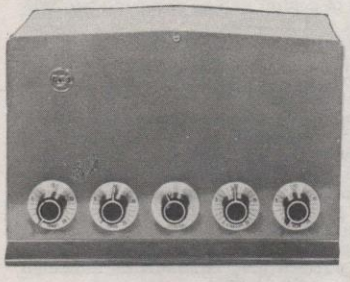
RCA VICTOR

"TV EYE" EQUIPMENT HA-1, HC-1

SERVICE DATA

—1953 No. E1—

PREPARED BY RCA SERVICE CO., INC.
FOR
RADIO CORPORATION OF AMERICA
RCA VICTOR DIVISION
CAMDEN, N. J., U. S. A.



The "TV Eye"

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GENERAL DESCRIPTION

The RCA "TV Eye" Equipment, consisting of a Camera Unit, HC-1, and a Control Unit, HA-1, is intended for use in closed circuit television monitor applications using standard television receivers of 72 or 300 ohms input. The Camera Unit contains the video and r.f. circuits. The Control Unit contains the power supply, sweep generating and sync circuits. A standard 16 mm. lens is used for camera image formation. The Camera Unit may be located remotely from the Monitor, at distances ranging up to 2000 feet. Modest power requirements allow operation from a standard a.c. outlet.

SPECIFICATIONS

Equipment Designations

Camera Unit (less Vidicon)	HC-1
Control Unit	HA-1
Camera Tube (Vidicon)	6198
Control Cable (Not supplied—length as required)	None

RCA Tube Complement

Tube Used	Camera Chassis	Function
(1) RCA 6198	1V4	Camera Tube
(2) RCA 6U8	1V1	1st & 2nd Video Amplifier
(3) RCA 6U8	1V2	3rd Video Amplifier & Sync Mixer
(4) RCA 6U8	1V3	R-F Oscillator & Modulator
1N34A	1CR1	D-C Restorer
1N34A	1CR2	Sync Clipper
1N34A	1CR3	D-C Restorer
	Control Chassis	
(1) RCA 12AU7	2V2	Vertical Osc. & Output
(2) RCA 12AT7	2V3	Horizontal Osc. & Sweep Gen.
(3) RCA 12AT7	2V1	Vertical Sync & Horiz. Amp.
(4) RCA 6BQ6GT	2V4	Horizontal Output
(5) RCA 12AT7	2V5	Vert. Sweep Rect. & Cath. Follower
(6) RCA 0A2	2V6	Voltage Stabilizer
(7) RCA 6AS6	2V7	Relay Control
1N94 (2 req'd)	2CR1, 2CR2	Voltage Doubler Rect.
RCA Stock No. 98727	2CR3	Bias Rectifier
1N34A	2CR4	Horiz. Sweep Rectifier

System Standards

Horizontal Sweep Frequency (Free running, nominal)	15,750 kc
Vertical Sweep Frequency	60 cps
Frame Frequency (Picture repetition rate)	30 fps
Scan (Random interlacing, lines per second, maximum)	525

Operating Requirements

Scene Illumination, Minimum	100 foot-candles
Ambient Temperature, Maximum	50°C (122°F)
Camera Cable, Maximum Length	500 feet
Camera Lens Mount	Std. 16 mm., Type "C"
Camera Base Mount	Screw, ¼"-20 thread
Maximum Cable Length	
Camera to Control Unit to Receiver Monitor	
Using RG-11/U cable	2000 ft.
Using RG-59/U cable	1200 ft.

Output Rating

R-F Frequency Range (Choice: Channels 2-6)	54-88 mc.
Voltage Output, Minimum	0.1 volt
Output Impedance	300 ohms

Power Supply Rating

115 volts a.c., single phase, 60 cycles	100 watts
Fuse Rating, Type 3AG	2 Amperes, Slow-Blow
Output Receptacle Rating	300 watts

Dimensions (Over-all)

	Camera Unit	
Height 5¼ in.	Width 4 in.	Depth 11⅜ in.
	Control Unit	
Height 7⅞ in.	Width 11 in.	Depth 8¼ in.

Weights (Approximate)

Camera Unit (less lens, cable)	4½ lbs.
Control Unit (less cable)	18 lbs.

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INSTALLATION PROCEDURE

GENERAL

The following installation procedures should be followed carefully to place the TV EYE Equipment in proper working condition. Initial adjustments of the TV EYE Camera, Control Unit, and Monitor Receiver are more convenient if the units are temporarily located near each other.

The complete installation procedure may be found in the Instruction Book, IB-36174-P1. The following material is included for service convenience.

Before proceeding with the installation, MAKE CERTAIN the television receiver to be used with the TV EYE equipment is in the best possible working order. For best results, a full 4 mc. bandwidth receiver is recommended.

TOOLS AND MATERIALS REQUIRED

1.—"Neut Stick" (A fully insulated shaft screwdriver with a small metallic tip 1/8" wide and 1/32" thick).
2.—Straight blade screwdriver with 1/4" blade.
3.—Ruler with 6 inch scale.
4.—100-Watt soldering iron and solder.
5.—Long-nose pliers.
6.—3/16" socket wrench or equivalent.
7.—Wire cutting pliers.
8.—Voltmeter (10 volt a.c. scale).

The following cables are required to connect the camera to the control unit. Lengths required will depend upon distance between the two.

12-conductor cable, No. 22 stranded wire, insulated for at least 300 volts may be used for distances up to 250 feet. For greater distances one pair of these wires must be No. 18.

RG-59/U Coaxial Cable.

RG-58/AU Coaxial Cable.

The following cable is required to connect the control unit to the receiver. Lengths required will depend upon the distance between the two.

300-ohm twin lead transmission line for distances up to 10 feet. For distances beyond 10 feet, either shielded 300-ohm twin lead or coaxial cable should be used. Coaxial cable, type RG-59/U, which can be used for camera-to-receiver distances up to approximately 1200 feet (of which a maximum of 500 feet may be between the camera and control unit), will require a transformer, RCA MI-6898 or equivalent, at the TV REC terminals to convert the 300-ohm output impedance to 72 ohms.

WIRING THE TV EYE CAMERA TO THE CONTROL UNIT

First disassemble camera plug, removing only the side plate held by the outside hex nuts and the top cover. FURTHER DISASSEMBLY BY REMOVING THE INSIDE HEX NUTS HOLDING THE SOCKET PINS AND SHELL IN PLACE IS NOT NECESSARY. Make sure these inside nuts hold the other side plate, shell and socket pins securely before soldering leads to the plug.

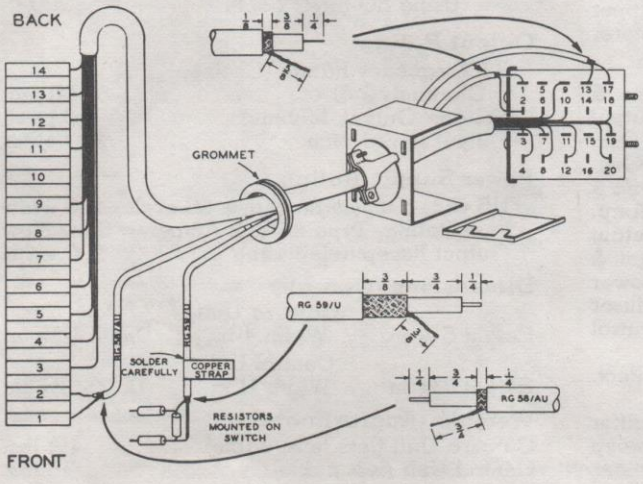


Figure 1—Wiring Diagram

Remove bottom cover of control unit by removing two self-tapping screws at each end of plate.

Insert one end of each cable through the clamp in the disassembled plug and the other end of each cable through the grommet on the rear panel of the control unit (located just below TV ANT terminal board).

When the interconnection is made between the camera and control unit, note that terminal 14 on the control unit terminal board is closest to the grommet at the back of the control unit. Terminals 1, 7, and 14 are identified by numbers stamped in the terminal board metal support plate. Care should be exercised to identify the terminal numbers accurately when making connections.

Solder the connections to the terminal board inside the control unit and to the camera plug terminals as indicated on diagram. (Figure 1.)

Connect R-F cable across the 82 ohm resistor, 2R51, mounted on the selector switch in the Control Unit. Bond the braid to the copper strap bonding the TV REC and TV ANT cables.

Reassemble the camera plug and tighten the cable clamp screws.

MOUNTING THE CAMERA

The TV EYE Camera may be mounted on any camera tripod.

Base of camera is tapped for a 1/4"-20 bolt.

In special situations it may be desirable to construct a bracket for holding the camera. Aluminum or other non-magnetic material must be used and the camera must be kept at least 3" away (in every direction) from magnetic material.

The camera should be so mounted as to avoid excessive vibration.

INSERTING THE VIDICON IN THE CAMERA

CAUTION

THE VIDICON IS A HIGHLY EVACUATED ELECTRON TUBE. EXTREME CARE SHOULD BE EXERCISED BY PERSONNEL HANDLING THIS TUBE TO PREVENT POSSIBLE INJURY AND/OR DAMAGE TO THE EQUIPMENT.

Loosen 8 captive head retaining screws then remove top cover from the camera.

Remove lens mounting plate by removing screws.

Loosen clamp around Vidicon socket and slide socket forward.

WIRING CONNECTIONS

Control Unit Terminal Board No.	Camera Unit Plug Pin No.	Wire Size or Type Required
1	13	RG58 Braid
2	17	RG58 Inner Conductor
3	20	#22
4	3	
5	8	
6	7	
7	12	
8	4	
9	19	#22**
10*	18	
11		
12	9	#22
13	10	
14	6	
To 2R51, 82 ohm resistor on 2S1	1	RG59 Inner Conductor
	2	RG59 Braid

*Used only for cable lengths less than 25 feet. For lengths over 25 feet, use terminal No. 11.

**For lengths over 250 feet, wires on pins 18 and 19 of camera plug must be No. 18 gauge.

INSTALLATION PROCEDURE

Insert pronged end of Vidicon in socket. Make certain that short pin is aligned with groove adjacent to notch in socket.

Using soft lint-free tissue, wipe off any fingerprints from face of Vidicon.

