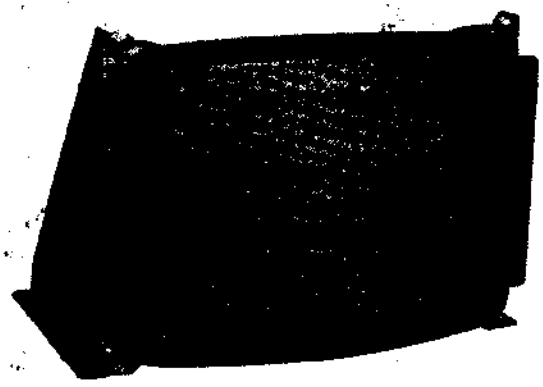
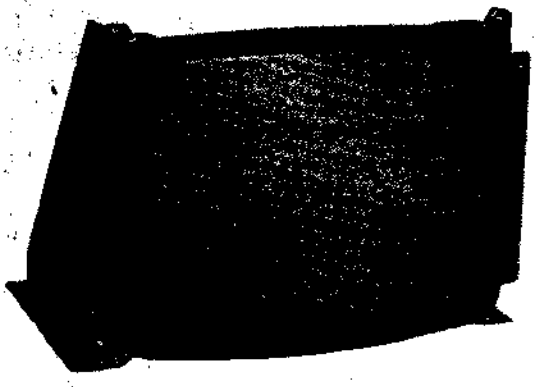
WELLS-GARDNER ELECTRONICS CORPORATION

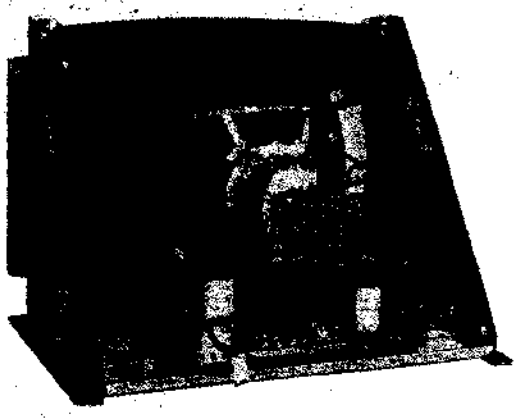
19" IN LINE COLOR MONITORS



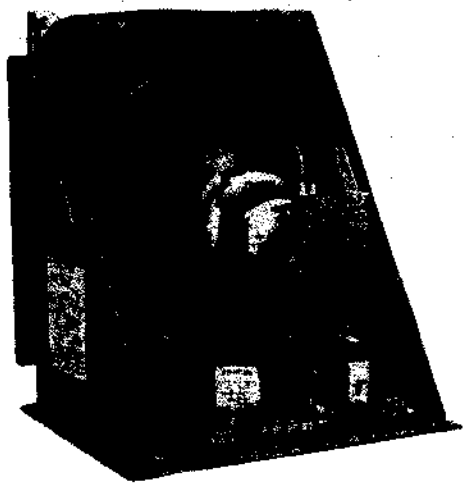
MODELS
19K4901
19K4902
19K4903
19K4906
19K4911



MODEL
19K4904



MODELS
19K4951
19K4952
19K4953
19K4956
19K4956R
19K4961



WELLS-GARDNER ELECTRONICS CORPORATION
2701 NORTH KILDARE AVENUE
CHICAGO, ILLINOIS 60639

THIS MANUAL APPLIES TO THOSE MONITORS WITH SERIAL NUMBERS OF 576001 AND ABOVE.

WARNINGS

1. Power Up Warning—

An isolation transformer must be used between the AC supply and the AC plug of the monitor before servicing or testing is performed since the chassis and the heat sink are directly connected to one side of the AC line which could present a shock hazard.

Before servicing is performed, read all the precautions labelled on the CRT and chassis.

2. X-RAY RADIATION WARNING NOTICE

WARNING: PARTS WHICH INFLUENCE X-RAY RADIATION IN HORIZONTAL DEFLECTION, HIGH VOLTAGE CIRCUITS AND PICTURE TUBE ETC. ARE INDICATED BY (★) IN THE PARTS LIST FOR REPLACEMENT PURPOSES. USE ONLY THE TYPE SHOWN IN THE PARTS LIST.

3. High Voltage—

This monitor contains HIGH VOLTAGES derived from power supplies capable of delivering LETHAL quantities of energy. Do not attempt to service until all precautions necessary for working on HIGH VOLTAGE equipment have been observed.

4. CRT Handling—

Care must be taken not to bump or scratch the picture tube as this may cause the picture tube to implode resulting in personal 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.

5. PRODUCT SAFETY NOTICE

WARNING: FOR CONTINUED SAFETY REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER RECOMMENDED PARTS. THESE PARTS ARE IDENTIFIED BY SHADING AND BY (⚠) ON THE SCHEMATIC DIAGRAM.

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.

For replacement purposes, use the same type or specified type of wire and cable, assuring the positioning of the wires is followed (especially for H.V. and power supply circuits). Use of alternative wiring or positioning could result in damage to the monitor or in a shock or fire hazard.

PERFORMANCE AND OPERATING DATA

1. Apply a suitable power source to the monitor through an isolation transformer.
2. Apply a suitable signal source to the monitor PCB by means of P201 and P202
3. Set Up Controls.
   All controls are preset at the factory, but may be adjusted to suit program material.

1.0 Supply

Voltage	108 VAC-132 VAC
Frequency	50 Hz-60 Hz

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

2.0 High Voltage (EHT)

For 19"V models	24.3 ± 0.8 K.V. at 0 Beam;	22.8 ± 0.8 K.V. at 1 mA Beam

Note: Condition for above: A.C. = 120V

3.0 Service Set-Up Controls

MAIN PC BOARD

3.1 Vertical Hold Control, VR301
3.2 Vertical Size Control, VR303
3.3 Horizontal Hold Control, VR351
3.4 Vertical Raster Position Control, VR 901
3.5 Horizontal Raster Position Adjustment Jumper (3 positions)
3.6 Screen Control (Part of H.V. Unit, T352)
3.7 Focus Control (Part of H.V. Unit, T352)
3.8 Horizontal Width Coil, L352 (L601 on Model K4904)
3.9 Black Level Control, VR201
3.10 Horizontal Video Position Control, (Horizontal Shift) VR352
3.11 Vertical Damping Control, VR302

NECK PC BOARD

3.12 Video Drive Controls, Red VR401
Green VR402
3.13 CRT Cut Off Controls, Red VR403
Green VR404
Blue VR405

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.

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. Examples of this include (but are not limited to) Models K4951, K4952, K4956, K4956R, and K4961 as in the pictures on the bottom of the front cover. Other than the physical orientation of the picture tube, there is no electrical difference between these models and their horizontal counterparts. The same circuits, the vertical circuits, produce and control deflection along the short dimension of the tube in all models.

The same circuits, 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 monitor, it refers to the short dimension of the picture tube; wherever "horizontal" appears, it refers to the long dimension of the picture tube.

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.
NOTE: This adjustment interacts with the vertical damping adjustment described in the paragraph below. It may be necessary to readjust the vertical size after the vertical damping control has been adjusted.

3.0 VERTICAL DAMPING

Adjustment of this control is required only if the monitor 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 4.0A pigtail fuse, mounted on the Main Board has been provided to protect the Power Output Circuit.

5.0 FOCUS

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

6.0 HORIZONTAL HOLD CONTROL ADJUSTMENT, VR351 (See Fig. 1a or 1b)

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.

7.0 HORIZONTAL VIDEO POSITION

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

8.0 VERTICAL RASTER POSITION ADJUSTMENT

If the video is off center vertically, (short dimension of picture tube) some compensation can be made by turning the vertical raster position control.

9.0 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".
NOTE: This adjustment is not provided on Model K4903.

10.0 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.

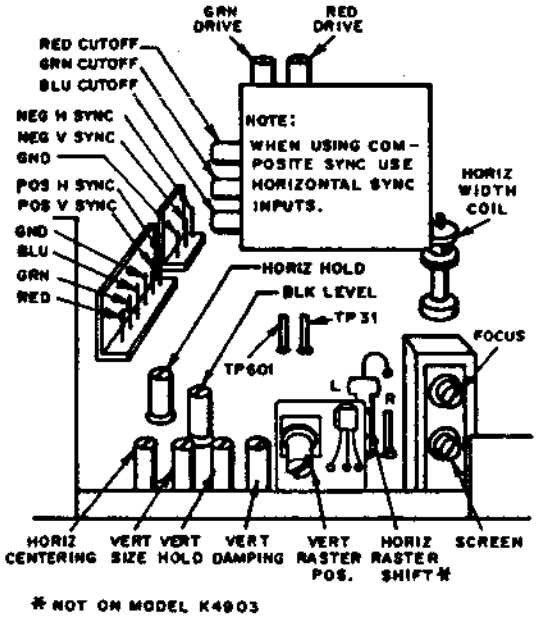


Figure 1(a)

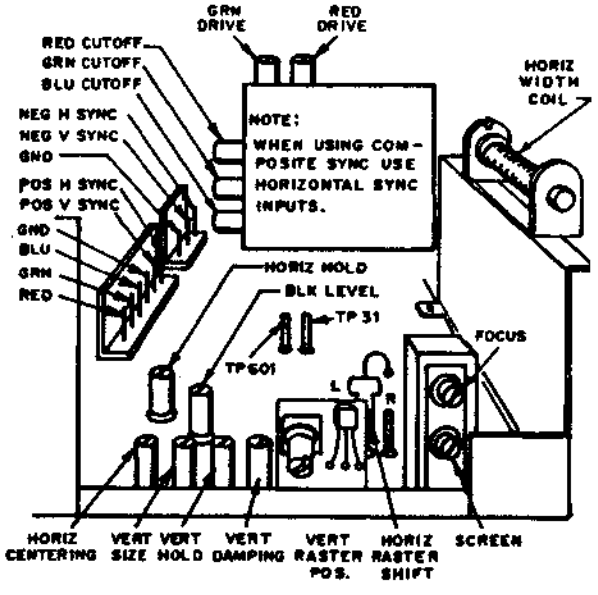


Figure 1(b)

NOTE: All of the following procedures have been performed at the factory and should require no further attention. If the monitor is serviced for any reason, it should be observed afterward to determine whether any of these procedures need to be performed again.

OUTLINE OF CONVERGENCE AND SET-UP PROCEDURE

1.0 **DEGAUSSING:** Demagnetize the shadow mask and all surrounding metal parts with an external degaussing coil.
2.0 **PURITY:** Adjust the purity magnets and the yoke position.
3.0 **STATIC CONVERGENCE:** Converge Red and Blue on Green in the center of the screen.
4.0 **DYNAMIC CONVERGENCE:** Converge Red and Blue at the edges of the screen.
5.0 **WHITE BALANCE:** Set Gray and White brightness tracking.

NOTE: Number 2.0 and 3.0 adjustments interact.

1.0 DEGAUSSING

The monitor is equipped with an automatic degaussing circuit. However, if the CRT shadow mask has become excessively magnetized, it may be necessary to degauss it with a manual coil. Do not switch the coil OFF while the raster shows any effect from the coil.

