

# **RCA COLOR TELEVISION MONITOR TM-10B**

## **Description**

The RCA Color Television Monitor, TM-10B, is designed to reproduce a color picture from a NTSC Color Television signal supplied by a colorplexer or other source. It is also capable of reproducing a monochrome picture. The unit is normally housed in a cabinet that has an unobstructed flat top and sides permitting the units to be stacked vertically or placed side by side. The units can either be used as portable instruments or, by using special rack mounting hardware, mounted in standard RCA 19-inch cabinet racks.

The monitor is air cooled by means of an exhaust fan in the rear of the monitor cabinet close to the top. An intake air vent is located at the bottom side of the cabinet back. This vent area also allows access to signal and power input connectors as well as certain set-up controls located on the rear of the monitor chassis. There are nine test jacks on the rear of the chassis that facilitate the testing and aligning of the instrument.

The monitor employs a fifteen-inch, three-gun, shadow-mask kinescope, RCA type 15GP22. The kinescope is mounted on a supporting mask assembly which is a part of the monitor chassis.

The TM-10B will operate with separate picture and sync signals, or with a composite signal input. A switch at the rear of the chassis provides a means of making the proper connections for the selected type of input signal. Picture and sync inputs are connected through standard coaxial fittings, each input has two paralleled connectors to permit bridging the monitor or terminating the cable.

When using external sync with the monitor, it is necessary to delay the sync to compensate for the delay in the colorplexer. This is to insure proper timing of the monitor burst gating pulse, which is derived from the scanning circuits.

A tally light relay circuit when connected to the switching system, serves to indicate when the monitor is switched into the program line. A numeral at the top of the front panel will glow white (stand-by) or red (on-air) depending on the control signal from the switcher. The tally light relay operates from a source of 6.3 volts a-c. A three way power connector (J301) and an auxiliary a-c outlet (J5), used for connecting power to the blower, are provided at the rear of the chassis. The three way power connector provides a means of selecting the proper power transformer tap whether the monitor is powered from a line Voltage Regulator or a 115-volt a-c unregulated line. The power plug (P301) must be wired to the power cord to suit the particular condition.

If the a-c line to which the monitor is to be connected is not regulated, a line voltage regulating transformer is recommended. For this purpose, the Line Voltage Regulator, MI-40213, is available from RCA on separate order.

**Warning!**

**Do not operate the monitor with the 3-way plug wired in the "R" position unless a voltage regulator is used. Failure to observe the precaution may result in damage to the equipment.**

The a-c line and the horizontal deflection circuit are protected by fuses. The 117-volt a-c line fuse is accessible from the front of the unit, The horizontal deflection circuit fuse is mounted in a fuse holder located on the rear of the high voltage compartment.

There are eight operating controls on the front panel of the monitor between the face of the kinescope and a hinged cover located near the bottom of the panel. When the hinged cover is open a series of set-up controls are accessible which allow convenient adjustment of the monitor while viewing the image on the face of the kinescope.

A simplified block diagram of the monitor is shown in Figure 15. The circuits consist basically of five principal sections: Video, Color Sync, Deflection and High Voltage, the Low Voltage Power Supplies and the Tricolor Kinescope.

**Video Section**

The video section of the monitor incorporates three separate functions: The luminance channel, the chrominance channel, and the matrixing circuits which combine the two channels.

**Luminance Channel**

The composite color signal is fed into the monitor through jacks J9 and J10 and applied to the control grid of V1, the first video amplifier. The gain of this amplifier can be adjusted by means of a potentiometer (R24) in its cathode circuit, which is referred to as the Video Gain control. The signal is then fed to V5, the second video amplifier. This amplifier has both positive and negative output polarities. The luminance information is allowed to pass through the "Y" filter in the plate circuit of V5 while the chrominance signal is highly attenuated. The "Y" filter is a low pass type filter designed to cut off at 3.58 mc, the chrominance subcarrier frequency, and maintain good phase response up to cut off. The luminance signal is fed to a potentiometer (R39B) in the grid circuit of V8, the Third Video Amplifier. This potentiometer is mechanically ganged to a potentiometer (R39A) in the cathode circuit of V5, from which a signal is fed to the grid circuit of V18A, the Chrominance Amplifier; the two act together as the picture Contrast control maintaining a constant ratio between luminance and chrominance for all contrast settings.

The luminance signal is amplified in V8 and fed to a constant delay type aperture corrector, V9, which incorporates adjustable high frequency peaking in its plate circuit.

