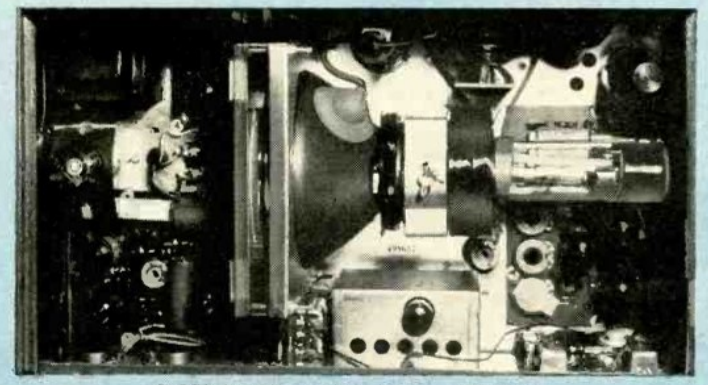
COVER STORY

TV ANALYST SIMPLIFIES SERVICING

By WAYNE LEMONS



B&K Analyst with top cover removed.

Unique test instrument substitutes whole sections of a TV receiver to pinpoint circuit faults

THE B&K ANALYST IS BASICALLY A SMALL TV transmitter capable of injecting both video and FM modulated audio at their natural frequencies or superimposed upon an rf or if carrier (modulation). In addition, the instrument supplies dynamic signals for checking vertical and horizontal sweep, sync and agc circuits. Also provided is a shorted-turns indicator for checking flybacks and yokes and a continuity-leakage checker. A 3.563-mc crystal oscillator (15,750 cycles below color burst) produces a rainbow pattern for checking color sets.

This versatile instrument uses transparent slides and a flying-spot scanner to produce various test patterns on the TV screen. A standard test pattern, cross-hatch pattern, dot pattern, and a color-bar pattern are included with the instrument. A blank for making your own design or advertising message, etc. is also included.

For troubleshooting individual circuits and localizing troubles, the Analyst includes a variety of test functions which should provide the technician with almost unlimited test procedures for cornering a particular TV fault.

The Analyst delivers:

1. Video, audio, rf and if signals.
2. Test pattern signals for adjusting height, width, linearity and centering.
3. A 4.5-mc FM sound channel that can be modulated either with an internal 400-cycle tone or from an external sound source.
4. A 400-cycle tone for tracing audio amplifier circuits.
5. Separate horizontal and vertical oscillator driving pulses for substitution tests.
6. Horizontal and vertical "plate drive" for injection at the plate of either horizontal or vertical output stages.
7. Adjustable amplitude, positive or negative sync pulses for tracing sync circuits.
8. Leakage-continuity and shorted-turns indicator for checking flybacks and yokes.
9. Low-impedance vertical yoke driving signal.
10. Agc keying pulse.
11. Adjustable calibrated negative bias supply.
12. White-dot and cross-hatch pattern for converging color sets.
13. Color bar pattern for testing chroma circuits of color sets.
14. Complete audio–video modulated transmitter for demonstrating TV sets, using as an advertising medium or for checking community antenna systems, etc.
15. High-level video test signal for directly modulating a TV picture tube.

How the Analyst works

The block diagram, Fig. 1, helps to explain its many functions. The scanner tube (5BKPV-1) is positioned so that light from it falls on the 931A photomultiplier tube. Since the scanner tube is deflected by the same horizontal and vertical signals used to sync the TV set being tested, at any given instant, the spot on the scanner tube is at exactly the same place as the spot on the TV tube. Now if we insert a transparency that, at any given instant, blocks the spot on the scanner tube from reaching the photomultiplier tube, this spot will also be missing (cut off) from the TV picture. Actually, this light variation is changed into a voltage variation by the photomultiplier since it doesn't conduct unless excited by light. This voltage (video) is amplified by the first video amplifier and fed into a video phase inverter so that either positive or negative signals are available at the VIDEO jack.

Horizontal and vertical sync signals from the Analyst's oscillators are fed into a sync mixer and phase inverter. The sync signals are mixed with the video in the plate circuits of the 1st video amplifier. They also go to the SYNC output jack through an amplitude control. Either positive or negative signals for tracing sync circuits are available, with a peak to peak voltage of 0–50.

The video and sync composite is also fed to the rf modulator which, in turn, amplitude-modulates the rf (or if) oscillator. Other signals that can modulate the rf–if oscillator are the sound and color oscillator.

An ingenious system of sound modulation is used so that two precisely controlled high-frequency rf carriers (such as used in a TV station) are not needed, and so that a frequency-modulated signal is available at the 4.5-MC output jack.

A 4.5-mc oscillator is first frequency-modulated. Then the composite is fed to the rf modulator which, in turn, amplitude-modulates the rf (or if) carrier with the already frequency-modulated sound. Seem complicated? The simplified schematic of the rf modulator should help to clear it up (Fig. 2).

