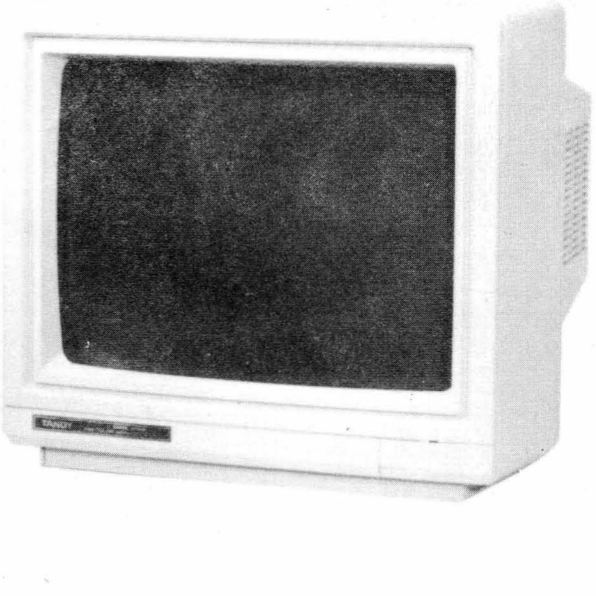
TANDY®

Service Manual

26-3215

Color Monitor CM-8
for Color Computer 3

Catalog Number : 26-3215



CUSTOM MANUFACTURED FOR RADIO SHACK, A DIVISION OF TANDY CORPORATION

CONTENTS

SPECIFICATIONS

Description	Nominal	Limit
1. Power input	AC 120V, 60Hz	
2. AC input current	0.75A	+10% −30%
3. Input signal		
a) RGB video	RGB separate analog level, positive (default)	0.8 — 2.0Vp-p (at 75 ohm)
b) Synchronous	T.T.L. level, positive going (default)	4.0 — 5.0Vp-p
c) Audio		1.0Vp-p
4. Resolution		
a) Horizontal	480 dots	
b) Vertical (non-interlaced)	225 lines	
5. Brightness		30 fl. min. (white peak)
6. Display color	All colors	
7. High voltage	23 kV/0μA	27.5 kV max./0μA
8. Picture linearity		
a) Horizontal		10% max.
b) Vertical		10% max.
9. Synchronous (pull-in range)		
a) Horizontal	15.701 kHz	+300 Hz −400 Hz
b) Vertical	59.7 Hz	−7 Hz
10. Screen pitch	0.52 mm	

Note: Nominal specs represent the design specs; all units should be able to approximate these — some will exceed and some may drop slightly below these specs. Limit specs represent the absolute worst condition that still might be considered acceptable; in no case should a unit perform to less than within any limit spec.

IMPORTANT SERVICE SAFETY PRECAUTIONS

Service work should be performed only by qualified service technicians who are thoroughly familiar with all of the following safety checks and servicing guidelines:

WARNING

1. For continued safety, do not attempt to modify the circuit.
2. Disconnect the AC power before servicing.
3. Semiconductor heat sinks are potential shock hazards when the chassis is operating.

SERVICING THE HIGH VOLTAGE SYSTEM AND PICTURE TUBE

When servicing the high voltage system, remove the static charge by connecting a 10k ohm resistor in series with an insulated wire (such as a test probe) between the chassis and the anode lead. (The AC line cord should be disconnected from the AC outlet.)

1. The picture tube in this display monitor employs integral implosion protection.
2. Replace with a tube of the same type number for continued safety.
3. Do not lift the picture tube by the neck.
4. Handle the picture tube only when wearing shatterproof goggles and after discharging the high voltage anode completely.

X-RADIATION AND HIGH VOLTAGE LIMITS

1. Be sure all service personnel are aware of the procedures and instructions covering X-radiation. The only potential source of X-ray in a current solid-state display monitor is the picture tube. However, the picture tube does not emit measurable X-ray radiation if the high voltage is as specified in the "high-voltage check" instructions.
   It is only when high voltage is excessive that X-radiation is capable of penetrating the shell of the picture tube, including the lead in glass material. The important precaution is to keep the high voltage below the maximum level specified.
2. It is essential that servicemen have available at all times an accurate high voltage meter. The calibration of this meter should be checked periodically.
3. High voltage should always be kept at the rated value — no higher. Operation at higher voltages may cause a failure of the picture tube or high voltage circuitry and, also, under certain conditions, may produce radiation in excess of desirable levels.
4. When the high voltage regulator is operating properly there is no possibility of an X-radiation problem. Every time a color chassis is serviced, the brightness should be tested while monitoring the high voltage with a meter to be certain that the high voltage does not exceed the specified value and that it is regulating correctly.
5. Do not use a picture tube other than that specified or make unrecommended circuit modifications to the high voltage circuitry.
6. When troubleshooting and taking test measurements on a display monitor with excessive high voltage, avoid being unnecessarily close to the display monitor. Do not operate the display monitor longer than is necessary to locate the cause of excessive voltage.

BEFORE RETURNING THE DISPLAY MONITOR

Fire and Shock Hazards

Before returning the display monitor to the user, perform the following safety checks:

1. Inspect all lead dress to make certain that the leads are not pinched or that hardware is not lodged between the chassis and other metal parts in the display monitor.
2. Inspect all protective devices such as nonmetallic control knobs, insulating materials, cabinet backs, adjustment and compartment covers or shield, isolation resistor-capacitor networks, mechanical insulators, etc.
3. To be sure that no shock hazard exists, check for leakage current in the following manner:

- Plug the AC line cord directly into a 120-volt AC outlet. (Do not use an isolation transformer for this test.)
- Using two clip leads, connect a 1.5k ohms, 10-watt resistor paralleled by a 0.15μF capacitor in series with all exposed metal cabinet parts and a known earth ground, such as an electrical conduit or electrical ground connected to earth ground.
- Use an SSVM or VOM with 1000 ohms-per-volt or higher sensitivity to measure the AC voltage drop across the resistor. (See Figure 1.)

- Connect the resistor connection to all exposed metal parts having a return path to the chassis (metal cabinet, screw heads, knobs and control shafts, escutcheon, etc.) and measure the AC voltage drop across the resistor.
  All checks must be repeated with the AC line cord plug connection reversed. (If necessary, a non-polarized adapter plug must be used only for the purpose of completing these checks.)
  Any reading of 0.3 volt RMS (this corresponds to 0.2 milliamp. AC) or more is excessive and indicates a potential shock hazard which must be corrected before returning the display monitor to the user.

SAFETY NOTICE

Many electrical and mechanical parts in display monitors have special safety-related characteristics. These characteristics often pass unnoticed and the protection afforded by them cannot necessarily be obtained by using replacement components rated for higher voltage, wattage, etc.
Replacement parts that have these special safety characteristics are identified in this manual; electrical components having such features are identified by a ⚠ and shaded in the Replacement Parts Lists and Schematic Diagram. For continued protection, replacement parts must be identical to those used in the original circuit. The use of a substitute replacement part that does not have the same safety characteristics as specified in this service manual, may create shock, fire, X-radiation or other hazards.

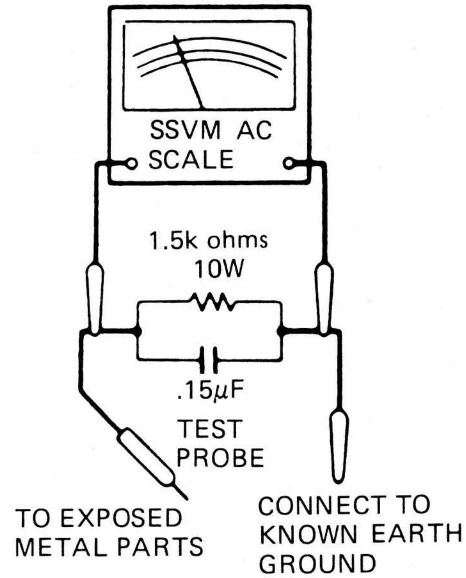


Figure 1. Leakage Current Test Circuit

THEORY OF OPERATION

1. RGB Drive Circuit

IC451 is a linear IC to amplify the RGB signals.
The DC restoration system of IC451 provides control of the simultaneous amplitude (contrast) and DC level (brightness) of RGB.
The synchronizing signal, as a DC restoration pulse, is fed from pin (16) of IC601 to pins (12) and (13) of IC451.

2. Video (RGB) Output (Fig. 2)

An RGB drive system is utilized in the video output circuit of this unit. The function of this circuit is to combine the color signals and the brightness signal, and amplify them sufficiently to drive the cathodes of CRT. 145V DC must be applied to the output transistor circuit (Q851, Q861, Q871). When the horizontal output circuit is operating, a pulse used for providing 145V DC and driving AFC circuit is developed incidentally at a winding of the horizontal output transformer (flyback transformer T602). This pulse is taken from terminal (5) of T602 and rectified by D717, and then used as 145V DC.
The brightness signal from the Blanking transistor (Q402) is applied to the emitters of Q851, Q861 and Q871.
C853, C854 and C855 are peaking capacitors.
Color signals from the outputs of IC451 are applied to the bases of Q851, Q861 and Q871. The picture tube used in this unit is a precision, inline gun-type. The control grid (G1) and the screen grid (G2) are common with respect to the red, green and blue cathodes. Consequently, the emitter circuits of Q851, Q861 and Q871 are provided with bias controls (R862, R863 and R864, respectively) for picture tube cut-off adjustment. Drive controls (R856 and R858) are provided in the emitter circuits of Q851 and Q871 for white balance adjustment.

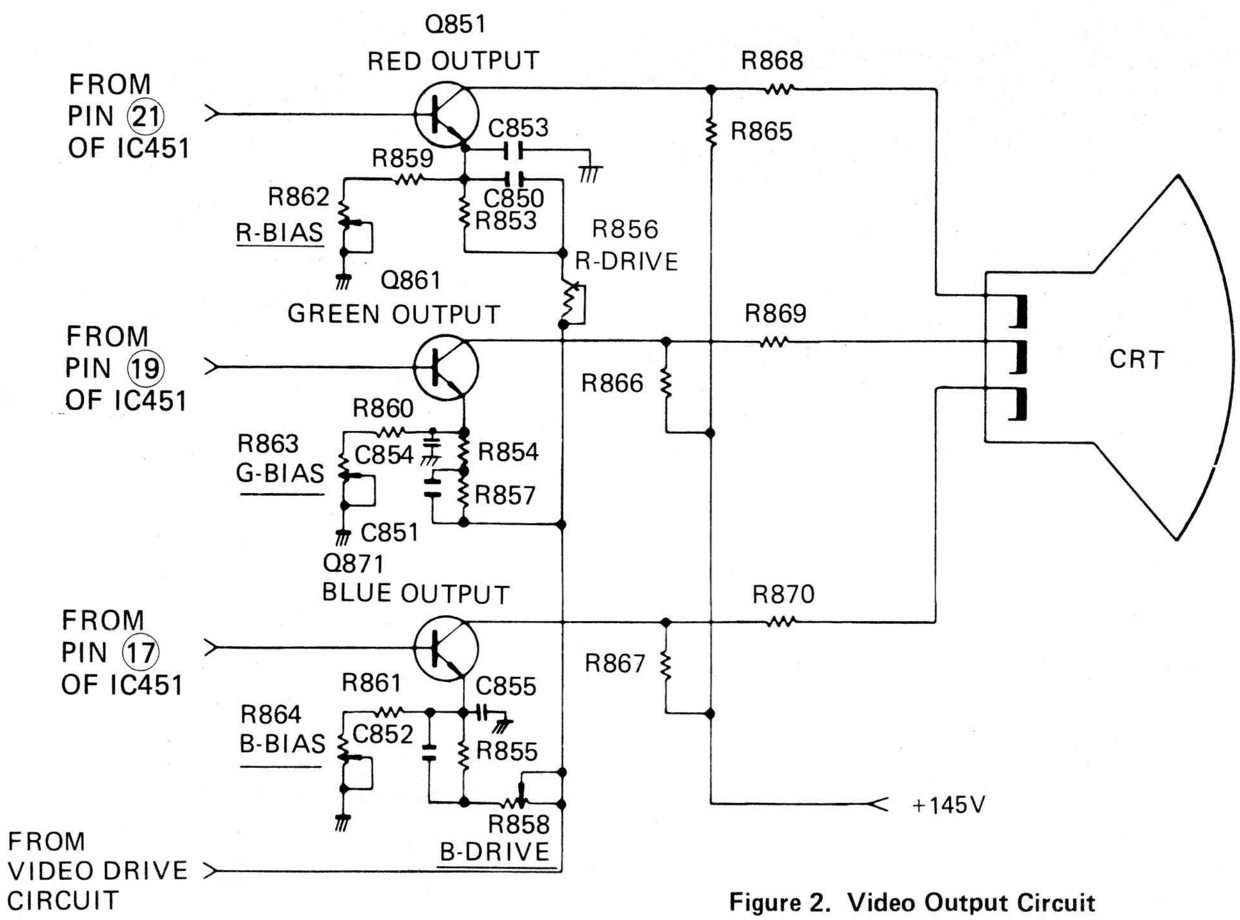


Figure 2. Video Output Circuit

3. Vertical Deflection Circuit

The vertical sync. signal with positive polarity is applied to pin ⑦ of the vertical and horizontal IC (IC601). Pin ⑧ of IC601 is connected to the internal vertical oscillator circuit. The frequency of the oscillator can be controlled by the voltage of pin ⑧ which can be varied by V.HOLD VR (R514). The sawtooth signal is obtained by the integrating circuit which is connected between pin ⑤ and pin ⑧.
The oscillator output is fed to the vertical drive circuit through a buffer circuit. Its output, derived from pin ②, is applied to the vertical output circuit (IC501).
The sawtooth wave is applied to pin ③ of IC601 as an AC feedback signal.
The output circuit of IC501 is controlled by V-SIZE VR (R507) to vary the vertical size of the raster.
The vertical linearity control (R526) is part of an integrating circuit which controls the linearity of the sawtooth waveform.

4. Horizontal Oscillator, AFC and Drive Circuit

The horizontal sync. signal with positive polarity is applied to pin ⑮ of IC601.
The output from the flyback transformer (T602) is integrated and connected to pin ⑬ of IC601 as part of the automatic frequency control circuit.
H. CENT control (R623) determines the relative position of the raster and picture.
The horizontal oscillation frequency can be controlled by H. HOLD VR (R607) connected to pin ⑫ of IC601.
The horizontal frequency is obtained from pin ⑩ of IC601, and is fed to the next horizontal drive circuit.
The pulse-switching mode of the driver and output stage is a reverse polarity type; that is, when the driver transistor Q601 is ON, the output transistor Q602 is OFF.

5. Horizontal Output and HV Rectifier (Figs. 3—5)

The horizontal dirve signal, developed at pin ⑩ of the deflection processor integrated circuit (IC601), is amplified through the horizontal drive stage (Q601) and coupled to the base of the horizontal output circuit via the horizontal drive transformer (T601). Refer to Fig. 3.
The horizontal output circuit generates the horizontal scanning signal and a high voltage to be applied to the picture tube. The function of the horizontal output stage (Q602) is to serve as a switch for the horizontal output circuit. Refer to Fig. 4.
During the horizontal scanning period, Q operates (S1 is closed, S2 is open) and the current is applied in one direction through the horizontal coils of the deflection yoke (LY) and the capacitor (C). During retrace time, Q is inoperative (S1 is open, S2 is closed) and the current is applied in the opposite direction through the damper diode (D), the horizontal coils of the deflection yoke (LY) and the capacitor (C).
The high voltage applied to the anode of the picture tube is generated by boosting the pulse from the collector of Q602 through T602 during the flyback (retrace) period and applying this boosted pulse to a series of silicon rectifiers. Refer to Figure 5.
High voltage regulation is accomplished internally in T602.

