

**Bally/Midway's**  
**Monitor Systems**

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**General Information and  
Troubleshooting Procedures  
Monitor Part One**

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*Bally*

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FORM 00361-8301

**WARNING**

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

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**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**

**Warnings**

1. Power Up Warning

Caution: If the monitor is to be powered up outside of the games console, an isolation transformer must be used for the AC power source.

2. X-Radiation

This chassis has been designed for minimal x-radiation hazard. However, to avoid possible exposure to soft x-radiation it is IMPERATIVE that the EHT circuitry IS NOT modified.

3. High Voltage

The colour monitor contains HIGH VOLTAGES derived from power supplies capable of delivering LETHAL quantities of energy. To avoid DANGER TO LIFE, do not attempt to service the chassis until all precautions necessary for working on HIGH VOLTAGE equipment have been observed.

4. CRT Handling

The picture tube encloses a high vacuum and due to the large surface area is subject to extreme force. Care must be taken not to bump or scratch the picture tube as this may cause the tube to implode resulting in personal injury and property damage. Shatter-proof goggles must be worn by individuals while handling the CRT or installing it in the monitor. Do not handle the CRT by the neck.

5. To prevent fire or shock hazard DO NOT EXPOSE THIS MONITOR TO RAIN OR MOISTURE.



# 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 a 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 "SYMPTOM — 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 Bally Midway Manufacturing Company on request. (There is a toll free number on the back side of the front cover of this manual.)

# Symptom Diagnosis

- 1. Insufficient width or height:**
  - A. Horizontal line (due to VERTICAL CIRCUIT DEFECT).
    - Bad yoke.
    - Bad vertical output section.
    - Open fusible resistor in vertical section.
    - Bad height control.
    - Bad flyback.
  - B. Vertical line (due to HORIZONTAL CIRCUIT DEFECT).
    - Bad yoke.
    - Open width coil.
    - Open part in horizontal output section.
- 2. Picture spread out too far or crushed in certain areas:**
  - A. Horizontal or vertical output transistor.
  - B. Bad Component in output circuitry.
  - C. Vertical linearity or damper control needs adjustment.
- 3. Line too close with black spacing:**
  - A. Problem in vertical section causing poor linearity.
- 4. Poor focus and convergence:**
  - A. Bad high voltage transformer ("flyback") or control.
  - B. Focus voltage wire not connected to neck-board terminal.
- 5. Colors missing; check:**
  - A. Interface color transistors.
  - B. Color output transistors.
  - C. Cracked printed circuit board (neck Board).
  - D. Color circuits.
  - E. Video input jack.
  - F. Defective picture tube.
- 6. Picture not bright enough:**
  - A. Weak emission from picture tube.
- 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).
  - B. Bad component in monitor's power supply.
- 10. Small picture and/or poor focus:**
  - A. Low B+ voltage (power supply trouble).
- 11. Vertical rolling:**
  - A. Vertical oscillator in the IC, vertical sync transistor, or circuit.
  - B. No sync from logic board.
  - C. Three pin sync jack is loose or plugged in wrong.
- 12. Horizontal line across center:**
  - A. Vertical output circuit is dead (see symptom No. 1. A.).
  - B. Vertical oscillator is not putting out the right wave form.
- 13. Picture bends:**
  - A. Horizontal sync needs adjusting.
  - B. Magnetic or electromagnetic interference.
- 14. Flashing picture, visible retrace lines:**
  - A. Broken neck board.
  - B. Internal short circuit in the picture tube (arcing).
- 15. Unsymmetrical picture or sides of picture:**
  - A. Defective yoke.
- 16. No brightness, power supply operating — No high voltage for the picture tube; check:**
  - A. Horizontal oscillator.
  - B. Horizontal amplifier and output.
  - C. Flyback transformer (high voltage unit).
- 17. No brightness, high voltage present; check:**
  - A. Heater voltage to the tube at the neck board.
  - B. Screen-grid voltage for the tube.
  - C. Focus voltage.
  - D. Grid to cathode picture tube bias.
- 18. No high voltage; check:**
  - A. For AC input to the "flyback".
  - B. Horizontal deflection stages.
  - C. Flyback transformer.
  - D. Yoke.
  - E. Power supply.
- 19. No horizontal and vertical hold; check:**
  - A. Sync transistors and circuit.
  - B. Wires and jack from logic board to the monitor.
- 20. Wavy picture — (power supply defect); check:**
  - A. Transistors, diodes, electrolytic capacitors in the power supply.

**21. Moving bars in picture:**

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

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

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

**23. Monitor won't turn on:**

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

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

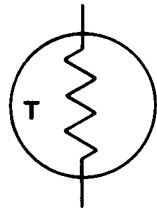
**24. Can't adjust purity or convergence:**

- A. Use a degausser to demagnetize the picture tube carefully following your degausser's instructions.
- B. Picture tube defective.
- C. Nearby equipment is electromagnetically interfering.
- D. The poles of the earth are pulling off the purity — see "A" above.
- E. Poor focus or width of picture.
- F. Make sure you have the correct CRT number for that brand of monitor.

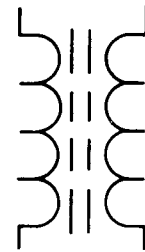
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## Guide To Schematic Symbols



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



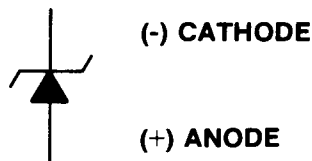
**IRON CORE TRANSFORMER**  
(SUCH AS A FLYBACK)



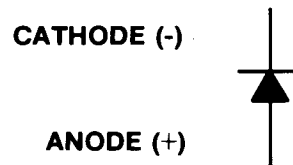
**INDUCTOR, COIL, CHOKe**  
(POLARITY DOESN'T MATTER)



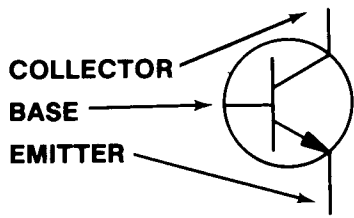
**FUSE**  
(POLARITY DOESN'T MATTER)



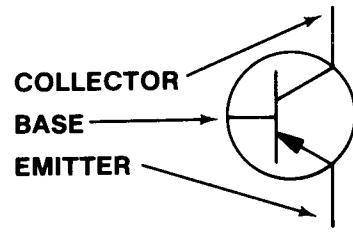
**ZENER DIODE**



**DIODE**



**NPN TRANSISTOR**



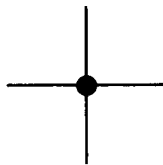
**PNP TRANSISTOR**



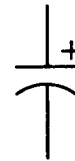
**VARIABLE RESISTOR, POT, CONTROL**  
(POLARITY DOESN'T MATTER)



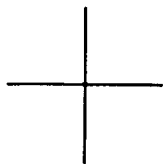
**RESISTOR**  
(POLARITY DOESN'T MATTER)



**LINES ARE CONNECTED**



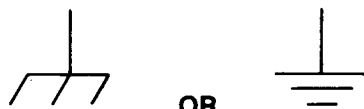
**ELECTROLYTIC CAPACITOR**



**LINES ARE NOT CONNECTED**



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



**OR**  
**GROUND**

# Troubleshooting

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

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

Always remember that a monitor can bite like a snake. Even when it is turned off, capacitors hold voltage and will discharge it to you should you be touching chassis ground. The picture tube or CRT, itself, is a giant capacitor, so avoid the flyback anode plug hole. With the monitor on, the power supply circuit and/or the flyback, which puts out at least 23,000 volts, **CAN BE KILLERS!!** Avoid handling power transistors (usually output transistors) or ICs, 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.

**IMPORTANT!** The side brackets of the monitor are chassis ground as is the aquadag, the picture tube's dark conductive coating. **BUT**, on the ZENITH MONITOR there are metallic mounting parts which **ARE NOT** chassis ground. Discharging the CRT to these will damage the monitor!

Be prepared for a fairly loud pop and a flash. The longer the monitor has been turned off, the smaller the pop and dimmer the flash. But **BE CAREFUL**, picture tubes will hold a very healthy charge for at least a **week** if not longer. Even after you've discharged it once, it may still carry a residual charge. It's better to be too careful than dead, which is why electronic equipment always carries stickers referring servicing to qualified personnel. Handle the side with the viewing screen against your chest when changing it. **ALWAYS** wear safety goggles when handling the picture tube.

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

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

### **CAUTION:**

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

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

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

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

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

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

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

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

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

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

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

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## 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. The Zenith monitor (CD19MXRF06) also uses an IC for the sync processing. Wells Gardner uses HA11423, Electrohome uses HA11244, and Zenith uses 221-175 (their part number). **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 24,000 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 on

Wells Gardner and Electrohome monitors. Zenith monitors have all three: red, blue and green.

The Wells Gardner and Electrohome monitor have another variable resistor in their emitter part of their color output transistors. These "cutoff controls" vary the amount of A.C. signal that the transistor amplifies and sends to the cathodes of the picture tube. The Zenith monitor has its cutoff controls in the interface section to vary the amount of signal going to the output transistors. The more signal, the more color.

If you think this is confusing, here is another little hitch. The Electrohome and Zenith monitors both have the actual A.C. picture information signal going through the emitters of the color output transistors. The Wells Gardner has the A.C. signal going to the base of the transistors. The blanking and beam limiting signals which come from the blanking and beam limiting transistors in the interface section go into the color output transistor base in the Electrohome and Zenith monitors, but enters into the emitter of the Wells Gardner monitor's color output transistor. Should you feel adventurous enough to look at this signal on an oscilloscope, it should look like a square.

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 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. Check the 95 volt test point (located near the "flyback") for the Zenith monitor. The Wells Gardner monitor doesn't use this circuit, but an open in the horizontal section could cause the monitor to appear off, yet still have power supply voltage flying around. Here are the voltages you should receive:

Wells Gardner	=	130VDC
Electrohome	=	120VDC
Zenith	=	95VDC

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) —

**ATTENTION!** For information on picture tube replacement types, go to the last section, "PICTURE TUBE INTERCHANGEABILITY".

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. A defective cathode may cause the particular color it handles to be missing.

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

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

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## Differences Between Monitors

The easiest way to identify the brand of monitor you are working with is to find the manufacturer's name or model number printed on the chassis or chassis base. But what if the monitor was in a Texas dust storm or buried in volcanic ash and this information is no longer there? Fear not! Each monitor has its own peculiarities and the following should help to identify them:

The **ELECTROHOME** G07-904 (19") and G07-902 (13") have their horizontal and vertical processing IC hidden under a silver can. A shiny metal top behind the "VERTICAL HEIGHT" and "HORIZONTAL FREQUENCY" control prove this is an Electrohome monitor.



The **WELLS GARDNER** K4906 (19") and K4806 (13") have their horizontal and vertical processing IC out in the open directly behind the "VERTICAL HOLD" control.

The **ZENITH** C019MXRF06 (19") monitor has its horizontal and vertical processing IC way in back by the picture tube. The monitor also has large white cables going from the main board to the neck board.

**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.

## 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.

The Zenith monitor has a 95 volt adjustment control. It is green and located behind the jack labeled 3D3. To discourage you from moving it, Zenith has placed a little glue on top of this control.

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## Parts Interchangeability

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

1. You **CAN** swap any resistor between monitors that has the same resistance, wattage rating, and tolerance.
2. You **CAN** swap any capacitor between monitors that has the same capacitance and voltage rating.
3. You **CAN** swap many of the parts between the 19" and the 13" versions of each manufacturer's monitor. **BUT**, be certain to compare the manufacturers' part numbers to be positive the parts you want to interchange are identical. **BE SURE** you have read the section DIFFERENCES BETWEEN MONITORS which was covered earlier.
4. You **MAY BE ABLE** to swap picture tubes between monitors. In the past you could swap any picture tube, but due to rampant engineering changes and new monitor models being introduced, you would need a computer to keep track of what could be swapped. For more information on this subject, go to "PICTURE TUBE INTERCHANGEABILITY".
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.

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# Picture Tube Interchangeability

## 13" MONITORS

There are currently two 13" monitors being used: the Wells Gardner K4806 and the Electrohome G07-902. The picture tubes used are NOT interchangeable. The pins on the neck of the CRT will not fit in the socket should you use the wrong CRT.

Here is a chart for all the 13" color monitors Bally Midway uses.

ELECTROHOME	G07-902	—	370ESB22
WELLS GARDNER	K4806	—	370KSB22

## 19" MONITORS

Here it gets a little tricky. All of the picture tubes will fit no matter which is used. But if you use the wrong one, you will have problems with purity and/or dynamic convergence.

Purity trouble means that the color won't be true. If you turn up the color control for one color, instead of seeing that solid color it will show blotches or blobs of other colors on the screen.

Trouble with dynamic convergence means that there will be color fringing around solid lines at the edges of the screen.

The only way to ensure that you avoid these problems is to get the right picture tube or the right substitute.

Here is a list of the 19" monitors and the **CORRECT** CRT numbers.

### **ALL ELECTROHOME G07-904 —**

19VMNP22 RCA  
19VMJP22 RAULAND  
510UJB22 HITACHI

### **WELLS GARDNER K4906 —**

19VLTP22 RCA  
19VMLP22 ZENITH  
19VMKP22 PHILLIPS

### **ZENITH CD19MXRF06 —**

19VMLP22 ZENITH  
19VLTP22 RCA  
19VMKP22 PHILLIPS

The factory recommended CRT type could change in the future for one reason or another, but the listed picture tubes will work. As a matter of fact, you can call another picture tube company to see if they have a replacement number to recommend...but caveat emptor — let the buyer beware.

# SERVICE INSTRUCTIONS

**NOTE:** All monitors are equipped with automatic degaussing coils (L701) which demagnetize the picture tube every time the monitor is turned on after being off for a minimum of 5 minutes. Should any part of the chassis become magnetized it will be necessary to degauss the affected area with a manual degaussing coil. Move the coil slowly around the CRT face area and all surrounding metal parts. Then slowly withdraw for a distance of 6 feet before turning off.

## 1.0 BLACK LEVEL CONTROL ADJUSTMENT

This control has been set at the factory and should not need further attention, however, when the game is connected a slight adjustment of VR201 may be necessary to obtain the proper black level (the black portion of the picture just extinguished).

## 2.0 VERTICAL SIZE (HEIGHT)

Location of this control is shown in Fig. 1. This control must be adjusted slowly, if necessary, until the picture or test pattern attains the correct vertical proportions.

## 3.0 CIRCUIT PROTECTION

A 4.0A pigtail fuse, mounted on the Main Board has been provided to protect the Power Output Circuit.

## 4.0 FOCUS

Adjust the Focus control, located on the HV unit (T352), for maximum over-all definition and fine picture detail.

## 5.0 HORIZONTAL HOLD CONTROL ADJUSTMENT, VR351 (See Fig. 1)

A warm-up period of at least five minutes should be allowed before alignment is carried out. With the monitor being driven from the game signal, short TP601 to TP31. Adjust VR351 until the picture stops sliding horizontally. Remove the short.

## 6.0 HORIZONTAL VIDEO POSITION

If the video is off center on the raster some compensation can be made by adjusting this control.

## 7.0 VERTICAL RASTER POSITION ADJUSTMENT

If the video is off center vertically, (short dimension of picture tube) some compensation can be made by moving the vertical raster position adjustment jumper to either positions "U" or "D".

## 8.0 HORIZONTAL RASTER POSITION ADJUSTMENT

If the video is off center horizontally (long dimension of the picture tube) some compensation can be made by moving the horizontal raster position adjustment jumper to either positions "R" or "L".

## 9.0 HORIZONTAL WIDTH ADJUSTMENT

The horizontal width coil is a hexagonal tuning tool adjustment. This control must be adjusted slowly, if necessary, until the picture or test pattern attains the correct horizontal proportions.

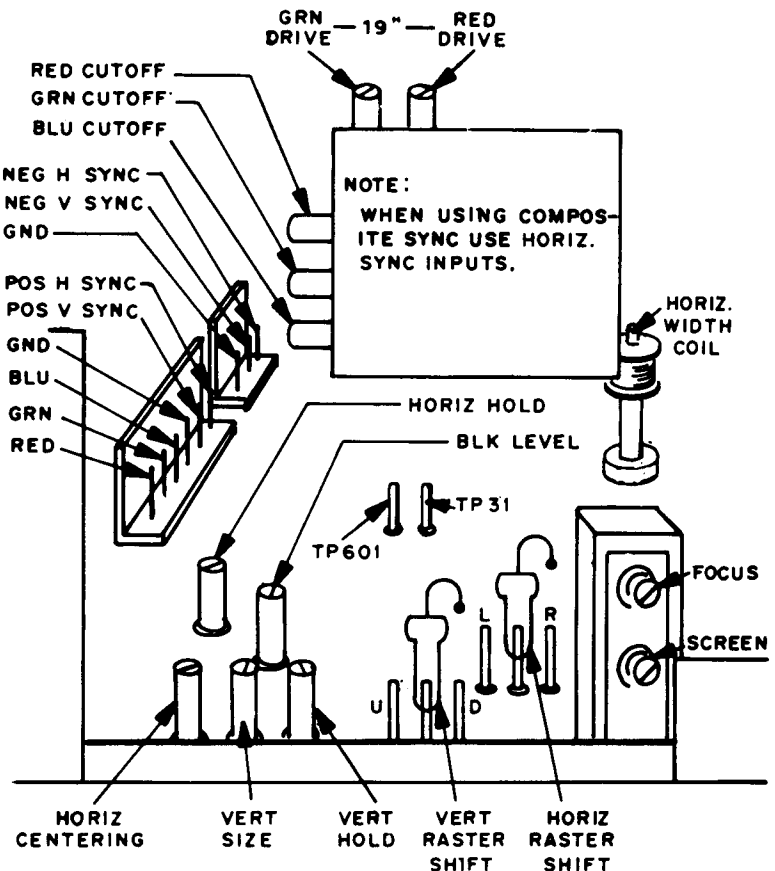
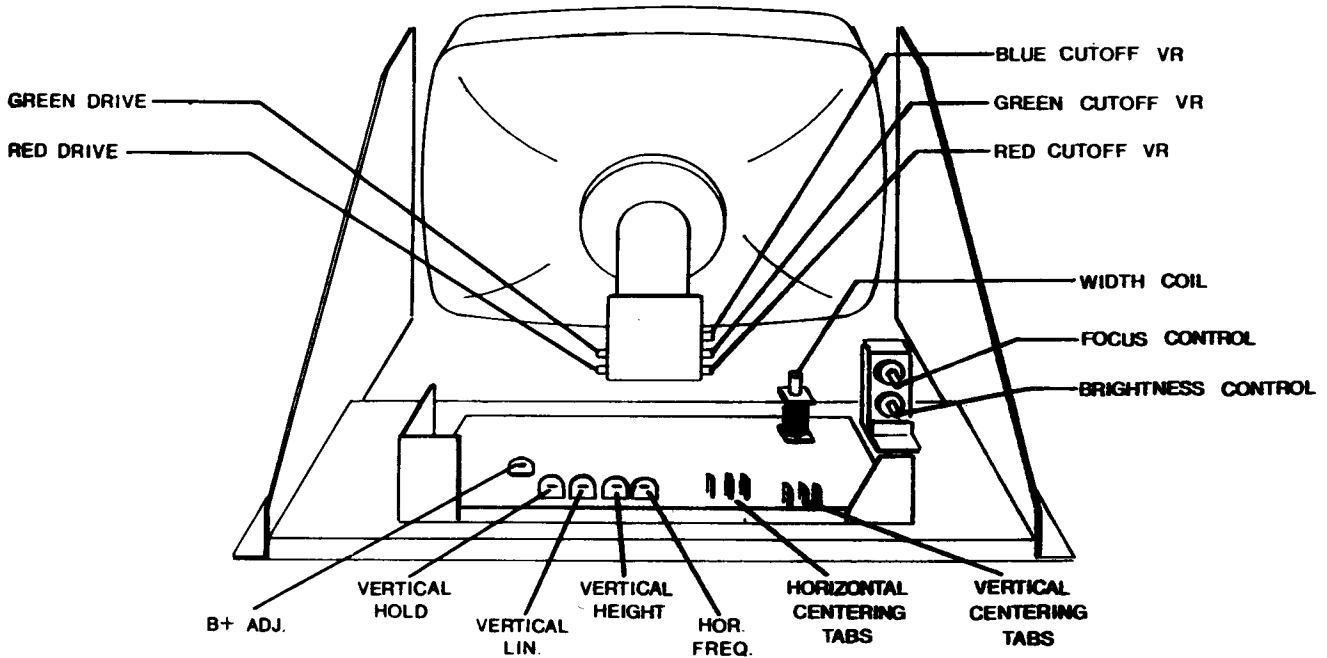


FIGURE 1

# SERVICE INSTRUCTIONS

**CAUTION: BE CAREFUL OF 'B' AND 'B' BOOST VOLTAGES PRESENT ON C.R.T. SOCKET P.C.B.**

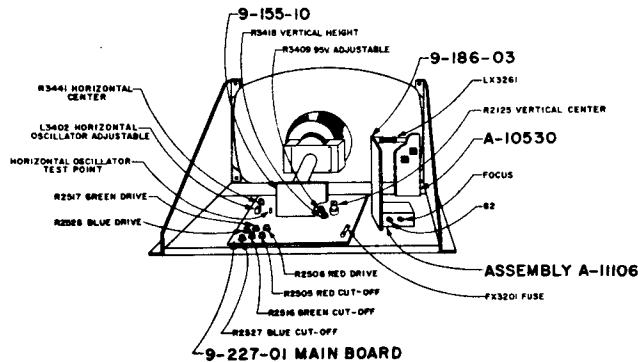


ELECTROHOME 19" COLOR MONITOR

MO51-00082-0000



**IMPORTANT SAFETY NOTICE**  
 FOR X-RADIATION, FIRE OR SHOCK HAZARD PREVENTION, CERTAIN SPECIAL OR REDUNDANT PARTS ARE USED. USE ONLY EXACT REPLACEMENTS. DO NOT ALTER THE CIRCUIT OR DEFEAT THE FUSES. FAILURE TO COMPLY MAY BE UNLAWFUL.



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101-6884

# 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



**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.

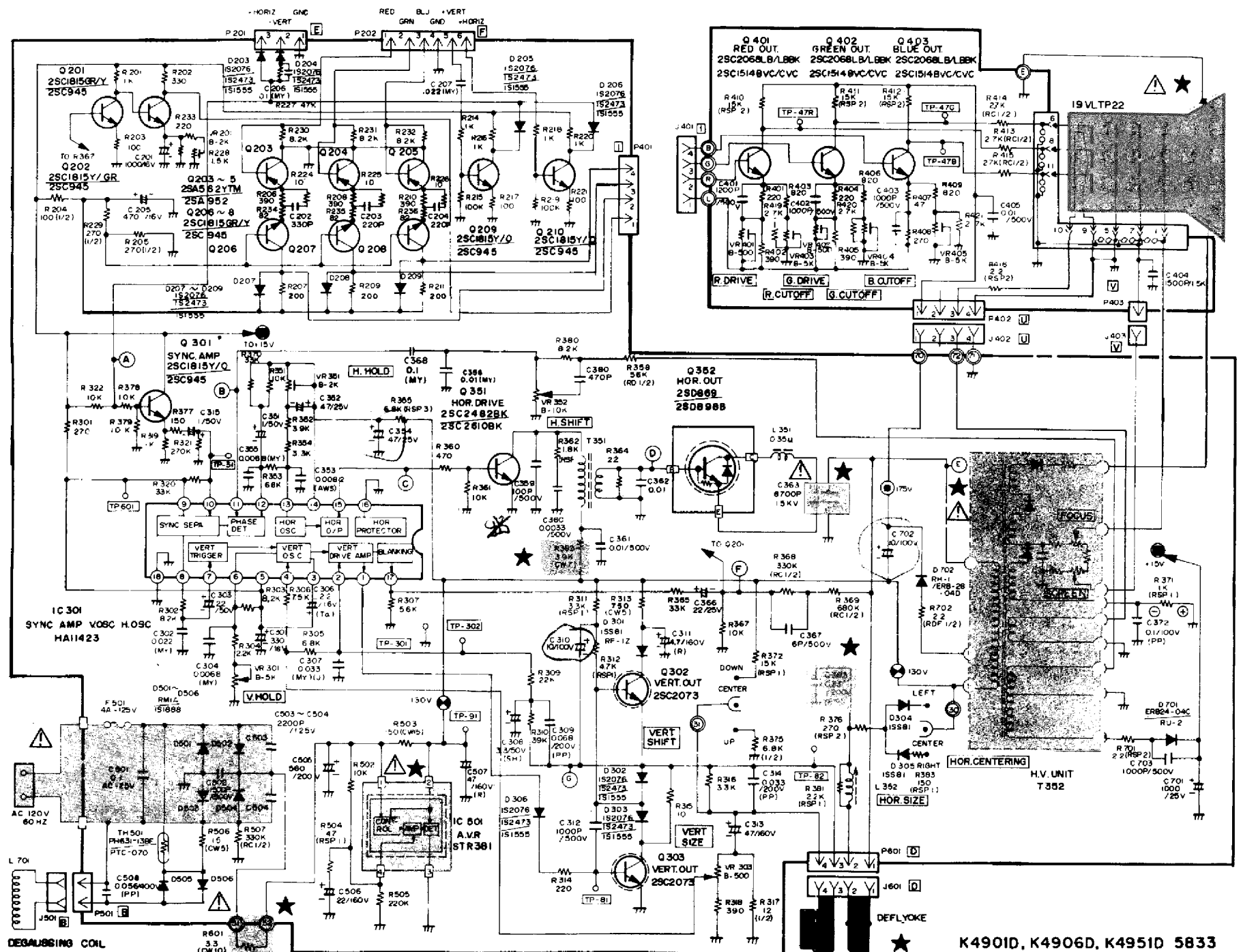
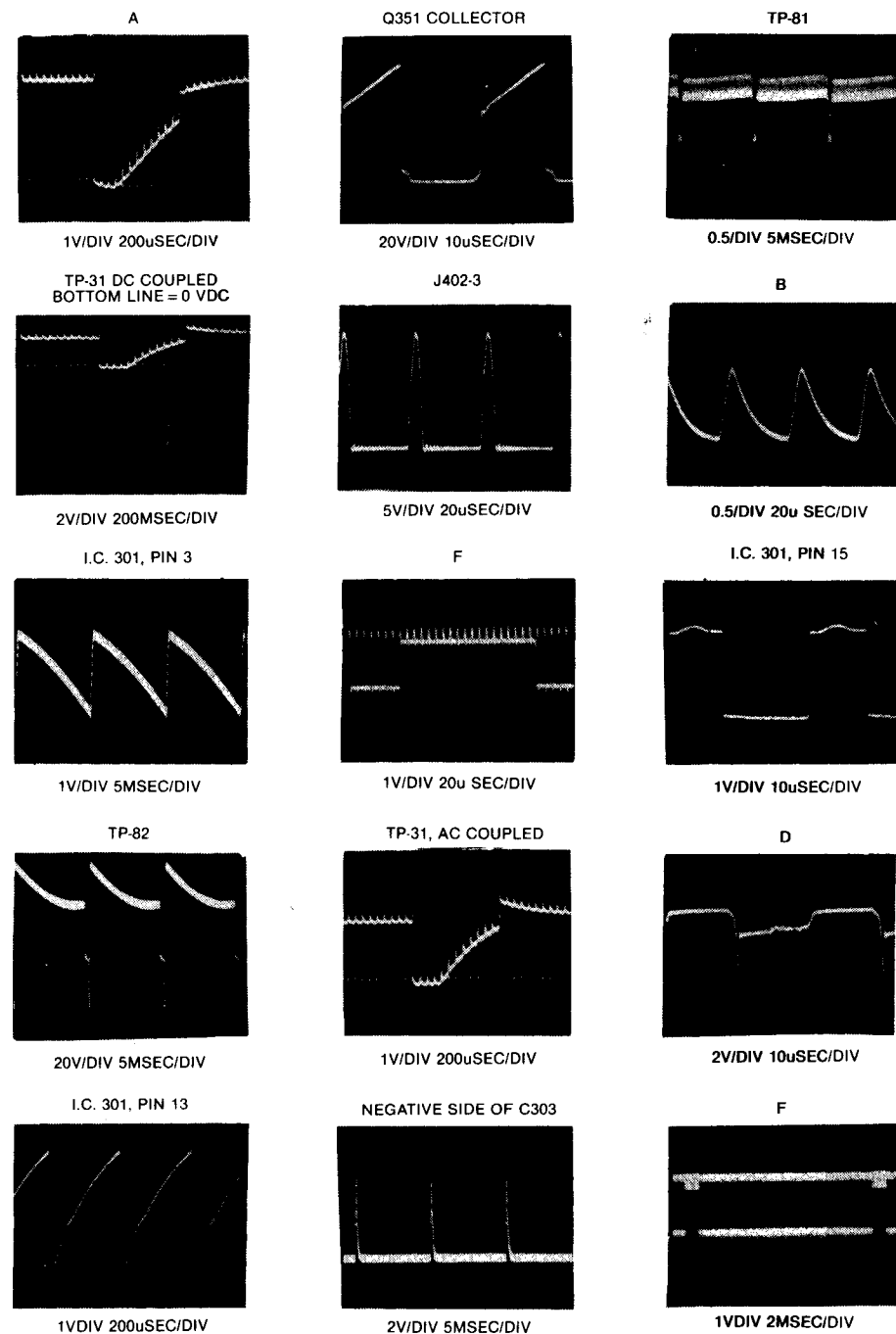


**SERVICE TECHNICIAN WARNING**  
**X-RAY RADIATION PRECAUTION:**  
 THIS PRODUCT CONTAINS CRITICAL ELECTRICAL AND MECHANICAL PARTS ESSENTIAL FOR X-RAY RADIATION PROTECTION.  
 FOR REPLACEMENT PURPOSES, USE ONLY TYPE PARTS SHOWN IN THE PARTS LIST.

