a two player game with a color T.V. monitor. The game gives a display which has all the parts shown in Figure 3-1.

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

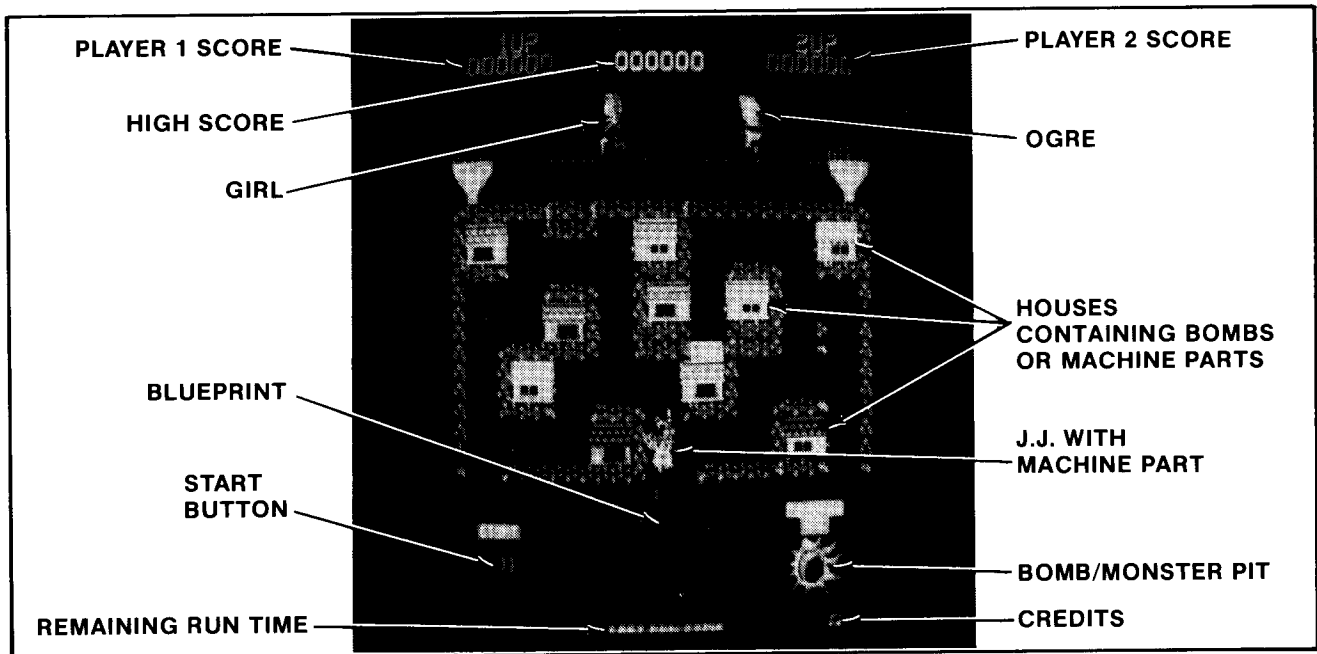


Figure 3-1 Identification of "On Screen" Graphics During Play

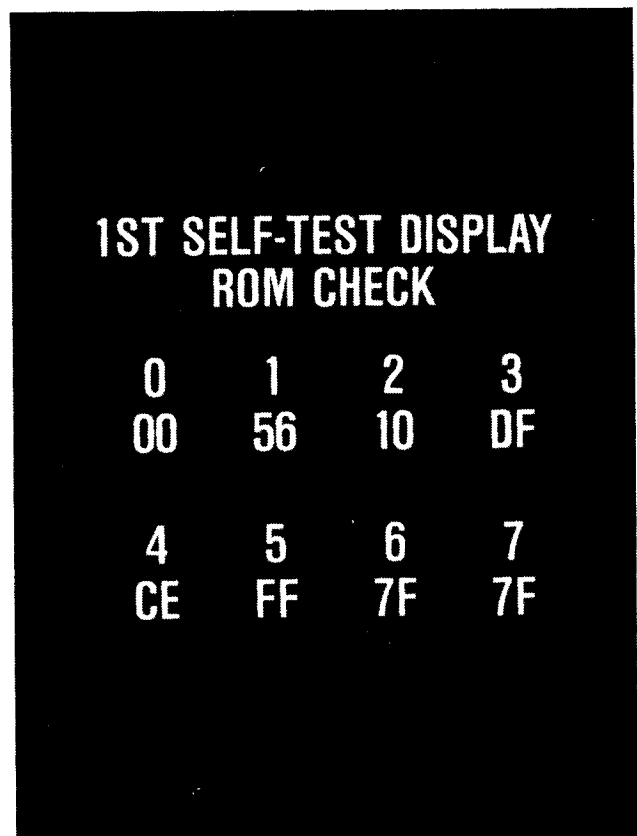
SELF-TEST MODE

The Self-Test mode is a special mode for checking game 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 right 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. Next, turn the power to the game "OFF" and then back "ON" again. Now that the game is in the Self-Test mode, it will react as follows:

1. You will see two rows of numbers displayed on the monitor screen. Zero through three in the top row and four through seven in the bottom row. These numbers are in a white color. Directly below each of the white numbers is a pair of yellow numbers or letters and numbers together. The correct presentation for each of the tests (0 through 7) is given at the right.
2. If you see any presentation other than this exact one, something in your game is not functioning correctly. **THE READINGS UNDER POSITIONS 5, 6 AND 7** can be disregarded because there is no ROM installed at these P.C. Board locations.



The table that follows shows the P.C. Board locations of all positions (0 through 7) given previously.

DESIGNATION	M.P.U.	P.C.B. LOCATION	DESIGNATION	M.P.U.	P.C.B. LOCATION
0		1M	4		1S
1		1N	5		NOT USED
2		1P	6		NOT USED
3		1R	7		NOT USED

3. By pressing the 1 and 2 PLAYER BUTTONS at the same time, the game will go to the switch check portion of the Self-Test mode. When this is done, you should see a display which looks like the following.

2ND SELF-TEST DISPLAY

PORT 0-BIT	0	1	2	3	4	5	6	7
	1	1	1	1	1	1	1	1
PORT 1-BIT	0	1	2	3	4	5	6	7
	1	1	0	1	1	1	1	1
DILSW1	1	2	3	4	5	6	8	7
	1	0	0	0	0	0	1	1
DILSW2	1	2	3	4	5	6	8	7
	1	0	0	0	1	1	1	1

4. Moving the game switches and controls will cause the "1's" to change to "0's" and vice versa. A "0" means that particular switch is "ON" or in the CLOSED condition and a "1" means that particular switch is "OFF" or in the OPEN condition. If you move a switch or control on the game and it has no effect on the above display, the switch/button is either not working, miswired, or disconnected. Check it out thoroughly.

5. By pressing the 1 and 2 PLAYER BUTTONS at the same time, the game will go to the cross hatch pattern display of the Self-Test mode. This may be used for alignments and checks of various types.

This pattern will remain sharp and clear for about 15 seconds and then it will change to a different rapidly changing one for about another 15 seconds as the game does a RAM check on itself.

If all the RAMs check good, the cross hatch pattern will return and appear to fade in and out for a short while as the game does a color check on itself before becoming sharp and clear again for another 15 seconds. This sequence continues to repeat itself until you decide to leave the Self-Test mode.

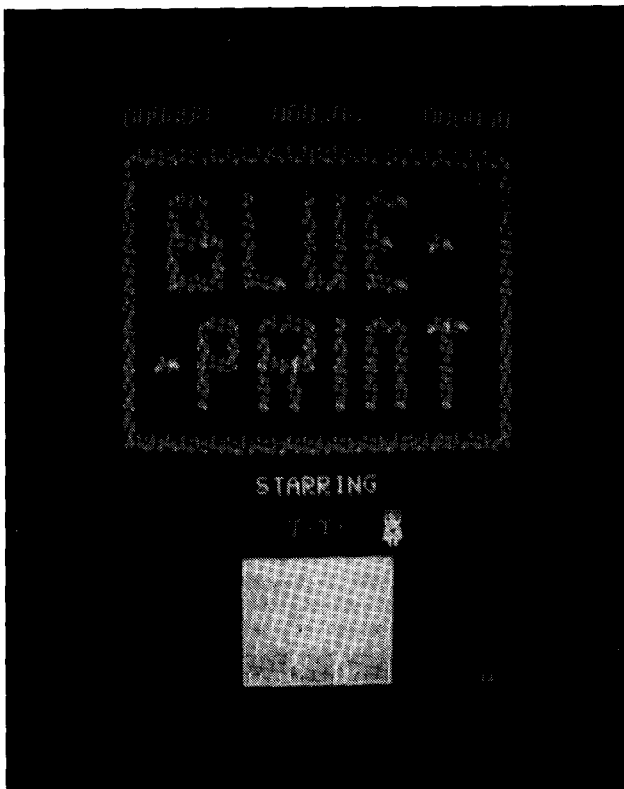
6. If a bad RAM chip is found by the game's internal check system during the Self-Test, the game indicates this to you by displaying any of the below coded on the monitor screen. The following table shows which code translates to which RAM chip locations on the Video P.C. Boards.

BAD RAM LOCATION INFORMATION		
SCREEN DISPLAY	ERROR DESCRIPTION	CHECK VIDEO P.C.B. CHIP LOCATIONS
0 DISPLAYED	SCRATCH PAD RAM ERROR	J1, K1, K2, J2, H2
1 DISPLAYED	BACKGROUND C H ERROR	B9, C7, C6, C9, C8, C10, F4, D6
2 DISPLAYED	BACKGROUND ROW POSITION ERROR	D8, D9, D10, D11, B10, D7, B9
3 DISPLAYED	FAST MOVING OBJECT RAM ERROR	D15, D16, D14, E16, E15, E17, C18, B13, B12, A13, A12, D2
7 DISPLAYED	BACKGROUND COLOR RAM ERROR	C11, C12, D12, D13, C9, C8, C10, F4, E14, B8

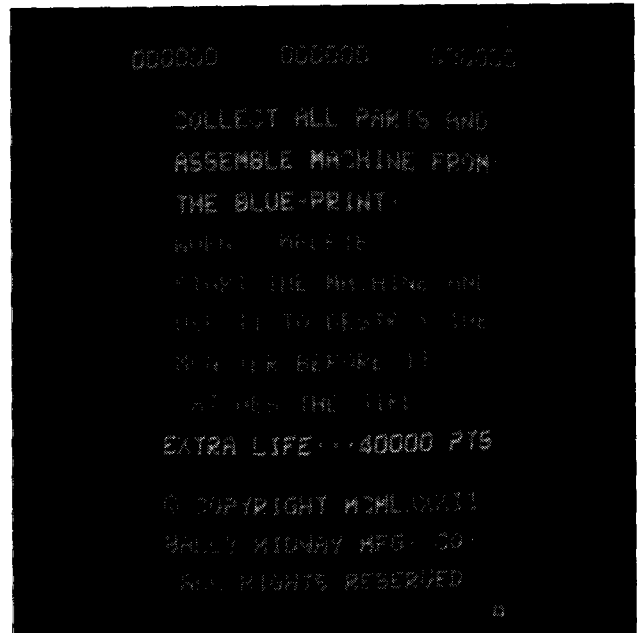
7. When finished with the Self-Test mode, slide the Self-Test switch back to the "OFF" position, and turn the power to the game "OFF" and then back "ON" again.
8. Normal game functions will now return to the monitor screen.

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:



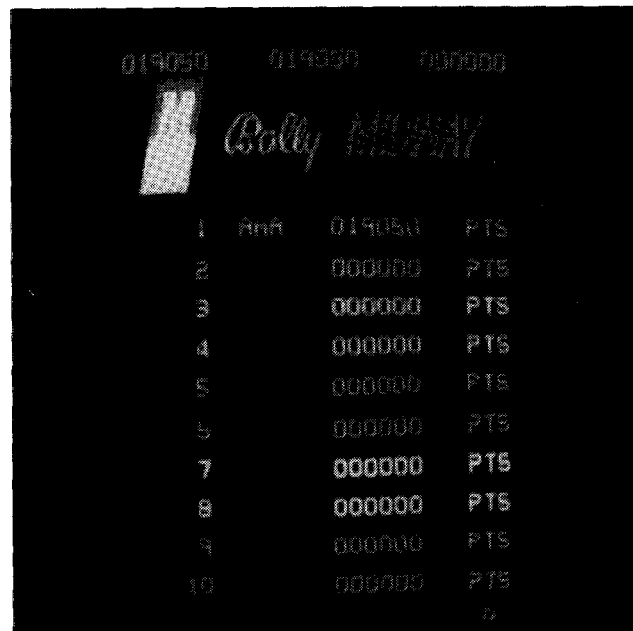
Attract Mode Display 1



Attract Mode Display 2

THE THIRD DISPLAY IN THE ATTRACT MODE SEQUENCE SHOWS SIMULATED GAME PLAY

- The next display in the series lists the ten highest scoring individuals that have played the game to date.



- 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 Display 1

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.

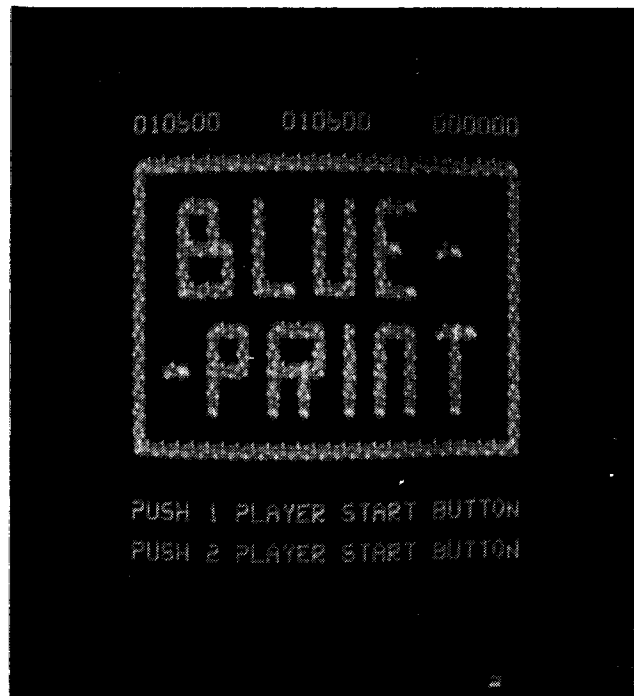
PLAY MODE

The Play mode begins when either the "1 PLAYER" or the "2 PLAYER" start button is pressed. The "READY-TO-PLAY MODE" display changes color, maze appears, "1 UP" flashes, J.J. appears, and play begins.

The Play mode ends when all of your J.J.'s have had their hearts broken. When this happens, "GAME OVER" is written across the top center of the monitor screen.

In this game, the ogre is chasing J.J.'s girl friend across the top of the monitor screen. **And he's catching up to her!** The **ONLY** way J.J. can save her is to visit all the houses in the maze, collect all the parts needed, and construct the Ammo Machine shown in the BLUEPRINT at the bottom center of the monitor screen. An easy enough task you say — **WRONG!**

Unfortunately for J.J. he has a number of obstacles to overcome, not to mention a time limit, before he will



Ready to Play Mode Display 2

be able to get the Ammo Machine completely built. Among these obstacles is the fact that two of the houses in the maze contain bombs instead of parts of the Ammo Machine. If he gets one of these, he must make his way to the bomb disposal pit at the lower right hand corner of the monitor screen **BEFORE** it explodes and throw it in. Also, if he enters any house that previously held a part for the Ammo Machine, he will come out with a bomb. This bomb must be thrown into the bomb disposal pit too. If any of the bombs explode **BEFORE** J.J. can throw them into the pit, you will lose one man. And if this is not enough, J.J. must accomplish all of the above while keeping an eye out for the KILLER FLOWER POTS. If he is so much as even slightly touched by one of these little devils, you will lose one man.

And then there's Weird Willie. He's a sort of cute little guy but he's got a screw loose somewhere. I mean, what other reason could you think of for anyone setting up housekeeping in a bomb disposal pit??

At any rate, J.J.'s got to keep an eye out for him. (Now you must understand that Weird Willie doesn't dislike J.J. It's just that he has this odd sense of humor.) If he gets out and J.J. allows him to run around the bottom of the screen, Weird Willie will eventually work his way over to the START BUTTON for the Ammo Machine and press it **BEFORE** it is complete. This will cause the unfinished Ammo Machine to fall apart. J.J. must grab Weird Willie and toss him back in his pit at the lower right hand corner of the screen. But Weird Willie is very persistent and will try it again sooner or later.

J.J. also has to remember not to touch that same START BUTTON before he completes construction

of his Ammo Machine. It will fall apart just as fast and as surely if he touches it as it does when Weird Willie touches it.

Once the Ammo Machine is built, J.J. must push the START BUTTON for it (located at the lower left hand corner of the screen). Once this is done, the Ammo Machine will start firing at the ogre chasing J.J.'s girl friend across the top of the screen. You can move the Ammo Machine back and forth across the bottom of the screen at this time by moving the control stick left or right. It does not move up and down on the screen.

As your skill level increases and you get into the higher racks, the ogre runs faster, the bomb fuses are shorter, a maze monster will appear which can cause you to lose one man if you touch him (in which rack he appears is switch selectable), and you will lose first the far left exit from the maze and then the far right exit from the maze leaving only the center exit from the maze for all future racks. In general, each maze will be harder to complete than the one before.

A bonus man is awarded to you as you reach or pass a certain preselected point value (switch selectable).

WAYS IN WHICH YOU CAN LOSE A MAN (J.J.):

1. J.J. doesn't make it to the bomb disposal pit with a bomb, it goes off before he gets there. J.J., complete with halo, ascends to heaven. Assuming you have at least one J.J. in reserve, nothing happens to the parts of the Ammo Machine that you've already assembled on the BLUEPRINT.
2. The ogre catches J.J.'s girl friend. J.J.'s heart breaks and complete with halo, he ascends to heaven. Assuming you have at least one J.J. in reserve, nothing happens to the parts of the Ammo Machine that you've already assembled on the BLUEPRINT.
3. In the later racks, if J.J. should touch the maze monster. Then, complete with halo, J.J. ascends to heaven. Assuming you have at least one J.J. in reserve, nothing happens to the parts of the Ammo Machine that you've already assembled on the BLUEPRINT.
4. Any time J.J. is touched by a Killer Flower Pot. Then, complete with halo, J.J. ascends to heaven. Assuming you have at least one J.J. in reserve, nothing happens to the parts of the Ammo Machine that you've already assembled on the BLUEPRINT.

WHEN YOU LOSE YOUR LAST MAN (J.J.):

When you loose your last J.J. **GAME OVER PLAYER 1** is written across the top center of the mgnitor screen. At this point several different things can happen depending on whether or not your score was high enough to cause the game to go into the High Score/Initial mode.

If your score was one of the ten highest of the day, the game will go into the High Score/Initial mode imme-

diately. 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 lefts in its memory).

HIGH SCORE/INITIAL MODE

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



High Score/Initial Mode Display

When in the High Score/Initial mode, there is an "A" and two blank spaces displayed at the bottom center of the screen. By moving the controller stick to the right, the letter can be made to sequence forward through the alphabet: "A", "B", "C", "D", etc. By moving the controller stick to the left, the 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 FAST button. Your initial is frozen in place and an "A" appears in the blank space next to your first initial at the same time. Select this and your last initial in the same manner as you did your first initial. If you do not wish to put your initials opposite your score, just press the FAST button three times. Three "A"s will appear in the spaces at the bottom of the monitor screen where your initials would have gone.

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 you lose one J.J. At this point, the game will do one of several things depending on whether or not the lost J.J. was your last or if you still have others remaining in reserve.

J.J. LOST — OTHERS STILL REMAINING IN RESERVE

- J.J., complete with halo, ascends to heaven.
- Next, the “RACK” changes to the “RACK” the other player is in, the “___ UP” flashes while what’s left of the other player’s Ammo Machine, his maze, and his J.J. appear on the monitor screen.
- Play begins for the other player.

J.J. LOST — NO OTHERS REMAINING IN RESERVE

- Game displays “GAME OVER PLAYER ___”.
- J.J., complete with halo, ascends to heaven.
- Next, the “RACK” changes to the “RACK” the other player is in, the “___ UP” flashes while what’s left of the other player’s Ammo Machine, his maze, and his J.J. appear on the monitor screen.
- Play begins for the other player.
- After the last player’s last J.J. is lost, the game displays “GAME OVER PLAYER ___” for him too.
- If neither of your scores is high enough to cause the game to go into the High Score/Initial mode, the game will then 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).
- On the other hand, if one or both of your scores was high enough to cause the game to go into the High Score/Initial mode, the game will tell you this by giving a display like that shown previously. The number “1” or “2” is displayed where the blank space is to indicate which player should enter his initials at this time.
- After you’ve entered your initials opposite your score(s), the game will then go to the list of high scorers after which 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).

IV. Maintenance and Repair

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

The most important thing for you to remember is to play your game thoroughly **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. **ONLY** being familiar with and playing your game will inform you whether or not it is working the way it should.

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

CLEANING

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

DO NOT dry-wipe any of the plastic panels. This is because any dust that was on them can scratch their surfaces. If this has happened, anyone looking through this type of damaged plastic would feel he was looking at the game through a fog. This fogging

damage **CANNOT** be repaired or reversed. The **ONLY** solution is to **replace** the damaged piece of plastic.

FUSE REPLACEMENT

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

1. UPRIGHT MODEL:

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

2. MINI MODEL:

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

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 Transformer and Power Supply Board Assemblies.

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

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

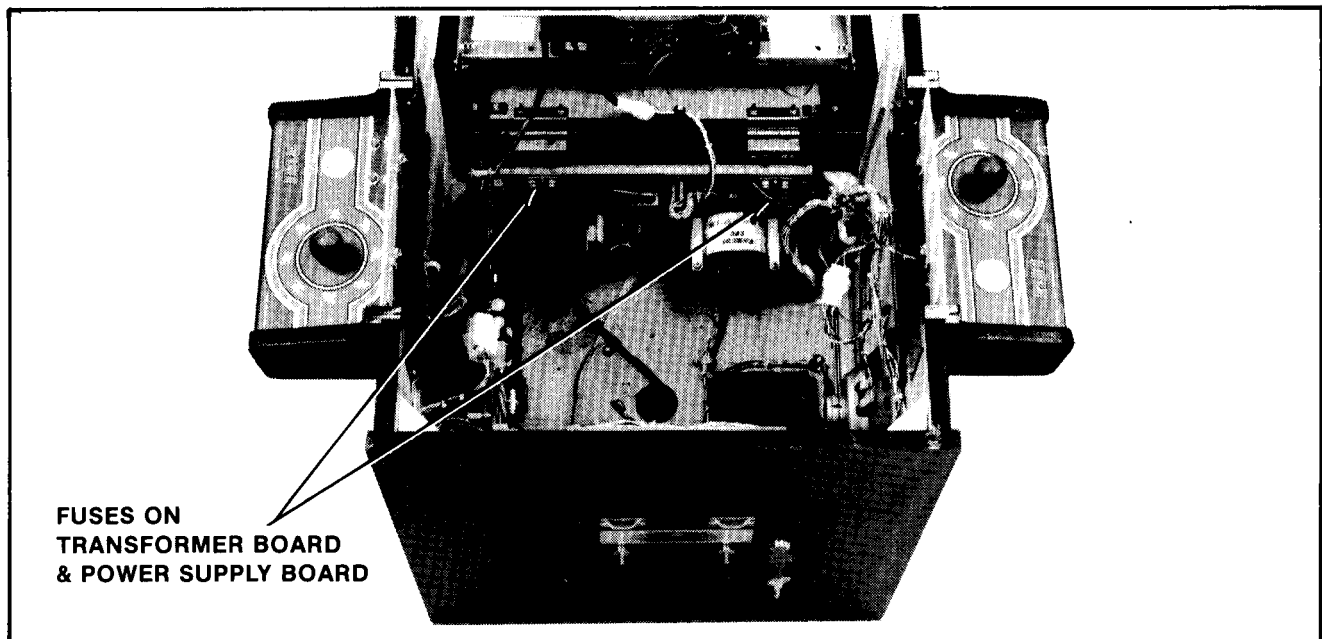


Figure 4-1 Location of Fuses

OPENING THE CONTROL PANEL

1. UPRIGHT MODEL: See Figure 4-2.

- The control panel is held in place by three latches, one on the left side, one on the right side, and one on the front center. They are spring loaded to provide constant positive pressure on their latch plates. They can be reached through the coin door **AFTER turning power to the game off.** To release the latches, lift up and toward the center of the control panel. Once they are released, unhook them from their latch plates.
- To remove the control panel:
Raise it up and tilt it toward you until you can see the cable behind it.
Cradling the control panel between yourself and the cabinet, disconnect it from its cabling. The control panel is now free and can be removed.
- To reinstall the control panel, reverse this procedure.

2. MINI MODEL: See Figure 4-2.

- The control panel is held in place by two latches, one on the right side, and one on the left side of the cabinet. They are spring loaded to provide constant positive pressure on their latch plates. They can be reached through the coin door **AFTER turning power to the game off.** To release the latches, lift up and toward the center of the control panel. Once they are released, unhook them from their latch plates.
- To remove the control panel:
Raise it up and tilt it toward you until you can see the cable behind it.
Cradling the control panel between yourself and the cabinet, disconnect it from its cabling. The control panel is now free and can be removed.
- To reinstall the control panel, reverse this procedure.

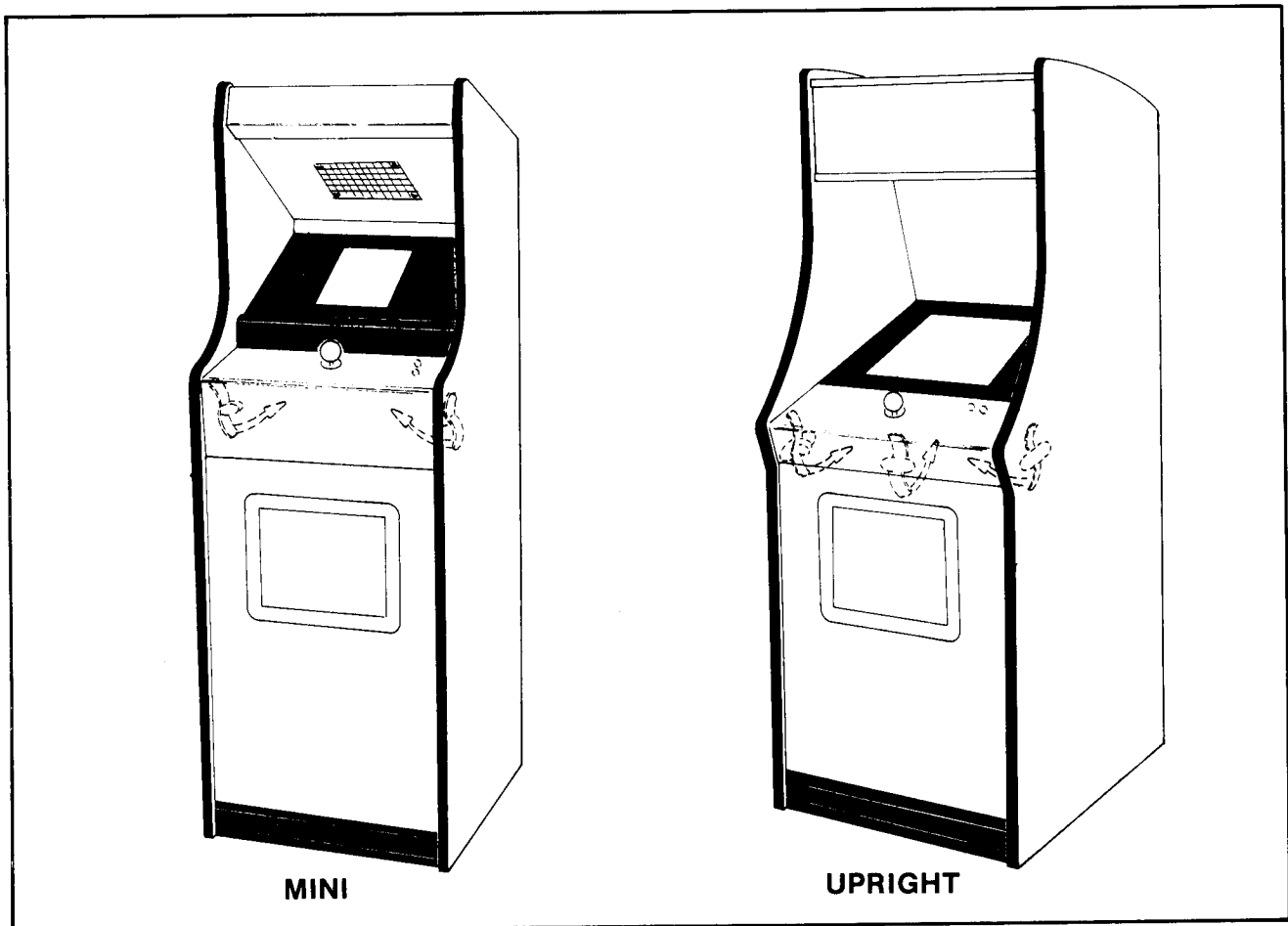


Figure 4-2 Opening the Control Panel — Upright & Mini

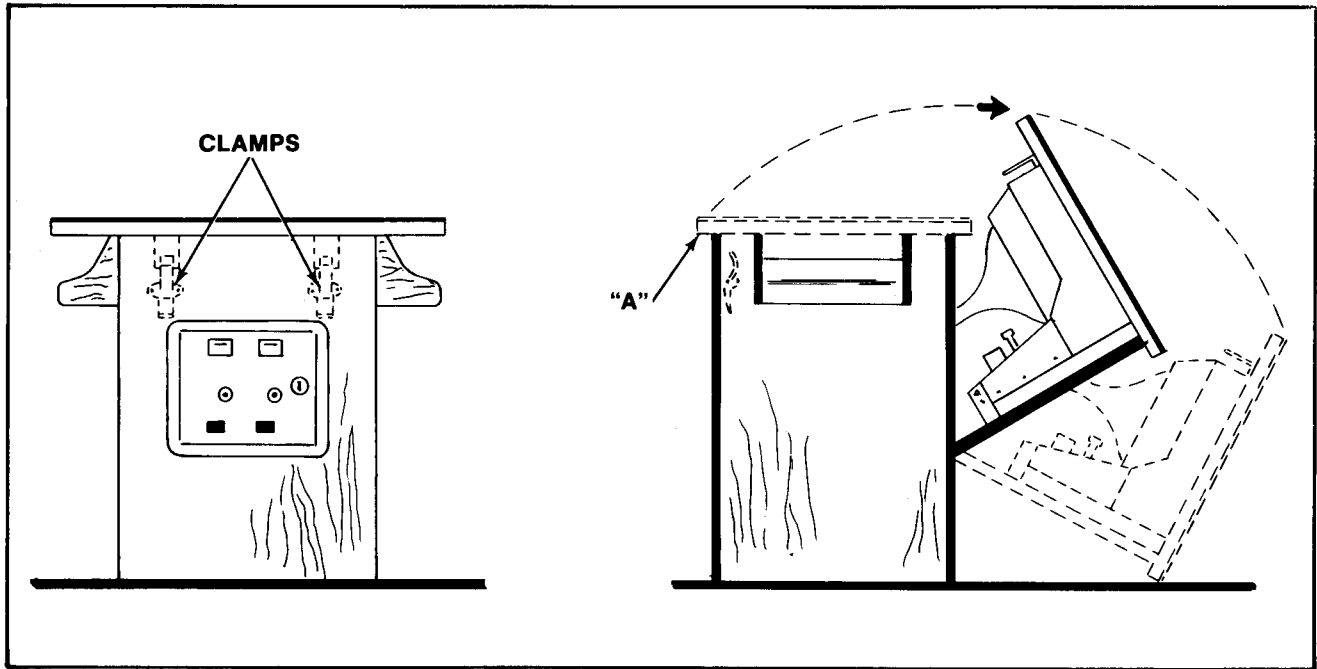


Figure 4-3 Opening the Cocktail Game

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

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

Turn power to the game off.

Open the coin box door and release the two latches indicated in Figure 4-3.