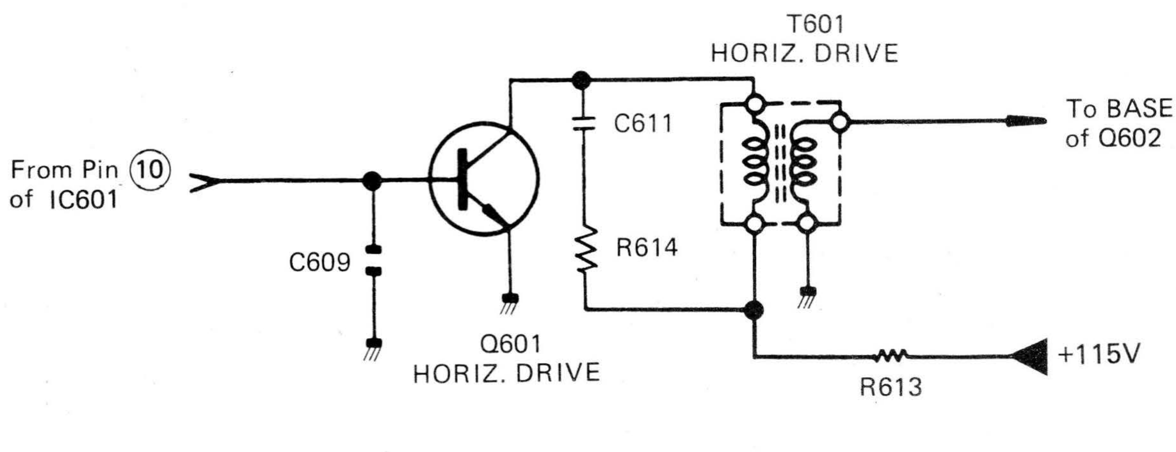


Figure 3. Horizontal Drive Circuit

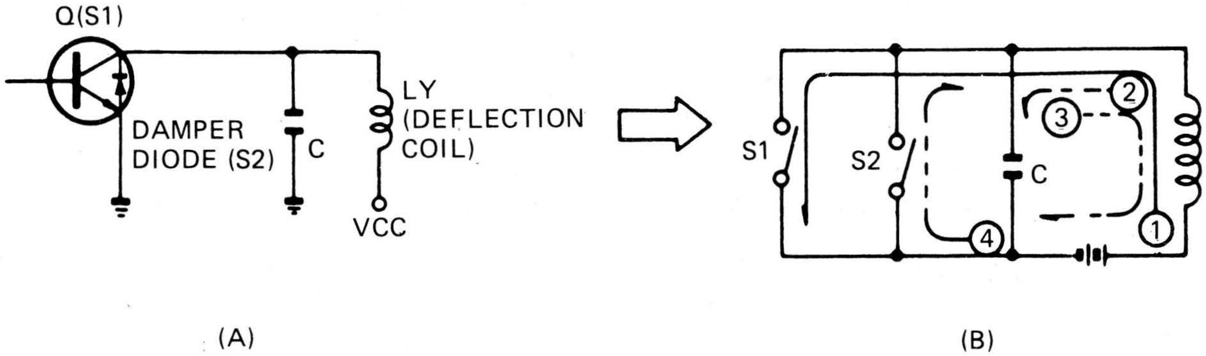


Figure 4. Equivalent Circuit of Horizontal Output Circuit

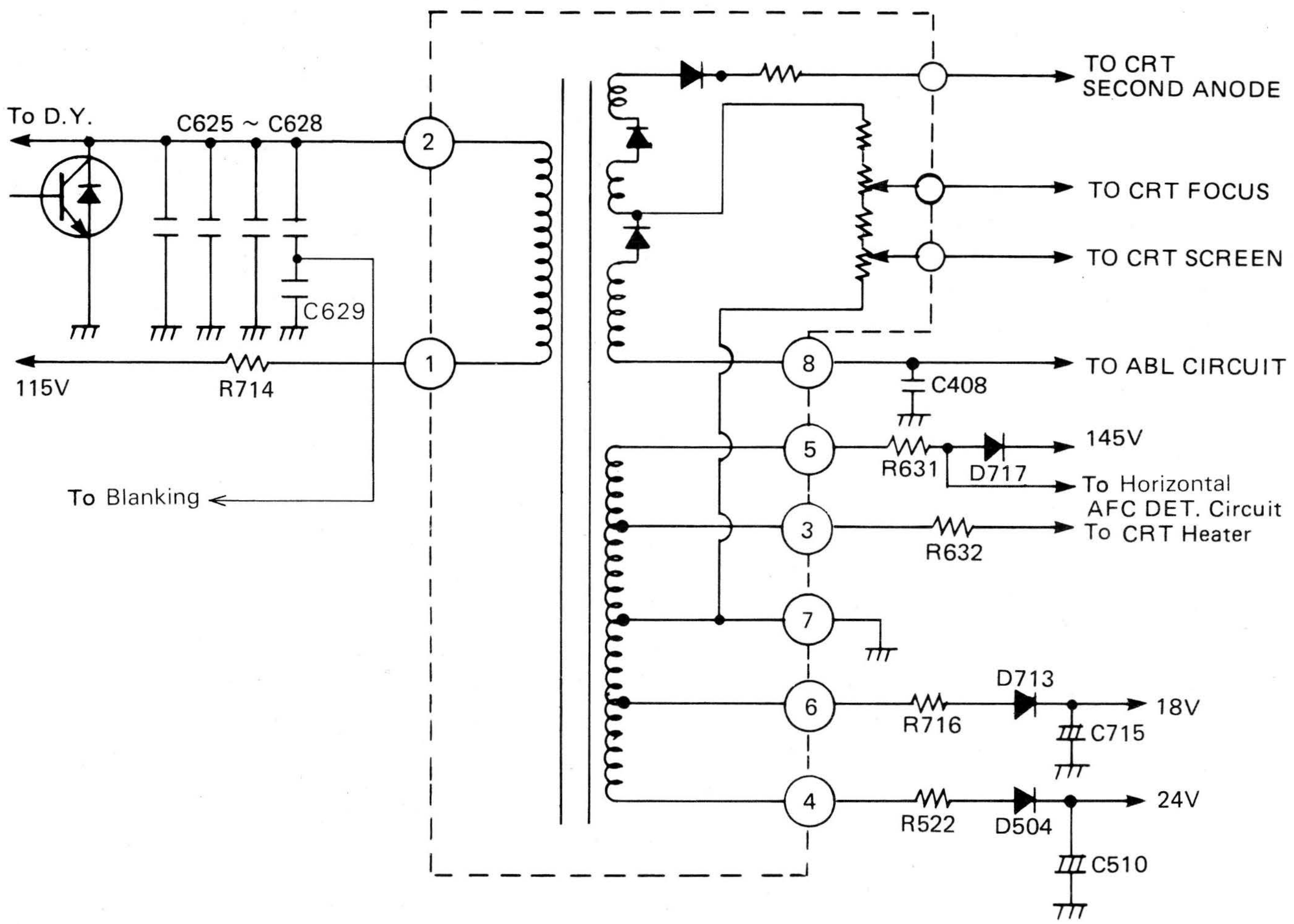


Figure 5. Horizontal Output and HV Rectifier Circuit

6. High Voltage Shutdown System

The shutdown circuit prevents the high voltage from rising above a preset level.
Under normal operating conditions, this circuit is inactive.
Operation of the protector circuit depends upon a heater pulse which appears at pin (3) of the horizontal output transformer (T602). It monitors a heater pulse rectified by D603. If the incoming high voltage increases and exceeds its limit, the heater pulse voltage also increases. As a result, there is a larger voltage produced to charge C617 so that its potential will eventually be higher than the knee voltage (+22V) of the Zener diode (D605) turning it ON. With D605 turned ON, the X-ray protector (of IC601) operates to stop the horizontal oscillator circuit, shutting down the resultant high voltage.

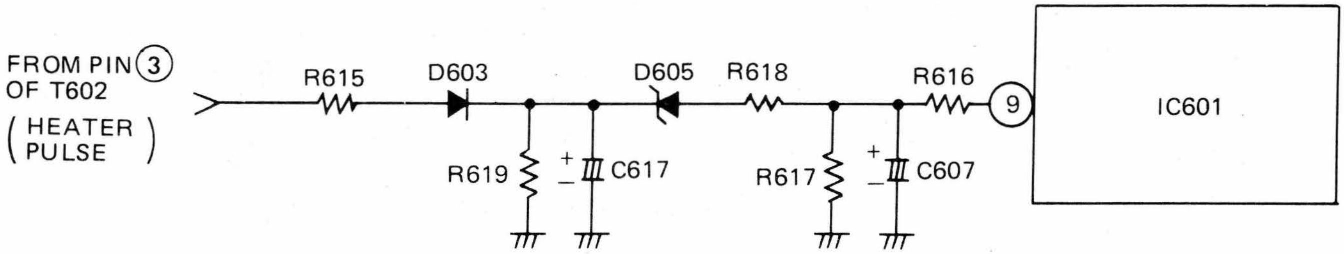


Figure 6. High Voltage Shutdown System Cirucit

7. Power Supply (Figs. 7—9)

The power supply circuit is a blocking oscillator type switching power circuit and substantially consists of the rectifier/smoother, blocking oscillator, control, and output rectifier/smoother circuits.
The AC input voltage is full-wave rectified by the rectifier/smoother circuit and then placed on the smoothing capacitor as a DC voltage.
The DC voltage is applied to the blocking oscillator circuit.
The blocking oscillator circuit operates at an oscillation frequency and duty ratio that depends upon the action of the control circuit.
Stabilization of the output voltage is accomplished by changing the conducting period of the output transistor used in the blocking oscillator circuit.

Operational Description

When the power is turned on, a small current flows to the base of the output transistor (Q702) via the startup resistor (R712). As a result, the collector current flows through the primary windings (8) and (1) of the converter transformer, which produces an electromotive force between those windings irrespective of the magnitude of the collector current, resulting in a voltage being induced between the driving windings (9) and (10). The induced voltage is positively feedback to the base of the output transistor (Q702) to increase the base current of this transistor, resulting in a further increase in the collector current. The above operation occurs instantaneously to impress sufficient base current on Q702, keeping it on. The collector current of Q702, determined by the equation $i = V/L \cdot t$, increases rectilinearly with time.

While the control circuit is at rest, the collector current increases with time, and the moment it reaches h_{FE} times that of the base current, Q702 turns off.
The control circuit always applies to the error amplifier circuit a voltage induced in the detecting winding situated at the primary side of the converter transformer.
This charges the capacitor (C714) while Q702 is off. Also the capacitor (C708) is charged with a reverse voltage produced between the driving windings (9) and (10) while Q702 is off. This voltage is a positive constant voltage.
If the voltage induced in the detecting winding becomes greater than a specified value, it also exceeds the voltage of the Zener diode in the error amplifier, resulting in a voltage being applied to the emitter of Q701. This causes the base current of Q701 to flow, turning it on.
The flow of the collector current of Q701 produces a voltage in the resistor connected between the collector of Q701 and the ground. When this voltage reaches the gate trigger voltage, the thyristor whose gate is connected to the above resistor turns on.
The instant the thyristor turns on, a current flows through R710, the thyristor, the emitter and base of Q702; in this sequence, the charging voltage of C708 is used as a power source, causing the base current of Q702 to stop and thus Q702 to turn off.
When Q702 turns off, the energy accumulated between the primary windings (8) and (1) while Q702 is on is transmitted to the secondary winding and then fed to the load via the rectifier circuit (D710, C711).

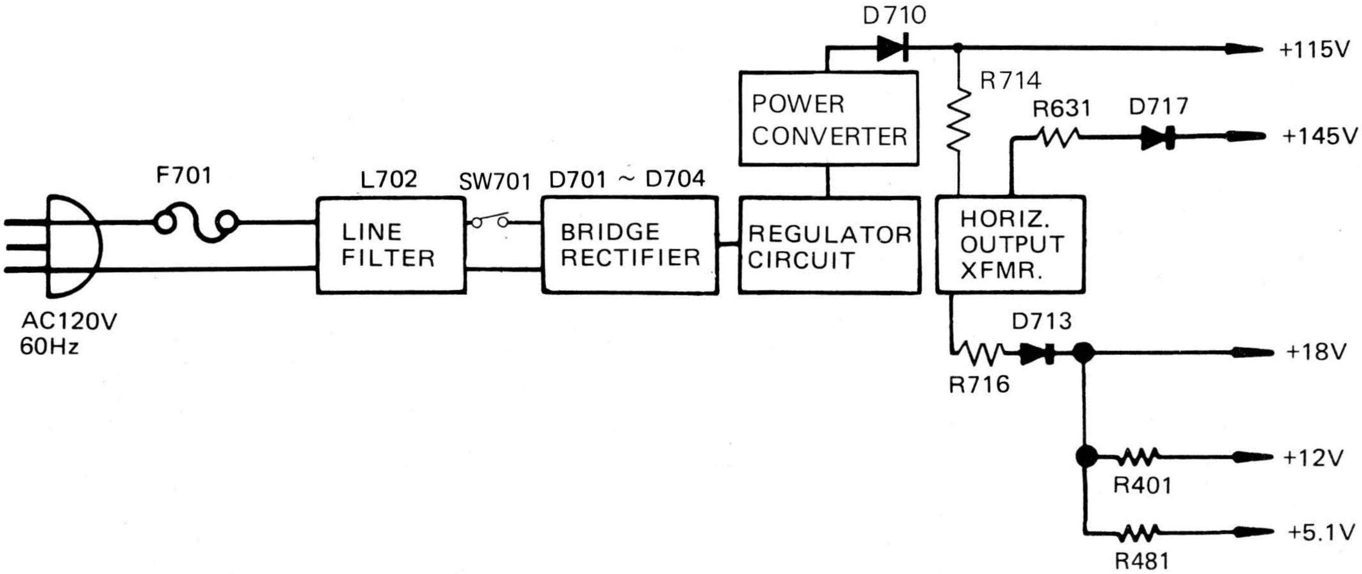


Figure 7. Block Diagram of Power Supply

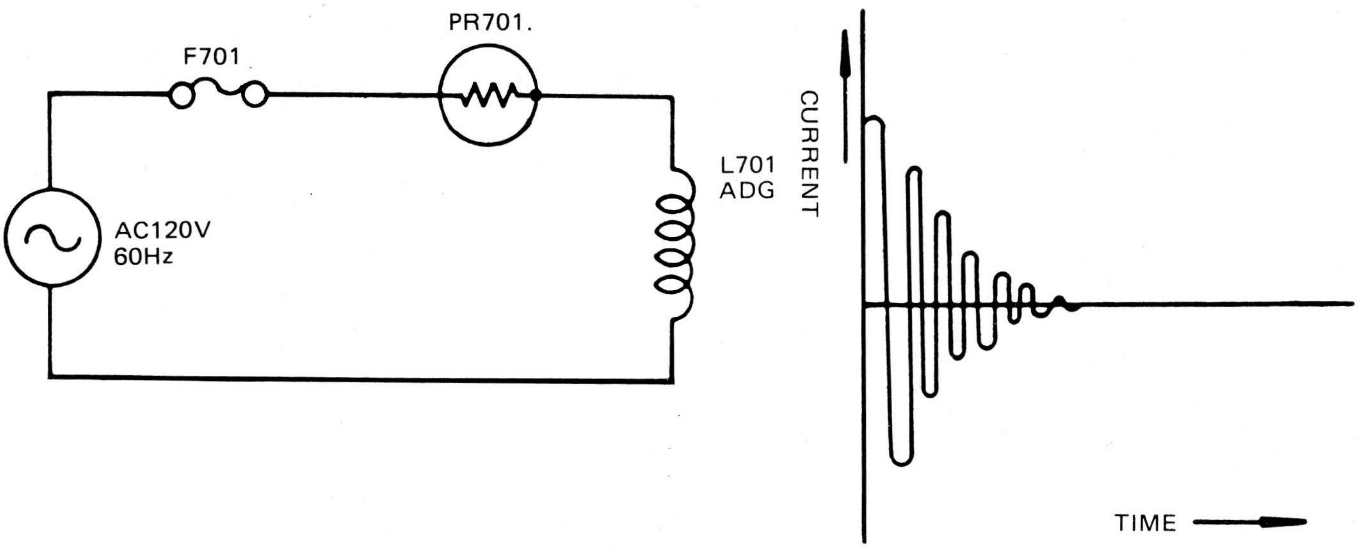


Figure 8. ADG Circuit

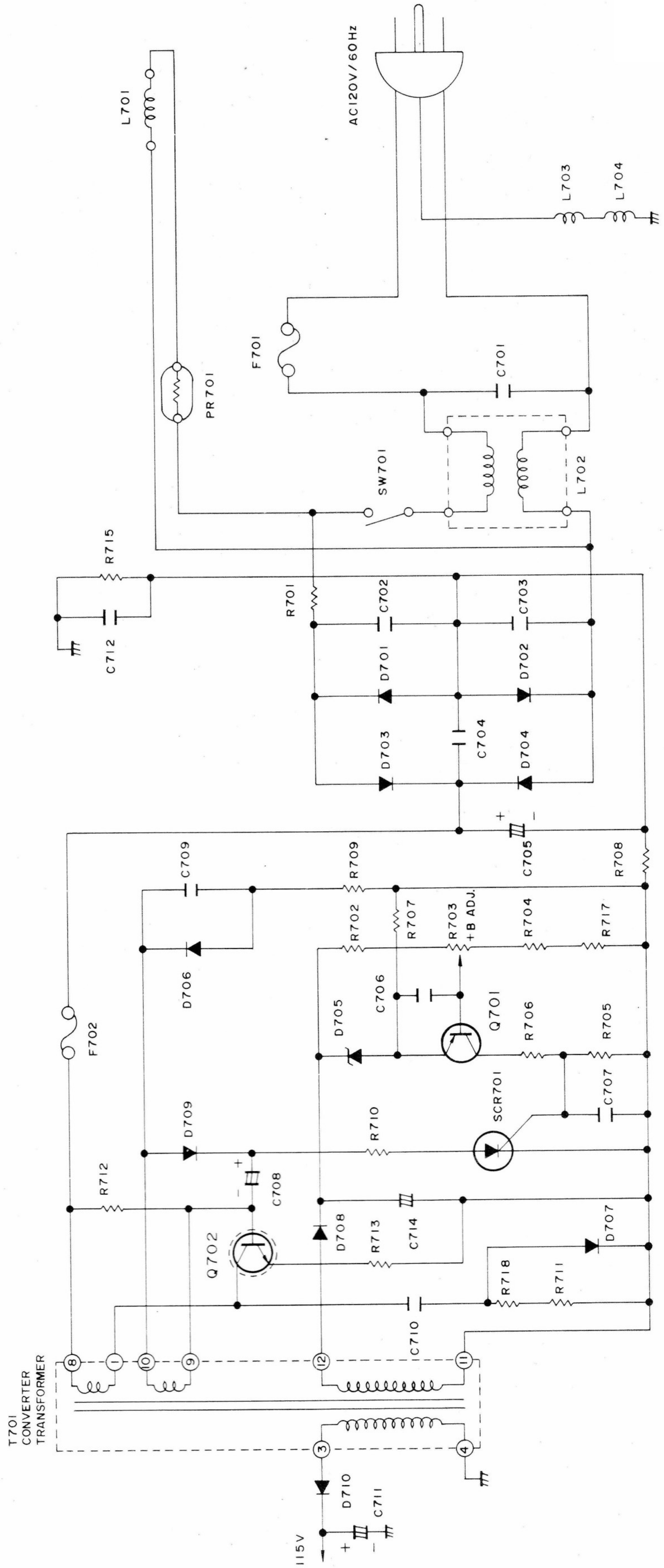


Figure 9. Power Supply Circuit

8. Audio Output Circuit (Fig. 10)

The audio output circuit is an output transformerless system which employs a bipolar analog IC. The audio signal coming out of the computer is applied via C301 and the buffer amplifier Q301 to pin (1) of IC301. The signal fed into IC301 is delivered to pin (5) through PRE-DRIVER, DRIVER, and POWER-OUT.