### OSCILLOSCOPE WAVEFORM PATTERN

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

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



K4901D, K4906D, K4951D 5833  
K4956B

# REPLACEMENT PARTS LIST

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

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

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

## MAIN BOARD

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
<b>RESISTORS</b>			<b>RESISTORS (CONT.)</b>		
R201	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R369	203X5602-329	680K Ohm, 5%, 1/2W Comp.
R202	203X6500-523	30 Ohm, 5%, 1/4W Carbon	R370	203X6501-002	33K Ohm, 5%, 1/4W Carbon
R203	203X6500-405	100 Ohm, 5%, 1/4W Carbon	R371	203X9014-584	1K Ohm, 5%, 1W Metal Oxide
R204	203X6700-327	100 Ohm, 5%, 1/2W Carbon	R372	203X9101-119	12K Ohm, 5%, 1W Metal Oxide
R205	203X6700-421	270 Ohm, 5%, 1/2W Carbon	R375	203X6700-763	6.8K Ohm, 5%, 1/2W Carbon
R206	203X6500-540	390 Ohm, 5%, 1/4W Carbon	R376	203X9104-404	270 Ohm, 5%, 2W Metal Oxide
R207	340X2201-934	200 Ohm, 5%, 1/4W Carbon	R377	203X6500-447	150 Ohm, 5%, 1/4W Carbon
R208	203X6500-540	390 Ohm, 5%, 1/4W Carbon	R378	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R209	340X2201-934	200 Ohm, 5%, 1/4W Carbon	R379	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R210	203X6500-540	390 Ohm, 5%, 1/4W Carbon	R380	203X6500-865	8.2K Ohm, 5%, 1/4W Carbon
R211	340X2201-934	200 Ohm, 5%, 1/4W Carbon	R381	203X6500-724	2.2K Ohm, 5%, 1W Metal Oxide
R214	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R383	203X9014-387	150 Ohm, 5%, 1W Metal Oxide
R215	203X6501-126	100K Ohm, 5%, 1/4W Carbon	R502	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R216	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R503	204X1700-535	150 Ohm, 5%, 1W Metal Oxide
R217	203X6500-405	100 Ohm, 5%, 1/4W Carbon	R504	203X9014-267	47 Ohm, 5%, 1W Metal Oxide
R218	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R505	203X6501-209	2.2K Ohm, 5%, 1/4W Carbon
R219	203X6501-126	100K Ohm, 5%, 1/4W Carbon	R506	203X9104-105	15 Ohm, 5%, 2W Metal Oxide
R220	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R507	203X5602-185	330K Ohm, 5%, 1/2W Comp.
R221	203X6500-405	100 Ohm, 5%, 1/4W Carbon	Δ★R601	204X1625-058	3.3 Ohm, 5%, 10W WW
R222	203X6500-762	3.3 Ohm, 5%, 1/4W Carbon	R701	203X9105-141	2.2 Ohm, 5%, 2W Metal Oxide
R224	203X6500-169	10 Ohm, 5%, 1/4W Carbon	R702	203X6206-441	2.2 Ohm, 5%, 1/2W Carbon
R225	203X6500-169	10 Ohm, 5%, 1/4W Carbon	VR201	204X2070-072	2K Ohm-B Semi-Fixed
R226	203X6500-169	10 Ohm, 5%, 1/4W Carbon	VR301	204X2070-084	5K Ohm-B Semi-Fixed
R227	203X6501-044	47K Ohm, 5%, 1/4W Carbon	VR303	204X2070-055	500 Ohm-B Semi-Fixed
R228	203X6500-645	1K Ohm, 5%, 1/4W Carbon	VR351	204X2070-072	2K Ohm-B Semi-Fixed
R229	203X6700-421	270 Ohm, 5%, 1/2W Carbon	VR352	204X2070-072	2K Ohm-B Semi-Fixed
R230	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.			
R231	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.			
R232	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.			
R233	203X6500-468	180 Ohm, 5%, 1/4W Carbon			
R234	340X2820-934	82 Ohm, 5%, 1/4W Carbon			
R235	340X2820-934	82 Ohm, 5%, 1/4W Carbon			
R236	340X2820-934	82 Ohm, 5%, 1/4W Carbon			
R301	203X6500-508	270 Ohm, 5%, 1/4W Carbon			
R302	203X6500-863	8.2K Ohm, 5%, 1/4W Carbon			
R303	203X6500-863	8.2K Ohm, 5%, 1/4W Carbon			
R304	203X6500-724	2.2K Ohm, 5%, 1/4W Carbon			
R305	203X6500-842	6.8K Ohm, 5%, 1/4W Carbon			
R306	203X6003-201	7.5K Ohm, 2%, 1/4W Carbon			
R307	203X6500-825	5.6K Ohm, 5%, 1/4W Carbon			
R309	203X6500-965	22K Ohm, 5%, 1/4W Carbon			
R310	203X6500-988	39K Ohm, 5%, 1/4W Carbon			
R311	203X6500-762	3.3K Ohm, 5%, 1/4W Carbon			
R312	203X9014-741	4.7K Ohm, 5%, 1/4W Carbon			
R313	204X1450-537	1K Ohm, 5%, 5W Carbon			
R314	203X6500-481	220 Ohm, 5%, 1/4W Carbon			
R315	203X6500-169	10 Ohm, 5%, 1/4W Carbon			
R316	203X6500-762	3.3K Ohm, 5%, 1/4W Carbon			
R317	203X6700-107	12 Ohm, 5%, 1/2W Carbon			
R318	203X6500-540	390 Ohm, 5%, 1/4W Carbon			
R319	203X6500-645	1K Ohm, 5%, 1/4W Carbon			
R320	203X6501-002	33K Ohm, 5%, 1/4W Carbon			
R321	203X6501-224	270K Ohm, 5%, 1/2W Carbon			
R322	203X6500-886	10K Ohm, 5%, 1/4W Carbon			
R351	203X6500-886	10K Ohm, 5%, 1/4W Carbon			
R352	203X6500-785	3.9K Ohm, 5%, 1/4W Carbon			
R353	203X6501-088	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	Δ★C363	203X1270-911	8700 pF, 1.5 KV PP
R364	203X6500-246	22 Ohm, 5%, 1/4W Carbon	★C365	203X1201-265	0.33 uF, 200V PP
R365	203X6501-002	33K Ohm, 5%, 1/4W Carbon	C366	203X0019-026	22 uF, 25V Electrolytic
R367	203X6500-886	10K Ohm, 5%, 1/4W Carbon	C367	202X8065-162	6 pF, 500V Ceramic
R368	203X5602-185	330K Ohm, 5%, 1/2W Comp.	C368	202X7203-032	0.01 uF, 50V Ceramic
			C372	203X1207-125	0.1 uF, 100V PP

## MAIN BOARD (CONT.)

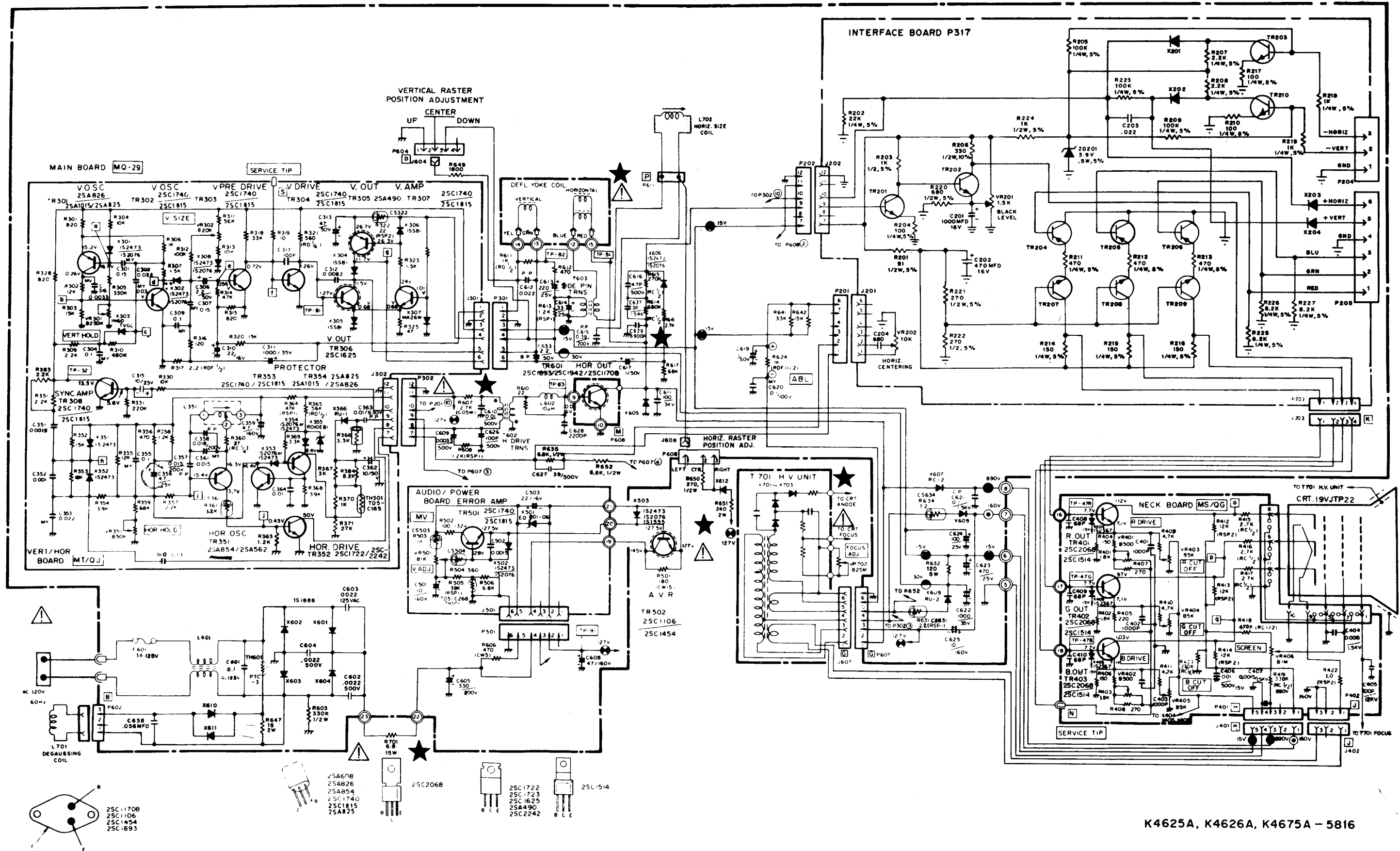
Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
<b>CAPACITORS (CONT.)</b>			<b>SEMICONDUCTORS (CONT.)</b>		
C380	202X7200-087	470 uF, 500V Ceramic	Q206	200X3181-523	Transistor (NPN) 2SC1815GR
△ C501	203X1810-149	0.1 uF, 125V Mylar	Q207	200X3181-523	Transistor (NPN) 2SC1815GR
△ C502	202X7050-282	1500 pF, 500V Ceramic	Q208	200X3181-523	Transistor (NPN) 2SC1815GR
△ C503	202X7810-214	2200 pF, 125V Ceramic	Q209	200X3181-523	Transistor (NPN) 2SC1851GR
△ C504	202X7810-214	2200 pF, 125V Ceramic	Q210	200X3181-523	Transistor (NPN) 2SC1851GR
C505	203X0220-075	580 uF, 200V Electrolytic	Q301	200X3181-523	Transistor (NPN) 2SC1851GR
C506	203X0040-034	22 uF, 160V Electrolytic	Q302	200X3207-306	Transistor (NPN) 2SC2073LBGL2
C507	203X0041-057	47 uF, 160V Electrolytic	Q303	200X3207-306	Transistor (NPN) 2SC2073LBGL2
C701	203X0019-092	1000 uF, 25V Electrolytic	Q351	200X3248-217	Transistor (NPN) 2SC2482BK
C702	203X0634-061	10 uF, 100V Electrolytic	Q352	200X4589-802	Transistor (NPN) 2SD898B
C703	202X7050-248	1000 pF, 500V Ceramic	IC301	200X2300-033	IC HA11423
<b>SEMICONDUCTORS</b>			△ ★ IC501	200X2800-183	IC STR381
D203	201X2010-159	Diode, IS2076-27	L351	201X4710-134	Coil, (RF Choke)
D204	201X2010-159	Diode, IS2076-27	L352	201X5000-083	Coil, Horiz. Size
D205	201X2010-159	Diode, IS2076-27	L701	611X0004-007	Coil, Adg.
D206	201X2010-159	Diode, IS2076-27	T351	202X1300-080	Transformer, Hor. Drive
D207	201X2010-159	Diode, IS2076-27	△ ★ T352	200X9720-301	HV-Unit M-11
D208	201X2010-159	Diode, IS2076-27	△ F501	204X7120-073	Fuse, 4 Amp. 125V
D209	201X2010-159	Diode, IS2076-27	J402	206X5008-632	Recep W Wire 3P-M-BG
D301	201X2010-165	Diode, ISS81	P201	204X9600-466	Plug, PWB 3P-J
D302	201X2010-159	Diode, IS2076-27	P202	204X9601-477	Plug, PWB 6P-Q
D303	201X2010-159	Diode, IS2076-27	P401	204X9600-298	Plug, PWB 4P-B
D304	201X2120-009	Diode, RH-IV	P501	204X9600-249	Plug, PWB 2P-B
D305	201X2120-009	Diode, RH-IV	P601	204X9600-304	Plug, PWB 4P-C
D306	201X2010-159	Diode, IS2076-27	TH501	201X0100-112	Thermistor
△ D501	201X3120-216	Diode, RM-1AV	<b>MISCELLANEOUS</b>		
△ D502	201X3120-216	Diode, RM-1AV	<b>FINAL ASSEMBLY PARTS</b>		
△ D503	201X3120-216	Diode, RM-1AV	△ ★ 88X0138-506	205X9800-158	19VLT P22 Pix Tube
△ D504	201X3120-216	Diode, RM-1AV	△ ★ 202X1111-201	204X9301-255	Lateral/Purity Assembly
D505	201X3120-216	Diode, RM-1AV		291X5004-262	Yoke Deflection
D506	201X3120-216	Diode, RM-1AV			CRT Socket
D701	201X2130-234	Diode, RU-2V			Automatic Degaussing Coil Unit
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			

## NECK BOARD

<b>RESISTORS</b>			<b>CAPACITORS</b>		
R401	203X6000-729	220 Ohm, 5% 1/4W Carbon	C401	202X7050-269	1200 pF, 500V Ceramic
R402	203X6500-540	390 Ohm, 5% 1/4W Carbon	C402	202X7050-248	1000 pF, 500V Ceramic
R403	203X6000-661	820 Ohm, 5% 1/4W Carbon	C403	202X7050-248	1000 pF, 500V Ceramic
R404	203X6000-729	220 Ohm, 5% 1/4W Carbon	C404	202X7050-282	1500 pF, 1.5KV Ceramic
R405	203X6500-540	390 Ohm, 5% 1/4W Carbon	C405	202X7050-483	0.01 uF, 500V Ceramic
R406	203X6000-661	820 Ohm, 5% 1/4W Carbon	<b>SEMICONDUCTORS</b>		
R407	203X6000-729	470 Ohm, 5% 1/4W Carbon	Q401	200X3206-800	Transistor (NPN) 2SC2068LB
R408	203X6000-998	270 Ohm, 5% 1/4W Carbon	Q402	200X3206-800	Transistor (NPN) 2SC2068LB
R409	203X6000-661	820 Ohm, 5% 1/4W Carbon	Q403	200X3206-800	Transistor (NPN) 2SC2068LB
R410	203X9104-824	15K Ohm, 5% 2W M.O. Forming	<b>MISCELLANEOUS</b>		
R411	203X9104-824	15K Ohm, 5% 2W M.O. Forming	J401	206X5009-296	RECEP W Wire 4P-E
R412	203X9104-824	15K Ohm, 5% 2W M.O. Forming	P402	204X9600-254	Plug, PWB 3P-A
R413	203X6000-998	2.7K Ohm, 5% 1/2W Comp.	P403	204X9600-981	Plug, Pin 1P-D
R414	203X6000-998	2.7K Ohm, 5% 1/2W Comp.	P701	204X9601-020	Plug, PWB 4P-E
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			

# WELLS-GARDNER 19" COLOR MONITOR SCHEMATIC DIAGRAM

# M051-00087-A012



K4625A, K4626A, K4675A - 5816



## VERT/HOR BOARD (MT/QJ)

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
<b>RESISTORS</b>			<b>CAPACITORS (CONT.)</b>		
R301	203X6500-628	820 Ohm, ± 5%, 1/8W Carbon	C313	203X0025-087	47 uF, 50V Electrolytic
R302	203X6500-902	12k Ohm, ± 5%, 1/8W Carbon	C315	203X0015-082	10 uF, 25V Electrolytic
R303	203X6500-927	15k Ohm, ± 5%, 1/8W Carbon	C316	203X1100-220	3300 uF, 50V, ± 10% Mylar
R304	203X6500-886	10k Ohm, ± 5%, 1/8W Carbon	C317	202X8000-618	100 pF, 50V, ± 10% Ceramic
R305	203X6501-241	330k Ohm, ± 5%, 1/8W Carbon	C351	202X7000-281	1500 pF, 50V, ± 10% Ceramic
R306	203X6500-645	1k Ohm, ± 5%, 1/8W Carbon	C352	202X7000-247	1000 pF, 50V, ± 10% Ceramic
R307	203X6500-689	1.5k Ohm, ± 5%, 1/8W Carbon	C353	203X1100-573	0.022 uF, 50V, ± 10% Mylar
R309	203X6500-724	2.2k Ohm, ± 5%, 1/8W Carbon	C355	203X1100-858	0.1 uF, 50V, ± 10% Mylar
R310	203X6501-285	470k Ohm, ± 5%, 1/8W Carbon	C356	203X0015-105	4.7 uF, 25V Electrolytic
R311	203X6501-065	56k Ohm, ± 5%, 1/8W Carbon	C357	203X1201-013	0.015uF, 200V ± 10% PP
R312	203X6501-126	100k Ohm, ± 5%, 1/8W Carbon	C358	203X1201-034	0.018 uF, 200V, ± 10% PP
R313	203X6001-326	10k Ohm, ± 5%, 1/8W Carbon	C359	203X0040-013	4.7 uF, 160V Electrolytic
R314	203X6501-044	47k Ohm, ± 5%, 1/8W Carbon	C360	202X7000-482	0.01 uF, 50V, ± 10% Ceramic
R315	203X6500-628	820 Ohm, ± 5%, 1/8W Carbon	C361	203X1100-509	0.015 uF, 50V, ± 10% Mylar
R316	203X6500-420	120 Ohm, ± 5%, 1/8W Carbon	C362	203X0025-058	10 uF, 50V Electrolytic
R317	203X6206-441	2.2 Ohm, ± 5%, 1/2W Carbon	C363	203X1205-487	0.01 uF, 630V, ± 10% PP
R319	203X6500-169	100 Ohm, ± 5%, 1/8W Carbon	C364	202X7000-482	0.01 uF, 50V, ± 10% Ceramic
R320	203X6500-927	15k Ohm, ± 5%, 1/8W Carbon			
R321	203X6700-509	560 Ohm, ± 5%, 1/2W Carbon			
R322	203X9100-121	22 Ohm, ± 5%, 2W M.O.			
R323	203X6500-689	1.5K Ohm, ± 5%, 1/8W Carbon			
R324	203X6500-988	27k Ohm, ± 5%, 1/8W Carbon	TR301	200X4082-614	Transistor, 2SA826Q
R325	203X6500-326	47 Ohm, ± 5%, 1/8W Carbon	TR302	200X3174-006	Transistor, 2SC1740Q
R328	203X6500-628	820 Ohm, ± 5%, 1/8W Carbon	TR303	200X3174-006	Transistor, 2SA1740Q
R330	203X6500-886	10k Ohm, ± 5%, 1/8W Carbon	TR304	200X3174-006	Transistor, 2SC1740Q
R331	203X6501-209	220k Ohm, ± 5%, 1/8W Carbon	TR305	200X4049-081	Transistor, 2SA490YLBGLI
R351	203X6500-724	2.2k Ohm, ± 5%, 1/8W Carbon	TR306	200X3162-538	Transistor, 2SC1625YLBGLI
R352	203X6500-927	15k Ohm, ± 5%, 1/8W Carbon	TR307	200X3174-014	Transistor, 2SC1740R
R353	203X6500-944	18k Ohm, ± 5%, 1/8W Carbon	TR308	200X3174-006	Transistor, 2SC1740Q
R354	203X6500-783	3.9k Ohm, ± 5%, 1/8W Carbon	TR351	200X4085-415	Transistor, 2SA854Q
R355	203X6500-902	12k Ohm, ± 5%, 1/8W Carbon	TR352	200X3172-208	Transistor, 2SC1722BKS
R356	203X6500-561	470 Ohm, ± 5%, 1/8W Carbon	TR353	200X3174-006	Transistor, 2SC1740Q
R357	203X6500-724	2.2k Ohm, ± 5%, 1/8W Carbon	TR354	200X4082-614	Transistor, 2SA826Q
R358	203X6500-666	1.2k Ohm, ± 5%, 1/8W Carbon	X301	201X2010-144	Diode, (SI) IS2473-T72
R359	203X6501-088	68k Ohm, ± 5%, 1/8W Carbon	X302	201X2010-144	Diode, (SI) IS2473-T72
R360	203X5500-471	27 Ohm, ± 5%, 1/4W Comp.	X303	200X8000-026	Diode, (GE), IN60TVGL
R361	203X6000-998	1.2k Ohm, ± 5%, 1/8W Carbon	X304	200X8010-165	Diode (SI) ISS81
R363	203X6500-666	1.2k Ohm, ± 5%, 1/8W Carbon	X305	201X2010-165	Diode (SI) ISS81
R364	203X9014-988	47k Ohm, ± 5%, 1W M.O.	X306	201X2010-165	Diode (SI) ISS81
R365	203X6700-989	56k Ohm, ± 5%, 1/2W Carbon	X307	200X8010-102	Diode (SI) MA26W
R366	203X6001-148	3.3k Ohm, ± 5%, 1/8W Carbon	X308	200X8010-094	Diode (SI) IS2473
R367	340X2222-734	2.2k Ohm, ± 5%, 1/2W Carbon	X351	201X2010-144	Diode (SI) IS2473-T72
R368	203X6500-785	3.9k Ohm, ± 5%, 1/8W Carbon	X352	201X2010-144	Diode (SI) IS2473-T72
R369	203X6500-762	3.3k Ohm, ± 5%, 1/4W Carbon	X353	201X2010-144	Diode (SI) IS2473-T72
R370	302X6100-961	1k Ohm, ± 5%, 1/4W Carbon	X354	201X2010-144	Diode (SI) IS2473-T72
R371	203X6104-751	2.7k Ohm, ± 5%, 1/4W Carbon	X355	200X8220-851	Diode (Zener) RD10EBI
VR301	204X2122-093	Varistor, 250K Ohm, Vert. Hold	X366	200X8100-130	Diode (HS) RU-1 0.3 US
VR302	204X2114-065	Varistor, 20K Ohm, Vert. Size			
VR351	204X2114-059	Varistor, 50K Ohm, Hor. Hold			

### SEMICONDUCTORS

### MISCELLANEOUS

<b>CAPACITORS</b>			<b>TRANSFORMERS &amp; COILS</b>		
C301	203X1100-928	0.15 uF, 50V, ± 10% Mylar	J301	204X9300-958	Socket, 6 Pin
C302	203X1100-573	0.022 uF, 50V, ± 10% Mylar	J302	204X9300-958	Socket, 6 Pin
C304	203X1100-858	0.1 uF, 50V, ± 10% Mylar	P301	204X9601-195	Plug, 6 Pin
C306	203X0025-026	2.2 uF, 50V, Electrolytic	P302	204X9601-195	Plug, 6 Pin
C307	203X1100-928	0.15 uF, 50V, ± 10% Mylar	TH301	201X0000-534	Thermistor
C309	203X1100-858	0.1 uF, 50V, ± 10% Mylar			
C310	203X0010-011	22 uF, 16V Electrolytic			
C311	203X0020-099	1000 uF, 35V Electrolytic	L351	201X5200-091	Coll, Horiz. Osc.
C312	202X7000-469	0.0082 uF, 50V, ± 10% Ceramic			

## POWER BOARD (MV)

<b>RESISTORS</b>			<b>SEMICONDUCTORS</b>		
R501	204X1725-052	180 Ohm, ± 10%, 15W WW	C503	203X0010-011	22 uF, 16V Electrolytic
R502	203X6000-608	100 Ohm, ± 5%, 1/8W Carbon	C551	203X0005-046	220 uF, 10V Electrolytic
R503	203X6000-960	1k Ohm, ± 5%, 1/8W Carbon			
R504	203X6000-879	560 Ohm, ± 5%, 1/8W Carbon	TR501	200X3174-006	Transistor, 2SC1740Q
R505	203X9014-965	39k Ohm, ± 5%, 1W M.O.	△★ TR502	200X3145-404	Transistor, 2SC1454
R506	203X6500-842	6.8k Ohm, ± 5%, 1/8W Carbon	TR551	200X3172-305	Transistor, 2SC1723
R551	203X6500-420	120 Ohm, ± 5%, 1/8W Carbon	X501	201X2230-042	Diode, (SI) Zener EQB01-06V
VR501	204X2050-001	Varistor Vert. Adj.	X502	201X2010-144	Diode, (SI) IS2473-T72

### CAPACITORS

C501	203X0040-020	10 uF, 160V Electrolytic	J501	204X9300-958	Socket, 6 Pin
C502	202X7000-281	1500 pF, 50V, ± 10% Ceramic	P501	204X9601-195	Plug, 6 Pin
			TH501	201X0000-618	Thermistor

### MISCELLANEOUS

## NECK BOARD (MS/QG)

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
<b>RESISTORS</b>					
R401	203X6500-709	1.8k Ohm ± 5% 1/8W Carbon	C403	202X7000-247	1000 pF, 50V, 10% Ceramic
R402	203X6500-709	1.8k Ohm ± 5% 1/8W Carbon	C404	202X7110-019	1500 pF, 2kV ± 10% Ceramic
R403	203X6500-709	1.8k Ohm ± 5% 1/8W Carbon	C405	202X7150-018	100 pF, 12kV, ± 10% Ceramic
R404	203X6500-447	150 Ohm ± 5% 1/8W Carbon	C408	202X7050-483	.01 uF, 500V, ± 10% Ceramic
R405	203X6500-481	220 Ohm ± 5% 1/8W Carbon	C407	202X7110-019	1500 pF, 2kV ± 10% Ceramic
R406	203X6500-447	150 Ohm ± 5% 1/8W Carbon	C408	202X8000-550	68 pF, 50V, ± 10% Ceramic
R407	203X6500-508	270 Ohm ± 5% 1/8W Carbon	C409	202X8000-550	68 pF, 50V, ± 10% Ceramic
R408	203X6500-508	270 Ohm ± 5% 1/8W Carbon	C410	202X8000-550	68 pF, 50V, ± 10% Ceramic
R409	203X6500-800	4.7k Ohm ± 5% 1/8W Carbon			
R410	203X6500-800	4.7k Ohm ± 5% 1/8W Carbon			
R411	203X6500-800	4.7k Ohm ± 5% 1/8W Carbon			
R412	203X9104-809	12k Ohm ± 5% 2.0W Metal Oxide			
R413	203X9104-809	12k Ohm ± 5% 2.0W Metal Oxide			
R414	203X9104-809	12k Ohm ± 5% 2.0W Metal Oxide			
R415	203X5601-313	2.7k Ohm ± 10% 1/2W Comp.	TR401	200X3206-800	Transistor, 2SC2068, 2SC1514 (R output)
R416	203X5601-313	2.7k Ohm ± 10% 1/2W Comp.	TR402	200X3206-800	Transistor, 2SC2068, 2SC1514 (G output)
R417	203X5601-313	2.7k Ohm ± 10% 1/2W Comp.	TR403	200X3206-800	Transistor, 2SC2068, 2SC1514 (B output)
R418	203X5602-254	470k Ohm ± 10% 1/2W Comp.	X404	201X2100-126	Diode, IS2367 (protector)
R419	203X5602-185	330k Ohm ± 10% 1/2W Comp.	X405	201X2100-126	Diode, IS2367 (protector)
R422	203X9105-117	1.0 Ohm ± 10% 2W Metal Oxide	X406	201X2100-126	Diode, IS2367 (protector)
R423	203X5102-155	270k Ohm ± 5% 1/4W Carbon			
VR401	204X2115-014	500 Ohm Varistor R Drive			
VR402	204X2115-014	500 Ohm Varistor B Drive			
VR403	204X2115-006	5k Ohm Varistor R Cutoff			
VR404	204X2115-006	5k Ohm Varistor G Cutoff			
VR405	204X2115-006	5k Ohm Varistor B Cutoff			
VR406	204X2000-025	1M Ohm Varistor Screen			
<b>SEMICONDUCTORS</b>					
<b>MISCELLANEOUS</b>					
C401	202X7000-247	1000 pF, 50V, 10% Ceramic	J401	206X5003-729	Socket, 5 Pin
C402	202X7000-247	1000 pF, 50V, 10% Ceramic	J402	206X5003-983	Socket, 3 Pin
			P401	204X9600-329	Plug, 5 Pin
			P402	204X9600-254	Plug, 3 Pin

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

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

★ 88X-0129-506 38A5554-000 205X9800-256 ★ 202X1110-810 208X2000-946 297X2000-072 6A0397 9A2753-003	19VJTP22 Pix Tube Assy. Purity Shld/Degaussing Lateral/Purity Assembly Yoke, Deflection CRT Socket HV Unit (T701) Plug, Line Cord Degaussing Coll (L701)
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## INTERFACE BOARD (P305) (MODEL 19K4606)

### RESISTORS

R201 R203 R204 R206 R207 R208 R209 R210 R211 R212 R213 R214 R215 R216 VR201	340X3910-934 340X3102-934 340X2101-934 340X3331-944 340X3102-934 340X3152-934 340X2101-934 340X3102-934 340X2331-934 340X2331-934 340X2331-934 340X2201-934 340X2201-934 40X0590-017	91 Ohm, 5%, 1/2W Carbon 1k Ohm, 5%, 1/2W Carbon 100 Ohm, 5%, 1/4W Carbon 330 Ohm, 10%, 1/2W Carbon 1k Ohm, 5%, 1/2W Carbon 1.5k Ohm, 5%, 1/4W Carbon 100 Ohm, 5%, 1/4W Carbon 1k Ohm, 5%, 1/2W Carbon 330 Ohm, 5%, 1/4W Carbon 330 Ohm, 5%, 1/4W Carbon 330 Ohm, 5%, 1/4W Carbon 200 Ohm, 5%, 1/4W Carbon 200 Ohm, 5%, 1/4W Carbon 200 Ohm, 5%, 1/4W Carbon 1.5k Ohm, Black Level Control
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### CAPACITORS

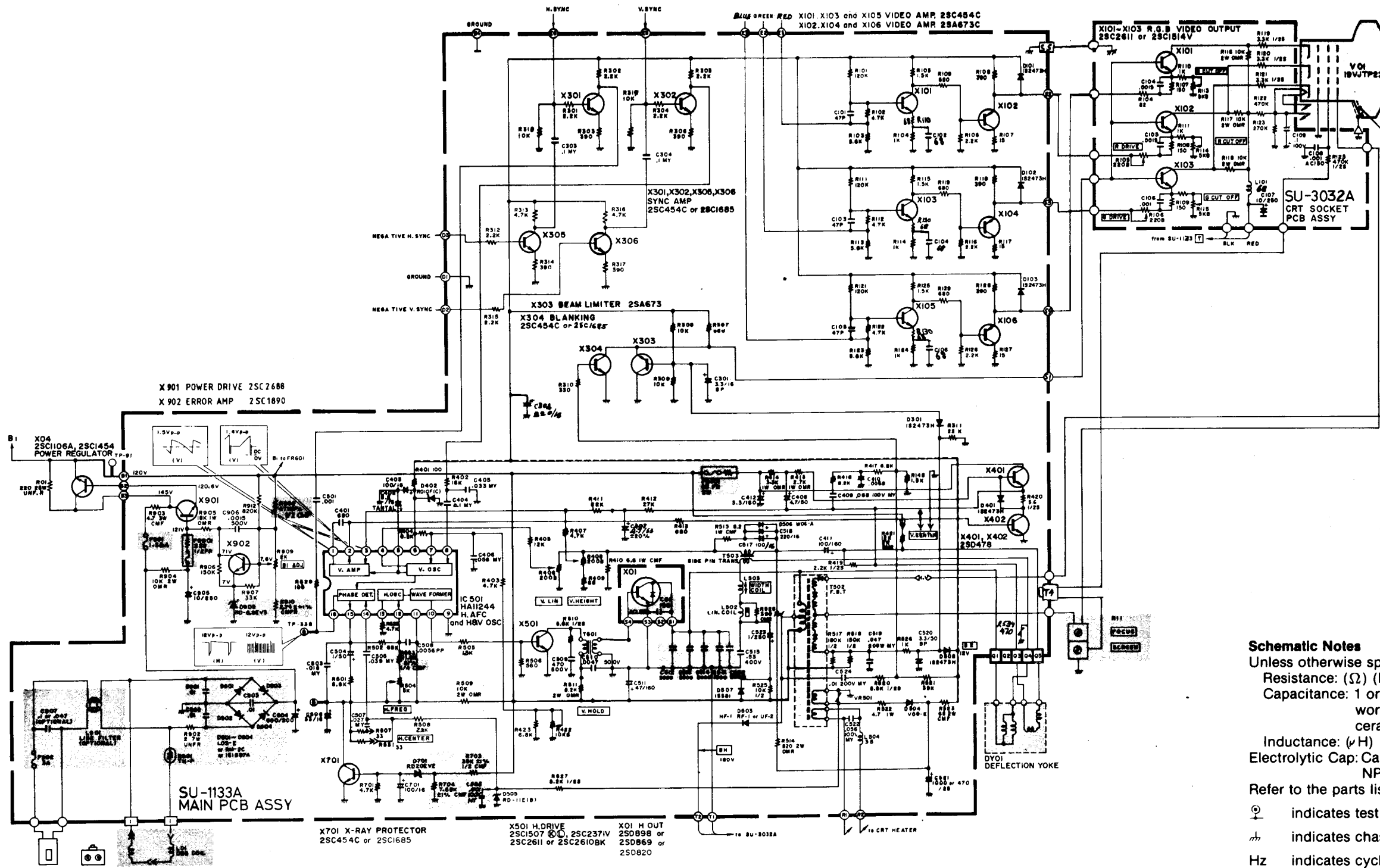
C201	45X0524-038	1000 uF, 16V Electrolytic
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### SEMICONDUCTORS