The luminance signal is further amplified in VIA and passed through a delay line, DL1, in the output of this stage before it is amplified by V12, to a level suitable for application to the matrixing section of the monitor.

## Chrominance Channel

The composite color signal that is tapped off the potentiometer (R39A of the ganged Contrast control) in the cathode leg of V5 is amplified in V18A, the chroma amplifier, and fed to a bandpass amplifier, VI8B. The output of VI8B incorporates a bandpass circuit which restricts the signal passed to a band of frequencies containing the chrominance information. A pulse from the horizontal output transformer is applied to the screen of V18B to key out the color sync burst signal that is undesired in the chrominance channel. The chrominance signal, carrying the I and Q information is then applied across a potentiometer (R144) that serves as the Chroma control of the monitor. The signal is directed from this potentiometer to the control grids of the I and Q demodulators, V20 and V13 respectively. The demodulation of the I and Q signals is accomplished by synchronous detectors operating in phase quadrature. The Q signal is demodulated in V13 and directed through a low pass filter (500 kc) for extraneous modulation suppression.

Since the bandpass of the Q channel is relatively narrow in comparison with the I and M channels, the Q signal is subject to the greatest delay. It is therefore used as the reference and delays are inserted in the I and M channels to insure time matching of the signal components entering the matrix section.

After passing through the filter, the signal is split by means of the phase splitter, V7B, forming two signals 180 degrees out of phase which are utilized in the matrix section of the monitor.

The demodulated I signal appears at the plate of V20. It is fed through a low pass filter (1.5 mc), and then passed through a delay circuit. The I signal is amplified in V19A. The amount of amplification can be governed by the setting of a potentiometer (R159) in the cathode circuit of V19A, which is the I Gain control and provides a means of maintaining the proper I to Q signal ratio that is required in the matrix section. Finally, the I signal is split into two signals 180 degrees out of phase by a phase splitting stage, VI9B, and applied to the matrix section of the monitor.

## Matrix and Output Section

The matrix section of the monitor combines the luminance and chrominance signals, in the ratios required to reproduce the red, green, and blue components of the original signal at the control elements of the tricolor kinescope.

The Y, I, and Q signals are fed through the matrix circuits where they are combined in the correct ratios to form the proper red, blue, and green signals. The red, blue, and green signals are amplified in the output stages V17, V11, and V6 respectively and then are applied to the appropriate control grid of the tricolor kinescope.

Individual gain controls, R361 and R376 are provided for the green and blue channels respectively.

D-c restoration is provided by V16A, V16B and V16C for the green, blue, and red signals respectively. The d-c restorers are returned to the Background controls R227A, R227B and R226 which are adjusted to maintain proper tracking of the three kinescope grid bias values throughout the range of the master Background control R226.

### **Color Synchronization**

A portion of the composite color signal is taken from the plate of the second video amplifier V5, and applied to the sync amplifier stage, V3A. The sync and burst information is then applied to the scanning synchronizing circuits and to the color synchronizing circuits.

The color synchronizing signal burst is fed through two burst amplifier stages V4A and V21A. A variable capacitor (C343) in the grid circuit of V21A, is used as the Phase control of the monitor.

The color synchronizing signal is used as phase reference information. It serves to establish the proper phase relationship between the transmitted signal and the local 3.58 megacycle subcarrier (Since the subcarrier is not transmitted, it is necessary to generate a local subcarrier of proper frequency and phase.)

The subcarrier is generated by a (quartz) crystal controlled oscillator, V15B. The oscillator operates as a cathode follower and drives the 3.58 megacycle subcarrier amplifier, V14. The subcarrier signal is fed from V14 to a quadrature transformer that supplies the quadrature phase reference signal to the Q Demodulator, V13, and the in-phase reference signal to the I Demodulator.

A reactance tube, V15A, is used to maintain exact control of the crystal oscillator phase. The reactance tube is controlled by a voltage from the phase detector, V22, which is proportional to the difference in phase between the transmitted color synchronizing signal and the crystal oscillator output.

A burst keyer tube, V4B, driven by pulses supplied by the horizontal output transformer is used to key the second burst amplifier, V21A. The cathode of V4B is connected to the cathode of V21A, thereby providing automatic keying level adjustment.

### **Deflection Synchronization**

The output circuit of the first sync amplifier V3A, supplies synchronizing information to the color sync circuits through a capacitor C172 and the deflection sync circuits through a switch (S2) labeled EXT-INT SYNC. This switch provides a means through which either internal or external deflection synchronization signals can be introduced to V2A, a sync clipper. When external sync signals are employed they are fed to the monitor through jacks J7 or J8 and amplified in V2B before they are applied to V2A through S2. The sync clipper V2A feeds the sync signals to the sync amplifier and clipper V3B. The output of V3B is coupled to the horizontal oscillator control tube through a capacitor C368, and to a vertical integrating network Z11 through a capacitor C15.

