SENCORE NEWS

Issue #155 Nov./Dec. 1991

From Concept Thru Design . . .

New!

. . . Introducing The Only Complete Solution To Computer Monitor Troubleshooting

See Page 4

Sencore and IBM join forces to automate your service center — page 15

Call 1-800-SENCORE Today!

FAX 605/339-0317 (736-2673)

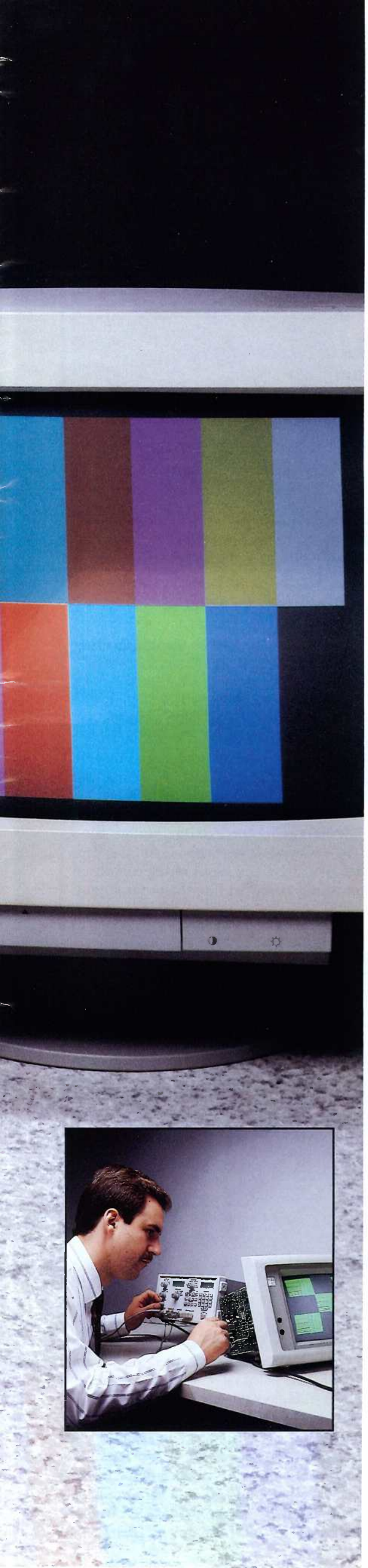
Introducing The Only Complete Solution For All Your Monitor Servicing Needs!

New!

CM2000 Computer Monitor Analyzer

Patented - A Sencore Exclusive!

The Only Analyzer That Helps You To Pinpoint Defects In All Computer Monitors!



We've Successfully Integrated All The Features Necessary For Complete Computer Monitor Servicing Into One Easy-To-Use Instrument

Now You Can Completely Test And Troubleshoot All High Resolution And Multi-Scan Computer Monitors From The Input Connector To The CRT... Guaranteed!

Here's What The CM2000 Offers You:

- Complete High Resolution Computer Monitor Analyzing
- Fully Programmable Scan Rate And Pixel Resolution
- Innovative Performance Testing Patterns
- Special Sync-Locked Substitution Signals
- Patented "Ringer" Test To Dynamically Analyze All:
  - Yokes
  - IHVT/Flybacks
  - Switching Transformers
- Integrated 2,000 DCV And PP Meter
- Exclusive "Hook-up" Adaptors Available
- Portable Troubleshooting For All Your Field Service Needs

Call 1-800-SENCORE ext. 792, (736-2673) and see what we've accomplished!

SENCORE

3200 Sencore Drive, Sioux Falls, South Dakota 57107

Circle #201 for FREE information.

Introducing

The New CM2000 Computer Monitor Analyzer

By Stan Warner, Application Engineer

- **All the signals needed to match the monitor under test**
- **Dynamic video patterns troubleshoot and performance test any monitor**
- **Special adaptors and portability let you troubleshoot monitors when and where needed**

On The Cover

Sencore's latest creation, the CM2000 Computer Monitor Analyzer is out of the design labs and into production. The article on page 4 tells you all about its features and benefits.

In This Issue

• Are you currently servicing computer monitors but need to improve your troubleshooting efficiency?

• Are your capabilities limited when a high resolution monitor comes in with a symptom of a collapsed raster?

• Do you have difficulty setting the correct frequency and pixel formats for making proper purity and convergence adjustments on high resolution color computer monitors?

• Are you able to locate single shorted turns in the most common computer monitor component failure?

If you've answered yes to any of the above questions, you could probably use some help with your computer monitor servicing. We believe we've got the answer for you.

After hundreds of hours of research and listening to servicers like yourself, we've developed what we believe is the best answer to computer monitor servicing. So whether you've been servicing computer monitors for years, or are looking to cash in on this growing service potential, you owe it to yourself to check out our newest analyzer.

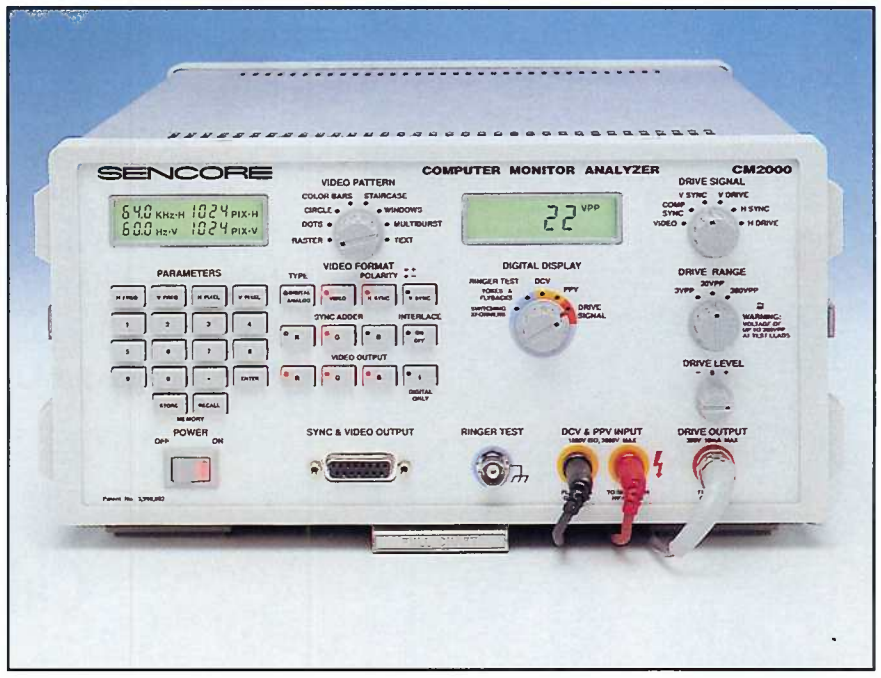


Fig. 1: The New CM2000 Computer Monitor Analyzer.

