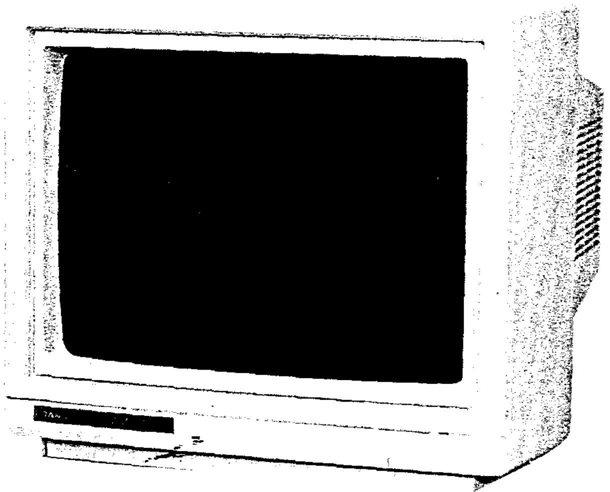
TANDY®

Service Manual

25-1021

COLOR MONITOR
CM-4
Catalog Number : 25-1021



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 T.T.L. Level, positive white (default)	2.4 − 5.0Vp-p
b) Synchronous	T.T.L. level, positive going (default)	
c) Intensity	T.T.L. level, positive going (default)	
4. Resolution		
a) Horizontal	640 dots	
b) Vertical (non-interlaced)	225 lines	
6. Brightness		30 fl. min. (at intensity white)
8. Display color	15 colors	
9. High voltage	23 kV/0μA	27.5 kV max./0μA
10. Picture linearity		
a) Horizontal		10% max.
b) Vertical		10% max.
11. Synchronous (Pull in range)		
a) Horizontal	15.701 kHz	$^{+300}_{-400}$Hz
b) Vertical	60 Hz	$^{+0}_{-7}$Hz
12. Dot Pitch	0.64 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 which 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 Hazard

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 an 120 volt AC outlet. (Do not use an isolation transformer for this test.)
- Using two clip leads, connect a 1.5k ohm, 10 watt resistor paralleled by a 0.15μF capacitor in series with all exposed metal cabinet parts and a known earth ground, such as electrical conduit or electrical ground connected to earth ground.
- Use a 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 nonpolarized 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.

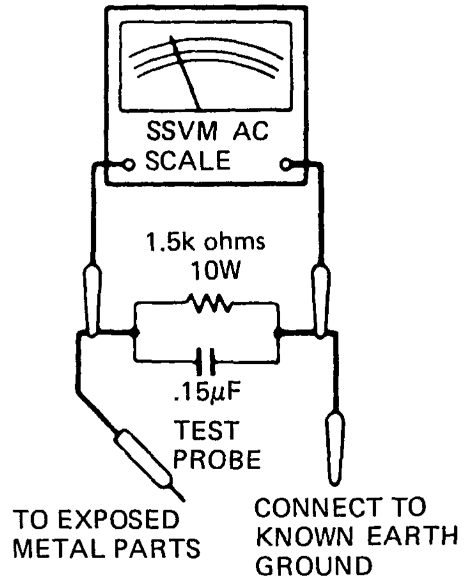


Figure 1. Leakage Current Test Circuit

THEORY OF OPERATION

1. RGB Drive Circuit

The RGBI signals are applied to HEX inverter IC491 (used as a buffer). The outputs of IC491 are then applied to IC492 which is an open collector HEX inverter. The resistors tied to the outputs of IC492 are used to set the appropriate voltage level for the color signals. The signals are then applied to the base of RGB-Amp transistors Q451, Q461 and Q471.

The brightness and sub brightness controls (R417 and R416) are used to adjust the bias of the RGB-Amp transistors. These controls are connected to the base of Q401 and Q402. When the intensity signal is LOW, transistor Q421 is turned ON.

The contrast control (R422) is used to adjust the contrast between high and low intensity color signals.

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. 145V DC must be applied to the collectors of the output transistors (Q851, Q861, Q871). When the horizontal output circuit is operating, pulses are developed and fed to the 116V supply where they are applied to a winding of the horizontal output transformer (T602). This pulsed DC voltage is then taken from terminal (5) of T602 and applied through D717, and R865 or R866 or R867 to the collectors of Q851, Q861 and Q871, respectively.

The brightness signal from the Blanking (Q402) is applied to the emitters of Q851, Q861 and Q871.

C853 and C855 are peaking capacitors.

Color signals from the outputs of Q451, Q461 and Q471 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.

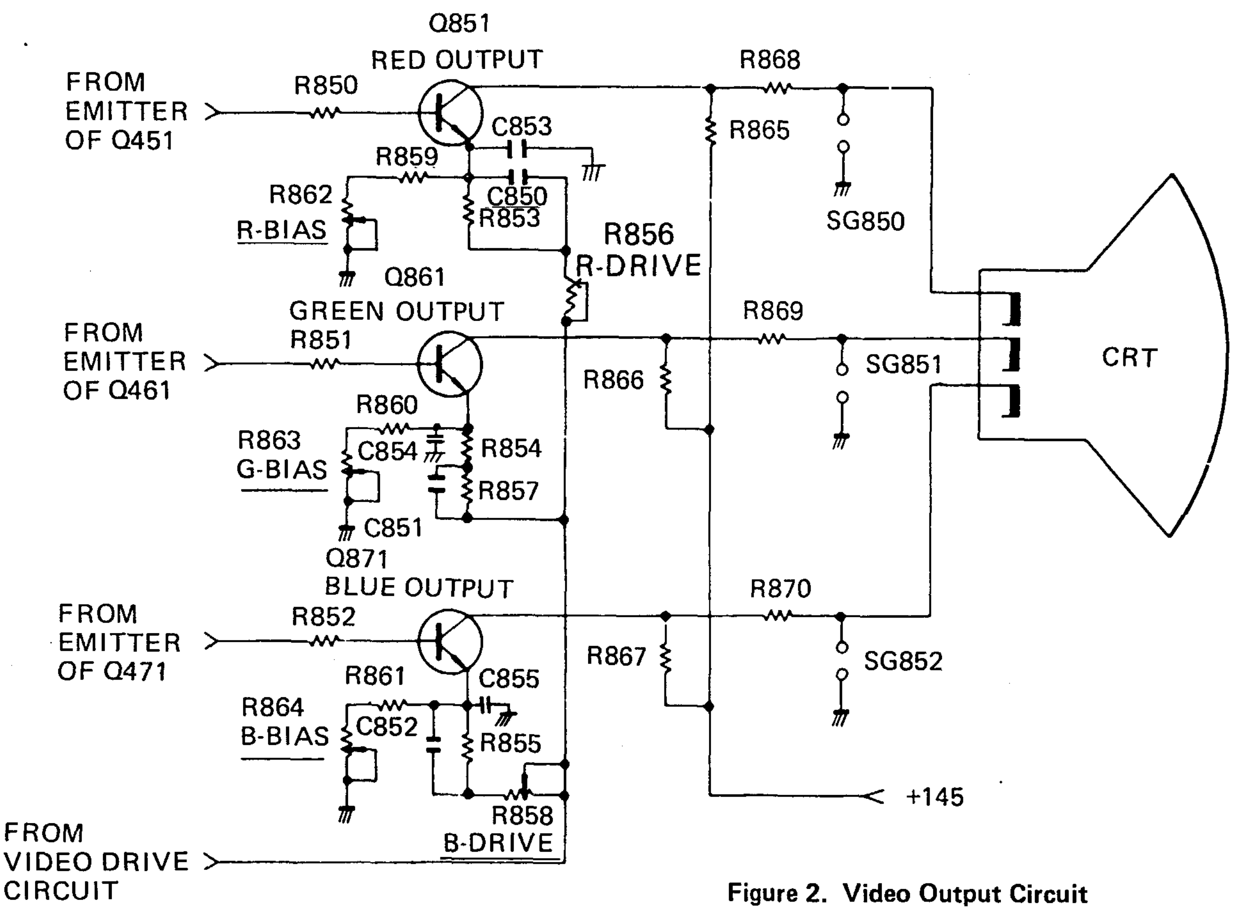


Figure 2. Video Output Circuit

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 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.
The sawtooth wave is applied to pin ③ of IC601 as an AC feedback signal.
The emitter circuit of Q501 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 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 fly-back 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.
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)

Horizontal drive voltage, 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 scan and 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 required to be 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.

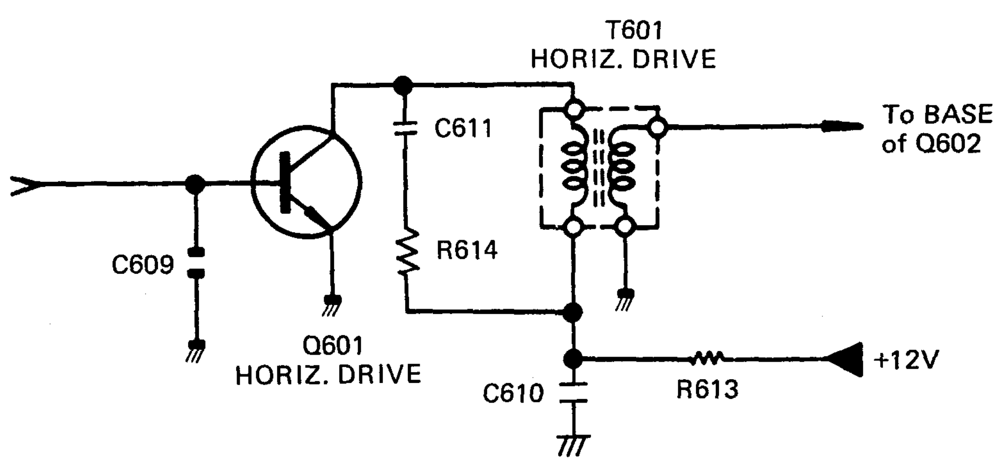


Figure 3. Horizontal Drive Circuit

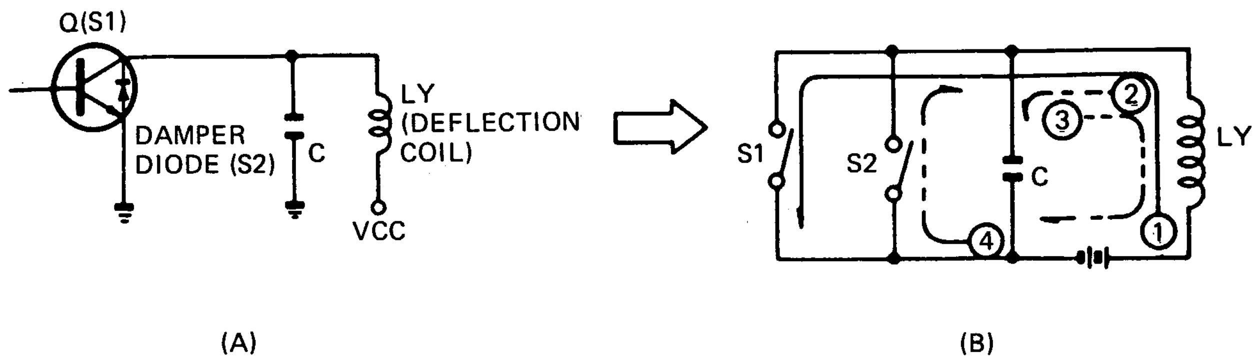


Figure 4. Equivalent Circuit of Horizontal Output Circuit

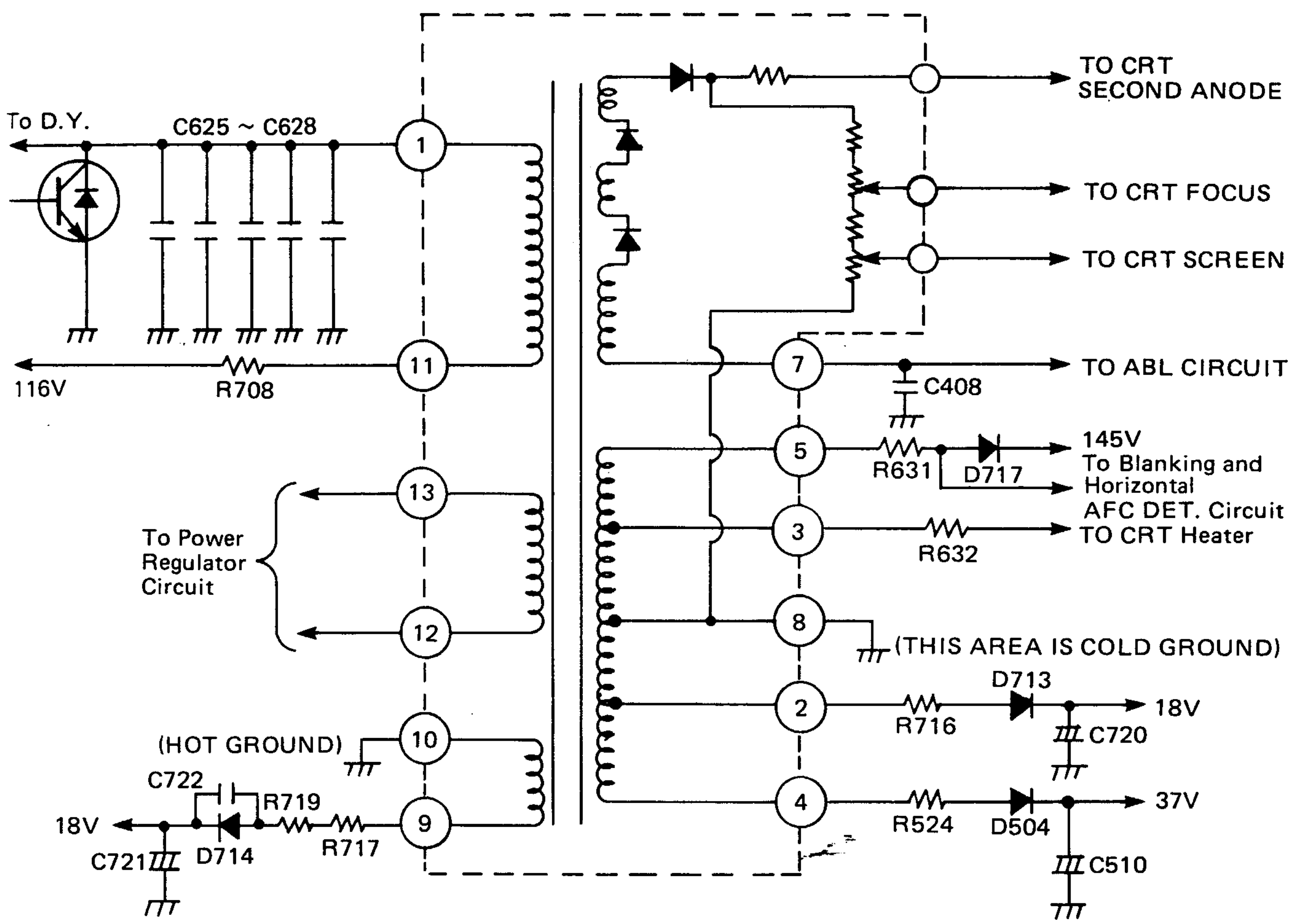


Figure 5. Horizontal Output and HV Rectifier Circuit

6. High Voltage Shut-down System

The shut-down 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 subjected to rectification by D603. Being in proportion to the voltage of that heater pulse, 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 voltage (+22V) of 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.

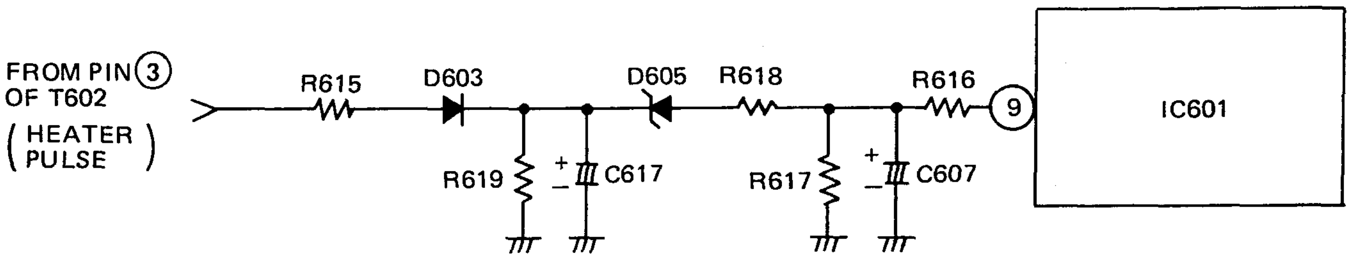


Figure 6. High Voltage Shut-Down System Circuit

7. Power Supply (Figs. 7—10)

The entire monitor circuitry is protected by a 4.0A fuse (F701), located on the Main Chassis Board (PCB-A) that is connected to the hot side of the AC line input. The secondary circuit is protected by a 1.5A fuse (F702), mounted on PCB-A. AC Line voltage is applied through the Line filter (L702) to the power ON-OFF SWITCH (SW701).
With SW701 set in the ON position, AC voltage is applied through a Bridge Rectifier circuit.
A conventional type Automatic Degaussing circuit, consisting of a positive coefficient thermistor (PR701) in series with the degaussing coil assembly (L701), is used.
The AC input voltage is rectified by the Bridge Rectifier circuit (D701, D702, D703, D704) and then applied to the Regulator circuit. A switching type Regulator circuit, utilizing a silicon controlled rectifier (SCR701), is used to maintain a constant DC voltage level regardless of fluctuations in the AC input voltage.