The audio signal coming out of IC301 is sent via C303 to the speaker.

Characteristics in low-frequency band are determined by C305 and C303; characteristics in high-frequency band are determined by C308.

The amplification factor of IC301 is determined by R307.

Power is supplied to IC301 through pin (6).

When current does not flow through pin (6), the voltage at pin (6) is increased. Due to the increase in voltage, a current flows into Q302 through R310 and D304: Q302 is then turned on so that current flows through R308 and the voltage at pin (6) is decreased. When current flows through pin (6) of IC301, the voltage applied to pin (6) is decreased. If the voltage is decreased, the current through R310 and D304 is off and Q302 is turned off, so that the current through R308 is cut off, and the voltage at pin (6) is increased. Thus the voltage at pin (6) of IC301 is stabilized.

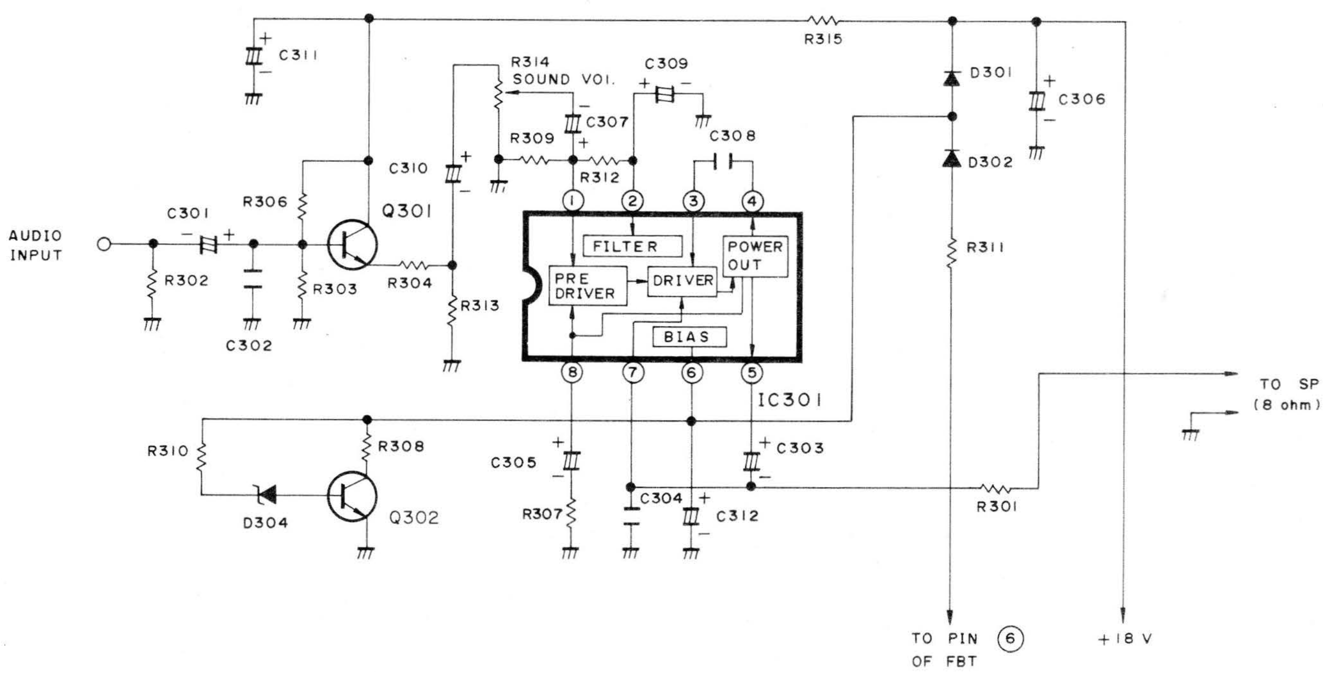


Figure 10. Audio Output Circuit

DISASSEMBLY INSTRUCTIONS

1. Remove the six screws (1) retaining the rear cabinet.
   Remove the rear cabinet. (Figure 11A)
   Note: The CRT must be discharged. Remove the speaker leads from the PCB-A. Refer to the high voltage discharge procedure on page 4.
2. (1) Remove the CRT's second anode cap (2) from the CRT.
   (2) Unsolder the grounding strap and remove the PCB-B (CRT PCB) lead of the CRT.
   (3) Remove the PCB-B.
   (4) Loosen the wire holder on the PCB-A and disconnect the connector K. (Figure 11B)
   (5) Disconnect the connectors NA and M on the PCB-A (main PCB).
   (6) Loosen the wire holder fixing the RGB output lead, degaussing lead, speaker lead and LED lead. (Figure 11B)
   (7) Remove the PCB-A (main PCB) from the front cabinet.
3. Remove screw (3) in the PCB-C (LED PCB) and remove PCB-C from the front cabinet. (Figure 11B)

Note: When servicing, be sufficiently careful with the control door since it may detach from the cabinet if it touches the surface while the set is inclined toward the front.

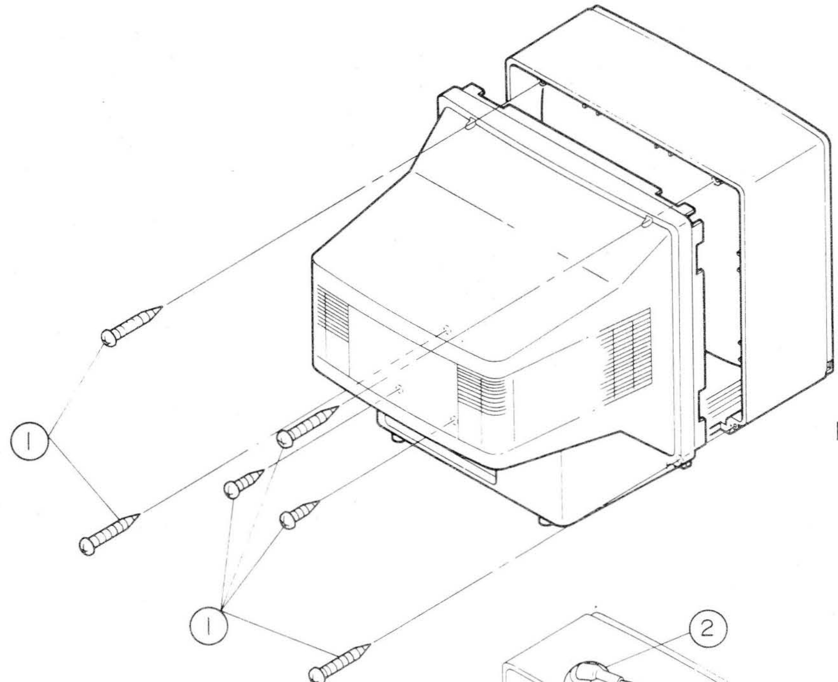


Figure 11A. Removal of Cabinet

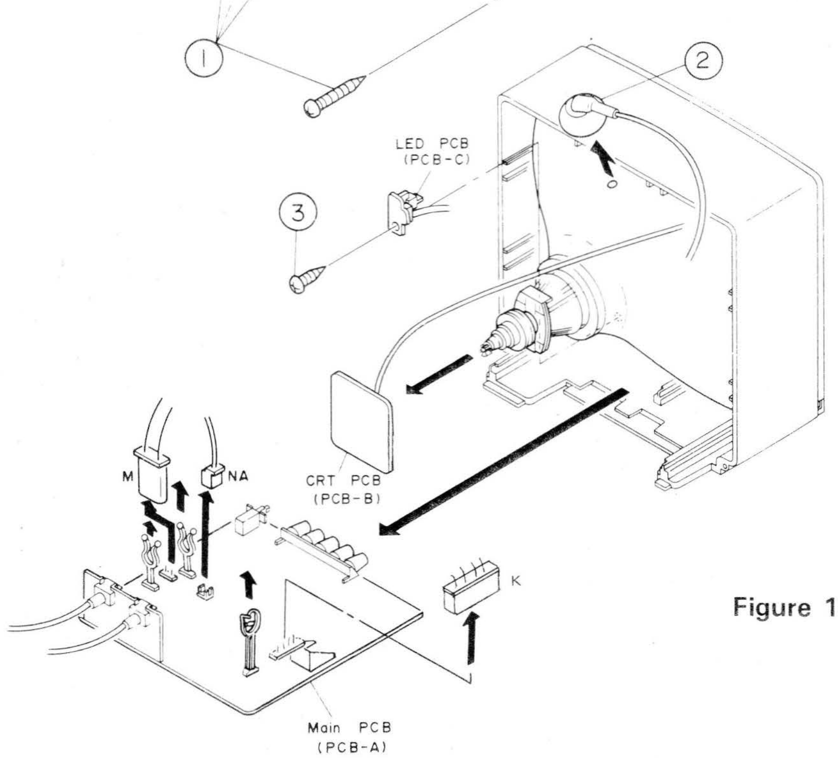
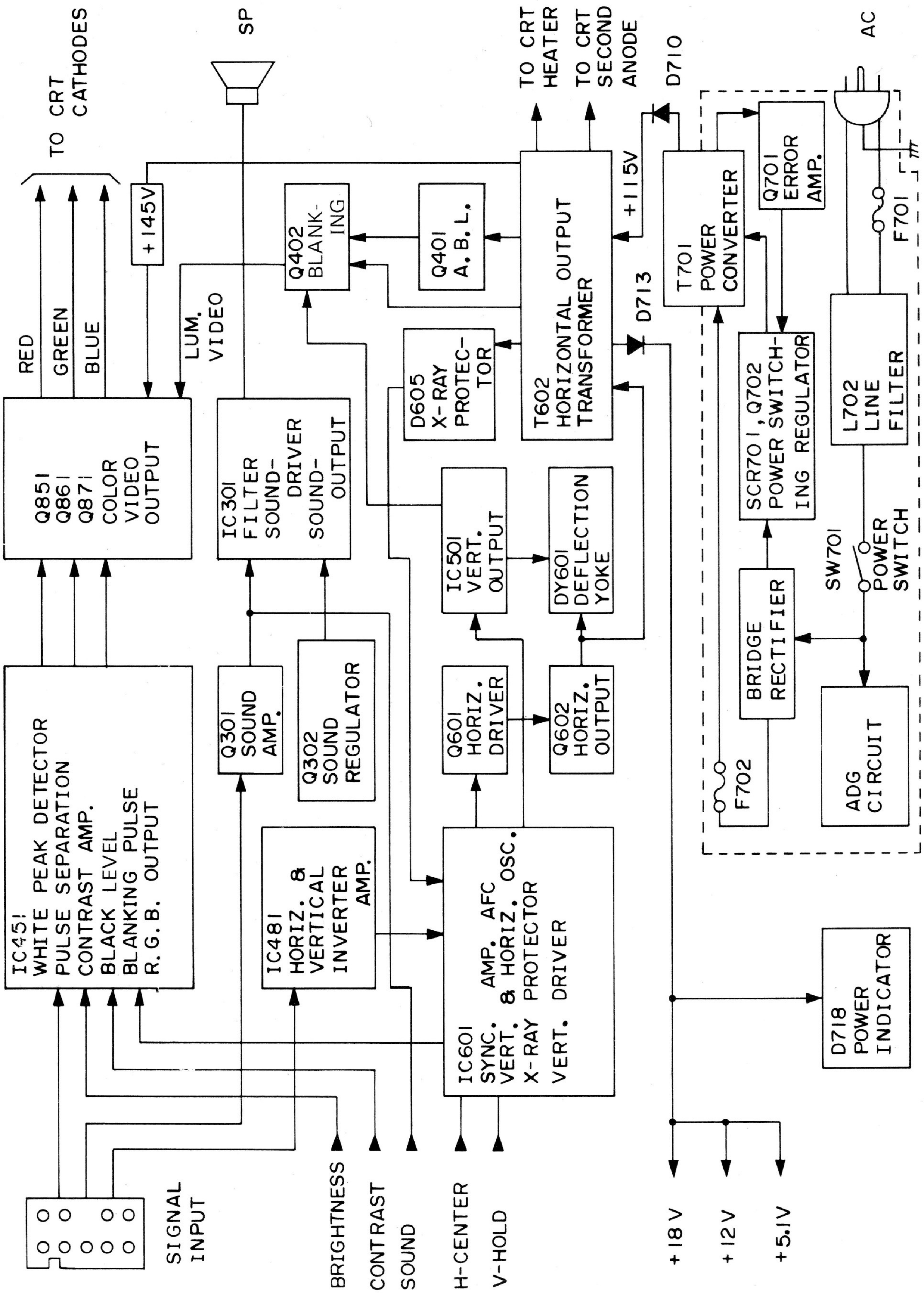


Figure 11B. Removal of PCBs

BLOCK DIAGRAM



ALIGNMENT INSTRUCTIONS

Note:

For this adjustment, connect the Monitor to the Color Computer 3 (Cat. No. 26-3334). Although the Monitor is adjusted before it is delivered, readjustment may be required when the setting position is changed or when a component is replaced.

Test Pattern Program Examples:

White pattern and 'H' character pattern.

```
10  WIDTH 80: PALETTE RGB
20  PRINT''This program will produce a white screen when run.''
30  PRINT''To generate the 'H' character pattern, press any key, after the screen is white.''
40  PRINT''Press <ENTER> to begin.''
50  A$=INKEY$:IF A$='' '' THEN 50
60  POKE&HFF98,4
70  POKE&HFF99,&H75
80  PALETTE 0,0
90  CLS1:PALETTE 0,64
100 A$=INKEY$:IF A$='' '' THEN 100
110 FOR A=1 TO 1919
120 PRINT''H'';:NEXT
130 GOTO 130
140 END
```

Crosshatch pattern:

```
10  REM **** Crosshatch pattern — 8H x 12V ****
20  WIDTH 80:PALETTE RGB:PALETTE 0,0:PALETTE 8,54:CLS9
30  HSCREEN 2
40  FOR Y=0 TO 192 STEP 16
45  H COLOR 4
50  HLINE (0,Y)—(320,Y),PSET
60  NEXT
70  FOR X=0 TO 320 STEP 40
80  HLINE(X,0)—(X,192),PSET
90  NEXT
100 GOTO 100
110 END
```

Green pattern:

```
10  REM****Green pattern****
20  WIDTH 80:PALETTE RGB
30  CLS1
40  GOTO 40
50  END
```

Gray scale (color bars) pattern:

```
10  REM **** Gray scale (color bars) pattern ****
20  WIDTH 80:PALETTE RGB
30  PRINT"This program will generate 16 colored bars per screen."
40  PRINT"To view the next set of 16 colors, press any key."
50  PRINT"Press <ENTER> to begin."
60  A$=INKEY$:IF A$="" THEN 60
70  ON BRK GOTO 250
80  HSCREEN 2
90  GOSUB 210
100 FOR R=0 TO 15
110 HCOLOR R,15
120 HLINE(R*20,0)-((R+1)*20,192),PSET,BF
130 HCOLOR 0,0
140 NEXT R
150 FOR N=0 TO 3
160 GOSUB 210
170 A$=INKEY$:IF A$="" THEN 170
180 NEXT N
190 PALETTE RGB
200 END
210 FOR R=0 TO 15
220 PALETTE R,(N*16)+R
230 NEXT R
240 RETURN
250 PALETTE RGB:END
```

1. B+ Power Circuit Adjustment

(Instrument in use: a 20 Kohm/V tester)

(1) Be sure that the AC line voltage is above 114V.

(2) Rotate the B+ voltage adjusting control (R703) to provide a DC voltage of 115V between the TP701 and TP702.

Note 1: If the AC line voltage is below 114V, the DC voltage may not increase to 115V, but this is not a problem related to this adjustment.

Note 2: Clockwise rotation of the B+ voltage adjusting control will increase the B+ power supply voltage.

2. Horizontal Hold Adjustment

(1) Operate the computer in such a way that the letter "H" covers the entire screen (data display period: 44.698 μS horizontal, 14.331 mS vertical).

(2) Adjust the horizontal hold control (R607) until the picture on the screen becomes still (synchronized).

(3) Turn the power switch on and off several times to check that the picture does not fluctuate.

3. Vertical Size Adjustment

(1) Operate the computer in such a way that the letter "H" covers the entire screen (data display period: 44.698 μS horizontal, 14.331 mS vertical).

(2) Adjust the vertical size control (R507) so that the height of the displayed pattern is 7.48 inches (190 mm).

4. Focusing

(1) Operate the computer to display the alphabetical characters on the screen.

(2) Set the brightness control at the center position.

(3) Rotate the focus control (part of T602) for the best focus.

(4) Change the position of the brightness control to confirm that the picture remains focused.

5. High Voltage Check

High voltage is not adjustable but must be checked to verify that the Monitor is operating within safe and efficient design limitations as specified.

1. Operate the Monitor for at least 15 minutes at 120VAC line voltage with the computer displaying a white pattern.
2. Turn off switch SW851 on PCB-B.
3. Rotate the screen control (on T602) to the maximum (counterclockwise) end of its rotation.
4. Connect an accurate, high-voltage meter to the CRT anode. Check that the reading is approximately 22.0kV to 23.0kV (at 0 beam current).

If a correct reading cannot be obtained, check the circuitry for malfunctioning components. On completion of the voltage check, readjust the screen control for proper operation as detailed in the ''Black and White Tracking'' procedures.

6. Vertical-Linearity Adjustment

1. Operate the computer in such a way that the letter ''H'' covers the entire screen (data display period: 44.698 μS horizontal, 14.331 mS vertical).
2. Adjust the V-Lin. control (R526) until the height of a character varies no more than 10 percent from the average character size.

