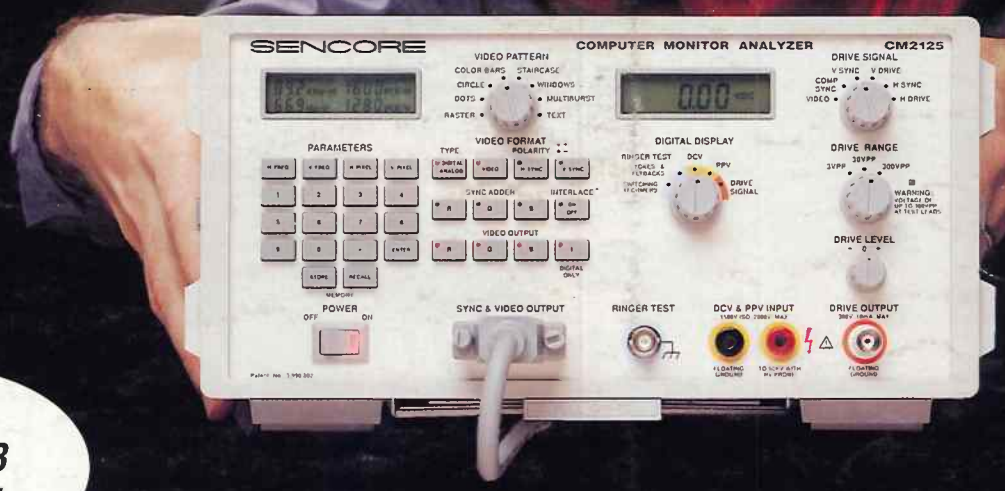
SENCORE NEWS

Issue #165 April/May 1994

Build "Super" Profits With The New CM2125 Computer Monitor Analyzer!

see page 3



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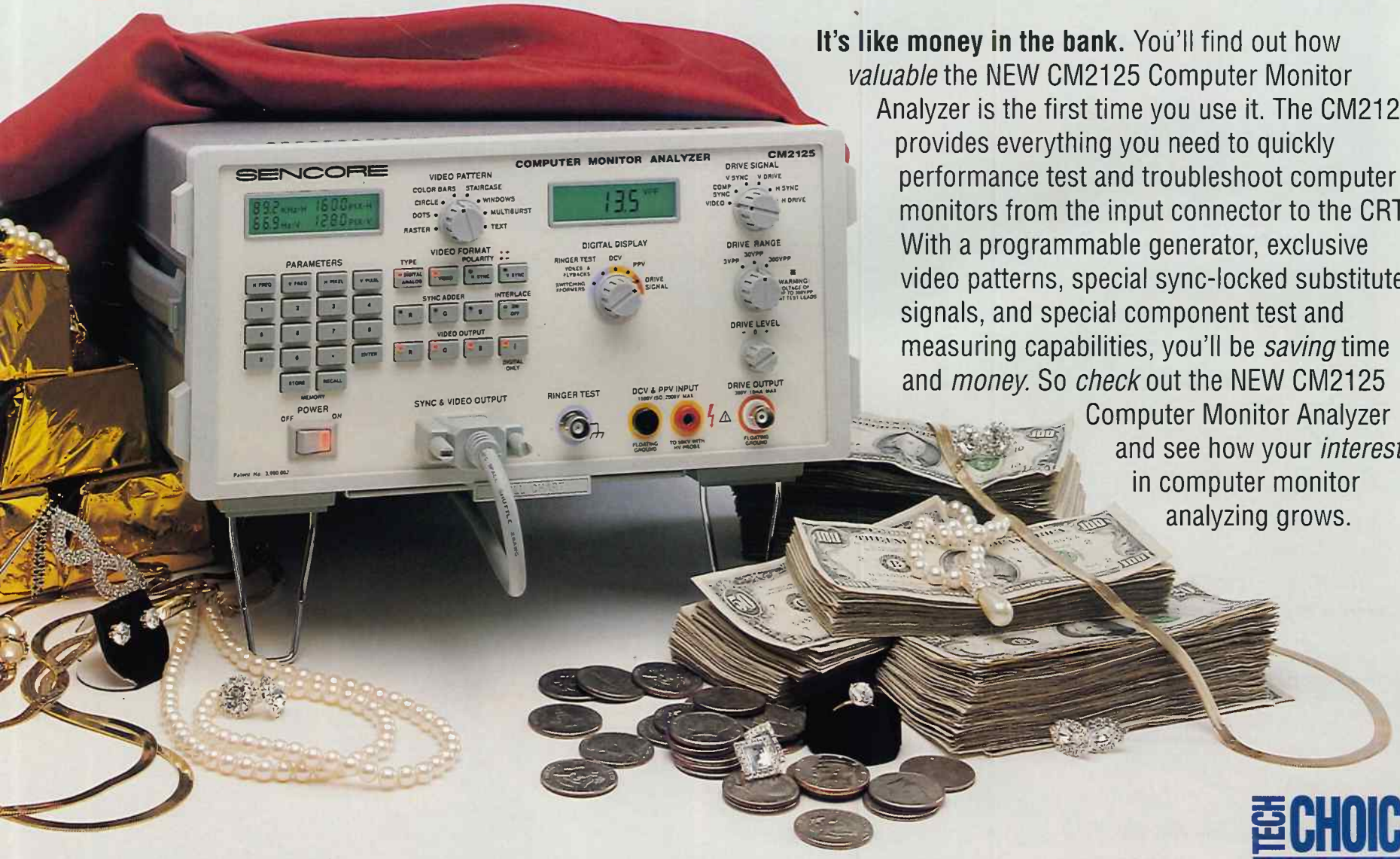

It's like money in the bank. You'll find out how *valuable* the NEW CM2125 Computer Monitor Analyzer is the first time you use it. The CM2125 provides everything you need to quickly performance test and troubleshoot computer monitors from the input connector to the CRT. With a programmable generator, exclusive video patterns, special sync-locked substitute signals, and special component test and measuring capabilities, you'll be *saving* time and *money.* So *check* out the NEW CM2125 Computer Monitor Analyzer and see how your *interest* in computer monitor analyzing grows.

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From The Computer Monitor Input To The CRT...

Troubleshooting With The New CM2125 Computer Monitor Analyzer

By Stan Warner, Application Engineer

On The Cover

Building profits in computer monitor servicing is easy with the right test equipment. The New CM2125 Computer Monitor Analyzer gives you the tests and features to help build those "super" profits. Check out the story on page 3.

In This Issue

The growing field of computer monitor repair holds great service potential for your business. We use computers and computer monitors in nearly every facet of our daily lives. Expanding your business into computer monitor servicing expands your service offering beyond consumer electronics repair into the profitable school, hospital, and industrial markets.

The CM2125 Computer Monitor Analyzer is a new product designed exclusively for complete computer monitor servicing. It is much more than just a signal source for getting a pattern up on the CRT. It provides you with features and tests for troubleshooting in every section of the monitor. No other instrument offers the same capabilities.

This article starts at the input connector of a computer monitor and works all the way to the CRT. Each section shows and explains the tests that can be done to troubleshoot in each circuit. The descriptions don't give the complete troubleshooting procedure (found in the CM2125 manual and Sencore Tech Tips), but they give a synopsis of the tests you could perform if you had a CM2125 Computer Monitor Analyzer on your bench.

Matching The Input Parameters Of The Monitor Under Test

The CM2125 Computer Monitor Analyzer has a fully programmable sync and pixel generator that lets you match the input requirements of the computer monitor under test. This full programmability lets you test and troubleshoot the high resolution computer monitors on the market today, plus any new formats introduced in the future (new computer graphics standards come onto the market every couple of years).

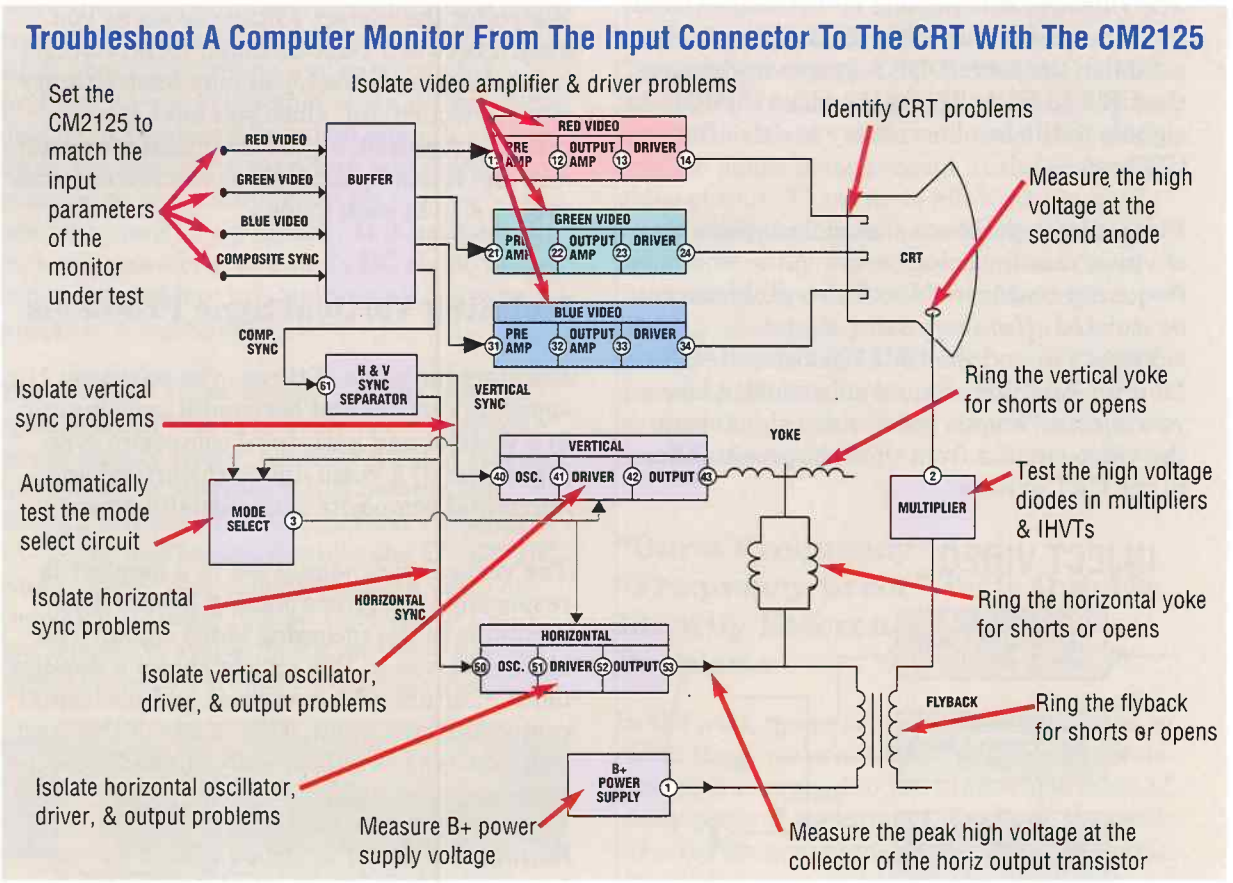


Fig. 1: The CM2125 Computer Monitor Analyzer has all the features and tests necessary for computer monitor servicing in one complete, easy-to-use instrument.

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

The CM2125 generates signals for both analog and digital computer monitors. The video, and horizontal and sync polarities can be set to either positive or negative for even more flexibility. The CM2125 generates the non-interlaced signal required by most computer monitors plus an interlaced signal for those times when you need it. Composite sync can also be added to any of the video lines.

The CM2125 contains internal memory locations for the most common computer monitor types. So instead of having to program in each signal parameter, you can quickly recall the setup you want and start testing. With 70 memory locations to choose from (42 pre-programmed), you'll be able to hook up to almost any computer monitor, recall a memory location, and start troubleshooting. Less programming and confusion mean less wasted time.

Isolate Video Amplifier And Driver Problems

The video circuits include all the stages from the input connector to the CRT. These stages establish the correct DC voltages for biasing the CRT and amplifying the video input signals to the level necessary to drive the CRT.

Video circuit problems include complete loss of video, missing colors, weak video, and poor frequency response. Most video problems can be isolated effectively using signal substitution and the CM2125 Computer Monitor Analyzer. Signal substitution lets you inject a "known good" video signal into the video circuits from the first preamplifier to the CRT drivers.

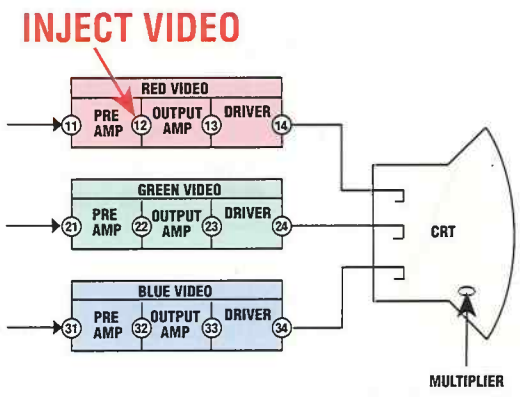


Fig. 3: Inject the Video Drive signal into the video circuits.

Example: Missing red video

Inject the CM2125's Video Drive signal at the input of the red output amplifier (TP12). If the missing color returns or the output improves, you are injecting after the problem indicating the circuits from the injection point to the CRT are working. Move back one stage and inject at the input of the red pre-amplifier (TP11).

If the same problem appears after you make the injection at TP12, you are injecting before the problem. Move forward one stage now and inject into the driver input (TP13).

Automatically Test "Multi-Sync" Computer Monitors

A multi-sync computer monitor has the capability of locking to a wide range of video graphics standards. For example, a multi-sync monitor type can lock to VGA, which has a horizontal scan frequency of 31.5 kHz, all the way up to 1280 x 1024, which scans at 64.0 kHz (plus a number of formats in between).

The monitor's mode select circuit controls the flow of current to the horizontal and vertical drive circuit to produce a full sized raster in all operating video formats. The mode select circuit detects the operating video format by sensing the frequency of horizontal and vertical sync as well as the polarity of the horizontal and vertical sync pulses.

Example: The display on a multi-sync monitor looks okay in one video format and scrunched and distorted in another.

Recall each of the multi-sync monitor's video formats stored in the CM2125's memory locations. Then monitor the output of the mode select circuit with the CM2125's DVM. Watch for the correct voltage levels as you switch between video formats. If the voltage is "stuck" in one level, you may have a faulty mode select circuit. Once you have the problem repaired, adjust the monitor's raster size and linearity controls so the raster is the proper size in each mode.

Isolating Vertical Sync Problems

Monitors have one of three sync schemes: 1) separate vertical and horizontal sync inputs; 2) a vertical and horizontal composite sync input; and 3) a video line with vertical and horizontal composite sync (usually green).

The vertical sync signal fed to a monitor is responsible for synchronizing the vertical oscillator to the incoming video signal. The block diagram in this article shows a monitor block diagram with a vertical and horizontal composite sync input. This is one of the most common sync schemes, but you need to be prepared for all three.

Example: Loss of vertical sync

Inject the CM2125's Vertical Sync drive signal into the input of the vertical oscillator (TP40). If vertical hold returns after you've made the injection, you've proven the oscillator circuit is working. Troubleshoot the vertical sync path next. If the same symptom returns, troubleshoot the vertical oscillator, driver, or output stage. Also check the wiring of the monitor connector and cable.

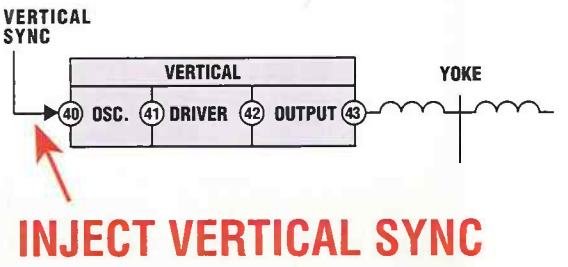


Fig. 4: Inject the Vertical Sync signal into the vertical sync path.

Isolate Vertical Oscillator, Driver, And Output Problems

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

Before you use signal injection to troubleshoot a vertical problem, use the CM2125's DVM to confirm the proper bias on the output components. The vertical stages are usually DC coupled for good linearity. A wrong DC voltage in one stage may affect all the voltages in the oscillator, driver, and output stages. Therefore, a DC bias problem must be repaired before you can use signal injection effectively.

Example: Collapsed vertical raster (thin horizontal line across the display)

First inject the CM2125's Vertical Drive signal into the output of the vertical driver circuit (TP42). Look for the sweep to expand (remember it may not be a full raster). If the sweep expands, either partially or fully, the circuits from the injection point to the output are good. If the sweep doesn't expand, check the output components or ring the deflection yoke with the CM2125's dynamic Ringer Test. Remember, the Vertical Drive signal is not designed to drive the vertical yoke.

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

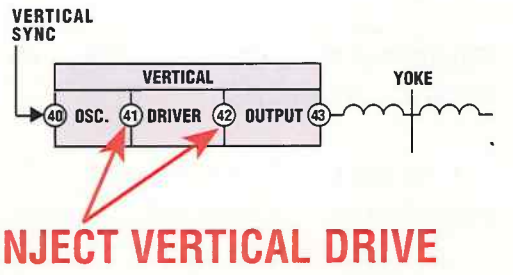


Fig. 5: Inject the Vertical Drive signal into the vertical driver and output stages.

Isolating Horizontal Sync Problems

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

Example: Loss of horizontal sync
Inject the CM2125's Horizontal Sync drive signal into the input of the horizontal oscillator (TP50).

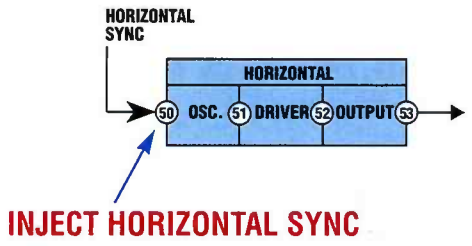


Fig. 6: Inject the Horizontal Sync signal into the horizontal sync path.

