INSTRUCTION MANUAL

B&K Model 1077

Television Analyst

A Product of DYNASCAN CORPORATION 1801 West Belle Plaine • Chicago, Illinois 60613

B&K

PRICE $3.00

INSTRUCTION MANUAL

FOR

MODEL 1077
TELEVISION ANALYST

B & K DIVISION OF DYNASCAN CORPORATION

1801 W. Belle Plaine Avenue

Chicago, Illinois 60613

INTRODUCTION

As generally acknowledged in the service business, it is the *approach* to servicing a Television receiver that determines:

1. how quickly you can locate the trouble and fix it . . . especially hard-to-find trouble.

2. how fully you can satisfy your customers.

3. how much you can avoid those unpleasant and unprofitable call-backs.

4. how you can efficiently service more television sets in less time.

5. how, by saving valuable time, you can make *your* time more profitable.

With this in mind, it has been our constant aim to simplify the approach and make the service job easier to accomplish with greater accuracy. This dedication to your needs has grown through actual servicing experience. The practical benefits of each new instrument are pre-tested in the field through the cooperation of leading service shops.

Over the years, this has generated one innovation after another—in simplified techniques, procedures, and instruments to speed the work of the professional and make the beginner-technician more competent.

Among these specialized B & K instruments are: the CRT checker and rejuvenator; the high speed, multiple-socket tube testers; the solid state color generator; the in-circuit out-of-circuit transistor analysts; the diagnostic oscilloscope with vectorscope and intermittent analyzer; the in-circuit out-of-circuit capacitor analyst; the sweep/marker alignment generator; the VOMs and VTVMs; and, of course, the original Television Analyst. Each is designed to do its job faster with greater simplicity and accuracy. Together, they provide an efficient basis for a high quality, professional and profitable service operation.

Not only is B & K Test Equipment widely accepted and used by many thousands of servicemen, but by set manufacturers as well. As a result, it has become a standard in the industry.

In this TELEVISION ANALYST, you have today's most versatile and useful TV service instrument. It's like having your own television station. You can inject your own TV signals at any time, at any point —and quickly track down the source of "tough dog", intermittent, or general TV troubles, as you watch the generated test pattern on the screen of the television receiver, or listen to the sound. This applies to black-and-white or color, vhf or uhf, tube-type or transistorized sets. If necessary in particular situations, you can actually demonstrate your servicing procedure and its results to your customers.

The TELEVISION ANALYST checks each circuit in precisely the way that the circuit itself operates, and through the signal substitution technique, it often saves "lost hours" and greatly reduces servicing time.

This comprehensive Manual is designed to simplify your use of the TELEVISION ANALYST. It takes you step-by-step through the various stages of operation and covers procedures, symptom analyses, and troubleshooting techniques.

The *Troubleshooting Procedures* section with its condensed charts, for example, gives you a quick point of reference as to symptoms, causes, and procedures which are covered in more detail in other sections. The complete Manual thus becomes a most valuable and helpful guide in servicing television receivers.

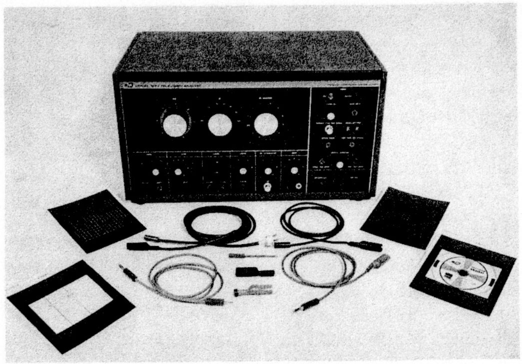

Figure 1. TELEVISION ANALYST and Accessories

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ADVANTAGES IN USING THE TELEVISION ANALYST

The TELEVISION ANALYST is an instrument that permits a service technician to quickly and accurately locate troubles in television receivers by the "signal substitution" technique. It is designed for analyzing black-and-white and color, vhf and uhf, tube-type and transistorized television receivers. This "signal substitution" technique of troubleshooting can often cut servicing time in half, or more, compared to any other troubleshooting method. The time saved, in turn, means more profitable television servicing. The technique quickly and accurately locates the section and stage of the television receiver with the malfunction, and many times locates the specific component that is defective. With the TELEVISION ANALYST, only one instrument is required for locating troubles in any section of the television receiver.

When there is trouble in a television receiver, a signal is absent or abnormal somewhere between the antenna and the picture tube or speaker. With the signal substitution method, a normal signal is injected into suspected stages where it substitutes for the absent or abnormal signal. If the injected signal restores operation, we know the trouble is located between the point of injection and the antenna. If the injected signal has no effect, we know the trouble is located between the point of injection and the picture tube or speaker.

The TELEVISION ANALYST is primarily intended for use in the television service shop. Tube testing during the service call in the home, of course, continues to be the first step in television servicing for vacuum tube receivers. (In color television especially, tube replacements may reveal or generate other problems that require critical analysis and correction.) When tube replacement and other short cuts do not correct the trouble, shop servicing is required. This is where the TELEVISION ANALYST provides the fastest method yet developed for locating otherwise hard-to-find troubles.

As more and more transistorized television receivers come on the market, the servicing job takes on some new aspects. Tube replacement, of course, does not apply. What, then, will make it easier to service transistorized sets? Here again the TELEVISION ANALYST, with its signal substitution technique and its complete versatility, becomes the ideal instrument because it provides low impedance signal outputs which are necessary for transistor circuits.

WHAT THE TELEVISION ANALYST WILL DO

1. Simplifies complete servicing on all black-and-white or color television receivers through use of a single test instrument.
2. Speeds servicing of transistorized, partially transistorized, and vacuum tube television receivers, including uhf and vhf tuners.
3. Generates all signals normally transmitted by a television station and those produced within a television receiver for point-by-point signal substitution troubleshooting techniques throughout a complete television receiver.
4. Generates uhf signals on channels 14 through 83 for testing uhf tuners.
5. Generates vhf signals on channels 2, 3, 4, 6, 7, 8, 12, and 13 for testing vhf tuners.
6. Generates i-f signals of 20 to 48 MHz for testing i-f amplifier stages.
7. Generates a positive or negative composite video signal for injection into video stages.
8. Generates a keyed color bar pattern which modulates the R.F. output for troubleshooting and adjusting color circuits.
9. Generates a color rainbow signal for injection into color amplifiers and demodulators.
10. Generates a 4.5 MHz sound channel test signal that is frequency modulated by a 1 KHz audio tone.
11. Generates a 1 KHz tone for audio circuit testing.
12. Generates composite sync pulse signals of positive or negative polarity, adjustable in amplitude, and with variable impedance for troubleshooting sync circuits, picture tubes, blanking circuits and transistorized keyed AGC circuits.
13. Generates vertical grid drive signal for troubleshooting vertical sweep circuits.
14. Generates vertical plate drive signal for checking vertical output transformers.
15. Generates solid state sweep drive signal for checking vertical and horizontal sweep circuits and vertical yoke windings.
16. Generates horizontal grid drive signal for troubleshooting horizontal sweep circuits.
17. Generates horizontal plate drive signal for checking horizontal output (flyback) transformers.
18. Provides B+ boost indication.
19. Provides high voltage indication.
20. Checks flyback transformers, horizontal deflection yokes, and width coils for shorted turns.
21. Generates a high level keying pulse for testing keyed circuits, AGC, burst amplifiers and blanking.
22. Provides positive or negative dc bias voltages, variable in amplitude, from a low impedance power supply which is completely isolated from the TELEVISION ANALYST chassis.
23. Provides a stable signal source for locating intermittent troubles.
24. Generates a test pattern for color convergence adjustments.
25. Generates test pattern for horizontal and vertical linearity, size, and aspect ratio checks and adjustment.
26. Checks bandwidth, resolution, shading, and contrast capabilities of television receivers.
27. Will reproduce any 3" x 4" positive transparency as a picture source to demonstrate the performance capabilities of television receivers.
29. Will display pictures on the screens of television receivers as an advertising medium.
30. Can be used as a transmitter for video paging at conventions, hospitals, and other gatherings.
31. Checks the performance of community and master antenna systems.

SPECIFICATIONS—TELEVISION ANALYST

Input Power	100 watts, 117 volts, 60 Hz ac
IF Output	20 to 48 MHz 0 to 70,000 microvolts minimum @ 75 ohms
VHF Output Channels 2 to 6	0 to 12,000 microvolts minimum @ 75 ohms
Channels 7 to 13	0 to 6,000 microvolts minimum @ 75 ohms
UHF Output	Channels 14 to 83 0 to 1,000 microvolts minimum @ 75 ohms
Video Output	composite signal 0 to 2.5 volts peak-to-peak minimum @ 1,000 ohms positive or negative polarity
Sync Output	0 to 50 volts peak-to-peak logarithmically variable impedance 10 K ohms @ 50 volts 1 K ohm @ 10 volts positive or negative polarity
4.5 MHz Output	frequency modulated by 1 KHz audio tone at 25 KHz deviation; @ 180 ohms
1 KHz Output	at least 1 volt peak-to-peak across 300 ohms
Color Output	crystal controlled 3,563,795 Hz ½ to 5 volts peak-to-peak 100 ohms @ min. volts 1,000 ohms @ max. volts
Bias Power Supply	positive or negative polarity 0 to 25 volts into infinite load 0 to 250 ma @ 50 ohms ungrounded
Vertical Grid Drive Output	60 Hz 0 to 150 volts peak-to-peak
Vertical Solid State Sweep Output	60 Hz 17.5 volts peak-to-peak @ 50 ohms
Horizontal Grid Drive Output	crystal controlled 15,750 Hz ± 0.5% 150 volts peak-to-peak minimum
Horizontal Solid State Sweep Output	15.75 KHz 11 volts peak-to-peak @ 2.5 ohms
AGC Keying Pulse Output	15,750 Hz 400 volts peak-to-peak @ 30 K ohms
Vertical Plate Drive Output	sufficient to drive all vacuum tube circuit vertical transformers
Horizontal Plate Drive Output	sufficient to drive all vacuum tube circuit flyback transformers
Dimensions	9¾" high 18" wide 12" deep
Weight	26 pounds

In this manual, frequencies are specified in Hertz (Hz). Hertz is a recent term, now used throughout the electronics industry, which is replacing "cycles per second".

New Term	*Old Term*
Hertz (Hz)	cycles per second (cps)
kiloHertz (KHz)	thousand cycles per second or kilocycles (kc)
megaHertz (MHz)	million cycles per second or megacycles (mc)

OPERATOR'S CONTROLS

(See Figure 2)

1. UHF control—selects uhf channel
2. IF control—selects i-f frequency
3. RF SELECTOR—selects i-f, uhf, or vhf operation and vhf channel
4. VIDEO POLARITY switch—selects video polarity (video output only)
5. VIDEO control—adjusts video level
6. GROUND jack—ground connection
7. VIDEO jack—video output signal
8. SYNC control—adjusts sync output level
9. SYNC POLARITY switch—selects sync polarity
10. SYNC jack—sync output signal
11. AUDIO ON-OFF switch—turns on and off 4.5 MHz and audio modulation of rf output signal.
12. 4.5 MHz jack—4.5 MHz sound i-f output signal
13. 1 KHz jack—1 KHz audio output signal
14. COLOR control—turns on and off color generator and adjusts color output level
15. COLOR jack—color output signal
16. RF ATTENUATOR control—adjusts level of vhf, uhf and i-f output signal.
17. RF jack—i-f, vhf, and uhf output signal
18. BIAS control—adjusts votlage output of bias power supply
19. POSITIVE BIAS jack—positive connection to bias power supply
20. NEGATIVE BIAS jack—negative connection to bias power supply
21. TEST INDICATOR lamp—horizontal yoke and flyback transformer shorted turns indicator
22. CALIBRATE control—calibrates the TEST INDICATOR circuit
23. FLYBACK and YOKE TEST SIGNAL jack — shorted turns test signal
24. BOOST INDICATOR lamp—B+ boost indicator
25. PLATE DRIVE jack — horizontal and vertical plate drive test signal
26. HORIZ-OFF-VERT switch—selects horizontal or vertical PLATE DRIVE signal and horizontal or vertical SOLID STATE SWEEP DRIVE signal (when not in use, leave in OFF position)
27. KEYING PULSE jack — agc keying pulse test signal
28. SOLID STATE SWEEP DRIVE jack and vertical deflection yoke test signal
29. HORIZ GRID DRIVE jack—horizontal grid drive test signal
30. AMPLITUDE control—adjusts level of vertical grid drive signal, the vertical plate drive signal and the SOLID STATE SWEEP DRIVE signal. (Both horizontal and vertical)
31. VERT GRID DRIVE jack—vertical grid drive test signal
32. OFF-STBY-ON switch—power OFF, to filaments only (STBY), or ON
33. PILOT lamp—lights in STBY and ON positions
34. GROUND jack—ground connection

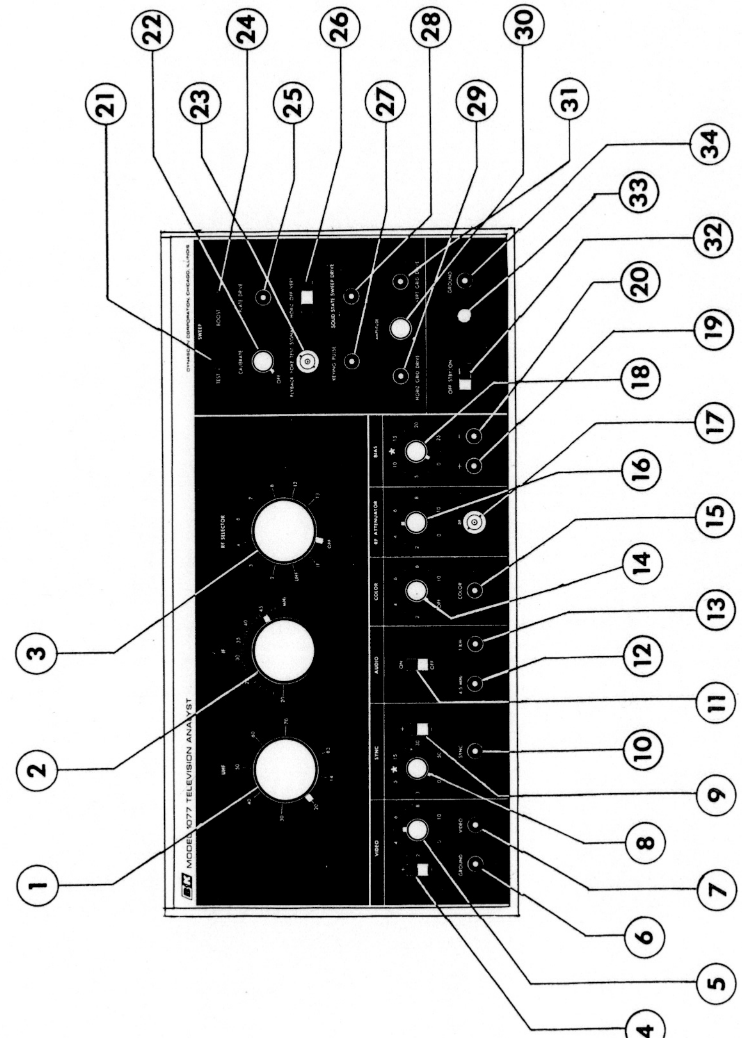


Figure 2. Operator's Controls

TYPICAL OPERATING PROCEDURE

Before you begin troubleshooting with the TELEVISION ANALYST you will need to become familiar with its controls, the various types of signals it can generate, and how the signals can be used. To become familiar with the controls and their operation, it is recommended that the TELEVISION ANALYST and an operating television receiver (adjusted for best reception of a local channel) be set up on a bench. A color television receiver with both vhf and uhf reception is preferred. To best demonstrate the capabilities of the TELEVISION ANALYST, a vacuum tube type television receiver is recommended. Tubes may be easily removed to simulate troubles, and injection of the proper test signal from the TELEVISION ANALYST should restore proper operation.

The procedures are divided into groups; one group for each type of signal that the TELEVISION ANALYST generates. These procedures demonstrate the use of all controls and signals, and typical signal amplitudes at various points in a television receiver.

NOTE

In this manual, names of controls appearing in all capital letters represent controls on the TELEVISION ANALYST. Example: adjust the COLOR control. Names of controls that are underlined represent controls on the television receiver. Example: set the contrast control.

Until the owner becomes familiar with the TELEVISION ANALYST, the controls may be set to the following positions. These settings are a combination of the most commonly used frequencies, disabling of all unused functions, typical signal levels, and minimum amplitude of all outputs that might damage transistorized circuits if used at high levels. For these reasons, it is recommended that the new owner return the controls to these reference settings upon completion of testing. Once he has become familiar with the controls, he may easily devise his own reference settings.

The OFF-STBY-ON switch can be left in the STBY position when the instrument is not in use. This eliminates any wait for warm-up the next time it is used. In the STBY position, all outputs (except bias supply) are disabled and power is applied only to the filaments of the tubes in the TELEVISION ANALYST.

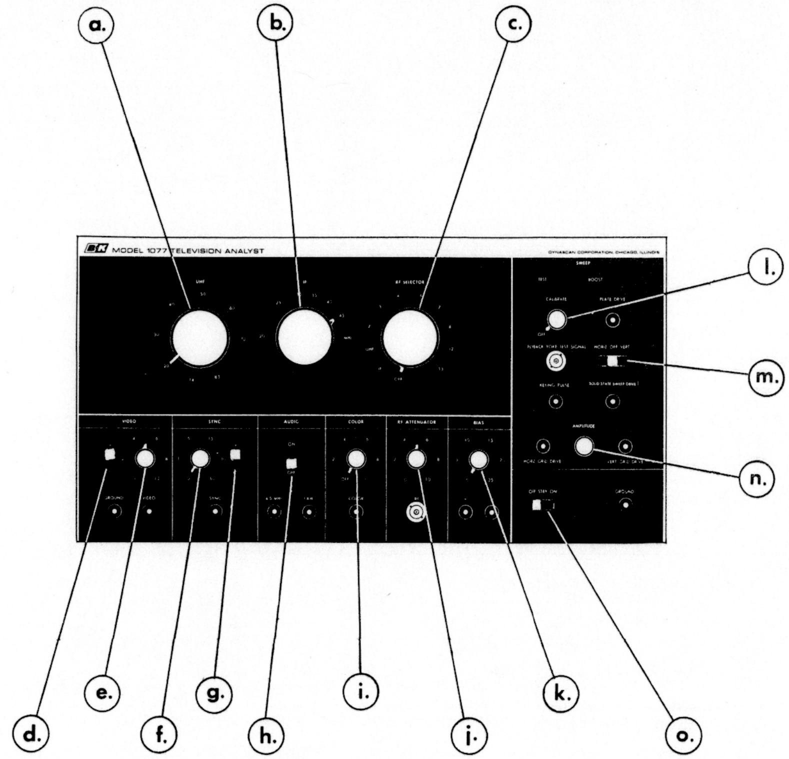


Figure 3. Initial Control Settings

a. UHF control to 20
b. IF control to 45
c. RF SELECTOR to OFF
d. VIDEO POLARITY switch to POSITIVE
e. VIDEO control to 5
f. SYNC control to 0
g. SYNC POLARITY switch to POSITIVE
h. AUDIO ON-OFF switch to OFF
i. COLOR control to OFF
j. RF ATTENUATOR control to 5
k. BIAS control to 0
*l. CALIBRATE control to OFF
*m. HORIZ-OFF-VERT switch to OFF
n. AMPLITUDE control to midposition between min and max
o. OFF-STBY-ON switch to OFF

*Always turn OFF when not in use

A. VHF SIGNAL

(See Figures 3-4-5-6-7-8)

The vhf signal will probably be the most commonly used signal in troubleshooting. Every troubleshooting procedure should start with injection of a vhf test signal at the antenna terminals of the faulty television to completely check the symptoms. Proper analysis of the test pattern can localize the trouble, showing which stages require additional troubleshooting. It also shows when alignment or adjustment is required. While injecting many other types of signals, the vhf signal continues to be injected at the antenna terminals. (See Figures 4 and 5.)

1. Set the controls on the TELEVISION ANALYST to the following positions before applying power:

   AUDIO ON-OFF switch to OFF

   COLOR control to OFF

   RF ATTENUATOR control to 5

   CALIBRATE control to OFF

   HORIZ-OFF-VERT switch to OFF

   OFF-STBY-ON switch to OFF

2. Plug the power cords of the TELEVISION ANALYST and the television receiver into 117-volt, 60-Hz, outlets.

3. Set the OFF-STBY-ON switch to STBY (standby). The pilot lamp will light. Allow the TELEVISION ANALYST to warm up for two or three minutes. The STBY position applies power only to the filaments of the tubes in the TELEVISION ANALYST.

4. Connect the coaxial test lead from the RF jack to the vhf ant. terminals after disconnecting any antenna that may be connected to the terminals.

5. Open the cover of the TELEVISION ANALYST and insert the test pattern slide into the slide track. Push it all the way down. The side of the slide on which "FRONT" appears correctly should face the photomultiplier tube.

6. Set the OFF-STBY-ON switch to ON.

7. Turn the television receiver on and allow it to warm up for two or three minutes.

8. Set the RF SELECTOR on the TELEVISION ANALYST and the channel selector on the television receiver to the same unused channel, preferably below channel 7. A video test pattern should appear on the television receiver picture tube.

   NOTE

   Do not use channels on which local television stations transmit. Sufficient signal may be present to interfere with the test pattern signal.

9. Adjust the fine tuning control for the best picture as you would tune in a television station.

10. Set the brightness and contrast controls at normal positions.

11. Adjust the VIDEO control for good contrast and a full range of grays around the center of the test pattern.

12. Set the AUDIO ON-OFF switch to ON. A 1 KHz audio tone should be heard from the speaker of the television receiver.

13. Adjust the volume control for a comfortable listening level.

Now that a test pattern has been obtained, adjust some of the controls to see the effect upon the picture.

Turn the VIDEO control in both directions and note the effect upon contrast. As the control is turned toward 0, there is less contrast and the picture becomes very light. As the control is turned toward 10, contrast increases and grays become dark or black. Too much signal may cause the picture to distort. Return the control to a setting which shows a full range of grays.

NOTE

Slides or photographs with greater or less density than the test pattern require a different VIDEO setting.

Turn the RF ATTENUATOR control in both directions and note the effect upon the picture. As the control is turned toward 0, the test pattern becomes snowy, then loses horizontal sync, and finally disappears entirely. As the control is turned toward 10, the picture becomes sharper and contrast increases. Return the control to the setting which gives the best picture.

Turn the RF SELECTOR on the TELEVISION ANALYST and the channel selector on the television receiver to other vhf channels on which local broadcasts are not carried, always tuning both to the same channel. A video test pattern and audio tone of good quality should be maintained on each channel. Adjustment of the fine tuning control and RF ATTENUATOR control may be necessary to obtain the best picture.

Thus far, controls have been set to provide the best possible display of the test pattern. When the display is compared to a perfect test pattern, overall performance of the television set is checked. It shows whether adjustments or alignment are necessary, and whether circuits are performing satisfactorily. If any abnormal indications are discovered during the following checks (see Figure 6), refer to the *Performance Testing* section of this manual for corrective measures.

a. The center of the test pattern display should be at the physical center of the screen.

b. The black circle should just fill the screen vertically.

c. The black outer circle and gray inner circles should be perfectly round.

d. The shades of gray in the circles around the center should be easily distinguishable from each other.

e. The vertical wedges extending from the center to the top and bottom of the screen will merge and be indistinguishable near the center. Near the outside, they can be easily distinguished from each other. Lines should be distinguishable at 3 or higher on the top scale (bandwidth 3 MHz or greater), 250 or higher on the bottom scale (resolution 250 lines or greater).

f. There should not be a black smear at the right edge of the three black bars.

g. There should be no ringing (multiple lines similar to ghost images) on the right edge of the vertical wedges.

If the vhf signal is applied to a color television receiver, the remaining steps of this procedure should be followed (see Figure 7):

14. Remove the test pattern slide from the TELEVISION ANALYST.

15. Turn the COLOR control to position 1 (turns on color generator). A color bar pattern will be displayed on the picture tube. Rotating the COLOR control from 1 to 10 has no effect upon the color bar pattern.

16. Adjust the color control for normal brilliance of colors. No more than ⅓ of the full setting should be required.

17. Adjust the hue control for the correct colors as shown in figure 7. The first and tenth color bars may not be visible on all television receivers. Adjustment of the horizontal hold control will usually shift the horizontal centering enough to show the outside bars.

Examine the color bar pattern displayed on the screen and check it for the following criteria:

—the correct colors are displayed

—the color bars fit within the black registration lines on each side of the bars (tests delay line)

—color bars are stable (a defective afc circuit can cause a "barber-pole" effect)

18. Reinsert the test pattern slide and notice that the black and white test pattern and the color bar pattern are both present on the display. This demonstrates the ability of the television receiver to display both black and white signals and color signals. (See Figure 8.)

19. The AUDIO ON-OFF switch may be in either position, as desired, during this test. In the ON position, all functions of the television receiver are tested: video, color, and sound.

The TELEVISION ANALYST can generate a vhf carrier signal either unmodulated or modulated with video, audio, or color signals. The modulation signals can be used individually or in any combination. When audio and color signals are used simultaneously, a 920 KHz "beat" signal is seen on the color display. Notice the difference when the AUDIO ON-OFF switch is changed from ON to OFF. This "beat" signal is the result of the difference between the 4.5 MHz audio i-f signal and the 3.58 MHz color i-f signal. The "beat" pattern is produced from commercially broadcast television signals as well as from those generated by the TELEVISION ANALYST, although suppression of the 3.58 MHz carrier in commercial broadcasting subdues the effect. The "beat" signal can be used to test the effectiveness of the 920 KHz trap, present in all television receivers (including black and white sets) to filter out the "beat" signal. The test is performed by comparing the amount of "beat" present in a particular television receiver with the amount normally present on other receivers.

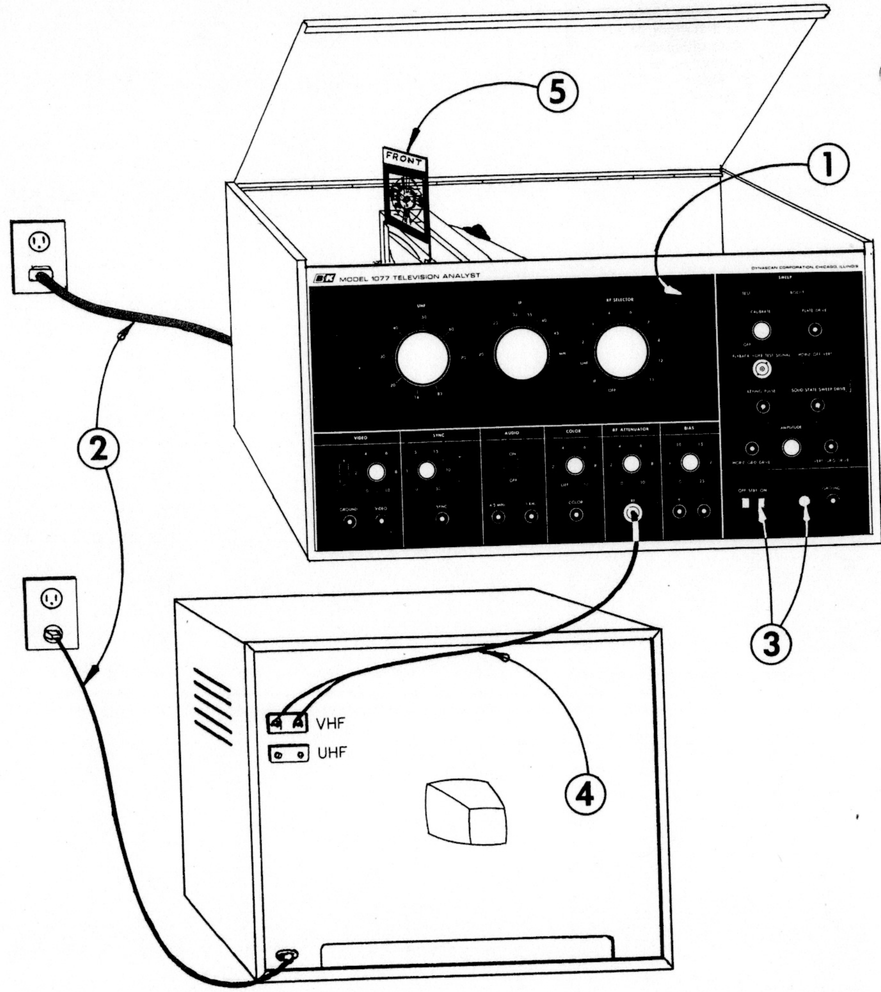


Figure 4. Connections for VHF Signal

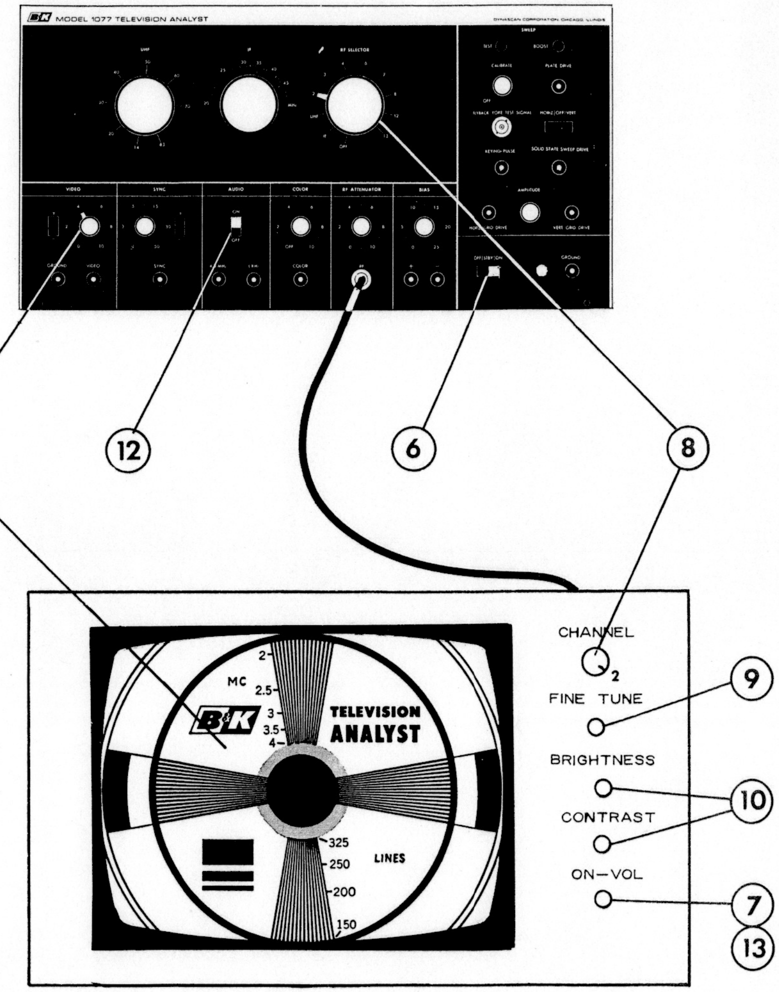


Figure 5. Control Settings for VHF Signal

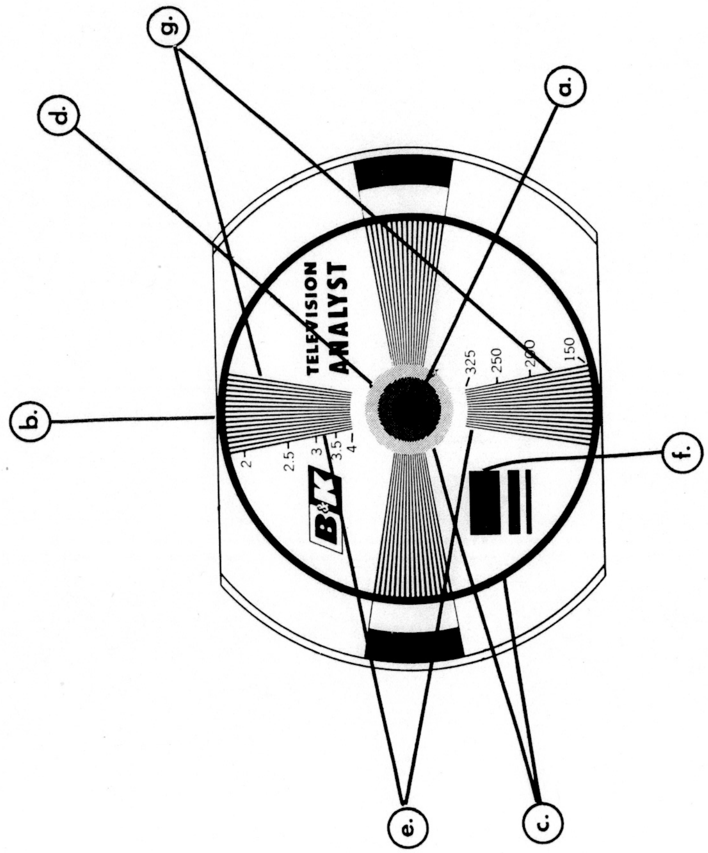


Figure 6. Compare Display to This Test Pattern

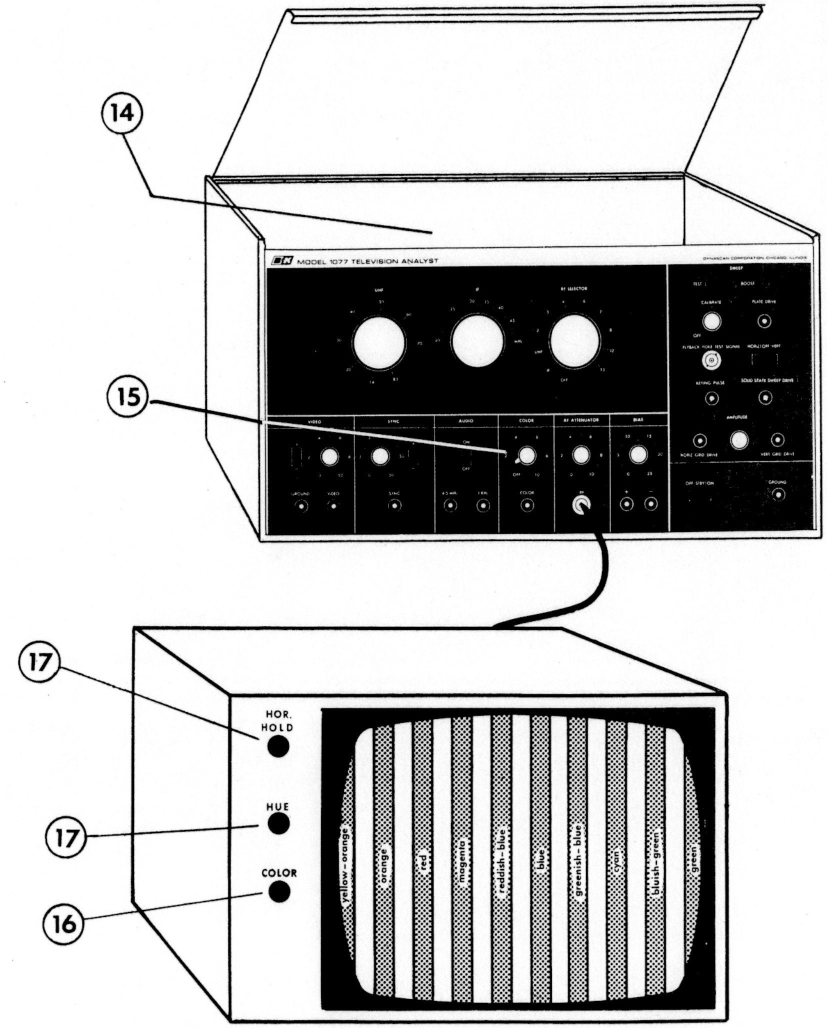


Figure 7. Control Settings for Color Test with VHF Signal

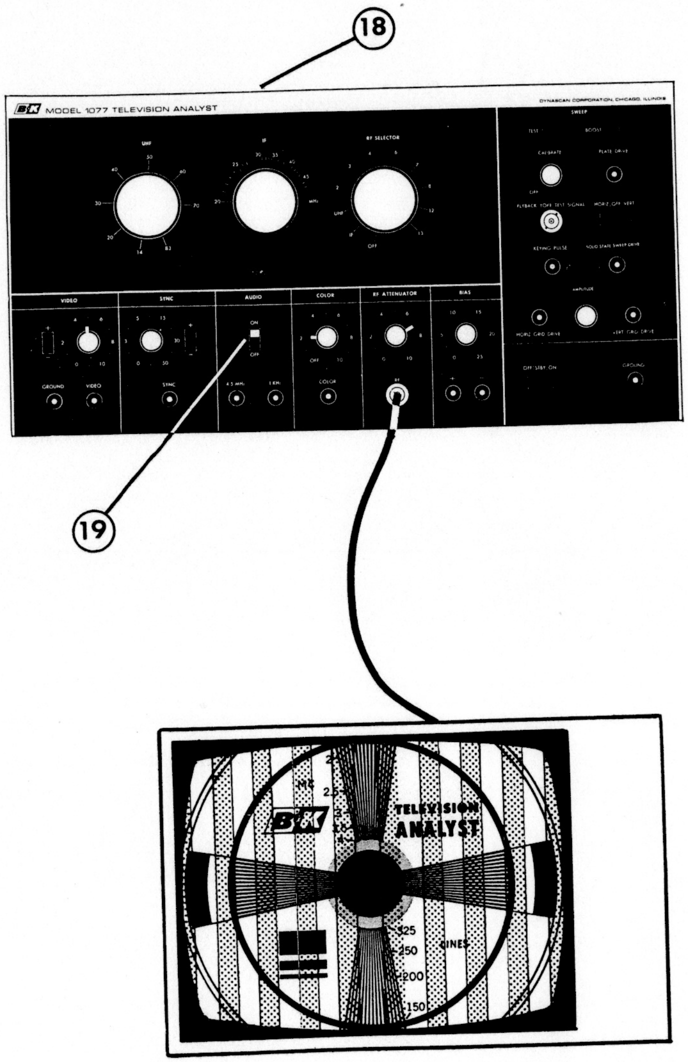


Figure 8. Black and White Video Test Pattern and Color Bar Pattern Superimposed

B. UHF SIGNAL

(See Figure 9)

1. Remove the coaxial test lead connections from the vhf ant. terminals and connect them to the uhf ant. terminals.

2. Set the RF SELECTOR to the UHF position.

3. Set the UHF control to an unused uhf channel on the low end of the band (channel 14 to 20).

4. Set the channel selector to uhf.

5. Tune the uhf tuning control to the same channel that was selected on the TELEVISION ANALYST. The video test pattern should be displayed and the audio test tone should be heard on the television receiver (AUDIO switch ON). Tune for the best picture.

6. Adjust the VIDEO and RF ATTENUATOR controls for the best picture. Varying these controls has the same effect as with vhf signals.

Adjust the UHF control from the low end to the high end of the band, stopping about every five channels. Tune the television receiver to the same channel at each stop. The video test pattern and audio test tone should retain the same quality throughout the tuning range.

The COLOR test can be performed exactly as that described for vhf signals.

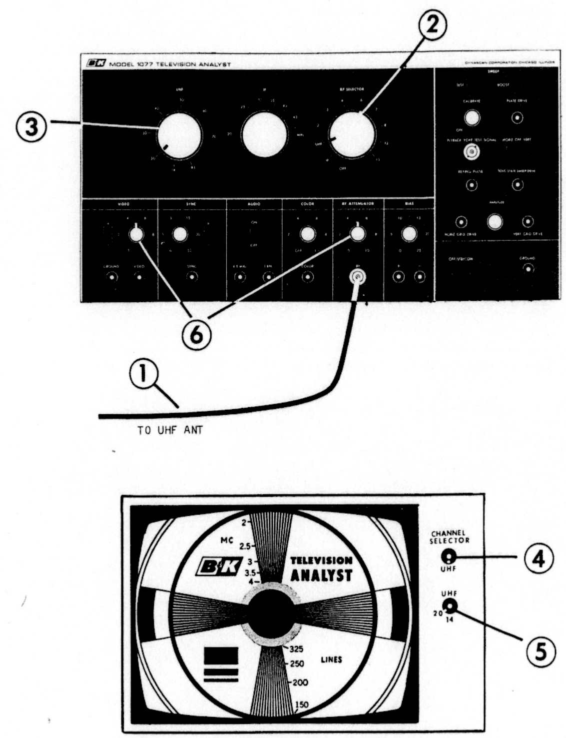


Figure 9. Connections and Control Settings for UHF Signal

C. IF SIGNAL

(See Figures 10-11-12)

Beginning with the i-f test signal, the remaining test signals described in the *Typical Operating Procedure* require access to circuits in the chassis. A schematic diagram of the television receiver will probably be required for locating all test points.

