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tech tips

Understanding Functional Analyzing With The VA62 Video Analyzer

What is it that makes technicians using the VA62 Video Analyzer so effective in troubleshooting? The answer is functional analyzing using signal substitution. Functional analyzing is an efficient method of troubleshooting used for years by top technicians and is taught by the U.S. military and the E.I.A.

A survey of 1,500 Sencore Video Analyzer owners showed that the average technician using functional analyzing cut his service troubleshooting time by 54% compared to his previous troubleshooting methods. Yet, many of our customers tell us they're still unfamiliar with the concept.

Since we believe functional analyzing is the key to productive service, we're writing this Tech Tip to help clarify this important subject.

What Is Functional Analyzing?

Functional analyzing is a systematic, logical approach to troubleshooting. It combines two proven troubleshooting techniques; signal substitution and signal tracing. You substitute known good signals into the television circuits and simply watch the picture tube or listen to the speaker to tell which stages are working properly. You actually restore a defective TV to proper operation when you substitute for the defective stage.

Once you locate the defective stage with signal substitution, you use signal tracing and component testing to isolate the bad part. By positively identifying the bad stage before you begin component testing, you only need to test a few components.

Functional analyzing with the VA62 is a universal troubleshooting technique that makes all TV receivers look alike by troubleshooting from the block diagram level. It works on all types of TVs, from the older tube type sets to the modern IC set.

You don't need to learn a new troubleshooting approach for each different chassis from every manufacturer. No matter what type of components are used; tubes, transistors, or ICs, you use the same universal troubleshooting approach. We've included a Universal TV Block Diagram (back cover) to help simplify your troubleshooting.

The VA62 is the key to functional analyzing video equipment. It supplies all the signals needed to substitute in the circuits found in televisions and VCRs. But, the real beauty of using functional analyzing with the VA62 is that you don't need to disconnect any parts to substitute a signal into the circuit. The VA62 drive signals are low impedance signals that swamp out whatever signal is already present and replace it with the proper input signal for that block. Simply hook the VA62 drive leads to the circuit, select the output level, and watch the results on the CRT.

Once you have the problem isolated to one small circuit block, you'll use signal tracing (with your Waveform Analyzer) and your component testers (transistor tester, Z Meter, DVM, etc.) to find the defective component(s) in minutes. The time-saving key to functional analyzing, then, is that you quickly find the defective block so you don't waste your time checking good components in good stages.

How Do I Use The VA62 For Functional Analyzing?

When a television comes in for service, you need to first determine if there really is a problem in the television and, if there is, what the symptoms are. This first step is called performance testing. To check the overall performance of the television, simply feed an RF signal from the VA62 into the antenna input. What advantage does this give you?

- You have a known good signal going into the television.
- The VA62 signal and its video patterns are easily controlled.
- There are no variations in signals from one channel to another, as may be the case in using over-the-air signals.
- You don't have to wait for a specific scene to judge the quality of the color or the video response.

Once you have verified the overall symptoms (you've already cut the number of suspected components approximately in half), you are ready to track down the defective stage, and then the bad part itself.

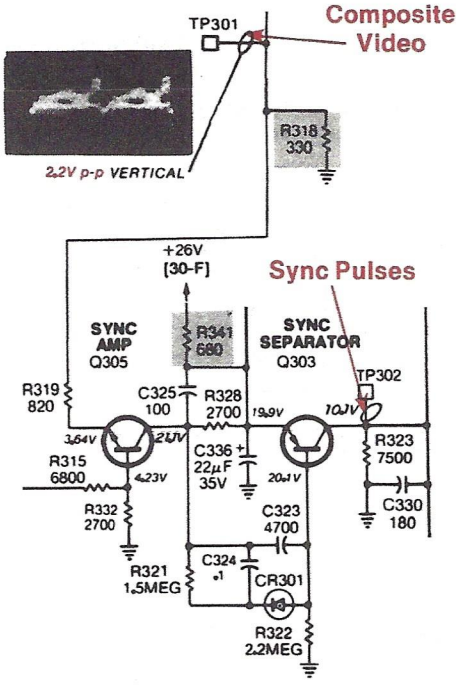


Fig. 1: The schematic often gives a clue as to which signal should be substituted into a circuit.

What Signal Should I Use?

The VA62 signal you use depends on which stage you are substituting into. When you are substituting into an IF stage, use the VA62 IF signal. When you substitute into an audio stage, use the audio signal. The signal normally present at the input of the video stages and the sync separator (Figure 1) is composite video, so when substituting into these stages, use composite video. In each case, you substitute the type of signal that is normally present at that point in the circuit.