The negative horizontal pulses that are produced at terminal (9) of the Horizontal Output transformer (T602) are converted into a saw tooth wave by R713 and C711 which is applied to the Phase Detector circuit in the IC701 (Power Regulator integrated circuit) via pin (5). Output from the Phase Detector circuit is applied internally to the SCR Drive stage where it is amplified and then utilized as the SCR gate (timing) pulse. Gate pulse timing is determined by the action of the Error Amplifier stage in IC701 which is controlled by the setting of the +116V Adjust control (R707). Filtered DC voltage derived from the pulses produced at terminals (13) and (12) of T602 is used to turn OFF SCR701. If the AC input voltage increases, the turn-on time of SCR 701 decreases. And if the AC input voltage decreases; the turn-on time of SCR701 increases.
The +5.1V, +12V and +18V supplies are produced as a result of rectification through D713 of the pulses developed at terminal (2) of T602.

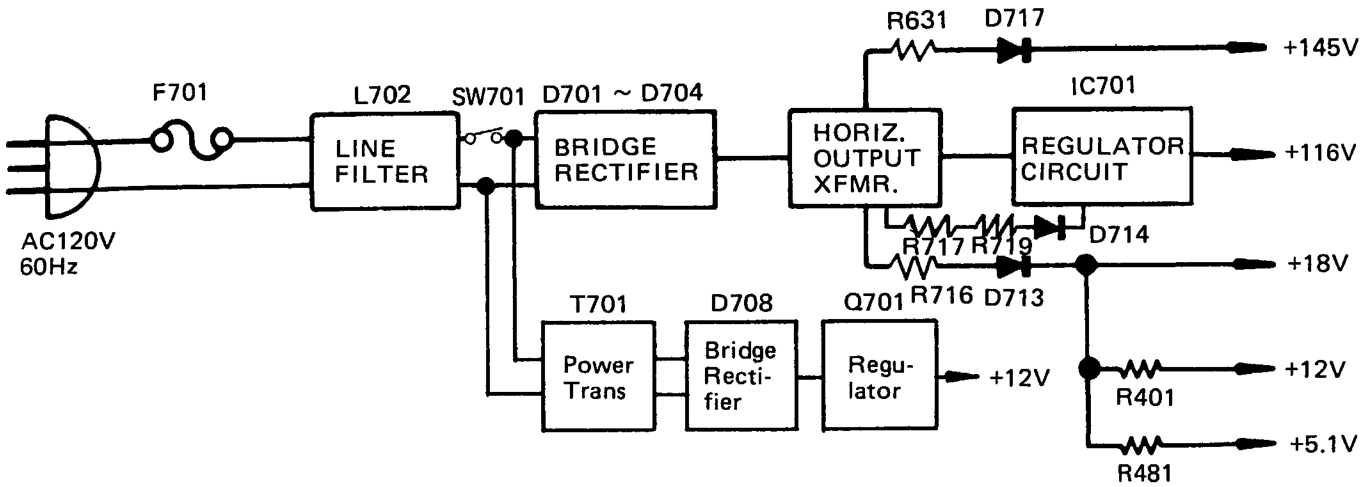


Figure 7. Block Diagram of Power Supply

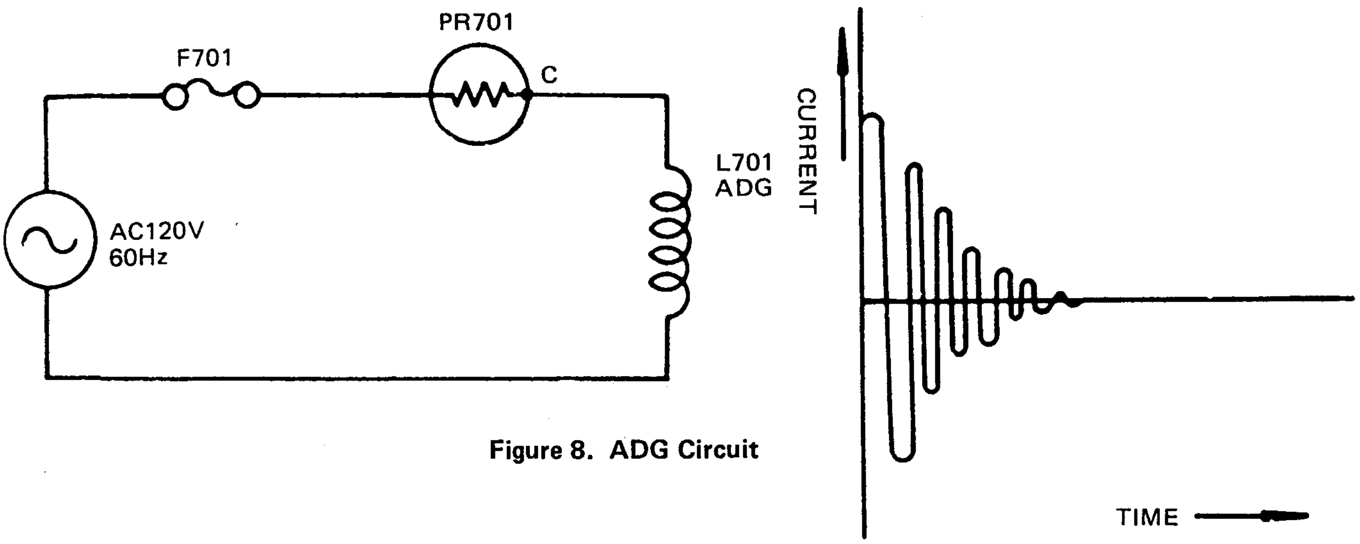


Figure 8. ADG Circuit

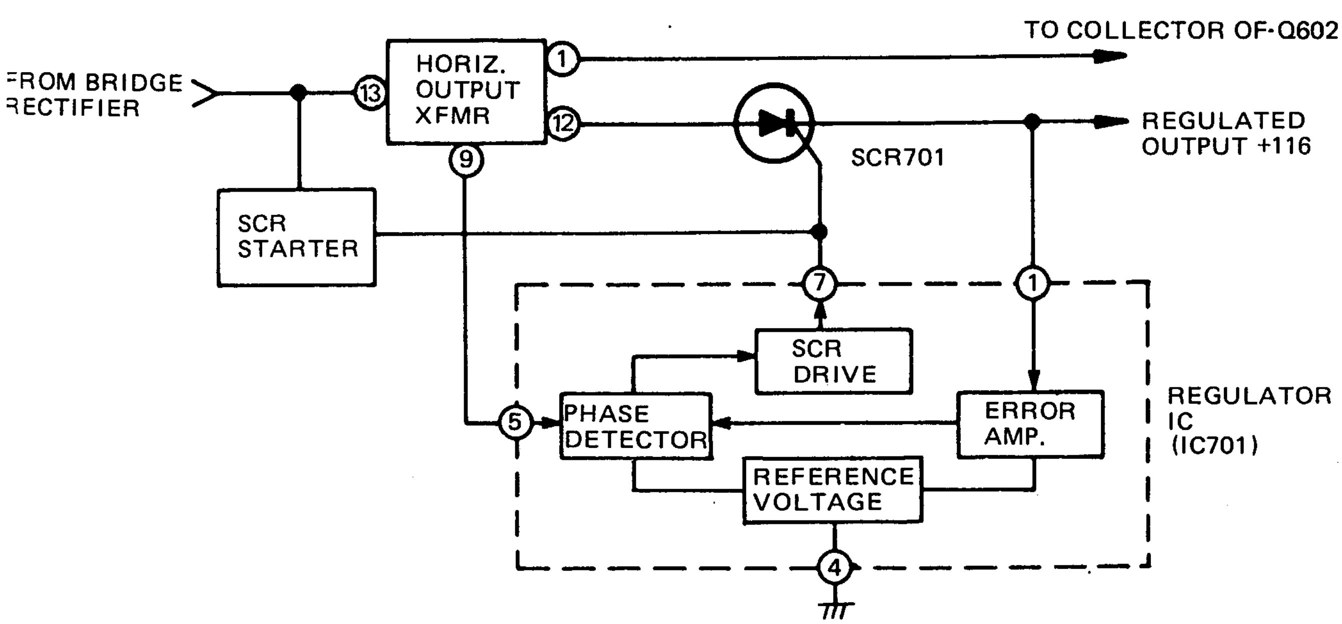


Figure 9. Block Diagram of Regulator Circuit

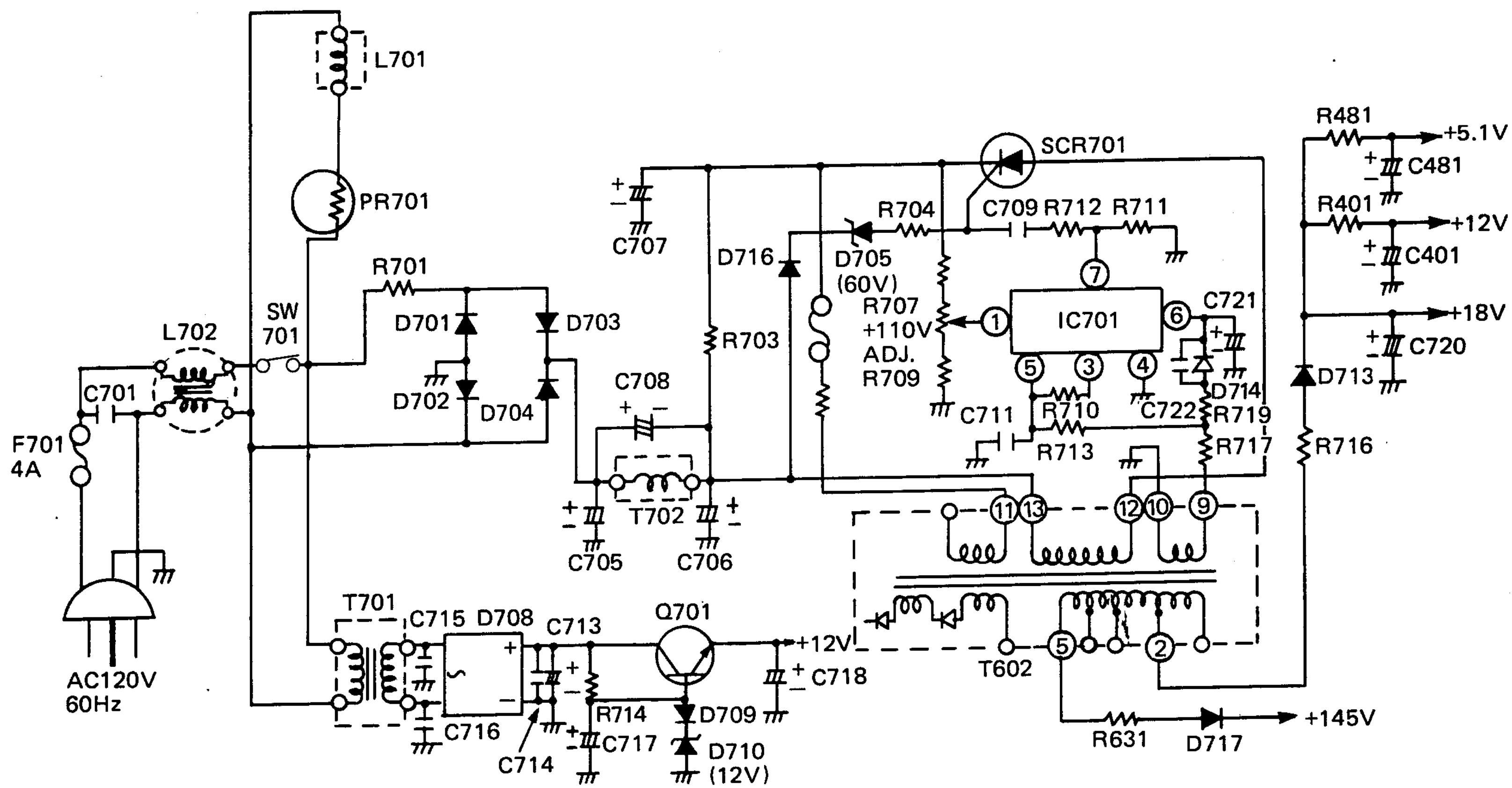


Figure 10. Power Supply Schematic

DISASSEMBLY INSTRUCTIONS

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

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

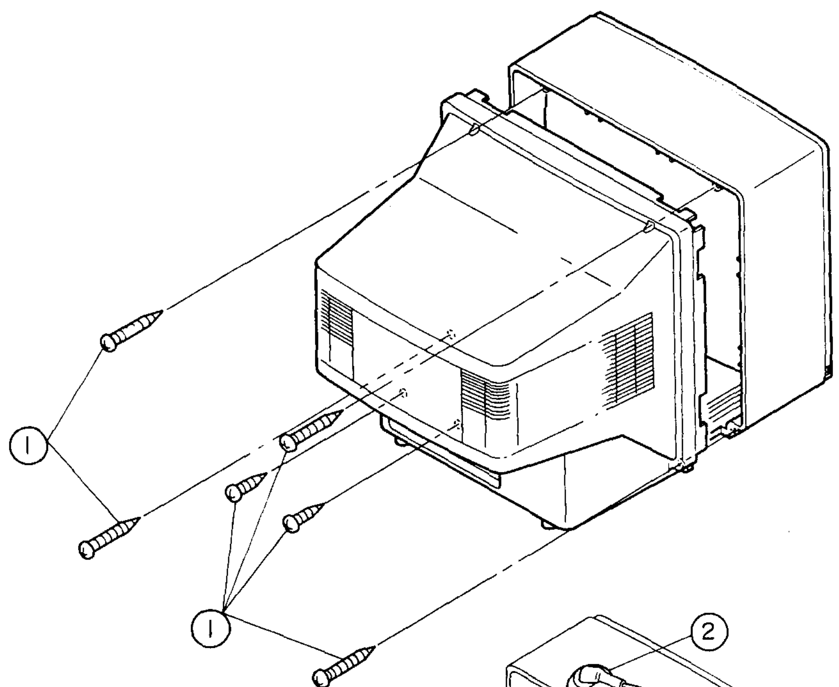


Figure 11A

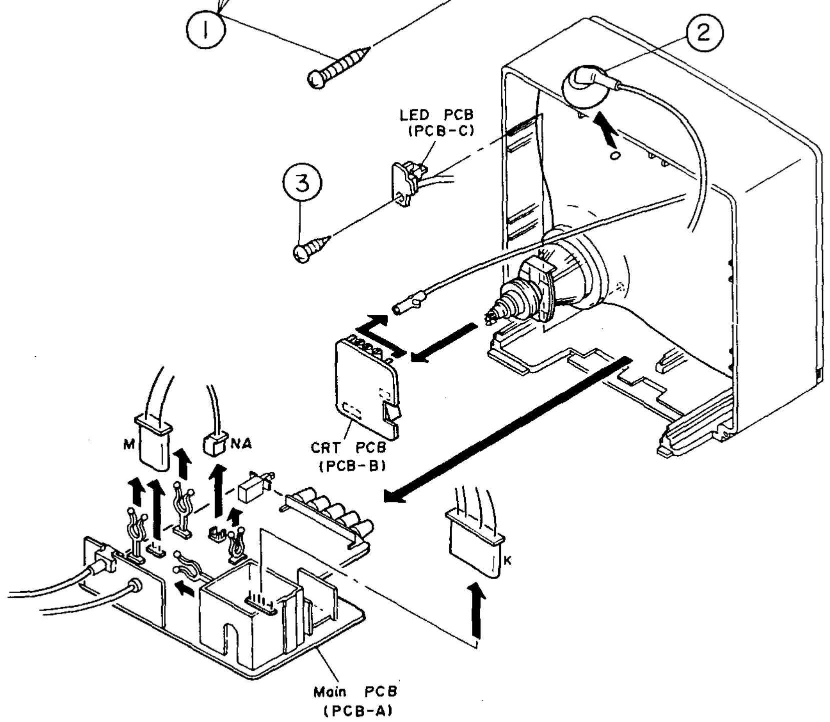
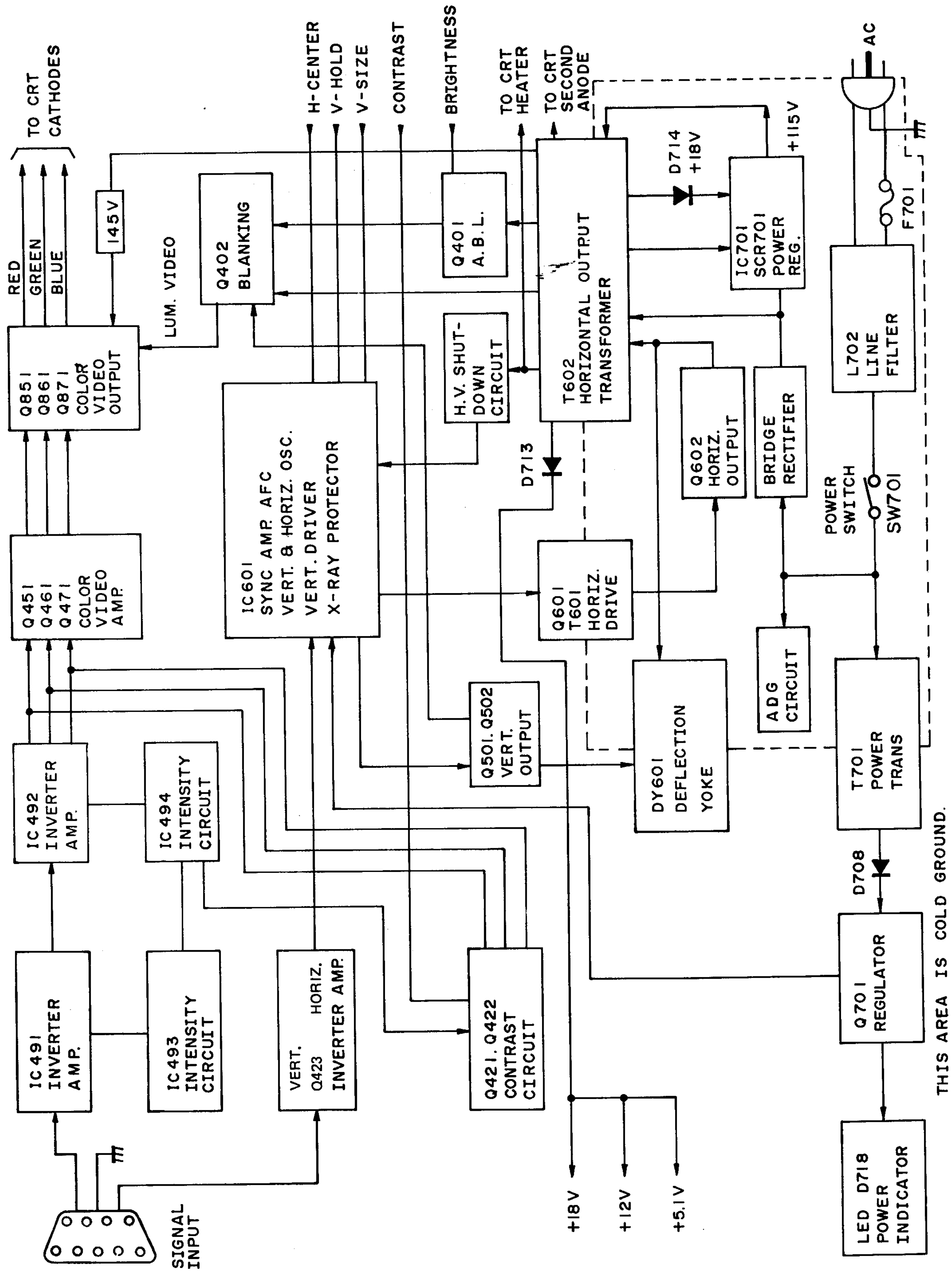


Figure 11B

BLOCK DIAGRAM



ALIGNMENT INSTRUCTIONS

Note:

This adjustment requires the connection of a personal computer to the Monitor. 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.

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 (R707) to provide a DC voltage of 116V between TP91 and ground.

Note 1: If the AC line voltage is below 114V, the DC voltage may not increase to 116V, but this is not a problem related to this adjustment. If the value of 116V DC is almost reached, the adjustment is enough.

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 letters "H" cover the entire screen (data display period: 44.698 μS horizontal, 14.33 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 letters "H" cover the entire screen (data display period: 44.698 μS horizontal, 14.33 mS vertical).
(2) Adjust the vertical size control (R507) so that the height of the displayed pattern is 170 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 adjusting 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 display Monitor for at least 15 minutes at 120VAC line voltage with the computer displaying high intensity 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 and 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 letters "H" cover the entire screen (data display period: 44.698 μS horizontal, 14.33 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 for accurate input voltage.
2. Operate the computer in such a way that the entire screen displays a high intensity white signal (data display period: 44.698 μS horizontal, 14.33 mS vertical).
3. Check the voltage of test point TP601. (Its voltage should be about 17.5VDC.)
4. Connect the cathode of diode D503 and TP601 through a 6.8K ohm, 1/2W resistor.
5. To start operation, remove the resistor and touch the IC601 ⑨ pin-to-chassis ground with a short clip lead. (Remove the short clip lead as soon as the set operates again with a normal picture).
6. Connect the short-clip lead between TP602 and chassis ground. When these points are connected, the operation of the horizontal osc. must stop.
7. To start operation, remove the short-clip lead when the set begins operating again with a normal picture.
