

SM-ZVM-121

Video Monitor

Service Manual



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PRODUCT SAFETY SERVICING GUIDELINES

CAUTION: Do not attempt to modify any circuit. Perform service work only after you are thoroughly familiar with all of the following safety checks and servicing guidelines. To do otherwise increases the risk of potential hazards and injury to the user. **CAUTION: Never attempt to service a chassis that is connected directly to an AC line. Make sure it is connected through an isolation transformer. No matter which way the AC plug is inserted, a potential shock hazard is present at chassis ground unless you use an isolation transformer during servicing.** Since one side of the AC input is fused; there's a 50% chance you'll blow a fuse, or a 50% chance you'll destroy

components and/or test equipment without an isolation transformer. The chassis consists of a single circuit board mounted horizontally in the bottom of the cabinet. All circuit parts are mounted on the board except the CRT and deflection yoke. The horizontal sweep transformer is also mounted on the chassis circuit board. You can slide the board out of the cabinet without disconnecting it, and the Monitor will operate with the board exposed. Screws are not required to hold the board in place. It slides into slots which are molded into the cabinet, and the cabinet back holds it in place.

SAFETY CHECKS

After the original service problem has been corrected, check for the following:

FIRE & SHOCK HAZARD

1. Be sure that all components are positioned in such a way to avoid the possibility of adjacent component shorts. This is especially important on those chassis which are transported to and from the repair shop.
2. Never release a repair unless all protective devices such as insulators, barriers, cover shields, strain reliefs, and other hardware have been reinstalled per the original design.
3. Inspect the soldering for possible cold solder joints, frayed leads, damaged insulation (including AC cord), solder splashes or sharp solder points. Remove all loose foreign particles.
4. Check "across-the-line" capacitors and other components for physical evidence of damage or deterioration, and replace them if necessary. Follow the original layout, lead length, and dress.
5. No lead or component should touch a receiving tube or a resistor rated at 1 watt or more. Avoid lead tension around protruding metal surfaces.
6. Always replace critical components (shaded on the Schematic Diagram and parts lists) such as: fuses, flameproof resistors, capacitors, etc. with exact Zenith types. Do not use replacement components other than those specified or make unrecommended circuit modifications.

- After you reassemble the set, always perform an AC leakage test on all exposed metallic parts of the cabinet to be sure the set is safe to operate without danger of electrical shock. **DO NOT USE A LINE ISOLATION TRANSFORMER DURING THIS TEST.** Use an AC voltmeter with a 5000 ohms per volt or more sensitivity in the following manner: Connect a 1500 ohm, 10-watt resistor (63-10401-76), paralleled by a 0.15 μF , 150 VAC type capacitor (22-4384), between a

known good earth ground (water pipe, conduit, etc.) and the exposed metallic parts, one at a time. Measure the AC voltage across the combination 1500 ohm resistor and 0.15 μF capacitor. Reverse the AC plug and repeat AC voltage measurements for each exposed metallic part. Voltage measured must not exceed 0.75 volts rms. This corresponds to 0.5 milliamps AC. Any value exceeding this limit constitutes a potential shock hazard and must be corrected immediately.

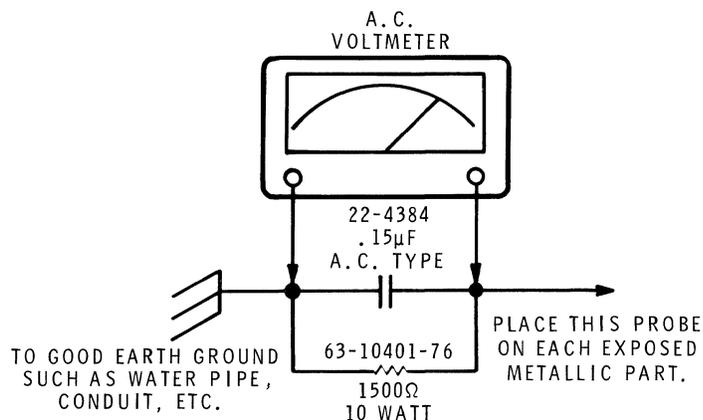


Figure 1-1

IMPLOSION PROTECTION

- All Zenith picture tubes are equipped with an integral implosion protection system, but be careful to avoid damage during installation. Avoid scratching the tube.
- Use only Zenith replacement tubes.

X-RADIATION

- Be sure procedures and instructions to all service personnel cover the subject of X-radiation. The only potential source of X-rays in the current Monitor is the picture tube. However, this

tube does not emit X-rays when the HV is at the factory-specified level. It is only when the HV is excessive that X-radiation can be generated. The basic precaution which must be exercised is to keep the HV at the factory-recommended level. Refer to the X-Ray Precaution Label which is located inside each Monitor for the correct high voltage. The proper value is also given in the applicable service manual. Operation at higher voltages may cause a failure of the CRT or high voltage supply and, under certain circumstances, may produce radiation in excess of desirable levels.

- Use only Zenith specified CRT anode connectors.

3. It is essential that the serviceman have an accurate high voltage meter available at all times. Check the calibration of this meter periodically against a reference standard, such as the one available at your distributor.
4. When the high voltage circuitry is operating properly, there is no possibility of an X-radiation problem. Every time you service a monochrome chassis, run the brightness up and down while you monitor 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. We suggest that you and your service organization review test procedures so that voltage regulation is always checked as a standard servicing procedure, and that the reason for this prudent routine be clearly understood by everyone. It is important to record an accurate high voltage reading on each customer's invoice.
5. When you are troubleshooting and making test measurements in a Monitor with a problem of excessive high voltage, avoid being unnecessarily close to the picture tube and the high voltage compartment. Do not operate the chassis longer than is necessary to locate the cause of excessive voltage.
6. Models which use a high voltage rectifier vacuum tube should have that tube replaced only with a Zenith recommended replacement type or a Zenith recommended solid-state rectifier replacement. The high voltage compartment and all metal shields, where used, must be kept in place whenever the chassis is operating. If a shield is missing, it should be replaced at once as a standard servicing procedure.

TIPS ON PROPER INSTALLATION

1. Never install a Monitor in a closed-in recess, cubbyhole, or closely fitting shelf space.
2. Never install a Monitor over or close to a heat duct, or in the path of heated air flow.
3. Avoid conditions of high humidity such as: outdoor patio installations where dew is a factor, or near steam radiators where steam leakage is a factor.
4. Avoid placement where draperies may obstruct rear venting. Customers should also avoid the use of decorative scarves or other coverings which might obstruct ventilation.
5. Wall and shelf-mounted installations must use the factory approved mounting kit and mounting instructions.
6. A Monitor mounted to a shelf or platform must retain its original feet or the equivalent thickness in spacers for adequate air flow from the bottom. Bolts or screws used for fasteners must not touch any parts or wiring. Perform leakage tests on customized installations.
7. Caution customers against the use of a Monitor on a sloping shelf or in a tilted position, unless it is properly secured.

SPECIFICATIONS

| | |
|----------------------------|------------------|
| Chassis | 12MB15X. |
| Operating Voltage | 120 VAC/12 VDC. |
| Overload Protection | 4.0 amperes std. |
| Nominal Power | 28 watts. |
| Operating Current | 0.3 amperes. |
| Nominal High Voltage | 12.0 kV. |
| Power Transformer | Standard. |
| Band Width | 15 MHz. |
| Rise Time | 50 nanoseconds. |
| Screen | 12" diagonal. |
| Phosphor | (P31) green. |
| Character Type | 8 × 10 matrix. |

CONTROLS

BLACK LEVEL (R204)

This 2 M Ω potentiometer is secured to a mounting bracket by two twist tabs. To remove the control, remove the bracket from inside the cabinet. Then remove the control knob and, with a pair of pliers, turn the two twist tabs to free the control. See Figure 3-1.

Adjustment — Adjust this control for a screen that is comfortable to the eye.

Test — Test this control with an ohmmeter. Place one lead on the middle terminal and the other lead on either outside terminal. Then rotate the control and observe the meter. If the reading is infinite or zero, the potentiometer may be open or shorted. NOTE: It may be necessary to disconnect the wires on the outside terminals.

CONTRAST CONTROL (R203)

This 1 k Ω potentiometer is secured to a mounting bracket by two twist tabs. To remove the control, remove the bracket from inside of the cabinet. Then remove the control knob and, with a pair of pliers, turn the two twist tabs to free the control. See Figure 3-1.

Adjustment — Adjust this control for a screen that is comfortable to the eye.

Test — Test this control with an ohmmeter. Place one lead on the middle terminal and the other lead on either outside terminal. Rotate the control and observe the meter. If the reading is infinite or zero, the control may be open or shorted. NOTE: It may be necessary to disconnect the wires on the outside terminals.

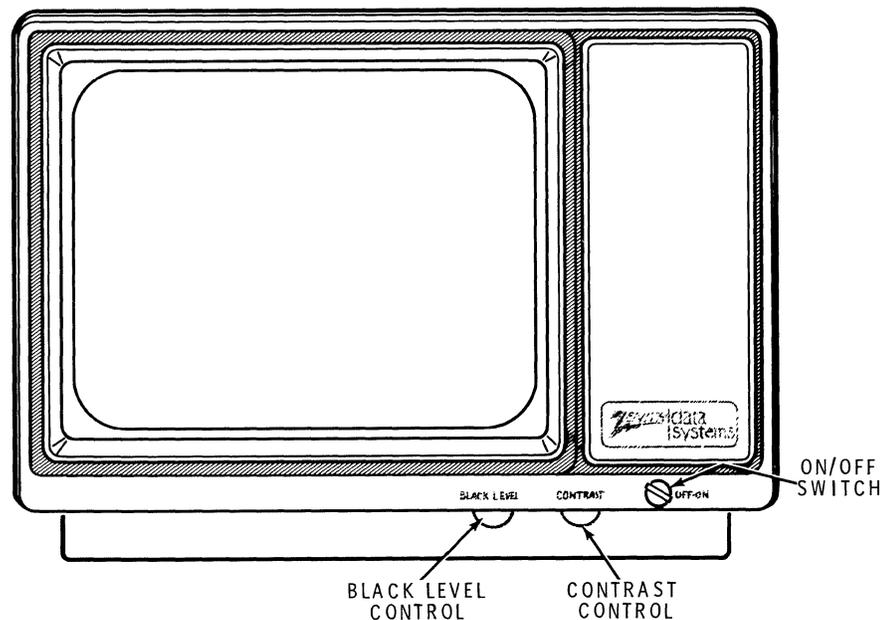


Figure 3-1

ON/OFF CONTROL (SX201)

This SPST switch is secured to a mounting bracket by two twist tabs. To remove it, first remove the switch knob, and then remove the bracket from inside the cabinet. With pliers, twist the two twist tabs to free the switch. See Figure 3-1.

