

Wells-Gardner 19-Inch Medium-Resolution Video Display

Model 19K7915

Service Manual

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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 en-

ergy. 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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TYPICAL DC VOLTAGES WITH INPUT SIGNAL

Voltages shown below are for reference only.

Voltages may vary with input signal and with control adjustment.

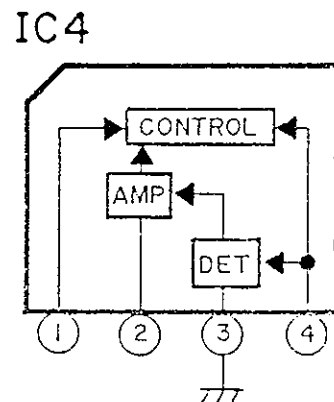
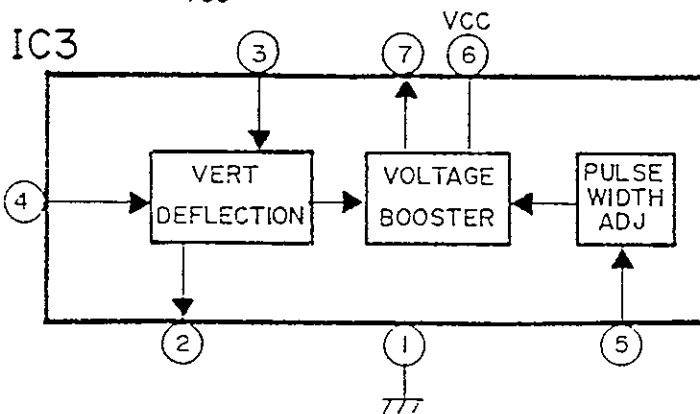
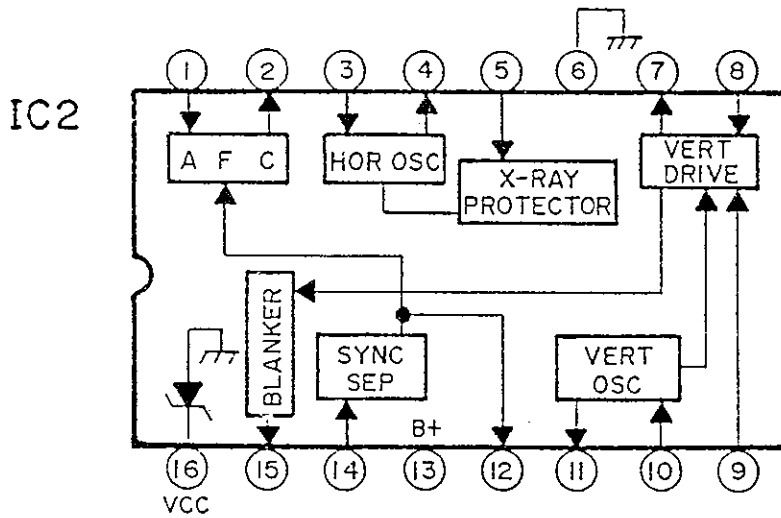
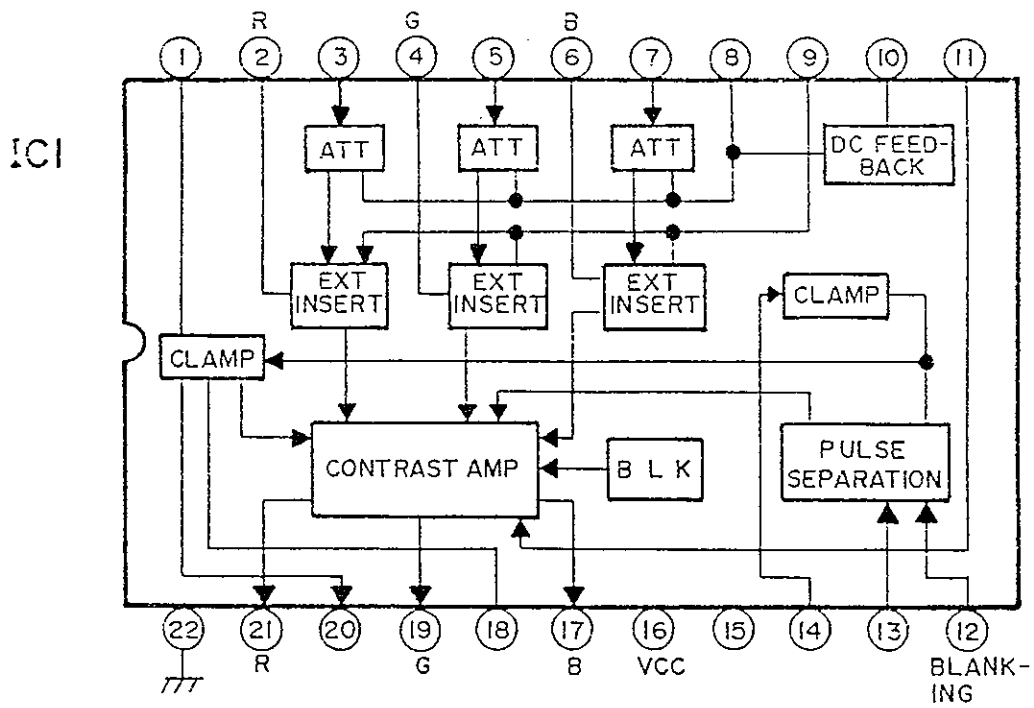
TRANSISTOR NO.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q201	Q202	Q203
COLLECTOR	12.0	12.0	12.0	10.7	11.0	11.0	12.0	12.0	12.3	40.6	*	107.8	107.8	107.8
BASE	1.7	1.7	1.7	0.1	0.2	0.2	6.0	12.8	3.3	0.4	0.03	1.7	1.7	1.7
EMITTER	1.0	1.0	1.0	0	0.01	0.01	5.4	12.0	2.6	0	0	1.4	1.4	1.4

* DO NOT MEASURE

DIODE NO.	ANODE	CATHODE
D1	8.5	9.1
D2	8.5	9.1
D3	8.5	11.0
D4	8.5	11.0
D5	0.9	10.7
D6	0.9	10.7
D7	0.9	10.7
D8	0.55	2.6
D9	7.7	12.0
D10	12.0	11.4
D11	0	2.6
D12	0.05	9.8
D13	--	24.0
D14	0.17	12.2
D15	0	8.0
D16	--	123
D17	123	--
D18	8	*
D19	--	164.3
D20	0	--
D21	0	--
D22	--	164.3
D23	--	--
D24	--	--
D25	24.0	23.6

* DO NOT MEASURE

IC NO.	1	2	3	4
TERMINAL NO.				
1	3.0	4.3	0	163.5
2	2.0	6.8	12.2	125.2
3	2.7	6.7	23.6	0
4	2.0	0.6	0.8	123.0
5	2.7	0.5	0	
6	2.0	0.3	24.0	
7	2.7	0.9	2.2	
8	2.7	3.5		
9	1.3	0.3		
10	10.4	6.2		
11	7.9	0.6		
12	0	1.3		
13	0.55	12.0		
14	2.1	13.7		
15	10.5	0.8		
16	12.0	12.8		
17	1.7			
18	3.0			
19	1.7			
20	3.0			
21	1.7			
22	0			



TROUBLESHOOTING NOTES

(Refer to Troubleshooting Chart on page 20.)

