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THE MOST ASKED FOR VA48 VIDEO ANALYZER "HOW TO" ARTICLES

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Let our customers tell you about the VA48 and then read these articles to see what you are missing if you don't own a VA48.

". . . Overall, the VA48 seems to be a highly useful piece of sophisticated test equipment, and I will heartily recommend its use to any and all service personnel in the TV business. I do commend you and your Engineering Department for a job well done. In combination with digital voltmeters, a high voltage probe, and oscilloscope, there's no reason an entire TV receiver can't be examined and a breakdown pinpointed to a specific section in less than a minute.

Keep up the good work".

STAN PRENTISS
Edgewater, MD 21037

". . . Just a note to let you at Sencore know that we are very satisfied with our recent purchase of your VA48.

It's all that your specs say it is, and more. In the approximate one week that we have put it to use, it has walked the problems out of no less than 6 sets that were shelved as tough dog repairs. Also, it has cut our bench time to minimum now on TV service as well as cutting alignment time to about one-half of what it used to be.

. . . Again I wish to say thanks for some fine engineering in the line of electronic test equipment".

Kenneth D. Simmons Sr.
ARK-TRONICS SERV. CO.
Gravel Ridge, AR 72116

"I operate a small one man operation but feel that I have paid for half the VA48 already! I am convinced that the term "Tough Dog Set" is a misnomer, in reality it is a lack of proper test equipment. I now welcome sets other shops send down the road as it is the best advertisement I have found. After 25 years in this trade, I'm sold on Sencore and their representatives".

W. H. Burghart
BILL'S T.V. REPAIR
Ft. Jones, CA 96032

". . . Being employed in the TV broadcast business, I wrote and suggested they develop a TV signal with multi-burst tones that was employed at the studio for servicing all TV equipment.

We are presently using your conventional sweep generator but quite frankly, you have outdone yourself. The VA48 concept is the greatest, and I am looking at my present budget to incorporate it in our service shop. You certainly design and think as though you work in a TV service center.

Don Marx
STATE U. OF NEW YORK
Long Island, NY 11794

"The VA48 is without doubt the finest instrument for color TV service on the market for about a thousand dollars.

It is a must for factory service defects, school labs, too".

James J. Dade
AMITY ELECTRONICS
Bethany, CT 06525

"We have been evaluating your VA48 TV-Video Analyzer and have found it to be a very versatile and valuable piece of test equipment, especially in working on video cassette recorders. We have recommended it to our GE Factory Service Shops throughout the country".

Jerry Surprise
GENERAL ELECTRIC CO.
Portsmouth, VA 23705

"Just thought you might like to know that after a month of using the VA48 I find it to be the most-used instrument in my shop. As I become more familiar with it I find more and more uses for this fine machine".

T. R. Busman
BUSMAN'S TV SERVICE
Nunica, MI 49448

"I recently suffered a failure of my VA48 upon which my shop operation has become heavily dependant on. It is a tremendous piece of equipment!

. . . I received the unit back minus the 'shop rash' not too uncommon from other like facilities. Best of all, you stood behind your 100% Made Right Warranty and charged me $0 for what must have been a bear of a problem".

Jan D. Goranson
JAN'S SOLID STATE SERV.
Cherry Valley, IL 61016

"I must say the VA48 is a fine piece of equipment and can save the technician many hours if used properly. It is unsurpassed for quick signal tracing (substitution), trap alignment, and this type thing. I do find many technicians going overboard and trying alignment procedures which would have been better left alone unless they knew the proper technique. I particularly like the idea of being able to spot IF frequencies without the complex hook up using sweep and marker generator".

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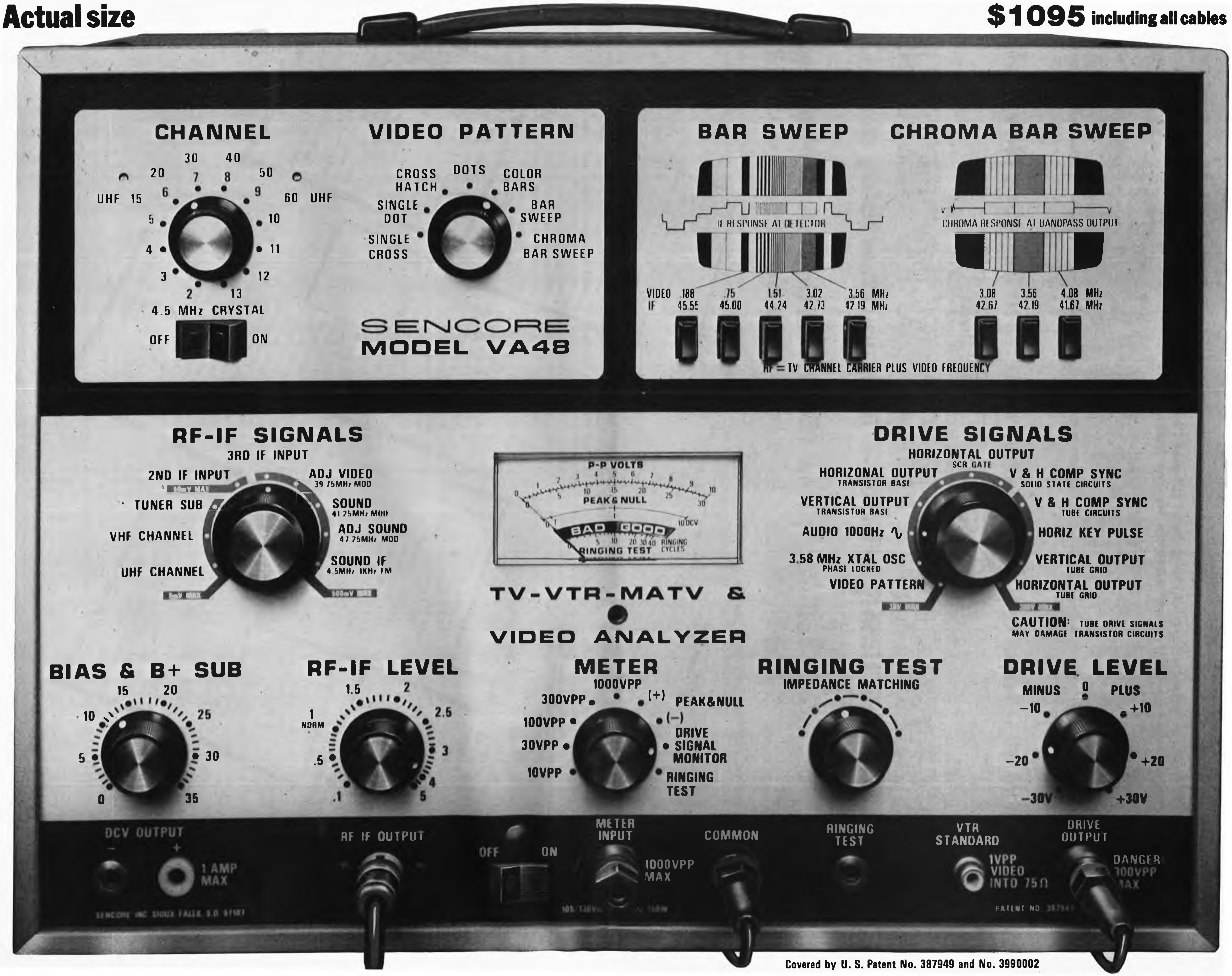


Covered by U. S. Patent No. 387949 and No. 3990002

Life size VA48 photo is shown on opposite page for you to refer to as you read through the questions and answers in this Sencore News.

Actual size is shown so you can imagine this instrument on your bench working for you. We suggest you remove this Sencore News front cover and lay it in front of you as you follow the copy.

Two patterns you should get used to —

The Bar Sweep pattern; what it is and where it is used.

This unique new patented development from Sencore will simplify your RF and IF troubleshooting beyond your fondest dreams. This unique pattern will enable you to check alignment and frequency response from the tuner to the CRT. Not only can you check alignment, but you can realign a complete IF system in just a fraction of the time it takes with a sweep and marker generator. The Bar Sweep system differs greatly from a sweep and marker because it checks the system with a dynamic signal across the TV IF bandwidth. The bar sweep actually harness up the circuits, just like the TV station signal does, to see if the TV receiver will respond to all the video signals generated by the TV station. We think that we can help you understand and appreciate this new patented dynamic test system if you will review the video system with us from the camera to the CRT.

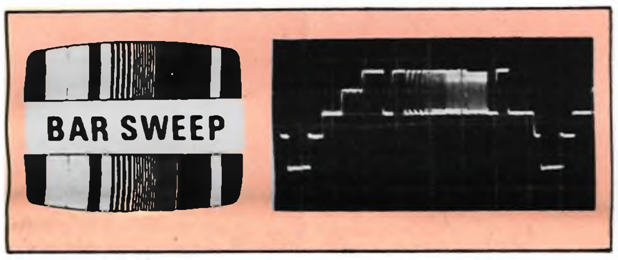


Fig. 1—The Bar Sweep is similar to the "multiburst" signal used by TV stations to test the frequency response of their transmitters. The frequencies and amplitudes of the Bar Sweep have been selected to produce equal amplitude bars at the video detector of a TV receiver when the IF stages are properly set.

The Camera

Let us look at a monochrome camera for simplification (because color cameras are simply three monochrome cameras combined with color filters) and see just how our camera looks at the video spectrum.

The FCC restricts every station from using more than six megaHertz in a given channel. The TV video carrier is located 1.25 MHz up from the beginning of the allocated channel. The video information, that modulates this carrier is limited to four megaHertz before it must be attenuated to leave enough room, at the high end, for the sound. The important point here is that we are always limited to video information from 0 to 4 MHz, because the FCC says so.

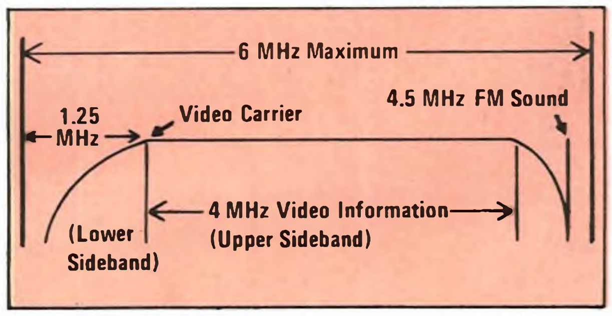


Fig. 2—A TV channel is 6 MHz wide. Only a portion of the lower sideband is transmitted in vestigal type transmissions to prevent the total signal from causing adjacent channel interference.

Just what does this four megaHertz video information give us in real practical terms? What can we see? What can we sell the customer? Note that we didn't say that a four megaHertz signal was any real criteria. We said that all video modulating frequencies from zero to four megaHertz were important. Let us have a good look at what these frequencies represent in real video information as we move from zero to four megaHertz. We have drawn a set of modulation bars that move from zero to four megaHertz so that you might reason this out with us. Beginning at zero change in video signal, we find that our beam doesn't change in intensity (as it moves across the screen) at all, and we are talking about solid black backgrounds. There really is nothing to learn here unless we make the mistake of having AC coupling in our video amplifier and lose the DC level. But, let us move up from zero modulation to some video modulation that we are familiar with. One of the standard low frequency bars that you will encounter is the color bar generator that has 10 bars exhibited (and two during retrace). These bars interrupt the beam 12 different times as they move from left to right and back through retrace and represent a modulation frequency of 188 KHz (the 15,750 Hz horizontal sweep x 12). 2 bars appear during the 13 percent of the time that the beam is retracing; 10 bars appear during the 87 percent of the time that the beam is tracing the pattern on the CRT. We have drawn these ten bar interruptions (during trace time) on a graph in Figure 3 for you to study and compare to other modulation frequencies on the TV set. This simply represents any object in the picture that fills about one-tenth of the screen, such as ten soldiers that we have drawn in here for comparison.

Let us move to a higher frequency of 40 interruptions as the beam moves across the screen. This represents a frequency of .75 MHz away from the video carrier, and interrupts the screen once every 1/40th of the time across, duplicating scenes like the neckties on each of the soldiers. Note: The video modulation frequency is always calculated by multiplying the horizontal sweep frequency (15,750) times the number of times the horizontal sweep is interrupted (40) by the video beam, and adding 13 to 14 percent for retrace time, to determine the total number of video interruptions per second. This gives us the modulating video signal frequency. These calculations will not come out exactly on the cycle because different TV receivers have different retrace times and retrace time must be estimated. The main issue is that you do get forty interruptions on each TV, but some may overscan a bit.

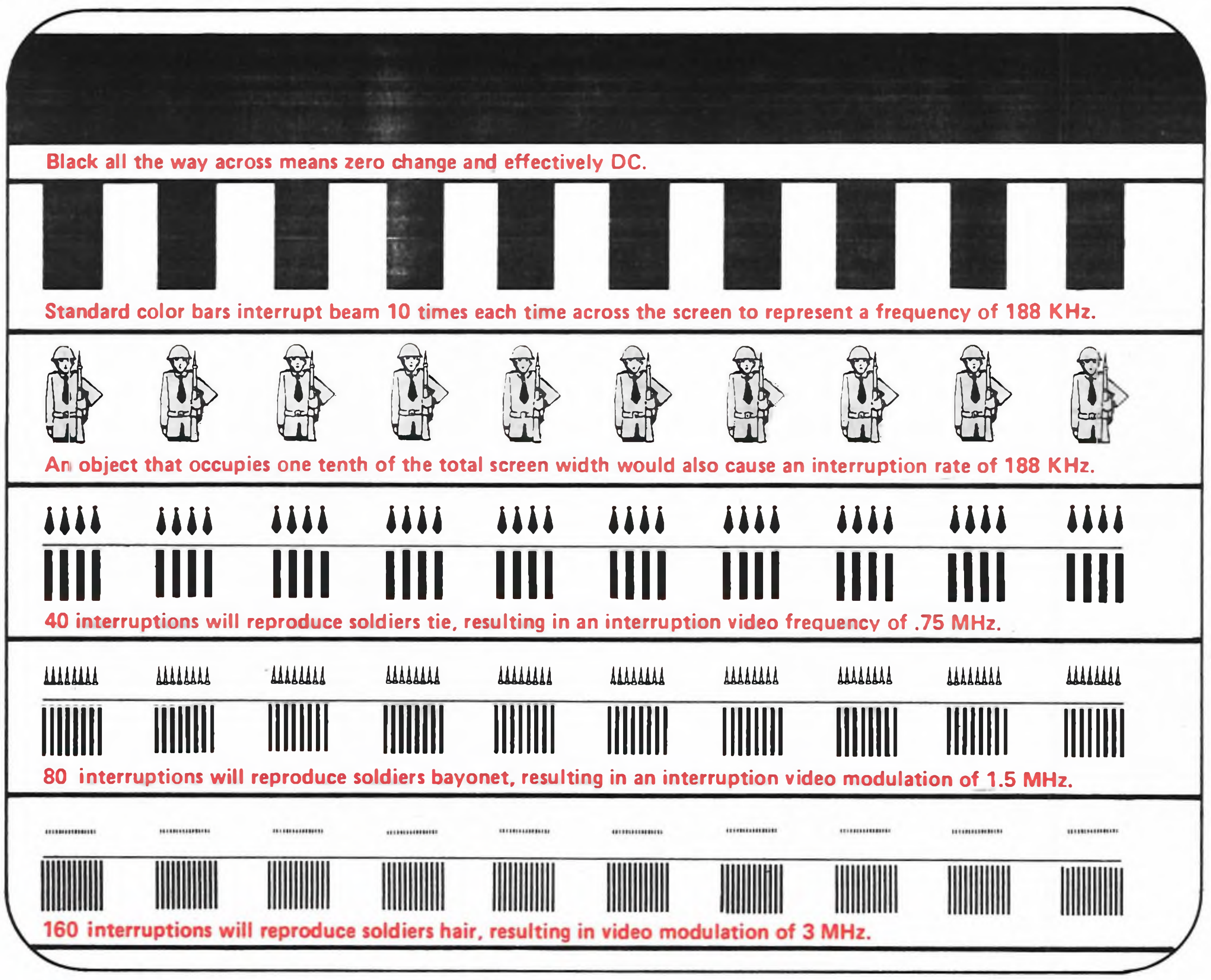


Fig. 3—Different video modulation frequencies are simply represented by the number of interruptions across the CRT screen.

If we understand our beam interruptions and relationships to modulating frequencies at this point, let us double our interruptions from 40 to 80 beam interruptions across the screen. These interruptions will be caused by a modulating frequency of 1.5 MHz, and represent a smaller object, such as the bayonet on the end of the soldier's rifle or some such object of that relative size to the overall picture width.

We are now getting down to pretty small details as we pass the 1.5 megaHertz (bayonet) reproductions, but we are sure that you wouldn't be satisfied to stop there because many smaller objects, such as the hair on the soldier's head, the edge of his coat, or even the press in his pants, must paint a sharp, clear picture. Let us double the interruptions from 80 to 160 during trace time, for this fine detail, and multiply this times the sweep frequency of 15,750 Hz (and add 13 to 14 percent for retrace time) and we arrive at a modulation frequency of 3 MHz. We can now reproduce the hair on the soldier's head, as shown in the graph, and we have pretty well painted our picture from the largest video interruptions to the smallest detail that modulates the CRT beam. It becomes apparent that we must pass from near zero to 3 MHz video with equal amplitude to paint a clear black and white picture on the CRT.

3 MHz will normally result in a satisfactory B & W picture and almost no B & W receivers attempt to reproduce beyond that because the 3.58 MHz color signal begins to interfere and tuning becomes critical. Color receivers are different and must add color with the 3.58 MHz color subcarrier. The 3.58 MHz subcarrier will interrupt the CRT beam at even greater detail; actually 197 times. The 3.58 MHz color carrier is of little significance to the monochrome check and, therefore, we do not show this modulation on this monochrome diagram. The 3.58 MHz signal is designed to "spin the color wheel" and paint color into the black and white detail. Very little 3.58 MHz signal actually gets to the CRT because the video amplifier has a trap to eliminate picture interference. A small amount feeds through the video amplifier because the 3.58 MHz trap is not 100 percent effective.

One does not have to interrupt all the way across the screen to prove that the video system will respond to one of these modulation frequencies. As a matter of fact, the video picture is randomly made up of all of these modulation bars from zero to over three megaHertz as it moves across the screen each time. So, why not simply modulate the beam with 10 interruptions for awhile (to represent 188 KHz), then another period of interruption of 40 times for a period of time (to represent .75 MHz), then an 80 time interruption for the 1.5 MHz check, then 160 time interruption for the 3 MHz check, and finally 197 for the 3.58 MHz color check.

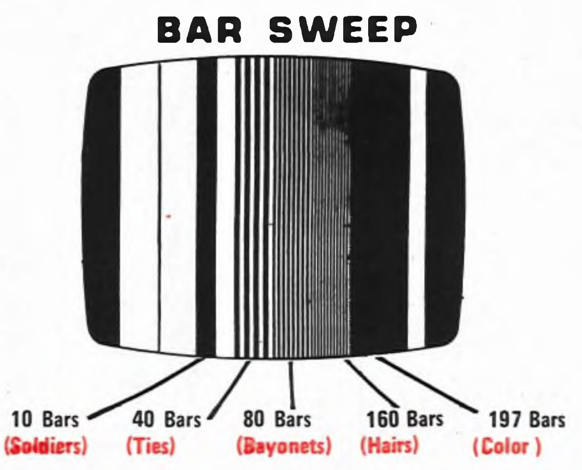


Fig. 4—The Video Bar Sweep provides samples of each interruption frequency from 10 to 197 bars to produce a dynamic check of the video frequency response.

Now, look at the Video Bar Sweep from the VA48 and note that each bar does exactly this as it precisely modulates the video carrier to sweep across the entire video system to ascertain whether that system will reproduce from zero through the 3.58 MHz color subcarrier. Does this take the mystery out of the Sencore patented bar sweep for you? It actually isn't a sweep and marker, but rather a dynamic simultaneous presentation for checking frequency response of the entire system. Yet, it performs the same function in a truly dynamic way, without connecting bias boxes or upsetting the circuits.

Now, that you understand just what these bars are, we want to be sure that you can identify them easily by doing two things: (1) Showing the pattern on the front panel of the VA48 and identifying the frequency of each bar. (2) By giving you an interruption switch, identified with the interruption frequency for each bar, so you can turn each bar off and on for further positive identification on the TV screen. Incidentally, the interruption switches serve another purpose too, as you can turn all bars off and leave only one bar (if you want) for stagger tuned stage setting or individual stage trouble-troubleshooting. You will find that each bar is tuned close enough to each of the stagger tuned stages for setting them, high, low, and "rocker stage" without referring to a schematic.

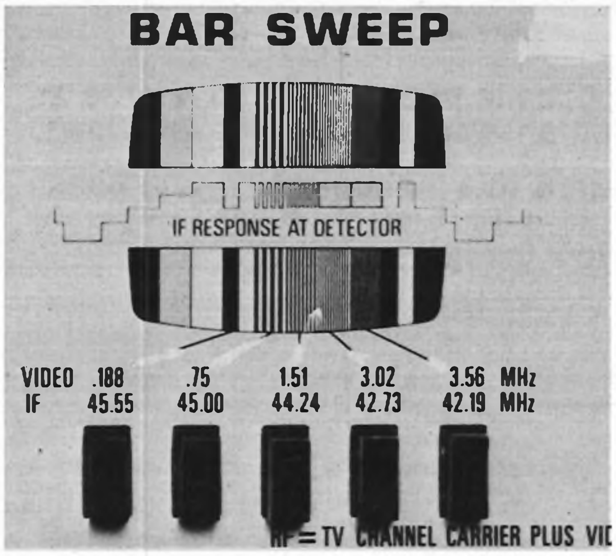


Fig. 5—Bar Sweep buttons select desired frequency bars when pressed in. Buttons will lock in place. Both the video interruption frequency and the corresponding IF frequency are shown above the buttons for reference.

Before we leave the makeup of the bars in the bar sweep, take note of the shape of each of the bars. These could easily have been sine waves for every application to this point in our discussion. As a matter of fact, a sweep and marker generator generates only sine waves and here is where the small square bars in these interrupting signals are far superior. You can often align a TV receiver with a sweep and marker generator, flip on a TV picture and our solider and all his detail are showing but the edges of his coat, his bayonet, or rims of his glasses are reproduced twice, three times, or even more as if the IF circuits ring with these sharp wave fronts. So, why not present the video system with sharp front square wave bars, the same as it will have to contend with from the TV station, to simultaneously check circuit ringing when you are aligning? That's exactly what we do on the VA48 and there never is a doubt about the picture not looking as clean as the pattern when you get it back to the customer's home. You will do much superior service, and the picture will often look better than when it came from the TV factory.

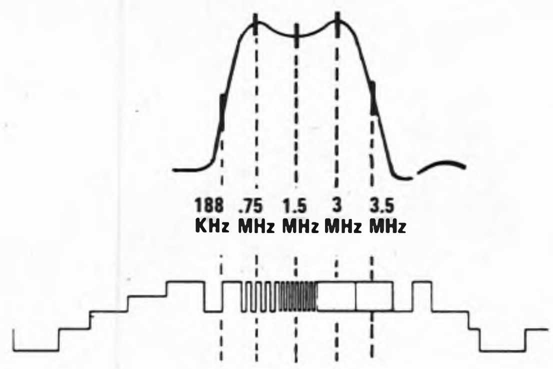


Fig. 6—The Sencore Bar Sweep uses sharp square waves to test the entire system for ringing. Sweep and marker checks video IFs with sine waves only that do not check ringing.

Okay, so you know what the bars are all about, you know why they are square, you know that the modulation patterns move away from the carrier in an exponential manner, and you know that you have yourself a truly dynamic check from the antenna terminal to the video detector. We should be asking ourselves just one more question: Can these bars all be the same amplitude if we feed them into the antenna terminals of the TV receiver? Let us reason this together to see the amplitudes each bar should be in relation to the other bars.

The overall response curve of a TV receiver is not flat from the video carrier to the 4 MHz point. As a matter of fact, the video carrier is down at the 50 percent point on the leading edge of the response curve. The IF response curve has the same overall characteristics and should look just like the overall. Let us use the IF response for simplification purposes (you can do this in actual practice, too). Let us apply the 188 KHz signal.

Fig. 7—The leading edge of the IF response curve amplifies lower frequencies less than upper frequencies.

Note that the 188 KHz signals falls on the IF response curve just above the video carrier. One would begin to think that you should deliver a bar with additional amplitude for the CRT to see a bar that is the same height. This is not true for one simple reason. Vestigal side band transmission (not transmitting the lower sideband under 1.25 MHz) causes all TV manufacturers to detune the IF response below the 1.25 MHz area because both upper and lower sidebands are present to beat against the carrier in the detector at the lower video frequencies only. This produces double power, at these lower frequencies, and this doubles the output at the detector. Therefore, our 188 KHz signal produces double power and the portion below the carrier adds to the portion above the carrier to give a resultant flat output. The next modulating bar of .75 MHz just reaches the top of the response curve and has virtually no lower sideband to add to the total detector output. The transmitter may actually transmit below the .75 MHz lower sideband level but TV receivers are tuned to pass only .75 MHz of this video information. Let us see what happens if we use a

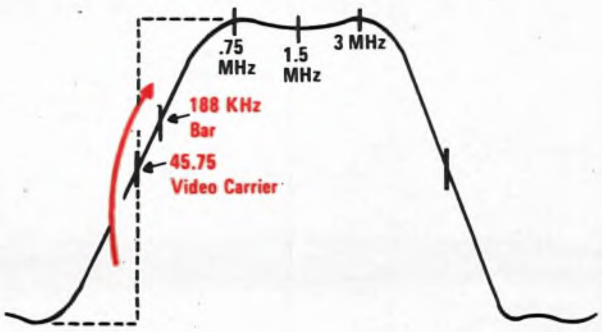
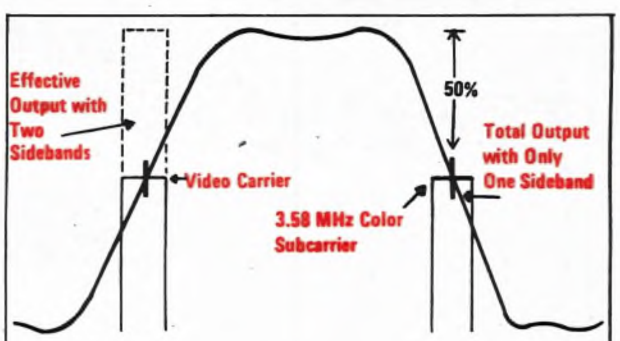


Fig. 8—Double sideband on low frequencies doubles output, for those frequencies only, resulting in even output at video detector.



A. If all five video bars were the same amplitude at the VA48 output, the color subcarrier would be smaller and require interpretation just like a sweep and marker.

B. VA48 must generate these bars to get even amplitude bars at video detector.

C. The five Bar Sweep bars will all be the same amplitude after passing through a properly aligned IF strip.

Fig. 9—Comparison of the Bar Sweep pattern to a sweep and marker curve.

sweep and marker to check these frequencies under .75 MHz. We have to visualize this lower sideband power, superimposed on top of the detuned portion of the IF response curve. We really have no positive check on this very important lower frequency portion of the video IF system with a sweep and marker. The check is made very simply with the VA48 by adjusting for equal bar amplitude at the video detector to see that upper and lower sidebands, added together, result in the same amplitude as it did at the TV station.

There should be no mystery about the next modulating bar of 1.5 MHz because it falls outside the double sideband area, as does the 3 MHz bar. Therefore, the 1.5 MHz and 3 MHz bars fed into the IF should be equal amplitude for proper circuit check. The 3.58 color bar is a "horse of another color" because it is detuned, just like the video carrier, on all modern TV receivers, about 50 percent of the way down the response curve. An equal amplitude bar here will produce only a half amplitude bar at the video detector (if that is where we wish to view it). The 3.58 MHz bar is doubled in amplitude from the VA48, to make it possible to simply adjust all bars to the same amplitude, at the video detector, for a fast positive alignment check from the antenna terminals to the detection point. This is one more way that the VA48 makes all sets look alike; it simply disregards all the circuit differences and standardizes on the station signals for flat detection. This means that you can align any kind of TV receiver without ever having to look up a response curve again, connect a battery or bias pack to the AGC bus, touch up the TV set on a picture off the air for ringing, or remove a chassis for alignment only. That's one reason why we claim that you can double your service output with superior service quality.

Let us go one step further: How many times have you aligned a TV set video IF response curve, with a sweep and marker, picture perfect but snapped on the picture and it wasn't perfect? How many times have you wished that you could check that darned video amplifier to see if it was reproducing what you had at the detector or was causing the ringing? Here is where the VA48 is really handy as all you have to do is remove your scope from the video detector (after you have equal bar amplitude at the video detector) and view these bars right on the CRT. A bad peaking coil will be detected in seconds because you have effectively purchased yourself a video sweep generator as well. As a matter of fact, you will find yourself seldom connecting to the video detector for alignment checks. You simply turn down the brightness control to determine if all five BAR SWEEP bars are the same intensity. If they are not, you know that you have a problem in either the IF stages or the video amplifiers themselves. The only time you actually connect your scope is when a problem is indicated with this performance test. If you wish to check the video amplifier only, these same bars are available from the DRIVE SIGNAL OUTPUT for injection directly into the video detector.

With the VA48, you find that you have the greatest troubleshooting tool that you could ever put on your bench. This is particularly true when you come to realize that stagger tuned stages just happen to be tuned very near the .75 MHz, 1.5 MHz, and 3 MHz bars. You can use these new patented bars to set stagger tuned stages or check them for gain and reproduction capabilities as you interrupt the bars with the individual switches.

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The Chroma Bar Sweep checks or aligns the chroma bandpass amplifier in seconds.

I hope that we have shown you that you aren't really aligning when you use the Bar Sweep, you are resetting the amplifiers where they should be to respond to the station TV signals and using this principle to troubleshoot, too. Yet, you can charge for an alignment because you have done the same things without going through all those time-consuming steps. The Chroma Bar Sweep works in the same way and is used for troubleshooting, checking out the response of the chroma amplifiers and simply seeing whether or not the modulation in that section of the signal reproduces color to your satisfaction. Let us look at a Chroma amplifier to see just what it is supposed to do.

The chroma bandpass amplifier is tuned to 3.58 MHz to extract the color information from the video signal. All chroma amplifiers have a frequency response of 1 MHz; 500 KHz above the 3.58 color signal and 500 KHz below. The chroma bandpass should be checked with a three bar system; one at 3.58 MHz, one bar 500 KHz below (3.08 MHz), and one bar 500 KHz above (4.08 MHz). The output of all chroma amplifiers should produce equal amplification of both the upper and lower color sidebands. But, we learned in the previous section that, since the 3.58 color signal was detuned to the 50 percent point in the IF response curve, the 3.58 MHz bar will have half amplification. This is compensated by creating a frequency response curve that is exactly opposite to the "roll off" in the video IF response. Feeding our equal amplitude bars into the chroma bandpass amplifiers directly results in uneven bars at the chroma bandpass output. We can feed these even chroma bars into the chroma circuits directly to isolate troubles to the chroma bandpass amplifiers but this is not very handy when you want to check or align the bandpass amplifiers because of the uneven output.

