TM-283
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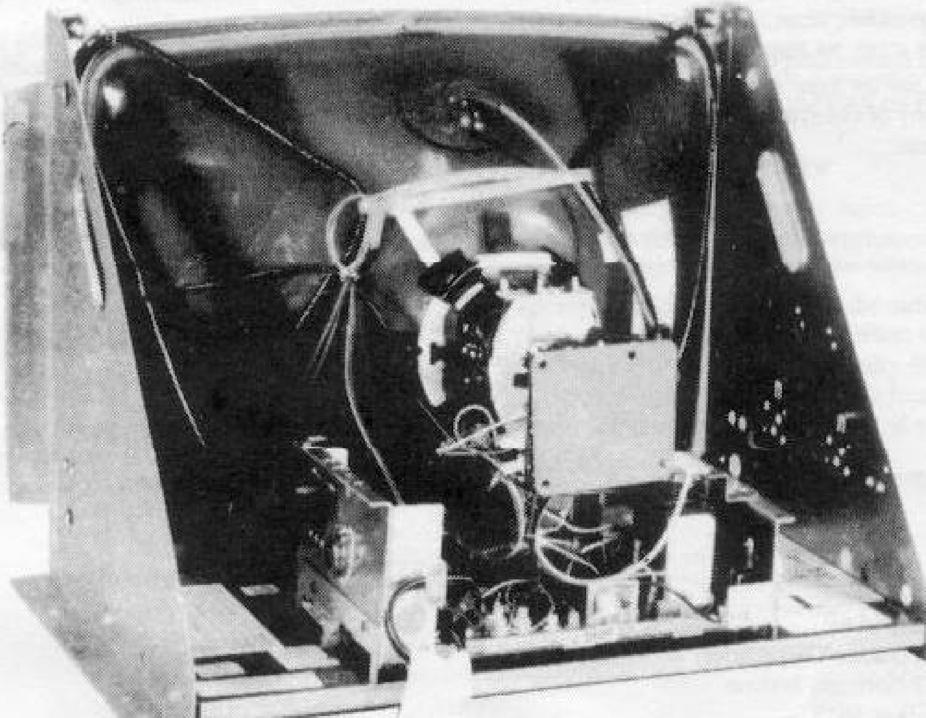
Wells-Gardner 19-Inch Color Raster Video Display

Model 19K4914



Service Manual

ATARI
GAMES

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▲ WARNINGS ▲

Power-Up Warning

Before making any servicing or testing, make certain that you use an isolation transformer between the AC supply and the AC plug of the video display. The chassis and the heat sink are *directly connected* to one side of the AC line, which could present a shock hazard.

Before making any servicing, read all the precautions on the CRT and chassis.

X-Ray Radiation Warning

Parts which influence X-ray radiation in the horizontal deflection and high-voltage circuits, the picture tube, etc., are indicated by a star (★) in the parts list. When replacing these components, use **only** the type shown in the parts list.

High Voltage

This video display contains **high voltages** derived from power supplies capable of delivering **lethal** quantities of energy. Do not attempt to service the video display until you have observed all precautions necessary for working on high-voltage equipment.

CRT Handling

Do not bump or scratch the picture tube because this may cause the picture tube to implode—resulting in injury. Shatter-proof goggles must be worn when handling the CRT. High voltage must be completely discharged before handling. Do not handle the CRT by the neck.

Product Safety Notice

For continued safety, replace safety-critical components **only** with manufacturer-recommended parts. These parts are identified by ▲ on the schematic diagram.

For replacement purposes, use the same type or specified type of wire and cable; make certain that you follow the positioning of the wires (especially for the high-voltage and power-supply circuits). Shock hazard, fire hazard, or video display damage may result if you use alternative wiring or positioning.

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Specifications

Supply

Voltage	108–132 VAC
Frequency	50–60 Hz

NOTE

Apply supply voltage through an isolation transformer with 1 Amp. minimum capability.

High Voltage (EHT)

24.5 ± 0.8 kV at 0 mA Beam,
22.8 ± 0.8 kV at 0.75 mA Beam

Note: Condition for above is that line voltage equals 120 V

Table 1 Video Display Adjustment Controls

MAIN PC BOARD

Vertical Hold Control, VR301

Vertical Size Control, VR303

Horizontal Hold Control, VR351

Vertical Shift Control, VR901

Horizontal Centering Adjustment Jumper (3 positions)

Horizontal Shift Control, VR352

Screen Control (Part of H.V. Unit), T352

Focus Control (Part of H.V. Unit), T352

Horizontal Size Coil, L352

Black Level Control, VR201

Vertical Damping Control, VR302

NECK PC BOARD

Video Drive Controls: Red (VR401), Green (VR402)

CRT Cut-off Controls: Red (VR403), Green (VR404), Blue (VR405)

Control Adjustments

NOTE

Horizontal vs. Vertical: Some models have the picture tube mounted vertically rather than horizontally. That is, the picture tube is mounted in the frame such that the long dimension of the tube is up and down. Other than the physical orientation of the picture tube, there is no electrical difference between these models and their horizontal counterparts. The vertical circuits produce and control deflection along the short dimension of the tube in all models.

The horizontal circuits produce and control deflection along the long dimension of the tube in all models. Therefore, wherever "vertical" appears in this manual or on the video display, the word refers to the *short* dimension of the picture tube; wherever "horizontal" appears, that word refers to the *long* dimension of the picture tube.

1.0 Black Level Control

This control has been set at the factory to 140 VDC (see Figure 10) and should not need further attention. However, when a game is connected to the video display, you may have to slightly adjust the screen control to obtain the proper black level (the black portion of the picture just extinguished).

2.0 Vertical Size (Height)

The location of this control is shown in Figure 1. If necessary, adjust this control slowly until the picture or test pattern has the correct vertical proportions.

NOTE

This adjustment interacts with the vertical damping adjustment described in the section below. You may have to readjust the vertical size after adjusting the vertical damping control.

3.0 Vertical Damping

You will have to adjust this control only if the video display is being used with a game in which the top several raster lines are visible on the screen. Adjust the vertical damping control for uniform spacing of the top raster lines.

4.0 Circuit Protection

A 4.0 Amp pigtail fuse is mounted on the Main Board. This fuse protects the power output circuit.

5.0 Focus

Adjust the focus control, located on the high-voltage unit (T352), for maximum overall definition and fine picture detail.

6.0 Horizontal Hold Control, VR351

You should allow a warm-up period of at least five minutes before aligning the video display. With the display being driven from the game signal, short TP601 to TP31. Adjust VR351 (see Figure 1) until the picture stops sliding horizontally. Remove the short.

7.0 Horizontal Video Position

If the video is off center on the raster, you can compensate somewhat by adjusting this control.

8.0 Vertical Raster Position

If the video is off center vertically, you can compensate somewhat by turning the vertical raster position control.

9.0 Horizontal Raster Position

If the video is off center horizontally, you can compensate somewhat by moving the horizontal raster position adjustment jumper to either position "R" or "L."

10.0 Horizontal Width

The horizontal width coil is adjusted with a hexagonal tuning tool. Adjust this control slowly, if necessary, until the picture or test pattern has the correct horizontal proportions.

