

SENCORE NEWS

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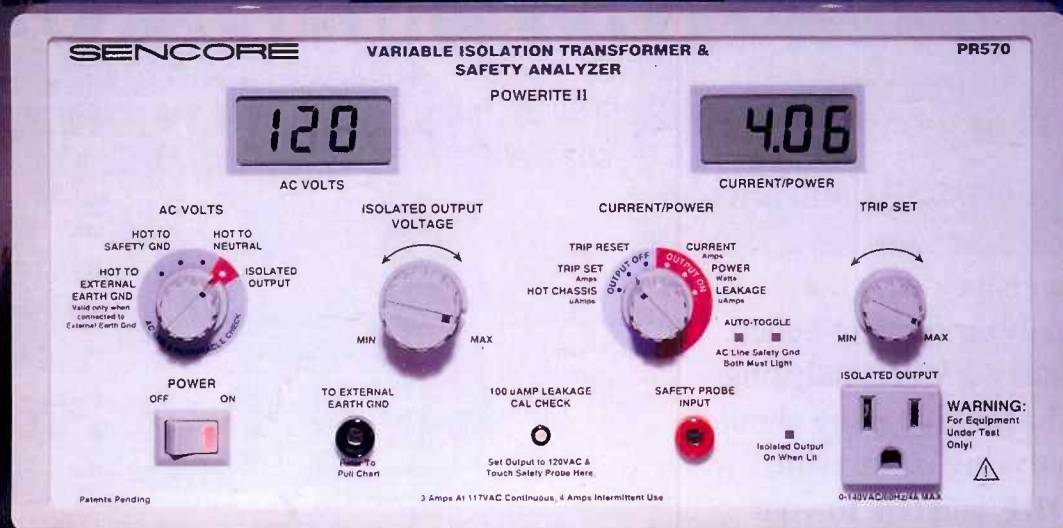
Introducing

**THE PR570
"POWERITE II"**

Your Complete

AAC
**TROUBLESHOOTING
CENTER**

**The New PR570 "POWERITE II"™
Variable Isolation Transformer & Safety Analyzer**
see page 3



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

Frustrated With Servicing The Tough Dog VCRs?

Would you be interested in servicing all types and formats of VCRs? Have you ever thought it would be possible to analyze a VCR problem without even taking off the VCR cover?

Take on all VCRs with the VC93 All Format VCR Analyzer!

Now, with the VC93, you'll have everything you need to completely analyze all VCR video, audio, tuner, and servo problems.

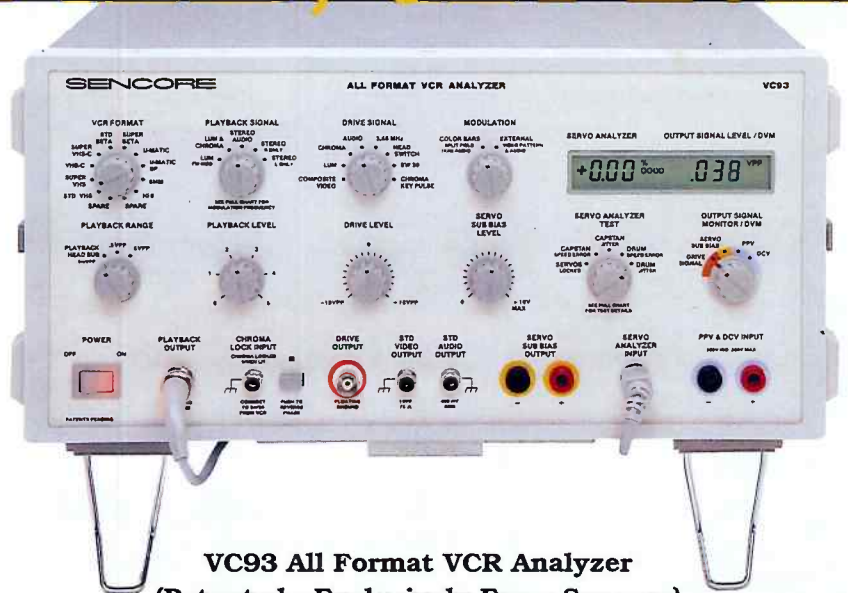
The VC93 All Format VCR Analyzer brings new, innovative solutions to VCR analyzing by providing:

- #1: An Automatic Servo Analyzer
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DON'T GET MAD, GET EVEN!



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Introducing The New PR570 "POWERITE II"™ Variable Isolation Transformer & Safety Analyzer

By Larry Schnabel, Editor

On The Cover

Sencore is introducing its newest product, the PR570 "POWERITE II" in this issue of the Sencore News. Read the article starting on page 3 describing how this new Variable Isolation Transformer & Safety Analyzer will become the AC troubleshooting center of your service bench.

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Take a look at the test equipment on your bench. Some of the equipment is probably used quite often, such as a waveform analyzer or digital voltmeter. However, more specialized pieces of equipment, such as a transistor or capacitor analyzer, are only used in special testing situations. They're essential pieces of equipment, but their use may be limited by your troubleshooting methods and the circuits you service.

We all know you have tools that you use every day, such as screwdrivers, soldering irons, etc. But what about test equipment? Do you use all of your equipment on every repair that comes across your bench? Do you have a single piece of test equipment that generates a profit on every unit you service?

Wouldn't it be nice if you had one piece of test equipment that answered all your AC supply needs and generated a profit at the same time? Now there's a single piece of test equipment that will be the AC troubleshooting center of all your repairs.

Sencore is introducing the new PR570 "POWERITE II" Variable Isolation Transformer & Safety Analyzer for all your AC supply problems and needs. It's the only variable isolation transformer and safety tester that provides safe power during repair or testing of electronic equipment and tests for safe products after repair, manufacture, or for calibration. You'll want to use the "POWERITE II" on every chassis that comes across your bench.

Until now, there hasn't been an instrument with the capabilities of the PR570 "POWERITE II". The PR570 features six functions in one compact package. Let's take a look at each in detail and see how the "POWERITE II" will fit into the center of your service bench.

Isolate Hot Chassis For Safe Servicing

Since the late 1970s, most consumer electronic products have used transformerless

or "hot chassis" for energy savings and lower prices. The older, less efficient transformer and half-wave circuits were eventually replaced by highly efficient full-wave bridge rectification and switched mode power supplies. Removing the old familiar protective power transformer resulted in greater power efficiency for consumers and lower cost to manufacturers.

So what's the problem? Hot chassis sets with half-wave rectifiers are not too difficult to deal with if you ignore the shock hazard. One side of the AC line is connected directly to the metal chassis in half-wave circuits as shown in Fig. 1A. There is no problem in connecting grounded test equipment to these chassis as long as the set's AC cord is plugged into the AC line so that the set chassis is at ground potential through the common side of the AC line. Many technicians confirm the proper connection by simply measuring between the chassis and the grounded test equipment with an AC voltmeter. A high AC line voltage reading indicates that the "hot" side of the AC line is feeding the chassis. If so, the AC plug is simply reversed.

Unfortunately, this approach will not work with bridge rectifier or switching power supplies. In bridge rectifier supplies, the metal chassis is at half the AC line potential, no matter how the AC plug is connected. Figure 1A shows how the bridge is connected

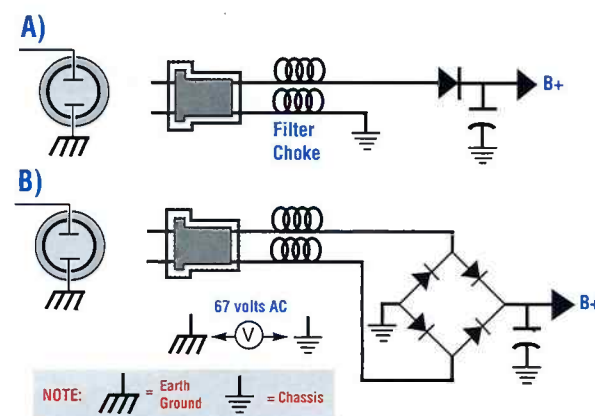


Fig. 1: (A) One side of the AC line is connected directly to the chassis in a half-wave rectifier hot ground TV. (B) There is always a 67 volt potential between the chassis and earth ground in a bridge-rectifier power supply.

in the typical TV chassis. Now, here comes the real problem.

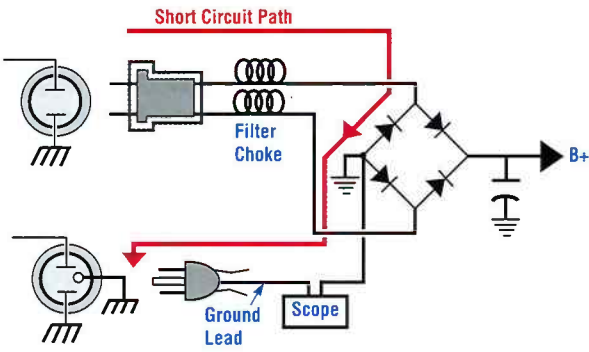


Fig. 2: Connecting a scope or other grounded test instrument to the chassis of a bridge rectifier power supply creates a short-circuit path to earth ground which usually damages components in the TV power supply.

Connection of scope, or other grounded test equipment to the chassis shorts out half of the power supply as shown in Fig. 2. This results in excessive current flowing through the rectifier diodes and other power supply components which will damage the power supply. The high current passing through the common test lead may be higher than the current rating of the ground return circuit in the test equipment, causing more damage.

An answer would seem to be to break the ground path that causes the short circuit. Breaking the third wire safety ground in the test equipment by cutting off the ground connector of the AC plug or using an AC adapter plug breaks the short-circuit path, but leads to two other problems. First, a

serious shock hazard is formed between the metal case of the test equipment and any metal object connected to earth ground. Secondly, the ground circuit of the test equipment is often necessary for proper shielding of sensitive circuits. A scope, for example, may show a large amount of AC ripple on all waveforms if it is not properly grounded. These problems can be eliminated if you make it a Golden Rule to ALWAYS plug every chassis (TV, VCR, monitor, etc.) into an isolation transformer before servicing it.

Now you can insure your safety and the safety of your test instruments when servicing electronic products. The PR570 "POWERITE II" provides the isolation you need for servicing any hot chassis. Its four amp, 470 watt isolation transformer eliminates dangerous shock hazards for you and your employees. Plus it protects you and your test equipment from shock or overload by isolating the equipment under test from the AC line.

You just plug the chassis into the PR570 and start your troubleshooting. There's no button to push or menu to read. The front panel outlet jack is isolated all the time, every time. Use the "POWERITE II" as your "downtime eliminator" since it prevents damage to hot chassis' and your valuable test equipment.

There's even a test to quickly and positively identify a hot chassis before the product is turned on. The "Hot Chassis Test" will identify the hot chassis so that you're sure to use the isolated supply of the PR570 if it is going to be serviced.

Conquer AC Power Source Problems

How can a variable AC supply add profits to your business? An adjustable AC supply is a tremendous time saver and a "must have" piece of equipment, as any servicer who has spent many frustrating hours dogging out tough shutdown problems will tell you.

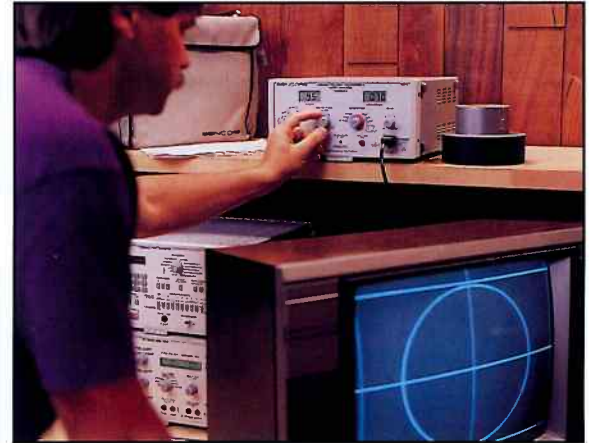


Fig. 4: The PR570's isolated output voltage is continuously variable from 0-140 volts so you can raise or lower the source voltage.

Technicians tell us that problems in TV regulator or shutdown safety circuits are the most time-consuming problems to troubleshoot. Service literature recommends a variable AC power supply as the only way to effectively service shutdown problems. Why? Because lowering the AC line voltage to about 90 VAC keeps the chassis from going into shutdown, letting you make waveform and voltage measurements to quickly find the circuit or component causing shutdown.

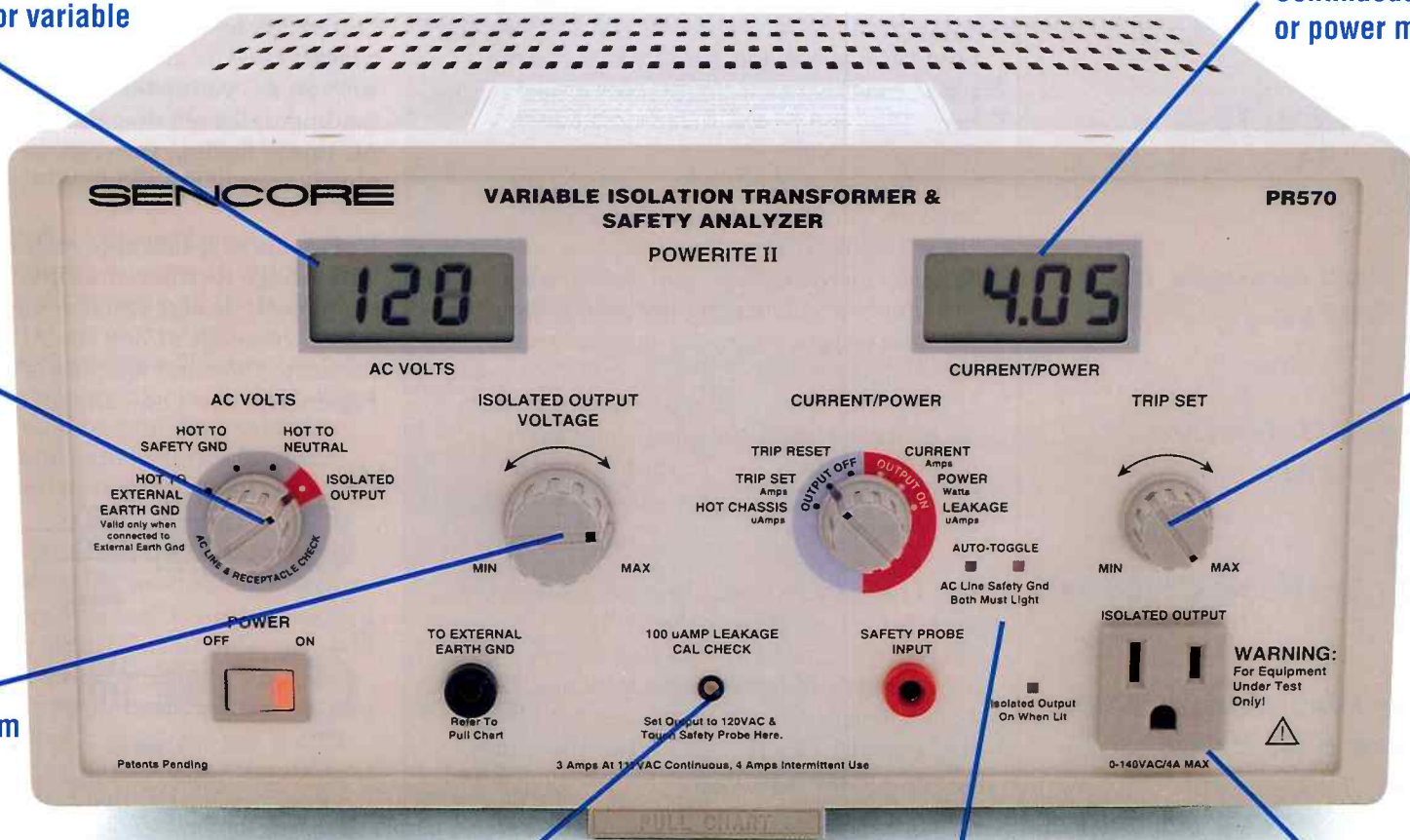
Continuously monitors AC line voltage or variable AC output.

Continuous output current or power monitoring.

Complete AC receptacle wiring tests.

Adjustable current trip protects expensive components.

Continuously variable AC from 0-140 volts.



Safety leakage test calibration check confirms accuracy.

Automated AC leakage results in seconds.

Isolated output voltage to 4 amps, 470 watts.

Fig. 3: The New PR570 "POWERITE II" identifies and troubleshoots virtually any AC supply problem.

The PR570 "POWERITE II" gives you the flexibility to make all recommended tests on startup, shutdown, and regulator circuits by providing a continuously variable source of AC from 0-140 volts. The PR570's digital display shows you how much voltage is present at the isolated output socket on the front panel. Only your imagination limits the possible uses for this time-saving variable AC voltage feature of the "POWERITE II".

In addition, the variable output of the "POWERITE II" allows you to raise and lower the line voltage to sweat out intermittents and sensitive components. Each and every TV, VCR, audio amp, stereo, etc. should be operated at both high and low AC voltage to avoid that expensive second time "no charge" repair. The PR570 saves you from these non-profitable callbacks when you did not catch the problem the first time. Fewer callbacks and less "no charge" repairs result in extra profits and more spare time.

Quickly Identify AC Line Problems

Every technician needs to know what voltage is being supplied to his or her service bench at all times. Line voltage variations occur unpredictably as power company consumption loads vary throughout the day.

Low voltage, for example, may be caused by "brown-out" conditions, long distances from a building to the power company transformer, long extension cords, or AC wiring that is too small for the amount of load carried. Typical symptoms on a TV would be reduced picture width, bad sync, or intermittent problems of almost any type. Most electronic devices will not operate properly if the AC source voltage is too low.

High voltage conditions occur when the load in the area suddenly changes due to a factory or other large power user reducing their power consumption. High line voltages may cause excessive second anode voltage and/or shutdown problems in TVs causing confusing symptoms and possible component damage.

The PR570 "POWERITE II" is also an AC line voltage monitor so you can easily monitor the voltage available at the AC outlet. Now you can go right to the power source for those hard-to-track-down problems. The "POWERITE II" prevents a lot of frustration

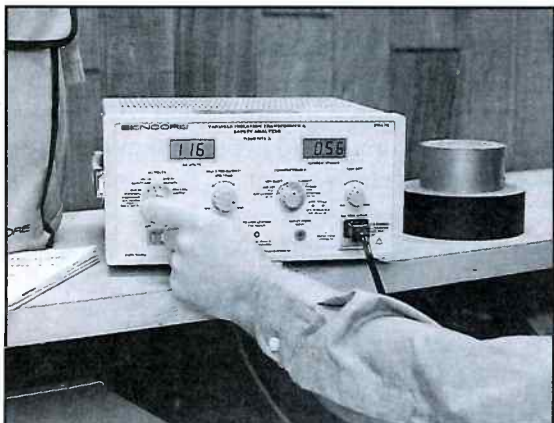


Fig. 5: The "POWERITE II" allows you to quickly identify high and low AC line conditions to prevent troubleshooting frustration.

SERVICING ^{plus}

SC3080 Waveform Analyzer

Triple Patented



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

What is the SC3080 Waveform Analyzer?

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

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

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

Meet The Triple Patented SC3080 Waveform Analyzer

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



Which Is More Accurate, The CRT Or Digital Meter?