7. X-ray Protector Circuit Test

After service has been performed on the horizontal deflection system, the high voltage system and the X-ray protector circuit must be tested for proper operation as follows:

1. Apply 120VAC, using a variac transformer.
2. Operate the computer in such a way that the entire screen displays a white signal, (data display period: 44.698 μS horizontal, 14.331 mS vertical).
3. Check the voltage of test point TP601. (Its voltage should be about 18.5V DC.)
4. Connect the cathode of the D504 and TP601 through a short clip lead. Then, connect another short clip lead between both sides of R522. The operation of the horizontal oscillator is stopped by connecting these points.
5. To start the operation again, remove the two short clip leads and connect TP602 and chassis ground (TP702) using a short clip lead. Disconnect the short clip lead as soon as the Monitor operates again with a normal picture.
6. If the operation of the horizontal oscillator does not stop in step 4, the circuit must be repaired before the set is returned to the customer.

8. Color Purity Adjustment

The Monitor must have been operating 15 minutes prior to this procedure, and with the faceplate of the CRT at room temperature. 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.)

1. Check for the correct location of all neck components. Refer to Figure 13.
2. Rough in the static convergence at the center of the CRT, as explained in the static convergence procedure.
3. Rotate the contrast control to the center of its range and rotate the brightness control to its maximum clockwise position.
4. To obtain a blank raster, disconnect E (Signal input) from PCB-A.
   Rotate the screen control (part of T602) clockwise until a normal raster is obtained.
5. Rotate the red bias (R862) and blue bias (R864) controls to the maximum counterclockwise positions.
   Rotate the green bias control (R863) sufficiently in a clockwise direction to produce a green raster.
6. Loosen the deflection yoke clamp screw and pull the deflection yoke as close as possible to the purity and convergence magnets assembly.
7. Begin the following adjustment with the tabs on the round purity magnet rings set together. Initially, move the tabs on the round purity magnet rings to the side of the CRT neck. Then, slowly separate the two tabs while at the same time rotating them to adjust for a uniform green vertical band at the center of the CRT screen. Refer to Figure 12.
8. Carefully slide the deflection yoke forward to achieve green purity (uniform green screen).
   Tighten the deflection yoke clamp screw.
   Note: Center purity is obtained by adjusting the tabs on the round purity magnet rings. Outer edge purity is obtained by sliding the deflection yoke forward.
9. Check for red and blue-field purity by reducing the output of the green bias control (R863) and alternately increasing the output of the red (R862) and blue (R864) bias controls, and touch up the adjustment, if required.
10. Reconnect E to PCB-A.
11. Perform the ''Black and White Tracking'' procedures.

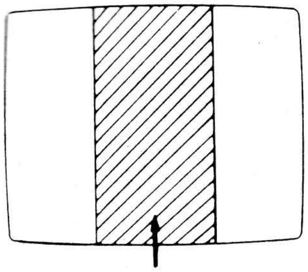


Figure 12. Color Purity Adjustment

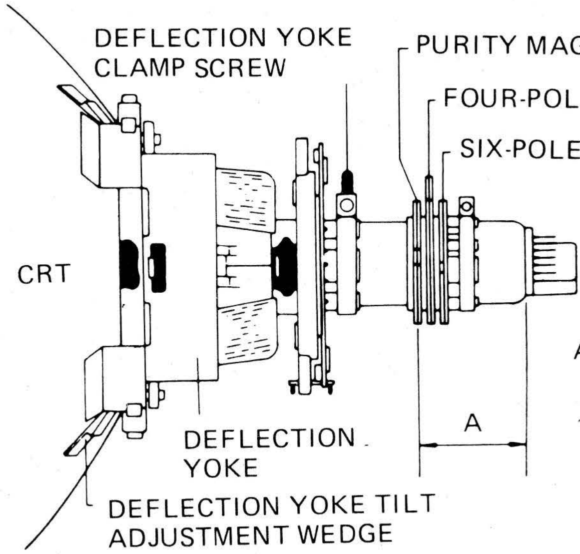
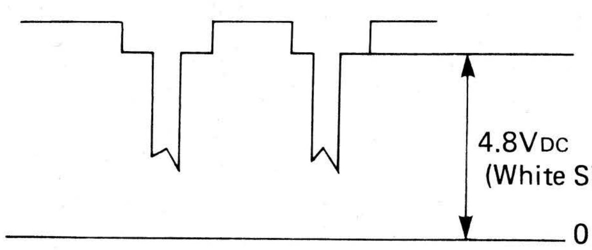


Figure 13. Picture Tube Neck Components Location

9. Black and White Tracking

1. Make the following settings.
   Contrast control (R465) and brightness control (R459): maximum
   R/G/B bias controls (R862, R863, R864): minimum
   R/B drive controls (R856, R858): center
2. Set the sub-contrast control (R454) to center position.
3. Connect an oscilloscope between TP451 and the ground.
   Adjust the sub-brightness control (R458) to achieve a pedestal level of 4.8 V_{DC}.



4. Hook up the computer and give an input for a black signal.
   (The raster should not be shining during the whole display period: horizontal, 44.698 μsec and vertical, 14.331 msec.)
5. Turn off the switch (SW851).
6. Adjust the screen control (on T602) so that the raster is dimly shining.
7. Achieve white balance using the other two bias controls for the shining color (for example, blue and green when the raster is shining in red).
8. Adjust the screen control to obtain the ''just cut off'' position.
9. Using the computer, feed a white signal input instead of the black one.
10. Turn on the service switch (SW851).
11. Achieve white balance again with the R/B drive controls (R856, R858).
12. Using a gray scale signal (16-graduation color difference signal is formed during all the display period: horizontal 44.698 μsec and vertical 14.331 msec), check to see if the 16 colors show up and if the low and high white balance is proper. If any of the 16 colors fails to show up, fine-adjust the sub-brightness control (R458). If the low and high white balance is not achieved, readjust the R/B drive controls.
13. Set the sub-contrast control (R454) to obtain a beam level of $5.2^{+0.2}_{-0.1}$ V.
14. Repeat Step 12 above.

10. Static (Center) Convergence (Figs. 13—16)

1. Switch the display monitor ON and allow it to warm up for 15 minutes.
2. Operate the computer in such a way that the entire screen is a crosshatch pattern (display period: 44.698 μS horizontal, 14.331 mS vertical) on the center of the CRT screen. (Fig. 14)
   Proceed as follows:
   a. Locate the pair of four-pole magnet rings. Rotate the individual rings (change spacing between tabs) to converge the vertical red and blue lines. Rotate the pair of rings (maintaining spacing between tabs) to converge the horizontal red and blue lines. Refer to Figure 15.
   b. After completing the red and blue center convergence, locate the pair of six-pole magnet rings. Rotate the individual rings (change spacing between tabs) to converge the vertical red and blue (magenta) and green lines. Rotate the pair of rings (maintaining spacing between tabs) to converge the horizontal red and blue (magenta) and green lines. Refer to Figure 16.

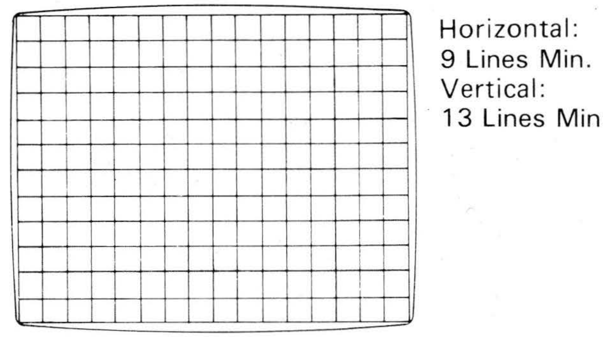


Figure 14. Crosshatch Pattern

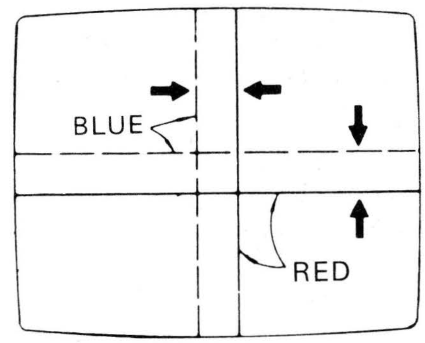


Figure 15. Static Convergence A

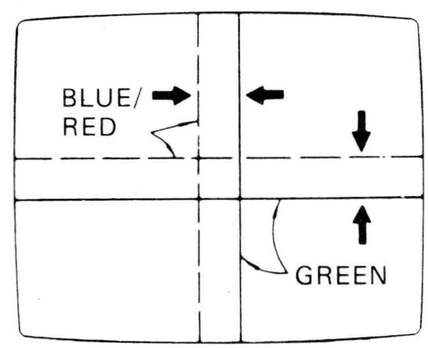


Figure 16. Static Convergence B

11. Dynamic Convergence (Figs. 17—19)

Dynamic convergence (convergence of the three color fields at the edges of the CRT screen) is accomplished by proper insertion and positioning of three rubber wedges between the edge of the deflection yoke and the funnel of the CRT.

This is accomplished in the following manner:

1. Switch the display monitor ON and allow it to warm up for 15 minutes.
2. Apply the crosshatch pattern (Fig. 14) from the computer to the display monitor. Observe spacing between lines around the edges of the CRT.
3. Tilt the deflection yoke up and down. Insert tilt adjustment wedges (1) and (2) between the deflection yoke and the CRT until the misconvergence illustrated in Figure 17 has been corrected.
4. Tilt the deflection yoke right and left. Insert tilt adjustment wedge (3) between the deflection yoke and the CRT until the misconvergence illustrated in Figure 18 has been corrected.
5. Alternately change the spacing between, and depth of insertion of, the three wedges until proper dynamic convergence is obtained.
6. Check purity and readjust, if necessary.

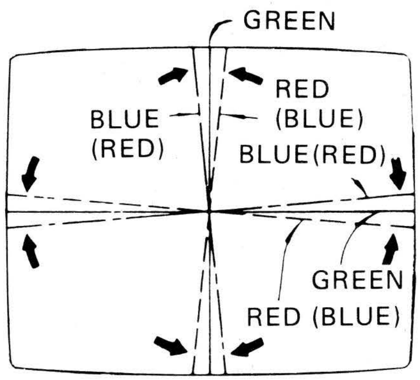


Figure 17. Dynamic Convergence A

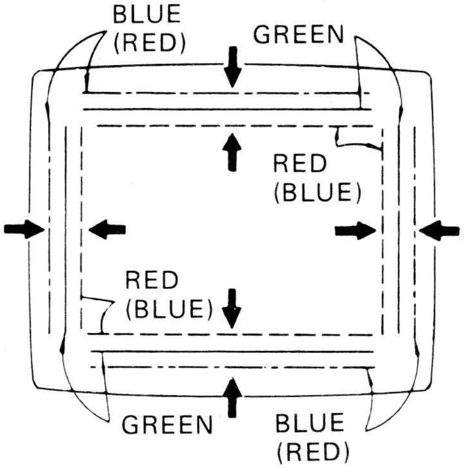


Figure 18. Dynamic Convergence B

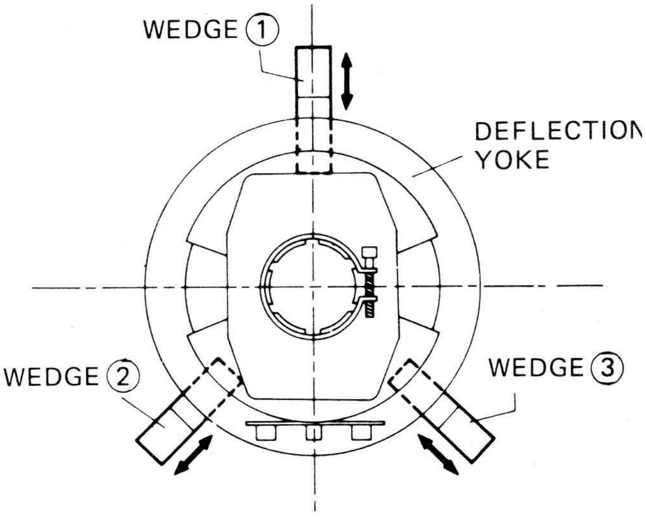
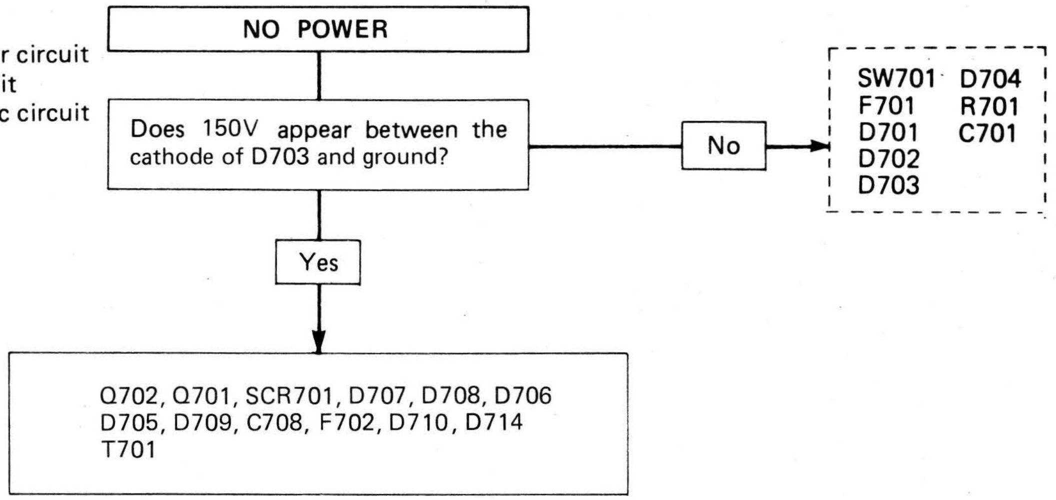


Figure 19. Deflection Yoke Rear View

TROUBLESHOOTING GUIDE

Circuits checked:

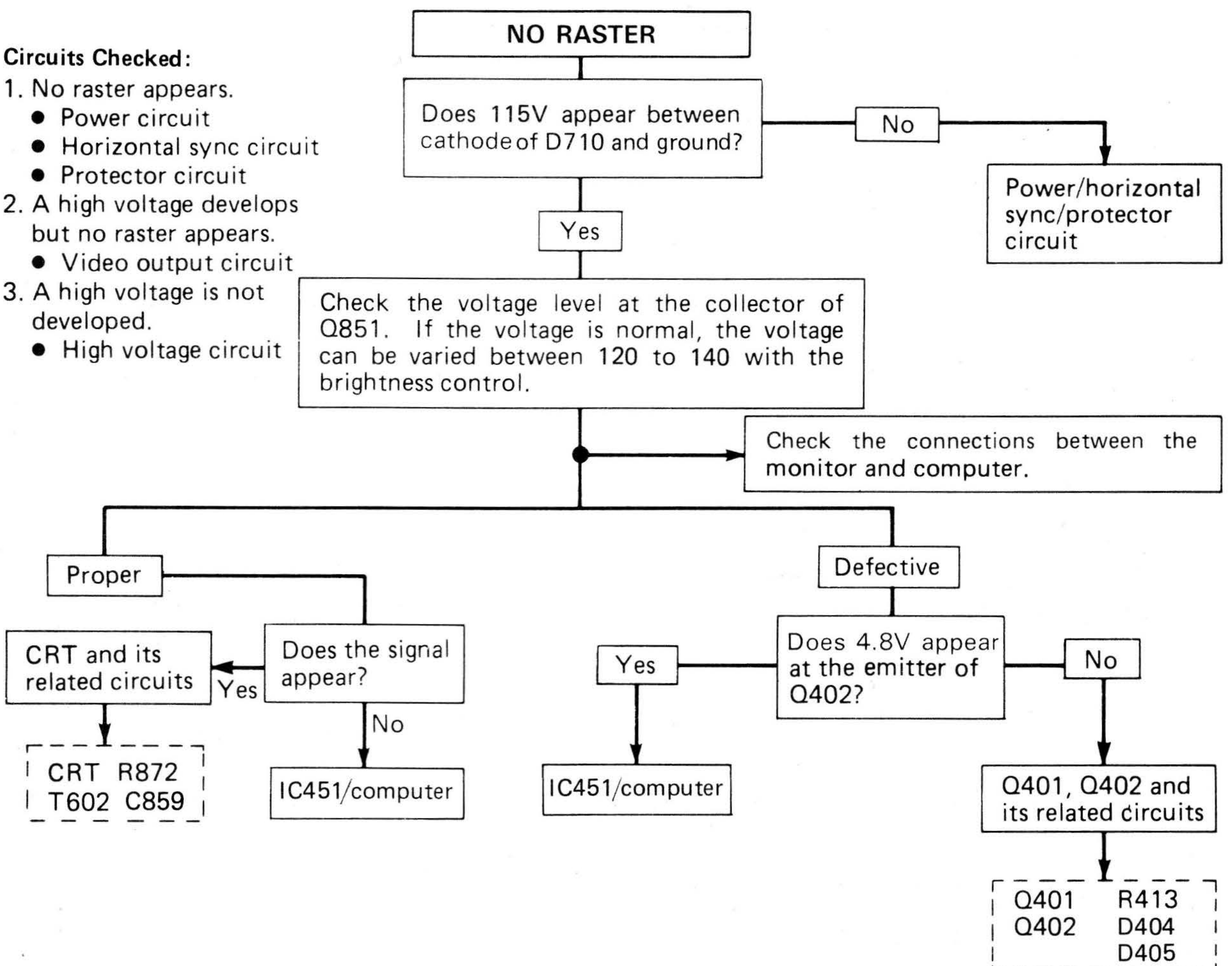
- Power regulator circuit
- Protector circuit
- Horizontal sync circuit



Note: First be sure the signal cable is plugged in securely and turn the computer power on. Now input any signal to produce the raster on the screen.

