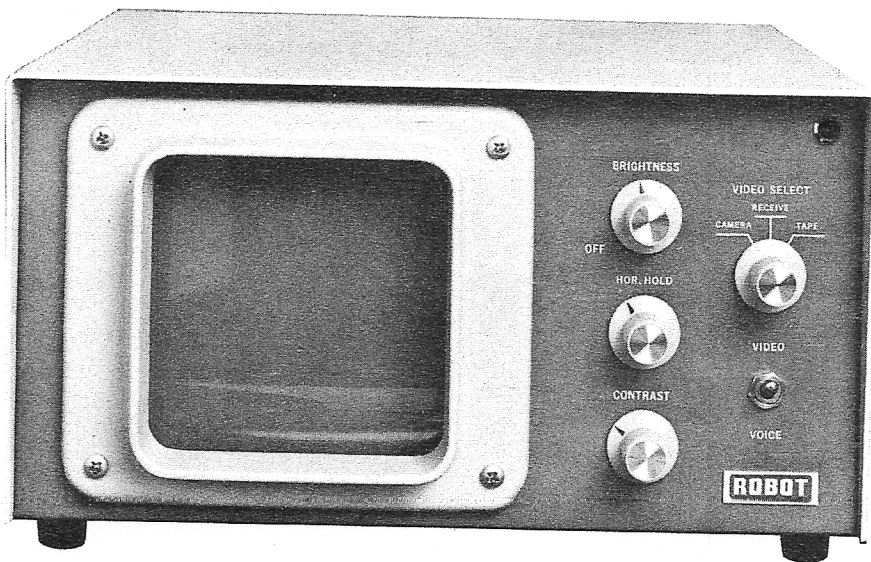


# instruction book



# model 70 slow scan television monitor

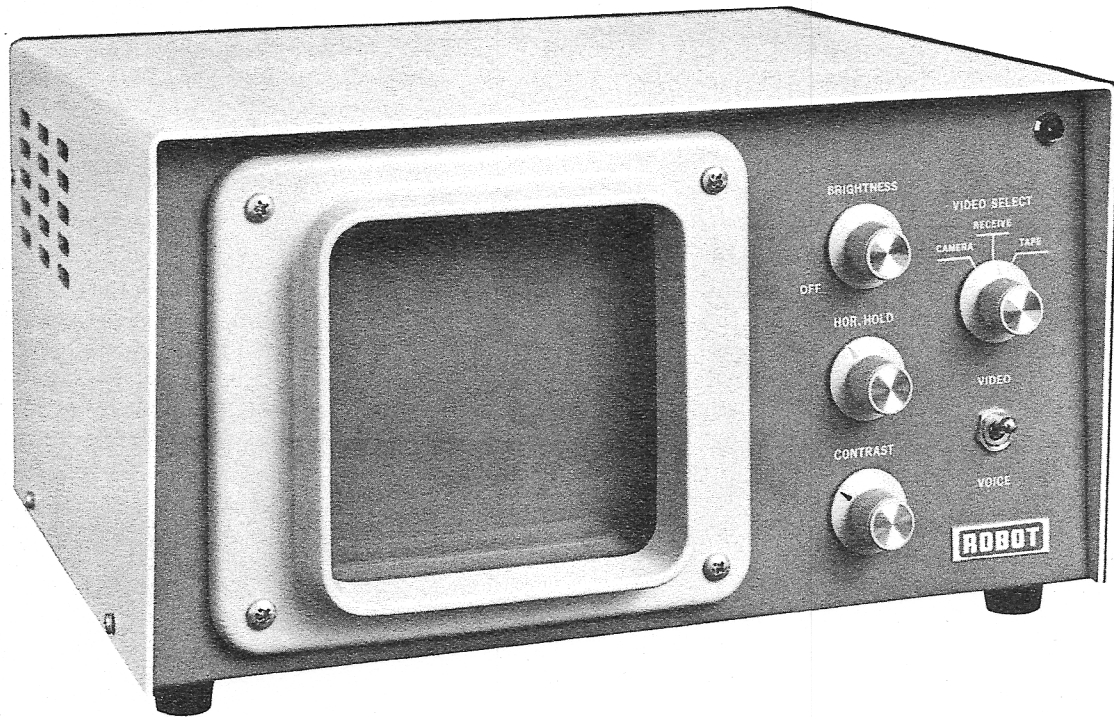
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# INSTRUCTION BOOK MODEL 70 SLOW SCAN TELEVISION MONITOR



The ROBOT Model 70 Slow Scan Television Monitor demodulates and displays the pictures sent by SSTV cameras. These pictures are transmitted from one location to another by means of radio sets, dial-up telephone lines or other voice-grade communication links. Included in the Model 70 are "control-box" functions to permit selection of the desired mode of operation. Some features of this monitor are:

**DISPLAY** — A magnetically deflected, electrostatically focused CRT, together with a 12 KV anode supply, assure a bright, sharp display. The picture format of 4.75 by 4.75 inches is suitable for use by one or more observers.

**DISCRIMINATOR** — Of the variety of discriminator types available, the classic "S" shaped characteristic makes the most of a signal possibly marred by channel interference. With this discriminator, noise frequencies higher or lower than the signal cause a gray display rather than saturation white or black.

**AUTOMATIC SYNC THRESHOLD** — Receiver mistuning or tape recorder speed shift result in an error in sync fre-

quency (nominally 1200 Hz). The automatic sync threshold circuit tracks the signal and provides proper sync separation.

**PHASE LOCKED HORIZONTAL OSCILLATOR** — A bandwidth of approximately 1 Hz is provided for the 15 Hz component of the horizontal sync. This narrow bandwidth allows sync recovery under conditions of severe interference.

**CONTINUOUSLY RUNNING SWEEP GENERATORS** — Both horizontal and vertical sweep are generated by oscillators which provide a raster at all times.

**BUILT-IN CONTROL FUNCTIONS** — All of the switches, jacks and wiring needed to integrate slow scan television into an existing communication station are included in the Model 70 Monitor.

**POWER SUPPLY** — A well-regulated power supply furnishes all voltages for the Monitor as well as for the ROBOT Model 80 Camera.

**SOLID STATE CONSTRUCTION** — Except for the CRT, all active elements are semiconductor.

# SECTION 1

## INTRODUCTION

ROBOT slow scan television is based on a set of widely accepted standards.

Number of TV lines:	128
Time per frame:	8.5 seconds
Modulation:	FM
White:	2300 Hz
Black:	1500 Hz
Sync:	1200 Hz
Sync duration:	
Horizontal:	5 milliseconds
Vertical:	66 milliseconds

You are able to see a picture that takes eight seconds to "paint" (broadcast TV uses 1/30 second and interlaced frames to avoid flicker) by means of the long persistence storage properties of the P-7 phosphor used in the picture tube of SSTV. As each new frame of picture information arrives, it is "painted over" the previous picture. The display has the appearance of a "window shade" being lowered across the CRT picture tube every eight seconds as a new picture is received while the old one is still visible.

SSTV standards call for approximately 128 lines in each picture, or a total of 16,500 resolvable elements. Transmitted picture intensity at each picture element is represented by instantaneous frequency. That is, intensity is frequency modulated according to the standards: 2300 Hz for highest brightness; 1500 Hertz for black. In addition, line and frame synchronization is achieved by 1200 Hz blacker-than-black pulses at the line and frame rates. These standards fit easily within the bandwidth limitations of any voice-grade communication channel.

### ROBOT SSTV EQUIPMENT

The ROBOT Model 70 Slow Scan Television Monitor and Model 80 Slow Scan Television Camera operate in accord-

ance with the above standards. The Model 80 sampling camera converts live scenes and printed or written material, drawings, etc., to the corresponding FM form, and inserts the appropriate sync pulses. The Model 70 monitor displays pictures on a six inch (diagonal) long-persistence picture tube in which faces, signs, photographs and other transmitted pictures are readily seen. Picture quality is approximately the equivalent of a one-column newspaper half-tone photograph.

The output spectrum of the television camera contains frequencies in the band between 1200 Hz and 2300 Hz. This audio range is readily passed by various radio transmitters employing SSB, AM or FM modulation. It is also passed by ordinary telephone lines and other voice-grade communication facilities. Pictures may be recorded on conventional audio tape recorders.

