

# Sanyo 14" Color TV Monitor

# Operation, Maintenance and Service Manual

Complete with Illustrated Parts List

 A Warner Communications Company

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# 1 Warnings and Cautions

## A. Before You Start...

You should **never attempt** to work on an exposed monitor chassis if you are not familiar with servicing procedures and precautions necessary for high-voltage equipment. Any TV monitor has three sources of possible danger: strong electric shock due to high voltages or unisolated AC line voltages, X-ray radiation, and implosion. Therefore, please read this chapter carefully.

## B. Safety Measures

Develop good safety habits, so when you're rushed with repair work, you'll still automatically take precautions.

A good practice when working on any TV monitor is to first ground the chassis and use only one hand when testing circuitry. This will avoid the possibility of carelessly putting one hand on the chassis or ground, and the other on an electrical connection. **Doing so could cause a severe electrical shock.**

If you service this color monitor on a test bench, you must isolate the monitor from AC line voltage! An isolation transformer is **mandatory** for your own safety. The Sanyo monitor does not contain an isolation transformer on its chassis. It is mounted instead on the game power supply. (It may appear like a regular power transformer, but is really also an isolation transformer.)

## C. Picture-Tube Handling

Use extreme care when handling the picture tube, since rough handling may cause it to implode, due to a vacuum inside. Do not nick or scratch the glass, or subject it to any undue pressure when removing or installing it.

Wear safety goggles and heavy gloves for protection when handling the picture tube. Keep others without safety goggles away. Do not lift the tube by the neck.

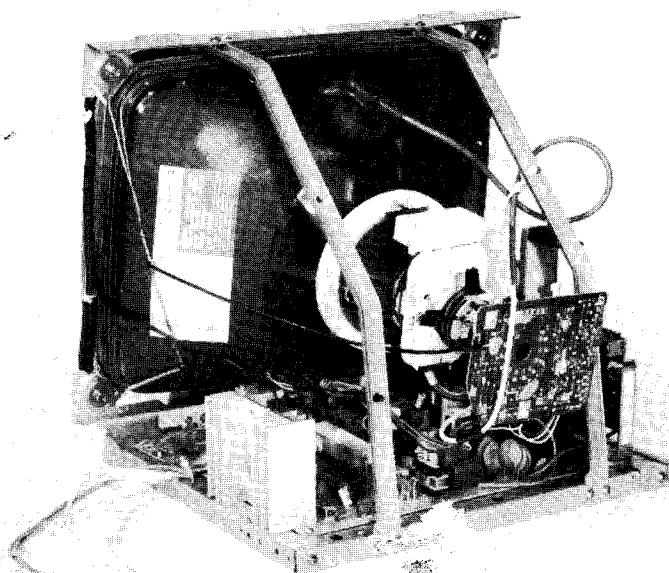


Figure 1 Overview of Sanyo 14" Color TV Monitor

Discharge the high voltage in the picture tube by shorting the anode connection to chassis ground—**not the cabinet or other mounting parts**. When discharging, go from ground to anode, and use a well-insulated piece of wire.

## D. Replacing with Proper Components

It is important to maintain the specified values and failure characteristics of all components in the horizontal and high-voltage circuits, and anywhere else in the monitor that could cause a rise in high voltage, or in operating supply voltages.

Refer to the parts lists in the back of this manual, and use **only exact replacement parts**, especially for the picture tube, semiconductors, transformers, coils, and fuses.

If you replace the picture tube with another type not specified in the parts list, then avoid prolonged exposure at close range to the unshielded areas of the tube. **You may endanger yourself from unnecessary exposure to X-ray radiation.**

## E. Final Testing Before Reinstalling Monitor

Before installing the color monitor back in the game, you must check the following:

1. Inspect all harness wiring on the monitor and be sure none of it is pinched between the chassis and other metal parts in the monitor.
2. Replace all protective devices such as insulating fishpaper, compartment covers and shields.

# 2 Specifications

## A. Power Input and Consumption

Line Voltage	A.C. <b>100 V</b> $\pm$ 10%
Line Frequency	50/60 Hertz
Power Consumption	46 Watts

## B. Temperatures and Humidity

Environmental Temp.	5-35° C (41-95° F)
Environmental Humidity	20-95%
Temp. Inside Game Cabinet	45° C max. (112° F)

## C. Currents and Voltages

The CRT anode average current is less than 650  $\mu$ A.

High voltage is 24  $\pm$  1.5 KV.

B + 1	105 $\pm$ 1.0 V
B + 2	19.5 $\pm$ 2.0 V
B + 3 (regulated)	12 $\pm$ 1.0 V
B + 4 (regulated)	175 $\pm$ 5.0 V
Heater Voltage	6.4 $\pm$ 0.2 V (RMS)

## D. CRT Specifications

Convergence Tolerance—  
 max. 0.2% of raster width, center of screen  
 max. 0.5% of raster width, corners of screen

Purity—Color purity should be practically uniform all over screen after being degaussed with hand-held degaussing coil

Pull-In Range, Horizontal	15.75 KHz $\pm$ 200 Hz
Pull-In Range, Vertical	More than 8 Hz

Type of CRT #370ECB22, 14-Inch, 90°

Tilt of Deflection Yoke declination is within 2 mm

## E. Connectors

6-Pin Connector for Video Signals:

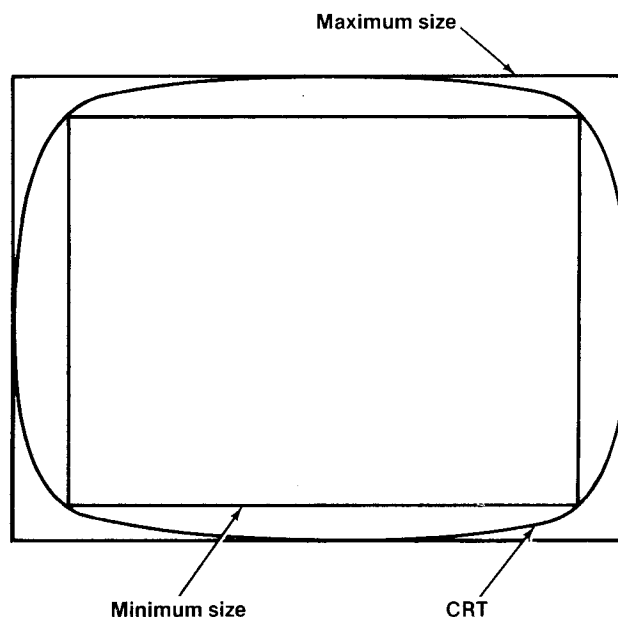
Pin 1 = Red	Pin 2 = Green	Pin 3 = Blue
Pin 4 = Ground		Pin 5 = Sync

3-Pin Connector for Power:

Pin 1 = 100 VAC	Pin 2 = 100 VAC
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## F. Pattern Size

You should be able to reproduce the following sizes of patterns:



# 3 Adjustable Controls

## A. Brightness

**Remember to observe the precautions regarding high voltages when you make any adjustments on this monitor!**

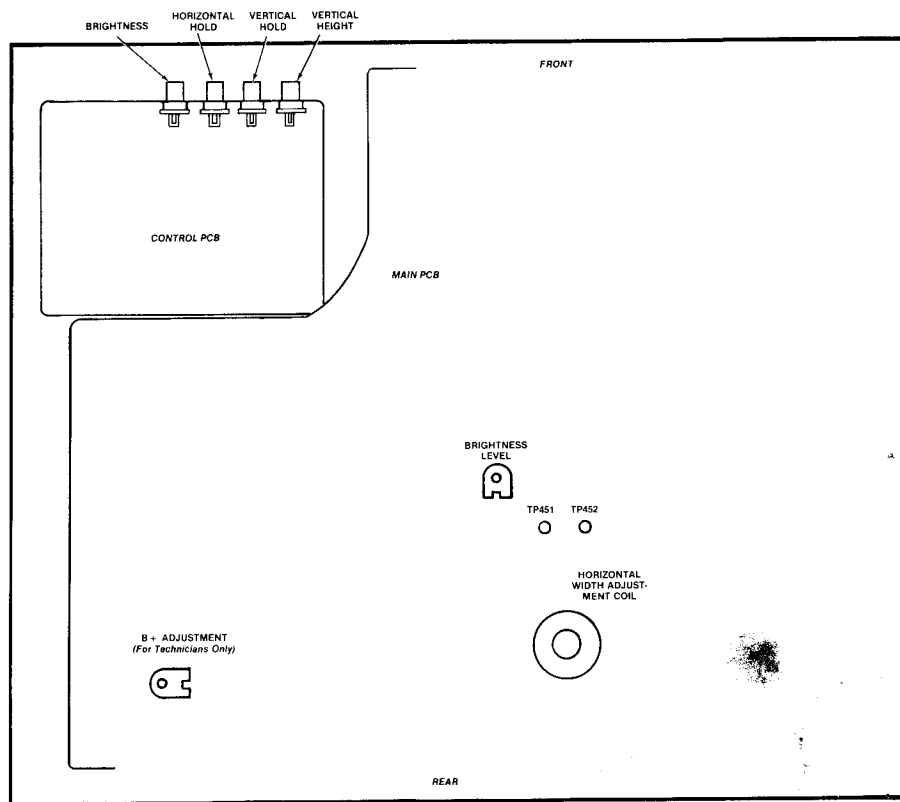
Note that before you adjust the brightness, the monitor should have been turned on for at least 5 minutes. Keep the game in the attract or play mode. Find the small white knob underneath the screen, located at the far right on the Control Printed-Circuit Board or PCB (see Figure 2). Turn this brightness or screen voltage control until you achieve a pleasing level of brightness.

Too high a brightness causes the retrace lines to show. Too low a brightness causes the entire screen to become dark and obscured.

However, if you cannot achieve the proper brightness by using this white adjustment knob, then you should **check the master brightness level adjustment**. This potentiometer is located almost dead center on the Main PCB, at VR201.

To reset the brightness level, disconnect the 6-pin video-signal connector from the monitor. Turn the white brightness control to maximum or fully clockwise. Connect a DC voltmeter's plus lead to TP452, and its minus lead to TP451—near the center of the Main PCB.

Set the voltmeter to the 1.5-3 V range. Now adjust the small VR201 potentiometer to 0.5 volts. Reconnect the 6-pin connector on the monitor.



**Figure 2 Adjustable Controls on Main PCB and Control PCB**

## B. Horizontal Hold

Use this adjustment if the picture drifts sideways across the screen. Find the second potentiometer from the right, on the Control PCB (as you face the monitor's screen)—see Figure 2. Turn the pot until the black lines no longer slant downwards or upwards, and you obtain a normal screen image.

## C. Vertical Hold

Use this adjustment if the picture drifts straight up or down on the screen. The vertical hold control is the second potentiometer from the left, on the Control PCB (as you face the monitor's screen)—see Figure 2.

Turn this control in either direction until the picture no longer drifts straight up or down on the screen.