TR201 TR202 TR203 TR204 TR205 TR206 TR207 TR208 TR209 ZD201 ZD202	86X0121-001 86X0121-001 86X0121-001 86X0066-001 86X0066-001 86X0066-001 86X0121-001 86X0121-001 86X0121-001 86X0121-001 86X0121-001 66X0040-018 66X0040-019	Transistor (NPN) Transistor (NPN) Transistor (NPN) Transistor (PNP) Transistor (PNP) Transistor (PNP) Transistor (NPN) Transistor (NPN) Transistor (NPN) Transistor (NPN) Diode, Zener, 6.8v, 5%, 0.5W Diode, Zener, 3.9v, 5%, 0.5W
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### MISCELLANEOUS

J201 J202 J203 P201 P202 P203 P205	204X9300-958 204X9300-958 206X5019-207 204X9601-195 204X9601-195 204X9600-845 6A0393-006	Socket, 6 Pin Socket, 6 Pin Socket, 4 Pin Plug, 6 Pin Plug, 6 Pin Plug, 4 Pin Plug, 6 Pin
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**Schematic Notes**

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

00-4147-04  
G07-CB0

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

# REPLACEMENT PARTS LIST—ELECTROHOME 19" MONITOR

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

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

## Abbreviations for Resistors and Capacitors

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

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

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

## 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
<b>Outside of the P.C.B. Ass'y</b>		
Symbol	Description	Part Number
	Picture Tube 19"	17-7198-03
$\Delta$	$\Delta$ Deflection Yoke	A29779-D=21-141-01
	PC Magnet	A75034-B=29-32-01
$\Delta$	$\Delta$ Flyback Transf.	A29951-B
$\Delta$	$\Delta$ HVR	A46600-A
R05	UNF Resistor 220 $\Omega$ , 25W K	QRF258K-221
C04	C Capacitor 150pF, AC1.5KV	QCZ0101-005
X01	Si. Transistor	2SD870
X02	Si. Transistor	2SC1106A
SC	Screw #8- $\frac{3}{4}$	31-610818-06
SC	Screw $\frac{1}{4}$ x $\frac{3}{4}$ Pix Tube Mtg. (4)	31-601418-12
WA	Pyramidal Lock Washer (4)	33-255-01
	Nut Retainer, Pix Tube Mtg. (4)	33-494-01
	Clip—P.C.B. Support	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 33 $\Omega$ , 4W	42-113301-03
	Fire Retardant Term. Strip 4 Lug	34-492-09

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

Resistors		
Symbol	Description	Part Number
R3105	V R 200	QVZ3234-022
R3106	V R 200	QVZ3234-022
R3113	V R 5K	QVZ3234-053
R3114	V R 5K	QVZ3234-053
R3115	V R 5K	QVZ3234-053
R3116	OM R 10K $\Omega$ 2W J	QRG029J-103
R3117	OM R 10K $\Omega$ 2W J	QRG029J-103
R3118	OM R 10K $\Omega$ 2W J	QRG029J-103
R3119	Comp. R 3.3K $\Omega$ $\frac{1}{2}$ W K	QRZ0039-332
R3120	Comp. R 3.3K $\Omega$ $\frac{1}{2}$ W K	QRZ0039-332
R3121	Comp. R 3.3K $\Omega$ $\frac{1}{2}$ W K	QRZ0039-332
Capacitors		
Symbol	Description	Part Number
C3107	E Cap. 10uF 250V A	QEW53EA-106
C3108	C Cap. 1000pF DC1400V P	QCZ9001-102M

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

Coils Symbol	Description	Part Number
L3101	Peaking Coil	QLL043K-101
Semi-conductors		
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

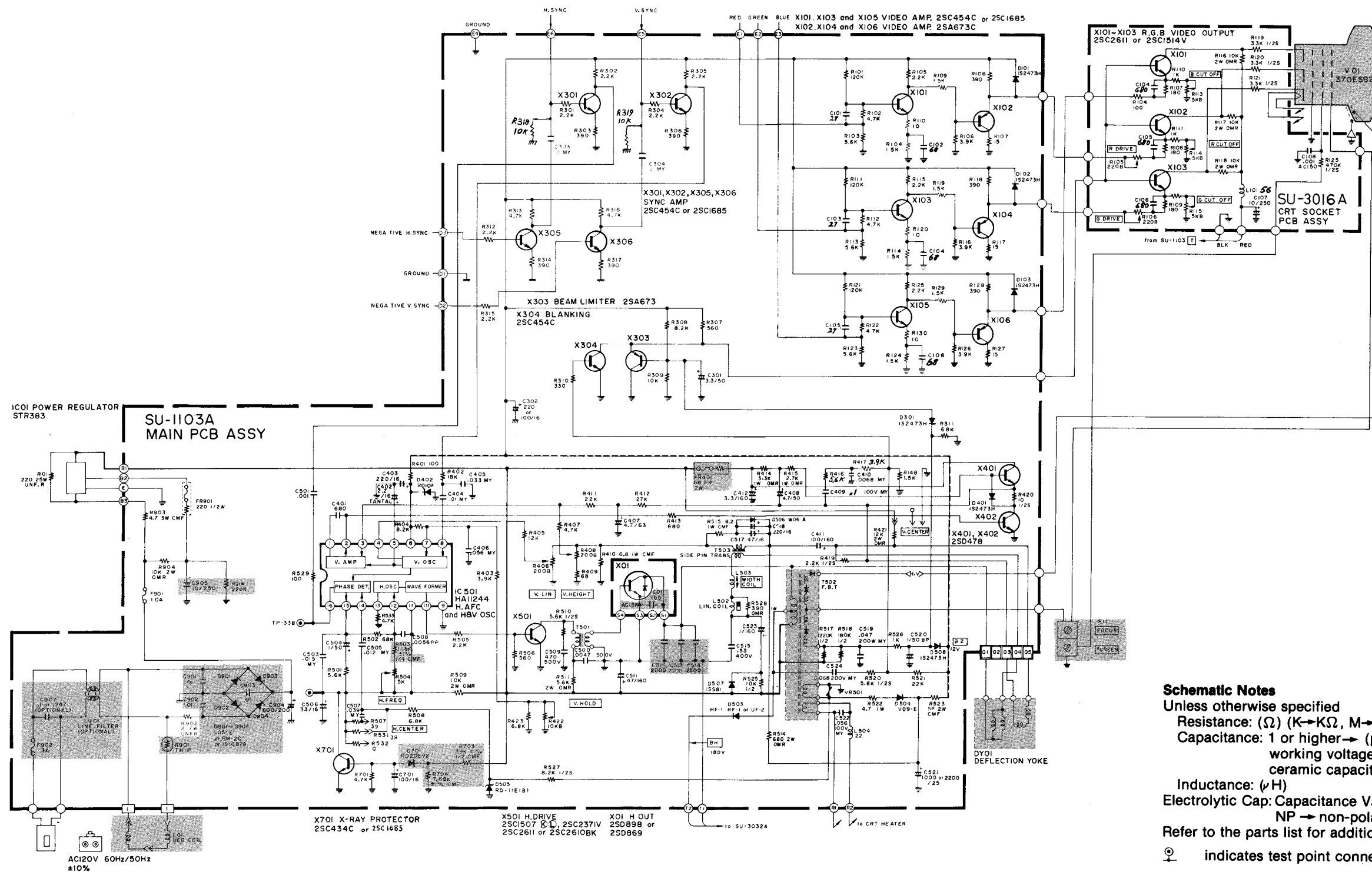
Resistors		
Symbol	Description	Part Number
R1406	V R 200Ω	QVZ3230-002
R1408	V R 200Ω	QVZ3230-002
R1410	CMF R 6.8Ω1W J	QRX019J-6R8
R1414	OM R 3.3KΩ1W J	QRG019J-332
R1415	OM R 2.7KΩ1W J	QRG019J-272
R1421	OM R 12KΩ2W J	QRG026J-123Z
R1422	V R 10KΩ	QVZ3230-014
△FR1401	△F R 68Ω2W K	QRH024K-680M
△R1503	△CMF 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-C05ZK271
△R1703	△CMF R 39Ω¼W+1%	QRV122F-3902
△R1704	△CMF R 7.68KΩ¼W+1%	QRV142F-7681
△R1901	△Posistor	A75414
R1902	UNF R 2.07W 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 47Ω¼W+1%	QRV122F-470Z
△R1909	V R 2KΩ	QVP5A0B-023E
R1910	△CMF R 2.74KΩ¼W+1%	QRV142F-274I
△FR1901	△F R 220Ω¼W 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

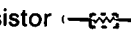
### Main PCB Ass'y (SU-1133A) Parts List (Cont.)

Coils Symbol	Description	Part Number
L1502	Linearity 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
Semi-conductors		
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)

13" G07-FBO  
 00-4147-03

## REPLACEMENT PARTS LIST—ELECTROHOME 13" MONITOR

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

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

### Abbreviations for Resistors and Capacitors

#### Resistor

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

#### Capacitor

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

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

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

### SERVICE REPLACEMENT PARTS LIST

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

Symbol	Description	Part Number
	Main P.C.B. Ass'y	SU-1103A
	CRT Socket P.C.B. Ass'y	SU-3016A
<b>Outside of the P.C.B. Ass'y</b>		
Symbol	Description	Part Number
$\Delta$ V01	$\Delta$ Picture Tube 13"	370ESB22(E)
$\Delta$ DY01	$\Delta$ Deflection Yoke	C29123-V
	PC Magnet	A76366-A
	Wedge	C30006
	$\Delta$ Flyback Transf.	A19183-A
$\Delta$ R11	$\Delta$ Focus V R	A46606-A
$\Delta$ R05	UNF Resistor 220 $\Omega$ ,25W. K	QRF258K-221
$\Delta$ C04	$\Delta$ C Capacitor 150pF, A C1.5KV	QCZ0101-005
X01	Si. Transistor	2SD869
IC01	IC Regulator	STR383
L01	Degaussing Coil	21-1007-31
	Degaussing Coil Pin Terminal (2)	34-708-01
	Degaussing Coil Pin Terminal Housing	34-709-01
	Groundstrap Ass'y	34-697-04
	Groundstrap Wire Terminal	34-228-03
	Groundstrap Spring (2)	35-3560-01
BR	Support Bracket RH	35-3919-01
BR	Support Bracket LH	35-3919-02
SC	SCREW 10- $\frac{1}{2}$ Pix Tube Mtg. (4)	31-631018-08
WA	Pyramidal Lockwasher (4)	33-255-01
	Clip P.C.B. Support (2)	33-629-02
	Ground Lug	34-33-04
CH	Chassis Base	38-452-01

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

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

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

Semi-conductors		
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	D20EV2
△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

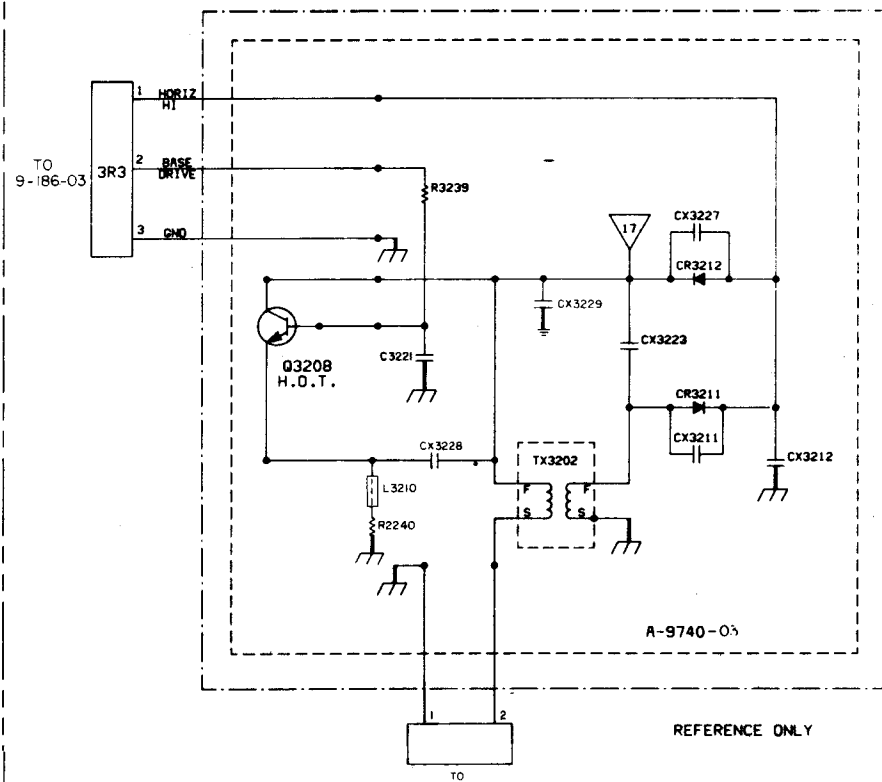
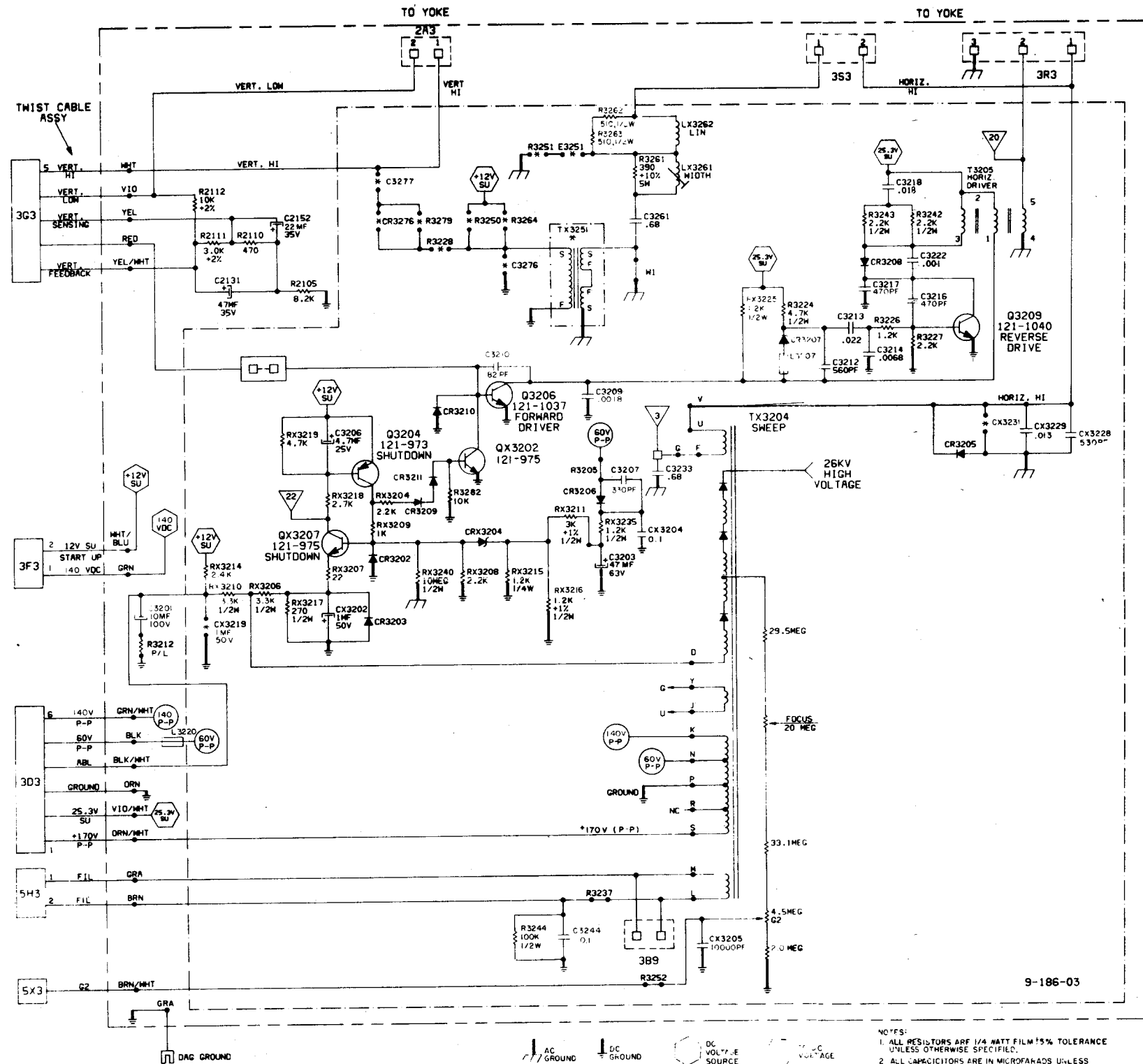
Capacitors		
Symbol	Description	Part Number
C3107	E Cap. 10uF 250V A	QEW52EA-106
C3108	C Cap. 1000pF DC1400V P	QCZ9001-102M

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





SCHEMATIC FOR  
9-186-03  
SWEEP BOARD  
RGB COLOR MONITOR

ZENITH RADIO CORP. CHICAGO, ILL.	ISSUE B	9-186
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M051-00087-A021

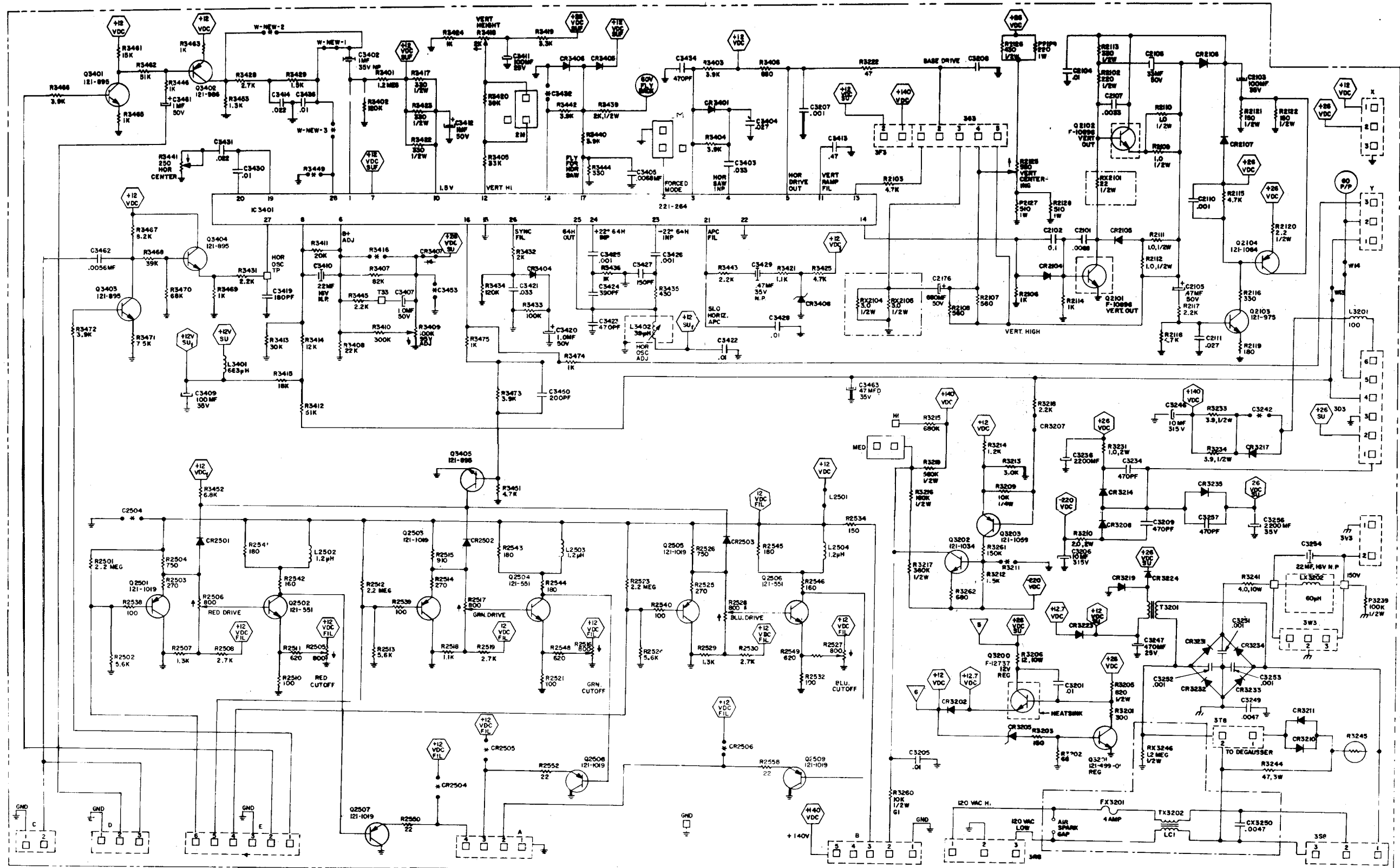
NOTES:  
1. ALL RESISTORS ARE 1/4 WATT 5% TOLERANCE UNLESS OTHERWISE SPECIFIED.  
2. ALL CAPACITORS ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

NOTES: (USED WITH CIRCUIT REFERENCE DESIGNATORS)  
A. P-L - SEE PARTS LIST FOR APPLICABLE USAGE.  
B. - - - JUMPER WIRE USED INSTEAD.  
C. - \* - PROVISION ON PRINTED CIRCUIT BOARD.

# ZENITH MONITOR — SWEEP BOARD REPLACEMENT PARTS LIST

## SWEEP BOARD (9-186-03)

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
<b>CAPACITORS</b>			<b>TRANSFORMERS &amp; COILS</b>		
C2131	22-7508	47 MF, 35V, ±20% Electrolytic	L3207	149-454	Core, Ferrite Bead
C2152	22-7508-01C	22 MF, 35V, ±20% Electrolytic	L3220	F-13834	Core & Sleeving Assy. (149-509-01)
C3201	22-7410-05	10 MF, 100V, ±20% Electrolytic	LX3261	20-3976	Coil Width
CX3202	22-7710-01C	1 MF, 50V, +50%–10% Electrolytic	LX3262	20-3975	Coil, Linearity, with 205-271 Hot Melt
C3203	22-7711-08C	47 MF, 63V, +50%–10% Electrolytic	T3205	95-3344	Transformer, Horizontal Driver
CX3204	22-7773-24A	0.1 MF, 100V, ±5% Polyester	TX3204	95-3581-01	Transformer, Sweep
CX3205	22-7523-01	0.01 MF, 2KV, ±20% Disc			
C3206	22-7708-04C	4.7 MF, 25V, +50%–10% Electrolytic			
C3207	22-5665	330 PF, 1000V, ±10% Disc	R2105	63-9921-94	8.2K Ohm, ±5% 1/4W Film
C3209	22-7242	0.0018 MF, 200V, ±10% Disc	R2110	63-9921-64	470K Ohm, ±5% 1/4W Film
C3211	22-7777-20B	0.047 MF, 200V, ±10% Polyester	R2111	63-9919-83	3K Ohm, ±2% 1/4W Film
C3212	22-7234	560 PF, 500V, ±10% Disc	R2112	63-9919-96	10K Ohm, ±2% 1/4W Film
C3213	22-7775-16A	0.022 MF, 100V, ±20% Polyester	RX3204	63-9921-80	2.2K Ohm, ±5% 1/4W Film
C3214	22-7775-10A	0.0068 MF, 100V, ±20% Polyester	RX3206	63-7805	3.3K Ohm, ±5% 1/2W Carbon
C3216	22-5684	470 PF, 500V, ±20% Disc	RX3207	63-9921-32	22 Ohm, ±5% 1/4W Film
C3217	22-5684	470 PF, 500V, ±20% Disc	RX3208	63-10235-80	2.2K Ohm, ±5% 1/4W Film
C3218	22-7774-15C	0.018 MF, 100V, ±10% Polyester	RX3209	63-10235-72	1K Ohm, ±5% 1/4W Film
C3222	22-7742-10	0.001 MF, 50V, ±10% Axial	RX3210	63-7805	3.3K Ohm, ±5% 1/2W Carbon
CX3228	22-6466	530 PF, 3KV, ±10% Disc	RX3211	63-10810-07	3K Ohm, ±1% 1/2W Film
CX3229	22-7672-07	0.013 MF, 1.6KV, ±5% Polypropylene	RX3214	63-10233-81	2.4K Ohm, ±2% 1/4W Film
C3233	22-7728	0.68 MF, 200V, ±10% Polyester	RX3216	63-10810-06	1.2K Ohm, ±1% 1/2W Film
C3244	22-7566-24	0.1 MF, 250V, ±10% Polyester	RX3217	63-7760	270 Ohm, ±5% 1/2W Carbon
C3261	22-7683-01	0.68 MF, 200V, ±5% Polypropylene	RX3215	63-10235-98	12K Ohm, ±5% 1/4W Film
			RX3218	63-10235-82	2.7K Ohm, ±5% 1/4W Film
			RX3219	63-10235-88	4.7K Ohm, ±5% 1/4W Film
			R3224	63-9946-88	4.7K Ohm, ±5% 1/2W Film
			R3225	63-10836-68	680 Ohm, ±5% 2W Wire Wound
			R3226	63-10235-74	1.2K Ohm, ±5% 1/4W Film
			R3227	63-10235-80	2.2K Ohm, ±5% 1/4W Film
			RX3235	63-10810-06	1.2K Ohm, ±1% 1/2W Film
			RX3240	53-10657-04	10 Meg Ohm, ±20% 1/2W Carbon
			R3242	63-10243-80	2.2K Ohm, ±5% 1/2W Film
			R3243	63-10243-80	2.2K Ohm, ±5% 1/2W Film
			R3244	63-7868	100K Ohm, ±5% 1/2W Carbon
			R3261	63-10444-86	390 Ohm, ±10% 5W Wire Wound
			R3262	63-10565-65	510 Ohm, ±10% 1/2W Film
			R3263	63-10565-65	510 Ohm, ±10% 1/2W Film
			R3282	63-10235-96	10K Ohm, ±5% 1/4W Film
<b>SEMICONDUCTORS</b>					
CR3202	103-142-01	Diode, Low Voltage			
CR3203	103-330A	Diode, Low Voltage			
CRX3204	103-308A	Diode, Zener			
CR3205	103-305	Diode, Damper			
CR3206	103-284A	Diode, Low Voltage			
CR3207	103-295-01A	Diode, Low Voltage (used with 149-454)			
CR3208	103-295-01A	Diode, Low Voltage			
CR3209	103-142-01	Diode, Low Voltage			
CR3210	103-142-01	Diode, Low Voltage			
CR3211	103-142-01	Diode, Low Voltage			
QX3202	121-975	Transistor, NPN			
QX3204	121-973	Transistor, PNP, Shutdown			
Q3206	121-1037	Transistor, NPN, Forward Driver			
QX3207	121-975	Transistor, NPN, Shutdown			
Q3209	121-1040	Transistor, NPN, Reverse Driver			



SCHEMATIC FOR  
9-227-01  
RGB COLOR MONITOR  
(MAIN BOARD)

ZENITH  
RADIO CORP. C 9-227  
CHICAGO, ILL.