The ROBOT Model 70 monitor and Model 80 camera, available separately, are the only equipment needed to outfit an existing communication link for picture transmission and reception. Moreover, addition of a slow scan television does not disturb the use of the facility for voice communication.

Compact and trouble-free equipment of the complexity of the Monitor and Camera would not be possible without modern semiconductor devices. The CRT and vidicon are the only vacuum tubes used. All of the semiconductor devices are silicon except one transistor for which special characteristics available only in germanium are required. Extensive use of integrated circuits permitted even greater simplification. A single plug-in glass-epoxy circuit board is used in the camera and monitor, permitting repair on a board exchange basis.

Specifications for the Model 70 are listed on the following page.



Table 1  
SPECIFICATIONS MODEL 70 SLOW SCAN TELEVISION MONITOR

### PICTURE

Size: 6 in. diagonal; (4.75 by 4.75 in.)  
Lines: 128  
Line rate: 15 Hz (nominal)  
Frame rate: 8.5 seconds (nominal)  
CRT: P-7 phosphor; magnetic deflection; 12 KV  
anode voltage.

### VIDEO INPUT

Modulation: FM 1200 to 2300 Hz  
White: 2300 Hz  
Black: 1500 Hz  
Sync: 1200 Hz  
Amplitude: 20 millivolts to 10 volts  
Input Impedance: 1K  
Sync:  
Horizontal: 5 milliseconds  
Vertical: 66 milliseconds  
Signal-to-noise: 6 db minimum

### FRONT PANEL CONTROLS

Brightness (including on-off)  
Horizontal Hold: Line rate  $15 \pm 3$  Hz  
Contrast: Video amplitude  
Video Select: Input/Output selector for Camera,  
Receive or Audio Tape  
Video-Voice: Selector for transmission

### REAR PANEL CONTROLS AND CONNECTORS

Camera: Supplies power to Model 80 SSTV Camera  
Microphone: Voice input  
Transmitter: FM video or voice to radio transmitter  
To Tape: FM video to audio tape recorder  
From Tape: Playback from audio tape  
Receiver: FM video from radio receiver  
Focus: Picture tube focus  
Phone Line: Connection to the telephone line  
Ground: Earth ground connection

### POWER INPUT

Line Voltage: 115/230 volts AC, 50/60 Hz  
Power: 50 watts (Monitor alone); 80 watts (with  
Camera)

### MECHANICAL

Width: 13-1/2 in.  
Depth: 12-3/4 in.  
Height: 7-3/4 in. (10 in. with bail extended)  
Weight: 25 pounds

### CONSTRUCTION

Circuit board: Glass epoxy; plug-in  
Bezel: Aluminum  
Cabinet: Aluminum  
Color: Two-tone gray

### COMPONENT COMPLEMENT

Transistors: 29  
IC's: 10  
Diodes: 25  
Tubes: 1 (CRT)

# SECTION 2 INSTALLATION

## 2.1 UNPACKING

Remove the monitor from the carton and remove the protective cover and packing material. If visible evidence of damage is observed, save the box and packing material, and notify the transportation company. Check controls and switches for freedom of action. Check the equipment included with the monitor against Table 2.

**Table 2  
MODEL 70 PACKING LIST**

Item	Quantity
Model 70 Monitor	1
6 ft. Shielded Cable	1
Instruction Manual	1
Warranty Card	1

## 2.2 CABLING TO A RADIO STATION

### Selecting the Audio Signal Source

The monitor will normally display signals from a radio receiver, a tape recorder or camera (not furnished) as selected by a front panel selector switch. The monitor presents a 1000 ohm impedance to the signal source and requires a signal level between 20 millivolts and 10 volts for proper operation. This impedance and signal level is such that good performance can be expected if the monitor is connected across the voice coil of a speaker. Before connecting the monitor to the signal source, determine that the proper signal level and source impedance conditions are met. If, for example, it is desired to connect the monitor to a 500 ohm receiver output, first determine the audio voltage. If the voltage exceeds 10 volts use a resistive attenuator between the receiver and monitor.

### External Connections

The Monitor is normally wired for 115 volt AC operation. Before connecting to a 230 volt AC source relocate selection jumpers as described below:

- (a) Remove the 6 screws which attach the cover to the chassis.

- (b) Slip the cover up and off.
- (c) Locate the primary terminal strip which is on the rear panel adjacent to the power transformer. Examine this strip to determine where the jumpers are located. Refer to Figure 1 for guidance.
- (d) Change from 115 VAC operation by cutting the jumper between 3 and 4 and also the jumper between 5 and 6. Add a jumper between 4 and 5. Be sure that the jumper placement agrees with Figure 1.

To connect the monitor to the station receiver, use the patch cable furnished, and connect the cable to the rear panel jack marked RECEIVER. Connect the other end of the cable to the receiver speaker voice coil or 500 ohm output.

To connect the monitor to a tape recorder connect patch cables (not furnished) as follows:

- (a) From the rear panel jack marked "FROM TAPE" connect a cable to the tape recorder speaker voice coil or auxiliary output terminals.
- (b) From the rear panel jacks marked "TO TAPE" connect a cable to the tape recorder, microphone or auxiliary input.

### Cabling with the Robot Model 80 Camera

Refer to camera instruction manual.

## 2.3 CABLING TO THE TELEPHONE LINE

### Use of a Voice-Coupler

Connection to the telephone line is best made through a VOICE-COUPLER which is installed by the telephone company. These couplers are small boxes (3" x 4" x 1½") with a ¼" phone jack at one end. A common Bell System part number for these couplers is 30A or F-57948.

The VOICE-COUPLER may be distinguished from other devices, such as DATA-COUPLES, by the fact that the expected installation cost is \$5.00 and the monthly rental is 50 cents.

When the VOICE-COUPLER is installed it is common to also receive a new handset which includes an exclusion key. This key allows the handset to be disconnected from the

line when the VOICE-COUPLER is in use. It should be noted that the SSTV will work through the VOICE-COUPLER with or without the exclusion key.

The purpose of the VOICE-COUPLER is to protect the telephone line from damage by the connection of foreign attachments.

### External Connection

Connection between the Model 70 Monitor and the Phone line is made with a single cord. On the Model 70, con-

nect to the insulated phone jack on the rear panel of the monitor marked PHONE LINE with a ¼ inch diameter phone plug. At the phone line make a connection to match the facilities at hand. For example; the 30A VOICE COUPLER employs a phone jack identical to the one on the monitor.

Where it is necessary to locate the SSTV Monitor some distance from the phone line a twisted pair cable may be used. The important consideration is that the line not introduce excessive attenuation or pick-up noise or radio-frequency interference.

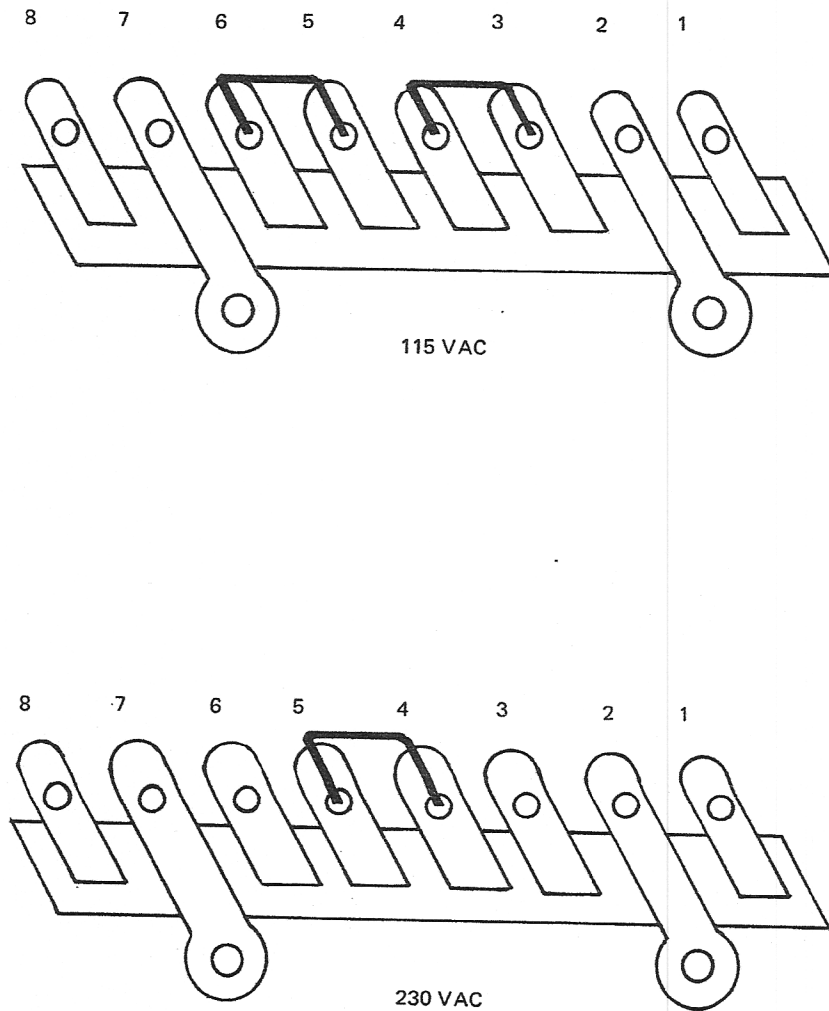


FIGURE 1. PRIMARY TERMINAL STRIP

# SECTION 3

## OPERATION

### 3.1 FRONT PANEL CONTROLS

The following controls are located on the front panel:

(a) **BRIGHTNESS, ON-OFF**

Power is applied to the monitor by rotating the BRIGHTNESS control clockwise. Evidence of power is supplied by the pilot light. Pilot light brilliance is limited to prevent interference with darkened viewing.

After a brief delay for the cathode-ray tube to warm up, advance the BRIGHTNESS control until a raster becomes visible. When viewing a picture the BRIGHTNESS control is used to set the picture highlights as required by the amount of ambient light.

(b) **CONTRAST**

The CONTRAST control determines the video voltage being applied to the cathode-ray tube. When this control is advanced too far the picture will be binary, that is, white and black with no intermediate gray shades. When the CONTRAST control is retarded too much the picture will have a "washed out" appearance. The CONTRAST control is adjusted to produce the most pleasing picture.

When adjusting the CONTRAST and BRIGHTNESS controls it is helpful to be aware of their function. The circuit is arranged such that increasing CONTRAST causes white areas to become brighter and dark areas to become blacker while gray areas remain unchanged. Rotation of the contrast control does not produce any change in the average brightness. The function of the BRIGHTNESS control is to set the average brightness to the desired level. This arrangement of the two controls provides a minimum of interaction and makes proper adjustment easy.

(c) **HORIZONTAL HOLD**

This control sets the free-running frequency of the phase-locked oscillator to match the horizontal sweep frequency of the received video. Evidence of improper adjustment will be black bars diagonal to the right or left when a picture is being received. Rotate the control until the picture comes into sync. The purpose of this control is to permit the monitor to receive pictures from cameras which produce line rates different than the standard 15 lines per second. Adjustment of this control should be in small increments because the circuit requires about one second to respond.

(d) **VIDEO SELECT**

The source of video signals, which may be from a radio receiver, a tape recorder, a camera or the phone line, is selected by means of the VIDEO SELECT switch. Pictures from the selected video source are displayed on the monitor and are also available to be transmitted. Thus the picture displayed on the screen is also the picture available to be transmitted.

(e) **VIDEO-VOICE**

A two-position switch is used to select between the microphone and a source of video as the input to the radio transmitter. For transmitters equipped with VOX the video will cause the transmitter to key just as voice does. In the absence of VOX some form of push-to-talk is required to key the transmitter. The monitor is wired to carry the microphone push-to-talk switch to the transmitter. For phone line usage the VIDEO-VOICE switch disconnects video when in the voice position. This removes the sound of the video from the phone line so that voice service with the phone handset is restored.

### 3.2 REAR PANEL CONTROLS

The following controls are located on the rear panel:

(a) **FOCUS**

A finger adjust FOCUS control is located on the rear panel. It will be observed that the focus action is slight. This is a characteristic of modern electrostatically focused, magnetically deflected tubes.

(b) **CIRCUIT BREAKER**

A push-to-reset circuit breaker is located on the rear panel near the line cord. An audible click occurs when the breaker trips.

### 3.3 OPERATION WITH A RADIO RECEIVER

The proper adjustment of all radio receiver controls is identical for SSTV and voice. The most direct way of tuning the receiver is to first receive voice from the transmitting station, and when pictures are sent leave all controls in the same position. When no voice has been received tune for best picture using the pitch of the sound as a guide. After some experience the operator will easily recognize the pitch of the signal when it is properly tuned.

It is helpful to understand the effect of tuning changes on monitor performance. Recall that the video signal consists of a series of audio tones ranging from 1200 Hz for sync to 2300 Hz for white. The monitor converts these tones to a voltage proportional to frequency in a discriminator circuit. The voltage-frequency characteristic of the discriminator is S-shaped in such a way that signals outside the normal range are interpreted as gray, rather than either black or white. With correct tuning, the sync frequency (1200 Hz) is located near the upper peak of the curve and the white frequency (2300 Hz) is located near the lower peak. All frequencies between these two lie on the straight portion of the curve.

If tuning is too low, the sync frequency will produce a lower voltage than black frequency (1500 Hz). Because the sync separator operates by picking off the most positive voltage, this degree of mistuning will cause the monitor to sync on black portions of the picture. The effect of this amount of mistuning will be observed in the picture as a loss of sync. When this occurs, tune to produce a higher pitched sound.

Tuning too high in pitch will cause sync (1500 Hz) to produce the most positive voltage and thus the picture will sync properly. However, white (2300 Hz) will be pushed over the peak causing white tones to be reduced in voltage. The effect of this tuning is to reduce the observable detail in the white portions of the picture.

When strong adjacent channel interference is present it will sometimes be helpful to turn off the AGC of the radio receiver. The monitor contains a limiter which removes the effect of large changes in signal amplitude.

### 3.4 OPERATION WITH THE TELEPHONE LINE

#### (a) TO TALK

Place the VIDEO-VOICE switch in the VOICE position. SSTV pictures from the local camera or tape

recorder may be viewed on the monitor during a conversation. Place the VIDEO SELECT switch in the TAPE position to view the local tape recorder or in the CAMERA position to view the local CAMERA.

#### (b) TO RECEIVE PICTURES

Place the VIDEO SELECT switch in the RECEIVE position and the VIDEO-VOICE switch in the VIDEO position. Adjust BRIGHTNESS and CONTRAST to suit local lighting conditions.

#### (c) TO SEND PICTURES

Place the VIDEO-VOICE switch in the VIDEO position. Place the VIDEO SELECT switch in CAMERA position to send pictures from the camera. Place the VIDEO SELECT switch in the TAPE position to send pictures recorded on the tape recorder.

When sending pictures from the tape recorder it is necessary for the tape recorder to produce about 2 volts peak to peak across the telephone line. The Model 70 places a one-to-one transformer between the tape recorder output and the phone line. Depending on the choice of tape recorder, it may be necessary to install either a matching transformer or amplifier between the tape recorder output and the Model 70 monitor.

#### CAUTION

*It is against the law to record telephone conversations without the express permission of the person being recorded. The above instructions in no way constitute an implied permission to violate the laws regarding the recording of phone conversations.*

# SECTION 4

## PRINCIPLES OF OPERATION

### 4.1 INPUT LIMITER AND DISCRIMINATOR

Referring to the block diagram, Figure 2, the front panel VIDEO SELECT switch feeds incoming FM audio from a slow scan television camera or flying spot scanner, or from a tape recorder or a radio receiver to a limiter amplifier. This amplifier removes amplitude variations on the incoming signal over a 50 db range, producing a clipped square-wave output containing only FM information.

A two tuned circuits FM discriminator possessing the classical "S" shaped response with peaks at 2600 Hz and 1000 Hz converts the amplitude limited FM to a 0 to 1000 Hz baseband AM signal in which amplitude represents brightness on the monitor display tube. Ripple is suppressed by full-wave rectification followed by a three-pole Butterworth filter. The resulting signal is applied to the CRT cathode via a video amplifier.

