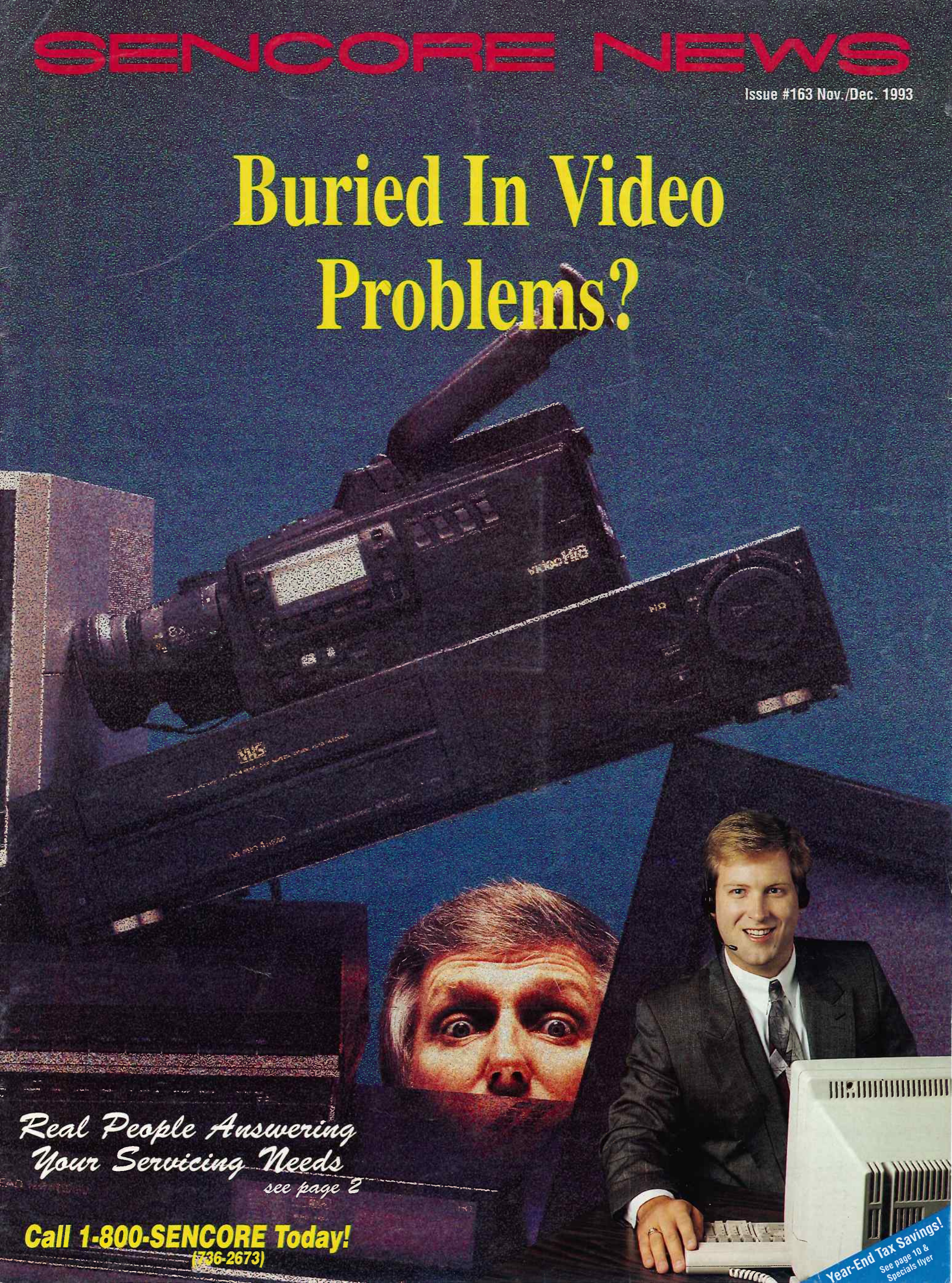
SENCORE NEWS

Issue #163 Nov./Dec. 1993

Buried In Video Problems?



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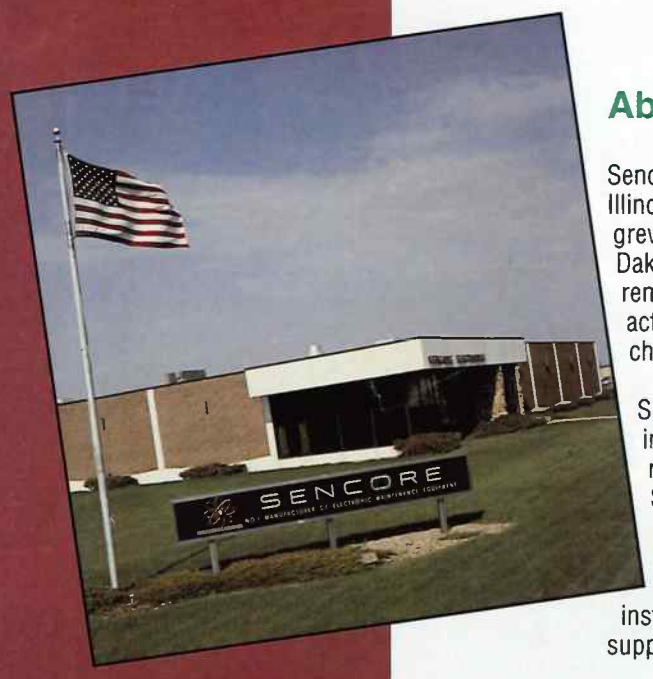
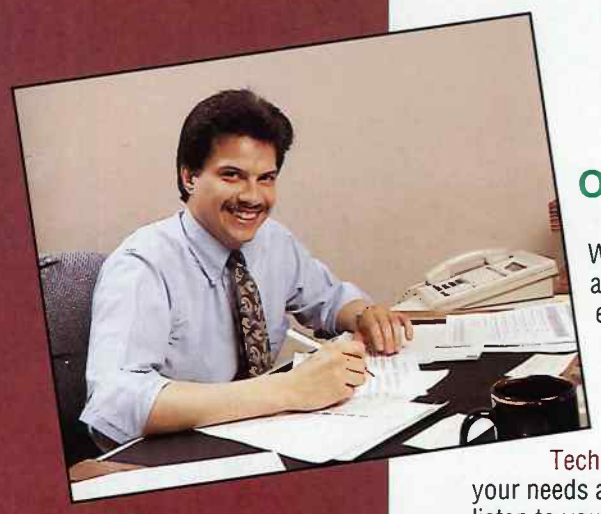


About Sencore.....

Sencore was started in 1951, in downtown Chicago, Illinois by R.H. ("Herb") Bowden. As the business grew, Sencore moved west to Sioux Falls, South Dakota. The now second generation business remains in Sioux Falls where Sencore is proud to be actively involved in community events and charities.

Sencore designs and manufactures test instruments that provide the highest quality and reliability in the entire service industry. Every Sencore instrument is engineered to provide you with exclusive tests and capabilities that will make your troubleshooting easier and more efficient. When you invest in Sencore instruments, you also receive the best after-the-sale support available in the service industry.

During the past 40-plus years, Sencore has remained dedicated to one goal — making you more successful in electronic servicing. And since our success depends on your success, we're working even harder to be your test equipment company.



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We'd like you to make Sencore your "One Stop Shop" for all your test equipment needs. When you invest in Sencore equipment, you invest in an entire company devoted to saving you time and making your job easier. This dedication assures you of the best customer support in the industry from people who care.

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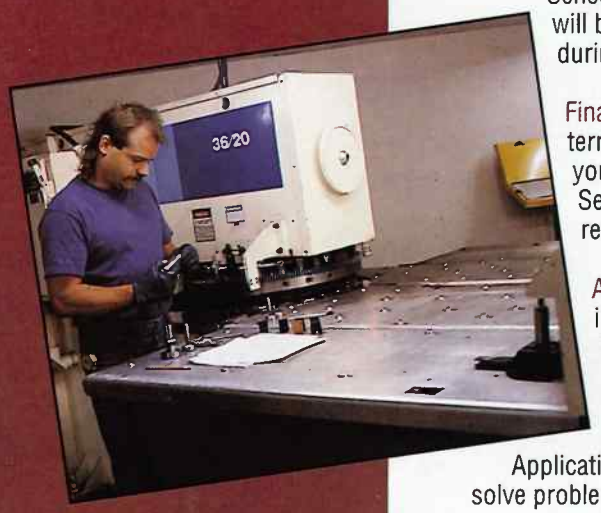

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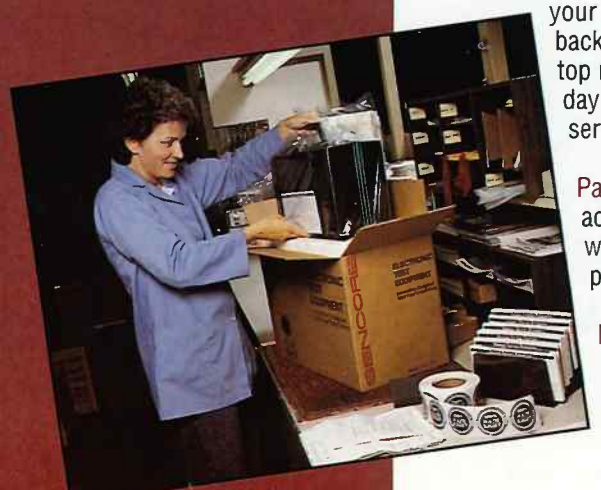

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On The Cover

Occasionally technicians can feel like they're buried in tough video problems. Sencore's exclusive line of test instruments are designed to help you climb out of that troubleshooting hole. While paging through this issue of the Sencore News, you'll also meet some of the "Real People" of Sencore.

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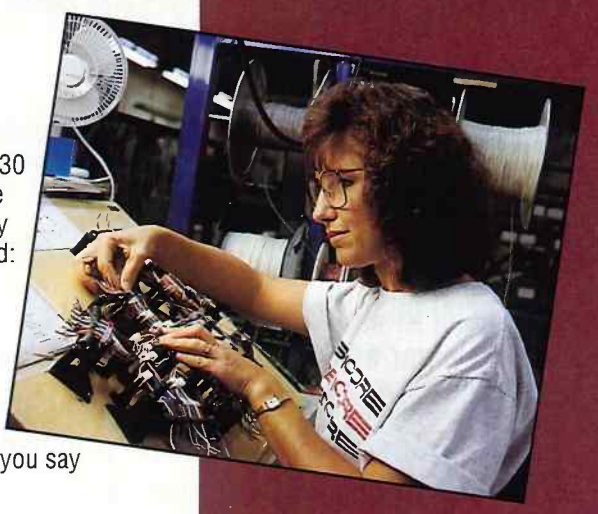
Buyer Protection



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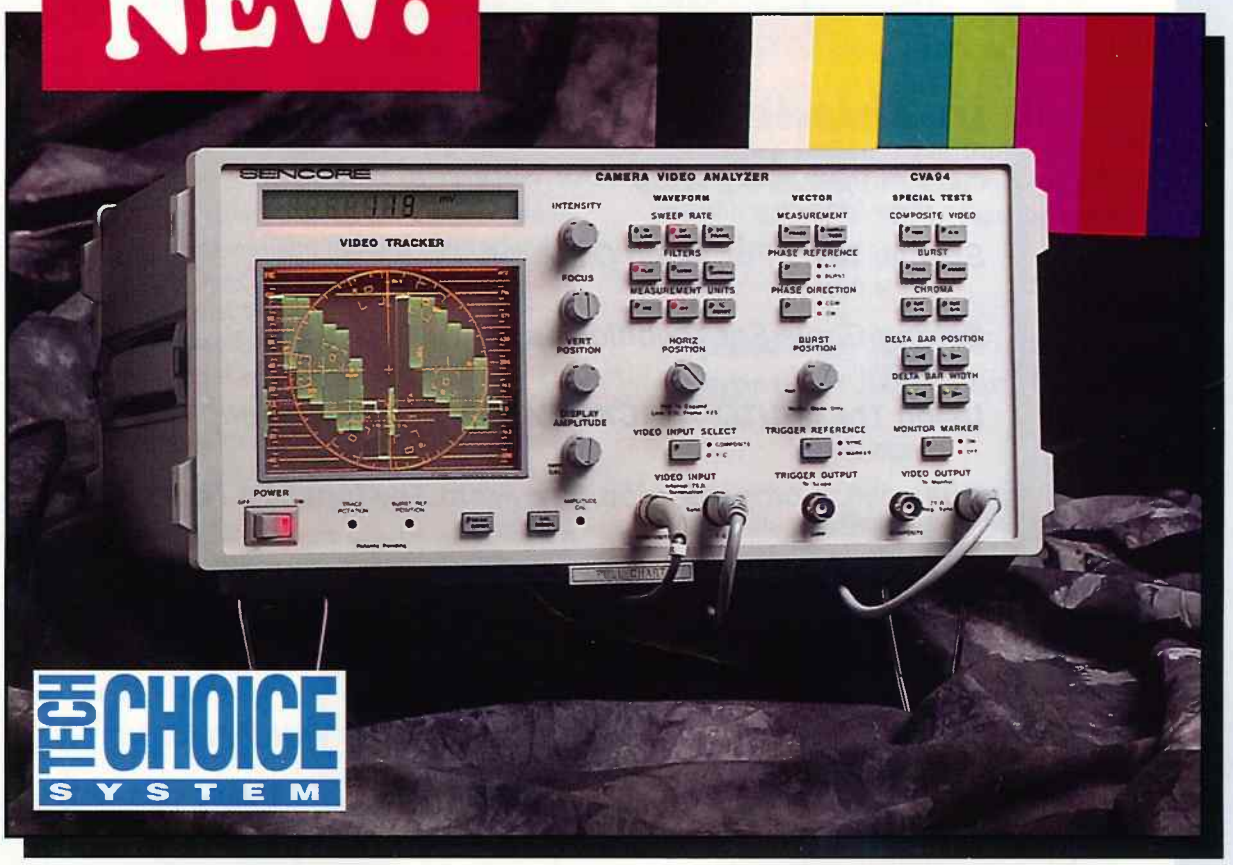

Quickly And Accurately Analyze Camera Video Signals With Time-Saving Digital Measurements, Waveform And Vector Displays, And Exclusive Special Tests Designed For Fast Camera Servicing And Alignment!

CVA94 "Video Tracker"™ Camera Video Analyzer

The CVA94 "Video Tracker"™ provides you with:

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- Digital vectorscope measurements for easy, error-free color checks.
- Special tests to positively identify and localize:
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  - Chroma circuit problems with exclusive "Chroma Noise" tests.
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- Selectable Video Inputs compatible with both composite and high resolution Y/C camera outputs.
- Scope Trigger Output to save you troubleshooting time. Plus, the new "Marker Trigger Reference" allows you to signal trace any signal defect to its source.
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If You'd Like To See How Your Business Will Benefit From Having A New Camera Video Analyzer Working For You, Simply Call 1-800-SENCORE (736-2673) Today!

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Use the VR940 Video Reference to complete your camera servicing package – call for details.

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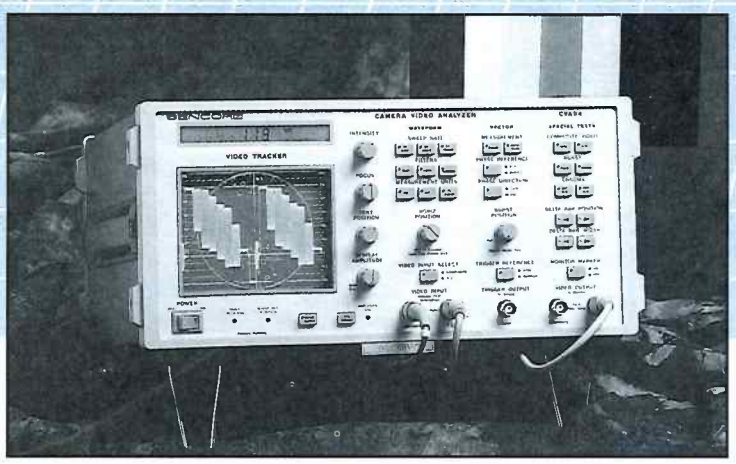

Servicing Cameras With The CVA94 "Video Tracker's" Special Tests

By Tom Schulte, Application Engineer, CET

What kind of difficulties do you have giving accurate camera repair estimates? Can you quickly troubleshoot camera problems to the defective board or component? Are you confident that your completed camera repairs produce satisfactory pictures under all operating conditions?

Let's take a look at how the CVA94 "Video Tracker" Camera Video Analyzer helps you service video cameras with exclusive tests and techniques you won't find anywhere else. The "Video Tracker" has the technology to give you maximum troubleshooting confidence resulting in faster camera service and greater customer satisfaction.

Are You Making Accurate Camera Service Estimates?

Accurate service estimates are important to your customer and to your success as a camera servicer. After all, only the satisfied customers return to your shop when they require additional electronic service work. And they're the ones who are able to give positive recommendations of your shop to friends and acquaintances.

The CVA94 "Video Tracker" Camera Video Analyzer can play an important role in your video camera estimating process. The CVA94 "Video Tracker", along with the VR940 Video Reference, helps you completely check a video camera's operation in a matter of minutes to localize defects to the section of the camera causing the problem. The following series of standard camera tests will help you determine which sections of a video camera are working properly and which are not so you can provide service estimates to your customers quickly and accurately.

Standard Frequency

This test allows you to quickly check whether the camera's master sync generator oscillator is operating at the proper frequency. The master oscillator is divided down to produce the camera's NTSC standard 3.58 MHz burst reference signal and sync signals. If the burst signal is too far from the proper frequency, no color or intermittent color operation will result on some televisions or monitors.

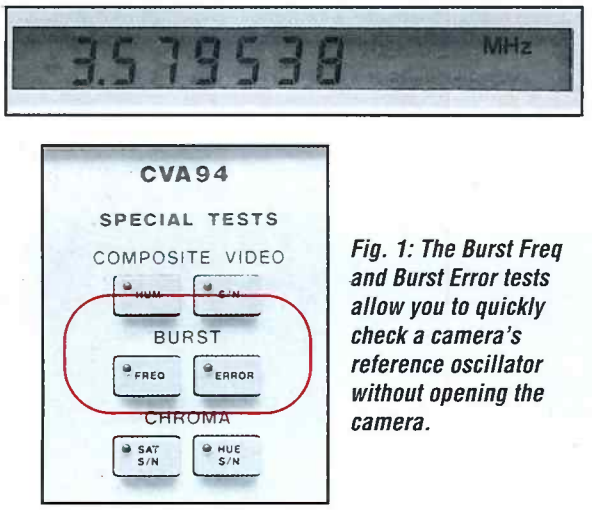

Fig. 1: The Burst Freq and Burst Error tests allow you to quickly check a camera's reference oscillator without opening the camera.

To perform the test, simply press the CVA94 BURST FREQ or BURST ERROR button (Fig. 1). The camera can be framed on any scene, or the lens can be capped. To insure color compatibility, the frequency of the burst output signal should be within 100 Hz (preferably 50 Hz) of the NTSC standard frequency of 3.579545 MHz. To adjust the camera's master oscillator to its proper frequency, push the BURST ERROR button and adjust the camera for zero error.

Luminance Level

When the camera's luminance stages, including the auto iris (AIC) and automatic gain (AGC) stages, are working properly, the video output level will be constant, regardless of scene light levels. If these stages aren't working properly, the camera's luminance output will be missing, or will be too large or too small at some light levels.

To test the camera's luminance level, frame the camera on the VR940 Gray Scale Chart and press the 1H or 2H SWEEP RATE buttons on the CVA94. The black levels in the waveform displayed on the CVA94 CRT should fall close to the dotted 7.5 IRE line. The maximum white levels should fall close to the 100 IRE line (Fig. 2).

Improper black level indicates a misadjustment or failure of the black setup circuit. Improper white levels indicates a misadjustment of the luminance output level or a failure of the AIC or AGC circuits. To confirm which, repeat the test at a low light condition. Insert the Neutral Density Filter behind the Gray Scale Chart and check the level of maximum whites on the CRT display. If the whites are at approximately the same levels as before, the AIC and AGC circuits are working properly to automatically hold the white levels constant. If the white levels change from high light to low light conditions, look into the lens while you change the lighting. If you can't see the size of the iris changing, the auto iris circuit is defective or the lens is jammed. If the white levels are wrong, but are approximately the same at both high and low light conditions, the luminance output level is probably just adjusted improperly.

Video Noise

The quality of the camera's luminance output signal depends greatly on the amount of noise generated in the CCD, prevideo, and luminance process stages. Excessive noise causes the luminance signal to be grainy or snowy. The amount of noise produced is usually compared to the standard signal level and is referred to as signal-to-noise ratio (S/N). Signal to noise ratios of 40 dB or greater result in very clean pictures, whereas ratios of 35 dB or less definitely indicate defective luminance circuits.