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

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

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

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

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

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

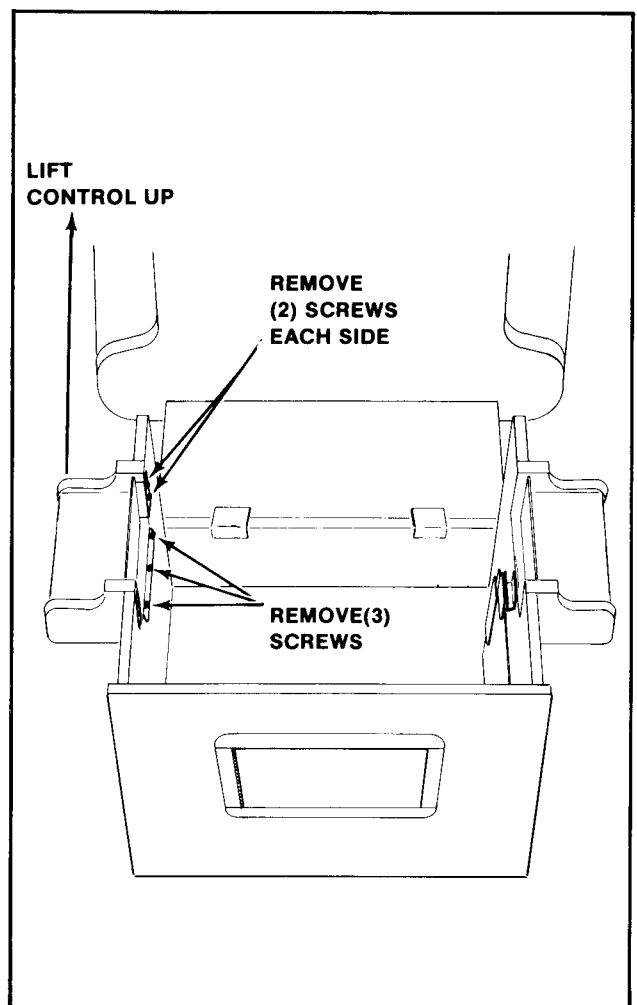


Figure 4-4 Removing the Control Panel — Cocktail

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

1. UPRIGHT MODEL: See Figure 4-5.

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

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

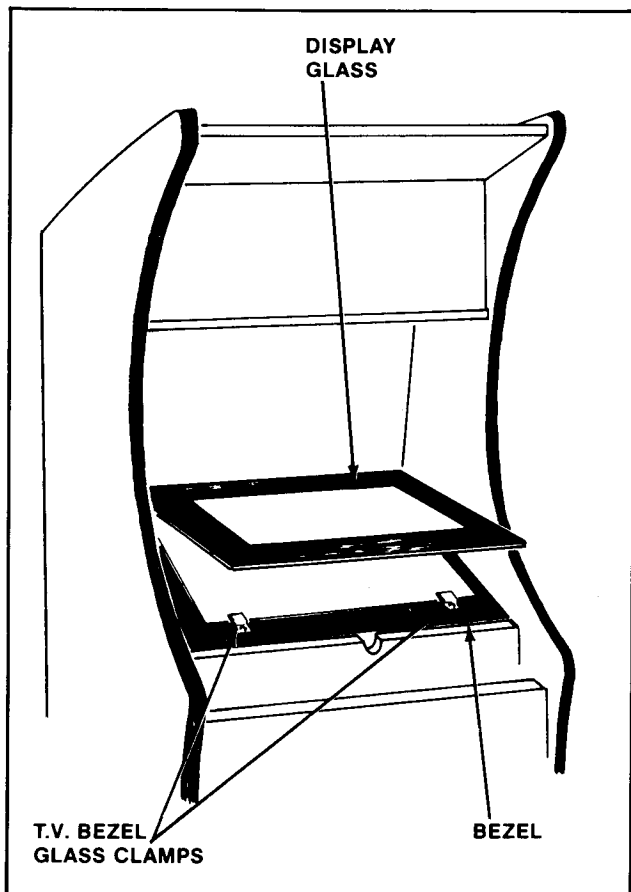


Figure 4-5 Removal of Main Display Glass & T.V. Bezel — Upright

2. MINI MODEL: See Figure 4-6.

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

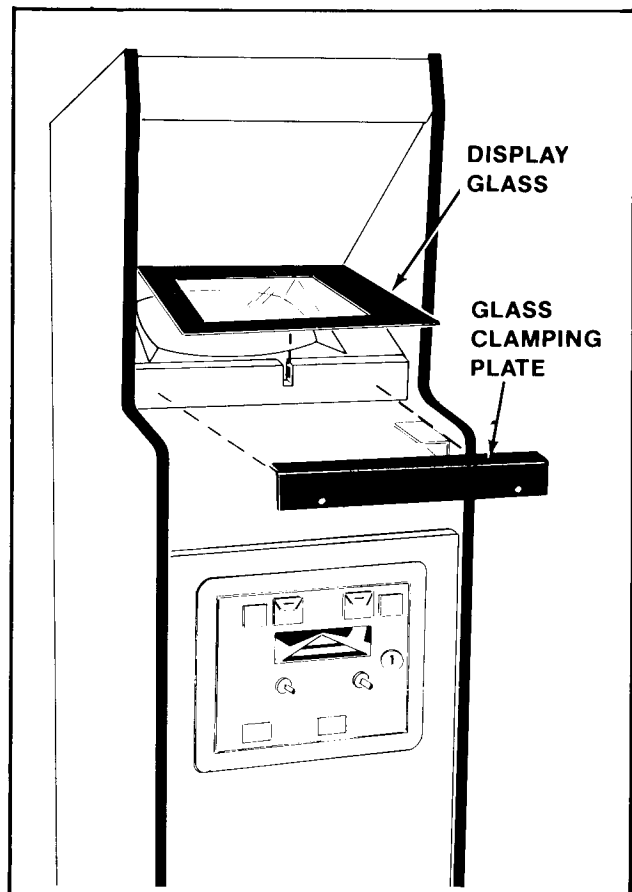


Figure 4-6 Removal of Main Display Glass & T.V. Bezel — Mini

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

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

- Remove the screws which secure the table top glass clamps in place.
- Remove the table top glass.
- Loosen the screws which secure the T.V. bezel-glass-clamps in place.
Move the clamps to the side and the bezel glass may be removed.
Remove the screws which secure the bezel assembly to the table top and the bezel with four bezel-glass-clamps may be removed.
- To reinstall the T.V. bezel assembly and the table top glass, reverse this procedure.

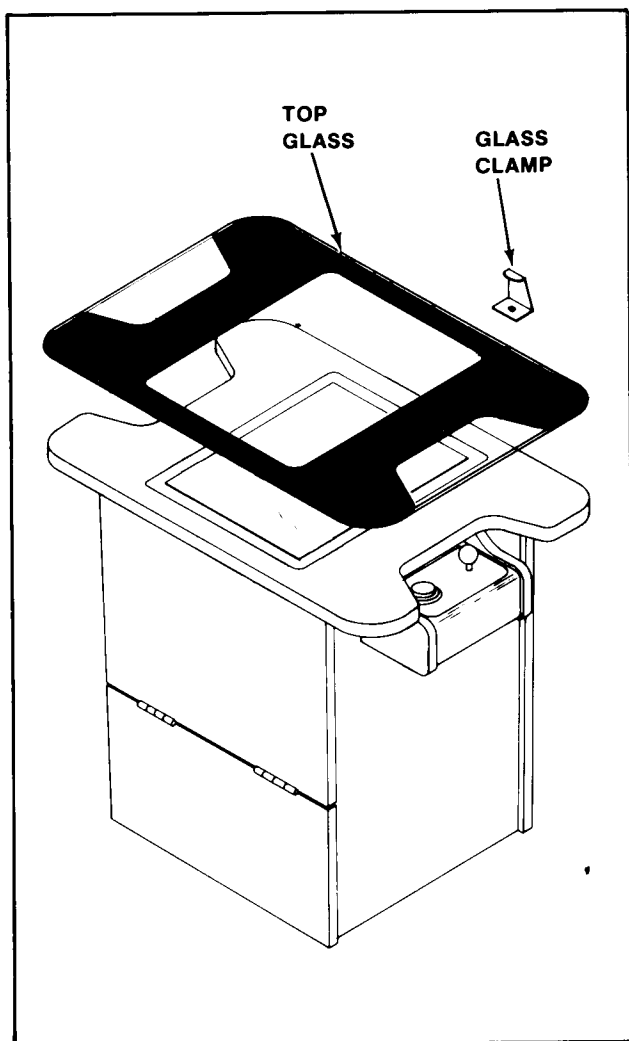


Figure 4-7 Removing Top Glass — Cocktail

T.V. MONITOR REPLACEMENT

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

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

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

1. UPRIGHT MODEL: See Figure 4-8.

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

Before removing the T.V. monitor, the main-display-glass **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. To reinstall the T.V. monitor, reverse this procedure.

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

2. MINI MODEL: See Figure 4-9.

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

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

With the removal of only four 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 4-11.

- Turn the power off to the game.

Open the coin box door and release the two latches indicated in Figure 4-10.

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

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

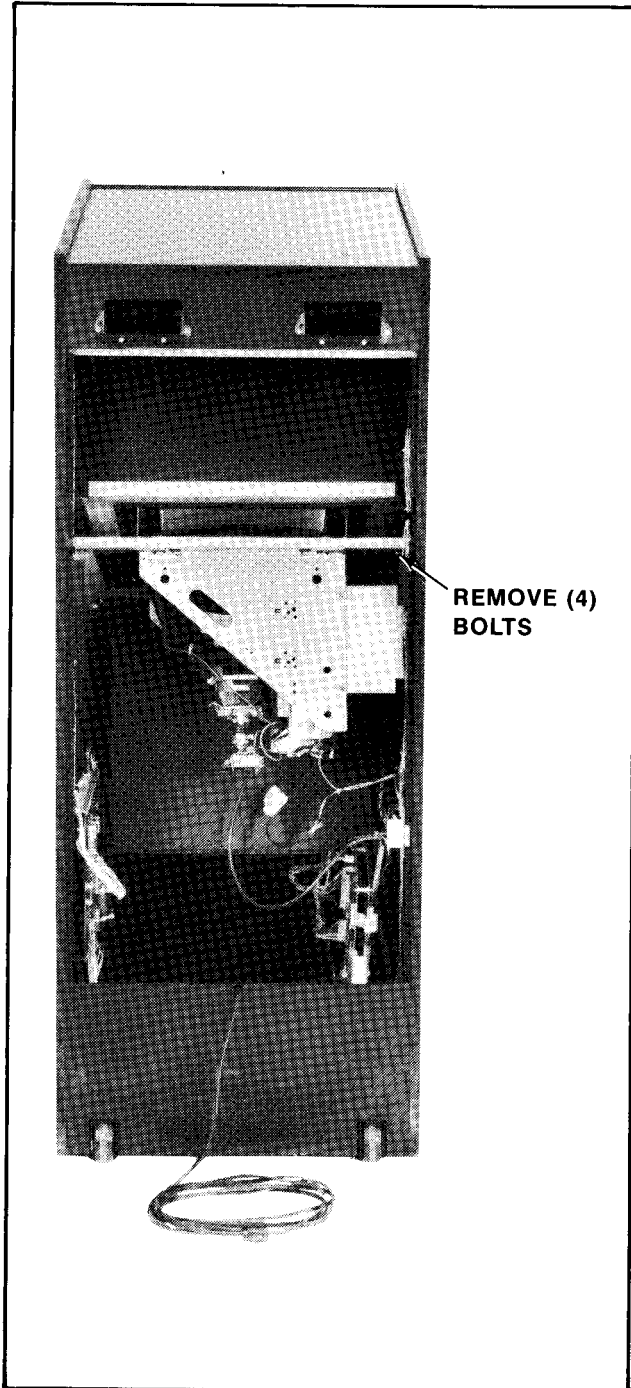


Figure 4-8 Removing Monitor — Upright

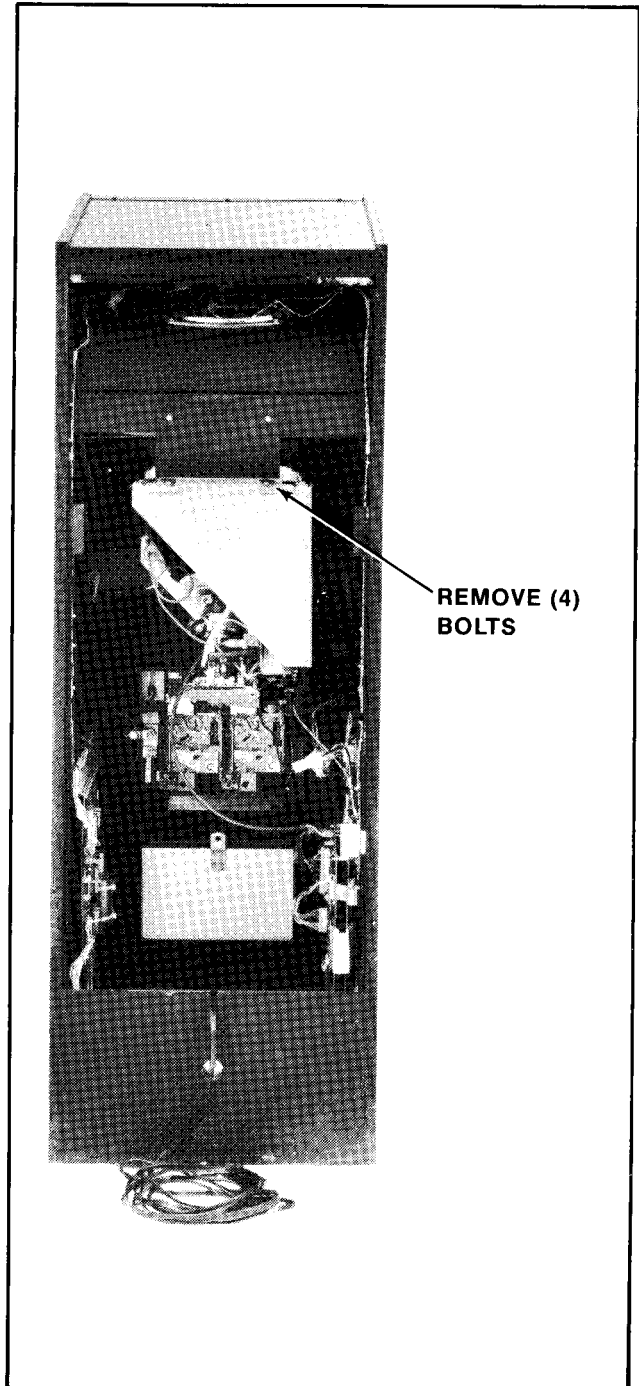


Figure 4-9 Removing Monitor — Mini

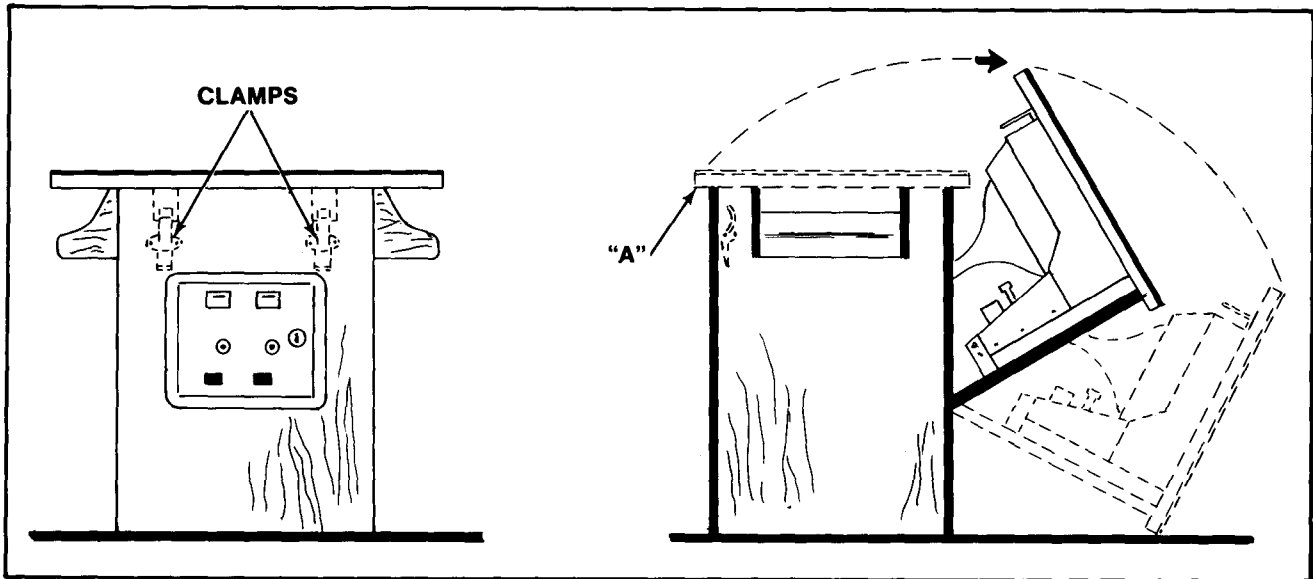


Figure 4-10 Opening the Cocktail Game

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

- Remove the screws which hold the table top glass clamps in place.
- Remove the table top glass.
- Lift out the T.V. bezel assembly.
- Completely disconnect the T.V. monitor from all its cabling. **DON'T FORGET THE CHASSIS GROUND WIRE.**
- Remove the screws holding the T.V. monitor chassis to the "L" brackets by the door hinge(s). See Figure 4-11.
- Close the Cocktail Table and re-latch it.
- Remove the screws which secure the T.V. monitor mounting brackets to the edges of the slot cut in the table top. See Figure 4-11.
- Pry up the end of each monitor mounting bracket with a screwdriver or similar tool until you can grasp them both.
- Lift the T.V. monitor straight up and out of the table top being **VERY CAREFUL** not to bump the neck of the picture tube.
- To reinstall the T.V. monitor assembly, reverse this procedure.
- Be sure to check the clearance of the "L" brackets **BEFORE** setting the monitor into the table top.
- After replacing the T.V. monitor, be sure to run the game Self-Test.

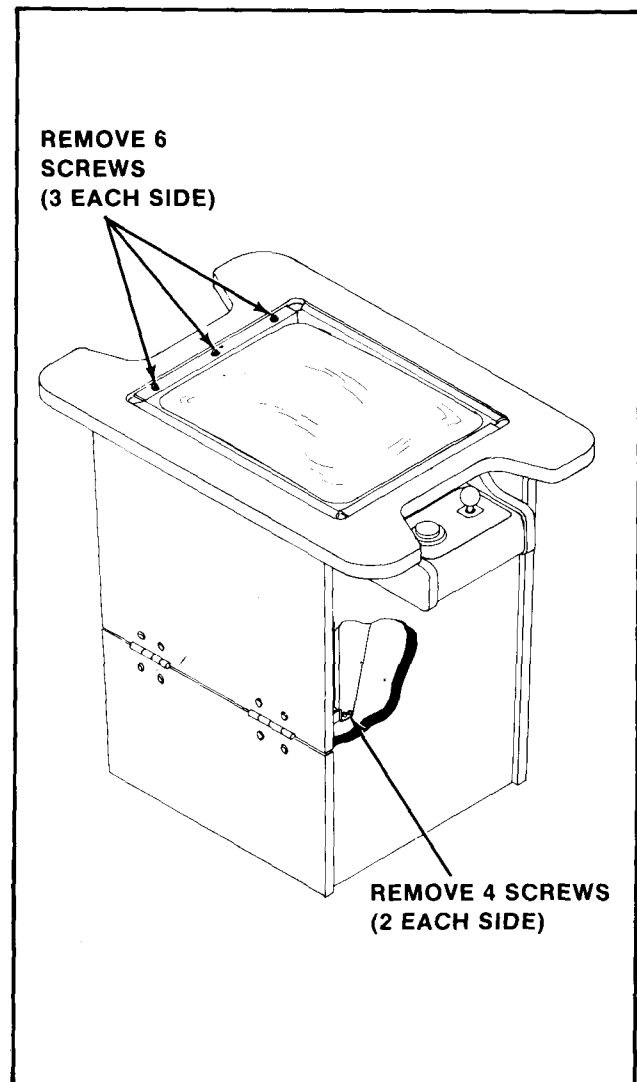


Figure 4-11 Removing Monitor — Cocktail

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

1. UPRIGHT MODEL: See Figure 4-12.

- Turn the power to the game off.
- Unlock and open the rear access door (game board) and the coin door (sound board).
- Disconnect the game board from all its cabling.
- Disconnect the sound board from all its cabling.
- Remove the indicated P.C.B. supports and lift the above P.C.B.'s out the cabinet.
- Disconnect the power supply board from all its cabling, remove the P.C.B. supports indicated in Figure 4-12, and slide it out the back of the cabinet.
- To reinstall the above P.C.B.'s, reverse this procedure.

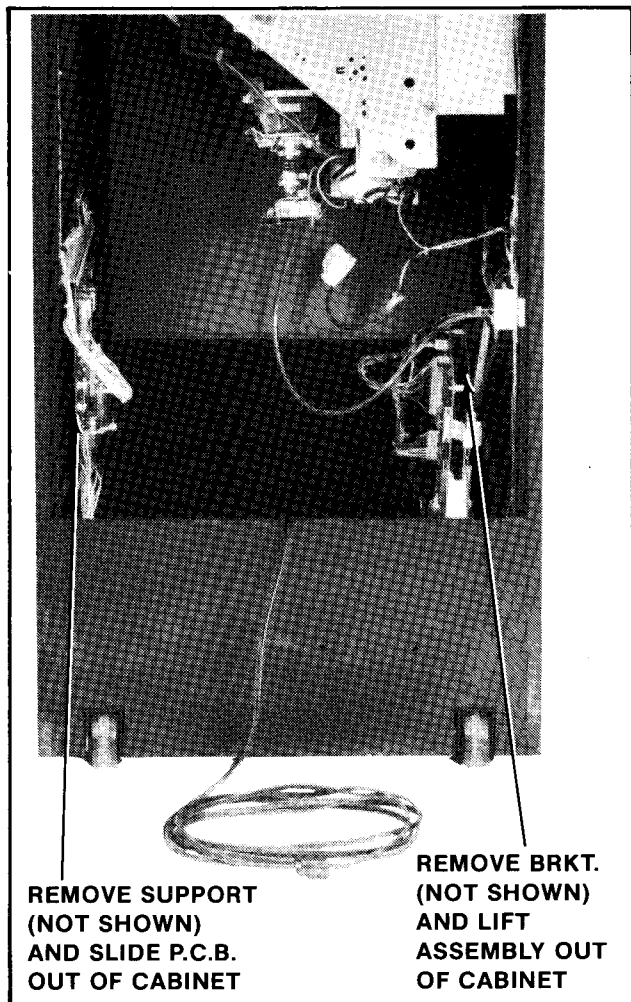


Figure 4-12 Replacing P.C.B.s — Upright

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 4-13.

- Turn the power off to the game.
- Unlock and open the rear access door.
- Disconnect the game board from all its cabling.
- Disconnect the sound board from all its cabling.
- Remove the indicated P.C.B. supports and lift the above P.C.B.'s out of the cabinet.
- Disconnect the power supply board from all its cabling, remove the P.C.B. supports indicated in Figure 4-13, and slide it out the back of the cabinet.
- To reinstall the above P.C.B.'s, reverse this procedure.

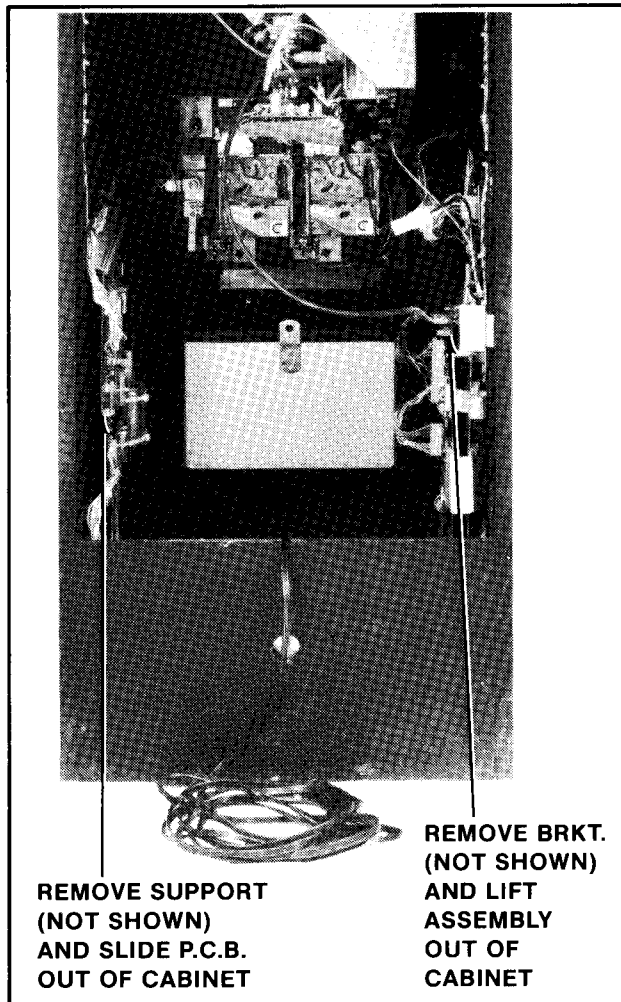


Figure 4-13 Replacing P.C.B.s — Mini

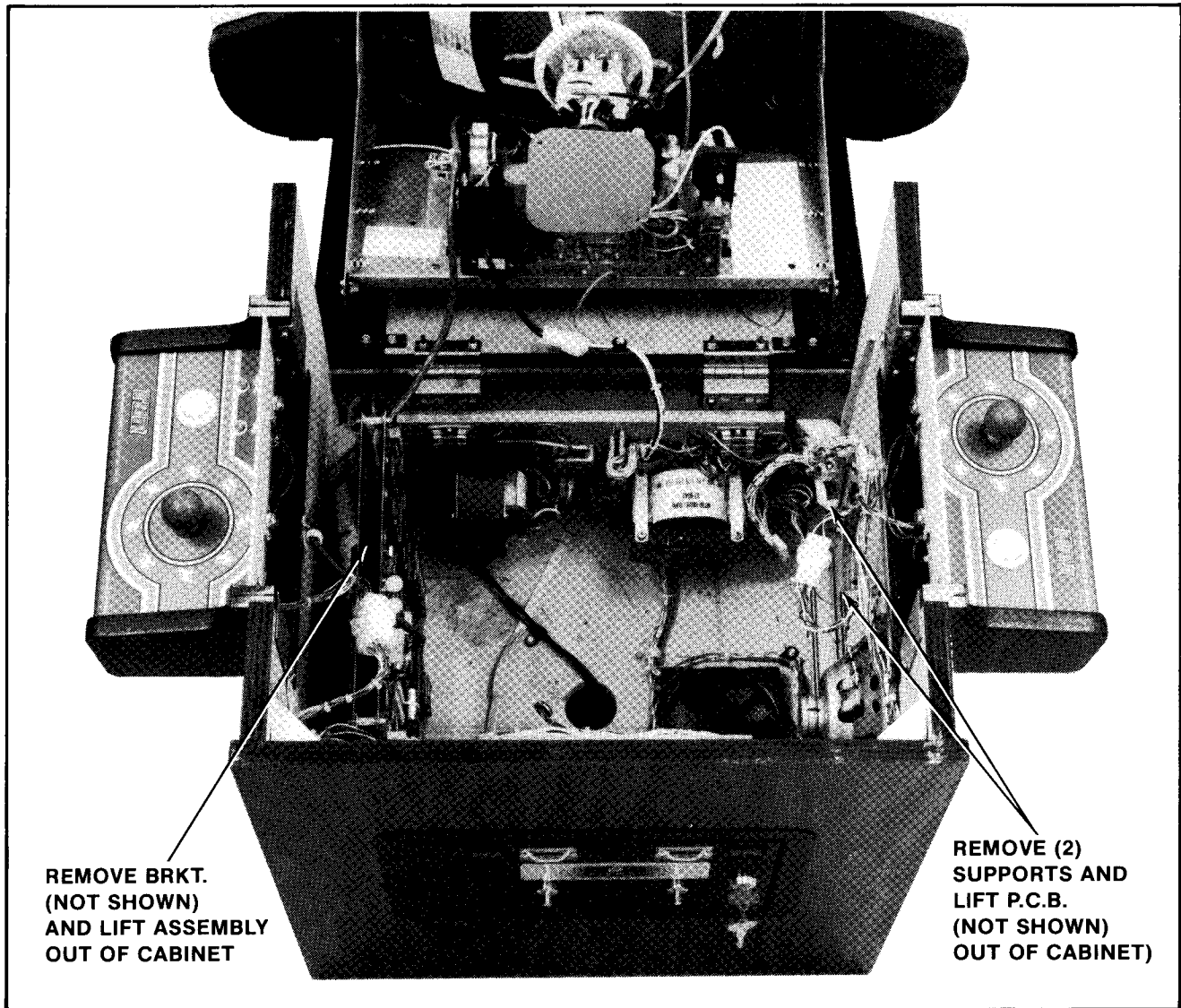


Figure 4-14 Replacing P.C.B.s — Cocktail

3. COCKTAIL TABLE MODEL: See Figure 4-14.

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

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

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

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

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

- To remove the power supply board. See Figure 4-14.
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 game and sound boards. See Figure 4-14.
Disconnect the game board from all its cabling.
Disconnect the sound board from all its cabling.
- Remove the indicated P.C.B. supports and lift the above P.C.B.'s out of the cabinet.
To reinstall the game and sound boards, reverse this procedure.

OPENING THE ATTRACTION PANEL

1. **UPRIGHT MODEL:** See Figure 4-15.

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

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

- Replacing the fluorescent tube starter. See Figure 4-16.
Be sure the power to the game has been turned off.

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

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

- Replacement of the fluorescent tube mounting bracket assembly.

Be sure the power is off to the game.

- Disconnect it from its power cable.

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

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

- Replacing the speaker.

Be sure the power is off to the game.

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

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

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

Reverse this procedure to reinstall the speaker.

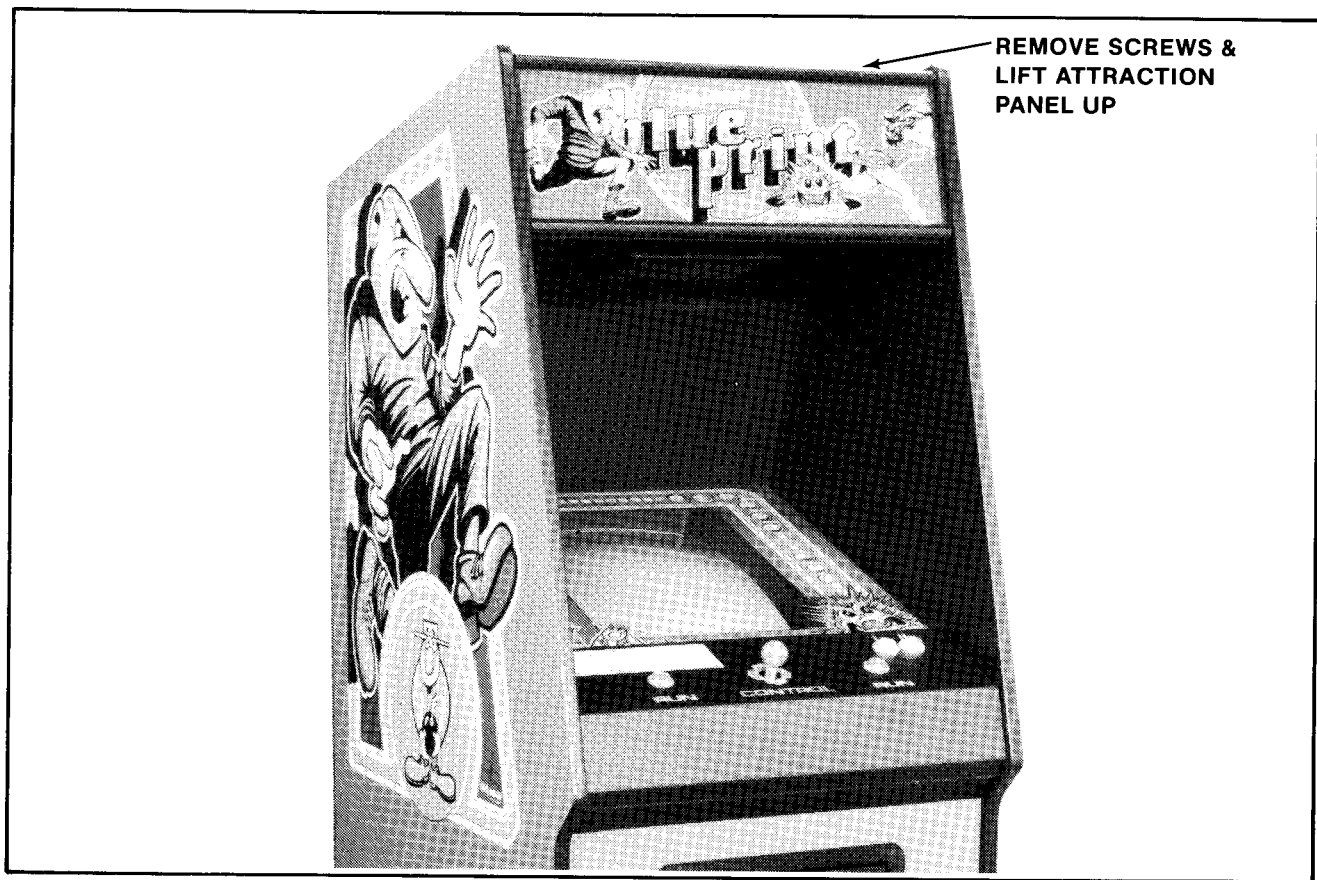


Figure 4-15 Opening the Attraction Panel — Upright

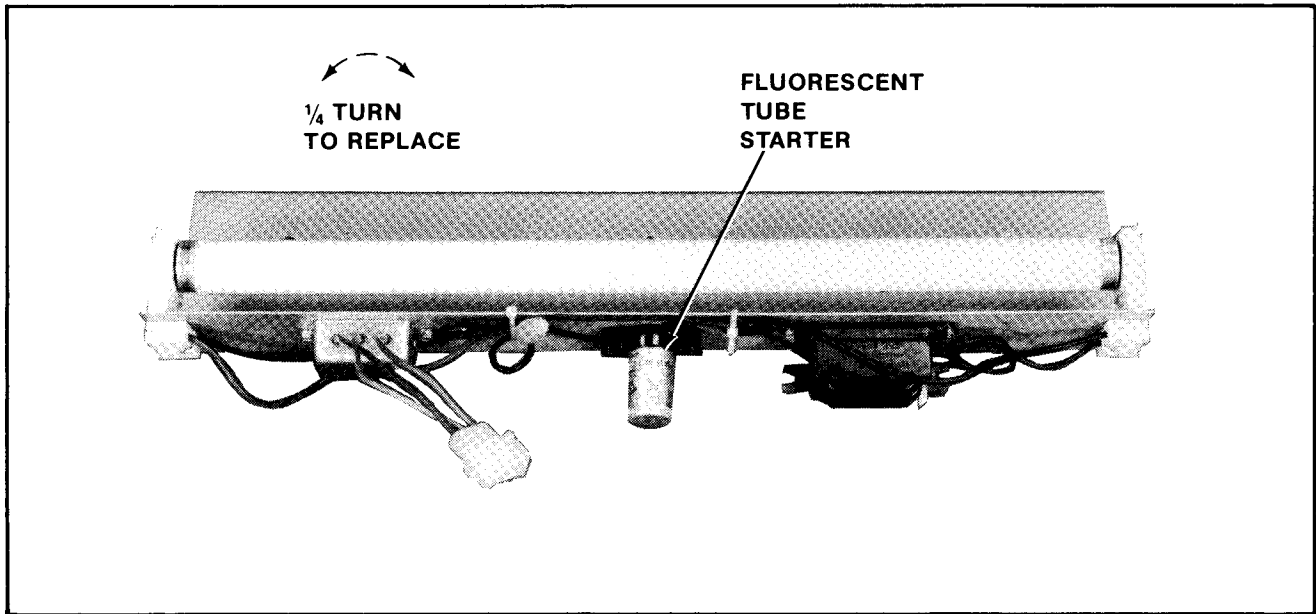


Figure 4-16 Replacing Fluorescent Tube Starter — Upright

2. **MINI MODEL.** See Figure 4-17.