### 4.2 SYNC SEPARATOR

The AM video signal is also applied to the sync separator, which removes the blacker-than-black 1200 Hz horizontal and vertical sync pulses inserted into the original picture signal generated in the camera. It employs a self-biased level-gating circuit which extracts proper sync pulses over a receiver tuning range (or equivalent audio tape speed variation range) of  $\pm 200$  Hz. The resulting pulses are applied to two circuits. One is a phase locked loop consisting of a phase detector, a voltage controlled oscillator and a horizontal deflection amplifier. The incoming sync pulses lock the oscillator — normally free-running at approximately the standard line rate of 15 Hz — to the exact line rate of the incoming video. The free-running rate of the oscillator is varied by the front panel HORIZONTAL HOLD control, which can be adjusted by observing the direction of diagonal black bars running across the screen from top to bottom when the picture is not in sync. The circuit can maintain lock for input variations up to  $\pm 20\%$  from standard. The output of the horizontal deflection amplifier drives the horizontal coils of the CRT deflection yoke with a linear current sawtooth, producing horizontal beam sweep. The amplifier output is also applied to a sweep failure protection circuit which biases off the CRT beam current in the event of a sweep failure, thereby preventing possible damage to the CRT phosphor.

The output of the sync separator is also applied to an integrating gate which rejects the 5 millisecond horizontal sync pulses occurring every 1/15 second, and gates through the 66 millisecond vertical sync pulses occurring every 8.5 seconds. This pulse triggers the otherwise free-running vertical oscillator, resetting it to a value corresponding to the top of the display screen, and thereby starting the vertical sweep for a new picture frame. In the absence of a vertical sync, the oscillator free runs, providing a constant raster on the CRT display. The oscillator output is applied to the vertical coils of the deflection yoke via the vertical deflection amplifier.

### 4.3 POWER SUPPLIES

The following voltages are produced by the power supply:

- $\pm 22$  VDC
- $\pm 15$  VDC Regulated
- +350 VDC
- 120 VDC Regulated
- 6.3 VAC

The principal power supply voltage employed by the circuits above is the symmetrical (+) and (-) 15 volts. This supply is regulated to better than 0.1%, load and line, and is protected against over-current surges exceeding 0.6 amps by a protection circuit which reduces the output voltage in the presence of overloads.

High voltage for the CRT anode (12,000 volts) is provided by a DC to DC converter operating from the regulated (+) and (-) 15 volt supply so that the brightness of the display is free of line voltage fluctuations. The converter, consisting of a 25 KHz oscillator and a peak voltage doubler, is completely shielded in a separate internal enclosure to eliminate possible interference.

All active components in the Model 70 Monitor are mounted on a glass epoxy printed circuit board located just under the removable top cover for easy servicing and adjustment. In addition to the front and back panel controls, adjustments located on the circuit board include: picture height and width; picture centering (horizontal and vertical); free-running vertical oscillator rate.

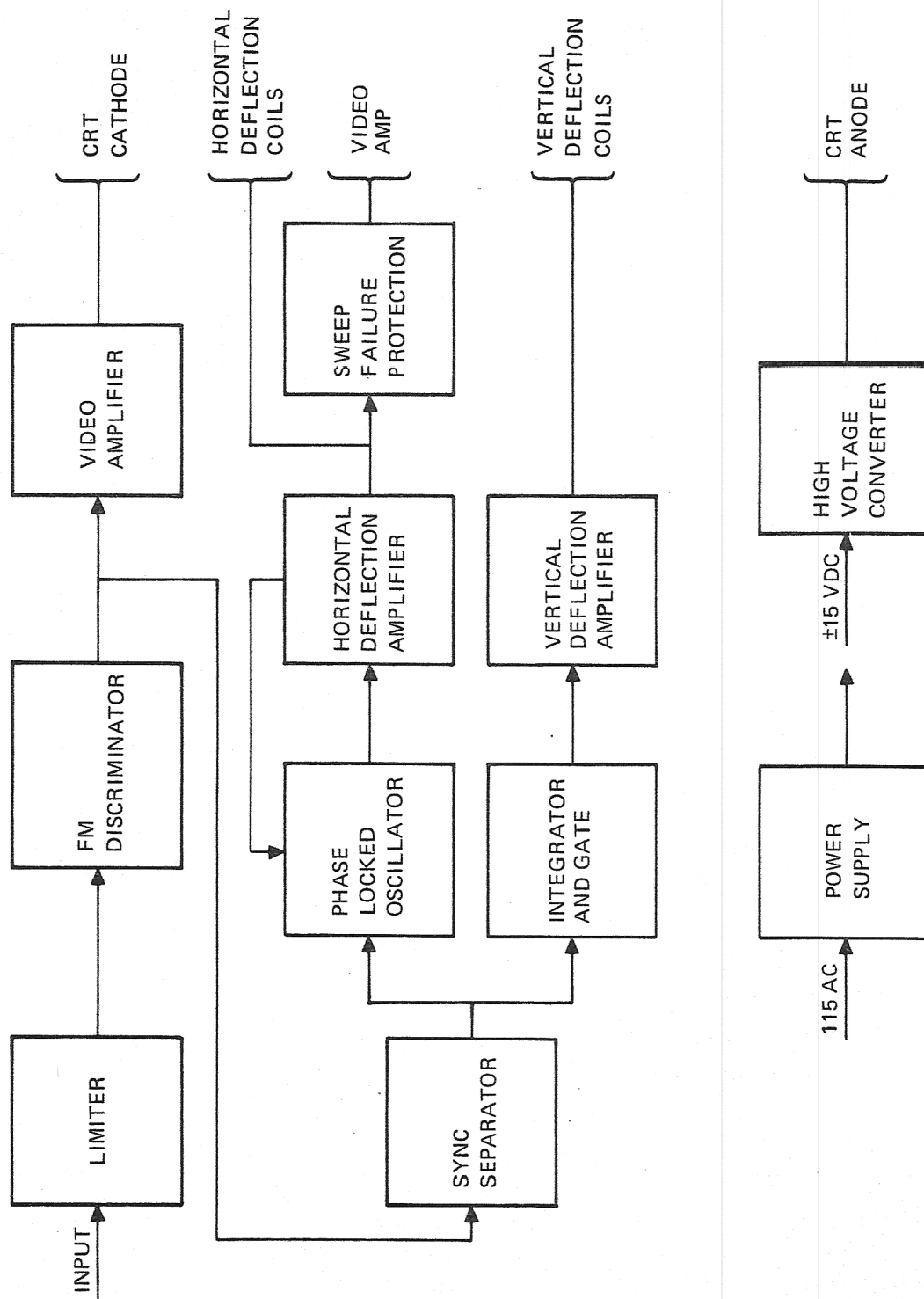


FIGURE 2. BLOCK DIAGRAM



# SECTION 5

## SERVICE INSTRUCTIONS

This section includes instructions for assembly and disassembly of the Model 70 monitor, and for adjustment of all internal controls. It also includes a set of waveforms keyed to the schematic and to the circuit board for aid in servicing.

### 5.1 ASSEMBLY AND DISASSEMBLY

To open the set, remove the cover as follows:

- (a) Remove the six screws which attach the cover to the chassis.
- (b) Grasp the cover at the bottom front and spring it apart slightly. Slide the cover upward.

#### CAUTION

*The Model 70 Monitor circuits are assembled on a circuit board. Any repair work which involves removal of components from the circuit board requires a small soldering iron, a "solder sucker" and some experience. Excessive heat or force can cause the wiring to lift from the circuit board.*

#### CAUTION

*When reinserting the circuit board, if power to the set has been turned on without the circuit board present, power supply capacitors may be fully charged and may discharge when connection is made resulting in possible damage to circuit components. Be sure the two power supply capacitors located at the left side of the cabinet are discharged before plugging in the circuit board.*

With the circuit board removed, the monitor appears from the top as shown in Figure 3.

