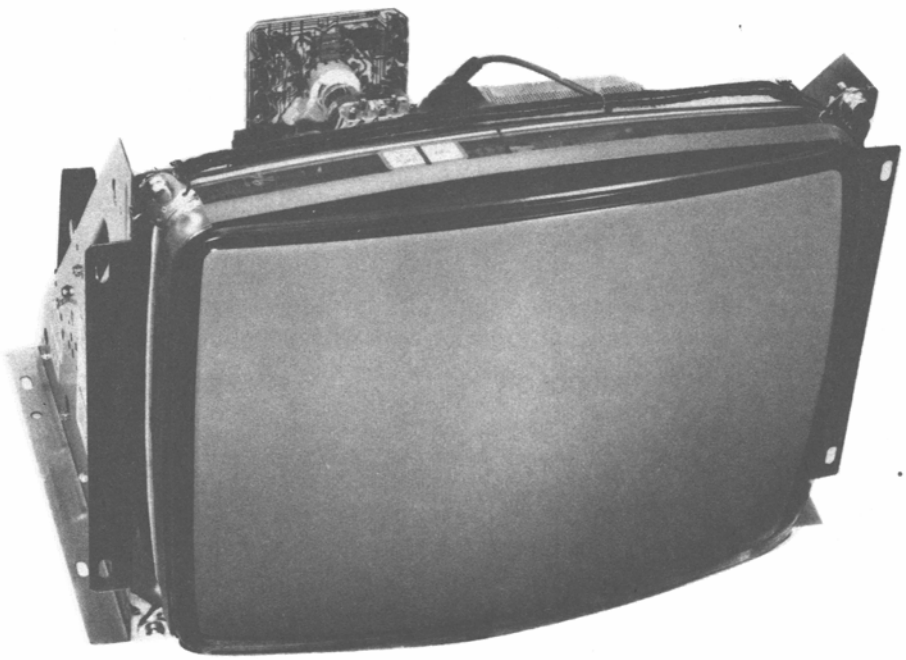
SERVICE MANUAL

19K6400 SERIES COLOR VECTOR MONITOR



GENERAL INFORMATION

The color X-Y display operates in an X-Y-Z mode for video game applications. Z input is composed of red, green and blue drive systems. AC power for the display is provided by a power transformer which is part of the game hardware.

This display is a complete assembly with the picture tube securely mounted to the chassis by brackets to create the complete unit.

Component reference numbers and circuit legend are printed on the circuit board to aid in servicing. Scope waveforms are shown in the manual which can be used when the display is driven with a cross-hatch pattern.

Customer controls include focus and brightness. Focus control is located on the rear of the high voltage assembly. The brightness control is located on the Neck PC Board.

WELLS-GARDNER ELECTRONICS CORPORATION

2701 NORTH KILDARE AVENUE, CHICAGO, ILLINOIS 60639

INPUT CONNECTORS

12-CIRCUIT INPUT CONNECTOR: POWER AND RGB DRIVE

DESCRIPTION:
Rectangular, self-locking, panel mount 12 circuit.

MANUFACTURER AND PART NO.:
AMP INC.
Connector Housing 350783-1
Contact Pin 350699-1

CONNECTIONS:
(Refer to Figure 1)

PIN NO.	CIRCUIT	LEAD COLOR
1.	Red Drive	Red
2.	Green Drive	Green
3.	Blue Drive	Blue
4.	Red Ground	Black
5.	Green Ground	Black
6.	Blue Ground	Black
7.	AC	Violet
8.	Center Tap	Gray
9.	Filament	White/Green
10.	AC	Violet
11.	Chassis Ground	White/Brown
12.	Filament	White/Green

CONNECTOR P200: X and Y INPUT

DESCRIPTION:
Header plug, PC board mount, 4 circuit.

MANUFACTURER AND PART NO.:
MOLEX INC.
09-65-1041

PIN NO.	CIRCUIT
1.	X Input
2.	X Ground
3.	Y Ground
4.	Y Input

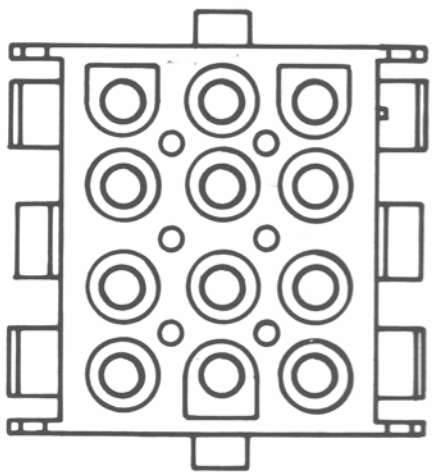


FIGURE 1: 12-Circuit Input Connector Numbering
NOTE: *Rear View of Connector Shown, Mounted*

WARNINGS
AND GENERAL SAFETY REQUIREMENTS

- **POWER UP WARNING**

  An isolation transformer must be used between display unit and AC line. Refer to PRODUCT SAFETY SERVICING GUIDELINES section for isolation transformer specifications.

- **GENERAL SAFETY REQUIREMENTS**

  Be sure to read all instructions and any other explanatory material thoroughly before attempting to install, operate or service these units. All persons servicing this unit must pay particular attention to the section entitled "PRODUCT SAFETY SERVICING GUIDELINES."

- **X-RADIATION**

  This unit has been designed for minimum X-radiation hazard. However, to avoid possible exposure to soft X-radiation, it is imperative that no modification be made in high voltage circuitry.

- **HIGH VOLTAGE**

  This display contains high voltages derived from power supplies capable of delivering lethal quantities of energy. To avoid danger to life, do not attempt to service the chassis until all precautions necessary for working on high voltage equipment have been observed. In order to prevent damage to solid state devices, do not arc CRT anode lead to chassis or earth ground.

- **CRT HANDLING**

  Extreme care should be used in handling the picture tube as rough handling may cause it to implode due to atmospheric pressure. Do not nick or scratch glass or subject it to any undue pressure in removal or installation. When handling, shatterproof safety goggles and heavy gloves should be worn for protection. Do not handle CRT by the neck.

IMPORTANT: *Before removing second anode lead, wait at least two minutes after power to monitor has been turned off. This will discharge high voltage from the picture tube through resistance of the focus control assembly.*

PRODUCT SAFETY NOTICE

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

AVERTISSEMENT: POUR MAINTENIR LE DEGRE DE SECURITE DE L'APPAREIL NE REMPLACER LES COMPOSANTS DONT LE FONCTIONNEMENT EST CRITIQUE POUR LA SÉCURITE QUE PAR DES PIECES RECOMMANDEES PAR LE FABRICANT.

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

WARNINGS
AND GENERAL SAFETY REQUIREMENTS

- **POWER UP WARNING**

  An isolation transformer must be used between display unit and AC line. Refer to PRODUCT SAFETY SERVICING GUIDELINES section for isolation transformer specifications.

- **GENERAL SAFETY REQUIREMENTS**

  Be sure to read all instructions and any other explanatory material thoroughly before attempting to install, operate or service these units. All persons servicing this unit must pay particular attention to the section entitled "PRODUCT SAFETY SERVICING GUIDELINES."

- **X-RADIATION**

  This unit has been designed for minimum X-radiation hazard. However, to avoid possible exposure to soft X-radiation, it is imperative that no modification be made in high voltage circuitry.

- **HIGH VOLTAGE**

  This display contains high voltages derived from power supplies capable of delivering lethal quantities of energy. To avoid danger to life, do not attempt to service the chassis until all precautions necessary for working on high voltage equipment have been observed. In order to prevent damage to solid state devices, do not arc CRT anode lead to chassis or earth ground.

- **CRT HANDLING**

  Extreme care should be used in handling the picture tube as rough handling may cause it to implode due to atmospheric pressure. Do not nick or scratch glass or subject it to any undue pressure in removal or installation. When handling, shatterproof safety goggles and heavy gloves should be worn for protection. Do not handle CRT by the neck.

IMPORTANT: *Before removing second anode lead, wait at least two minutes after power to monitor has been turned off. This will discharge high voltage from the picture tube through resistance of the focus control assembly.*

PRODUCT SAFETY NOTICE

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

AVERTISSEMENT: POUR MAINTENIR LE DEGRE DE SECURITE DE L'APPAREIL NE REMPLACER LES COMPOSANTS DONT LE FONCTIONNEMENT EST CRITIQUE POUR LA SÉCURITE QUE PAR DES PIECES RECOMMANDEES PAR LE FABRICANT.

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

SPECIFICATIONS:

ELECTRICAL SPECIFICATIONS:

1. Input Power Requirements:

Voltage: 40-0-40 VRMS @ 1.75 ARMS (Typical)
6.6 VRMS @ 0.74A (Filament)

Input Voltage Range: + 10% to -10% for performance specifications.

Input Power: 140 W typical

All secondary windings must be isolated from the power line.

2. Signal Inputs:

"X" full deflection 8 V P-P (+ 4 V to -4 V)—15 inches.

"Y" full deflection 6 V P-P (+ 3 V to -3 V)—11.25 inches.

Red, Green and Blue Drive

Blanking Level	1.0 V
CRT Cutoff	1.5 V
Low Beam	1.8 V
High Beam	3.6 V
Max. Drive	4.0 V

3. Input Impedance:

"X"	1.3 kΩ
"Y"	1.3 kΩ
R,G,B	1.0 kΩ

4. Writing Distance vs. Time

Measured maximum time durations per line segment @ -10% line.

"X"	"Y"
6.0 μs for 0.5"	6.0 μs for 0.5"
8.0 μs for 1.0"	11.0 μs for 1.0"
16.0 μs fro 2.0"	21.0 μs for 2.0"
30.0 μs for 4.0"	42.0 μs for 4.0"
62.0 μs for 8.0"	94.0 μs for 8.0"
110.0 μs for 14.5"	131.0 μs for 10.5"

5. X-Y Deflection Amplifier Duty Cycle:

The maximum duty cycle of deflection, in any one direction off center, is 60% of the frame time for full deflection. Amplifier protection circuitry will activate if this level is exceeded.

6. X-Y Deflection Delay with respect to Z:

1.5 μs maximum.

7. Drift with Temperature:

Pattern shift after stabilization, 0.15 inch max. (25 °C to 55 °C).

8. High Voltage:

19.5 kV ± 0.5 kV @ 0 beam.
Regulation . . . 2.0%

9. Pincushion Distortion: 15 x 11.25 inch rectangle.

N-S 1.5% max.
E-W 1.5% max.

10. Linearity Distortion: Crosshatch Pattern Largest Square v.s. Smallest Square

X axis 10% max.
Y axis 10% max.

ENVIRONMENTAL:

1. Altitude:

Normal operation to an altitude of 15,000 feet.

2. Temperature:

Operating: 0 °C to 55 °C
Storage: –40 °C to 65 °C

3. Humidity:

Operating: 10% to 90% non-condensing.
Storage: 10% to 90% non-condensing.

SAFETY:

1. C.S.A. Certified as a component

2. U.L. Recognized Component

3. X-ray radiation less than 0.5 mR/hr.

OPERATING INSTRUCTIONS

POWER INPUT

Apply correct power and signal source to the display. Refer to "GENERAL INFORMATION" for correct plug types.

BRIGHTNESS AND FOCUS

These controls are preset at the factory, but may be adjusted to suit program material. Refer to "GENERAL INFORMATION" section for control location.

CAUTION: *The screen control located at the rear of the high voltage assembly has been sealed at the factory and must not be used as a brightness control.*

SPOT KILLER INDICATOR

A spot killer circuit is used to blank the CRT under a no-signal condition. When the spot killer is active, the CRT will be extinguished and LED D800 will light, indicating spot killer operation.

DETAILS OF OPERATION

LOW VOLTAGE POWER SUPPLY

The AC input voltage for the X-Y display unit is provided by a power transformer which is part of the game hardware. This transformer also provides power line isolation for the display unit.

40-0-40 VAC is supplied to the unit through fuses F100 and F101. Diodes D100 through D103 are high current rectifier diodes to convert AC voltage to a pulsating DC output. Capacitors C100 and C101 form the first stage of filtering. RC networks R102-C102 and R103-C103 provide the 2nd low pass filter for active filter composed of Q100 through Q103. Diodes ZD100 and ZD101 (46 volt zener) are used to limit B+ and B– levels to +49V and –49V maximum.

INTERFACE AND I.P.C. CIRCUIT

The interface circuit provides all the control functions to adjust amplitude and waveshaping.

The circuit contains an operational amplifier for "X" and for "Y". The op amp has a typical voltage gain of 2 when gain controls R207 and R221 are adjusted for the correct display size. The output of the op amp at terminal #6 is used to drive linearity circuits and the I.P.C. (Input Protection Circuit).

VDR200 and VDR201 are used to correct the on-screen linearity of the display by adding "S" shaping to the "X" and "Y" signal waveform. The amount of "S" correction is adjusted by R209 and R223.

The I.P.C. is used to protect the deflection amplifiers should the logic hardware in the game go into a positive or negative lock-up mode. In a positive lock-up, C203 will charge through diode D202 or D203. The voltage charge on C203 will cause ZD203 and Q201 to trip on. Diodes D206 and D207 will clamp the positive portion of both the "X" and "Y" signal to a safe level to protect the deflection amplifiers.

Diodes D200, D201, D204, D205; zener diode ZD202, capacitor C202 and transistor Q200 are used should a negative lock-up occur.

The "X" and "Y" centering controls are used to add a DC component to the "X" signal and "Y" signal.

Additional information can be found in the adjustment procedure section.

X AND Y AMPLIFIERS

The circuit configuration and operation of both amplifiers are identical. "Y" amplifier operation is described below. The "X" amplifier operates in the same manner.

"Y" signal from game hardware is applied to the base of transistor Q600. Transisitors Q600 and Q601 form a differential amplifier.

Transistor Q602 is a constant current source for the differential amplifier. R610 will develop a voltage feedback which is proportional to current produced in the yoke.

The "Y" signal at Q600 will be compared to the feedback signal at Q601. The base input to driver transistor Q603 is taken from this differential amplifier.

Q604 is a constant current source which provides current for driver transistor Q603. Q605 through Q608 are the output current amplifiers which directly drive the yoke.

SPOT KILLER OPERATION

The purpose of the "Spot Killer" is to turn off the picture tube when deflection is not occurring. Failure of the spot killer can burn phosphor coating of picture tube.

The two signal input voltages to the spot killer are taken from resistors R610 and R710 in the "X" and "Y" deflection circuits. Diodes D801 through D804 and capacitors C800 through C803 form two separate peak voltage detectors. The outputs of the voltage doublers are applied to the bases of transistors Q801 and Q802.

When either deflection amplifier is not driving current through the deflection coils, either transistor Q801 or Q802 becomes biased so that it conducts, which turns on transisitor Q800 and LED D800 in its collector circuit. When transistor Q800 is conducting, transistor Q503 in the Neck PC Board is cut off, forcing the red, green and blue amplifiers, in addition to the picture tube, to be in the "off" condition (that is, a condition of zero beam current).