The new CM2000 Computer Monitor Analyzer is the only instrument that can completely test and troubleshoot high resolution and multi-scan computer monitors from the input connector to the CRT. This article introduces the CM2000 Computer Monitor Analyzer by showing you effective and profitable methods of servicing computer monitors.

The CM2000 Is A Complete, Easy-To-Use, High Resolution Computer Monitor Analyzer!

Until now, computer monitor troubleshooting was done with an RGB signal source: either an RGB signal generator or a computer and a graphics card. Servicers have told us neither of these were providing the tests or methods needed for finding all problems in computer monitors. A signal source alone doesn't allow you to get inside and troubleshoot a computer monitor – where the defect really lies.

The CM2000 Computer Monitor Analyzer is a complete analyzer. It provides a signal source to match and drive the input of the computer monitor under test (just like the other signal sources on the market), but in addition it provides troubleshooting features that help you quickly narrow problems to a single stage. The CM2000 provides you with tests for isolating problems in the video, CRT, vertical, horizontal, high voltage, and power supply circuits. If you have a computer monitor with a defect, the CM2000 will help you fix it.

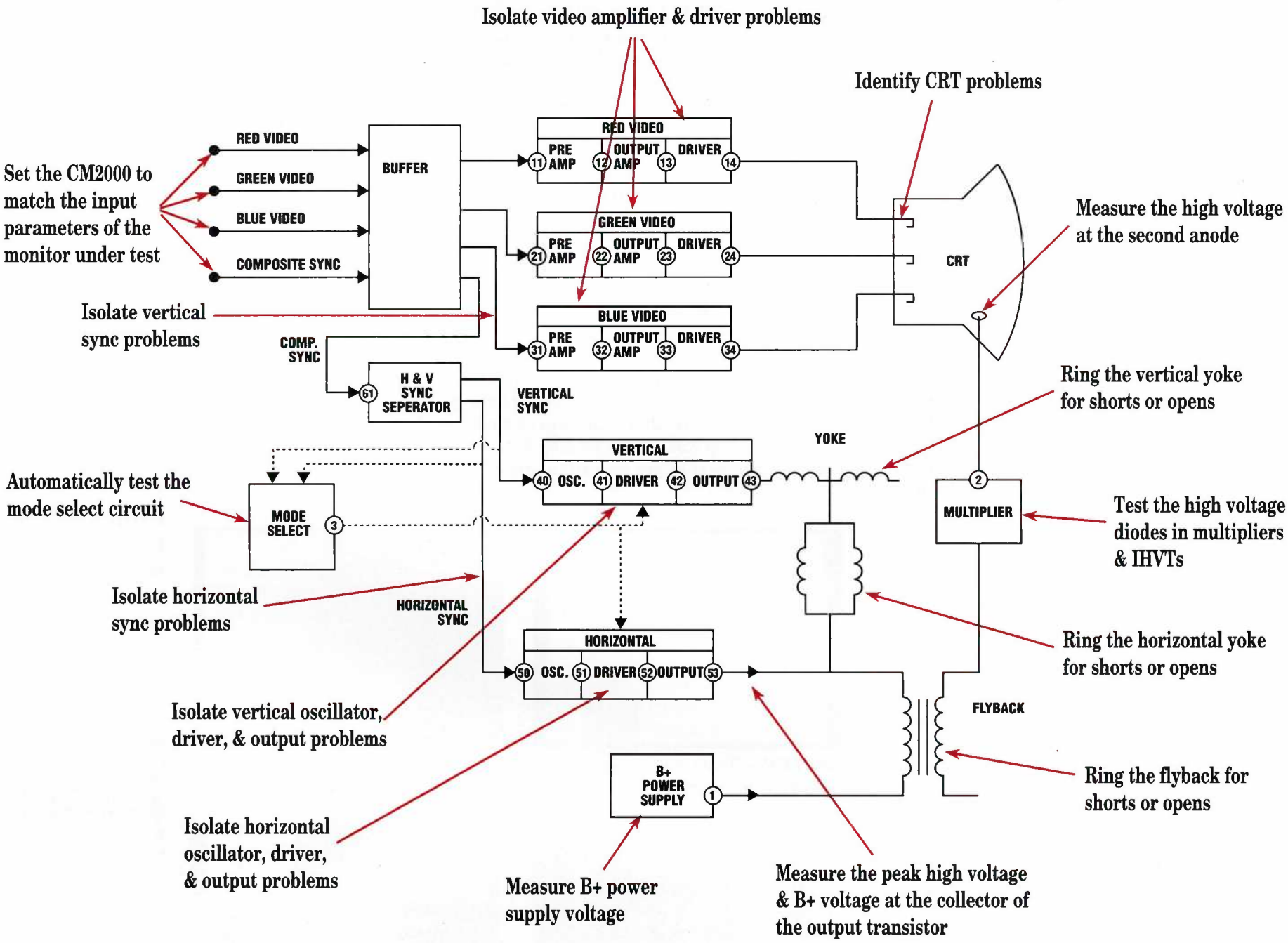


Fig. 2: Troubleshoot computer monitors from the input connector to the CRT with the CM2000.

Program The Sync Frequency And Number Of Pixels To Match The Monitor

To improve the resolution of the picture displayed on computer monitors, manufacturers have increased the scanning frequency and the number of displayed horizontal and vertical pixels. Common horizontal scan rates of computer monitors used in today's market include 18.4 kHz, 22.0 kHz, 31.5 kHz, 35 kHz and 48.4 kHz. But faster scanning (higher resolution) computer monitors are continually being introduced on the market, meaning the servicer must be flexible enough to service any computer monitor format.

In order to test these computer monitors, you need an instrument that can be programmed to generate both the horizontal and vertical scan frequencies of any computer monitor on the market. You need something that will work with the monitors on the market today as well as those that come out in the future.

The CM2000 Computer Monitor Analyzer lets you match the input requirements of the computer monitor under test with a fully programmable sync and pixel generator. Full programmability lets you test and troubleshoot the high resolution computer monitors in the field now plus any new formats introduced in the future.

You can analyze both analog and digital computer monitors with the CM2000. One button lets you pick the computer format: analog or digital. Plus the horizontal and vertical sync polarities can be set to either positive or negative to match the computer monitor's requirements.

Fig. 3: The CM2000 Computer Monitor Analyzer matches the input requirements of the computer monitor under test.