Replace lens mounting plate. Set distance between outer face of this plate and face of Vidicon accurately at 5/8" (Figure 2.)

See the lens data on page 7 for explanation of field sizes and the effect of varying this 5/8" dimension.

Tighten Vidicon socket clamp.

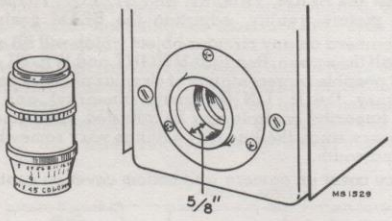


Figure 2—Vidicon Focal Plane Adjustment

WIRING THE CONTROL UNIT TO THE RECEIVER

Disconnect the outside antenna from the receiver.

Connect 300 ohm transmission line between the TV REC terminals (located on back of the TV EYE control unit) and the antenna terminals on the TV receiver. (Figure 3.)

If standard TV broadcasts are desired, connect antenna lead-in to the TV ANT (antenna) terminals on the back of the TV EYE control unit.

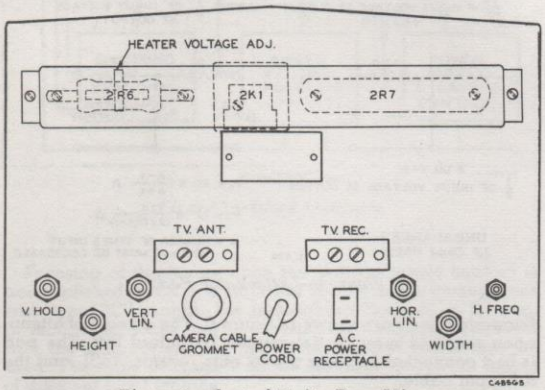


Figure 3—Control Unit—Rear View

TAKE THESE PRECAUTIONS BEFORE ACTIVATING THE EQUIPMENT FOR THE FIRST TIME.

Adjust the controls on the TV EYE control unit as follows:

Turn SELECTOR switch to OFF and turn BEAM and TARGET controls to zero on the dial. Turn STABILITY control to 20 on the dial. (Figure 4.)

Adjust slide wire resistor located on back of the control unit to minimum filament voltage position by moving resistor slider to extreme right. Slide wire resistor can be uncovered by removing box-like cover from rear of control unit.

Turn WIDTH and HEIGHT controls on rear of TV EYE control unit to maximum scan position (overscanning) by turning shafts full clockwise (screwdriver adjustment—Figure 3).

INITIAL ADJUSTMENT OF THE TV EYE

CAUTION

NEVER OPERATE THE EQUIPMENT WITH THE CAMERA DISCONNECTED

Insert wired plug into camera. Plug power cord of the TV EYE control unit into a 115 volt a.c. outlet.

If a TV broadcast is available, adjust the horizontal and vertical hold controls on the TV receiver to secure a stable picture. If a TV broadcast is not available, adjust the horizontal and vertical hold controls on the receiver to the mid-point of their ranges. If the receiver has an AGC control, set it at

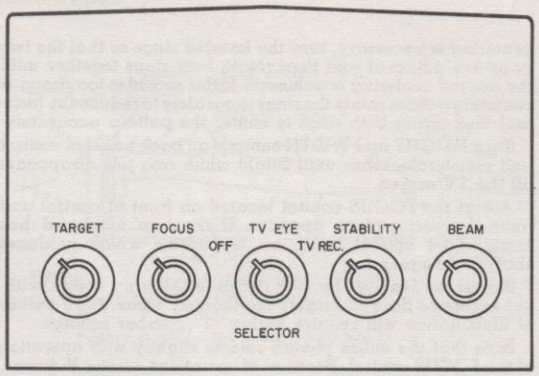


Figure 4—Control Unit—Front View

mid-range initially or so that the output signal does not overload the Monitor receiver.

Turn SELECTOR switch on the control unit to the TV EYE position.

Connect the voltmeter leads between camera plug terminal 18 and ground, and adjust the slide wire resistor so that the voltmeter registers 6.3 volts. Tighten slider. Disconnect voltmeter from camera and replace resistor cover on rear of control unit.

This adjustment is provided to compensate for the different cable lengths that may be used between the camera and control unit. If the cable is changed, the slide wire resistor must be readjusted.

The TV EYE Camera permits operation on channels 2 to 6 inclusive. Set the TV receiver channel selector to an unused channel in this range. The camera is shipped from the factory tuned for channel 2. Since the fine tuning range varies among TV receivers of different manufacture, it is advisable to retune the camera oscillator slightly to secure the best possible picture.

Carefully adjust the oscillator tuning capacitor located in the camera until a snow-free screen appears on the TV receiver. (Figure 5.)

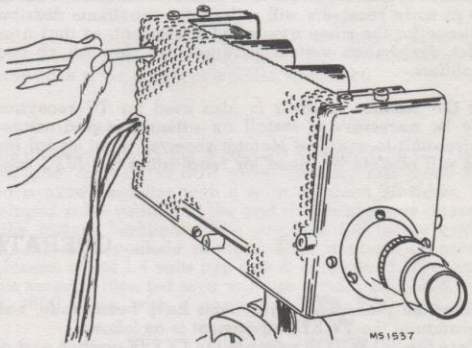


Figure 5—R-F Channel Adjustment

Screw lens into lens mount on front of camera.

Open the lens iris by turning the knurled ring to the lowest "f" number.

On the control unit, turn BEAM control to 15 on the dial and the TARGET control clockwise until an image appears. The image should be a bright white ring (which represents the outer edge of the Vidicon face) and may or may not have picture content in the center.

If the image "rolls", adjust the V. HOLD (vertical hold) control on the rear panel of control unit. If screen is covered with diagonal lines, adjust H. FREQ. (horizontal frequency) control.

Centralize the bright white ring on the TV screen by turning the knurled rings of the two centering magnets located near center of Vidicon mounting assembly. If a large amount of

INSTALLATION PROCEDURE

centering is necessary, turn the knurled rings so that the two gaps are adjacent and then rotate both rings together until the desired centering is achieved. If this provides too strong a centering action, rotate the rings separately to reduce the force and then rotate both rings to center the pattern accurately.

Turn HEIGHT and WIDTH controls on back panel of control unit counterclockwise until bright white ring just disappears off the TV screen.

Adjust the FOCUS control located on front of control unit until sharpest picture appears. If the lens employed has facilities for optical focus, set to position which produces sharpest image.

Adjust the lens iris for best detail in the gray areas, without excessive flare in brighly highlighted areas. High values of illumination will require higher "f" number settings.

Note that the entire picture rotates slightly with operation of the FOCUS control. Because of variations among Vidicons, it may be necessary to re-orient the deflection yoke to make the picture appear upright at the sharp-focus setting.

To re-orient the picture, loosen the clamp directly behind the metal frame housing the Vidicon, and rotate the silvered tube until vertical lines in the subject appear as vertical lines in the picture. Do not attempt to move the yoke by pulling on the cables. Rotate the silvered tube only to avoid damage to the yoke and to the Vidicon. Tighten clamp when satisfactoy orientation is obtained.

Adjust the STABILITY control located on the control unit for a stable picture with pleasing contrast.

Readjust the BEAM, TARGET, and STABILITY controls for optimum picture quality, adjusting the BEAM control last.

Focus camera on any circular object which will fill approximately half the screen. Readjust HEIGHT and WIDTH controls until best possible representation of circular object is achieved. If necessary, the H. LIN (horizontal linearity) and V. LIN (vertical linearity) controls may be adjusted. Adjustment may be necessary since the linearity settings vary somewhat with height and width.

Replace cover on camera and bottom cover on control unit.

INSTALLATION NOTES

A convenience outlet is provided on the rear panel of the control unit to supply power to the Monitor receiver. This outlet can be used to supply power to any 115 volt a-c electrical appliance with a power consumption of 300 watts or less. The power to this outlet is not switched or fused. Therefore, the outlet is energized as long as the TV EYE is plugged into a power source.

If the signal distribution is made on RG-59/U coaxial cable, the maximum distance between the camera and a single TV receiver is 1200 feet, of which a maximum of 500 feet may be between the camera and control unit. If greater separation is desired, RG-11/U coaxial cable may be used to extend the maximum distance to 2000 feet, or "booster" amplifiers may be used to give almost unlimited distribution.

More than one Monitor receiver may be connected to the TV EYE control unit by using the same techniques used to connect several receivers to a common antenna. The use of two or more receivers will reduce the maximum distribution distance for the same amount of equipment, so that a multi-outlet distribution system may require the use of booster amplifiers.

If the Monitor receiver is also used for TV reception, it may be necessary to install an attenuator pad inside the control unit to equalize Monitor receiver input signal levels. This will obviate the need for readjusting the AGC control.

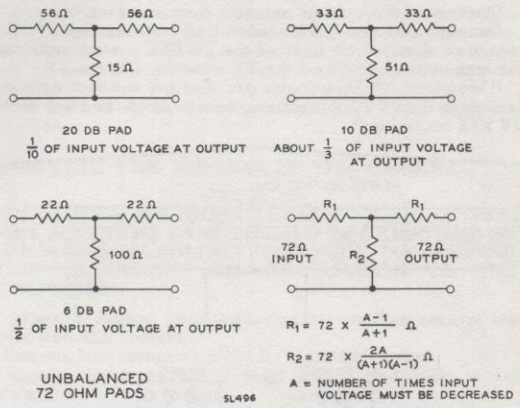


Figure 6—Attenuator Pads

Suggested pads are shown in figure 6. The amount of attenuation required may be determined by actual test. The pad is best connected between the 82 ohm resistor, 2R51, and the R-F input cable.

OPERATING INSTRUCTIONS

After the preceding adjustments have been made, normal operation of the TV EYE equipment is as follows:

Turn the SELECTOR switch to the TV EYE position and allow the equipment to "warm up" for two minutes.

Apply power to the TV receiver.

Set channel selector on TV receiver to the channel selected for TV EYE operation. (2 to 6 inclusive.)

Adjust the TV receiver Fine Tuning control for a snow-free screen.

Adjust the BEAM, TARGET, and FOCUS controls for a good quality picture. If the lens employed has facilities for optical focus, set to position which produces sharpest image.

Adjust the TV receiver fine tuning control for best picture quality.