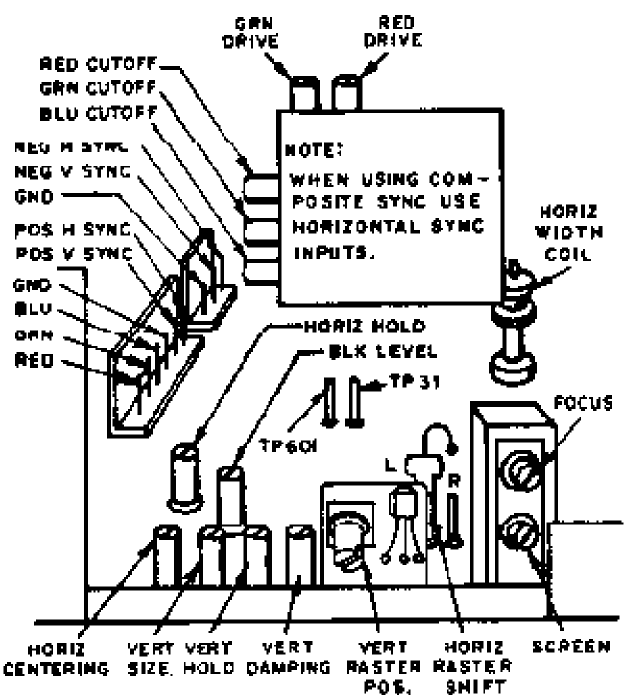


Figure 1 Input Connectors and Controls

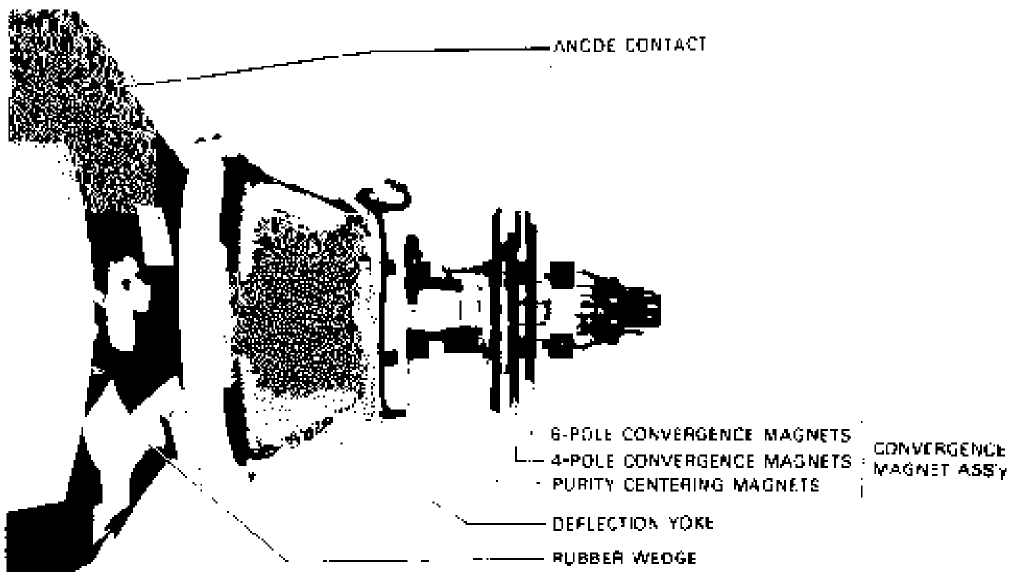


Figure 6 Location of Color Purity and Convergence Controls

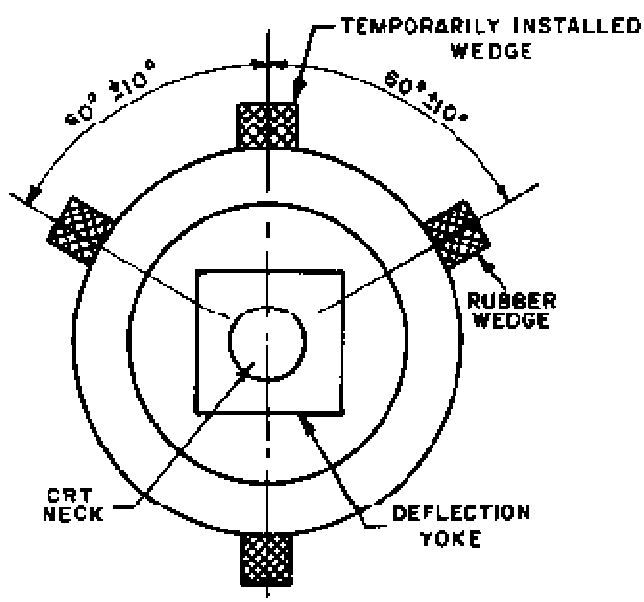


Figure 7 Proper Positioning of Rubber Wedges Under Deflection Yoke

Servicing Adjustments

> **NOTE**
>
> After replacing any parts in the CRT assembly, you must make all five adjustments described in this section. Before making these adjustments, apply a suitable power source to the video display through an isolation transformer. Then apply a suitable signal source to the Main PCB through P201 and P202.

1.0 Degaussing

Summary: Demagnetize the shadow mask and all surrounding metal parts with an external degaussing coil.

All video displays are equipped with automatic degaussing coils (L701) that demagnetize the picture tube every time the video display is turned on after being off for a minimum of five minutes. Should any part of the chassis become magnetized, you will have to degauss the affected area with a manual degaussing coil. Move the coil slowly over the screen and over all surrounding metal parts. Then slowly withdraw the coil for a distance of 6 feet before turning off the coil.

2.0 Color Purity

Summary: Adjust the purity magnets and the yoke position to produce an overall uniform color.

> **NOTE**
>
> Purity and static convergence adjustments will interact. The video display must have been operating 15 minutes before you start this procedure.

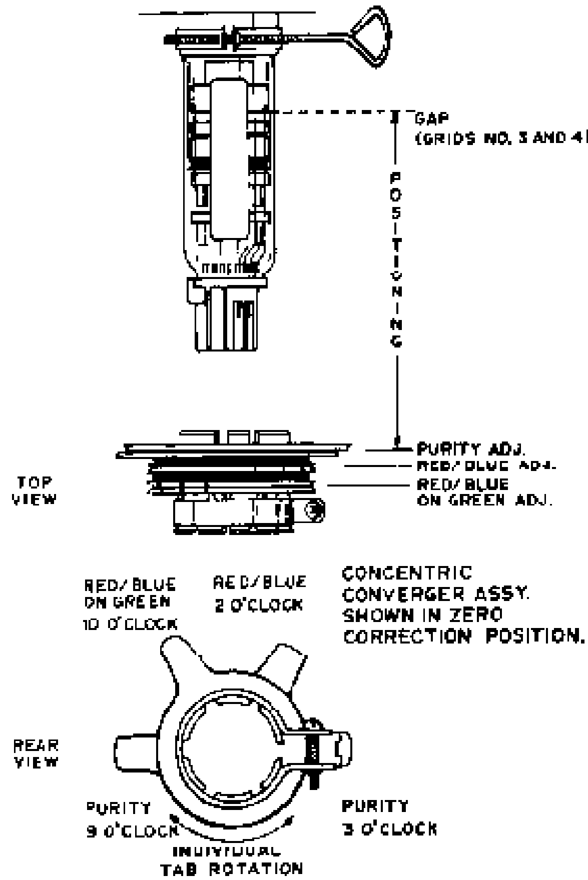


Figure 2 Convergence and Purity Adjustments

2.1 For best results, we recommend that the purity adjustment be made after the video display is placed in its final location. If the display must be moved, make this adjustment with it facing east or west.

2.2 Set the converger assembly on the CRT neck with the centerline of the purity adjustment magnet over the gap between grids no. 3 and 4 (see Figures 2 and 6).

2.3 Make certain that the magnetic ring pairs are in their correct positions before starting this procedure. This produces a zero-correction condition on the CRT beam and helps you make adjustments.

2.4 Make certain that the vertical raster position control is at the center of its rotation.

2.5 Remove the R/G/B signal from the video display.

2.6 Turn the green cutoff control (VR404) on the Neck Board fully clockwise (see Figure 3).

2.7 Turn the the red and blue cutoff controls (VR403 and VR405) fully counterclockwise.

2.8 Pull the deflection yoke backward so that a green belt appears on the screen (see Figure 4).

2.9 Decrease the horizontal width of the raster, if necessary, to see the right and left edges of the raster.

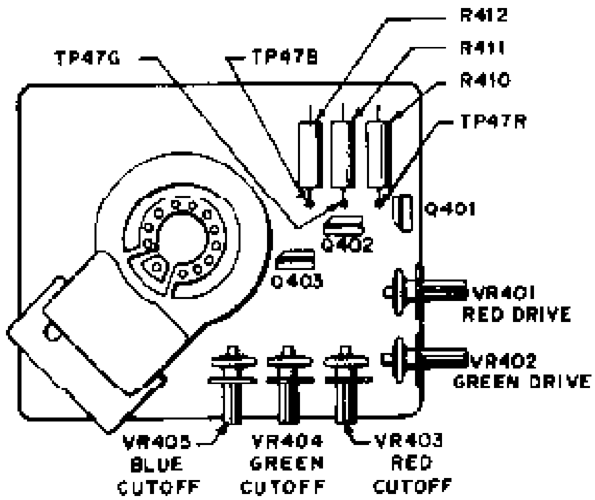


Figure 3 Neck Board—Component Side (With Horizontally Mounted CRT)

2.10 Move the two purity magnets with respect to each other to center the raster horizontally on the screen and the green belt on the raster horizontally.