The CM2000 generates the non-interlaced signal required by most computer monitors as well as an interlaced signal. And for those monitors that require sync from a video line (usually green), you can add composite sync to any of the red, green, and/or blue signals.

The CM2000 has storage locations for the most common computer monitor types. Twenty of the most common monitor formats are already programmed into the CM2000's permanent memory. So instead of having to program in each of the signal parameters, you can quickly recall the setup you want and start testing. You also have 40 locations to store the most common non-standard formats you encounter for quick set-up and testing. And all of the information is non-volatile so you don't have to reprogram the data every time you remove power from the CM2000. The information is there when you need it – every time.

Performance Test And Troubleshoot With Dynamic Video Patterns

The image or pattern displayed on a computer monitor tells you what's happening inside the monitor. Many times you can pinpoint a defect

to an individual block or circuit just by evaluating the image on the CRT.

The CM2000 provides all the patterns you need for complete monitor troubleshooting and performance testing as shown in Fig. 4. Its dynamic patterns show you important symptoms and point you toward the real monitor defect. Here are the patterns you get with the CM2000:

RASTER - Use this pattern to check color purity and high voltage power supply regulation. The box should be pure white with no color hue when all the VIDEO OUTPUT buttons are "on". (It changes to black in negative video polarity.) In the positive video polarity, the box edges should remain straight and ripple free. The outside white border should remain straight and unchanged in either video polarity.

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

CIRCLE - The CIRCLE pattern provides a test of the monitor's linearity, and can be used to check dynamic convergence. Check that each line is straight and that each box is square and the same size throughout the raster. Also check that each circle is round with no visible distortion. If the CRT is converged properly, the lines will each be a single, white line instead of two or three colored lines.

COLOR BARS - The COLOR BARS pattern tests the monitor's ability to produce proper color. Check that each color bar is present. A missing bar, or wrong color sequence may indicate that a video channel is connected incorrectly or is defective. Also check that the colors are uniform in intensity from top to bottom and left to right. Non-uniform bars may indicate problems in the video amplifiers.

STAIRCASE - The STAIRCASE pattern tests the brightness and contrast linearity of analog and monochrome digital monitors. A properly working and adjusted analog or monochrome digital monitor will display 16 evenly spaced bars ranging from black to 100% white (or amber or green, depending on phosphor). Each step should have a sharp and distinct transition. The bars should be pure shades of gray with no hint of color.

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

MULTIBURST - The MULTIBURST pattern tests monitor resolution and bandwidth. The sets of vertical lines test horizontal pixel resolution and the sets of horizontal lines test vertical pixel resolution. The lines in each set are grouped according to pixel width. The lines in the first group are one pixel wide, the second group two pixels wide, the third group three pixels wide, etc. The one pixel wide lines should be individually discernible on a properly operating monitor.

TEXT - Use the CM2000's TEXT pattern to make a final performance test on the computer monitor. This pattern fills the screen with upper and lower case text characters that duplicate user conditions. All the characters on the screen should be focused and easy to read. This pattern is the best test for picture clarity.

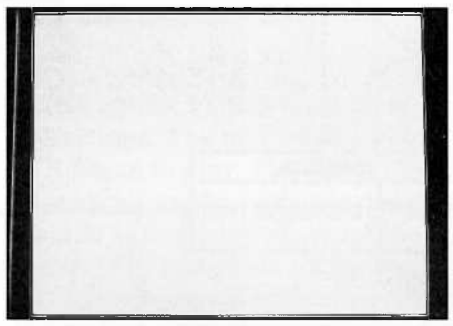
Improve Your Troubleshooting Efficiency With The Only Sync-Locked Signal Substitutor

If you've ever wrestled with isolating a defective monitor circuit, you know that often a problem in one stage creates misleading voltages and waveforms even in circuits that are working. Because of this, troubleshooting with only voltage readings and waveforms may lead you to waste time looking for problems in circuits that are operating properly.

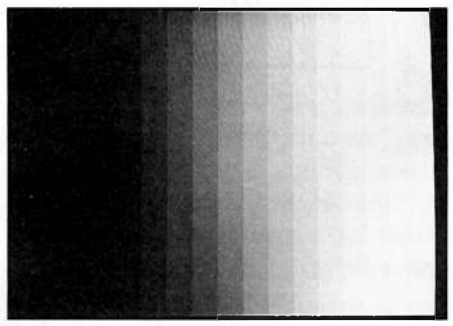
The CM2000 Computer Monitor Analyzer provides all the signals needed for functional analyzing using signal injection. Signal injection lets you inject a good signal into a stage as you watch the CRT. If the same problem appears, you are injecting before the defective circuit. If the problem clears up, you've injected after the defect. Signal injection troubleshooting helps you quickly narrow a problem down to a single circuit stage.

You can inject known-good substitute signals into the computer monitor's video circuits, sync circuits, and vertical and horizontal sweep circuits with the CM2000. From the input to the CRT, the CM2000 gives you all the signals you need to pinpoint any defect.

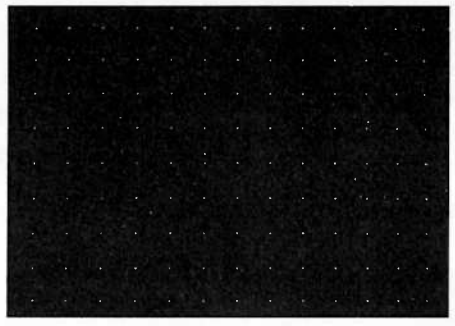
The exclusive drive signals also let you test high voltage diodes in IHVTs and multipliers. By confirming the condition of these components, you don't have to play guessing games or use expensive component substitution.



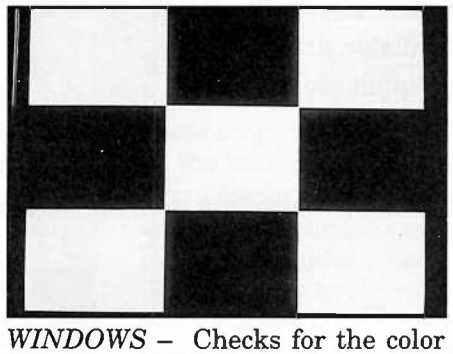
RASTER – Tests purity as well as power supply regulation.



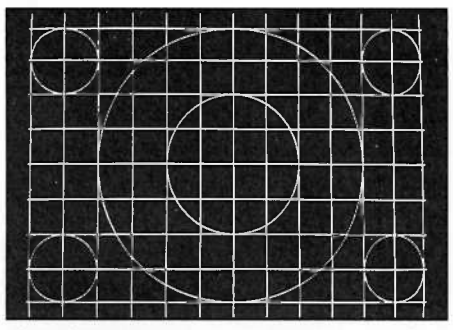
STAIRCASE – Tests for luminance linearity and gray scale.