2.0 COLOR PURITY ADJUSTMENT

2.1 For best results, it is recommended that the purity adjustment be made in the final monitor location. If the monitor will be moved, perform this adjustment with it facing west or east. The monitor must have been operating 15 minutes prior to this procedure.
2.2 Set the converger assembly on the CRT neck with the center line (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 procedure.
This produces a zero-correction condition on the CRT beam and helps facilitate adjustments.
2.4 Vertical raster position control must be at the center of its rotation.
2.5 Remove the R-G-B signal from the monitor.
2.6 Turn the Green Cut off Control (VR404) on the Neck Board fully CW. (See Fig. 3)
2.7 Turn the Red and Blue Cut off Controls (VR403 & VR405) fully CCW.
2.8 Pull the Deflection Yoke backward so that the Green belt will appear. (See Fig. 4)
2.9 Decrease the horizontal width of the raster, if necessary, in order to be able to see the right and left edges of the raster.
2.10 Move the two Purity Magnets with respect to each other in order to center the raster horizontally on the screen and the Green belt on the raster horizontally.
2.11 Push the Deflection Yoke forward gradually and fix it at the place where the Green screen becomes uniform throughout.
2.12 Turn the Cut off and Drive Controls and confirm that each color is uniform.
2.13 If the color is not uniform, re-adjust it, moving the Purity Magnets slightly.

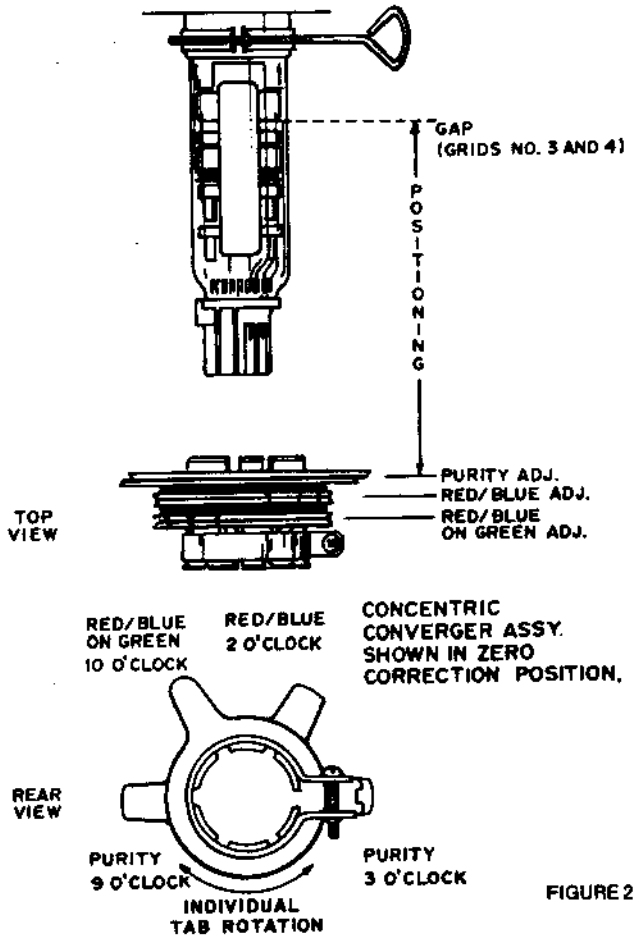


FIGURE 2

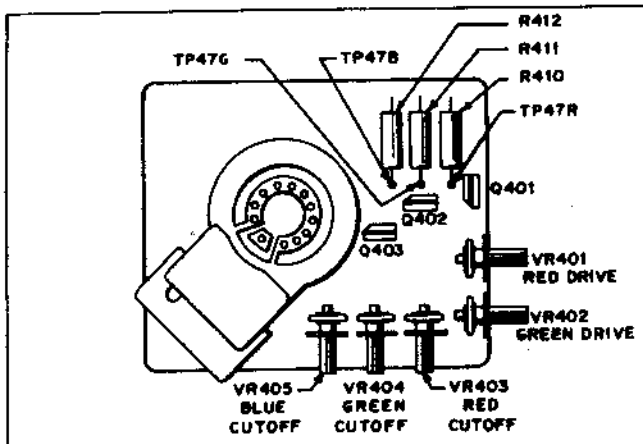


FIGURE 3: Component Side of Neck Board
(with horizontally mounted CRT)

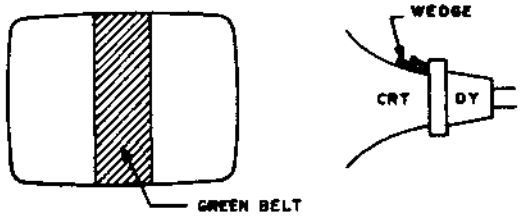


FIGURE 4

2.14 Turn all three cut off controls fully counterclockwise (CCW). Slowly turn up (CW) the Red cutoff control until a Red raster is just barely visible.

2.15 Slowly turn up the Green and Blue cutoff controls such that their associated colors, mixing with the Red, results in a White or Gray raster.

2.16 Confirm that the white or gray color is uniform throughout the screen.

2.17 Insert a wedge temporarily as shown in Fig. 4 and adjust the angle of the Deflection Yoke.

3.0 STATIC CONVERGENCE ADJUSTMENT

4-Pole Magnets and 6-Pole Magnets are for static convergence.

3.1 A cross hatch signal should be connected to the monitor.

3.2 A pair of 4-Pole Convergence Magnets is provided and adjusted to converge the blue and red beams (See Fig. 6). When the Pole opens to the left and right 45° symmetrically, the magnetic field maximizes. Red and blue beams move to the left and right (See Fig. 5). Variation of the angle between the tabs adjusts the convergence of red and blue vertical lines.

3.3 When both 4-Pole Convergence Magnet Tabs are rotated as a pair, the convergence of the red and blue horizontal lines is adjusted.

3.4 A pair of 6-Pole Convergence Magnets is also provided and adjusted to converge the magenta (red + blue) to green beams (See Fig. 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 Fig. 5). Variation of the opening angle adjusts the convergence of magenta to green vertical lines.

3.5 When both 6-Pole Convergence Magnet Tabs are rotated as a pair, the convergence of magenta to green horizontal lines is adjusted.

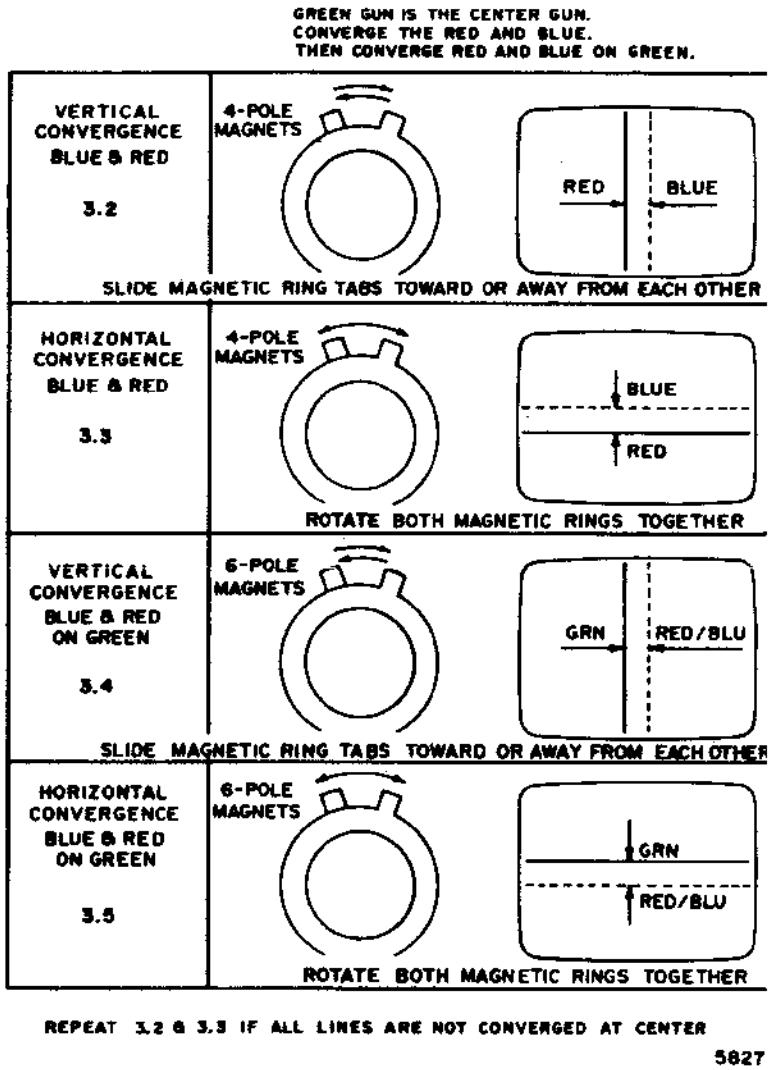


FIGURE 5

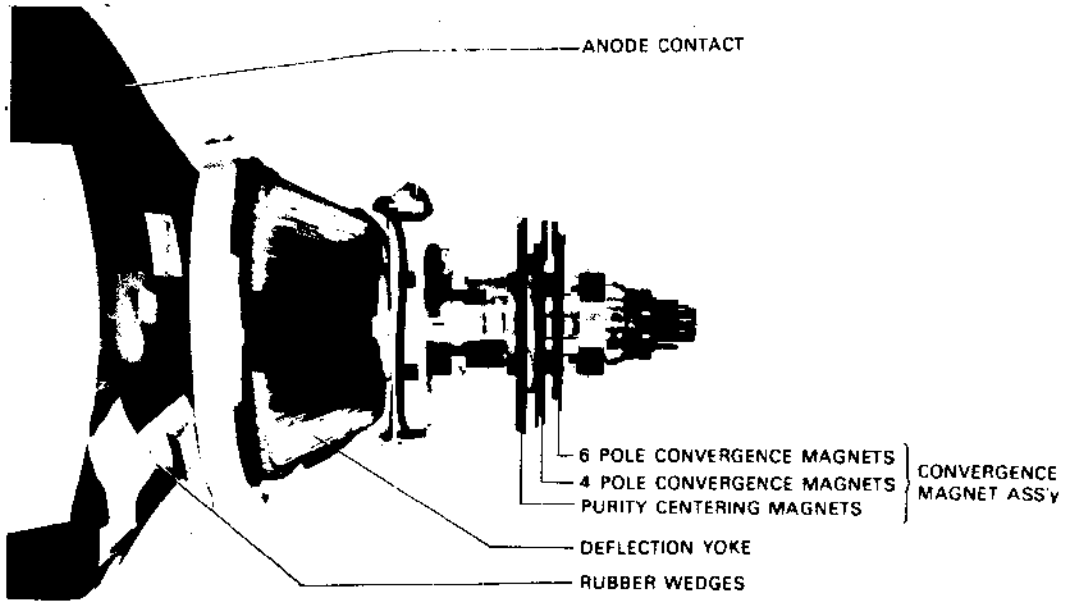


FIGURE 6

4.0 PRECISE ADJUSTMENT OF DYNAMIC CONVERGENCE (See Fig. 7, 8 and 9)

4.1 Feed a cross hatch signal to the monitor.

4.2 Insert a wedge temporarily and fix the Deflection Yoke so as to obtain the best circumference convergence (See Fig. 8 and 9)
NOTE:
The wedges may need to be moved during adjustments.