M051-00087-A024

# ZENITH MONITOR — MAIN BOARD REPLACEMENT PARTS LIST

Board 9-227		Board 9-227		
9-227	-01	Ref. No.	Part No.	Description
<b>RESISTORS</b>				
X	X	RX2101	63-10565-32	22 Ohm, ±5%, 1/2W Film
X	X	R2102	63-10243-56	220 Ohm, ±5%, 1/2W Film
X	X	R2103	63-10235-88	4.7K Ohm, ±5%, 1/2W Film
X	X	RX2104	63-10243-11	3 Ohm, ±5%, 1/2W Film
X	X	RX2105	63-10243-11	3 Ohm, ±5%, 1/2W Film
X	X	R2106	63-10235-72	1K Ohm, ±5%, 1/4W Film
X	X	R2107	63-10235-66	560 Ohm, ±5%, 1/4W Film
X	X	R2108	63-10235-66	560 Ohm, ±5%, 1/4W Film
X	X	R2109	63-10565	1 Ohm, ±5%, 1/2W Film
X	X	R2110	63-10565	1 Ohm, ±5%, 1/2W Film
X	X	R2111	63-10565	1 Ohm, ±5%, 1/2W Film
X	X	R2112	63-10565	1 Ohm, ±5%, 1/2W Film
X	X	R2113	63-10243-60	330 Ohm, ±5%, 1/2W Film
X	X	R2114	63-10235-72	1K Ohm, ±5%, 1/4W Film
X	X	R2115	63-10235-88	4.7K Ohm, ±5%, 1/4W Film
X	X	R2116	63-10235-60	330 Ohm, ±5%, 1/4W Film
X	X	R2117	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
X	X	R2118	63-10235-88	4.7K Ohm, ±5%, 1/4W Film
X	X	R2119	63-10235-54	180 Ohm, ±5%, 1/4W Film
X	X	R2120	63-10565-08	2.2 Ohm, ±5%, 1/2W Film
X	X	R2121	63-10243-52	150 Ohm, ±5%, 1/2W Film
X	X	R2122	63-10243-52	150 Ohm, ±5%, 1/2W Film
X	X	R2125	63-9023-02	550 Ohm, ±20%, Control-Rotary Single-GRAY
	X	R2126	63-10243-66	560 Ohm, ±5%, 1/2W Film
X	X	R2126	63-10243-53	160 Ohm, ±5%, 1/2W Film
	X	R2127	63-10243-69	750 Ohm, ±5%, 1W Carbon
X	X	R2128	63-10243-66	560 Ohm, ±5%, 1/2W Film
	X	R2128	63-6058	510 Ohm, ±5%, 1W Carbon
	X	R2129	63-10243-65	510 Ohm, ±5%, 1/2W Carbon
X	X	R2501	63-10236-28	220K Ohm, ±5%, 1/4W Film
	X	R2501	63-10236-52	2.2 Meg Ohm, ±5%, 1/4W Film
X	X	R2502	63-10235-90	5.6K Ohm, ±5%, 1/4W Film
X	X	R2503	63-10235-56	220 Ohm, ±5%, 1/4W Film
	X	R2503	63-10235-58	270 Ohm, ±5%, 1/4W Film
X	X	R2504	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
	X	R2504	63-10235-69	750 Ohm, ±5%, 1/4W Film
X	X	R2505	63-10857-11	5K Ohm, Control-Rotary Single-RED
	X	R2505	63-10857-27	800 Ohm, Control-Rotary Single-Red Cut-Off
X	X	R2506	63-10857-30	1K Ohm, Control-Rotary Single-Yellow
	X	R2506	63-10857-27	800 Ohm, Control-Rotary Single-Red Drive
X	X	R2507	63-10235-76	1.5K Ohm, ±5%, 1/4W Film
	X	R2507	63-10235-75	1.3K Ohm, ±5%, 1/4W Film
	X	R2508	63-10235-93	7.5K Ohm, ±5%, 1/4W Film
X	X	R2508	63-10235-82	2.7K Ohm, ±5%, 1/4W Film
X	X	R2509	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
X	X	R2510	63-10235-50	120 Ohm, ±5%, 1/4W Film
	X	R2510	63-10235-48	100 Ohm, ±5%, 1/4W Film
X	X	R2511	63-10235-74	1.2K Ohm, ±5%, 1/4W Film
	X	R2511	63-10235-67	620 Ohm, ±5%, 1/4W Film
X	X	R2512	63-10236-28	220K Ohm, ±5%, 1/4W Film
	X	R2512	63-10236-52	2.2 Meg Ohm, ±5%, 1/4W Film
X	X	R2513	63-10235-90	5.6K Ohm, ±5%, 1/4W Film
X	X	R2514	63-10235-56	220 Ohm, ±5%, 1/4W Film
	X	R2514	63-10235-58	270 Ohm, ±5%, 1/4W Film
X	X	R2515	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
X	X	R2515	63-10235-71	910 Ohm, ±5%, 1/4W Film
X	X	R2516	63-10857-32	5K Ohm, Control-Rotary Single-GREEN
	X	R2516	63-10857-25	800 Ohm, Control-Rotary Single-Green Cut-Off
X	X	R2517	63-10857-30	1K Ohm, Control-Rotary Single-Yellow
	X	R2517	63-10857-25	800 Ohm, Control-Rotary Single-Green Drive
X	X	R2518	63-10235-76	1.5K Ohm, ±5%, 1/4W Film

Board 9-227		Board 9-227		
9-227	-01	Ref. No.	Part No.	Description
<b>RESISTORS (Continued)</b>				
X	X	R2518	63-10235-73	1.1K Ohm, ±5%, 1/4W Film
	X	R2519	63-10235-93	7.5K Ohm, ±5%, 1/4W Film
	X	R2519	63-10235-82	2.7K Ohm, ±5%, 1/4W Film
X	X	R2520	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
X	X	R2521	63-10235-50	120 Ohm, ±5%, 1/4W Film
	X	R2521	63-10235-48	100 Ohm, ±5%, 1/4W Film
X	X	R2522	63-10235-74	1.2K Ohm, ±5%, 1/4W Film
X	X	R2523	63-10236-28	220K Ohm, ±5%, 1/4W Film
	X	R2523	63-10236-52	2.2 Meg Ohm, ±5%, 1/4W Film
X	X	R2524	63-10235-90	5.6K Ohm, ±5%, 1/4W Film
X	X	R2525	63-10235-56	220 Ohm, ±5%, 1/4W Film
	X	R2525	63-10235-58	270 Ohm, ±5%, 1/4W Film
X	X	R2526	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
	X	R2526	63-10235-69	750 Ohm, ±5%, 1/4W Film
X	X	R2527	63-10857-31	5K Ohm, Control-Rotary Single-BLUE
	X	R2527	63-10857-26	800 Ohm, Control-Rotary Single-Blue Cut-Off
X	X	R2528	63-10857-30	1K Ohm, Control-Rotary Single-YELLOW
	X	R2528	63-10857-26	800 Ohm, Control-Rotary Single-Blue Drive
X	X	R2529	63-10235-76	1.5K Ohm, ±5%, 1/4W Film
	X	R2529	63-10235-75	1.3K Ohm, ±5%, 1/4W Film
X	X	R2530	63-10235-93	7.5K Ohm, ±5%, 1/4W Film
X	X	R2530	63-10235-82	2.7K Ohm, ±5%, 1/4W Film
X	X	R2531	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
X	X	R2532	63-10235-50	120 Ohm, ±5%, 1/4W Film
	X	R2532	63-10235-48	100 Ohm, ±5%, 1/4W Film
X	X	R2533	63-10235-74	1.2K Ohm, ±5%, 1/4W Film
	X	R2534	63-10235-52	150 Ohm, ±5%, 1/4W Film
X	X	R2535	63-10235-52	150 Ohm, ±5%, 1/4W Film
X	X	R2536	63-10235-52	150 Ohm, ±5%, 1/4W Film
X	X	R2537	63-10235-52	150 Ohm, ±5%, 1/4W Film
X	X	R2538	63-10235-56	220 Ohm, ±5%, 1/4W Film
	X	R2538	63-10235-48	100 Ohm, ±5%, 1/4W Film
X	X	R2539	63-10235-56	220 Ohm, ±5%, 1/4W Film
	X	R2539	63-10235-48	100 Ohm, ±5%, 1/4W Film
X	X	R2540	63-10235-56	220 Ohm, ±5%, 1/4W Film
	X	R2540	63-10235-48	100 Ohm, ±5%, 1/4W Film
X	X	R2541	63-10235-54	180 Ohm, ±5%, 1/4W Film
X	X	R2542	63-10235-53	160 Ohm, ±5%, 1/4W Film
X	X	R2543	63-10235-54	180 Ohm, ±5%, 1/4W Film
X	X	R2544	63-10235-54	180 Ohm, ±5%, 1/4W Film
X	X	R2545	63-10235-54	180 Ohm, ±5%, 1/4W Film
X	X	R2546	63-10235-53	160 Ohm, ±5%, 1/4W Film
X	X	R2548	63-10235-67	620 Ohm, ±5%, 1/4W Film
X	X	R2549	63-10235-67	620 Ohm, ±5%, 1/4W Film
X	X	R2550	63-10235-32	22 Ohm, ±5%, 1/4W Film
X	X	R2552	63-10235-32	22 Ohm, ±5%, 1/4W Film
X	X	R2554	63-10235-32	22 Ohm, ±5%, 1/4W Film
X	X	R3201	63-10235-59	300 Ohm, ±5%, 1/4W Film
X	X	R3202	63-10235-44	68 Ohm, ±5%, 1/4W Film
X	X	R3203	63-10235-52	150 Ohm, ±5%, 1/4W Film
X	X	R3205	63-7781	820 Ohm, ±5%, 1/2W Carbon
X	X	R3206	F-11851	12 Ohm, ±10%, 10W Resistor & Splice Assy.
	X	R3206	63-10460-50	12 Ohm, ±10%, 10W Wirewound
X	X	R3210	63-10420-31	2 Ohm, ±5%, 2W Wirewound
X	X	R3212	63-10235-76	1.5K Ohm, ±5%, 1/4W Film
X	X	R3213	63-10235-83	3K Ohm, ±5%, 1/4W Film
	X	R3213	63-10235-86	3.9K Ohm, ±5%, 1/4W Film
X	X	R3214	63-10235-74	1.2K Ohm, ±5%, 1/4W Film
	X	R3215	63-10244-38	560K Ohm, ±5%, 1/2W Film
	X	R3215	63-10244-40	680K Ohm, ±5%, 1/2W Film
	X	R3216	63-10244-25	160K Ohm, ±5%, 1/2W Film
X	X	R3217	63-10244-33	360K Ohm, ±5%, 1/2W Film
X	X	R3218	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
X	X	R3219	63-10244-38	560K Ohm, ±5%, 1/2W Film

# MAIN BOARD (Continued)

Board		Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
9-227	-01						
<b>RESISTORS (Continued)</b>							
X	X	R3222	63-10235-40	47 Ohm, ±5%, 1/4W Film	C2101	22-7775-10A	0.0068 MF, 100V ±20% Polyester
X	X	R3231	63-9982	1 Ohm, ±10%, 2W Wirewound	C2102	22-7775-24A	0.1 MF, 100V ±20% Polyester
X	X	R3233	63-10565-14	3.9 Ohm, ±5%, 1/2W Film	C2103	22-7709-09C	100 MF, 35V +50%–10% Electrolytic
X	X	R3234	63-10565-14	3.9 Ohm, ±5%, 1/2W Film	C2104	22-7613-24D	0.01 MF, 50V ±10% Disc
X	X	R3239	63-10244-20	100K Ohm, ±5%, 1/2W Film	C2105	22-7390-02	0.47 MF, 50V ±20% Electrolytic
X	X	R3241	63-8246	4 Ohm, 10W Wirewound	C2106	22-7710-07C	33 MF, 50V +50%–10% Electrolytic
X	X	R3244	63-10840-40	47 Ohm, ±5%, 3W Film, Tin Oxide	C2107	22-7615-03D	0.0033 MF, 50V +80%–10% Disc
X	X	R3245	63-10710A	Thermistor	C2110	22-7742-10	0.001 MF, 50V ±10% Polyester
X	X	RX3246	63-10657-03	1.2 Meg Ohm, ±20%, 1/2W Carbon	C2111	22-7774-17A	0.027 MF, 100V ±10% Polyester
	X	R3260	63-10243-96	10K Ohm, ±5%, 1/2W Film	C2176	22-7725	680 MF, 50V +100%–10% Electrolytic
	X	R3261	63-10244-24	150K Ohm, ±5%, 1/4W Film	C2501	22-7621-42C	220 PF, 50V ±5% Disc
	X	R3262	63-10235-68	680 Ohm, ±5%, 1/4W Film	C2502	22-7621-42C	220 PF, 50V ±5% Disc
X	X	R3401	63-10236-46	1.2 Meg Ohm, ±5%, 1/4W Film	C2503	22-7621-42C	220 PF, 50V ±5% Disc
X	X	R3402	63-10236-22	120K Ohm, ±5%, 1/4W Film	C3201	22-7775-24A	0.1 MF, 100V ±20% Polyester
X	X	R3403	63-10235-86	3.9K Ohm, ±5%, 1/4W Film	C3204	22-7603	4.7 MF, 315V +100%–10% Electrolytic
X	X	R3404	63-10235-86	3.9K Ohm, ±5%, 1/4W Film	C3205	22-3512	0.01 MF, 1KV +40%–20% Disc
X	X	R3405	63-10236-08	33K Ohm, ±5%, 1/4W Film	C3206	22-7603-01A	10 MF, 315V +100%–10% Electrolytic
X	X	R3406	63-10235-68	680 Ohm, ±5%, 1/4W Film	C3207	22-7742-10	0.001 MF, 50V ±10% Axial
X	X	R3407	63-10236-18	82K Ohm, ±5%, 1/4W Film	C3208	22-7742-10	0.001 MF, 50V ±10% Axial
X	X	R3408	63-10236-04	22K Ohm, ±5%, 1/4W Film	C3209	22-7395	470 PF, 500V ±5% Disc
X	X	R3409	63-10857-17	100K Ohm, Control-Rotary Single-Green	C3234	22-7395	470 PF, 500V ±5% Disc
X	X	R3410	63-10236-31	300K Ohm, ±5%, 1/4W Film	C3236	22-7861-14	2200 MF, 35V ±20% Electrolytic
X	X	R3411	63-10236-03	20K Ohm, ±5%, 1/4W Film	C3246	22-7603-01A	10 MF, 315V +100%–10% Electrolytic
X	X	R3412	63-10236-13	51K Ohm, ±5%, 1/4W Film	C3247	22-7860-12	470 MF, 25V ±20% Electrolytic
X	X	R3413	63-10236-07	30K Ohm, ±5%, 1/4W Film	C3249	22-7431-06	0.0047 MF, ±20% Disc
X	X	R3414	63-10235-98	12K Ohm, ±5%, 1/4W Film	CX3250	22-7431-06	0.0047 MF, ±20% Disc
X	X	R3415	63-10236-02	18K Ohm, ±5%, 1/4W Film	C3251	22-7811	0.001 MF, 1KV ±10% Disc
X	X	R3417	63-10243-60	330 Ohm, ±5%, 1/2W Film	C3252	22-7811	0.001 MF, 1KV ±10% Disc
X	X	R3418	63-10857-08	2K Ohm, Control-Rotary Single-Yellow	C3253	22-7811	0.001 MF, 1KV ±10% Disc
X	X	R3419	63-10235-84	3.3K Ohm, ±5%, 1/4W Film	C3254	22-7404-06	22 MF, 16V ±20% Electrolytic
X	X	R3420	63-10236-10	39K Ohm, ±5%, 1/4W Film	C3256	22-7508-05B	2200 MF, 35V +50%–10% Electrolytic
X	X	R3421	63-10235-73	1.1K Ohm, ±5%, 1/4W Film	C3257	22-7395	470 PF, 500V ±5% Disc
X	X	R3422	63-10243-60	330 Ohm, ±5%, 1/2W Film	C3401	22-7613-24D	0.01 MF, 50V ±10% Disc
X	X	R3423	63-10243-60	330 Ohm, ±5%, 1/2W Film	C3402	22-7406-01	1.0 MF, 35V ±20% Electrolytic
X	X	R3424	63-10235-72	1K Ohm, ±5%, 1/4W Film	C3403	22-7773-18A	0.033 MF, 100V ±5% Polyester
X	X	R3425	63-10235-88	4.7K Ohm, ±5%, 1/4W Film	C3404	22-7773-17A	0.027 MF, 100V ±5% Polyester
X	X	R3428	63-10235-82	2.7K Ohm, ±5%, 1/4W Film	C3405	22-7775-10A	0.0068 MF, 100V ±20% Polyester
X	X	R3429	63-10235-76	1.5K Ohm, ±5%, 1/4W Film	C3407	22-7710-01A	1.0 MF, 50V +50%–10% Electrolytic
X	X	R3431	63-10235-80	2.2K Ohm, ±5%, 1/4W Film	C3409	22-7709-09C	100 MF, 35V +100%–10% Electrolytic
X	X	R3432	63-10235-55	200 Ohm, ±5%, 1/4W Film	C3410	22-7404-06A	22 MF, 16V ±20% Electrolytic NP
X	X	R3432	63-10235-79	2K Ohm, ±5%, 1/4W Film	C3411	22-7708-09	100 MF, 25V +50%–10% Electrolytic
X	X	R3433	63-10236-20	100K Ohm, ±5%, 1/4W Film	C3412	22-7710-01C	1.0 MF, 50V +50%–10% Electrolytic
X	X	R3434	63-10236-22	120K Ohm, ±5%, 1/4W Film	C3413	22-7562-32	0.47 MF, 100V ±5% Polyester
X	X	R3435	63-10235-63	430 Ohm, ±5%, 1/4W Film	C3414	22-7774-16A	0.022 MF, 100V ±10% Polyester
X	X	R3436	63-10235-72	1K Ohm, ±5%, 1/4W Film	C3419	22-7751-39	180 PF, 50V ±5% Axial
X	X	R3439	63-10243-79	2K Ohm, ±5%, 1/2W Film	C3420	22-7710-01C	1.0 MF, 50V +50%–10% Electrolytic
X	X	R3440	63-10235-86	3.9K Ohm, ±5%, 1/4W Film	C3421	22-7773-18B	0.033 MF, 100V ±5% Polyester
X		R3441	63-10857	100 Ohm, Control-Rotary Single-Horizontal Center	C3422	22-7613-24D	0.01 MF, 50V ±10% Disc
	X	R3441	63-10857-02	250 Ohm, Control-Rotary Single-Horizontal Center	C3423	22-7613-08D	470 PF, 50V ±10% Disc
X	X	R3442	63-10235-86	3.9K Ohm, ±5%, 1/4W Film	C3424	22-7742-05	390 PF, 50V ±10% Axial
X	X	R3443	63-10235-65	510 Ohm, ±5%, 1/4W Film	C3425	22-7742-10	0.001 MF, 50V ±10% Axial
X	X	R3443	63-10235-80	2.2K Ohm, ±5%, 1/4W Film	C3426	22-7742-10	0.01 MF, 50V ±10% Axial
X	X	R3444	63-10235-60	330 Ohm, ±5%, 1/4W Film	C3427	22-7647-35C	150 PF, ±10% Axial
X	X	R3445	63-10235-80	2.2K Ohm, ±5%, 1/4W Film	C3428	22-7774-12	0.01 MF, 100V ±10% Polyester
X	X	R3446	63-10235-72	1K Ohm, ±5%, 1/4W Film	C3428	22-7774-20A	0.047 MF, 100V ±10% Polyester
X	X	R3449	63-10235-76	1.5K Ohm, ±5%, 1/4W Film	(on-01 version)		
X	X	R3451	63-10235-82	2.7K Ohm, ±5%, 1/4W Film	C3429	22-7405-04	4.7 MF, 25V ±20% Electrolytic NP
X	X	R3451	63-10235-88	4.7K Ohm, ±5%, 1/4W Film	C3429	22-7406	0.47 MF, 35V ±20% Electrolytic NP
X	X	R3452	63-10235-92	6.8K Ohm, ±5%, 1/4W Film	(on-01 version)		
X	X	R3453	63-10235-75	1.3K Ohm, ±5%, 1/4W Film	C3430	22-7613-24D	0.01 MF, 50V ±10% Disc
X	X	R3461	63-10236	15K Ohm, ±5%, 1/4W Film	C3431	22-7774-16A	0.022 MF, 100V ±10% Polyester
X	X	R3462	63-10236-13	51K Ohm, ±5%, 1/4W Film	C3434	22-7742-06	470 PF, 50V ±10% Axial
					C3436	22-7613-24C	0.01 MF, 100V ±10% Disc
					C3450	22-7739-29A	0.27 MF, 100V ±10% Polyester
					C3450	22-7619-41C	200 PF, 50V ±5% Disc
					(on-01 version)		
					C3461	22-7710-01C	1.0 MF, 50V +50%–10% Electrolytic
					C3462	22-7710-01C	1.0 MF, 50V +50%–10% Electrolytic
					C3462	22-7739-09	0.0056 MF, 100V ±10% Polyester
					(on-01 version)		
					C3463	22-7508	47 MF, 35V ±20% Electrolytic

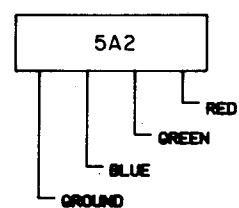
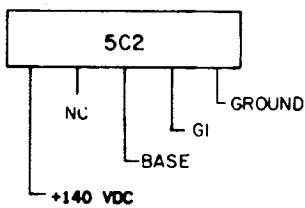
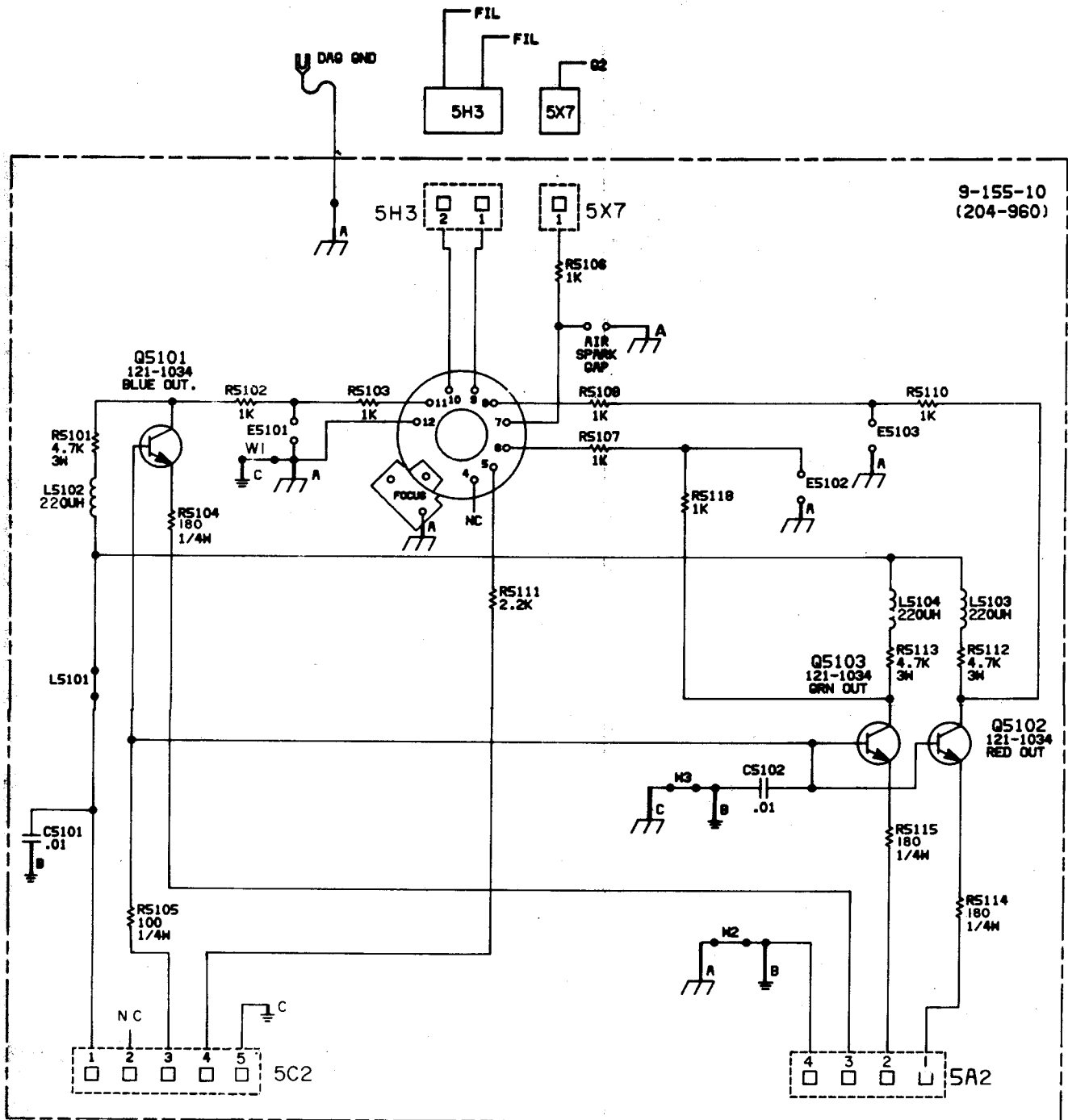
# ZENITH MONITOR — CRT SOCKET BOARD REPLACEMENT PARTS LIST

## MAIN BOARD (Continued)

## CRT SOCKET (9-155-10)

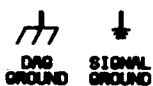
Ref. No.	Part No.	Description
<b>SEMICONDUCTORS</b>		
CR2104	103-142-01	Diode, Low Voltage
CR2105	103-254-01	Diode, Low Voltage
CR2106	103-254-01	Diode, Low Voltage
CR2107	103-254-01	Diode, Low Voltage
CR2501	103-142-01	Diode, Low Voltage
CR2502	103-142-01	Diode, Low Voltage
CR2503	103-142-01	Diode, Low Voltage
CR3202	103-330A	Diode, Low Voltage
CR3205	103-309-01	Diode, Zener 10V 1W
CR3206	103-254-01	Diode, Low Voltage
CR3208	103-326A	Diode, Low Voltage
CR3210	103-254-01	Diode, Low Voltage
CR3211	103-254-01	Diode, Low Voltage
CR3214	103-284-A	Diode, Low Voltage
CR3217	103-326A	Diode, Low Voltage
CR3219	103-330A	Diode, Low Voltage
CR3223	103-330A	Diode, Low Voltage
CR3224	103-330A	Diode, Low Voltage
CR3231	103-315-06A	Diode
CR3232	103-315-06A	Diode
CR3233	103-315-06A	Diode
CR3234	103-315-06A	Diode
CR3235	103-284A	Diode, Low Voltage
CR3401	103-142-01	Diode, Low Voltage
CR3404	103-143-01	Diode, Low Voltage
CR3405	103-142-01	Diode, Low Voltage
CR3406	103-142-01	Diode, Low Voltage
CR3408	103-279-14	Diode, Zener 6.8V 1/2W
Q2101	F-10896	Transistor & Heat Sink Assy.
Q2102	F-10896	Transistor & Heat Sink Assy.
Q2103	121-975	Transistor NPN
Q2104	121-1064	Transistor PNP
Q2501	121-1019	Transistor PNP
Q2502	121-895	Transistor NPN
Q2502	121-551	Transistor NPN
(on -01 version)		
Q2503	121-1019	Transistor PNP
Q2504	121-895	Transistor NPN
Q2504	121-551	Transistor NPN
(on -01 version)		
Q2505	121-1019	Transistor PNP
Q2506	121-895	Transistor NPN
Q2506	121-551	Transistor NPN
(on -01 version)		
Q2507	121-1019	Transistor
Q2508	121-1019	Transistor
Q2509	121-1019	Transistor
Q3200	F-12737	Transistor & Heat Sink Assy.
Q3201	121-499-01	Transistor NPN Regular Feed Back
Q3202	121-1034	Transistor NPN
Q3203	121-1059	Transistor PNP
Q3401	121-895	Transistor NPN
Q3402	121-986	Transistor PNP
Q3403	121-985	Transistor NPN
Q3404	121-895	Transistor NPN
Q3405	121-895	Transistor NPN
<b>TRANSFORMERS &amp; COILS</b>		
L2502	20-3887-01	Coil Peaking 1.2 UH
L2503	20-3887-01	Coil Peaking 1.2 UH
L2504	20-3887-01	Coil Peaking 1.2 UH
L3201	20-2021	Coil Peaking 100 UH
LX3202	95-3501-01	Transformer Choke 60 UH
L3401	20-3831	Coil Peaking 663 UH
L3402	20-3998	Coil Peaking 39 UH
L3402	20-4026	Coil Turnable 39 UH
(on -01 version)		

Ref. No.	Part No.	Description
<b>CAPACITORS</b>		
C5101	22-4671	0.01 MF, 1.5KV, +80%—20% Disc
C5102	22-3512	0.01 MF, 1KV, +40%—10% Disc
<b>TRANSFORMERS &amp; COILS</b>		
L5102	20-3887-28E	220 MH Peaking
L5103	20-3887-28E	220 MH Peaking
L5104	20-3887-28E	220 MH Peaking
<b>SEMICONDUCTORS</b>		
Q5101	F7510	Transistor, NPN, Video Out, Blue
Q5102	F7510	Transistor, NPN, Video Out, Red
Q5103	F7510	Transistor, NPN, Video Out, Green
<b>RESISTORS</b>		
R5101	63-10840-88	4.7K Ohm, ±5%, 3W Film
R5102	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5103	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5104	63-10235-54	180 Ohm, ±5%, 1/4W Film
R5105	63-10235-48	100 Ohm, ±5%, 1/4W Film
R5106	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5107	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5108	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5109	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5110	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5111	63-7799	2.2K Ohm, ±10%, 1/2W Carbon
R5112	63-10840-88	4.7K Ohm, ±5%, 3W Carbon
R5113	63-10840-88	4.7K Ohm, ±5%, 3W Carbon
R5114	63-10235-54	180 Ohm, ±5%, 1/4W Film
R5115	63-10235-54	180 Ohm, ±5%, 1/4W Film
<b>MISCELLANEOUS</b>		
5A2	86-799	Stake Connector 4/.156
5C2	86-799	Stake Connector 4/.156
5H3	86-799	Stake Connector 2/.156
5X7	86-799	Stake Connector 1/.312
A-10008		CRT Socket



NOTE:  
1. ALL RESISTORS ARE 1/2WATT UNLESS OTHERWISE SPECIFIED.

NOTES: (USED WITH CIRCUIT REFERENCE DESIGNATORS)  
A. P/L = SEE PARTS LIST FOR APPLICABLE USAGE.  
B. —●—●— = JUMPER WIRE USED INSTEAD.  
C. —■—■— = PROVISION ON PRINTED CIRCUIT BOARD.



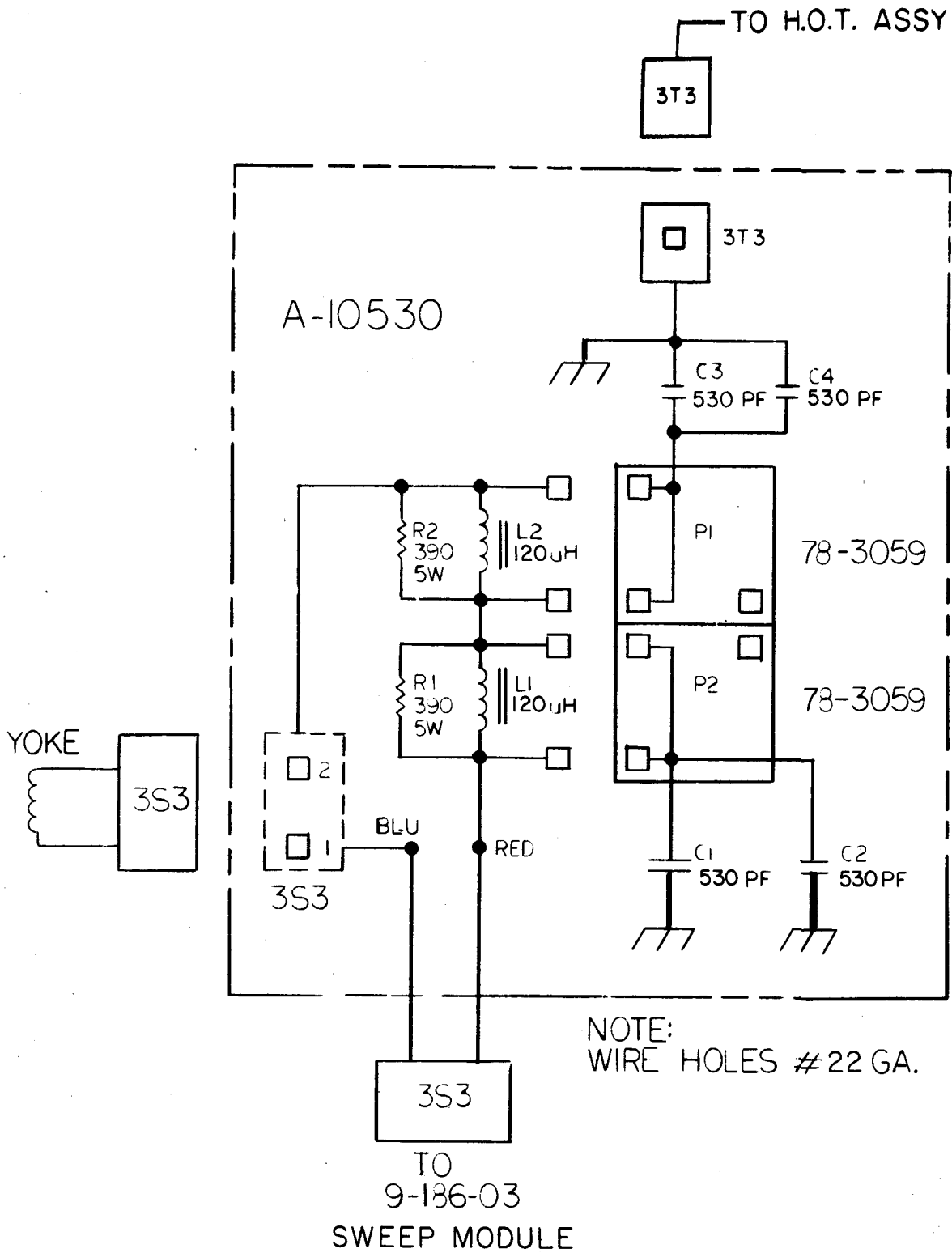
M051-00087-A022

SCHEMATIC FOR  
9-155-10  
RGB COLOR MONITOR  
CRT SOCKET BOARD

ZENITH  
RADIO CORP.  
CHICAGO, ILL.