1. The troubleshooting chart mentions specific components to be checked. It is intended that the entire circuit associated with these components be checked.
2. This chart is a guide to servicing rather than a complete list of each component that could fail. Therefore, troubleshooting should not be limited only to those components mentioned in the chart.
3. It is always useful to begin checking a circuit by measuring the DC voltages and then comparing the measurements to those listed in the Typical DC Voltages chart.
4. The cutoff controls and drive controls on the neck board and the screen control at the bottom of the flyback transformer have been preset at the factory. When servicing the monitor for a lack of video, do not adjust any of these controls unless it is suspected that the problem is a result of these controls having been tampered with. Otherwise do not adjust these controls; if they are so severely out of adjustment that there is a lack of video, then there is something malfunctioning.
5. The Wells-Gardner Service Department does accept telephone calls for servicing assistance. Call 1-312-252-8220, between 7:00am and 3:30pm Central Time. Ask for the Service Department. The Service Department is closed during the first two weeks of July. Telephone assistance is not available during this period. Before calling, be sure to have available the model number of the monitor being serviced and the schematic diagram of the monitor being serviced.
6. Replacement parts may be ordered from the Service Department between 7:00am and 4:30pm Central Time.

SERVICE INSTRUCTIONS

7. NOTE: All monitors are equipped with automatic degaussing coils 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.

8. 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 **13K7951 and 19K7951.**

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.

USER ADJUSTMENTS

1. BRIGHTNESS CONTROL VR6

This control has been preset at the factory. However, when the video signal is applied to the monitor, a slight adjustment may be desired. Adjust this control such that the illumination is just barely extinguished from portions of the display which should be black.

2. CONTRAST CONTROL VR7

Adjust the contrast control for the desired picture intensity.

3. FOCUS CONTROL

Adjust the focus control, located on the high voltage unit (T1), for maximum over-all definition and fine picture detail.

4. HORIZONTAL HOLD CONTROL VR2

With the monitor being driven with the display signal, connect one jumper between TP1 and TP2 and another jumper between TP3 and TP4. Adjust the horizontal hold control until the picture stops sliding horizontally. Remove the jumpers. Do not use the horizontal hold control for horizontal centering. (See#5).

NOTE: If the sync signal is composite, use the horizontal sync input of the same polarity as the composite sync signal.

5. HORIZONTAL VIDEO SHIFT CONTROL VR1

Use this control to center the picture horizontally.

6. HORIZONTAL RASTER POSITION ADJUSTMENT

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

7. HORIZONTAL SIZE COIL L1

The horizontal size 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.

8. VERTICAL HOLD CONTROL VR5

Adjust this control until the picture stops rolling and it locks in vertically.

9. 50 - 60 Hz CONTROL VR9

This control is used to limit the range of vertical size. This control is preset at the factory and should not require readjustment unless the vertical size control or vertical hold control are readjusted from their original factory settings. In order to set this control, first

adjust the vertical size control so that the picture is slightly larger than desired. Turn VR9 so that any vertical foldover which may be present will disappear. If the monitor is to be operated alternately at more than one vertical frequency, then perform form this adjustment at the higher frequency.

10. VERTICAL SIZE CONTROL

This control must be adjusted slowly, if necessary, until the picture or test pattern attains the correct vertical proportions.

11. VERTICAL RASTER POSITION CONTROL VR3

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

12. CUT OFF AND DRIVE CONTROLS ON NECK BOARD VR201, VR202, VR203, VR204, VR205, VR206.

These controls have been preset at the proper gray scale. Before adjusting any of these controls, refer to Troubleshooting Note 4 and to the White Balance procedure.

VIDEO INTERFACE AND OUTPUT

The red, green, and blue video inputs come into the monitor at P1. Isolation and attenuation is provided by emitter followers Q1, Q2 and Q3. Forced blanking of the video signals is provided by the circuit of Q4, D5, D6, and D7. The forced blanking causes there to be an interruption in the video signal before it goes to the inputs of IC1. This interruption occurs between scan periods, while retrace is taking place; it is required by IC1. The forced blanking is not necessary for most video signals since they already have an interruption of video (blanking) between scan periods. Some do not; it is to accommodate such signals that the forced blanking circuit is included.

The red, green, and blue signals go into IC1 at pins 2, 4, and 6. Their levels are controlled by the gain of separate channels of the contrast amplifier. The gain is controlled by a DC voltage input to pin 11, which varies with the setting of the contrast control.

IC1 provides blanking of the video during retrace in response to blanking pulses at pin 13, derived from the horizontal and vertical sweep circuits. IC1 also requires a gating signal at pin 12 in order to provide red, green, and blue outputs at pins 21, 19, and 17. If the gating signal is not present, IC1 will not provide video output signals. The gating signal comes from IC2, pin 12 and is derived from horizontal sync.

The brightness is varied by varying the DC level of the outputs at pins 17, 19, and 21. This is accomplished by varying the DC voltage input to pin 14.

The video outputs from IC1 are provided via R30, R31, and R32 to the neck board where they are amplified by the video output stages Q201, Q202, and Q203 before being applied to the cathodes of the CRT through R10, R11, and R12.

SYNC

Sync is applied at P1 (positive sync) or at P2 (negative sync). Composite sync should be applied only to the horizontal sync input of the appropriate polarity. Positive sync is inverted by Q5 and Q6 then applied through D3, D4 and R51 to the sync amplifier Q7.

The sync amplifier output is applied through C22, R53, and R55 to pin 14 of IC2. Pin 14 is the sync separation input.

The sync separation extracts the horizontal and vertical sync from each other - providing horizontal sync to the horizontal AFC circuit in the IC. A composite sync output is provided at pin 12. This output signal is used for gating IC1 the video interface IC and for triggering the vertical oscillator.

VERTICAL OSCILLATOR AND OUTPUT

The composite sync output of IC2, pin 12 is filtered through the network of R65, C25, C24 and R66 so that only vertical sync is applied to the vertical trigger input at pin 11. The vertical oscillator frequency is controlled by the vertical hold control and its input to pin 10.

The vertical drive output at IC2, pin 7 is applied to pin 4 of IC3, the vertical output IC. Output current from IC3, pin 2 flows through the yoke to cause vertical deflection. During upward deflection, current flows out of pin 2, through the yoke, and into C50 to charge it. Downward deflection is caused by C50 discharging through the yoke in the opposite direction and back into IC3, pin 2. AC feedback is provided through the wiper of the vertical size control VR4 to IC2, pin 8 in order to control the drive amplitude. DC feedback at IC2, pin 9 maintains good vertical linearity at all sizes.

DC current from the +24V supply flows through R83 and through the yoke to provide downward raster shift. Some of this DC current is diverted from the yoke through the collector of Q9. The amount of this current which is diverted from the yoke can be varied by varying the base drive to Q9 by adjusting VR3, the vertical position control, thus providing manual adjustment of the vertical position of the display.

The drive signal at IC3, pin 2 is also used to furnish the vertical blanking input to IC1, pin 13 via R63 and C14.

AUTOMATIC DEGAUSSING ADG

The ADG circuit automatically demagnetizes the CRT. This circuit is activated only when the monitor is initially powered up after having been off for at least 20 minutes.