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

Ring The Horizontal And Vertical Yokes For Shorts Or Opens

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

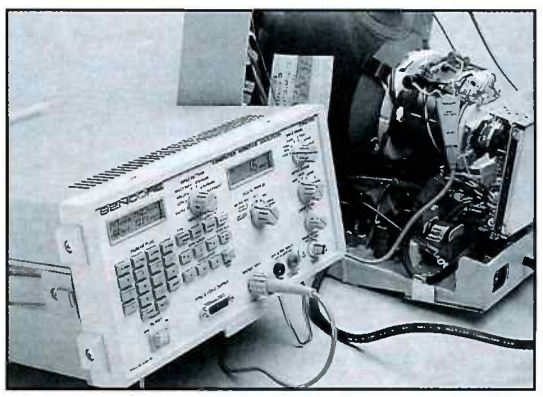


Fig. 7: The Ringer Test finds open and shorted windings on horizontal and vertical yokes.

The CM2125's Ringer Test will find defective yokes, even single shorted turns. Readings of 10 rings or more are accompanied by a "GOOD" display and shows that the winding does not have a shorted turn. A "BAD" reading, less than 10 rings, indicates a shorted turn, meaning the yoke is defective and needs to be replaced.

Example: Collapsed raster
Ring the horizontal and vertical yoke windings with the CM2125. Remember to unhook the yoke from the circuit and unsolder any damping resistors (leave the yoke mounted on the CRT). This assures you of accurate readings with the Ringer Test.

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

Measure The PPV And B+ Voltage At The Collector Of The Output Transistor

An abundance of troubleshooting information can be gained about the monitor's operation by measuring the DC and peak-to-peak voltage at the collector of the horizontal output transistor. The CM2125 has a DC and peak-to-peak voltmeter with the input protection needed (2000 VPP) for measuring signals at this high-powered test point. The DC reading tells you if the B+ supply is working correctly, while the peak-to-peak reading tells you if the output circuits are creating the high voltage necessary for normal operation.

Example: Dead monitor
Measure the DC voltage (B+) at the collector of the horizontal output transistor with the

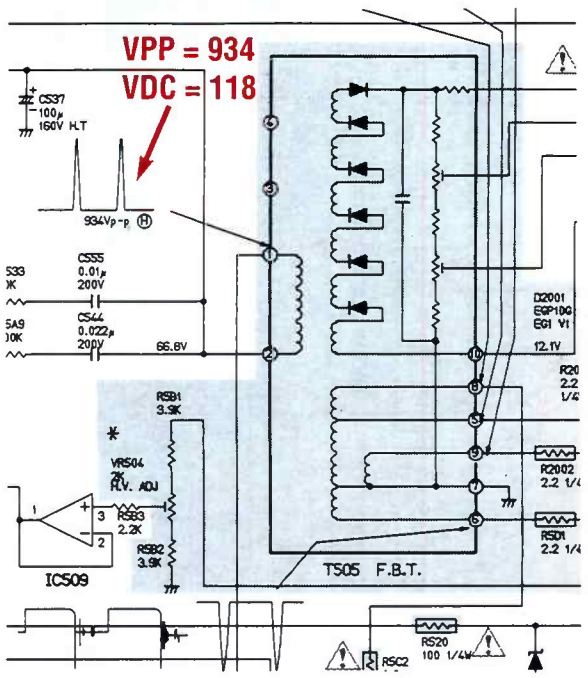


Fig. 8: The CM2125's DVM has the input protection needed (up to 2000 VPP) to measure the pulse at the horizontal output collector.

CM2125's DVM. If the B+ voltage is low or missing, unload the power supply by disconnecting the collector of the horizontal output transistor from the circuit. Then measure the voltage at the output of the power supply regulator again. If the voltage is still low or missing, troubleshoot the power supply. If the voltage returns to its schematic value, something is loading down the supply. Troubleshoot the output transistor, flyback, or yoke.

Ring The Flyback For Shorts Or Opens

The flyback transformer in a computer monitor is responsible for creating the focus voltage, high voltage, and other scan derived power supply voltages. The flyback is a high failure item that happens to be one of the most expensive components in the computer monitor.

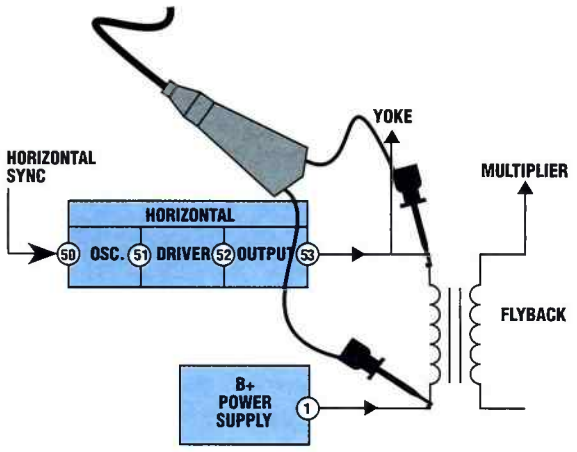


Fig. 9: The CM2125 Ringer Test finds shorts and opens in flyback transformer windings.

While an open transformer winding may be easy to identify using an ohmmeter, finding a shorted turn in flyback windings is nearly impossible using conventional testing methods. The CM2125 uses the patented Ringer Test that gives you an easy-to-use, fail-safe method of finding opens and shorts in flyback transformers.

Example: Dead monitor
Connect the CM2125 Computer Monitor Analyzer across the flyback's primary winding and ring the transformer. A "GOOD" reading of 10 rings or more means that none of the windings in the flyback are shorted. A shorted turn in any other winding will cause the primary to ring "BAD" also. You do not need to ring any other winding for shorted turns.

A "BAD" reading, less than 10 rings, may also be caused by a circuit connected to the flyback that is loading the Ringer Test. Disconnect the most likely circuits in the following order: 1) yoke; 2) CRT filament (unplug the CRT socket); 3) HOT collector; 4) scan derived supplies. Retest the flyback after you disconnect each circuit. If the flyback now rings "GOOD", it does not have a shorted winding.

If the flyback still tests "BAD" after you've disconnected each circuit, unsolder it to completely remove it from the circuit. If the flyback primary still rings less than 10, the flyback is bad and must be replaced.

Test The High Voltage Diode In Multipliers And IHVTs

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

Because these are high voltage components, it is often difficult using conventional methods to dynamically determine if the diodes will break down under high voltage conditions. The CM2125 has a special test for determining if these diodes are good or bad.

Note: It is only necessary to perform this test if all the following conditions are met:
1) High voltage and/or focus voltage is low or missing, 2) The B+ and PPV voltages at the horizontal output transistor are normal,
3) The flyback passes the Ringer Test.

Example: Low or no high voltage (monitor has an integrated high voltage transformer)
Start by injecting the CM2125's 25 VPP Horizontal Sync drive signal into the primary winding of the flyback transformer. The step-up action of the transformer and high voltage diodes should create a DC voltage level between the second anode and high voltage resupply pin on the flyback. Measure this voltage with the CM2125's DC voltmeter. Then look up this voltage on the CM2125's reference chart to determine if the high voltage diodes are good or bad.

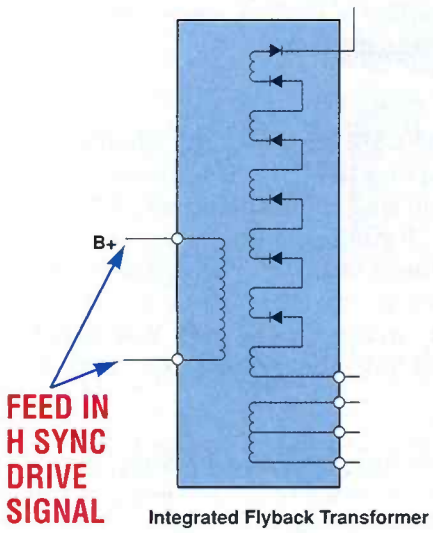


Fig. 10: To test the multiplier diodes, inject the CM2125 drive signal into the primary and monitor the DC voltage across the secondary.

Isolate Horizontal Oscillator, Driver, And Output Problems

If the horizontal yoke, flyback, multiplier, horizontal output transistor, and B+ supply have tested good, but the monitor still lacks deflection or high voltage, the horizontal driver circuit may be defective. A missing or reduced amplitude horizontal drive signal could prevent the computer monitor from starting up and operating properly. Use the CM2125's Horizontal Drive signal to isolate problems in the horizontal drive circuit.

NOTE 1: Before injecting into the horizontal drive circuit, test the flyback and yoke, the high voltage multiplier, the horizontal output transistor, and the B+ supply.

NOTE 2: When injecting at the output transistor, disconnect the secondary winding of the driver transformer from the base.

Example: Computer monitor won't start up
Inject the Horizontal Drive signal into the driver circuit and watch for horizontal deflection on the CRT. If deflection returns, you are injecting after the defective stage. If nothing happens, inject the Horizontal Drive signal at the base of the horizontal output transistor (TP52) and watch the CRT for results.

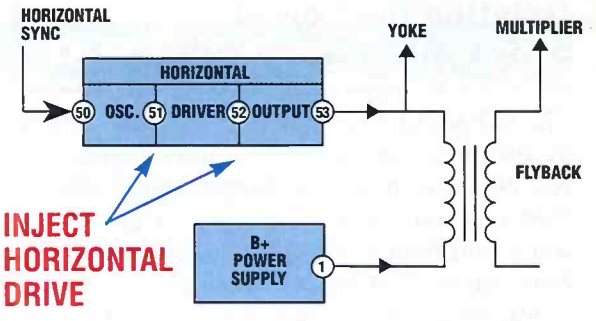


Fig. 11: Inject the Horizontal Drive signal into the horizontal driver and output stages.

Measuring High Voltage

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

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

Example: Dim, bloomed picture
Measure the high voltage with the CM2125's DC voltmeter and the HP200 High Voltage probe. The HP200 is a 100x probe, so all you need to do is multiply the CM2125's DC voltmeter display by 100, then compare that result to the level shown in the schematic.

Testing Switching Transformers In Switch Mode Power Supplies

Switching transformers are used in switch mode power supply circuits to step voltages up or down. These transformers are common failure items, however, and need to be quickly identified for efficient service. Open windings are easy to find with an ohmmeter, but shorted turns are nearly impossible using conventional test methods. The CM2125's Ringer Test easily finds switching transformers with both open and shorted windings.

NOTE: The switching transformer must be removed from the circuit.

Example: Dead power supply
Connect the CM2125 Ringer Test across any winding on the switching transformer. Readings of 10 rings or more shows that the winding does not have a shorted turn. Readings of less than 10 rings show an open or shorted turn(s) in the transformer, meaning it is defective and needs to be replaced.

Turning profits in computer monitor servicing is a new challenge, but the potential is tremendous. With the New CM2125 Computer Monitor Analyzer, you'll have all the signals and tests necessary for computer monitor servicing in one complete, easy-to-use instrument. To find out more about how the CM2125 can help you troubleshoot today's computer monitors, call **1-800-SENCORE.** Your Area Sales Representative can help put a CM2125 on your bench today. There's no obligation, all you need to do is call. ■

TECH CHOICE SYSTEM

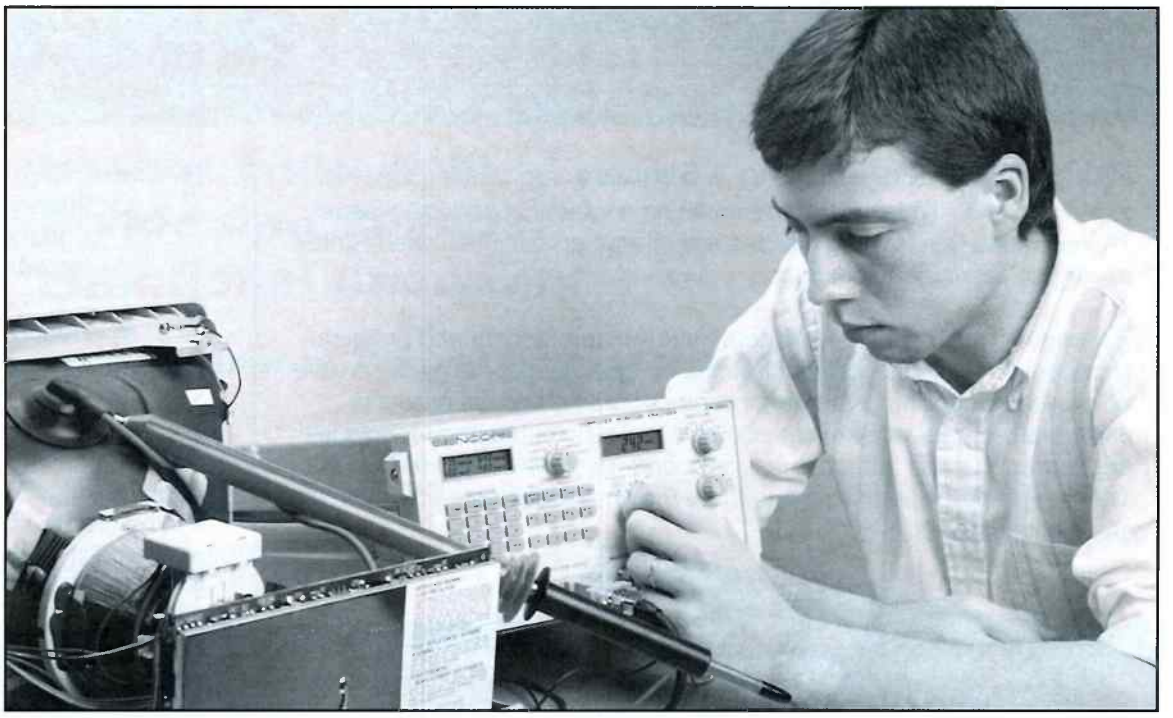
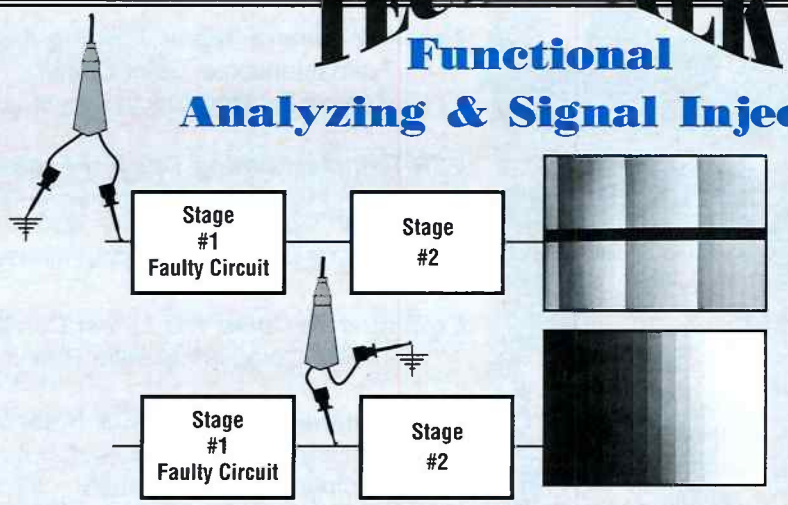


Fig. 12: Measuring high voltage with the CM2125 and the HP200 high voltage probe.

TECH TALK

Functional Analyzing & Signal Injection



Use signal injection to narrow a problem down to a single stage.

The CM2125 improves troubleshooting effectiveness through a technique called "Functional Analyzing". This method consists of two parts: (1) signal injection and (2) signal tracing. Signal injection lets you inject a "known good" signal (supplied by the CM2125) into the circuits. The low impedance of the Drive Signal output "swamps out" the signal present at the injection point and places a known good signal in its place. Watch the CRT to decide whether you are injecting before or after the defective stage. If the output remains bad, your injection is before the defective stage. If the output returns to normal or improves, you can be confident that all the circuits between the injection point and the output are good.

Once you narrow the problem to a single stage, use signal tracing and component analyzing to find the faulty component. As you signal trace, compare the voltage levels, frequencies, and waveshapes to those in the service literature.

Observe the following guidelines when using signal injection:

1. The CM2125 must be connected to the input of the computer monitor before making a signal injection and the CM2125 must be programmed to match the monitor's input requirements. This ensures the injected drive signal syncs to all the other signals in the monitor.

2. Match the CM2125's Drive Signal level to that shown in the service literature. Too much signal may overpower a bad stage leading to confusing results.

3. If no level is shown, do not drive with voltages exceeding the B+ voltage of the stage.

4. Match the Drive Signal polarity to the signal in the circuit.

PHILIPS TECHNICAL TRAINING

Philips Technical Training & Sencore are working together to offer Hands-On Training classes covering a variety of servicing issues. These Hands-On Training classes are offered across the United States at various convenient locations.

Hands-On Training gives servicers better understanding and practical experience. Following demonstrations of repair functions, each servicer will have the opportunity to perform procedures on actual products using state-of-the-art Sencore equipment. Troubleshooting techniques are shared that will reduce guesswork and repair time. Hands-On Training prepares technicians to meet the challenges faced today in the service industry.