## D. Vertical Height

If the screen image is not large enough or too large vertically, then you can adjust it very easily with this control. Using this control will stretch or compress the image vertically. The vertical height control affects the spacing between the raster lines equally.

Set the game for the diagnostic that displays the

convergence grid and dots. Locate the vertical height control on the monitor's Control PCB: it is the knob on the far left underneath the screen. Turn this control until the top and bottom grid lines run along the edges of the screen. The lines should not disappear off the edges, which would indicate overscanning.

## E. Horizontal Width

Before using this control, be sure the monitor has been turned on for 5 minutes or more. If the screen image is too wide or narrow, you should use this control to adjust it for proper width.

Set the game for the diagnostic that displays the convergence grid and dots. Locate the horizontal width control on the monitor's Main PCB: it is the coil at the center of this board, directly underneath the yoke. **Be sure to use only a non-metal Allen wrench (commonly called a "tweaking" tool) for this adjustment!** Turn this control until the right and left grid lines run along the edges of the screen. The lines should not disappear off the edges, which would indicate overscanning.

## F. Focus

This control simply changes the sharpness of the screen image. The white focus adjustment knob is located on the plastic bracket above the flyback transformer. Turn this control until you get the optimum screen sharpness possible.

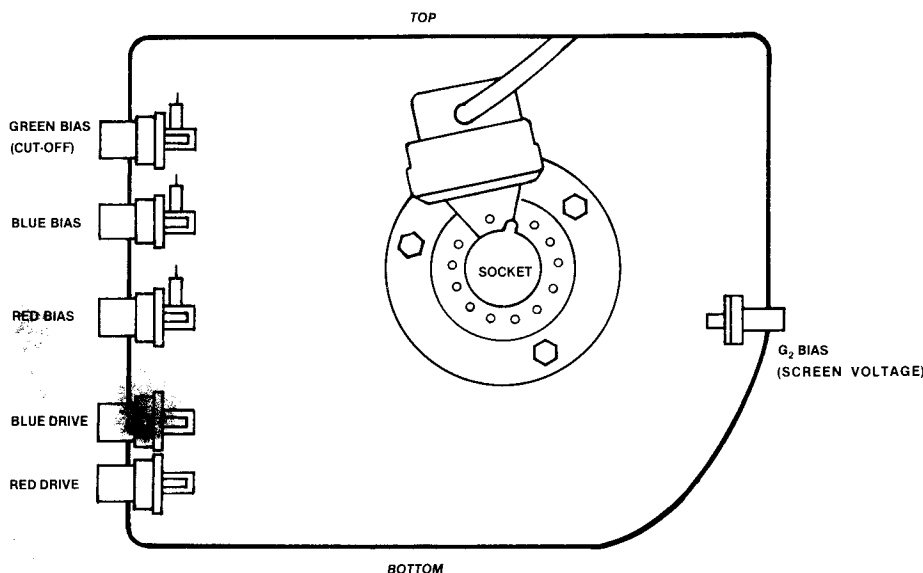


Figure 3 Adjustable Controls on Neck PCB



## 4 Supply Voltages

To test for proper +105V supply, locate the test point TP91 at the front end of the very large 20-watt resistor R609. This resistor is in the center rear area of the Main PCB. Connect a voltmeter at this point and to ground.

Adjust the brightness control on the Neck PCB to maximum. Use the nearby potentiometer (VR601) on the monitor's Main PCB that is labeled "B+ ADJUSTMENT" in Figure 2. Turn this pot until the meter reads +105V. Then return the brightness control to normal.

## 5 Signal Test Points

### A. RGB Signals

The blue, red, and green signals can be tested at the points labeled ED, EE, and EA, respectively. These are located on the back of the Neck PCB.

### B. Horizontal and Vertical Sync

This synchronization signal can be tested at pin 5 of the 6-pin video signal connector. When using a test prod, do not jam it into the connector pin. Otherwise you will stretch the pin and it could later fall out of the connector housing.