Chroma amplification actually takes place (at the higher end of the video response) from the tuner, through the video IFs and then through the chroma bandpass amplifiers. If we are going to check the entire system, to see just how the color signal is amplified in relation to the other video information, we need to check from the tuner or input to the video IF amplifiers. But, if we use our BAR SWEEP pattern (not the Chroma Bar Sweep) to inject into the antenna terminals, we just learned that the 3.58 color bar is twice amplitude of the other bars and our same unbalance occurs because this bar receives twice the amplification in the chroma bandpass amplifiers, too. Therefore, we need another set of bars that are even in amplitude with our 3.58 MHz color carrier in the middle and two bars one half megaHertz to each side. These bars can then be fed into the antenna terminals, or the video IF input, and the entire system checked at the chroma bandpass output for even amplitude bar levels. This is the reason that the VA48 has a second set of bar patterns called "CHROMA BAR SWEEP".

If all this seems rather complicated, it must be a real relief to learn that the VA48 has done all the compen-

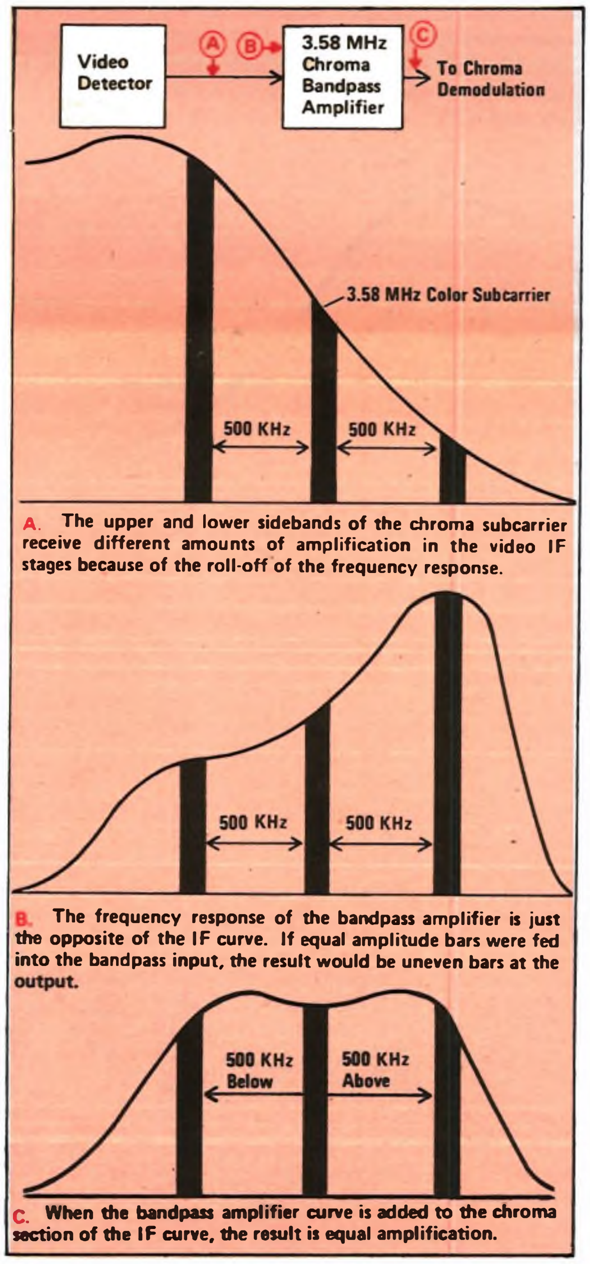


Fig. 10—The chroma bandpass amplifiers compensate for the uneven amplification the color signals receive in the IF stages.

sating for you and all you have to do is to feed the VA48 into the antenna terminals (or video IF input), and look for even amplitude bars at the output of either the video or chroma amplifier.

You may be thinking that we are making too big an issue of the IF and Chroma alignment, particularly if you are from the old school and have convinced yourself that alignment is just too time-consuming and doesn't always do what it is supposed to. We had field

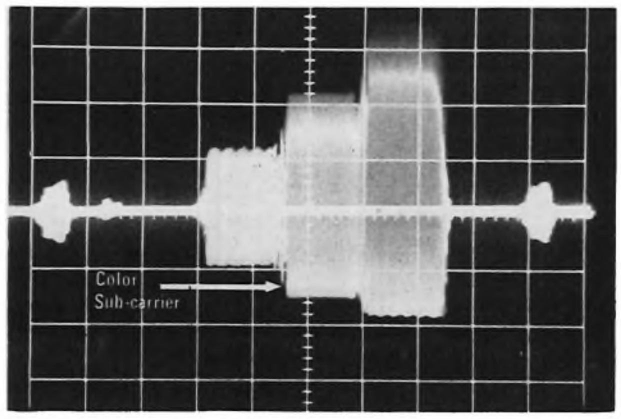


Fig. 11—The Video Bar Sweep cannot be used for chroma bandpass amplifier checking because the color subcarrier bar (which is double amplitude) will receive additional amplification in the bandpass amplifier.

engineers that thought the same way, but have changed their minds as they have been using the VA48 in the field to whip those tough dogs that others set back on the bench. Their field reports tell another story as well as over 50 percent of these so-called "tough dogs" were simple alignment problems. Our TV friends didn't realize that they may have been aligning with a sweep and marker that did not have a dynamic check on the AGC (such as we do with the VA48 that doesn't use a bias box) with resultant sync pulse clipping in the video amplifiers or ringing sync pulses that caused instability. The most common tough dog is the complaint of poor color or poor color sync caused by poor overall alignment from the tuner to the chroma bandpass output. Mis-set traps, (causing adjacent channel interference on cable), poor operation on rabbit ears or in fringe areas, poor contrast ratio due to compressed video and naturally poor picture quality, have been some of the other tough dog problem that we have taken out of these TV

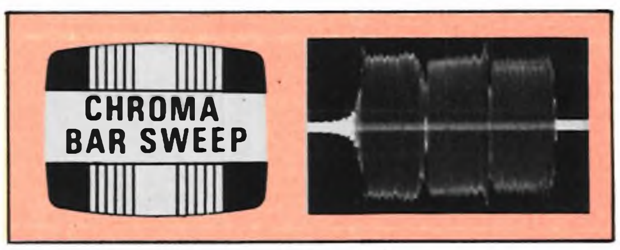


Fig. 12—The Chroma Bar Sweep should produce 3 equal amplitude bars at the output of a properly adjusted chroma bandpass amplifier. If your scope is not flat beyond 4 MHz, use a detector probe.

sets by simply touching up the alignment with the VA48. That's how the VA48 Bar Sweep system will help you cut your servicing time in half with far superior service output.

How the VA48 Video Analyzer helps you align and walk the troubles out of any TV-IF in minutes

—By Rich Brockway, Technical Customer Service Director

The Sencore VA48 TV and Video Analyzer is the only instrument that is designed to completely analyze troubles in any stage of a television receiver, including the IF amplifier stages. The patented Bar Sweep video pattern provides a truly dynamic method of troubleshooting or aligning the IF stages with a higher degree of accuracy than with any other TV IF generator. The VA48 is the only analyzer with crystal-controlled, adjustable-amplitude signals for injection into the first, second, or third IF amplifier so you can isolate a defective stage with signal substitution.

We will answer the most common questions about the VA48 IF generator in this article. These answers should help you understand your VA48 if you are one of the thousands of shops that already owns the VA48. *If you do not yet own the VA48, you should consider each of these points so you begin to understand how the VA48 can help you in your day-to-day servicing.*

Just how does the VA48 Bar Sweep pattern compare to a sweep and marker generator for RF and IF alignment?

We should review what the functions of the IF stages are before we actually compare the Bar Sweep pattern, and the sweep and marker, so you see exactly what alignment is supposed to do. The IF stages perform two important functions in any TV receiver: 1.) They determine the receiver sensitivity, and 2.) They limit the bandwidth of the received signal so we do not get interference from other signals. The traps establish the upper and lower frequency limits of the video portion of a single TV channel. The IF bandpass coils, on the other hand, allow us to tune the individual IF amplifiers to make sure that we can detect picture detail from DC (pure black) to around 3 MHz. The upper frequency portion of our picture represents the smallest portions of our picture detail. *We must have even amplification over the range of picture information so that different sized objects have the correct brightness relationships.*

The IF stages must take the very small signal from the output of the tuner and amplify it until we have enough signal to operate the video detector. The combined gain of the IF amplifiers is typically around 1,000 times (60 dB). Each stage is designed to provide gain at a slightly different frequency (stagger tuned) to prevent feedback (regeneration) and to make sure we are amplifying all portions of the video signal at about the same level.

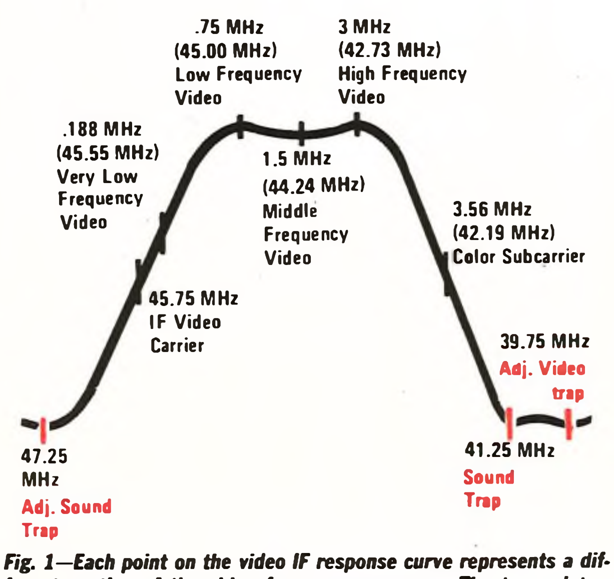


Fig. 1—Each point on the video IF response curve represents a different portion of the video frequency response. The traps determine the upper and lower frequency limits.

The IF stages in a color receiver must also pass the 3.58 MHz color subcarrier along with sidebands extending 500 KHz either side of 3.58 MHz. Remember, however, that we do not want to pass the 4.5 MHz sound information to the video or chroma circuits because this signal will cause interference in our picture. We cannot hold our frequency response flat to 4.08 MHz (the upper limit of our upper color sideband) and then drop off suddenly to eliminate our 4.5 MHz sound. A steep drop-off of this type would cause severe ringing in the fast risetime square wave information that makes up our picture. We compromise by rolling our IF frequency response off more gradually. This means that the 3.58 MHz color subcarrier is amplified half as much as the lower frequency picture information. This gives us enough color information to operate our color detector stages, plus it gives us minimum ringing on square wave information, and allows us to trap out the sound information.

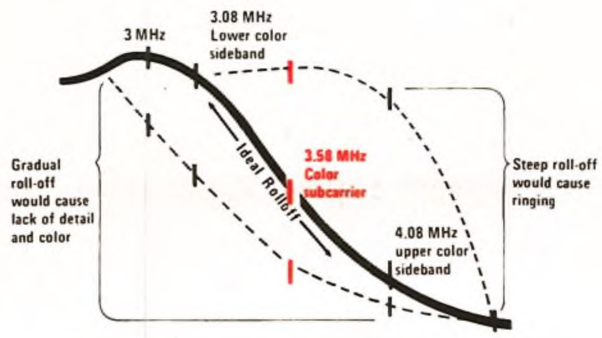


Fig. 2—The Bar Sweep alignment prevents tuning problems at the color end of the IF curve because all key frequencies are present to test for good chroma output with minimum ringing.

The function of alignment.

Actually, all alignment is supposed to do is allow us to adjust our IF stages to give the best possible picture, over a wide range of input signal levels, and allow us to set our traps to reduce interfering signals. The sweep and marker generator is designed to test the actual frequency bandwidth of the IF stages by feeding a constantly changing frequency into the input and looking at this same signal after it has passed through the IF stages. The input frequency is changing at a 60 Hertz rate *which is totally unnatural to the keyed AGC circuits* that are tuned to the horizontal sync pulses. The time constants in the AGC circuit react to the 60 Hz sweep signal and produce a constantly changing gain so we must block the AGC

Fig. 3—The bias supply must be used because a sweep and marker signal is totally unnatural to the keyed AGC circuits. The bias supply setting will affect the response curve.

action with a DC voltage supplied by a bias supply. The AGC bias voltage, applied to the tuner and first IF amplifier, fixes the gain of these stages to a single level so our output is closer to the actual frequency response of the total IF system.

Clamped AGC is one key limitation to the sweep and marker alignment system. Many IF stages are designed to have different frequency response curves for different input signal levels. If, for example, we use a large bias voltage and large input signal, we usually get more high frequency detail than with a small bias and a small input signal. This design provides better noise immunity on a weak signal such as in fringe areas or when using rabbit-ears. The actual amount of bias needed for a given signal level varies from one chassis to another because of the tolerances of the components. We never really know the correct AGC bias voltage because the circuits are adjusted on the individual receivers to compensate for component tolerances.

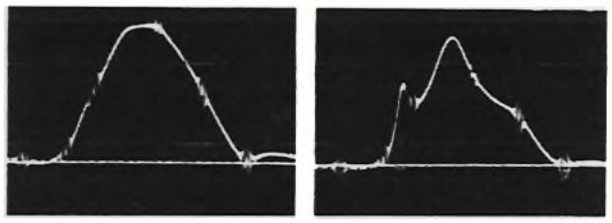


Fig. 4—Actual scope waveform of two sweep and marker curves on the same chassis with the AGC bias changed only .3 Volts.

A second limitation is that *there is no test for video ringing* because the sweep and marker only produces sine waves. It takes a square wave to cause a stage to ring. The station signal is actually made up of square waves which means the sweep and marker does not duplicate the signals the receiver must process. Some technicians attempt to tune ringing out by re-setting the IF stages with an off-the-air signal. The results are always questionable because the off-the-air signal is constantly changing. This "eyeball method" of alignment may also sacrifice picture or color detail because the effects on the other portions of the picture are not readily seen.

Overall, the biggest problem with a sweep and marker is that we have no way to tell if the alignment has done what was intended; provide a good picture at different input signal levels.

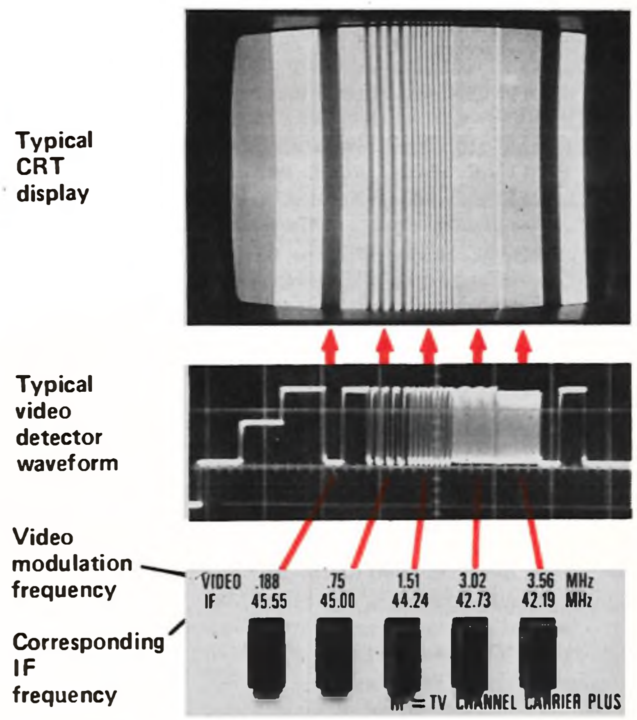


Fig. 5—Each Bar Sweep bar corresponds to an IF frequency shown above the selector pushbutton for a reference.

What are the advantages to the Bar Sweep? Are there any disadvantages?

First, we should point out that there are no real disadvantages to the Bar Sweep alignment system. You only need to remember that it is a new system and you should take your time as you learn it.

The Bar Sweep simply duplicates the signal coming from the TV station for a truly dynamic test of the IF stages and video detector. The Bar Sweep is much easier to use than an off-the-air signal, however, because each of the key frequencies is in a specific location. The Bar Sweep is made up of five different frequency bars, selected to produce an IF frequency that is very close to the marker frequencies of the sweep and marker generator so you can use your present service literature. *You do not need to clamp the AGC* circuits because the Bar Sweep is part of a signal that has the horizontal sync pulses and the AGC circuits adjust themselves for changing input signal levels. *The Bar Sweep modulation information is made up of square waves* so you can test for ringing while you are adjusting the IF stages.

The amplitudes of the five bars that make up the Bar Sweep are adjusted to compensate for the normal frequency response curve of an IF strip. The 3.56 MHz bar that represents the color information is delivered from the VA48 at twice the amplitude of the other bars because this bar only receives half as much amplification in the IF strip. We simply adjust the IF stages until all five of the bars are as close as possible to equal amplitude.

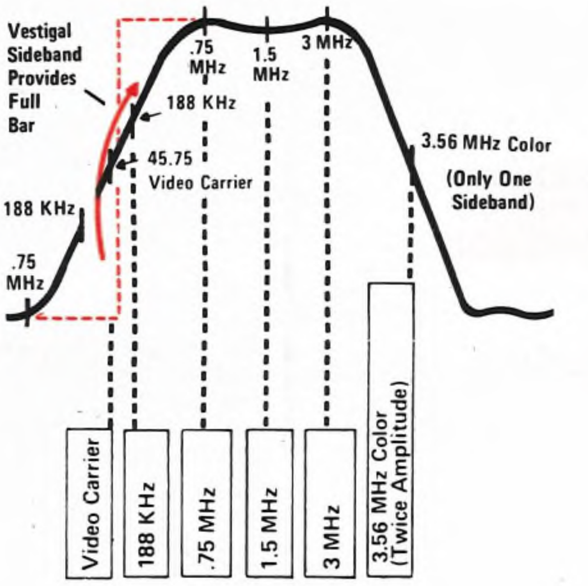


Fig. 6 — The amplitude of each Bar Sweep bar is adjusted to compensate for the normal IF curve. See the article beginning on page 3 for details.

There are a few IF stages that will not produce bars that are the same amplitude because they are not designed to produce full video response. These exceptions fall into three general areas: 1.) Black and white receivers do not need the color information and usually roll off the color

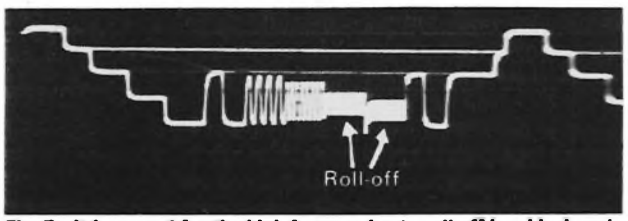


Fig. 7—It is normal for the high frequencies to roll off in a black and white IF stage.

portion of the curve, 2.) Some sets with only two IF stages cannot produce totally equal amplification, and 3.) Some older solid-state IF stages (like the RCA CTC38 and CTC39) simply do not have flat response all the way to the highest frequency limits. We will simply try to obtain an alignment that is as close as possible to equal amplification at all five Bar Sweep frequencies. One shouldn't be too critical, however, because there is not a noticeable reduction in picture detail until the higher frequency bars are reduced by more than half (6 dB) from the other bars. The eye just doesn't detect less than that.

Why is the Sencore VA48 the only analyzer that has the Bar Sweep?

The answer to this question is simple. The United States Patent Office found the Bar Sweep pattern to be a totally unique approach to IF alignment and troubleshooting. Sencore was issued patent number 3,990,002 to protect the Bar Sweep pattern. Simply stated, this means that only Sencore will have the Bar Sweep.

Can I use the Bar Sweep to "spot align" an IF stage with a single frequency before I do the final alignment?

We should probably stop for a second to review the "spot alignment" technique because the term may be new to you. Spot alignment allows you to set each of the stagger tuned stages to the correct frequency before you balance the alignment adjustments. The advantage of spot alignment is that you know that each stage is tuned to the correct frequency. The procedure is generally done with a generator with an adjustable (non-sweep) frequency. You simply set the generator to a given frequency and set the coils that correspond to that frequency for the maximum reading on a DC meter connected to the video detector.

The frequency bars of the Bar Sweep are controlled by pushbutton switches so you can turn them on and off at will. All you need to do to use the Bar Sweep to spot align an IF stage is turn off all of the bars except for the one frequency you need to adjust a coil, and adjust the coil for maximum amplitude on that single bar. Then, after you have set each stage for maximum amplification at the correct frequency, simply turn the rest of the bars back on and balance the coils for equal amplitude bars. This technique is especially important when you have a TV that has the IF stages totally out of alignment because spot alignment prevents the possibility of tuning the stagger tuned stages to the wrong frequency.

Fig. 8—Use your VA48 for "spot alignment" by selecting the one bar whose frequency is closest to the frequency called out in the alignment instructions and adjusting for maximum.

I have heard that alignment is really a form of troubleshooting. Is this true with the Bar Sweep?

You need to remember that the VA48 is the only IF generator that is designed for both alignment and troubleshooting. Any time a set is totally out of alignment you should try to find the reason for the poor response. The two most obvious causes for poor alignment are circuit defects and "screwdriver drift".

Most sets should only require a touch-up alignment to correct for slight component drift (or in the case of a tube-type IF for differences in the capacitance of a replacement tube) or to compensate for the fact that the set was aligned with a sweep and marker which left some ringing in the picture.

"Screwdriver drift" is caused by someone that has attempted to align the set and has "botched" the job. You should ask the customer if the set was serviced by another shop before it was brought to you. In a few cases, the customer himself has tried to improve the IF alignment. Symptoms like missing or broken slugs, or slugs that are turned completely to the bottom of the coils, point to screwdriver drift. In these cases you may be able to correct the condition by doing a complete alignment.

The best advice for you when you encounter a set that has very poor alignment (but no signs of screwdriver drift) is to *leave the slugs where they are until you locate the cause of the alignment problem.* This will save you time in the long-run because you will only need to do a touch-up alignment once you have located the circuit defect.

Take advantage of the fact that your VA48 is designed to inject an IF signal into the first, second, or third IF stage. The Bar Sweep pattern gives you a reference that allows you to interpret the results as you inject into each stage. Simply connect your scope to the input of the first video amplifier so you can see the results of each step of signal injection. *You should not expect the five frequency bars of the Bar Sweep pattern to have the same amplitude when you inject into the second or third IF stages but you should at least have some of each of the bars.* This indicates that the stage is passing all of the IF frequencies that it was designed to pass.

The level of each of the IF outputs duplicates the gain normally found in the individual IF amplifiers. The second IF output is 10 times larger than the "Tuner Sub" (first IF) output and the third IF output is 10 times larger than the second IF output. This means that you should have about the same amount of amplitude in your scope waveform as you inject at the input to each stage with the known good signal from the VA48. You can actually determine the exact amount of gain in each stage because the RF-IF level control on the VA48 is calibrated. The instructions for determining IF gain are included in the VA48 instruction manual.

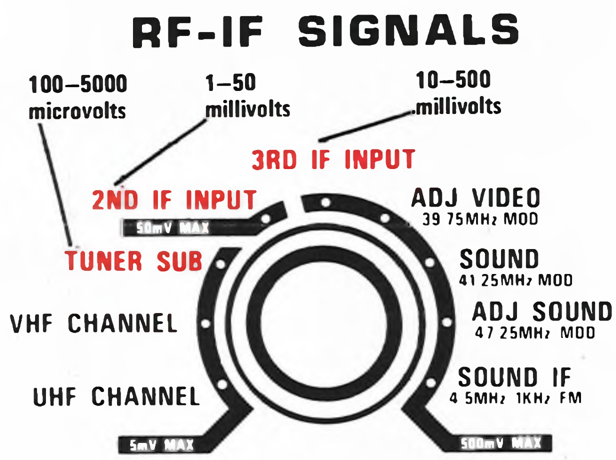


Fig. 9—The amplitude of each VA48 IF signal corresponds to the typical signal level for each stage to allow direct substitution with known good signals.

How do I use the Bar Sweep to troubleshoot a typical IF defect.

The VA48 IF generator allows you to quickly narrow a defect down to a particular stage. Each IF stage simply represents a block in our overall block diagram. Any type of analyzing is more effective when you understand the function of each block. Fig. 10 shows the schematic for an IF stage that uses three transistors for amplification. We have outlined each of the IF blocks so you can see where the function of each stage starts and stops. It does not really matter whether each block contains a tube, transistor, or part of an integrated circuit because the function is identical in each case. The application of the VA48 IF generator is also identical for each type of IF stage. We begin by injecting our substitute signal at the input to each stage, starting with the last one. We then move back one stage at a time until we find a point when the known good signal from the VA48 does not give us an adequate output. The defect must then be between the last point that gave a good output and the point that does not give an output.

Let's use an example of an IF strip that will not give an

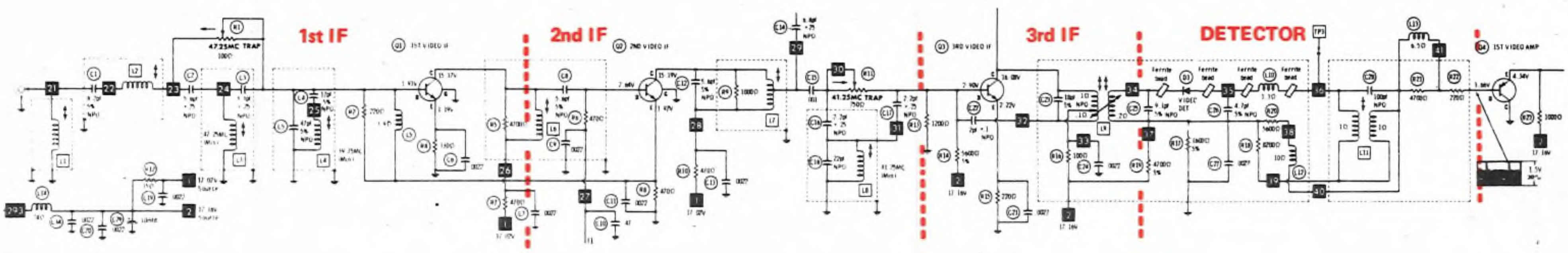


Fig. 10—A typical IF strip has three amplifiers using tubes, transistors, or ICs. The VA48 IF generator is used for injection into any type of IF stage.

output when we inject at the input to the first IF stage. We know that we have a defect somewhere between the first IF input and our video detector, but how do we find this defect? See Fig. 10 on page 7.

Let's start by setting our VA48 to the 3rd IF position and injecting at the base of Q_3 our third IF amplifier. An output signal tells us that both the third IF amplifier and our video detector are working. So, the next logical step is to move back to the 2nd IF amplifier Q_2. We now find that we have no output.

We have isolated our defect to the second IF amplifier. The problem could be a bad 2nd IF transistor, a missing power supply voltage to this stage or a defect in the coupling components between the second IF transistor and the third IF transistor. We can narrow our defect down even more by moving our injection point to the collector of the second IF transistor. *Remember to move the RF-IF selector switch on the VA48 to the "3rd IF" position* because the signal level at the output of the second stage is the same as the input to the third stage. If we now get an output we know the amplifier stage itself is our defective stage. A transistor tester like the Sencore TF46 Portable Super Cricket will allow us to test the transistor itself. A high-impedance DVM will allow us to confirm that the transistor is supplied with the proper power supply and bias voltages.

But, what if the amplifier is not the problem? Injecting at the collector still will not give us a satisfactory output. We then know that the problem is somewhere between the output of the second IF stage and the input of the third IF stage. All we need to do is move our injection test lead to the input and output of each interconnecting component. Let's say, for example, that we have an output when the signal is injected at the output of the coupling transformer L7 but not when we inject at the primary side of the same transformer. This tells us that we either have a defective transformer or a shorted component on the primary side of the transformer. We are now down to just a few components which can be individually tested or substituted. We can isolate the components, on the input side of the transformer, for example, by unsoldering the primary of the transformer and again injecting our signal. A defective transformer will still give no output. A shorted component in the primary circuit, on the other hand, will now be isolated from the transformer and our signal will now be allowed to pass through the transformer.

To recap, the VA48 IF generator lets us troubleshoot an IF defect down to a single stage and then lets us trace the signal through each component in series with the signal path. We then use conventional troubleshooting techniques to locate the actual cause of our circuit defect.

Should I align a stage while injecting into the second or third IF stage?

We would have to say that the general answer to this question is no. We have two variables that we need to take into account when injecting into the second or third IF stages. First, we need to remember that almost all modern IF stages are stagger tuned. If we align the IF by injecting into the individual stage, it is too easy to peak each stage and lose the advantages of stagger tuning. In many cases, peak tuning will result in regeneration and instability because the input and output of each stage will be tuned too closely to the same frequency. This changes our IF stages from amplifiers to oscillators. The second variable is that we do not know how much the capacitance of our test leads will affect the tuning of the stage.

The exception to this rule is when we have an IF strip that is totally out of alignment because someone has unsuccessfully attempted to align the stages or because we have had to replace a component in the third IF or detector stage. We will cover this case in the next section.

Where should I start when the IF strip is totally out of alignment?

The best place to inject your signal is at the UHF input to the VHF tuner because the signal is then made to pass through the mixer stage in the tuner. The VA48 is supplied with a special adapter that fits the UHF input of most VHF tuners. *Be sure to switch the VHF tuner to the UHF position* to make sure the signal is properly passing through the tuner. Make your connection by disconnecting the cable that runs between the two tuners (at the VHF tuner end) and plug your VA48 cable in place of the disconnected cable.

You should always start by making sure the traps are set correctly. The traps are the most critical adjustment in

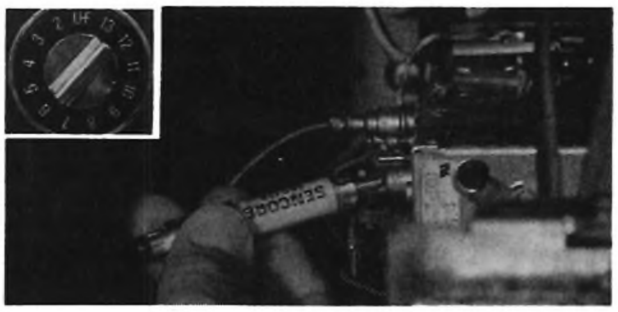


Fig. 11—The best place to inject a signal for IF alignment is the UHF input of the VHF tuner. This point is easy to locate and provides a superior injection point because the tuner mixer circuits are part of the total test. Switch the tuner UHF.

your alignment because they establish the upper and lower limits of the video frequency response.

How does the VA48 help me set the traps?