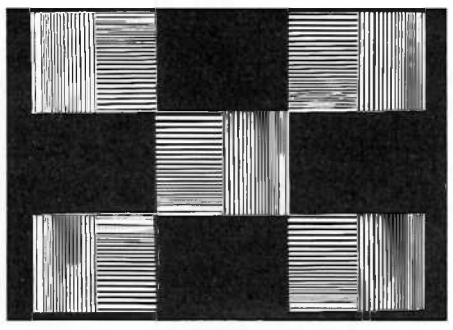
DOTS – Used for convergence checks.



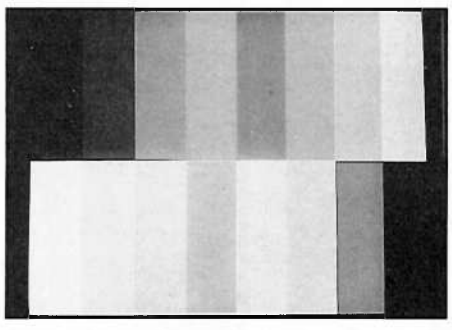
WINDOWS – Checks for the color and brightness uniformity.



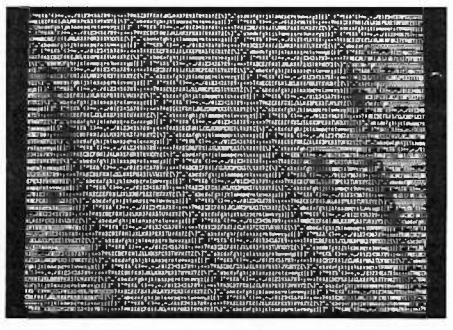
CIRCLE – Tests the computer monitor's linearity.



MULTIBURST–Tests for bandwidth and resolution.



COLOR BARS – Provides dynamic check of RGB lines.



TEXT – Tests for picture clarity under typical operator conditions.

Fig. 4: The CM2000's video patterns give you complete troubleshooting and performance testing capabilities.

Pinpoint Bad Components With The Patented Ringer Test

Flybacks are very high failure items in computer monitors due to the constant high voltage and high current stress. It was reported in a recent *Service News* article that, "Larger users are reporting more than a 50% fatality rate of their VGA monitors." The major source of the problem was reported to be defective flyback transformers. Yokes and switching transformers are also on the high failure list.

Without good troubleshooting procedures and test equipment, horizontal output problems can be difficult to isolate because the components interact so closely, and the failure of any component often creates the same symptom: a dead monitor. While an ohmmeter will detect an open winding in a yoke or flyback, it can't find the most common defect – a shorted turn.

The CM2000 employs the patented Ringer Test that finds open and shorted turns in flyback transformers, yokes, and switching transformers. The test is so accurate, it will detect even a single shorted turn. You even get a GOOD/BAD indication with the CM2000 leaving no doubt of the component's condition. That means no more guessing and no more expensive inventory for parts substitution.

Gain Maximum Efficiency With The Built-In DCV And PPV Meter

Troubleshooting efficiency comes from having all of your instruments where you need them. The less switching you have between instruments, the better off you are.

The CM2000 contains a DC volt and peak-to-peak meter so you don't have to reach for another meter every time you need to take a voltage reading. The meter in the CM2000 is designed exclusively for computer monitor troubleshooting. Unlike competitive DVMs, it has both AC and DC input protection up to 2,000 volts so you can even measure the signal at the collector of the horizontal output transistor without risk of damage.

Take The Portable CM2000 Where You Go For Servicing Flexibility

Computer monitor service is not always confined to the bench. You'll often be called on-site to determine if the customer's problem is the monitor or the signal source feeding the monitor. You may also be called to do on-site alignments on permanently mounted setups.

The CM2000 has been designed with field service in mind. Its rugged construction absorbs the knocks and bumps of on-site service. It's a compact, lightweight unit making it easy to carry. The optional PC263 Protective Cover snaps onto the front panel to protect the CM2000 from getting bumped and scratched as you move the unit between the site and your service vehicle.

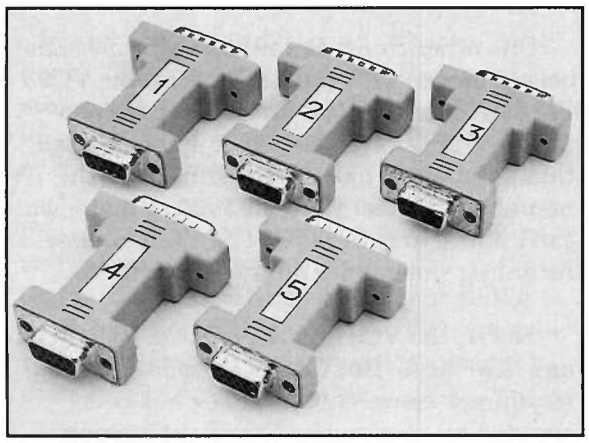


Fig. 6: A variety of connectors are available for quick hookup to common computer monitor types.

Another Opportunity – Time To Take Advantage

The similarities between video circuits and computer monitors make the transition into monitor service a natural for any video servicer. The opportunity for substantial added profit is available with only a small investment in equipment – the CM2000 Computer Monitor Analyzer. The CM2000 is your vehicle for expanding your business into the profitable industrial, school, commercial, and medical fields.

Have questions? Ready to try one on your bench? Call your Area Sales Engineer toll-free at **1-800-SENCORE**. We'll answer your questions and help put a CM2000 on your bench to use with your applications. ■

Circle Fast Facts # 250 for more information on the CM2000 Computer Monitor Analyzer.

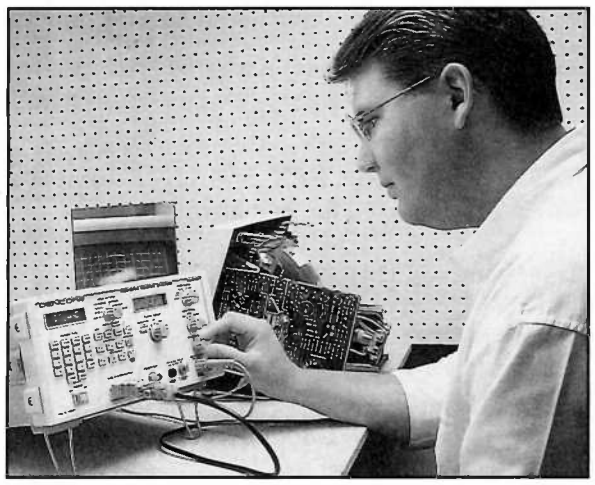


Fig. 5: Signal injection isolates computer monitor defects down to a single stage.