# 6 Troubleshooting

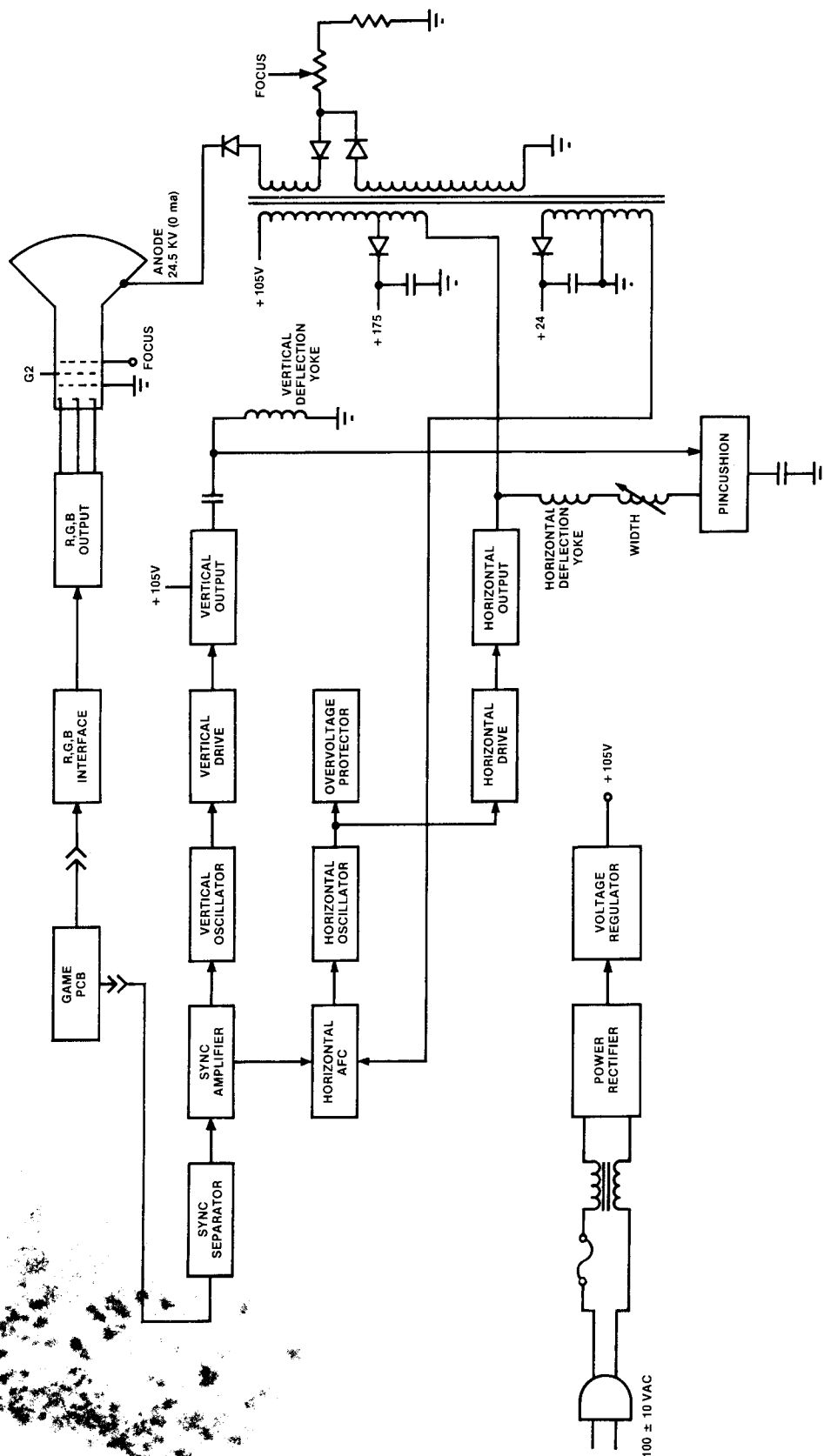


Figure 4 Block Diagram of Sanyo Monitor

# 7 Repair

## A. Picture Tube Replacement

Be sure to first unplug the power and video-signal connectors. Remove monitor assembly from game.

1. Discharge the high voltage from the tube. Remove the large high-voltage anode connector near the top of the picture tube. Unplug the neck board at rear of picture tube.
2. Unplug the degaussing coil 2-pin connector.
3. Unplug the 4-wire connector on Main PCB. Unhook the spring that holds the braided ground wire (near the bottom corner of picture tube).
4. Using a 5/16" hex socket wrench, remove the four screws that hold the picture tube in the steel frame. Carefully remove the tube by pulling it out towards the front.

## B. Yoke Replacement

***You need to reconverge the picture whenever you replace a yoke.***

First unplug the power and video-signal connectors. Remove monitor assembly from game.

1. Discharge the high voltage from the tube. Unplug the neck board at rear of picture tube.
2. Using a thin knife or single-edged razor blade, carefully loosen the rubber wedges from the picture-tube surface.

3. Loosen the Phillips screws that tighten the two neck clamps around the neck. Now slide the magnet assembly, then the yoke assembly off the end of the picture tube.

## C. Flyback Transformer Replacement

First unplug the power and video-signal connectors. Remove monitor assembly from game.

1. Discharge the high voltage from the tube. Remove the large anode connector at top of picture tube. Also open the white twist-and-tie anode holder and remove the anode wire from this holder.
2. Unplug the neck board at rear of picture tube. Unplug the two white wires at the very top of the "FOCUS" adjustment bracket.
3. Remove the two small hex nuts and the Phillips screw that secure the flyback transformer cover plate.
4. Unsolder the 9 connections for the transformer on the circuit or bottom side of the Main PCB.
5. Now lift out the transformer. When replacing with a new transformer, be sure to check the picture for sharpness. If it's not sharp, adjust the white focus knob on the transformer.

# 8 Adjustments

## A. Purity Adjustments

### 1. Preliminary

First remove the monitor from the game, but leave the connectors still attached. The purity and convergence magnets can be moved without loosening the rear Phillips screw. If you will also be converging the outer area of the picture (see Section 2 on the next page), you should loosen both the deflection yoke and magnet mounting screws at this time.

Turn the picture tube so it faces north or south. **Then degauss the picture tube with a hand-held degaussing coil.** If the magnets have been secured with a white glue, you will find that its hold can be easily broken when you move the magnets.

### 2. Red Purity Adjustment

Refer to Figure 3 and turn off the green and blue guns with the G and B bias or cutoff controls, located on the neck board. (Leave the **red** gun on.) Display any self-test pattern on the screen that shows solid white. **Keep this display throughout the purity adjustments.**

Rotate and spread the tabs of the purity magnets (the pair farthest towards the front) until you center the screen image vertically and horizontally. You should also obtain a pure red overall.

### 3. Green Purity Adjustment

Turn off the red and blue guns by using the controls on the neck board; leave the **green** gun on. Readjust the purity magnets if necessary for a uniformly green screen.

### 4. Blue Purity Adjustment

Turn off the red and blue guns by using the controls on the neck board; leave the **blue** gun on. Repeat the purity adjustment for a uniformly blue screen. \*

### 5. Final Check

As a final check for total color purity, turn on all guns again. Leave the all-white self-test pattern on the screen. The screen should be pure, clean white—not tinted with other hues.