ISSUE

9-155



M051-00087-A023

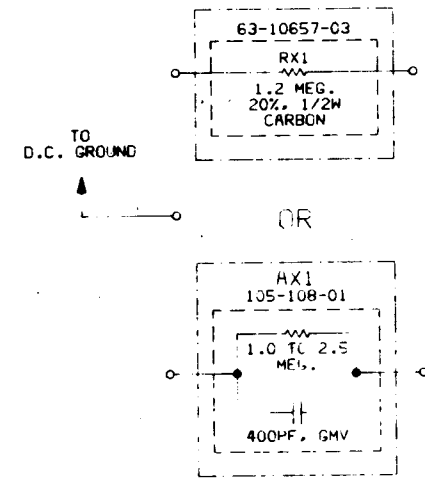
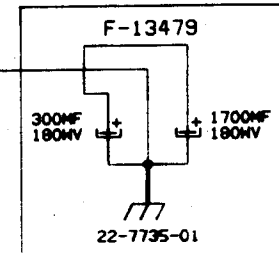
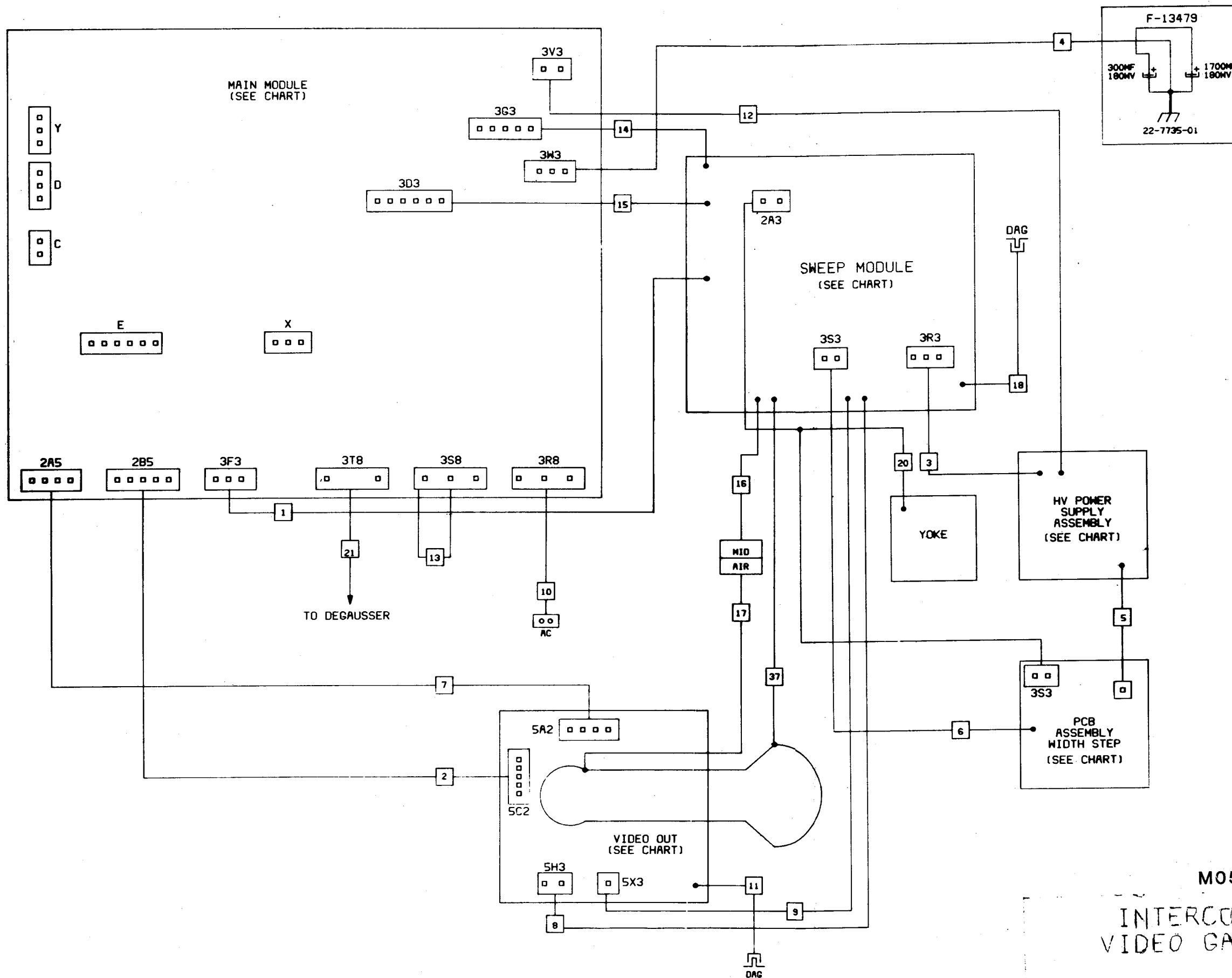
SCHEMATIC  
FOR A-10530  
WIDTH STEP ASSY.

ZENITH  
RADIO CORP.  
CHICAGO, ILL.

ISSUE  
B

A-10530





**IMPORTANT SAFETY NOTICE**  
 WHEN SERVICING THIS CHASSIS, UNDER NO CIRCUMSTANCES SHOULD THE ORIGINAL DESIGN BE MODIFIED OR ALTERED WITHOUT PERMISSION FROM THE ZENITH RADIO CORPORATION. ALL COMPONENTS SHOULD BE REPLACED ONLY WITH TYPES IDENTICAL TO THOSE IN THE ORIGINAL CIRCUIT, AND THEIR PHYSICAL LOCATION, WIRING AND LEAD DRESS, MUST CONFORM TO ORIGINAL LAYOUT UPON COMPLETION OF REPAIRS.

SPECIAL CIRCUITS ARE ALSO USED TO PREVENT SHOCK AND FIRE HAZARD. THESE AREAS ARE SHADED ON THE SCHEMATIC FOR EASY IDENTIFICATION. THE LETTER "X" INCLUDED IN THE ITEM NUMBER DESIGNATES SPECIAL FAILSAFE COMPONENTS IN THESE AREAS WHICH ARE REQUIRED TO MAINTAIN SAFE PERFORMANCE. NO LEVIATIONS ARE ALLOWED WITHOUT PRIOR APPROVAL BY THE PRODUCT SAFETY ENGINEERING DEPARTMENT.

THIS CIRCUIT DIAGRAM MAY OCCASIONALLY DIFFER FROM THE ACTUAL CIRCUIT USED. THIS WAY, IMPLEMENTATION OF THE LATEST SAFETY AND PERFORMANCE IMPROVEMENT CHANGES INTO THE SET IS NOT DELAYED UNTIL THE NEW SERVICE LITERATURE IS PRINTED.

M051-00087-A025  
 INTERCONNECT FOR  
 VIDEO GAME MONITOR

ZENITH  
 RADIO CORP.  
 CHICAGO, ILL.

ISS:JE

# Black & White X-Y T.V. Monitor

## Introduction

(How to use this section of your manual.)

Welcome to the world of the X-Y monitor, an electronic device that strikes terror into the heart of many a technician. The **main reason** it is so intimidating is that the Vector Beam, Quadrascan, or X-Y monitor is **TOTALLY UNLIKE** the Rasterscan monitor or T.V. set as you probably call it. Since many technicians are generally unfamiliar with the circuit operation, they may not be able to figure out when a symptom correlates with (points to) a particular circuit. If you are a technician, this section of the manual will certainly be a life-saver (our modest opinion). If you don't know anything about electronics, just relax because these monitors are a lot simpler than a regular monitor or T.V. set.

Vectorbeam or X-Y monitors are used because a regular Rasterscan monitor constructs the picture in a different way. For example, your T.V. set has 525 horizontal lines on the screen from top to bottom. Each line is a slice of the picture. If you stare real close at the edge of a picture of a curved object (a large ball) or an angular object (the peak of a roof) on the screen of your T.V., you will be able to see the individual slices that the objects edge is made up of. The edge of the curved or angular objects will not appear to be completely smooth but will look like they are stepped. However, at normal viewing distance, these same curved or angular lines will appear to be smooth or straight and not stepped. To make sure that the pieces or slices of the picture stay together just like they were transmitted, T.V. sets have synchronization circuits. Vectorbeam monitors don't use ANY of this. Here, the electron beam smoothly goes anywhere it is told to to paint the picture. It DOES NOT go across the screen 525 times to paint the picture in slices. Because of this shortcut, the circuitry is less complex and the detail in the

figures will appear smoother. One drawback is that the brightness level is intentionally designed to be at a level high enough to burn or etch right into the picture tube face. This will be covered in more detail later in this section.

If your X-Y monitor develops a problem, you can go directly to the "SYMPTOM DIAGNOSIS" subsection where you can match up your problem to the problem described and the circuit that may be causing it. From there you go to the schematic diagrams for your particular brand of monitor and troubleshoot the circuits mentioned in the "SYMPTOM DIAGNOSIS" subsection.

If you are a technician who is unfamiliar with X-Y monitors, you may want to read the "THEORY OF OPERATION" subsection first. This section **IS NOT** a rigorous description of circuit operation, but a simplified general description of major circuit blocks. Some literature has been written on this subject. Electrohome's instruction and service manual on the G05-801 is an analysis on one X-Y monitor (which Midway Mfg. Co. does not use) **described from an engineering standpoint**. All that is necessary to understand it is a battery of U.N. interpreters. Electrohome's instruction and service manual on the G05-802 and G05-805 monitors (which Midway Mfg. Co. does use) is simpler and more condensed. The best manual we have found on the subject so far is Wells Gardner's publication on their Graphic Display Unit, model 19V2000 (which Midway Mfg. Co. also uses). Most technicians will understand it and it is very complete. The above manuals are available on request from your distributor or monitor manufacturer.

For those who know nothing of electronics, we suggest that you read the "THEORY OF OPERATION" subsection, and we definitely recommend that you read the "TROUBLESHOOTING" subsection. From there, go to the "SYMPTOM DIAGNOSIS" subsection, and then to the schematic diagrams — the monitor's road map.

# Symptom Diagnosis

1. **Insufficient width or height :**
  - A. Horizontal line (due to "Y" amplifier defect).
    - Bad yoke.
    - Bad "Y" amplifier output transistors.
    - Blown "Y" amplifier fuse.
    - Open fusible resistor in the "Y" amplifier.
    - Yoke pins not making good contact (very common).
  - B. Vertical line (due to "X" amplifier defect).
    - Bad yoke.
    - Bad "X" amplifier output transistors.
    - Blown "X" amplifier fuse.
    - Open fusible resistor in the "X" amplifier.
    - Yoke pins not making good contact (very common).
2. **Picture spread out too far and/or crushed in certain areas:**
  - A. Controls for linearity (located on the deflection board and set at the factory) are misadjusted.
  - B. Bad yoke.
3. **Poor focus:**
  - A. Low focus voltage from the high voltage board.
  - B. Defective diode off the flyback.
  - C. Defective focus control.
  - D. Defective picture tube (CRT).
4. **Picture not bright enough:**
  - A. If the CRT voltages are present, the picture tube is probably bad. The surest way to cure this on an X-Y monitor is to replace the picture tube (CRT).
  - B. Weak 90 volt supply from the EHT power supply.
  - C. Loose wire to socket of CRT for G2 voltage.
5. **Silvery effect to the white lines, or picture looks dim, washed out:**
  - A. If the CRT voltages are present, the picture tube is probably bad. The surest way to cure this on an X-Y monitor is to replace the picture tube (CRT).
6. **Increasing brightness causes an increase in picture size and weakens focus:**
  - A. For the most part, this is normal in X-Y monitors. But if this should occur at normal viewing levels, either:
    - The CRT is defective.
    - The high voltage rectifier is weak.
    - Or the high voltage circuitry has poor regulation.
7. **Picture rapidly blinks on and off:**
  - A. Internal short in the picture tube (arcing).
8. **A dot on the middle of the screen — Red LED is turned on (located on the deflection board):**
  - A. The "X" and "Y" signals are not making it into the monitor.
  - B. Check cabling, jacks, and logic boards.
  - C. "X" and "Y" amplifier failure. See Number 1 above and *check the fuses first*.
9. **Monitor won't turn on:**
  - A. Open fuse(s).
  - B. A defect in the power supply; check:
    - Fuse(s).
    - Transistors.
    - Open fusible resistor.
  - C. Check jack to make certain all pins are obtaining their voltage from the other game circuitry.
  - D. Check for loose foil, especially by D100.
10. **Blown 5 amp fuses:**
  - A. Caused by bad luck. Change fuses.
  - B. If they keep blowing, check all power transistors that are heat-sinked on the side (as in the 19" version) or the bottom (as in the 13" version) of the monitor.
11. **Extremely bright picture; spider-web like retrace lines floating around on the picture:**
  - A. Defective "Z" amplifier circuitry; check:
    - The brightness and contrast controls.
    - For peeled foil on the deflection board.
    - Semiconductors, etc.
  - B. See symptom 4, diagnosis "B" and "C" ONLY. A bad EHT power supply or loose G2 wire can cause the same thing.
12. **Hazy blob of light that shimmers on the screen.**
  - A. Open secondary on flyback winding.
  - B. Failure of some component in the high voltage section.
13. **Corners of the picture are missing:**
  - A. Yoke is too far back on the picture tube neck.
14. **Picture is too far up, down, or not centered properly:**
  - A. Metallic yoke tabs need to be adjusted.
15. **A shadowy image of the game remains on the screen, even after monitor is off:**
  - A. Picture tube has burnt phosphor.

**16. 2 amp fuses keep blowing:**

- A. Check the large heat-sinked power transistors.
- B. Check D608 and D708
- C. Check semiconductors, especially the transistors in the "X" and "Y" amplifiers.
- D. Bad yoke.

**17. Video information is distorted: letters and figures are "crinkly" — like crumpled paper, and it shakes slightly:**

- A. Bad 90 volt power being supplied by the EHT unit. If everything looks good, check the electrolytics.
- B. The regulator control (R905) may need adjusting.
  - On the Wells Gardner monitor, the anode voltage is supposed to read 14.5KV High Voltage. That's 14,500 volts with the beam current at zero. R905 adjusts this output voltage. To read this voltage, your meter needs a separate high voltage probe. Follow the directions **EXACTLY** as stated with the literature that comes with the probe. IF you don't,

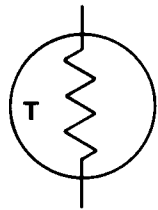
or you touch something you shouldn't, **you're dead**. If this scares you, have someone qualified (a technician) perform this adjustment for you. Better **SAFE** than sorry.

- In the case of the Electrohome monitor, the adjustment is complex and, of course, **potentially DANGEROUS**. Basically, the Electrohome anode voltage from the "flyback" and rectifier is supposed to be set at 12,000 volts with the beam current at zero. That's right — **THOUSANDS** of volts! To read this voltage, your meter needs a separate high voltage probe. Follow the directions **EXACTLY** as stated with the literature that comes with the probe. IF you don't or you touch something you shouldn't, **you're dead**. If this scares you, have someone qualified (a technician) perform this adjustment for you. Better **SAFE** than sorry.

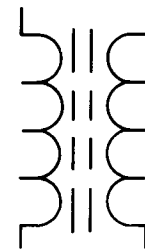
If you are still unsure, it may be best if you call Electrohome at (519) 744-7111 and obtain exact information from one of their staff engineers.

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## Guide To Schematic Symbols



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



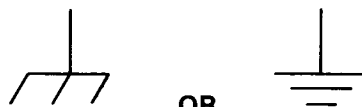
**IRON CORE TRANSFORMER**  
(SUCH AS A FLYBACK)



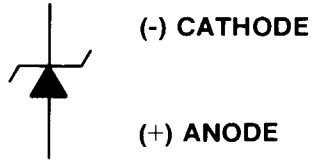
**INDUCTOR, COIL, CHOKE**  
(POLARITY DOESN'T MATTER)



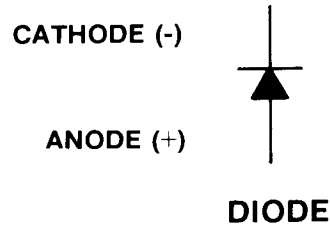
**FUSE**  
(POLARITY DOESN'T MATTER)



OR  
**GROUND**



**ZENER DIODE**



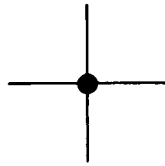
**DIODE**



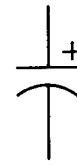
**VARIABLE RESISTOR, POT, CONTROL**  
(POLARITY DOESN'T MATTER)



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



**LINES ARE CONNECTED**



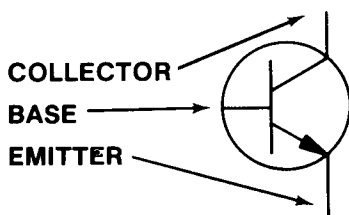
**ELECTROLYTIC CAPACITOR**



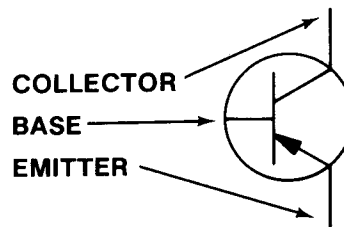
**LINES ARE NOT CONNECTED**



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



**NPN TRANSISTOR**



**PNP TRANSISTOR**

# 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 12,000 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 picture distortion may result from the wrong transistor being placed in the deflection circuitry. Component manufacturers offer specification sheets which are useful for "mixing and matching", but why go through all the trouble? Order exact replacement parts! Service your monitor on a nonconductive firm table like wood, **NOT METAL**, and take off all of your jewelry just in case. With all this in mind, you are ready to begin troubleshooting.

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

### **CAUTION:**

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

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

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

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

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

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

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

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

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

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

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

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## Theory of Operation

To understand what goes on inside the monitor, large general groups of circuits will be examined instead of laborously 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 best way to begin explaining the innards of the X-Y monitor is at its beginning or the inputs to the monitor. Ignoring the ground or common tie points for many of the components, which represents zero voltage, there is 30 volts AC going in pins seven and ten of P100 — the input jack. These voltages meet at DB100 which is a device that has four diodes in it. The 30 volts AC means the voltage and current alternate or jump up and down going positive and negative with zero voltage in between. DB100 and the capacitors immediately after it make up the power supply. Most of the circuits in the monitor can't use power that jumps up and down since your picture would do the same thing. DB100 chops up the wave form and capacitors C100 and C101 build up the power that DB100 chops up. The capacitors then

leak it out so the power is smooth and not varying. If any component fails in the circuit, the usual result is blown fuses, burning in this area, or just less power. The power supply starts the whole ball rolling, but remember that other circuits build up voltages that can be tapped for those circuits that need more than this thirty plus thirty volts AC from the game transformer.

### THE "X" AND "Y" AMPLIFIERS —

Let's go back to the input jack, P100, again. Along with the grounds and the two 30 volt AC inputs is the "X" and "Y" channel video information. The "X" input is about 10 volts AC and the "Y" input is about 7.5 volts AC. The "X" channel information represents parts of objects from **LEFT** to **RIGHT** on the screen. The "Y" channel information represents parts of objects from **TOP** to **BOTTOM** on the screen. To get **complete objects**, then, you **MUST** have both the "X" and "Y" inputs. If this is so, then why aren't the input voltages equal? Well, notice how a T.V. tube is shorter than it is wide? The up and down voltages ("Y" input =  $\pm 7.5$  volts AC) don't need as much as the side to side voltages ("X" input =  $\pm 10$  volts AC).

If we divide the picture into four quadrants, the responsibilities of the "X" and "Y" amplifiers may be seen more clearly:

The **upper left** quadrant is represented by "-X" and "+Y" information.

The **upper right** quadrant is represented by "+X" and "+Y" information.

The **lower left** quadrant is represented by "-X" and "-Y" information.

The **lower right** quadrant is represented by "+X" and "-Y" information.

So let's say your monitor only has the right side of the picture and the left side is missing. The top and bottom right of the screen has "+X", "+Y", and "-Y" information. The left side has "-X", "+Y", and "-Y" information. But since the right side is O.K., obviously the only information missing is "-X". Therefore, there's got to be a problem somewhere in the "X" amplifier.

From P100, the "X" or "Y" signals each go through a resistor and the linearity control of their respective channels. The Wells Gardner monitor only has **one** linearity control per channel while the Electrohome monitor has **two** linearity controls per channel. These controls are supposed to be set at the factory. But sometimes they need additional adjusting. The best way to do this is to get a test pattern on the monitor screen, remove the glue holding the control adjustments in place, vary the controls until the size is right and the lines are nice and straight, and then re-glue the control adjustments so they can not move.

After the linearity controls, the rest of the circuitry just corrects the signal for the picture tube and amplifies it. The output power transistors (two for each channel) are heat-sunked on the bottom or the side of the monitor chassis. These feed the "X" and "Y" signals in the form of current to the yoke. The yoke then puts out two invisible electromagnetic fields or forces. These fields pull the stream of electrons that is spit out of the neck of the picture tube to the various quadrants of the monitor screen where they will write or paint a picture. Just as you may use a magnet to pull nails across a table, so does the yokes magnetic field pull the electron beam all over the picture tube screen to write the picture. The "X" and "Y" information we talked about earlier is what tells the electron beam **WHERE** to write or paint the picture. When the electron beam hits the phosphor coating on the back side of the front of the picture tube or screen, the phosphor glows in proportion to the electron beam intensity. In other words, the more electrons in the beam, the brighter the light that comes from the screen of the picture tube where it is being hit by the electron beam. This varying beam intensity is the function of the "Z" amplifier.

## THE "Z" AMPLIFIER

At pin one of P100, the "Z" amplifier signal voltage is sent to the base of Q504 in the "Z" amplifier circuit. This circuit amplifies the AC "Z" signal and is then sent to the cathode of the picture tube. This varying "Z" signal voltage in turn varies the intensity of the electron beam producing at least eight different amounts of brightness or "eight gray scale steps" as the engineers would say.

In case the "X" and "Y" signals are missing, there is a 90 volt DC power failure — from the high voltage circuitry that feeds the "Z" amplifier, or if any other missing signal condition should occur, the "spot killer" circuitry comes on to effectively turn off the electron beam thus keeping the phosphor from being burned. At the same time, the light emitting diode turns on informing you of this. If the "spot killer" didn't come on when any of the above conditions exists, the electron beam wouldn't be moved around and the phosphor in the center of the screen would be burned from the intense electron beam that is hitting it without moving. Transistors Q500 through Q502 and their circuitry affect the voltages on Q503 to turn the beam current off. This **DOES NOT** mean you have automatic protection against CRT burns from too much brightness. In fact, it would probably be a good idea to keep the brightness and contrast controls **TURNED DOWN** to the point where the game looks good but not too bright. If the picture is way too bright, fine spider web-like retrace lines will follow the figures wherever they move and you are headed for a burnt CRT. The brightness control affects the DC voltage between the cathode and G1 of the picture tube. The contrast control varies the amount of signal to the cathode. Both control picture intensity.

## THE HIGH VOLTAGE GENERATOR — OR — EHT SUPPLY

On the side of your monitor is a box-like cage with a wire that goes to the CRT. This is the EHT supply. It performs several functions, one of which is to supply the high voltage for the CRT.

The input to the EHT supply is at pin eight of P900 where 40 volts AC is fed through a large resistor, R900. Actually, this is a **VERY** important resistor because it limits the current to the oscillator, keeping it from taking off on its own and increasing the high voltage to the point where X-rays are emitted from the CRT, which is **DEFINITELY NOT GOOD**.

Did we mention an oscillator? What's an oscillator? Well, in this case, it is made up of: transistor Q903, the primary winding of the "flyback" transformer, and a few other components that toss the voltage back and forth (oscillate) 25,000 times each second. By doing this, it electromagnetically induces a bigger voltage in the "flyback" transformers secondary winding



since it is bigger. This voltage is rectified (chopped up) by diode D904 to get 12,000 volts DC in Electrohome monitors and 14,500 volts DC in Wells Gardner monitors. This voltage is used to light up the CRT (picture tube). The other transistors, from Q900 to Q902 and their circuit components keep the power to the oscillator steady or regulated, as they say in engineering. There is an adjustment control, R905, to make certain the oscillator is fed the proper power.

The “flyback” transformer also has an additional secondary winding which generates more voltage to power other circuits. At pin three of P900 there is about 400 volts DC for focus voltage to the CRT. This can be adjusted with R909, the focus control. From pin five at the other side of the “flyback” transformer secondary winding, there is 90 volts DC for the “Z” amplifier circuit. In between pins three and five of P900 there are two diodes and capacitors that change the AC from the “flyback” secondary winding to DC just like the power supply. In fact, that’s just what it is, a “mini power supply”.

## THE CRT — (PICTURE TUBE)

The CRT has already been described indirectly. However, to make a picture or turn the CRT on, certain voltages are needed. Otherwise it won’t work. These are: about 6 volts AC (**note that’s AC**) is needed for the heater filament in the tube neck to light up; the electron beams intensity must be controlled by the “Z” amplifiers signal which is applied to the CRT’s cathode; there must be voltage at G1 of the CRT for brightness; there should be about 400 volts DC at G2; there should be focus voltage which varies but can go as high as 400 volts DC; and there should be high voltage at the anode of the CRT which runs into the **thousands of volts (this voltage can jump almost one inch - so BE CAREFUL!!)**

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 CRT or picture tube, 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 12,000 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.

## WHAT TO DO WHEN YOU DON’T KNOW WHAT TO DO — AND OTHER TIPS

If you are totally confused about where to begin to hunt for a problem, and can’t find the problem in the “SYMPTOM DIAGNOSIS” subsection, there may be another way to proceed.

Take a VOLT METER and (if possible) an oscilloscope and begin probing the jacks. You can start with the input jack to the monitor. Using the oscilloscope, make sure both the “X” and “Y” information is present (which it isn’t during the “SOUND” test).

**NOTE:** It is advisable to use one of the games test patterns (obtained when you put the game into the Self-Test mode) when using the oscilloscope. **The simple diamond one is a good choice.** This way the “X” and “Y” information at the above jack isn’t changing and a recognizable wave form is easy to see if it’s there. The DC voltages tend to jump around like crazy when the game is being played or is running through its ATTRACT mode, so, using the test pattern tends to keep them still.

Next, use the volt meter to make sure the other voltages are present at each pin. Similarly, you proceed to P500 on the deflection board, and P900 on the EHT unit to make sure all the correct voltages are present. Use the schematic to determine what the correct voltages should be.

Check the pins on the CRT to be sure the voltages are getting this far. If everything looks good to this point, perhaps the CRT is bad. **DO NOT** check the anode voltage unless you have a special high voltage probe or you may wind up repairing X-Y monitors in heaven.

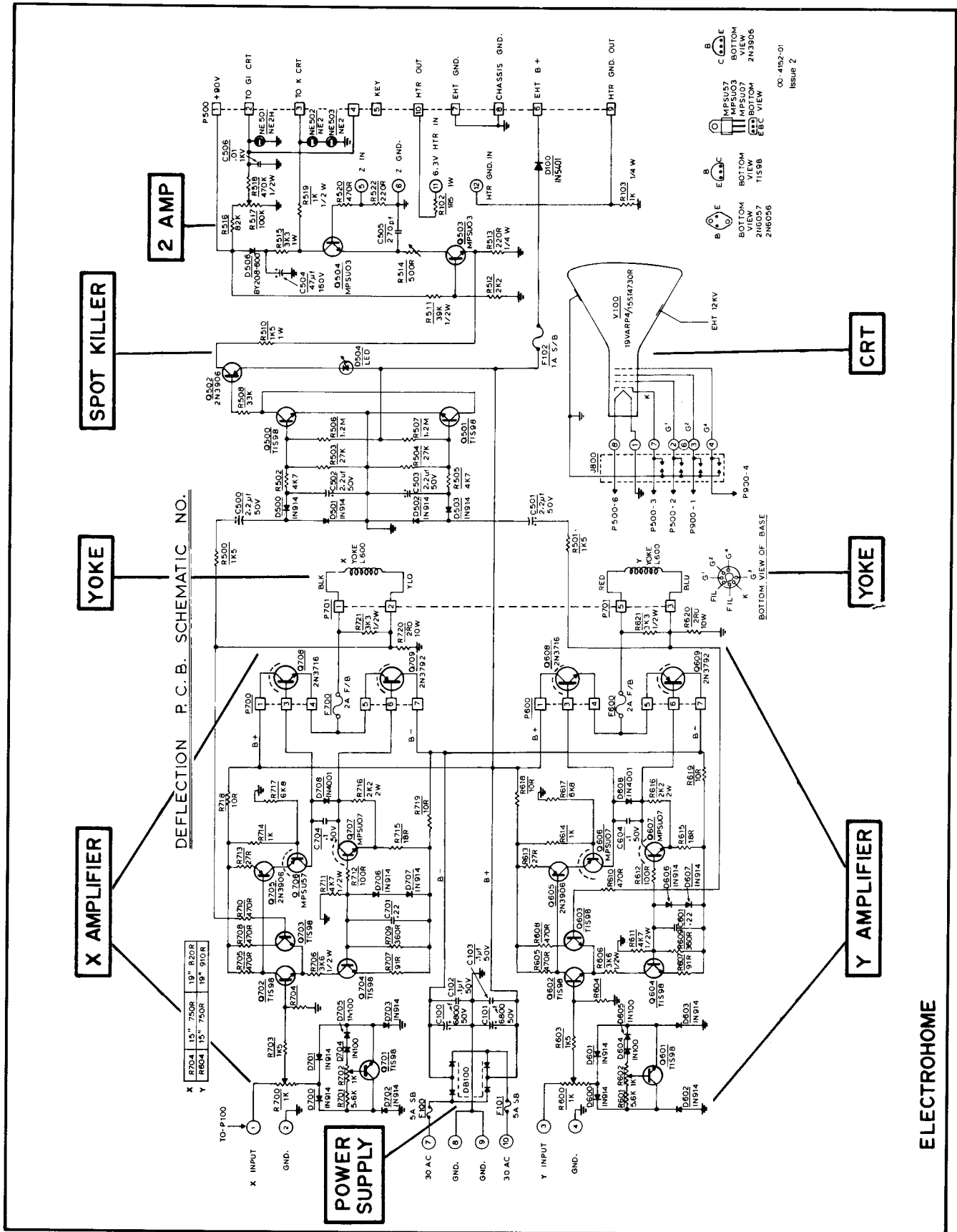
**DO NOT BE FOOLED** by the silent operation of the monitor. Regular T.V. sets and monitors buzz and crackle a lot when they're operating — this is normal for them. BUT, Vectorbeam monitors are noiseless unless something is wrong.

Whatever you do, **ALWAYS** read the literature that comes with any test equipment you use so that you will not damage the equipment, the monitor, and most of all **YOURSELF**.