1. Disconnect the coaxial test lead from the uhf ant. terminals and unplug the power cord of the television receiver.
2. Remove the back and cabinet of the television receiver, as required, for access to the chassis. Disable the tuner by removing the i-f input plug from the i-f amplifier or equivalent.
3. Reapply power with a cheater cord.

WARNING

WHENEVER TESTING TRANSFORMERLESS TELEVISION RECEIVERS, CONNECT A 1:1 ISOLATING TRANSFORMER IN THE POWER LINE BETWEEN THE TV SET AND THE AC OUTLET. SERIOUS SHOCK MAY RESULT IF THIS SAFETY PRECAUTION IS IGNORED. (See Figure 10)

4. Connect the black test lead from the GROUND jack to the chassis of the television receiver.
5. Connect the coaxial test lead to the RF jack. Connect the black clip of the coaxial test lead to the chassis of the television receiver. Connect the red clip of the coaxial test lead to the input of the 3rd i-f amplifier.
6. Set the RF ATTENUATOR control to 10. The maximum setting of the control is required because the signal is not amplified by the 1st and 2nd i-f amplifiers.
7. Set the RF SELECTOR to the IF position. This engages the IF tuning control and provides an i-f signal at the RF jack.
8. Adjust the IF control to the intermediate frequency (i-f) of the television receiver. Most sets have a 45 MHz i-f, but some older sets operate in the 25 MHz region. When the IF control is adjusted to the proper frequency, the test pattern will be displayed on the screen. Tune the IF control for the best picture.

The VIDEO and COLOR controls have the same effect as with vhf and uhf signals. If the AUDIO switch is ON, the audio test tone may or may not be heard, depending upon the design of the circuit. In some sets, audio and video separation precede the video detector and the audio will not be heard. In practically all sets, the audio will be heard when the i-f signal is injected into the 3rd i-f amplifier.

9. Reduce the setting of the RF ATTENUATOR control until snow is present in the display. Note the setting of the control.
10. Move the red clip of the coaxial test lead from the 3rd i-f amplifier to the input of the 2nd i-f amplifier. The snow should disappear. This demonstrates the amplifying ability of the stage.
11. Again reduce the setting of the RF ATTENUATOR control until snow is present in the display. Note the difference between the setting in step 9 and step 11. The difference represents the amount of relative gain. The greater the difference, the greater the gain. All amplifiers should exhibit gain; experience will show the gain to be expected of various types of amplifiers. Note the gain of this stage as typical reference for future troubleshooting.

NOTE

In a few cases, large differences in impedance between the two signal injection points produce an indication of "apparent" loss instead of gain.

12. Repeat the gain measurement procedures for each of the i-f amplifier stages. For each stage, move the red lead of the coaxial test lead one stage toward the antenna. The mixer will exhibit little gain, but it can be tested by applying an i-f signal to its input.

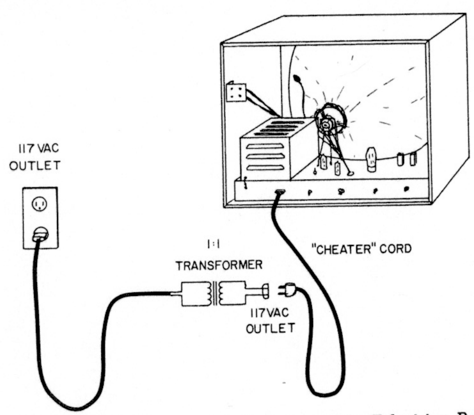


Figure 10. Safety Connections for Transformerless Television Receiver

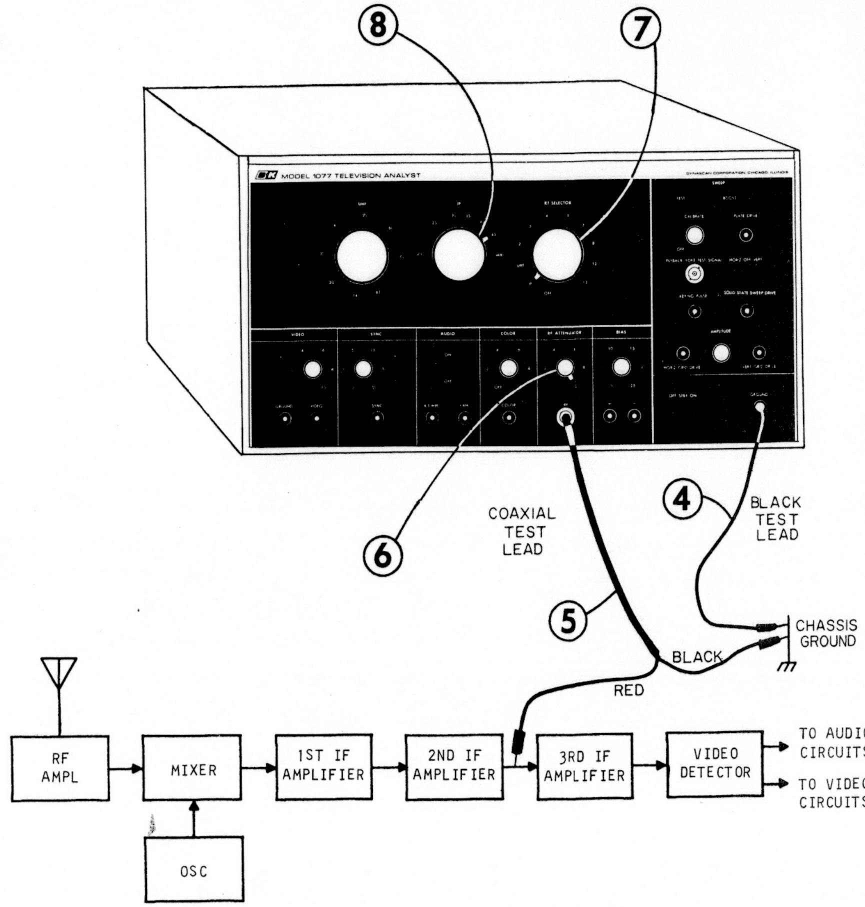


Figure 11. Connections and Control Settings for IF Test Signal

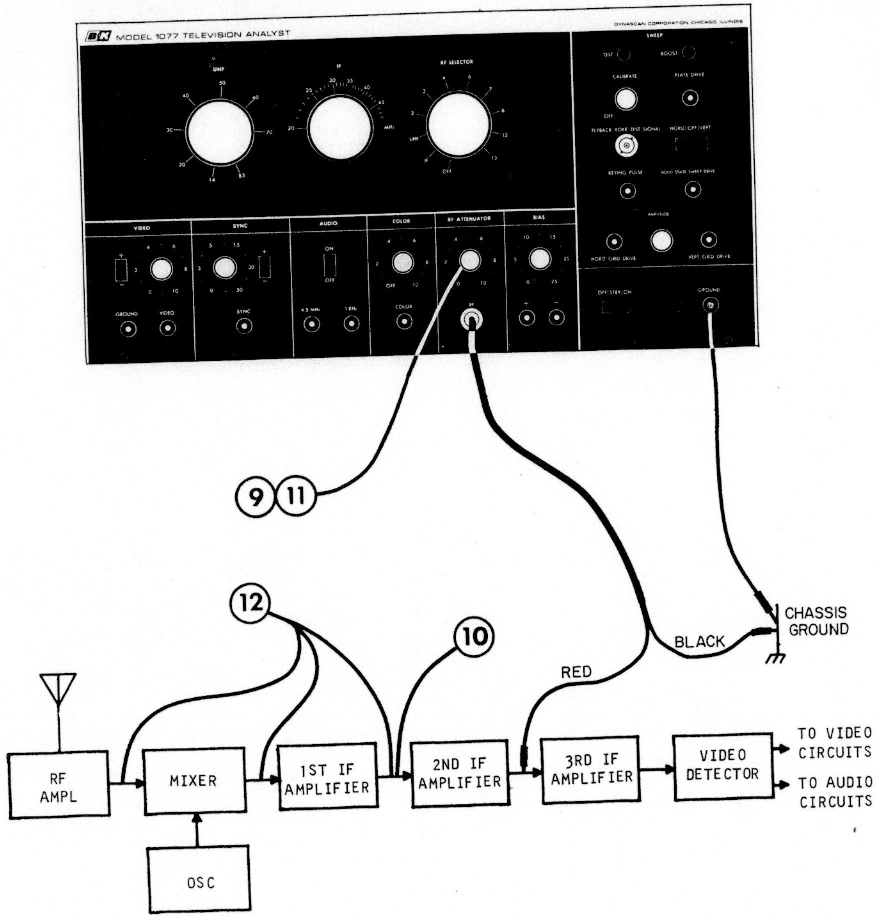


Figure 12. Making Gain Measurements with the IF Signal

D. VIDEO SIGNAL

(See Figure 13)

1. Inject a vhf signal at the antenna terminals and adjust for the best video test pattern and audio (perform steps 1 through 13 of the *VHF Signal Procedure*).
2. Remove the 3rd i-f amplifier tube. If series filaments are used in the set, connect a jumper across the filament pins. This simulates a trouble with symptoms of no video and no audio (although normal troubleshooting procedures for such a symptom would begin in the i-f section, for demonstration purposes we will check the video section).
3. Connect the black test lead from the GROUND jack to the chassis of the television receiver.
4. Connect the red test lead from the VIDEO jack to the input of the 2nd video amplifier.
5. Set the VIDEO control to 10. A test pattern, probably unsynchronized, will appear on the screen. Since video is displayed, the trouble must lie before the 2nd video amplifier.
6. If a negative picture is displayed (blacks and whites are reversed), reverse the setting of the VIDEO POLARITY switch.
7. Reduce the VIDEO control setting until a dim test pattern is displayed.
8. Move the red test lead to the input of the 1st video amplifier.
9. Reverse the setting of the VIDEO POLARITY switch. A synchronized test pattern, much darker than in step 7, should appear. This demonstrates the amplifying ability of the 1st video amplifier. It also shows that the trouble is located before the 1st video amplifier.
10. Again reduce the VIDEO control setting for a dim test pattern as obtained in step 7. Note the difference in the control setting between step 7 and step 10 for a relative indication of gain. Return the VIDEO control to the setting used in step 7.
11. Move the red test lead to the input of the video detector. The test pattern should again be displayed, showing that the trouble is located in the i-f section.
12. Remove the red test lead and replace the 3rd i-f amplifier tube. If filament pins were bridged during test remove jumper wire.

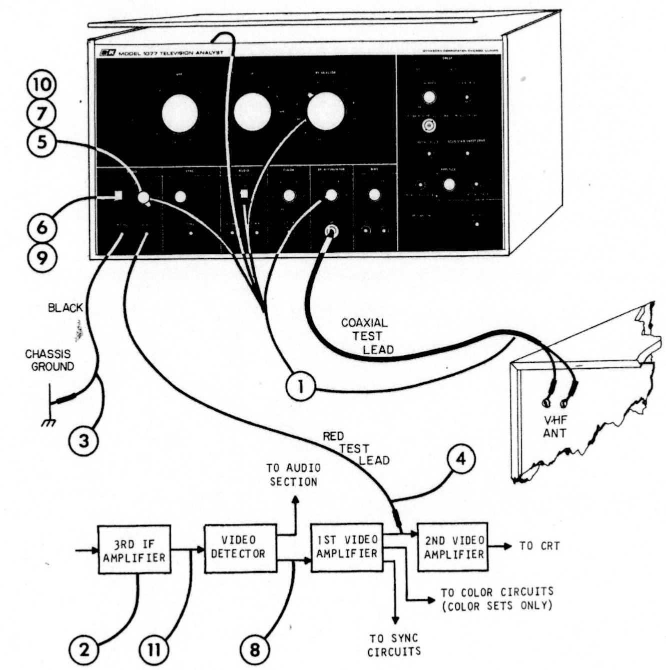


Figure 13. Connections and Control Settings for Video Signal

E. SYNC SIGNAL

(See Figures 14-15-16)

CAUTION

In transistorized television receivers, a SYNC control setting of higher than 10 volts (indicated by an asterisk*) may burn out transistors. Do not exceed this amount unless you are absolutely sure the stage normally operates at higher signal levels.

1. Leave the vhf signal injected at the antenna terminals as in step 1 of the *Video Signal* procedure.
2. Remove the sync separator tube from the television receiver. If series filaments are used, jumper the filament pins. This simulates a trouble with symptoms of no vertical or horizontal sync.
3. Set the SYNC control to 0.
4. Set the SYNC POLARITY switch to the positive position.
5. Make sure the black test lead is still connected from the GROUND jack to the chassis of the television receiver.
6. Connect the red test lead from the SYNC jack to the output of the SYNC separator.
7. Increase the SYNC control setting to the value normally used in the circuit (control is graduated in volts peak-to-peak). The required sync voltage is usually shown on the schematic diagram of the television receiver. If sync is not obtained, reverse the setting of the SYNC POLARITY switch. Vertical and horizontal synchronization will be restored, indicating that the trouble is before the output of the sync separator stage.

NOTE

Injection of the SYNC signal will restore synchronization to a television receiver only if the antenna input signal is also generated by the TELEVISION ANALYST. Do not attempt to restore sync while receiving a transmitted signal from a local channel. The SYNC signal in the TELEVISION ANALYST is entirely independent of the transmitted signal.

8. Move the red test lead to the input of the sync separator. Reverse the SYNC POLARITY switch setting. There will be loss of sync. This indicates that the trouble lies between the input and output of the sync separator stage.
9. Remove the red test lead and replace the sync separator tube. If filament pins were bridged during test remove jumper wire. Return the SYNC control setting to 0.

The sync signal can also be used as a high amplitude video test signal for injection directly into the picture tube to determine whether or not the picture tube is capable of displaying a video signal. Steps 10 through 17 give procedures for such a test on black and white television receivers.

10. Remove the final video amplifier tube. This simulates a trouble with symptoms of no video. (For normal troubleshooting techniques, we would first inject a VIDEO signal at the input of the final video amplifier. The test pattern would not be displayed. We would then follow this procedure.)
11. The black test lead is still connected from the GROUND jack to the chassis of the television receiver.
12. Connect the red test lead from the SYNC jack to the video input element of the picture tube (may be the cathode or the grid).
13. Set the SYNC control to 50.
14. Set the SYNC POLARITY switch to NEGATIVE if the signal goes to the cathode of the picture tube, to POSITIVE if it goes to the grid.
15. Turn the vertical hold control on the television receiver to roll the picture. The injected sync signal will produce black and white diagonal bars across the screen. This shows that the picture tube is capable of accepting video signals.
16. Move the red test lead to the output of the final video amplifier. The diagonal bars are still produced, which shows that all coupling devices from the final video amplifier to the picture tube are good. The trouble has been isolated to the area between the input and output of the final video amplifier.
17. Remove the red test lead and replace the final video amplifier tube. Return the SYNC control to 0 (see CAUTION at the beginning of this procedure).

Steps 18 through 27 give procedures for testing the picture tube and high amplitude video circuits of a color television receiver.

18. Turn the COLOR control to 2. The color bar pattern will be superimposed on the black and white test pattern.
19. Remove the 1st video amplifier tube. Jumper the filament pins if it is a series filament set. This simulates a trouble with symptoms of no video and no color.
20. Check that the black test lead is still connected from the GROUND jack to the chassis of the television recevier.
21. Connect the red test lead from the SYNC jack to the output of the final video amplifier.
22. Set the SYNC control to 50.
23. Turn the vertical hold control on the television receiver to roll the picture. The injected sync signal will produce black and white bars across the screen. This shows that the picture tube is capable of accepting black and white signals.

24. Move the red test lead to the output of the blue output amplifier (called B-Y output amplifier on many schematics). Blue diagonal bars will now appear on the screen, showing that the picture tube is capable of accepting blue signals.
25. Move the red test lead to the output of the green output amplifier (G-Y output amplifier). Green diagonal bars will now appear on the screen, showing that the picture tube is capable of accepting green signals.
26. Move the red test lead to the output of the red output amplifier (R-Y output amplifier). Red diagonal bars will now appear on the screen, showing that the picture tube is capable of accepting red signals.
27. Remove the red test lead, and replace the 1st video amplifier tube. Remove filament jumper wire, if used. Return the SYNC control to 0 (see the CAUTION at the beginning of this procedure). Return the COLOR control to the OFF position.

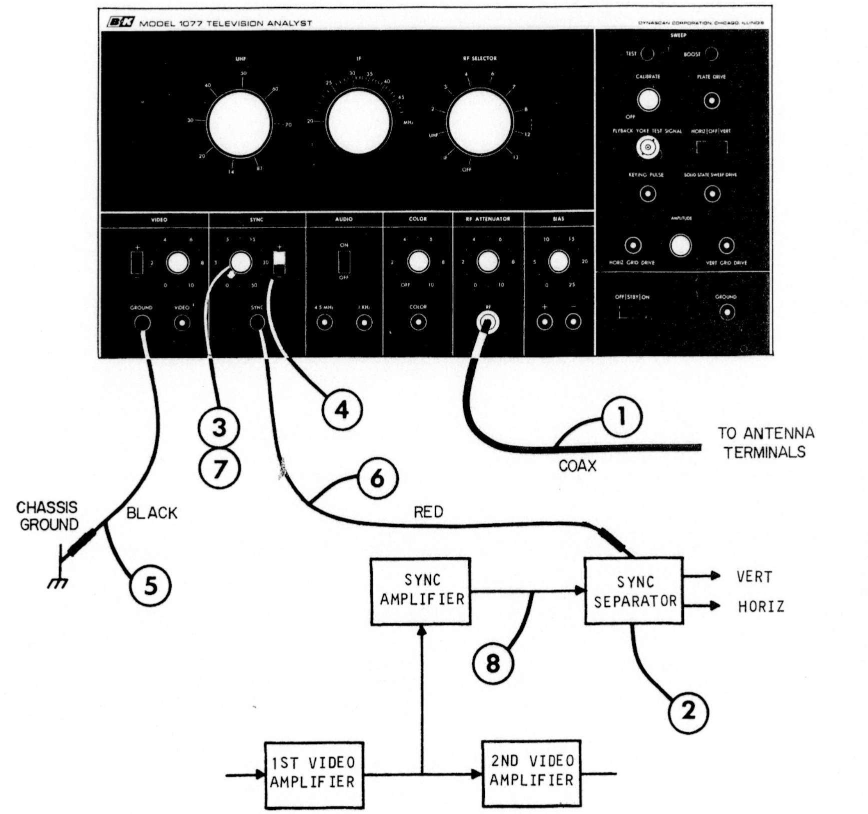


Figure 14. Connections and Control Settings for Sync Signal

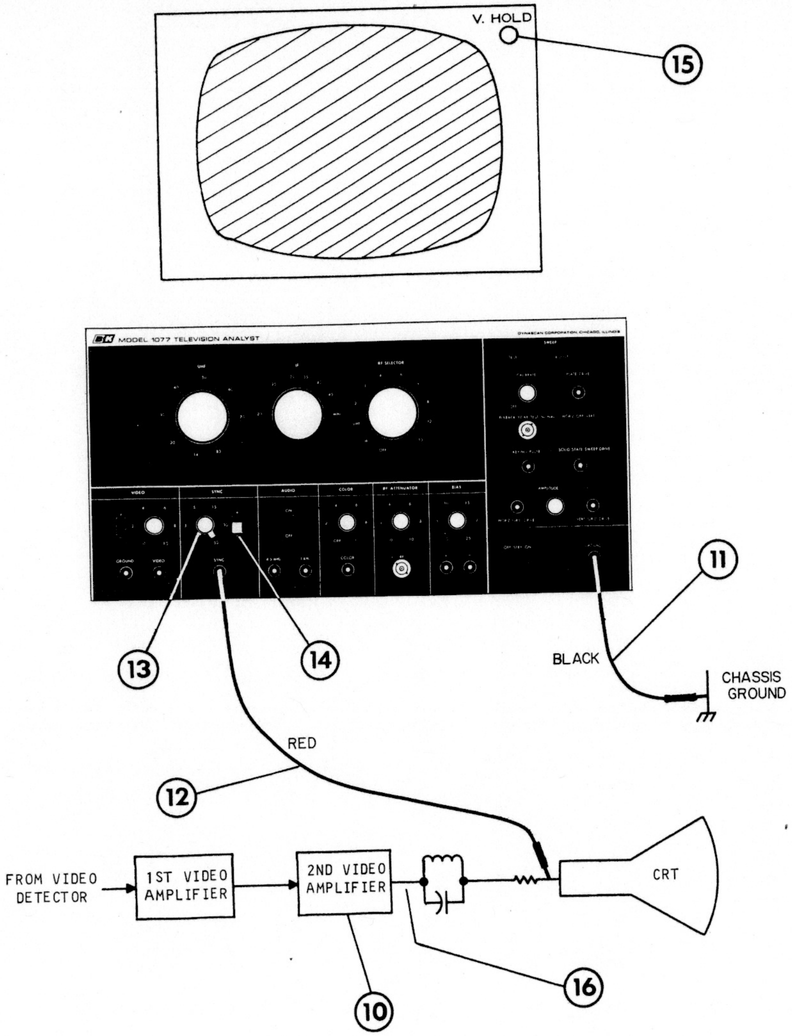


Figure 15. Sync Signal as High Amplitude Video Test Signal for Black and White Television Receiver

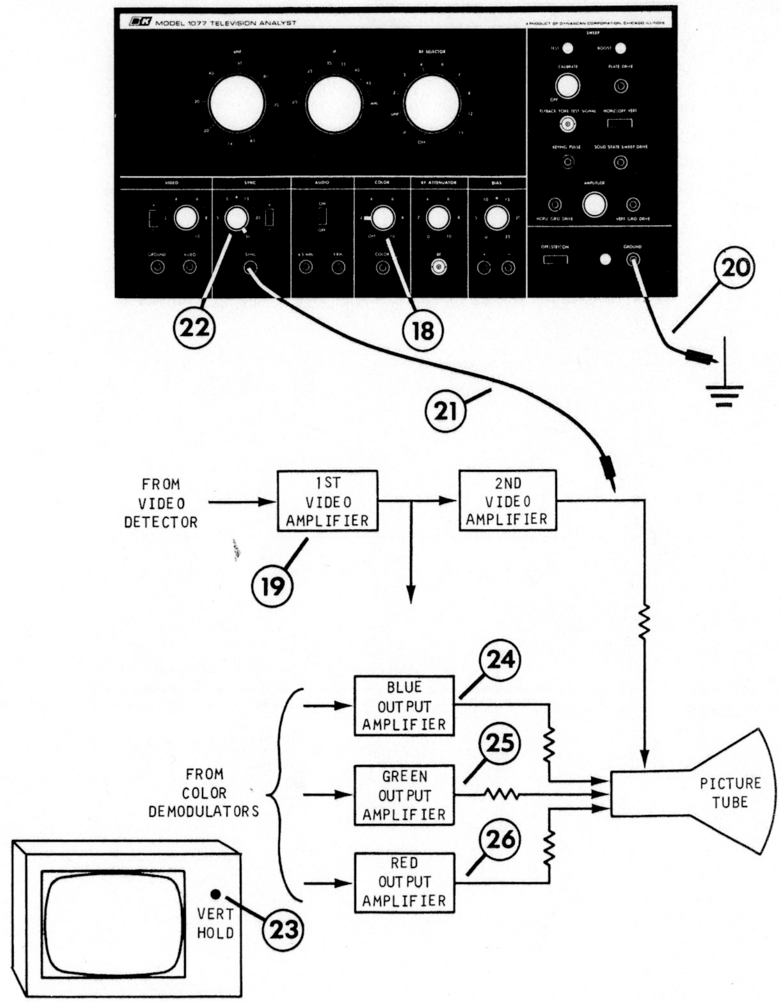


Figure 16. Sync Signal as High Amplitude Video Test Signal for Color Television Receiver

F. 4.5 MHz AND 1 KHz SIGNALS

(See Figures 17 and 18)

1. Leave the vhf signal injected at the antenna terminals as in step 1 of the *Video Signal* procedure.
2. Remove the 3rd i-f amplifier tube. Jumper the filament pins if series filaments are used. This simulates a trouble with symptoms of no video and no audio (although normal troubleshooting techniques for such a sympton would begin in the i-f section, for demonstration purposes we will check the audio section).
3. Connect the black test lead from the GROUND jack to the grounded side of the speaker voice coil. If the voice coil is ungrounded, either side will do.
4. Connect the red test lead from the 1 KHz jack to the other side of the speaker voice coil. The AUDIO ON-OFF switch may be in either position, the 1 KHz signal is still available. A low volume 1 KHz audio tone will be heard from the speaker. This listening test checks speaker operation.
5. Now, connect the black test lead from the GROUND jack to the chassis of the television receiver.
6. Connect the red test lead to the input of the audio output amplifier. The 1 KHz audio tone will be heard at a louder volume. This test checks the ability of the stage to amplify, and whether or not undue distortion is introduced by the stage.
7. Move the red test lead to the input of the 1st audio amplifier. The 1 KHz audio tone will be heard at a still louder volume. This proves that the trouble lies prior to the 1st audio amplifier.
8. Move the red test lead to the output of the audio detector. There will be less volume (unless the volume control is set at maximum) because of the attenuation of the volume control.
9. Adjust the volume control through its entire adjustment range and listen for a smooth change of loudness at the speaker. Also check for the introduction of distortion. Because the audio is heard at the speaker, the trouble is known to be located before the volume control.
10. Connect the red test lead from the 4.5 MHz jack to the input of the audio detector.
11. Set the AUDIO ON-OFF switch to ON. The 1 KHz audio tone will still be heard at the speaker, proving that the audio detector is operating properly.
12. Move the red test lead to the input of the 4.5 MHz sound i-f amplifier. A louder 1 KHz audio tone should be heard at the speaker. This test checks the amplifying ability of the stage.
13. Move the red test lead to the input of the video detector. The sound is still heard, which indicates that the trouble is located in the i-f section.
14. Remove the red test lead and replace the 3rd i-f amplifier tube. Remove filament jumper wire, if used.

G. COLOR SIGNAL

(See Figures 19 and 20)

1. Leave the vhf signal injected at the antenna terminals as in step 1 of the *Video Signal* procedure.
2. Set the COLOR control to 1 (color generator on). The color bar pattern will be superimposed on on the black and white test pattern.
3. Remove the 1st color i-f amplifier tube (this stage is also called the 1st bandpass amplifier or 1st chroma i-f amplifier on many schematics). This simulates a trouble with the symptoms of no color, but black and white reception is normal.
4. Make sure the black test lead is still connected from the GROUND jack to the chassis of the television receiver.
5. Connect the red test lead from the COLOR jack to the input of the demodulators.
6. Set the COLOR control to 10. A rainbow color pattern will be displayed (the rainbow color pattern available at the COLOR jack is not broken into color bars). A "barber pole" effect will be noticed in the color display in some sets because there is no color synchronization (the burst amplifier has no input).
7. Move the red test lead to the input of the 2nd color i-f amplifier (2nd bandpass amplifier or 2nd chroma i-f amplifier). No color will be displayed because the color killer is not biased into conduction.
8. Bias the color killer into conduction by turning the intensity control (or its equivalent in the color killer circuit) to maximum. The rainbow color pattern will again be displayed, without color sync. The colors will be brighter, which demonstrates the amplifying ability of the 2nd color i-f amplifier.
9. Reduce the COLOR control setting for light colors.
10. Move the red test lead to the output of the 1st color i-f amplifier (1st bandpass amplifier or 1st chroma i-f amplifier). A rainbow pattern with color sync should now be displayed. This demonstrates that the burst amplifier and oscillator control circuitry are operating properly.
11. Move the red lead to the input of the 1st color i-f amplifier. The rainbow pattern will disappear. The trouble is known to be located between the input and output of the 1st color i-f amplifier.
12. Remove the red test lead and replace the 1st color i-f amplifier tube. Readjust the intensity control (or its equivalent in the color killer circuit) for no color during black and white only reception.

13. Remove the burst amplifier tube. This simulates a trouble with symptoms of no color sync ("barber pole" effect).
14. Connect the red test lead from the COLOR jack to the input of the oscillator control (or automatic phase control) stage.
15. Set the COLOR control to 10. Color sync should be restored.
16. Set the COLOR control to 1.
17. Move the red test lead to the input of the burst amplifier. Color sync is lost. The trouble is isolated to the burst amplifier or the horizontal flyback pulse input path.
18. Remove the red test lead and replace the burst amplifier tube. Return the COLOR control to the OFF position.

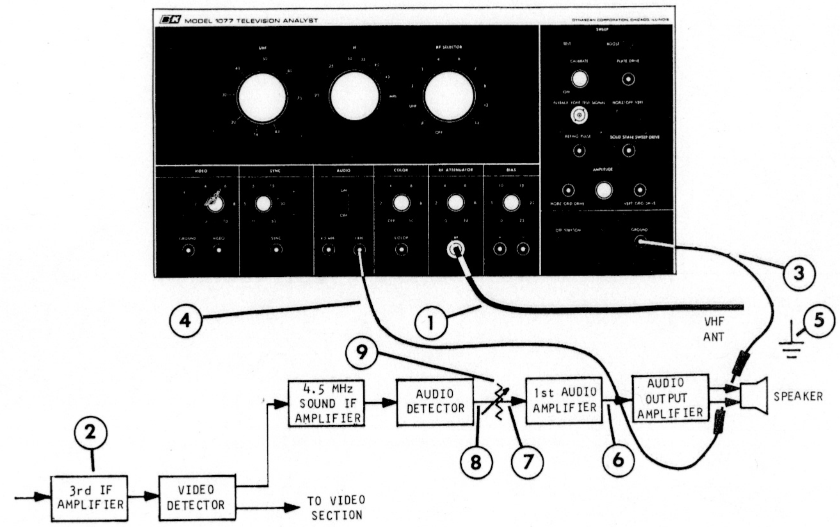


Figure 17. Connections for 1 KHz Signal

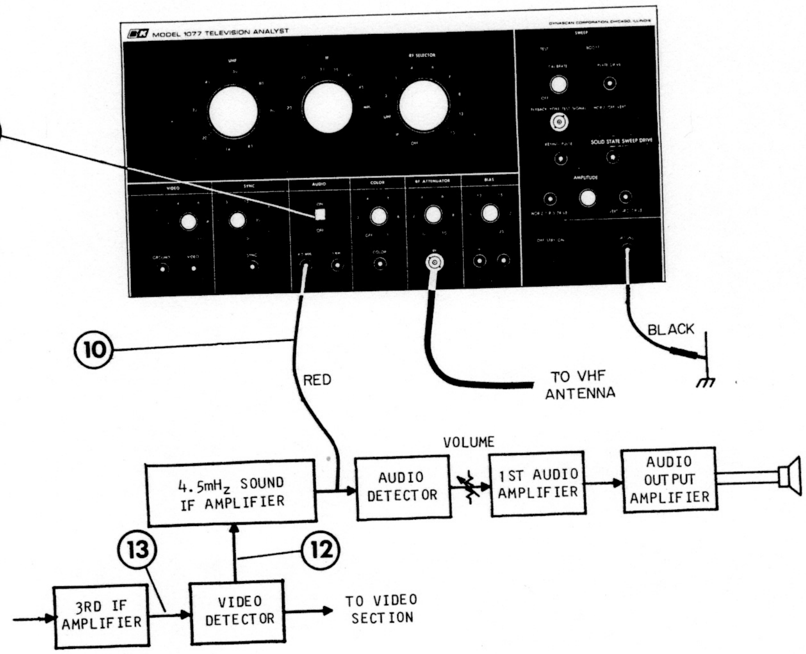


Figure 18. Connections and Control Settings for 4.5 MHz Signal

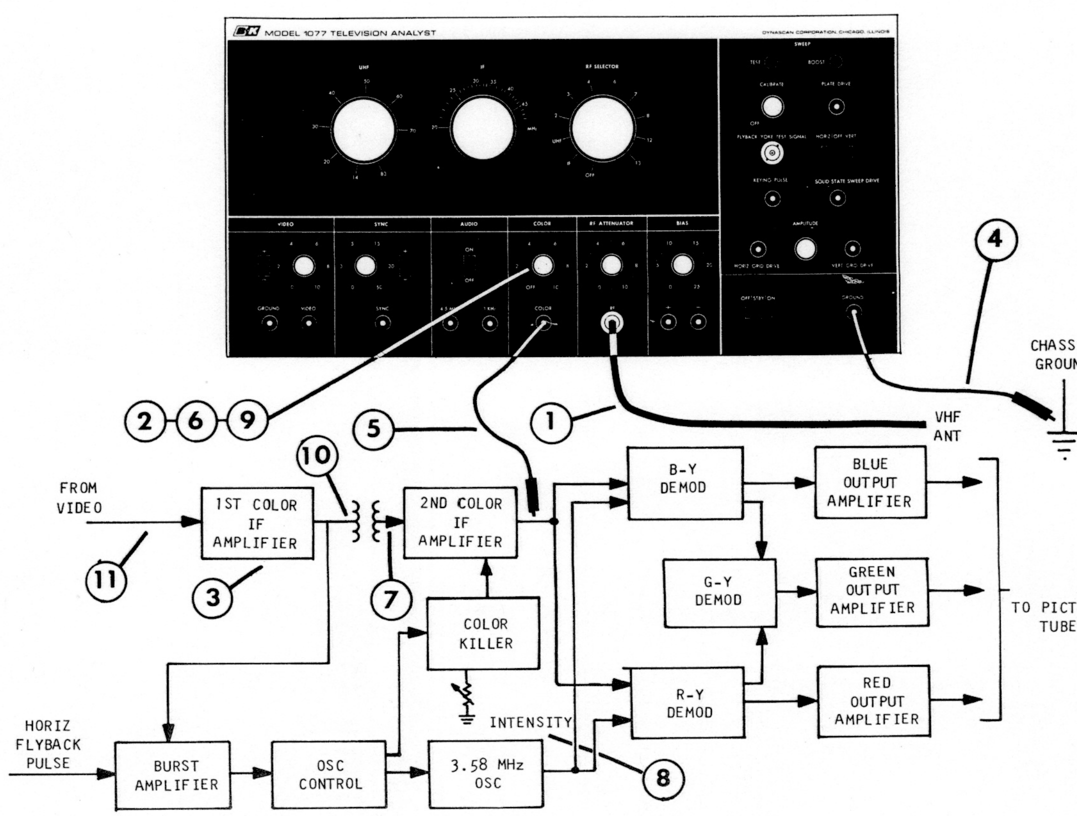


Figure 19. Connections for Color Signal in Color IF Stages

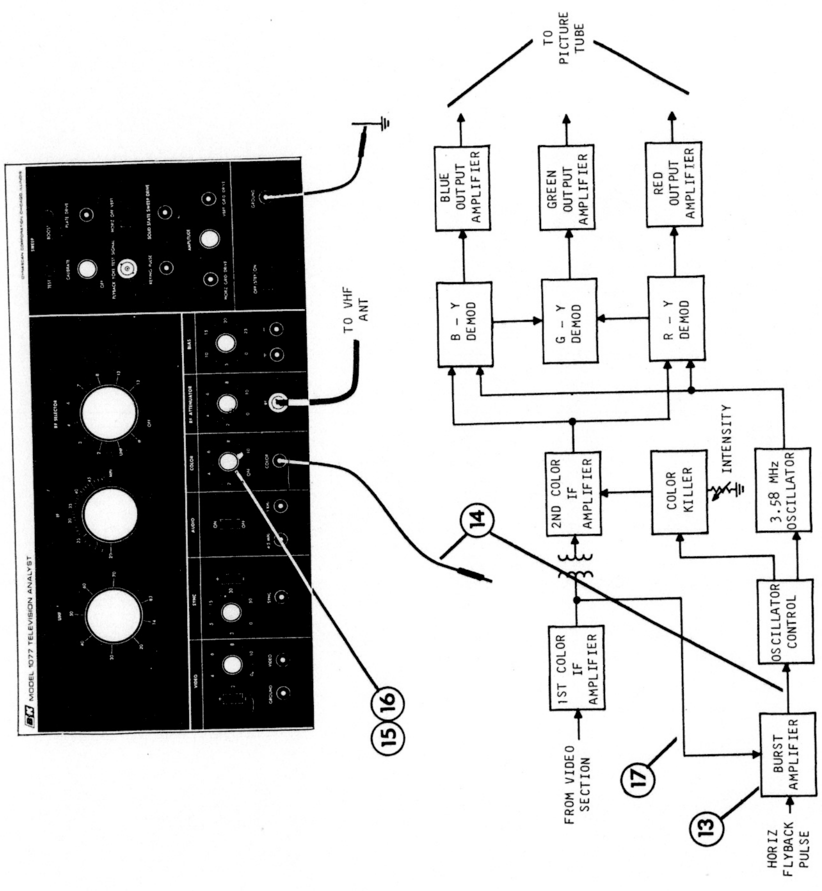


Figure 20. Connections for Color Sync Stages

H. BIAS VOLTAGE

(See Figues 21-22-23)

The bias voltage is a low dc voltage source, suitable for substitution in agc (automatic gain control) circuits, color oscillator control circuits, afc (automatic frequency control) circuit for horizontal oscillators, aft (automatic fine tuning) circuits, fine tuning indicator circuits, dc amplifiers and regulators, and similar dc circuits in television receivers. The low impedance bias signal "takes over" from the normal signal when it is injected. Testing of circuits is performed by adjusting the bias voltage and observing its effect.

The bias voltage is obtained from a "floating" power supply that can be referenced to any dc voltage desired, or chassis ground, by connection of test leads. Positive or negative voltage is obtained by proper lead connection.

CAUTION

In transistorized circuits, too much bias voltage can easily and instantaneously burn out a transistor. Do not exceed the asterisk (*), which is located at 12.5 volts on the BIAS control, unless you are absolutely sure the transistor requires more voltage for normal operation. As a precaution, always return the BIAS control to 0 before changing the voltage injection point and when not being used.

Steps 1 through 7 demonstrate the use of the bias voltage to test the agc circuit of a vacuum tube television receiver.

1. Leave the vhf signal injected at the antenna terminals as in step 1 of the *Video Signal* procedure.
2. Connect the black test lead from the POSITIVE BIAS jack to the agc reference (usually chassis ground).
3. Connect the red test lead from the NEGATIVE BIAS jack to the agc line.
4. Adjust the BIAS control for the best picture on the television receiver.
5. Turn the BIAS control toward 0. Contrast will increase, then the picture will distort.
6. Turn the BIAS control toward 25. Contrast will decrease, the picture will get dim, and finally disappear.
7. Remove the test leads. Turn the BIAS control to 0.

In vacuum tube circuits, agc is always a negative voltage which is applied to the grids of the rf and i-f amplifiers to control the gain of those stages. When the voltage approaches zero, gain is very high. If a strong signal is applied in this condition, the stages will be overloaded. The signal will be clipped causing over-contrast, distortion, and loss of sync. When the voltage is increased, the gain of the stages decreases and the picture becomes weaker. Normally, at 6 to 12 volts, the picture disappears entirely because the amplifiers are completely cut off.

Steps 8 through 17 demonstrate the use of the bias voltage in an agc circuit of a transistorized television receiver.

8. Leave the vhf signal injected into the antenna terminals as in step 1 of the *Video Signal procedure.*
9. Set the BIAS control to 0.
10. For testing agc action in a PNP transistor, connect the black test lead from the POSITIVE BIAS jack to the emitter of the amplifier. This is the reference point.
11. Connect the red test lead from the NEGATIVE BIAS jack to the agc line.