8. If the operation of the horizontal osc. does not stop in steps 4 and 6, the circuit must be repaired before the set is returned to the customer.

8. Color Purity Adjustment

The display monitor must have been operating 15 minutes prior to this procedure, and with the faceplate of the CRT at room temperature. The display 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 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).
   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.
   Tighten the deflection yoke clamp screw.
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 RCB-A.
11. Perform the "Black and White Tracking" procedures.

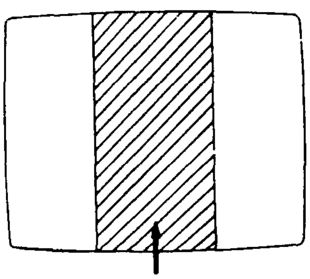


Figure 12. Color Purity Adjustment

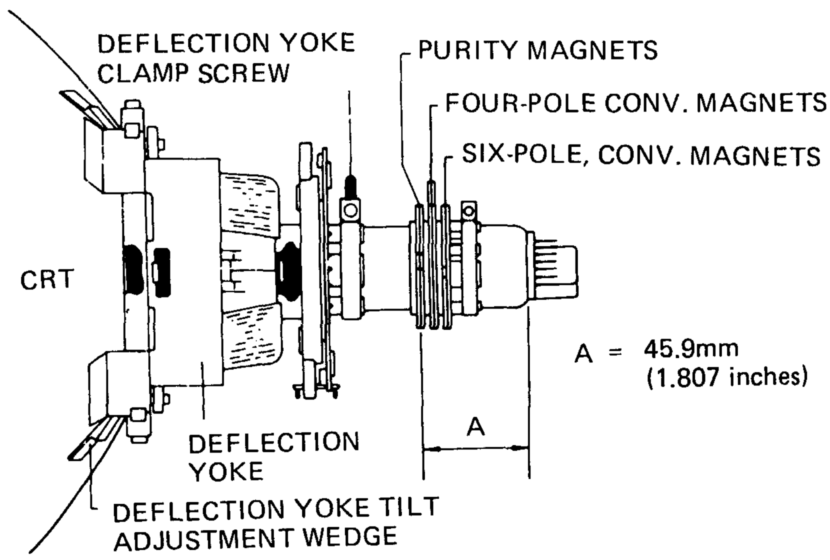
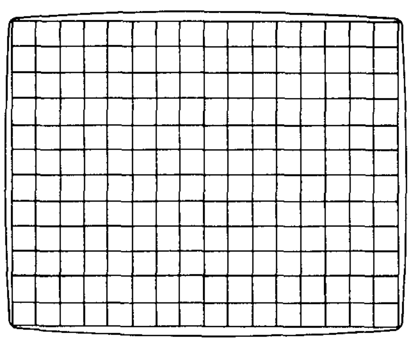


Figure 13. Picture Tube Neck Components Location

9. Black and White Tracking

1. Turn the screen control fully clockwise. Turn the red, green and blue bias controls fully clockwise. Set the brightness control and the red and blue drive controls at the center positions.
2. Operate the computer in such a way that the entire screen is high intensity white (display period: 44.698 μS horizontal, 14.33 mS vertical).
3. Turn off the switch SW851.
4. Rotate the screen control counterclockwise until a raster (either the red, green or blue) appears dimly on the screen.
5. Rotate two of the three bias controls counterclockwise until the raster becomes whitish: position rotated controls must be the ones which control the colors other than the raster's colors.
   Notes: Adjust R863 and R864 if the red appears.
   Adjust R862 and R864 if the green appears.
   Adjust R862 and R863 if the blue appears.
6. Return switch SW851 to its original position.
7. Rotate the red and blue drive controls until the raster is white.
8. Set the brightness control at its maximum position and adjust the screen control until a reading of 3.8V DC appears between TP-402 and TP-403 (at both ends of R407).
9. Turn the brightness control in either direction to check that the picture maintains a good white balance.
10. Repeat steps 3 thru 9 for readjustment.



Horizontal:
12 Lines Min.
Vertical:
16 Lines Min.

Figure 14. Crosshatch Pattern

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

1. Switch the display monitor ON and allow it to warm up 15 minutes.
2. Operate the computer in such a way that the entire screen is a crosshatch pattern (display period: 44.698 μS horizontal, 14.33 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 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.

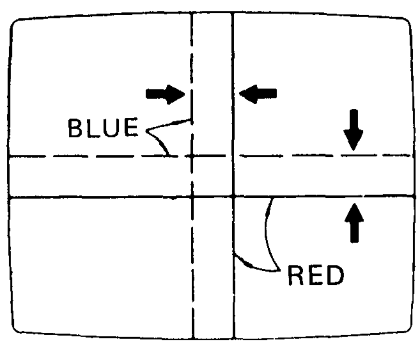


Figure 15

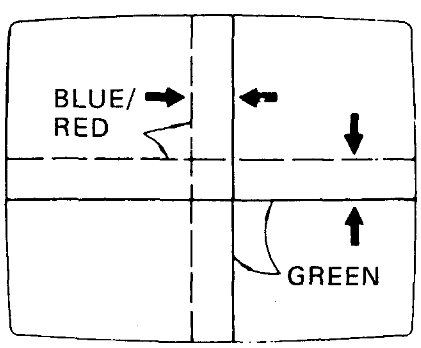


Figure 16. Static (Center) Convergence

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.

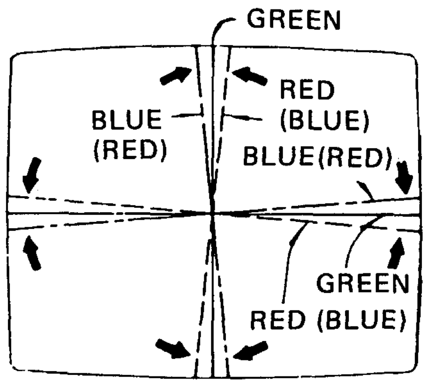


Figure 17

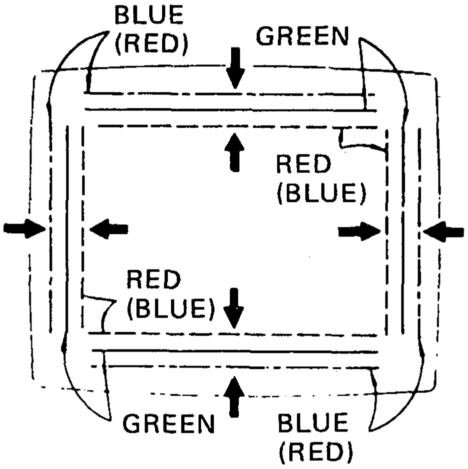


Figure 18

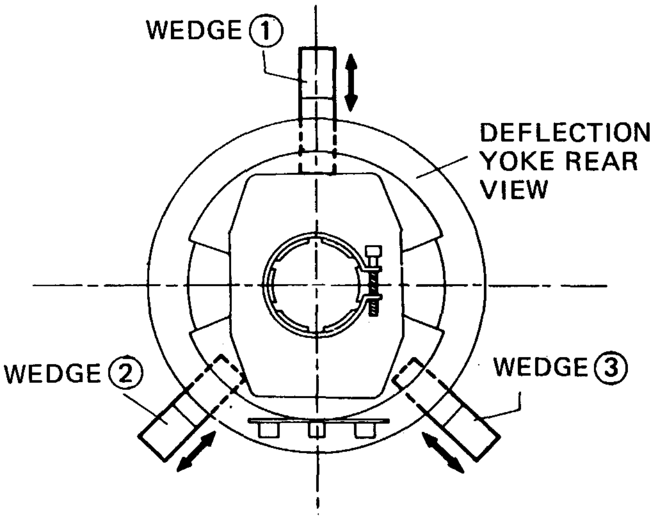


Figure 19. Dynamic Convergence

TROUBLESHOOTING GUIDE

Circuits checked:

- Power regulator circuit
- Protector circuit
- Horizontal sync circuit

NO POWER

Does 150V appear between the anode of SCR701 and ground?

- No → SW701 D704 F701 T702 F702 T701 D701 R701 D702 C701 D703 D709 Q701
- Yes ↓

Connect a zener diode (60V) between the gate of SCR701 and T702-to-D716 junction: connect the zener diode anode to the gate of SCR701.

Is the power circuit activated?

- Yes → D705 D716
- No ↓

Connect a resistor (15W, 50 ohms) between TP-91 and T702-to-D716 junction.

Is the horizontal sync circuit activated?

- No → R615 D605 IC601 R613 Q601 R620 Q602 D603 D602
- Yes ↓

Does 18V appear between pin⑥of IC701 and ground?

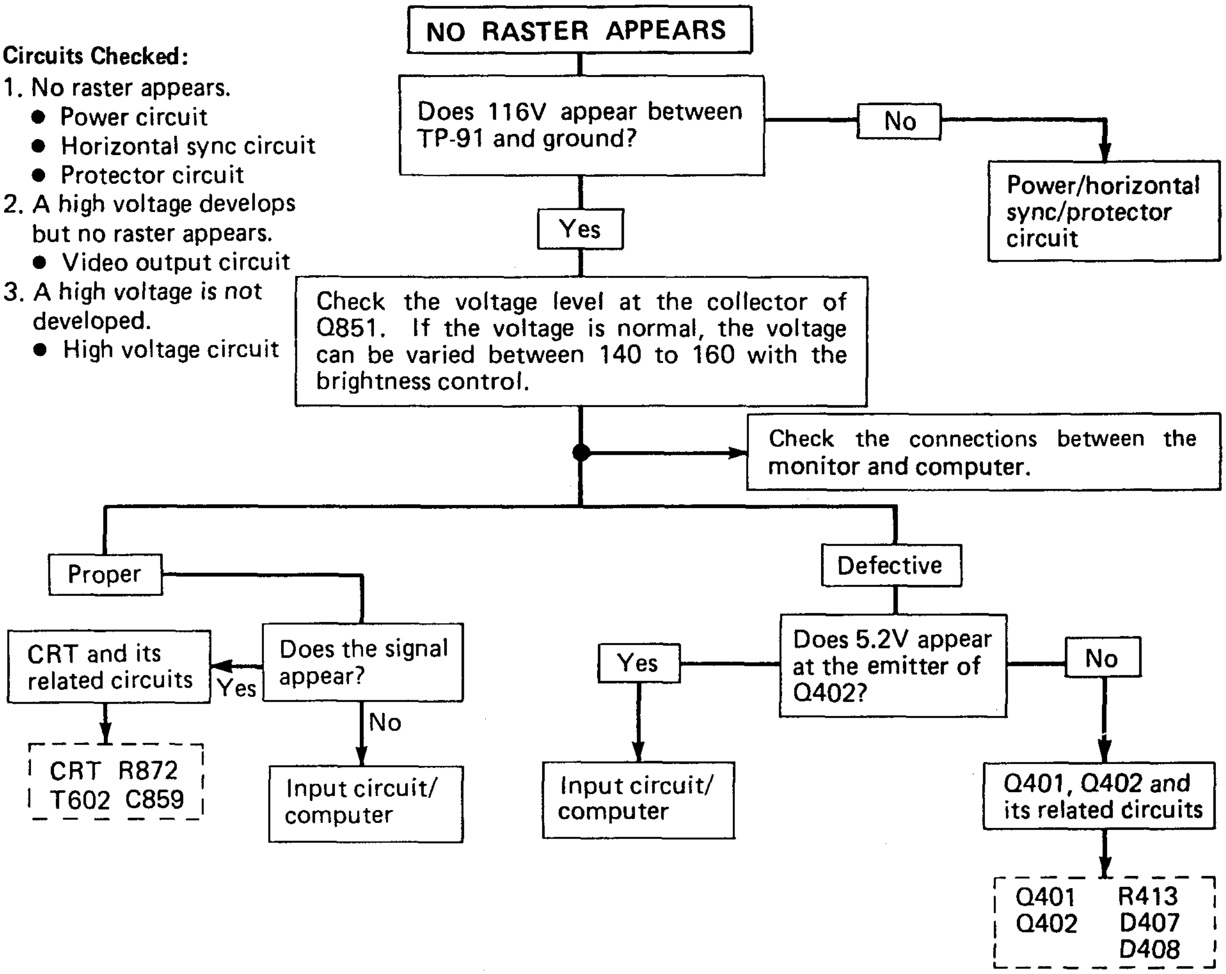
- No → R717 R719 D714 R716 D713
- Yes ↓

Does 7.8V appear between pin⑦of IC701 and ground?