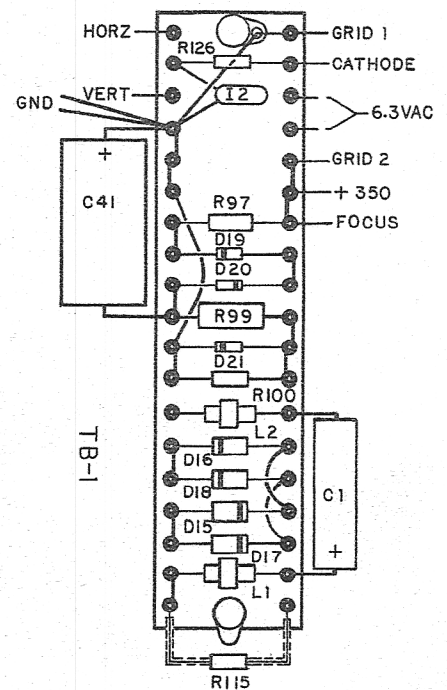
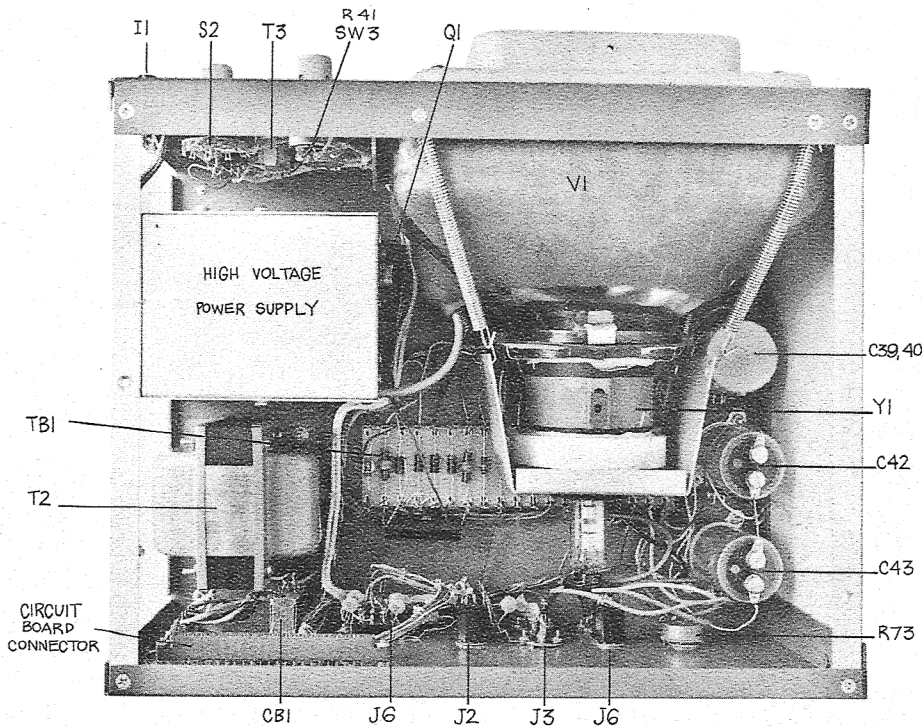
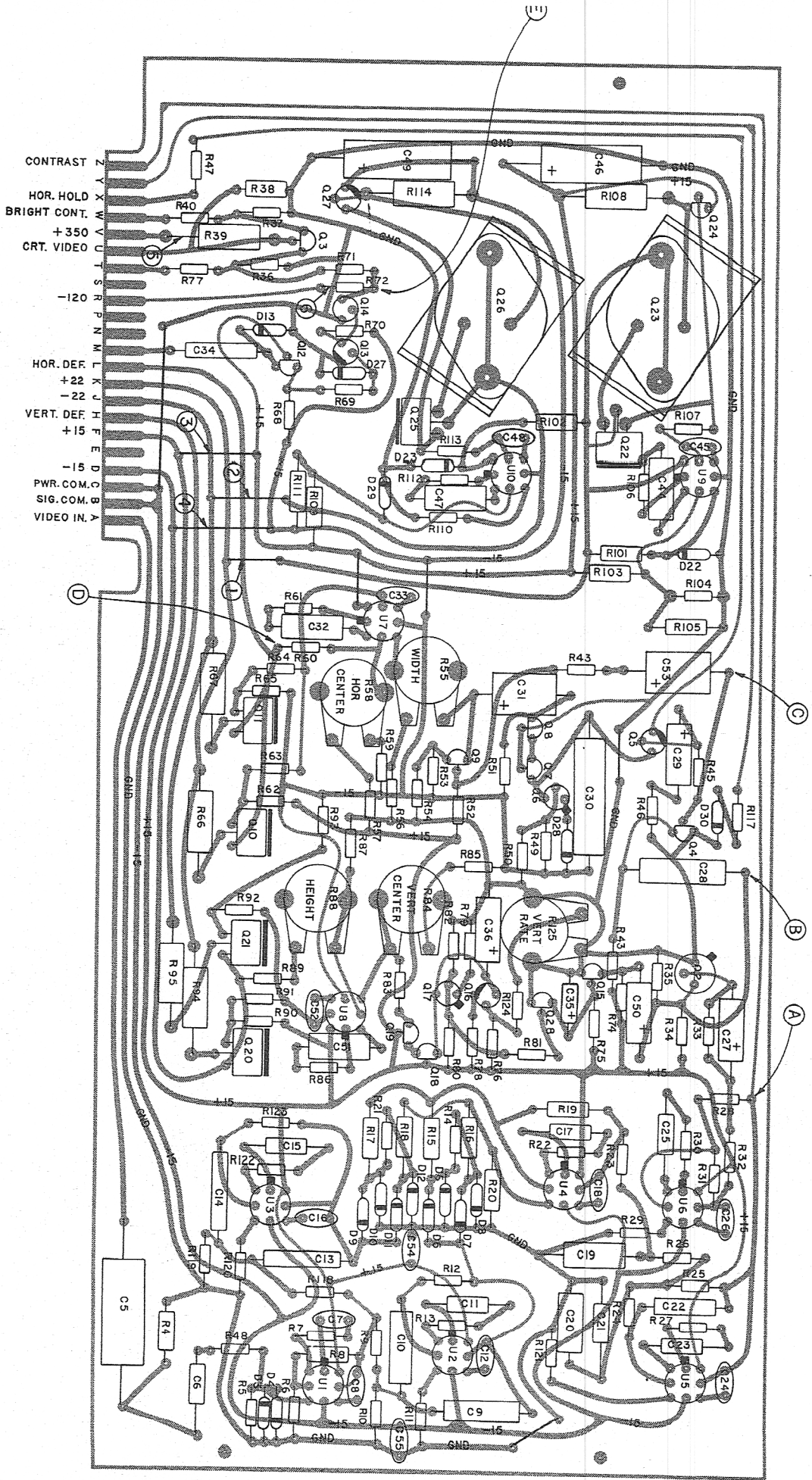


FIGURE 3. MONITOR WITH CIRCUIT BOARD REMOVED



CONTRAST  
HOR. HOLD  
BRIGHT CONT.  
+ 350  
CRT. VIDEO  
-120  
HOR. DEF.  
+ 22  
- 22  
VERT. DEF.  
+ 15  
- 15  
PWR. COM.  
SIG. COM.  
VIDEO IN.