CAUTION

Always try to connect so that the resistor is located between the point of connection and the base of the transistor. There is usually only a few tenths of a volt difference of potential between the base and emitter. The resistor will absorb much of the voltage difference and permit a wider adjustment range for the BIAS control without burning out the transistor.

12. The picture will probably disappear because the transistor is cut off. Turn the BIAS control clockwise and note that the test pattern will reappear, get darker, then distort and lose sync. Do not increase the setting beyond the asterisk (*) mark.
13. Return the BIAS control setting to 0.
14. For testing agc action in an NPN transistor, connect the black test lead from the NEGATIVE BIAS jack to the emitter of the amplifier (chassis ground may be used if the emitter is connected to ground through a small resistance).
15. Connect the red test lead from the POSITIVE BIAS jack to the agc line (see the CAUTION after step 11). The picture will be blank because the transistor is cut off.
16. Increase the setting of the BIAS control and note the effect upon the display. The test pattern will reappear, get darker, then distort and lose sync. Do not increase the setting beyond the asterisk (*) mark.
17. Remove the test leads and return the BIAS control to 0.

In transistorized circuits agc is a forward bias. In PNP transistors the base is negative with respect to the emitter to produce forward bias. In NPN transistors, the base is positive with respect to the emitter. At zero potential difference, the transistor is cut off and no picture appears. As the forward bias is increased, the gain increases until overloading occurs.

Steps 18 through 23 demonstrate the use of the bias voltage in an acc (automatic color control) circuit of a color television receiver.

18. With vhf signal injected at the antenna terminals as in step 8, set the COLOR control to 1. The color bar pattern will be superimposed on the video test pattern.

19. Set the BIAS control to 0.

20. If a vacuum tube circuit, connect the black test lead from the POSITIVE BIAS jack to the chassis of the television receiver. If an NPN transistor is used as the 1st color i-f amplifier, connect the black test lead from the NEGATIVE BIAS jack to the emitter of the 1st color i-f amplifier. If a PNP transistor is used as the 1st color i-f amplifier, connect the black test lead from the POSITIVE BIAS jack to the emitter of that stage. If it is uncertain whether an NPN or PNP transistor is being used, an NPN transistor will use a positive collector source voltage and a PNP transistor will use a negative collector source voltage.

21. Connect the red test lead from the other BIAS jack to the acc line. In a vacuum tube circuit, there will be brilliant color. In transistorized circuits, there will be no color.

22. Increase the BIAS control setting and note the effect upon the color. In the vacuum tube circuit, color will decrease and cut off as the setting is increased. In the transistorized circuit, color will increase as the setting is increased. (Do not exceed the asterisk (*) mark.)

23. Remove the test leads from the BIAS jacks, return the BIAS control to 0, and return the COLOR control to OFF.

The bias signal can be used to test many other dc circuits in television receivers by similar procedures.

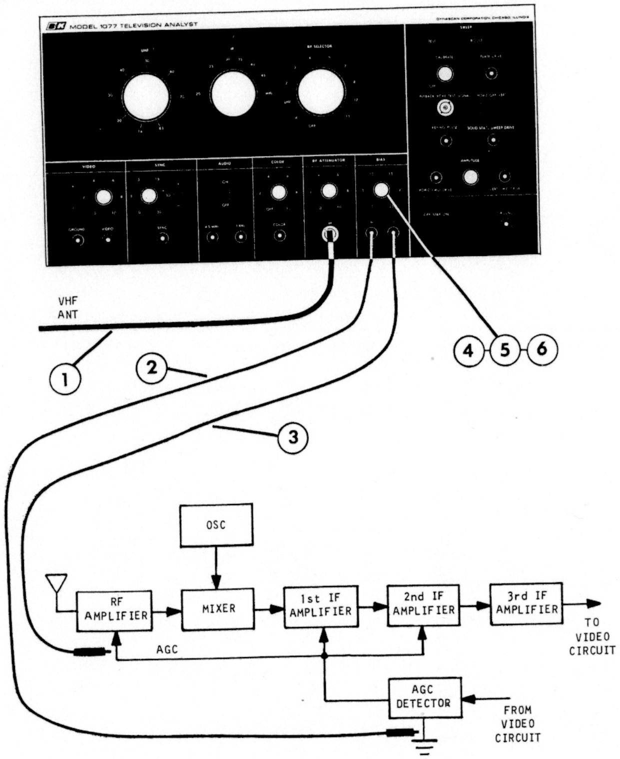


Figure 21. Bias Voltage Connections for AGC Circuit in Vacuum Tube Television Receiver

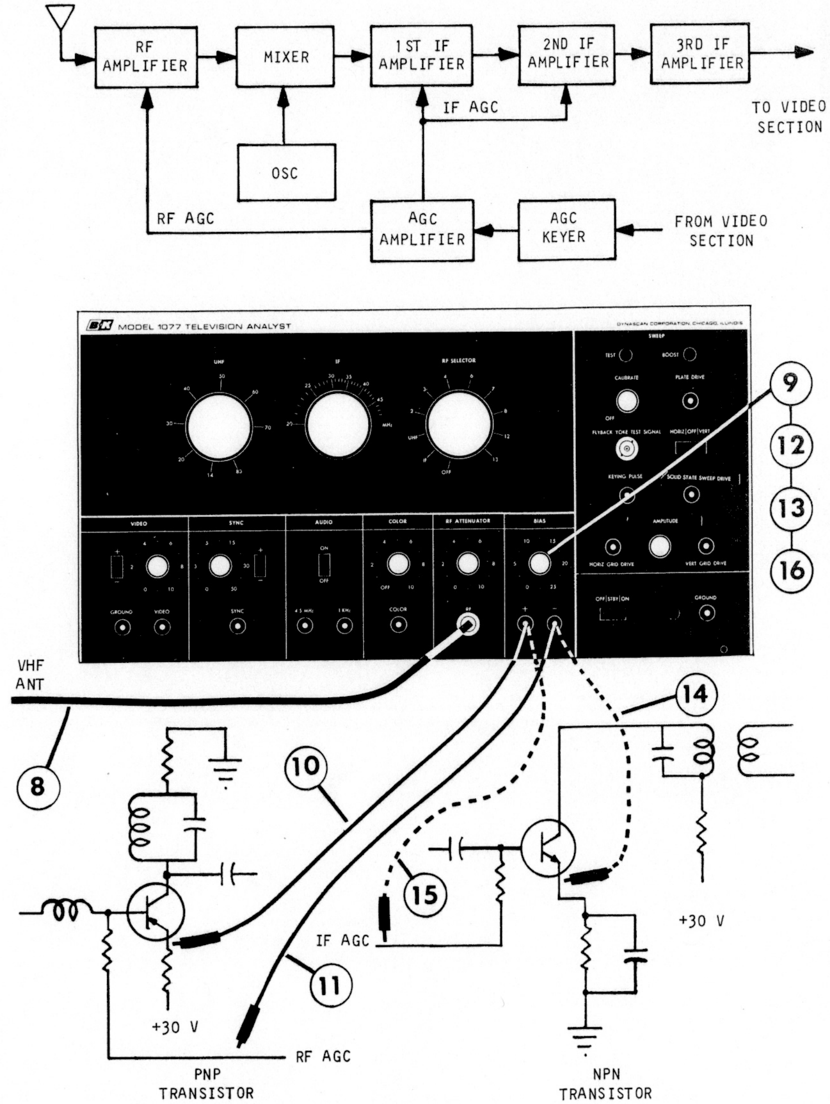


Figure 22. Bias Voltage Connections for AGC Circuit in Transistorized Television Receiver

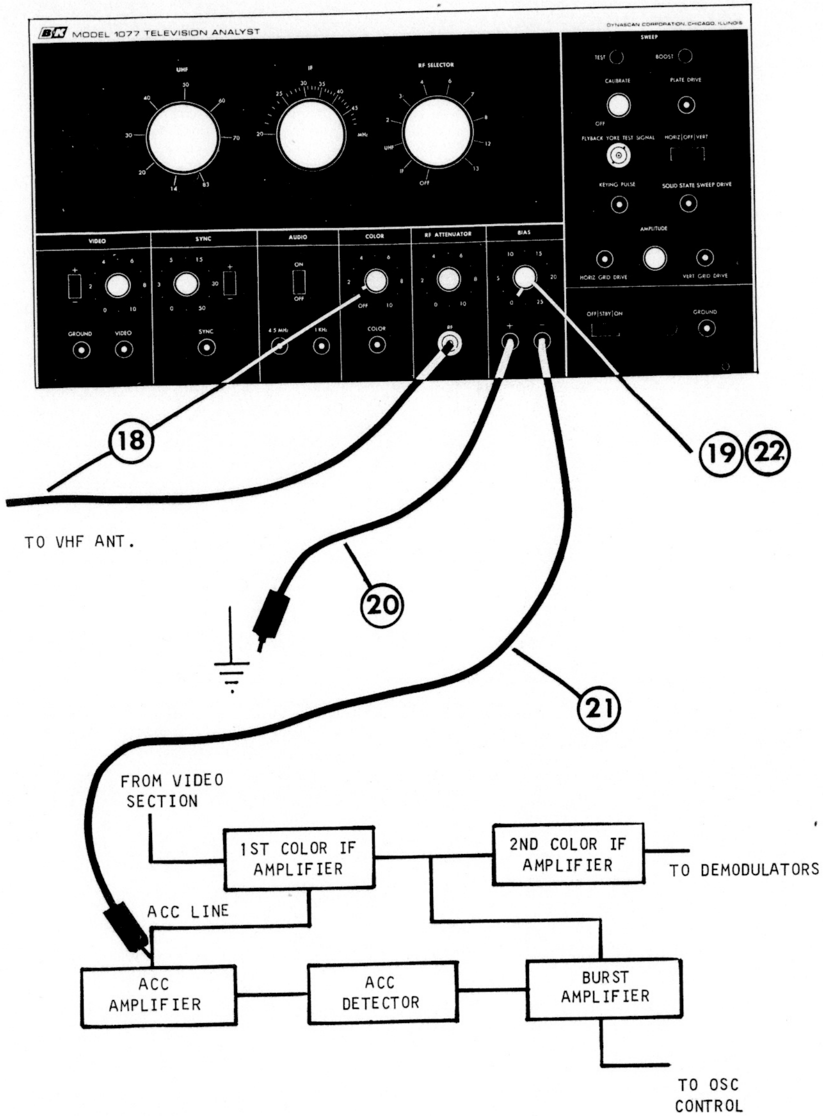


Figure 23. Bias Voltage Connection for Automatic Color Control (ACC) Circuit

I. VERTICAL GRID DRIVE SIGNAL
(See Figure 24)

Troubleshooting vertical circuits with the TELEVISION ANALYST is easily accomplished by the use of VERTICAL GRID DRIVE and VERTICAL PLATE DRIVE. The VERTICAL GRID DRIVE signal is designed to substitute for the signal driving the output amplifier. (VERTICAL PLATE DRIVE is covered in another section of this manual.)

The VERTICAL GRID DRIVE output of the ANALYST is adjustable in amplitude to better match a wider variety of receivers. When using the output, the control is normally set to half of the setting and can be adjusted if necessary to fill out the raster of the receiver under test.

1. Inject the vhf signal at the antenna terminals of the receiver.
2. Disable vertical oscillator in receiver. This can be done by removing vertical oscillator tube or shorting the grid and cathode of the oscillator.
3. Connect black ground lead from the TELEVISION ANALYST to the chassis of the television receiver.
4. Connect red lead from VERTICAL GRID DRIVE jack to the grid of the vertical output tube.
5. Set AMPLITUDE control to approximately half of the full setting while noting on the screen that vertical deflection has been restored. The deflection may not be linear but it is adequate for proving that the TELEVISION ANALYST can substitute for a missing signal.
6. Restore proper operation of vertical oscillator (reinsert tube or remove grid to cathode short).

In the above test we simulated a typical service problem (no vertical sweep). Since vertical sweep was restored when the VERTICAL GRID DRIVE pulse was applied to the grid of the vertical output tube we pinpointed the trouble to the vertical oscillator since the vertical output tube, vertical output transformer and vertical yoke windings must be functioning properly in order to restore vertical sweep with the pulse from the TELEVISION ANALYST. When servicing a television receiver if the VERTICAL GRID DRIVE pulse does not restore vertical sweep the VERTICAL PLATE DRIVE and the SOLID STATE SWEEP DRIVE will pinpoint the defective stage and, in many cases, the exact component which is defective.

VERTICAL MULTIVIBRATOR

The second vertical oscillator system which has been widely used is the multivibrator. This consists of an integrating network, a vertical multivibrator, and a vertical output tube, etc.

1. Disable the multivibrator by opening feedback path from amplifier.

   NOTE

   This multivibrator feedback path usually consists of one or two capacitors from the amplifier plate circuit, to the oscillator grid circuit.
2. Connect black lead from GROUND jack of ANALYST to chassis ground of receiver.
3. Connect red lead from VERTICAL GRID DRIVE jack to the grid of vertical output amplifier.
4. If vertical sweep occurs on the screen of the receiver the output amplifier, output transformer and vertical yoke can be assumed to be okay. The sweep may not be linear and the raster may not fill the entire screen area but it can be judged qualitatively. If sweep does occur as noted above, the trouble must be elsewhere in the system.
5. Connect lead from SOLID STATE SWEEP DRIVE jack to grid of the oscillator. (NOTE—VERTICAL GRID DRIVE jack cannot be used because it will reach the grid of the vertical amplifier with incorrect polarity.)

If the circuit from grid of the oscillator to the deflection yoke is functioning properly the image will show sweep on the screen. The sweep may not be linear but will prove the ability of the oscillator to pass the vertical pulse. This test will determine whether the defect is in the oscillator and routine troubleshooting is necessary to further isolate defective components.

VERTICAL SOLID STATE SWEEP DRIVE
(See Figure 24a)

Transistorized vertical deflection circuit troubles can be isolated by using the SOLID STATE SWEEP DRIVE output signal.

Vertical solid state sweep drive is designed to substitute for a missing drive signal to the base of the output transistor or transistors, from the driver or oscillator. Troubleshooting using the VERTICAL SOLID STATE SWEEP DRIVE output is outlined below:

1. Leave the vhf signal injected at the antenna terminals as in step 1 of the video signal procedure.
2. Disconnect power source to receiver.
3. Connect red lead from SOLID STATE SWEEP DRIVE jack to the base of the vertical output amplifier transistor. HORIZ OFF VERT switch in the VERT position.
4. Connect black lead from GROUND jack to chassis ground of receiver.
5. Set AMPLITUDE control to maximum rotation.
6. Reapply power to receiver. If vertical deflection is produced the vertical output amplifier transistor is good. Go to step 7.
7. Disconnect power source to receiver. Remove red test lead from the base of the vertical output amplifier transistor and connect to the base of the driver transistor. Set AMPLITUDE to approximately ¼ rotation.
8. Reapply power to receiver. If vertical deflection is produced the vertical driver transistor is good. Go to step 9.
9. Disconnect power source to receiver. Remove red test lead from the base of the vertical driver transistor and connect to the base of the oscillator transistor. Set AMPLITUDE to approx. ¼ rotation.

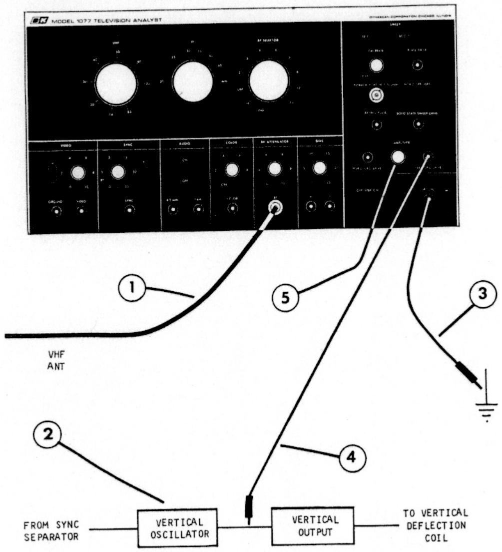


Figure 24. Connections for Vertical Grid Drive Signal

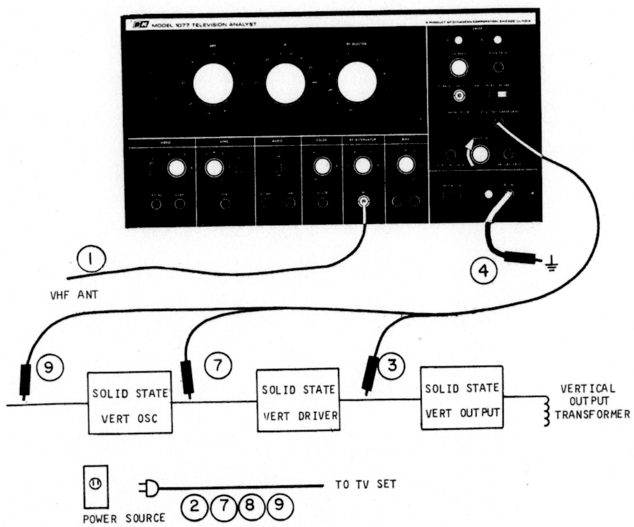


Figure 24a. Connections for Solid State Sweep Drive

J. HORIZONTAL GRID DRIVE SIGNAL

(See Figure 25)

Horizontal deflection troubles can be isolated using the HORIZ GRID DRIVE or HORIZONTAL PLATE DRIVE outputs. (Horizontal plate drive is covered in another section of this manual.)

Horizontal grid drive is designed to substitute for a missing or distorted driving signal to the horizontal output amplifier. (CAUTION — A receiver should never be operated without a proper driving signal applied to the horizontal amplifier. These amplifiers are normally operated Class "C" and excessive current drain and overheating will occur when the driving signal is absent.) Troubleshooting using the HORIZONTAL GRID DRIVE jack is outlined below:

CAUTION

Do not use the HORIZ GRID DRIVE jack signal in transistorized television receivers.

1. Leave the vhf signal injected at the antenna terminals as in step 1 of the Video Signal procedure.
2. Disconnect power source to receiver.
3. Remove the horizontal oscillator tube or otherwise disable the oscillator. This simulates a trouble with symptoms of no raster.
4. Remove plate cap from high voltage rectifier.
5. Connect high voltage indicator lamp to the insulated wire going to the plate cap disconnected in Step 4.
6. Connect red lead from HORIZONTAL GRID DRIVE jack to the grid of the horizontal amplifier.
7. Connect black lead from GROUND jack to chassis ground of receiver.
8. Reapply power to receiver. If lamp glows, it indicates the presence of high level RF pulses on the plate cap lead of the high voltage rectifier. If lamp does not glow, no RF is present and trouble has been isolated to horizontal amplifier or flyback transformer. Step 9 and 10 are not necessary and analyzing components in horizontal amplifier or flyback should determine defect.
9. Turn off power to receiver and reconnect the lead to the plate of the high voltage rectifier that was disconnected in step 2.
10. Reapply power. If the high voltage indicator remains lit, high voltage should be present and deflection should be observed on the face of the CRT (no deflection on the CRT with the high voltage indicator lamp lit indicates a defective high voltage rectifier circuit).

If application of a driving pulse to the horizontal amplifier resulted in restoring operation to the receiver, the trouble must lie in the horizontal oscillator circuit.

Troubles such as oscillator off frequency, dead or weak oscillator may be isolated in this manner.

Horizontal multivibrator circuits may also be tested using the horizontal grid drive. The procedure is similar to troubleshooting vertical multivibrators. Each section of the horizontal multivibrator can be tested separately to determine which section is at fault.

Multivibrators must have the ability to amplify. Therefore, if signal injection is used through the multivibrator, a specific point of failure can be determined.

HORIZONTAL SOLID STATE SWEEP DRIVE

(See Figure 25a)

Transistorized horizontal deflection circuit troubles can be isolated by using the SOLID STATE SWEEP DRIVE output signal.

Horizontal solid state sweep drive is designed to substitute for a missing drive signal to the base of the output transistor or transistors, from the drivers, buffer or oscillator. Troubleshooting using the horizontal solid state sweep drive output is outlined below:

1. Leave the vhf signal injected at the antenna terminals as in step 1 of the Video Signal procedure.
2. Disconnect power source to receiver.
3. Remove plate cap from high voltage rectifier.
4. Connect high voltage indicator lamp to the insulated wire going to the plate cap disconnected in Step 3.
5. Connect red lead from SOLID STATE SWEEP DRIVE jack to the base of the horizontal output amplifier transistor. HORIZ OFF VERT switch in the HORIZ position. AMPLITUDE control should be set to ¾ of full rotation.
6. Connect black lead from GROUND jack to chassis ground of receiver.
7. Reapply power to receiver. If lamp glows, it indicates the presence of high level RF pulses on the plate cap lead of the high voltage rectifier. If lamp does not glow, no RF is present and trouble has been isolated to horizontal amplifier or flyback transformer. Step 8 and 9 are not necessary and analyzing components in horizontal amplifier or flyback should determine defect.
8. Turn off power to receiver and reconnect the lead to the plate of the high voltage rectifier that was disconnected in step 3.
9. Reapply power. If the high voltage indicator remains lit, high voltage should be present and deflection should be observed on the face of the CRT (no deflection on the CRT with the high voltage indicator lamp lit indicates a defective high voltage rectifier circuit).

If application of a driving pulse to the horizontal amplifier resulted in restoring operation to the receiver, the trouble must lie in the horizontal oscillator, buffer or driver.

Repeat steps 1 through 9 for the driver, buffer and oscillator using a slightly lower setting of the AMPLITUDE control for each stage preceding the output amplifier.

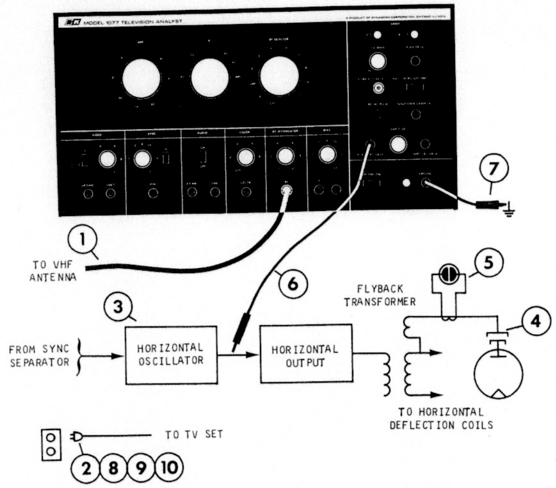


Figure 25. Connections for Horizontal Grid Drive Signal

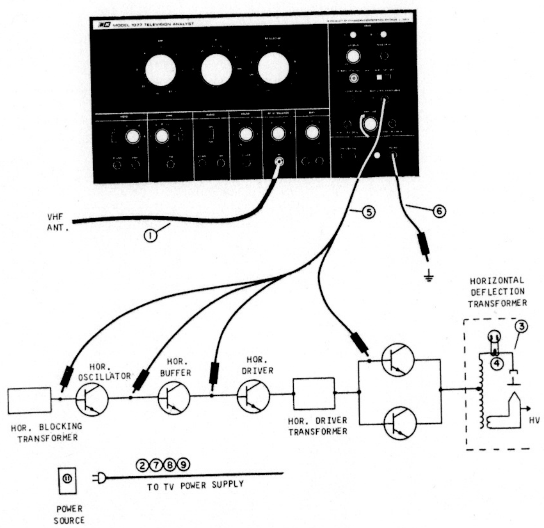


Figure 25a. Connections for Horizontal Solid State Sweep Drive

K. VERTICAL PLATE DRIVE SIGNAL

(See Figure 26)

1. Leave the vhf signal injected at the antenna as in step 1 of the *Video Signal* procedure.
2. Remove power from the television receiver.

   WARNING

   Disconnect power before making connections. High voltage is present in this circuit.
3. Remove the vertical output amplifier tube. This simulates a trouble with symptoms of no vertical deflection.
4. Connect the black test lead from the GROUND jack to the chassis of the television receiver.
5. Connect the red test lead from the PLATE DRIVE jack to the plate pin of the tube socket from which the vertical output amplifier tube was removed.
6. Place the HORIZ-OFF-VERT switch in the VERT position.
7. Apply power to the television receiver. Vertical sweep will be provided. It may be non-linear, but its operation proves that the vertical output transformer and deflection coils are operating. The AMPLITUDE control adjusts the size of the pattern.
8. Remove power from the receiver, remove the red test lead, replace the vertical output amplifier tube, and return the HORIZ-OFF-VERT switch to OFF.

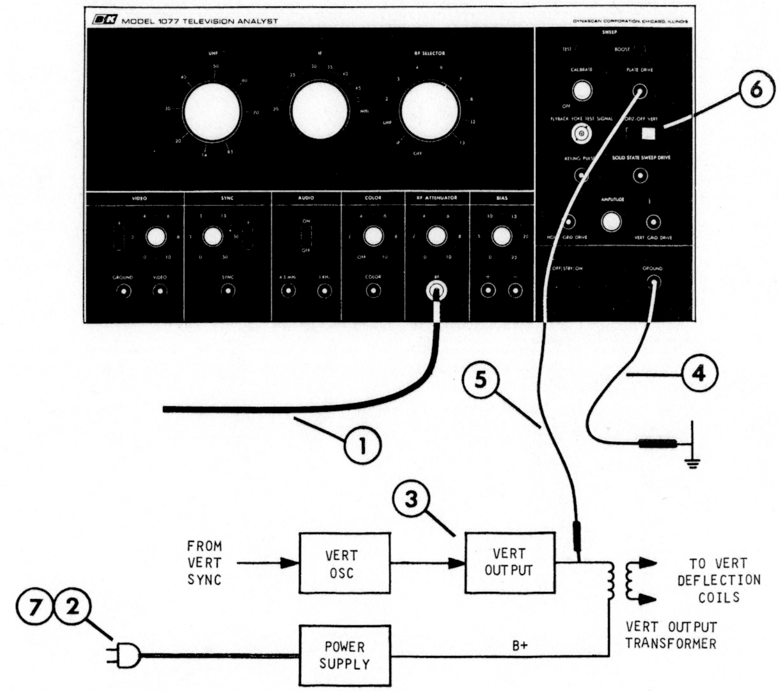


Figure 26. Connections for Vertical Plate Drive Signal

L. HORIZONTAL PLATE DRIVE SIGNAL AND BOOST INDICATOR

(See Figure 27)

WARNING

Disconnect power before making connections. High voltage is present in this circuit.

1. Leave the vhf signal injected at the antenna as in step 1 of the *Video Signal* procedure.
2. Remove power from the television receiver.
3. Remove the plate cap from the horizontal output amplifier tube. This simulates a trouble with symptoms of no raster. If the tube does not have a plate cap, disconnect the plate lead from the tube socket.
4. Connect the black test lead from the GROUND jack to the chassis of the television receiver.
5. Connect the red test lead from the PLATE DRIVE jack to the plate lead that was removed from the horizontal output amplifier.
6. Place the HORIZ-OFF-VERT switch in the HORIZ position.
7. Apply power to the television receiver. Horizontal sweep will be restored.
8. The BOOST INDICATOR lamp will light showing that B+ boost voltage is being developed.
9. Remove power from the television receiver, remove the red test lead, replace the plate connection to the horizontal output amplifier tube, and return the HORIZ-OFF-VERT switch to the OFF position.

M. KEYING PULSE

(See Figure 28)

Some circuits in a TV receiver are biased to cut off and operate only during the retrace period. These circuits (AGC—Blanker—Burst amp., etc.) are turned on by a pulse from the flyback transformer. This pulse has enough amplitude to overcome the cut off bias and allow the circuits to operate. The KEYING PULSE provides a pulse (approximately 400V peak to peak) that may be used to test these circuits.

AGC

1. Leave the vhf signal injected at the antenna terminals as in step 1 of the *Video Signal* procedure.
2. Remove power from the television receiver.
3. Unsolder the connection from the flyback transformer to the agc keyer stage.
4. Reapply power; the picture will have too much contrast and be overloaded.
5. Connect the black test lead from the GROUND jack to the chassis of the television receiver.
6. Connect the red test lead from the KEYING PULSE jack to the plate of the agc keyer tube. The picture will return to normal.
7. Remove the red test lead, and replace the connection from the flyback transformer to the agc keyer stage.

OTHER USES OF KEYING PULSE

The KEYING PULSE can be used to test other circuits requiring a high level pulse with occurs at flyback. Color killer, burst amplifier, and blanker circuits in the chroma section of a color receiver are typical examples.

1. Leave the vhf signal injected at the antenna terminals as in step 1 of the *Video Signal* procedure.
2. Remove power from the television receiver.
3. Unsolder the connection from flyback transformer to the circuit to be tested.
4. Connect the black test lead from the GROUND jack to the chassis of the television receiver.
5. Connect red lead from KEYING PULSE to the point from which flyback connection was disconnected in step 3 above. If normal operation of the receiver is restored by substituting signal from keying pulse jack, you can assume the defect is not caused by lack of keying pulse and routine voltage and resistance tests should then be made to locate defective parts or circuit.

CAUTION

Do not use the KEYING PULSE in transistorized circuits. The peak voltage (400 volts) far exceeds the breakdown voltage for most transistor circuits. Determine the normal operating pulse voltage from the schematic diagram for the television receiver. Often the SYNC pulse can be used in solid state circuits and tube type circuits requiring less than 400V peak to peak. Most blanking circuits for example use a pulse of 65V peak to peak. This may be tested with the SYNC pulse output from the Analyst. Use the procedure as outlined above except that the SYNC pulse is used instead of the KEYING PULSE.

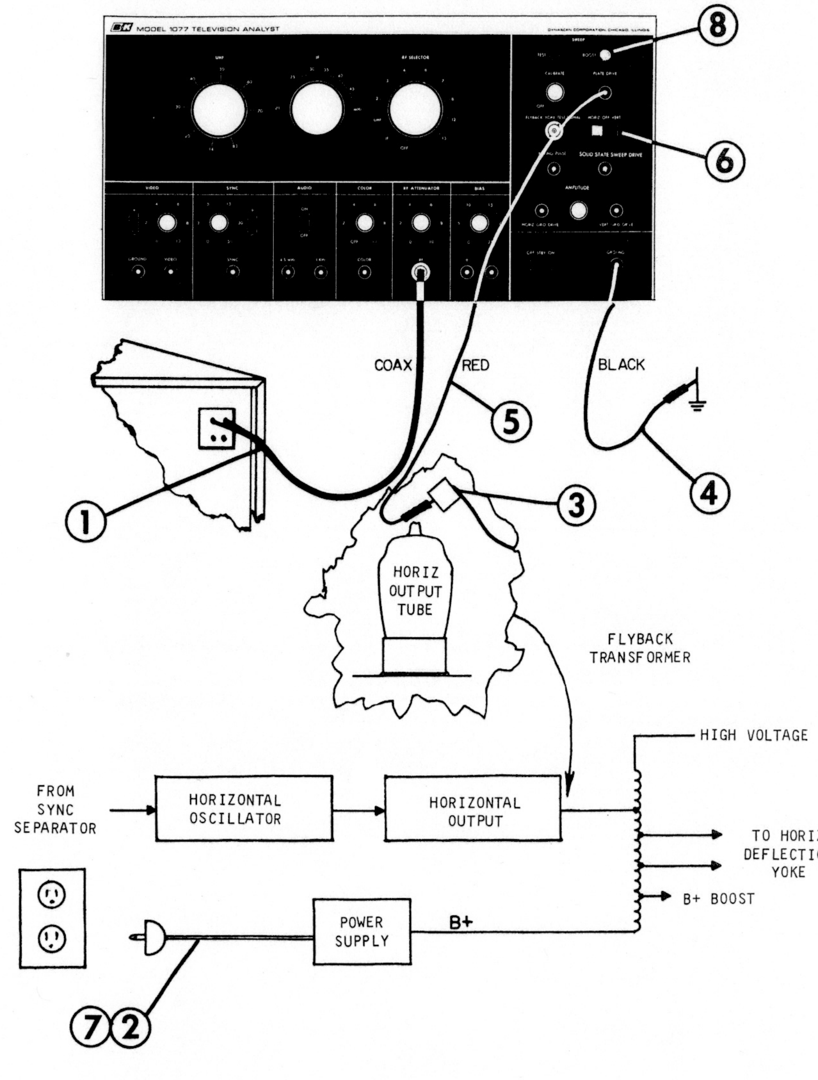


Figure 27. Connections for Horizontal Plate Drive Signal and B+ Boost Indicator

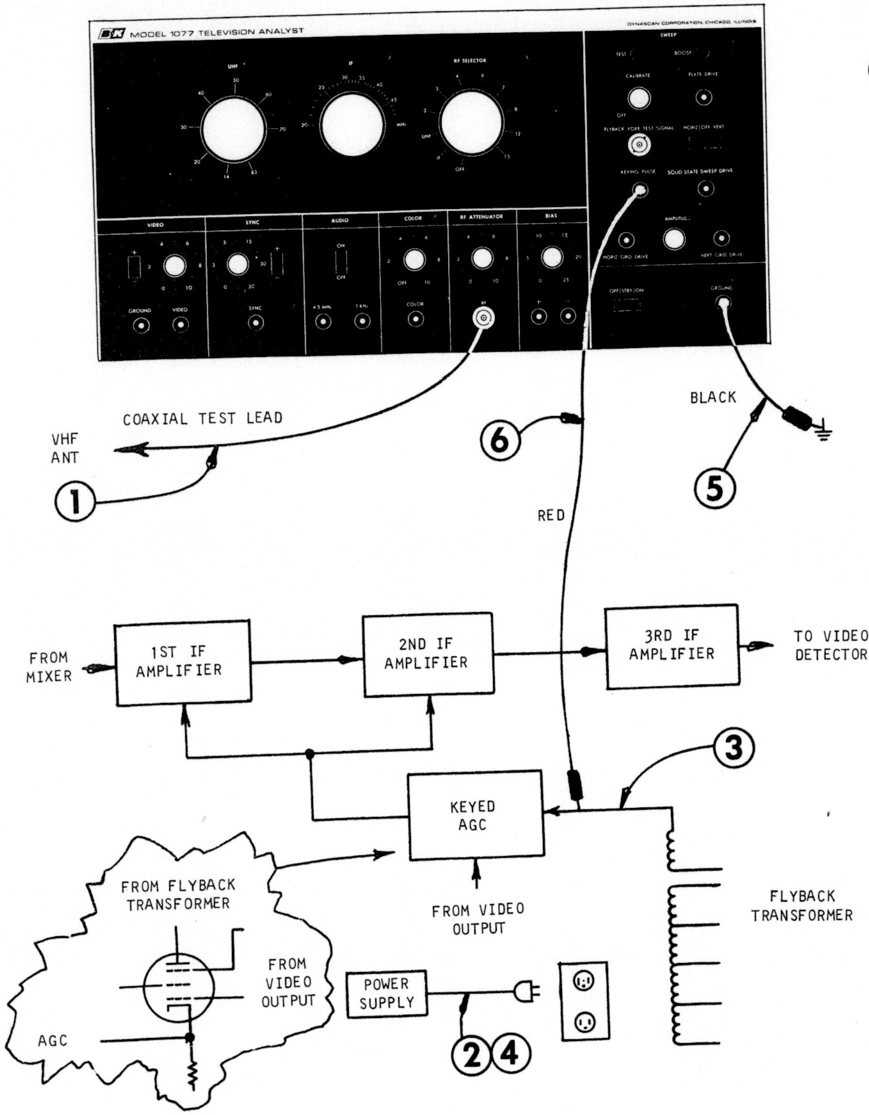


Figure 28. Connections for AGC Keying Pulse

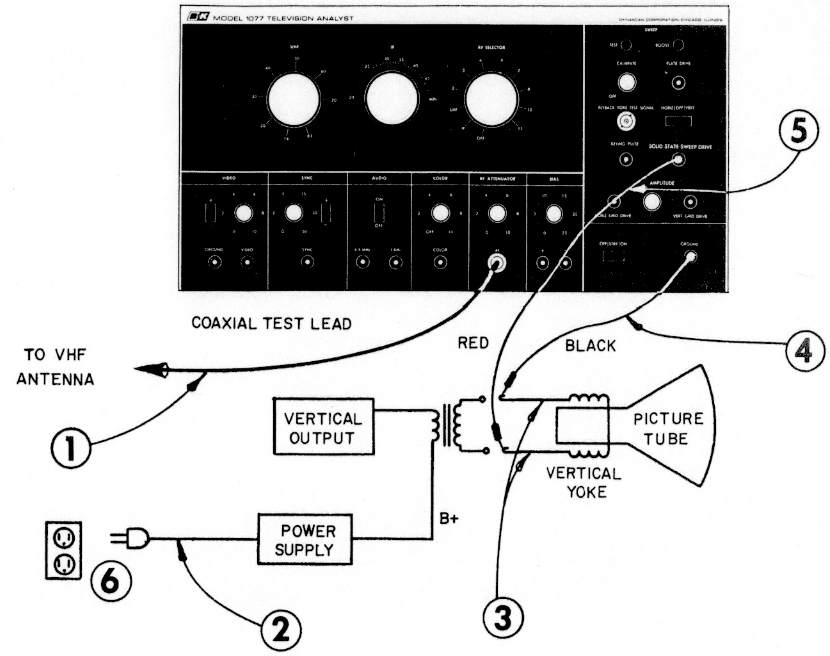


Figure 29. Connections for Vertical Yoke Test Signal

Figure 30. Display Developed Using Vertical Yoke Test Signal

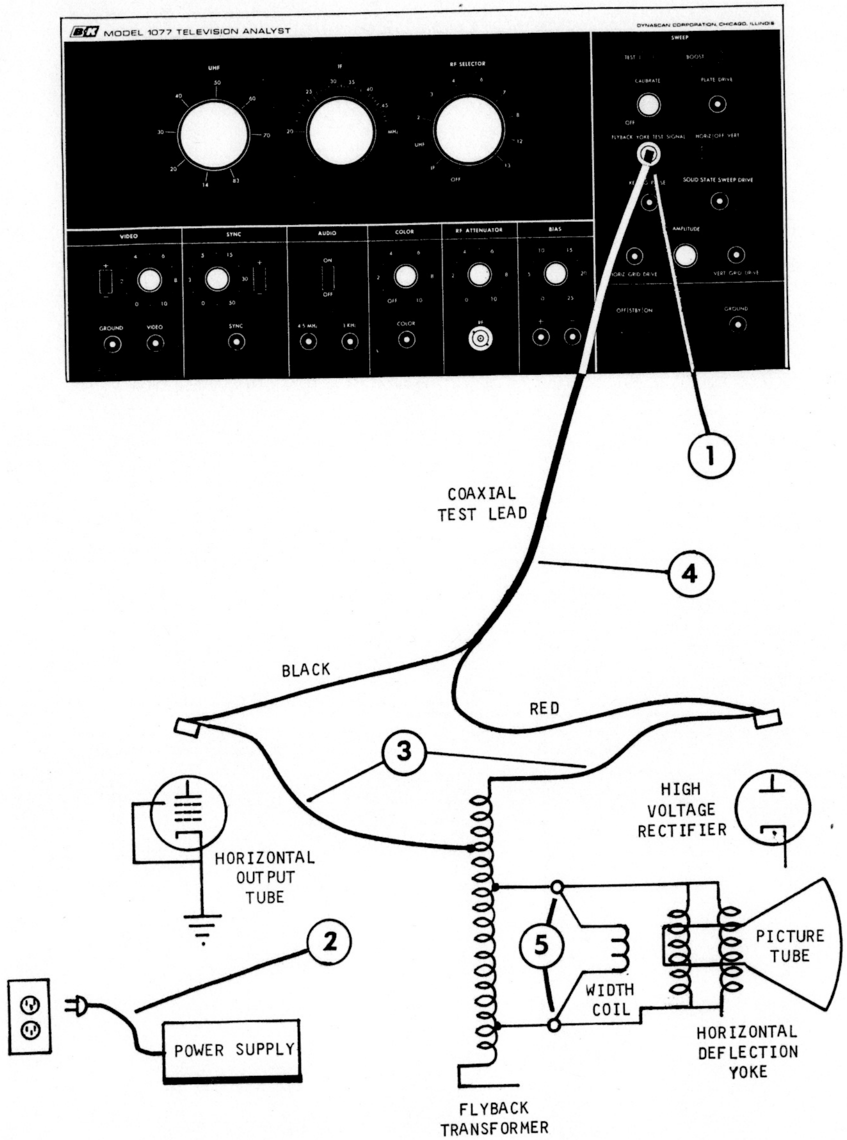


Figure 31. Connections for Flyback Yoke Test Signal

N. VERTICAL YOKE TEST

(See Figures 29 and 30)

1. Leave the vhf signal injected at the antenna terminals as in step 1 of the *Video Signal* procedure.
2. Remove power from the television receiver.
3. Disconnect the leads from the vertical deflection yoke.
4. Connect the black test lead from the GROUND jack to one side of the vertical deflection yoke.
5. Connect the red test lead from the SOLID STATE SWEEP DRIVE jack to the other side of the vertical deflection yoke.
6. Place the HORIZ-OFF-VERT switch in the VERT position.
7. Adjust the AMPLITUDE control for full sweep.
8. Remove power, disconnect the test leads, and reconnect the vertical yoke.