2.11 Gradually push the deflection yoke forward; fix it at the place where the green screen becomes uniform throughout.

2.12 Turn the cutoff and drive controls. Confirm that each color is uniform.

2.13 If any color is not uniform, readjust it, moving the purity magnets slightly.

2.14 Turn all three cutoff controls fully counterclockwise. Slowly turn the red cutoff control up or clockwise until a red raster is just barely visible.

2.15 Slowly turn up the green and blue cutoff controls so that their associated colors, mixed with the red, result in a white or grey raster.

2.16 Make certain that the white or grey color is uniform throughout the screen.

2.17 Insert a wedge temporarily as shown in Figure 4; adjust the angle of the deflection yoke.

3.0 Static Convergence

Summary: Converge red and blue on green in the center of the screen.

3.1 Connect a crosshatch signal or grid pattern to the video display.

3.2 A pair of 4-pole convergence magnets is provided to converge the blue and red beams (see Figure 6). When the pole opens to the left and right 45° symmetrically, the magnetic field is maximized. Red and blue beams move to the left and right (see Figure 5). Vary the angle between the tabs to adjust the convergence of red and blue vertical lines.

3.3 Rotate both 4-pole convergence magnet tabs as a pair to adjust the convergence of the red and blue horizontal lines.

3.4 A pair of 6-pole convergence magnets is provided to converge the magenta (red + blue) to the green beams (see Figure 6). When the pole opens to the left and right 30° symmetrically, the magnetic field is maximized. Red and blue beams both move to the left and right (see Figure 5). Vary the opening angle to adjust the convergence of magenta to green vertical lines.

3.5 Rotate both 6-pole convergence magnet tabs as a pair to adjust the convergence of magenta to green horizontal lines.

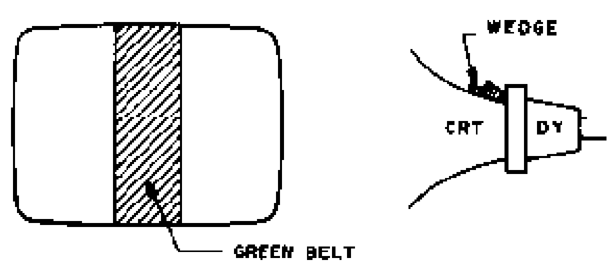


Figure 4 Video Image for Color Purity Adjustment

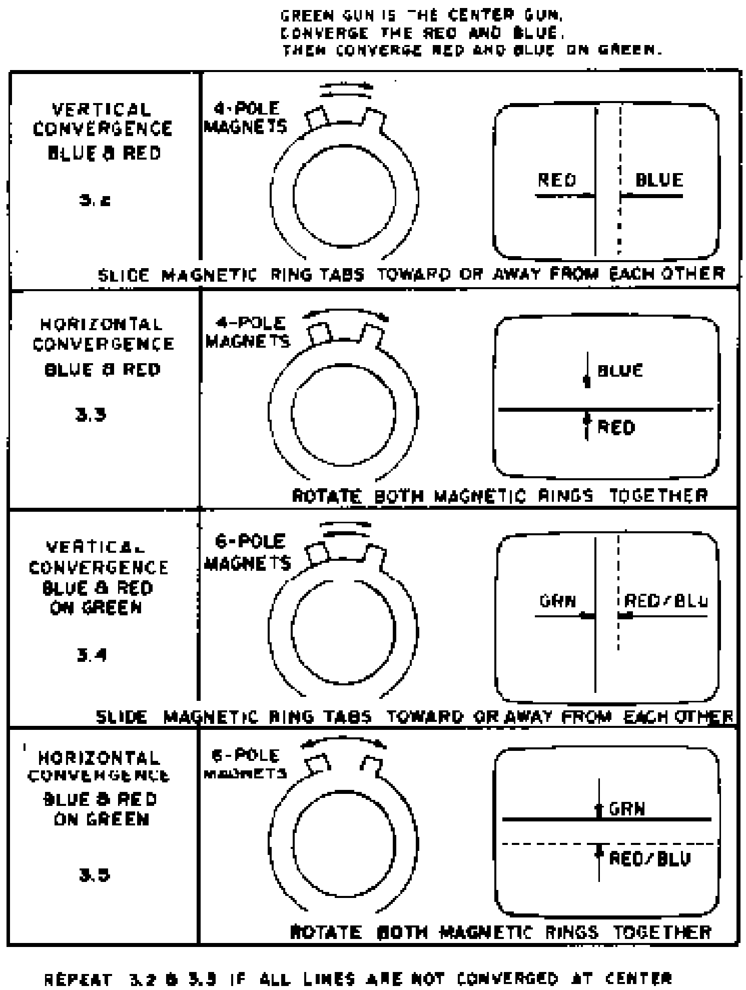


Figure 5 Adjustment of Red and Blue Beams During Static Convergence

4.0 Dynamic Convergence

Summary: Converge red and blue at the edges of the screen.

4.1 Feed a crosshatch signal or grid pattern to the video display.

4.2 Temporarily insert a rubber wedge as shown in Figure 7.

4.3 Tilt the angle of the yoke up and down to adjust the crossover of both vertical and horizontal red and blue lines. See Figure 8 (a) and (b)

4.4 Tilt the angle of the yoke sideways to adjust the parallel convergence of both horizontal and vertical lines at the edges of the screen. See Figure 9 (a) and (b).

4.5 After you have positioned the yoke, insert three more rubber wedges in the positions shown in Figure 7. Do NOT force the permanent wedges in: insert the wedges until they just make contact with the yoke.

4.6 Fix the three permanent rubber wedges with chloroprene rubber adhesive.

4.7 After the adhesive has dried enough to hold the wedges in place, carefully remove the temporarily installed wedge.

5.0 White Balance

Summary: Set the grey and white brightness tracking.

To adjust the white balance of the video display, you will need an oscilloscope with a DC-coupled mode in the vertical amplifier.

Refer to Figure 1 and 3 while doing the following adjustments in subdued light after degaussing and setting the purity of the CRT.

5.1 Ground the R/G/B video inputs.

5.2 Set the red and green drive controls, VR401 and VR402, to approximately 80% of fully clockwise rotation.

5.3 Set the screen and R/G/B cutoff controls to their minimum (fully counterclockwise) positions.

5.4 Connect the test equipment to the collector of a video output transistors (Q401, Q402, and Q403) on the CRT neck PCB at TP47R, TP47G, and TP47B (see Figure 3). Determine which color has the lowest black-level voltage. This is the lead color gun.

5.5 Adjust the black level control (VR201) of the lead color gun to obtain the waveform shown in Figure 10.

5.6 Slowly turn the screen control clockwise until the raster is just visible.

5.7 Adjust the screen control counterclockwise until the raster is just extinguished.

5.8 Connect a 1.5 VDC source to the R/G/B inputs. Then adjust the three cutoff controls for best grey uniformity.

5.9 Connect a 3.0 VDC source to the R/G/B inputs. Then adjust the R/G drive controls, if necessary, for best neutral white (7500° K).