- No → IC701 R706 R707 R709 R711 C707
- Yes → SCR701 R712 R705 C709 C710

Circuits Checked:

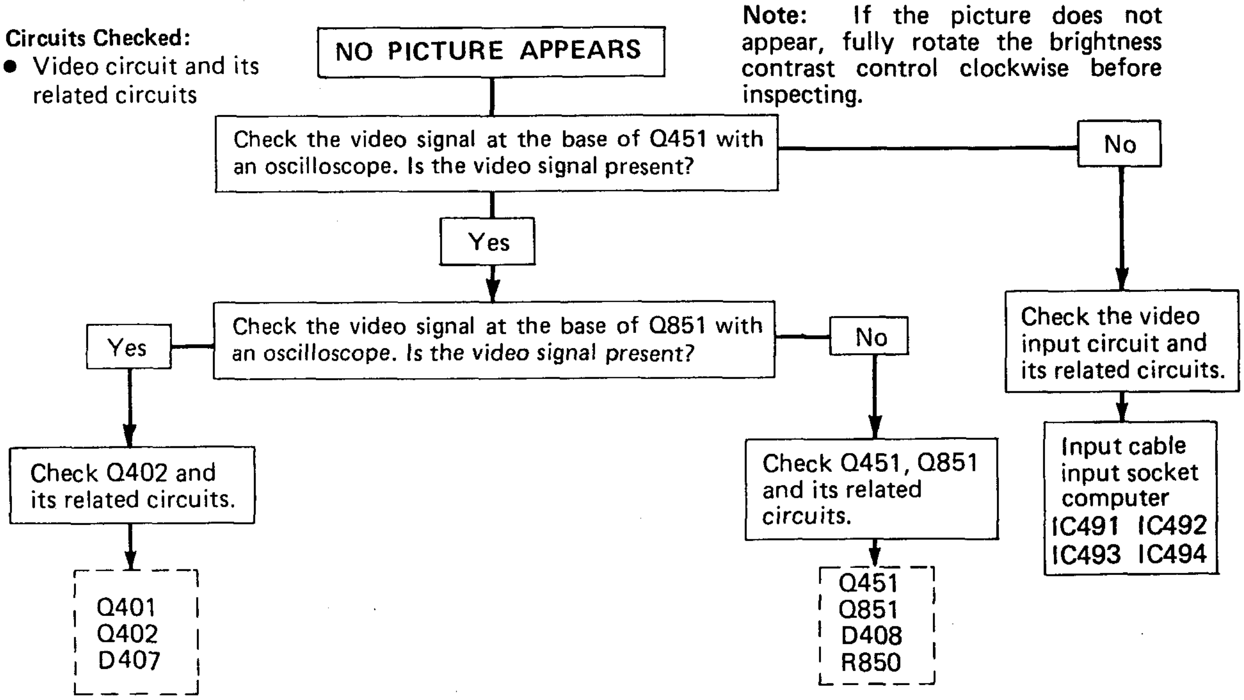
1. No raster appears.
   - Power circuit
   - Horizontal sync circuit
   - Protector circuit
2. A high voltage develops but no raster appears.
   - Video output circuit
3. A high voltage is not developed.
   - High voltage circuit



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 SYNCHRONIZATION CAN BE PROVIDED

Circuits checked:
- IC601 and its related circuits.

IC601, Q423

Both horizontal and vertical synchronization cannot be obtained.

HORIZONTAL SYNCHRONIZATION CANNOT BE OBTAINED.

(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, Q423

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

- Yes → C606, C604
- No → IC601, R620, D602, R607, Q423

VERTICAL SYNCHRONIZATION CANNOT BE OBTAINED

(But horizontal synchronization is normal.)

Vertical sync, adjustment is not possible at all.

→ IC601 R502 C501
IC601 R514 C504

The vertical sync frequency can be varied slightly.

→ IC601 R513
R510 R514
R511 C503
R512 C505

VERTICAL SWEEP DOES NOT OCCUR

Circuits Checked:
- IC601 and its related circuits
- Q501 and Q502, and their related circuits

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

Sweep occurs vertically on the raster.

→ IC601 R508 R511
R504 R509 R512
R505 R510 R513
R506 C503 R514
R507 C506 R515

No sweep occurs.

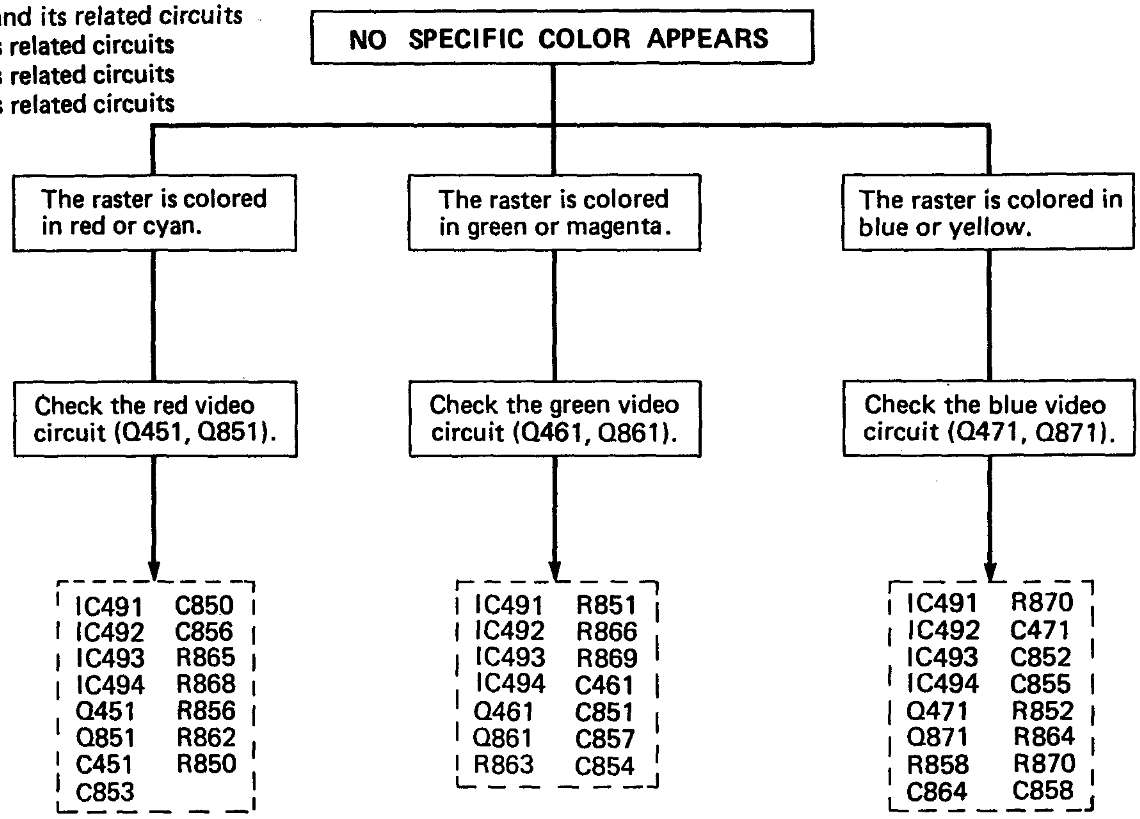
→ IC601 R505 R506 R519
Q501 D502 R507 R520
Q502 D503 R508 C509
DY601 R503 R516 C510
D504 R504 R518 C512
R524

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

Note:
Ripple current signal is represented at the junction of C706 and R703.

Circuits Checked:

- IC491 to 4 and its related circuits
- Q851 and its related circuits
- Q861 and its related circuits
- Q871 and its related circuits

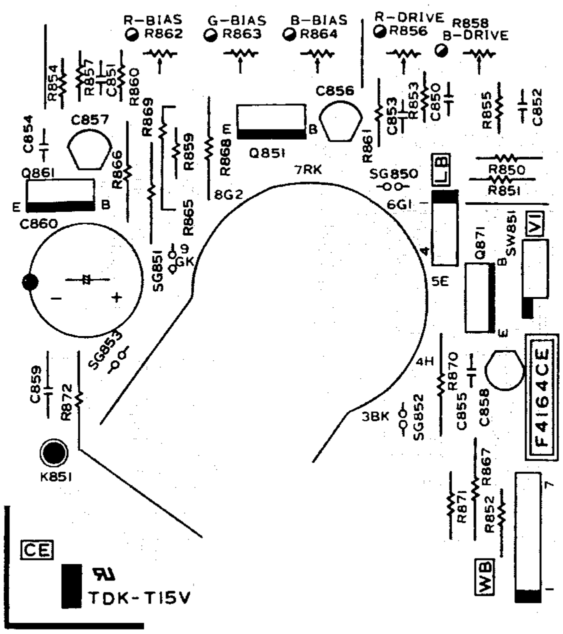


P. C. BOARD (Top and Bottom Views)

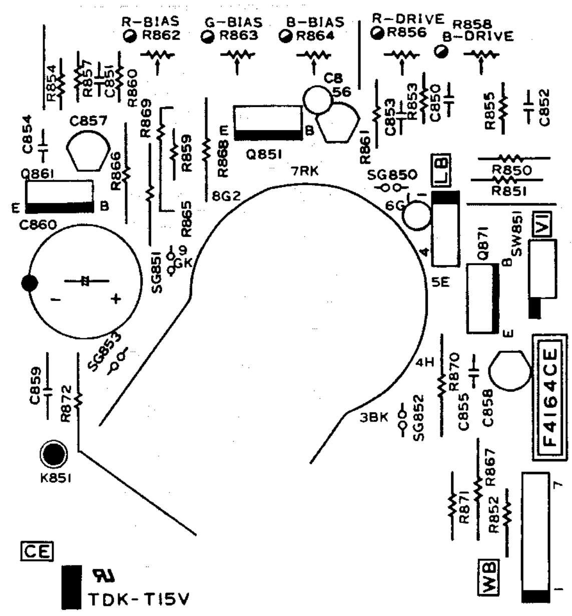
CRT Socket PCB (Top View)

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

* U.S.A. up to 55050/CANADA up to 7004

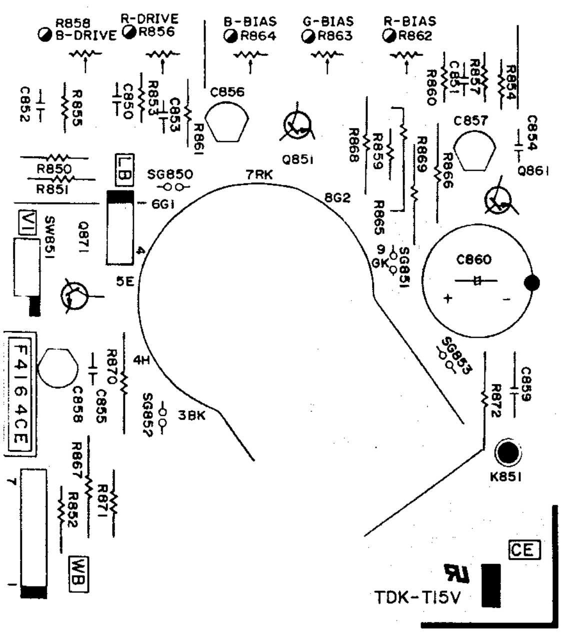


* U.S.A. 55051 ~ /CANADA 7005 ~

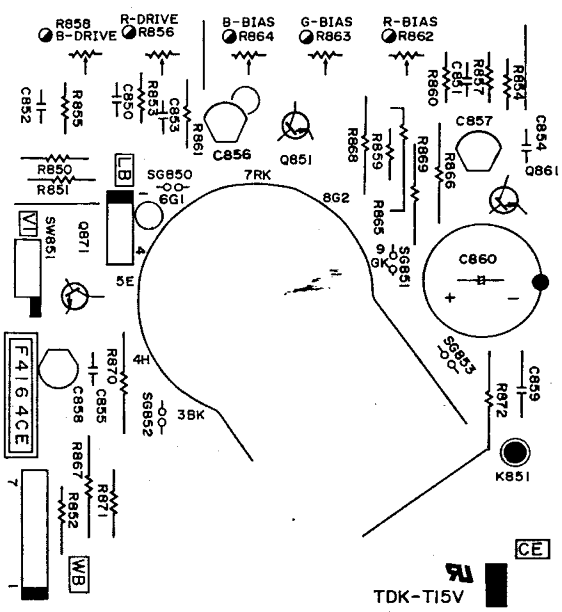


CRT Socket PCB (Bottom View)

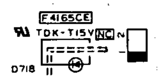
* U.S.A. up to 55050/CANADA up to 7004



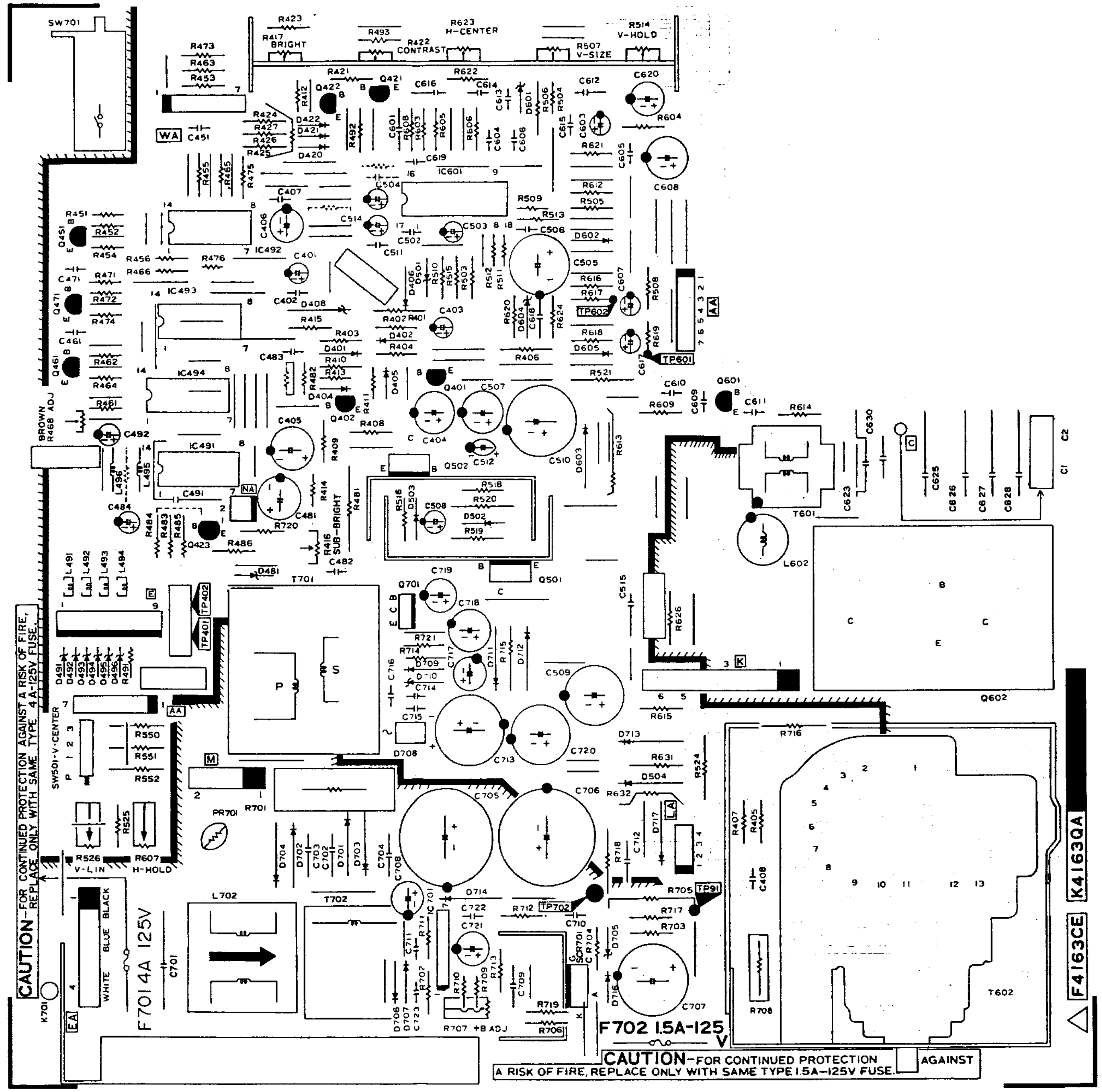
* U.S.A. 55051 ~ /CANADA 7005 ~



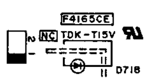
LED PCB (Top View)