At times, the CRT and digital meter may show slightly different readings. The circuits for the digital readout are more accurate than any CRT-based circuit. This doesn't even consider the added human errors from parallax and interpolation when using the CRT.

If the digital readout shows a higher value than the CRT, an extra signal may be present which is not showing on the CRT. The digital circuits measure the full signal amplitude, even if the entire signal is not shown on the CRT. Just increase the CRT intensity or slow the sweep rate to find the extra signal. The Delta PPV function can also help find the extra signal, as explained in Tech Tip #110.

by checking for low or high line voltage before you start your troubleshooting.

You can use the PR570's AC line monitor all day long on your service bench to be sure that your bench voltage is not your problem. You get a quick and accurate digital reading of the AC line voltage without poking probes or screwdrivers in AC receptacles.

Minimize Parts Damage With The Adjustable Output Current Trip

How many times have you turned on a repair after replacing a defective part, only to have the same part burn out again? Or what about the chassis' that work OK while you're watching, but end up smoking several parts when you turn your back for just 10 minutes? Some defective units will operate for a period of time and break down with a sudden increase in current. During the time of this current surge, one or more components could be damaged before the power supply fails or the unit is shut off. If you're not standing by

the unit watching the input current level, ready to cut the power, extensive damage could result.

The PR570 "POWERITE II" provides an adjustable current trip feature to protect the equipment being tested. The current trip level is easily adjustable from 0-4 amps so you can set the "POWERITE II" to match the maximum current draw for each device you test. This feature saves you time and money by preventing parts damage and the labor it takes to repeatedly replace defective parts. The "POWERITE II" even gives you the confidence to leave the device unattended while the adjustable current trip shuts the power down when the current reaches the preset level.

If the device plugged into the PR570's front panel isolated output jack draws more than the preset current, the isolated output trips off. This removes the AC voltage from the device and stops the current flow through the device. Your "POWERITE II" will be your insurance policy and safety net from

expensive parts damage giving you that extra bit of confidence for those times when you can't watch a repaired unit every minute.

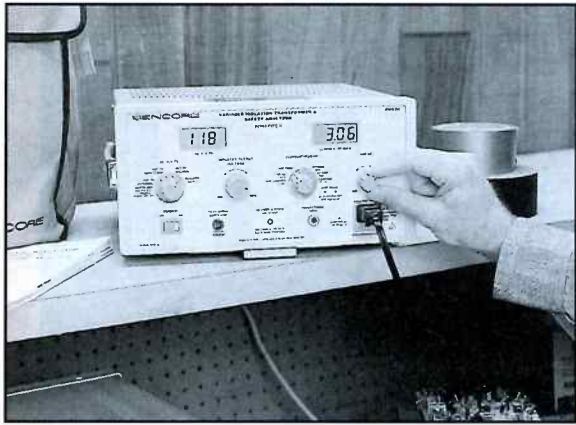


Fig. 6: The PR570's 0-4 amp adjustable current trip feature prevents parts damage and saves time.

Simultaneous Current And Voltage Digital Displays

Today's efficient technicians need to gather as much information at a glance without moving probes, pushing buttons, or breaking their train of thought. Most servicers can't afford to waste time pushing knobs and buttons switching back and forth to monitor current draw and voltage from their AC power supplies.

Now you can watch voltage levels and current or power draw simultaneously with the PR570's dual digital meters. The dual display of the "POWERITE II" shows you all the information you need at a glance giving you full control of your AC troubleshooting at your fingertips. The PR570 will deliver and measure up to 4 amps of current (3 amps continuous) and 470 watts of power (350 continuous). The "POWERITE II" gives you the power and the capability to speed all your AC troubleshooting.

Completely Test AC Receptacles

Safe power starts with the source – at the AC wall receptacle. You need to know if the receptacle is wired correctly and that it is earth grounded for safe and accurate testing.

The PR570 "POWERITE II" provides you with an exclusive receptacle checker to ensure correct wiring and earth grounding

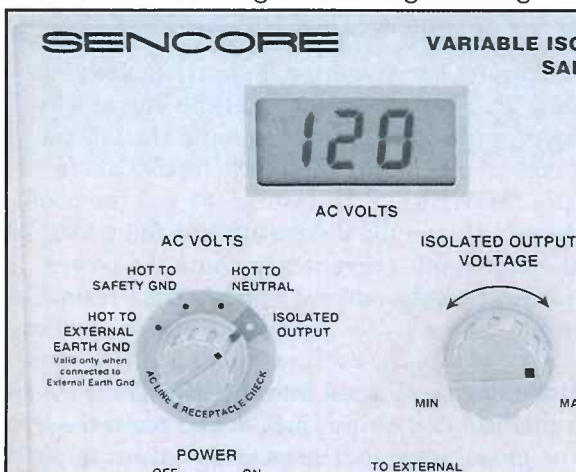


Fig. 7: The PR570 completely checks AC receptacles to ensure correct wiring and earth grounding for safe and accurate testing.

for the highest level of safety. Here are the three tests included with the "POWERITE II":

Hot To External Earth Ground Test

This test monitors the AC voltage between the AC line hot lead and an external earth ground. This allows you to check the AC receptacle for proper polarity of the hot lead with respect to earth ground, indicated by normal line voltage. If the Hot To Neutral test indicates normal line voltage, but the Hot To External Earth Ground Test doesn't, it indicates improper receptacle wiring.

Hot To Safety Ground Test

This function monitors the AC voltage between the AC line hot lead and the AC line third wire safety ground. This allows you to check the AC receptacle for proper connection of the safety ground to earth ground. This tests for the possibility of a reversed line connection or an open safety ground.

Hot To Neutral Test

This test monitors the AC voltage between the AC line hot lead and the AC line neutral lead. This allows you to check the AC receptacle for normal line voltage either with or without a load.

Now you can make sure the AC power source is right and safe, eliminating wasted time and confusion. The "POWERITE II" gives you the assurance the AC power source is right before you start your troubleshooting.

Build Additional Profits With Safety Leakage Checks

The servicer needs to be sure the repaired unit does not pose a shock hazard to the customer. All exposed metal needs to be thoroughly checked for any chance of AC leakage before it reaches the customers' hands. Shock hazards on repaired instruments also pose a serious liability threat for your business. Safety leakage tests are recommended by most manufacturers and actually required in some states.

Many technicians confess that they would like to perform the leakage test on every chassis, but can't justify the time it takes since only one out of every 100 will have a problem. It only takes one to put you out of commission so you are unable to work or damage your expensive test equipment. More importantly, how comfortable do you feel sending out one chassis out of every 100 with a potential shock hazard? It only takes one shock incident to injure a customer who may take you to court for a costly lawsuit. Can you really afford to let one more chassis leave your service center today without a safety leakage test?

Another reason many technicians do not perform the safety leakage test is because the conventional procedure is too complicated. It requires that a good ground must be located,

a resistor/capacitor combination "made up" or located among the multitude of shop parts, and the chassis disconnected from isolation. Obviously, this is a tedious, error-prone, and time-consuming operation.

The PR570 protects your customers from shock and shields your business from lawsuits with an automatic, auto-toggling AC line and safety ground leakage test. You simply plug the chassis into the PR570 and touch the probe to the exposed metal on the chassis (screws, antenna jacks, etc.). The "POWERITE II" automatically toggles between the high and low sides of the AC line in four separate power line conditions. The results are displayed directly on the PR570's LCD digital readout (leakage down to 10 microamps). There's even a leakage calibration check on the PR570's front panel to confirm the accuracy of your readings.

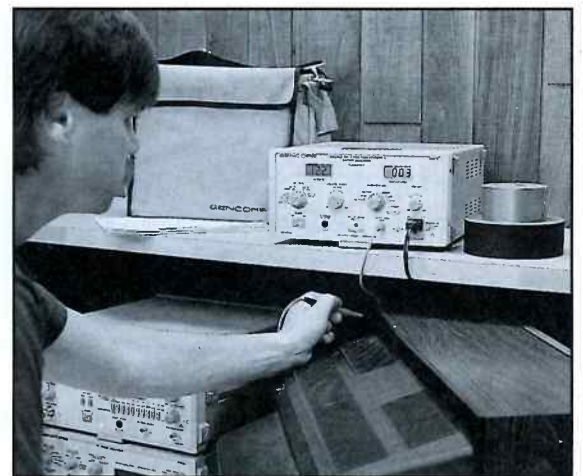


Fig. 8: To make the safety leakage test with the PR570 "POWERITE II", simply plug the chassis into the PR570 and touch the probe to all exposed metal surfaces.

These safety leakage tests protect your customers and build profits at the same time. The simplified safety leakage test of the PR570 "POWERITE II" can actually generate additional income if you simply add a small charge to every chassis you test with the "POWERITE II".

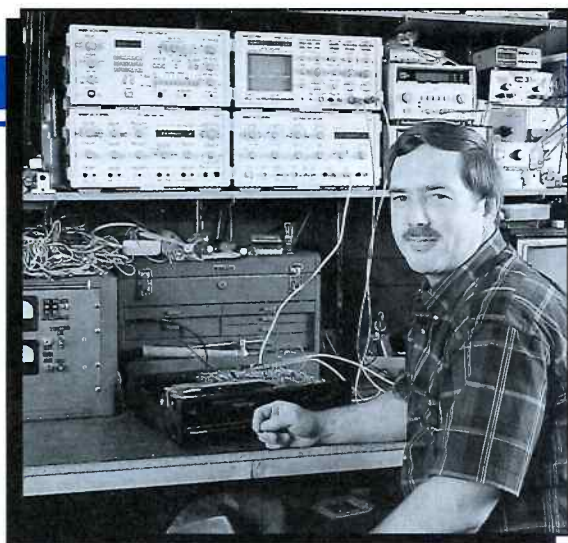
Look at this example:

5 sets per day x 5 days per week =
25 sets per week

\$5 safety leakage charge x 25 sets per week =
\$125 per week

52 weeks per year x \$125 per week =
\$6500 added income per year

You may be already paying for a PR570 "POWERITE II" with damaged parts, damaged test equipment, increased liability insurance premiums, and poor customer relations when you send out an intermittent or dangerous chassis to a customer. And you're losing money every day by not charging for those important safety leakage tests. Why not invest in the "POWERITE II" and protect yourself, your customer, and your equipment? Just give us a call toll-free at **1-800-SENCORE**. Your Area Sales Representative will see that your PR570 "POWERITE II" is on its way to you as soon as possible. ■



Customer Focus: A Visit With Chris Carter Of Custom Electronics

By Larry Schnabel, Editor

Chris Carter is the owner of Custom Electronics in Plainview, Minnesota. The following article profiles his business and reflects some of the practices used by Chris in his business. Servicing VCRs with the VC93 All Format VCR Analyzer is just a part of his successful business.

The day I interviewed Chris Carter of Custom Electronics for this Sencore News article, his biggest concern was having a customer come into his service center during the interview. His Plainview, Minnesota business is a one-man operation, so Chris doesn't often have a lot of time to spend on outside projects. Since Chris' duties include: owner, technician, salesman, book-keeper, and any other job that needs to be done, every walk-in customer and phone call demands his immediate personal attention.

subscriptions on his own. Chris described his childhood as, "I was the kid who liked taking things apart to see how they worked." He kept his interest up through the years either by tinkering with things or reading books to learn how or why things worked. When Chris was young, his favorite subject was science and was regularly involved with science fairs at his local schools.

After high school, Chris attended engineering school, then worked at IBM for six years. During those six years, Chris took an electronics correspondence course scheduled to last three years. That wasn't fast enough for Chris, however. With some extra initiative and a lot of hard work, he finished the three year course in just a year and a half. This was the type of hard-work ethic and perseverance I sensed from Chris during the entire interview.

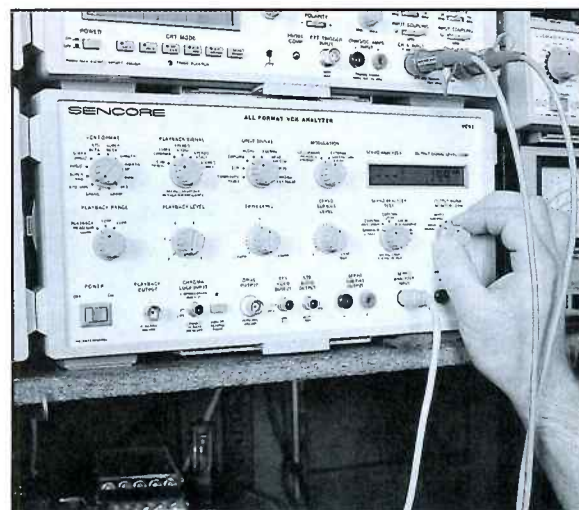


Fig 2: Chris first used the VC93 All Format VCR Analyzer on a no-obligation trial basis.

have the VC93 to keep (more on the VC93 later).

In retrospect, Chris says Sencore equipment has added more basic value to his troubleshooting than other test equipment. He checked out many other test equipment companies and dealers, but Sencore always came out on top. About Sencore equipment, Chris says, "Sencore equipment fits in well with my business needs. I work primarily on TVs and VCRs. That's where my Sencore equipment helps me most." On his very first purchase, Chris was offered a very favorable interest rate through Sencore's own financing program. His banker even said it was a good deal, so he went with it.

Now that Chris has been a customer of Sencore for several years, he feels he's made a wise choice. He says Sencore has been great at standing behind their products. Whenever he has a problem, all it takes is one toll-free phone call and the problem is resolved or at least an answer is in process or in the mail. Chris really applauds the support of the Application Engineering staff who are always there when he needs help using Sencore equipment. He commented, "The Engineers have been very patient with me. When I'm struggling with a circuit or test, I need all the patience I can get."

The Birth Of Custom Electronics

It was 19 years ago that Chris started his business out of his home. When the business started to outgrow his home, he rented a building at a downtown location and moved the entire operation. Then 3½ years ago, Chris bought his own downtown building, where he operates his service center today.

Custom Electronics services televisions, VCRs, home stereos, car stereos, etc. - almost anything electronic. Chris added retail sales on most of these products when he made the move downtown. His business now performs service, sales, and even service calls when necessary. Location and word-of-mouth from satisfied customers are his best advertising, but he also does some radio spots and newspaper advertising.

At first, Chris wasn't sure Sencore instruments were the right fit for his business. But his business, "Was just limping along", and decided to start updating his equipment. Chris got his first exposure to Sencore equipment when he used the VC93 All Format VCR Analyzer on a no-obligation trial basis. It didn't take long, and Chris knew he had to



Fig 1: Even though Custom Electronics has a great location, the owner, Chris Carter, says "word-of-mouth" is his best advertising.

As we talked, it was apparent Chris had a passion for his chosen occupation. He told me he always had an interest in electronics, even back in fourth grade. His dad received several electronic trade magazines which interested him, and he later kept up the

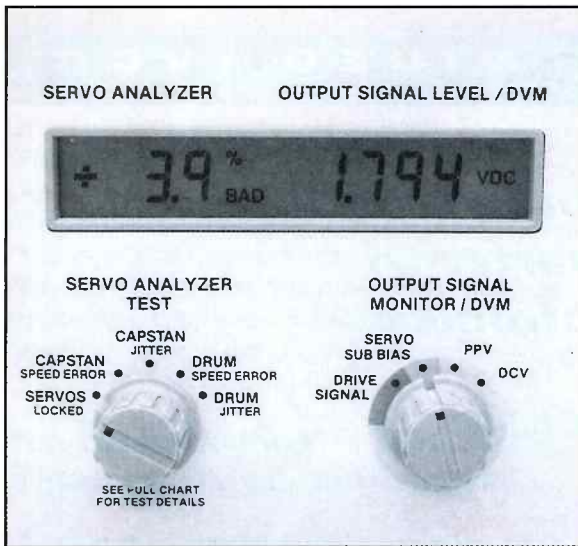


Fig 3: The VC93 analyzes servo circuits and displays a GOOD/BAD reading and a percentage of error indication.

No More Guesswork With The VC93 All Format VCR Analyzer

Chris was anxious to try a VC93 on his bench after reading the literature he had received from Sencore. When he took advantage of the VC93 trial offer, Chris saw first-hand all the things the VC93 would do to help him repair VCRs. The VC93 gave Chris testing capabilities that he never had before. He could clearly see that the VC93 was going to be a large part of his VCR analyzing future.

The most valuable advantages of the VC93 in his business are the time savings and elimination of guesswork when working on VCRs. Chris says, "The VC93 feeds the signals when and where I need them. Now I don't have to guess if the problem is a dirty head, bad head, or alignment problem. Not anymore." Chris told me he would not feel very comfortable replacing a \$150 head assembly unless he was confident it was going to solve all of the VCR's problems. Now, with the VC93, he doesn't have to worry about that situation any longer.

One of the biggest problems Chris had before he had the VC93 was not knowing how well a VCR was working. The VC93's five Servo Analyzing tests tell him exactly how a VCR is performing. Every VCR Chris repairs is tested by the VC93 for two reasons. One is to give him the peace-of-mind knowing the VCR is working and will stay working. It costs money to work on callbacks, says Chris, and he'd rather not have bad "word-of-mouth" get out on the streets. The second reason he likes the Servo Analyzing tests is because it lets the customer know the condition of his/her VCR while promoting a positive image for his service center. Chris believes honesty is the best policy in all customer service situations.

The data Chris collects also comes in handy in another way. If a VCR comes in for service twice in six months, for example, he can look at the Servo Analyzing test results and see if the VCR performance is getting any worse. If any areas are suspect, Chris informs the customer about the problem. At that point, it's up to the customer whether they want further work done to the VCR. Chris main-

tains this has saved him from having to eat the cost of several callbacks.

In fact, Chris thinks the Servo Analyzer test function is the best feature on the VC93. He especially likes these five tests because they point him to borderline symptoms on "working" VCRs. By talking to the customer, documenting the results, and even attaching a sticker to VCRs with the results, Chris takes less risk of losing profits and upsetting customers.

Better Estimate Practices

Custom Electronics charges a \$20-25 fee for an estimate, refundable upon repair. Chris didn't always charge for estimates, but says he ended up storing a lot of "junk" because people weren't serious about repairing their machines. The up-front fee helps screen out a lot of these non-repairs, and keeps him

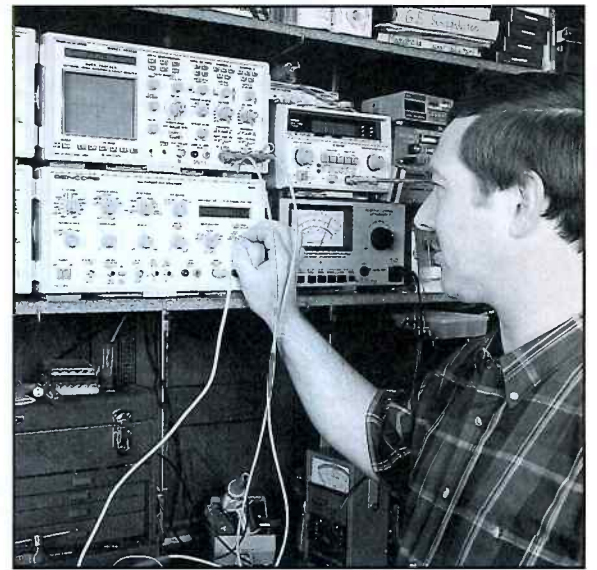


Fig 4: Since he's had the VC93, Chris can give more accurate estimates without guessing.

working on profitable items. The SM2001 Service Center Manager is instrumental in

SERVICING^{plus}

PA81 Stereo Power Amplifier Analyzer

Exclusive - Only From Sencore!