Finally, reinstall the monitor in the game.

## B. Convergence Adjustments

### 1. Static Convergence (Center Area)

First remove the monitor from the game, but leave the connectors still attached.

If you will also be converging the outer area of the picture (see Section 2 that follows), you should loosen both the deflection yoke and magnet mounting screws at this time.

Display the diagnostics pattern that shows black background with white lines and dots. **Keep this display throughout all convergence adjustments.**

Refer to Figure 3 and turn off the green gun with the G bias or cutoff control, located on the neck board. (Leave the red and blue guns on.)

Adjust the angle of the 4-pole or center pair of magnets, and superimpose the red and blue **vertical** lines in the center area of the screen.

Keeping their angles the same, rotate both tabs of the 4-pole magnets to superimpose the red and blue **horizontal** lines in the center area of the screen.

— — —  
Turn on the green gun again. Adjust the angle of the 6-pole or rear pair of magnets, and superimpose the green **vertical** lines on the red/blue ones, in the center area of the screen.

Finally, keeping their angles the same, rotate both tabs of the 6-pole magnets to superimpose the green **horizontal** lines on the red/blue ones.

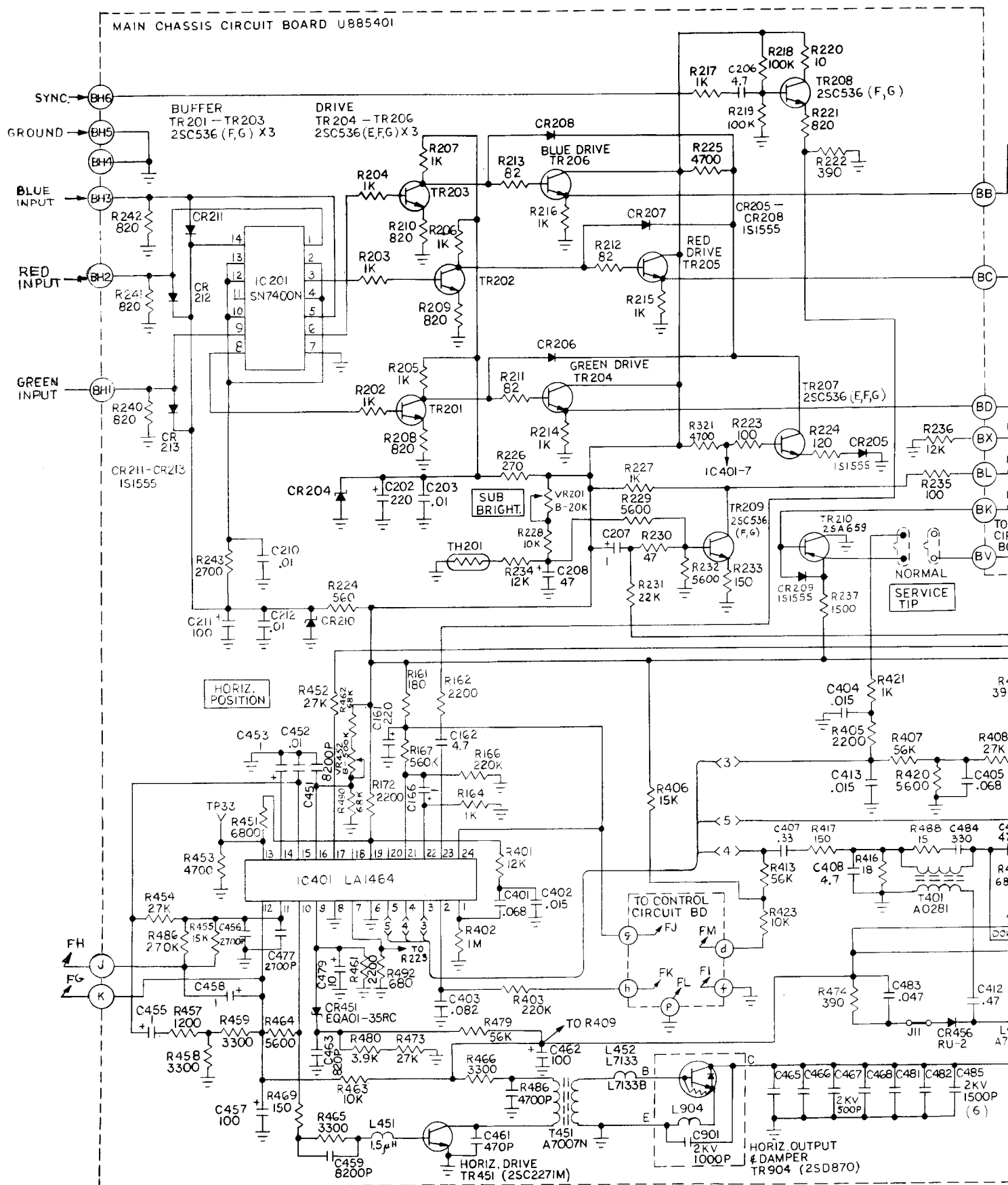


Figure 5 Schematic Diagram of Sanyo Monitor



If you do not need to converge the outer screen areas, you are done with the convergence procedure. (Otherwise, immediately proceed with Section 2 below.)

## 2. Dynamic Convergence (Outer Area)

Be sure to keep the same convergence pattern on the screen—white lines and dots with black background. Using a razor blade or thin knife, carefully loosen the glue holding the three rubber wedges and remove them. Be sure both the magnet and deflection yoke mounting screws are loosened.