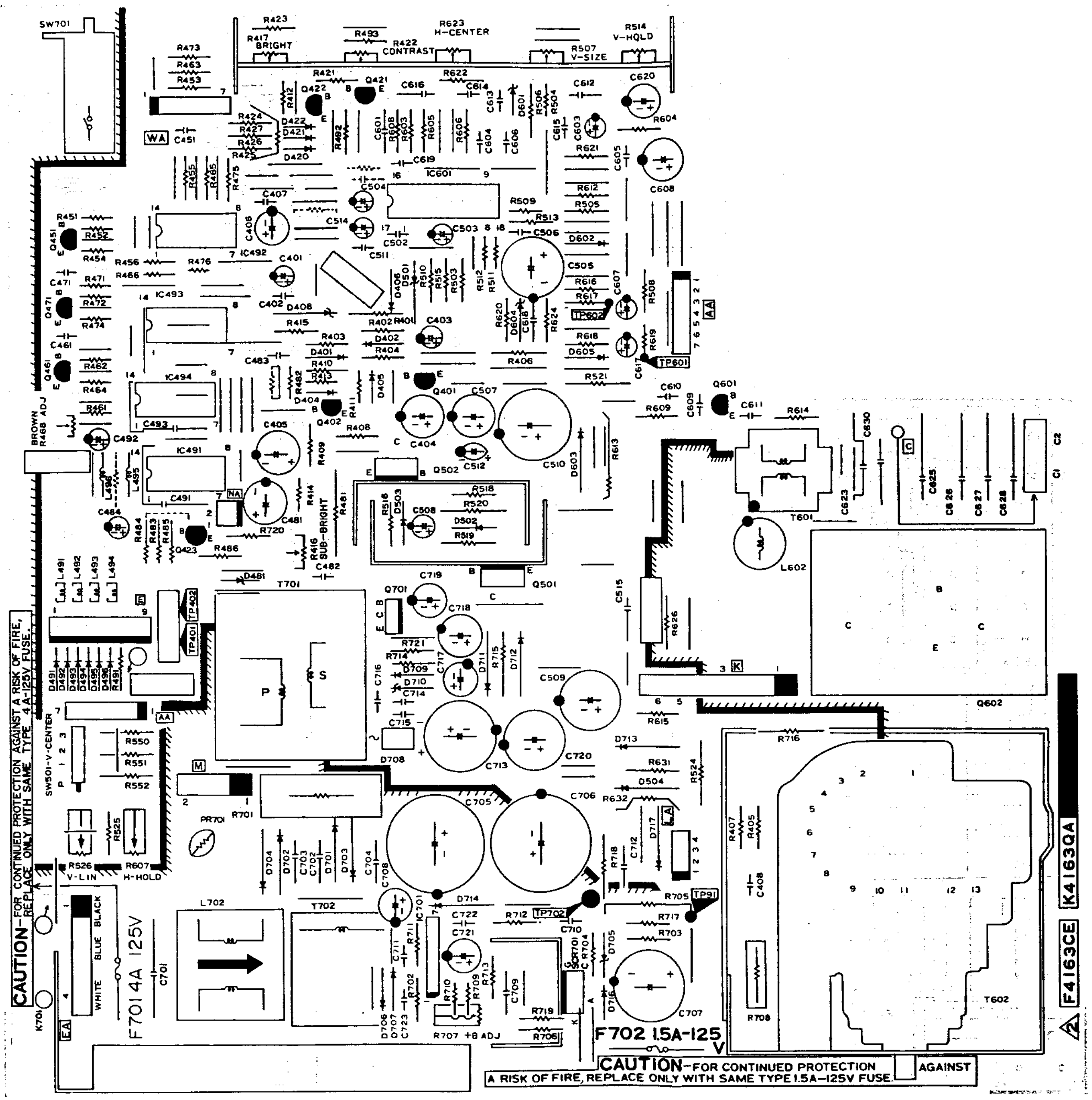
Main PCB (Top View) * U.S.A. up to 55050/CANADA up to 7004



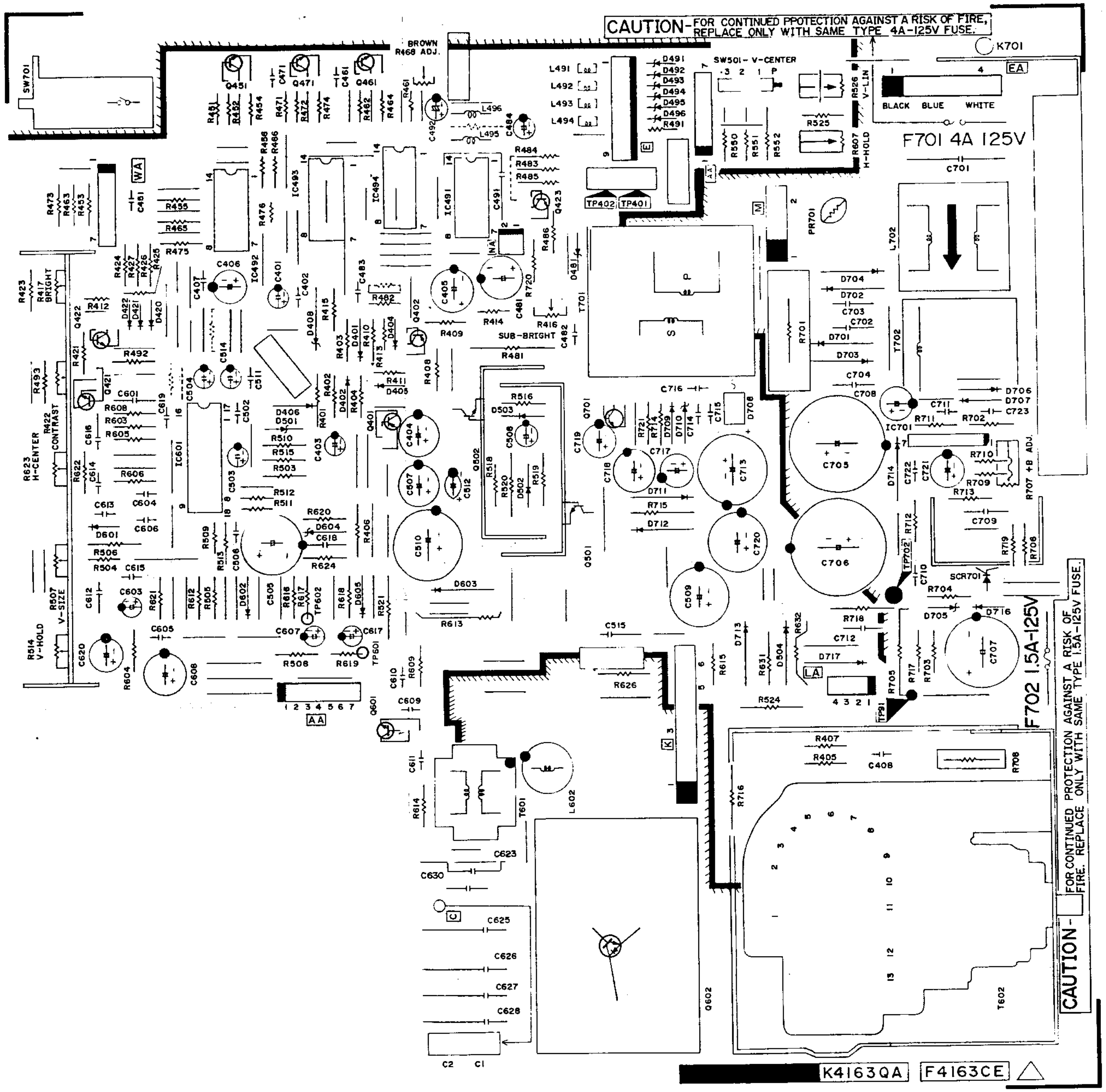
LED PCB (Bottom View)



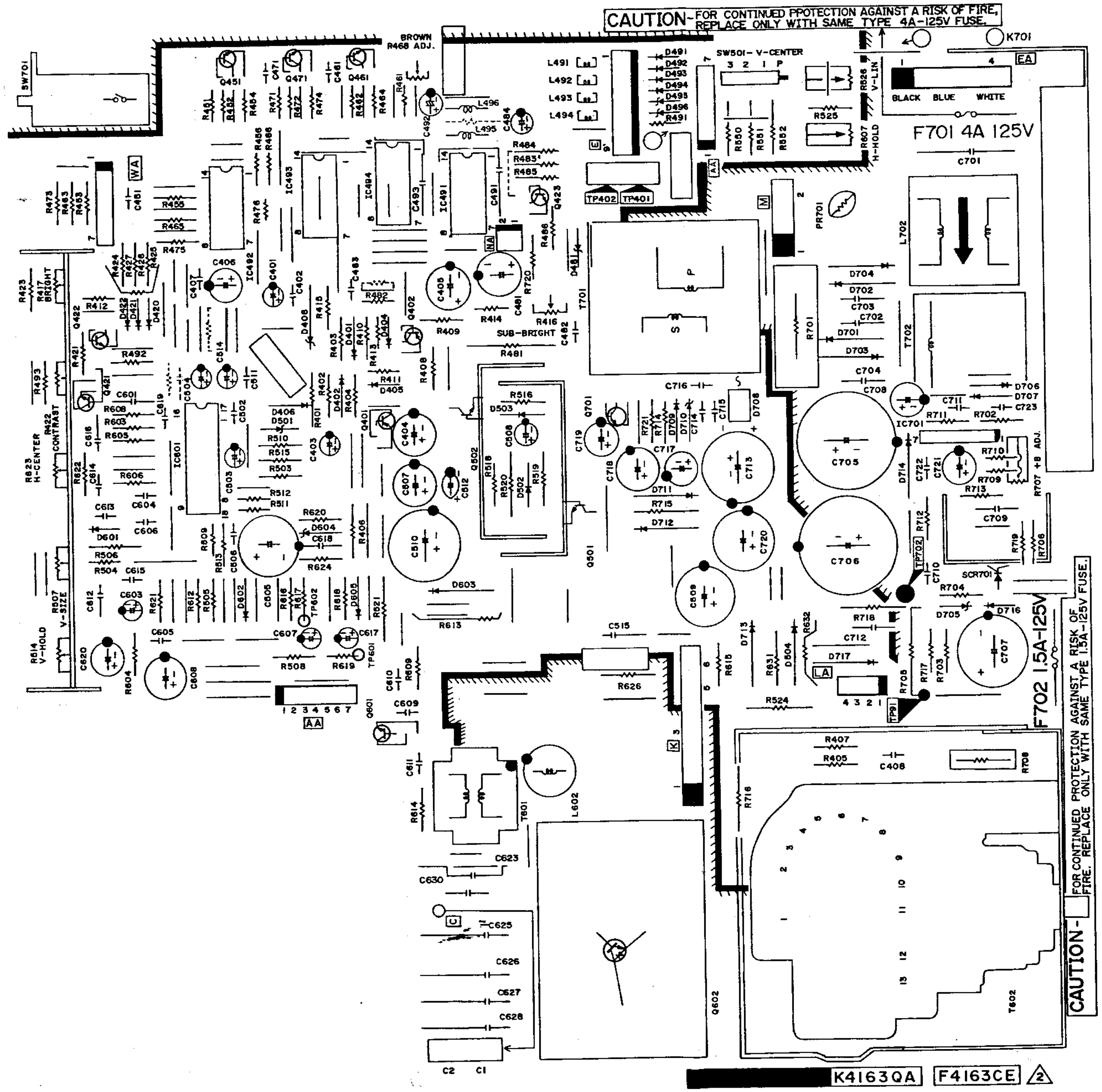
Main PCB (Top View)   * U.S.A. 55051 ~ /CANADA 7005 ~



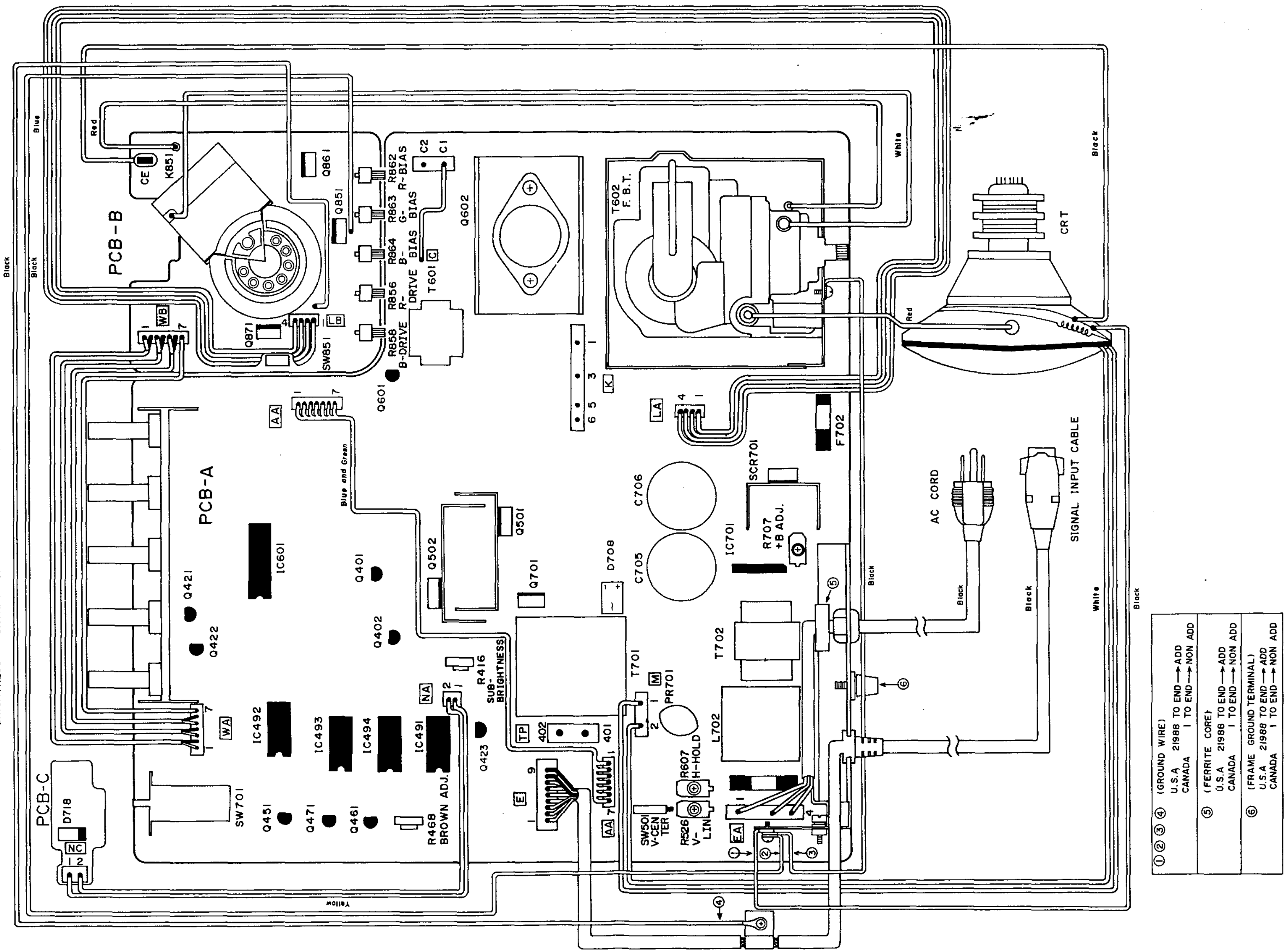
Main PCB (Bottom View) * U.S.A. up to 55050/CANADA up to 7004