FIGURE 4. CIRCUIT BOARD COMPONENT LOCATION

Some differences  
From book

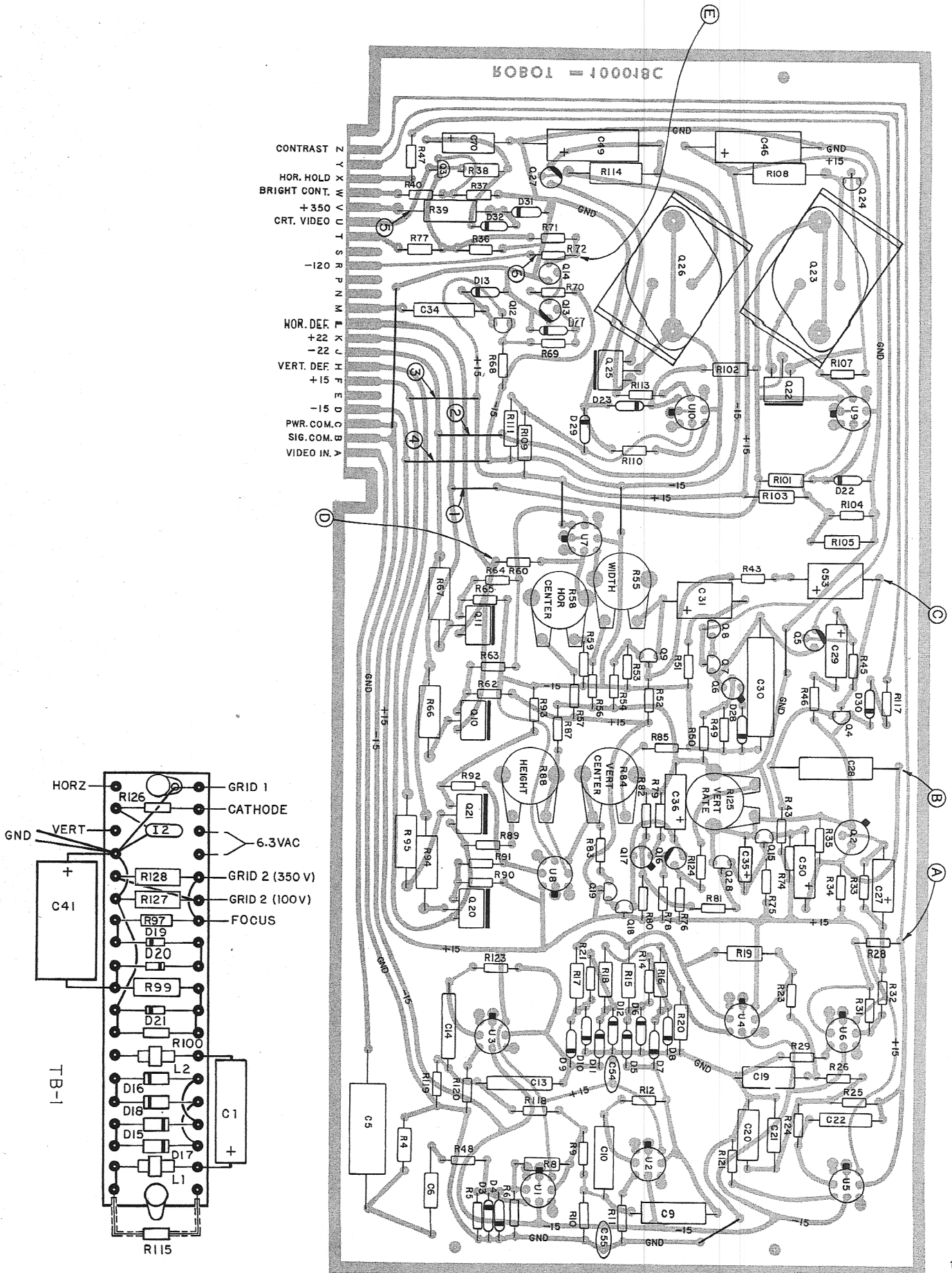


FIG 4 CIRCUIT BOARD COMPONENT LOCATION

## CRT Removal

To remove the cathode ray tube, observe the following steps:

- (a) Unplug the tube socket by pushing it gently toward the rear panel.
- (b) Disconnect the high-voltage anode connector (red lead from high-voltage power supply) by folding back the rubber cap and squeezing the connector spring wires together until they clear the tube recess.
- (c) Unhook the two lower springs holding the bracket around the yoke as follows. Using long-nose pliers, grasp the straight portion of the hook close to the spring, stretch the spring, and remove the hook from the hole in the bracket.
- (d) Unhook the two upper springs by hand.
- (e) With the bracket and yoke still on the tube neck, remove the tube from the cushion surrounding the tube face, tilt the face upward, and carefully remove the assembly from the cabinet.
- (f) When the bottom of the tube face clears the top of the front panel, slide the bracket and yoke (whose leads are soldered to the terminal strip on the bottom of the chassis) from the tube neck.

**NOTE:** When re-installing the CRT, follow the above procedure in reverse sequence. Be sure the tube face is snugly and evenly seated in its cushions on the front panel before re-hooking the springs to the bracket.

## High-Voltage Power Supply Removal

To remove the cover from the high-voltage power supply it is necessary to first remove this sub-assembly from the cabinet. This can be done as follows:

- (a) Disconnect the high-voltage CRT anode connector, as in tube removal, above.
- (b) Three leads, red, green, and black leave the high-voltage power supply via the grommet near the base. Unsolder these leads from the terminal strip (+ and - terminals of the 100 mfd, 50 volt electrolytic capacitor and ground).

## Yoke Rotation

If the scan lines are not horizontal, the yoke may be rotated in its mounting on the neck of the CRT. To rotate the yoke, grasp the yoke and spring-loaded bracket as a unit

and rotate the two together until the scan lines are horizontal. Then, holding the yoke in place, rotate the bracket in the reverse direction until it is upright again. Spring tension and friction between the surfaces will hold the yoke in place.

## 5.2 INTERNAL ADJUSTMENTS

Referring to Figure 3, the controls listed below are located on the circuit card just under the top cover of the Model 70 Monitor.

### (a) HORIZONTAL CENTERING

Turn the CONTRAST control fully CCW and adjust BRIGHTNESS to obtain a raster. Reduce HORIZONTAL WIDTH until both ends of the horizontal scan lines are visible. Center these scan lines with the HORIZONTAL CENTERING control.

### (b) HORIZONTAL WIDTH

Adjust until the scan lines just fill the screen.

### (c) VERTICAL RATE

With no video signal connected adjust the VERTICAL RATE control until approximately 9 seconds elapse between the start and finish of the vertical scan. This adjustment can be made with a sweep second hand watch.

### (d) VERTICAL CENTERING

Reduce HEIGHT until the top and bottom of the raster are visible. Center the raster using the VERTICAL CENTERING control.

### (e) HEIGHT

Display a picture from a tape recorder or camera. Adjust HEIGHT and VERTICAL CENTERING such that the picture fills the screen in the vertical direction.

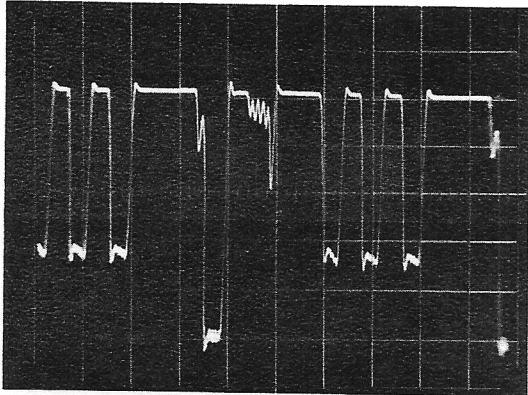
### (f) TOUCH-UP

With the picture displayed readjust WIDTH and HORIZONTAL CENTERING until the picture fills the screen in the horizontal direction.

## 5.3 WAVEFORMS

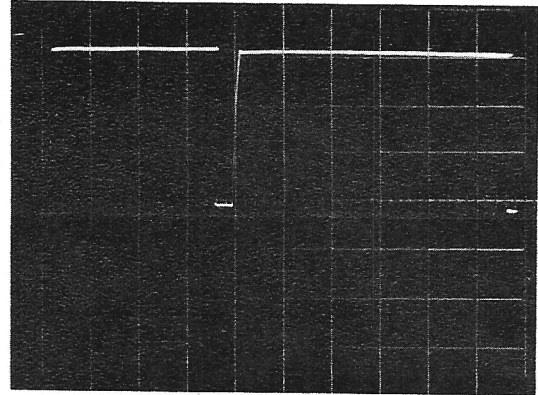
The waveforms shown in Figure 5 and listed in Table 3 can be observed with an oscilloscope having 1M input impedance at the points indicated in the schematic and in the call-outs on Figure 4.