- Turn the power off to the game.**
- 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 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 cabinet being careful not to catch its cable on anything.
To reinstall the above removed items, reverse this procedure.
- To replace the speaker.
Be sure the power is off to the game.
Disconnect the speaker from its cabling.
Remove the nuts and bolts securing the speaker.

Slide the speaker out through the rear access door.

To reinstall the speaker, simply reverse this procedure.

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

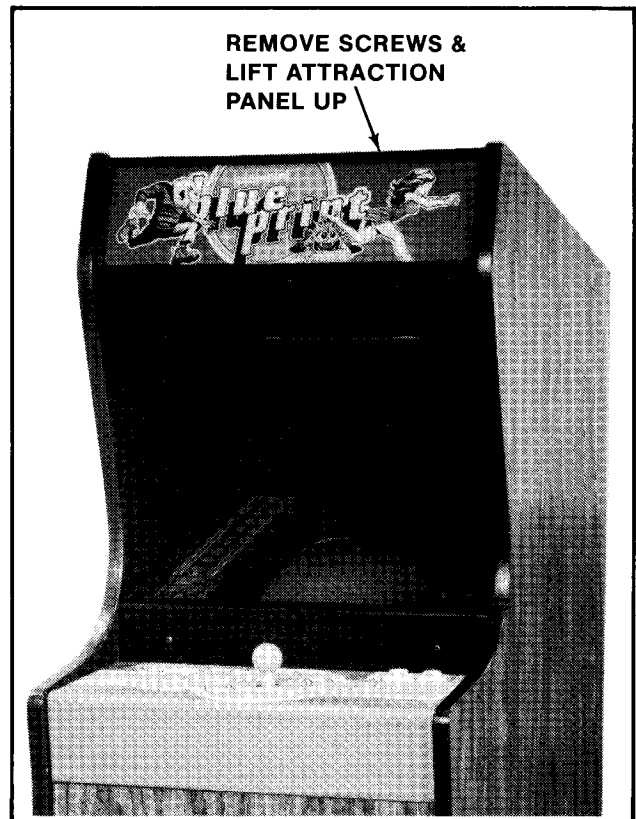


Figure 4-17 Opening the Attraction Panel — Mini

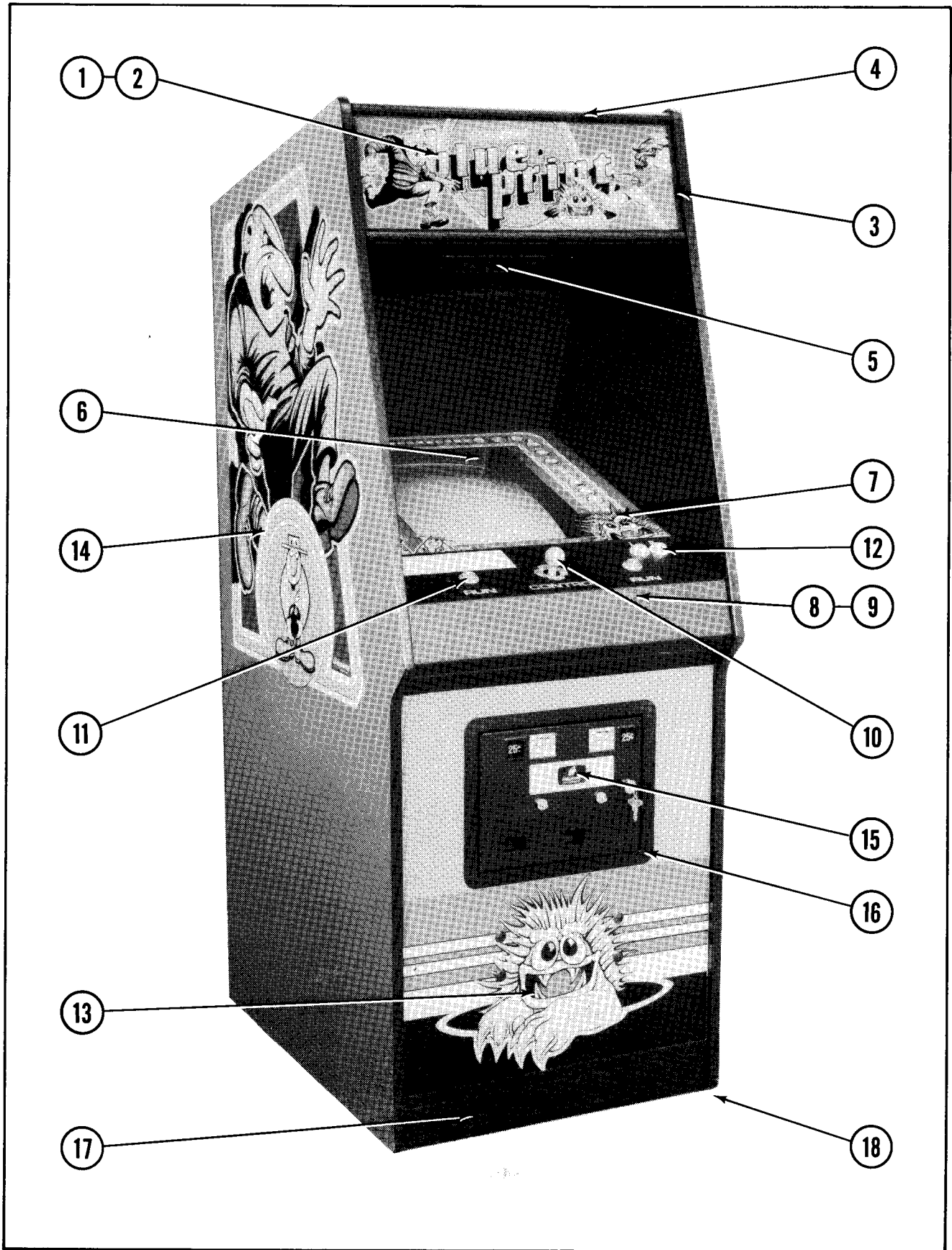
V Illustrated Parts Breakdown

BLUEPRINT — TRANSFORMER BOARD ASSEMBLY — NO PHOTOGRAPH

ORDER BY PART NUMBER ONLY

ITEM	PART NO.	DESCRIPTION
	MT00-00087-0000	POWER TRANSFORMER — 120/240V. (UPRIGHT & MINI)
	MT00-00092-0000	TRANSFORMER (UPRIGHT & MINI)
	MT00-00091-0000	SHIELDED TRANSFORMER — 115/120V (COCKTAIL ONLY)
	MT00-00093-0000	TRANSFORMER W/MAGNETIC SHIELD (COCKTAIL ONLY)
	0720-00001-0100	1 POSITION FUSE CLIP ASSY. (MINI ONLY)
	0720-00001-0200	2 POSITION FUSE CLIP ASSY. (ALL)
	0720-00001-0300	3 POSITION FUSE CLIP ASSY. (UPRIGHT & COCKTAIL)
	0017-00003-0002	1/2A., 250V. SLO-BLO FUSE (1 REQ'D. — UPRIGHT & COCKTAIL)
	0017-00003-0004	2A., 250V. SLO-BLO FUSE (2 REQ'D. — UPRIGHT, 3 REQ'D. — MINI & COCKTAIL)
	0017-00003-0177	3/4A., 250V. SLO-BLO FUSE (1 REQ'D. — UPRIGHT)
	0017-00003-0217	2-1/2A., 250V. SLO-BLO FUSE (1 REQ'D. — UPRIGHT, COCKTAIL & MINI)
	0017-00021-0634	2 POSITION TERMINAL STRIP
	A151-00079-0000	115V. CONVENIENCE OUTLET ASSY.
	A508-00037-0000	2 LEAD TRANSFORMER BOARD FILTER ASSY.
	A089-00014-0000	LINE CORD CABLE ASSY.
	3010-03003-0000	GROUNDING CLIP (2 REQ'D.)
	3000-17246-0500	5-1/2" LG. — GROUND STRAP (UPRIGHT & COCKTAIL)
	3000-17246-0900	48" LG. — GROUND STRAP (UPRIGHT ONLY)
	3000-17246-0300	GROUND STRAP (COCKTAIL ONLY)
	3000-17246-0200	GROUND STRAP (MINI ONLY)
	3000-17246-1000	36" LG. — GROUND STRAP (MINI ONLY)

NO. 300 — BLUEPRINT — UPRIGHT — FRONT

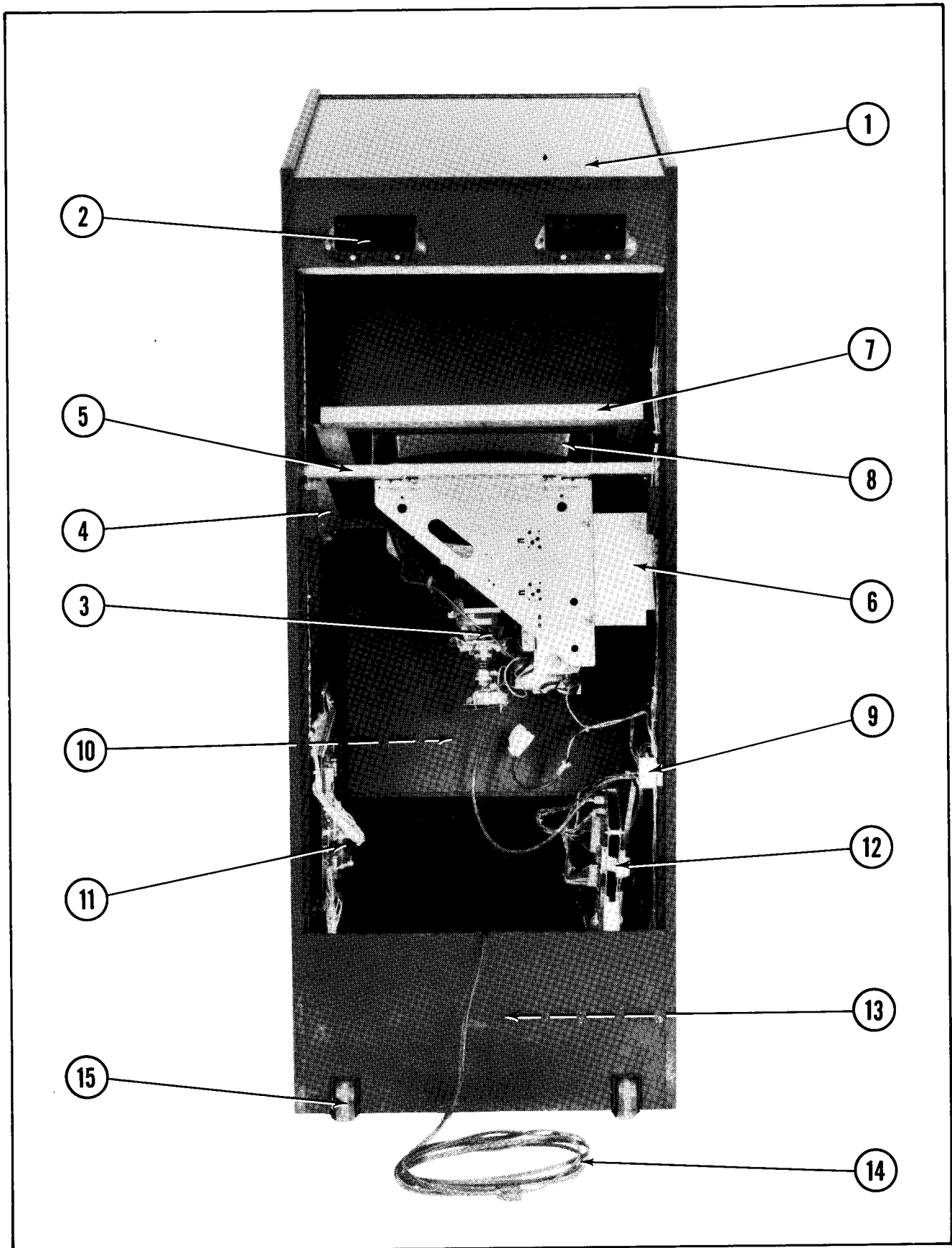


NO. 300 — BLUEPRINT — UPRIGHT — FRONT — PARTS LIST

ORDER BY PART NUMBER ONLY

ITEM	PART NO.	DESCRIPTION
1	0300-00901-00XF	HEADER DISPLAY PLEXI
2	A595-00011-0000	HEADER LIGHT ASSY.
3	0537-00903-0058	GLASS CHANNEL — 6-15/16" LG. (2 REQ'D.)
4	0574-00903-0100	HEADER BRKT. RETAINER (2 REQ'D.)
	0017-00101-0138	#8 x 5/8 TORX TAMPER PROOF PAN HD. SCR. (6 REQ'D.)
	0017-00009-0522	LONG ARM KEY T-20 (FOR ABOVE SCREW)
5	0017-00003-0430	6" x 9" SPEAKER — 4 OHM, 10W.
	0017-00009-0393	BLACK SPEAKER GRILL W/SLOTS
	0017-00101-0127	#8-32 x 1-1/2" CARRIAGE BOLT (4 REQ'D.)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (4 REQ'D.)
6	0508-00900-0000	19" T.V. BEZEL
7	0300-00900-00XF	MAIN VIEWING GLASS
	0508-00108-0000	GLASS STOP BRKT. (CABINET REAR)
	0017-00101-0027	#8 x 3/4 SLT. HEX HD. M.S. (3 REQ'D.)
8	0300-00902-0000	CONTROL SHELF OVERLAY — DECORATIVE
9	A300-00015-0000	CONTROL SHELF PLATE ASSY. — WELDED
	0982-00102-00XF	STRIKE (2 REQ'D.)
	0017-00009-0033	LATCH CLAMP (3 REQ'D.)
	0550-00101-0100	CONTROL SHELF MTG. BRKT. — RIGHT
	0550-00101-0200	CONTROL SHELF MTG. BRKT. — LEFT
	0555-00901-0000	PLASTIC LOCATING PIN (4 REQ'D.)
	0017-00101-0141	#8 x 11/16 UNSLOT HEX HD. M.S. (6 REQ'D.)
10	A300-00021-0000	8-POSITION CONTROL ASSY.
	A300-00013-0000	CONTROL SHELF CABLE ASSY.
11	0017-00042-0304	RED — PUSH BUTTON ASSY. (2 REQ'D.)
12	0017-00042-0260	WHITE — PUSH BUTTON ASSY. (2 REQ'D.)
	0017-00032-0093	PUSH BUTTON SWITCH W/HOLDER (4 REQ'D.)
	0017-00103-0054	5/8-11 PAL NUT (4 REQ'D.)
13	0300-00904-0000	FRONT DECAL
14	0300-00903-0100	SIDE DECAL — LEFT
	0300-00903-0200	SIDE DECAL — RIGHT
15	A090-00300-11BK	U.S.A. 25¢ DOUBLE COIN DOOR ASSY.
	A982-00015-0000	COIN DOOR CABLE ASSY.
16	0090-00002-04BK	LARGE COIN DOOR FRAME
	0017-00101-0121	#6-32 x 5/16 PHIL. TRS. HD. SCR. (3 REQ'D.) (MOUNTS COIN DOOR TO FRAME)
17	0935-00906-0100	KICK PLATE — 23" LG.
18	0017-00102-0048	3/8-16 x 2" LEG LEVELERS (4 REQ'D.)
	0017-00103-0026	3/8-16 LEG LEVELER HEX NUTS (4 REQ'D.)

NO. 300 — BLUEPRINT — UPRIGHT — REAR ACCESS

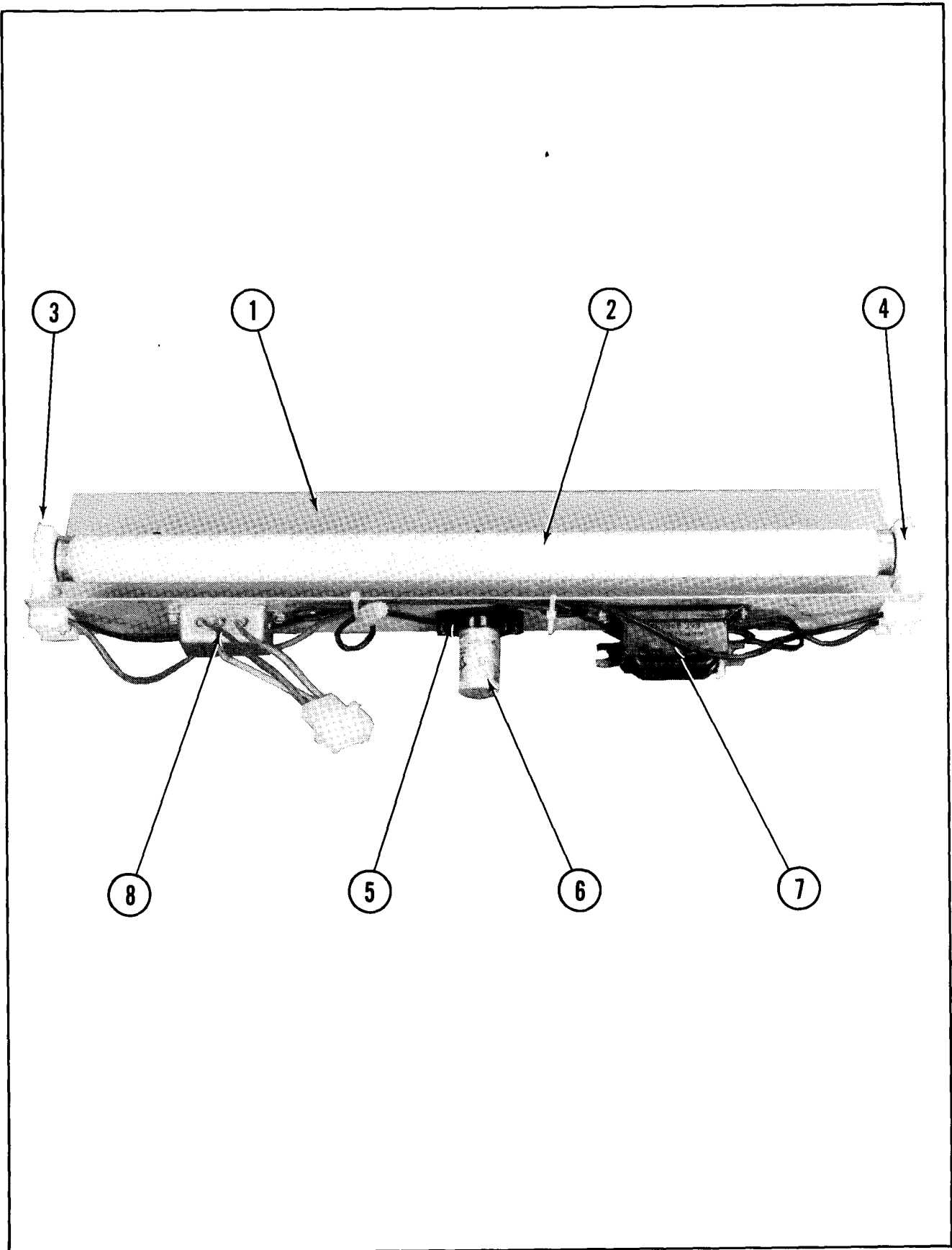


NO. 300 — BLUEPRINT — UPRIGHT — REAR ACCESS — PARTS LIST

ORDER BY PART NUMBER ONLY

ITEM	PART NO.	DESCRIPTION
1	A088-00013-0000	ON-OFF SWITCH & BRKT. ASSY.
2	0894-00916-0000	RECESSED HAND PULL & VENT (2 REQ'D.)
	0017-00101-0141	#8 x 11/16 UNSLOT. HEX HD. M.S. (8 REQ'D.)
3	0017-00003-0339	ELECTROHOME — 19" COLOR DUAL SYNC HORIZ. MTG. MONITOR (OR)
3	0017-00003-0439	WELLS-GARDNER — 19" COLOR DUAL SYNC HORIZ. MTG. MONITOR
4	0508-00102-0000	MONITOR MTG. CHANNEL (2 REQ'D.)
5	0595-00104-0000	MONITOR RAIL (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.)
	0555-00901-0000	PLASTIC LOCATING PIN (4 REQ'D.)
6	0866-00120-0000	CHASSIS BRACE
	0017-00101-0141	#8 x 11/16 UNSLOT. HEX HD. M.S. (4 REQ'D.)
7	0508-00108-0000	GLASS STOP BRACKET
8	0508-00900-0000	19" T.V. BEZEL
9	A088-00015-0000	INTERLOCK SWITCH & BRKT. ASSY.
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 COIN BOX
	0950-00103-0000	COIN BOX DIVIDER — OPTIONAL
	0017-00101-0142	1/4-20 x 1-3/8 BLK. 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.)
11	A082-90427-A000	POWER SUPPLY BOARD ASSY.
	0624-00902-0100	P.C. SUPPORT BRKT. — 12" LG. (2 REQ'D.)
	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. (10 REQ'D.)
	0017-00104-0037	#8 WASHER (10 REQ'D.)
12	A300-00004-0000	CARD RACK W/BOARDS ASSY.
13	A300-00006-0000	TRANSFORMER BOARD ASSY.
14	A089-00014-0000	LINE CORD CABLE ASSY.
15	A961-00007-0000	CASTER ASSY. (2 REQ'D.)
	0961-00109-0000	WHEEL BRKT. (2 REQ'D.)
	0017-00042-0255	PLASTIC WHEEL (2 REQ'D.)
	0894-00702-00XF	SHAFT (2 REQ'D.)
	0017-00100-0037	3/8" E-RING (2 REQ'D.)
		ADDITIONAL PARTS LIST
	A082-91109-A000	CREDIT MULT. BYPASS P.C.B.
	A151-00098-0000	BACK DOOR LOCK ASSY.
	0017-00009-0490	5-5/8" SQR. VENT GRILL — BACK DOOR (4 REQ'D.)
	A300-00018-0000	MASTER CABLE W/BRKT. ASSY.
	A300-00007-0000	HIGH VOLTAGE CABLE ASSY.
	A300-00008-0000	LOW VOLTAGE CABLE ASSY.
	A300-00010-0000	VIDEO SIGNAL CABLE ASSY.
	A515-00020-0000	TEST SWITCH & BRKT. ASSY.
	3000-17246-0700	20" GROUND STRAP — CONTROL SHELF
	3000-17246-0800	23" GROUND STRAP — CONTROL SHELF

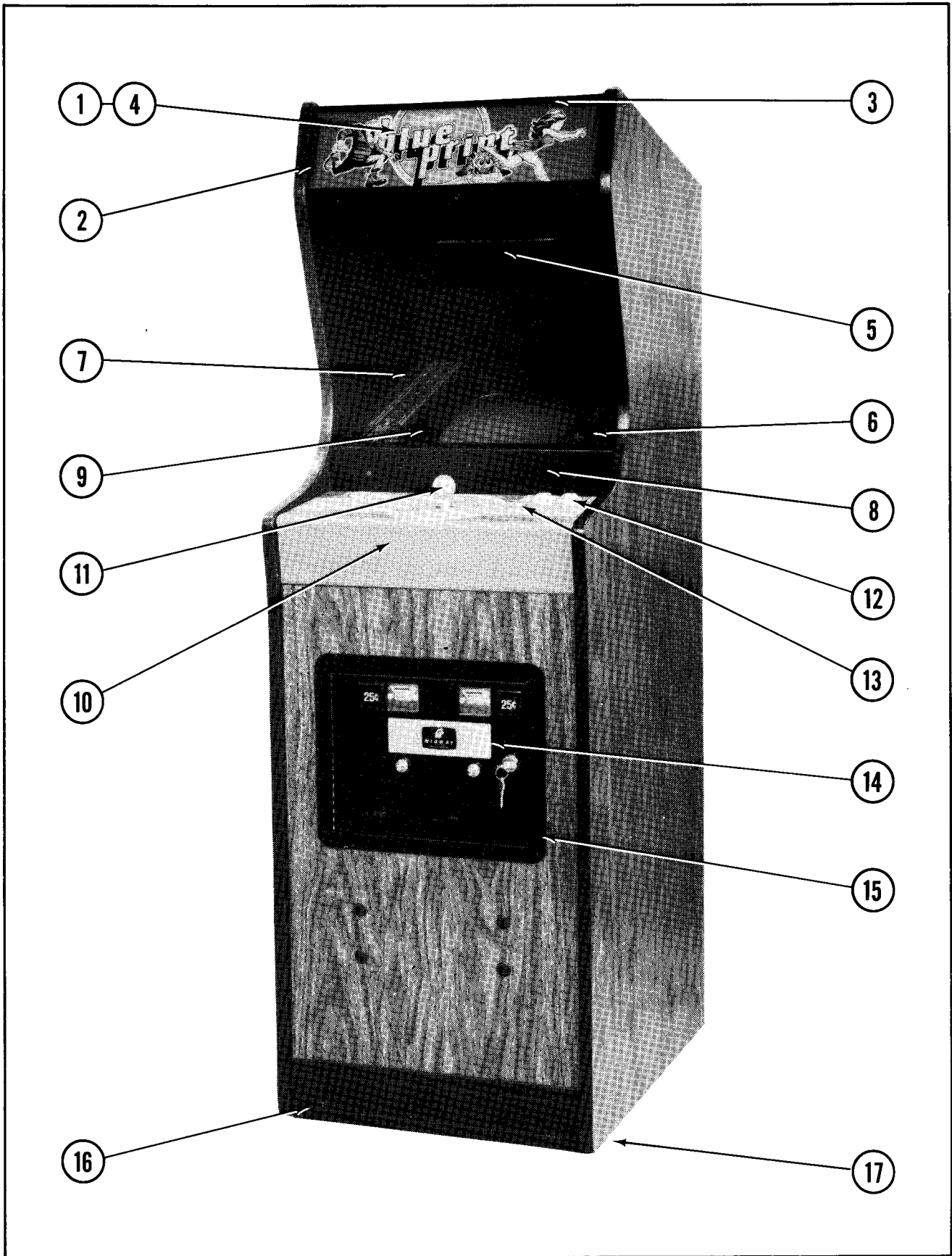
NO. 300 — BLUEPRINT — UPRIGHT — HEADER FLUORESCENT LIGHT ASSY.



NO. 300 — BLUEPRINT — UPRIGHT — HEADER FLUORESCENT LIGHT ASSY. — PARTS LIST*ORDER BY PART NUMBER ONLY*

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

NO. 301 — BLUEPRINT — MINI — FRONT

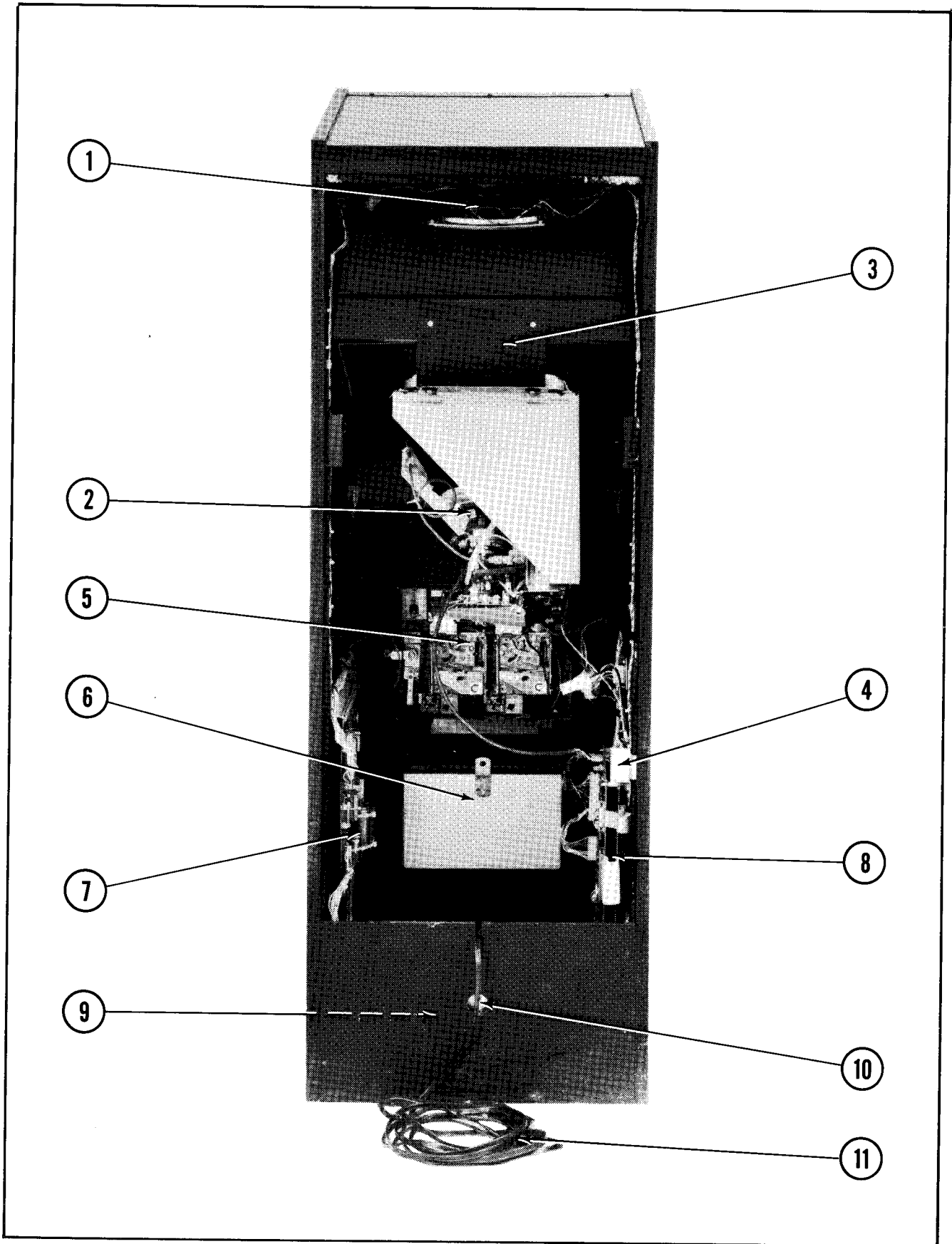


NO. 301 — BLUEPRINT — MINI — FRONT — PARTS LIST

ORDER BY PART NUMBER ONLY

ITEM	PART NO.	DESCRIPTION
1	0301-00901-00XF	DISPLAY HEADER
2	0537-00903-0062	GLASS CHANNEL — 3-7/8" LG. (2 REQ'D.)
3	0574-00903-0200	HEADER RETAINER BRKT. (2 REQ'D.)
	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)
4	A574-00007-0000	INSERT DISPLAY ASSY.
	0017-00031-0030	WEDGE BASE LAMP SOCKET (5 REQ'D.)
	0017-00003-0219	#194 LAMP — 14V., .27A. (5 REQ'D.)
	A574-00015-0000	INSERT DISPLAY CABLE ASSY.
5	0017-00009-0393	BLACK SPEAKER GRILL W/SLOTS
	0017-00003-0259	6" x 9" SPEAKER — 8 OHM, 7W.
	0017-00101-0127	#8-32 x 1-1/2 CARRIAGE BOLT (4 REQ'D.)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (4 REQ'D.)
6	0301-00900-00XF	MAIN VIEWING GLASS
7	0537-00903-0056	GLASS CHANNEL — 14-1/2" LG. (2 REQ'D.)
8	A555-00016-0000	GLASS CLAMPING PLATE ASSY.
	0017-00101-0138	#8 x 5/8 TORX TAMPER RESISTANT SCREW (2 REQ'D.)
9	0513-00900-0000	T.V. BEZEL
	A961-00026-0000	BEZEL MTG. BRKT. ASSY. (2 REQ'D.)
10	0301-00902-0000	CONTROL SHELF OVERLAY — DECORATIVE
	A301-00015-0000	CONTROL SHELF PLATE WELD ASSY.
	0555-00101-0100	CONTROL SHELF MTG. BRKT. — RIGHT
	0550-00101-0200	CONTROL SHELF MTG. BRKT. — LEFT
	0550-00901-0000	PLASTIC LOCATING PINS (4 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.)
11	A300-00021-0000	8-POSITION CONTROL ASSY.
	A301-00009-0000	CONTROL SHELF CABLE ASSY.
12	0017-00042-0260	PUSH BUTTON ASSY. — WHITE (2 REQ'D.)
13	0017-00042-0304	PUSH BUTTON ASSY. — RED (2 REQ'D.)
	0017-00032-0093	PUSH BUTTON SWITCH W/HOLDER (4 REQ'D.)
	0017-00103-0054	5/8-11 PAL NUT (4 REQ'D.)
14	A090-00300-11BK	25¢ U.S.A. DOUBLE COIN DOOR ASSY.
	A982-00015-0000	COIN DOOR CABLE ASSY.
15	0090-00002-04BK	LARGE COIN DOOR FRAME
	0017-00101-0121	#6-32 x 5/16 PHIL. TRS. HD. SCR. (3 REQ'D.) (MOUNTS COIN DOOR TO FRAME)
16	0935-00906-0400	KICK PLATE — 17-15/16" LG.
17	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. 301 — BLUEPRINT — MINI — REAR ACCESS

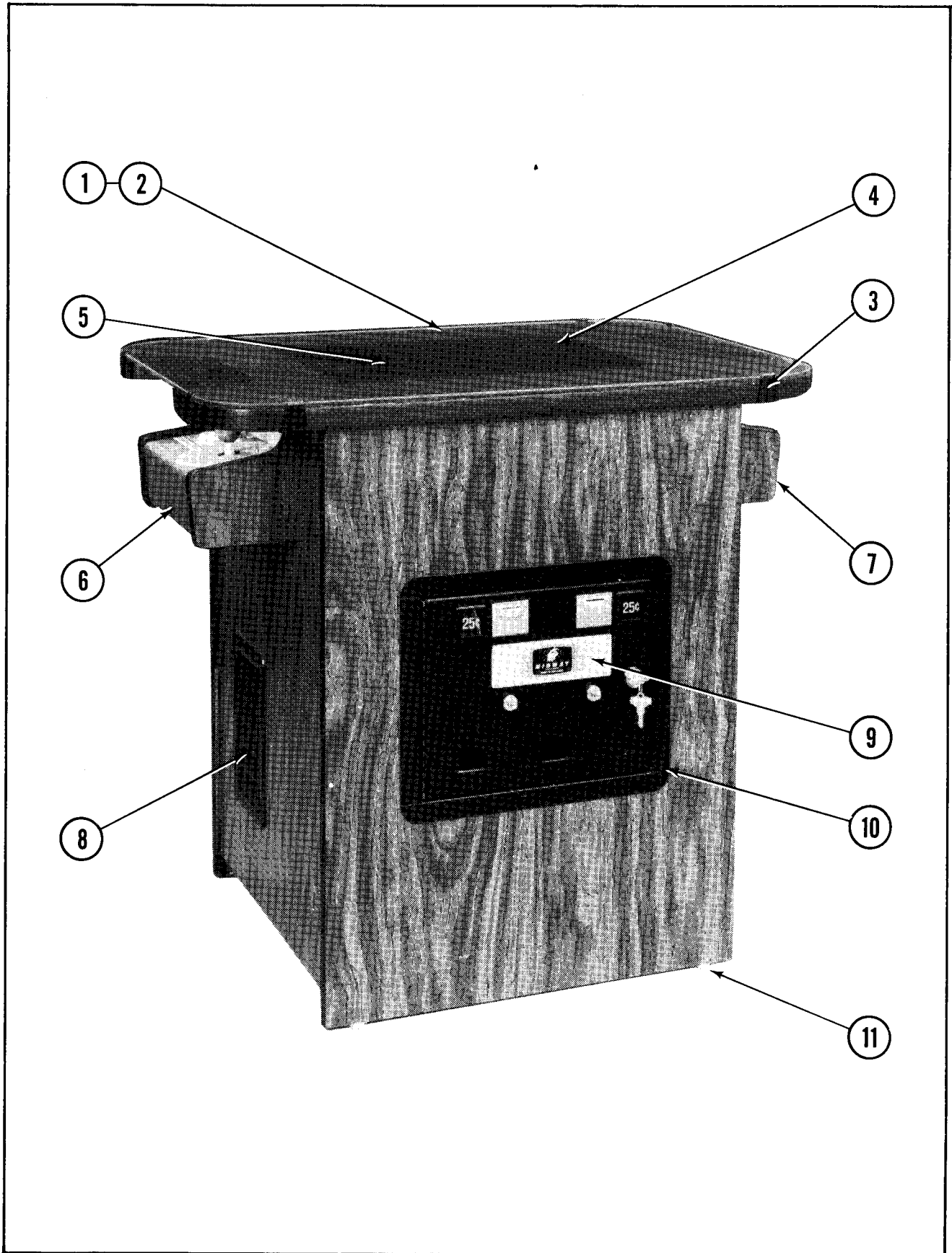


NO. 301 — BLUEPRINT — MINI — REAR ACCESS — PARTS LIST

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	0017-00003-0435	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.)
	0017-00103-0018	1/4-20 HEX NUT (2 REQ'D.)
	0513-00101-0000	MONITOR MTG. BRKT.
4	A088-00015-0000	INTERLOCK SWITCH & BRKT. ASSY.
5	A090-00300-11BK	25¢ U.S.A. DOUBLE COIN DOOR ASSY.
6	A950-00004-0000	COIN BOX ASSY.
	A950-00006-0000	COIN BOX CRADLE ASSY.
	0950-00105-0000	COIN BOX COVER
	0950-00104-0000	COIN BOX HANDLE
	0950-00900-0000	LARGE PLASTIC CASH BOX
	0950-00101-00XF	COIN DEFLECTOR (2 REQ'D.)
	0950-00103-0000	COIN BOX DIVIDER — OPTIONAL
	0017-00101-0142	1/4-20 1-3/8 BLK. 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	A082-90427-A000	POWER SUPPLY BOARD ASSY.
	0624-00902-0100	P.C. SUPPORT BRKT. — 12" LG. (2 REQ'D.)
	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. (10 REQ'D.)
	0017-00104-0037	#8 FLAT WASHER (10 REQ'D.)
8	A300-00004-0000	CARD RACK W/BOARDS ASSY.
9	A301-00005-0000	TRANSFORMER BOARD ASSY.
10	A088-00013-0000	ON-OFF SWITCH & BRKT. ASSY.
11	A089-00014-0000	LINE CORD CABLE ASSY.
		ADDITIONAL PARTS LIST
	A082-91109-A000	CREDIT MULT. BYPASS P.C.B.
	A151-00098-0000	BACK DOOR LOCK ASSY.
	0017-00009-0490	5-5/8" SQR. VENT GRILL (4 REQ'D.)
	0926-00904-0000	PROTECTIVE BUBBLE — BACK DOOR
	0017-00101-0628	#8-32 x 3/4 CARRIAGE BOLT (10 REQ'D.)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (10 REQ'D.)
	A515-00020-0000	TEST SWITCH & BRKT. ASSY.
	A301-00014-0000	MASTER CABLE W/BRKT. ASSY.
	A301-00006-0000	HIGH VOLTAGE CABLE ASSY.
	A301-00007-0000	LOW VOLTAGE CABLE ASSY.
	A300-00010-0000	VIDEO SIGNAL CABLE ASSY.