R105 is a positive temperature coefficient device. When it is cold, it has a very low resistance. As it gets warm, its resistance increases. If the monitor is cold when AC power is applied, then R105 with a low resistance allows current to pass through it, D23, D24, and the degaussing coil. As current flows through R105, it heats up and eventually has a very high resistance, allowing very little current to flow through it. The residual current now flowing through R105 produces a voltage drop across R104 of less than 0.6 volts. This is not enough to forward bias D23 and D24, so there is no current through the degaussing coil.

The process of initially having a large current through the degaussing coil and then having the current decay to zero is what produces the degaussing action. The degaussing current decays to zero before the CRT warms up, so the degaussing is completed before the picture comes on.

HIGH VOLTAGE HOLD-DOWN CIRCUIT DESCRIPTION:

The high voltage hold down circuit is part of the main PC board P447 of this monitor. The +12V DC supply is sensed via D10. Since the +12V DC supply is flyback pulse derived, the +12V DC supply will rise as the high voltage rises. If the +12V DC exceeds a threshold which is set with VR8, then D12 will conduct, thereby providing drive to IC2, pin 5 - holddown input of deflection oscillator IC. The drive being applied to pin 5 causes the horizontal oscillator within the IC to shut down - thus preventing the generation of high voltage.

The horizontal oscillator will remain in its OFF state, even if the input to IC2, pin 5 is removed, unless and until AC power is removed from the monitor input. The power may then be reapplied.

HORIZONTAL OSCILLATOR AND OUTPUT

The horizontal AFC circuit of IC2 receives a horizontal sync input from the sync separator and a feedback signal at pin 1, derived from the horizontal output. Slight differences in frequency and phase of the two signals will cause the AFC to generate a correction voltage at pin 2.

The horizontal oscillator in IC2 has its free running frequency determined by the RC time constant of C19, R56, R57, R58, and VR2, the horizontal hold control. The horizontal hold control varies the horizontal frequency by varying the RC time constant. Slight correction in frequency is provided by a correction voltage at IC2, pin 3 which comes from pin 2 through R60.

The oscillator output at pin 4 is amplified and shaped by the horizontal drive stage Q10. The drive signal is then coupled to the base circuit of the horizontal output transistor Q11 by the horizontal drive transformer T2. T2 is used for impedance transformation to provide the Q11 base circuit with the low impedance source that it requires.

The horizontal output transistor Q11 is operated as a switch. It is either on or off. It is turned on and off at the scan rate which is determined by the horizontal oscillator frequency which is ultimately determined by the incoming horizontal sync frequency. A yoke current with a sawtooth waveform is needed to deflect the beam linearly across the CRT. The beam begins at the center of the CRT and is deflected from center to right. This center-to-right deflection occurs when Q11 is turned on. The deflection yoke coupling capacitor C38, also known as the S-shaping capacitor, begins to discharge through the yoke; the discharge current causes the beam to be deflected to the right CRT edge. At this time, Q11 is turned off, and the current provided by C38 stops. As the current falls to zero, a voltage is induced across the yoke windings as the magnetic field collapses; an oscillation is produced by the yoke windings and C36, the retrace tuning capacitor. During the first half cycle of oscillation, the induced voltage is impressed on the collector of Q11, C36, and the primary of the flyback transformer T1. This induced voltage is stepped up by the flyback transformer's secondary winding. This high voltage is then rectified and applied to the high voltage anode of the CRT. When this induced voltage occurs, the electron beam is deflected from the right edge of the CRT face to the left edge. This is called retrace. During the second half cycle of the oscillation (of C36 and the yoke windings), the voltage at the Q11 collector tries to go negative or below ground. When this happens, the damper diode (include in same package with Q11) becomes forward biased. The conduction of the damper diode allows energy stored in the horizontal system to decay linearly to zero, thus allowing the beam to return to the center of the CRT face.

The focus voltage and the screen, G2, voltage are obtained from the anode voltage with a resistor divider network within the T1 assembly. An auxiliary winding (pin 10) provides feedback to the horizontal AFC through R71, R70, and C29. This signal is also used to furnish the horizontal blanking input to IC1 via C28, R69, and R68. The signal from the auxiliary winding at pin 5 of T1 is rectified by D14 and filtered to provide the +12VDC supply for the video interface and sync circuits. The auxiliary winding of pins 3 and 4 produces a signal which is rectified by D13 and filtered to produce the +24VDC supply for the vertical output circuit.

The horizontal linearity coil L2 is a magnetically biased coil which shapes the yoke current for optimum linearity. The horizontal size coil L1 is a variable series inductor which is used to vary the horizontal size of the display.