The VA48 has three special crystal-controlled trap setting signals. These signals are modulated with a 1000 Hertz sine wave. This modulation produces a distinctive pattern of horizontal bars on the front of the CRT when a trap is not properly set. Most traps are set by simply switching to the appropriate trap signal; Adjacent Video (39.75 MHz), Sound (41.25 MHz), or Adjacent Sound (47.25 MHz), and adjusting the trap for minimum bars on the CRT. It is not even necessary to use a scope to set the traps because the CRT shows the best trap setting.

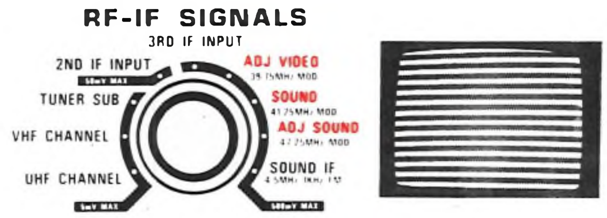


Fig. 12—Only the VA48 provides special crystal-controlled, modulated signals for alignment of traps. Simply adjust the corresponding trap until the distinctive modulation pattern on the CRT becomes as weak as possible.

Begin your trap alignment by injecting the trap signal at the standard alignment injection point explained earlier. Then, turn down the RF-IF LEVEL control until you see the modulation bars disappear and you get snow on the CRT. Then increase the trap signal level until the modulation bars just return to the CRT. Adjust the trap until the modulation bars are as weak as possible. This is the best trap setting.

You will probably find a few traps that have a very broad nulling point or possible more than one null point. These traps will probably also exhibit an unusual characteristic in that the trap modulation will not appear to get weaker when the RF-IF LEVEL control is turned fully counterclockwise. *These traps are being affected by the keyed AGC circuit.* As you adjust the trap and it reduces the amount of 1000 Hertz modulation signal, the AGC increases the amount of gain (in the first IF stage) which in turn increases the amount of signal coming into the trap. The easiest way to prevent this AGC action is to use the VA48 Bias and B-Plus Sub Supply to clamp the AGC. Sometimes, you may not want to remove the chassis for trap adjustments, or you can't find or get to the AGC bias, and you may want to simply reduce the total trap signal level below the threshold of the AGC circuit so the IF gain is always held at a fixed maximum level. This AGC action can often be eliminated by simply moving the VA48 RF-IF OUTPUT cable from the normal test point on the tuner to the input of the first IF stage. This removes the mixer and RF amplifier from circuit which reduces the total signal level applied to the first IF stage. Simply connect the VA48 output cable to the cable running from the VHF tuner to the IF input. The use of a standard "female to female" RCA phono-type audio adapter (available at most audio stores) simplifies this connection.

The signal level may be further reduced by inserting a simple attenuator in series with the VA48 RF-IF cable. The simplest form of this attenuator is a 30 Kilohm, one-half Watt resistor, placed in series with the center conductor of the RF-IF cable, plus a 75 Ohm resistor from the center conductor to ground as shown in Fig. 13. You will find that a trap that was previously very broadly tuned will now have a sharp null point.

Some traps have both a coil and an adjustable resistor while others have two coil adjustments in the same transformer. *The two adjustments in these traps always have slightly different functions.* One adjustment is used to tune the trap for the correct frequency, and the other is used to control the "depth" or effect of the trap. *Always adjust the frequency adjustment first.* This is always the

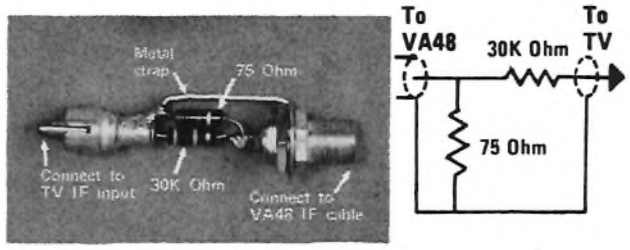


Fig. 13—Build this simple attenuator or order part AT218 from the Service Department if you have trouble setting traps. The AT218 has a switch to select attenuated or direct connections.

coil in a coil/resistor combination, and usually the slug closest to the P. C. (bottom) board in a transformer with two slugs. The sweep and marker alignment instructions will usually indicate which adjustment is which.

What does it mean when adjusting the trap has no effect on the output signal?

The first thing to check is whether you are actually adjusting the trap. Some traps are in the same coil as one of the bandpass adjustments. Make sure you are turning the correct slug. Other IF stages may have two coils very close to each other and you may be in the wrong coil.

If you are sure you are in the correct coil, make sure that the AGC is not "fighting" your setting by turning down the RF-IF control. You should be able to reduce the signal to a point that gives snow on the CRT as explained earlier.

The last possibility is a defective trap. *This is another example of how alignment is actually a form of troubleshooting* since a defective trap will have no effect as you attempt to make the adjustment. Only the VA48 equips you to adjust traps without a scope and troubleshoot IF defects with simple signal substitution.

After I have set the traps, what sequence should I use to set the bandpass coils?

Set the last IF stage after you have set your traps. This tunes the detector circuit to the IF carrier frequency. The last IF stage should be set for the best sync-to-video ratio as shown in Fig. 14. The sync pulse should be about one-half of the total peak-to-peak value of the entire waveform. If you do not get any signal through the IF stages, even with the RF-IF Level control fully clockwise, you should inject the signal at the input to the last IF stage with the RF-IF Signals switch in the "3rd IF" position. This is the exception to the general rule we mentioned earlier about aligning while injecting into the third IF stage. *Be sure to replace all shields before you go back to the first IF stage because they usually have an effect on the alignment.*

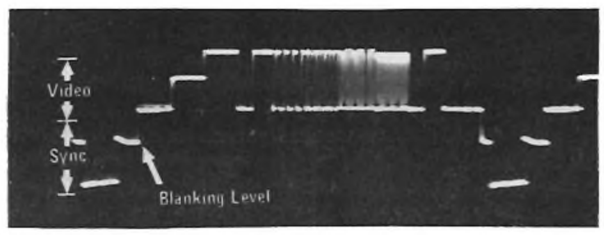


Fig. 14—The crystal-controlled IF generator allows the output of the IF stages to be easily tuned to the proper frequency by adjusting for the best video-to-sync ratio.

The next step is to make sure that the output of the tuner is matched to the input ("link") of the first IF stage for best sensitivity. Simply return the RF-IF selector switch to the "Tuner Sub" position and reduce the setting of the RF-IF LEVEL control until the Bar Sweep pattern becomes snowy. Then adjust the first IF stage and the mixer coil (in the tuner) until you have a clear picture. Again reduce the VA48 output and repeat these steps until you get no further improvement in sen-

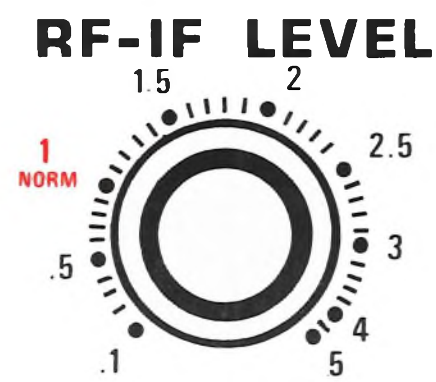
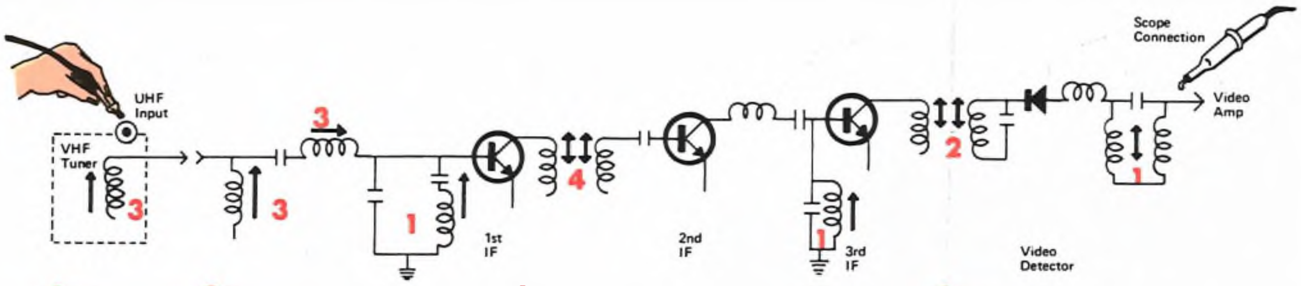


Fig. 15—The "Norm" position of the special RF-IF LEVEL control assures good sensitivity in alignment because the proper signal level is applied to the IF input.



1 Set all traps. 2 Set the output of the last stage. 3 Set the mixer and 1st IF for best sensitivity. 4 Set the second IF input for balance.

Fig. 16—The IF alignment should be made in this sequence with the Bar Sweep.

sitivity. The RF-IF LEVEL control should be set to the "Norm" position or lower at the conclusion of this step. *If you require a much larger signal level, for a snow-free picture, you should suspect a defective IF amplifier.*

You are now ready to set the second IF stage. This stage generally affects the balance between the lowest and highest frequency signals. Set the second IF coil(s) for the best overall balance between the best video-to-sync ratio and the largest amplitude in the 3.02 and 3.56 MHz Bar Sweep bars.

The final step is to set the RF-IF LEVEL control to the "Norm" position and touch-up each coil for the best balance at all frequencies. You should proceed in the same order as before, starting with the last IF stage, then proceeding to the first IF stage and tuner mixer, and ending with the second IF stage. *Watch for signs of ringing* as you make these adjustments and set each coil for the best compromise between minimum ringing and best overall response. Only the VA48 Bar Sweep lets you align the IF stages for the best balance between good video response and minimum ringing.

You should remember that weak RF signals have more noise than strong signals. This noise has a much stronger effect on the higher frequency video information and color information. *Many RF-IF stages are designed so that there is less high frequency response when the AGC controlled IF stage is running "wide open" on a weak signal.* This, in turn, reduces the noise content of the picture.

Always adjust the IF stages with the RF-IF LEVEL control in the "Norm" position. You can then check the operation with a weak signal by reducing the control and observing the Bar Sweep pattern at this lower signal level to make sure you will still have an acceptable picture in fringe areas. Remember that, unlike the sweep and marker, *the Bar Sweep causes the keyed AGC system to operate just like it will with a station signal.* This lets you test the operation at all signal levels from fringe areas all the way to AGC overload to make sure the AGC is working properly and you are getting the best possible picture with different signal levels. Only the VA48 Bar Sweep pattern allows you to easily make this important test on every TV you service.

One last condition to watch for is having some of the bars below the black level as shown in Fig. 17. The cause is an IF stage that is going into regeneration (oscillation) because the input and output coils are set too close to the same frequency. You should remember that the sync pulses represent a 100 percent carrier level and white objects represent the minimum carrier level. The only way a bar can drop below the black level (after detection) is by increasing the carrier level which can only happen with oscillation. This oscillation will often cause an unstable picture because the oscillations are separated along with the sync pulses in the sync separator. *Always adjust your IF stages to eliminate this oscillation.* You can usually do this by detuning the high-frequency bars in your second IF stage and increasing them in the first IF stage. If you must settle for a compromise between reduced high-frequency response and a "shifted black level", *choose the first.* A slight reduction in picture detail will not be noticed by the viewer but sync instability most certainly will. The VA48 Bar Sweep lets you align the IF stages for best sync stability because it duplicates the TV station signal.

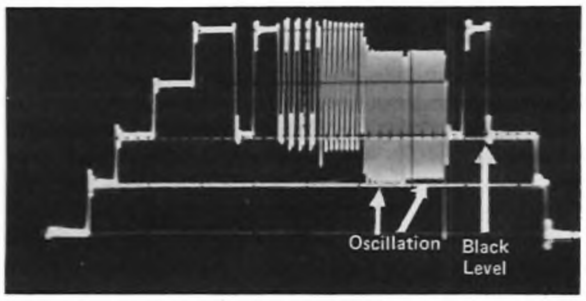


Fig. 17—The high frequency bars should not drop below the black reference level, as shown here, because sync instability may result.

What does it mean when one of the bars is completely missing?

The only way the IF stages can eliminate one bar completely, but have the two adjacent bars at good amplitude, is if one of the traps is incorrectly set into the video response. Rock each trap slightly to see which one is causing the problem and re-set that trap.

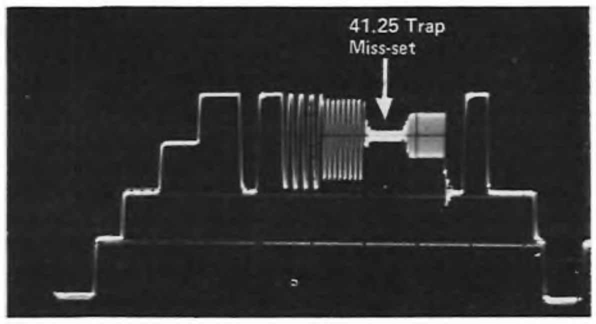


Fig. 18—A missing Bar Sweep bar indicates an improperly set trap.

What does it mean when I have a good IF response but have a weak picture off the air?

The only way the IF stages can cause this is if you used too much signal during the alignment of the first IF stage and tuner mixer coil. Make sure that the RF-IF LEVEL control is in the "Norm" position and the RF-IF SELECTOR switch is in the "Tuner Sub" position when doing an alignment.

If you have followed this rule, your problem is in the tuner or the antenna. *The VA48 provides all 12 VHF channels and 6 UHF channels to allow you to check the tuner itself.* You should have a strong, snow-free picture with the RF-IF LEVEL control in the "Norm" position while you inject at the antenna terminals. You should suspect a weak RF amplifier if the picture is snowy. If the condition is only present on a few channels, you should check the fine tuning on those channels or suspect that these channels are out of alignment in the tuner. The VA48 eliminates the need for a tuner sub because it provides both calibrated tuner input and output signals to allow you to easily detect a defective tuner.

The space in this article limits us to just a few of the ways the VA48 can help you produce superior service in the RF and IF stages. The VA48 instruction manual, for example, gives details about setting the Automatic Fine Tuning (AFT) adjustments, the 3.58 MHz trap in the video amplifier, and the 4.5 MHz sound trap. *If you have not tried a VA48, don't you owe it to yourself to try one to see just how much time it will save you?* Contact your nearest Sencore distributor right now to arrange for your VA48 to be delivered. Or, phone us at 800-843-3338 (toll-free) and ask for Customer Service. They will see that your nearest distributor contacts you.

How the VA48 simplifies alignment of synchronous video detectors.

by Jim Smith, Field Engineer

INTRODUCTION

The germanium diode detector has been used for years to detect the video information in television receivers. The diode detector has many shortcomings, but its low cost was a prime consideration in its widespread usage. Modern integrated circuit technology has made the use of a more effective video detector, the synchronous detector, practical in many newer TV receivers. Almost all manufacturers are now using this type of detector in at least some of their new receivers

The synchronous video detector allows IF stages to be designed with fewer amplifier stages, fewer traps, and improved picture quality. The synchronous detector, however, cannot be tested or aligned with a sandard sweep and marker generator because it requires an IF carrier signal which the sweep and marker generator simply does not supply. The all new Sencore VA48 TV and Video Analyzer does produce this carrier, with crystal-controlled accuracy, to allow you to quickly and accurately test or align these new circuits.

There has been very little literature available that explains the why and how the synchronous detectors are used or even their basic operation. We will cover this background information and then go into details about how to tell whether or not the TV you are servicing uses a synchronous detector. We will then explain how the VA48 should be used to align the IF stages and the detector itself when you encounter a TV that uses this type of video detection.

What is "synchronous detector"?

Although the synchronous detector may sound new, it is only new in its application as a video detector in the television receiver. The synchronous detector has been used for years in color receivers as chroma demodulators. The synchronous detector is simply a double balanced demodulator with a tuned circuit that resonates with the incoming IF carrier frequency of 45.75 MHz. This carrier signal is used to switch several transistors on and off at the correct time to recover the video information. The name "synchronous detector" comes from the fact that this switching action must be synchronized with the IF carrier for proper operation.

What advantages do synchronous detectors have compared to diode detectors?

A diode detector (also called an "envelope detector") has many shortcomings that must be compensated for in the design of the IF amplifier stages. We should look at some of these shortcomings to better understand why the synchronous detector is becoming so popular among the different TV set manufacturers.

First, the diode detector is a non-linear device. This means that different input signal and modulation levels produce different detected outputs. *These differences will appear as variations in the picture information supplied to the CRT.* Second, a diode detector, because of its non-linear properties, produces sum and difference beat frequencies of the IF carrier and the modulation sideband signals. These beat frequencies may be radiated back into the antenna input and the IF amplifiers and can cause interference (called "tweets") on the CRT. *Extensive shielding of the IF stages is required to reduce this type of interference.* Third, the sum and difference frequencies produce additional low frequency signals which are applied directly to the detected output signal. *These signals must be eliminated in filter circuits (traps) which increase the complexity of the detector load circuits.* Fourth, the diode detector will detect both the desired IF frequency and undesired signals, such as the sound carrier, the adjacent channel video, and the adjacent channel sound signals. *This potential interference must be trapped out in the IF amplifiers before the signal is applied to the detector, again requiring additional traps.*

These are the biggest problems with a diode detector, but there are others as well. The diode detector has no gain in itself and actually produces a signal loss. This means that the preceding IF amplifier stages must have additional gain to insure that enough signal is applied to the diode to cause it to conduct. Additional video amplifier stages are also required (after detection) to amplify the very small detector output signal. *With all of these limitations, you may wonder why the germanium detector was ever used in the first place!* It is certainly a long way from the "ideal" detector.

How can I tell if the receiver uses a synchronous detector?

Presently, there are at least five different ICs being used that include the synchronous detector. Other receivers, however, use an IC that actually has a standard detector diode inside and is not a synchronous detector. One would think that there is a better way to determine a synchronous detector and there is. *You can always tell whether or not any TV set has a synchronous detector by noting whether or not it has a 45.75 MHz tuning coil.*

Some manufacturers label the functional blocks inside the IC blocks, on their schematics, and you can determine very quickly when the block is labeled "Synchronous Detector". However, not all manufacturers label the blocks or may even give the synchronous detector another name, such as "Low Level Detector" or just "Video Detector".

If the schematic is not labeled (or no other information is available), simply check the schematic or the circuit board for the tell-tale signs of the synchronous detector.

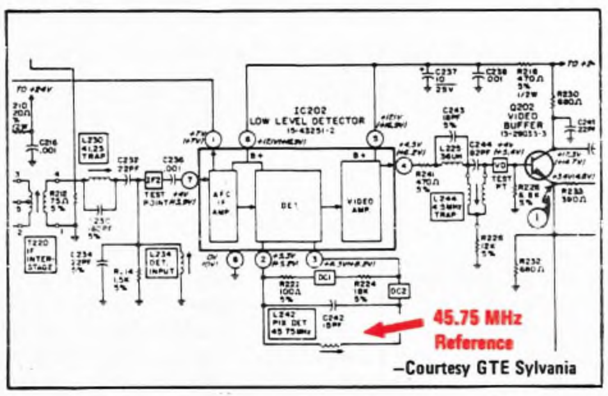


Fig. 1—The 45.75 MHz reference coil confirms that a synchronous detector is used.

One type of synchronous detector (such as that used in the GTE-Sylvania E21-22 color chassis, the Quasar TS953 color chassis, or the Admiral 9M50 color chassis) uses a 45.75 MHz reference coil. This coil is connected to two pins of the IC and may be labeled in several different ways, including 45.75 MHz Reference, 45.75 MHz Pix Det, Oscillator, 45.75 MHz, or have no label at all. In the case of the Admiral receiver there is also a Zero Centering control.

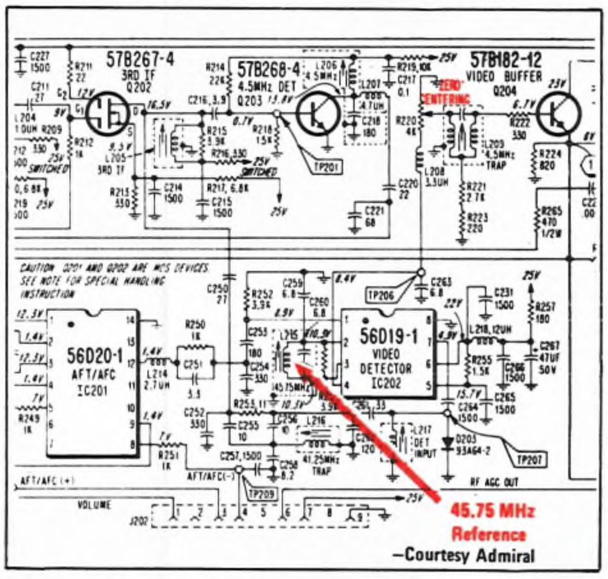


Fig. 2—Admiral 9M50 chassis with synchronous detector and zero centering control.

The second type, such as used by Zenith in the 19HC55 chassis with the 150-190-01 IF module, has the 45.75 MHz Reference coil, the Zero Carrier adjustment and also a Limiter coil adjustment.

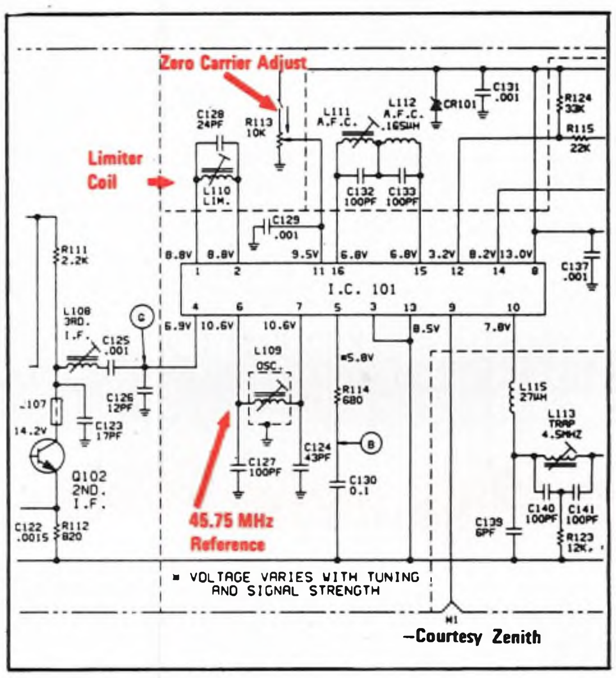


Fig. 3—Synchronous detector used in Zenith 150-190-01 video IF module.

In all cases, the receivers *will not* have a germanium diode for a video detector and may also lack a sound detector diode. If the 45.75 MHz Reference coil is present (along with the absence of the germanium diode) you can be sure that the receiver uses a synchronous detector.

As mentioned, some receivers use ICs in the IF but do not use the synchronous detector. An example is the RCA CTC91 series chassis. This chassis uses a single IC for the three stages of IF amplification with a conventional diode detector built into the chip. The circuit lacks the 45.75 MHz Reference coil, however, which tells you that it is not a synchronous detector system.

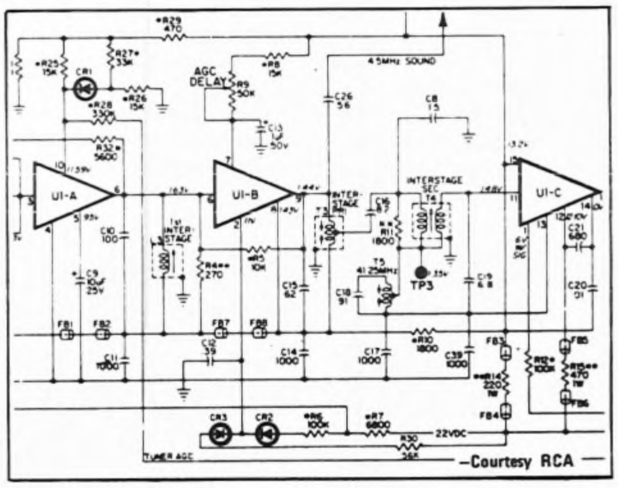


Fig. 4—RCA CTC91 using IC amplifiers with a conventional diode detector built in.

Why can't a sweep generator be used to align a receiver that uses a synchronous detector?

From the description of the workings of the synchronous detector (see box on P. 11) we found that the carrier frequency must be present to provide the switching signal for the demodulator transistors. A sweep generator does not provide the continuous carrier to allow the synchronous detector to operate properly.

To understand that a sweep generator lacks a separate carrier, you need to see exactly what signal is present at the sweep generator output. The sweep generator starts by putting out a frequency of about 40 MHz. The generator then gradually increases its output frequency (at a 60 Hz rate) until the output is somewhere around 48 MHz. *The important point is that the sweep generator can only supply one frequency at a time.* The 45.75 MHz video carrier signal is only present every 60th of a second and only for a very small portion of the total time that a signal is supplied. The only time that the synchronous detector will produce an output is when the sweep generator signal is close to the 45.75 MHz frequency.

Fig. 5 shows the alignment curve of the synchronous detector using a regular sweep generator. Note that instead of showing a conventional double humped response curve, the curve is peaked near the 45.75 MHz marker on the curve. The tuned circuit is reacting to the 45.75 MHz energy, but because it is only present for a short period of time, the circuit will not demodulate other portions of the sweep curve correctly. Note that the curve drops off well before reaching the color carrier. Attempting to align the IF coils under these conditions would result in a grossly **improperly aligned receiver.**

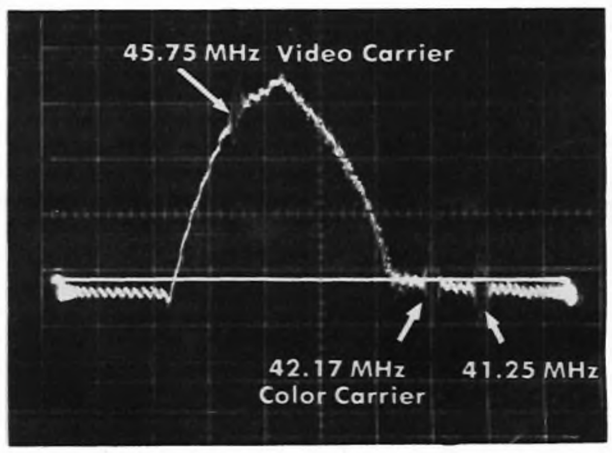


Fig. 5—Sweep alignment curve of synchronous detector.

Several methods have been suggested to get around this problem. One is the use of an extra 45.75 MHz CW generator who's output is added to the sweep generator output. The problem with the arrangement is that the 45.75 MHz carrier oscillator and the sweep generator output must be set to exacting amplitudes. The technician must carefully set up the output of the 45.75 MHz CW generator by measuring for a given voltage at the detector. *The sweep generator output must then be carefully adjusted for proper balance of the two signals.* Too little or too much of either signal could upset the operation of the synchronous detector and lead to improper alignment.

Another method is to shunt the 45.75 MHz reference or oscillator coil with a low value resistor to swamp out the carrier regenerator system. This means that one side of the demodulator in the IC will be conducting at all times and will give an output that appears to be correct. *This method does not take the operation of the entire circuit into consideration and the alignment is again questionable.* This is especially true of the critical adjustment of the 45.75 MHz carrier generator which has been disabled by the swamping resistor.

To properly align the synchronous detector, a signal just like the one supplied by the broadcast station is required. Here is where the Sencore VA48 really comes through for you. The VA48 supplies both the IF carrier needed for demodulation and full modulation sideband Bar Sweep to check the frequency response of the detector and IF amplifiers.

How does the VA48 align the synchronous detector?

The Sencore VA48 provides a broadcast quality, phase-locked signal with the proper ratio of the carrier and sideband signals required for the proper operation of the synchronous detector. The alignment procedure is now nearly the same as when you use the patented Bar Sweep pattern to align a conventional IF amplifier and diode detector system. Simply adjust the IF stages until the five Bar Sweep alignment bars are as close as you can get to equal amplitude.

The first step in any IF alignment procedure is to set all traps. There will generally be fewer traps present when a synchronous detector is used than in a conventional IF strip and, therefore, these traps must be set accurately. The VA48 trap settings signals let you quickly and accurately set these traps with crystal-controlled modulated signals. Simply adjust the traps for minimum modulation right on the CRT.

As we have mentioned, there are two basic types of synchronous detectors being used in television receivers. They perform the same function, but must be aligned slightly differently due to the extra adjustment (the limiter coil) in some systems. Let's first cover the simpler (and more common) of the two types used. This is the one with the oscillator (or 45.75 MHz reference adjustment) but no limiter adjustment. There may also be a zero centering adjustment as in the case of the Admiral 9M50 chassis.

If the receiver uses a zero centering adjustment, it must be set up first, as it establishes the DC bias level on the video amplifier chain and controls the contrast and brightness ratio of the picture. The control is generally set up for a DC voltage of 5 to 6 Volts measured at the base of the first video amplifier under a no-signal condition. If the manufacturer's information is not available, use a DVM and set the control (with no signal applied to the receiver input) for a 5.5 Volt DC level.

Adjustment of the 45.75 MHz reference coil is extremely simple. The VA48 Bar Sweep pattern is injected into the receiver through the UHF input on the VHF tuner using the 39G118 Adapter supplied with the VA48 or the optional AT218 IF Attenuator. Connect a scope, such as the Sencore PS163 or PS29, to the output of the synchronous detector or to the base of the first video amplifier input if you are not sure of the detector output point. The 45.75 MHz reference coil is adjusted until the waveform shown in Fig. 6 is obtained. Note that correct alignment will have the sync tip of the Bar Sweep pattern nearly ¼ of the total composite video waveform. The grey-scale part of the pattern, to the left of the bars, should show a linear stair step effect showing that the detector is linear and not clipping or distorting the detected video informatio. Notice that we have purposely shown the higher frequency video bars in Fig. 6 lower in amplitude than the other bars. We did this to show you that it is not necessary to have a good high frequency response to get linear detection. *Do not be concerned about the high frequency response at this point.* The first alignment step is to make sure that the output of the detector is linear for different modulation levels. The overall frequency response will be adjusted later when you adjust the first and second IF amplifier stages and the mixer coil in the tuner.

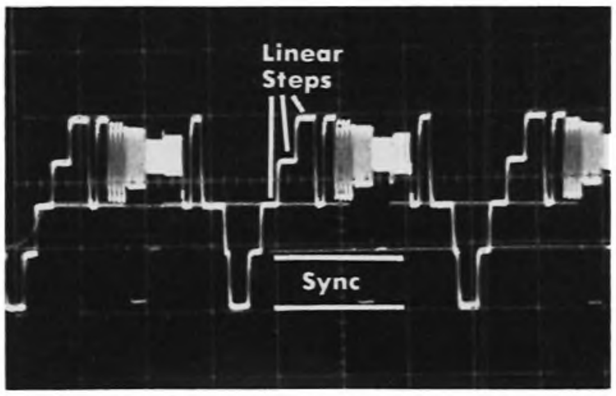


Fig. 6—Correct alignment of the 45.75 MHz reference coil showing equal steps and sync level at ¼ of total amplitude.