4.3 Insert three rubber wedges to the position as shown in Fig. 7 to obtain the best circumference convergence.

NOTE:

1) Tilting the angle of the yoke up and down adjusts the crossover of both vertical and horizontal red and blue lines. See Fig. 8 (a) and (b).
2) Tilting the angle of the yoke sideways adjusts the parallel convergence of both horizontal and vertical lines at the edges of the screen. See Fig. 9 (a) and (b).
3) Use three rubber wedges (tapered rubber wedges are used for a purpose).
4) The position of each rubber wedge is shown in Fig. 7.
5) Do NOT force the permanent wedges in. They are to be inserted until they just make contact with the yoke—after the yoke has been positioned.
6) Fix the three permanent rubber wedges with chloroprene rubber adhesive.
7) After the adhesive has dried enough to hold the wedges in place, carefully remove the temporarily installed wedge.

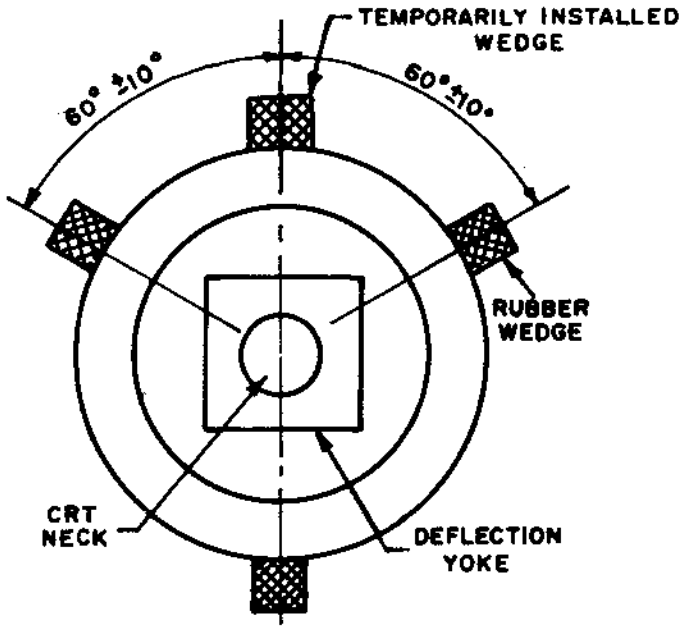


FIGURE 7

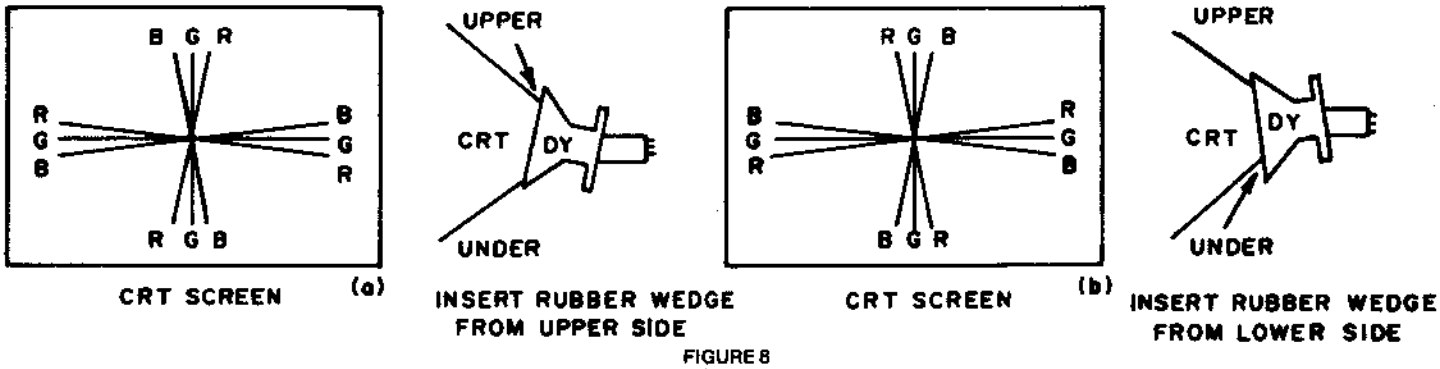


FIGURE 8

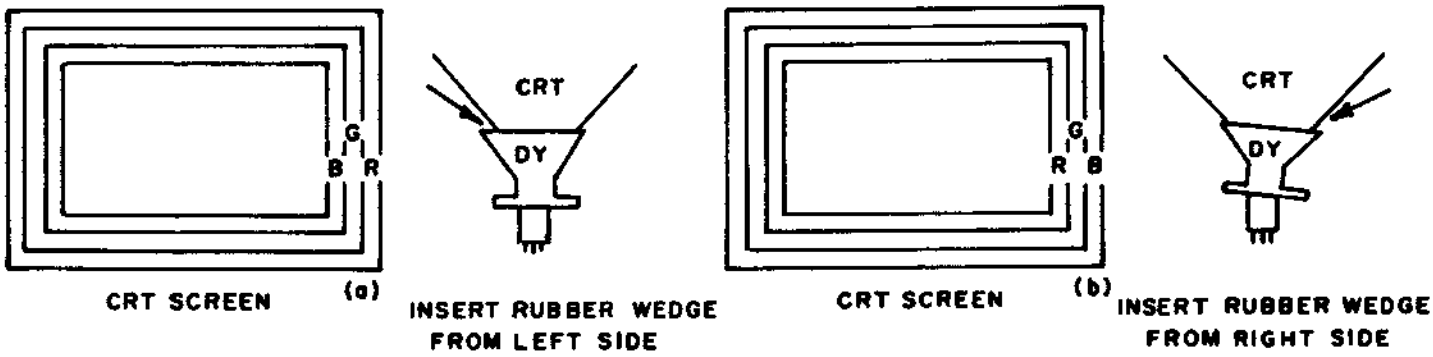


FIGURE 9

5.0 WHITE BALANCE

5.1 Equipment Required: An oscilliscope with a DC coupled mode in the vertical amplifier, or a digital multimeter, or a VOM with a DC input impedance of at least 20,000 ohms/volt.

5.2 Referring to Fig. 1(a) or 1(b) and 3, do the following adjustments in subdued light after degaussing and setting the purity of the CRT.

5.3 Ground the R/G/B video inputs.

5.4 Set the Red and Green drive controls, VR401 and VR402, to approximately 80% of full CW rotation.

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

5.6 Connect the oscilloscope, multimeter, or VOM, to the collector of a video output transistor (Q401, Q402, or Q403) on the CRT neck PCB at TP47R, TP47G, or TP47B as shown in Fig. 3.

5.7 Adjust the black level control (VR201) to obtain the waveform shown in Fig. 10 or a +150 volt DC reading on the multimeter or the VOM.

5.8 Slowly turn the screen control CW until the raster is just visible. The color of this raster is called the lead color gun. DO NOT adjust its associated cutoff control. It must remain fully CCW.

5.9 Adjust the screen control CCW until the raster is just extinguished. Then adjust the black level control for a dim raster.

5.10 Adjust the two remaining cutoff controls (NOT the lead color gun cutoff control) for best gray uniformity.

5.11 Adjust the black level control for a bright raster but not maximum brightness. Adjust the R/G drive controls, if necessary, for best neutral white.

5.12 Repeat steps 5.10 and 5.11 until good tracking of white balance is achieved.

5.13 With the oscilloscope, multimeter, or VOM connected to the collector of the lead color video output transistor (See Fig. 3), adjust the black level control to obtain the waveform in Fig. 10 or a +150 volt DC reading on the multimer or VOM.

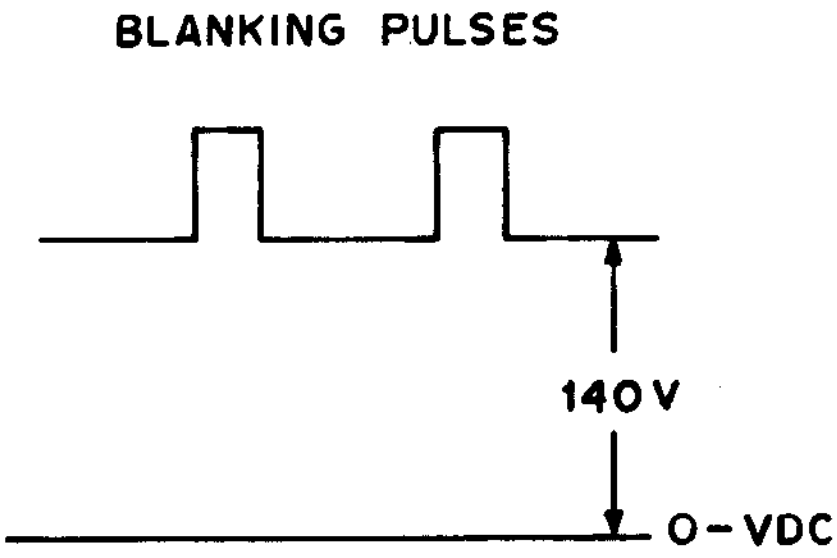


FIGURE 10

REPLACEMENT PARTS LIST

MODELS K4901, K4906, K4951, and K4956

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

RESISTORS

Ref. No.	Part No.	Description
R201	203X6500-645	1K Ohm, 5%, 1/4W Carbon
R202	340X2331-934	330 Ohm, 5%, 1/4W Carbon
R203	203X6500-405	100 Ohm, 5%, 1/4W Carbon
R204	203X6700-327	100 Ohm, 5%, 1/2W Carbon
R205	203X6700-421	270 Ohm, 5%, 1/2W Carbon
R206	203X6500-540	390 Ohm, 5%, 1/4W Carbon
R207	340X2221-934	220 Ohm, 5%, 1/4W Carbon
R208	203X6500-540	390 Ohm, 5%, 1/4W Carbon
R209	340X2221-934	220 Ohm, 5%, 1/4W Carbon
R210	203X6500-540	390 Ohm, 5%, 1/4W Carbon
R211	340X2221-934	220 Ohm, 5%, 1/4W Carbon
R214	203X6500-645	1K Ohm, 5%, 1/4W Carbon
R215	203X6501-126	100K Ohm, 5%, 1/4W Carbon
R216	203X6500-645	1K Ohm, 5%, 1/4W Carbon
R217	203X6500-405	100 Ohm, 5%, 1/4W Carbon
R218	203X6500-645	1K Ohm, 5%, 1/4W Carbon
R219	203X6501-126	100K Ohm, 5%, 1/4W Carbon
R220	203X6500-645	1K Ohm, 5%, 1/4W Carbon
R221	203X6500-405	100 Ohm, 5%, 1/4W Carbon
R222	203X6500-762	3.3 Ohm, 5%, 1/4W Carbon
R224	203X6500-169	10 Ohm, 5%, 1/4W Carbon
R225	203X6500-169	10 Ohm, 5%, 1/4W Carbon
R226	203X6500-169	10 Ohm, 5%, 1/4W Carbon
R227	203X6501-044	47K Ohm, 5%, 1/4W Carbon
R228	340X2152-934	1.5K Ohm, 5%, 1/4W Carbon
R229	203X6700-421	270 Ohm, 5%, 1/2W Carbon
R230	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.
R231	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.
R232	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.
R233	203X6500-468	180 Ohm, 5%, 1/4W Carbon
R234	340X2820-934	82 Ohm, 5%, 1/4W Carbon
R235	340X2820-934	82 Ohm, 5%, 1/4W Carbon
R236	340X2820-934	82 Ohm, 5%, 1/4W Carbon
R301	203X6500-508	270 Ohm,5%, 1/4W Carbon
R302	203X6500-863	8.2K Ohm, 5%, 1/4W Carbon
R303	203X8500-863	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	203X9014-709	3.3K Ohm, 5%, 1W Carbon
R312	203X9014-741	4.7K Ohm, 5%, 1W Metal Oxide
R313	204X1527-528	470 Ohm, 5%, 7W Carbon
R314	203X6500-481	220 Ohm, 5%, 1/4W Carbon
R315	203X6500-169	10 Ohm, 5%, 1/4W Carbon
R317	203X6700-061	8.2 Ohm, 5%, 1/2W Carbon
R318	203X6500-584	560 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	340X3683-934	68K 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	204X1450-516	3.9K Ohm, 5%, 5W Metal Oxide
R364	203X6500-246	22 Ohm, 5%, 1/4W Carbon
R365	340X2183-934	18K Ohm, 5%, 1/4W Carbon
R367	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R368	203X5602-185	330K Ohm, 5%, 1/2W Comp.
R369	203X5602-329	680K Ohm, 5%, 1/2W Comp.