To test the camera's video noise, frame the camera on the VR940 Video S/N Chart and press the CVA94 VIDEO S/N button. The "Video Tracker" measures the video signal and automatically calculates and displays the

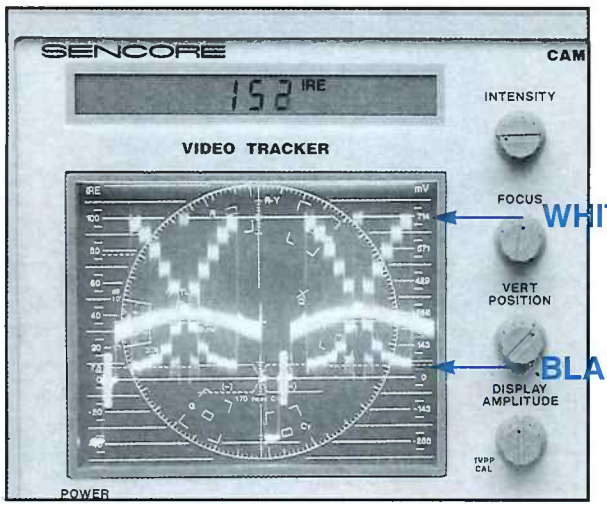

Fig. 2: The CVA94 shows the resultant video waveform of the VR940's Gray Scale Chart testing a camera's luminance levels.

S/N ratio on its digital display (Fig. 3). If the camera has excessive video noise, perform the chroma noise test to localize the problem even further within the camera.

Fig. 3: The special video S/N test easily identifies noisy camera video signal sources with an automatic, digital readout of the results.

White Balance

In order to produce properly colored pictures, the camera's chroma circuits first have to be balanced to produce no chroma output when the camera is scanning a white or gray (non-colored) area of a scene. A camera with improper white balance will typically produce a picture with an overall reddish or bluish cast. Video cameras typically have manual indoor and outdoor white balance functions as well as an auto white balance function.

To test the camera's indoor white balance, frame the camera on the VR940 Gray Scale Chart, set the camera's white balance switch to "indoor", and press the CVA94 VECTOR PHASE button. Since the camera is framed on a chart containing no color, the camera's output signal should also contain no color information. The CVA94 CRT Vector display should show the burst reference vector extending to the left of center, but no other vectors should extend away from the center of the display (Fig. 4).

Fig. 4: The "Video Tracker" shows only the burst reference vector extending to the left of center indicating good white balance with the camera focused on a non-colored pattern.

To test the camera's outdoor white balance, frame the camera on the VR940 Gray Scale Chart with the Temperature Conversion Filter installed behind it, and set the camera's white balance switch to "outdoor." Again, check that the CVA94 CRT Vector display shows no vectors other than burst extending from the center.

To test the camera's auto white balance, set the camera's white balance switch to "auto" and frame the camera on the VR940 Gray Scale Chart, both with and without the Temperature Conversion Filter installed behind it. In each case, the CVA94 CRT Vector display should show no vectors other than burst extending from the center. Improper white balance indicates a problem with the camera's Chroma Process circuits, especially the white balance correction circuits.

Chroma Phase

The phase of a camera's chroma signals determines the chroma hue or tint of the colors in a scene. Improper phase is most easily recognized as wrong fleshtones in camera scenes with people.

To test the camera's chroma phase, frame the camera on the VR940 Color Bar Chart and press the CVA94 VECTOR PHASE button. Press the left or right DELTA BAR POSITION button to highlight the red portion of the signal both on the CVA94 CRT and on the video monitor display. Read the phase of the camera's red signal on the CVA94 digital display. The red signal should be within 15° of 103° as measured CCW from the B-Y axis (Fig. 5). Press the left DELTA BAR POSITION button to highlight the yellow portion of the signal. The yellow signal should be within 15° of 167° CCW from the B-Y axis. Slight errors in chroma phase indicate the need for readjustment of the camera's chroma phase controls. Large errors indicate a probable defect in the chroma encoder circuits.

Fig. 5: Use the "Video Tracker" to measure a camera's chroma phase. A good camera's red signal output should be within 15° of 103°.

Chroma Amplitude

The amplitude of a camera's chroma signals determines the chroma saturation or amount of color in a scene. Improper amplitude causes the color to be either washed out or glaring.

To test the camera's chroma amplitude, set up the camera and "Video Tracker" as for the chroma phase test, then press the CVA94 VECTOR AMPLITUDE button. Read the amplitude of the camera's red signal, as compared to standard burst level, on the CVA94 digital display. The red signal should be approximately 190% to 220% of standard burst (Fig. 6). If the signal is higher or lower, readjustment of the camera's chroma gain is required. If the signal is missing entirely, the camera's chroma process circuit is defective.

Fig. 6: The red signal should be approximately 190-220% of standard burst.

Chroma Noise

The quality of the camera's chroma output signal depends greatly on the amount of noise generated in the CCD, prevideo, and chrominance process stages. Excessive noise affects the chroma signal two ways. Amplitude noise in the chroma output signal affects chroma saturation, which causes brightly colored areas of the picture to be grainy. Phase noise in the chroma output signal affects chroma hue, which causes brightly colored areas of the picture to be smeary.

To test the camera's chroma saturation noise, turn the autofocus "off" and frame the camera on the VR940 Red Chart. Press the CVA94 CHROMA SAT S/N button and read the camera's chroma saturation S/N on the "Video Tracker's" digital display. Signal to noise ratios of 40 dB or greater result in very clean pictures, whereas ratios of 35 dB or less definitely indicate problems in one of the circuits which processes the chroma signals.

To test the camera's chroma saturation noise, again frame the camera on the VR940 Red Chart and press the CVA94 CHROMA HUE S/N button. Read the camera's chroma hue S/N on the CVA94 digital display. You should judge the chroma hue S/N the same as chroma saturation S/N. If chroma hue S/N is bad but chroma saturation S/N is good, the difference signal gain is probably misadjusted. If both chroma noise tests are bad and the video noise test is bad, one of the signal circuits common to luma and chroma, such as the CCD or prevideo process circuits, is probably defective.

Focus

Proper focus should be checked both in autofocus mode and while zooming the lens (if a zoom lens is used). The autofocus circuit needs to be able to properly focus the camera at both near and far distances. If a zoom lens is used, manual focus should not change as the lens is zoomed from telephoto to wide angle. This is known as proper back focus.

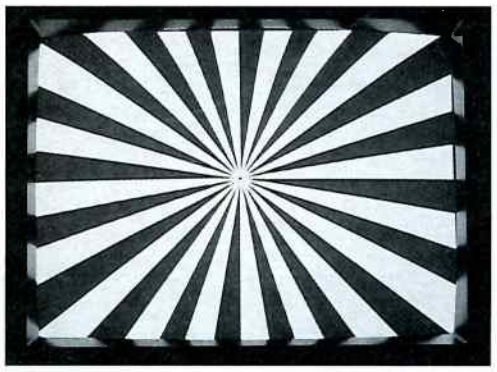

Fig. 7: The center of the VR940's Focus Chart should be sharp and clear on the video monitor with the camera focused on objects both near and far.

To test the camera's autofocus, turn the autofocus on and frame the camera on the VR940 at about six feet with the Focus Chart and Neutral Density Filter installed (the filter lowers the light level to make focus easier to check and adjust). Check that the center of the pattern comes sharply into focus on your video monitor (Fig. 7). Then pan the camera to frame on the VR940 Paper Focus Chart which you have attached to a wall 20 feet or further away. The camera's focus should readjust to again bring the pattern into focus. Finally, pan the camera back to the VR940 Focus Chart and check that the pattern again comes sharply into focus. If the camera won't focus properly at both distances, the autofocus circuit is defective.

To test the camera's back focus, turn the autofocus off, zoom the lens to wide angle, and frame the camera on the VR940 Focus Chart with the Neutral Density Filter installed behind it. Adjust the manual focus for a sharp pattern, then zoom the lens to telephoto. If the pattern goes out of focus, the camera's back focus is misadjusted.

Frequency Response

The sharpness of fine objects in a camera's output signal depends primarily on the frequency response of circuits which process the luminance output signal. Poor frequency response in any of the circuits from the CCD to the video output can cause blurry or smeary pictures, even if the camera is set for best focus.

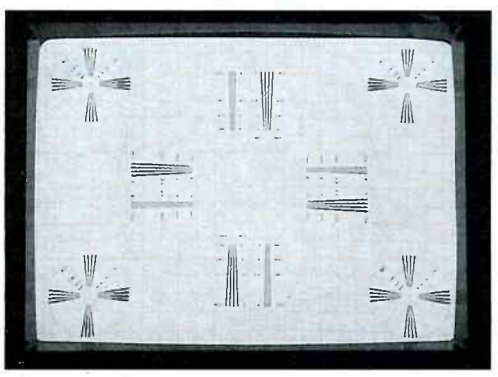

Fig. 8: Check the vertical wedges of the Registration/Response Chart to test the camera's frequency response.

To test the camera's frequency response, frame the camera on the VR940 Registration/Response Chart. On your video monitor, check the vertical wedges at the top and bottom of the pattern to see at what point the wedge lines blend (Fig. 8). Note the frequency printed on the chart where the wedges blend together. A camera with a composite output signal should have at least a 3.5 MHz frequency response, while a camera with Y/C output should have at least a 4 MHz frequency response.

Quickly Isolate Defective Circuits

Once you have defined the extent of a camera problem, you need to signal trace the camera circuits to the board or component level to isolate the circuit board or component causing the problem. The difficulty is that signals at most points in the camera don't contain sync signals. Sync isn't added to the video signal until just before the signal leaves the camera. That means the triggering on an oscilloscope will be very unstable as you attempt to signal trace most circuits. One solution is to locate the sync generator output testpoint and trigger on that signal with your second oscilloscope channel.

An easier method, though, is to use the CVA94's Scope Trigger Output with sync referenced trigger. This eliminates the extra probe connection into the camera circuits. Once the "Video Tracker" is connected to the camera's video output, it separates horizontal and vertical sync signals from the composite video signal and sends them to the Trigger Output jack. You simply connect the CVA94 Trigger Output to your scope's external trigger input, and set the trigger source control to external (Fig. 9). Your scope is then triggered precisely to all camera signals, no matter what test point in the camera you probe with your scope.

Fig. 9: You can trigger your scope (SC3100 "AUTO TRACKER") to the CVA94 so all waveforms are precisely triggered, no matter where you trace a signal.

The CVA94 Trigger Output also helps you trace defective parts of the camera signal to their source. Set the CVA94 Trigger Reference to "Marker" and the Trigger Output pulses occur at the start of the Delta Bar. Simply set the Delta Bar to start just before the defective portion of the camera signal you wish to trace to its source. As you probe any signal test point in the camera, your scope is automatically triggered to begin its sweep at the point you've selected. You can then adjust your scope's timebase to expand the selected portion of the signal to whatever detail you desire.

Verify Operation For Customer Satisfaction

When you have completed a camera repair, you should fully check the camera's operation to verify that all the camera circuits are functioning properly. This will insure you and your customer that the camera will give the best possible picture under all lighting and operating conditions. Once the repair is completed, simply repeat the standard camera tests outlined above to guarantee that the camera is operating to its maximum capability and to guarantee your customer complete satisfaction with the serviced camera.

The CVA94 "Video Tracker" is the answer to your camera servicing. Call your Area Sales Representative toll-free at **1-800-SENCORE,** and we'll help put a "Video Tracker" on your bench today. Or, if you have questions on the "Video Tracker" or need information on camera servicing, just pick up the phone and call. We'll listen to your needs and work with you to come up with solutions that work for you. ■

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Measuring And Rewarding Technician Effort And Efficiency

By Al Bowden, Owner And President, Sencore, Inc.

Editor's Note: In the last issue of the Sencore News, we preempted our business article series in favor of announcing the first price increase that Sencore has had in the past five years. We felt it was important to announce our pricing intentions to our valued customers and to communicate the reasons that the price increase was placed into effect. In this Sencore News, we resume with our series of business articles. This issue's article "Measuring And Rewarding Technician Effort And Efficiency" (part one) discusses a management controls strategy that, when implemented, can produce significant increases in technician productivity and improvements to the bottom line.

In our last few articles, we discussed and defined the principles of inventory, operating expense, revenue, and profit as the key elements that can affect an organization's progress and success. Here's a brief review of those definitions for reference purposes:

REVENUE: The amount of money a business collects from selling the goods/services the business produces/provides.

INVENTORY: All of the money spent on goods and services that a business buys in order to provide value added goods and services to their customers.

OPERATING EXPENSES: The amount of money a business spends in order to turn inventory to revenue.

PROFIT= (REVENUE) – (OPERATING EXPENSES)

From a business standpoint, our success is dictated by our ability to develop systems and operating procedures (handles and levers) that help us to constantly drive operating expenses down – while increasing revenue at the same time (remember, a balance is needed here). As well, we need to keep our inventories in line since excess or low quality parts, equipment, and stock eat up operating cash. We cannot, however, accomplish this on our own accord – it is our employees that have to assist us in this process. Although we can dictate policies and procedures, we cannot be successful in implementing programs until we get our employees to understand the importance of them and the relevance of these programs to our success. This success applies not only to the business, but to the individual employee as well. We need to be able to achieve company-wide understanding of our goals and we need to provide an environment within which our employees can see themselves as a contributing member. This leads to an environment where company success can translate to individual success. Not unlike a sports team, each individual player must understand his or her role and must know the reward for accomplishing the goal.

Why all this discussion about goals when this article is about measuring technician efficiency? Well, say you have the best system in the world and you are measuring efficiencies. What are you going to do with the numbers? I'd bet you would want to set some goals so you can improve the numbers. Thus, let's talk about goals first.

What Is A Goal?

"Our goal is to increase revenue through better customer service and satisfaction", said one of our Sales Engineers. This is truly a noble statement and a statement that I support. But it is not a goal. It is a strategy. Satisfy your customers and they will be back to purchase more equipment plus their word of mouth advertising will bring more new customers in the door. Great strategy, but it is not a goal. Why not? Because a goal needs to be measurable. The effort that will go into the goal must be defined and the results expected must be stated up front. You could very well say that a goal is nothing more than your business strategy expressed in understandable and measurable terms.

We cannot, and should not, expect every employee to know how to read and understand a financial statement (or our strategic plans) and then make the determination on their own as to what they need to do to help the organization. It is up to us, as owners and managers, to communicate our organization's goals to each employee in terms they can understand. Then we can set reasonable goals for each employee that will help the organization achieve its objectives.

For example, telling our technicians that, "Inventory control is of critical importance

since it reduces the unnecessary allocation of liquid assets", is not going to provide any sensible reason for the technician to be more careful with his/her parts ordering. It also provides very little direction as to what the technician should be doing in order to help the organization achieve its goals. However, telling technicians that they can earn additional income (or recognition and/or a prize) by reducing the amount of unnecessary component orders could produce some amazing results. The bottom line here is to express the organization's goal in terms that our employees understand, then provide incentives for the accomplishment of a goal that they understand within an environment that they can control.

Setting A Goal

An organization's strategy in itself is nothing but words on paper until we develop the strategies into a goal with a plan behind it. We can accomplish this by following a simple process:

1. ***Communicating the concept/strategy to our employees in terms they understand.***
2. ***Setting a measurable goal with deadlines.***
3. ***Communicating the anticipated obstacles.***
4. ***Developing an action plan.***
5. ***Listing the benefits/incentives to the employees involved.***

How would you go about developing a goal for a service center strategy? Let's take one specific service center strategy and develop it into a goal by utilizing the outline above and the strategy of: "Increasing Liquid Assets By Reducing Parts Inventory."

1 Communicate The Concept/Strategy To Our Employees In Terms They Understand

We need to reduce the amount of money that we dedicate in purchasing parts inventory. For every part that we do not absolutely need to order, we can keep our money in the bank. This gives us the funds necessary to make investments in the business as opportunities come up. Investments in training that can help our people grow and expand their horizons, investments in better furniture and equipment that can make our job easier and make us more efficient, investments in additional personnel, additional benefits, etc., are reasons why we need to reduce parts inventory.

2 Set A Measurable Goal With Deadlines

For the reasons previously stated, we would like to set a goal of reducing our parts inventory by 30% over the next six months. This would result in savings of $6,000 over the next 6 months, or approximately a savings of $1,000 per month.

(continued on page 10)

Real People . . .

MEET OUR SERVICE TECHNICIANS

Call toll-free to talk with service technicians trained to assist you with servicing your Sencore instruments. Sencore technicians specialize in Sencore test equipment repair and know the instruments – inside and out.

"Troubleshooting Sencore instruments over the phone can be tough, but it's a good feeling to know I'm helping get a service center back up to speed."

BUSINESS STRATEGIES

Sencore, Your Financial Business Partner!

Why finance your next test equipment purchase with us? Here's why!

One stop service shop.

Oftentimes when you look to make a large purchase, you can be faced with the scenario of buying the product from one company, financing it with another, and end up having it serviced somewhere else. Sencore believes that most people would rather deal with one person or one company to meet their needs. That's why, when it comes to financing, we have our own in-house financing division dedicated to making your entire purchase with Sencore one quick and painless task.

Flexible credit terms to meet your needs.

We understand that in today's marketplace, flexibility and adaptability play a major role in the success of any organization. That's why Sencore has designed a variety of financing plans tailor-made to meet your individual needs. Whether you need 30 days or 48 months to pay for your next piece of test equipment, we've got the financing plan to make your next purchase an easy one.

Competitive interest rates.

If you are a small business owner, it can be difficult to get the financing you want, let alone a good interest rate. Sencore recognizes this fact. That's why we're offering some of the most competitive rates in the industry. With rates starting as low as 7.9%, you can lock in some extraordinary savings. That leaves us asking you, "Why pay more interest if you don't have to?" Give us a call at **1-800-SENCORE**, and we'll help you start saving money today!

Automatic bank checking.

For your convenience, this program allows us to automatically deduct your monthly payment directly from your checking account, thus eliminating the need for coupon books, envelopes, and postage. Give it a try. It's easy, and it saves time.

Use us as a credit reference.

Have you ever had a hard time getting credit because you don't have a prior credit track record? Once you're established with Sencore, you can use us as a highly reputable trade reference when applying for credit with other firms or business. Just give them our name and number and we'll see that your payment performance is noted and communicated to the requestor immediately.

24-hour credit approval and order processing.

Our Order Processing staff is dedicated to getting your financing approved and instruments shipped immediately. In fact, 98% of all orders received are cleared within 24 hours. It's just our way of making financing with Sencore that much easier.

How do I get started?

The answer is simple. Give us a call toll-free at **1-800-SENCORE** and ask for your Area Sales Representative. We'll set up the financing plan that will help make your next investment in Sencore products a smart and profitable one.

Call 1-800-SENCORE, And We'll Discuss How A Well-Equipped Service Center Can Pay For Itself!

3 Communicate The Anticipated Obstacles

This parts inventory reduction will result in some frustration up front. Parts will not always be available and customers may have to wait a couple extra days to pick up their sets. In addition, we cannot wait for days before placing an order – we have to place orders for parts the same day as we need them. Furthermore, our parts costs may see an increase since we are ordering in lower quantities. Despite all this, if we optimize our work, we should see a significant reduction in parts inventory (and an increase in available funds) that will help us in the long run.

NOTE: This is just an example about goal setting – do not rush off and make this a strategy for your company. Inventory reduction is not always recommended.

4 Develop An Action Plan

In order to accomplish this inventory reduction without a serious effect on our business, we need to:

- Troubleshoot and diagnose failed components as soon as the customer's set is in. This may require a change in the way we inventory sets for repair (possibly changing from a First-In, First-Out to a Last-In, First-Out approach).
- Identify the problem component up front and eliminate (or drastically reduce) ordering unnecessary components for replacement. This will require plans to train technicians, acquire better diagnostic equipment, and devise a better way of processing sets through our troubleshooting technicians.
- Order the right components up front and confirm the right component has been ordered to avoid time consuming incorrect shipments. This may require a distributor agreement and some negotiation time with our top vendors. An automated computer link directly to their order processing system may also improve delivery times.
- Work out a deal/negotiate with our parts distributors for volume discounts made over a period of time so we do not have to pay for a minimum charge every time we order a few components.

5 List The Benefits/Incentives To The Employees Involved

Develop a control (measurement) for inventory reduction and compensate your technicians on the reduction. This inventory reduction incentive can be tied in with other controls with separate incentives. In fact, we must tie it in to production controls in some way. For example, a good way to reduce inventory (as far as the tech is concerned) could be to repair only the sets that need parts already in existing inventory. This would avoid ordering parts, but it's certainly not the route we want to take. Set up a deadline for a specific inventory level reduction and provide them with an incentive. Money incentives work, but we may not be able to afford to pay money for inventory reduction. However, setting up a contest between the technicians for a single prize may work very well (the prize can be a vacation day, a new stereo, show tickets, etc.)

Look for part two of this article in the next Sencore News. We'll discuss measuring results and setting up incentives for technicians. For copies of this business building article series, call your Area Sales Representative toll-free at ***1-800-SENCORE.*** ■

Real People . . .

MEET OUR APPLICATION ENGINEERS

Call us toll-free anytime for help in using your Sencore test equipment. Our Application Engineers are fully trained on all Sencore equipment and can help you with special tests or servicing techniques.

