JULY, 1982
Game Nos. 628, 727, & 728

Bally MIDWAY

TRON

Parts and Operating Manual

NO. 628 UPRIGHT

NO. 727 COCKTAIL

NO. 728 MINI

Bally

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Form No. 628-00300-0000

WARNING

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

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

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF FIGURES

TABLE OF FIGURES (Continued)

TRON

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

TRON 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 take TRON 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, TRON is under **YOUR** control. **YOU** make him move back and forth across the screen to confront his opponents, alien and otherwise. The methods he uses to eliminate these opponents depend on which phase of the rack he is in.

The game is displayed in "racks"; each of which has four completely separate phases. By using the control stick, the contestant(s) can determine which of the four phases he will send TRON into. Once TRON has entered and completed a phase of any particular rack, that phase will not be available again until all of the other remaining phases in that rack have been completed. If TRON is eliminated in any particular phase, the next TRON is allowed to re-enter that phase to play it over again if you want him to.

The four phases that make up each rack are as follows:

PHASE # 1 — TANKS: You are provided with a top view of a maze with your Tank and enemy Tanks in it. The higher the number of the rack you are in, the greater the number of enemy Tanks in there with you. This phase ends when all the enemy Tanks are destroyed — or — when you are.

PHASE #2 — GRID BUGS: A side view of a vertical grid is presented to the player in this phase. The Grid Bugs (which look something like spiders) begin to appear and start multiplying immediately. At the same time they are also coming after you. Shoot as many of these as you can while working your way to the I.O. TOWER in the center of the screen. Once you enter this I.O. TOWER, this phase is over.

PHASE #3 — CYCLES: In this phase you have a top view of Cyclists. The higher the number of the rack you are in, the greater the number of enemy Cyclists in there with you. You cannot run into any walls, cross your own light trail or cross the enemy Cyclist's trail. If you do, you will be destroyed. You must box in the enemy Cyclists, forcing them to run into either their own light trail, your light trail, or a wall, destroying themselves.

PHASE #4 — MCP BLOCKS: Here there is a rotating cylinder composed of colored blocks that is constantly descending on you. The higher the number of the rack you are in, the greater the speed with which the cylinder descends. You must either shoot all the blocks out of the descending cylinder or clear a space so you can enter the cone shaped area at its top. When you do either of these, this phase ends.

Bonus TRONS are awarded to you periodically throughout the game as you reach or pass certain preselected point values. Each item that can be shot has an assigned point value as listed in Figure 1-1.

Major Features

There are several major features in your TRON game: 1) There is a completely new and easy to use diagnostic package featuring: A) a complete ROM/RAM check with bad chip location information read out on the monitor screen; B) the capability to check each of the games' different sounds **INDIVIDUALLY;** C) provision for checking each control and switch **SEPARATELY;** D) a full function Bookkeeping mode; E) an entire options list that can be set from the front console with **NO NEED** to crawl inside the back of the cabinet and look for tiny switches located on P.C. boards; F) a sound system test; and G) a "PRE-SET" category that returns **ALL** information in the Bookkeeping mode to zero and all operator selected options back to factory recommended settings; 2) The game is equipped with a rechargeable battery so that it won't forget where it was the night before at closing — even if you turn it off. It will "remember" this information for up to two weeks; 3) There are four separate games contained in the program; and 4) As the player's skill level increases, so does his fire power to help him meet the increased difficulty of the game.

Game Objective

The object of the game is to **HAVE FUN** while constantly increasing your skill as you play, wiping out as many of the enemy as possible each time to get the highest score.

DESCRIPTION	POINTS AWARDED
1st HIT ON TANK	100 POINTS AWARDED
2nd HIT ON TANK	300 POINTS AWARDED
3rd HIT ON TANK (TANK DESTROYED)	500 POINTS AWARDED
GRID BUG DESTROYED	50 POINTS AWARDED
GRID BUG EGG DESTROYED	50 POINTS AWARDED
CYCLIST DESTROYED	500 POINTS AWARDED
EACH MCP BLOCK DESTROYED	25 POINTS AWARDED
ENTIRE CYLINDER DESTROYED	1000 POINTS AWARDED
ENTERING CONE AT TOP OF CYLINDER	1000 POINTS AWARDED

Figure 1-1 Assigned Point Values

II Location and Setup

INSPECTION:

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

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

   - ☐ Replug any connectors found unplugged. DO NOT FORCE PLUGS ONTO CONNECTORS. DO NOT FORCE PLUGS TOGETHER. If it won't go on easily, assuming the keys are lined up, it either does not belong there or is damaged.
   - ☐ Make sure all printed circuit boards (P.C.B.'s) are firmly seated in their connectors. See Figure 2-1. These connectors are also keyed. The P.C.B.'s will only go into them one way without being damaged.
   - ☐ Note the location of the games' 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 and 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 36"	(63 x 91cm)
Mini	20" x 24"	(50 x 60cm)
Cocktail	32" x 22"	(81 x 55cm)

   - ☐ **Game height:**

Upright	70"	(175cm)
Mini	61"	(153cm)
Cocktail	29"	(73cm)

2. **Voltage Selection**

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

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

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

3. **Interlock and power ON/OFF switches.** See Figure 2-1.
   - ☐ To help prevent the possibility of getting an electric shock while working inside the game cabinet, interlock switches have been installed at each cabinet access door (this **DOES NOT** include the coin door in the Upright and Mini models).
   - ☐ When any access door is opened, the interlock switch installed there turns off all power to the game.
   - ☐ Check each interlock switch for proper operation.

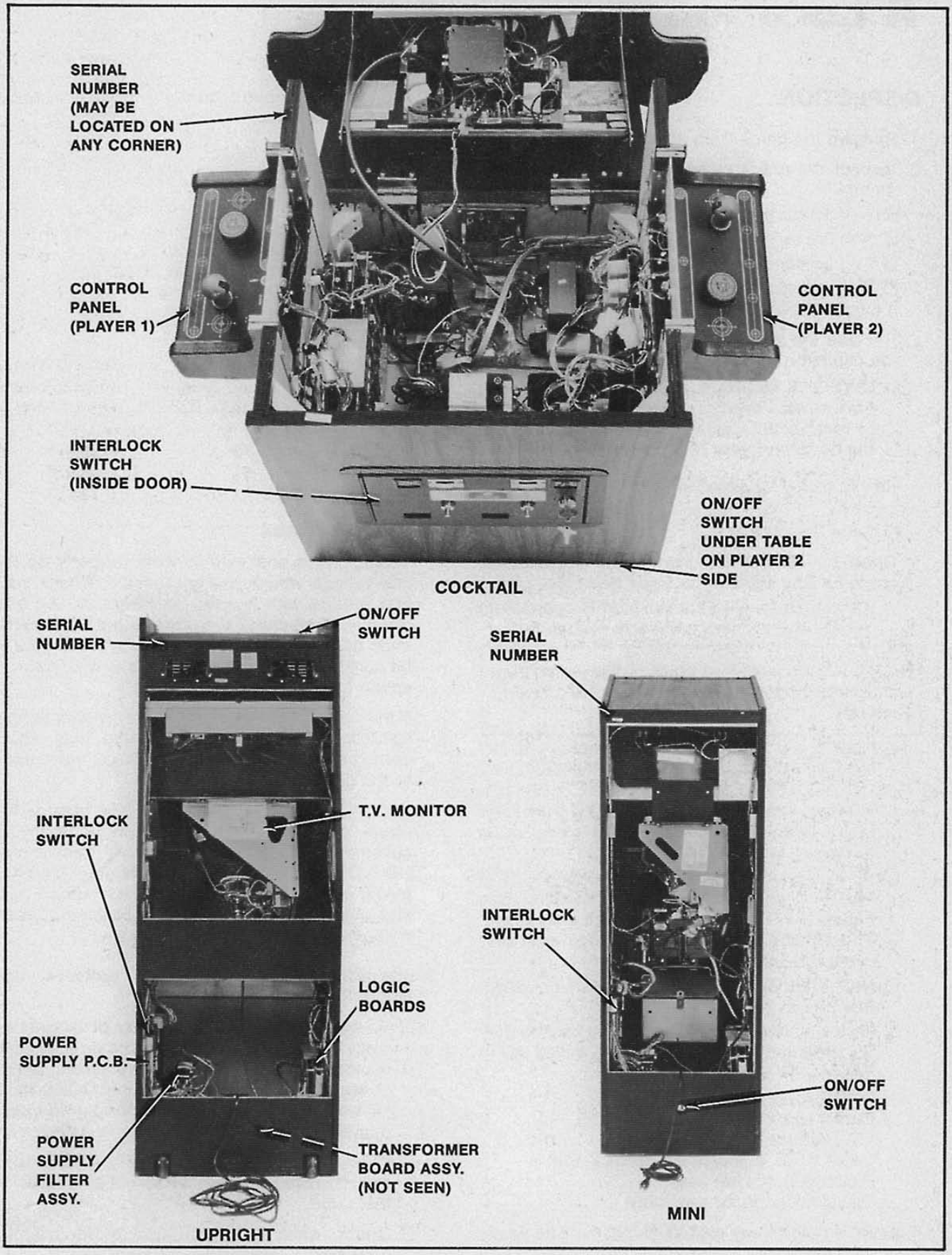


Figure 2-1 Location of Serial No., Interlock Switch, On/Off Switch, & Major Sub-Assys.

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.

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

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.

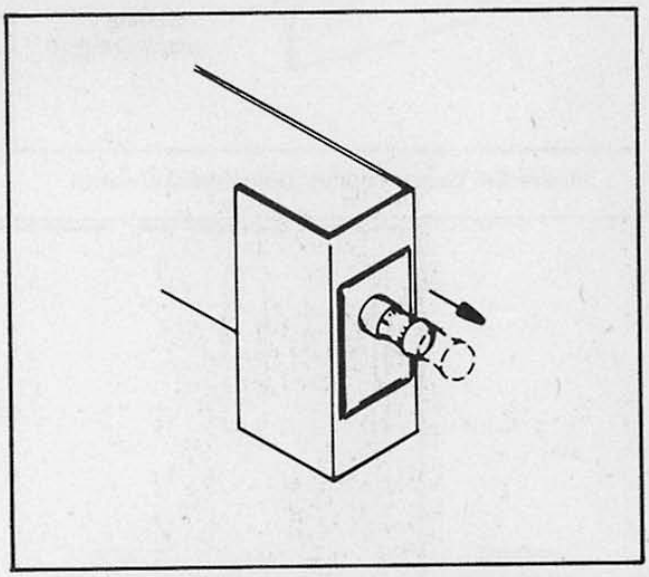


Figure 2-3 Interlock Switch Operation

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. Some information can also be heard through the game's speaker system. See the GAME OPERATION section for a more detailed description of this function.

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

GAME VOLUME ADJUSTMENT CONTROL. (See Figure 2-4)

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

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

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

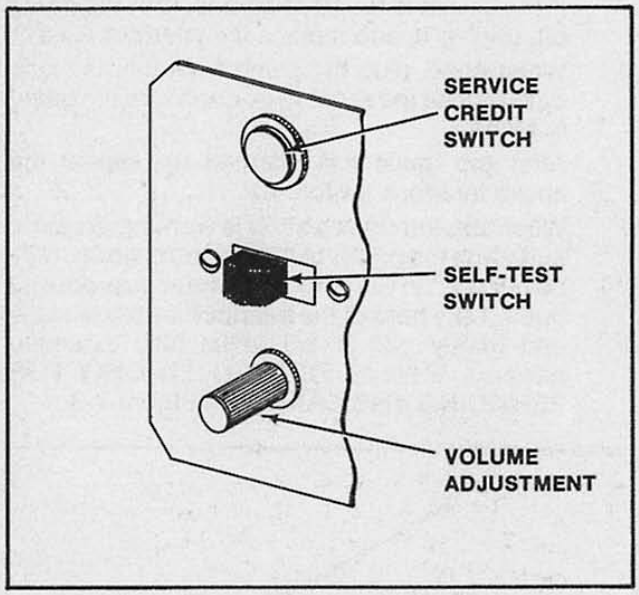


Figure 2-4 Game Volume Adjustment Control

OPTION SETTINGS:

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

When changing any cptions, ALWAYS perform the Self-Test and play the game to be sure the ones selected are working properly. Of course, when you must change one of the switches that is located on one of the game's P.C. boards, it is also recommended that you perform the Self-Test and play the game to be sure the switches have worked properly and that no switches were accidentally moved that were not meant to be. (These switches are small and this can happen.)

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

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

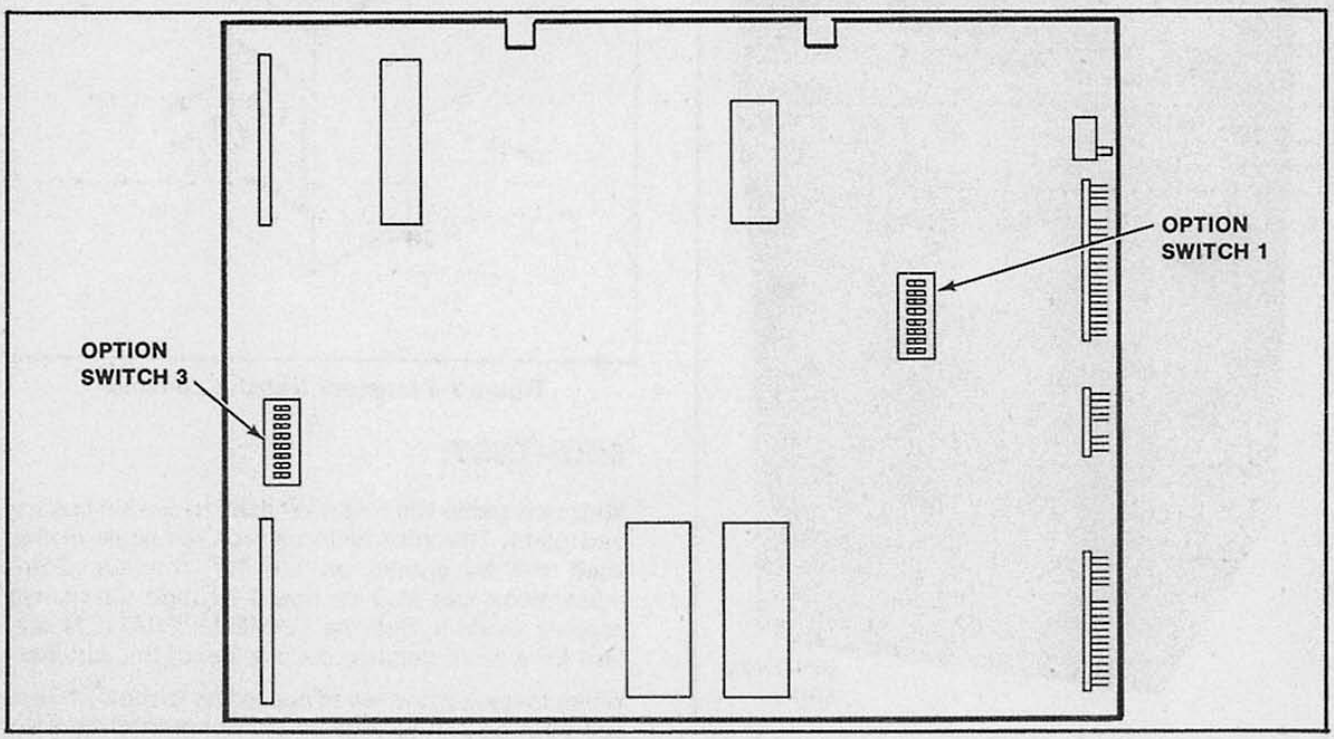


Figure 2-5 Option Switch Location

TRON

OPTION SWITCH SETTINGS

SWITCH NO. 1 — AT B 3 — LOCATED ON SOUND I/O P.C. BOARD

	SW#1	SW#2	SW#3	SW#4	SW#5	SW#6	SW#7	SW#8	SW#9	SW#10
2 COIN METERS	ON			NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	
1 COIN METER	OFF									
MINI/UPRIGHT		ON								
COCKTAIL TABLE		OFF								
BUY IN ALLOWED			ON							
NO BUY IN			OFF							
FREEZE VIDEO										ON
NORMAL OPERATION										OFF

SWITCH NO. 3 — AT D 14 — LOCATED ON SOUND I/O P.C. BOARD

	SW#1	**SW#2	**SW#3	**SW#4	
NORMAL OPERATION	OFF				
SOUND I/O DIAGNOSTIC MODE	ON				
NORMAL OPERATION RAM/ROM TEST INDICATES TEST RESULTS VIA YELLOW LED ON SOUND I/O BOARD: **FAST FLASH = BAD ROM** **SLOW FLASH = BAD RAM**		OFF ON			THE REMAINDER OF TRON'S MOST COMMON OPTION SETTINGS ARE CONDUCTED DURING THE **MACHINE SETUP** PORTION OF THE SELF-TEST MODE AND WILL BE COVERED IN DETAIL IN THAT SECTION OF THIS MANUAL
NORMAL OPERATION OSCILLATOR TEST			OFF ON		
NORMAL OPERATION FILTER TEST				OFF ON	

NO EFFECT IF **SW#1 OF SWITCH NO. 3 IS IN THE **"OFF"** POSITION.

Figure 2-6 Option Switch Settings

III Game Operation

TRON 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, HIGH SCORE INITIAL and SELF-TEST.

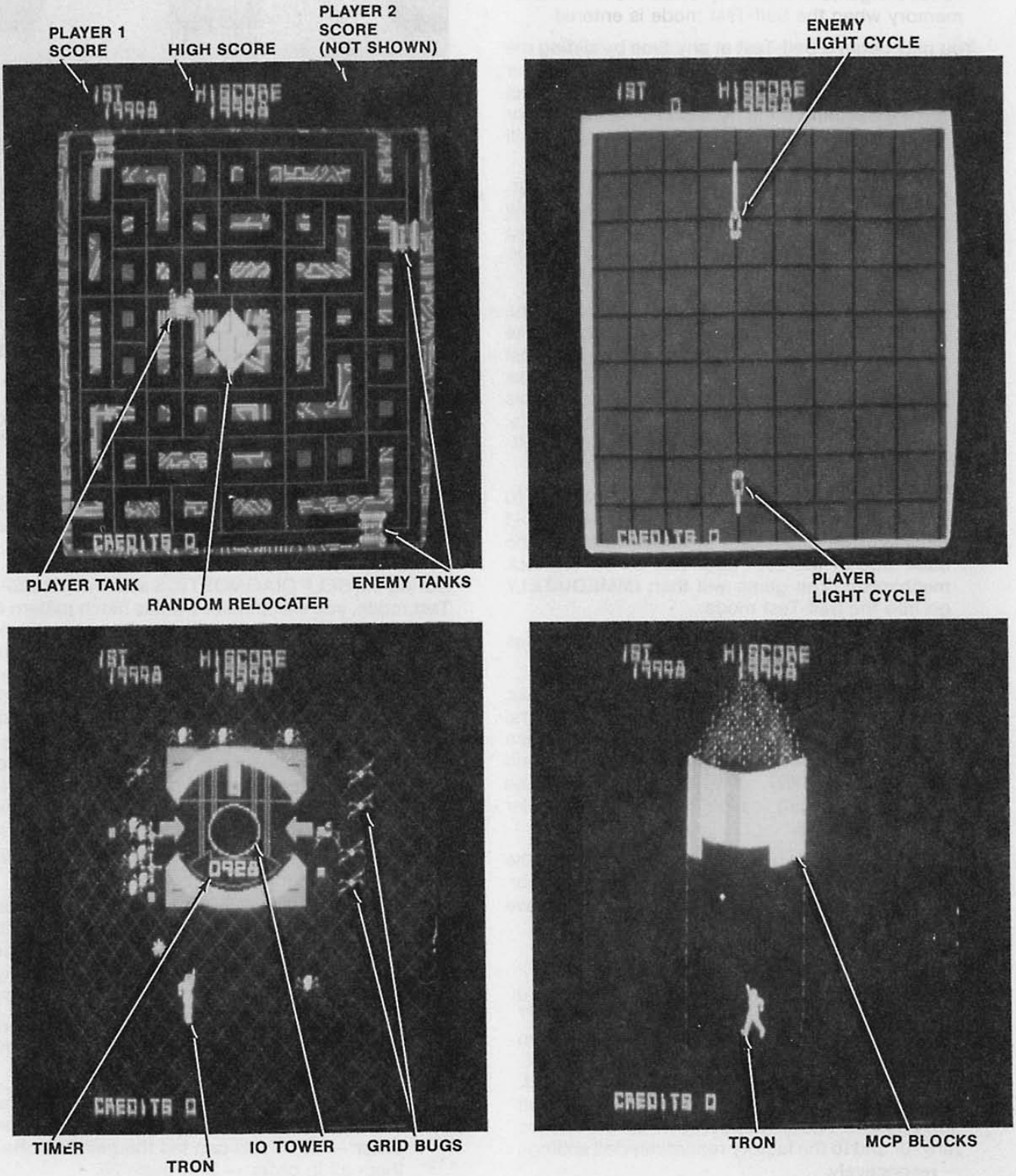


Figure 3-1 Game Operation

SELF-TEST MODE

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

NOTE: Putting the game into Self-Test **WILL NOT** cause the game to erase any CREDITS it has in its memory when the Self-Test mode is entered.

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

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

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

1. It is easy to select what category you want to enter. By pushing forward or pulling backward on the controler stick, the Cursor at the left of the screen can be moved UP and DOWN, (forward=UP) and (backward=DOWN), until it is in front of the category you want to test. Release the controler stick at this time.
2. After the Cursor has been positioned, pull the trigger on the controler stick and the monitor screen will display the test category you have selected.

NOTE: There is one exception to this. If you position the Cursor in front of the "PRESET" category on the Self-Test Mode Menue, when you pull the trigger on the controler stick — EVERYTHING, I repeat — **EVERYTHING;** including **ALL** information in the "BOOKKEEPING" mode, and **ALL operator selected options,** will be set back to zero "0" and to the factory recommended settings **— respectively.**

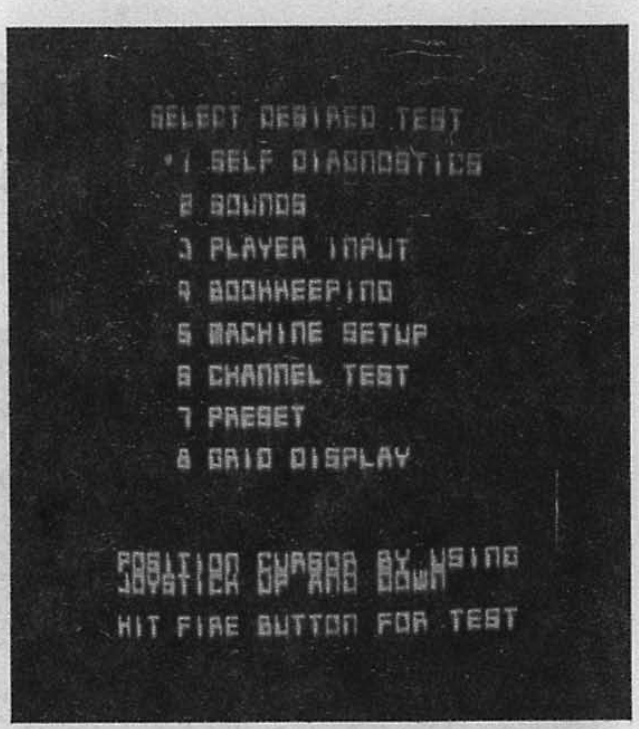


Figure 3-2 Self-Test—Menu

- ☐ Once you are **IN** one of the Self-Test mode categories, FOLLOW THE **ON-SCREEN** INSTRUCTIONS TO **COMPLETE** THE TEST.

3. The next group of figures shows the **CORRECT** screen presentation for **EACH** category of the Self-Test mode.

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

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

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

- ☐ In this category, each of the game's 24 separate sounds can be checked individually in any order — or — you can tell the game to check them all in order — 3 through 26.

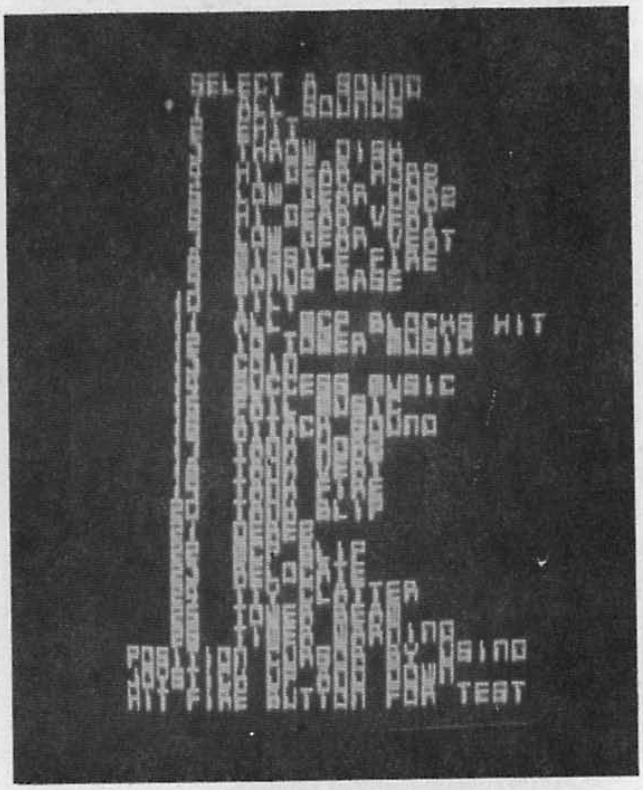


Figure 3-2a Self-Test—Sounds

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

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

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

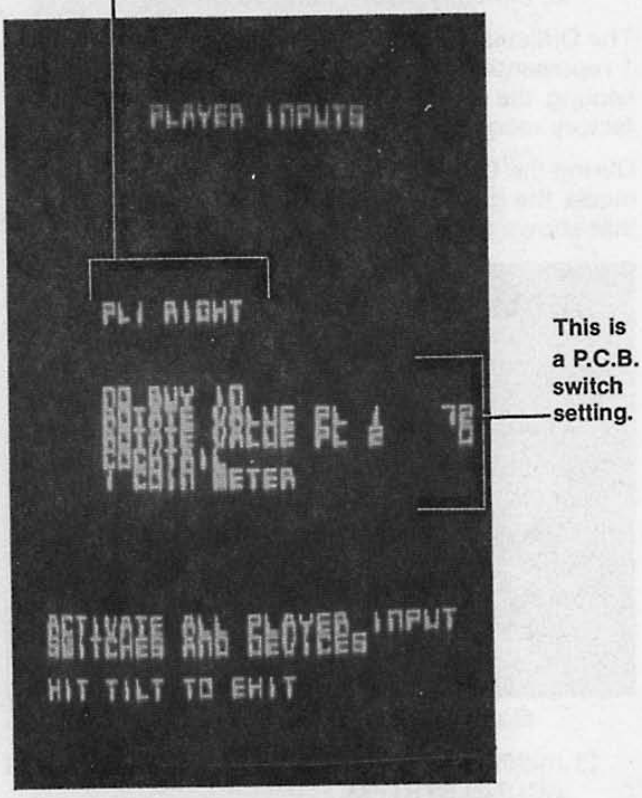


Figure 3-2b Self-Test—Player Input

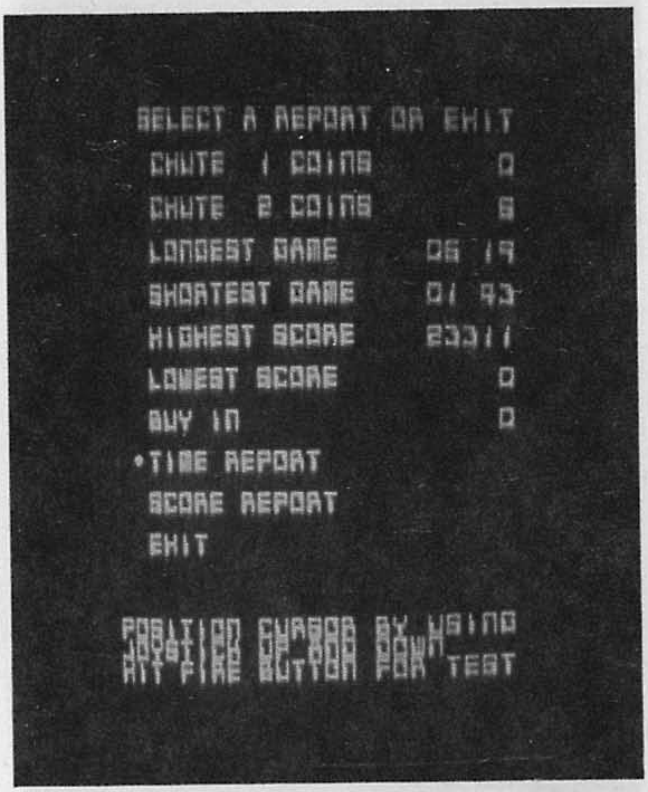


Figure 3-2c Self-Test—Bookkeeping

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

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

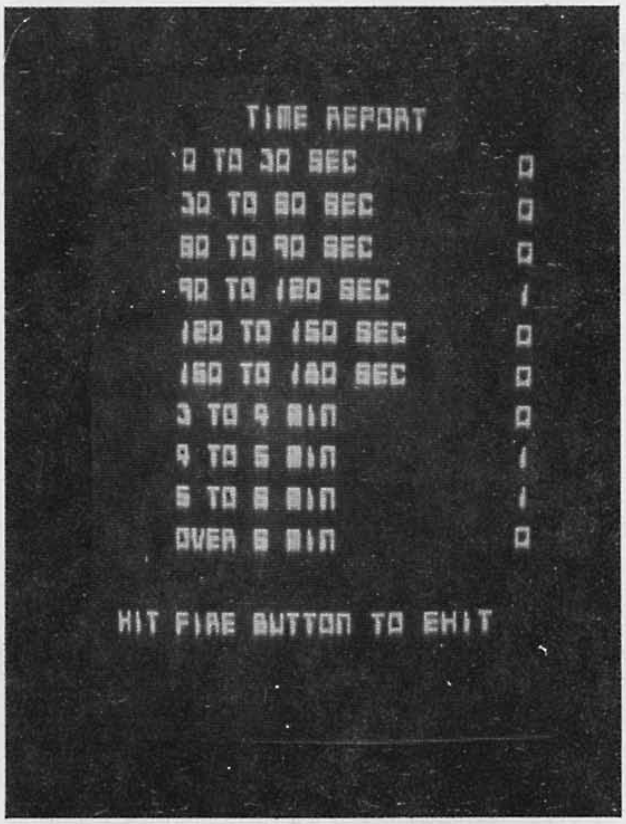


Figure 3-2d Self-Test—Time Report

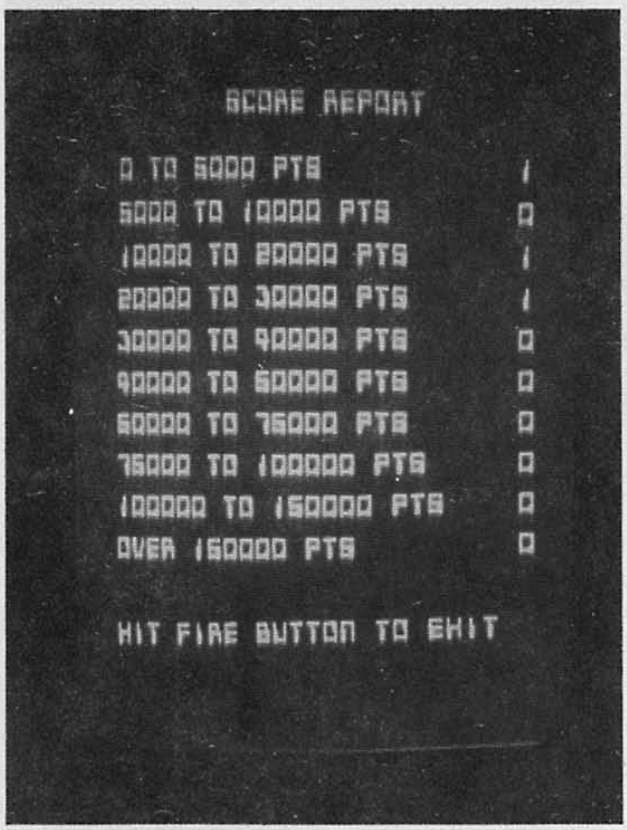
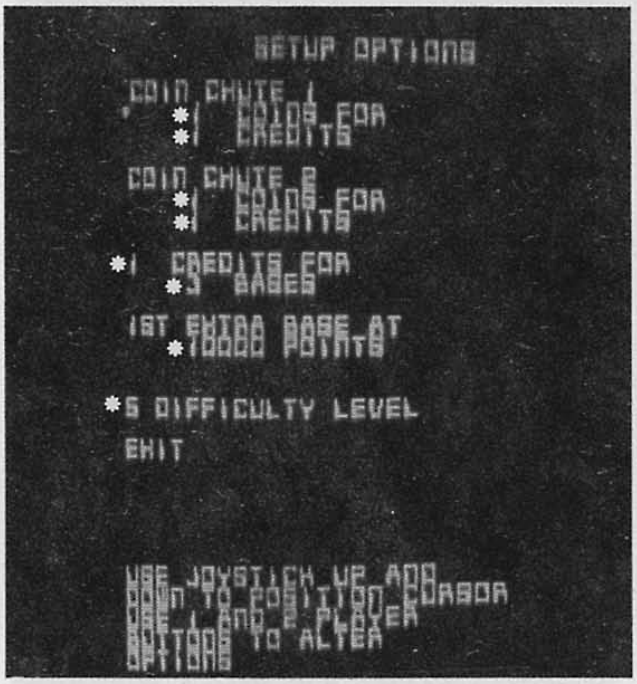


Figure 3-2e Self-Test—Score Report

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



*** = Factory recommended settings.**

Figure 3-2f Self-Test—Setup Options

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

The Difficulty Level setting has a range of 1 to 9 with 1 representing the easiest level of play and 9 representing the most difficult level of play. One is the factory recommended setting.

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

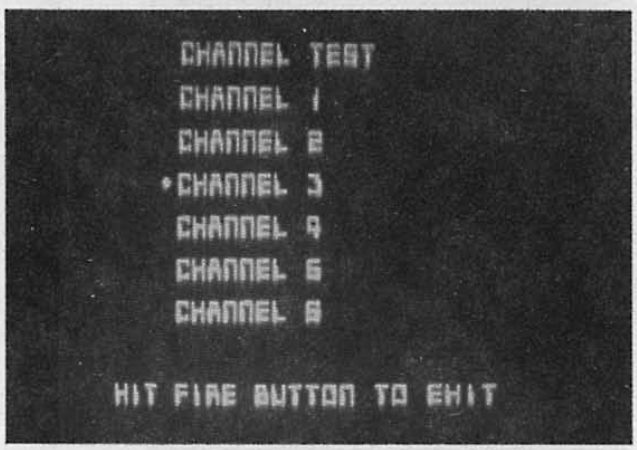


Figure 3-2g Self-Test—Channel Test

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

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

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

To leave the Self-Test mode, simply slide the Self-Test switch to the "OFF" position at **ANY** time. Normal game functions will return to the monitor screen.

RACK ADVANCE:

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

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

CROSS HATCH PATTERN:

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

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

When you are finished using the cross hatch pattern, simply hit the Fire button to return to the Self-Test Mode Menue.

HARDWARE MASTER RESET SWITCH:

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

The function of each of these switches — when pressed — is to make the game think it has **JUST** been turned on. They set up an "initial power-up" condition.

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

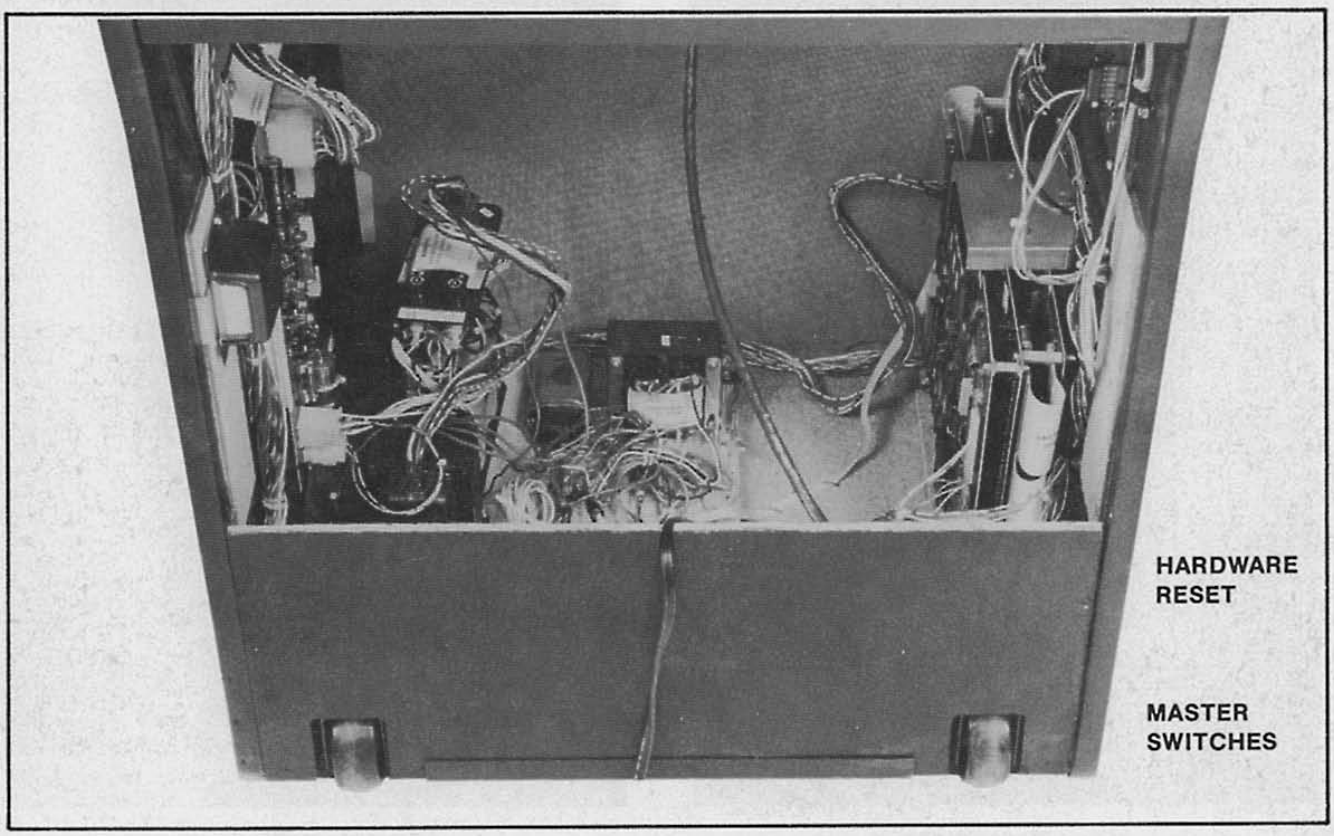
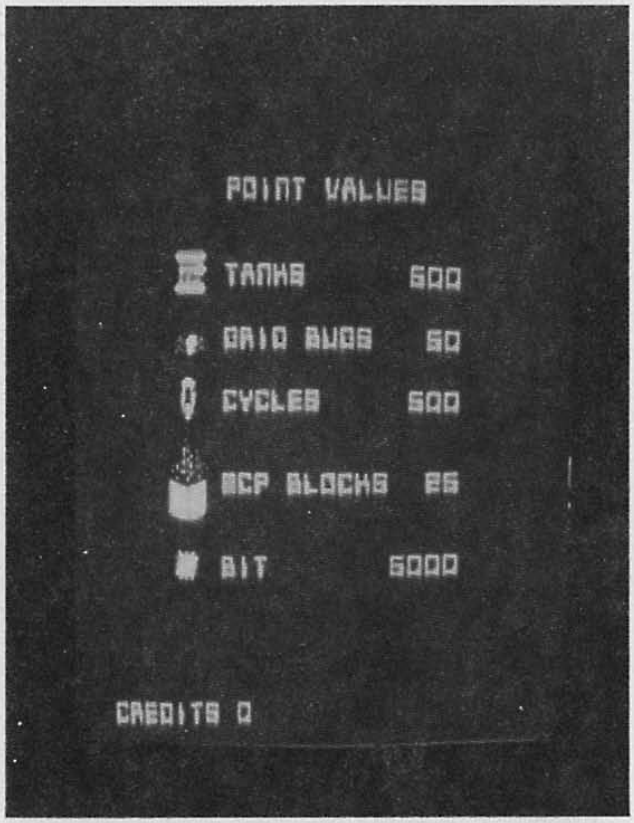


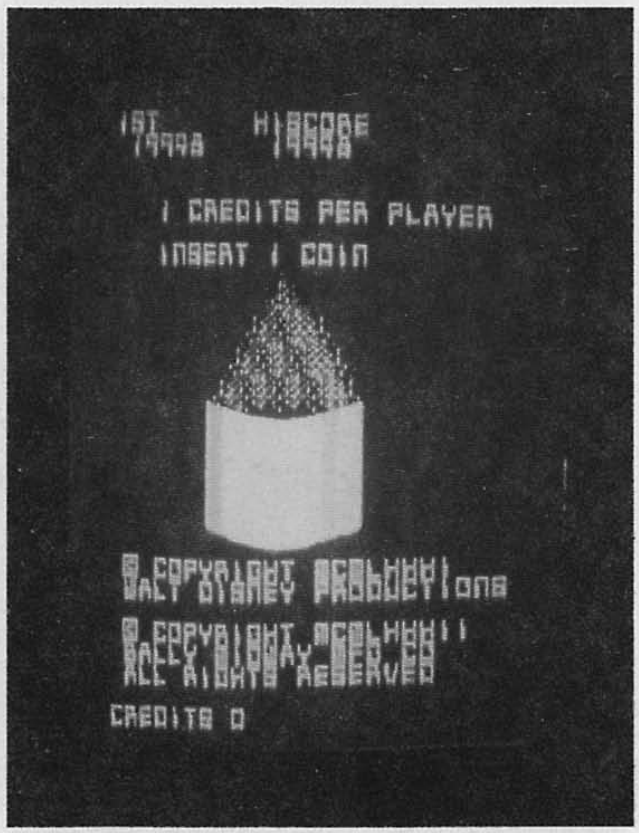
Figure 3-3 Location of Hardware Master Reset Switches

ATTRACT MODE

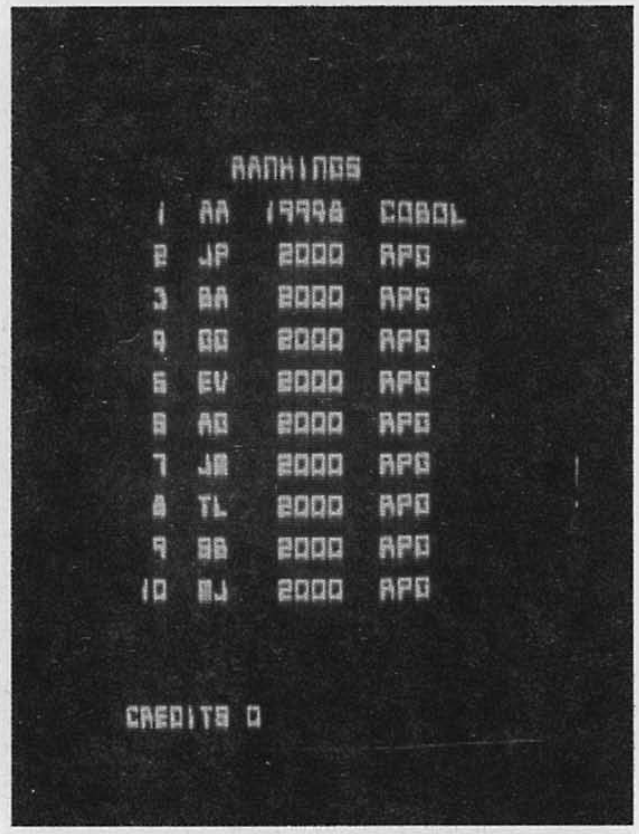
1. The Attract mode starts:
   - ☐ Just after the power has been turned on to the game. (Self-Test switch is in the "OFF" position.)
   - ☐ After a Self-Test has been completed and there are no more credits left in the game's memory.
   - ☐ After a play has been finished, the score was not high enough to put the game into the High Score/Initial mode, and there are no more credits left in the game's memory.
   - ☐ After the High Score/Initial mode when there are no more credits left in its memory.
   - ☐ In the Attract mode, the game will give the following displays **centered** on the monitor screen:
   - ☐ No matter where the game is in the Attract mode sequence, it will immediately go to the following display as soon as a game has been paid for. It will hold this display on the monitor screen until the "1 PLAYER" or the "2 PLAYER" start button is pushed.