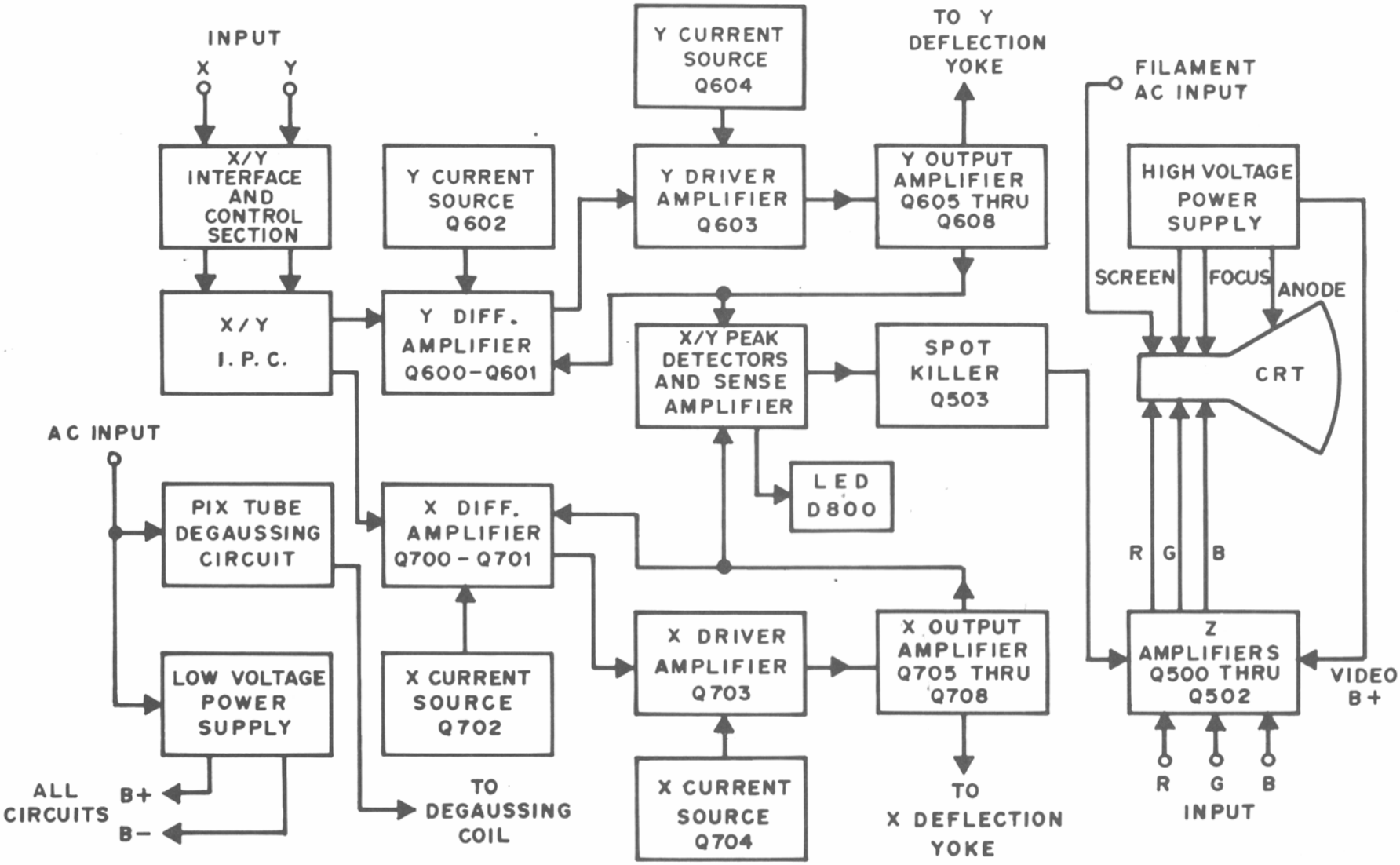


FIGURE 2: Functional Block Diagram

R, G AND B AMPLIFIERS

The three amplifiers located on the Neck PC Board are identical. Their outputs are connected to their respective cathodes of the picture tube for red, green and blue drive signals.

The amplifiers are of the common-emitter type. They are direct coupled from input to output.

The gain and operating point of each amplifier can be adjusted to optimize the picture tube for white balance. For additional information on white balance, refer to "ADJUSTMENT PROCEDURES."

HIGH VOLTAGE POWER SUPPLY

The purpose of the H.V. supply is to deliver anode voltage, in addition to supplying focus, screen and video B+ voltages.

The following block diagram of the H.V. supply shows some of the main functions of the circuit.

Output voltages from the system are generated by switching active device Q906 at a 20 kHz rate. The 20 kHz pulse is formed by a clock circuit which includes IC901. The pulse driver circuit is required to provide a low impedance source for the input of Q906.

Peak voltage and duty cycle of the clock output are controlled by fixed components in clock circuit. No adjustments are required.

To improve high voltage regulation of the system, a feedback voltage is sampled from video B+ line and compared to a reference voltage at error amplifier Q902.

Any change in feedback voltage will be corrected by an increase or decrease in current supplied to H.V. transformer by series regulator Q900; refer to Figure 3, "Block Diagram, H.V. Power Supply".

High voltage variations which occur are normally caused by changes in picture tube anode current which is controlled by game program. These variations are linked to video B+ tap on T900 by magnetic field of H.V. transformer. These voltage variations will be minimized at normal anode current variations by the closed loop connection between T900, Q902 and Q900.

Additional information can be found in "ADJUSTMENT PROCEDURES" section.

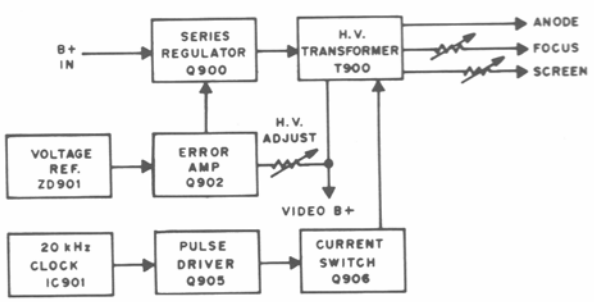


FIGURE 3:
Block Diagram, High Voltage Power Supply

PRODUCT SAFETY SERVICING GUIDLINES

IMPORTANT:
An isolation transformer must be used between the display unit and the AC line.

This transformer must supply 80 VRMS C.T. ± 3% and 6.6 VRMS ± 5% *with a line input of 120 V. A typical crosshatch pattern will produce a drain current of 2.0 ARMS.*

CAUTION:
No modification of any circuit should be attempted. Service work should be performed only after service personnel are thoroughly familiar with all of the following safety checks and service guidelines. To do otherwise increases risk of potential hazards and injury to user.

The picture tube used in this display unit employs integral implosion protection. Replace with tube of same type number for continued safety. Do not lift picture tube by the neck. Handle the picture tube only when wearing shatterproof goggles and after discharging the high voltage completely. Keep others without shatterproof safety goggles away.

After removing 2nd anode lead, connect a clip lead from aquadag coating to anode button. Connect to aquadag coating first.

SAFETY CHECKS

SUBJECT: Fire and Shock Hazard

1. To prevent fire or shock hazard DO NOT EXPOSE THIS DISPLAY TO RAIN OR MOISTURE.
2. Check for frayed insulation on wires.
3. Check the high voltage for proper value (19.5 kV ±5% at 0 beam current) using a meter of known accuracy and calibration.
4. When service is required, observe the original lead dress. Extra precaution should be given to assure correct lead dress in the high voltage circuitry area. Where a short circuit has occurred, replace those components that indicate evidence of overheating. Always use specified replacement component. See parts list in this manual.

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

1. Inspect all lead dress to make certain that leads are not pinched or that hardware is not lodged between the chassis and other metal parts in the display.
2. Replace all protective devices such as insulating fishpapers, adjustment and compartment covers or shields.
3. Pin 11 of the 12-circuit input connector, which is a chassis ground return lead, must have continuity to PC board ground circuit.

IMPORTANT SERVICE NOTES

Work on these models should only be performed by those who are are thoroughly familiar with precautions necessary when working on high voltage equipment.

Exercise care when servicing this chassis with power applied. Many B+ and high voltage RF terminals are exposed which, if carelessly contacted, could cause serious shock or result in damage to the chassis. Maintain interconnecting ground lead connections between chassis and picture tube aquadag when operating chassis.

Certain H.V. failures can increase X-ray radiation. Units should not be operated with H.V. levels exceeding the specified rating for their chassis type. The maximum operating H.V. specified for the chassis used in these units is 19.5 kVDC ± 5% at zero beam current.

It is important to maintain specified values of all components in the high voltage circuits and anywhere else that could cause a rise in high voltage of operating supply voltages. Refer to the Parts List and use ONLY exact replacement parts; especially picture tubes, semiconductor devices, transformers, coils, and fuses.

To determine the presence of high voltage, use an accurate high impedance H.V. meter connected between second anode lead and metal chassis frame only. Refer to page 11.

SERVICE INFORMATION

CIRCUIT TRACING

Component reference numbers are printed on top of the plug-in circuit board to facilitate circuit tracing. In addition, terminal numbers are also shown and referenced on the chassis schematic diagram in this manual.

Transistor elements are identified as follows:
E = emitter; B = base; C = collector

COMPONENT REMOVAL

Removing components from the etched board is facilitated by the fact that the circuitry (plating) appears on one side of the board only.

It is recommended that a solder extracting gun be used to aid in component removal. An iron with a temperature controlled heating element would be desirable since it would reduce the possibility of damaging the board due to over-heating.

The nozzle of the soldering gun is inserted directly over the component lead and when sufficiently heated, the solder is drawn away, leaving the lead free from the copper plating. This method is particularly suitable in removing multi-terminal components.

PICTURE TUBE REPLACEMENT

CAUTION: *Do not install, remove, or handle the picture tube in any manner unless shatterproof goggles are worn. People not so equipped should be kept away while handling picture tubes.*

Before removing second anode lead, wait at least two minutes after power to monitor has been turned off. This will remove high voltage charge on picture tube through resistance of the focus control assembly. After removing second anode lead, connect a clip lead from aquadag coating to anode button. Connect to aquadag coating first.

Power must be removed before any of the assemblies can be removed from the display. Neck assemblies can be removed in the following order:

1. Remove plugs connecting Neck PC Board to chassis.
2. Remove silicone rubber adhesive at picture tube socket.
3. Remove Neck PC Board by sliding board to the rear of the chassis.

NOTE: *Use pressure on the socket and not the PC board material.*

4. Remove magnetic ring assembly using a ¼-inch nut driver.
5. Remove yoke plug.
6. Remove yoke which is held by a retaining screw at the rear of the yoke.

The picture tube and degaussing coil assembly can be removed as a unit. Unplug 2-pin connector for degaussing coil. Using a 7/16-inch hex socket wrench, remove 4 screws holding picture tube. Remove CRT carefully by pulling it out toward the front.

NOTE: *Replacing the picture tube will require checking adjustments for purity, convergence and white balance. Readjustments may be required. Refer to pages 11 through 12 and Figures 6 through 9.*

REMOVAL OF INTERFACE PC BOARD P325

To remove this PC board use a ¼-inch nut driver. Remove one screw which retains the board to the bracket. The board may then be removed by moving upward, away from the Deflection PC Board P322.

SERVICE INFORMATION (Cont.)

REMOVAL OF DEFLECTION PC BOARD P322

Interface PC Board must first be removed before removal of Deflection PC Board. Remove two screws which retain rear of Deflection PC Board.

All plugs and one clip on ground lead must be removed before PC Board can be removed. It will be necessary to make note of plugs removed so that they will be replaced correctly when board is replaced.

HIGH VOLTAGE ASSEMBLY REMOVAL

The display unit must be removed from the game in order to remove the H.V. Assembly.

1. Remove anode lead after power to monitor has been off for at least two minutes.
2. Unplug 3-pin connector P901 from side of H.V. Assembly.
3. Remove J501 from Neck PC Board.
4. Unplug power connector P101 at Deflection PC Board.
5. Using a ¼-inch nut driver, remove the five screws which retain the H.V. cage to the chassis. Do not remove screws which hold together side and bottom panels of display chassis.

The cover of assembly can then be removed, which will expose H.V. PC Board. Any inspection or service can be done without removing the PC board from the metal cage.

POWER TRANSISTOR REPLACEMENT:

When replacing any "plug-in" transistor, please observe the following precautions and note the general warnings or precautions stated elsewhere in this manual.

1. The metal mount for certain transistors also serves as a heat sink. After turning off power, be sure heat sink has cooled sufficiently to avoid burns.
2. Transistor sockets are not "captive"; that is, transistor mounting screws also secure socket. When installing transistor, socket and mica insulator must be held in its proper location. Observe location when transistor is removed.
3. When replacing power and output transistors, thermal grease must be applied evenly to both sides of mica insulator. A mica insulator will be placed between transistor and heat sink.
4. All transistor mounting screws must be tight before applying power to display.

CAUTION: *Do not apply excessive torque to transistor mounting screws. 7-10 in./lbs should usually be sufficient. If screw threads are stripped by excessive torque, a poor electric and/or thermal connection could result.*

FAILURE TO COMPLY WITH THESE INSTRUCTIONS COULD RESULT IN FAILURE OF THE TRANSISTOR AND/OR OTHER COMPONENTS IN THE CIRCUIT.

INDIVIDUAL CIRCUIT ANALYSIS

DC voltage measurements, using a meter with a 1.0 megohm, or higher, input impedance are useful in analyzing circuit faults in the H.V. Power Supply and Deflection Amplifier sections. A digital meter with 10 megohm input impedance, will be required for certain voltage readings. Refer to page 11.

Scope waveforms are useful when checking the deflection amplifier and other circuits. Waveforms can be compared to the scope photos in the service manual. An ohmmeter may be used to check for a shorted transistor or diode. In some cases, this can be done without removing the component from the circuit. When using an ohmmeter, the AC power must be removed from the display.

OPERATIONAL TESTS

FAULT INDICATOR:

The PC Board P322 contains a red LED indicator D800. The indicator will be on when an "X" or "Y" amplifier fault occurs. This indicator must be fully off when the chassis is in normal operations.

Do not attempt to produce beam current when D800 is on. The indicator is the 'ON" state means that a loss of "X" or "Y" yoke current has occurred. The loss of input signal from game hardware ("X" or "Y") will cause the indicator to light.

LOW VOLTAGE POWER SUPPLY

1. Measure the AC voltage between the output side of F100 and F101.
   READING: 80 VRMS ± 10% (maximum limit).

2. Measure the DC voltage of the power supply at collector of Q605 and Q606.
   POSTIVE: 46 V nominal; 49 V maximum at Q605.
   NEGATIVE: -46 V nominal; -49 V maximum at Q606.

HIGH VOLTAGE POWER SUPPLY

The video B+ supply to RGB amplifiers can be measured with a standard multimeter or digital meter.

READING: 182 VDC typical at J501 on Neck PC Board.

The following high voltage measurements will require the use of a high voltage probe and digital meter with 10 megohm input impedance. A high voltage probe such as Fluke Model 80K-40 will increase the voltage range of the digital meter by 1000 times.

WARNING: *Operation of these monitors outside the cabinet involves a shock hazard from the monitor power supplies. Work on the monitor should not be attempted by anyone who is not thoroughly familiar with precautions necessary when working on high voltage equipment.*

- Anode voltage: 19.5 kV at zero beam current
- Focus voltage: 5 kVDC
- Screen voltage: 680 VDC
- These voltages will vary with the settings of the high voltage adjustment, focus or screen controls.