O. FLYBACK YOKE TEST SIGNAL

(See Figure 31)

Do not use this yoke test on vertical windings. Erroneous results will be obtained.

1. Turn the CALIBRATE control clockwise until the TEST INDICATOR lamp comes on; then turn slowly counterclockwise to the point where the TEST INDICATOR lamp barely goes off.
2. Remove power from the television receiver.
3. Disconnect the plate caps from the horizontal output tube and the high voltage rectifier.
4. Connect the coaxial test cable to the FLYBACK YOKE TEST SIGNAL jack. Clip the black lead of the coaxial test cable to the cap that was removed from the horizontal output tube. Clip the red lead of the coaxial test cable to the cap that was removed from the high voltage rectifier.

   If the TEST INDICATOR lamp glows, this indicates a short in the windings of the flyback transformer (or the horizontal deflection yoke which is connected across the flyback transformer; on some television receivers a width coil is also connected in parallel with the flyback transformer). *It will respond to as little as one shorted turn.*
5. If the TEST INDICATOR lamp glows during the test, disconnect the horizontal deflection yoke and width coil, one at a time, and repeat the test until the faulty component is located.
6. Remove the coaxial test lead and reconnect all circuits in the television receiver. Return the CALIBRATE control to OFF.

P. HIGH VOLTAGE TEST

(See Figure 32)

1. Remove power from the television receiver.
2. Clip the high voltage probe around the insulated wire that connects to the plate cap of the high voltage rectifier.
3. Remove the plate cap from the high voltage rectifier tube.
4. Reapply power to the television receiver.
5. If high voltage rf is present, the bulb in the high voltage probe will light. This proves that the high voltage is being developed properly in the flyback transformer.
6. Again remove power from the television receiver.
7. Replace the plate cap on the high voltage rectifier tube.
8. Reapply power. If the bulb is still lit, the entire high voltage circuit is good. If the bulb goes out, there is a short circuit in the dc output path of the rectifier. The short kills the high voltage rf oscillations.
9. Remove power from television receiver and remove the high voltage probe.

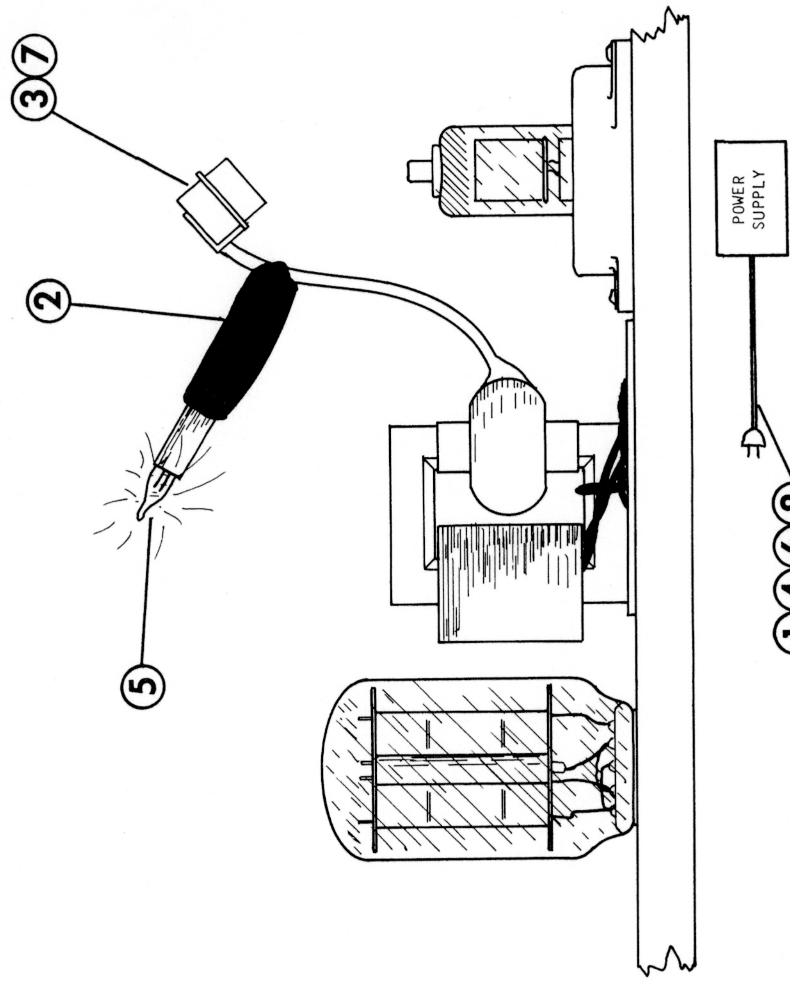


Figure 32. Connections for High Voltage Test

TROUBLESHOOTING TECHNIQUES

A. BASIC SIGNAL SUBSTITUTION TECHNIQUES

(See Figures 33-34-35)

The signal substitution method of troubleshooting uses the signals generated by the TELEVISION ANALYST and injects them into a television receiver. The signal substitutes for the missing signal in the malfunctioning television receiver and restores operation. The signal is usually injected nearest the picture tube, then moved one stage at a time toward the antenna until signal injection does not restore operation. The defective stage has then been located.

Every television receiver has many different types of signals present at various stages throughout the set. The TELEVISION ANALYST generates 15 types of signals, most of them adjustable in amplitude, which permits substitution of the correct signal at almost any point in any television receiver. Figure 33 shows a block diagram of a typical black and white television receiver. It illustrates 23 typical signal injection points that may be used for locating a defective stage. Figure 35 illustrates a transistorized color television receiver with 45 typical signal injection points. To successfully use the TELEVISION ANALYST, you need only to know which signal to inject at each stage and the approximate amplitude of the signal. The steps in the *Troubleshooting Procedures* section of this manual give you the specific information for such signal injection. It is permissible to simultaneously use as many outputs as necessary to restore proper operation.

The basic procedure for troubleshooting by the signal substitution method may be summarized as follows:

1. First, the symptoms are analyzed to determine the group of stages that should be checked. A complete section of this manual is devoted to analyzing symptoms.
2. A signal of the proper type is injected into the suspected stage furthest from the antenna.
3. If proper operation is restored, a signal is injected into the next stage nearer the antenna. The proper type and level of signal must be injected to simulate normal operating conditions in each stage. This stage-by-stage injection is continued until a point is found where signal injection does not restore proper operation. The defective stage is now located.
4. Inject the signal at each component that is in series with the signal path (such as coupling capacitors and transformers) until the trouble has been isolated to as small an area as possible.
6. If the specific defective component has not already been determined, a minimum number of voltage and resistance checks will locate the trouble.

When you become more familiar with the instrument, you may wish to skip stages and check a complete section at a time. The TELEVISION ANALYST then becomes even more of a time saver and a more profitable servicing instrument.

To further explain the signal substitution technique, a typical example follows (refer to Figure 33):

1. A vhf signal is injected at the antenna terminals (point 9) and the symptoms are analyzed. Symptoms: no video, audio normal, raster normal. These symptoms tell us that the horizontal and high voltage sections are operating because raster is present. Since sound is normal, we can assume that all stages from the antenna to the video detector are operating. The stages that require checking are the picture tube, 2nd video amplifier, and 1st video amplifier.
2. A high amplitude sync signal is injected directly into the picture tube (point 1) and video bars are displayed on the screen. This proves that the picture tube is good.
3. Maximum video signal is injected at the input to the 2nd video amplifier (point 2). A test pattern is displayed on the screen. This proves that the 2nd video amplifier is good.

The video signal amplitude is reduced until the picture is barely visible. (The next step will inject the signal at the 1st video amplifier. If it amplifies normally, it should provide a much stronger picture when the signal is applied to it).

Inject the low level video signal at the input of the 1st video amplifier (point 3). The test pattern disappears entirely. We have found the defective stage. The trouble lies between the input of the 1st video amplifier and the input of the 2nd video amplifier.

4. Refer to Figure 34 which is a schematic diagram of the defective stage. Inject maximum video signal at point 2A. The test pattern is again displayed. This proves that the coupling capacitor is good.

Inject maximum video signal at the plate of the 1st video amplifier (point 2B). The test pattern is still displayed. This means that the amplifier tube VI is not providing an output signal. The tube has already been tested and found to be good.

5. Voltage measurements show plate voltage normal, but screen voltage is zero. A resistance check shows that C4 is shorted.

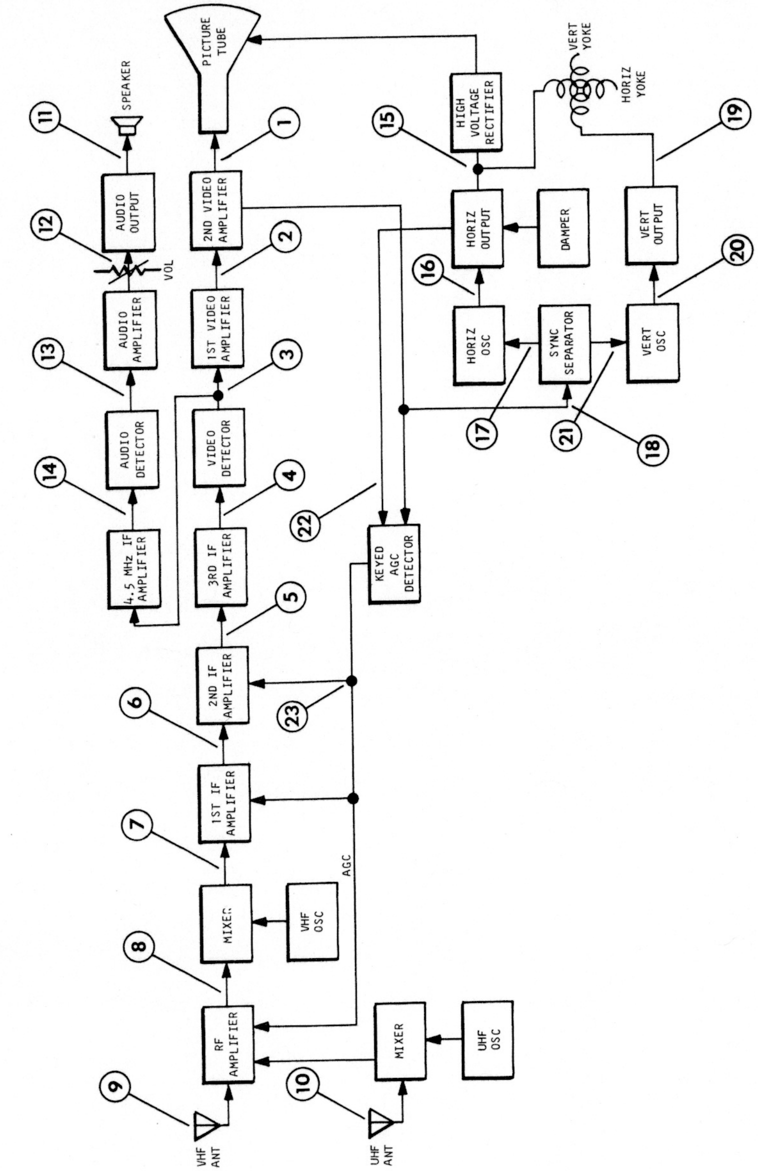


Figure 33. Block Diagram of Typical Vacuum Tube Black and White Television Receiver

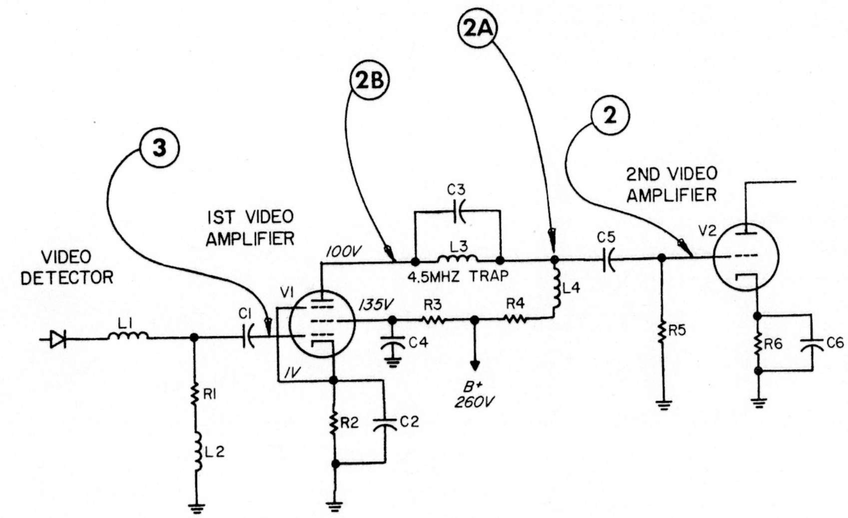


Figure 34. Schematic Diagram of Typical Video Amplifier

B. TROUBLESHOOTING TRANSISTOR STAGES

(See Figures 35-36-37)

Transistor stages are essentially equivalent to vacuum tube stages. The emitter is equivalent to the cathode, the base is equivalent to the control grid, and the collector is equivalent to the plate. One difference which should be noted that directly concerns signal substitution troubleshooting techniques is the different biasing. Vacuum tubes always use negative bias on the control grid. Transistors use forward bias; that is, the base is positive in respect to the emitter in NPN transistors and negative in PNP transistors. The biasing voltage for transistors, as well as the collector voltage, is normally much lower than in equivalent vacuum tube stages. Transistor stages usually have low input and output impedances compared to vacuum tubes. The TELEVISION ANALYST uses low impedance signals which are well suited for injection into transistorized or vacuum tube circuits.

Unlike vacuum tube circuits, transistors cannot normally be plucked from a socket and a new one substituted. A complete stage-by-stage troubleshooting procedure is required. The TELEVISION ANALYST and the signal substitution technique are essential for efficient troubleshooting of transistor stages.

There are some precautions that must be taken for transistor stages that are not necessary in vacuum tube circuits. First, transistors are very vulnerable to transient voltage spikes and shorts. Careless or random use of test probes will undoubtedly cause trouble in this respect. The safest method for preventing transient voltages from damaging transistors is to turn off the television receiver while making and removing test connections.

A short can easily burn out a transistor. Transistors are especially vulnerable to a short between the base and the collector. Since the components are usually very small compared to equivalent vacuum tube circuit components, care must be exercised to prevent shorting transistor leads to other circuits with the tip of the test probe. Use the miniature tips when servicing transistorized circuits with the TELEVISION ANALYST.

Remember this one important precaution when using signal injection in transistor stages: *TOO MUCH VOLTAGE WILL BURN OUT A TRANSISTOR.* This is especially true when too much voltage is applied across the base-emitter junction. Such applications, even accidentally for only a fraction of a second, will break down the base-emitter junction and the transistor will have to be replaced. Most of the output signals from the TELEVISION ANALYST can be used in transistor stages, even at maximum amplitude. Precaution must be used only with the following output signals:

1. Do not use the HORIZ GRID DRIVE output in transistorized circuits.

2. Use the sync output at low level in transistorized circuits. The asterisk (*) on the SYNC control setting represents the highest level (10 volts peak-to-peak) that should be used unless you have checked the manufacturer's data and are absolutely sure that higher levels are normally used in the circuit.

3. Use the BIAS voltage at low level in transistorized circuits. The asterisk (*) on the BIAS control setting represents the highest level (12.5 volts) that should be used unless you have checked the manufacturer's data and are absolutely sure that higher levels are normally used in the circuit.

When injecting sync signals, we recommend that you make it a habit to keep the SYNC control at 0 when not in use. Then, if you happen to make a circuit connection before you adjust the level, it will not burn out a transistor. After injecting the sync signal, make sure the amplitude is reduced to a safe level before changing the point of injection. A safe level in one circuit may not be safe in another circuit. When possible, select an injection point that will route the signal through a series resistor into the transistor base. The resistor will help absorb the signal and help protect the transistor.

When injecting the bias voltage, always apply it to provide forward bias across the base-emitter junction. When possible, select an injection point that will route the signal through a series resistor into the transistor base. The resistor will absorb much of the voltage difference and prevent possible damage to the transistor. There is normally only a few tenths of a volt forward bias for most transistors.

Be careful of the reference point that is used. Usually, it is preferable to use the emitter of the transistor as reference, rather than chassis ground. In both examples shown in Figure 37, chassis ground cannot be used as reference. If used, a low or zero setting on the BIAS control would place a substantial difference of potential (18.5 volts in one case, 34 volts in the other case) across the base-emitter junction the instant the test lead is touched to the base of the transistor. The result would be a burned out transistor.

Transistors are very dependable components and should not be replaced until it is proven that they are actually defective. Sometimes another defective component in the circuit will cut off the transistor and it will appear defective. Even when the transistor is proven defective, a check of other components in the circuit is wise. Many times, a defective component caused the transistor to burn out in the first place. Replacing the transistor without replacing the other defective part will just result in another burned out transistor.

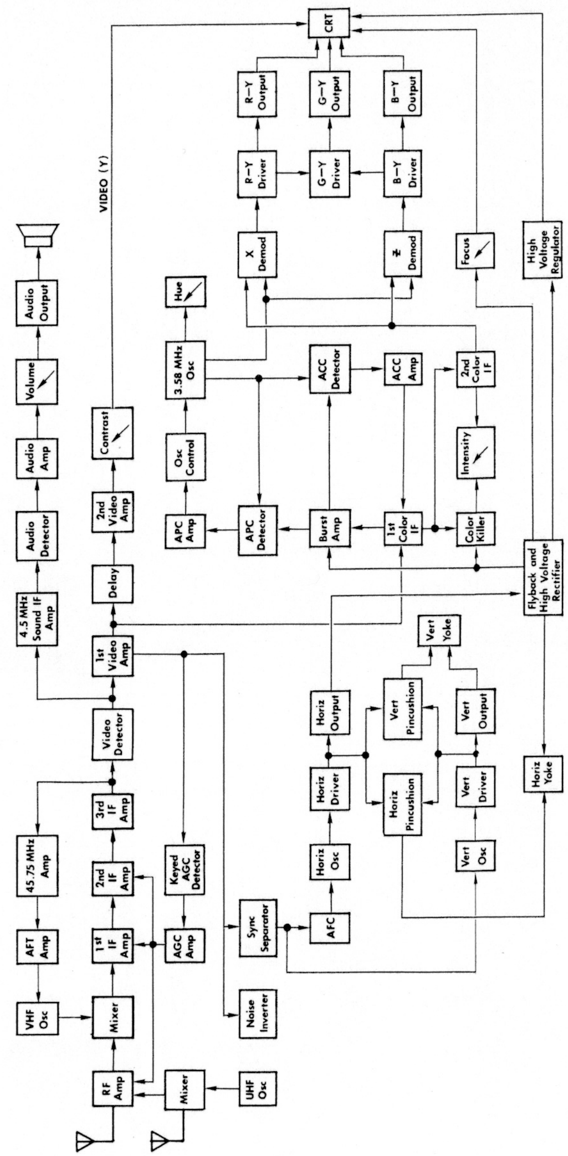
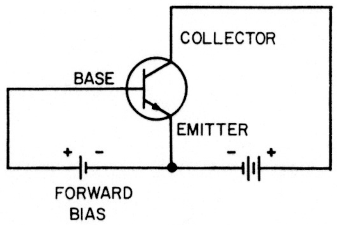


Figure 35. Block Diagram of Typical Transistorized Color Television Receiver

NPN TRANSISTOR



PNP TRANSISTOR

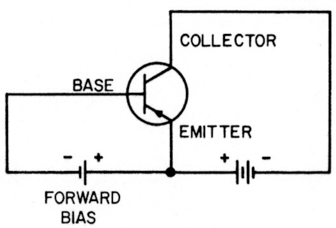


Figure 36. Transistor Biasing

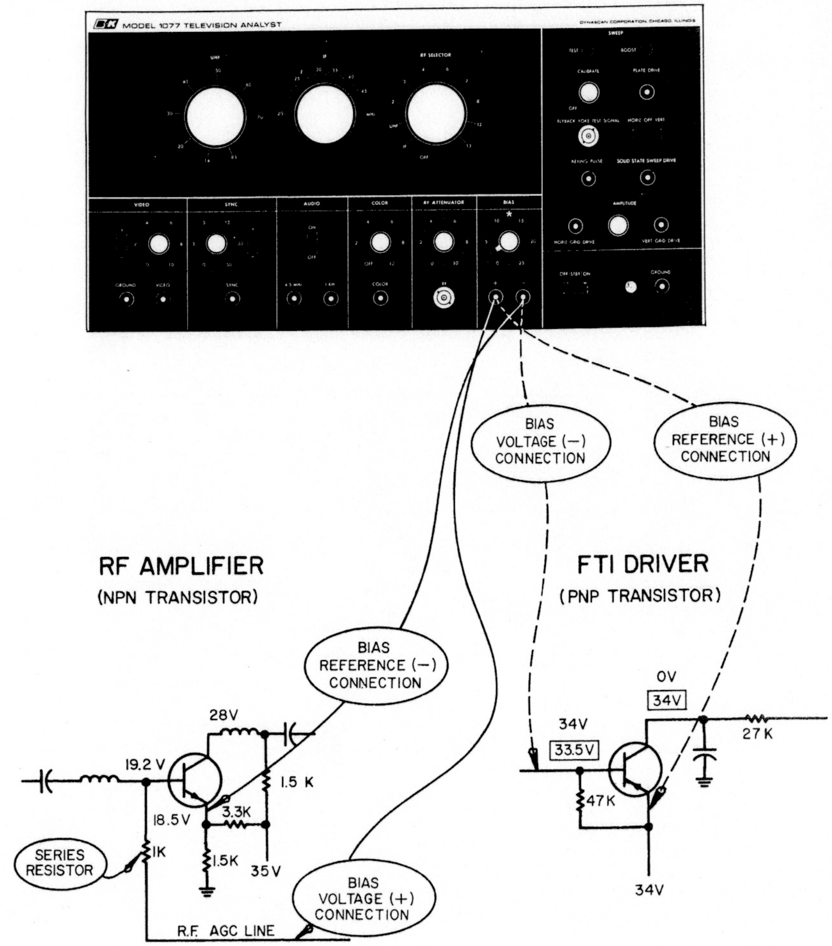


Figure 37. Proper Bias Connection for Transistor Stages

C. TROUBLESHOOTING TUNED AMPLIFIERS

(See Figure 38)

Tuned amplifiers are stages which amplify signals within a specific frequency band, and block signals of other frequencies. The stages are characterized by transformer coupling between stages. Such stages in a television receiver are the rf amplifier, i-f amplifiers, 4.5 MHz sound i-f amplifier, and color i-f amplifiers.

Troubleshooting of all tuned amplifiers is done in essentially the same manner. First, the injected signal must be of the correct frequency. With the TELEVISION ANALYST, the vhf signal is of the correct frequency for the channel indicated on the RF SELECTOR. The frequency of the uhf signal is selected by the UHF control. An i-f signal must be set to the proper frequency by the IF control. The IF control may be adjusted to provide the best display while injecting the signal. The 4.5 MHz signal and the color signal are stable, fixed-frequency sources that will provide the correct frequency without adjustment.

Second, the signal is injected at the input (grid of tube or base of transistor) of the suspected stage that is farthest from the antenna. The input of the stage is preferred because the low impedance signal source is less likely to load the tuned circuit which may affect its frequency response. If no display is provided, this is probably the defective stage. If the desired results are obtained (test pattern, color, or sound depending upon the stage being tested), reduce the amplitude of the injected signal until the display is barely visible (the sound signal is not adjustable in amplitude).

Third, move the injection point to the input of the next stage nearer the antenna. If that stage is operating properly, the display will be much brighter. The amplification of the stage should produce the brighter display. This method not only locates inoperative stages, but weak stages as well. Reduce the signal amplitude again to the point where the display is barely visible. Note the difference in the setting of the amplitude adjustment, which is a relative indication of gain. After checking a few television receivers, you will soon learn the normal gain to be expected in various stages. This information will help you spot a weak stage immediately.

Fourth, continue to move the point of signal injection toward the antenna one stage at a time until no display or a poor display is produced. When this occurs, the defective stage has been located. Now, we must locate the defective component within the stage.

Fifth, inject the signal at the secondary and primary of the coupling transformer. If no display is produced with signal injected at the secondary, the coupling capacitor is probably defective. If the display is normal with signal injected at the secondary, but no display is produced when signal is injected at the primary, the transformer is probably defective. If the display is normal with signal injected at the primary, check collector, emitter, and base voltages (plate, cathode, and grid voltages). If any voltages are abnormal, make resistance checks of resistors and capacitors until the defective part is located.

D. TROUBLESHOOTING UNTUNED AMPLIFIERS

(See Figure 39)

Untuned amplifiers differ from tuned amplifiers, described in the previous paragraphs, in that they amplify a wide band of frequencies. Resistive-capacitive coupling is normally used between stages. Such stages in a television receiver include the audio amplifiers and video amplifiers.

Troubleshooting of untuned amplifiers is performed by injecting signal at the output of the stage farthest from the antenna to produce normal operation. For video signals, the signal amplitude is decreased until the display is barely visible, then the point of injection is changed to the input of the stage. If the stage is operative, the amplification should produce a brighter display. For audio, listen for a louder volume when the signal is moved to the input of the stage.

Continue moving the point of injection toward the antenna until no output is obtained. This is the defective stage.

E. TROUBLESHOOTING PULSE STAGES

(See Figure 40)

Pulse circuits have short duration of operation compared to off time. Such stages in a television receiver include the sync separator, sync amplifiers, keyed agc circuit, burst amplifier, horizontal and vertical sweep circuits. In these stages, wave shaping as well as operation is important. The TELEVISION ANALYST is invaluable in troubleshooting pulse circuits. It substitutes the type of signal actually used in the stage during normal operation. Other methods of troubleshooting provide doubtful or hard to interpret results. The TELEVISION ANALYST can easily locate causes of distortion or inoperation because the results are displayed directly on the screen of the television set with the malfunction. Signals are injected at every point in the series path of the pulse signal (see Figure 40) until the point is located at which the display is abnormal.

The only special procedure to remember when injecting signals into pulse stages is selection of the correct polarity. In some stages, a positive pulse is required, while others require a negative pulse. Amplifiers usually invert the signal, thus the polarity must be reversed as the point of injection is changed from one stage to the next, or from the output to the input of a stage. The video and sync signals from the TELEVISION ANALYST have reversible polarities. The agc, vertical, and horizontal sweep circuits in television receivers require only positive pulses.

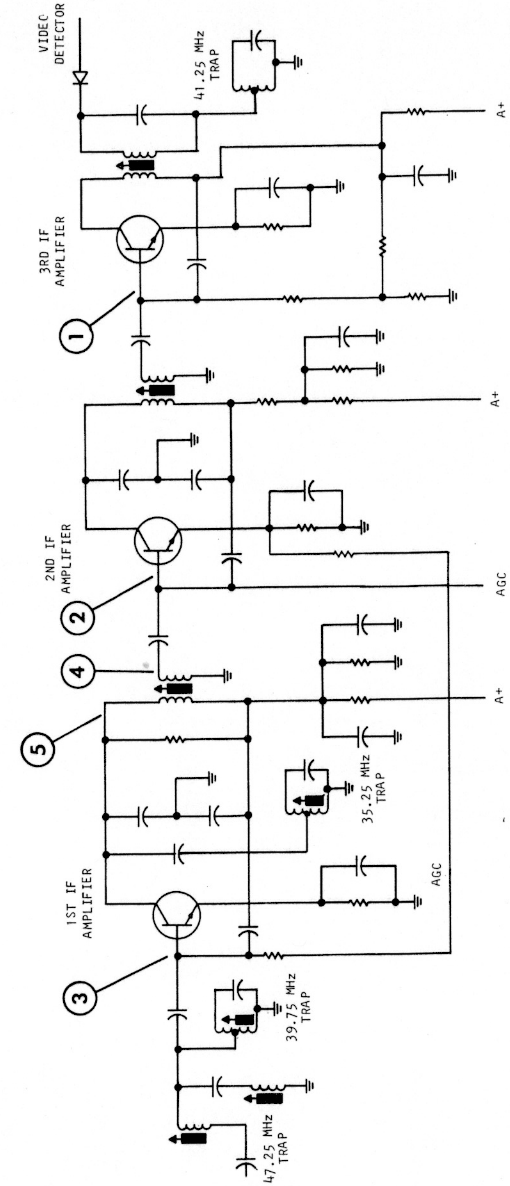


Figure 38. Typical Tuned Amplifier Schematic Diagram

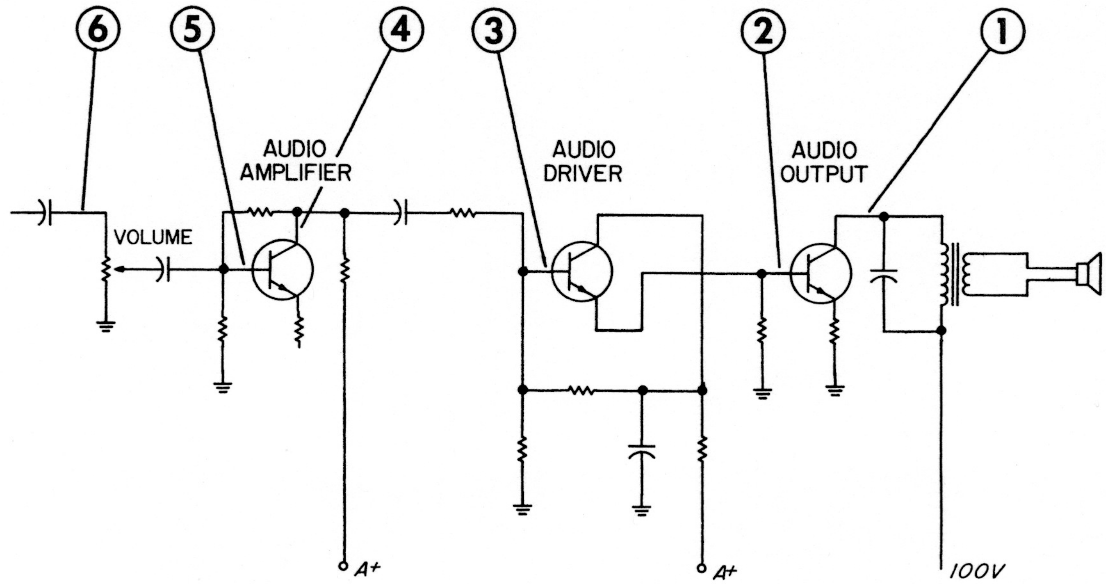


Figure 39. Typical Untuned Amplifier Schematic Diagram

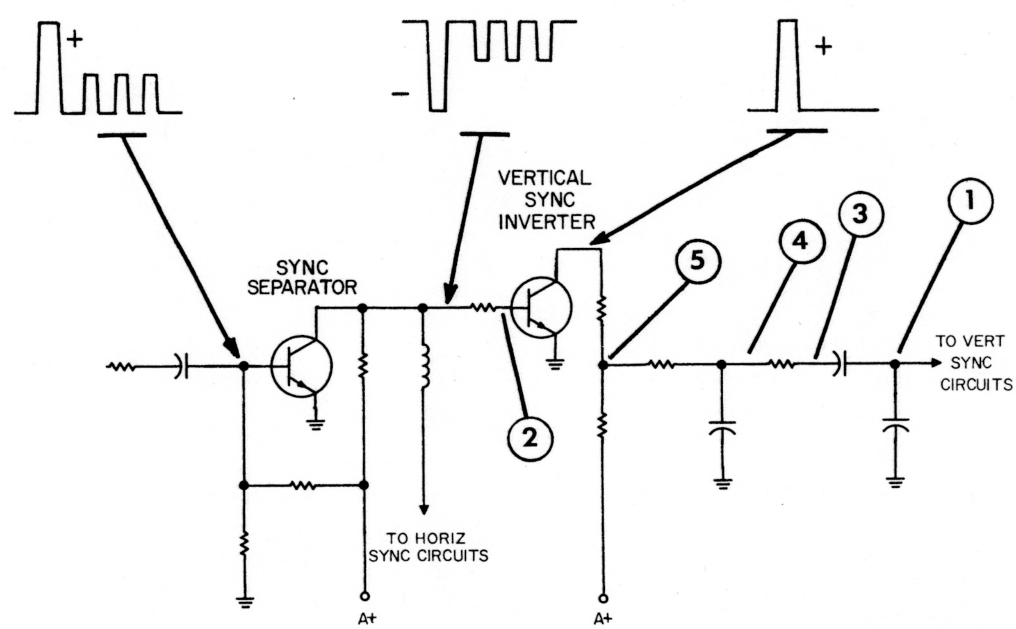


Figure 40. Typical Pulse Stage Schematic Diagram

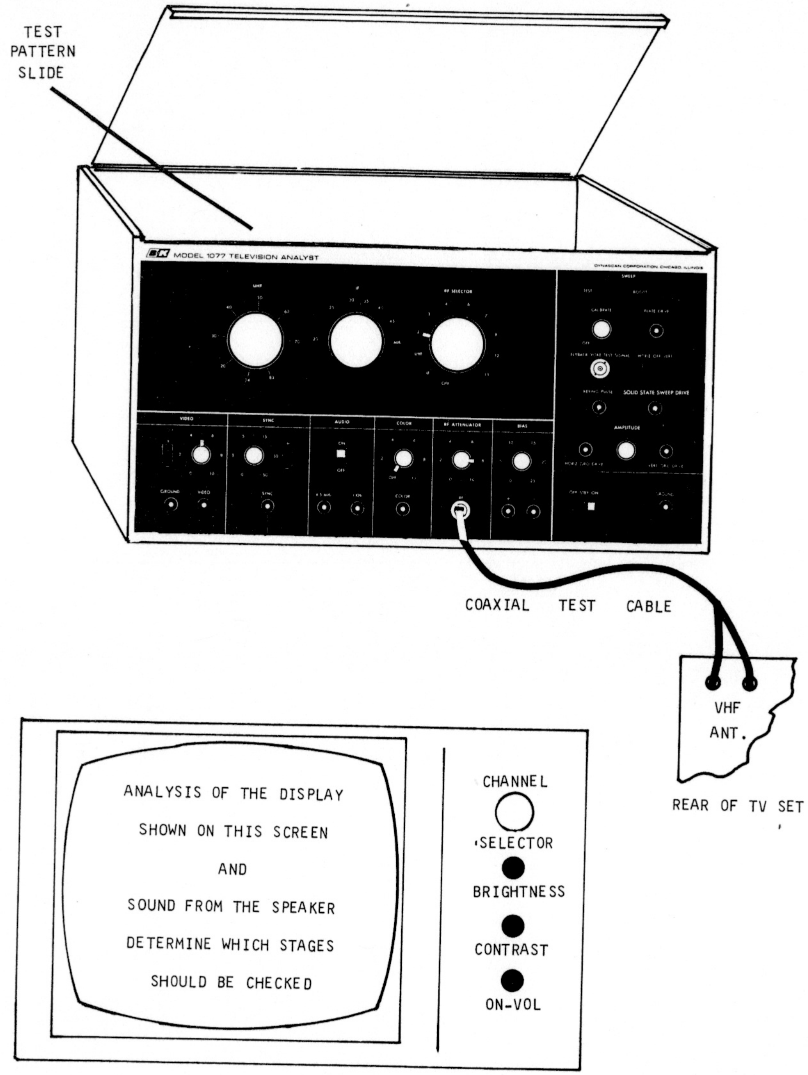


Figure 41. Injecting VHF Signal and Analyzing Symptoms

TROUBLESHOOTING PROCEDURES

A. SYMPTOM ANALYSIS

(See Figure 41)

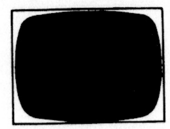
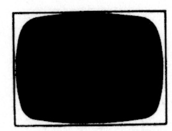
1. Always start troubleshooting by injecting a vhf test signal at the antenna terminals of the television receiver with the malfunction and checking the symptoms. Complete procedures are given in the *VHF Signal* portion of the *Typical Operating Procedure*.

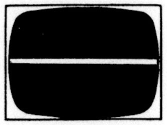
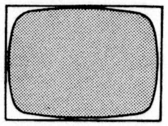
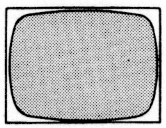
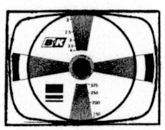
2. Use the video test pattern from the TELEVISION ANALYST, not a picture from a television station. The picture broadcast by a television transmitter continuously changes, but the test pattern is reliable. If the display does not match the test pattern slide, it is easily detected. Small irregularities would not be seen easily with a transmitted picture.

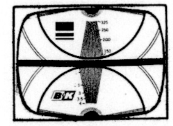
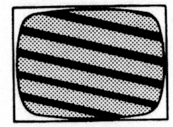
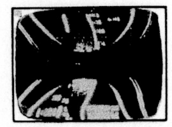
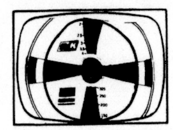
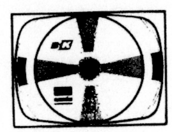
3. Analyze the symptoms thoroughly. A careful check of symptoms will direct you to specific stages that could cause the trouble. Do not rely on another person's description of the symptoms. You may gain additional information that will save you time by making your own observations. Check both video and sound, and if a color set, check color reception.

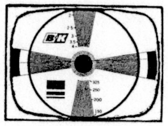
4. Learn to analyze the test pattern. It shows much more than merely whether the television receiver is operating or not operating. It provides a complete check of overall performance and shows whether adjustments are necessary. Additional insight into locating troubles that do not disable a television receiver but do inhibit peak performance is given in the *Performance Testing* section of this manual. After repairing a trouble that has disabled the television receiver, the performance tests should be made and corrective measures taken to restore peak performance. Such action will reduce "call backs" and improve customer satisfaction.

5. The following table correlates the symptoms with the stages that could produce the symptoms if a component failed in that stage. The table is based upon an analysis of the circuits in a television receiver.

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE PROCEDURE
NO RASTER NO SOUND 	No low voltage or B+ No filaments	Paragraph B
NO RASTER SOUND NORMAL 	No high voltage High voltage rectifier Flyback transformer Horizontal yoke Horizontal output tube (or transistor) Horizontal oscillator High voltage regulator Bad picture tube Blanking circuit	Paragraph C

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE PROCEDURE
NO VERTICAL DEFLECTION 	Vertical yoke Vertical output tube (or transistor) Vertical oscillator Vertical output transformer	Paragraph D
NO VIDEO SOUND NORMAL 	Video output Video driver CRT	Paragraph E
NO VIDEO NO SOUND 	Video detector 1st i-f amplifier 2nd i-f amplifier 3rd i-f amplifier RF amplifier Oscillator Mixer	Paragraph F
NO SOUND VIDEO NORMAL 	Speaker Audio output tube (or transistor) Audio amplifier Discriminator 4.5 MHz amplifier Audio output transformer	Paragraph G

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE PROCEDURE
NO VERTICAL SYNC 	Vertical sync inverter Sync separator	Paragraph H
NO HORIZONTAL SYNC 	Sync separator Horizontal AFC	Paragraph I
OVERLOADED VIDEO 	AGC detector AGC amplifier AGC line	Paragraph J
NON-LINEAR SWEEP 	Requires adjustment Pincushion amplifier (color)	Adjustment Section Paragraph A
POOR RESOLUTION 	Needs i-f alignment	Performance Testing Section Paragraph E

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE PROCEDURE
NO COLOR BLACK AND WHITE NORMAL 	Color oscillator Color i-f amplifiers Color killer	Paragraph K
ONE COLOR ABSENT ALL COLORS INCORRECT	Demodulator Color amplifier Picture tube	Paragraph L
NO COLOR SYNC DIAGONAL COLOR BARS ACROSS SCREEN CAUSING "BARBER POLE" EFFECT	Burst amplifier Phase detector Phase amplifier Color oscillator Color oscillator control	Paragraph M

B. NO RASTER—NO SOUND

(See Figure 42)

The most probable cause of this symptom is the absence of one of the B+ voltages, possibly all low dc voltages. In most television receivers, this is the only portion common to the sound and high voltage sections. In vacuum tube television receivers, it is also possible that filament voltage is absent or interrupted.