Circuits Checked:

1. No raster appears.
   - Power circuit
   - Horizontal sync circuit
   - Protector circuit
2. A high voltage develops but no raster appears.
   - Video output circuit
3. A high voltage is not developed.
   - High voltage circuit



Circuits Checked:

- Video circuit and its related circuits

Note: If the picture does not appear, fully rotate the brightness contrast control clockwise before inspecting.

NO PICTURE

Check the video signal at the TP451 with an oscilloscope. Is a video signal present?

- **Yes** → Check the video signal at the base of Q851 with an oscilloscope. Is a video signal present?
  - **Yes** → Check Q402 and its related circuits.
    - Q401, Q402, D405
  - **No** → Check Q851 and its related circuits.
    - Q851, D404
- **No** → Check the video input circuit and its related circuits.
  - Input cable, input socket, computer, IC451

NO SYNCHRONIZATION

Circuits checked:

- IC601 and its related circuits.

IC601, IC481

Both horizontal and vertical synchronization cannot be obtained.

NO HORIZONTAL SYNCHRONIZATION

(But vertical synchronization is normal.)

Does pin ⑭ of IC601 have a saw-tooth wave and sync signal?

- **Yes** → IC601, R605, R606, R607
- **No** → IC601

With the H-hold control adjusted, does the horizontal sync frequency vary?

- **Yes** → C606, C604
- **No** → IC601, R620, R607, IC481

NO VERTICAL SYNCHRONIZATION

(But horizontal synchronization is normal.)

Vertical sync adjustment is not possible at all.

- IC601 R514 C504

The vertical sync frequency can be varied slightly.

- IC601, R513, R510, R514, R511, C503, R512, C505

NO VERTICAL SWEEP

Circuits Checked:
- IC601 and its related circuits
- IC501 and its related circuits

Apply a ripple current signal, across a resistor (1 Kohm) and capacitor (10μF) in series, to pin (2) of IC601.

Sweep occurs vertically on the raster.

IC601	R508	R511
R504	R510	R512
R505	C503	R513
R507	C506	R514
		R525

Caution: When inspecting, reduce the brightness level to protect the CRT from damage.

Note: Ripple current signal is representedat the junction of D703 and D704.

No sweep occurs.

IC601	R505	IC501	C510
DY601	D502	R507	C512
D504	R503	R508	
R522	R504		

NO SPECIFIC COLOR

Circuits Checked:
- IC451 and its related circuits
- Q851 and its related circuits
- Q861 and its related circuits
- Q871 and its related circuits

The raster is colored in red or cyan. → Check the red video circuit (Q851).

IC451	C850
Q851	R865
C853	R868
	R856
	R862

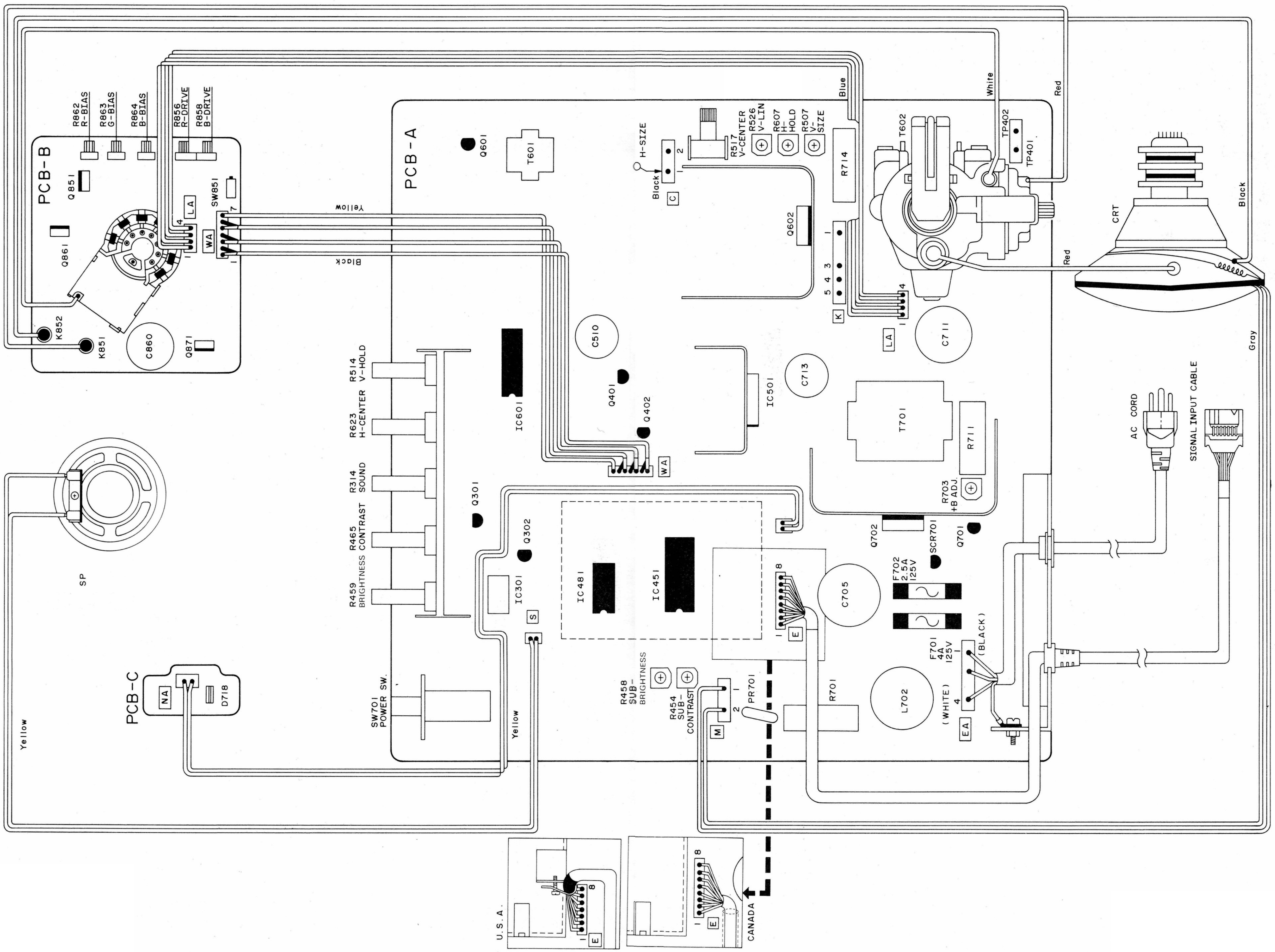
The raster is colored in green or magenta. → Check the green video circuit (Q861).

IC451	R866
Q861	R869
R863	C851
	C854

The raster is colored in blue or yellow. → Check the blue video circuit (Q871).

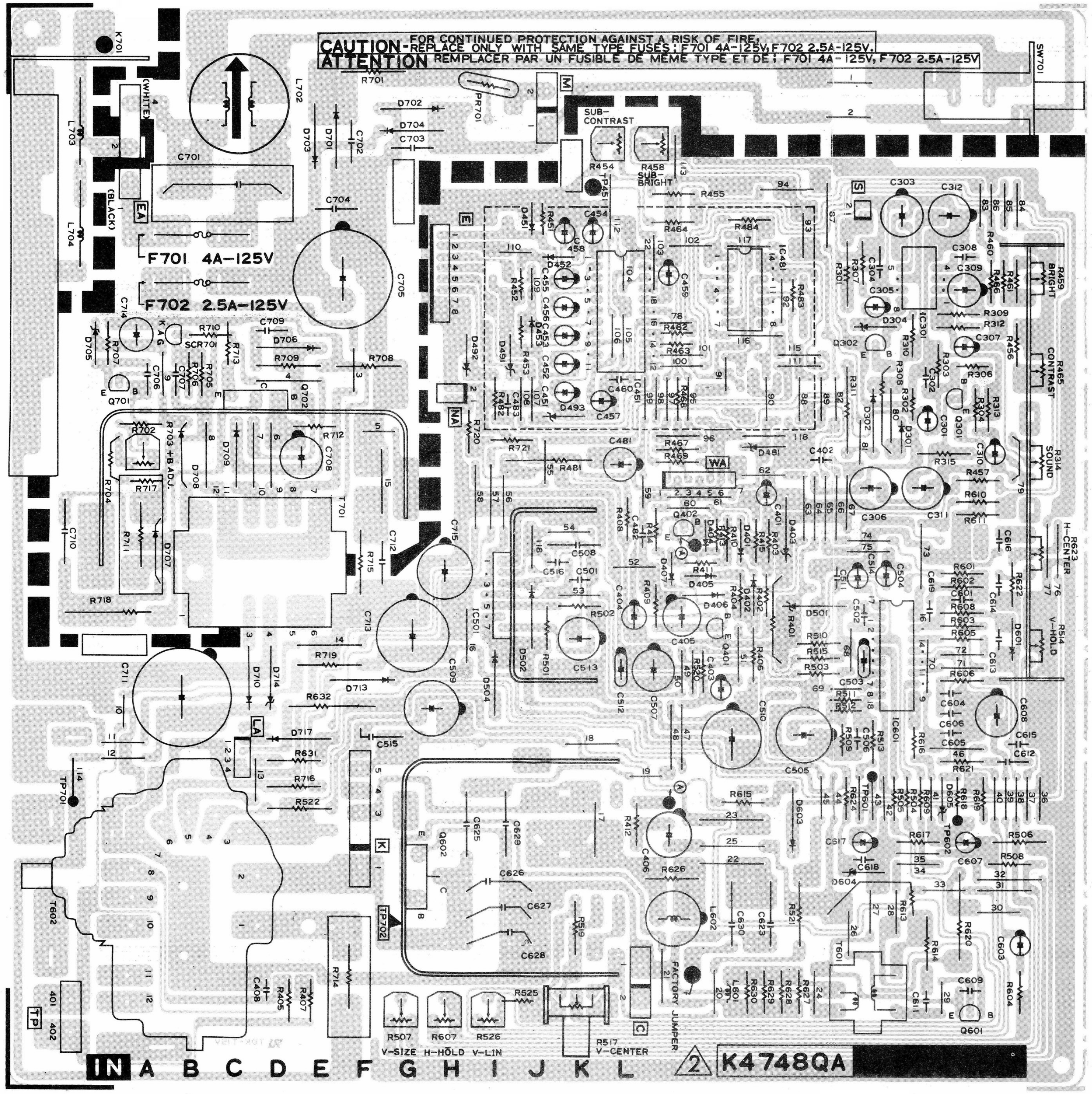
IC451	R870
Q871	C852
R858	C855
C864	R864

WIRING DIAGRAM AND PARTS LOCATION

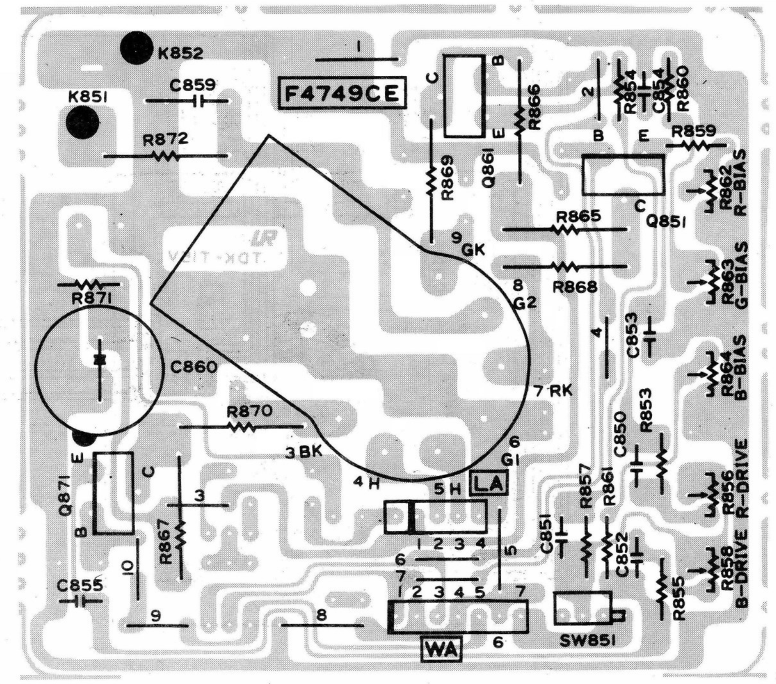


P.C. BOARD (Top and Bottom Views)

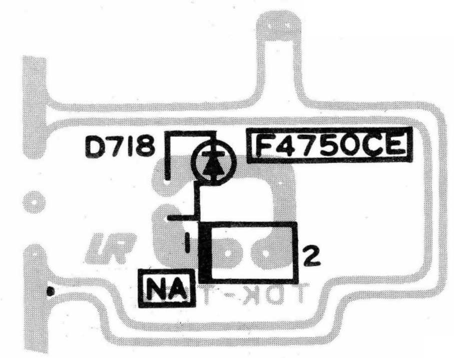
Main PCB (Top View)



CRT Socket PCB (Top View)

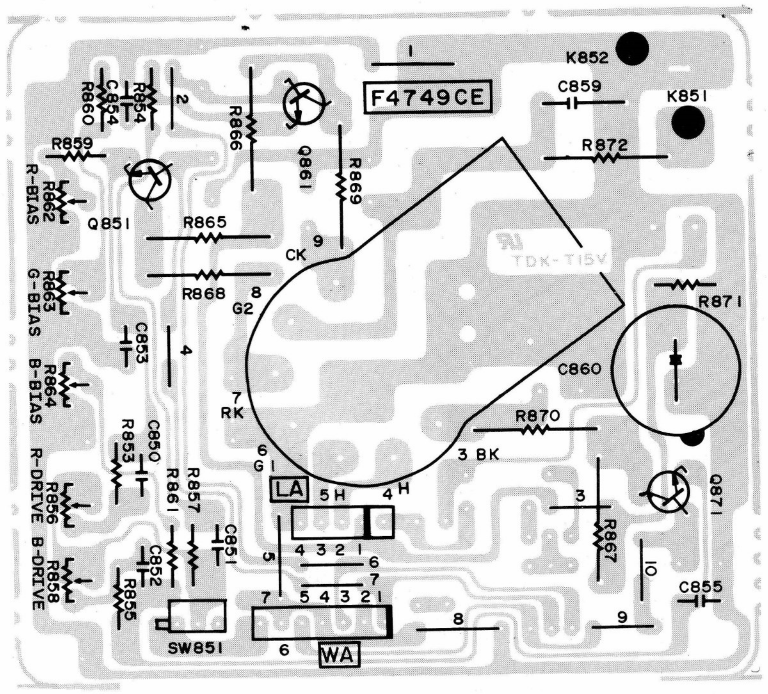


LED PCB (Top View)

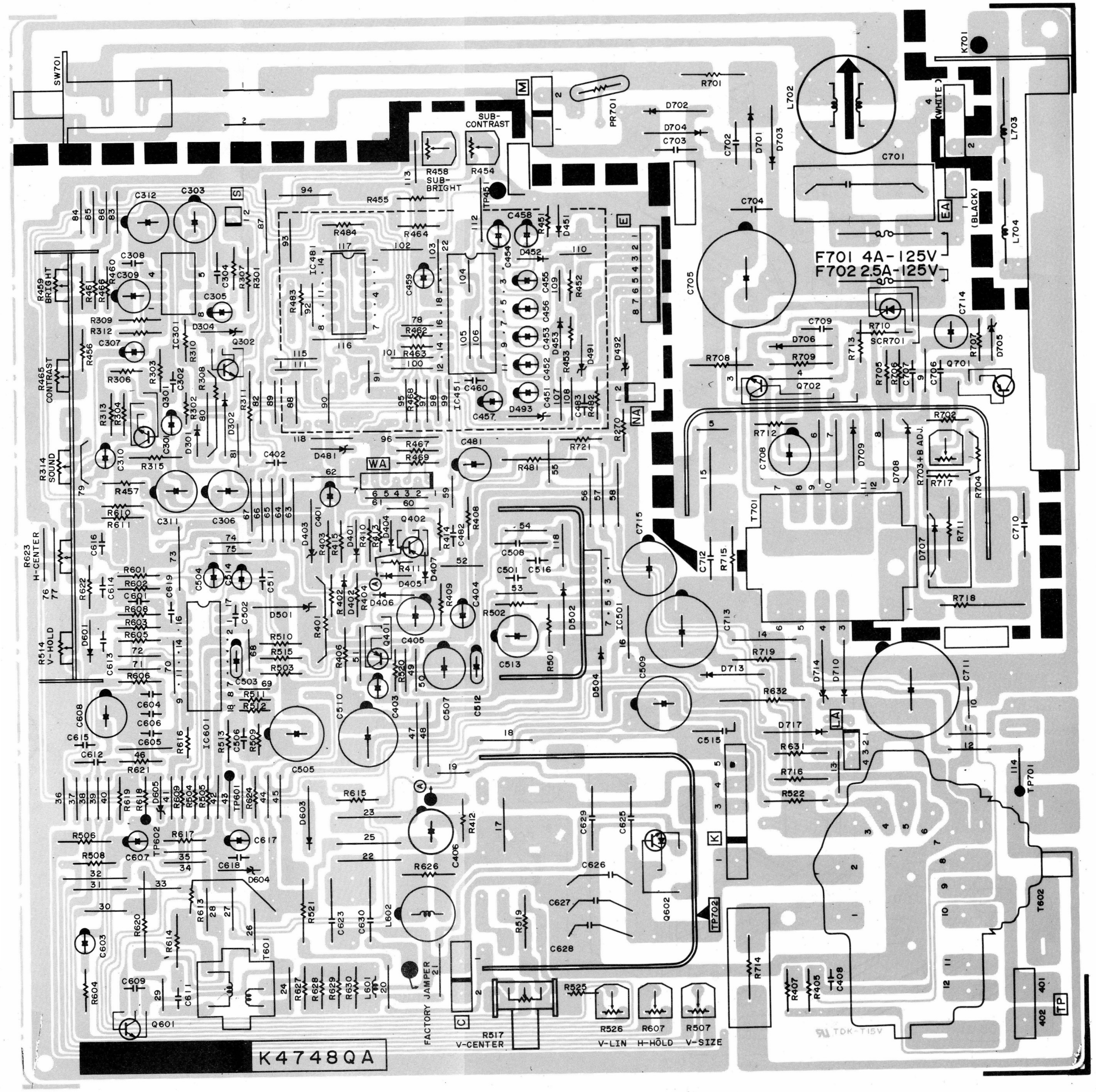


NOTE: The parts shown with solid symbols for this P.C. Board are inserted from the top side.