Test — Test this switch with an ohmmeter. Place the leads across the switch terminals. With the switch in the OFF position, the meter should read infinite resistance. With the switch in the ON position, the meter should read zero resistance.

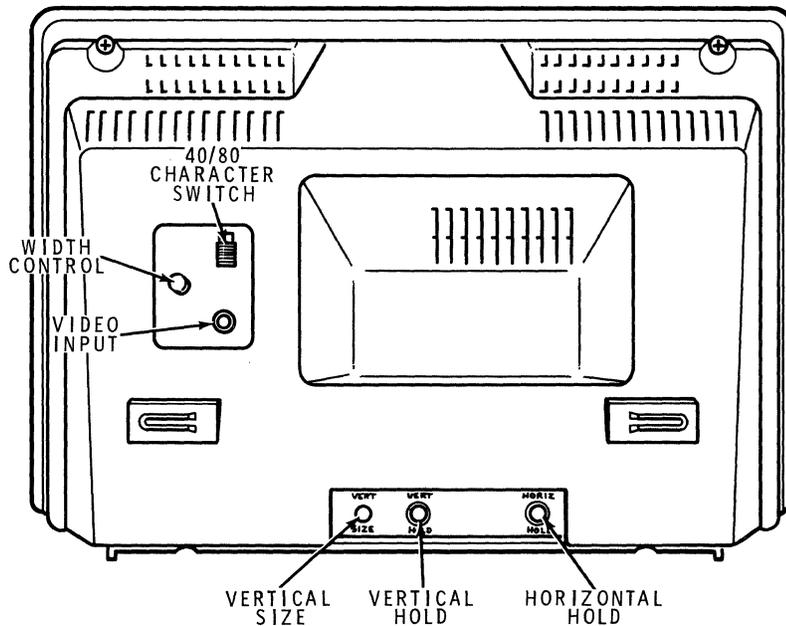


Figure 3-2

VERTICAL HOLD (R612)

This 250 k Ω potentiometer is soldered to the rear of the chassis PC board. See Figure 3-2.

Adjustment — If the picture rolls upward or downward, adjust the vertical hold control. Turn the control clockwise or counterclockwise until the rolling stops.

Test — Test this control by removing it from the circuit board. Place an ohmmeter across the terminals to determine if it is open or shorted.

VERTICAL SIZE (R616)

This 300 k Ω potentiometer is soldered to the rear of the chassis PC board. See Figure 3-2.

Adjustment — Adjust this control for proper picture height.

Test — Test this control by removing it from the circuit board. Place an ohmmeter across the terminals to determine if it is open or shorted.

HORIZONTAL HOLD (R519)

This 3 k Ω potentiometer is soldered to the rear of the chassis PC board. See Figure 3-2.

Adjustment — Adjust this control to correct diagonal distortion of the picture (tearing). Turn it clockwise or counterclockwise until the tearing stops.

Test — Test this control by removing it from the circuit board. Place an ohmmeter across the terminals to determine if it is open or shorted.

CHARACTER SWITCH

This SPST slide switch is near the video input connector. It is secured to the video input board by two rivets. To remove the switch, drill out the two rivets. See Figure 3-2.

Adjustment — Use this switch to select 40 or 80 characters per line.

Test — To check the switch, place the ohmmeter across the terminals. The 40-character position will indicate zero ohms. The 80-character position will indicate .1 ohms. In the 80-character position, the switch is open. The meter is reading the resistance of L503.

WIDTH CONTROL

The width control is soldered to the input PC board. See Figure 3-2.

Adjustment — Adjust this control for proper picture width. The adjustment knob is located next to the character switch.

CAUTION: If you do not detect a response in the picture's width, do not continue rotating the width control in the same direction. Continued rotation in the same direction can damage the coil.

B+ ADJUST (R709)

This 10 k Ω potentiometer is soldered to the left-hand side of the chassis PC board. See Figure 3-3.

Adjustment — Measure the B+ voltage at R709. See Figure 3-3. The B+ voltage should be set at 12.7 VDC.

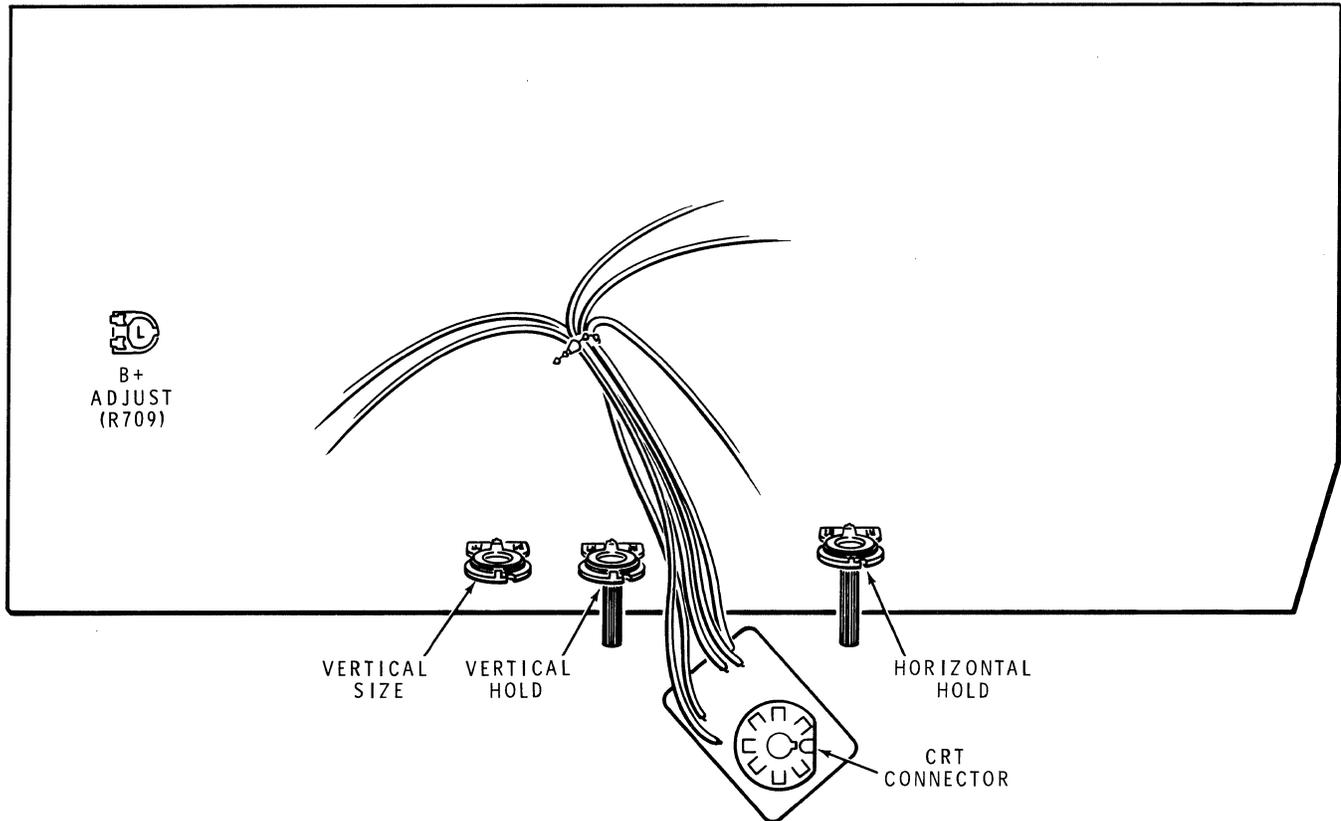


Figure 3-3

DISASSEMBLY

CABINET REMOVAL

Before you remove the cabinet, **always unplug the power cord from the receptacle.**

To remove the cabinet, remove the four mounting screws at the back. See Figure 4-1. Remove the rear cover as far as possible. Then remove the character switch and width control PC board from the rear cabinet cover. First, remove the two screws that secure the PC board to the switch bracket (accessible

from inside the rear cover). From the outside of the rear cover, remove the one screw holding the character switch bracket. See Figure 4-1. Slide the switch bracket through the cabinet opening.

CHASSIS PC BOARD REMOVAL

After you remove the cabinet, you can remove the chassis PC board with all the connections intact. The PC board will slide out.