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

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

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



Introducing The Missing Link In Stereo Power Audio Amplifier Servicing

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



How To Check Audio Line Outputs

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

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



Fig 5: Chris uses his VC93 to performance test every VCR that crosses his bench.

accurate estimate. Even for the tougher problems, Chris uses the VC93 to check out problems in each section of the VCR.

Substituting for the video heads with the VC93 has saved a lot of time and money. Chris says it's a whole different ball game knowing for sure if the heads are bad, dirty, or good - before you give that estimate. And with substitution signals for all formats, Chris is able to work on all types of VCRs.

The VC93 Adds Profits And Customer Satisfaction

I asked what the VC93 means to Chris and the business side his service center. Without hesitation, he replied, "I can't afford the lost profits, not counting the customer satisfaction I would lose. With the VC93, I can estimate and repair VCRs quicker and more accurately. This gives me more confidence in my repair, which makes me feel better, plus the customer also gets that same feeling."

Chris doesn't know what he'd do now without

the VC93. He says he'd probably have to go back to the old way, which was, "By guess and by golly." The VC93 just eliminates a lot of questions related to estimating and repairing VCRs, according to Chris. Now he doesn't have to guess at any symptoms - like he used to. Whether it's heads, servos, alignment, etc., Chris lets his VC93 do the talking.

In addition to the VC93 All Format VCR Analyzer, Chris and Custom Electronics also own these Sencore instruments:

- SC3100 "AUTO TRACKER" Automatic 100 MHz Waveform & Circuit Analyzer
- VG91 Universal Video Generator
- TVA92 TV Video Analyzer
- PR57 "POWERITE" Variable Isolation Transformer & Safety Analyzer
- CR70 "BEAM BUILDER" Universal CRT Analyzer & Restorer
- SM2001 Service Center Manager
- LC101 "Z Meter" Capacitor/Inductor Analyzer
- TF46 "Super Cricket" Transistor Tester

For more information on the VC93 All Format VCR Analyzer, call your Sales Representative toll-free at **1-800-SENCORE**. We can help put a VC93 on your bench with no obligation so you know you're making the right investment decision. ■

this process. The business management software package he bought from Sencore prints the estimate fee on the estimate form and lists the terms. This eliminates any confusion and keeps the lines of communication open with his customers.

With the information Chris obtains from the customer, he can use the VC93 to make an estimate many times within just a few minutes. His years of experience, plus the tests and signals of the VC93, give Chris the capability of quickly giving the customer an

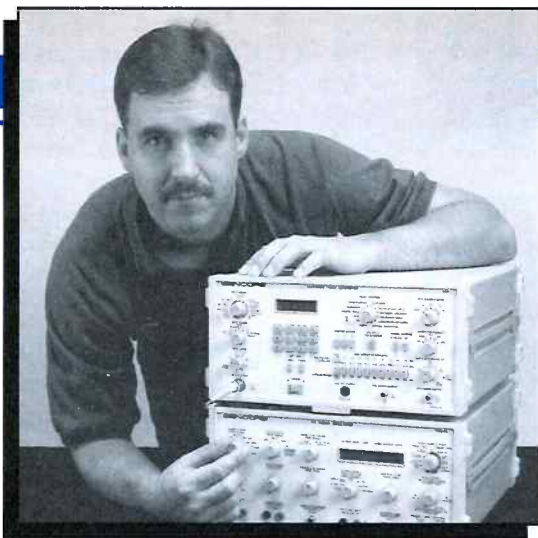
Four new ways to test, troubleshoot, and maintain your system. The Sencore CHANNELIZER's™ and CA780 were designed by technicians and engineers like yourself. That's why they have earned the name "Tech Choice." We believe they will become your choice for RF signal and cable analyzing now and in the future.



We guarantee the Sencore line of RF signal and cable analyzing instruments to be the best you'll ever use. Try them for yourself today.

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CALL 1-800-SENCORE (736-2673)



The Foundation To A Successful Service Bench!

By Brian Phelps, Product Marketing Specialist

Successful video servicers welcome the revolutionary changes that have occurred over the past decade in the video field. We've witnessed the expansion of video from the living room TV set to entire entertainment systems, as well as educational and industrial applications for video.

Meeting the challenge and opportunities of servicing today's high-tech video systems may require you to purchase up to four separate generators. However, these generators simply do not provide the accuracy, performance, or variety of video signals needed to determine if a video system is working properly.

In this article we will show you all that the VG91 Universal Video Generator has to offer, plus give some brief, technical examples of some areas the VG91 can help you solve potential "tough dog" problems.

Fully Performance Test Video Systems

Today's NTSC video systems can be divided into three basic sections: 1) Tuner/IF, 2) Video, and 3) Audio. Any given video product may contain variations of one, two, or all three of these basic sections. The VG91 Universal Video Generator provides accurate reference test signals and adjustable levels to fully performance test these video systems.

The VG91 performance tests fall into two general categories: 1) Testing tuner/IF

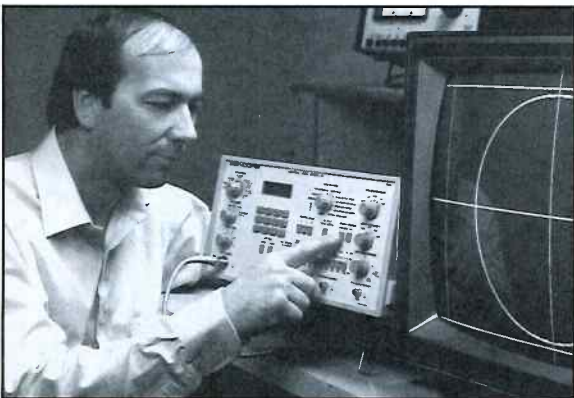


Fig. 1: The VG91 provides you with all the tests and signals to performance test any NTSC video system.

circuits, and 2) Testing video and audio processing circuits. If you are testing tuner/IF circuits, apply the VG91's RF signals to the tuner input. To test audio and video processing circuits, apply the VG91's standard output signals to the corresponding Y/C, video, or audio input jacks.

Tech. # 1 Help

Confirming the Symptoms

Our first TV servicing challenge is a television that came in for service with a snowy picture complaint. A performance test is needed to confirm if the problem is in the TV, or if the cable/antenna signal at the customer's home is bad. Performance tests also indicate if individual channels or entire tuner bands are bad.

To confirm the symptoms, apply the VG91's RF signal to the TV's antenna terminals, adjust the RF output level to 1000 μ V, and increment through several channels in each of the tuning bands. The CRT shows a snowy picture on every channel. No further performance testing is needed as the customer's complaint has been confirmed.

Fully Analyze Any Video Tuning System

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

Imagine how much easier it would be to diagnose and troubleshoot TV tuning systems if you had access to every TV channel. This is really what the VG91's RF generator is all about.



Fig. 2: You get every VHF, UHF, cable, HRC, and ICC RF channel necessary to test the performance of any video tuning system.

Tech. # 2 Help

Isolating Tuner Problems

The snowy picture is likely caused by a tuner or IF problem which can be very difficult to troubleshoot. Schematics seldom show waveforms as they are usually below the measuring ranges of most oscilloscopes. And modulated carrier noise and distortions are impossible to detect with an oscilloscope anyway.

To determine if the problem is in the tuner or IF circuits, substitute for the tuner's output. We'll inject a known good 45.75 MHz video-IF signal from the VG91 into the first IF stage. The chassis has a link cable to the tuner, so we'll unplug it and connect the VG91's IF Adapter Cable between the TV's IF input and VG91's RF-IF Cable.

The "45.75 MHz VIDEO-IF" position of the VG91's RF-IF SIGNAL switch sets us up with the proper substitute signal. The RF-IF RANGE switch is set to "LO" giving us the proper signal level. If the picture on the CRT is still snowy, the problem is most likely in the latter video-IF stages.

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

A quick check of the schematic reveals common IF circuitry consisting of a 1st IF transistor followed by a S.A.W. (surface acoustical wave) filter and a video-IF IC. To narrow the problem, we'll inject the 45.75 MHz Video-IF signal into the balanced inputs of the video-IF IC using the "MED" RF-IF Range setting.

We'll inject into the IC with the VG91's IF Troubleshooting Balun. Connect the two balanced output miniature lead clips of the balun to the IC's IF input pins and the ground clip to IF circuit ground.

If the picture returns to normal, the circuits from the input of the IC all the way through the CRT are good. Therefore, the problem must be between the 1st IF input and the input to the IC.

By moving the VG91's balun to the S.A.W. filter input, you can prove the S.A.W. filter is processing the signal properly and further isolate the problem between the IF input and S.A.W. filter. A few voltage and resistance checks are all that remain to isolate the problem.

Test Tuner/IF Sensitivity And AGC

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

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

To test tuner/IF sensitivity, set the VG91 and tuner to corresponding channels. If properly tuned, the tuner/IF stages should produce a snow free picture at 1,000 μ V. The VG91's RF-IF attenuator equips you to output and vary TV-RF signal levels to test television receivers, cable distribution systems/equipment, or other TV video applications.

Test And Align AFT Circuits

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

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

To test the AFT circuits, set the VG91 and tuning system to properly receive a TV channel. Using the EIA Color Bar pattern, observe the video output as you push and hold one of the VG91's AFT TEST buttons. Pushing either of the AFT TEST buttons causes the RF carrier of the VG91 to shift 0.5 MHz above or below the selected carrier. The video should momentarily degrade when you first push in the button, but recover as the AFT action restores proper tuning.

To test or align the AFT circuits, use the VG91's 45.75 MHz Video IF signal along with the AFT TEST buttons. The AFT TEST buttons permit you to shift the 45.75 MHz

carrier \pm 500 kHz as you substitute into the receiver's video IF stage. Monitor the AFT voltage with a DVM as you push the AFT TEST buttons. The AFT voltage should shift near equal amounts but in opposite polarity to the carrier shifts.

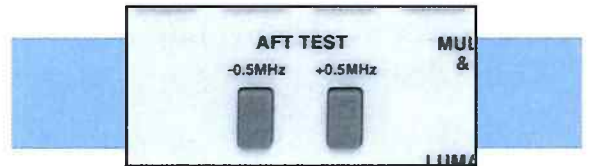


Fig. 3: The AFT Test provides a quick check of the receiver's AFT circuits.

Test Audio/MTS Stereo/SAP

Most television receivers and most video systems receive and process the audio portion of the TV signal. The audio circuits may detect and amplify only the monaural portion

SERVICING *plus*

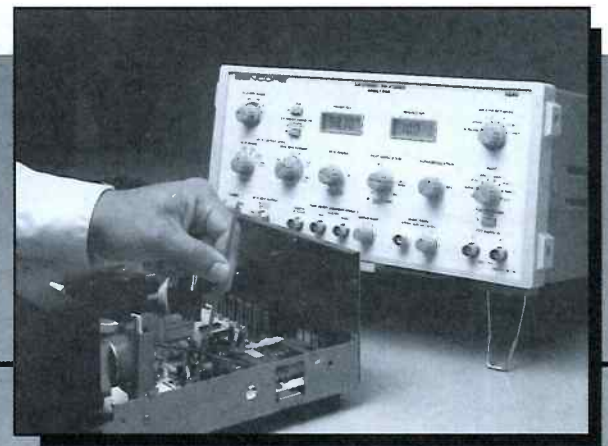
SG80 AM Stereo - FM Stereo Analyzer

Patented

Pinpoint Any Receiver Problem From The Antenna To The Output With The Only Fully Integrated AM Stereo - FM Stereo Analyzer

The SG80 AM Stereo - FM Stereo Analyzer is the only system on the market that equips you for servicing today's high-end, high performance tuners and receivers. The SG80 gives you all the signals you need to performance test and troubleshoot any AM C-QUAM and FM stereo system. Walk any problem out of a tuner or receiver from the antenna to the speakers without swapping cables or changing signal sources. The SG80 provides RF, IF, stereo multiplex, and audio drive signals for both AM and FM receivers.

The modulation levels and frequencies are adjustable to meet all EIA/IHF specified tests. An exclusive, tunable IF sweep system tests any FM IF stage, including ceramic filters. The SG80's microprocessor controls all RF and IF signal frequencies and levels for an accurate output that won't drift. You get the precise output levels needed to do performance tests like S/N and 50 dB quieting sensitivity. All the signals are top quality with low distortion for precise receiver service.



- Every FM and AM signal you need with exclusive tunable IF sweep system.
- Rock solid tuning with microprocessor controlled attenuators.
- Patented analyzing signals for both FM and AM receivers.
- Isolated high quality audio drive signal.
- High quality signals for confident troubleshooting.
- Automated testing with IEEE 488 or RS232.



What's SCA?

The SCA (Subsidiary Communication Authority) signal is used by some broadcast stations to carry background music, data, or paging signals. Most tuners and receivers do not allow for the reception of the SCA signal, and use a filter to remove the signal. The SCA signal can cause interference with normal programming by intermodulating with the 38 kHz subcarrier frequency. This effect is especially noticeable during quiet points in the normal programming.

The SG80 dynamically aligns the SCA trap in FM receivers with an EIA standard 67 kHz SCA signal automatically added to the stereo MPX signal. This dynamic method ensures minimal interference to FM reception and gives you peace of mind knowing it's right.

What Is The True Benefit Behind A Video Pattern?

Analyze The Performance Of Video Stages

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



RASTER

– The Raster pattern provides a blank color raster of any primary or secondary color. Use the Raster pattern to evaluate the operation of each color gun, and to test and align color purity. For each color selected, the CRT should display a uniform color display.



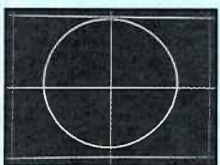
DOT

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



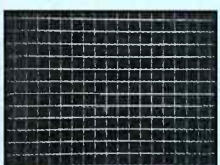
DOTS

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



WINDOW CIRCLE

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



CROSSHATCH

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



10 BAR STAIRCASE

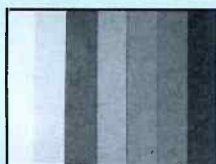
– The 10 Bar Staircase pattern consists of 10 evenly-spaced bars, with video levels ranging from black to 100% white. Use it to test the video circuits for proper dynamic

range and for alignment of the synchronous video detector and color tracking controls. When properly aligned, each bar should show a distinct change in brightness level with no hint of color.



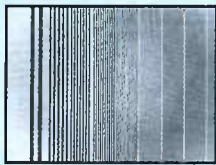
COLOR BARS

– The Color Bars pattern is similar to the industry accepted 10 Bar Gated Rainbow pattern used by video servicers for years and still referenced on schematics. Each color bar represents a phase shift of approximately 30 degrees, resulting in 10 visible bars of different color hues. There are three improvements to the VG91's Color Bars pattern to insure proper performance with today's color circuits: 1) a true color burst, 2) color information phase-locked to the horizontal sync, and 3) the color information at a 100% saturated level.



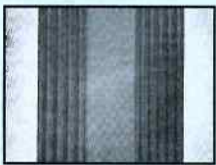
EIA COLOR (Full Field)

– The EIA Color Bars pattern meets the industry-standard color pattern specified by manufacturers for video equipment testing. It consists of two distinct amplitude portions – luminance (brightness) and color level (saturation). The luminance portion of the signal forms an uneven, seven-level staircase. The color saturation is 75%, which brings the top of the yellow and cyan bars to the 100% white level.



MULTIBURST BAR SWEEP

– The Multiburst Bar Sweep pattern consists of ten reference frequency bars beginning with a solid white "0 MHz" reference bar, and increasing in 0.5 MHz steps to 4.5 MHz. This pattern isolates frequency response problems in video IFs, comb filters, and luminance processing circuits. A stage that is restricting video signals will reduce the amplitude or distort the shape of one or more frequency bars.



CHROMA BAR SWEEP

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



LUMA/CHROMA BAR SWEEP

– The Luma/Chroma Bar Sweep pattern combines luminance and chroma test frequencies. This pattern simplifies testing and alignment of comb filters and may be used to analyze today's wideband I color decoding circuits and Y/C (S-Video) inputs. Proper comb filter separation should produce luminance without color interference.

or include an MTS decoder to recover the MTS stereo and SAP audio signals. MTS decoder circuits, once a luxury item, are now standard.

The VG91 integrates an MTS Stereo/SAP generator with an all-channel RF and IF generator. This lets you isolate individual channel problems or audio defects to IF stages.

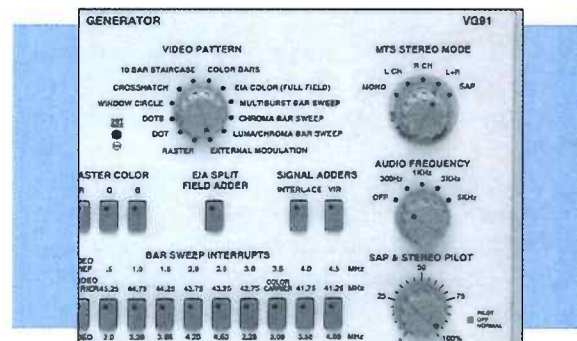


Fig. 4: The VG91 integrates an MTS Stereo/SAP generator with its all-channel RF generator so you can diagnose and repair MTS audio problems.

Tech. #4 Help

Troubleshooting Audio

Let's assume the VG91's performance test confirms a "missing audio" complaint. The schematic indicates that most of the audio circuits are part of a single IC.

With expensive, multifunction ICs, it is critical to confirm the IC is bad before you order a replacement. The fastest and most cost-effective way to isolate the problem is to divide the IC into its functional blocks, then divide and conquer the problem much like troubleshooting discrete circuits.

The VG91 offers a complete list of modulated audio analyzing signals. To isolate the audio problem to either the audio IF or video IF stages, simply inject the modulated 4.5 MHz FM signal in the audio IF stage. If normal audio returns, you know the defect is in the video IF stages. If you still don't see an improvement in audio performance, the defect lies in the direction of the speakers or audio output.

Expand The VG91 With Companion Analyzers Or Accessories

The VG91 Universal Video Generator provides you with flexibility to meet new video servicing challenges. Presently the VG91 has two companion analyzers: the Sencore VC93 All Format VCR Analyzer and the TVA92 TV Video Analyzer.

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

synergy (sin'ər jē) n.