Exclusive Time-Saving Adaptors Make Hook-Up A Breeze

Just as there are a wide variety of computer monitor types, there are also a wide variety of input connectors: 9 pin D-sub, 15 pin D-sub, 15 pin high-density D-sub, BNC, etc. Some computer monitor types use identical connector jack types but have different wiring configurations.

Building connectors for each of the common computer monitor types can be a time consuming task. First, you'd need to find a source for the connectors. Then you'd need to find out all of the wiring configurations. And finally, you'd need to wire up the connectors. Most servicers don't have the time or resources necessary to invest into this process.

The CM2000 has connectors available that match the output of the CM2000 to the input of the monitor under test. These connectors are available for all of the common computer monitor types. You simply hook up the monitor and start testing.

Specifications

Video Bandwidth
98 MHz.

Horizontal Sync
Range: 10.0 kHz to 250 kHz.
Steps: 10.0 kHz to 99.9 kHz, .1 kHz
and 100 kHz to 250 kHz, 1 kHz.
Level: 5 VPP.
Polarity: (+) or (-)

Vertical Sync
Range: 10.0 Hz to 250 Hz.
Steps: 10.0 Hz to 99.9 Hz - .1 Hz.
100 Hz to 250 Hz - 1 Hz.
Level: 5 VPP.
Polarity: (+) or (-)

Digital Signal Format
Level: 5 VPP.
Polarity: (+) or (-)
Video Output: Red, green, blue, and intensity.

Analog Signal Format
Level: 0.714 VPP.
Polarity: (+) or (-)
Sync Adder: Red, green, blue.
Mode: Non-interlace or interlace.
Video Output: Red, green, blue.

Composite Sync
Level: 5 VPP (negative polarity).

Video Patterns
Raster, dots, circle, color bars, staircase, windows, multiburst, and text.

Horizontal Resolution
Range: 80 pixels to 1,024 pixels in one pixel steps.

Vertical Resolution
Range: 80 pixels to 1,024 pixels in one pixel steps.

Memory
Includes 20 preset computer monitor setups and 40 user-programmable memory setups.

Digital Display (Autoranging)

Ringer Test
Accuracy: ± 1 count on readings between 8 and 13 rings.
Resolution: ± 1 count.

DC Voltmeter
Ranges: Three ranges - 0.00 to 19.99 V,
20.0 to 199.9 V,
and 200 to 1999 V
Accuracy: ± 0.5% ± 2 counts.
Resolution: 10 mV on 20 V range, .1 V on 200 V range, and 1 V on 2000 V range.
Input Impedance: 15 megohms ± 1%.

Peak-To-Peak Voltmeter
Ranges: Three ranges - 0.0 to 19.9 V,
20 to 199 V,
and 200 to 1999 V
Accuracy: ± 1% ± 2 counts.
Frequency Response: 30 Hz to 5 MHz ± 1 dB on 20 V range.
30 Hz to 250 kHz ±1 dB on 199 V and 2000 V ranges.
Resolution: .1 V on 20 V range
1 V on 200 V and 2000 V ranges
Input Impedance: 15 megohm shunted by less than 40 pF.

Drive Signals
All drive signals are phase-locked to the SYNC & VIDEO OUTPUT.
Signals: Video, Composite Sync, Vertical Sync, Vertical Drive, Horizontal Sync, Horizontal Drive.
Range: 3 ranges - 0.0 to 3.0 VPP
0 to 30 VPP
and 0 to 300 VPP
Accuracy: ±1% (± 2 digits for H DRIVE signal)

General
Size: 6" x 11.5" x 15" (15.2 x 29.1 x 38.1 cm) HWD.
Weight: 16 lbs (7.3 kg).
Power: 105-130 VAC 60 Hz.
Displays: LCD readout for FREQUENCY and PIXEL parameters.
3 1/2 digit LCD readout for DRIVE OUTPUT/DVM.

Supplied Accessories
39G264 DVM Test Leads
39G221 Direct Test Lead

Optional Accessories
39B271 Extension Cable
39B273 Universal Adaptor Cable
Interface Adaptor #1: 39B275 (CGA-MDA-Hercules)
#2: 39B280 (EGA)
#3: 39B281 (PGC)
#4: 39B274 (VGA-PS/2)
#5: 39B276 (Apple-Mac)
#6: 39B272 (BNC)
IB72 IEEE 488 Bus Interface Accessory
IB78 RS232 Interface Accessory
TP212 10 kV Transient Protector Probe
HP200 50 kV Hi-Voltage Probe
PC263 Protective Cover

LETTERS To The Editor

Editor's Note: Thank you for your generous response to our request for letters and feedback. We've received many letters worthy of publishing, and we'll print as many as space allows.

We will continue to print viewpoints that represent the Sencore News' entire readership, not just one subject or part of the country. So read on to see what's affecting your business and the electronics industry.

VCR Analyzer Report

Just wanted to drop you people a line and let you know how our new VC93 is working out for us. We've only had it a couple months, but we're already wondering how we got along without it before.

We work on mostly the VHS and S-VHS formats here at the school [Muskegon Community College], although an occasional odd format will filter in among our VCRs. The VC93 has been a lifesaver for us. We've identified several video head problems that we wouldn't have found without this equipment. We've also run across a couple rotary transformer problems that could have turned into nightmares without the VC93 to back us up. The equipment just plain helps us get the job done fast and reliably.

Every VCR that crosses our bench, we test with the VC93. The servo test tells us right away if the servos are working correctly. It saves us a lot of time and reduces rework later down the road. And the fact that we can perform the test without having to take the cover off the VCR is as convenient as it gets. There aren't too many machines that can take complicated circuits and signals and give you a simple GOOD/BAD reading. We've found at least two VCRs that appeared to be working, but showed up BAD with our VC93. Without this test, these decks would have been back on our bench in no time.

Being able to use the VA62A with our VC93 has also been a great help. The external patterns help us find a variety of problems in VCRs. We also run through all the cable channels on the VCR tuners to make sure they're working right. The VA62A/VC93 team gives us everything we need for all our VCR service work.

One other thing. Recording test tapes has been a breeze with the line outs on the VC93. We don't have to hook up any resistor networks or anything. Just hook up and record, that's the way I like things: simple. With manufacturer test tapes at $300 or more, we can't afford to ruin them. The VC93 makes recording work tapes all the easier for us.