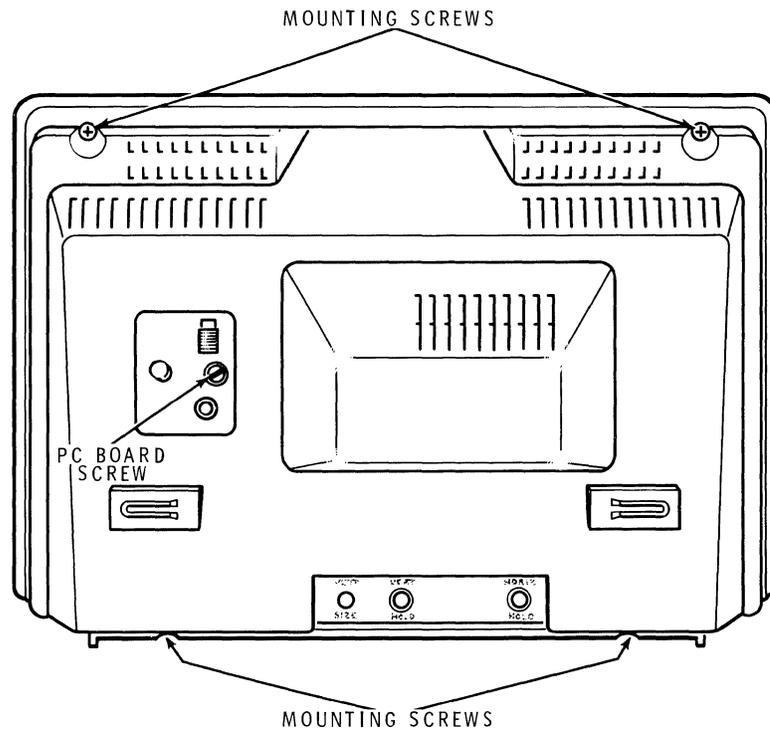


Figure 4-1

CRT REMOVAL (Figure 4-2)

NOTE: Be sure to ground the CRT anode.

To remove the CRT, first lay the Monitor face down on a soft cloth. Then proceed with the following steps.

1. Remove the pin socket from the CRT.
2. Remove the anode from the CRT.
3. Remove the four screws, one at each corner of the CRT. The lower left-hand screw has all the ground connections and grounding strap. Be sure all the connections are in place after reassembly.
4. Loosen the screw on the yoke and slide the yoke off the CRT.
5. Carefully lift out the CRT. CAUTION: Serious injury may occur if you should drop the CRT.

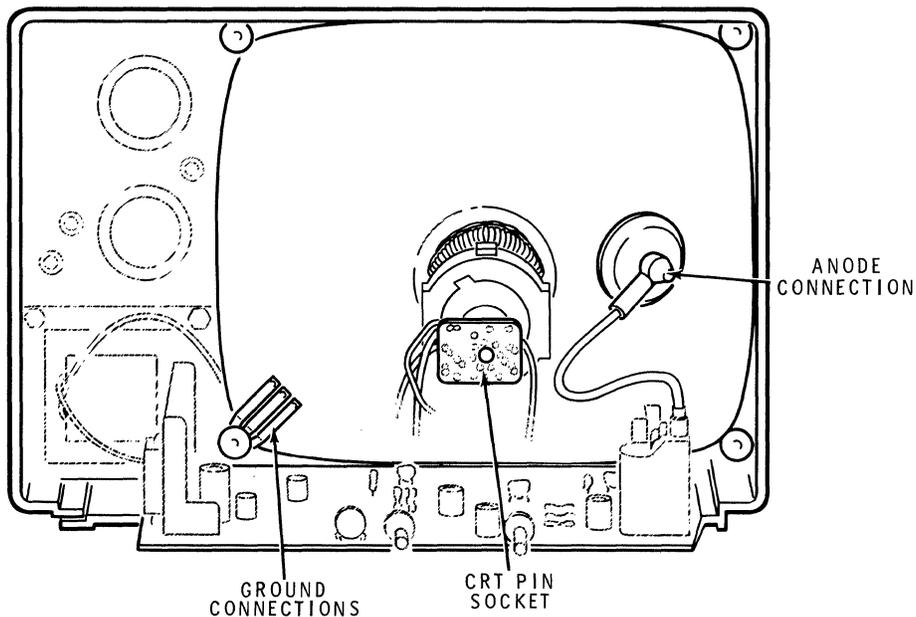


Figure 4-2

CIRCUIT DESCRIPTION

Refer to the Schematic Diagram while you read the following information. The signal flow from input to output is shown in the Block Diagram, Figure 5-1.

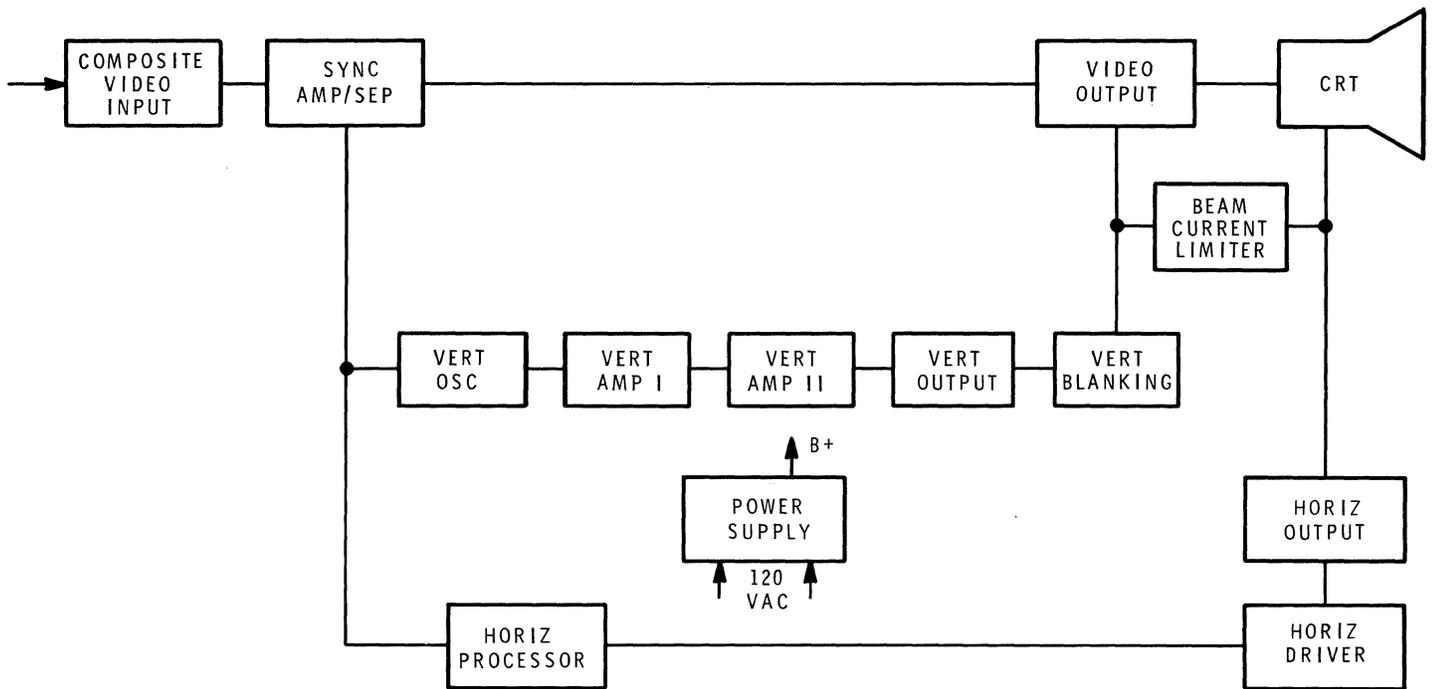


Figure 5-1

POWER SUPPLY (Figure 5-2)

Power transformer TX201 and bridge diodes CRX701, CRX702, CRX703, and CRX704 develop approximately 17.5 volts DC on capacitor CX707, with 1.7 volts of ripple present. QX703 acts as a variable series element, dropping more or less voltage across it in order to maintain the output voltage at a constant 12.7 volts.

When the output voltage increases or decreases due to line voltage fluctuations or load variations, this voltage change appears at the base of Q701. The voltage divider network that feeds this voltage to the base is made up of R704, R706, R707, R708, RX709, and C709. The potentiometer is configured to minimize voltage drift caused by tolerances or temperature variations. The AC ripple is coupled to the base by C709. This voltage is compared against the reference of CR706 (4.7 volt zener) and C708. Any difference causes the collector current to increase or decrease

proportionally. This current is amplified by Q702 and fed to control transistor QX703. If the output voltage tries to rise, Q701 will try to turn off, causing Q702 and Q703 to turn off. Conversely, when the output voltage drops, Q701 turns on harder, turning on Q702 and Q703 and raising the output voltage back to normal.

A unique feature of this circuit is its ability to switch from a regulator to an active filter at low line voltages. The voltage at the collector of Q702 is proportional to the available input voltage to the regulator. When the input is too low to maintain 12.7 volts, the voltage at the collector of Q702 drops below the reference zener voltage, causing CR705 to conduct. This additional current sinking through R701 disables the zener reference, causing the DC output voltage to drop and no longer be regulated for DC variations. However, the AC reference remains in control; so AC ripple regulation continues — in effect — producing an active filter.