The color oscillator signal (when on) is also fed into the rf modulator. This oscillator produces a rainbow pattern

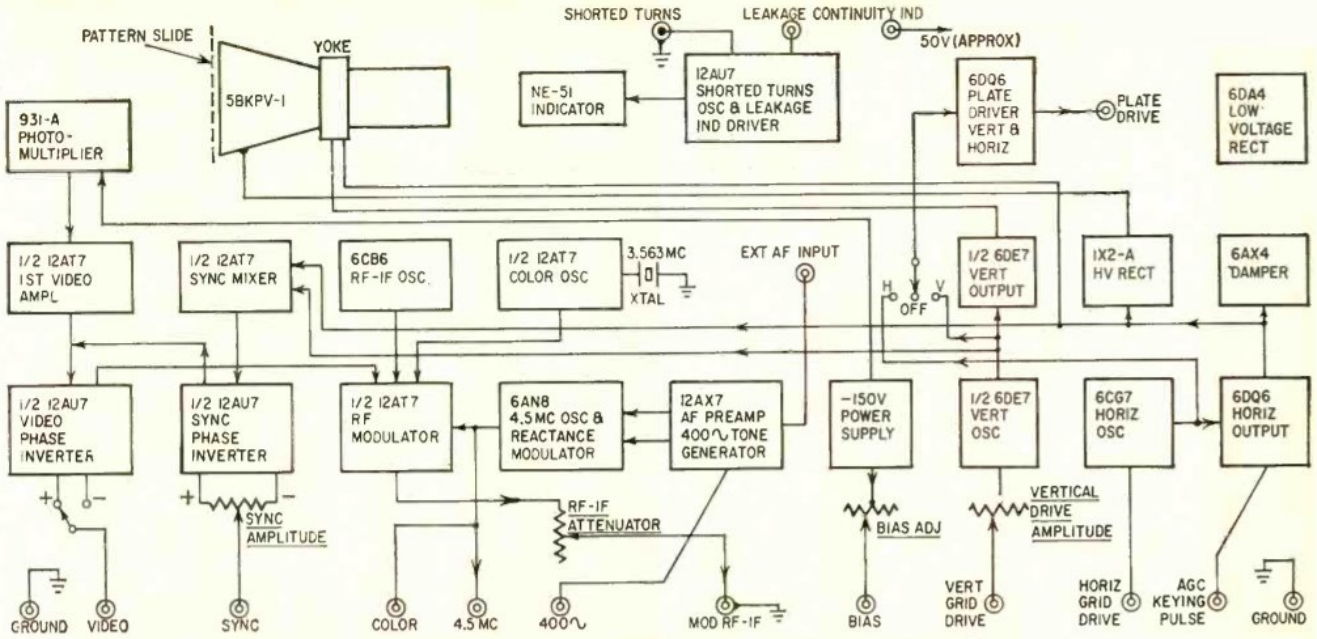


Fig. 1—Block diagram of the B&K model 1076 Television Analyst.

Fig. 2—Rf modulator section of the model 1076.

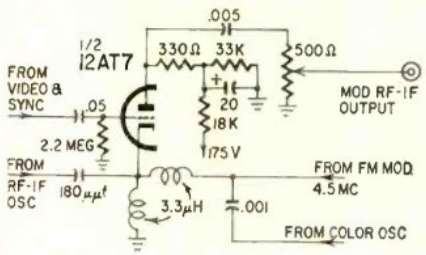


Fig. 3—This color bar pattern is produced by mixing the output of a rainbow generator with that of a flying-spot scanner.

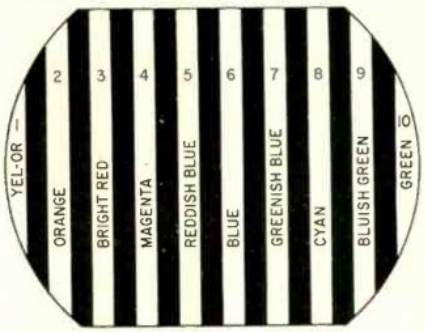
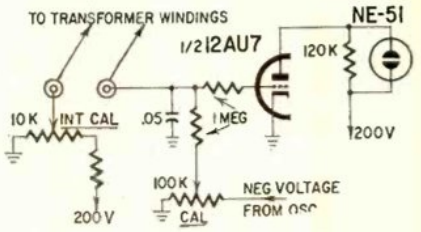


Fig. 4—Basic circuit of the leakage-continuity checker in the Analyst.



because it is exactly 15,750 cycles (horizontal scan frequency) below the color burst frequency. Color is produced since the color oscillator is exactly 1 cycle (for each horizontal scan line) removed from the color burst frequency. This represents phase excursion of 360° and, since color is produced by phase changes, a color rainbow pattern is produced on the TV screen. This rainbow is exhibited whether a color pattern slide is used or not. However, by using the color-pattern transparency, the colors appear in distinct bars and the proper color is identified by name and number (Fig. 3).