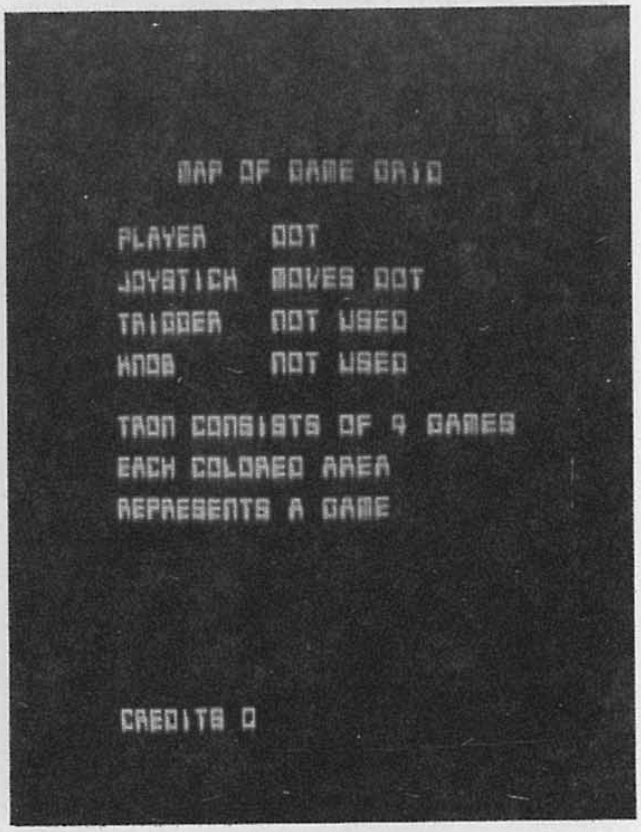
Attract Mode Display 2



Attract Mode Display 1

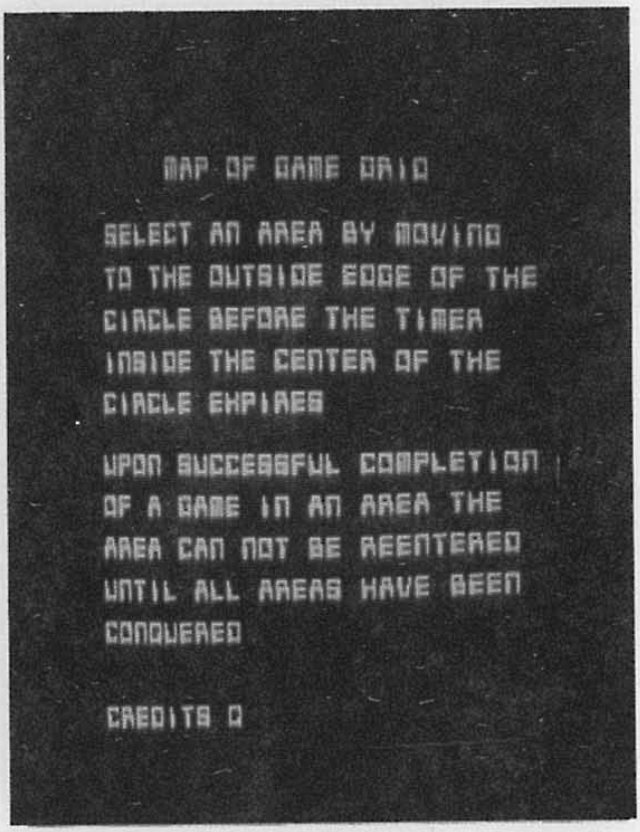


Attract Mode Display 3

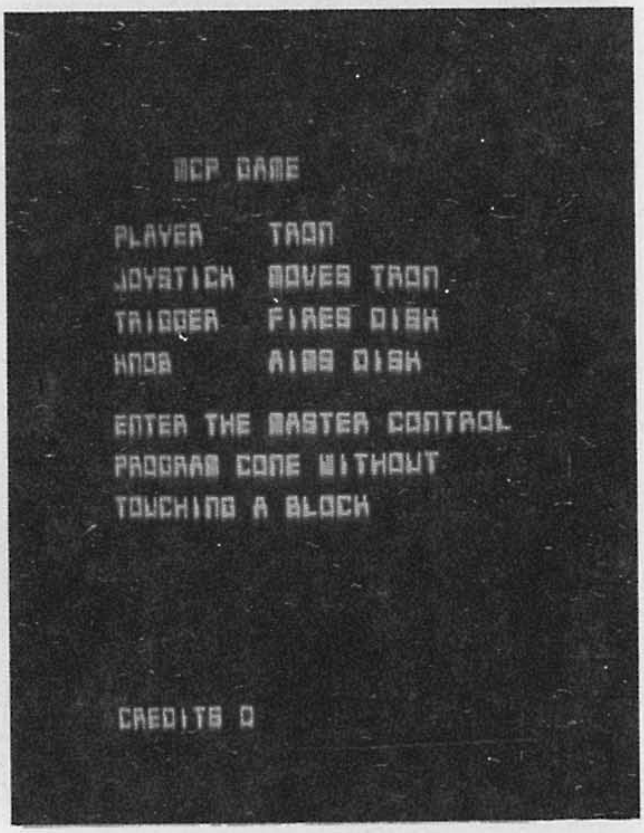


Attract Mode Display 4

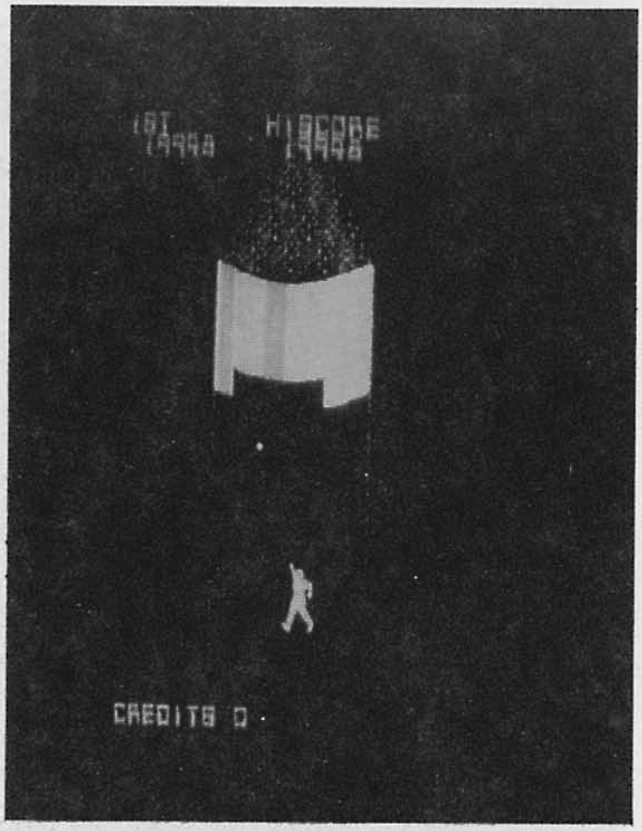
Attract Mode Display 6



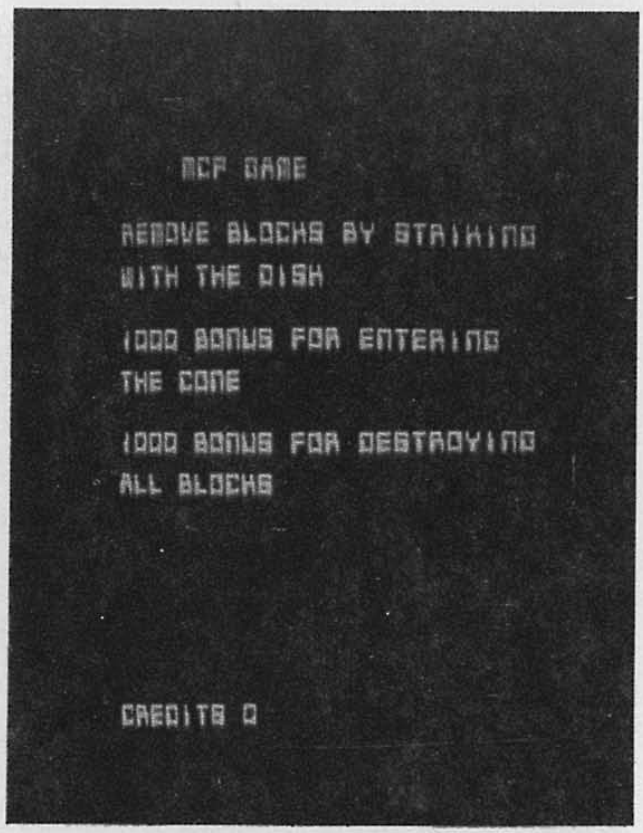
Attract Mode Display 5



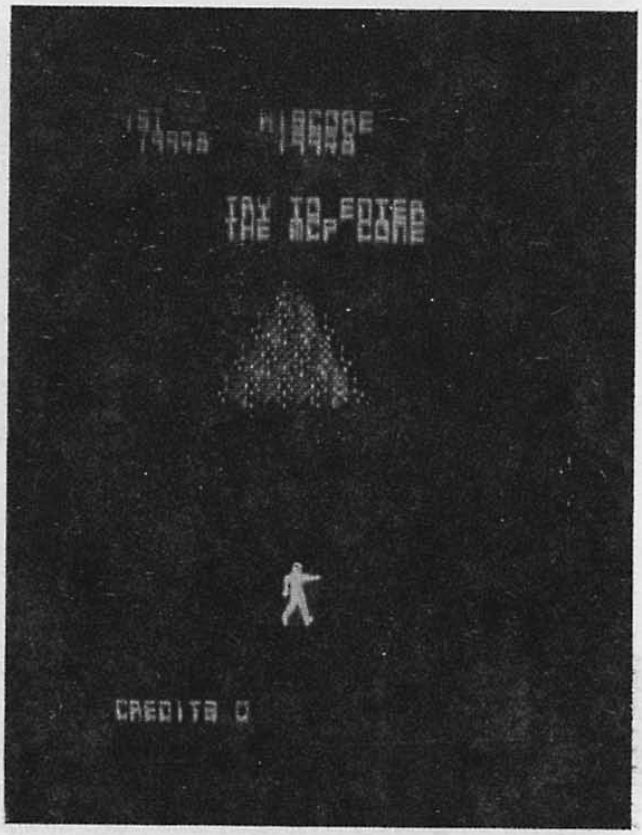
Attract Mode Display 7



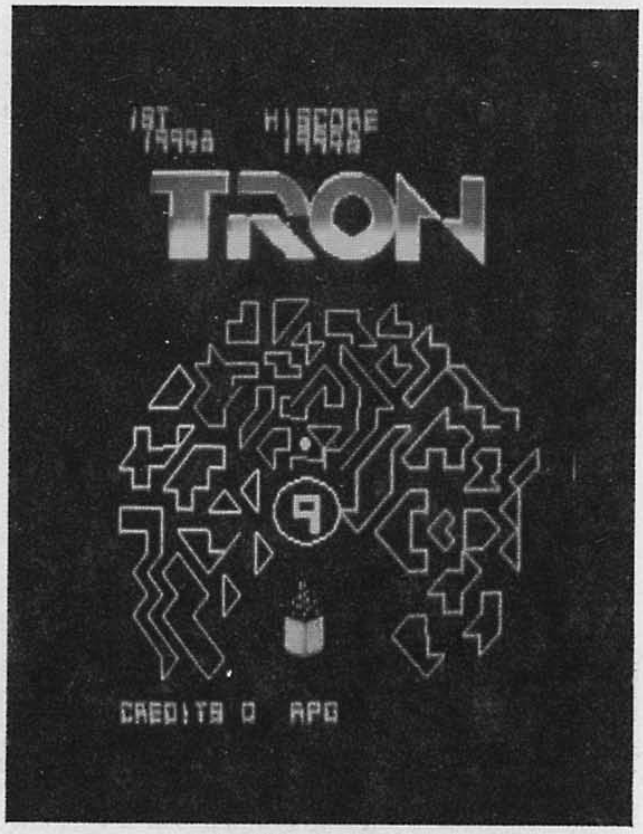
Attract Mode Display 8



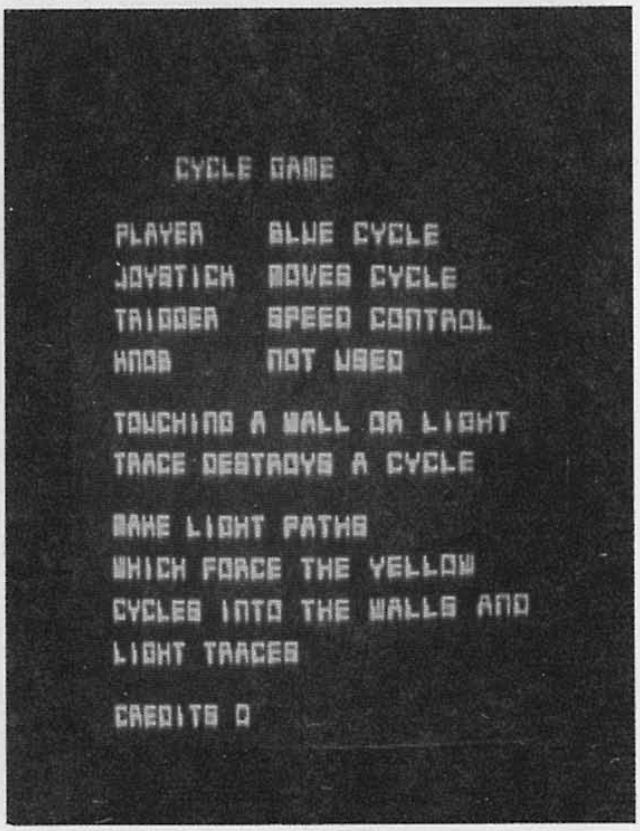
Attract Mode Display 10



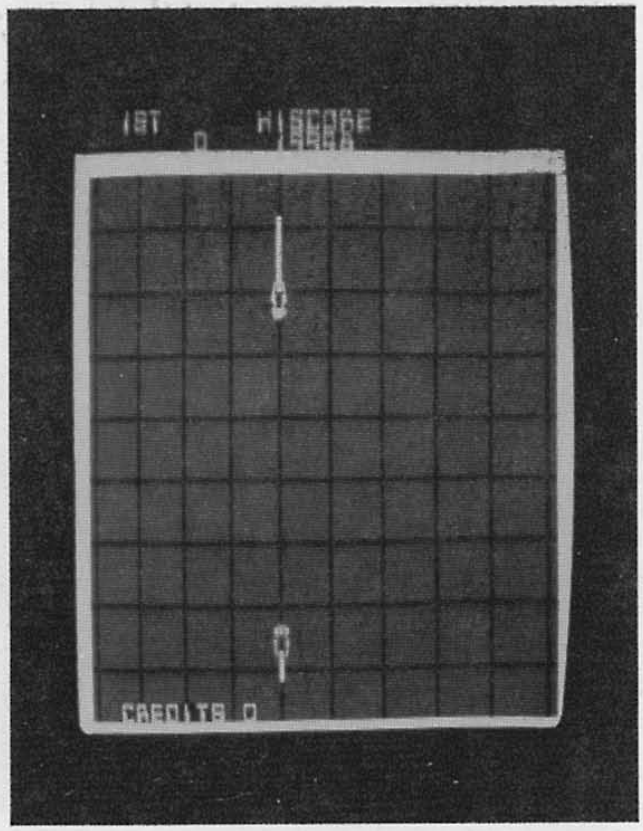
Attract Mode Display 9



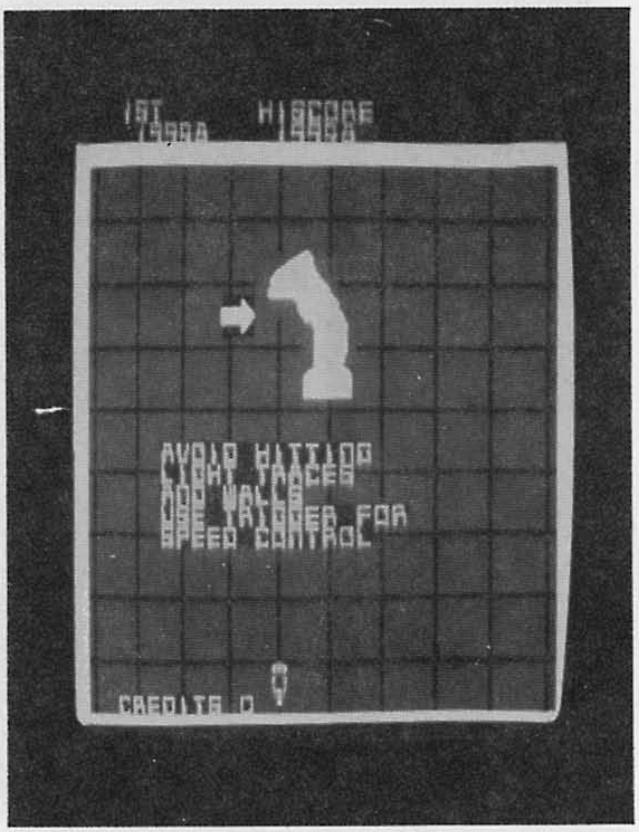
Attract Mode Display 11



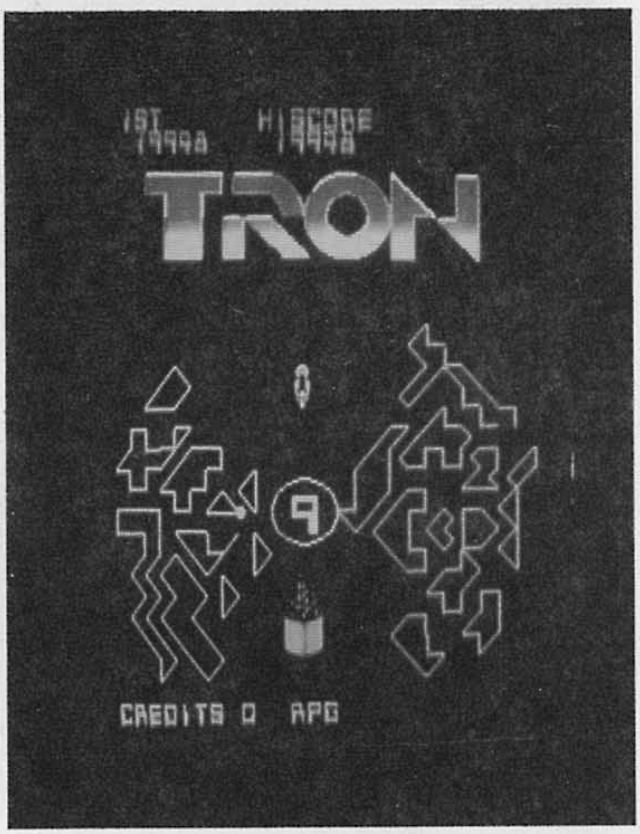
Attract Mode Display 12



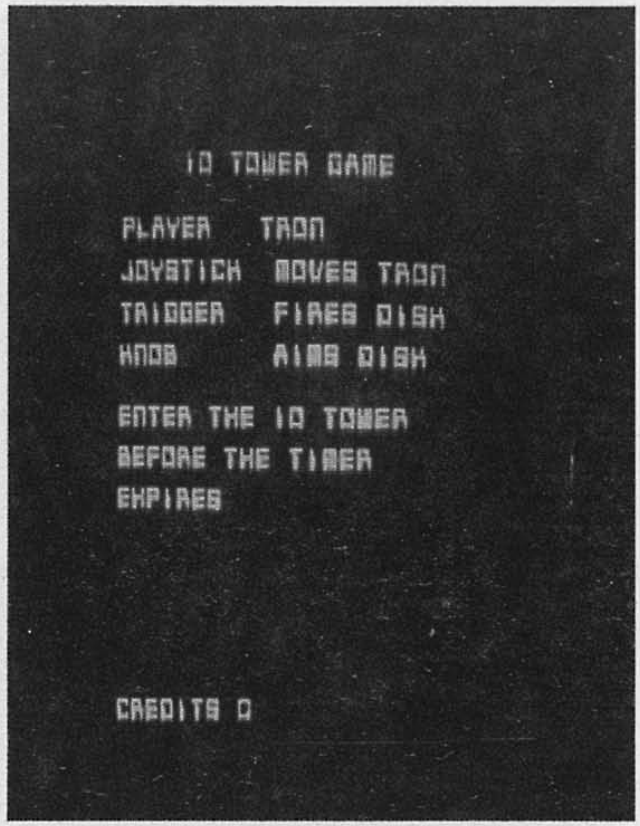
Attract Mode Display 14



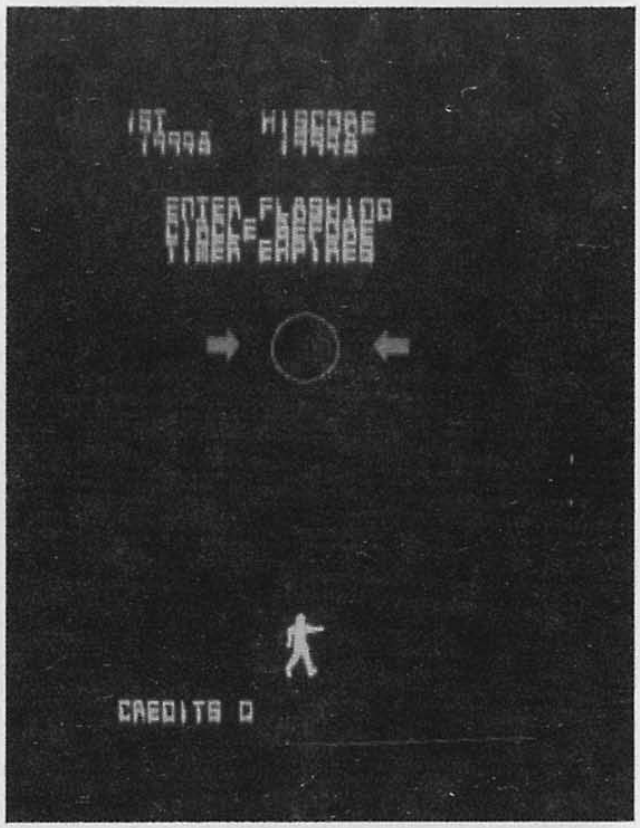
Attract Mode Display 13



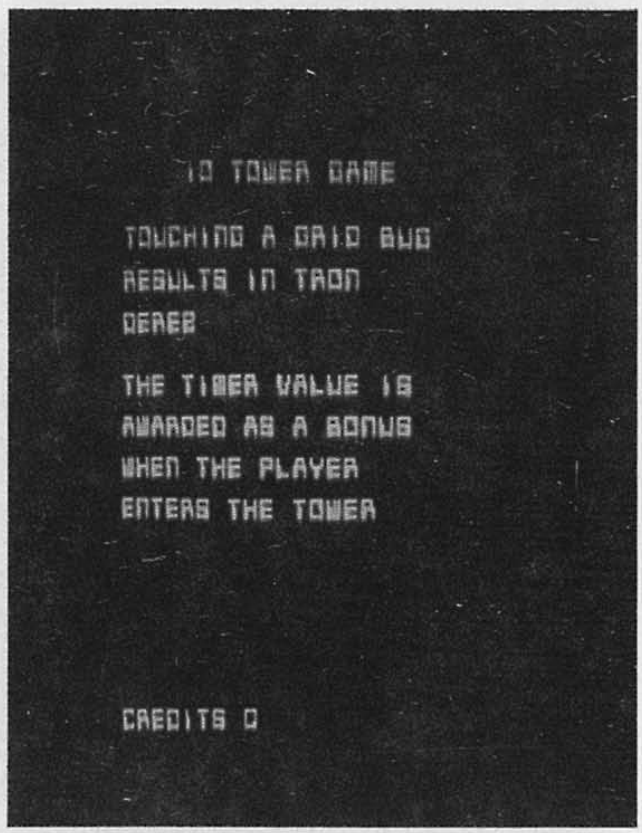
Attract Mode Display 15



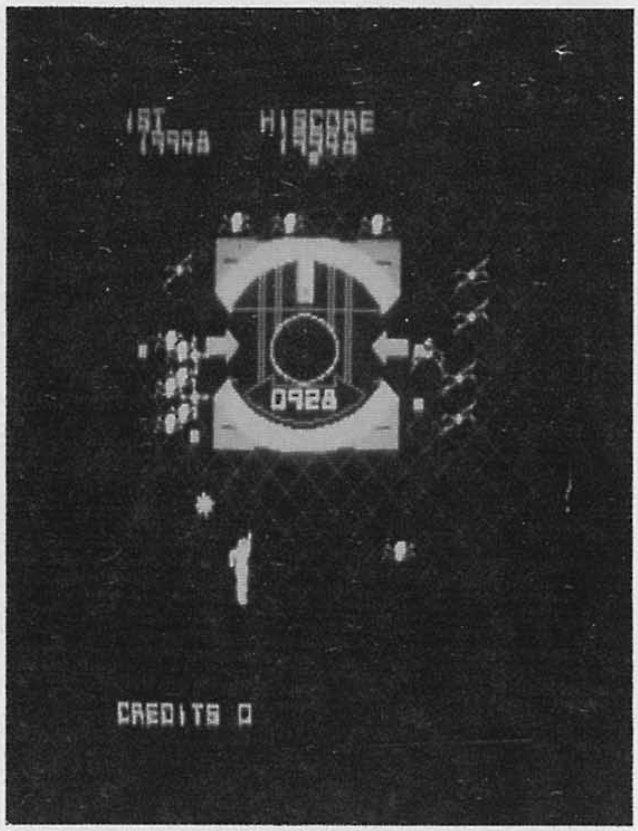
Attract Mode Display 16



Attract Mode Display 18

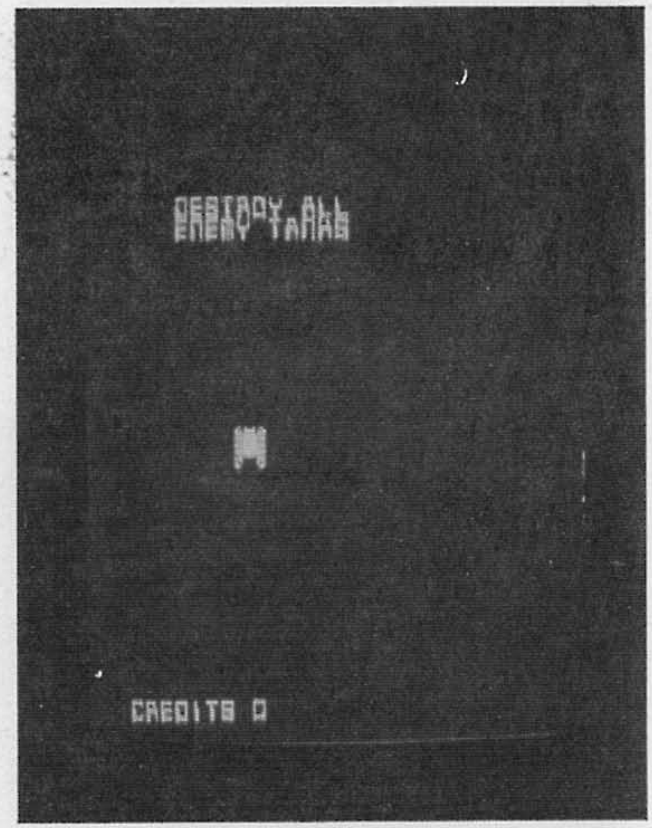


Attract Mode Display 17

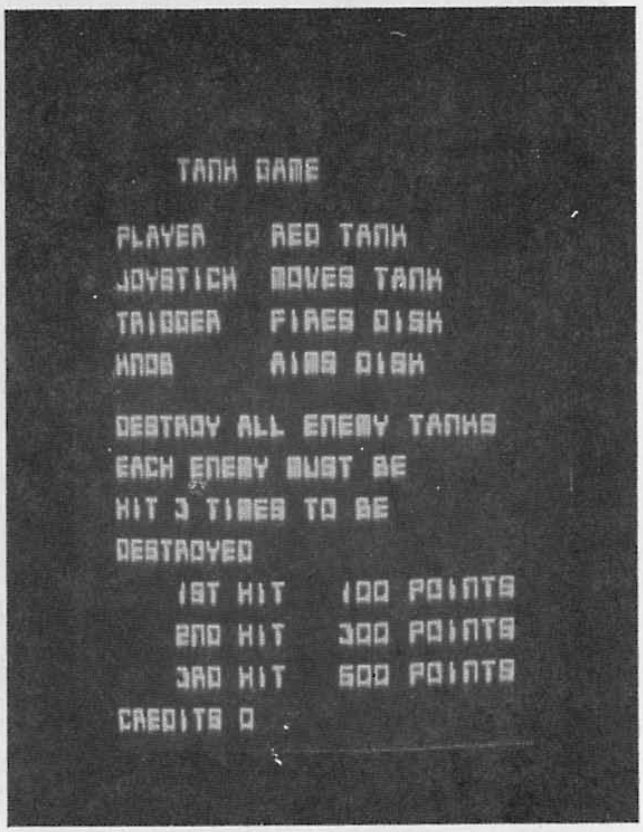


Attract Mode Display 19

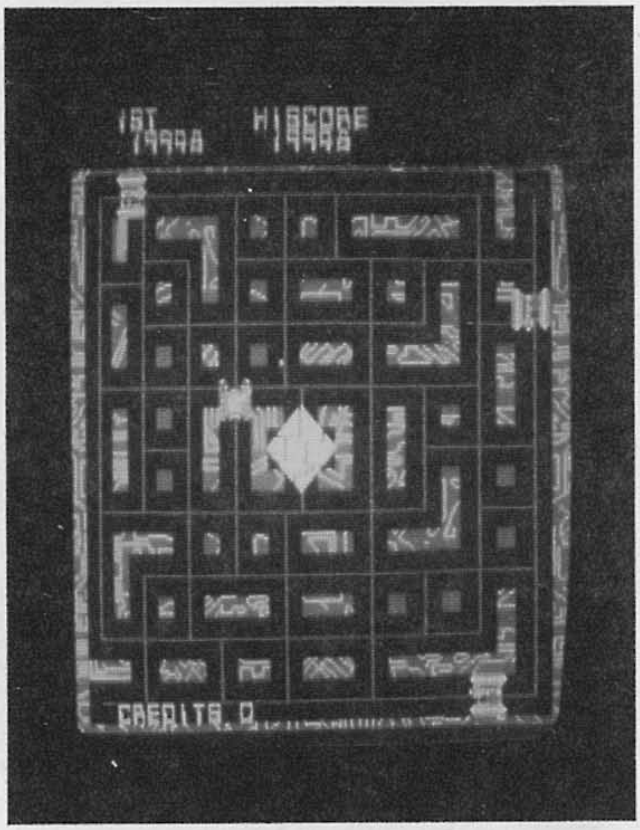
Attract Mode Display 20



Attract Mode Display 22



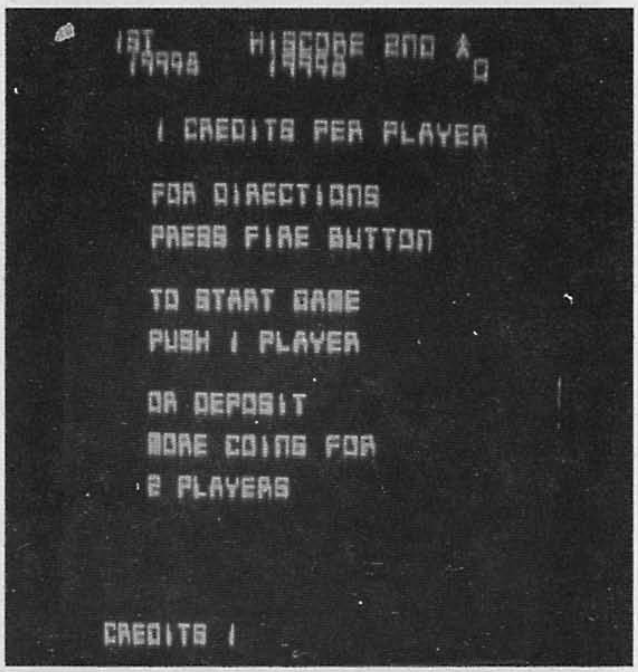
Attract Mode Display 21

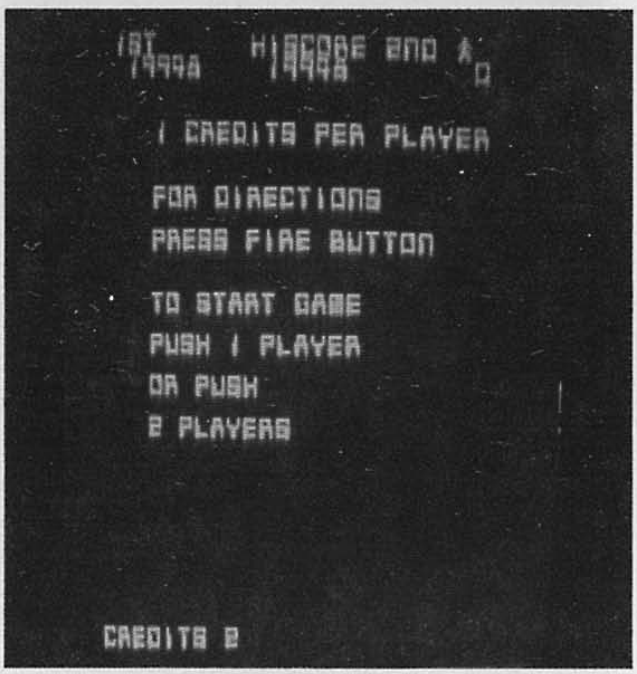


Attract Mode Display 23

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



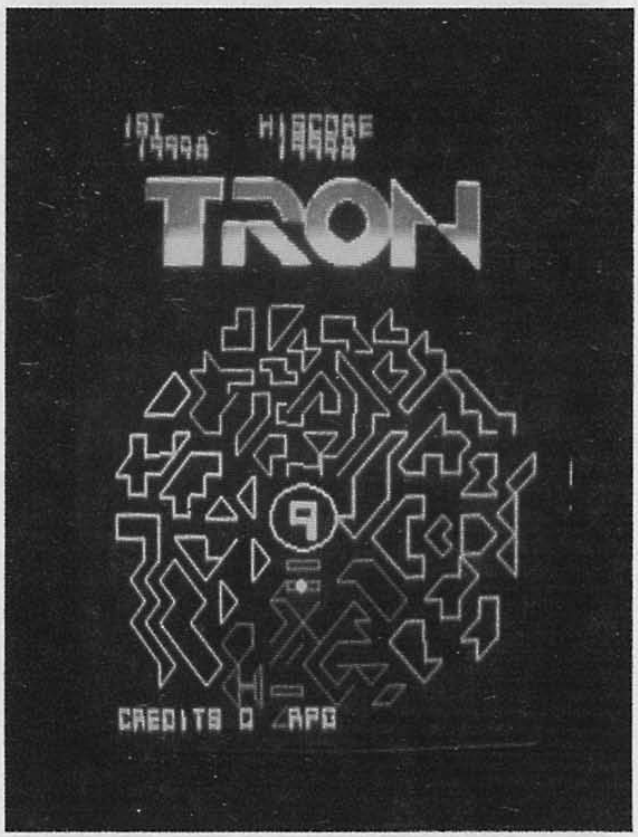


PLAY MODE

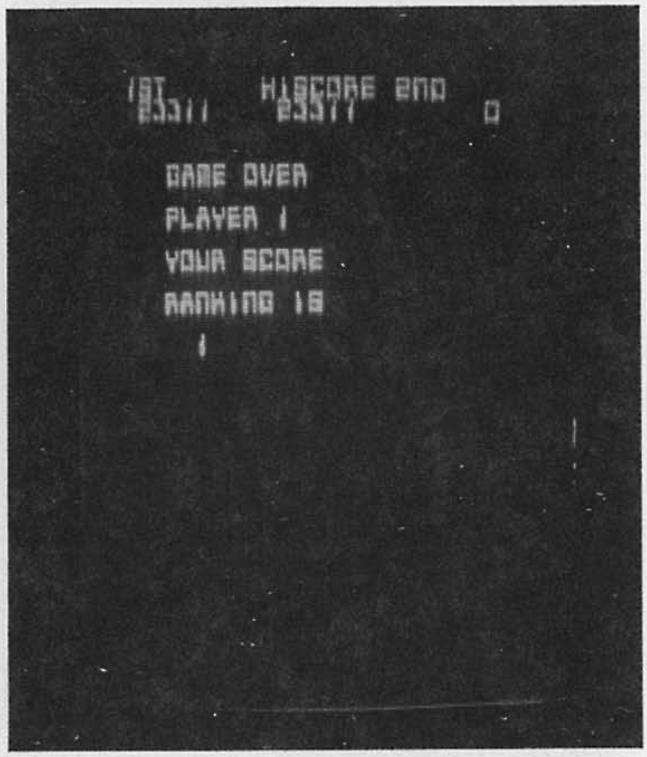
1. The play mode begins when either the "1 PLAYER" or the "2 PLAYER" start button is pressed. When this happens, the following is displayed **centered** on the monitor screen. With the cursor, you must select one of the colored areas at the left, right, top, or bottom of the screen before the timer in the center of the screen reaches zero (timer counts in seconds **BACKWARD** from 10 to 0). This is done by moving the joystick to the left, right, etc. If you do not make the selection in the 10 seconds allowed you, the game will pick for you.

   There are four separate games that must be completed **BEFORE** you can advance to the next rack of the game. This timer/selection sequence is repeated after you have completed each game of a rack and after you have lost a player in one of the games of a rack.

   Once any particular game in the rack you are playing has been completed successfully, you cannot play it again until you successfully complete the other remaining games of the rack you are in.



2. The Play mode ends when you have no more participants left to carry on with. When this happens, the following is displayed **centered** on the monitor screen.



3. TRON is made up of racks. There are 12 racks in all and the name of each is spelled out at the bottom center of the monitor screen when you are in it. The names of these racks are (from the easiest to the hardest, respectively): 1) RPG, 2) COBOL, 3) BASIC, 4) FORTRAN, 5) SNOBOL, 6) PL1, 7), PASCAL, 8) ALGOL, 9) ASSEMBLY, 10) OS, 11) JCL, and 12) USER. Each rack contains 4 **SEPARATE** games: "TANKS", "LIGHT CYCLES", "M.C.P. BLOCKS", and "GRID BUGS".

   You **MUST SUCCESSFULLY COMPLETE EACH** of the separate games that make up a particular rack **BEFORE** you can be advanced to the next rack which will consist of the same 4 games — but they will be harder to complete successfully.

   Game selection is random. For instance, if you always pull back on the joystick when you enter a new rack, you **WILL NOT** always get the same game. One time it could be Tank's, the next it might be Grid Bugs, and so on.

   TANKS: In this game you are driving the light colored Tank. The knob on the control panel aims the Tank's gun. The joystick controls your Tank's direction of travel and the trigger on the joystick fires your Tank's gun. **ALL** enemy Tanks (dark blue or rust colored) must each be hit 3 times to be eliminated. However, they only have to hit your Tank 1 time to eliminate you.

   The rust colored enemy Tanks **DO NOT** shoot at you but they do travel at a very fast speed and will try to ram you. If they (or a blue one for that matter) touch your Tank, you've had it.

LIGHT CYCLES: In this game you are driving the blue Light Cycle. Wherever you go with it you leave a trail of blue light. Your opponents are driving the Yellow Light Cycles (anywhere between 1 and 3 of them).

The knob on your control panel has **NO EFFECT** in this game. The joystick controls the direction your Light Cycle will go. The trigger on the joystick controls the speed of your Light Cycle. If you pull it, your Light Cycles speed will be approximately doubled. If you release it, you will slow down again.

You cannot stop or back up. You cannot touch their light trail, the walls, or your own light trail. If you do, you will be eliminated. You must out maneuver your opponents, causing them to run into the walls, your light trail, or their own light trail. This will eliminate them.

MCP BLOCKS: In this game you are placed under a rotating multicolored cylinder which has a cone on top of it. This descends on top of you and you cannot get out from underneath it. You have 2 choices: 1) shoot out all the blocks the descending multicolored cylinder is made of and then enter the cone at its top or 2) shoot a passageway through the blocks of the descending multi colored cylinder and enter the cone at its top through the passageway you just cleared. The latter of these two choices is very tricky to say the least. If you are touched by any part of the multicolored blocks in the rotating cylinder you will be disintegrated.

As above, the joystick controls Tron's movements to the left, right, and up or down. The knob on the control panel moves Tron's arm. Pulling the trigger on the joystick fires Tron's weapon in the direction that his arm is pointing.

GRID BUGS: In this game you are placed on a grid which has an I/O Tower (Input/Output Tower) at its center and Grid Bugs all around it. The I/O Tower is equipped with a counter that counts backward from 1000 to 0 at a high rate of speed. This is equal to about 35 seconds.

As above, the joystick controls Tron's movements to the left, right, and up or down. The knob on the control panel moves Tron's arm. Pulling the trigger on the joystick fires Tron's weapon in the direction that his arm is pointing.

The object of this game is to shoot as many Grid Bugs as you can during the allotted time while working your way to the entrance to the I/O Tower. You must enter the I/O Tower before the counter reaches zero. If you fail to enter the I/O Tower before the time runs out — or — if you are touched by a Grid Bug, you will be disintegrated.

4. **FIRST RACK PLAY:** Just after you push the 1 or 2 player button, the message displayed below is shown **centered** on the monitor screen:

"BONUS BASES AWARDED"
"AT 10000 POINTS"

Immediately after this, the game selection display is presented. After you select a game — or — after one is selected for you, the game appears on the screen and play begins.

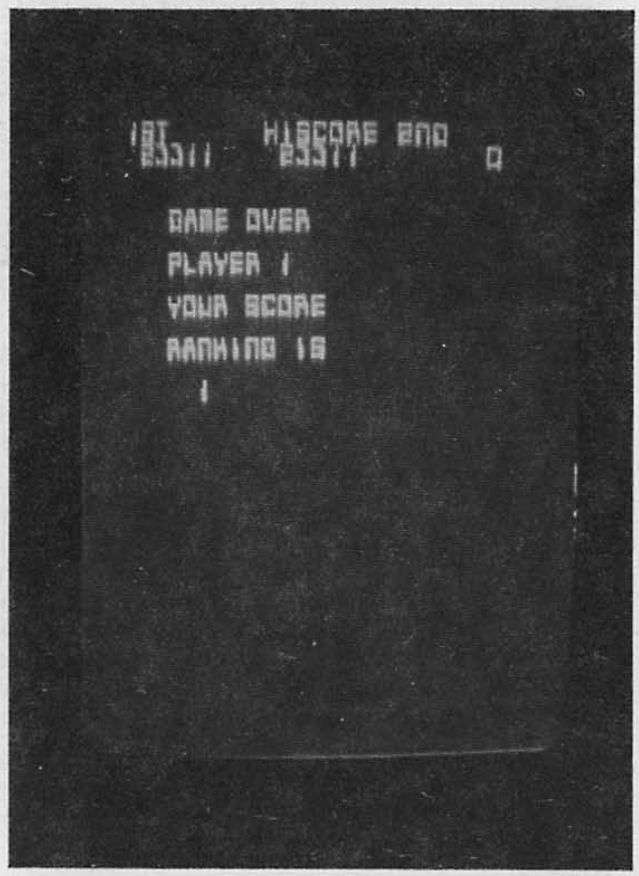
When you successfully complete a game, the game selection display is presented to you again. It will look similar to the one shown below. This time you will not be able to pick the game you just completed successfully. You are only allowed to pick one of the three remaining games.

When you lose a player in one of the games you selected, the game selection display is presented to you again. This time you have the option of picking the game where you just lost a player or of picking one of the games you have not tried yet.

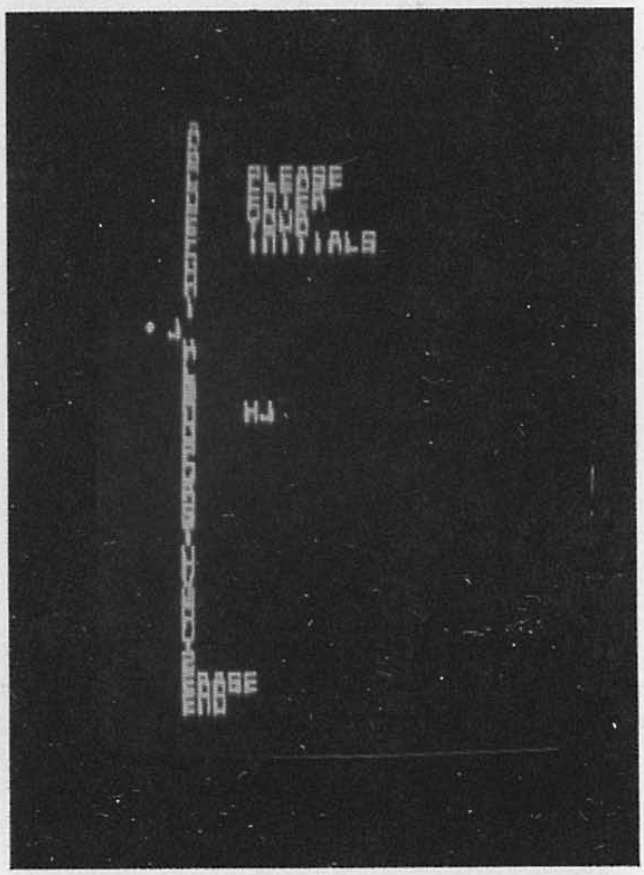
5. **SECOND RACK PLAY:** The Second Rack begins immediately after you have successfully completed the last of the 4 games in the preceding rack. This is indicated to the player by the presentation of a new game selection display which has a different level name spelled out at the bottom center of the monitor screen. The message about bonus bases is not repeated. The games of the Second Rack are selected in the exact same manner as in the First Rack. This pattern is repeated from this point on throughout the game.

6. As you improve your skills and become better and better at the game, advancing into the more difficult racks, you will notice that the number of opponents you have per game of each rack will increase and that they will become smarter, trying to trap you, sneak up behind you, catch you in a cross fire, etc.

When you are eliminated in one of the games and you have **NO MORE** reserve Trons, these words are displayed **centered** on the monitor screen.



If your score was high enough to become one of the ten best scores, the game will go into the High Score/Initial mode immediately after the above display. If your score is not high enough to cause the game to go into the High Score/Initial mode, it will either go to the Attract mode (if there are no more credits left in its memory) or into the Ready-To-Play mode (if there are still credits left in its memory). In the High Score/Initial mode the game gives a display which looks like the following:



By pulling back on the joystick, you can make the cursor move down the alphabet: "A", "B", "C", "D", etc. By pushing forward on the joystick, you can make the cursor move up the alphabet: "Z", "Y", "X", "W", etc.

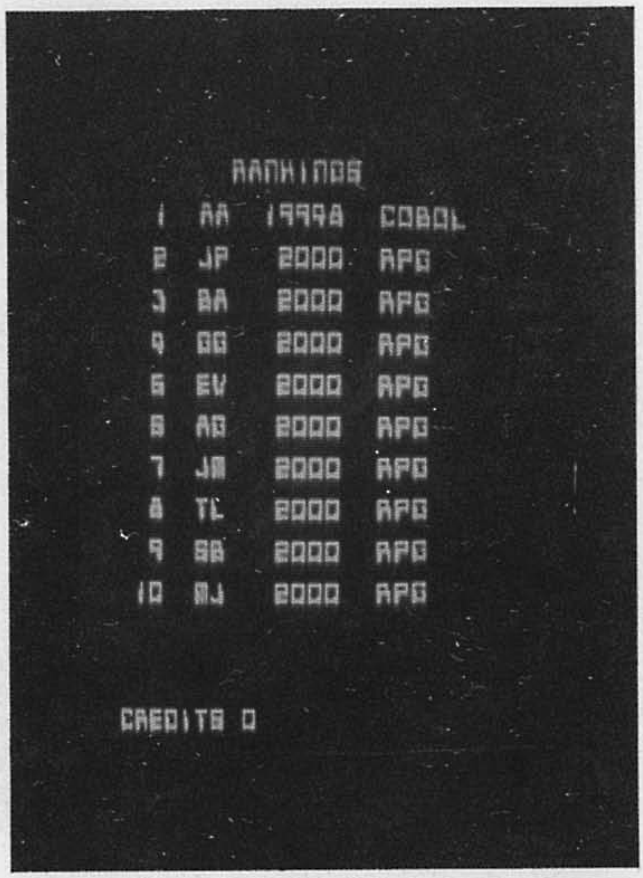
When you reach your initial, release the joystick and pull the trigger. Your initial is printed out below the on-screen instructions. If you do not wish to put your initials opposite your score, just pull the trigger two times. Two "A"'s will appear below the on-screen instructions. Or — you can push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

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

When you've printed out your last initial, move the cursor opposite the "END" word and pull the trigger to tell the game you are through printing out your initials. The game will then give either the Attract mode display or the Ready-To-Play mode display — depending on whether it has any credits still remaining on it.

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

If you are wondering how well you did "point wise" as compared to the other 9 best players, the rankings display will show you. This display is part of the Attract mode sequence and it is also part of the "Instructions" sequence in the Ready-To-Play mode.



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

TWO PLAYER OPERATION

The Upright, Mini, and Cocktail Table models all have two player operation.

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

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

ELIMINATED PARTICIPANT — OTHERS REMAINING IN RESERVE

- ☐ The game stops and "PLAYER _____ UP" is displayed near the top of the monitor screen.
- ☐ Next, the other player's game selection display appears on the screen and play begins.

ELIMINATED PARTICIPANT — NO OTHERS REMAINING IN RESERVE

- ☐ Game displays:

  "GAME OVER"
  "PLAYER _____"
  "YOUR SCORE"
  "RANKING IS"
  "_____"

  centered on the monitor screen.

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

  After this mode, "PLAYER _____ UP" and the other player's game selection display appears on the monitor screen. Play then begins for the other player.

  If your score was **NOT** high enough to cause the game to go into the "HIGH SCORE/INITIAL" mode, the game will tell you what your "SCORE RANKING" is, display "PLAYER _____ UP", and the other player's game selection displays on the monitor screen. Then play begins for the other player.

IV Maintenance and Repair

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

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

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

CLEANING

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

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

FUSE REPLACEMENT

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

1. **UPRIGHT MODEL:**
   As viewed from the back, facing the cabinet, with the lower rear access door removed; the fuses are located on the Mech. Panel and the Power Supply Board.
2. **MINI MODEL:**
   As viewed from the back, facing the cabinet, with the rear access door removed; the fuses are located on the Mech. Panel and the Power Supply Board.
3. **COCKTAIL TABLE MODEL:**
   As viewed from the coin door side of the cabinet, with the monitor tilted open to one side; the fuses are located on the Mech. Panel and the Power Supply Board.

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

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

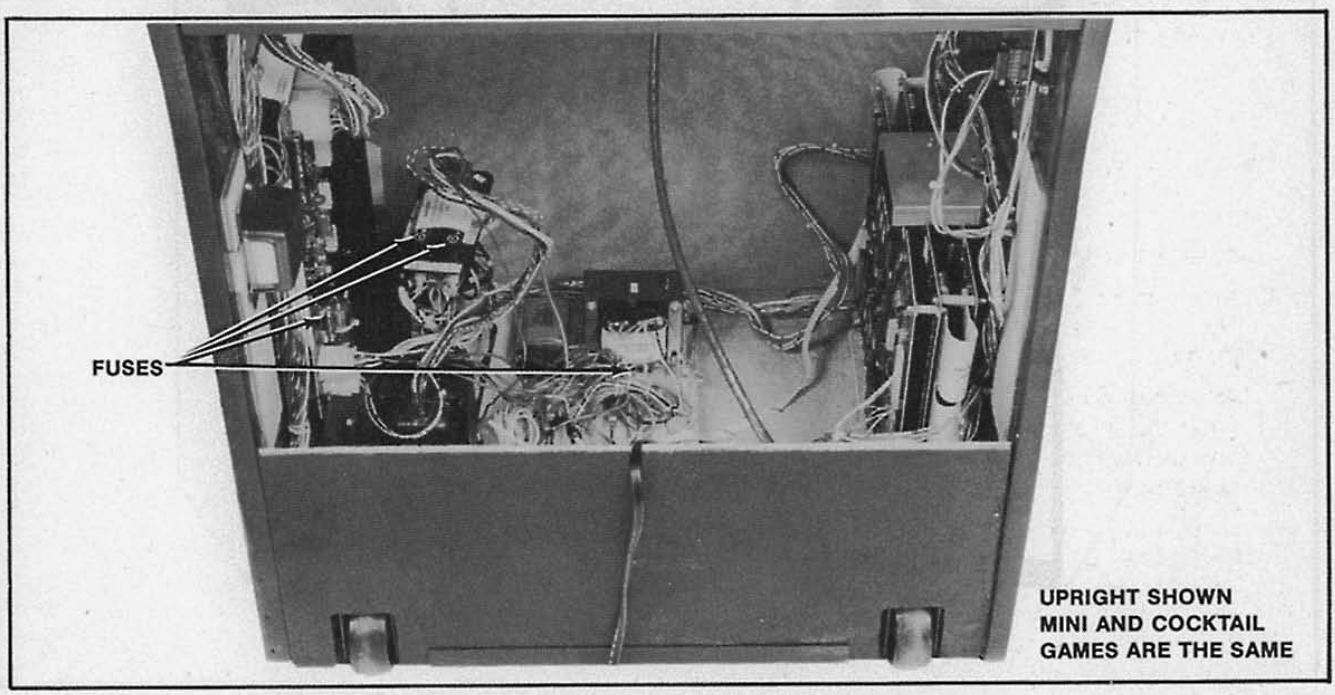


Figure 4-1 Location of Fuses

OPENING THE CONTROL PANEL

1. UPRIGHT MODEL: See Figure 4-2.

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

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

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

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

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

- ☐ To remove the control panel:

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

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

  The control panel is now free and can be removed.

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

2. MINI MODEL: See Figure 4-2.

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

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

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

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

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

- ☐ To remove the control panel:

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

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

  The control panel is now free and can be removed.

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

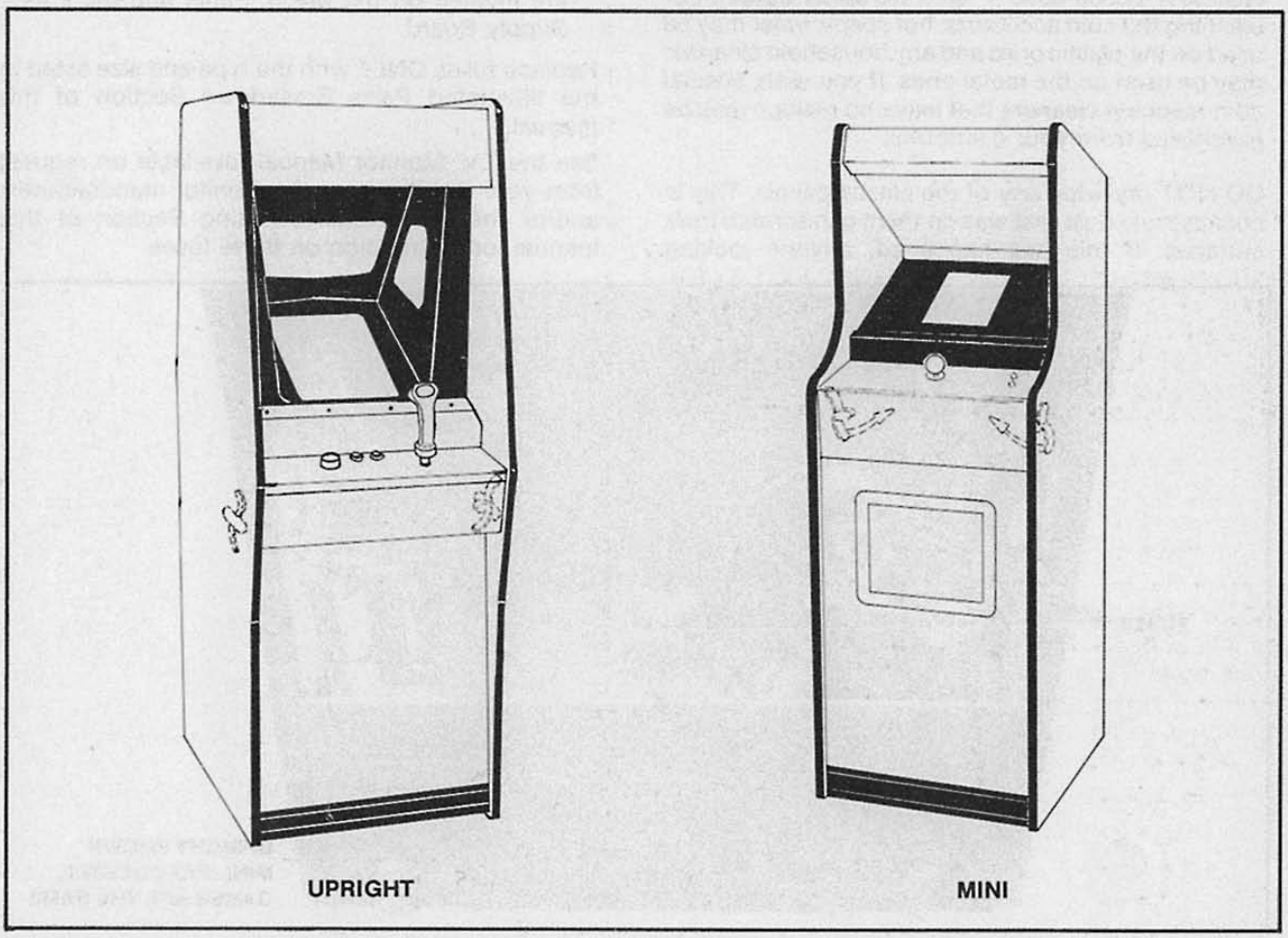


Figure 4-2 Opening the Control Panel — Upright & Mini

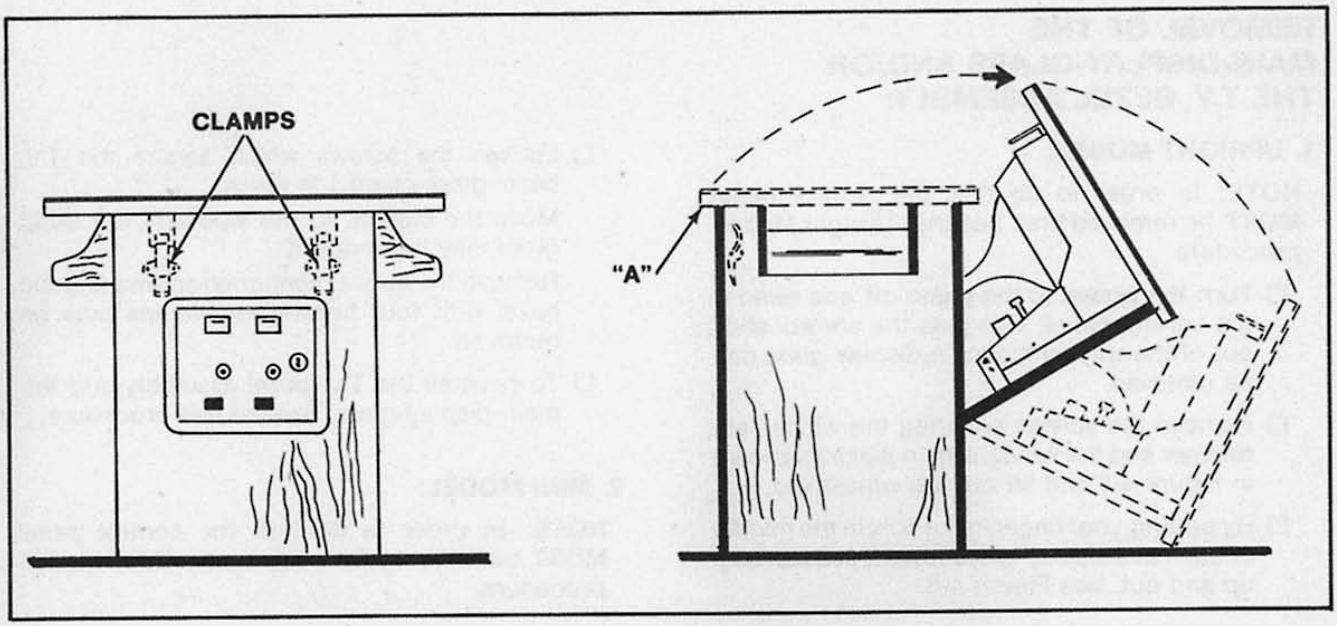


Figure 4-3 Opening the Cocktail Game

3. COCKTAIL TABLE MODEL:

☐ 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. BE CAREFUL!!