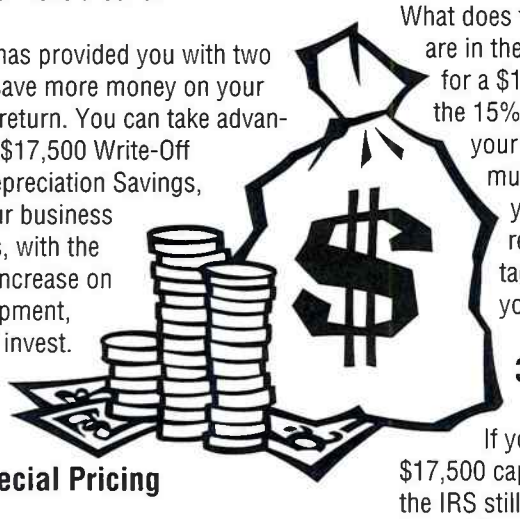
"Every call I get is different, yet they all have one thing in common. It's a customer needing help, and that's what I enjoy most - helping the customer."

TECH TALK

Save On Your Taxes In 1993!

It's time for year-end tax planning for 1993. We'd like to show you three ways to save big money before 1994 rolls around.

The government has provided you with two opportunities to save more money on your 1993 income tax return. You can take advantage of either the $17,500 Write-Off Savings or the Depreciation Savings, depending on your business investments. Plus, with the impending price increase on Sencore test equipment, now's the time to invest. Let's explain:



1. Sencore Equipment Special Pricing

You can save big money by investing in Sencore equipment before December 17, 1993. Take a look at the special pricing shown in the enclosed flyer and decide which package fits your testing needs the best. You automatically qualify for the savings. No questions asked.

2. $17,500 Write-Off Savings

Congress and the President passed a lot of tax increases in 1993, but there is one change that increases your tax *savings* which can benefit you. Effective with the new law, you can write off up to $17,500 of business equipment purchases directly as a business expense, up from $10,000 under the old law. This means your investment in Sencore test instruments can save you even more on your 1993 taxes.

What does this mean in dollars and cents? If you are in the 28% tax bracket, your net savings for a $17,500 purchase is $4900 ($2625 for the 15% bracket). The only limitation is that your taxable income must be at least as much as the equipment cost. Assuming you meet the minimum income requirement, if you do not take advantage of this write-off opportunity now, you will lose it for 1993.

3. Depreciation Savings

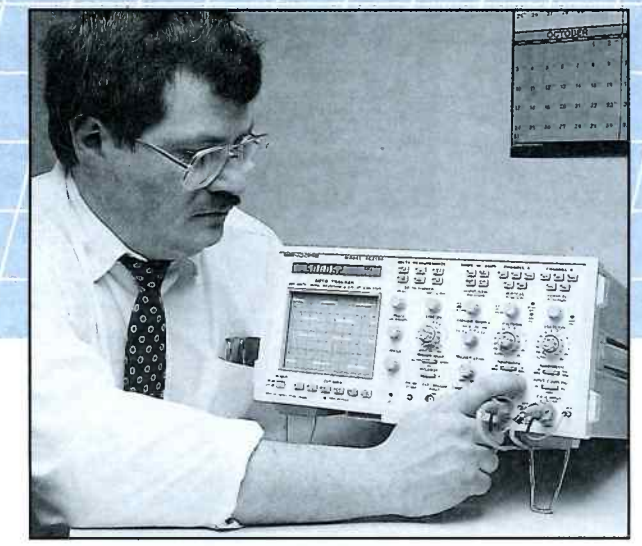
If you have already used up your $17,500 capital equipment write-off for 1993, the IRS still lets you depreciate your business investments. This allows you to update your equipment, plus write off some of the expense.

Business equipment purchased above and beyond $17,500 can still be depreciated. Generally, first year depreciation is 20% of the purchase price. First year tax savings on $10,000 of business equipment is $560 in the 28% tax bracket ($300 in the 15% bracket).

For more information, call your Area Sales Representative at 1-800-SENCORE.

Understanding And Using The SC3100 "AUTO TRACKER's"™ Delta DC Function

By Paul Nies, Application Engineer



Every service technician knows that proper DC voltage is important for correct circuit operation. But many technicians may not realize that there are two types of DC voltages - "average DC" and "instantaneous DC." Depending on the type of circuit you are troubleshooting, one or both of these DC parameters is critical and may need to be measured as part of your troubleshooting procedure.

The SC3100 "AUTO TRACKER" provides digital measurements of both types of DC voltages. Average DCV is measured by pressing the "DCV" button for either channel, and instantaneous DCV is measured by pressing either of the "DELTA DC" buttons.

There is an important difference between the SC3100's Auto-Tracking™ DC voltage measurement and its Delta DC volts measurement. This article explains the difference between average DC and instantaneous DC and how to measure them using your "AUTO TRACKER."

Average DC

Of the two DC voltage measurements, average DC is the most familiar to technicians and most common. Mathematically, average DC is defined as,

"The instantaneous sums of all the voltage points along a waveform, divided by the number of samples."

While this definition sounds complicated, it will help in our understanding of instantaneous DC. Let's look at average DC in more familiar and simpler terms.

Whenever you connect a DVM to a circuit test point and measure "DC", you are measuring the *average* DC voltage. The DC voltage listed at test points on schematics is also the average DC value. If you apply a waveform to a capacitor, the capacitor will charge to the average DC voltage of the signal. When you measure the output of a DC power supply, you are measuring average DC voltage. Several examples of average DC voltages on different waveshapes are illustrated in Figures 2 through 7.

The "AUTO TRACKER" measures the average DC value when you press the "DCV" button for either channel A or channel B. This measurement is the average DC level of the entire waveform. The SC3100's Auto-Tracking DC function is autoranged and totally independent from the CRT circuits, meaning the settings of the VOLTS/DIV and vertical vernier controls aren't important. In addition, you can measure DC volts no matter where the INPUT COUPLING switch is set. As the voltage changes, the SC3100's Auto-Tracking DC function follows the changes.

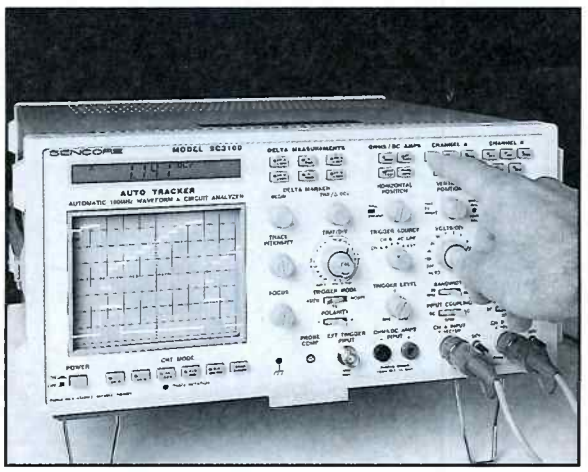


Fig. 1: Press the "DCV" button to automatically measure the average DC voltage at any test point.

Instantaneous DC

Unlike average DC voltage, which is an average of all points along the waveform, instantaneous DC voltage is the voltage level of just a single point on a waveform, measured with respect to ground. The circuit responds to this voltage level at that specific point in time. The instantaneous voltage value is critical in applications where a signal triggers the circuit, such as digital logic circuits, sample and hold stages, comparators, and SCR or triac controls.

Let's look at some waveforms that will help to illustrate the difference between average DC and instantaneous or "Delta DC".

Figure 2 shows a pure DC signal, the signal you would find at the terminals of a battery or at the output of a well-filtered power supply. Since all points on the waveform are the same potential from ground, the average and instantaneous DC voltages are the same.

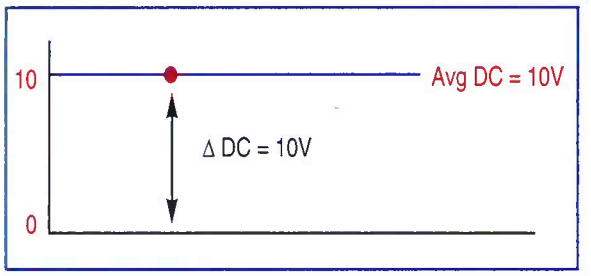


Fig. 2: On a pure DC signal, the average and instantaneous DC voltages are the same.

But look at the waveforms in Figures 3 through 7. These illustrations show that as soon as the waveform has amplitude variations, the average and instantaneous DC values become different. Remember that the average DC value is an average of all points on the waveform. Thus, if there are as many high points as there are points at ground potential on a symmetrical waveform, as Fig. 3 shows, the average DC voltage is half of the peak voltage. Notice the instantaneous voltage is either equal to the peak of the waveform or zero.

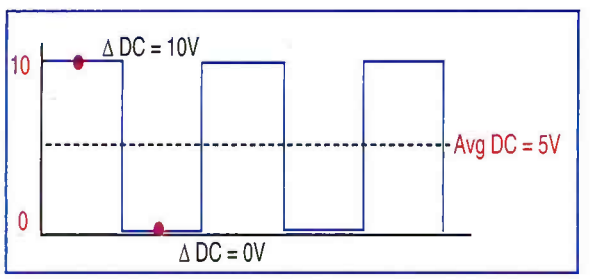


Fig. 3: The average DC voltage is one-half of the peak voltage when the number of high points equals the number of points at ground potential. The instantaneous voltage is either the peak voltage or zero.

Notice what happens when the number of high points does not equal the number of low points, as illustrated by Fig. 4. In this example, the average DC voltage changes as the duty cycle changes. The instantaneous DC voltages, however, remain either equal to the peak voltage or zero. (This is the concept behind the PWMs used in switch mode power supplies and VCR servos).

Figure 5 illustrates what happens when you add a DC level to an AC signal, which is similar to adding ripple on a DC power supply output. In this case, the average DC level is less than the peak (ripple) voltage, but it is greater than the lowest portion of the

AC (ripple) signal. As you can see, the instantaneous voltages vary above and below the average DC voltage amount.

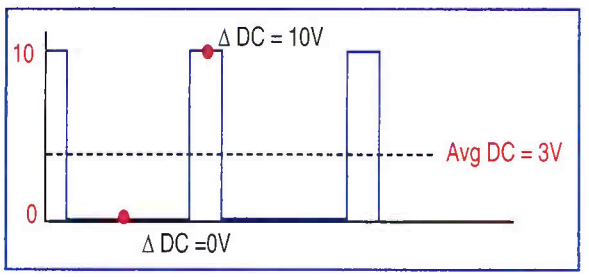


Fig. 4: Changing the duty cycle causes a change in the average DC voltage, but has no effect on the instantaneous voltage.

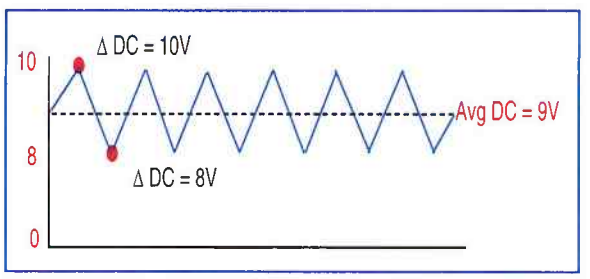


Fig. 5: The instantaneous voltage may be above or below the average DC voltage when you add an AC signal to a DC level.

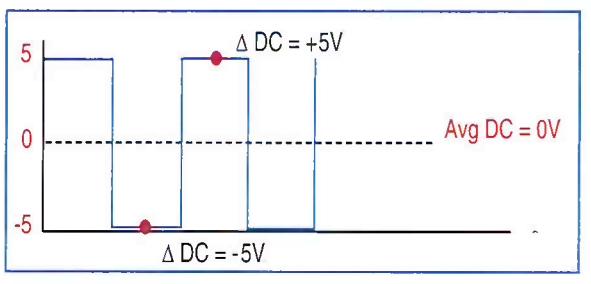


Fig. 6: Depending on the waveform, the instantaneous DC voltages may have different polarities.

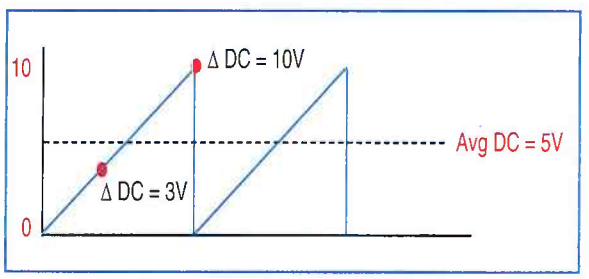


Fig. 7: Waveforms other than square waves have numerous instantaneous DC voltage values.

As Fig. 6 illustrates, a waveform may vary above and below a DC ground reference. When this occurs, the average DC may actually equal zero, and the instantaneous voltages may be different polarities. Of course when the waveform is something other than a squarewave, there will be numerous instantaneous DC voltage values, as Fig. 7 illustrates.

Using The "AUTO TRACKER's" Delta DC Function

Now that you have a good understanding of instantaneous DC voltage, let's take a look at how the SC3100 "AUTO TRACKER" Automatic 100 MHz Waveform & Circuit Analyzer makes this all-important measurement.

To measure the instantaneous DC voltage of any point on a waveform, you use the "AUTO TRACKER's" DELTA DCV function. Press the "Delta DCV" button for either channel A or B, and an intensified spot called the "Delta Marker" appears on the CRT trace(s). You can position the "Delta Marker" anywhere on the waveform using the Delta Marker "END/DELTA DCV" control. The "AUTO TRACKER" automatically locates the DC ground or zero reference point of the waveform, then displays the instantaneous voltage level from the Delta Marker to the ground reference on the digital LCD display.

As with the SC3100's Auto-Tracking DC measurement, the Delta DC measurements are faster and many times more accurate than measurements made using the CRT. Both measurements are made independent of the CRT circuits. This means that the INPUT COUPLING switch can be set to either "AC" or "DC", and the vertical vernier control does not need to be set to "CAL" for accurate readings.

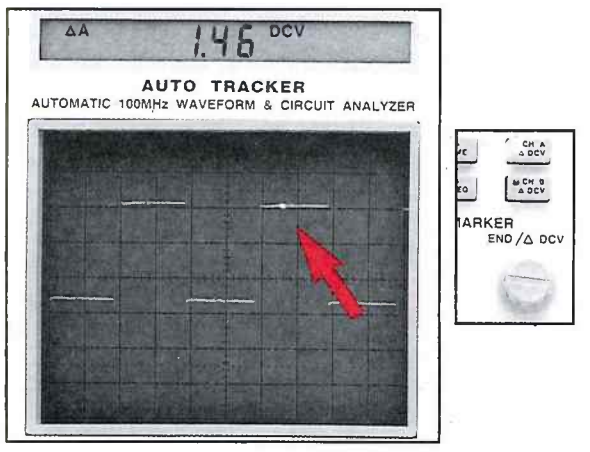
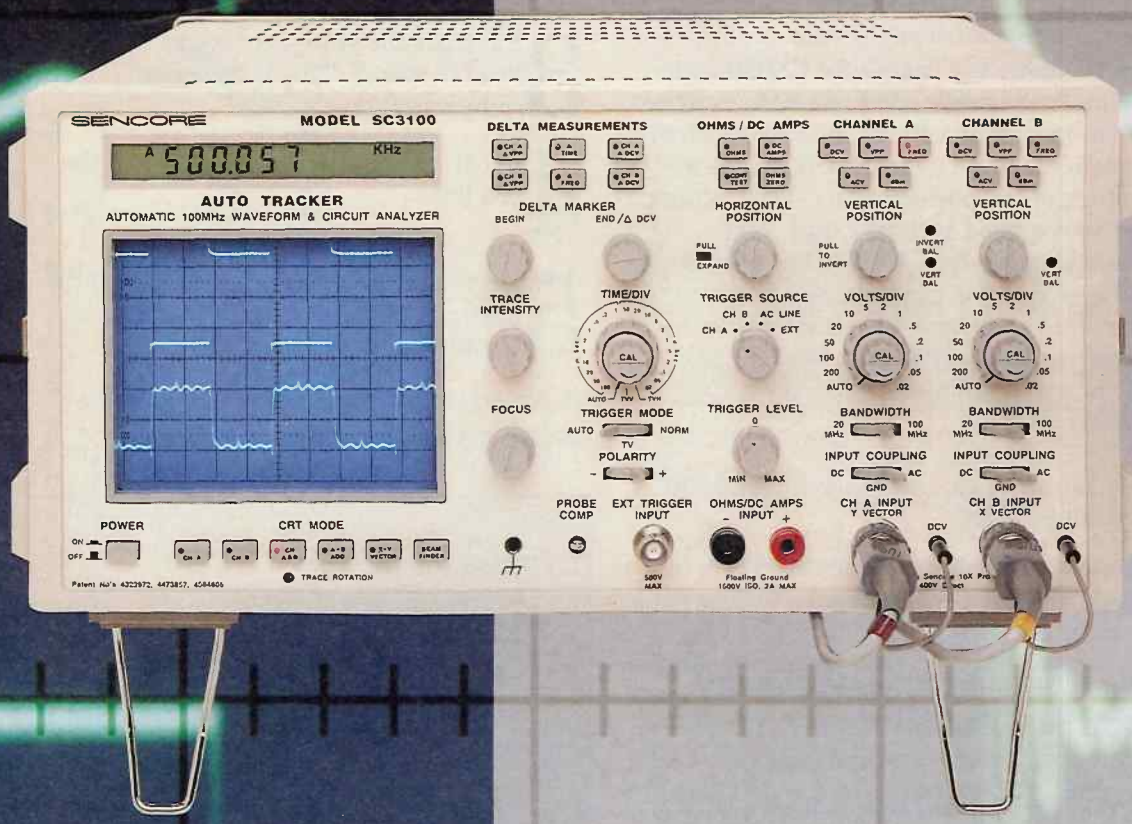


Fig. 8: Use the "AUTO TRACKER's" Delta DCV function to measure the instantaneous DC voltage of a specific point on the waveform.

"AUTO TRACKER"™

The Only Waveform & Circuit Analyzer

NEW!



In A Nutshell, Here's What The "AUTO TRACKER"™ Offers You!

- A complete waveform and circuit analyzing system in one instrument
- Auto-Tracking™ digital readout of voltage and frequency with one probe connection
- Integrated measurements of all circuit parameters for fast analyzing answers
- Full performance, 100 MHz dual trace oscilloscope
- Exclusive autoranged timebase and vertical attenuators eliminate wasted time
- Digital delta measurements to analyze every portion of any waveform
- All functions microprocessor integrated for ease of use

Exclusive:

- ***Autoranging timebase***
- ***Autoranging attenuators***
- ***Integrated current & ohms measurements***

SC3100 "AUTO TRACKER"™ Automatic 100 MHz Waveform & Circuit Analyzer

Only the SC3100 "AUTO TRACKER"™ provides virtually hands-free digitally accurate waveform and circuit analyzing.

If you feel like something has been missing from your service bench, then maybe you're needing a waveform and circuit analyzer. Only the SC3100 "AUTO TRACKER" allows you to touch and test any circuit test point and make autoranged, error free measurements in a fraction of the time you now take.

TECH CHOICE SYSTEM

The SC3100 is the only analyzer that guarantees an increase in technician efficiency and bottom-line profits for your business. But we'll let you prove it to yourself. Simply call Sencore and request a waveform and circuit analyzing package. The package is free and could prove to be one of the best business decisions you'll make this year.

Call 1-800-SENCORE, Today!

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SENCORE
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Direct (605) 339-0100 Fax (605) 339-0317

To use the "AUTO TRACKER's" Delta DC function:

1 Adjust the VOLTS/DIV control to display the waveform with sufficient vertical detail.

2 Press the channel A or B DELTA DCV button, corresponding to the waveform which you want to measure.

3 Adjust the "END/DELTA DCV" control to place the Delta Marker at the waveform point to be measured.

4 Read the instantaneous voltage level on the "AUTO TRACKER's" digital display.

The resultant digital reading indicates the DC level at that specific point in the waveform. The "AUTO TRACKER" confirms the logic high and low levels for quick and easy troubleshooting.

Where Do I Use Delta DC?

The Delta DC function has numerous applications. We'll discuss two different types of uses to give you an idea of the versatility of the Delta DC function. Anytime you find yourself selecting DC Input Coupling to determine a trigger point or DC level, or counting graticules to determine the relative level difference between two points on a waveform, you have an application for the "AUTO TRACKER's" Delta DC volts function.

Using Delta DC To Determine Logic Levels

A typical application of the SC3100's Delta DC function is to confirm logic levels, such as confirming the output level of a VCR sensor or the input and output levels of digital ICs. The digital logic "high" and logic "low" levels must be correct, or the circuit will confuse one level for the other. A questionable area exists where the digital circuits cannot determine if the signal is a high level or a logic low level. This questionable area depends upon the type of logic family.

The most common logic families are TTL and ECL. Figure 9 shows the logic low, high, and questionable areas for the TTL digital logic family. TTL circuits operate with a supply voltage of 5 volts and have a questionable area from 0.8 to 2.8 volts. Levels that are .8 volts or less are a low, while levels 2.8 volts and higher are a high.

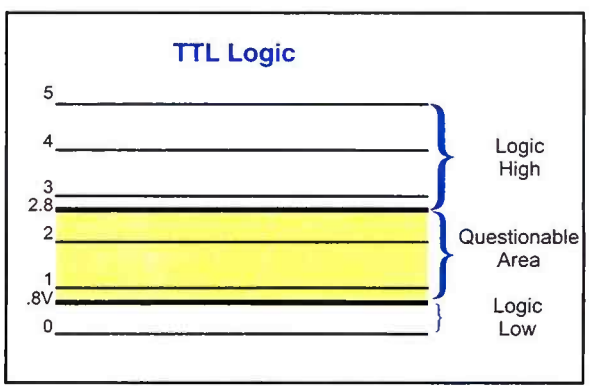


Fig. 9: Logic high and logic low voltage levels for TTL.