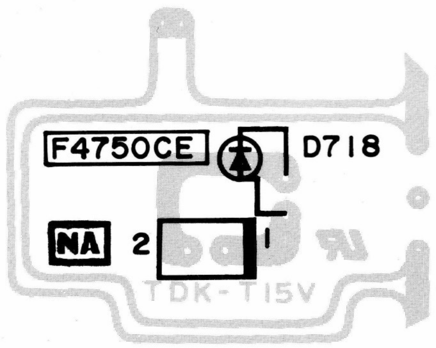
CRT Socket PCB (Bottom View)



MAIN PCB (Bottom View)

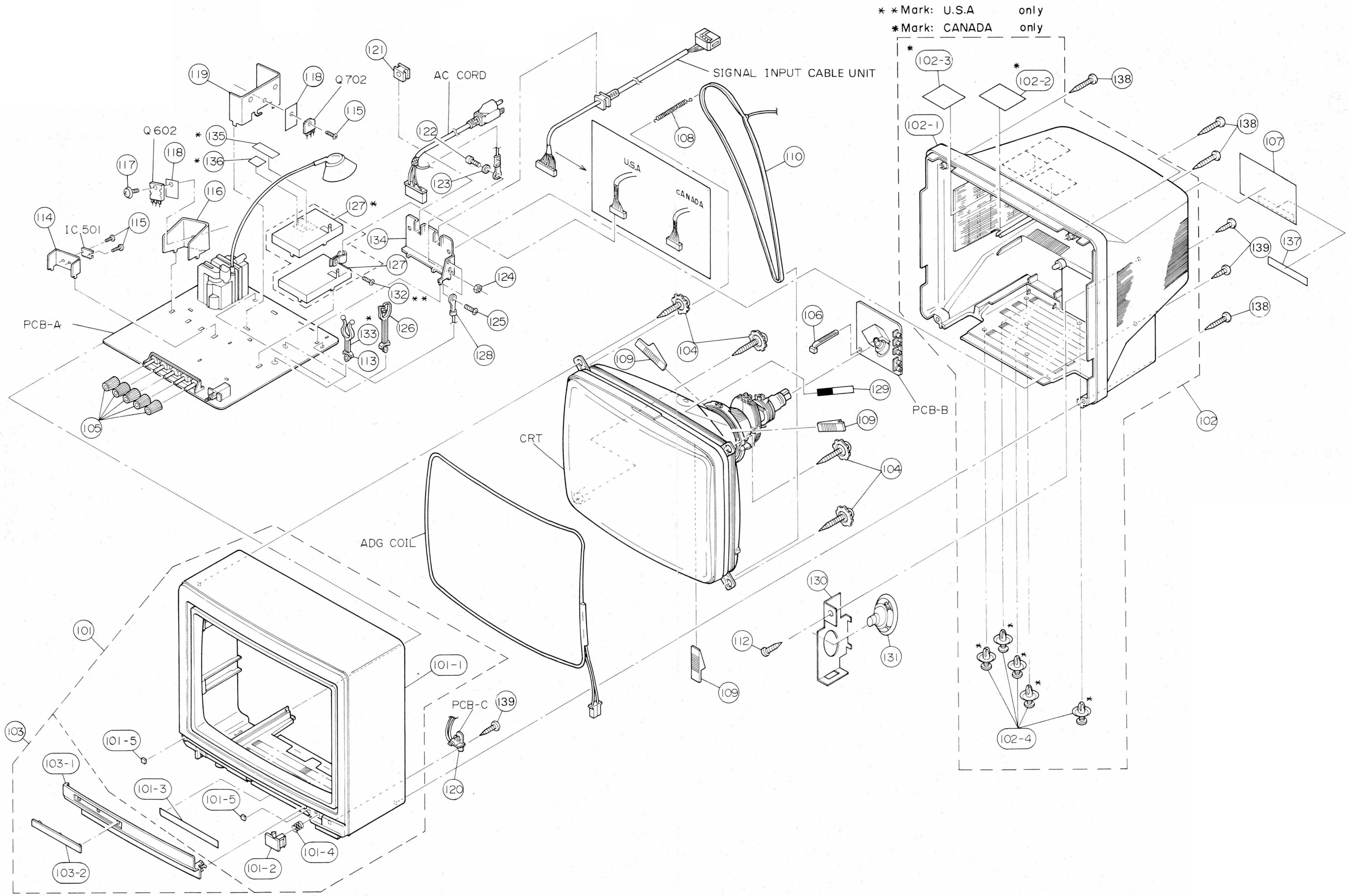


LED PCB (Bottom View)



CABINET EXPLODED VIEW/PARTS LIST

1. Cabinet Exploded View



2. Cabinet Parts List

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
101	Cabinet Ass'y, Front (U.S.A.)	AZ-0118	CCABA1606TAKC
	(CANADA)		CCABA1628TAKB
101-1	Cabinet, Front (U.S.A.)		GCABA1606CEKF
	(CANADA)		GCABA1628CEKB
101-2	Button, Power Switch	AK-0516	JBTN-1305CEKF
101-3	Plate, Control Door		HINDP2448CESA
101-4	Spring, Button	ARB-5023	MSPRC0072CEFW
101-5	Felt, Door	ARB-5023	GCOVH9182CE09
102	Cabinet Ass'y, Rear (CANADA)	AZ-0119	CCABB1672TAKA
102-1	Cabinet, Rear (U.S.A.)		GCABB1655CEKA
	(CANADA)		GCABB1672CEKA
102-2	Label, Warning (CANADA)		TCAUS3055CEZZ
102-3	Warning (CANADA)		TCAUS3052CEZZ
102-4	Clip (CANADA)		LX-LZ0022TAZZ
103	Door Ass'y	ADB-0262	CDORF1430TA4A
103-1	Door, Control		GDORF1430CESB
103-2	Badge, Tandy		HBDGZ3067CESA
104	Screw, 5 x 30mm, Tapping-1, Hexagon Head		LX-TZ3042CEFD
105	Knob, Control	AK-0338	JKNBK1168CEKA
106	Wire Holder, Black	W-3384	LHLDW1033CE00
107	Label, Model No. (U.S.A.)		TLABM1966CEZZ
	(CANADA)		TLABM2040CEZZ
108	Spring, Grounding Strap		MSPRT0020CEZZ
109	Wedge, Yoke		PSPAG0028CEZZ
110	Wire, Grounding Strap		QEARC1408CEZZ
111	Not used		
112	Not used		
113	Wire Holder, White (U.S.A.)		LHLDW1037CEZZ
114	Heatsink (IC501)		PRDAR5058CEFW
115	Screw, 3 x 10mm, Machine, Pan Head	HD-2061	XBPSD30P10KS0
116	Heatsink (Q602)		PRDAR5071CEFW
117	Screw, 3 x 10mm, Tapping-2, Binding Head	AHD3001	LX-BZ3096CEFD
118	Mica		PZETM0015CEZZ
119	Heatsink (Q702)		PRDAR5098CEFW
120	Holder, LED	ART-0105	LHLDZ9055CEZZ
121	Holder, AC Cord Stopper	AHC-0367	LHLDK1012CEZZ
122	Screw, 4 x 8mm, Machine, Pan Head	AHD-2922	XBPBW40P08000
123	Spring Washer	HD-8662	XWSPW42-10000
124	Nut, 4 x 3.2mm	HD-7189	XNEBW40-32000
125	Screw, 3 x 8mm, Tapping-2, Brazier Head	AHD-2883	XCASD30P08000
126	Wire Holder		LHLDW1016TAZZ
127	Shield Case (U.S.A.)		PSLDM3698CEFW
	(CANADA)		PSLDM3697CEFW
128	Ground Wire		CLUGZ0105RA19
129	Ferrite Sheet		PSPAV0044CEZZ

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
130	Angle, Speaker	HC-4301	LANGS0071CEFW
131	Speaker	AS-4005	VSP0080P-B38A
132	Screw, 3 x 10mm, Tapping-2, Binding Head		LX-BZ3090CEFD
133	Wire Holder (CANADA)		LHLDW1005GEZZ
134	Bracket, AC Cord	HC-4302	LANGK0276CESA
135	Address Label		TLABZ0107CEZZ
136	Model Label (Internal)		TLABN0042CEZZ
137	Manufactured Label		TLABN0059CEZZ
	HARDWARE KIT	AHW-2603215	DBNW-0001RA0A
138	Screw, 4 x 20mm, Tapping-1, Brazier Head	AHD-6002	XTASD40P20000
139	Screw, 4 x 12mm, Tapping-1, Brazier Head	HD-1671	XTASD40P12000

3. Electrical Parts List

PRODUCT SAFETY NOTE: Components marked with a ⚠ have special characteristics important to safety. Before replacing any of these components, read carefully the SAFETY NOTICE on page 5 of this service manual. Do not degrade the safety of the product through improper sevicing. Components marked with an (▲) are related to the X-ray protection circuit.

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
	P.C.B. Assembly, Main (PCB-A) (U.S.A.) **Consists of the following (CANADA)**	MRB-NIS	DUNTK4748RA0H DUNTK4748RA1H
CAPACITORS			
C301	Electrolytic, 22μF, 16V, ±20%	CC-226MDCA	VCEAAA1CW226M
C302	Ceramic, 470pF, 50V, ±10%	CC-471KJBC	VCCSPA1HL471K
C303	Electrolytic, 330μF, 10V, ±20%	CC-337MCBA	VCEAAA1AW337M
C304	Mylar*, 0.1μF, 50V, ±10%	CC-104KJBM	VCQYSH1HM104K
C305	Electrolytic, 22μF, 16V, ±20%	CC-226MDCA	VCEAAA1CW226M
C306	Electrolytic, 330μF, 25V, ±20%	CC-337MFBA	VCEAAA1EW337M
C307	Electrolytic, 4.7μF, 50V, ±20%	CC-475MJBA	VCEAAA1HW475M
C308	Ceramic, 470pF, 50V, ±10%	CC-471KJBC	VCCSPA1HL471K
C309	Electrolytic, 100μF, 25V, ±20%	CC-107MFBA	VCEAAA1EW107M
C310	Electrolytic, 10μF, 16V, ±20%	CC-106MDCA	VCEAAA1CW106M
C311	Electrolytic, 1000μF, 16V, ±20%	CC-108MDCA	VCEAGA1CW108M
C312	Electrolytic, 470μF, 16V, ±20%	CC-477MDCA	VCEAAA1CW477M
C313 | C400	Not used		
C401	Electrolytic, 22μF, 16V, ±20%	CC-226MDCA	VCEAAA1CW226M
C402	Ceramic, 0.01μF, 50V, +80% −20%	CC-103KJBC	VCKZPA1HF103Z
C403	Electrolytic, 4.7μF, 50V, ±20%	CC-475MJBA	VCEAAA1HW475M
C404	Electrolytic, 47μF, 16V, ±20%	CC-476MDCA	VCEAGA1CW476M
C405	Electrolytic, 100μF, 25V, ±20%	CC-107MFBA	VCEAAA1EW107M
C406	Electrolytic, 10μF, 160V, ±20%		VCEAAA2CW106M
C407	Not used		
C408	Ceramic, 100pF, 500V, ±10%	CC-101KUBC	VCKYPA2HB101K
C409 | C450	Not used		
C451	Electrolytic, 2.2μF, 50V, ±20%	CC-225MJBA	VCEAAA1HW225M
C452	Electrolytic, 33μF, 16V, ±20%	CC-336MDCA	VCEAAA1CW336M
C453	Electrolytic, 0.15μF, 50V, +50% −15%	CC-154MJBA	VCEAAA1HW154T
C454	Electrolytic, 0.15μF, 50V, +50% −15%	CC-154MJBA	VCEAAA1HW154T
C455	Electrolytic, 0.15μF, 50V, +50% −15%	CC-154MJBA	VCEAAA1HW154T
C456	Electrolytic, 0.15μF, 50V, +50% −15%	CC-154MJBA	VCEAAA1HW154T
C457	Electrolytic, 1μF, 50V, ±20%	CC-105MJBA	VCEAAA1HW105M
C458	Electrolytic, 0.15μF, 50V, +50% −15%	CC-154MJBA	VCEAAA1HW154T
C459	Electrolytic, 0.15μF, 50V, +50% −15%	CC-154MJBA	VCEAAA1HW154T
C460	Ceramic, 0.1μF, 25V, +80% −20%	CC-104ZFBC	VCTYPA1EF104Z
C461 | C480	Not used		

*Mylar is a registered trademark of E.I.Du Pont de Nemours and Company.

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
C481	Electrolytic, 220μF, 16V, ±20%	CC-227MDCA	VCEAGA1CW227M
C482	Ceramic, 0.01μF, 50V, +80%−20%	CC-103KJBC	VCKZPA1HF103Z
C483	Ceramic, 820pF, 50V, ±10%	CC-821KJBC	VCKZPA1HB821K
C484 | C500	Not used		
C501	Mylar, 0.0022μF, 50V, ±10%		VCQYSH1HM222K
C502	Ceramic, 180pF, 50V, ±5%	CC-181JJBC	VCCSPA1HL181J
C503	Tantalum, 2.2μF, 35V, ±10%	CC-225JJBT	VCSATA1VE225K
C504	Electrolytic, 1μF, 50V, ±20%	CC-105MJBA	VCEAAA1HW105M
C505	Electrolytic, 1000μF, 16V, ±20%	CC-108MDCA	VCEAAA1CW108M
C506	Ceramic, 0.0047μF, 50V, ±10%	CC-472KJBC	VCKZPA1HB472K
C507	Electrolytic, 33μF, 16V, ±10%	CC-336KDCA	VCEACA1CC336K
C508	Mylar, 0.22μF, 50V, ±10%	CC-224JJBM	VCQYSH1HM224K
C509	Electrolytic, 470μF, 25V, ±20%	CC-477MFBA	VCEAGA1EW477M
C510	Electrolytic, 470μF, 35V, ±20%	CC-477MGBA	VCEAAA1VW477M
C511	Ceramic, 39pF, 50V, ±5%	CC-390JJBC	VCCSPA1HL390J
C512	Tantalum, 2.2μF, 35V, ±10%	CC-225JJBT	VCSATA1VE225K
C513	Electrolytic, 100μF, 35V, ±20%	CC-107MGBA	VCEAAA1VW107M
C514	Electrolytic, 10μF, 16V, ±20%	CC-106MDCA	VCEAAA1CW106M
C515	Ceramic, 0.01μF, 500V, ±10%	CC-103KUBC	VCKYPB2HB103K
C516	Ceramic, 120pF, 50V, ±5%	CC-121JJBC	VCCSPA1HL121J
C517 | C600	Not used		
C601	Mylar, 0.018μF, 50V, ±10%	CC-183JJBM	VCQYSH1HM183K
C602	Not used		
C603	Electrolytic, 1μF, 50V, ±20%	CC-105MJBA	VCEAAA1HW105M
C604	Polypro Film, 0.0027μF, 100V, ±2%	CC-272GUBH	VCQPSA2AA272G
C605	Mylar, 0.0068μF, 50V, ±10%	CC-682KJBM	VCQYSH1HM682K
C606	Mylar, 0.0022μF, 50V, ±5%	CC-222JJBM	VCQYSH1HM222J
C607	Electrolytic, 10μF, 16V, ±20%	CC-106MDCA	VCEAAA1CW106M
C608	Electrolytic, 100μF, 50V, ±20%	CC-107MJBA	VCEAGA1HW107M
C609	Ceramic, 0.001μF, 50V, ±10%	CC-102KJBC	VCKZPA1HB102K
C610	Not used		
C611	Ceramic, 0.001μF, 500V, ±10%	CC-102KUBC	VCKYPA2HB102K
C612	Mylar, 0.056μF, 50V, ±10%	CC-563KJBM	VCQYSH1HM563K
C613	Mylar, 0.027μF, 50V, ±10%	CC-273JJBM	VCQYSH1HM273K
C614	Ceramic, 0.001μF, 50V, ±10%	CC-102KJBC	VCKZPA1HB102K
C615	Ceramic, 0.01μF, 50V, ±10%	CC-103KJBC	VCKZPA1HB103K
C616	Ceramic, 470pF, 50V, ±10%	CC-471KJBC	VCKZPA1HB471K
C617	Electrolytic, 4.7μF, 50V, ±20%	CC-475MJBA	VCEAAA1HW475M
C618	Ceramic, 0.001μF, 50V, ±10%	CC-102KJBC	VCKZPA1HB102K
C619	Ceramic, 82pF, 50V, ±5%	CC-820JJBC	VCCSPA1HL820J
C620 | C622	Not used		
C623 ▲⚠	Metalized Polypro, 0.33μF, 200V, ±5%	CC-334JPBH	VCFPPD2DB334J
C624	Not used		
C625 ▲⚠	Metalized Polypro, 0.0012μF, 1.6kV, ±5%	CC-122JYCH	VCFPPC3CA122J

