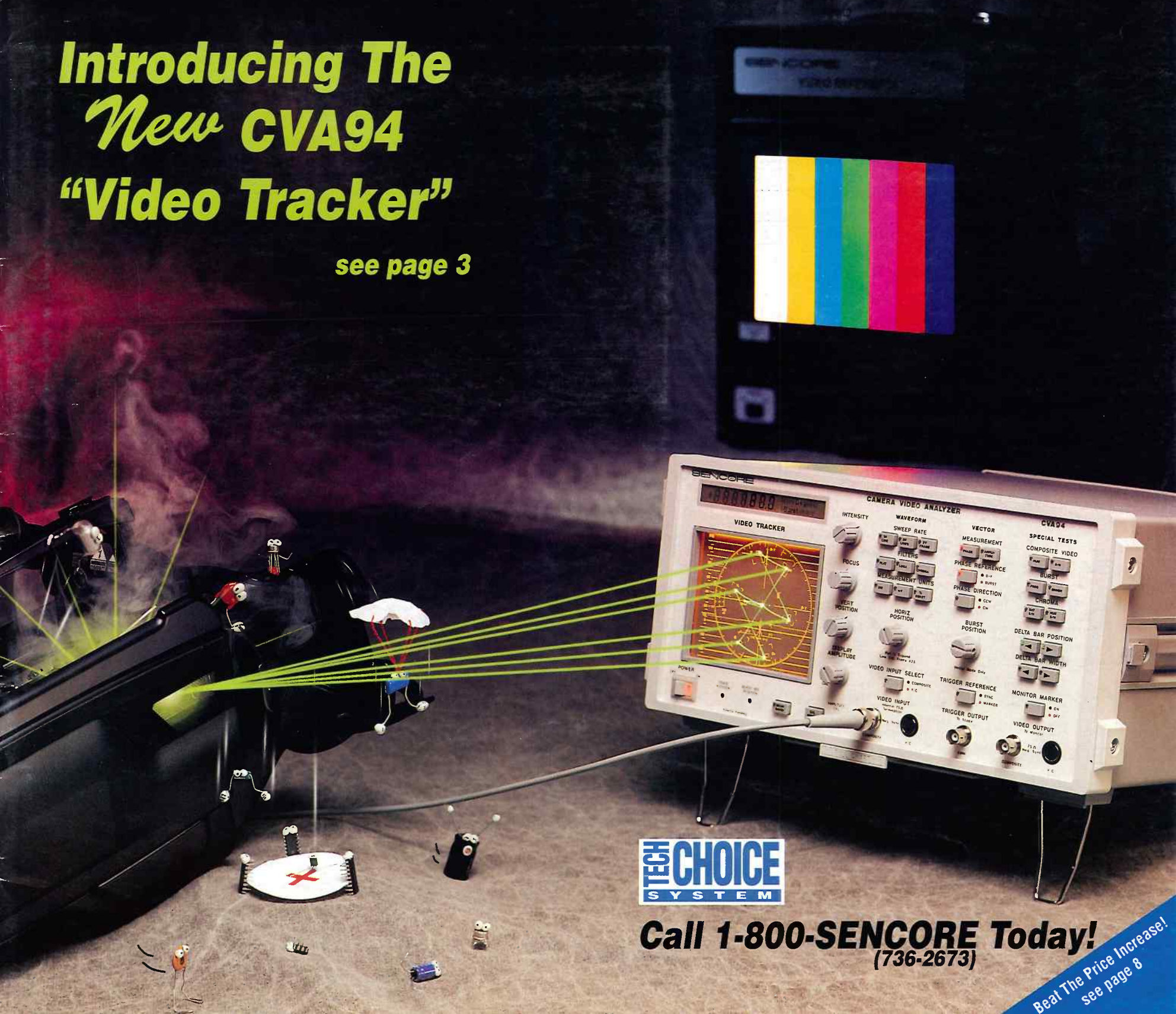


Track And Eliminate "BUGS" Out Of Cameras And Camcorders

Introducing The
New CVA94
"Video Tracker"

see page 3



THE CHOICE
SYSTEM

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(736-2673)

Beat The Price Increase!
see page 8

NEW!



CVA94 "Video Tracker"™ Camera Video Analyzer

The CVA94 "Video Tracker"™ provides you with:

- Digital waveform measurements for fast signal troubleshooting.
- Digital vectorscope measurements for easy, error-free color checks.
- Special tests to positively identify and localize:
 - Power adapter and power supply problems with exclusive "Hum" test.
 - Poor picture quality with exclusive "Video Noise" test.
 - Chroma circuit problems with exclusive "Chroma Noise" tests.
 - Reference oscillator problems with exclusive "Burst Frequency" and "Frequency Error" tests.
- 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.
- Composite and Y/C Outputs match any video monitor input, while the exclusive integrated "Monitor Marker" positively identifies the signal measurement.
- Extra features to insure profitable servicing:
 - Exclusive Beam Saver™ automatically prevents CRT phosphor burns.
 - Built-in Cal Signals for measurement confidence.
 - Integrated RS232 computer interface for automated testing.

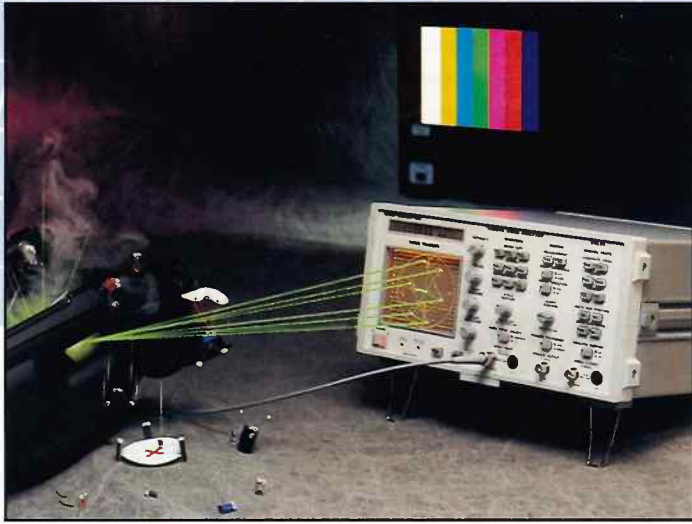
If You'd Like To See How Your Business Will Benefit From Having A New Camera Video Analyzer Working For You, Simply Call 1-800-SENCORE (736-2673) Today!

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!



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

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The Next Step In Camera Service Equipment — The CVA94 “Video Tracker”™

By Tom Schulte, Application Engineer, CET

On The Cover

Camera and camcorder analyzing has never been easier. Sencore's new CVA94 “Video Tracker” Camera Video Analyzer and VR940 Video Reference give you the tools you need to tackle even the toughest camera/camcorder service challenges. Read the article on page 3 for more details.

In This Issue

The Next Step In Camera/Camcorder Servicing – page 3

Invest Now And Beat The Price Increase – page 8

How To Troubleshoot Modern Video-IF Stages – page 10

Streamlining The Processes In Your Service Center – page 14

Expanding Your Service Business Into Computer Monitor Repair – page 17

Substituting For The Horizontal Output Transistor – page 21

All Format VCR Analyzing – page 25

Are You Wasting Time With Your Waveform Analyzing – page 28

Test equipment for camera service over the past twenty years has evolved from standard waveform monitors and vectorscopes, to combination waveform monitor and vectorscopes, to expensive digital analyzing instruments costing \$10,000-20,000. And with the growing popularity of camcorders, there's definitely a need for servicing equipment that will help your troubleshooting efficiency. It's time for another step of evolution.

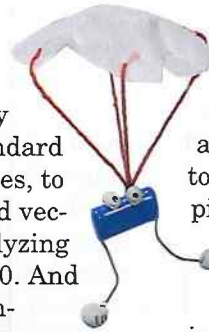
The latest evolution in camera/camcorder service equipment is now available. It is the CVA94 “Video Tracker” Camera Video Analyzer from Sencore. The CVA94 “Video Tracker” includes all the best servicing features of earlier test instruments, plus tests and features designed to take your camera troubleshooting and testing to new levels of convenience and efficiency.

Evolving Camera Service Needs

Camera/camcorder service needs have been evolving over just the past several years. This has been due to changes in video camera construction and quality, and also due to changes in the performance expectations of camera owners. Video cameras have evolved from monochrome to color and from tube-type pick-up devices to high performance solid state CCD pick-up devices. The low light sensitivity of cameras has been improving constantly, with modern cameras providing high quality pictures at very low light levels without the need for additional artificial lighting.

Higher resolution cameras are available with Y/C signal outputs for better picture definition on high resolution monitors. This goes along with the trend toward 8mm camcorders which are able to record better quality color from the built-in camera. Recently, high-end consumer cameras have been developed which have multiple pickup devices and use digital signal processing for markedly improved picture quality.

Higher quality cable signals and higher performance TVs, especially those with comb filters, have raised consumers' expectations for video picture quality. This, along with the evolution in camera signal quality, has led to



higher performance expectations by camera owners. When consumers purchase a camera or camcorder costing from \$700 to \$1500, they expect it to produce sharp pictures and good color quality. When they have their camera serviced, they expect it to be restored to its original performance and they are becoming more critical in what they consider acceptable camera performance.

After servicing a camera, simply pointing it across the room and noting that the picture seems to “look right” doesn't insure that the camera will produce an acceptable quality picture under all the customer's operating conditions. A successful camera service business with satisfied customers requires verification that the camera has been serviced properly and will produce the highest possible quality video output signal under all conditions.

Standard Waveform Monitors And Vectorscopes

Video test instruments which have been available for camera service include standard waveform monitors and vectorscopes. These instruments have been adopted from the broadcast industry, where they were designed for monitoring the quality of broadcast signals. Due to the quality specs that broadcast signals need to observe, there is usually no need for actually measuring the signals. Instead, graticule target marks are included on the CRT displays to indicate the amplitude and phase limits of properly formed broadcast test signals. If the test signals don't fall within the required limits, adjustments are made to bring the test signal within the graticule target.

Since consumer and industrial cameras don't produce signals with amplitude and phase test signals equivalent to broadcast signals, standard broadcast graticule marks are of little use in evaluating a consumer camera's performance or adjusting it to required limits. Vectorscopes, in particular, provide no method of measuring amplitude, and only a basic means of measuring phase. Although waveform monitors and vectorscopes measure many of the aspects of a camera's video output signal necessary for proper camera operation, many of these instruments

purchased for camera service have ended up on the shelf collecting dust because of their poor usability for service applications.

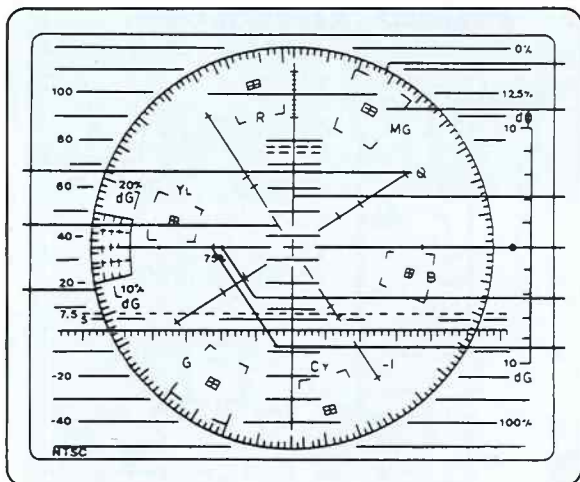


Fig. 1: Conventional vectorscope and waveform monitor displays can be confusing leaving room for interpretation errors.

Vectorscope Adapters

Adapters have also been available to convert a dual trace oscilloscope into a demodulated chroma vector display. The oscilloscope is placed in its X-Y vector mode and the adapter box feeds demodulated R-Y and B-Y chroma into the scope inputs. To view the display, a vector overlay is added over the CRT graticule. These adapters provide an inexpensive vector display, but suffer from poor stability and accuracy and from a display which is difficult to interpret.

Combination Waveform/Vector Monitors

In the last few years, test instrument manufacturers have produced combination waveform monitor/vectorscopes. These instruments again have been designed primarily with the monitoring needs of the broadcast industry in mind. These instruments combine standard waveform monitor and standard vectorscope functions into a single box. This is an advantage from a servicing convenience and space-saving standpoint, but doesn't offer improved servicing functions or significant cost savings over separate instruments.

Digital Test Instruments

Video test instruments with digital measurement capabilities have recently become available. These instruments add a long-needed level of convenience and capability to video signal measurements. They provide an easy-to-read digital display to simplify waveform and vector video measurements. Practically any element of the video signal can be easily measured. Plus, a full range of automated tests allow you to completely check the quality of a video signal.

These instruments are usable anywhere a standard video signal is present. They are, however, designed specifically with broadcast needs and specifications in mind and are highly accurate units with extensive test

capabilities and extremely high price tags. Models are available ranging from approximately \$10,000 to over \$20,000. Although the signal measurement and testing capabilities of these digital video test instruments are valuable for camera service, their high cost makes them extremely impractical for a standard camera service bench.

The Evolutionary CVA94 "Video Tracker" Camera Video Analyzer

GOOD NEWS!! Sencore has introduced the next step in camera/camcorder service equipment, an instrument designed from the ground up especially to aid in efficient camera service. In developing a camera service instrument, Sencore looked first at the test and measurement capabilities needed by servicers. This was primarily determined by the need of giving accurate estimates, localizing defective circuits and troubleshooting to the defective board or component, and verifying proper camera performance after repairs are completed to insure customer satisfaction. Then we looked at the full range of existing video test instruments and what they offered for camera service. Finally, we looked at the unmet camera service needs and the test instrument features needed to answer those needs.

The result of our development is the CVA94 "Video Tracker" Camera Video Analyzer, the complete answer for efficient camera service in the evolution of video test instruments. The CVA94 "Video Tracker" offers the best features and service capabilities of present video test instruments, plus additional features which will improve your camera service confidence and efficiency. Let's talk briefly about each of these features.

Standard Waveform Display

The CVA94 includes a standard waveform display feature. The preset waveform mode sweep rates allow you to quickly view and measure the camera signal at standard 1H (single line), 2H (two lines), or 2V (two fields, one frame) sweep rates. Plus, sweep expand allows you to examine any part of a line or frame in expanded detail.

A choice of three signal filters allows you to view and measure all or just a portion of the camera output signal. The three filters provide FLAT response for viewing and measuring the entire video signal, LUMA response for viewing and measuring only the low frequency luminance information, and CHROMA response for viewing and measuring the 3.58 MHz chrominance information.

Standard Vector Display

The CVA94 "Video Tracker" also includes a standard vectorscope display feature. This allows you to quickly view a demodulated chroma vector display of the phase and amplitude of a video camera's chroma output signals. This display gives you a quick visual

display of the phase and amplitude of the camera's color output to help you determine whether the camera's color circuits are working correctly and will produce color that "looks right."

Digital Waveform And Vector Measurements

The real "Video Tracker" advantage for standard signal measurements is a digital display of amplitude and phase measurements in both the waveform and vector modes. These digital measurements make it easy to perform quick camera measurements and to verify service literature measurements to determine whether a camera is operating properly.



Fig. 2: The CVA94 "Video Tracker's" direct digital readout simplifies chroma measurements for easier and faster camera servicing.

The CVA94 allows you to easily make digital waveform measurements of a video camera's luma and chroma output signals. The CVA94's selectable measurement units allow you to easily match measurements specified in any manufacturer's service literature, whether they are specified in IRE, mV, or as a percentage of burst. This allows you to quickly determine whether the camera's signal processing circuits are functioning properly to give your customer a sharp picture under all operating conditions.

To make waveform measurements with the "Video Tracker", you simply push a button to select the sweep rate at which you wish to view the signal, and push the desired MEASUREMENT UNITS button. Then, use the exclusive CVA94 intensified DELTA BAR to select the portion of the waveform you wish to measure and read the measurement results on the LCD display without conversion or chance of error.

A camera's chroma output signal contains information about the colors of objects in the scene that the camera is framed on. Camera manufacturers specify a vectorscope for measuring the chroma output signal's phase and amplitude to verify proper operation of the camera's color circuits.

The difficulty that you as a camera servicer will have is that standard vectorscopes don't

provide easy methods of verifying the manufacturers' measurements, since the signals don't usually match the standard broadcast specs that vectorscopes were designed to test. So, how confident are you in guaranteeing your customer that the camera will produce good-looking color?

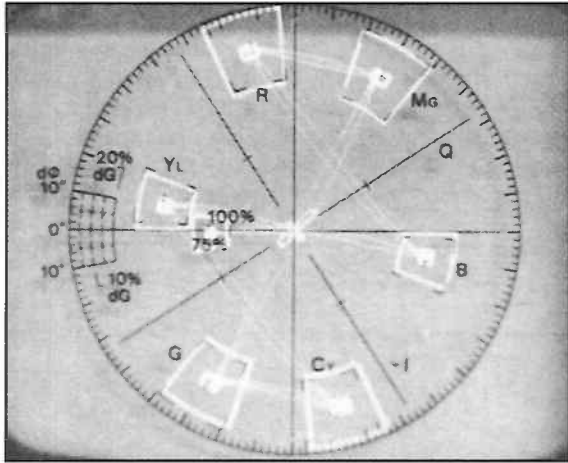


Fig. 3: Standard vectorscope degree markings may be difficult to interpret.

In order to measure the phase of the chroma signals, you would normally compare the position of vector dots on a vector display to the degree tic marks on the vector display circle. Since there aren't any degree markings, this isn't always easy to do. Camera manufacturers add to the confusion by measuring chroma phase from two different starting points on the display and by measuring either direction around the display. To verify a service literature measurement, you have to start at the right point on the display and count off the degree tic marks on the display circle either clockwise or counter clockwise around the display.

A similar problem exists when you try to check the amplitude of the camera's chroma signals. Manufacturers usually specify the correct amplitudes of the chroma signals by comparing them to the amplitude of the camera's reference burst signal. For example, the yellow chroma signal should be about twice the amplitude of the burst signal, also stated as 200% of burst. The difficulty is that standard vectorscopes don't include any CRT amplitude calibration graticules to help you make this measurement. About the best you can do is hold a ruler up to the vectorscope display to compare the lengths of the burst and chroma vectors.

These measurement difficulties cause many camera servicers to simply skip chroma measurements entirely. If colors seem to "look right" on their shop monitor when they point the camera across the shop, they figure the camera color circuits are working good enough, and they send the camera back to their customer. When the customer complains that the camera's color doesn't look right to them, the servicer is left without an easy way of resolving the problem.

The CVA94 Camera Video Analyzer makes chroma phase and amplitude measurements as easy as a couple of quick button pushes. It includes a standard vector display for quick

viewing of the chroma phase and amplitude relationships. However, to make chroma measurements, you don't need to waste time trying to interpret the visual display as you do with a standard vectorscope.

To make chroma measurements with the "Video Tracker", you simply push a button to select phase or amplitude measurements. If you need to verify a measurement made with a non-standard phase reference or direction, simply press a button to select the reference or direction the measurement was made with. Then, use the exclusive CVA94 DELTA BAR to select the color you wish to measure, and the digital measurement result appears on the LCD display.

Special Tests Speed Testing And Troubleshooting

The CVA94 Camera Video Analyzer includes six "Special Tests" to help you quickly evaluate camera operation and to help narrow problems down to the defective section of the camera. These six tests, VIDEO HUM, VIDEO S/N, BURST FREQUENCY, BURST ERROR, CHROMA SATURATION S/N, and CHROMA HUE S/N are exclusive "Video Tracker" tests that aren't available on other camera test equipment. Each of them helps you quickly check a different part of the video camera for quick estimates, troubleshooting, or final performance checks before you send a serviced camera back to your customer, to assure total customer satisfaction.

"HUM" Test Quickly Identifies Power Adapter And Power Supply Problems

Improper filtering in a camera's AC power adapter or internal power supply causes low frequency ripple from the AC power line to be added to the camera's video output signal. When the problem becomes bad enough that the ripple is larger than about 5% of the video signal level, the low frequency ripple begins to show up as dark "hum bars" that move slowly up through the picture.