The NO RASTER—NO SOUND chart provides a procedure that will isolate the defective stage. The first step is a visual check of the dial light or tube filaments. For a fully transistorized set without a dial light, start with step 2.

C. NO RASTER—SOUND NORMAL

(See Figure 43)

This symptom appears whenever the picture tube does not have the proper electron beam to illuminate the screen. This could be caused by a bad picture tube or absence of voltage on cathode or grids of the picture tube, but usually by absence of high voltage on the anode of the picture tube. High voltage, in turn, is dependent upon the horizontal sweep signal. There are quite a number of stages in which the trouble could be located, therefore an orderly procedure is required to locate the defective component quickly. The following procedure should lead you to the defect in minimum time.

It is assumed, as with all symptoms, that vacuum tubes already have been tested or substituted and the symptom remained unchanged. With this symptom, the picture tube also should have been tested because it is a prime suspect.

WARNING

DANGEROUS HIGH VOLTAGE RF AND DC IS PRESENT IN THESE CIRCUITS. TURN OFF THE TELEVISION RECEIVER WHILE MAKING CONNECTIONS. MAKE CLIP TYPE CONNECTIONS AND KEEP HANDS OUT OF THE CHASSIS WHILE IT IS TURNED ON.

1. Set the brightness and contrast controls on the television receiver to maximum.
2. Disconnect the plate cap from the high voltage rectifier tube. Clip the high voltage probe of the TELEVISION ANALYST around the plate cap lead.

   If the lamp in the high voltage probe lights, high voltage rf is being developed by the flyback transformer and the trouble lies between the transformer and the picture tube. Additional isolation procedures continue in step 3.

   If the lamp does not light, the trouble lies in the flyback transformer or horizontal sweep circuitry. Proceed directly to step 7 for additional isolation procedure.
3. Replace the cap on the high voltage rectifier tube. If the lamp in the high voltage probe goes off, there is a short in the high voltage circuit. Procedures for locating the short are continued in step 4. If the lamp stays on, go directly to step 5.
4. Disconnect the high voltage lead from the picture tube anode. If the light comes on, there is an internal high voltage short in the picture tube. If the lamp stays off, disconnect any filter capacitors, bleeder resistor, or other component one at a time until the lamp comes on. The defective part is now located.

WARNING

IN MANY TELEVISION RECEIVERS, HIGH VOLTAGE (APPROXIMATELY 20,000 VOLTS) MAY BE PRESENT AFTER THE SET IS TURNED OFF. GROUND THE HIGH VOLTAGE CIRCUIT WITH A WELL INSULATED TEST LEAD BEFORE HANDLING.

5. With the television receiver off, check continuity of all parts in the high voltage rectifier filament circuit. Make sure a tight connection is made where the high voltage lead connects to the anode of the picture tube. If good, go to step 6.
6. Check dc voltages at the cathode and all grids of the picture tube. Isolate the reason for any missing voltage.
7. Replace the plate cap on the high voltage rectifier tube. Inject HORIZONTAL PLATE DRIVE signal at the plate of the horizontal output tube. Complete procedures are given in the *Horizontal Plate Drive and Boost Indication* portion of the *Typical Operating Procedure*.

If the lamp in the high voltage probe lights and the BOOST INDICATOR lamp lights and raster is restored on the picture tube, the flyback transformer and associated circuitry are proven good. The trouble lies in the horizontal sweep stages. Proceed directly to step 13 for trouble isolation procedures.

If the BOOST INDICATOR lights but the high voltage lamp does not, there is an open turn in the flyback transformer between the plate of the horizontal output and the plate of the high voltage rectifier.

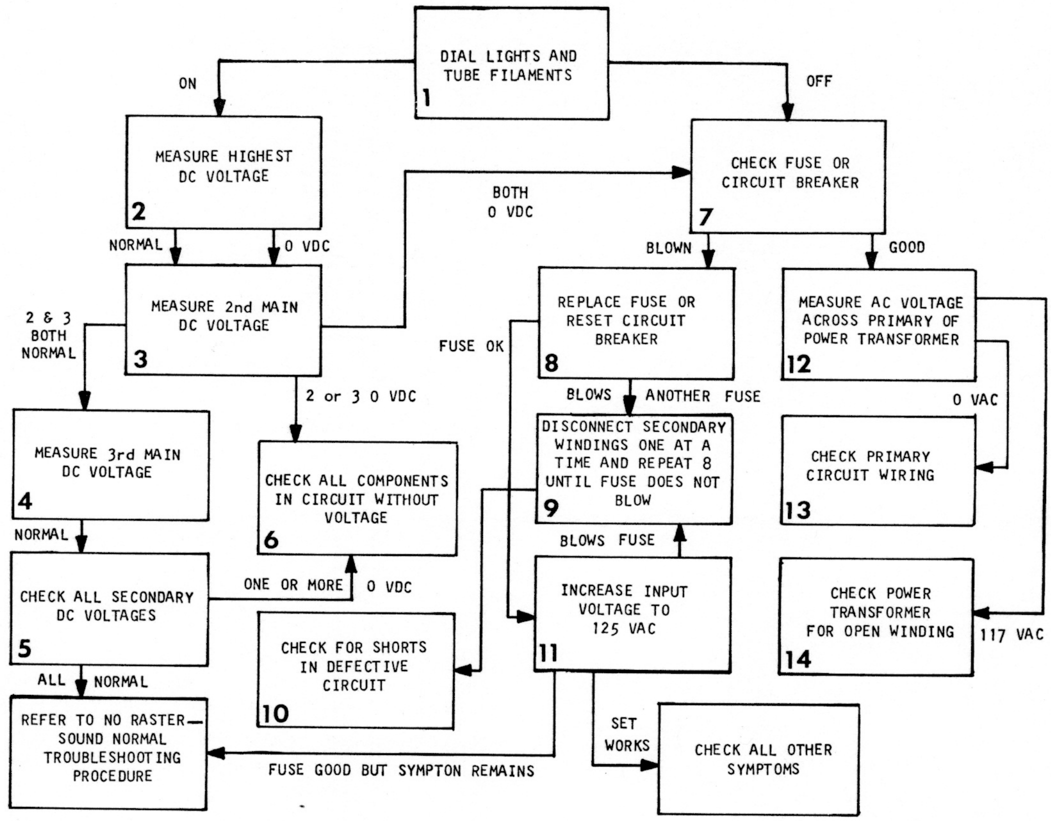
If neither lamp lights, the flyback transformer, horizontal yoke, or damper stage is defective. To isolate the defective part, proceed to step 8.

The flyback transformer and damper stage generate the boosted B+ voltage which is used as plate voltage for the horizontal output stage (sometimes it is also used for focus voltage on the picture tube, as plate voltage for the vertical output stage, and other stages). If B+ is not boosted, insufficient plate drive is developed to provide a raster.

Naturally, if the flyback transformer or horizontal yoke is open, no raster will be developed.

If the flyback transformer or horizontal yoke has shorted windings, it will load the horizontal output stage and attenuate the flyback pulse to prevent high voltage and boosted B+ from being developed.

8. Remove the damper tube from its socket and measure the dc voltage at the plate pin of the tube socket. B+ voltage should be measured. If zero or unusually low reading is obtained,



Condensed Troubleshooting Procedure—NO RASTER—NO SOUND (See Figure 42)

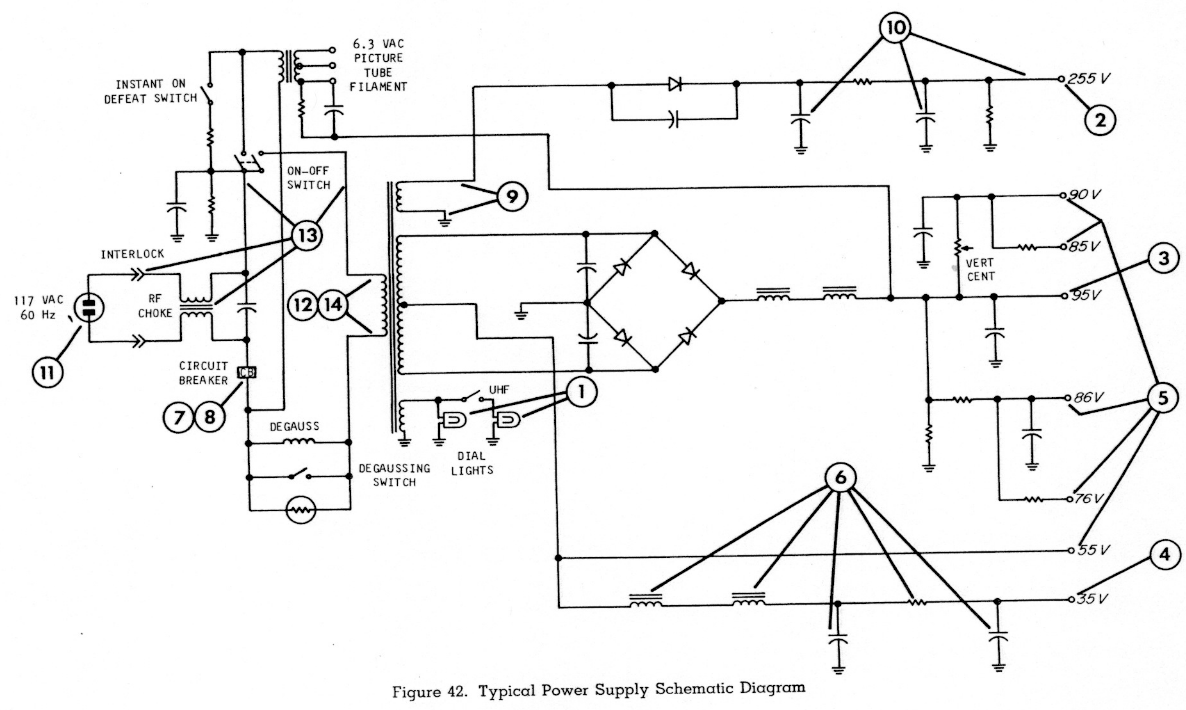
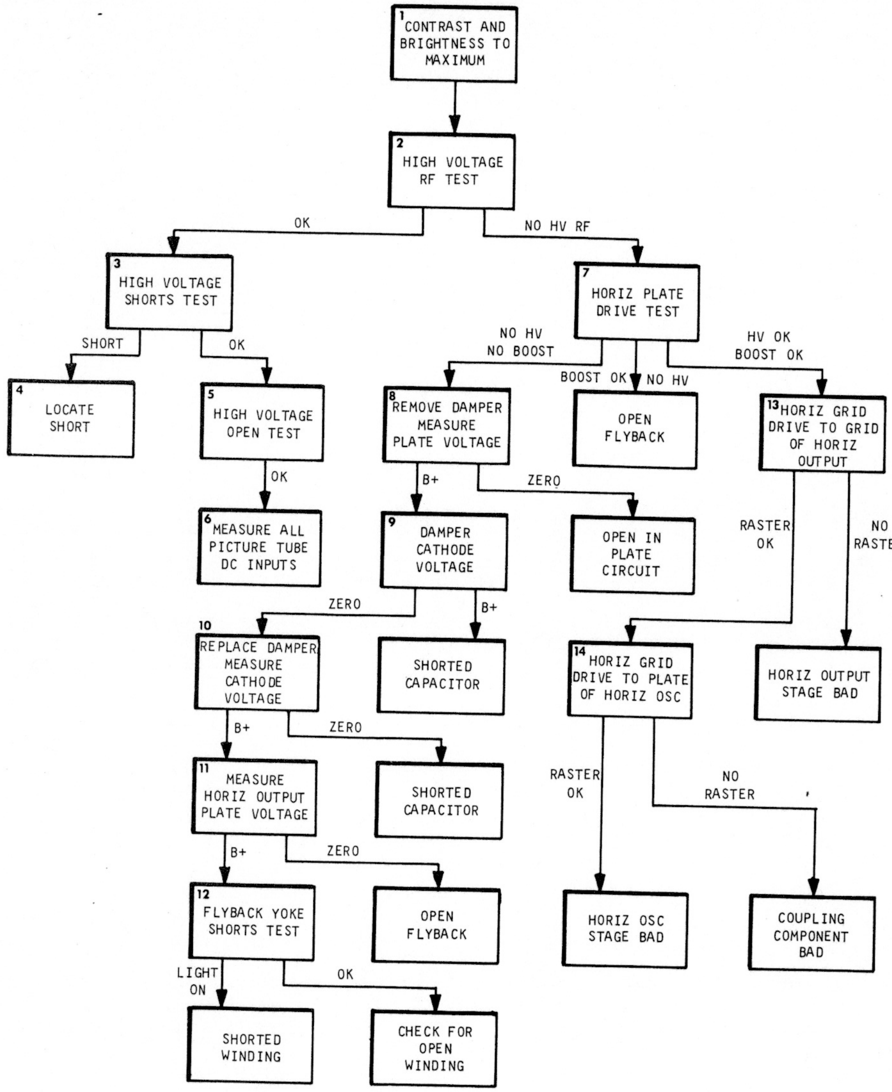
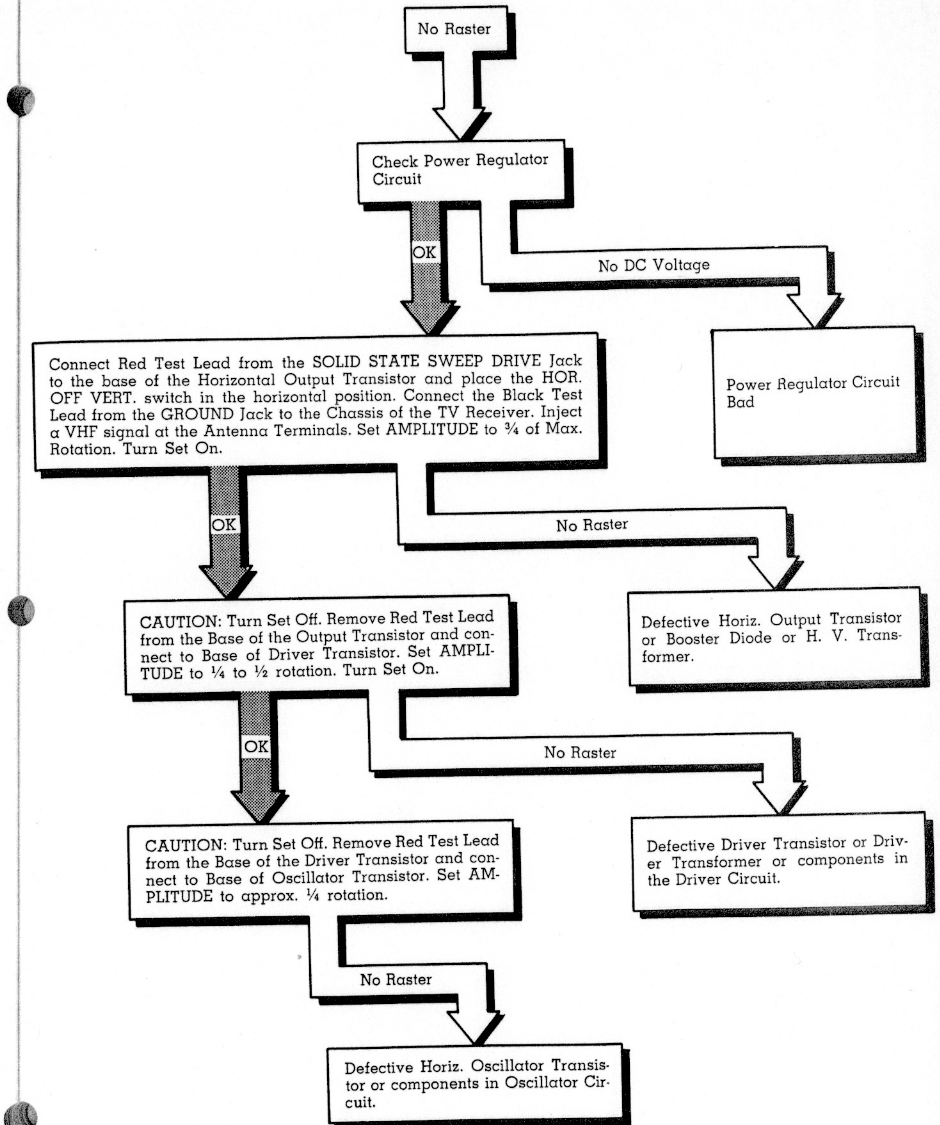


Figure 42. Typical Power Supply Schematic Diagram



Condensed Troubleshooting Procedure—NO RASTER—SOUND NORMAL (See Figure 43)



Condensed Troubleshooting Procedure No Raster. Solid State Sets See Page 39.

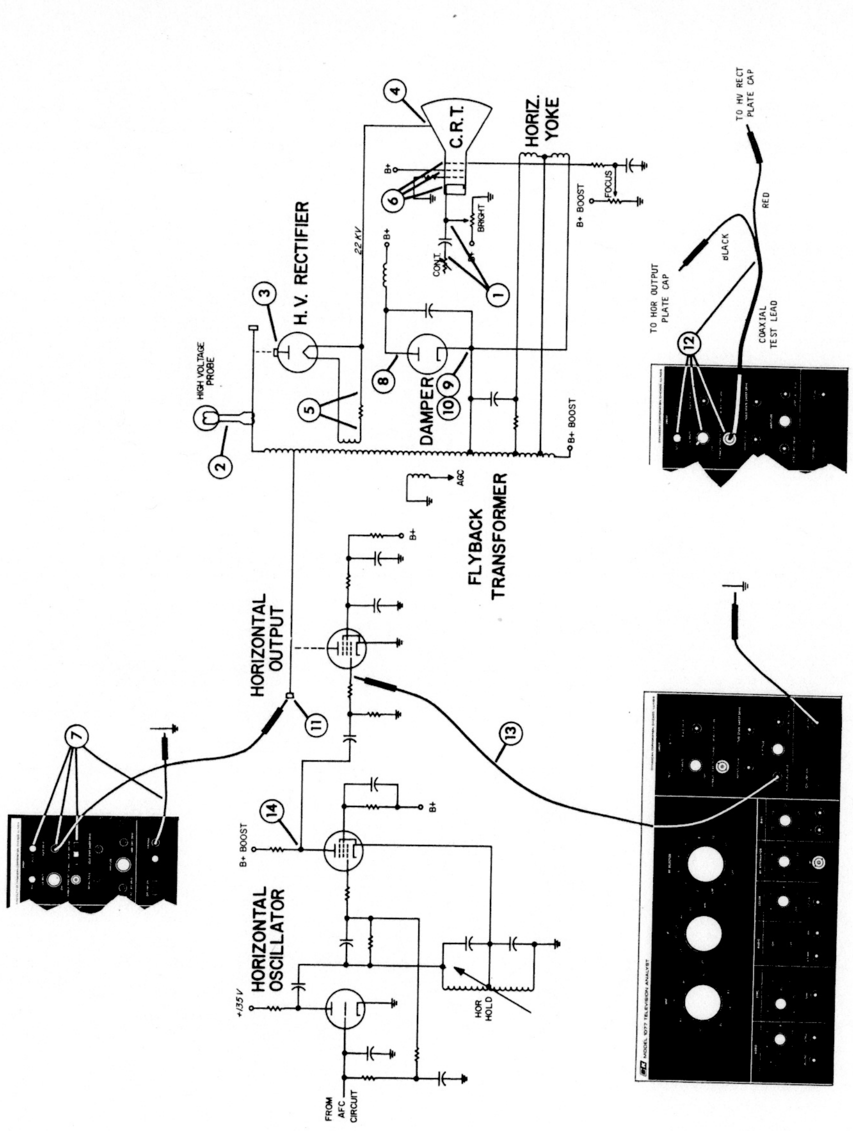


Figure 43. Typical Horizontal Sweep and High Voltage Section Schematic Diagram

measure resistances of parts in the plate circuit. If normal, go to step 9.

9. With the damper tube still removed, measure the dc voltage at the cathode. Zero volts should be measured. If B+ is measured, check for a shorted capacitor between the B+ and boosted B+ lines. If normal, go to step 10.

10. Replace the damper tube and again measure cathode voltage. B+ or boosted B+ should be measured. If zero or unusually low, check for a shorted capacitor in the cathode circuit. If normal, go to step 11.

11. Measure the dc voltage at the plate lead of the horizontal output tube. B+ or boosted B+ should be measured. If zero, check for an open circuit in the flyback transformer or other series component between the damper and the horizontal output stages. If normal, go to step 12.

12. Make the flyback transformer and horizontal yoke shorted windings test. Complete procedures are given in the FLYBACK YOKE TEST SIGNAL portion of the *Typical Operating Procedure*. If no shorts are indicated, make continuity checks of the entire flyback transformer and horizontal yoke to check for an open circuit.

13. Replace the plate cap (or resolder the plate lead) to the horizontal output tube. Inject the HORIZ GRID DRIVE jack output signal to the grid of the horizontal output tube. If raster is not restored, check screen grid and cathode circuit components. If raster is restored, go to step 14.

14. Inject the HORIZ GRID DRIVE jack output signal to the plate of the horizontal oscillator stage. If raster is not produced, check the coupling capacitor. If raster is produced, the trouble lies in the horizontal oscillator stage. Make voltage and resistance checks throughout the horizontal oscillator stage until the defective component is located.

EXCEPTIONS FOR TRANSISTORIZED SETS

1. If a solid state diode is used for a damper, disconnect the diode for measurements which specify that the damper tube be removed.

2. Do not use the HORIZ GRID DRIVE signal in transistorized circuits. SOLID STATE SWEEP DRIVE output signal and its use for horizontal deflection circuits is illustrated on page 39 & 40. Reference may also be made to the condensed procedure "No raster, solid state sets" on page 69.

D. NO VERTICAL DEFLECTION

(See Figure 44a)

This symptom can be caused by a component failure in the vertical oscillator, vertical output stage, vertical output transformer and associated parts, or vertical yoke. Isolate the trouble with the TELEVISION ANALYST by the following procedure:

1. Disconnect the vertical yoke and inject the SOLID STATE SWEEP DRIVE VERTICAL SIGNAL. Complete procedures are given in the *Vertical Yoke Test Signal* portion of the *Typical Operating Procedure*. If necessary, connect a jumper to complete test path.

   If vertical deflection is produced (although nonlinear), it proves that the vertical yoke is good. Go to step 2.

   If no vertical deflection is produced, the vertical yoke is open or completely shorted. A few shorted turns will cause the vertical deflection to "keystone" (less height on one side of the screen than the other).

2. Reconnect the vertical yoke and remove the vertical output tube. Inject a VERTICAL PLATE DRIVE signal at the plate lead of the vertical output stage and adjust the AMPLITUDE control to fill the screen. Complete procedures are given in the *Vertical Plate Drive Signal* portion of the *Typical Operating Procedure.*

   If vertical deflection is produced, it proves that the vertical output transformer and associated components that couple the signal from the vertical output stage to the vertical yoke are good. Go to step 3.

   If no vertical deflection is produced, the trouble is in the vertical output transformer or associated circuit. Check B+ voltage to the vertical output stage and make resistance checks to locate the defective part.

3. Replace the vertical output tube. Inject the VERTICAL GRID DRIVE signal at the grid of the vertical output stage. Set the AMPLITUDE control to minimum before injecting signal and increase slowly to see if vertical deflection is produced. Refer to the *Vertical Grid Drive Signal* portion of the *Typical Operating Procedure* for complete procedures.

   If vertical deflection is produced, the vertical output stage is good. Go to step 4.

   If vertical deflection is not produced, the trouble is in the vertical output stage. Check screen grid and cathode components.

4. Inject the VERTICAL GRID DRIVE signal at the plate of the vertical oscillator stage. If vertical deflection is not produced, check coupling components between the vertical oscillator and the vertical output stages.

   If vertical deflection is produced, the trouble is in the vertical oscillator. Make voltage and resistance checks in the vertical oscillator stage to locate the defective component.

EXCEPTIONS FOR TRANSISTORIZED SETS

Do not use the VERT GRID DRIVE signal in transistorized circuits. SOLID STATE SWEEP DRIVE output signal and its use for vertical deflection circuits is illustrated on page 37 & 38. Reference may also be made to figure 44b and the condensed procedure "No vert sweep, solid state sets" on page 73.

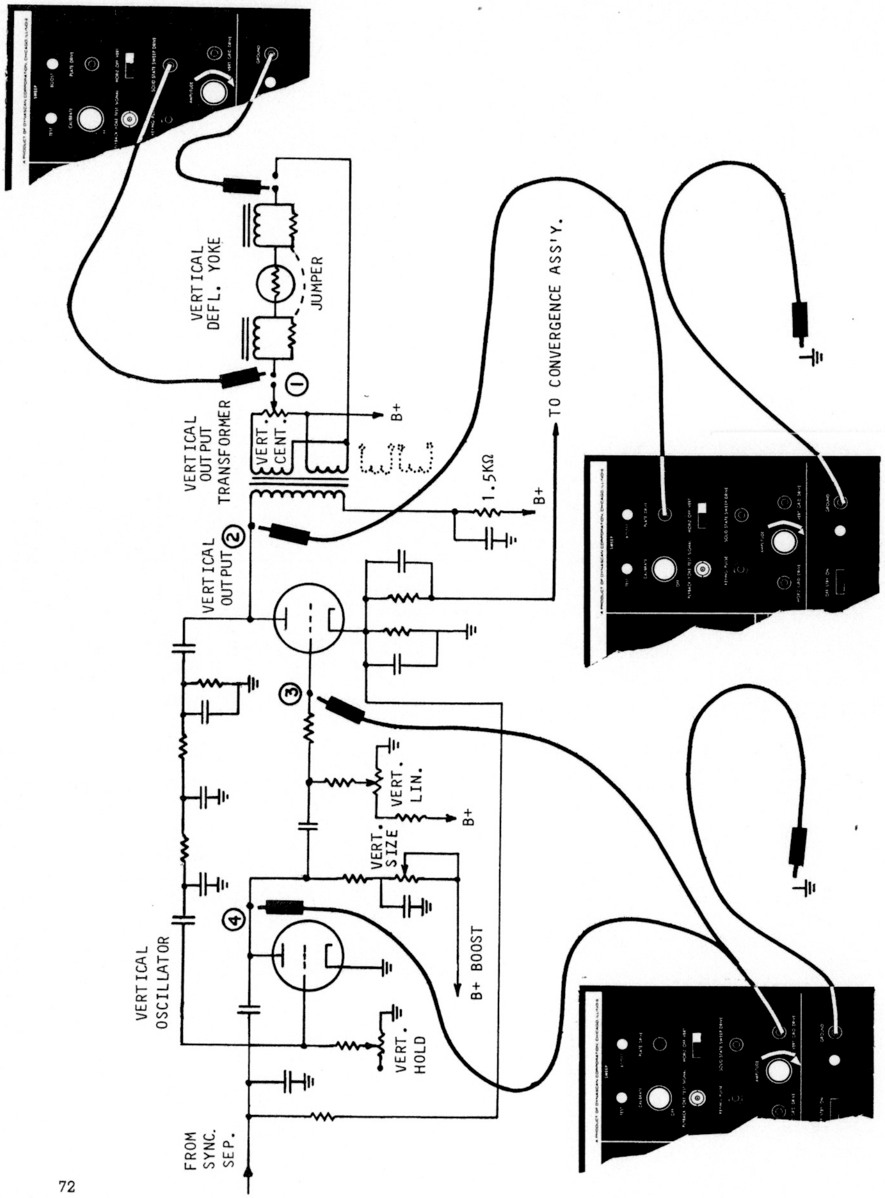


Figure 44a. Vertical Sweep Circuit Schematic Diagram

No Vertical Sweep

1. Leave the VHF signal injected at the antenna terminals as in step 1 of the *Video Signal* procedure. 2. Remove power from the television receiver. 3. Disconnect the leads from the vertical deflection yoke. 4. Connect the black test lead from the GROUND jack to one side of the vertical deflection yoke. 5. Connect the red test lead from the SOLID STATE SWEEP DRIVE jack to the other side of the vertical deflection yoke. 6. Place the HORIZ-OFF-VERT switch in the VERT position. 7. Adjust the AMPLITUDE control for full sweep. 8. Remove power, disconnect the test leads, and reconnect the vertical yoke.

- No Vertical Sweep → **Defective Yoke**
- OK ↓

CAUTION: Turn Set Off. Remove Red Test Lead from the Yoke and connect to Base of the Vert. Output Transistor. Set AMPLITUDE to ¼ to ½ rotation. Turn Set On.

- No Vertical Sweep → **Defective Vertical Output Transistor.**
- OK ↓

CAUTION: Turn Set Off. Remove Red Test Lead from Base of the Vertical Output Transistor and connect to the Base of the Driver Transistor. Set AMPLITUDE to approx. ¼ rotation. Turn Set On.

- No Vertical Sweep → **Defective Driver Transistor or components in Driver Stage.**
- OK ↓

CAUTION: Turn Set Off. Remove Red Test Lead from the Base of the Vertical Driver Transistor and connect to the Base of the Vertical Oscillator Transistor. Set AMPLITUDE to approx. ¼ rotation.

- No Vertical Sweep → **Defective Vertical Oscillator Transistor or Vert. Blocking Transformer or Components in Vertical Stage.**

Condensed Troubleshooting Procedure No Vertical Sweep. Solid State Sets See Page 37.

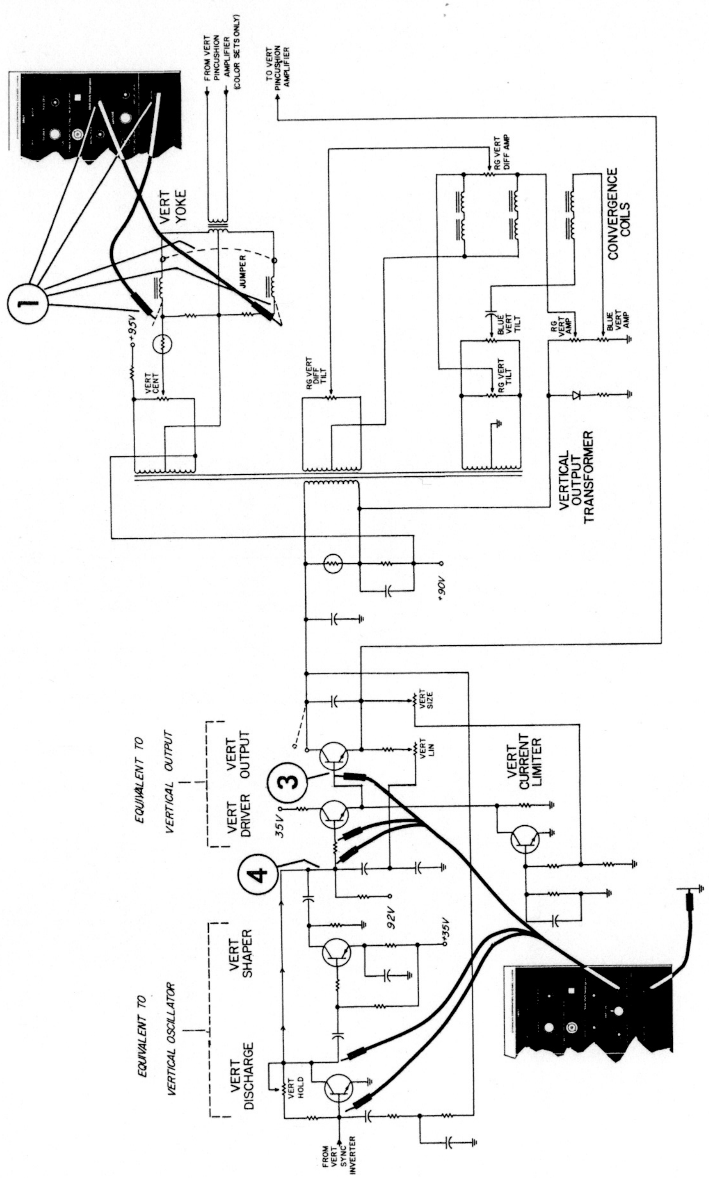


Figure 44b. Vertical Sweep Schematic Diagram

E. NO VIDEO—SOUND NORMAL

(See Figure 45)

This symptom is normally caused by a defective video amplifier or a bad picture tube. Because the sound and video separation point varies from set to set, it is also possible that the video detector stage is at fault. In other sets, only the final video amplifier could produce the symptoms. This procedure will locate the defect no matter where the sound and video separation occurs.

1. Inject maximum VIDEO test signal into the input of the final video amplifier. For complete procedures, refer to the *Video Signal* portion of the *Typical Troubleshooting Procedure.*

   If no video is produced on the picture tube, the trouble lies between the input of the final video amplifier and the picture tube. Go to step 2 for additional isolation procedures.

   If video is produced (probably out of sync), the trouble lies before the final video amplifier stage. Go to step 4.

2. Inject maximum SYNC signal directly to the picture tube. Refer to steps 11 through 17 of the *Sync Signal* portion of the *Typical Operating Procedure* for correct procedures and an explanation of results. Be sure to turn the vertical hold control on the television receiver to roll the picture.

   If no diagonal bars are seen (do not expect test pattern video), the picture tube is defective or the circuit is shorted to ground. Check for shorts.

   If diagonal bars are seen, the picture tube is proven capable of displaying video. Go to step 3.

3. Inject maximum SYNC signal at each series component from the picture tube to the output of the final video amplifier. If diagonal bars are not displayed for all injection points, check to see at which component the display is lost.

   If diagonal bars are still displayed with signal injected at the output of the final video amplifier stage, the stage is inoperative. Make voltage and resistance checks to find the defect.

4. Inject maximum VIDEO signal at the output of preceding amplifier stages. If no video is displayed on the picture tube, check the coupling components between the 1st and final video amplifier stages. If video is displayed, go to step 5.

5. Inject medium amplitude VIDEO signal at the input of the 1st video amplifier stage. If no video is displayed on the picture tube, the 1st video amplifier is inoperative. Make voltage and resistance checks to locate the defective part.

   If video is displayed, sound and video separation occur ahead of the video detector. The trouble will be located if you follow the "No Video—No Sound" *Troubleshooting Procedure.*

EXCEPTIONS FOR TRANSISTORIZED SETS

None

F. NO VIDEO—NO SOUND

(See Figure 46)

This symptom is caused by a malfunction between the antenna terminals and the point where video and sound are separated. This normally includes the tuner, rf amplifier, oscillator, mixer, i-f amplifiers, and the video detector. The following procedure will isolate the trouble:

1. Inject an i-f test signal into the input of the 3rd i-f amplifier. If no test pattern is displayed, or is unusually weak, the i-f stage or detector is defective. Make voltage and resistance checks as required to isolate the defective component.

   If video is displayed, the trouble lies toward the antenna. Go to step 2.

2. Move the i-f test signal to the input of the 2nd i-f amplifier. Measure the gain of the amplifier (procedures are given in the *IF Signal* portion of the *Typical Operating Procedure).* If no test pattern is displayed or gain is unusually low, the 2nd i-f amplifier stage is defective. Inject the i-f signal at each component that is in series with the signal path to locate the point where signal is lost. Make voltage and resistance checks to isolate the defective component.

   If video is displayed, the stage is good. Go to step 3.

3. Repeat the procedures of step 2, but this time injecting the signal at the input of the 1st i-f amplifier.

   If video is displayed, the stage is good. Go to step 4.

4. If the test pattern is still displayed with the i-f signal injected at the 1st i-f amplifier, the trouble lies in the rf amplifier, oscillator, or mixer circuit. To test the mixer, inject signal into the input of the mixer. If the mixer is operating, the signal will be passed and the test pattern will again be displayed. If defective, no test pattern will be seen. However, the mixer may pass the i-f signal even if it is not operating.

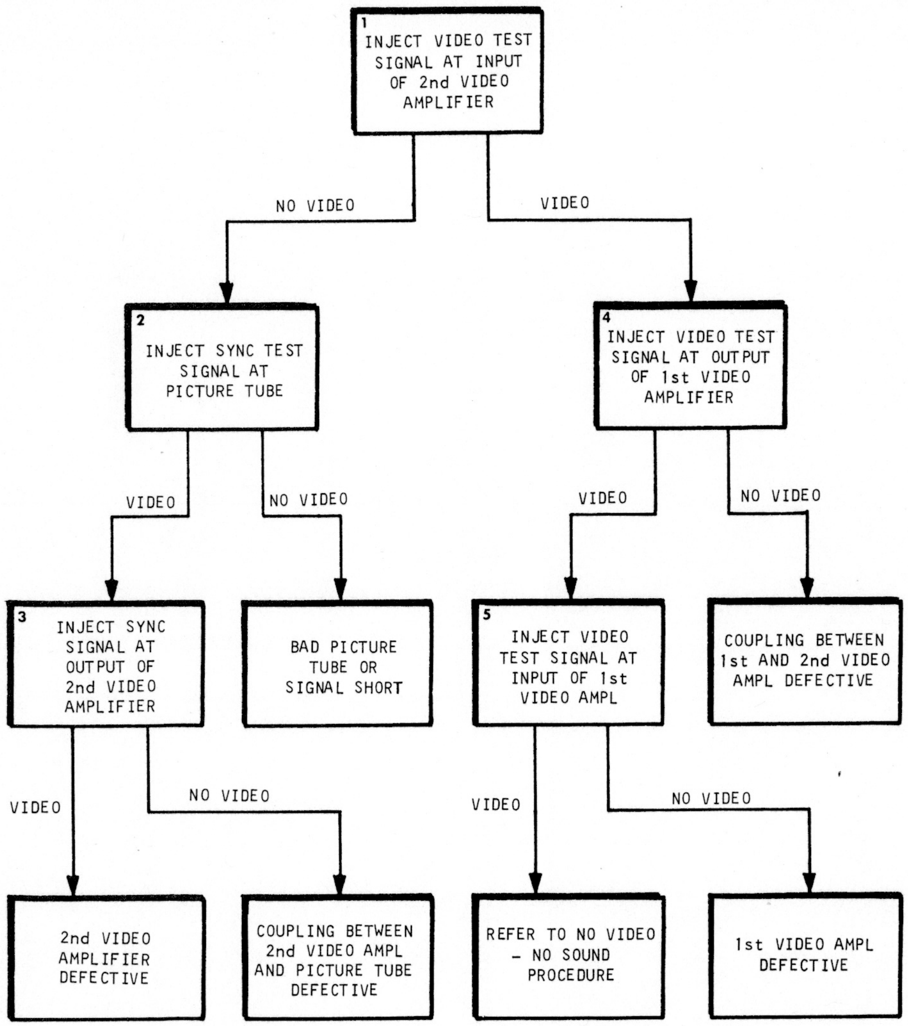
5. To test the vhf oscillator, inject a vhf test signal into the input of the mixer. If the oscillator is operating, and on the proper frequency, the injected signal and oscillator signal will mix to produce the i-f signal and the test pattern will be displayed. If the oscillator or mixer is defective, no test pattern will be seen.

6. If the mixer and oscillator are good, the trouble is in the rf amplifier or tuner. Inject the vhf test signal at various points in the circuit to localize the malfunction. Always inject a vhf signal on the same channel to which the television receiver is tuned. Try several channels.

7. If there is no video and no sound on uhf channels only, the trouble is in the uhf oscillator, uhf mixer, or uhf position of the channel selector.