Fig. 7 shows an improperly adjusted 45.75 MHz reference coil. Notice that the step portion of the Bar Sweep pattern is not linear and that the sync pulse is less than 25 percent. This type of mis-adjustment will result in poor contrast and generally poorer picture detail. The sweep and marker system does not provide any method of determining whether the output will be set for proper linearity, yet, this is the most important part of adjusting the 45.75 MHz reference coil. The synchronous detector must actually be adjusted or aligned first and the sweep and marker won't do that at all.

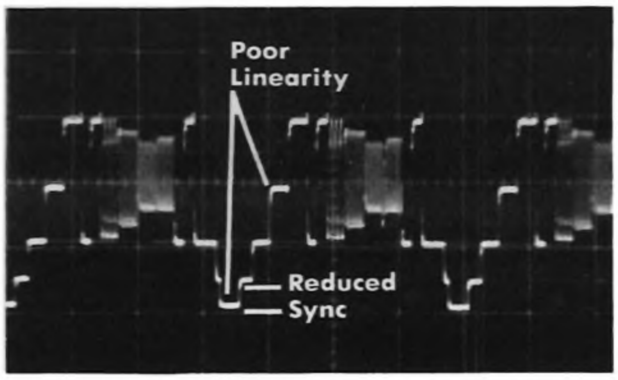


Fig. 7—Incorrect alignment of the 45.75 MHz reference coil showing poor linearity and compressed sync.

Setting limiter adjustments

The second type of synchronous detector, you will recall, has an additional adjustment called the "limiter" adjustment. This is the type of detector used in some Zenith models. This system still has the two adjustments (the 45.75 MHz reference and the zero carrier) just covered and the procedures for adjusting these controls remains the same. *These two adjustments should be made before the limiter control is adjusted.*

The limiter adjustment will affect the amount of overshoot present in the low frequency video bars. Fig. 8 shows the resulting detector waveform when the limiter and other adjustments are properly set. Fig. 9, on the other hand, shows the same chassis with the limiter control improperly adjusted to produce overshoot on the leading edge of the low-frequency

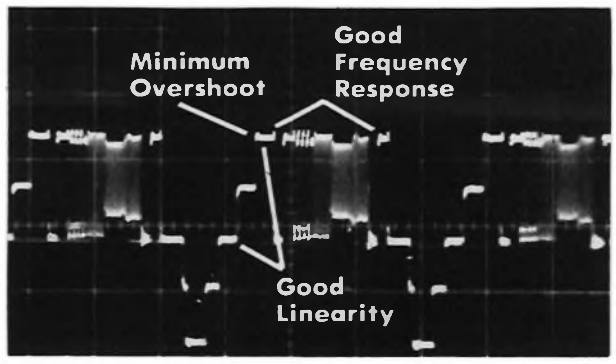


Fig. 8—Synchronous detector with proper alignment of 45.75 MHz reference and limiter adjustments showing the linear stair-step, minimum overshoot, and good frequency response.

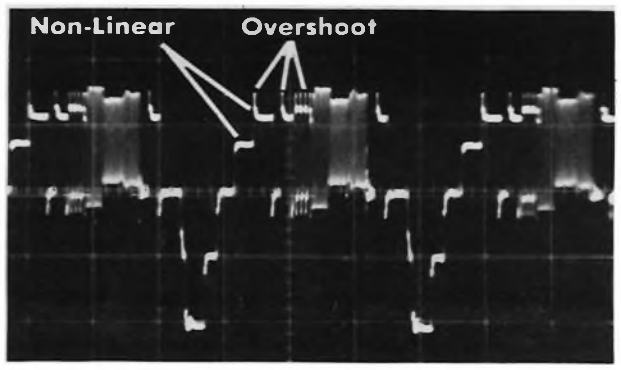


Fig. 9—Incorrectly adjusted limiter coil showing overshoot in the leading edge of the bars and non-linearity of the white bar.

square wave Bar Sweep signals. Fig. 10 shows the same chassis with the limiter adjustment mis-adjusted in the other direction. The overshoots now appear on the trailing edges of the square wave Bar Sweep signals. Also notice that the linearity of the grey-scale

How does the synchronous detector work?

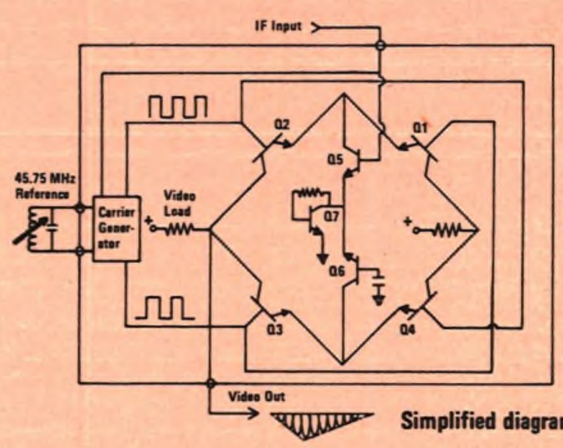
The synchronous detector is basically a double-balanced full wave demodulator. The schematic of a typical detector IC is shown below. A simplified schematic diagram is shown also, so that we can get a basic understanding of the operation of the synchronous detector. The basic operation is similar to that of the chroma demodulation system except that the 45.75 MHz reference carrier is generated inside of the IC rather than in a separate crystal oscillator referenced to a burst signal as is done with the chroma.

The IF input signal (which is amplitude-modulated) is fed into the base of Q5 as well as to the carrier generator. The carrier generator, with the external tuned circuit, oscillates at the IF carrier frequency of 45.75 MHz and clips or limits the signal before applying it to the bases of the detector transistors (Q1, 2, 3, and 4) in the IC. The input IF signal is coupled through the emitter of Q5 to the emitter of Q6 so that there is an identical signal on both transistors. When the carrier, supplied by the carrier generator, is positive on the base of Q2, the positive signal is also coupled to the base of Q4. At the same time, the signal is negative on the base of Q3 and Q1, turning them off. Q2 conducts through the Video Load resistor which creates a signal across the video load which is proportionate to the amplitude of the incoming IF signal at that time.

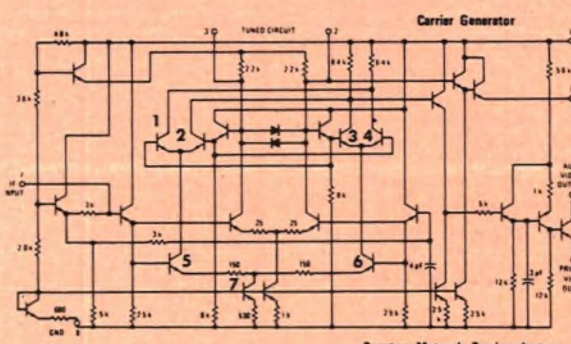
On the next half cycle of the carrier frequency, the bases of Q2 and Q4 are negative (turning these transistors off) while the bases of Q3 and Q1 are positive, allowing them to conduct. Q3 then conducts through the video load resistor in the same direction as did Q2. The result is a signal of the same polarity as the previous half cycle just described. The amplitude is again proportionate to the amplitude of the incoming IF signal at the time Q3 is turned on. This action produces full-wave AM detection of the IF signal. The detected video output is filtered and the result is a composite video signal with very good detail from DC through the highest frequency video information.

With this system, the carriers of 45.75 MHz video and the 41.25 MHz sound are totally eliminated and only the composite video and the FM-modulated 4.5 MHz sound are left. The beat signals resulting from the non-linear detection of these carriers has been eliminated. A 4.5 MHz trap, after the detector, prevents interference from the 4.5 MHz sound carrier and the resultant video is free of unwanted interference.

One advantage of the synchronous detector that we did not mention earlier is that the only signals that are detected are the ones that are in phase with the demodulation signal produced by the carrier generator. Signals that are not synchronized with the IF carrier, such as the adjacent channel video and sound carriers and random noise, are not detected. This requires less extensive trapping of interfering signals in earlier IF stages. You may find some sets with only one IF trap rather than the 3, 4, or 5 traps found with conventional diode detectors.



Simplified diagram



—Courtesy Motorola Semiconductor

Actual I.C. schematic

section of the pattern is affected by the adjustment of the limiter control. The limiter control is simply set for the best balance between good linearity and minimum overshoot.

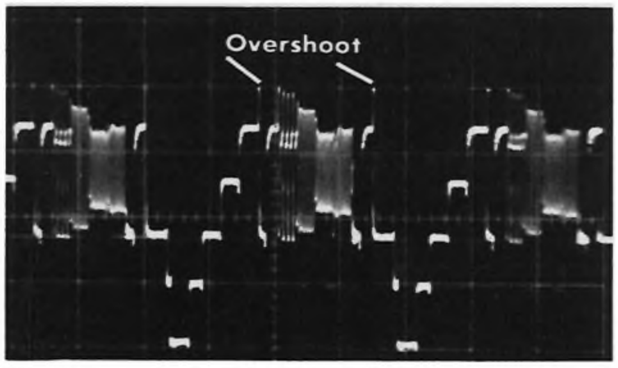


Fig. 10—Incorrect adjustment of the limiter coil showing overshoot on the trailing edge of the bars.

The 45.75 MHz reference coils should be set to the middle of its lock-in range after the limiter coil has been set. This is done by simply adjusting the coil through its entire range and noting the two points where you lose your detector output. The slug should then be set to the point that is the physical center of these two points. If, for example, you find that there are two full turns between the loss of signal with the slug closest to the P.C. board and the one farthest from the board, the slug should be re-set exactly one turn from either of the two points. This will assure that the synchronous detector will function properly as components change values slightly with aging.

Final IF bandwidth alignment

Thus far, we have covered the procedures for setting the adjustments that are directly connected to the detector IC. There are usually additional bandpass coil adjustments in the preceding IF stages that affect the balance between the various Bar Sweep bars amplitudes. These coils are adjusted just like those found in a conventional IF strip. The tuner mixer coil and the coils at the input to the first IF stage will have the greatest effect on the sensitivity of the receiver and the high frequency video response. Make sure that you have set these adjustments for best sensitivity by keeping the VA48 RF-IF Level Control adjusted to the "Norm" position while adjusting these coils. Adjust each coil for the best compromise between the best sensitivity and best high frequency response.

Remember, that once the various adjustments have been made to the detector itself, *they should not be readjusted* to balance the frequency response on the other frequency bars. This signal shaping should occur in the earlier amplifier stages.

Special Note on Admiral 9M50 Chassis

These chassis have a small board near the input with six individual coils. These same boards will also be found in certain color TV chassis with the Montgomery Ward and Western Auto brand names. These coils should not be adjusted as bandpass coils! This board was intended to substitute for a special IC called a SAW (Surface Acoustic Wave) filter which was to be added in later models. The procedure for setting these coils is much too lengthy to cover in this article. The adjustment of these coils is not likely to change since there are no active amplifier stages in the circuits. It is best to leave these coils at their factory set positions!

The VA48 does the whole job.

The number of chassis that use synchronous detectors is increasing each year, and very simply, your shop will fast become obsolete without an instrument like the VA48. The synchronous detector offers so many advantages compared to a diode detector that various manufacturers are adopting the synchronous detector to produce the best possible picture. As the usage of these special ICs increases, their cost drops making it practical to use them in lower-priced receivers. This cost trade-off is further aided by the fact that the other sections of the IF stages do not need to be as complicated with extra traps and gain stages that were needed with the diode detectors.

The VA48 Bar Sweep alignment pattern is the only alignment system that works directly with a synchronous video detector. Sweep and marker generators require special procedures in order to be used and do not provide a test for setting linearity at the detector output. As mentioned earlier, linearity must be set on these new synchronous detectors before IF alignment begins. This can only be done with the Sencore VA48 TV-Video Analyzer.

The biggest single difference between the VA48 IF signal, and that produced by a sweep generator, is that the VA48 provides a continuous, crystal-controlled carrier. The synchronous detector requires this signal for proper operation. You don't even need to learn a new procedure when the VA48 is used to align an IF with a synchronous detector. The same alignment system is used for conventional diode detectors and the new synchronous detectors.

Shouldn't you be ready to service all of the new circuits that are now becoming standard with so many manufacturers? The VA48 is the only unit that totally updates you for analyzing, aligning, and troubleshooting any stage in the modern TV receivers.

VA48 phase-locked signals, a magic answer to chroma troubleshooting

The VA48 Video Analyzer is like having a miniature TV station at your fingertips for troubleshooting.

by Greg Carey, Chief Field Engineer

INTRODUCTION

This article covers the exclusive features of the VA48 that enable you to service the TV color processing circuits more effectively and with higher confidence than with any other piece of TV test equipment on the market today. The VA48 is the only analyzer on the market that equips you to walk every trouble out of every stage of every color TV. The reason is that the VA48 is the only analyzer with all of the substitute signals phase-locked to each other. You simply inject a signal from the VA48 and let the TV receiver supply the other in-phase signals so that every stage in the TV stays in synchronization during testing time. Very simply stated, the TV picture stays in sync at all times, if all stages past your point of injection are operating correctly. This lets you substitute for one stage at a time until the operation of the TV returns to normal. In this way, you can isolate the defect to a single stage.

Not only must the TV stay in sync for rapid troubleshooting, but all of the color processing stages must be phase-locked to the substitute signal in order to produce the correct colors on the CRT. Signal substitution in the color stages becomes meaningless if these signals are not phase-locked to the color signal applied to the antenna terminals. Yet, the VA48 is the first and only TV analyzer that provides all phase-locked substitute signals.

If you have been using the B & K TV analyzer (and getting only a green output when you sub your color signals), you are in for a pleasant surprise when you use your VA48 for the first time. Not only do you view all colors on the CRT, but the colors are properly locked with solid color bars coming through in the proper sequence. Since the amount of color is dependent on amplitude and hue on the phase swing, you now know that both the amplitude and the phase of the substitute signals are correct. You simply use the CRT as a reference to indicate when you have located the defective color circuit. We make the statement at the beginning of the article, that the VA48 Video Analyzer is like having a miniature TV station at your fingertips for troubleshooting. Perhaps you can see why we make this statement as you learn that the VA48 is all phase-locked, just like the signals at the TV transmitter, while other TV analyzers are not phase-locked. Let's discuss color circuit troubleshooting with the VA48 so you'll know what we mean.

Phase-locked substitute signals enable you to pinpoint color circuit troubles in a fraction of the time.

Let's review the importance of signal phases in the normal operation of the TV receiver color circuits in order to better understand why our substitute signals must also be phase-locked. Fig. 2 shows a typical block diagram

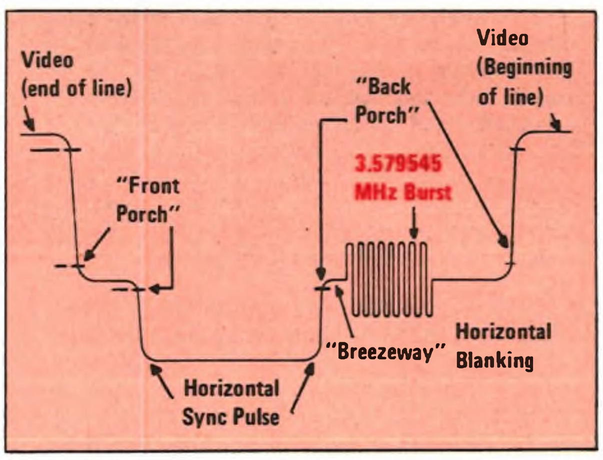


Fig. 1—The 9 cycle color burst supplies the phase reference for the color circuits.

of the color circuits in a TV receiver. *All of these circuits have only one function; they must separate the red, blue, and green color information from the composite video signal, amplify each color and drive the CRT guns with the respective color.*

The heart of this system is the 3.58 MHz local oscillator. This oscillator must operate at the exact phase of the master color oscillator at the TV station. The master color oscillator produces continuous 3.579545 Megahertz with very little phase change over long periods of time. The problem is that the TV set receives only a very small sample of this signal in the form of the "color burst" signal on the back porch of the horizontal sync pulse. This color burst consists of just 9 cycles of the 3.58 MHz reference signal. Both the phase and frequency of our receiver 3.58 MHz oscillator are compared with the 9 cycle color burst at the beginning of each horizontal line of video information. The phase of the local oscillator is corrected during this comparison to maintain a receiver oscillator output signal that has both the proper frequency and the phase relationship. In this way, the TV receiver local color oscillator provides a signal that is a duplicate of the master color oscillator signal at the TV station.

The corrected 3.58 MHz reference signal is then applied to the color TV demodulators, along with the composite color signal (chroma). The chroma signal is the same frequency as the 3.58 MHz reference signal but has a constantly changing phase and amplitude. The phase difference represents the different colors (hue) that make up the picture. The different amplitudes represent the amount of color (saturation) of each portion of the picture.

Most color TV receivers use only two demodulators, not three as you might expect. One demodulator detects the red signal and one demodulator detects the blue signal.

The green color information is derived by using the demodulated red and blue signals and subtracting them from an all-white signal, called the Y signal. This can be done because red, blue, and green combined form a white picture. This is done in the "matrix" circuit.

That, in a nutshell, is how the color circuits operate. As a service technician, you may be more concerned with what can go wrong in these circuits than the theory of operation. Let's discuss some typical defects and see how we can get right at the heart of the problems. Because the color circuits described above depend on phase information, you should see that any color circuit defect can produce only four different symptoms: 1.) No color at all, 2.) Incorrect colors, 3.) Improperly locked or "rainbowing" color, 4.) Having color during black and white programs. Let's see which circuit defects can cause each of these four color circuit problems.

Before we get into the color circuit defects, we need to review what is meant by "phase-locked" signals in order

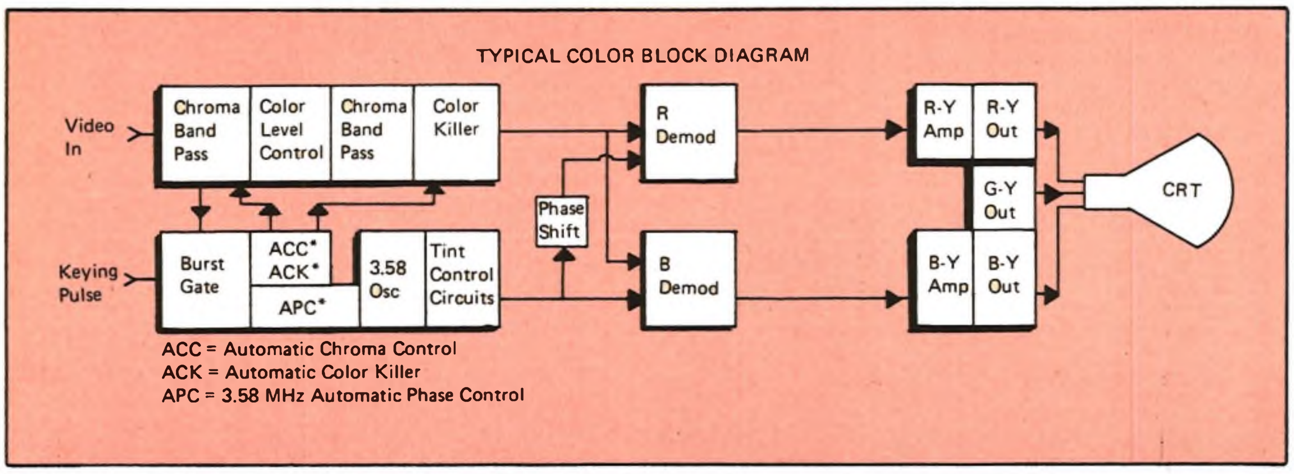


Fig. 2—All signals in the color processing circuits must be properly phase-locked to produce the correct colors.

to better understand why the VA48 allows direct substitution in color circuits when no other TV analyzer will. *By phase-locking, we mean that all of the substitute signals are locked to the signals that are used to modulate the RF and IF generator in the VA48.* If the RF or IF signal is fed into the TV from the VA48, the entire TV stays in sync during the time that you are substituting phase-locked signals into other stages of the receiver.

To fully understand the importance of phase-locked signals, we must understand how a color generator produces colors in the first place. The actual frequency of the color bar information is 3.56 MHz, not 3.58 MHz as you might think. "Why", you might ask, "are the color bars generated at 3.56 MHz?" The answer is simply, "That's what generates the color."

The color bar frequency is 3.563811 MHz which is exactly 15,734 Hz lower in frequency than the 3.579545 color oscillator frequency. The horizontal oscillator in a television receiver, picking up a color program, runs at 15,734 Hz, not the 15,750 Hz sweep rate for black and white. The demodulation of the 3.56 MHz oscillator, compared with the 3.58 MHz local color oscillator, produces one cycle change per horizontal sweep line or a 360 degree phase shift for each horizontal line. *This produces every possible chroma phase which, in turn, produces a full rainbow of color from the left side of the screen to the right.* This rainbow is then "gated" by inserting 10 black bars to identify different portions of the rainbow.

This should give you a good understanding of how the gated rainbow patterns work. We do have one problem that we have not discussed, however. The 3.58 MHz receiver color local oscillator must be synchronized to the

Fig. 3—Only the VA48 phase-locked signals prevent this non-locked condition. The VA48 will produce properly locked colors.

random 3.56 MHz signal phase on each horizontal line to prevent color running in the bars. You should realize that the same phase relationship problem exists between the 3.56 MHz oscillator and the horizontal sync pulses. If these two signals are not synchronized, as is the case with all other color bar generators, the substitute 3.58 MHz signal will not be the same phase as a properly operating 3.58 MHz local oscillator. This will result in "sliding colors" and a running gear effect on the side of the bars. The VA48 has rock solid bars, with solid color sync and no "running gear" effect on the color bars. That's because the 3.56 MHz oscillator is phase-locked to the 3.58 MHz oscillator and to the horizontal sync pulses too. No other analyzer or color bar generator does this but the TV station does.

Phase-locked substitute signals require special design.

The phase-locked VA48 signals did not happen by accident. A total of five different oscillators, three of which are crystal-controlled, all had to be locked to a single crystal oscillator. Fig. 4 shows the block diagram of the video pattern generator in the VA48. *Notice that the 3.02 MHz oscillator is the master oscillator and all other oscillators are locked to its output.* The 3.02 MHz master oscillator controls the sync generator which produces the horizontal and vertical sync information. The 3.58 MHz crystal oscillator is then phase-locked to the 3.02 MHz oscillator with a varactor tuning circuit. The 3.56 MHz crystal oscillator is, in turn, locked to the 3.58 MHz oscillator so that we have a fixed phase relationship between the 3.56 MHz color bar signal and the 3.58 MHz drive signal. Finally, the 3.08 and 4.08 MHz oscillators, that are necessary for the upper and lower color sideband bars in the Chroma Bar Sweep, are locked to the 3.56 MHz oscillator so that we have stable patterns when doing color alignment or troubleshooting.

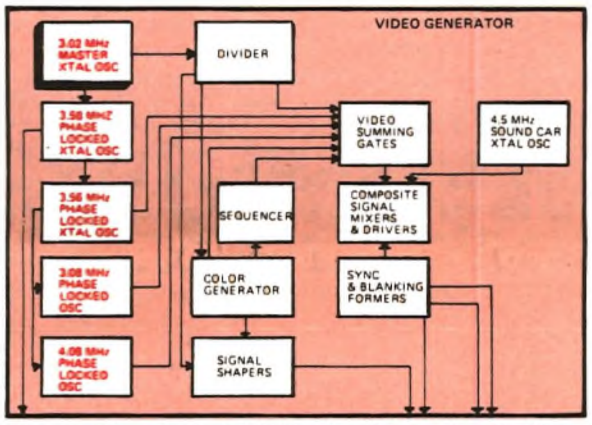


Fig. 4—Phase-locked VA48 signals require 5 different oscillators—three of which are crystal-controlled—to be locked to the 3.02 MHz master oscillator.

Phase-locking three crystal-controlled oscillators together requires additional steps in manufacturing to make sure that they remain locked at different ambient temperatures. Each crystal must be specially graded at different temperatures. These graded crystals must then be matched to each other to assure that your VA48 remains phase-locked for many years of operation. Special compensation controls are also necessary so that each crystal oscillator may be properly adjusted to the correct frequency and locked to each other.

How phase-locked signals let you divide and conquer color troubles.

The first thing we must do to effectively use the substitute signals from the VA48 is to synchronize the TV by simply connecting the VA48 RF output signal to the TV antenna input terminals. The VA48 and TV tuner, of course, should be set to the same channel. If all TV circuits are working correctly, all stages will be in sync and in phase with the VA48 RF substitute signal. If a stage is defective, all we need to do is inject our substitute signal to see if the operation of the color circuits return to normal by seeing if color returns to the CRT. Let's study the color circuits to see how this happens.

The color information follows two paths after it has passed through the first chroma bandpass amplifiers as shown in Fig. 5. One path feeds all of the chroma information from the output of the bandpass amplifiers to the input of the demodulator stages. The second path passes to the burst gate, the 3.58 MHz local oscillator and the tint stages. *Both of these signal paths come back together at the color demodulator stages.* Therefore, you can roughly halve your troubleshooting time if you begin troubleshooting at the demodulators because they need both signals for proper operation. Further, injecting substitute signals at the demodulator inputs approximately divides the color stages in half so you know whether the defect is before or after the demodulators, saving more time.

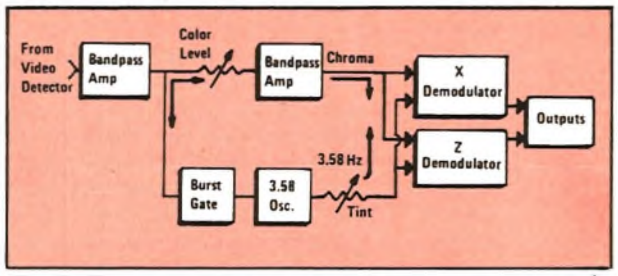


Fig. 5—The demodulators are a good point to begin analyzing because they require both phase-locked signals (shown in red) to function properly.

This troubleshooting technique is often called the "divide and conquer" troubleshooting method because each step of signal substitution divides the circuit in half. If the first step shows that the defect is before the demodulators, you know which of the two input paths have the defect; the one that returned the operation to normal when substituted. Your next injection point should again divide that path in half until the defect has been narrowed down to a single stage.

Once you have determined the stage that has the trouble, you use conventional troubleshooting methods, such as voltage readings or testing of transistors or tubes, to find the actual circuit defect.

Divide and conquer troubleshooting will only work if you have the correct signal to inject at each stage and only if each signal is phase-locked to the other signals in the TV.

Quickly locate defects in color circuits without disconnecting a single component.

One of the most often asked questions that we run into at our seminars is, "Do you need to disconnect components, to eliminate the incoming signal, when injecting a substitute signal in a given stage?" The impedance of the VA48 Drive Signal Output has been carefully selected, at each setting of the Drive Signal Output, to swamp out any signal that is present in the TV. *Therefore, you never need to disconnect a single component to inject a signal from the VA48.* The output of the VA48 is also AC-coupled, through a capacitor, so you do not even need to worry about the VA48 changing the DC bias voltages, loading the B Plus voltages, or affecting other potentials needed to operate the stage. *What's more, the VA48 is especially protected so that it will not be damaged from the TV signals or DC potentials.*

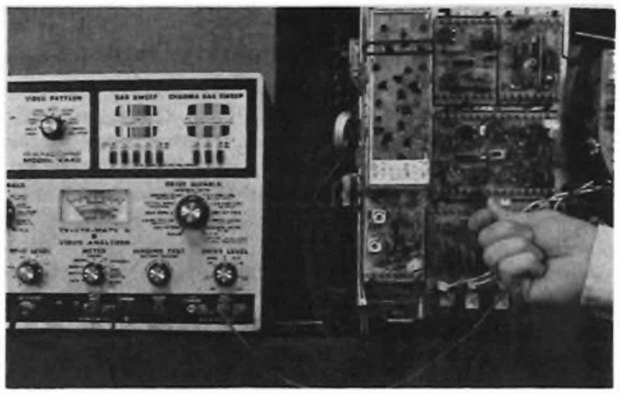


Fig. 6—The VA48 substitute signals are injected without the need of eliminating other signals in the circuit because the VA48 simply "swamps" out any signals that are present.

All VA48 substitute signals are adjustable, with both positive and negative polarities, so you can match the TV driving signal amplitude and phases. This assures proper color lock-in at any signal injection point. *Generally, start with the positive polarity, because it is used most of the time, double-checking with the negative polarity if the positive polarity does not correct the defect.* There is no stage in the color TV where selecting the wrong phase will cause a stage to "blow up" unless the substitute signal is much too high in amplitude and applied for too long a period of time. The drive signal output control is calibrated in peak-to-peak volts so you always know the amplitude of the substitute signal. You are further protected by the VA48 peak-to-peak reading meter which reads the signal amplitude at all times.

Sort out integrated circuit (IC) defects with ease with the VA48 phase-locked signals.

Most of the newer receivers use one or two integrated circuits to process the color information. These integrated circuits present new problems to color TV technicians. Many technicians ask questions like, "How do I test an IC?" or "How am I supposed to know what actually happens inside the IC?" or "Why don't schematics show the actual schematic of what is inside the IC?"

Let's try to understand the IC a little better before we discuss testing it.

An IC is really not a component at all and cannot be tested like a tube or transistor. An IC is just what the name implies; it is an entire circuit that has been "integrated" into a very small package. *This means that we must test the circuit function of the IC connected to the circuits with which it operates.* We cannot test the IC circuit without its supporting components or without its input signals and output loads.

The phase-locked substitute signals of the VA48 provide a method of testing the circuit function of the IC while it is still in the circuit. We simply substitute for the input and output signals and watch the CRT for our results. This approach gives a more positive indication of the IC status than tracing signals with an oscilloscope. A scope is used to compare input and output signals. A bad IC will have the proper input signal but no output signal.

But a good IC, with a shorted output load, will give an identical set of input and output waveforms as did the bad IC. The VA48 signal substitution method will simply return proper operation when the signal is substituted for the bad IC. A shorted output load will cause the signal level on the Drive Signal Monitor meter to drop so we can tell where the defect is.

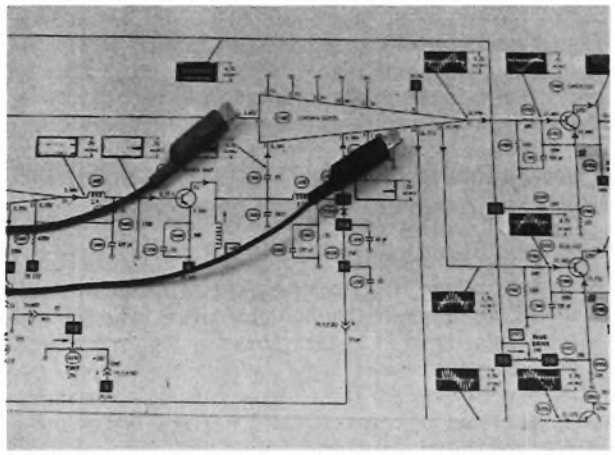


Fig. 7—The VA48 substitutes for the IC function since an IC cannot be tested as a component.