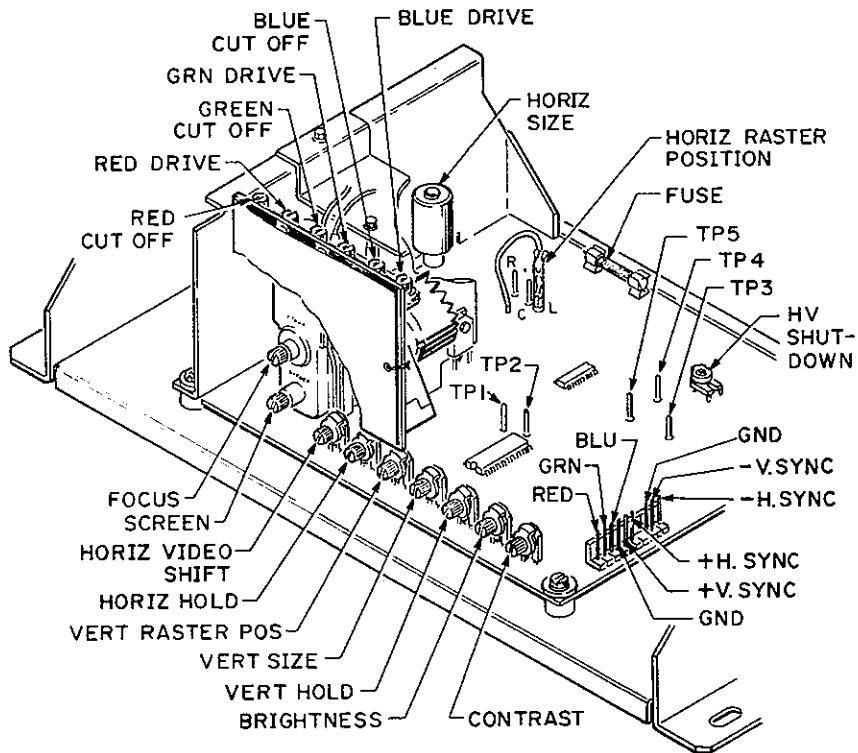


Figure 1 Locations of Controls & Important Components

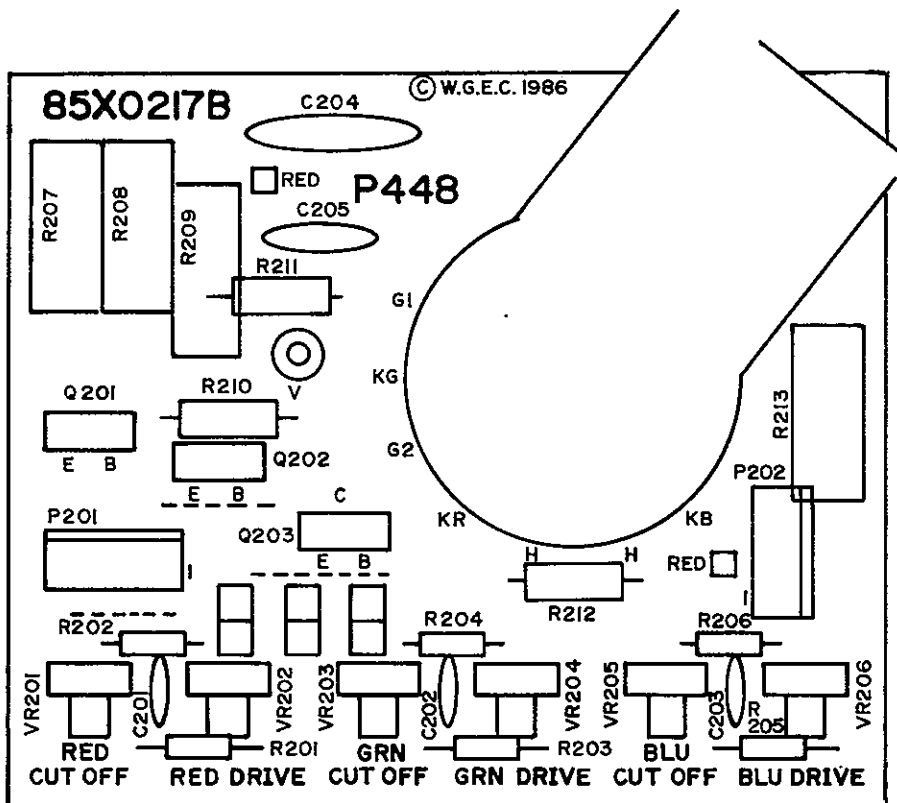


Figure 2 Neck PCB Assembly

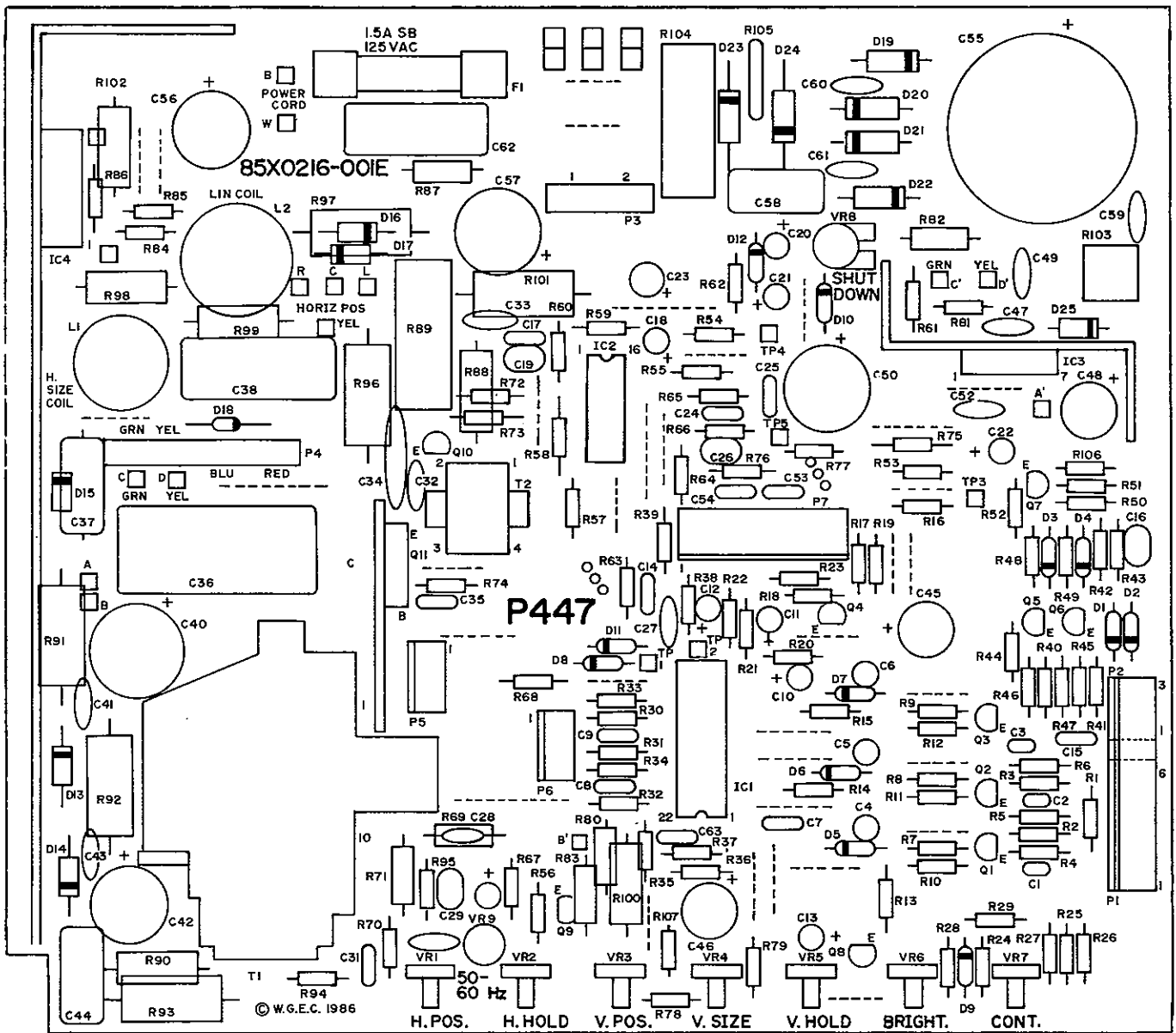
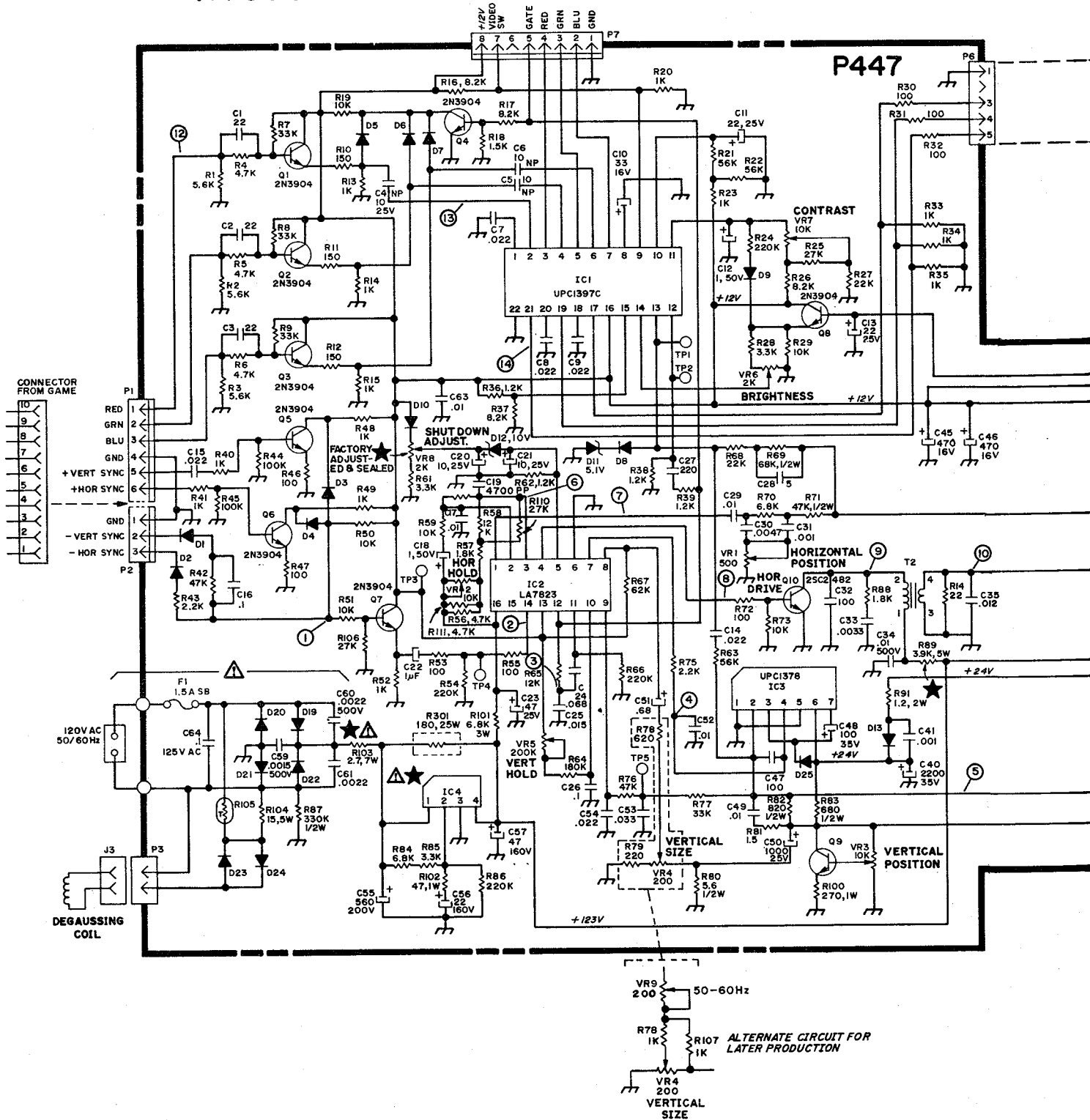
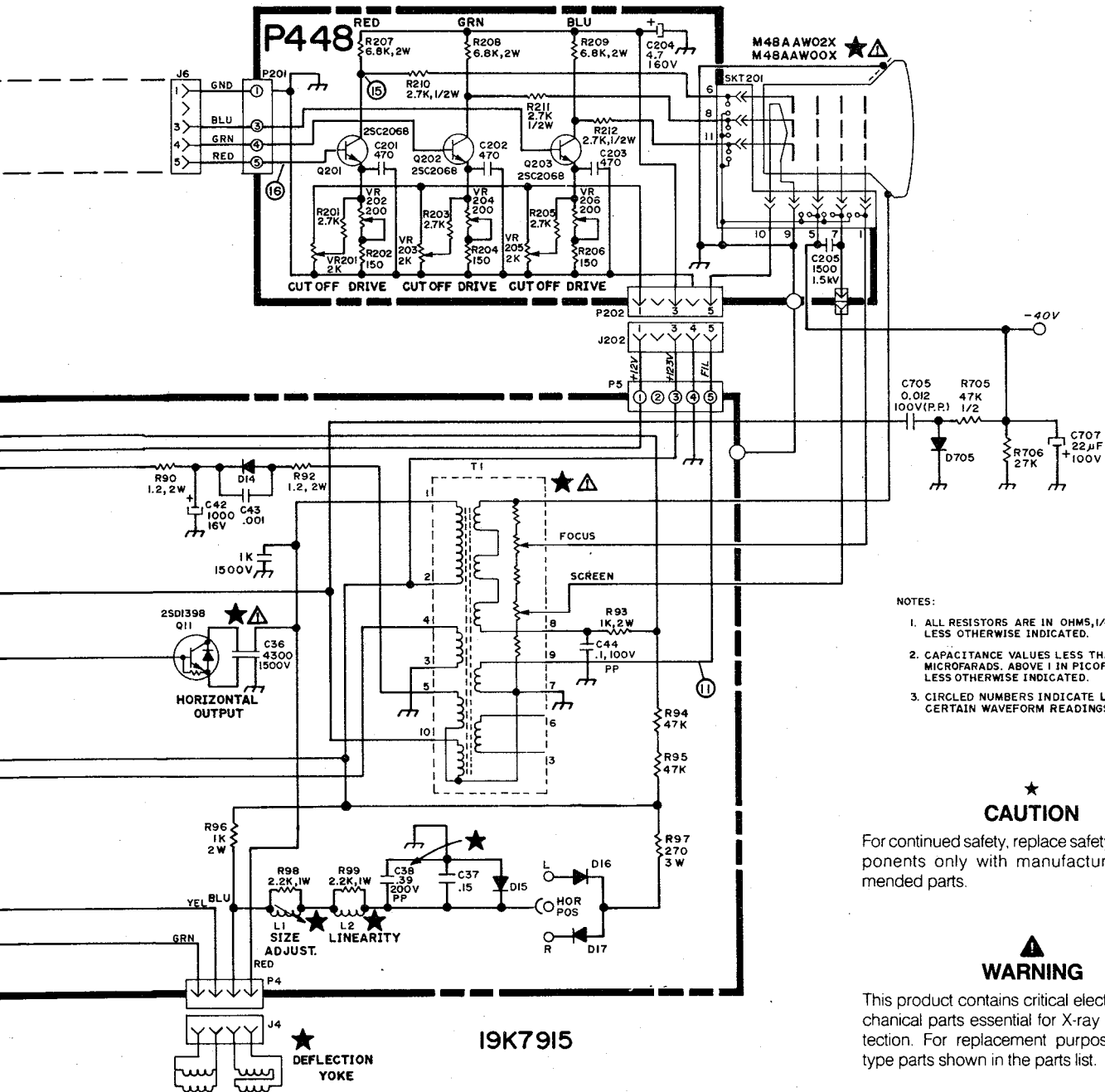


Figure 3 Main PCB Assembly

K7000 COLOR MONITOR SCHEMATIC DIAGRAM





NOTES:

1. ALL RESISTORS ARE IN OHMS, 1/4W, 5% UNLESS OTHERWISE INDICATED.
2. CAPACITANCE VALUES LESS THAN 1 ARE IN MICROFARADS. ABOVE 1 IN PICOFARADS UNLESS OTHERWISE INDICATED.
3. CIRCLED NUMBERS INDICATE LOCATION OF CERTAIN WAVEFORM READINGS.

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.