Hands-On Training gives you the opportunity to:

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- Learn about new servicing products
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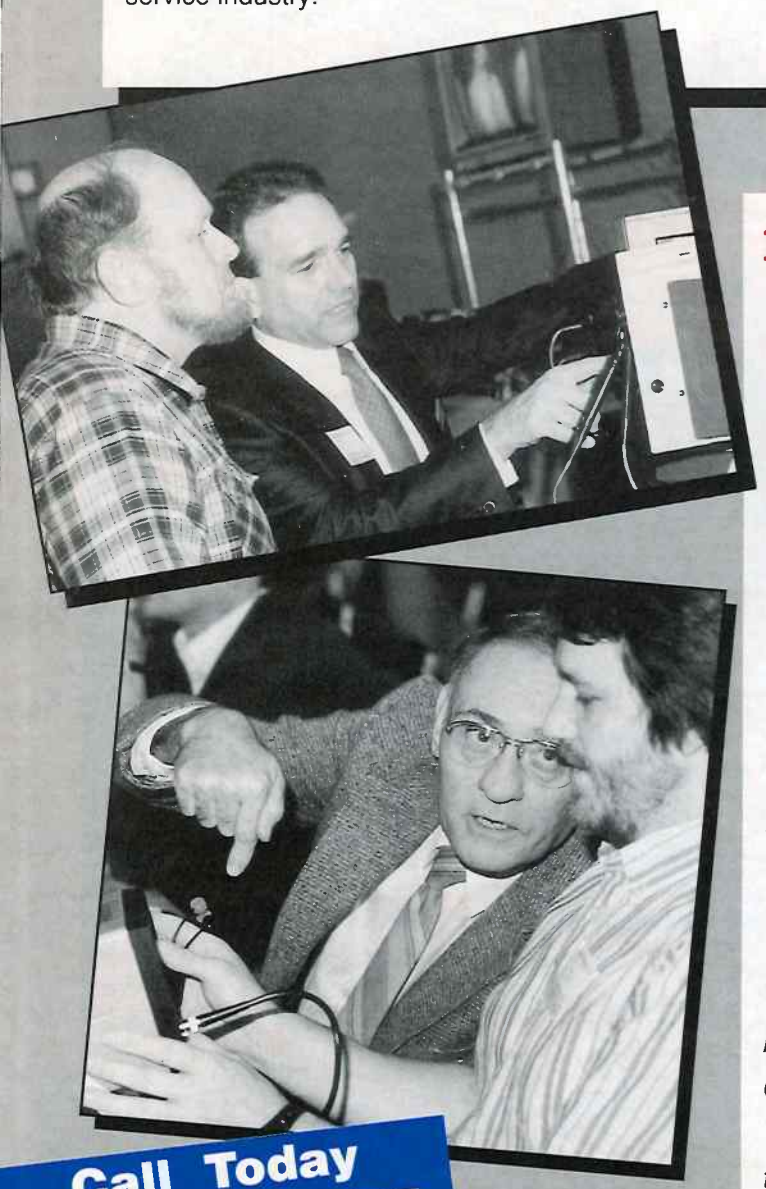
- Decrease wrong part orders
- Raise your service profits

Each Hands-On Training class concentrates on a specific subject providing technical information with hands-on lab activities. A wide variety of subjects are offered to appeal to almost any technician. Look at the following list of classes and see which ones interest you. Then call us at **1-800-SENCORE** for information on registering and attending.



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These technical training classes are equipped with Sencore equipment, including hands-on use with the SC3100 "AUTO TRACKER". The Fundamentals Of Color Camera (CM254) includes demonstrations with the CVA94 "Video Tracker" and VR940 Video Reference light box. You'll pick up some valuable VCR troubleshooting tips using the VC93 All Format VCR Analyzer in the VCR classes (V223 and V224). And the computer monitor troubleshooting class (M402) features the new CM2125 Computer Monitor Analyzer. Call ***1-800-SENCORE****(736-2673) for more details.*

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7/15/94	VCR Mechanical Maintenance (1 Day)	V225
7/18/94	High Speed VHS VCR Troubleshooting (3 Days)	V224
7/21/94	Switch Mode Power Supply V Pulse/ Driven and Dual Controller (2 Days)	C133

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Date	Description	Code
6/07/94	VCR Operating Systems (3 Days)	V223
6/10/94	VCR Mechanical Maintenance (1 Day)	V225
6/13/94	Switch Mode Power Supply V Pulse/ Driven and Dual-Controller (2 days)	C133
6/15/94	Hi-Res Computer Monitor Repair (2 Days)	M402

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Date	Description	Code
5/10/94	Compact Disc Digital Audio (3 Days)	CD355
5/13/94	VCR Mechanical Maintenance (1 Day)	V225
5/16/94	Fundamentals of Color Camera (3 Days)	CM254
5/19/94	Camcorder Mechanical Maintenance(1 Day)	CM255

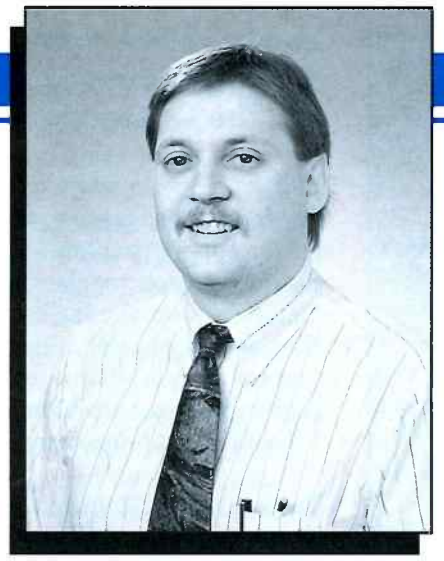
Las Vegas, NV

Date	Description	Code
5/03/94	Fundamentals of Color Camera (3 Days)	CM254
5/06/94	Camcorder Mechanical Maintenance (1 Day)	CM255
5/09/94	Compact Digital Audio (3 Days)	CD355
5/12/94	Compact Disc-Interactive (2 Days)	CD354
5/16/94	High Speed VHS VCR Troubleshooting (3 Days)	V224

Westlake, OH

Date	Description	Code
6/28/94	VCR Mechanical Maintenance (1 Day)	V225
6/29/94	Switch Mode Power Supply V Pulse/ Driven and Dual-Controller (2 Days)	C133

To Register, Call 1-800-SENCORE And Ask For Your Area Sales Representative or Cheri at ext. 281!



Is It The Signal Source Or The TV?

By Brad Johnson, Product Marketing Specialist

Many servicers who service TVs and VCRs, also work with master antenna systems or some type of TV-RF distribution systems. They learn to listen carefully as the customer explains the problems with their reception, quality, and/or interference. Typical responses include, "The picture is bad," or, "It's too snowy," or even, "We see funny lines rolling through the picture."

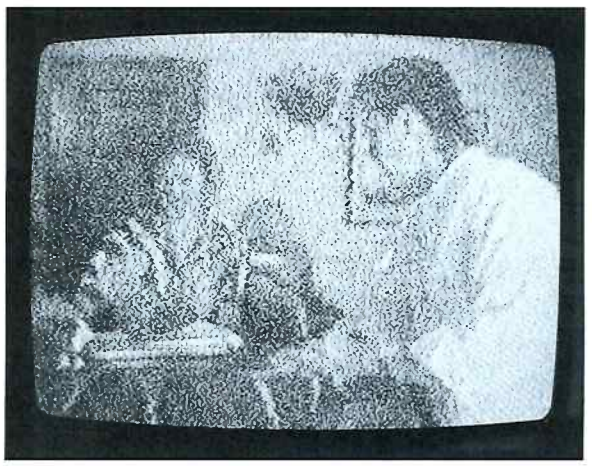


Fig 1: Customers don't want to hear excuses when they can't watch their favorite program. With the right equipment, you won't need excuses.

From the customers' comments, you can't always tell if the problem is hum, signal to noise, interference – or whether the problem is in the "system" or the customer's TV. Could it be as simple as a flipped switch or misadjusted fine tuning from either the VCR or TV?

Sure it could! And you know how irate customers can become when the problem affects their "pay channels" – no matter who's at fault. All the while the customer is talking, you're probably wondering if the problem is in the hyperband or the midband. Or maybe you're wondering if the TV tuner is bad or if the channel's off frequency. How long will it take you to analyze the symptoms, locate the problem, make a trip to the shop for the parts (if necessary), convince the customer, and get on your way?

It's the proof that really counts, both for you and your customer. What you truly need is a source of confidence that lets you quickly locate the trouble, correct it, check the signal levels, verify the video and audio quality, look at the important channels, convince the customer, and move on....

Let's imagine your next service call, a "poor reception" complaint. The customer meets you at the door with a list of problems. "The picture has been bad for a long time and the sound isn't good either." They add, "Strange lines showed up this morning, and I'm not going to pay for this channel! How long will this take, anyway?" Sidestepping the question, you ask politely if you can step inside and look at the customer's TV.

The First Step Is To Analyze The Symptoms

Tuning through the channels, you notice that the sound on all channels is scratchy, there are diagonal lines in some midband channels, and the superband channels are snowy. There's also a hum bar rolling through the picture on every channel. Does the TV need repair, or is the problem in the distribution system?

Successful Servicing Requires System Know-How And A Complete TV-RF Signal Analyzer

We've got the answer to your RF measuring and analyzing needs – the SL750A "CHANNELIZER" TV-RF Signal Analyzer. The SL750A helps you pinpoint RF/video and performance signals anywhere in the distribution system. Now you have the capability of tuning any channel and making all the tests necessary to quickly analyze problems from the signal source all the way to the TV or VCR tap. We'll use the SL750A to track down and pinpoint the defect(s) on this typical service call.

First, you disconnect the cable from the back of the TV and attach it to your SL750A "CHANNELIZER" to analyze the incoming signals. Channel 12's signal level is a good +6 dBmV and a quick check of the channel frequency shows it's right on. The SL750A makes both of these tests automatically. The SL750A also tunes and displays your audio and video carriers and displays the audio level at -9.5 dB. The "CHANNELIZER"

Fig. 2: The SL750A "CHANNELIZER" TV-RF Signal Analyzer helps you quickly pinpoint RF/video problems in any RF distribution system.

automatically calculates the ratio and shows the audio to be 15.5 dB lower than the video. That's right where it should be.

Signal Level And Signal Quality Tests Quickly Isolate System Problems.

What about the diagonal lines showing up on several of the midband channels? A quick check of the signal level shows all the midband channels are within FCC level specs. The SL750A confirms your fears though. The diagonal lines are very distinct on its color LCD display. The SL750A's LCD visual image has proven the signal does have an interference problem.

When you listen to the audio with the SL750A, everything sounds as it should. Looks like the sound problem is in the TV.

Fig. 3: The SL750A's exclusive color LCD display lets you look at the signal to confirm good picture quality to you and your customer. (photo shown is black & white)

Your SL750A Proves Whether The Problem Is In The System Or The Customer's TV

Is there also a system hum problem to track down, or does the customer's TV have a power supply problem? You press the SL750A button marked "HUM." The digital display shows about 3% as you tune from channel to channel meaning the distribution system hum is within tolerable specs. You've proven the hum problem is in the customer's TV and not the incoming signal.

Tuning the SL750A to the superband channels to check the snowy picture symptom, you notice the superband channels above 26 have fallen below the required minimum level of 0 dBmV. The score now stands at two problems in the TV (audio and hum), and two problems for you track down in the distribution system (interference lines and two signal level). It's time to put your SL750A's troubleshooting abilities to work to locate the source of your signal problems.

Portability Gets You Started Troubleshooting Without Delays

The first step in troubleshooting the distribution system is to check the signal at the customer's tap. You take the battery-operated SL750A "CHANNELIZER" back to the pedestal containing the 20 dB tap and again measure signal levels and check the picture quality. The LCD color display still shows lines in the midband channels, and the superband channels above 26 are at +5 dBmV. You know +5 dBmV at the tap is too low to provide a good signal at the TV set since the signals are attenuated by the drop to the TV.

Fig. 4: The battery operated, portable SL750A lets you analyze signals anywhere your testing takes you.

Signal Quality Tests Take You Right To The Source Of The Problem

You now follow the system back to the line extender that feeds the 20 dB tap. Opening the housing of the line extender, you measure

the input signals with the SL750A. The levels are around + 20 dBmV on the superband channels and the lower channels are all higher, indicating the correct levels and correct slope at the amplifier input. A glance at the SL750A's color monitor shows nice, clear picture quality on all channels. A quick AC power check at the amplifier with the SL750A's built-in digital AC voltmeter confirms everything is normal here. Everything is right at the amplifier input. Is the output okay? Could the amplifier be bad?

With the SL750A's test cable now connected to the amplifier output, you again measure the signal levels and check picture quality. The output levels on the superband channels are 5 dB too low and the lines are back on the SL750A's monitor. The maximum amplifier gain is 24 dB, although it normally has a maximum gain of about 30 dB. These levels tell you the amplifier isn't working properly. A 5 dB signal loss is enough to cause the problems.

The SL750A's Built-In DVM Keeps You Testing, Not Scrambling For Additional Equipment

After a quick trip back to the truck, you return with a replacement line extender module and install it. Now, you test DC power to the amplifier with the SL750A's built-in DVM. The SL750A's digital meter reads 23.9 V: close enough to the 24 V rated value. Verifying the correct equalizer and pad are installed, you set the gain and slope controls for the proper output levels.

Carrier/Noise (C/N) And Hum Are Important Tests Of Signal Quality

After adjusting the amplifier, you step through the channels and watch the SL750A's color monitor for signal quality. A signal quality test includes carrier/noise and hum modulation, so you press the noise reference button and your "on-channel" C/N measurement is automatically calculated and displays a ratio of 46 dB. A quick check of on-channel hum also turns out positive (no hum). The line extender is now working perfectly, time to wrap things up.

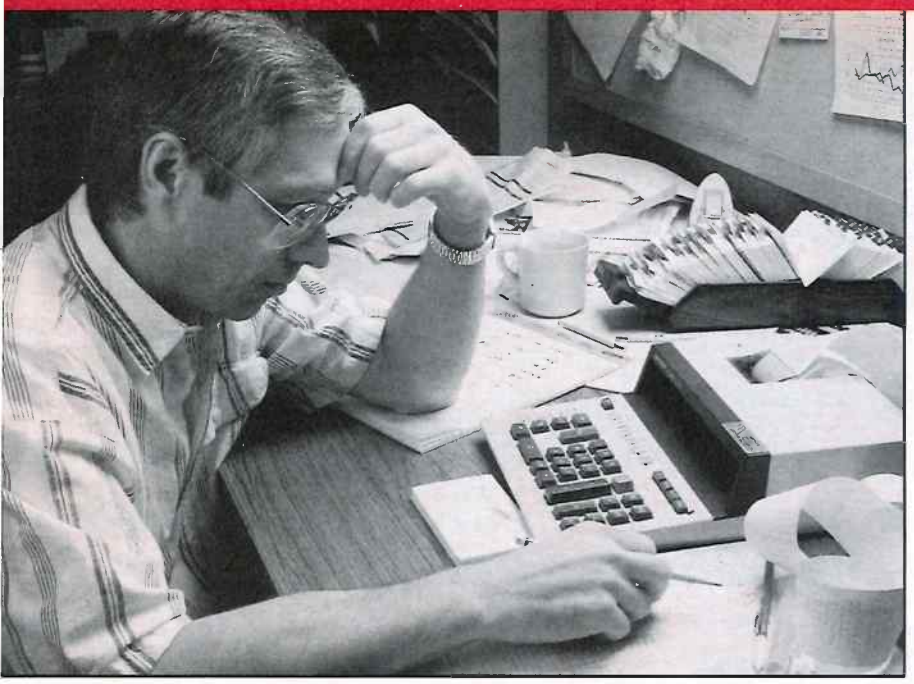
An Overall Signal Quality Test Is A Must On Every Service Call

Later, at the customer's home, you see the results. Your SL750A shows that all the signal levels have been restored to standard specifications. The carrier/noise test shows 45 dB, and the hum test shows less than 3% hum, indicating the hum bars are not a fault of the cable system.

You reattach the antenna lead to the TV, and it now displays sharp, clear pictures. Hum bars are still present on the TV, but clear, hum-free pictures on the SL750A's color monitor convinces the customer that the signal is good. Now it's time to do some work on that TV!

The new SL750A line of signal level meters can make a difference. To find out for yourself, call **1-800-SENCORE** and ask for your Area Sales Representative.

TECH CHOICE SYSTEM



What Kind Of Help Does Your Service Center Need?

SM2001
Service Center Manager
by SENCORE

Most service centers can handle the technical side of their business, but there is more to running a *profitable* business. The SM2001 Service Center Manager is guaranteed to be the most complete, fully customized, and easy-to-use business management program on the market. The SM2001 is designed specifically to help you manage all aspects of your business more efficiently, effectively, and profitably.

Here's what the SM2001 Service Center Manager offers:

1. Manage customer invoicing and work flow from creation to tracking and billing – automatically!
2. Automatically generate, track, and control parts orders to save you effort, time, and money.
3. Gain inventory control through searching, cross referencing, pricing levels, ordering advice, general ledger codes, gross profit reports, and more.
4. Customize business reports from any or all of the invoices you've ever processed.
5. Automate accounts receivable functions such as posting payments & credits, aging, month end processing, and more, with just a few keystrokes.
6. Perform daily and end of month transaction reports showing cost, sale price, and profit in just seconds.
7. Electronically file warranty claims through KeyPrestige, Inc., the nation's largest independent warranty claims processor, providing an automated link to many electronics manufacturers.
8. Utilize unique and special features specifically designed for the service industry, with your time in mind.
9. Rapid execution of reports and file searches provides you with information in just seconds. You never have to archive a file – ever!

The SM2001 Can Help Build Your Business In 1994!

We're confident the SM2001 is absolutely the best business management program available. It's specifically designed for the service industry by the service industry and it's available exclusively from Sencore – the leader in American-Made Electronic Analyzing Equipment, and now Business Management Software. Give us a call. We're here to help.

"My old paper processes couldn't easily identify the problem areas of my business. Now, with the SM2001 Service Center Manager, I know automatically what's happening with my business and where my profits are coming from."

Don Hollinger
Family Video Service

Don founded his first business in Easton, MD over 10 years ago. He has been in the service business for well over 25 years, and started by repairing typewriters. Don was also in the antenna business when he started, however his business revenue wasn't growing over the past several years like it should. After Don added the SM2001 to his service center, he quickly pinpointed that the antenna business wasn't the area to be in, and switched to strictly consumer product servicing. Don's old paper shuffling techniques simply couldn't allow him to effectively manage his repairs and build profits into his business.