If the WIDTH, HEIGHT, H. LIN, and V. LIN controls are badly misadjusted, so that the picture is stretched and obviously distorted, the picture may not appear when the set is next turned on. This occurs because of the Vidicon protective circuit. This circuit permits normal operation and overscanning and will protect the Vidicon from damage should a tube become defective.

The setting of the BEAM control will have some effect on the amount of detail seen in the picture. If printed matter is to be televised, it will usually be advisable to set the BEAM control between 5 and 15 on the dial. However, if the scene includes moving objects in bright light, the BEAM control setting should be relatively high (between 10 and 20 on the scale).

If the camera is moved to scan a scene or if a stationary camera is viewing moving objects, the image may tend to smear or lag behind the motion. This effect can be reduced by a combination of a higher setting of the BEAM control, a lower setting of the TARGET control, and a lower "f" number setting of the lens.

For the best possible pictures, the lighting of any scene should be uniform and of sufficient intensity to permit setting the TARGET control toward the low end of its range.

Changing the scene illumination to a different light intensity will necessitate a change in the iris ("f") setting.

For each degree of light intensity there will be an optimum setting of each operating control. These settings will best be learned through experience.

CIRCUIT DESCRIPTION

GENERAL

As shown in the block diagram, figure 7, the equipment is divided into two units, the Camera Unit and the Control Unit.

The Camera Unit contains the RCA 6198 Vidicon camera tube and associated components, a three stage video amplifier, a mixer stage combining video, horizontal, and vertical sync signals, and an R.F. oscillator and modulator stage. The R.F. signal is generated in the Camera Unit, and is fed from the Camera Unit through a coaxial cable into the Control Unit selector switch terminals through a matching pad. This permits matching the standard 300 ohm input of a television receiver.

The Control Unit contains horizontal and vertical deflection circuits for the Vidicon tube, a sweep failure protection circuit which prevents burning of the Vidicon target coating in the event of a sweep circuit malfunction, a blanking and vertical sync stage, the power supply, and the selector switch and Vidicon controls.

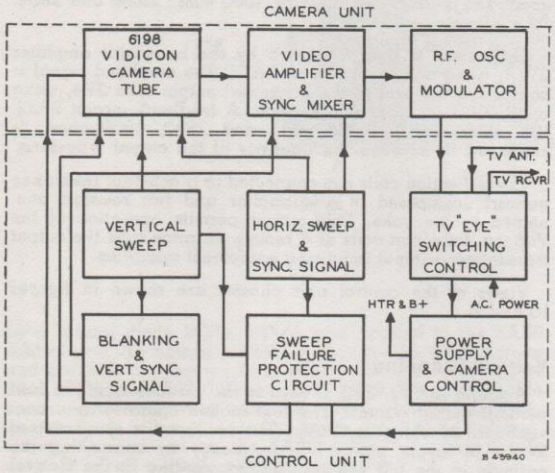


Figure 7—Block Diagram

Focusing of the image upon the Vidicon target coating is accomplished by using a standard 16 mm. movie camera lens with type "C" mount. For general application, a 50 mm. (2 inch) fixed focus lens is supplied as standard equipment with the unit. For specific applications, other lenses may be used. The table on page 7 shows the field of view for lenses of different focal lengths.

CAMERA UNIT

Camera Tube

The RCA 6198 Vidicon is a one inch diameter camera tube with a photoconductive target coating adjacent to the optical glass tube face. Connection is made to this coating through an external metal ring near the tube face. The tube contains an electron gun assembly and a long metal sleeve between the gun assembly and the target, located near the inner surface of the cylindrical glass barrel. The metal sleeve is split into two sections, grid Nos. 3 and 4. The section nearest the target is known as the wall screen, which serves to provide a uniform decelerating field in front of the target and which traps secondary emmission electrons from the target. Grid No. 3 provides an electrostatic field and is used as a focus electrode by adjusting the applied d.c. voltage. An outline drawing of the tube is shown in figure 8.

The target consists of a transparent conducting signal plate on which is deposited the sensitive material which is an effective insulator in darkness, but which becomes semi-conducting under the influence of light. The surface of this target on the cathode side is scanned by the electron beam from the electron gun assembly. In darkness, this surface accumulates a negative charge until no more electrons can strike it. A low potential d.c. is applied to the signal plate so that a difference in potential exists below the window side and the cathode

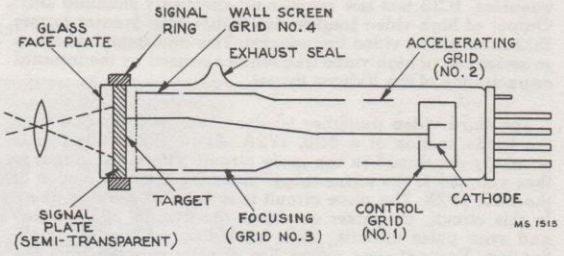


Figure 8—Vidicon Cross-Sectional Diagram

side. The optimum d.c. potential will vary with the average light intensity. Under the influence of light in the picture, the sensitive material becomes semi-conducting, and the cathode side becomes more positive. The electron beam must then recharge the surface. This recharging current, flowing through a resistor of approximately 50,000 ohms connected to the target plate, constitutes the video signal.

A magnetic field for beam alignment on the target plate is set up by four Alnico rods surrounding the tube, which supply the primary focus field of approximately 40 gauss. Fine control of focus is obtained, however, by varying the d.c. voltage applied to the wall electrode. Proper alignment is obtained by optimizing the field strength in manufacture of the units. Compensation for field non-uniformities is achieved by adjusting the position of soft iron shunting sleeves sliding on the Alnico rods. These sleeves are adjusted so that focus at all four corners of the image occurs simultaneously with the center when the FOCUS control is adjusted.

Centering of the scanning beam upon the image is accomplished by means of two adjustable ring magnets, placed around the center of the Vidicon. This adjustment may be made upon installation, if required. Maximum displacement of the image as seen on the Monitor is obtained when the two air gaps in the rings are located adjacent to each other. By rotating one ring with respect to the other, the field may be weakened as necessary to obtain the desired centering adjustment.

Deflection is obtained magnetically by means of vertical and horizontal deflection coils. These coils are surrounded by an iron wire wrap in the completed assembly.

Video Amplifier Chain

The camera tube output is coupled through 1C9, 0.25 mfd., to the grid of 1V1A, a 6U8 triode section. This stage is a shunt peaked amplifier with a gain of about 30 times. The developed video voltage at the grid is in a negative direction for the picture highlights. The output is fed to the grid of 1V1B, the 6U8 pentode section. With a scene of normal brightness, about 1.4 volts p/p output is obtained. The output of this stage is then fed to a voltage divider 1R11, 20K, and 1R12, 1600 ohms, with a capacitor, 1C13, 5-50 mmf., high

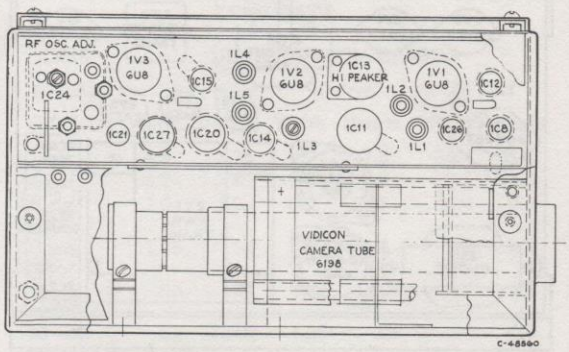


Figure 9—Camera Unit—Right Side View

CIRCUIT DESCRIPTION

peaker adjustment, shunted across 1R11. At high video frequencies, 1C13 has low reactance, effectively shunting 1R11. Output at high video frequencies is therefore greater across 1R12 than at low video frequencies. This adjustment compensates for loss of high video frequencies caused by the internal capacitance of the Vidicon target.

The third video amplifier is also shunt-peaked, and uses the triode section of a 6U8, 1V2A. About 0.25 volts p/p is normally developed in the plate circuit. The video signal is then coupled to the mixer stage, using the pentode section of the 6U8, 1V2B. The plate circuit is series and shunt peaked. In this circuit, the mixer combines the outputs of the video and sync pulse circuits, while providing additional amplification. Vertical sync pulses are directly coupled from the cathode of 2V1B, 12AU7 vertical sync amplifier, to the cathode of the mixer stage. A clamp from ground potential is established for the video signal by 1CR1, a 1N34A crystal diode used as a d.c. restorer. Horizontal pulses from the yoke are coupled from 1C25, 0.1 mfd., and 1R31, 1000 ohms, to the plate circuit of the mixer stage. The horizontal sync voltage is developed across 1R30, 220 ohms.

The combined signal is then fed through 1CR3, a 1N34A sync clipper stage. This keeps the horizontal and vertical sync pulses of essentially equal amplitude under varying signal conditions, thereby maintaining stable Monitor synchronization. The bias voltage applied to the crystal is controlled by the STABILITY control, which is adjusted to obtain maximum contrast without picture bending. Major components of the camera chassis are shown in figure 9.

R. F. Oscillator and Modulator

The oscillator circuit uses the pentode section of a 6U8, 1V3B. The tuned circuit is connected in a grounded cathode, Hartley oscillator circuit using the screen electrode as the plate. The output circuit is electron-coupled to the screen electrode. The oscillator may be tuned by capacitor 1C24 to any frequency between 54 and 88 mc., which covers the 5 lower frequency VHF television channels. This adjustment is made upon installation. The unit is pretuned to channel 2 at the factory.

The modulator uses the triode section of a 6U8, 1V3A. A coil, 1L6, is connected from cathode to ground. This coil is broadly resonant to the R.F. oscillator frequency, possessing considerable impedance at radio frequencies. It has little impedance at video frequencies. R.F. voltage from the oscillator output circuit appearing across 1R24, 220 ohms, is coupled to the modulator cathode through 1C18, 1000 mmf. The combined video and sync signal is applied to the grid. A d.c. level is obtained by using a crystal diode 1N34A, 1CR2, as a d.c. restorer. The plate current flowing through 1L6 is then determined by the grid signal amplitude, resulting in modulation of the R.F. carrier. The output is then fed from the plate circuit of the modulator through 1C19, 4700 mmf. to the Camera Unit pin plug.