DEGAUSSING

The display unit is equipped with an automatic degaussing circuit. The degaussing effect is confined to the picture tube. This is because the degaussing coil is mounted on picture tube. Should any part of chassis become magnetized, it will be necessary to degauss affected area by means of a manual degaussing coil. Move coil slowly around all monitor surface areas, then slowly withdraw to a distance of 6 feet before disconnecting coil from AC Power Supply.

IMPORTANT DEGAUSSING NOTE:

It is recommended that the picture tube and surrounding metal parts be degaussed with an external degaussing coil immediately before setting color purity and/or convergence adjustments.

SPOT KILLER AND INPUT PROTECTION CIRCUIT TEST

1. Test "X" circuit and "Y" circuit individually and not simultaneously.
2. The switching used for test is shown below:

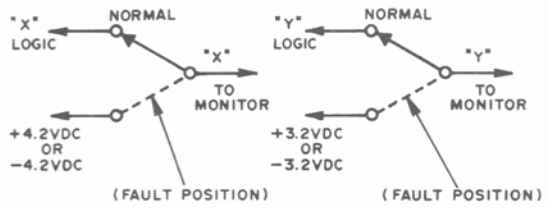


FIGURE 4

3. Hold switch in fault position. Display pattern should be in cut-off.
4. Move switch to normal position. Display pattern should move out from center.

NOTE: *This display unit contains an input protection circuit (I.P.C.) which reduces the yoke current to a safe value to protect the unit from game hardware lockup. Yoke current may be sampled by viewing the waveform across R610 for "Y" fault test or R710 for "X" fault test.*

ADJUSTMENT PROCEDURES

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

INTERFACE PC BOARD ADJUSTMENTS:

1. 6 controls are located on the PC board. The drawing shown below is a chassis rear view of the Interface PC Board.
2. Observe a crosshatch display to determine which controls require adjustment. To determine signal input level, refer to electrical specifications.
3. The control functions are listed below:

   "X" CENTERING—Moves display to the right or left.

   "Y" CENTERING—Moves display up or down.

   "X" GAIN—Adjusts the horizontal size of display for 15 inch.

   "Y" GAIN—Adjusts the vertical size of display for 11.25 inch.

   "X" LIN.—Adjusts left and right square to agree with center square.

   "Y" LIN.—Adjusts top and bottom square to agree with center square.

NOTE: *Any adjustments of linearity must be followed by readjustment of gain settings.*

The following adjustments should be made in consecutive order as shown in this manual.

Refer to "IMPORTANT DEGAUSSING NOTE" on page 11.

HIGH VOLTAGE ADJUSTMENT

Refer to the section entitled "HIGH VOLTAGE POWER SUPPLY" under the heading "OPERATIONAL TESTS" for equipment required. In addition, it will be neccesary to have an insulated potentiometer adjustment tool for hex or slotted potentiometer. Remove power from the display unit, and wait two minutes.

Connect high voltage probe tip to CRT anode button. Insert insulated adjustment tool through top of high voltage cage, making contact with potentiometer R918. Turn on power to display unit, allow 10 minutes warm up time, and then adjust high voltage for 19.5 kV with zero beam current.

FOCUS CONTROL:

1. This control, which is located at the rear of the high voltage assembly, is for customer adjustment.
2. The control may be set slightly de-focused to improve the overall display.

SCREEN CONTROL:

1. The screen control has been adjusted in factory and sealed. This control is located at the rear of the high voltage assembly.
2. Screen control is adjusted for picture tube cutoff when driving R, G and B with a peak voltage input of 1.5V and the brightness control has been adjusted for 0.0V from G1 of picture tube to ground.

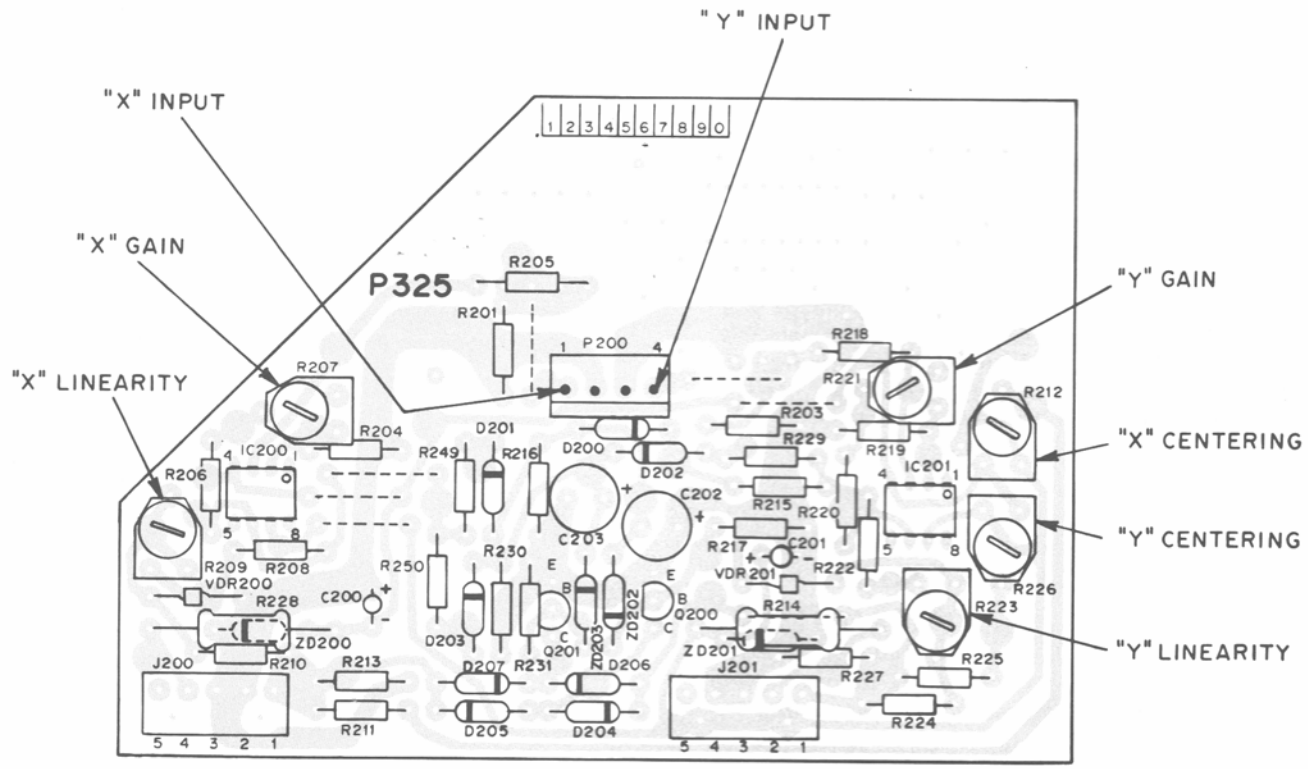


FIGURE 5: Rear View Interface PC Board P325

SCREEN CONTROL:

3. The screen control will require adjustment only when the picture tube or high voltage assembly has been changed.

CAUTION: *CARE MUST BE TAKEN WHEN ADJUSTING THE SCREEN CONTROL TO AVOID A CENTER SPOT WHICH WILL BURN THE PICTURE TUBE.*

NOTE: *Rest position of the electron beam, when it is not being driven, is center of picture tube.*

If rapid adjustment of screen control is made, there is a possibility of burning picture tube. Adjustment of screen control must be made slowly while power is applied to display unit.

WHITE BALANCE:

The Neck PC Board contains 6 controls which are used for white balance. The controls have been optimized at factory to balance the 3 guns of the picture tube.

1. The 3 bias controls (black) are used to balance the low beam gray scale using equal inputs of RGB at 1.8 V peak positive.
2. The 3 drive controls (green) are used to balance the high beam white output using equal inputs of RGB at 3.6 V peak positive.

   NOTE: *The drive control of the gun with lowest output should be in the maximum clockwise position.*
3. Interaction between controls will make it necessary to repeat Steps 1 and 2 as required.

COLOR PURITY

For best results, it is recommended that purity adjustment be made with display unit facing west or east. The display unit must have been operating 15 minutes or more prior to this procedure.

With yoke on CRT neck, set convergence assembly on CRT neck with the center line (of Purity Adjustment Magnet) over gap between grids No. 3 and No. 4. The convergence assembly consists of 3 sets of ring magnets with tabs (Figure 6).

Tabs of the 3 magnetic ring-pairs are to be in a vertical position which will produce a zero-correction state and facilitate adjustments (Figure 6).

Connect a generator or game (self-test mode) which can generate a crosshatch pattern of red, green and blue independently and in combination of colors. Refer to "INTERFACE PC BOARD ADJUSTMENTS" for input signal level and pattern size.

With a green crosshatch pattern, pull the deflection yoke backward as far as it will go. The center vertical portion will be green. If green is not horizontally centered between other colors, move the 2 purity magnets with respect to each other in order to center green crosshatch on screen.

Push deflection yoke forward gradually, until crosshatch is a uniform green (pure in color) across the entire pattern. The deflection yoke should subsequently be secured in place.

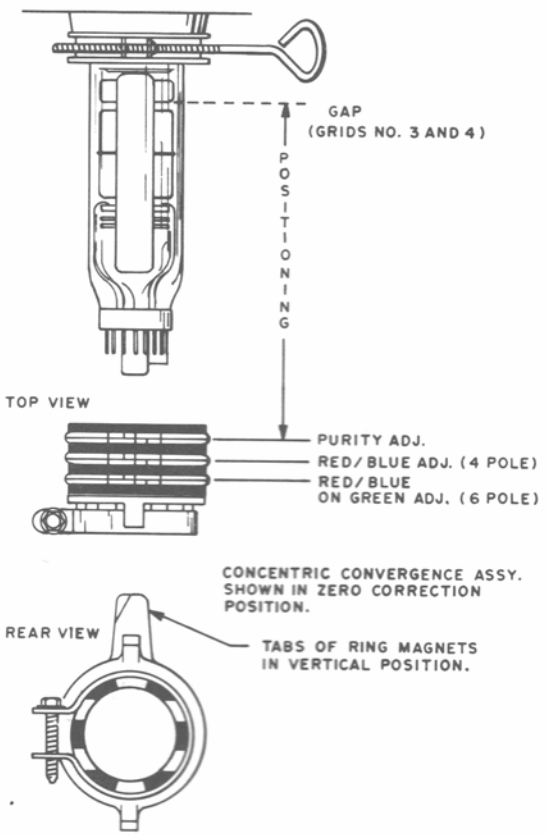


FIGURE 6

Both red and blue colors are to be checked for uniformity and true color. Reposition deflection yoke, if necessary, to obtain optimum purity of all colors. Tighten clamp to secure deflection yoke.

STATIC CONVERGENCE ADJUSTMENT

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

1. A crosshatch signal should be connected to the monitor.
2. A pair of 4-Pole Convergence Magnets is provided and adjusted to converge the blue and red beams (Figure 6). When the Pole opens to the left and right 45° symmetrically, the magnetic field maximizes. Red and blue beams move to the left and right. Variation of the angle between the tabs adjusts the convergence of red and blue vertical lines.
3. When both 4-Pole Convergence Magnet Tabs are rotated as a pair, the convergence of the red and blue horizontal lines is adjusted.
4. A pair of 6-Pole Convergence Magnets is also provided and adjusted to converge the magenta (red + blue) to green beams (Figure 6). When the Pole opens to the left and right 30° symmetrically, the magnetic field is maximized. Red and blue beams both move to the left and right. Variation of the opening angle adjusts the convergence of magenta to green vertical lines.
5. When both 6-Pole Convergence Magnet Tabs are rotated as a pair, the convergence of magenta to green horizontal lines is adjusted.

ADJUSTMENT OF DYNAMIC CONVERGENCE (Figures 7,8 and 9)

1. Feed a cross hatch signal to the monitor.
2. Insert a wedge temporarily and fix the Deflection Yoke so as to obtain the best circumference (Figures 8a through 9b).

   NOTE: *The wedges may need to be moved during adjustments.*
3. Insert three rubber wedges to the position as shown in Figure 7 to obtain the best circumference convergence.

NOTE:

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

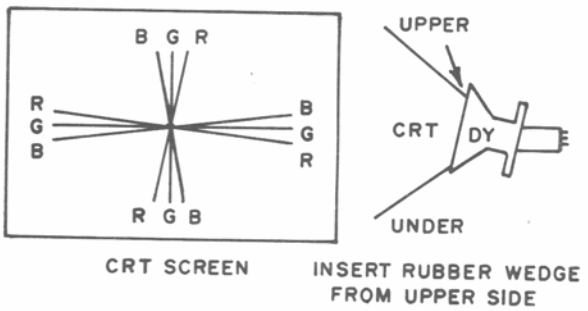


FIGURE 8a

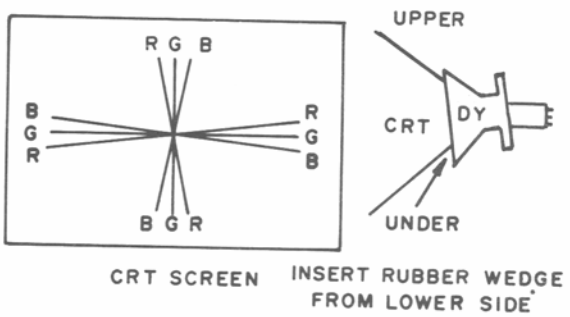


FIGURE 8b

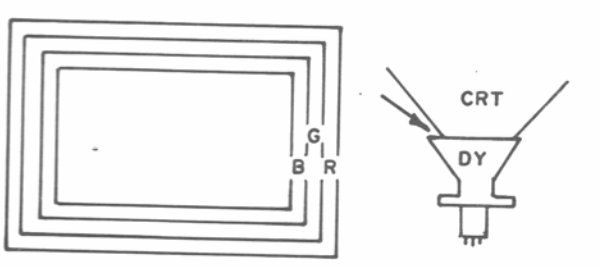


FIGURE 9a

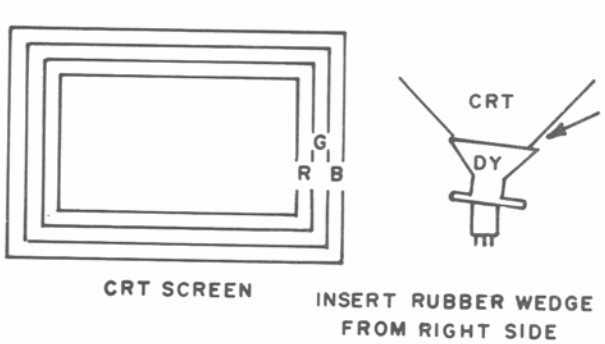


FIGURE 9b

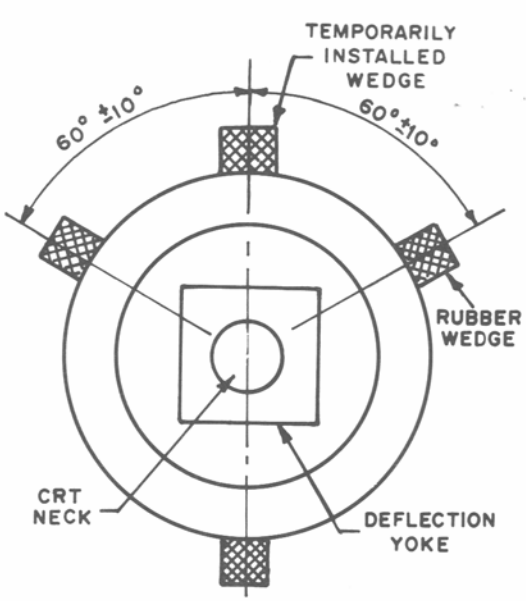


FIGURE 7
Rear View

FIGURE 11: High Voltage PC Board P324

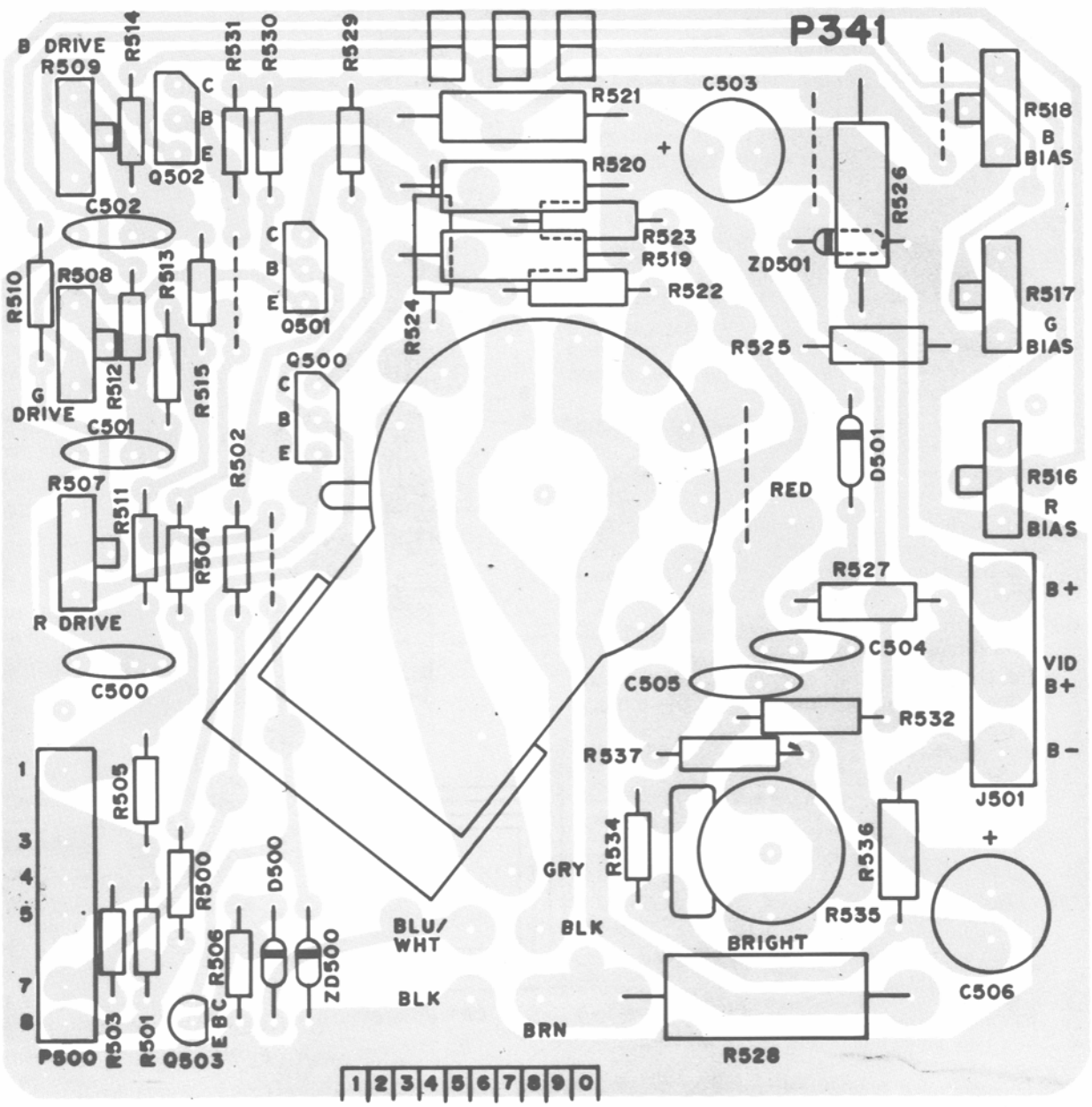


FIGURE 10: Neck PC Board P341

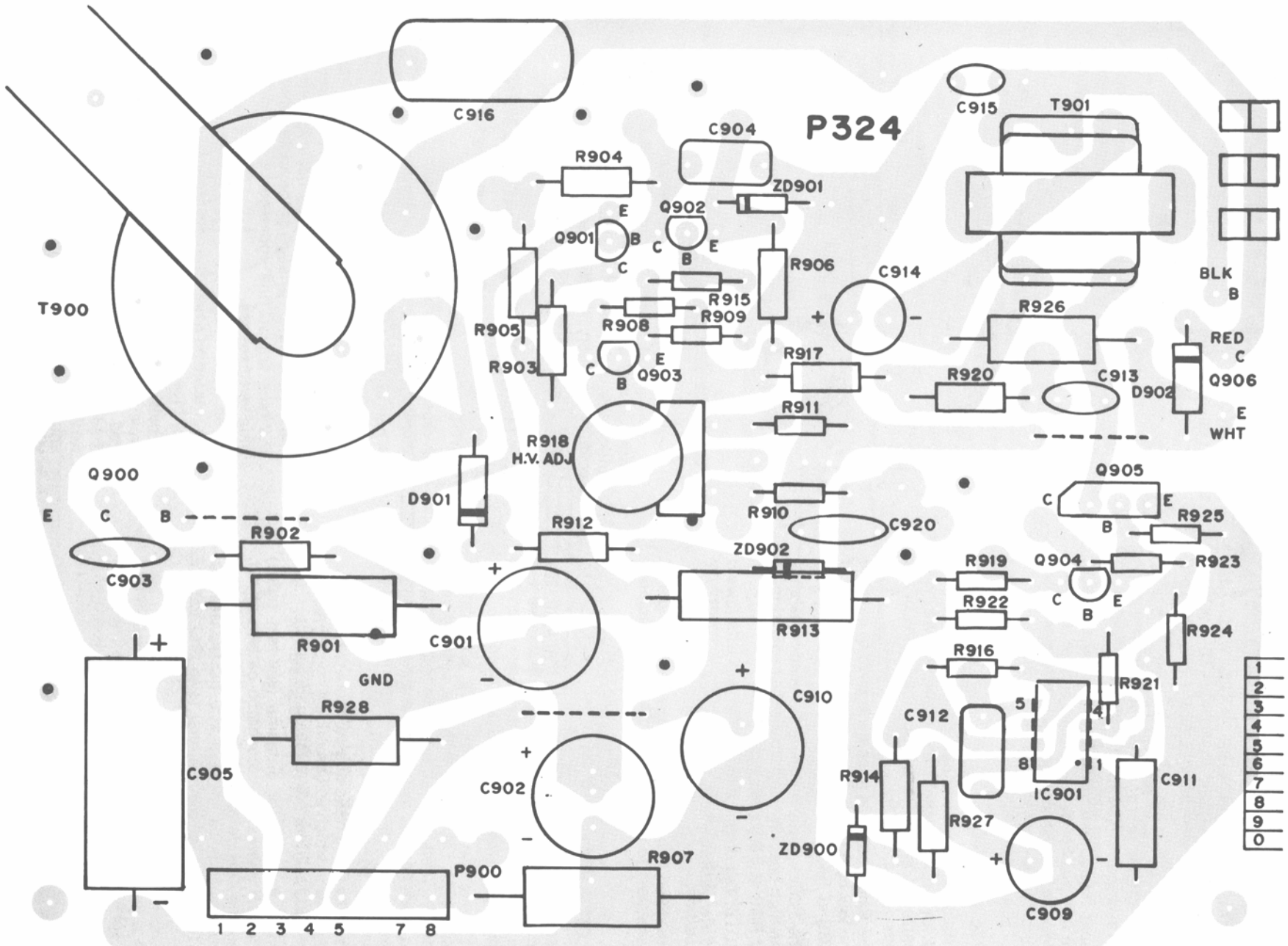


FIGURE 11: High Voltage PC Board P324

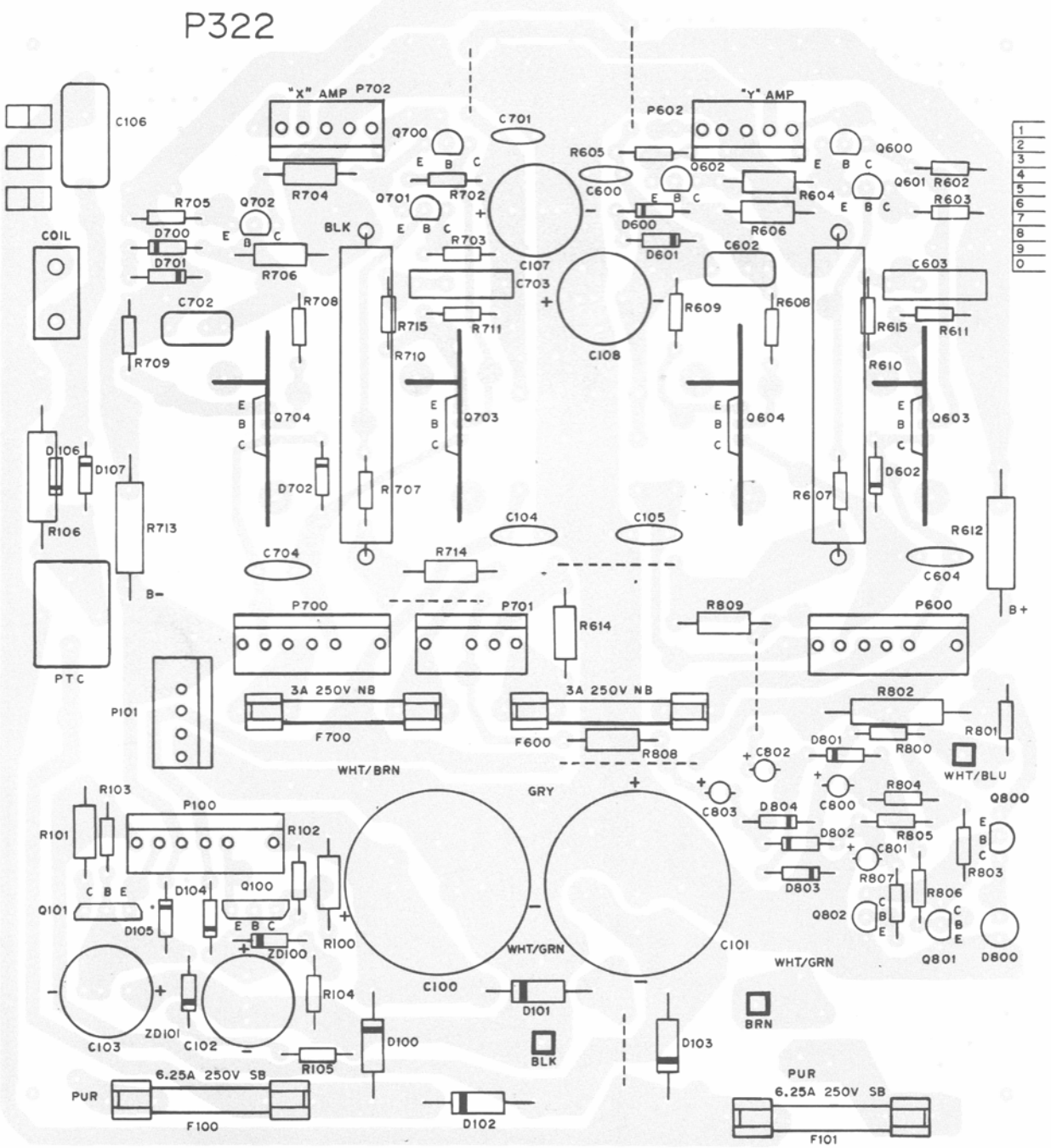


FIGURE 12: Deflection PC Board
(Component Side Shown)

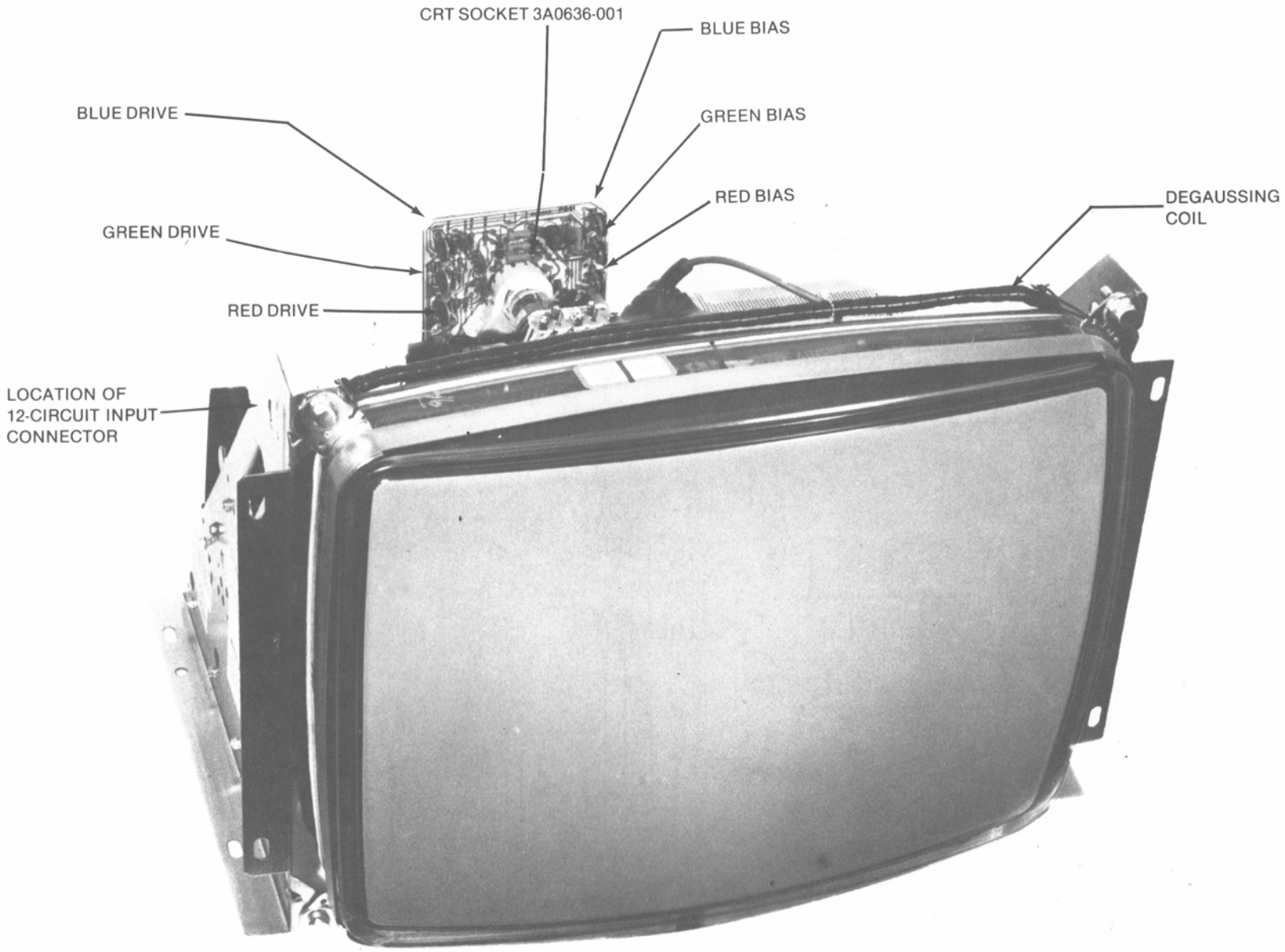

CRT SOCKET 3A0636-001
BLUE BIAS
BLUE DRIVE
GREEN BIAS
RED BIAS
DEGAUSSING COIL
GREEN DRIVE
RED DRIVE
LOCATION OF 12-CIRCUIT INPUT CONNECTOR