NO. 302 — BLUEPRINT — COCKTAIL — FRONT

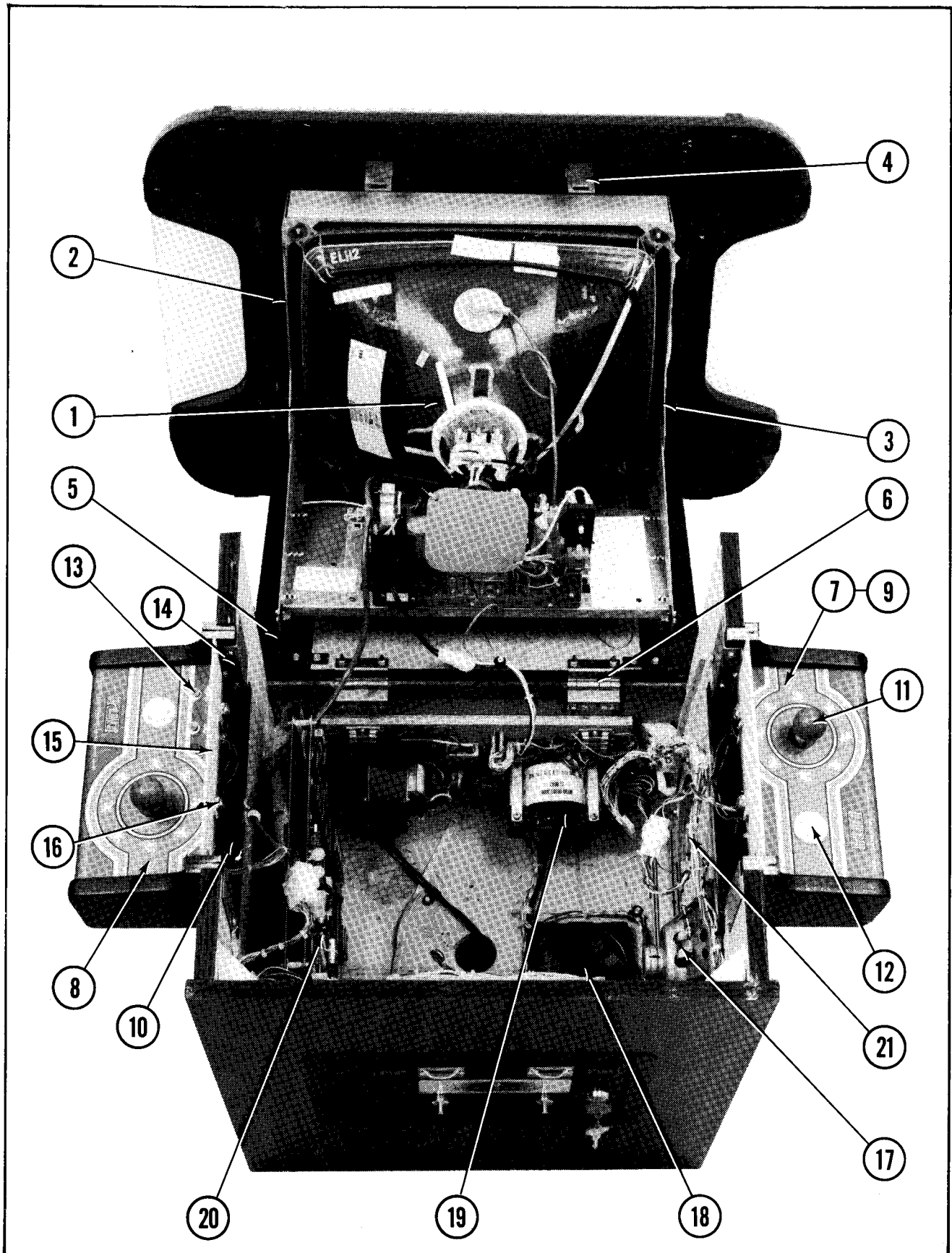


NO. 302 — BLUEPRINT — COCKTAIL — FRONT — PARTS LIST

ORDER BY PART NUMBER ONLY

ITEM	PART NO.	DESCRIPTION
1	0017-00009-0499	COVER GLASS — 32" x 22" x 1/4"
2	0302-00900-0000	ARTWORK UNDERLAY
3	0775-00104-00XF	GLASS CLIPS (8 REQ'D.)
4	0017-00101-0117	#8 x 5/8 BLK. PHIL. TRS. HD. SCR. (16 REQ'D.)
	0557-00900-0000	T.V. BEZEL
5	0508-00106-0000	BEZEL MTG. BRKT. (2 REQ'D.)
	0530-00903-0000	ACRYLIC DIFFUSER
6	A302-00009-0100	CONTROL SHELF ASSY. — PLAYER #1
	A302-00010-0100	CONTROL SHELF CABLE ASSY. — PLAYER #1
7	A302-00009-0200	CONTROL SHELF ASSY. — PLAYER #2
	A302-00010-0200	CONTROL SHELF CABLE ASSY. — PLAYER #2
8	0017-00009-0393	BLACK SPEAKER GRILL 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.)
9	A090-00300-11BK	25¢ U.S.A. DOUBLE COIN DOOR ASSY.
	A982-00015-0000	COIN DOOR CABLE ASSY.
10	0090-00002-02BK	LARGE COIN DOOR FRAME
	0017-00101-0121	#6-32 x 5/16 PHIL. TRS. HD. SCREW (3 REQ'D.) (MOUNTS COIN DOOR TO FRAME)
11	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. 302 — BLUEPRINT — COCKTAIL — INTERIOR ACCESS



NO. 302 — BLUEPRINT — COCKTAIL — INTERIOR ACCESS — PARTS LIST

ORDER BY PART NUMBER ONLY

ITEM	PART NO.	DESCRIPTION	
1	0017-00003-0339	ELECTROHOME — 19" COLOR DUAL SYNC. HORIZ. MTG. MONITOR (OR)	
1	0017-00003-0439	WELLS-GARDNER — 19" COLOR DUAL SYNC. HORIZ. MTG. MONITOR	
2	A515-00019-0000	MONITOR SUPPORT ASSY. — LEFT	
3	A515-00019-0100	MONITOR SUPPORT ASSY. — RIGHT	
4	0017-00101-0109	#8 x 5/16 UNSLOT. HEX HD. BOLT (6 REQ'D.)	
	0610-00132-00ZN	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.)	
5	0017-00101-0141	#8 x 11/16 UNSLOT. HEX HD. SCREW (4 REQ'D.)	
	0927-00101-00XF	SUPPORT ANGLE (2 REQ'D.)	
	0017-00101-0598	#8-32 x 5/16 SLT. HEX HD. M.S. (8 REQ'D.)	
6	0017-00009-0514	2-1/2" HINGE (2 REQ'D.)	
	0017-00101-0136	#8-32 x 1-1/4 CARRIAGE BOLT (8 REQ'D.)	
	0017-00103-0061	#8-32 HEX NUT W/SEMS (8 REQ'D.)	
7	A302-00015-0000	CONTROL PANEL ASSY. — WELDMENT (2 REQ'D.)	
8	0302-00901-0100	DECORATIVE OVERLAY PLAYER #1	
9	0302-00901-0200	DECORATIVE OVERLAY PLAYER #2	
10	0017-00101-0341	#6 x 1/4 PHIL. TRS. HD. SCR. (6 REQ'D.)	
	0510-00101-00XF	BOTTOM PAN (2 REQ'D.)	
11	A300-00021-0000	8-POSITION CONTROL ASSY. (2 REQ'D.)	
12	A302-00010-0100	CONTROL SHELF CABLE ASSY. — PLAYER #1	
	A302-00010-0200	CONTROL SHELF CABLE ASSY. — PLAYER #2	
	0017-00042-0304	RED — PUSH BUTTON ASSY. (2 REQ'D.)	
	0017-00032-0093	PUSH BUTTON SWITCH W/HOLDER (2 REQ'D.)	
13	0017-00103-0054	5/8-11 PAL NUT (2 REQ'D.)	
	0017-00032-0051	SMALL RED BUTTON SWITCH (2 REQ'D.)	
14	0930-00104-0000	PANEL LOCATING BRKT. (4 REQ'D.)	
	0017-00101-0025	#8 x 1/2 SLT. HD. SCREW (12 REQ'D.)	
15	0930-00904-0000	LIGHT SHIELD (2 REQ'D.)	
16	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. SCR. (4 REQ'D.)	
17	0017-00003-0187	6" x 9" SPEAKER — 8 OHM, 9W.	
18	A775-00013-0000	FAN ASSY.	
	0151-00081-0000	4" FAN	
	0775-00110-00XF	FAN PLATE	
	0749-00106-00XF	FAN SCREEN	
	A775-00018-0000	FAN CABLE ASSY.	
	0017-00101-0347	#6-32 x 1/2 RND. HD. M.S. (4 REQ'D.)	
	0017-00104-0009	#6 EXT. WASHER (4 REQ'D.)	
	0017-00103-0005	#6-32 HEX NUT (4 REQ'D.)	
	0017-00101-0026	#8 x 5/8 SLT. HEX HD. SCREW (4 REQ'D.)	
	19	A302-00006-0000	TRANSFORMER BOARD ASSY.
	20	A300-00004-0000	CARD RACK ASSY. W/BOARDS
21	A082-90427-A000	POWER SUPPLY BOARD ASSY. — NOT SHOWN	
	0624-00902-0100	P.C. SUPPORT BRKT. — 12" LG.	
	0624-00902-0300	P.C. SUPPORT BRKT. — 2-1/2" LG. (2 REQ'D.)	
	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.)	

NO. 302 — BLUEPRINT — COCKTAIL — INTERIOR ACCESS — PARTS LIST (Continued)

ORDER BY PART NUMBER ONLY

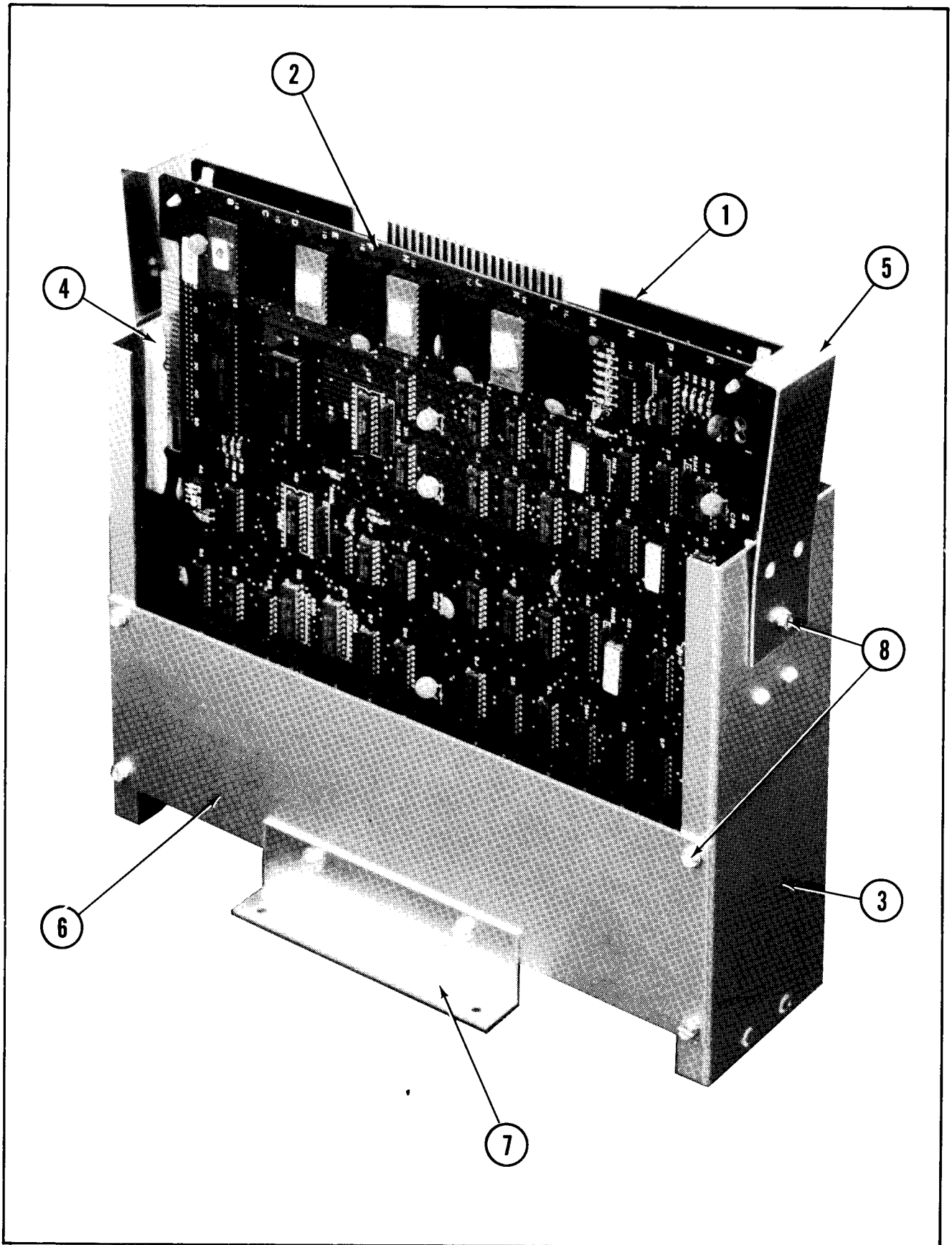
ITEM	PART NO.	DESCRIPTION
ADDITIONAL PARTS LIST		
	A082-91109-A000	CREDIT MULT. BYPASS P.C.B.
	A088-00013-0000	ON-OFF SWITCH & BRKT. ASSY.
	A088-00014-0000	INTERLOCK SWITCH & BRKT. ASSY.
	A515-00020-0000	TEST SWITCH & BRKT. ASSY.
	A927-00019-0000	COIN BOX ASSY.
	A962-00004-0000	COIN BOX COVER ASSY.
	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.)
	A302-00012-0000	MASTER CABLE W/BRKT. ASSY.
	A302-00007-0000	HIGH VOLTAGE CABLE ASSY.
	A302-00008-0000	LOW VOLTAGE CABLE ASSY.
	A300-00010-0000	VIDEO SIGNAL CABLE ASSY.
	0927-00907-0000	FORMED HIGH VOLTAGE SHIELD
	A927-00005-0000	HIGH BASE LEG KIT ASSY. — OPTIONAL

BLUEPRINT — ALL VERSIONS — CARD RACK ASSY. — PARTS LIST

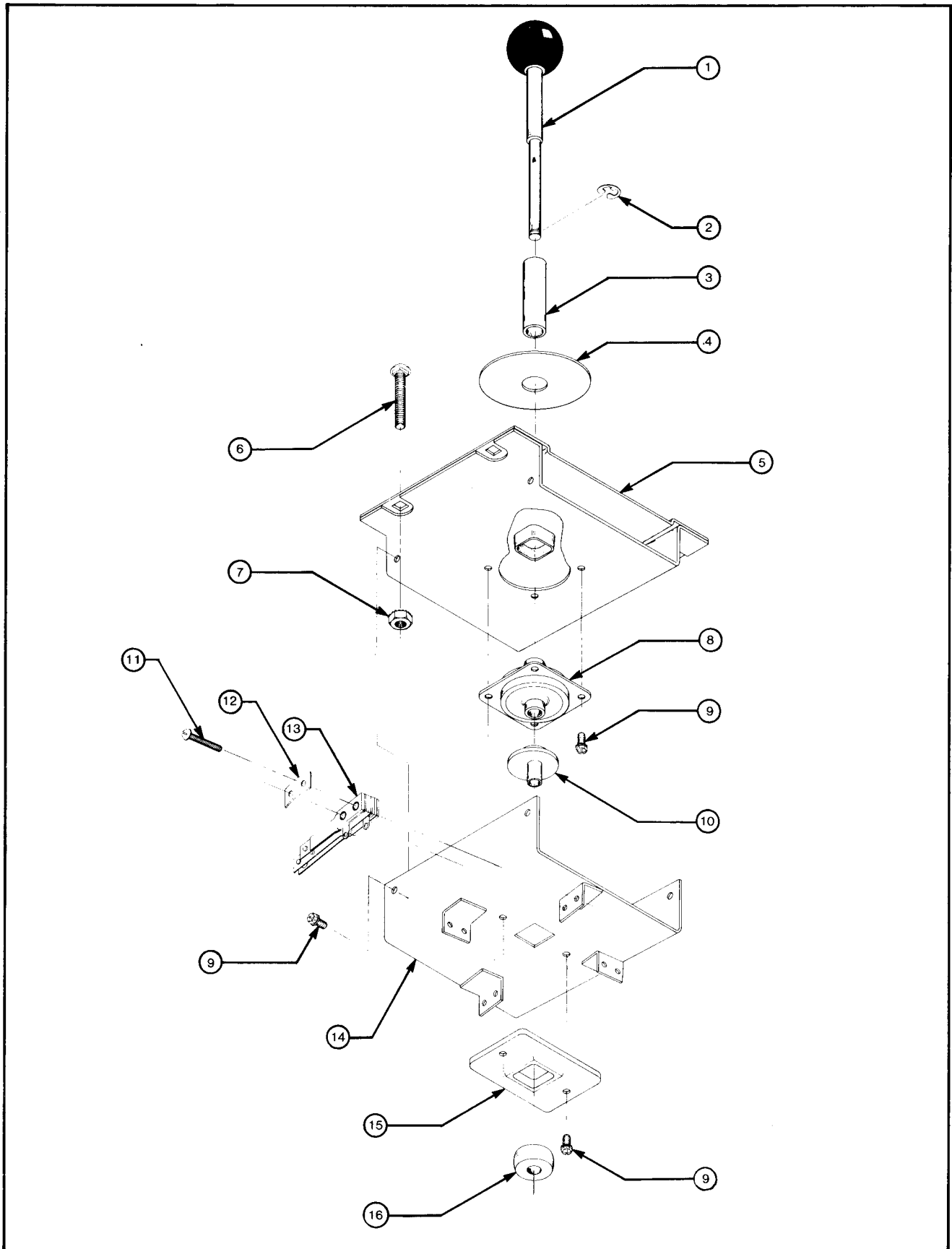
ORDER BY PART NUMBER ONLY

ITEM	PART NO.	DESCRIPTION
1	A084-91430-C300	MPU/SOUND BOARD ASSY.
2	A084-91431-A300	VIDEO BOARD ASSY.
3	A935-00015-0000	HOLDER PLATE & STOP ASSY. (2 REQ'D.)
4	0017-00009-0478	NYLON GUIDE (4 REQ'D.)
5	0935-00105-0000	RETAINER (2 REQ'D.)
6	0935-00103-0000	SIDE SUPPORT (2 REQ'D.)
7	0935-00102-0000	MOUNTING BRACKET (2 REQ'D.)
8	0017-00101-0096	#6 x 3/8 SLT. HEX HD. SCR. (14 REQ'D.)

BLUEPRINT — ALL VERSIONS — CARD RACK ASSY.



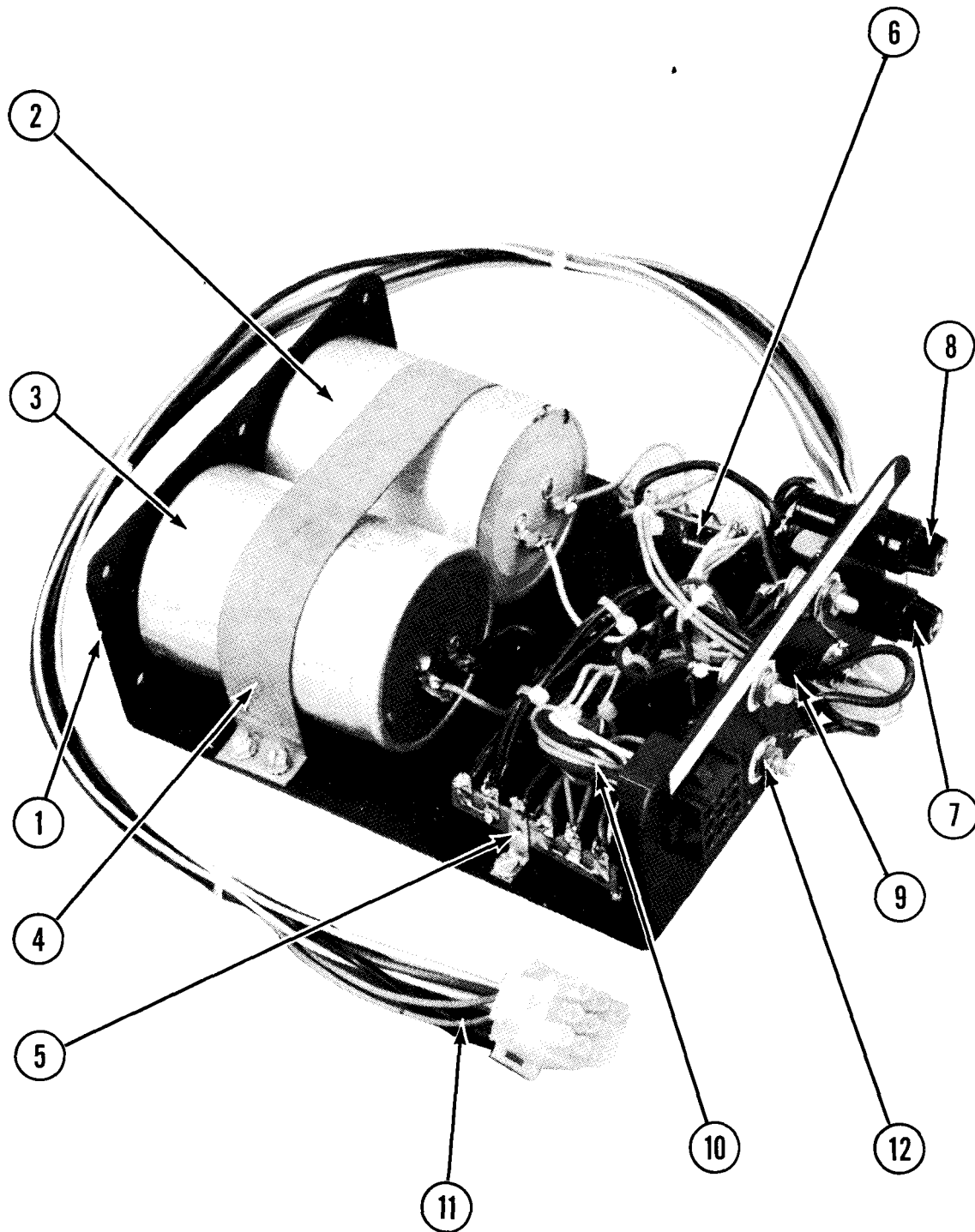
BLUEPRINT — CONTROL ASSY.



BLUEPRINT — CONTROL ASSY. — 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	0530-00907-0000	SLIDE PLATE
5	A982-00019-0000	PIVOT PLATE WELD ASSY.
6	0017-00101-0637	#8-32 x 1" CARRIAGE BOLT (4 REQ'D.)
7	0017-00103-0061	#8-32 HEX NUT W/SEMS (4 REQ'D.)
8	0932-00902-0000	GROMMET
9	0017-00101-0598	#8-32 x 5/16 SLT. HEX HD. M.S. (10 REQ'D.)
10	0962-00904-0000	SLEEVE
11	0017-00101-0527	#5-40 x 5/8 SLT. RND. HD. SCR. (8 REQ'D.)
12	0020-00202-0000	SWITCH PLATE (4 REQ'D.)
13	A932-00009-0000	SWITCH ASSEMBLY (4 REQ'D.)
14	A921-00009-0000	STOP PLATE & SWITCH BRKT. ASSY.
15	0927-00908-0000	WEAR PLATE
16	0921-00700-0000	ACTUATOR

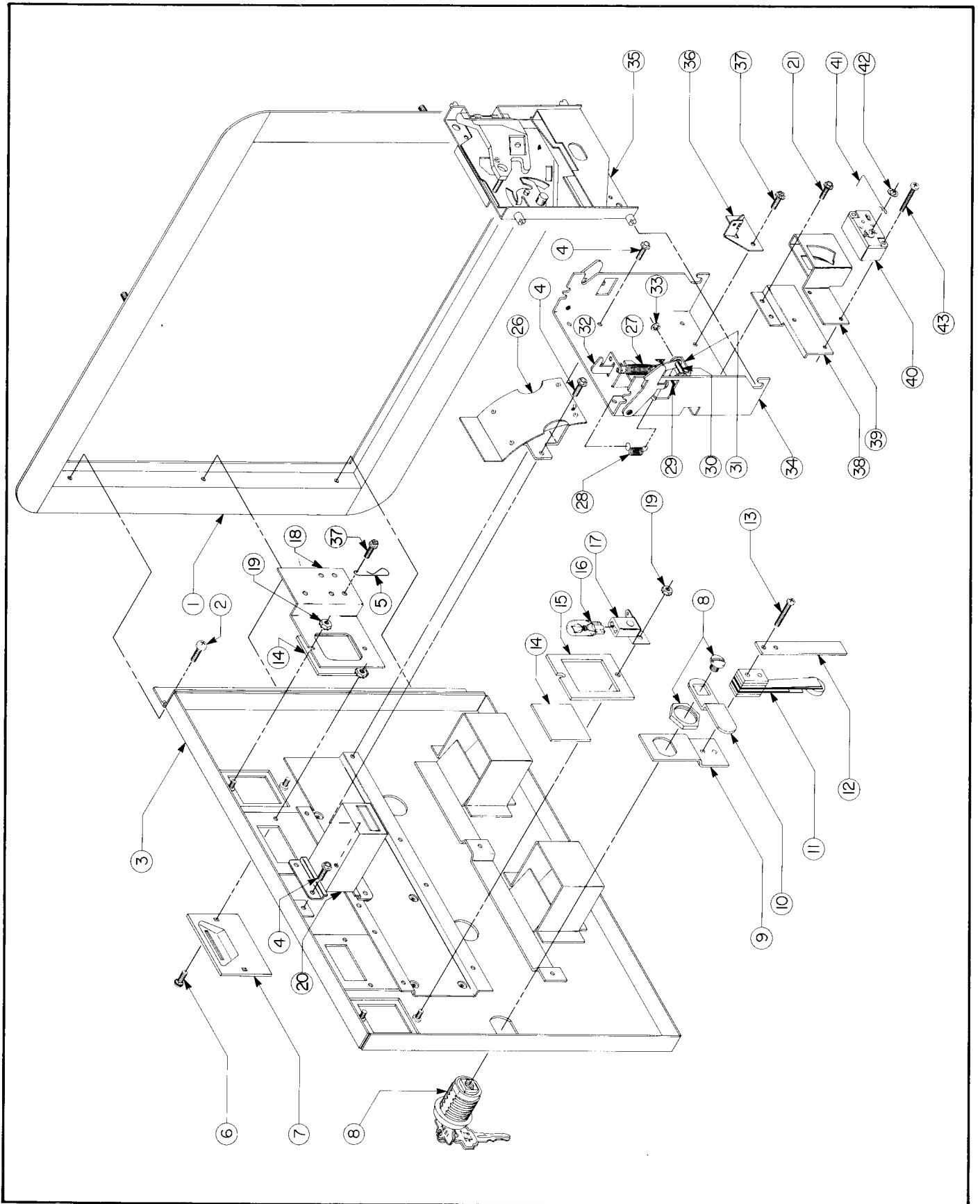
FILTER ASSY.