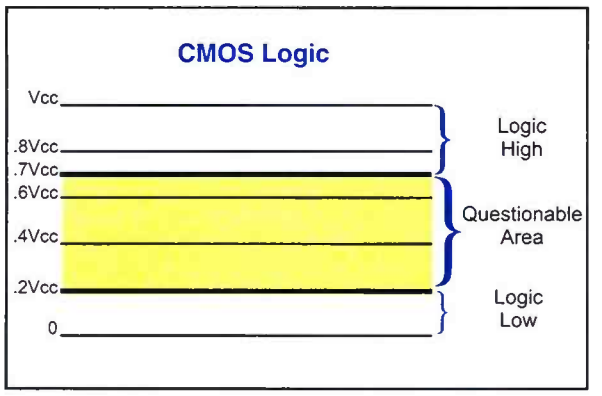


Fig. 10: Logic high and logic low voltage levels for CMOS are based on the supply voltage.

Figure 10 shows the ranges for CMOS logic. CMOS devices operate over a specific range of the power supply voltage. Because of this, the questionable area for CMOS logic is a percentage of the power supply (Vcc) voltage, rather than a fixed voltage range. The questionable area for CMOS is between 20% and 70% of Vcc. For example, the questionable area for a 10 volt supply is between two and seven volts. Logic high is seven volts or higher, and logic low is two volts and less.

To determine a logic level with the SC3100 "AUTO TRACKER":

1 Lock the waveform on the "AUTO TRACKER's" CRT.

2 Set the TIME/DIV and VOLTS/DIV controls to display the entire waveform.

3 Press the channel A or B "Delta DCV" button for the channel corresponding to the signal to be measured.

4 Adjust the END/DELTA DCV control to position the DC marker at the logic low or logic high point.

5 Confirm that the voltage displayed in the digital readout matches the logic level for the corresponding logic family.

Using Delta DC to Determine Relative Level Differences

Another application example of the SC3100's Delta DC function is to determine the difference in levels between two portions of a waveform. We'll use the alignment procedure for a camcorder, shown in Fig. 11, as an example.

This alignment procedure requires that you adjust the average DC levels of the green and red waveform portions for a 0.9 to 3 ratio. Because you need to set the ratio of the DC levels rather than the amplitudes, the Delta PPV function will not help in this situation.

Unless you have the "AUTO TRACKER's" Delta DC function, you will need to DC couple the input to your oscilloscope, and manually set the VOLTS/DIV and vernier controls. Next you must carefully count the number of graticules from the center of each level to ground and subtract the result. The Delta DC function speeds up this procedure and gives you a much more accurate result.

Here's how to make this measurement with the SC3100 "AUTO TRACKER":

1 Press the "DELTA DC" button and set the Delta Bar to the center of the black level. Note the instantaneous DC of the black level (keep in mind this level may not be zero).

2 Set the Delta Bar to the center of the green level.

3 Subtract the voltage in step 1 from the level in step 2. This is the green comparison level.

4 Set the Delta Bar to the center of the red level.

5 Subtract the voltage in step 1 from the level in step 4. This is the red comparison level.

Now you simply adjust the circuit for the proper ratio between the two levels.

Matrix Adjustment
[Adjustment procedure]
1.) Confirm that white balance is in INDOOR mode (CN702 pin ① (WB INDR) is low, pin ② (WB AUTO) is high).
2.) Adjust "green" and "red" levels to 0.9 : 3.0 with CP-19 board RV002.

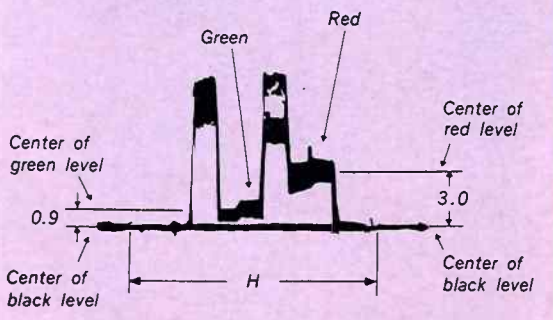
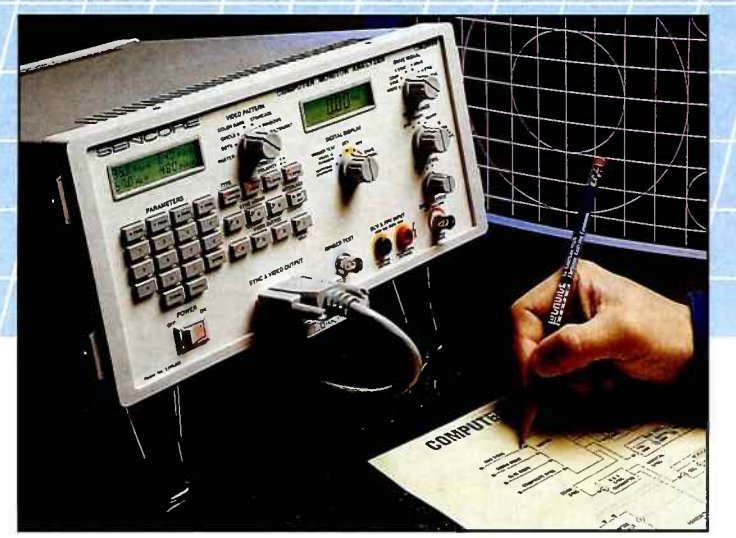


Fig. 11: The Delta DC function allows you to quickly and accurately make the measurement needed for this camcorder adjustment.

Invest In The "AUTO TRACKER"

The SC3100's ease-of-use is unmatched by any other instrument. All measurements are based on digital circuits, not the analog CRT. This means fast, easy, and accurate readings. There are no hidden menus, no multiple function buttons, no complicated setups, and no confusing on-screen displays. Just push a button and read the results on the LCD display.

If you'd like to learn more about the SC3100 "AUTO TRACKER", call your Area Sales Representative toll-free at **1-800-SENCORE.** If you'd like more proof, we can arrange for you to try an "AUTO TRACKER" on your bench – risk free. Give us a call today. ■



Analyzing Computer Monitors From The Input To The CRT

By Stan Warner, Application Engineer

Turning profits in computer monitor servicing is tough business. Yet the potential is tremendous. We use computers (and computer monitors) in nearly every facet of our daily lives. Expanding your business into computer monitor servicing expands your service offering beyond consumer electronics repair into the profitable school, hospital, and industrial markets.

The CM2000 Computer Monitor Analyzer is designed exclusively for complete computer monitor servicing. It is much more than just a signal source for producing a pattern on the CRT. The CM2000 provides you with features and tests for troubleshooting in every section of the monitor.

This article starts at the input connector of a computer monitor and works toward the CRT, showing the tests that can be done to troubleshoot each section. The descriptions don't give the complete troubleshooting procedure (found in the CM2000 manual and Sencore Tech Tips), but rather a synopsis of the tests you could perform if you had a CM2000 on your bench.

Matching Computer Monitor Input Parameters

The CM2000 Computer Monitor Analyzer has a fully programmable sync and pixel generator that lets you match the input requirements of the computer monitor under test. Full programmability lets you test and troubleshoot the high resolution computer monitors on the market today, plus any new formats introduced in the future (new computer graphics standards come onto the market every couple of years).

The CM2000 generates signals for both analog and digital computer monitors. The video, and horizontal and sync polarities can be set to either positive or negative. The CM2000 generates the non-interlaced signal required by most computer monitors and the interlaced signal. Composite sync can be added to any of the video lines.

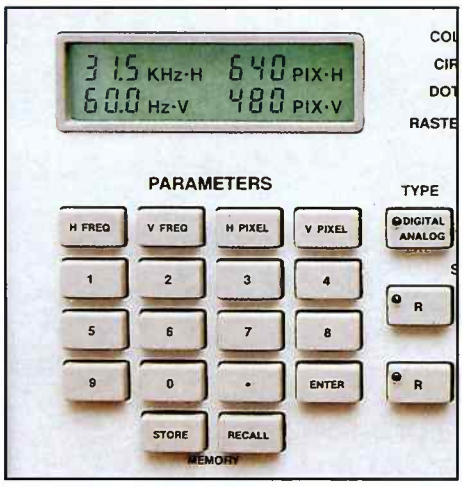


Fig. 2: The sync and pixel rates are programmable to match the monitor's input requirements.

The CM2000 has storage locations for the most common computer monitor types. So instead of having to program in each signal parameter you can quickly recall the setup you want and start testing.

Isolate Video Amplifier And Driver Problems

The video circuits stretch all the way from the input connector to the CRT. These stages establish the correct DC for biasing the tube and amplify the applied signal to drive the CRT.

Video circuit problems include a complete loss of video, missing colors, and weak video and poor frequency response. Most video problems can be effectively isolated using signal substitution. Signal substitution lets you inject a "known good" video signal into the video circuits from the first preamplifier to the CRT drivers.

Example: Missing red video.
Inject the CM2000's VIDEO drive signal at the input of the red output amplifier (TP 12 in Fig. 3). If the missing color returns or the output improves, you are injecting after the

Troubleshoot A Computer Monitor From The Input Connector To The CRT With The CM2000

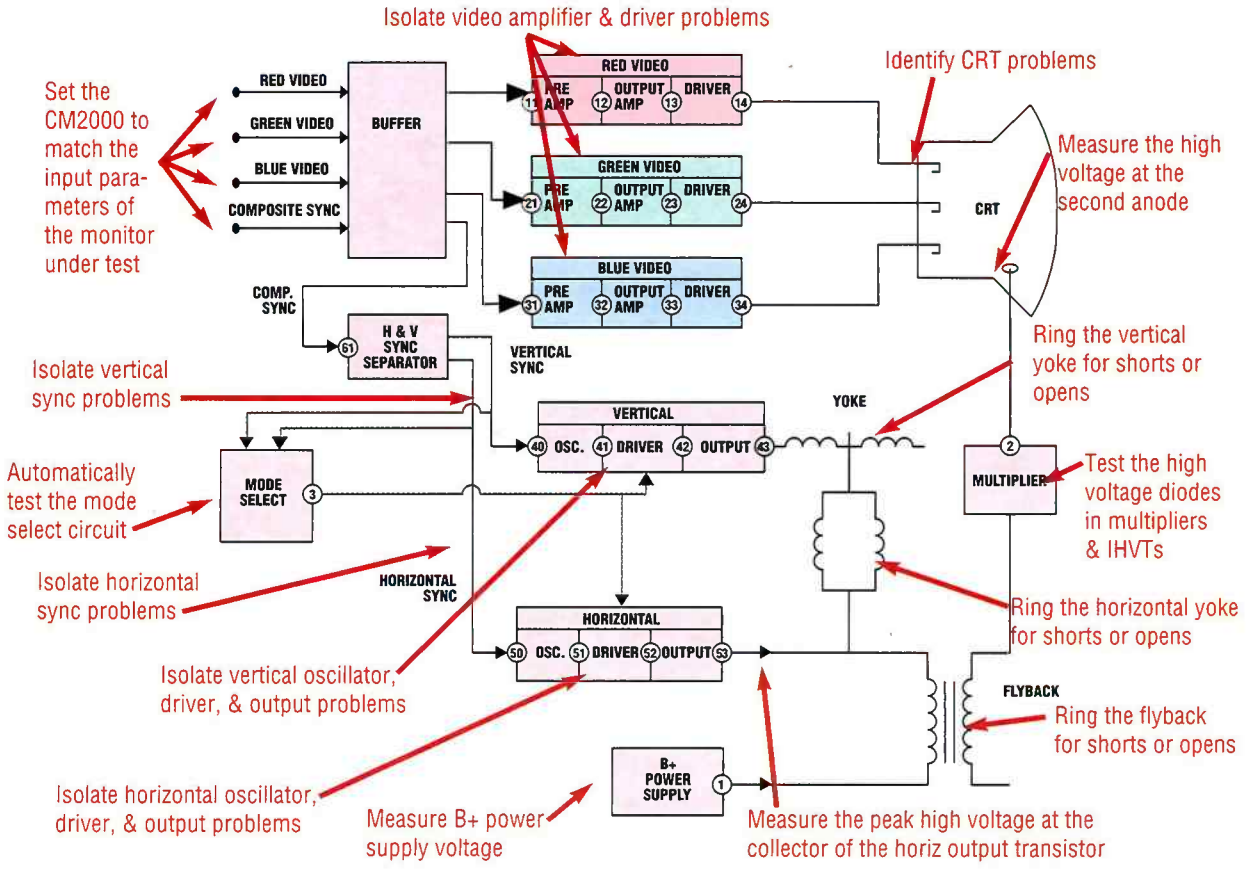


Fig. 1: The CM2000 has all the features and tests necessary for computer monitor analyzing from the input to the CRT.

Computer Monitor Analyzing & Troubleshooting

Are you looking for a new way to analyze and troubleshoot computer monitors? Would you like to have one complete, yet easy to use instrument that guarantees you'll be able to repair monitors faster and with higher profits?

If you're reading this, then you've probably answered "yes" to these service questions, and are looking for answers. The CM2000 Computer Monitor Analyzer is the instrument for your servicing needs. That's because the CM2000 provides:

- A complete, easy-to-use, high resolution computer monitor analyzer
- A fully programmable sync and pixel generator
- An innovative performance testing pattern generator
- A special sync-locked signal substituter
- A patented "Ringer" test to dynamically analyze all:
  - Yokes
  - Integrated high voltage transformers (IHVTs)
  - Switching transformers
- An integrated 2,000 VDC and PPV meter
- An exclusive "hook-up" adapter design for all popular monitors
- A portable troubleshooter for all your field service needs

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problem meaning the circuits from the injection point to the CRT are working. Move back one stage and inject at the input of the red pre-amplifier (TP 11).

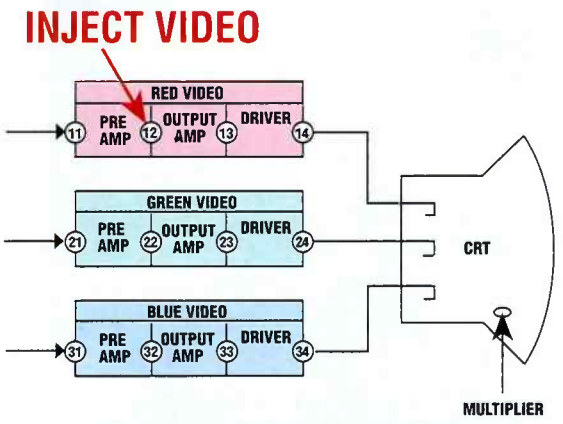


Fig. 3: Inject the CM2000's VIDEO drive signal into the video circuits.

But, if the same problem remains unchanged after you make the first injection at TP 12, you are injecting before the problem. Move forward one stage and inject into the driver input (TP 13).

Automatically Test The Mode Select Circuit

Most video graphics standards have several modes. For example, VGA has three standards (see Fig. 4). The scan frequencies remain the same, but the horizontal and vertical pixels and vertical scan frequencies change. Text applications use the higher resolution modes while graphics applications use the lower.

Mode	Horizontal Resolution	Vertical Resolution (Pixels)	Horiz. Sync Polarity	Vert. Sync Polarity
(1) VGA	640	350	(+)	(–)
(2) VGA	720	400	(–)	(+)
(3) VGA	640	480	(–)	(–)

Fig. 4: Standards for the three VGA modes.

The mode select circuit in a computer monitor controls the flow of current to the horizontal and vertical drive circuit to produce a full sized raster in all operating modes. The mode select circuit detects the operating mode by sensing the polarity of the horizontal and vertical sync pulses.

Example: The display on a VGA monitor looks okay in one mode and scrunched and distorted in another.
Recall each VGA mode stored in the CM2000's memory locations. Monitor the output of the mode select circuit with the CM2000's DVM. Watch for the correct voltage levels as you switch between modes. If the voltage is "stuck" in one level, you may have a faulty mode select circuit.

Once you have the problem repaired, adjust the monitor's raster size and linearity controls so the raster is the proper size in each mode.

Isolating Vertical Sync Problems

Monitors have one of three sync schemes: 1) separate vertical and horizontal sync inputs; 2) a vertical and horizontal composite sync input; and 3) a video line with vertical and horizontal composite sync (usually green). The most common sync scheme uses separate horizontal and vertical sync inputs. The vertical sync signal fed to a monitor is responsible for synchronizing the vertical oscillator to the incoming video signal.

Example: Loss of vertical sync.
Inject the CM2000's VERTICAL SYNC drive signal into the input of the vertical oscillator (TP 40 in Fig. 5). If vertical sync returns after you've made the injection, you've proven the oscillator circuit is working. Troubleshoot the vertical sync path back toward the input. Also check the wiring of the monitor connector and cable.

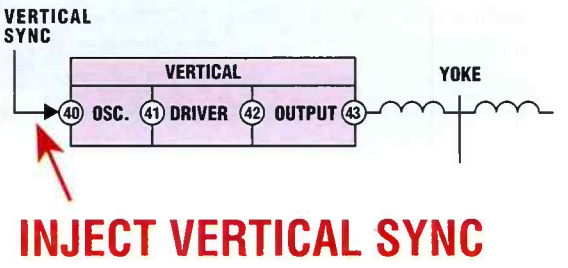


Fig. 5: Inject the VERTICAL SYNC signal into the vertical sync path. If the same symptom returns, troubleshoot the vertical oscillator, driver, or output stage.

Isolating Vertical Oscillator, Driver, And Output Problems

The vertical driver and output stages amplify the oscillator signal and provide the current drive needed for the vertical deflection yokes. A defective driver, output, or yoke can cause loss of deflection, reduced height, or vertical non-linearity.

Before you use signal injection to troubleshoot a vertical problem, use the CM2000's DVM to confirm the proper bias on the vertical output components. The vertical stages are usually DC coupled to get good linearity. A wrong DC voltage affects all the components in the oscillator, driver, and output stages. A DC bias problem must be repaired before you can effectively use signal injection.

Example: Collapsed vertical raster (thin horizontal line across the display).
Inject the CM2000's VERTICAL DRIVE signal into the output of the vertical driver circuit (TP 42 in Fig. 6).

NOTE: Injecting into the vertical stages won't always produce full vertical deflection because most of the signals are uniquely shaped by feedback loops and waveshaping circuits.

Look for the sweep to expand (remember it may not be a full raster). If the sweep expands, either partially or fully, the circuits

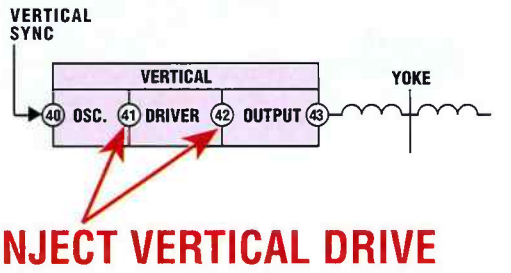


Fig. 6: Inject the VERTICAL DRIVE signal into the vertical driver and output stages.

from the injection point to the output are good. If the sweep doesn't expand, check the output components or ring the deflection yoke.

NOTE: The VERTICAL DRIVE signal is not designed to drive the vertical yoke.

Isolating Horizontal Sync Problems

The horizontal sync pulses control the timing of the horizontal oscillator. Many monitors receive horizontal sync directly. Other monitors have a composite sync, or "sync on video" input and require the use of sync separators. Sync pulses that are low in amplitude, the wrong frequency, or are missing cause the monitor to lose horizontal hold.

Example: Loss of horizontal sync.
Inject the CM2000's HORIZONTAL SYNC drive signal into the input of the horizontal oscillator (TP 50 in Fig. 7).

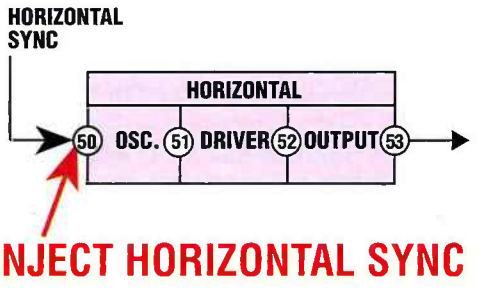


Fig. 7: Inject the HORIZONTAL SYNC signal into the horizontal sync path.

If the monitor regains horizontal hold and gives full horizontal deflection, the driver and output stages work properly. Troubleshoot the horizontal sync path. If the monitor displays the same symptoms with the drive signal applied, troubleshoot the horizontal oscillator circuit.

Ringing Horizontal And Vertical Yokes For Shorts Or Opens

The changing current through the windings of the deflection yoke produces a magnetic field that scans the electron beam across the face of the CRT. Yokes often develop shorted or open windings causing reduced vertical or horizontal raster size, or a complete loss of deflection.