What Signal Level Should I Use?

Here are several tips to help you determine what signal level to use:

1. If a schematic is available, check it for sample waveforms. Schematic waveforms often give the peak-to-peak amplitudes of the signals (Figure 1). Simply set the VA62 drive signal to the amplitude shown on the schematic (use the VA62 digital meter to monitor the output level) and substitute the signal.

2. If no schematic is available, use common sense. For example, you wouldn't expect the base of a transistor to operate with a 300 volt peak-to-peak signal. It will usually run in the range of 30 volts or less. Look at a few schematics from other televisions to become familiar with the relative size of signals at various stages in a television. Often, other schematics have similar circuits that can be used for comparison.

3. NEVER substitute a signal greater than the stage's supply voltage. Driving a stage beyond the supply voltage will result in a distortion of the signal or the possibility of overheating the semiconductor in that stage. If no schematic voltages are available, use your VA62's DC voltmeter to measure the supply voltage to the stage. Then, use this voltage as the maximum peak-to-peak amplitude of your substitution signal.

How Does Functional Analyzing Work?

To get a better understanding of how functional analyzing works, lets look at an example. Say that your customer has asked you to repair her TV, a Magnavox C2 chassis. Let's see how you troubleshoot and repair her set in the least amount of time using functional analyzing.

First, before you remove the back, performance test the television to be sure there actually is a problem and to determine the general nature of the problem. Here's how: Supply a known good VA62 Multiburst Bar Sweep pattern to the tuner (at the antenna terminals) and observe the results on the CRT.

This pattern consists of sharp white lines on a solid black background, when viewed on a properly operating TV. Instead, you end up with the picture in Figure 2. The picture shows a noisy pattern. This symptom tells you that the problem is somewhere in the signal (RF/IF or video) stages of the receiver. Before you take the back off the set, you've already narrowed your list of suspect stages to approximately half the TV stages. (back cover)

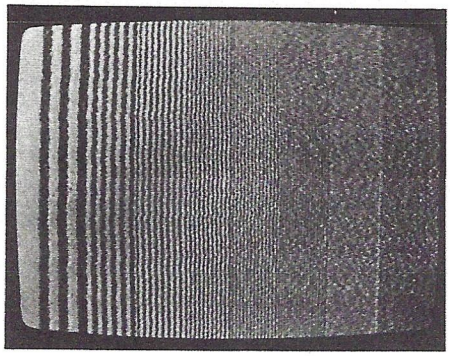


Fig. 2: The defective TV distorts the Bar Sweep when you substitute into the tuner. The problem is in the RF, IF, or video amp circuits.

When you begin troubleshooting, you cut the suspected circuitry in half again by substituting a known good video signal from the VA62 at the output of the video detector. The result is a good, clean Bar Sweep pattern, as we see in Figure 3. This tells you without a doubt that the circuits after the video detector are working perfectly. There's no guesswork. The problem is ''back up the line'', somewhere in the RF/IF section.

So, you move to a halfway point in the remaining suspect circuitry, and substitute a known good Bar Sweep pattern at the IF input.The VA62 Video Analyzer provides a modulated Bar Sweep pattern to substitute directly into any of the IF stages.The CRT shows you the problem has reappeared.

What does this tell you? You know the circuit works from the output of the video detector, yet the circuit doesn't work from the IF input on. The problem is in the Video IF section. This late model TV's IF section has a SAW driver, a SAW filter and an IF amp/detector IC (Figure 4). So, to isolate the defective IF stage, you substitute at the output of the SAW driver transistor. This gives you a perfect picture.

Conclusion; the SAW driver stage is defective. It's that simple. Your transistor tester tells you that the transistor is your culprit - you change it and the picture is restored.

Notice that in three troubleshooting steps you located the problem block, without any waveform interpretation. Instead, you selected the proper input signal (depending on which test point you substituted to) and watched for a good Bar Sweep pattern on the picture tube. Just for the record, the scoped output of the defective SAW driver is shown in Figure 5.

Would you know from this waveform whether the SAW driver stage was defective? Most techs would find it difficult to say for sure, yet even a non-technical person would recognize the picture as bad when you substituted into the defective stage. That's the advantage of substituting known good signals and watching the output for proper operation. Functional analyzing leaves nothing to guesswork.

How Do I Troubleshoot ICs With Functional Analyzing?