Many of the newer ICs combine several circuit functions. Functions like color killer circuits or automatic chroma level control circuits may be part of the same IC that also contains the bandpass amplifier and the 3.58 MHz oscillator. Testing these ICs is actually simpler than testing a circuit made up of discrete components because we have fewer input and output connections. *Generally, an IC either works or it doesn't.* It doesn't really matter if the defect is in one of these four sections of the IC because we cannot get inside the IC to fix the defective stage even if we could tell what was wrong. For example, if the set operates properly when we inject at the IC output but does not operate properly when we inject at the IC input, we have no choice but to replace the IC.

Another very important consideration of IC troubleshooting techniques is the high cost of these integrated circuits. A "shotgun" method of IC troubleshooting can be very expensive in terms of replacement components that were not defective in the first place and the time lost in ordering these special integrated circuits.

A very time-consuming part of IC troubleshooting is determining the inputs and outputs of the IC. It is indeed unfortunate that some manufacturer's service literature does not indicate which pin is which. And, there is no standard as to which pin has which function. There are two sources of information that can help.

First, most Howard W. Sams literature shows the key input and output pins, even though the original manufacturer's literature may not show these pins. Secondly, cross-reference books for replacement parts, such as Sylvania "ECG" or Motorola "HEP", often show the entire basing diagram for the most common color ICs.

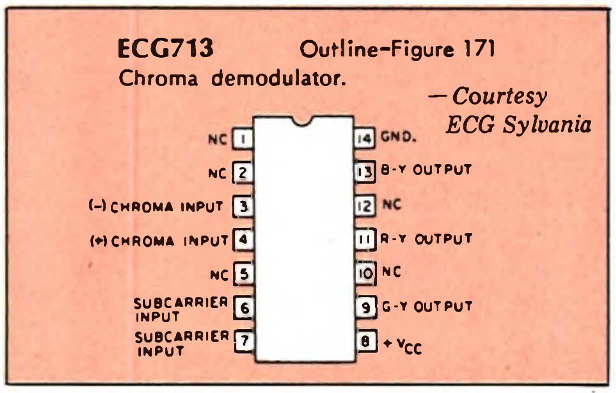


Fig. 8—The proper injection points are indicated in service literature or cross-reference manuals.

Once you know the basing information, all you need to do is begin injecting the VA48 phase-locked substitute signals at the input and output of each IC function to determine if the IC is operating properly.

Phase-locked substitute signals help you tie down chroma bandpass troubles with confidence.

The main function of the chroma bandpass amplifier is to separate the color information from the composite video signal. The bandpass amplifiers are actually filters that are tuned to accept the 1 Megahertz of color information that extends 500 Kilohertz above and below the 3.58 MHz color subcarrier. The bandpass amplifiers have two outputs, one that goes to the burst gate to operate the 3.58 MHz local oscillator and the second that goes directly to the chroma demodulators. We will have a total loss of color if either of these outputs are not present.

Fig. 9 shows the color circuits of a typical TV chassis. Notice that the output of the second bandpass amplifier is fed to the burst gate for separation of the 9 cycle burst signal. The output of the second bandpass amplifier stage is also fed to the color level control which feeds the third bandpass amplifier. The third bandpass amplifier boosts the signal to a level that will operate the demodulators.

Okay, so much for the operation. Let's talk about dividing and conquering the bandpass amplifiers. A defective bandpass amplifier will result in a total loss of color because the chroma signal does not reach the demodulators. *But, if you see no color on the CRT, you do not know whether the trouble is in the bandpass amplifiers or a missing 3.58 MHz local oscillator signal.* You can quickly eliminate the 3.58 MHz local oscillator (and associated stages) as the defect by substituting the VA48 3.58 MHz phase-locked signal at the input of the demodulators and noting whether the color returns to the CRT. If color does return, you know that the trouble has to be in the 3.58 MHz signal path because substituting for this signal returned color information. Furthermore, you know that the chroma bandpass amplifiers are passing a signal to the demodulators because, if the chroma signal was not present, you would not get color when subbing the 3.58 signal. The demodulators need both signals to produce color.

Now you know that a defective bandpass amplifier will be indicated by a loss of colors, even when the 3.58 MHz signal is substituted at the demodulators. How do you locate the specific stage that is defective? Simply switch the DRIVE SIGNALS switch on the VA48 to the "Video Pattern" position and set your VIDEO PATTERN switch to the "Chroma Bar Sweep" position. *This now gives you a substitute chroma signal to inject for each chroma bandpass amplifier stage.* The reason that you should use the Chroma Bar Sweep video pattern (instead of the color bars) is that this pattern will indicate how well the bandpass amplifiers are passing the full chroma frequency range. We will cover the details about the uses of this pattern for aligning the bandpass amplifiers in the next section of this article.

Start by injecting your composite chroma signal at the output of your chroma bandpass amplifiers. Why is this the best place to start injecting substitute signals? Simply because it will tell you more about the operation of the bandpass amplifier stages than any other injection point.

Let's say, for example, that substituting for the output of the last bandpass amplifier returns solid, locked-in colors on the CRT. *This should immediately tell you that the 3.58 MHz local oscillator is locked onto the color signal that is being fed into the antenna terminals.* This fact, in turn, means that the proper signal is appearing at the input to the burst gate amplifier. This indicates that the bandpass amplifier signal is present up to the point where the burst gate signal is separated from the composite chroma signal. This point is usually just before the color level control so you know that the defect is between the color level control and the demodulators. You now simply inject across each component from the demodulator back to the color control until you find a point that does not return your locked-in color to the CRT. You have now located your defect.

What if injecting either the Chroma Bar signal or the 3.58 MHz signal at the demodulator inputs did not produce color? This tells you that neither signal is present. Troubles after the demodulator will only cause no color if both demodulators are defective, otherwise you get some color. The trouble must then be in the first or second bandpass amplifier because they are the only stages that are common to both signals in this TV. You should move your injection point to the input of the first bandpass amplifier to see if the problem is actually in the color stages. If you get good color when you inject at the input to the first bandpass amplifier, you know that the color stages are good. *The problem has to be a loss of high frequency (color) response in the RF, IF, or video detector stages.* You should use the IF generator portion of the VA48 and check the IF alignment to make sure that the color portions of the composite video response are being passed by the IF stages.

Finally, if you do not get color when the signal is injected at the input to the first bandpass amplifier, you know that the problem is between the input to the bandpass amplifier and the demodulators. You now simply move your injection point one stage at a time towards the demodulators until the colors return to the CRT. If, for example, you do not get locked-in colors when injecting at the input to the first bandpass amplifier, move to the output of that same stage. If you now get colors, you know that the defect is in the first amplifier stage. If you do not get color, repeat the injection process at the input and output of the second bandpass amplifier and so on until you find an injection point that returns color.

What happens if you inject at every color injection point and do not find any stage that returns color? Generally, this indicates that there is more than one defect present so you will want to tie down one defect and then the other. To be absolutely sure that the chroma bandpass

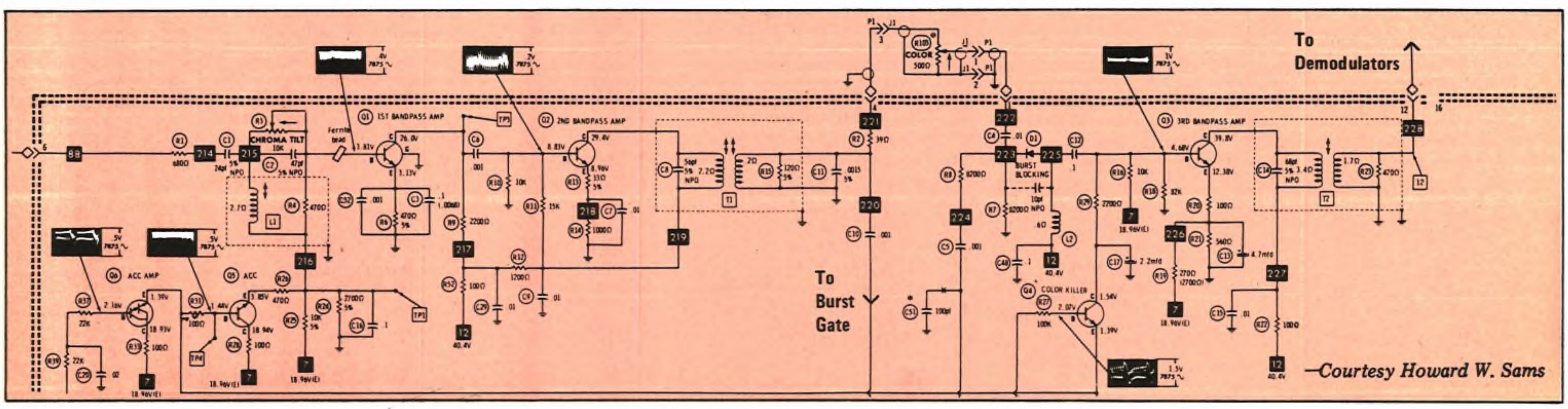


Fig. 9—Bandpass amplifier stages schematic of typical 3-stage bandpass amplifier.

amplifier is okay, connect your PS29 or PS163 oscilloscope to the output of the last bandpass amplifier stage and watch your amplifier output as you inject at each stage. You should keep the level of your injection signal at about the same amplitude as the waveform shown on the schematic for the set you are working on to make sure that you are not forcing a signal through a bad stage by using too much input signal. The combination of signal substitution with the VA48 and signal tracing with a good oscilloscope will let you tie down the most complex bandpass amplifier failures as you divide and conquer the number of possible defective stages down to a single stage and then use conventional troubleshooting on that one stage.

Accurately align the chroma bandpass amplifiers with the patented Bar Sweep.

Separating the color information from the composite video signal is only one function of the chroma bandpass amplifiers. *The second function is to compensate for the fact that the color signal does not receive equal amplification in the video IF amplifiers.* Notice in Fig. 10 that the upper sideband (4.08 MHz) of the color signal receives about half the amplification of the lower (3.08 MHz) sideband and will result in poor color if not compensated for in the chroma bandpass amplifiers.

The frequency response curve of the bandpass amplifier is designed to compensate for the IF response curve by boosting the high frequency end of the video signal. The resulting output provides equal amplification to all portions of the color signal. The patented Chroma Bar Sweep signal allows the bandpass amplifiers to be accurately aligned by either connecting a scope to the bandpass amplifier output or watching the effects on the CRT screen.

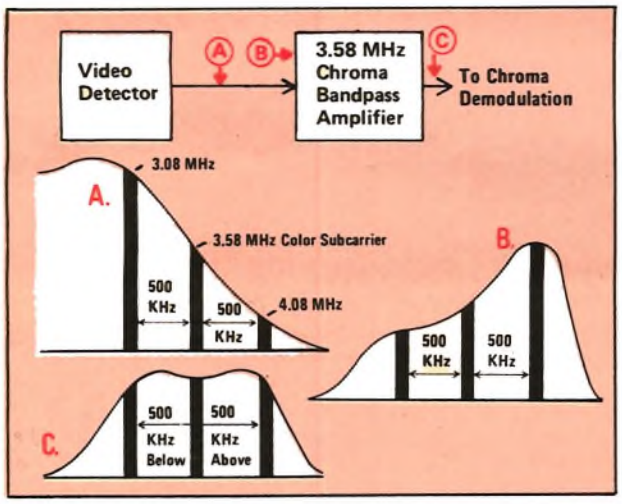


Fig. 10—
- **A. *The color information receives unequal amplification in the video IF stages.***
- **B. *The frequency response of the chroma bandpass amplifiers compliments the IF response curve.***
- **C. *Equal color amplification results when A and B are added together.***

Simply inject your VA48 IF generator output to the input of the video IF stages (output of tuner). This injection point is the same one that is used for IF alignment with the Bar Sweep signal because color bandpass alignment actually starts at this 1st IF. Then, simply connect your scope to the output of the bandpass amplifiers or turn your brightness control on the TV down while watching the CRT and adjust the bandpass tuning coils until all three of the bars are the same amplitude. It is obvious that the video IF must be in good alignment first or it will affect the chroma bandpass alignment.

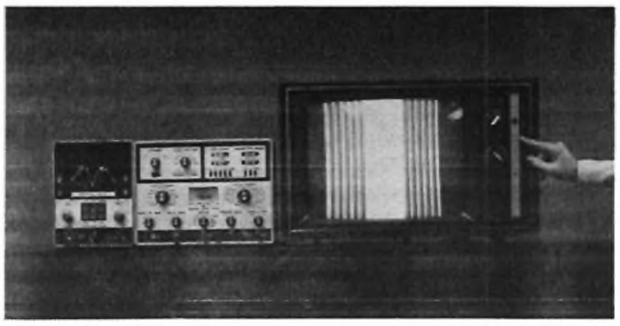


Fig. 11—Use a scope connected to the output of the bandpass amplifier or the pattern on the TV CRT as a reference as the bandpass amplifier is aligned with the patented Chroma Bar Sweep pattern.

The patented Chroma Bar Sweep pattern assures you that you can align the bandpass amplifiers to produce the best possible color output once you have corrected the defects in the color stages. The VA48 is the only instrument that is designed to both troubleshoot and align the color stages.

Isolate defects in the color oscillator, frequency and phase correction circuits, and tint circuits with the VA48 phase-locked substitute signals.

Let's look at our typical color circuits with a different defect. This time, we find that substituting the 3.58 MHz signal at the demodulator does correct our colors. Remember that substituting the 3.58 MHz signal with a defective bandpass amplifier gave no improvement because there was no composite chroma signal from the bandpass amplifier. The loss of 3.58 MHz could be in any of the circuits from our burst gate to the injection point of the demodulators. How do we locate the specific circuit that is causing the trouble?

The 3.58 oscillator is the first point that gives us our continuous wave 3.58 MHz signal and should be our first suspect. Injection of the VA48 3.58 MHz phase-locked substitute signal at the oscillator output will tell us whether the trouble is somewhere between the oscillator and the demodulator, such as our tint circuits or 3.58 MHz amplifiers. If we find that our colors return when we inject at this point, we now know that the trouble has to be in one of the remaining 3.58 MHz circuits, which are the oscillator, the phase correction circuit, or in the burst gate.

A defective burst gate can cause either of two different problems. A burst gate that is open (or is missing the flyback keying pulse) will result in no color at all because the color killer will switch to black and white since no color burst is detected. A shorted burst gate, on the other hand, will produce color that is not in sync because all color signals, not just the burst, are passed to the 3.58 phase detectors. The 3.58 oscillator no longer has a reference so the result is rainbowing color.

To check the burst gate, we simply move our 3.58 MHz signal to its input and see whether we get color. *It does not matter that we are injecting a continuous wave signal because the burst gate will only pass the signal during the time that the flyback keying pulse signal, that turns on the burst gate, is present.* If we find that injecting at the burst gate input gives us color, we know that the signal from the second bandpass amplifier output is not reaching the burst gate even though the chroma signal is getting to the demodulators.

If we do not get color, the 3.58 MHz signal should be substituted at the output of the burst amplifier to check the 3.58 MHz phase detector. It should be noted that a continuous 3.58 MHz signal is being substituted for a 9 cycle burst. This simply means that the phase detector will operate continuously and may improve stability but will serve as a good test on the phase detector. A good positive check on the 3.58 MHz phase detector circuit is to simply use the highly filtered BIAS and B+ SUB supply to substitute for the DC output of the phase detector to see if the color can be synchronized. If it can, the phase detector is defective.

Simplify automatic color killer analyzing with the VA48 phase-locked substitute signals.

The Automatic Color Killer (ACK) circuits depend on the presence of a color burst signal to indicate whether the picture should be shown in color or black and white. The Bar Sweep pattern provides a dynamic test of the

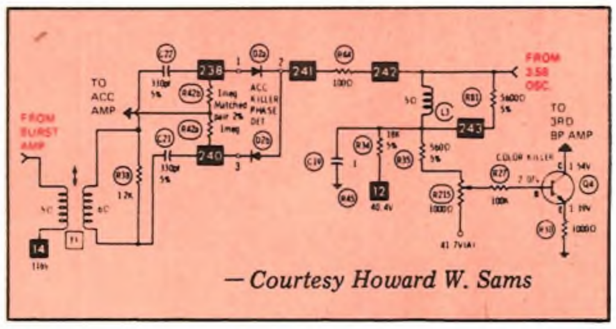


Fig. 13—The phase-locked substitute 3.58 MHz signal may be used to inject either signal that operates the color killer phase detector.

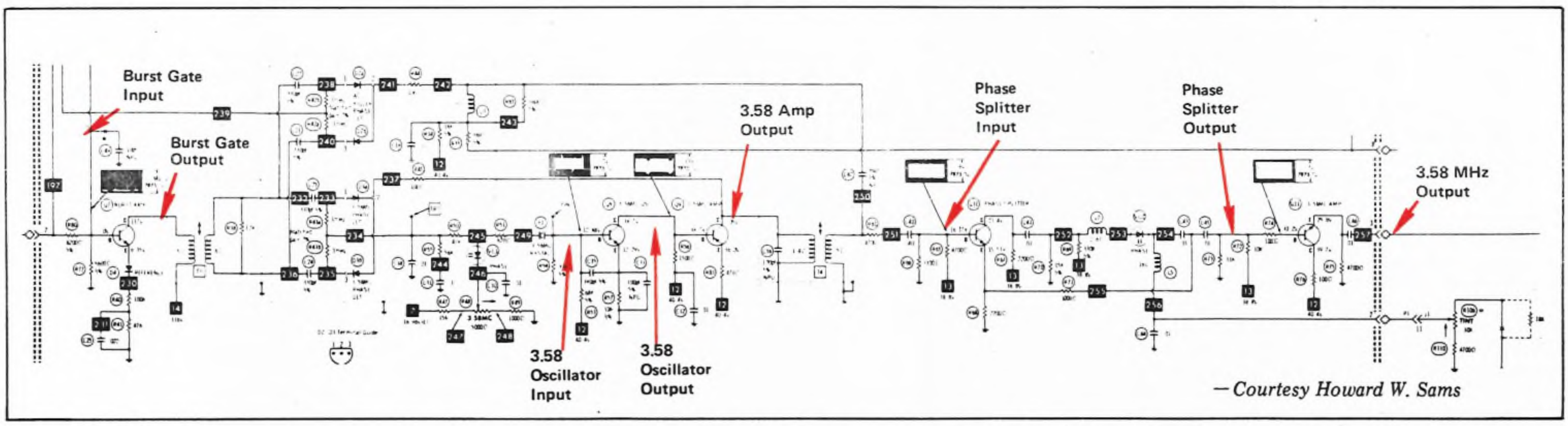
color killer circuits because it does not have a color burst, but does have a 3.56 MHz bar. You should not get any color at all, just like you would expect on a black and white transmission. If you get any color, it will show on the 3.56 MHz bar because this frequency will pass through the chroma circuits and be demodulated. You should set the color killer control until the 3.56 MHz bar just loses its color. When you then switch to the color bars pattern or the Chroma Bar Sweep pattern, the color should return because both of these signals have a standard color burst signal whose relative amplitude is the same as the color burst supplied by the TV station. Other color generators produce an abnormally large color burst which may cause the color killer circuit to operate improperly.

If the color killer does not work properly, it can be isolated as the real problem in a hurry by substituting the Bias and B Plus supply from the VA48. Simply increase the DC potential, positive or negative depending on the circuit used, to see if the color bars switch from black and white to color as the bias is changed.

Analyzer the color demodulators, matrix and CRT drivers with absolute assurance with the VA48 phase-locked substitute signals.

Up to this point, we have been working with defects before the demodulators. The VA48 is the only analyzer that supplies a full range of signal amplitudes from zero to 30 Volts peak-to-peak for injection at the output of the demodulators and the matrix amplifiers. Other analyzers are limited to about 1 Volt peak-to-peak maximum.

A defect in the demodulators, matrix amplifiers, or the R—Y, G—Y, or B—Y output stages result in a different symptom than defects in the earlier stages. *Instead of a total loss of color, we now find that only one (or two) of the colors is missing.* If, for example, the R—Y demodulator is defective, we will have blue and green (actually blue-green) signals but no red signal. The demodulator is not the only stage, however, that will result in a loss of red. A defective driver stage or output stage will result



Fit. 12—The phase-locked 3.58 MHz signal may be used to substitute for any portion of the 3.58 MHz circuitry.

in a similar symptom. How can the VA48 help us locate this type of defect?

We simply inject our phase locked color bar signal at each point in the red color circuits. We can start at the input to the R—Y output stage and see whether we have red returned to the screen. This time we will see all of the color bars turn red because the signal is injected after demodulation. If there is no change, we know the trouble is in the output stage itself or the wiring running to the CRT. The CRT can be driven with the substitute signal is some solid state sets (that require less than 30 Volts drive) or the CRT can be tested with an accurate CRT tester such as the Sencore CR31A Super Mack to make sure that the CRT is not the problem.

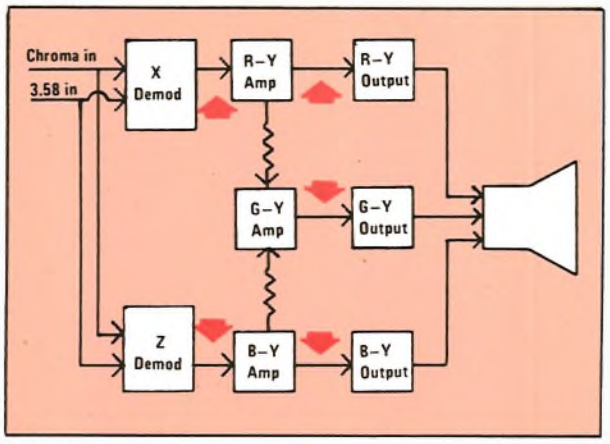


Fig. 14—The adjustable amplitude of the composite video signal may be used to inject at any demodulator matrix or output stage.

If we get a red screen when we inject at the input to the R—Y output stage, we simply move our injection point back one stage at a time until we get to the output of the R—Y demodulator. If our reds are present when we inject at the output of the demodulators, we know that the demodulator itself is the defect. We have once again been able to isolate our defect to a single stage to reduce the amount of time necessary to troubleshoot color problems.

You can make all color adjustments faster and more accurately with the special features of the VA48 phase-locked signals.

The special features of the Bar Sweep pattern allow you to make the adjustments, like the 3.58 MHz oscillator Automatic Phase Control (APC) and color tracking adjustments, much faster because it is not necessary to disable the APC circuit or even flip the setup switch on the back of the receiver. Complete details are covered in the instruction manual, but here are just a few of the adjustments you can make.

First, the color oscillator is adjusted by simply turning up the color killer adjustment until the 3.56 MHz bar of the Bar Sweep pattern shows in color. The color will not be locked in because this pattern does not have a color burst. Simply adjust the 3.58 MHz APC adjustment until the bar shows a solid color from top to bottom. This has now "zero beated" the TV local oscillator with the master oscillator in the VA48. Remember to re-adjust the color killer, using this same pattern, when you have completed this adjustment.

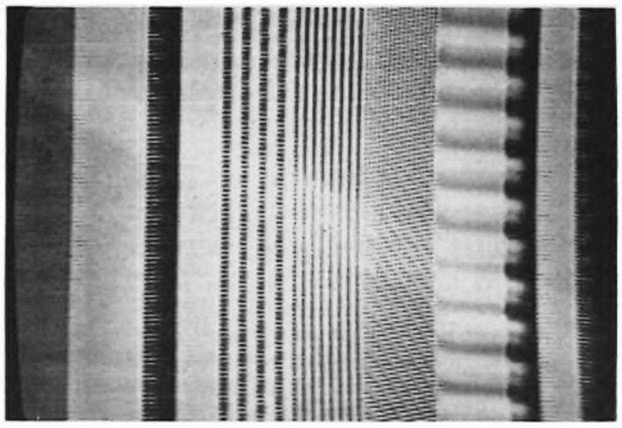


Fig. 15—The color oscillator is adjusted until the 3.56 MHz Bar Sweep bar locks in as a solid color.

The CRT screen and drive controls, that determine black and white tracking, are made without the need of using the old procedure of flipping the setup switch, adjusting for a white line and then trying to get a good black and white picture with an off-the-air signal. The Bar Sweep has a special grey-scale which is simply used as a black and white reference. The CRT drive and screen controls are then adjusted until there is no hint of color in any portion of the grey-scale pattern. This procedure is faster, and the results more reliable, than using the old system.

Finally, the VA48 has all of the standard color generator patterns, including a single cross, a single dot, a cross-hatch and a dot pattern so that you can make all of your convergence adjustments.

Haven't you wanted and waited long enough?

How long have you wanted a piece of equipment that would let you narrow color troubles down to a single stage? The VA48 is the only TV analyzer on the market that supplies all phase-locked signals, with the correct amplitudes, for injection into any stage from the chroma takeoff point right up to the color output stages. Phase-locked substitute signals are the only way to confirm that each and every color circuit is performing properly.

How long have you wanted a system for adjusting the chroma bandpass amplifiers for best performance right on the CRT? The patented Chroma Bar Sweep pattern is the only way that you can make these adjustments without even needing to connect a scope. And, these adjustments are made with the same instrument and the same cable connections that you used to troubleshoot the color circuits so that you do not need to totally disconnect and reconnect equipment as you need to do with a sweep and marker alignment system. The VA48 is the only instrument that has the Chroma Bar Sweep because it has been patented by Sencore.

How long have you wanted to be able to make all of your color tracking, color killer, and color oscillator adjustments with a truly dynamic pattern? The VA48 is the only instrument on the market that has the special features that let you make all of these adjustments without disabling a single circuit or without the need of switching the color service set-up switch. It's just like having a miniature TV station on your bench and at your fingertips for signal substitution troubleshooting.

Haven't you wanted and waited long enough? Your VA48 is waiting to be delivered by your nearest Sencore distributor. The VA48 costs you less than a dollar a day if written off over four years. Can you afford not to have this analyzer on your bench? Call your toll-free Customer Service number (800-843-3338) so we can get you and your new VA48 together to speed your color servicing. *Just think, that extra hour you save with the VA48 can get you home an hour earlier tomorrow and with a little more cash in your pocket, too.*

How to walk "tough dog" troubles out of SCR drive circuits with the VA48

By Duane Shultz, Directer of Technical Training

Horizontal sweep circuits can present a TV technician with some of the most serious troubleshooting problems that he will ever face. There are many reasons for this, but the most common reason is the fact that the horizontal sweep circuit is a "closed loop" feedback circuit. This means that the failure of one component can make all the other components look like they have failed. Many new TV receivers use silicon controlled rectifiers (SCR) in place of tubes or transistors to drive the horizontal flyback transformer and yoke. Many technicians dread the thought of servicing a horizontal stage that uses SCRs because they do not understand the operation of the circuit, and they do not have the proper signals to substitute for the SCR drive in the defective set. We will begin by briefly explaining the operation of the SCR drive system so that you might have a better understanding of these complex circuits and appreciate just how important the special SCR drive signal of the VA48 TV and Video Analyzer is in troubleshooting these circuits.

The SCR drive circuit has many similarities to a conventional tube type horizontal output stage. We will, therefore, start with a tube set so we have a common starting point in understanding these newer circuits. We won't go into too much detail on the tube circuits as most TV technicians already have a basic understanding of their operation. Here is a brief review.

The function of the horizontal output tube is to simply provide the power we need to drive the deflection yoke to move the electron beam across the CRT. The output tube, which is biased deep into cutoff (class C), actually only provides the power to move the electron beam from the center of the CRT to the right-hand side of the screen. The drive is then cut off and the energy stored as a magnetic field inside the yoke and flyback begins to collapse. The electron beam literally "flys back" to the left side of the screen at a rate about 4 times as fast as it moved from the center to the right-hand side. As soon as the beam

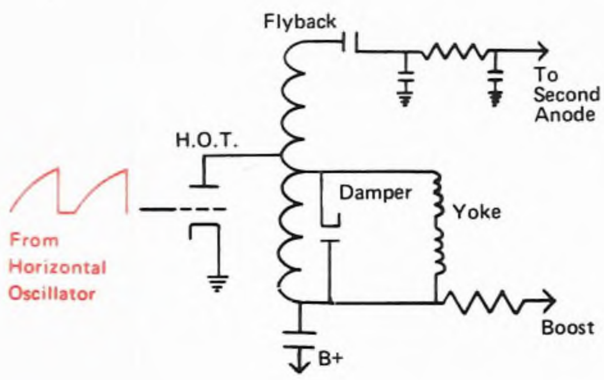


Fig. 1—The horizontal output tube conducts only to move the electron beam from center screen to the right. The damper takes the beam from the left back to center and also produces the boost voltages.

reaches the left side of the screen, the output circuit will begin to ring at its resonant frequency. The damper diode, however, begins to conduct on the first cycle of ringing and damps the ringing by shorting the remaining energy through a tuned circuit that returns the beam to the center of the screen at the proper scanning rate. The output tube bias is set so that it begins conduction as soon as the beam is at center-screen, and the process of moving from the center to the right-hand side begins again.

Rather than returning the damper diode to ground, it is returned to B+ through a capacitor to produce a high DC voltage (boost voltage) which is used to supply power to the plate of the output tube.

The horizontal output tube requires a signal from the horizontal oscillator for proper synchronization with the incoming TV signal. The output tube also requires the boost voltage generated from the damper diode. The damper can't operate unless it has an AC voltage that is generated by the magnetic field stored in the yoke. The yoke is fed from the flyback which gets its energy from the horizontal output tube. A defect in any stage in this windup feedback loop will cause the entire loop to stop working resulting in no high voltage or horizontal deflection.

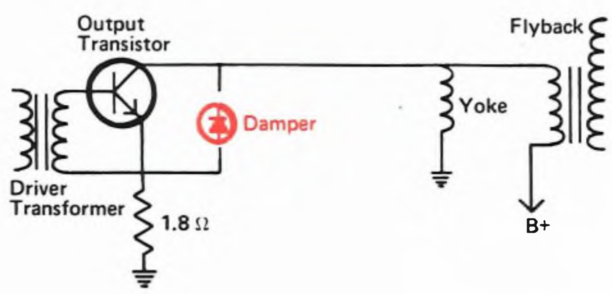


Fig. 2—A transistor output operates the same as a tube output except the damper is returned to ground.

The operation of a transistor output stage is almost the same except that we return the damper diode directly to ground (rather than to B+ as with a tube stage) because we do not need the boost voltage to operate the output transistor. Power for the transistor is generally derived from the 110-150 VDC supply. The transistor also requires a square wave driving signal with a much higher current than a tube output stage.