FILTER ASSY. — PARTS LIST
ORDER BY PART NUMBER ONLY

ITEM	PART NO.	DESCRIPTION
1	0945-00101-00XF	CHASSIS
2	0945-00803-0100	CAPACITOR — 55000MF — 25V.
3	0945-00803-0200	CAPACITOR — 100000MF — 15V.
4	0945-00100-0000	CAPACITOR STRAP
	0017-00101-0555	#6-32 x 5/16 SLT. HEX HD. SCR. (4 REQ'D.)
5	0017-00021-0539	5 POSITION TERMINAL STRIP (2 REQ'D.)
	0017-00101-0510	#4-40 x 1/2 SLT. PAN HD. SCR. (4 REQ'D.)
	0017-00104-0087	#4 FLAT WASHER (4 REQ'D.)
	0017-00104-0071	#4 EXT. TOOTH WASHER (4 REQ'D.)
	0017-00103-0002	#4-40 HEX NUT (4 REQ'D.)
6	0062-122H7-1XXX	RESISTOR — 150 OHM, 2W.
	0062-086H7-1XXX	RESISTOR — 47 OHM, 2W. — LOCATED ON OPPOSITE TERMINAL STRIP
7	0017-00003-0008	FUSE — 6 AMP — 120V.
8	0017-00003-0174	FUSE — 10 AMP — 32V.
	0017-00003-0433	FUSE HOLDER (2 REQ'D.)
9	0017-00041-0008	RUBBER GROMMET
10	A089-00007-0000	FILTER CABLE ASSY. #2
11	A089-00006-0000	FILTER CABLE ASSY. #1
12	0945-00804-0100	DIODE — 12A. — 50V. (4 REQ'D.)
	0017-00103-0086	#10-32 HEX NUT (4 REQ'D.)
	0017-00021-0484	SOLDER LUG (4 REQ'D.)
	0017-00104-0107	#10 FLAT WASHER (4 REQ'D.)
	0017-00009-0510	INSULATOR (8 REQ'D.)
	0017-00042-0283	BUSHING (4 REQ'D.)
	0945-00900-0000	DIODE FORMED FISHPAPER COVER — NOT SHOWN

FRONT DOOR ASSEMBLY



FRONT DOOR ASSEMBLY — U.S.A. 25¢

ORDER BY PART NUMBER ONLY

ITEM	PART NO.	DESCRIPTION
1	0090-00002-02BK	DOUBLE ENTRY COIN DOOR FRAME
2	0017-00101-0121	#6-32 x 5/16 PHIL. TRS. HD. SCR. (3 REQ'D.)
3	A090-00073-02BK	DOUBLE ENTRY COIN DOOR W/DRESS PLATE
4	0017-00101-0123	#8 x 1/4 UNSLOT. HEX HD. SCREW (12 REQ'D.)
5	0017-00007-0019	KEY HOOK
6	0017-00101-0552	#6-32 x 1/4 CARRIAGE BOLT (4 REQ'D.)
7	0090-00117-03XF	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. #194 (2 REQ'D.)
17	0017-00031-0048	WEDGE SOCKET W/BRKT. (2 REQ'D.)
18	A090-00100-0000	BRKT. ASSY.
19	0017-00103-0084	#6-32 HEX NUT W/SEMS (4 REQ'D.)
20	A090-00089-0000	COIN METER W/DIODE
21	0017-00101-0124	#6 x 1/4 UNSLOT. HEX HD. SCR. (4 REQ'D.)
26	A090-00087-0000	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	A090-00105-0000	COIN ACCEPTOR FRAME ASSY. (2 REQ'D.)
35	0017-00005-0003	COIN ACCEPTOR W/STRING CUTTER (2 REQ'D.) (OR)
35	0017-00005-0211	COIN ACCEPTOR W/ANTI STRING DEVICE (2 REQ'D.) (OR)
35	0017-00005-0214	COIN ACCEPTOR W/STRING CUTTER (2 REQ'D.)
36	A090-00064-0000	ANTI-PENNY DEVICE
37	0017-00101-0099	#6 x 1/4 SLT. HEX HD. M.S. (2 REQ'D.)
38	0090-00162-00XF	COIN SWITCH MTG. BRKT.
39	0017-00005-0203	COIN SWITCH CHUTE
40	0017-00005-0195	COIN SWITCH
41	0010-00599-0000	COIN SWITCH WIRE
42	0017-00007-0132	PUSH-ON RING
	A090-00059-0400	COIN SWITCH & WIRE ASSY. (ITEMS 40 THRU 42)
43	0017-00101-0147	#4-40 x 3/4 PHIL. PAN. HD. M.S. (2 REQ'D.)
	A090-00077-0000	COIN GUIDE & SWITCH ASSY. (ITEMS 38 THRU 43)

VI Technical Troubleshooting

Introduction

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

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

General Suggestions

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

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

Harness Component Troubleshooting

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

NO GAME CREDIT

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

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

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

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

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

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

Transformer and Line Voltage Problems

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

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

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

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

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

HARNESS PROBLEMS

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

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

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

MALFUNCTIONING CONTROLS

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

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

A Glossary of Microprocessor Terms

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

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

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

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

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

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

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

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

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

Introduction to the Z-80 CPU

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

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

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

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

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

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

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

General Purpose Registers

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

Arithmetic & Logic Unit (ALU)

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

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

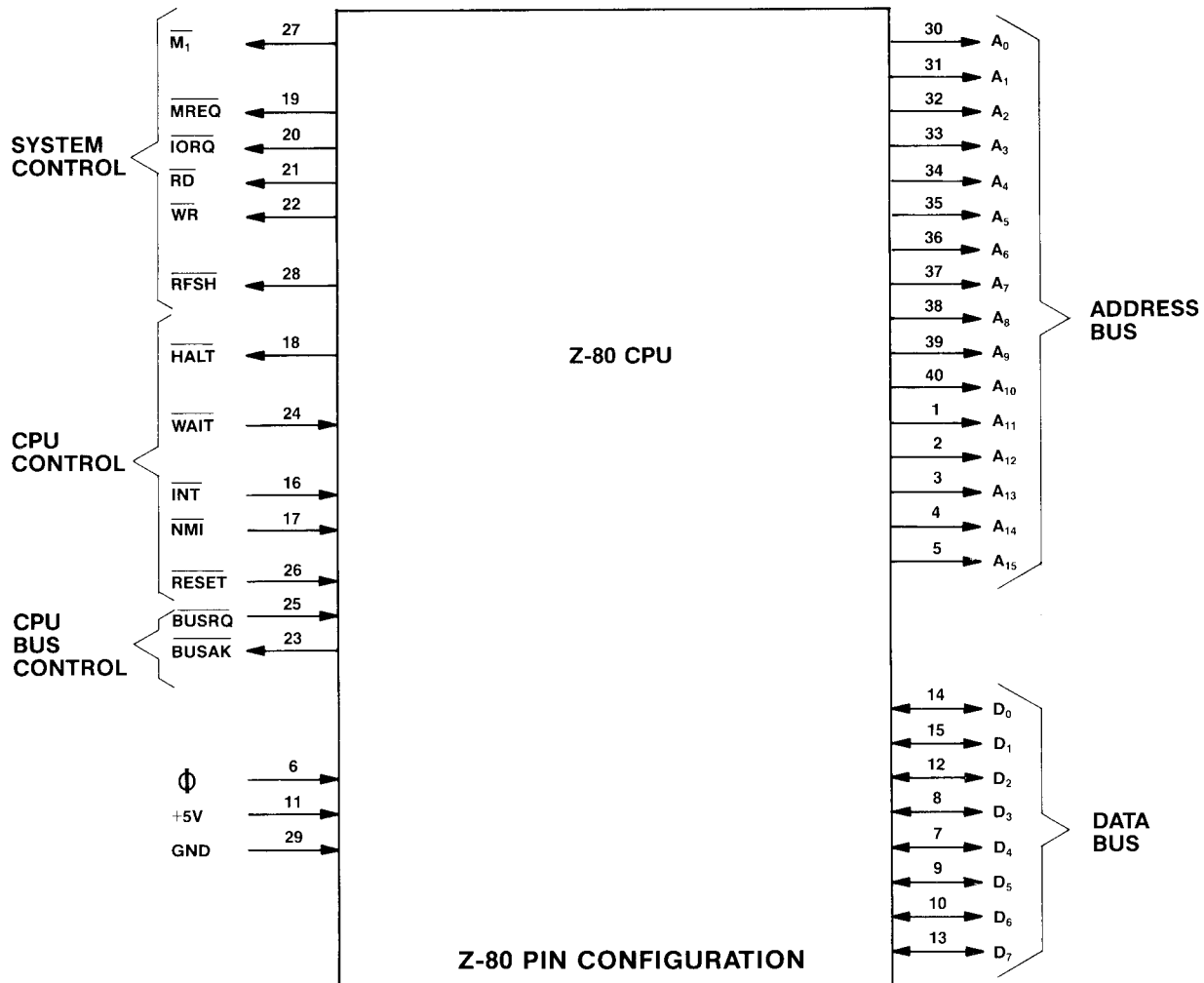
Add	Left or right shifts or rotates (arithmetic and logical)
Subtract	Increment
Logical AND	Decrement
Logical OR	Set bit
Logical Exclusive OR	Reset bit
Compare	Test bit

Instruction Register and CPU Control

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

Z-80 CPU Pin Description

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



A₀-A₁₅**(Address Bus)**

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

D₀-D₇**(Data Bus)**

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

M₁**(Machine Cycle one)**

Output, active low. M₁ 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, M₁ is generated as each op code byte is fetched. These two byte op-codes always begin with CBH, DDH, EDH or FDH. M₁ also occurs with 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 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 IORQ signal is also generated with an M₁ signal when an interrupt is being acknowledged to indicate that an interrupt response vector can be placed on the data bus. Interrupt Acknowledge operations occur during M₁ time while I/O operations never occur during M₁ time.

RD**(Memory Read)**

Tri-state output, active low. 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. 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. 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. 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. 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 BUSRQ signal is not active. When the CPU accepts the interrupt, an acknowledge signal (IORQ during M₁ time) is sent out at the beginning of the next instruction cycle. The CPU can respond to an interrupt in three different modes that are described in detail in section 5.4 (CPU Control Instructions).

NMI**(Non-Maskable Interrupt)**

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

RESET

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

- 1) Disable the interrupt enable flip-flop

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

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

BUSRQ

(Bus Request)

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

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

BUSAK

(Bus Acknowledge)

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

CLK

(Clock)

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

VII. Coin Door Maintenance

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

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

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

COIN DOOR MAINTENANCE

METAL COIN ACCEPTOR MECHANISMS

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

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

3. Remove the coin acceptor mechanism as shown in Figure 7-1.

- Push down on the two spring loaded latches.
- While holding the latches down, pull the top of the coin acceptor mechanism toward you.
- Release the latches and lift out the coin acceptor mechanism.

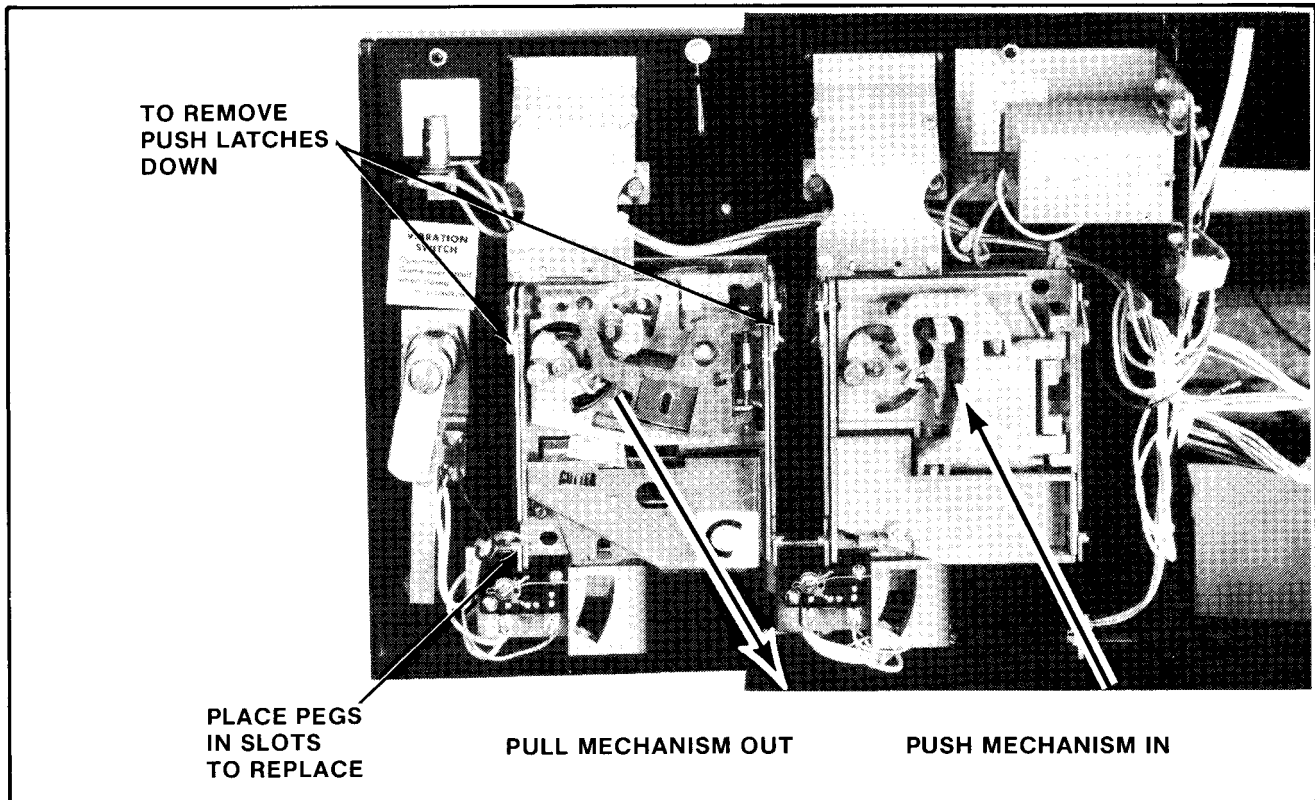


Figure 7-1 Removing and replacing coin acceptor

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

CAUTION: BE CAREFUL NOT TO BURN YOURSELF.

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

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

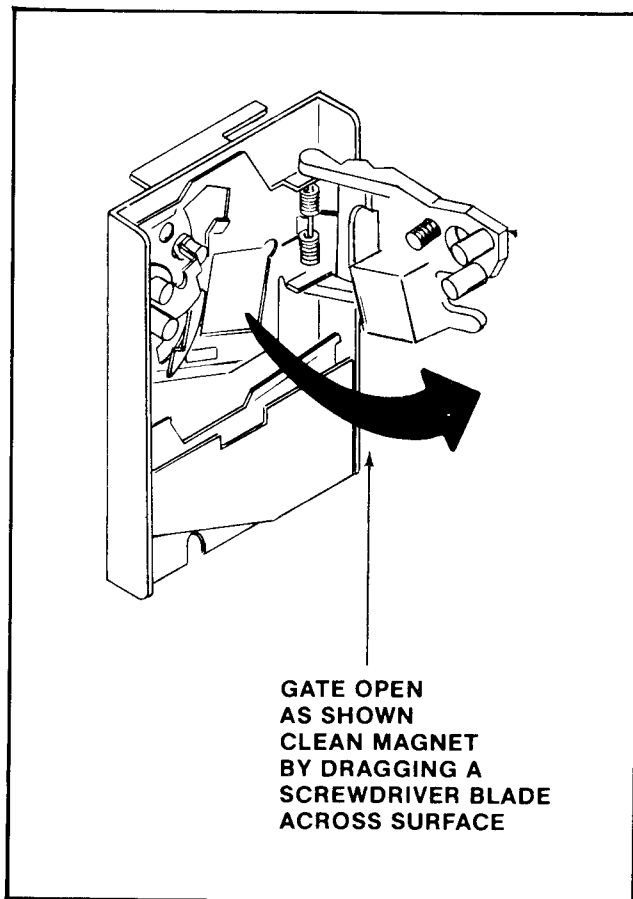


Figure 7-2 Cleaning the metal coin acceptor

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

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

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

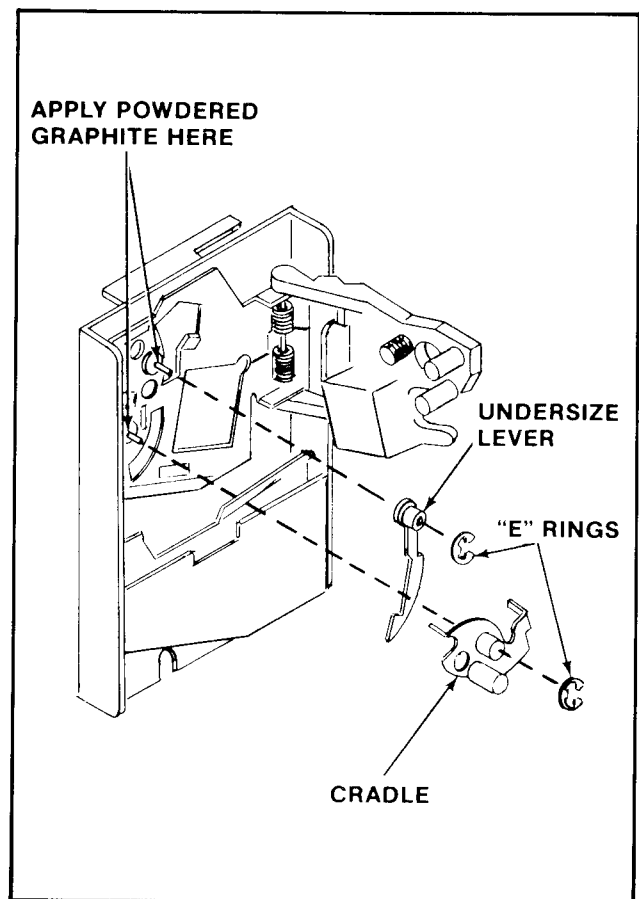


Figure 7-3 Lubricating the metal coin acceptor

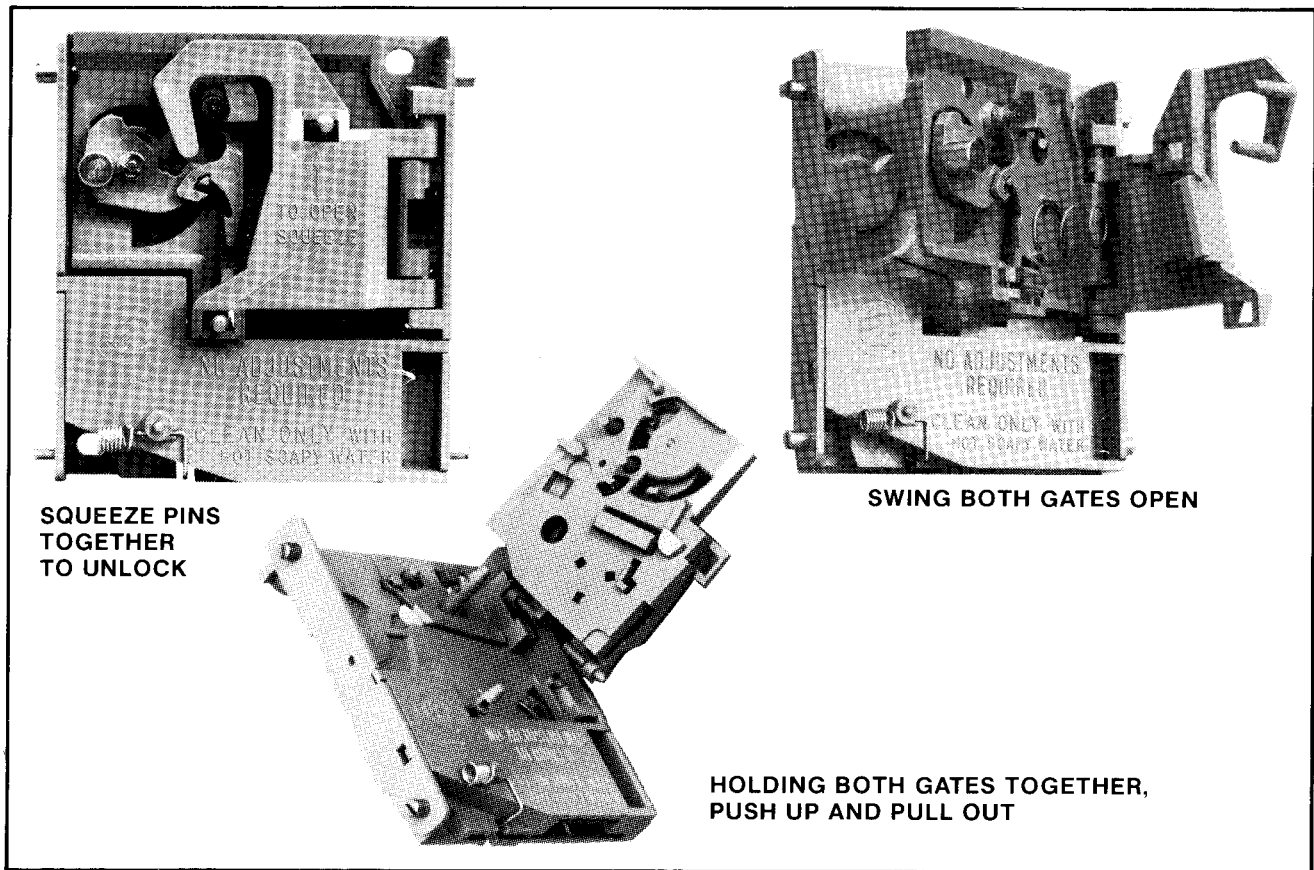


Figure 7-4 Opening the plastic coin acceptor

PLASTIC COIN ACCEPTOR MECHANISMS

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

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

Reassemble the mechanism (it never needs lubrication).

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

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

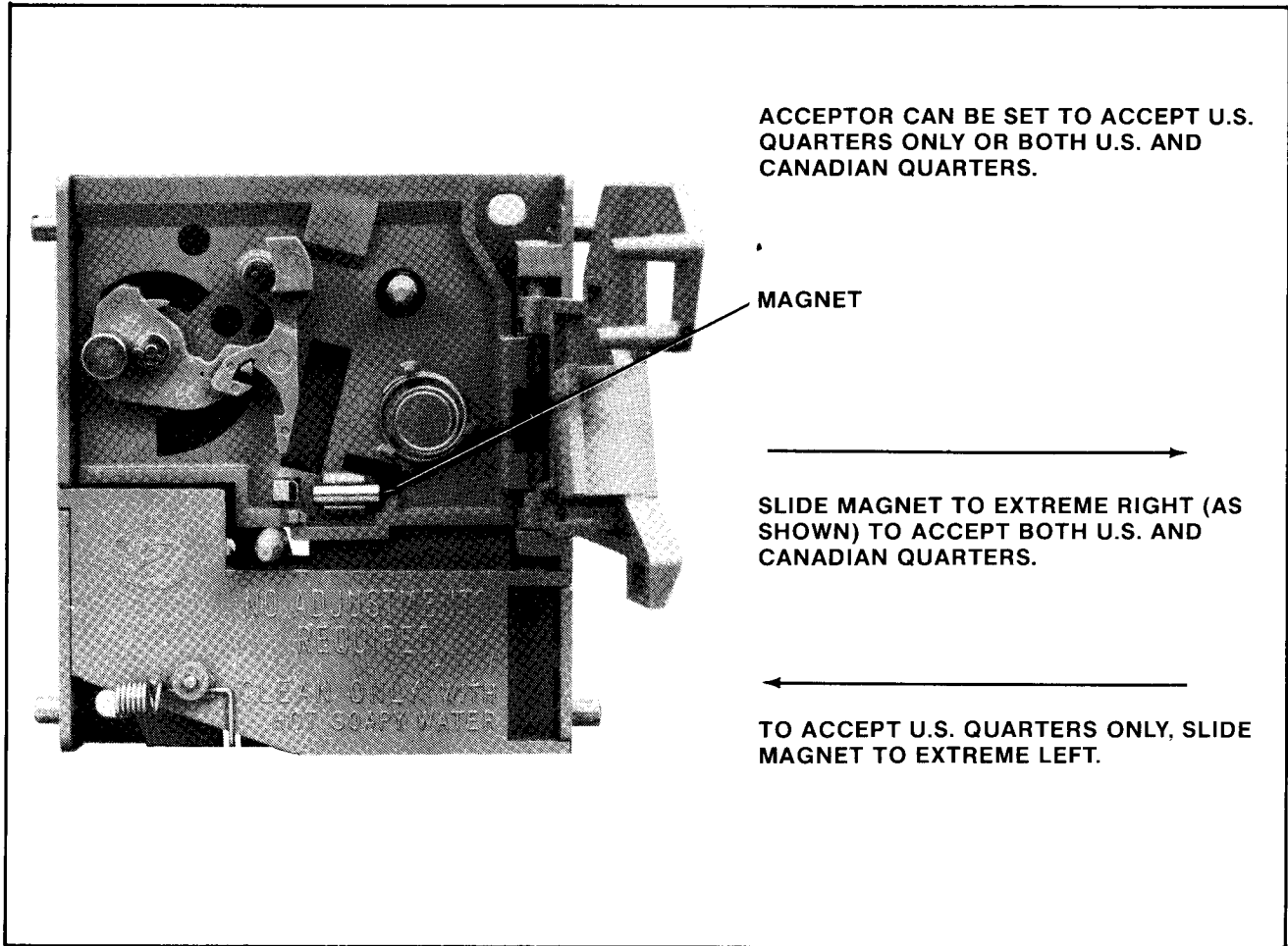


Figure 7-5 Changing the plastic coin acceptor to accept American or Canadian quarters.

PLEASE NOTE:

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

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

OUR STAFF AND OUR DISTRIBUTORS STAND READY TO HELP YOU!

THANK YOU

VIII T.V. Monitor Manual

Color T.V. Monitor

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

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

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

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

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

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

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

Symptom Diagnosis

1. Insufficient width or height:

- A. Horizontal line (due to VERTICAL CIRCUIT DEFECT).
 - Bad yoke.
 - Bad vertical output section.
 - Open fusible resistor in vertical section.
 - Bad height control.
 - Bad flyback.
- B. Vertical line (due to HORIZONTAL CIRCUIT DEFECT).
 - Bad yoke.
 - Open width coil.
 - Open part in horizontal output section.

2. Picture spread out too far or crushed in certain areas:

- A. Horizontal or vertical output transistor.
- B. Bad component in output circuitry.

3. Line too close with black spacing:

- A. Problem in vertical section causing poor linearity.

4. Poor focus and convergence:

- A. Bad high voltage transformer ("flyback") or control.
- B. Focus voltage wire not connected to neck-board terminal.

5. Colors missing; check:

- A. Interface color transistors.
- B. Color output transistors.
- C. Cracked printed circuit board.
- D. Color circuits.
- E. Video input jack.

6. Picture not bright enough:

- A. Weak emission from picture tube. (Turn horizontal sync off frequency and put brightness all the way up for about 15 minutes. Occasionally this cures the problem.)

7. Silvery effect in white areas; check:

- A. Beam current transistors.
- B. Weak picture tube emission.

8. Too much brightness with retrace lines; check:

- A. Beam limiter transistors.
- B. Brightness and/or color blanking control set too high.

9. Increasing brightness causes an increase in size and poor focus.

- A. Weak high voltage rectifier or regulation (high voltage unit).

10. Small picture and/or poor focus:

- A. Low B+ voltage (power supply trouble).

11. Vertical rolling:

- A. Vertical oscillator transistor, IC, or circuit.
- B. No sync from logic board.

12. Horizontal line across center:

- A. Vertical output circuit is dead (see symptom No. 1. A.).
- B. Vertical oscillator is not putting out the right wave form.

13. Picture bends:

- A. Horizontal sync needs adjusting.
- B. Magnetic or electromagnetic interference.

14. Flashing picture, visible retrace lines:

- A. Broken neck board.
- B. Internal short circuit in the picture tube (arcing).

15. Unsymmetrical picture or sides of picture:

- A. Defective yoke.

16. No brightness, power supply operating — No high voltage for the picture tube; check:

- A. Horizontal oscillator.
- B. Horizontal amplifier and output.
- C. Flyback transformer (high voltage unit).

17. No brightness, high voltage present; check:

- A. Heater voltage to the tube at the neck board.
- B. Screen-grid voltage for the tube.
- C. Focus voltage.
- D. Grid to cathode picture tube bias.

18. No high voltage; check:

- A. For AC input to the "flyback".
- B. Horizontal deflection stages.
- C. Flyback transformer.
- D. Yoke.
- E. Power supply.

19. No horizontal and vertical hold; check:

- A. Sync transistors and circuit.
- B. Wires and jack from logic board to the monitor.

20. Wavy picture — (power supply defect); check:

- A. Transistors, diodes, electrolytic capacitors in the power supply.

21. Moving bars in picture:

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

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

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

23. Monitor won't turn on:

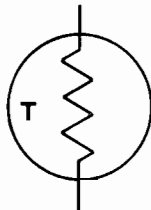
- A. Problem in the power supply: Check fuse, transistors, open fusible resistor.
- B. Shorted horizontal output transistor.

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

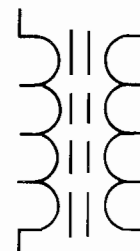
24. Can't adjust purity or convergence:

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

Guide To Schematic Symbols



THERMISTOR
(POLARITY DOESN'T MATTER)



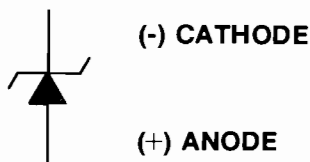
IRON CORE TRANSFORMER
(SUCH AS A FLYBACK)



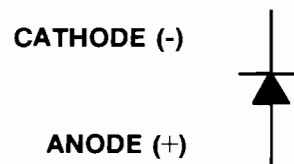
INDUCTOR, COIL, CHOKE
(POLARITY DOESN'T MATTER)



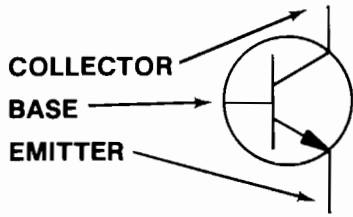
FUSE
(POLARITY DOESN'T MATTER)



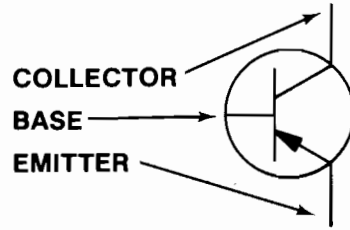
ZENER DIODE



DIODE



NPN TRANSISTOR



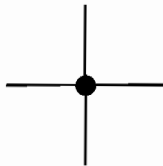
PNP TRANSISTOR



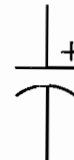
VARIABLE RESISTOR, POT, CONTROL
(POLARITY DOESN'T MATTER)



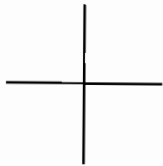
RESISTOR
(POLARITY DOESN'T MATTER)



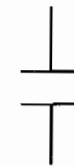
LINES ARE CONNECTED



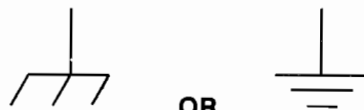
ELECTROLYTIC CAPACITOR



LINES ARE NOT CONNECTED



CAPACITOR
(POLARITY DOESN'T MATTER)



OR
GROUND

Troubleshooting

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

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

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

WARNING: That picture tube is a bomb!

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

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

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

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

CAUTION:

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

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

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

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

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

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

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

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

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

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

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

Theory of Operation

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

THE POWER SUPPLY —

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

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

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

THE INTERFACE SECTION OF THE CHASSIS —

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

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

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

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

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

VERTICAL AND HORIZONTAL DEFLECTION—

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

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

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

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

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

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

THE FLYBACK TRANSFORMER (OR HIGH VOLTAGE UNIT) —

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

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

COLOR CIRCUITS —

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

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

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

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

PROTECTION CIRCUIT —

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

Wells Gardner = 130VDC
Electrohome = 120VDC

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

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

THE PICTURE TUBE (OR CRT) —

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

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

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

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

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

Differences Between Monitors

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

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

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

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

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

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

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

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

K4906 **WITHOUT** the Damper Control: 202111201

K4906 **WITH** the Damper Control: 202111258

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

Picture distortion.

Excessive brightness.

Too much or too little vertical picture size.