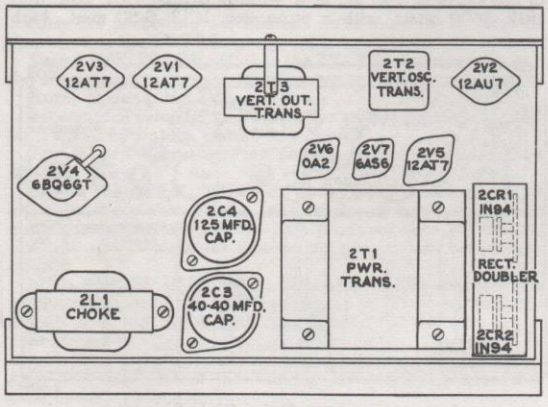


Figure 10—Control Unit—Top View—Cover Removed

CONTROL UNIT

Horizontal Scanning

A free-running sine wave oscillator, using one section of a 12AT7, 2V3A, is used to generate the horizontal frequency and provide stability. The tuned circuit is composed of 2T4 and 2C12, 8200 mmf. A voltage on the order of 100 volt p/p is obtained across the tuned circuit. The output is coupled to the grid of the second section, 2V3B, the horizontal sweep generator tube. The large amplitude positive-going portion of the sine wave causes heavy grid current to be drawn, resulting in a negative bias of about —54 volts at the grid of 2V3B. Since the sine wave peak exceeds this value during only a few degrees of the cycle, a pulse of plate current flows in 2V3B so that a switch action is obtained which periodically discharges the sweep-forming network. Control of sweep width is obtained by adjusting the d.c. voltage applied to the plate. Control of linearity is obtained by varying the resistance 2R28, HORIZ. LINearity control, in the sweep forming network composed of 2R27, 820K; 2C16, 1000 mmf.; 2R28; and 2R54, 100K ohms.

The sweep is then amplified by the horizontal amplifier 2V1A, using one section of a 12AT7. The amplified signal is coupled to the grid of the horizontal output tube 2V4, using a 6BQ6GT in class A operation. A feedback circuit 2R32, 10K ohms; 2C18, 0.056 mfd.; and 2R30, 1800 ohms, is employed to improve the linearity of the output waveform.

The deflection coils are connected in a constant resistance network, composed of a capacitor and two resistors connected to the yoke. This circuit permits operation of the Vidicon deflection coils at a remote distance from the output transformer without impairing equipment operation.

Views of the control unit chassis are shown in figures 10 and 11.

Vertical Scanning

A single 12AU7, 2V2, is used in the vertical oscillator and vertical output circuits. The first section operates as a conventional blocking oscillator. The oscillator is synchronized to the 60 cycle power line frequency by connecting the cathode to the 6.3 volt a.c. heater winding in the Control Unit. 2C8, 0.22 mfd., and 2R15, 10K ohms, serve as the sweep forming network. The HEIGHT control, 2R12, 1 megohm, controls the plate voltage applied to the blocking oscillator. Vertical pulses for blanking and synchronization are taken from the secondary winding of the vertical blocking transformer.

The second section of the 12AU7 operates as a conventional amplifier stage which is matched to the Vidicon deflection coils through a step-down transformer. Vertical linearity is controlled by varying the total resistance in the cathode circuit of the amplifier stage.

Vertical Blanking and Synchronizing

A vertical pulse is fed from 2C6, 0.022 mfd., and 2R11, 100K ohms to the grid of a 12AT7 triode section, 2V1B. The pulse is amplified and the output of the plate circuit is used to blank the Vidicon during retrace time. This is necessary to prevent spurious signals and noise from upsetting the operation of the synchronizing circuits. The cathode of the vertical sync amplifier is tied in parallel with that of 1V2B, the mixer tube in the Camera Unit. This provides the vertical sync signal.

Protective Circuit

A protective circuit is included in the equipment to protect the Vidicon target coating from damage resulting from lack of sufficient horizontal or vertical deflection voltage.

The circuit functions by rectifying the vertical and horizontal sweep voltages to obtain d.c. voltages which is applied as bias voltage to a relay control tube. If either or both sweeps should fail, the reduced rectified voltage causes decreased plate current to be drawn, causing the relay to drop out and grounding the Vidicon accelerator electrode.

In detail, the vertical sweep voltage is rectified by one section of a 12AT7, 2V5B. A positive voltage is developed across the cathode resistor 2R48, 2.2 meg., which is applied to the 6AS6, 2V7 suppressor grid. The horizontal sweep is rectified

CIRCUIT DESCRIPTION

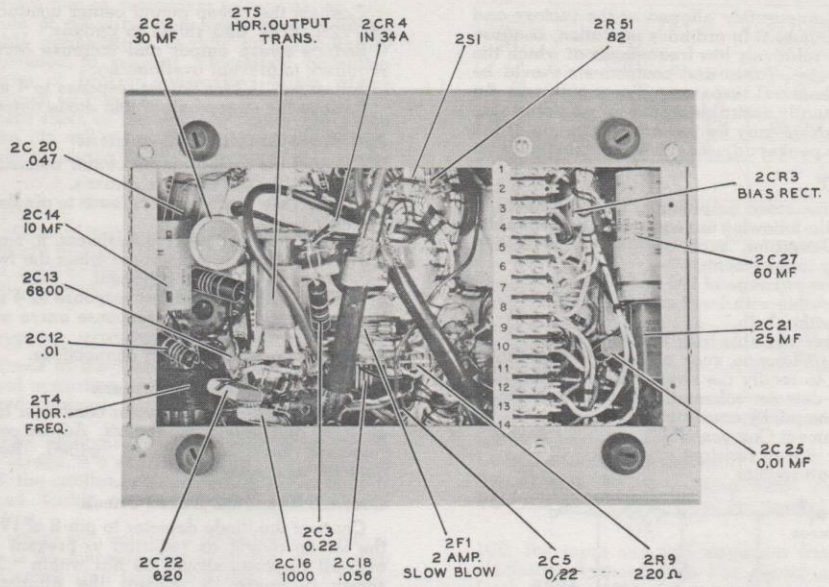


Figure 11—Control Unit—Bottom View—Cover Removed

by a crystal diode 2CR4, 1N34A and applied to the 6AS6 control grid. To obtain positive operation, the 6AS6 screen and cathode are tapped to a voltage divider consisting of 2R41, 15K ohms, 2R42, 18K ohms, and 2R43, 510 ohms. Stable operation is achieved by using one section of a 12AT7, 2V5A, as a cathode follower, connected in a series tube stabilizer circuit. The voltage on the 6AS6 cathode is held nearly constant for all normal operating conditions.

Power Supply

A half wave voltage doubler circuit, using two 1N94 germanium junction diodes, supplies plate power for the Control and Camera Units. A small encased selenium rectifier 2CR3, together with the filter 2R1, 2C1, provides bias for the Vidicon beam control electrode. This bias is adjusted by means of 2R2, 1 meg., BEAM control.

The 250 volt d.c. output of the voltage doubler rectifier supplies the relay control tube, vertical output tube, and the horizontal sweep chain. The FOCUS control 2R20, 100K ohms, is placed in a bleeder circuit across the output. A filter 2R56, 560 ohms, and 2C2, 30 mf., prevents coupling of sweep pulses from the horizontal output tube.

An 0A2, 150 volt stabilizer tube, feeds the vertical oscillator, vertical sync amplifier, and relay control circuit cathode follower. Power for the Camera Unit is also obtained from the stabilized voltage through an additional filter. STABILITY (2R5, 5000 ohms) and TARGET (2R38, 100K ohms) controls are connected in this circuit so that the proper d.c. voltage ranges are obtained.

Selector Switch

The SELECTOR switch 2S1 has three positions: OFF, TV EYE, and TV RECeiver. In the OFF position, the TV ANT terminals are connected to the TV REC terminals. Heater and B+ power circuits are opened. In the TV EYE position, the TV ANT terminals are grounded, the R.F. output of the TV EYE is connected to the TV REC terminals, and power is applied to the Heater and B+ circuits. In the TV REC position, the TV ANT terminals are connected through to the TV REC terminals. Heater power only is operative, permitting standby operation of the TV EYE equipment. The television monitor receiver may then be used conventionally.

OPTICAL DATA

The field sizes shown are maximums possible with the Vidicon Camera and are larger than the lens manufacturer quotes because the picture area on the face of the Vidicon is larger than the frame size on 16 mm film. Width and height of fields are in feet.

Note: The fixed-focus lenses are designed to have objects in focus at distances between 15 feet and infinity. If operation at less than 15 feet is desired, the Vidicon tube face must be pulled back to a distance greater than the 5/8 inch specified on page 3. When this adjustment is made, the lens will no longer focus on distant objects.

Note: On variable-focus lenses, the object-distance calibration on the lens barrel should be correct when the Vidicon face is set 5/8" back from the outer face of the lens mounting plate. Variations in Vidicon tubes may require some adjustment of the tube position to secure an exact agreement between the lens calibration and the object distance.

LENS DATA

LENS	DISTANCE FROM CAMERA					
FOCAL	5 Feet		10 Feet		25 Feet	
LENGTH	Width	Height	Width	Height	Width	Height
13 mm	4.9	3.7	9.7	7.3	24.4	18.3
17 mm	3.7	2.8	7.5	5.6	18.7	14.0
25 mm (approx. 1")	2.5	1.9	5.0	3.7	12.5	9.3
50 mm (approx. 2")	1.25	.94	2.5	1.9	6.2	4.7
75 mm (approx. 3")	.83	.62	1.67	1.25	4.2	3.1
100 mm (approx. 4")	.62	.46	1.25	.94	3.1	2.3
6 inches	.41	.31	.82	.62	2.1	1.6

ALIGNMENT PROCEDURE

GENERAL

The unit has been accurately aligned at the factory and should not require alignment in ordinary operation, because of the stability at the relatively low frequencies at which the video amplifier operates. Tubes and components should be checked first if an abnormal response curve is obtained. An alignment check is usually desirable whenever an adjustable peaking coil replacement may be required. Location of the peaking coil and high peaker adjustments is shown in figure 14.