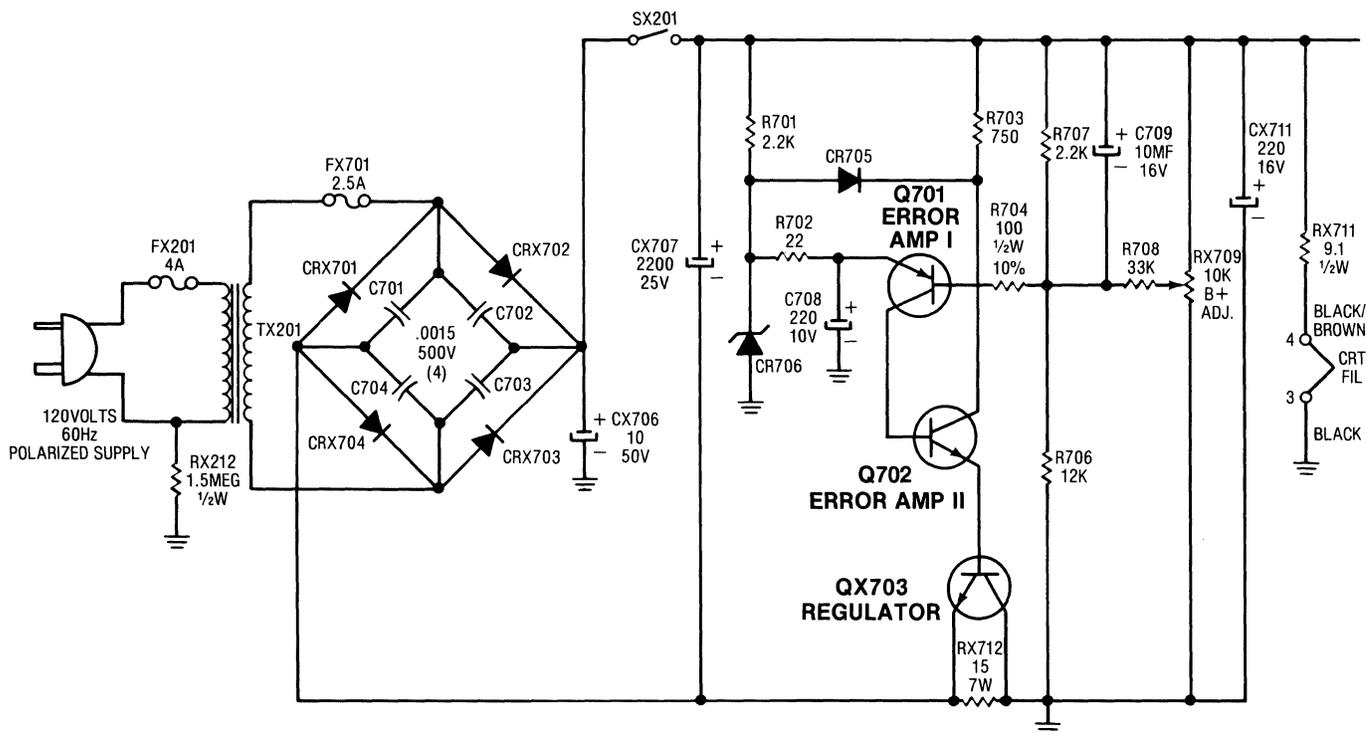


Figure 5-2

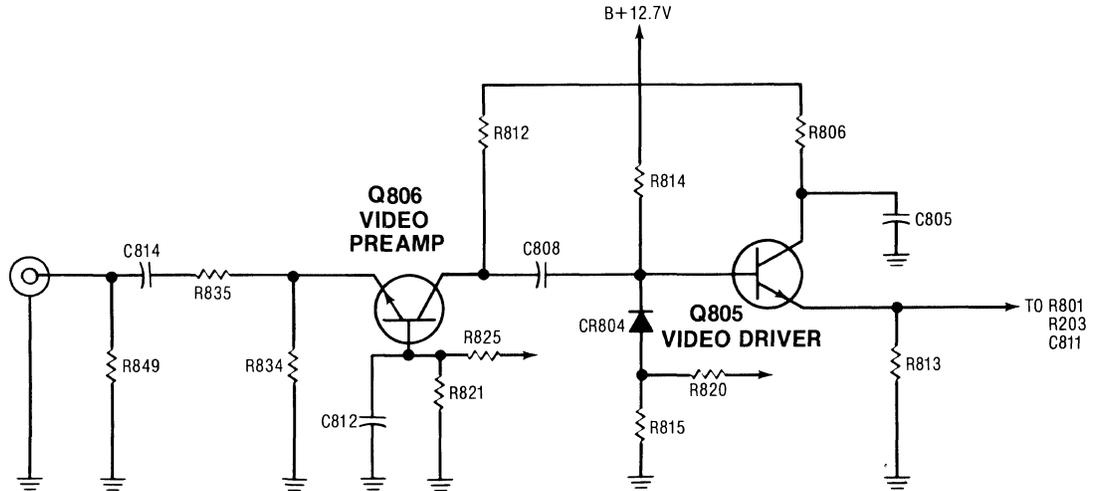


Figure 5-3

VIDEO PREAMP (Figure 5-3)

The video input is configured to accept a standard RS170 composite video with a 75-ohm terminating input. The video is coupled to the emitter of Q806 through C814 and R835. Q806 is a common-base amplifier which amplifies the one-volt peak-to-peak video to three volts without a phase inversion. The output of Q806 is coupled through C808 to the base of the video driver (Q805). In the base circuit of Q805, a sync tip clamp; consisting of CR804, R814, R815, and R820; is used to clamp the video signal so there are no black level shifts with variation in input signal.

SYNC AMP (Figure 5-4)

The video signal at the emitter of video driver Q805 is sent to the video output through the contrast control. It is also sent to the base of sync amplifier Q801. The sync amplifier is used to stretch the sync portion of the video signal before the signal is sent to the sync separator, Q802. Q802 is a standard dual-time-constant sync separator. Its output is sent to the horizontal and vertical oscillators to keep the deflection in sync.

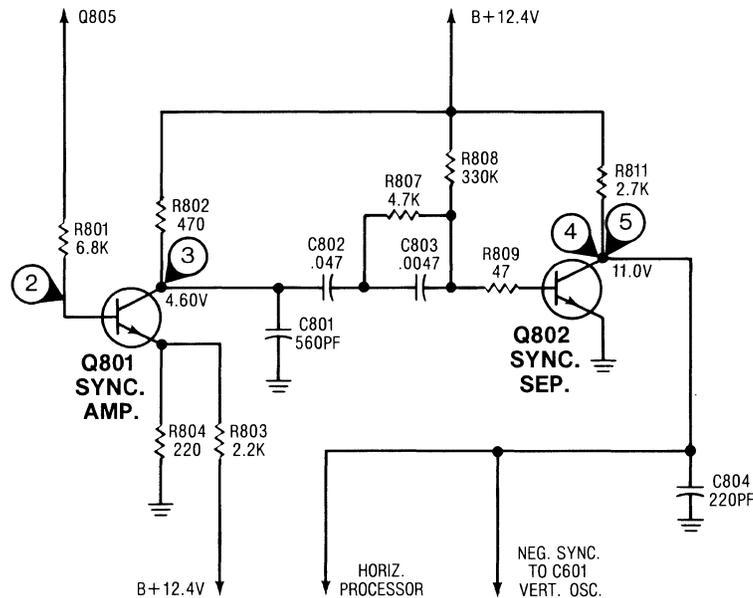


Figure 5-4

SPOT BURN PROTECTION (Figure 5-6)

When the Monitor is turned off, CR803 and C809 keep the collector voltage high. This keeps the CRT biased off, preventing spot burn.

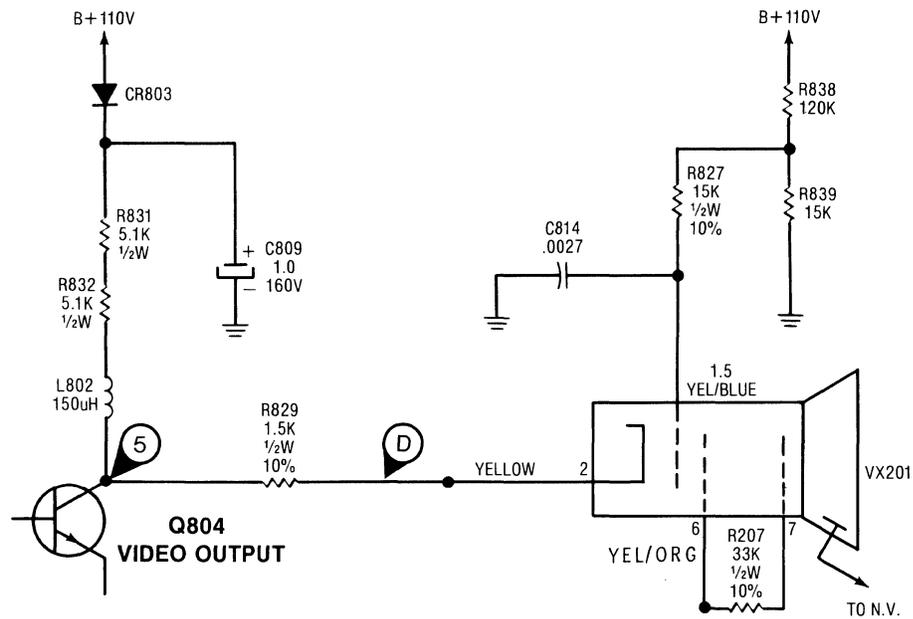


Figure 5-6

VERTICAL SWEEP CIRCUIT (Figure 5-7)

The vertical sweep circuit is a self-oscillating DC-coupled ramp-generating circuit that uses complementary push-pull class B output transistors, a driver transistor, a differential amplifier transistor and an oscillator transistor.

The emitters of the output stage are fed back to the input through C613, R618, R617, and Q601. The differentiated, positive-going, fly-back pulse from the emitter charges C606 and C608 through Q601. The capacitors discharge through their respective resistor networks. Capacitor C606 discharges during the trace interval to 0.6 volts below the emitter voltage of Q601. At this point Q601 conducts and turns off the amplifier stages. This causes the yoke voltage to fly up and repeat the cycle.

The presence of a sync signal causes Q601 to conduct slightly before the voltage on C606 decreases to 0.6 volts below the Q601 emitter voltage, bringing the circuit timing into sync with the sync signal. Capacitor C608 discharges linearly through its resis-

tor network, because this network is returned to yoke current sensing resistor R624, where a ramp voltage appears of the same amplitude as the ramp voltage across C608. A constant voltage appears across the discharge resistor and maintains the constant discharge current from C608. Capacitor C608 provides a linear, negative-going ramp voltage of average DC value, established by R608 and R609, to the base of Q602. The signal to the emitter of the differential amplifier comes from the yoke return circuit.