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

Grasp the table top at "A" and open is 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.

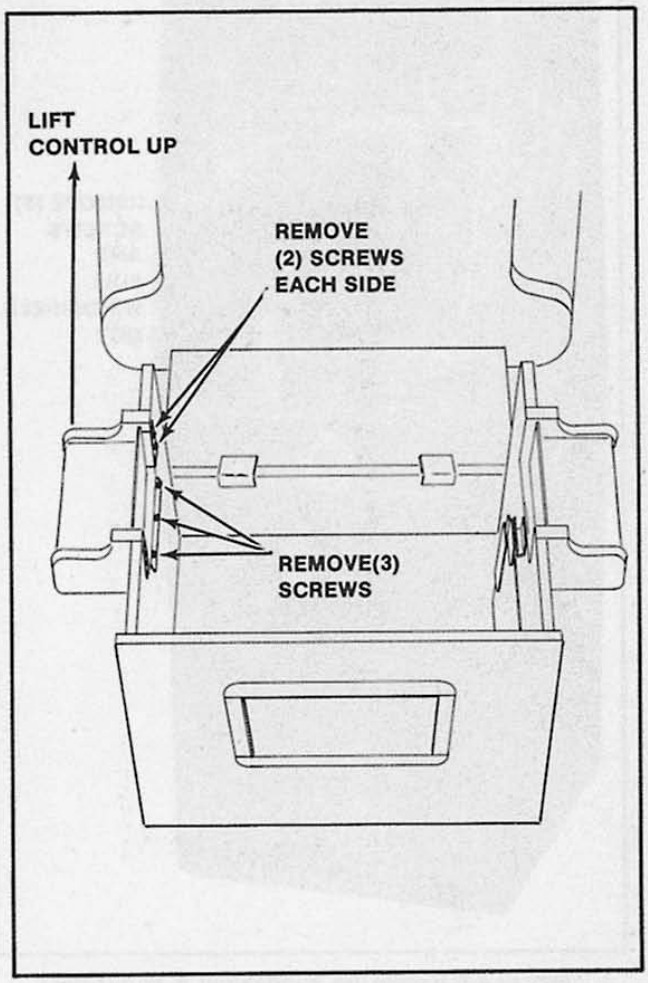


Figure 4-4 Removing the Control Panel — Cocktail

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

1. UPRIGHT MODEL:

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

- ☐ **Turn the power to the game off** and remove the control panel. This gets the control stick out of the way so the main-display-glass can be removed.
- ☐ Remove the screws securing the windshield retainer and the windshield in place as shown in Figure 4-5 and lift out the windshield.
- ☐ By putting your finger in the hole in the middle of the main-display-glass suport, you can lift it up and out. See Figure 4-6.
- ☐ Loosen the screws which secure the T.V. bezel-glass-clamps in place.

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

  Remove the above mentioned screws and the bezel with four bezel-glass-clamps may be removed.
- ☐ To reinstall the T.V. bezel assembly and the main-display-glass, reverse this procedure.

2. MINI MODEL:

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

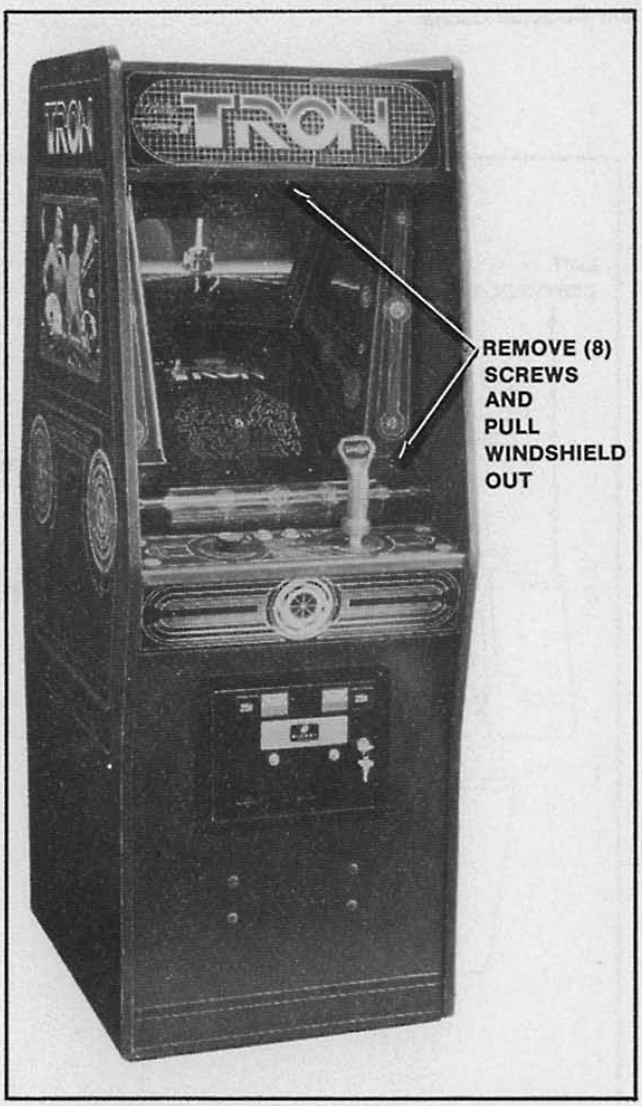


Figure 4-5 Removing Windshield & Windshield Retainers — Upright

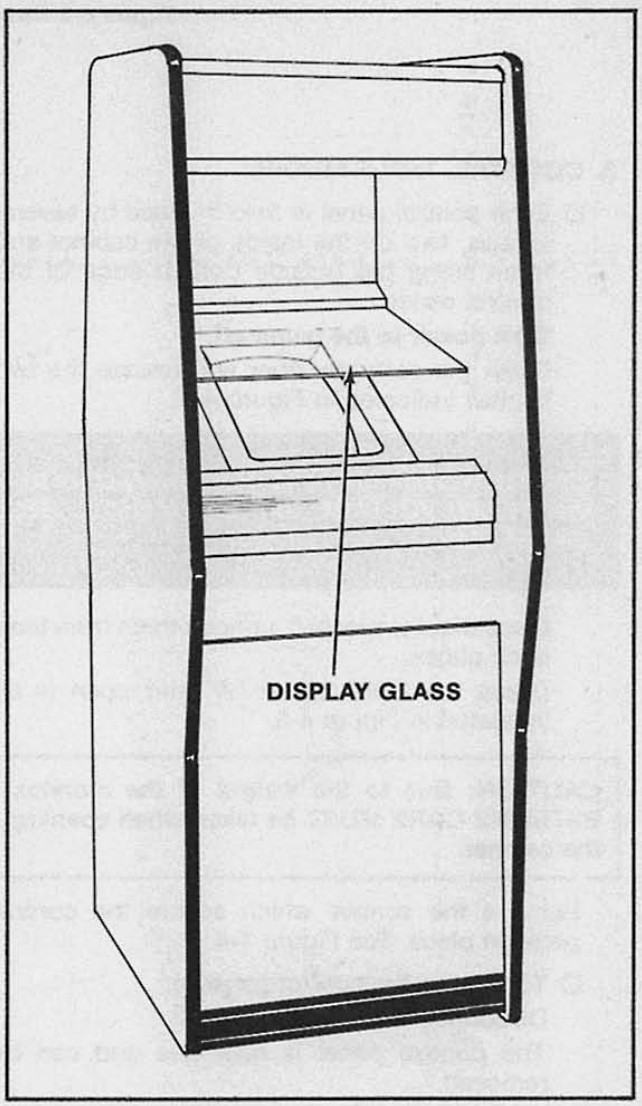


Figure 4-6 Removing Main-Display-Glass & T.V. Bezel — Upright

- ☐ **Turn the power off the game** and remove the control panel.
- ☐ Remove the screws which secure the glass clamping plate. See Figure 4-7.
- ☐ Lift out the glass clamping plate. This frees the main-display-glass so it can be lifted up.
- ☐ By putting your finger in the hole in the middle of the main-display-glass support, you can lift it up and out.
- ☐ Remove the screws which secure the T.V. bezel assembly and lift it out.

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

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

3. COCKTAIL TABLE MODEL:

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

- ☐ Remove the screws which secure the table top glass clamps in place. See Figure 4-8.
- ☐ Remove the table top glass.
- ☐ Lift out the T.V. bezel assembly.
- ☐ To reinstall the T.V. bezel assembly and the table top glass, simply reverse this procedure.

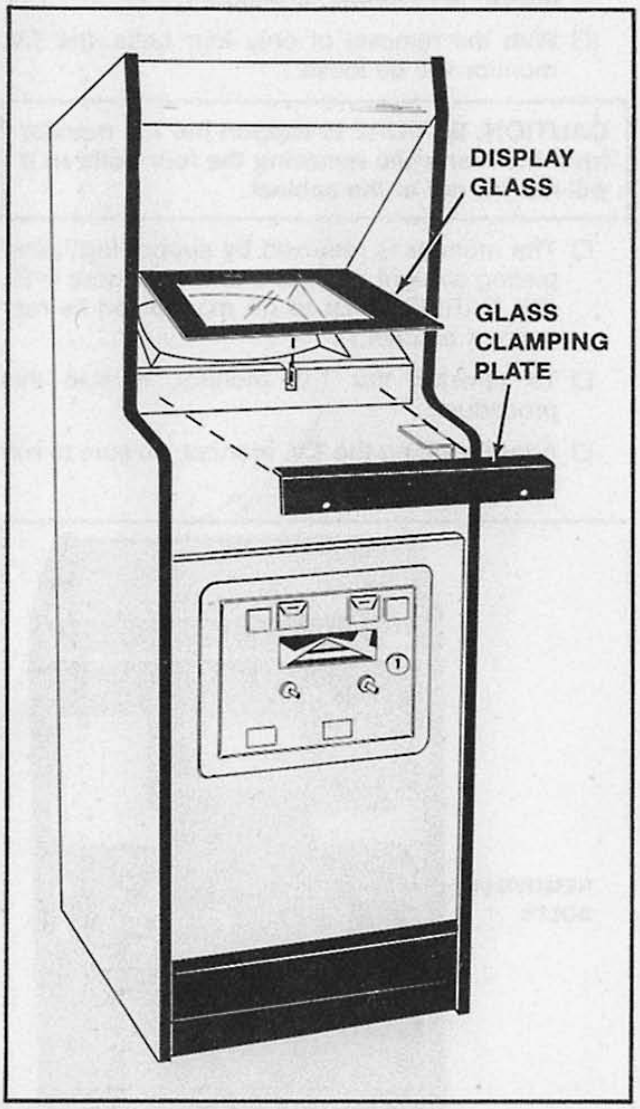


Figure 4-7 Removing Main-Display-Glass & T.V. Bezel — Mini

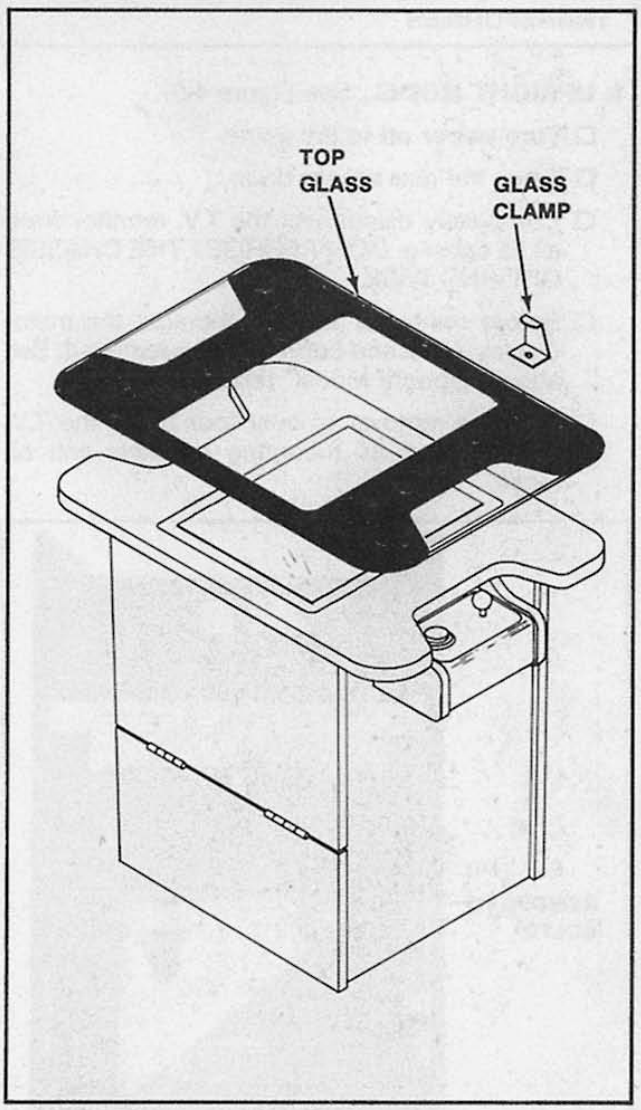


Figure 4-8 Removing Top Glass & T.V. Bezel — Cocktail

T.V. MONITOR REPLACEMENT

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

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

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

1. **UPRIGHT MODEL.** See Figure 4-9.
   - ☐ **Turn power off to the game.**
   - ☐ Open the rear access door.
   - ☐ Completely disconnect the T.V. monitor from all its cabling. DON'T FORGET THE CHASSIS GROUND WIRE.
   - ☐ Before removing the T.V. monitor, the main-display-glass and bezel must be removed. See above "Upright Model" procedure.
   - ☐ With the removal of only four bolts, the T.V. monitor and its mounting brackets will be loose.
   - ☐ The monitor mounting brackets slide on top of and against two metal guides mounted to the cabinet's right and left sides. The monitor is removed by sliding it out the back of the cabinet. See Figure 4-9.
   - ☐ 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 4-10.
   - ☐ **Turn the power off to the game.**
   - ☐ Open the rear access door.
   - ☐ Completely disconnect the T.V. monitor from all its cabling. DON'T FORGET THE CHASSIS GROUND WIRE.
   - ☐ Before removing the T.V. monitor, the main-display-glass and bezel must be removed. See above "Mini Model" procedure.
   - ☐ With the removal of only four bolts, the T.V. monitor will be loose.

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

   - ☐ The monitor is removed by supporting it and pulling straight back as shown in Figure 4-10. (BE CAREFUL not to hit monitor on its rear support bracket.)
   - ☐ To reinstall the T.V. monitor, reverse this procedure.
   - ☐ After replacing the T.V. monitor, be sure to run the game Self-Test.

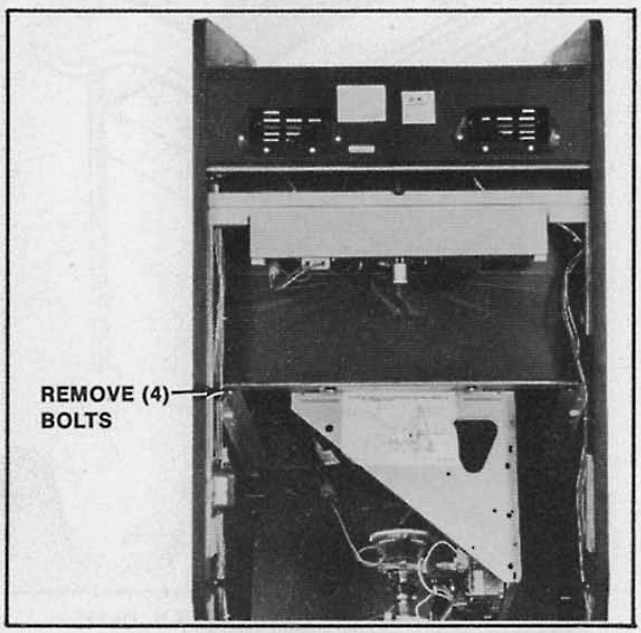


Figure 4-9 Removing Monitor — Upright

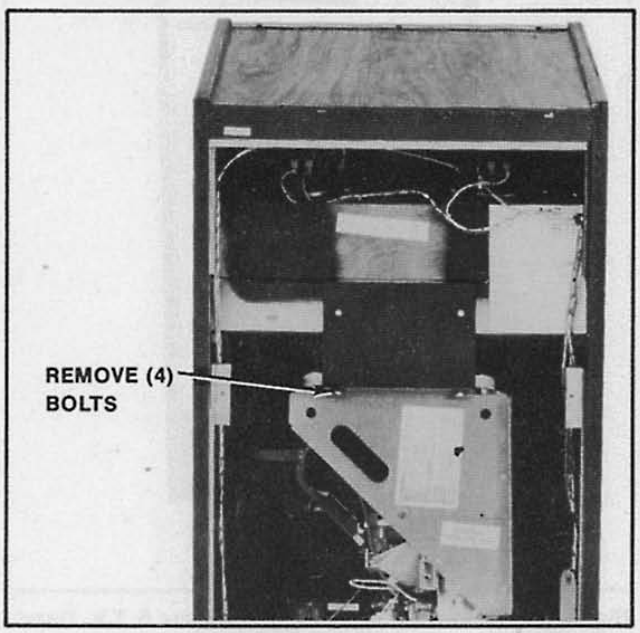


Figure 4-10 Removing Monitor — Mini

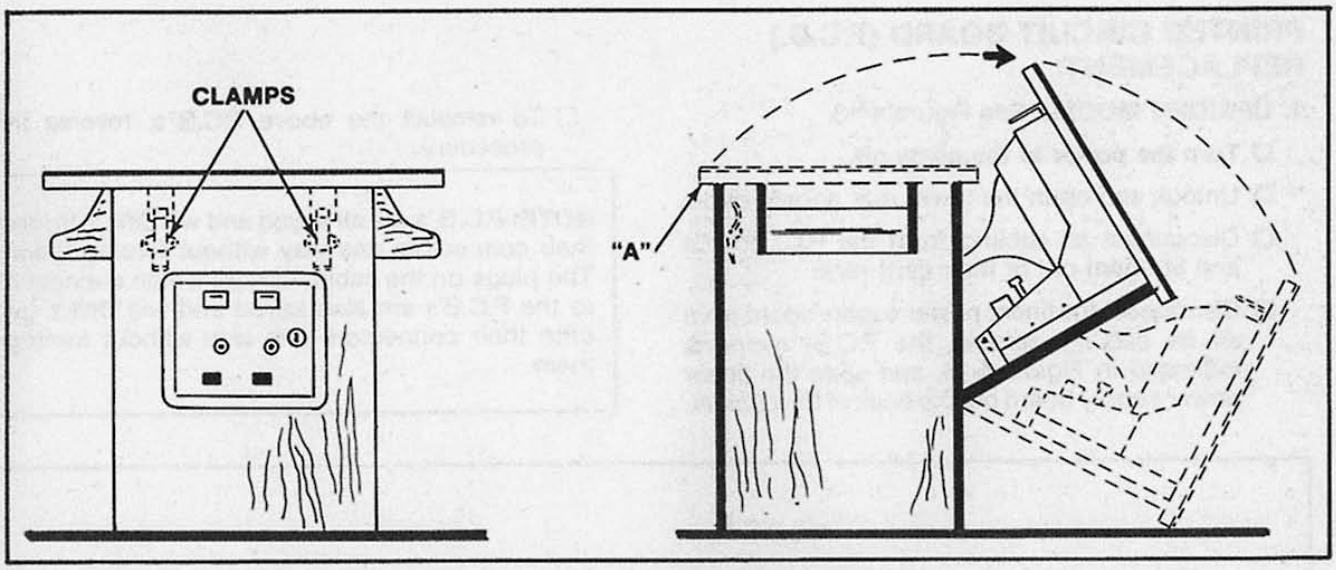


Figure 4-11 Opening the Cocktail Game

3. COCKTAIL TABLE MODEL:

- ☐ **Turn the power off to the game.**
- ☐ Open the coin box door and release the two latches indicated in Figure 4-11.

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

Once the latches are released, unhook them from their latch plates.

- ☐ Grasp the table top at "A" and open it as indicated in Figure 4-11.

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 4-12.
- ☐ 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 4-12.
- ☐ 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.

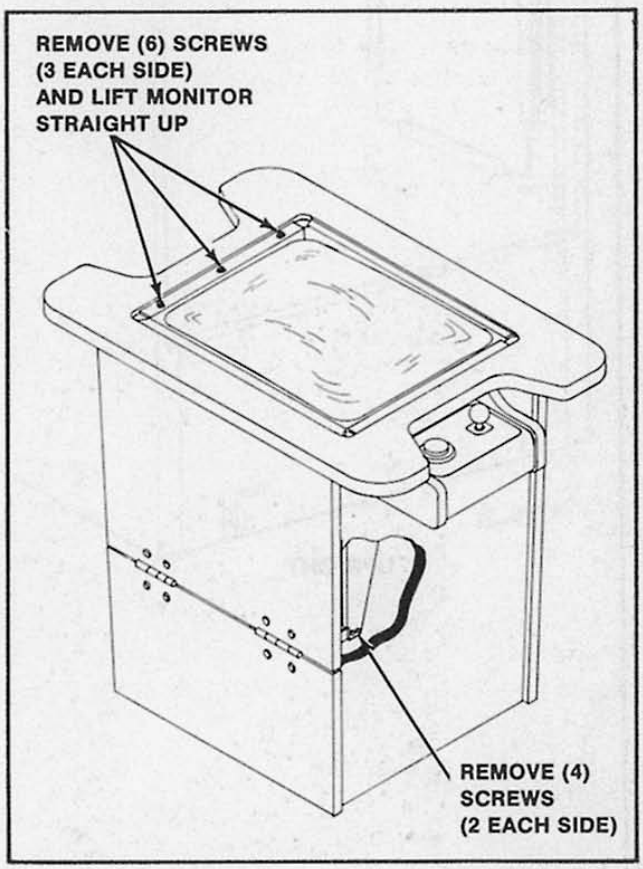


Figure 4-12 Removing Monitor — Cocktail

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

1. **UPRIGHT MODEL.** See Figure 4-13.
   - ☐ **Turn the power to the game off.**
   - ☐ Unlock and open the lower rear access door.
   - ☐ Disconnect all cabling from the P.C. boards and lift them out of their card rack.
   - ☐ Disconnect the linear power supply board from all its cabling, remove the P.C.B. supports indicated in Figure 4-13, and slide the linear power supply board out the back of the cabinet.
   - ☐ To reinstall the above P.C.B.'s, reverse this procedure.

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

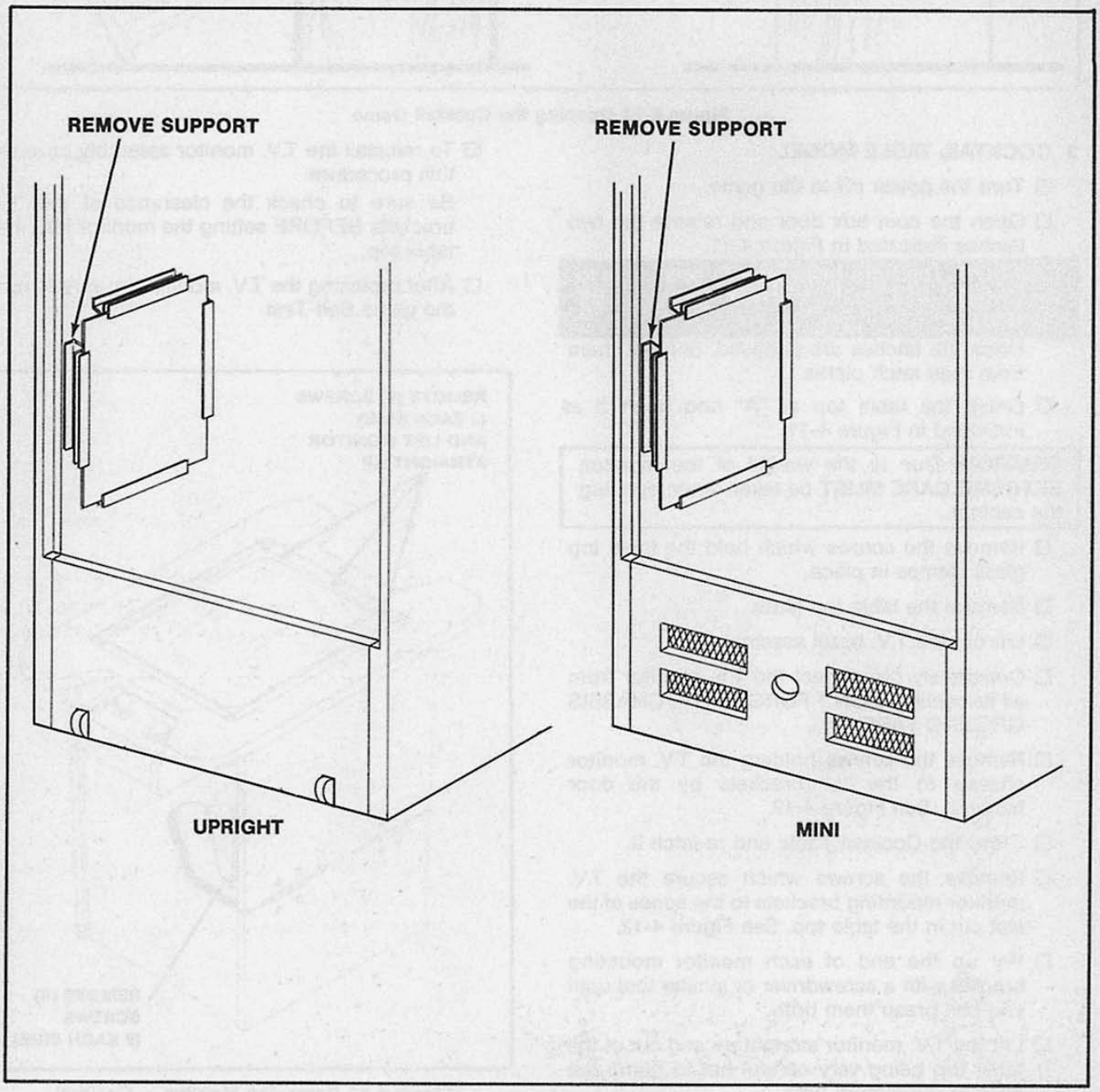


Figure 4-13 Removing PCBs

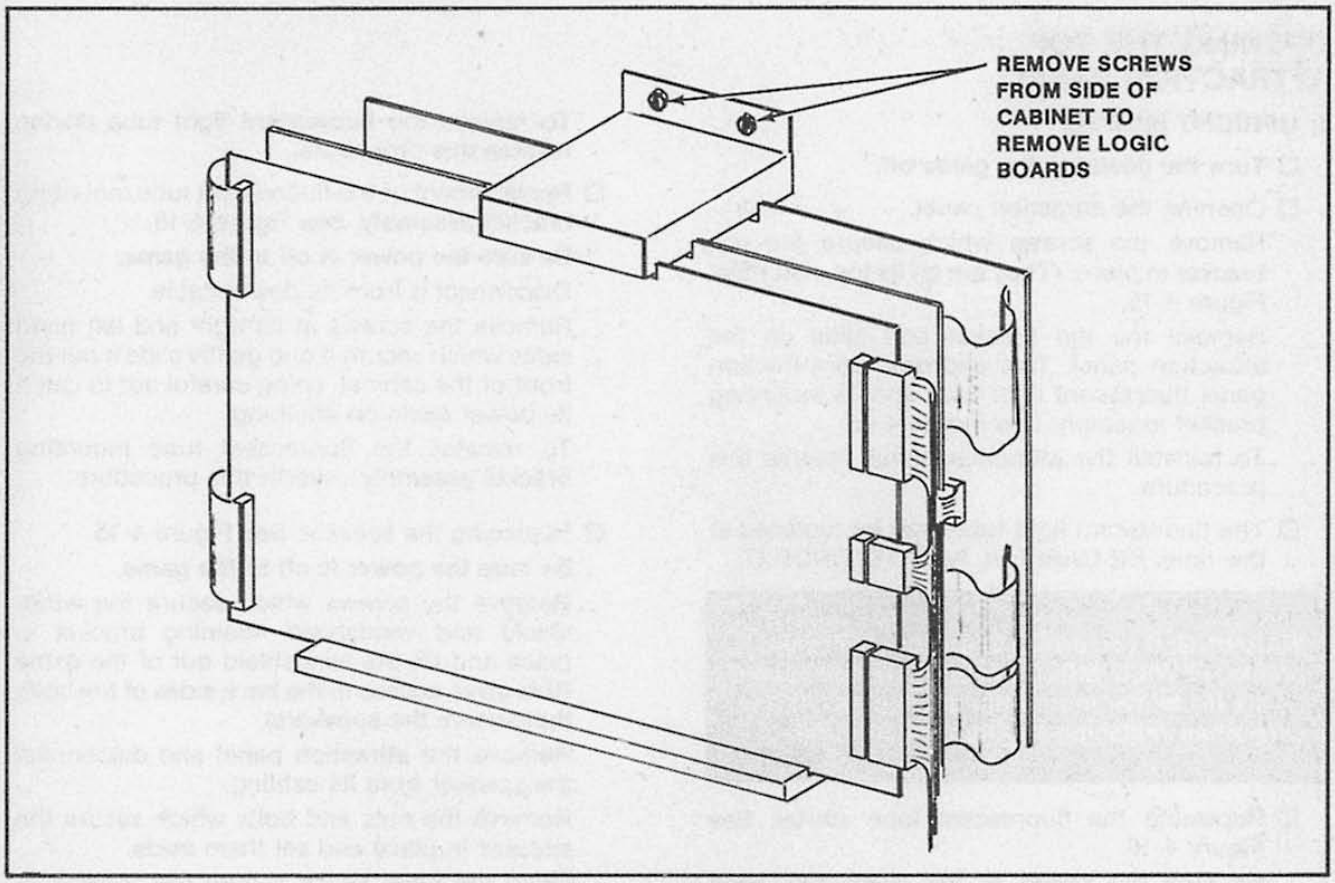


Figure 4-14 Removing PCBs From Card Rack

2. **MINI MODEL.** See Figure 4-13.
   - ☐ **Turn the power off to the game.**
   - ☐ Unlock and open the rear access door.
   - ☐ Disconnect all cabling from the P.C. boards and lift them out of their card rack.
   - ☐ Disconnect the linear power supply board from all its cabling, remove the P.C.B. supports indicated in Figure 4-13 and slide the linear power supply board out the back of the cabinet.
   - ☐ To reinstall the above P.C.B.'s, reverse this procedure.

3. **COCKTAIL TABLE MODEL.** See Figure 4-13.
   - ☐ **Turn the power off to the game.**
   - ☐ Open the cabinet:
     Open the coin box door and release the two latches indicated in Figure 4-11.

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

   Once they're released, unhook them from their latch plates.
   - ☐ Grasp the table top at "A" and open it as indicated in Figure 4-11.

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

   - ☐ Remove the linear power supply board. See Figure 4-13.
     Disconnect it from all its cabling.
     Remove the two smallest P.C.B. supports.
     Once these are removed, the linear power supply can be lifted out the top of the cabinet.
     To reinstall the linear power supply board, reverse this procedure.
   - ☐ To remove the P.C. boards from the card rack. See Figure 4-14.
     Disconnect them from ALL their cabling.
     The P.C. boards are now free and can be slid from their rack.
     To reinstall the P.C. boards, reverse this procedure.

OPENING THE TOP ATTRACTION PANEL:

1. UPRIGHT MODEL:

☐ **Turn the power to the game off.**

☐ Opening the attraction panel:

Remove the screws which secure the top bracket in place. (They are on its top side.) See Figure 4-15.

Remove the top bracket and slide up the attraction panel. This exposes the attraction panel fluorescent light tube and its mounting bracket assembly. See Figure 4-15.

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. See Figure 4-15.

Be sure the power is off to the game.

Disconnect it from its power cable.

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

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

☐ Replacing the speaker. See Figure 4-15.

Be sure the power is off to the game.

Remove the screws which secure the windshield and windshield retaining bracket in place and lift the windshield out of the game (this gives access to the back sides of the bolts that secure the speakers).

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

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

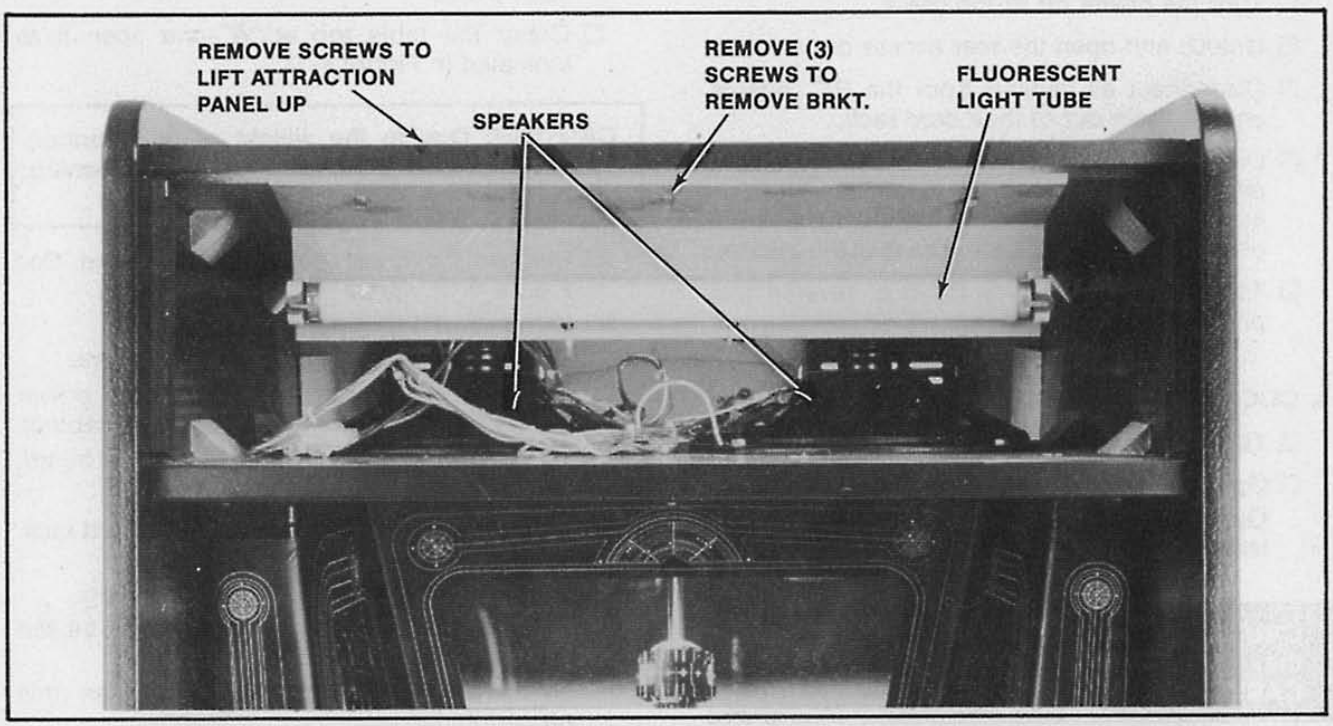


Figure 4-15 Opening Attraction Panel — Upright

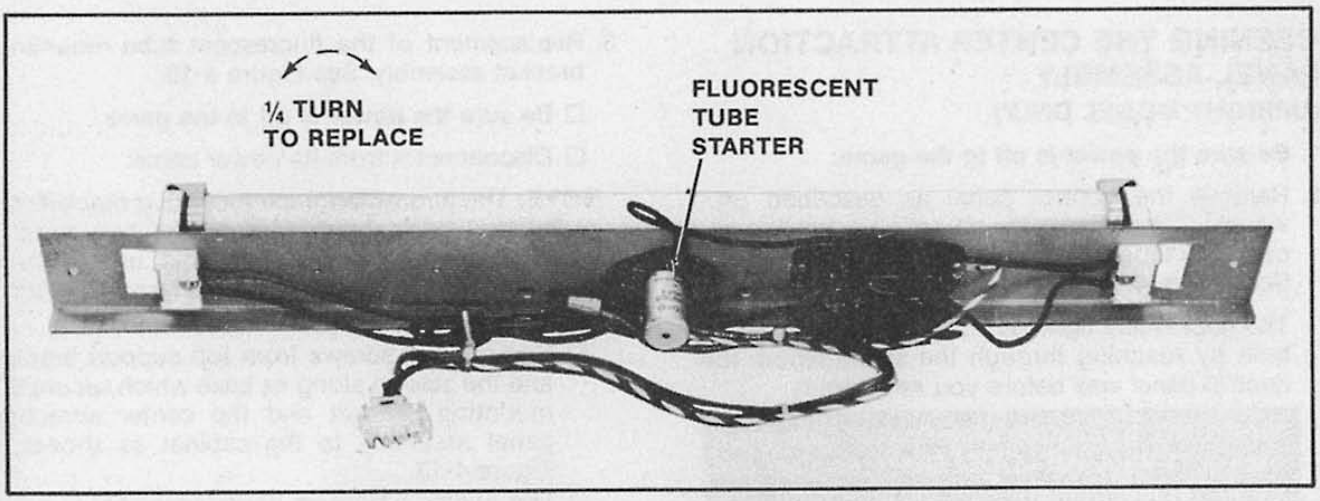


Figure 4-16 Replacing Fluorescent Tube Starter — Upright

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 MODE HAS NO BACK-LIT ATTRACTION PANEL.**

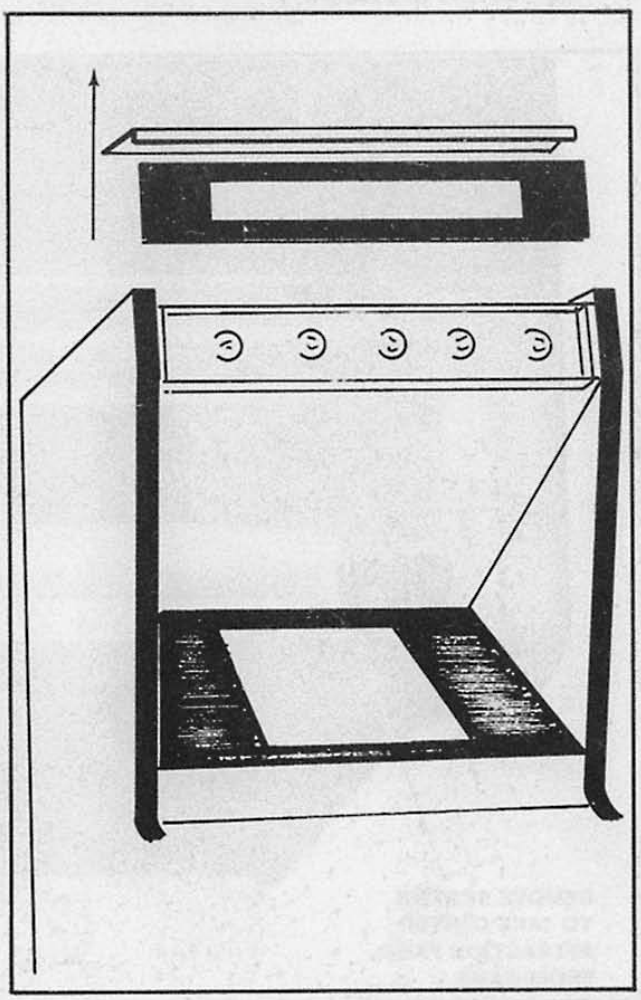


Figure 4-17 Opening Attraction Panel — Mini

OPENING THE CENTER ATTRACTION PANEL ASSEMBLY
(UPRIGHT MODEL ONLY)

1. **Be sure the power is off to the game.**
2. Remove the control panel as described previously. This exposes the attraction panel fluorescent light tube and its mounting bracket assembly. See Figure 4-18.

   The fluorescent light tube may be replaced at this time by reaching through the space where the control panel was before you removed 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.

   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.

3. Replacement of the fluorescent tube mounting bracket assembly. See Figure 4-18.

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

   ☐ Disconnect it from its power cable.

   NOTE: The fluorescent tube mounting bracket is an integral part of the center attraction panel assembly and cannot be replaced unless the center attraction panel assembly is removed from the game cabinet.

   ☐ Remove the screws from top support bracket and the screws along its base which secure the mounting bracket and the center attraction panel assembly to the cabinet as shown in Figure 4-18.

   ☐ The center attraction panel assembly is now free and can be rotated forward and lifted out of the cabinet.

   ☐ The screws which secure the fluorescent tube mounting bracket to the center attraction panel are now accessible so it can be separated from the center attraction panel and replaced.

   ☐ To reinstall any of the above removed items, reverse this procedure.

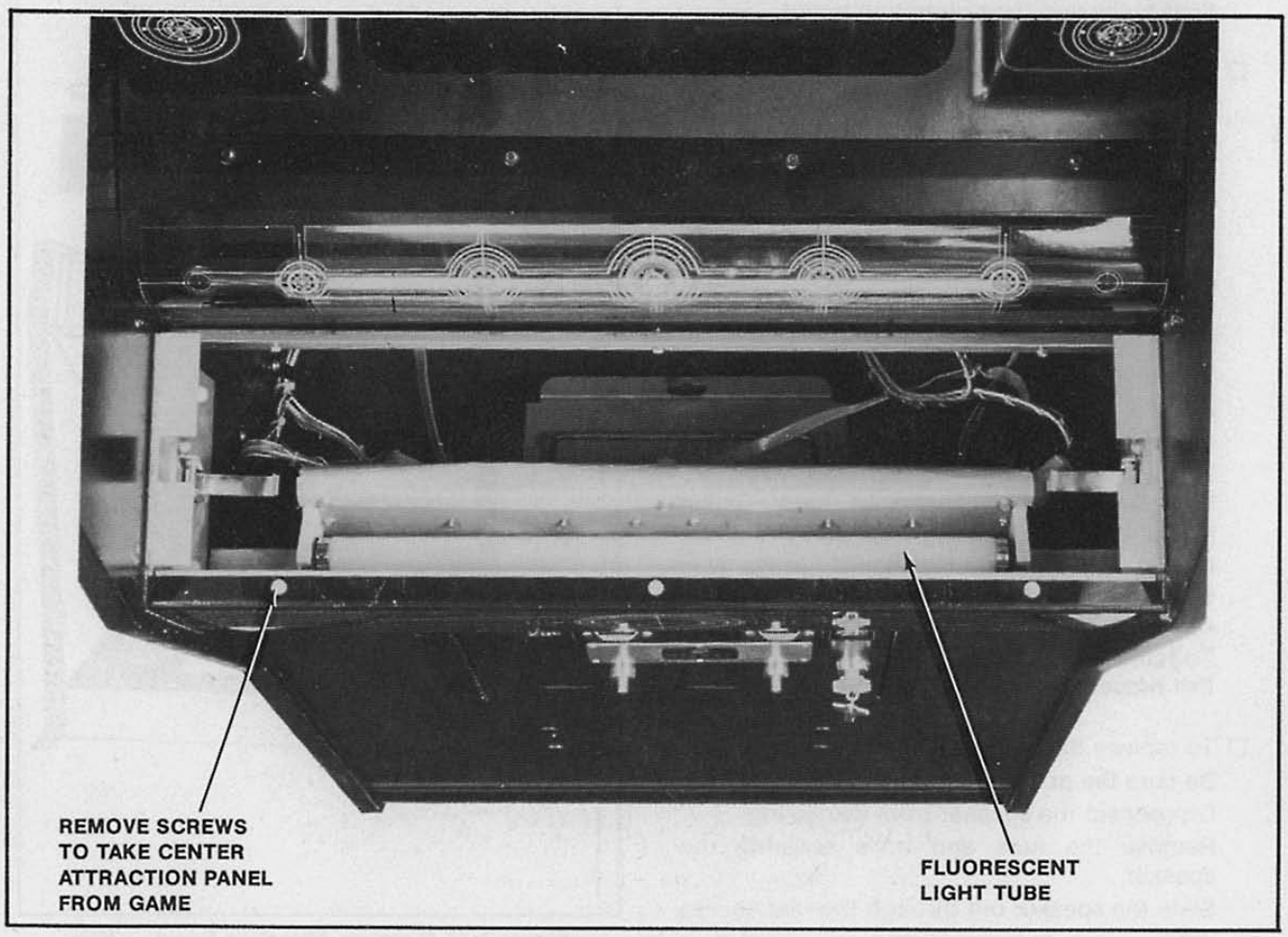


Figure 4-18 Opening Center Attraction Panel — Upright

SERVICING THE CONTROL PANEL BLACK LIGHT
(UPRIGHT MODEL ONLY)

1. **Be sure the power is off to the game.**
2. Remove the control panel as described previously. This exposes the bottom row of screws which secure the control panel support bracket and the black light protector in place. See Figure 4-19.
3. Remove all the screws which secure the above items in place and set them aside.
   - ☐ The black light tube may be replaced at this time by reaching through the space where the light protector was before you removed it.

WARNING: If you drop a 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.

4. Replacing the black light tube starter. See Figure 4-16.
   - ☐ Remove the black light tube.
   - ☐ Remove the screws which secure the black light tube mounting bracket to the cabinet. See Figure 4-20.

     The mounting bracket is now loose and can be pulled out and slightly to one side until you can see the black light tube starter.
   - ☐ Grasp the starter (it is on the back of the mounting bracket), give it a quarter turn, and remove it from its socket.

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

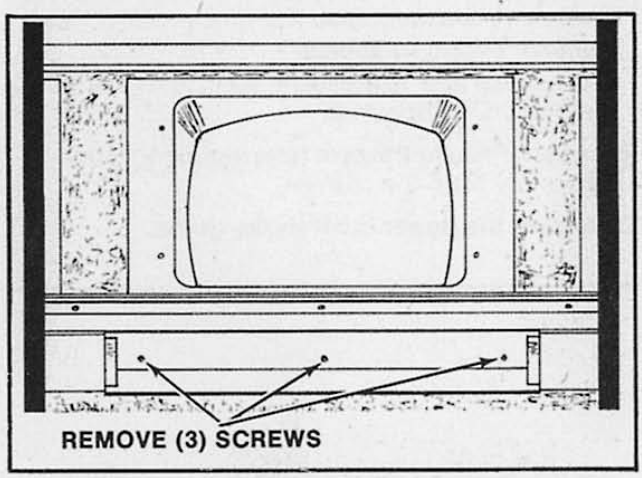


Figure 4-20 Removing Black Light Tube Mtg. Brkt. — Upright

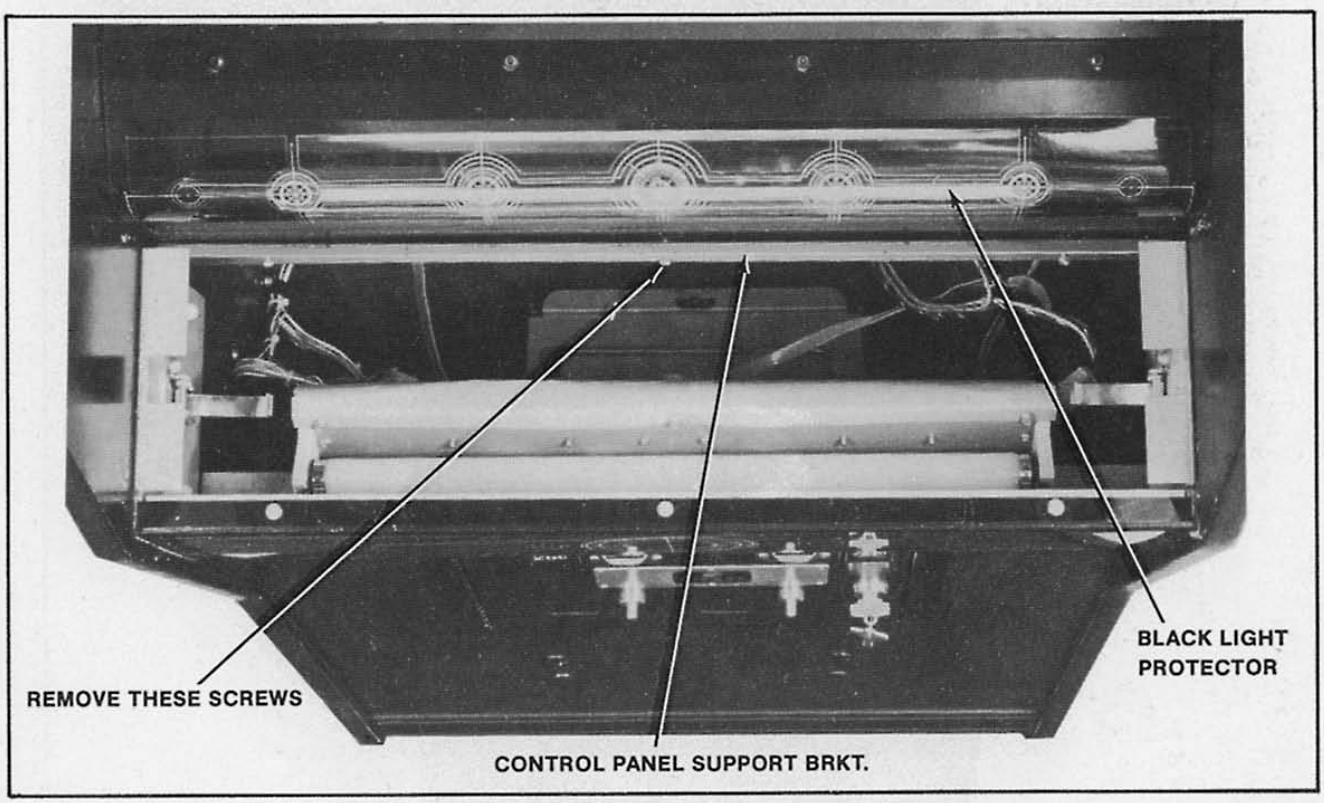


Figure 4-19 Servicing Control Panel Black Light — Upright

SERVICING THE WINDSHIELD FLUORESCENT LIGHT
(UPRIGHT MODEL ONLY)

1. **Be sure the power is off to the game.**
2. Remove the upper rear access door. This exposes the windshield fluorescent light tube mounting bracket assembly. See Figure 4-21.
3. Replacing the fluorescent tube starter. See Figure 4-16.
   - ☐ 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.
4. Removal of the fluorescent tube mounting bracket assembly from the cabinet.
   - ☐ **Be sure the power is off to the game.**
   - ☐ Disconnect it from its power cable.
   - ☐ Remove the screws along its base which secure the mounting bracket to the inside of the cabinet as shown in Figure 4-21. Remove the two end screws first and the center one last.
   - ☐ The fluorescent tube mounting bracket assembly is now free and can be removed from the cabinet.
5. The fluorescent light tube may be easily replaced at this time.