RESISTORS (Cont.)

Ref. No.	Part No.	Description
R370	203X6501-002	33K Ohm, 5%, 1/4W Carbon
R371	203X9014-584	1K Ohm, 5%, 1W Metal Oxide
R372	203X9104-809	12K Ohm, 5%, 2W Metal Oxide
R375	203X9014-724	3.9K Ohm, 5%, 1W Carbon
R376	203X9104-404	270 Ohm, 5%, 2W Metal Oxide
R377	203X6500-447	150 Ohm, 5%, 1/4W Carbon
R378	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R379	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R380	203X6500-865	8.2K Ohm, 5%, 1/4W Carbon
R381	203X6500-724	2.2K Ohm, 5%, 1W Metal Oxide
R383	203X9014-387	150 Ohm, 5%, 1W Metal Oxide
R384	203X6501-088	68K Ohm, 5%, 1/4W Carbon
R385	340X2122-934	1.2K Ohm, 5%, 1/4W Carbon
R387	340X2224-934	220K Ohm, 5%, 1/4W Carbon
R389	340X5183-633	18K Ohm, 5%, 2W Metal Oxide
R390	340X4222-633	2.2K Ohm, 5%, 1W Metal Oxide
R502	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R503	204X1700-535	150 Ohm, 5%, 15W Metal Oxide
R504	203X9014-267	47 Ohm, 5%, 1W Metal Oxide
R505	203X6501-209	220K Ohm, 5%, 1/4W Carbon
R506	204X1425-196	15 Ohm, 5%, 5W Wire Wound
R507	203X5602-185	330K Ohm, 5%, 1/2W Comp.
⚠★ R601	204X1625-058	3.3 Ohm, 5%, 10W WW
R701	203X9105-141	2.2 Ohm, 5%, 2W Metal Oxide
R702	203X6206-441	2.2 Ohm, 5%, 1/2W Carbon
VR201	204X2070-072	2K Ohm-B Semi-Fixed
VR301	204X2070-084	5K Ohm-B Semi-Fixed
VR302	204X2070-084	5K Ohm-B Semi-Fixed
VR303	204X2070-055	500 Ohm-B Semi-Fixed
VR351	204X2070-072	2K Ohm-B Semi-Fixed
VR352	204X2070-072	2K Ohm-B Semi-Fixed

CAPACITORS

C201	203X0014-088	1000 uF, 16V, Electrolytic
C202	202X7200-064	330 pF, 500V, Ceramic
C203	202X7200-043	220 pF, 500V, Ceramic
C204	202X7200-043	220 pF, 500V, Ceramic
C205	203X0014-076	470 uF, 16V, Electrolytic
C206	203X1810-149	0.1 uF, 125V Mylar
C207	349X2232-109	.022 uF, 100V Mylar
C301	203X0014-065	330 uF, 50V Electrolytic
C302	203X1600-563	.022 uF, 50V Mylar
C303	203X0629-037	2.2 uF, 50V Electrolytic
C304	203X1600-366	.0068 uF, 50V Mylar
C306	203X0412-012	2.2 uF, 16V Tantalum
C307	203X1600-634	0.033 uF, 50V Mylar
C308	203X0025-163	2.2 uF, 50V Electrolytic
C309	203X1207-100	0.068 uF, 100V PP
C310	203X0629-061	10 uF, 100V Electrolytic
C311	203X0041-162	4.7 uF, 160V Electrolytic
C312	202X7050-248	1000 pF, 500V Ceramic
C313	203X0040-068	100 uF, 160V Electrolytic
C314	203X1201-096	0.039 uF, 200V PP
C315	203X0629-023	1 uF, 50V Electrolytic
C351	203X0629-023	1 uF, 50V Electrolytic
C352	203X0619-045	47 uF, 25V Electrolytic
C353	203X1190-015	0.0082 pF, 50V Mylar-PP
C354	203X0619-045	47 uF, 25V Electrolytic
C355	203X1600-366	0.0068 pF, 50V Mylar
C356	203X1130-287	0.0047 uF, 50V, Mylar
C359	202X8065-606	100 pF, 500V Ceramic
C360	202X7050-366	0.0033 pF, 500V Ceramic
C361	202X7050-483	0.01 uF, 500V Ceramic
C362	202X7203-032	0.01 uF, 50V Ceramic
⚠★ C363	203X1270-911	8700 pF, 1.5 KV PP
C365	203X1201-265	0.33 uF, 200V PP
C366	203X0019-026	22 uF, 25V Electrolytic

CAPACITORS (Cont.)

Ref. No.	Part No.	Description
C367	202X8065-162	6 pF, 500V Ceramic
C368	202X7203-032	0.1 uF, 50V
C369	203X1207-087	0.047 uF, 100V, PP
C372	203X1207-125	0.1 uF, 100V PP
C373	203X0029-021	1 uf, 50V, Electrolytic
C380	202X7200-087	470 pF, 500V Ceramic
C381	80X0099-006	470 pF, 500V, Ceramic
⚠ C501	203X1810-149	0.1 uF, 125V Mylar
⚠ C502	202X7050-282	1500 pF, 500V Ceramic
⚠ C503	202X7810-214	2200 pF, 125V Ceramic
⚠ C504	202X7810-214	2200 pF, 125V Ceramic
C505	203X0220-075	560 uF, 200V Electrolytic
C506	203X0040-034	22 uF, 160V Electrolytic
C507	203X0041-057	47 uF, 160V Electrolytic
C701	203X0019-092	1000 uF, 25V Electrolytic
C702	203X0634-061	10 uF, 100V Electrolytic
C703	202X7050-248	1000 pF, 500V Ceramic

SEMICONDUCTORS

D203	201X2010-159	Diode, IS2076-27
D204	201X2010-159	Diode, IS2076-27
D205	201X2010-159	Diode, IS2076-27
D206	201X2010-159	Diode, IS2076-27
D207	201X2010-159	Diode, IS2076-27
D208	201X2010-159	Diode, IS2076-27
D209	201X2010-159	Diode, IS2076-27
D302	201X2010-159	Diode, IS2076-27
D303	201X2010-159	Diode, IS2076-27
D304	201X2120-009	Diode, RH-IV
D305	201X2120-009	Diode, RH-IV
D306	201X2010-159	Diode, IS2076-27
D307	201X2010-165	Diode, ISS81
⚠ 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

SEMICONDUCTORS (Cont.)

Q203	200X4056-260	Transistor (PNP) 2SA562-Y-TM
Q204	200X4056-260	Transistor (PNP) 2SA562-Y-TM
Q205	200X4056-260	Transistor (PNP) 2SA562-Y-TM
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	200X4589-802	Transistor (NPN) 2SD898B
ZD301	66X0040-031	Diode, Zener 24V, 3%, 1/2W
IC301	200X2300-033	IC HA11423
⚠★ IC501	200X2600-183	IC STR381

TRANSFORMERS & COILS

■ L351	201X4710-134	Coil, (RF Choke)
★ L352	201X5000-083	Coil, Horiz. Size
L701	611X0005-005	Coil, Degaussing
T351	202X1300-080	Transformer, Hor. Drive
⚠★ T352	200X9720-301	HV-Unit M-11
■ L351		Omitted from late versions

MISCELLANEOUS

⚠ F501	204X7120-073	Fuse, 4 Amp. 125V
J402	206X5008-632	Recep W Wire 3P-M-BG
P201	204X9600-466	Plug, PWB 3P-J
P202	204X9601-477	Plug, PWB 6P-Q
P401	204X9600-298	Plug, PWB 4P-B
P501	204X9600-249	Plug, PWB 2P-B
P601	204X9600-304	Plug, PWB 4P-C
TH501	201X0100-112	Thermistor

FINAL ASSEMBLY PARTS

⚠★	88X0138-506	19VLTP22 Pix Tube
	205X9800-158	Lateral/Purity Assembly
⚠★	202X1111-258	Yoke Deflection
or	202X1111-264	
	291X5004-262	Automatic Degaussing Coil Unit

NECK BOARD

RESISTORS

R401	203X6000-729	220 Ohm, 5% 1/4W Carbon
R402	203X6500-540	390 Ohm, 5% 1/4W Carbon
R403	203X6000-661	820 Ohm, 5% 1/4W Carbon
R404	203X6000-729	220 Ohm, 5% 1/4W Carbon
R405	203X6500-540	390 Ohm, 5% 1/4W Carbon
R406	203X6000-661	820 Ohm, 5% 1/4W Carbon
R407	203X6000-729	47 Ohm, 5% 1/4W Carbon
R408	203X6000-998	270 Ohm, 5% 1/4W Carbon
R409	203X6000-661	820 Ohm, 5% 1/4W Carbon
R410	203X9104-824	15K Ohm, 5% 2W M.O. Forming
R411	203X9104-824	15K Ohm, 5% 2W M.O. Forming
R412	203X9104-824	15K Ohm, 5% 2W M.O. Forming
R413	203X6000-998	2.7K Ohm, 5% 1/2W Comp.
R414	203X6000-998	2.7K Ohm, 5% 1/2W Comp.
R415	203X6000-998	2.7K Ohm, 5% 1/2W Comp.
R416	203X9105-154	2.2 Ohm, 5% 2W Metal Oxide
R419	203X6500-741	2.7K Ohm, 5% 1/4W Carbon
R420	203X6500-741	2.7K Ohm, 5% 1/4W Carbon
R421	203X6500-741	2.7K Ohm, 5% 1/4W Carbon
VR401	204X2115-014	500 Ohm, -B Semi-Fixed
VR402	204X2115-014	500 Ohm, -B Semi-Fixed
VR403	204X2115-006	5K Ohm, -B Semi-Fixed
VR404	204X2115-006	5K Ohm, -B Semi-Fixed
VR405	204X2115-006	5K Ohm, -B Semi-Fixed

CAPACITORS

C401	202X7050-269	1200 pF, 500V Ceramic
C402	202X7050-248	1000 pF, 500V Ceramic
C403	202X7050-248	1000 pF, 500V Ceramic
C404	202X7050-282	1500 pF, 1.5KV Ceramic
C405	202X7050-483	0.01 uF, 500V Ceramic

SEMICONDUCTORS

Q401	200X3206-800	Transistor (NPN) 2SC2068LB
Q402	200X3206-800	Transistor (NPN) 2SC2068LB
Q403	200X3206-800	Transistor (NPN) 2SC2068LB

MISCELLANEOUS

J401	206X5009-296	RECEP W Wire 4P-E
P402	204X9600-254	Plug, PWB 3P-A
P403	204X9600-981	Plug, 1 Pin
P701	204X9601-020	Plug, PWB 4P-E
	204X9301-255	CRT Socket

VERTICAL POSITION BOARD (P344)

RESISTORS

VR901	40X0645-001	25K Ohm Vert. Position Control

SEMICONDUCTORS

Q901	86X0127-001	Transistor (NPN) TPS98

REPLACEMENT PARTS LIST

Ref. No.	Part No.	Description

MODELS K4902, K4952

Same as K4901, K4906, K4951, K4956 except:

C365	46X0536-021	0.27uF, 200V, PP
R389		Omitted from certain versions of these models.
L351		Omitted from late versions.