The ramp voltage across R624 has S-correction in its waveform as required in the yoke current to produce linear pictures on the CRT. Across C609 is an inverse S-correction signal, which is derived through the shaping network of R620, R621, and C615. This adds to the ramp-plus-S-correction signal appearing across R624 to produce a linear ramp at the emitter of Q602. This linear ramp is compared by Q602 with the linear ramp across C608. Any difference results in a correcting current in the collector of Q602 and in the succeeding amplifier stages. This returns the yoke current to the desired current for producing a linear picture.

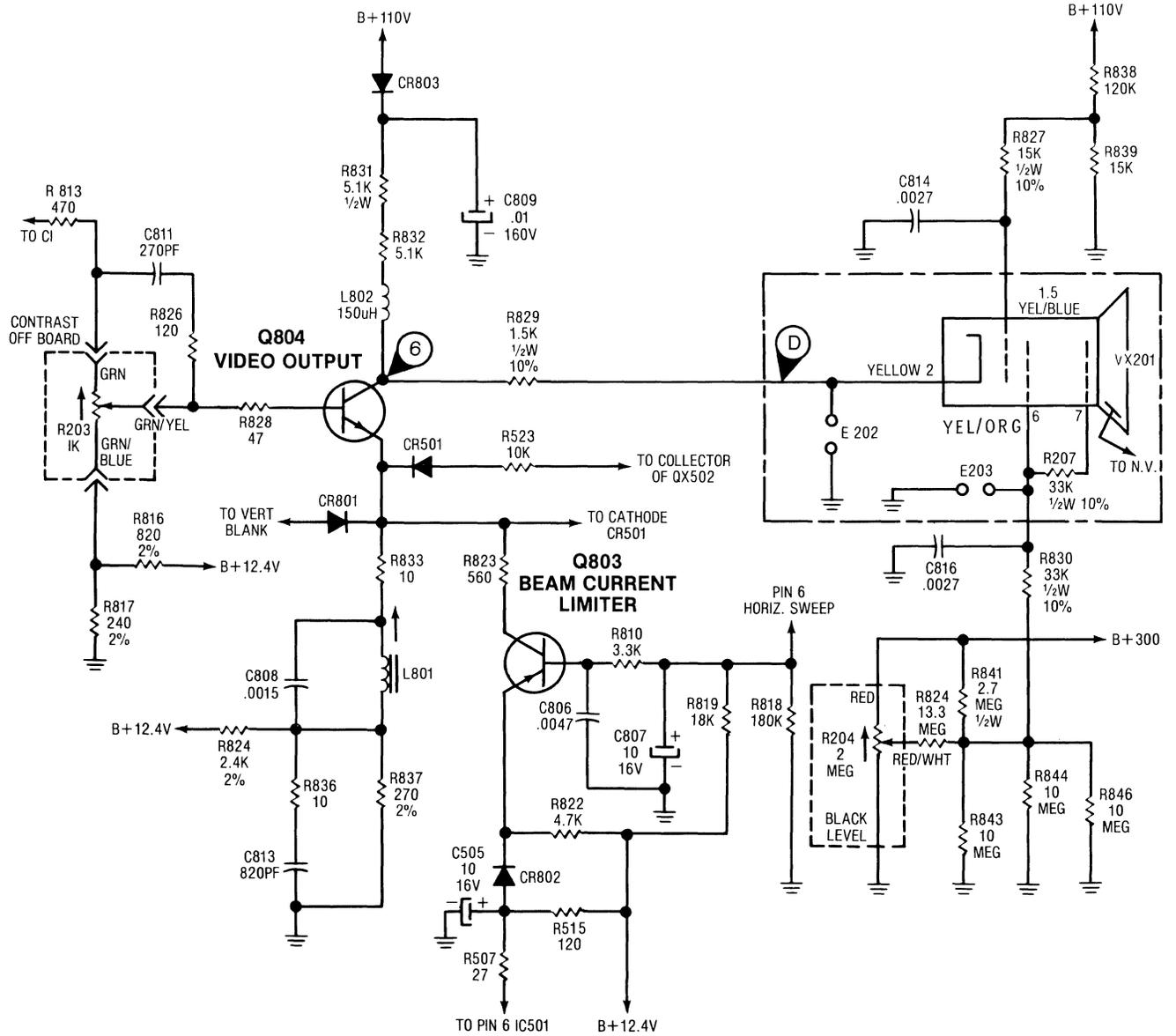


Figure 5-7

HORIZONTAL PROCESSOR (Figure 5-8)

The operation of the horizontal processor (IC501), 221-141, is the same as the 221-86. The 221-141 can be replaced by the 221-86. However, the 221-86 cannot be replaced by 221-141.

The 221-141 integrated circuit is divided into four sections: the phase detector, the oscillator, the regulator, and the predriver.

The phase detector is comprised of a differential amplifier and a gated current source. The current source is strobed on by a negative sync, which is AC coupled to pin 3. The current division between the two transistors of the differential amplifier is determined by the phase relationship of the sync and sawtooth waveform on pin 4. This sawtooth is derived from a negative horizontal flyback pulse. When the sync and sawtooth are in phase, the current division between the two transistors in the differential amplifier will be equal. When there is a phase difference, current will either flow into or out of pin 5, which is connected by way of a low-pass filter to pin 7 of the oscillator. This current controls the oscillator.

The oscillator is the RC type, with pin 7 being the control point. The timing capacitor is charged up by an external resistor to a trip voltage set in the integrated circuit. When this trip voltage is reached, the capacitor is discharged to a new trip value. This process is repeated, producing a sawtooth waveform.

The output of the phase detector controls the oscillator through resistive coupling from pin 5 to pin 7. The horizontal hold control is also connected at pin 7. The two 100k resistors in the horizontal hold circuit are used to center the hold control range. The diode in series with the hold control is used to temperature compensate the oscillator.

The regulator (pin 6) is temperature-compensated and consists of two high-current diodes in series with a zener diode. The zener current is determined by an external resistor connected to the 12.7 volt power supply. The voltage set by the regulator is between 8 and 9 volts.

The predriver is a four-transistor circuit which takes the sawtooth formed at pin 7 and produces a variable duty cycle waveform at pin 1. This output is used to drive the horizontal driver. On-time of the output waveform is determined by the bias voltage on pin 8. This voltage is determined by a series of clip resistors that match the integrated circuit to the Monitor.

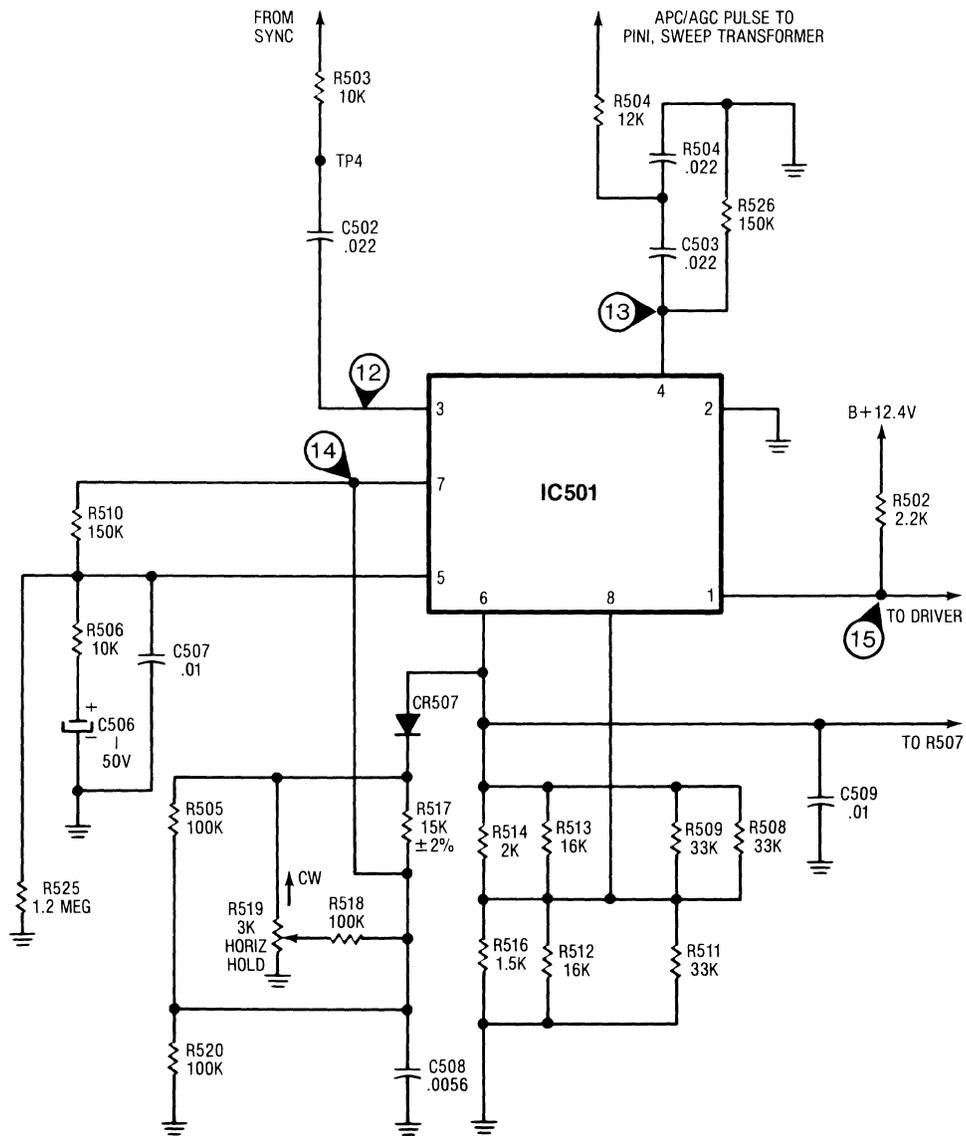


Figure 5-8

TROUBLESHOOTING GUIDE

This section could not possibly include all of the problems you might encounter. However, it offers some hints for the various circuits in the Monitor.