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

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

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

CONTROLS YOU MAY NOT TOUCH

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

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

Parts Interchangeability

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

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

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

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

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

19" COLOR MONITOR SCHEMATIC DIAGRAM

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

Power Supply Voltage and Symbols

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



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

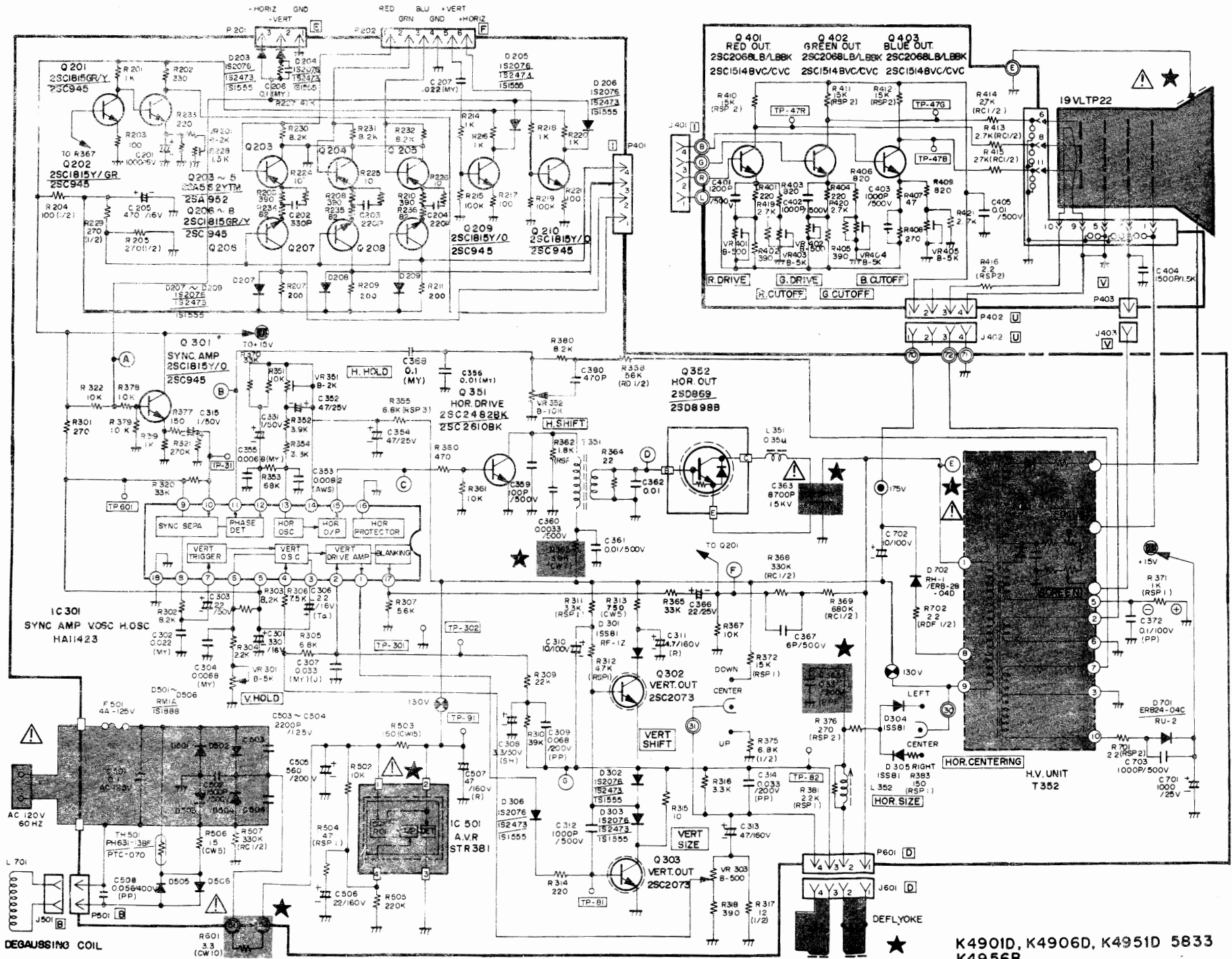
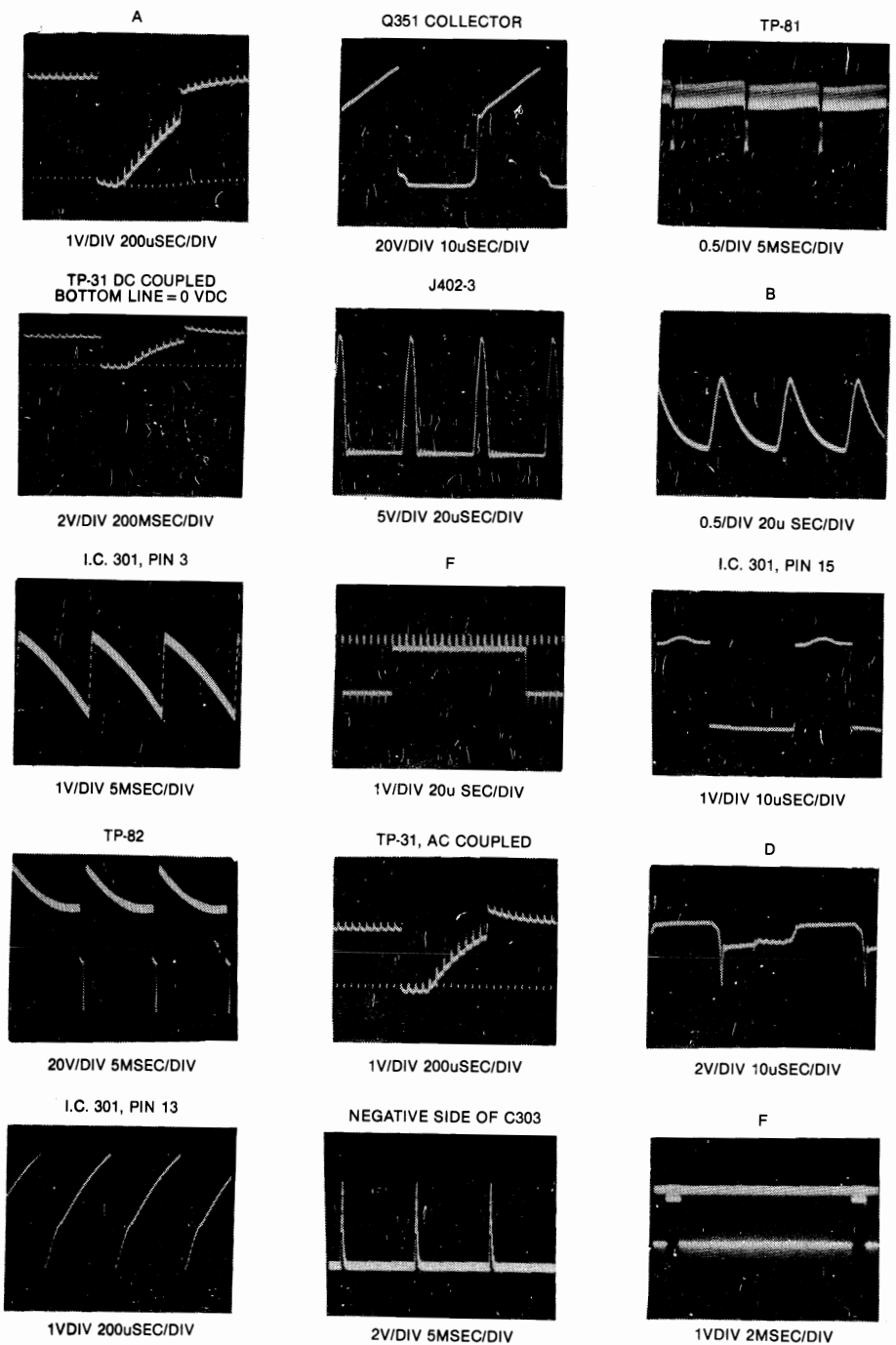


CAUTION: FOR CONTINUED SAFETY, REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER'S RECOMMENDED PARTS.
AVERTISSEMENT: POUR MAINTENIR LE DEGRE DE SECURITE DE L'APPAREIL NE REMPLACER LES COMPOSANTS DONT LE FONCTIONNEMENT EST CRITIQUE POUR LA SECURITE QUE PAR DES PIECES RECOMMANDEES PAR LE FABRICANT.

OSCILLOSCOPE WAVEFORM PATTERN

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

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



K4901D, K4906D, K4951D 5833
K4956B

REPLACEMENT PARTS LIST

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

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

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

MAIN BOARD

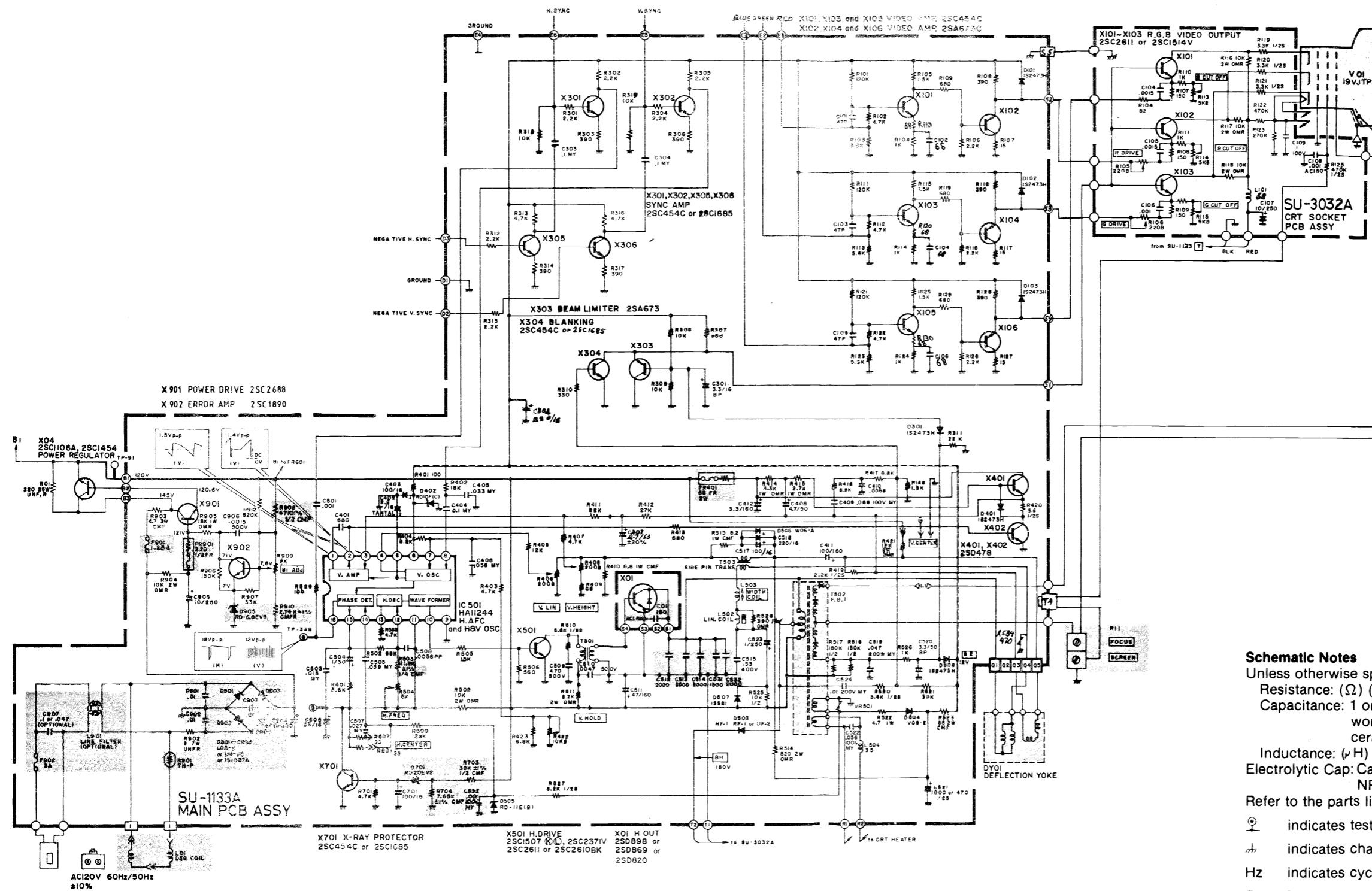
Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
RESISTORS			RESISTORS (CONT.)		
R201	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R369	203X5602-329	680K Ohm, 5%, 1/2W Comp.
R202	203X6500-523	30 Ohm, 5%, 1/4W Carbon	R370	203X6501-002	33K Ohm, 5%, 1/4W Carbon
R203	203X6500-405	100 Ohm, 5%, 1/4W Carbon	R371	203X9014-584	1K Ohm, 5%, 1W Metal Oxide
R204	203X6700-327	100 Ohm, 5%, 1/2W Carbon	R372	203X9101-119	12K Ohm, 5%, 1W Metal Oxide
R205	203X6700-421	270 Ohm, 5%, 1/2W Carbon	R375	203X6700-763	6.8K Ohm, 5%, 1/2W Carbon
R206	203X6500-540	390 Ohm, 5%, 1/4W Carbon	R376	203X9104-404	270 Ohm, 5%, 2W Metal Oxide
R207	340X2201-934	200 Ohm, 5%, 1/4W Carbon	R377	203X6500-447	150 Ohm, 5%, 1/4W Carbon
R208	203X6500-540	390 Ohm, 5%, 1/4W Carbon	R378	203X6500-806	10K Ohm, 5%, 1/4W Carbon
R209	340X2201-934	200 Ohm, 5%, 1/4W Carbon	R379	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R210	203X6500-540	390 Ohm, 5%, 1/4W Carbon	R380	203X6500-865	8.2K Ohm, 5%, 1/4W Carbon
R211	340X2201-934	200 Ohm, 5%, 1/4W Carbon	R381	203X6500-724	2.2K Ohm, 5%, 1W Metal Oxide
R214	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R383	203X9014-387	150 Ohm, 5%, 1W Metal Oxide
R215	203X6501-126	100K Ohm, 5%, 1/4W Carbon	R502	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R216	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R503	204X1700-535	150 Ohm, 5%, 15W Metal Oxide
R217	203X6500-405	100 Ohm, 5%, 1/4W Carbon	R504	203X9014-267	47 Ohm, 5%, 1W Metal Oxide
R218	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R505	203X6501-209	2.2K Ohm, 5%, 1/4W Carbon
R219	203X6501-126	100K Ohm, 5%, 1/4W Carbon	R506	203X9104-105	15 Ohm, 5%, 2W Metal Oxide
R220	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R507	203X5602-185	330K Ohm, 5%, 1/2W Comp.
R221	203X6500-405	100 Ohm, 5%, 1/4W Carbon	Δ \star R601	204X1625-058	3.3 Ohm, 5%, 10W WW
R222	203X6500-762	3.3 Ohm, 5%, 1/4W Carbon	R701	203X9105-141	2.2 Ohm, 5%, 2W Metal Oxide
R224	203X6500-169	10 Ohm, 5%, 1/4W Carbon	R702	203X6206-441	2.2 Ohm, 5%, 1/2W Carbon
R225	203X6500-169	10 Ohm, 5%, 1/4W Carbon	VR201	204X2070-072	2K Ohm-B Semi-Fixed
R226	203X6500-169	10 Ohm, 5%, 1/4W Carbon	VR301	204X2070-084	5K Ohm-B Semi-Fixed
R227	203X6501-044	47K Ohm, 5%, 1/4W Carbon	VR303	204X2070-055	500 Ohm-B Semi-Fixed
R228	203X6500-645	1K Ohm, 5%, 1/4W Carbon	VR351	204X2070-072	2K Ohm-B Semi-Fixed
R229	203X6700-421	270 Ohm, 5%, 1/2W Carbon	VR352	204X2070-072	2K Ohm-B Semi-Fixed
R230	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.			
R231	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.			
R232	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.			
R233	203X6500-468	180 Ohm, 5%, 1/4W Carbon			
R234	340X2820-934	82 Ohm, 5%, 1/4W Carbon			
R235	340X2820-934	82 Ohm, 5%, 1/4W Carbon			
R236	340X2820-934	82 Ohm, 5%, 1/4W Carbon			
R301	203X6500-508	270 Ohm, 5%, 1/4W Carbon			
R302	203X6500-863	8.2K Ohm, 5%, 1/4W Carbon			
R303	203X6500-863	8.2K Ohm, 5%, 1/4W Carbon			
R304	203X6500-724	2.2K Ohm, 5%, 1/4W Carbon			
R305	203X6500-842	6.8K Ohm, 5%, 1/4W Carbon			
R306	203X6003-201	7.5K Ohm, 2%, 1/4W Carbon			
R307	203X6500-825	5.6K Ohm, 5%, 1/4W Carbon			
R309	203X6500-965	22K Ohm, 5%, 1/4W Carbon			
R310	203X6500-988	39K Ohm, 5%, 1/4W Carbon			
R311	203X6500-762	3.3K Ohm, 5%, 1/4W Carbon			
R312	203X9014-741	4.7K Ohm, 5%, 1/4W Carbon			
R313	204X1450-537	1K Ohm, 5%, 5W Carbon			
R314	203X6500-481	220 Ohm, 5%, 1/4W Carbon			
R315	203X6500-169	10 Ohm, 5%, 1/4W Carbon			
R316	203X6500-762	3.3K Ohm, 5%, 1/4W Carbon			
R317	203X6700-107	12 Ohm, 5%, 1/2W Carbon			
R318	203X6500-540	390 Ohm, 5%, 1/4W Carbon			
R319	203X6500-645	1K Ohm, 5%, 1/4W Carbon			
R320	203X6501-002	33K Ohm, 5%, 1/4W Carbon			
R321	203X6501-224	270K Ohm, 5%, 1/2W Carbon			
R322	203X6500-886	10K Ohm, 5%, 1/4W Carbon			
R351	203X6500-886	10K Ohm, 5%, 1/4W Carbon			
R352	203X6500-785	3.9K Ohm, 5%, 1/4W Carbon			
R353	203X6501-086	68K Ohm, 5%, 1/4W Carbon			
R354	203X6500-762	3.3K Ohm, 5%, 1/4W Carbon			
R355	203X9205-143	6.8K Ohm, 5%, 3W Metal Oxide			
R358	203X5601-878	56K Ohm, 5%, 1/2W Carbon			
R360	203X6500-561	470 Ohm, 5%, 1/4W Carbon			
R361	203X6500-886	10K Ohm, 5%, 1/4W Carbon			
R362	203X9014-645	1.8K Ohm, 5%, 1W Metal Oxide			
\star R363	204X1527-751	3.9K Ohm, 5%, 7W Metal Oxide	Δ \star C363	203X1270-911	8700 pF, 1.5 KV PP
R364	203X6500-246	22 Ohm, 5%, 1/4W Carbon	\star C365	203X1201-265	0.33 uF, 200V PP
R365	203X6501-002	33K Ohm, 5%, 1/4W Carbon	C366	203X0019-026	22 uF, 25V Electrolytic
R367	203X6500-886	10K Ohm, 5%, 1/4W Carbon	C367	202X8065-162	6 pF, 500V Ceramic
R368	203X5602-185	330K Ohm, 5%, 1/2W Comp.	C368	202X7203-032	0.01 uF, 50V Ceramic
			C372	203X1207-125	0.1 uF, 100V PP

MAIN BOARD (CONT.)

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
CAPACITORS (CONT.)					
C350	202X7200-087	470 uF, 500V Ceramic	Q206	200X3181-523	Transistor (NPN) 2SC1815GR
△ C501	203X1810-149	0.1 uF, 125V Mylar	Q207	200X3181-523	Transistor (NPN) 2SC1815GR
△ C502	202X7050-282	1500 pF, 500V Ceramic	Q208	200X3181-523	Transistor (NPN) 2SC1815GR
△ C503	202X7810-214	2200 pF, 125V Ceramic	Q209	200X3181-523	Transistor (NPN) 2SC1815GR
△ C504	202X7810-214	2200 pF, 125V Ceramic	Q210	200X3181-523	Transistor (NPN) 2SC1815GR
C505	203X0220-075	560 uF, 200V Electrolytic	Q301	200X3181-523	Transistor (NPN) 2SC1815GR
C506	203X0040-034	22 uF, 160V Electrolytic	Q302	200X3207-306	Transistor (NPN) 2SC2073LBGL2
C507	203X0041-057	47 uF, 160V Electrolytic	Q303	200X3207-306	Transistor (NPN) 2SC2073LBGL2
C701	203X0019-092	1000 uF, 25V Electrolytic	Q351	200X3248-217	Transistor (NPN) 2SC2482BK
C702	203X0634-061	10 uF, 100V Electrolytic	Q352	200X4589-802	Transistor (NPN) 2SD898B
C703	202X7050-248	1000 pF, 500V Ceramic	IC301	200X2300-033	IC HA11423
SEMICONDUCTORS					
D203	201X2010-159	Diode, IS2076-27	△ ★ IC501	200X2600-183	IC STR381
D204	201X2010-159	Diode, IS2076-27			
D205	201X2010-159	Diode, IS2076-27	L351	201X4710-134	Coil, (RF Choke)
D206	201X2010-159	Diode, IS2076-27	L352	201X5000-083	Coil, Horiz. Size
D207	201X2010-159	Diode, IS2076-27	L701	611X0004-007	Coil, Adg.
D208	201X2010-159	Diode, IS2076-27	T351	202X1300-080	Transformer, Hor. Drive
D209	201X2010-159	Diode, IS2076-27	△ ★ T352	200X9720-301	HV-Unit M-11
D301	201X2010-165	Diode, ISS81			
D302	201X2010-159	Diode, IS2076-27			
D303	201X2010-159	Diode, IS2076-27	△ F501	204X7120-073	Fuse, 4 Amp. 125V
D304	201X2120-009	Diode, RH-IV	J402	206X5008-632	Recep W Wire 3P-M-BG
D305	201X2120-009	Diode, RH-IV	P201	204X9600-466	Plug, PWB 3P-J
D306	201X2010-159	Diode, IS2076-27	P202	204X9601-477	Plug, PWB 6P-Q
△ D501	201X3120-216	Diode, RM-1AV	P401	204X9600-298	Plug, PWB 4P-B
△ D502	201X3120-216	Diode, RM-1AV	P501	204X9600-249	Plug, PWB 2P-B
△ D503	201X3120-216	Diode, RM-1AV	P601	204X9600-304	Plug, PWB 4P-C
△ D504	201X3120-216	Diode, RM-1AV	TH501	201X0100-112	Thermistor
D505	201X3120-216	Diode, RM-1AV			
D506	201X3120-216	Diode, RM-1AV			
D701	201X2130-234	Diode, RU-2V			
D702	201X2120-009	Diode, RH-1V			
Q201	200X3181-523	Transistor (NPN) 2SC1815GR			
Q202	200X3181-523	Transistor (NPN) 2SC1815GR			
Q203	200X4056-260	Transistor (PNP) 2SA562-Y-TM			
Q204	200X4056-260	Transistor (PNP) 2SA562-Y-TM			
Q205	200X4056-260	Transistor (PNP) 2SA562-Y-TM			
SEMICONDUCTORS (CONT.)					
TRANSFORMERS & COILS					
MISCELLANEOUS					
FINAL ASSEMBLY PARTS					

NECK BOARD

RESISTORS			CAPACITORS		
R401	203X6000-729	220 Ohm, 5% 1/4W Carbon	C401	202X7050-269	1200 pF, 500V Ceramic
R402	203X6500-540	390 Ohm, 5% 1/4W Carbon	C402	202X7050-248	1000 pF, 500V Ceramic
R403	203X6000-661	820 Ohm, 5% 1/4W Carbon	C403	202X7050-248	1000 pF, 500V Ceramic
R404	203X6000-729	220 Ohm, 5% 1/4W Carbon	C404	202X7050-282	1500 pF, 1.5KV Ceramic
R405	203X6500-540	390 Ohm, 5% 1/4W Carbon	C405	202X7050-483	0.01 uF, 500V Ceramic
R406	203X6000-661	820 Ohm, 5% 1/4W Carbon			
R407	203X6000-729	470 Ohm, 5% 1/4W Carbon			
R408	203X6000-998	270 Ohm, 5% 1/4W Carbon			
R409	203X6000-661	820 Ohm, 5% 1/4W Carbon			
R410	203X9104-824	15K Ohm, 5% 2W M.O. Forming	Q401	200X3206-800	Transistor (NPN) 2SC2068LB
R411	203X9104-824	15K Ohm, 5% 2W M.O. Forming	Q402	200X3206-800	Transistor (NPN) 2SC2068LB
R412	203X9104-824	15K Ohm, 5% 2W M.O. Forming	Q403	200X3206-800	Transistor (NPN) 2SC2068LB
R413	203X6000-998	2.7K Ohm, 5% 1/2W Comp.			
R414	203X6000-998	2.7K Ohm, 5% 1/2W Comp.			
R415	203X6000-998	2.7K Ohm, 5% 1/2W Comp.			
R416	203X9105-154	2.2 Ohm, 5% 2W Metal Oxide	J401	206X5009-296	RECEP W Wire 4P-E
R419	203X6500-741	2.7K Ohm, 5% 1/4W Carbon	P402	204X9600-254	Plug, PWB 3P-A
R420	203X6500-741	2.7K Ohm, 5% 1/4W Carbon	P403	204X9600-981	Plug, Pin 1P-D
R421	203X6500-741	2.7K Ohm, 5% 1/4W Carbon	P701	204X9601-020	Plug, PWB 4P-E
VR401	204X2115-014	500 Ohm, -B Semi-Fixed			
VR402	204X2115-014	500 Ohm, -B Semi-Fixed			
VR403	204X2115-006	5K Ohm, -B Semi-Fixed			
VR404	204X2115-006	5K Ohm, -B Semi-Fixed			
△ VR405	204X2115-006	5K Ohm, -B Semi-Fixed			



Schematic Notes

- Unless otherwise specified
- Resistance: (Ω) (K→KΩ, M→MΩ), 1/4 (W) carbon resistor
- Capacitance: 1 or higher → (pF), less than 1 → (μF) working voltage → 50 (V) ceramic capacitor
- Inductance: (μH)
- Electrolytic Cap: Capacitance Value (μF)/working voltage (V), NP → non-polar (or bipolar) electrolytic cap.
- Refer to the parts list for additional component information.
- ⊙ indicates test point connection
- ⊕ indicates chassis ground unless otherwise specified
- Hz indicates cycles per second
- For **safety** purposes (and continuing reliability)
 - ⚠ replace all components marked with safety symbol with identical type.
- NOTE: FR → fusible resistor

00-4147-04
G07-CB0

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

REPLACEMENT PARTS LIST - ELECTROHOME 19" MONITOR

Components identified by the Δ 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 #8-3/8	31-610818-06
SC	Screw 1/4 x 3/4 Pix Tube Mtg. (4)	31-601418-12
WA	Pyramidal Lock Washer (4)	33-255-01
	Nut Retainer, Pix Tube Mtg. (4)	33-494-01
	Clip — P.C.B. Support	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
D911, D912	Degaussing Coil	21-1007-30
	Rectifier 1 Amp 600V (2)	28-22-27
	Pin Terminal (2)	34-708-01
	Pin Terminal Housing	34-709-01
	Purity Shield (2 pcs.)	35-3847-01
	Purity Shield (2 pcs.)	35-3847-02
C911	Capacitor 100nF 10% 400V	48-171544-62
R921	Resistor, Wirewound 33Ω, 4W	42-113301-03
	Fire Retardant 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 3.3KΩ1/2W K	QRZ0039-332
R3120	Comp. R 3.3KΩ1/2W K	QRZ0039-332
C3121	Comp. R 3.3KΩ1/2W 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	QVZ3230-007
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-2741
△FR1901	△F R 220Ω½W K	QRH124K-221M

Capacitors

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

Coils

Symbol
L1502
L1503
L1504

Description
Linearity Coil
Width Coil
Heater Choke

Part Number
A39835
C30380-A
C30445-A

Transformers

Symbol
T1501
T1503

Description
Hor. Drive Transf.
Side Pin Transf.

Part Number
A46022-BM
C39050-A

Semiconductors

Symbol
IC1501

Description
IC

Part Number
HA11244

X1101
X1102
X1103
X1104
X1105
X1106
X1301
X1302
X1303
X1304
X1305
X1401
X1402
X1501
X1901
X1902

Si. Transistor
Si. Transistor
Si. Transistor
Si. Transistor
Si. Transistor
Si. Transistor
Si. Transistor
Si. Transistor
Si. Transistor
Si. Transistor
Si. Transistor
Si. Transistor
Si. Transistor
Si. Transistor
Si. Transistor
Si. Transistor
Si. Transistor

2SC1685(R)
2SA673(C)
2SC1685(R)
2SA673(C)
2SC1685(R)
2SA673(C)
2SC1685(R)
2SC1685(R)
2SA673(C)
2SC1685(R)
2SC1685(R)
2SD478
2SD478
2SC2610BK
2SC2688 (K.L.M.)
2SC1890A (E.F.)

D1101
D1102
D1103
D1301
D1401
D1402

Si. Diode
Si. Diode
Si. Diode
Si. Diode
Si. Diode
Zener Diode

W06A
W06A
W06A
1SZ473H
1SZ473H
RD10F(C)

D1503
D1504
D1505
D1506
D1507
D1508

Si. Diode
Si. Diode
Zener Diode
Si. Diode
Si. Diode
Si. Diode

HF-1
V09E
RD11E(B)
W06A
1SS81
1SZ473H

△D1701
△D1901
△D1902
△D1903
△D1904
△D1905

△Zener Diode
△Si. Diode
△Si. Diode
△Si. Diode
△Si. Diode
△Zener Diode

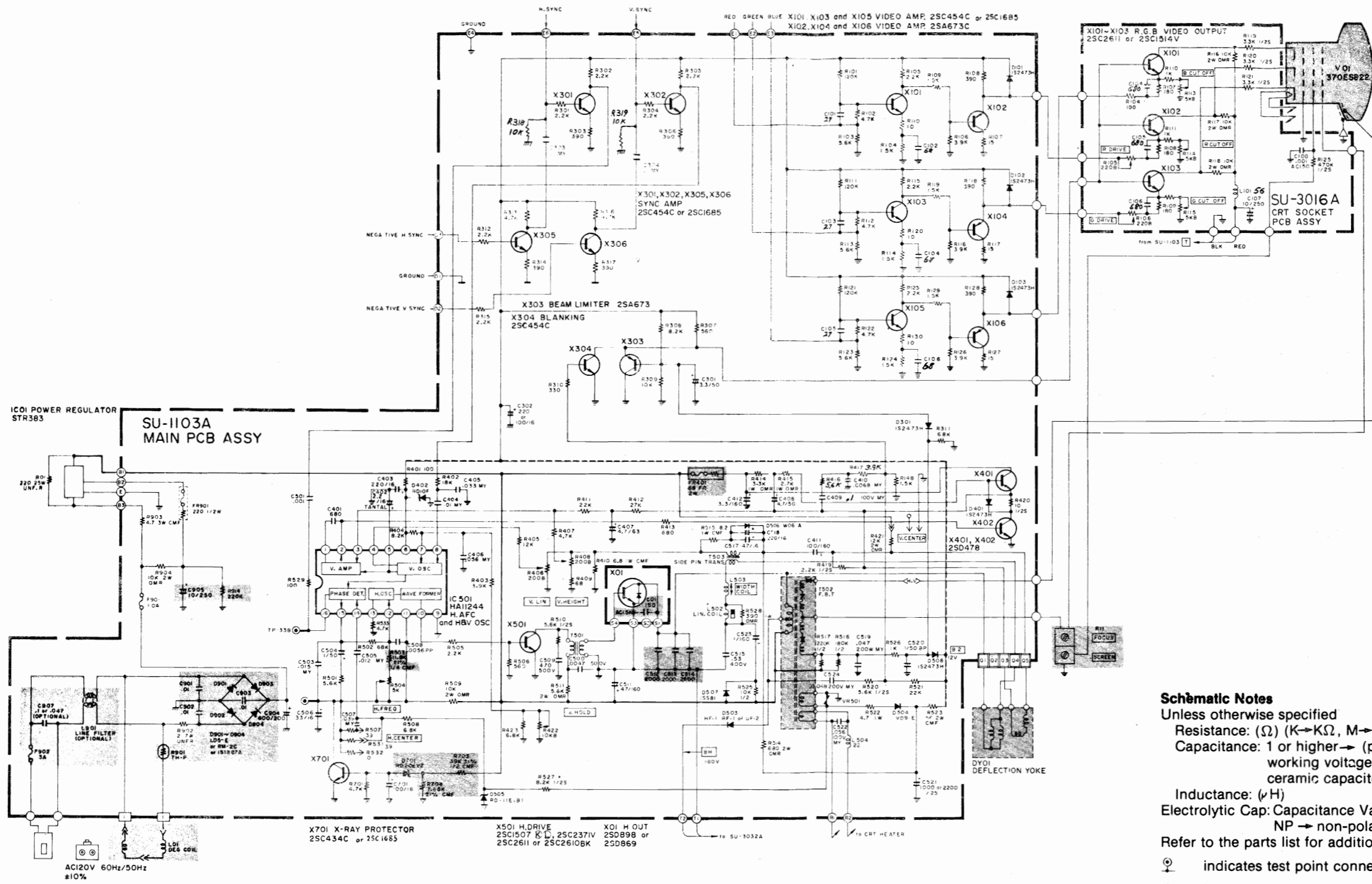
RD20EV2
1S1887A
1S1887A
1S1887A
1S1887A
RD6.8EV3

Miscellaneous

Symbol
△F1901
△F1902

Description
△Fuse 1.25A
△UL Fuse 3A

Part Number
QMF53U1-1R25S
QMF66U1-3R0S



Schematic Notes

- Unless otherwise specified
- Resistance: (Ω) (K→KΩ, M→MΩ), 1/4 (W) carbon resistor
- Capacitance: 1 or higher → (pF), less than 1 → (μF)
- working voltage → 50 (V)
- ceramic capacitor
- Inductance: (μH)
- Electrolytic Cap: Capacitance Value (μF)/working voltage (V),
- NP → non-polar (or bipolar) electrolytic cap.
- Refer to the parts list for additional component information.
- ⊕ indicates test point connection
- ⊔ indicates chassis ground unless otherwise specified
- Hz indicates cycles per second
- For **safety** purposes (and continuing reliability)
- ⚠ replace all components marked with safety symbol with identical type.
- NOTE: FR → fusible resistor (—/—)

G07-FBO
00-4147-03

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

REPLACEMENT PARTS LIST - ELECTROHOME 13" MONITOR

Components identified by the Δ 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.