Main PCB (Bottom View) * U.S.A. 55051 ~ /CANADA 7005 ~



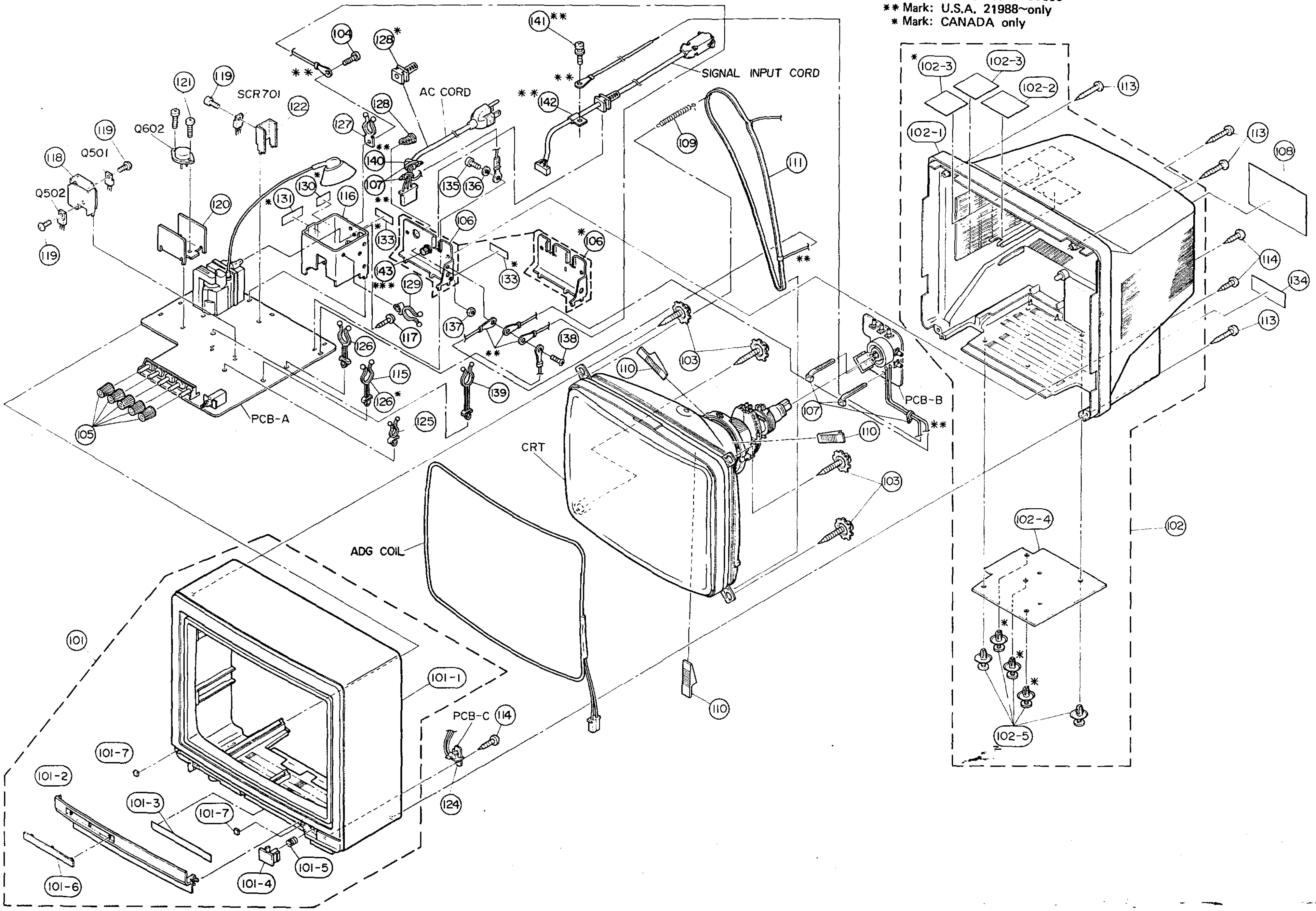
WIRING DIAGRAM AND PARTS LOCATION



1. Cabinet Exploded View

CABINET EXPLODED VIEW/PARTS LIST

*** Mark: U.S.A. 21988~55000
** Mark: U.S.A. 21988~only
* Mark: CANADA only



2. 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 4 of this service manual. Do not degrade the safety of the product through improper servicing. 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)**	AX9203	DUNTK4163RA0H DUNTK4163RA1H
CAPACITORS			
C401	Electrolytic, 22μF, 16V, ±20%	CC226MDAP	VCEAAA1CW226M
C402	Ceramic, 0.01μF, 50V, +80−20%	CC103ZJCP	VCKZPA1HF103Z
C403	Electrolytic, 10μF, 50V, ±20%	CC106MJAP	VCEAGA1HW106M
C404	Electrolytic, 47μF, 16V, ±20%	CC476MDAP	VCEAGA1CW476M
C405	Electrolytic, 100μF, 25V, ±20%	CC107MFAP	VCEAGA1EW107M
C406	Electrolytic, 47μF, 25V, ±20%	CC476MFAP	VCEAGA1EW476M
C407	Ceramic, 0.01μF, 50V, +80−20%	CC103ZJCP	VCKZPA1HF103Z
C408	Ceramic, 100pF, 500V, ±10%	CC104KJCP	VCKYPA2HB101K
C451	Ceramic, 15pF, 50V, ±5%	CC150JJCP	VCCSPA1HL150J
C461	Ceramic, 15pF, 50V, ±5%	CC150JJCP	VCCSPA1HL150J
C471	Ceramic, 15pF, 50V, ±5%	CC150JJCP	VCCSPA1HL150J
C481	Electrolytic, 220μF, 16V, ±20%	CC227MDAP	VCEAGA1CW227M
C482	Ceramic, 0.01μF, 50V, ±+80−20%	CC103ZJCP	VCKZPA1HF103Z
C483	Ceramic, 820pF, 50V, ±10%	CC821KJCP	VCKZPA1HB821K
C484	Electrolytic, 1μF, 50V, ±20%	CC105MJAP	VCEAAA1HW105M
C491	Ceramic, 0.1μF, 25V, +80−20%	CC104ZFCP	VCTYPU1EF104Z
C492	Electrolytic, 1μF, 50V, ±20%	CC105MJAP	VCEAAA1HW105M
C493	Ceramic, 0.1μF, 25V, +80−20% (U.S.A. 21988~)	CC104ZFCP	VCTYPU1EF104Z
C502	Ceramic, 180pF, 50V, ±5%	CC181JJCP	VCCSPA1HL181J
C503	Tantalum, 2.2μF, 35V, ±10%	CC225KGTP	VCSATA1VE225K
C504	Electrolytic, 1μF, 50V, ±20%	CC105MJAP	VCEAAA1HW105M
C505	Electrolytic, 1000μF, 16V, ±20%	CC108MJAP	VCEAAA1CW108M
C506	Ceramic, 0.0047μF, 50V, ±10%	CC472KJCP	VCKZPA1HB472K
C507	Electrolytic, 33μF, 16V, ±10%	CC336KDAP	VCEACA1CC336K
C508	Electrolytic, 10μF, 25V, ±20%	CC106MFAP	VCEAAA1EW106M
C509	Electrolytic, 470μF, 25V, ±20%	CC477MFAP	VCEAAA1EW477M
C510	Electrolytic, 1000μF, 50V, ±20%	CC108MJAP	VCEAAH1HW108M
C511	Ceramic, 39pF, 50V, ±5%	CC390JJCP	VCCSPA1HL390J
C512	Tantalum, 2.2μF, 35V, ±10%	CC225KGTP	VCSATA1VE225K
C514	Electrolytic, 10μF, 16V, ±20%	CC106MDAP	VCEAAA1CW106M
C515	Ceramic, 0.01μF, 500V, ±10%	CC103KUCP	VCKYPB2HB103K
C601	Mylar*, 0.018μF, 50V, ±10%	CC183KJMP	VCQYSH1HM183K
C603	Electrolytic, 1μF, 50V, ±20%	CC105MJAP	VCEAAA1HW105M
C604	Polypro Film, 0.0027μF, 100V, ±2%	CC272GLHP	VCQPSA2AA272G

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

REF.NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
C605	Mylar, 0.0068μF, 50V, ±10%	CC682KJMP	VCQYSH1HM682K
C606	Mylar, 0.0022μF, 50V, ±5%	CC222KJMP	VCQYSH1HM222J
C607	Electrolytic, 10μF, 16V, ±20%	CC106MDAP	VCEAAA1CW106M
C608	Electrolytic, 220μF, 25V, ±20%	CC227MFAP	VCEAGA1EW227M
C609	Ceramic, 0.001μF, 50V, ±10%	CC102KJCP	VCKZPA1HB102K
C610	Mylar, 0.0047μF, 50V, ±10%	CC472KJMP	VCQYSH1HM472K
C611	Mylar, 0.015μF, 50V, ±10%	CC153KJMP	VCQYSH1HM153K
C612	Mylar, 0.056μF, 50V, ±10%	CC563KJCP	VCQYSH1HM563K
C613	Mylar, 0.027μF, 50V, ±10%	CC273KJMP	VCQYSH1HM273K
C614	Ceramic, 0.001μF, 50V, ±10%	CC102KJCP	VCKZPA1HB102K
C615	Ceramic, 0.01μF, 50V, ±10%	CC103KJCP	VCKZPA1HB103K
C616	Ceramic, 470pF, 50V, ±10%	CC471KJCP	VCKZPA1HB471K
C617	Electrolytic, 4.7μF, 50V, ±20%	CC475MJAP	VCEAGA1HW475M
C618	Ceramic, 0.001μF, 50V, ±10%	CC102KJCP	VCKZPA1HB102K
C619	Ceramic, 82pF, 50V, ±5%	CC820JJCP	VCCSPA1HL820J
C620	Electrolytic, 100μF, 25V, ±20%	CC107MFAP	VCEAGA1EW107M
C623 ⚠	Metalized Polypro, 0.33μF, 200V, ±5%	CC334JPGP	VCFPPD2DB334J
C625 ▲⚠	Metalized Polypro, 0.0022μF, 1.6kV, ±5%	CC222JYHP	VCFPPC3CA222J
C626 ▲⚠	Metalized Polypro, 0.0015μF, 1.6kV, ±5%	CC152JYHP	VCFPPC3CA152J
C627 ▲⚠	Metalized Polypro, 0.0015μF, 1.6kV, ±5%	CC152JYHP	VCFPPC3CA152J
C628 ▲⚠	Metalized Polypro, 0.0015μF, 1.6kV, ±5%	CC152JYHP	VCFPPC3CA152J
C629	Not used		
C630 ⚠	Polypro Film, 0.068μF, 200V, ±10%	CC683KPHP	VCQPSC2DA683K
C701 ⚠	Across Line, 0.22μF, 125V (AC), ±20%	AC-0091	RC-QZ019DCEZZ
C702	Ceramic, 0.01μF, 250V (AC)/1.4kV (DC), ±5%	CC103JYCP	RC-KZ007JCEZZ
C703	Ceramic, 0.01μF, 250V (AC)/1.4kV (DC), ±5%	CC103JYCP	RC-KZ007JCEZZ
C704	Ceramic, 0.01μF, 500V, ±10%	CC103KUCP	VCKYPB2HB103K
C705 ⚠	Electrolytic, 470μF, 200V, ±20%	CC477MPAP	RC-EZ0164CEZZ
C706 ⚠	Electrolytic, 330μF, 200V, ±20%	CC337MPAP	RC-EZ0162CEZZ
C707 ⚠	Electrolytic, 100μF, 160V, ±20%	CC107MNAP	VCEAAH2CW107M
C708	Electrolytic, 47μF, 50V, ±20%	CC476MJAP	VCEAGA1HW476M
C709	Polypro Film, 0.047μF, 200V, ±10%	CC473KPHP	VCQPSB2DA473K
C710	Ceramic, 0.0047μF, 500V, ±10%	CC472KUCP	VCKYPA2HB472K
C711 ▲⚠	Ceramic, 0.01μF, 50V, ±10%	CC103KJCP	VCKZPA1HB103K
C712 ⚠	Ceramic, 3300pF, 125V AC, ±20%	CC332MXCP	RC-KZ0030CEZZ
C713	Electrolytic, 1000μF, 35V, ±20%	CC108MGAP	VCEAAH1VW108M
C714	Ceramic, 0.01μF, 50V, +80−20%	CC103ZJCP	VCKZPA1HF103Z
C715	Ceramic, 0.01μF, 50V, +80−20%	CC103ZJCP	VCKZPA1HF103Z
C716	Ceramic, 0.01μF, 50V, +80−20%	CC103ZJCP	VCKZPA1HF103Z
C717	Electrolytic, 100μF, 16V, ±20%	CC107MDAP	VCEAGA1CW107M
C718	Electrolytic, 470μF, 16V, ±20%	CC477MDAP	VCEAGA1CW477M
C719	Electrolytic, 100μF, 25V, ±20%	CC107MFAP	VCEAGA1EW107M
C720 ⚠	Electrolytic, 470μF, 25V, ±20%	CC477MFAP	VCEAAA1EW477M
C721 ⚠	Electrolytic 100μF, 25V, ±20%	CC107MFAP	VCEAGA1EW107M
C722	Ceramic, 0.001μF, 500V, ±10%	CC102KUCP	VCKYPA2HB102K
C723	Ceramic, 0.022μF, 50V, +80−20% (U.S.A. Up to 66050/CANADA Up to 7004)	CC223ZJCP	VCKZPA1HF223Z
C723	Mylar, 0.022μF, 50V, ±10% (U.S.A. 66051~/CANADA 7005~)		VCQYSH1HM223K

REF.NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
CONNECTORS			
TP401/ TP402	Plug, TP	J7460	QPLGN0207CEZZ
C	Plug, H-Size, 2-Pin	J7460	QPLGN0207CEZZ
M	Plug, ADG coil, 2-pin	J7460	QPLGN0207CEZZ
NA	Plug, LED, 2-pin	J7501	QPLGN0213GEZZ
E	Plug, Video Input, 9-pin	J7508	QPLGN0913GEZZ
EA	Plug, AC Input, 4-pin	AJ7597	QPLGN0404CEZZ
K	Plug, Deflection Yoke, 6-pin	J4001	QPLGN0603CEZZ
LA~LB	Socket for CRT PCB, 4-pin	AJ4023	CSOCN0430RA5C
WA~WB	Socket for CRT PCB, 7-pin (U.S.A.)	AJ4024	CSOCN0730RA07
	(CANADA)		CSOCN0730RA08
DIODES			
D401	1S2471 Silicon	DX2447	RH-DX0046CEZZ
D402	1S2473 Silicon	DX0230	RH-DX0048CEZZ
D404	1SS133 Silicon	DX2230	RH-DX0142CEZZ
D405	1SS133 Silicon	DX2230	RH-DX0142CEZZ
D406	1S2473 Silicon	DX0230	RH-DX0048CEZZ
D407	Not used		
D408	Zener AW 08—12 Silicon	DX2451	RH-EX0061CEZZ
D420	1SS133 Silicon	DX2230	RH-DX0142CEZZ
D421	1SS133 Silicon	DX2230	RH-DX0142CEZZ
D422	1SS133 Silicon	DX2230	RH-DX0142CEZZ
D481	Zener RD 5.1EB	DX0398	RH-EX0049CEZZ
D491	Zener RD 5.1EB (CANADA/USA Up to 21987)	DX0398	RH-EX0049CEZZ
	1SS119 Silicon (USA 21988~)		VHD1SS119//-1
D492	Zener RD 5.1EB (CANADA/USA Up to 21987)	DX0398	RH-EX0049CEZZ
	1SS119 Silicon (USA 21988~)		VHD1SS119//-1
D493	Zener RD 5.1EB (CANADA/USA Up to 21987)	DX0398	RH-EX0049CEZZ
	1SS119 Silicon (USA 21988~)		VHD1SS119//-1
D494	Zener RD 5.1EB (CANADA/USA Up to 21987)	DX0398	RH-EX0049CEZZ
	1SS119 Silicon (USA 21988~)		VHD1SS119//-1
D495	Zener RD 5.1EB	DX0398	RH-EX0049CEZZ
D496	Zener RD 5.1EB	DX0398	RH-EX0049CEZZ
D501	Zener RD 6.2EB Silicon (Up to 4050 U.S.A.)	DX0501	RH-EX0024CEZZ
D501	Zener RD 6.2F Silicon (CANADA/U.S.A. 4051~)		RH-EX0247CEZZ
D502	1S2473 Silicon	DX0230	RH-DX0048CEZZ
D503	1S2473 Silicon	DX0230	RH-DX0048CEZZ
D504 ⚠	TVR1J Silicon	DX2617	RH-DX0105TAZZ
D601	1SS133 Silicon	DX2230	RH-DX0142CEZZ
D602	1S2473 Silicon	DX0230	RH-DX0048CEZZ
D603 ▲⚠	RH1S Silicon	DX2275	RH-DX0086TAZZ
D604	Zener RD 12E Silicon	DX2311	RH-EX0047CEZZ
D605 ▲⚠	Zener RD 22E Silicon	DX1162	RH-EX0091CEZZ