MODEL K4903, K4953

Same as K4901, K4906, K4951, K4956 except:

C365	46X0536-022	0.15 uF, 400V, PP
R389		Omitted from these models.
L351		Omitted from late versions of these models.
	Add the following to late versions:	
C385	46X0536-037	820 pF, 1600V, PP, 5%

MODELS K4911, K4961

Same as K4901, K4906, K4951, K4956 except:

MAIN BOARD

RESISTORS

R206	340X2221-934	220 Ohm, 5%, 1/4W Carbon
R208	340X2221-934	220 Ohm, 5%, 1/4W Carbon
R210	340X2221-934	220 Ohm, 5%, 1/4W Carbon
R229	340X3391-934	390 Ohm, 5%, 1/2W Carbon

CAPACITORS

C202	80X0099-020	680 pF, 500V, Ceramic
C203	80X0099-012	560 pF, 500V, Ceramic
C204	80X0099-006	470 pF, 500V, Ceramic

TRANSFORMERS AND COILS

L351		Omitted from late versions.

NECK BOARD

CAPACITORS

C406	80X0099-020	680 pF, 500V, Ceramic
C407	80X0099-020	680 pF, 500V, Ceramic

MODEL K4904

Same as K4901, K4906, K4951, K4956 except:

MAIN BOARD

RESISTORS

R391	340X221-934	220 Ohm, 5%, 1/4W Carbon

CAPACITORS

C365	46X0536-025	0.56 uF, 200V, PP
C390	46X0544-004	0.012 uF, 100V, PP

TRANSFORMERS AND COILS

L352	9A2813-003	Coil, Horiz. Lin.
★L601	9A2822-001	Coil, Horiz. Size
L351		Omitted from late versions.

MODEL K4956R

✱Same as K4901, K4906, K4956, except add the following:

RELAY BOARD (P 340)

RESISTORS

R801	340X2162-934	1.6K Ohm, 5%, 1/4W Carbon
R802	340X2473-934	47K Ohm, 5%, 1/4W Carbon
R803	340X2222-934	2.2K Ohm, 5%, 1/4W Carbon
R804	340X2514-934	510K Ohm, 5%, 1/4W Carbon
R805	340X2102-934	1K Ohm, 5%, 1/4W Carbon

SEMICONDUCTORS

D801	66X0046-001	Diode, Silicon FDH-444
Q801	86X0113-001	Transistor (NPN) 2N3904
Q802	86X0113-001	Transistor (NPN) 2N3904

MISCELLANEOUS

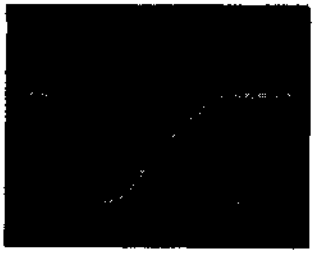
K801	2A0685-001	Relay, 12V, DPDT
K802	2A0685-001	Relay, 12V, DPDT
J601	3A0627-004	Socket, 4 Pin
P802	6A0393-004	Plug, 3 Pin, Right Angle
P803	6A0406-001	Plug, 4 Pin

✱**NOTE:** *L351 omitted from all late versions of all models included in this manual.*

OSCILLOSCOPE WAVEFORM PATTERNS

The waveforms 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 more rounded than those shown and the amplitude of any high frequency pulse will tend to be less.

A



2V/DIV 100uSEC/DIV

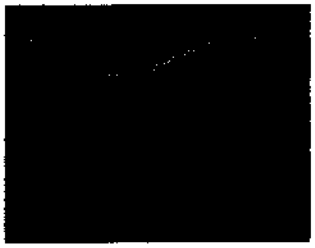
TP-81

0.5V/DIV 2mSEC/DIV

Q351 COLLECTOR

20V/DIV 10uSEC/DIV

TP-31 DC COUPLED
BOTTOM LINE = 0 VDC



2V/DIV 100uSEC/DIV

TP-82

20V/DIV 2mSEC/DIV

D

2V/DIV 10uSEC/DIV

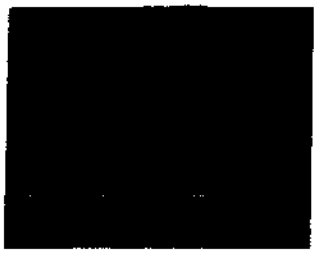
TP-31, AC COUPLED

0.5V/DIV 100uSEC/DIV

B

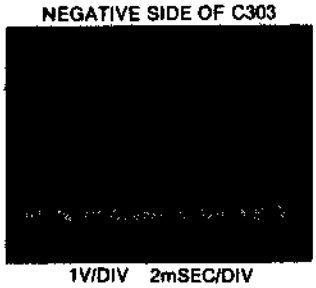
0.2V/DIV 20uSEC/DIV

J402-3



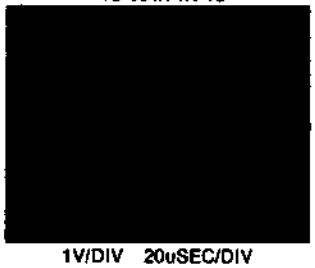
5V/DIV 10uSEC/DIV

NEGATIVE SIDE OF C303



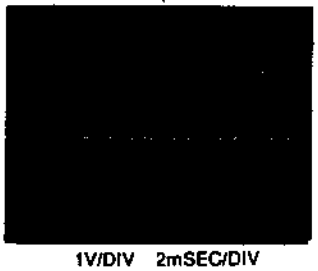
1V/DIV 2mSEC/DIV

IC 301/PIN 13



1V/DIV 20uSEC/DIV

F



1V/DIV 2mSEC/DIV

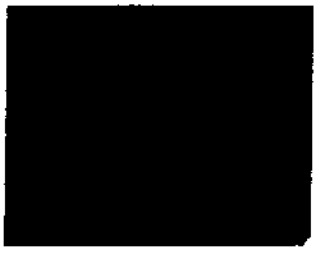
IC 301/PIN 3

0.5V/DIV 5mSEC/DIV

IC 301/PIN 15

1V/DIV 10uSEC/DIV

F



1V/DIV 100uSEC/DIV

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

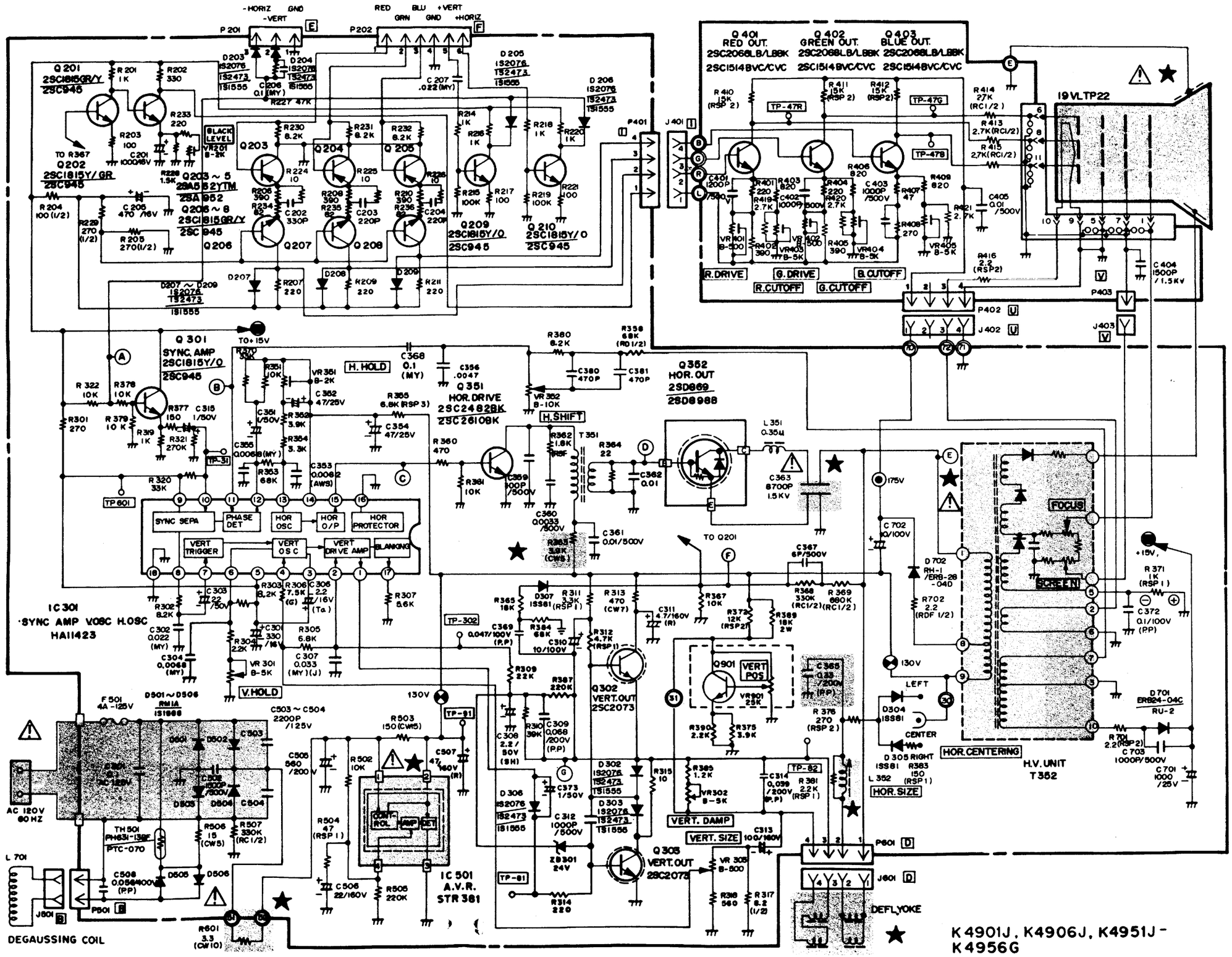
⚠

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.