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

Designator	Description	Part No.
Capacitors		
C1-C3	Capacitor, ceramic, 22 pF, $\pm 10\%$, npo	99-130940
C4-C6	Capacitor, electrolytic, 10 μF , 25 V, np	99-130941
C7-C9	Capacitor, myr, .022 μF $\pm 10\%$, 50 V	99-130942
C10	Capacitor, electrolytic, 33 μF , 16 V	99-130943
C11	Capacitor, electrolytic, 22 μF , 25 V	99-130944
C12	Capacitor, electrolytic, 1.0 μF , 50 V	99-130945
C13	Capacitor, electrolytic, 22 μF , 25 V	99-130944
C14-C15	Capacitor, myr, .022 μF $\pm 10\%$, 50 V	99-130942
C16	Capacitor, myr, .1 μF , $\pm 10\%$, 50 V	99-130946
C17	Capacitor, polyester, .01 μF , $\pm 10\%$, 50 V	99-130947
C18	Capacitor, electrolytic, 1.0 μF , 50 V	99-130945
C19	Capacitor, polystyrene, .0047 μF , 33 V	99-130788
C20, C21	Capacitor, electrolytic, 10 μF , 25 V	99-130949
C22	Capacitor, electrolytic, 1.0 μF , 50 V	99-130945
C23	Capacitor, electrolytic, 47 μF , 25 V	99-130950
C24	Capacitor, myr, .068 μF , $\pm 10\%$, 50 V	99-130951
C25	Capacitor, polyester, .015 μF , $\pm 10\%$, 50 V	99-130952
C26	Capacitor, myr, .1 μF , $\pm 10\%$, 50 V	99-130946
C27	Capacitor, ceramic, 220 μF , $\pm 10\%$, Z5F	99-130953
C28	Capacitor, 5 pF, $\pm 20\%$, 2 KV, npo	99-130954
C29	Capacitor, polyester, .01 μF , $\pm 10\%$, 50 V	99-130947
C30	Capacitor, .00047 μF , $\pm 10\%$, 50 V	99-131004
C31	Capacitor, ceramic, 1000 pF, $\pm 20\%$, Z5F	99-130553
C32	Capacitor, ceramic, 100 μF , $\pm 10\%$, Z5F, 500 V	99-130956
C33	Capacitor, ceramic, .0033 μF , $\pm 10\%$, Y5P, 500 V	99-130957
C34	Capacitor, ceramic, .01 μF , $\pm 10\%$, Y5P, 500 V	99-130958
C35	Capacitor, polyester, .01 μF , $\pm 10\%$, 50 V	99-130947
C36 ▲ ★	Capacitor, pp, 4300 pF, 1.5 KV	99-130789
C37	Capacitor, pp, .15 μF , 100 V	99-130960
C38 ★	Capacitor, pp, .39 μF , $\pm 5\%$, 200 V	99-130961
C40	Capacitor, electrolytic, 2200 μF , 35 V	99-130962
C41	Capacitor, ceramic, .001 μF , $\pm 20\%$, Z5F, 500 V	99-130955

Main Board, Continued

Designator	Description	Part No.
C42	Capacitor, electrolytic, 1000 μ F, 16 V	99-130963
C43	Capacitor, ceramic, .001 μ F, \pm 20%, Z5F, 500 V	99-130955
C44	Capacitor, pp, .1 μ F, \pm 10%, 100 V	99-130964
C45, C46	Capacitor, electrolytic, 470 μ F, 16 V	99-130965
C47	Capacitor, ceramic, 100 μ F, \pm 10%, Z5F, 500 V	99-130956
C48	Capacitor, electrolytic, 100 μ F, 35 V	99-130966
C49	Capacitor, polyester, .01 μ F, \pm 10%, 50 V	99-130947
C50	Capacitor, electrolytic, 1000 μ F, 25 V	99-130967
C51	Capacitor, tant, .63 μ F, \pm 10%, 35 V	99-130968
C52	Capacitor, polyester, .01 μ F, \pm 10%, 50 V	99-130947
C53	Capacitor, polyester, .033 μ F, \pm 5%, 50 V	99-130969
C54	Capacitor, myr, .022 μ F, \pm 5%, 50 V	99-130970
C55	Capacitor, electrolytic, 560 μ F, 200 V	99-130971
C56	Capacitor, electrolytic, 22 μ F, 160 V	99-130972
C57	Capacitor, electrolytic, 47 μ F, 160 V	99-130973
C59	Capacitor, ceramic, .0015 μ F, \pm 10%, Y5P, 500 V	99-130974
C60, C61	Capacitor, ceramic, .0022 μ F, \pm 10%, Y5P, 500 V	99-130975
C62	Capacitor, .1 μ F, \pm 20%, 125 VAC	99-130976
C63	Capacitor, polyester, .01 μ F, \pm 10%, 50 V	99-130947
C65	Capacitor, pp, 1000 pF, 1.6 KV	99-130791
C705	Capacitor, pp, .012 μ F, \pm 5%, 100 V	99-130778
C707	Capacitor, electrolytic, 22 μ F, 100 V	99-130794
Semiconductors		
D1-D10	Diode, 1N914B	99-130977
D11	Diode, zener, 5.1 V, \pm 5%, .5 W	99-130978
D12	Diode, zener, 10 V, \pm 5%, .5 W	99-130979
D13-D17 *	Diode, switching	99-130980
D19-D24	Diode, 1 A, 600 V	99-130982
D25	Diode, boost	99-130983
D705	Diode, 1N4005	99-130795
Integrated Circuits		
IC1	Ic, video, UPC1397	99-130987
IC2	Ic, horiz/vert, LA7823	99-130988
IC3	Ic, vert output, UPC1378	99-130989
IC4	Ic, regulator, STR3123	99-130991
IC4 ▲ *	Insulator, mica	99-130990
Coils		
L1 *	Coil, width	99-130798
L2 *	Coil, linearity	99-130918
Transistors		
Q1-Q9	Transistor, NPN, 2N3904	99-130984
Q10	Transistor, NPN, cc	99-130985
Q11	Transistor, 2SD1398	99-130986
Resistors		
R1-R3	Resistor, 5.6K Ω , \pm 5%, $\frac{1}{4}$ W	99-130869
R4-R6	Resistor, 4.7K Ω , \pm 5%, $\frac{1}{4}$ W	99-130586
R7-R9	Resistor, 33K Ω , \pm 5%, $\frac{1}{4}$ W	99-130369
R10-R12	Resistor, 150 Ω , \pm 5%, $\frac{1}{4}$ W	99-130355

Main Board, Continued

Designator	Description	Part No.
R13-R15	Resistor, 1K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130392
R16-R17	Resistor, 8.2K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130870
R19	Resistor, 10K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130581
R20	Resistor, 1K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130392
R21	Resistor, 56K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130871
R22	Resistor, 5.6K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130869
R24	Resistor, 220K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130685
R25	Resistor, 27K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130643
R26	Resistor, 8.2K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130870
R27	Resistor, carbon, 22K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130783
R28	Resistor, 3.3K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130572
R29	Resistor, 10K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130581
R30-R32	Resistor, 100 Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130351
R33-R35	Resistor, 1K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130392
R36	Resistor, 1.2K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130658
R37	Resistor, 8.2K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130870
R38, R39	Resistor, 1.2K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130658
R40, R41	Resistor, 1K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130392
R42	Resistor, 47K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130657
R43	Resistor, 2.2K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130373
R44, R45	Resistor, 100K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130377
R46, R47	Resistor, 100 Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130351
R48, R49	Resistor, 1K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130392
R50, R51	Resistor, 10K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130581
R52	Resistor, 1K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130392
R53	Resistor, 150 Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130355
R54	Resistor, 220K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130685
R55	Resistor, 100 Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130351
R56	Resistor, 4.7K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130586
R57	Resistor, 1.8K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130384
R58	Resistor, 12K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130578
R59	Resistor, 10K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130581
R60	Resistor, 56K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130871
R61	Resistor, 3.3K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130572
R62	Resistor, 1.2K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130658
R63	Resistor, 56K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130871
R64	Resistor, 180K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130873
R65	Resistor, 12K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130578
R66	Resistor, 220K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130685
R67	Resistor, 62K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130872
R68	Resistor, carbon, 22K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130783
R69	Resistor, 68K Ω , $\pm 5\%$, $\frac{1}{2}$ W	99-130677
R70	Resistor, 6.8K Ω , $\pm 5\%$, $\frac{1}{4}$ W	99-130395
R71	Resistor, 47K Ω , $\pm 5\%$, $\frac{1}{2}$ W	99-130875