Once the filtering problem becomes bad enough, it shows up on a video monitor. But what about identifying and correcting the problem for your customer when it first starts

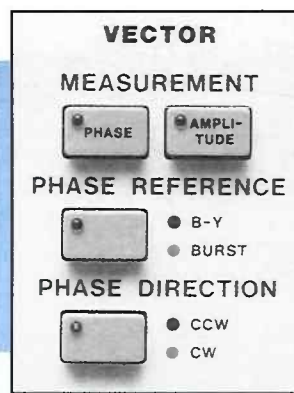


Fig. 4: Chroma phase and amplitude measurements are as easy as pressing a button.

developing, before it gets bad enough to show up in the picture? A standard waveform monitor or vectorscope used for camera servicing won't help identify this problem. In fact, the waveform monitor's DC clamp circuit hides the problem by clamping all the sync pulses to a constant DC level.

The CVA94 "Video Tracker" includes a special HUM test to identify low frequency power supply ripple, whether it's just starting to develop, or whether it has become bad enough to show up in the picture. Pressing the HUM test button disables the CVA94 DC clamp circuit and displays camera video at the vertical frame rate on the CRT so that low frequency ripple riding on the video signal is easily viewable. Plus, digital circuits automatically measure the amount of low frequency ripple signal and display a digital hum measurement on the LCD display.

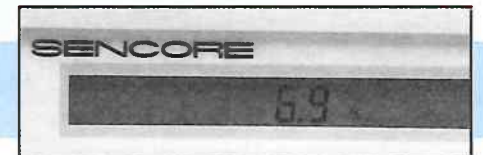


Fig. 6: The special Hum test quickly identifies low frequency ripple problems.

"Video Noise" Test Quickly Identifies And Localizes Poor Picture Quality

Poor performance of any stage from the camera lens to the video output can cause extra noise to be added to the video signal. This added noise shows up as a grainy, poor resolution effect in the picture, or in extreme cases shows up as heavy "snow" in the picture. Often it is difficult to judge whether the camera's picture is as sharp and clean as it should be or whether the bench monitor is showing the true picture quality.

To help assure customer satisfaction with every completed camera repair and to aid in troubleshooting noisy picture effects, the "Video Tracker" includes a special VIDEO S/N test. This test automatically determines the amount of undesired noise contained in the video signal. The VIDEO S/N test allows you to verify proper camera noise performance, or when used with the Chroma Noise tests allows you to quickly localize the source of poor noise performance.

"Chroma Noise" Tests Quickly Identify And Localize Poor Chroma Quality

Poor performance of any camera stage (except luminance processing) can also cause extra noise to be added to the chroma signal. This noise may be difficult to distinguish from noise originating in the luma processing stages.

To help identify and localize this type of noise, the CVA94 includes two special Chroma Noise tests. The CHROMA SATURATION S/N and CHROMA HUE S/N tests check the amount of chroma amplitude and



Fig. 5: The six special tests complement waveform and vector measurements to provide efficient video camera service.

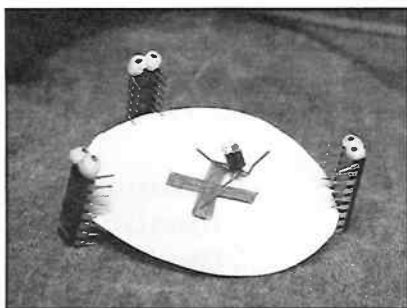
chroma phase noise present at the camera's video output. These tests allow you to easily verify camera chroma noise performance for troubleshooting or final performance checks. Comparing the results of the video and chroma noise tests allows you to quickly localize even marginal camera noise performance to the luminance, chrominance, or common signal processing stages which are causing the problem.

“Burst Frequency” And “Frequency Error” Tests Quickly Identify Reference Oscillator Problems

In the past, many servicers have hesitated to check the camera's reference oscillator, even though it is crucial to the proper operation of many parts of the camera. To check the oscillator for proper frequency, you have to open the camera case, locate the oscillator test point, connect a frequency counter probe, read the frequency of the oscillator, check the service literature for the proper reference frequency, and compare the oscillator frequency for the amount of error. To add to your problems, once the camera case is opened, you may still have to remove circuit boards to access the necessary test point. Also, when you connect the counter probe to the test point, there may be a loading effect on the oscillator, causing an error in the frequency counter reading.

Some servicers have tried to simplify this important measurement by checking the frequency of the burst in the video output signal instead. No matter what the internal reference oscillator frequency, it will always be divided down to produce chroma burst at 3.579545 MHz. If the burst signal is at its correct frequency, the internal reference oscillator frequency must also be correct. If the burst signal is the wrong frequency, not only is the internal reference oscillator at the wrong frequency, but some monitors may not produce locked-in color from the camera signal. Making this measurement is difficult because no standard frequency counter can measure the burst signal directly, since it isn't continuous. It only occurs for a few microseconds during each horizontal blanking period.

Some servicers have overcome this difficulty by feeding the camera output signal to the “gen-lock” input of a special video generator with gen-lock capability. The generator locks to the incoming burst



signal and produces a continuous subcarrier output signal at the same frequency as the camera's burst signal. They then connect a frequency counter to measure the generator's subcarrier output. If the counter reads exactly 3.579545 MHz, they know the camera's internal reference oscillator is running at exactly the right frequency. The problem with this solution is that it adds an expensive generator to the camera test setup for its gen-lock feature alone.

The “Video Tracker” simplifies this important camera troubleshooting procedure to an easy two steps. Simply push the BURST FREQ button and read the frequency of the burst signal on the LCD display. You don't have to open the camera, there are no extra instruments to connect, and the reference oscillator isn't loaded down.



Fig. 7: The Burst Freq and Burst Error tests allow you to quickly check a camera's reference oscillator without opening the camera.

For a quick display of the amount of error from the standard burst frequency, simply push the BURST ERROR button and read the amount of frequency error on the LCD display. When adjustments are necessary to the reference oscillator, the BURST ERROR display allows you to quickly adjust the oscillator to center frequency by watching the display for zero error as you make the adjustment.

Selectable Composite And Y/C Video Inputs Assure Camera Compatibility

Video cameras and camcorders provide a composite video output jack – either on the camera body or on an output adapter. This jack includes both luma and chroma signals on the same output line. In terms of picture resolution, this is less than ideal since the luma and chroma signals are forced to share the frequency spectrum between three and four MHz. A video monitor receiving this type of signal usually loses most of the high frequency luminance signals in the process of separating them from the chroma signals.

Some newer cameras and camcorders include a Y/C output jack (also called S-Video) on the camera body. This type of connector has separate luma (Y) and chroma (C) signal lines, so the signals aren't forced to share the same frequency spectrum. When a video monitor with a Y/C input connector receives a signal from this type of camera, it doesn't have to separate the signals before processing them, and higher picture resolution is achieved.

But how do you test the high resolution output of these newer cameras? No currently available camera test equipment accepts a Y/C signal input. That means you can't check the camera for its full performance capabilities. Also, those cameras with a Y/C output don't have a composite output on the camera body, so to test the camera through the composite output jack you need to be sure to have the camera's output signal adapter.

The all new CVA94 Camera Video Analyzer includes both composite and Y/C video inputs to assure compatibility and testing convenience

with all types of cameras and camcorders. Now you can fully test all cameras, even high resolution Y/C output cameras, to their full performance capabilities. Plus, the “Video Tracker's” video inputs are internally terminated with protected 75 ohm terminations for convenient, error-free camera connections every time.

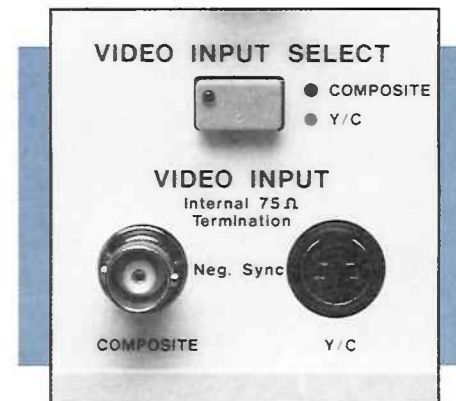


Fig. 8: Both Composite and Y/C Video Inputs allow you to fully test all cameras.

Scope Trigger Output With Both Sync And Marker Trigger References Saves You Troubleshooting Time

When you use an oscilloscope to signal trace camera circuits stage by stage, you need to externally trigger the scope to the camera's sync generator. The luma and chroma signals present in most of the camera circuits don't contain the horizontal and vertical sync signals needed to provide a stable scope trigger point for easy signal tracing. The sync signals are added to the video signal at the very end of the signal processing circuits, just before the signals are sent to the camera's video output jack. If you scope the signals in the camera circuits before the sync adder stage, you often get a jumbled display, unless you use an external sync trigger. To obtain the necessary external trigger signal though, you need to either find a sync generator test point in the camera or make an extra connection to the camera's video output.

The “Video Tracker” simplifies this process by providing a convenient TRIGGER OUTPUT signal to provide a constant, positive trigger signal for your scope without making an extra probe connection to the camera. This allows you to probe test point after test point in the camera and obtain instantly locked-in scope displays without once touching the scope's trigger controls.

Selecting SYNC TRIGGER REFERENCE allows you to trace signals at either the horizontal or vertical sweep rate, with the scope display beginning at the start of each horizontal line or each vertical field. Setting the scope's horizontal timebase allows you to view the desired number of lines or fields. This mode is perfect for general signal tracing through any of the camera's signal processing stages. The perfectly locked signals allow you to concentrate on the camera waveforms rather than the scope-trigger controls.



Selecting the CVA94's exclusive MARKER TRIGGER REFERENCE allows you to easily signal trace specific parts of the video signals which you mark with the Delta Bar. You control the expansion of the marked signal by setting the scope's horizontal timebase. This allows you to zero in on any part of the signal that you see on either the CVA94 CRT display or the video monitor display. Simply set the Delta Bar on either the CRT or monitor display to start just before the signal defect. Then scope any circuit within the camera. The signal at the left of the scope display is the same signal occurring just after the Delta Bar starting point. Expand the signal to the desired detail by adjusting the scope's timebase. Then simply scope trace the defect stage by stage to its source.

Composite And Y/C Outputs Match Any Video Monitor Input

When you service a camera, you want to connect both a video monitor and your test equipment to the camera's video output. This usually leads to a confusing array of connectors and signal terminators. Also, if the video monitor you are using on your bench isn't able to switch out its internal input termination, the accuracy of all your test equipment measurements is limited by the accuracy of this termination.

The CVA94 Camera Video Analyzer simplifies the video monitor connection problem and provides a great bonus to further simplify your signal measurements as well. The "Video Tracker" provides both composite and Y/C video outputs to allow you to easily connect video monitors with either composite or high resolution Y/C inputs. The COMPOSITE VIDEO OUTPUT connects to a video monitor's standard 1 VPP composite video input. This provides the best signal connection when servicing cameras with standard composite outputs. The Y/C VIDEO OUTPUT connects to a video monitor's high resolution Y/C (S-Video) video input. This allows you to easily evaluate the full performance of video cameras equipped with Y/C outputs.

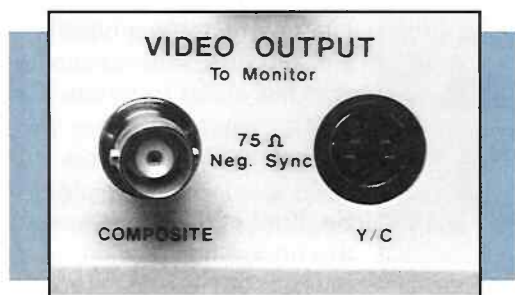


Fig. 9: Both Composite and Y/C Video Outputs allow you to match any video monitor input for optimum camera testing.

Integrated "Monitor Marker" Positively Identifies Your Signal Measurement

The bonus to the CVA94's video monitor connection is that it also provides a DELTA BAR MARKER signal to the monitor. This MONITOR MARKER is synchronized to the

CRT DELTA BAR markers used for digital waveform and vector measurements. The MONITOR MARKER allows you to easily see, directly on the picture, exactly what parts of the picture you are measuring.

When you are measuring the red bar in a color bar test signal, the MONITOR MARKER positioned on the picture's red bar confirms your measurement selection. When you wish to change your measurement to the yellow bar, you simply watch the picture as you press one of the CVA94 DELTA BAR POSITION buttons to move the highlighted MONITOR MARKER to the yellow color bar. For times when you may want to see all parts of the picture in detail without the MONITOR MARKER present, the CVA94 also allows you to disable the marker. Simply press the MONITOR MARKER button to turn the marker off, or back on again.



Fig. 10: The CVA94 provides a video monitor Delta Bar Marker synchronized with the CRT Delta Bar to make signal measurement selections quick and easy.

Beam Saver™ Automatically Prevents CRT Phosphor Burns

Most camera test signals tend to be unchanging signals that repeatedly produce bright traces in the same area of waveform monitor and vectorscope CRT screens. This tends to darken or "burn" the CRT phosphor in those bright areas of the trace. In fact, some areas of the phosphor are often burned away entirely over time, especially at the center dot of vectorscope displays. This results in a total loss of the visible CRT beam in those areas.

The "Video Tracker" includes an automatic CRT phosphor protection circuit. This exclusive Beam Saver™ automatically blanks the CRT trace after approximately ten minutes of inactivity to save the CRT phosphors from burning. To restore normal CRT operation, simply press the Beam Saver button or any of the other function buttons.

Built-In CRT Cal Signals Add Measurement Confidence

The CVA94 "Video Tracker" includes built-in waveform and vector CRT calibration signals to quickly verify the accuracy of displayed CRT signals. These calibration signals, a square wave in the waveform mode and a circle in the vector mode, are available at the touch of the CAL SIGNAL button. These



signals can be used to check or adjust the calibration of the preset 1VPP CAL position of the DISPLAY AMPLITUDE control. This mode is used for accurate CRT displays of all standard 1 VPP composite video and Y/C signals.

Video Reference Companion To The CVA94 Camera Video Analyzer

The VR940 Video Reference is also available as a companion camera servicing unit to the CVA94 Camera Video Analyzer. The VR940 provides a light source at both 3200 and 5500 degrees Kelvin. It also includes a full complement of test charts and filters (nine total) to provide all the reference signals needed for complete camera testing, troubleshooting, and alignment.

The CVA94 "Video Tracker" Camera Video Analyzer and VR940 Video Reference, when combined with a Waveform Analyzer such as the SC3100 "AUTO TRACKER", form a complete camera test bench. The "Video Tracker", as the heart of this bench setup, will help you service cameras quickly and profitably. Plus, when you add the VC93 All Format VCR Analyzer to the bench, you have a complete camcorder service bench, ready to service all formats of camcorders.



Fig. 11: The VR940 Video Reference provides all the accurate reference signals you need for dependable camera servicing.

Have questions? Ready to place an order or want to try a "Video Tracker" on your bench? Call your local Area Sales Representative toll-free at 1-800-SENCORE. We'll answer your questions and help put a CVA94 Camera Video Analyzer to work for you. ■

THE CHOICE SYSTEM



A Message From The President

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

Sometimes peace of mind is not as easy to achieve as we would like. The time necessary to take a walk in the park, swing a golf club, or spend a quiet evening by the beach can also be very elusive. Sometimes the responsibility of keeping your employees content bears down on a businessman more than it should. Plus, the obligation of keeping your customers satisfied and supporting the investment they've made can be more than a full time job – it can become a series of difficult choices. These choices aren't always easy ones and the final judgement can affect your employees and customers both.

Why am I telling you all this? Because just a few days ago, I made a decision that involves you – our valued Sencore customers. Let me explain . . .

As we have discussed in previous articles, there are three major elements in every business: revenue, inventory, and operating expenses. Over the past couple years, thanks to you, we have been experiencing good, solid business growth. We believe the increase in revenue is a direct result of our customers' appreciation of our overall offering: our customer support, our innovative products, and our commitment to the service industry. Revenue increase is the good news. The unpleasant news is that our operating expenses are also growing at an alarming rate. Bottom line, we are doing more business, but we are spending even more to get there.

As part of our continuous improvement process during the past couple years, we've been closely monitoring our costs and eliminating unnecessary expenses by fine tuning our processes. Even with all this effort, expenses are still increasing. After serious analysis, we finally isolated the areas responsible for the highest increases.

Administrative And Manufacturing Labor Costs:

Automation has proven to be a true benefit to Sencore. For the past couple years, we have been able to provide products to our

customers without a serious increase in the number of people we employ. The cost of living has risen over the past few years, however, forcing us to increase salaries in order to keep our employees happy and serving our most valuable resource – our customers. This cost we found to be necessary.

Technology Updates:

Supplying test and analyzing instruments to the service industry demands a serious commitment on the part of an organization. It demands that the organization be agile and willing to make changes that support the industry's needs and trends. Along these lines, with instrumentation becoming more and more complex, Sencore had to make some substantial investments in the area of surface mount technology while updating our manufacturing and service areas with top-of-the-line manufacturing equipment — (otherwise our "AUTO TRACKER" would be the size of a washing machine).

This decision was not much different than you having to purchase surface mount soldering and desoldering equipment, but on a larger scale. In the long run, these investments will make our test equipment last longer with higher quality. And we all know, high quality instruments that last a long time are wise investments.

Customer Support Costs:

An increase in revenue means more than just shipping a few more products or increasing capacities in manufacturing. It means more customers out there – in the field – needing support. It means more customers calling our Application Engineering department with questions. It means more customers requesting Tech Tips and Tech Tapes from our Area Sales Representatives. It also means this

support material must be more sophisticated in order to cover the vast issues revolving around today's consumer electronics.

More complicated consumer products, more sophisticated test equipment, more customers, more support. Bottom line, this expense was not about to be cut – no matter what the cost – not as long as I'm in charge.

So, if all of these expenses are necessary, how do we balance our income state-

ment? We cannot back off technology – we must keep pace with new technologies to stay competitive. We cannot reduce labor costs or hire cheaper labor because our employees are the heart of our products and form the basis of our customer support initiative. And, finally, we cannot reduce customer support as we truly believe that when a customer purchases a Sencore product, they don't just own the product – they are investing in our company and their future.

It became apparent the past several weeks that we needed to make a tough choice. We



needed to reduce customer support, reduce labor costs, become less sensitive to technology demands, OR increase the price of our products and services – and implement the change quickly!

Being the owner of this organization, I can't help but feel responsible for having to increase prices. The only consolation is that Sencore's last price increase was during 1987 – over six years ago. Having held the line for six years without a price increase, I hope our customers can appreciate this fact being business owners themselves.

Much like a price increase with your business, our price increase was a serious decision. Only after meetings (with Sencore's Application Engineering, Sales/Marketing, and Accounting Departments) that carefully considered all aspects of a price increase, were we comfortable with the need for this change. We took the extra time to ensure that the increases were at the level we needed, yet still kept the instruments accessible to our customers. After all, we don't have a price increase very often and we wanted to make sure this serious decision was right for our customers.

Implementation Of The New Price Increase

Sencore is planning its first price increase in over six years. In order to make sure that our customers' plans are not hindered by this increase, I have made the following requests to our Sales, Marketing, and Accounting Departments:

1. Maintain present pricing and present discounting practices until September 30, 1993. This should provide our customers sufficient time to execute their purchases.
2. Announce the new pricing effective October 4, 1993.
3. Offer special financing with no down payment and low interest rates enabling our customers to make their purchases during September at the lower, pre-increase pricing. Specifically, for purchases occurring during the month of September, I have directed our Sales and Order Processing people to offer these special financial incentives:

Length Of Term	Required Down Payment	Percentage
6 – 12 Months	0 Down Payment	0%
13 – 24 Months	0 Down Payment	6.9%
25 – 36 Months	1 Monthly Payment	7.9%
37 – 48 Months	1 Monthly Payment	8.9%

My hope is that the majority of our customers take advantage of this opportunity to purchase at the lower prices in order to avoid budget difficulties once the new prices go into effect.

To conclude, I have made a decision that affects you, our valued customers. I hope we've given you enough notice to budget your test equipment purchases accordingly. I have done this in good faith and with one thought in mind – to protect our customer support programs of the best instruments in the industry.