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

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

Resistors

Symbol	Description	Part Number
R1406	V R 200 Ω	QVZ3230-022
R1408	V R 200 Ω	QVZ3230-022
R1410	CMF R 6.8 Ω 1W J	QRX019J-6R8
R1414	OM R 3.3K Ω 1W J	QRG019J-332
R1415	OM R 2.7K Ω 1W J	QRG019J-272
R1421	OM R 12K Ω 2W J	QRG029J-123
R1422	V R 10K Ω	QVZ3224-014H
Δ FR1401	Δ F R 68 Ω 2W K	QRH024K-680M
Δ R1503	Δ CMF R 11.8K Ω 1/4W +1%	QRV142F-1182
R1504	V R 5K Ω	QVZ3230-053
R1509	OM R 10K Ω 2W J	QRG029J-103
R1511	OM R 5.6K Ω 2W J	QRG029J-562
R1514	OM R 680 Ω 2W J	QRG029J-681
R1515	CMF R 8.2 Ω 1W J	QRX019J-8R2
R1522	CMF R 4.7 Ω 1W J	QRX019J-4R7
R1523	OM R 56 Ω 2W J	ORG029J-560
R1528	OM R 390 Ω 1W J	ORG019J-391
R1534	ZN R	ERZ-C05ZK471
VR1501	ZN R	ERZ-C05DK271
Δ R1703	Δ CMF R 39K Ω 1/2W +1%	QRV122F-3902
Δ R1704	Δ CMF R 7.68K Ω 1/4W +1%	QRV142F-7681
Δ R1901	Δ Posistor	A75414
R1902	UNF R 2 Ω 7W K	QRF076K-2R0
R1903	CMF R 5.6 Ω 3W J	QRX039J-5R6
R1904	OM R 10K Ω 2W J	QRG026J-103Z
Δ FR1901	Δ F R 220 Ω 1/2W 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
Δ C1512	Δ PP Cap. 2000pF DC1500V J	QFZ0082-202
Δ C1513	Δ PP Cap. 2000pF DC1500V J	QFZ0082-202
Δ C1514	Δ 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
Δ C1907	Δ MM Cap. 0.1uF AC150V Z	QFZ9008-104

Coils

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

Transformers

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

Semiconductors		
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		
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

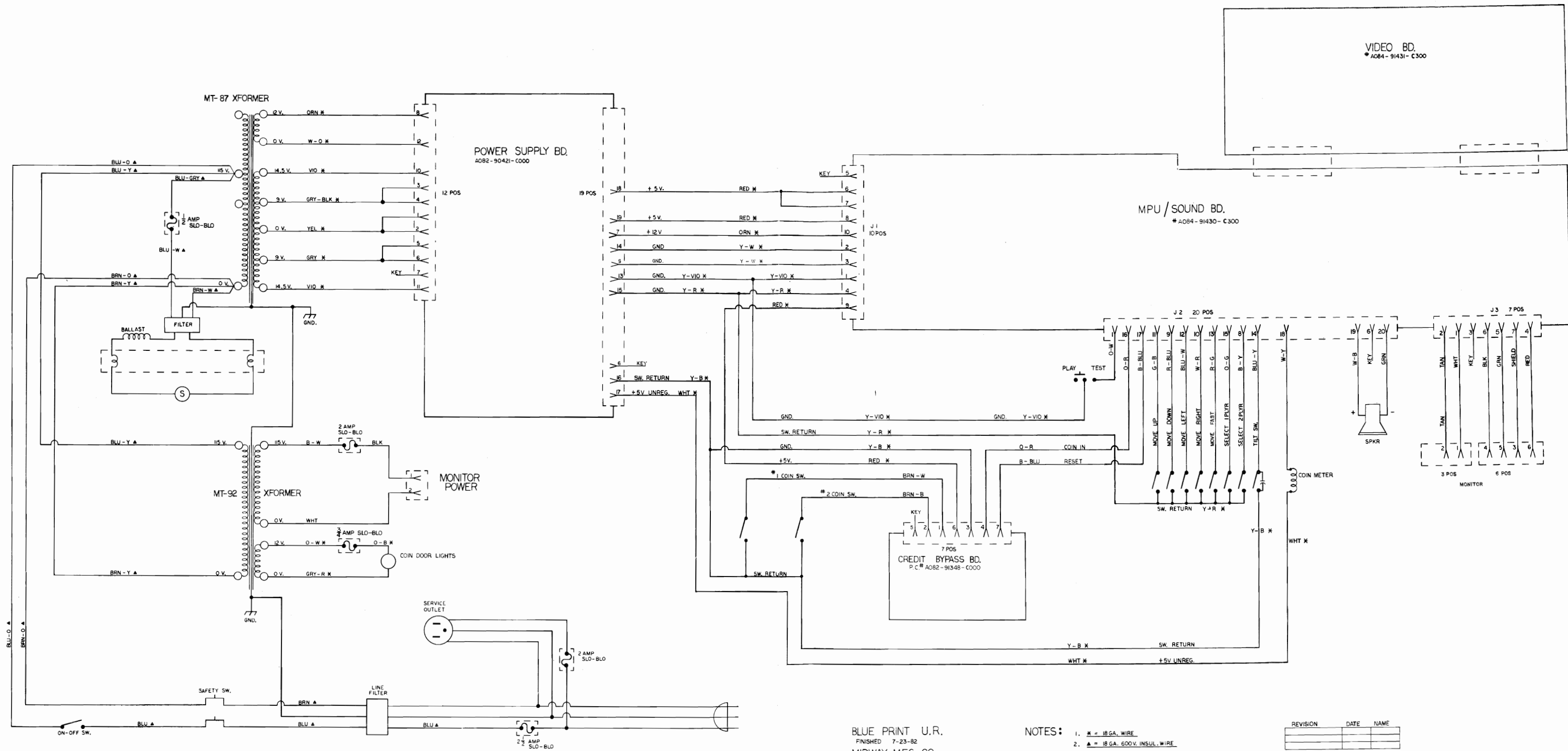
Semiconductors

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

Miscellaneous

Symbol	Description	Part Number
△	△ CRT Socket	A75522

IX Schematics and Wiring Diagrams

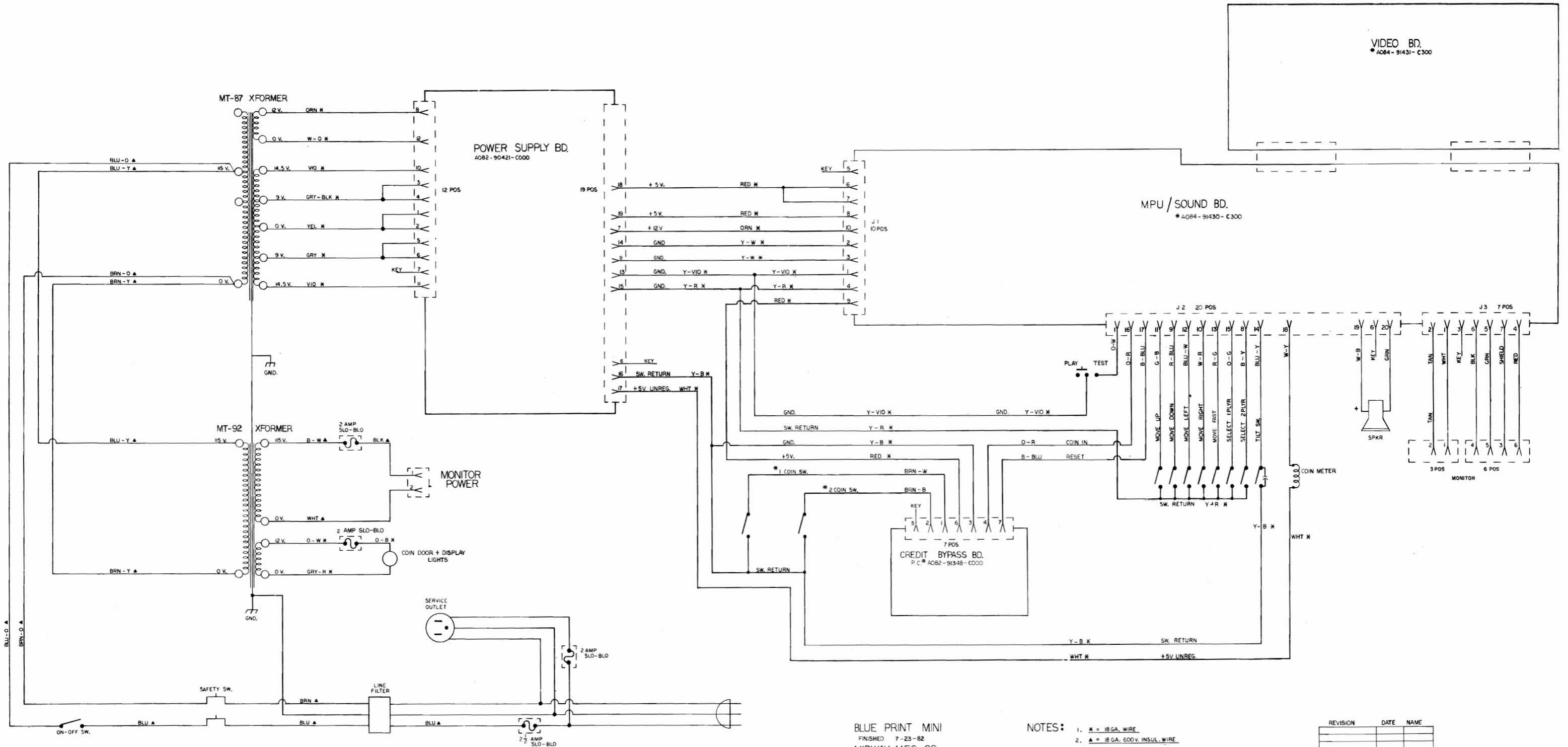


BLUE PRINT U.R.
 FINISHED 7-23-82
 MIDWAY MFG CO.
 10601 W. BELMONT AVE.
 FRANKLIN PARK, ILL. 60131

- NOTES:
1. * = 18 GA. WIRE
 2. ▲ = 18 GA. 600V. INSUL. WIRE
 3. G-Y GND. GOES TO ON-OFF SW. MONITOR, COIN-DOOR, CONTROL PANEL + SPKR.

REVISION	DATE	NAME

M051-00300 - A0C3

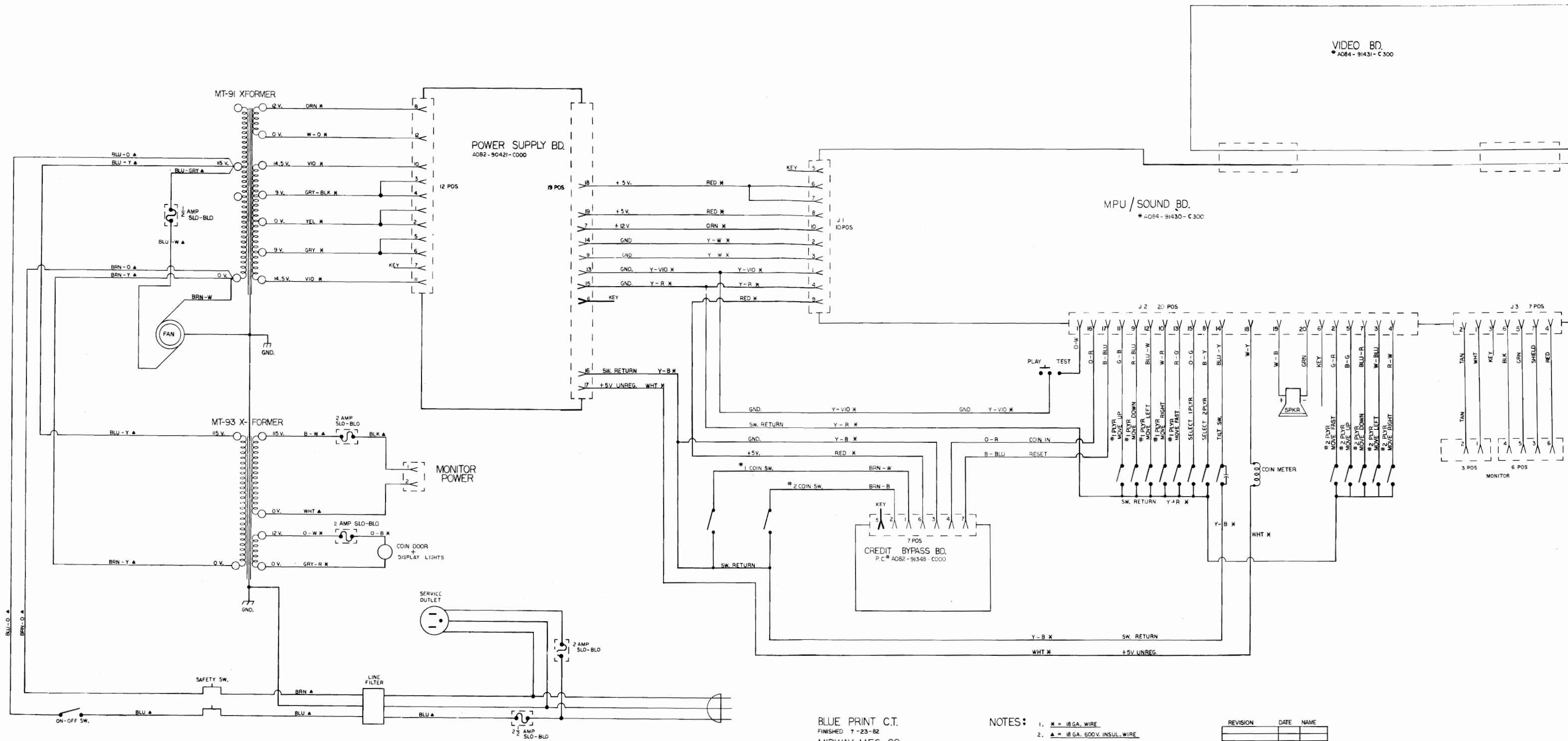


BLUE PRINT MINI
 FINISHED 7-23-82
 MIDWAY MFG CO.
 10601 W. BELMONT AVE.
 FRANKLIN PARK, ILL. 60131

- NOTES:
1. X = 18 GA. WIRE
 2. ▲ = 18 GA. 600V. INSUL. WIRE
 3. G-Y GND. GOES TO ON-OFF SW. MONITOR, COIN-DOOR, CONTROL PANEL & SPKR.

REVISION	DATE	NAME

† M051-00301-A003



BLUE PRINT C.T.
 FINISHED 7-23-82
 MIDWAY MFG CO.
 10601 W. BELMONT AVE.
 FRANKLIN PARK, ILL. 60131

- NOTES:
- * = 18 GA. WIRE
 - ▲ = 18 GA. 600V. INSUL. WIRE
 - G-Y GND. GOES TO ON-OFF SW. MONITOR, COIN-DOOR, CONTROL PANEL + SPKR.

REVISION	DATE	NAME

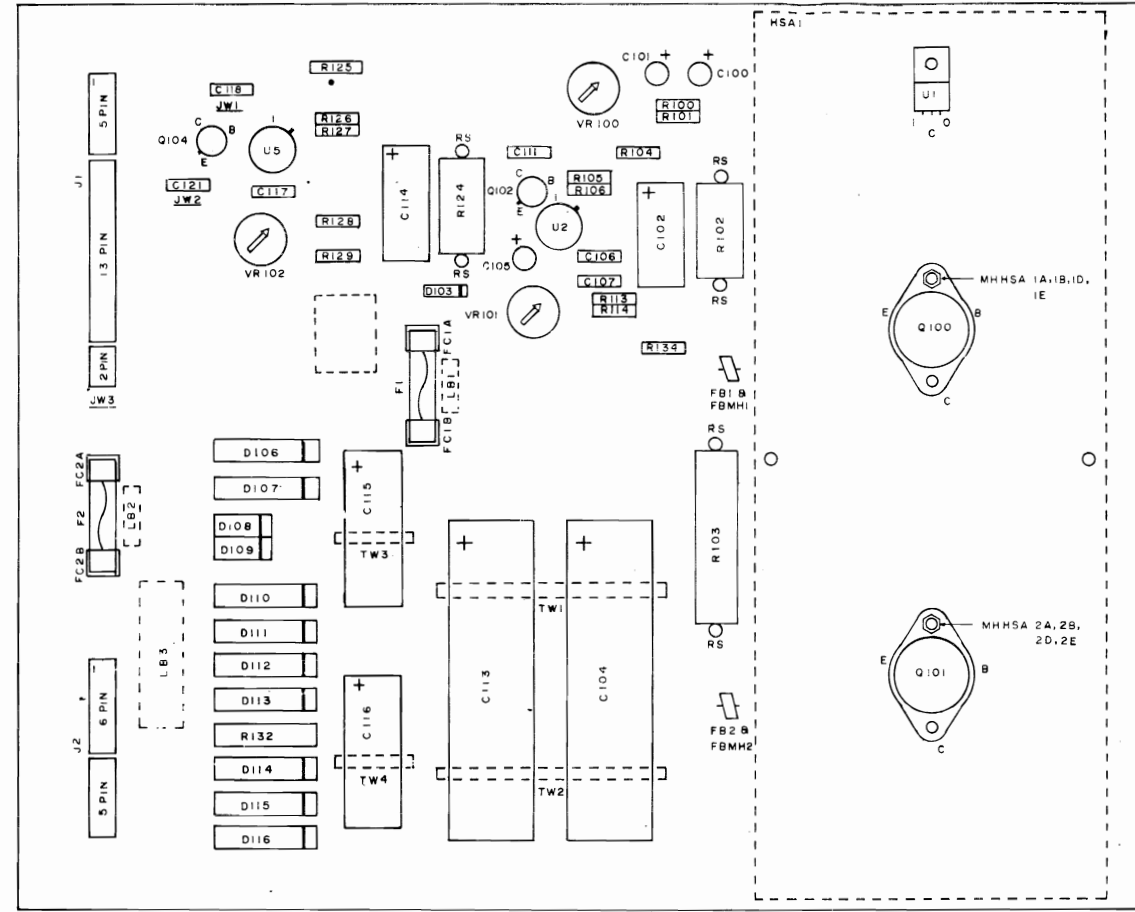
M051-00302-A003

DESIGNATION LIST

CROSS REFERENCE LIST

DESIGNATION DESCRIPTION DESIGNATION

C100	10mf RD TANT	R126
C101	0.47mf RD TANT 35V	R127
C102	470mf AX ELEC.	R128
		R129
C104	25,000mf AX ELEC.	R132
C105	4.7mf RD TANT 35V	R134
C106, C107	0.1mf	
		VR100, VR101, VR102
C111	0.1mf	
C113	40,000mf AX ELEC	
C114	470mf AX ELEC	
C115	2200mf AX ELEC 25V	
C116	4700mf AX ELEC 25V	
C117	47pf	
C118	0.1mf	
C121	0.1mf	
		D103
		D106, D107
		D108, D109
		D110, D111, D112, D113,
		D114, D115, D116
R100	100 OHM 1/4 W 5% CRB	Q102, Q104
R101	470 " " "	
R102	0.18 OHM 5W 5%	
R103	0.16 OHM 15W 5%	
R104	68 OHM 1/2W 5% CRB	
R105	24 OHM 1/4 W 5% CRB	
R106	270 " " "	
		U2
		U5
R113	1.2K OHM 1/4W 5% CRB	
R114	560 " " "	
		FBI, FB2
		FBMH1, FBMH2
R124	25 OHM 5W 10%	
R125	68 OHM 1/2W 5% CRB	



* NOTE: RS-RESISTOR SPACER

10 OHM 1/4 W 5% CRB	HSA1	HEATSINK ASSY.
1K " " "	MHSA	HEATSINK ASSY. MTG. HRW
6.2K " " "		2-4-40 X 10 SLT RND
1K " " "		4- WASHER, 4, 120-.250-018
		2-4-40 HEX NUT
		THERMAL COMPOUND

150 OHM 2W 10%		
68 OHM 1/2W 5%		

100 OHM POT		
-------------	--	--

	F1	FUSE, 1/4A. SLO-BLO
	F2	FUSE, 1AMP
	F1, F2	FUSE CLIP W/STOP

IN4001		
MR 750		
IN4001		
A15F 50V 5A		

	J1	2 POS KK-156
	J1, J2	5 POS " "
	J1	13 POS " "
	J2	6 POS " "

2N2905		
	JW1, JW2, JW3	JUMPER WIRE

LM305		
LM305		

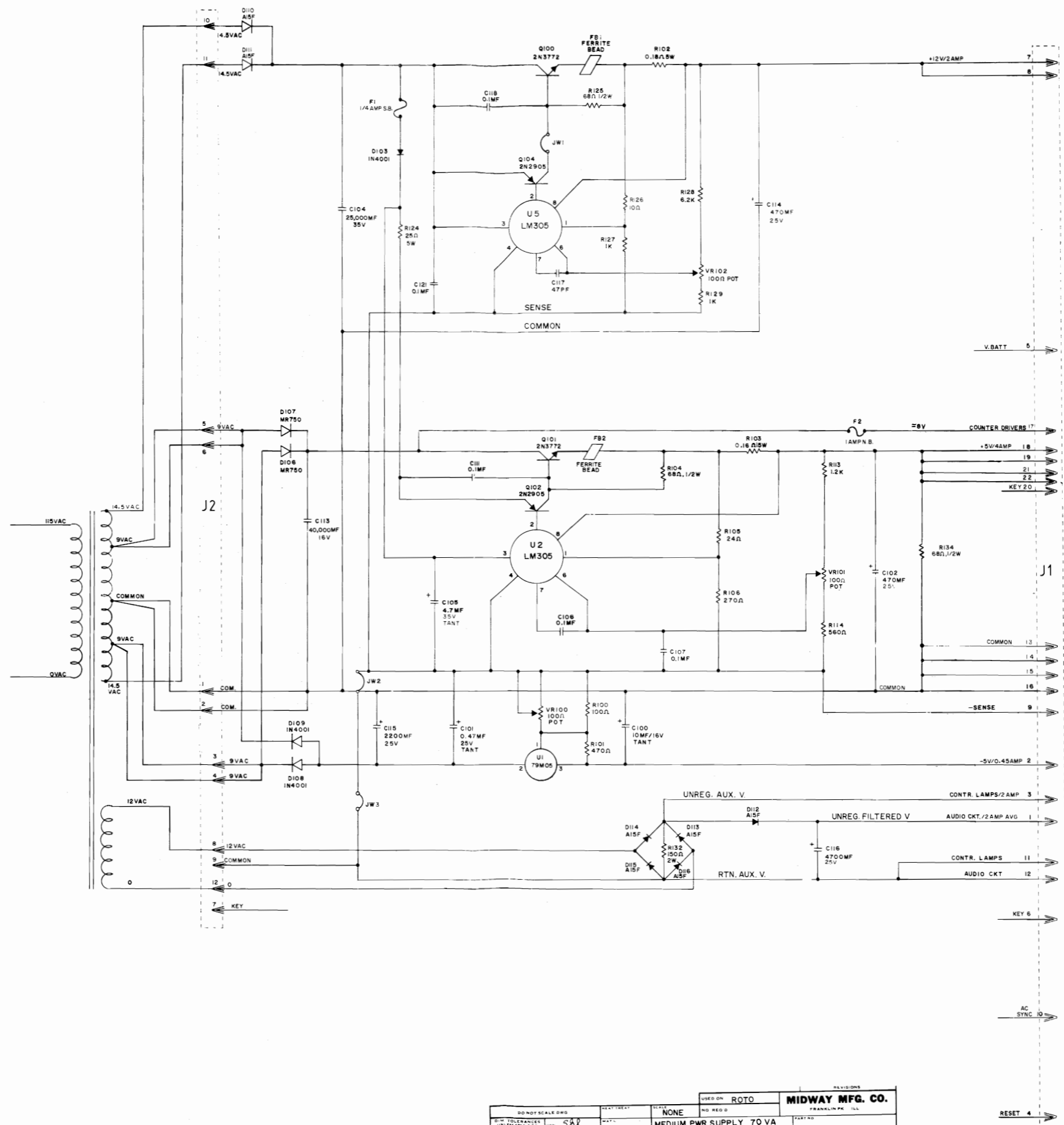
	TW1, TW2	TIE WRAP
	TW3, TW4	TIE WRAP

FERRITE BEAD	LB1	TAG, FUSE 1/4 A. SLO-BLO
FERRITE BEAD MTG HRW	LB2	TAG, FUSE 1AMP
2-20G SOLID WIRE	LB3	TAG, PWR. SPLY. I.D.

DESCRIPTION	QTY	DESIG. NOS.	PART NOS.
47 pf	1	C117	0945-00811-0100
0.1mf	5	C106, C107, C111, C118, C121	0945-00811-0200
0.47 pf RD TANT 35V	1	C101	0945-00816-1100
4.7 pf RD TANT 35V	1	C105	0945-00811-0400
10 pf RD TANT	1	C100	0945-00816-1000
470 pf AX. ELEC.	2	C102, C114	0945-00816-0600
2200 pf AX. ELEC. 25V	1	C115	0945-00816-1300
4700 pf AX. ELEC. 25V	1	C116	0945-00811-0700
25000 pf AX. ELEC.	1	C104	0945-00816-1700
40000 pf AX. ELEC.	1	C113	0945-00816-1800
.16 OHM 15W 5%	1	R103	0945-00815-0100
.18 " 5W 5%	1	R102	0945-00815-0200
10 " 1/4W 5% CRB	1	R126	0062-051B3-1XXX
24 " " "	1	R105	0062-065B3-1XXX
25 " 5W 10%	1	R124	0945-00815-1000
68 " 1/2 W 5%	3	R104, R125, R134	0062-09803-1XXX
100 " 1/4W 5% CRB	1	R100	0062-110B3-1XXX
150 " 2W 10%	1	R132	0945-00812-0200
270 " 1/4 W 5%	1	R106	0062-138B3-1XXX
470 OHM 1/4W 5%	1	R101	0062-156B3-1XXX
560 " " "	1	R114	0062-162B3-1XXX
1K " " "	2	R127, R129	0062-179B3-1XXX
1.2K " " "	1	R113	0062-183B3-1XXX
6.2 K OHM 1/4W 5%	1	R128	0062-217 B3-1XXX
100 OHM POT	3	VR100, VR101, VR102	0945-00814-0000
A15F 50V 5A DIODE	7	D110, D111, D112, D113, D114, D115, D116	0945-00804-0200
IN4001	3	D103, D108, D109	0945-00804-0300
MR 750	2	D106, D107	0945-00804-0800
2N2905	2	Q102, Q104	0945-00808-0300
LM 305	2	U2, U5	0945-00813-0100
FERRITE BEAD	2	FBI, FB2	0017-00009-0225
FERRITE MTG HARDWARE		FBMH1, FBMH2	
20G SOLID WIRE	2	FBMH1, FBMH2	0017-00033-0139
HEAT SINK ASSY	1	HSA 1	A945-00008-0100
HEAT SINK MTG HARDWARE		MHSA	
4-40 X 10 SLT RND	2	HSA1	0017-00101-0727
WSH, 4, 120-.250-018	4	HSA1	0017-00104-0071
4-40 HEX NUT	2	HSA1	0017-00103-0002
FUSE, 1/4A SLO-BLO	1	F1	0017-00003-0446
FUSE, 1AMP	1	F2	0017-00003-0001
FUSE CLIP W/STOP	4	F1, F2	0017-00071-0033
2 POS. KK-156 CONN.	1	J1	3000-16387-0200
5 POS " "	2	J1, J2	3000-16387-0500
6 POS " "	1	J2	3000-16387-0600
13 POS " "	1	J1	3000-16387-1300
22 AWG. 2 1/2 IN.	3	JW1, JW2, JW3	0151-00087-0000
TIE WRAP 7 5/8 IN.	2	TW3, TW4	0945-00814-0300
TIE WRAP 10 3/4 IN.	2	TW1, TW2	0945-00814-0400
TAG, FUSE 1/4 A. SLO-BLO	1	LB1	M051-00945-A020
TAG, FUSE 1AMP	1	LB2	M051-00945-A021
TAG, PWR. SPLY. I.D.	1	LB3	M051-00945-A022
70 VA PWR. SPLY. P.C.	1		A080-90421-C000
HEAT SINK ASS'Y	1		0017-00033-0139

REVISIONS	

PROJECT ENG: J. JARON		USED ON BLUEPRINT		REVISIONS	
DO NOT SCALE DWG.		HEAT TREAT	SCALE FULL	NO. REQ'D I PER	
DIM TOLERANCES UNLESS SPECIFIED		DRAWN: JJ	DATE: 08/26/82	ASSY DRWNG. MED RS. 70 VA (A082-90421-C000) A082-90427-A000	
CONCENTRICITY ±.001		FRANKLIN PK. ILL.		PART NO. M051-00945-A031	



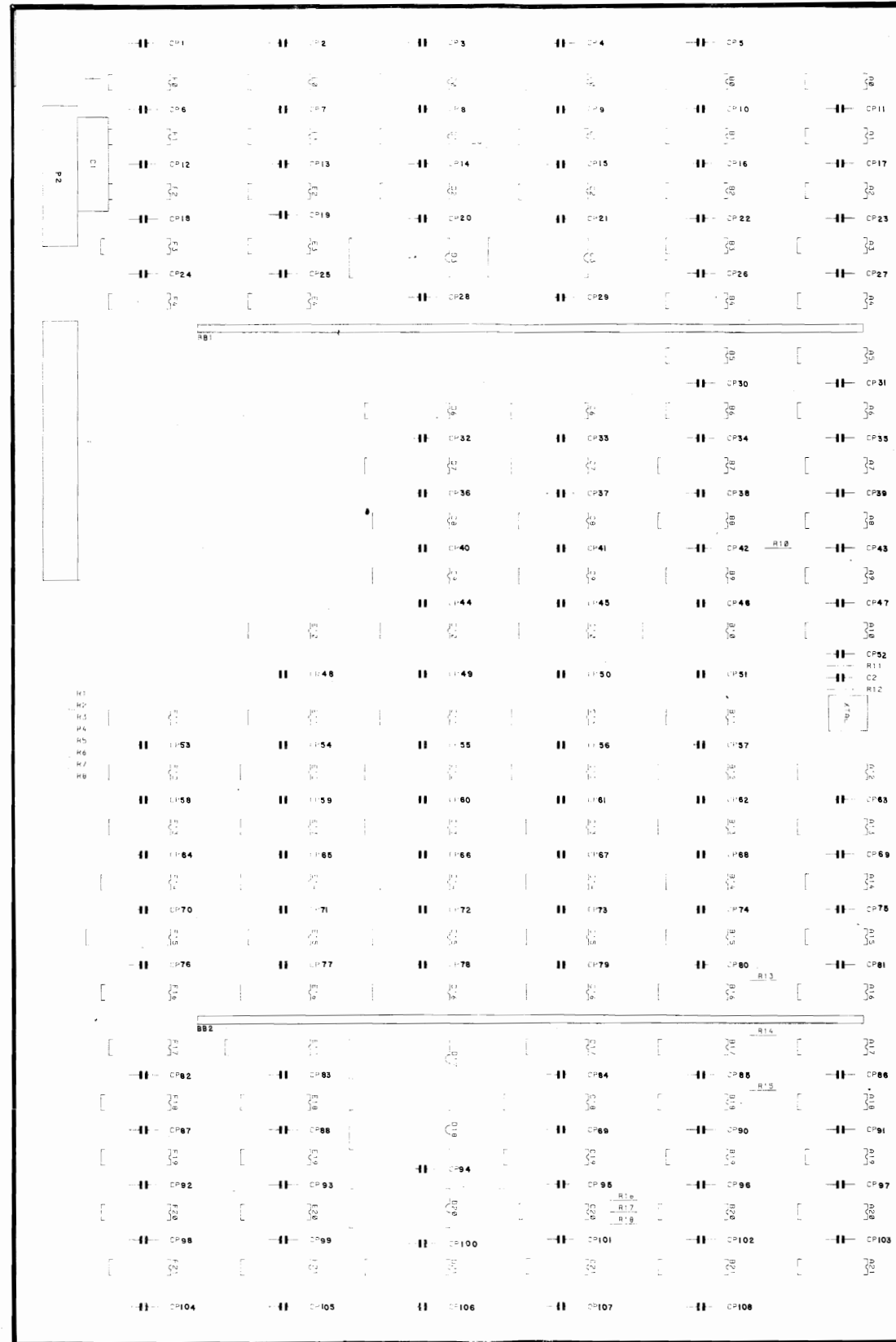
DONOR SCALE DIMS		SCALE	USED ON	DIVISIONS	
NONE		NONE	ROTO	MIDWAY MFG. CO.	
MEDIUM PWR SUPPLY 70 VA BARE BONES		NO REG D		FRANKLIN PK. ILL.	
A082-90427-A000				PART NO	
8/20/82				M051 -00945 -A032	

DESIGNATION LIST

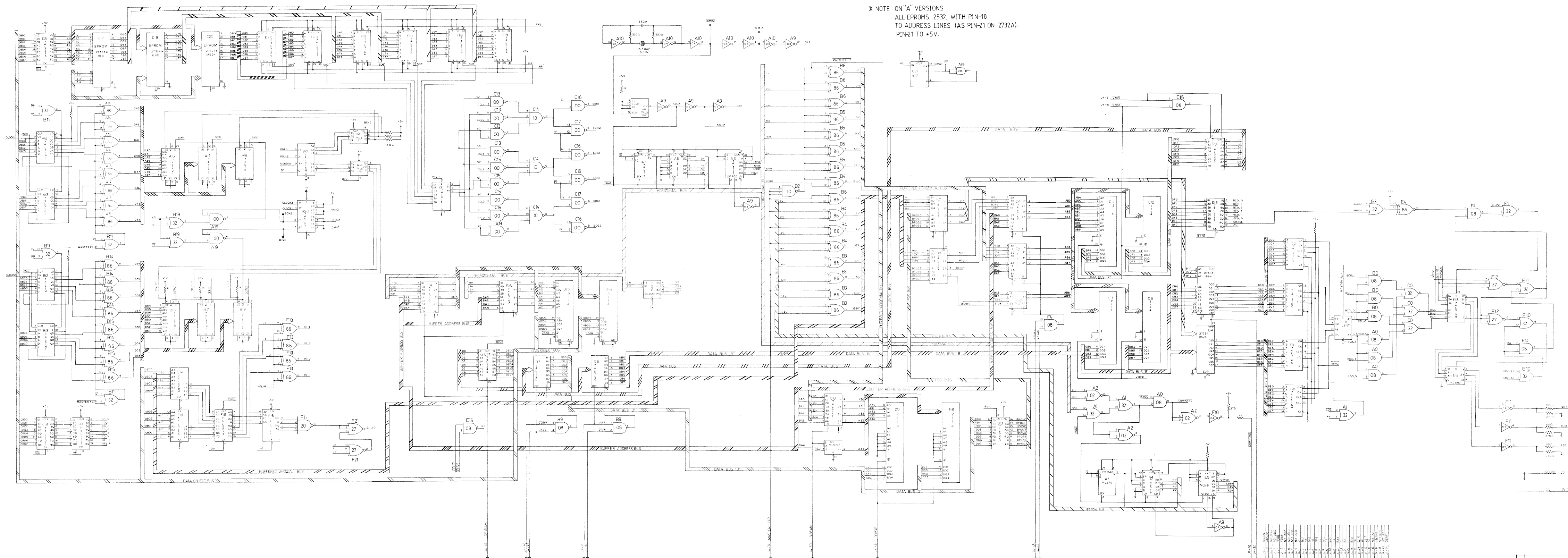
DESIGNATION	DESCRIPTION	DESIGNATION	DESCRIPTION
CPI - CPI08	.1uf AX CER	1E	74LS32
C1	1000uf 25VAXELEC	2E	74LS10
C2	330pf 50V CR DSC	4E	74LS86
		10E,11E	74LS32
		12E	74LS157
R1 - R4	100 OHM 1/4W	13E	74LS158
R5 - R8	270 OHM 1/4W	14E	74LS283
R9, R10	1K OHM 1/4W	15E	74LS08
R11, R12	330 OHM 1/4W	16E	74LS157
R13 - R18	1K OHM 1/4W	17E	74LS245
		18E - 20E	74LS166
		21E	74LS157
0A	74LS08		
1A	74LS32		
2A	74LS02		
3A - 6A	74LS161		
7A	74LS74	2F	74LS00
8A	74LS107	4F	74LS08
9A, 10A	74LS04	11F	74LS04
12A, 13A	74LS161	12F	74LS27
14A, 15A	74LS86	13F	74LS86
16A - 18A	74S201	14F	74LS283
19A	74LS00	15F	74LS273
20A	74LS157	16F	74LS174
21A	74LS175	17F	74LS20
		18F - 20F	74LS166
		21F	74LS27
0B	74LS08		
1B	74LS74		
2B	74LS10		
3B - 6B	74LS86		
7B, 8B	74LS283		
9B	74LS08		
10B	74LS273		
11B	74LS32		
12B, 13B	74LS161		
14B, 15B	74LS86		
16B - 18B	74S201		
19B	74LS32		
20B	74LS175		
21B	74LS158		
0C	74LS32		
1C, 2C	74LS166		
3C	EPROM		
6C, 7C	2114		
8C - 10C	74LS157		
11C, 12C	2114		
13C	74LS00		
14C	74LS10		
15C - 17C	74LS00		
18C, 19C	74LS273		
20C	74LS139		
21C	74LS107		
0D	74LS157		
1D, 2D	74LS166		
3D	EPROM		
6D, 7D	74LS245		
8D, 9D	2114		
10D, 11D	74LS157		
12D	74LS245		
13D	74LS273		
14D	74LS157		
15D, 16D	2114		
17D, 18D, 20D	EPROM		
21D	74LS273		
		1CS16A - 18A	16-PIN IC SOCKET
		" 16B - 18B	"
		" 3C	24-PIN "
		" 6C, 7C	18-PIN "
		" 11C, 12C	18-PIN "
		" 3D	24-PIN "
		" 8D, 9D	18-PIN "
		" 15D, 16D	18-PIN "
		" 17D, 18D	24-PIN "
		" 20D	24-PIN "
		XTAL	10MHZ CRYSTAL
		BB1, BB2	BUSS BAR
		P1	50-PIN CONN, MALE
		P2	20-PIN CONN, MALE