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.

- ☐ To reinstall any of the above removed items, reverse this procedure.

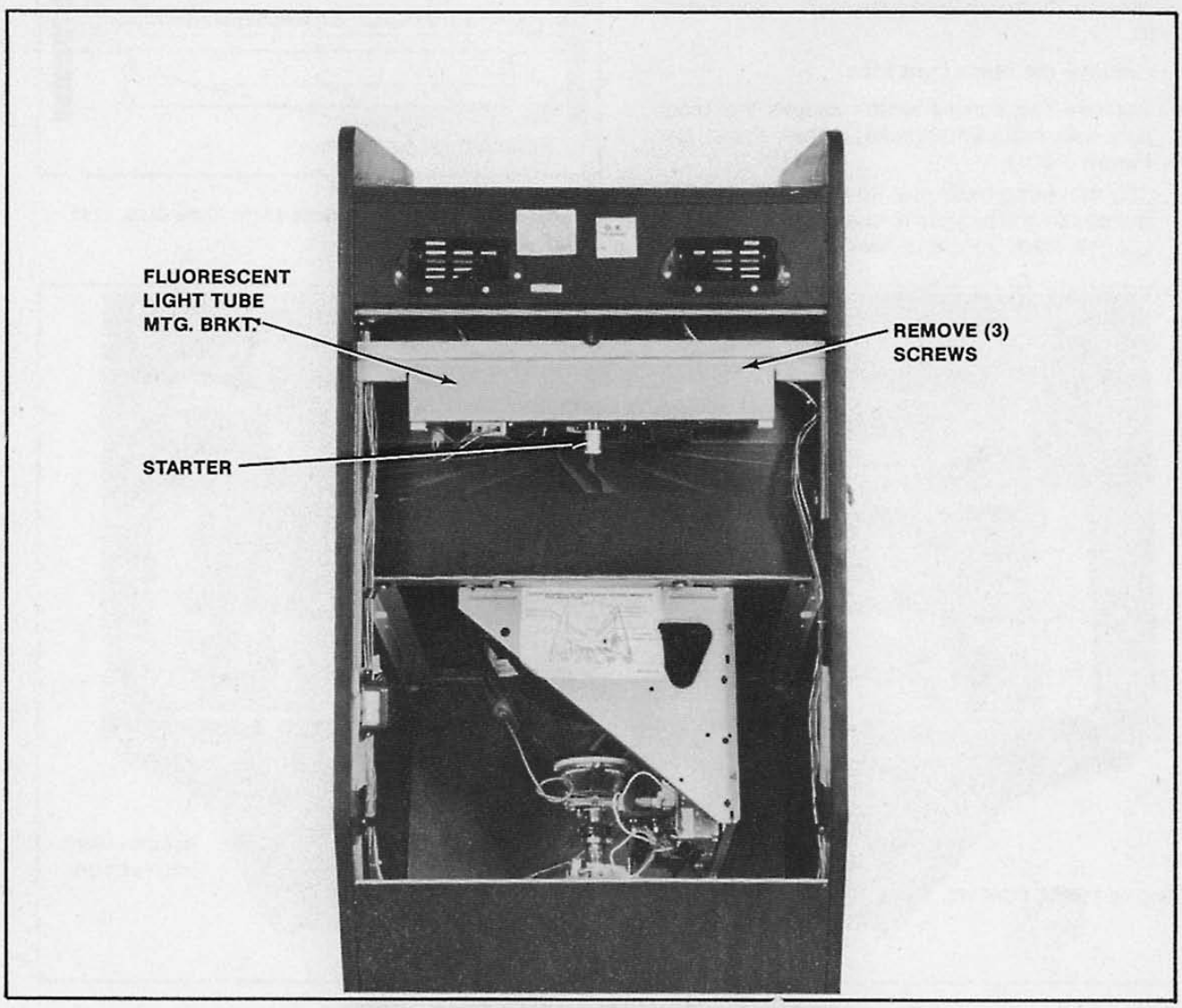


Figure 4-21 Servicing Windshield Fluorescent Light — Upright

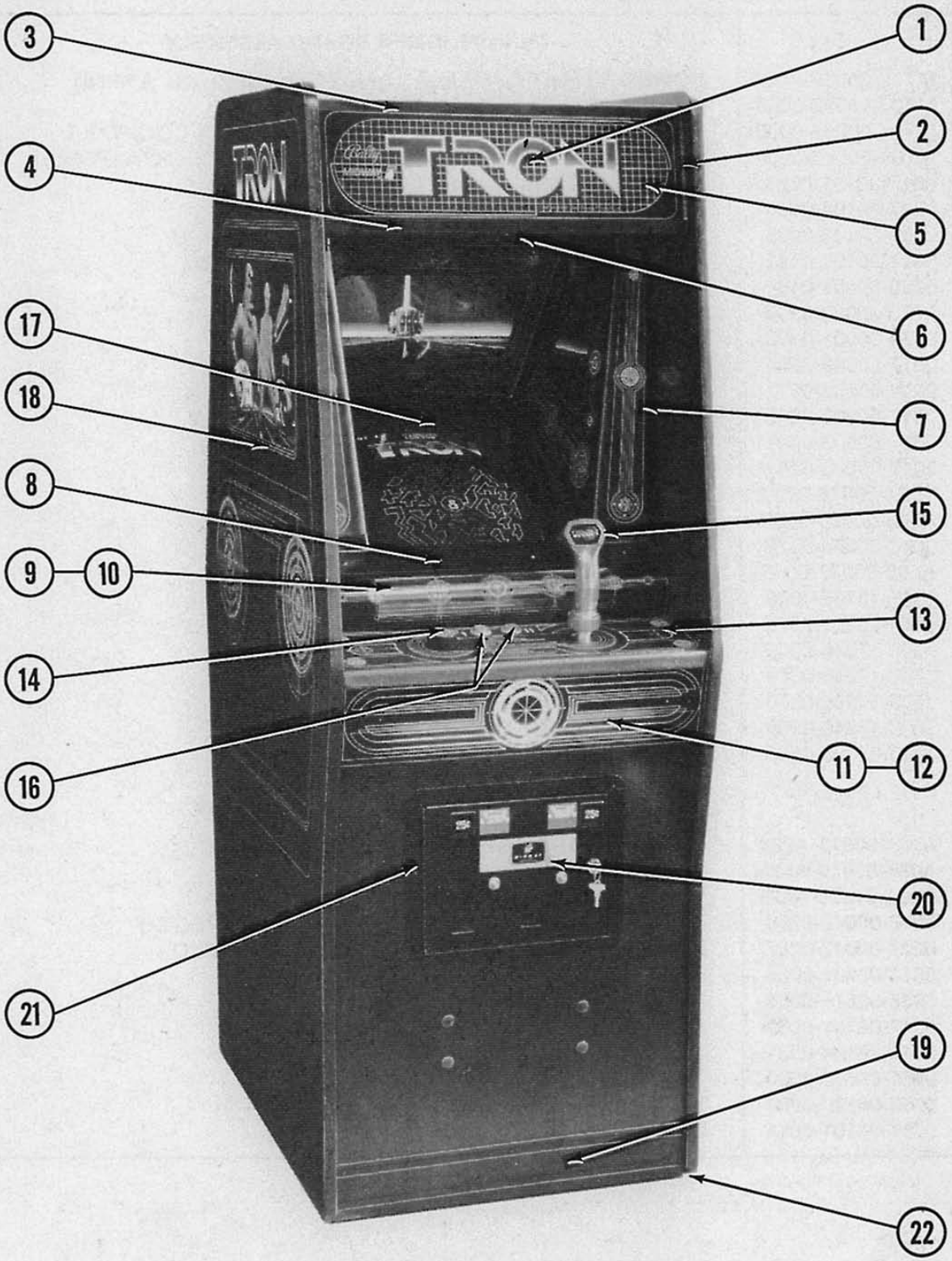
V Illustrated Parts Breakdown

TRON — ALL VERSIONS — NOT SHOWN — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
		TRANSFORMER BOARD ASSEMBLY
	MT00-00089-A000	POWER TRANSFORMER — 115V., 60 Hz (UPRIGHT & MINI)
	MT00-00092-0000	TRANSFORMER (UPRIGHT ONLY)
	MT00-00093-0000	TRANSFORMER W/MAGNETIC SHIELD (MINI & COCKTAIL)
	MT00-00096-0000	POWER TRANSFORMER — 100/125V., 60 Hz (COCKTAIL ONLY)
	0017-00101-0628	#8-32 x 3/4 CARRIAGE BOLT (4 REQ'D.)
	0017-00104-0026	#8 FLAT WASHER (4 REQ'D.)
	0017-00103-0008	#8-32 HEX NUT (4 REQ'D.)
	0017-00101-0141	#8 x 11/16 UNSLOT HEX HD. SCREW (22 REQ'D.)
	0720-00001-0100	1 POSITION FUSE CLIP ASSY.
	0720-00001-0200	2 POSITION FUSE CLIP ASSY.
	0720-00001-0300	3 POSITION FUSE CLIP ASSY.
	0017-00003-0004	SLO-BLO FUSE 2A., 250V. (3 REQ'D.)
	0017-00003-0217	SLO-BLO FUSE 2-1/2A., 250V. (COCKTAIL & MINI)
	0017-00003-0002	SLO-BLO FUSE 1/2A., 250V. (COCKTAIL & MINI)
	0017-00003-0047	SLO-BLO FUSE 3A., 250V. (UPRIGHT)
	0017-00003-0261	SLO-BLO FUSE 1-1/2A., 250V. (UPRIGHT)
	A151-00079-0000	115V. CONVENIENCE OUTLET ASSY.
	A945-00005-0000	CAPACITOR ASSY. — 60 Hz
	0017-00003-0379	CAPACITOR CLAMP
	A508-00037-0000	NOISE FILTER ASSY. 2 LEAD
	3010-13106-0000	TERMINAL STRIP
	0017-00021-0370	MALE CONNECTOR — 5 TAB
	3000-17246-0200	.350 WIDE GROUND STRAP
	3000-17246-0300	.350 WIDE GROUND STRAP
	3000-17246-0500	5.50 x .350 WIDE GROUND STRAP
	3000-17246-0900	48.00 x .350 WIDE GROUND STRAP
	3010-03003-0000	GROUNDING CLIP
		CARD RACK W/BOARDS ASSY.
	A084-90913-A628	SOUND BOARD ASSY.
	A084-90010-A628	C.P.U. BOARD ASSY.
	A084-91399-A628	VIDEO GENERATOR BOARD ASSY.
	0017-00042-0208	P.C. BOARD SPACER SUPPORT 1-1/8" LG (4 REQ'D.)
	0017-00042-0287	P.C. BOARD SPACER SUPPORT 5/8" LG (4 REQ'D.)
	0017-00101-0085	#6 x 5/16 SLT. HEX HD. SCREW (8 REQ'D.)
	0968-00511-0000	BASE CARD RACK SUPPORT — BLOCK
	0017-00101-0033	#8 x 1-1/4" SLT. HEX HD. SCREW (2 REQ'D.)
	0017-00104-0031	#8 WASHER (2 REQ'D.)
	0968-00510-0000	TOP CARD RACK SUPPORT — BLOCK
	0968-00125-0000	SUPPORT BRKT. TO CABINET SIDE
	0017-00101-0014	#6 x 1/2 SLT. HEX HD. SCREW (2 REQ'D.)

NO. 628 — TRON UPRIGHT — FRONT

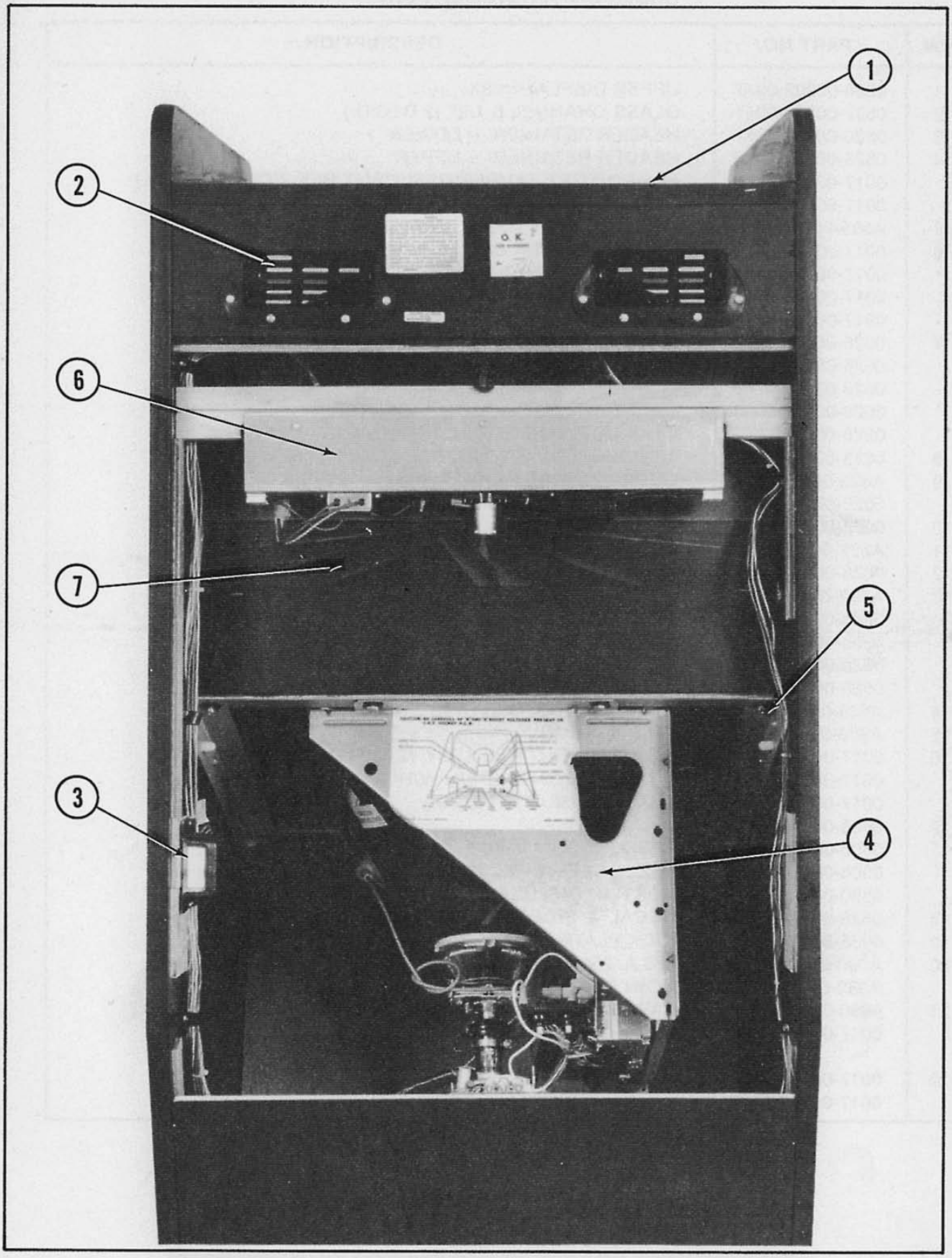


NO. 628 — TRON UPRIGHT — FRONT — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
1	0628-00902-00XF	UPPER DISPLAY PLEXI
2	0537-00903-0041	GLASS CHANNEL 6-1/2" (2 REQ'D.)
3	0628-00106-00XF	HEADER RETAINER — LOWER
4	0628-00107-00XF	HEADER RETAINER — UPPER
	0017-00101-0138	#8 x 5/8 TORX TAMPER RESISTANT BLK. SCR. (6 REQ'D.)
	0017-00009-0522	LONG ARM KEY T-20 (FOR ABOVE SCREW)
5	A595-00011-0000	HEADER LIGHT ASSY.
6	0017-00009-0393	BLACK SPEAKER GRILLE W/SLOTS (2 REQ'D.)
	0017-00003-0430	6" x 9" SPEAKER 4 OHM, 10W. (2 REQ'D.)
	0017-00101-0127	#8-32 x 1-1/2" CARRIAGE BOLTS (8 REQ'D.)
	0017-00103-0061	#8-32 HEX NUTS W/SEMS (8 REQ'D.)
7	0628-00918-0000	WINDSHIELD
	0628-00913-0100	DECORATIVE APPLIQUE — LEFT
	0628-00913-0200	DECORATIVE APPLIQUE — RIGHT
	0628-00917-0000	DECORATIVE APPLIQUE — CENTER
	0628-00116-00XF	WINDSHIELD RETAINING BRACKET — UPPER
8	0628-00115-00XF	WINDSHIELD RETAINING BRACKET — LOWER
9	A628-00009-0000	CONTROL SHELF LIGHT ASSY. — UPPER
	0628-00916-0000	MIDDLE FLUORESCENT REFLECTOR
10	0628-00901-0000	LAMP PROTECTOR
11	A628-00010-0000	CONTROL SHELF LIGHT ASSY. — LOWER
12	0628-00903-0000	LOWER HEADER
13	A628-00033-0000	CONTROL SHELF
	0628-00908-0000	CONTROL SHELF OVERLAY
	0555-00901-0000	LOCATING PIN (PLASTIC) (8 REQ'D.)
	0628-00105-0100	CONTROL SHELF MTG. BRKT. LEFT
	0628-00105-0200	CONTROL SHELF MTG. BRKT. RIGHT
14	A628-00037-0000	OPTICAL ENCODER DISC. ASSY.
15	A628-00032-0000	GRIP ASSEMBLY
16	0017-00042-0304	RED PUSH BUTTON ASSY. (2 REQ'D.)
	0017-00032-0093	PUSH BUTTON SWITCH W/HOLDER (2 REQ'D.)
	0017-00103-0054	5/8-11 PAL NUT (2 REQ'D.)
17	0628-00914-0000	VIEWING GLASS
	0508-00900-0000	BEZEL
	0508-00901-0000	BEZEL CLIP (4 REQ'D.)
	0530-00903-0000	ACRYLIC DIFFUSER
18	0628-00912-0000	DECAL — SIDE (2 REQ'D.)
19	0935-00906-0100	KICK PLATE
20	A090-00300-11BK	U.S.A. 25¢ COIN DOOR ASSEMBLY
	A982-00015-0000	COIN DOOR CABLE ASSY.
21	0090-00002-04BK	LARGE COIN DOOR FRAME
	0017-00101-0121	#6-32 x 5/16" PHIL. TRS. HD. SCREW (3 REQ'D.) (MOUNTS COIN DOOR TO FRAME)
22	0017-00102-0048	3/8-16 x 2" LEG LEVELERS (4 REQ'D.)
	0017-00103-0026	3/8-16 LEG LEVELER NUTS (4 REQ'D.)

NO. 628 — TRON UPRIGHT — REAR ACCESS (TOP)

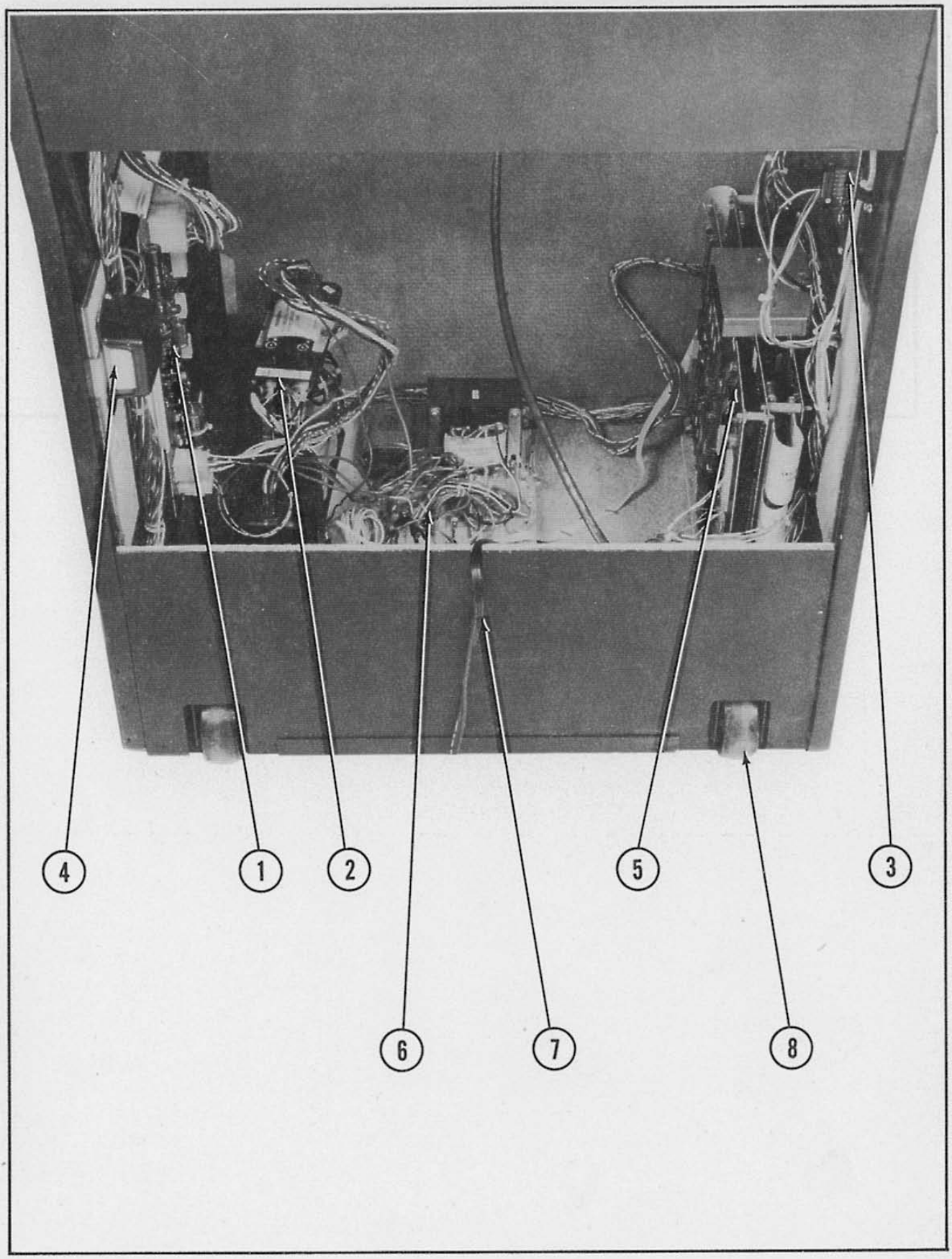


NO. 628 — TRON UPRIGHT — REAR ACCESS (TOP) — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
1	A088-00013-0000	ON-OFF SWITCH & BRKT. ASSY.
2	0894-00916-0000	PLASTIC PULL & VENT
3	A088-00015-0000	INTERLOCK SWITCH & BRKT. ASSY.
4	0017-00003-0339	ELECTROHOME — 19" COLOR DUAL SYNC HORIZ. MTG. MONITOR (OR)
4	0017-00003-0439	WELLS GARDNER — 19" COLOR DUAL SYNC HORIZ. MTG. MONITOR
5	A508-00005-0000	MONITOR MTG. CHANNEL ASSY. (2 REQ'D.)
	0017-00102-0066	1/4-20 x 3/4" UNSLOT HEX HD. BOLT (4 REQ'D.)
	0017-00104-0014	7/8" DISH WASHER
	0508-00106-0000	BEZEL MTG. BRKT. (2 REQ'D.)
6	A628-00008-0000	SCENERY LIGHT ASSY.
7	0628-00915-0000	ILLUMINATED REAR SCENE
	0628-00119-0000	SCENERY BRKT.

NO. 628 — TRON UPRIGHT — REAR ACCESS (BOTTOM)

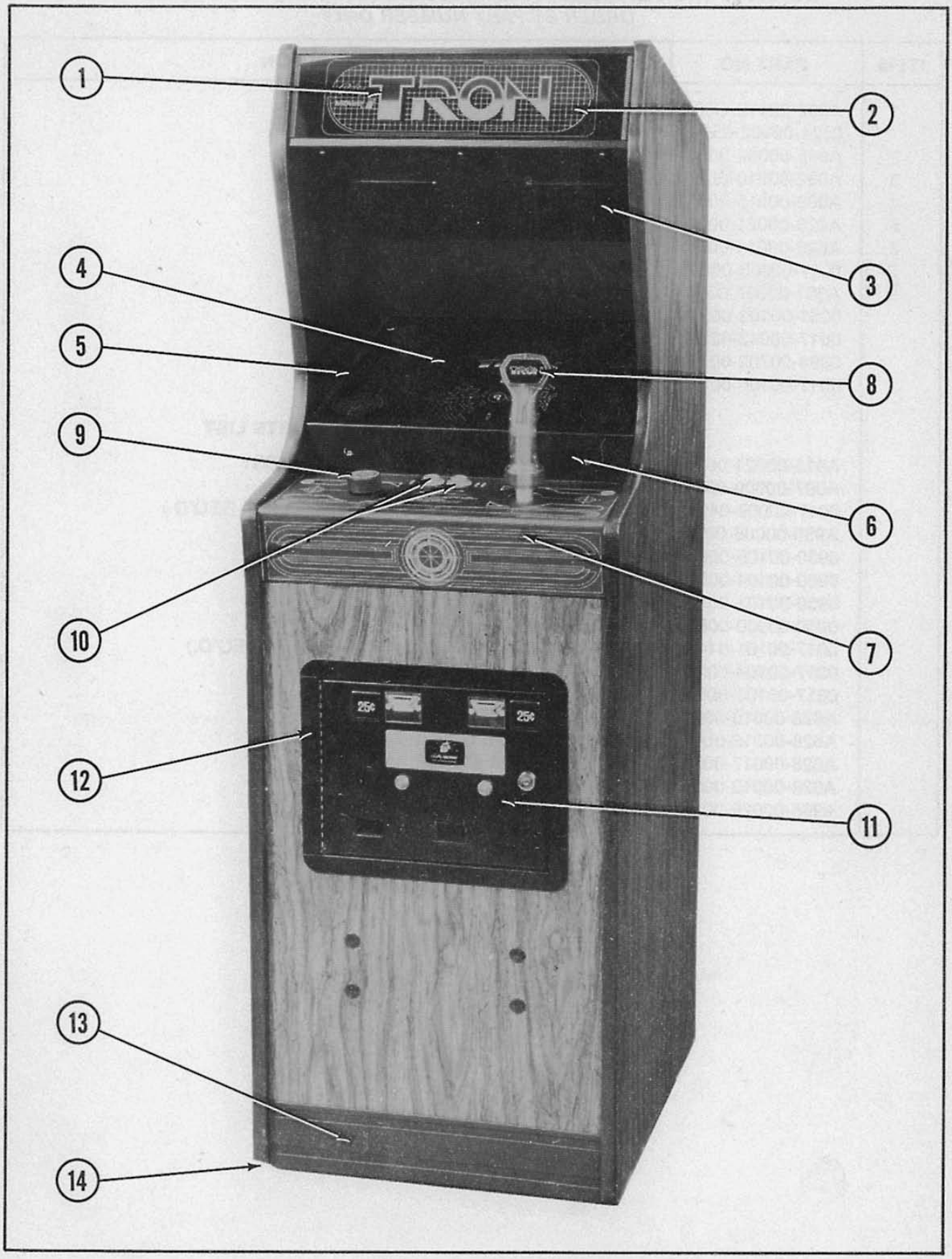


NO. 628 — TRON UPRIGHT — REAR ACCESS (BOTTOM) — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
1	A082-90412-C000	125 VA. POWER SUPPLY P.C. ASSY.
	0624-00902-0500	P.C. SUPPORT BRKT. 6-1/2" (4 REQ'D.)
2	A945-00002-0000	125 VA. FILTER ASSY.
3	A082-90910-E000	DUAL POWER AMP P.C. ASSY. MCR-2
4	A088-00015-0000	INTERLOCK SWITCH & BRKT. ASSY.
5	A628-00021-0000	CARD RACK W/P.C. BDS. ASSY.
6	A628-00015-0000	TRANSFORMER BOARD ASSY.
7	0017-00003-0064	LINE CORD
8	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
	A515-00021-0000	MULTIFUNCTION SWITCH & BRKT. ASSY.
	A097-00009-0000	BACK DOOR LOCK ASSY. (2 REQ'D.)
	0017-00009-0490	5-5/8 SQR. BACK DOOR VENT GRILLE (4 REQ'D.)
	A950-00006-0000	COIN BOX CRADLE ASSY.
	0950-00105-0000	COIN BOX COVER
	0950-00104-0000	COIN BOX HANDLE
	0950-00101-00XF	COIN DEFLECTOR (2 REQ'D.)
	0950-00900-0000	LARGE PLASTIC CASH BOX
	0017-00101-0142	1/4-20 x 1-3/8" RND. HD. BOLT BLK. (4 REQ'D.)
	0017-00104-0014	7/8" DISH WASHER (4 REQ'D.)
	0017-00103-0018	1/4-20 HEX NUT (4 REQ'D.)
	A628-00018-0000	MASTER CABLE ASSY.
	A628-00016-0000	HIGH VOLTAGE CABLE ASSY.
	A628-00017-0000	LOW VOLTAGE CABLE ASSY.
	A628-00013-0000	CONTROL SHELF CABLE ASSY.
	A968-00029-0000	VIDEO SIGNAL CABLE ASSY.

NO. 728 — TRON MINI — FRONT

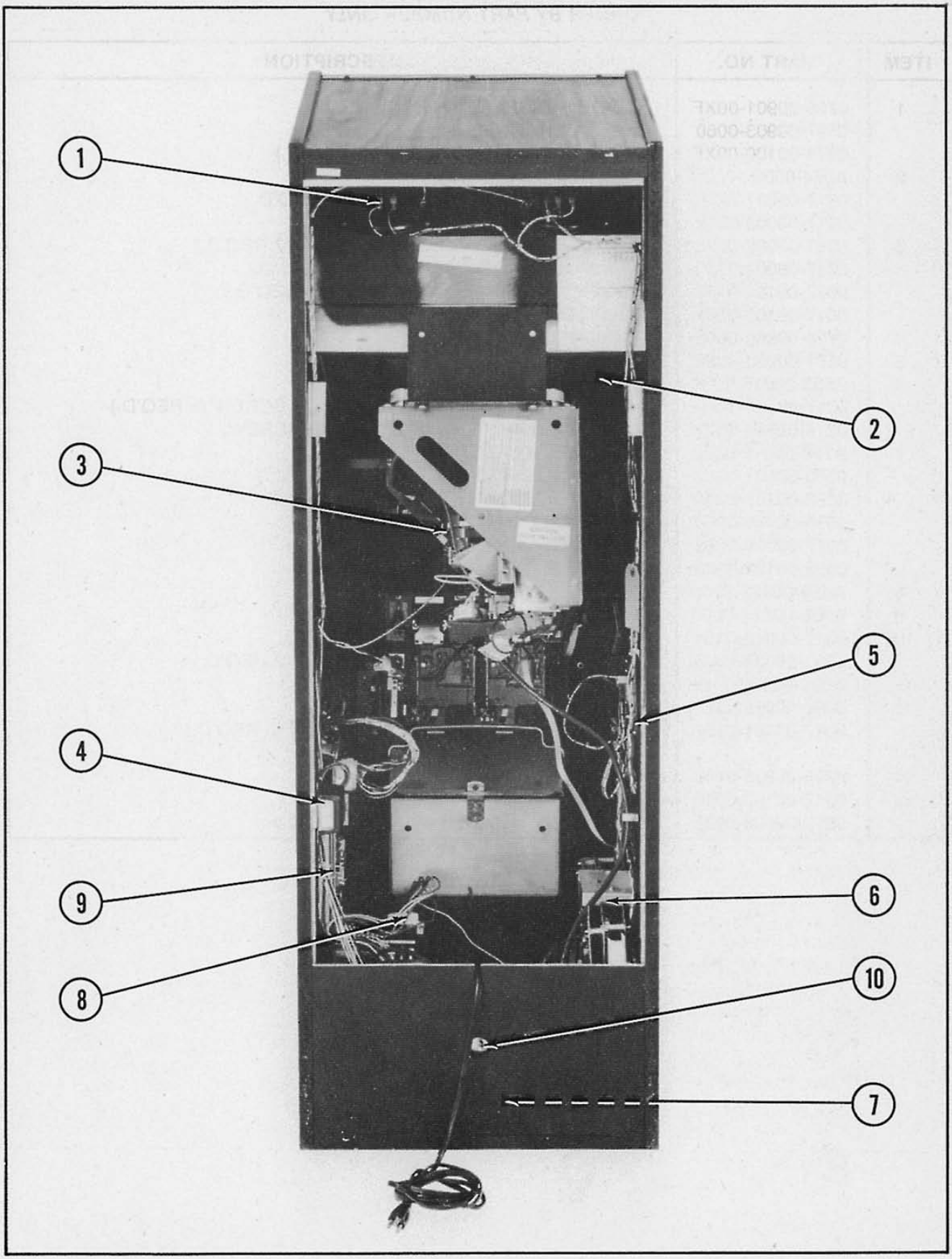


NO. 728 — TRON MINI — FRONT — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
1	0728-00901-00XF	HEADER DISPLAY PANEL
	0537-00903-0060	GLASS CHANNEL 4-1/2" (2 REQ'D.)
	0574-00100-00XF	HEADER RETAINING BRKT. (2 REQ'D.)
2	A574-00007-0000	INSERT DISPLAY ASSY.
	0017-00031-0030	WEDGE BASE LIGHT SOCKET (5 REQ'D.)
	0017-00003-0219	#194 LAMP 14V.,.27A. (5 REQ'D.)
3	0017-00009-0393	BLACK SPEAKER GRILLE W/SLOTS (2 REQ'D.)
	0017-00003-0430	6" x 9" SPEAKER 4 OHM, 10W. (2 REQ'D.)
	0017-00101-0127	#8-32 x 1-1/2" CARRIAGE BOLTS (8 REQ'D.)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (8 REQ'D.)
4	0728-00900-0000	VIEWING GLASS
5	0537-00903-0056	GLASS CHANNEL 14-1/2" (2 REQ'D.)
6	A555-00016-0000	GLASS CLAMPING PLATE ASSY.
	0017-00101-0138	#8 x 5/8" TORX TAMPER RESISTANT SCREW (8 REQ'D.)
	0017-00009-0522	LONG ARM KEY T-20 (FOR ABOVE SCREW)
7	A728-00015-0000	CONTROL PLATE
	0550-00101-0100	CONTROL SHELF MTG. BRKT. — RIGHT
	0550-00101-0200	CONTROL SHELF MTG. BRKT. — LEFT
	0555-00901-0000	PLASTIC LOCATING PIN (6 REQ'D.)
	0017-00009-0033	LATCH CLAMP (2 REQ'D.)
	0982-00102-0000	STRIKE (2 REQ'D.)
8	A628-00032-0000	GRIP ASSY.
9	A628-00037-0000	OPTICAL ENCODER DISC. ASSY.
10	0017-00042-0304	RED PUSHBUTTON ASSY. (2 REQ'D.)
	0017-00032-0093	PUSHBUTTON SWITCH W/HOLDER (2 REQ'D.)
11	A090-00300-11BK	U.S.A. 25¢ COIN DOOR ASSY.
12	0090-00002-04BK	LARGE COIN DOOR FRAME
	0017-00101-0121	#6-32 x 5/16" PHIL. TRS. HD. SCREW (3 REQ'D.) (MOUNTS COIN DOOR TO FRAME)
13	0935-00906-0400	KICK PLATE
14	0017-00102-0048	3/8-16 x 2" LEG LEVELERS (4 REQ'D.)
	0017-00103-0026	3/8-16 LEG LEVELER NUTS (4 REQ'D.)

NO. 728 — TRON MINI — REAR ACCESS

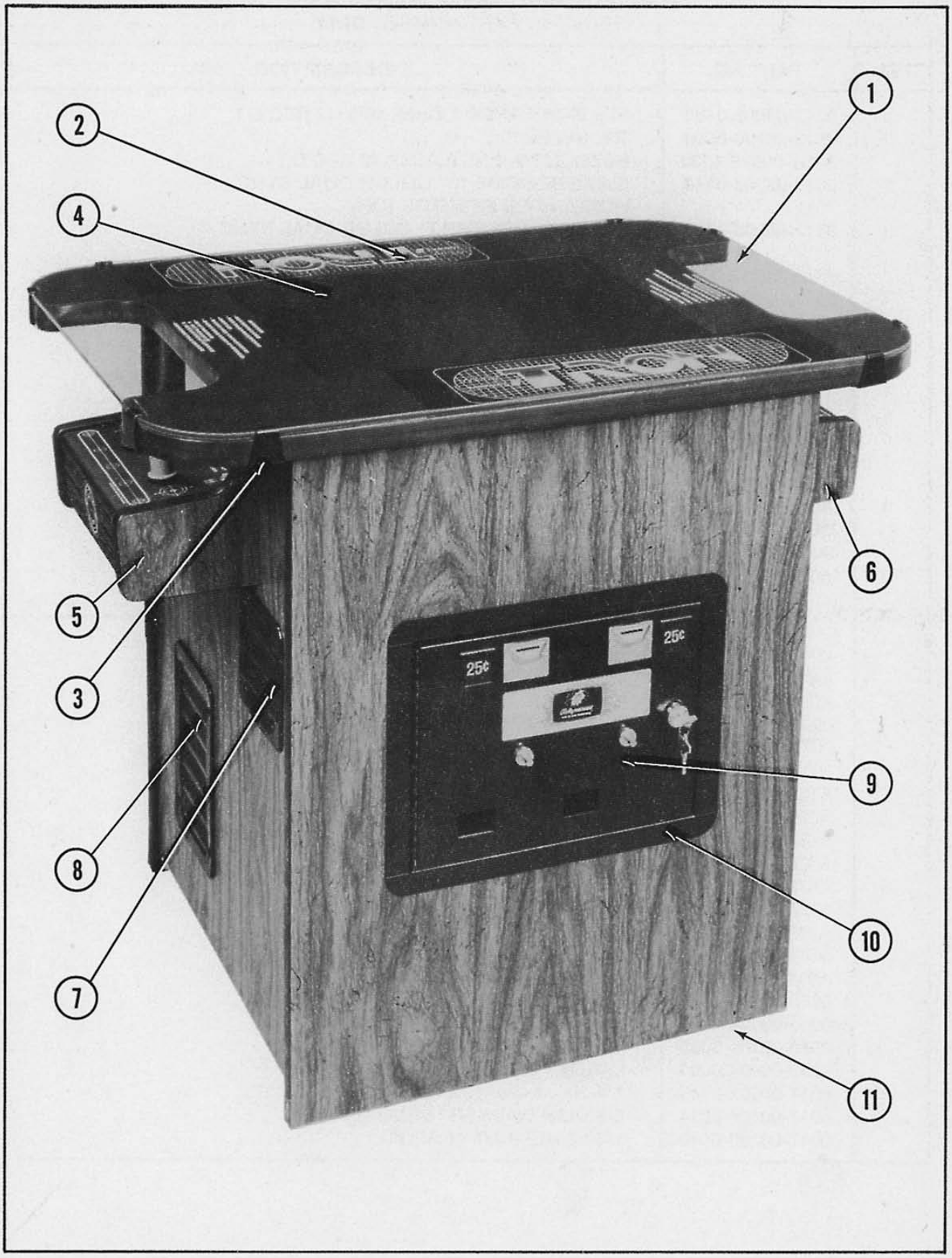


NO. 728 — TRON MINI — REAR ACCESS — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
1	0017-00003-0430	6" x 9" SPEAKER 4 OHM, 10W. (2 REQ'D.)
2	0513-00900-0000	T.V. BEZEL
	A961-00026-0000	BEZEL MTG. BRKT. ASSY. (2 REQ'D.)
3	0017-00003-0340	ELECTROHOME 13" COLOR DUAL SYNC HORIZ. MTG. MONITOR (OR)
3	0017-00003-0435	WELLS GARDNER 13" COLOR DUAL SYNC HORIZ. MTG. MONITOR
	A926-00012-00XF	T.V. MTG. BRKT. ASSY.
	0513-00101-0000	MONITOR MTG. BRKT.
	0017-00101-0628	#8-32 x 3/4" CARRIAGE BOLT (4 REQ'D.)
	0017-00104-0026	#8 FLAT WASHER (4 REQ'D.)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (4 REQ'D.)
4	A088-00015-0000	INTERLOCK SWITCH & BRKT. ASSY.
5	A082-90910-E000	DUAL POWER AMP P.C. ASSY. MCR 2
6	A628-00021-0000	CARD RACK ASSY.
7	A728-00005-0000	TRANSFORMER BOARD ASSY.
8	A945-00002-0000	125 V.A. FILTER ASSY.
9	A082-90412-C000	125 V.A. POWER SUPPLY P.C. ASSY.
	0624-00902-0100	P.C. SUPPORT BRKT. 12" (2 REQ'D.)
	0624-00902-0500	P.C. SUPPORT BRKT. 6-1/2" (2 REQ'D.)
10	A088-00013-0000	ON-OFF SWITCH & BRKT. ASSY.
		ADDITIONAL PARTS LIST
	0017-00009-0490	5-5/8" SQR. VENT GRILLE (4 REQ'D.)
	A515-00021-0000	MULTIFUNCTION SWITCH & BRKT. ASSY.
	A097-00008-0000	BACK DOOR LOCK ASSY.
	0926-00904-0000	PLASTIC PROTECTIVE BUBBLE-BACK DOOR
	0017-00101-0628	#8-32 x 3/4" CARRIAGE BOLTS (10 REQ'D.)
	0017-00103-0061	#8-32 HEX NUTS W/SEMS (10 REQ'D.)
	A728-00010-0000	CONTROL SHELF CABLE ASSY.
	A728-00008-0000	MASTER CABLE ASSY.
	A968-00029-0000	VIDEO SIGNAL CABLE ASSY.
	A578-00010-0000	HIGH VOLTAGE CABLE ASSY.
	A578-00011-0000	LOW VOLTAGE CABLE ASSY.
	0017-00036-0064	LINE CORD — 3 COND.
	A982-00015-0000	COIN DOOR CABLE ASSY.
	A574-00015-0000	INSERT CABLE ASSY.
	A950-00006-0000	COIN BOX CRADLE ASSY.
	0950-00105-0000	COIN BOX COVER
	0950-00104-0000	COIN BOX HANDLE
	0950-00101-0000	COIN DEFLECTOR (2 REQ'D.)
	0950-00900-0000	LARGE PLASTIC CASH BOX
	0017-00101-0142	1/4-20 x 1-3/8" RD. 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.)

NO. 727 — TRON COCKTAIL — FRONT

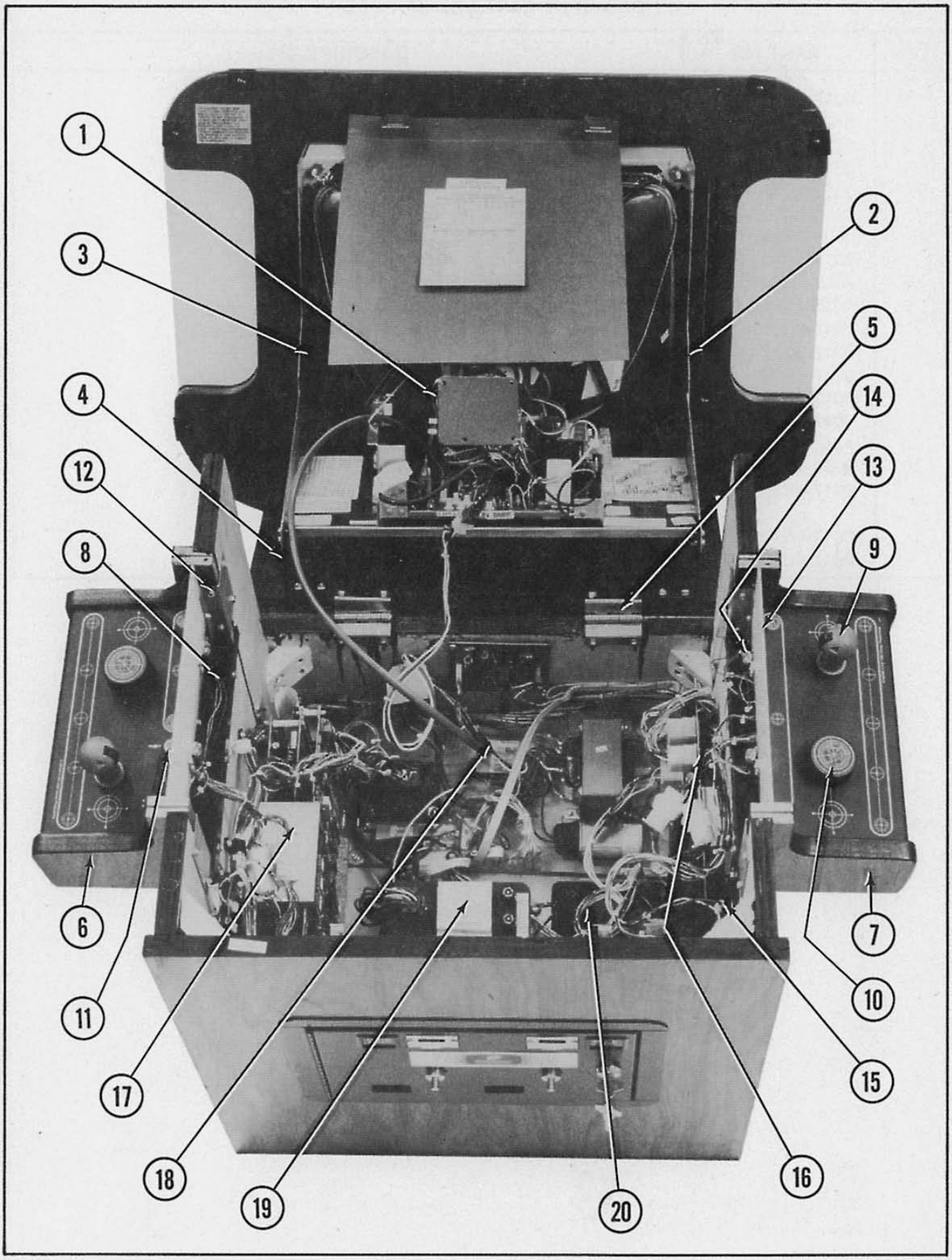


NO. 727 — TRON COCKTAIL — FRONT — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
1	0017-00009-0499	COVER GLASS — 32" x 22" x 1/4"
2	0727-00900-0000	ARTWORK UNDERLAY
3	0775-00104-00XF	GLASS CLIP (8 REQ'D.)
	0017-00101-0117	#8 x 5/8" PHIL. TRS. HD. SCREW (16 REQ'D.)
4	0557-00900-0000	T.V. BEZEL
	0530-00903-0000	ACRYLIC DIFFUSER
	0508-00901-0000	PLEXI GLASS CLIP (4 REQ'D.)
	0017-00101-0017	#6x 1/2" SLT. HEX HD. BLK. SCREW (4 REQ'D.)
5	A727-00004-0100	CONTROL SHELF ASSY. — PLAYER 1
6	A727-00004-0200	CONTROL SHELF ASSY. — PLAYER 2
7	0017-00009-0482	SPEAKER GRILLE — SMALL (2 REQ'D.)
	0017-00003-0431	4" SQR. SPEAKER 4 OHM, 10W. (2 REQ'D.)
8	0017-00009-0393	BLACK SPEAKER GRILLE W/SLOTS (2 REQ'D.)
	0017-00101-0136	#8-32 x 1-1/4" CARRIAGE BOLTS (16 REQ'D.)
	0017-00103-0061	#8-32 HEX NUTS W/SEMS (16 REQ'D.)
9	A090-00300-11BK	U.S.A. 25¢ COIN DOOR ASSY.
10	0090-00002-04BK	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 NUTS (4 REQ'D.)

NO. 727 — TRON COCKTAIL — REAR ACCESS



NO. 727 — TRON COCKTAIL — REAR 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
	0017-00101-0109	#8 x 5/16" UNSLOT HEX HD. BOLT (6 REQ'D.)
4	0927-00101-00XF	SUPPORT ANGLE (2 REQ'D.)
	0017-00101-0598	#8-32 x 5/16" SLT. HEX HD. SCREW (4 REQ'D.)
5	0017-00009-0514	2-1/2" HINGE (2 REQ'D.)
	0017-00101-0639	#8-32 x 1-1/4 CARRIAGE BOLT (4 REQ'D.)
	0017-00101-0628	#8-32 x 3/4 CARRIAGE BOLT (4 REQ'D.)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (8 REQ'D.)
6	A727-00018-0100	CONTROL PANEL — PLAYER 1
7	A727-00018-0200	CONTROL PANEL — PLAYER 2
8	0510-00101-00XF	BOTTOM PAN (2 REQ'D.)
9	A727-00021-0000	CONTROL ASSY. (2 REQ'D.)
10	A628-00037-0000	OPTICAL ENCODER DISC ASSY. (2 REQ'D.)
11	0017-00042-0304	RED PUSH BUTTON SWITCH ASSY. (2 REQ'D.)
12	0930-00104-0000	PANEL LOCATING BRKT. (4 REQ'D.)
	0017-00101-0025	#8 x 1/2" SLT. HEX HD. SCREW (12 REQ'D.)
13	0727-00901-0000	LIGHT SHIELD (2 REQ'D.)
14	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. SCREW (4 REQ'D.)
15	0017-00003-0431	4" SQR. SPEAKER 4 OHM 10W.
16	A082-90412-C000	125 VA. POWER SUPPLY
	0624-00902-0500	P.C. SUPPORT BRKT. 6-1/2" LG. (4 REQ'D.)
17	A628-00021-0000	MECH. CARD RACK ASSY. W/BOARDS
18	A727-00007-0000	TRANSFORMER BOARD ASSY.
19	A945-00002-0000	125 VA. FILTER ASSY.
20	A775-00013-0000	FAN ASSY.
	0151-00081-0000	4" FAN
	0775-00110-00XF	FAN PLATE
	0749-00106-00XF	VENT SCREEN
	0017-00101-0347	#6-32 x 1/2 R.H.M.S. (4 REQ'D.)
	0017-00104-0009	#6 EXT. WASHER (4 REQ'D.)
	0017-00103-0005	#6-32 HEX NUT (4 REQ'D.)
	0017-00101-0026	#8 x 5/8 SLT. HEX HD. SCREW (4 REQ'D.)
		ADDITIONAL PARTS LIST
	A082-90910-E000	DUAL POWER AMP P.C. ASSY. — MCR2
	A088-00014-0000	INTERLOCK SWITCH & BRKT. ASSY.
	A515-00021-0000	MULTIFUNCTION SWITCH BRKT. ASSY.
	A088-00013-0000	ON/OFF SWITCH ASSY.
	0610-00132-00ZN	STRIKE (2 REQ'D.)
	0017-00009-0033	LATCH CLAMP (2 REQ'D.)
	0017-00101-0141	#8 x 11/16 UNSLOT. HEX HD. SCREW (8 REQ'D.)
	A927-00019-0000	COIN BOX ASSY.