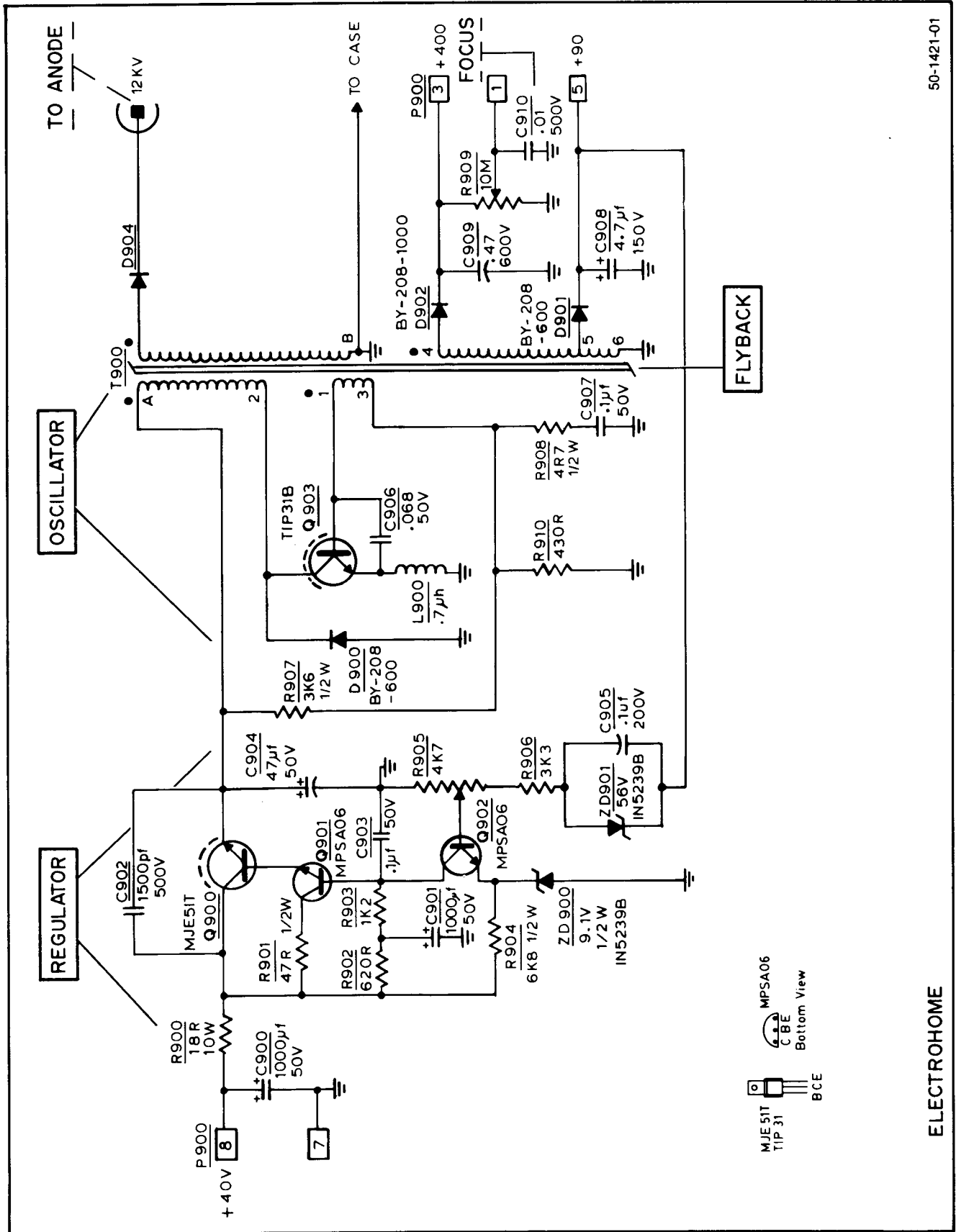
## **PARTS INTERCHANGEABILITY**

Quite a few of the parts between the Electrohome and the Wells Gardner monitors may be swapped. The CRT's for example are completely interchangeable. Also, many of the transistors used in each monitor are the same. Certain critical components in the power supply and the EHT unit are dangerous to interchange. The best thing to do is to compare both monitors parts lists to see if the descriptions of any two particular parts you want to swap match exactly. Substitution manuals are available for transistors and semiconductors, but you never know about them. Sometimes they work and sometimes they don't, depending on the critical circuit parameters. If in doubt, order exact replacement parts.

# Schematic — Deflection/Power/Z amp



# Schematic — EHT Supply



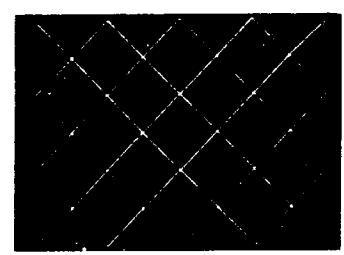
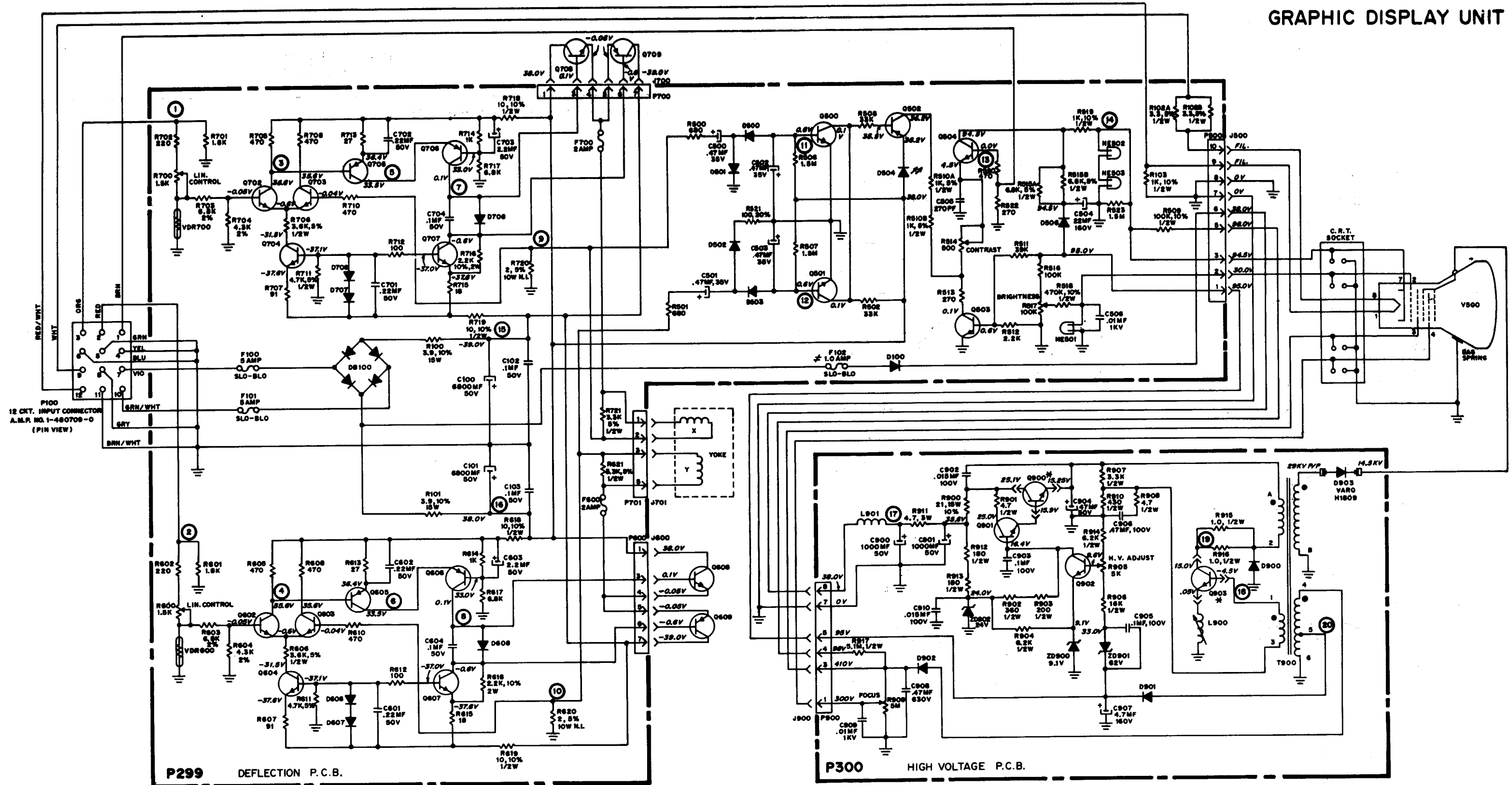
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ELECTROHOME

# NOTES

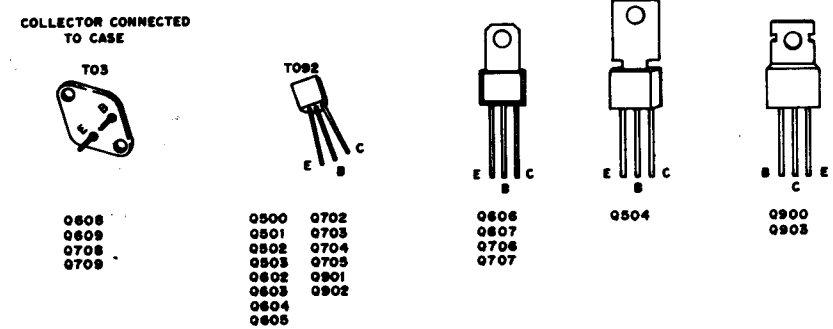
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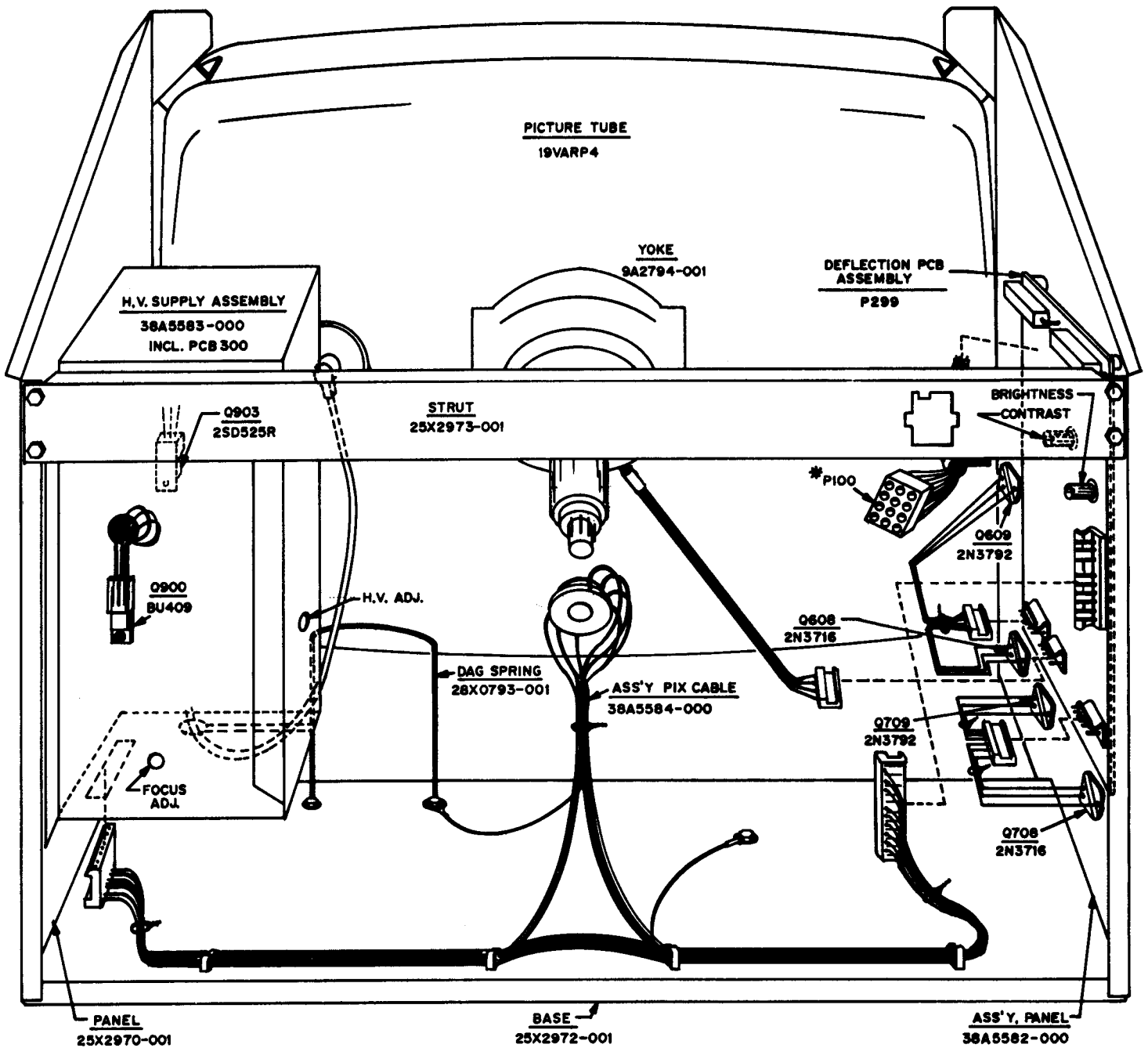
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Diagonal Crosshatch on CRT

**WELLS-GARDNER ELECTRONICS**

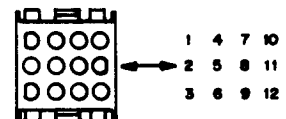




# INPUT CONNECTOR P100  
 12 CKT A.M.P. TYPE  
 A.M.P. NO. 1-480709-0

PIN NO.	COLOR	FUNCTION
1.	BRN.	"Z" INPUT
2.	RED	"Y" INPUT
3.	ORANGE	"X" INPUT
4.	YEL.	"Z" GND.
5.	GRN.	"Y" GND.
6.	BLUE	"X" GND.
7.	VIOLET	AC 30V RMS.
8.	GRAY	CENTER TAP (30V-0-30V) AC RMS
9.	WHITE	FILAMENT 6.8VAC RMS
10.	GRN/WHT.	AC 30V RMS.
11.	BRN/WHT.	GND. (MAIN POWER SUPPLY)
12.	RED/WHT.	FILAMENT 6.8 VAC RMS

P100 CONNECTOR NUMBERING



# Guide for Monitor Repair

by Bernie Barranger

Troubleshooting a monitor is not a matter of a thorough knowledge of the monitor circuitry. The first step in the troubleshooting process is to be able to identify the problem and then to proceed to the proper malfunctioning circuit. In some cases, such as a black screen, the malfunctioning circuit is unknown. Then the procedure is to start with the most common circuit and then by the process of elimination, locate the defective circuit.

The purpose of this article is to help you identify the symptom, guide you to the malfunctioning circuit and then to list the probable faulty components. This should eliminate most of the guessing and reduce the all-important element of troubleshooting time.

Proper identification of a symptom will require some knowledge of what comprises a picture. A picture is made up with four components:

1. The RASTER is the brightness of the entire screen. It can be black or very bright and is controlled by the brightness potentiometer.
2. The VIDEO portion of the picture is the white, black, and grey information superimposed on the Raster.
3. The VERTICAL is the motion from the top to the bottom of the screen.
4. The HORIZONTAL is the motion from the left to right of the screen.

Each picture component will have its own failure symptoms. So, we must define these symptoms.

1. VERTICAL COLLAPSE is seen as a narrow Raster line running from left to right. This is caused by no vertical motion.
2. VERTICAL ROLL is an unstable picture which moves up or down the screen.
3. HORIZONTAL TEAR appears as a picture which is diagonally torn in several places.
4. HORIZONTAL COLLAPSE is seen as a narrow Raster line running from top to bottom of the screen.
5. RETRACE LINES are four to eight thin white video lines running diagonally across the screen.

## Using the Charts

The charts are labeled by symptom as seen on the picture tube. For each symptom, probable faulty circuits are listed and then the suspected faulty components are shown.

When two symptoms appear at the same time, the charts can pinpoint the circuit. For example, a monitor exhibits a horizontal tear and a vertical roll. Looking at the charts, the only common circuit is the Sync Separator.

### HORIZONTAL TEAR

#### A. SYNC SEPARATOR CIRCUIT

1. SEPARATOR TRANSISTOR
2. AMPLIFIER TRANSISTOR
3. SHORTED DIODE
4. PHASE DIODES OPEN OR SHORTED
5. SHORTED CAPS

#### B. FEEDBACK INTEGRATOR CIRCUIT

1. CAPACITORS OPEN OR SHORTED
2. RESISTOR OPEN

### BLACK SCREEN—FUSE BLOWN

#### A. HORIZONTAL OUTPUT STAGE

1. OUTPUT TRANSISTOR SHORTED
2. DAMPER DIODE SHORTED
3. LIMITER DIODE SHORTED
4. HIGH VOLTAGE DIODE DEFECTIVE
5. HIGH VOLTAGE TRANSFORMER DEFECTIVE

#### B. LOW VOLTAGE POWER SUPPLY

1. BRIDGE DIODE(S) SHORTED
2. POWER TRANSFORMER—INTERNAL SHORT

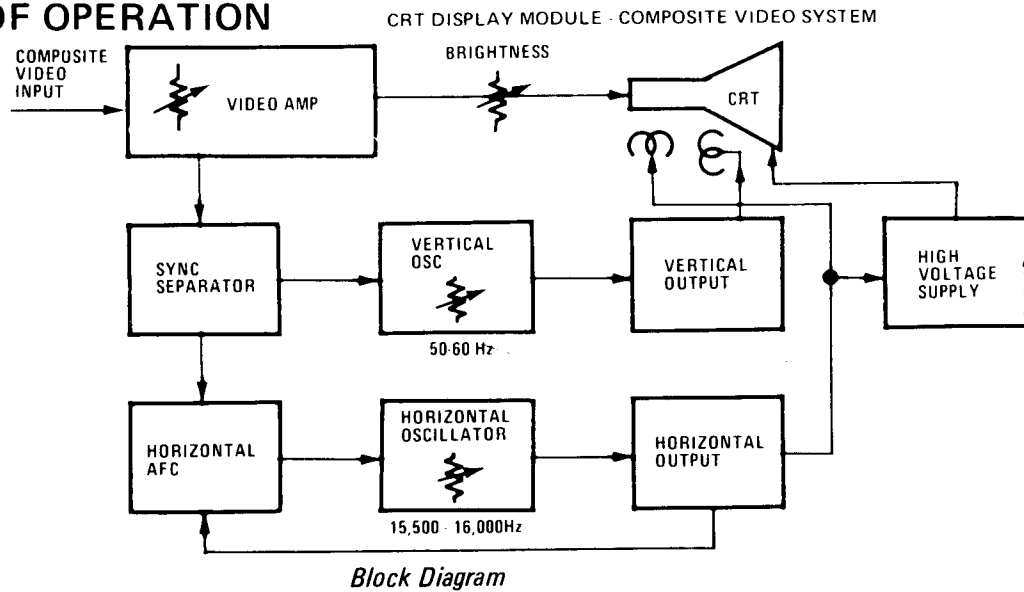
MOTOROLA XM501/ 701	MOTOROLA XM5000/ 7000	TEC	WELLS GARNER
Q5	Q10	Q301	Q206
Q1	Q11	Q400	Q201
D23			D201
D7	D5,6	D401,402	D205
C2			C201
C15,32	C12,14	C403,415	C207,210
R45	R24	R408	R216
Q9	Q9	Q403	Q103
D1	D7	D403	D106
D2	D8	D801	D206
D4	D11	D404	D105
T2	T2	T403	T102
D9,10,11,12	D16,17,18,19	D901—904	D101—104
T4	T3	T901	T101



	MOTOROLA XM501/ 701	MOTOROLA XM5000/7000	TEC	WELLS GARNER
<b>BLACK SCREEN—FUSE OK</b>				
A. HORIZONTAL OUTPUT CIRCUIT				
1. OUTPUT TRANSISTOR OPEN	Q9	Q9	Q403	Q103
2. HIGH VOLTAGE TRANSFORMER OPEN	T2	T2	T403	T102
3. HIGH VOLTAGE DIODE OPEN	D4	D11	D404	D105
4. OPEN B+ RESISTOR		R43	R420	
B. HORIZONTAL DRIVER CIRCUIT				
1. TRANSFORMER OPEN	T1	T1	T402	T201
2. DRIVER TRANSISTOR OPEN OR SHORTED	Q8	Q8	Q402	Q209
C. PULSE SHAPER CIRCUIT				
1. SHAPER TRANSISTOR OPEN OR SHORTED	Q7	Q7		Q208
D. HORIZONTAL OSCILLATOR CIRCUIT				
1. OSCILLATOR TRANSISTOR OPEN OR SHORTED	Q6	Q6	Q401	Q207
2. TRANSFORMER DEFECTIVE	L1	L1	T401	L201
3. CAPACITORS OPEN	C18,19	C18,19	C408,409	C213,214
E. CRT AND SOCKET				
1. SPARK GAP SHORTED	PIN 2	PIN 2	PIN 6	PIN 2
2. SOCKET WIRE OPEN	PIN 2	PIN 2	PIN 6	PIN 2
<b>LOW VOLTAGE POWER SUPPLY TOO LOW</b>				
A. REFERENCE AMPLIFIER				
1. REFERENCE ZENER LOW	D6	D20	D906	ZD201
2. REFERENCE TRANSISTOR SHORTED	Q15	IC1,Q19	Q903	Q204
B. SERIES PASS AMPLIFIER				
1. DRIVER TRANSISTOR OPEN	Q14	Q18	Q902	Q102
2. SERIES PASS TRANSISTOR OPEN	Q16	Q17	Q901	Q101
<b>LOW VOLTAGE POWER SUPPLY TOO HIGH (NOTE 1)</b>				
A. REFERENCE AMPLIFIER				
1. REFERENCE ZENER OPEN	D6	D20	D906	ZD201
2. REFERENCE TRANSISTOR OPEN OR LEAKY	Q15	IC1,Q19	Q903	Q204
B. SERIES PASS AMPLIFIER				
1. DRIVER TRANSISTOR SHORTED	Q14	Q18	Q902	Q102
2. SERIES PASS TRANSISTOR SHORTED	Q16	Q17	Q901	Q101
<b>RASTER CANNOT BE TURNED OFF, RETRACE LINES</b>				
A. LOW VIDEO OUTPUT STAGE POWER SUPPLY VOLTAGE				
1. DIODE BREAKDOWN TOO LOW	D5	D10	D207	D107
2. CAPACITOR OPEN	C43D	C32D	C220	C101D
B. VIDEO OUTPUT CIRCUIT				
1. VIDEO OUTPUT TRANSISTOR LEAKY	Q3	Q5	Q202	Q203
2. VIDEO DRIVER TRANSISTOR LEAKY	Q4	Q4	—	Q205
3. BLANKING DIODE LEAKY	—	—	D204	—
C. CRT SOCKET				
1. SPARK GAP SHORTED	PIN 7 IN SOCKET	PIN 7 IN SOCKET	PIN 7 Z-801	PIN 7 IN SOCKET
2. OPEN BRIGHTNESS CONTROL	R-21			R-121
3. NO VOLTAGE TO BRIGHTNESS CONTROL	R-21			R-121
D. SPOT KILLER				
1. TRANSISTOR SHORT	Q21			
<b>NO OR DISTORTED VIDEO, RASTER OK</b>				
A. VIDEO OUTPUT CIRCUIT				
1. VIDEO OUTPUT TRANSISTOR HAS LOW GAIN	Q3	Q5	Q202	Q203
2. VIDEO DRIVER TRANSISTOR HAS LOW GAIN	Q4	Q4	—	Q205
3. COUPLING CAPACITOR SHORTED OR OPEN	—	—	C208	—
4. BYPASS CAPACITOR OPEN OR SHORTED	C6	C5	C207	C204
5. ZENER DIODE OPEN OR SHORTED	—	D1,D3	—	—

	MOTOROLA XM501/701	MOTOROLA XM5000/7000	TEC	WELLS GARNER
<b>B. AMPLIFIER CIRCUIT</b>				
1. VIDEO TRANSISTOR DEFECTIVE	Q2	Q2,3	Q201	Q202
2. COMPENSATION DIODES SHORTED OR OPEN	D8,13	—	—	D202,203
3. COUPLING CAPACITORS OPEN OR SHORTED	C4	C3,4	C203,205	C221
4. CONTRAST POT OPEN	R5	R6	R211	R116
<b>C. VIDEO INPUT CIRCUIT</b>				
1. VIDEO INPUT TRANSISTOR DEFECTIVE	Q1	Q1	Q200	Q201
2. INPUT COUPLING CAPACITOR OPEN OR SHORTED	C1	C1	C201	C202
<b>NO RASTER—VIDEO VISIBLE</b>				
<b>A. CRT CIRCUIT</b>				
1. BRIGHTNESS CONTROL OPEN		R73	R803	
2. SPARK GAP SHORTED OR OPEN LEAD		PIN 2	Z-802	
3. NO VOLTAGE TO BRIGHTNESS CONTROL		R73	R803	
<b>VERTICAL ROLL</b>				
<b>A. SYNC INTEGRATOR CIRCUIT</b>				
1. SYNC INTEGRATOR TRANSISTOR(S)		Q12,13		
2. INTEGRATOR CAPACITORS SHORT OR OPEN	C34,35	C34,35	C306,307	C226,227
<b>B. SYNC SEPARATOR CIRCUIT</b>				
1. SYNC SEPARATOR TRANSISTOR(S)	Q5	Q10,11	Q301	Q206
<b>C. INPUT VIDEO CIRCUIT</b>				
1. VOLTAGE TRANSIENT DIODE SHORTED	D23			D201
2. BYPASS CAPACITOR SHORTED OR OPEN	C2			C201
<b>D. VERTICAL OSCILLATOR CIRCUIT</b>				
1. VERTICAL OSCILLATOR TRANSISTOR(S)	Q10,11	D12	Q302	Q217,210
2. RAMP CAPACITORS	C37,38	C37,38	C313,314	C231
<b>HORIZONTAL COLLAPSE</b>				
<b>A. HORIZONTAL YOKE CIRCUIT</b>				
1. COUPLING CAPACITOR OPEN	C29	C25	C418	C105
2. LINEARITY COIL OPEN	L3	L3	L406	L202
3. WIDTH COIL OPEN	L4	L2	L405	L101
4. YOKE OPEN	L5	L4A	L401	NO NUMBER
<b>VERTICAL COLLAPSE</b>				
<b>A. VERTICAL OUTPUT CIRCUIT</b>				
1. VERTICAL OUTPUT TRANSISTOR(S)	Q13	Q15	Q304,305	Q215,216
2. COUPLING CAPACITOR OPEN		C40	C317	C234
3. OUTPUT TRANSFORMER OPEN	T3	—	—	—
4. CHOKE OPEN	—	L5	—	—
5. YOKE OPEN	L5	L4B	L401	NO NUMBER
<b>B. VERTICAL DRIVER CIRCUIT</b>				
1. DRIVER TRANSISTOR(S) OPEN OR LEAKY	Q12	Q14	Q303	Q211,212, 213,214
<b>C. VERTICAL OSCILLATOR CIRCUIT</b>				
1. OSCILLATOR TRANSISTOR(S) OPEN OR LEAKY	Q10,11	D12	Q302	Q210,217
2. RAMP CAPACITOR(S) OPEN OR SHORTED	C37,38	C37,38	C313	C231
3. HEIGHT CONTROL OPEN	R65	R60	R321	R256
4. VERTICAL HOLD CONTROL OPEN	R82	NONE	R319	R108
<b>D. VERTICAL POWER SUPPLY IS LOW OR HIGH</b>				
1. SHORTED CAPACITOR(S)	C33,36	—	C419	—
2. ZENER OPEN OR SHORTED	—	D21	—	—
3. DIODE OPEN OR SHORTED	—	D23	D203	—
4. RESISTOR(S) OPEN	R50,55,56	R95	R421	—

## THEORY OF OPERATION



## TV MONITOR PROCEDURES

The three main monitor problems are (1) no raster and no picture, (2) raster and no picture and (3) a distorted picture. The aim of this section is to instruct you how to tell if the monitor is definitely malfunctioning; we are not going to delve any deeper into monitor troubleshooting. Once you have determined that your monitor is behaving incorrectly, you have two choices: (1) you may remove it and take it to a local TV repair shop and (thereby saving yourself the headache) or

(2) you can take two aspirin tablets and try to fix it yourself. Generally speaking, TV repair is best handled by those who know what they are doing and have the necessary TV repair instruments (a scope, VTVM, and some signal-generating equipment). If you do know something about TV repair and have the necessary equipment, turn to the Motorola repair manual. This manual is quite complete, and contains a nicely written theory of operation section as well.

**NO RASTER, NO PICTURE** -- First, check to see if the filament in the rear of the CRT is glowing. If not, proceed to check the line voltage at the monitor. Be aware that the monitor is fused separately, so check its own fuse. If it is hard to tell that the fuse is good, turn off all power, remove the fuse, and test it with the VOM. If the fuse is good and the filament will not glow, troubleshoot the monitor's and CRT's power supply, or take the TV elsewhere to be repaired.

**RASTER, BUT NO PICTURE** -- If you have a correct raster (that pattern of lines generated by an unmodulated electron beam) but no video display, you may have any one of the following problems: (1) the PCB may not be outputting the video information, (2) the PCB is functioning correctly, but the monitor is not receiving the signal or (3) the monitor is receiving the information but is not processing it correctly.

There are many techniques for differentiating between the good and malfunctioning components. The substitution technique is widely used. In this case, plug the PCB into your test fixture or another identical game and if the game video display comes up on the screen, the other TV must be malfunctioning. Or, if you are at a location with two video games and no test equipment, run some jumpers from the PCB of the suspected game to the monitor of the other, or vice versa.

The TV sync probe will be of no value in this case since it can only verify the presence of sync signals. It is not sensitive to video signals and will give no indication of their presence.

Another quick and dirty monitor test is as follows: disconnect the PCB edge connector and turn the monitor brightness all the way up. Touch your finger to the video input line somewhere and, if the monitor is OK, your body capacitance should cause faint vertical columns to appear on the CRT.