TEST EQUIPMENT

To properly align the video amplifier of this equipment, it is recommended that the following test equipment be available:

1. Video Sweep Generator, such as the RCA WA-21A, meeting the following requirements:
   (a) Sweep frequency range of 100 kc to 10 mc.
   (b) Output adjustable with 1 volt maximum.
   (c) Output flat within 1 db.
   (d) Built-in Marker variable from 100 kc to 10 mc.
2. Cathode Ray Oscilloscope, such as the RCA WO-56A.
3. Diode Detector, to rectify the swept output of the video amplifier. A suitable detector schematic, Figure 12, is shown below. It should be compactly constructed.
4. Accessory Alignment Components
   2 100,000 ohm, ½ watt resistors
   1 180 ohm, ½ watt resistor

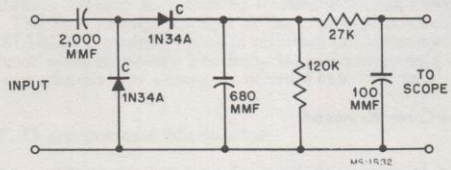


Figure 12—Video Detector Probe Schematic

ALIGNMENT PROCEDURE

Preliminary Operations

Remove tube 2V4, 6BQ6GT.

Disconnect the lead from capacitor 1C15, 100 mfd. at pin 8 of 1V2A, 6U8.

Disconnect coil 1L6 and capacitor 1C18 from pin 8 of 1V3A, 6U8, and replace with 180 ohm resistor from pin 8 to ground.

Remove 1CR1 and 1CR2, 1N34A crystal diodes, and replace with 100,000 ohm resistors from grids of 1V2B and 1V3A to ground.

Place a short jumper directly across 1CR3, 1N34A.

Connect the diode detector input leads between pin 8 of 1V3A, 6U8 and ground.

Mixer Stage Alignment

Connect the 75 ohm sweep output center conductor lead to pin 2 of 1V2B, 6U8, and shield to chassis.

Adjust coils 1L4 and 1L5 for flattest response to 4 mc.

Remove the sweep output connection.

3rd Video Amplifier Alignment

Connect the sweep output center conductor lead to pin 9 of 1V2A, 6U8, and shield to chassis.

Reduce sweep output and increase oscilloscope gain as required, to prevent overloading.

Adjust coil 1L3 for flattest response to 4 mc.

Remove the sweep output and diode detector connections.

2nd Video Amplifier Alignment

Connect the sweep output center conductor lead to pin 2 of 1V1B, 6U8, and shield to chassis.

Connect the diode detector leads to pin 8 of 1V2A, 6U8 and ground.

Set 1C13, high peaker adjustment, to maximum capacity. Maximum capacity is obtained when the two solder globules on stator and rotor are adjacent.

Adjust coil 1L2 for flattest response to 4 mc. Disregard the low frequency end of the response curve as 1C13 will cause some attenuation.

Remove the sweep output connections.

1st Video Amplifier Alignment

Connect sweep output center conductor lead to target lead of 1C9, and shield to chassis. Adjust coil 1L1 for flattest response to 4 mc. (within ±15%). Remove the diode detector connections.

Over-all Response Curve Check

Connect the diode detector to pin 8 of 1V3A, 6U8. Reduce the sweep output as required to prevent overloading. The over-all response should be flat within −25% to 4 mc., as shown in figure 13. Repeat the alignment procedure if necessary. Restore all circuit components and connections changed or removed when alignment is completed.

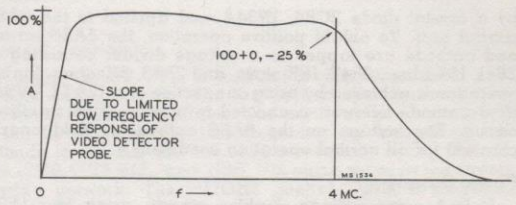


Figure 13—Over-all Response Curve

High Peaker Adjustment 1C13

This adjustment is best made while viewing a scene or resolution chart upon the Monitor receiver. Adjust to eliminate trailing whites or trailing blacks, while retaining picture crispness. Correct adjustment is usually obtained at slightly less than 50% of maximum capacity.

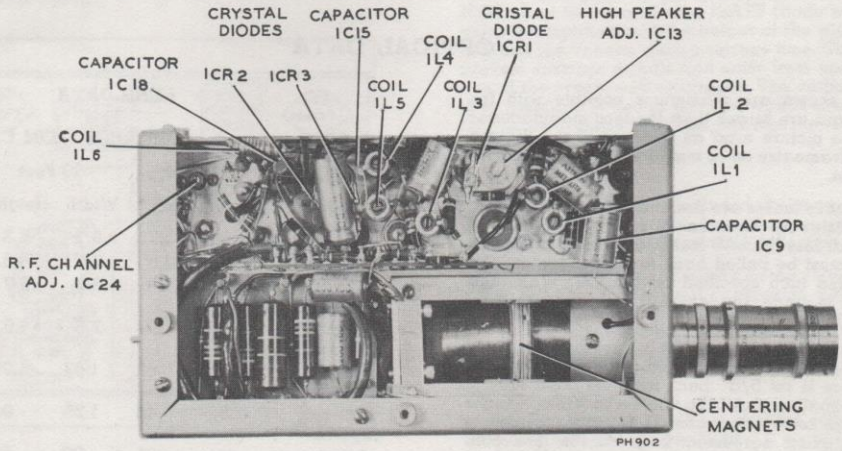


Figure 14—Coil and Trimmer Locations

MAINTENANCE

ROUTINE MAINTENANCE AND CLEANING

To insure maximum operating efficiency and to avoid interruption of service due to component failure during use, a regular schedule of cleaning and inspection should be established. Cable connections should be periodically checked and tightened to prevent intermittent operation because of a loose or broken connection. Cable wiring connections are shown on page 2.

Only replacement fuses of the original rating should be used. A log of tube life will aid in anticipating tube failure. Spare tubes should be available in the event of an obvious failure.

TEST EQUIPMENT

The following pieces of test equipment are suggested as being useful for circuit troubleshooting.

1. Oscilloscope, such as the RCA WO-56A.
2. Vacuum Tube Voltmeter, such as the RCA VoltOhmyst WV-97A.

TROUBLESHOOTING SUGGESTIONS

Begin with a check of the Monitor Receiver to determine that it is in normal operating condition. If a check reveals service is required, normal television service procedures may be applied.

With the TV EYE equipment in operation, observe the Monitor Receiver screen. If a snowy screen with no apparent signal is obtained, the oscillator, modulator, and d.c. circuits should be checked. Cable connections and tubes should always be tested first.

A quick check which will isolate Camera Unit or Control Unit malfunctions is the measurement of the d.c. and sweep voltages on the Control Unit terminal board, Nos. 1 to 14. Lack of, or abnormal readings, indicate a further check of the Control Unit should be made.

If a noise-free raster is obtained on the Monitor Receiver, the TV EYE equipment should first be turned OFF for a few minutes, and then turned to the TV EYE position. During warmup, the click of relay 2K1, mounted on the back panel of the Control Unit, should be heard. Failure to hear the relay operate may indicate insufficient vertical or horizontal sweep voltages, or a protective circuit or power supply malfunction.

If relay 2K1 operates, but no picture is obtained, the perforated metal shield on the Camera Unit may be removed and a finger pressed against the plastic sleeve over capacitor 1C9, the input coupling capacitor from the Vidicon target electrode. A strong hum bar should appear on the raster. Lack of response to this test indicates a more detailed check of the video amplifiers should be made. If a response is obtained, the Vidicon should be removed from its socket and socket connections, signal ring, and signal ring contact checked. Voltages should also be checked at the Vidicon socket.

A quick check of the tubes in the camera video amplifier may be made by measuring the cathode voltages, to insure that current is flowing in each tube. The 1N34A crystal diodes may be measured by means of a VoltOhmyst. Forward resistance should read approximately 200 ohms, while back resistance should be approximately 100,000 ohms.

By the use of the test equipment suggested, it should be possible to quickly locate any tube or component not functioning normally.

CONTROL UNIT TERMINAL BOARD VOLTAGE AND RESISTANCE READINGS

TERM. NO.	VOLTS D.C.	VOLTS A.C.	RESISTANCE*
1	GND (0)	—	(0)
2	—	18.5**	(1.6)
3	(+130)	—	(8200)
4	−8 to −120(−32)	95.0**	1.2 Meg. to 1.7 Meg.
5	0 to +88 (+32)	—	8 to 35,000
6	+88 to +110 (+100)	—	9200 to 9500
7	+125 to 255 (+240)	—	8500 to 55,000
8	+255	—	330,000
9	—	6.3	INF.
10	—	6.3	INF.
11	—	13.0	INF.
12	(+1.2)	0.5**	INF.
13	—	3.7**	(70)
14	GND (0)	—	(0)

*Resistance Readings taken with Camera Plug removed from Camera Unit. Readings in ohms.

( ) Indicates typical values.

**Read with VTVM reading peak a.c. voltages, such as VoltOhmyst WV-97A. Read for normal operating condition.

RESOLUTION CHART INSTRUCTIONS

GENERAL

The resolution chart on the pull-out page, Figure 15, has been included to aid in the adjustment of the TV EYE equipment and the Monitor receiver when an adjustable focus lens is used. The Monitor receiver used should preferably be a full 4 mc. bandwidth receiver. Linearity, contrast, and brightness controls should be preset to the positions used in normal reception.

The chart should be mounted approximately 3 feet distant from the camera when a 50 mm. lens is used. For other focal length lenses, a distance should be chosen which circumscribes the bright white ring of the Vidicon target about the chart. A convenient light source for illumination is a 150 watt Type R-40 floodlamp. It is desirable to make the final adjustments at approximately the illumination level which will be encountered in actual use.

USING THE RESOLUTION CHART

Linearity and Size controls (horizontal and vertical) should be adjusted so that the large circles (black inside—white outside) are as round as possible, and so that the pattern circumscribed by the white circle just fills the screen.

Brightness, contrast, and stability controls should be adjusted so that each of the steps from black to white in the shading circle are separate and distinct.

Hold controls (horizontal and vertical) on the receiver should first be adjusted to the center of their hold range, as determined by station reception. The Control Unit Vertical Hold and Horizontal Frequency controls should then be adjusted for maximum stability of the picture for vertical and horizontal movement, respectively.