NO. 727 — TRON COCKTAIL — REAR ACCESS — PARTS LIST (Continued)

*ORDER BY PART NUMBER **ONLY***

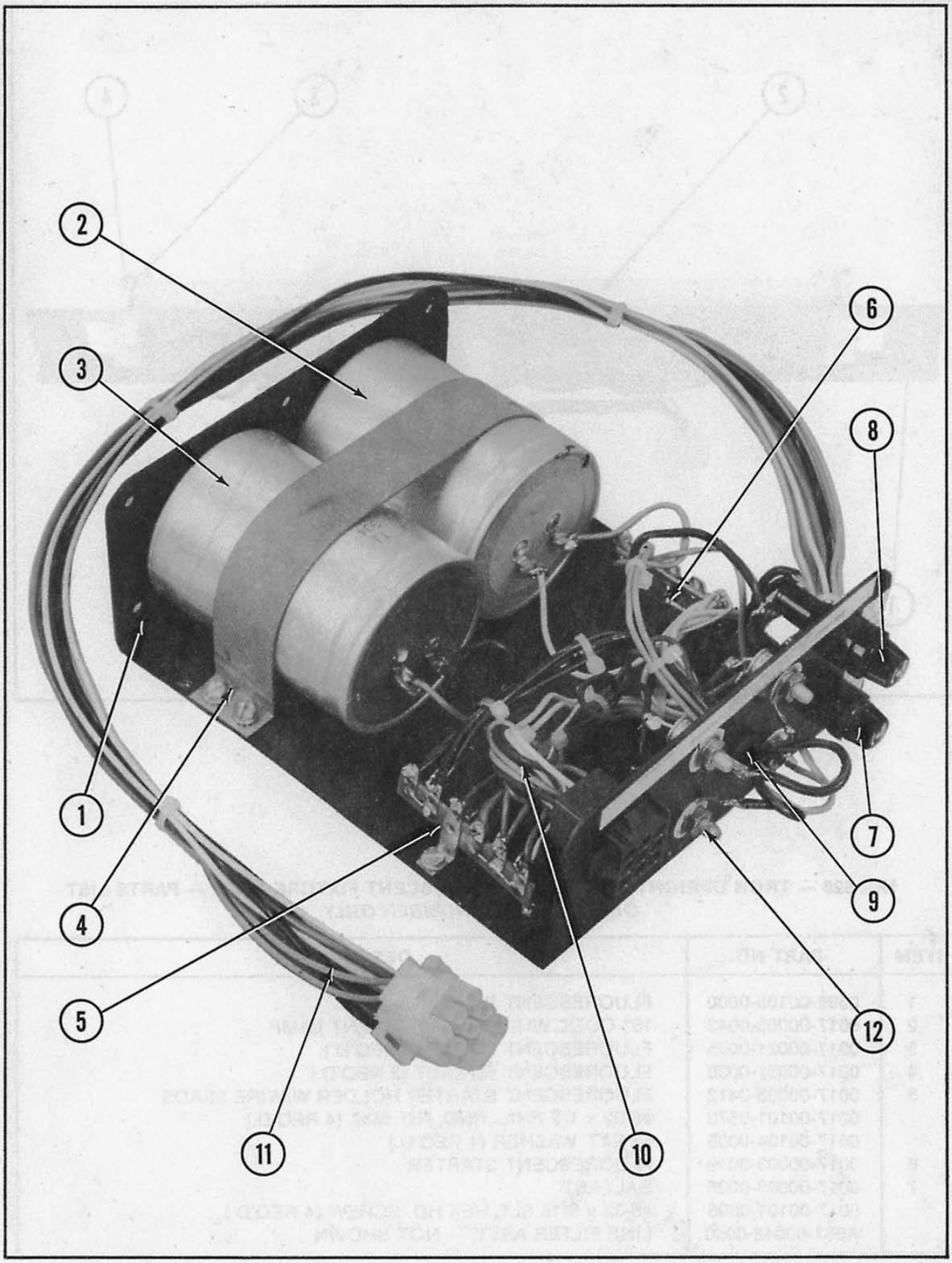
ITEM	PART NO.	DESCRIPTION
	A962-00004-0000	COIN BOX COVER ASSY.
	A962-00005-0000	COIN BOX SIDE CHANNEL ASSY. — SHORT
	0962-00101-0000	COIN BOX SIDE CHANNEL — SHORT
	0017-00101-0628	#8-32 x 3/4 CARRIAGE BOLT (4 REQ'D.)
	0017-00104-0022	#8 WASHER (4 REQ'D.)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (4 REQ'D.)
	A727-00010-0000	MASTER CABLE ASSY.
	A580-00008-0000	HIGH VOLTAGE CABLE ASSY.
	A727-00008-0000	LOW VOLTAGE CABLE ASSY.
	A727-00005-0100	CONTROL SHELF CABLE ASSY. — PLAYER 1
	A727-00005-0200	CONTROL SHELF CABLE ASSY. — PLAYER 2
	A580-00011-0000	VIDEO SIGNAL CABLE ASSY.
	A982-00015-0000	COIN DOOR CABLE ASSY.
	A927-00005-0000	LEG KIT ASSY. (HIGH BASE) — OPTIONAL (INCLUDES 4 LEGS & HARDWARE)
	0017-00003-0429	3 COND. LINE CORD

FILTER ASSY. — PARTS LIST

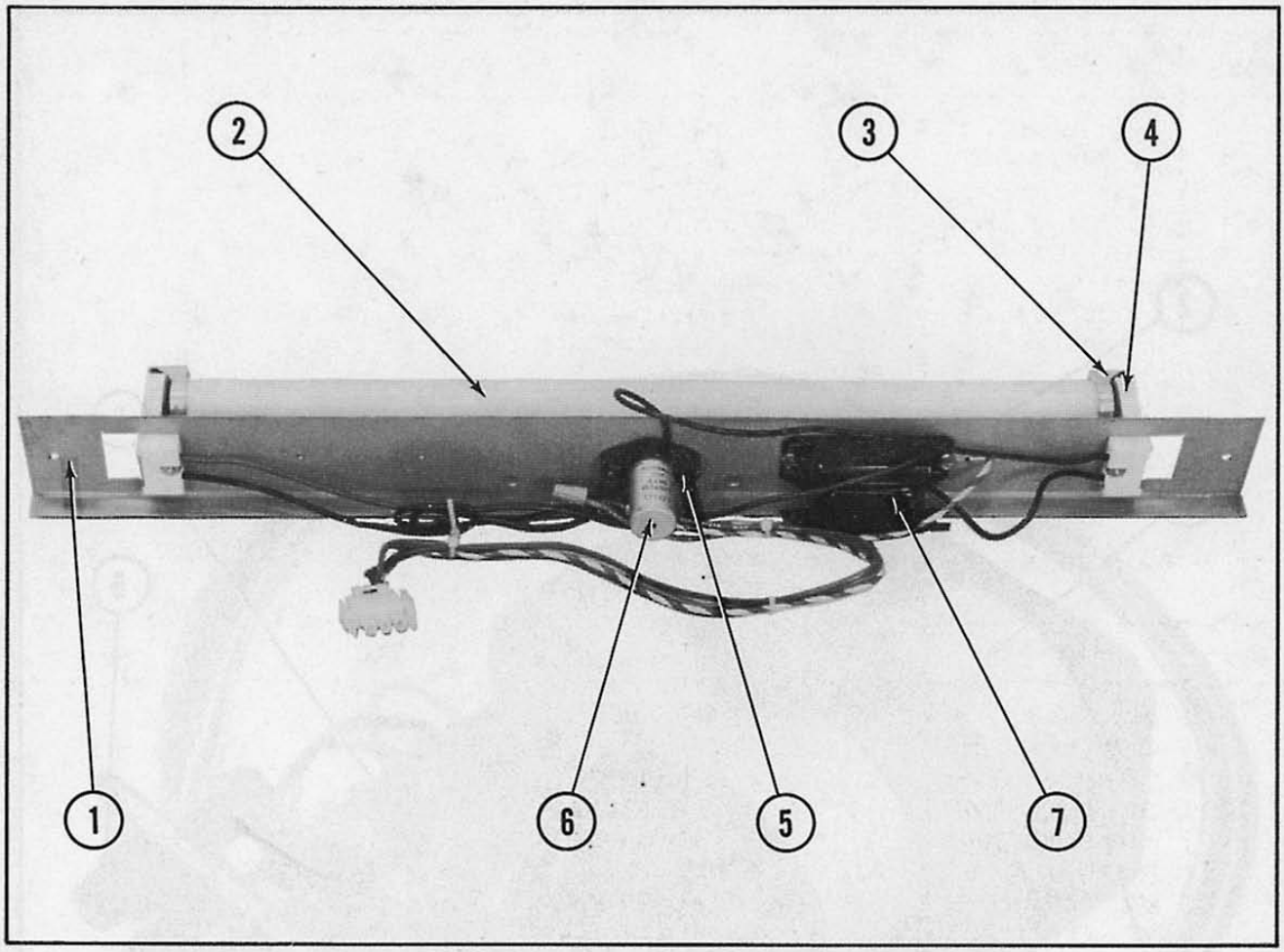
*ORDER BY PART NUMBER **ONLY***

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

FILTER ASSY.



NO. 628 — TRON UPRIGHT — HEADER FLUORESCENT FIXTURE ASSY.



NO. 628 — TRON UPRIGHT — HEADER FLUORESCENT FIXTURE 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	0017-00021-0005	FLUORESCENT LOCKS (2 REQ'D.)
4	0017-00031-0036	FLUORESCENT SOCKET (2 REQ'D.)
5	0017-00003-0412	FLUORESCENT STARTER HOLDER W/WIRE LEADS
	0017-00101-0573	#6-32 x 1/2 PHIL. RND. HD. M.S. (4 REQ'D.)
	0017-00104-0009	#6 EXT. WASHER (4 REQ'D.)
6	0017-00003-0019	FLUORESCENT STARTER
7	0017-00003-0026	BALLAST
	0017-00101-0598	#8-32 x 5/16 SLT. HEX HD. SCREW (4 REQ'D.)
	A961-00042-0000	LINE FILTER ASSY. — NOT SHOWN

NO. 628 — TRON UPRIGHT — SCENERY LIGHT ASSY. — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
1	0628-00118-0000	FLUORESCENT BRKT.
2	0017-00003-0043	18" COOL WHITE FLUORESCENT LAMP
3	0017-00021-0005	FLUORESCENT LOCKS (2 REQ'D.)
4	0017-00031-0036	FLUORESCENT SOCKET (2 REQ'D.)
5	0017-00003-0412	FLUORESCENT STARTER HOLDER W/WIRE LEADS
	0017-00101-0573	#6-32 x 1/2 PHIL. RND. HD. M.S. (4 REQ'D.)
	0017-00104-0009	#6 EXT. WASHER (4 REQ'D.)
6	0017-00003-0019	FLUORESCENT STARTER
7	0017-00003-0026	BALLAST
	0017-00101-0598	#8-32 x 5/16 SLT. HEX HD. SCREW (4 REQ'D.)
	A961-00042-0000	LINE FILTER ASSY. — NOT SHOWN

NO. 628 — TRON UPRIGHT — UPPER CONTROL SHELF FLUORESCENT FIXTURE ASSY. — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

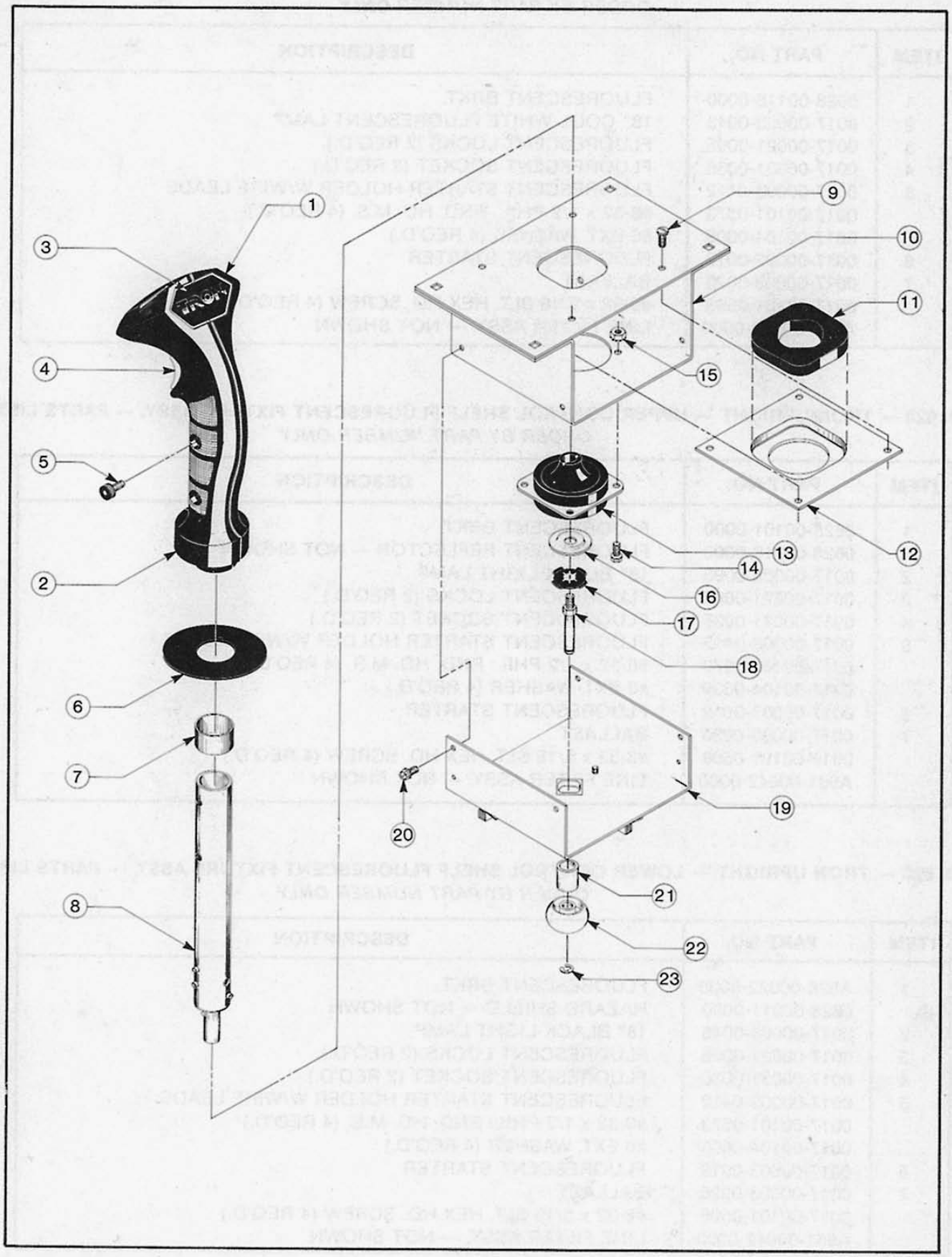
ITEM	PART NO.	DESCRIPTION
1	0628-00101-0000	FLUORESCENT BRKT.
	0628-00916-0000	FLUORESCENT REFLECTOR — NOT SHOWN
2	0017-00003-0095	18" BLACK LIGHT LAMP
3	0017-00021-0005	FLUORESCENT LOCKS (2 REQ'D.)
4	0017-00031-0036	FLUORESCENT SOCKET (2 REQ'D.)
5	0017-00003-0412	FLUORESCENT STARTER HOLDER W/WIRE LEADS
	0017-00101-0573	#6-32 x 1/2 PHIL. RND. HD. M.S. (4 REQ'D.)
	0017-00104-0009	#6 EXT. WASHER (4 REQ'D.)
6	0017-00003-0019	FLUORESCENT STARTER
7	0017-00003-0026	BALLAST
	0017-00101-0598	#8-32 x 5/16 SLT. HEX HD. SCREW (4 REQ'D.)
	A961-00042-0000	LINE FILTER ASSY. — NOT SHOWN

NO. 628 — TRON UPRIGHT — LOWER CONTROL SHELF FLUORESCENT FIXTURE ASSY. — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
1	A628-00022-0000	FLUORESCENT BRKT.
	0628-00911-0000	HAZARD SHIELD — NOT SHOWN
2	0017-00003-0046	18" BLACK LIGHT LAMP
3	0017-00021-0005	FLUORESCENT LOCKS (2 REQ'D.)
4	0017-00031-0036	FLUORESCENT SOCKET (2 REQ'D.)
5	0017-00003-0412	FLUORESCENT STARTER HOLDER W/WIRE LEADS
	0017-00101-0573	#6-32 x 1/2 PHIL. RND. HD. M.S. (4 REQ'D.)
	0017-00104-0009	#6 EXT. WASHER (4 REQ'D.)
6	0017-00003-0019	FLUORESCENT STARTER
7	0017-00003-0026	BALLAST
	0017-00101-0598	#8-32 x 5/16 SLT. HEX HD. SCREW (4 REQ'D.)
	A961-00042-0000	LINE FILTER ASSY. — NOT SHOWN

TRON — UPRIGHT & MINI — CONTROL GRIP ASSY

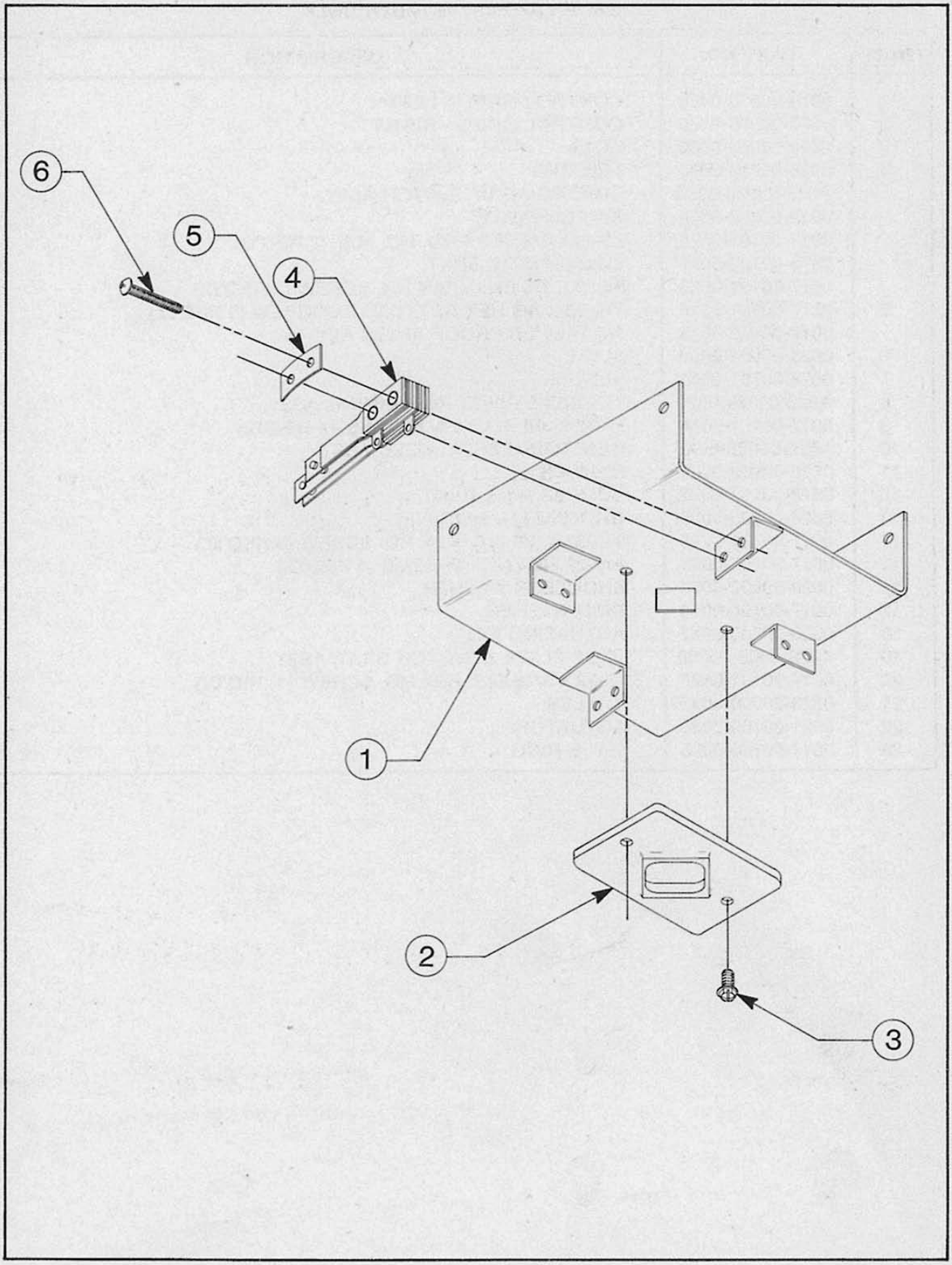


TRON — UPRIGHT & MINI — CONTROL GRIP ASSY — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
1	0873-00900-0400	CONTROL GRIP — LEFT
2	0873-00900-0300	CONTROL GRIP — RIGHT
3	0628-00907-0000	LENS
4	0628-00906-0000	TRIGGER
	A628-00028-0000	CONTROL GRIP SWITCH ASSY.
	0020-00202-0000	SWITCH PLATE
	0017-00101-0528	#5-40 x 3/4 SLT. RND. HD. M.S. (2 REQ'D.)
	0873-00123-00XF	SWITCH MTG. BRKT.
	0017-00101-0083	#4-20 x 3/8 PHIL. PAN HD. SCREW (2 REQ'D.)
5	0017-00101-0116	#10-32 x 3/8 HEX BUTTON HD. SCREW (5 REQ'D.)
	0017-00009-0513	1/8 TAMPER PROOF ALLEN KEY
6	0628-00904-0000	SLIDE
7	0628-00701-00XF	SLEEVE
8	A628-00024-0000	TUBING & PIVOT PIN PINNING ASSY.
9	0017-00101-0615	#8-32 x 3/8 SLT. PAN HD. M.S. (4 REQ'D.)
10	A628-00026-00XF	CENTERING BRKT. WELD ASSY.
11	0628-00909-0000	BUMPER
12	0873-00113-00XF	BUMPER MTG. BRKT.
13	0628-00905-0000	GROMMET — MODIFIED
14	0017-00101-0799	#10-32 x 3/8 SLT. HEX HD. SCREW (4 REQ'D.)
15	0017-00103-0081	#10-32 HEX NUT W/SEMS (4 REQ'D.)
16	0628-00922-0000	SHOULDER WASHER
17	0017-00104-0014	DISH WASHER
18	0628-00700-00XF	ACTUATING PIN
19	A628-00031-0000	STOP PLATE & SWITCH BRKT. ASSY.
20	0017-00101-0598	#8-32 x 5/16 SLT. HEX HD. SCREW (4 REQ'D.)
21	0628-00706-00XF	ROLLER
22	0921-00700-0000	ACTUATOR
23	0017-00100-0025	1/4" E-RING

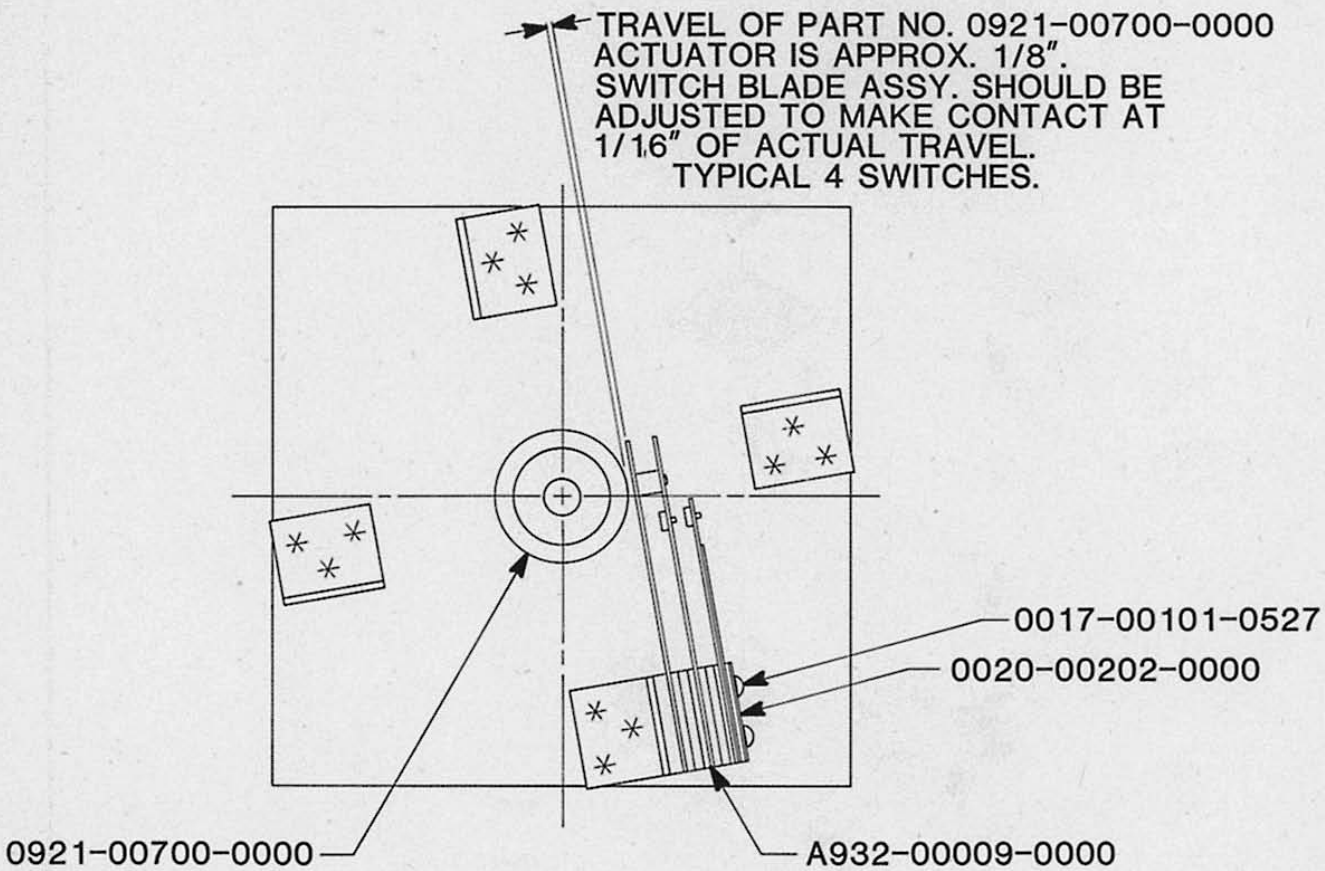
TRON — UPRIGHT & MINI — CONTROL SWITCH ASSY



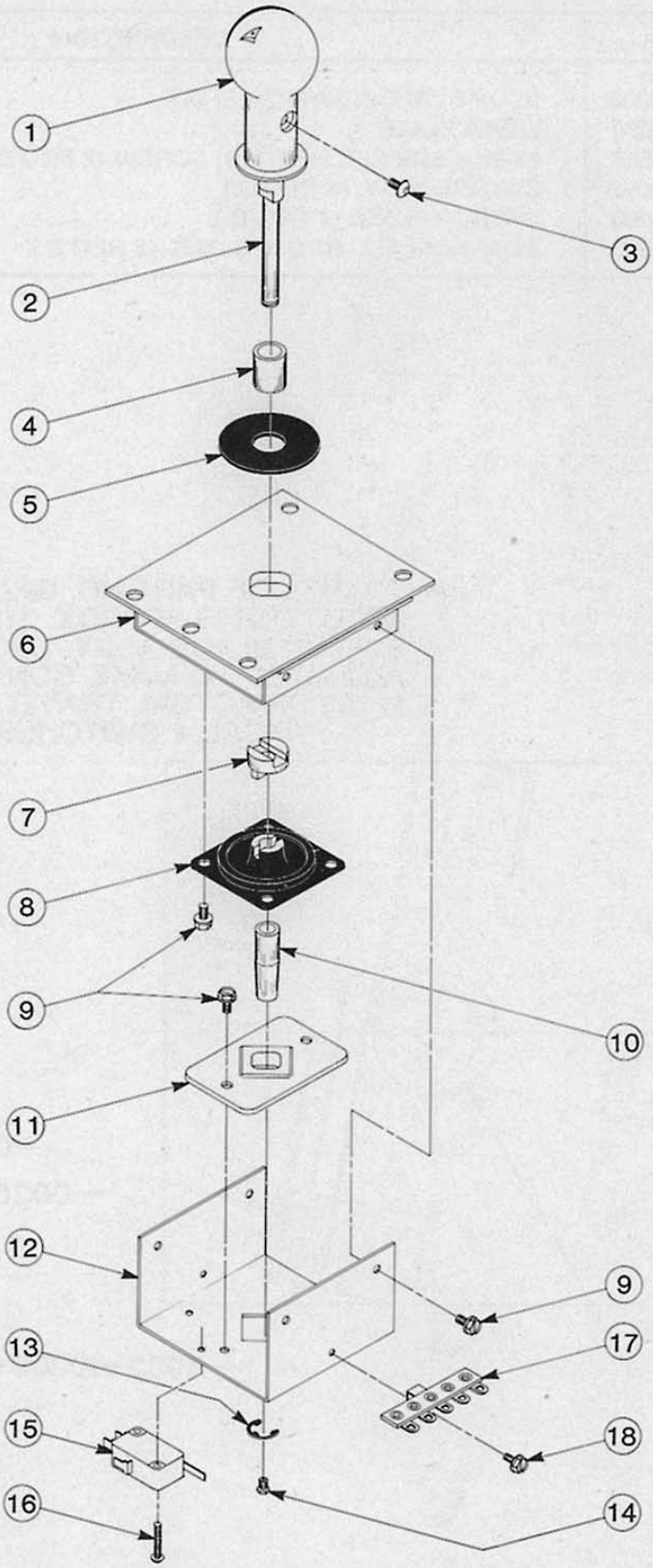
TRON — UPRIGHT & MINI — CONTROL SWITCH ASSY. — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
1	A628-00031-0000	STOP PLATE & SWITCH BRKT.
2	0932-00905-0000	WEAR PLATE
3	0017-00101-0598	#8-32 x 5/16 SLT. HEX. HD. SCREW (2 REQ'D.)
4	A932-00009-0000	SWITCH ASSY. (4 REQ'D.)
5	0020-00202-0000	SWITCH PLATE (4 REQ'D.)
6	0017-00101-0527	#5-40 x 5/8 SLT. RND. HD. M.S. (8 REQ'D.)



NO. 727 — TRON COCKTAIL — CONTROL GRIP ASSY

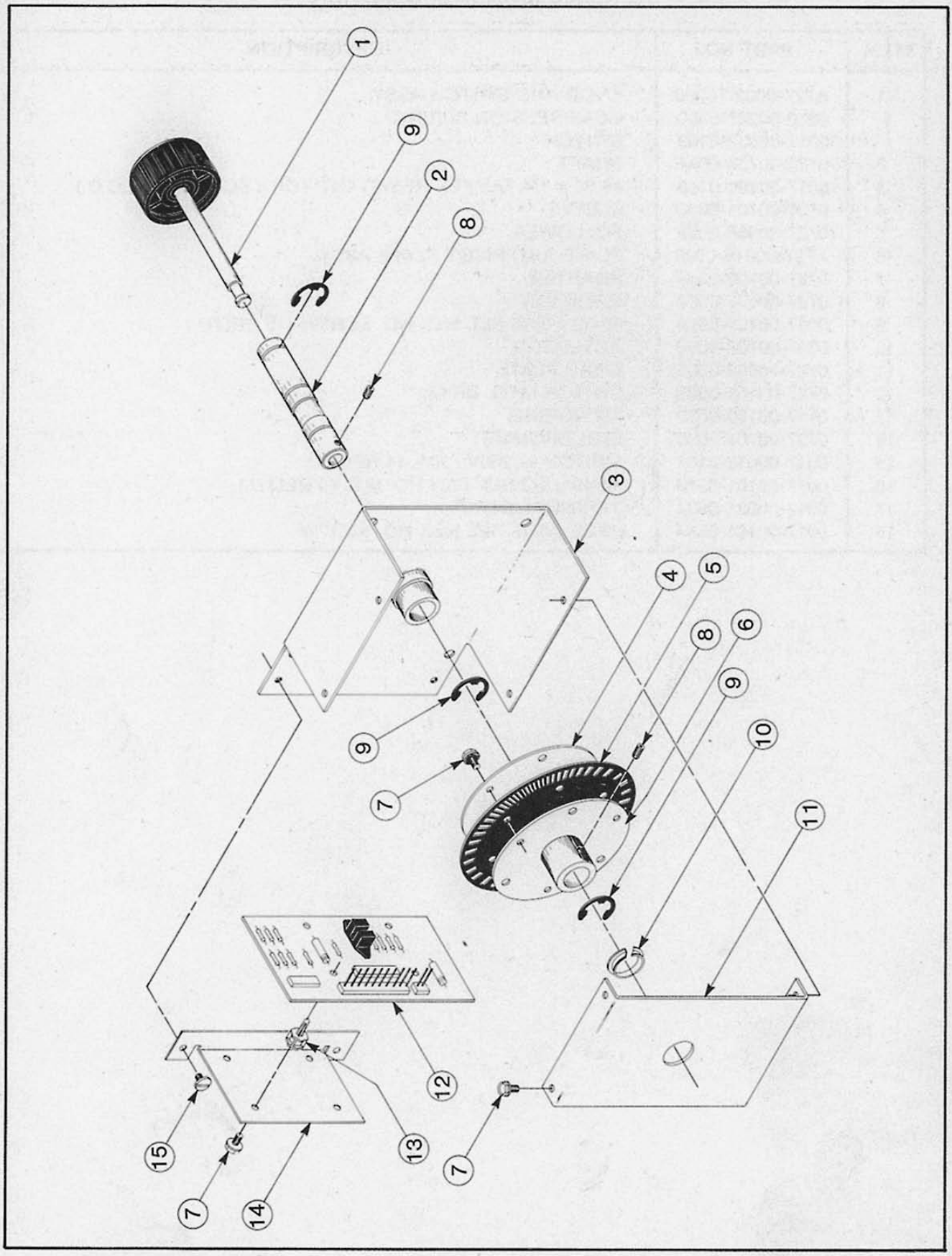


NO. 727 — TRON COCKTAIL — CONTROL GRIP ASSEMBLY — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
1	A727-00020-0000	KNOB AND SWITCH ASSY.
	0010-00267-0000	COMPRESSION SPRING
	0017-00032-0103	SWITCH
2	0727-00703-00XF	SHAFT
3	0017-00101-0148	#8-32 x 1/4 TAMPER RESISTANT TORX SCREW (2 REQ'D.)
4	0727-00701-0000	SLEEVE
5	0727-00905-0000	FOLLOWER
6	A727-00016-0000	PLATE AND PIVOT PLATE ASSY.
7	0727-00700-00XF	ADAPTER
8	0727-00907-0000	GROMMET
9	0017-00101-0598	#8-32 x 5/16 SLT. HEX HD. SCREW (10 REQ'D.)
10	0727-00702-0000	ACTUATOR
11	0727-00908-0000	WEAR PLATE
12	0727-00101-0000	SWITCH MTG. BRKT.
13	0017-00100-0025	1/4" E-RING
14	0727-00704-0000	END GROMMET
15	0017-00032-0104	SWITCH — 250V., 10A. (4 REQ'D.)
16	0017-00101-0510	#4-40 x 1/2 SLT. PAN HD. M.S. (8 REQ'D.)
17	0017-00021-0634	TERMINAL STRIP
18	0017-00101-0555	#6-32 x 5/16 SLT. HEX HD. SCREW

TRON — ALL VERSIONS — OPTICAL ENCODER DISC ASSY.

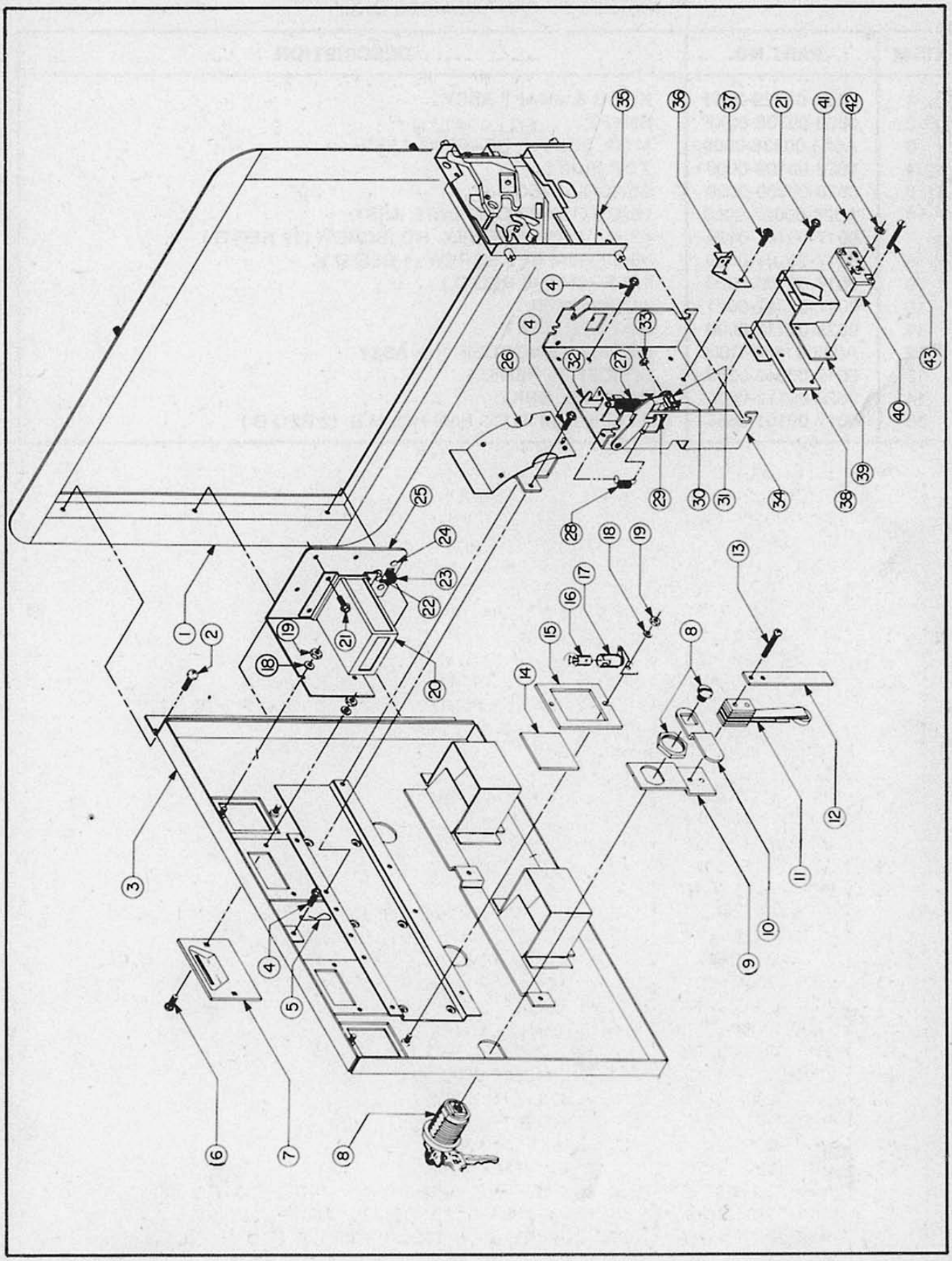


TRON — ALL VERSION — OPTICAL ENCODER DISC ASSY. — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
1	A628-00029-0000	KNOB & SHAFT ASSY.
2	0628-00705-00XF	SHAFT
3	A628-00038-0000	MTG. BRKT. & BEARING ASSY.
4	0628-00109-0000	TOP PLATE
5	0628-00900-0000	SENSOR DISC
6	A628-00027-0000	HUB TO BOTTOM PLATE ASSY.
7	0017-00101-0124	#6 x 1/4 UNSLOT HEX HD. SCREW (11 REQ'D.)
8	0017-00101-0309	#8-32 x 1/4 SET SCREW (4 REQ'D.)
9	0017-00100-0050	1/2 E-RING (3 REQ'D.)
10	0017-00042-0021	1/2 NYLINER
11	0628-00113-0000	BOTTOM BRKT.
12	A082-91418-D000	OPTICAL ENCODER P.C. ASSY.
13	0017-00042-0285	SPACER (4 REQ'D.)
14	0628-00112-0000	P.C. MTG. BRKT.
15	0017-00101-0586	#8-32 x 3/16 SLOT PAN HD. M.S. (2 REQ'D.)

FRONT DOOR ASSEMBLY — U.S.A. 25¢



FRONT DOOR ASSEMBLY — U.S.A. 25¢

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
1	0090-00002-02BK	DOUBLE ENTRY COIN DOOR FRAME
2	0017-00101-0121	#6-32 x 5/16 PHIL. TRS. HD. SCR. (3 REQ'D.)
3	A090-00073-02BK	DOUBLE ENTRY COIN DOOR W/DRESS PLATE
4	0017-00101-0123	#8 x 1/4 UNSLOT. HEX HD. SCREW (4 REQ'D.)
5	0017-00007-0019	KEY HOOK
6	0017-00101-0552	#6-32 x 1/4 CARRIAGE BOLT (4 REQ'D.)
7	0090-00117-03XF	COIN ENTRY PLATE — 25¢ (2 REQ'D.)
8	A097-00005-0000	DOOR LOCK & KEY W/SCREW & NUT (OR)
8	A097-00006-0000	DOOR LOCK & KEY W/SCREW & NUT
9	0090-00128-00XF	DOOR TILT SWITCH BRKT.
10	0017-00005-0041	DOOR CAM
11	A090-00095-0000	DOOR TILT SWITCH
12	0090-00126-01XF	SWITCH BACK-UP PLATE
13	0017-00101-0525	#5-40 x 9/16" PHIL. HD. M.S. (2 REQ'D.)
	A090-00096-0000	DOOR TILT SWITCH & BRKT. ASSY. (ITEMS 9 & 11 THRU 13)
14	0090-00903-9500	25¢ WINDOW (2 REQ'D.)
15	0090-00143-00XF	COIN PLEX RETAINER
16	0017-00003-0219	12 VOLT LAMP — G.E. #1895 (2 REQ'D.)
17	0017-00031-0048	BAYONET SOCKET W/BRKT. (2 REQ'D.)
18	0017-00104-0002	#6 SPLIT LOCK WASHER (8 REQ'D.)
19	0017-00103-0084	#6-32 HEX NUT W/SEMS (4 REQ'D.)
20	A090-00057-0000	COIN METER
21	0017-00101-0124	#6 x 1/4 UNSLOT. HEX HD. SCR. (8 REQ'D.)
22	0017-00032-0051	PUSH BUTTON SWITCH
23	0017-00032-0007	SLIDE SWITCH
24	0017-00072-0034	STEEL OVAL HD. RIVET
25	0090-00173-0000	COIN COUNTER MTG. BRKT.
	A090-00082-0000	TEST SWITCH & BRKT. ASSY. (ITEMS 23 THRU 25)
26	A090-00087-0000	COIN CHUTE & TOP ASSY. (2 REQ'D.)
27	0010-00134-0000	SPRING
28	0010-00181-0000	SPRING
29	0017-00007-0083	1/8 x 1-5/8 ROLL PIN
30	0090-00129-00XF	PIVOT POST
31	0090-00167-00XF	PIVOT LEVER
32	0093-00155-00XF	REJECT LEVER
33	0017-00100-0018	E-RING
	A090-00088-0000	REJECT LEVER ASSY. (2 REQ'D.) (ITEMS 30 THRU 33)
34	A090-00085-0000	COIN ACCEPTOR FRAME ASSY. (2 REQ'D.)
35	0017-00005-0003	COIN ACCEPTOR W/STRING CUTTER (2 REQ'D.) (OR)
35	0017-00005-0211	COIN ACCEPTOR W/ANTI STRING DEVICE (2 REQ'D.) (OR)
35	0017-00005-0214	COIN ACCEPTOR W/STRING CUTTER (2 REQ'D.)
36	A090-00064-0000	ANTI-PENNY DEVICE
37	0017-00101-0099	#6 x 1/4 SLT. HEX HD. M.S. (2 REQ'D.)
38	0090-00162-00XF	COIN SWITCH MTG. BRKT.
39	0017-00005-0203	COIN SWITCH CHUTE
40	0017-00005-0195	COIN SWITCH
41	0010-00599-0000	COIN SWITCH WIRE
42	0017-00007-0132	PUSH-ON RING
	A090-00059-0400	COIN SWITCH & WIRE ASSY. (ITEMS 40 THRU 42)
43	0017-00101-0698	#4-40 x 3/4 SLT. RND. HD. M.S. (2 REQ'D.)
	A090-00077-0000	COIN GUIDE & SWITCH ASSY. (ITEMS 38 THRU 43)

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. Nonerasable. Used for low-volume applications.

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

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

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

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

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

Introduction to the Z-80 CPU

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

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

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

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

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

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

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

General Purpose Registers

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

Arithmetic & Logic Unit (ALU)

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

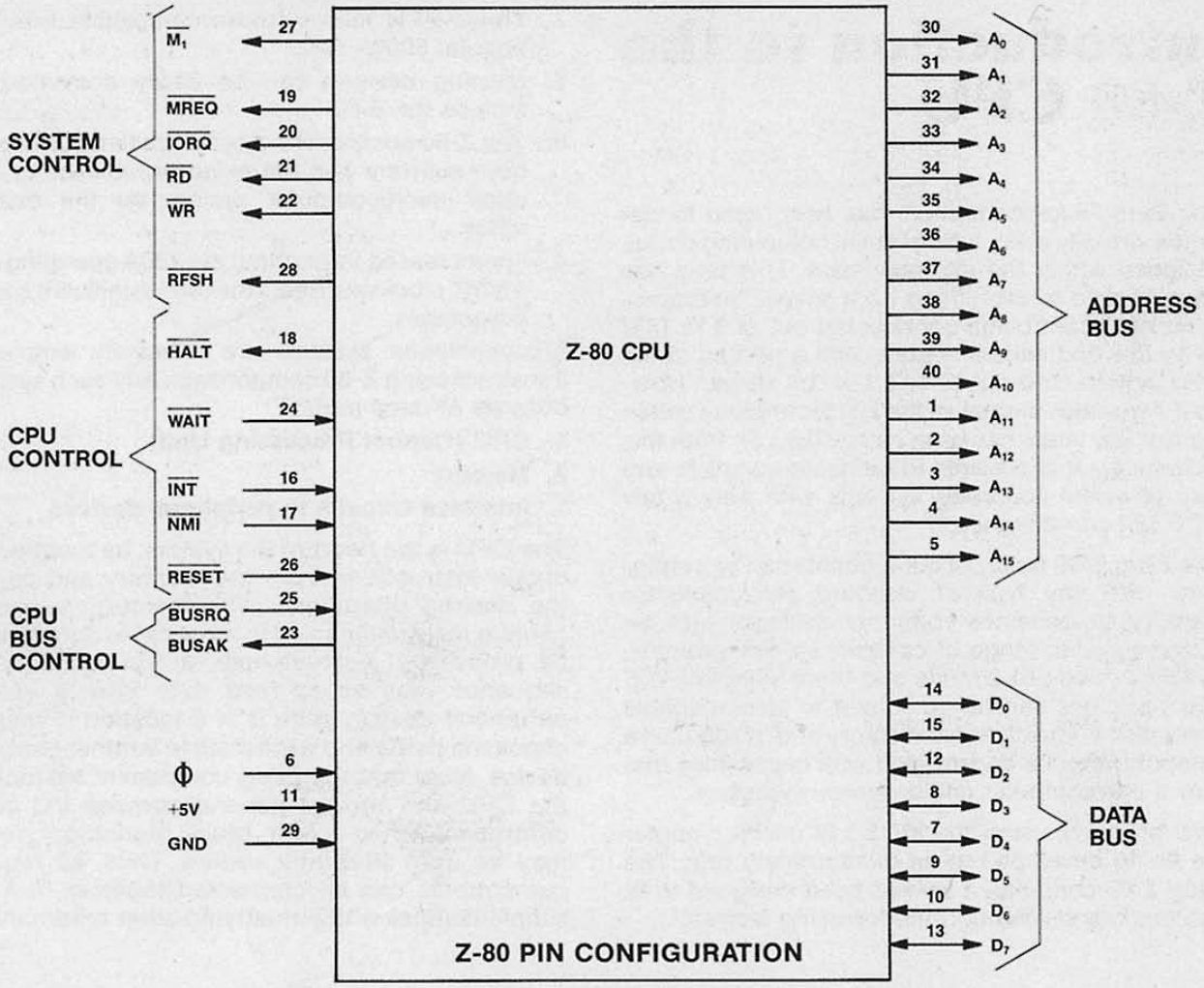
Add	Left or right shifts or rotates (arithmetic and logical)
Subtract	Increment
Logical AND	Decrement
Logical OR	Set bit
Logical Exlusive OR	Reset bit
Compare	Test bit

Instruction Register and CPU Control

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

Z-80 CPU Pin Description

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



A_0-A_{15}
(Address Bus)
Tri-state output, active high. A_0-A_{15} constitute a 16-bit address bus. The address bus provides the address for memory (up to 64K bytes) data exchanges and for I/O device data exchanges. I/O addressing uses the 8 lower address bits to allow the user to directly select up to 256 input or 256 output ports. A_0 is the least significant address bit. During refresh time, the lower 7 bits contain a valid refresh address.

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

M_1
(Machine Cycle one)
Output, active low. $\overline{M_1}$ indicates that the current machine cycle is the OP code fetch cycle of an instruction execution. Note that during execution of 2-byte op-codes, $\overline{M1}$ is generated as each op code byte is fetched. These two byte op-codes always begin with CBH, DDH, EDH or FDH. $\overline{M1}$ also occurs with $\overline{IORQ}$ to indicate an interrupt acknowledge cycle.

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

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

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

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

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

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

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

INT
(Interrupt Request)
Input, active low. The Interrupt Request signal is generated by I/O devices. A request will be honored at the end of the current instruction if the internal software controlled interrupt enable flip-flop (IFF) is enabled and if the $\overline{BUSRQ}$ signal is not active. When the CPU accepts the interrupt, an acknowledge signal ($\overline{IORQ}$ during M_1 time) is sent out at the beginning of the next instruction cycle. The CPU can respond to an interrupt in three different modes that are described in detail in section 5.4 (CPU Control Instructions).

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

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

1) Disable the interrupt enable flip-flop

2) Set Register I = 00_H

3) Set Register R = 00_H

4) Set Interrupt Mode 0

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

BUSRQ
(Bus Request)

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

BUSAK
(Bus Acknowledge)

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

CLK
(Clock)

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

MCR II SYSTEM
P.C. BOARD JUMPER OPTIONS

VIDEO GENERATOR P.C. BOARD

MANUFACTURER	EPROM NO.	JW#1	JW#2	JW#3	JW#4	JW#5	JW#6	JW#7	JW#8
MOTOROLA	68764	#	*	*	#	*	*	*	*
	68766	#	*	*	#	*	*	*	*
INTEL	2764	*	#	#	*	#	*	*	#
T. I.	2564	#	*	*	#	*	#	#	*

SUPER C.P.U. P.C. BOARD

JUMPER OPTIONS FOR PROGRAM ROMS ONLY

MANUFACTURER	EPROM NO.	JW#2	JW#4	JW#5	JW#6	JW#7	JW#18	JW#19	
MOTOROLA	68764	#	#	*	#	*	*	#	
	68766	#	#	*	#	*	*	#	
T. I.	2564	#	#	*	#	*	*	#	
INTEL	2764	*	*	#	*	#	#	*	

JUMPER OPTIONS FOR BACKGROUND ROMS ONLY

MANUFACTURER	EPROM NO.	JW#10	JW#11	JW#12	JW#13	JW#14	JW#15	JW#16	JW#17
MOTOROLA	68764	*	#	*	#	*	#	#	*
	68766	*	#	*	#	*	#	#	*
T. I.	2564	*	#	*	#	*	#	#	*
INTEL	2764	#	*	#	*	#	*	*	#

SOUND I/O P. C. BOARD

MANUFACTURER	EPROM NO.	JW#1	JW#2
NUMEROUS MFR'S	2532	*	#
NUMEROUS MFR'S	2732	#	*

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

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

All of the above Boards can be used with a variety of different **SETS of EPROM chips.** However, these EPROMS are not all made by the same manufacturer and do have some internal differences. So, in order to make them function properly in their respective P.C. Boards, certain jumper wires on these Boards have to be cut.