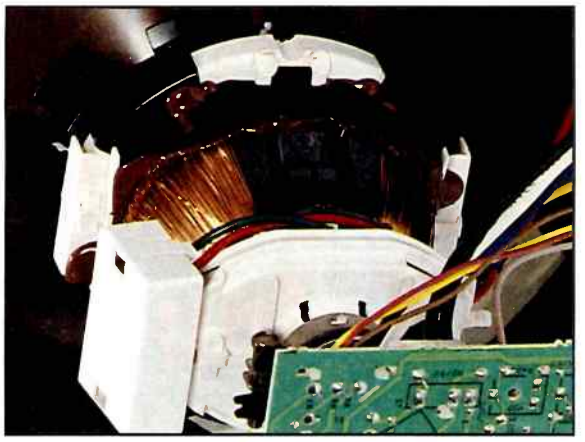


Fig. 8: The "Ringer" test finds open and shorted windings on horizontal and vertical yokes.

The CM2000 "Ringer" Test will find defective yokes, even single shorted turns. Readings of 10 rings or more are accompanied by a "GOOD" display that indicates the winding does not have a shorted turn. "BAD" readings, less than 10 rings, indicate a shorted turn.

Example: Collapsed raster.
Ring the horizontal and vertical yoke windings. Always unhook the yoke from the circuit and unsolder any damping resistors (leave the yoke mounted on the CRT).

If the horizontal and vertical yoke windings ring above 10 rings, the yoke is good. If any of the sections ring below 10, the yoke is bad and needs to be replaced.

Measuring Voltages At The Horizontal Output Transistor's Collector

A wealth of troubleshooting information can be gained about the monitor's operation by measuring the DC and peak-to-peak voltage at the collector of the horizontal output transistor. The CM2000 has a DC and peak-to-peak digital voltmeter with the input protection necessary for measuring signals at this test point. The DC reading tells you if the B+ supply is working correctly, while the peak-to-peak reading tells you if the output circuits are creating the needed high voltage.

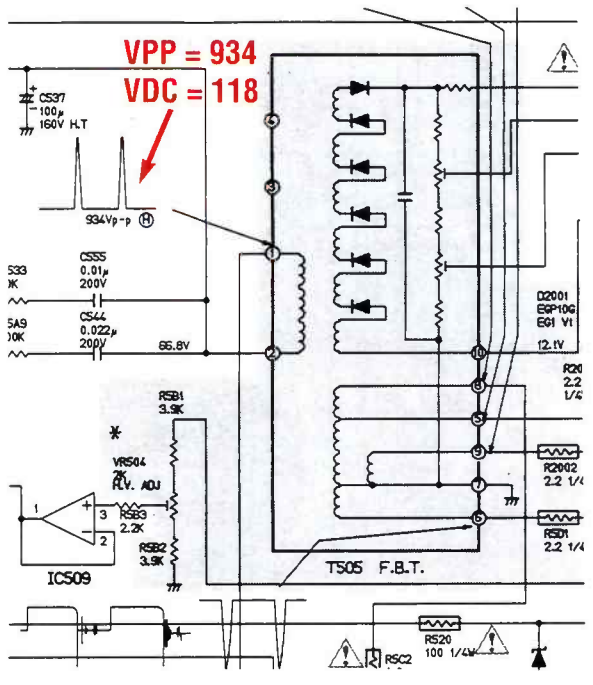


Fig. 9: The CM2000's DVM has the input protection needed to measure the pulse at the horizontal output collector.

Example: Dead monitor #1.
Measure the DC voltage at the collector of the horizontal output transistor with the CM2000. If the B+ voltage is low or missing, unload the power supply by disconnecting the collector of the horizontal output transistor from the circuit. Measure the voltage at the output of the power supply regulator again. If the voltage is still low or missing, troubleshoot the power supply. If the voltage goes to its schematic value, something is loading down the supply. Troubleshoot the output transistor, flyback, or yoke.

Ringing The Flyback For Shorts Or Opens

The flyback transformer in a computer monitor is responsible for creating the focus and high voltage signals along with other scan derived power supply voltages. The flyback is a high failure component in the computer monitor, and also one of the most expensive.

While an open transformer winding is easy to identify using an ohmmeter; a shorted transformer winding (which is more common) is nearly impossible to find using conventional testing methods. The CM2000 has a patented "Ringer" test that gives you an easy to use fail-safe method of finding opens and shorts in flyback transformers.

Example: Dead monitor #2.
Connect the CM2000 across the flyback's primary winding and "Ring" the transformer. A "GOOD" reading of 10 rings or more means that none of the windings in the flyback are shorted. You do not need to ring any other winding. A shorted turn in any other winding will cause the primary to ring bad.

A "BAD" reading, less than 10 rings, may be caused by a circuit connected to the flyback

that is loading the "Ringer" test. Disconnect the most likely circuits in the following order: 1) yoke; 2) CRT filament (unplug the CRT socket); 3) HOT collector; 4) scan derived supplies. Retest the flyback after you disconnect each circuit. If the flyback now rings "GOOD", it does not have a shorted winding. If the flyback still tests bad after you've disconnected each circuit, unsolder it and completely remove it from the circuit. If the flyback primary still rings less than 10, the flyback is bad and must be replaced.

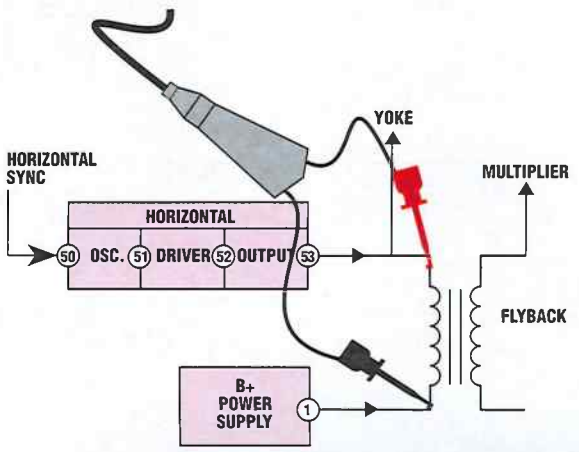


Fig. 10: The CM2000 "Ringer" test finds shorts and opens in flyback transformer windings.

Testing Multipliers And IHVTs

During normal monitor operation, a large pulse appears at the collector of the horizontal output transistor. The output connects to the primary of the flyback transformer so the pulses are induced into the flyback's secondary. The pulses are stepped up and rectified to produce the focus and high voltage signals. The voltage pulses are rectified by high voltage diodes contained in the flyback or in a stand-alone multiplier package.

Because these are high voltage components, it is often difficult to dynamically determine if the diodes will break down under high voltage conditions. The CM2000 has a special test for determining if these diodes are good or bad.

Example: Low or no high voltage (monitor has an IHVT).

NOTE: It is only necessary to do this test if all the following conditions are met: 1) Symptom is low or missing high voltage or focus voltage 2) The B+ and PPV voltages at the horizontal output transistor are normal. 3) The flyback passes the "Ringer" test.

Inject a 25 VPP HORIZONTAL SYNC drive signal into the primary winding of the flyback transformer with the CM2000. The step up action of the transformer and the high voltage diodes should create a DC voltage between the second anode and high voltage resupply pin on the flyback. Measure this voltage with the CM2000's DC voltmeter. Look up this voltage on the CM2000's reference chart to determine if the high voltage diodes are good or bad.

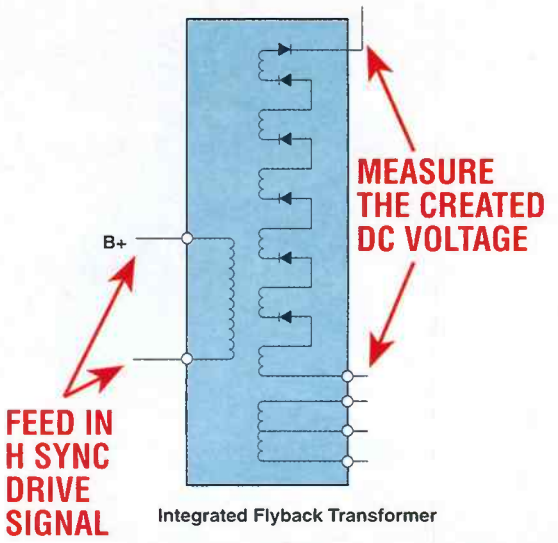


Fig. 11: To test the multiplier diodes, inject the CM2000 drive signal into the primary and monitor the DC voltage across the secondary.

Isolating Horizontal Oscillator, Driver, And Output Problems

If the horizontal yoke, flyback, multiplier, horizontal output transistor, and B+ supply have tested good, but the monitor still lacks deflection or high voltage, the horizontal driver circuit may be defective. A missing or reduced-amplitude horizontal drive signal could prevent the computer monitor from starting up and operating properly. Use the CM2000's HORIZONTAL DRIVE signal to isolate problems in the horizontal drive circuit.

NOTE: Before injecting into the horizontal drive circuit, test the flyback, yoke, high voltage multiplier, the horizontal output transistor, and the B+ supply.

Example: Computer monitor won't start up.

Inject the CM2000's HORIZONTAL DRIVE signal into the driver circuit. Watch for horizontal deflection on the CRT. If deflection returns, you are injecting after the defective stage. If nothing happens, inject the HORIZONTAL DRIVE signal at the base of the horizontal output transistor (TP 52 in Fig. 12).

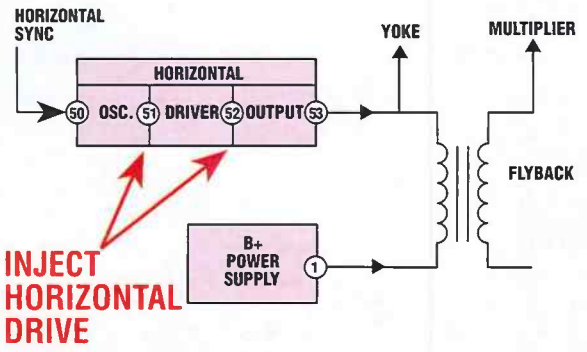


Fig. 12: Inject the HORIZONTAL DRIVE signal into the horizontal driver and output stages.

NOTE: When injecting at the output transistor, disconnect the secondary winding of the driver transformer from the base.

Measuring High Voltage

The CRT requires a very high DC voltage to accelerate the electrons toward the screen. This voltage develops in the secondary winding of the flyback transformer and is amplified and rectified by the integrated diodes in the flyback, or by a separate multiplier circuit.

Measuring the high voltage at the second anode of the CRT lets you know if the output circuit, flyback, high voltage multiplier, and power supply regulation circuits are working correctly. Additionally, some monitors have adjustments to set the high voltage and/or focus voltage.

Example: Dim, bloomed picture.

Measure the high voltage with the CM2000's DC voltmeter and the HP200 high voltage probe. Compare the voltage reading to that shown in the schematic.

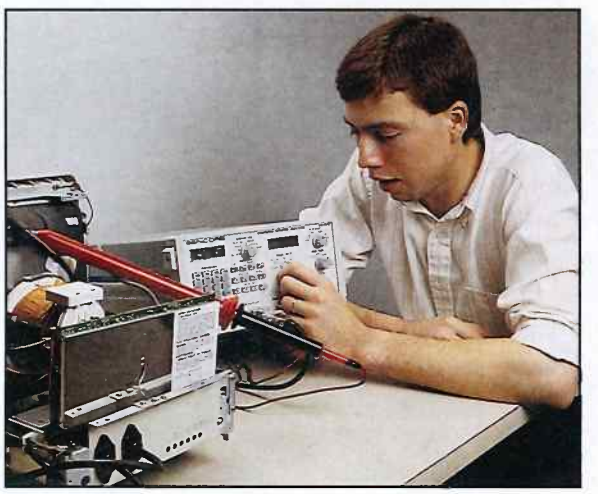
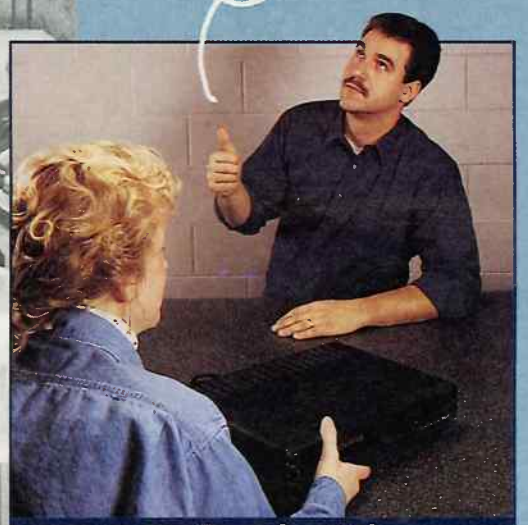


Fig. 13: Measuring high voltage with the CM2000 and the HP200 high voltage probe.

Are You Ready For More Profits?

The potential is tremendous for turning profits in computer monitor servicing. With the CM2000 Computer Monitor Analyzer, you'll have all the features and tests necessary for computer monitor servicing in one complete, easy-to-use instrument. To find out more about how the CM2000 can help you troubleshoot today's computer monitors, call **1-800-SENCORE**. Your Area Sales Representative can help put a CM2000 on your bench today so you can take advantage of a growing service opportunity. ■

Business Is Not A Game Of Chance!



Heads → Servos?
Tails → Video?

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All too often a servicer is forced to place the profits on the line based solely on the flip of a coin or an educated guess. What happens to your productivity when you go down the wrong circuit, or spend time diagnosing the heads when the servos aren't tracking correctly? You lose the gamble, right?

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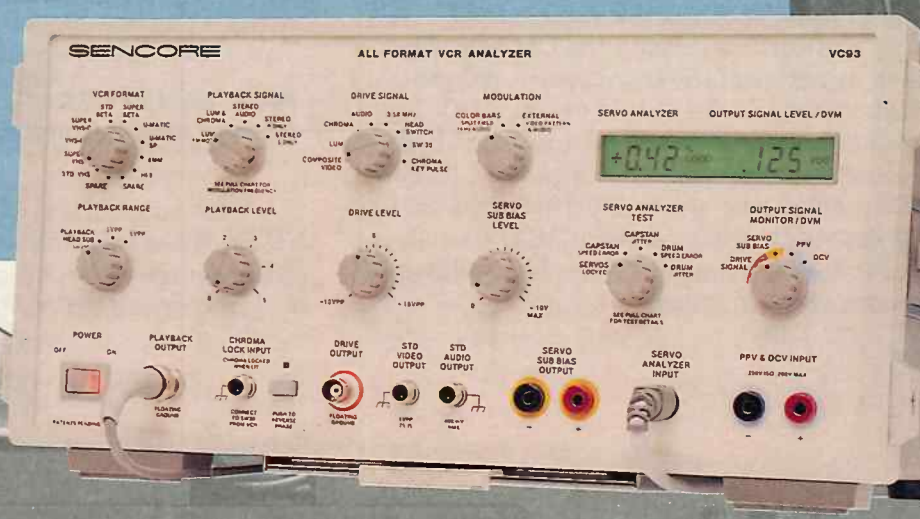

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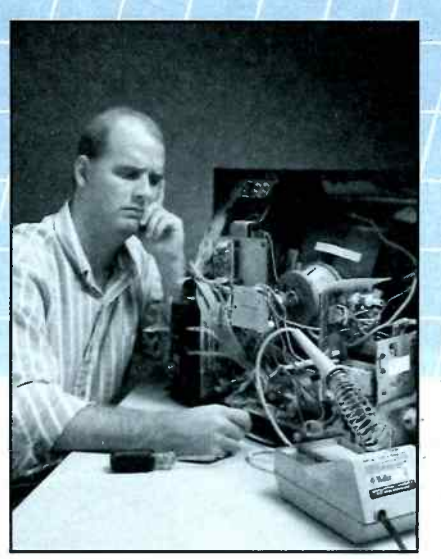


Are You Positive? Or Are You Playing the Hit & Miss Game?

By Rick Mull, Sales Manager

Let's set the stage.....
A customer walks into your service center and sets a dead TV or a snowy pictured VCR on your counter. The first words out of your customer's mouth are, "How much do you think this is going to cost me to have it repaired?"

How many times have you heard these words? If you answered many, you are not alone. Many of the servicers that we've talked to at our Tech Schools have agreed they are confronted with this scenario almost daily. Do you hear this in your service center?

What thoughts do you have when you hear those words?

First of all, you haven't even had a chance to confirm the defect. How can you give an accurate estimate without at least looking at it first? Secondly, if your customer is worried this soon about how much the repair will cost, there's a good chance that the customer may not want to put much money into the repair. Would you agree?

Let's take it one step further. You proceed to tell your customer that before you can determine what the repair will cost, you must take a look at it so you can give an accurate estimate. Your customer's mouth opens and you hear another set of commonly spoken words, "Before you get too deep into the repair, I just want you to know that I don't want to spend more than $80 to $90 for the repair."

Fig. 1: Servicers run the risk of losing repair jobs if the estimate is too high.

As your heart sinks, what now goes through your mind?

If your customer brought a dead set to you, the defect could range from a 25 cent capacitor to a $90 IHVT (integrated high voltage transformer). If the customer brought you a snowy pictured VCR, the defect could be the video heads which could run as high as $120. Both of these cases would exceed what your customer wanted to spend.

Now you must decide what to do. Do you spend the time necessary to find the defect and possibly risk your customer saying "no" to the estimate which means losing the time you put into it. Or, do you estimate high right from the beginning, save the time of checking it out, and hope the customer says, "Go ahead and fix it." Either way, you're taking a large potential risk.

If you've taken the time to give the estimate, and it turns out to be more than the customer wants to spend, you have wasted valuable time. Of course, you could charge for estimates, but this charge merely helps you come close to break-even by taking care of the time you spent on the estimate. Am I right? At this point you may find yourself asking the question,"Am I in business to break even, or to make a profit?"

If you give a high estimate at the beginning, you run the risk of having your customer say "no" and walking out of your service center with a possibly profitable repair in their hands. But how could this repair possibly be profitable? What if the defect was just a 25 cent part!

If you find yourself frustrated with a scenario such as we've mentioned, you are not alone.

If there were a way that you could decrease a great deal of the frustration that you experience with giving estimates and at the same time have the opportunity to increase your bottom line profits anywhere from a possible 20-50%, would that be of interest to you? If so.....read on!

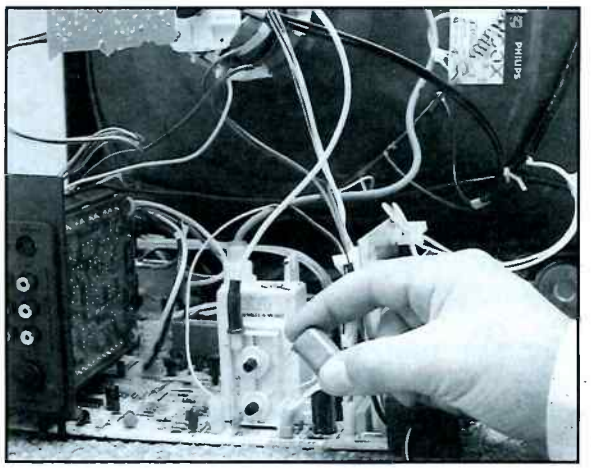


Fig. 2: A $90 IHVT and a 25 cent capacitor can give you the same symptoms on a TV. You need a way to identify the defect before you put a high estimate on the set.

What Would You Do With An Extra $11,700 Per Year?

Remember that last TV or VCR the customer said "no" to your estimate? Do you remember what you gave for an estimate? Are you 100% proof positive the estimate was accurate? Are you sure your customer didn't go to another service center for another opinion? Have you ever second-guessed your own estimate after the customer turned it down?

Most servicers we've talked to tell us that it is not uncommon to have two or three rejections on estimates each week. Think about this for a minute. If you experience just three rejections each week, you could be turning away a large amount of revenue. In fact, here's the amount of profits that could be walking out your door each year:

$11,700

That's right! According to NESDA (National Electronics Service Dealers Association) and their yearly survey, the average invoice for a TV or VCR repair is $75. Based on this average and three rejections per week, that's a possible $225 worth of repairs being sent away unrepaired each week. This represents $11,700 of possible service income each year. What would you do with an extra $11,700 of income each year?

Profitable Or Not Profitable, That Is The Question

When customers receive an estimate they feel is too high, they often reply, "I'll just buy a new one." Have you wondered how many customers actually purchase a new TV or VCR because of the estimate? And what happens to a TV or VCR after it leaves your service center?

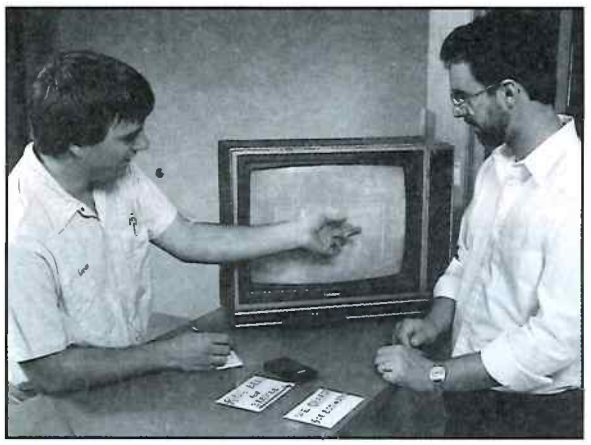


Fig. 3: What happens to the rejected, high estimate set that is taken to the service center down the street for a second estimate?

How many times have you had a customer bring a TV or VCR into your service center and tell you they already had an estimate done at another shop and they wanted you to give them a second opinion? How many of those were you able to repair? The question you must ask yourself at this point is, how do you know for sure that the unrepaired estimates that leave your service center haven't gone to another service center for a second opinion?