HORIZONTAL DRIVER

Check the collector pulse and base drive to the horizontal drive. If the horizontal output shows poor saturation or the circuit fails to start, suspect diodes CR502 and/or CR503. If no waveforms are present, Q501, CR504, or Q502 could be the problems.

1. No horizontal blanking — R523 may be open.
2. Ringing in picture and/or horizontal scan distorted or reduced — C204 may be open or shorted.
3. No high voltage, no raster — Q501 may be open or shorted.

HORIZONTAL PROCESSOR

The horizontal processor uses the 221-141 IC. This integrated circuit is essentially the same as the 221-86. The 221-141 can be replaced by the 221-86. However, the 221-86 cannot be replaced by the 221-141.

1. No lock — R503, R504, or R510 may be open.
2. Check the waveform at 15 for bad Q501 or RX521.
3. Check the B+ at pin 6. It should be 8-9 volts. If the regulator is defective, the voltage drops.

VERTICAL SWEEP

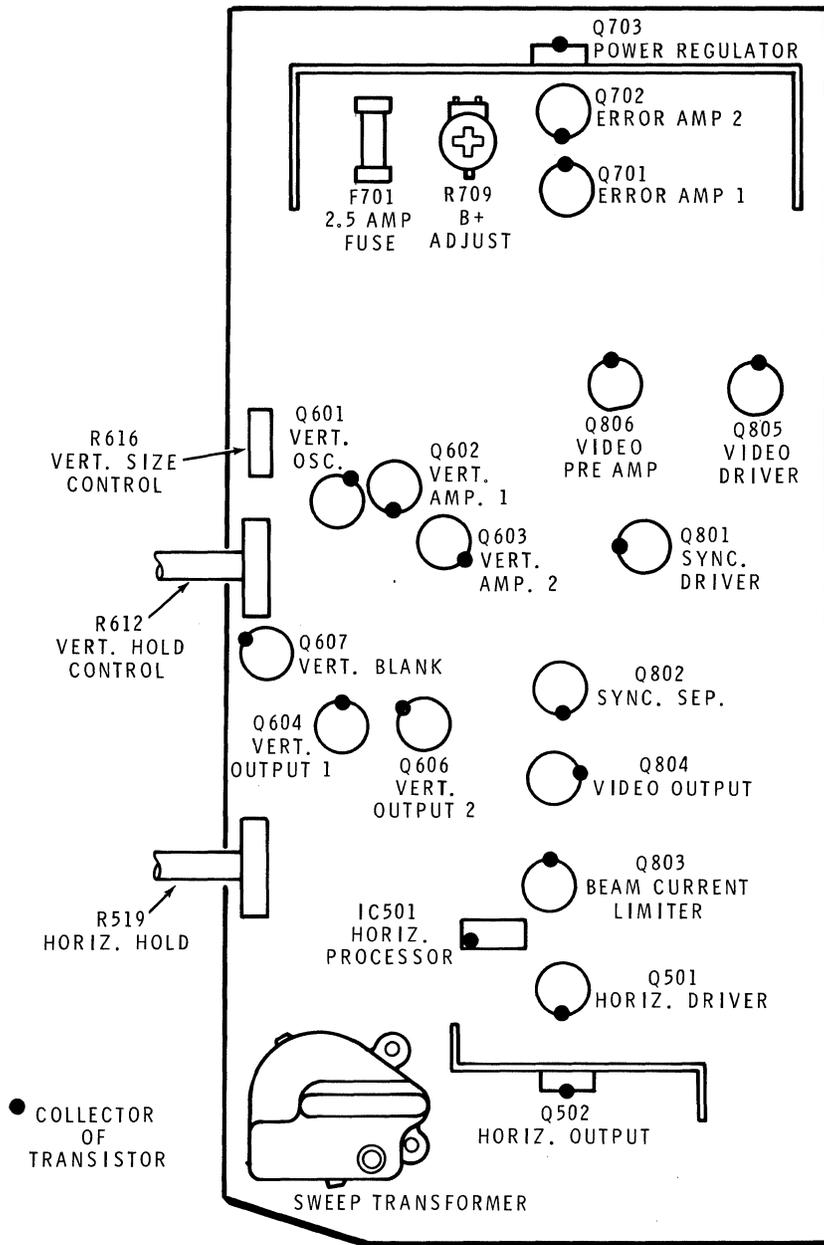
1. Small vertical height — R624 value may be too high.

2. Picture deflected up — C614 may be leaky.
3. Vertical fold-over — C618, C617, or Q607 may be open.
4. R631 and R632 will overheat if Q618, Q617, or Q607 are shorted.
5. Top half of picture lost — R622 or R623 may be open.
6. Increase dissipation in Q603 and R622 — R622 value may be too low.
7. No vertical deflection — Q604 and Q606 fail due to high dissipation; CR602 and/or CR603 may be shorted.
8. Center horizontal line in picture (crossover distortion) — CR602 and/or CR603 may be shorted.

POWER SUPPLY

The power supply has current limiting capabilities. A lack of B+ does not mean the problem is in the power supply. If there is a short or heavy current drain in the Monitor, the regulator reduces its output voltage to zero if necessary. When the fault is corrected, the regulator will return to normal.

If the 12.7 volts B+ drops at normal line voltage ranges (108-132 VAC), Q702 or CR705 may be defective. A quick check of the zener voltage will help you diagnose this problem. If RX709 has no effect on B+ voltage, suspect Q701 or QX703.



Component Location for Chassis PC Board

Figure 6-1

REPLACEMENT PARTS LIST

| ITEM NUMBER | ZDS PART NO. | DESCRIPTION |
|-------------------|--------------|----------------------------------|
| CAPACITORS | | |
| C201 | 22-7763 | 2700 pF, ±20%, disc, 500 V |
| C202 | 22-7763 | 2200 pF, ±20%, disc, 500 V |
| C501 | 22-7614-24A | .01 μF, ±20%, disc, 50 V |
| C502 | 22-7615-08B | .022 μF, +80% -20%, disc, 50 V |
| C503 | 22-7615-08A | .022 μF, +80% -20%, disc, 50 V |
| C504 | 22-7615-08A | .022 μF, +80% -20%, disc, 50 V |
| C505 | 22-7151-04 | 10 μF, +100% -10%, elect, 16 V |
| C506 | 22-7153 | 1 μF, +100% -10%, elect, 50 V |
| C507 | 22-7615-06A | .01 μF, +80% -20%, disc, 50 V |
| C508 | 22-7739-09 | .0056 μF, ±10%, polyester, 100 V |
| C509 | 22-7615-06A | .01 μF, +80% -20%, disc, 50 V |
| C510 | 22-7433 | 1000 pF, ±20%, disc, 500 V |
| C511 | 22-7433 | 1000 pF, ±20%, disc, 500 V |
| CX512 | 22-3255 | 330 pF, ±10%, disc, 500 V |
| CX513 | 22-7433 | 1000 pF, ±20%, disc, 500 V |
| CX514 | 22-7612 | .027 μF, ±5%, polyester, 200 V |
| C515 | 22-7433 | .001 μF, ±20%, disc, 500 V |
| C516 | 22-7313 | 10 μF, ±20%, NP elect, 25 V |
| C517 | 22-7151-09 | 220 μF, +100% -10%, elect, 16 V |
| C518 | 22-7674-01 | 4.7 μF, +100% -10%, elect, 160 V |
| C519 | 22-4782 | 4700 pF, ±20%, disc, 500 V |
| C520 | 22-7313 | 10 μF, ±20%, NP elect, 25 V |
| C521 | 22-4782 | 4700 pF, ±20%, disc, 500 V |
| C522 | 22-7154-08 | 100 μF, +100% -10%, elect, 35 V |
| C601 | 22-7613-24B | .01 μF, ±10%, disc, 50 V |
| C603 | 22-7613-24A | .01 μF, ±10%, disc, 50 V |
| C604 | 22-7613-08A | 470 pF, ±10%, disc, 50 V |
| C606 | 22-7547 | .1 μF, ±10%, polyester, 50 V |
| C607 | 22-7151-04 | 10 μF, +100% -10%, elect, 16 V |
| C608 | 22-7547 | .1 μF, ±10%, polyester, 50 V |
| C609 | 22-7456-01 | 10 μF, ±20%, elect, 16 V |
| C611 | 22-7613-24A | .01 μF, ±10%, disc, 50 V |
| C613 | 22-7179 | .022 μF, ±10%, polyester, 50 V |
| C614 | 22-7579-06 | 220 μF, ±20%, elect, 16 V |
| C615 | 22-7389-02 | 1 μF, ±20%, elect, 25 V |
| C616 | 22-7613-24A | .01 μF, ±10%, disc, 50 V |
| C617 | 22-7151-05 | 22 μF, +100% -10%, elect, 16 V |
| C618 | 22-7152-07 | 47 μF, +100% -10%, elect, 25 V |
| C701 | 22-7244 | 1500 pF, ±5%, disc, 500 V |
| C702 | 22-7244 | 1500 pF, ±5%, disc, 500 V |
| C703 | 22-7244 | 1500 pF, ±5%, disc, 500 V |
| C704 | 22-7244 | 1500 pF, ±5%, disc, 500 V |
| CX706 | 22-7153-04 | 10 μF, +100% -10%, elect, 50 V |
| CX707 | 22-7152-13 | 2200 μF, +100% -10%, elect, 25 V |
| C708 | 22-7150-09 | 220 μF, +100% -10%, elect, 10 V |
| C709 | 22-7151-04 | 10 μF, +100% -10%, elect, 16 V |
| CX711 | 22-7151-09 | 220 μF, +100% -10%, elect, 16 V |
| C801 | 22-7613-11A | 820 pF, ±10%, disc, 50 V |
| C802 | 22-7071 | .047 μF, ±10%, polyester, 50 V |
| C803 | 22-7614-20A | 4700 pF, ±20%, disc, 50 V |
| C804 | 22-7613-04A | 220 pF, ±10%, disc, 50 V |
| C805 | 22-7613-12A | 1000 pF, ±10%, disc, 50 V |
| C806 | 22-7614-20A | 4700 pF, ±20%, disc, 50 V |

