

Color Receivers III

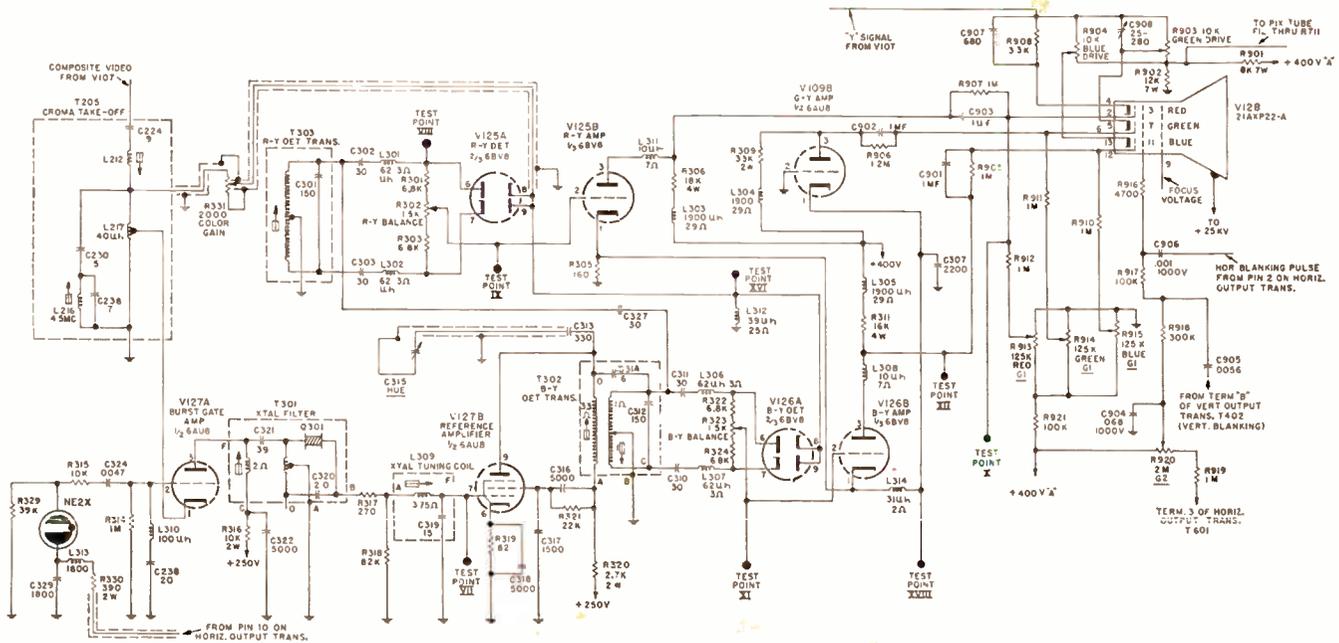


Fig. 1. Chroma circuits used in General Electric "CL" receiver.

The NTSC system as well as the video portion of the General Electric type "CL" color chassis has been discussed in previous issues. In this issue a description of that section of the receiver which utilizes the chroma signals will be given.

It has been pointed out previously that most sections of a color receiver perform the same function as their counterparts in a monochrome receiver. The tuner, i-f amplifier, video detector, and video amplifier circuits are very similar, and the audio portion of a color receiver is practically a carbon copy of that portion of a monochrome receiver.

The next section to be described is that part which picks off and develops the actual color signals. The circuits shown in Fig. 1 are new to the monochrome technician and represent one of the major differences between the black and white receiver and the color receiver. It should be pointed out that the only tubes used in Fig. 1, outside of the picture tube, are one and a half 6AU8 tubes (V109B and V127A and B) and two 6BV8 tubes (V125A and B and V126A and B) or a total of three and

a half tubes. These are the only tubes used to reproduce the color signals. It should also be noted that the complete circuit is comparable in complexity to the ordinary five tube radio.

The composite video signal is present in the cathode of the video output tube V107. The "Y" signal is passed on

through the circuitry (shown in the last issue, Fig. 1) to the picture tube. A portion of the chroma signal is taken from the chroma take-off transformer T205, shown in Fig. 1, and fed to the color gain control and then to the R-Y and B-Y detectors. How this portion of the signal is used will be discussed in detail later.