The bottom line result that you need to determine is: **WILL THIS REPAIR BE PROFITABLE?** This decision needs to be confirmed in the least amount of time possible, wouldn't you agree?

Sencore understands what you're up against, and we're here to help you overcome those "profit-eaters" and turn them into "profit-generators." We've listened to your concerns and asked you what we can do to help you become more profitable. Because of the input you gave to Sencore, we are proud to introduce the system that you helped design - the "Tech Choice System."

The "Tech Choice System"

The "Tech Choice System" was designed by technicians for technicians. This system offers complete troubleshooting from the input of any television or VCR all the way through the output stages. The divide-and-conquer technique (also known as functional analyzing or signal substitution) is time-proven to be the most effective trouble-shooting method used today. The "Tech Choice System" gives you all the tools and techniques necessary for fast and profitable servicing. In a nutshell, here is what the Tech Choice System offers you:

TECH CHOICE SYSTEM

SERVICING plus

LC102 "AUTO-Z"™

Capacitor & Inductor Analyzer

Five Patents - Only From Sencore!

The Only Dynamic, Portable, Automatic, Capacitor/Inductor Analyzer Guaranteed To Help You Quickly Find All Defective Capacitors And Inductors That Other Testers Miss, Anywhere, Without Calculations, Look-Up Tables, Or Error!

The LC102 AUTO-Z brings speed, reliability, and extended ranges to cap/coil testing. Advanced digital technology allows you to completely analyze capacitors to 20 farads and inductors to 20 henries.

You simply enter the component's parameters: value, rated voltage, and tolerance. The AUTO-Z makes the readings, compares them against industry standard tables stored in memory, and displays whether the component is good or bad. With the push of a button you obtain the exact reading for value, leakage, dielectric absorption, and ESR for all capacitors. Plus, analyze inductors for value and shorts (even a single shorted turn).

- Find defective components that all other testers miss.
- Fully analyze capacitors from 1 pF to 20 farads for value, leakage (with up to 1,000 volts applied), dielectric absorption, and equivalent series resistance.
- Dynamically analyze inductors from 1 uH to 20 henries for value, opens, shorts, and even a single shorted turn.
- Dynamically analyze SCRs, triacs, high value resistors, HV diodes, and transmission lines.
- Automatically make all the tests, in both portable and bench use without confusing look-up charts or tables.

plus

What Is Dielectric Absorption?

Dielectric absorption (DA) is the inability of a capacitor to release all its stored energy, even if a dead short is applied across its leads. Some capacitors with DA may even regain a large percentage of the original charge. Dielectric absorption plays a critical role in precise circuits such as A to D converters, sample and hold circuits, and peak detecting circuits.

The LC102 "AUTO-Z" uses a patented, automatic DA test that takes just a few seconds with the push of one button. The test is microprocessor controlled and gives you a "Good/Bad" readout. Call your Area Sales Representative and ask for a free copy of Tech Tip #105 which explains dielectric absorption in detail.

The VG91 Universal Video Generator And The TVA92 TV Video Analyzer

The VG91 Universal Video Generator and the TVA92 TV Video Analyzer offer complete TV troubleshooting capabilities. With this system, you can completely analyze any TV from the input (or cable hook-up) all the way to the CRT with the highly effective and proven divide-and-conquer technique. The VG91 and TVA92 give you all the substitution signals you need to troubleshoot any NTSC TV circuit faster and more efficiently.

Here's how the system works....

You simply inject the same signal you would find at a particular test point, then watch the CRT (or listen to the speaker) to see if the original symptom has changed. If the

Fig. 4: The VG91 Universal Video Generator and TVA92 TV Video Analyzer give you all the signals you need to troubleshoot video circuits with the time proven divide-and-conquer technique.

symptom disappears, you know all the circuits past the point of injection are working properly and the defect lies between the antenna and the point of injection. You now move your point of injection halfway between the antenna and your last injection point. You continue with this procedure until you've narrowed the defect down to a single circuit.

According to a survey of Sencore test equipment owners, the results were staggering. Comparing the divide and conquer method of troubleshooting to their previous method, divide and conquer reduced their troubleshooting time by an average of 54%. That's right.....54%!

Let's take a look at how this "Tech Choice System" can help you.

Remember the customer who brought the dead set into your shop and asked you how much it was going to cost? This was also the customer who told you they didn't want to spend over $80 on the repair? Here's what you might have done.....

1) Estimated high right away because the customer didn't want to spend over $80. And you really didn't want to put a lot of time into it anyway since wasted time is wasted money.

2) You spent an hour trying to get the dead set up and operating coming to a conclusion that other items in the shop would be more profitable to repair.

3) You spent an hour trying to locate the defect by swapping out parts to see if they would eliminate the problem.

The end result of each of these scenarios was an estimate of approximately $125-150, the customer refused the estimate, and you were left wondering if the repair could have been profitable. How would you like the opportunity to determine not so much what the defect is, but if the repair would be profitable without a large investment in analyzing time?

Using the same scenario after your customer said that the repair could not go over $80, here's what you could do with your "Tech Choice System".....

Using the TVA92 TV Video Analyzer's Horizontal Output Tests, you would quickly confirm whether or not the IHVT or yoke is defective. This can be done in circuit and with the television unplugged. That's right. .....UNPLUGGED!

After these components have been confirmed either good or bad, where do you go next? If one (or more) of these expensive parts is defective, you can confidently quote an accurate estimate to your customer. But if these expensive components check out okay, the odds are stacked in your favor for a profitable repair!

This entire test can be done in less than 10 minutes. What would you rather do.....spend an hour and be no further ahead than when you started, or spend 10 minutes and know that the repair will be profitable? Again, how many repairs have walked out of your shop unrepaired but yet could have been profitable?

The VC93 All Format VCR Analyzer

For your VCR servicing needs, we offer another exclusive addition to your "Tech Choice System." The VC93 All Format VCR Analyzer along with the VG91 Universal Video Generator offer you everything you need to test and troubleshoot any VCR from the video heads all the way through the output stages. Again, like the VG91 and TVA92, the VC93 generates all the signals necessary to signal inject into any test point in any VCR format.

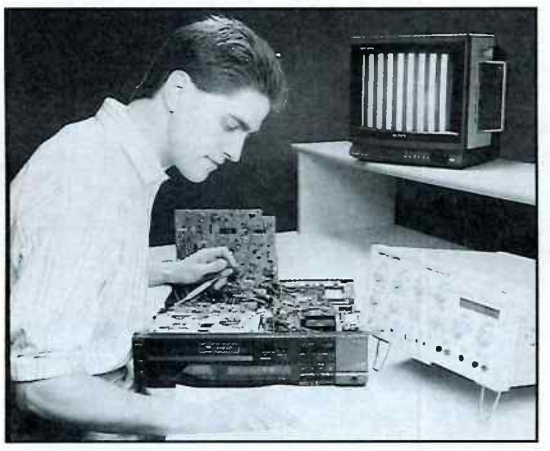


Fig. 5: Troubleshoot any VCR from the heads to the output with the exclusive VC93 All Format VCR Analyzer.

The VC93's patented servo test gives you the opportunity to perform a quick diagnosis to determine whether a defect lies in the servos or another section of the VCR. As with a television, this test allows you to confirm whether or not the VCR will be profitable - especially if your customer tells you they don't want to spend much for the repair.

The amazing part of this test is that it can be performed without even taking the cover off the VCR! Call your Sencore Area Sales Representative at **1-800-SENCORE** for more details on this test and the Tech Tip describing the test in detail.

Ready To Stop Playing The Hit And Miss Game?

Again, have you ever spent time on an estimate only to have your customer say "no" to it, and afterwards you were left with that uneasy feeling of uncertainty? Isn't it time to stop playing the hit and miss game?

The "Tech Choice System" will give you the same confidence that it has given thousands of "Tech Choice System" users. The bottom line is that you need to accurately troubleshoot and estimate TV and VCR repairs in the least amount of time possible to be profitable. According to users of the "Tech Choice System", it has cut their service time nearly in half compared to their previous method of troubleshooting. More importantly, they have stopped playing the hit and miss game while realizing those "profit-eaters" were actually "profit-generators."

Close your eyes and imagine no longer having to give a high estimate because you don't have a quick and accurate way to determine what is actually defective. Imagine returning every estimate to your customers with the confidence that it is accurate and will yield a reasonable profit. Imagine the possibilities of giving yourself a pay raise by putting an extra $11,700 each year into your bank account!

The "Tech Choice System" has proven itself in making these dreams come true. The innovative and exclusive testing procedures have generated overwhelming profits for many service centers. Why continue having the frustrations that come from today's estimating and repairing? Why not make a change today for the future and begin your quest toward decreasing headaches and frustration, while increasing profits? You have two choices: to continue the frustration, or do something about it. The choice is yours. Why not make it the **"Tech Choice System"?**

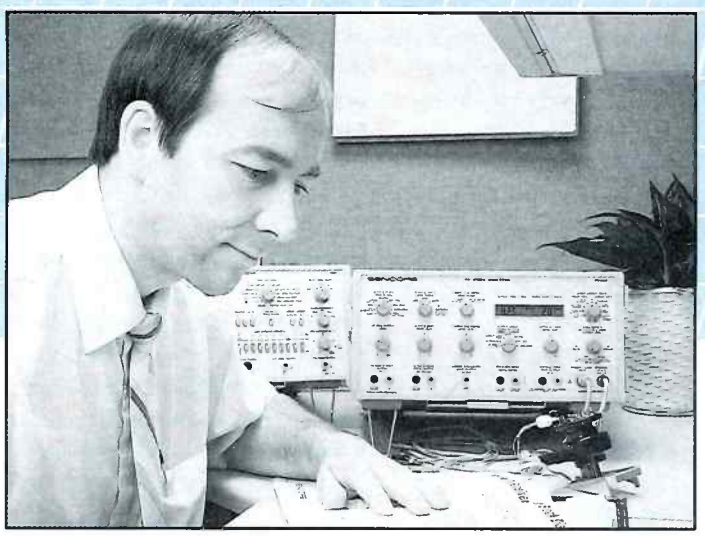
Call your Area Sales Representative today at **1-800-SENCORE** (736-2673) and make arrangements to get the "Tech Choice System" into your service center. The "Tech Choice System" will start you on your way to reducing frustrations and increasing your bottom-line profits. ■

Real People . . .

MEET OUR TECHNICAL SALES REPRESENTATIVES

Your Area Sales Representatives are technically trained to give you assistance before, during, and after the sale. Your "friend at the factory" can assist you with business advice, special pricing, seminar schedules, and just keeping up-to-date with service trends and technology.

"My work just begins when I make a sale. I do everything possible to make sure my customers are using and benefitting from their Sencore equipment. Keeping in contact with my customers is very important to me."



Win Tough Repair Battles With The TVA92 TV Video Analyzer

By Glen Kropuenske, Application Engineer

Do you run out of ammunition when waging war on those tough TV problems? Are your old strategies of measuring voltages and scoping waveforms causing you to fight long, frustrating battles? Does your battle plan shift to hopelessly subbing for parts or performing nonconclusive tests in a desperate attempt for victory?

If you're fighting long, hard, and expensive battles when repairing modern TVs, it may not be a lack of technical know-how! Studies confirm that time and money wasting troubleshooting tasks are more often related to the technicians' troubleshooting technique and not their technical knowledge.

This article will examine how a logical, organized troubleshooting approach can help you isolate TV problems in the shortest time possible. Furthermore, it will show you how adding signal substitution to your arsenal can help you quickly win those tough TV repair battles.

Signal Tracing Often Wastes Valuable Servicing Time!

There are two ways to troubleshoot an electronic system: signal tracing or signal substitution. Signal tracing has you start at the input and trace signals towards the output. Signal substitution has you start at the midpoint and inject substitution signals working toward the defect. Many modern TV service technicians depend solely on signal tracing. This dependency causes many good technicians to waste valuable service time. Here's why.

Signal tracing is the age old method of connecting a scope to a test point and comparing the waveshape to the one shown on the schematic (if you have a schematic). The idea is to move from one circuit to the next until you spot a waveform that doesn't match the schematic.

The success of signal tracing depends on your ability to interpret the waveshape. This presents several problems. First, waveforms shown on many schematics are often dark and blurry making interpretation difficult Secondly, it is hard to tell if slight waveshape variations indicate a defect, or are due to normal circuit or signal generator tolerances. If you mistakenly conclude a normal variation as a problem, you could be trying to chase down a defect in perfectly operational circuits.

The biggest problem with signal tracing is that waveforms are often missing or bad due to problems elsewhere in the chassis. Therefore, you cannot determine if a circuit or stage is working correctly. Here are a few examples you'll likely recognize.

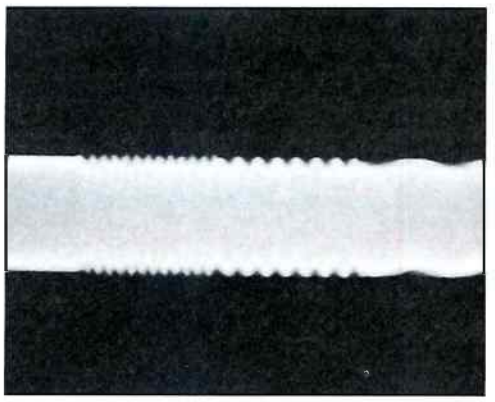


Fig. 1: Can you tell if this waveform is good or bad? Signal tracing leaves too many variables open to interpretation and possible error.

A lack of DC bias or voltages can result in missing or momentary waveforms. A startup or shutdown problem produces voltages and waveforms for only a brief moment making diagnoses extremely difficult. Or a lack of horizontal drive to produce scan-derived voltages can rob stages of voltages needed to produce waveforms.

Problems in earlier stages of the receiver can result in missing or improper waveforms to luma, chroma, and deflection circuits. Therefore you cannot trace signals to see if these stages operate normally. Likewise, problems in circuit loops such as vertical amps, horiz AFC, etc., alter every waveform in the loop, making every stage look bad.

It's not surprising that these obstacles increase the number of signal tracing troubleshooting steps needed to isolate most TV problems. In many cases, these signal tracing dilemmas cause servicers to abandon effective systematic troubleshooting techniques in favor of less effective and more expensive parts swapping.

Functional Analyzing With Substitution Signals Is The Key To Victory

Your ability to win decisive victories in the battle of repairing modern TV defects lies in your weapons and strategy. The highest degree of success and service profits are achieved with a full arsenal of weapons. The highest troubleshooting efficiency results when signal substitution is used to supplement present troubleshooting techniques. Using signal substitution with the TVA92 TV Video Analyzer (companion unit to the VG91 Universal Video Analyzer) in a divide and conquer approach can quickly analyze stages and isolate the problem.

With divide and conquer troubleshooting, you apply the proper substitution signal to the input of a stage and simply watch the CRT (or listen to the speaker). If the picture on the CRT returns to near normal, you are injecting after the defective stage. If the output remains bad, your injection point is before the defective stage. In this manner, you prove which circuits are good and quickly narrow in on the defective stage. Let's look at an example to see how this really works.

This example has a video problem in the TV receiver confirmed by the VG91 Universal Video Generator's performance test. Instead of a crisp, clear 10 Bar Staircase video pattern on the CRT, we have a dark pattern which shows a loss of picture sync. The problem could be anywhere in the video or sync stages of the receiver.

The first thing we do is break the video circuits into sections or functional stages. Next, we inject a known good video signal into the input of a stage about halfway along the video signal path. Injecting into stage 1, as shown in Fig. 2a, recreates the original symptom on the CRT. This tells us that the problem is between the point of injection and the CRT. So we move ahead and inject the video signal into stage 2. Our result is a good, clear 10 Bar Staircase pattern as shown in Fig. 2b. This tells us stage 2 and the CRT

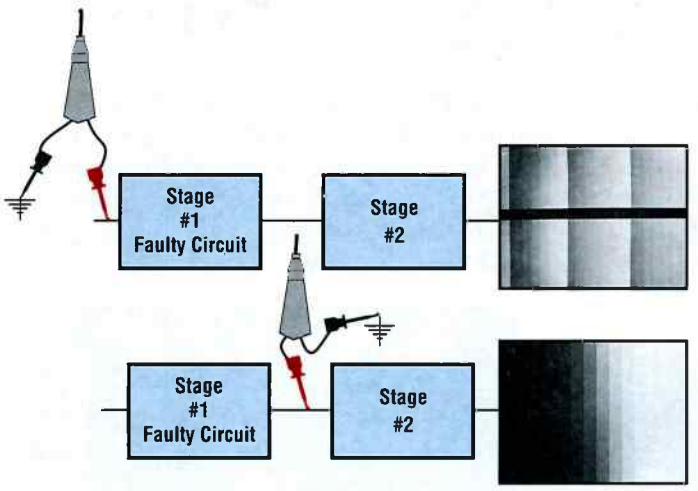


Fig. 2: Signal substitution quickly proves which stages are good, leading you to the defective stage.

are working correctly. We know for sure the problem is in stage 1.

Signal substitution leaves little interpretation compared to analyzing waveforms. When the substitution signals injected into the TV receiver are synchronized to the input signal, the results are shown on the CRT. Signal substitution only requires you to select the proper signal and introduce it to the stage at the appropriate signal level and polarity.

Divide & Conquer Strategy Makes Signal Substitution Even More Efficient

It should be made clear that we cannot become efficient with signal substitution by injecting signals into stages at random. We need a plan of action (strategy) to direct us when injecting signals to keep our troubleshooting steps to a minimum, but still isolate the problem to a single stage.

A divide and conquer strategy isolates the defective stage in the fewest steps possible. You may compare a TV troubleshooting job to the challenge of isolating a worm inside an apple in the fewest steps. You may choose to cut away small sections subtracting from the apple until you stumble on the worm. If on the other hand you would use "divide and conquer", you would slice the apple in half and repeat the process until you had localized the worm to one small section. The dividing process requires three steps to isolate the worm to the same sized area that requires up to eight subtractive steps.

To streamline this process, the circuits in a television receiver can be divided into functional blocks. Every TV receiver has the same functional blocks used to process signals from the antenna terminals to the CRT screen (or speaker). Although the circuitry in each functional stage may vary from chassis to chassis, the basic functional operation is the same.

An important first step to functional analyzing is a complete TV performance test. Use the VG91 Universal Video Generator to evaluate the TV performance. Relate the symptoms to the operation of the functional stages. For example, reduced picture height indicates a vertical problem. A picture that is visible but has some snow indicates a likely RF or IF problem. Organizing the circuits into functional blocks tells you what stages are working and which to suspect as defective.

The results of the performance tests will guide you to one of the six major symptoms: 1) missing or poor color, 2) missing or poor video, 3) bad audio and/or MTS, 4) no vertical or horizontal sync, 5) startup and/or shut down problems, and 6) no raster. Once you identify the symptom(s),

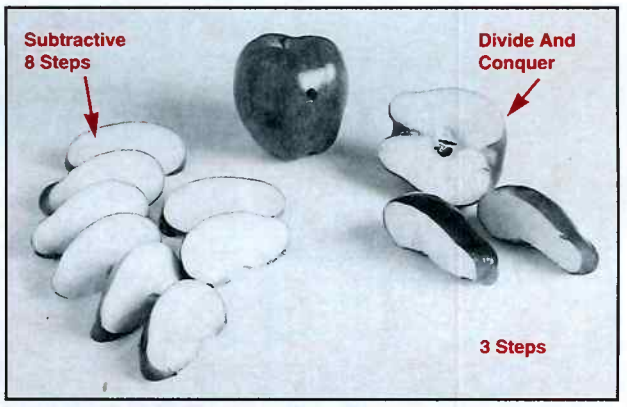


Fig. 3: The divide and conquer technique leaves the apple in the least possible number of pieces. You'll see the same results in your troubleshooting steps.

refer to the Sencore VG91 & TVA92 Analyzing Troubleshooting Guide to determine the shortest path for finding the defective stage. Now you are ready to use the functional analyzing process to track down the defective stage, and then, the bad part.

When several symptoms are noted during the performance test, you need to decide which one to respond to first. Always repair circuit problems in the following order: 1) high voltage, startup, or shutdown, 2) sweep, 3) sync, 4) video, 5) color, and 6) audio.

While isolating a problem in a TV receiver requires more than looking for worms, divide and conquer provides the best overall troubleshooting efficiency. The best place to start dividing the television receiver are the main detector points. The video detector changes the 45.75 MHz IF signal to video, the audio detector changes the 4.5 MHz IF signal to audio, and the chroma demodulators recover R, G, and B signals.

Injecting a signal at the detector reduces the total number of stages that may cause a problem by a factor of two. Then, once you determine what stages can process known good signals, you keep dividing the defective stages into sections until the single defective stage is found.

You can simplify the process of dividing and conquering any circuit trouble by using the Universal TV Receiver/Monitor Block Diagram and the Sencore VG91 & TVA92 TV Analyzing Troubleshooting Guide. The troubleshooting guide provides you with divide and conquer step-by-step instructions to isolate symptoms to the defective functional block. Just call your Area Sales Representative at **1-800-SENCORE** for your copy.