We've got the quality test equipment and support necessary to put your service center in the profit column for years to come. Call us toll-free, **1-800-SENCORE**, for all your instrument questions and the kind of support you've come to expect from the leader in American-Made electronic test equipment.



When you invest in Sencore test equipment, help is just a toll-free call away!

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 60 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 0%, 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.

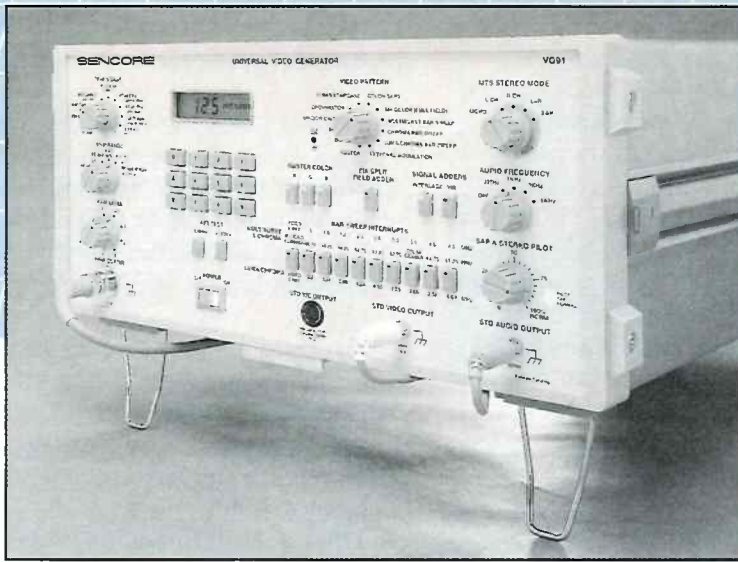
How do I get started?

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!

How To Troubleshoot Modern Video-IF Stages

By Glen Kropuenske, Application Engineer



Snowy picture, loss of picture detail, interferences, or poor sound are all symptoms of problems in the video-IF stages. These symptoms are difficult to isolate to the video-IF stages and even harder to pinpoint. Plus, these symptoms often lead us into troubleshooting the wrong circuit.

Why is this? Probably because conventional methods yield no effective or easy ways to find IF problems. The IF signal is a modulated carrier at low signal levels rendering an oscilloscope noneffective. Tuner subbers and inexpensive IF generators provide little help with fixed IF signal levels with questionable frequency accuracy.

This article provides you with the information you need to confidently troubleshoot video-IF stages with the VG91 Universal Video Generator. First we will look briefly at today's video-IF stages found in consumer TVs and VCRs. Second, we will look at the difficulties with troubleshooting video-IF circuits with conventional methods. And finally, we'll explain how the VG91's variable level 45.75 MHz video-IF and trap setting signals quickly isolate problems to give you the confidence you need in today's competitive service industry.

Understanding Today's Video-IF Circuits

Modern video-IF circuits commonly include four stages. The signal from the tuner feeds the first IF amplifier stage which, in turn, feeds the SAW filter. The IF signal passes through the SAW filter to additional IF amplifier stages and then to a video detector stage. Figure 1 shows a basic block diagram of a modern video-IF and how you would find those blocks arranged on a typical schematic.

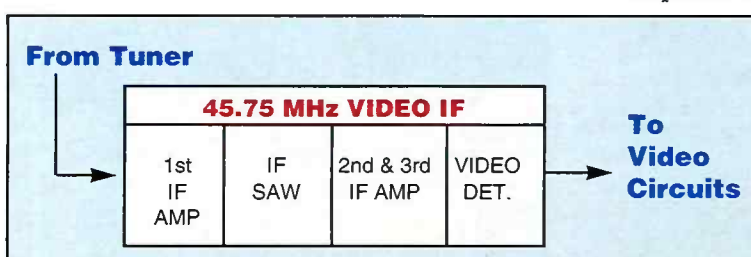


Fig. 1: Block diagram and corresponding circuits for a typical video-IF schematic.

The video-IF signal from the tuner is comprised of video sidebands containing the luminance and color information. These video sideband frequencies extend in the range of 41.5 MHz to 46 MHz. The channel's audio carrier and accompanying audio sidebands are also present at 41.25 MHz. Video-IF stages provide proper bandpass and amplification for these sideband signals while rejecting adjacent TV channel carriers.

The SAW filter provides an IF bandpass response that is much closer to ideal than was possible with tuned circuits. It further provides better attenuation of adjacent channel than L/C trap coils. The SAW filter response is fixed during manufacturing and field adjustment is not possible. SAW filters have eliminated IF bandpass adjustments and most trap adjustments.

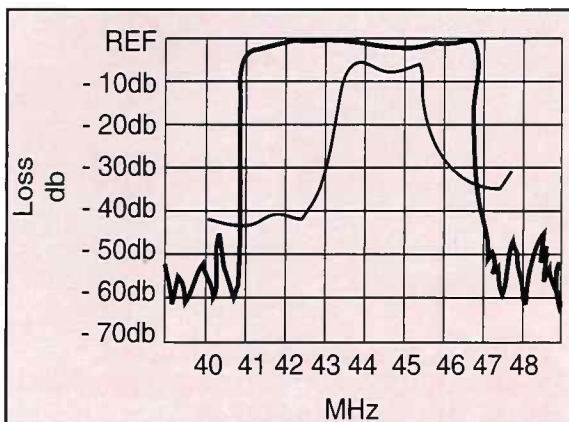


Fig. 2: The SAW filter passes IF sideband frequencies while rejecting unwanted adjacent channel signals.

An initial first IF amplifier stage provides amplification to the IF signals before entering the SAW filter. The amplifier is needed to make up for the normal insertion signal loss of the SAW filter. The first IF amplifier is typically a discrete transistor amplifier stage found on the main chassis circuit board or inside the tuner enclosure. When included in the tuner, it generally is referred to as an IF preamp. Many modern tuning systems now integrate the first IF "preamp" stage inside an IC located in the tuner enclosure.

The output of the SAW filter is an IF signal that has the proper

frequency response. The IF sideband signals are applied differentially to an "IF processor" IC input. The signal passes through several stages of IF amplification in the IC and is applied to a synchronous video detector. The video detector removes the video information from the IF carrier and outputs a composite video signal. Some "IF Processor" ICs provide some initial video amplification before the output. Video-IF ICs also contain the AGC detector and AFT detector circuits.

Video-IF Troubleshooting Difficulties

Troubleshooting the video-IF stages is especially challenging. Signal tracing is not a practical way to isolate problems in the video-IF stages for several reasons. First, schematics do not provide typical oscilloscope waveforms in these stages because the video-IF stages are low level signals (1 mV) and high frequencies (45.75 MHz). These values are beyond the viewing capabilities of most oscilloscopes.

Secondly, a modulated IF waveform is not easy to interpret when displayed on an oscilloscope. In many cases, circuit loading by the test probe alters the IF waveform, making the measurement even more useless. Figure 3 shows a defective waveform in the 1st IF amplifier stage. Can you tell whether the waveform is good or bad?

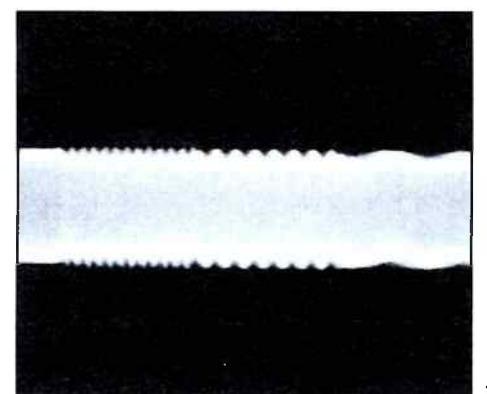


Fig. 3: Can you tell if this video-IF waveform is good or defective by viewing this waveform?

Finally, the input signal to the video-IF stage is dependent on proper tuner operation to produce a good input signal. Proper tuner operation is dependent on the AFT circuits which are part of the video-IF stages. A

problem in the tuner or video-IF AFT stages results in improper tuning which produces abnormal IF waveforms.

Using The VG91's 45.75 MHz Video-IF Substitution Signal

The Sencore VG91 Universal Video Generator overcomes these troubleshooting difficulties by providing an accurate video-IF substitution test signal. The VG91 provides a 45.75 MHz video-IF signal you can input into the receiver's video-IF stages to isolate problems with confidence.

Signal substitution with the VG91 lets you inject a known-good IF signal at the proper level into the input of a stage. If the problem is after your injection point, you will see little change on the CRT. If you are injecting after the defect, the substitute signal passes through the good stages producing a noticeable improvement on the CRT. You input the substitution signal stage-by-stage until the

original symptom appears on the CRT indicating you are injecting at the input of the defective stage. This divide-and-conquer method of troubleshooting has been proven over the years to be the most effective and time-saving approach to troubleshooting.

Three features of the VG91's IF generator make signal substitution into modern IF circuits possible. First, the VG91 IF carrier is a stable and accurate IF carrier frequency. An accurate IF carrier is needed to pass properly through the SAW filter and for normal synchronous detector operation. Other tuner subbers or channel converters may shift the IF carrier causing frequency errors.

Secondly, the VG91's video-IF signal has full video and/or audio modulation so the IF, detector, and AGC circuits can all operate under normal conditions. You can use the VG91's video and audio test signals to analyze the IF, video, and audio stages from the point of injection to the CRT or speaker. You simply observe the CRT or listen to the

speaker to evaluate the performance of each individual stage.

Finally, the fully variable IF output signal level (.5 mV to 500 mV) matches the signal level found in any video-IF stage. This is especially important when isolating gain problems which produce noisy pictures. Other subbers or generators output IF levels fixed at 1 mV or 10 mV. These levels are too low when subbing into the SAW filter or IF processor IC. In addition, the VG91 comes equipped with a special IF troubleshooting balun that connects the substitution signal to the circuit without upsetting the circuit's normal DC bias.

SERVICING^{plus}

LC102 "AUTO-Z"TM 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.



What Is ESR?

ESR (equivalent series resistance) is the electrical resistances in series with the capacitor plates. This includes the resistance of the metal leads and plates and the connections between them.

There are two common causes of high ESR, 1) Bad electrical connections, and 2) Drying of the electrolyte solution. Electrical connection problems can happen in any capacitor, new or old, while drying is usually only a problem in older capacitors.

The LC102 "AUTO-Z" automatically measures ESR with a dynamic, patented test. You get a numeric digital readout, plus a GOOD/BAD indication telling you if the ESR is out of tolerance for the capacitor under test.

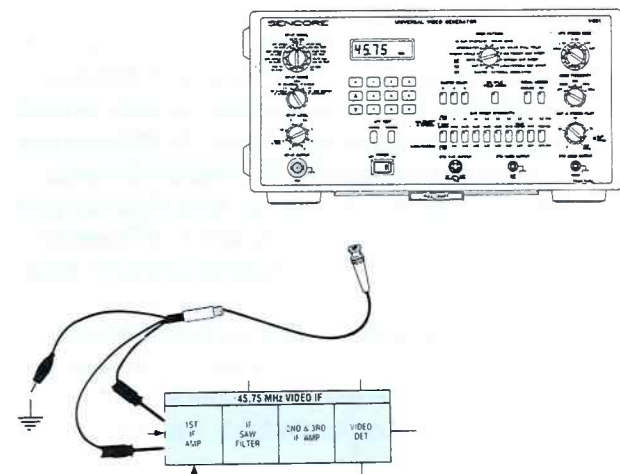


Fig. 4: The 45.75 MHz video-IF signal may be used to substitute for the tuner to isolate defects to the individual IF stages.

Connecting The VG91 To Video-IF Circuits

The VG91's 45.75 MHz video-IF signal can be used to substitute into any video-IF stage. You have three options for making connections to the circuitry: 1) Troubleshooting Matching Balun, 2) F-connector to RCA-female adapter, and 3) F-connector to RCA male adapter. Each of these options connects to the F-connector end of the VG91's RF-IF Test Cable.



Fig. 5: The VG91 gives you three cable options to connect to the video-IF circuitry.

Video-IF stages found in many older model television receivers have a link cable that connects the tuner to the IF circuit input. The link cable usually has an RCA connector on one end. To connect to these chassis, disconnect one end of this link cable and use one of the VG91's supplied RCA adapters.

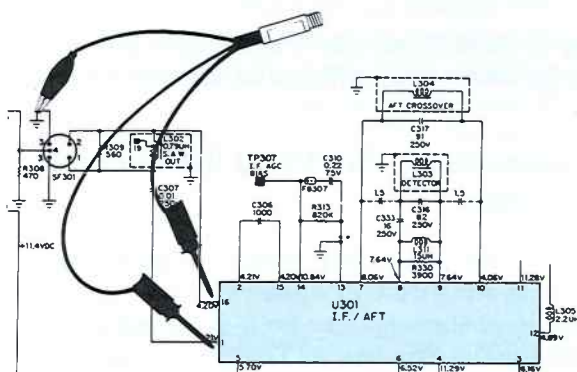
In newer TV/video systems and receivers, the link cable is eliminated. The tuner module is generally soldered directly to the circuit board that contains the video-IF stages. In these types, use the IF Trouble-

shooting Matching Balun to connect to the first video-IF amplifier (you don't even need to open the signal path). If the first video-IF amplifier transistor is contained in the tuner module, use the IF Troubleshooting Matching Balun to drive the SAW filter. The IF Troubleshooting Matching Balun contains blocking capacitors to prevent upsetting the DC voltage present in the IF circuits.

Note: Do not use a regular CATV-type balun to make connections to video-IF stages. Some circuit test points have a DC potential which will be shorted using a conventional balun. Only the IF Troubleshooting Balun supplied with the VG91 contains special DC blocking capacitors for safe troubleshooting.

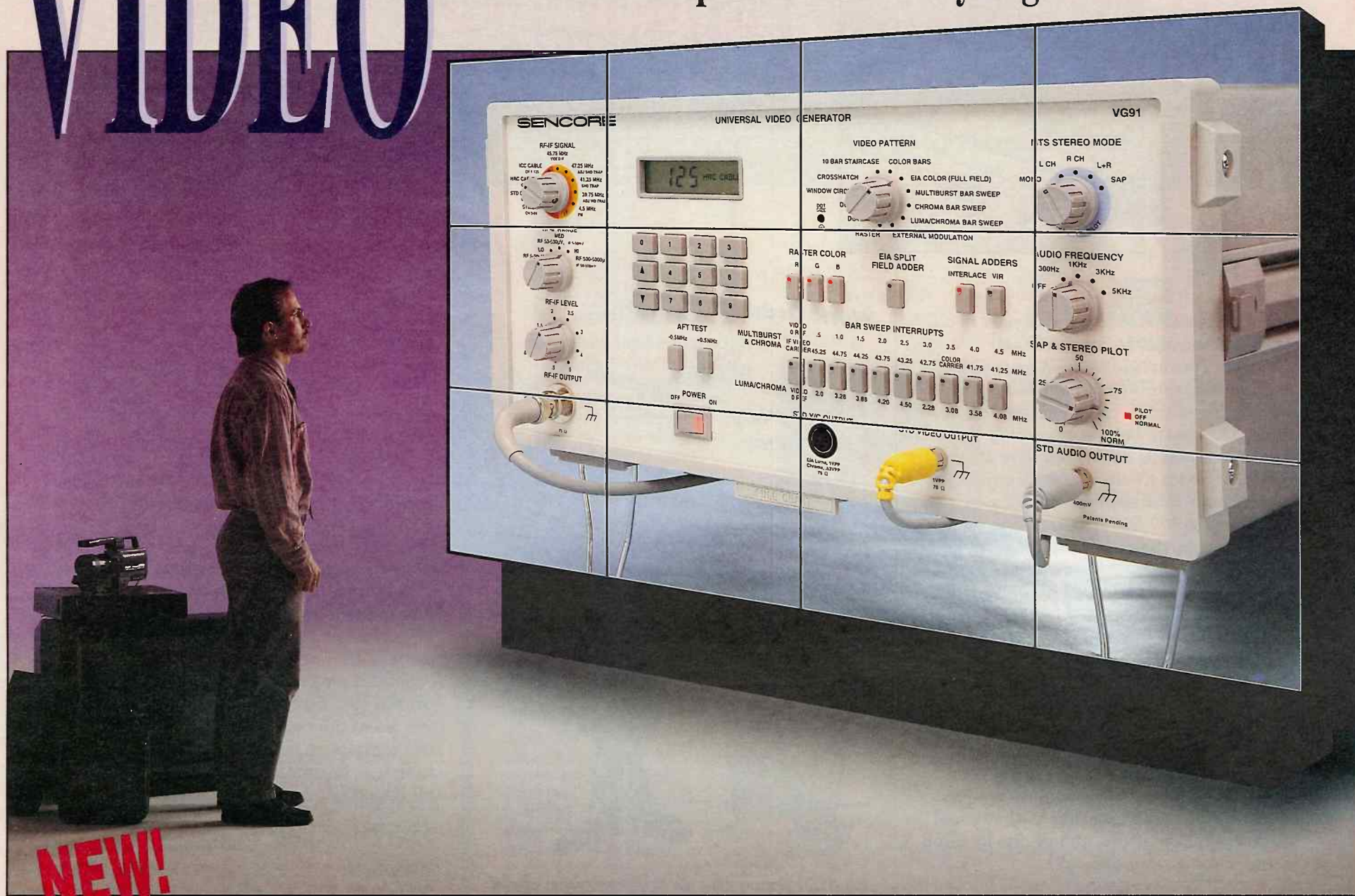
Integrated circuits found in modern video-IF stages commonly contain balanced differential inputs, neither at common circuit ground. When applying the VG91's 45.75 MHz signal to these points, use the IF Troubleshooting Matching Balun. Miniature test clips are provided to allow easy connection to IC inputs without the risk of shorting between IC pins.

The IF Troubleshooting Matching Balun includes a third lead. This lead is for making a ground connection to eliminate interference when subbing the 45.75 MHz video-IF signal into balanced inputs.



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!

- ◆ Direct View TVs As Big As 35 Inches
- ◆ Projection TV
- ◆ 10 Or More VCR Formats
- ◆ 125 Or More Cable Channels
- ◆ Picture-In-Picture
- ◆ Video Cameras
- ◆ Comb Filters
- ◆ High Resolution
- ◆ Video Laser Disc Machines
- ◆ Even Projection Cubes

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.

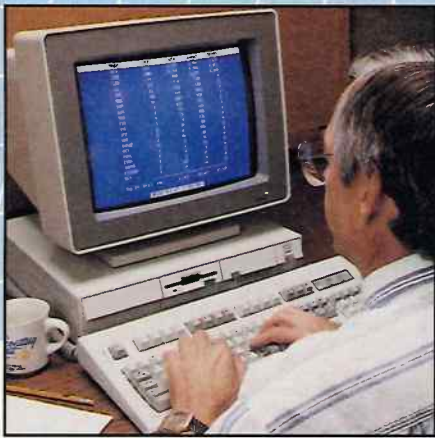
THE CHOICE SYSTEM

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.

Call Today! 1-800-SENCORE
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Streamlining Processes Improves Efficiency And Eliminates Duplication Of Effort

By Brian Phelps, Product Marketing Specialist

SM2001
Service Center Manager

Editor's Note: This is the second part in a series on the SM2001 Service Center Manager. This article shows how you can build your business by streamlining processes making you more efficient, effective, and profitable. The next article, in upcoming Sencore News #163, will be addressing how the SM2001 Service Center Manager can help you improve your business controls. Please, give us a call at 1-800-SENCORE if you have any questions regarding the material presented in this article, or if you'd like to receive more information on the SM2001 and how it fits your business.

Are your current business management techniques limiting your business and bottom-line profits? Are you spending excessive time filling out paperwork, tracking repairs, controlling parts orders, filling out invoices, or doing your books? Are your current business management techniques as accurate as they could be? Are you losing time and profits by duplicating many of your efforts?