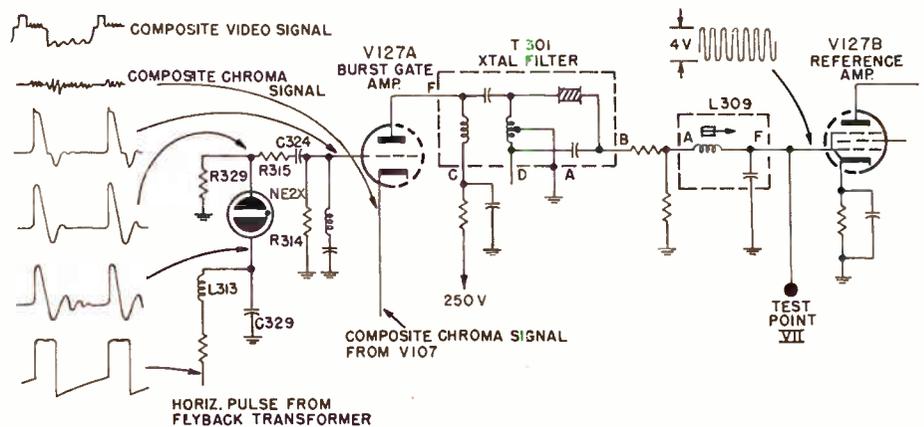


Fig. 2. Burst gate and reference amplifier circuits with typical signals and waveforms.

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R. G. KEMPTON, Editor

BURST GATE

Another portion of the chroma signal is taken from a tap on choke L217 and applied to the cathode of the burst gate amplifier (V127A). Fig. 2 illustrates the signals and waveforms present at different points in the burst gate and reference amplifier circuits.

The signal at the cathode of V127A is a composite chroma signal composed of the 8 to 10 cycle burst signal as well as chrominance information centered around 3.58 mc. If the chrominance information is not eliminated, it can cause the 3.58 mc frequency to shift erroneously in frequency or phase. Accordingly, the burst gate amplifier (V127A) is gated or keyed so that only the burst signal is passed.

Since the duration of the flyback pulse taken from the horizontal transformer is too wide for proper gating of V127A, this pulse is used to shock-excite a series resonant circuit composed of L313 and C329. This circuit resonates at approximately 50 kilocycles and produces a rapidly decaying wave train, as shown in Fig. 2. Only the first cycle of this wave train is used as a gate pulse. To permit passage of only the first cycle of the damped wave, this wave train is fed to a neon bulb (NE2X) and to load resistor R329. The firing and extinction points of the lamp are above the peak amplitude of the undesired cycles of the damped wave and hence, only the first cycle is passed on to R329. R315 is used to square-off the resulting waveshape peak. The pulse is then coupled to the grid through a long time-constant circuit (C324 and R314). When V127A conducts grid-leak bias is developed which maintains this tube at cut-off except during the duration of the pulse. During this time the tube conducts and passes only the burst component of the chrominance signal.

SUBCARRIER GENERATION

The burst (3.58 mc) signal at the plate of V127A is then applied to the crystal ringing circuit, T301. It shock-excites this circuit into oscillation and because of the extremely high Q of the circuit ultimately results in a pure sine wave output. Since the output of this wave is too low to properly operate the synchronous detectors (V125A and V126A), a reference

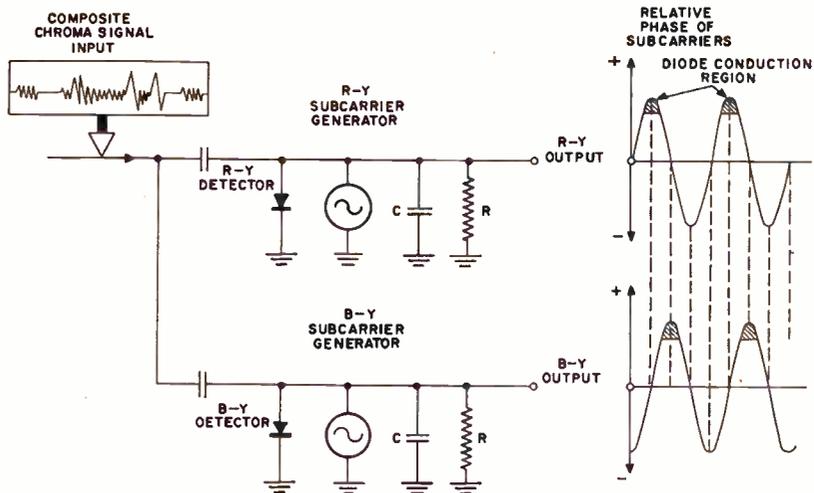


Fig. 3. Basic schematic of synchronous detection.

amplifier, V127B, is used to amplify the signal to the required level.