5.10 Repeat steps 5.8 and 5.9 until you obtain good tracking of white balance.

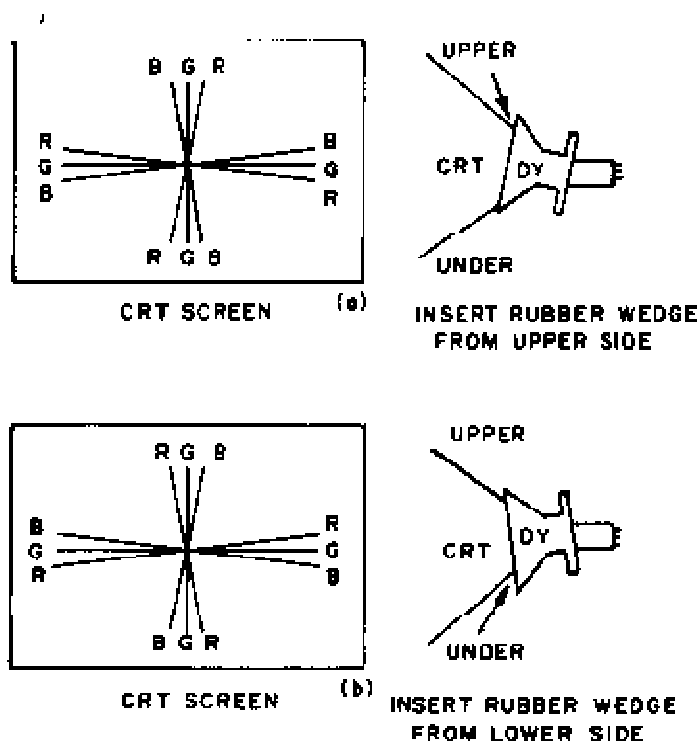


Figure 8 Adjustment of Red and Blue Beams During Dynamic Convergence

Parts List

This monitor contains circuits and components included specifically for safety purposes. The two symbols described below are used in the parts list to mark components that you should replace only with exact factory replacement parts. Using substitute parts may create a shock, fire, radiation or other hazard. Only qualified personnel should perform service.

★ indicates parts that influence X-ray radiation in the horizontal deflection and high-voltage circuits, the picture tube, etc.

▲ indicates safety-critical parts

Main Board

Refer. No.	Wells-Gardner Part No.	Description
	Resistors	
R201	203X6500-645	1 kΩ, ±5%, ¼ W Carbon
R202	340X2680-934	68 Ω, ±5%, ¼ W Carbon
R203	203X6500-405	100 Ω, ±5%, ¼ W Carbon
R204	203X6700-327	100 Ω, ±5%, ½ W Carbon
R205	203X6700-421	270 Ω, ±5%, ½ W Carbon
R206	203X6500-540	390 Ω, ±5%, ¼ W Carbon
R207	340X2221-934	220 Ω, ±5%, ¼ W, Carbon
R208	203X6500-540	390 Ω, ±5%, ¼ W Carbon
R209	340X2221-934	220 Ω, ±5%, ¼ W, Carbon
R210	203X6500-540	390 Ω, ±5%, ¼ W Carbon
R211	340X2221-934	220 Ω, ±5%, ¼ W, Carbon
R214	203X6500-645	1 kΩ, ±5%, ¼ W Carbon
R215	203X6501-126	100 kΩ, ±5%, ¼ W Carbon
R216	203X6500-645	1 kΩ, ±5%, ¼ W Carbon
R217	203X6500-405	100 Ω, ±5%, ¼ W Carbon
R218	203X6500-645	1 kΩ, ±5%, ¼ W Carbon
R219	203X6501-126	100 kΩ, ±5%, ¼ W Carbon
R220	203X6500-645	1 kΩ, ±5%, ¼ W Carbon
R221	203X6500-405	100 Ω, ±5%, ¼ W Carbon
R222	203X6500-762	3.3 Ω, ±5%, ¼ W Carbon
R224	203X6500-169	10 Ω, ±5%, ¼ W Carbon
R225	203X6500-169	10 Ω, ±5%, ¼ W Carbon
R226	203X6500-169	10 Ω, ±5%, ¼ W Carbon
R227	203X6501-044	47 kΩ, ±5%, ¼ W Carbon
R228	340X2152-934	1.5 kΩ, ±5%, ¼ W Carbon
R229	203X6700-421	270 Ω, ±5%, ½ W Carbon
R230	203X6500-863	8.2 kΩ, ±5%, ½ W Composite
R231	203X6500-863	8.2 kΩ, ±5%, ½ W Composite
R232	203X6500-863	8.2 kΩ, ±5%, ½ W Composite
R233	340X2221-934	220 Ω, ±5%, ¼ W, Carbon
R234	340X2820-934	82 Ω, ±5%, ¼ W Carbon
R235	340X2820-934	82 Ω, ±5%, ¼ W Carbon
R236	340X2820-934	82 Ω, ±5%, ¼ W Carbon
R237	340X2471-934	470 Ω, ±5%, ¼ W, Carbon
R238	340X2471-934	470 Ω, ±5%, ¼ W, Carbon
R239	340X2471-934	470 Ω, ±5%, ¼ W, Carbon
R240	340X2471-934	470 Ω, ±5%, ¼ W, Carbon
R301	203X6500-508	270 Ω, ±5%, ¼ W Carbon
R302	203X6500-863	8.2 kΩ, ±5%, ¼ W Carbon
R303	203X6500-863	8.2 kΩ, ±5%, ¼ W Carbon
R304	203X6500-724	2.2 kΩ, ±5%, ¼ W Carbon
R305	203X6500-842	6.8 kΩ, ±5%, ¼ W Carbon
R306	203X6003-201	7.5 kΩ, 2%, ¼ W Carbon
R307	203X6500-825	5.6 kΩ, ±5%, ¼ W Carbon
R309	203X6500-965	22 kΩ, ±5%, ¼ W Carbon
R310	203X6500-988	39 kΩ, ±5%, ¼ W Carbon
R311	203X9014-709	3.3 kΩ, ±5%, 1 W Carbon
R312	203X9014-741	4.7 kΩ, ±5%, 1 W Metal Oxide
R313	204X1527-528	470 Ω, ±5%, 7 W Carbon
R314	203X6500-481	220 Ω, ±5%, ¼ W Carbon
R315	203X6500-169	10 Ω, ±5%, ¼ W Carbon
R317	203X6700-061	8.2 Ω, ±5%, ¼ W Carbon
R318	203X6500-584	560 Ω, ±5%, ¼ W Carbon
R319	203X6500-645	1 kΩ, ±5%, ¼ W Carbon
R320	203X6501-002	33 kΩ, ±5%, ¼ W Carbon
R321	203X6501-224	270 kΩ, ±5%, ½ W Carbon
R322	203X6500-886	10 kΩ, ±5%, ¼ W Carbon
R351	340X2183-934	10 kΩ, ±5%, ¼ W, Carbon
R352	203X6500-785	3.9 kΩ, ±5%, ¼ W Carbon
R353	340X2473-934	47 kΩ, ±5%, ¼ W, Carbon

Continued on next page

Main Board Continued

Refer. No.		Wells-Gardner Part No.	Description
R354		340X2332-934	3.3 kΩ, ±5%, ¼ W, Carbon
R355		203X9205-143	6.8 kΩ, ±5%, 3 W Metal Oxide
R358		340X3683-934	68 kΩ, ±5%, ½ W Carbon
R360		203X6500-561	470 Ω, ±5%, ¼ W Carbon
R361		203X6500-886	10 kΩ, ±5%, ¼ W Carbon
R362		203X9014-645	1.8 kΩ, ±5%, 1 W Metal Oxide
R363	★	204X1450-516	3.9 kΩ, ±5%, 5 W Metal Oxide
R364		203X6500-246	22 Ω, ±5%, ¼ W Carbon
R365		340X2183-934	18 kΩ, ±5%, ¼ W Carbon
R367		203X6500-886	10 kΩ, +5%, ¼ W Carbon
R368		203X5602-185	330 kΩ, ±5%, ½ W Composite
R369		203X5602-329	680 kΩ, ±5%, ½ W Composite
R370		340X2223-934	22 kΩ, ±5%, ¼ W, Carbon
R371		203X9014-584	1 kΩ, ±5%, 1 W Metal Oxide
R372		203X9104-809	12 kΩ, ±5%, 2 W Metal Oxide
R375		203X9014-724	3.9 kΩ, ±5%, 1 W Carbon
R376		203X9104-404	270 Ω, ±5%, 2 W Metal Oxide
R377		203X6500-447	150 Ω, ±5%, ¼ W Carbon
R378		203X6500-886	10 kΩ, ±5%, ¼ W Carbon
R379		203X6500-886	10 kΩ, ±5%, ¼ W Carbon
R380		203X6500-865	8.2 kΩ, ±5%, ¼ W Carbon
R381		203X6500-724	2.2 kΩ, ±5%, 1 W Metal Oxide
R383		203X9014-387	150 Ω, ±5%, 1 W Metal Oxide
R384		203X6501-088	68 kΩ, ±5%, ¼ W Carbon
R385		340X2122-934	1.2 kΩ, ±5%, ¼ W Carbon
R388		340X5183-633	18 kΩ, ±5%, 2 W Metal Oxide
R390		340X4222-633	2.2 kΩ, ±5%, 1 W Metal Oxide
R391		340X4222-633	2.2 kΩ, ±5%, 1 W, Metal Oxide
R394		43X0478-001	680 Ω, ±5%, 5 W, Wirewound
R502		203X6500-886	10 kΩ, ±5%, ¼ W Carbon
R503		43X0481-001	180 Ω, ±5%, 25 W, Wirewound
R504		203X9014-267	47 Ω, ±5%, 1 W Metal Oxide
R505		203X6501-209	220 kΩ, ±5%, ¼ W Carbon
R506		204X1425-196	15 Ω, ±5%, 5 W Wire Wound
R507		203X5602-185	330 kΩ, ±5%, ½ W Composite