Slide the yoke slightly away from the picture tube. Up/down movement of the yoke causes the outer edges of the screen image to swivel clockwise or counterclockwise. Side-to-side movement causes the lines and dots at the outer screen edges to expand and contract.

Move the yoke in the up/down and side-to-side directions until the outer lines and dots on the screen are pure white.

Then secure the deflection yoke by putting the wedges back in between the picture tube and the yoke's white collar. Secure the wedges with glue. Tighten the screws that secure the deflection yoke clamp and the magnets.

# 9 Schematic and Illustrated Parts Lists

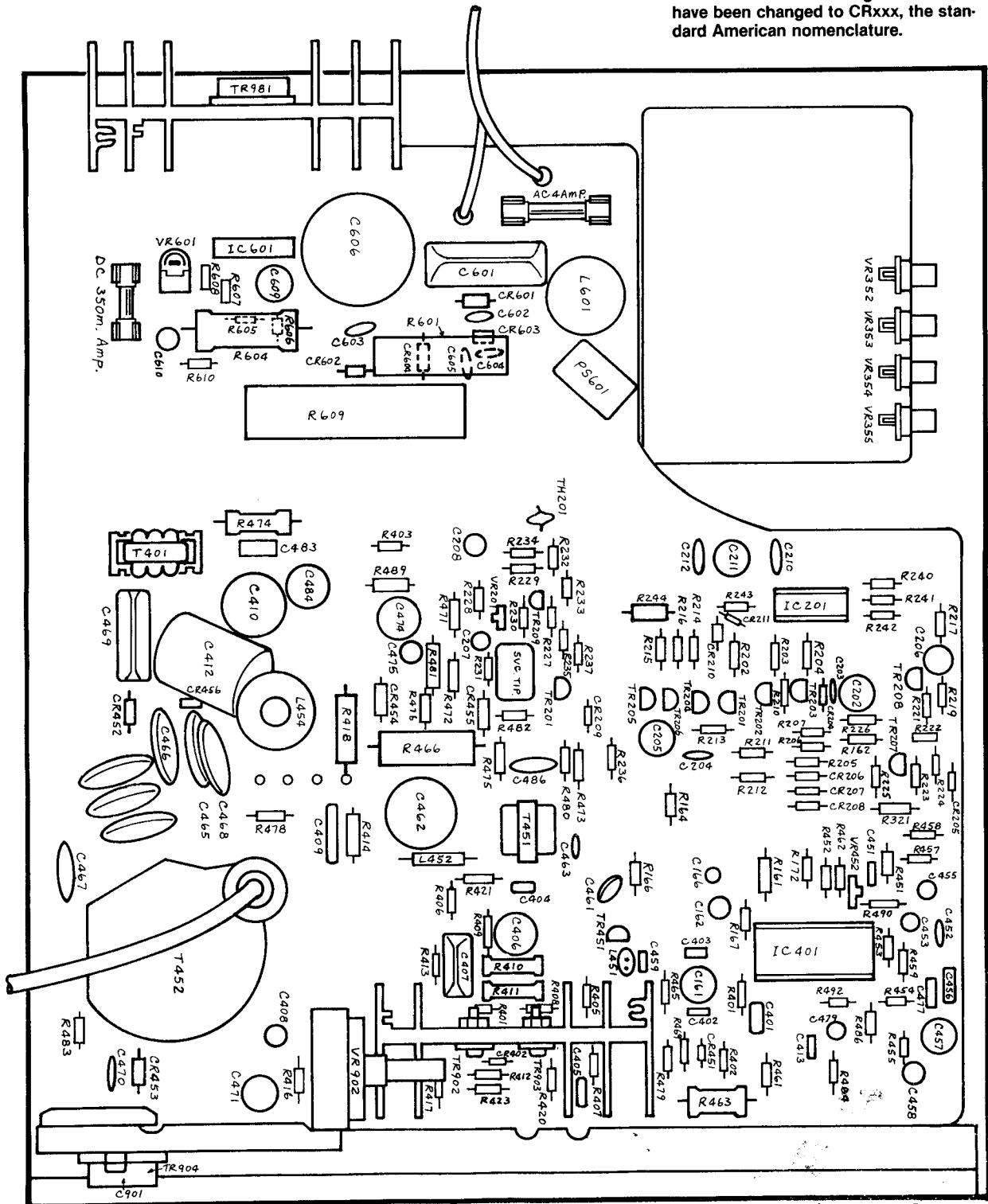
The purpose of this chapter is to provide you with the necessary information for ordering replacement parts for your Sanyo 14" color monitor. Please note that, for simplicity, **common hardware and certain other parts have been deleted** from this parts list. This includes screws, nuts, washers, certain connectors and tie wraps, in addition to metal parts,

such as heat sinks, shields and supports.

When ordering parts from your distributor, give the part number, part name and serial number of your game. This will help to avoid confusion and mistakes in your order. We hope the results will be less downtime and more profit from your game.