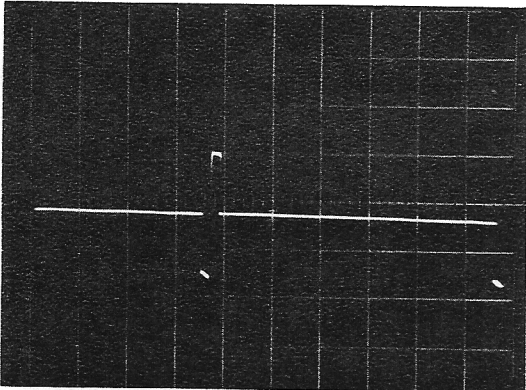
0.5 VOLT/DIV  
10 MSEC/DIV  
LINE SYNC

TEST POINT A



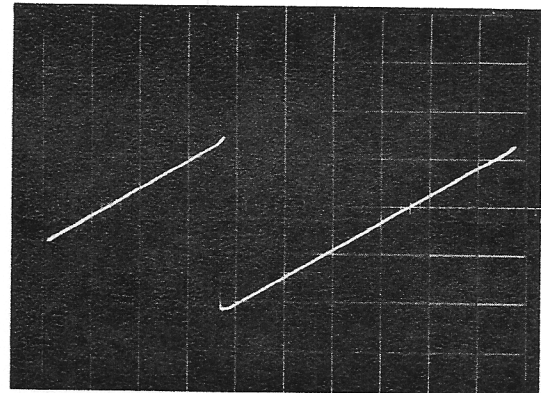
2 VOLTS/DIV  
10 MSEC/DIV  
LINE SYNC

TEST POINT B



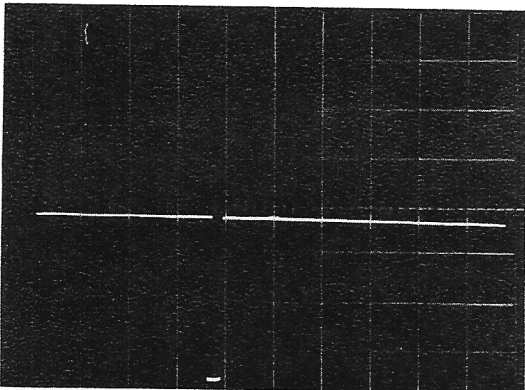
2 VOLTS/DIV  
10 MSEC/DIV  
LINE SYNC

TEST POINT C



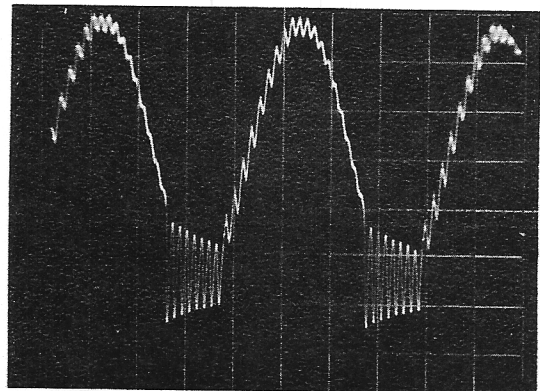
5 VOLTS/DIV  
10 MSEC/DIV  
LINE SYNC

TEST POINT D



10 VOLTS/DIV  
10 MSEC/DIV  
LINE SYNC

TEST POINT E



10 VOLTS/DIV  
10 MSEC/DIV  
INTERNAL SYNC

TEST POINT F

FIGURE 5. TEST POINT WAVEFORMS

**Table 3**  
**LIST OF WAVEFORMS**

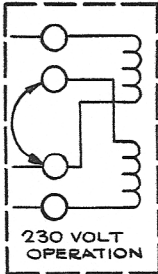
Test Point	Conditions
A	Standard SSTV input signal from camera or tape recording of a test chart containing vertical bars.
B	Standard SSTV input.
C	Standard SSTV input, with HOR HOLD set so that monitor is in sync.
D	No input required.
E	No input required; horizontal oscillator operating normally.
F	Set operating normally.

#### 5.4 VOLTAGES

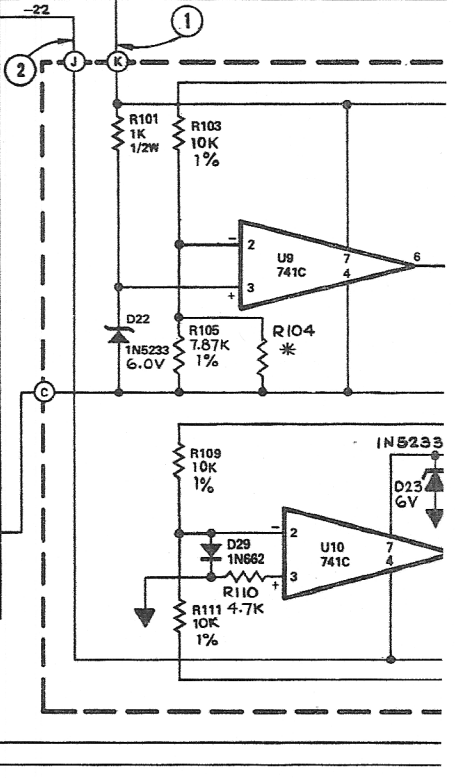
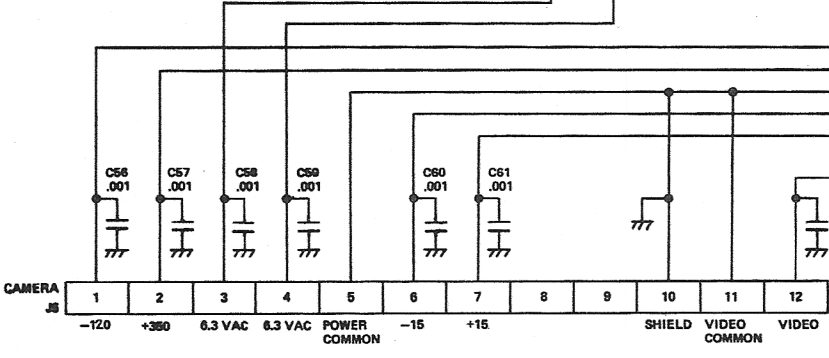
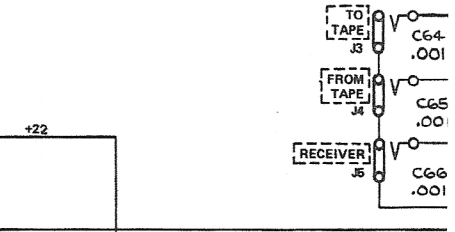
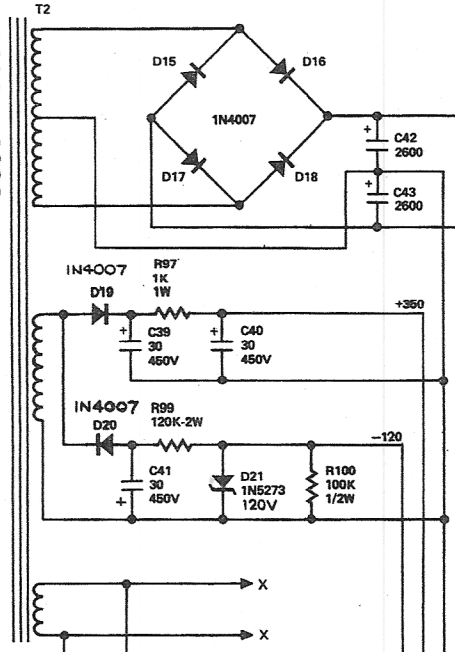
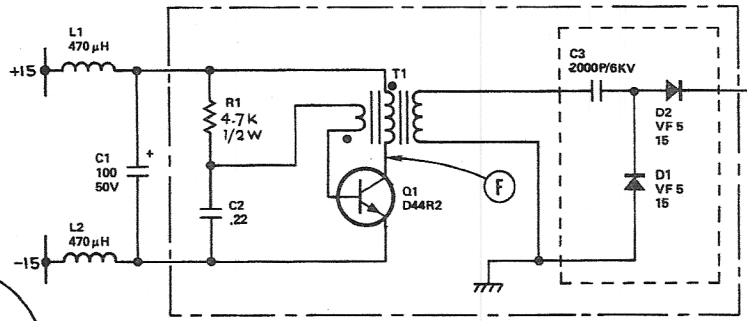
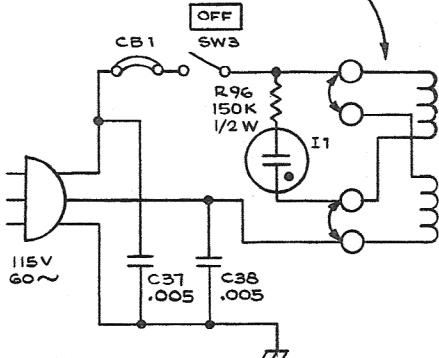
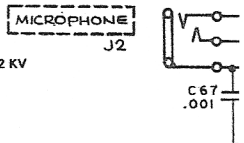
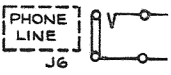
The voltages listed in Table 4 can be observed with a d.c. voltmeter having at least 20,000 ohms per volt impedance, at the points indicated in the schematic and in the call-outs of Figure 4.