Streamlining your processes with a business management system will allow you to be more efficient and effective with your time. This extra time can be used to better manage or build your business to generate more profits. The SM2001 Service Center Manager, offered exclusively by Sencore, will help you streamline your processes. This article highlights some key areas where the SM2001 software program can benefit your business. Please read on and learn how the Service Center Manager can help you become more efficient, effective, and profitable.

Reduce Paperwork Duplication For A Streamlined Business Flow!

If you're like most service centers, you probably have an area full of drawers, file cabinets, and card files stuffed with papers, old service invoices, bills, accounting papers, and business reports. Take a quick look at the paperwork you use and identify the areas where you can streamline your business management techniques.

As you can see from this rough example in Fig. 1, there are several processes that are simply a matter of pulling paperwork, recording information, and refiling the papers. A streamlined process will put all the information and "paperwork" at your



Fig. 1: Are you spending too much time cycling papers when you could be managing your business toward a more profitable year?

fingertips. Your business management system should update all associated records once you've entered the information to any one of the files. You should be able to change dates, pricing, repairs, parts orders, and easily control the operation of your business by streamlining your processes.

Streamline Your Business For Improved Profits!

Have you ever considered streamlining as a way to improve the profitability of your business - allowing you to better handle customer inquiries, run a tax report, or produce business reports? There are six general areas where an improvement in the process (streamlining) can improve profits. These areas are: invoices, parts ordering, inventory, business reports, accounts receivables, and transaction registers. Let's quickly look at each of these areas and learn key elements where we could improve and perhaps where we are falling short.

INVOICES

The invoice shows exactly what has transpired with the repair. It allows you to track the unit through your service center, point

you toward inventory so you can accurately predict repair times, let you keep track of the parts being used, and keep accurate notes. The invoice is much more than a way to bill the customer. The invoice provides historical information on defects, fixes, taxes, labor, etc., so you can handle customer inquiries and better manage your business on a daily, weekly, monthly, quarterly, or yearly basis.

For a streamlined operation, you simply cannot manually track a repair efficiently while constantly pulling invoices and adding notes, checking on parts, seeing if the customer has paid, etc. That's why many service centers have already made the change to computer aided business management and the SM2001 Service Center Manager. With the aid of the computer and the SM2001, you can completely automate and streamline the functions of your service center, including the all important invoice.

PARTS ORDERING

How quickly can you determine what parts need to be ordered, what parts are back-ordered, and which invoices are waiting for the parts? The SM2001 Service Center Manager streamlines your parts ordering process so you can manage and control your purchase orders more effectively. It lets you know exactly when a part was ordered, which invoices are affected, and when the parts arrived. All parts order processing interfaces with the invoicing automatically, so when you look up the repair, you'll know its status immediately. This totally eliminates duplicating efforts by going to the card file, logbooks, or customer repair ticket searching for current or previous information. It's all done automatically, inside the computer, as you process the parts orders.

INVENTORY CONTROL

Do you have parts in stock that are used frequently? Can you locate and identify parts quickly? Can you cross-reference parts automatically? And are you consistent in the pricing of parts as you put them into inventory? Most manual processes are laced with errors in these four areas. Our research has found that many service centers aren't sure what parts they have, where the parts are located, nor do they track or run reports on inventory usage. This information can be used to help make inventory decisions, but is often overlooked because of the time it takes to summarize the information contained in the stacks of papers.

INVOICE

UPDATE MODE SERVICE CENTER MANAGER DATE: 04-06-1993

INVOICE NO: 1234 DATE IN: 04/06/93 NAME: Andrews, Joseph
 TENU: 2031 SPRING CDR CAT CODE: C UNIT CODE: AD BLD: DTD TEL CODE: R
 Address: 2031 Spring Street
 City: Charleston ST: SC ZIP: 29408 H. PHONE: (803)555-1232
 Name: JTL Description: COL rodell 276191 Serial: 27775944
 Ref Order: HI Unit Code: Travel Time: 0 Mileage: 0 Company Code: 0
 Comments: COLOR PRINTING, INTERMITTENT
 Make: CUMMINS ENGINEERING
 Service Performed: CUMMINS CIRCUIT REPAIR, SET-UP AND ADJUST
 Times: 0
 Parts: 34.89 1 0603583004 11.81 Date: 04/05/93
 Sales: 0.00 SLIP 1 2762860001 23.89 P. NO. 2356
 Ship/rdy: 0.00 CLIB 0 0.00 DATE REC: 04/06/93
 Trly Charges: 0.00 TECH 0 0.00 COMPANY: 04/06/93
 Is-Install: 0.00 TECH 0 0.00 Location: SI
 Technical Chgs: 65.06 JS TECH 0 0.00 EST:
 Tax: 0.00
 Invoice Total: 99.93 Date: 04/06/93
 Repair Fee: 0.00 Date: 04/06/93
 Balance: 99.93 Date: 04/06/93
 Date Pld By: 04/06/93 Date Notified: 04/06/93
 TDU: 04/06/93
 Update: (F5) Parts (F6) Look-Up (F7) Repeat (F8) Menu (Ctrl-L) Literature

PARTS ORDERING

MAIN MENU 04/06/93 MAIN MENU

Advanced Electronics
 PARTS ORDER PROCESSING

Order Parts
 Print Purchase Orders
 Receive Parts from Vendor
 Outstanding Orders Report
 Print Order Status Report
 Delete Purchase Orders
 Look-Up Parts on Order
 Quit - Return to Main Menu

INVENTORY

DATE: 04-02-1993 INVENTORY FILE MAINTENANCE EDIT MODE

Last No: 2762860001 Type: U Measure: EA Min-Level: 0
 Re-Order Level: 0
 Description: PVL KWACTIMM Status: A
 Date last In: 04/06/93
 Date last In: 04/01/93

Level	Qty	Unit Cost	Ord Value	Total Cost	Retail Price
A	5	9.55	0.00	47.75	Price Lvl 1: 0.00
B	0	0.00	0.00	0.00	Price Lvl 2: 0.00
C	0	0.00	0.00	0.00	Price Lvl 3: 0.00
Totals	5	47.75	0.00	47.75	

Quantity Sold: 1 NTD: 3 YTD: 3 Vendor Number: 23
 Total Sales: 23.00 71.64 Last Order Date: 04/01/93
 Cost of Sales: 9.55 28.65 Purchase Order No: 2356
 Cost of Receipts: 9.55 19.10 Department File Maintenance
 Gross Margin: 0.00% Quantity on Order: 0
 Qty Committed: 0
 Location Code: F33
 Department Code: 3

REPORTS

DATE	PDU UNITS	PARTS	SALES	SC	LABOR	PDU LABRA	SHIP	LABOR	TAX	TOTAL
04/11/91	27	343.75	759.95	264.65	20.00	1029.95	187.00	206.10		2263.57
05/11/91	13	158.40	1481.65	54.95	15.00	382.40	119.27	223.87		559.99
05/14/91	13	155.25	137.21	29.90	0.00	11.00	58.28	595.99		196.47
05/14/91	16	469.57	759.95	104.25	20.00	327.69	134.41	1966.77		2555.61
05/15/91	21	269.50	0.00	84.35	35.00	741.06	76.57	1512.41		2855.61
05/15/91	16	102.73	323.95	162.75	50.00	636.25	93.14	1637.89		2855.61
05/17/91	13	277.55	1510.65	32.33	24.95	435.86	136.43	2655.61		3521.65
05/19/91	20	322.13	0.00	139.35	39.00	551.63	57.35	1686.02		3521.65
05/20/91	9	54.94	959.35	19.96	0.00	205.25	29.39	1403.74		3521.65
05/21/91	22	404.71	1524.35	129.75	110.00	504.90	216.50	2140.77		3521.65
05/22/91	7	23.15	2220.84	124.45	0.00	119.95	159.07	2752.62		3521.65
05/23/91	16	298.15	725.95	249.75	36.00	422.39	131.71	1321.93		3521.65
05/24/91	19	227.56	2074.49	139.00	75.00	792.75	323.20	4537.35		3521.65
05/25/91	17	256.55	2237.79	114.00	80.00	505.70	250.42	3401.47		3521.65
05/26/91	10	152.70	1749.00	37.95	10.00	132.45	161.83	2536.48		3521.65
05/29/91	12	237.65	-430.10	80.95	15.00	79.85	-12.20	-319.95		3521.65
05/29/91	17	318.27	1557.00	335.45	30.00	233.46	151.86	2411.24		3521.65
TOTALS	274	4150.04	10830.41	2649.50	544.95	7200.15	2475.40	35294.99		

TOTAL LABOR = 10403.72
 Press Return for More or (ESC) to Quit:

Address 1:
 Address 2:
 City:
 Contact:
 Telephone No:
 Fax No:
 Zip:
 Tax Code:
 Priority Code:
 Category:
 Limit:
 Terms:
 Discounts:
 Comments:

72 Update F6 Look-Up Key F7 Display Invoices F8 Repeat ESC Quit

ACCOUNTS RECEIVABLE

American Electronics
 TRANSACTION REGISTER

Daily Transaction Report
 End of Month Processing
 Sales Report (No Service)
 Department File Maintenance
 Display Department Sales
 Quit - Return to Main Menu

TRANSACTION REGISTER

Advanced Electronics
 SERVICE CENTER MANAGER

INVOICE PROCESSING
 PARTS ORDER PROCESSING
 INVENTORY MANAGEMENT
 SEARCH FILES
 ACCOUNTS RECEIVABLE
 TRANSACTION REGISTER
 UTILITY PROGRAMS

SYSTEM STATUS
 BACKUP DATA FILES
 REBUILD FILES
 COMPANY MAINTENANCE
 WARRANTY MAINTENANCE
 DOS SHELL

UTILITY PROGRAMS

Fig. 2: Only the Service Center Manager links each section of the program for a completely streamlined business management program.

Automating and streamlining your business management system can completely control your inventory and provide intelligent information to help you make wise inventory management decisions quickly and easily.

The SM2001 automated business management system allows you to add, edit, search, sort, and cross reference items in inventory. You'll have the power to track month and year-to-date figures, receive reordering advice, run a history of parts used report, gross profit report, and more. Only the Service Center Manager provides this level of flexibility and in-depth tracking in one easy-to-use system.

BUSINESS MANAGEMENT REPORTS

How do you currently decide if your business is successful? Do you look at the daily profit or weekly repair volume? Or do you simply walk through your service center and see if everyone is busy? Proper business management for today's successful service center requires complete analysis of every element of your business, including the technician productivity, repair history to protect you against returned products, and complete business transaction reports.

With the SM2001 business management system, you can get the information you need in less than 10 seconds. It's quick and accurate, and helps streamline your accounting and management processes. By closely monitoring the transactions and workflow in your business, you can manage and control the

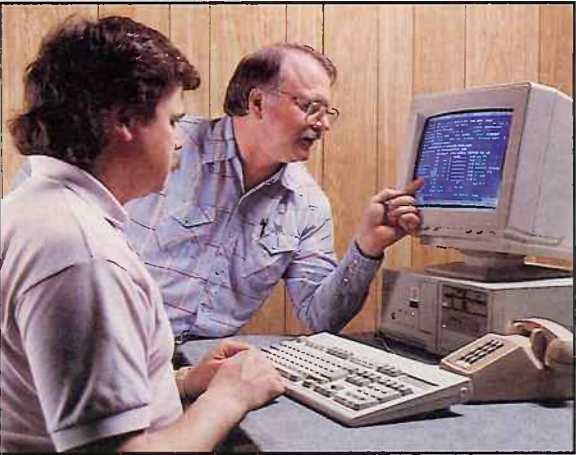


Fig. 3: The Service Center Manager is easy to use and flexible enough to fit any operation.

revenue side (profit) of your business quickly, easily, and accurately. When you perform an activity with the Service Center Manager, the program interacts and updates the associated files so your records are always up-to-date. This streamlines the processes of data entry and reporting, while eliminating duplication of effort.

CUSTOMIZED FOR EASE-OF-USE

Each business runs and operates differently. Your business is customized to operate the way you want it to - it reflects your ideas, plans, and dreams. The tools you choose to help run your business should help you reach your goals. Your business management system should be researched and designed by servicers who fully understand the complex issues you face. It should be flexible and adaptive, yet it must remain easy to use so all members of the service team can operate it and are comfortable with its operation. That's exactly what the SM2001 Service Center Manager provides you — ease-of-use and flexibility to fit any operation.

There's Only One SM2001 Service Center Manager - Designed To Help Streamline Your Service Center

Effective service center management in today's business environment calls for streamlining and reducing unnecessary duplication of efforts to improve your workflow, parts ordering, and inventory control. You also need detailed management reports at your fingertips to help you make wise, well-informed business decisions to stay competitive and profitable. Servicers like yourself have told us they need a complete software package that is customized for the electronic service industry and fully supported by dedicated professionals who are available when you need them.

The response to our introduction of the SM2001 Service Center Manager has been overwhelming. We are busy filling requests for information and special demonstration packets from servicers eager to try the SM2001 in their service centers. The SM2001

Service Center Manager is quickly proving to be the software management system preferred by service centers throughout the country.

Now, we'll let you prove it to yourself. For a limited time, we're offering special price reductions on the SM2001 Service Center Manager demonstration disk and on the complete software program - both single and multi-user formats. Or if you'd like to learn more about the Service Center Manager, simply call 1-800-SENCCORE, ext. 238 and talk to your Area Sales Representative. We can help you manage your service center more efficiently. Just give us a call. ■

Here's What You Get With The SM2001 Service Center Manager:

The Fastest, Most Complete, Customized And Easy-To-Use Program On The Market. Designed Specifically To Help You Manage All Aspects Of Your Business More Efficiently, Effectively, And Profitably

- Manage customer invoicing and workflow from creation to tracking and billing - automatically!
- Automatically generate, track, and control parts orders to save effort, time, and money.
- Gain inventory control through searching, cross referencing, pricing levels, reordering advice, general ledger codes, gross profit reports, and more.
- Customize business reports from any or all of the invoices you've ever processed.
- Automate accounts receivable functions such as posting payments & credits, aging, month end processing, and more with just a few keystrokes.
- Perform daily and end-of-month transaction reports showing cost, sale price, and profit in just seconds.
- Electronically file warranty claims through KeyPrestige Inc., the nation's largest independent warranty claims processor, providing an automated link to many electronic manufacturers.
- Utilize unique and special features specifically designed for the servicing industry, with your time in mind.
- Rapidly execute reports and file searches to provide information in just seconds. You never have to archive a file - ever! A Sencore exclusive.

Call 1-800-SENCCORE today!

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



But you don't have to take our word for it. Prove it to yourself with Sencore's 10 Day "Try Before You Buy" Program.* You can use the CM2000 on your bench for 10 days with no obligation and no down payment. To start servicing more monitors and making better profits, call 1-800-SENCORE, today.

**Subject to credit approval. Canadian customers please call for details.*



Call 1-800-SENCORE, Today!
(736-2673)

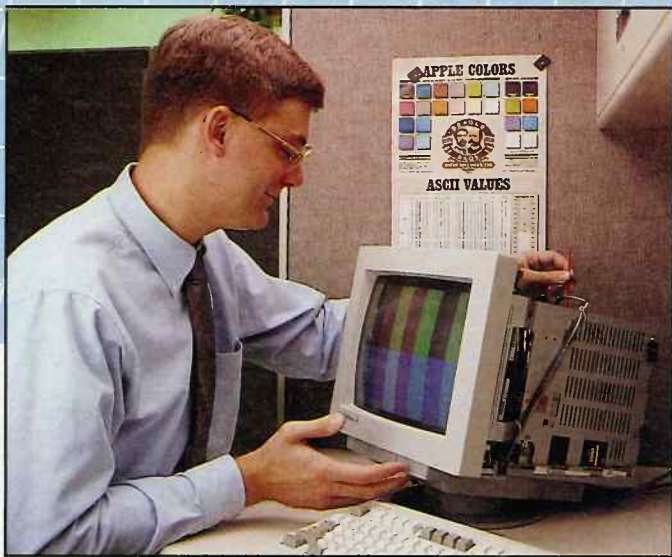
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CM2000 Computer Monitor Analyzer
Patented

Expanding Your Electronic Servicing Business Into Computer Monitor Repair

By Stan Warner, Application Engineer



Editor's Note: This is the first of two articles on expanding your business into computer monitor repair. The article in the next Sencore News takes you through the steps required in expanding your business into computer monitor repair.

Have the revenues of your service business stalled? Have you completely penetrated your local service market? Would you like to take on new challenges? Would you like to be able to expand your business, create new jobs, and enhance your bottom line?

Business Growth Analysis Matrix

Every business needs a strategy for expanding their business. A good tool for establishing a business growth strategy is the Business Growth Analysis Matrix. It helps you define where your electronic repair business is today and helps you identify three different paths you can take for business expansion.

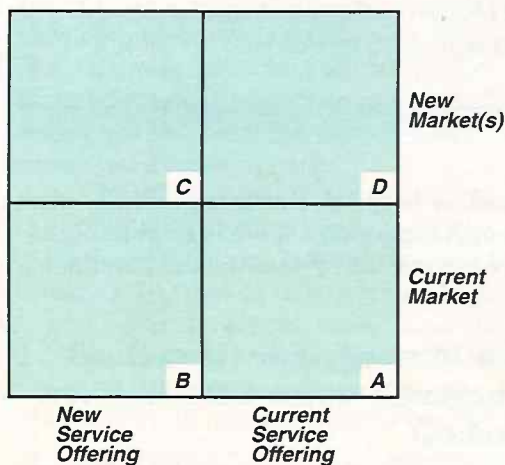


Fig. 1: The Business Growth Analysis Matrix helps you define strategies for expanding your business.

To start this exercise, draw a matrix like the one shown in Fig. 1. Label the axis' on the sides of the matrix with these four titles: new markets, current markets, new service offerings, and current service offerings. Beginning at the lower right hand side of the matrix, quadrant A represents your current market and current service offering. This is your "as-is" situation.

To fill out quadrant A, ask yourself two simple questions: (1) What service does my

business currently offer, and (2) Who receives my services? If your business is like most Sencore News readers', quadrant A would be filled out as shown in Fig. 2.

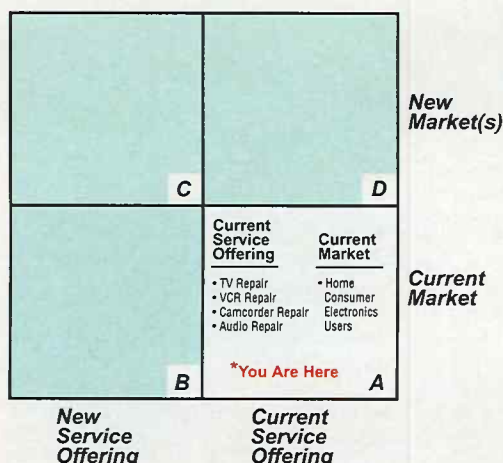


Fig. 2: Your "as-is" situation shows the services your business currently offers and who receives the services.

New Strategy For Growth #1 (New Service Offering/Current Markets)

Now that you've defined what services you provide and who receives them, let's examine some new and exciting possibilities for your business. Like a chess player making his next strategic move, move your game piece (your business) one square to the left - current market/new service offering. Now's the time to unleash some creative thinking. What new electronic products are your current customers (home consumer electronics users) purchasing that your business currently does not service?

Have you considered servicing computer monitors? Home consumers (your established market base) have been purchasing personal computers in record numbers the past couple years. According to the Electronic Industries Association (EIA), 6.4 million computers were sold for home use in 1991, and sales reached 7.1 million in 1992. Over 33% of the households in the United States now have a personal computer.

Falling prices are generally responsible for the massive numbers of personal computers moving into the home market. Prices of some 386, 486, and MacIntosh computer models

have fallen between 11% and 35% in just the past eight months.

Yet, the computer monitor is one of the most expensive components in the system. In comparison, the motherboard, hard drive, and floppy drive are all less expensive. Plus, the prices of monitors are remaining fairly stable because of the high cost of the CRT.