The Analyst is ideal for setting up color convergence since the cross-hatch or dot pattern is automatically locked in and stable. The cross-hatch pattern also has small dots near the center for setting dc convergence.

Flyback–yoke checker

The Analyst will check flybacks and yokes for continuity or leakage between windings. It will also check them for shorted turns. Leakage is checked by applying approximately 50 volts between the windings. Any leakage (or continuity) puts a positive voltage on the grid of the 12AU7 (Fig. 4). The tube conducts and the voltage drop increases across the 120,000-ohm resistor, lighting the neon NE-51. The negative voltage used for calibrating this circuit is developed by the shorted-turns test oscillator. When checking for shorted turns (or leakage continuity), the CAL (calibration) control is set so the neon is just extinguished. If a transformer with a shorted turn is connected to the jack, a load is placed on the oscillator and it develops less negative voltage. The neon lights, indicating the defect (Fig. 5).

Other interesting circuits let you drive the horizontal or vertical output circuits by connecting the Analyst right to the plate cap of the horizontal or vertical output tubes in the TV receiver. Or you can drive the grid circuits of the output stages with the oscillator outputs. When driving the plate circuits, a neon BOOST INDICATOR lights up on the front panel if the circuit is working. A clip-on boost indicator is also furnished and is stored in a holder on the front panel.

The techniques of troubleshooting that could be evolved using this instrument would seem to be limited only by the ingenuity of the operator. Now let's look at some actual service problems and use the Analyst to find the trouble.

Case histories

Symptom: Raster, No picture or sound.

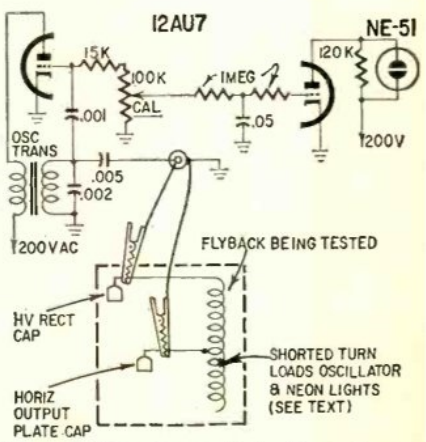


Fig. 5—This circuit finds shorted turns in flybacks and yokes.

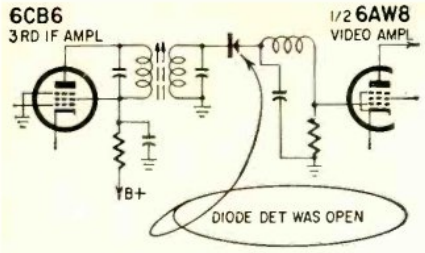


Fig. 6—Open detector diode resulted in no picture or sound.

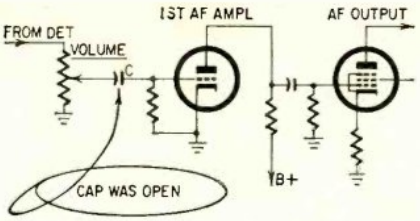


Fig. 7—Here an open capacitor caused weak sound.

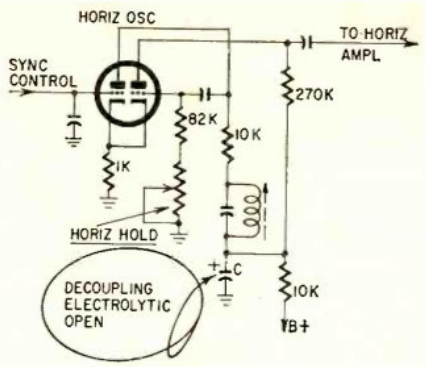


Fig. 8—An open decoupling electrolytic killed the high voltage.

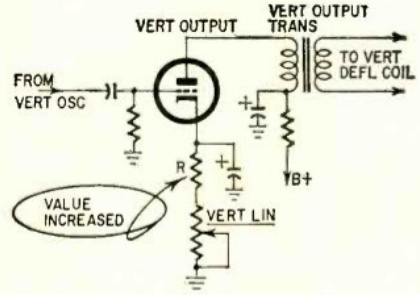


Fig. 9—Insufficient vertical deflection was caused by a resistor increasing in value.