SYNCHRONOUS DETECTORS

During the discussion of the transmitted signal in Vol. 6, No. 5, it was pointed out that the R-Y and B-Y color signals were fed to two balanced modulators. The process of balanced modulation suppresses the subcarrier but generates phase and amplitude modulated

signals are connected in series with the R x C load circuits, each diode develops negative "back-bias" due to rectification of the subcarrier and ultimate charging of the R x C time constants. Because "R" in each case allows the charge to partially leak off "C" between positive sine wave peaks, each diode will conduct for a small portion of the driving cycle as shown in the shaded sine wave regions. Only within these regions will the diodes be capable of

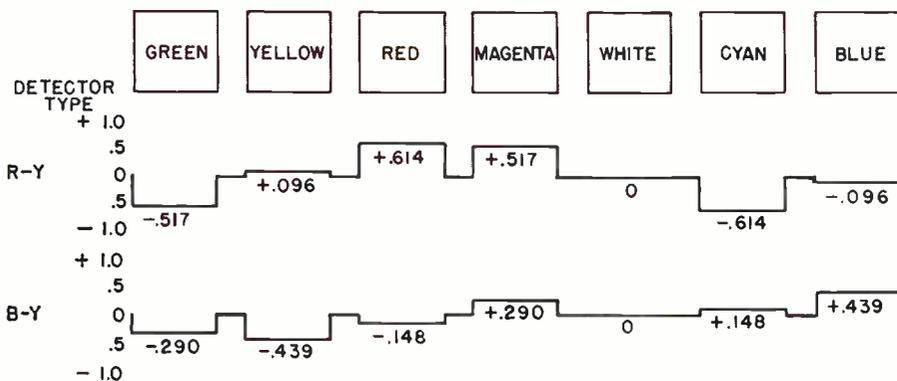


Fig. 4. Synchronous detector output signals for color bar pattern.

sidebands of 3.58 mc. The purpose of synchronous detection in the receiver is to reverse this process and recover the original color signals.

Synchronous detection is a sampling process in which two conventional amplitude modulation detectors may be employed. However, each detector must be gated or keyed "on" at a specific time so that it will recover only a specific component of the complex chrominance signal. A simple circuit for such a system is shown in Fig. 3. Chrominance information is capacity coupled into each diode detector. The R-Y subcarrier generator produces a 3.58 mc signal which lags the burst signal by ninety degrees, whereas the B-Y subcarrier generator signal lags the burst signal by one hundred and eighty degrees. Since the subcarrier sig-

passing chrominance signal components. It should be noted that due to the phase difference of the subcarrier signals, the diodes conduct ninety degrees apart. Therefore, when the R-Y subcarrier is at positive maximum, the B-Y subcarrier passes through zero and vice versa. Only a specific component of this complex signal is thereby detected by each diode.

It will be recalled that the chroma signals applied to the balanced modulators at the transmitter had specific amplitudes and these amplitudes varied depending upon the color. Fig. 4 shows the plus or minus R-Y and B-Y voltages applied to the balanced modulators and therefore, reproduced by the synchronous detectors as a result of scanning a color bar pattern.

The resultant voltages obtained at the detector output terminals will be better

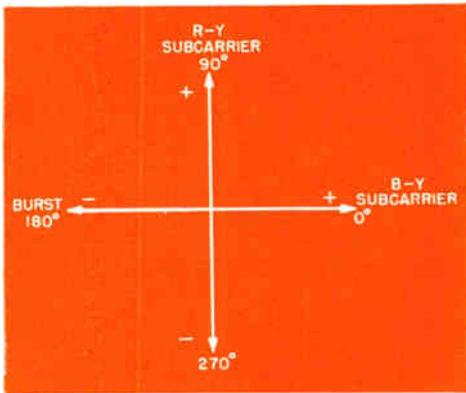


Fig. 5. Relative phase angles of R-Y and B-Y subcarriers with respect to the burst signal.

understood if illustrated vectorially. Fig. 5 shows the relative phase angles of R-Y and B-Y subcarriers with respect to the burst signal. The detector output resulting from a saturated red signal would be plus .614 units R-Y and minus .148 units B-Y, as indicated in Fig. 4. If these two outputs are added vectorially by plotting them on the R-Y and B-Y axes shown in Fig. 5, the resultant voltage will have an amplitude of .63 units with a phase angle of 103.5 degrees, as shown in Fig. 6.

The vector voltages and phase angles produced by the color bar pattern in Fig. 4 are shown in Fig. 7.