EXCEPTIONS FOR TRANSISTORIZED SETS

None



Condensed Troubleshooting Procedure—NO VIDEO—SOUND NORMAL (See Figure 45)

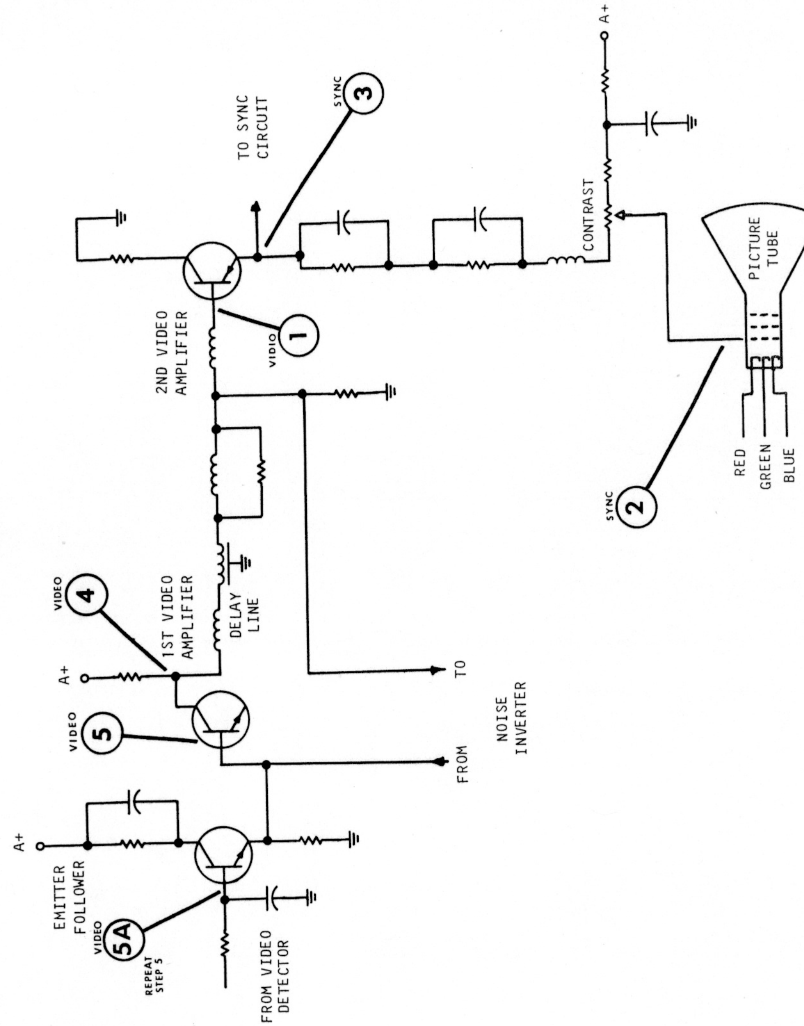
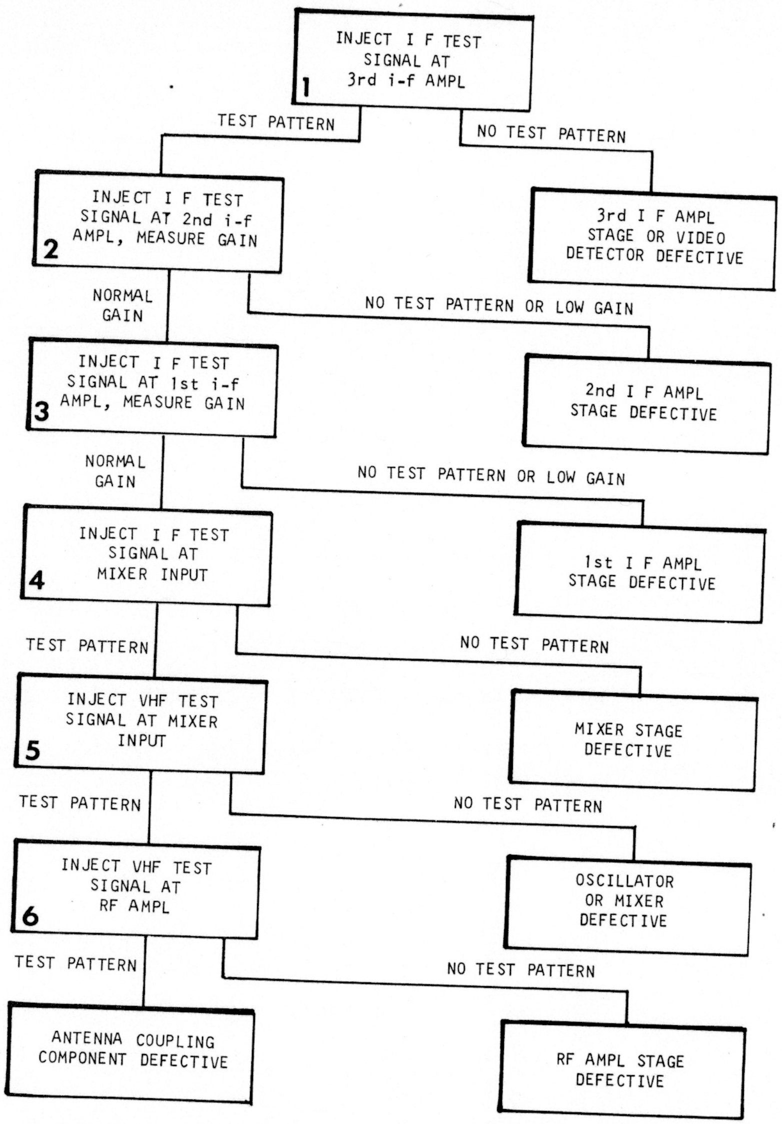


Figure 45. Transistorized Video Amplifier Circuits Schematic Diagram



Condensed Troubleshooting Procedure—NO VIDEO—NO SOUND (See Figure 46)

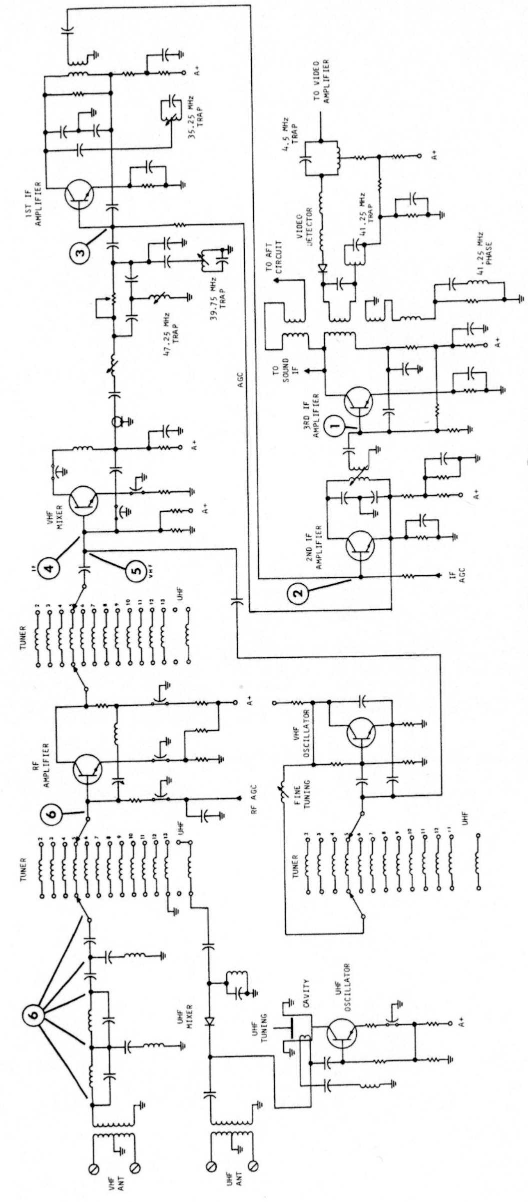


Figure 46. RF and IF Circuit Schematic Diagram

G. NO SOUND—VIDEO NORMAL
(See Figure 47)

This symptom is caused by a malfunction in the 4.5 MHz sound i-f stages, discriminator, audio amplifier, or speaker. Refer to the *4.5 MHz and 1 KHz Signal* portion of the *Typical Operating Procedure* for complete instructions on test connections and control settings on the TELEVISION ANALYST for isolating the trouble.

This troubleshooting procedure applies specifically to the circuit shown in Figure 47. However, the procedures are typical for all sound systems. Add or omit signal injection points as required so that a signal is injected to test each stage. Check the gain of each audio amplifier by listening for increased volume for each additional stage through which the 1 KHz tone passes.

EXCEPTIONS FOR TRANSISTORIZED SETS

None

H. NO VERTICAL SYNC
(See Figure 48)

With loss of vertical sync, the picture will roll no matter where the vert hold is set. This symptom is caused by the absence of vertical sync pulses at the vertical oscillator. Since the picture has horizontal sync, the trouble could lie only in a section of the sync separator stage or in a vertical sync amplifier stage (if used).

Inject the SYNC signal at the points indicated in Figure 48 or equivalent. The required signal may be of positive or negative polarity; try both. Remember to reverse polarity when changing the injection point from the output to the input of a stage. Inject sufficient signal to simulate normal operating values (refer to the schematic diagram of the television receiver for normal peak-to-peak signal values). If too much signal is required to restore proper operation, check for a component that has changed value drastically. Also check the gain of the sync separator stage. It may provide sufficient signal to provide horizontal sync but not vertical sync. Gain is checked by injecting minimum SYNC signal that will provide sync at the output and the input of the stage and noting the difference of the SYNC control setting.

Normal operation should be restored when the SYNC signal is injected at point 1. Move the point of injection toward the sync separator stage until vertical sync is lost. The defective component can then be easily checked with voltage or resistance measurements.

EXCEPTIONS FOR TRANSISTORIZED SETS

Refer to the schematic diagram of the television receiver and note the peak-to-peak sync voltage normally present in the circuit. Do not exceed this value when injecting signal from the TELEVISION ANALYST.

I. NO HORIZONTAL SYNC
(See Figure 49)

With this trouble, diagonal lines are seen on the screen but a picture cannot be locked in with the horizontal hold control on the television receiver. Since no picture is visible, presence or absence of vertical sync cannot be easily detected. However, this is of little consequence, because this troubleshooting procedure will locate the source of trouble for either case.

The symptom could be caused by a defective sync separator stage or the afc circuit which precedes the horizontal oscillator.

1. Inject SYNC signal at the sync input of the horizontal oscillator stage. It may require negative or positive polarity, try both. Refer to the schematic diagram of the television receiver that you are troubleshooting and adjust the SYNC control for typical level of sync pulse signal. Horizontal sync should be restored. Readjust the horizontal hold control if necessary.
2. Inject SYNC signal into the horizontal phase detector. If sync is not restored, this circuit is defective. If normal operation is restored, go to step 3.
3. Inject SYNC signal at the ouptut and input of the sync separator stage. Check the gain of the stage if it is operational. If no sync is obtained, this circuit is defective. If sync is restored, check coupling components into the sync separator stage.

EXCEPTIONS FOR TRANSISTORIZED SETS

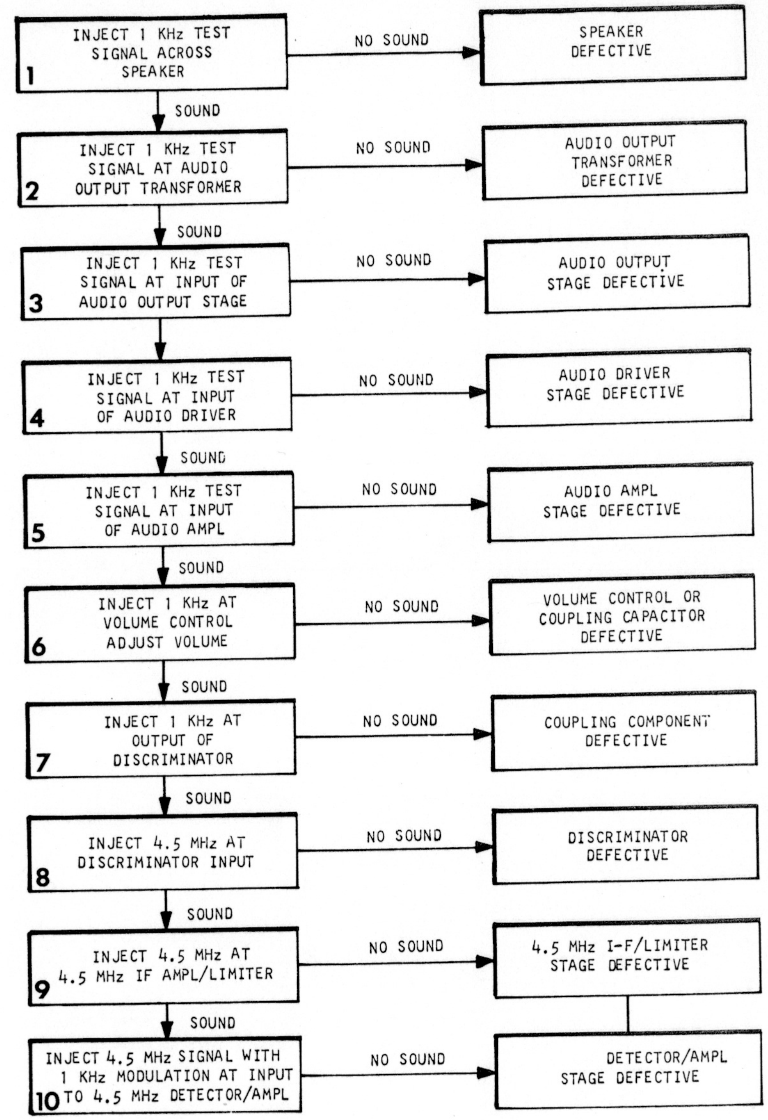
Refer to the schematic diagram of the television receiver and note the peak-to-peak sync voltage normally present in the circuit. Do not exceed this value when injecting signal from the TELEVISION ANALYST.

J. OVERLOADED VIDEO
(See Figure 50)

Overloaded video causes the picture to appear negative and out of sync at normal and high signal levels injected at the antenna terminals. Decrease the signal to a very low level and the normal test pattern will usually appear, accompanied by snow. This symptom is caused by an rf, i-f, or video amplifier that is overdriven, which results in clipping of the signal at normal and high signal levels. A defect in the agc (automatic gain control) section would produce such a symptom because it would allow the amplifiers to operate at maximum gain.

The first step of the procedure is to determine whether or not the trouble is definitely in the agc section.

1. Inject i-f signal into the 3rd i-f amplifier and set the RF ATTENUATOR control to 10. Normally, the agc section does not control the gain of the 3rd i-f amplifier. If the overloaded video symptom still appears, the trouble is not in the agc section. Inject VIDEO signal into each video amplifier stage and locate the defective stage. Make



Condensed Troubleshooting Procedure—NO SOUND—VIDEO NORMAL (See Figure 47)

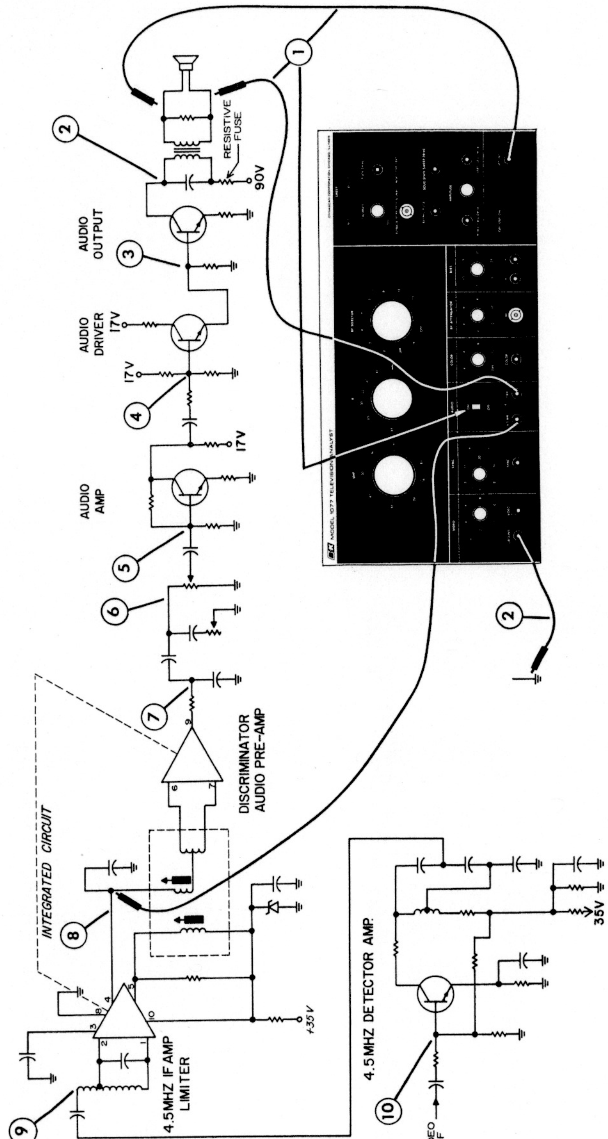


Figure 47. Sound Section Schematic Diagram

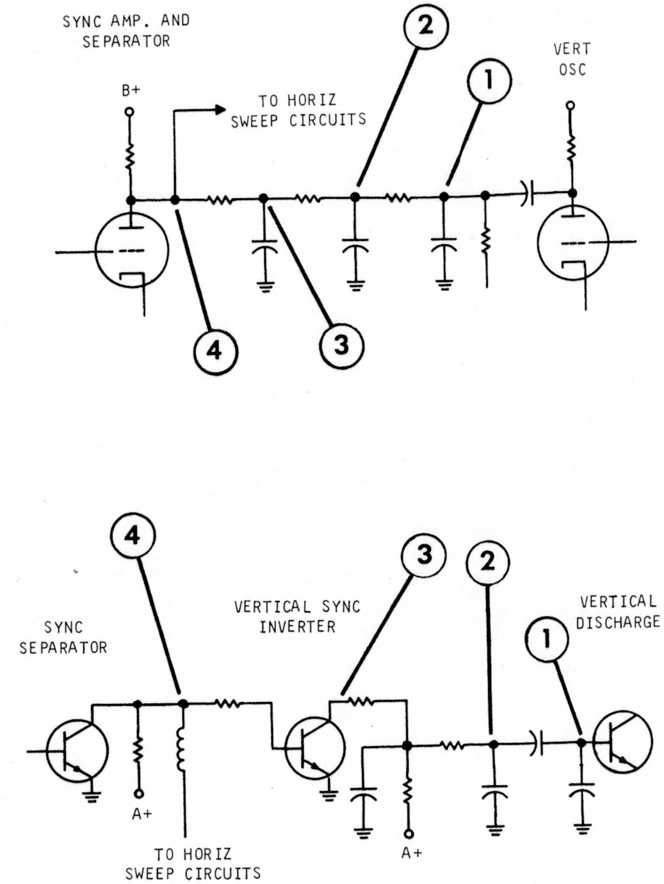


Figure 48. Two Types of Vertical Sync Circuits, Schematic Diagram

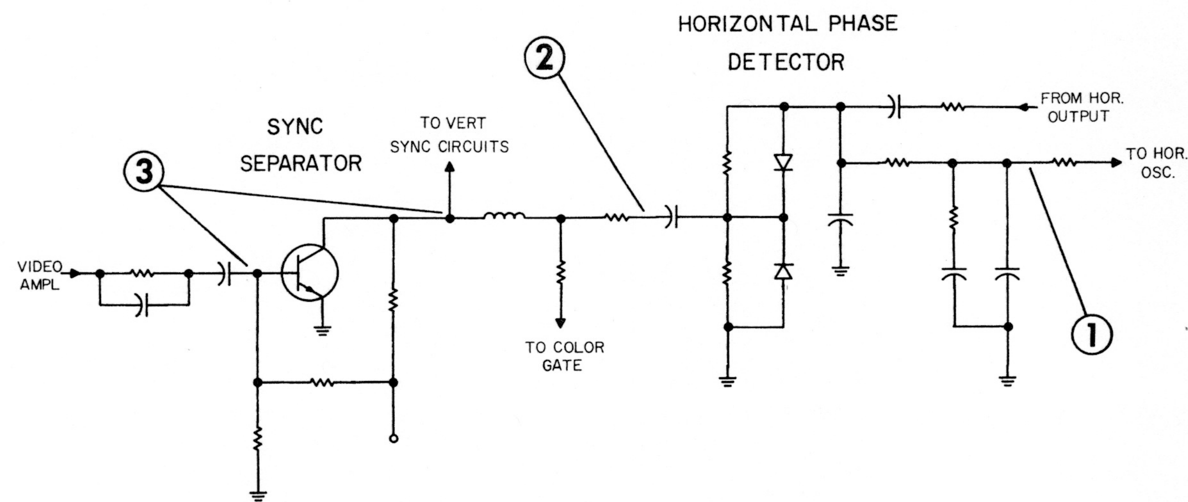


Figure 49. Horizontal Sync Circuit Schematic Diagram

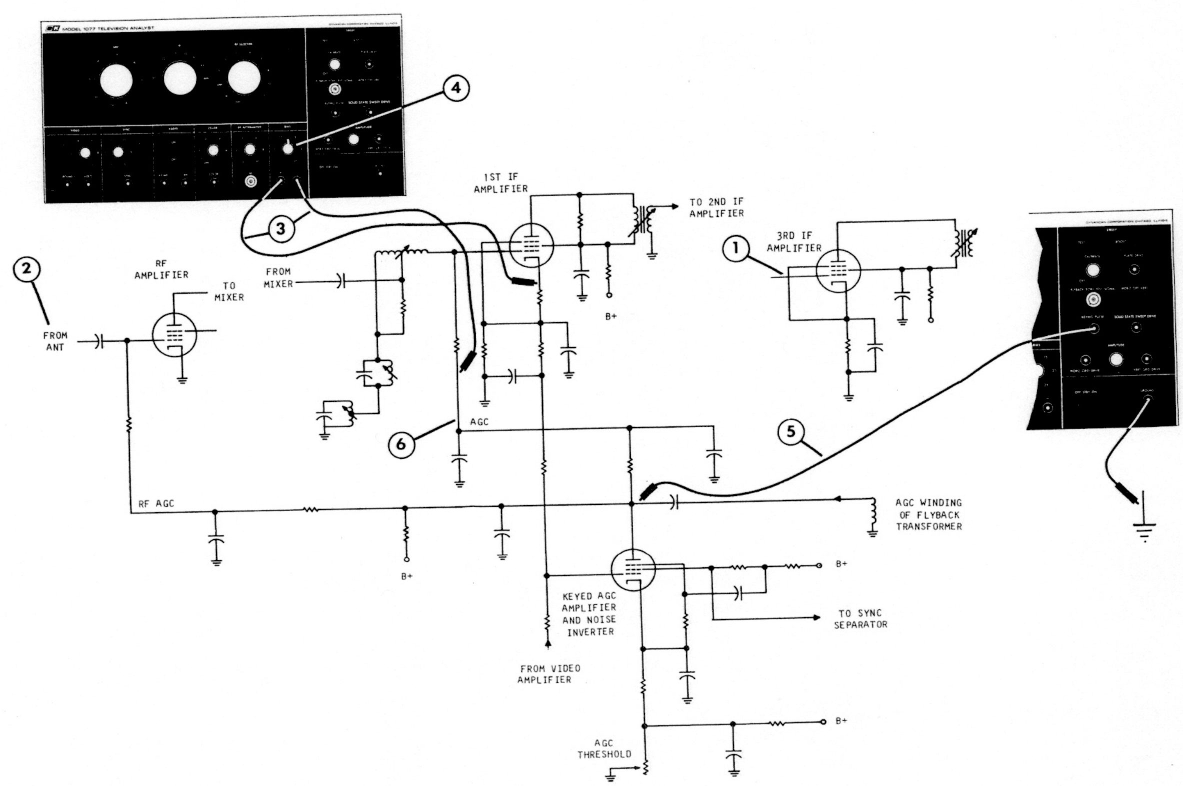


Figure 50. AGC Circuit Schematic Diagram

voltage and resistance checks in the defective stage to locate the defective part. Especially check for a leaky capacitor or changed resistor value that would shift the bias on the stage.

If a normal test pattern is displayed with the i-f signal injected at the 3rd i-f amplifier, it is probable that the trouble is located in the agc section, although not conclusive. Go to step 2.

2. Again inject vhf signal at the antenna terminals and adjust the RF ATTENUATOR control for the symptom of overloaded video.

3. Set the BIAS control to 0 (zero). Connect the bias test voltage to the agc line using the cathode of the 1st video IF amplifier (emitter if a transistor is used) as reference. Connect the polarity to provide negative bias for a vacuum tube or forward bias for a transistor.

4. Increase the BIAS control setting and observe the test pattern display. As the control is turned higher on vacuum tube circuits, the overloaded video symptom should diminish and normal operation should be restored. If turned further, the picture should dim then disappear as the tube is cut off.

On transistorized circuits, the picture should be dim or cut off with the BIAS control set at 0. As the control is increased, normal operation should be restored, then the overloaded video symptom should return.

If varying the BIAS control affects the picture as described, the trouble is definitely in the agc section. The amplifiers have demonstrated that they can be controlled if agc voltage is properly developed. The bias supply has such low impedance compared to the agc circuit that the TELEVISION ANALYST will "take over" and maintain complete control of the agc function. Go to step 5.

If the overloaded video symptom continues to appear while the BIAS control is adjusted, either the trouble is unrelated to the agc section or the agc line is completely shorted. Go to step 6 for complete isolation procedures.

5. Remove the bias voltage connections and inject the KEYING PULSE output at the plate of the keyed agc amplifier. If this step produces normal operation, check for the trouble in the agc winding of the flyback transformer or the coupling components between the flyback transformer and the keyed agc amplifier.

If overloaded video continues, check voltages and resistances of components that would disable the keyed agc amplifier stage.

6. Disconnect the grid (base of transistor) of the 2nd i-f amplifier from the agc circuit and connect the BIAS voltage source in its place (same as step 3). If there is a short in the agc circuit, it will now be disconnected from the amplifier circuit. Vary the BIAS control. If the BIAS control affects the picture as described in step 4, repeat this procedure for the 1st i-f amplifier and r-f amplifier stages. If the overloaded video symptom does not appear continuously at any of these stages, it is conclusive that the trouble is in the agc circuit. Disconnect the agc filter capacitors one at a time and repeat the test procedure (steps 3 and 4) until the defective capacitor is located.

If the overloaded video symptom reappears and the BIAS control has no effect upon the picture in any of the stages (2nd i-f amplifier, 1st i-f amplifier or rf amplifier), check for a defective part in that stage. Be alert for a leaky capacitor that may shift the bias on the amplifier.

EXCEPTIONS FOR TRANSISTORIZED SETS

1. Do not exceed the asterisk (*) on the BIAS control setting.

2. Do not use the KEYING PULSE output. The SYNC output will provide sufficient pulse for most transistorized circuits. Check the schematic diagram of the television receiver for the required peak-to-peak voltage.

K. NO COLOR—BLACK AND WHITE NORMAL

(See Figure 51)

This symptom can be caused by a failure in the color i-f amplifiers, or the color killer. Locate the specific stage with the following procedure:

1. Inject maximum amplitude COLOR signal at the input of the color demodulators. It is very improbable that all demodulators have failed simultaneously, so we will assume that the trouble lies before the demodulators. If synchronized color is displayed, the color oscillator is operating. Go to step 2.

2. Inject maximum amplitude COLOR signal at the output of the 2nd color i-f amplifier.

If no color is displayed, check the coupling components between the 2nd color i-f amplifier and the color demodulators. Use signal injection to isolate the defect to as small an area as possible.

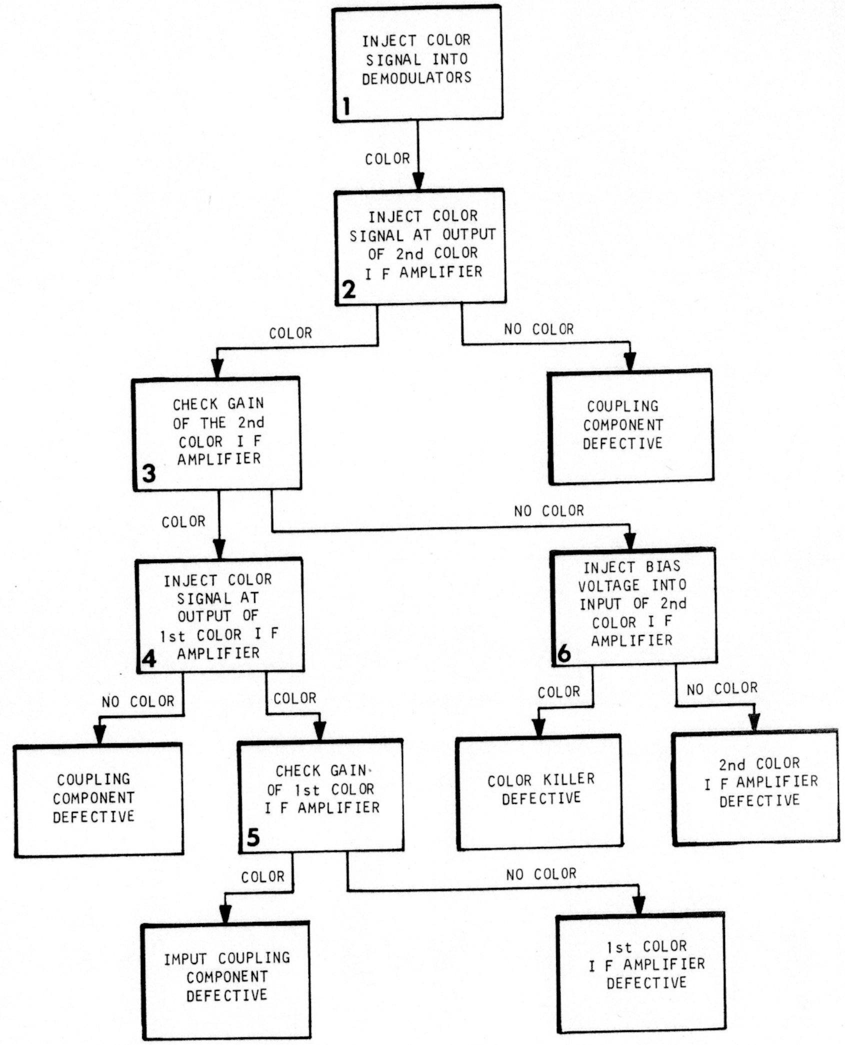
If color is displayed, the coupling components are good. Go to step 3.

3. Check the gain of the 2nd color i-f amplifier by moving the signal injection point to the input of the stage and observing the difference in color intensity on the screen. If the amplifier is operating properly, the intensity of the color display should increase radically when the signal injection point is changed to the input of the stage.

The relative amount of gain may be checked more accurately by reducing the COLOR control setting until color is barely perceptible with the color signal injected at the output of the stage, then moving the injection to the input of the stage and again reducing the COLOR control setting until color is barely perceptible.

If gain is normal, go to step 4.

If gain is low, or no color display is provided with signal injected at the input of the stage, the trouble could be in the 2nd color i-f amplifier or the color killer. Go to step 6 for isolation procedures.



Condensed Troubleshooting Procedure—NO COLOR—BLACK AND WHITE NORMAL (See Figure 51)

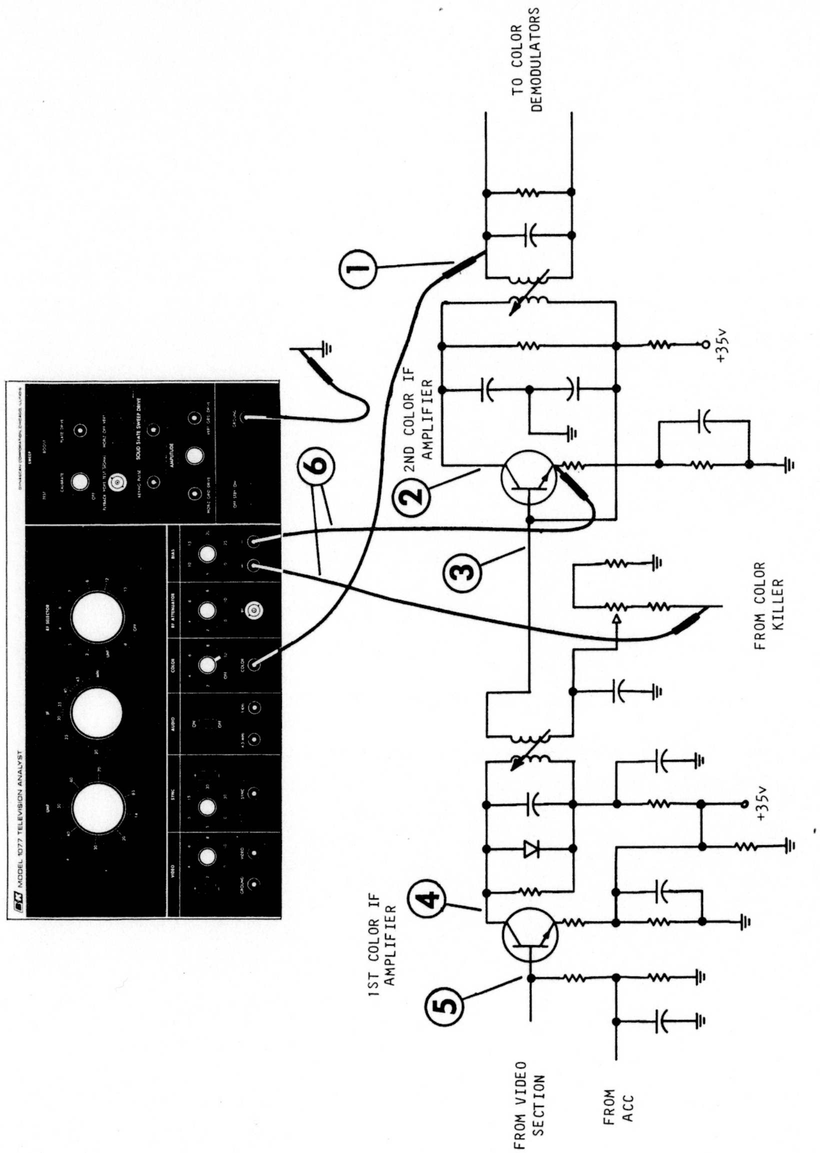


Figure 51. Color IF and Color Killer Schematic Diagram

4. Inject a medium amplitude COLOR signal at the output of the 1st color i-f amplifier. If no color is displayed, the coupling components between the 1st color i-f amplifier and the 2nd color i-f amplifier are defective.

   If color is displayed, the coupling components are good. Go to step 5.

5. Check the gain of the 1st color i-f amplifier. Refer to step 3 for procedures.

   If gain is normal, check the coupling components between the video amplifier section and the 1st color i-f amplifier.

   If gain is low or color is not displayed, the 1st color i-f amplifier is inoperative. Locate the component that has disabled the stage.

6. The procedures in this step isolate a trouble to the 2nd color i-f amplifier or the color killer. The dc output of the color killer normally keeps the amplifier cut off until a color signal is received. If the color killer is defective, the amplifier will stay cut off all the time.

   Leave the vhf signal injected at the antenna terminals and with the COLOR control on. Also connect the BIAS power supply to the input of the 2nd color i-f amplifier and adjust the BIAS control to assure that the amplifier is not cut off.

   If the color display is restored, the color killer is the defective stage.

   If no color can be displayed, the 2nd color i-f amplifier is the defective stage.

EXCEPTIONS FOR TRANSISTORIZED SETS

Do not exceed the asterisk (*) on the BIAS control setting.

L. ONE COLOR ABSENT

(See Figure 52)

With this symptom, all color will be missing on one of the primary color bars (red = bar #3, blue = bar #6, green = bar #10) when the hue control is adjusted to obtain correct color on one of the other primary color bars. All other color bars will probably be of incorrect colors because color mixing cannot be performed when a primary color is missing.

The symptom would be caused by an inoperative demodulator, color amplifier, or color gun in the picture tube. Procedures are virtually the same for red, blue, or green color circuits. For simplicity, the following procedures use the red color circuit only, but a blue or green circuit can be substituted.

1. Remove the antenna terminal connections and either 1st or 2nd video amplifier.

2. Inject maximum amplitude SYNC signal (+) at the red gun of the picture tube. We are not concerned with a test pattern or discernible picture. All we want to check is the ability to produce red on the screen of the picture tube. It may be necessary to adjust HORIZ HOLD to produce visible pattern, the result should be 3-10 diagonal bars.

   If red lines are seen on the screen, the red gun of the picture tube is good. Go to step 3.

   If no red color is displayed, the red gun of the picture tube is defective.

3. Inject a maximum amplitude video signal at the input of the red output amplifier. Try both the positive and negative polarities. If red video is displayed, this stage is good. Go to step 4.

   If no red color is displayed, inject the SYNC signal at various points in the output of the stage to isolate the trouble to as small an area as possible.

4. If the television receiver has a red pre-driver or equivalent stage such as shown in Figure 52, inject a VIDEO signal at the input to that stage.

   If red video is displayed, this stage is good. Go to step 5.

   If no red color is displayed, this stage is inoperative.

5. Inject a VIDEO signal at the output of the red demodulator. If red video is displayed, the trouble is in the demodulator.

   If red color is not displayed, check the coupling components between the demodulator and red amplifier.

EXCEPTIONS FOR TRANSISTORIZED SETS

None.

M. NO COLOR SYNC

(See Figure 53)

With this symptom the color bars are not in the proper sequence or colors are erratic and confetti-like at each color bar. The symptom is caused by loss of synchronization to the 3.58 MHz oscillator by a defective burst amplifier, phase detector, reactance control stage, or oscillator. These stages control the phase of the oscillator. The TELEVISION ANALYST can be used to isolate troubles in these stages as follows:

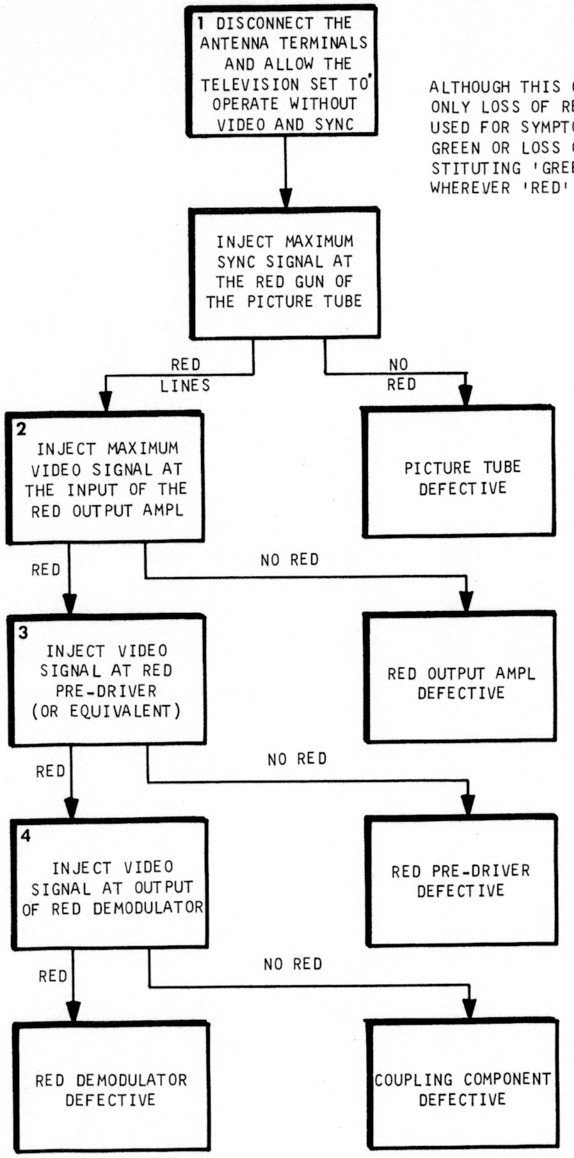
1. Inject bias voltage at the input of the reactance modulator and vary the BIAS control setting. If the reactance modulator stage is good, the hue of the color bars should vary as the BIAS control is adjusted and it should be possible to adjust for proper color display. If varying the BIAS control has no effect, the reactance modulator or oscillator stage is defective.

2. Set the COLOR control to 1 (on) and inject COLOR signal into the burst amplifier. If the burst amplifier and phase detector are good, injection of the signal should restore color sync. If either is defective, the symptom will remain unchanged.

EXCEPTIONS FOR TRANSISTORIZED SETS

Do not exceed asterisk (*) on the BIAS control setting.