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

VII. Coin Door Maintenance

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

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

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

COIN DOOR MAINTENANCE

METAL COIN ACCEPTOR MECHANISMS

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

1. **Make sure the power to the game is off.**
2. Unlock and open the coin door.
3. Remove the coin acceptor mechanism as shown in Figure 7-1.
   - ☐ Push down on the two spring loaded latches.
   - ☐ While holding the latches down, pull the top of the coin acceptor mechanism toward you.
   - ☐ Release the latches and lift out the coin acceptor mechanism.

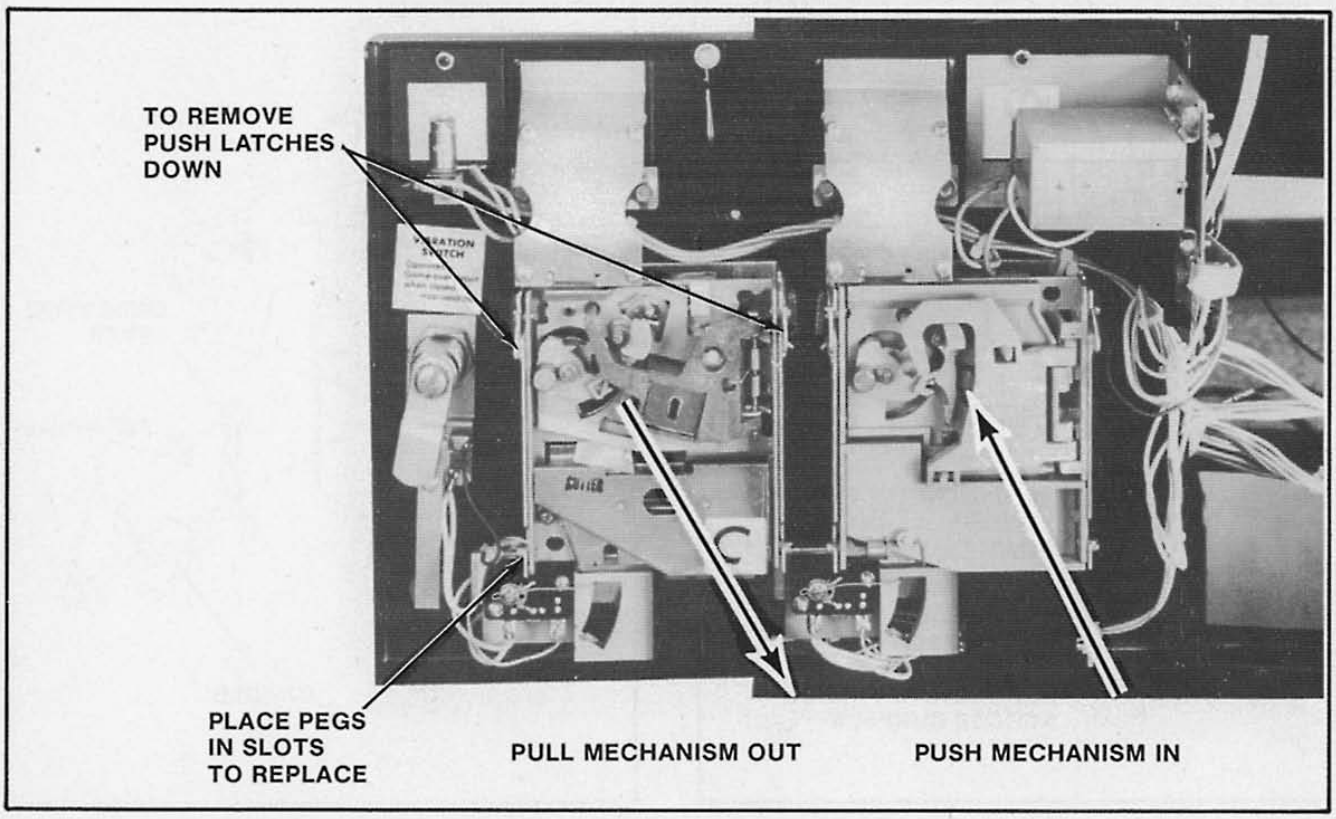


Figure 7-1 Removing and replacing coin acceptor

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

CAUTION: BE CAREFUL NOT TO BURN YOURSELF.

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

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

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.

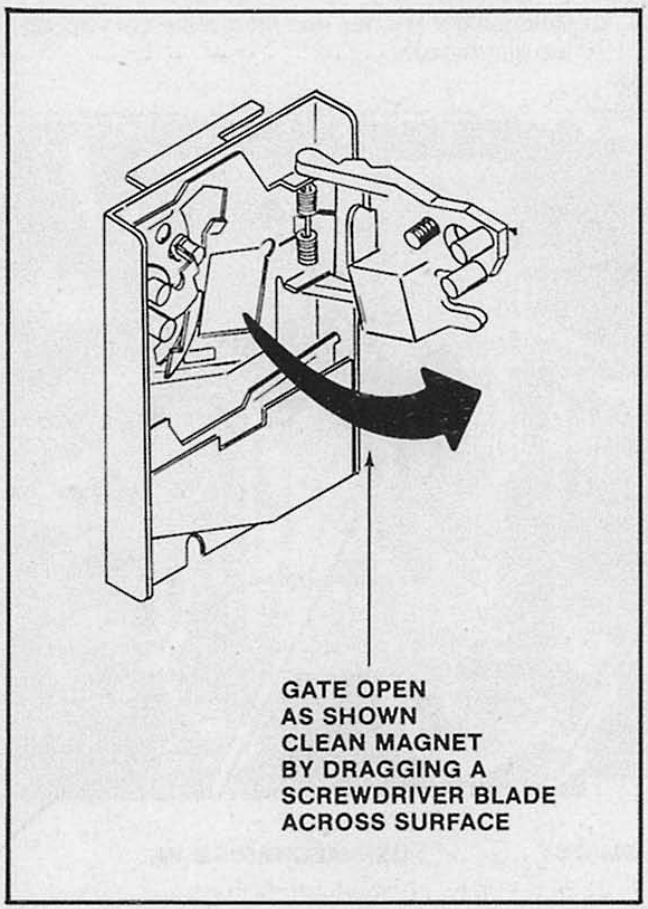


Figure 7-2 Cleaning the metal coin acceptor

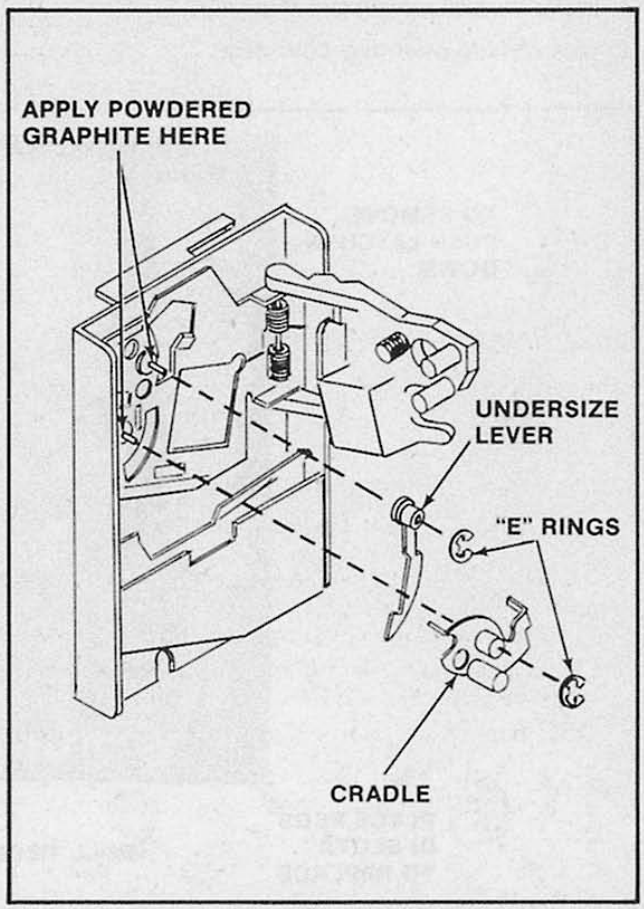


Figure 7-3 Lubricating the metal coin acceptor

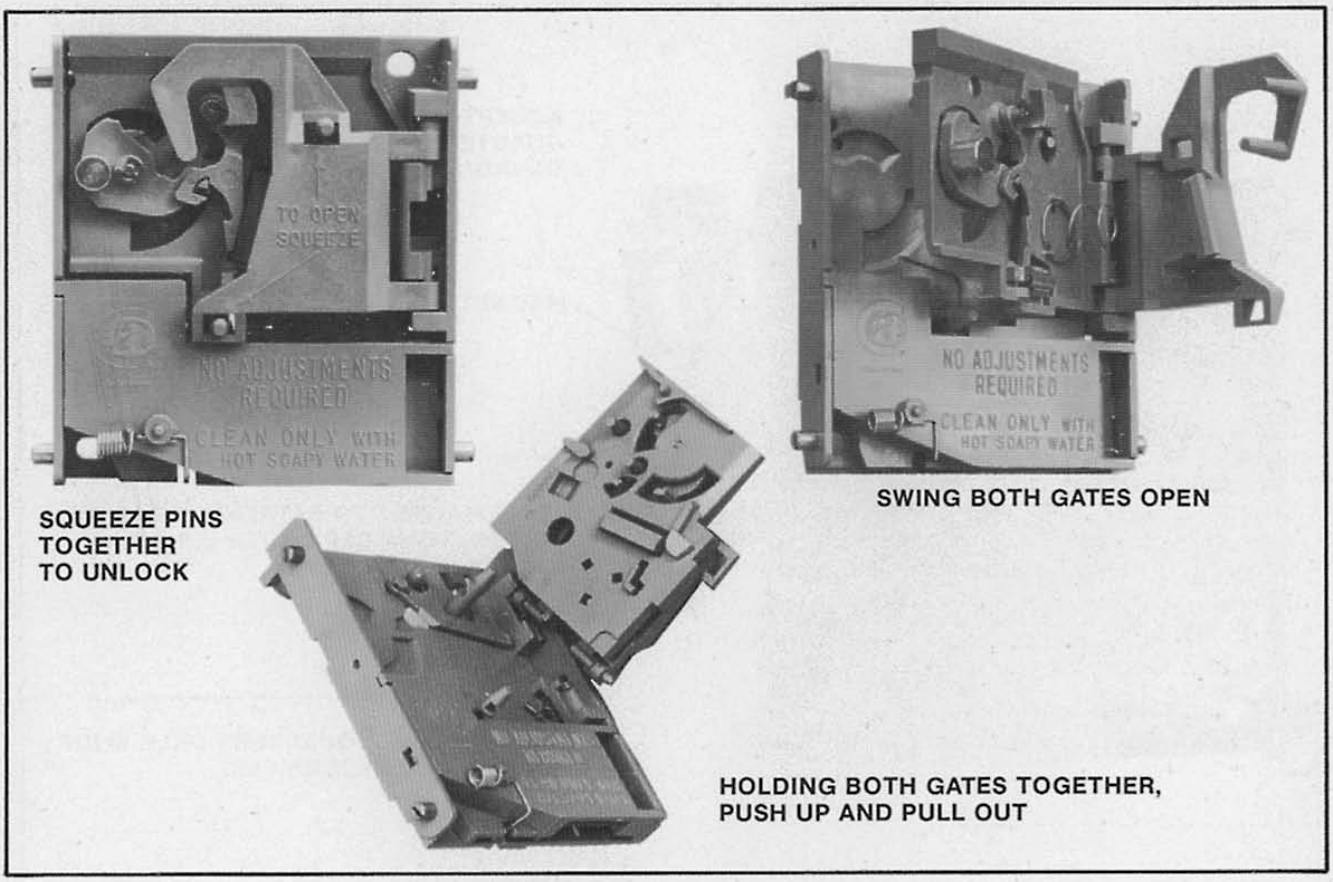


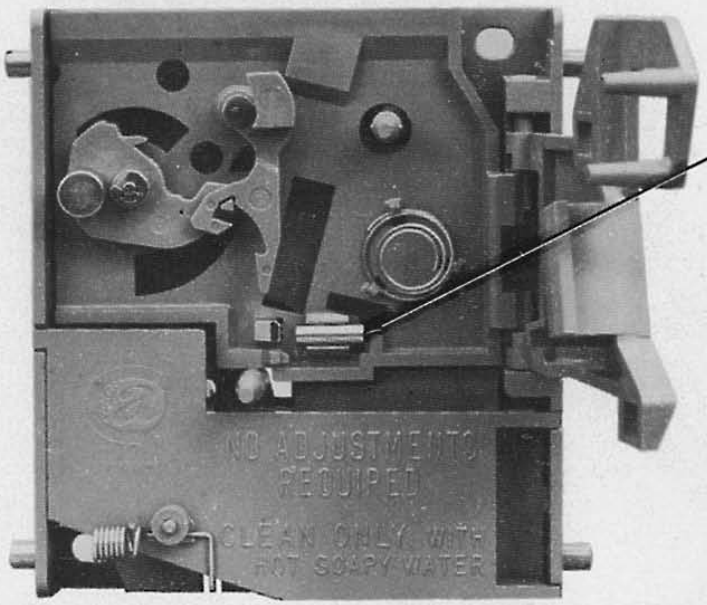
Figure 7-4 Opening the plastic coin acceptor

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.



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

MAGNET

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

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

Figure 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 heighth:**
   A. Horizontal line (due to VERTICAL CIRCUIT DEFECT).
      - ☐ Bad yoke.
      - ☐ Bad vertical output section.
      - ☐ Open fusible resistor in vertical section.
      - ☐ Bad height control.
      - ☐ Bad flyback.

   B. Vertical line (due to HORIZONTAL CIRCUIT DEFECT).
      - ☐ Bad yoke.
      - ☐ Open width coil.
      - ☐ Open part in horizontal output section.

2. **Picture spread out too far or crushed in certain areas:**
   A. Horizontal or vertical output transistor.
   B. Bad component in output circuitry.

3. **Line too close with black spacing:**
   A. Problem in vertical section causing poor linearity.

4. **Poor focus and convergence:**
   A. Bad high voltage transformer ("flyback") or control.
   B. Focus voltage wire not connected to neckboard terminal.

5. **Colors missing; check:**
   A. Interface color transistors.
   B. Color output transistors.
   C. Cracked printed circuit board.
   D. Color circuits.
   E. Video input jack.

6. **Picture not bright enough:**
   A. Weak emission from picture tube. (Turn horizontal sync off frequency and put brightness all the way up for about 15 minutes. Occasionally this cures the problem.)

7. **Silvery effect in white areas; check:**
   A. Beam current transistors.
   B. Weak picture tube emission.

8. **Too much brightness with retrace lines; check:**
   A. Beam limiter transistors.
   B. Brightness and/or color blanking control set too high.

9. **Increasing brightness causes an increase in size and poor focus.**
   A. Weak high voltage rectifier or regulation (high voltage unit).

10. **Small picture and/or poor focus:**
    A. Low B+ voltage (power supply trouble).

11. **Vertical rolling:**
    A. Vertical oscillator transistor, IC, or circuit.
    B. No sync from logic board.

12. **Horizontal line across center:**
    A. Vertical output circuit is dead (see symptom No. 1. A.).
    B. Vertical oscillator is not putting out the right wave form.

13. **Picture bends:**
    A. Horizontal sync needs adjusting.
    B. Magnetic or electromagnetic interference.

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

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

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

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

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

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

20. **Wavey picture — (power supply defect); check:**
    A. Transistors, diodes, electrolytic capacitors in the power supply.

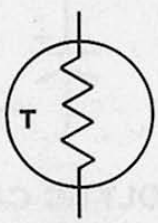
21. **Moving bars in picture:**
    A. Ground connector off between monitor and logic boards.
    B. Defect in the power supply (see wavy picture symptom).

22. **Washed out picture (see picture not bright enough):**
    A. Check video signal at the cathode pins with an oscilloscope. If there is about 80 volts peak to peak, the picture tube has weak emission.

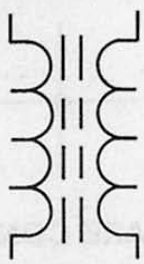
23. **Monitor won't turn on:**
    A. Problem in the power supply: Check fuse, transistors, open fusible resistor.
    B. Shorted horizontal output transistor.
    C. Defective high voltage disabling circuit.
    D. Crack(s) somewhere on main chassis board.

24. **Can't adjust purity or convergence:**
    A. Use a degausser to demagnetize the picture tube carefully following your degausser's instructions.
    B. Picture tube defective.
    C. Metal foreign material is in picture tube shield.
    D. Nearby equipment is electromagnetically interferring.
    E. The poles of the earth are pulling off the purity.
    F. Poor focus or width of picture.

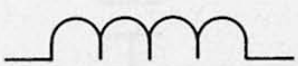
Guide To Schematic Symbols



THERMISTOR
(POLARITY DOESN'T MATTER)



IRON CORE TRANSFORMER
(SUCH AS A FLYBACK)

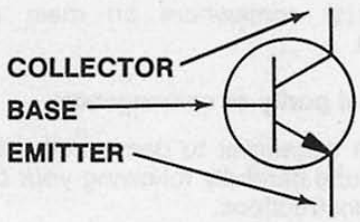


INDUCTOR, COIL, CHOKE
(POLARITY DOESN'T MATTER)

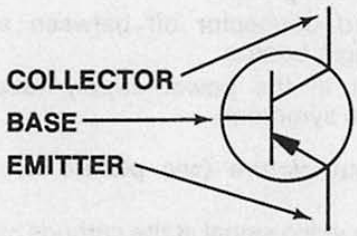
FUSE
(POLARITY DOESN'T MATTER)

ZENER DIODE

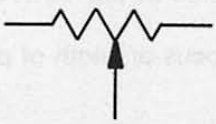
DIODE



NPN TRANSISTOR



PNP TRANSISTOR



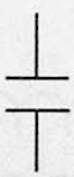
VARIABLE RESISTOR, POT, CONTROL
(POLARITY DOESN'T MATTER)

RESISTOR
(POLARITY DOESN'T MATTER)

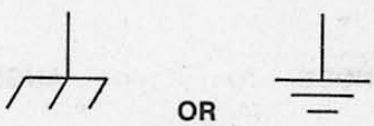
LINES ARE CONNECTED

ELECTROLYTIC CAPACITOR

LINES ARE NOT CONNECTED



CAPACITOR
(POLARITY DOESN'T MATTER)



GROUND

Troubleshooting

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

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

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

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

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

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

CAUTION:

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

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

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

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

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

A diode is tested like a transistor except it only has two leads. Again, there should be high resistance one way and little resistance the other. If it tests bad, take one lead out of the circuit in case some component is messing up the ohmmeter reading.

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

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

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

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

Theory of Operation

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

THE POWER SUPPLY —

The AC going to the monitor from the game transformer is just like the voltage and current from your wall outlet. It jumps up and down going positive and negative sixty times a second. But a monitor needs nice, smooth DC; direct current, not alternating. So diodes chop up the AC and a big electrolytic capacitor filters it out to make it even smoother. Since the monitor is a big piece of electronic equipment, with many circuits demanding a lot of power from the power supply, there are also zener diodes and transistors to help maintain a nice, constant, smooth voltage so that the monitor circuits don't jump around. And this is what happens when you see a wavy picture. There is AC creeping through the power supply, so it must be malfunctioning. If the voltage from the power supply is too low, the other circuits will be starved for power and you may see a small, wavy picture, or none at all.

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

THE INTERFACE SECTION OF THE CHASSIS —

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

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

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

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

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

VERTICAL AND HORIZONTAL DEFLECTION—

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

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

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

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

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

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

THE FLYBACK TRANSFORMER (OR HIGH VOLTAGE UNIT) —

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

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

COLOR CIRCUITS —

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

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

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

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

PROTECTION CIRCUIT —

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

Wells Gardner = 130VDC
Electrohome = 120VDC

The best place to measure this voltage on an Electrohome monitor is at a pin marked B1 on the chassis. This is because a 13 inch color Electrohome monitor, The G07-FB0 or G07-902, has an integrated circuit and very little else in the power supply. Still, there should be 120VDC at B1.

THE PICTURE TUBE (OR CRT) —

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

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

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

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

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

Differences Between Monitors

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

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

Now let's say you have a Wells Gardner that isn't working. **STOP!!** This could be a problem. There are 3 different types of Wells Gardner K4900 **SERIES** monitors in the games. Here are ways to identify them.

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

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

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

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

K4906 **WITHOUT** the Damper Control: 2021111201

K4906 **WITH** the Damper Control: 2021111258

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

Picture distortion.

Excessive brightness.

Too much or too little vertical picture size.

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

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

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

CONTROLS YOU MAY NOT TOUCH

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

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

Parts Interchangeability

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

1. You **CAN** swap any resistor between monitors that has the same resistance, wattage rating, and tolerance.
2. You **CAN** swap any capacitor between monitors that has the same capacitance and voltage rating.
3. You **CAN** swap many of the parts between the 19" and the 13" versions of each manufacturer's monitor. **BUT,** be certain to compare the manufacturers' part numbers to be positive the parts you want to interchange are identical. **BE SURE** you have read the section DIFFERENCES BETWEEN MONITORS which was covered earlier.
4. You **CANNOT** swap any picture tubes between monitors!! In the past you could, but Wells Gardner is now using a new monitor. When ordering a replacement picture tube, **ALWAYS SPECIFY THE PICTURE TUBE NUMBER!**
5. You **CANNOT** change any part that is a **safety part,** one that is shaded in gray on the schematic; it **MUST** be **IDENTICAL** to the original. **To do otherwise IS DANGEROUS.** For instance, the 13 inch Electrohome (G07-902) monitor "flyback" looks identical to the 19 inch Electrohome (G07-904) monitor "flyback". In fact, there is even a 19 inch Electrohome (G07-905) monitor (which is an obsolete model) with a similar looking "flyback". **NONE OF THESE ARE INTERCHANGEABLE!!**
6. You **CAN** change any of the parts between the G07-904 and G07-907. They're essentially the same monitor except that the G07-907 has a vertically mounted picture tube.

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

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.

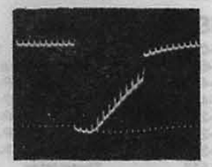
⚠

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.

A



1V/DIV 200uSEC/DIV

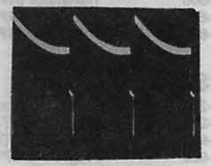
TP-31 DC COUPLED
BOTTOM LINE = 0 VDC

2V/DIV 200MSEC/DIV

I.C. 301, PIN 3

1V/DIV 5MSEC/DIV

TP-82



20V/DIV 5MSEC/DIV

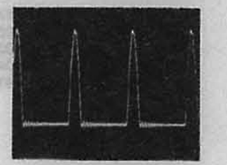
I.C. 301, PIN 13

1VDIV 200uSEC/DIV

Q351 COLLECTOR

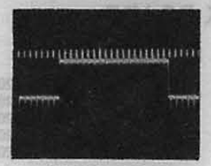
20V/DIV 10uSEC/DIV

J402-3



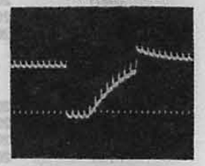
5V/DIV 20uSEC/DIV

F



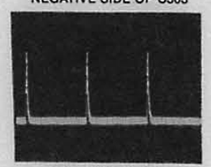
1V/DIV 20u SEC/DIV

TP-31, AC COUPLED



1V/DIV 200uSEC/DIV

NEGATIVE SIDE OF C303

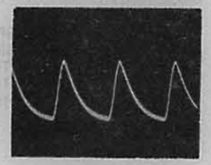


2V/DIV 5MSEC/DIV

TP-81

0.5/DIV 5MSEC/DIV

B



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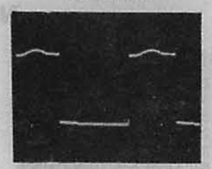
I.C. 301, PIN 15



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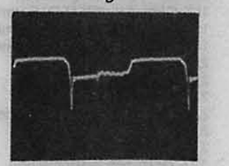
D



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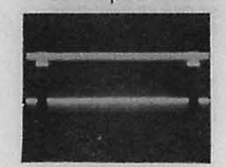

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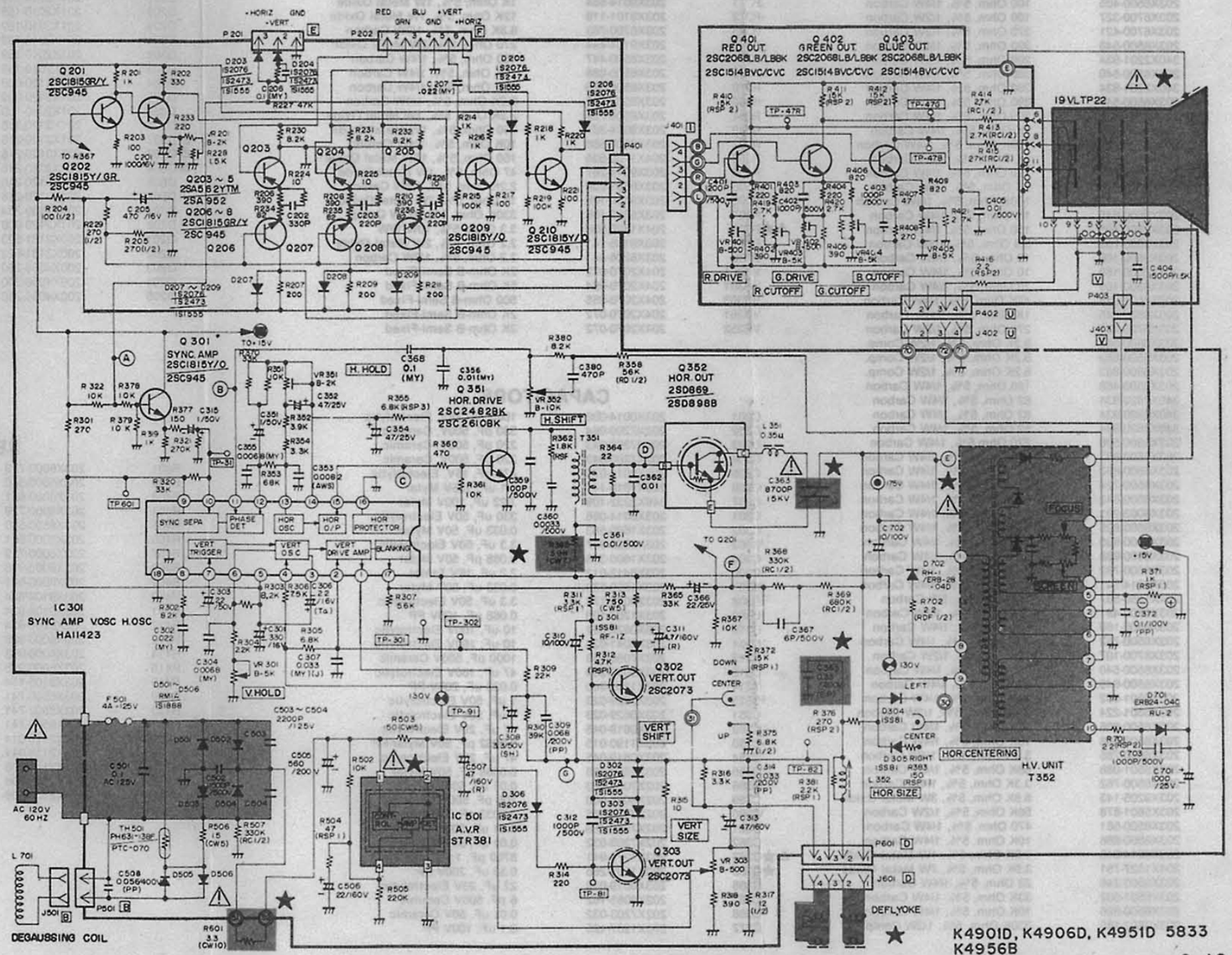


K4901D, K4906D, K4951D 5833
K4956B

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 △★ 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
	RESISTORS	
R201	203X6500-645	1K Ohm, 5%, 1/4W Carbon
R202	203X6500-523	30 Ohm, 5%, 1/4W Carbon
R203	203X6500-405	100 Ohm, 5%, 1/4W Carbon
R204	203X6700-327	100 Ohm, 5%, 1/2W Carbon
R205	203X6700-421	270 Ohm, 5%, 1/2W Carbon
R206	203X6500-540	390 Ohm, 5%, 1/4W Carbon
R207	340X2201-934	200 Ohm, 5%, 1/4W Carbon
R208	203X6500-540	390 Ohm, 5%, 1/4W Carbon
R209	340X2201-934	200 Ohm, 5%, 1/4W Carbon
R210	203X6500-540	390 Ohm, 5%, 1/4W Carbon
R211	340X2201-934	200 Ohm, 5%, 1/4W Carbon
R214	203X6500-645	1K Ohm, 5%, 1/4W Carbon
R215	203X6501-126	100K Ohm, 5%, 1/4W Carbon
R216	203X6500-645	1K Ohm, 5%, 1/4W Carbon
R217	203X6500-405	100 Ohm, 5%, 1/4W Carbon
R218	203X6500-645	1K Ohm, 5%, 1/4W Carbon
R219	203X6501-126	100K Ohm, 5%, 1/4W Carbon
R220	203X6500-645	1K Ohm, 5%, 1/4W Carbon
R221	203X6500-405	100 Ohm, 5%, 1/4W Carbon
R222	203X6500-762	3.3 Ohm, 5%, 1/4W Carbon
R224	203X6500-169	10 Ohm, 5%, 1/4W Carbon
R225	203X6500-169	10 Ohm, 5%, 1/4W Carbon
R226	203X6500-169	10 Ohm, 5%, 1/4W Carbon
R227	203X6501-044	47K Ohm, 5%, 1/4W Carbon
R228	203X6500-645	1K Ohm, 5%, 1/4W Carbon
R229	203X6700-421	270 Ohm, 5%, 1/2W Carbon
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
★R363	204X1527-751	3.9K Ohm, 5%, 7W Metal Oxide
R364	203X6500-246	22 Ohm, 5%, 1/4W Carbon
R365	203X6501-002	33K Ohm, 5%, 1/4W Carbon
R367	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R368	203X5602-185	330K Ohm, 5%, 1/2W Comp.

Ref. No.	Part No.	Description
	RESISTORS (CONT.)	
R369	203X5602-329	680K Ohm, 5%, 1/2W Comp.
R370	203X6501-002	33K Ohm, 5%, 1/4W Carbon
R371	203X9014-584	1K Ohm, 5%, 1W Metal Oxide
R372	203X9101-119	12K Ohm, 5%, 1W Metal Oxide
R375	203X6700-763	6.8K Ohm, 5%, 1/2W Carbon
R376	203X9104-404	270 Ohm, 5%, 2W Metal Oxide
R377	203X6500-447	150 Ohm, 5%, 1/4W Carbon
R378	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R379	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R380	203X6500-865	8.2K Ohm, 5%, 1/4W Carbon
R381	203X6500-724	2.2K Ohm, 5%, 1W Metal Oxide
R383	203X9014-387	150 Ohm, 5%, 1W Metal Oxide
R502	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R503	204X1700-535	150 Ohm, 5%, 15W Metal Oxide
R504	203X9014-267	47 Ohm, 5%, 1W Metal Oxide
R505	203X6501-209	2.2K Ohm, 5%, 1/4W Carbon
R506	203X9104-105	15 Ohm, 5%, 2W Metal Oxide
R507	203X5602-185	330K Ohm, 5%, 1/2W Comp.
△★R601	204X1625-058	3.3 Ohm, 5%, 10W WW
R701	203X9105-141	2.2 Ohm, 5%, 2W Metal Oxide
R702	203X6206-441	2.2 Ohm, 5%, 1/2W Carbon
VR201	204X2070-072	2K Ohm-B Semi-Fixed
VR301	204X2070-084	5K Ohm-B Semi-Fixed
VR303	204X2070-055	500 Ohm-B Semi-Fixed
VR351	204X2070-072	2K Ohm-B Semi-Fixed
VR352	204X2070-072	2K Ohm-B Semi-Fixed
	CAPACITORS	
C201	203X0014-088	1000 uF, 16V, Electrolytic
C202	202X7200-064	330 pF, 500V, Ceramic
C203	202X7200-043	220 pF, 500V, Ceramic
C204	202X7200-043	220 pF, 500V, Ceramic
C205	203X0014-076	470 uF, 16V, Electrolytic
C206	203X1810-149	0.1 uF, 125V Mylar
C207	349X2232-109	.022 uF, 100V Mylar
C301	203X0014-065	330 uF, 50V Electrolytic
C302	203X1600-563	0.033 uF, 50V Mylar
C303	203X0629-037	3.3 uF, 50V Electrolytic
C304	203X1600-366	0.068 pF, 50V Mylar
C306	203X0412-012	2.2 uF, 16V Tantal
C307	203X1600-634	0.033 uF, 50V Mylar
C308	203X0025-174	3.3 uF, 50V Electrolytic
C309	203X1207-100	0.068 uF, 100V PP
C310	203X0629-061	10 uF, 100V Electrolytic
C311	203X0041-025	10 uF, 160V Electrolytic
C312	202X7050-248	1000 pF, 500V Ceramic
C313	203X0040-052	47 uF, 160V Electrolytic
C314	203X1201-265	0.033 uF, 200V PP
C315	203X0629-023	1 uF, 50V Electrolytic
C351	203X0629-023	1 uF, 50V Electrolytic
C352	203X0619-045	47 uF, 25V Electrolytic
C353	203X1190-015	0.0082 pF, 50V Mylar-PP
C354	203X0619-045	47 uF, 25V Electrolytic
C355	203X1600-366	0.0068 pF, 50V Mylar
C356	202X7050-483	0.01 uF, 500V Ceramic
C359	202X8065-606	100 pF, 500V Ceramic
C360	202X7050-366	0.0033 pF, 500V Ceramic
C361	202X7050-483	0.01 uF, 500V Ceramic
C362	202X7203-032	0.01 uF, 50V Ceramic
△★C363	203X1270-911	8700 pF, 1.5 KV PP
★C365	203X1201-265	0.33 uF, 200V PP
C366	203X0019-026	22 uF, 25V Electrolytic
C367	202X8065-162	6 pF, 500V Ceramic
C368	202X7203-032	0.01 uF, 50V Ceramic
C372	203X1207-125	0.1 uF, 100V PP

MAIN BOARD (CONT.)

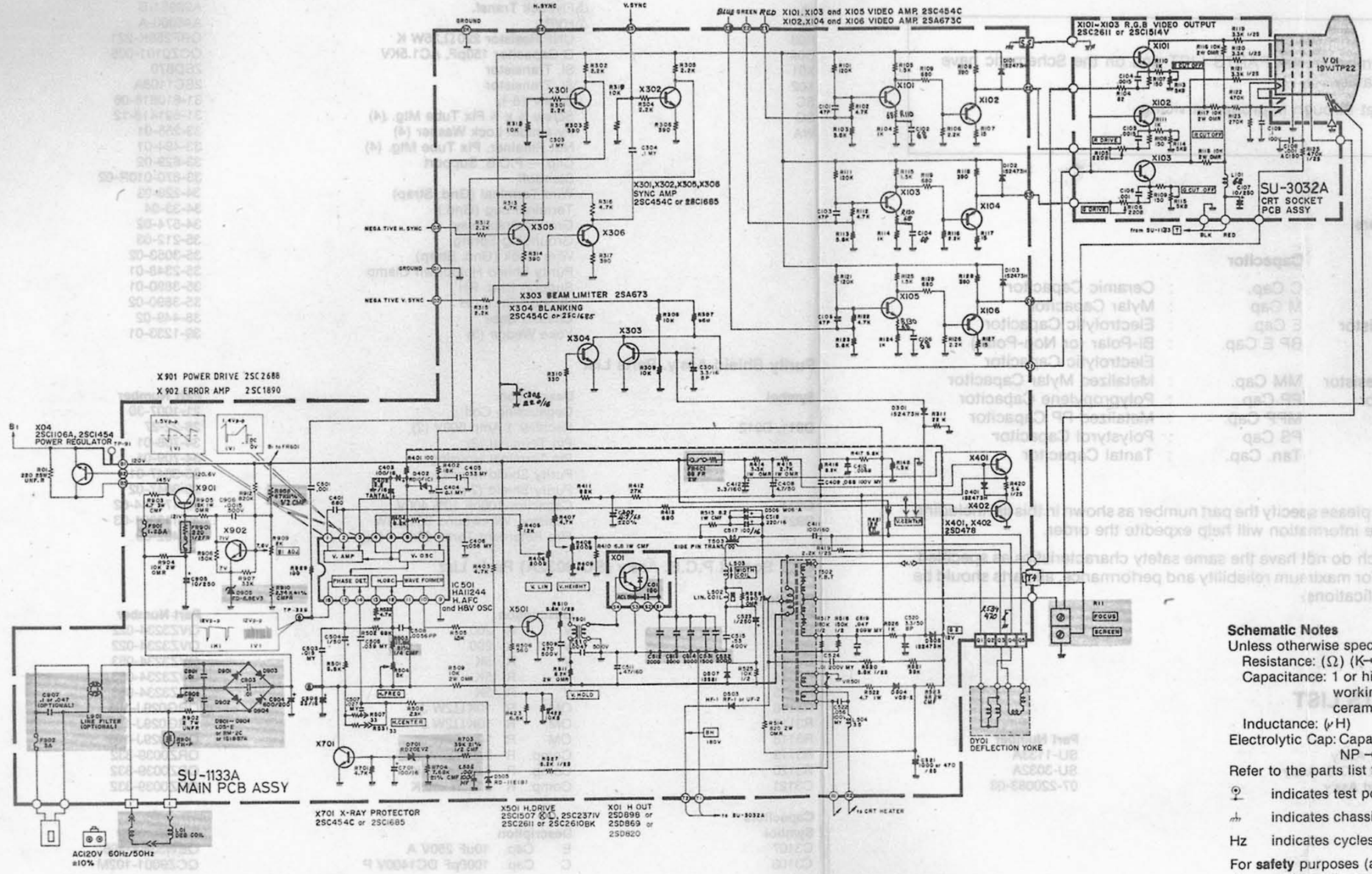
Ref. No.	Part No.	Description
	CAPACITORS (CONT.)	
C380	202X7200-087	470 uF, 500V Ceramic
△C501	203X1810-149	0.1 uF, 125V Mylar
△C502	202X7050-282	1500 pF, 500V Ceramic
△C503	202X7810-214	2200 pF, 125V Ceramic
△C504	202X7810-214	2200 pF, 125V Ceramic
C505	203X0220-075	560 uF, 200V Electrolytic
C506	203X0040-034	22 uF, 160V Electrolytic
C507	203X0041-057	47 uF, 160V Electrolytic
C701	203X0019-092	1000 uF, 25V Electrolytic
C702	203X0634-061	10 uF, 100V Electrolytic
C703	202X7050-248	1000 pF, 500V Ceramic
	SEMICONDUCTORS	
D203	201X2010-159	Diode, IS2076-27
D204	201X2010-159	Diode, IS2076-27
D205	201X2010-159	Diode, IS2076-27
D206	201X2010-159	Diode, IS2076-27
D207	201X2010-159	Diode, IS2076-27
D208	201X2010-159	Diode, IS2076-27
D209	201X2010-159	Diode, IS2076-27
D301	201X2010-165	Diode, ISS81
D302	201X2010-159	Diode, IS2076-27
D303	201X2010-159	Diode, IS2076-27
D304	201X2120-009	Diode, RH-IV
D305	201X2120-009	Diode, RH-IV
D306	201X2010-159	Diode, IS2076-27
△D501	201X3120-216	Diode, RM-1AV
△D502	201X3120-216	Diode, RM-1AV
△D503	201X3120-216	Diode, RM-1AV
△D504	201X3120-216	Diode, RM-1AV
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

Ref. No.	Part No.	Description
	SEMICONDUCTORS (CONT.)	
Q206	200X3181-523	Transistor (NPN) 2SC1815GR
Q207	200X3181-523	Transistor (NPN) 2SC1815GR
Q208	200X3181-523	Transistor (NPN) 2SC1815GR
Q209	200X3181-523	Transistor (NPN) 2SC1851GR
Q210	200X3181-523	Transistor (NPN) 2SC1851GR
Q301	200X3181-523	Transistor (NPN) 2SC1851GR
Q302	200X3207-306	Transistor (NPN) 2SC2073LBGL2
Q303	200X3207-306	Transistor (NPN) 2SC2073LBGL2
Q351	200X3248-217	Transistor (NPN) 2SC2482BK
Q352	200X4589-802	Transistor (NPN) 2SD898B
IC301	200X2300-033	IC HA11423
△★IC501	200X2600-183	IC STR381
	TRANSFORMERS & COILS	
L351	201X4710-134	Coil, (RF Choke)
L352	201X5000-083	Coil, Horiz. Size
L701	611X0004-007	Coil, Adg.
T351	202X1300-080	Transformer, Hor. Drive
△★T352	200X9720-301	HV-Unit M-11
	MISCELLANEOUS	
△F501	204X7120-073	Fuse, 4 Amp. 125V
J402	206X5008-632	Recep W Wire 3P-M-BG
P201	204X9600-466	Plug, PWB 3P-J
P202	204X9601-477	Plug, PWB 6P-Q
P401	204X9600-298	Plug, PWB 4P-B
P501	204X9600-249	Plug, PWB 2P-B
P601	204X9600-304	Plug, PWB 4P-C
TH501	201X0100-112	Thermistor
	FINAL ASSEMBLY PARTS	
△★	88X0138-506	19VLTP22 Pix Tube
	205X9800-158	Lateral/Purity Assembly
△★	202X1111-201	Yoke Deflection
	204X9301-255	CRT Socket
	291X5004-262	Automatic Degaussing Coil Unit

NECK BOARD

Ref. No.	Part No.	Description
	RESISTORS	
R401	203X6000-729	220 Ohm, 5% 1/4W Carbon
R402	203X6500-540	390 Ohm, 5% 1/4W Carbon
R403	203X6000-661	820 Ohm, 5% 1/4W Carbon
R404	203X6000-729	220 Ohm, 5% 1/4W Carbon
R405	203X6500-540	390 Ohm, 5% 1/4W Carbon
R406	203X6000-661	820 Ohm, 5% 1/4W Carbon
R407	203X6000-729	470 Ohm, 5% 1/4W Carbon
R408	203X6000-998	270 Ohm, 5% 1/4W Carbon
R409	203X6000-661	820 Ohm, 5% 1/4W Carbon
R410	203X9104-824	15K Ohm, 5% 2W M.O. Forming
R411	203X9104-824	15K Ohm, 5% 2W M.O. Forming
R412	203X9104-824	15K Ohm, 5% 2W M.O. Forming
R413	203X6000-998	2.7K Ohm, 5% 1/2W Comp.
R414	203X6000-998	2.7K Ohm, 5% 1/2W Comp.
R415	203X6000-998	2.7K Ohm, 5% 1/2W Comp.
R416	203X9105-154	2.2 Ohm, 5% 2W Metal Oxide
R419	203X6500-741	2.7K Ohm, 5% 1/4W Carbon
R420	203X6500-741	2.7K Ohm, 5% 1/4W Carbon
R421♣	203X6500-741	2.7K Ohm, 5% 1/4W Carbon
VR401	204X2115-014	500 Ohm, -B Semi-Fixed
VR402	204X2115-014	500 Ohm, -B Semi-Fixed
VR403	204X2115-006	5K Ohm, -B Semi-Fixed
VR404	204X2115-006	5K Ohm. -B Semi-Fixed
VR405	204X2115-006	5K Ohm, -B Semi-Fixed

Ref. No.	Part No.	Description
	CAPACITORS	
C401	202X7050-269	1200 pF, 500V Ceramic
C402	202X7050-248	1000 pF, 500V Ceramic
C403	202X7050-248	1000 pF, 500V Ceramic
C404	202X7050-282	1500 pF, 1.5KV Ceramic
C405	202X7050-483	0.01 uF, 500V Ceramic
	SEMICONDUCTORS	
Q401	200X3206-800	Transistor (NPN) 2SC2068LB
Q402	200X3206-800	Transistor (NPN) 2SC2068LB
Q403	200X3206-800	Transistor (NPN) 2SC2068LB
	MISCELLANEOUS	
J401	206X5009-296	RECEP W Wire 4P-E
P402	204X9600-254	Plug, PWB 3P-A
P403	204X9600-981	Plug, Pin 1P-D
P701	204X9601-020	Plug, PWB 4P-E



00-4147-04
G07-CB0

Schematic Notes

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

⏚ indicates test point connection

⏚ indicates chassis ground unless otherwise specified

Hz indicates cycles per second

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

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

REPLACEMENT PARTS LIST - ELECTROHOME 19'' MONITOR

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

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

Abbreviations for Resistors and Capacitors

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

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

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

SERVICE REPLACEMENT PARTS LIST

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

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

Symbol	Description	Part Number
	Picture Tube 19"	17-7198-03
⚠	⚠Deflection Yoke	A29779-D = 21-141-01
	PC Magnet	A75034-B = 29-32-01
⚠	⚠Flyback Transf.	A29951-B
⚠	⚠HVR	A46600-A
R05	UNF Resistor 220Ω,25W K	QRF258K-221
C04	C Capacitor 150pF, AC1.5KV	QCZ0101-005
X01	Si. Transistor	2SD870
X02	Si. Transistor	2SC1106A
SC	Screw #8-⅜	31-610818-06
SC	Screw ¼ x ¾ Pix Tube Mtg. (4)	31-601418-12
WA	Pyramidal Lock Washer (4)	33-255-01
	Nut Retainer, Pix Tube Mtg. (4)	33-494-01
	Clip — P.C.B. Support	33-629-02
	Standoff	33-670-010R-02
	Wire Terminal (Gnd. Strap)	34-228-03
	Terminal Lug (Gnd.)	34-33-04
	Groundstrap Assy.	34-574-02
	Grounding Spring	35-212-03
	Wire Hook (Gnd. Strap)	35-3053-02
	Purity Shield Holddown Clamp	35-2348-01
	Support Brkt. RH	35-3890-01
	Support Brkt. LH	35-3890-02
	Chassis Base	38-449-02
	Yoke Wedge (3)	39-1233-01

Purity Shield Ass'y. Parts List

Symbol	Description	Part Number
	Degaussing Coil	21-1007-30
D911, D912	Rectifier 1 Amp 600V (2)	28-22-27
	Pin Terminal (2)	34-708-01
	Pin Terminal Housing	34-709-01
	Purity Shield (2 pcs.)	35-3847-01
	Purity Shield (2 pcs.)	35-3847-02
C911	Capacitor 100nF 10% 400V	48-171544-62
R921	Resistor, Wirewound 33Ω, 4W	42-113301-03
	Fire Retardent Term. Strip 4 Lug	34-492-09

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

Resistors

Symbol	Description	Part Number
R3105	V R 200	QVZ3234-022
R3106	V R 200	QVZ3234-022
R3113	V R 5K	QVZ3234-053
R3114	V R 5K	QVZ3234-053
R3115	V R 5K	QVZ3234-053
R3116	OM R 10KΩ2W J	QRG029J-103
R3117	OM R 10KΩ2W J	QRG029J-103
R3118	OM R 10KΩ2W J	QRG029J-103
R3119	Comp. R 3.3KΩ½W K	QRZ0039-332
R3120	Comp. R 3.3KΩ½W K	QRZ0039-332
C3121	Comp. R 3.3KΩ½W K	QRZ0039-332

Capacitors

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

Coils

Symbol	Description	Part Number
L3101	Peaking Coil	QQL043K-101

Semiconductors

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

Miscellaneous

Symbol	Description	Part Number
⚠	⚠CRT Socket	A76068

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

Resistors

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

Capacitors

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

Coils

Symbol	Description	Part Number
L1502	Linarity Coil	A39835
L1503	Width Coil	C30380-A
L1504	Heater Choke	C30445-A

Transformers

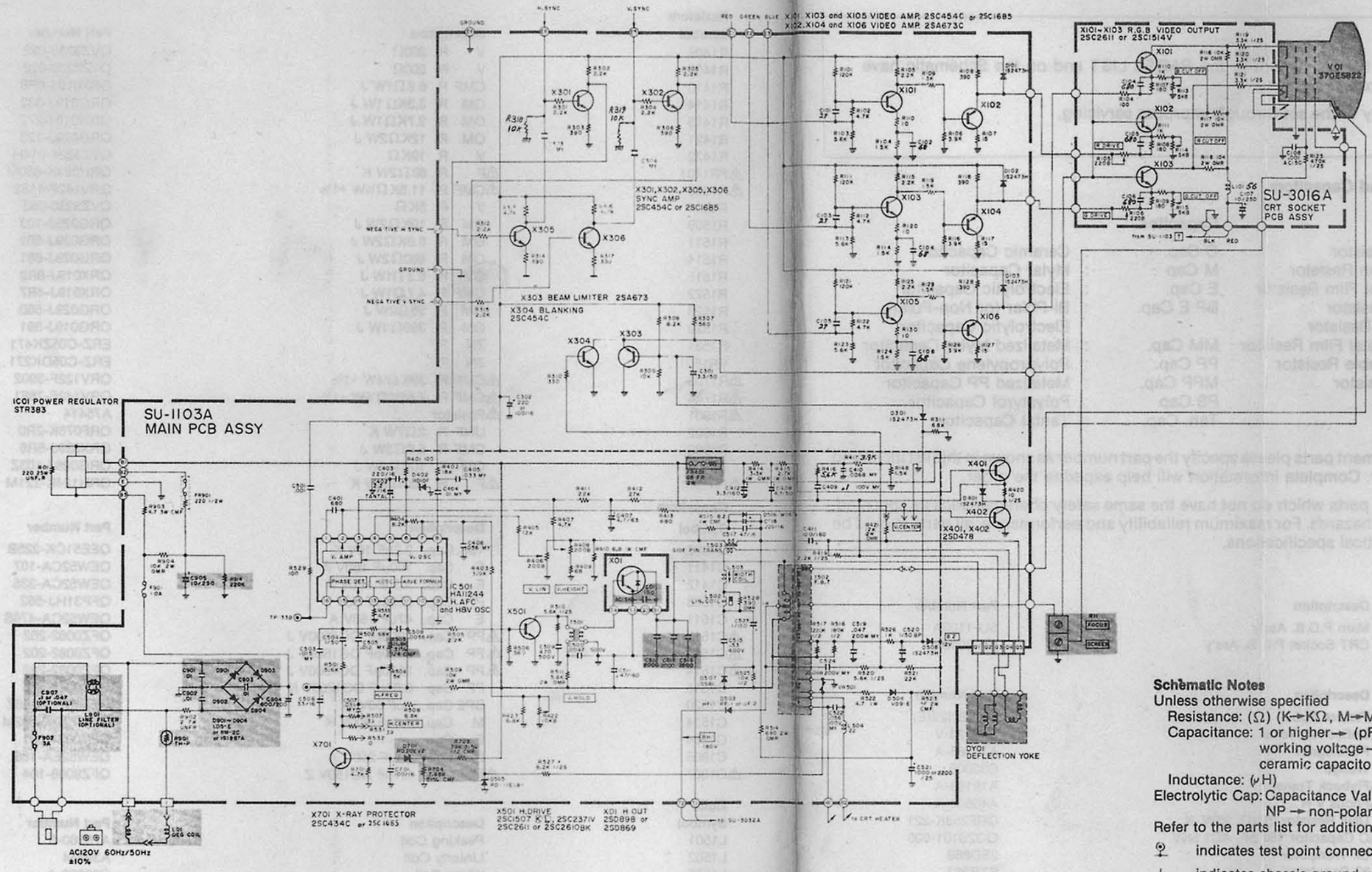
Symbol	Description	Part Number
T1501	Hor. Drive Transf.	A46022-BM
T1503	Side Pin Transf.	C39050-A

Semiconductors

Symbol	Description	Part Number
IC1501	IC	HA11244
X1101	Si. Transistor	2SC1685(R)
X1102	Si. Transistor	2SA673(C)
X1103	Si. Transistor	2SC1685(R)
X1104	Si. Transistor	2SA673(C)
X1105	Si. Transistor	2SC1685(R)
X1106	Si. Transistor	2SA673(C)
X1301	Si. Transistor	2SC1685(R)
X1302	Si. Transistor	2SC1685(R)
X1303	Si. Transistor	2SA673(C)
X1304	Si. Transistor	2SC1685(R)
X1305	Si. Transistor	2SC1685(R)
X1401	Si. Transistor	2SD478
X1402	Si. Transistor	2SD478
X1501	Si. Transistor	2SC2610BK
X1901	Si. Transistor	2SC2688 (K.L.M.)
X1902	Si. Transistor	2SC1890A (E.F.)
D1101	Si. Diode	W06A
D1102	Si. Diode	W06A
D1103	Si. Diode	W06A
D1301	Si. Diode	1SZ473H
D1401	Si. Diode	1SZ473H
D1402	Zener Diode	RD10F(C)
D1503	Si. Diode	HF-1
D1504	Si. Diode	V09E
D1505	Zener Diode	RD11E(B)
D1506	Si. Diode	W06A
D1507	Si. Diode	1SS81
D1508	Si. Diode	1SZ473H
⚠D1701	⚠Zener Diode	RD20EV2
⚠D1901	⚠Si. Diode	1S1887A
⚠D1902	⚠Si. Diode	1S1887A
⚠D1903	⚠Si. Diode	1S1887A
⚠D1904	⚠Si. Diode	1S1887A
⚠D1905	⚠Zener Diode	RD6.8EV3

Miscellaneous

Symbol	Description	Part Number
⚠F1901	⚠Fuse 1.25A	QMF53U1-1R25S
⚠F1902	⚠UL Fuse 3A	QMF66U1-3R0S



Schematic Notes

Unless otherwise specified
- Resistance: (Ω) (K→KΩ, M→MΩ), 1/4 (W) carbon resistor
- Capacitance: 1 or higher→ (pF), less than 1→ (μF)
  working voltage→ 50 (V)
  ceramic capacitor
- Inductance: (μH)

Electrolytic Cap: Capacitance Value (μF)/working voltage (V),
NP → non-polar (or bipolar) electrolytic cap.