| ITEM NUMBER | ZDS PART NO. | DESCRIPTION |
|----------------------------|--------------|------------------------------------|
| Capacitors (Cont'd) | | |
| C807 | 22-7151-04 | 10 μF, +100% -10%, elect, 16 V |
| C808 | 22-7407-01 | 1 μF, ±20%, NP elect, 50 V |
| C809 | 22-7674-02 | 1 μF, +100% -10%, elect, 160 V |
| C811 | 22-7622-28A | 56 pF, ±10%, disc, 50 V |
| C812 | 22-7151-05 | 22 μF, +100% -10%, elect, 16 V |
| C813 | 22-7613-04A | 220 pF, ±10%, disc, 50 V |
| C814 | 22-7403-09 | 100 μF, +100% -10%, NP elect, 10 V |
| RESISTORS | | |
| R201 | 63-07792 | 1.5 kΩ, 10%, carbon, 1/2 W |
| R203 | 63-10770-09 | Control, rotary contrast, 1 kΩ |
| R204 | 63-10770-08 | Control, rotary black level, 2 MΩ |
| R207 | 63-1848 | 33 kΩ, 10%, carbon, 1/2 W |
| RX212 | 63-10526 | 1.5 MΩ (special) |
| R501 | 63-9921-56 | 220 Ω, 5%, film, 1/4 W |
| R502 | 63-9921-80 | 2.2 kΩ, 5%, film, 1/4 W |
| R503 | 63-9921-96 | 10 kΩ, 5%, film, 1/4 W |
| R504 | 63-9921-98 | 12 kΩ, 5%, film, 1/4 W |
| R505 | 63-9922-20 | 100 kΩ, 5%, film, 1/4 W |
| R506 | 63-9921-96 | 10 kΩ, 5%, film, 1/4 W |
| R507 | 63-9921-34 | 27 Ω, 5%, film, 1/4 W |
| R508 | 63-9922-08 | 33 kΩ, 5%, film, 1/4 W |
| R509 | 63-9922-08 | 33 kΩ, 5%, film, 1/4 W |
| R510 | 63-9922-24 | 150 kΩ, 5%, film, 1/4 W |
| R511 | 63-9922-08 | 33 kΩ, 5%, film, 1/4 W |
| R512 | 63-9922-01 | 16 kΩ, 5%, film, 1/4 W |
| R513 | 63-9922-01 | 16 kΩ, 5%, film, 1/4 W |
| R514 | 63-9921-79 | 2 kΩ, 5%, film, 1/4 W |
| R515 | 63-9921-50 | 120 Ω, 5%, film, 1/4 W |
| R516 | 63-9921-76 | 1.5 kΩ, 5%, film, 1/4 W |
| R517 | 63-9920 | 15 kΩ, 2%, film, 1/4 W |
| R518 | 63-9922-20 | 100 kΩ, 5%, film, 1/4 W |
| R519 | 63-10637-09 | 3 kΩ horizontal hold control |
| R520 | 63-9922-20 | 100 kΩ, 5%, film, 1/4 W |
| RX521 | 63-10559-20 | 6.8 Ω, 5%, film, 1/4 W |
| R522 | 63-7740 | 82 Ω, 10%, carbon, 1/2 W |
| R523 | 63-9921-96 | 10 kΩ, 5%, film, 1/4 W |
| RX524 | 63-10559-24 | 10 Ω, 5%, film, 1/4 W |
| R525 | 63-9922-46 | 1.2 MΩ, 5%, film, 1/4 W |
| R526 | 63-9922-24 | 150 kΩ, 5%, film, 1/4 W |
| RX527 | 63-10565-68 | 680 Ω, 5%, film, 1/2 W |
| R528 | 63-9921-64 | 470 Ω, 5%, film, 1/4 W |
| RX529 | 63-10559-24 | 10 Ω, 5%, film, 1/4 W |
| R602 | 63-9922 | 15 kΩ, 5%, film, 1/4 W |
| R603 | 63-9922-32 | 330 kΩ, 5%, film, 1/4 W |
| R604 | 63-9922-36 | 470 kΩ, 5%, film, 1/4 W |
| R606 | 63-9922-44 | 1.0 MΩ, 5%, film, 1/4 W |
| R607 | 63-9922-54 | 2.7 MΩ, 5%, film, 1/4 W |
| R608 | 63-9921-98 | 12 kΩ, 5%, film, 1/4 W |
| R609 | 63-9921-96 | 10 kΩ, 5%, film, 1/4 W |

| ITEM NUMBER | ZDS PART NO. | DESCRIPTION |
|---------------------------|--------------|--------------------------------------|
| Resistors (Cont'd) | | |
| R610 | 63-9921-64 | 470 Ω , 5%, film, 1/4 W |
| R611 | 63-9921-82 | 2.7 k Ω , 5%, film, 1/4 W |
| R612 | 63-10637-04 | 250 k Ω vertical hold control |
| R613 | 63-9922-39 | 620 k Ω , 5%, film, 1/4 W |
| R614 | 63-9922-46 | 1.2 M Ω , 5%, film, 1/4 W |
| R616 | 63-10521-04 | 300 k Ω vertical size control |
| R618 | 63-9921-96 | 10 k Ω , 5%, film, 1/4 W |
| R619 | 63-9922-12 | 47 k Ω , 5%, film, 1/4 W |
| R620 | 63-9921-60 | 330 Ω , 5%, film, 1/4 W |
| R621 | 63-9922-06 | 27 k Ω , 5%, film, 1/4 W |
| R622 | 63-9947-05 | 24 k Ω , 5%, film, 1/2 W |
| R623 | 63-9921 | 1 Ω , 5%, film, 1/4 W |
| R624 | 63-9921-21 | 7.5 Ω , 5%, film, 1/4 W |
| R626 | 63-9921-75 | 1.3 k Ω , 5%, film, 1/4 W |
| R627 | 63-9921-52 | 150 Ω , 5%, film, 1/4 W |
| R628 | 63-9922-04 | 22 k Ω , 5%, film, 1/4 W |
| R629 | 63-9921-42 | 56 Ω , 5%, film, 1/4 W |
| R631 | 63-9921-58 | 270 Ω , 5%, film, 1/4 W |
| R632 | 63-9921-48 | 100 Ω , 5%, film, 1/4 W |
| R701 | 63-9921-74 | 1.2 k Ω , 5%, film, 1/4 W |
| R702 | 63-9921-76 | 1.5 k Ω , 5%, film, 1/4 W |
| R703 | 63-9921-60 | 330 Ω , 5%, film, 1/4 W |
| R704 | 63-7743 | 100 Ω , 10%, carbon, 1/2 W |
| R705 | 63-9922-04 | 22 k Ω , 5%, film, 1/4 W |
| R706 | 63-9921-98 | 12 k Ω , 5%, film, 1/4 W |
| R707 | 63-9922-06 | 27 k Ω , 5%, film, 1/4 W |
| R708 | 63-9922-08 | 33 k Ω , 5%, film, 1/4 W |
| RX709 | 63-10817 | 10 k Ω , B+ adjust control |
| RX711 | 63-7968-59 | 9.1 Ω , 5%, carbon, 1/2 W |
| RX712 | 63-10449-52 | 15 Ω , 5%, wirebound, 7 W |
| R801 | 63-9921-92 | 6.8 Ω , 5%, film, 1/4 W |
| R802 | 63-9921-64 | 470 Ω , 5%, film, 1/4 W |
| R803 | 63-9921-68 | 680 Ω , 5%, film, 1/4 W |
| R804 | 63-9921-42 | 56 Ω , 5%, film, 1/4 W |
| R806 | 63-9921-56 | 220 Ω , 5%, film, 1/4 W |
| R807 | 63-9921-88 | 4.7 k Ω , 5%, film, 1/4 W |
| R808 | 63-9922-32 | 330 k Ω , 5%, film, 1/4 W |
| R809 | 63-9921-40 | 47 Ω , 5%, film, 1/4 W |
| R810 | 63-9921-84 | 3.3 k Ω , 5%, film, 1/4 W |
| R811 | 63-9921-82 | 2.7 k Ω , 5%, film, 1/4 W |
| R812 | 63-9921-66 | 560 Ω , 5%, film, 1/4 W |
| R813 | 63-9921-68 | 680 Ω , 5%, film, 1/4 W |
| R814 | 63-9922-44 | 1 M Ω , 5%, film, 1/4 W |
| R815 | 63-9921-82 | 2.7 k Ω , 5%, film, 1/4 W |
| R816 | 63-9919-70 | 820 Ω , 2%, film, 1/4 W |
| R817 | 63-9919-57 | 240 Ω , 2%, film, 1/4 W |
| R818 | 63-9922-26 | 180 k Ω , 5%, film, 1/4 W |
| R819 | 63-9922-02 | 18 k Ω , 5%, film, 1/4 W |
| R820 | 63-9921-93 | 7.5 k Ω , 5%, film, 1/4 W |
| R821 | 63-9921-92 | 6.8 k Ω , 5%, film, 1/4 W |
| R822 | 63-9921-88 | 4.7 k Ω , 5%, film, 1/4 W |
| R823 | 63-9921-66 | 560 Ω , 5%, film, 1/4 W |
| R824 | 63-9919-81 | 2.4 k Ω , 2%, film, 1/4 W |
| R825 | 63-9922-06 | 27 k Ω , 5%, film, 1/4 W |
| R826 | 63-9921-50 | 120 Ω , 5%, film, 1/4 W |
| R827 | 63-7834 | 15 k Ω , 10%, carbon, 1/2 W |
| R828 | 63-9921-40 | 47 Ω , 5%, film, 1/4 W |
| R830 | 63-7848 | 33 k Ω , 10%, carbon, 1/2 W |
| R831 | 63-9946-80 | 2.2 k Ω , 5%, film, 1/2 W |