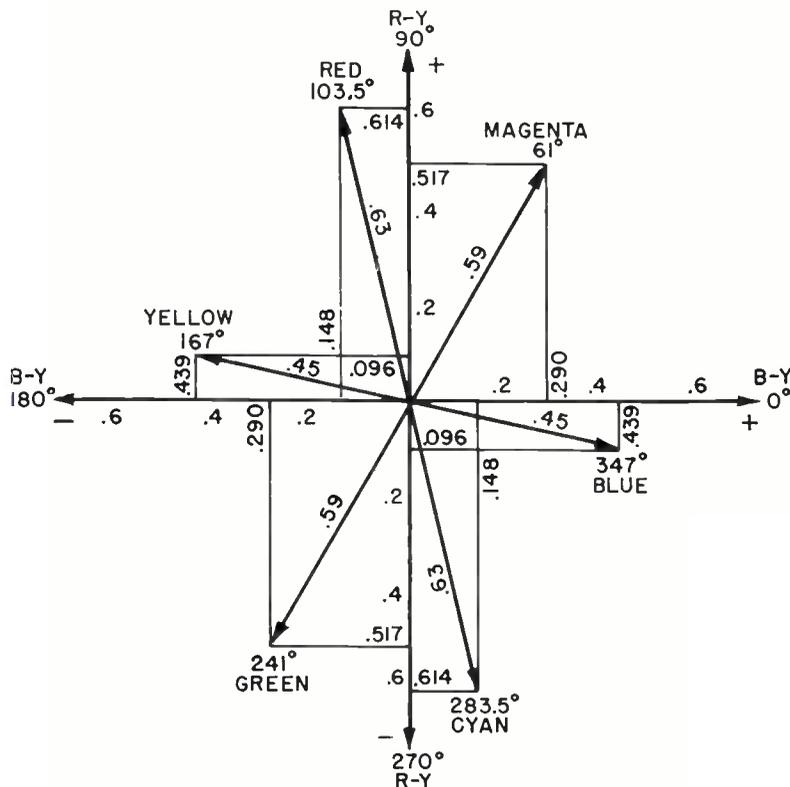


Fig. 7. Vector voltages and phase angles produced by color bar pattern.

The development of the various color signal amplitudes and phase angles was discussed in considerable detail in the Vol. 7, No. 1 and Vol. 7, No. 2 issues of *TECHNI-TALK*. If you do not have these issues, just drop us a line and they will be sent by return mail.

BALANCED DIODE DETECTORS

The synchronous detectors (V125A and V126A) shown in Fig. 1 are of the balanced diode type. Subcarrier voltage at the secondary of T302 is of a B-Y phase. A ninety degree phase shift occurs across C327 producing an R-Y subcarrier signal from the color gain control is fed to pins 8 and 9 of each detector, and the properly phased subcarrier is fed to pins 6 and 7. The outputs of these two detectors are then fed to their respective amplifiers.

The balanced diode type synchronous detector is particularly suited for use with the crystal filter method of subcarrier generation. The reason for this is that during the nine line vertical retrace interval no burst is present and the crystal filter output decays to near zero. This decay results in color shading of the picture unless means are taken to remove the effects. This is accomplished by connecting balancing potentiometers R302 and

R323 in each detector output circuit as indicated in Fig. 1. These potentiometers are used to balance out the subcarrier and make the output relatively insensitive to variations in the amplitude of the applied subcarrier.

Balancing out the subcarrier is also necessary to prevent a shift in the grey scale when changing from monochrome to color programs. Since d-c coupling is maintained between the detectors, chroma amplifiers, and the picture tube, any d-c voltage change across the plates of the R-Y or B-Y detectors would be amplified and carried through to the cathodes of the picture tube and thus result in a shift in the grey scale. The adjustment balancing out the subcarrier is made with the chroma gain control at minimum setting.

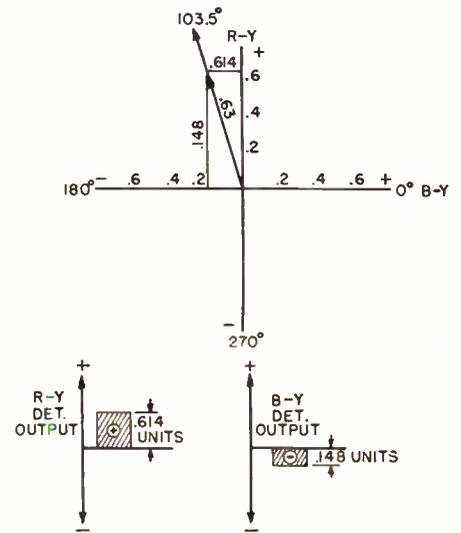


Fig. 6. Vector voltage and phase angle produced by a saturated red signal.

CHROMA AMPLIFIERS

The R-Y and B-Y color difference signals from the synchronous detectors are applied to their respective color difference amplifiers V125B and V126B. The amplified outputs of these tubes are applied to the respective picture tube grids (red and blue).