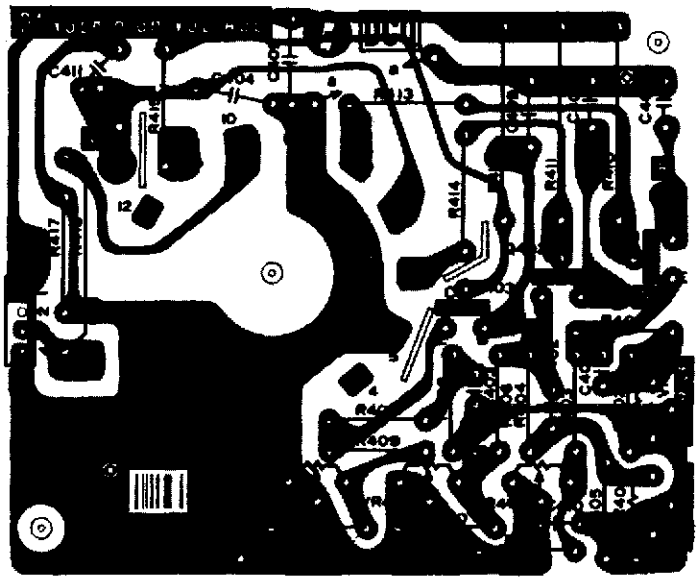
★

SERVICE TECHNICIAN WARNING
X-RAY RADIATION PRECAUTION:

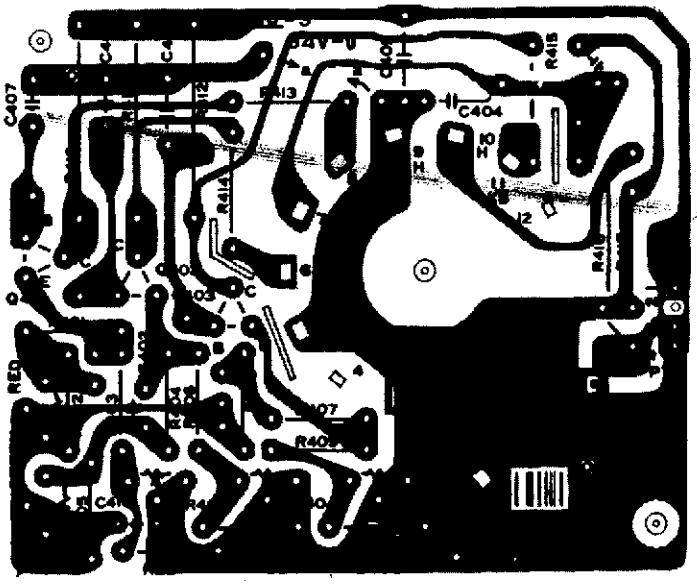
THIS PRODUCT CONTAINS CRITICAL ELECTRICAL AND MECHANICAL PARTS ESSENTIAL FOR X-RAY RADIATION PROTECTION.
FOR REPLACEMENT PURPOSES, USE ONLY TYPE PARTS SHOWN IN THE PARTS LIST.



PC BOARD LAYOUT



VIEW OF COMPONENT SIDE



VIEW OF FOIL SIDE

FIGURE 12 NECK PC BOARD

PC BOARD LAYOUT

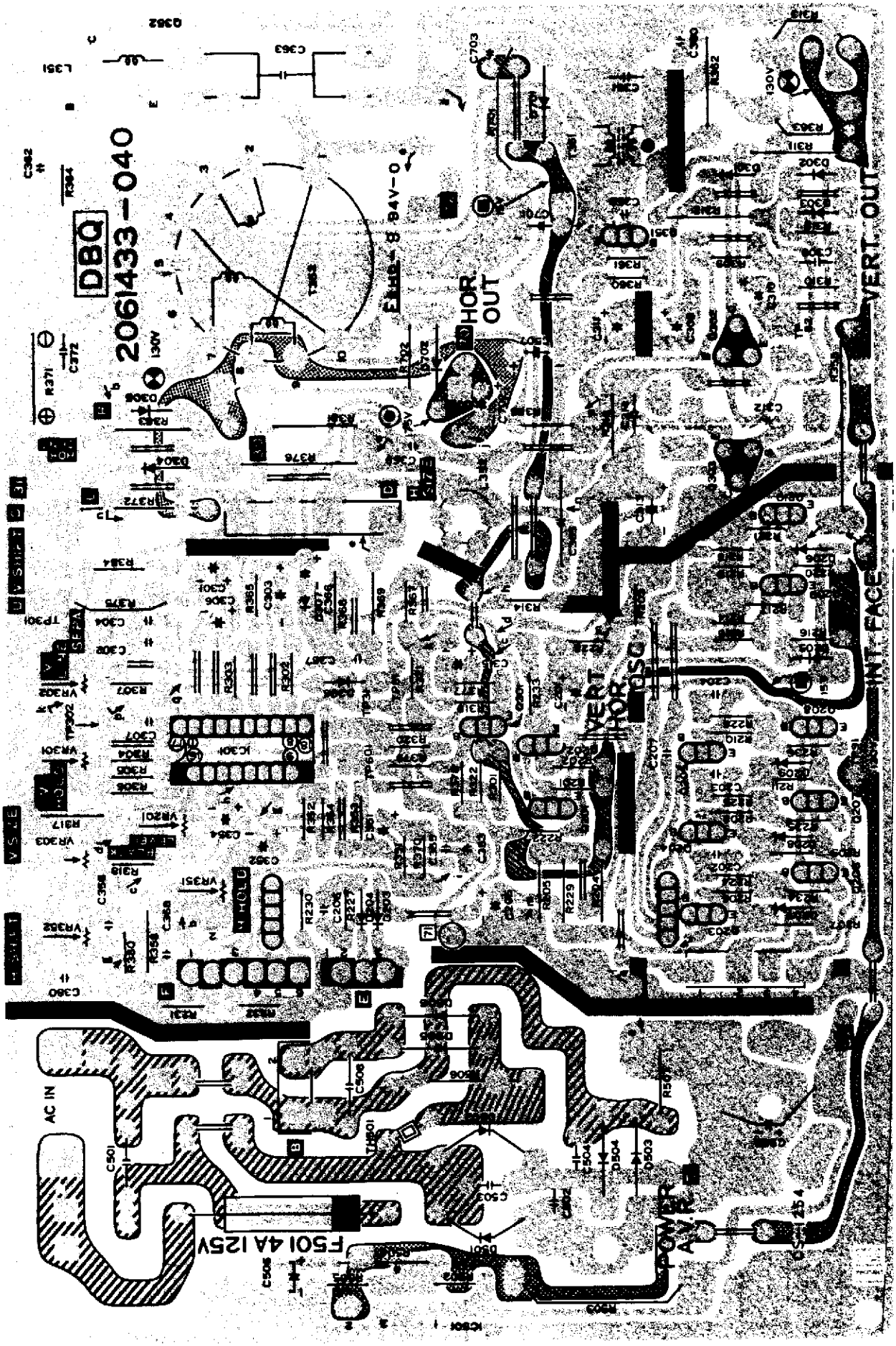
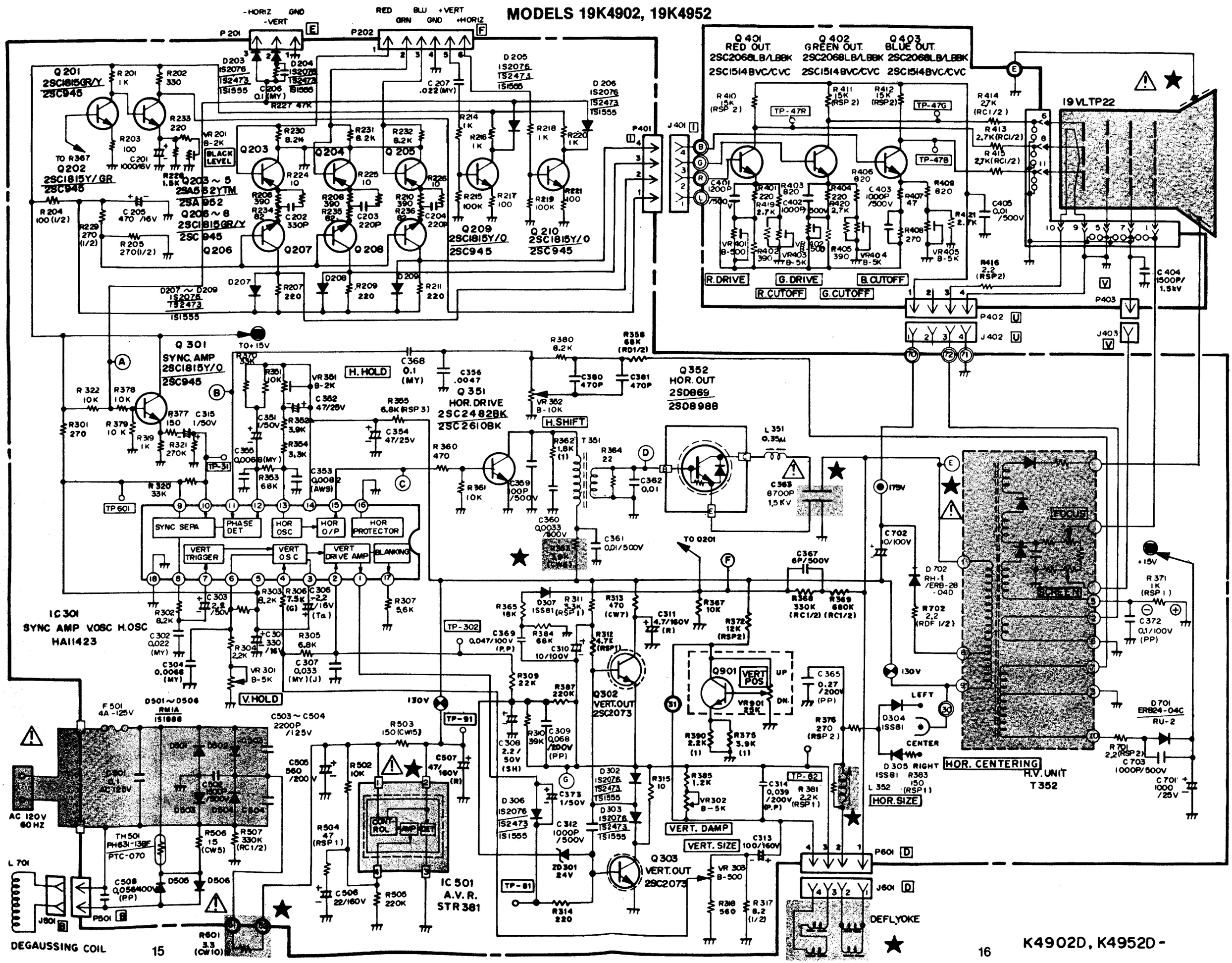