1. Two or more substances working together to achieve an effect greater than each individual's capability.

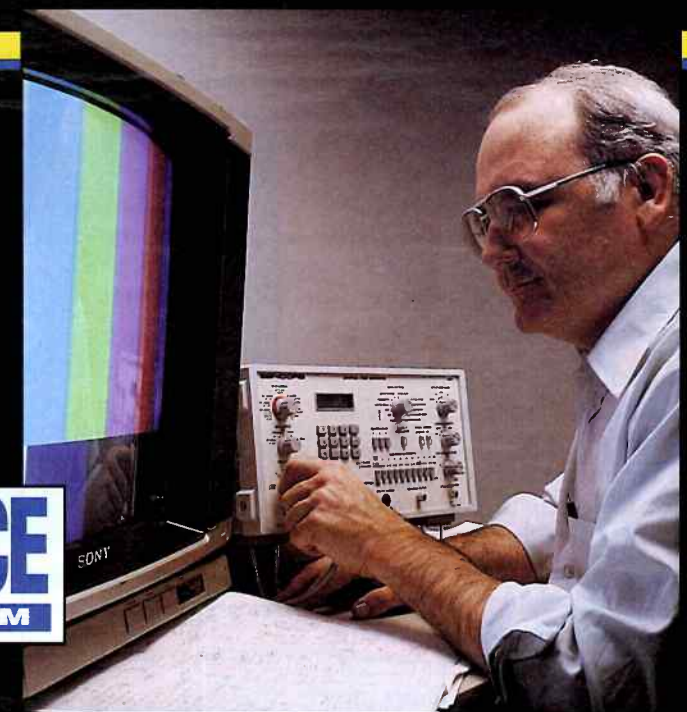
Video generators do just that – generate video.

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.

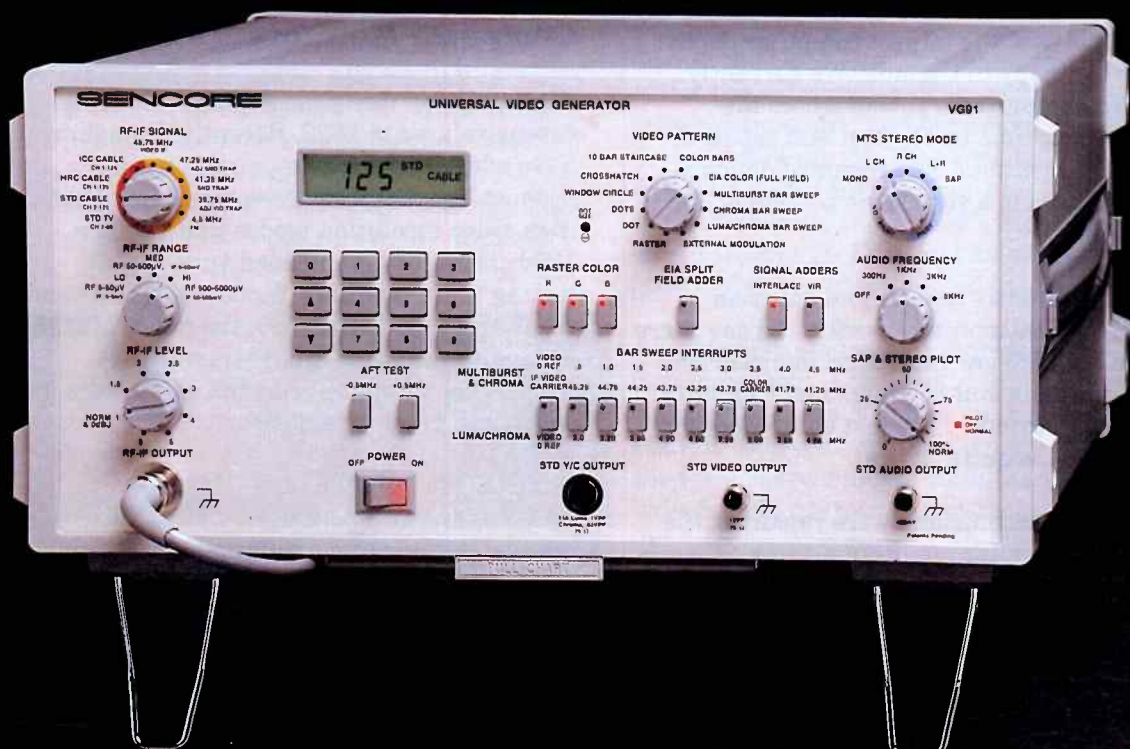
The VG91 is the only generator that offers these exclusive features:

- ▶ 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
- ▶ Standard Y/C, composite video, and audio line outputs
- ▶ Spare video output and exclusive interconnect design permits future updates or expansion
- ▶ Portable and easy-to-use

THE CHOICE
SYSTEM

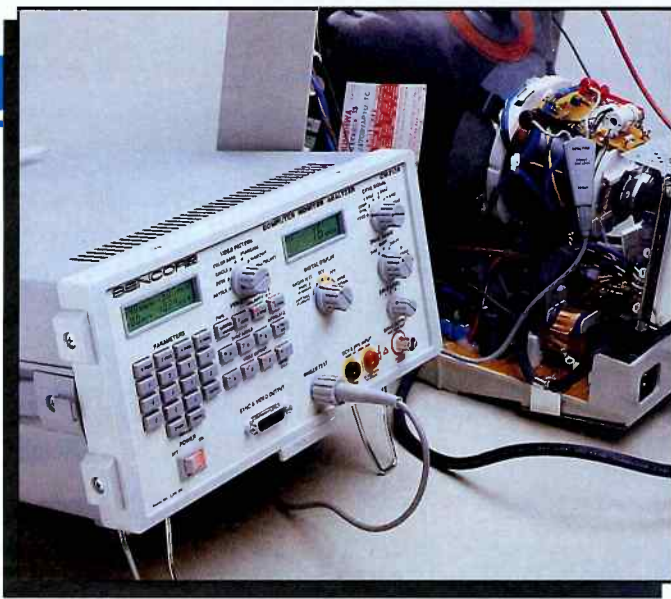


VG91 Universal Video Generator
Patented



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(736-2673)



Sencore And Nulogix See Eye To Eye

By Marc Niklaus, Nulogix Technical Services Inc.

Editor's Note: I'd like to thank Marc Niklaus, John Coulter, and the rest of the Nulogix staff for their cooperation with this article. Nulogix Technical Services Inc. head office is located at 844 Don Mills Road, Station 11, North York, Ontario M3C 1V7 Canada. Telephone: (800) 668-5649 or (416) 448-5856. FAX: (416) 448-5883

In November of 1991, IBM formed an alliance company to incorporate a new firm called Nulogix Technical Services Inc. From four locations in Toronto and one in Montreal, Canada, Nulogix set about to repair and/or rebuild personal computers, keyboards, printers, monitors, logic and circuit boards, automated teller machines (ATMs), and many other pieces of banking and credit related equipment. I have been with the company since November, 1991 as a process engineer developing test setups and writing test diagnostics.

Nulogix is now the largest computer depot repair company in Canada. We currently have 190 employees, 10% of whom are working full time on the test and repair of computer monitors. The repair of displays and monitors is a very large portion of our business.

Nulogix currently repairs and ships an average of 500 monitors weekly. I'd say there is a mix of 15% low resolution monochrome data terminals and 85% personal computer monitors. Obviously the test equipment for this process is quite critical.

At first, our technicians were repairing the personal computer monitors using a PC with screen test diagnostics. However, monitors were increasingly supporting more and more varied high resolution modes which would only be available from a PC configuration with a video driver adapter card supporting these specific resolution modes. It didn't take long before we realized the PC method was obsolete. We just didn't have the signals and



Fig 1: Nulogix Technical Services Inc. in Toronto is the largest depot repair company in Canada.

troubleshooting capabilities we needed to compete in the expanding marketplace.

Driving High Resolution Computer Monitors

We have been using the Sencore CM2000 extensively since 1992. Recently, though, we have added some new monitors in our product line. Some of these monitors support high video resolution modes up to 1600 x 1200. Therefore, we needed a means of testing these monitors. Since we were already familiar with the CM2000, the new CM2125 (Computer Monitor Analyzer) was the obvious choice since it has the extended bandwidth and pixel capabilities.

The Sencore CM2125 (and CM2000) Computer Monitor Analyzers have aided us greatly by providing emulation for any video mode available in the PC world. The analyzer's ease-of-use has been quickly embraced by our technicians. The CM2125 is definitely not a piece of equipment that sits idle in the corner of the bench. In short, the CM2125 has replaced an otherwise cumbersome PC configuration which was necessary to test the mix of displays and monitors which we service.

Since we service such a variety of monitors at Nulogix, the CM2125 has been especially helpful. Analog, TTL, and even ECL (with adapter) formats are all supported by our CM2125s. And with all the formats we encounter, almost all are preprogrammed into its memory locations so we don't have to look up specifications. That alone saves us a lot of research time. The more time we can save on any task around here, the better.

Since we've had the Sencore CM2125 Computer Monitor Analyzer, there's been a noticeable improvement in our troubleshooting efficiency. We've found that the CM2125 greatly reduces our test time thanks to its ability of switching between different video formats.

Some of the monitors that we repair support up to nine different modes. Without the CM2125, we'd be pulling video cards left and right. We'd also be pulling our hair if things weren't going right.

Once the repair is complete, the CM2125 helps us in two ways. First we run the monitor through a quick performance test. One thing we don't want is to send a monitor back with a hidden problem. We can't afford the cost to us or the bad image it reflects. We can also put the CM2125 in its burn-in mode



Fig 2: The CM2125 Computer Monitor Analyzer was an obvious choice to Nulogix because of its high resolution capabilities.

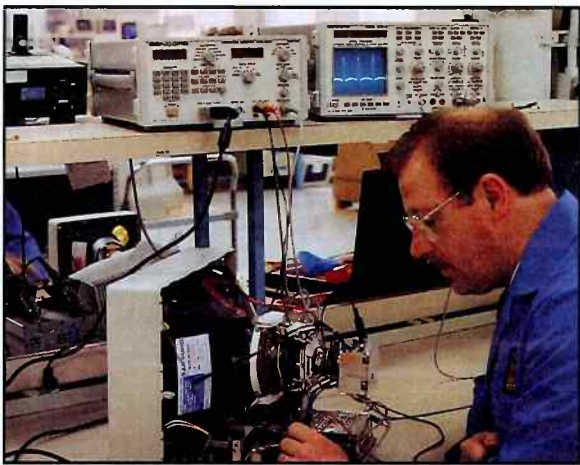


Fig 3: Ease-of-use makes the CM2125 one of the most-used pieces of test equipment at Nulogix.

after a monitor is repaired. That weeds out the early failures and problems that are just about to occur.

“Now that we have the CM2125, I don’t know what we’d do without it.”

All-In-One Tester

Features like the “Ringer Test” have been a great help to us at Nulogix. This test has helped us diagnose faulty flyback transformers and yokes. We’ve found that flybacks, especially, are a common failure part in monitors. Of course, it wouldn’t be so critical if they weren’t so expensive. The bottom line is that we can’t afford to replace flybacks unnecessarily. We’ve avoided a lot of unnecessary parts replacements by using the “Ringer Test” which has saved us time and money in the long run.

But the capability to generate a variety of video patterns in the format(s) we need is probably the best feature of the CM2125. That combined with its troubleshooting capabilities make the CM2125 a complete all-in-one tester that answers our computer

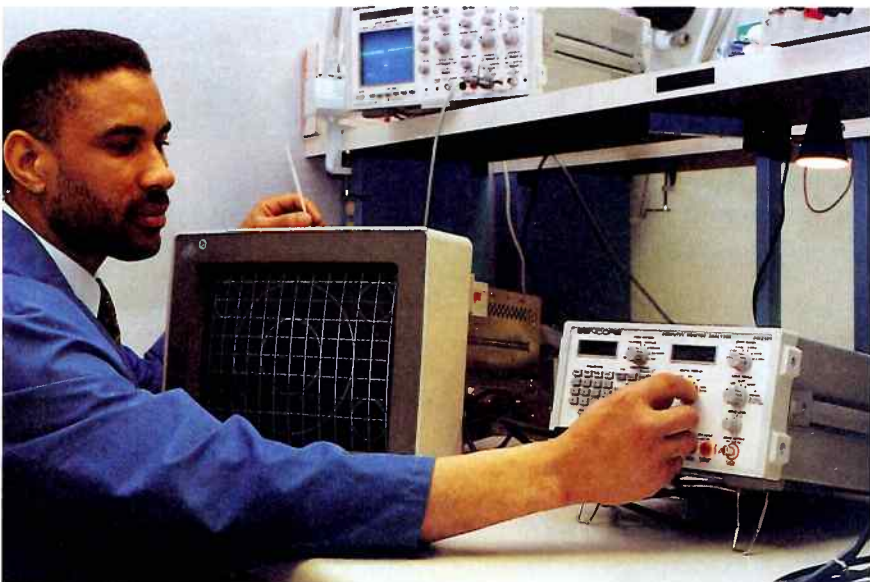


Fig 4: The technicians at Nulogix feel the CM2125 is an all-in-one tester that answers all their monitor servicing needs.

SERVICING ^{plus}

CR70 “BEAM BUILDER”[®]

Universal CRT Analyzer & Restorer

Patented - Dynamic Tests Exclusively From Sencore!

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

Now, you can safely restore every CRT!

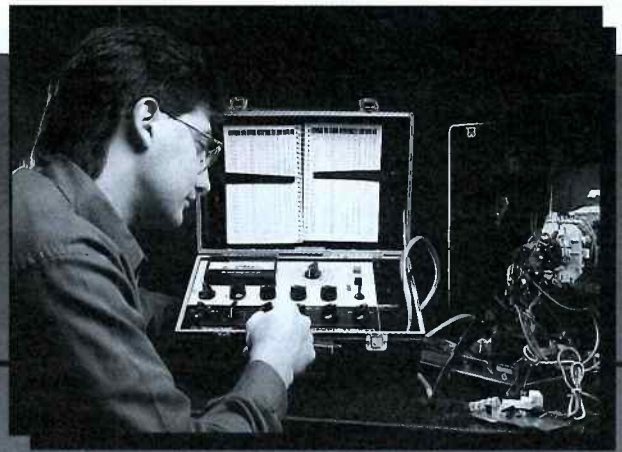
CRTs run long and hard each day. When it comes time to replace one, you could be looking at \$200 or more. No wonder many servicers are afraid when it comes to restoring CRTs. Only the CR70 provides five levels of restoration to guarantee safe and reliable results every time. We call this progressive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

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

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

monitor servicing needs. When we sit down to work on a computer analyzer, we know the Sencore unit is all we’ll need for over 90% of the repairs. That makes it easy to cost justify both to myself and my superiors.

Now that we have the CM2125, I don’t know what we’d do without it. We would have to use PCs with their respective video adapter cards in order to test the monitors that we repair. This would mean a substantial mix of different configurations because of the mix of monitors that we service. In some cases, video test



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

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



What Is Bad “Cutoff?”

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

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

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

software would need to be written (especially for the higher resolution modes). Also, troubleshooting would be limited to signal monitoring only, with oscilloscopes, voltmeters, etc.

Plus, who knows where technology is headed? There are new computer monitor formats on the market all the time. That’s why our CM2125 is such a valuable asset. We can program in any format we need using almost any parameter variation. We can even save the format into memory for use down the road. With the fast paced changes in the industry, I feel we’ve made an investment in the future with the CM2125.

Our technicians describe the analyzers as sophisticated test equipment whose application dedicated to monitor repair assists us greatly in “getting the job done.” We can truly say that it is several testers in one. The CM2125 is simply the solution to our monitor servicing. And if it meets our needs, I’d bet it

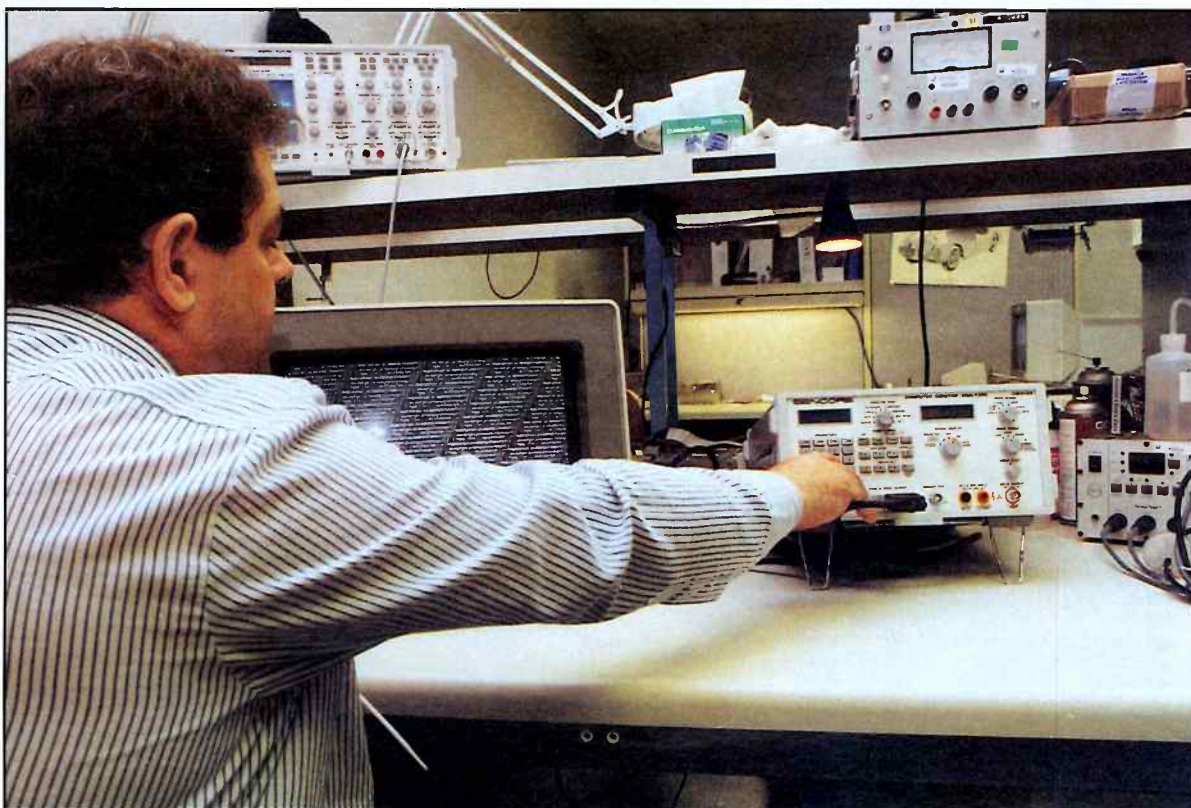


Fig 5: The ability to switch between video formats has improved the overall troubleshooting efficiency at Nulogix.

meets the needs of many others in the servicing profession.

From a business standpoint, the CM2125 represents professionalism and efficiency in the monitor repair business. We don't have to go hunting for equipment anymore or guess if we're doing things right. Now we know for sure with the readout on the CM2125's front panel. It also enables us to perform a more efficient job, which makes us competitive in the marketplace.

"...our Sencore test equipment has helped us to reduce the average repair and test time for a typical monitor significantly."

Decreased Repair Time And Increased Productivity

Our monitor repair facility is an important part of our business. Technically speaking, it



Fig 6: The CR70 "BEAM BUILDER" has increased the CRT rejuvenation yield at Nulogix from 50% to approximately 80%.

is also a very specialized field. I feel that Sencore has invested in this technology and is dedicated to providing efficient solutions to monitors and related product servicing. Sencore has developed a line of affordable test equipment which has allowed us to remain competitive in the service industry.