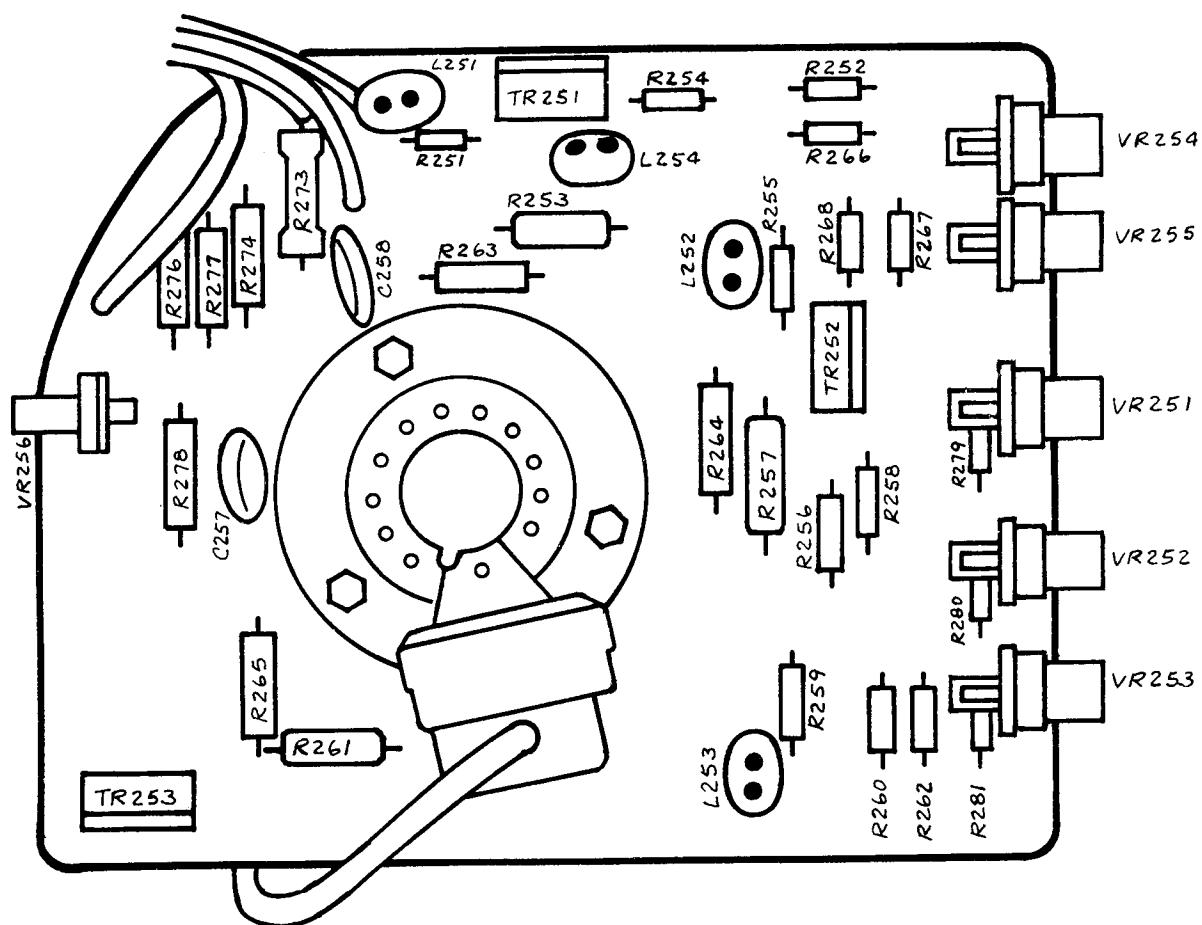
**Note:**

All diode reference designations Dxxx have been changed to CRxxx, the standard American nomenclature.



**Figure 6 Main PCB Assembly**





**Figure 7 Neck PCB Assembly**

## Figure 8 Parts List of Sanyo Monitor

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Atari Part No.	Description (Reference Designations in <b>Bold</b> )
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*Note: All diode reference designations Dxxx have been changed to CRxxx, the standard American nomenclature.*

99-160001	Control PCB Assembly
99-160002	Main PCB Assembly
99-160003	Neck PCB Assembly
99-160004	Convergence and Purity Magnets
99-160005	Picture-Tube Socket
99-160006	14" Picture Tube, Type 370ECB22
99-160007	Type LA1464 Integrated Circuit ( <b>IC401</b> )
99-160008	Type LA5110 Integrated Circuit ( <b>IC601</b> )
99-160009	Pincushion Correction Transformer ( <b>T401</b> )
99-160010	Horizontal Drive Transformer ( <b>T451</b> )
99-160011	Flyback Transformer ( <b>T452</b> )
99-160012	NPN Transistor ( <b>TR902</b> )
99-160013	NPN Transistor ( <b>TR901</b> )
99-160014	NPN Transistor/Damper ( <b>TR904</b> )
99-160015	NPN Transistor ( <b>TR201-203, 208</b> )
99-160016	PNP Transistor ( <b>TR210</b> )
99-160017	NPN Transistor ( <b>TR451</b> )
99-160018	NPN Transistor ( <b>TR251-253</b> )
99-160100	Type SIB01-02 Diode ( <b>CR455</b> )
99-160101	Type RU1 Diode ( <b>CR453</b> )
99-160102	Type RU2 Diode ( <b>CR454, 456</b> )
99-160103	Type RC2 Diode ( <b>CR452</b> )
99-160104	Type ERC04-06 Diode ( <b>CR601-604</b> )
99-160105	Type EQA01-05S Diode ( <b>CR451</b> )
99-160106	Type 1S1555 Diode ( <b>CR205-209, 211-213, 401, 402</b> )
99-160107	Type EQA01-11 Diode ( <b>CR204</b> )
99-160200	Focus Resistor ( <b>VR902</b> )
99-160201	Type PTH451CO5 Posistor ( <b>PS601</b> )
99-160202	Type SDT-500 Thermistor ( <b>TH201</b> )
99-160203	100K Ohm, 1/4W Metal-Film Resistor ( <b>R610</b> )
99-160204	5600 Ohm, 1/4W Metal-Film Resistor ( <b>R608</b> )
99-160205	33 Ohm, 1/2W Metal-Film Resistor ( <b>R409</b> )
99-160206	3.9 Ohm, 1W Metal-Film Resistor ( <b>R481</b> )
99-160207	390 Ohm, 2W Metal-Film Resistor ( <b>R474</b> )
99-160208	560 Ohm, 1W Metal-Oxide Resistor ( <b>R244</b> )
99-160209	10K Ohm, 2W Metal-Oxide Resistor ( <b>R463</b> )
99-160210	6800 Ohm, 2W Metal-Oxide Resistor ( <b>R418</b> )
99-160211	1200 Ohm, 3W Metal-Oxide Resistor ( <b>R604</b> )
99-160212	3300 Ohm, 3W Metal-Oxide Resistor ( <b>R466</b> )
99-160213	180 Ohm, 20W Wirewound Resistor ( <b>R609</b> )
99-160214	2.0 Ohm, 20W Wirewound Resistor ( <b>R601</b> )
99-160215	1.0 Ohm, 1W Metal-Oxide Resistor ( <b>R273</b> )
99-160216	5600 Ohm, 1W Metal-Oxide Resistor ( <b>R253, 257, 261</b> )
99-160300	470 uf, 10V Electrolytic Capacitor ( <b>C609</b> )
99-160301	10 uf, 16V Electrolytic Capacitor ( <b>C479</b> )