Today, Family Video Service is doing warranty work for over 30 companies, and with the addition of the SM2001, Don's warranty claims are much easier to file. Don says that with the ability of the SM2001 to handle his unit tracking, parts ordering, inventory, and accounting procedures, he's able to watch his business grow in the right directions, on a daily basis.

For information or a demonstration package on the SM2001 Service Center Manager for your business, call today!

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Ten Steps To Successful Servicing With Your Video Analyzing Team

By Brian Phelps, Product Marketing Specialist

Some video technicians see the Sencore Video Analyzing Team, the VG91 Universal Video Generator and TVA92 TV Video Analyzer, as a tool which is used primarily for "tough dog" problems. While this exclusive equipment does a good job of helping you troubleshoot the tough problems, the team can serve a more important function on nearly every set you service.

The processes covered in this article are based on reports from many successful video technicians who use Sencore test equipment and video analyzers. If you adopt these methods, you will find that troubleshooting is easier, your customers will respect you more, and you'll have fewer callbacks for marginal performance. As a side benefit, you will be using your Video Analyzing Team more often, so you will become more skilled at using it when you do meet those tough-dog problems.

Learn The Ten Steps That Can Guarantee Your Success

If you break your servicing down into separate tasks, you'll see that most service jobs need the same steps. You might try to skip a step or two, but doing so often leads to more work later, as you may have to back up and re-do the skipped steps.

You can attempt these steps without the Video Analyzing Team, but your troubleshooting will be more difficult with more component-level testing, and you'll have more backtracking because you followed the wrong circuit path. The Video Analyzing Team gives you all the tests you need in one, integrated analyzing team. It has been designed to give you the best effectiveness in any video troubleshooting. As you see, the Video Analyzing Team plays a role in three out of the 10 steps used by successful servicers.

TECH CHOICE SYSTEM

Here are the 10 steps used by successful servicers:

1. Ask customer for symptoms and history
2. Do performance test with customer
3. Determine all related symptoms
4. Check for obvious defects
5. Narrow problem to functional block/ defective stage
6. Pinpoint bad components
7. Replace bad components
8. Re-test to confirm operation restored
9. Repair secondary symptoms
10. Run complete performance test

Let's look at these steps, so that you can understand why each is important.

STEP 1 Ask the customer for symptoms and history.

Many servicers get a chuckle about this step. Often times, they explain, the only clue they get from a customer is, "It just quit working." While this may be all you can get from some customers, the set's owner can often fill some very important gaps in the diagnosis process.

Notice that this step asks for two kinds of information: symptoms and history. If the customer can explain the exact symptom, such as, "The picture went first, then the sound," you can get an important clue about the mode of the failure. Modern television receivers often appear to work fine one moment, then fail to start the next time. So the reply, "It just doesn't work", might be all the customer knows.

Don't forget to ask about the set's history. Did it do this before? Has it been fixed by another shop? If so, when and where? Were there any unusual symptoms in the week or month before the failure, such as popping in the audio or sparks in the picture? Was there a thunderstorm in the area recently? All these clues can be especially helpful when tracing an intermittent or a failure that's out of the ordinary.

Fig. 1: Be sure to ask your customer for all the symptoms and service history before you start the repair process.

STEP 2 Do a performance test with your customer.

Few technicians bother with this step, yet some of Sencore's most successful customers tell us that it's the most important. With the customer watching, plug the set into a live outlet and run through every function to see what works and what does not. Sometimes, you'll find there's really nothing wrong – the problem is a dead AC outlet, a bad antenna, or a disconnected cable TV tap.

Fig. 2: Always do a performance test with your customer. A little extra time invested up front can save confusion, embarrassment, and lost revenue down the road.

But, there's an even more important reason to run through a complete performance test. The set may have more than one problem and the customer has only mentioned the most recent one. For example, they may be complaining about the loss of horizontal sync, but your test shows that audio is also weak. Or, they may not have noticed the low brightness caused by a weak picture tube, and may be glad to learn that you can restore the picture tube with the Sencore CR70 "BEAM BUILDER".

Most especially, a complete performance test shows the customer that you are concerned about doing the job correctly. You've taken the time up front to show that you want to do a complete job, with the customer knowing about the work before you start.

The Video Analyzing Team lets you test the performance of every TV circuit by simply connecting to the antenna terminals. You don't even need to take the back off the set to perform these tests. The Video Analyzing Team's exclusive signals and patterns give you the capability to help identify and show problems to your customer before the work begins.

Before the customer leaves your shop (or before they leave the room if you're doing home service), have them agree with you on what they want fixed. You and your customer should come to an agreement on such questions as whether they want the picture tube restored, or whether there are some other, secondary problems they want you to look at. By pointing out that there are several, unrelated problems, it's easier to itemize the bill. Otherwise, they may think that all your work was to find only one problem, and may feel you are overcharging them when the final bill is presented.

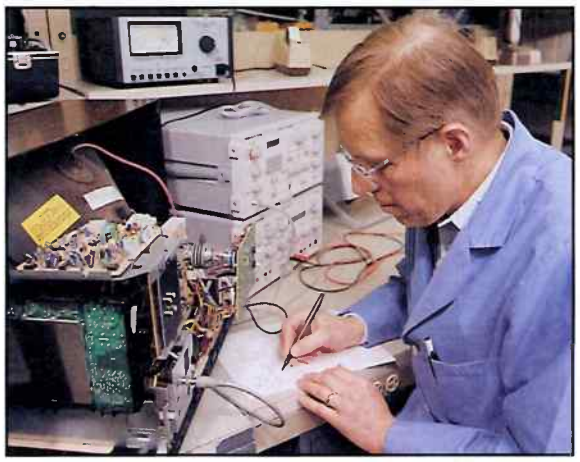

Fig. 3: Determine all related symptoms before you start so you can troubleshoot the primary symptom first.

STEP 3 Determine all related symptoms.

Here's one of the steps where many technicians build in their own inefficiency. Instead of identifying ALL the symptoms, they find one symptom and begin tracing it. But, this symptom may be a secondary symptom of an even larger problem. If they had taken a few more moments, they may have noticed that two or three symptoms all point to the same source, such as a bad tuner, or poorly regulated power supply.

If you use all the features of the Video Analyzing Team, this step becomes easy. The information gained from the performance test in step 2 has already identified the main symptoms. Now, it's a matter of using the Video Analyzing Team to further define these symptoms, by making a more detailed test, or by using additional Video Analyzing Team functions that weren't used during the simple performance test.

If you confirm several symptoms, you need to decide which one to troubleshoot first. You shouldn't try to follow more than one symptom at a time, because it is too easy to get crossed up as one may affect the other. Since one problem can cause multiple symptoms, finding one bad component often clears up all the symptoms. Always repair circuit problems in the following order:

1. **High Voltage**
2. **Sweep**
3. **Sync**
4. **Luminance (video)**
5. **Color**
6. **Audio**

Each of these general symptoms directs you to one of the areas of the "trouble tree" troubleshooting guide supplied with the Video Analyzing Team. They, in turn, let you isolate the defective stage in the fewest steps possible.

STEP 4 Check for obvious defects.

This step relies on your senses of observation and your own practical experience. If, for example, you see a burned resistor, or smell smoke, you should attend to these obvious defects, even before making a measurement. Sometimes repairing the burned part solves the problem. But, even if it doesn't, you have fixed something you know must be corrected before the service job is done.

You may also know that a particular chassis has a manufacturing defect which causes a particular symptom. Service literature, for example, may instruct you to resolder certain connections, or to replace certain components with improved ones. Here again, checking for these obvious defects first ensures that they won't mislead you in your final troubleshooting.

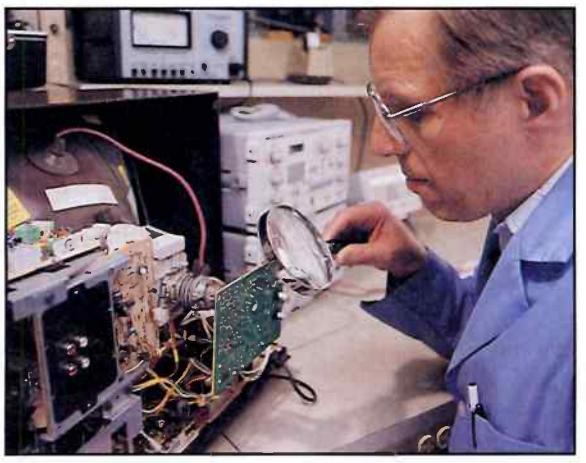

Fig. 4: Making a quick check for obvious defects can sometimes save you a lot of troubleshooting time.

STEP 5 Narrow the problem to one functional block.

Up to this point, the Video Analyzing Team has been used to make general tests. Now it's time to put its full analyzing capabilities to work with functional analyzing. Functional analyzing means that you base your troubleshooting on the function of a circuit, instead of the specific parameters of each component. This lets you move through the suspect stages much faster than using conventional troubleshooting methods, such as analyzing waveforms with an oscilloscope or measuring DC voltages with a voltmeter.

Functional analyzing uses duplicate signals substituted into each of the stages you think might cause the symptom identified earlier. These substitute signals are good, so injecting them into a good circuit causes it to operate normally. If you inject a signal into a test point, and the symptoms improve, you

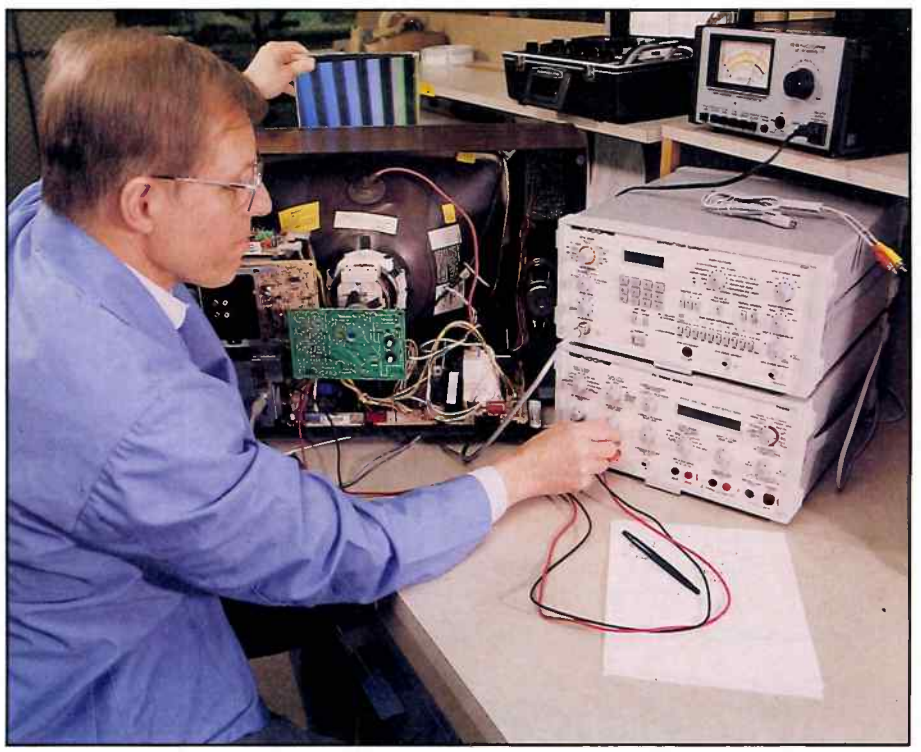

Fig. 5: The Video Analyzing Team helps narrow the problem to a single defective functional block stage.

know that all the circuits from there to the output are working correctly. If, by comparison, the symptoms remain, you know that the bad circuit is affecting the substituted signal, and the problem is between the injection point and the output.

You inject the Video Analyzing Team signal right over the top of the signals at the test point. There's no need to disconnect components to interrupt the original signal, because the Video Analyzing Team output circuits "swamp" out the signal already in the circuit. This is done by using output amplifiers with a driving impedance well below the normal circuit impedance, allowing the Video Analyzing Team to over-power the circuit signal. The Video Analyzing Team has DC blocking built-in, so you don't need to worry about shorting out bias circuits and damaging good components in good circuits.

If you use the "divide and conquer" troubleshooting method, you'll find the bad stage in four troubleshooting stages or less (steps 3-6 above). The Video Analyzing Team is supplied with troubleshooting guides based on this highly effective troubleshooting method.

The guides instruct you to substitute into a test point about half-way through the circuits related to the symptoms. If the symptom improves, you have proven that all the circuits to the output are good. Now you move the injection point toward the input. If the symptom remains, you are now ahead of the bad stage, so you move your injection point toward the output. In either case, you divide the remaining stages in half again. This halving process repeats until you have found the bad stage. You know that you have the bad stage when you get an improvement in the symptom when injecting at its output and the original symptom when injecting at its input. The isolated stage has only a few parts that might be bad. These are tested with conventional testing methods.

STEP 6 Pinpoint bad components.

It's only after using the Video Analyzing Team to isolate a single stage that you bring in your conventional testers. You might use a waveform analyzer to look at a signal. You might use your volt/ohmmeter to measure a resistor or to test a power supply. You can use the LC102 "AUTO-Z" to test a capacitor or an inductor, or you can use the TF46 Portable "SUPER CRICKET" to test a transistor. In addition to DC and peak-to-peak voltages, the Video Analyzing Team's digital meter lets you test flyback transformers, yokes, and high-voltage triplers all with special tests.

Now that the Video Analyzing Team has narrowed the suspect parts to a dozen or so, conventional test methods are your most effective means of narrowing the defect to a single component. Functional analyzing isolates the problem stage, and conventional tests point you to the defective part. It's a troubleshooting team that's time-tested and proven to be the most effective analyzing method available.

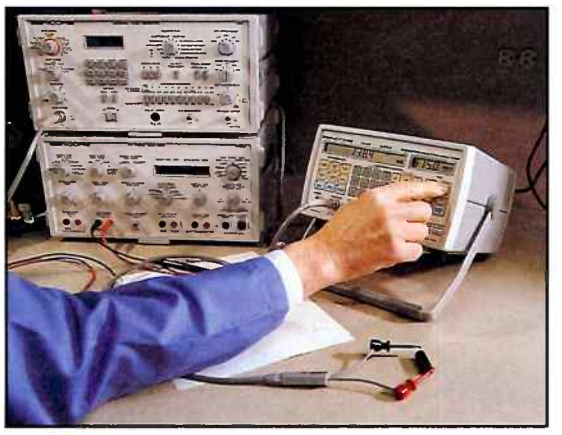

Fig. 6: Conventional analyzing methods lead you to the defective part. Here the LC102 "AUTO-Z" locates a capacitor with excessive leakage.

STEP 7 Replace bad components.

This step doesn't directly involve the Video Analyzing Team. It is a good idea, however, to use component tests and common sense to check components associated with the bad part you found. For example, don't forget to check emitter resistors if a transistor was bad. Also, look for shorted P.C. boards, bad solder connections, and other mechanical problems.

STEP 8 Re-test to confirm proper operation.

Changing a bad part may only fix part of the problem. Double check your work by using the Video Analyzing Team signal to dynamically test the circuit associated with the original problem. The exclusive video patterns produced by the Video Analyzing Team provide dynamic tests you can interpret right on the screen of the TV. For example, the Multiburst Bar Sweep video pattern checks the video bandwidth of the IF stages, video detector, and video amplifiers. The 10 Bar Staircase pattern dynamically tests those same stages for gray scale tracking and dynamic range. And finally, the Chroma Bar Sweep confirms that the color circuits work correctly.

If your tests show there is still a problem, use the Video Analyzing Team's signal substitution to find its cause. This time, start at the circuit you just repaired to learn whether another part in the same circuit might be defective.

STEP 9 Repair secondary symptoms.

If repairing the first problem did not clear up the secondary problems, you now turn your attention to them. Move back to step number 3, and follow the troubleshooting sequence to find each remaining problem, one at a time. Use your Video Analyzing Team to test, isolate, and then confirm each defect.

STEP 10 Run complete performance test again.

When you have found and repaired all the problems, repeat all the steps of the performance test used at the beginning of the process. It's important to repeat this test so you don't miss any hidden problems or any symptoms that have mysteriously appeared since you did the performance test in step 2. Even if it's not your fault, your customer could lose faith in your servicing abilities if his/her product is returned with any kind of defect.

Fig. 7: After the repairs have been made, be sure to run a complete performance test again to make sure you don't miss any problems.

The Video Analyzing Team does much more than help you fix "tough dogs." It is a complete video analyzer, which becomes part of a professional approach to video servicing. The ten steps we've covered apply equally well to TV receivers, video monitors, VCRs, and NTSC capable computer monitors. It applies to any video system based on NTSC standards.

If you follow the steps used by successful servicers, your customer will know you are doing a good job. More importantly, each step directs you to the problem, using the most efficient troubleshooting methods ever devised. That translates to less time wasted and higher profits on every service job. If you have questions on these methods or the Video Analyzing Team, call us toll-free at **1-800-SENCORE.** We'll discuss your analyzing needs and help come up with a solution. ■

synergy (sin´ər jē) n.
1. Two or more substances working together to achieve an effect greater than each individual's capability.

Video generators do just that – generate video.

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 covering all your video servicing and alignment needs. Now you can actually build your bench one instrument at a time, and be confident you'll have complete compatibility with the industry's best video generator, the VG91. This synergy gives you the flexibility to meet and conquer new video servicing challenges.