Functional analyzing is a time-saver in any circuit. But it's especially valuable for one

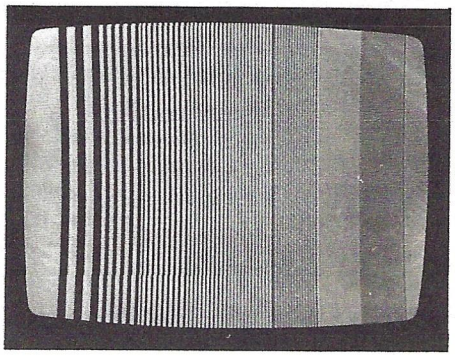


Fig. 3: A good picture when you substitute at the video detector output proves that all the stages beyond the video detector are good.

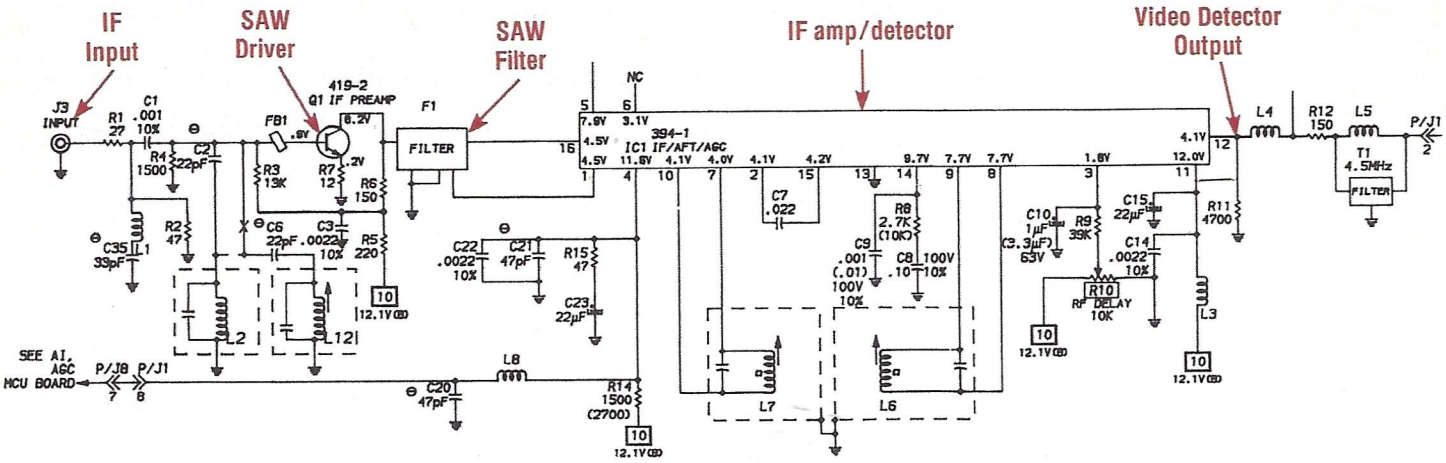


Fig. 4: Functional analyzing quickly proves which IF stages are working properly and which is bad.

of the toughest problems you're faced with as a service tech today - checking ICs. Signal substitution provides the only efficient way to confirm the function of ICs and isolate problems associated with them. The only alternative is expensive and time-consuming chip swapping. Here's why.

To confirm that a chip is good, you could measure the voltages and look at signals on the various pins. That means using a meter or scope to look at 14, 24 or even 48 pins. But what if one of the output signals isn't right? Chances are good that you'll end up having to unsolder and resolder all those pins to swap chips. How else can you be sure that the wrong signal isn't caused by a bad chip? But, still, you have no guarantee that a new chip will fix the problem.

That's why functional analyzing using signal substitution is so important. ICs are complete circuits that perform the function of one or more of the blocks in the Universal Block Diagram. In fact, most of the chips used in TV sets today perform the function of several blocks. Signal substitution confirms whether the IC functions properly when you substitute a known good signal at its input, without unsoldering delicate IC pins. It's just like substituting into one of the blocks shown on the Universal Block Diagram. The VA62 supplies you with the signals necessary to functional analyze ICs so you know whether the IC is good or bad.