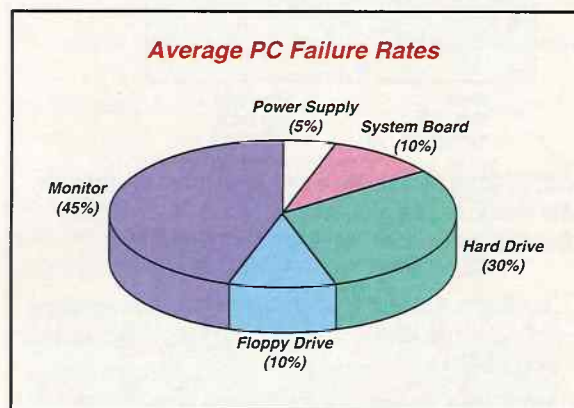


Fig. 3: This comparison chart shows the monitor has the highest failure rate in the average personal computer.

Computer monitors are one of the highest failure items in the computer system because of their high voltage and high power circuitry. According to a national computer training and service center, the computer monitor is the highest profit item for service in the computer system and is responsible for 45% of all computer system failures.

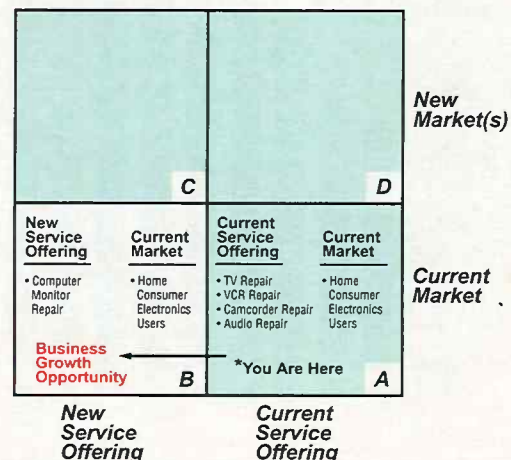


Fig. 4: Consider offering a new service, computer monitor repair, to your current home consumer electronics user market.

New Strategy For Growth #2 (New Service Offering/New Market(s))

You've seen the growth possibilities of expanding your service offering (computer monitors) to your current market. Now let's make a bold upward move on the Business Growth Analysis Matrix and examine the possibilities.

The move to quadrant C has us strategizing a business move to a new market as well as a new service offering. Of all the moves on the matrix, this one holds most risks because there are two "news" (market and offering). However, as in business and investing, calculated risk taking also offers the most potential for financial rewards.

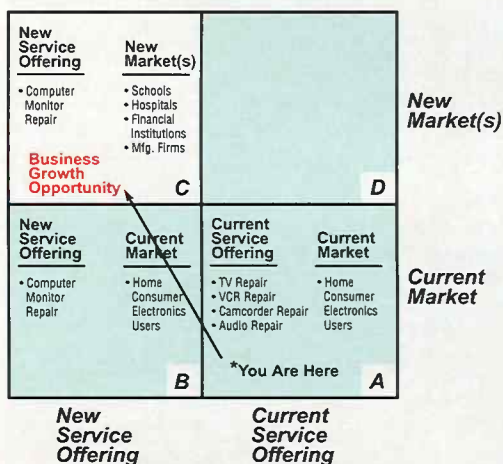


Fig. 5: Consider offering a new service, computer monitor repair, to new markets (i.e., schools, hospitals, financial institutions, and manufacturing firms).

This time, unleash your creative thinking beyond your day-to-day activities (look at the big business picture) and study the trends happening in markets outside of your current customer base. Consider the trends in today's schools, hospitals, financial institutions, and manufacturing firms (new markets). The computer plays a leading role in every facet of these operations.

Today, products are designed, drawn, tested, and prototyped on a computer monitor display before being manufactured. Surgeons

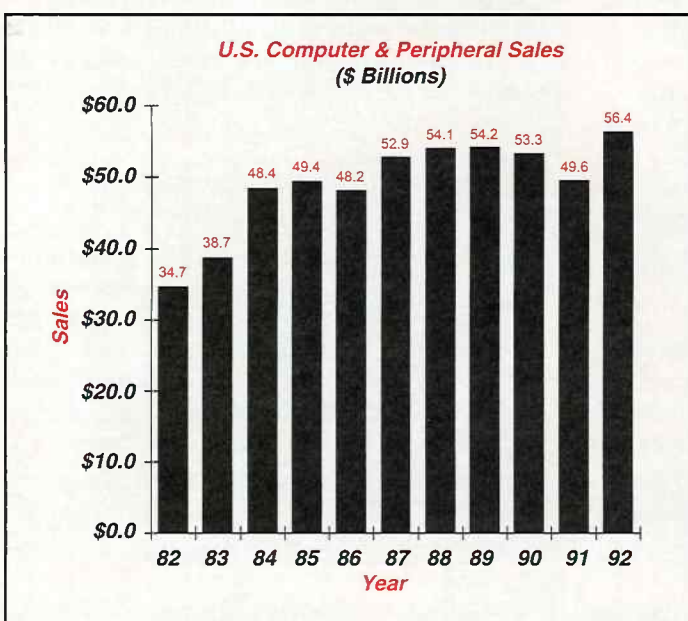


Fig. 6: United States computer and computer peripheral sales.

create computer generated 3-D images of their patients long before they pick up a scalpel. Desktop publishing systems, which combine text and graphics, bring print shop quality to financial reports, company newsletters, and sales presentations.

According to the EIA, the computer and peripheral market was a \$56.4 billion business in the United States last year. Included in that number, 19 million personal computers were sold in 1992, and the number is expected to rise to 27 million by 1995. The millions of terminals, higher resolution, and multiscan computer monitors have created tremendous servicing opportunities. Again, the monitor is the highest failure item in the computer system, and it's typically the most expensive. Whether the monitor comes from a business,

school, or hospital, the user generally wants the unit repaired as quickly as possible so they can get the system up and running.

New Strategy For Growth #3 (Current Service Offering/New Market)

Finally, let's move to quadrant D. The third strategic move involves expanding your existing business offering (TV, VCR, camcorder, and audio repair) into new markets. This move offers minimal risk because of your familiarity with the service procedures.

For example, consider the audio and video equipment used in schools. Televisions and VCRs are common teaching tools. And the booming growth with interactive video telecourses will expand the need for camera

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CR70 "BEAM BUILDER"®

Universal CRT Analyzer & Restorer

Patented - Dynamic Tests Exclusively From Sencore!



For The First Time Ever, Test Every CRT On The Market — Now And In The Future, Plus Restore 90% Of All Weak Or Shorted CRTs Or Your Money Back!

Now, you can safely restore every CRT!

CRTs run long and hard each day. When it comes time to replace one, you could be looking at \$200 or more. No wonder many servicers are afraid when it comes to restoring CRTs. Only the CR70 provides five levels of restoration to guarantee safe and reliable results every time. We call this progressive restoration. You only use the restoring level needed to get the job done.

Test every CRT on the market. The CR70 is the only CRT tester that gives you the ability and confidence to test every type of CRT in use today — and we mean every!

- All B & W and color video CRTs
- Projection CRTs
- Computer display CRTs
- Closed circuit video CRTs
- Camera pickup tubes — broadcast, industrial and surveillance
- Even scope, radar, and other industrial CRTs

Guaranteed To Be The Most Reliable CRT Tester On The Market — Or Your Money Back!

- Guaranteed to test every CRT, now and in the future.
- Exclusive tests cover the CRT's full dynamic range from cutoff to peak emission — the highest reliability available.
- Guaranteed to safely restore 9 out of 10 weak or shorted CRTs (video, projection, and scope).
- Guaranteed to be totally protected from damage from charged CRTs.



What Is Bad "Cutoff"?

The CR70 meter indication on a tube that fails the "Cutoff" test will either, 1) Not adjust up to the "Cutoff" box, or 2) It will be very difficult to adjust down into the box.

If the needle stays below the box, the CRT cathode is worn. This produces a symptom of a picture with deep blacks and bright "silvery" whites, or a gray scale that changes hue with brightness changes. A worn cathode can usually be restored with the CR70's "BEAM BUILDER."

If the needle stays above the box, the G1 grid is open or air has leaked into the tube due to a leaky seal. This defect shows up as a very bright white or colored raster. Neither an open G1 grid or an air contaminated tube can be restored with lasting results.

repair. Additionally, hospitals have a television in every room, plus VCRs and cameras are used extensively by the medical and administrative staff.

Financial institutions and manufacturing firms provide servicing opportunities with audio and video equipment in their video conference rooms and training centers. Plus, many corporations have video studios for producing marketing and training tapes.

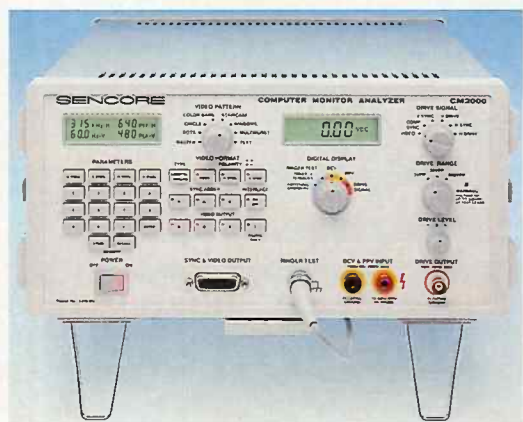
New Service Offering • Computer Monitor Repair	New Market(s) • Schools • Hospitals • Financial Institutions • Mfg. Firms	Current Service Offering • TV Repair • VCR Repair • Camcorder Repair • Audio Repair	New Market(s) • Schools • Hospitals • Financial Institutions • Mfg. Firms	New Market(s)
	C	D		
New Service Offering • Computer Monitor Repair	Current Market • Home Consumer Electronics Users	Current Service Offering • TV Repair • VCR Repair • Camcorder Repair • Audio Repair	Current Market • Home Consumer Electronics Users	Current Market
	B	A	*You Are Here	
New Service Offering		Current Service Offering		

Fig. 7: Consider offering your existing services to new markets (schools, hospitals, financial institutions, and manufacturing firms).

Service Opportunities Abound

Many opportunities exist in the field of electronics servicing. Consider expanding your business into computer monitor repair. Then offer these services to your current customers and even to new markets. Also consider expanding your current service offerings into new markets.

Join us in the next issue of the *Sencore News* where we take you through the strategies for expanding your business with new services and new market areas. We're working with you to expand your business and build your profits. For more ideas and strategies, give us a call toll-free at **1-800-SENCORE**. ■



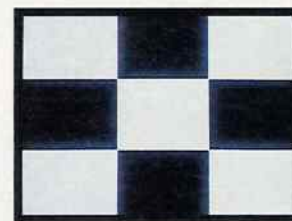
The CM2000 Computer Monitor Analyzer has all the patterns you need for complete computer monitor analyzing.

TECH TALK

The CM2000 Is An Innovative Performance Testing Pattern Generator



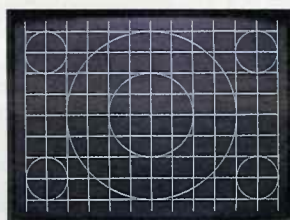
Color Bars: Use this pattern to test the monitor's ability to produce proper color. Check that each color bar is present. Check that the colors are uniform in intensity from top to bottom and left to right to catch possible video amplifier defects.



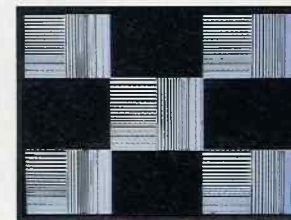
Windows: Use this pattern to test the monitor's power supply regulation. Check for a clear, distinct transition between the black and white portions. All the white boxes should be the same brightness level and the entire screen should be free of any ripple.



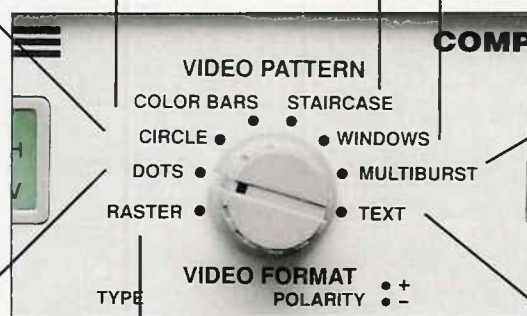
Staircase: This pattern tests the brightness and contrast linearity of analog and monochrome digital monitors. A properly working and adjusted analog or monochrome digital monitor will display 16 evenly spaced bars ranging from black to 100% white.



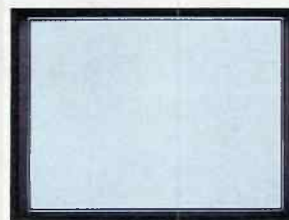
Circle: The circle pattern provides a test of the monitor's linearity and can be used to check dynamic convergence. Check that each line is straight and that each box is square and the same size throughout the raster. Also, check that each circle is round with no visible distortion.



Multiburst: This pattern tests monitor resolution and bandwidth. The vertical lines test the horizontal pixel resolution and the horizontal lines test the vertical resolution. The one pixel wide line should be discernible on a properly operating monitor.



Dots: Use the dots pattern for checking static and dynamic convergence. Check for white dots with no visible color. A misconverged CRT will show colored dots, instead of white dots.



Raster: The raster pattern produces a box, surrounded by a 1 pixel-wide border. Use this pattern to check color purity and high voltage power supply regulation.



Text: Use this pattern to make a final performance test on the monitor. This pattern fills the screen with upper and lower case text characters that duplicate user conditions. All the characters on the screen should be focused and easy to read.

Call 1-800-SENCORE

to receive information on how these patterns can help you troubleshoot.

Imagine If You Could Divide Every TV Into Its Functional Blocks!

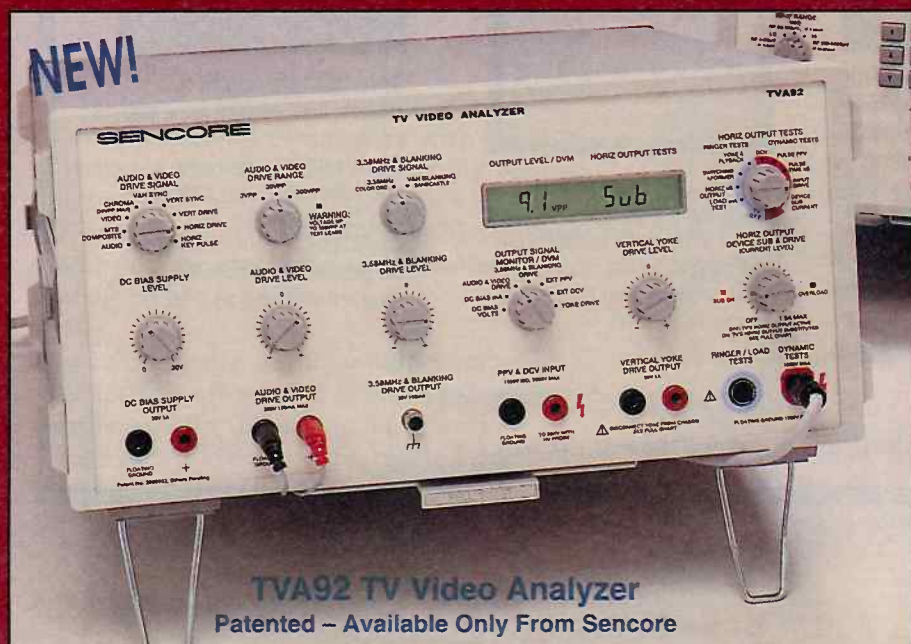
- Productivity would rise.
- Profits would increase.
- Inventory would decrease.
- Estimates would be more accurate.

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.

Now you can isolate TV defects, troubleshoot startup/shutdown problems, test expensive TV components, plus accurately estimate TV repair costs in minutes with:

- Exclusive "TV OFF" horizontal output load test
- Dynamic tests through a simple 3 lead hook-up to the H.O.T.
- Horizontal output transistor sub and drive
- Universal substitute TV signals
- Patented ringer test to pinpoint shorted turns in flybacks, IHVTs, yokes, and switching transformers
- An exclusive yoke drive signal
- DC biasing supply
- Built-in monitor for all sub-signal results and making DCV and PPV measurements



If you're looking for the only complete TV Analyzer to help build your TV servicing business - reserve your new TVA92 TV Video Analyzer today. Act now and lock-in special limited introductory pricing. (New video demonstration tape available upon request.)

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Substituting For The Horizontal Output Transistor & Base Drive With The TVA92 TV Video Analyzer

By Glen Kropuenske, Application Engineer

Do you set fire to a \$50 dollar bill every night before you lock the doors to your service shop? Of course not, but dollars and profits could be burning away everyday if you're burning out replacement horizontal output transistors or finding expensive high voltage parts or ICs bad after you've quoted service estimates. What happens to your productivity if you're sitting idle pondering what to try next when unusual horizontal/HV symptoms arise?

We'll look at several horizontal/HV troubleshooting challenges in this article that commonly burn away service profits. We'll show you how the TVA92 TV Video Analyzer fits into the picture with its exclusive capabilities of substituting for both the TV's horizontal output transistor and its base drive. These features let you energize the TV's horizontal output/HV circuits to full potentials so you can avoid blowing components and giving inaccurate estimates. Let's first take a look at how this exclusive TVA92 function works.

How The TVA92 Substitutes For The TV's Horizontal Output Transistor

Failures such as a blown horizontal output transistor (HOT) or a defect in the horizontal oscillator, driver, or startup circuits prevent normal horizontal output/HV circuit operation. The TVA92's Horiz Output Device Sub & Drive feature provides a substitute horizontal output transistor with a known-good horizontal base drive. This exclusive innovation lets you power-up and test the horizontal output, high voltage, and flyback scan-derived powered circuits at full potential.

Let's briefly explain how the TVA92 TV Video Analyzer substitutes for the chassis HOT. A TV's horizontal output transistor essentially functions as an on/off switch controlled by a drive signal (current) applied to its base. This drive signal turns the HOT on approximately 30-35 uS prior to horizontal sync and off at the beginning of sync.

When the HOT is turned on, it serves as a conduction path for current to the flyback and yoke. When the transistor is switched off,

the horizontal output stage changes its resonant frequency producing a high voltage flyback pulse. The transistor remains off during retrace and for a brief time following retrace. The switching action repeats at a rate of 15,734 kHz.

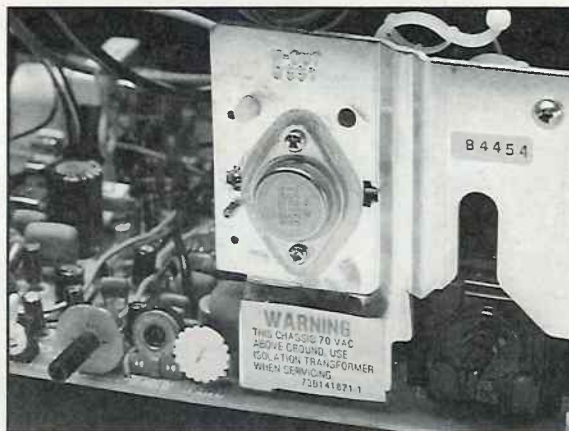


Fig. 1: The horizontal output transistor is one of the most important (and volatile) components in the horizontal/HV section of a TV.

The TVA92's substitute HOT works as a replacement for the HOT in a TV chassis. The substitute HOT is switched on and off by a horizontal drive signal within the TVA92 completing a current path for the TV's flyback and yoke currents. This drive signal is synchronized to the video supplied to the TV by the Sencore VG91 Universal Video Generator, companion unit to the TVA92. When using the TVA92's Horiz Output Device Sub & Drive feature, a properly working TV chassis will produce near normal deflection, high voltage, and a good video pattern display.

Substituting with the TVA92's Horiz Output Device Sub & Drive requires only three connections to the chassis. The test lead clips of the Dynamic Test Leads are connected to the three HOT elements or equivalent (red to collector, blue to base, black to emitter).

Variable On-Time Control Of The TVA92's Horizontal Subbing Transistor

The TVA92 TV Video Analyzer uses a known-good horizontal drive applied to the base of its horizontal subbing transistor. This

insures a proper drive signal and HOT operation when testing the horizontal output/HV circuits. The duty cycle of the drive signal is adjustable providing control over the current which is allowed to pass through the subbing transistor. This lets you slowly increase the flyback pulse amplitude and resulting high voltage to detect component or high voltage breakdowns.