Main Board, Continued

Designator	Description	Part No.
R72	Resistor, 100 Ω \pm 5%, ¼ W	99-130351
R73	Resistor, 10K Ω \pm 5%, ¼ W	99-130581
R74	Resistor, 22 Ω , \pm 5%, .25 W	99-130867
R75	Resistor, 2.2K Ω , \pm 5%, ¼ W	99-130373
R76	Resistor, 47K Ω , \pm 5%, ¼ W	99-130657
R77	Resistor, 33K Ω , \pm 5%, ¼ W	99-130369
R78	Resistor, 1K Ω , \pm 5%, ¼ W	99-130392
R80	Resistor, 5.6 Ω , \pm 5%, ½ W	99-130874
R81	Resistor, 15 Ω , \pm 5%, ¼ W	99-130592
R82	Resistor, 820 Ω , \pm 5%, ½ W	99-130868
R83	Resistor, 680 Ω , \pm 5%, ½ W	99-130598
R84	Resistor, 6.8K Ω , \pm 5%, ¼ W	99-130395
R85	Resistor, 3.3K Ω , \pm 5%, ¼ W	99-130572
R86	Resistor, 220K Ω , \pm 5%, ¼ W	99-130685
R87	Resistor, 330K Ω , \pm 10%, ½ W	99-130876
R88	Resistor, 1.8K Ω , \pm 5%, 1 W	99-130840
R89 ★	Resistor, mo, 3.9K Ω , \pm 5%, 5 W	99-130926
R90-R92	Resistor, mf, 1.2 Ω , \pm 5%, 2 W	99-130927
R93	Resistor, 1K Ω , \pm 5%, 2 W	99-130841
R94, R95	Resistor, 47K Ω , \pm 5%, ¼ W	99-130657
R96	Resistor, 1.0K Ω , \pm 5%, 2 W	99-130841
R97	Resistor, 270 Ω , \pm 5%, 3 W	99-130842
R98, R99	Resistor, mo, 2.2K Ω , \pm 5%, 1 W	99-130687
R100	Resistor, 270 Ω , \pm 5%, 1 W	99-130839
R101	Resistor, 6.8 K Ω , \pm 5%, 3 W	99-130843
R102	Resistor, 47 Ω , \pm 5%, 1 W	99-130838
R103 ▲ ★	Resistor 2.7 Ω , \pm 5%, 7 W	99-130929
R104	Resistor, 15 Ω , \pm 5%, 5 W	99-130930
R105	Thermistor	99-130931
R106	Resistor, 27 K Ω , \pm 5%, ¼ W	99-130643
R107	Resistor, 1K Ω , \pm 5%, ¼ W	99-130392
R110	Resistor, 27 K Ω , \pm 5%, ¼ W	99-130643
R111	Resistor, 4.7 K Ω , \pm 5%, ¼ W	99-130586
R301	Resistor, ww, 180 Ω , 25 W	99-130785
R705	Resistor, 4.7 K Ω , \pm 5%, ½ W	99-130787
R706	Resistor, 27 K Ω , \pm 5%, ¼ W	99-130643
Transformers		
T1 ▲ ★	Transformer, flyback	99-130994
T2	Transformer, horiz driver	99-130995
Potentiometers		
VR1	Potentiometer, 500 Ω	99-130933
VR2, VR3	Potentiometer, 10K Ω	99-130934
VR4	Potentiometer, 200 Ω	99-130935
VR5	Potentiometer, 200K Ω	99-130936

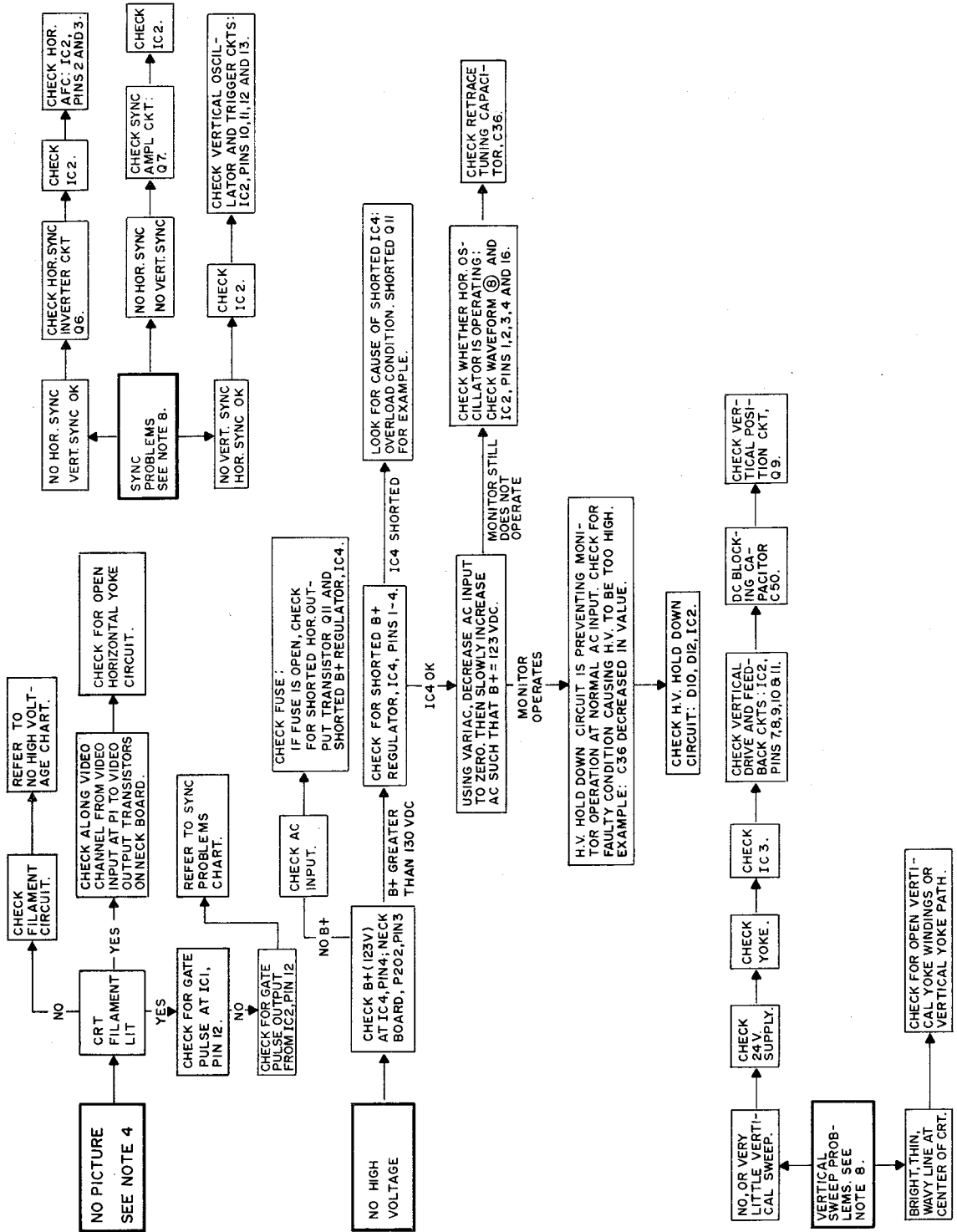
Main Board, Continued

Designator	Description	Part No.
VR6	Potentiometer, 2K Ω	99-130937
VR7	Potentiometer, 10K Ω	99-130934
VR8 ★	Potentiometer, 2K Ω , .3 W	99-130938
VR9	Potentiometer, 200 Ω	99-130939
Miscellaneous		
F1	Fuse, 1.5 Amp, sb	99-130996
Final Assembly Parts		
	Purity/Convergence Ring Assembly	99-130767
▲ ★	Cathode Ray Tube, Rauland, Type M48AAW00X, 86% OR	99-130800
▲ ★	Cathode Ray Tube, Rauland, Type M48AAW02X, 52%	99-131006
▲ ★	Deflection Yoke	99-131007