The VG91 is the only generator that offers these exclusive features:

- ☛ All channel TV-RF generator for complete tuner analyzing
- ☛ Variable level 45.75 MHz video-IF troubleshooting and alignment generator
- ☛ Exclusive and dynamic NTSC video test signal generator
- ☛ Proof-positive tests for MTS stereo/SAP on all channels
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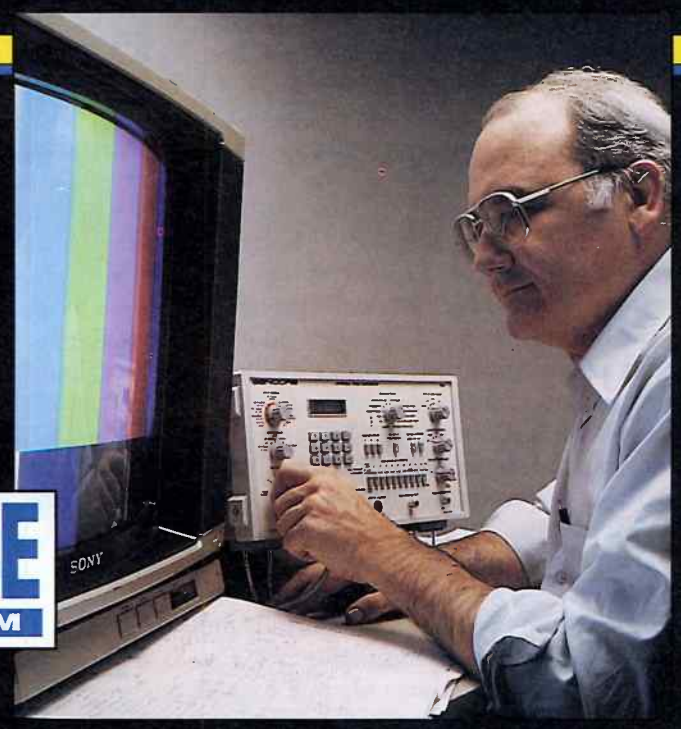
- ☛ Spare video output and exclusive interconnect design permits future updates or expansion
- ☛ Portable and easy-to-use



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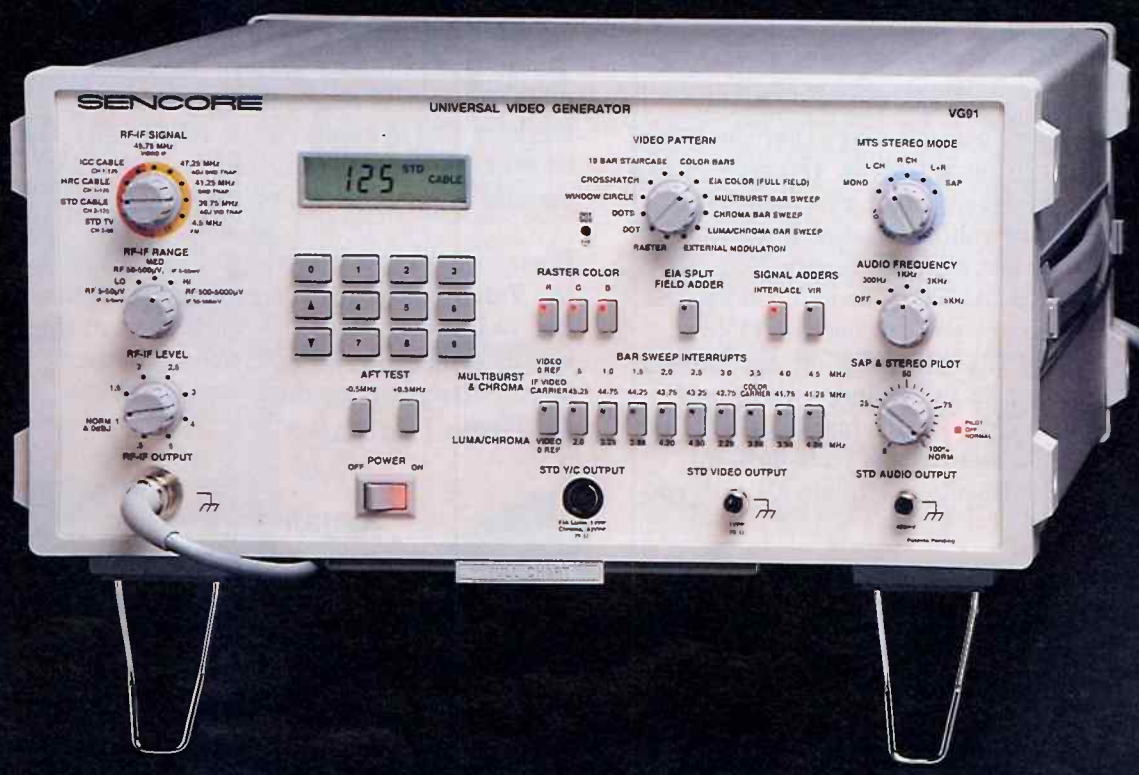

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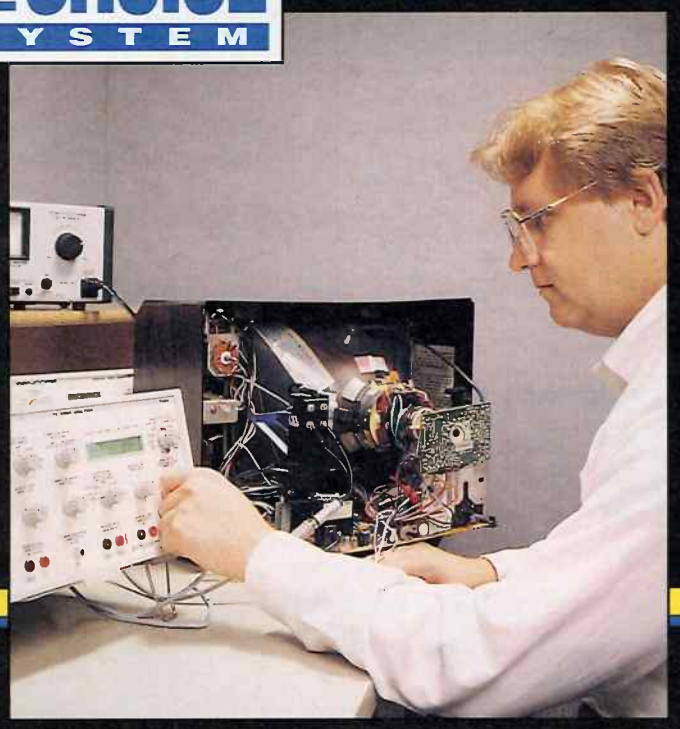

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- Exclusive "TV OFF" horizontal output load test
- Dynamic tests through a simple 3 lead hook-up to the H.O.T.
- Horizontal output transistor sub and drive
- Universal substitute TV signals
- Patented ringer test to pinpoint shorted turns in flybacks,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

TVA92 TV Video Analyzer
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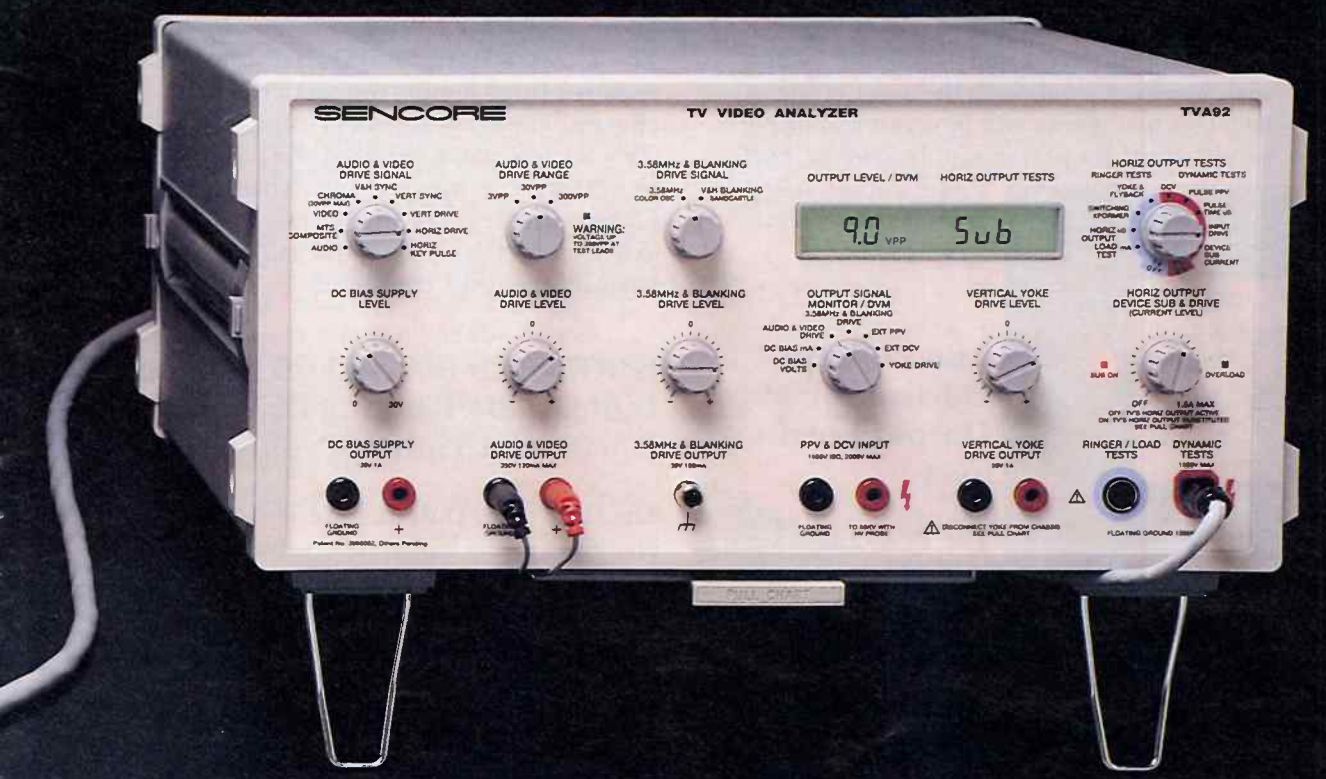

e VG91 and/or the TVA92,
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complete (kəm′ plēt) n.
1. Having all necessary or normal parts, components, or steps; entire, whole.

Innovative troubleshooting.

Now, you can actually pull the entire TV together while isolating individual stages. The TVA92 TV Video Analyzer lets you isolate TV defects, troubleshoot startup/shutdown problems, test expensive TV components, plus accurately estimate TV repair costs in minutes. Your service bench will be complete with the TVA92 (companion unit to the VG91 Universal Video Generator).

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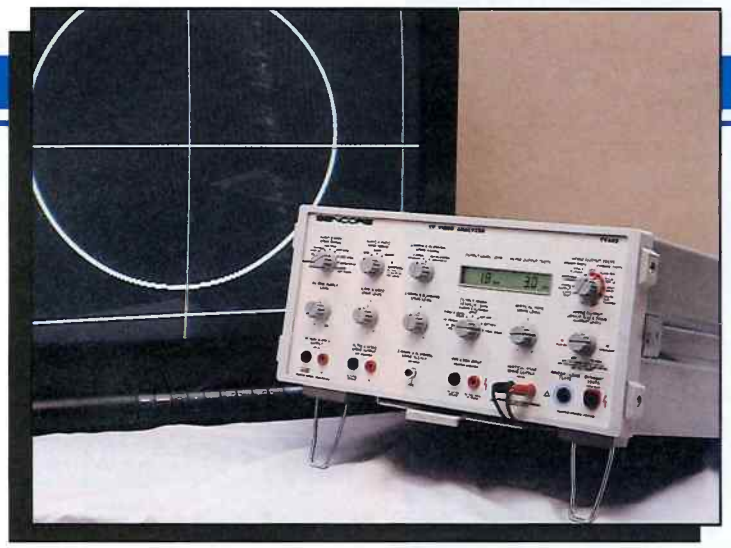

Isolating "Power Up" Problems With The TVA92's Horizontal Output Load Test

By Glen Kropuenske, Application Engineer

How do you troubleshoot a TV when the circuits won't come on or are shut down right away? You can't measure any voltages or look at any waveforms! And what about those chassis that instantly burn up components? How do you isolate those chassis problems without spending a fortune on parts?

These are only a few of the TV servicing questions presented to Sencore's Field Representatives and Application Engineers. When these questions were relayed back to the Product Design Team of our TVA92 TV Video Analyzer, we immediately went to work to identify the causes and find solutions. Here's what we found.

Relationship Of B+ Supply, Horizontal Output, And High Voltage Shutdown Circuits

After studying schematics and performing service procedures on many chassis based on your input, we identified the most common servicing problems. It became clear that troubleshooting TV "power up" problems involved testing more circuits than just the power supply. Figure 1 shows the relationship between the switching mode power supply, horizontal output/flyback, safety circuits, and control circuits. When the TV will not power-up properly or parts are instantly damaged, there is no procedure to make measurements to isolate the problem. Our research showed the horizontal output stage was the key to detecting power supply loading and "power up" problems. The horizontal output stage is responsible for taking current (power) from the B+ supply and transferring it to much of the TV circuitry via the flyback transformer. Furthermore, the timing or resonant action of the horizontal output stage determines the amplitude of the flyback pulse used to develop normal high voltage.

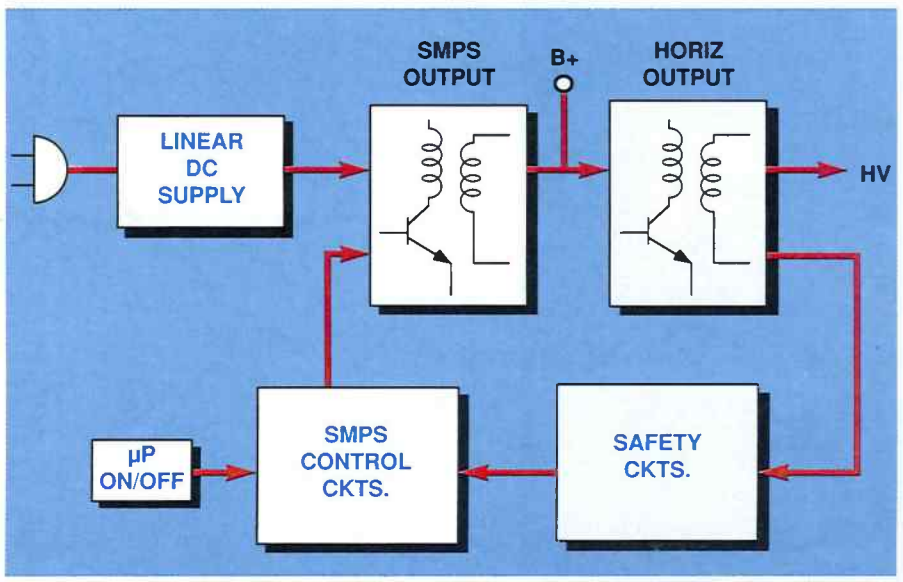

Fig. 1: Problems in the horizontal output, flyback secondaries, safety shutdown, or control circuits may prevent normal power supply operation.

After months of intensive study and testing, the TVA92's Horizontal Output Load Test was developed to fill these power supply servicing voids. This test checks the horizontal output circuit and associated loads with no power applied to the set. Let's look at how this test works and how you can use it to troubleshoot B+ power supply loading, horizontal output stage problems, and shutdown problems.

The TV "OFF" Horizontal Output Load Test

The TVA92's Horizontal Output Load Test enables you to simulate the normal operation of the TV's horizontal output stage with no AC power applied to the TV. Simulating the operation of the horizontal output stage requires: 1) B+ voltage to the flyback primary, and 2) a transistor switch that switches flyback primary current to ground at a 15.7 kHz rate with a 30 μS on-time.

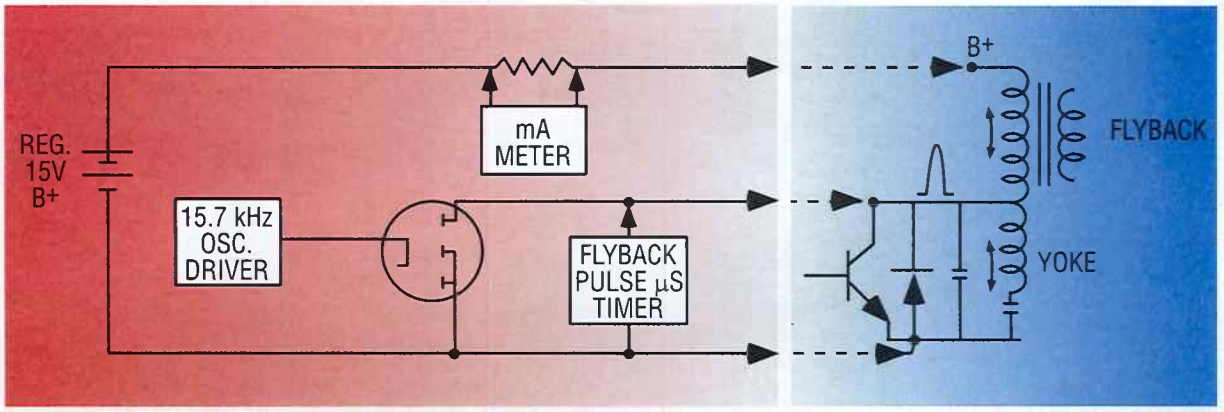

Fig. 2: The TVA92's Horizontal Output Load Test simulates the normal action of the TV's horizontal output stage without applying AC power to the TV.

The TVA92's Horizontal Output Load Test fulfills these requirements with a 15 volt B+ substitute supply and a power transistor switched at the proper rate and time simulating the action of the horizontal output stage. During the load test, alternating currents are produced in the TV's flyback and yoke, closely matching the full power operation of the horizontal output stage.

The TVA92's Horizontal Output Load Test requires three simple connections to the TV chassis. The B+ test lead is connected to the TV's B+ test point either at the power supply or at the B+ terminal of the flyback transformer primary. The other two connections are made to the emitter and collector of the horizontal output transistor.

GOOD/BAD mA And μS Readouts Indicate B+ Loading Or Horizontal Timing Problems

The Horizontal Output Load Test checks the operation of the horizontal output stage and monitors the current load demanded of the TV's B+ supply. Separate mA and μS readouts are provided to detect abnormal conditions with GOOD/BAD indicators for each.