REF.NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
D701 ⚠	1S1887 Silicon	DX2443	RH-DX0038CEZZ
D702 ⚠	1S1887 Silicon	DX2443	RH-DX0038CEZZ
D703 ⚠	1S1887 Silicon	DX2443	RH-DX0038CEZZ
D704 ⚠	1S1887 Silicon	DX2443	RH-DX0038CEZZ
D705 ⚠	Zener HZ60 Silicon	DX0237	RH-EX0086CEZZ
D706	1S2473 Silicon	DX0230	RH-DX0048CEZZ
D707	1S2473 Silicon	DX0230	RH-DX0048CEZZ
D708	1D4B42 Silicon	DX0235	RH-DX0200CEZZ
D709	1SS119 Silicon	DX2272	VHD1SS119//-1
D710	Zener RD 12E Silicon	DX2311	RH-EX0047CEZZ
D711	S5277G Silicon	DX2276	RH-DX0110CEZZ
D712	RH1S Silicon	DX2275	RH-DX0086TAZZ
D713 ⚠	RG2 Silicon	DX0236	RH-DX0181CEZZ
D714 ▲⚠	RF1 Silicon	DX2450	RH-DX0101CEZZ
D716	1S2473 Silicon	DX0230	RH-DX0048CEZZ
D717 ⚠	RH1S Silicon	DX2275	RH-DX0086TAZZ
SCR701⚠ ▲	Silicon Controlled Rectifier S6192F	DX2454	VHSS6192FLB1E
FUSES			
F701 ⚠	4A, Fast Blow	HF-1193	QFS-B4021GEZZ
F702 ⚠	1.5A, Fast Blow	AHF0010	QFS-B1521GEZZ
ICs			
IC491	IC SN74S04N HEX Inverter	AMX4945	VHISN74S04/-1
IC492	IC HD7406 HEX Inverter (Open Collector)	AMX3675	VHIHD7406//-1
IC493	IC HD7426 Quad 2-Input Gate	MX4297	VHIHD7426//-1
IC494	IC SN74S11N Tripple 3-Input AND Gate	MX6406	VHISN74S11/-1
IC601 ▲⚠	IC HA11235 SYNC. AFC, X-Ray Protector, Bipolar Linear	MX6452	RH-IX0065CEZZ
IC701 ▲⚠	IC T2058 Power Regulator, Bipolar Linear	MX6092	RH-IX0137CEZZ
COILS			
L491	Ferrite Bead		RBLN-0038CEZZ
L492	Ferrite Bead		RBLN-0038CEZZ
L493	Ferrite Bead		RBLN-0038CEZZ
L494	Ferrite Bead		RBLN-0038CEZZ
L495	Ferrite Bead		RBLN-0018CEZZ
L496	Ferrite Bead		RBLN-0018CEZZ
L602	Linearity Coil	ACA8373	RCILZ0213CEZZ
L702 ⚠	Line Filter	ACA8382	RCILF0087CEZZ
TRANSISTORS			
Q401	2SA1015(Y) A.B.L., Silicon PNP	2SA1015	VS2SA1015Y/1E

REF.NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
Q402	2SA854(Q) Blanking, Silicon PNP	2SA854Q	VS2SA854-Q/1E
Q421	2SC1815(Y) Contrast Circuit, Silicon NPN	2SC1815Y	VS2SC1815YW-1
Q422	2SC1815(Y) Contrast Circuit, Silicon NPN	2SC1815Y	VS2SC1815YW-1
Q423	2SC1815(Y) Horizontal Sync. Silicon NPN	2SC1815Y	VS2SC1815YW-1
Q451	2SC1815(Y) Red Amp., Silicon NPN	2SC1815Y	VS2SC1815YW-1
Q461	2SC1815(Y) Green Amp., Silicon NPN	2SC1815Y	VS2SC1815YW-1
Q471	2SC1815(Y) Blue Amp., Silicon NPN	2SC1815Y	VS2SC1815YW-1
Q501	2SC1826 (G) Vertical Output, Silicon NPN	2SC1826	VS2SC1826GL2E
Q502	2SC1826 (G) Vertical Output, Silicon NPN	2SC1826	VS2SC1826GL2E
Q601	2SC1213A (C) Horizontal Driver, Silicon NPN	2SC1213C	VS2SC1213AC1A
Q602 ⚠	2SD869 Horizontal Output, Silicon NPN	2SD869	VS2SD869-//1E
Q701	2SD325 (F) B+ Regulator, Silicon NPN	2SD325	VS2SD325-F/1E
RESISTORS: Unless otherwise specified, resistors are 1/4W, ±5%, carbon type.			
R401	Oxide Film, 270 ohm, 1W, ±5%	N0155EGD	VRS-VV3AB271J
R402	330 ohm	N0189EEC	VRD-RA2EE331J
R403	12k ohm	N0288EEC	VRD-RA2EE123J
R404	5.6k ohm	N0257EEC	VRD-RA2EE562J
R405	10k ohm	N0281EEC	VRD-RA2EE103J
R406	Oxide Film, 3.9k ohm, 1W, ±5%	N0237EGD	VRS-VV3AB392J
R407	10k ohm	N0281EEC	VRD-RA2EE103J
R408	1.2k ohm	N0199EEC	VRD-RA2EE122J
R409	820 ohm	N0187EEC	VRD-RA2EE821J
R410	120 ohm	N0136EEC	VRD-RA2EE121J
R411	Carbon, 1.5k ohm, 1/8W, ±5%	N0206EBC	VRD-RA2BE152J
R412	Carbon, 1.8k ohm, 1/8W, ±5%	N0210EBC	VRD-RA2BE182J
R413	Carbon, 470 ohm, 1/8W, ±5%	N0169EBC	VRD-RA2BE471J
R414	Carbon, 330 ohm, 1/8W, ±5%	N0159EEC	VRD-RA2BE331J
R415	330 ohm	N0189EEC	VRD-RA2EE331J
R416	*See* Controls (PCB-A)		
R417	*See* Controls (PCB-A)		
R421	1.2k ohm	N0199EEC	VRD-RA2EE122J
R422	*See* Controls (PCB-A)		
R423	270 ohm	N0155EEC	VRD-RA2EE271J
R424	Oxide Film, 470 ohm, 1W, ±5%	N0169EGD	VRS-VV3AB471J
R425	Carbon, 270 ohm, 1/2W, ±5%	N0155EFC	VRD-RA2HD271J
R426	Carbon, 270 ohm, 1/2W, ±5%	N0155EFC	VRD-RA2HD271J
R427	Carbon, 270 ohm, 1/2W, ±5%	N0155EFC	VRD-RA2HD271J
R451	Carbon, 680 ohm, 1/8W, ±5%	N0183EBC	VRD-RA2BE681J
R452	Carbon, 1.5k ohm, 1/8W, ±5%	N0206EBC	VRD-RA2BE152J
R453	470 ohm	N0169EEC	VRD-RA2EE471J
R454	Carbon, 820 ohm, 1/8W, ±5%	N0187EBC	VRD-RA2BE821J
R455	1.2k ohm	N0199EEC	VRD-RA2EE122J
R456	8.2k ohm	N0122EEC	VRD-RU2EE822J
R461	Carbon, 680 ohm, 1/8W, ±5%	N0183EBC	VRD-RA2BE681J
R462	Carbon, 1.5k ohm, 1/8W, ±5%	N0206EBC	VRD-RA2BE152J
R463	470 ohm	N0169EEC	VRD-RA2EE471J

REF.NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
R464	Carbon, 820 ohm, 1/8W, ±5%	N0187EBC	VRD-RA2BE821J
R465	1.2k ohm	N0199EEC	VRD-RA2EE122J
R466	8.2k ohm	N0122EEC	VRD-RU2EE822J
R468	*See* Controls (PCB-A)		
R471	Carbon, 680 ohm, 1/8W, ±5%	N0183EBC	VRD-RA2BE681J
R472	Carbon, 1.5k ohm, 1/8W, ±5%	N0206EBC	VRD-RA2BE152J
R473	470 ohm	N0169EEC	VRD-RA2EE471J
R474	Carbon, 820 ohm, 1/8W, ±5%	N0187EBC	VRD-RA2BE821J
R475	1.2k ohm	N0199EEC	VRD-RA2EE122J
R476	8.2k ohm	N0122EEC	VRD-RU2EE822J
R481 ⚠	Oxide Film, 82 ohm, 3W, ±5%	N0122EJD	VRS-VV3LB820J
R482	Carbon, 330 ohm, 1/8W, ±5%	N0189EEC	VRD-RA2BE331J
R483	120k ohm	N0375EEC	VRD-RA2EE124J
R484	10k ohm	N0281EEC	VRD-RA2EE103J
R485	680 ohm	N0183EEC	VRD-RA2EE681J
R486	100 ohm	N0132EEC	VRD-RA2EE101J
R491	Carbon, 560 ohm, 1/8W, ±5%	N0176EBC	VRD-RA2BE561J
R492	56 ohm	N0107EEC	VRD-RA2EE560J
R493	5.6k ohm	N0257EEC	VRD-RA2EE562J
R503	390 ohm	N0162EEC	VRD-RA2EE391J
R504	Carbon, 2.7k ohm, 1/8W, ±5%	N0224EBC	VRD-RA2BE272J
R505	10k ohm	N0281EEC	VRD-RA2EE103J
R506	Oxide Film, 82 ohm, 1W, ±5%	N0122EGD	VRS-VV3AB820J
R507	*See* Controls (PCB-A)		
R508	Carbon, 4.7 ohm, 1/2W, ±5%	N0040EFC	VRD-RA2HD4R7J
R509	Carbon, 4.7k ohm, 1/8W, ±5%	N0247EBC	VRD-RA2BE472J
R510	470 ohm	N0169EEC	VRD-RA2EE471J
R511	Carbon, 12k ohm, 1/8W, ±5%	N0288EBC	VRD-RA2BE123J
R512	Carbon, 47k ohm, 1/8W, ±5%	N0340EBC	VRD-RA2BE473J
R513	3.3k ohm	N0230EEC	VRD-RA2EE332J
R514	*See* Controls (PCB-A)		
R515	4.7k ohm	N0247EEC	VRD-RA2EE472J
R516	3.3k ohm	N0230EEC	VRD-RA2EE332J
R518	Carbon, 5.6 ohm, 1/2W, ±5%	N0052EFC	VRD-RA2HD5R6J
R519	Carbon, 390 ohm, 1/2W, ±5%	N0162EFC	VRD-RA2HD391J
R520	Oxide Film, 390 ohm, 1W, ±5%	N0162EGD	VRS-VV3AB391J
R521	Oxide Film, 680 ohm, 2W, ±5%	N0183EHD	VRS-VV3DB681J
R523	Not used		
R524 ⚠	Oxide Film, 15 ohm, 2W, ±5%	N0074EHD	VRS-VV3DB150J
R525	82 ohm	N0122EEC	VRD-RA2EE820J
R526	*See* Controls (PCB-A)		
R527	Not used		
R528	Not used		
R550	Oxide Film, 3.3k ohm, 1W, ±5%	N0230EGD	VRS-VV3AB332J
R551	Oxide Film, 2.2k ohm, 1W, ±5%	N0216EGD	VRS-VV3AB222J
R552	Oxide Film, 270 ohm, 1W, ±5%	N0155EGD	VRS-VV3AB271J
R603	15k ohm	N0297EEC	VRD-RA2EE153J
R604	8.2k ohm	N0271EEC	VRD-RA2EE822J

REF.NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
R605	33k ohm	N0324EEC	VRD-RA2EE333J
R606	12k ohm	N0288EEC	VRD-RA2EE123J
R607	*See* Controls (PCB-A)		
R608	680k ohm	N0433EEC	VRD-RA2EE684J
R609	220 ohm	N0149EEC	VRD-RA2EE221J
R612	220 ohm	N0149EEC	VRD-RA2EE221J
R613 ⚠	Oxide Film, 47 ohm, 3W, ±5%	N0099EJD	VRS-VV3LB470J
R614	100 ohm	N0132EEC	VRD-RA2EE101J
R615 ▲⚠	Carbon, 47 ohm, 1/2W, ±5%	N0099EFC	VRD-RA2HD470J
R616	100 ohm	N0132EEC	VRD-RA2EE101J
R617	3.9k ohm	N0237EEC	VRD-RA2EE392J
R618 ▲⚠	10k ohm	N0281EEC	VRD-RA2EE103J
R619 ▲⚠	Carbon, 10k ohm, 1/8W, ±5%	N0281EBC	VRD-RA2BE103J
R620	100 ohm	N0132EEC	VRD-RA2EE101J
R621	100 ohm	N0132EEC	VRD-RA2EE101J
R622	4.7k ohm	N0247EEC	VRD-RA2EE472J
R623	*See* Controls (PCB-A)		
R624	15k ohm	N0297EEC	VRD-RA2EE153J
R626	Oxide Film, 560 ohm, 1W, ±5%	N0176EGD	VRS-VV3AB561J
R631 ⚠	Oxide Film, 10 ohm, 1/2W, ±5%	N0063EFD	VRS-SV2HC100J
R632 ⚠	Oxide Film, 3.3 ohm, 1W, ±5%	N0037EGD	VRN-VV3AB3R3J
R701 ⚠	Cement, 1.8 ohm, 5W, ±10%	N0029FKF	VRW-KP3HC1R8K
R702	180k ohm	N0387EEC	VRD-RA2EE184J
R703 ▲⚠	33k ohm	N0324EEC	VRD-RA2EE333J
R704 ⚠	Oxide Film, 150 ohm, 1/2W, ±5%	N0142EFD	VRS-SV2HC151J
R705 ⚠	Oxide Film, 330 ohm, 3W, ±5%	N0159EJD	VRS-VV3LB331J
R706 ▲⚠	82k ohm	N0360EEC	VRD-RA2EE823J
R707	*See* Controls (PCB-A)		
R708 ⚠	Cement, 2.7 ohm, 5W, ±10%	N0034FKF	RR-WZ0058CEZZ
R709 ▲⚠	Carbon, 3.9k ohm, 1/8W, ±5%	N0237EBC	VRD-RA2BE392J
R710	Carbon, 15k ohm, 1/8W, ±5%	N0297EBC	VRD-RA2BE153J
R711	560 ohm	N0176EEC	VRD-RA2EE561J
R712	56 ohm	N0107EEC	VRD-RA2EE560J
R713	Carbon, 12k ohm, 1/2W, ±5%	N0288EFC	VRD-RA2HD123J
R714	1k ohm	N0196EEC	VRD-RA2EE102J
R715 ⚠	Oxide Film, 39 ohm, 1/2W, ±5%	N0092EFD	VRS-SV2HC390J
R716 ⚠	Oxide Film, 0.68 ohm, 1W, ±5%	N0015EGD	VRN-VV3ABR68J
R717 ⚠	1 ohm	N0022EEC	VRD-RA2EE1R0J
R718 ⚠	Carbon, 3.9M ohm, 1/2W, ±10%	N0460FFB	VRC-UA2HG395K
R719 ▲⚠	680k ohm	N0433EEC	VRD-RA2EE684J
R720	1.5k ohm	N0206EEC	VRD-RA2EE152J
R721	1.2k ohm	N0199EEC	VRD-RA2EE122J

TRANSFORMERS

REF.NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
T601	Horizontal Driver	ATB0425	RTRNZ0217CEZZ
T602 ▲⚠	(Flyback)	ATB0428	RTRNF1545CEZZ

REF.NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
T701	Power (U.S.A.)	ATA0011	RTRNP0361CEZZ
	(CANADA)		RTRNP0372CEZZ
T702	Power Choke	ATA1062	RTRNC0028CEZZ

SWITCHES

SW501	V-Center	AS0020	QSW-B0006CEZZ
SW701	Power	AS0015	QSW-P0317CEZZ

CONTROLS

R416	Pot, Sub-Brightness, B-curve 10k ohm	AP7412	RVR-M7053TAZZ
R417/	Pot, Brightness, B-curve 10k ohm	AP7003	RVR-Z4044CEZZ
R422/	Pot, Contrast B-curve 100 ohm		
R507/	Pot, V-Size, B-curve 100 ohm		
R514/	Pot, V-Hold, B-curve 5k ohm		
R623	Pot, H-Center, B-curve 50k ohm		
R468	Pot, Brown ADJ, B-Curve 5k ohm	AP6690	RVR-M7198TAZZ
R526	Pot, V-Line, B-curve 500 ohm	AP7416	RVR-B4456CEZZ
R607	Pot, H-Hold, B-curve 5k ohm	AP7419	RVR-B4460CEZZ
R707 ▲⚠	Pot, B + ADJ, B-curve 1k ohm	P-7681	RVR-B4457CEZZ

MISCELLANEOUS

PR701 ⚠	Posistor	T-1251	RMPTP0026CEZZ
	Holder, Fuse	F-1406	QFSHD1002CEZZ

REF.NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
	P.C.B. Assembly, CRT Socket (PCB-B) **Consists of the following:**	AX9204	DUNTK4164RA0H