Refer. No.		Wells-Gardner Part No.	Description
R601	▲ ★	204X1625-058	3.3 Ω, ±5%, 10 W Wire Wound
R701		340X5022-633	2.2 Ω, ±5%, 2 W, Metal Oxide
R702		203X6206-441	2.2 Ω, ±5%, ½ W Carbon
VR201		204X2070-072	2 kΩ-B Semi-Fixed
VR301		204X2070-084	5 kΩ-B Semi-Fixed
VR302		204X2070-084	5 kΩ-B Semi-Fixed
VR303		204X2070-055	500 Ω-B Semi-Fixed
VR351		204X2070-072	2 kΩ-B Semi-Fixed
VR352		204X2070-072	10 kΩ-B Semi Fixed
		Capacitors	
C201		203X0014-088	1000 µF, 16 V, Electrolytic
C202		202X7200-064	330 pF, 500 V, Ceramic
C203		202X7200-043	220 pF, 500 V, Ceramic
C204		202X7200-043	220 pF, 500 V, Ceramic
C205		203X0014-076	470 µF, 16 V, Electrolytic
C206		203X1810-149	0.1 µF, 125 V, Mylar
C207		349X2232-109	.022 µF, 100 V, Mylar
C301		203X0014-065	330 µF, 50 V, Electrolytic
C302		203X1600-563	.022 µF, 50 V, Mylar
C303		203X0629-037	2.2 µF, 50 V, Electrolytic
C304		203X1600-566	.0068 µF, 50 V, Mylar
C306		203X0412-012	2.2 µF, 16 V, Tantalum
C307		203X1600-634	0.033 µF, 50 V, Mylar
C308		203X0025-163	2.2 µF, 50 V, Electrolytic
C309		203X1207-100	0.068 µF, 100 V, Polypropylene
C310		203X0629-061	10 µF, 100 V, Electrolytic
C311		203X0041-162	4.7 µF, 160 V, Electrolytic
C312		203X1201-265	0.33 µF, 200 V, Polypropylene
C313		203X0040-068	100 µF, 160 V, Electrolytic
C314		203X1201-096	0.039 µF, 200 V, Polypropylene
C315		203X0629-023	1 µF, 50 V, Electrolytic
C351		203X0629-023	1 µF, 50 V, Electrolytic
C352		203X0619-045	47 µF, 25 V, Electrolytic
C353		203X1190-015	0.0082 µF, 50 V, Polystyrene
C354		203X0619-045	47 µF, 25 V, Electrolytic
C355		203X1600-566	0.0068 µF, 50 V, Mylar
C356		203X1130-287	0.0047 µF, 50 V, Mylar
C359		202X8065-606	100 pF, 500 V, Ceramic
C360		202X7050-466	0.0033 µF, 500 V, Ceramic
C361		202X7050-483	0.01 µF, 500 V, Ceramic
C362		202X7203-032	0.01 µF, 50 V, Ceramic
C363	▲ ★	203X1270-911	8700 pF, 1.5 kV, Polypropylene
C365		46X0536-046	0.39 µF, 200 V, Polypropylene
C366		203X0010-026	22 µF, 25 V, Electrolytic
C367		202X8065-162	6 pF, 500 V, Ceramic

Continued on next page

Refer. No.		Wells-Gardner Part No.	Description
C368		203X1100-858	0.1 µF, 50 V
C369		203X1207-087	0.047 µF, 100 V, Polypropylene
C372		203X1207-125	0.1 µF, 100 V, Polypropylene
C373		203X0029-021	1 µF, 50 V, Electrolytic
C380		202X7200 087	470 pF, 500 V, Ceramic
C381		80X0099-006	470 pF, 500 V, Ceramic
C501	▲ ★	203X1810-149	0.1 µF, 125 V, Mylar
C502	▲ ★	202X7050-282	1500 pF, 500 V, Ceramic
C503	▲ ★	202X7810 214	2200 pF, 125 V, Ceramic
C504	▲ ★	202X7810-214	2200 pF, 125 V, Ceramic
C505		203X0220-075	560 µF, 200 V, Electrolytic
C506		203X0040-034	22 µF, 160 V, Electrolytic
C507		203X0041-057	47 µF, 160 V, Electrolytic
C701		203X0019 092	1000 µF, 25 V, Electrolytic
C702		203X0624-061	10 µF, 100 V, Electrolytic
C703		202X7050 248	1000 pF, 500 V, Ceramic
		Semiconductors	
D203		201X2010 159	Diode, 1S2076-27
D204		201X2010-159	Diode, 1S2076 27
D205		201X2010-159	Diode, 1S2076-27
D206		201X2010-159	Diode, 1S2076-27
D207		201X2010 159	Diode, 1S2076 27
D208		201X2010 159	Diode, 1S2076-27
D209		201X2010 159	Diode, 1S2076-27
D302		201X2010 159	Diode, 1S2076-27
D303		201X2010-159	Diode, 1S2076-27
D304		201X2120-009	Diode, RH-1V
D305		201X2120-009	Diode, RH-1V
D306		201X2010 159	Diode, 1S2076 27
D307		201X2010 165	Diode, 1SS81
D310		66X0084-001	Diode, GFF 10R
D311		66X0083-001	Diode, RGP 10G
D501	▲ ★	201X3120-216	Diode, RM 1AV
D502	▲ ★	201X3120-216	Diode, RM-1AV
D503	▲ ★	201X3120-216	Diode, RM-1AV
D504	▲ ★	201X3120-216	Diode, RM-1AV
D505		201X3120-216	Diode, RM-1AV
D506		201X3120-216	Diode, RM 1AV
D701		201X2130-234	Diode, RU-2V
D702		201X2120-009	Diode, RH-1V
Q201		200X3181-523	Transistor (NPN), 2SC1815GR
Q202		200X3181-523	Transistor (NPN), 2SC1815GR
Q203		200X4056-260	Transistor (PNP), 2SA562-Y-TM
Q204		200X4056-260	Transistor (PNP), 2SA562-Y-TM
Q205		200X4056-260	Transistor (PNP), 2SA562-Y-TM