The TVA92 uses 15 volts as a substitute for the TV's B+ supply which is approximately 1/10 of the normal B+ voltage found in most

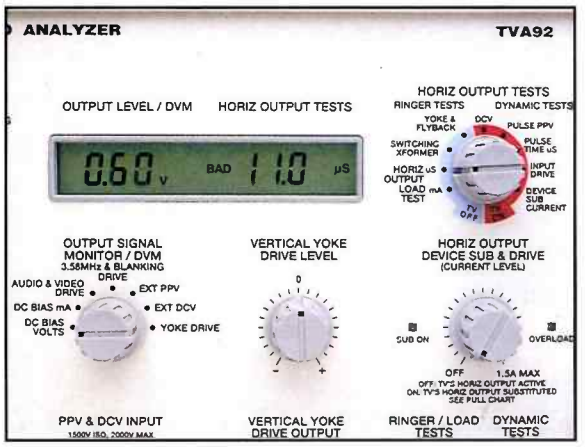

Fig. 3: Horizontal Output Load Test readouts of less than 11.3 µS indicate abnormally fast retrace timing which produces excessive high voltage and shutdown symptoms.

TVs. At this reduced B+ level, the TV's horizontal output stage operates similarly as it would if the full B+ voltage was applied, but with approximately 1/10 the current and voltage amplitudes.

The TVA92 measures and displays the current supplied by the Horizontal Output Load Test's 15 volt supply. Readouts between 5-80 mA represent a normal range of current for a wide variety of horizontal output stages and are displayed as "GOOD" by the TVA92. Current levels less than 5 mA indicate improper test lead connections or an open in the horizontal output circuits. Readings greater than 80 mA indicate heavy current load demands from the horizontal output, flyback, or other B+ circuits. Readings outside the 5-80 mA range are shown as "BAD" by the TVA92.

The mA readout of the Horizontal Output Load Test may be used to anticipate the TV's B+ power supply current at full operating voltages. To approximate the load current, simply multiply the mA readout of the Horizontal Output Load Test by 10. In most receivers, the TV's actual B+ current at full voltage will be slightly higher due to additional CRT current. Readings higher than 80 mA relate to excessive B+ power supply current demands of 1 amp or more at full B+ operating voltages.

During the Horizontal Output Load Test, a flyback pulse is produced at the collector of the horizontal output transistor. The TVA92 measures and displays the µS duration of this flyback pulse. The duration or on-time of the flyback pulse is dependent on the operation of the horizontal output circuits of the TV – primarily the flyback, retrace timing capacitors, yoke, and yoke capacitor.

The pulse time readout indicates if proper timing and resonant action are occurring in the flyback and yoke circuits. Readings between 11.3 and 15.9 µS represent a normal range for horizontal output stages and are considered "GOOD." If the µS readout indicates "GOOD", you can be assured that the horizontal output stage is developing normal flyback pulses. Readings above or below this range are considered "BAD" and indicate improper timing, flyback defects, or severe loading problems.

When both the mA and µS readouts indicate "GOOD", the horizontal output stage and flyback secondaries are operating within a normal range. In the majority of cases, this indicates a 100% problem-free horizontal output stage.

HORIZ LOAD mA	TEST READOUTS µS	MOST LIKELY CAUSES
---	---	IMPROPER CONNECTIONS, OPEN FLYBACK, OPEN HORIZ OUTPUT STAGE CIRCUIT PATHS
GOOD	GOOD	NO SEVERE LOADING OR TIMING DEFECTS
BAD	---	SEVERE B+ SUPPLY SHORT OR LEAKAGE PATH, < 5 mA = OPEN FLYBACK OR HORIZ CIRCUIT PATH
GOOD	---	OPEN FLYBACK, IMPROPER "COLLECTOR" CONNECTION, OPEN RINGER/LOAD FUSE
BAD	GOOD	SEVERE B+ LEAKAGE AND/OR FLYBACK SECONDARY SHORT OR LEAKAGE PATH, FLYBACK TRANSFORMER
GOOD	BAD	DEFECTIVE HORIZ OUTPUT TIMING COMPONENTS, FLYBACK TRANSFORMER, OR SEVERE FLYBACK SECONDARY SHORT OR LEAKAGE PATH
BAD	BAD	SEVERE B+ LEAKAGE AND/OR FLYBACK SECONDARY SHORT OR LEAKAGE PATH, FLYBACK TRANSFORMER, DEFECTIVE HORIZ OUTPUT TIMING COMPONENTS

NOTE: Fluctuating readings in the µS readout values indicate abnormal flyback pulse ringing or timing.

Fig. 4: Possible Horizontal Output Load Test results and likely causes.

A "BAD" reading in one or both of the Horizontal Output Load Test parameters indicates a problem in the horizontal output circuit, flyback, or flyback secondaries. Use the "BAD" readout to help determine the cause when isolating the problem. Figure 4 outlines "likely causes" for different combinations of the GOOD/BAD Horizontal Output Load Test readouts.

Troubleshooting B+ Shorts Or Loading With The mA Readout

The Horizontal Output Load Test mA readout can be used to determine the severity of the loading problem. There are three common types of B+ supply shorts or leakage problems:

1. Short (low resistance DC current path to ground)
2. DC leakage (higher resistance DC current path to ground)
3. AC short or leakage (added AC current or power demand due to a shorted turn in the yoke/flyback or a defect in the flyback secondary circuits).

The maximum current output by the TVA92's Horizontal Output Load Test is 250 mA. A readout near 250 mA during the Horizontal Output Load Test indicates a low resistance short on the B+ power supply. A likely cause of a B+ short is a shorted horizontal output transistor. The horizontal output transistor and/or damper, if good, will not draw excessive current affecting the Horizontal Output Load Test results. If the mA readout changes to "GOOD" after removing the horizontal output transistor, you have confirmed the horizontal output transistor is shorted. If the mA readout remains "BAD" after removing the horizontal output transistor, continue to open possible DC short paths to isolate the short.

Loading problems consisting of higher-resistance shorts produce readouts on the Horizontal Output Load Test ranging from 80 mA to 200 mA. The first step in isolating a loading problem is to determine if the added load current is caused by DC loading or AC loading (see Fig. 5). You can determine this by disconnecting the yellow test lead (collector). This stops the switching action in the horizontal output stage by removing any alternating currents to the flyback and yoke.

The remaining current indicated by the Horizontal Output Load Test display is DC current to the horizontal output stage, driver, and other B+ powered circuits. If the current is higher than 5 mA, suspect a DC short or leakage path on the B+ power supply. To isolate DC short or leakage paths, open

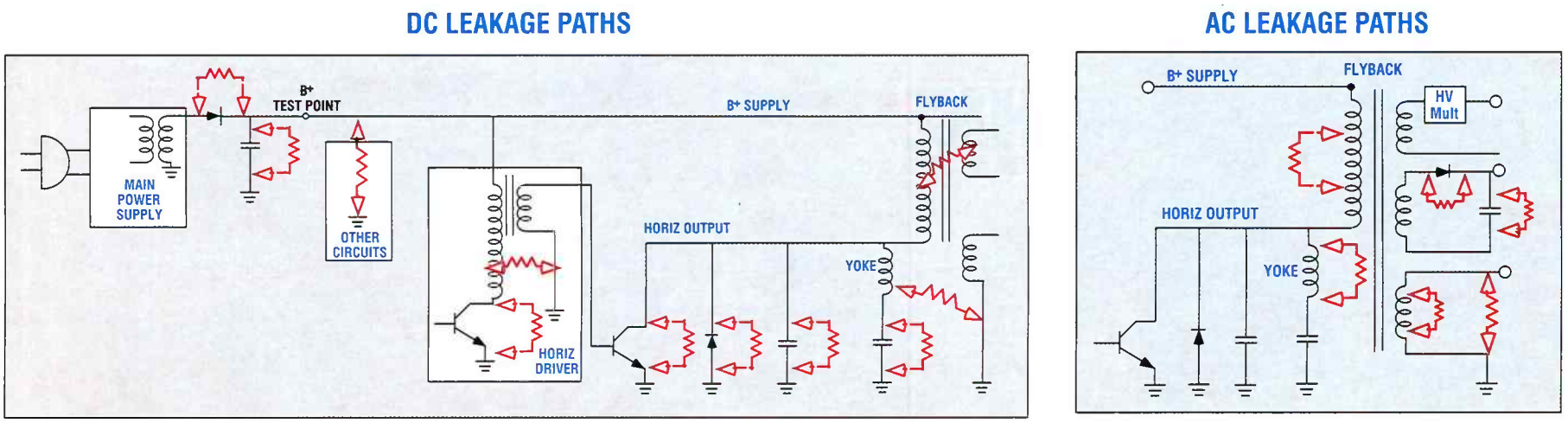

Fig. 5: Possible short or leakage paths which can load down the TV's B+ power supply.

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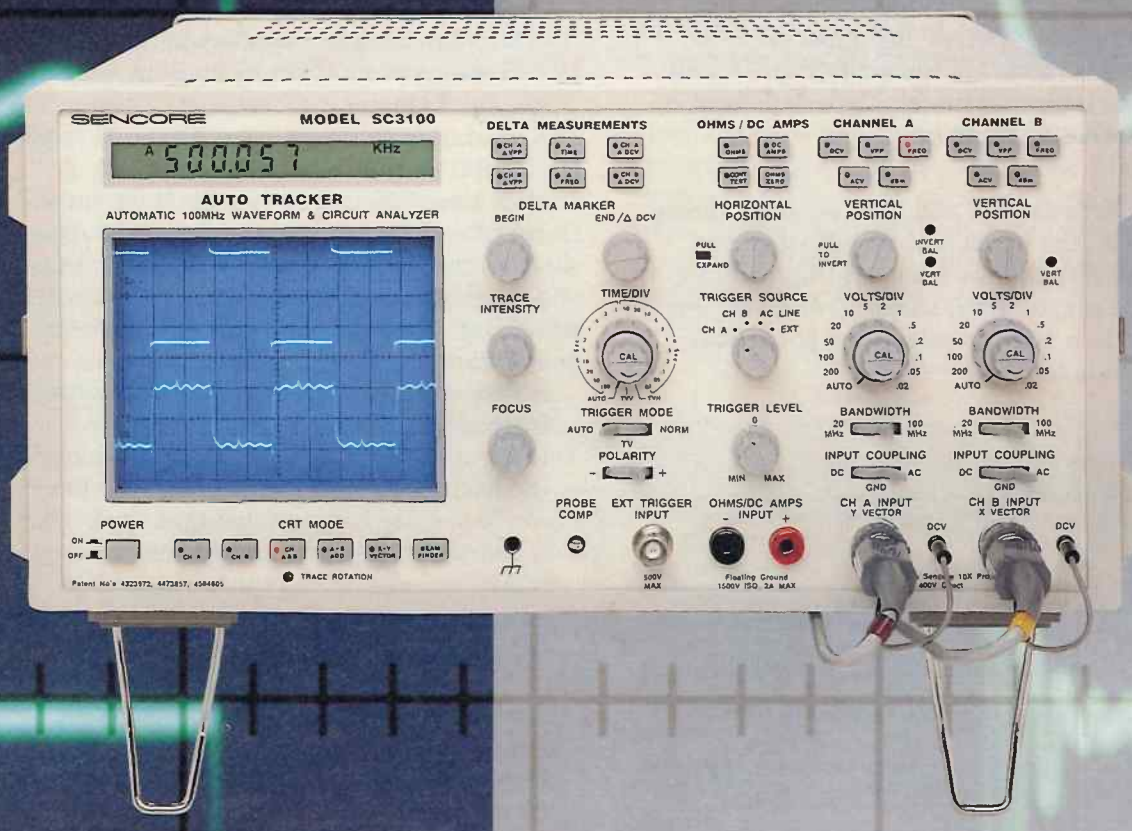

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circuit paths while comparing mA readouts to earlier readings.

If the current readout is greater than 80 mA during the Horizontal Output Load Test but is less than 5 mA when the yellow (collector) lead is removed, the high current is a result of a severe AC current load in the horizontal output stage. The current demand may be caused by shorted turns in the flyback/yoke or by a short or leakage on any of the secondary circuits of the flyback. To isolate an AC loading problem, use the EXT PPV & DCV INPUT of the TVA92 to measure DC voltages and peak-to-peak flyback pulse amplitudes on the secondary windings of the flyback. The voltage and current levels should be approximately 1/10 of the normal values indicated by the schematic. Waveforms or DC voltages which are missing or considerably lower indicate a possible problem associated with that flyback winding. Open the current path by unsoldering a flyback lead, scan-diode, etc. Repeat the Horizontal Output Load Test and compare the mA readout to the previous value. A large decrease in the mA readout confirms a problem with the load on that flyback winding.

If all the secondary voltages appear normal or equally reduced, the problem is likely caused by a shorted turn in the flyback/yoke, or a component is breaking down in the horizontal output stage. Use the patented Ringer test of the TVA92 to check the flyback and yoke for even a single shorted turn.

Troubleshoot Horizontal Timing Problems With The µS Readout

The Horiz Output Load Test µS readout provides an indication of the resonant timing change in the horizontal output stage or problems affecting the flyback pulse waveshape. There are three common types of problems in the horizontal output flyback circuits which will be evident on the µS readout of the TVA92's Horizontal Output Load Test.

1. Open B+, flyback primary, ground path, or component in the horizontal output stage.
2. Change in value of the critical timing components in the horizontal output stage.
3. Short or leakage in the horizontal output stage or flyback secondaries. (Often accompanied by higher than normal mA readout of the Horizontal Output Load Test.)

A "- - - -" (blank) µS readout indicates that flyback pulses normally produced during the Horizontal Output Load Test are not present. This readout can be an indication of improper test lead connections or an open circuit path from B+ through the flyback primary to ground. The open may be in the flyback primary, B+ path, or emitter ground path. A "- - - -" µS readout may also be caused by a short in the horizontal output stage. A short is indicated when this blank readout is accompanied by a "BAD" mA readout.

A steady "BAD" µS readout indicates a value change in one of the critical timing components in the horizontal output stage. A µS readout greater than 16 µS usually indicates a problem with the yoke components. Check the yoke, yoke series capacitor, and other components associated with the yoke.

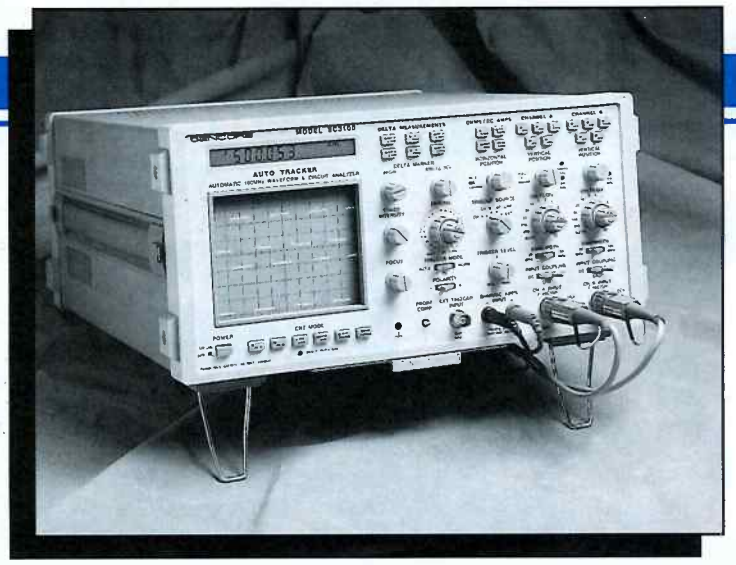
If the µS readout is below 11.3 µS, check the retrace timing capacitors and use the TVA92's Ringer test to test the flyback and yoke. In some cases, a short on a flyback secondary will effectively decrease the flyback transformer's inductance value causing the µS readout to fall below 11.3 µS. If the Ringer test shows the flyback and yoke OK, check for abnormal loading of the flyback secondaries.

Readouts that vary by several µS or more indicate an abnormal flyback pulse waveshape. Varying µS readouts may be caused by multiple flyback pulses or abnormal flyback pulse ringing. This symptom is typical of loading problems in the flyback secondary or horizontal output stage.

Boost Your Confidence

The TVA92 TV Video Analyzer is your answer to tough TV powering and shutdown servicing problems. In addition to the patent pending Horizontal Output Load Test, the TVA92 provides you with many other exclusive TV analyzing features which we'll discuss in future issues.

Let the TVA92 boost your TV servicing confidence and increase your profits in 1994 and beyond. For complete information or a video demonstration on the TVA92 TV Video Analyzer, call your Sencore Area Sales Representative at **1-800-SENCORE (736-2673)** today. ■



Sencore's Super Scope!

Reprinted from Play Meter Magazine (September, 1993)

By Randy Fromm *(Courtesy of Play Meter)*

Editor's Note: *This article is reprinted from Play Meter magazine, a monthly publication dedicated to the coin-operation entertainment industry. Due to space restrictions, we could only print an excerpt of the article. For a copy of the entire article, call your Area Sales Representative at* ***1-800-SENCORE****.*

For the past two months, my column in *Play Meter* has focused on how to use an oscilloscope to view and measure all types of electronic signals. As you recall, after going through the procedure of obtaining a stable display on an oscilloscope, you're only half finished. You still have to count graticule divisions (and subdivisions) and do the math required to obtain the exact voltage, frequency, or timebase of the signal you're viewing.

Needless to say, this is a time-consuming hassle that also leaves the troubleshooting procedure wide open to all kinds of human error. As a technician, math is not my strong point; electronics is what I do best. Wouldn't it be nice if there was a way to use an oscilloscope without doing all the math? As long as I'm dreaming, I might as well dream of an oscilloscope that will automatically synchronize and display the signals without having to mess around with the vertical, horizontal, and trigger adjustments every time I move the probe to another point in the circuit.

If you're ready to make the big move and invest in an oscilloscope, you'll want to consider the Sencore SC3100 "AUTO TRACKER." The SC3100 is such an amazing piece of test equipment that Sencore doesn't even refer to it as an oscilloscope. Instead, it's called an "Automatic Waveform & Circuit Analyzer."