### **Vertical Deflection Section**

The vertical oscillator and output tube, V10 incorporates a blocking oscillator circuit, the output of which is amplified in the output stage and applied to the vertical deflection coils through the vertical output transformer.

### **Horizontal Deflection Section**

A horizontal oscillator and control tube V28, is employed in a modified synchroguide circuit, the output of which is used to drive the horizontal output tube, V25. A pulse from the horizontal output transformer drives a sawtooth generator, V29A, that provides the sawtooth output voltage required in the oscillator control circuit.

### **High Voltage Section**

The output of the horizontal output transformer is rectified by V26 to provide the required ultor voltage for the tricolor kinescope. Focus voltage is obtained in the same manner by V27.

The high voltage supply is regulated by a shunt regulator, V24. The high voltage output is controlled by the amount of bias voltage applied to the shunt regulator tube. The voltage regulator is arranged to complement the load of the kinescope and thus maintain a constant load on the high voltage supply.

### **Convergence Circuits**

The d-c convergence voltage is maintained as a fixed part of the ultor voltage by means of the Convergence control, R82, located in series with a high-voltage bleeder network from the high voltage ultor to ground.

The vertical dynamic convergence amplifier V30 and its associated circuits, combines, shapes, and amplifies the parabola and sawtooth waveforms, derived from the vertical deflection circuit. They are then combined with the sine wave horizontal waveform which is derived from two series tuned circuits connected to the horizontal output transformer.

This combined waveform is used for modulation of the d-c convergence and focus voltages applied to the kinescope so that convergence and focus are maintained across the entire area of the kinescope face.

### **Low Voltage Supply**

The plate voltages are supplied by a conventional unregulated voltage doubler type selenium rectifier power supply. If the 115-volt power source is not stable, a Line Voltage Regulator, RCA M1-40213, may be required to minimize the effect of line voltage surges on the picture.

## Tricolor Kinescope

The type 15GP22 tricolor kinescope is used in the TM-10B monitor. It is a directly viewed picture tube capable of producing either a full color or a monochrome picture 11-1/2 inches wide and 8-5/8 inches high with rounded sides.

Three electron guns are mounted at the base of the tube with their axial centers parallel to the central axis of the tube and spaced 120 degrees apart with respect to each other.

Enclosed within the glass tube envelope, at the viewing end of the tube, is an assembly consisting of an aperture mask, the phosphor dot viewing screen and a decorative mask.

The focus electrode potential is adjusted so that the beam from each of the three electron guns comes to focus at the phosphor dot viewing screen.

By means of a convergence electrode all three beams are made to converge at any given point at the plane of the aperture mask.

The tricolor phosphor dot plate (the viewing screen) has printed on its rear surface an orderly array of small, closely spaced phosphor dots, arranged in a triangular group of three which are called "trios." Each trio consists of a red light-emitting dot, a blue light-emitting dot and a green light-emitting dot.

Aluminization of the surface after the dot trios have been printed, effectively increases the light output from the viewing screen and eliminates the need for an ion trap.

The aperture mask, a thin plate positioned a short distance behind the phosphor dot plate, contains round holes equal in number to and centered with respect to the dot trios (one hole for each dot trio).

A magnetic shield is placed around the glass bell end of the tube envelope to prevent stray magnetic fields from affecting tube operation.

Another mu-metal shield placed around the neck of the tube, prevents extraneous magnetic fields from interfering with the low velocity beams in the neck of the tube. This shield also supports the beam positioning magnets which are spaced 120 degrees apart to correspond with the positions of the electron guns in the neck of tube. The beam positioning magnets are adjustable to provide accurate positioning of their associated beams in a direction perpendicular to the change in beam direction produced by the electrostatic convergence element in the kinescope.

The purifying coil is made adjustable to provide accurate alignment of the axes of the three beams so that their common axis coincides with the axis of the kinescope. As a result when the beams are focused, converged and deflected, they approach each hole in the aperture mask at the proper angle to strike the center of their respective dots and produce color purity.

The screen purity coil placed around the face plate of the kinescope produces a uniform magnetic field which can be varied to neutralize extraneous magnetic fields which may cause displacement of the beams from their color centers.

The high-voltage (ultor) connection is part of the peripheral face plate tube-envelope seal.

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