Currently, Nulogix owns:

- 9 CM2125 (and CM2000) Computer Monitor Analyzers
- 1 CR70 "BEAM BUILDER" CRT Analyzer & Restorer
- 1 LC102 "AUTO-Z" Capacitor-Inductor Analyzer
- 1 SC3100 "AUTO TRACKER" Automatic 100 MHz Waveform & Circuit Analyzer

Sencore analyzers have built-in diagnostics which have helped us reduce the "guessing game" for components such as CRTs, capacitors, inductors, and deflection coils. With the LC102 coil and capacitor meter, we have virtually eliminated the guesswork with faulty high voltage capacitors (previously, we had no means to test these). The capacitors are only a couple dollars each, but if we have to order them, we need to be sure they'll fix the problem. Our technicians' confidence has gone up since they are able to test the high power and expensive monitor parts. The results have been decreased repair time and increased productivity.

The CR70 CRT meter/rejuvenator has improved our yield with the older monochrome CRTs. Having the ability to rejuvenate the CRT has increased this yield from approximately 50% to about 80%. On one of the color monitor product lines, 10% of the CRTs require rejuvenation. The CR70's rejuvenating capabilities lets us save a lot of service jobs that otherwise would have been lost.

Hot Summer Deals...



From The Sencore Service Department

Refurbished SC61/SC3080 Probes

Sencore has a limited supply of refurbished probes for the SC61 and SC3080 Waveform Analyzers. These probes are only \$79.95 each and come with a 90 day warranty. Call us at 1-800-SENCORE (736-2673), ext. 308 and place your order before they're gone.

Special Repair And Calibration Discounts

Calibration - Now is the best time for you to have your Sencore instrument(s) tuned to top working condition. For a limited time, the Sencore Factory Service Department is offering a 10% discount on the calibration of Sencore instruments. Send in your Sencore instrument for calibration-only before August 31, 1994, and we'll give you 10% discount right off the top.

Repair - For every Sencore instrument sent in for repair and calibration, we'll knock 15% off the final bill. But hurry, this offer also expires on August 31, 1994, and is not valid with any other offers.

Parts Specials

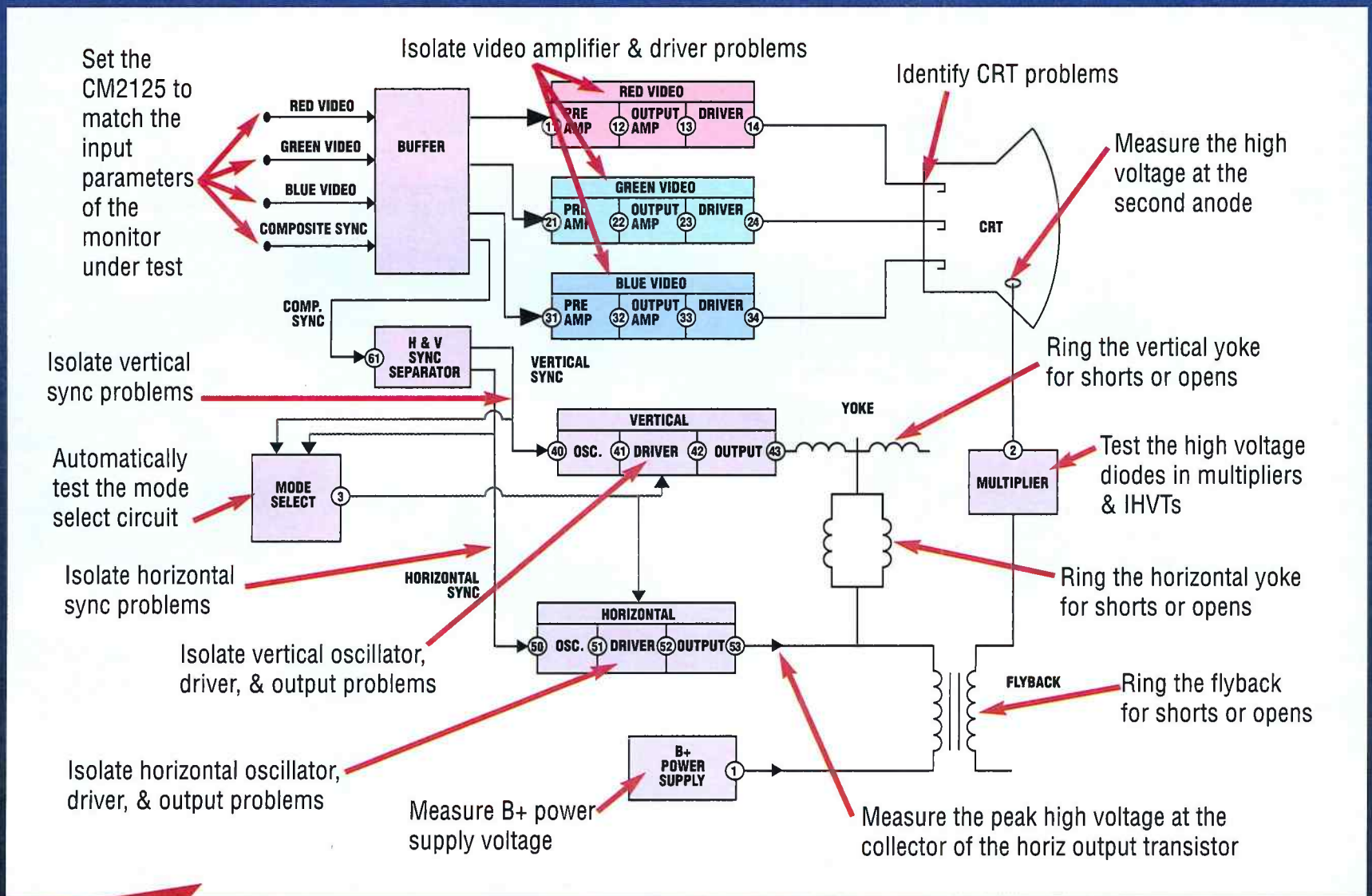
Right now, our Factory Parts Department is giving a 10% discount on parts orders exceeding \$50. For orders under \$50, you'll still get a 5% discount. *These special offers are valid only on new parts orders and will expire August 31, 1994.*

Call 1-800-SENCORE
(736-2673)

The combined benefits of our Sencore test equipment has helped us to reduce the average repair and test time for a typical monitor significantly. That translates into time saved and increased profits. I don't know what Sencore instrument is coming out next, but I know one thing for sure. We'll be interested in using it here at Nulogix if it compares to the rest of their equipment.

For more information on the CM2125 Computer Monitor Analyzer, call us at 1-800-SENCORE. Your Area Sales Representative will help set you up for computer monitor repair at your business. ■

Troubleshoot A Computer Monitor From The Input Connector To The CRT With The **New CM2125 Computer Monitor Analyzer**



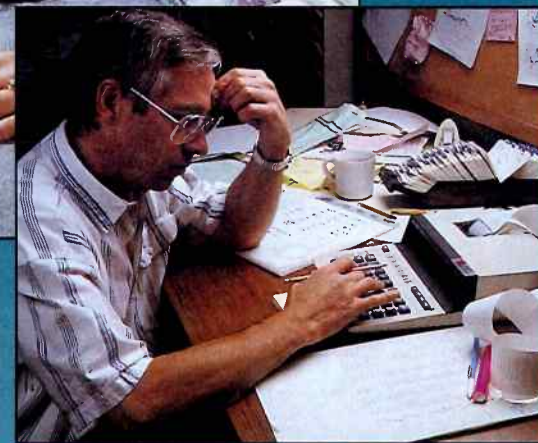
CM2125 Computer Monitor Analyzer



- 125 MHz Video Bandwidth
- 2048 x 2048 Pixel Output
- 70 Monitor Setup Storage Locations

**CALL TODAY -
1-800-SENCORE
(736-2673)**

SENCORE
3200 Sencore Drive, Sioux Falls, SD 57107
Phone (605) 339-0100 Fax: (605) 339-0317



Does This Look Familiar?

"I have never lost a record nor a day of operation since I purchased the system (SM2001)... This is a very reliable system and help is just a phone call away. I recommend this system highly."

Johnny Owens
Homemakers Television Service

Running the customer side of your business is just as important as the technical side. You can't afford to lose customers, no matter how good your technical skills are. Maybe it's time for a change.

When your business is managed better, your customers are more satisfied. Many service centers are turning to business management software for help as their business continues to grow. 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 - resulting in greater customer satisfaction. Call us today for a FREE demo package!

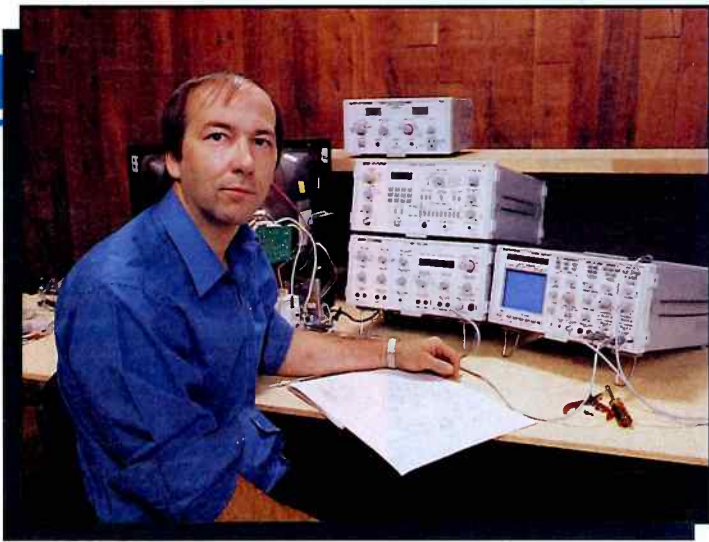
Here's what the SM2001 Service Center Manager offers you and your business:

1. Manage customer invoicing and workflow 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.
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6. Perform daily and end-of-month transaction reports showing cost, sale price, and profit in just seconds.
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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!

SM2001
Service Center Manager
by **SENCORE**

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



Analyzing A Defective NAP L4 Chassis With The Sencore TVA92 TV Video Analyzer

By Glen Kropuenske, Application Engineer

There's an invisible force in us technicians. It's the force that pulls you into committing to a serious service challenge. Especially a service challenge over which other technicians have swallowed their pride or given up.

Recently, while talking to Bruce in our service department, I noticed a television receiver near his service bench. My curiosity got the best of me and I had to ask about it. Bruce told me that a co-worker from a previous employer started working on it. He replaced the horizontal output transistor and it still didn't work. He said the flyback was bad and the owner decided it wasn't worth fixing. Bruce said it was on its way to the dumpster when he intercepted it. Bruce hoped to replace the flyback and use it at his lake cabin.

The force was growing stronger! Through my daily phone conversations with service technicians, I find flybacks are needlessly replaced all too often. I asked Bruce what brand and chassis it was. A quick look revealed it was an NAP L4 chassis. What a coincidence! Just yesterday I had a servicer report a narrower than normal flyback pulse in this chassis. The force was now overwhelming! "Would you mind if I look at it with the TVA92?" I asked.

With Bruce's OK, moments later I was setting the TV chassis and the service schematic on the bench within reach of the

Sencore VG91 Universal Video Generator and TVA92 TV Video Analyzer. After removing several loose screws holding the back on, I was inside inspecting the circuit board. I positioned the overhead light and looked closely over the flyback and circuit board for clues. Surprisingly, everything was in its place and the previous technician's soldering was commendable.

Finding Severe Horizontal Output/Flyback Problems Using The "TV OFF" Horizontal Output Load Test

Anticipating problems in the flyback or horizontal output circuit, I decided to delay the usual performance test and go right to the TVA92's Horizontal Output Load Test. This test detects severe problems in the horizontal output stage without applying AC power to the TV chassis and risking further damage. If there was a severe problem, the previous technician may have burned out the replacement output transistor.

The Horizontal Output Load Test works by applying 15 volts to the B+ supply test point and then duplicating the action of the horizontal output transistor. Alternating currents are produced in the horizontal output stage producing flyback pulses. Since the horizontal output stage is simulated at about 1/10 of normal, the flyback pulse amplitude and the current drawn from the B+ supply is about 1/10 of normal. However, the duration of the

flyback pulse is the same as when operating at full power levels.

Anxious to see the results of the TVA92's Horizontal Output Load Test on this chassis, I grabbed the Ringer/Load test leads and plugged them into the TVA92 Ringer/Load jack. A quick look at the schematic told me the orange clip was to be connected to pin 1, the B+ input of the flyback transformer. Then I attached the yellow clip to the center lead (collector) of the horizontal output transistor and the black lead to the emitter.

Reaching up to the TVA92, I turned the TVA92's HORIZ OUTPUT TESTS switch to the LOAD TEST mA position. This readout shows how much current the horizontal output stage is demanding from the Load Test's 15 volt regulated supply. Most full size color chassis when working will draw somewhere between 20 and 80 mA. The TVA92's digital display read 34 mA with a "GOOD" indicator. This level was very close to other working NAP chassis I had tested.

Reaching up to the TVA92 again, I turned the switch to the μ S position. This readout shows the duration of the flyback pulse produced during the Load Test. It reflects the operation of the critical timing components: the flyback, retrace capacitors, and yoke components in the output stage. Most chassis produce flyback pulses ranging from 11.3 to 15 μ S. For this chassis, the TVA92's digital display read 11.1 μ S ("BAD") - just below the good/bad range programmed in the TVA92.

A little confused by the marginally low timing readout, I decided to think about it on my way for a cup of coffee. In the past I'd seen increases in current demand from one of the flyback secondaries circuits reduce the flyback pulse duration. But these problems or flyback problems cause a greater reduction in the pulse duration and a significant increase in the mA readout. Since the current had not increased and the timing reduction was only 0.1 or 0.2 μ S from the normal range, I reasoned that I should be able to power on the chassis to analyze the horizontal output and flyback secondary circuits.

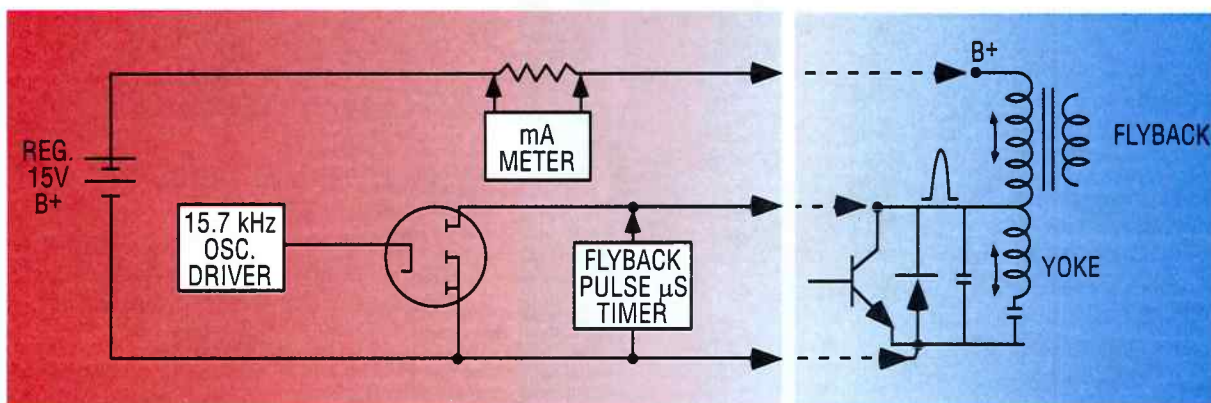


Fig. 1: The TVA92's Horizontal Output Load Test simulates the normal action of the TV's horizontal output stage without applying power to the TV.



Build your servicing bench potential with these TVA92 dynamic features:

- ✦ 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
Patented



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

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).

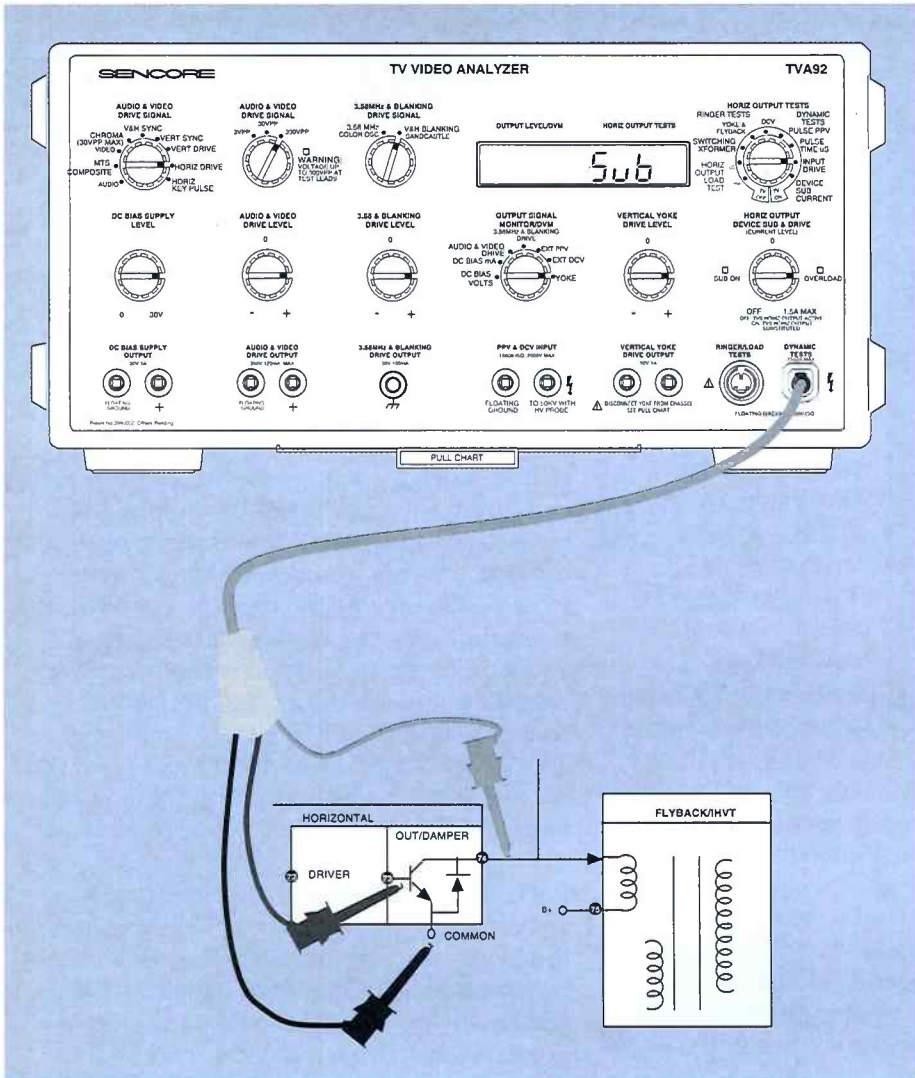


Fig. 4: The Dynamic Tests and Horiz Sub & Drive tests are made with a three lead connection to the collector, base, and emitter of the TV's horizontal output transistor.

could not produce flyback pulses or high voltage.