FIGURE 13

Dim.	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q
IN	20.406	14.281	7.250	19.593	19.593	9.796	2.750	9.000	3.078	18.343	3.062	8.000	13.250	14.638	17.094	13.260
MM	518.2	362.7	184.6	497.7	497.7	248.8	69.8	228.6	78.2	465.7	77.8	203.2	336.5	371.8	434.2	336.8

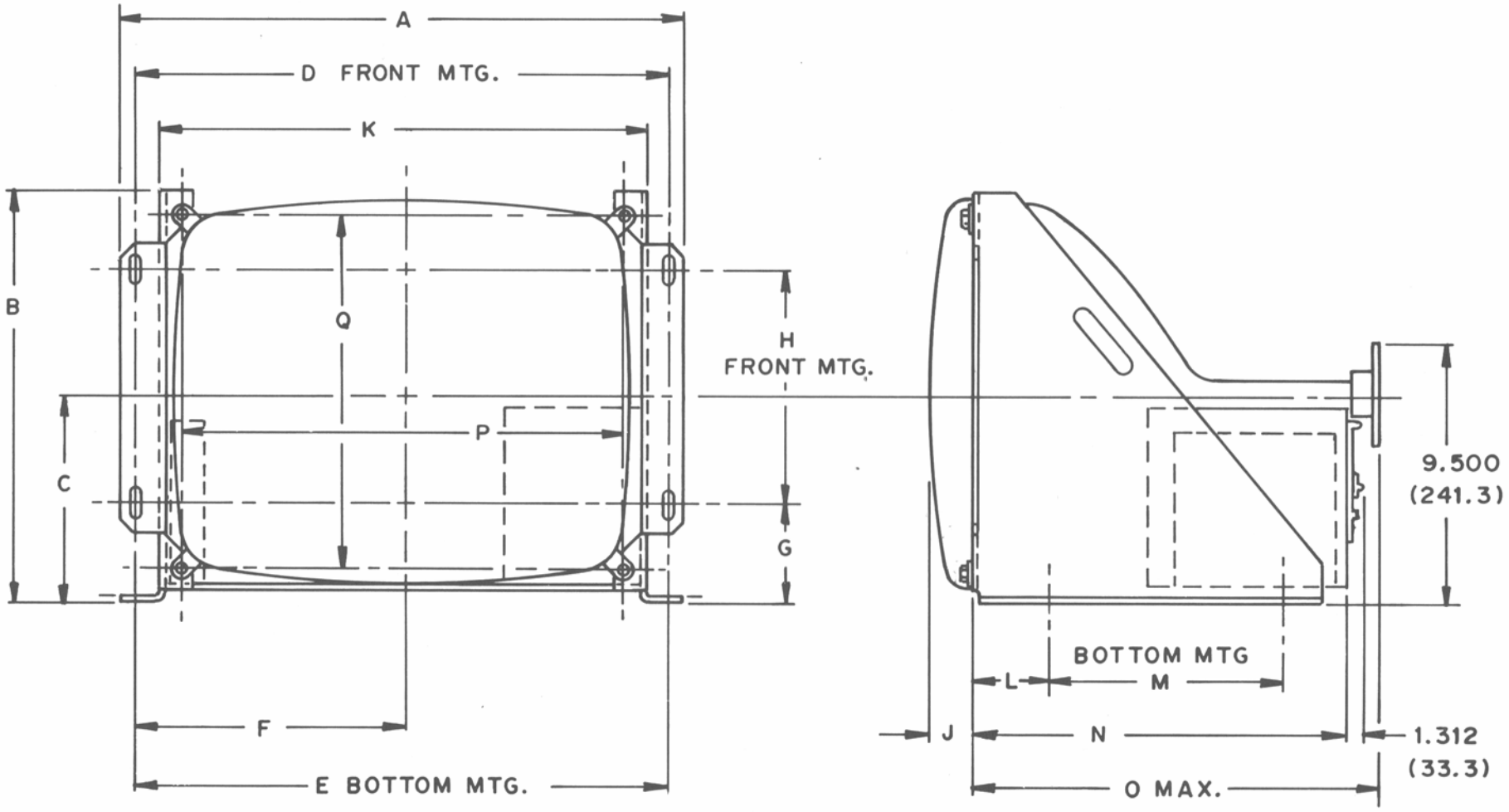
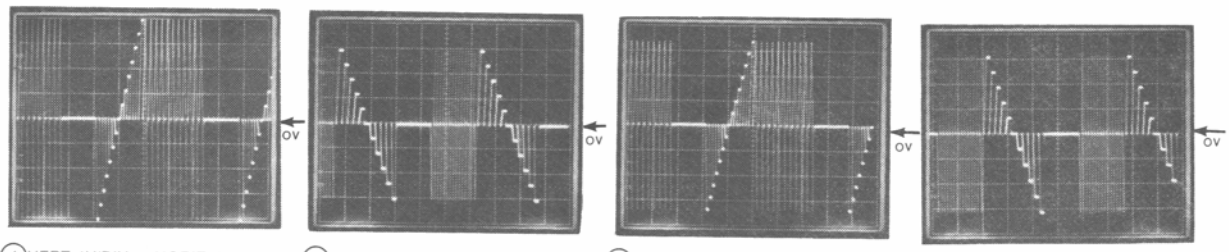


FIGURE 14: 19V Color Vector Monitor—Horizontal View

WAVEFORMS

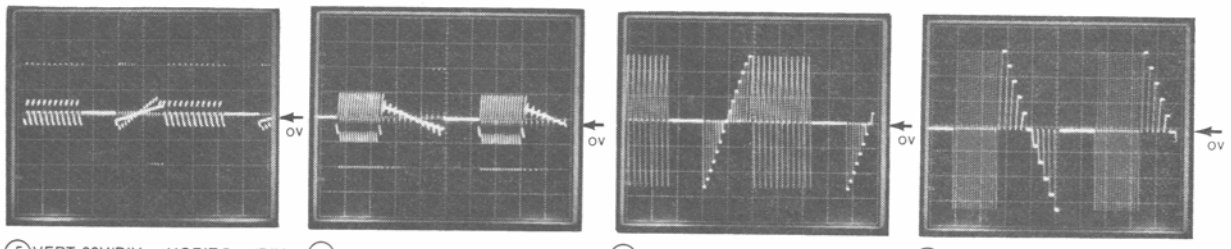


(1) VERT. 1V/DIV. HORIZ. 5ms/DIV. 8VP/P SCOPE MODE DC

(2) VERT. 1V/DIV HORIZ 5ms/DIV. 6VP/P SCOPE MODE DC

(3) VERT. 2V/DIV. HORIZ. 5ms/DIV. 14VP/P SCOPE MODE DC

(4) VERT. 2V/DIV. HORIZ 5ms/DIV. 12.6VP/P SCOPE MODE DC

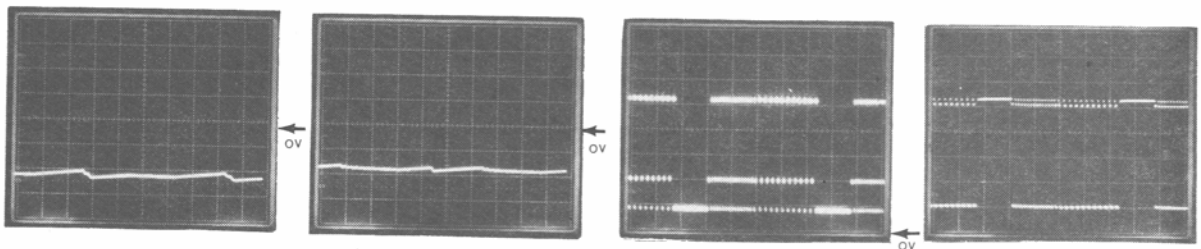


(5) VERT. 20V/DIV HORIZ 5ms/DIV 80VP/P SCOPE MODE DC

(6) VERT. 20V/DIV HORIZ 5ms/DIV. 80VP/P SCOPE MODE DC

(7) VERT. 1V/DIV. HORIZ 5ms/DIV 5.2VP/P SCOPE MODE DC

(8) VERT. 1V/DIV HORIZ. 5ms/DIV. 6-2VP/P SCOPE MODE DC

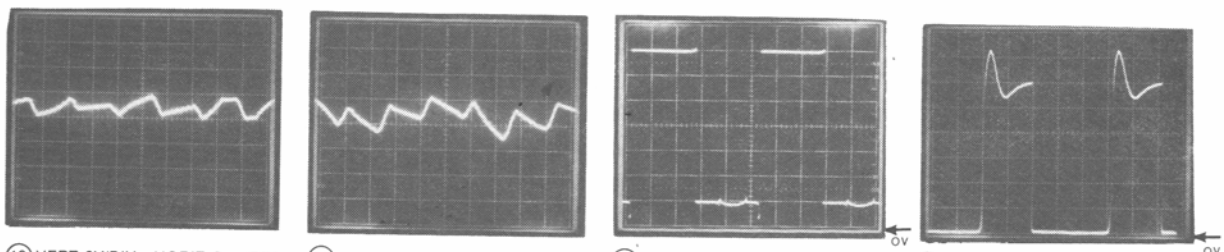


(9) VERT 2V/DIV. HORIZ. 5ms/DIV 1VP/P SCOPE MODE DC

(10) VERT. 2V/DIV. HORIZ. 5ms/DIV 0.8VP/P SCOPE MODE DC

(11) VERT. 0.5V/DIV. HORIZ. 5ms/DIV. 2.2VP/P SCOPE MODE DC

(12) VERT. 10V/DIV HORIZ. 5ms/DIV. 44VP/P SCOPE MODE AC

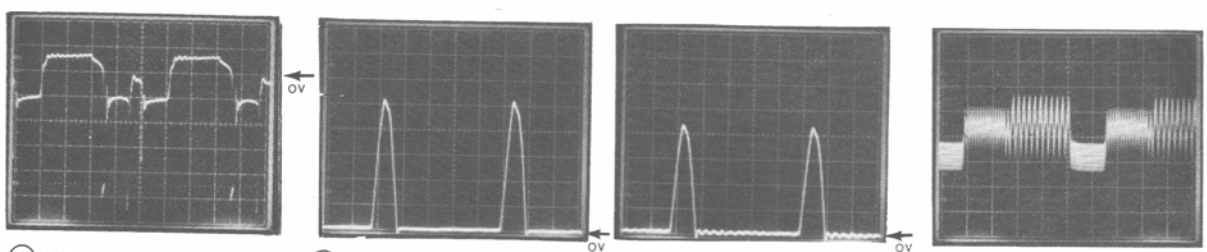


(13) VERT. 2V/DIV. HORIZ. 5ms/DIV. 2VP/P SCOPE MODE AC

(14) VERT. 2V/DIV HORIZ. 5ms/DIV. 1.5VP/P SCOPE MODE AC

(15) VERT. 2V/DIV. HORIZ. 10µs/DIV. 12VP/P SCOPE MODE DC

(16) VERT. 20V/DIV. HORIZ. 10µs/DIV. 144VP/P SCOPE MODE DC



(17) VERT. 2V/DIV. HORIZ. 10µs/DIV. 13VP/P SCOPE MODE DC

(18) VERT. 50V/DIV. HORIZ. 10µs/DIV. 260VP/P SCOPE MODE DC

(19) VERT. 50V/DIV. HORIZ. 10µs/DIV. 230VP/P SCOPE MODE DC

(20) VERT. 0.5V/DIV. HORIZ. 5ms/DIV. 1.8VP/P SCOPE MODE AC

NOTE: *Waveform measurements taken from point indicated to chassis with a wide band oscilloscope. Vertical sensitivity and time base shown below photo. Input signal is a green crosshatch pattern with "X" input equal to 8 V P-P and "Y" input equal to 6 V P-P. the pattern is adjusted for correct size, linearity and centering.*

For waveform reference numbers, check schematic with circled numbers.

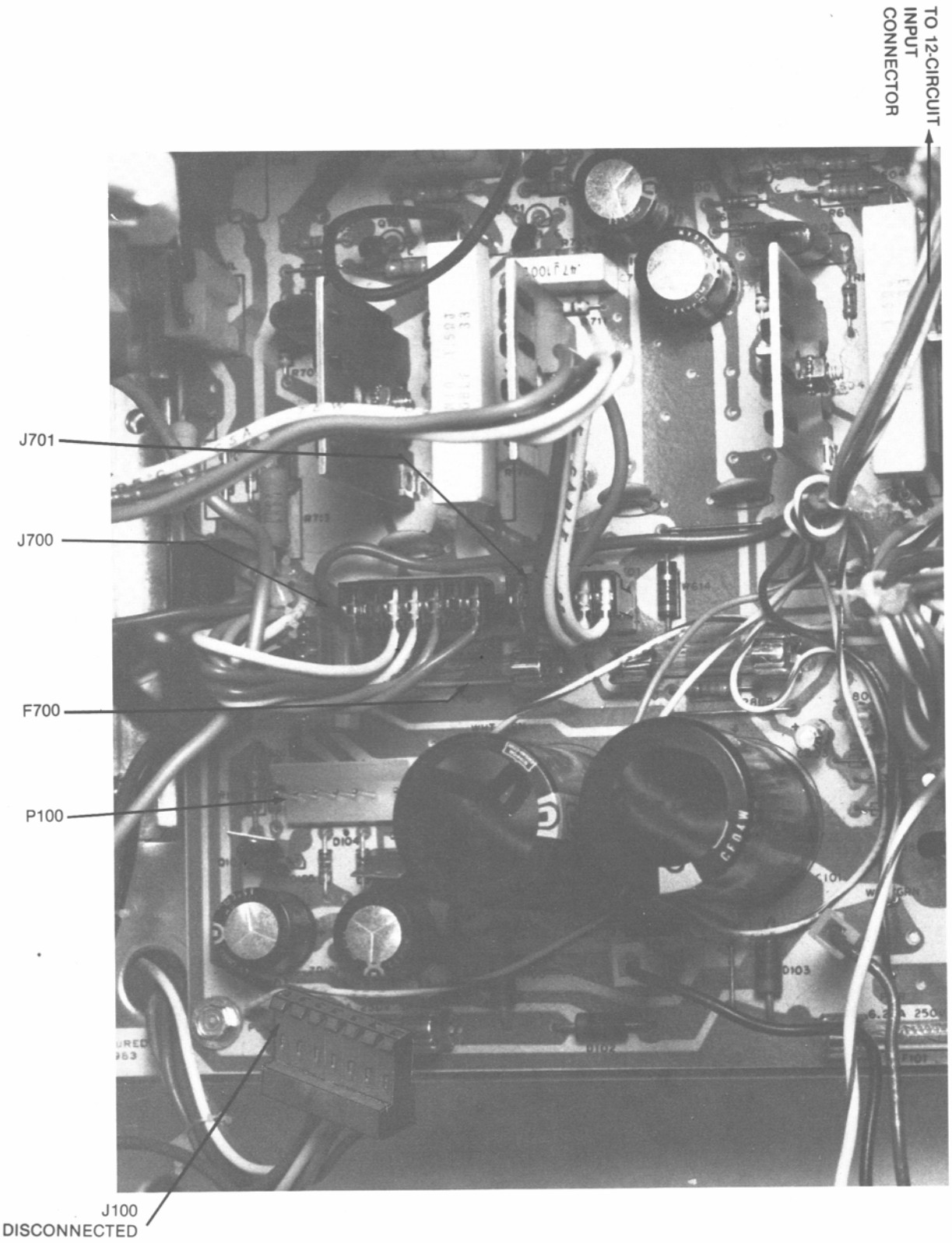


FIGURE 15: Partial Top View, Deflection PC Board P322 (Mounted)