So far, the VC93 has saved us a lot of grief and heartache. But until we tried the VC93, we did not know. Our servicing has been speeded up tremendously and the support we've had from the factory has been more than helpful.

Frank Thomas
Muskegon, MI

Feedback On The Auto-Z

After discussing my service center's situations and needs with one of the gentlemen at Sencore about one year ago, I put the LC102 Auto-Z meter on my TV troubleshooting bench. Since that first day, I've discovered that I wasn't actually providing my customers with the absolute best service I could, because I was actually spending more time per repair and missing with some of my estimates.

Over this past year the Auto-Z has helped me with several challenges that ordinarily would have cost me time and money. I can remember one instance where the Auto-Z saved my backside in a vertical circuit. Since that day I've found that not only the caps in-circuit can go bad, but also many replacement caps will have incorrect values, opens, leakage, or ESR. I don't know what I'd do without my LC102.

I've also discovered that the LC102 can be of great help when diagnosing flybacks. The LC102 has proven to be 100% accurate and has never lied to me when testing for shorted windings. I even use the Auto-Z to catch high potential shorts or arcs by applying 800-900 volts across windings. I don't know how a shop can accurately troubleshoot without the LC102 Auto-Z.

To this time I've used most everything on the Auto-Z, and I find the articles on how to test caps and coils very beneficial. Please keep the good material coming. You'll never know the full benefits of the support you've been providing.

John Cunningham
Campbellford, Ontario

Parts Distributor Correction

We couldn't help but notice the omission of CitiTronix from your 7/15/91 release of the Sencore Parts Supply Sources brochure. We believe CitiTronix deserves to be included in the list and we hope you'll add our name to future printings of this fine informational source.

CitiTronix, Inc. has been a wholesale distributor of electronic and appliance parts for 55 years. We are an authorized parts distributor for Sanyo, Fisher, Sylvania, Sony, GE, Technics, RCA, Quasar, Panasonic, Philco, and Magnavox. We also carry a broad range of generic substitute parts, batteries, chemicals, tools, antennas, and special repair and test items.

Located at 1641 Dielman Road in St. Louis, MO. 63132-1597, CitiTronix provides the following telephone, FAX, and LINK numbers which may be used for any purpose:

Telephone — (314)-427-3420
1-800-383-1641
(8AM - 5PM M-F) (9AM - 1PM Sat)

FAX (24 Hours) — (314)-427-3360
1-800-387-8587

LINK (24 Hours) — (314)-427-5424
1-800-779-LINK

Victor P. Holec
CitiTronix
St. Louis, MO

Editor's Note: You're right. We inadvertently left CitiTronix, Inc. off the last printing of our parts supply brochure. We regret the omission, and CitiTronix will be included in the next printing.

We Invite Your Letters

The *Sencore News* welcomes letters from its readers. We encourage mail on subjects ranging from troubleshooting tips to feedback on *Sencore News* articles. Address the letters to:

Letters To The Editor
Sencore
3200 Sencore Dr.
Sioux Falls, SD 57107

We reserve the right to edit letters for space and clarity. All submitted material becomes property of Sencore.

Use The Instrument That Shows You The Whole Picture

FS74A CHANNELIZER Sr.

Double Patented – A Sencore Exclusive!

IEEE 488 BUS-COMPATIBLE

RS232 Compatible

Only The FS74A Allows You To See The Picture, Hear The Audio, Plus Measure The Critical Levels, Ratios, Hum, And Noise In Just Seconds. . .

In today's CATV/MATV market, one of the most important concerns is providing good service to your customers. The only way a customer can judge the quality of your service is by the picture that comes into his home or business. The customer is not concerned about how many dBs or what the Hum level of the signal is. These are measurements used to help the technician analyze his system. That's why it is important for technicians to check all the parameters of the signal including the actual picture.

The Sencore FS74A allows you to measure signals all the way from the headend to the subscriber's tap, and actually see what the customer is seeing in full detail with the built-in monitor. The FS74A Channelizer Sr. is the only instrument that provides both on-channel and off-channel analyzing. You simply tune the channel and take the reading. There's no faster or more accurate method!

Here's Some Of The Things You Can Do With Your FS74A Channelizer Sr.—

• Digitally tune to any cable sub-band, VHF, UHF, HRC, ICC, and FM channel quickly and automatically for fast RF level measurements

• Exclusive -46 dB sensitivity with autoranging attenuator lets you test signals you previously couldn't — it's excellent for leakage testing

• Automatic fine tuning with the frequency offset readout on any channel with 1 kHz resolution — tests frequency accuracy anywhere on the system

• Exclusive "on-channel" automatic tests allow you to measure all important system parameters in seconds, including...
  Automatic A/V ratio — without calculation!
  Patented S/N Ratio — uses the actual on-channel noise reference!
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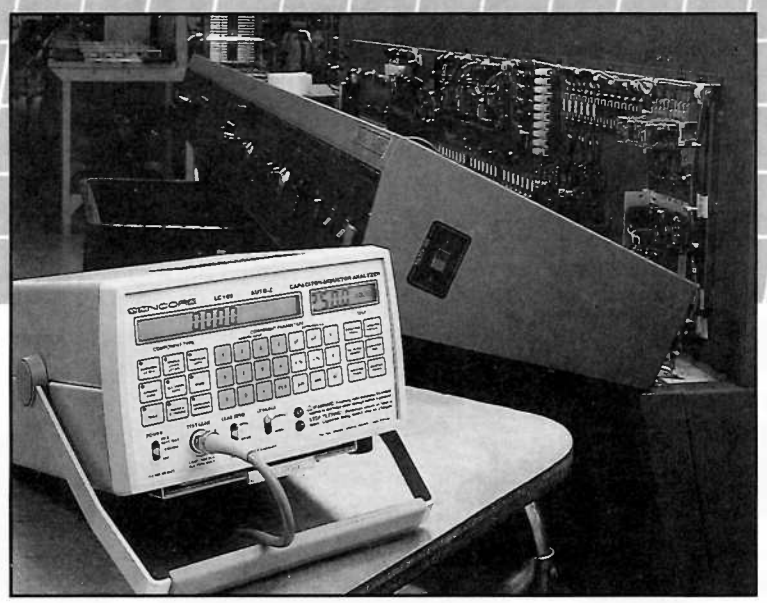


How The LC102 Auto-Z Takes The Costly Guesswork Out Of Industrial Component Testing

By Brad Johnson, Technical Writer

- **Identify component values and confirm the parts are correct**
- **Test high-voltage components under in-circuit conditions**
- **Confirm the condition of replacement parts**

Problems in capacitors and inductors can reduce the efficiency of any engineer or technician. There were only two methods of dealing with these components before the advent of the Z Meters and the LC102 Auto-Z: substitution, or testing them with an impedance bridge. Both methods are costly because of the time wasted in trying to confirm whether a capacitor or inductor is good or bad. Substitution, for example, must assume that the component used to make the substitution is good. This is not always the case. The bridge, on the other hand, is both time consuming to operate and results in questionable readings with some components, especially electrolytic capacitors.