Focus controls should be adjusted so that the separate lines in the vertical resolution wedge are as distinct as possible at the narrow edge of the vertical wedge.

The monitor receiver focus control may be adjusted first by means of station reception. The TV EYE electrical focus and optical focus adjustments may then be made to obtain the clearest picture.

Centering controls should be adjusted so that the complete pattern is centered with respect to the screen.

Before adjusting electrical centering controls on either the Monitor receiver or TV EYE equipment, the optical axis of the Camera Unit should be aligned with the optical center of the scene or resolution chart. This may be accomplished by overscanning and manually centering the Camera Unit so that the outer edge of the Vidicon target, as seen on the Monitor receiver, is centrally circumscribed about the picture.

SIGNIFICANCE OF THE RESOLUTION CHART

Horizontal wedges indicate vertical resolution, which is expressed in terms of lines.

Vertical wedges indicate horizontal resolution, which may be expressed either in terms of lines, or bandwidth.

Horizontal and vertical wedges are marked at several points by white dots to indicate the equivalent number of lines. This may be computed by using the relation $r = \frac{v \times l}{d}$

where v = resolution chart height or width in inches, l = total number of black and white lines in the wedge, and d = distance in inches across the wedge at the desired point. To obtain the horizontal resolution in bandwidth, divide by 80.

Bandwidth	Horizontal Resolution In Lines
1.0 mc.	80 lines
2.0 mc.	160 lines
3.0 mc.	240 lines
4.0 mc.	320 lines

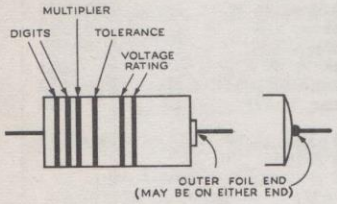
NOTES

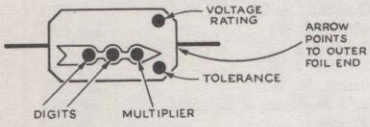
SAFETY WARNING

OPERATION OF THIS EQUIPMENT OUTSIDE THE CABINET OR WITH THE COVERS REMOVED, INVOLVES A SHOCK HAZARD FROM THE POWER SUPPLY. WORK ON THE EQUIPMENT SHOULD NOT BE ATTEMPTED BY ANYONE WHO IS NOT FAMILIAR WITH THE PRECAUTIONS NECESSARY WHEN WORKING ON HIGH VOLTAGE EQUIPMENT.

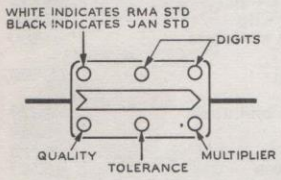
COLOR CODES

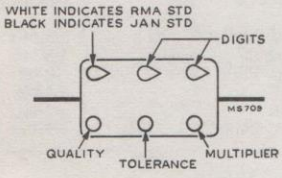
MOULDED PAPER CAPACITORS

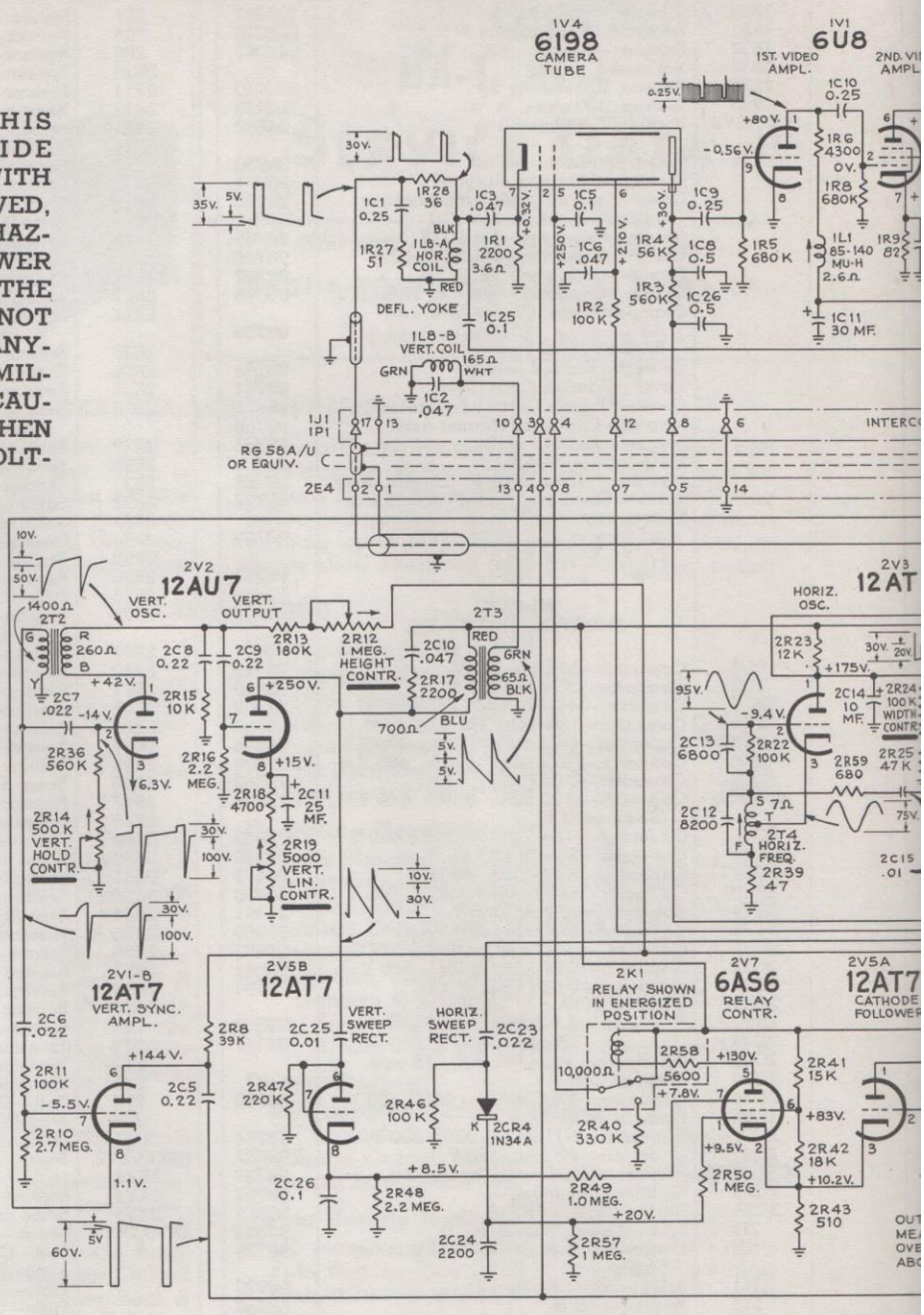




FIXED MICA CAPACITORS







* VARIES WITH STABILITY CONTROL SETTING.

In some equipments, 2CR1 and 2CR2 are 1N158 diodes, which are interchangeable with 1N94 diodes.

In some equipments, 2C12 is .01 mfd.

In some equipments, 2C22 is 680 mmf.

THE VIDICON IS A HIGHLY EVACUATED ELECTRON TUBE. EXTREME CARE SHOULD BE EXERCISED BY PERSONNEL HANDLING THIS TUBE TO PREVENT POSSIBLE INJURY, AND/OR DAMAGE TO THE EQUIPMENT.

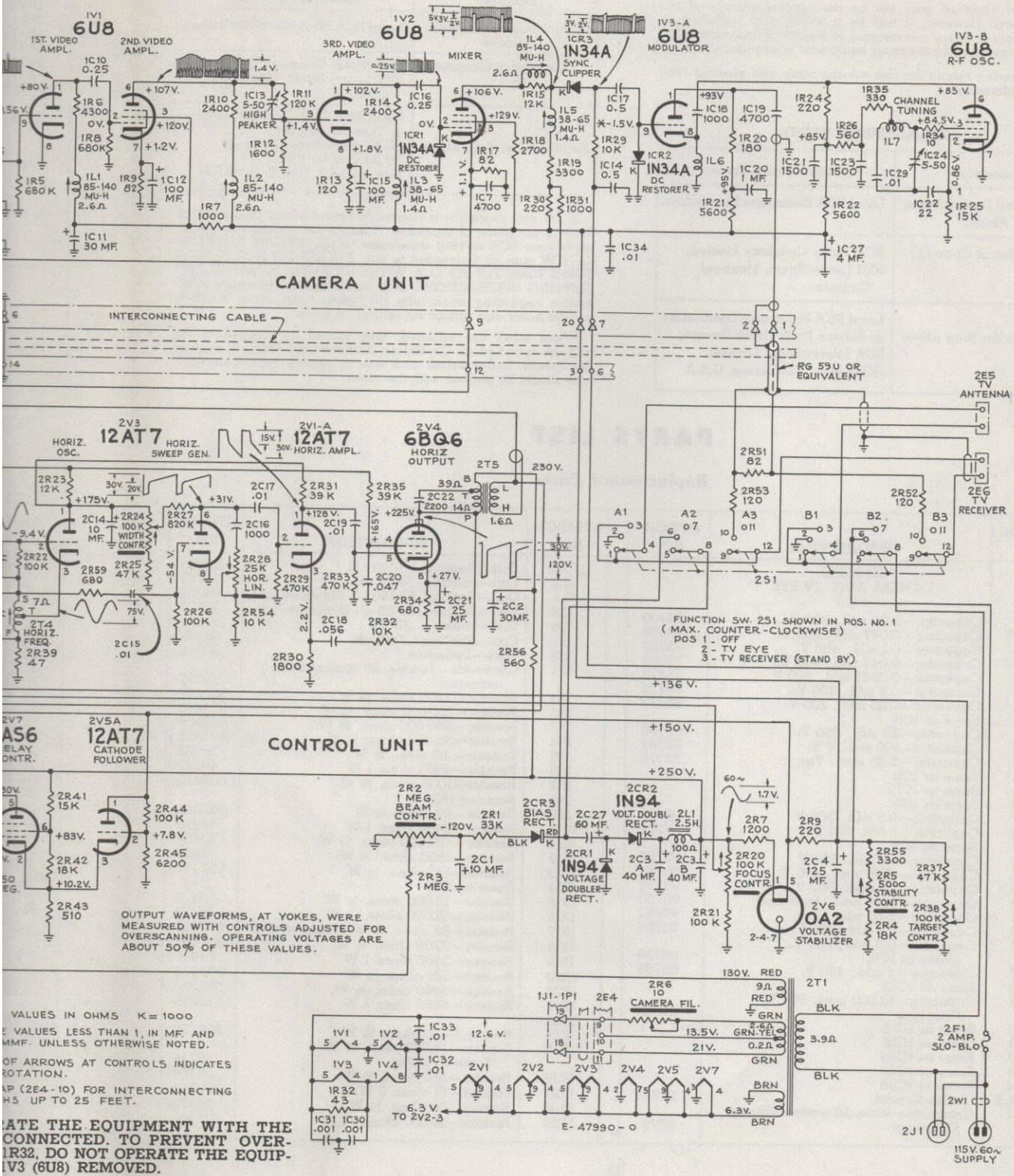
RESISTANCE VALUES IN OHMS

CAPACITANCE VALUES LESS THAN 1 ABOVE 1. IN MMF. UNLESS OTHERW

DIRECTION OF ARROWS AT CONTR CLOCKWISE ROTATION.