# NOTES

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This space is provided for personal notes



## REPLACEMENT PARTS LIST

REF. NO.	PART NUMBER	DESCRIPTION	REF. NO.	PART NUMBER	DESCRIPTION
<b>ELECTRICAL PARTS</b>			<b>COILS &amp; CHOKES</b>		
	1Y25017A01	MONITOR PANEL: complete; KT364LM	L-1	24D68822A08	HORIZ SET
	1Y25017A02	POWER, Audio Panel: complete; KT365LM	L-2	24D68801A67	COMPENSATING: 2000 uh
<b>CAPACITORS</b>			L-3	24D69163A18	HORIZ LINEARITY
C-1	23C65282A41	50 mf 50V Lytic	L-4	24V25000A74	HORIZ WIDTH: incl C42 & R68
C-2	23C65282A41	50 mf 50V Lytic	L-5	24D68523A15	DEFLECTION YOKE
C-3	21S180D10	220 pf 20% 100V X5F (Use 21R132503)	<b>TRANSISTORS</b>		
C-4	23C65282A41	50 mf 50V Lytic	Q-1	48S137171	1st VIDEO: A6H
C-5	21S180B98	180 pf 10% 500V X5F	Q-2	48S137127	2nd VIDEO: P2S
C-6	23S10255A78	470 mf 16V Lytic	Q-3	48S134919	VIDEO OUTPUT: A1M
C-7	21S180C01	680 pf 10% 500V X5F	Q-4	48S137317	VIDEO DRIVER: A8H
C-8	21S180B85	560 pf 10% 500V X5F	Q-5	48S137115	SYNC SEPERATOR: A5U
C-10	8S10191B67	.22 mf 10% 250V Polyester	Q-6	48S137172	HORIZ OSCILLATOR: A6J
C-11	8S10191A54	.0068 mf 10% 160V Polyester	Q-7	48S137127	HORIZ PULSE SHAPER: P2S
C-12	21S180D10	220 pf 20% 100V X5F (Use 21R132503)	Q-8	48S137093	HORIZ DRIVER: A5F
C-13	21S131625	330 pf 10% X5F	Q-9	48S137203	HORIZ OUTPUT: A6Z
C-15	21S180C41	.0027 mf 10% 500V Z5F (Use 21K121699)	Q-10	48S137173	VERT OSCILLATOR (1): P2W
C-16	23S10229A07	1.0 mf +40-20% 15V Lytic (Use 23C43280A17)	Q-11	48S137171	VERT OSCILLATOR (2): A6H
C-17	8S10191B90	.033 mf 10% 160V Polyester	Q-12	48S137115	VERT DRIVER: A5U
C-18	8S10299A73	.01 mf 10% 100V Poly carb	Q-13	48S134900	VERT OUTPUT: A1C
C-19	8S10299A74	.0082 mf 10% 160V Poly carb	Q-14	48S134952	REGULATOR DRIVER: A2J
C-20	8S10191B98	.01 mf 10% 250V Polyester	Q-15	48S137315	REFERENCE AMP: A8G
C-21	21S180B51	.001 mf 10% 500V X5F	Q-16	48S137368	REGULATOR: A8W
C-22	8S10191B98	.01 mf 10% 160V Polyester	Q-17	48S137172	AUDIO DRIVER: A6J
C-23	21S180C02	10 pf 10% N150	Q-18	48S137168	AUDIO OUTPUT: P2V
C-24	23D65282A40	150 mf 10V Lytic	Q-19	48S137169	5V REGULATOR, Driver: A6G
C-25	21S180B51	.001 mf 10% 500V X5F	Q-20	48S137344	5V REGULATOR: A8U
C-26	8S10212B53	.47 mf 10% 630V Mtlz Poly	Q-21	48S137476	SPOT KILLER: B1E
C-27	8S10212A11	1.0 mf 10% 630V Mtlz Poly	<b>CONTROLS</b>		
C-28	8S10571A06	.01 mf 5% 1200V Poly Prop Foil	R-5	18D68222A34	CONTRAST: 250 Ohm
C-29	8S10571A23	.56 mf 10% 250V Mtlz Prop Foil	R-10	18D66401A44	VIDEO BIAS: 4K
C-30	8S10191A32	.047 mf 10% 250V Polyester	R-17	18D67858A12	FOCUS: 2 meg
C-31	21S180B87	220 pf 10% 500V X5F	R-21	18D68222A35	BRIGHTNESS: 200K
C32	21S180D34	.005 mf 20% 1KV Z5F (Use 21S180D31)	R-34	18D68222A37	HORIZ HOLD: 25K
C-33	8S10212A69	.47 mf 10% 100V Mtlz Poly	R-59	18D66401A44	VERT LINEARITY: 4K
C-34	8S10191A32	.047 10% 250V Polyester	R-65	17D65820A38	VERT SIZE: 15 Ohm
C-35	8S10191B98	.01 mf 10% 250V Polyester	R-74	17D65820A37	REGULATOR ADJUST: 2K
C-36	23S10255A69	4.7 mf 100V Lytic	R-82	18D68222A36	VERT HOLD: 3K
C-37	8S10212A20	2.2 mf 10% 100V Mtlz Poly	R-85	18D68222A34	VOLUME: 250 Ohm
C-38	8S10212A20	2.2 mf 10% 100V Mtlz Poly	<b>RESISTORS</b>		
C-39	8S10191B67	.22 mf 10% 250V Polyester	R-1	6S127633	470 10% 1/2W
C-40	8S10212A10	1.0 mf 10% 100V Mtlz Poly (Use 8S10191A46)	R-2	6S125568	22K 10% 1/2W
C-41	8S10064A06	.01 mf 10% 600V Mylar	R-3	6S127541	56K 10% 1/2W
C-42	21S180A71	470 pf 10% 500V X5F	R-4	6S127633	470 10% 1/2W
C43	23C65807A47	400 mf/125V; 600 mf/50V; 20 mf/200V Lytic	R-6	6S128955	1500 10% 1W
C-44	21S180E60	.01 mf +80-20% 50V Z5V	R-7	6S121847	4700 10% 1/2W
C-47	*23C65807A52	5000 mf 20V Lytic	R-8	6S122445	1800 10% 1/2W
C-49	23S10255A31	470 mf 40V Lytic	R-9	6S119926	2700 10% 1/2W
C-50	23D65282A41	50 mf 50V Lytic	R-11	6S128226	120 10% 1/2W
C-51	23S10255B43	40 mf 100V Lytic	R-12	6S127633	470 10% 1/2W
<b>DIODES &amp; RECTIFIERS</b>			R-13	17S10731A02	7500 5% 5W WW
D-1	48S134921	DIODE, Silicon: D1D; Damper	R-14	6S124797	150 10% 1/2W
D-2	48S134978	DIODE, Silicon: D1K; Pulse Limiter	R-15	6S127516	82 10% 1/2W
D-3	48D67120A11	DIODE, Low Power	R-18	-----	Part of CRT socket assembly
D-4	48S137114	RECTIFIER, H. V.: Silicon: D2Y	R-19	-----	Part of CRT socket assembly
D-5	48S191A05	RECTIFIER, Silicon: 91A05 (Use 48S191A07)	R-20	-----	Part of CRT socket assembly
D-6	48S137469	DIODE, Silicon: zener; D7G	R-22	6S129296	270K 10% 1/2W
D-7	48S134917	DIODE, Dual: D1C; Detector	R-23	6S10053C67	27K 5% 1/2W
D-8	48S67120A11	DIODE, Low Power	R-24	6S127538	3.3 meg 10% 1/2W
D-9	*48S191A10	RECTIFIER, Silicon: 91A10	R-25	6S121300	27K 10% 1/2W
D-10	48S191A10	RECTIFIER, Silicon: 91A10	R-26	6S127541	56K 10% 1/2W
D-11	48S101A10	RECTIFIER, Silicon: 91A10	R-27	6S129875	2200 10% 1/2W
D-12	48S191A10	RECTIFIER, Silicon: 91A10	R-28	6S125531	180K 10% 1/2W
D-13	48D67120A11	DIODE, Low Power	R-29	6S125531	180K 10% 1/2W
D-14	48S191A05	RECTIFIER, Silicon: 91A05 (Use 48S191A07)	R-30	6S125892	47K 10% 1/2W
D-15	48S191A05	RECTIFIER, Silicon: 91A05 (Use 48S191A07)	R-31	6S125534	100K 10% 1/2W
D-16	48S191A05	RECTIFIER, Silicon: 91A05 (Use 48S191A07)	R-32	6S124506	3300 10% 1/2W
D-17	48S191A05	RECTIFIER, Silicon: 91A05 (Use 48S191A07)	R-33	6S10053C53	6800 5% 1/2W
D-18	48S191A05	RECTIFIER, Silicon: 91A05 (Use 48S191A07)	R-35	6S127541	56K 10% 1/2W
D-19	48D67120A11	DIODE, Low Power	R-36	6S125545	390 10% 1/2W
D-20	*48S10641D43	DIODE, Silicon: D4.3	R-37	6S121301	1000 10% 1/2W
D-21	48D67120A11	DIODE, Low Power	R-38	6S10053C33	1000 5% 1/2W
D-22	48S191A05	RECTIFIER, Silicon: 91A05 (Use 48S191A07)	R-39	6S127516	82 10% 1/2W
D23	48S191A05	RECTIFIER Silicon: 91A05 (Use 48S191A07)	R-40	6S127547	1000 10% 1W
<b>FUSES</b>			R-41	6S127099	220 10% 1/2W
F-1	65S139424	FUSE: 1A-250V	R-42	6S127513	1500 10% 1/2W
F-2	65S139424	FUSE: 1A-250V	R-43	17S10130B07	1500 10% 3W fxd mtl film
<b>INTEGRATED CIRCUITS</b>			R-44	17S744356	2.2 10% 2W v'w
IC-1	*51S10732A01	INTEGRATED CIRCUIT: T3F	R-45	6S120141	150K 10% 1W
			R-46	6S127634	33K 10% 1W
			R-47	6S128229	680K 10% 1/2W
			R-48	6S10053D21	4.7 meg 10% 1/2W
			R-49	6S124797	150 10% 1/2W
			R-50	6S10053C45	3300 5% 1/2W
			R-52	6S124506	3300 10% 1/2W
			R-53	6S129874	68 10% 1/2W
			R-54	6S131972	39 10% 1/2W
			R-55	6S10053C65	22K 5% 1/2W
			R-56	6S125535	39K 10% 1/2W
			R-57	6S124506	3300 10% 1/2W
			R-58	6S129793	82K 5% 1/2W
			R-60	6S129875	2200 10% 1/2W
			R-61	6S10053F29	820 10% 1W
			R-62	6S127515	3900 10% 1/2W

## REPLACEMENT PARTS LIST

REF. NO.	PART NUMBER	DESCRIPTION	REF. NO.	PART NUMBER	DESCRIPTION
R-63	6S121301	1000 10% 1/2W			
R-64	17S10130C91	10 10% 1/2W (special)	E-1	50V25008A22 65S139451	SPEAKER: 4" PM; incld D22 LAMP: No. 1436
R-66	6S129064	4700 10% 1W	<b>MECHANICAL PARTS</b>  9D66133A28 CAP, SS Rect (HV Transformer - PRI/SEC lead) 42B25 158A01 CLAMP, Metal: Defl Yoke Mtg 31D70080B04 CONNECTOR, PC panel: 9 contact; on chassis S-2 *15S10390A06 CONNECTOR, PC panel: 12 contact; less key and contacts (power-audio panel) P-1 *15S10183A69 CONNECTOR, Plug: 12 contact; less contacts (power) *39S10184A63 CONTACT, Plug: for power connector 15S10183A69 39S10184A22 CONTACT: for S2 connector 15S10630A01 COVER, nylon: slide switch; SW1 *7S10609A03 GROMMET, Plastic: PC panel mtg 26C66745A05 HEAT SINK: Q3 *26C25 198A01 HEAT SINK: Q20 9C66238A02 HOLDER, Fuse: F1 & F2 14A562353 INSULATOR, Mica: Transistor socket; Q9, Q13, Q16 & Q20 (Use 14A543810) 28S10733A01 KEY, Plug: for S2 connector 2S7051 NUT, hex: 3/8-32; control mtg 5S10281A03 RIVET, drive pin: nylon; HV transf mtg 47C66082A03 ROD, Adjustment: width coil; L4 3S136050 SCREW, tpg: 6-20 x 1/2 clu pan hd; Q9, Q13, Q16 & Q20 9S10143A41 SOCKET, lamp: E1 9D67555V27 SOCKET, CRT: incld leads & resistors *9D25201A01 SOCKET, HV Rectifier (4): complete; incld 2nd anode lead & cup 9C63825A01 SOCKET, transistor: Q9, Q13, Q16 9C63825A02 SOCKET, transistor: Q20 41D65987A01 SPRING, special: CRT aquadag grnd 66P65173A47 TOOL, contact removal (S2 connector)		
R-67	6S122848	18K 10% 1/2W			
R-68	6S124797	150 10% 1/2W			
R-69	17S647132	1200 10% 5W WW (Use 17S136197)			
R-71	6S119926	2700 10% 1/2W			
R-72	6S124551	15K 10% 1/2W			
R-73	6S129875	2200 10% 1/2W			
R-75	6S121301	1000 10% 1/2W			
R-76	6S124506	3300 10% 1/2W			
R-77	6S129221	100 10% 1/2W			
R-78	6S127005	5600 10% 1/2W			
R-79	17S135589	150 10% 10W WW			
R-81	6C66263A08	VARISTOR (Use 6S66263A16)			
R-86	6S127099	220 10% 1/2W			
R-88	6S121301	1000 10% 1/2W			
R-89	---	Part of CRT Socket			
R-90	6S131412	56 10% 1/2W			
R-91	6S10053C39	1800 5% 1/2W			
R-92	6S10053C57	10K 5% 1/2W			
R-95	6S125568	22K 10% 1/2W			
R-96	6S125568	22K 10% 1/2W			
R-97	6S121847	4700 10% 1/2W			
R-98	6S127099	220 10% 1/2W			
R-99	6S128226	120 10% 1/2W			
<b>SWITCHES</b>					
SW-1	40S10624A01	SWITCH, Slide: DPDT (115V-230V)			
<b>TRANSFORMERS</b>					
T-1	25D67440A03	HORIZ DRIVER			
T-2	24D69791A21	H. V. TRANSFORMER: complete			
T-3	25D65840A22	VERT OUTPUT (Use 25D65840B23)			
T-4	*25D68164A31	POWER			
<b>MISCELLANEOUS ELECTRICAL PARTS</b>					
V-1	20WP4 23JEP4	CRT (XM501-10 19VP111) CRT (XM701-10 23VP111)			

\* DENOTES NEW ITEM APPEARING ON ANY LIST FOR FIRST TIME.

**MOTOROLA PARTS DEPT.**  
**MOTOROLA INC.**  
**1155 HARVESTER RD.**  
**WEST CHICAGO, IL 60185**  
**PHONE (312) 231-4400**

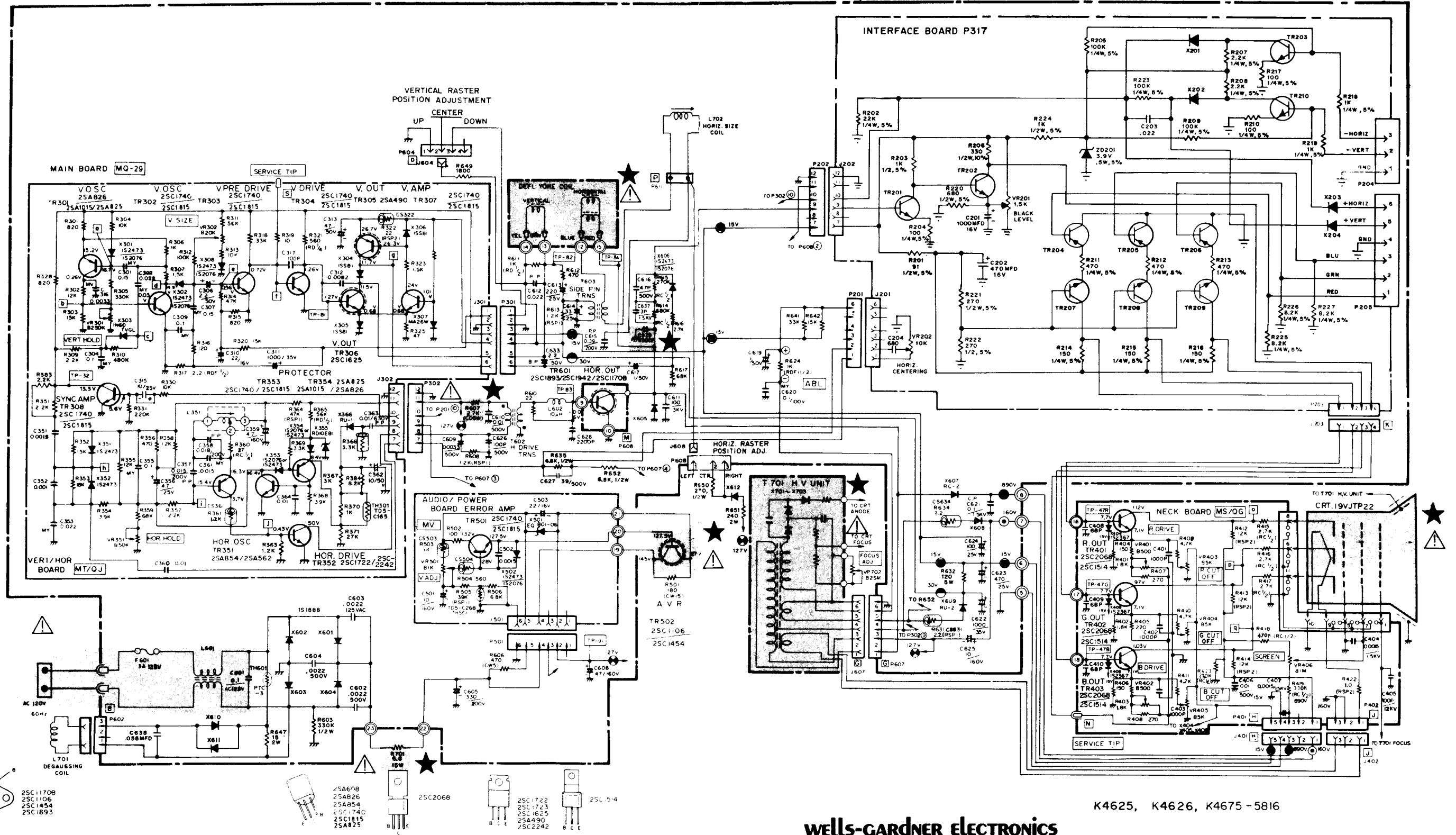


# NOTES

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# 19" COLOR MONITOR SCHEMATIC DIAGRAM



K4625, K4626, K4675-5816

**WELLS-GARDNER ELECTRONICS CORPORATION**

2701 NORTH KILDARE AVENUE  
CHICAGO, ILLINOIS 60639

## NECK BOARD (MS/QG)

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
<b>RESISTORS</b>					
R401	203X6500-709	1.8k Ohm ± 5% 1/8W Carbon	C403	202X7000-247	1000 pF, 50V, 10% Ceramic
R402	203X6500-709	1.8k Ohm ± 5% 1/8W Carbon	C404	202X7110-019	1500 pF, 2kV ± 10% Ceramic
R403	203X6500-709	1.8k Ohm ± 5% 1/8W Carbon	C405	202X7150-018	100 pF, 12kV, ± 10% Ceramic
R404	203X6500-447	150 Ohm ± 5% 1/8W Carbon	C406	202X7050-483	.01 uF, 500V, ± 10% Ceramic
R405	203X6500-481	220 Ohm ± 5% 1/8W Carbon	C407	202X7110-019	1500 pF, 2kV ± 10% Ceramic
R406	203X6500-447	150 Ohm ± 5% 1/8W Carbon	C408	202X8000-550	68 pF, 50V, ± 10% Ceramic
R407	340X2271-934	270 Ohm ± 5% 1/4W Carbon	C409	202X8000-550	68 pF, 50V, ± 10% Ceramic
R408	203X6500-508	270 Ohm ± 5% 1/8W Carbon	C410	202X8000-550	68 pF, 50V, ± 10% Ceramic
R409	203X6500-800	4.7k Ohm ± 5% 1/8W Carbon			
R410	203X6500-800	4.7k Ohm ± 5% 1/8W Carbon			
R411	203X6500-800	4.7k Ohm ± 5% 1/8W Carbon			
R412	203X9104-809	12k Ohm ± 5% 2.0W Metal Oxide			
R413	203X9104-809	12k Ohm ± 5% 2.0W Metal Oxide			
R414	203X9104-809	12k Ohm ± 5% 2.0W Metal Oxide			
R415	203X5601-313	2.7k Ohm ± 10% 1/2W Comp.	TR401	200X3206-800	Transistor, 2SC2068, 2SC1514 (R output)
R416	203X5601-313	2.7k Ohm ± 10% 1/2W Comp.	TR402	200X3206-800	Transistor, 2SC2068, 2SC1514 (G output)
R417	203X5601-313	2.7k Ohm ± 10% 1/2W Comp.	TR403	200X3206-800	Transistor, 2SC2068, 2SC1514 (B output)
R418	203X5602-254	470k Ohm ± 10% 1/2W Comp.			
R419	203X5602-185	330k Ohm ± 10% 1/2W Comp.	X404	201X2100-126	Diode, IS2367 (protector)
R422	203X9105-117	1.0 Ohm ± 10% 2W Metal Oxide	X405	201X2100-126	Diode, IS2367 (protector)
R423	203X5102-155	270k Ohm ± 5% 1/4W Carbon	X406	201X2100-126	Diode, IS2367 (protector)
VR401	204X2115-014	500 Ohm Varistor R Drive			
VR402	204X2115-014	500 Ohm Varistor B Drive			
VR403	204X2115-006	5k Ohm Varistor R Cutoff			
VR404	204X2115-006	5k Ohm Varistor G Cutoff			
VR405	204X2115-006	5k Ohm Varistor B Cutoff			
VR406	204X2000-025	1M Ohm Varistor Screen			
<b>CAPACITORS</b>					
C401	202X7000-247	1000 pF, 50V, 10% Ceramic	J401	206X5003-729	Socket, 5 Pin
C402	202X7000-247	1000 pF, 50V, 10% Ceramic	J402	206X5003-983	Socket, 3 Pin
			P401	204X9600-329	Plug, 5 Pin
			P402	204X9600-254	Plug, 3 Pin
<b>SEMICONDUCTORS</b>					
<b>MISCELLANEOUS</b>					

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

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

△★ 88X-0129-506 38A5554-000 205X9800-256 △★ 202X1110-810 208X2000-946 297X2000-072 6A0397 9A2753-003	19VJTP22 Pix Tube Assy. Purity Shld/Degaussing Lateral/Purity Assembly Yoke, Deflection CRT Socket HV Unit (T701) Plug, Line Cord Degaussing Coil (L701)
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# INTERFACE BOARD (P317)

## RESISTORS

R201	340X3910-934	91 Ohm $\pm$ 5%, 1/2W Carbon	R211	340X2331-934	330 Ohm $\pm$ 5%, 1/4W Carbon
R202	340X3183-944	18k Ohm $\pm$ 10%, 1/2W Carbon	R212	340X2331-934	330 Ohm $\pm$ 5%, 1/4W Carbon
R203	340X3102-934	1k Ohm $\pm$ 5%, 1/2W Carbon	R213	340X2331-934	330 Ohm $\pm$ 5%, 1/4W Carbon
R204	340X2101-934	100 Ohm $\pm$ 5%, 1/4W Carbon	R214	340X2151-934	150 Ohm $\pm$ 5%, 1/4W Carbon
R205	340X2333-934	33k Ohm $\pm$ 5%, 1/4W Carbon	R215	340X2151-934	150 Ohm $\pm$ 5%, 1/4W Carbon
R206	340X3331-944	330 Ohm $\pm$ 10%, 1/2W Carbon	R216	340X2151-934	150 Ohm $\pm$ 5%, 1/4W Carbon
R207	340X3102-934	1k Ohm $\pm$ 5%, 1/2W Carbon	R217	340X2101-934	100 Ohm $\pm$ 5%, 1/4W Carbon
R208	340X3102-934	1k Ohm $\pm$ 5%, 1/2W Carbon	R218	340X3102-934	1k Ohm $\pm$ 5%, 1/2W Carbon
R209	340X2333-934	33k Ohm $\pm$ 5%, 1/4W Carbon	R219	340X3102-934	1k Ohm $\pm$ 5%, 1/2W Carbon
R210	340X2101-934	100 Ohm $\pm$ 5%, 1/4W Carbon	R220	340X3681-934	680 Ohm, 5%, 1/2W Carbon

## CAPACITORS

C201	45X0524-038	100 uF, 16V Electrolytic
C202	45X0524-053	470 uF, 16V Lytic
C203	349X2232-109	.022 uF, 10%, 100V
C204	80X0099-020	680 pF, 10%, Z5F

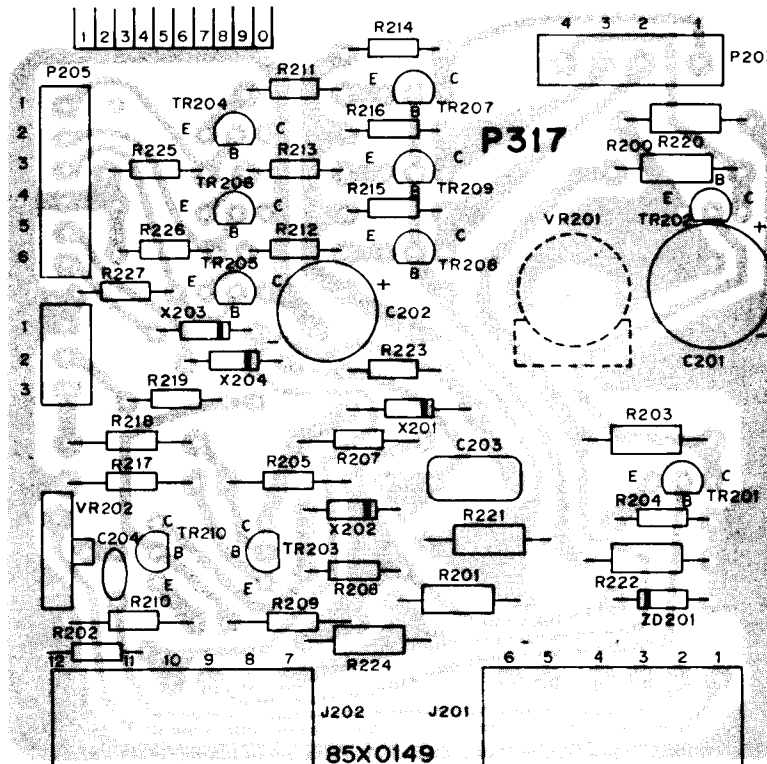
R221	340X3271-934	270 Ohm, 5%, 1/2W Carbon
R222	340X3271-934	270 Ohm, 5%, 1/2W Carbon
R223	340X2104-934	100k Ohm, 5%, 1/4W Carbon
R224	340X3102-934	1k Ohm, 5%, 1/2W Carbon
R225	340X2822-934	8.2k Ohm, 5%, 1/4W Carbon
R226	340X2822-934	8.2k Ohm, 5%, 1/4W Carbon
R227	340X2822-934	8.2k Ohm, 5%, 1/4W Carbon
VR201	40X0590-017	1.5k Ohm Black Level Control
VR202	40X0592-007	10k Ohm Horizontal Centering

## SEMICONDUCTORS

TR201	86X0121-001	Transistor (NPN) MPS-A20
TR202	86X0121-001	Transistor (NPN) MPS-A20
TR203	86X0121-001	Transistor (NPN) MPS-A20
TR204	86X0066-001	Transistor (PNP) MPS-A70
TR205	86X0066-001	Transistor (PNP) MPS-A70
TR206	86X0066-001	Transistor (PNP) MPS-A70
TR207	86X0121-001	Transistor (NPN) MPS-A20
TR208	86X0121-001	Transistor (NPN) MPS-A20
TR209	86X0121-001	Transistor (NPN) MPS-A20
TR210	86X0121-001	Transistor (NPN) MPS-A20
X201	66X0046-001	Diode Silicon FDH-444
X202	66X0046-001	Diode Silicon FDH-444
X203	66X0046-001	Diode Silicon FDH-444
X204	66X0046-001	Diode Silicon FDH-444
ZD201	66X0040-019	Diode, Zener 6.8V, 5%, 0.5W IN5235B

## MISCELLANEOUS

J201	204X9300-958	Socket, 6 Pin
J202	204X9300-958	Socket, 6 Pin
P203	204X9600-845	Plug, 4 Pin
P204	6A393-003	Plug, 3 Pin
P205	6A0393-006	Plug, 6 Pin



# PRELIMINARY REPLACEMENT PARTS LIST & SCHEMATIC DIAGRAM K4625—K4626—K4675

## △★ SAFETY CRITICAL 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 (MQ-29)

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
<b>RESISTORS</b>			<b>CAPACITORS</b>		
R603	340X3334-944	330k Ohm, ± 10%, 1/2W Carbon	△ C601	203X1800-451	0.1 uF, 125V, ± 20% MM
R605	203X9014-584	1k Ohm, ± 5%, 1W M.O.	C602	80X0096-038	2200 pF, ± 10%, Z5F
R606	204X1425-021	470 Ohm, ± 10%, 5W W.W.	△ C603	202X7810-214	2200 pF, 125V Ceramic
△★ R607	204X1450-508	2.7k Ohm, ± 10%, 5W W.W.	C604	80X0096-038	2200 pF, ± 10%, Z5F
R608	203X9014-603	1.2k Ohm, ± 5%, 1W M.O.	C608	203X0220-043	330 uF, 200V Electrolytic
R610	203X6500-246	22 Ohm, ± 5%, 1/8W Carbon	C605	203X1205-165	.0068 uF, 600V, ± 10% PP
R611	203X6700-562	1k Ohm, ± 5%, 1/2W Carbon	C607	203X0040-020	10 uF, 160V Electrolytic
R612	340X3471-944	470 Ohm, ± 10%, 1/2W Carbon	C608	203X0040-052	47 uF, 160V Electrolytic
R613	203X9010-757	1.2k Ohm, ± 5%, 1W M.O.	C609	202X7050-366	.0033 uF, 500V, ± 10% Ceramic
R614	203X5202-320	680k Ohm, ± 5%, 1/2W Comp.	C610	202X7050-483	.01 uF, 500V, ± 10% Ceramic
R615	203X5602-156	270k Ohm, ± 5%, 1/2W Comp.	C611	202X8140-022	100 pF, 3KV, ± 10% Ceramic
R616	203X6500-741	2.7k Ohm, ± 5%, 1/8W Carbon	C612	203X1201-047	.022 uF, 200V, ± 10% PP
R617	203X6501-088	68k Ohm, ± 5%, 1/8W Carbon	C613	203X0015-035	220 uF, 25V Electrolytic
R620	203X6500-508	270 Ohm, ± 5%, 1/8W Carbon	C614	203X0015-006	33 uF, 25V Electrolytic
R622	203X6500-689	1.5k Ohm, ± 5%, 1/8W Carbon	C615	203X1201-288	0.39 uF, 200V, ± 10% PP
R624	203X6205-843	1k Ohm, ± 5%, 1/2W Carbon	C616	202X8065-499	47 pF, 500V Ceramic
R630	203X5601-906	68k Ohm, ± 5%, 1/2W Carbon	C617	203X0025-019	1 uF, 50V Electrolytic
R631	203X9015-087	2.2 Ohm, ± 10%, 5W M.O.	C618	202X8000-577	82 pF, 50V, ± 5% Ceramic
R632	340X8121-731	120 Ohm, ± 5%, 5W Carbon	C619	203X0025-019	1 uF, 50V Electrolytic
R634	203X6000-002	2.2 Ohm, ± 5%, 1/8W Carbon	C620	203X1107-038	0.1 uF, 100V, ± 10% Mylar
R635	340X3682-944	6.8k Ohm, ± 5%, 1/2W Carbon	C621	202X9040-155	0.1 uF, 1.5KV, ± 20% Paper
R636	203X6500-645	1k Ohm, ± 5%, 1/8W Carbon	C622	203X0020-099	1000 uF, 35V Electrolytic
R640	203X6500-762	3.3k Ohm, ± 5%, 1/8W Carbon	C623	203X0015-053	470 uF, 25V Electrolytic
R641	203X6501-002	33k Ohm, ± 5%, 1/8W Carbon	C624	203X0015-021	100 uF, 25V Electrolytic
R642	203X6500-927	15k Ohm, ± 5%, 1/8W Carbon	C625	203X0040-020	10 uF, 160V Electrolytic
R643	203X5602-648	3.9M Ohm, ± 5%, 1/2W Comp.	C626	202X7050-009	100 pF, 500V, ± 10% Ceramic
R646	203X6500-468	180 Ohm, ± 5%, 1/8W Carbon	C627	202X8065-461	39 pF, 500V, ± 10% Ceramic
R647	340X5150-844	15 Ohm, ± 10%, 2W Carbon	C628	202X7000-327	2200 pF, 50V, ± 10% Ceramic
R648	340X2225-934	2.2M Ohm ± 5%, 1/4W Carbon	★ C629	203X1270-470	6900 pF, 1.5KV, ± 5% PP
R649	340X3182-944	1.8k Ohm, ± 10%, 1/2W Carbon	C630	202X7810-214	2200, pF, 125V Ceramic
R650	340X3271-944	270 Ohm, ± 10%, 1/2W Carbon	C632	203X0005-029	470 uF, 6.3V Electrolytic
R651	340X5241-743	240 Ohm, ± 10%, 2W Carbon	C633	203X0315-033	2.2 uF, 50V Electrolytic
R652	340X3682-944	6.8k Ohm, ± 10%, 1/2W Carbon	C634	202X8000-164	6 pF, 50V, ± 0.5 pF Ceramic
			C637	202X8105-014	3 pF, 2 kV, ± 0.5 pF Ceramic
			C638	342X5632-040	.056 uF, 10% Mylar
<b>SEMICONDUCTORS</b>			<b>MISCELLANEOUS</b>		
TR601	200X3189-304	Transistor, 2SC1893	△ F601	204X7120-062	Fuse (UL/CSA) 3A-125
X601	201X3130-109	Rectifier, (SI) RM-2AV 600V	J607	206X5003-960	Socket, 6 Pin
X602	66X0023-009	Rectifier, Power (S1) 500V PIV	P602	204X9600-260	Plug, 3 Pin (GT)
X603	66X0023-009	Rectifier, Power (S1) 500V PIV	P603	204X9600-254	Plug, 3 Pin (NM)
X604	66X0023-009	Rectifier, Power (S1) 500V PIV	P604	204X9600-298	Plug, 4 Pin (NM)
X605	200X8130-171	Diode (HS) SB-2CGL 1200V min.	P606	204X9600-351	Plug, 6 Pin (NM)
X606	201X2010-144	Diode (SI) IS2473-772	P607	204X9600-380	Plug, 6 Pin (GT)
X607	201X2100-119	Diode (HS) RC-2V 0.8 US	P608	204X9600-254	Plug, 3 Pin (NM)
X608	201X2130-234	Diode (HS) RU-2V	P610	204X9600-249	Plug, 2 Pin (GT)
X609	201X2130-234	Diode (HS) RU-2V	P611	204X9600-670	Plug, 2 Pin (NM)
X610	66X0023-009	Rectifier, Power (SI) 500V PIV	TH601	201X011-034	Thermistor
X611	66X0023-009	Rectifier, Power (SI) 500V PIV	TH602	201X022-007	Varistor
X612	66X0023-009	Rectifier, Power (SI) 500V PIV	J03	206X5019-207	Socket, 4 Pin
<b>TRANSFORMERS &amp; COILS</b>			P201	204X9601-195	Plug, 6 Pin
△ L601	201X6000-112	Coil, Line Filter R-3	P202	204X9601-195	Plug, 6 Pin
L602	201X4600-042	Coil, Filter, 10 uH			
L603	201X4100-024	Coil, Peaking, 22 uH			
L607	201X4710-134	Coil, R-F Choke			
T601	201X9500-337	Transformer, Audio Output			
T602	201X1300-080	Transformer, Hor. Drive			
T603	202X1210-191	Transformer, Side PC			
L702	9A2795-001	Width Coil			