The VA48 simplifies service of both tube and transistor circuits by supplying the proper amplitude, waveshape, and current levels for direct substitution of the driving signals for both tube and transistor output stages. If we substitute our signal and the raster returns, we know that the trouble is in the oscillator or driver stages. If we do not get an output with the substitute signal, we will suspect our yoke, flyback, or the output device itself. A quick check of the tube or transistor with a Mighty Mite tube tester or Cricket transistor tester will confirm whether it is the problem. If the horizontal output amplifier checks good, we need to test the yoke and flyback. The patented Ringing test, included in the VA48, allows us to locate a defective yoke or flyback by simply connecting two test leads and checking the coil as "good" or "bad" with 100 percent reliability.

This rapid method of troubleshooting horizontal sweep circuit isn't new. It has been used for many years in sweep circuit analyzers manufactured by Sencore and other companies. The VA48, however, is the only analyzer on the market that provides signals for tubes, transistors, and the new SCR circuits.

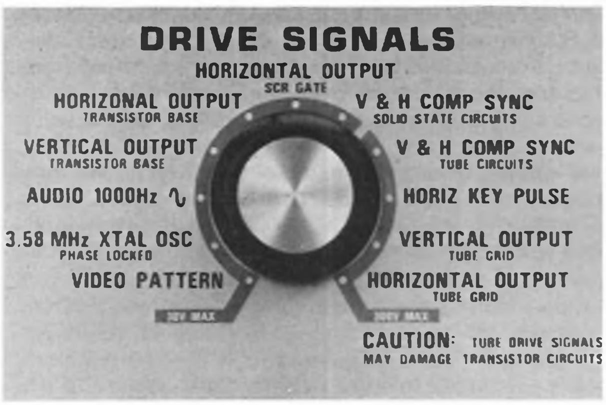


Fig. 3—The VA48 is the only TV analyzer that has a special drive signal for tube, transistor, or SCR horizontal output stages.

An SCR drive circuit operates differently than either a tube or transistor output stage. Can the VA48 help me with these new circuits?

The answer to this question is YES. Before we tell you how the VA48 will take care of these circuits, let's take a closer look at how the SCR horizontal output circuits operate so we can better understand what we need to service them.

First, we need to remember that the SCR drive circuits must do the same thing as a tube or transistor; provide a drive signal to move the electron beam across the CRT screen. In order to understand how the SCR circuit works, we need to know two things: 1.) How an SCR works, and 2.) What function each SCR serves in the operation of the sweep circuit as there are two SCRs used. First, let's review how an SCR works.

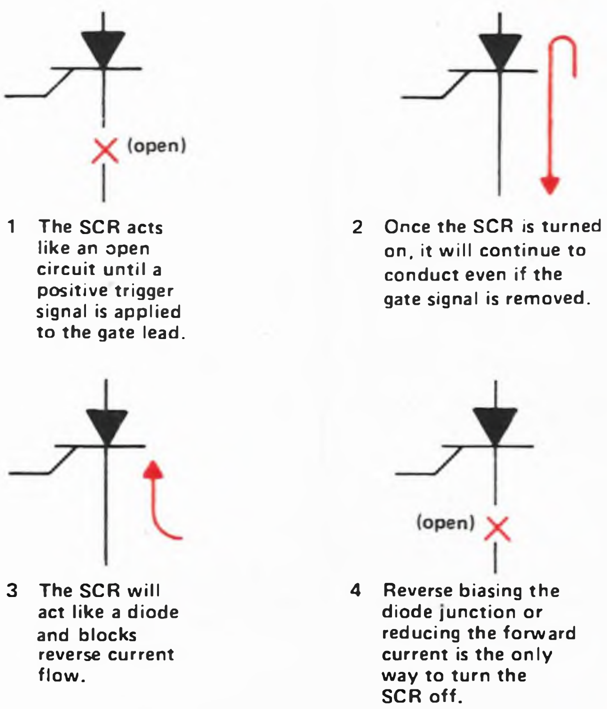


Fig. 4—The SCR acts like a solid-state relay.

An SCR is really just a diode that has a third control element called a "gate". You can think of an SCR as a solid-state relay that will latch, once a positive current is applied to the gate, and will continue to conduct as long as the anode/cathode junction is forward biased. This diode junction will continue to conduct until one of two things happens: 1.) The voltage across the diode drops to zero, or 2.) The diode is reverse-biased. If either of these conditions occur, the diode junction becomes an effective open circuit until the gate lead is again supplied with a positive bias current. This operation is similar to a tube that is biased into cutoff (class C bias) with one exception. The tube will turn itself off when the grid signal goes negative, while the SCR will remain in the "on" state until the diode junction is reverse-biased. This is why we need two SCRs in a horizontal drive circuit. The first SCR is turned on by the horizontal oscillator. This SCR, fed through a timing network, turns the second SCR on. The second SCR produces a signal that will turn the first SCR off, and finally the timing network causes the second SCR to turn off.

There are two important things we need to know about the gate of the SCR to keep from burning up the SCR. First, we need enough current to fire the SCR. But, once the SCR is fired, we need to remove the gate signal quickly to prevent excessive gate current and possible gate circuit burn-up. The VA48 TV Video Analyzer provides a specially shaped SCR drive signal that prevents this from happening. This signal provides sufficient driving current but is of a short duration to prevent damage to the gate circuit.

Let's move to an explanation of the SCR circuit for better understanding of how the SCR is utilized in the circuit. We have simplified the SCR sweep circuit for explanation purposes, but if you wish to get into detail, we have shown an actual schematic for you to study. Notice that two SCRs are used in these horizontal output stages; one is called a "trace" SCR (SCR_T) and the other a "retrace" SCR (SCR_R). Both SCRs have diodes in parallel with them that are connected in the opposite polarity to the SCR polarity. These diodes, in conjunction with the energy stored in the commutator coil (L_C), are critical to the operation of the sweep circuit and work in conjunction with the SCRs to give proper timing to the horizontal sweep.

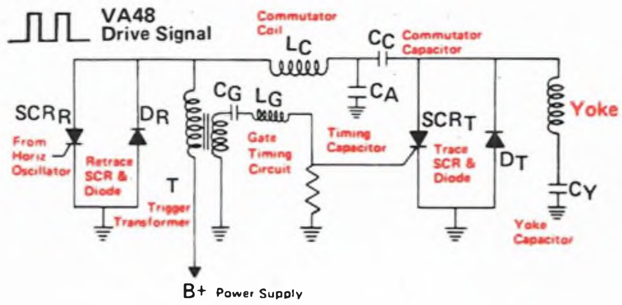


Fig. 6—Simplified SCR output schematic.

The horizontal SCR sweep circuit is made up of two tuned (resonant) circuits that operate at approximately 10 and 40 KHz. (This is no different than the tube or transistor sweep circuits.) The 10 KHz tuned circuit is made up of the trace SCR (SCR_T), trace diode (D_T), yoke, flyback, and the yoke capacitor (C_Y). This 10 KHz circuit is the one that gives us "trace" as it causes the CRT electron beam to scan across the CRT (from left to right) at the proper rate. The 40 KHz tuned circuit is made up of the retrace SCR (SCR_R), retrace diode (D_R), and a couple more special inductors and capacitors (L_C, C_C, and C_A). The main function of the 40 KHz circuit is to move the electron beam from the right side of the screen, all the way back to the left, for retrace.

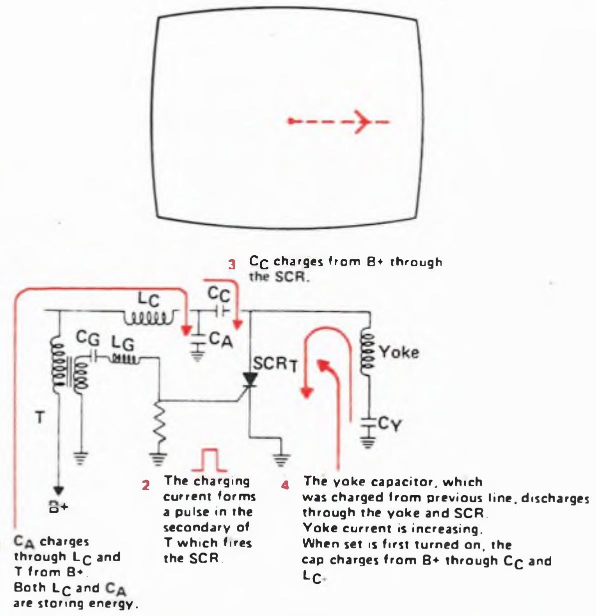


Fig. 7—Beginning of cycle and movement from center to right.

Let's begin our explanation with the CRT beam at rest in the middle of the screen when we first turn the set on. C_Y will charge from B+ through L_C and C_C. This capacitor will be charged from the rest of the circuits for all following lines. Current will flow through the transformer primary (T) and the commutator coil (L_C) as the capacitor (C_A) charges from B plus. The current in the transformer primary induces a positive polarity spike in the transformer secondary which is passed to the gate of the trace SCR (through C_G and L_G) which causes it to turn on. The trace SCR now acts like a closed switch and current flows through the SCR, the yoke, and its 10 KHz tuned circuit. The current flow through the yoke creates a magnetic field to begin to move the electron beam to the right of the screen.

As we near the right side of the screen, resonance is reached in the 10 KHz trace circuit. You should recall that when a coil reaches resonance, the *current change is minimum*. The voltage across the coil is determined by the amount of change in current through the coil (if we ignore the small amount of resistance) and drops to zero when the current change drops to zero. With zero voltage across the anode/cathode junction of the SCR, the SCR_T turns off.

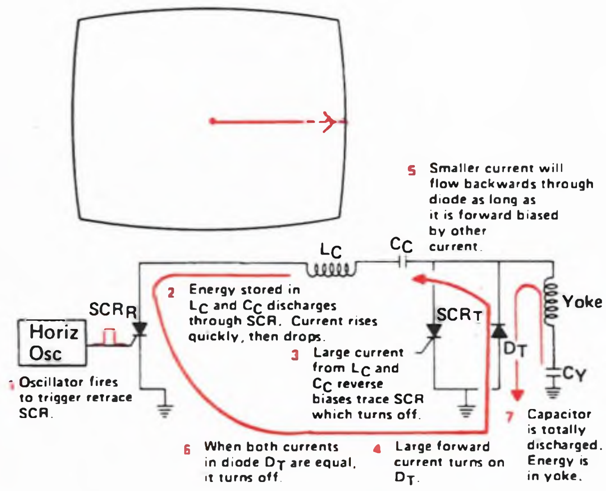


Fig. 8—End of trace & initiation of retrace.

As soon as current through the yoke reaches this maximum current condition, the field around it begins to collapse which induces a voltage of the opposite polarity. This reversed voltage provides a forward bias for the trace diode (D_T across the trace SCR) and the trace diode begins to conduct, providing a current path for our 10 KHz trace circuit and the electron beams continue to move to the right.

At approximately the same time that the trace SCR stopped conducting, a positive pulse, from our horizontal oscillator, is applied to the gate of the retrace SCR (SCR_R). This positive pulse turns the retrace SCR on and it begins to conduct. We now have two paths for current flow; a forward current through the trace diode, (D_T), yoke, and its capacitance (C_Y) forming our 10 KHz trace circuit, and a reverse current path through the retrace SCR (SCR_R), trace diode (D_T), and the added capacitance and inductance in the 40 KHz retrace SCR circuit. The reverse current rapidly builds a voltage of the opposite polarity across the trace diode. When the reverse voltage reaches the same level as that developed in the forward polarity across the yoke, the trace diode will no longer be forward biased and it will stop conducting. With the trace diode and trace SCR turned off, our

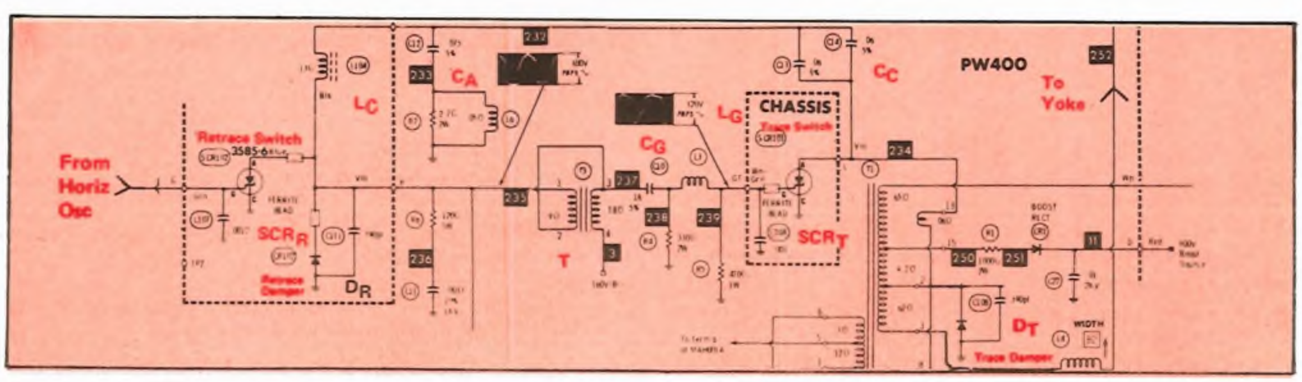


Fig. 5—Typical SCR output stage.

circuit now has only one path left for current flow. This path is through the retrace SCR and the added capacitance and inductance in its associated circuit which forms our 40 KHz retrace circuit.

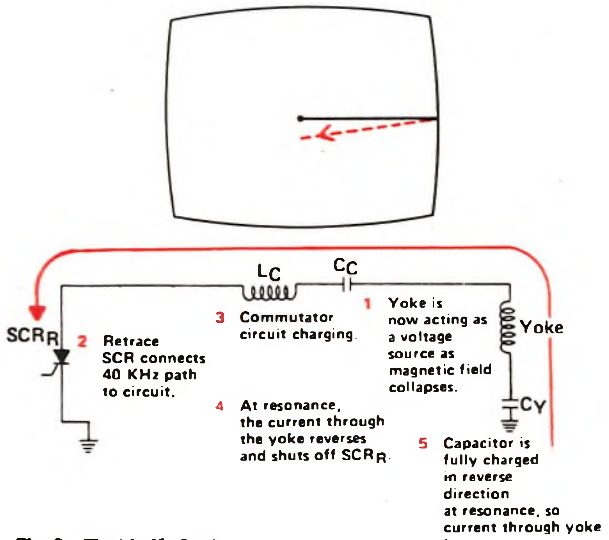


Fig. 9—First half of retrace.

The energy built up in the yoke is now discharging into the 40 KHz resonant circuit made up of the commutator coil (L_C) and capacitor (C_C),SCR$_R$ and yoke. This quickly returns our electron beam to the center of the screen where the 40 KHz circuit reaches resonance and the voltage reverses. At this point, the DC potential (on the anode of the retrace SCR) is low enough to stop conduction, and the retrace diode (D_R) begins to conduct until the beam reaches the maximum opposite potential and the beam is all the way to the left side of the screen. This builds up a negative potential across the deflection yoke.

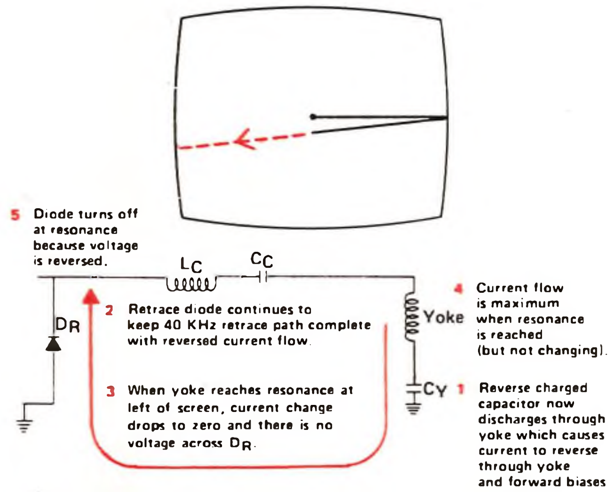


Fig. 10—Second half of retrace.

This high negative potential on the yoke forward biases the trace diode (D_T) and it begins to conduct, placing the 10 KHz trace circuit back into operation. The trace diode is now functioning exactly like a conventional damper diode. The magnetic field begins to collapse and our CRT beam moves from the left to the center of the screen at the same rate of travel it moved from the center to the right because they are both controlled by the 10 KHz circuit time constants. We now have one complete scan line across the face of the CRT.

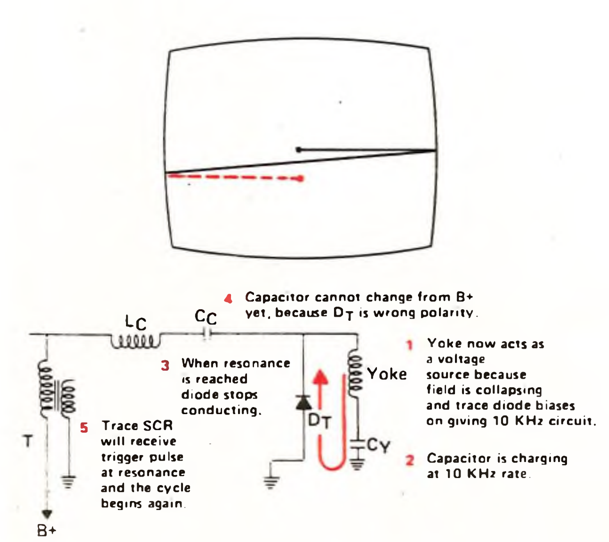


Fig. 11—Moving from left to center.

We started our beam from the center of the screen by turning on the TV which charged the capacitor (C_A) and turned on the trace SCR. We must turn on the trace SCR to have it start the second cycle of scan. This is accomplished by charging the capacitor (C_A) from B plus again because it had discharged through the retrace SCR during retrace. This fires the trace SCR to repeat the process for the next line. This action repeats itself over 15,000 times each second.

Now that we have followed the operation of the drive circuits through one complete horizontal line, what do I need to know to troubleshoot the circuits?

You should have noticed, as we followed the signals in our description, that there really was not much difference between the operation of the SCR system than a conventional tube or transistor drive circuit. The key difference is that the signal that controls the trace SCR comes from the other circuits and not from the horizontal oscillator as it does from tube and transistor horizontal output circuits. This is the reason that we should not attempt to drive the trace SCR directly with a substitute signal. Any attempt to substitute this gate signal will upset the resonance of this circuit and cause too much current to be drawn from the power supply. This will usually cause the circuit breaker in the set to trip. It is important to note the action of L_C and C_C and see why you cannot upset the resonance of this circuit while you are troubleshooting. L_C is called a commutator coil, and is used in SCR circuits only, and pretty much determines the entire timing of this circuit.

We mentioned earlier that the SCR Drive Signal provided by the VA48 has the proper current capabilities and the proper pulse duration to prevent the possibility of damaging the SCR gate. We should repeat that the VA48 is the only analyzer available that has this special driving pulse. This signal is designed to substitute for the horizontal oscillator output and is connected directly to the gate of the retrace SCR. Let's see how we use the SCR Drive Signal to locate problems in the output stage.

Loss of horizontal sweep could be caused by the lack of output from our horizontal oscillator, or a defect in the trace or retrace circuits. We need to be able to isolate the actual cause of our defect. The first step is to substitute for the horizontal oscillator output. First, we will select the Horizontal Output, SCR Gate position of the Drive Signals Switch on the VA48. We know that an SCR always requires a positive drive polarity, so the only other thing we need to know is the amplitude. The schematic will generally tell us this. If we do not have the proper waveform on the schematic, we should remember that underdriving the retrace SCR can be worse than overdriving, so we should start with the Drive Level control in the maximum positive position. Before we apply power to the receiver, we should make sure that we have connected the RF output of the VA48 to the antenna input as a synchronizing signal. This signal will give us our vertical synchronization and a video pattern to observe to make sure that we have proper operation when we are feeding in our substitute signal. We should not make our connection to the retrace SCR until after we have powered up the set. This will prevent the possibility of damaging the SCR with a gate signal and no other bias on the SCR. Now, we simply substitute the signal and see if our horizontal sweep and high voltage returns. If we get proper operation, we know that the defect is in

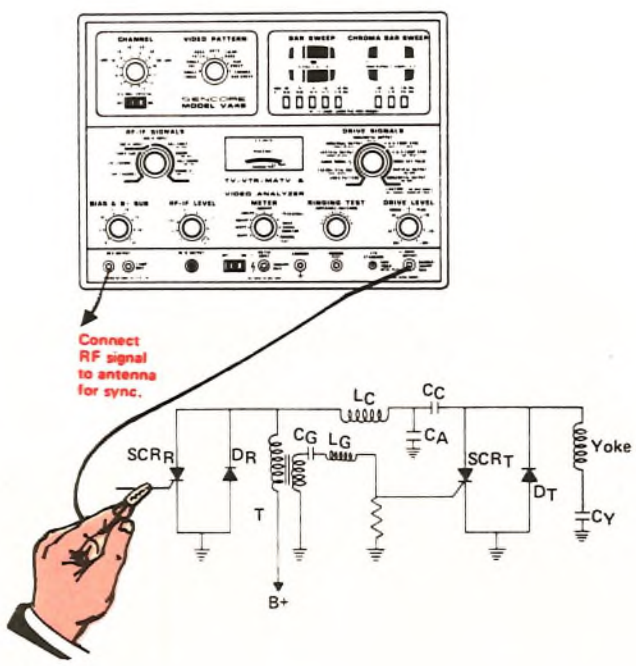


Fig. 12—The SCR drive signal should be connected only to the retrace SCR to substitute for the horizontal oscillator. The VA48 meter will drop if the SCR gate is shorted.

the oscillator circuits of the horizontal output because we have substituted a "known good" drive signal from the VA48.

The Drive Signal Monitor meter, built into the VA48, enables us to determine if the retrace SCR gate is shorted. If the SCR gate is shorted, the signal level of the meter will drop appreciably when we connected to the retrace SCR gate because we are loading the VA48 output with a shorted SCR. If our operation does not return to normal with the substitute signal applied, and the meter does not show a loading effect, we have determined that we do not have a defective horizontal oscillator nor shorted retrace SCR gate.

Sometimes we cannot check the horizontal oscillator drive circuit because the fast-acting horizontal output circuit breaker continues to trip. This is not all bad, however, because the circuit breaker of the receiver under test can give us a good clue as to where our defect is located. When the horizontal drive signal is removed from the gate of the retrace SCR, we should be pulling no current at all through either SCR. Therefore, the first step (if our circuit breaker continues to trip) is to disable the signal coming from our horizontal oscillator, if we have determined that the horizontal oscillator is good. If in doubt, use the VA48 SCR signal that you know is good, and it can simply be turned down for this test. The horizontal oscillator is easily disabled in modular TV sets by simply pulling the horizontal oscillator module from the chassis. If we do not have a modular set, we simply open the gate lead of the retrace SCR. If the circuit breaker continues to trip, with no signal applied to the retrace SCR, we should suspect a defect in the retrace circuits. The retrace SCR or diode are most likely shorted. This can be quickly determined with an ohmmeter check across the suspected bad components.

If removing the drive signal from the retrace SCR has stopped the circuit breaker from opening, we know that the retrace SCR is good because it acts as an open circuit when there is no signal applied to its gate but draws current when we have a signal applied.

Let's go a step farther and see how to determine if the trace SCR is good. At this point we should still have the drive signal disconnected from the retrace SCR gate lead. The circuit breaker, in our example, does not trip when we apply power to the set.

To check the trace SCR, we must now reconnect our horizontal oscillator or apply our SCR drive signal from the VA48 to the gate of the retrace SCR. We must once again observe the operation of the circuit breaker. If the breaker trips, we know that we have an open circuit in our 10 KHz trace circuit. The reason that we know that the trace circuit is open is because the trace SCR, and its associated components, are necessary to turn the retrace SCR off at the proper time. If the trace circuits are open, there is no "turn off" pulse, so the retrace SCR will continue to conduct (as long as B+ is applied) after a trigger signal has been applied to the gate lead. This condition will load the B+ line, which will cause the circuit breaker to open. The open circuit could be the SCR itself, but could be one of the components in the associated circuit. We explain how to check all of these components later in this article.

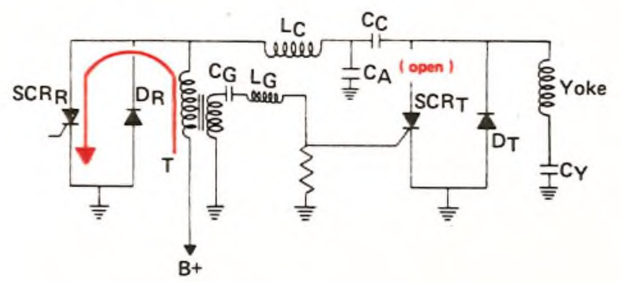


Fig. 13—An open trace SCR will cause the circuit breaker to trip because there is no signal to turn the retrace SCR off and it will load the power supply.

What if the trace SCR was shorted? We would find that driving the retrace SCR with our VA48 would not return operation to our horizontal sweep circuit, but we would also find that the circuit breaker does not trip. The reason is that even though the trace SCR is shorted, we still get enough reverse E. M. F. from our commutator circuit made up of L_C and C_C to turn the retrace SCR off each cycle. As long as the retrace SCR is turned off during each cycle, we will not draw enough extra current to trip the circuit breaker. There is no sweep, of course, because the shorted trace SCR is shorting the yoke.

Let's talk about checking the SCRs with the VA48. The Bias and B+ Sub power supply built into the VA48 provides us with a voltage source that we can use to test either SCR. We only need to remember that an SCR will act like an open circuit until we apply a positive signal to the gate lead. Once the SCR fires, it should continue to conduct until we remove the B plus power to the SCR. With this background information, we can reliably test the questionable SCR by simply placing a 100 Ohm (½ Watt) resistor in series with the SCR and the VA48 "Bias and B+ Sub" power supply.

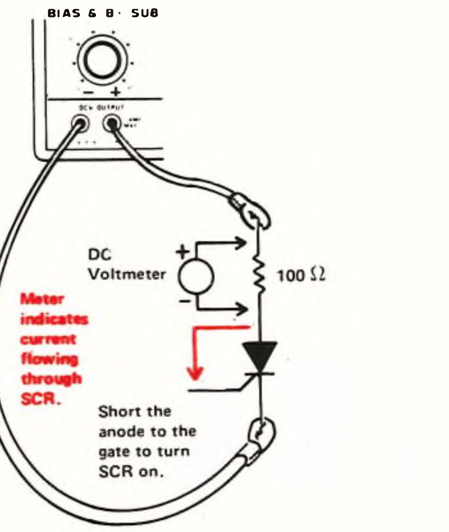


Fig. 14—The VA48 Bias and B+ Sub supply provides a convenient method to test suspected bad SCRs.

We will begin by connecting the negative lead of our power supply to the cathode of the SCR. The cathode is usually circuit ground. Next, set the voltage of the VA48 power supply to 20 to 30 Volts to be sure we have enough voltage to fire our SCR. We then place the 100 Ohm resistor in series with the positive test lead of the VA48 supply and connect the other end of the 100 Ohm resistor to the anode of the SCR. Now, connect a voltmeter across the 100 Ohm resistor. The resistor now limits the current to prevent the possibility of damaging the SCR and also acts as a current shunt so that our meter effectively reads the current through the SCR itself. At this point, our meter should show a very low reading indicating that there is little or no current passing through the resistor and SCR because the gate is not connected to anything and the SCR is "wide open". Now, momentarily short the anode to the gate of the SCR. The meter should show a greatly increased voltage reading across the 100 Ohm resistor, indicating that the SCR is turned on. If we do not get an increased reading, we know that the SCR is open. Next, remove the short between the anode and the gate to see that the meter continues to read the higher voltage. This tells us that the SCR has properly latched. One final test is to momentarily open the positive lead of the power supply and then reconnect it. The meter should drop to almost zero to indicate that the SCR has turned itself off. We have now tested the SCR for opens, shorts, triggering capability and latching action.

If we have not located our trouble, the flyback transformer or yoke are real suspects. The Ringing test, built into the VA48, tests these SCR drive system coils with the same, reliable, good/bad test that is used with a tube or transistorized set. Simply connect the Ringing test leads across the coil to be tested (after removing power to the set), switch the meter switch to the "Ringing Test" position, and rotate the "Impedance Matching" switch for the highest meter reading. If the coil is good, it will always show a reading of at least 10 ringing cycles. If it is bad, it will show less than 10 rings or no reading at all.

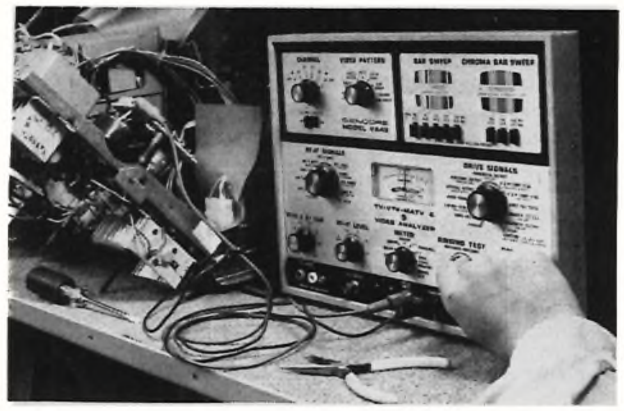
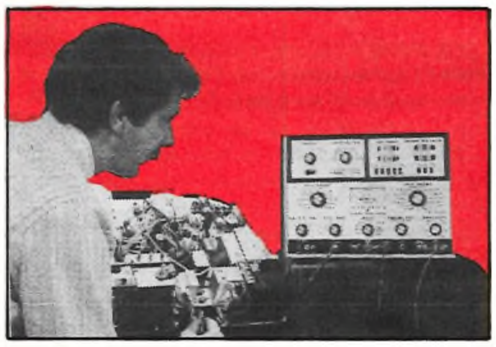


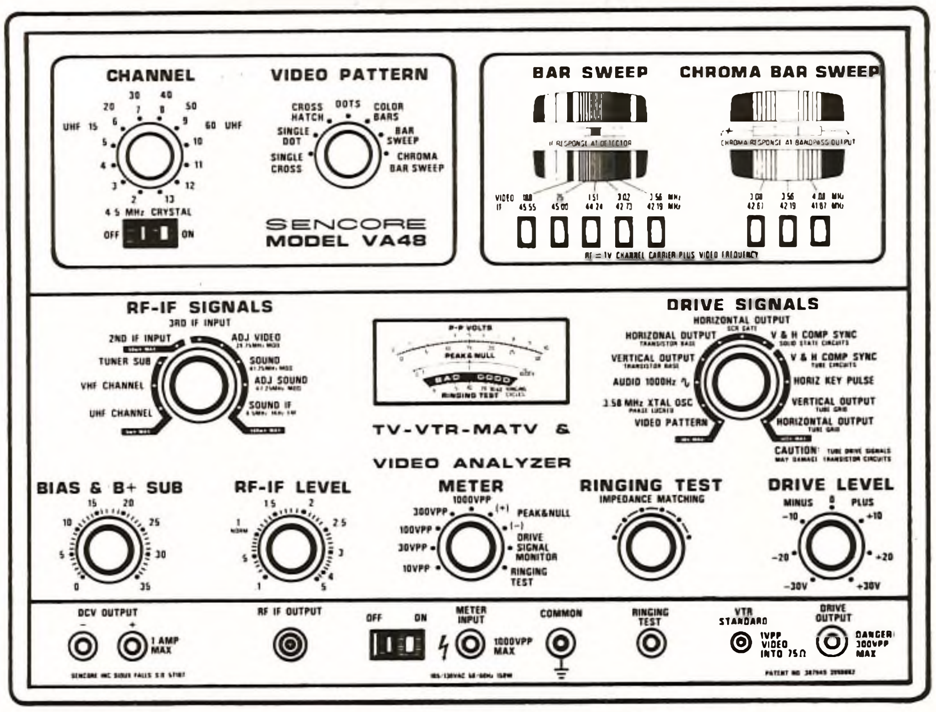
Fig. 15—The quality of a yoke or flyback is read as "good" or "bad" on the VA48 meter to confirm that they are not loading our circuits.