Select From A Pool Of TVA92 TV Substitution Signals

The TVA92 TV Video Analyzer provides substitute signals to inject into each major block of the TV receiver following the video or audio detectors. All the substitution signals provided by the TVA92 are variable in level and polarity to match the circuit waveform. The drive signal levels are continuously monitored by the digital readout of the TVA92. In reality, the VG91 and TVA92 are like having a miniature TV station with all the signals required to substitute into any TV stage.

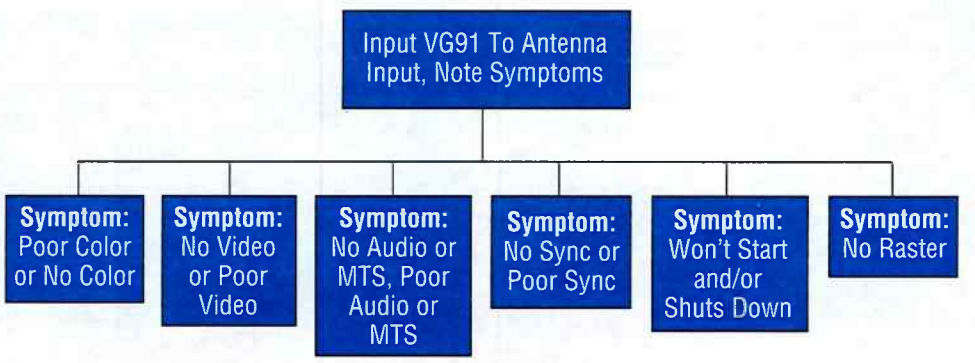


Fig. 4: Select the path on the "Trouble Tree" that closely matches the symptom of the TV you are servicing.

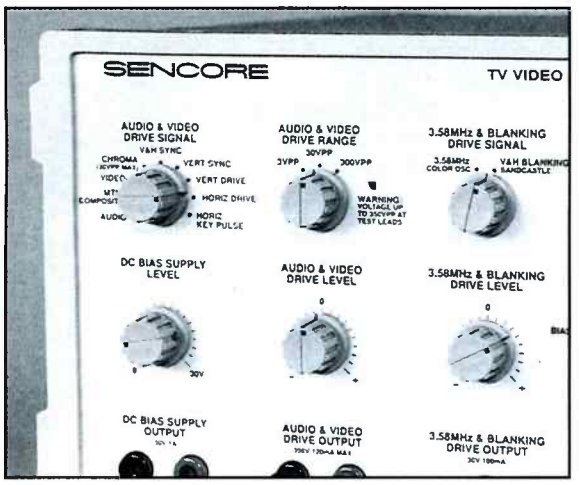


Fig. 5: The TVA92 TV Video Analyzer drive signal levels and polarities are adjustable so you can adjust to any circuit.

The TVA92 signal you use depends on which functional stage you are injecting into. Select the signal which corresponds to the normal input signal to that stage. For example, when you inject into the audio stages, use the TVA92's Audio Drive Signal. The signal normally present at the input to the video stages and the sync separator is composite video, so use the TVA92's Video Drive Signal when injecting into these stages. In each case, you inject the signal that is normally at that point in the circuit.

Here are some basic guidelines to follow when using signal substitution with the TVA92 TV Video Analyzer:

1. Use a reference signal from the VG91 at the antenna, IF, or video input of the chassis to synchronize all of the stages during signal substitution.

2. Set the Drive Range and Drive Level controls to match the PPV amplitude shown in the schematic.

3. If the PPV signal level is not shown on the schematic, start at 0VPP and increase the drive level slowly. If no level is shown, never exceed the B+ voltage to the stage. Monitor the drive output with the TVA92's Output Signal Monitor/DVM.

TVA92 Drive Signal Substitution Chart

Test Point	TVA92 Drive	Test Point	TVA92 Drive
8-10	Video	64	Vert Sync
23 (Mono)	Audio	65-67	Vert Drive
23 (MTS)	MTS Composite	68	[See Vert Yoke Test]
24-26	Audio	70	V&H Sync
27-29	Audio	71	DC Bias Supply
30-34	Video	72, 73	Horiz Drive
40-46	Chroma	74	[Use Dynamic Tests]
47-49	Video	75	[Measure DCV]
50	V&H Blanking	76, 77	[Measure DCV *]
51-54	3.58 Mhz	78-82	[Measure DCV, PPV}
61	Video	83	H Key Pulse
62, 63	V&H Sync		

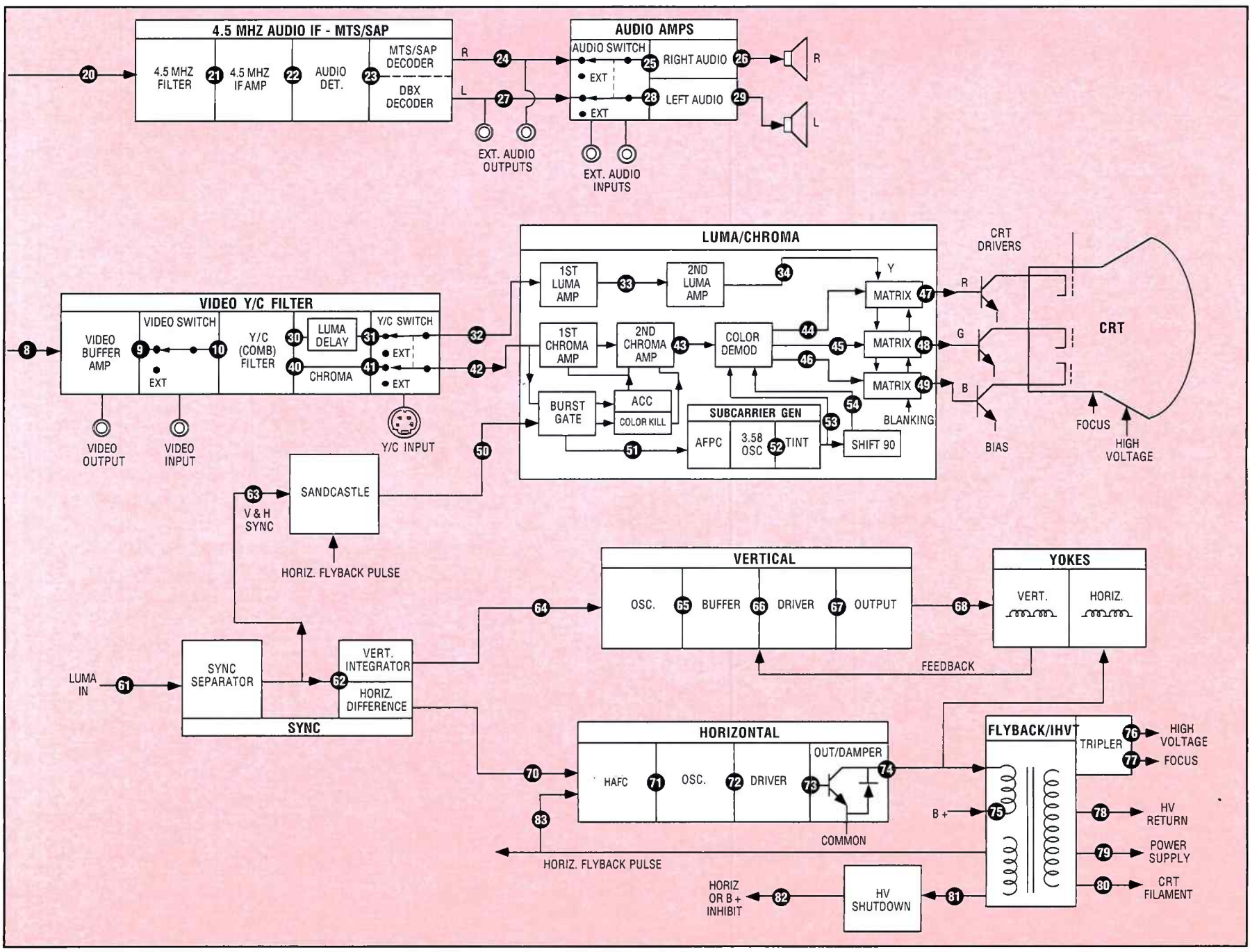


Fig. 6: The TVA92 provides a substitute signal to inject into each major block of the TV receiver following the video or audio detectors.

Use Functional Analyzing To Isolate Problems In IC Circuits

Functional analyzing is the only effective method of isolating problems in modern IC circuits. Integrated circuits are not really a component but many functional stages made up of many individual components within one component package. ICs perform the function of one or several blocks in the Universal TV Receiver/Monitor Block Diagram. To effectively troubleshoot IC circuits, you must analyze the functional stages within the IC using the same methods we've described.

Signal substitution can be used effectively to confirm whether functional stages in the IC are good or bad. You may substitute signals using the VG91 or TVA92 into the functional stages of the IC using available input pins of the IC. For example, look at a typical sound IF section in a television. The IC has several functions including converting the modulated 4.5 MHz sound IF signal to an audio signal, them amplifying and sending the audio signal to the speaker. By breaking the IC down to specific stages, you can inject the proper signals to isolate the defective stage.

You need to treat the IC just as you would a discrete component when signal injecting. It's just like substituting into one of the functional stages shown on the Universal TV Receiver/Monitor Block Diagram. The VG91/TVA92 supplies you with the signals necessary to functional analyze ICs so you know whether the IC is good or bad.

Equip Yourself To Do TV Battle

With the help of signal injection you can overcome the roadblocks of signal tracing. Add the TVA92 TV Video Analyzer to your arsenal and experience victory after victory as well as increased servicing profits.

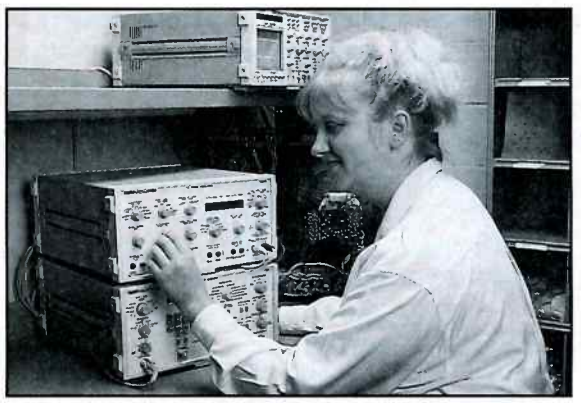
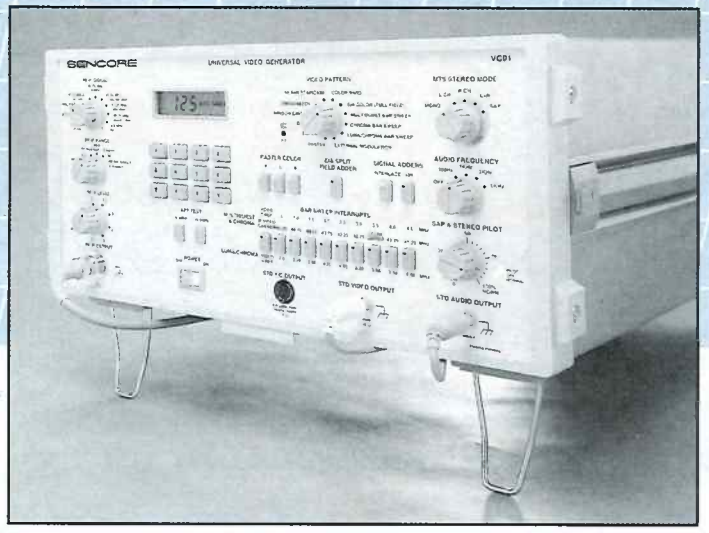


Fig. 7: Troubleshooting with the VG91 and TVA92 is like having a miniature TV station with all the signals required to substitute into any TV stage.

For complete information or a video demonstration on the VG91/TVA92, call your Sencore Area Sales Representative at **1-800-SENCORE** (736-2673) today. We'll also reserve copies of the Universal TV Receiver/Monitor Block Diagram or Sencore VG91 & TVA92 TV Analyzing Troubleshooting Guide mentioned in this article. All you have to do is call. ■



Analyzing Video Problems With Exclusive Tests And Video Patterns

By Glen Kropuenske, Application Engineer

Video is experiencing revolutionary changes. From technical improvements in circuit design, display sizes, delivery systems to growing applications in business, education, and entertainment. These changes mean new opportunity and growing demands on those who maintain and service today's high-tech NTSC video systems.

Presently, servicing today's video systems can require multiple test instruments. Low cost video generators provide several TV channels, basic video patterns, and one audio tone at best. But they fall short of what's needed to isolate most video problems. You can add an RF channel converter, MTS generator, audio generator, and high performance video pattern generator, but still be short of what you need.

Technicians suggest an all-purpose video generator with all the accurate test signals combined into one easy-to-use instrument. This is what the new "Tech Choice" VG91 Universal Video Generator gives you. The VG91 is the only Universal Video Generator with all the channels, IF analyzing signals, video patterns, and mono/MTS/SAP audio signals needed to performance test and isolate defects in any NTSC video systems.

Fully Performance Test Video Systems

Today's video systems can be divided into three basic sections: 1) Tuner/IF, 2) Video, and 3) Audio. A video product may contain variations of one, two, or all three of these basic sections.

The VG91 provides accurate reference test signals and adjustable levels to fully test video systems. You can observe the operation of the video system by viewing the CRT, or by using an external video monitor or "Waveform Analyzer" to monitor the video output.

The VG91 tests fall into two general categories: 1) Testing tuner/IF circuits, and 2) Testing video and audio processing circuits. If you are testing tuner/IF circuits, apply the VG91's RF signals to the tuner input. To test audio and video processing circuits, apply the VG91's standard output signals to the corresponding Y/C, video, or audio input jacks.

Fully Analyze Any Video Tuning System

Cable ready tuners require extensive testing to ensure correct operation. Cable TV systems shift channel frequencies as much as 2 MHz from standard broadcast or conventional cable frequencies. Therefore, cable ready tuners must perform a tuning search to locate these shifted carriers. This digitally controlled search occurs when a channel is selected. A cable ready tuner may have problems tuning to either off-air or cable channels, have trouble tuning to shifted cable channels, or have trouble tuning to specific channels.

Imagine how much easier it would be to diagnose and troubleshoot TV tuning systems if you had access to every TV channel. Imagine having these channels with analyzing video test patterns and mono/stereo SAP audio test signals. This is really what the VG91's RF Generator is all about. The VG91 has 4 RF functions: STD TV, STD CABLE, HRC CABLE, and ICC CABLE.

Use the "STD TV" position of the VG91's RF-IF SIGNAL switch to test single channel or non-cable ready tuning systems. Use the "STD CABLE", "HRC CABLE," or "ICC CABLE" positions to duplicate the cable system that the tuner must receive or to test the tuning search function of the digital tuner.

To test a TV tuner, hook the RF-IF cable to the antenna input, select the VG91 channel, select video and audio test signals, and adjust the RF output level to 1000 µV. Select the tuner channel to match the VG91 and observe the video ouput to confirm proper reception. The tuner should produce a good picture and audio output. Switch through various channels and tuning bands for a thorough test.

Test Tuner/IF Sensitivity And AGC

Defective RF or IF amplifiers or AGC circuit problems can cause snowy reception or overload problems. In some cases, the receiver may work fine with a strong cable signal (5,000 µV) but be snowy with a weaker but adequate cable signal (1,000 µV).

An important part of testing a video tuner/IF stages is to vary the signal level to duplicate fringe or overdriving signals. This lets you analyze the tuner/IF circuits for proper gain or overall receiver sensitivity. It further lets you check for proper AGC circuit action needed during strong signal reception to prevent overdriving tuner or IF circuits.

To test tuner/IF sensitivity, set the VG91 and tuner to corresponding channels. If properly tuned, the tuner/IF stages should produce a snow free picture at 1,000 µV. Starting at 1000 µV, decrease the RF output to 500 µV and observe the monitor or display. Most TV tuner/IFs begin to shown slight snow between these levels but should maintain good sync and color. Snowy reception at 1000 µV or above indicates insufficient RF or IF gain.

The VG91's RF-IF attenuator equips you to output and vary RF-TV signal levels to test television channel receivers, cable distribution systems and equipment, or other TV video applications requiring a variable TV-RF channel signal source.

Test and Align AFT Circuits

Tuner/IF stages include an automatic fine tuning circuit (AFT). AFT circuits monitor the 45.75 MHz IF carrier frequency. When the tuner's oscillator is at the correct frequency, the 45.75 MHz video-IF carrier is centered within the IF passband. If the oscillator drifts in either direction, so does the video-IF carrier. The AFT circuit detects the frequency change and outputs a voltage to the oscillator or digital control circuits to move the oscillator back on frequency.

The AFT circuits found in video receivers can be tested using a common test. All receivers compensate the tuner's oscillator to cover a carrier shift of up to approximately 500 kHz. The AFT circuits can be tested by shifting the incoming TV signal and observing if the AFT circuits restore proper video.

To test the AFT circuits, set the VG91 and tuning system to properly receive a TV channel. Using the EIA Color Bar pattern, observe the video output as you push and hold one of the AFT TEST buttons. Pushing either of the AFT TEST buttons causes the RF carrier of the VG91 to shift 0.5 MHz above or below the selected carrier. The video should

momentarily degrade when you first push in the button but recover as the AFT action restores proper tuning. Release and repeat the test using the second AFT TEST button.

To test or align the AFT circuits, use the VG91's 45.75 MHz Video IF signal along with the AFT TEST buttons. The AFT TEST buttons permit you to shift the 45.75 MHz carrier + or – 500 kHz as you substitute into the receiver's video IF stage. Monitor the AFT voltage with a DVM as you push the AFT TEST buttons. The AFT voltage should shift near equal amounts but in opposite polarity to the carrier shifts.

Isolate IF Problems To The Defective Stage

IF stages amplify the video-IF from the tuner and reject adjacent signals. Improper gain or response causes snowy video pictures, loss of picture detail, interference from adjacent cable channels, or poor sound. IF problems produce symptoms similar to those of tuner problems misleading many servicers.

The VG91 provides modulated IF signals to troubleshoot or align video-IF or audio-IF stages. The VG91's IF Generator has three main sections: 1) 45.75 MHz video IF, 2) Video IF Trap setting signals, and 3) 4.5 MHz sound IF generator. The IF signals are fully adjustable and modulated with video and/or audio.

To isolate tuner or IF problems, use the VG91's 45.75 MHz Video IF signal to substitute into the first IF stage. Adjust the IF output of the VG91 to match the level of the IF stage, and monitor the results by viewing the CRT or VIDEO OUTPUT jack with a scope. If the video output is good with the proper frequency response, the IF stages beyond the point of injection are good. If bad, continue to substitute the 45.75 MHz Video IF signal into latter IF stages to isolate the defect.

The VG91's IF trap signals insure proper rejection to adjacent channel signals to eliminate interference on receivers hooked to cable systems. Use the VG91's IF trap signals to recreate the interfering carrier when testing or aligning the IF traps. Observe the CRT and/or oscilloscope display as you adjust the appropriate trap coil for the least interference or noise.

To troubleshoot audio problems, use the VG91's 4.5 MHz FM signal to inject into the audio IF stages. Adjust the output level of the VG91 to match the level of the IF stage. If proper audio is heard from the speaker, the IF stages beyond the point of injection are good. Continue to substitute the 45.75 MHz Video IF signal to isolate the defective stage.