Refer. No.		Wells-Gardner Part No.	Description
Q206		200X3181-523	Transistor (NPN), 2SC1815GR
Q207		200X3181-523	Transistor (NPN), 2SC1815GR
Q208		200X3181-523	Transistor (NPN), 2SC1815GR
Q209		200X3181-523	Transistor (NPN), 2SC1815GR
Q210		200X3181-523	Transistor (NPN), 2SC1815GR
Q301		200X3181-523	Transistor (NPN), 2SC1815GR
Q302		200X3207-306	Transistor (NPN), 2SC2073LBGL2
Q303		200X3207-306	Transistor (NPN), 2SC2073LBGL2
Q351		200X3248-217	Transistor (NPN), 2SC2482BK
Q352		86X0178-001	Transistor (NPN), 2SD870
ZD202		66X0040 019	Diode, Zener, 3.9 V, ± 5%, ½ W
ZD301		66X0040-031	Diode, Zener 24 V, ± 3%, ½ W
IC301		200X2300-033	Integrated Circuit, HA 11423
IC501	▲ ★	86X0179-001	Integrated Circuit, STR381
		Transformers and Coils	
L352	★	9A2838-002	Horizontal Size Coil
L353		9A2851-001	Linearity Coil
L701		611X0005-005	Degaussing Coil
T351		202X1300-080	Horizontal Drive Transformer
T352	▲ ★	200X9720-301	HV Unit, M-11
		Miscellaneous	
F501	▲ ★	204X7120-073	Fuse, 4 Amp. 125V
J402		206X5008-632	Receptacle, W Wire 3P-M-BG
P201		204X9600-466	Plug, PWB 3P-J
P202		204X9601 477	Plug, PWB 6P-Q
P401		204X9600-298	Plug, PWB 4P-B
P501		204X9600-249	Plug, PWB 2P-B
P601		204X9600-304	Plug, PWB 4P-C
TH501		201X0100-112	Thermistor
		Final Assembly Parts	
	▲ ★	88X0138-506	Cathode-Ray Tube, RCA Type 19VJTP22
	▲ ★	202X1111-258 or 202X1111-264	Deflection Yoke
		291X5004-262	Automatic Degaussing Coil Unit
		205X9800-158	Purity/Convergence Assembly

Neck Board

Refer. No.	Wells-Gardner Part No.	Description
	Resistors	
R401	203X6000-729	220 Ω, ±5% ¼ W Carbon
R402	203X6500-540	390 Ω, ±5% ¼ W Carbon
R403	203X6000-661	820 Ω, ±5% ¼ W Carbon
R404	203X6000-729	220 Ω, ±5% ¼ W Carbon
R405	203X6500-540	390 Ω, ±5% ¼ W Carbon
R406	203X6000-661	820 Ω, ±5% ¼ W Carbon
R407	203X6000-729	47 Ω, ±5% ¼ W Carbon
R408	203X6000-998	270 Ω, ±5% ¼ W Carbon
R409	203X6000-661	820 Ω, ±5% ¼ W Carbon
R410	203X9104-824	15 kΩ, ±5%, 2 W, Metal Oxide
R411	203X9104-824	15 kΩ, ±5%, 2 W, Metal Oxide
R412	203X9104-824	15 kΩ, ±5%, 2 W, Metal Oxide
R413	203X6000-998	2.7 kΩ, ±5% ½ W Composite
R414	203X6000-998	2.7 kΩ, ±5% ½ W Composite
R415	203X6000-998	2.7 kΩ, ±5% ½ W Composite
R416	203X9105-154	2.2 Ω, ±5% 2 W Metal Oxide
R419	203X6500-741	2.7 kΩ, ±5% ¼ W Carbon
R420	203X6500-741	2.7 kΩ, ±5% ¼ W Carbon
R421	203X6500-741	2.7 kΩ, ±5% ¼ W Carbon
VR401	204X2115-014	500 Ω, -B Semi-Fixed
VR402	204X2115-014	500 Ω, -B Semi-Fixed
VR403	204X2115-006	5 kΩ, -B Semi-Fixed
VR404	204X2115-006	5 kΩ, -B Semi-Fixed
VR405	204X2115-006	5 kΩ, -B Semi-Fixed
	Capacitors	
C401	80X0099-021	820 pF, 500 V, Ceramic
C402	202X7050-248	1000 pF, 500 V, Ceramic
C403	202X7050-248	1000 pF, 500 V, Ceramic
C404	202X7050-282	1500 pF, 1.5 kV, Ceramic
C405	202X7050-483	0.01 µF, 500 V, Ceramic
	Semiconductors	
Q401	200X3206-800	Transistor, (NPN) 2SC2068LB
Q402	200X3206-800	Transistor, (NPN) 2SC2068LB
Q403	200X3206-800	Transistor, (NPN) 2SC2068LB
	Miscellaneous	
J401	206X5009-296	Receptacle, W Wire 4P-E
P402	204X9600-254	Plug, PWB 3P-A
P403	204X9600-981	Plug, 1-Pin
P701	204X9601-020	Plug, PWB 4P-E
	204X9301-255	CRT Socket

Vertical Position Board (P344)

Refer. No.	Wells-Gardner Part No.	Description
	Resistors	
VR901	40X0645-001	25 kΩ Vert. Position Control
	Semiconductors	
Q901	86X0127-001	Transistor, (NPN) TPS98

Table 2 Typical DC Voltages With Input Signal

Transistor Number	Collector	Transistor Base	Emitter
Q201	8.1	0.43	0.36
Q202	9.8	8.1	9.3
Q203	0.0	0.35	1.0
Q204	0.0	0.35	1.0
Q205	0.0	0.35	1.0
Q206	9.7	5.5	4.8
Q207	9.7	5.5	4.8
Q208	9.7	5.5	4.8
Q209	13.4	-0.30	0.01
Q210	14.0	0.31	0.17
Q301	15.5	4.7	4.2
Q302	79.0	37.8	37.7
Q303	37.0	0.51	0.0
Q351	41.4	0.41	0.0
Q352	Do not measure	−0.03	0.0
Q401	88.3	8.5	8.4
Q402	88.3	8.5	8.4
Q403	88.3	8.5	8.4
Q901	34.6	17.5	16.9

I. C. 301

Pin No.	Voltage
1	1.16
2	4.0
3	6.8
4	3.9
5	12.1
6	4.1
7	4.1
8	1.9
9	12.2
10	14.2
11	3.6
12	7.9
13	6.8
14	12.8
15	1.52
16	0.0
17	0.83
18	0.0