After switching on the PR570 and adjusting it to 120 volts, I pressed the chassis power button. The TVA92's digital readout showed a B+ voltage at 162 volts. This was considerably higher than the normal 130 volts B+ indicated by the schematic. But this was not unusual because a linear regulator's output voltage increases when there is no current flowing to the load circuitry. I would need to draw current, then meter the voltage to see if the power supply would regulate as it should. To do this I could rig-up a light bulb or resistor, but this would take some time to set up. A quicker way is to use the Horizontal

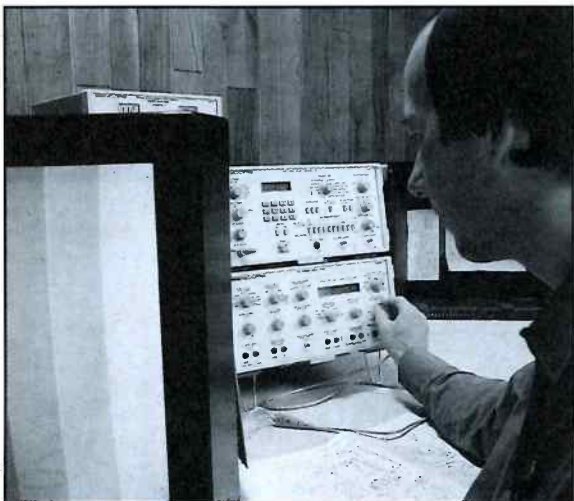


Fig. 5: Only the TVA92 TV Video Analyzer lets you substitute directly for the horizontal output transistor saving you time and expensive parts damage.

156 volts, but still much higher than its regulated value of 130 volts. Slightly increasing the SUB & DRIVE control resulted in an additional drop of one volt - now at 155 volts. It was conclusive, the B+ power supply was not regulating. The STK30130 regulator was likely shorted and the cause of the high voltage shutdown. I reached up and returned the HORIZ OUTPUT DEVICE SUB & DRIVE control to "OFF".

Proving The Flyback, Video, Shutdown And Deflection Circuits "GOOD" Using The HORIZ OUTPUT DEVICE SUB & DRIVE

I was about to go tell Bruce that a new regulator IC would fix the chassis when I realized I hadn't seen the flyback and the other circuits work for sure. I was confident the regulator IC was bad, but it commonly fails when the horizontal output transistor or flyback has problems. The first technician felt the flyback was bad - which was still a possibility. I had to do some more testing to make sure the regulator IC was the only problem.

The TVA92 Horizontal Output Device Sub & Drive lets you check the flyback, scan-derived circuits, and others. I could have analyzed video on the CRT, measured CRT high voltage, and monitored voltages in the shutdown circuit if I needed to. But first I needed to reduce the B+ voltage to the horizontal

Output Device Sub & Drive.

Adjusting the TVA92's HORIZ OUTPUT DEVICE SUB & DRIVE control would begin to substitute the chassis horizontal output transistor and draw B+ current to the horizontal output stage. However, the current permitted to flow through the subbing transistor would only be a fraction of normal, keeping the flyback pulses far below the level where high voltage shutdown would occur.

Reaching for the HORIZ OUTPUT DEVICE SUB & DRIVE control, I turned it slightly clockwise and the "SUB ON" light came on. The DCV reading dropped to

output stage to prevent HV shutdown. Monitoring the DCV readout of the TVA92, I reduced the PR570's output until the B+ read 130 volts. Turning the HORIZ OUTPUT DEVICE SUB & DRIVE control slightly on, I increased the PR570 output to re-establish the 130 volt B+ voltage.

After connecting the RF cable from the VG91 Universal Video Generator to the chassis antenna input, I turned the TVA92's HORIZ OUTPUT TESTS switch to the DEVICE SUB CURRENT position. This position monitors the current through the collector of TVA92's built-in subbing transistor. The reading was below 500 mA, indicating no serious problems. So I increased the DEVICE SUB & DRIVE control to about the two o'clock position. This position enables full operation of the chassis horizontal output stage. After a short delay, the CRT screen became illuminated and a color pattern appeared. There was some waving in the pattern from the lack of B+ regulation, but beyond that, the Color Bars pattern looked good. A glance at the DEVICE SUB CURRENT readout showed about 800 mA - a typical reading for a modern chassis.

Remembering the slightly narrow pulse time indicated by the Load Test, I was anxious to see if the flyback pulse amplitude was much higher than the schematic. Switching the HORIZ OUTPUT TESTS switch to PULSE PPV, the TVA92's LCD readout indicated about 1150 VPP. Although this was slightly higher than the 1120 VPP indicated by the waveform shown in the schematic, it was not significant and was not triggering high voltage shutdown. Switching the HORIZ OUTPUT TESTS switch to PULSE TIME μ S, I saw a readout of 11.1 μ S as seen earlier during the HORIZ OUTPUT LOAD TEST. This timing is apparently normal for this chassis. Things were looking good, so I decided to switch through the analyzing video patterns of the VG91.

While switching patterns, it became clear that the picture was not focused properly. I turned the focus control to clear things up but then it went out of focus again. Could the focus divider section of the flyback module be bad? Perhaps that's why the previous technician said a new flyback was needed. My excitement was starting to fade as I reached up and turned the HORIZ OUTPUT DEVICE SUB & DRIVE to "OFF" permitting the subbing transistor to cool while I found a high voltage test probe.

After connecting a high voltage probe to monitor the focus voltage, I powered up the chassis and slowly increased the TVA92's SUB & DRIVE. The focus voltage gave a steady reading but would change as I lightly tapped on the circuit board. However, when I wiggled the focus control it would remain steady. I was just about to condemn the focus divider portion of the flyback when I wiggled the focus wire to the CRT board. Much to my amazement the voltage jumped around and focus changed considerably. Could it be as simple as a wire connection? I turned the

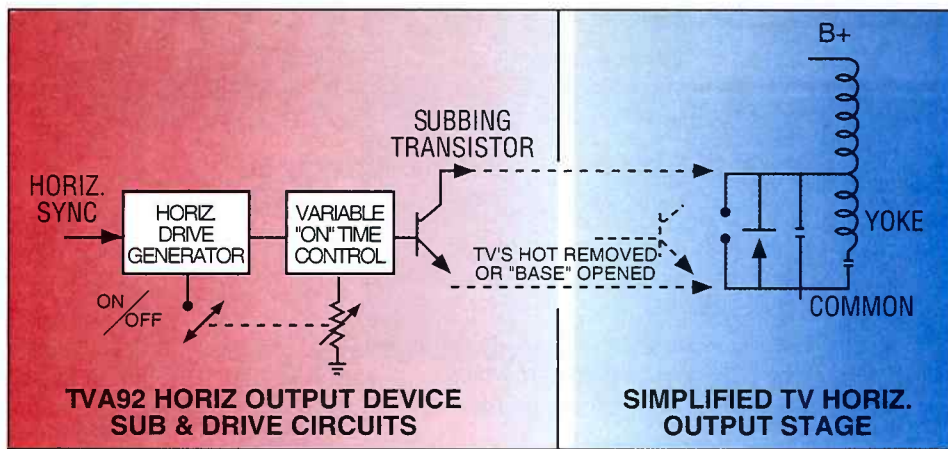


Fig. 6: The TVA92 provides a substitute horizontal output transistor switched by a variable duty-cycle horizontal drive.

SUB & DRIVE to "OFF" and then turned off the PR570 to shut the chassis down.

When I pushed up the rubber boot covering the focus wire connection to the flyback, I discovered the problem. The focus wire was supposed to be crimped in a receptacle pin which mates with a flyback male pin. The wire had become unattached and was laying beside the receptacle pin. The rubber boot held the wire against the pin but the connection would vary in resistance causing the focus voltage to change. It may have always been that way or slipped out during the course of servicing.

After repairing the connection, I once again turned on the PR570, pushed the chassis power button, and turned up the HORIZ DEVICE SUB & DRIVE control. With a slight adjustment of the focus control, the picture focused up and remained focused when I tapped on the circuit board and wiggled the focus wire. I was now confident

the flyback, high voltage section, and other circuits responsible for producing video on the CRT were good. The only circuits in the chassis I had not proven good were the horizontal sync and oscillator circuits. Since I had horizontal drive earlier during the performance test, they were likely OK, but I needed to confirm the drive was at the proper frequency. A quick one minute check with the SC3100 "AUTO TRACKER" Waveform & Circuit Analyzer should do it. Attaching the

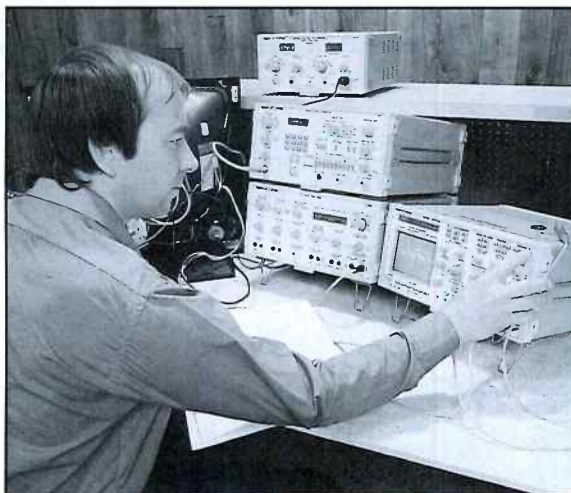


Fig. 7: One quick final check with the SC3100 "AUTO TRACKER" proved the drive was present and locked to the video's horizontal sync.

Needless to say, Bruce was delighted when he found out he would not need to buy a new flyback. When he asked how I figured it out, I proudly told him how I had used the TVA92's Horizontal Output Tests to isolate two separate problems. I couldn't resist telling him how I had proved the flyback, high voltage, shutdown, video, and deflection circuits all good. After all, the satisfaction of a tough repair is why a technician can't avoid that invisible force from within!

Proudly Telling How I Had Solved The Problem With The TVA92

If you're like me, and like to give into the invisible force now and then, the TVA92 TV Video Analyzer can earn a few good troubleshooting experiences to put in your technical memory file. If you would like to learn more about how the Sencore TVA92 isolates problems without applying power to the TV chassis, isolates shutdown problems, or proves circuits and components good for more accurate service estimates, call your Area Sales Representative today at 1-800-SENCORE (736-2673). The TVA92 can be your best asset when that invisible force visits you! ■

EIA Announces "Hands-On" Technical Workshops For Electronics Instructors & Technicians

The Electronic Industries Association (EIA) will offer several technical courses covering theory and "hands-on" training. All workshops are five days, 40 hours with an enrollment maximum of 20 people, except for Video Laser Disc which is a three day session. The workshops are designed to upgrade the skills of both technicians and instructors of vocational education.

The technician programs are co-sponsored by local chapters of NESDA/ISCET while the five day workshops for vocational educators is co-sponsored by vocational education state departments and local teaching institutions. **The workshops are provided at no cost by EIA.** For general questions pertaining to the EIA's programs contact the EIA staff by calling (202)457-4986 or writing to: Product Services, EIA/CEG 2001 Pennsylvania Avenue, NW Washington, DC 20006

VCR Servicing Technology (VCR)

- VCR Servo Systems
- VHS Signal Processing
- Tape Transport Alignment
- Troubleshooting Techniques

Video Laser Disc Servicing (VLD)

- VDL Servo Systems
- Video Signal Path
- Laser Optics
- Troubleshooting Techniques

Interfacing Microprocessors In PCs & PC Servicing (UPC)

- IBM PC Interfacing
- I/O Techniques
- Microprocessor Technology
- Troubleshooting Techniques

Digital Microprocessor Applications (DUP)

- IBM PC Interfacing
- Digital Logic
- Microprocessor Technology
- Troubleshooting Techniques

1994 Workshop Schedule*

Who	Date	Type	City	State	Phone
E	7/11/94	VCR	Aurora	CO	(303)344-4910
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E	7/25/94	UPC	Albuquerque	NM	(505)827-6651
E	8/1/94	VLD	Prattville	AL	(205)347-4287
E	8/15/94	DUP	Big Rapids	MI	(616)592-3515
T	7/11/94	UPC	Baltimore	MD	(410)644-6400
T	7/12/94	VLD	Boise	ID	(208)322-3304
T	7/18/94	DUP	Corning	NY	(607)962-9226
T	7/18/94	UPC	Milford	NE	(402)761-2131
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T	7/25/94	UPC	Windsor	CT	(203)776-9123
T	7/25/94	VCR	Memphis	TN	(800)365-8732
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T	8/8/94	UPC	Portland	OR	(817)921-9061
T	8/8/94	VLD	Ankeny	IA	(515)964-6330
T	8/12/94	VLD	Portland	OR	(817)921-9061
T	8/15/94	VCR	San Diego	CA	(619)495-0392
T	8/22/94	VLD	Cypress	CA	(714)827-4986
T	9/26/94	VCR	Cypress	CA	(714)827-4986

E - Educator
T - Technician

* Contact local phone numbers to register.

PHILIPS TECHNICAL TRAINING

Philips Technical Training and 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:

- Improve your troubleshooting skills
- Enhance your use of test equipment
- Increase your daily completes
- Learn about new servicing products
- Reduce the number of tough problems
- 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.



Call Today
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 (736-2673)

CLASS SIZES ARE LIMITED TO 15 PEOPLE. CALL NOW TO RESERVE YOUR SEAT.

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

Schedule of Classes for July '94 - September '94

VCR Operating Systems V223/3 Days/\$279

This program provides fundamental information needed by technicians to service VHS VCRs, including:

- Electrical operation
- Signal processing
- Hi-Fi
- MTS
- Servo systems
- Microprocessor control circuits

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High Speed VHS VCR Troubleshooting V224/3 Days/\$279

This program is product specific, but not model specific. For each symptom of a problem, a generic approach is suggested. Thus, troubleshooting is the main topic, with minimal technical explanation. Topics include tricks-of-the-trade and handy, inexpensive gadgets.

Boise, ID 7/06/94
 Indianapolis, IN 7/18/94
 Roanoke, VA 7/18/94
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VCR Mechanical Maintenance V225/1 Day/\$129

This hands-on program provides detailed discussion on maintenance procedures and failure histories for Y and H2 VCR mechanisms, with a half day devoted to each. During the labs, mechanisms are completely disassembled, reassembled, and aligned.

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 Gadsden, AL 8/12/94
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 Hazelton, PA 9/01/94
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Switching Mode Power Supply V Pulse-Driven And Dual-Controller C133/2 Days/\$199

This new program covers power supply basics, linear regulators, free-running, IC-controlled, pulse-driven, and dual-controller switching mode power supplies. The program emphasizes practical knowledge, understanding, and troubleshooting these power supplies.

Indianapolis, IN 7/21/94
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Hi-Res Computer Monitor Repair M402/2 Days/\$199

This course offers in-depth instruction on display systems, vertical and horizontal modes, standard formats, cable configuration, graphic modes, and more. Hands-on troubleshooting labs with the CM9214 EVGA monitor are included.

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Compact Disc Digital Audio CD355/3 Days/\$279

The course material encompasses a full description of a typical single-play CD audio player, as well as carousel and cartridge multi-play systems. Descriptions of the single-beam and three-beam (CDV) optical pick-up systems, player operation and features, mechanical functions, and circuit functions are also included.

Chicago, IL 8/23/94
 Houston, TX 8/29/94

Fundamentals Of Color Camera CM254/3 Days/\$329

This course is a generic program needed by technicians first entering the camera repair business. It covers the fundamentals of camera features, operating controls, basic light theory, the lens system, color processing, troubleshooting, and more.

Denver, CO 7/19/94
 Chicago, IL 7/26/94
 Danbury, CT 8/22/94
 Las Vegas, NV 9/14/94
 Chicago, IL 9/19/94
 Boston, MA 9/19/94

Compact Disc Interactive (CD-i) CD354/2 Days/\$199

This course covers virtually every aspect of the CD-1910's operation and features, including data formats, circuit descriptions, and troubleshooting procedures.

Houston, TX 9/01/94

Digital Compact Cassette DA601/3Days/\$279

As more manufacturers use DCC technology, this course offers a terrific introduction to servicing these products.

Chicago, IL 8/01/94

Camcorder Mechanical Maintenance CM255/1 Day/\$129

This hands-on program provides detailed discussion on maintenance procedures and failure histories for VHS-C and full-size camcorder mechanisms, with a half day devoted to each.

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 Chicago, IL 7/29/94
 Danbury, CT 8/19/94
 Boston, MA 9/16/94
 Chicago, IL 9/22/94
 Baltimore, MD 9/30/94



**Analyze Any Waveform Faster,
With Zero Chance Of Error With
Your SC3100 "AUTO TRACKER"™**

By Brad Johnson, Product Marketing Specialist

When you first look at the SC3100 "AUTO TRACKER" Automatic 100 MHz Waveform & Circuit Analyzer, it's easy to view it simply as an oscilloscope. And rightfully so, since it looks like an oscilloscope at first glance. But, we call the "AUTO TRACKER" a Waveform & Circuit Analyzer because its digital readout analyzes waveform parameters for you with only one probe - with or without a waveform on the CRT!

The differences might not sound like much, until you take a look at how you really analyze signals. Look at Fig. 1 to see what we mean.

Imagine the schematic is a circuit you frequently service. Now, think about which troubleshooting information you use most often.

DCV – What percentage of the time do you need more than a DC voltage reading to tell you whether the circuit or its power supply is working?

PPV – Does peak-to-peak tell you everything you need to know about stage gain of the circuit?

Frequency – How do you confirm that an oscillator or a digital divider is working correctly?

Waveshape – How often do you use a scope to look at a waveshape without also needing to know one or all of these other parameters?

If you're like many servicers, waveshape is used by itself in only a small portion of your troubleshooting. The rest of the time, you either need a parameter without regard to the signal's waveshape, or you need the parameter and the waveform both. That's why the Sencore SC3100 "AUTO TRACKER" Automatic 100 MHz Waveform & Circuit Analyzer is designed differently than a common oscilloscope.

Most digital-readout scopes are still just oscilloscopes. They require you to have a waveform locked onto the CRT every time you take a reading because all their tests are based on the displayed waveform. Without a waveform on the CRT, these digital-readout scopes cannot provide you with any valuable troubleshooting information.

Every time you have to set up a scope display to get a simple DC or peak-to-peak value, you break your train of thought. You risk backtracking and losing your place in the circuit, which leads to ineffective troubleshooting. If time weren't important in your work, you probably wouldn't mind the extra steps it takes to lock the waveform every time you measure a signal. But, since your time is important, you don't need the extra hassle of fiddling with knobs trying to lock in waveforms. That's why the SC3100 "AUTO TRACKER" is designed to give you parameter readings, even if you

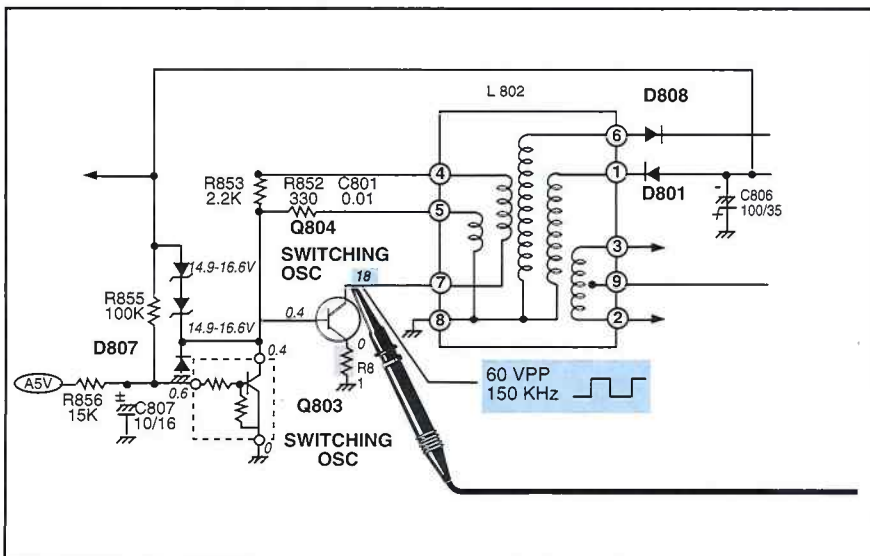


Fig. 1: DC volts, PP volts, and frequency are used more often than waveshape in most troubleshooting applications.