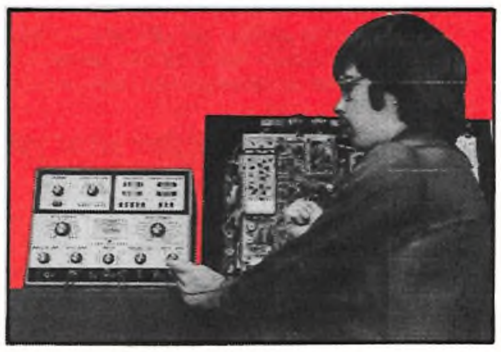
We hope that we have shown you some shortcuts to servicing SCR drive systems with your VA48. The VA48 is the only video analyzer on the market that lets you troubleshoot ANY circuit in a TV receiver with direct signal substitution. More importantly, all of the substitute signals are phase-locked back to the signal that is applied to the antenna terminals for circuit synchronization. This means that all patterns will pop on the CRT in sync so that you know in an instant that you have located your defect.

Most importantly, be sure to contact your nearest Sencore distributor and arrange a demonstration of a VA48 in your shop so that you can check each of the points we covered in this article. Once you have tried the VA48, we're sure that you will see just how quickly it will pay for itself with both faster and higher quality service.

40 Things you can do with the VA48 that you can't do with any other analyzer







Introduction

Since its introduction just two years ago, the VA48 has found very wide acceptance from the manufacturers of TV, Video Tape players, MATV and CATV systems, as well as the service industry. Many thousands of VA48s are in daily use across the country saving many hours of valuable time. If you are one of the many owners of a VA48, there may be some points in this article that you have not considered that may save you even more time. If you do not own a VA48, then by all means be sure you read this article and we are sure that you will agree, it's time you, too, owned a VA48 and cashed in on the time-saving features.

1. The only analyzer that allows you to check a set's performance on all channels, VHF and UHF

With the VA48, you can check every set before it's returned to the customer on both VHF and UHF channels and know how the set will operate. Only the VA48 gives you all 12 VHF channels and 6 UHF channels, two of which can be set to the channels (14 through 83) used in your area. Then all you do is connect the cable to the antenna terminals, set the RF-IF LEVEL control to NORM and check that each channel gives a stable, snow-free picture.

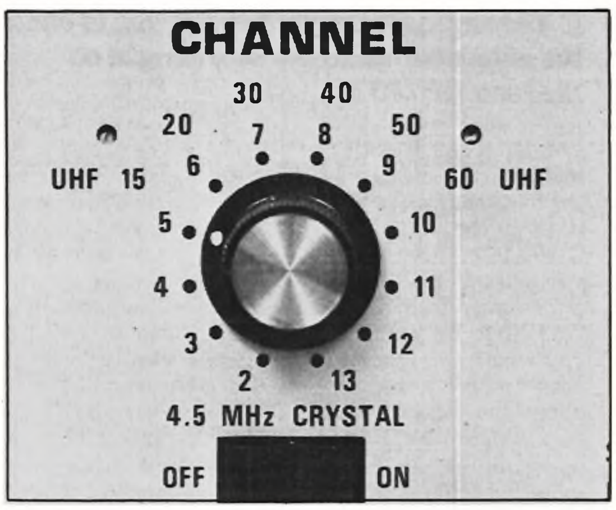


Fig. 1—The VA48 gives you all channel output on VHF and UHF with a 4.5 MHz crystal for accurate fine tuning.

2. The only analyzer that gives you calibrated RF output for testing the sensitivity of the receiver

The VA48 lets you test the set under "fringe" or "rabbit ear" conditions and check for color dropout on weak signals. Just rotate the RF-IF LEVEL control slowly counterclockwise and watch the screen. If the color stays in sync to the end of the control rotation, you know it will perform properly in the weakest signal areas. If not, simply touch up the IF or Chroma alignment with the VA48.

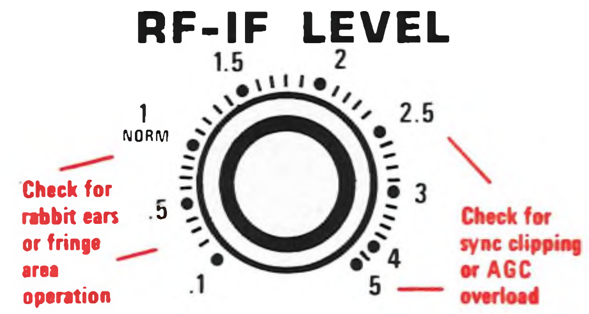


Fig. 2—The calibrated output from the RF-IF LEVEL control lets you check receiver sensitivity for fringe or strong signal areas fast and easy.

3. The only analyzer that lets you make a dynamic check of the receiver AGC operation

The VA48 lets you make a truly dynamic check of the AGC operation of the receiver right on the screen and without removing the back of the set. Simply connect the VA48 to the antenna terminals, set the RF-IF LEVEL control to NORM and adjust the TV for a good picture. Turn the RF-IF LEVEL control counter-clockwise while observing the screen for snow in the picture. Then rotate the control clockwise while observing the screen for overload. This allows you to check the receiver from only 100 microvolts to 5000 microvolts for proper AGC operation. If the receiver overloads, as indicated by tearing of the picture, the AGC circuits should be adjusted until the receiver gives a good picture over the full rotation of the RF-IF LEVEL control. That's all there is to it.

4. The only analyzer that lets you completely check out MATV or CATV systems

The VA48 provides you with both 75 Ohm and 300 Ohm outputs for matching the MATV and CATV systems without standing waves. The patented Bar Sweep patterns lets you check frequency response of splitters and amplifiers from the head end right down to the last tap off. The calibrated RF output gives you a dynamic check of the system gain and signal level required at the amplifier input for a good snow-free picture. When servicing MATV or CATV systems, feed the VA48 into an unused channel. This allows you to check out the system or individual TV sets without disrupting the other channels or TV receivers.

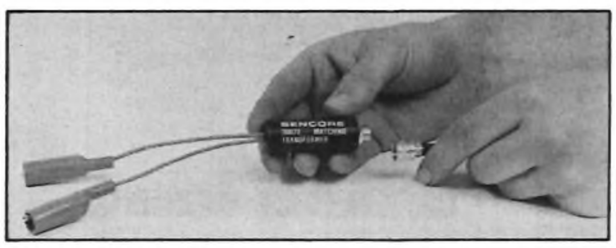


Fig. 3—The VA48 provides you with both 300 Ohm through a special matching transformer and a 75 Ohm output with a standard "F" type fitting that matches right into standard distribution systems.

5. The only analyzer that gives you a built-in tuner sub

You can substitute for any tuner with the VA48, tube or solid state, and localize your problem to the tuner or the IF stages. You simply inject directly into the IF, bypassing the tuner, with a calibrated signal. Check the operation of the set right on the CRT screen, eliminating all guesswork. You can use the VA48 right in the home to check the set and know just where the trouble lies before you take it to the shop. You can also check out each and every channel on the tuner to determine if all channels are bad or just certain channels. The VA48 will let you know for sure, VHF or UHF.

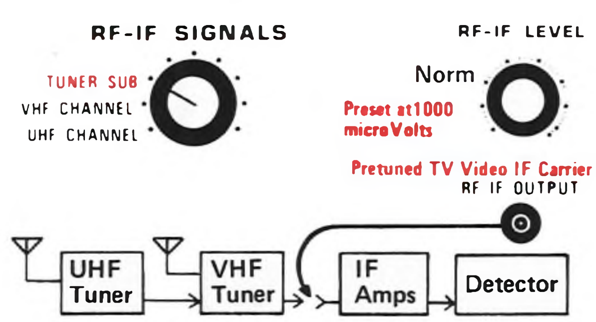


Fig. 4—The microVolt controlled tuner sub signal of the VA48 lets you quickly isolate defective tuners.

6. The only analyzer that lets you locate a defective IF stage

The VA48 has three calibrated IF outputs that allow you to inject directly into the input of the 1st, 2nd, or 3rd IF stages. Each output is calibrated for the 10 times gain normally found in each IF amplifier stage. Just set the RF-IF SIGNALS switch to the appropriate IF position, connect the output cable from the VA48 to the desired input and observe the CRT screen for a video pattern. Starting at the 3rd IF amplifier and working your way back to the 1st IF, you can locate a loss of signal or a stage with poor gain by simply watching for the loss of picture or a weak picture on the screen. The signal levels of the VA48 are designed to provide a 1 Volt peak-to-peak signal on an oscilloscope connected to the video detector to test for proper IF gain in every stage.

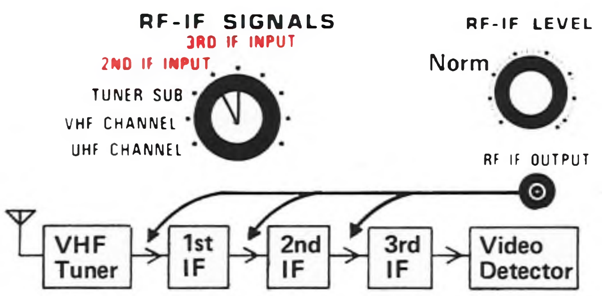


Fig. 5—RF-IF LEVEL automatically presets IF output level to detect low gain in any IF stage.

7. The VA48 is the only analyzer that lets you align the IF stages while troubleshooting

Alignment is really a form of troubleshooting. If, for example, you find a stage that will not align properly, you know that you have a defect in a tuning component like a capacitor or coil. The patented Bar Sweep pattern provides a reference signal to use to test the frequency response of each individual IF stage as you inject the signal stage by stage. A quick touch-up of the IF bandpass coils or traps in the stage into which you are injecting will confirm that the entire stage is working properly before you move your signal injection cable back to the previous stage. This troubleshooting procedure makes your IF servicing even more efficient as you can often isolate an IF defect to a single component with simple signal injection.

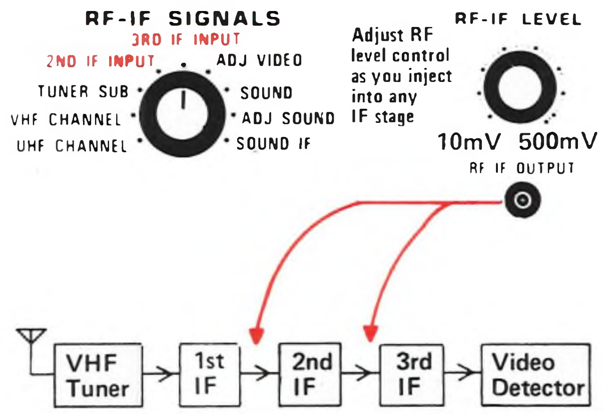


Fig. 6—The VA48 calibrated IF output signals allow you to inject into individual stages for troubleshooting and stage by stage alignment.

IF ALIGNMENT

8. The only analyzer that allows you to check the alignment without a scope, right on the receiver CRT screen

The patented Bar Sweep pattern gives you the key testing frequencies that you need to be able to check the frequency response of the video IF amplifier stages right on the screen. You get the low (188 KHz) to high (3.56 MHz) video frequencies in the bar pattern so that you can tell how the receiver will respond to the video information from a station signal. Each bar (except the 3.56 MHz bar) should show equal intensity without any ringing or ghosting. When the receiver's brightness control is reduced, all the bars should fade at about the same time. The 3.56 MHz bar should fade just before the 3.02 MHz bar to indicate proper operation at the 3.58 MHz color trap in the video amplifier. You don't even have to connect a scope or remove the back of the set to check out the system. Only the VA48 gives you this big plus for your shop.

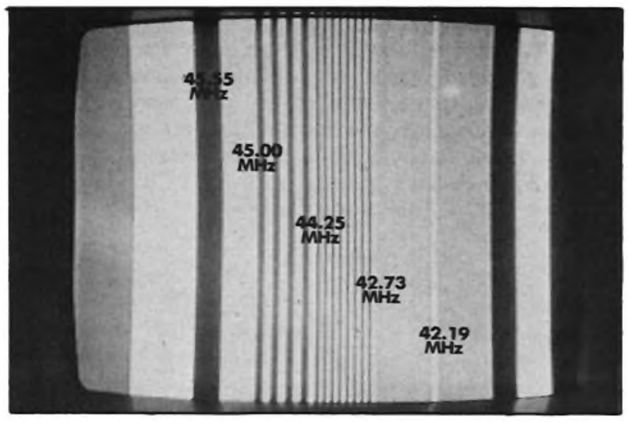


Fig. 7—The VA48 provides you with all the frequencies necessary to check the alignment of the receiver right on the screen. Note the bars and their frequencies cover the critical points in the response of the video system so you can see the response and determine if alignment is good or a touch up is needed without taking the back off the set.

9. The only analyzer that allows you to align the IF without clamping the AGC

The VA48 gives you station like signals with the proper horizontal sync pulses. This means that the AGC circuits will operate just like it was receiving an "air" signal and do not have to be clamped during alignment. You just simply align the IF for the proper Bar Sweep pattern on a scope connected to the video detector output. A sweep and marker generator must have the AGC clamped with a bias supply because it provides no sync pulses for proper AGC action. This condition is totally unnatural to the AGC circuits. The time constants of the AGC circuit will try to follow the 60 Hertz sweep signal and cause the alignment to be distorted. You have no distortion with the VA48 as the AGC operates in a normal, dynamic fashion for a true test of the IF response.

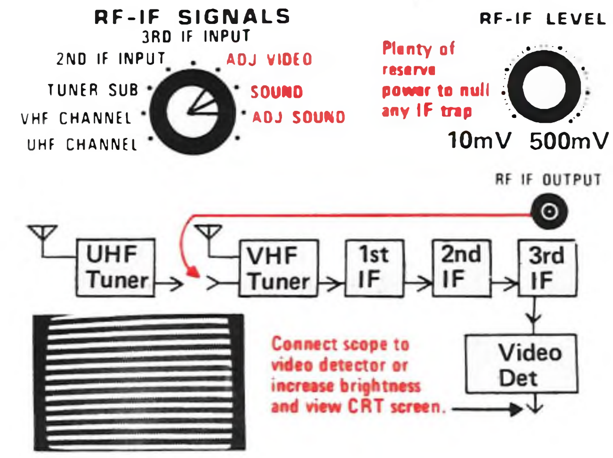


Fig. 8—All crystal-controlled, AM-modulated trap signals produce a pattern right on the CRT to allow rapid testing of trap settings.

10. The only analyzer that allows you to set the IF traps with crystal accuracy without removing the chassis

The special modulated trap signals from the VA48 lets you properly set the IF traps faster and easier, right on the receiver screen. Simply set the RF-IF SIGNALS switch to the desired trap frequency. The modulation will appear on the screen as black bars. You then simply adjust the trap until the bars are as weak as possible. You can now set the traps in just seconds rather than the minutes it used to take with a sweep and marker generator, and you don't even have to hook up a scope or clamp the AGC.

11. The only analyzer that lets you align and troubleshoot the new synchronous video detector system

The synchronous detector must have a continuous carrier, like that from an "air" signal, to operate

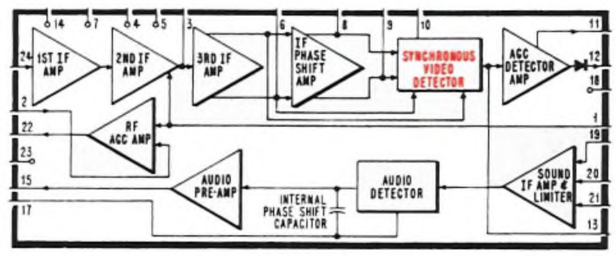


Fig. 9—The synchronous detector is fast becoming popular with more and more TV manufacturers and the VA48 is the only analyzer that lets you check out and align this new detector system with accuracy.

properly. Only the VA48 Bar Sweep provides this type of signal so that you can both align and troubleshoot the synchronous detector just like the standard diode video detector. A sweep generator does not have a continuous carrier and cannot be used to completely align this type of detector. The operation of the synchronous detector and how to align it are covered in details in a separate article in this issue of the *Sencore News*.

12. The only analyzer that gives you a peak and null meter for alignment and troubleshooting

The built-in peak and null meter on the VA48 gives you a handy tool for setting up the AFC/AFT circuits of a TV right on the button with crystal-controlled accuracy of the VA48 IF generator. You can also use the meter for setting those traps that are really deep and may be hard to see on the screen or on the scope. The handy peak and null meter can also be used in some sets for the audio detector adjustment where a meter is normally required.

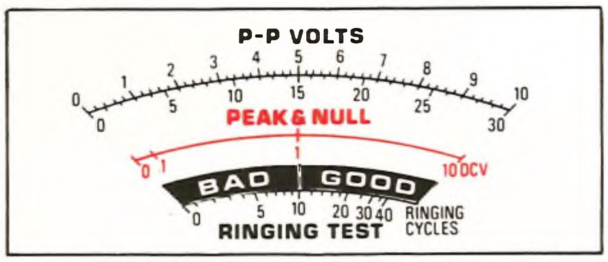


Fig. 10—The Peak & Null meter on the VA48 gives you a handy tool for setting those really deep traps or aligning AFC/AFT systems.

13. The only analyzer you can use to check video amplifier response in TV, CATV, closed circuit TV, and VCR systems

The patented Bar Sweep pattern of the VA48 allows you to check the frequency response of a video amplifier fast and easy, right on the CRT screen. The square wave bars will show up ringing, smearing and video frequency rolloff. Just look at the bars on the screen of a receiver or at the video amplifier output with a scope. Ringing will show up as ghosts after the bars on the screen or as overshoot on the scope waveform. Frequency rolloff will show up as a reduction of the amplitude of the higher frequency bars on the scope and dimmer or faded bars on the receiver screen.

You can set the 3.58 MHz traps, found in some receivers, quickly and accurately using the VA48. Just switch to Chroma Bar Sweep, connect the scope to the output of the video amp, and adjust the trap for minimum amplitude of the center bar.

You can also determine if the receiver needs alignment or has a video problem with the Bar Sweep pattern. If the set shows ringing or frequency rolloff as described above, use the DRIVE signal output to inject into the video amplifier directly. If the screen still shows the same problem, you know the problem is in the video amp. If the problem disappears, the problem is in the IF amplifiers.

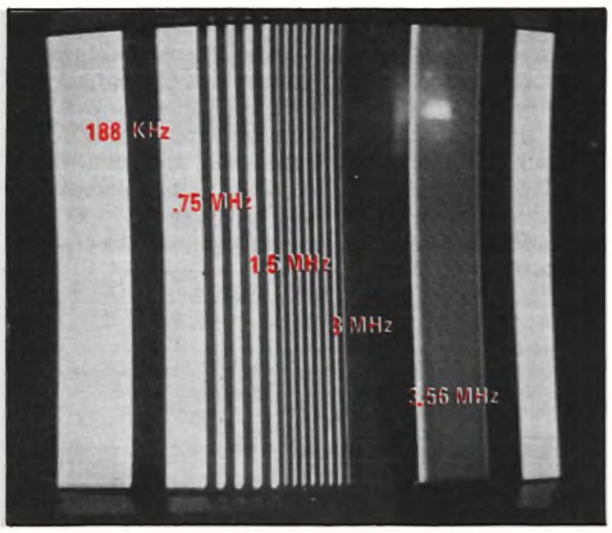


Fig. 11—Lower the brightness control until the first bar disappears to determine the relative brightness of each bar. Notice that the 3 MHz bar has disappeared before the 1.5 or 3.56 MHz bar indicating an improperly aligned IF.

COLOR ALIGNMENT & TROUBLESHOOTING

14. For the first time you can substitute for the 3.58 MHz oscillator with any real meaning and keep the colors in sync on the screen

Only the VA48 gives you phase-locked signals that allow you to inject a 3.58 MHz substitute signal directly at the color oscillator output or into the color oscillator and keep the colors in sync. The 3.58 MHz substitute signal from the VA48 is phase-locked to the horizontal and vertical sync pulses. This means that when you inject the 3.58 MHz signal into the color oscillator, the keying pulse is in sync and the colors will lock on the screen just like an "air" signal to locate color problems faster and easier than ever before.

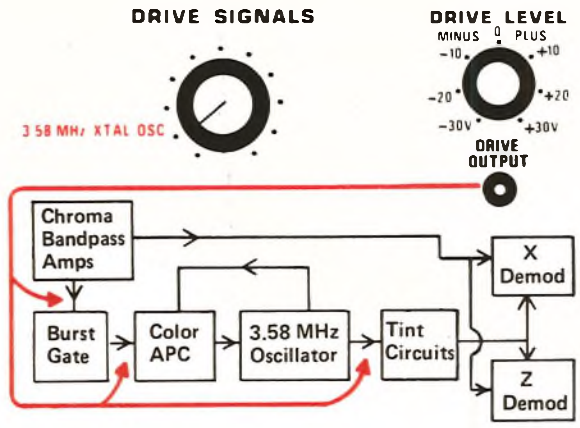


Fig. 12—The phase-locked crystal-controlled 3.58 MHz signal is used to substitute for any color subcarrier signal to simplify color servicing.

15. The VA48 is the only analyzer that lets you inject a chroma signal before the demodulators and keep the colors in sync

You can inject a signal from the chroma takeoff to the color demodulators with the VA48 phase-locked signals and keep the colors in sync on the screen. This lets you troubleshoot from the chroma takeoff to the input of the color demodulators for color problems in the chroma bandpass amplifiers. You can isolate loss of color quickly by just injecting the signal from the input of the demodulators and working back to the chroma takeoff point. The defective stage lies between the injection point that gave locked-in colors and the one that does not. You now have only one stage to troubleshoot for added efficiency.

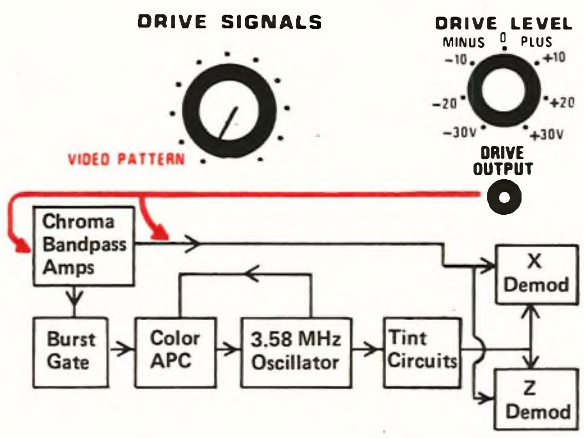


Fig. 13—The VA48 phase-locked signals allow to inject into the color circuits from the chroma takeoff to the demodulators.

16. The only analyzer that allows you to inject a chroma signal after the demodulators with real meaning

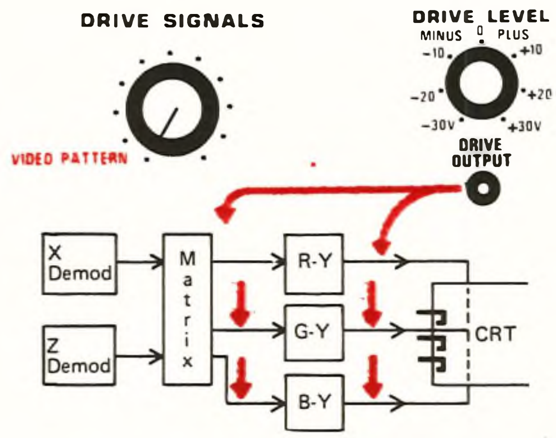


Fig. 14—With the VA48 you can inject phase-locked color signals all the way to the CRT.

The VA48 lets you inject a color signal in stages after the color demodulators right up to the CRT in most solid-state sets with meaningful results. When the chroma signal is injected into the input of the R-Y amplifier, for example, the screen of the receiver will turn red if the amplifier is good. You can check out all the amplifiers in a tube or solid-state set and even drive the CRT for a dynamic check of defects in the color circuits.

17. The VA48 is the only TV analyzer that allows you to align the chroma bandpass right on the screen

The patented Chroma Bar Sweep is just about like the regular Bar Sweep pattern. It allows you to see the response of the chroma circuits and lets you align the bandpass amplifiers by simply watching the screen. All you do is adjust the bandpass amplifier coils for equal color intensity of the bars on the screen. The center bar is 3.56 MHz, and the bars on either side represent the 500 KHz band limits of the chroma bandpass amplifier system. When all three bars are equal in intensity on the screen, your bandpass is right on. It couldn't be any simpler. There are no bias points to tie down or scope to hook up. You don't even have to pull the chassis.

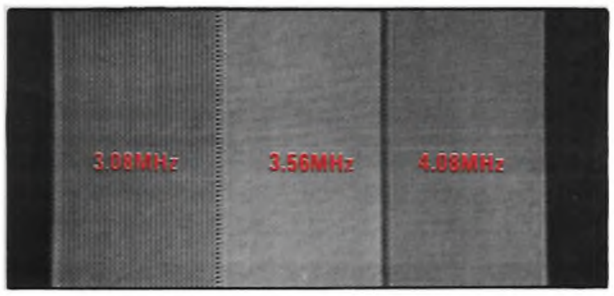


Fig. 15—Chroma Bar Sweep should produce three bars on the CRT screen—the center bar should be bright blue.

18. For the first time you can set the color oscillator right on the screen without hunting down test points and grounding them out

The patented Bar Sweep pattern allows you to set the color automatic phase correction circuit (APC) without even needing to find special test points. Simply inject the Bar Sweep pattern into the set, turn the color killer off, and observe the 3.56 MHz bar in the pattern. If the color in the bar is barber poling, adjust the APC coil or capacitor until the bar locks in as a solid color. You have now set the color APC dynamically right on the screen faster and easier than ever before.

Fig. 16—You can readily set the APC by observing the barber poling of the color in the 3.56 MHz bar. Just set the APC until the bar locks in only one color.

19. The only analyzer that allows you to check and adjust the color killer dynamically, right on the screen, faster, easier, and more accurately

You can quickly determine if the color killer is working properly and if adjustment is needed when you inject the Bar Sweep pattern into the receiver. Just observe the 3.56 MHz bar in the pattern on the screen. If it shows any color, the color killer needs adjustment. Rotate the color killer control until the color in the bar just disappears. You have set the control dynamically on a station-like signal for a more accurate setting than can be obtained with a volt meter or color bar generator. A problem in the color killer is indicated if the color cannot be killed in the 3.56 MHz bar.

20. The only analyzer that allows you to dynamically set the CRT screen and drive controls without using the set-up switch

The patented Bar Sweep pattern gives you the three necessary levels, black, grey, and white, for setting the screen and drive controls on a TV receiver. Just turn off the other bars and observe the screen. Adjust the CRT screen controls for the best white bar without blooming. Then adjust the drive controls for no color in the grey or white bars as the receiver brightness control is rotated from maximum to minimum. You have now set the screen and drive controls dynamically (with a signal just like the TV station signal the receiver will be reproducing) on the screen to give your customer the best possible color or black and white picture.

Fig. 17—You can set the screen and drive controls dynamically with the grey scale portion of the Bar Sweep pattern.

21. The only analyzer that has phase-locked color bars to allow you to check the new high resolutions TVs and VCRs with comb filters

The VA48 gives you the properly phase-locked signals necessary for checking and adjusting comb filters in VCRs, projection TVs and some top-of-the-line models. The color bars must be phase-locked to the sync signals in order for these circuits to operate properly. If the signals are not phase-locked, the color information may cancel and result in no output. Only the VA48 gives you the phase-locked color bar signals that you will need for these special high-performance circuits.

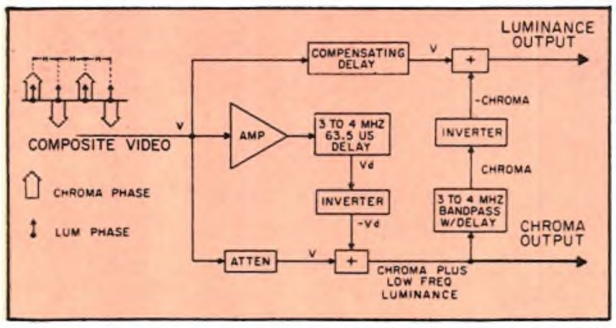


Fig. 18—Only with the phase-locked color bars from the VA48 can you check the new comb filters such as this one from the Magnavox T815 chassis.

VERTICAL & HORIZONTAL TROUBLESHOOTING

22. The only analyzer that lets you check yokes and flybacks, tube or solid-state, in or out of circuit

The patented Sencore ringing test lets you pick out troublesome yokes or flybacks, even while still in-circuit, fast and accurately. Just connect the test leads from the ringing test jack, rotate the RINGING TEST IMPEDANCE MATCHING switch and watch the meter for a reading of 10 or more rings which indicates a good coil. The ringing test quickly isolates the problem to the yoke or flyback or the circuit loading the flyback to make your servicing easier and faster.

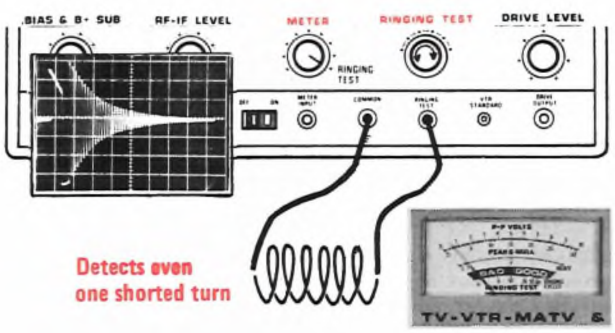


Fig. 19—The VA48 Ringing Test checks the entire yoke or flyback or individual sections with a 100% reliable dynamic test. Meter shows number of rings before decay to the 25% level. Ten or more rings indicate a good coil.