USE 13.5V. TAP (2E4-10) FOR INT CABLE LENGTHS UP TO 25 FEET.

NEVER OPERATE THE EQUI CAMERA DISCONNECTED. TO LOADING OF 1R32, DO NOT OP MENT WITH 1V3 (6U8) REMOV



VALUES IN OHMS K = 1000
VALUES LESS THAN 1, IN MF. AND MMF. UNLESS OTHERWISE NOTED.
OF ARROWS AT CONTROLS INDICATES ROTATION.
AP (2E4-10) FOR INTERCONNECTING HS UP TO 25 FEET.

ATE THE EQUIPMENT WITH THE CONNECTED. TO PREVENT OVER-1R32, DO NOT OPERATE THE EQUIP-1V3 (6U8) REMOVED.

Figure 16—Schematic Diagram

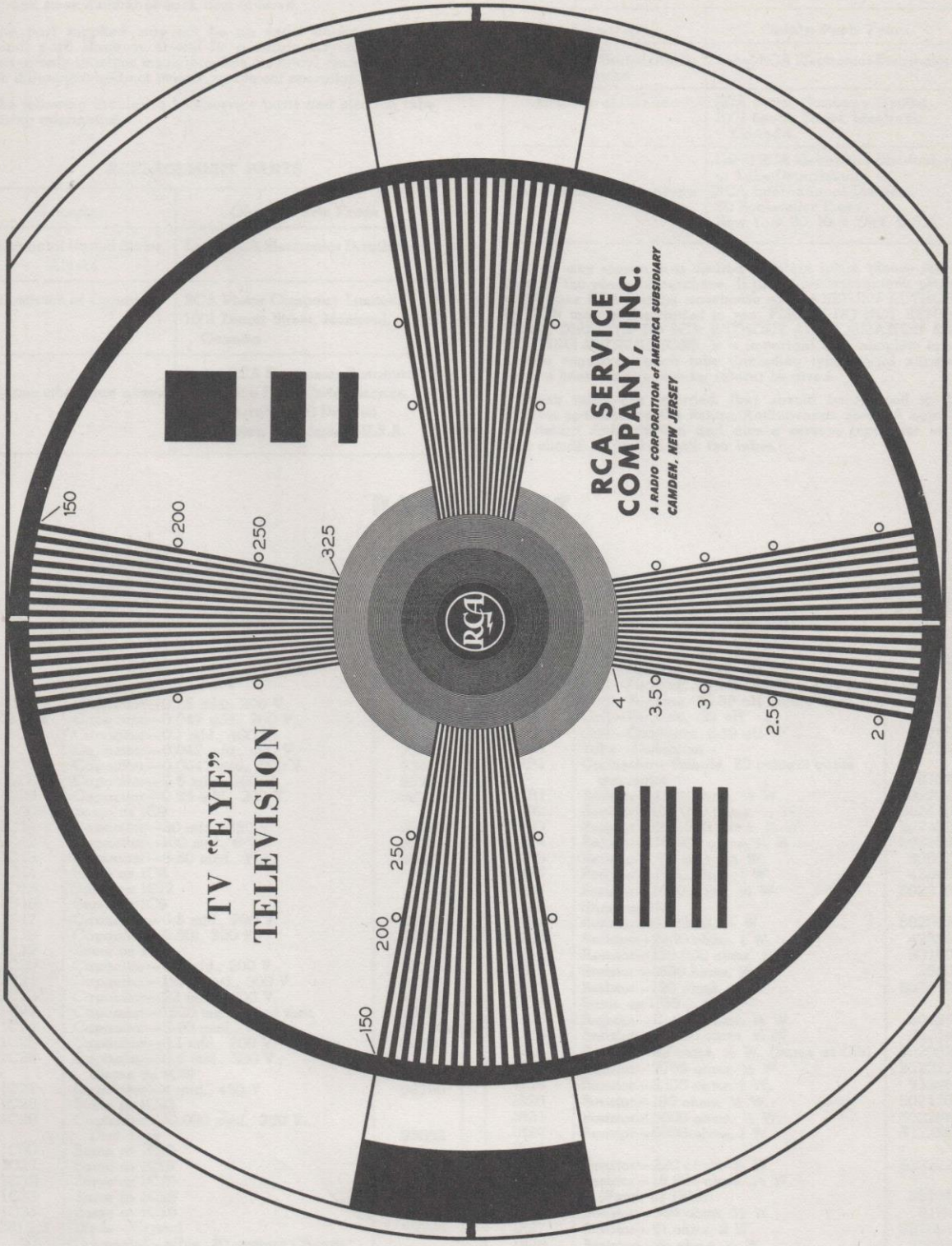


Figure 15—Resolution Chart

When ordering replacement parts, please give symbol, description, and stock number of each item ordered.

The part supplied may not be an exact duplicate of the original part. However, it will be a satisfactory replacement differing only in minor mechanical or electrical characteristics. Such differences will not impair equipment operation.

The following tabulation lists service parts and electron tube ordering information.

REPLACEMENT PARTS

Location	Obtain Parts From
Continental United States, Alaska	Local RCA Electronics Distributors
Dominion of Canada	RCA Victor Company Limited, 1001 Lenoir Street, Montreal, Canada
Regions other than above	Local RCA Electronics Distributors or Service Parts Order Service, RCA International Division, Gloucester, New Jersey, U.S.A.

ELECTRON TUBES

Location	Obtain Parts From
Cohtinental United States, Alaska	Local RCA Electronics Distributors
Dominion of Canada	RCA Victor Company Limited, 1001 Lenoir Street, Montreal, Canada
Regions other than above	Local RCA Electronics Distributors or Tube Department, RCA International Division, 30 Rockefeller Plaza, New York 20, New York, U.S.A.

If, for any reason, it is desired to return tubes, please return them to the place of purchase. If this is not convenient, please notify your RCA serving warehouse so that RETURN AUTHORIZATION may be forwarded to you. PLEASE DO NOT RETURN TUBES DIRECTLY TO RCA WITHOUT AUTHORIZATION AND SHIPPING INSTRUCTIONS. It is important that complete information regarding each tube (including type, serial number, service hours and reason for return) be given.

When tubes are returned, they should be shipped to the address specified on the Return Authorization Form. A copy of the Return Authorization and also a service report for each tube should be packed with the tubes.

PARTS LIST

Replacement Parts

SYMBOL NO.	DESCRIPTION	STOCK NO.
	MI-36250 CAMERA ASSY. TV EYE HC-1	
1C1	Capacitor—0.25 mfd., 200 V.	99400
1C2,1C3	Capacitor—0.047 mfd., 200 V.	73558
1C5	Capacitor—0.1 mfd., 400 V.	73551
1C6	Capacitor—0.047 mfd., 400 V.	73553
1C7	Capacitor—0.0047 mfd., 500 V.	73473
1C8	Capacitor—0.5 mfd., 200 V.	98778
1C9	Capacitor—0.25 mfd., 200 V.	98779
1C10	Same as 1C9	
1C11	Capacitor—30 mfd., 350 V.	98780
1C12	Capacitor—100 mfd., 6 V.	98781
1C13	Capacitor—5-50 mmf., Var.	52378
1C14	Same as 1C8	
1C15	Same as 1C12	
1C16	Same as 1C9	
1C17	Capacitor—0.5 mfd., 200 V.	98782
1C18	Capacitor—0.001, 500 V.	77252
1C19	Same as 1C7	
1C20	Capacitor—1.0 mfd., 200 V.	98783
1C21	Capacitor—1500 mmf., 500 V.	98784
1C22	Capacitor—22 mmf., 500 V.	95318
1C23	Capacitor—1500 mmf., Feed thru	95790
1C24	Capacitor—5-50 mmf., Var.	98750
1C25	Capacitor—0.1 mfd., 200 V.	98785
1C26	Capacitor—0.5 mfd., 200 V., (Same as 1C8)	98778
1C27	Capacitor—4 mfd., 450 V.	98786
1C28	Same as 1C22	
1C29	Capacitor—10,000 mmf., 250 V., Disc. type	99882
1C30	Same as 1C18	
1C31	Same as 1C18	
1C32	Same as 1C29	
1C33	Same as 1C29	
1C34	Same as 1C29	
1CR1,2,3	Diode—Crystal	59395
1J1	Connector—Male, 20 contact Chassis Connector	98751
1L1,1L2	Coil—Peaking, 85-140 uH	98753
1L3	Coil—Peaking, 38-65 uH	98752
1L4	Coil—Peaking, 85-140 uH (Same as 1L1)	98753
1L5	Coil—Peaking, 38-65 uH (Same as 1L3)	98752
1L6	Coil—Peaking, .22 uH	98754
1L7	Coil—Oscillator, 0.19 uH	98755
1L8	Yoke—Deflection	98756
1P1	Connector—Female, 20 contact cable connector	98757
1R1	Resistor—2200 ohms, ½ W.	502222
1R2	Resistor—100,000 ohms, ½ W.	502410
1R3	Resistor—560,000 ohms, ½ W.	502456
1R4	Resistor—56,000 ohms, ½ W.	502356
1R5	Resistor—.68 meg., ½ W.	30562
1R6	Resistor—4300 ohms, 1 W.	43649
1R7	Resistor—1000 ohms, ½ W.	502210
1R8	Same as 1R5	
1R9	Resistor—82 ohms, ½ W.	502082
1R10	Resistor—2400 ohms, 1 W.	47236
1R11	Resistor—120,000 ohms, ½ W.	30180
1R12	Resistor—1600 ohms, ½ W.	3560
1R13	Resistor—120 ohms, ½ W.	502112
1R14	Same as 1R10	
1R15	Resistor—12,000 ohms, ½ W.	30436
1R16	Resistor—15,000 ohms, ½ W.	36714
1R17	Resistor—82 ohms, ½ W. (Same as 1R9)	502082
1R18	Resistor—2700 ohms, ½ W.	502227
1R19	Resistor—3300 ohms, 1 W.	71986
1R20	Resistor—180 ohms, ½ W.	502118
1R21	Resistor—5600 ohms, ½ W.	502256
1R22	Resistor—5600 ohms, 1 W.	512256
1R23		
1R24	Resistor—220 ohms, ½ W.	502122
1R25	Resistor—15,000 ohms, ½ W. (Same as 1R16)	36714
1R26	Resistor—560 ohms, ½ W.	5164
1R27	Resistor—51 ohms, 2 W.	522051
1R28	Resistor—36 ohms, ½ W.	70079
1R29	Resistor—10,000 ohms, ½ W.	502310