ALTHOUGH THIS CHART MENTIONS ONLY LOSS OF RED, IT CAN BE USED FOR SYMPTOMS OF LOSS OF GREEN OR LOSS OF BLUE BY SUBSTITUTING 'GREEN' OR 'BLUE' WHEREVER 'RED' IS MENTIONED.



 Condensed Troubleshooting Procedure—ONE COLOR ABSENT (See Figure 52)

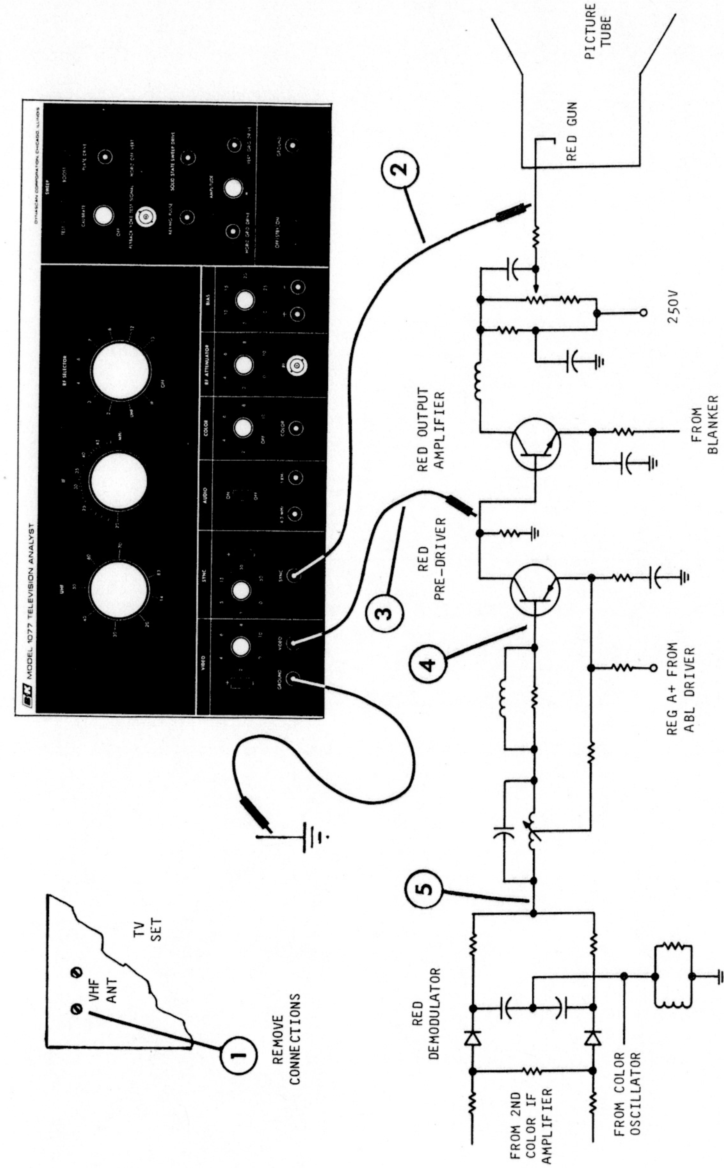


Figure 52. Red Demodulator and Amplifier Schematic Diagram

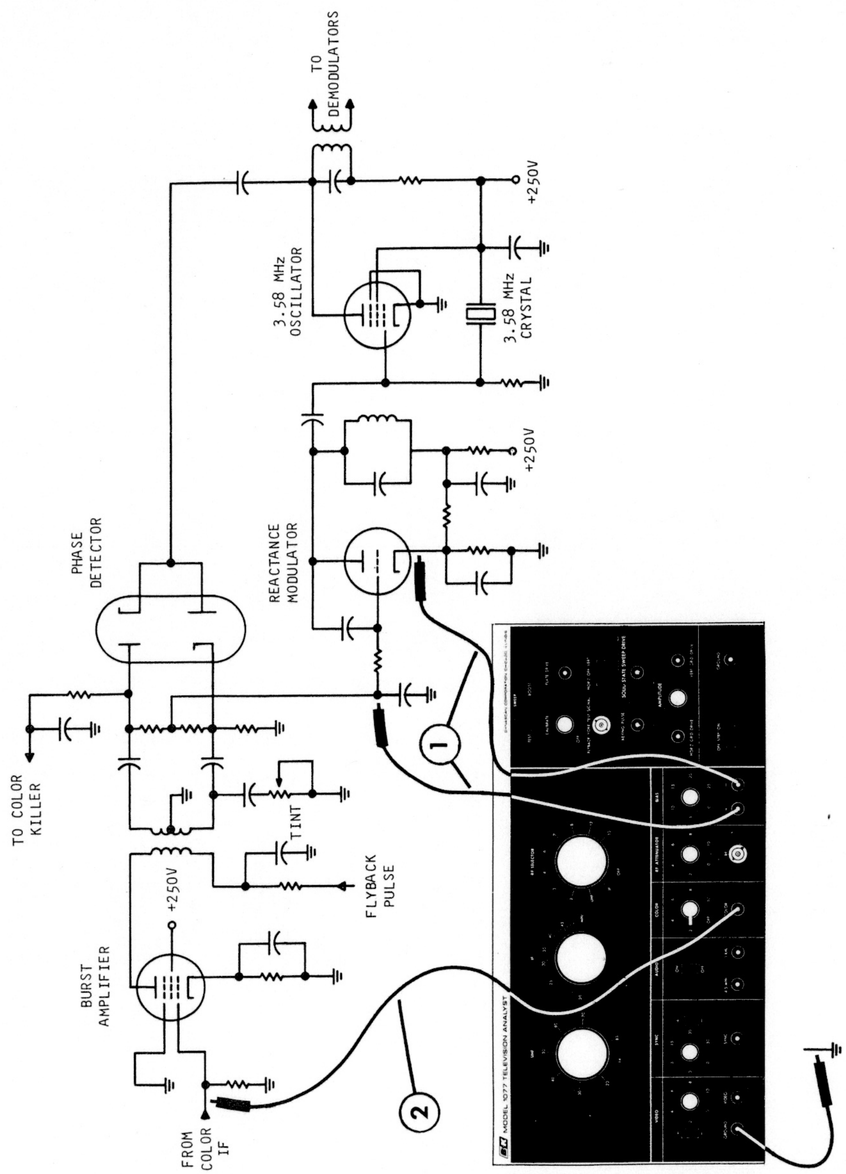


Figure 53. Color Sync Circuit Schematic Diagram

N. INTERMITTENT TROUBLES

Intermittent troubles are the most difficult of all to isolate. The symptom will show up after the television receiver has been in operation, last a while, then disappear for a time. There is no set pattern to the rapidity with which the symptom will appear, nor any guarantee that it will remain equally long when it does show up again. This is the reason intermittent troubles are so hard to track down. Also, it is not unusual for an intermittent trouble to disappear just as the serviceman starts to check the circuit. Because intermittent troubles normally take so much time to locate, the television serviceman often suffers a loss rather than making a profit on the repair. The TELEVISION ANALYST can drastically cut servicing time and convert such losses to profit because it is the ideal instrument for locating intermittent troubles.

During the short duration of the intermittent trouble, the symptom will fall into one of the categories previously given. This alone isolates the trouble to a few stages in a specific section of the television receiver. The TELEVISION ANALYST can be used to inject signals into these stages, and by a process of elimination, the trouble will be narrowed down to one stage.

With intermittent troubles, most technicians prefer to start in the suspected area nearest the antenna and work toward the picture tube (or speaker for audio troubles). Signal is injected from the TELEVISION ANALYST and the television receiver is allowed to operate until the symptom reoccurs. The technician can be servicing another set while waiting for the intermittence to recur.

B&K offers additional test equipment that can be used advantageously with the TELEVISION ANALYST for locating intermittent troubles. The B&K Diagnostic Oscilloscope includes an intermittent analyzer circuit that indicates any change in signal level. Of course, a constant signal source is required such as that from the TELEVISION ANALYST. The Remote Alarm is an accessory for the oscilloscope that provides a flashing light and buzzer alarm whenever the signal level changes. The alarm indications continue until reset. These items of equipment free the technician from closely monitoring the set while waiting for the intermittent trouble to recur.

When the intermittent symptom appears, the point of signal injection is moved to the next stage and the procedure repeated. The last stage at which the intermittent symptom occurred is the defective stage.

Once the defective stage is located, it may be wise to replace components one at a time until the defective part is found. After each part is replaced, inject signal and recheck for the intermittent symptom. When the intermittent symptom ceases, the defective part has been located and replaced.

ADJUSTMENTS

A. CENTERING, SIZE, AND LINEARITY

(See Figure 54)

It is difficult to adjust centering, size, and linearity without the aid of a test pattern such as the TELEVISION ANALYST provides. Using the picture that is normally transmitted by a station, no image remains fixed long enough to permit complete adjustment. Furthermore, any image not containing a fairly large circular pattern will not provide enough visible markings to establish true linearity. If this method is attempted, the non-linearity will be apparent when a circular object finally does appear on the screen.

The test pattern produced by the TELEVISION ANALYST is the ideal signal source for making centering, size, and linearity adjustments. The pattern is unchanged over the duration of the adjustment sequence, it has a large outer circle as a standard for making size adjustments, and it has a number of smaller circles which should all be perfectly round when the linearity of the deflection is properly adjusted.

1. Measure from opposite diagonal corners of the picture tube screen and mark the physical center of the screen with a grease pencil or similar marker.
2. Insert the test pattern into the TELEVISION ANALYST and inject VHF signal at the vhf antenna terminals of the television receiver. Adjust the controls of the TELEVISION ANALYST and the television receiver for the best test pattern display.
3. Adjust the ion trap or centering adjustment of the television receiver so the center circle of the test pattern coincides with the physical center of the screen.

   NOTE

   If the test pattern is badly distorted, perform the linearity adjustments (or troubleshoot and repair if necessary) before the centering adjustment is finalized.
4. If the television receiver has a width adjustment, adjust it so the raster just fills the screen.
5. Adjust the height adjustment so the outer circle of the test pattern just fills the screen vertically.
6. Adjust the vertical linearity and horizontal linearity adjustments for a round outer circle and round inner circles on the test pattern display.
7. Wipe the grease pencil centering marks from the face of the picture tube.

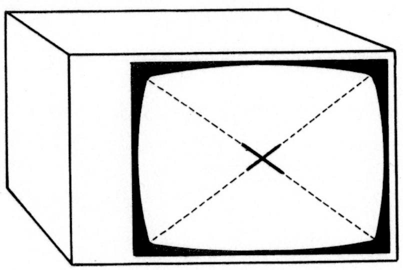


Figure 54. Marking Physical Center of Screen

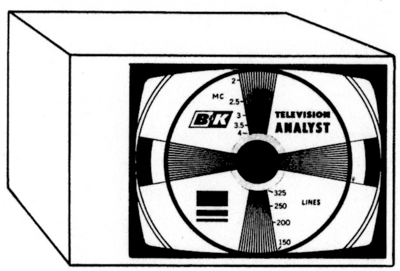


Figure 55. Proper Centering, Size, and Linearity

B. COLOR DEMODULATOR ALIGNMENT

(See Figures 56-57)

1. Inject vhf signal at the antenna terminals of the television receiver. Insert the test pattern slide in the TELEVISION ANALYST and adjust the controls on the TELEVISION ANALYST and the television receiver for the best black and white test pattern display.
2. Remove the test pattern slide and turn the COLOR control to 2. Adjust the controls on the television receiver for best color reception, and correct colors on the color bars, insofar as possible.
3. Connect an oscilloscope of adequate bandwidth to the output of the R-Y amplifier. Set the oscilloscope sweep frequency to 15,750 Hz. A waveform similar to that shown in Figure 56 will be displayed on the oscilloscope.
4. Set the hue control to the center of its range, then adjust the coarse hue control adjustment for zero amplitude on the 6th bar of the oscilloscope display.
5. Move the oscilloscope connection to the output of the B-Y amplifier. Adjust the quadrature transformer which drives the B-Y demodulator so that the 3rd bar is at zero amplitude as shown in Figure 57.

The 6th bar is the blue color bar which is adjusted for zero amplitude in the red demodulator, and the 3rd bar is the red color bar which is adjusted for zero amplitude in the blue demodulator. None of the blue signal gets through the red amplifier and none of the red signal gets through the blue amplifier. The G-Y amplifier is normally driven by the output of the red and blue demodulators, thus no red or blue signals get through the green amplifier.

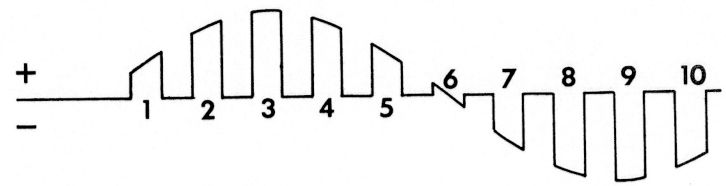


Figure 56. R-Y Amplifier Output as Seen on an Oscilloscope

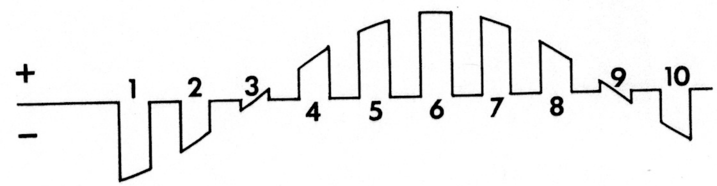


Figure 57. B-Y Amplifier Output as Seen on an Oscilloscope

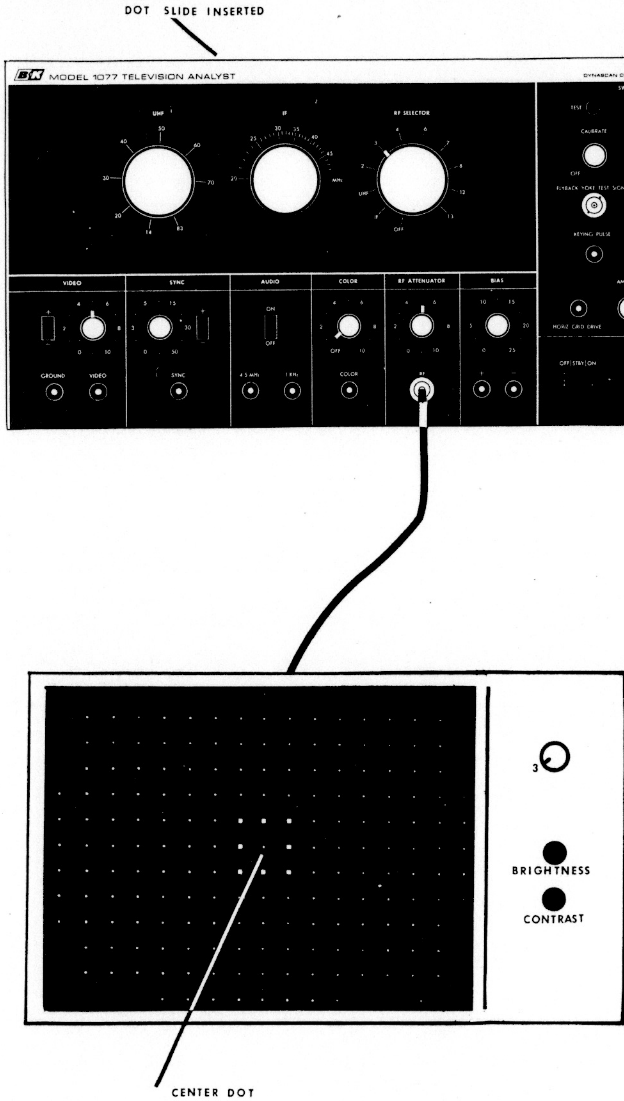


Figure 58. Insert Dot Pattern Slide for Static Convergence Adjustment

C. COLOR CONVERGENCE

(See Figures 58-59-60)

This portion of the manual provides general color convergence instructions and tells how to use the TELEVISION ANALYST as the signal source for color convergence. For complete color convergence instructions for a specific television receiver, refer to the manufacturer's instructions. These will vary from model to model.

1. Set the high voltage for the value specified by the manufacturer (typically 23.5 kv).
2. Adjust the centering, size, and linearity for black and white reception. Refer to the instructions in paragraph A of this section.
3. Degauss the cabinet and the face of the picture tube with a degaussing coil. This step should be performed even if the television receiver has a built-in degaussing coil. They are usually insufficient to correct for large amounts of magnetism.
4. For static convergence adjustments, insert the dot slide into the TELEVISION ANALYST and adjust the static convergence magnets for a white center dot. The center dot is easily identified because it is surrounded by square dots. (See Figure 58)

   Adjust the brightness and contrast controls on the television receiver for a low brightness level that will keep the dot from blooming and becoming enlarged. It may be necessary to slightly increase the VIDEO amplitude; too much video will also cause the spot to bloom. A low brightness level will also make any misconvergence easier to see.

   Figure 59 shows the direction of motion of the red, blue, and green dots that movement of the static convergence magnets will produce. When the three dots are superimposed equally on the center dot, a white dot will result.

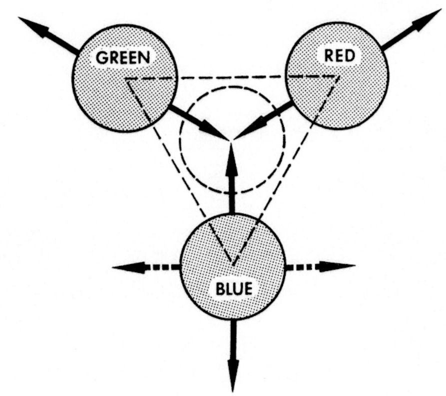


Figure 59. Direction of Dot Movement for Static Convergence

5. Color purity adjustments are made with a synchronized blank raster. The TELEVISION ANALYST provides such a signal by removing the slide. Do not merely reduce the VIDEO control setting to minimum; remove the slide entirely and leave the VIDEO control setting at a normal level. Refer to the manufacturer's instructions for color purity adjustment procedure.
6. It may be necessary to repeat the static convergence and color purity adjustments until there is no interaction.
7. Dynamic convergence is performed with the line slide inserted into the TELEVISION ANALYST.

   The center of the pattern is easily distinguished by dots which surround the center line intersection. (See Figure 60)

   Refer to the manufacturer's instructions for dynamic convergence adjustments. Adjust the brightness and contrast controls on the television receiver and the VIDEO control on the TELEVISION ANALYST so that the lines do not bloom and become enlarged. A brightness level at which the background becomes solid black, and fine white lines are visible is preferred. Any misconvergence is easiest to see at this brightness level.

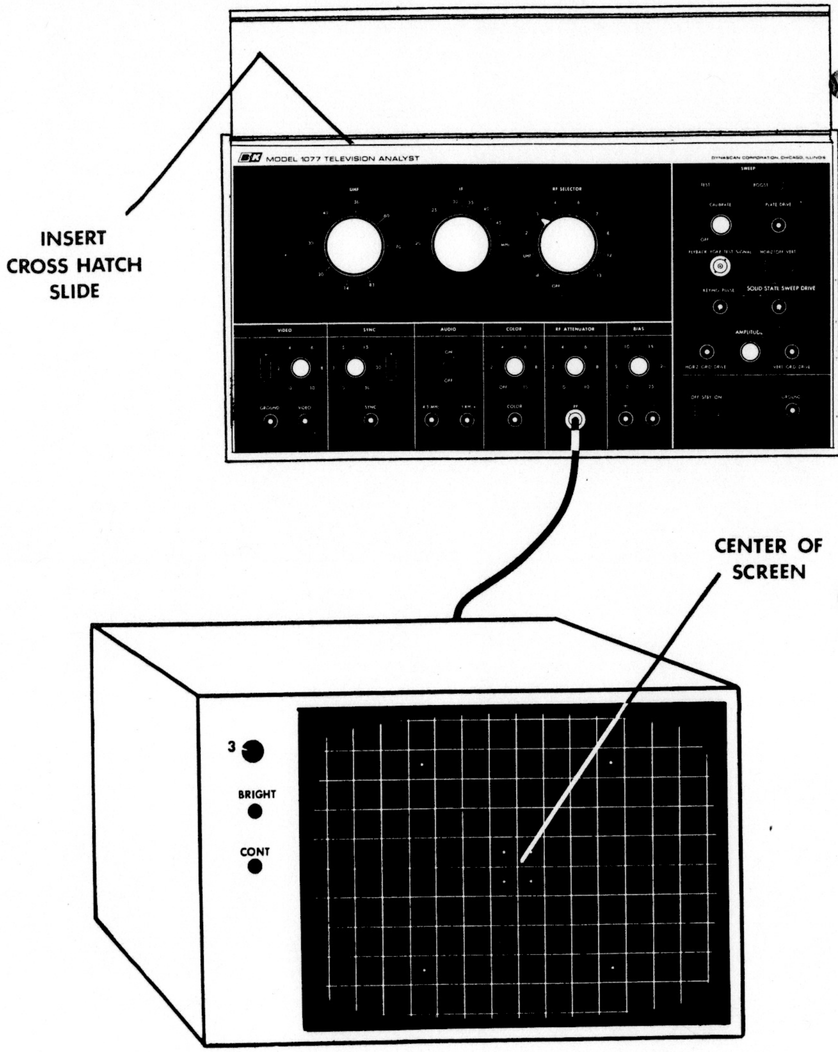


Figure 60. Insert Line Slide for Dynamic Convergence

PERFORMANCE TESTING

The TELEVISION ANALYST can be used to test overall performance of television receivers, including rf sensitivity, agc action, centering, size and linearity, shading, resolution and bandwidth, and frequency response. A performance test should be made at the conclusion of troubleshooting and repair of a trouble that disabled the television receiver. The performance test assures that all troubles are corrected and all adjustments have been made to restore peak performance. If the television receiver is returned to the customer in this condition, there will be few "call backs" and high customer satisfaction. Conduct all of the performance tests listed and take corrective action as required.

For all performance tests, insert the test pattern slide into the TELEVISION ANALYST and inject vhf or uhf signal at the antenna terminals of the television receiver. Tune the television receiver to bring in the test pattern and adjust for the best video.

A. RF SENSITIVITY TEST

Adjust the RF ATTENUATOR control to the lowest amplitude that will provide a picture suitable for viewing. Good rf sensitivity is always important, but especially so in fringe areas. Experience will soon show the highest setting of the RF ATTENUATOR control that will provide suitable viewing in your locality. For example, assume that the minimum acceptable rf sensitivity in your locality is a setting of 3 on the RF ATTENUATOR control. If you are testing a television receiver which has poor video at a control setting of 4 or 5 (or any setting higher than 3), the rf sensitivity of that set is low and steps should be taken to improve the gain. Stage gain checks of the rf and i-f amplifiers should be made to locate the low gain stage. Procedures for measuring gain with the TELEVISION ANALYST are given in both the *Typical Operating Procedure* and *Troubleshooting Procedures* sections of this manual. Realignment of the i-f section may also improve gain.

B. AGC ACTION TEST

Gradually increase the setting of the RF ATTENUATOR control from the low setting used in the rf sensitivity test to maximum. If the agc circuits are operating properly, the television receiver should be able to provide a good quality picture throughout this signal amplitude range. If agc action is inadequate, the picture will tear and produce the "overloaded video" symptom. Refer to that symptom in the *Troubleshooting Procedures* section of the manual for corrective action, but first attempt to correct inadequate agc action by adjusting the agc control on the television receiver.

C. SIZE, CENTERING, AND LINEARITY TEST

Refer to Figure 6 near the front of the manual for a view of the desired test pattern display. The outer circle of the test pattern should just fill the television screen vertically. The raster should fill the entire width of the screen and the outer circle and inner circles of the test pattern should be perfectly round. The outer circle should not reach the sides of the screen because the picture has greater width than height.

If these circles are not round, pictures will be distorted and out of proportion. The customer would notice this most on round objects.

If the television receiver fails this test, perform the applicable procedures from the "Adjustments" section of this manual. If adjustment will not correct the situation, troubleshoot the vertical or horizontal sweep circuits, as applicable.

D. SHADING CHECK

Again refer to Figure 6. Each of the circles at the center of the test pattern is a different shade of gray. Does the television receiver display these circles as separate, distinguishable shades of gray? Improper shading is the result of nonlinear amplification in the video section. Signal injection with the TELEVISION ANALYST may help you locate the specific stage which is causing the trouble.

E. RESOLUTION AND BANDWIDTH CHECK

With the controls on the TELEVISION ANALYST and the television receiver adjusted for the best video display, read the resolution and bandwidth directly from the test pattern that is displayed. Refer to Figure 6; the point at which the vertical lines merge and become indistinguishable is the point where the reading is taken. The bottom scale is marked to show resolution in number of lines, which is dependent upon bandwidth. Bandwidth is marked on the upper scale. Resolution should be at least 250 lines (bandwidth should be at least 3 MHz approximately) for good quality video. A narrower bandwith, and subsequently less resolution, will produce fuzzy images. The highest possible resolution is desired for sharp crisp images.

Poor resolution is usually caused in the video i-f section. Injection of i-f signal at various points may disclose an appreciable decrease in resolution at a specific point in the circuit. If so, that part of the circuit should be checked for a defective part or improper tuning. If no specific part of the i-f circuit can be defined as the cause of poor resolution, realignment of the rf and i-f sections should be performed.

F. FREQUENCY RESPONSE CHECK

The high frequency response was already checked with the resolution and bandwidth test in the previous step. However, if overcompensation is made for high frequencies, the vertical lines of the test pattern may be followed by multiple lines similar to ghost images. Furthermore, it should be possible to tune out the multiple lines with the fine tuning control.

Slight overcompensation can be detected by examining the black horizontal bars at the bottom of the image. The left hand edge will be excessively black and the right hand edge will be followed by a short, excessively white margin.

Low frequency response will also be checked by examining the black horizontal bars at the bottom of the image. Poor low frequency response allows the edges of the bars to be sharply defined, but they will change from black to an excessive white with a streamer shading from this white back to the normal background. The visual effect is one of smearing, with the smear going from left to right.

Poor frequency response, low or high, will probably require realignment of the i-f section.

OTHER USES FOR THE TELEVISION ANALYST

A. DISPLAY YOUR OWN PICTURES OR PATTERNS ON ANY TELEVISION RECEIVER

The TELEVISION ANALYST will transmit any picture or pattern that is in the form of a black and white positive transparency. The only restriction is that the size of the image area be 3 x 4 inches and the full size of the transparency be 4⅞ x 6½ inches to fit into the slide holder. Thus, any pattern may be drawn on a piece of clear plastic or acetate and displayed on any television receiver. To display photographs, have a positive film transparency made and use it in the slide holder.

B. DISPLAY ADVERTISING ON A GROUP OF TELEVISION RECEIVERS

The TELEVISION ANALYST has sufficient output to drive 10 or 12 television receivers simultaneously. More sets can be driven by using an antenna amplifier and feeding the output of the TELEVISION ANALYST into that unit. The advertising, or any other video presentation that is desired, can be made up on a positive transparency slide as described above. Then, for example, all the television receivers in a retail store could display the message. (See Figure 61)

C. SERVICING CABLE TELEVISION AND MASTER ANTENNA SYSTEMS

The TELEVISION ANALYST, since it generates test signals on all vhf and uhf channels, can be used to test and troubleshoot cable television and master antenna systems. These systems are primarily rf amplifier and converter items. The signal substitution method of troubleshooting is used, starting at the television receivers where the complaint of poor reception originated and working toward the master antenna.

D. VIDEO PAGING TRANSMITTER

The TELEVISION ANALYST can be used as a video paging transmitter at hospitals, conventions, and other gatherings. The information to be transmitted is written on a piece of clear acetate with crayon, grease pencil, or similar marker that may be easily wiped clean and reused, or it may be typewritten if desired. For typewritten messages, place the carbon side of two pieces of good quality carbon paper against the front and back side of the clear acetate and insert into the typewriter. Type the desired message and remove the carbons. Using the acetate slide in the TELEVISION ANALYST, the message will be clearly visible on the television monitor, and the acetate may be easily wiped clean and used again. Conventional audio paging may be used to direct the paged person to the television monitor for the visual message.

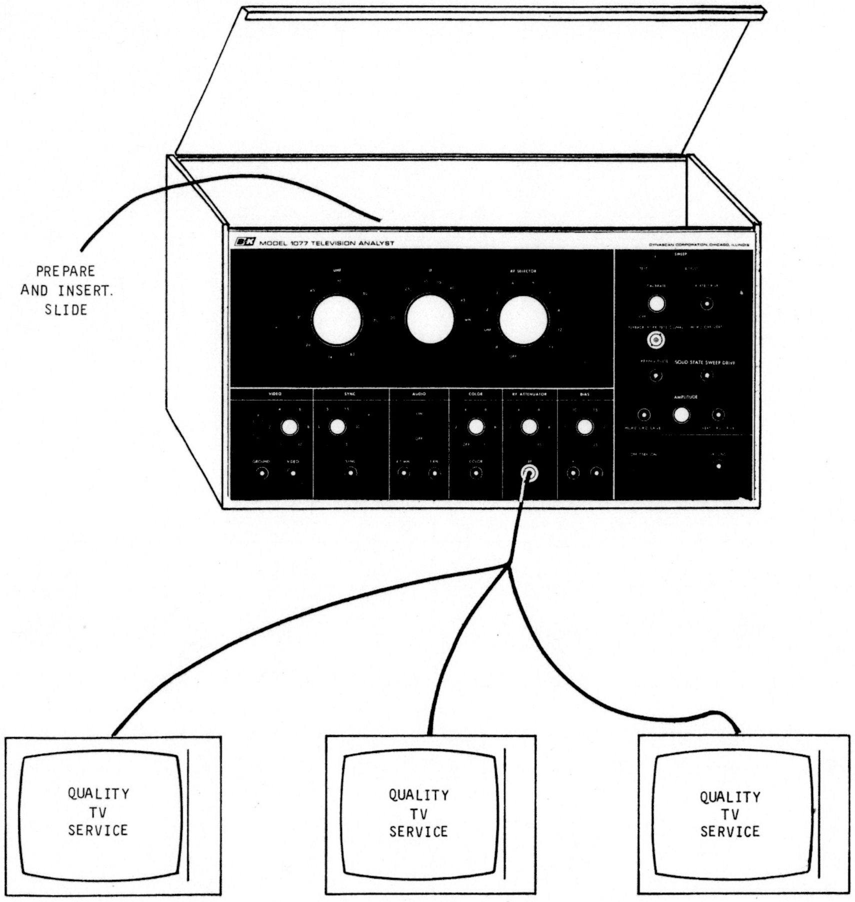


Figure 61. Using the TELEVISION ANALYST for Advertising Display

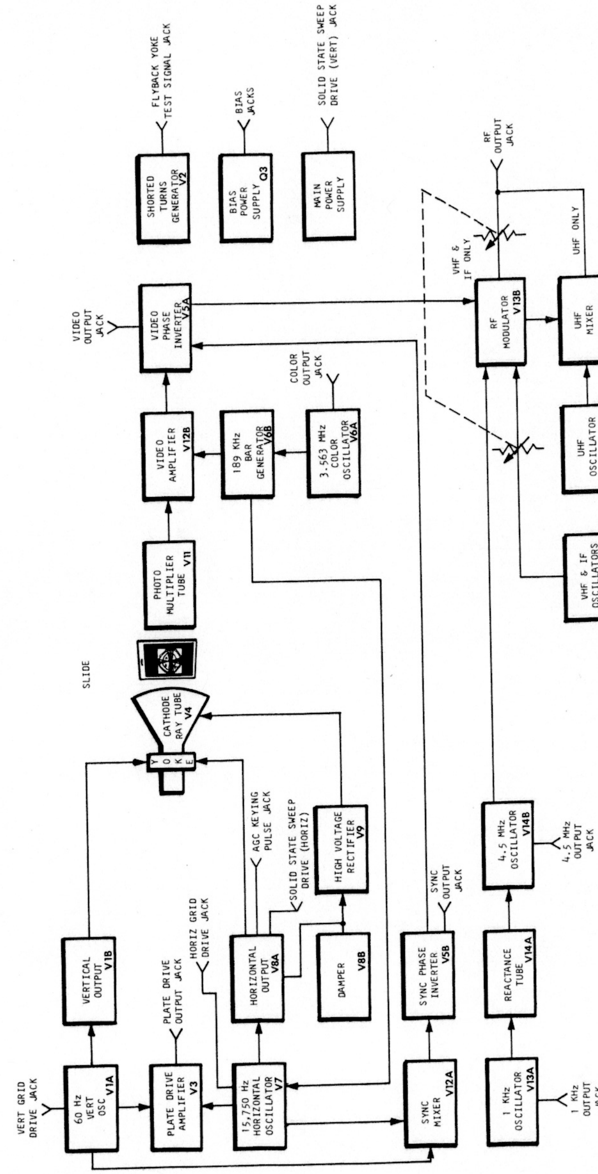


Figure 62. Block Diagram of the TELEVISION ANALYST

THEORY OF OPERATION

A. GENERAL

Refer to the block diagram (Figure 62) and the following explanations for functional operation of the TELEVISION ANALYST. Many of the stages in the TELEVISION ANALYST are basically the same as those used in many television receivers. Brief circuit descriptions are provided for these stages. Special circuits are described in greater detail.

B. SCANNING SECTION

(See Figures 63-64)

The scanning section is the heart of the TELEVISION ANALYST. It consists primarily of the cathode ray tube and the photo-multiplier tube. Basically, the following actions are performed in the scanning section:

- a dot of light scans the cathode ray tube
- a slide masks the light which reaches the photomultiplier tube
- the photomultiplier tube converts the light into a video signal that is equivalent to the image on the slide

An electron beam scans the face of the cathode ray tube just as in a television receiver. That is, the beam starts at the top and moves from left to right, retraces quickly to the left and moves down one line, then again moves from left to right. This is repeated until the beam reaches the bottom, then the whole process is repeated.

As the electron beam scans, it produces a flying dot of light. The light is directed toward a photo-multiplier tube which produces an output signal that is proportional to the amount of light which strikes it. A positive transparency slide may be inserted between the cathode ray tube and the photomultiplier tube. As the small spot of light sweeps across the slide from left to right, light passes through the transparent portions of the slide and maximum output voltage is produced by the photomultiplier tube (see Figures 63 and 64). When the spot passes behind the black parts of the slide, no light reaches the photomultiplier tube and no output voltage is produced. Shades of gray in the transparency (partially transparent) will produce some output voltage, but less than the fully transparent areas. Thus, as the entire slide is scanned, the photomultiplier tube will produce a video signal equivalent to the image on the slide. If this same video signal is amplified and applied to the Video section of a television receiver, the image on the slide will be reproduced on the screen of that television receiver.

A special type of cathode ray tube is used in the TELEVISION ANALYST, and it is matched to the spectral response of the photomultiplier tube.

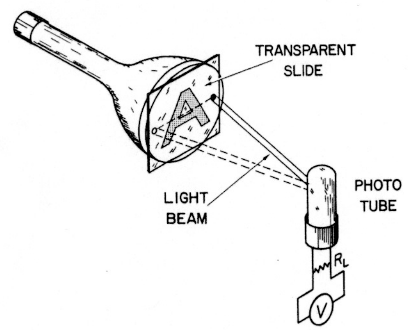


Figure 63. Changing a Visual Image to an Electrical Signal

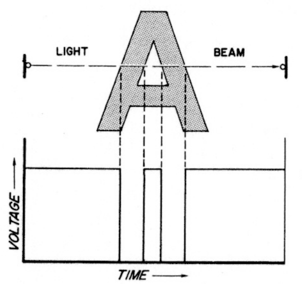


Figure 64. Voltage as Light Beam Moves Across Pattern

C. VERTICAL DEFLECTION SECTION

Vertical deflection of the "flying dot" is provided by this section of the TELEVISION ANALYST. It consists of the vertical oscillator and vertical output stages. The oscillator uses 60 Hz ac input power for synchronization. The ac power is applied across a transistorized clipping circuit and converts it into a square wave. Shaping and timing circuits further modify the signal into a sawtooth sweep signal. The VERT GRID DRIVE jack permits a signal to be taken directly from the stage for injection into a malfunctioning television receiver. Vertical size and linearity adjustments are included in the circuit. The vertical signal is also applied to the plate drive amplifier, which provides high level vertical test signals.

D. HORIZONTAL DEFLECTION SECTION

The horizontal deflection section, which consists of the horizontal oscillator, horizontal output stage, damper, high voltage rectifier, and the horizontal deflection yoke, provides horizontal deflection for the "flying dot". The horizontal oscillator provides a 15,750 Hz sawtooth waveform from a multi-vibrator type circuit. An internal adjustment is provided for frequency adjustment. The output of this stage is available at the HORIZ GRID DRIVE jack for injection into television receivers. The horizontal oscillator is synchronized with a sub-multiple of the 189 KHz color bar generator.

The output of the horizontal oscillator is continuously applied to the horizontal output stage. The horizontal output stage contains an amplifier and conventional flyback transformer. These devices drive the yoke to give horizontal deflection. A width coil shunts the yoke a variable amount to adjust horizontal size. The flyback transformer, in conjunction with the damper and high voltage rectifier, provide approximately 12.5 kv high voltage for the cathode ray tube. Boosted B+ is developed by the flyback transformer and damper for use as plate voltage by many of the stages in the TELEVISION ANALYST. The KEYING PULSE is taken directly from a winding of the flyback transformer.

The horizontal oscillator signal is applied to the plate drive amplifier. A switch allows the operator to select vertical or horizontal sweep signal as the input to the plate drive amplifier. The switch also has an OFF position which disables the amplifier. The output signal, used for signal injection troubleshooting, is taken at the PLATE DRIVE jack.

E. SYNC SECTION

Output from the vertical oscillator and horizontal oscillator are sampled and applied to a sync mixer. The sync mixer provides isolation between the two inputs, but produces an amplified sync signal containing both vertical and horizontal sync pulses at its output.

This composite sync signal is applied to the sync phase inverter stage which provides output at both the cathode and plate. The SYNC POLARITY switch selects the cathode signal in the positive position and plate signal in the negative position. The output signal is available from the SYNC jack for injection into television receivers. The amplitude of the signal at the jack is adjusted by the SYNC control, but this control has no effect upon the amplitude of the signal within the TELEVISION ANALYST. An internal adjustment sets this level.

F. VIDEO SECTION

The video signal is produced by the photomultiplier tube. The amplitude of this signal is adjusted by the VIDEO control. Additional amplification is provided by the video amplifier stage. It is here that color signal is added whenever color is used (see paragraph G below. The output of the video amplifier is applied to the video phase inverter along with the composite sync signal. A composite video signal with vertical and horizontal sync pulses is provided at both the plate and cathode of this stage. Since these signals are of opposite polarities, the video polarity switch selects a positive signal by connecting the plate output to the VIDEO jack or a negative signal by connecting the cathode output to the VIDEO jack.

G. COLOR SECTION

The color signal is provided by a 3.563 MHz crystal controlled oscillator. This signal, when demodulated against a 3.58 MHz oscillator signal in the television receiver, produces a full 360° phase difference in the time required for one horizontal scan. Since the phase difference is converted to color, and the phase linearity shifts from 0° through 360° as it moves from left to right on each horizontal scan, a full rainbow of colors is generated. The rainbow color signal is available at the COLOR jack and is adjustable by the COLOR control. The control does not affect the amplitude of the color signal used internally in the TELEVISION ANALYST. The OFF position disconnects the oscillator from the output points.

The 189 KHz bar generator is essentially a crystal controlled oscillator with wave shaping components to produce a 189 KHz square wave. A low level 3.563 MHz color rainbow signal is also injected into the stage, with the resultant output a gated color signal which produces the bars of color when displayed on a television screen. The rainbow signal is blocked by the negative portion of the square wave, but the color rainbow signal passes during the positive portion of the square wave. This gated color signal is fed to the video amplifier stage where color signal is added to the black and white video signal which may be present there. The 189 KHz square wave is also coupled to the horizontal oscillator to keep the color bars in sync with the horizontal sweep.

H. SOUND SECTION

The 1 KHz oscillator operates continuously when the TELEVISION ANALYST is turned on. It produces a tone output which is available at the 1 KHz jack. The tone is also applied to a reactance tube which frequency modulates the 4.5 MHz oscillator at a 1 KHz rate. Approximately 25 KHz of deviation is produced. The 4.5 MHz oscillator is turned on and off by the AUDIO switch. Its output is available at the 4.5 MHz jack. The output is also applied to the rf modulator stage which is described in the next paragraph.