| ITEM NUMBER | ZDS PART NO. | DESCRIPTION |
|---------------------------|--------------|------------------------------------|
| Resistors (Cont'd) | | |
| R832 | 63-9946-80 | 2.2 k Ω , 5%, film, 1/2 W |
| R833 | 63-9921-24 | 10 Ω , 5%, film, 1/4 W |
| R834 | 63-9921-56 | 220 Ω , 5%, film, 1/4 W |
| R835 | 63-9921-56 | 220 Ω , 5%, film, 1/4 W |
| R836 | 63-9921-24 | 10 Ω , 5%, film, 1/4 W |
| R837 | 63-9919-58 | 270 Ω , 2%, film, 1/4 W |
| R838 | 63-9922-22 | 120 k Ω , 5%, film, 1/4 W |
| R839 | 63-9922 | 15 k Ω , 5%, film, 1/4 W |
| R840 | 63-9921-50 | 120 Ω , 5%, film, 1/4 W |
| R841 | 63-7928 | 2.7 M Ω , 5%, carbon, 1/2 W |
| R842 | 63-10182-56 | 3.3 M Ω , 5%, carbon, 1/4 W |
| R843 | 63-10182-68 | 10 M Ω , 5%, carbon, 1/4 W |
| R844 | 63-10182-68 | 10 M Ω , 5%, carbon, 1/4 W |
| R846 | 63-10182-68 | 10 M Ω , 5%, carbon, 1/4 W |

INDUCTORS — TRANSFORMERS

| | | |
|--------|--------------|----------------------------------|
| L501 | 149-379 | Ferrite sleeve |
| L502 | 149-379 | Ferrite sleeve |
| L503 | 20-3906-03 | Coil RCF linearity |
| LX504 | 20-3984 | Coil RCF parasitic suppressor |
| L505 | 20-3943-02 | Coil RCF tunable width control |
| TX201 | 95-3262-02 | Power transformer |
| TX202A | 95-3438(1/2) | Deflection yoke |
| TX202B | 95-3438(1/2) | Deflection yoke |
| TX203 | 95-3388-02 | Power transformer |
| TX501 | 95-3136-03 | Transformer horizontal driver |
| TX502 | 95-3434 | Sweep XFMR black and white final |

DIODES

| | | |
|--------|-------------|---------------------|
| CR501 | 103-295-02A | Low voltage general |
| CR502 | 103-261-02A | Low voltage general |
| CR503 | 103-261-02A | Low voltage general |
| CR504 | 103-295-02A | Low voltage general |
| CR505 | 103-295-03A | Low voltage general |
| CR506 | 103-261-04 | Low voltage general |
| CR507 | 103-142-01 | Low voltage general |
| CR601 | 103-142-01 | Low voltage general |
| CR602 | 103-142-01 | Low voltage general |
| CR603 | 103-142-01 | Low voltage general |
| CR604 | 103-142-01 | Low voltage general |
| CR605 | 103-142-01 | Low voltage general |
| CRX701 | 103-261-04 | Low voltage general |
| CRX702 | 103-261-04 | Low voltage general |
| CRX703 | 103-261-04 | Low voltage general |
| CRX704 | 103-261-04 | Low voltage general |
| CR705 | 103-142-01 | Low voltage general |
| CR706 | 103-279-09A | Zener 4.7 V, 5 W |
| CR801 | 103-142-01 | Low voltage general |
| CR802 | 103-142-01 | Low voltage general |
| CR803 | 103-261-02A | Low voltage general |
| CR804 | 103-142-01 | Low voltage general |

| ITEM NUMBER | ZDS PART NO. | DESCRIPTION |
|----------------|-----------------|-------------|
|----------------|-----------------|-------------|

TRANSISTORS

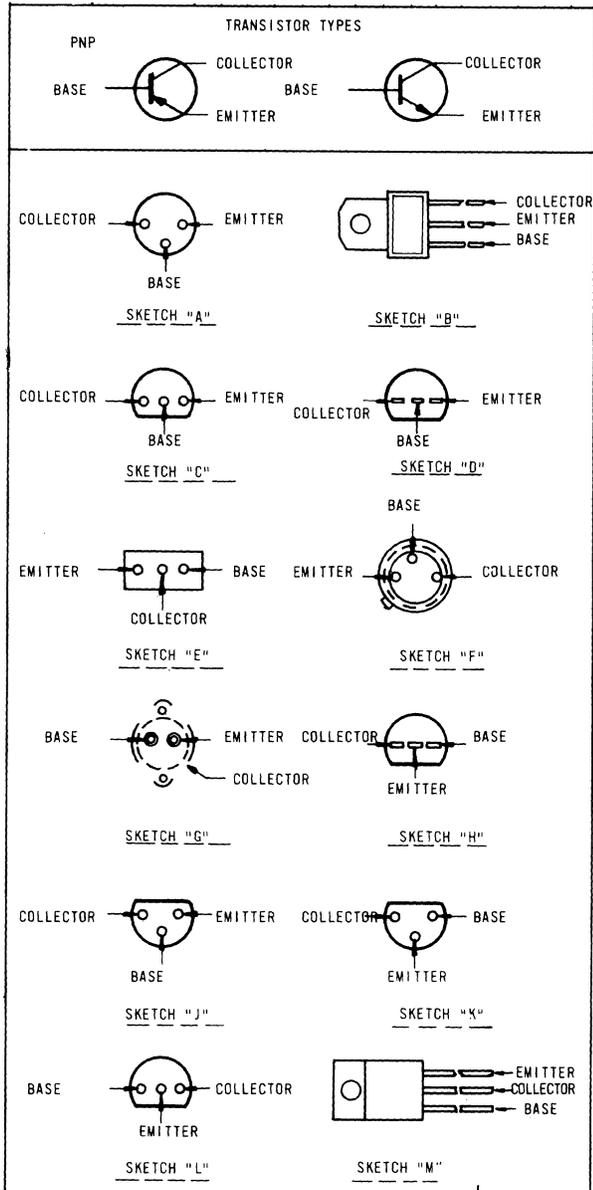
| | | |
|-------|-------------|----------------------|
| Q501 | 121-819 | Horizontal driver |
| Q502 | 121-1028-01 | Horizontal output |
| Q601 | 121-699 | Vertical oscillator |
| Q602 | 121-699 | Vertical amp 1 |
| Q603 | 121-975 | Vertical amp 2 |
| Q604 | 121-819 | Vertical output 1 |
| Q606 | 121-1036 | Vertical output 2 |
| Q607 | 121-819 | Vertical blanker |
| Q701 | 121-699 | Error amp 1 |
| Q702 | 121-975 | Error amp 2 |
| QX703 | 121-992-01 | Regulator |
| Q801 | 121-895 | Sync amp |
| Q802 | 121-895 | Sync separator |
| Q803 | 121-699-01 | Beam current limiter |
| Q804 | 121-990 | Video output |
| Q805 | 121-895 | Video driver |
| Q806 | 121-895 | Video preamp |

| ITEM NUMBER | ZDS PART NO. | DESCRIPTION |
|----------------|-----------------|-------------|
|----------------|-----------------|-------------|

MISCELLANEOUS

| | | |
|-------|------------|-------------------------------------|
| IC501 | 221-141 | Integrated CKT horizontal processor |
| E202 | 52-958-04 | Spark gap |
| E203 | 52-958-04 | Spark gap |
| FX701 | 136-120-07 | Fuse normal lag 2.25 amp, 32 V |
| FX201 | 136-114-23 | Fuse 4.0 amp |
| FX202 | 136-113-23 | Fuse 4.0 amp |
| VX201 | 100-718-02 | CRT 12VCBP31 |
| SX201 | 85-1610 | Switch |
| S202 | 85-1606 | Switch |
| SX203 | 85-1545-03 | Switch 110/220 |

SEMICONDUCTOR IDENTIFICATION



| | | BOTTOM VIEWS OF TRANSISTORS | | | | | | | | | | | | |
|----------|--------------|-----------------------------|---|---|---|---|---|---|---|---|---|---|---|--|
| Q NUMBER | ZDS PART NO. | SKETCHES | | | | | | | | | | | | |
| | | A | B | C | D | E | F | G | H | J | K | L | M | |
| Q501 | 121-819 | | | X | | | | | | | X | | | |
| Q502 | 121-1028-01 | | | | | | | | | | | | X | |
| Q601 | 121-699 | | | | X | | | | | X | | | | |
| Q602 | 121-699 | | | | X | | | | | X | | | | |
| Q603 | 121-975 | | | | X | | | | | X | | | | |
| Q604 | 121-819 | | | | X | | | | | X | | | | |
| Q606 | 121-1036 | | | | X | X | | | | | | | | |
| Q607 | 121-819 | | | | X | | | | | X | | | | |
| Q701 | 121-699 | | | | X | | | | | X | | | | |
| Q702 | 121-975 | | | | X | | | | | X | | | | |
| QX703 | 121-992-01 | | | | | | | | | | | | X | |
| Q801 | 121-895 | | | | X | | | | | X | | | | |
| Q802 | 121-895 | | | | X | | | | | X | | | | |
| Q803 | 121-699-01 | | | | X | | | | | X | | | | |
| Q804 | 121-990 | | | | X | | | | | | | | | |
| Q805 | 121-895 | | | | | X | | | | X | | | | |
| Q806 | 121-895 | | | | | X | | | | X | | | | |

CIRCUIT BOARD X-RAY VIEW