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
C626 ▲⚠	Metalized Polypro, 0.0012μF, 1.6kV, ±5%	CC-122JYCH	VCFPPC3CA122J
C627 ▲⚠	Metalized Polypro, 0.0012μF, 1.6kV, ±5%	CC-122JYCH	VCFPPC3CA122J
C628 ▲⚠	Metalized Polypro, 0.0012μF, 1.6kV, ±5%	CC-122JYCH	VCFPPC3CA122J
C629 ▲⚠	Polypro Film, 0.012μF, 400V, ±10%	CC-123KTBH	VCQPSB2GA123K
C630 ▲⚠	Polypro Film, 0.068μF, 200V, ±10%	CC-683KPBH	VCQPSC2DA683K
C631 – C700	Not used		
C701 ⚠	Across Line, 0.22μF, 125V AC, ±20%	C-1864	RC-QZ019DCEZZ
C702	Ceramic, 0.01μF, 250V AC/1.4kV DC +80% −20%	CC-103JYBC	RC-KZ007JCEZZ
C703	Ceramic, 0.01μF, 250V AC/1.4kV DC +80% −20%	CC-103JYBC	RC-KZ007JCEZZ
C704	Ceramic, 0.01μF, 500V, ±10%	CC-103KUBC	VCKYPB2HB103K
C705 ⚠	Electrolytic, 470μF, 200V, ±20%	CC-477MPBA	RC-EZ0164CEZZ
C706	Mylar, 0.068μF, 50V, ±10%	CC-683KJBM	VCQYSH1HM683K
C707	Ceramic, 0.0056μF, 50V, ±10%	CC-562KJBC	VCKZPA1HB562K
C708	Electrolytic, 220μF, 25V, ±20%	CC-227MFBA	VCEAGA1EW227M
C709	Mylar, 0.1μF, 50V, ±10%	CC-104KJBM	VCQYSH1HM104K
C710	Polypro Film, 0.01μF, 630V, ±10%	CC-103KVCH	VCQPSB2JA103K
C711	Electrolytic, 330μF, 160V, ±20%	CC-337MNCA	RC-EZ0070CEZZ
C712 ⚠	Ceramic, 0.0033μF, 125V AC, ±20%	CC-332MXCC	RC-KZ0030CEZZ
C713	Electrolytic, 100μF, 160V, ±20%	CC-107MNCA	VCEAAH2CW107M
C714	Electrolytic, Nonpolarized, 10μF, 50V, ±20%	CC-106MJBA	VCE9AA1HW106M
C715	Electrolytic, 470μF, 50V, ±20%	CC-477MJBA	VCEAGA1HW477M

CONNECTORS

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
TP401/ TP402	Plug, TP, 2-Pin	J-7460	QPLGN0207CEZZ
C	Plug, H-Size, 2-Pin		QPLGN0207CEZZ
M	Plug, ADG Coil, 2-Pin		QPLGN0207CEZZ
NA	Plug, LED, 2-Pin		QPLGN0213GEZZ
E	Plug, Video Input, 8-Pin	J-7507	QPLGN0841CEZZ
EA	Plug, AC Input, 4-Pin	AJ-7597	QPLGN0404CEZZ
K	Plug, Deflection Yoke, 5-Pin	J-7461	QPLGN0505CEZZ
LA ~ LA	Socket for CRT PCB, 4-Pin		CSOCN0430RA9C
WA ~ WA	Socket for CRT PCB, 7-Pin (U.S.A)		CSOCN0730RA18
	(CANADA)		CSOCN0730RA19
C	Socket for Factory Jumper, 2-Pin		CSOCN0103RA6C
S	Socket for Speaker, 2-Pin		CSOCN0230RA16

DIODES

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
D301	1SS133 Silicon	DX-2230	RH-DX0142CEZZ
D302	EU1 Silicon	DX-2277	RH-DX0131CEZZ
D303	Not used		
D304	Zener RD11E Silicon	DX-2150	RH-EX0193CEZZ
D305 – D400	Not used		

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
D401	1S2471 Silicon	DX-2447	RH-DX0046CEZZ
D402	1SS133 Silicon	DX-2230	RH-DX0142CEZZ
D403	Zener AW 08-12 Silicon	DX-2451	RH-EX0061CEZZ
D404	1SS133 Silicon	DX-2230	RH-DX0142CEZZ
D405	1SS133 Silicon	DX-2230	RH-DX0142CEZZ
D406	1SS133 Silicon	DX-2230	RH-DX0142CEZZ
D407	1SS133 Silicon	DX-2230	RH-DX0142CEZZ
D408–D450	Not used		
D451	1SS133 Silicon	DX-2230	RH-DX0142CEZZ
D452	1SS133 Silicon	DX-2230	RH-DX0142CEZZ
D453	1SS133 Silicon	DX-2230	RH-DX0142CEZZ
D454–D480	Not used		
D481	Zener RD5.1EB Silicon	DX-0398	RH-EX0049CEZZ
D482–D490	Not used		
D491	Zener RD5.1EB Silicon	DX-0398	RH-EX0049CEZZ
D492	Zener RD5.1EB Silicon	DX-0398	RH-EX0049CEZZ
D493	Zener RD5.1EB Silicon	DX-0398	RH-EX0049CEZZ
D494–D500	Not used		
D501	Zener RD6.2F Silicon	DX-2553	RH-EX0247CEZZ
D502	S5277G Silicon	DX-2276	RH-DX0110CEZZ
D503	Not used		
D504 ⚠	TVR1J Silicon	DX-2617	RH-DX0105TAZZ
D505–D600	Not used		
D601	1SS133 Silicon	DX-2230	RH-DX0142CEZZ
D602	Not used		
D603 ▲⚠	RH1S Silicon	DX-2275	RH-DX0086TAZZ
D604	Zener RD12E Silicon	DX-2306	RH-EX0047CEZZ
D605 ▲⚠	Zener RD22E Silicon	DX-0235	RH-EX0091CEZZ
D606–D700	Not used		
D701 ⚠	1S1887 Silicon	DX-2443	RH-DX0038CEZZ
D702 ⚠	1S1887 Silicon	DX-2443	RH-DX0038CEZZ
D703 ⚠	1S1887 Silicon	DX-2443	RH-DX0038CEZZ
D704 ⚠	1S1887 Silicon	DX-2443	RH-DX0038CEZZ
D705 ▲	Zener RD8.2EB2 Silicon	DX-1440	RH-EX0089CEZZ
D706	ES1 Silicon	DX-2556	RH-DX0248CEZZ
D707	ES1 Silicon	DX-2556	RH-DX0248CEZZ
D708	EU1 Silicon	DX-2277	RH-DX0131CEZZ
D709	ES1 Silicon	DX-2556	RH-DX0248CEZZ
D710 ⚠	RU3AM Silicon	DX-2557	RH-DX0247CEZZ

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
D711	Not used		
D712	Not used		
D713 ⚠	RG2 Silicon	DX-2446	RH-DX0181CEZZ
D714 ⚠	Zener R2M 130V Silicon	DX-0856	RH-EX0152CEZZ
D715	Not used		
D716	Not used		
D717 ⚠	RH1S Silicon	DX-2275	RH-DX0086TAZZ
SCR701 ⚠ ▲	Silicon Controlled Rectifier HSSH3D42	DX-2558	VHSSH3D42//-1
FUSES			
F701 ⚠	4A, Fast Blow	HF-1193	QFS-B4021GEZZ
F702 ⚠	2.5A, Fast Blow	AHF-1302	QFS-B2521GEZZ
INTEGRATED CIRCUITS			
IC301	IC μPC575C2 Sound Drive Sound Output Bipolar Linear	MX-3393	RH-IX0054CEZZ
IC302 | IC450	Not used		
IC451	IC μPC1397C Contrast Amp. Black Level, White Peak Det., RGB Output, Blanking Pulse, Pulse Separation, Bipolar Linear	MX-7117	RH-IX0280CEZZ
IC452 | IC480	Not used		
IC481	IC HD74LS136P Sync. EX-OR Bipolar Digital	MX-6531	VHIHD74LS136P
IC482 | IC500	Not used		
IC501	IC μPC1378H Voltage Booster, Blanking Pulser, Vertical Output, Bipolar Linear	MX-6160	RH-IX0238CEZZ
IC502 | IC600	Not used		
IC601 ▲⚠	IC HA11235 SYNC. AFC, X-RAY Protector, Horizontal OSC., Vertical OSC., Driver, Bipolar Linear	MX-6452	RH-IX0065CEZZ
COILS			
L601	Peaking Coil	CA-9995	VP-MK120K0000
L602	Linearity Coil	ACA-8373	RCILZ0213CEZZ
L603 | L701	Not used		

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
L702 ⚠	Line Filter	CA-9676	RCILF0049CEZZ or RCILF0113CEZZ
L703	Ferrite Bead		RBLN-0010CEZZ
L704	Ferrite Bead		RBLN-0010CEZZ
TRANSISTORS			
Q301	2SC1815(Y) Sound Amp., Silicon NPN	2SC-1815Y	VS2SC1815YW-1
Q302	2SC2002 Power Regulator, Silicon NPN	2SC-2002	VS2SC2002-K1A
Q303 | Q400	Not used		
Q401	2SA1015(Y) A.B.L., Silicon PNP	2SA-1015Y	VS2SA1015Y/1E
Q402	2SA854(Q) Blanking, Silicon PNP	2SA-854Q	VS2SA854-Q/1E
Q403 | Q600	Not used		
Q601	2SC2482 Horizontal Driver, Silicon NPN	2SC-2482	VS2SC2482//-1
Q602 ⚠	2SD1426 Horizontal Output, Silicon NPN	2SD-1426	VS2SD1426//1E
Q603 | Q700	Not used		
Q701 ▲⚠	2SA1015(Y) Error Amp., Silicon PNP	2SA-1015Y	VS2SA1015Y/1E
Q702 ▲⚠	2SC2555 Power Switching Regulator, Silicon NPN	2SC-2555	VS2SC2555//-1
RESISTORS: Unless otherwise specified, resistors are 1/4W, ±5%, carbon type.			
R301	Metal Film, 1.5 ohm, 2W, ±5%	N-0028EHD	VRN-VV3DB1R5J
R302	100K ohm, 1/8W, ±5%	N-0371EBC	VRD-RA2BE104J
R303	68K ohm	N-0354EEC	VRD-RA2EE683J
R304	2.2K ohm	N-0216EEC	VRD-RA2EE222J
R305	Not used		
R306	33K ohm, 1/8W, ±5%	N-0324EBC	VRD-RA2BE333J
R307	390 ohm	N-0162EEC	VRD-RA2EE391J
R308	Oxide Film, 82 ohm, 3W, ±5%	N-0122EJD	VRS-VV3LB820J
R309	47K ohm	N-0340EEC	VRD-RA2EE473J
R310	100 ohm	N-0132EEC	VRD-RA2EE101J
R311 ⚠	Oxide Film, 47 ohm, 3W, ±5%	N-0099EJD	VRS-VV3LB470J
R312	270K ohm	N-0402EEC	VRD-RA2EE274J
R313	1K ohm	N-0196EEC	VRD-RA2EE102J
R314	*See Controls (PCB-A)*		
R315	Oxide Film, 820 ohm, 1W, ±5%	N-0187EGD	VRS-VV3AB821J
R316 | R400	Not used		
R401 ⚠	Oxide Film, 82 ohm, 3W, ±5%	N-0122EJD	VRS-VV3LB820J
R402	100 ohm	N-0132EEC	VRD-RA2EE101J

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
R403	12K ohm	N-0288EEC	VRD-RA2EE123J
R404	5.6K ohm	N-0257EEC	VRD-RA2EE562J
R405	Oxide Film, 10K ohm, 1/2W, ±5%	N-0281EFC	VRS-SV2HC103J
R406	Oxide Film, 3.9K ohm, 1W, ±5%	N-0237EGD	VRS-VV3AB392J
R407	Oxide Film, 10K ohm, 1/2W, ±5%	N-0281EFC	VRS-SV2HC103J
R408	1K ohm		VRD-RA2EE102J
R409	820 ohm	N-0187EEC	VRD-RA2EE821J
R410	120 ohm	N-0136EEC	VRD-RA2EE121J
R411	1.5K ohm, 1/8W, ±5%	N-0206EBC	VRD-RA2BE152J
R412	8.2K ohm		VRD-RA2EE822J
R413	470 ohm, 1/8W, ±5%	N-0169EBC	VRD-RA2BE471J
R414	4.7K ohm		VRD-RA2EE472J
R415	270 ohm		VRD-RA2EE271J
R416 | R450	Not used		
R451	75 ohm, 1/8W, ±5%	N-0116EBC	VRD-RA2EE750J
R452	75 ohm, 1/8W, ±5%	N-0116EBC	VRD-RA2EE750J
R453	75 ohm, 1/8W, ±5%	N-0116EBC	VRD-RA2EE750J
R454	*See Controls (PCB-A)*		
R455	2.7K ohm	N-0224EEC	VRD-RA2EE272J
R456	1.5K ohm	N-0206EEC	VRD-RA2EE152J
R457	4.7K ohm	N-0247EEC	VRD-RA2EE472J
R458	*See Controls (PCB-A)*		
R459	*See Controls (PCB-A)*		
R460	6.8K ohm	N-0262EEC	VRD-RA2EE682J
R461	1.8K ohm	N-0210EEC	VRD-RA2EE182J
R462	12K ohm, 1/8W, ±5%	N-0288EBC	VRD-RA2BE123J
R463	22K ohm, 1/8W, ±5%	N-0311EBC	VRD-RA2BE223J
R464	100 ohm	N-0132EEC	VRD-RA2EE101J
R465	*See Controls (PCB-A)*		
R466	4.7K ohm	N-0247EEC	VRD-RA2EE472J
R467 | R480	Not used		
R481 ⚠	Oxide Film, 120 ohm, 3W, ±5%	N-0136EJD	VRS-VV3LB121J
R482	330 ohm	N-0159EBC	VRD-RA2EE331J
R483	820 ohm, 1/8W, ±5%	N-0187EBC	VRD-RA2BE821J
R484	1K ohm		VRD-RA2EE102J
R485 | R500	Not used		
R501	3.9K ohm	N-0237EEC	VRD-RA2EE392J
R502	5.6K ohm	N-0257EEC	VRD-RA2EE562J
R503	1K ohm	N-0196EEC	VRD-RA2EE102J
R504	2.7K ohm	N-0224EEC	VRD-RA2EE272J
R505	8.2K ohm	N-0271EEC	VRD-RA2EE822J
R506	Oxide Film, 68 ohm, 1W, ±5%	N-0111EGD	VRS-VV3AB680J
R507	*See Controls (PCB-A)*		
R508	6.8 ohm, 1/2W, ±5%		VRD-RA2HD6R8J

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
R509	4.7K ohm, 1/8W, ±5%	N-0247EBC	VRD-RA2BE472J
R510	470 ohm	N-0169EEC	VRD-RA2EE471J
R511	12K ohm, 1/8W, ±5%	N-0288EBC	VRD-RA2BE123J
R512	47K ohm, 1/8W, ±5%	N-0340EBC	VRD-RA2BE473J
R513	2.2K ohm		VRD-RA2EE222J
R514	*See Controls (PCB-A)*		
R515	4.7K ohm	N-0247EEC	VRD-RA2EE472J
R516	Not used		
R517	*See Controls (PCB-A)*		
R518	Not used		
R519	Oxide Film, 330 ohm, 1W, ±5%		VRS-VV3AB331J
R520	2.2K ohm	N-0216EEC	VRD-RA2EE222J
R521	Oxide Film, 680 ohm, 2W, ±5%	N-0183EHD	VRS-VV3DB681J
R522 ⚠	Metal Film, 4.7 ohm, 2W, ±5%	N-0047EHD	VRN-VV3DB4R7J
R523	Not used		
R524	Not used		
R525	82 ohm, 1/8W, ±5%	N-0122EEC	VRD-RA2BE820J
R526 | R600	Not used		
R601	1.2K ohm	N-0199EEC	VRD-RA2EE122J
R602	4.7K ohm	N-0247EEC	VRD-RA2EE472J
R603	15K ohm	N-0297EEC	VRD-RA2EE153J
R604	8.2K ohm	N-0217EEC	VRD-RA2EE822J
R605	33K ohm	N-0324EEC	VRD-RA2EE333J
R606	12K ohm	N-0288EEC	VRD-RA2EE123J
R607	*See Controls (PCB-A)*		
R608	680K ohm	N-0433EEC	VRD-RA2EE684J
R609	220 ohm	N-0149EEC	VRD-RA2EE221J
R610	1.8K ohm		VRD-RA2EE182J
R611	2.2K ohm		VRD-RA2EE222J
R612	Not used		
R613	Oxide Film, 1.2K ohm, 3W, ±5%	N-0199EJD	VRS-VV3LB122J
R614	Oxide Film, 4.7K ohm, 1W, ±5%	N-0247EGD	VRS-VV3AB472J
R615 ▲⚠	Carbon, 47 ohm, 1/2W, ±5%	N-0099EFC	VRD-RA2HD470J
R616	Carbon, 100 ohm, 1/8W, ±5%	N-0132EBC	VRD-RA2BE101J
R617	3.9K ohm	N-0237EEC	VRD-RA2EE392J
R618 ▲⚠	10K ohm	N-0281EEC	VRD-RA2EE103J
R619 ▲⚠	10K ohm	N-0281EEC	VRD-RA2EE103J
R620	Oxide Film, 8.2K ohm, 3W, ±5%	N-0217EJD	VRS-VV3LB822J
R621	100 ohm	N-0132EEC	VRD-RA2EE101J
R622	4.7K ohm	N-0247EEC	VRD-RA2EE472J
R623	*See Controls (PCB-A)*		
R624	15K ohm	N-0297EEC	VRD-RA2EE153J
R625	Not used		
R626	Oxide Film, 560 ohm, 1W, ±5%	N-0176EGD	VRS-VV3AB561J
R627	12 ohm, 1/2W, ±5%	N-0067EFC	VRD-RA2HD120J
R628	12 ohm, 1/2W, ±5%	N-0067EFC	VRD-RA2HD120J
R629	12 ohm, 1/2W, ±5%	N-0067EFC	VRD-RA2HD120J