Refer to the parts list for additional component information.

⏚ indicates test point connection

⏚ indicates chassis ground unless otherwise specified

Hz indicates cycles per second

For **safety** purposes (and continuing reliability)

⚠ replace all components marked with safety symbol with identical type.
NOTE: FR → fusible resistor

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

REPLACEMENT PARTS LIST - ELECTROHOME 13'' MONITOR

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

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

Abbreviations for Resistors and Capacitors

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

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

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

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

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

Symbol	Description	Part Number
⚠V01	⚠Picture Tube	370ESB22(E)
⚠DY01	⚠Deflection Yoke	C29123-V
	PC Magnet	A76366-A
	Wedge	C30006
	⚠Flyback Transf.	A19183-A
⚠R11	⚠Focus V R	A46606-A
⚠R05	UNF Resistor 220Ω, 25W. K	QRF258K-221
⚠C04	⚠C Capacitor 150 pF, AC1.5KV	QCZ0101-005
X01	Si. Transistor	2SD869
IC01	IC Regulator	STR383
L01	Degausing Coil	21-1007-31
	Degausing Coil Pin Terminal (2)	34-708-01
	Degausing Coil Pin Terminal Housing	34-709-01
	Groundstrap Ass'y.	34-697-04
	Groundstrap Wire Terminal	34-228-03
	Groundstrap Spring (2)	35-3560-01
BR	Support Bracket RH	35-3919-01
BR	Support Bracket LH	35-3919-02
SC	SCREW 10-½ Pix Tube Mtg. (4)	31-631018-08
WA	Pyramidal Lockwasher (4)	33-255-01
	Clip P.C.B. Support (2)	33-629-02
	Ground Lug	34-33-04
CH	Chassis Base	38-452-01

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

Resistors

Symbol	Description	Part Number
R1406	V R 200Ω	QVZ3230-022
R1408	V R 200Ω	QVZ3230-022
R1410	CMF R 6.8Ω1W J	QRX019J-6R8
R1414	OM R 3.3KΩ1W J	QRG019J-332
R1415	OM R 2.7KΩ1W J	QRG019J-272
R1421	OM R 12KΩ2W J	QRG029J-123
R1422	V R 10KΩ	QVZ3224-014H
⚠FR1401	⚠F R 68Ω2W K	QRH024K-680M
⚠R1503	⚠CMF R 11.8KΩ¼W +1%	QRV142F-1182
R1504	V R 5KΩ	QVZ3230-053
R1509	OM R 10KΩ2W J	QRG029J-103
R1511	OM R 5.6KΩ2W J	QRG029J-562
R1514	OM R 680Ω2W J	QRG029J-681
R1515	CMF R 8.2Ω1W J	QRX019J-8R2
R1522	CMF R 4.7Ω1W J	QRX019J-4R7
R1523	OM R 56Ω2W J	ORG029J-560
R1528	OM R 390Ω1W J	ORG019J-391
R1534	ZN R	ERZ-C05ZK471
VR1501	ZN R	ERZ-C05DK271
⚠R1703	⚠CMF R 39KΩ½W +1%	QRV122F-3902
⚠R1704	⚠CMF R 7.68KΩ¼W +1%	QRV142F-7681
⚠R1901	⚠Posistor	A75414
R1902	UNF R 2Ω7W K	QRF076K-2R0
R1903	CMF R 5.6Ω3W J	QRX039J-5R6
R1904	OM R 10KΩ2W J	QRG026J-103Z
⚠FR1901	⚠F R 220Ω½W K	QRH124K-221M

Capacitors

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

Coils

Symbol	Description	Part Number
L1501	Peaking Coil	A75360-6
L1502	Liniarty Coil	A39934
L1503	Width Coil	C30380-A
L1504	Heater 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

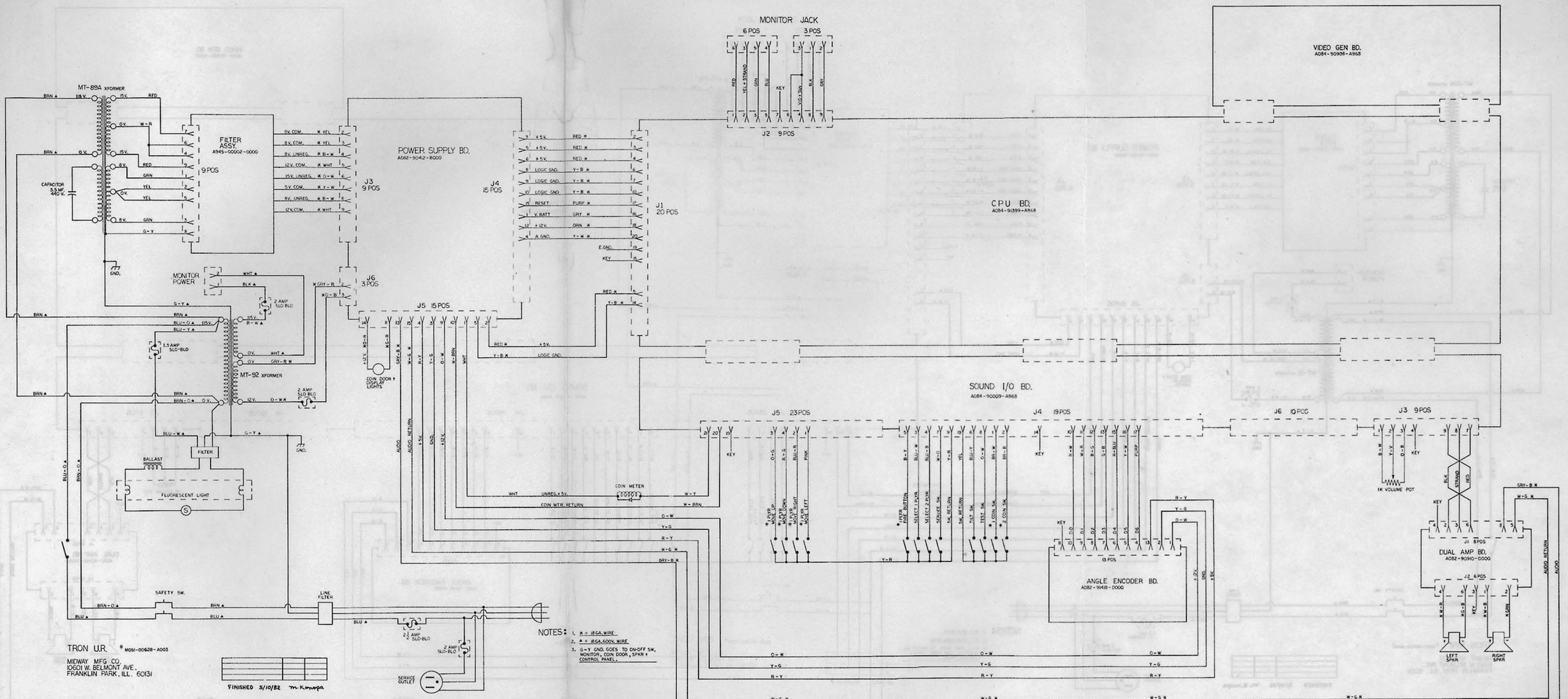
Semiconductors

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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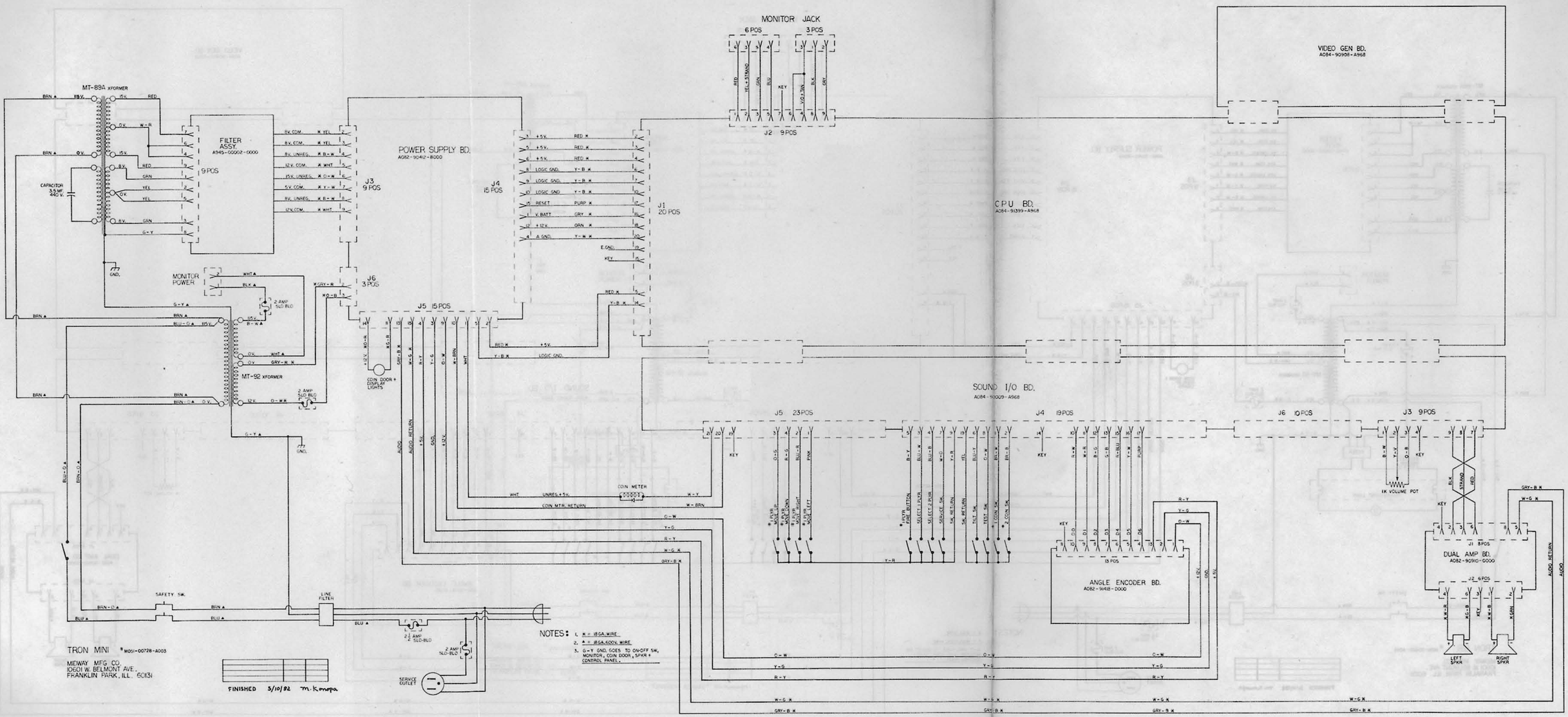
3 POS
J2 9 POS
VIDEO GEN BD.
A084-90908-A968
MT-89A XFORMER
FILTER ASSY.
A945-00002-0000
9 POS
J3 9 POS
J4 15 POS
J1 20 POS
POWER SUPPLY BD.
A082-90412-B000
CPU BD.
A084-91599-A968
J6 3 POS
J5 15 POS
MONITOR POWER
2 AMP SLO BLO
1.5 AMP SLO-BLO
MT-92 XFORMER
COIN DOOR DISPLAY LIGHTS
SOUND I/O BD.
A084-90009-A968
J5 23POS
J4 19POS
J6 10POS
J3 9POS
1K VOLUME POT
BALLAST
FILTER
FLUORESCENT LIGHT
COIN METER
SAFETY SW.
LINE FILTER
2½ AMP SLO-BLO
SERVICE OUTLET
ANGLE ENCODER BD.
A082-91418-D000
13 POS
DUAL AMP BD.
A082-90910-C000
J1 8POS
J2 6POS
LEFT SPKR
RIGHT SPKR
TRON U.R. * M051-00628-A003
MIDWAY MFG. CO.
10601 W. BELMONT AVE.,
FRANKLIN PARK, ILL. 60131
FINISHED 5/10/82 M. Konopa
NOTES:
1. K = 18GA. WIRE.
2. A = 18GA. 600V. WIRE
3. G-Y GND. GOES TO ON-OFF SW, MONITOR, COIN DOOR, SPKR + CONTROL PANEL.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6 POS
3 POS
J2 9 POS
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FILTER ASSY.
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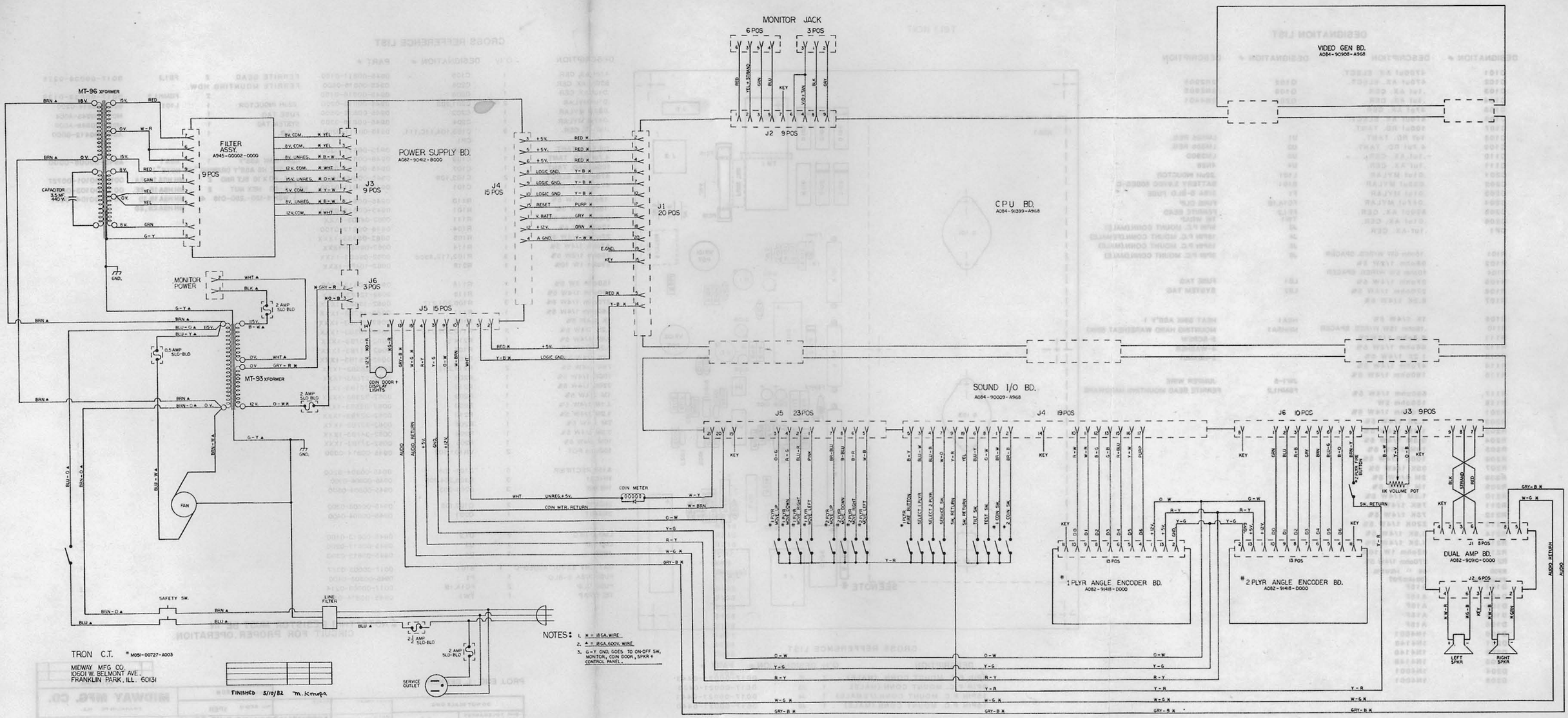
9 POS
CAPACITOR 3.3 MF 440 V.
POWER SUPPLY BD.
A082-90412-B000
J3 9 POS
J4 15 POS
J1 20 POS
J6 3 POS
J5 15 POS
CPU BD.
A084-91299-A968
MONITOR POWER
2 AMP SLO BLO
MT-92 XFORMER
COIN DOOR + DISPLAY LIGHTS
SOUND I/O BD.
A084-90009-A968
J5 23 POS
J4 19 POS
J6 10 POS
J3 9 POS
1K VOLUME POT
COIN METER
ANGLE ENCODER BD.
A082-91418-D000
13 POS
DUAL AMP BD.
A082-90910-C000
J1 8 POS
J2 6 POS
LEFT SPKR
RIGHT SPKR
SAFETY SW.
LINE FILTER
2½ AMP SLO-BLO
SERVICE OUTLET
TRON MINI *A051-00728-A003
MIDWAY MFG. CO.
10601 W. BELMONT AVE.
FRANKLIN PARK, ILL. 60131
FINISHED 5/10/82 M. Kempa
NOTES: 1. K = 18GA. WIRE
2. A = 22GA. 600V. WIRE
3. G-Y GND. GOES TO ON-OFF SW, MONITOR, COIN DOOR, SPKR & CONTROL PANEL.



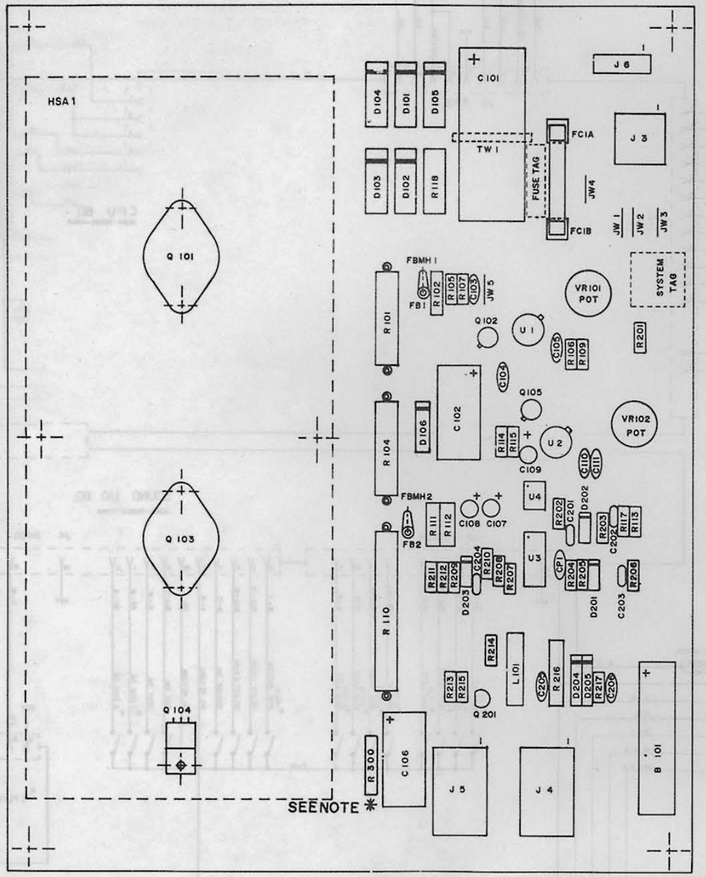
TRON C.T. * MDSI-00727-A003

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

FINISHED 5/10/82 M. Kompa

DESIGNATION LIST

DESIGNATION #	DESCRIPTION	DESIGNATION #	DESCRIPTION
C101	4700uf AX. ELECT.		
C102	470uf AX. ELECT.	Q102	2N2905
C103	.1uf AX. CER.	Q105	2N2905
C104	.1uf AX. CER.	Q201	2N4401
C105	47pf AX. CER.		
C106	470uf AX. ELECT.		
C107	100uf RD. TANT.		
C108	1uf RD. TANT.	U1	LM305 REG.
C109	4.7uf RD. TANT.	U2	LM305 REG.
C110	.1uf AX. CER.	U3	LM3900
C111	.1uf AX. CER.	U4	4N28
C201	.01uf MYLAR	L101	.22uH INDUCTOR
C202	.033uf MYLAR	B101	BATTERY 3.6VDC 60DEG-C
C203	.01uf MYLAR	F1	3/8A S-BLO FUSE
C204	.047uf MYLAR	FC1A,1B	FUSE CLIP
C205	820pf AX. CER.	FE1,2	FERRITE BEAD
C206	.01uf AX. CER.	TW1	TIE WRAP
CP1	.1uf AX. CER.	J3	9PIN P.C. MOUNT CONN.(MALE)
		J4	15PIN P.C. MOUNT CONN.(FEMALE)
		J5	15PIN P.C. MOUNT CONN.(MALE)
R101	.18ohm 5W W/RES. SPACER	J6	3PIN P.C. MOUNT CONN.(MALE)
R102	68ohm 1/2W 5%		
R104	10ohm 5W W/RES. SPACER		
R105	27ohm 1/4W 5%	LB1	FUSE TAG
R106	270ohm 1/4W 5%	LB2	SYSTEM TAG
R107	6.2K 1/4W 5%		
R109	1K 1/4W 5%	HSA1	HEAT SINK ASS'Y 1
R110	.16ohm 15W W/RES. SPACER	MHHSA1	MOUNTING HARD WARE(HEAT SINK)
R111	6.8ohm 1/2W5%		2-SCREW
R112	68ohm 1/2W 5%		4-WASHER
R113	1.2K 1/4W 5%		2-HEXNUT
R114	47ohm 1/4W 5%		
R115	160ohm 1/4W 5%	JW1-5	JUMPER WIRE
		FBMH1,2	FERRITE BEAD MOUNTING HARDWARE
R117	560ohm 1/4W 5%		
R118	150ohm 2W		
R201	270ohm 1/4W 5%		
R202	1.2K 1/4W 5%		
R203	1.1M 1/4W 5%		
R204	3.3M 1/4W 5%		
R205	10M 1/4W 5%		
R206	100K 1/4W 5%		
R207	33K 1/4W 5%		
R208	2M 1/4W 5%		
R209	1M 1/4W 5%		
R210	1.2M 1/4W 5%		
R211	75K 1/4W 5%		
R212	75K 1/4W 5%		
R213	220K 1/4W 5%		
R214	3.9K 1/4W 5%		
R215	1.2K 1/4W 5%		
R216	82ohm 1W 10%		
R217	270ohm 1/4W 5%		
R300	68 " 1/2W5%		
VR101,102	100ohm POT		
D101	A15F		
D102	A15F		
D103	A15F		
D104	A15F		
D105	A15F		
D106	1N4001		
D201	1N4148		
D202	1N4148		
D203	1N4148		
D204	1N4001		
D205	1N4001		



CROSS REFFERENCE LIST

DESCRIPTION	Q'ty	DESIGNATION #	PART #
3PIN P.C. MOUNT CONN. (MALE)	1	J6	0017-00021-0443
9PIN P.C. MOUNT CONN.(MALE)	1	J3	0017-00021-0425
15PIN P.C. MOUNT CONN.(FEMALE)	1	J4	0017-00021-0441
15PIN P.C. MOUNT CONN.(MALE)	1	J5	0017-00021-0440
22 AWG T&R BARE 2.5"	5	JW1-5	0151-00087-0000

CROSS REFFERENCE LIST

DESCRIPTION	Q'ty	DESIGNATION #	PART #
47pf AX. CER.	1	C105	0945-00811-0100
820pf AX. CER.	1	C205	0945-00816-0400
.01uf AX. CER	1	C206	0945-00816-0100
.01uf MYLAR	2	C201,203	0945-00816-0200
.033uf MYLAR	1	C202	0945-00816-0500
.047uf MYLAR	1	C204	0945-00816-0300
.1uf AX. CER.	5	C103,104,110,111, CP1	0945-00811-0200
1uf RAD. TANT	1	C108	0945-00811-0300
4.7uf RAD. TANT	1	C109	0945-00811-0400
100uf RAD. TANT	1	C107	0945-00811-0500
470uf AX. ELECT.	2	C102,106	0945-00816-0600
4700uf AX. ELECT.	1	C101	0945-00811-0700
.16ohm 15W 5%	1	R110	0945-00815-0100
.18ohm 5W 5%	1	R101	0945-00815-0200
6.8ohm 1/2W 5%	1	R111	0062-047D3-1XXX
10ohm 5W 5%	1	R104	0945-00812-0100
27ohm 1/4W 5%	1	R105	0062-068B3-1XXX
47ohm 1/4W 5%	1	R114	0062-086B3-1XXX
68ohm 1/2W 5%	3	R102,112,R300	0062-098D3-1XXX
82ohm 1W 10%	1	R216	0062-104F5-1XXX
150ohm 2W 5%	1	R118	0945-00812-0200
160ohm 1/4W 5%	1	R115	0062-124B3-1XXX
270ohm 1/4W 5%	3	R106,201,217.	0062-138B3-1XXX
560ohm 1/4W 5%	1	R117	0062-162B3-1XXX
1K 1/4W 5%	1	R109	0062-179B3-1XXX
1.2K 1/4W 5%	3	R113,202,215	0062-183B3-1XXX
3.9K 1/4W 5%	1	R214	0062-207B3-1XXX
6.2K 1/4W 5%	1	R107	0062-217B3-1XXX
33K 1/4W 5%	1	R207	0062-251B3-1XXX
75K 1/4W 5%	2	R211,212	0062-269B3-1XXX
100K 1/4W 5%	1	R206	0062-275B3-1XXX
220K 1/4W 5%	1	R213	0062-291B3-1XXX
1M 1/4W 5%	1	R209	0062-323B3-1XXX
1.1M 1/4W 5%	1	R203	0062-325B3-1XXX
1.2M 1/4W 5%	1	R210	0062-327B3-1XXX
2M 1/4W 5%	1	R208	0062-337B3-1XXX
3.3M 1/4W 5%	1	R204	0062-347B3-1XXX
10M 1/4W 5%	1	R205	0062-371B3-1XXX
100ohm POT	2	VR101,102	0945-00814-0000
A15F RECTIFIER	5	D101-105	0945-00804-0200
1N4001	3	D106,204,205	0945-00804-0300
1N4148	3	D201-203	0945-00804-0500
2N2905	2	Q102,105	0945-00808-0300
2N4401	1	Q201	0945-00804-0400
LM305 REG.	2	U1,2	0945-00813-0100
LM3900	1	U3	0945-00813-0200
4N28	1	U4	0945-00813-0300
BATTERY 3.6VDC 60DEG-C	1	B101	0017-00003-0377
FUSE 3/8A S-BLO	1	F1	0945-00808-0400
FUSE CLIP	2	FC1A,1B	0017-00003-0214
TIE WRAP	1	TW1	0945-00814-0300
FERRITE BEAD	2	FB1,2	0017-00009-0225
FERRITE MOUNTING HDW.	2	FBMH1,2	0017-00033-0139
.22uH INDUCTOR	1	L101	0945-00814-0200
FUSE TAG	1		M051-00945-A004
SYSTEM TAG	1		M051-00945-A009
P.C.B.	1		A080-90412-B000
HEAT SINK ASS'Y (SEE HS ASS'Y DRAWING "** NOTE")	1	HSA1	A945-00008-0000
** 4-40 X 10 SLT RND	2	MH HSA 1A,2A.	0017-00101-00727
** 4-40 HEX NUT	2	MH HSA 1E, 2E.	0017-00103-0002
** WSH 4-120-.250-018	4	MH HSA 1B,1D MH HSA 2B,2D	0017-00104-0071

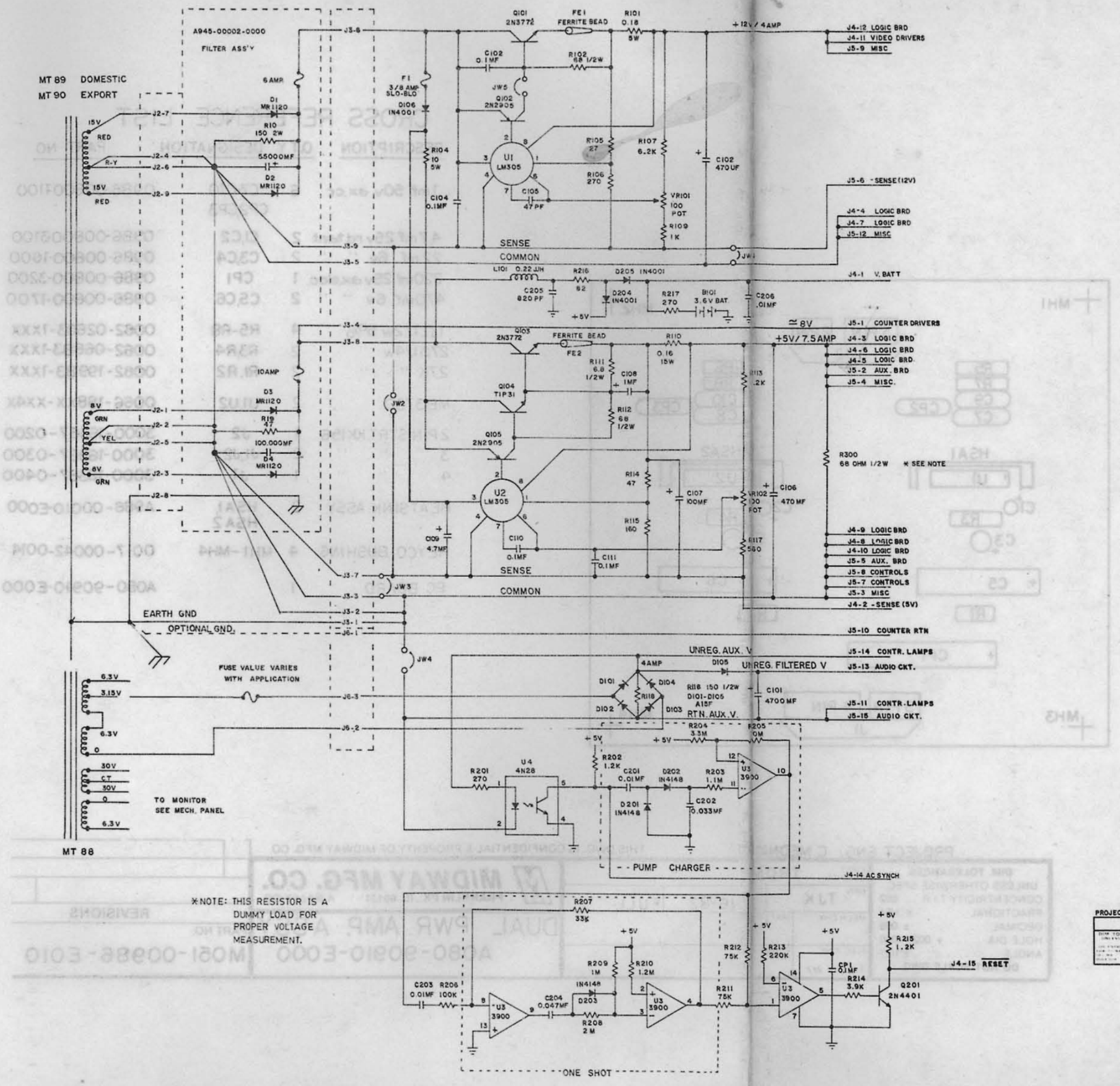
**NOTE: THIS RESISTOR MUST BE IN CIRCUIT FOR PROPER OPERATION.

PROJ. ENG : L. DEKKER

DO NOT SCALE DWG	HEAT TREAT	SCALE	USED ON TRON
DIM TOLERANCES UNLESS SPECIFIED: CONCENTRICITY T.I.R. .003, FRACTIONAL 1/64, DECIMAL .005, HOLE DIA + .002 .000	MAT'L		NO REQ'D 1PER
DRN. C.L. CKD L.D. DATE 6/4/82	FINISH	ASSEMBLY DRAWING PWR SPLY 125VA W/CKT SPRT A082-90412-C000	PART NO M051-00945-C006

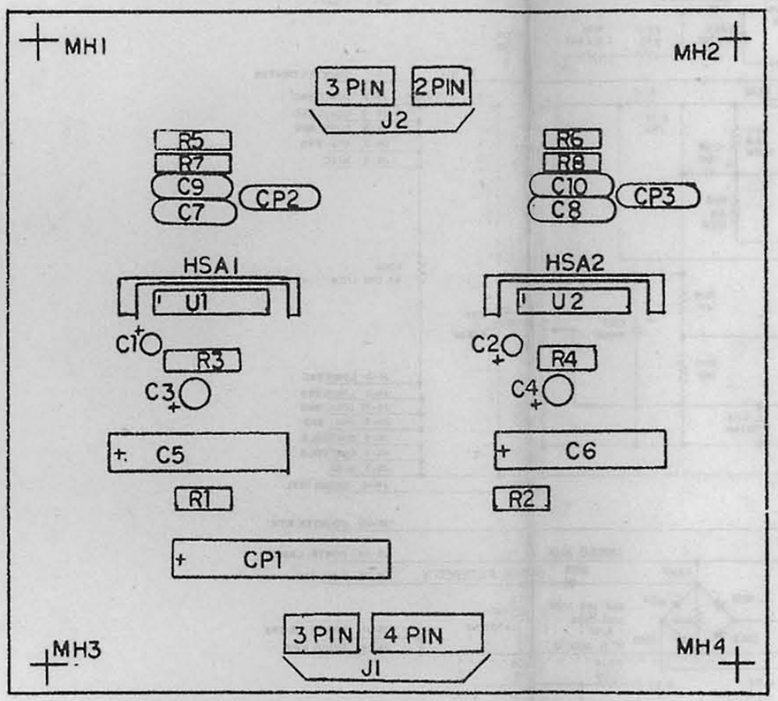
REVISIONS

MIDWAY MFG. CO. FRANKLIN PK ILL


A945-00002-0000
FILTER ASS'Y
MT 89 DOMESTIC
MT 90 EXPORT
MT 88
6 AMP
10 AMP
4 AMP
FUSE VALUE VARIES WITH APPLICATION
TO MONITOR SEE MECH. PANEL
EARTH GND
OPTIONAL GND.
SENSE
COMMON
UNREG. AUX. V
UNREG. FILTERED V
RTN. AUX. V.
+12V / 4AMP
+5V / 7.5AMP
≃8V
PUMP CHARGER
ONE SHOT
J4-12 LOGIC BRD
J4-11 VIDEO DRIVERS
J5-9 MISC
J5-6 +SENSE(12V)
J4-4 LOGIC BRD
J4-7 LOGIC BRD
J5-12 MISC
J4-1 V. BATT
J5-1 COUNTER DRIVERS
J4-3 LOGIC BRD
J4-6 LOGIC BRD
J4-5 LOGIC BRD.
J5-2 AUX. BRD
J5-4 MISC.
J4-9 LOGIC BRD
J4-8 LOGIC BRD
J4-10 LOGIC BRD
J5-5 AUX. BRD
J5-8 CONTROLS
J5-7 CONTROLS
J5-3 MISC
J4-2 -SENSE (5V)
J5-10 COUNTER RTN
J5-14 CONTR. LAMPS
J5-13 AUDIO CKT.
J5-11 CONTR. LAMPS
J5-15 AUDIO CKT.
J4-14 AC SYNCH
J4-15 RESET
R300 68 OHM 1/2W * SEE NOTE
Q101 2N3772
Q102 2N2905
Q103 2N3772
Q104 TIP31
Q105 2N2905
Q201 2N4401
U1 LM305
U2 LM305
U3 3900
U4 4N28
FE1 FERRITE BEAD
FE2 FERRITE BEAD
F1 3/8 AMP SLO-BLO
D1 MR1120
D2 MR1120
D3 MR1120
D4 MR1120
D101-D105 A15F
VR101 100 POT
VR102 100 POT
C101 4700MF
C102 470UF
C106 470 MF
C107 100MF
C108 1MF
C109 4.7MF
C110 0.1MF
C111 0.1MF
C201 0.01MF
C202 0.033MF
C203 0.01MF
C204 0.047MF
C205 820 PF
C206 .01MF
CP1 0.1MF
R101 0.18 5W
R102 68 1/2W
R104 10 5W
R105 27
R106 270
R107 6.2K
R109 1K
R110 0.16 15W
R111 6.8 1/2W
R112 68 1/2W
R113 1.2K
R114 47
R115 160
R117 560
R118 150 1/2W
R201 270
R202 1.2K
R203 1.1M
R204 3.3M
R205 0M
R207 33K
R208 2M
R209 1M
R210 1.2M
R211 75K
R212 75K
R213 220K
R214 3.9K
R215 1.2K
R216 82
D201 IN4148
D202 IN4148
D203 IN4148
D204 IN4001
D205 IN4001
D106 IN4001
L101 0.22 UH
B101 3.6 V BAT.
JW1
JW2
JW3
JW4
JW5
15V RED
R-Y
15V RED
8V GRN
YEL
8V GRN
6.3V
3.15V
6.3V
0
30V
CT
30V
0
6.3V
* NOTE: THIS RESISTOR IS A DUMMY LOAD FOR PROPER VOLTAGE MEASUREMENT.
PROJECT ENG.: L. DEKKER
DO NOT SCALE DRG
FULL
USED ON SOLARFOX
NO REQ'D 1 PER.
MIDWAY MFG. CO.
FRANKLIN PK. ILL.
POWER SUPPLY 125VA
W/CKT SUPORT A082-90412-C000
M051-00945-C007
8/17/82

DESIGNATION LIST

DESIGNATION	DESCRIPTION
C1,C2	4.7mf 25v rd.tant.
C3,C4	22mf 6v " "
C5,C6	470mf 6v ax.elect.
C7-C10	.1mf 50v ax.cr.
CP1	220mf 25v ax.elect.
CP2,CP3	.1mf 50v ax.cr.
R1,R2	2.7KΩ 1/4w 5% CRBN.
R3,R4	27Ω " " "
R5-R8	1Ω 1/2w " "
U1,U2	MB3730
J1	3 PIN STRT. KK156
	4 " " "
J2	3 " " "
	2 " " "
HSA1,2	HEATSINK ASSY.
MH1-MH4	HEYCO BUSHING



CROSS REFERENCE LIST

DESCRIPTION	QTY	DESIGNATION	PART NO.
.1mf 50v ax.cr.	6	C7-C10 CP2,CP3	0986-00800-1100
4.7mf 25v rd.tant.	2	C1,C2	0986-00800-3100
22mf 6v " "	2	C3,C4	0986-00800-1600
220mf 25v ax.elec.	1	CP1	0986-00800-3200
470mf 6v " "	2	C5,C6	0986-00800-1700
1Ω 1/2w 5%	4	R5-R8	0062-02603-1XXX
27Ω 1/4w "	2	R3,R4	0062-06803-1XXX
2.7K " "	2	R1,R2	0062-19903-1XXX
MB3730	2	U1,U2	0066-188XX-XX4X
2 PIN STRT. KK156	1	J2	3000-16367-0200
3 " " "	2	J1,J2	3000-16367-0300
4 " " "	1	J1	3000-16367-0400
HEATSINK ASSY.	2	HSA1, HSA2	A986-00010-E000
HEYCO BUSHING	4	MH1-MH4	0017-00042-0014
PC BOARD	1		A080-90910-E000

PROJECT ENG. C.MEDNICK

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 TRON		
	DRN TJK	DATE 6-16-82	SCALE FULL
	MECH CHK	MAT'L	
	ELEC CHK C.J.M.	FINISH	

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

DUAL PWR. AMP. ASSY
A080-90910-E000

REVISIONS

PART NO.
M051-00986-E010

REVISIONS

MIDWAY MFG. CO.
FRANKLIN PK. ILL.

PART NO. M051-00986-E011

SCHEMATIC, DUAL POWER AMP, A082-90910-E000

USED ON TRON
NO. REQ'D 1 PER.

SCALE NONE

HEAT TREAT | MAT'L. | FINISH

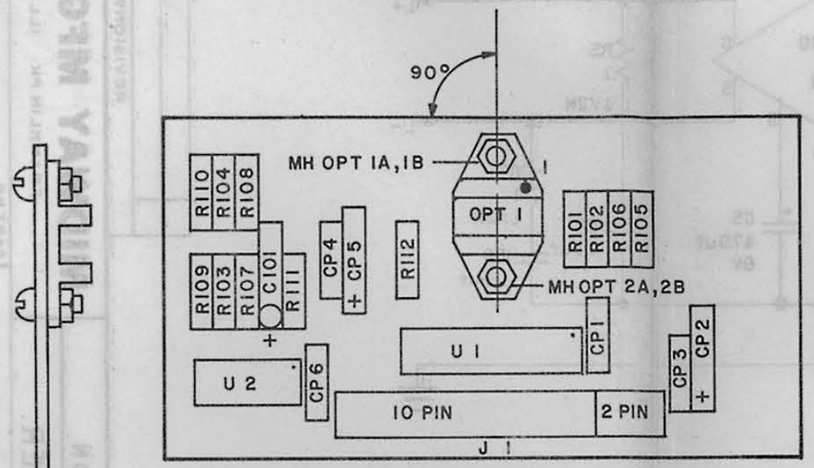
DO NOT SCALE DWG.

DIM. TOLERANCES UNLESS SPECIFIED
CONCENTRICITY T I R .003
FRACTIONAL ± 1/64
DECIMAL ± .005
HOLE DIA ± .002 .000

DRN Sdb
CKD.
DATE 5/17/82

DESIGNATION LIST

DESIGNATION NO.	DESCRIPTION
C 101	4.7 µf TANT 16V RAD.
CP 1	.01 µf 50V AX. CER.
CP 2	10 µf 16V AX. ELECT.
CP 3	.01 µf 50V AX. CER.
CP 4	.01 µf 50V AX. CER.
CP 5	10 µf 16V AX. ELECT.
CP 6	.01 µf 50V AX. CER.
R 101	4.7 K 1/4W 5%
R 102	4.7 K 1/4W 5%
R 103	200K 1/4W 5%
R 104	200K 1/4W 5%
R 105	6.2K 1/4W 5%
R 106	120 ohm 1/4W 5%
R 107	20K 1/4W 5%
R 108	100K 1/4W 5%
R 109	200K 1/4W 5%
R 110	200K 1/4W 5%
R 111	4.7 K 1/4W 5%
R 112	6.2K 1/4W 5%
OPT 1	OPB4453
U 1	74LS491
U 2	LM 339
J 1	10 PIN KK-156 TYP. STRT. CONN.
	2 PIN KK-156 TYP. STRT. CONN.
MH OPT 1A	5-40 SCREW
MH OPT 1B	5-40 NUT
MH OPT 2A	5-40 SCREW
MH OPT 2B	5-40 NUT
A080-91418-D000	P.C. BOARD



** NOTE
OPTICAL SENSOR TO BE MOUNTED FLUSH WITH P.C. BOARD

CROSS REFERENCE LIST

DESCRIPTION	Q'TY	DESIGNATION NO.	PART NO.
.01 µf 50V AX. CER.	4	CP1, 3, 4, 6.	0628-00800-0100
4.7 µf 16V RAD. TANT.	1	C 101	0628-00800-0200
10 µf 16V AX. ELECT.	2	CP 2, 5.	0628-00800-0300
120 ohm 1/4W 5%	1	R 106	0062-11683-1XXX
4.7K 1/4W 5%	3	R 101, 102, 111.	0062-21183-1XXX
6.2K 1/4W 5%	2	R 105, 112	0062-21783-1XXX
20K 1/4W 5%	1	R 107	0062-24183-1XXX
200K 1/4W 5%	4	R 103, 104, 109, 110	0062-28983-1XXX
100K 1/4W 5%	1	R 108	0062-27583-1XXX
74LS491	1	U 1	0628-00803-2700
LM 339	1	U 2	0628-00803-2900
OPB 4453	1	OPT 1	0628-00804-0100
10 PIN KK-156 TYP. STRT. CONN.	1	J 1	3000-16367-1000
2 PIN KK-156 TYP. STRT. CONN.	1	J 1	3000-16367-0200
5-40 SCREW	2	MH OPT 1A, 2A	0017-00101-0084
5-40 NUT	2	MH OPT 1B, 2B	0017-00103-0003
P.C. BOARD	1		A080-91418-D000

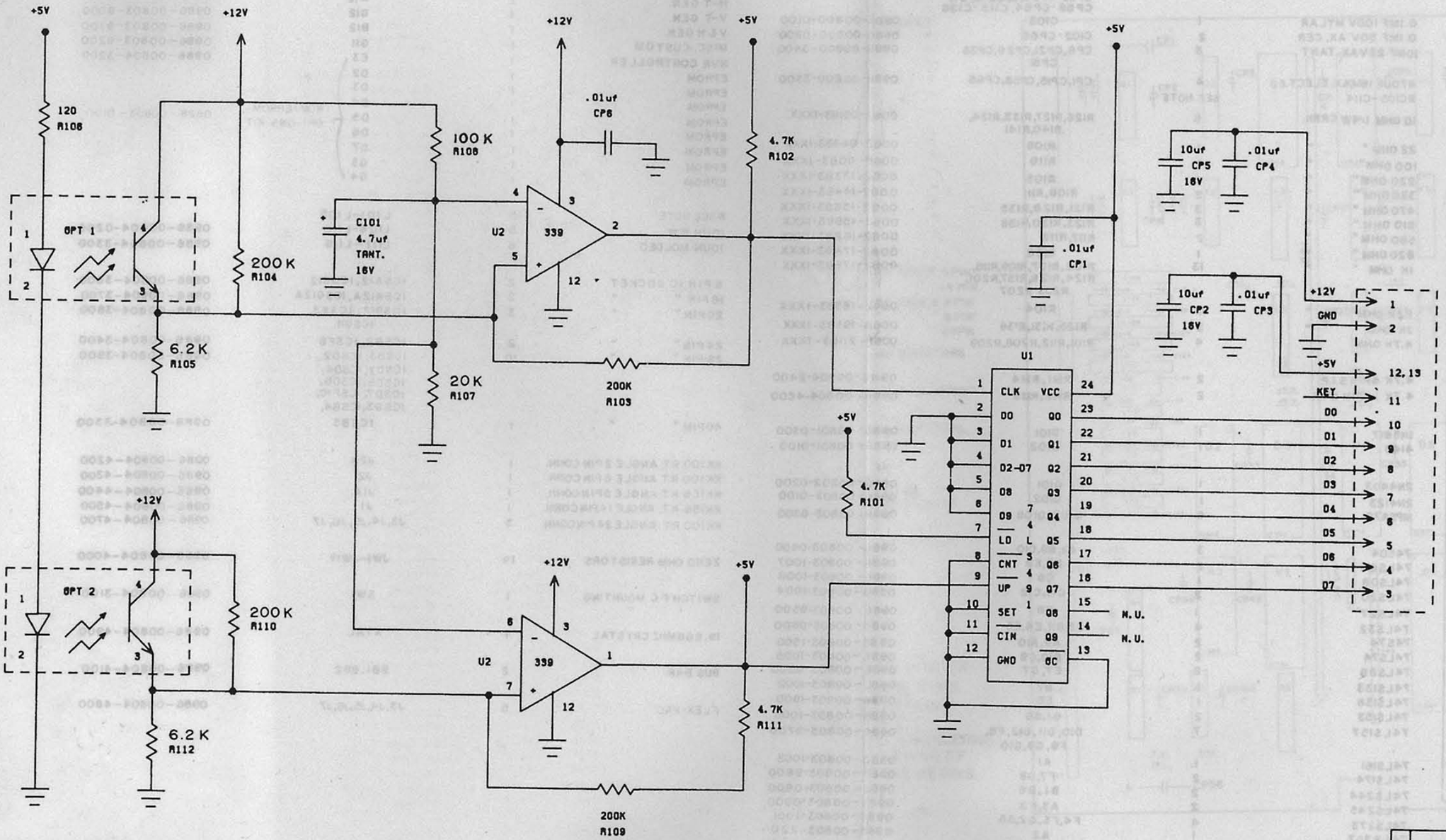
PROJ. ENG: JOHN BOYDSTON

DO NOT SCALE DWG.		HEAT TREAT	SCALE	USED ON TRON	MIDWAY MFG. CO. FRANKLIN PK. ILL.
DIM. TOLERANCES UNLESS SPECIFIED CONCENTRICITY T.I.R. .003 FRACTIONAL ± 1/64 DECIMAL ± .005 HOLE DIA. +.002 -.000	DRN. C.L CKD. J.B. DATE 6/14/82	MAT'L. FINISH		NO. REQ'D 1 PER	

ASS'Y DRAWING
OPTICAL ENCODER
A082-91418-D000

PART NO. M051-00114-D006

REVISIONS



PROJ. ENG: JOHN BOYDSTON

DO NOT SCALE DWG		HEAT TREAT	SCALE NONE	USED ON TRON	MIDWAY MFG. CO. FRANKLIN PK. ILL.
DIM TOLERANCES UNLESS SPECIFIED	DRN TBB	MAT'L		NO REQ'D ONE PER	
CONCENTRICITY T.I.R .003 FRACTIONAL ±1/64 DECIMAL ±.005 HOLE DIA +.002 .000	CKD	FINISH	SCHEMATIC DRAWING OPTICAL ENCODER A082-91418-D000		PART NO. M051-00114 -D007
	DATE 6/22/82				

REVISIONS

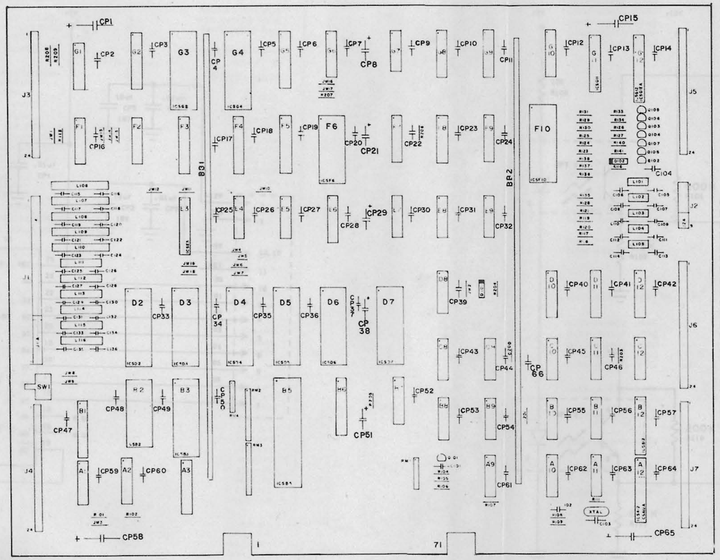
DESIGNATION LIST

DESIGNATION	DESCRIPTION
C101	33PF AX.CER.
C102	0.1UF AX. CER.
C103	0.1UF MYLAR
C104	390PF AX.CER.
* C105 – C114	SEE NOTE
C115 – C136	0.01UF AX.CER.
C200	390 PF AX. CER.
CP1	470UF 16V ELECT.AX.
CP2 – CP7	0.01UF 50V AX.CER.
CP8	10UF 25V AX. TANT.
CP9 – CP14	0.01UF 50V AX. CER.
CP15	470UF 16V ELECT. AX.
CP16 – CP20	0.01UF 50V AX. CER.
CP21	10UF
CP22 – CP28	0.01UF
CP29	10UF
CP30 – CP37	0.01UF
CP38	10UF
CP39 – CP50	0.01UF
CP51	10UF
CP52 – CP57	0.01UF
CP58	470UF 16V ELECT.AX.
CP59 – CP64	0.01UF
CP65	470UF
CP66	0.1UF 50V AX. CER.
R101	4.7K OHM 1/4W CRBN.
R102	1K OHM " "
R104	1.2K OHM " "
R105	220 OHM " "
R106	22 OHM " "
R107	1K OHM " "
R108	330 OHM " "
R109	1K OHM " "
R111	330 OHM " "
R112	4.7K OHM " "
R116	1K OHM " "
R117, R118	560 OHM " "
R119	100 OHM " "
R120	820 OHM " "
R121	470 OHM " "
R123	510 OHM " "
R124	1K OHM " "
R125	2K OHM " "
R126 – R127	10 OHM " "
R128	470 OHM " "
R129	1K OHM " "
R130	510 OHM " "
R131	2K OHM " "
R133 – R134	10 OHM " "
R135	470 OHM " "
R136	510 OHM " "
R137	1K OHM " "
R138	2K OHM " "
R140 – R141	10 OHM " "
R201	1K OHM " "
R203 – R207	1K OHM " "
R208, R209	4.7K OHM " "
RM1	4.7K 6 PIN S.I.P.
RM2 – RM3	4.7K 10 PIN S.I.P.
RM4	4.7K 6 PIN S.I.P.