FIGURE 13 VIEW OF FOIL SIDE, MAIN PC BOARD

MODELS 19K4902, 19K4952



PC BOARD LAYOUT

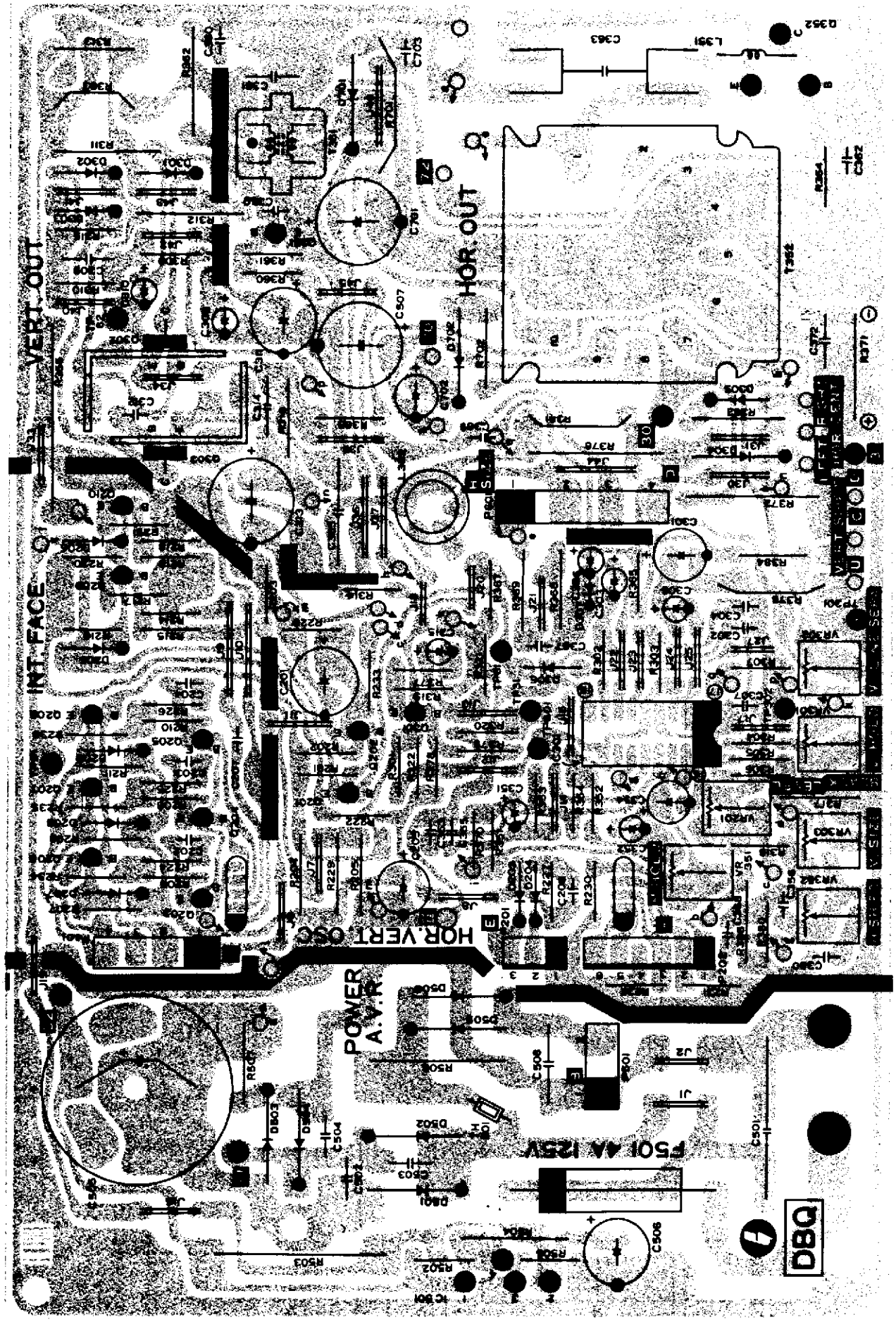
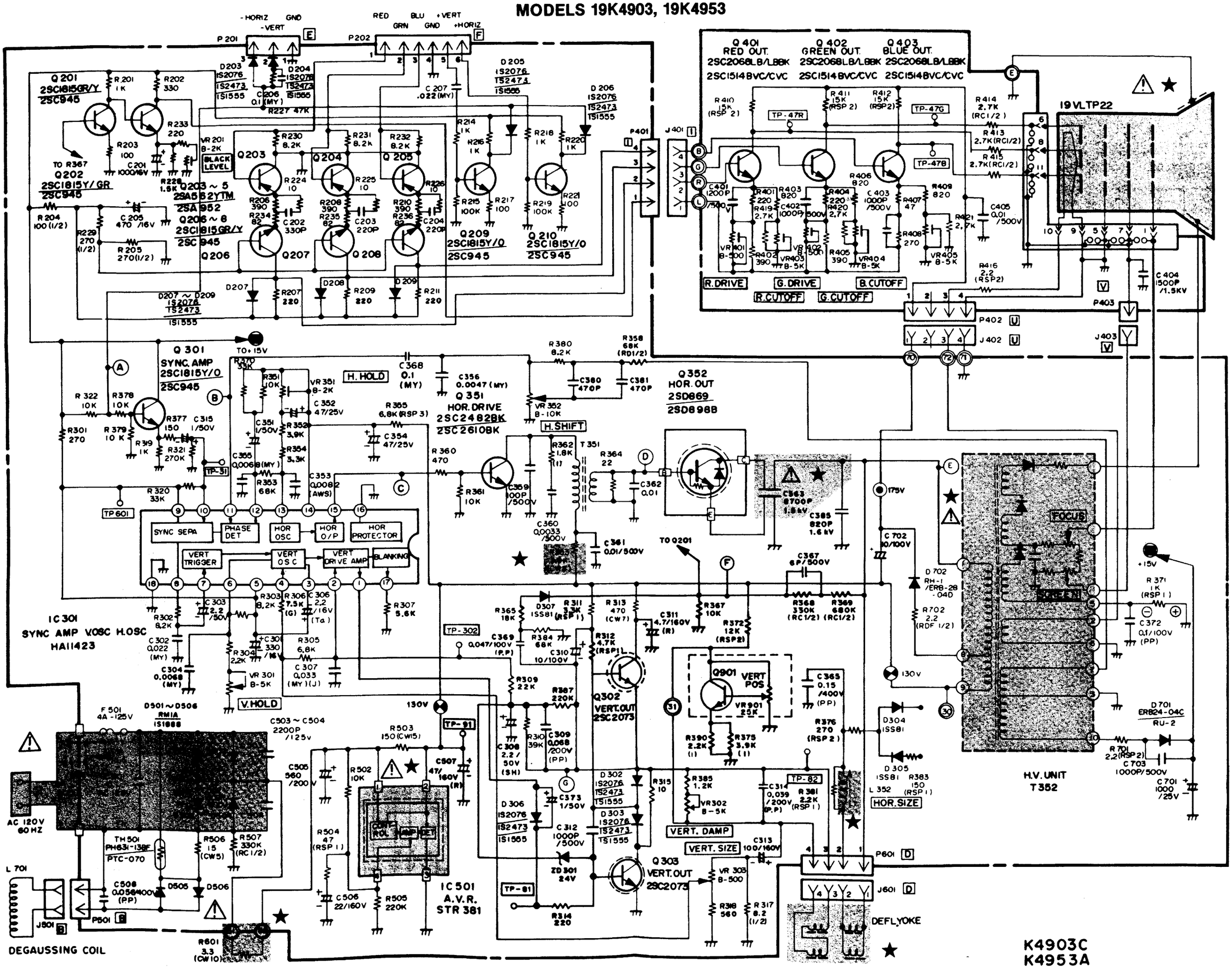