This extraordinary piece of servicing equipment has so many interesting features that I want you to just sit back, relax, and let me tell you about them. In a nutshell, however, the "AUTO TRACKER" selects the proper settings for volts/div and sec/div, automatically displaying two complete cycles of a periodic waveform. No knobs to tweak or buttons to push. You just move the probe

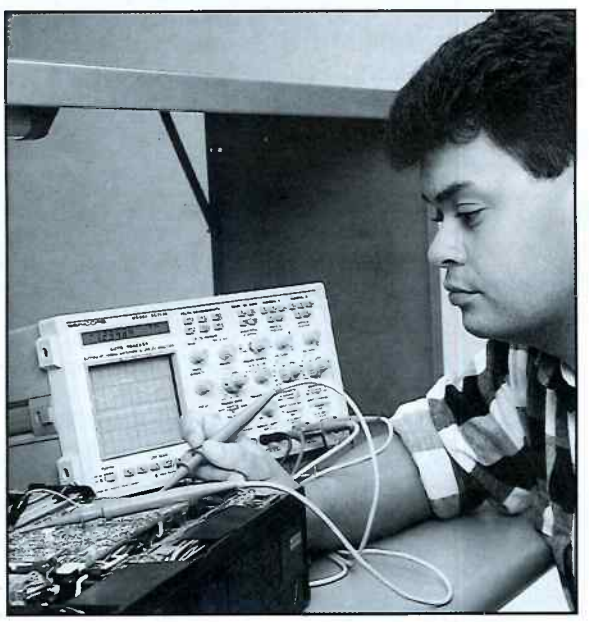


Fig. 1: The autoranging feature of the "AUTO TRACKER" automatically selects the horizontal sweep speed and displays two to five waveforms - without touching a single control.

from point to point in the circuit, and the SC3100 does the rest. At the same time, a digital display located just above the CRT gives you a readout of DC volts, AC volts, frequency, or time period. There's even a built-in ohmmeter! I swear the thing does everything but make the coffee (although I hear that's going to be offered as an option sometime in '95).

Operation

The operation of the SC3100's CRT display section is identical to that of a standard oscilloscope. The vertical and horizontal controls are calibrated to allow CRT analog measurements of signals just as we have seen in the June and July issues of *Play Meter*.

However, most of your measurements will be made using the digital readout. The Waveform & Circuit Analyzer's digital functions give results that are faster, more accurate, and subject to much less operator error than conventional analog oscilloscope measurements.

The controls on the front panel are grouped according to their function. To display and lock in a waveform on the CRT, simply move from right to left across the front panel performing these steps, **1.** Apply the signal, **2.** Adjust the trigger controls, **3.** Adjust the horizontal sweep controls.

Connecting To A Hot Chassis

As with other oscilloscopes, the BNC input connectors, probe ground leads, and front panel ground jack of the SC3100 are connected to the AC line third wire safety ground. This requires caution when you connect to a "hot chassis" piece of equipment. A hot chassis is a device that does not have an internal isolation transformer. In coin-op repair, we typically encounter a hot chassis in monitors and on the primary side of switching regulator power supplies.

Always connect a hot chassis to an isolation transformer (i.e., PR57 "POWERITE") before connecting the SC3100 to the unit under test. The isolation transformer allows the hot chassis to float in reference to earth ground. Connecting the ground of the SC3100 to the hot chassis without isolation will damage the chassis power supply or the ground connections in the SC3100. Only connect the chassis to the isolation transformer. Do not connect the SC3100 to the isolation transformer.

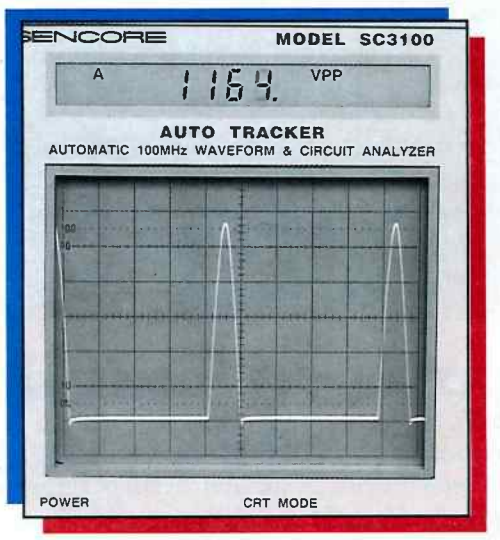


Fig. 2: You get maximum troubleshooting confidence knowing your "AUTO TRACKER" is protected from damage all the way up to 3000 VPP.

Selecting AC Or DC Coupling

As we saw in the June issue of *Play Meter*, the input coupling switch selects how the signal is coupled to the vertical circuits. When the switch is in the "DC" position, any change in the average DC level applied to the input will cause the trace to move vertically by an amount proportional to the DC voltage. This is important when you need to view the sum of the AC and DC components of the signal.

But this trace shifting may be annoying when the DC component is not important or when the DC voltage is being monitored with the Auto-Tracking digital DCV readout. You can use AC coupling for many tests. In this mode, a capacitor is connected in series with the input circuits to block the DC component. This allows the trace to stay at the same vertical position on the CRT as the DC voltage changes or as the probe is moved to different test points. Remember, the cool thing about the SC3100 is that the readout will always tell you what the DC voltage is, regardless of the input coupling. The input coupling switch may be in any position when making any of the digital readout measurements.

Autoranging

This is one of the neatest features of the "AUTO TRACKER." When the VOLTS/DIV switch is set to the "Auto" position, the SC3100 automatically selects the range needed to produce a display that is approximately three vertical divisions tall. The ranges that are automatically selected are the same as those available by manually turning the VOLTS/DIV switch. The amplitude of the display will vary between two and four divisions depending on the range that is selected. The vertical vernier control is not automatically adjusted in "Auto" and may be used manually to fine-tune the size of the waveform display.

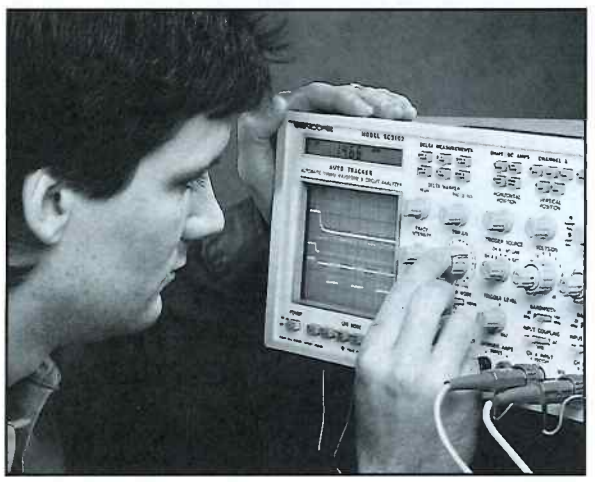


Fig. 3: The SC3100 "AUTO TRACKER's" error-free tests and easy-to-use features let you analyze more waveforms faster and increase your troubleshooting confidence.

NOTE: Signals that are larger than 800 volts peak-to-peak will result in a display that is larger than four divisions. But you wouldn't be silly enough to 'scope something greater than 800 volts, would you? (The SC3100 is protected to 3000 VPP.)

The SC3100 will autorange to follow the input signal as you move between test points. You will, however, need to adjust the VERTICAL POSITION control to position the trace on the screen.

EXCELLENT SERVICE TIP:

If you select "AC" INPUT COUPLING when using "Auto" VOLTS/DIV, the DC component of the signal does not move the waveform as you move between test points. You can probe a half-dozen test points in the time it would take you to set up for just one using conventional scoping techniques.

Setting The Sweep Speed

The TIME/DIV switch (timebase) sets the speed of the electron beam as it moves across the CRT screen. For most applications, you simply set the TIME/DIV switch and its associated vernier control for the desired amount of horizontal detail on the CRT.

Turning the TIME/DIV switch clockwise causes the electron beam to move faster across the CRT. This expands a waveform horizontally and allows you to see more waveform detail. It also allows you to view higher frequency signals. Turn the TIME/DIV switch counterclockwise to view signals that are lower frequencies.

The waveform can be expanded horizontally by a factor of ten by pulling the HORIZONTAL POSITION control outward. This allows you to view signals in more detail as well as view higher frequency signals. The fastest sweep is increased to .002 microseconds (2 nanoseconds)/division.

The digital measurement functions will continue to read correct when the waveform is expanded horizontally. However, you will need to divide all CRT-based time measurements by 10. The waveform will be at the same approximate horizontal position when it is expanded as it was in the normal view.

Autoranging is another excellent feature! When the TIME/DIV switch is set to the "Auto" position, the SC3100 automatically selects the range needed to display approximately two to five cycles of the waveform. The ranges that are automatically selected are the same as those available by manually turning the TIME/DIV switch. Therefore, the number of displayed cycles varies depending upon the range that is selected. Neither the horizontal vernier control nor the 10x expand are automatically controlled and may be operated normally to fine tune the waveform display in the "Auto" position.

The SC3100 will autorange to follow the input frequency as you move between test points. In order for the SC3100 to automatically select the sweep speed, the trigger circuits must be set to properly lock-in the waveform. Simply set the Trigger controls the same as you would if you were manually setting the TIME/DIV switch. For most signals, set the LEVEL control to "0" and the SOURCE to match the input channel. Always set the TRIGGER SOURCE switch to the input that has the lowest frequency when you are displaying two different frequencies. The timebase will autorange to match the frequency of the channel selected by the TRIGGER SOURCE switch.

Using The Auto-Tracking Digital Functions

The Auto-Tracking digital tests provide AC voltage, DC voltage, and frequency of the signal applied to either the channel A or B inputs at the push of a button. These digital parameter measurements are called "Auto-Tracking" because the readout constantly and automatically follows the input signal without you needing to adjust any controls or set measurement cursors. In fact, the signal does not even need to be displayed on the CRT to use the Auto-Tracking tests! The signals for both the CRT display and digital readout are applied through the same probe.

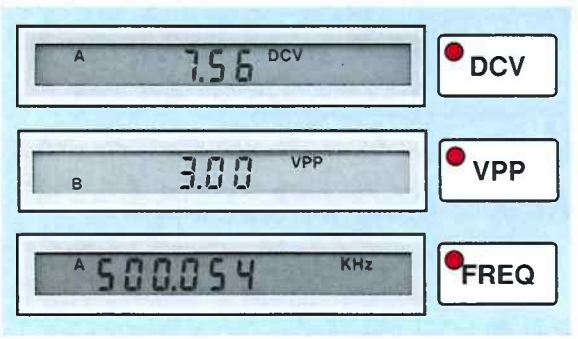


Fig. 4: Push a button to automatically read the DC voltage, peak-to-peak voltage, and frequency of the signal at any test point.

Frequency Measurements

Pressing the channel A or B "FREQ" button displays the frequency of the signal applied to the vertical input from 10 Hz to 150 MHz. The frequency function is fully autoranged, so there is no need to select resolution, read rates, or frequency ranges. All readings are updated in a half second or less.

The ACV function allows you to measure AC voltage as an RMS value (.707 of peak) for direct comparison to service literature and to true RMS reading DVMs. Most service literature, for example, lists the AC voltage at switches, fuses, and other AC power supply test points as an RMS value. Use the SC3100's ACV function when making these measurements to eliminate calculating the RMS voltage value from peak-to-peak readings.

The ACV function is semi-autoranged and has four ranges selected by the VOLTS/DIV control. This insures that the measuring circuits have proper signal level to provide a correct reading. If the digital readout shows flashing "8888", turn the VOLTS/DIV switch counterclockwise. If the ACV reading has very little resolution, turn the VOLTS/DIV switch clockwise. The ACV readings are unaffected by the setting of the trigger and timebase controls and vertical verniers.

The Delta Bar

The Delta bar is a portion of the trace that is brighter than the rest of the trace. It defines the part of the waveform that is measured by the digital circuits. The Delta marker "Begin" and "End" controls set the portion of the trace(s) that is intensified when one of the Delta measurement buttons is selected. If you have selected a dual trace display mode, both CRT traces will show the Delta bar. Which channel is measured depends on the selected function.

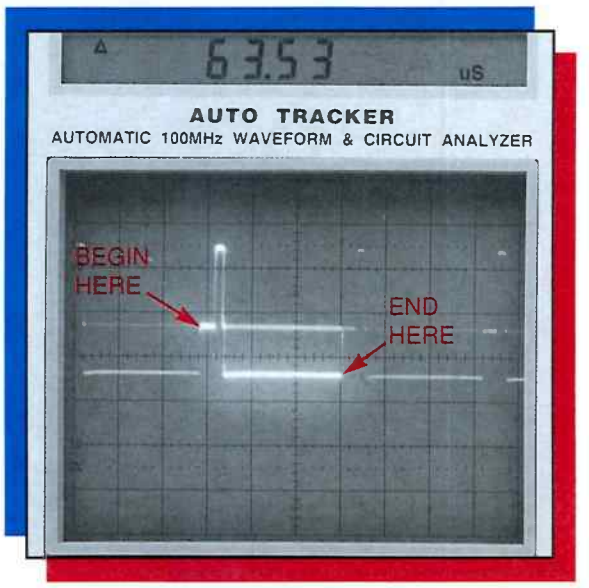


Fig. 5: Set the SC3100's Delta Bar to make time measurements quickly and accurately.

The Delta marker "Begin" and "End" controls are multi-turn potentiometers. The function of the two controls automatically reverses if you position the end of the Delta bar before the beginning. This prevents you from losing the intensified bar if the beginning and end are exchanged. This is also helpful when you want to make a measurement before and after a certain point on the waveform, as it is only necessary to change the position of one end of the Delta bar to make the two measurements.

When you select the Delta DCV function, only a small spot of the waveform will be intensified. This is the Delta DC Marker. You can move the position of the Delta DC marker with the "End/DCV" DELTA MARKER control.

The intensified area of the Delta bar and Delta DC Markers is part of the waveform. This eliminates parallax errors — errors in interpreting a part of a CRT division — and minimizes interpretation errors when setting the waveform portion that is measured. Other digital scopes use cursor measurement bars, which are subject to much greater setup error.

The Delta functions can be used to accurately measure peak-to-peak voltage, time, frequency, or DC voltage at any point or points along the waveform, all by tweaking a couple of knobs and pushing a button!

Measuring Ohms And Amps

The SC3100 Waveform & Circuit Analyzer allows you to completely analyze a circuit. In addition to its waveform analyzing functions, the SC3100 includes an ohmmeter, continuity tester, and DC current meter.

These tests are made through the OHMS/DC AMPS INPUT jacks using the supplied DVM test leads. They are completely separate from the Auto-Tracking test functions, Delta measurements, and CRT display. The measurements are displayed in the digital readout and each function is fully autoranged. . . .

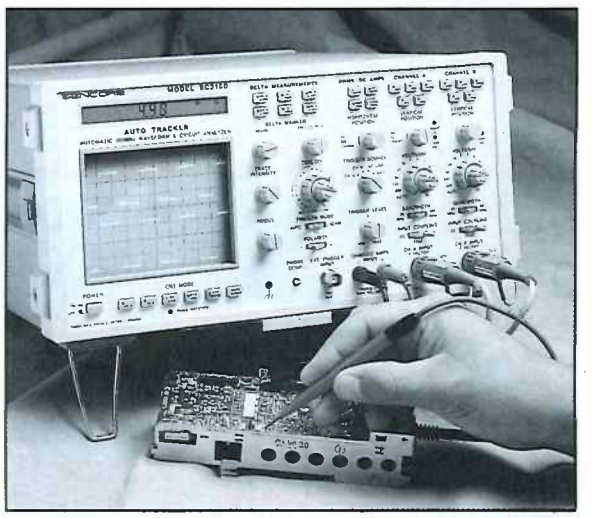
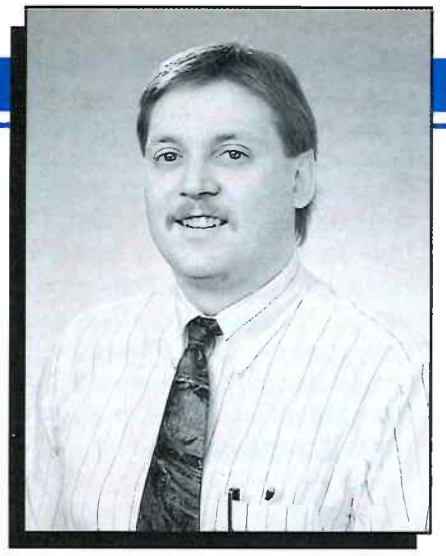


Fig. 6: The integrated ohmmeter makes the "AUTO TRACKER" the complete answer for your measurement needs and eliminates the need for extra pieces of test equipment.

Whew! That's about it — kind of. In reality, this piece of test equipment is so cool, you have to get your hands on one to appreciate how easy it is to troubleshoot using the SC3100. For a free information package, contact:



Saving Time With Divide And Conquer Functional Analyzing

By Brad Johnson, Product Marketing Specialist

As most servicers are discovering, VCRs and TVs use similar circuits to process video and audio signals, making VCR servicing a natural for the television servicer. Therefore, many of the same substitute signals that you use for TVs are also needed for VCRs. For example, VCRs and TVs have similar signals in the tuner, IF, video detector, luminance, color, audio detector, audio, sync, and control circuits resulting in a lot of crossover technology.

In this article, we'll show you how to use your VC93 All Format VCR Analyzer's substitution signals to speed VCR servicing. But first, let's look at troubleshooting methods and examine the one that is guaranteed to bring you success – divide and conquer functional analyzing.

Many Analyzing Techniques Rely On Guesswork

There are several different analyzing techniques used by electronic technicians. Some of the most popular troubleshooting methods include signal tracing, component testing, and divide and conquer functional analyzing. The technique you use will depend upon your familiarity with the process and the success you've had with it.