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## Figure 8 Parts List of Sanyo Monitor, continued

Atari Part No.	Description (Reference Designations in Bold)
99-160302	100 uf, 16V Electrolytic Capacitor (C211)
99-160303	220 uf, 16V Electrolytic Capacitor (C161, 202)
99-160304	47 uf, 16V Electrolytic Capacitor (C208)
99-160305	330 uf, 25V Electrolytic Capacitor (C484)
99-160306	4.7 uf, 25V Electrolytic Capacitor (C162, 206, 408)
99-160307	1.0 uf, 50V Electrolytic Capacitor (C166, 207, 453, 455, 458)
99-160308	100 uf, 25V Electrolytic Capacitor (C457, 610)
99-160309	10 uf, 160V Electrolytic Capacitor (C471)
99-160310	100 uf, 160V Electrolytic Capacitor (C462)
99-160311	4.7 uf, 160V Electrolytic Capacitor (C406)
99-160312	47 uf, 160V Electrolytic Capacitor (C410)
99-160313	Type 160EE4719C Electrolytic Capacitor (C606)
99-160314	0.01 uf, 50V Ceramic Capacitor (C203, 204, 210, 212, 452)
99-160315	0.022 uf, 50V Ceramic Capacitor (C207)
99-160316	0.015 uf, 50V Mylar Capacitor (C402, 404, 413)
99-160317	8200 pf, 50V Mylar Capacitor (C451, 459)
99-160318	2700 pf, 50V Mylar Capacitor (C477)
99-160319	0.047 mf, 100V Mylar Capacitor (C483)
99-160320	0.068 mf, 50V Mylar Capacitor (C405)
99-160321	820 pf, 50V Ceramic Capacitor (C463)
99-160322	470 pf, 500V Ceramic Capacitor (C461)
99-160323	4700 pf, 500V Ceramic Capacitor (C486)
99-160324	820 pf, 500V Ceramic Capacitor (C470, 473)
99-160325	1000 pf, 1000V Ceramic Capacitor (C602-605)
99-160326	1500 pf, 2000V Ceramic Capacitor (C465, 466, 468, 481, 482, 485)
99-160327	500 pf, 2000V Ceramic Capacitor (C467)
99-160328	0.082 mf, 50V Mylar Capacitor (C403)
99-160329	0.33 mf, 50V Mylar Capacitor (C407)
99-160330	0.056 mf, 125V Mylar Capacitor (C601)
99-160331	0.1 mf, 1000V Mylar Capacitor (C469)
99-160332	0.068 mf, 50V Mylar Capacitor (C401)
99-160333	0.47 mf, 400V Polypropylene Capacitor (C412)
99-160334	2700 pf, 630V Polypropylene Capacitor (C456)
99-160335	1000 pf, 2000V Ceramic Capacitor (C901)
99-160336	100 pf, 50V Ceramic Capacitor (C251-253)
99-160337	1000 pf, 1000V Ceramic Capacitor (C257, 258)
99-160400	Type 8C1FR5B 3K-Ohm Variable Resistor (VR353)
99-160401	Type 8C1FR5B 200K-Ohm Variable Resistor (VR354)
99-160402	Type 8C1FR5B 50K-Ohm Variable Resistor (VR352, 355)
99-160403	Type 8C1FR5B 10K-Ohm Variable Resistor (VR251-253)
99-160404	Type 8C1FR5B 200-Ohm Variable Resistor (VR254, 255)
99-160405	Type 15CFR10B 1M-Ohm Variable Resistor (VR256)
99-160406	Type 8L2FRB 5K-Ohm Variable Resistor (VR601)
99-160407	Type 8LFRB 20K-Ohm Variable Resistor (VR201)
99-160408	Type 8CFRB 500K-Ohm Variable Resistor (VR452)

**Figure 8 Parts List of Sanyo Monitor, continued**

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<i>Atari Part No.</i>	<i>Description (Reference Designations in Bold)</i>
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99-160450	Deflection Yoke ( <b>L902</b> )
99-160451	Filter Coil ( <b>L452</b> )
99-160452	Width Coil ( <b>T454</b> )
99-160453	Width Coil ( <b>T455</b> )
99-160454	Peaking Coil ( <b>L451</b> )
99-160455	Line Filter ( <b>L601</b> )
99-160456	Peaking Coil ( <b>L251-253</b> )
99-160457	Peaking Coil ( <b>L254</b> )

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