To obtain the G-Y color difference signal, the negative R-Y and the negative B-Y signal are added together across the common (V125B, V126B and V109B) cathode resistor R305. The resulting positive G-Y signal is amplified without changing polarity by the grounded grid amplifier tube V109B and applied to the green picture tube grid.

(To be continued)

BENCH NOTES

Contributions to this column are solicited. For each question, short-cut or chronic-trouble note selected for publication, you will receive \$10.00 worth of electronic tubes. In the event of duplicate or similar items, selection will be made by the editor and his decision will be final. The Company shall have the right without obligation beyond the above to publish and use any suggestion submitted to this column. Send contributions to The Editor, Techni-talk, Electronic Components Division, General Electric Company, Schenectady 5, New York.

QUICK TESTER

If caught without your VOM, just plug your test leads in pins 1 and 12 of your G-E SERIES HEATER CHECKER'S picture tube socket, and you have a nice handy continuity checker. This uses the light and battery in series with the part being checked.

STOP CALLBACKS

Some G-E receivers with a 6CD6-GA horizontal output tube used a clip which held the tube at the base. When replacing the 6CD6-GA, remove the clip by taking out the screw holding it to the chassis. Since the clip puts tension on the glass bulb, the heat of the tube plus the tension may cause the glass to crack.

Walter J. Vickers, Jr.
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WIRE STRIPPING

A pair of long nose pliers and a pair of cutting pliers with a hole in the cutting edge for stripping can be used together as a very effective wire stripper. First cut through the insulation with the cutting pliers. Then, hold the wire with the long nose pliers directly below the cutting pliers. Now, using the long nose pliers as a support and lever, lift off the insulation with the cutting pliers. In this manner, the hardest type of insulation can be easily removed without an automatic tool.

Emil F. C. Backstrom, Jr.
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PRINTED CIRCUIT AID

In the repairing of "Printed Circuits" much difficulty is encountered by servicemen because the printed circuit board is not transparent. The printed wiring is on one side and the components are on the other.

By placing a small 6-watt trouble light in the rear of the printed circuit board (on the side with the printed wiring on it) a sharp outline of the printed wiring is visible from the other side.

The components on the front of the board may be unsoldered and replaced while the printed wiring is visible.

This method cuts service time and minimizes the possibility of error.

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ZENITH SPACE COMMAND CHANGES STATIONS BY ITSELF

I recently ran across a Zenith space command Model No. 3001R which changed stations by itself right in the middle of a program. After careful checking I found that the 2.2 meg. resistor from the screen of the 6BX6 tube in the limiter circuit of the space command control chassis had changed value from 2.2 meg. to 1.5 meg. After replacing it the space command returned to normal.

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PROBE FOR CHECKING TV SIGNAL IN I.F.'s

Remove the xtal detector circuit complete with can, coils, resistor, capacitor and 1N61 xtal from a scrapped chassis, e.g. G-E Model 10T1, 10T4, etc. Attach proper leads for ground, input signal and socket for scope input.

This probe will make an excellent signal tracer for checking the operation of the I.F.'s in a TV receiver.

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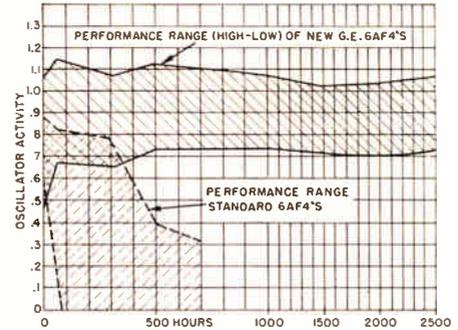
What's new!

"Long Life"

6AF4

The new General Electric 6AF4 will now provide many more hours of uninterrupted u-h-f reception. Now, for the first time, a 6AF4 u-h-f oscillator tube is fully as efficient and dependable as other tubes.

The life-test comparison chart shown below represents tests made with many thousands of tubes. It should be noted that oscillator activity for the General Electric "long life" design 6AF4 tubes is practically a straight horizontal line, whereas standard 6AF4 tubes show a sharp sudden drop.



Virtually no other receiving tube is called on to undergo the same electrical stresses as the 6AF4. With electrodes small and spacing close to meet the low-inductance, low-capacitance demands of up to 900 mc operation, current density is five to six times that of other triodes.

Consequently, extremely high cathode emission is required. The plate and grid, subjected to high temperatures, must resist gas-forming tendencies that would destroy tube efficiency. Still requirements like these have meant short life for 6AF4 tubes. Now General Electric, through creative design, combines new materials usage with new manufacturing and test methods to give TV-technicians and set-owners a reliable long-life 6AF4.

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