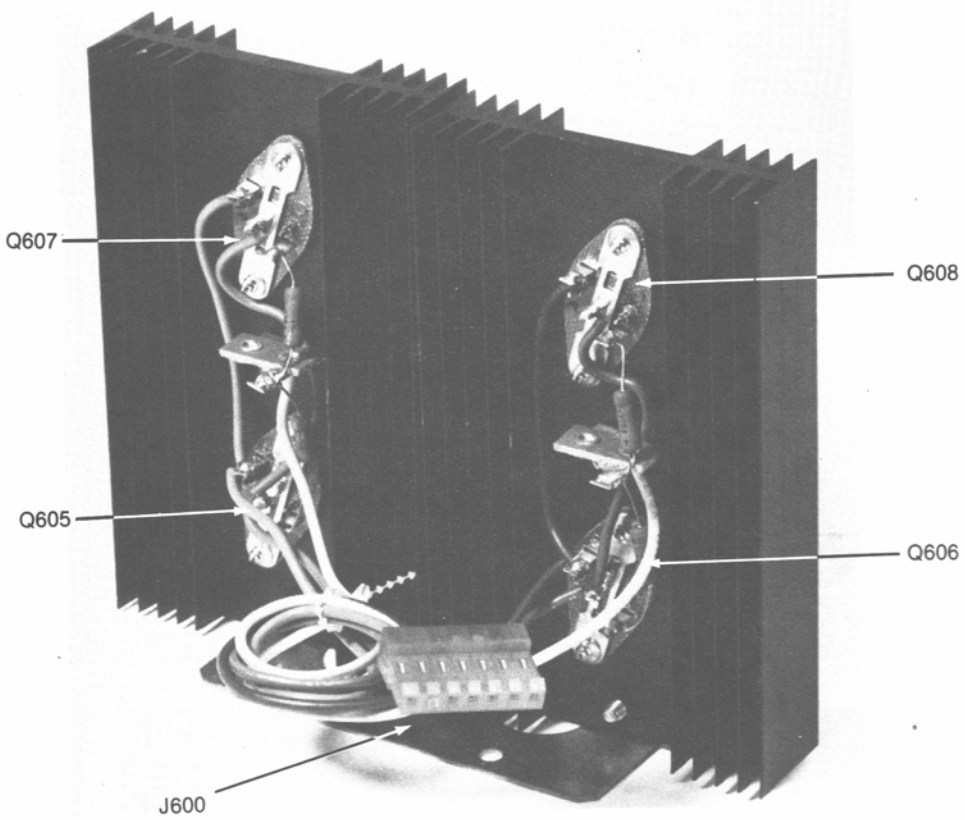


FIGURE 16: Y Output Amplifier/Heat Sink Assembly, 38A5767-000

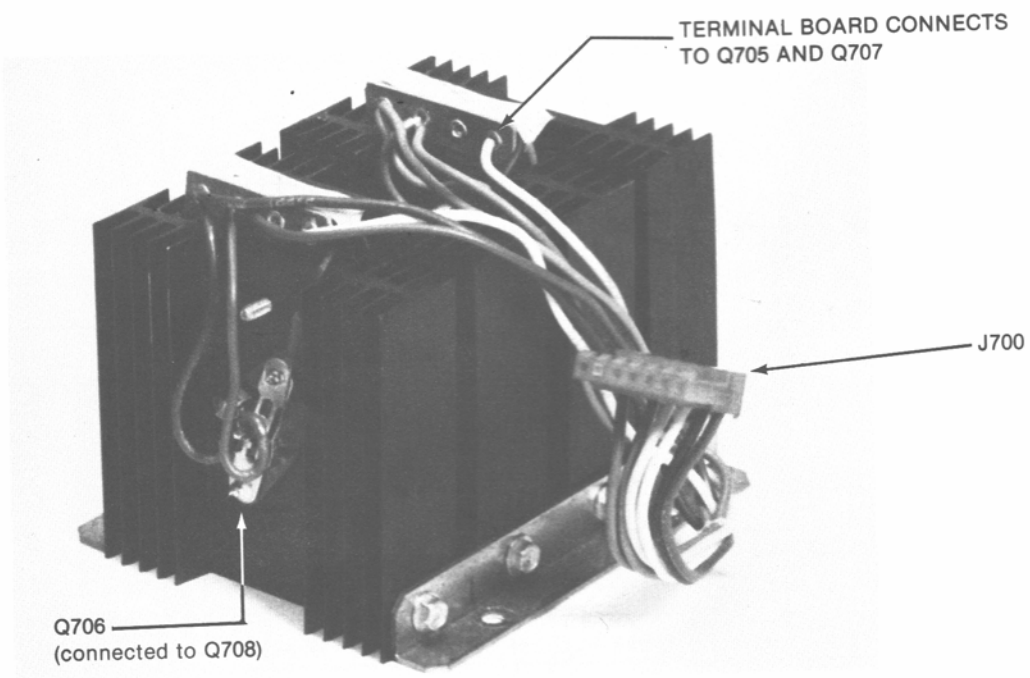


FIGURE 17: X Output Amplifier/Heat Sink Assembly 38A5765-000

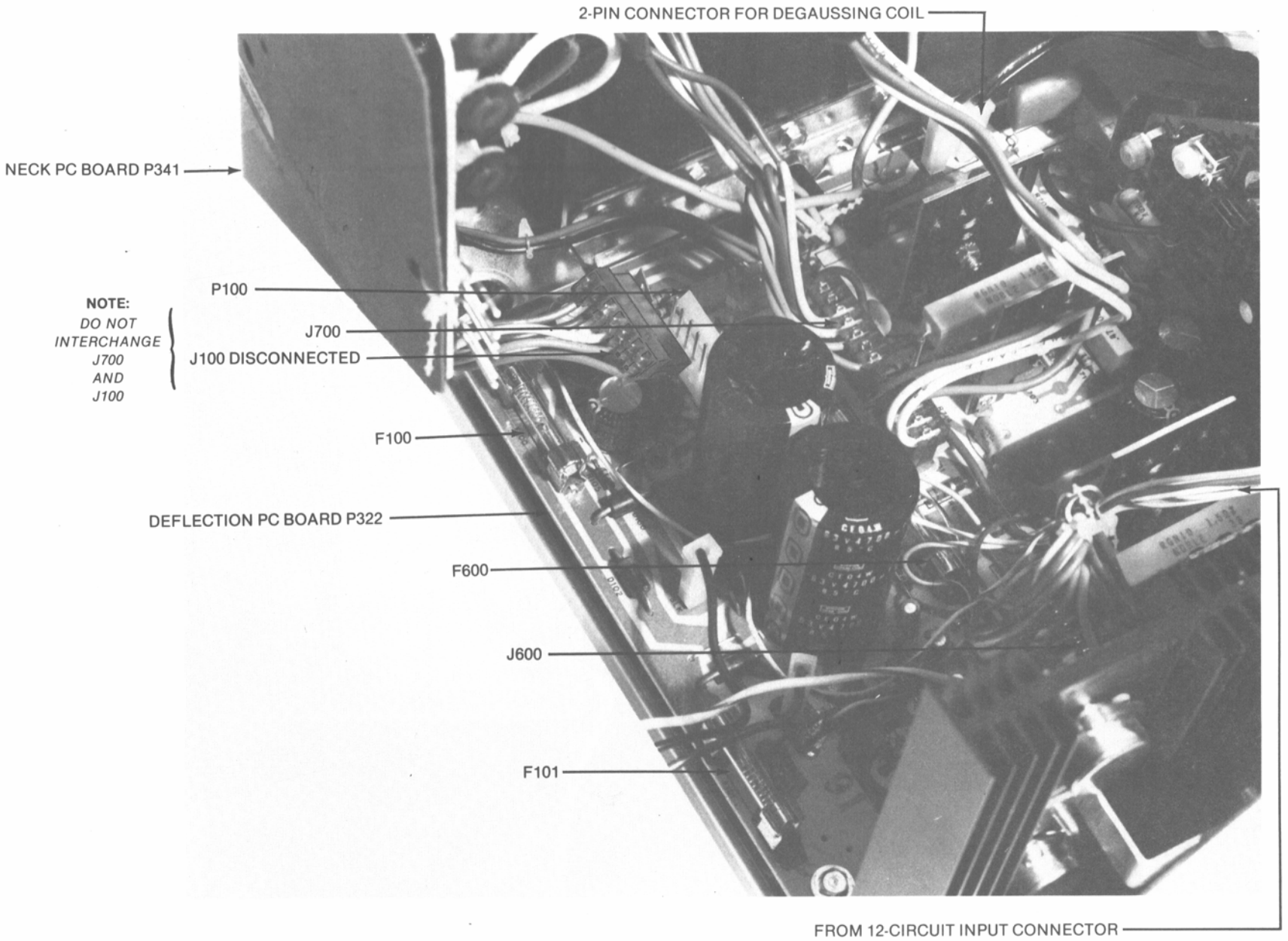

2-PIN CONNECTOR FOR DEGAUSSING COIL
NECK PC BOARD P341
P100
NOTE:
DO NOT INTERCHANGE J700 AND J100
J700
J100 DISCONNECTED
F100
DEFLECTION PC BOARD P322
F600
J600
F101
FROM 12-CIRCUIT INPUT CONNECTOR