CROSS REFERENCE LIST

DESCRIPTION	QTY	DESIGNATION	PART NOS.
330pf 50V CR DSC	1	C2	0300-00800-1402
.1uf AX CER	108	CPI - CPI08	0300-00800-0700
1000uf AX ELEC	1	C1	0300-00800-1200
100 OHM 1/4W	4	R1 - R4	0062-110B3-1XXX
270 OHM 1/4W	4	R5 - R8	0062-138B3-1XXX
330 OHM 1/4W	2	R11, R12	0062-144B3-1XXX
1K OHM 1/4W	8	R9, R10, R13 - R18	0062-179B3-1XXX
2114	8	6C, 7C, 11C, 12C, 8D, 9D, 15D, 16D	0300-00803-0041
74LS00	6	19A, 13C, 15C - 17C, 2F	0300-00803-0027
74LS02	1	2A	0300-00803-0028
74LS04	3	9A, 10A, 11F	0300-00803-0029
74LS08	5	0A, 0B, 9B, 15E, 4F	0300-00803-0030
74LS10	3	2B, 14C, 2E	0300-00803-0051
74LS20	1	17F	0300-00803-0052
74LS27	2	12F, 21F	0300-00803-0053
74LS32	7	1A, 11B, 19B, 0C, 1E, 10E, 11E	0300-00803-0031
74LS74	2	7A, 1B	0300-00803-0032
74LS86	10	14A, 15A, 3B - 6B, 14B 15B, 4E, 13F	0300-00803-0054
74LS107	2	8A, 21C	0300-00803-0055
74LS139	1	20C	0300-00803-0034
74LS157	11	20A, 8C - 10C, 0D, 10D, 11D, 14D, 12E, 16E, 21E	0300-00803-0050
74LS158	2	21B, 13E	0390-00803-0049
74LS161	8	3A - 6A, 12A, 13A, 12B, 13B	0300-00803-0044
74LS166	10	1C, 2C, 1D, 2D, 18E - 20E, 18F - 20F	0300-00803-0048
74LS174	1	16F	0300-00803-0047
74LS175	2	21A, 20B	0300-00803-0035
74S201	6	16A - 18A, 16B - 18B	0300-00803-0056
74LS245	4	6D, 7D, 12D, 17E	0300-00803-0046
74LS273	6	10B, 18C, 19C, 13D, 21D, 15F	0300-00803-0038
74LS283	4	7B, 8B, 14E, 14F	0300-00803-0045
R-G-B EPROM KIT	3	17D, 18D, 20D	A300-90000-R300
BKG EPROM KIT	2	3C, 3D	A300-90000-R400
16 PIN IC SOCKET	6	16A - 18A, 16B - 18B	0508-00804-0700
18 PIN IC SOCKET	8	6C, 7C, 11C, 12C, 8D, 9D, 15D, 16D	0300-00804-0900
24 PIN IC SOCKET	5	3C, 3D, 17D, 18D, 20D	0300-00804-1000
10MHZ CRYSTAL	1	XTAL	0300-00804-1100
BUS BAR	2	BB1, BB2	0069-239XX-XBNX
20 PIN CONN, MALE	1	P2	0300-00804-1103
50 PIN CONN, MALE	1	P1	0300-00804-1104
VIDEO P. BOARD	1		



PROJECT ENG: J. SZERSZEN		USED ON BLUEPRINT		REVISIONS	
DO NOT SCALE DWG.		HEAT TREAT	SCALE NONE	Bally / MIDWAY MFG. CO.	
DIM TOLERANCES UNLESS SPECIFIED		MAT'L.	NO. REQ'D 1(ONE)	FRANKLIN PK. ILL.	
CONCENTRICITY ± 0.01		ASSEMBLY DRWG. BLUEPRINT		PART NO.	
HOLE DIA. ± 0.02		VIDEO P.C. BOARD		M051 - 00300 - D007	
DATE 9/2/82		A084 - 91431 - D300			

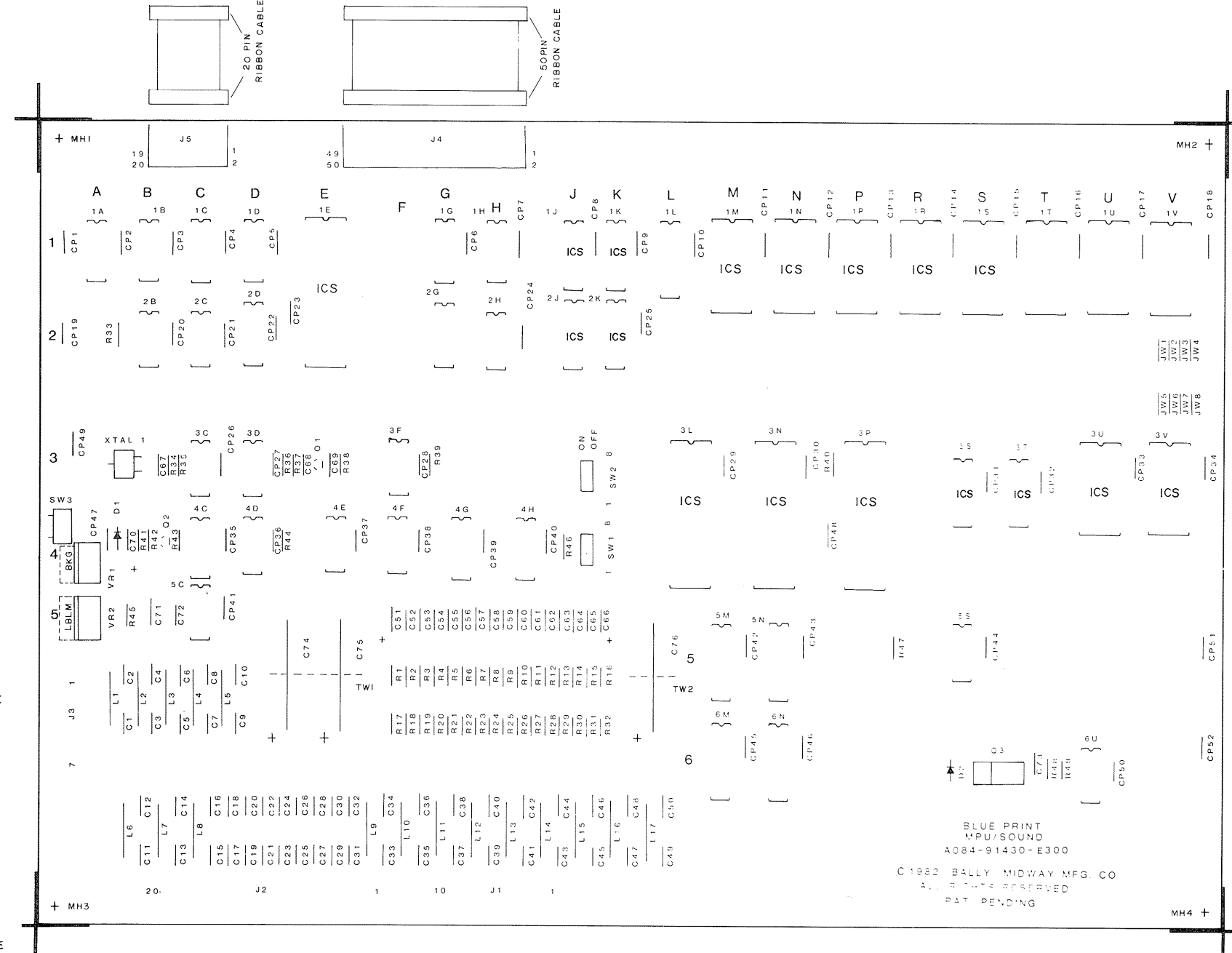


NOTE: ON "A" VERSIONS
 ALL EPROMS, 2532, WITH PIN-18
 TO ADDRESS LINES (AS PIN-21 ON 2732A).
 PIN-21 TO +5V.

PROJECT ENG. J. STERSZEN	DATE 11/11/83	REV. 1	MIDWAY MFG. CO.
DESIGNED BY S.M.	DATE 11/11/83	REV. 1	
CHECKED BY J.M.	DATE 11/11/83	REV. 1	
DATE 11/11/83			
SCHEMATIC VIDEO BOARD			MIDWAY MFG. CO.
A084-9431-0300			M031-00300-1008

DESIGNATION LIST

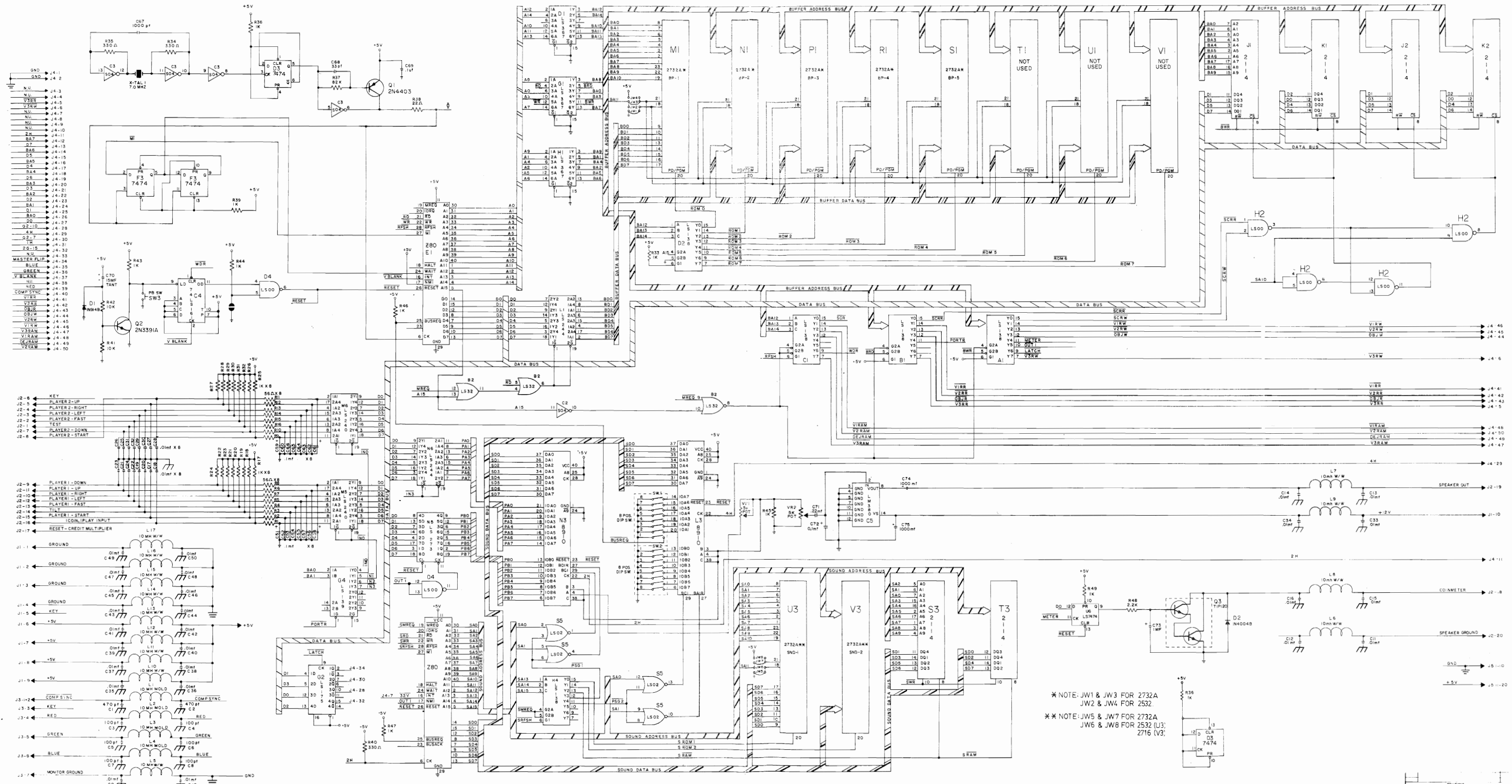
DESIGNATION	DESCRIPTION	DESIGNATION	DESCRIPTION
C1, C2	470 PF AX. CER.	IC 4C	74 LS 161
C3 - C8	100 PF " "	" 4D	74 LS 00
C9 - C50	.01 MF " "	" 4E	74 LS 08
C51 - C66	1 MF RD. TANT.	" 4F	74 LS 02
C67	.001 MF AX. CER.	" 4G	74 LS 139
C68	33 PF " "	" 4H	74 LS 138
C69	.1 MF " "	IC 5C	LM 380
C70	15 MF " TANT.	" 5M	74 LS 240
C71	.22 MF " CER.	" 5N	74 LS 273
C72	.1 MF " "	" 5S	74 LS 02
C73	1 MF RD. TANT.	IC 6M	74 LS 240
C74 - C76	1000 MF AX. ELEC.	" 6N	74 LS 244
		" 6U	74 LS 74
CPI - CP52	.1 MF AX. CER.		
RI - R16	56 OHM 1/4W 5% CRBN	LI - L4	CHOKE 10JH MOLDED
R17 - R33	1 K " " " "	L5 - L17	CHOKE 10JH W/W
R34, R35	330 " " " "		
R36	1 K " " " "	ICS IE	40 PIN IC SOCKET
R37	82 K " " " "	" 1J, 1K	18 PIN " " " "
R38	22 " " " "	" 1M, 1N, 1P, 1R, 1S	24 PIN " " " "
R39	1 K " " " "	" 2J, 2K	18 PIN " " " "
R40	330 " " " "	" 3L, 3N, 3P	40 PIN " " " "
R41, R42	10 K " " " "	" 3S, 3T	18 PIN " " " "
R43 - R46	1 K " " " "	" 3U, 3V	24 PIN " " " "
R47	330 " " " "		
R48	2.2 K " " " "		
R49	1 K " " " "		
VR1, VR2	5 K POT	J1	10 PIN CONN KK-156
		J2	20 PIN " " " "
		J3	7 PIN " " " "
		J4	50 PIN MALE CONN.
		J5	20 PIN " " " "
D1	1N 914 B	JWI, JW3, JW5, JW7	JUMPER WIRES
D2	1N 4004	MHI - MH4	DUAL LKG PC BD SPACE
Q1	2N 4403	SW1, SW2	8 POS. DIP S.W.
Q2	2N 3391 A	SW3	P.B. SWITCH
Q3	TIP 120	TWI - TW2	TIE WRAPS
IC 1A - 1C	74 LS 138	XTAL 1	7.0 MHZ CRYSTAL
" 1D	74 LS 367		
" 1E	Z80A		
" 1G, 1H	74 LS 367		
" 1J, 1K	2114		
" 1L	74 LS 244		
" 1M - 1S	EPROM		
" 1T - 1V	NOT USED		
IC 2B	74 LS 32		
" 2C	74 LS 04		
" 2D	74 LS 138		
" 2G	74 LS 175		
" 2H	74 LS 00		
" 2J, 2K	2114		
IC 3C	74 S04		
" 3D, 3F	74 LS 74		
" 3L, 3N	8910		
" 3P	Z80A		
" 3S, 3T	2114		
" 3U, 3V	EPROM		



CROSS REFERENCE LIST

DESCRIPTION	QTY	DESIGNATION	PART NO.	DESCRIPTION	QTY	DESIGNATION	PART NO.
33 PF AX. CER.	1	C 68	0300-00800-1400	MPU EPROM KIT	1	IM, 1N, 1P, 1R, 1S	A300-90000-R100
100 PF " "	6	C3 - C8	0300-00800-0500	SOUND EPROM KIT	1	3U, 3V	A300-90000-R200
470 PF " "	2	C1, C2	0508-00800-1700				
.001 MF " "	1	C67	0300-00800-0600				
.01 MF " "	42	C9 - C50	0300-00800-1300	CHOKE 10 JH MOLDED	4	L1 - L4	0300-00804-1107
.1 MF " "	54	C69, C72, CPI - CP52	0300-00800-0700	CHOKE 10 JH W/W	13	L5 - L17	0300-00804-1108
.22 MF AX. CER.	1	C71	0300-00800-0800	18 PIN IC SOCKET	6	1J, 1K, 2J, 2K, 3S, 3T	0300-00804-0900
1 MF RD. TANT.	17	C51 - C66, C73	0300-00800-0900	24 PIN " "	7	1M, 1N, 1P, 1R, 1S, 3U, 3V	0300-00804-0C00
15 MF AX. TANT.	1	C70	0300-00800-1401	40 PIN " "	4	1E, 3L, 3N, 3P	0300-00804-1100
1000 MF AX. ELEC.	3	C74 - C76	0300-00800-1200				
22 OHM 1/4W 5% CRBN	1	R38	0062-063B3-1XXX	7 PIN CONN KK-156	1	J3	3000-16367-0710
56 " " " "	16	RI - R16	0062-092B3-1XXX	10 PIN " " " "	1	J1	3000-16367-1011
330 " " " "	4	R34, R35, R40, R47	0062-144B3-1XXX	20 PIN " " " "	1	J2	3000-16367-2014
1 K " " " "	24	R17 - R33, R36, R39, R43 - R46, R49	0062-179B3-1XXX	20 PIN MALE CONN.	1	J5	0300-00804-1105
				50 PIN " " " "	1	J4	0300-00804-1104
2.2K " " " "	1	R48	0062-195B3-1XXX	ZERO OHM 22 AWG BARE	4	JWI, JW3, JW5, JW7	0986-00805-0200
10 K " " " "	2	R41, R42	0062-227B3-1XXX				
82 K " " " "	1	R37	0062-271B3-1XXX	SWITCH 8 POS. DIP SWITCH PB.	2	SW1, SW2	0300-00804-0700
					1	SW3	0300-00804-0800
5 K POT	2	VR1, VR2	0300-00804-0600	7.0 MHZ CRYSTAL	1	XTAL 1	0300-00804-1109
1N 914 B	1	D1	0300-00801-0001	TIE WRAPS	2	TWI, TW2	0017-00042-0048
1N 4004	1	D2	0300-00801-0002				
2N 4403	1	Q1	0300-00802-0002				
2N 3391A	1	Q2	0300-00802-0003				
TIP 120	1	Q3	0300-00802-0001				
2114	6	IC 1J, 1K, 2J, 2K, 3S, 3T	0300-00803-0041	20 PIN RIBBON CABLE	1		A300-00019-C000
74 LS 00	2	IC 2H, 4D	0300-00803-0027	50 PIN " " " "	1		A300-00020-U000
74 LS 02	2	IC 4F, 5S	0300-00803-0028				
74 LS 04	1	IC 2C	0300-00803-0029	BACKGROUND VOL. CONTR. LBL	1	BKG	M051-00300-A014
74 S04	1	IC 3C	0300-00803-0043	MASTER VOL. CONTR.	1	LBLM	M051-00300-A013
74 LS 08	1	IC 4E	0300-00803-0030				
74 LS 32	1	IC 2B	0300-00803-0031	BLUEPRINT MPU/SOUND PC	1		A080-91430-E300
74 LS 74	3	IC 3D, 3F, 6U	0300-00803-0032				
74 LS 138	5	IC 1A, 1B, 1C, 2D, 4H	0300-00803-0033				
74 LS 139	1	IC 4G	0300-00803-0034				
74 LS 161	1	IC 4C	0300-00803-0044				
74 LS 175	1	IC 2G	0300-00803-0035				
74 LS 240	2	IC 5M, 6M	0300-00803-0036				
74 LS 244	2	IC 1L, 6N	0300-00803-0037				
74 LS 273	1	IC 5N	0300-00803-0038				
74 LS 367	3	IC 1D, 1G, 1H	0300-00803-0039				
8910	2	IC 3L, 3N	0066-853AX-XXSX				
LM 380	2	IC 5C	0066-040BX-XXAX				
Z80A	2	IC 1E, 3P	0300-00803-0042				

PROJECT ENG. J. SZERSZEN		REVISIONS	
DATE	SCALE FULL	USED ON BLUEPRINT	NO REQ'D ONE PER
MIDWAY MFG. CO.		PART NO. M051-00300-E005	
ASSEMBLY DWG.		BLUEPRINT MPU/SOUND A084-91430-E300	
DATE 08/30/82			

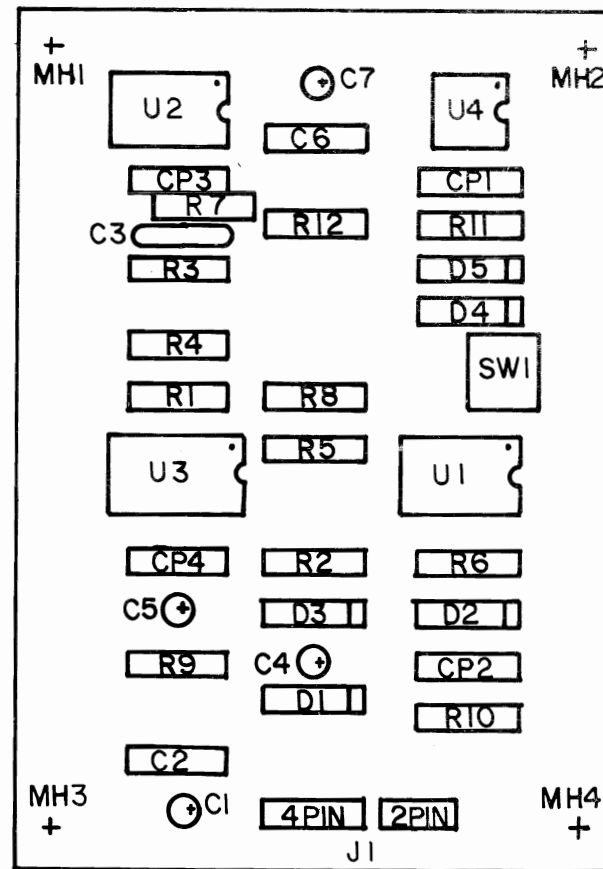


* NOTE: JW1 & JW3 FOR 2732A
 JW2 & JW4 FOR 2532
 ** NOTE: JW5 & JW7 FOR 2732A
 JW6 & JW8 FOR 2532 (J3,
 2716 (V3)

PROJECT ENG. J. SZERSZEN	REV. 1	USED ON BLUEPRINT	DATE 1/10/82
NO. 1000	NO. 1000	NO. 1000	NO. 1000
MPU/SOUND BOARD SCHEMATIC	A084-7430-E300	MIDWAY MFG. CO.	PART NO. M051-00300-E006

DESIGNATION LIST

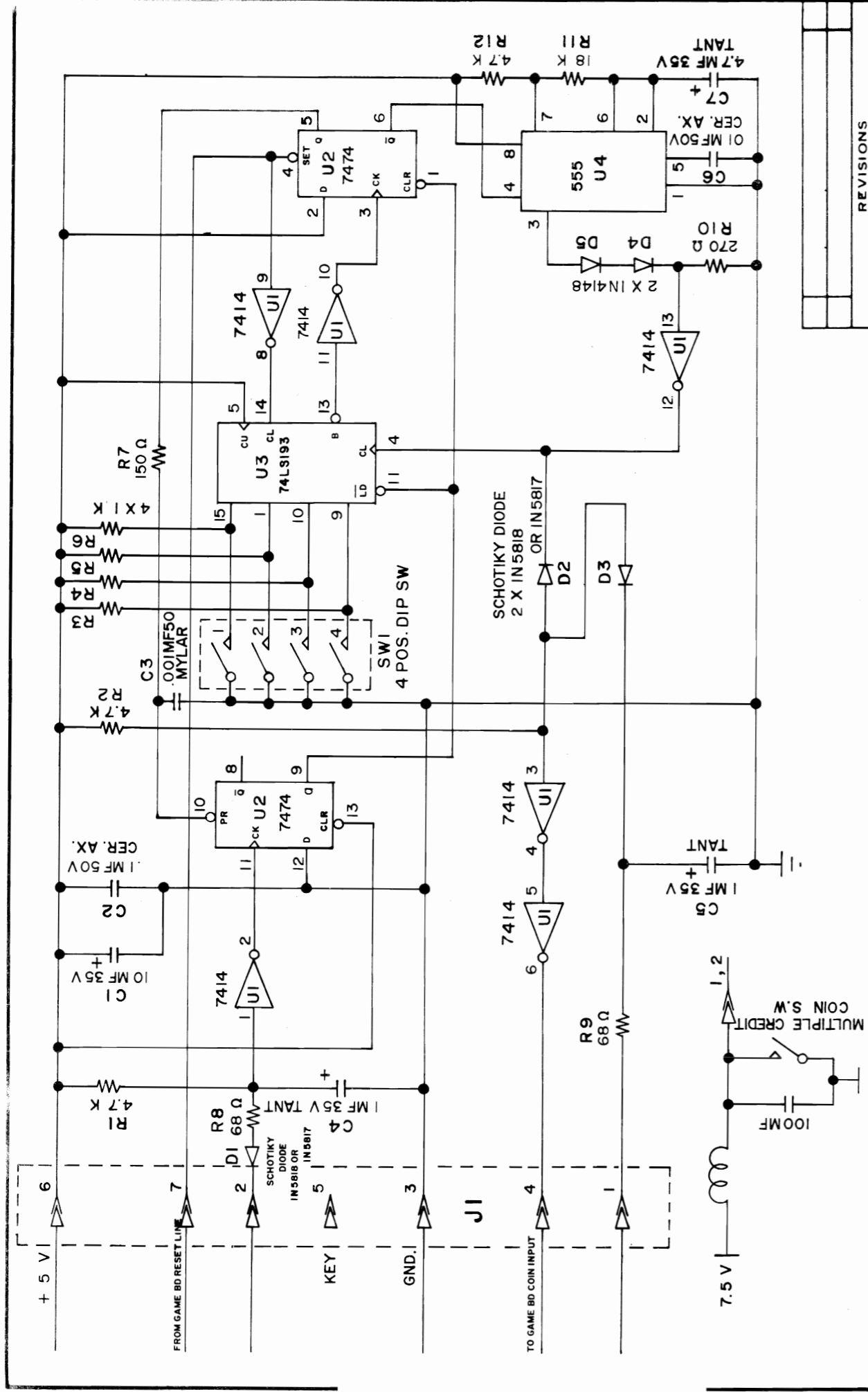
DESIGNATION	DESCRIPTION
C1	10mf 16V RD. TANT
C2	0.1mf 50V CR. DSC.
C3	.001mf 100V ESTERF
C4, C5	1mf 35V RD. TANT
C6	.01mf 500V CR. DSC.
C7	4.7mf 35V RD. TANT
CPI-CP4	.1mf 50V CR. DSC.
R1, R2	4.7K OHM 1/4W
R3-R6	1K OHM 1/4W
R7	150 OHM 1/4W
R8, R9	68 OHM 1/4W
R10	270 OHM 1/4W
R11	18K OHM 1/4W
R12	4.7K OHM 1/4W
D1-D3	IN5817 SCHOTTKY
D4, D5	IN4148 DIODE
U1	7414
U2	7474
U3	74LS193
U4	555 TIMER
J1	CONNECTOR ASSY.
SW1	4 POS DIP SW.
MHI-MH4	SNAP BUSHINGS, 1/8"



CROSS REFERENCE LIST

DESCRIPTION	QTY.	DESIGNATION	PART NOS.
.001mf 100V ESTERF	1	C3	0932-00820-0303
.01mf 500V CR. DSC	1	C6	0932-00821-0401
.1mf 50V CR. DSC	5	C2, CPI-CP4	0932-00820-0302
1mf 35V RD. TANT	2	C4, C5	0932-00820-0304
4.7mf 35V RD. TANT	1	C7	0932-00820-0305
10mf 16V RD. TANT	1	C1	0932-00820-0306
68 OHM 1/4W	2	R8, R9	0062-098B3-1XXX
150 OHM 1/4W	1	R7	0062-122B3-1XXX
270 OHM 1/4W	1	R10	0062-138B5-1XXX
1K OHM 1/4W	4	R3-R6	0062-179B3-1XXX
4.7K OHM 1/4W	3	R1, R2, R12	0062-211B3-1XXX
18K OHM 1/4W	1	R11	0062-239B3-1XXX
IN4148 DIODE	2	D4, D5	0932-00821-0402
IN5817 SCHOTTKY	1	D1-D3	0932-00809-0000
555 TIMER	1	U4	0932-00819-1801
7414	1	U1	0932-00819-1803
7474	1	U2	0932-00819-1804
74LS193	1	U3	0932-00819-1802
CONNECTOR ASSY.	1	J1	0932-00817-0400
4 POS. DIP SW.	1	SW1	0932-00821-0401
SNAP BUSHINGS, 1/8"	4	MHI-MH4	0017-00042-0014
CREDIT MULTIPLIER P. C. BOARD	1		A080-91348-C000

PROJECT ENG: J. SZERSZEN		USED ON PAC MAN		Bally / MIDWAY MFG. CO. FRANKLIN PK. ILL.	
DO NOT SCALE DWG.		HEAT TREAT	SCALE NONE		
DIM. TOLERANCES UNLESS SPECIFIED		DRW. <i>SZL</i>	ASSEMBLY DRAWING, CREDIT MULTIPLIER P. C.		PART NO.
CONCENTRICITY T.I.R. 003		CHKD.	A082 91348 C000		M051-00932 -C027
FRACTIONAL 1/64		DATE 8/20/82			
DECIMAL .005					
HOLE DIA. +.002-.000					

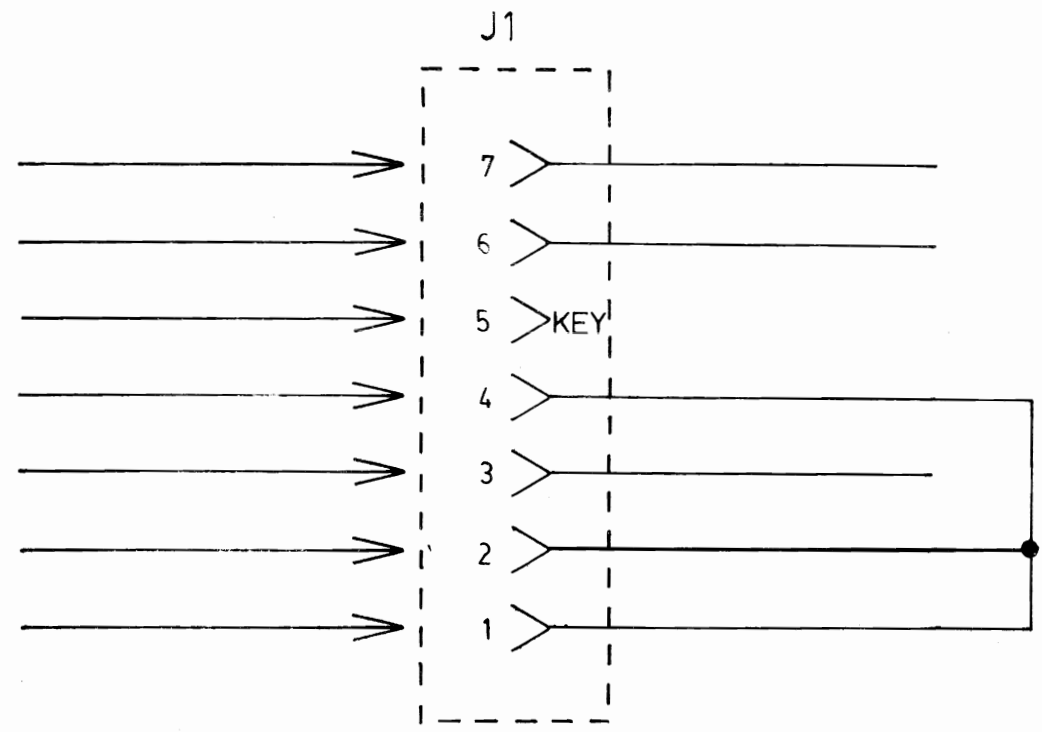


DO NOT SCALE DWG.		HEAT TREAT	SCALE	FULL	USED ON	PAC-MAN	MIDWAY MFG. CO.	
DIM. TOLERANCES UNLESS SPECIFIED		MAT'L			NO. REQ'D		ONE PER	FRANKLIN PK. ILL.
CONCENTRICITY T.I.R. .003				SCHEMATIC DIAGRAM				PART NO.
FRACTIONAL .1/64				CREDIT MULTIPLIER				M051 - 00932 - C029
DECIMAL .005				A082-91348-C000				
HOLE DIA. + .002 - .000				DATE 08/17/82				
REVISIONS								

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DESIGNATION LIST		CROSS REFERENCE LIST	
DESIGNATION	DESCRIPTION	DSCR.P.	QTY DESIG. PART NOS.
J1	7 PIN CONN. KK-156 W/PIN 3 REMOVED	J1	0932-00817-0400
PCM1, PCM2	1/8" HEYCO NUT	PCM1, PCM2	0017-00042-0014
		PC BD	A080-91109-A000
PROJ. ENG = J. 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 USED ON PAC-MAN DATE 08/18/82 SCALE FULL MECH CHK. MAT'L FINISH ELEC CHK. FINISH	
MIDWAY MFG. CO. FRANKLIN PK., ILL. 60131		REVISIONS	
ASSEMBLY DWG		PART NO.	
CREDIT MULT. BYPASS PC BD		M:0.5.1 - 0.0.9.3.2 - A.0.2.7	
A082-91109-A000			

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PROJ. ENG.: J. 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 USED ON PACMAN			 MIDWAY MFG. CO. FRANKLIN PK., IL. 60131 A BALLY CO.		
	DRN <i>szh</i>	DATE 8/20/82	SCALE NONE			
	MECH. CHK.	MAT'L.		SCHEMATIC DRAWING, CREDIT MULTI. BYPASS P. C. BOARD A082-91109-A000		
	ELEC. CHK.	FINISH				
				PART NO. M·0·5·1 - 0·0·9·3·2 - A·0·2·8		