I. C. 501

Pin No.	Voltage
1	159
2	123
3	0
4	125

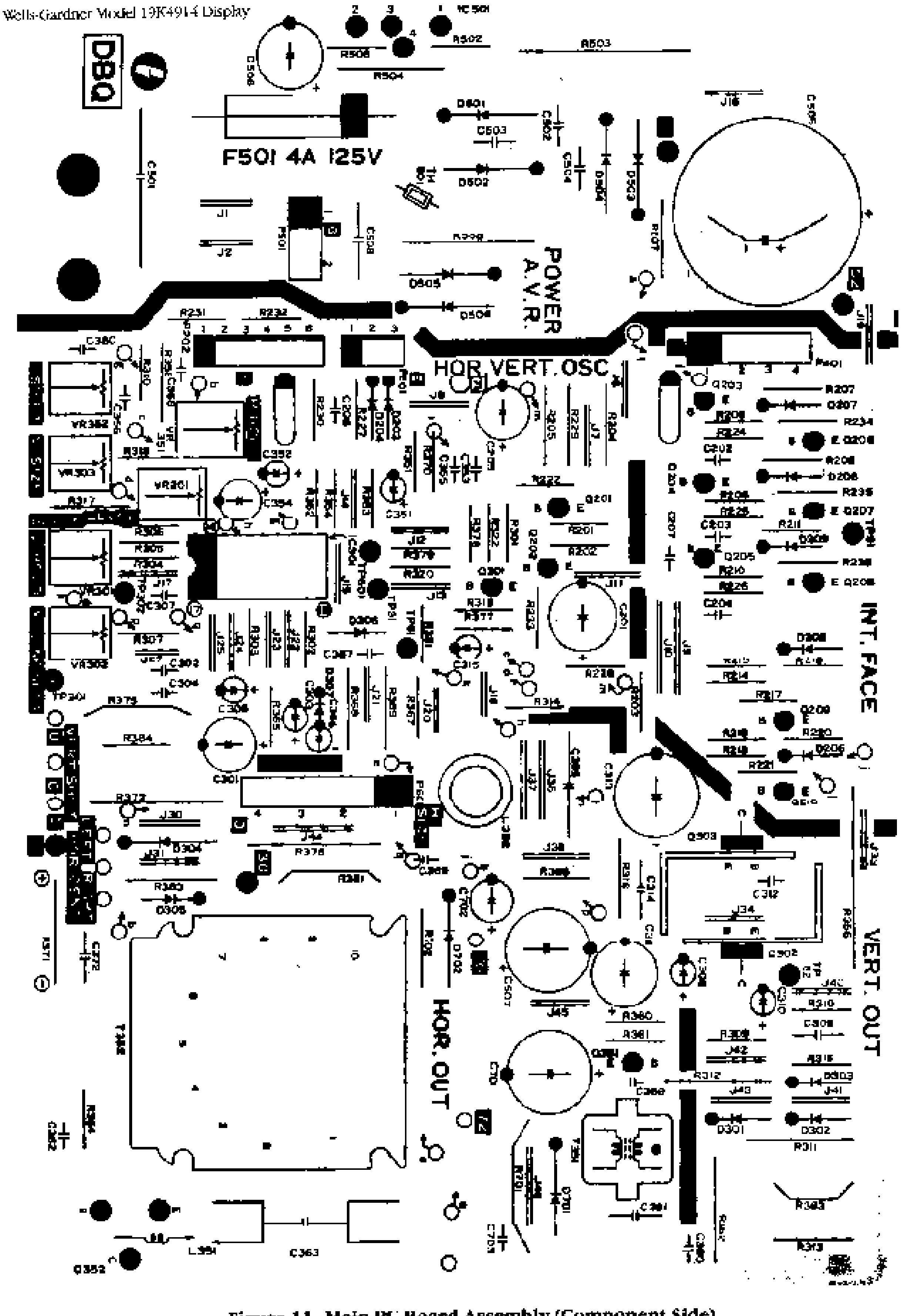


Figure 11 Main PC Board Assembly (Component Side)

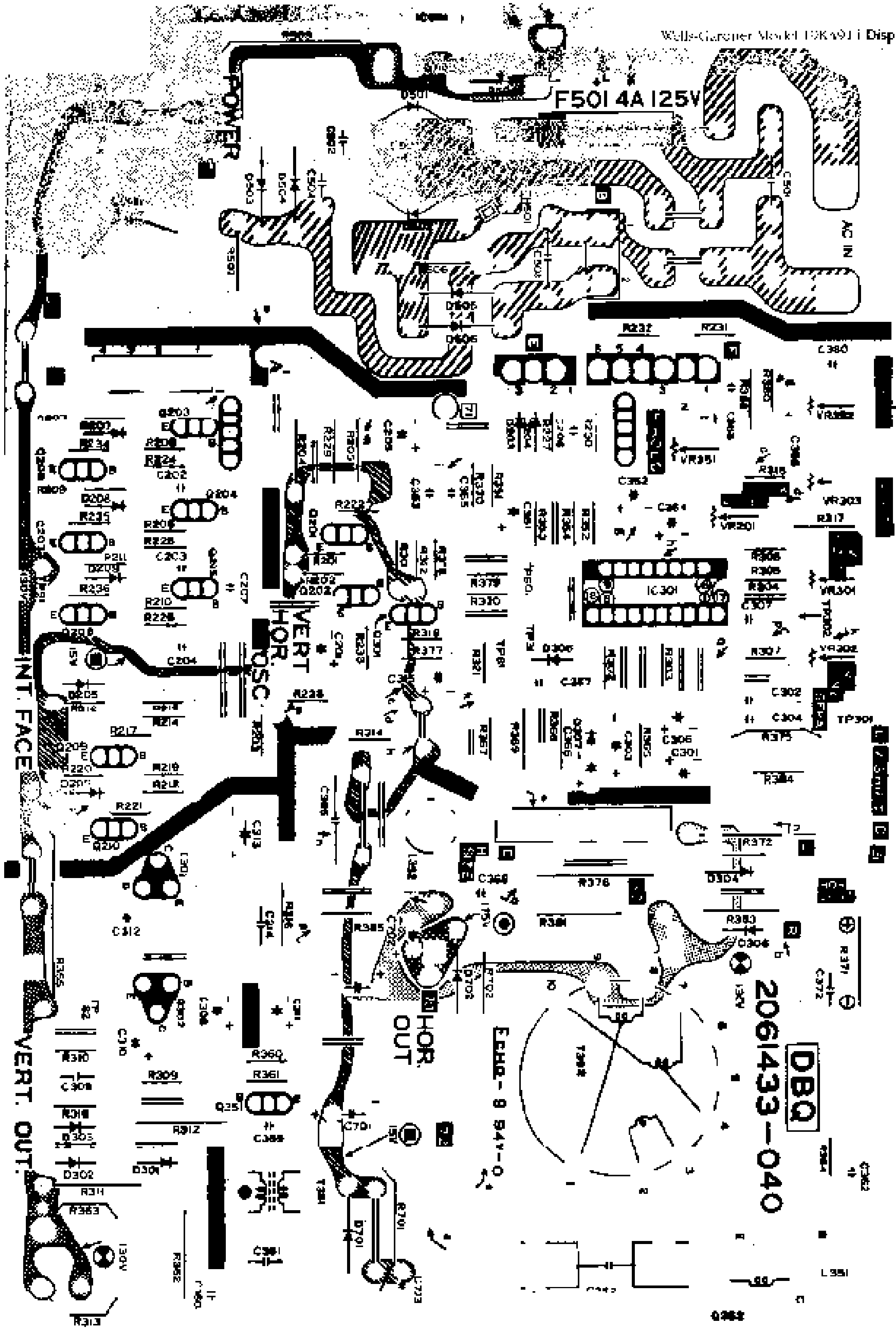
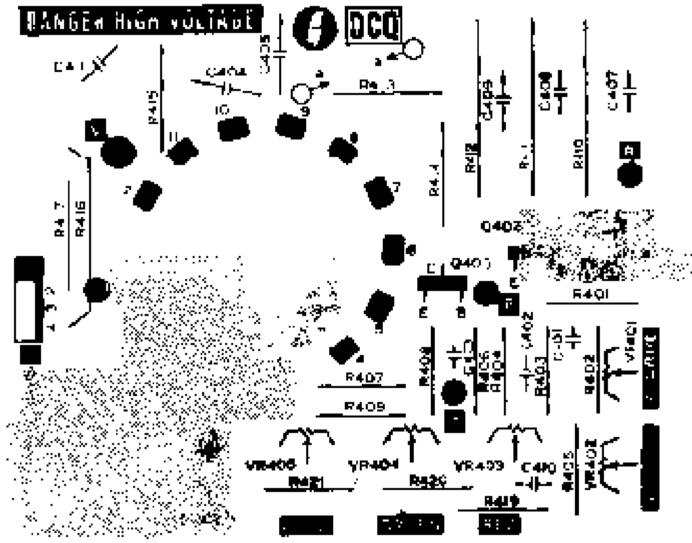
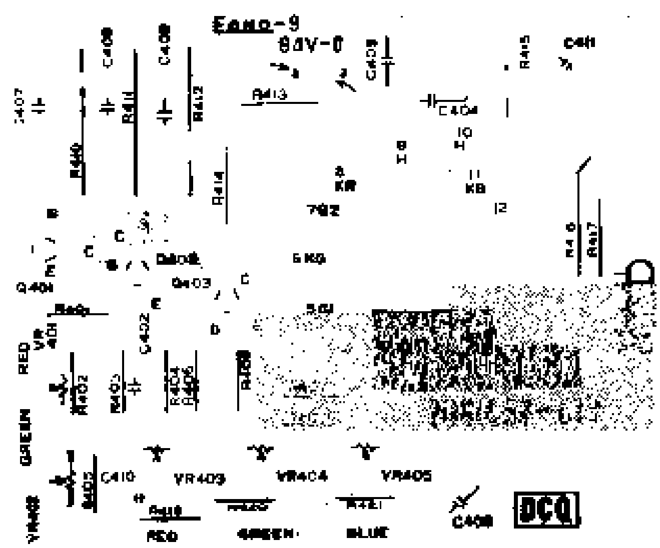


Figure 12 Main PC Board Assembly (Foil or Circuit Side)