DESIGNATION	DESCRIPTION
D101	2N4403
D102	2N4123
Q103 – Q108	MPSA70
A1	74LS161
A2	74LS367
A3	74LS245
A9, A10	74S74
A11	74S04
A12	H-T
B1	74LS244
B2	CMOS RAM
B3	MK3882
B5	MK3880
B6	74LS244
B7	74LS133
B8	74LS32
B9	74S04
B10	74LS74
B11	74LS32
B12	V&H-T
C8	74LS08
C9	74LS74
C10	74S04
C11, C12	74LS20
D2	EPROM
D3	EPROM
D4	EPROM
D5	EPROM
D6	EPROM
D7	EPROM
D8	74LS04
D10 – D12	74LS157
E3	NVR CONTROLLER
E4, E5	74LS32
E6	74LS138
E7	74LS86
E8	74LS27
E9	74LS04
F1	4053
F2	4017
F3	74LS245
F4 – F5	74LS273
F6	6116
F7	74LS174
F8, F9	74LS157
F10	93419
G1	H-T
G2	74LS273
G3	EPROM
G4	EPROM
G5	74LS273
G6	74LS153
G7	74LS86
G8	74LS174
G9, G10	74LS157
G11	CUSTOM IC
G12	V-T GEN.

DESIGNATION	DESCRIPTION
* L101 – L105	SEE NOTE
L106 – L110	10UH WW
L111 – L116	10UH MOLDED
ICSA12	8 PIN IC SOCKET
ICSA12A	16 PIN " "
ICSB2	24 PIN " "
ICSB3	28 PIN " "
ICSB5	40 PIN " "
ICSB12	20 PIN " "
ICSD2, D3, D4, D5, D6, D7	28 PIN " "
ICSE3	20 PIN " "
ICSF6	24 PIN " "
ICSF10	28 PIN " "
ICSG3, G4	28 PIN " "
ICSG11	20 PIN " "
ICSG12	8 PIN " "
ICSG12A	16 PIN " "
J1A	KK156 RT. ANGLE 5 PIN
J1	KK156 " " 14 PIN
J2A	KK100 RT. ANGLE 2 PIN
J2	KK100 " " 6 PIN
J3, J4, J5, J6, J7	KK100 " " 24 PIN
JW1 – JW19	ZERO OHM RESISTORS
SW1	SWITCH P.C. MOUNTING
XTAL	19.968 MHZ CRYSTAL
BB1, BB2	BUS BAR
J3, J4, J5, J6, J7	FLEX-PAC JUMPER
A080-90010-C000	SUPER CPU BOARD

* NOTE: ALL BOARDS COME WITH JUMPER WIRES. CHOKES AND CAPACITORS ARE NEEDED FOR RADIATION SUPPRESSION ONLY. F.C.C. REGULATIONS PENDING. ENGINEERING WILL NOTIFY WHEN STUFFING OF CHOKES AND CAPACITORS BEGINS.



CROSS REFERENCE LIST

DESCRIPTION	QTY.	DESIGNATION	PART NOS.
33PF 50V AX. CER.	1	C101	0986-00800-0300
390PF 50VAX. CER.	2	C104, C200	0986-00800-3000
0.01UF 50V AX. CER.	78	CP2-CP7, CP9-CP14, CP16-CP20, CP22-CP28, CP30-CP37, CP39-CP50, CP52-CP57, CP59-CP64, C115-C136	0986-00800-2200
0.1MF 100V MYLAR	1	C103	0986-00800-0100
0.1MF 50V AX. CER.	2	C102-CP66	0986-00800-0200
10MF 25VAX. TANT	5	CP8, CP21, CP29, CP38 CP51	0986-00800-3400
470UF 16V AL. ELECT.	4	CP1, CP15, CP58, CP65	0986-00800-3300
*C105 – C114	SEE NOTE		
10 OHM 1/4W CRBN.	6	R126, R127, R133, R134, R140, R141	0062-05183-1XXX
22 OHM " "	1	R106	0062-06383-1XXX
100 OHM " "	1	R119	0062-11083-1XXX
220 OHM " "	1	R105	0062-13383-1XXX
330 OHM " "	2	R108, R111	0062-14483-1XXX
470 OHM " "	3	R121, R128, R135	0062-15683-1XXX
510 OHM " "	3	R123, R130, R136	0062-15983-1XXX
560 OHM " "	2	R117, R118	0062-16283-1XXX
820 OHM " "	1	R120	0062-17483-1XXX
1K OHM " "	13	R102, R107, R109, R116, R124, R125, R137, R201, R203-R207	0062-17983-1XXX
1.2K OHM " "	1	R104	0062-18383-1XXX
2K OHM " "	3	R125, R135, R138	0062-19183-1XXX
4.7K OHM " "	4	R101, R112, R208, R209	0062-21183-1XXX
4.7K 6PIN S.I.P.	2	RM1, RM4	0986-00804-2400
4.7K 10 PIN S.I.P.	2	RM2, RM3	0986-00804-4600
IN5817	1	D101	0986-00801-0300
4148 "	1	D102	0986-00801-0100
2N4403	1	Q101	0986-00802-0200
2N4123	1	Q102	0986-00802-0100
MPSA70	6	Q103-Q108	0986-00802-0300
74S04	3	A11, B9, C10	0986-00803-0400
74LS04	2	D8, E9	0986-00803-1007
74LS08	1	C8	0986-00803-1006
74LS20	2	C11, C12	0986-00803-1004
74LS27	1	E8	0986-00803-9500
74LS32	4	B8, B11, E4, E5	0986-00803-0600
74S74	2	A9, A10	0986-00803-1500
74LS74	2	B10, C9	0986-00803-1005
74LS86	2	E7, G7	0986-00803-9900
74LS133	1	B7	0986-00803-1002
74LS138	1	E6	0986-00803-1900
74LS153	2	G1, G6	0986-00803-1000
74LS157	7	D10, D11, D12, F8, F9, G9, G10	0986-00803-9700
74LS161	1	A1	0986-00803-1003
74LS174	2	F7, G8	0986-00803-9800
74LS244	2	B1, B6	0986-00803-0800
74LS245	2	A3, F3	0986-00803-0900
74LS273	4	F4, F5, G2, G5	0986-00803-1001
74LS367	1	A2	0986-00803-2200
MK3380	1	B5	0986-00803-7800
MK3382	1	B3	0986-00803-7700
4017	1	F2	0986-00803-8700

DESCRIPTION	QTY.	DESIGNATION	PART NOS.
4053	1	F1	0986-00803-2000
CMOS RAM	1	B2	0986-00803-8100
6116	1	F6	0986-00803-1008
93419	1	F10	0986-00803-9600
H-T GEN.	1	A12	0986-00803-8900
V-T GEN.	1	G12	0986-00803-9000
V&H GEN.	1	B12	0986-00803-9100
MISC. CUSTOM	1	G11	0986-00803-9200
NVR CONTROLLER	1	E3	0986-00804-3200
EPROM	1	D2	ROM/EPROM OPTIONS KIT 0628-00803-0100
EPROM	1	D3	
EPROM	1	D4	
EPROM	1	D5	
EPROM	1	D6	
EPROM	1	D7	
EPROM	1	G3	
EPROM	1	G4	
*SEE NOTE	5	L101-L105	
10UH WW	5	L106-L110	0986-00804-0200
10UH MOLDED	6	L111-L116	0986-00804-3300
8 PIN IC SOCKET	2	ICSA12, ICSG12	0986-00804-3600
16 PIN " "	2	ICSA12A, ICSG12A	0986-00804-3700
20 PIN " "	3	ICSB12, ICSE3, ICSG11	0986-00804-3800
24 PIN " "	2	ICSB2, ICSF6	0986-00804-3400
28 PIN " "	10	ICSB3, ICSD2, ICSD3, ICSD4, ICSD5, ICSD6, ICSD7, ICSF10, ICSG3, ICSG4,	0986-00804-3900
40PIN " "	1	ICSB5	0986-00804-3500
KK100 RT. ANGLE 2 PIN CONN.	1	J2A	0986-00804-4200
KK100 RT. ANGLE 6 PIN CONN.	1	J2	0986-00804-4200
KK156 RT. ANGLE 5 PIN CONN.	1	J1A	0986-00804-4400
KK156 RT. ANGLE 14 PIN CONN.	1	J1	0986-00804-4500
KK100 RT. ANGLE 24 PIN CONN.	5	J3, J4, J5, J6, J7	0986-00804-4700
ZERO OHM RESISTORS	19	JW1-JW19	0986-00804-4000
SWITCH P.C. MOUNTING	1	SW1	0986-00804-3100
19.968MHZ CRYSTAL	1	XTAL	0986-00804-4900
BUS BAR	2	BB1, BB2	0986-00804-4100
FLEX-PAC	5	J3, J4, J5, J6, J7	0986-00804-4800

PROJECT ENG: A. GHOSH.

DO NOT SCALE DRAWING	DRAWN BY TRON			MIDWAY MFG. CO.
TOLERANCES UNLESS OTHERWISE SPECIFIED	DATE 06/22/82	SIZE FULL	NO. REQ'D 1 PER	SUPER CPU BOARD ASSEMBLY DRWNG. A082-90010-C000
				PART NO. M051-00628-A007

REVISIONS

PROJECT ENG. A GHOSH

FULL

TRON

I PER

MIDWAY MFG. CO.

FRANKLIN PK ILL

SUPER CPU SCHEMATIC DRAWING

A082-90010-C000

M051-00628-A008

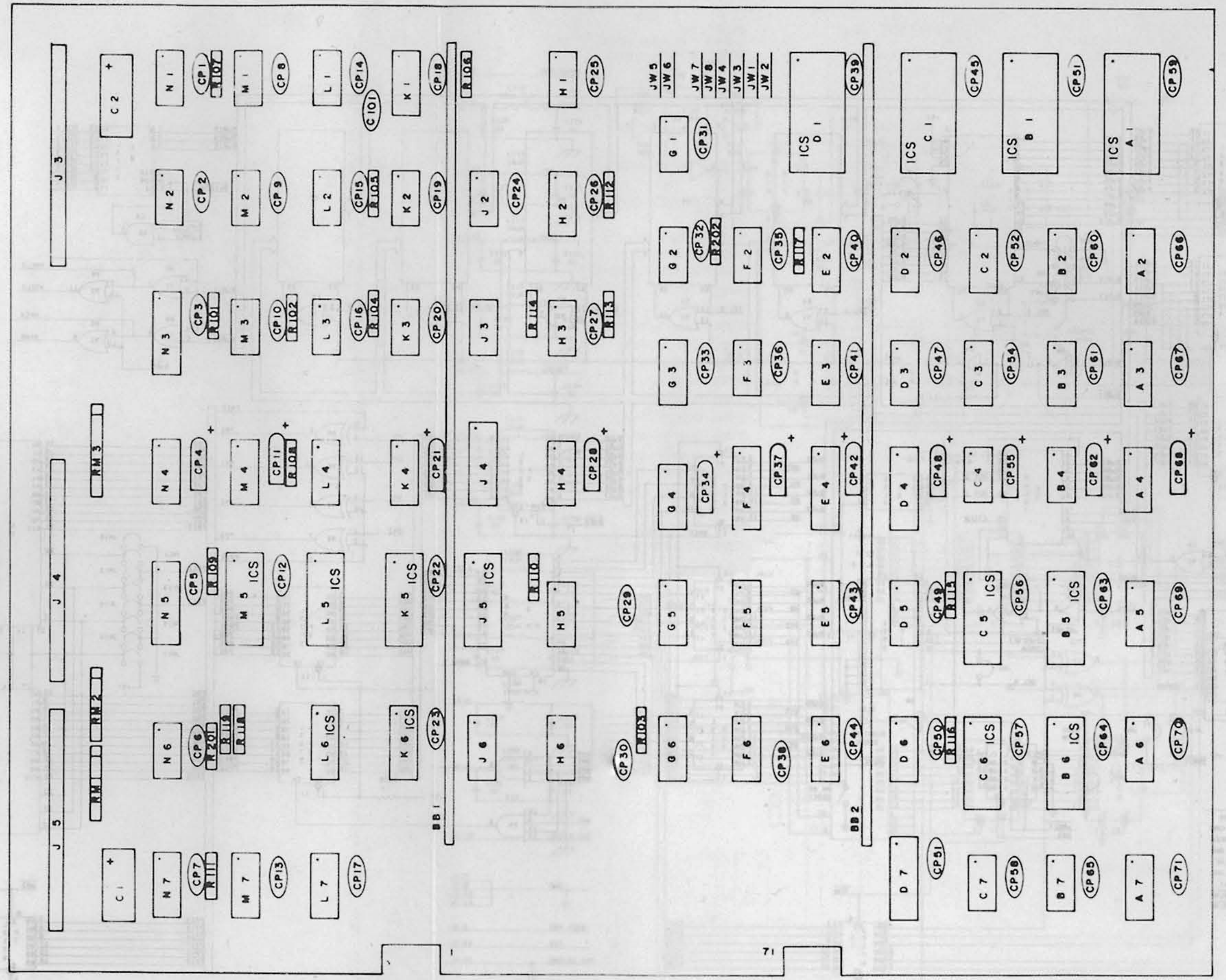
06/22/82

DESIGNATION LIST

DESIGNATION	DESCRIPTION
C1, 2	100 µf AX. ELECT
C101	100 pf AX. CER.
CP1-3, 5-10, CP12-20, 22-27, CP29-33, 35, 36, CP38-41, 43-47, CP49-54, 56-61, CP63-67, 69-71.	.01 µf AX. CER.
CP4, 11, 21, 28, 34, CP37, 42, 48, 55, CP62, 68.	10 µf 25V AX. TANT.
R101-119, 201, 202,	1 K 1/4W 5%
RM1, 2	8PIN 1K SIP
RM 3	10PIN 1K SIP
IC A1	EPROM
IC A2	74LS157
IC A3	74LS157
IC A4	74LS157
IC A5	74LS157
IC A6	74LS157
IC A7	74LS157
IC B1	EPROM
IC B2	74LS194
IC B3	74LS194
IC B4	74LS32
IC B5	422
IC B6	422
IC B7	74LS32
IC C1	EPROM
IC C2	74LS194
IC C3	74LS194
IC C4	74LS32
IC C5	422
IC C6	422
IC C7	74LS32

DESIGNATION	DESCRIPTION
IC D1	EPROM
IC D2	74LS194
IC D3	74LS194
IC D4	74LS273
IC D5	74LS157
IC D6	74LS157
IC D7	74LS273
IC E2	74LS194
IC E3	74LS194
IC E4	74LS374
IC E5	74LS157
IC E6	74LS157
IC F2	7400
IC F3	74S04
IC F4	74LS374
IC F5	74LS157
IC F6	74LS157
IC G1	74LS86
IC G2	74LS20
IC G3	74LS283
IC G4	74LS283
IC G5	74LS283
IC G6	74LS157
IC H1	74LS86
IC H2	74174
IC H3	74S74
IC H4	74175
IC H5	74174
IC H6	74LS157
IC J2	74LS30
IC J3	7430
IC J4	74LS273
IC J5	422
IC J6	74LS157
IC K1	74161
IC K2	7430
IC K3	7474
IC K4	74161
IC K5	422
IC K6	2114-2

DESIGNATION	DESCRIPTION
IC L1	74LS20
IC L2	7408
IC L3	7474
IC L4	74LS283
IC L5	422
IC L6	2114-2
IC L7	74LS157
IC M1	7430
IC M2	7432
IC M3	74S74
IC M4	74161
IC M5	422
IC M7	74LS157
IC N1	7430
IC N2	7427
IC N3	74LS273
IC N4	74LS283
IC N5	74LS245
IC N6	7404
IC N7	74LS157
ICS A1, B1, C1, D1.	28PIN IC SOCKET
ICS B5, 6, C5, 6, J5, K5, L5, M5.	22PIN IC SOCKET
ICS K6, L6.	18PIN IC SOCKET
J3, 4, 5	24PIN SOCKET
JW1-8	JUMPER WIRE
BB1, 2	BUSS BAR



CROSS REFERENCE LIST

Q'TY	DESCRIPTION	DESIGNATION	PART NO.
1	100 Pf 50V AX. CER.	C101	0986-00800-1000
60	.01 µf 50V AX. CER.	CP1-3, CP5-10, CP12-20, CP22-27, CP29-33, CP35, 36, CP38-41, CP43-47, CP49-54, CP56-61, CP63-67, CP69-71.	0986-00800-2500
11	10 µf 25V AX. TANT.	CP4, 11, 21, 28, 34, 37, CP42, 48, 55, 62, 68.	0986-00800-2400
2	100 µf 25V AX. ELECT.	C1, 2.	0986-00800-1800
21	1 K 1/4 W CRBN. FLM.	R101-119, 201, 202.	0062-17983-1XXX
2	1 K 8 PIN SIP	RM1, 2.	0986-00804-1100
1	1 K 10 PIN SIP	RM 3	0986-00804-1000
2	2114-2	K6, L6.	0986-00803-2300
1	7400	F2	0986-00803-2800
1	7404	N6	0986-00803-8300
1	74S04	F3	0986-00803-3100
1	7408	L2	0986-00803-3200
2	74LS20	G2, L1	0986-00803-3400
1	7427	N2	0986-00803-3500
4	7430	J3, K2, M1, N1	0986-00803-3600
1	74LS30	J2	0986-00803-4300
1	7432	M2	0986-00803-4400
4	74LS32	B4, 7, C4, 7,	0986-00803-3700
2	7474	K3, L3	0986-00803-4500
2	74S74	H3, M3	0986-00803-4100
2	74LS86	G1, H1	0986-00803-4200
18	74LS157	A2, 3, 4, 5, 6, 7, D5, 6, E5, 6, F5, 6, G6, H6, J6, L7, M7, N7.	0986-00803-2400
3	74161	K1, K4, M4.	0986-00803-2500
2	74174	H2, 5	0986-00803-2600
1	74175	H4	0986-00803-2700
8	74LS194	B2, 3, C2, 3, D2, 3, E2, 3.	0986-00803-2900
1	74LS245	N5	0986-00803-3000
4	74LS273	D4, 7, J4, N3	0986-00803-3800
5	74LS283	G3, 4, 5 L4, N4,	0986-00803-3900
2	74LS374	E4, F4	0986-00803-4000
8	93422	B5, 6, C5, 6, J5, K5, L5, M5	0986-00804-0800
1	EPROM	A1 (VG A)	ROM/EPROM OPTIONS KIT 0628-00803-3026
1	EPROM	B1 (VG B)	
1	EPROM	C1 (VG C)	
1	EPROM	D1 (VG D)	
8	JUMPER WIRE	JW1-8	0986-00805-0200
2	BUSS BAR	BB1, 2	0986-00804-0900
1	P.C. BOARD		A080-91399-E000
3	24 PIN SOCKET	J3, 4, 5	0986-00804-4700
4	28 PIN SOCKET	ICS A1, B1, C1, D1	0986-00804-0300
8	22 PIN SOCKET	ICS B5, 6, C5, 6, J5, K5, L5, M5	0986-00804-0700
2	18 PIN SOCKET	ICS K6, L6	0986-00804-0600

PROJ. ENG. ATISH GHOSH

REVISIONS

DO NOT SCALE DWG

USED ON TRON

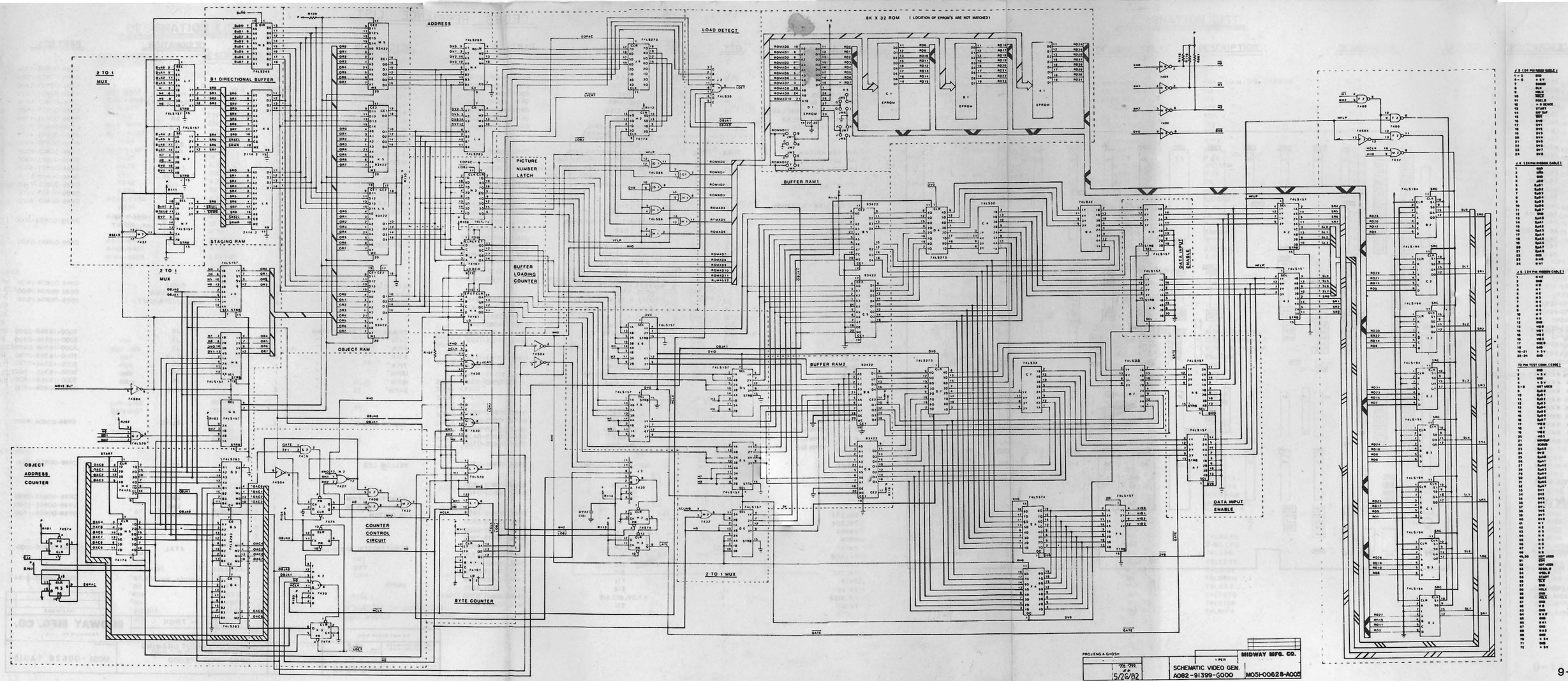
NO REQ'D 1 PER

MIDWAY MFG. CO.
FRANKLIN PK. ILL.

ASS'Y DRAWING
VIDEO GENERATOR P.C
A082-91399-G000

6/1/82

M051-00628-A006

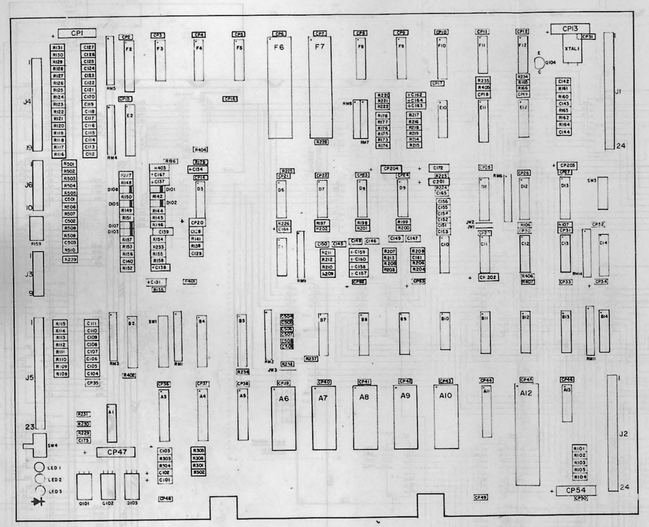

8K X 32 ROM (LOCATION OF EPROM'S ARE NOT MATCHED)
ADDRESS
LOAD DETECT
2 TO 1 MUX
B1 BIDIRECTIONAL BUFFER
STAGING RAM
OBJECT RAM
PICTURE NUMBER LATCH
BUFFER LOADING COUNTER
BUFFER RAM1
BUFFER RAM2
OBJECT ADDRESS COUNTER
COUNTER CONTROL CIRCUIT
BYTE COUNTER
2 TO 1 MUX
DATA INPUT ENABLE
MOVE BUF
PROJ ENG A GHOSH
5/26/82
1 PER
SCHEMATIC VIDEO GEN.
A082-91399-G000
MIDWAY MFG. CO.
M031-00628-A005

DESIGNATION LIST

DESIGNATION	DESCRIPTION
C101-C103	10MF 25V AX.TANT.
C104-C127	.1 MF 50V AX. CER.
C128-C129	47PF 50V AX. CER.
C131	10 MF 25V AX. TANT
C134, C137	1MF 20V AX. TANT.
C138	10MF 25V AX. TANT.
C139	.047 MF 100V MYLAR
C140	.01MF 50V AX. CER.
C142	100PF 50V AX. CER
C143	.1MF 50V AX. CER.
C144	33 PF 50V AX. CER
C145-C156	.0022 MF 100V 10% MYLAR
C157-C159	1MF 20V AX. TANT
C161	330 PF 50V AX. CER.
C162-C164	1MF 20V AX. TANT
C165	330PF 50V AX. CER
C166, C167	10MF 25V AX. TANT.
C172	10MF 25V AX. TANT.
C173	.01MF 50V AX. CER.
C501-C509	.1 MF 50V AX. CER.
CP1	470MF 16V AX. ELECT.
CP2-CP2	01MF 50V AX. CER
CP13	470MF 16V AX. ELECT.
CP14-CP19	.01MF 50V AX. CER
CP20	10MF 25V AX. TANT.
CP21-CP27	.01MF 50V AX. CER.
CP29-CP33	.01MF 50V AX. CER.
CP34	10MF 25V AX. TANT
CP35-CP46	.01MF 50V AX. CER.
CP47	470MF 16V AX. ELECT.
CP48-CP51	.01MF 50V AX. CER.
CP52-CP53	10MF 25V AX. TANT.
CP54	470MF 16V AX. ELECT.
CP202-CP204	10MF 25V AX. TANT.
R101-R107	4.7K OHM 1/4W 5% CARBON
R108-R131	220 OHM " " "
R135	33K " " "
R138, R141	180K " " "
R142	100K " " "
R144, R145	620K " " "
R146	10K " " "
R148	100K " " "
R149, R150	620K " " "
R151	10K " " "
R152	1MEG " " "
R153	1K " " "
R154	1MEG " " "
R155, R156	10K " " "
R157, R158	1.2K " " "
R160, R161	330 OHM " " "
R162	220 OHM " " "
R163	1.2K " " "
R164	22 OHM " " "
R165, R166	4.7K " " "
R173-R178	5.6K " " "
R179, R196	24K " " "

DESIGNATION	DESCRIPTION
R197-R202	5.6K 1/4W 5% CARBON
R203-R208	33K " " "
R209-R211	13K " " "
R213	27K " " "
R214-R219	33K " " "
R220-R222	13K " " "
R224	27K " " "
R225, R226	4.7K " " "
R227	1K " " "
R228	4.7K " " "
R231	300 OHM " " "
R232	4.7K " " "
R233	3K " " "
R234, R235	4.7K " " "
R239	100 OHM " " "
R301-R306	2.7K " " "
R401	1K " " "
R402	4.7K " " "
R403-R404	33K OHM " " "
R405-R407	4.7K " " "
R501-R509	220 OHM " " "
R510	2.7K " " "
RM1	4.7K 10 PIN S.I.P.
RM2-RM5	2.7K 10 PIN S.I.P.
RM7	4.7K 8 PIN S.I.P.
RM8	820 OHM " " "
RM9	1.8K " " "
RM14	4.7K 10 " "
D101-D103	IN4148
D105-D107	IN4148
Q101-Q103	TIP 110
Q104	2N4403
IC A1	7406
" A4	74LS273
" A5	74LS374
" A6	1K X 8 RAM
" A7	ROM/EPROM 0
" A8	" " 1
" A9	" " 2
" A10	" " 3
" A11	74LS245
" A12	Z-80 CPU
" A13	74LS08
"B2,B4,B5	74LS244
"B7,B8	74LS138
"B9	74LS670
"B10	74LS32
"B11	74LS670
"B12,B13	74LS138
"B14	74LS174

DESIGNATION	DESCRIPTION
IC C6	7407
" C10	MC3403
" C11	74LS04
" C12	MCI4024
" C13	7427
" C14	74LS367
" D3	LM3900
" D6	74LS02
" D7-D9	MCI4016
" D11	74190
" D12	PROMSB2A
" D13	74166
" E2	74LS244
" E10	MC3403
" E11	74161
" E12	74126
" F2	74LS244
" F3-F5	74LS191
" F6,F7	AY-3-8910
" F8-F10	74LS191
" F11	7474
" F12	74S04
ICSA6-ICSA10	24 PIN IC SOCKET
" A12	40 PIN " "
" D12	16 PIN " "
" F6,F7	40 PIN " "
J1, J2	24 PIN KK100 RT. ANGLE CONN.
J3	5 PIN KK100 "
	3 PIN KK100 "
J4	13 PIN KK100 "
	5 PIN KK100 "
J5	18 PIN KK100 "
	4 PIN KK100 "
J6	7 PIN KK100 "
	2 PIN KK100 "
JW1, JW2	JUMPER WIRE
LED 3	YELLOW LED
SW1	10 POSITION DIP
SW3	8 " "
SW4	PUSH BUTTON S.W.
XTAL 1	16 MHZ CRYSTAL
MHQI01-MHQ103	SNAP

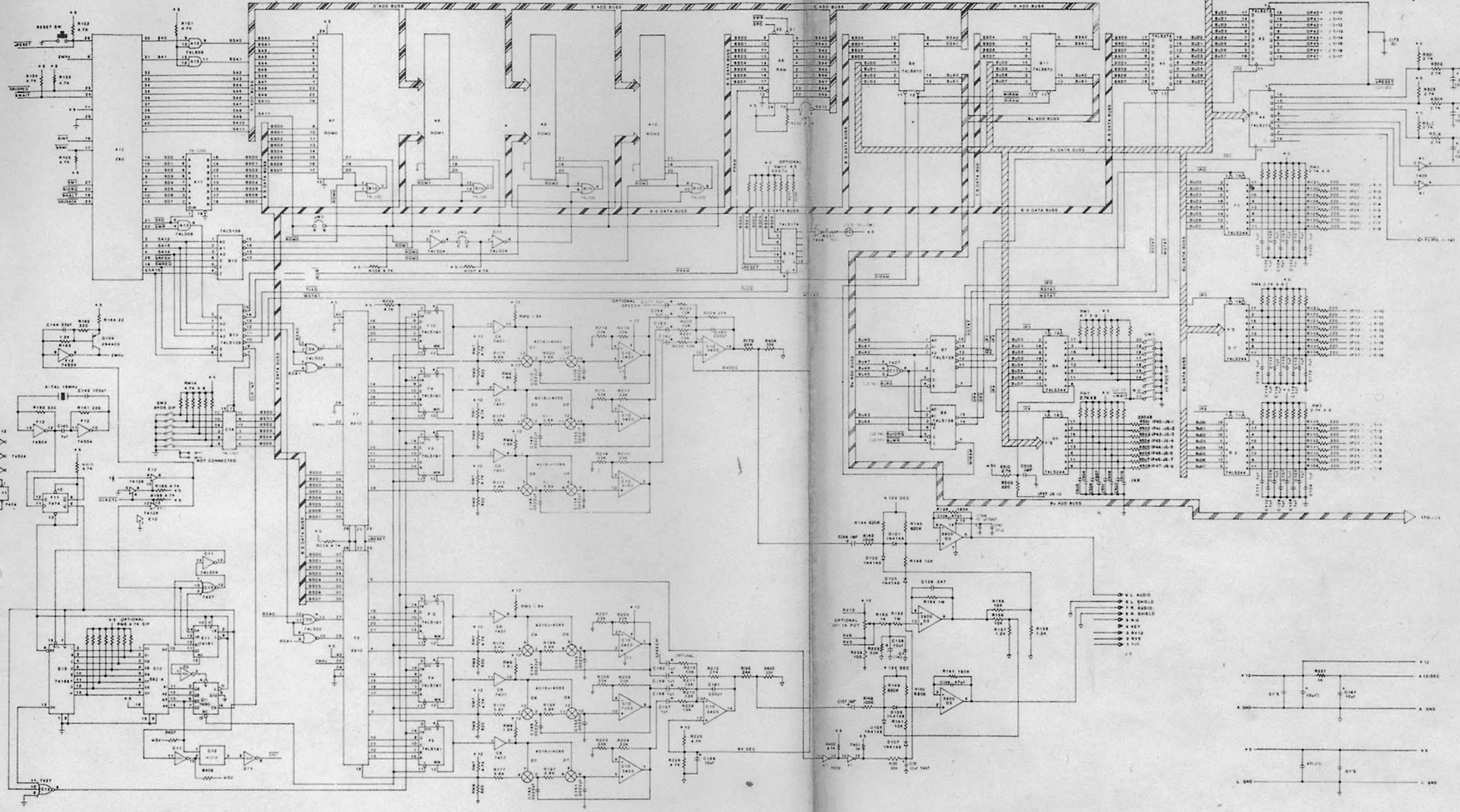


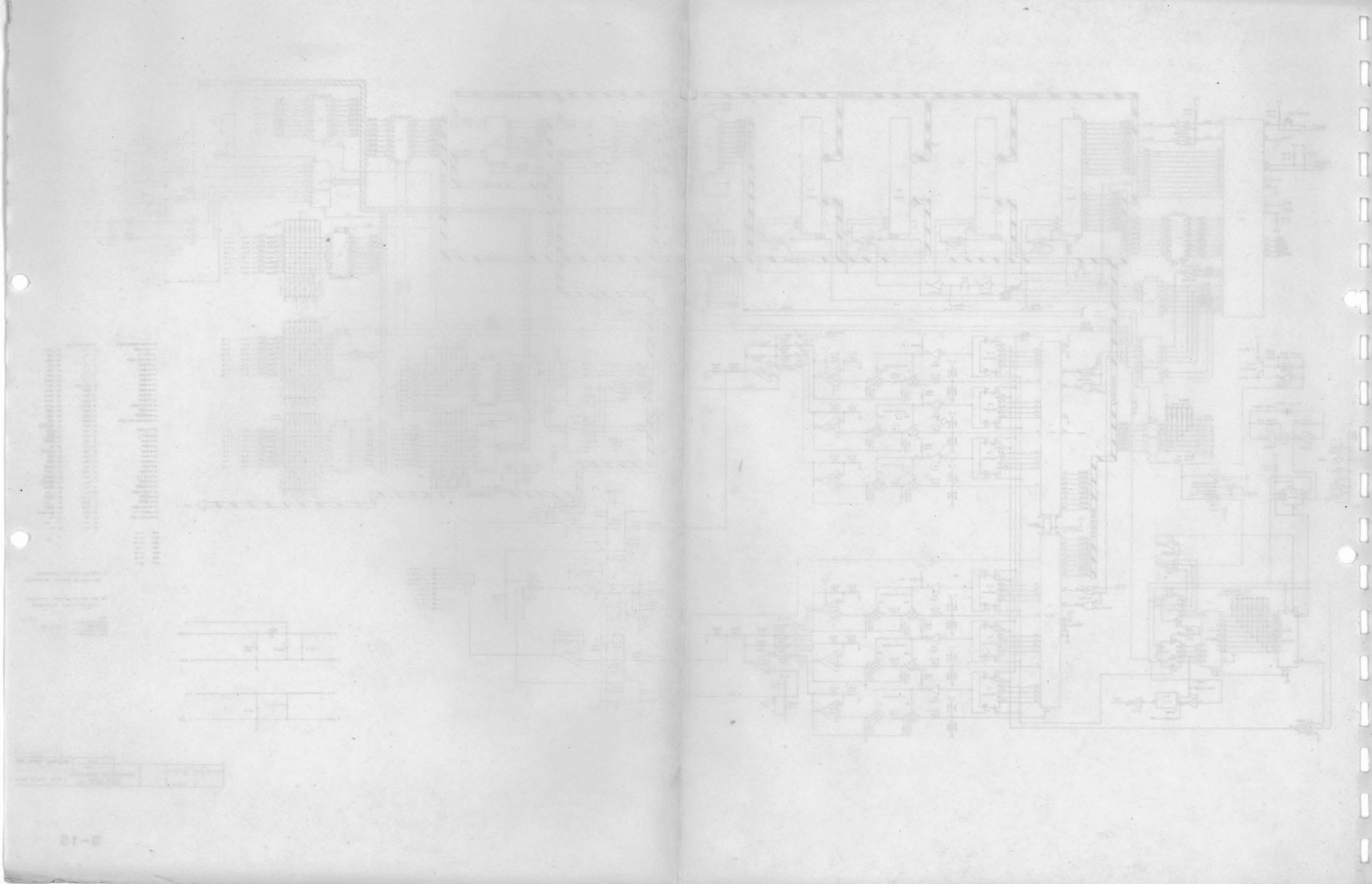
CROSS REFERENCE LIST

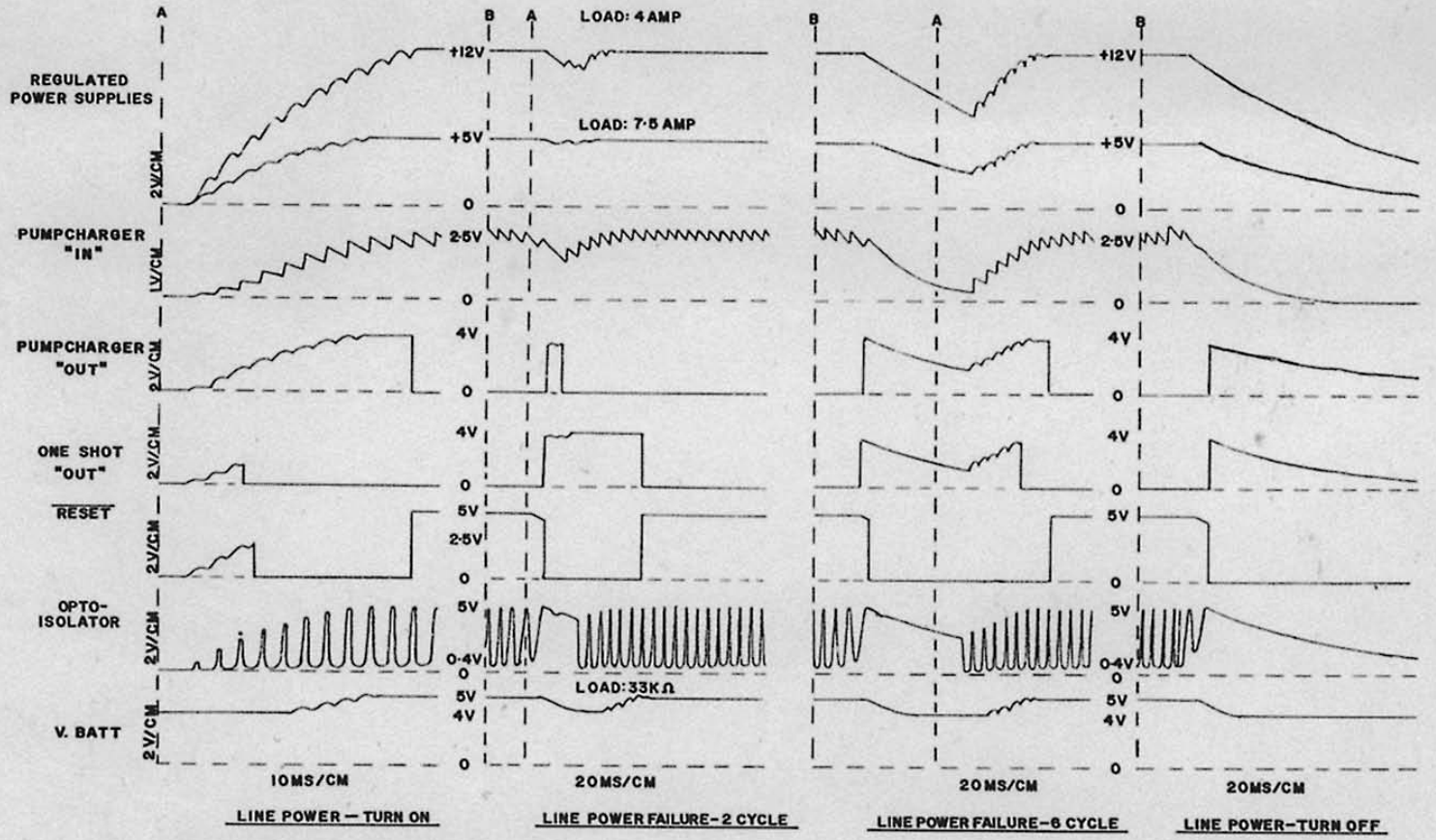
DESCRIPTION	QTY	DESIGNATION	PART NOS.
33PF 50V 5% AX.CER	1	C144	0986-00800-0900
47 PF 50V AX.CER.	2	C128, C129	0986-00800-2800
100PF 50V 5% AX.CER.	1	C142	0986-00800-1000
330PF 50V AX. CER.	2	C161, C165	0986-00800-1300
.0022MF 100V 10% MYLAR	12	C145-C156	0986-00800-1200
.047MF 100V MYLAR	1	C139	0986-00800-2600
.01MF 50V AX. CER	47	CP2-CP12, CP14-CP19, CP21-CP27, CP29-CP33, CP35-CP46, CP48-CP51, C140, C173	0986-00800-2000
.1MF 50V AX. CER.	34	C104-C127, C143, C501-C509	0986-00800-1100
1MF 20V AX. TANT.	8	C134, C137, C157-C159, C162-C164	0986-00800-1400
10MF 25V AX. TANT.	15	CP20, CP34, CP52-CP53, CP202-CP204, C101-C103, C131, C138, C166, C167, C172	0986-00800-0700
470 MF 16V AX. ELECT.	4	CP1, CP13, CP47, CP54	0986-00800-2700
22 OHM 1/4W 5% CARBON	1	R164	0062-06383-1XXX
100 OHM " "	1	R239	0062-11083-1XXX
220 OHM " "	34	R108-R131, R162, R501-R509	0062-13383-1XXX
300 OHM " "	1	R231	0062-14183-1XXX
330 OHM " "	2	R160-R161	0062-14483-1XXX
1K " "	3	R153, R227, R401	0062-17983-1XXX
1.2K " "	3	R157, R158, R163	0062-18383-1XXX
2.7K " "	7	R301-R306, R510	0062-19981-1XXX
3K " "	1	R233	0062-20183-1XXX
4.7K " "	19	R101-R107, R165, R166, R225, R226, R228, R232, R234, R235, R402, R405-R407	0062-21183-1XXX
5.6K " "	12	R173-R178, R197-R202	0062-21583-1XXX
10K " "	4	R146, R151, R155, R156	0062-22783-1XXX
13K " "	6	R209-R211, R220-R222	0062-23383-1XXX
24K " "	2	R179, R196	0062-24583-1XXX
27K " "	2	R213, R224	0062-24783-1XXX
33K " "	15	R135, R203-R208, R214-R219, R403-R404	0062-25183-1XXX
100K " "	2	R142, R148	0062-27583-1XXX
180K " "	2	R138, R141	0062-28783-1XXX
620K " "	4	R144, R145, R149, R150	0062-31303-1XXX
1MEG " "	2	R152, R154	0062-32383-1XXX
820 OHM 8 PIN S.I.P.	1	RM8	0986-00805-0800
1.8K 10 PIN S.I.P.	1	RM9	0986-00805-0600
2.7K 10 PIN S.I.P.	4	RM2-RM5	0986-00805-0500
4.7K 8 PIN S.I.P.	1	RM7	0986-00805-0400
4.7K 10 PIN S.I.P.	2	RM1, RM14	0986-00805-0300
IN4148	6	D101-D103, D105-D107	0986-00801-0200
2N4403	1	Q104	0986-00802-0500
TIP 110	3	Q101-Q103	0986-00802-0400
74LS02	1	D6	0986-00803-7400
74LS04	1	C11	0986-00803-6900
74S04	1	F12	0986-00803-6600
7406	1	A1	0986-00803-7600
7107	1	C6	0986-00803-5900
74LS08	1	A13	0986-00803-7300
7427	1	C13	0986-00803-7200
74LS32	1	B10	0986-00803-6100
7474	1	F11	0986-00803-6700
74126	1	E12	0986-00803-6800
74LS138	4	B7, B8, B12, B13	0986-00803-6500
74161	1	E11	0986-00803-5100
74166	1	D13	0986-00803-5300
74LS174	1	B14	0986-00803-7500
74190	1	D11	0986-00803-9400
74LS191	6	F3-F5, F8-F10	0986-00803-5600
74LS244	5	B2, B4, B5, E2, F2	0986-00803-4800
74LS245	1	A11	0986-00803-6400
74LS273	1	A4	0986-00803-4700
74LS367	1	C14	0986-00803-7000
74LS374	1	A5	0986-00803-4600
74LS670	2	B9, B11	0986-00803-6300
AY-3-8910	2	F6, F7	0986-00803-8500
LM3900	1	D3	0986-00803-4900
MC3403	2	C10, E10	0986-00803-5000
MCI4016	3	D7-D9	0986-00807-6200
MCI4024	1	C12	0986-00803-7100
PROM SB2-A	1	D12	0986-00803-8200
RAM IX X 8	1	A6	0986-00803-8000
ROM/EPROM 0	1	A7	EPROM/ROM OPTIONS KIT
" " 1	1	A8	0628-00803-3000
" " 2	1	A9	
" " 3	1	A10	
Z-80 3880	1	A12	0986-00803-5500
16 PIN IC SOCKET	1	ICSD12	0986-00804-1400
24 PIN " "	5	ICSA6-ICSA10	0986-00804-1600
40 PIN " "	3	ICSA12, ICSF6, ICSF7	0986-00804-1500
2 PIN KK100 RT. ANGLE CONN.	1	J6	3000-16366-0200
3 PIN " "	1	J3	3000-16366-0300
4 PIN " "	1	J5	3000-16366-0400
5 PIN " "	2	J3, J4	3000-16366-0500
7 PIN " "	1	J6	3000-16366-0700
13 PIN " "	1	J4	3000-16366-1300
18 PIN " "	1	J5	3000-16366-1800
24 PIN " "	2	J1, J2	0986-00804-4700
JUMPER WIRE	2	JW1, JW2	0986-00804-4000
YELLOW LED	1	LED 3	0986-00804-2000
8 POSITION DIP SW.	1	SW3	0986-00805-0900
10 POSITION DIP SW.	1	SW1	0986-00805-1000
PB. SWITCH	1	SW4	0986-00805-1700
16 MHZ CRYSTAL W/3RD LEAD	1	XTAL	0986-00805-1100
SNAPS	3	MHQI01-MHQ103	0017-00007-0134

PROJ. ENG.: C. MEDNICK

DO NOT SCALE DWG	HEAT TREAT	SCALE	USED ON TRON	REVISIONS	
DIM. TOLERANCES UNLESS SPECIFIED		FULL	NO REQ'D	MIDWAY MFG. CO.	
DRAWN SH2 6/23/82	MATL			FRANKLIN PK ILL	
CHECKED	FINISH			COMPONENT LAYOUT DRAWING SUPER SOUND I/O P.C. BRD. A082-90913-E000	PART NO. M051-00628-A015


MIDWAY MFG. CO.
SCHEMATIC DRAWING
SUPER SOUND I/O
A084-90813-E000
MOSI-00628-A014





A = ACTUAL TURN-ON POINT OF LINE POWER
B = ACTUAL TURN-OFF POINT OF LINE POWER
TIME DELAY IS DUE TO TRANSFORMER REACTANCE.
USE 10MΩ OSCILLOSCOPE PROBES.

AUXILIARY CIRCUITS OF A082-90412-D000 AND A082-90421-C000