The horizontal drive signal to the TVA92's subbing transistor is controlled by the HORIZ OUTPUT DEVICE SUB & DRIVE control. The "OFF" position completely removes the drive signal to the TVA92's substitute transistor. In this position, the subbing transistor remains an open switch and the TV chassis horizontal output transistor is free to operate as normal. You may use the TVA92's Dynamic Test measurements to analyze the horizontal output stage's normal performance with this control set to "OFF."

When turned "ON", the HORIZ OUTPUT DEVICE SUB & DRIVE control adjusts the duty cycle of the internal horizontal drive signal. This varies the conduction time of the TVA92's substitute HOT from approximately 5 uS (min) to 35 uS (max). By changing the conduction time of the subbing transistor, the current flow (power) to the horizontal output stage can be limited and slowly increased.

Most fully functional horizontal output and flyback circuits will operate normally at just above midscale on the control. Increasing the TVA92 drive signal conduction time beyond the necessary level for normal operation of the horizontal output stage will not significantly increase current to the flyback or yoke. Therefore, you cannot cause circuit damage in a working chassis by turning the control (conduction time) beyond normal operation ranges.

Device Sub Current Readout Shows Subbing Transistor's Collector Current

The TVA92's Horizontal Output Device Sub & Drive provides an indication of the current flowing through its subbing transistor to assist in identifying breakdown or high

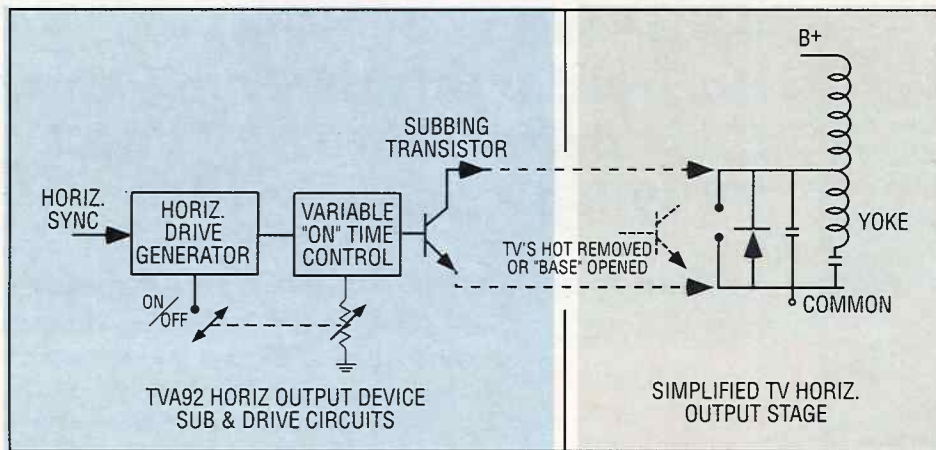


Fig. 2: The TVA92 provides a substitute horizontal output transistor switched by a variable conduction time horizontal drive.

current conditions. The "Device Sub Current" readout of the TVA92 indicates the current flowing through the TVA92's subbing transistor's collector. The readout reflects the average flyback primary current plus yoke current in the chassis horizontal output stage. The collector current provides the most accurate indication of the current (power) delivered to the flyback and yoke, and therefore the best means to detect normal or abnormal conditions when subbing.

When using the Horiz Output Sub & Drive to test the TV at full high voltage and deflection, the Device Sub Current readout will closely reflect the conduction current of the horizontal output transistor. The subbing transistor's collector current for normal TV operation will vary between TV chassis. The normal current depends on the CRT size, scan-derived supplies, etc. For example, the HOT current in a small B&W will range 300-500 mA while an older full-sized color set may approach 1.5 amps.

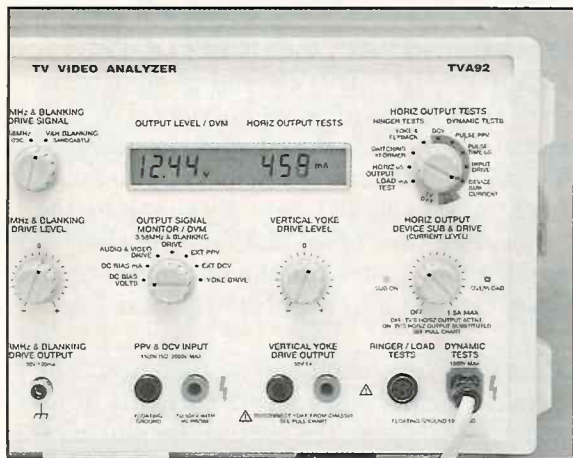


Fig. 3: The "Device Sub Current" readout indicates the TVA92's subbing transistor's collector current when using the Horiz Output Device Sub & Drive.

The Device Sub Current readout will vary with some special TV chassis conditions. For example, the flyback high voltage section delivers current for the CRT color guns. The amount of current in each color gun varies with the dark and light objects in the video. This current change reflects an increase or decrease in power from the horizontal output stage or current through the horizontal output transistor. Therefore, problems in the flyback or secondary circuits demand higher HOT conduction current which produces abnormal current readings.

The Device Sub Current readout may also be used to alert you of unusually high flyback or yoke current levels when subbing. Service schematics sometimes record the horizontal output transistor's normal emitter conduction current level as measured with a current meter. This value may be compared to the Device Sub Current readout when using the Horiz Output Device Sub & Drive. This value is useful in determining if the horizontal output stage is demanding added current or if it is operating normally.

Test The Circuits Before You Blow Another HOT

How often have you replaced a horizontal output transistor only to have it blow out as soon as you apply power to the chassis? These horizontal output transistors are normally victims of problems in the B+ power supply, horizontal output, HV, or horizontal driver stages.

In the past, the only way to troubleshoot HOT failures was to order and solder in a replacement HOT. But when the new transistor was destroyed by remaining circuit problems, the investment in time and money was lost. Furthermore, you were left with a dead horizontal output stage and without a way to troubleshoot the problem. In other instances, the investment of time and money revealed a more costly HV component or other circuit problem not figured into your initial repair estimate.

The TVA92's exclusive Horiz Output Device Sub & Drive lets you substitute for the chassis HOT without the time and risk of soldering in a replacement. You can energize the horizontal output and high voltage circuits to full operating potentials to check for high voltage breakdown, arcing, and corona problems. It further lets you test the operation of the remaining TV circuits by viewing the CRT. This is especially important when preparing service estimates because it lets you check the operation of tuner, IF, and video stages.

To test the chassis horizontal output/HV circuits and confirm chassis operation with the TVA92's Horiz Output Device Sub & Drive, first remove AC power to the TV chassis.

Then perform the Horiz Output Load Test and correct the abnormal loading or timing problems (see *Sencore News #160*). Then disconnect the Ringer/Load test leads and connect the three DYNAMIC TESTS lead clips to the chassis HOT circuit points (red to collector, blue to base, black to emitter).

Begin with the HORIZ OUTPUT DEVICE SUB & DRIVE control set to "OFF" and apply AC power to the TV chassis. Turn the HORIZ OUTPUT TESTS switch to "DCV" and compare the DCV reading with the B+ voltage indicated by the schematic. *Note: Be sure to troubleshoot and correct B+ power supply or power supply regulation problems before attempting to use the TVA92's subbing transistor and drive.*

If the B+ voltage is proper, switch the HORIZ OUTPUT TESTS switch to "DEVICE SUB CURRENT" and monitor the readout as you increase the HORIZ OUTPUT DEVICE SUB & DRIVE control. Observe the CRT for a picture (there will be a slight delay as the CRT filament heats). Increase the HORIZ OUTPUT DEVICE SUB & DRIVE control just above the point where picture foldover disappears (typically just above mid-range).

If normal HV is produced with a near-normal CRT picture, the TV's RF-IF, video, sync, and vertical deflection circuits are functioning properly. If problems are evident, rotate the HORIZ OUTPUT TEST switch to "DCV", "PULSE PPV", "PULSE TIME μ S", and "DEVICE SUB CURRENT" to analyze the horizontal output stage. Also be sure to measure for the presence of high voltage. Near normal HV with no CRT picture indicates proper horizontal/HV circuit operation and points to a problem elsewhere in the chassis.

Quickly Pinpoint Problems To Horizontal Oscillator, Driver, And Scan-Derived Power Supplies

Many problems that appear to be caused by the horizontal output stage actually originate with a bad horizontal drive signal to the base of the chassis HOT. For example, insufficient drive current to the base of the horizontal output transistor or low transistor gain (beta) can rob the horizontal output stage



Fig. 4: Only the TVA92 lets you substitute directly for the horizontal output transistor saving you time and expensive parts.

of current. This reduces the high voltage and horizontal deflection giving the appearance of a horizontal output stage problem.

Problems in horizontal circuit feedback loops (signal or voltage) can also result in horizontal output stage symptoms. Problems in horizontal AFC and flyback scan-derived DC voltages affect the horizontal output stage because the frequency, waveshape, or oscillations contained in the drive signal alters the switching action of the HOT. Drive signal defects can cause HOT failures, flyback squealing, deflection foldovers, and other unusual symptoms.

Startup problems are often the most difficult horizontal stage problems to isolate. Initial start voltages must momentarily power the horizontal oscillator and the horizontal driver stage. The start voltage produces several drive pulses to the base of the horizontal output transistor. The horizontal output transistor begins switching producing flyback pulses to produce scanned-derived voltages. The scanned-derived voltage then permanently supplies power to run the horizontal oscillator and driver stages. A problem in any of the circuits in this sequence results in a dead (no start) symptom.

The TVA92's Horiz Output Device Sub & Drive helps to quickly isolate these difficult horizontal related problems. The Horiz Output Device Sub & Drive breaks the loop at the HOT providing a known-good sub transistor and drive signal to the horizontal output/HV circuits.

To troubleshoot startup or horizontal drive problems, use the Horiz Output Device Sub & Drive to produce scan-derived voltages. While subbing, test the voltages and waveforms in the horizontal oscillator and driver stages to isolate the problem. When troubleshooting startup problems, proper voltages and waveforms indicate the startup circuits are bad.

Protecting The TVA92's Horiz Subbing Transistor

The horizontal output circuit is the most powerful section in a television. It's also one of the most destructive when it fails. The TVA92 prevents damage to its horizontal output subbing transistor with exclusive built-in protection and features that significantly decrease the chance of damage. These features help extend the life of the transistor and reduce the chance of failures when used in a defective chassis.

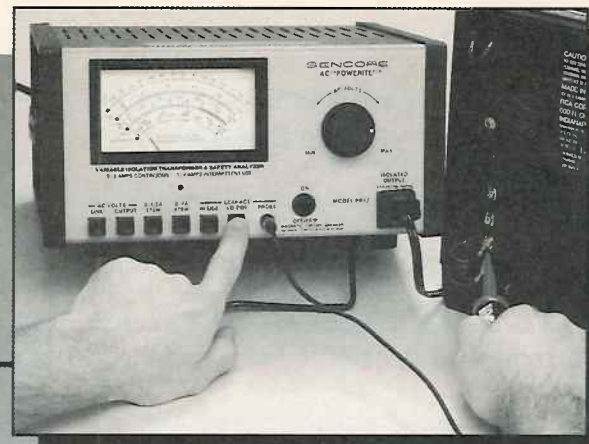
HORIZONTAL BASE DRIVE DISABLE

Using the TVA92's Horiz Subbing Transistor & Drive requires that the chassis horizontal output transistor be removed or its base drive disabled. Should you forget to remove or disable the TV's horizontal output transistor, the TVA92 provides protection by switching the "BASE" connection of the Dynamic Tests Lead to ground. This occurs anytime the HORIZ OUTPUT DEVICE SUB & DRIVE control is moved from the "OFF" detent position. Shunting the base lead to emitter

SERVICING ^{plus}

PR57 AC "POWERITE"® Variable Isolation Transformer & Safety Analyzer

Patented - You Can't Get This Anywhere Else!



Avoid Embarrassment And Risk - Know Beyond A Doubt That Your AC Power (And The Equipment You Service) Is Right And Safe!

The PR57 "POWERITE" lets you know that your AC power is right. Its output is isolated and variable from 0 to 150 volts or 470 Watts. You can continuously monitor voltage, current, or wattage to prove that the equipment under test isn't drawing too much current at any voltage setting.

The PR57's AC line leakage safety test assures that excessive leakage is not present on any exposed part of the equipment being tested. Perform this important safety test on every electronic product for your customer's security and your peace of mind.

Conquer challenging shutdown problems and eliminate callbacks. Lower the line voltage to solve tough shutdown problems; raise the line voltage to sweat out intermittents or sensitive parts. Test every set at high and low line voltage catching stressed power supply components. Identify AC line related problems like picture width, sync, and intermittents in the customer's home, or test in the shop at their line voltage.

Five Ways To Make Sure Your Power Is Right And Safe

- It's an isolation transformer.
- It's a variable AC supply.
- It's a power line monitor.
- It's an amp/watt meter.
- It's a safety leakage tester.

^{plus}

How Much Leakage Is Dangerous?

Many people are surprised to learn that the most likely range of life threatening current is between 30 and 250 mA. This is the area where the breathing and heart are most severely affected.

In an ideal chassis, there should be no leakage at all. But decoupling capacitors, matching transformers, etc., will allow some normal current to flow. The maximum UL allowable limit on consumer electronic devices is 500 microamps.

For a more in-depth explanation on how leakage current affects the human body, call your Area Representative at **1-800-SENCORE** and ask for a free copy of Tech Tip #146.

ground prevents the TV's horizontal output transistor from switching on and off preventing damage to both the TV's and TVA92's horizontal output circuits.

OVERLOAD LIGHT INDICATOR

The maximum current allowed to pass through the TVA92's subbing transistor is limited to 1.5 amps average. This level allows

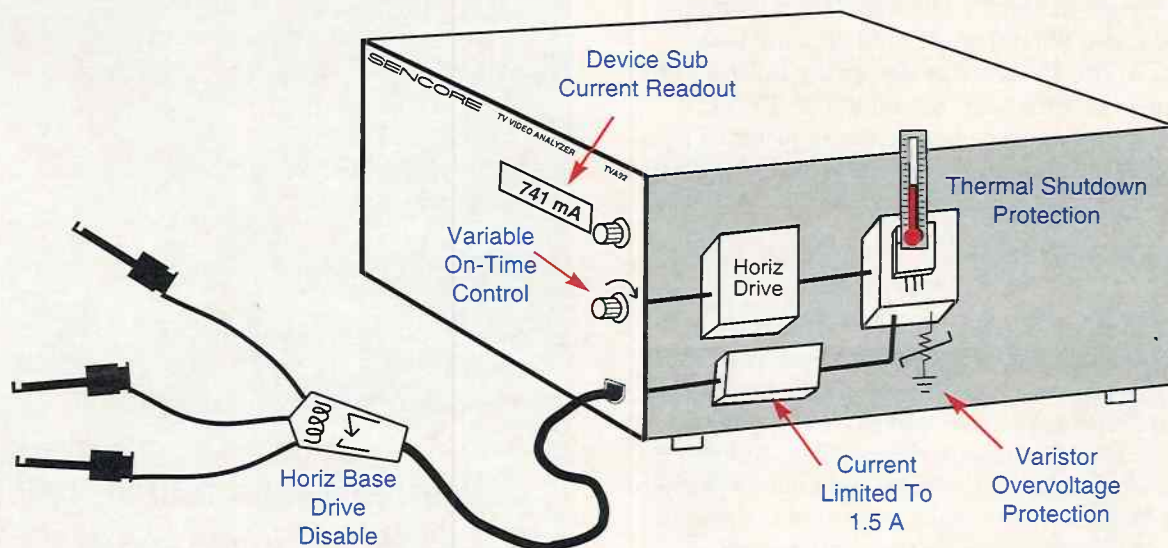


Fig. 5: The TVA92 TV Video Analyzer's horizontal subbing transistor is protected to decrease the chance of damage.

you to adequately test most horizontal output stages, while still reducing the potential of damaging either the chassis or TVA92 subbing transistor. An overload light located beside the TVA92's HORIZ OUTPUT DEVICE SUB & DRIVE control illuminates when the current is being limited to 1.5 amps. This indicates an abnormally high current demand by the flyback and/or yoke circuitry.

ON-TIME CONTROL WITH DEVICE SUB CURRENT READOUT

The subbing transistor's collector current readout of the TVA92 alerts you of unusual conditions when using the Horiz Output Device Sub & Drive. If you see the current readout climb to levels over one amp or the overload light illuminates as you begin to increase the Horiz Output Device Sub & Drive, there is a severe problem. You should turn the HORIZ OUTPUT DEVICE SUB & DRIVE to "OFF" and use the Horiz Output Load Test to isolate the problem.

THERMAL SHUTDOWN PROTECTION

The TVA92 TV Video Analyzer continuously monitors the temperature of its horizontal subbing transistor. If the temperature becomes excessive to the point it approaches the transistor's thermal breakdown region, the drive to the subbing transistor is interrupted. This prevents further current flow through the transistor allowing it to cool. This condition is indicated by a flashing "OVERLOAD" light. After the subbing transistor has had ample time to cool, it may be reset by turning the HORIZ OUTPUT DEVICE SUB & DRIVE control to "OFF", then adjusted to resume testing.

VARISTOR OVERVOLTAGE PROTECTION

Varistors are built into the TVA92 to protect the subbing transistor from excessive voltage spikes. If voltage spikes exceed 1500 volts, the varistors quickly lower their resistance to clamp the voltage spike. This provides an additional element of protection for the subbing transistor.

These protective measures greatly reduce the chance of the TVA92's subbing transistor failing. However, unusual circuit conditions and heat stress may lead to transistor failure. In the event the TVA92's horizontal subbing transistor should short, a diagnostic test within the TVA92 will detect the failure and display a "Sub bAd" readout. The TVA92's horizontal subbing transistor is socketed for easy replacement in your service center.

It All Adds Up!

The Sencore TVA92 TV Video Analyzer is specially designed to put out those fires that burn away your service profits. Consider one horizontal transistor and several fusible parts weekly that are damaged by unknown circuit problems. Consider only one repair job weekly which you over-estimated the repair cost and subsequently the customer decided not to fix. Consider only one repair job weekly

Circumstance	Lost Profit/Weekly	Yearly	Total \$
HOT Damage	\$5 (HOT Avg. Cost)	X 52 =	\$ 260
Lost Repair (High Estimate)	\$20 (Est. TV Profit For Each Repair)	X 52 =	\$1040
Lost Repair Profit (Found Problems After Estimate)	\$20 (Couldn't Recover Added Costs From Customer)	X 52 =	\$1040
Burning Profit Total (1 year) =			\$2340
2 Additional Profitable Repairs	\$40 (Turn Problems Into Profit Makers)	X 52 =	\$2080
Total =			\$4420

where you found additional expensive HV or deflection parts were required after you quoted the repair estimate. Now consider one or two added repairs you gain weekly when you turn those unusual horizontal/HV symptoms into profit makers.

The chart above will help you add it up! Don't forget about the associated expenses of

ordering unneeded or extra parts, phone calls to customers, unsoldering time, replacing parts, etc. For complete information on how the TVA92 TV Video Analyzer can help with your TV servicing, call your Sencore Area Sales Representative at **1-800-SENCORE (736-2673)** today. We'll listen to your needs and work with you to come up with a solution. ■

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. Beat The Price Increase And Save

Investing in Sencore test equipment before the price increase takes effect (October 4, 1993) is your first savings vehicle. Investing before the increase can save you hundreds of dollars in addition to the tax savings that follow. And remember, financing your purchase is as easy as a toll-free phone call to Sencore (see Business Strategies on page 8).