# VERT/HOR BOARD (MT/QJ)

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
<b>RESISTORS</b>			<b>CAPACITORS (CONT.)</b>		
R301	203X6500-628	820 Ohm, ± 5%, 1/8W Carbon	C313	203X0025-087	47 uF, 50V Electrolytic
R302	203X6500-902	12k Ohm, ± 5%, 1/8W Carbon	C315	203X0015-082	10 uF, 25V Electrolytic
R303	203X6500-927	15k Ohm, ± 5%, 1/8W Carbon	C316	203X1100-220	3300 uF, 50V, ± 10% Mylar
R304	203X6500-886	10k Ohm, ± 5%, 1/8W Carbon	C317	202X8000-616	100 pF, 50V, ± 10% Ceramic
R305	203X6501-241	330k Ohm, ± 5%, 1/8W Carbon	C351	202X7000-281	1500 pF, 50V, ± 10% Ceramic
R306	203X6500-645	1k Ohm, ± 5%, 1/8W Carbon	C352	202X7000-247	1000 pF, 50V, ± 10% Ceramic
R307	203X6500-689	1.5k Ohm, ± 5%, 1/8W Carbon	C353	203X1100-573	0.022 uF, 50V, ± 10% Mylar
R309	203X6500-724	2.2k Ohm, ± 5%, 1/8W Carbon	C355	203X1100-858	0.1 uF, 50V, ± 10% Mylar
R310	203X6501-285	470k Ohm, ± 5%, 1/8W Carbon	C356	203X0015-105	4.7 uF, 25V Electrolytic
R311	203X6501-065	56k Ohm, ± 5%, 1/8W Carbon	C357	203X1201-013	0.015uF, 200V ± 10% PP
R312	203X6501-126	100k Ohm, ± 5%, 1/8W Carbon	C358	203X1201-034	0.018 uF, 200V, ± 10% PP
R313	203X6001-326	10k Ohm, ± 5%, 1/8W Carbon	C359	203X0040-013	4.7 uF, 160V Electrolytic
R314	203X6501-044	47k Ohm, ± 5%, 1/8W Carbon	C360	202X7000-482	0.01 uF, 50V, ± 10% Ceramic
R315	203X6500-628	820 Ohm, ± 5%, 1/8W Carbon	C361	203X1100-509	0.015 uF, 50V, ± 10% Mylar
R316	203X6500-420	120 Ohm, ± 5%, 1/8W Carbon	C362	203X0025-058	10 uF, 50V Electrolytic
R317	203X6206-441	2.2 Ohm, ± 5%, 1/2W Carbon	C363	203X1205-487	0.01 uF, 630V, ± 10% PP
R319	203X6500-169	100 Ohm, ± 5%, 1/8W Carbon	C364	202X7000-482	0.01 uF, 50V, ± 10% Ceramic
R320	203X6500-927	15k Ohm, ± 5%, 1/8W Carbon			
R321	203X6700-509	560 Ohm, ± 5%, 1/2W Carbon			
R322	203X9100-121	22 Ohm, ± 5%, 2W M.O.			
R323	203X6500-689	1.5K Ohm, ± 5%, 1/8W Carbon			
R324	203X6500-988	27k Ohm, ± 5%, 1/8W Carbon	TR301	200X4082-614	Transistor, 2SA826Q
R325	203X6500-326	47 Ohm, ± 5%, 1/8W Carbon	TR302	200X3174-006	Transistor, 2SC1740Q
R328	203X6500-628	820 Ohm, ± 5%, 1/8W Carbon	TR303	200X3174-006	Transistor, 2SA1740Q
R330	203X6500-886	10k Ohm, ± 5%, 1/8W Carbon	TR304	200X3174-006	Transistor, 2SC1740Q
R331	203X6501-209	220k Ohm, ± 5%, 1/8W Carbon	TR305	200X4049-081	Transistor, 2SA490YLBGLI
R351	203X6500-724	2.2k Ohm, ± 5%, 1/8W Carbon	TR306	200X3162-538	Transistor, 2SC1625YLBGLI
R352	203X6500-927	15k Ohm, ± 5%, 1/8W Carbon	TR307	200X3174-014	Transistor, 2SC1740R
R353	203X6500-944	18k Ohm, ± 5%, 1/8W Carbon	TR308	200X3174-006	Transistor, 2SC1740Q
R354	203X6500-783	3.9k Ohm, ± 5%, 1/8W Carbon	TR351	200X4085-415	Transistor, 2SA854Q
R355	203X6500-902	12k Ohm, ± 5%, 1/8W Carbon	TR352	200X3172-208	Transistor, 2SC1722BKBS
R356	203X6500-561	470 Ohm, ± 5%, 1/8W Carbon	TR353	200X3174-006	Transistor, 2SC1740Q
R357	203X6500-724	2.2k Ohm, ± 5%, 1/8W Carbon	TR354	200X4082-614	Transistor, 2SA826Q
R358	203X6500-666	1.2k Ohm, ± 5%, 1/8W Carbon	X301	201X2010-144	Diode, (SI) IS2473-T72
R359	203X6501-088	68k Ohm, ± 5%, 1/8W Carbon	X302	201X2010-144	Diode, (SI) IS2473-T72
R360	203X5500-471	27 Ohm, ± 5%, 1/4W Comp.	X303	200X8000-026	Diode, (GE), IN60TVGL
R361	203X6000-988	1.2k Ohm, ± 5%, 1/8W Carbon	X304	200X8010-165	Diode (SI) ISS81
R363	203X6500-666	1.2k Ohm, ± 5%, 1/8W Carbon	X305	201X2010-165	Diode (SI) ISS81
R364	203X9014-988	47k Ohm, ± 5%, 1W M.O.	X306	201X2010-165	Diode (SI) ISS81
R365	203X6700-989	56k Ohm, ± 5%, 1/2W Carbon	X307	200X8010-102	Diode (SI) MA26W
R366	203X6001-148	3.3k Ohm, ± 5%, 1/8W Carbon	X308	200X8010-094	Diode (SI) IS2473
R367	340X2222-734	2.2k Ohm, ± 5%, 1/2W Carbon	X351	201X2010-144	Diode (SI) IS2473-T72
R368	203X6500-785	3.9k Ohm, ± 5%, 1/8W Carbon	X352	201X2010-144	Diode (SI) IS2473-T72
R369	203X6500-762	3.3k Ohm, ± 5%, 1/4W Carbon	X353	201X2010-144	Diode (SI) IS2473-T72
R370	302X6100-961	1k Ohm, ± 5%, 1/4W Carbon	X354	201X2010-144	Diode (SI) IS2473-T72
R371	203X6104-751	2.7k Ohm, ± 5%, 1/4W Carbon	X355	200X8220-851	Diode (Zener) RD10EBI
R383	340X2222-934	2.2k Ohm, ± 5%, 1/4W Carbon	X366	200X8100-130	Diode (HS) RU-1 0.3 US
R384	340X2822-934	8.2k Ohm, ± 5%, 1/4W Carbon			
VR301	204X2122-093	Varistor, 250K Ohm, Vert. Hold			
VR302	204X2114-065	Varistor, 20K Ohm, Vert. Size			
VR351	204X2114-059	Varistor, 50K Ohm, Hor. Hold			
<b>CAPACITORS</b>			<b>MISCELLANEOUS</b>		
C301	203X1100-928	0.15 uF, 50V, ± 10% Mylar	J301	204X9300-958	Socket, 6 Pin
C302	203X1100-573	0.022 uF, 50V, ± 10% Mylar	J302	204X9300-958	Socket, 6 Pin
C304	203X1100-858	0.1 uF, 50V, ± 10% Mylar	P301	204X9601-195	Plug, 6 Pin
C306	203X0025-026	2.2 uF, 50V, Electrolytic	P302	204X9601-195	Plug, 6 Pin
C307	203X1100-928	0.15 uF, 50V, ± 10% Mylar	TH301	201X0000-534	Thermistor
C309	203X1100-858	0.1 uF, 50V, ± 10% Mylar			
C310	203X0010-011	22 uF, 16V Electrolytic			
C311	203X0020-099	1000 uF, 35V Electrolytic			
C312	202X7000-469	0.0082 uF, 50V, ± 10% Ceramic	L351	201X5200-091	Coil, Horiz. Osc.
<b>POWER BOARD (MV)</b>			<b>TRANSFORMERS &amp; COILS</b>		
<b>RESISTORS</b>			<b>MISCELLANEOUS</b>		
R501	204X1725-052	180 Ohm, ± 10%, 15W WW	C503	203X0010-011	22 uF, 16V Electrolytic
R502	203X6000-608	100 Ohm, ± 5%, 1/8W Carbon	C551	203X0005-046	220 uF, 10V Electrolytic
R503	203X6000-960	1k Ohm, ± 5%, 1/8W Carbon			
R504	203X6000-879	560 Ohm, ± 5%, 1/8W Carbon			
R505	203X9014-965	39k Ohm, ± 5%, 1W M.O.	TR501	200X3174-006	Transistor, 2SC1740Q
R506	203X6500-842	6.8k Ohm, ± 5%, 1/8W Carbon	★ TR502	200X3145-404	Transistor, 2SC1454
R551	203X6500-420	120 Ohm, ± 5%, 1/8W Carbon	TR551	200X3172-305	Transistor, 2SC1723
VR501	204X2050-001	Varistor Vert. Adj.	X501	201X2230-042	Diode, (SI) Zener EQB01-06V
			X502	201X2010-144	Diode, (SI) IS2473-T72
<b>CAPACITORS</b>			<b>MISCELLANEOUS</b>		
C501	203X0040-020	10 uF, 160V Electrolytic	J501	204X9300-958	Socket, 6 Pin
C502	202X7000-281	1500 pF, 50V, ± 10% Ceramic	P501	204X9601-195	Plug, 6 Pin
			TH501	201X0000-618	Thermistor

TRANSISTOR BASES - BOTTOM VIEW

sym	FUNCTION	ELEC. PART No.	U/E DEC HOUSE No.	type	sym	FUNCTION	ELEC. PART No.	U/E DEC HOUSE No.	type
Q101	VIDEO PREAMP	14-802-12	T1S 98	A	IC301	HORIZ DELAY	14-2029-01	MC3486	
Q102	VIDEO OUTPUT	14-904-12	MPS U10	F					
Q201	VERTICAL PREAMP	14-802-12	T1S 98	A	D301	VERT BIAS	14-514-14	IN914	
Q202	VERT & TRIGGER	14-802-12	T1S 98	A	D302	FOCUS RECTIFIER	14-514-23	BY184	
Q203	MILLER INTEGRATOR	14-802-12	T1S 98	A	D303	FLYBACK DAMPER	28-22-25	DO1	
Q204	MILLER INTEGRATOR	14-802-12	T1S 98	A	D304	ERT RECTIFIER	28-42-01	1N802	
Q205	MILLER INTEGRATOR	14-822-12	T1S 97	A	D304	B-FOCUS SUPPLY	28-22-27	1N5081	
Q206	MILLER INTEGRATOR	14-811-32	SP55449	B	D401	B+ POWER SUPPLY	28-22-27	1N5081	
Q207	MILLER INTEGRATOR	14-802-12	T1S 98	A	D402	B+ POWER SUPPLY	28-22-27	1N5081	
Q208	MILLER INTEGRATOR	14-802-12	T1S 98	A	D403	B+ POWER SUPPLY	28-22-27	1N5081	
Q209	MILLER INTEGRATOR	14-861-12	S24815	A	D404	B+ POWER SUPPLY	28-22-27	1N5081	
Q208	VERT DRIVER	14-861-12	S24815	A	D404	B+ POWER SUPPLY	28-22-27	1N5081	
Q209	VERT OUTPUT	14-601-23	SJ5481	E					
Q210	VERT OUTPUT	14-601-23	SJ5481	E	ZD101	82V HOLD DOWN ZEN.	14-515-54	D5M8252	
Q301	TRIGGER AMP	14-802-12	T1S 98	A	ZD201	82V ZENER B+	14-515-56	1N5234B	
Q302	HORIZ DRIVER	14-904-12	MPSU10	F	ZD301	25V SPOT KILL ZEN.	14-515-36	1N5809B	D
Q303	HORIZ OUTPUT	14-601-36	25C1413	E					
Q401	REGULATOR	14-601-28	2N5240	E	ZD402	5.1V REF. ZENER	14-515-44	1N751A	
Q402	PRE-REGULATOR	14-823-32	2N5400	B	ZD403	10V REF. ZENER	14-515-45	1N4740A	
Q403	REG. DRIVER	14-904-12	MPSU10	F					
Q404	ERROR AMP	14-904-12	MPSU10	F					
Q405	CURRENT LIMITER	14-802-12	T1S 98	A					

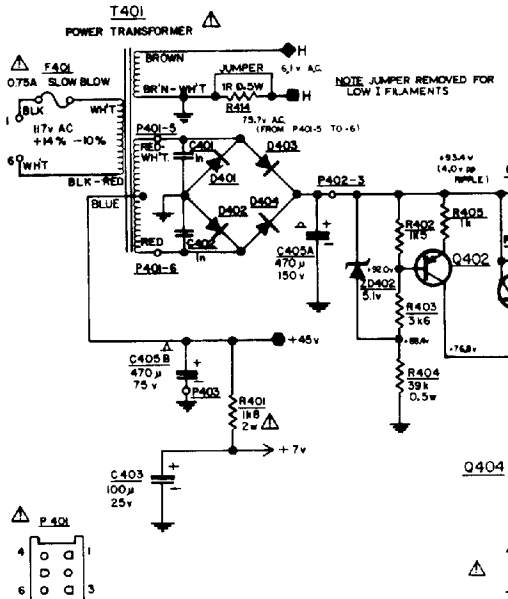
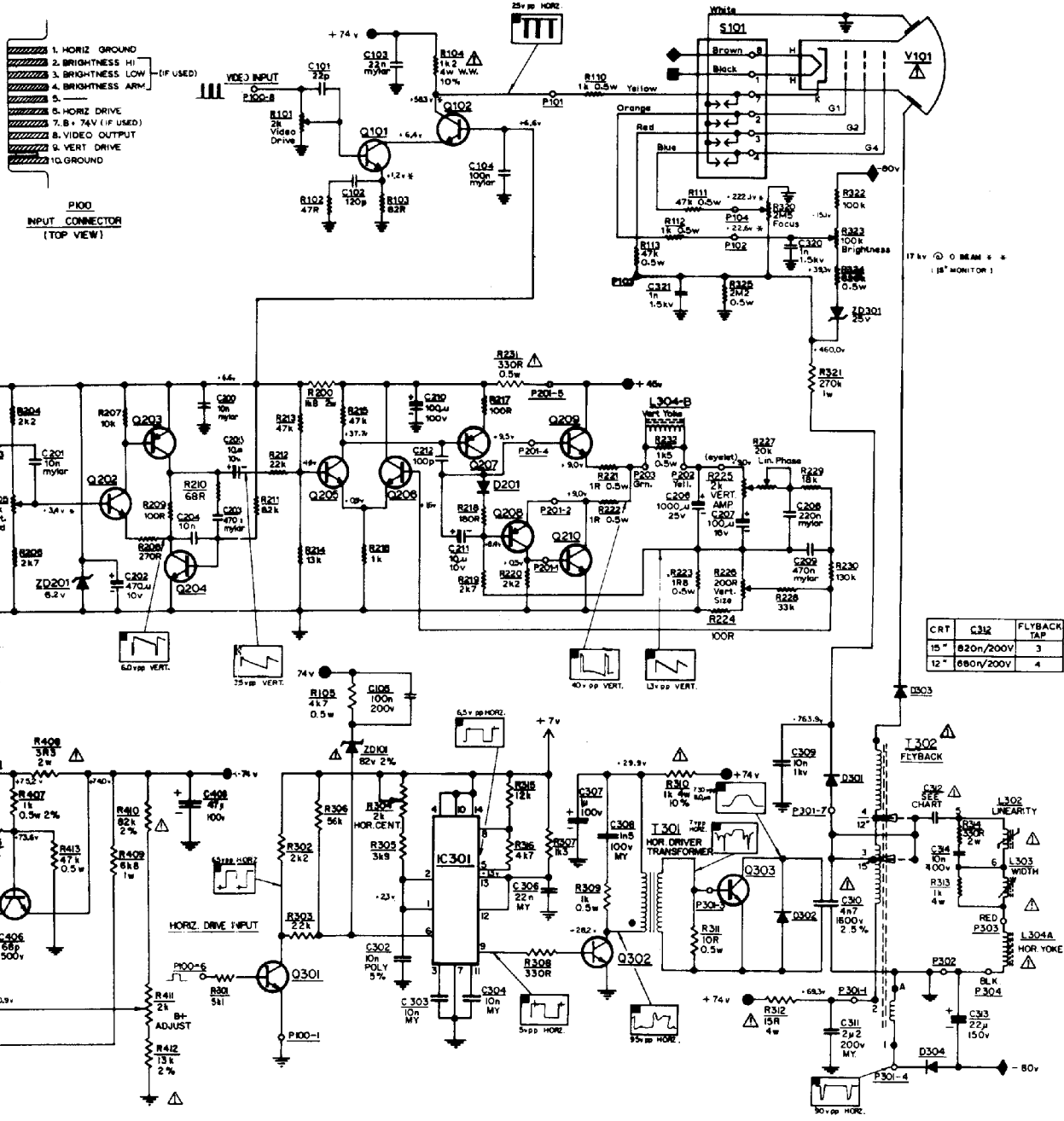
RESISTORS - RESISTANCE IN OHMS, K (KILOHMS), OR M (MEG OHMS)  
 1/4 WATT, 5% TOLERANCE UNLESS OTHERWISE NOTED.  
 CAPACITORS - CAPACITY IN p (PICOFARADS), n (NANOFARADS), OR  
 μ (MICROFARADS) D.C.W.V. AND TOLERANCE  
 NOTED WHERE CRITICAL.

CAUTION FOR CONTINUED SAFETY REPLACE COMPONENTS  
 INDICATED BY Δ WITH EXACT REPLACEMENT PARTS ONLY.  
 CONSULT SERVICE MANUAL PARTS LIST SECTION  
 \*SAFETY COMPONENTS\*

\* DEPENDS ON CONTROL SETTINGS  
 AND/OR SIGNAL CONDITION

00-19007-01 Issue 2

V17 SCHEMATIC



CRT	C312	FLYBACK TAP
15"	820n/200V	3
12"	680n/200V	4

ELECTROHOME

## ELECTROHOME REPLACEMENT PARTS LIST

### CHASSIS ASSEMBLY (02-210233-03)\*

SYMBOL	DESCRIPTION	PART NO.
Q 209	Vertical Output Transistor, SJ5461	14-601-23
Q 210	Vertical Output Transistor, SJ5461	14-601-23
Q 303	Horizontal Output Transistor, 2SC1413	14-601-36
Q 401	Regulator Power Transistor 2N5840 select.	14-601-26
D 302	Damper Diode, DG1	28-22-25
D 303	HV Rectifier 30KV, H1802	28-42-01
F 401	75A 125V Fuse	27-5-28
L 101	10MH Coil	21-1400-06
L 302	Linearity Coil	21-1428-01
L 303	Width Coil	21-1427-01
L 304	Deflection Yoke	21-244-01
T 302	Flyback Transformer	21-243-01
T 401	Power Transformer	24-10197-03
SW 401	Line Switch	26-230-01
	Heat-shrinkable Sleeving, .187 ID	20-300013-04
	Heat-shrinkable Sleeving, .750 ID	20-300013-08
	Cable Tie	33-523-01
	Clip - PCB Support	33-629-01
	Fuse Holder	34-198-01
	CRT Socket	34-213-11
TS1, 2	Terminal Strip, Fire Retardant	34-491-03
	Transistor Socket	34-515-03
P 201	Connector Housing	34-549-05
P 402	Connector Housing	34-549-06
P 301	Connector Housing	34-549-07
	Crimp Terminal	34-550-01
	Anode connector with spring	34-678-01
P 401	Power connector housing	34-677-06
	Pin Terminal	34-676-21
	Transistor Cover	39-1151-01
C 405	Electrolytic 470, 470 uF/150, 75v	44-202-37
C 314	10 NF 400v capacitor	48-121034-01
C 312	820 NF 200v capacitor	49-19-26

\* Not a replacement or stock item

### MONITOR PCB ASSEMBLY

SYMBOL	DESCRIPTION	PART NO.
D 201	Signal Diode, 1N914	14-514-14
D 301	Signal Diode, 1800 Piv, BY 184	14-514-23
D 304, 401, 402, 403, 404	Rectifier 1A 600v, 1N5061	28-22-27
ZD 101	82v 2% Zener Diode, 0.5M82ZS2	14-515-64
ZD 201	6.2v Zener Diode, 1N5234B	14-515-66
ZD 301	25v 5% Zener Diode, 1N5869B	14-515-36
ZD 402	5.1v 5% Zener Diode, 1N751A	14-515-44
ZD 403	10v 5% Zener Diode, 1N4740A	14-515-45
Q 101	Small Signal Transistor, MPS 6514	14-800-32
Q 201, 202, 206, 301 405	Small Signal Transistor, T1S98	14-802-12
Q 203	Small Signal Transistor, T1S101	14-808-12
Q 205	Small Signal Transistor, SPS5449	14-811-32
Q 204	Small Signal Transistor, T1S97	14-822-12
Q 402	Small Signal Transistor, 2N5400	14-823-32
Q 207, 208	Small Signal Transistor, S24615	14-861-12
Q 102, 302, 403, 404	Plastic Power Transistor, MPSU10	14-904-12
IC 301	Double one-shot IC, MC3456	14-2029-01
T 301	Horizontal Buffer Transformer	24-170001-04
R 304	Cermet Trim Pot 2K	41-328-01
R 226	Carbon Trim Pot 200R	41-299-16
R 205, 225, 411	Carbon Trim Pot 2K	41-299-12
R 227	Carbon Trim Pot 20K	41-299-01
R 320, 323	Carbon Trim Pot 2M5	41-299-07
R 408	Critical Safety Resistor, 3R3 5% 2W	42-63-54
R 312	15R 4W 10% Resistor	42-111501-03
R 310	1K 4W 10% Resistor	42-111021-03
R 104	1K2 4W 10% Resistor	42-111221-03
C 307	1uF 100v Electrolytic	44-310508-01
C 205, 211	10 uF 10v Electrolytic	44-310002-01
C 313	22 uF 150v Electrolytic	44-322009-05



SYMBOL	DESCRIPTION	PART NO.
C 408	47 uF 100v Electrolytic	44-347008-08
C 403	100 uF 25v Electrolytic	44-310104-04
C 207	100 uF 16v Electrolytic	44-310103-12
C 210	100 uF 100v Electrolytic	44-310108-06
C 202	470 uF 10V Electrolytic	44-347102-04
C 206	1000 uF 25v Electrolytic	44-310204-10
C 212	100 pF 25p 10% 50v Capacitor	46-310113-51
C 102	120pF 5% Mica Capacitor	47-41215-05
C 204	10NF 10% Polypropelene Capacitor	48-131031-11
C 406	68pF 10% 500v Capacitor	46-368013-02
C 401, 402	1NF 10% 25P 500v Capacitor	46-310213-06
C 320, 321	1NF 20% 25V 1500v Capacitor	46-510228-74
C 309	10NF 1Kv Capacitor	46-510311-37
C 308	1.5NF 100v Mylar Capacitor	48-171521-22
C 200, 303, 304, 201	10NF 10% 200v Mylar Capacitor	48-171032-22
C 103, 306	22NF 10% 200v Mylar Capacitor	48-172232-22
C 104, 105	100NF 10% 200v Mylar Capacitor	48-171042-22
C 208	220NF 10% 200v Mylar Capacitor	48-172242-22
C 203, 209	470NF 10% 200v Mylar Capacitor	48-174742-22
C 311	2.2 uF 20% 200v Mylar Capacitor	48-172252-51
C 302	10NF 5% Polypropelene Capacitor	48-181032-04
	Monitor P.C.B. (less components)	50-1568-01

#### SAFETY COMPONENTS

For continued reliability and safety, the following components should be replaced with Electrohome parts:

V 101	Picture tube, 15"	17-6152-03 or-04
R 104	1K2 4W Wirewound Resistor	42-111221-03
ZD 101	82v 2% Zener Diode	14-515-64
R 231	330R .5W 5% Carbon Comp. Res.	40-223315-13
R 310	1K 4W Wirewound Resistor	42-111021-03
R 312	15R 4W Wirewound Resistor	42-111501-03
C 310	4N7 1600v Critical Safety Cap.	49-24-06
T 302	Flyback Transformer	21-243-01
L 304	Deflection Yoke	21-244-01
F 401	.75A 125v slow-blow Fuse	27-5-28
T 401	Power Transformer	24-10197-03
SW 401	Line Switch	26-230-01
R 401	1K8 2W 5% Resistor	40-621825-01
R 408	3R3 2W 5% Resistor	42-63-54

All safety components are marked with  on the schematic.



**MIDWAY MFG. CO.**

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10601 W. Belmont Avenue  
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November 7, 1980

**S E R V I C E   B U L L E T I N**

SUBJECT: MONITOR'S BALLY/MIDWAY GAMES

<b>MANUFACTURE</b>	<b>MODEL NO.</b>	<b>GAME</b>
WELLS GARDNER	19K4500 (19'')	GALAXIAN UPRIGHT
WELLS GARDNER	19K4601 (19'')	GALAXIAN UPRIGHT & COCKTAIL
ELECTROHOME	G02 (25'')	GALAXIAN UPRIGHT
ELECTROHOME	G07-901 & 904	UPRIGHT & COCKTAIL
ELECTROHOME	V-17 (15'')	SPACE ZAP, SPACE ENCOUNTERS MINI
WELLS GARDNER	V1001 (19'')	SPACE ZAP & SPACE ENCOUNTERS
MOTOROLA	M-500 (19'')	SPACE ZAP & SPACE ENCOUNTERS
ELECTROHOME	G07 (13'')	PAC-MAN, GORF & RALLY-X
WELLS GARDNER	(19'') (XY)	OMEGA RACE
ELECTROHOME	G05 (19'') (XY)	OMEGA RACE
ELECTROHOME	G05 (13'')	OMEGA RACE
WELLS GARDNER	19K4900 (19'')	MS PAC-MAN
WELLS GARDNER	13K4800 (13'')	MS PAC-MAN
ZENITH	CD-19MRF06	MS PAC-MAN & SUPER PAC-MAN

Andy Ducay  
Service Manager

AD/dd



**MIDWAY MFG. CO.**

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**MONITOR MANUFACTURERS**

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Display Products  
455 East North Avenue  
Carol Stream, Illinois 60187  
Telephone: (312) 231-4400  
Chris Petri, Product Service Manager

WELLS GARDNER ELECTRONICS CORP.  
2701 North Kildare Avenue  
Chicago, Illinois 60639  
Telephone: (312) 252-8220  
Harry McComb, Service

ELECTROHOME LIMITED  
809 Wellington St. N.  
Kitchener, Ont. N2G 4J6  
Telephone: (519) 744-7111  
Tom Van Gink, Program Co-Ordinator

ZENITH RADIO CORP.  
1000 N. Milwaukee Avenue  
Glenview, Illinois 60025  
Telephone: (312) 391-7000



**MIDWAY MFG. CO.**

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January 12, 1982

**SERVICE BULLETIN**

GAME: ALL GAMES WITH 19" COLOR MONITORS

SUBJECT: CRT REPLACEMENTS

Reviewing the difference in 19" in-line CRT's with internal degaussing shield versus exterior degaussing shield with CRT manufacturers and with vendors (Electrohome and Wells-Gardner). It was found that the CRT with internal degaussing shield can be used as a replacement in a monitor with an external shield with no need to modify the monitor in any manner.

This being the case, it is recommended that you purchase only 19" in-line color CRT's with internal shields for replacement purposes. This will simplify our stocking requirement as well as reduce possible replacement errors.

Any of the below listed 19" in-line CRT's with internal degaussing shield can be used as a substitute for each other:

19VMNP22	(RCA)
19VMJP22	(Rauland)
510UJB22	(Hitachi)

Any of the above CRT's can also be used as a substitute for below listed CRT's, designed to be used with external degaussing shield:

19VJTP22	(RCA)
19VMBP22	(Rauland)
19VMAP22	(Vendor not known)
MV19VLGP22	(Vendor not known)

Andy Ducay  
Service Manager

AD/dd



**MIDWAY MFG. CO.**

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May 15, 1981

**S E R V I C E   B U L L E T I N**

SUBJECT: BRIGHTNESS ADJUSTMENT  
WELLS GARDNER COLOR MONITOR (K4604 - 4)

1. To set the brightness level on a Wells Gardner Color Monitor, use the Black Level Control located on the interface PC Board.
2. Location of the Black Level Control can be found by following the logic board video cable which will be connected to the Interface PC Board.
3. Do not alter the screen control on the neck board, this can distort the picture when used as a brightness control.

ANDY DUCAY  
SERVICE MANAGER

AD/dd



**MIDWAY MFG. CO.**

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10601 W. Belmont Avenue  
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October 21, 1982

**S E R V I C E   B U L L E T I N**

SUBJECT: ELECTROHOME G07 HVL CIRCUIT

Servicing the monitor with a B+ voltage of 138.5 VDC or more could be quite time consuming.

1. Remove all power from monitor.
2. Disconnect the collector of transistor X701.
3. Apply power to monitor.
4. Check for a raster (lit screen). If no raster is obtained, turn up the brightness control to verify a no raster condition.
5. With a raster, measure B+ at the emitter of the power regulator transistor X04.
6. B+ normal with a raster, the problem will be in the protection circuit. Check X701 & D701.
7. B+ still high with raster indicates the problem is in the power regulator circuit. Check X04, X901, X902, D905 & C905.
8. With a no raster condition, the problem will be in the horizontal section. Check from the oscillator to the horizontal output (IC501, X501, T-501, X01 & T-502).
9. Remember to reconnect the collector of X701.

Kevin Moeller  
Service Technician

KM/dd