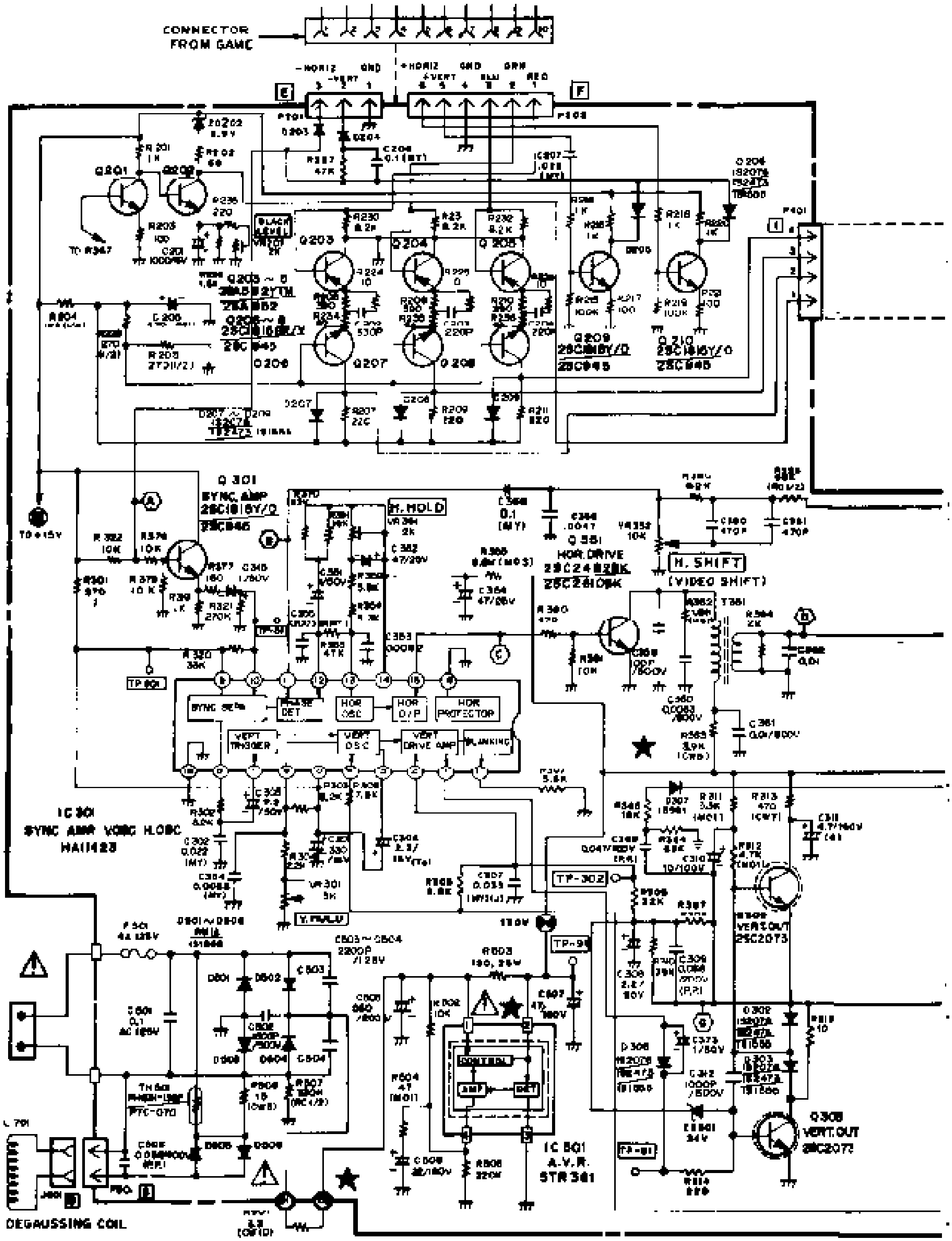


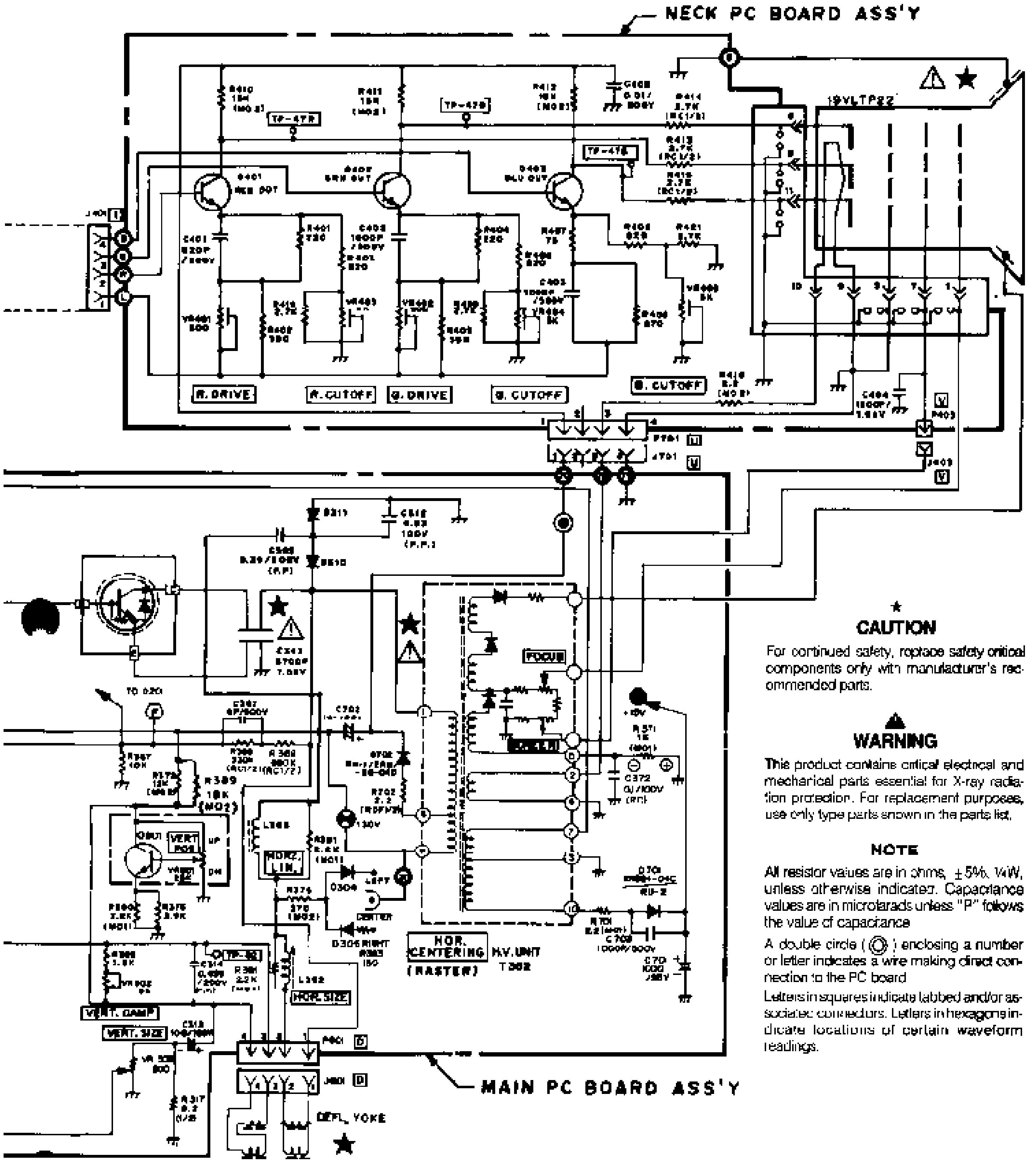
VIEW OF COMPONENT SIDE



VIEW OF FOIL SIDE

Figure 13 Neck PC Board





★ CAUTION

For continued safety, replace safety critical components only with manufacturer's recommended parts.

WARNING

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.

NOTE

All resistor values are in ohms, ±5%, ¼W, unless otherwise indicated. Capacitance values are in microfarads unless "P" follows the value of capacitance.

A double circle (◎) enclosing a number or letter indicates a wire making direct connection to the PC board.

Letters in squares indicate tabbed and/or associated connectors. Letters in hexagons indicate locations of certain waveform readings.

Figure 14 Schematic Diagram

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