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

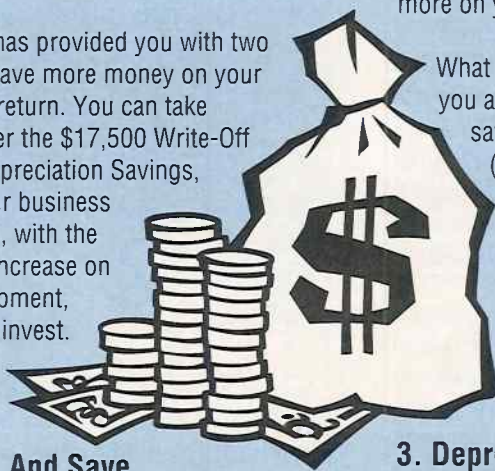
you. Effective with the new law, you can write off up to \$17,500 of business equipment purchases directly as a business expense, up from \$10,000 under the old law. This means your investment in Sencore test instruments can save you even more on your 1993 taxes.

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.



VCR Analyzing With The VC93 All Format VCR Analyzer

By Brad Johnson, Product Marketing Specialist



Where do you start when you need to analyze a VCR problem? You probably plug the machine in, observe its operation, and make a diagnosis. But how many times has the symptom caused you to troubleshoot the wrong section of the VCR? For most of us, more than we would like to admit. Eventually, the VCR gets repaired, but at what expense? It takes more time than is really necessary, more parts, and definitely more frustration.

These are some of the reasons Sencore designed the VC93 All Format VCR Analyzer. Let's face it, we need every weapon available to maintain a good profit margin in today's competitive VCR servicing market. The VC93 brings new, innovative solutions to your VCR analyzing. In this article, we'll show you how the VC93 can speed your VCR servicing even on the newest technologies found in today's VCRs.

Automatic Servo Analyzing!

Before we designed the VC93 All Format VCR Analyzer, VCR servicers told us that one of their most difficult and time-consuming problems was troubleshooting the servo section of a VCR. Servicers cited several reasons for these difficulties. One of the biggest reasons was that the servo circuits are closed loop systems. They told us this can make it very difficult to identify the source of the defect and whether it is a capstan or a drum servo problem.

Troubleshooting servos can also be difficult because they are a combination of mechanical devices and electrical circuits. Servicers often have difficulty in determining whether the problem is a mechanical or electrical failure. The symptoms can often appear the same, as shown in Fig. 1.

The third reason associated with difficult servo circuit troubleshooting is that the symptoms can sometimes be caused by a circuit not connected with the servos. This leaves you wondering if the problem is in the servos or some other section of the VCR. If you don't even know where to begin troubleshooting, what do you suppose your chances are of turning a profit on the VCR?

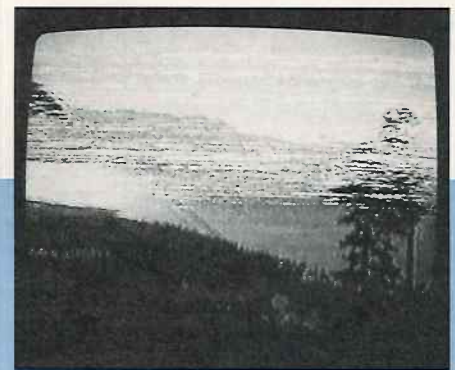


Fig. 1: Many VCR defects appear the same if you only compare the symptoms on a CRT. Can you tell which symptom is caused by an electrical failure and which by a mechanical problem?

Sencore listened to your frustrations and invested thousands of hours of research to come up with a solution. We developed a quick and easy, five step servo analyzer test in the VC93 All Format VCR Analyzer that identifies the source of the servo defect and proves if the servo circuits are working properly. All five of these tests take less than two minutes to perform and can save you hours of frustration that can come from conventional test methods.

The VC93 lets you make the servo analyzing tests two ways. One way is to use the "Servo Performance Test Lead" and the special "Servo Performance Test Tape." When you use this test lead and test tape, there is **no need to take the cover off the VCR**. This method uses the audio and video signals that are pre-recorded on the Servo Performance Test Tape to analyze the condition of the drum and the capstan servos.

The test is simple and easy. Just hook up the test lead to the audio and video output jacks on the VCR (see Fig. 2) and step through the five servo tests. The VC93 will automatically determine if the VCR has a capstan servo, cylinder servo, or luminance/chrominance circuit defect. You get a GOOD/BAD reading without taking the cover off the VCR (great for diagnosing a VCR and giving an estimate to the customer). These tests are patent pending, and are not found anywhere else.

You might be wondering, "What happens if the audio or the video coming from the VCR

is bad?" And what about VCRs that blank the video?

The VC93 All Format VCR Analyzer has these problems covered. You simply remove the cover from the VCR and use the Servo Troubleshooting Test Lead. Three simple hookups, one to ground, one to the CTL test point, and one to the SW30 test point, and you perform the same five servo tests (most of the time these test points are already labeled on the board). At this point, the VC93 has completely and dynamically analyzed the VCR's servo circuits.

To fully understand what these servo tests are telling you, let's take a closer look and see how they can help you identify and troubleshoot servo problems.



Fig. 2: The VC93 All Format VCR Analyzer lets you analyze VCR servo operation without taking the cover off the VCR.

Servo Locked Test

The first servo test is the Servo Locked test. A phase loop problem is probably the most difficult failure to identify because the symptoms are often less defined than other servo problems. A bad phase loop in either the capstan or the drum servo can cause the video heads to mistrack on the tape. The usual symptom is noise that periodically comes and goes in the picture. Problems associated with other circuits, or the tape path, can also show the same symptoms. Plus, you will get nothing but a blank or colored screen in VCRs that mute the video.

The VC93's Servo Locked test quickly tells you whether the capstan and cylinder phase loops are locked up to the VCR's internal reference source. If the servos are not locked, you can use the remaining servo tests to help track down the defective phase servo loop. If the Servo Locked test shows "GOOD", then you know the servos are locked together.

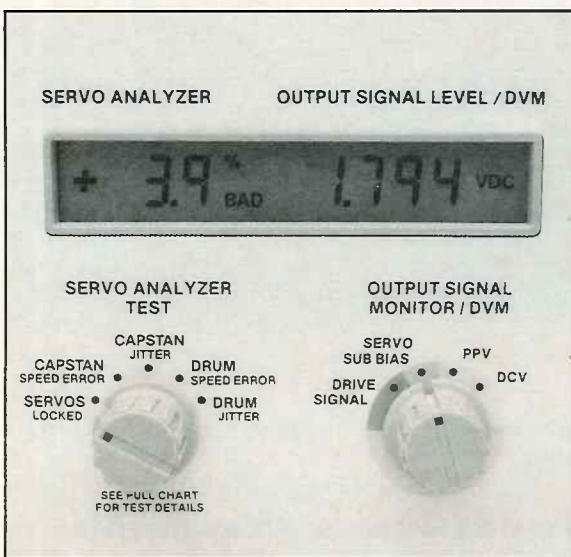


Fig. 3: The VC93 analyzes servo circuits and displays a GOOD/BAD reading and a percentage of error indication.

During the development of this test, it was discovered that some VCR's servos lock tighter than others. Some VCRs, particularly if they are beginning to have problems, have phase loops that are locking, but just barely. A GOOD/ BAD reading will not give you all the information you need. That's why the VC93 also gives a percentage error indication of how well the servos are locking. The Servo Locked percentage reading test gives you a way to judge how healthy the servo phase loops are, or on the other hand, how far off they are if they are bad.

Capstan Speed Test

Many servicers have relied on a test tape with a constant audio tone to check for tape speed problems. This method is generally accepted, but one can easily be deceived. The human ear is not the ideal test instrument for determining the frequency of an audio tone, or if the tone is changing frequency.

The Capstan Speed test on the VC93 eliminates that margin of error. This test is designed to tell you if the tape is being pulled through the VCR at the correct speed. To

perform this test, you simply dial in the Capstan Speed Error test and read the results on the display. The Capstan Speed test GOOD/BAD and percentage reading tells you if the capstan is turning too fast or too slow. By analyzing this percentage reading, you can quickly determine whether the problem is a tape speed defect or a failure in the capstan speed servo loop.

Capstan Jitter Test

Again this is a test that most servicers will perform using their constant audio test tone to check for wow and flutter (or warble) in the audio. The odds of detecting this defect with the human ear are slim at best!

The VC93's Capstan Jitter test checks for minor speed variations in the capstan speed. These variations can be caused by problems such as a bad capstan phase loop or by mechanical problems such as a bad capstan motor bearing, slipping belts, or worn idlers. By using the results of this test along with the other VC93 servo tests, you narrow a problem down to only a few sections within the servos. The Capstan Jitter test eliminates the need for a wow and flutter meter and the need to make a judgment call on the audio warble that you may have thought you heard.

Drum Speed Error Test

A problem in the drum speed servo or a lack of pulses from the drum sensors can cause the drum to run at erratic speeds, which can initiate a multitude of possible symptoms. The VC93's Drum Speed Error test eliminates your need to diagnose these symptoms. A quick hookup tells you if the drum is turning too fast or too slow. Like the other servo analyzer tests, the Drum Speed Error test also gives you a GOOD/BAD reading, plus a percentage of error reading.

Drum Jitter Test

The symptom of a drum with excessive jitter can also be difficult to interpret. The results of this test and the other Servo Analyzer tests can quickly tell you if a problem exists in the drum phase loop. Other problems such as bad drum bearings, or open motor windings will show up immediately with the Drum Jitter test.

Like the other VC93 servo tests, the Drum Jitter test gives you both a GOOD/BAD indication and a percentage reading of the drum jitter. There is no other reliable method to check for excessive drum jitter.

These five quick and easy servo analyzer tests allow you to check the operation of the entire servo circuits in less than two minutes. To make the interpretations of these tests even easier, a handy reference chart on the VC93's pullchart (see Fig. 4) helps you quickly narrow in on the servo problem.

But what if the servo tests don't indicate a problem? Well, since VCR problems aren't

Servo Locked	Capstan Speed Error	Capstan Jitter	Drum Speed Error	Drum Jitter	Most Likely Defect
Good	Good	Good	Good	Good	No Servo Defects
Good	Good	Good	Good	Bad	Drum Mechanical
Good	Good	Good	Bad	N/A	Reference Frequency
Good	Good	Bad	Good	Good	Capstan Mechanical
Good	Bad	N/A	Good	Good	Reference Frequency
Good	Bad	N/A	Bad	N/A	Reference Frequency
Good	Bad	N/A	Good	Bad	Reference Frequency
Bad	Good	Good	Good	Good	Capstan Phase Loop or Drum Phase Loop
Bad	Bad	N/A	Good	Good	Capstan Speed Loop or Mechanical
Bad	Good	Bad	Good	Good	Capstan Phase Loop or Mechanical
Bad	Good	Good	Bad	N/A	Drum Speed Loop or Mechanical
Bad	Good	Good	Good	Bad	Drum Phase Loop or Mechanical
Bad	Bad	N/A	Bad	N/A	Reference Frequency
Bad	Bad	N/A	Good	Bad	Reference Frequency

Fig. 4: This reference chart on the VC93's pullcart helps you narrow servo problems with the GOOD/BAD readings from the performance test.

confined to the servo section, let's examine how the VC93 can help you in the other sections of VCR troubleshooting.

Video Head Troubleshooter

One of the most expensive components in a VCR is the video head assembly. The customer's decision to have their VCR repaired may depend on the condition of this assembly. With all the different VCR formats available today, the servicer is faced with a huge challenge keeping up with new technology.

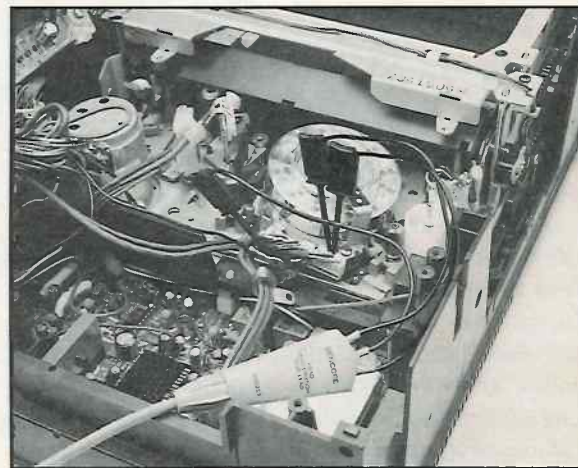


Fig. 5: The VC93 lets you substitute signals in any VCR format to isolate problems to any circuit in the VCR.

We understand this situation, and that's why the VC93 supplies all the standard video head formats found in today's VCR market, including VHS, Beta, U-Matic, and 8MM. You need to be able to test the wide variety of video head assemblies to remain competitive in today's servicing market.

Substituting for the video head signals is easy with the VC93 All Format VCR Analyzer. Simply select the same format as the VCR and inject the playback signals into the FM luminance section of the VCR. The supplied test lead allows you to inject into

both video heads simultaneously so you can correctly diagnose a problem in any stage.

The VC93 All Format VCR Analyzer's playback signals let you inject a known-good signal anywhere from the rotary transformer to the FM detector. This gives you full assurance of the condition of the video heads, and confidence the estimate you're giving your customer is accurate.

The exclusive chroma lock test allows you to lock the VC93 signals to the VCR. If all the circuits are working after the injection point, you will get a clear, locked-in color signal, even when substituting for the video heads. The playback signal injection capabilities of the VC93 make short work of determining the cause of a bad video picture. In addition, it helps you make fast and accurate estimates and keeps your customers coming back in the future.

Hi-Fi Stereo Signal Substitutor

The sales of Hi-Fi Stereo VCRs continue to increase every year as these higher-end VCRs become more popular. These decks are also more expensive than a standard VCR, so your customers are more willing to have these machines repaired versus buying new decks.

Hi-Fi VCRs also have additional components that can add to their chance of failure. These decks, for instance, use separate rotary heads and rotary transformers for the Hi-Fi signals. These heads can go bad just like video heads. Troubleshooting Hi-Fi Stereo problems using perceived symptoms alone can be difficult since many Hi-Fi VCRs turn off the stereo signals if anything is wrong or misadjusted.

The VC93 All Format VCR Analyzer provides Hi-Fi Stereo injection signals for all VCR formats that have a Hi-Fi audio system. These signals can be injected anywhere from the rotary transformer to the audio FM detectors for troubleshooting in any audio circuit. The VC93 Hi-Fi Stereo signals are modulated on continuous FM carriers eliminating headswitching problems from affecting your initial signal injections. After the FM detectors, you can use the VC93 drive signals by simply connecting the signal and listening to the results.

Complete Luminance/Chroma/Audio Troubleshooter

The VC93's troubleshooting capabilities don't stop at the FM detectors. The VC93 also provides all the drive signals you need to troubleshoot the remaining luminance, chroma, and audio circuits in the VCR.

Luminance circuit troubleshooting is simple and easy with the VC93. You get both a composite video signal as well as a luminance (B&W only) signal. These signals allow you to walk through each luminance stage from the FM detector output to the video output jack. In addition, the composite video signal lets you quickly check out the RF modulator as a problem source.

SERVICING ^{plus}

SC3080 Waveform Analyzer

Triple Patented



Analyze Any Waveform To 100 MHz, 10 Times Faster, 10 Times More Accurately, Absolutely Error-Free . . . Guaranteed, Or Your Money Back!

What is the SC3080 Waveform Analyzer?

At first glance the SC3080 Waveform Analyzer, a high performance, dual trace, wide bandwidth (useable to 100 MHz), may look like an ordinary oscilloscope. To find out why we call it a waveform analyzer, just pick up the probe and connect it to a test point — the patented, time saving, AUTO-TRACKING™ digital readout features of the Waveform Analyzer quickly reveal themselves.

There are other scopes with digital readouts, but none completely eliminate the inaccuracies of conventional CRT based measurements like the SC3080. You see, the SC3080 Waveform Analyzer is the first piece of test equipment to integrate a high performance scope with a patented, autoranging digital display.

You simply view the waveform on the CRT, then push a button to read DC volts, peak-to-peak volts, or frequency, plus you can analyze waveform portions directly on the easy-to-read auto-ranging digital display with the delta features. The SC3080 has obsoleted conventional scopes just like the digital calculator obsoleted the slide rule — your waveform analyzing results will be just as dramatic.

Meet The Triple Patented SC3080 Waveform Analyzer

- 80 MHz (useable to 100 MHz), high performance scope that allows you to completely analyze all modern waveforms.
- 100% automatic AUTO-TRACKING™ digital readout of all key waveform parameters at just the push of a button.
- Rock solid sync eliminates frustrating fiddling with complicated controls and reduces your servicing time.
- Five times the measuring capability of any conventional scope for truly safe analyzing.
- Plus, many extra, exclusive, high performance features designed to benefit you and your business.



Peak-To-Peak Readings Without Error

Many scopes use cursors (dotted lines) on the CRT's screen for voltage measurements. Using cursors for voltage measurements is subject to interpretation errors and takes extra time-wasting steps. You need to see the waveform on competitive scopes, then move the cursors to the appropriate areas.

The SC3080 Waveform Analyzer doesn't use cursors. You just press the VPP button and the SC3080's microprocessor does the rest. Don't worry about having the attenuators set to "CAL". You don't even need to have the signal displayed since the microprocessor gets its signals through a different circuit path than the CRT display. Just apply the signal, press the button, and read the LCD digital display.

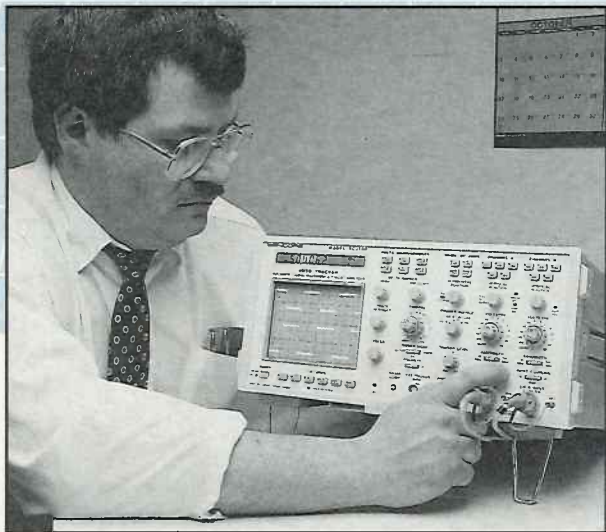
The VC93 All Format VCR Analyzer makes chroma troubleshooting simpler than ever before. The VC93's exclusive chroma lock technique takes the guesswork out of chroma troubleshooting. You simply connect the Chroma Lock Test Lead to the SW30 signal in the VCR locking the VC93 injection signals to the VCR. If your injection does not produce color, simply press the button next to the Chroma Lock Input to select the opposite phase of the SW30 signal. If you still don't have color, use the VC93's color troubleshooting drive signals to walk the color problem out of the VCR. The color troubleshooting signals include a 3.58 MHz drive signal, 30 Hz signal, and a chroma key pulse signal - every signal you need to quickly troubleshoot color problems in any VCR.

Part Of The "Tech Choice System"

The VC93 All Format VCR Analyzer was designed as part of the Sencore "Tech Choice System" of analyzing and troubleshooting

equipment. It works hand in hand with the VG91 Universal Video Generator for complete VCR servicing capabilities, plus is a valuable tool to use in combination with the new CVA94 "Video Tracker" Camera Video Analyzer for camera and camcorder servicing. Once you narrow down the problem to the VCR section with the CVA94, you can use the VC93 to quickly analyze the circuits resulting in faster repair time and more profit.

The VC93 All Format VCR Analyzer is the easiest and most advanced VCR servicing tool on the market. Find out how to profitably service and estimate every VCR that comes through the door. Better yet, take us up on our offer. Simply try the VC93 on your servicing bench for 30 days. If you're not completely convinced that the VC93 will make a difference in your VCR servicing, return it for a full refund, no questions asked. To take advantage of this super offer, simply call **1-800-SENCORE** and talk with your Area Sales Representative today! ■



Speed Your Waveform Analyzing With The SC3100 "AUTO TRACKER"™

By Paul Nies, Application Engineer

Is it possible that you're wasting valuable time every time you connect an oscilloscope probe to a circuit test point to view the waveform or make a measurement? Would you deny it and say, "I know how to use my oscilloscope"? Maybe you would say "Oh, but each measurement only takes a second." Or would your response be, "Well, if I'm wasting time, you show me how I can do it faster." Whatever your response, the fact remains:

If you are using an oscilloscope rather than the SC3100 "AUTO TRACKER" Automatic 100 MHz Waveform & Circuit Analyzer to view circuit waveforms, you ARE wasting time.