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
R630	12 ohm, 1/2W, ±5%	N-0067EFC	VRD-RA2HD120J
R631 ⚠	Oxide Film, 10 ohm, 1/2W, ±5%	N-0063EFD	VRS-SV2HC100J
R632 ⚠	Metal Film 3.3 ohm, 1W, ±5%	N-0037EGD	VRN-RU3AA3R3J
R633 | R700	Not used		
R701 ⚠	Cement, 1.8 ohm, 5W, ±10%	N-0029FKF	VRW-KP3HC1R8K
R702 ▲⚠	3.9K ohm	N-0237EEC	VRD-RA2EE392J
R703 ▲⚠	*See Controls*		
R704 ▲⚠	8.2K ohm	N-0271EEC	VRD-RA2EE822J
R705	820 ohm	N-0187EEC	VRD-RA2EE821J
R706	1.8K ohm	N-0210EEC	VRD-RA2EE182J
R707	8.2K ohm	N-0271EEC	VRD-RA2EE822J
R708 ⚠	Metal Film, 1 ohm, 2W, ±5%	N-0022EHD	VRN-VV3DB1R0J
R709 ⚠	Metal Film, 27 ohm, 2W, ±5%	N-0082EHD	VRN-VV3DB270J
R710	12 ohm	N-0067EEC	VRD-RA2EE120J
R711 ⚠	Cement, 56 ohm, 5W, ±10%	N-0107FKF	VRW-KP3HC560K
R712	180K ohm, 1/2W, ±5%	N-0387EFC	VRD-RA2HD184J
R713 ⚠	Metal Film, 0.33 ohm, 1/2W, ±5%	N-0522EFD	VRN-SV2HCR33J
R714 ⚠	Cement, 2.7 ohm, 5W, ±10%	N-0034EKF	VRW-KP3HC2R7K
R715 ⚠	Solid, 3.9M ohm, 1/2W, ±10%	N-0460FFB	VRC-UA2HG395K
R716 ⚠	Metal Film, 0.68 ohm, 1W, ±5%	N-0015GED	VRN-VV3ABR68J
R717 ▲⚠	330 ohm, 1/8W, ±5%	N-0159EBC	VRD-RA2BE331J
R718 ⚠	Oxide Film, 12 ohm, 3W, ±5%	N-0067EJD	VRS-VV3LB120J
R719 ⚠	Oxide Film, 68 ohm, 2W, ±5%	N-0111EHD	VRS-VV3DB680J
R720	1.5K ohm	N-0206EEC	VRD-RA2EE152J
R721	1.2K ohm	N-0199EEC	VRD-RA2EE122J
TRANSFORMERS			
T601	Horizontal Driver	ATB-0495	RTRNZ0059CEZZ
T602 ▲⚠	Flyback		RTRNF1644CEZZ
T603 | T700	Not used		
T701 ⚠	Power Converter	ATA-0026	RTRNZ0258CEZZ
SWITCH			
SW701 ⚠	Power	AS-0015	QSW-P0317CEZZ

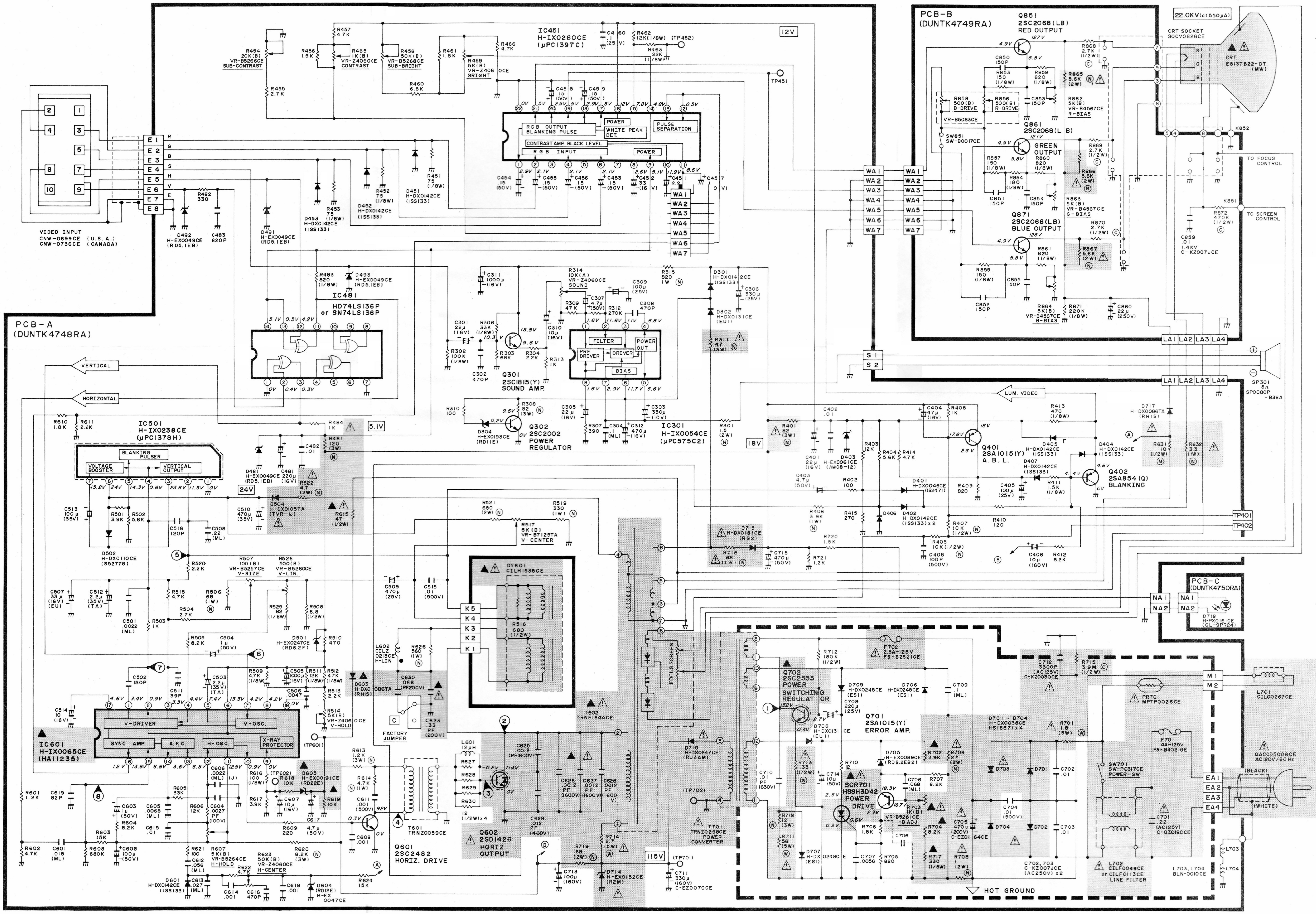
REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
CONTROLS			
R314/ R459/ R465/ R514/ R623	Pot., Sound, A-Taper, 10K ohm/ Brightness, B-Taper, 5K ohm/ Contrast, B-Taper, 1K ohm/ V-Hold, B-Taper, 5K ohm/ H-Center, B-Taper, 50K ohm	P-7943	RVR-Z4060CEZZ
R454	Pot., Sub-Contrast, B-Taper, 20K ohm	AP-7017	RVR-B5266CEZZ
R458	Pot., Sub-Brightness, B-Taper, 50K ohm	AP-7018	RVR-B5268CEZZ
R507	Pot., V-Size, B-Taper, 100 ohm	AP-7019	RVR-B5257CEZZ
R517	Pot., V-Center, B-Taper, 5K ohm	AP-6005	RVR-B7125TAZZ
R526	Pot., V-Lin., B-Taper, 500 ohm	P-7947	RVR-B5260CEZZ
R607	Pot., H-Hold, B-Taper, 5K ohm	P-2009	RVR-B5264CEZZ
R703 ▲⚠	Pot., +B ADJ., B-Taper, 1K ohm	P-2011	RVR-B5261CEZZ
MISCELLANEOUS			
PR701 ⚠	Posistor	T-1251	RMPTP0026CEZZ
	Holder, Fuse	F-1406	QFSHD1002CEZZ
TP451	Test Point		QLUPG0109CEFW

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
	P.C.B. Assembly, CRT Socket (PCB-B) **Consists of the following**	AX-0134	DUNTK4749RAOH
CAPACITORS			
C850	Ceramic, 150pF, 50V, ±5%		VCCSPA1HL151J
C851	Ceramic, 150pF, 50V, ±5%		VCCSPA1HL151J
C852	Ceramic, 150pF, 50V, ±5%		VCCSPA1HL151J
C853	Ceramic, 150pF, 50V, ±5%		VCCSPA1HL151J
C854	Ceramic, 150pF, 50V, ±5%		VCCSPA1HL151J
C855	Ceramic, 150pF, 50V, ±5%		VCCSPA1HL151J
C856 | C858	Not used		
C859	Ceramic, 0.01μF, 250VAC/1.4kVDC, +80% −20%		RC-KZ007JCEZZ
C860	Electrolytic, 22μF, 250V, +50% −10%		VCEAAH2EW226Y
CONNECTOR			
	Socket, CRT, 8-Pin	AJ-7087	QSOCV0826CEZZ

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
TRANSISTORS			
Q851	2SC2068(LB) Red output, Silicon, NPN		VS2SC2068LB1E
Q852 | Q860	Not used		
Q861	2SC2068(LB) Green output, Silicon, NPN		VS2SC2068LB1E
C862 | C870	Not used		
Q871	2SC2068(LB) Blue output, Silicon, NPN		VS2SC2068LB1E
RESISTORS: Unless otherwise specified, resistors are 1/8W, ±5%, Carbon type.			
R853	150 ohm		VRD-RA2BE151J
R854	180 ohm		VRD-RA2BE181J
R855	150 ohm		VRD-RA2BE151J
R856	*See Controls (PCB-B)*		
R857	150 ohm		VRD-RA2BE151J
R858	*See controls (PCB-B)*		
R859	820 ohm		VRD-RA2BE821J
R860	820 ohm		VRD-RA2BE821J
R861	820 ohm		VRD-RA2BE821J
R862	*See Controls (PCB-B)*		
R863	*See Controls (PCB-B)*		
R864	*See Controls (PCB-B)*		
R865 ⚠	Oxide Film, 5.6K ohm, 2W, ±5%		VRS-VV3DB562J
R866 ⚠	Oxide Film, 5.6K ohm, 2W, ±5%		VRS-VV3DB562J
R867 ⚠	Oxide Film, 5.6K ohm, 2W, ±5%		VRS-VV3DB562J
R868	Solid, 2.7K ohm, 1/2W, ±10%		VRC-MA2HG272K
R869	Solid, 2.7K ohm, 1/2W, ±10%		VRC-MA2HG272K
R870	Solid, 2.7K ohm, 1/2W, ±10%		VRC-MA2HG272K
R871	220K ohm		VRD-RA2BE224J
R872	Solid, 470K ohm, 1/2W, ±10%		VRC-MA2HG474K
SWITCH			
SW851	Luminance Video Cut-off	AS-0016	QSW-B0017CEZZ
CONTROLS			
R856/ R858	Pot., Red Drive, B-Taper, 500 ohm/ Blue Drive, B-Taper, 500 ohm		RVR-B5083CEZZ
R862	Pot., Red Bias, B-Taper, 5K ohm	AP-0003	RVR-B4567CEZZ
R863	Pot., Green Bias, B-Taper, 5K ohm	AP-0003	RVR-B4567CEZZ
R864	Pot., Blue Bias, B-Taper, 5K ohm	AP-0003	RVR-B4567CEZZ

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
	P.C.B. Assembly, LED (PCB-C) **Consists of the following:**	AX-0135	DUNTK4750RA0H
CONNECTOR			
NA-NA	Socket for Main PCB, 2-Pin		CSOCN0230RA20
DIODE			
D718	GL-9PR24, LED		RH-PX0161CEZZ
MISCELLANEOUS (Parts not located on the PCBs.)			
⚠	Cord, AC	AW-3354	QACCD5008CEZZ
L701 ⚠	Coil, Automatic Degaussing	ACA-9017	RCILG0267CEZZ
	Magnet, Purity and Static Convergence	HC-3479	PMAGF3006CEZZ
CRT ▲⚠	Picture Tube E8137B22-DT (MW)	AXX-8022	VBE8137B22/1Y
DY601▲⚠	Yoke, Deflection	HTB-0436	RCILH1535CEZZ
	Signal Input Cable Unit (U.S.A.)	AW-3355	QCNW-0699CEZZ
	(CANADA)		QCNW-0736CEZZ

SCHEMATIC DIAGRAM



NOTES:

1. The unit of resistance "ohm" is omitted. (K:1000 ohms, M:1 Meg ohm)
2. All resistors are 1/4 watt, unless otherwise noted.
3. All capacitors are μF, unless otherwise noted (P:μμF)
4. (G) indicates ±2% tolerance may be used.

VOLTAGE MEASUREMENT CONDITIONS:

1. All DC voltages are measured with SSVM connected between points indicated and chassis ground. Line voltage is set at 120V AC and all contols are set for a normal picture unless otherwise indicated.
2. All voltages are measured with "H" characters mode.

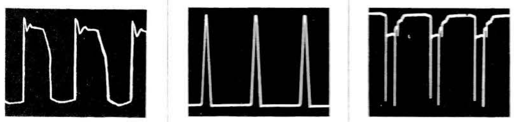
⚠ AND SHADED COMPONENTS: SAFETY RELATED PARTS, ▲MARK: X-RAY RELATED PARTS.

	C403		C714		C706 Point Change
U.S.A.	Up to 25004 10μ/50V	U.S.A.	Up to 7000 10μ/50V (NP)	U.S.A.	Up to 7000 Q701 between (B) and (E)
	25005 to END 22μ/50V		7001 to END 47μ/50V		7001 to END Q701 between (C) and Ground
CANADA	Up to 4400 10μ/50V	CANADA	Up to END 47μ/50V	CANADA	Up to END Q701 between (C) and Ground
	4401 to END 22μ/50V		——		

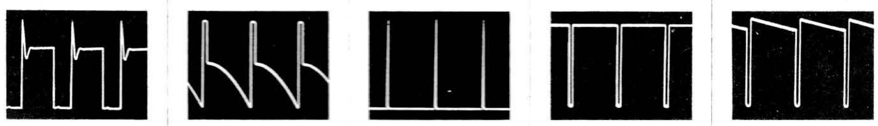
WAVEFORMS

Waveform Measurement Conditions:

1. The voltage level and waveform at each point are given below on 120V/AC power when this set is connected to the color computer with a video signal input at 0 volt (namely, with no brightness on the screen).
2. ○▶ indicates the waveform check points. (In the chart, waveforms are measured from the point indicated to chassis ground.)

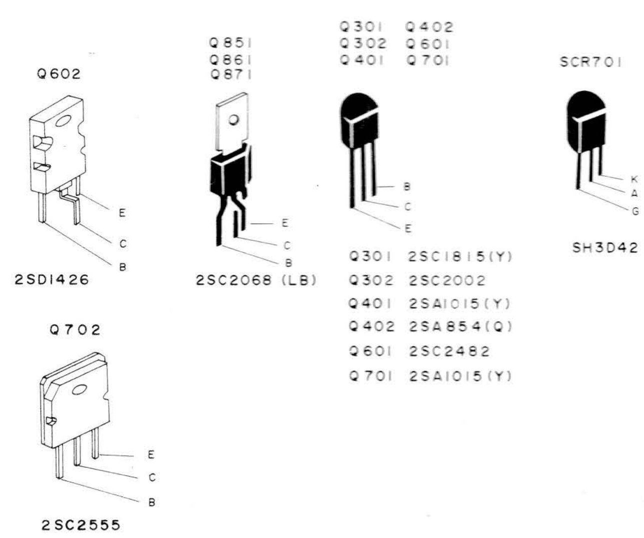


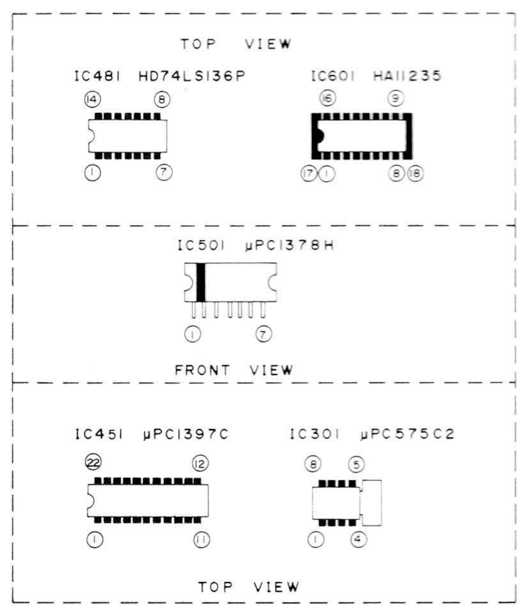
(1) 300 Vp-p (H) (2) 900 Vp-p (H) (3) 12 Vp-p (H)



(4) 175 Vp-p (H) (5) 35 Vp-p (V) (6) 5.0 Vp-p (V) (7) 0.9 Vp-p (V) (8) 2.2 Vp-p (H)

SEMICONDUCTOR LEAD IDENTIFICATION





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