**Table 4**  
**LIST OF VOLTAGE TEST POINTS**

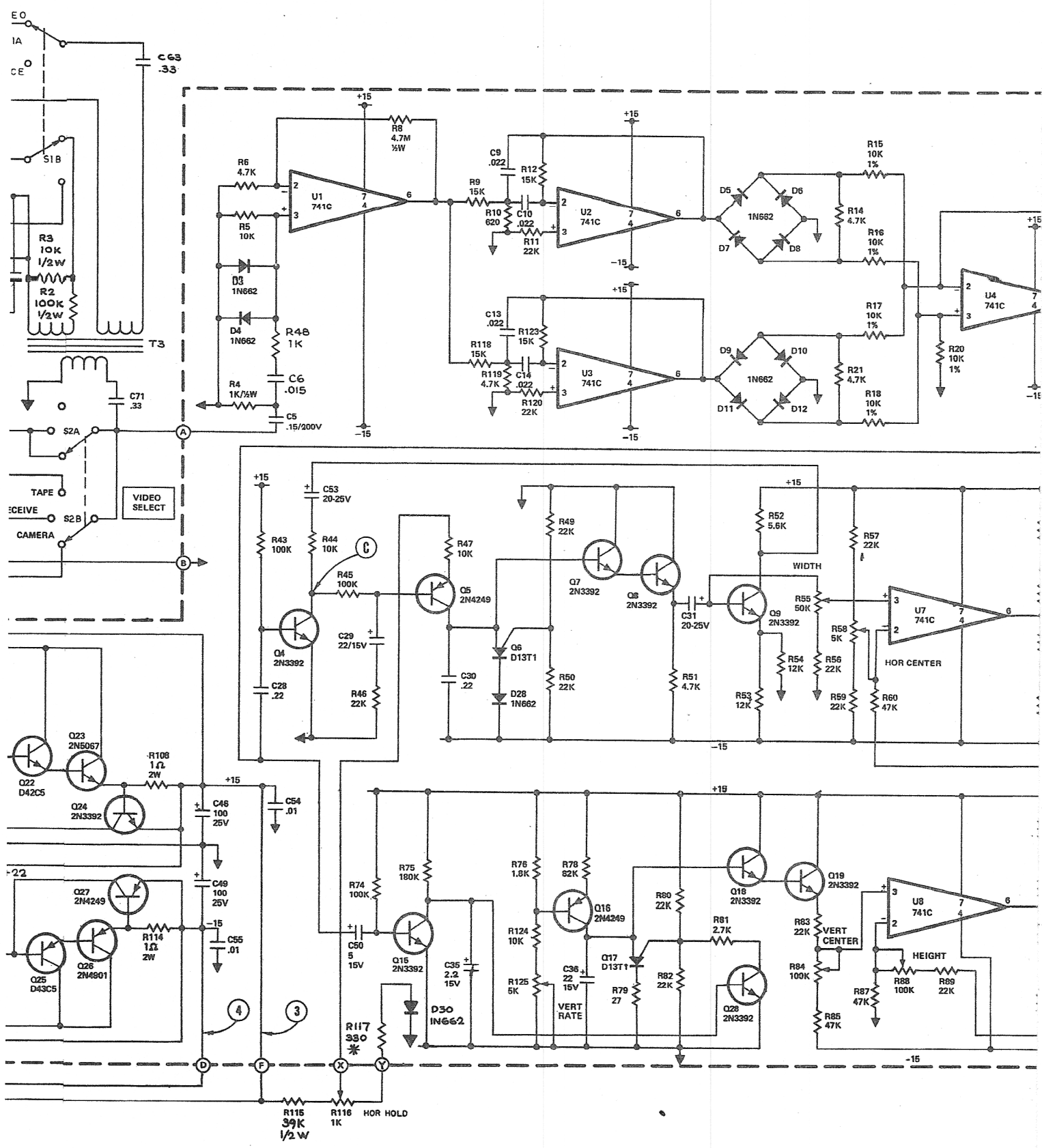
Test Points	Voltage
1	+22
2	-22
3	+15 ±0.25
4	-15 ±0.25
5	+350
6	-120

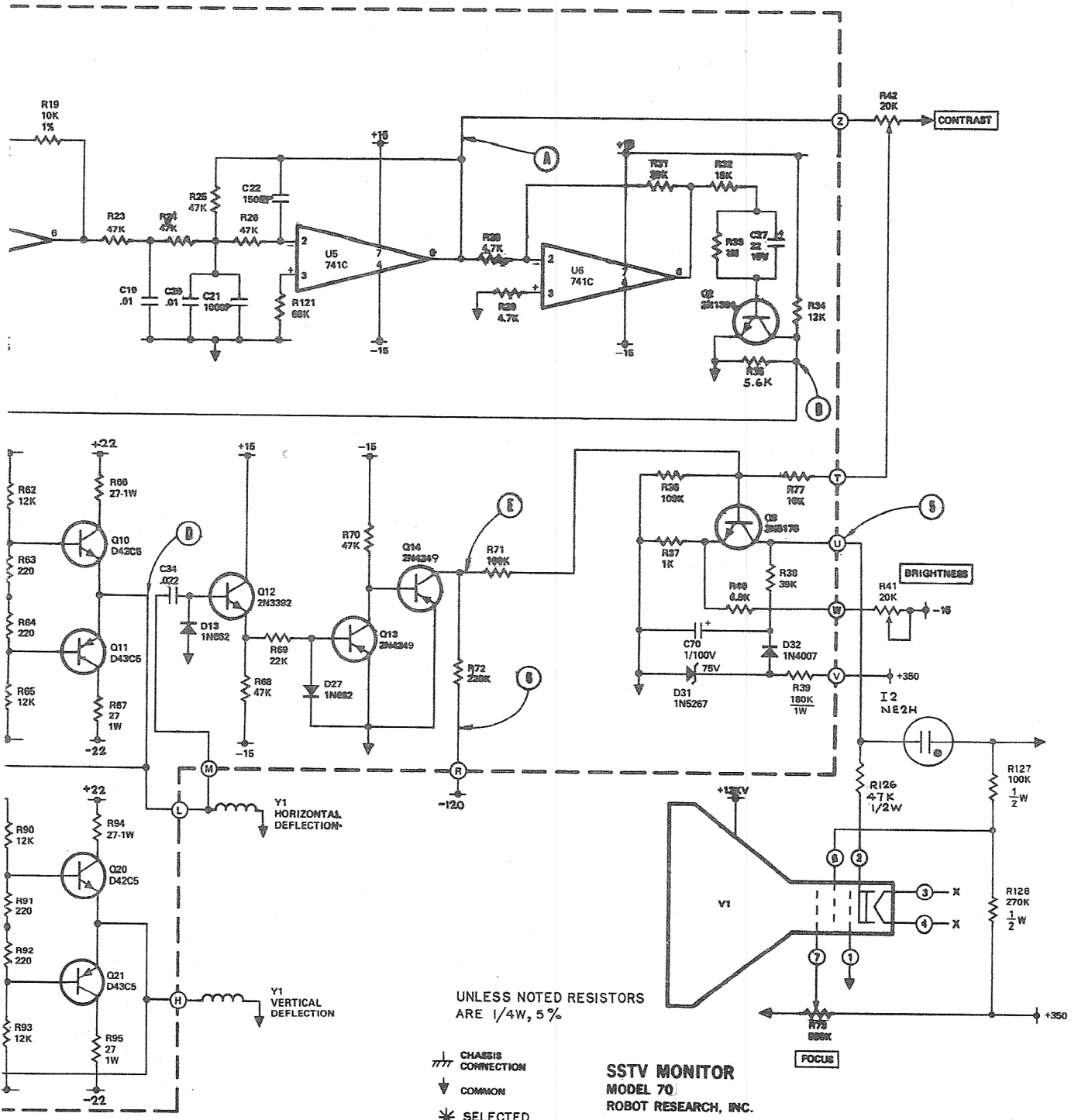


NOTE  
SEE BOX FOR  
230 V OPERATION









CONTRAST

BRIGHTNESS

FOCUS

Y1 HORIZONTAL DEFLECTION

Y1 VERTICAL DEFLECTION

SSTV MONITOR  
MODEL 70  
ROBOT RESEARCH, INC.

# *warranty*

The Robot Model 80 slow scan television camera and Robot Model 70 slow scan television monitor are warranted against defects in materials and workmanship, except for tubes, under normal use for a period of one year from the date of the original purchase. Tubes are warranted for a period of 90 days.

This warranty becomes valid upon our receipt of the completed Robot Research warranty card which accompanies our equipment. Do not ship equipment to factory without prior authorization. This warranty is limited to repairing or replacing only defective parts. This warranty becomes invalid if the equipment has been tampered with, misused, or damaged.