23. The only analyzer that gives you all the signals to service tube, transistor, or SCR horizontal drive systems

The VA48 gives you a 0 to 30 Volt peak-to-peak horizontal square wave for transistor bases, a 0 to 30 Volt peak-to-peak pulse for SCR gate drive and a 0 to 300 Volt peak-to-peak horizontal grid drive for tube sets. Only the VA48 gives you all three with adjustable levels that can be monitored right on the built-in meter. The VA48 lets you substitute the drive signals in transistor, SCR, and even tube type receivers with phase-locked accuracy. Details about these applications are found in a separate article in this issue of the *Sencore News*.

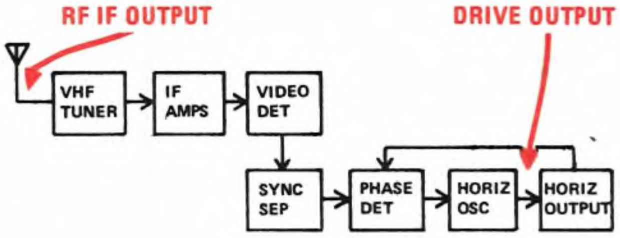


Fig. 20—The VA48 provides universal horizontal output drives to substitute for tube, transistor, and SCR outputs. It's the only one on the market that does.

24. The only analyzer that provides you with an adjustable horizontal keying pulse to substitute in tube or solid-state

Only the Sencore VA48 gives you a horizontal keying pulse that is adjustable both positive and negative polarity from 0 to 300 Volts peak-to-peak. Other analyzers only give you a fixed 300 Volt positive pulse that can't be used in solid-state. You can inject into the horizontal APC in either tube or solid-state receivers for horizontal lock problems. You can inject into the burst gate in tube or solid-state for color problems and keep the colors in sync on the screen. You can also inject into AGC systems, tube or solid-state with the phase-locked keying pulse for proper circuit operation.

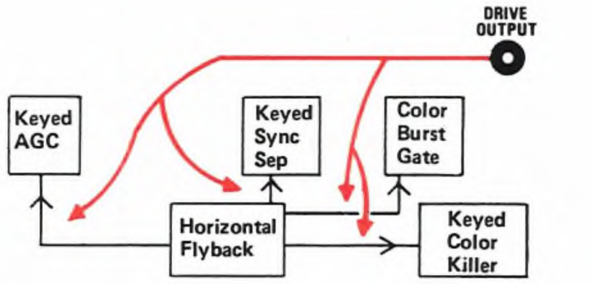


Fig. 21—With the horizontal keying pulse from the VA48 drive signals you can substitute for the different keying signals supplied by the flyback transformer in tube or solid-state circuits.

25. The only analyzer that gives you separate and adjustable vertical drive signals for tube and solid-state

The VA48 gives you true vertical ramp signals for injection into tube or solid-state circuits. You can inject from the oscillator to the output for a positive indication of the operation of the vertical circuits. Many analyzers provide only a 60 Hertz sine wave from the AC line which is not phase-locked to the vertical sync information of the video signal. The results are a distorted, out-of-sync raster at best. Only with the VA48 can you get a locked in raster with linearity that is close to correct for that positive check of the circuits that you need.

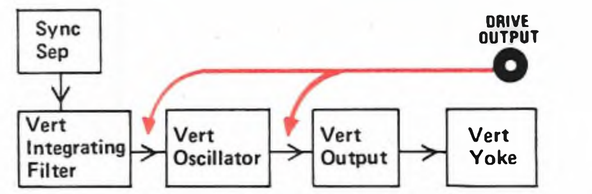


Fig. 22—Two drive signals are available for pinpointing vertical problems. The signal level is automatically switched from 30 to 300V P-P (max) by the Drive Signal switch.

VIDEO CASSETTE TAPE RECORDERS

26. The only analyzer that provides you with a standard VTR test signal

The Sencore VA48 is the only analyzer designed for TV service that also provides the standard 1 Volt peak-to-peak signal (across 75 Ohms) that is needed in the servicing and checking of VCRs. The VTR STANDARD jack (right on the VA48 front panel) provides the patterns selected with the VIDEO PATTERN switch for injection into the VIDEO IN jack found on many VCRs. This allows you to record your own test tapes, check out the frequency response, and may other function tests of the VCR.

Fig. 23—Only the VA48 gives you this special 1 Volt peak-to-peak signal for use in VCR servicing.

27. The only analyzer that allows you to check the frequency response on record and playback function of the VCR

The patented Bar Sweep pattern allows you to actually see the frequency response of the VCR on the screen of a TV or on a scope if you prefer. You can record your own test tape to check out the VCR playback circuits using the Bar Sweep pattern and then observe the TV screen for the intensity of the individual frequency bars, or any ringing or smear.

28. The VA48 is the only VCR analyzer that lets you service or align the tuner and IF stages, too

The patented Bar Sweep signal and crystal-controlled IF generator in the VA48 let you service and align the tuner and IF stages of the VCR, just like in color television service. Other instruments designed for VCR service only provide the direct video connection and do not provide the same signals to inject into the IF stages. IF alignment is just as important in VCR servicing as television servicing and the VA48 does the whole job.

29. The VA48 is the only VCR analyzer that supplies phase-locked substitute signals for injection into defective recording circuits

The recording circuits of a VCR are all referenced to the incoming video signal. The substitute composite sync signals, keying pulse signals, and color signals supplied by the VA48 are all phase-locked to the signal supplied by the VTR Standard Output jack. This allows you to inject the substitute signals into suspected bad stages while the signal from the VTR Standard jack keeps all other circuits in sync. This allows you to test the sync separator circuits, color processing circuits, and AGC circuits faster than with just a pattern generator alone. No other pattern generator designed for VCR servicing supplies these signals.

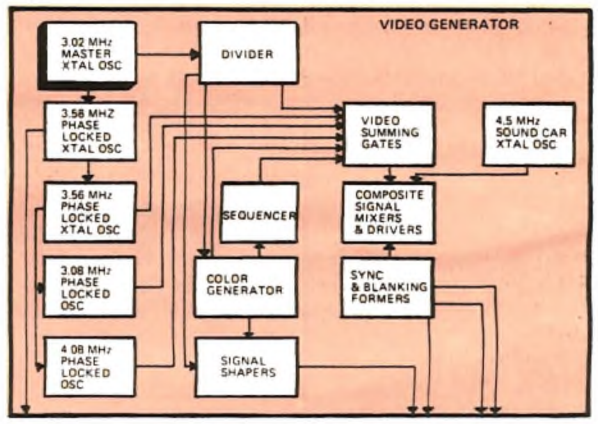


Fig. 24—The VA48 phase-locks all the signals to a master oscillator just like in a TV station.

30. The only analyzer that allows you to check the chroma response of the VCR

Only the VA48 lets you check the full 1 MHz chroma response of a VCR with the exclusive Chroma Bar Sweep pattern. Other color generators, including NTSC type generators, only provide 1-200 KHz of color bandwidth. The phase-locked signals provided by the VA48 allow you to inject into the VCR and see the actual response of the chroma amplifiers or see the effects of the adjustment of the comb filter. If the chroma signals are not phase-locked, the comb filter will not operate properly and result in a poor indication at best. The VA48 is the only analyzer that lets you check and make the critical adjustments in the chroma circuits of the VCR.

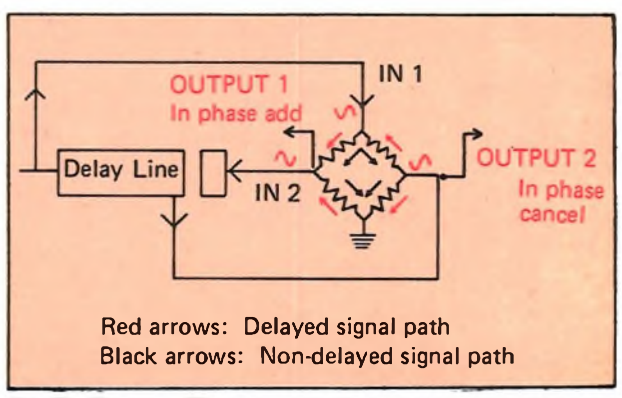


Fig. 25—The comb filter separates phase-related signals by means of phase addition and cancellation. Output 1 passes only signals that are in phase in 2 adjacent lines and output 2 passes those that have a 180° phase shift. With phase-locked signals from the VA48 the comb filter operates properly.

GENERAL SPECIFICATIONS AND APPLICATIONS

31. The only analyzer that keeps the TV in sync at all times with phase-locked signals when you are troubleshooting

Only the Sencore VA48 locks all the signal oscillators to a crystal-controlled master reference oscillator just like a TV broadcast station does. This means that you can inject anywhere in the TV or VCR and have the patterns stay in sync on the screen. With phase-locked signals, you know for sure when you find the problem. This makes your troubleshooting faster and easier.

32. The only analyzer that provides you with all electronically generated patterns for trouble-free alignment and troubleshooting

You get advanced digital electronic circuits with the VA48 that generate highly stable, accurate, and trouble free phase-locked patterns. You no longer have to wonder if the photo multiplier tube is going soft or the linearity has drifted. The VA48 eliminates all these problems and more. Now you can concentrate on your servicing without worry and do it faster and easier.

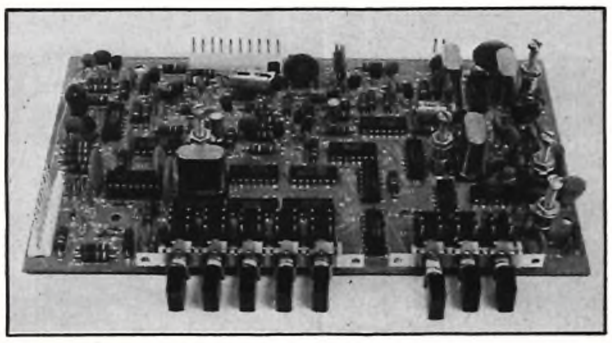


Fig. 26—The heart of your VA48 is the video pattern board where all the patterns are generated electronically and then phase-locked together just like at the TV station.

33. The only analyzer that gives you completely adjustable audio for injection into the sound IF, the audio amplifier, and even drive the speaker

The VA48 gives you a 0 to 30 Volts peak-to-peak 1000 Hertz audio signal as well as an adjustable 4.5 MHz frequency modulated sound IF signal. Other video analyzers provide only one level of each signal. This allows you to troubleshoot and align the sound system of a TV or VCR all the way to the speaker. You can align and troubleshoot the sound IF and detector with the modulated 4.5 MHz. Then you can inject the 1000 Hertz audio into the preamp and output stages as well as the speaker for complete audio troubleshooting capabilities.

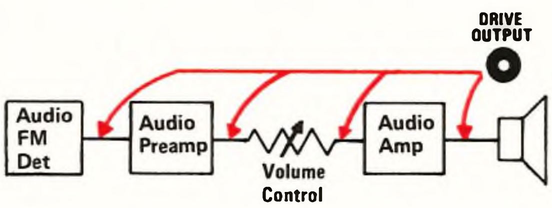


Fig. 27 — The audio drive signal can be injected into any stage, including the speaker for complete audio troubleshooting.

34. The only analyzer that allows you to inject a synchronized signal from the antenna terminals all the way to the CRT for a complete check of the entire video system

The VA48 gives you RF, IF, and video signals, phase-locked to a master oscillator for signal injection all the way from the antenna terminals to the CRT. The VA48 is the only analyzer that gives you all the signals that you need, adjustable and calibrated for the complete check of the video system. With just a flip of the switch, you can walk the VA48 signals through the receiver from the antenna input to the CRT and keep the patterns in sync all the way.

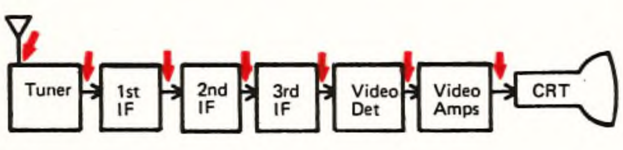


Fig. 28—The VA48 provides you with all the signals you need to go from the antenna to the CRT for that complete check of the video system.

35. The only analyzer that gives you NTSC specified sync just like the TV station

If the set works with signals supplied by the VA48, you will know for sure if the set will operate on a station signal. The sync pulses generated by the VA48 meet the EIA specifications RS-240 for broadcast stations regarding the sync pulse rise time and width. Only the VA48 gives you this big plus of operating the TV just like an off-the-air signal for more precise troubleshooting. Other analyzers supply non-standard sync signals which could lead you astray and waste valuable servicing time.

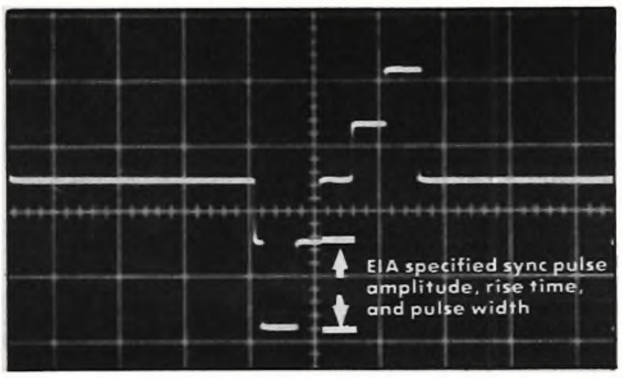


Fig. 29—The sync pulses from the VA48 meet the EIA specifications RS-240 for broadcast standards for rise time and width so that your VA48 puts out the best possible signal for servicing.

36. The only analyzer that allows you to inject into any stage without removing a single component

The output impedance of the VA48 Drive Signals lets you inject directly into any circuit without having to disconnect a coupling capacitor or opening the signal path. The impedance has been selected to swamp out the signals that may be present and allow the signal from the VA48 to take over the operation of the circuit. The VA48 makes your troubleshooting faster and easier than ever before.

37. The only analyzer that gives you both positive and negative drive signals for injection into tube or solid-state in any stage

Only with the VA48 do you get both positive and negative drive signals for tube and solid-state signal substitution. The VA48 gives you plus or minus signals from 0 to 30 Volts peak to peak for solid-state troubleshooting. You also get a plus or minus from 0 to 30 Volt peak-to-peak SCR gate signal not found on any other analyzer. For tube circuits, you get plus or minus 0 to 300 Volt drive signals. You can inject into any stage, video, sync, AGC, vertical, and even horizontal in any tube or solid-state receiver. Only the VA48 gives you all the signals you need for complete servicing.

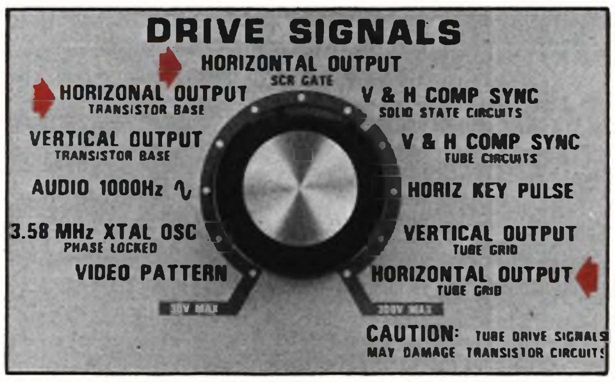


Fig. 30—Only the VA48 gives you all the necessary signals for injection into any stage of a TV or VCR, be it tube or solid-state.

38. The only analyzer that allows you to automatically monitor the amplitude of the drive signals with a built-in meter

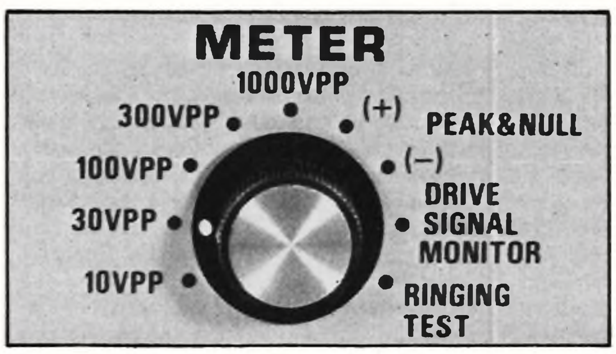


Fig. 31—The Drive Signal monitor position of the meter lets you set the level of drive signal to match the circuit.

Not only does the VA48 give you all the drive signals that you need for servicing, but lets you monitor the actual peak-to-peak level of the signal right on the built-in meter. There's no guesswork, or need to use an external meter or rely on the calibration of the output control. You know for sure just what amplitude signal you are injecting so you don't overdrive the circuits or inject too little signal for proper operation. You can keep the signal levels at the proper amplitude with the VA48 and the built-in meter and prevent damage to the circuits in the TV.

39. The only analyzer that gives you a bias supply and B+ Sub Power Supply built right in so you can troubleshoot scan derived power supplies or check AFC, APC, ACC, or AGC control circuits directly

You can substitute directly for the scan derived B+ supply in a receiver with the VA48 when you are troubleshooting a horizontal problem. When the horizontal output is not working, there is no scan derived B+ and the horizontal oscillator and other circuits will not be working. Just connect the output of the BIAS & B+ SUB to the output of the scan derived supply, set the control for the proper voltage, and start your troubleshooting procedure. You can also substitute a DC voltage for the control voltages of the AFC, APC, ACC, or AGC circuits to check their operation and troubleshoot problems that may be present.

40. The only analyzer that lets you signal trace with a built-in peak-to-peak meter

The VA48 gives you a built-in peak-to-peak reading meter that you can use to signal trace in the video, sync, vertical and horizontal circuits, without using a scope. Simply inject a signal into the circuit while monitoring the amplitude with the meter. Then switch the meter to the desired peak-to-peak range and check the signals in the various stages. By monitoring the input signal level, and then measuring the signal level at the output of a stage, the gain of the stage can be quickly determined. You can quickly check for stage gain and find where the signal is being lost. The peak-to-peak function of the VA48 will help reduce your bench serving time even more.

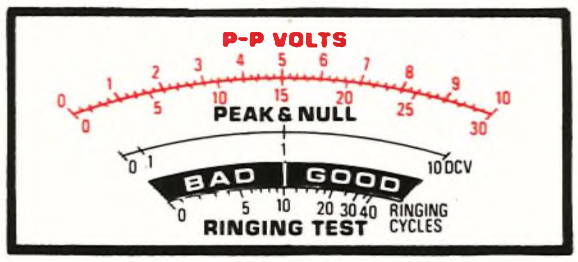


Fig. 32—Built-in Peak-to-Peak meter lets you signal trace and check stage gain in video, sync, vertical, and horizontal circuits.

The only analyzer that comes complete with a special "Speed Setup Book" and an audio tape to help you learn to use it quickly

The special "Speed Setup Book" that comes with the VA48 shows you what signal to use, where to connect the signal, and what polarity or pattern to use. The simplified book shows each test with special drawings and helps you make those checks faster. The 30-minute audio cassette tape gets you familiar with the controls and how they operate so that you can begin to understand its complete functions the day you receive it and keep your learning time to a minimum.

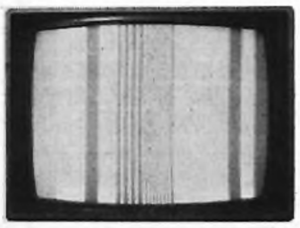
As a final reminder:

The *Sencore News* features many articles on the use of the VA48 such as the articles that have been reprinted here for your convenience. Sencore not only gives you more in the instruments, but keeps you abreast of the latest in servicing and how to use the Sencore line of equipment. If you haven't already ordered your VA48 or picked it up at your nearest distributor, do so now and reap the benefits of the VA48 in your shop today. If you don't know where to get your VA48, call the Customer Service Department today at 800-843-3338, and they will get you in touch with your nearest distributor. Don't delay. Get your VA48 and start making your servicing faster, easier, and more profitable.

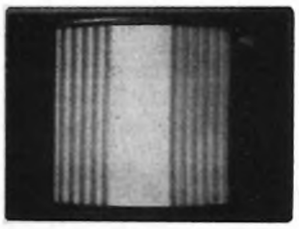
Sencore calls for video test signal standardization

-by Herb Bowden, President

Standard Color Bars



Bar Sweep



Chroma Bar Sweep

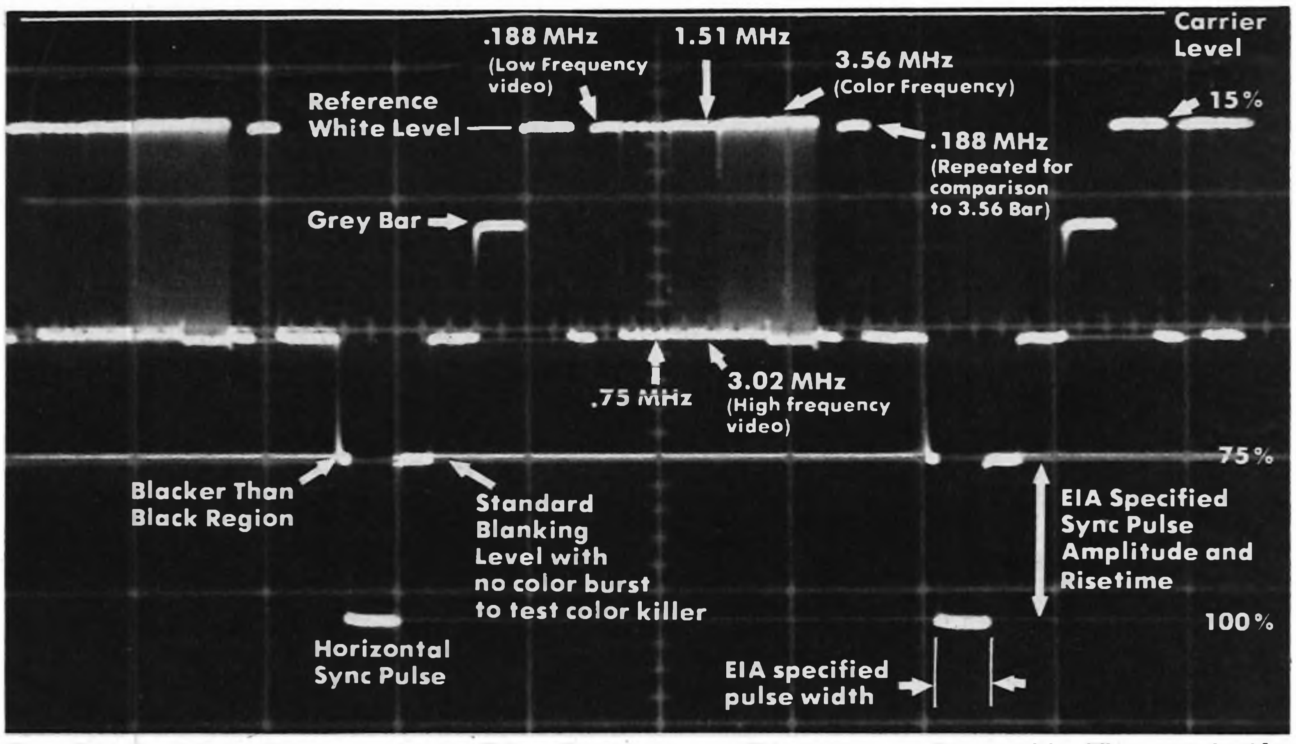


Fig. 1—The patented Sencore Bar Sweep pattern has EIA specified rise time and width sync pulses as well as a special multiburst type signal for checking and aligning of TV video IFs and video tape players dynamically.

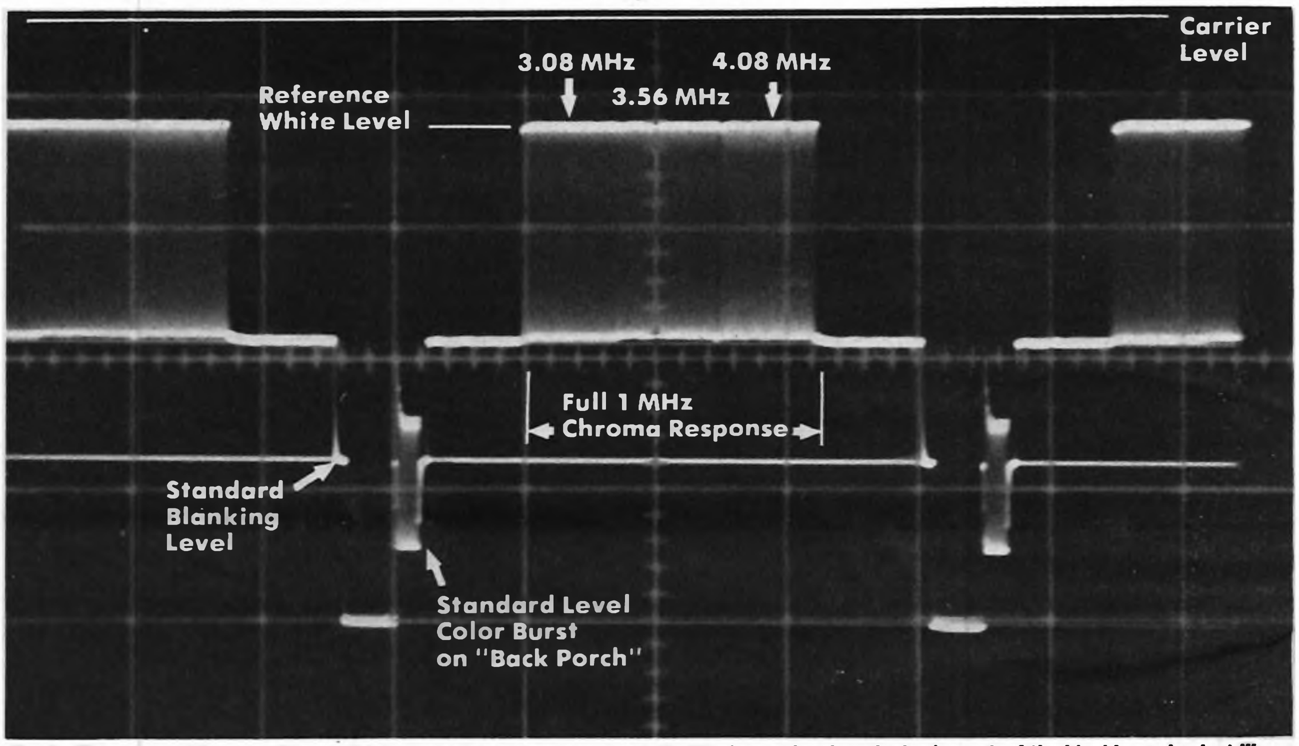


Fig. 2—The patented Sencore Chroma Bar Sweep pattern provides the 3.58 MHz burst signal on the back porch of the blanking pulse just like a station signal and phase-locks this to the sync and all other signals in the VA48.

The service TV-Video technician is faced with more new things to learn than ever before. The video tape recorder is brand new to most of us and certainly needs simplification. Manufacturers must be made aware of this and act accordingly. The industry needs simplification, not complication. Now is the time to speak out in favor of standardization and simplification before it is too late.

The so called NTSC generator was recommended by all TV manufacturers when color TV hit the market a number of years ago. The reason for this recommendation was not an error of commission but rather one of omission. The TV engineers recommended what they used in the lab without taking the time to find out what the TV service technician really needed. The RCA service company was the first to adopt a keyed rainbow pattern because it was easier to use, easier to understand, and less expensive to buy. Sencore was the first test equipment company to see the wisdom of the keyed rainbow and introduced two color generators to the market with these patterns at that time. Within one year, the entire industry had changed and you couldn't buy an NTSC generator anywhere, except in the surplus stores.

Color video tape recorders are now on the market. The numbers are growing to the point where enough service is required to cause many of us to be interested in VTR service work. What do we use for VTR service? Someone has pulled out the same song book and is playing the same old tune. The service manuals are full of recommendations of NTSC generators for VTR performance testing and service. Once again, Sencore challenges these recommendations and is sticking to a phase-locked color bar system in the VA48 and will not produce an NTSC generator where it is not needed. The *Sencore News* has carried many articles showing technicians how to service every stage of a video tape recorder with the standard color bars. A special *Sencore News* issue is available to all who will write for it, telling the industry just how much easier the standard color bars are to use. A new VTR manual, that goes through VTR service step by step with the VA48 is also available to all VA48 owners for the asking.

Little by little, video tape recorder manufacturers are changing over to the VA48 standard signals. General Electric was first, followed by others who must use this signal in their own service, such as J. C. Penney. There are some manufacturers who have not made this switch, and we think that you should join Sencore in helping them understand your position. You need standard color signals for many reasons as listed here.

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1. An NTSC generator means that you will need to make an extra investment for low volume work at this stage of the game.
2. An NTSC generator means that you will have one test signal for tape recorders and another for color TV service. This is confusing.
3. Non-standardization of signals at this time means that you will find NTSC waveforms on one schematic and keyed rainbow on another. This is confusing.
4. If the entire industry changes, you will be stuck with an NTSC generator that you can't sell, just like you were when the manufacturers adopted keyed rainbow for color TV.
5. Half NTSC and half keyed rainbow will make all instructions complicated in a technology that needs simplification.

We assure you that you can service any and all consumer-type video tape recorders and video cassette recorders on the market with the VA48. We are willing to sell you the VA48 with a money-back guarantee if you can't locate all troubles, align all stages, and perform all performance tests in any VCR with the VA48. We have done it many, many times.

While we are talking about standard test signals, let's look at the alignment generators as well. The sweep and marker generator is still recommended by most manufacturers even though it will not work on many new TVs. Manufacturers are switching to synchronous detectors for video detection because they reproduce superior pictures with less interference. These synchronous detectors need to be adjusted for linearity first and frequency response second. Synchronous detectors require a carrier signal to detect all video frequencies. A sweep and marker generates no carrier and has no linearity test and thus cannot be used effectively.

A sweep and marker has never been the best kind of alignment signal to start with because it is only a simulation of the actual TV signal. Sweep generators are so unnatural that a bias box or battery must be connected to the AGC buss to use them. We all know that this is no real indication of dynamic frequency response as the AGC fluctuates with incoming signal strength. Further, the sweep and marker generates a smooth 60 Hertz derived FM signal with no square waves or steep waveform fronts as found in the real TV signal.

TV stations and CATV people have converted from the sweep and marker and have been using a multiburst signal that truly duplicates the TV signal. This all electronic pattern holds all signals to fixed levels for aligning and testing purposes. The VA48 signal is a multiburst signal that has been altered to conform to the color TV alignment curve for simplified alignment and troubleshooting. The VA48 Chroma Bar Sweep signal is also a multiburst signal especially made for the chroma amplifiers. Both of these signals enable you to check overall gain or stage gain, bandwidth, and the circuit's ability to reproduce sharp square waves without ringing or overshoots. The VA48 video Bar Sweep pattern also has a three step modulation level, between the white level and the blacker than black region. This enables you to check linearity of any amplifier or to set the linearity of synchronous detectors and other such video circuits, such as the white clipper circuits found in the VCR recording stages.

We think that these two signals will become the standard color TV and VCR signals of tomorrow. If you agree, now is the time to take action and get this information to those in our industry that may not understand the TV service business as you do.