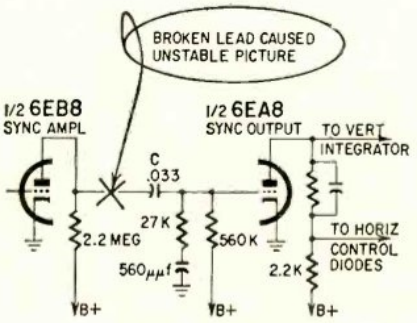


Fig. 10—Poor sync was traced down to a broken capacitor lead.

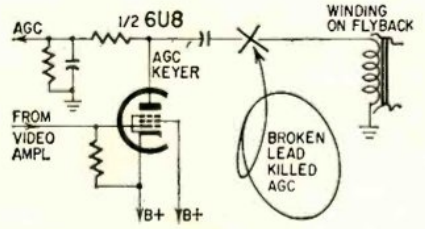


Fig. 11—Negative picture was caused by a break in a flyback lead.

Service procedure: Injected negative video signal into grid of 6AW8 video amplifier. A locked-in picture appeared. Injected if signal into grid of third if tube and swept if dial through its range. Got no picture or sound. Injected if at plate of third if and swept if dial through its range. Still no picture or sound.

Conclusion: Signal being lost between plate of third if and grid of video amplifier. Further checks revealed that diode detector was open. Replacing it cured the trouble (Fig. 6).

* * *

Symptom: Weak sound.

Service procedure: Injected 400-cycle tone at grid of audio output tube. Result: clear tone. Injected signal at grid of first audio. Large increase in tone volume meant first af stage was OK. Injected signal to "hot" side of volume control. Tone very much weaker than at the grid.

Conclusion: Signal being attenuated between volume control and first af grid. Further checks revealed that capacitor C (Fig. 7) was open.

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Symptom: No high voltage—Singing in flyback.

Service Procedure: Removed plate cap from 6BQ6 horizontal amplifier and injected horizontal plate drive from Analyst into it. Boost indicator on Analyst lit, raster returned. Injected horizontal grid drive into grid (pin 5) of 6BQ6. Also had high voltage and raster.

Conclusion: Horizontal oscillator not functioning properly. Checked horizontal oscillator circuit and found open electrolytic decoupling capacitor (C in Fig. 8). Replaced it and set functioned properly.

Symptom: About 1-inch vertical deflection.

Service Procedure: Injected vertical plate drive signal at plate of vertical output tube. Vertical deflection normal. Injected vertical grid drive signal into grid of vertical output tube. Deflection still inadequate.

Conclusion: Trouble in vertical output stage. Checking proved that resistor R in series with the vertical linearity control in the cathode circuit had increased to a high value (Fig. 9). Replacement cured the trouble.

* * *

Symptom: Virtually no sync—vertical hold very critical, horizontal hold somewhat better.

Service Procedure: Injected rf signal into antenna terminals. Injected sync signal into plate circuit of sync output stage (positive polarity). Picture locked in with about 20 volts of sync. Injected sync signal into grid of sync output tube (reversed polarity using sync output control and reduced output). Picture still locked in. Injected same signal into plate of sync amplifier. No lock-in of picture except with sync output control turned to feed in about 30 volts of sync.

Conclusion: Sync signal being attenuated between plate of first sync amplifier and grid of sync output. Investigation disclosed that the wire lead of capacitor C had broken off (Fig. 10).

* * *

Symptom: Color programs could not be received in color. Black-and-white reception perfect.

Service Procedure: Inject color signal from Analyst to input screen of bandpass amplifier. Color pattern appeared on screen. No circuit faults in if strip.

Conclusion: Align if's. Color burst at 3.58 was suppressed because misalignment did not allow full if bandpass.

* * *

Symptom: Receiver produces color and black-and-white pictures but colors were wrong.

Service Procedure: Obviously, the if strip is OK or no color would appear at all. Hook up Analyst to feed color signal to receiver antenna terminals. Examine color bar pattern. No red in pattern. R − Y demodulator must be defective. Check R − Y demodulator. No plate voltage. Coil in plate circuit open.

Conclusion: Replace open coil with new unit. Replace demodulator tube.

* * *

Symptom: No color, picture or sound. Normal raster.

Service Procedure: Defect not isolated to color circuits as monochrome picture also missing. Use Analyst as if servicing monochrome set. Fault traced to defective if transformer.

Conclusion: Replace transformer.

* * *

Symptom: Negative picture, no sync.

Service Procedure: Trouble in the agc was suspected. To confirm our suspicions, the adjustable negative bias available on the front panel of the Analyst was connected to the agc line, and adjusted. At about 5 or 6 volts negative, the picture locked in. Set had keyed agc. No negative voltage was being developed by the keyer even when zero biased. Keyer pulse from Analyst was injected at the keyer plate and the negative agc voltage returned.

Conclusion: No keyer pulse to plate of keyer tube. Investigation uncovered a broken lead wire on the flyback transformer (Fig. 11). END