Every department, from Design Engineering to Production to Service, must deal with different types of capacitor and inductor problems. The Auto-Z is now being used by all types of industrial engineers and technicians to quickly and accurately confirm which components are good and which are bad.

The LC102 Auto-Z offers fully automatic tests of capacitance and inductance value. The Auto-Z automatically selects the proper range, places the decimal, and converts the reading to a standard multiplier value. The value is then compared to the limits you've programmed into memory and displays the results as "GOOD" or "BAD".

A value test alone, however, will not locate all types of defective components. In capacitors, for example, improper value accounts for only about 25% of all component failures. Leakage at the applied voltage, excessive dielectric absorption, and equivalent series resistance (ESR) make up the other 75%. The Auto-Z backs up its value tests with dynamic tests under true circuit conditions for capacitors and inductors.

This article is based on the input from many industrial Auto-Z users. We have broken these industrial applications into ten different categories because each has different needs for accurate capacitor and coil testing. The flow chart in Fig. 1 shows the steps a product takes from its initial design to the hands of the customer. The article is organized to follow this same flow.

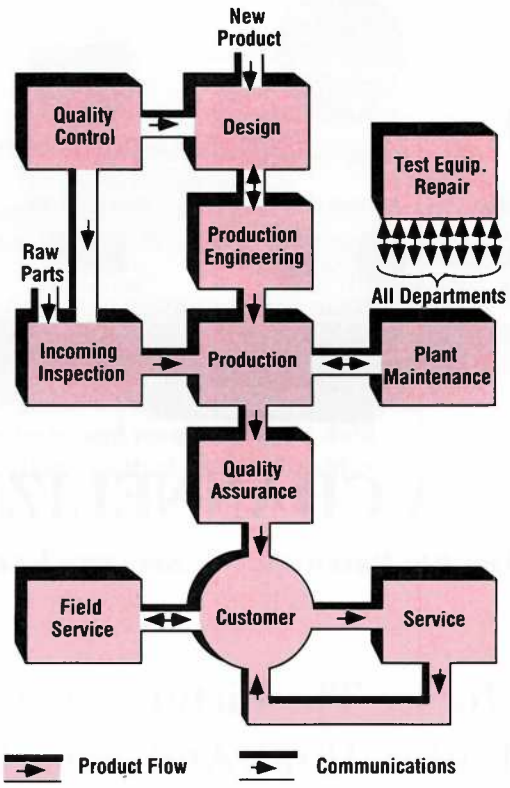


Fig. 1: Each of these ten departments have different needs that are satisfied by the Auto-Z. This article covers all ten.

1. The design engineer specifies component values from samples

One of the design engineer's biggest problems is that theory must be made to work in actual circuits. Some paper theory does not work exactly as intended when the circuit is built on a breadboard. Capacitors often must be paralleled with the original specified value until the circuit provides the desired results. Coils must often be wound by hand because the delays for a sample from the supplier are just too long. At other times, a known coil must be modified by removing turns or by changing the core material to get a value that will work in the circuit.

Once the circuit works properly, the engineer has a new problem. The correct component value (to replace the hand-made part or the combination of parts) must be specified to the component supplier. The direct readings of capacitance or inductance supplied by the Auto-Z offer an answer here. The engineer simply connects the component to the Auto-Z, presses a button, and gets an immediate reading of the component value.

The engineer's job would be difficult enough, but Murphy's Law (if anything can go wrong, it will) adds even more problems. Some sample parts, for example, are not the same value as marked. And other times, a component taken from stock is not good. In either case, the engineer may design an entire circuit around a defective part. The circuit will work fine (after changing other component values), but then not work when it is duplicated, component by component, on another prototype unit.

One engineer related an experience where all of the sample parts had the same defect. A whole series of prototype units were built and worked fine. But, when the circuit was sent to the production line, none of the units would work. The engineer ended up designing the unit on the production line in order to get the units to pass the tests. Oddly enough, the circuit that resulted was closer to the theoretical paper design than the ones used in the prototypes. The cause was a batch of capacitors that were all marked with the wrong value. He assumed they were correctly marked and specified the marked value in the circuit. The parts that were used in production were the actual marked value but would not work in the circuit because the circuit was designed around the prototype capacitor. Problems like this can be avoided by testing

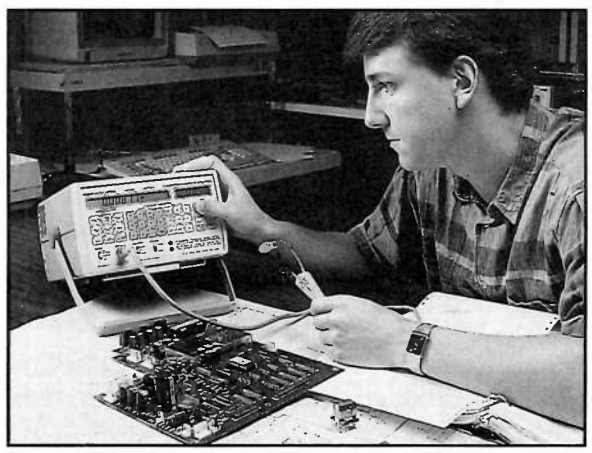


Fig. 2: The design engineer must often determine the exact value of a sample part in order to specify the correct value for the circuit.

every component before it is actually used in the circuit. This is true of both new sample parts and standard parts pulled off the shelf. Most engineers do not make these important tests because the only instrument they have to do the tests is a time-consuming impedance bridge. The autoranging, direct-reading Auto-Z allows you to test every component value before the circuit is actually built – preventing subsequent headaches.

Bridges are not only difficult to use, they are also inaccurate when testing for true capacitance value of electrolytic capacitors. As one engineer pointed out, "You can adjust the bridge to give you practically any value you want on an electrolytic by simply varying the amount of signal applied to the capacitor."

The Auto-Z reads true capacitance value because it measures capacitance using the actual amount of DC voltage that appears on the capacitor after charging it through a high accuracy resistor. The Auto-Z confirms the capacitor will work properly in-circuit because it not only tests capacitor value but also capacitor leakage (at full rated voltage), dielectric absorption, and ESR. Coils too, are tested for true inductance value and ringing ability with the Auto-Z's exclusive tests.