Neck Board

Designator	Description	Part No.
Capacitors		
C201-C203	Capacitor, ceramic, 470 pF, $\pm 10\%$, Z5F	99-130998
C204	Capacitor, electrolytic, 4.7 μ F, 160 V	99-131005
C205	Capacitor, ceramic, .0015 μ F, 1.5 KV	99-130999
Transistor		
Q201-Q203	Transistor, 2SC2068LB/LBBK	99-131000
Resistors		
R201	Resistor, 2.7K Ω , $\pm 5\%$, 1/4 W	99-130738
R202	Resistor, 150 Ω , $\pm 5\%$, 1/4 W	99-130355
R203	Resistor, 2.7K Ω , $\pm 5\%$, 1/4 W	99-130738
R204	Resistor, 150 Ω , $\pm 5\%$, 1/4 W	99-130355
R205	Resistor, 2.7K Ω , $\pm 5\%$, 1/4 W	99-130738
R206	Resistor, 150 Ω , $\pm 5\%$, 1/4 W	99-130355
R207-R209	Resistor, metal oxide, 6.8K Ω , $\pm 5\%$, 2 W	99-130802
R210-R212	Resistor, 2.7K Ω , $\pm 10\%$, 1/2 W	99-130583
Potentiometers		
VR201	Potentiometer, 2.0K Ω	99-130937
VR202	Potentiometer, 200 Ω	99-130935
VR203	Potentiometer, 2.0K Ω	99-130937
VR204	Potentiometer, 200 Ω	99-130935
VR205	Potentiometer, 2.0K Ω	99-130937
VR206	Potentiometer, 200 Ω	99-130935
Miscellaneous		
SKT201	CRT Socket	99-131001

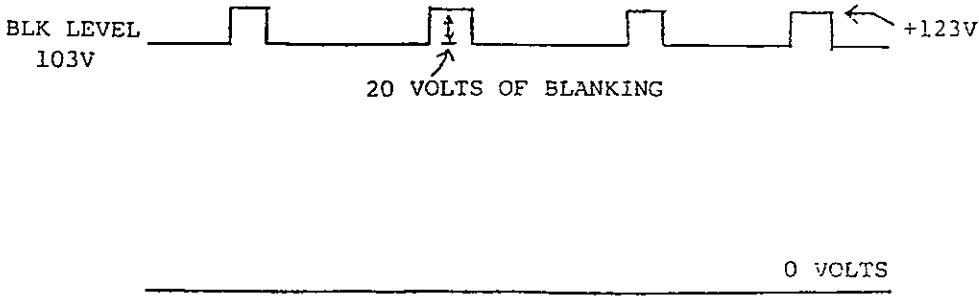
TROUBLESHOOTING CHART



CHANGE NOTICE T0106
T0117

90X3406-001A

Test and Adjustments for Y03G, 19K7901

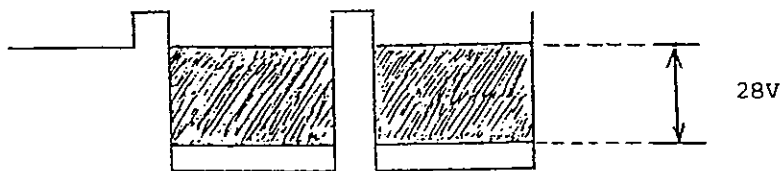
- I. PRELIMINARY ADJUSTMENTS:
1. Neck PCB - Adjust cutoff controls to min. (CCW). Adjust drive controls to 50% rotation.
 2. Main PCB - Adjust focus and screen controls as shown in Fig. 1. Adjust all other controls to 50% rotation. Horiz. raster shift in center position.
- II. BURN-IN:
- Adjust screen control for 10-20 fL light output.
- III. PURITY:
- A. POSITION: CRT facing WEST; neck VERTICAL
 - B. INPUT SIGNALS REQUIRED: Positive sync; green video.
 - C. RINGS: Begin with the purity rings in their zero correction position. The exact alignment of the purity ring tabs with respect to each other corresponding to zero correction can vary from one ring assembly supplier to another. Therefore, it will be necessary to determine the zero correction alignment experimentally.
- IV. BLACK LEVEL AND CUT OFF:
1. Connect sync signals, and ground the RGB inputs.
 2. Note lead screen while screen control is set high. Adjust screen control CCW.
 3. Connect oscilloscope to lead gun collector and adjust brightness control for the wave-form shown below.
- 
- BLK LEVEL 103V
- 20 VOLTS OF BLANKING
- +123V
- 0 VOLTS
4. Slowly turn the screen control CW until the raster is just visible, then CCW until raster is barely extinguished.

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90X3406-001

5. The black level has now been set. Do not readjust the screen control or brightness control

V. CONTRAST CONTROL: With a 2.2 volt video input signal (LOW output of buffer box), adjust the contrast control for 28 volts p-p of video on the collector of the video output transistor.



VI. WHITE BALANCE: Adjust as follows to produce 8500° color temperature:

1. Apply sync to the sync inputs and a variable DC signal to all three (RGB) video inputs.
2. Adjust the DC input to produce approx. 10 fL light output. Adjust two cut-off controls to match the lead screen.
3. Adjust the DC input to produce approx. 20 - 30 fL and adjust the red and green drive controls to match the blue.
4. Repeat for good white tracking.

VII. HIGH VOLTAGE SHUTDOWN:

1. With the AC line supplied by a variac and set to minimum, connect a DC volt meter to the 123V DC buss.
2. Short out R301.
3. Increase the line voltage with the variac to where the DC voltmeter reads 133 volts. Adjust the auto-shutdown control to where the high voltage is shutdown.
4. The must activate voltage is between 130 and 136V DC.
5. Seal control with adhesive epoxy 3M type 3520.

VIII. CONTRAST CONTROL: Readjust the control, if necessary, such that the collector of the video output transistor has 28 volts of video when the video input is 2.2 volts.

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IX. HORIZONTAL FREQUENCY:

1. Connect video signal jumper between TP3 and 4 (this removes horiz. sync), jumper between TP1 and 2 (this removes horiz. blanking in order to make the video visible).
2. Turn the horiz. hold control to where the display is stationary.
3. Remove the jumpers.

X. Test signal for adjusting size, position, and free running horizontal frequency.: WELLS-GARDNER crosshatch.

XI. VERTICAL SCAN TEST:

Turn the vertical size control through its entire range of rotation, and observe whether there is any vertical foldover.

XII. Using the above format, adjust the horizontal size and position such that the video exactly fills the CRT screen.



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