FIGURE 18

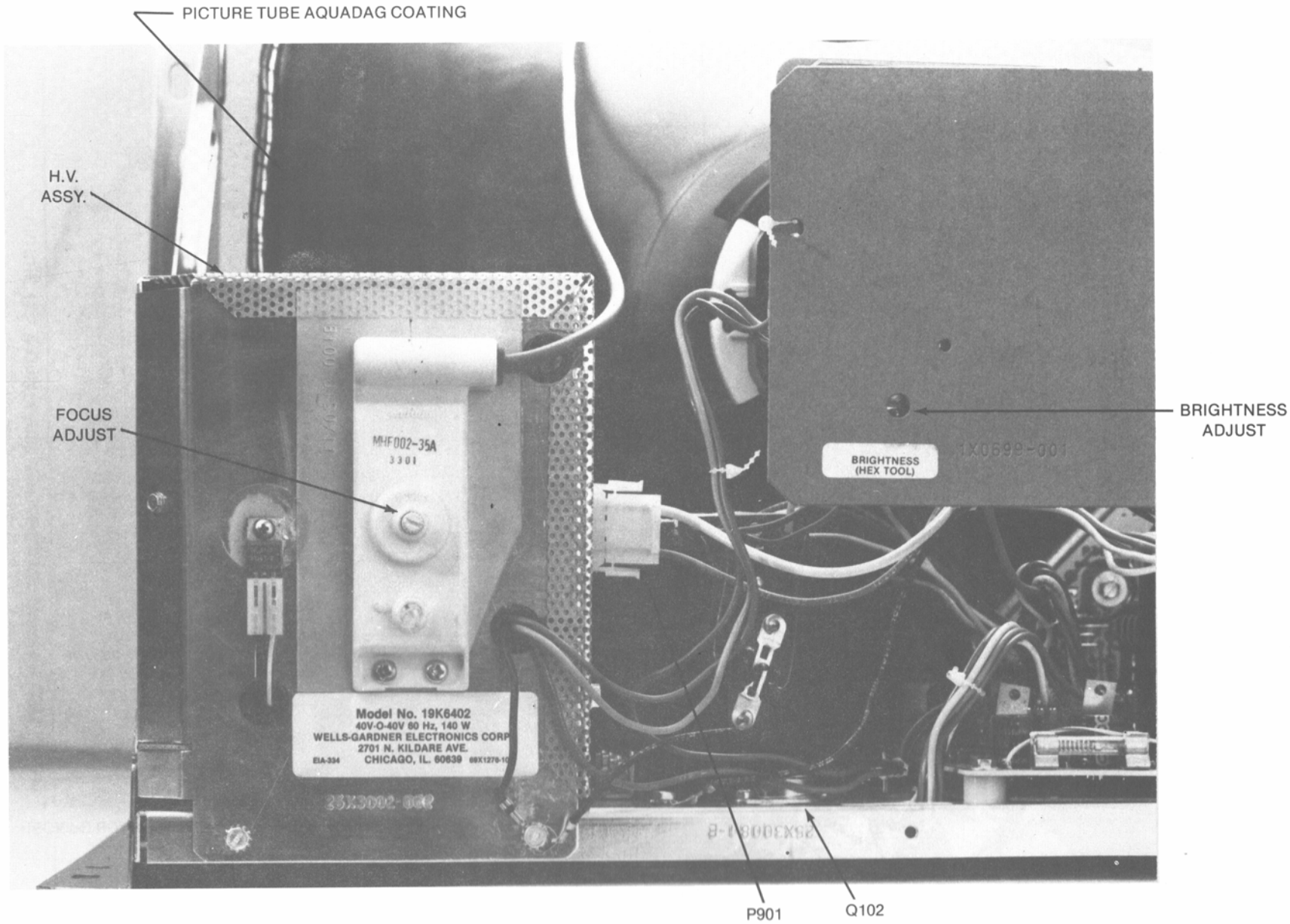


FIGURE 19a: Partial Rear View Showing Unit as Shipped

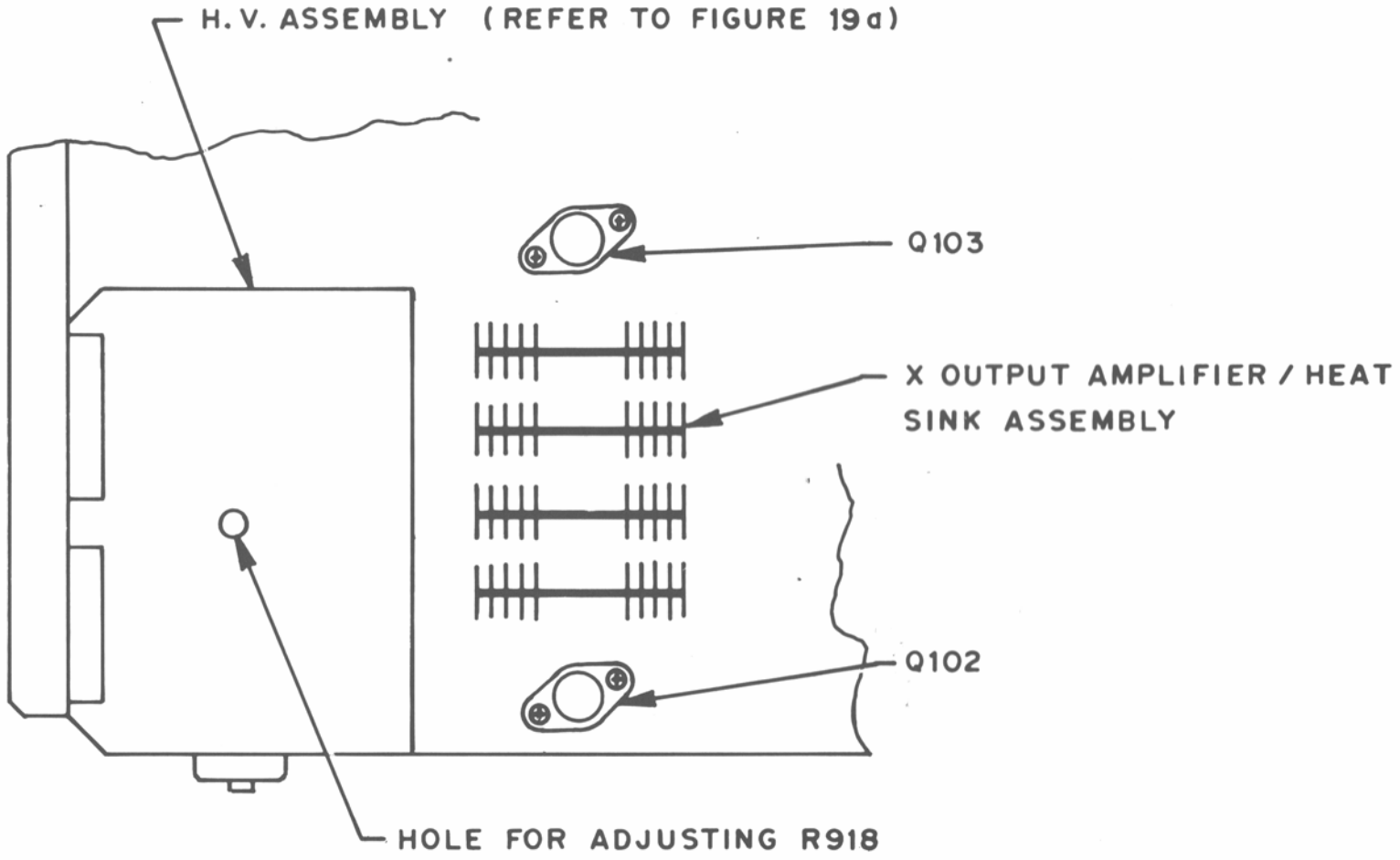
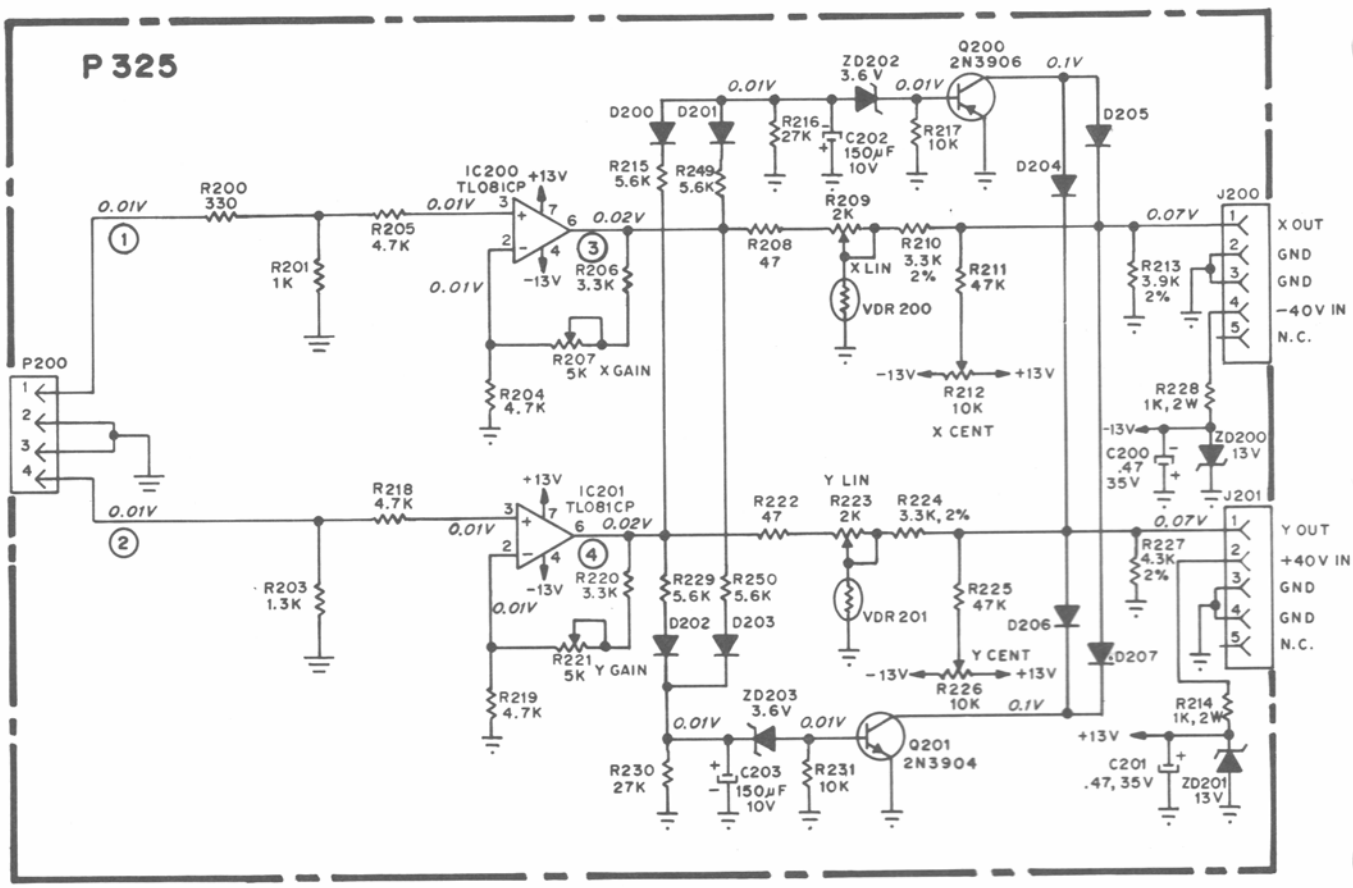


FIGURE 19b: Partial Top View With CRT Removed



GENERAL NOTES:

1. FOR DETAIL OF GENERAL NOTES SEE NOTES NO. 1, 2 AND 4 ON MAIN SCHEMATIC (19K6400 SERIES, ISSUE D)

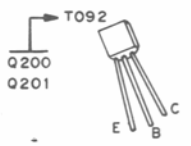
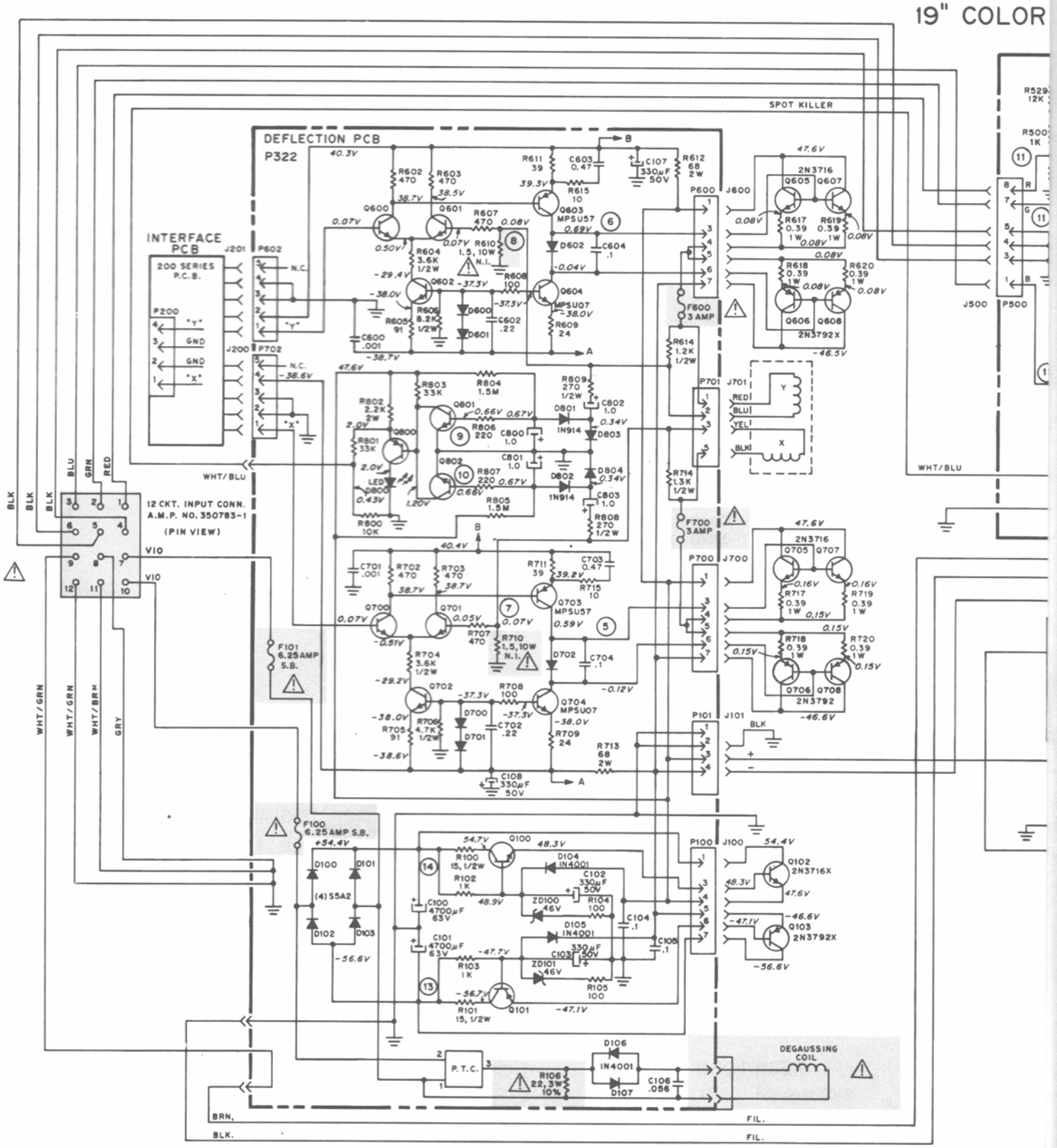


FIGURE 20: Interface PC Board P325

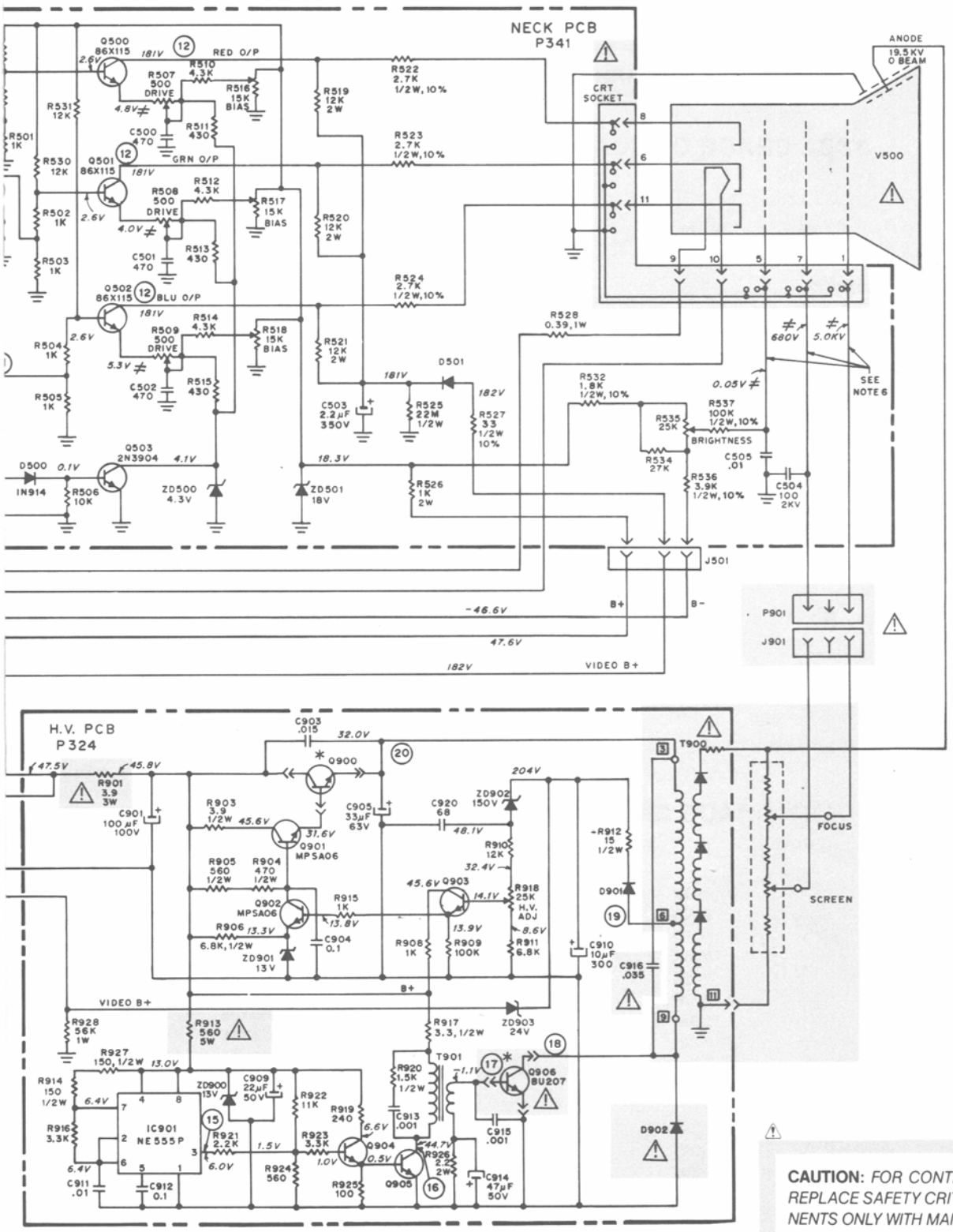


GENERAL NOTES:

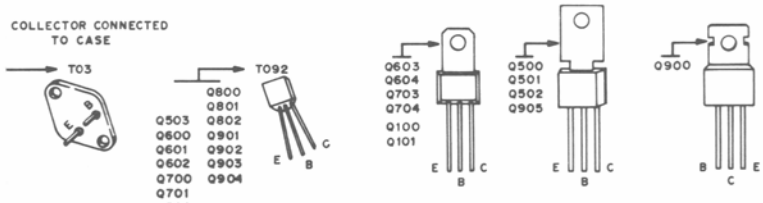
1. RESISTANCE VALUES IN OHMS 1/4 WATT, 5% UNLESS OTHERWISE NOTED. K=1,000, M=1,000,000
2. CAPACITANCE VALUE OF 1 OR LESS IN MICROFARADS, ABOVE 1 IN PICOFARADS UNLESS OTHERWISE NOTED.
3. * Q900 AND Q906 ARE NOT ON H.V.P.C.B.
4. ALL D.C. VOTAGES ± 10% MEASURED FROM POINT INDICATED TO GROUND USING A HIGH IMPEDANCE METER. VOLTAGES ARE MEASURED WITH NO SIGNAL INPUT AND CONTROLS ARE IN A NORMAL OPERATING POSITION.
5. USE A 1,000 : 1 PROBE WHEN MEASURING SCREEN OR FOCUS VOLTAGE.
6. ≠ VOLTAGE VARIES WITH CONTROL SETTINGS.
7. CIRCLED NUMBERS INDICATE LOCATIONS OF WAVEFORM READINGS.