Analyze The Performance Of Video Stages

The VG91 provides industry standard and exclusive video test patterns. Each pattern provides specific information concerning the performance and alignment of the video circuits. The VG91 offers video patterns to specifically test the luminance stages, while others test chroma stages, synchronous detectors, comb filters, or deflection circuits. In many cases, you can pinpoint a defect just by viewing the video pattern. Here are the video patterns you get with the VG91:

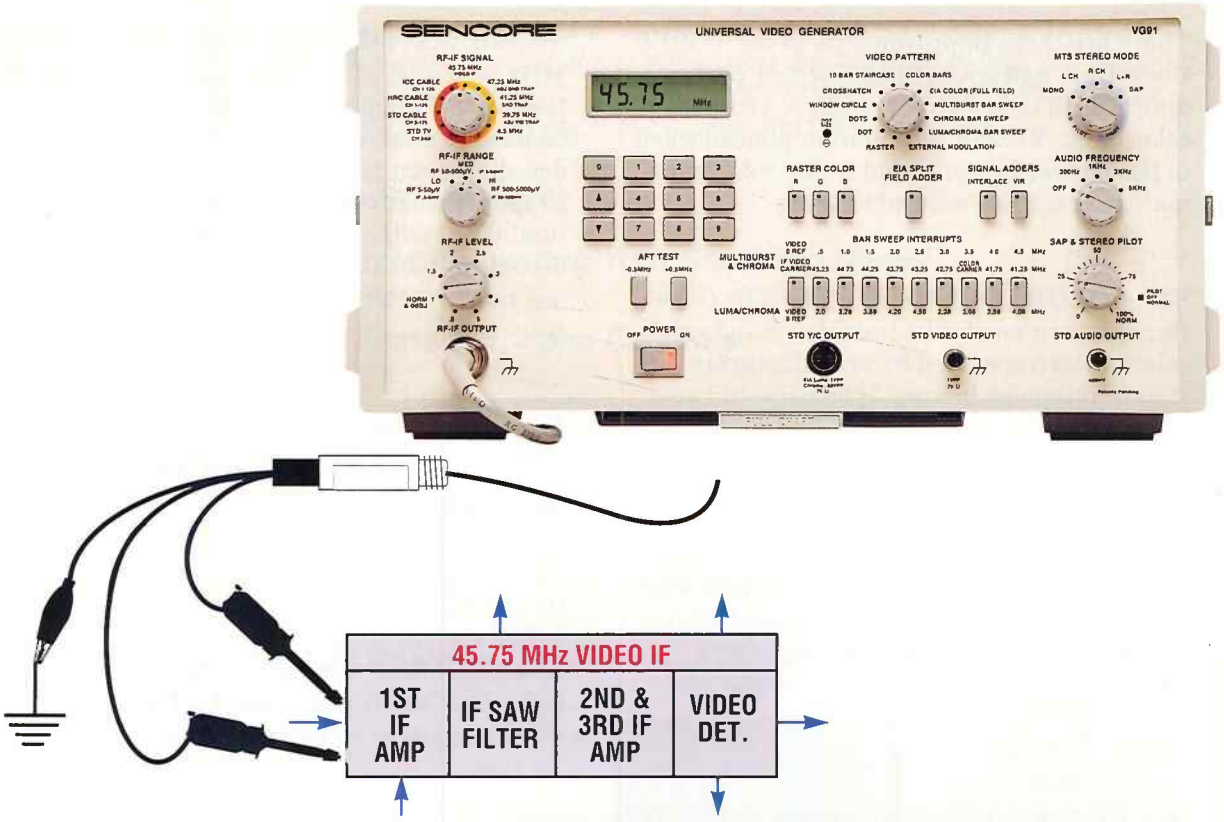
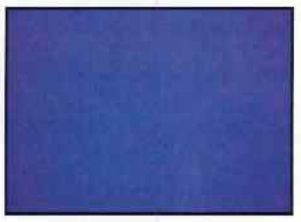
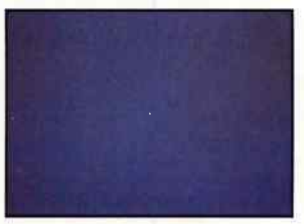


Fig. 2: The 45.75 MHz Video-IF signal may be used to sub for the tuner, inject into the IF stages to isolate defects, or to align video IF stages.

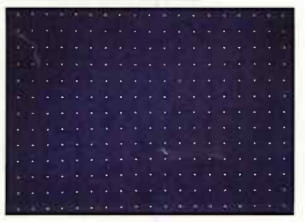
RASTER – The Raster pattern provides a blank color raster of any primary or secondary color. The color is selected with the RASTER COLOR switches. The RASTER COLOR switches also add or delete colors to the Raster, Dot, Dots, Window Circle, Crosshatch and EIA Color pattern. Use the Raster pattern to evaluate the operation of each color gun, and to test and align color purity. For each color selected, the CRT should display a uniform color display.



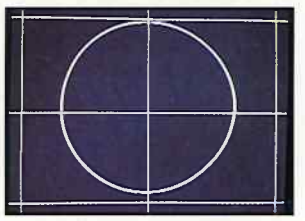
DOT – The Dot pattern provides a single dot centered within the raster. It is used to set the static convergence of a color receiver or monitor to produce a white dot without color shading in the center of the display.



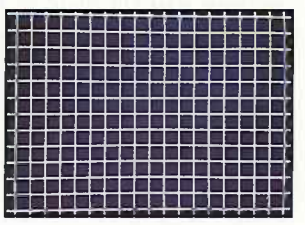
DOTS – The Dots pattern provides the standard dynamic convergence pattern recommended by most manufacturers. It is used to set the dynamic convergence of a color receiver or monitor to produce white dots without color shading throughout the display.



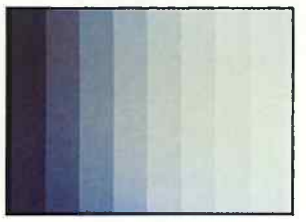
WINDOW CIRCLE – The Window Circle pattern consists of several patterns combined into one useful pattern; a cross, a box, and a circle all centered within the raster. This pattern is used for evaluating or adjusting centering, width, height, linearity, pincushion, and other deflection circuits.



CROSSHATCH – The Crosshatch pattern produces 21 vertical and 15 horizontal lines that form squares on the screen. This pattern is used for the entire convergence procedure on one gun CRTs or in-line gun CRTs.



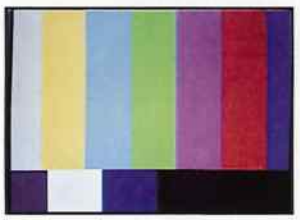
10 BAR STAIRCASE – The 10 Bar Staircase pattern consists of 10 evenly-spaced bars, with video levels ranging from black to 100% white. Use it to test the video circuits for proper dynamic range and for alignment of the synchronous video detector and color tracking controls. When properly aligned, each bar should show a distinct change in brightness level with no hint of color.



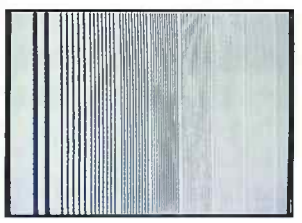
COLOR BARS – The Color Bars pattern is similar to the industry accepted 10 Bar Gated Rainbow pattern used by video servicers for years and still referenced on schematics. Each color bar represents a phase shift of approximately 30 degrees, resulting in 10 visible bars of different color hues.

There are three improvements to the VG91's Color Bars pattern to insure proper performance with today's color circuits: 1) a true color burst, 2) color information phase-locked to the horizontal sync, and 3) the color information at a 100% saturated level.

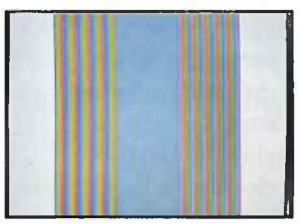
EIA COLOR (Full Field) – The EIA Color Bars pattern meets the industry-standard color pattern specified by manufacturers for video equipment testing. It consists of two distinct amplitude portions – luminance (brightness) and color level (saturation). The luminance portion of the signal forms an uneven, seven-level stairstep. The color saturation is 75%, which brings the top of the yellow and cyan bars to the 100% white level. The EIA COLOR pattern can be used with a conventional vectorscope and waveform monitor to analyze the relative amplitudes and phase of the color signals. The EIA SPLIT FIELD ADDER switch adds a -I, white, Q and black reference test signals to the bottom quarter of the EIA COLOR pattern.



MULTIBURST BAR SWEEP – The Multiburst Bar Sweep pattern consists of ten reference frequency bars beginning with a solid white "0 MHz" reference bar, and increasing in .5 MHz steps to 4.5 MHz. This pattern isolates frequency response problems in video IFs, comb filters, and luminance processing circuits. A stage that is restricting video signals will reduce the amplitude or distort the shape of one or more frequency bars.



CHROMA BAR SWEEP – The Chroma Bar Sweep pattern consists of three frequency bars at 3.0 MHz, 3.5 MHz, and 4.0 MHz. This pattern is used to isolate chroma response problems in IF, comb filters, and chroma processing circuits. Video stages which may be restricting the 1 MHz band of color signals required for good color reproduction will reduce the amplitude of one or more of the frequency bars.



LUMA/CHROMA BAR SWEEP – The Luma/Chroma Bar Sweep pattern combines luminance and chroma test frequencies. The pattern consists of six luminance frequency bars (0 MHz reference white, 2.0 MHz, 3.28 MHz, 3.88 MHz, 4.2 MHz, and 4.5 MHz), and four chroma frequency bars (2.28 MHz, 3.08 MHz, 3.58 MHz, and 4.08 MHz). This pattern simplifies testing and alignment of comb filters and may be used to analyze today's wideband I color decoding circuits and Y/C (S-Video) inputs. Proper comb filter separation should produce luminance without color interference. When testing wideband color circuits or Y/C inputs, use the 2.28 MHz bar to test the color response.

Expand The VG91 With Companion Analyzers Or Accessories

The VG91 is designed to resist obsolescence. Its signals are common to current FCC and NTSC specifications. The FCC has mandated that any future video format be compatible with these existing standards. Therefore, the VG91's signals can be used on video products for years to come.

The VG91 provides you with flexibility to meet new video servicing challenges. A rear Synchronizing Signal Output jack and 1 VPP Video Output provide DC voltages, video, audio, and sync signals. These signals are available to design companion analyzers or accessories to the VG91 as future servicing needs arise. Presently the VG91 has two companion analyzers: The Sencore VC93 All Format VCR Analyzer and the TVA92 TV Video Analyzer.

The VG91 is the only all-channel, all-pattern, all-purpose, universal video generator which lets you accurately performance test, align, or isolate defects in any NTSC video system. For complete information on the VG91 Universal Video Generator or the "Tech Choice Systems," call your Sencore Area Sales Engineer at **1-800-SENCORE (736-2673).** ■

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If you service audio amplifiers, the PA81 is the missing link you've been looking for. There are lots of "fidelity" checkers and audio analyzers on the market that test distortion parameters, frequency response, etc. Until now, there hasn't been an instrument that will let you analyze failures in the driver or output stages of a power amplifier.

The PA81 Stereo Power Amplifier Analyzer fills that missing link. Its twin, autoranged meters take the guesswork out of linearity and stereo tracking tests. Built-in IHF dummy loads match all common amplifier output impedances (2, 4, 8, 16, and 32 ohms) and the filters insure that each test meets industry defined standards. Monitor sound quality with the PA81's built-in speakers, or view the signals on a scope connected to the isolated output jacks. Use the External, Audio Line, or Dummy Load Inputs to trace signals from a phono pickup cartridge to speaker terminals. The PA81's DC balance function continually monitors the amplifier output, and disconnects the dummy loads if a DC imbalance occurs so you won't blow output transistor stages. You get accurate, safe amplifier analyzing, in a portable, battery operated package.

plus

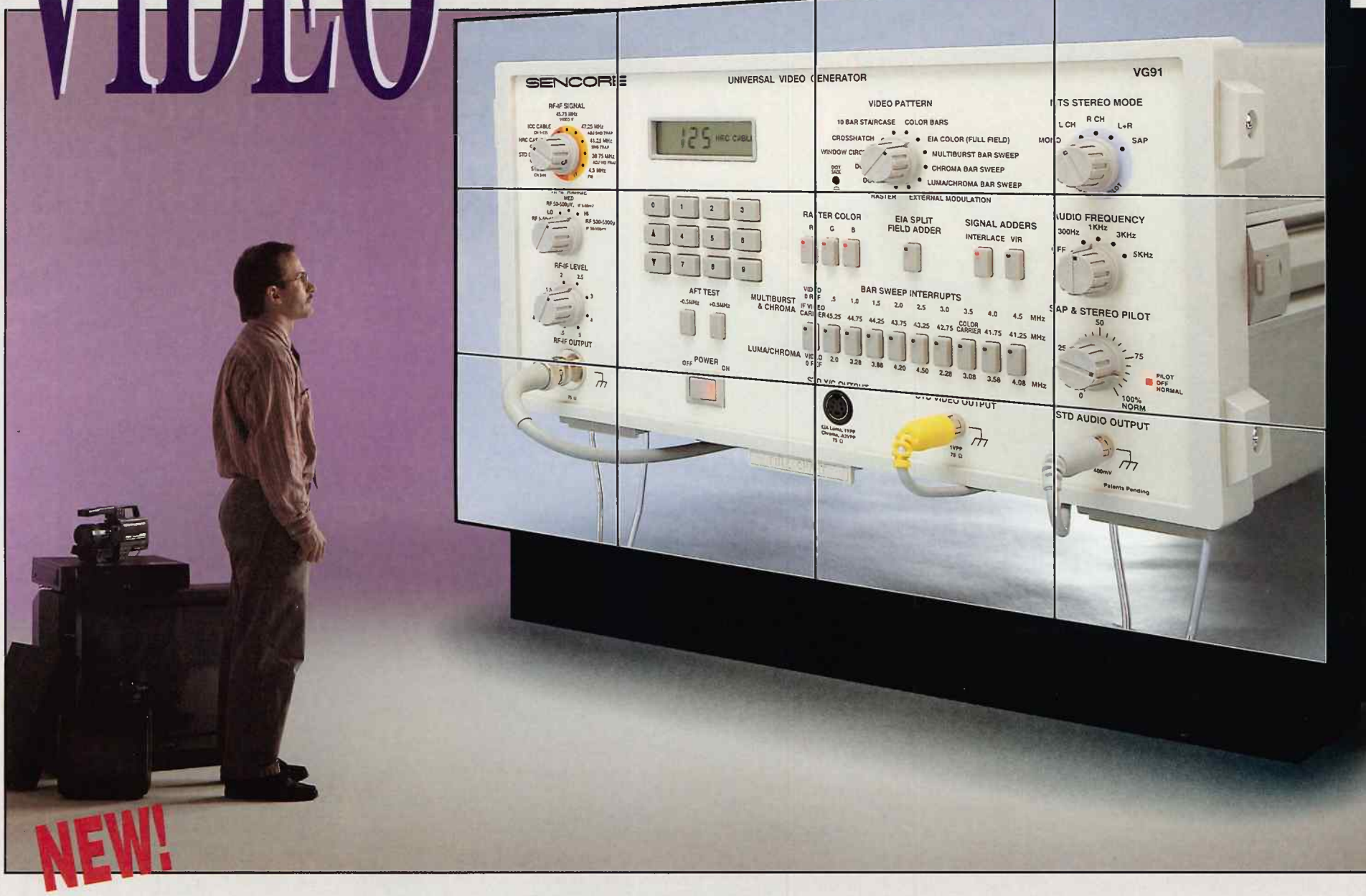
How To Check Audio Line Outputs

It is essential to check the input signal (CD, FM tuner, VCR, etc.) to the amplifier of any audio system before you start troubleshooting. This quickly eliminates the input as the possible problem and gives you the confidence to efficiently troubleshoot the defective audio system.

The PA81 provides a standard audio line input to determine if the input signal is correct before you continue with further testing and troubleshooting. There's both a left and right channel audio line input for measuring RMS volts, dBm, and dBp. As with the other inputs, you can also listen to the audio on the PA81's built-in speakers or look at the signals with a scope. For more information, call for a free copy of Tech Tip #179.

VIDEO

Look At The Big Picture And See The Future Of Complete Video Analyzing!



NEW!

Introducing The All Channel RF/IF/MTS "VG91 Universal Video Generator" Designed To Performance Test And Isolate Defects In Any NTSC Video System!

Patented – A Sencore Exclusive

Mr. Philo Farnsworth must have known what he was doing when he invented the first television system in the United States. That was over 70 years ago – just look at video today!

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- Projection TV
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The new age of video is upon us, and Sencore is here to meet your needs head-on with the only complete instrument that offers more than ordinary video generation. The VG91 Universal Video Generator is the only instrument that provides all the TV-RF and innovative NTSC video tests and signals in one expandable instrument that covers all your video servicing and alignment needs. TECH CHOICE SYSTEM

Find out more about how Sencore and the New VG91 Universal Video Generator can help. It's a powerful way to help build your business.

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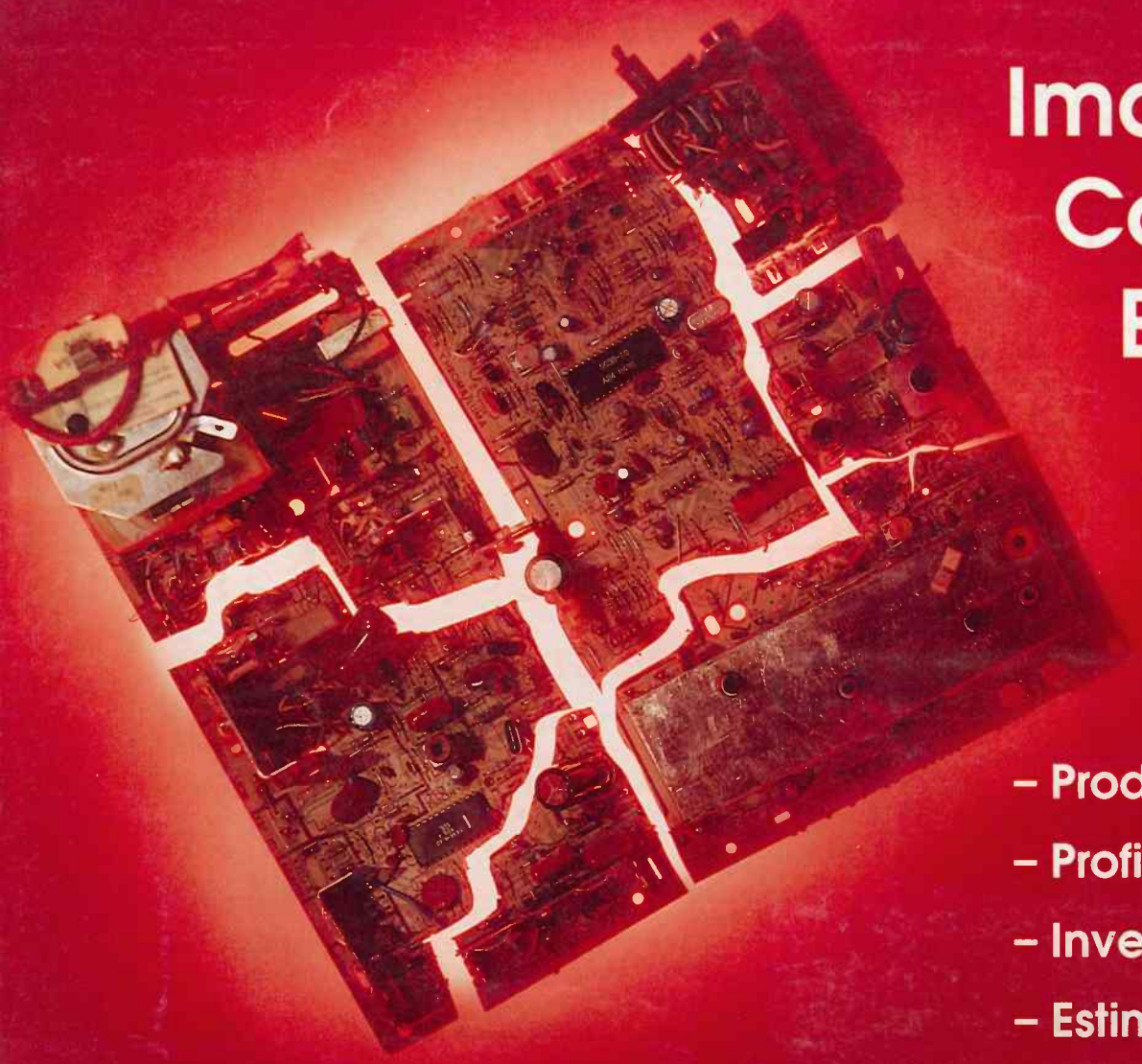

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Physically cutting the TV chassis into the functional blocks isn't practical, but there is a way you can electrically isolate them. There's a way that will help you determine defects by simply watching the CRT. And there's a way to isolate horizontal circuit (startup/shutdown) faults without risking damage to replacement components – or your pride.

Sencore has been designing instruments that allow servicers to use signal injection for troubleshooting for many years. Now, with the new TVA92 TV Video Analyzer, TV servicing actually pulls the entire TV together while isolating individual stages.

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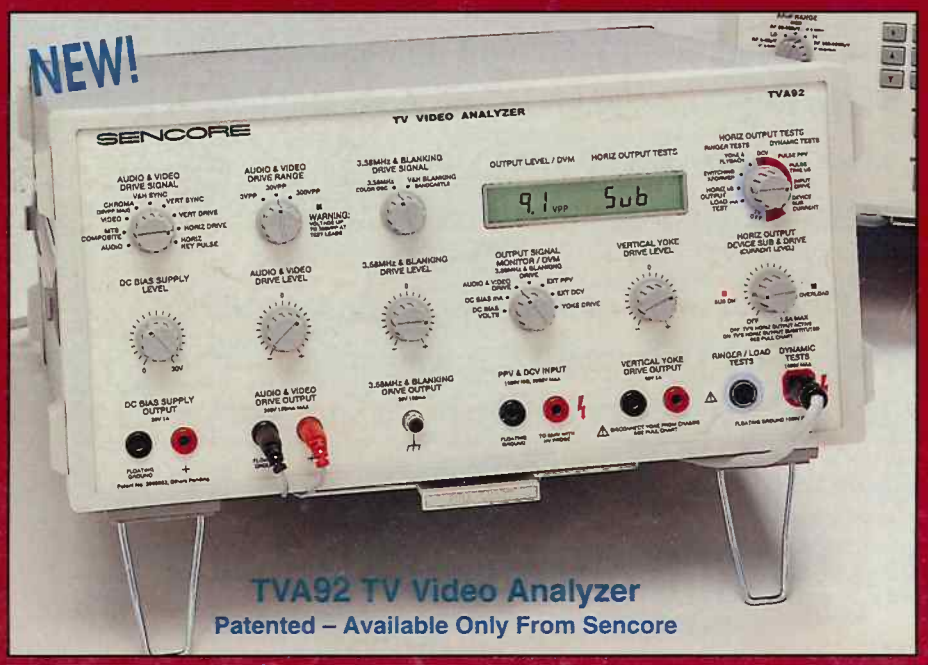

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