Have you ever taken note of how much time you actually spend adjusting your oscilloscope in order to view the waveforms as you move from test point to test point? Think of how much valuable time you would save if you could just connect a probe to a test point, view the waveform, and make a measurement without fiddling with the scope's controls. Those wasted seconds would quickly turn into profitable minutes of extra time saved each day.

That's what the SC3100 "AUTO TRACKER" is all about. But describing the time savings provided by the "AUTO TRACKER" isn't enough - you have to experience the simplicity and speed of connecting to a

test point and viewing the signal without adjusting any controls. That's why we're comparing the SC3100 side-by-side with a conventional oscilloscope in this article. We'll show you the steps necessary for viewing several typical waveforms for each instrument. We think you'll quickly see how your old oscilloscope is costing you valuable time.

We selected several test points which you would typically view while servicing a television chassis. Our goal is not to walk you through the test points in a troubleshooting sequence, but rather to show you how the "AUTO TRACKER" takes away virtually all the fiddling and knob turning associated with oscilloscope use.

Initial Setup For Both Instruments

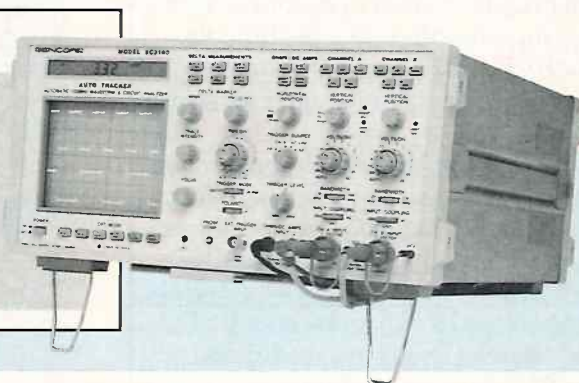
Your oscilloscope:

- Trigger Source: Channel A
- Input Coupling: AC
- Trigger Mode: Auto
- Trigger Polarity: "-"

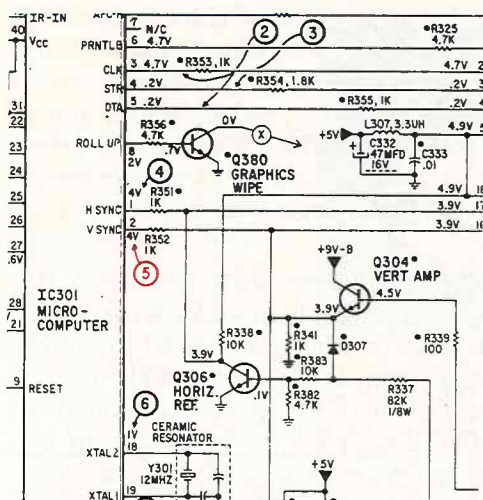
SC3100 "AUTO TRACKER":

- Trigger Source: Channel A
- Input Coupling: AC
- Trigger Mode: Auto
- Trigger Polarity: "-"

Connect probe ground to "cold ground" unless indicated.



Test Point #5



Conventional Scope

CONTROL SETTINGS:

- Timebase: 5 mSec
- Volts/Div.: 1 volt

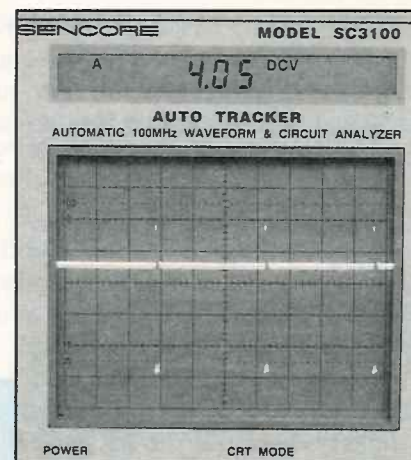
WAVEFORM MEASUREMENT: DC volts

1. Set verniers to "Cal"
2. Select "DC" Input Coupling to measure DC.
3. Adjust vertical position control for a reference.
4. Count graticules from ground reference to average DC portion of waveform.
5. Multiply number of graticules by volts/div setting.

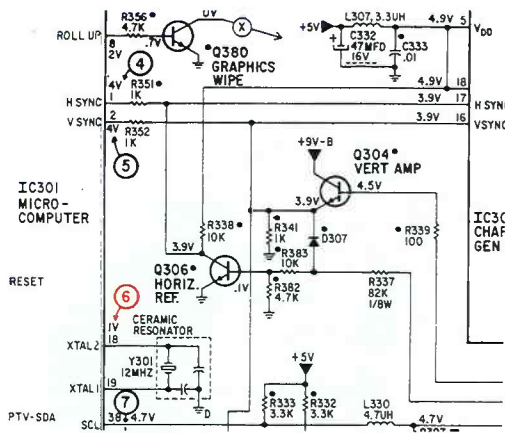
SC3100 "AUTO TRACKER"

- Timebase: "AUTO"
- Volts/Div.: "AUTO"

1. Push the DCV button.



Test Point #6



Conventional Scope

CONTROL SETTINGS:

Timebase: .1 uSec

Volts/Div.: .5 volt

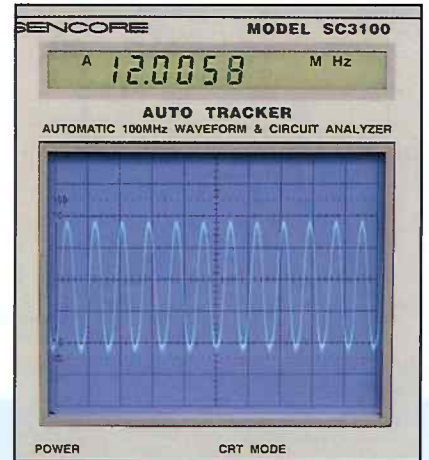
WAVEFORM MEASUREMENT: Frequency

1. Set verniers to "Cal"
2. Adjust horizontal position control for a reference.
3. Count graticules from beginning to end of one complete waveform.
4. Multiply number of counted graticules by volts/div setting.
5. Calculate the frequency by dividing the result into 1.

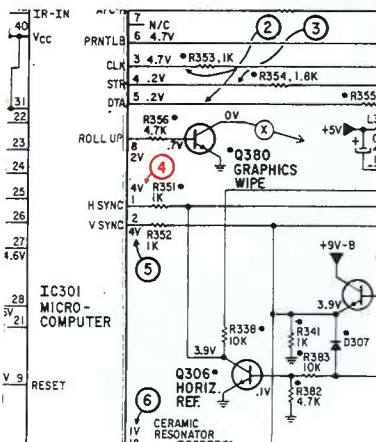
SC3100 "AUTO TRACKER"

No changes required

1. Push the FREQ button



Test Point #4



Conventional Scope

CONTROL SETTINGS:

Timebase: 20 uSec

Volts/Div.: 1 volt

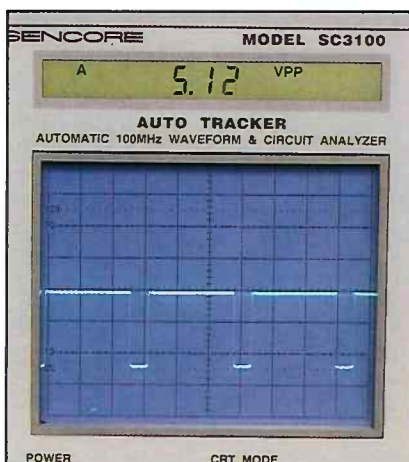
WAVEFORM MEASUREMENT: Peak-to-Peak volts

1. Set verniers to "cal"
2. Adjust vertical and horizontal position control for a reference.
3. Count graticules from the bottom peak to the top peak.
4. Multiply number of graticules by volts/div setting.

SC3100 "AUTO TRACKER"

No changes required

1. Push the VPP button



SERVICING^{plus}

PA81 Stereo Power Amplifier Analyzer

Exclusive - Only From Sencore!

Dynamically Analyze Stereo Power Amplifiers, Anywhere, In Less Than 1/2 The Time You Now Take, With Superior Accuracy And Reduced Measurement Errors

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.



Introducing The Missing Link In Stereo Power Audio Amplifier Servicing

- Twin, autoranged, and frequency compensated wattmeters.
- Built-in EIA/IHF dummy loads (250 watts per channel) and filters for fast, accurate tests.
- Monitor sound quality at every step to prevent backtracking.
- Trace signals through any audio stage with built-in RMS and dB meters.
- Prevent amplifier damage and save time with intermittent monitor and circuit protector.
- Audio line test insures the signal from the source is good.
- Stereo separation test to 126 dB speeds AM and FM stereo work.

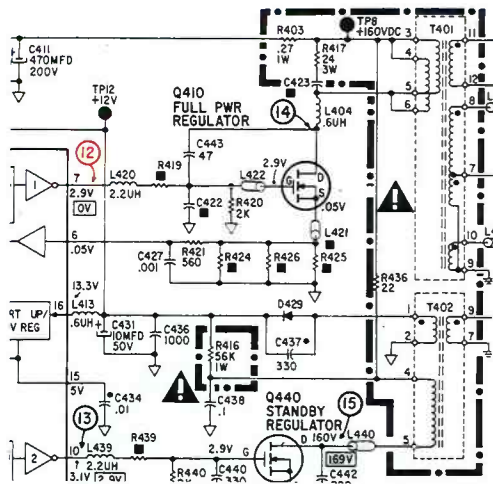


"Open Load" Testing An Audio Amplifier

Many manufacturers recommend that an open load test be performed immediately after major servicing has been done on an audio amplifier. This helps assure that extensive damage will not be caused by excessive current being drawn through the outputs.

The PA81 provides an "OPEN" load setting on its IHF DUMMY LOADS control for performing this test. In addition, the PA81 lets you view the amplifier output with its "Scope Output" jacks on the front panel. Just supply a 1 kHz sinewave input to the amplifier, and increase the sinewave level until clipping or distortion is seen on the scope. If everything tests satisfactory, retest the amplifier under full load to confirm normal operation.

Test Point #12



Conventional Scope

CONTROL SETTINGS: (move ground to Hot Ground)

Timebase: 10 uSec

Volts/Div.: 5 volt

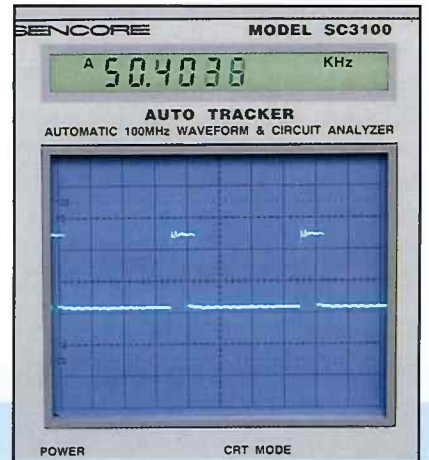
WAVEFORM MEASUREMENT: Frequency

1. Set verniers to "cal"
2. Adjust vertical and horizontal position control for a reference.
3. Count graticules from beginning to end of one complete waveform.
4. Multiply number of counted graticules by volts/div setting.
5. Calculate the frequency by dividing the result into 1.

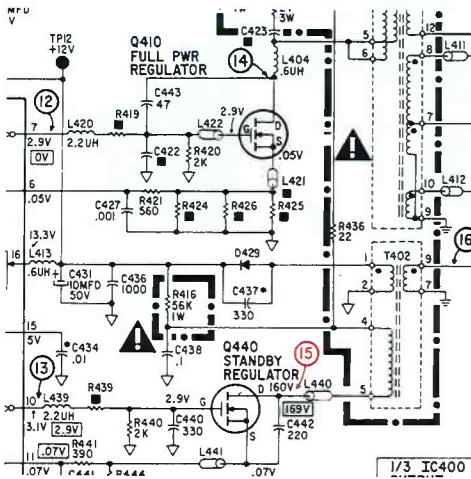
SC3100 "AUTO TRACKER"

No changes required

1. Push the FREQ button



Test Point #15



Conventional Scope

CONTROL SETTINGS: (move ground to Hot Ground)

Timebase: 10 uSec

Volts/Div.: 100 volt

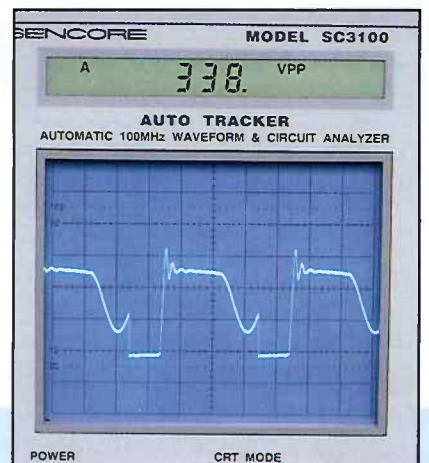
WAVEFORM MEASUREMENT: Peak-to-Peak volts

1. Set verniers to "cal"
2. Adjust vertical and horizontal position control for a reference.
3. Count graticules from the bottom peak to the top peak.
4. Multiply number of graticules by volts/div setting.

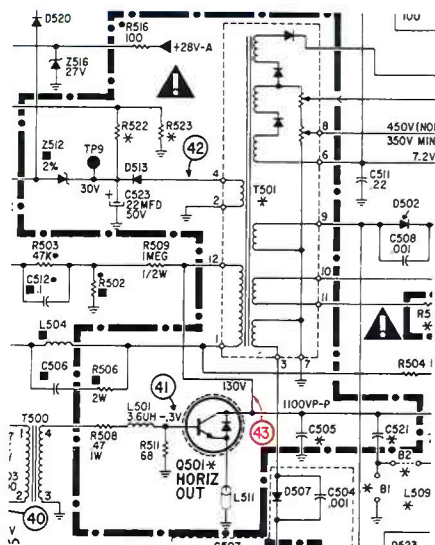
SC3100 "AUTO TRACKER"

No changes required

1. Push the VPP button



Test Point #43



Conventional Scope

Caution: DO NOT view unless your scope is capable of a 1500 volt input.

CONTROL SETTINGS: (move ground to Hot Ground)

Timebase: 20 uSec

Volts/Div.: 200 volt

WAVEFORM MEASUREMENT: Peak-to-Peak volts

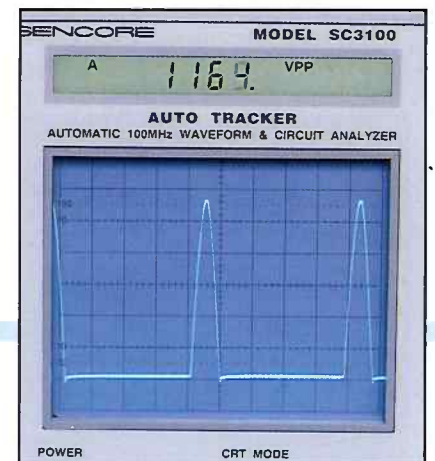
1. Set verniers to "cal"
2. Adjust vertical and horizontal position control for a reference.
3. Count graticules from the bottom peak to the top peak.
4. Multiply number of graticules by volts/div setting.

SC3100 "AUTO TRACKER"

Measuring capability: 2000 VPP
Protection: Up to 2500 VPP

No changes required

1. Push the VPP button



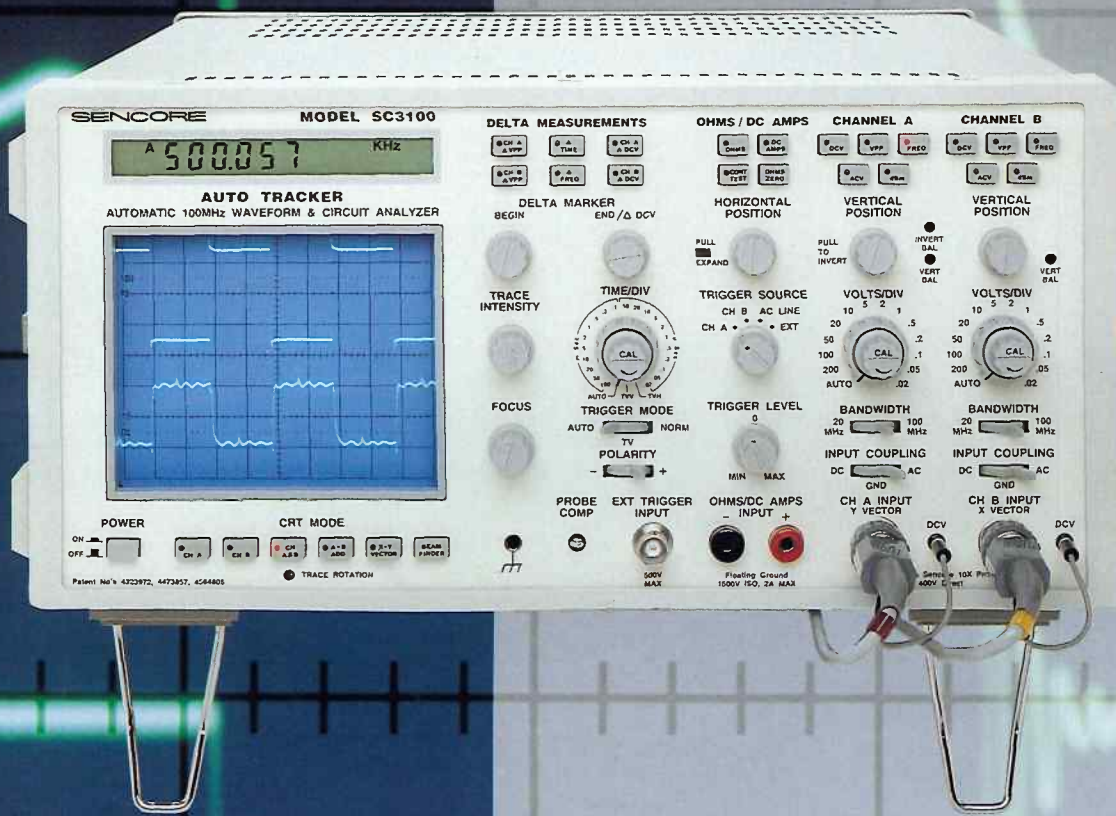
We think you'll agree that the "AUTO TRACKER" is faster and easier to use than any oscilloscope on the market. But the only way to find out is to try it for yourself. Call us toll-free 1-800-SENCORE,

and we'll make arrangements for you to try an SC3100 "AUTO TRACKER" on your own bench. Make sure to ask about our flexible investment options and affordable financing. ■

"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

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.



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



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!
(736-2673)

SENCORE

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

Business Is Not A Game Of Chance!

**You Either Win Or You Lose -
There's No Two Out Of Three!**

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?

Don't take that chance! Here's the answer . . .



Thousands of satisfied customers have invested in the VC93 All Format VCR Analyzer for various reasons: servo analyzing, head checking, luminance/chrominance circuit troubleshooting, audio and Hi-Fi circuit analyzing, plus the simple ability to add an additional \$2-\$5 of profit on each VCR coming through their service center.

And they can do all of these things because the VC93 provides:

- ◆ Dynamic VCR head signal substitution
- ◆ Exclusive Hi-Fi Stereo head substitution
- ◆ Innovative VCR luminance, chrominance, and audio circuit analyzing
- ◆ Automatic servo analyzer
- ◆ Stand-alone ability or can be integrated with the new "Tech Choice System" instruments
- ◆ Complete all-format troubleshooting, including:
 - Servo bias supply
 - Standard video & audio line outputs
 - Autoranging DCV and PPV meter
 - Output signal monitor



**Heads → Servos?
Tails → Video?**

New!

If you'd like to learn more about the VC93, call your Sencore Area Sales Representative today, and find out why the VC93 is one of the best investments you'll make in your 1993 VCR servicing.

VC93 All Format VCR Analyzer
Patented - Exclusively From Sencore

Call 1-800-SENCORE
(736-2673)



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