SIGNAL TRACING. Signal tracing is a valuable troubleshooting method. However, you must know exactly what the voltages and waveforms are at each test point. The biggest problem is, most of the time you don't have the schematic or the schematic doesn't show the voltage or waveform at the point you want to look at. Many times, you'll take a measurement and make an educated guess if the voltage or waveform is good or bad. If you guess right, your next step leads you closer to the problem. If you guess wrong, your next step turns a simple repair into a day-long project.

COMPONENT TESTING. This method relies heavily on educated guesses. Based on the symptoms, you might say, " I think this part is bad." And you might be right! However, statistically the odds are against you. In theory though, if you change enough parts, you will eventually find the bad one. Unfortunately, most servicers don't have that kind of time.

Functional Analyzing Tests Circuits Rather Than Components

DIVIDE AND CONQUER FUNCTIONAL ANALYZING. All systems are composed of subsystems. VCRs, for example, have subsystems that perform specific functions (Fig. 1). The luminance circuits process black and white video information, while the chrominance circuits process color. The servos control the capstan and cylinder speed. Each subsystem, or set of circuits, is designed to perform a specific function.

Functional analyzing uses a combination of signal injection, signal tracing, and component testing, all done in a logical sequence. You start by testing the functions of the major functional blocks, rather than looking at individual components. Using this method, large numbers of components are quickly eliminated from suspicion. Functional analyzing differs from the other troubleshooting methods in that the first step is not proving which stages are bad, but what stages are good.

Once the good stages are identified, they are no longer of concern. The number of questionable stages is systematically reduced until the bad stage(s) is found. Once the bad stage is located, signal tracing and component testing will quickly identify the problem with the few remaining components.

Speed in functional analyzing is achieved when you keep the number of tests to a minimum. The key is to divide functional circuits into various levels. For instance, you can view the VCR luminance system as extending

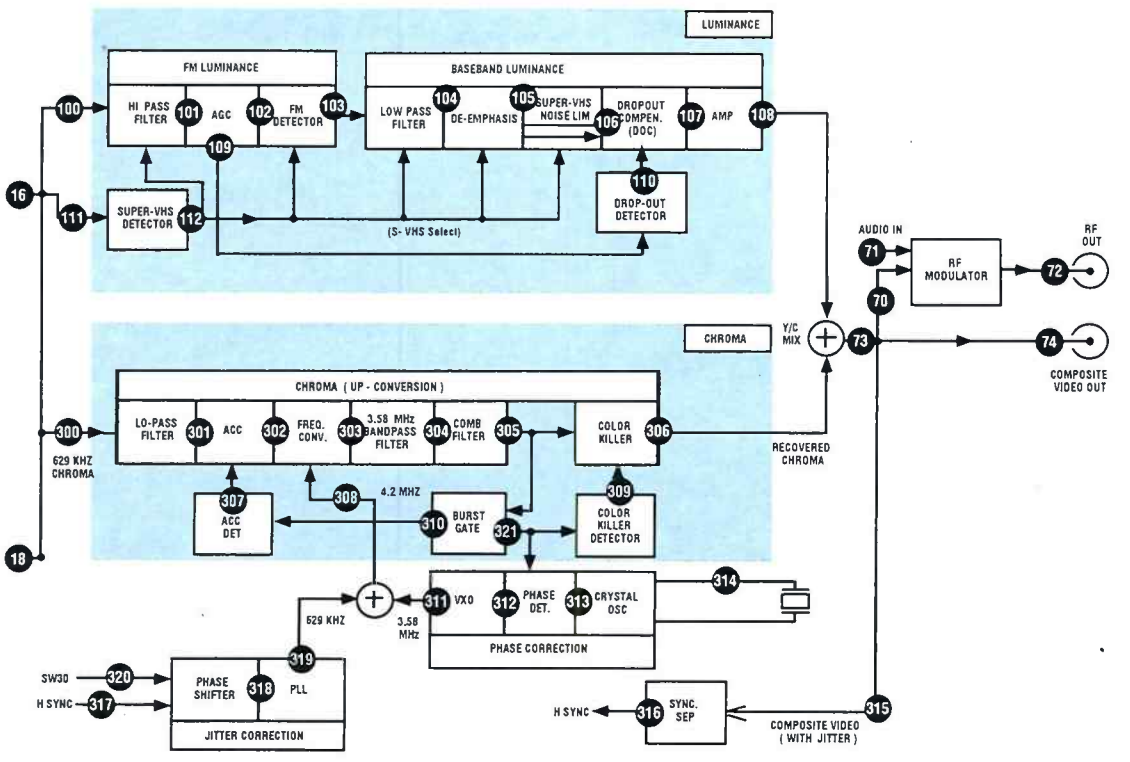


Fig. 1: VCRs use different groups of circuits to perform specific functions. Your VC93 All Format VCR Analyzer provides the signals needed to prove which circuits are good.

from the tuner to the video heads or you can break it into smaller functional blocks (see Fig. 2).

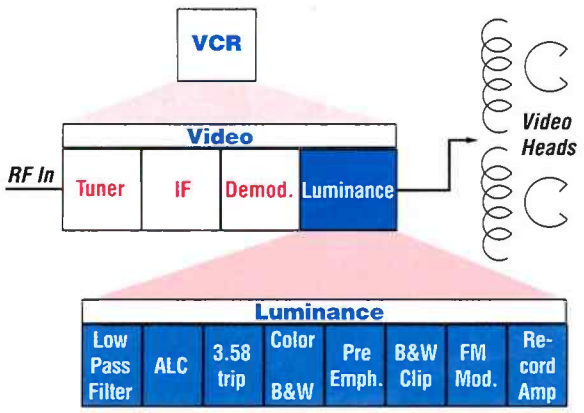


Fig. 2: You can troubleshoot faster by testing the largest functional block first – then test smaller functional circuits within the block.

Test the largest functional block possible first. Each test after that will break the system down into smaller blocks. Once you get to the smallest functional block, or circuit, only a few individual components remain to be tested.

The Divide & Conquer Technique Produces The Highest Troubleshooting Efficiency

Divide and conquer functional analyzing saves you time by minimizing the number of tests you need to make. Let's look at how the divide and conquer technique works and see why it saves troubleshooting time.

Think of the bad stage in a VCR as a worm in an apple. You job is to locate the worm in the fewest number of steps. The "symptom" is the small hole on the outside of the apple. You don't know whether the worm turned to the left or right after it entered the apple. Did it go in only a short distance, or is it on the other side of the apple?

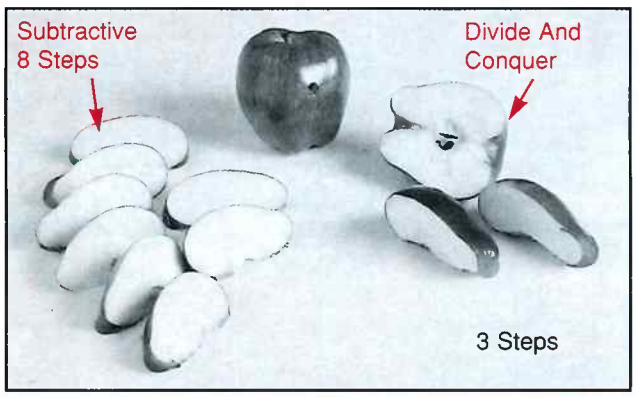


Fig. 3: The divide and conquer technique leaves the apple in the largest possible pieces. You'll see the same results in your troubleshooting steps.

Using the "subtractive" method, you would start at the worm hole and slice out a small section of the apple. If the worm hole still exists in the remaining apple, you would slice out another section and continue to make slices until you stumbled onto the worm. The number of slices needed depends on where the worm is and how small you make your cuts.

The divide and conquer technique keeps your test sections as large as possible. It allows you to quickly whittle the sections down to the problem. In the example of the worm, if the worm were on the opposite side of the apple, the divide and conquer could locate the worm in only 3 cuts. The "subtractive" method, however, could require up to 8 steps.

Proper Tools And A Block Diagram Speed Functional Analyzing

To use divide and conquer functional analyzing to its fullest potential, you need a good functional block diagram. Some VCR manufacturers now supply functional block diagrams in their service literature. If the service literature doesn't have a block diagram, a universal block diagram, such as Sencore's Universal VCR Block Diagram (Form 3038) can be very useful. Always start with a block diagram so you can stay away from shotgunning or component swapping too early. By injecting a known-good signal, you can tell if the circuits after your signal injection point are good. The individual circuits or components are important only after you have identified the stage that is not functioning properly.

TVs And VCRs Have Many Similar Signals

Both VCRs and TVs convert modulated RF signals into video, including color and audio. In the case of a television, video is displayed

on the CRT and audio is delivered to the speakers. In a VCR, the video and audio are recorded on the video tape for future playback.

To get a better understanding of the signals needed to functionally analyze a VCR, let's look at the different circuits or systems. VCRs have six major sections (see Fig. 4):

1. RF Demodulation
2. Luminance Processing
3. Chroma Processing
4. Audio Processing
5. Servo Control Of Capstan And Drum
6. Overall System Control

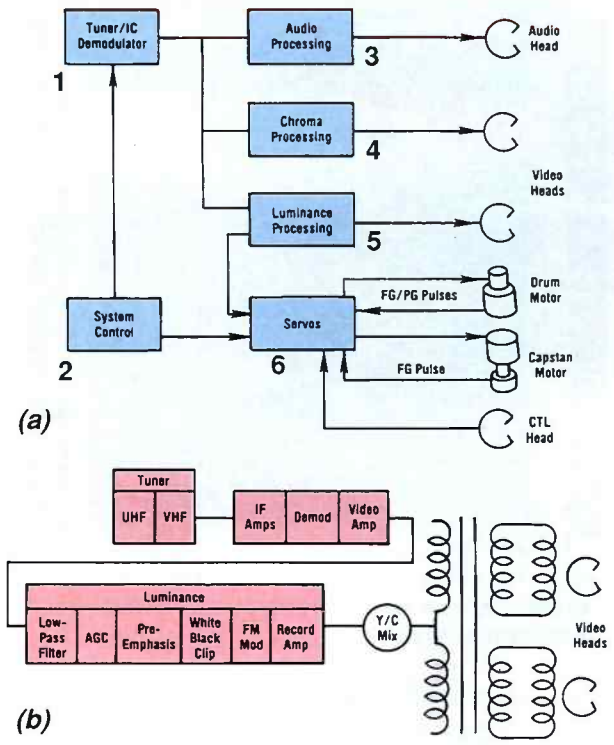


Fig. 4: VCRs are made of six major systems each composed of several functional circuits.

VCR circuits, from the tuner to the video sound detectors, are identical to television circuits. Most VCRs contain an all-channel tuner which converts the RF signal to an IF signal. The IF section amplifies the signal, then feeds it to the video detector. The detected signal is fed through a filter, pre-emphasis circuits, and clipping circuits which prepare the signal for the FM modulator. The modulated FM is further amplified and routed to the video heads which records the signal on the tape.

How To Use Divide And Conquer Functional Analyzing On A Typical VCR Problem

Let's look at a typical VCR problem and see how divide and conquer functional analyzing with your VC93 All Format VCR Analyzer can save you valuable troubleshooting time.

The problem we're going to take a look at is a fairly common one – a no-record problem. The first thing you need to do is a general performance test. This verifies the customer's complaint and gives you valuable information on where the problem lies. In fact, performance testing is the first test in functional analyzing. You must first consider the entire VCR as a functional system. Its function is to record and play back video and audio.

To begin, simply connect a TV or video monitor to the VCR and play a pre-recorded test tape. If the VCR plays back a pre-recorded tape properly, this eliminates a number of systems from your list of suspects. In this case, the tape plays back properly. You have good video and color as well as audio coming from the speakers of the TV. This gives you some valuable information:

1. The system control (for playback) is working.
2. The servos circuits are working.
3. The video heads and rotary transformer are good.
4. The video playback circuits are working.
5. The MTS audio circuits are good.

Now, connect the VG91 Universal Video Generator to the antenna input terminals on the VCR. Select channel 3 on the VG91 and channel 3 on the VCR. Also, make sure the VCR's "TV/VCR" switch is in the "VCR" mode.

What's wrong? You can't tune in a picture on channel 3 of the VCR tuner. Turn on the audio signal from the VG91. Now tune the tuner on the VCR again and you get a good audio tone coming from the tuner. What does this tell you?

Apparently, the audio channel from the tuner to the output is working properly. Looking at the Universal Block Diagram, you can see that the presence of audio shows that the tuner is on the right frequency, and at least part of the IF section must be working. It appears that you have a video problem.

Let's connect a cable from the VC93's Video Output jack to the video input jack of the VCR. You already know that the audio goes through part of the circuit. However, to be sure, simply connect the VC93's Audio Output signal to the audio input jack of the VCR.

These connections give you video on the monitor as well as audio from the speaker. Now check if the recording circuits are working. Place a blank tape in the VCR and press the record button. After you have recorded a short length of tape, rewind it and play it back. You now have good video as well as audio from the tape. You have just verified that the record circuits from the video and audio input jacks to the tape are working properly.

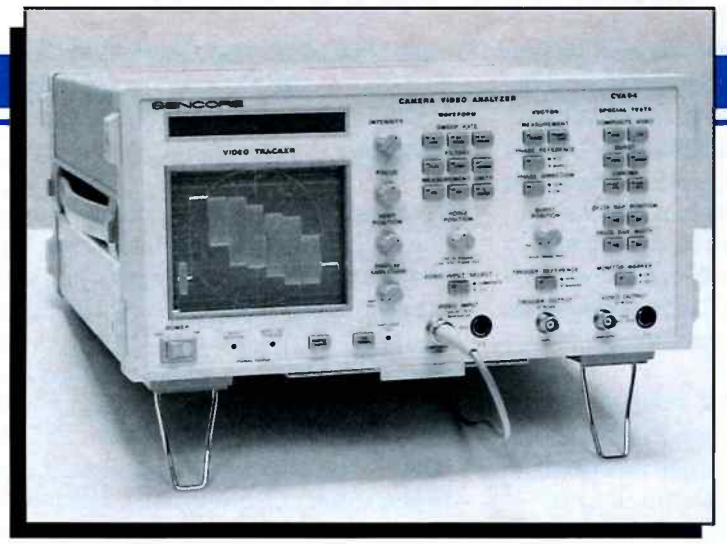
This test has already narrowed the problem down and eliminated a lot of circuits from suspicion. You have learned that a signal fed into the video input jack can be recorded onto a tape. A signal fed into the tuner cannot be recorded, however. From the block diagram, you can see that the problem is somewhere between the RF input and the VCR input jacks. This narrows the defective stage down to the tuner, IF amplifiers, video detector, or video amplifiers – without even taking the cover off the VCR.

Fig. 5: Standard and troubleshooting signals from the VC93 All Format VCR Analyzer help you narrow down VCR defects in the least amount of steps possible.

Notice how functional analyzing systematically narrows the problem down, just like the example of the worm in the apple. By using functional analyzing and divide and conquer techniques, you can narrow the problem down to the defective stage.

If you haven't tried the VG91 Universal Video Generator or the VC93 All Format VCR Analyzer, take advantage of Sencore's industry exclusive "No Obligation Trial" program. There's no better way to find out how functional analyzing can work in your service business – just try them for yourself. The best way of getting used to this technique is to take a good TV or VCR and inject the VG91's or VC93's signals into various stages. You'll instantly become familiar with the benefits of divide and conquer functional analyzing.

If you would like to learn more on how functional analyzing can make servicing VCRs easier than ever before, call your Area Sales Representative to discuss its many advantages. Having the VG91 Universal Video Generator and VC93 All Format VCR Analyzer on your bench is just a toll-free phone call away. Call **1-800-SENCORE** today! ■



Good News For Camera Servicers – The CVA94 "Video Tracker"™!

By Tom Schulte, Application Engineer, CET

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.

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 carefully looked at the unmet camera service needs and the test instrument features needed to answer those important 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.

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.

Fig. 1: The CVA94 "Video Tracker's" direct digital readout simplifies chroma measurements for easier and faster camera servicing.

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?

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.

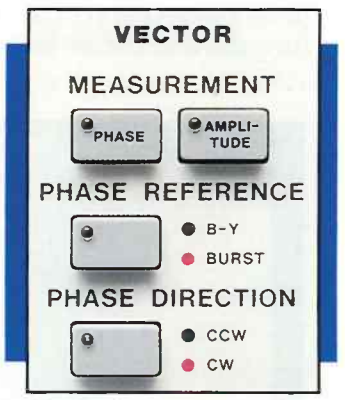


Fig. 2: Chroma phase and amplitude measurements are as easy as pressing a button.

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.

Fig. 3: The six special tests complement waveform and vector measurements to provide efficient video camera service.

"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 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. 4: 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 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.

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.

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. 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. 5: 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

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.

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. 6: 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 "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.

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.

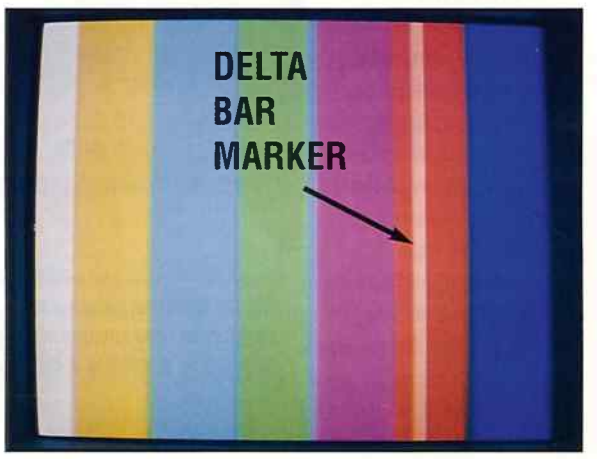


Fig. 7: The CVA94 provides a video monitor Delta Bar Marker synchronized with the CRT Delta Bar to make signal measurement selections quick and easy.

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. ■

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!

PLUS

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

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