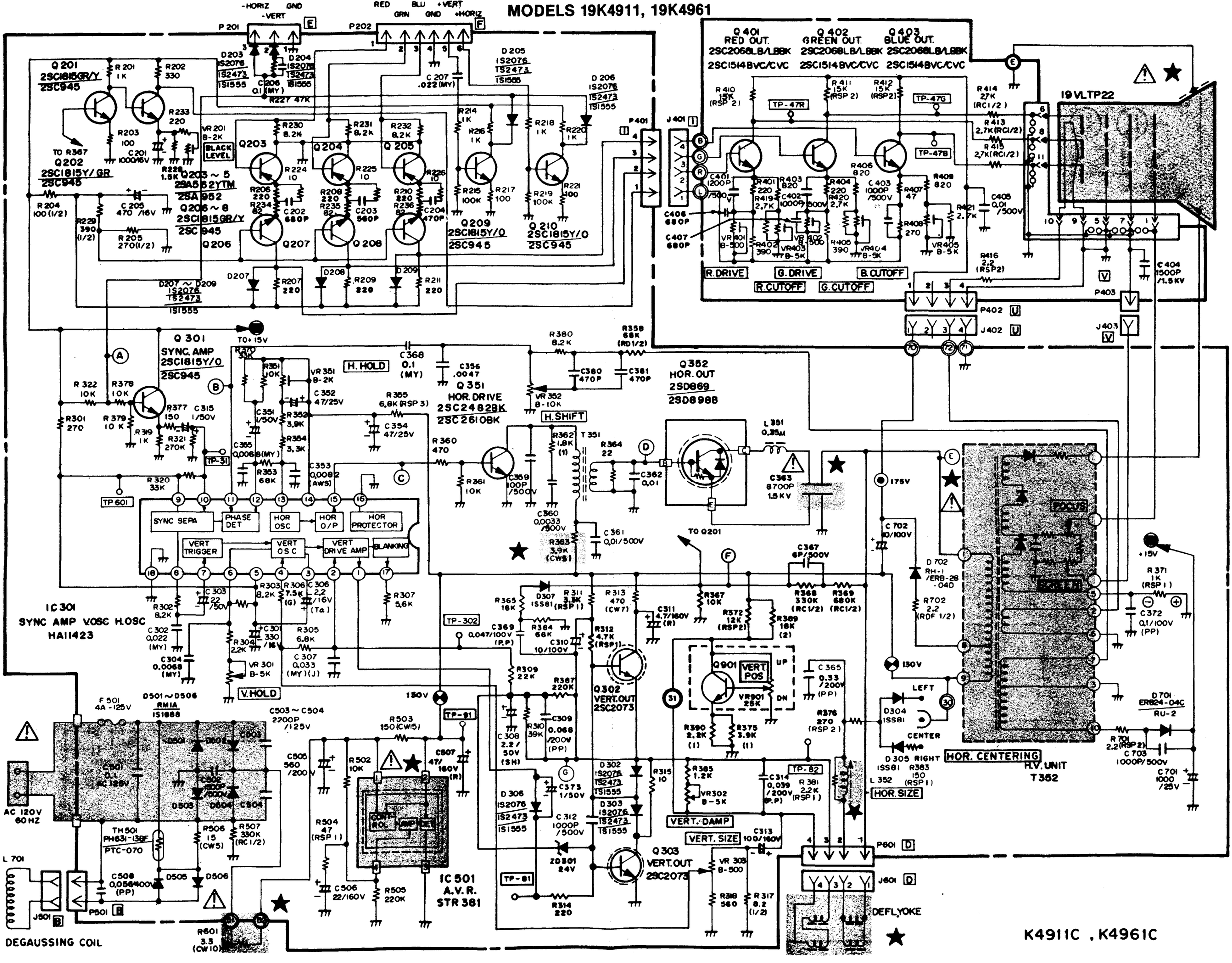
FIGURE 14 COMPONENT SIDE, MAIN PC BOARD

MODELS 19K4903, 19K4953



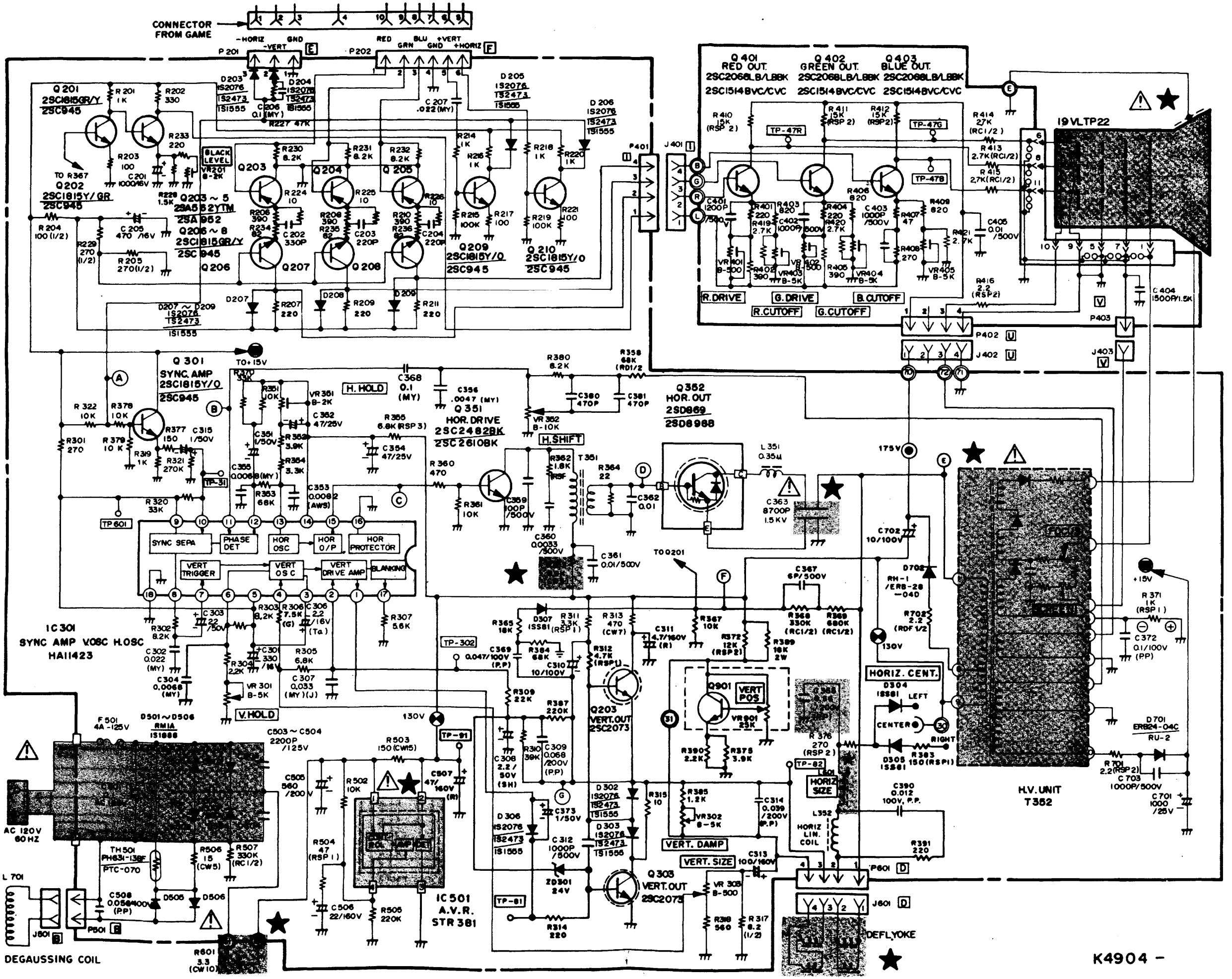
K4903C
K4953A

MODELS 19K4911, 19K4961



19" COLOR MONITOR SCHEMATIC DIAGRAM

MODEL 19K4904



K4904 -

MODEL 19K4956R

-HORIZ GND -VERT — P201 — E — RED BLU +VERT GRN (GND) +HORIZ — P202 — F

Q201 2SC1815GR/Y 2SC945 — R201 1K — R202 330 — R233 220 — R203 100 — C201 100/16V — VR201 B-2K BLACK LEVEL — R228 1.5K — TO R367

Q202 2SC1815Y/GR 2SC945 — Q203~5 2SA562YTM 2SA952 — Q206~8 2SC1815GR/Y 2SC945

R204 100(1/2) — R229 270(1/2) — C205 470/16V — R205 270(1/2)

R230 8.2K — R231 8.2K — R232 8.2K — Q203 — Q204 — Q205 — R224 10 — R225 10 — R226 10 — R206 390 — R208 390 — R210 390 — R234 82 — R235 82 — R236 82 — C202 330P — C203 220P — C204 220P — Q206 — Q207 — Q208

D203 1S2076 TS2473 1S1555 — D204 1S2076 TS2473 1S1555 — C206 0.1(MY) — R227 47K — C207 .022(MY)

D205 1S2076 TS2473 1S1555 — D206 1S2076 TS2473 1S1555

R214 1K — R216 1K — R218 1K — R220 1K — R215 100K — R217 100 — R219 100K — R221 100 — Q209 2SC1815Y/O 2SC945 — Q210 2SC1815Y/O 2SC945

D207~D209 1S2076 TS2473 1S1555 — D207 — D208 — D209 — R207 220 — R209 220 — R211 220

P401 — J401 — B G R L

Q401 RED OUT. 2SC2068LB/LBBK 2SC1514BVC/CVC — Q402 GREEN OUT. 2SC2068LB/LBBK 2SC1514BVC/CVC — Q403 BLUE OUT. 2SC2068LB/LBBK 2SC1514BVC/CVC

R410 15K (RSP2) — R411 15K (RSP2) — R412 15K (RSP2) — TP-47R — TP-47G — TP-47B

R414 2.7K (RC1/2) — R413 2.7K (RC1/2) — R415 2.7K (RC1/2) — 19VLTP22

C401 1200P/500V — R401 220 — R419 2.7K — R403 820 — C402 1000P/500V — R404 220 — R420 2.7K — R406 820 — C403 1000P/500V — R407 47 — R409 820 — C405 0.01/500V — R421 2.7K

VR401 B-500 — R402 390 — VR403 B-5K — R405 390 — VR404 B-5K — R408 270 — VR405 B-5K

R.DRIVE — G.DRIVE — B.CUTOFF — R.CUTOFF — G.CUTOFF

R416 2.2 (RSP2) — C404 1500P/1.5K — P403 — P402 U — J402 U — J403 V

Q301 SYNC. AMP 2SC1815Y/O 2SC945 — TO+15V — R370 33K — R322 10K — R378 10K — R377 150 — C315 1/50V — R301 270 — R379 10K — R319 1K — R321 270K — TP-31

R351 10K — VR351 B-2K — C352 47/25V — C351 1/50V — R352 3.9K — R354 3.3K — C355 0.0068(MY) — R353 68K — C353 0.0082(AWS) — R320 33K — TP601

H.HOLD — C368 0.1(MY) — C356 .0047 — R365 6.8K (RSP3) — C354 47/25V

Q351 HOR. DRIVE 2SC2482BK 2SC2610BK — R360 470 — R361 10K — C359 100P/500V — R362 1.8K 1RF — T351 — R364 22 — C362 0.01

R380 8.2K — R358 68K (RD1/2) — C380 470P — C381 470P — VR352 B-10K — H.SHIFT

Q352 HOR. OUT 2SD869 2SD898B — L351 0.35μ — C363 8700P 1.5KV

175V — C702 10/100V — D702 RH-1/ERB-28-04D — R702 2.2 (RDF1/2) — 130V — D304 1SS81 — LEFT — CENTER — RIGHT — R383 150,(RSP1) — HORIZ. CENTERING — R376 270 (RSP2) — HORIZ SIZE

FOCUS — SCREEN — +15V — R371 1K (RSP1) — C372 0.1/100V (PP) — C701 1000/25V — D701 ERB24-04C/RU-2 — R701 2.2 (RSP2) — C703 1000P/500V — H.V. UNIT T352

SYNC SEPA — PHASE DET — HOR OSC — HOR O/P — HOR PROTECTOR — VERT TRIGGER — VERT OSC — VERT DRIVE AMP — BLANKING

IC301 SYNC AMP VOSC H.OSC HA11423

R302 8.2K — C303 22/50V — R303 8.2K — R306 7.5K (G) — C306 2.2/16V (Ta) — C302 0.022 (MY) — C304 0.0068 (MY) — R304 2.2K — C301 330/16 — R305 6.8K — C307 0.033 (MY)(J) — VR301 B-5K — V.HOLD — R307 5.6K

TP-302 — C369 0.047/100V (P.P) — R309 22K — R310 39K — C308 2.2/50V (SH) — R365 18K — D307 1SS81 — R311 3.3K (RSP1) — R364 68K — C310 10/100V — R312 4.7K (RSP1) — R367 220K — C309 0.068/200V (P.P)

130V — TP-91 — R503 150(CW15) — C505 560/200V — R502 10K — C507 47/160V (R) — R504 47 (RSP1) — C506 22/160V — R505 220K — CONTROL — AMP — DET — IC501 A.V.R. STR381

Q302 VERT. OUT 2SC2073 — R313 470 (CW7) — C311 4.7/160V (R) — R367 10K — R368 330K (RC1/2) — R369 680K (RC1/2) — C367 6P/500V — R372 12K — R369 18K 2W — VERT. POS Q901 — VR901 25K — R390 2.2K 1W — R375 3.9K (1) — C365 0.33 500V — R361 2.2K (RSP1) — TP-82

D302 1S2076 TS2473 1S1555 — D303 1S2076 TS2473 1S1555 — C373 1/50V — C312 1000P/500V — ZD301 24V — R316 10 — R385 1.2K — VR302 B-5K — VERT. DAMP — C314 0.039/200V (P.P) — VERT. SIZE — C313 100/160 — Q303 VERT. OUT 2SC2073 — VR303 B-500 — R318 560 — R317 8.2 (1/2) — R314 220

TP-81 — P501

F501 4A-125V — D501~D506 RM1A 1S1888 — C503~C504 2200P/125V — C501 0.1 AC 125V — C502 1500P/600V — C503 — C504 — D501 — D502 — D503 — D504 — AC 120V 60HZ — TH501 PH631-138F PTC-070 — R506 15 (CW5) — R507 330K (RC1/2) — C508 0.056/400V (P.P) — D505 — D506 — L701 — J601 B — P501 B — DEGAUSSING COIL — R601 3.3 (CW10)

P601 — J601 — WHT/RED — WHT/BLU — WHT/GRN — WHT/YEL — P340 — K801 — K802 — Q801 — Q802 — R801 1.6K — R802 47K — R803 2.2K — R804 510K — R805 1K — D801 — P803 — J803 — DEFL. YOKE — 12V SWITCH 5V/0V GND — P802

K4956RD-5838

TYPICAL DC VOLTAGES WITH INPUT SIGNAL

TRANSISTOR NO.	TERMINAL		
	COLLECTOR	BASE	EMITTER
Q201	8.1	0.43	0.36
Q202	9.8	8.1	9.3
Q203	0	0.35	1.0
Q204	0	0.35	1.0
Q205	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	15.4	—0.30	0.01
Q210	14.0	0.31	0.17
Q301	15.5	4.7	4.2
Q302	79	37.8	37.7
Q303	37	0.51	0
Q351	41.4	0.41	0
Q352	DO NOT MEASURE	—0.03	0
Q401	139	9.7	9.3
Q402	139	9.7	9.3
Q403	139	9.7	9.3

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
17	0.83
18	0

I.C. 501	
PIN NO.	VOLTAGE
1	163
2	130
3	0
4	132