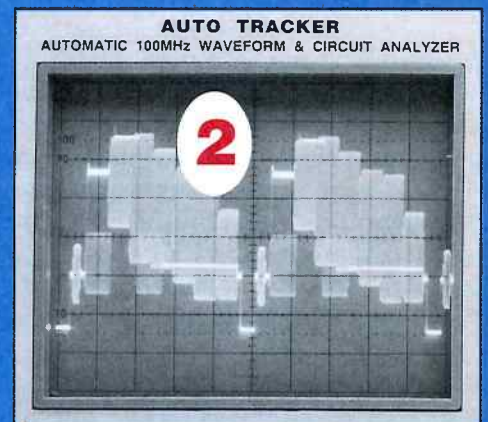
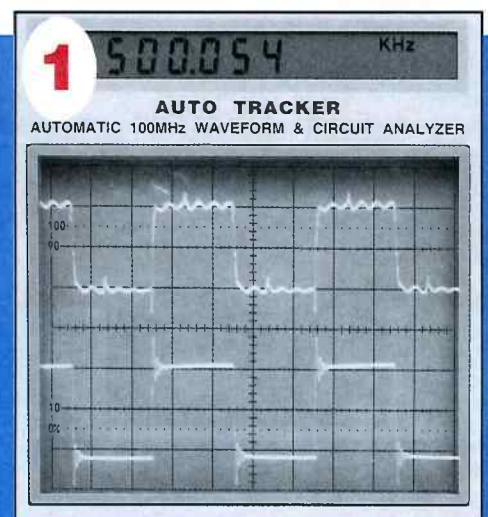


Fig. 2: The "AUTO TRACKER" provides three different ways to test a signal: 1) Autotracking digital readouts, 2) the CRT, and 3) the Delta digital tests.

don't have a waveform displayed on the CRT.

Figure 2 shows how the SC3100 gives you the choice of three ways to test a signal: 1) The "Autotracking" digital readouts. 2) The easy-to-use CRT, and 3) The "Delta" digital tests. What difference do these features make? They save you time on every signal you test. They give you measurements free from setup errors. And they make waveform analyzing as simple as using a digital meter.

The "Autotracking"™ Tests Work Without A Waveform Displayed

The first three digital readout functions are called the "Autotracking" tests. Autotracking means the test automatically tracks with the input signal, but doesn't need a waveform on the CRT. The same probe feeds both the digital circuits and the CRT. You'll use that same analyzing probe to fully test the signal at any test point.

Autotracking DC Volts

Most technicians make DC voltage readings more frequently than any other. Most DC readings confirm that the power supplies are working properly and/or the stage biases are correct.

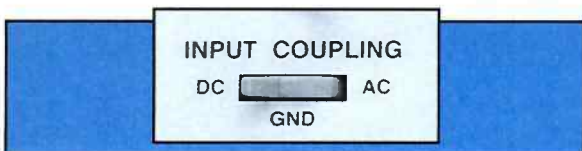


Fig. 3: You can have the "AUTO TRACKER's" Input Coupling switch set to AC, DC, or ground and still measure DC voltage accurately.

To measure DC volts with the SC3100 "AUTO TRACKER", just connect the analyzing probe and press the "DCV" button for channel A or B. The test is fully autoranged, so you don't have to make any scope adjustments - none. The "AUTO TRACKER's" probe routes the DC around the CRT's input coupling switch. This gives you error-free DC readings, even with the input coupling switch in the "AC" or "Ground" position.

Autotracking Peak-To-Peak

After DC, peak-to-peak voltage is the most important parameter in circuit analyzing. The peak-to-peak amplitude confirms that each stage is processing the signal correctly. Tracing a weak or missing signal identifies poor coupling components, bad gain stages, and so on. That's why the second Auto-tracking test measures true peak-to-peak signal amplitude.

Like the DC readings, you don't need a displayed waveform to measure peak-to-peak with the "AUTO-TRACKER." The digital readings remain error-free no matter how you set the CRT controls. The peak-to-peak circuits are not affected by the setting of any of the vertical vernier controls.

Autotracking Frequency

Modern digital circuits are largely frequency dependent. Frequency measurements confirm that oscillators, multipliers, and dividers are working the way they were designed. When you connect the "AUTO TRACKER's" probe and press the "frequency" button, the SC3100 gives a fully autoranged display for frequency. You get a solid reading of frequency every time with no calculations or chance of error. The three Autotracking tests, of DC, peak-to-peak, and frequency give easy-to-use, error-free readings on either channel.

Analyzing Waveforms Faster Can Make The Difference

But what about those times when waveshape is important? That's where the "AUTO TRACKER" can make a significant difference in your troubleshooting and circuit analyzing. The SC3100 "AUTO TRACKER" has taken waveform analyzing a step further than most oscilloscopes. In addition to the Autotracking digital parameter measurements, the "AUTO TRACKER" features an autoranging timebase and attenuator. It allows you to simply touch and test any waveform parameter for hands free troubleshooting. You simply set the SC3100's VOLTS/DIV and TIME/DIV controls to the "AUTO" position, and begin your circuit analyzing. Because its circuits are fully autoranged, you get a proper waveform every time as you move from test point to test point.

Circuit analyzing and signal troubleshooting can require you to view a variety of waveforms. Some are easily viewed using any type of oscilloscope, while others can be a bit more difficult. One of the most complex waveforms is a composite video waveform. Composite video can be difficult to sync, especially when trying to view signals at the 60 Hz vertical sync rate, unless your oscilloscope has sync separators.

The SC3100 prevents video sync problems when you switch its TIME/DIV switch to the "TVV" position. This function provides stable triggering, plus special logic circuits which prevent signals such as vertical sync and vertical equalizing pulses from causing

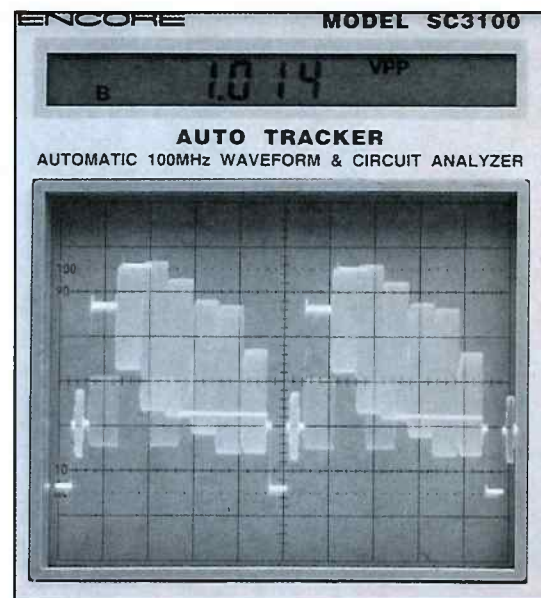


Fig. 5: The SC3100's built-in sync separators prevent problems of locking onto video waveforms at the vertical and horizontal rate.

misleading readings on any test. The "TVH" position lets you sync onto video at the horizontal rate.

The squarewave is another frequently viewed waveform. With the expanded use of digital technology, the squarewave has become very common and can be found in most consumer electronic equipment. Ideally, a squarewave is simply a voltage that alternates between two levels. In digital circuits, one level corresponds to a logic "1" and the other level corresponds to a logic "0". Like most waveforms, a squarewave has three important characteristics:

1. Peak-to-Peak Amplitude
2. Frequency
3. Average DC Level

On the surface, a squarewave looks quite simple - the voltage is either high or low. The "AUTO TRACKER" will easily measure these squarewave parameters with the push of a button.

In reality, the squarewave is much more complex. In an ideal squarewave, the voltage switches levels instantaneously. This change in level requires infinitely high frequency signals. The capacitance, inductance, and resistance in the circuit limit how fast the voltage level can change. Many times, you're looking for a pulse of some type on the square wave to indicate frequency or timing between two signals. These pulses can be very difficult or impossible to measure with a typical oscilloscope.

Measuring Pulse Widths Quickly And Accurately With The Delta Functions

Let's look at another signal, the flyback pulse at the collector of a television's horizontal output transistor. This signal is classified as a pulse even though it does not have square edges like a digital pulse. Again, we can analyze this pulse by observing it on the "AUTO TRACKER's" CRT as well as checking

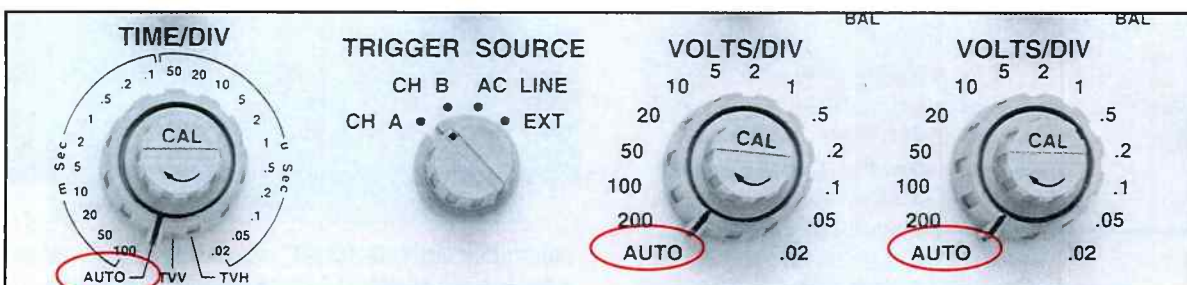


Fig. 4: The "AUTO TRACKER's" timebase and attenuators autorange independently of each other for fast waveform analyzing.

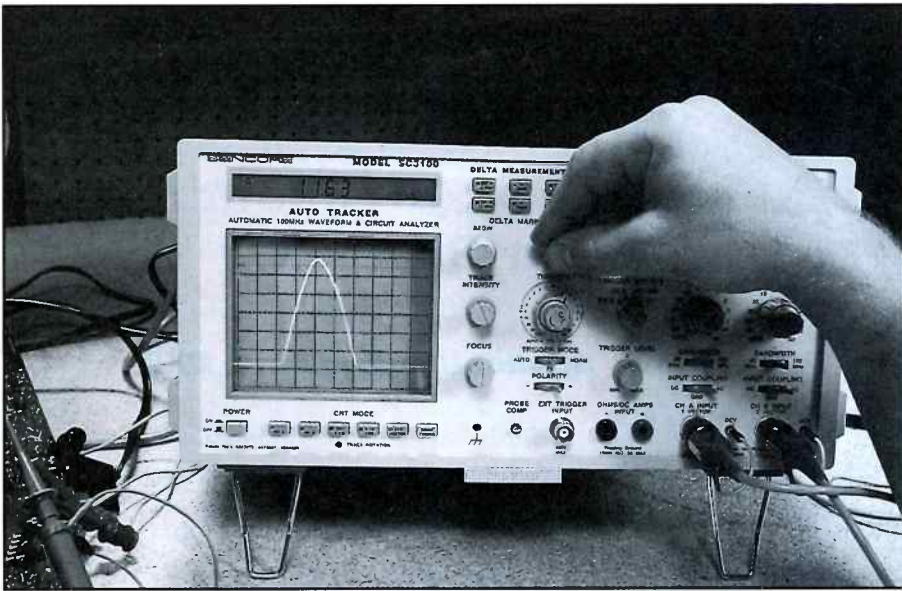


Fig. 6: Use the "AUTO TRACKER's" Delta Time function to measure the width of the horizontal output pulse.

its important characteristics with the SC3100's digital meter. In less than five seconds, you can measure the peak-to-peak amplitude of the pulse, check its frequency, and measure the DC voltage. With its exclusive 3000 volt input protection, the "AUTO TRACKER" lets you quickly and safely analyze the collector of the horizontal output transistor.

This signal has two additional characteristics that you will need to check. First, use the SC3100's CRT to check the waveshape of the pulse. Be sure that it does not have deep saddles in it, which could indicate circuit problems. This cannot be measured with a meter. It must be viewed on the CRT.

Second, measure the duty cycle of the pulse. A pulse that is too wide or too narrow indicates a circuit problem. Your SC3100 Waveform & Circuit Analyzer's Delta features allow you to check any portion of a waveform with digital accuracy. Press the Delta Time button and look for the part of the CRT trace that is brighter than the rest. The bright portion of the trace is being measured by the "AUTO TRACKER's" digital meter. By using the Delta Begin and Delta End controls, you intensify just the pulse portion of the waveform. You then read the on-time of the pulse from the digital display. The exclusive Delta functions of the SC3100 "AUTO TRACKER" allows you to quickly analyze any portion of the waveform that you need.

The "AUTO TRACKER's" Digital Features Along With The CRT Speeds Your Troubleshooting

Understanding, measuring, and interpreting waveforms is an everyday part of electronic servicing. Your business success could depend upon how confident you are at analyzing waveforms.

As many "AUTO TRACKER" owners testify, the SC3100 pays for itself with its speed of measuring and analyzing waveforms. Not only does the CRT of the "AUTO TRACKER" let you view the waveform and look for distur-

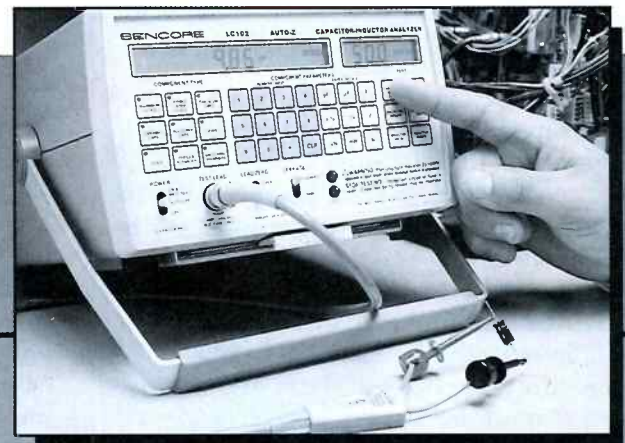
tions or signal glitches, but the digital meter also gives you fast, digitally accurate readings of all waveform parameters. If you would like to update your service operation to an SC3100 "AUTO TRACKER" Automatic 100 MHz Waveform & Circuit Analyzer, call Sencore at 1-800-SENCORE (736-2673) and ask for your Sales Representative. We're here to help.

**To Try An SC3100
"AUTO TRACKER"
On Your Bench,
Just Complete And
Return The Card
Next Page
Or Call
1-800-SENCORE
(736-2673)**

SERVICING ^{plus}

LC102 "AUTO-Z"TM Capacitor & Inductor Analyzer

Five Patents - Only From Sencore!



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

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

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

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



Watch Out For "On-Shelf" Leakage

As electrolytic capacitors age on the shelf, they often develop leakage. Placing a leaky capacitor into a circuit can cause disastrous results.

You can prevent further circuit damage from happening in your shop by checking every capacitor you take off the shelf. If the leakage is below its acceptable amount, you can put the capacitor into circuit without worry. If the leakage is above the maximum allowed, try reforming the capacitor's dielectric. The dielectric can be reformed when a voltage, with a limited current, is applied to the capacitor by the LC102 AUTO-Z.



Total Customer Satisfaction For Camcorder Repairs

By Tom Schulte, Application Engineer, CET

Are you looking for a new source of profits for your business? Do you turn down customer requests for camcorder service because you're not sure how to provide this service? Or, do you already service camcorders, but send camera problems back to the factory or to another service center? If so, then camcorder/camera servicing may provide the opportunity you've been looking for.

In order to be profitable in any line of electronic servicing, you need to be able to make accurate service estimates and quality repairs. Camcorder/camera service is no different in this respect. You need to understand the operation of the unit you are servicing, be familiar with how it fails, and be able to apply efficient servicing techniques to quickly and accurately restore the unit to proper operation.

Camcorder Facts

Camcorder sales have grown from 1.2 million units sold in 1986 to 3.2 million units in 1993. Even with this tremendous sales growth, only 15% of United States households currently own a camcorder, so there is still tremendous potential for growth in both sales and service.

Camcorder prices have come down, but they're still not inexpensive. This encourages owners to repair, rather than replace, defective units. According to Consumer Reports magazine, 79% of camcorder owners have their defective units repaired, and the average repair bill is \$100.

camcorder's VCR section or on a home deck.

What Fails In A Camcorder?

Many camcorder failures occur in the mechanical VCR transport section and the camera lens assembly. The same mechanical failures that occur in standard home VCRs also occur frequently in the VCR section of camcorders, i.e., worn rubber and broken gears. The camera lens assembly, including the iris, focus, and zoom control motors and gears, also has a high occurrence of failure. These lens failures, as well as broken circuit boards and broken connections are caused primarily by the rough handling that camcorders receive.

The other major type of failure in both the VCR and camera section is electrical failure. In the VCR section, this includes servo, head, preamp, chroma, luma, power supply, and

system control problems. In the camera section, electrical failures include sync generator, CCD imager, chroma, luma, power supply, and system control problems (Fig. 2). But since these electrical difficulties occur less often than mechanical failures, even an experienced technician doesn't have as much chance to become familiar enough with them to recognize specific symptoms for specific defects.

Mechanical failures in both the VCR and camera section of the camcorder are often relatively easy to diagnose and repair by an experienced technician. But once the repair

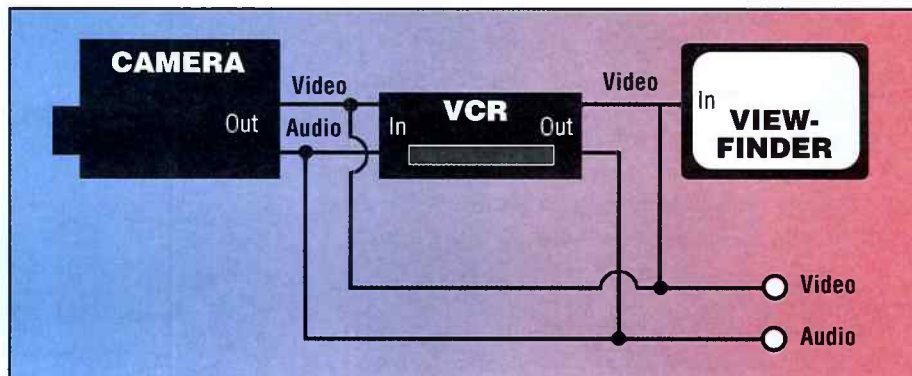


Fig. 1: A camcorder is a simple combination of a VCR and a camera with a viewfinder for monitoring their signals.

What Is A Camcorder?