I. RF SECTION

The vhf oscillator operates similar to most television tuners with a different coil selected for each channel selection. These coils are pre-tuned to the correct frequency. The same oscillator is used for i-f signal generation, but a front panel tuning control gives a 20 to 48 MHz frequency range. The oscillator output is routed to the rf modulator. The RF ATTENUATOR control adjusts the amplitude of the signal. The rf modulator mixes the rf signal with the video signal (including color which was pre-mixed) and the audio signal. The output of the rf modulator is an rf signal modulated with sync pulses, video, color, and sound. The other part of the RF ATTENUATOR control adjusts the output level at the RF jack.

When the CHANNEL SELECTOR is in the UHF position, the rf oscillator operates, producing a modulated rf signal from the rf modulator stage into the uhf mixer. The uhf oscillator is also energized at this time. It also feeds the uhf mixer. The resultant output of the uhf mixer is a modulated uhf signal at the RF jack.

J. SHORTED TURNS GENERATOR

The FLYBACK YOKE TEST SIGNAL jack provides the signal for testing flyback transformers and horizontal yoke windings for shorted turns. The stage which drives this jack is a high "Q" oscillator. Shorted turns reduce the "Q" of the oscillator circuit, which causes the bias to shift on an associated bulb driver stage. The bias shift causes the stage to conduct and lights the TEST INDICATOR lamp. As little as one shorted turn will reduce the "Q" sufficiently to light the test lamp.

K. POWER SUPPLIES

The bias power supply is a floating power supply; that is, it has no connection to the chassis of the TELEVISION ANALYST. It provides a dc voltage output of either polarity, depending upon the polarity of the connections. It provides up to ¼ ampere of current. The output voltage is somewhat dependent upon the current, but is adjusable from 0 to 25 volts into a high impedance circuit. The source impedance of the power supply is very low.

The power supply for the TELEVISION ANALYST is a conventional transformer type. A full wave rectifier provides 200 volts B+ as plate voltage for many of the stages. Silicon diodes also develop a negative voltage for application to the cathode of the photomultiplier tube and the phase inverter stages. When the OFF-STBY-ON switch is in the STBY position, voltage is applied only to the filaments of the tubes and bias jacks. This way, oscillators can be stabilized and immediate operation is available by merely setting the switch to ON.

ADJUSTING THE TELEVISION ANALYST FOR LOCAL CONDITIONS

The TELEVISION ANALYST is ready for operation as shipped from the factory, but a few adjustments may peak the instrument for most satisfactory operation in your locality. This is primarily due to the fact that all television stations do not produce an identical test pattern. The TELEVISION ANALYST should be adjusted to produce the same linearity, etc. as the local station. These adjustments should be checked periodically and readjusted if necessary.

1. All areas have available at some time during the week a standard test pattern from a local television station. Find out when this pattern is available and warm up a television receiver in good operating condition and the TELEVISION ANALYST for 5 minutes before starting.

2. Tune the television to the local station which is transmitting the test pattern. Follow the Centering, Size, and Linearity adjustment instruction from the Adjustments section of this manual using this signal. Mark the exact center and the circles of the station test pattern on the face of the screen with crayon or similar marker.

3. Tune to an unused channel and inject the test pattern signal from the TELEVISION ANALYST. Readjust the fine tuning if necessary for best resolution. DO NOT READJUST CONTROLS ON THE TELEVISION RECEIVER, IT IS SERVING AS THE CALIBRATION STANDARD FOR THE TELEVISION ANALYST.

4. Adjust the centering, vertical size and linearity, horizontal size, and width controls on the TELEVISION ANALYST so that the test pattern is superimposed over the circles that have been drawn on the face of the screen.

5. The CHANNEL SELECTOR provides vhf signals on channels 2, 3, 4, 6, 7, 8, 12, and 13. These channels should ordinarily provide all the channels necessary for testing. If, however, you desire a test signal on channel 5, 9, 10, or 11, these can be obtained by readjusting the coils of an adjacent channel. The following table provides readjustment instructions:

DESIRED CHANNEL	READJUST COIL OF CHANNEL	TURN COIL SLUG
5	6	4 turns counterclockwise
9	8	1½ turns clockwise
10	8	2½ turns clockwise
11	8	4 turns clockwise

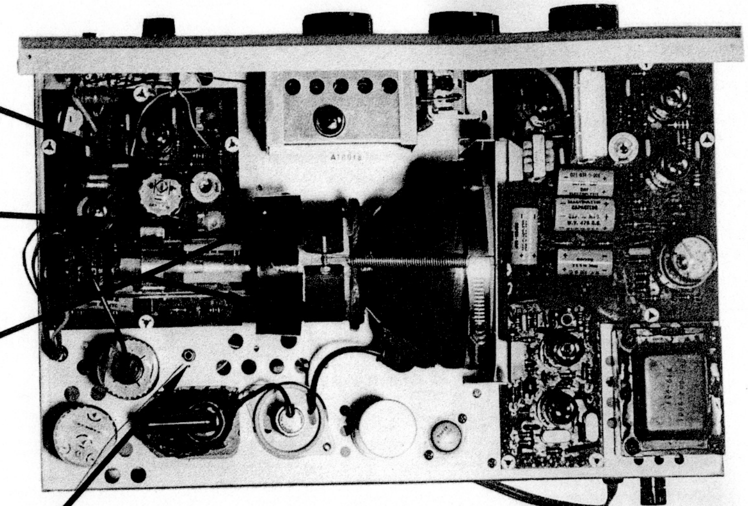


Figure 65. Size and Linearity Adjustment Locations

MAINTENANCE

A. GENERAL

Very little periodic maintenance is required. A periodic check of the adjustments listed in the *Adjusting the TELEVISION ANALYST for Local Conditions* section of the manual and occasional cleaning of the face of the cathode ray tube are the only recommended steps. Any time that the instrument does not meet the specifications listed at the beginning of the manual, adjustment or repair should be performed. Calibration of the instrument must be maintained if the television receivers which you service are to be tuned to peak performance.

In the event of instrument failure, presence or absence of the output signals at the various jacks will isolate the trouble to one or two stages (see the block diagram Figure 62). Tubes from the suspected stages should be tested or substituted. If tube replacement does not restore operation, voltage checks at a few points in the circuit should reveal the trouble.

Figure 66 illustrates removal of the housing of the TELEVISION ANALYST for access to the circuits. Figure 67 shows the tube and fuse locations. The following table will help correlate tube locations in Figure 67 with the stage names on the block diagram (Figure 62).

TUBE REFERENCE DESIGNATION	STAGE NAME
V1	Vertical Oscillator and Amplifier
V2	Shorted Turns Generator
V3	Plate Driver
V4	Cathode Ray Tube
V5A	Video Paraphase Amplifier
V5B	Sync Paraphase Inverter
V6	Color Oscillator and 189 KHz Oscillator
V7	Horizontal Oscillator
V8	Horizontal Output and Damper
V9	High Voltage Rectifier
V10	VHF-IF Oscillator
V11	Photomultiplier
V12A	Sync Mixer
V12B	Video Amplifier
V13A	1 KHz Oscillator
V13B	RF Modulator
V14	4.5 MHz Oscillator and Reactance Modulator

B. SERVICE ADJUSTMENTS

Linearity and size adjustments are described in the *Adjusting the TELEVISION ANALYST for Local Conditions* section of this manual.

SYNC LEVEL—Measure the signal amplitude at the grid of the rf modulator on an oscilloscope and adjust for 0.7 volt peak-to-peak sync signal.

HORIZ FREQ—Adjust for 15,750 Hz. This can be done by connecting an oscilloscope adjusted to 7875 Hz. horiz sweep to point M on the sweep printed circuit board, adjust R54 for 12 pulses. Refer to Fig. 16 waveform chart.

4.5 MHz OSC—Adjust to exactly 4.5 MHz. If an accurate 4.5 MHz standard oscillator is available, feed both signals into a mixer and adjust the 4.5 MHz control for a zero beat. If no accurate standard is available, tune a television receiver to a local channel and adjust the discriminator for an absolute zero output. Now inject the 4.5 MHz signal into the same discriminator and adjust the 4.5 MHz for absolute zero output from the discriminator.

BEAM CURRENT—Adjust the cathode current of the cathode ray tube for 75 microamperes.

RF-IF OSCILLATOR COILS—These coils are factory adjusted and should not normally have to be readjusted. If adjustment is required, an accurate signal source must be used and the two signals zero beat. This adjustment can be approximated by tuning the television receiver to a local station and simultaneously injecting a signal from the TELEVISION ANALYST on the same channel. Turn the VIDEO control to zero. The zero beat can be seen on the screen.

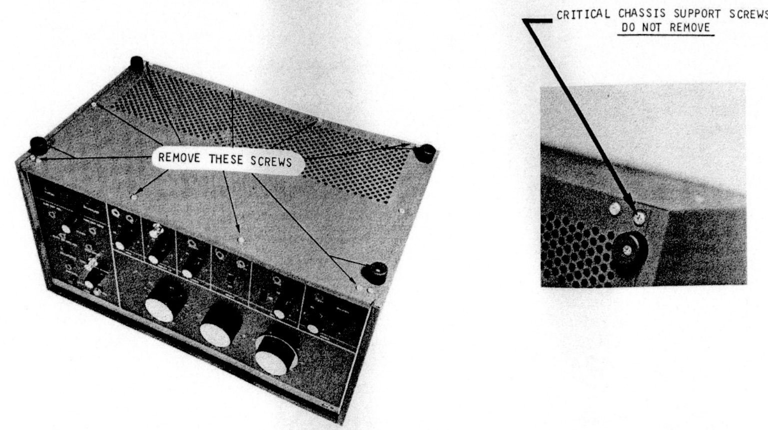


Figure 66. Removal of Housing

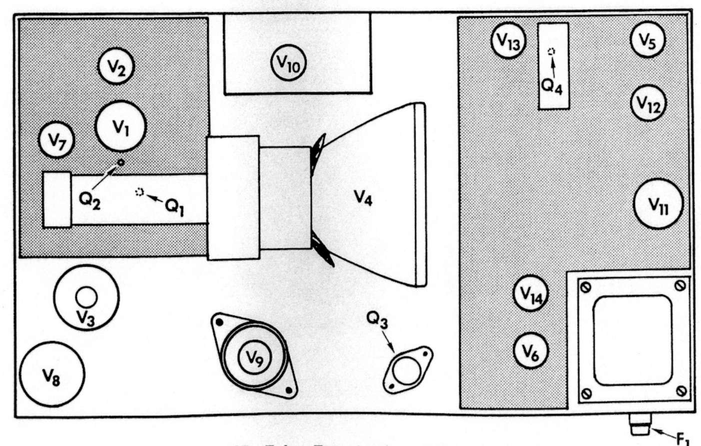


Figure 67. Tube, Transistor, and Fuse Locations.

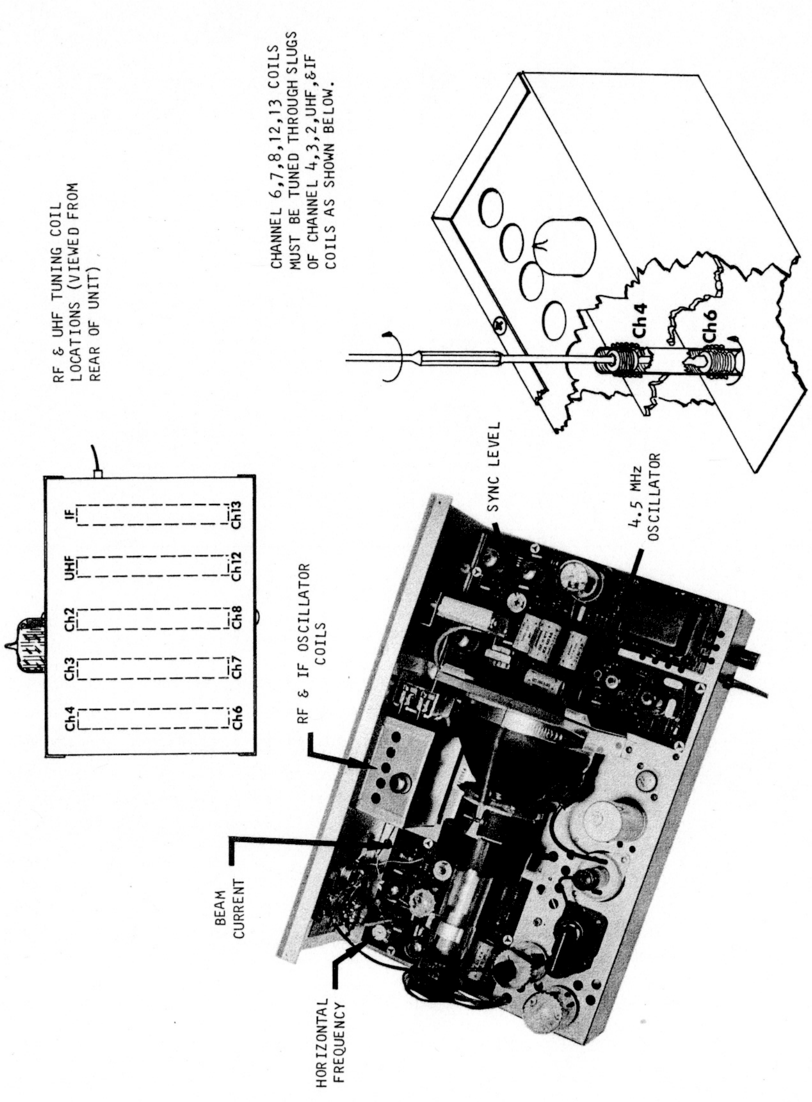


Figure 68. Service Adjustment Locations

WARRANTY SERVICE INSTRUCTIONS

1. Refer to the maintenance section of the instruction manual for adjustments that may be applicable.
2. Check common electronic parts such as tubes, transistors and batteries. Always check instruction manual for applicable adjustments after such replacement.
3. Defective parts removed from units which are within the warranty period should be sent to the factory prepaid with model and serial number of product from which removed and date of product purchase. These parts will be exchanged at no charge.
4. If the above mentioned procedures do not correct the difficulty, pack the product securely (preferably in original carton or double packed). A detailed list of troubles encountered must be enclosed as well as your name and address. Forward prepaid (express preferred) to the nearest B & K authorized service agency.

Contact your local B & K Distributor for the name and location of your nearest service agency, or write to

Service Department
B & K DIVISION OF DYNASCAN CORPORATION
1801 W. Belle Plaine
Chicago, Illinois 60613

WARRANTY

"B & K warrants that each product manufactured by it will be free from defects in material and workmanship under normal usage and service for a period of ninety days after its purchase new from an authorized B & K distributor. Our obligation under this warranty is limited to repairing, or replacing any product or component which we are satisfied does not conform with the fore-going warranty and which is returned to our factory or our authorized service contractor, transpor-tation prepaid, and we shall not otherwise be liable for any damages, consequential or otherwise. *The foregoing warranty is exclusive and in lieu of all other warranties (including any warranty of merchantability), whether expressed or implied.* Such warranty shall not apply to any product or component (i) repaired or altered by anyone other than B & K or its authorized service contractor (except normal tube replacement) without B & K's prior written approval; (ii) tampered with or altered in any way or subjected to misuse, negligence or accident; (iii) which has the serial number altered, defaced or removed; or (iv) which has been improperly connected, installed or adjusted otherwise than in accordance with B & K's instructions. B & K reserves the right to discontinue any model at any time or change specifications or design without notice and without incurring any obligation. *The warranty shall be void and there shall be no warranty of any product or com-ponent if a B & K warranty registration card is not properly completed and postmarked to the B & K factory within five days after the purchase of the product new from an authorized B & K distributor.*"

VOLTAGE CHART

PIN NUMBERS

	TUBE	1	2	3	4	5	6	7	8	9	10	11	12	CAP
V-1	13GF7A	0	0	38	A.C. 101.2	A.C. 88.2	220	0	210	-10				
V-2	6GH8A	150	-4	143	A.C. 88.2	A.C. 81.9	345	0	5.1	-7				
V-3	21JZ6	A.C. 12.6	21	131	0	0					0		A.C. 33.6	0
V-4	230-004-9-001	A.C. 67.2	0				*				300	30	A.C. 73.5	
V-5	12AU7	136.4	9.5	12.8	A.C. 6.3	A.C. 6.3	110.6	-65	-15	0				
V-6	6GH8A	62	7	150	A.C. 6.3	0	218	11	2.2	-4				
V-7	8FQ7/CG7	250	-22	11.1	A.C. 73.5	A.C. 81.9	250	0	11.1	0				
V-8	33GY7	A.C. 67.2	225		★	★			7.25		-54.7	80	A.C. 33.6	
V-9	1BC2	→ 11,500 ALL PINS ←												★
V-10	6CB6	0	15	A.C. 6.3	0	195	55	0						
V-11	231-001-9-001	-170	-115	-58	0	22	43	61	75	90	385	-262		
V-12	12AT7	120	-1.64	0	A.C. 6.3	A.C. 6.3	133.4	-0.21	.5	0				
V-13	12AT7	70	-0.5	.5	A.C. 6.3	A.C. 6.3	70	-5	0	0				
V-14	6GH8A	60	0	175	A.C. 12.6	A.C. 6.3	225	3.3	.5	-5				

★ DO NOT MEASURE.

ALL READINGS REFERENCED TO CHASSIS GROUND

ALL DC READINGS TAKEN WITH 11 MEG VTVM

ALL AC READINGS TAKEN WITH 5000 OHMS/VOLT METER

AUDIO "ON OFF" IN THE ON POSITION

PLATE DRIVE SWITCH IN "VERTICAL POSITION"

ALL FRONT PANEL CONTROLS AT MID POSITION

RF SELECTOR AT "UHF"

COLOR CONTROL ON

*PIN 6 OF V4 IS FOCUS VOLTAGE AND IS FACTORY ADJUSTED FOR BEST SPOT SIZE. IT MAY VARY BETWEEN 0 AND +300 VOLTS.

ADJUST VIDEO FRONT PANEL CONTROL TO READ 22VDC AT PIN 5 OF V11 BEFORE READING OTHER VOLTAGES ON V11

VOLTAGES ARE FOR REFERENCE ONLY AND MAY VARY DUE TO CIRCUIT CONDITIONS

482-018-9-001D 10-70 RR PRESS

MODEL 1077 VOLTAGE WAVEFORMS

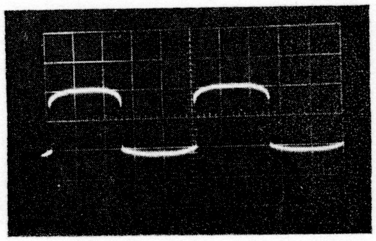


Fig. 1. Base of Q1, 1V P-P, Scope Frequency = 30 Hz.

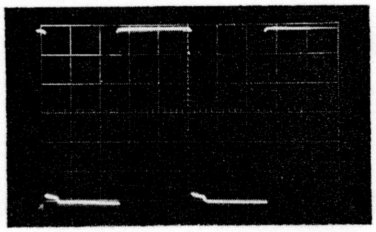


Fig. 2. Collector of Q1, 12V P-P, Scope Frequency = 30 Hz.

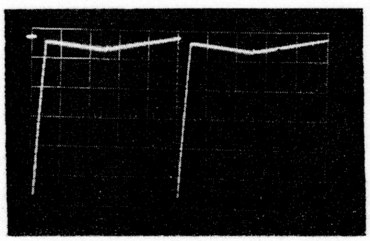


Fig. 3. Base of Q2, 3V P-P, Scope Frequency = 30 Hz.

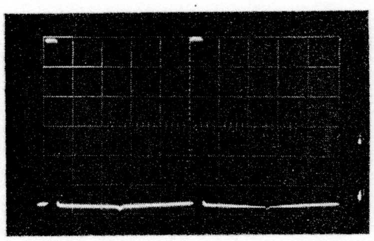


Fig. 4. Collector of Q2, 12V P-P, Scope Frequency = 30 Hz.

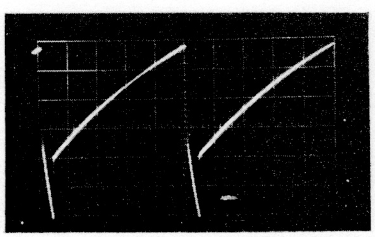


Fig. 5. Pin #2 of V1B, 120V P-P, Scope Frequency = 30 Hz.

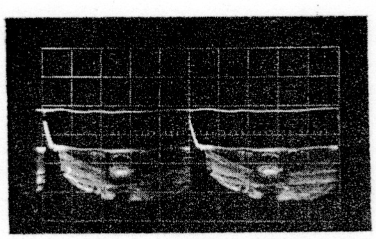


Fig. 6. Pin #7 of V13B, 1.5V P-P, Scope Frequency = 30 Hz.

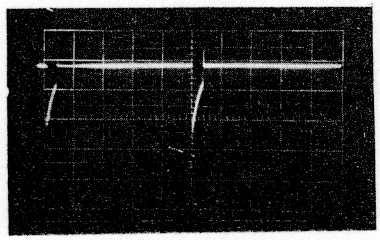


Fig. 7. Pin #2 of V12A, 10V P-P, Scope Frequency = 30 Hz.

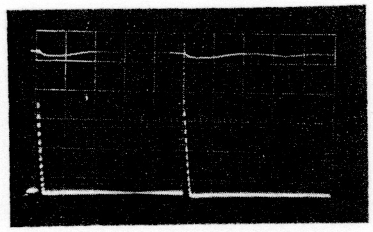


Fig. 8. Pin #8 of V5B, 50V P-P, Scope Frequency = 30 Hz.

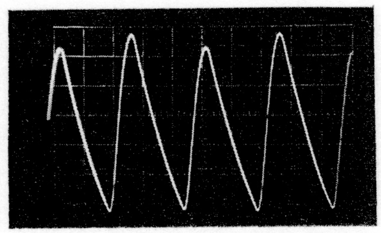


Fig. 9. Ripple 1st Filter Capacitor C8B, 20V P-P, Scope Frequency = 30 Hz.

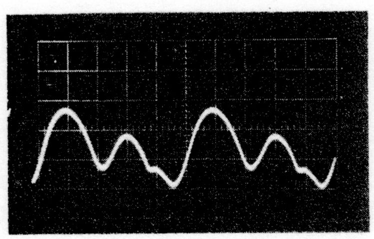


Fig. 10. Ripple 2nd Filter Capacitor C8C, 1.5V P-P, Scope Frequency = 30 Hz.

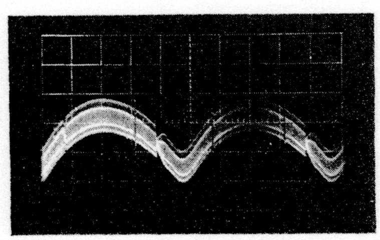


Fig. 11. Bias Output Jacks 1KΩ Load, Control at Max., .15V P-P, Scope Frequency = 30 Hz.

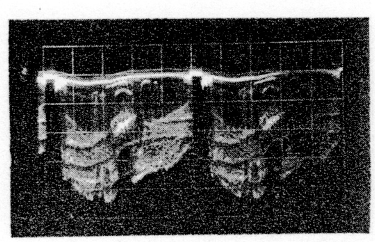


Fig. 12. Pin #10 of V11 (Test Pattern Slide), .2V P-P, Scope Frequency = 30 Hz.

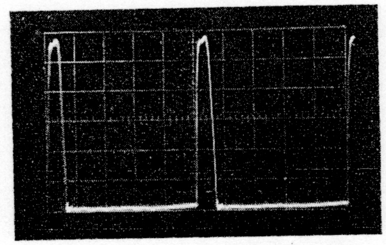


Fig. 13. Pin #3 of V12A, 12V P-P, Scope Frequency = 7875 Hz.

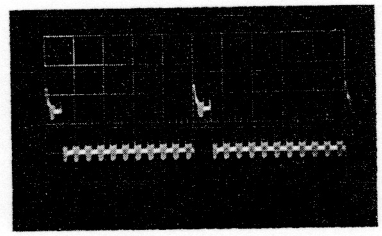


Fig. 14. Video Output Jack, Video Control @ 0, Color "ON", 1V P-P, Scope Frequency = 7875 Hz.

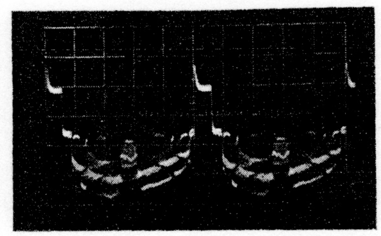


Fig. 15. Video Output Jack Video Control @ 6, 2.5V P-P, Scope Frequency = 7875 Hz.

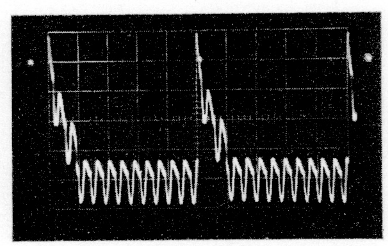


Fig. 16. Junct. of R52 & C19, 6V P-P, Scope Frequency = 7875 Hz.

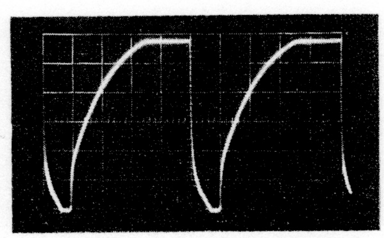


Fig. 17. Pin #10 of V8A, 300V P-P, Scope Frequency = 7875 Hz.

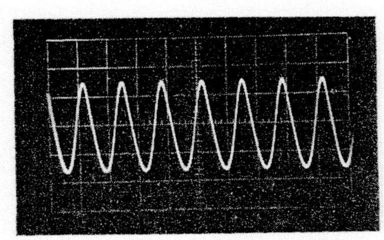


Fig. 18. 1 KHz Audio Jack, 1.5V P-P, Scope Frequency = 120 Hz.

B & K MODEL 1077 PARTS LIST

SCHEMATIC SYMBOL	DESCRIPTION	B & K PART No.
	SLIDE KIT	
	Small Dot Slide	380-089-9-001
	Cross Hatch Slide	380-089-9-002
	Analyst Pattern Slide	380-089-9-003
	R-Y B-Y Slide	380-089-9-004
	Slide Kit Complete	528-001-9-001
	PROBE KIT	
	High Voltage Indicator Assembly (S-4808)	520-022-9-001
	Adaptor Assembly (S-4809)	521-065-9-001
	Red Test Lead Assembly (S-4810)	522-035-9-001
	Black Test Lead Assembly (S-4811)	522-036-9-001
	Red Jumper Cable Assembly (S-4812)	522-037-9-001
	Cable Assembly (S-4813)	522-038-9-001
	Assembled Probe Kit (S-4814)	522-039-9-001

NOTE—Standard value resistors and capacitors are not listed. Values may be obtained from schematic diagram.

Minimum charge $2.00 per invoice. Orders will be shipped C.O.D. unless previous open account arrangements have been made or remittance accompanies order. Advance remittance must cover postage or express.

Specify serial number when ordering replacement parts

B & K MODEL 1077 PARTS LIST

488-081-9-002C

SCHEMATIC SYMBOL	DESCRIPTION	B & K PART No.
	CAPACITORS	
C-8A, B,C,D	40 40 80 50 MFD. Quad Section 350 350 350 50 W.V. Electrolytic Capacitor	021-023-9-001
C-15	50 MFD. @ 50 W.V. Electrolytic Capacitor	022-001-9-002
C-36, C-52	10 MFD. @ 475 W.V. Electrolytic Capacitor	021-033-9-001
C-38A, C-38B	9-281 PF. 2 Gang Tuning Capacitor	029-009-9-001
C-48, C-49	160 MFD. @ 40 W.V. Electrolytic Capacitor	022-001-9-016
C-61, C-63	20 MFD. @ 250 W.V. Electrolytic Capacitor	021-034-9-001
C-62	10 MFD. @ 350 W.V. Electrolytic Capacitor	021-035-9-001
C-64	10 MFD. @ 64 W.V. Electrolytic Capacitor	022-039-9-001
C-92	20 MFD. @ 350 W.V. Non polarized Electrolytic Capacitor	034-002-9-001
	RESISTORS — POTENTIOMETERS	
R-10	3M Ohm Control Vertical Size (Internal)	008-082-9-001
R-11	3M Ohm Dual Control Vertical Amplitude/ Solid State Drive	008-102-9-001
R-15	4K Ohm Control Vertical Linearity (Internal)	009-003-9-001
R-18	100K Ohm Control Shorted Turns Calibrate Control w/Switch	008-078-9-001
R-22	1.5K Ohm 2W Glass Resistor	003-002-6-152
R-51	33K Ohm 2W Glass Resistor	003-002-6-333
R-27	250K Ohm Control Beam Current (Internal)	008-081-9-001
R-37A, R-37B	10K Ohm 10K Ohm Dual Control Sync Amplitude Control	008-073-9-001
R-44	1K Ohm Control Color Amplitude Control w/Switch	008-077-9-001
R-52	1.2K Ohm ½W Glass Resistor	003-102-5-122
R-54	50K Ohm Control Horiz. Freq. (Internal)	008-080-9-001
R-55	47K Ohm 1W Glass Resistor	033-001-5-473
R-59	100 Ohm 2W Glass Resistor	003-002-6-101
R-23	6.8K Ohm 4W Glass Resistor	003-004-6-682
R-71, R-71B	500 Ohm 500K Ohm Dual Control R.F. Attenuator	008-072-9-001
R-72	20 Ohm 5W Glass Resistor	003-005-6-200
R-75	1K Ohm Control Bias Control	008-075-9-001
R-85	250K Ohm Control Video Control	008-076-9-001
R-91	500 Ohm Control Sync Level (Internal)	009-003-9-002
R-106	220 Ohm 7W Glass Resistor	003-007-6-221
R-108	2.2K Ohm 2W Glass Resistor	003-002-6-222
	CHOKES — COILS — TRANSFORMERS	
L-1	50 Mhy Coil	041-033-9-001
L-2, L-3 L-4, L-5, R-30, R-31, C-16	Deflection Yoke Complete	541-002-9-001

COMPOSITE
499-004-9-001C

B & K MODEL 1077 PARTS LIST

SCHEMATIC SYMBOL	DESCRIPTION	B & K PART No.
L-6	1K UH Coil	041-031-9-001
L-7	Width Coil	044-003-9-002
L-18	39 UH Peaking Coil	041-037-9-001
L-19	100 UH Peaking Coil	041-038-9-001
L-20, L-21, L-22	3.3 UH R.F. Choke	041-032-9-001
L-24	4.5 MHz Oscillator Coil	044-010-9-001
T-1	Vertical Output Transformer	061-002-9-002
T-2	Horizontal Output Transformer	063-003-9-001
T-3	Power Transformer (60 cycle)	065-054-9-001
T-3	Power Transformer (50 cycle)	065-054-9-002
T-4	Audio Oscillator, Output Transformer	061-011-9-001

SWITCHES

S-1	Plate Drive/Solid State Selector Switch	084-019-9-001
S-2	Sync Polarity Switch	084-001-9-001
S-4	Video Polarity Switch	084-001-9-001
S-6	Tone Off-On Switch	084-001-9-001
S-3	R.F. Selector Switch	083-077-9-001
S-5	Off-Standby-On Switch	084-013-9-001

DIODES AND TRANSISTORS

D-1, D-9	Germanium Diode 1N48	150-001-9-006
D-2, D-3	Silicon Rectifier 1N4004	151-011-9-001
D-4	Silicon Diode SPECIAL	151-014-9-001
D-5, D-6, D-7	Silicon Diode 1N4006	151-019-9-001
Q-1	Silicon Transistor PNP 2N5139	177-002-9-001
Q-2	Silicon Transistor NPN 2N5126	176-011-9-001
Q-3	Germanium Transistor PNP RCA 40022	171-013-9-001

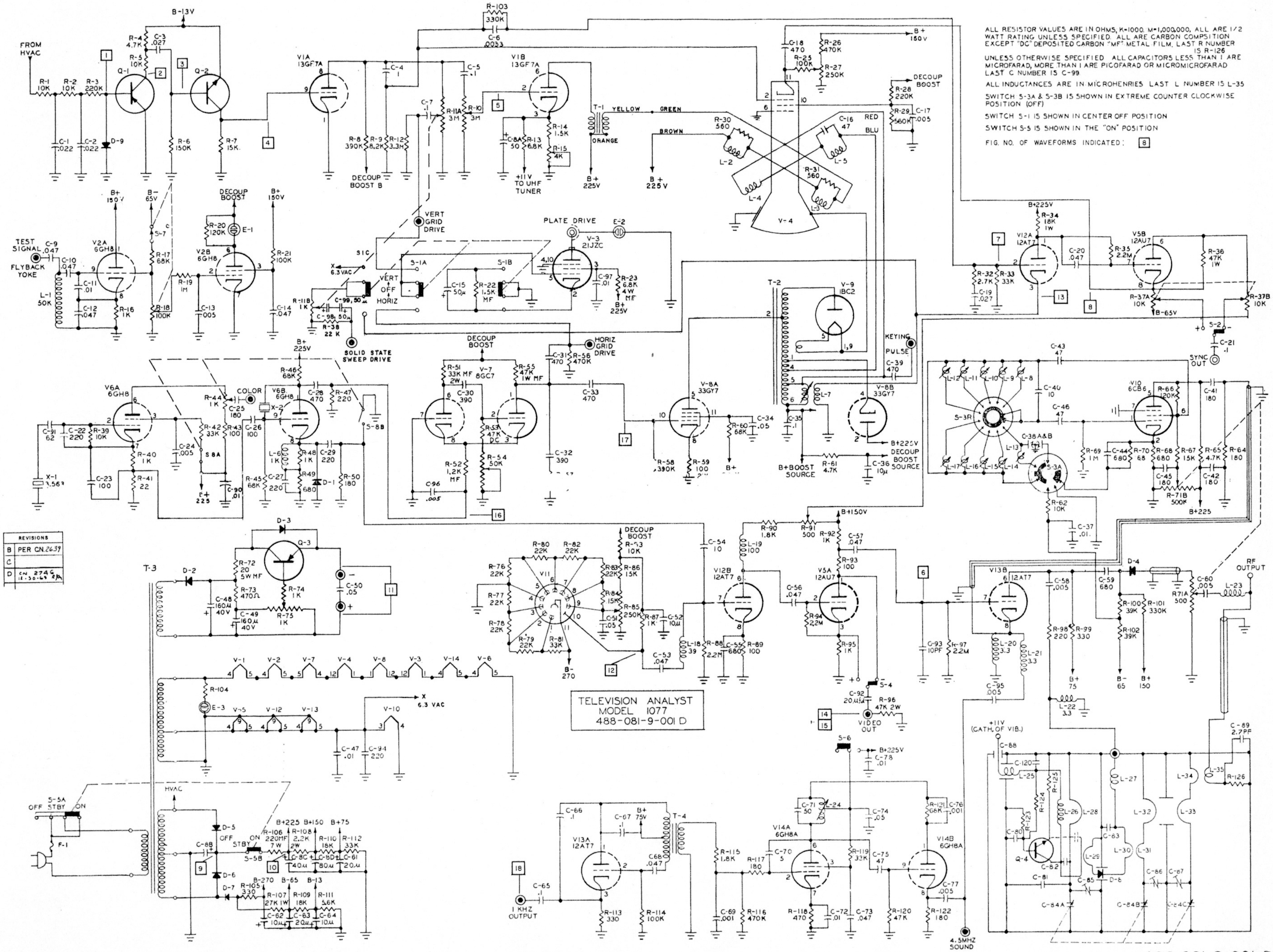
TUBES

V-1	13GF7A Vacuum Tube	235-130-7-067
V-2, V-6, V-14	6GH8A Vacuum Tube	235-060-7-088
V-3	21JZ6 Vacuum Tube	235-211-0-266
V-4	CRT	230-004-9-001
V-5A, V-5B	12AU7 Vacuum Tube	235-120-1-217
V-7	8FQ7 Vacuum Tube	235-005-9-001
V-8A, V-8B	33GY7 Vacuum Tube	236-330-7-257
V-9	1BC2 Vacuum Tube	235-010-2-032
V-10	6CB6 Vacuum Tube	235-060-3-026
V-11	Vacuum Tube Photomultiplier Tube	231-001-9-001
V-12A, V-12B, V-13A, V-13B	12AT7 Vacuum Tube	235-120-1-207

B & K MODEL 1077 PARTS LIST

MISCELLANEOUS

SCHEMATIC SYMBOL	DESCRIPTION	B & K PART No.
F-1	3 Amp. 250V Line Fuse Type: 3AG	191-251-3-003
E-3 w/ R-104	Neon Lamp with 100K Resistor	401-001-9-002
E-1	Neon Light NE-2L	401-002-9-001
E-2	Neon Light NE-2	401-002-9-003
X-1	3563.795 KHz Crystal	131-003-9-001
X-2	189.000 KHz Crystal	131-001-9-020
	Complete Video-Modulator Board with all Components Less Tubes	S-4803
	Complete Sweep Circuit Board with all Components Less Tubes	S-4802
	Complete R.F. Tuner Board with all Components Less Tubes	S-4804
	CRT Support Bracket	250-030-9-001
	Slide Frame with Slide Guides	254-007-9-902
	CRT Clamp	741-031-9-001
	Front Panel	255-067-9-903
	Case Top	272-058-9-903
	Case Left End	272-060-9-903
	Case Right End	272-061-9-903
	Case Back	272-062-9-903
	Case Bottom	272-063-9-903
	7 Pin Printed Circuit Socket	749-049-9-001
	9 Pin Printed Circuit Socket	749-046-9-001
	CRT Socket Assembly with Leads	522-034-9-001
	11 Pin Printed Circuit Socket	749-048-9-001
	12 Pin Socket	749-045-9-001
	9 Pin H.V. Socket	749-050-9-001
	Centering Device	761-001-9-001
	Rubber Feet	381-002-9-001
	Panel BNC Connector	772-018-9-803
	Black Output Jack	774-001-9-002
	Red Output Jack	774-001-9-001
	Small Knob	751-040-9-001
	Large Knob with Pointer	751-056-9-001
	Large Knob UHF Tuner	751-057-9-001
	Dial for UHF Tuner Complete	S-4816
	Ion Trap	755-001-9-001
	Carton with Fillers	500-156-9-001
	Line Cord	420-011-9-001
	9 Pin Printed Circuit Socket (Novar)	749-047-9-001
	Instruction Manual	480-095-9-001
	Voltage and Wave Form Chart	482-018-9-001
	Schematic	488-081-9-001
	Parts List	488-081-9-002
	UHF Tuner Complete	523-023-9-001
	Fuse Holder Complete	742-001-9-805
	Slug for Tuner Coils I.F. UHF Ch2 Ch3 Ch4	870-001-9-001
	Slug for Tuner Coils Ch6 Ch7 Ch8 Ch12 Ch13	870-001-9-002



ALL RESISTOR VALUES ARE IN OHMS, K=1000. M=1,000,000. ALL ARE 1/2 WATT RATING UNLESS SPECIFIED. ALL ARE CARBON COMPSITION EXCEPT "DC" DEPOSITED CARBON "MF" METAL FILM. LAST R NUMBER IS R-126

UNLESS OTHERWISE SPECIFIED. ALL CAPACITORS LESS THAN 1 ARE MICROFARAD, MORE THAN 1 ARE PICOFARAD OR MICROMICROFARAD. LAST C NUMBER IS C-99

ALL INDUCTANCES ARE IN MICROHENRIES. LAST L NUMBER IS L-35

SWITCH S-3A & S-3B IS SHOWN IN EXTREME COUNTER CLOCKWISE POSITION (OFF)

SWITCH S-1 IS SHOWN IN CENTER OFF POSITION

SWITCH S-5 IS SHOWN IN THE "ON" POSITION

FIG. NO. OF WAVEFORMS INDICATED: 8

REVISIONS	
B	PER CN. 2639
C	
D	CN 2746 12-30-69 RM

TELEVISION ANALYST
MODEL 1077
488-081-9-001 D

488-081-9-001 D