SYMBOL NO.	DESCRIPTION	STOCK NO.
1R30	Resistor—220 ohms, ½ W.	502122
1R31	Resistor—1000 ohms, ½ W.	502210
1R32	Resistor—43 ohms, ±5%, 2 W.	522043
1R33	Not used	
1R34	Resistor, 10 ohms, ½ W.	502010
1R35	Resistor, 330 ohms, ½ W.	502133
1XV1,1XV2, 1XV3	Socket—7 pin miniature	94880
1XV4	Socket—Vidicon	59950
	Bushing—Lens mtg. Bushing	98774
	Case—Camera Case, Bottom Section	98770
	Clamp—Capacitor—For 1C11	98764
	Clamp—Capacitor—For 1C27	98765
	Clamp—Capacitor—For 1C12, 1C15	98766
	Clamp—Capacitor—For 1C20	98767
	Clamp—Capacitor—For 1C8, 1C14, 1C26	98768
	Clamp—Vidicon Clamp Assy. A-1 Clamp B-1 #4-40 x ⅜ Screw	98759
	Contact—Vidicon Socket	98763
	Cover—Camera Case Cover	98771
	Cover—Chassis Cover—Perforated	98773
	Magnet—Centering Magnet Assy.	98769
	Magnet—Rod (4 req'd)	98761
	Monogram—"RCA"	
	Mounting—Focus & Deflection mtg. Assy.	98758
	Screw—Cover mtg. Screw—#6-32 x ¼	98772
	Sleeve A-1 Sleeve B-1 #6-32 x ⅛ S.S.	98760
	Spring	98762
	MI-36251 CONTROL UNIT TV EYE HA-1	
2C1	Capacitor—10 mfd., 150 V.	78145
2C2	Capacitor—30 mfd., 350 V.	76450
2C3	Capacitor—40—40 mfd., 450 V.	58567
2C4	Capacitor—125 mfd., 350 V.	93406
2C5	Capacitor—0.22 mfd., ±20%, 400 V.	73794
2C6	Capacitor—.022 mfd., ±20%, 400 V.	73562
2C7	Capacitor—0.022 mfd., ±10%	73562
2C8,2C9	Capacitor—0.22 mfd., ±20%, 400 V. (Same as 2C5)	73794
2C10	Capacitor—0.047 mfd., ±10%, 400 V.	73553
2C11	Capacitor—25 mfd., 25 V.	52518
2C12	Capacitor—8200 mmf., 400V.	76477
2C13	Capacitor—6800 mmf., ±20%, 500 V.	50400
2C14	Capacitor—10 mfd., 350 V.	91391
2C15	Capacitor—0.01 mfd., 450 V.	73960
2C16	Capacitor—1000 mmf., ±10%, 500 V.	39652
2C17	Capacitor—0.01 mfd., ±20%, 400 V.	73561
2C18	Capacitor—0.056 mfd., ±10%	73791
2C19	Same as 2C17.	
2C20	Capacitor—0.047 mfd., ±20%	73553
2C21	Capacitor—25 mfd., 50 V.	53147
2C22	Not Stocked. Included with 2T5 only.	
2C23	Same as 2C6	
2C24	Capacitor—2200 mmf., ±20%, 500 V.	39660
2C25	Same as 2C15	
2C26	Capacitor—0.1 mfd., ±20%, 200 V.	73784
2C27	Capacitor—60 mfd., 350 V.	202967
2CR1,2CR2	Rectifier—Germanium Power Rect.	98726
2CR3	Rectifier—Selenium	98727
2CR4	Diode—Crystal, 1N34A	59395
2F1	Fuse—2 amp., Slow-Blow	93939
2J1	Connector—Service Outlet, 2 contact, Female	98728
2K1	Relay—Projector Circuit	98729
2L1	Reactor—2.5 H.	98730
2P1	Connector—Tube Plate Cap—For 2V4 Tube	95894
2R1	Resistor—33,000 ohms, ½ W.	502333
2R2	Resistor—1 meg., ¼ W. Var. "Beam"	98731
2R3	Resistor—1 meg., ½ W.	502510
2R4	Resistor—18,000 ohms, ½ W.	3219
2R5	Resistor—5,000 ohms, ¼ W. Var.–Stability	98732
2R6	Resistor—10 ohms, 25 W., Wire Wound–Adj.	16929
2R7	Resistor—1200 ohms, 10 W.—Wire Wound	98776
2R8	Resistor—39,000 ohms, ½ W.	502339
2R9	Resistor—220 ohms, 2 W.	522122
2R10	Resistor—2.7 meg., ½ W.	72788
2R11	Resistor—100,000 ohms, ½ W.	502410
2R12	Resistor—1 meg., ¼ W. Var.—Height	98733
2R13	Resistor—180,000 ohms. ½ W.	11959
2R14	Resistor—.5 meg., ¼ W. Var.—Vert. Hold	98734
2R15	Resistor—10,000 ohms, ½ W.	502310
2R16	Resistor—2.2 meg., ½ W.	30649
2R17	Resistor—2200 ohms, ½ W.	502222
2R18	Resistor—2700 ohms, ½ W.	502227
2R19	Resistor—5000 ohms, ¼ W. Var.–Vert. Lin.	98735
2R20	Resistor—100,000 ohms, ¼ W. Var.–"Focus"	98737
2R21,2R22	Same as 2R11	
2R23	Resistor—12,000 ohms, 2 W.	522312
2R24	Resistor—100,000 ohms, ¼ W. Var.—Width	48983
2R25	Resistor—47,000 ohms, ½ W.	30787
2R26	Same as 2R11	
2R27	Resistor—820,000 ohms, ½ W.	502482
2R28	Resistor—25,000 ohms, ¼ W. Var.—Horiz. Lin.	98738
2R29	Resistor—470,000 ohms, ½ W.	502447
2R30	Resistor—1800 ohms, ½ W.	502218
2R31	Resistor—39,000 ohms, ½ W.	30147
2R32	Same as 2R15	
2R33	Same as 2R29	
2R34	Resistor—680 ohms, 2 W.	522168
2R35	Resistor—39,000 ohms, 1 W.	71084
2R36	Resistor—560,000 ohms, ½ W.	502456
2R37	Resistor—Same as 2R25	
2R38	Resistor—100,000 ohms, ¼ W. Var.—"Target" (Same as 2R20)	98737
2R39	Resistor—47 ohms, ½ W.	502047
2R40	Resistor—330,000 ohms, ½ W.	502433
2R41	Resistor—15,000 ohms, 5 W.	53658
2R42	Resistor—18,000 ohms, 2 W.	39158
2R43	Resistor—510 ohms, ½ W.	3383
2R44	Resistor—100,000 ohms, ½ W.	502410
2R45	Resistor—6200 ohms, ½ W.	35255
2R46	Same as 2R11	
2R47	Resistor—220,000 ohms, ½ W.	502422
2R48	Resistor—Same as 2R16	
2R49	Same as 2R3	
2R50	Same as 2R3	
2R51	Resistor—82 ohms, ½ W.	502082
2R52,2R53	Resistor—120 ohms, ½ W.	502112
2R54	Resistor—10,000 ohms, ½ W., ±20%	502310
2R55	Resistor—3,300 ohms, ½ W.	30733
2R56	Resistor—560 ohms, 2 W.	522156
2R57	Resistor—Same as 2R3	
2R58	Resistor—5600 ohms, 1 W.	512256
2R59	Resistor—680 ohms, ½ W.	502168
2S1	Switch—Rotary, 3 Position, 2 Section	98739
2T1	Transformer—Power	98740
2T2	Transformer—Vert. Blocking Osc.	74144
2T3	Transformer—Vert. Output	234T1
2T4	Coil—Osc.—High Freq. Tank Coil	98742
2T5	Transformer—Horiz. Output	98743
2XF1	Holder—Fuse Holder Clip	13526
2XV1,2XV2, 2XV3	Socket—Tube—9 Pin Miniature	94880
2XV4	Socket—Tube—Octal	68590
2XV5	Same as 2XV1	
2XV6,2XV7	Socket—Tube—7 Pin Miniature	94879
	Foot—Case Foot	98749
	Knob—Control	98775
	Plate—Control—"Beam"—0—20	98745
	Plate—Control—"Focus"—0—20	98747
	Plate—Control—"Selector"—Off—TV Eye—TV Rec.	98744
	Plate—Control—"Stability"—0—20	98748
	Plate—Control—"Target"—0—20	98746
	Plate—Capacitor Mtg. Plate—For 2C3,2C4	18469
	Shield—Tube, for 2V7	54428
	Shield—Tube, for 2V6	57540
	Shield—Tube, for 2V1, 2V2, 2V3, 2V5	57533

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