A camcorder is simply a combination of two common electronic devices, a VCR and a camera, plus an electronic viewfinder (a small monochrome monitor) for convenient viewing of the camera or VCR signal (Fig. 1). These two sections can be used independently of each other, but more often, the camera section develops the video and audio signals which the VCR section records on the videotape. The recording is then played back either on the

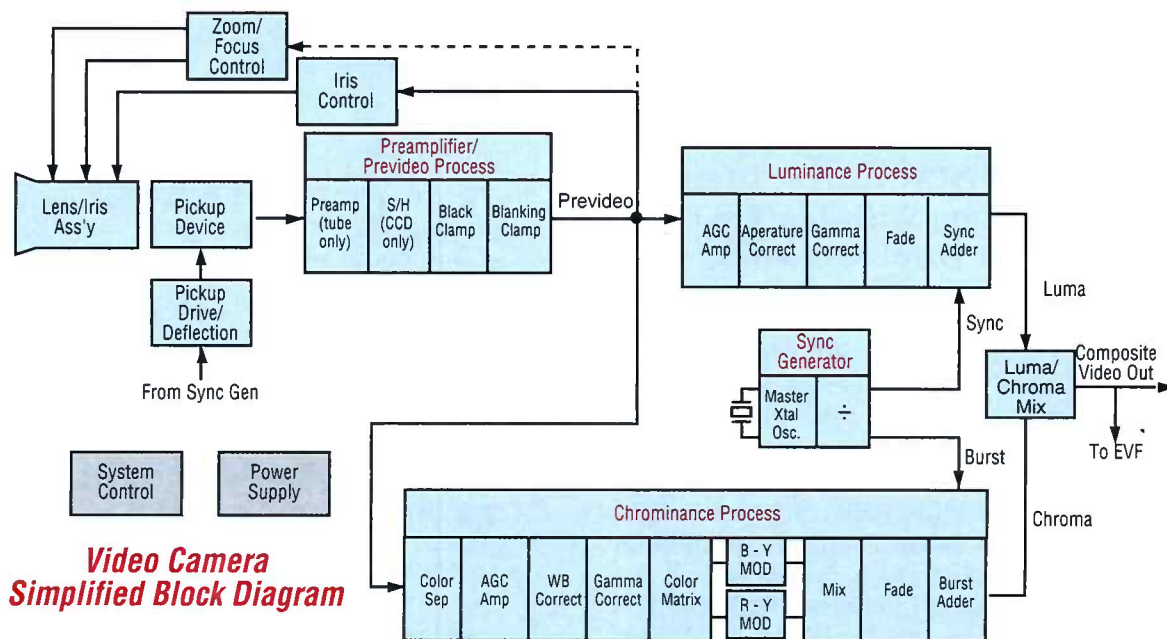


Fig. 2: Video cameras are similar in complexity to other video products you may already be servicing.

is completed, how do you know the camera performs properly in all respects to insure customer satisfaction? When a camera has electrical problems, and the picture "doesn't look quite right," can you easily tell what type of performance problem the camera has? How do you currently test a camcorder or camera repair to insure that it will provide a satisfactory picture under all operating conditions?

Use A Logical Servicing Approach

The key to efficient camcorder service is a controlled, step-by-step servicing approach that uncovers all camcorder defects. First, correct any obvious mechanical problems such as a jammed lens, broken gear, or cracked circuit board. Then, identify any electrical problems and remaining mechanical problems by testing the camcorder for operation under all normal operating conditions. This will help you identify all the camcorder problems and get you started troubleshooting the right circuits.

In the VCR section of the camcorder, you're possibly already familiar with troubleshooting mechanical, servo, and signal processing circuit problems. Here, the Sencore VC93 All Format VCR Analyzer will help you quickly localize the problem to the defective section, double-check all VCR mechanical repairs, and easily troubleshoot VCR electrical problems that can otherwise turn into tough problems.

In the camera section of the camcorder, however, you may not have been able to develop efficient testing and troubleshooting procedures. Once obvious camera mechanical problems are corrected, a full set of operational tests will help determine the full extent and possible cause of any additional camera problems. When additional camera problems are indicated, you need to signal trace the problem while the camera is focused on a standard test signal. Finally, once you believe the repair is complete, you need to thoroughly test the camera to catch all camera performance problems that might not be obvious from a simple point-and-shoot checkout.

Can't I Just Watch The Camera Signal On A Monitor?

When you repair a camera problem, the tendency is to check the camera's final operation by simply watching the picture on a monitor while pointing the camera across the room. There are two problems with this test procedure. First, when you simply point a video camera across the room, you don't have much control over the level, uniformity, or color of the light illuminating the scene. You also have very little control of the color amount and hues of objects appearing in the scene. This prevents you from easily judging whether the video camera's output signal accurately represents what the camera is seeing.

Second, your customer expects the camera to produce acceptable pictures under a much wider range of operating conditions than those present within your service center's walls. A video camera needs to:

- provide proper luminance under very high and very low light levels
- provide proper color with both indoor (reddish) and outdoor (bluish) lighting
- be compatible with all TV monitors
- provide proper focus at all distances

A single-condition test, with the camera pointed across the room, usually doesn't show all the camera's problems. A video camera you check under one set of conditions may produce unacceptable pictures for the owner under different conditions. You need to know that the camera is going to work well for your customer who may be taping a candle-lit birthday celebration, an outdoor football game, or the dimly lit, once-in-a-lifetime church wedding.

Use Standard Test Signals For Camera Troubleshooting

One difference in servicing cameras is that the normal input to the camera is the reflected light from an illuminated image, rather than an electrical signal. This means that to accurately evaluate camera operation, you'll need standard test pattern charts and a method of lighting them with the proper type of light.

Properly illuminated test patterns allow you to easily check a video camera for proper operation under a variety of conditions. The Sencore VR940 Video Reference (see Fig. 3) provides standard video test patterns at controlled light levels with consistent lighting across the entire pattern. The color of light (color temperature) illuminating the VR940's patterns is controlled to match both normal indoor and outdoor conditions. The standard test patterns supplied with the Sencore VR940 Video Reference simplify complete luminance and color testing.

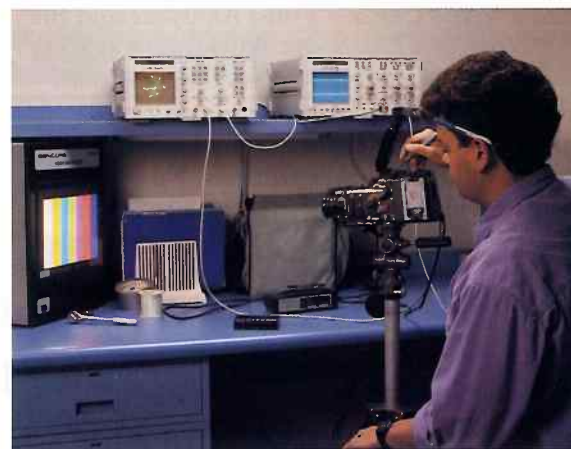


Fig. 3: The VR940 Video Reference is a high quality reference source for accurate camera servicing.

Completely Test The Camera's Output Signal

To service your customer's cameras more accurately without wasting troubleshooting time, you'll need a method of evaluating the camera output to correctly isolate defective operation. An oscilloscope and/or waveform monitor will be needed to accurately test video and sync levels produced by the camera. A vector display with precision chroma demodulators will be needed to accurately test chroma saturation and hue. A frequency counter will be needed to test the accuracy of the master sync generator to insure camera compatibility with all TVs and video monitors. Also, a method of testing camera signal quality will speed the troubleshooting process and assure you of customer satisfaction with the completed repair.

The CVA94 "Video Tracker" Camera Video Analyzer provides all of these camera test functions in one easy-to-use service instrument. The "Video Tracker" allows you to quickly perform digital waveform and vector measurements as well as special tests for video and chroma noise, burst frequency, and power adapter hum. The CVA94's tests and measurements are all designed around your service needs for quick and accurate camera testing.

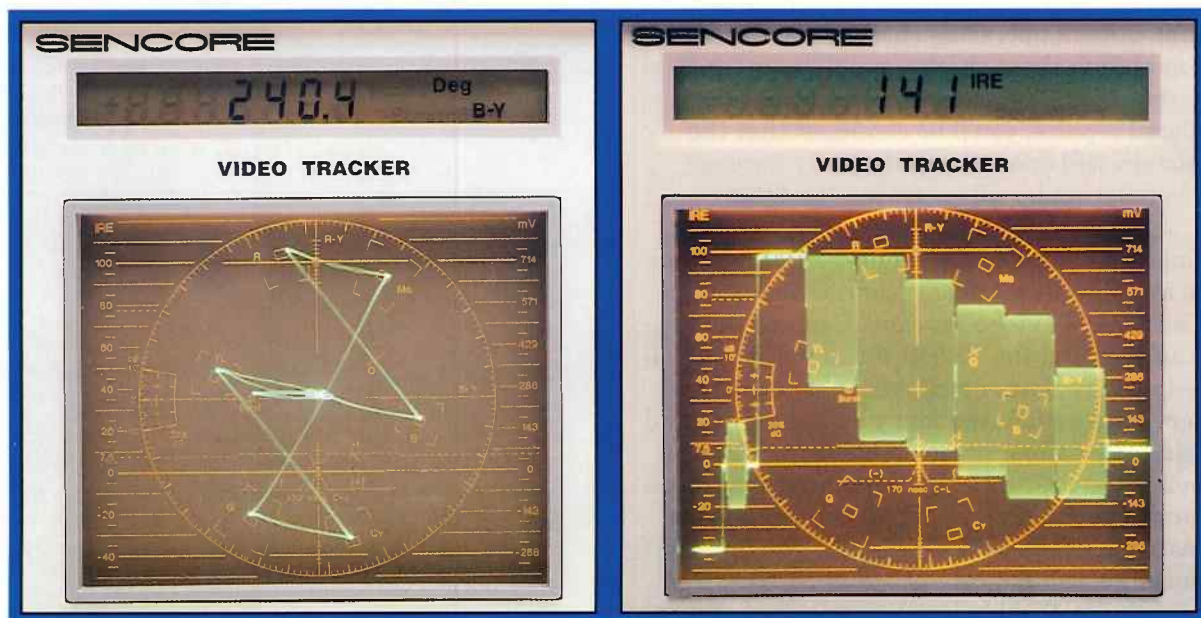


Fig. 4: With a vectorscope, waveform monitor, and special digital troubleshooting tests combined into one instrument, the CVA94 "Video Tracker" is your complete answer to camera/camcorder testing and troubleshooting.

The CVA94 Camera Video Analyzer and the VR940 Video Reference allow you to quickly prove that you haven't missed any camera defects and that the camera is adjusted properly to give your customer acceptable pictures under all operating conditions. Now you can service video cameras with efficient troubleshooting methods and be totally confident of the completed repairs you send back to your customers.

How Can I Quickly Check Whether A Camera Is Working Properly Or Whether It Needs Repair Or Adjustments?

Following are the camera characteristics which you should check to insure that a camera will work properly under all operating conditions for your customer:

- Proper sync and color burst level and frequency for TV compatibility
- Focus at all distances under all light levels
- Proper output signal level at all light levels
- Proper white balance under all lighting conditions
- Proper saturation levels for all scene colors
- Proper hue for all scene colors
- Low noise in the video and chroma signals
- No bright light blooming
- Proper video frequency response

Without the proper equipment, it may sound complicated and time-consuming to check all these camera characteristics. With the CVA94 Camera Video Analyzer and the VR940 Video Reference, however, these important camera checks can be completed easily in a matter of a few minutes. Now, in just a few minutes, you can tell what is wrong with the camera and know what circuits aren't functioning properly.

The following "Video Camera Dynamic 10 Point Test Procedure" outlines 10 quick tests you can use to quickly verify all these important camera operating characteristics. After completing these checks, you'll know the total extent of any camera problems. And for completed repairs, you'll be confident that the camera will operate satisfactorily for your customer under all operating conditions.

Customer satisfaction is one of the first steps to a profitable electronic service business. The CVA94 "Video Tracker" Camera Video Analyzer and the VR940 Video Reference will help you perform quick, efficient camcorder service to satisfy you and your customers and minimize callbacks for problems you didn't notice the first time. For more information on how to put this great pair of camera service instruments to work earning profits for your business, call Sencore at **1-800-SENCORE** (736-2673). We'll help set up your bench for even the toughest camera and camcorder servicing challenges with our exclusive "no-obligation" trial offer. ■

Video Camera Dynamic 10 Point Test Procedure			
Test	Procedure	Circuit(s) Tested	Approximate Test Time
1. Burst Reference Frequency	Press the CVA94 BURST ERROR button and read the frequency error on the LCD display.	Sync generator master oscillator.	2 seconds
	Hum	Press CVA94 Hum button and read the % of hum on the LCD display	Camera Power Supply
2. Back Focus	Turn the camera's autofocus off, zoom the lens to wide angle, and frame the camera on the VR940 Focus Chart with the Neutral Density Filter overlayed. Adjust the manual focus for a sharp pattern, then zoom the lens to telephoto. If the pattern goes out of focus, the camera's back focus is misadjusted.	Camera lens backfocus setting and autofocus circuits.	20 seconds
	Autofocus	Turn the camera's autofocus on and frame the camera on the Focus Chart. Then pan the camera to frame on the Paper Focus Chart at 20 feet or further away. Finally pan the camera back to the Focus Chart. In each case, check that the center of the pattern comes sharply into focus on your video monitor.	
3. Blooming	Frame the camera on the VR940 Blooming Test Chart. Check the video monitor for white smearing to the right of the white block.	Luminance and chrominance circuit.	5 seconds
4. Black Setup Luminance Level	Cap the camera's lens, select the CVA94 1H Sweep Rate, and check that the black signal level falls on the 7.5 IRE dotted line on the CRT display.	Black clamp and luminance circuit gain.	15 seconds
	Peak White Luminance Level	Frame the camera on the VR940 Gray Scale Chart, select the CVA94 1H Sweep Rate, and check that the white signal level falls on the 100 IRE dotted line on the CRT display	
5. Indoor White Balance	Frame the camera on the VR940 Gray Scale Chart, select the CVA94 Vector mode, and check that the trace is collected in a single dot at the center of the vector display.	White balance and auto white balance circuits.	15 seconds
	Outdoor White Balance	Frame the camera on the VR940 Gray Scale Chart with the Temperature Conversion Filter overlayed, and again check that the trace is collected in a single dot at the center of the vector display.	
6. Video S/N	Frame the camera on the VR940 Video S/N Chart, press the CVA94 Video S/N button, and read the video S/N on the LCD display.	Iris control, pickup device, prevideo and luminance process stages.	5 seconds
7. Chroma Saturation	Frame the camera on the VR940 Color Bars Chart, press the CVA94 Vector Amplitude button, position the Delta Bar on the red color bar (watch the CRT or monitor display), and read the red bar amplitude on the LCD display.	Chrominance circuit gain.	15 seconds
8. Chroma Hue	With the camera still framed on the VR940 Color Bars Chart, press the CVA94 Vector Phase button and read the red bar phase on the LCD display. Reposition the Delta Bar on any other color bar to read its phase.	3.58 MHz Modulators	10 seconds
9. Chroma Saturation S/N	Frame the camera on the VR940 Red Chart, press the CVA94 SAT S/N button, and read the chroma saturation S/N on the LCD display.	Iris control, pickup device, prevideo and chrominance process stages	15 seconds
	Chroma Hue S/N		
10. Video Frequency Response	Frame the camera on the VR940 Registration/ Response Chart. On the video monitor, check the vertical wedges at the top and bottom of the pattern to see at what point the wedge lines blend together. Check the chart for the frequency calibration at that point.	Pickup device, luminance circuit aperture correct.	10 seconds

Total Test Procedure Time: Under 2 minutes

Total Customer Satisfaction For Camcorder Repairs

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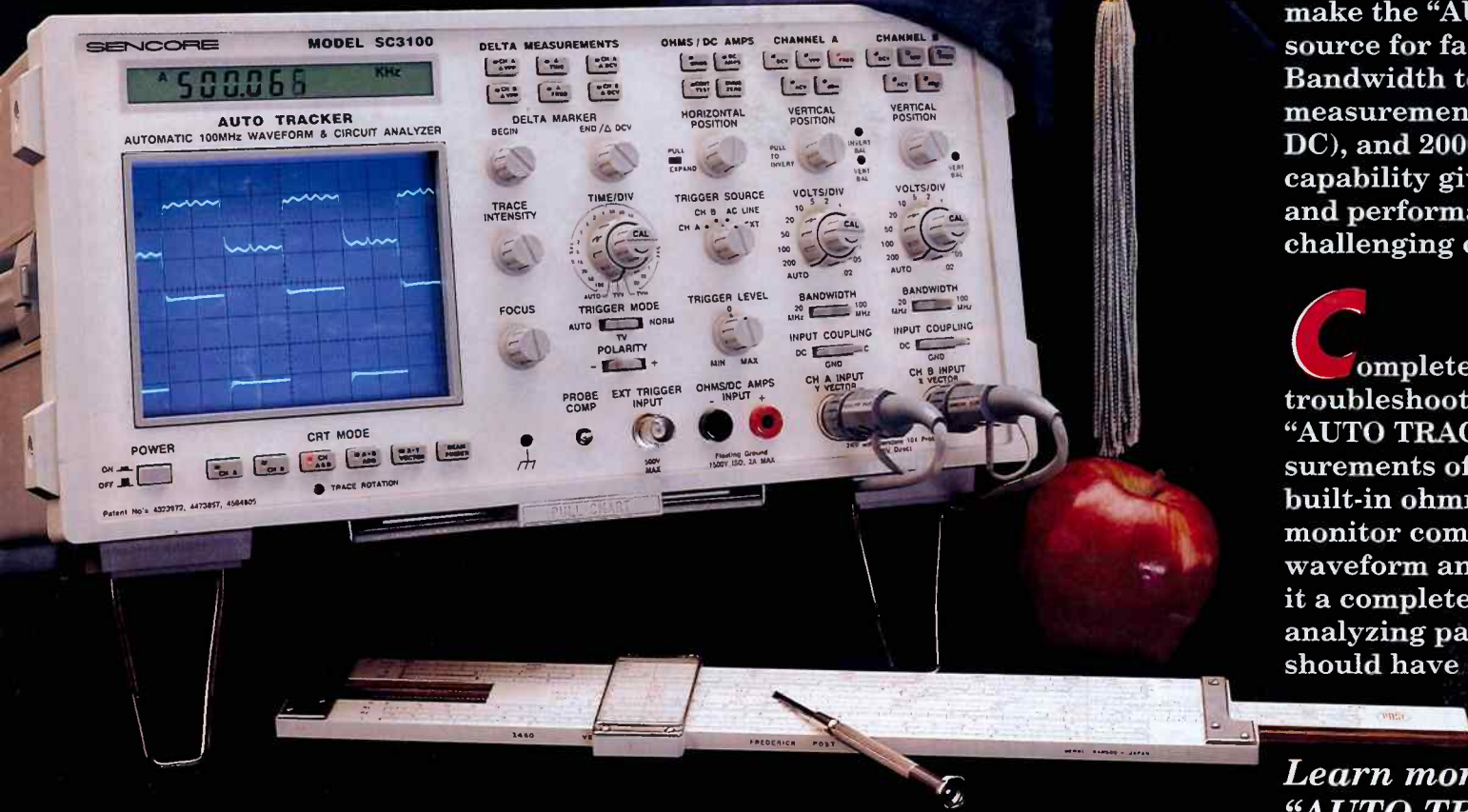
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