Q102
Q103
Q605
Q606
Q705
Q706
Q906

GRAPHIC DISPLAY SCHEMATIC DIAGRAM



COLLECTOR CONNECTED TO CASE



19K6400 SERIES – ISS. D

CAUTION: *FOR CONTINUED SAFETY, REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER'S RECOMMENDED PARTS.*

AVERTISSEMENT: *POUR MAINTENIR LE DEGRE DE SECURITE DE L'APPAREIL NE REMPLACER LES COMPOSANTS DONT LE FONCTIONNEMENT EST CRITIQUE POUR LA SECURITE QUE PAR DES PIECES RECOMMANDEES PAR LE FABRICANT.*

NOTES

GENE
1.
2.
3.

REPLACEMENT PARTS LIST

This monitor contains circuits and components included specifically for safety purposes.

For continued protection no changes should be made to the original design, and components shown in shaded areas of schematic, or ⚠★ on parts list should be replaced with exact factory replacement parts.

The use of substitute parts may create a shock, fire, radiation or other hazard. Service should be performed by qualified personnel only.

P325 INTERFACE PC BOARD ASSY.

Ref. No.	Part No.	Description
	CAPACITORS	
C200,201	45X0525-003	0.47 μF, 37V, Lytic
C202,203	45X0524-052	150 μF, 10V Lytic
	RESISTORS	
R200	340X2331-934	330Ω , 5%, 0.25W
R201	340X2102-934	1kΩ , 5%, 0.25W
R203	340X2132-934	1.3kΩ , 5%m 0.25W
R204,205,218	340X2472-934	4.7kΩ , 5%, 0.25W
R206,220	340X2332-934	3.3kΩ , 5%, 0.25W
R208,222	340X2470-934	47Ω , 5%, 0.25W
R209,223	40X0639-006	Control, 2kΩ
R210,224	340X2332-924	3.3kΩ , 2%, 0.25W
R211,225	340X2473-934	47kΩ , 5%, 0.25W
R212,226	40X0639-008	Control, 10kΩ
R213	340X2392-924	3.9kΩ , 2%, 0.25W
R214,228	340X5102-733	1kΩ , 5%, 2W
R215,229,249	340X2562-934	5.6kΩ , 5%, 0.25W
R216,230	340X2273-934	27kΩ , 5%, 0.25W
R217,231	340X2103-934	10kΩ , 5%, 0.25W
R221,207	40X0639-007	Control, 5kΩ
R227	340X2432-924	4.3kΩ , 2%, 0.25W

Ref. No.	Part No.	Description
	SEMICONDUCTORS	
D200,201,206	66X0070-001	Diode 1N914B
IC200,201	86X0138-001	IC TL081CP
Q200	86X0114-001	Transistor, PNP, 2N3906
Q201	86X0113-001	Transistor, NPN, 2N3904
VDR200,201	43X0470-001	Voltage Dependent Resistor
ZD200,201	66X0040-017	Zener Diode, 13V, 5%, 1.0W
ZD202,203	66X0040-034	Zener Diode, 3.6V. 7% Special

P322 DEFLECTION PC BOARD ASSY.

	43X0474-001	Dual Thermistor (P.T.C.), Special
	CAPACITORS	
C100,101	45X0564-001	4700 μF, 63V, Lytic
C102,103	45X0565-001	330 μF, 50V, Lytic
C106	343X5632-040	.056μF, 10%, 400V
C600,701	80X0099-005	.001 μF, 20%, Z5F, Disc
C602,702	47X0786-006	0.22 μF, 50V
C603,703	46X0541-003	0.47μF, 100V
C604,704	80X0099-193	0.1 μF, 50V, Disc
C800,801	45X0560-019	1μF, 50V, Lytic
	RESISTORS	
R100,101	340X3150-934	15Ω , 5%, 0.5W
R102,103	340X2102-934	1kΩ , 5%, 0.25W
⚠ R106	43X0477-002	22Ω , 10%, 3W
R602,603	340X2471-934	470Ω , 5%, 0.25W
R604,704	340X3362-934	3.6kΩ , 5%, 0.5W
R605,705	340X2910-934	91Ω , 5%, 0.25W
R606	340X3822-934	8.2kΩ , 5%, 0.5W
R608,708	340X2101-934	100Ω , 5%, 0.25W
R609,709	340X2240-934	24Ω , 5%, 0.25W
⚠ R610,710	43X0401-056	1.5Ω , 5%, N.I., 10W
R611,711	340X2390-934	39Ω , 5%, 0.25W
R612,713	340X5680-733	68Ω , 5%, 2W
R614	340X3122-234	1.2kΩ , 5%, 0.5W

	RESISTORS (Cont.)	
R615,715	340X2100-934	10Ω , 5%, 0.25W
R706	340X3472-934	4.7kΩ , 5%, 0.5W
R714	340X3132-234	1.3kΩ , 5%, 0.5W
R800	340X2103-934	10kΩ , 5%, 0.25W
R801	340X2333-934	33kΩ , 5%, 0.25W
R802	340X5222-743	2.2kΩ , 10%, 2W
R803	340X2333-934	33kΩ , 5%, 0.25W
R804,805	340X2155-934	1.5MΩ , 5%, 0.25W
R806,807	340X2221-934	220Ω , 5%, 0.25W
R808,809	340X3271-934	270Ω , 5%, 0.5W
	SEMICONDUCTORS	
D100,101	66X0079-001	Diode, S5A2
D600,601,700	66X0070-001	Diode, 1N914B
D602,702	66X0071-001	Diode, IN4001
D800	7A0363-001	LED
Q100	86X0125-001	Transistor, NPN
Q101	86X0126-001	Transistor, PNP
Q600,601,602	86X0127-001	Transistor, NPN, TPS 98
Q603,Q703	86X0126-001	Transistor, PNP
Q604,Q704	86X0125-001	Transistor, NPN
Q800	86X0072-001	Transistor, PNP
ZD100,101	66X0040-027	Zener Diode, 46V, 5%, 1.0W

P341 NECK PC BOARD ASSY.

Ref. No.	Part No.	Description
CAPACITORS		
C500,501,502	80X0099-006	470pF, 10%, Z5F, Disc
C503	45X0569-004	2.2μF, 350V, Lytic
C504	80X0099-118	100pF, 10%, 2kV, N750, Disc
C505	80X0099-061	.01μF, 20%, 1kV, Z5U, Disc
RESISTORS		
R501,503,505	340X2102-934	1kΩ, 5%, 0.25W
R506	340X2103-934	10kΩ, 5%, 0.25W
R507,508,509	40X0641-001	Control, 500Ω, Green
R510,512,514	340X2432-934	4.3kΩ, 5%, 0.25W
R511,513,515	340X2431-934	430Ω, 5%, 0.25W
R516,517,518	40X0641-004	Control, 15kΩ, Black
R519,520,521	340X5123-733	12kΩ, 5%, 2W
R522,523,524	340X3272-244	2.7kΩ, 10%, 0.5W
R525	340X3226-244	22MΩ, 10%, 0.5W
R526	340X5102-733	1kΩ, 5%, 2W
R527	340X3330-934	33Ω, 5%, 0.5W
R528	340X4399-331	0.39Ω, 5%, 1W
R529,530,531	340X2123-934	12kΩ, 5%, 0.25W
R532	340X3182-944	1.8kΩ, 10%, 0.5W
R534	340X2273-934	27kΩ, 5%, 0.25W
R535	40X0590-014	Trim Pot, 25kΩ
R536	340X3392-944	3.9kΩ, 10%, 0.5W
R537	340X3104-244	100kΩ, 10%, 0.5W

Ref. No.	Part No.	Description
SEMICONDUCTORS		
D500	66X0070-001	Diode, 1N914B
D501	66X0069-001	Diode, 250V, HS
Q500,501,502	86X0115-001	Transistor, NPN, D40P3
Q503	86X0113-001	Transistor, NPN, 2N3904
ZD500	66X0040-011	Zener Diode, 4.3V, 5%, 0.5W
ZD501	66X0040-026	Zener Diode, 18V, 5%, 1.0W

P324 HIGH VOLTAGE PC BOARD ASSY

CAPACITORS		
C901	045X0569-003	100μF, 100V, Lytic
C903	80X0099-134	0.015μF, 100V, Disc
C904	349X1044-109	.1μF, 20%, 100V, Polyester
C905	45X0568-001	33μF, 63V, Lytic
C909	45X0524-021	22μF, 50V, Lytic
C910	45X0524-036	10μF, 300V, Lytic
C911	46X0536-015	.01μF, Polypropylene
C912	349X1041-100	0.1μF, 5%, 100V, Polyester
C913,915	80X0099-005	.001μF, 20%, Z5F, Disc
C914	45X0569-001	47μF, 50V, Lytic
⚠ C916	46X0536-016	0.35μF, 5%, 400V, Polypropylene
C920	80X0099-028	68pF, 10%, NPO, Disc
RESISTORS		
⚠ R901	43X0477-001	3.9Ω, 10%, 3.0W
R903	340X3039-934	3.9Ω, 5%, 0.5W
R904	340X3471-934	470Ω, 5%, 0.5W
R905	340X3561-934	560Ω, 5%, 0.5W
R906	340X3682-934	6.8kΩ, 5%, 0.25W
R908,915	340X2102-934	1kΩ, 5%, 0.5W
R909	340X2104-934	100kΩ, 5%, 0.25W
R910	340X2123-934	12kΩ, 5%, 0.25W
R911	340X2682-934	6.8kΩ, 5%, 0.25W
R912	340-3150-834	15Ω, 5%, 0.5W
⚠ R913	43X0401-057	560Ω, 10%, 5W
R914,927	340X3151-934	150Ω, 5%, 0.5W
R917	340X3033-934	3.3Ω, 5%, 0.5W
R918	40X0590-014	Trim Pot, 25kΩ
R919	340X2241-934	240Ω, 5%, 0.25W
R920	340X3152-834	1.5kΩ, 5%, 0.5W
R921	340X2222-934	2.2kΩ, 5%, 0.25W
R922	340X2113-934	11kΩ, 5%, 0.25W
R923,916	340X2332-934	3.3kΩ, 5%, 0.25W
R924	340X2561-934	560Ω, 5%, 0.25W
R925	340X2101-934	100Ω, 5%, 0.25W
R926	340X5022-333	2.2Ω, 5%, 2W
R928	340X4563-933	56kΩ, 5%, 1W

SEMICONDUCTORS		
D901	66X0083-001	Diode, HS
⚠ D902	66X0068-002	Diode, Silicon
IC901	86X0134-001	IC, Clock, #NE555P
Q900	86X0128-001	Transistor, BU409
Q901,902,904	86X0071-001	Transistor, NPN
Q903	86X0120-001	Transistor
Q905	86X0116-001	Horiz. Driver, 2N6557
⚠ Q906	86X0118-001	Transistor, BU207
ZD900-901	66X0040-017	Zener Diode, 13V, 5%, 1W
ZD903	66X0040-007	Zener Diode, 24V, 5%, 1W
ZD902	66X0040-008	Zener Diode, 150V, 5%, 1W
TRANSFORMERS AND COILS		
⚠ T900	53X0487-002	HV Transformer
⚠ T901	52X0126-001	Horiz. Driver Transformer
	38A5873-000	Coil, Degaussing Assy.
	9A2825-001	Yoke, Deflection (Model 19K 6402 only)
	9A2819-001	Yoke, Deflection (Model 19K 6401 only)

P324 HIGH VOLTAGE PC BOARD ASSY. (Continued)

Ref. No.	Part No.	Description
		MISCELLANEOUS (Including chassis mounted components)
⚠F100,101	16X0185-001	Fuse, 6.25A, SB
⚠F600,700	16X0184-001	Fuse, 3A, NB
J200,201	3A0618-005	Connector for Interface PC Board (5-Circuit)
P200	6A0618-004	4-Circuit Header
P322	38A5759-000	Deflection PC Board Assy.
P324	38A5762-000	High Voltage PC Board Assy.
P325	38A5764-000	Interface PC Board Assy.
P341	38A5874-000	Neck PC Board Assy.
P600,700	6A0394-007	7-Circuit Header
P701,101	6A0394-005	5-Circuit Header
⚠P901	6A0401-001	Plug, 3-Circuit
Q102	86X0137-001	Transistor, 2N3716X
Q103	86X0135-001	Transistor, 2N3792X
⚠V500	88X0138-506	19VLTP22 CRT, RCA (Used on Model 19K6402)
⚠V500	88X0145-506	19VNJP22 CRT, Rauland (Used on Model 19K6401)

Ref. No.	Part No.	Description
		NOTE: Refer to Figure 17
	38A5765-000	X Output Amplifier/ Heat Sink Assy. which incorporates the following components:
Q705,707	86X0123-001	Transistor, 2N3716
Q706,708	86X0124-001	Transistor, 2N3792
R717,R718 R719,R720	340X4399-331	Resistor, 0.39Ω , 5%, 1W
		NOTE: Refer to Figure 16
	38A5767-000	Y Output Amplifier/Heat Sink Assy. which incorporates the following components:
Q605,607	86X0123-001	Transistor, 2N3716
Q606,608	86X0135-001	Transistor, 2N3792X
R617, R618, R619, R620	340X4399-331	Resistor, 0.39Ω , 5%, 1W

Part No.	Description
38A5769-000	Assy. HV Unit, Complete
2A0684-001	Assy., Lateral/Purity
3A0627-002	Housing, AMP No. 350342-2 (Used for Degaussing Assy. Plug)
3A0627-003	Housing, AMP No. 350342-3
3A0627-001	Housing, 1-Circuit
3A0614-001	Socket for Power Transistor
3A0629-005	5-Circuit Housing
3A0631-001	Housing, 3-Circuit
3A0629-007	7-Circuit Housing (For Power Supply Cable)
3A0629-008	8-Circuit Housing (Used in 12 CKT input connector/ cable assy. 38A5760-000)
⚠6A0391-001	Connector, 12-Pin Input (AMP No. 350783-1)
30X0768-001	Pin, Female (Used on P901 Red Wire)
30X0769-001	Pin, Female (Used on P901 White Wire)
⚠30X0748-001	Pin, Male (For 12 circuit input connector and J901)
30X0754-001	Pin, AMP No. 350850-1 (Used on degaussing coil connector and J501)
8X0374-001	Yoke Wedge
9A2808-001	Yoke Tab

The following PC boards include parts shown to the right of each:

P322	16X0182-001	Fuse Clips
P322	38A5760-000	12-Pin Connector Assy.
P324	38A5573-000	3-Circuit Transistor Lead Assy.
P324	38A5763-000	Power Cable Assy.
P324	38A5967-000	To-3 Transistor Lead Assy.
P341	38A5689-000	Focus & Red Wire Assy.
⚠P341	3A0636-001	CRT Socket
P341	6A0395-001	8Circuit Header, 90 Degree
P941	30X0756-001	Bead Chain Pin