CAPACITORS

C850	Ceramic, 150pF, 50V, ±5%	CC151KJCP	VCCSPA1HL151J
C851	Ceramic, 150pF, 50V, ±5%	CC151KJCP	VCCSPA1HL151J
C852	Ceramic, 150pF, 50V, ±5%	CC151KJCP	VCCSPA1HL151J
C853	Ceramic, 150pF, 50V, ±5%	CC151KJCP	VCCSPA1HL151J
C854	Ceramic, 180pF, 50V, ±5%	CC181JJCP	VCCSPA1HL181J
C855	Ceramic, 180pF, 50V, ±5%	CC181JJCP	VCCSPA1HL181J
C856	*See* Controls		
C857	*See* Controls		
C858	*See* Controls		
C859	Ceramic, 0.01μF, 1.4KV, ±20%	CC103MYCP	RC-KZ007JCEZZ
C860	Electrolytic, 22μF, 250V, +50−10%	CC226WRAP	VCEAAH2EW226Y

REF.NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
CONNECTOR			
	(Socket) CRT Socket, 8-pin	AJ6018	QSOCV0819CEZZ
TRANSISTORS			
Q851	2SC2068 (LB) Red output, Silicon, NPN	2SC2068LB	VS2SC2068LB1E
Q861	2SC2068 (LB) Green output, Silicon, NPN	2SC2068LB	VS2SC2068LB1E
Q871	2SC2068 (LB) Blue output, Silicon, NPN	2SC2068LB	VS2SC2068LB1E
RESISTORS: Unless otherwise specified, resistors are 1/8W, ±5%, Carbon type.			
R850	47 ohm	N0099EBC	VRD-RA2BE470J
R851	47 ohm	N0099EBC	VRD-RA2BE470J
R852	47 ohm	N0099EBC	VRD-RA2BE470J
R853	150 ohm	N0142EBC	VRD-RA2BE151J
R854	270 ohm	N0155EBC	VRD-RA2BE271J
R855	150 ohm	N0142EBC	VRD-RA2BE151J
R856	*See* Controls (PCB-B)		
R857	150 ohm	N0142EBC	VRD-RA2BE151J
R858	*See* Controls (PCB-B)		
R859	820 ohm	N0187EBC	VRD-RA2BE821J
R860	820 ohm	N0187EBC	VRD-RA2BE821J
R861	820 ohm	N0187EBC	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%	N0257EHD	VRS-VV3DB562J
R866 ⚠	Oxide Film, 5.6k ohm, 2W, ±5%	N0257EHD	VRS-VV3DB562J
R867 ⚠	Oxide Film, 5.6k ohm, 2W, ±5%	N0257EHD	VRS-VV3DB562J
R868	Solid, 2.7k ohm, 1/2W, ±10%	N0224EFB	VRC-MA2HG272K
R869	Solid, 2.7k ohm, 1/2W, ±10%	N0224EFB	VRC-MA2HG272K
R870	Solid, 2.7k ohm, 1/2W, ±10%	N0224EFB	VRC-MA2HG272K
R871	Carbon, 220k ohm, 1/4W, ±5%	N0396EEC	VRD-RA2EE224J
R872	Solid, 470k ohm, 1/2W, ±10%	N0423FFB	VRC-MA2HG474K
SWITCH			
SW851	Luminance Video Cut-off	AS0016	QSW-B0017CEZZ
CONTROLS			
R856	Pot, Red Drive, B-curve 500 ohm	AP0002	RVR-B4563CEZZ

REF.NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
R858	Pot, Blue Drive, B-curve 500 ohm	AP0002	RVR-B4563CEZZ
R862	Pot, Red Bias, B-curve 5K ohm	AP0003	RVR-B4567CEZZ
R863	Pot, Green Bias, B-curve 5K ohm	AP0003	RVR-B4567CEZZ
R864	Pot, Blue Bias, B-curve 5K ohm	AP0003	RVR-B4567CEZZ
MISCELLANEOUS			
SG850 ⚠	Spark Gap	C-1615	QSPGC0015CEZZ
SG851 ⚠	Spark Gap	C-1615	QSPGC0015CEZZ
SG852 ⚠	Spark Gap	C-1615	QSPGC0015CEZZ
SG853 ⚠	Spark Gap	C-1489	QSPGC0011CEZZ

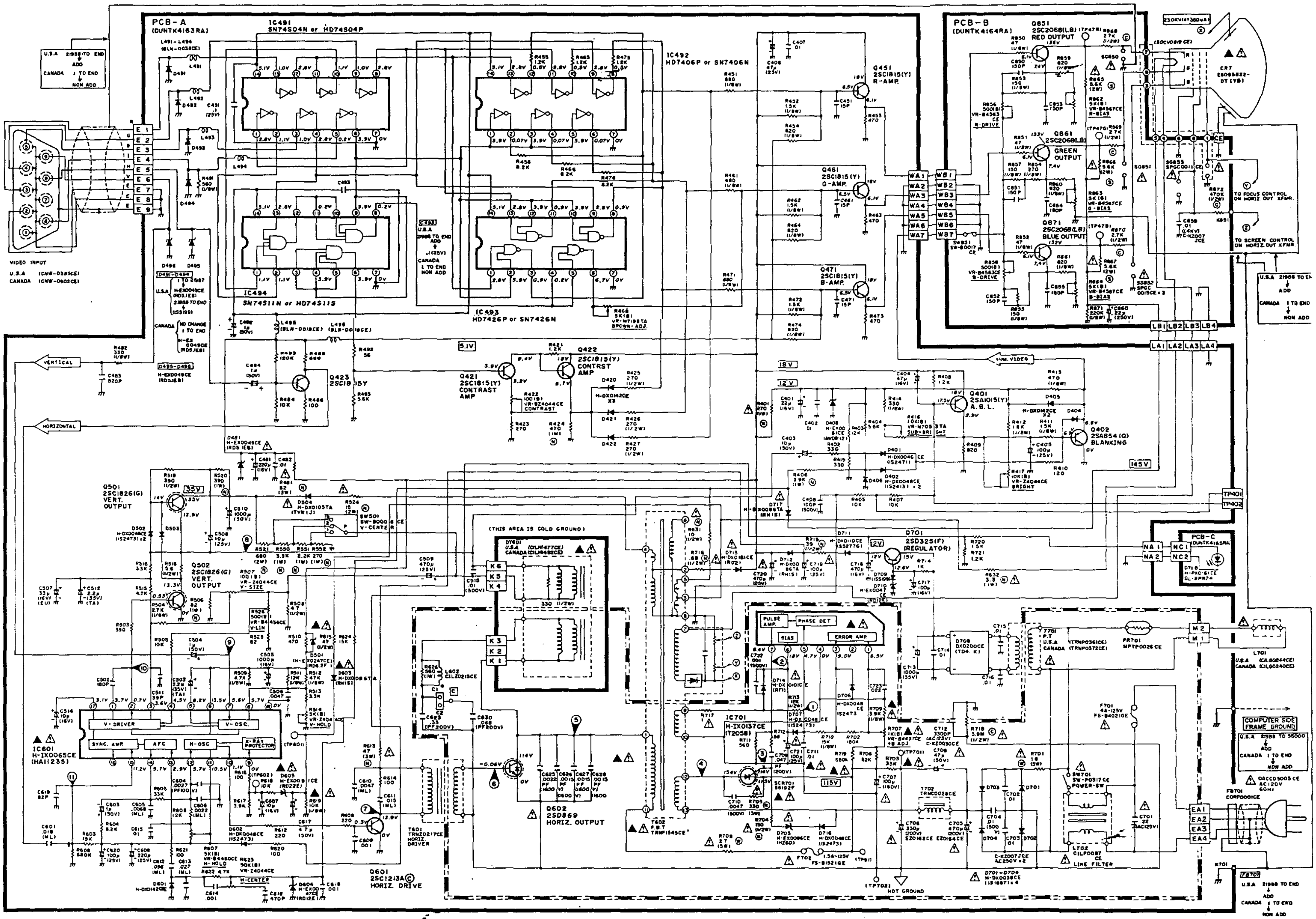
REF.NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
	P.C.B. Assembly, LED (PCB-C) **Consists of the following:**	AX9205	DUNTK4165RA0H
CONNECTOR			
NA-NC	Socket for Main PCB, 2 pin	AJ-4028	CSOCN0230RA03
DIODE			
D718	GL-9PR24	AL0010	RH-PX0161CEZZ
MISCELLANEOUS (Parts not located on the PCBs.)			
⚠	Cord, AC	AW1012	QACCD5005CEZZ
L701	Coil, Automatic Degaussing (U.S.A.)		RCILG0244CEZZ
	(CANADA)		RCILG0240CEZZ
	Magnet, Purity and Static Convergence	HC3479	PMAGF3006CEZZ
CRT ▲⚠	Picture Tube (E8093B22(PD))	AXX8018	VBE8093B22/1Y
DY601▲⚠	Yoke, Deflection (U.S.A.)	ATB0429	RCILH1477CEZZ
	(CANADA)		RCILH1482CEZZ
	Signal Input Cable Unit (U.S.A.)	AW1023	QCNW-0585CEZZ
	(CANADA)		QCNW-0602CEZZ

3. Cabinet Parts List

REF.NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
101	Cabinet Ass'y, Front (U.S.A.)	AZ0043	CCABA1527TAKB
	(CANADA)		CCABA1565TAKB
101-1	Cabinet, Front (U.S.A.)		GCABA1527CEKB
	(CANADA)		GCABA1565CEKB
101-2	Door, Control	ADA-0242	GDORF1430CESA
101-3	Plate, Control Door		HINDP2328CESA
101-4	Button, Power Switch	AK0336	JBTN-1305CEKB
101-5	Spring, Button	ARB5023	MSPRC0072CEFW
101-6	Badge, TANDY	AHC0049	HBDGZ3065CESA
101-7	Felt Door	BK0337	GCOVH9182CE09
102	Cabinet Ass'y, Rear (U.S.A.)	AZ0031	CCABB1560TAKA
	(CANADA)		CCABB1594TAKA
102-1	Cabinet, Rear (U.S.A.)		GCABB1560CEKA
	(CANADA)		GCABB1594CEKA
102-2	Label, Warning (U.S.A.)		TCAUS3062CEZZ
	(CANADA)		TCAUS3055CEZZ
102-3	Label, X-Ray Caution (U.S.A.)		TCAUH0092TAZZ
	Warning (CANADA)		TCAUS3052CEZZ
102-4	Shield		PSLDM3588CEFW
102-5	Clip, Shield		LX-LZ0022TAZZ
103	Screw, 5 x 30mm, Tapping-1, Hexagon Head		LX-TZ3042CEFD
104	Screw, 3 x 6mm, Machine, Bind Head		XHBSD30P06000
	(U.S.A. Up to 55000/CANADA Up to 7000)		
	Screw, 3 x 8mm, Machine, Binding Head		XHBSD30P08000
	(U.S.A. 55001~/CANADA 7001~)		
105	Knob, Control	AK0338	JKNBK1168CEKA
106	Bracket, AC Cord (U.S.A. Up to 21987, 55001~)		LANGK0288CESA
	(USA 21988~55000)		LANGK0298CESA
	(CANADA)		LANGK0276CESA
107	Wire Holder, Black		LHLDW1033CE00
108	Label, Model NO. (U.S.A.)		TLABM1692CEZZ
	(CANADA)		TLABM1723CEZZ
109	Spring, Grounding Strap		MSPRT0020CEZZ
110	Wedge, Yoke		PSPAG0028CEZZ
111	Wire, Grounding Strap		QEARC1405CEZZ
112	Not used		
HARDWARE KIT		AHW2501021	DBNW-0001RA0H
113	Screw, 4 x 20mm, Tapping-1, Brazier Head		XTASD40P20000
114	Screw, 4 x 12mm, Tapping-1, Brazier Head	AHD3007	XTASD40P12000
115	Wire Holder, White (U.S.A.)		LHLDW1037CEZZ
116	Shield case, FBT		PSLDM3614CEFW
117	Screw, 4 x 10mm, Tapping-2, Brazier Head		XCASD40P10000
118	Heat Sink (Q501, Q502)		PRDAF0258TAFW
119	Screw, 3 x 8mm, Machine, Pan Head	AHD-2915	LX-BZ3100CEFD

REF.NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
120	Heat Sink (Q602)		PRDAR1156CEFW
121	Screw, 3 x 16mm, Tapping-2, Binding Head	AHD3001	LX-CZ3004CEFU
122	Heat Sink (SCR701)		PRDAR5043CEFW
123	Not used		
124	Holder, LED	ART0105	LHLDZ9055CEZZ
125	Wire Holder, White		LHLDW1047CEUZ
126	Wire Holder, Black		LHLDW1005GEZZ
127	Wire Holder, White		LHLDW1015TAZZ
128	Holder, AC Cord Stopper (U.S.A.)		LHLDW1001TA00
	(CANADA)		LHLDK1010CEZZ
129	Wire Holder, White		LHLDW1019CEZZ
130	Label, Model NO. (CANADA)		TLABN0042CEZZ
131	Label, Address (CANADA)		TLABZ0107CEZZ
132	Label, Fuse Caution (CANADA)		TCAUS3111CEZZ
133	Label, Fuse Caution (CANADA)		TCAUS3095CEZZ
134	Label, CSA (CANADA)		TLABS0003CEZZ
135	Screw, 4 x 8mm, Machine, Pan Head		XBPBW40P08000
136	Spring Washer		XWSPW42-10000
137	Nut, 4 x 3.2mm		XNEBW40-32000
138	Screw, 3 x 8mm, Tapping-2, Brazier Head		XCASD30P08000
139	Wire Holder		LHLDW1002GEZZ
140	Ferrite Core, FB701 (U.S.A. 21988~)		RCORF0001CEZZ
141	Screw, 3 x 10mm, Machine, Pan Head (U.S.A. 21988~)		XBPSD30P10JS0
142	Ground Plate (U.S.A. 21988~)		QEARP0018CEFW
143	Screw (Ground) (U.S.A. 21988~55000)		LX-BZ3125CEFN

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:

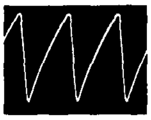
1. All DC voltages are measured with SSVM connected between points indicated and chassis ground. Line voltage is set at 120V AC and all contols are set for a normal picture unless otherwise indicated.
2. All voltages are measured with 1000μV B&W or Color signal.

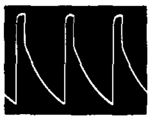
⚠ AND SHADED COMPONENTS: SAFETY RELATED PARTS, ▲ MARK: X-RAY RELATED PARTS.

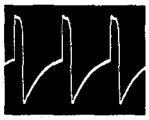
WAVEFORMS

Waveform Measurement Conditions:

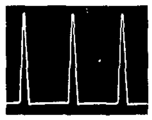
1. The voltage level and waveform at each point are given below on 120V/AC power when this set is connected to a personal computer with a video signal input at 0-volt (namely, with no brightness on the screen).
2. ⮞ indicates the waveform check points (in the chart, waveforms are measured from the point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


① 6.0 Vp-p (H)

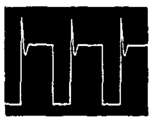

② 15 Vp-p (H)

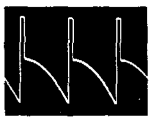

③ 4.2 Vp-p (H)

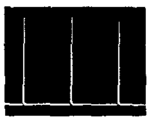

④ 225 Vp-p (H)


⑤ 900 Vp-p (H)

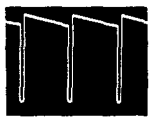

⑥ 12 Vp-p (H)


⑦ 31 Vp-p (H)


⑧ 35 Vp-p (V)

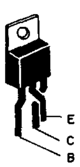

⑨ 4.2 Vp-p (V)


⑩ 1.9 Vp-p (V)


⑪ 2.0 Vp-p (H)

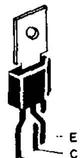
SEMICONDUCTOR LEAD IDENTIFICATION

Q501
Q502



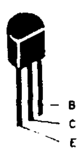
2SC1826(G)

Q851
Q861
Q871



2SC2068 (LB)

Q401 Q451
Q402 Q461
Q421 Q471
Q422 Q601

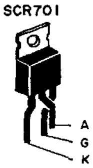


Q401 2SA1015(Y)
Q402 2SA854(Q)
Q421, Q422, Q451, Q461, Q471 2SC1815(Y)
Q601 2SC1213A(C)

Q701

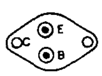
2SD325(F)

SCR701

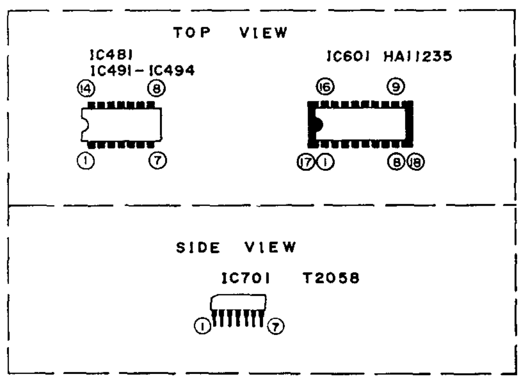


S6192F

Q602



2SD869



IC481 HD74LS136P
IC491 SN74S04N
IC492 HD7406P
IC493 HD7426P
IC494 SN74S11N

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