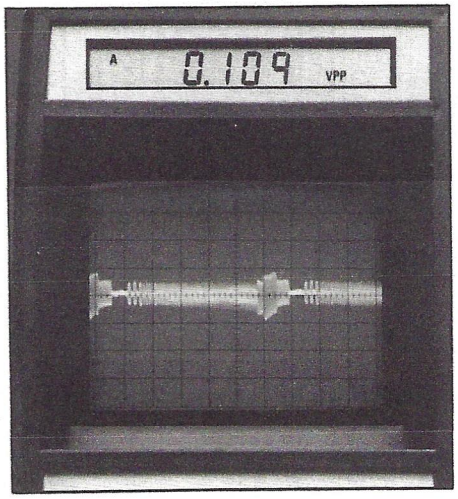
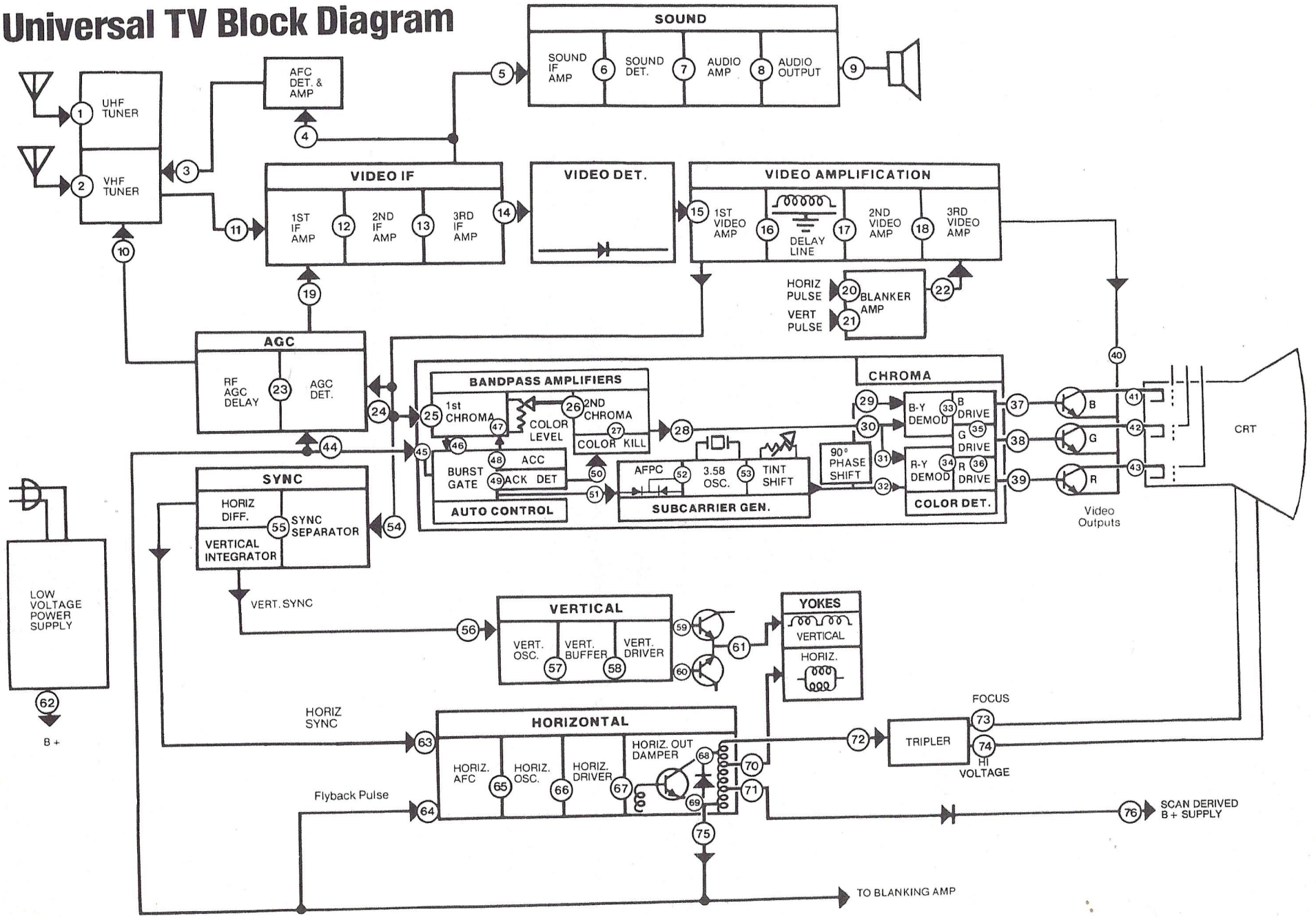


Fig. 5: Scope waveform at SAW driver output. Can you tell whether the SAW driver stage is defective by interpreting this waveform?

Universal TV Block Diagram



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