2. Engineering Quality Control confirms the parts are correct

The design engineer works very closely with the Engineering Quality Control (QC) engineer to make sure that all of the components specified for a new circuit meet minimum quality requirements. The QC engineer confirms that a given component is within its rated specifications for parameters such as power, voltage, current, and frequency response. The QC engineer tests the worst-case conditions as well. These tests confirm that the components will not change with age or temperature, that the components will with-

Fig. 3: The Auto-Z helps the QC engineer determine what components failed during a destructive overload test.

stand all expected overload conditions, and that the entire circuit is safe.

The QC engineer's first job, confirming the components will work properly, involves many tests of value and voltage rating. Capacitors, for example, must have the proper tolerance. They should not show excessive leakage at their rated voltage. They must not exhibit dielectric absorption or ESR which may affect their operation under in-circuit conditions. Coils must also have the proper tolerance. Adjustable coils must have the proper tuning range. Every one of these factors is easily tested with the fully automatic tests of the Auto-Z.

The destructive testing done by QC often involves "detective" work. The QC engineer is often instructed to push the circuits to their limits until something goes wrong. But what is done when the circuits actually fail? First, the defective component must be located. The Auto-Z helps here because capacitors, coils, SCRs, and other components can be tested for "GOOD/BAD" results with fast, reliable tests.

Then the QC engineer must be able to document why the component failed. Did a capacitor change in value? Did it become leaky or shorted? Did a coil develop a shorted turn? The Auto-Z answers all of these questions and more so the QC engineer can properly report the condition to the designer for improvement.

3. Production Engineering must troubleshoot new circuits

The new product moves from the designer to the production engineer who must build enough prototype units to assure that the production line has proper tooling, tests, and procedures. The production engineer has additional problems because many of the parts

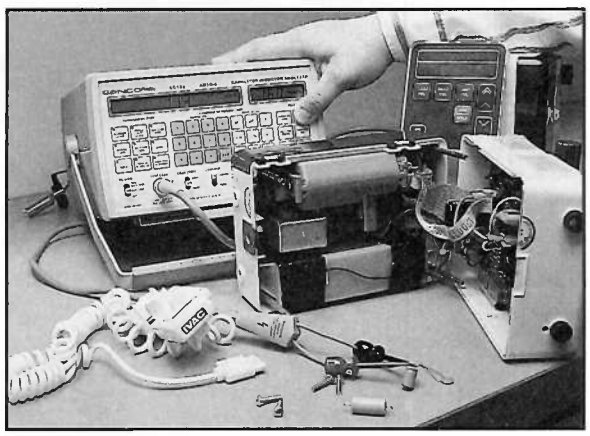


Fig. 4: The Auto-Z helps the production engineer who must troubleshoot circuits that have just been developed in Engineering. Many of the components used have not been tested in Incoming Inspection and the Auto-Z helps sort them out.

used are not identical to the ones that will be used in actual production. The parts, in many cases, have not gone through all of the Incoming Inspection steps that will be used to weed out bad parts in actual production. Wrong-value or defective parts may find their way into the prototype units which must be found before the unit can be made to work.

A second problem is that the production engineer is usually the first person, other than the designer, who has to troubleshoot a new circuit. He usually is not as familiar with the circuit as the designer who has worked with the circuit for months. He also does not have the experience of servicing hundreds of units, like the production technician.

The Auto-Z helps keep the efficiency of the production engineer high in two ways. First, the Auto-Z can be used to test the components before they are actually installed into the circuit. This, in effect, allows the production engineer to set up his own little incoming inspection test to prevent defective components from getting into the prototype unit in the first place.

Second, when there is a problem in one or more of the prototypes, the production engineer uses the Auto-Z to confirm that the actual defect is located. This scenario also applies to the technician that will have to troubleshoot the product later. Knowing what type of failures occur in the prototypes often helps the production engineer train the production technicians that will be working on this unit on the final assembly line. The Auto-Z identifies not only which components are defective, but also what actually went wrong with them.

4. Incoming Inspection tests thousands of components

The Incoming Inspection department's job is to screen raw parts to prevent bad components from going to the production line. Some companies test all parts and others only test a sample of the parts. The Auto-Z offers alternatives for companies requiring low or high volume testing.

Larger companies often use computer-controlled component testers for Incoming Inspection testing. The Auto-Z, interfaceable to IEEE 488 and RS232 computer formats, is an excellent analyzer to use for high volume testing. The Auto-Z can confirm the test results when an unusual condition arises. It also allows non-technical personnel to test high volumes of components, saving labor costs.

The LC102 Auto-Z also allows small sample batches to be tested without the need of setting up a computer program or an entire process of instructions. This is particularly important when a small batch of components arrives which must be tested immediately. The small batch may be the result of a backorder which was filled after the main parts shipped. Or perhaps a production line ran out of a capacitor or coil unexpectedly, requiring a special emergency order.

The leakage test and power supply of the Auto-Z are not usually found on other testers. The leakage test is important to confirm that the capacitor not only has the proper value but will also work properly at the rated voltage. The Auto-Z, used as a spot check or a thorough component analyzer, offers one more quality checkpoint on capacitors passing through Incoming Inspection.

We talked to an Incoming Inspection supervisor at a medium sized electronics plant recently about the leakage test. He told us, "The LC102 is much faster than setting up a

Fig. 5: The Auto-Z is ideal in Incoming Inspection applications because the tests are complete, automatic, and fast.

power supply and current meter to check leakage. I don't know of any other instrument that is better suited for bench testing applications than the Auto-Z."

The Auto-Z's leakage voltage may also be used for special tests on other components, especially SCRs and triacs. The Auto-Z, along with the SCR250 SCR & Triac Test Accessory, tests SCRs and triacs for breakdown under load to catch even the marginal components.

One computer manufacturing company is using the leakage voltage to test for breakdown voltages between the windings of a power transformer after the inductance test is used to check the coils themselves. Another manufacturer is using it for a general purpose test of potentiometers. A third manufacturer, who builds CRT displays in the northeast, uses the Auto-Z to confirm that the deflection yokes are good before they are installed into the final assembly. The patented Ringing test, which gives a simple GOOD/BAD readout of the yoke's quality, replaces the time-consuming process they had used previously of actually installing every yoke onto a CRT to see if it would work properly.

These tests, of course, are secondary to the main tests of capacitance and inductance. They add extra versatility and usefulness to the Auto-Z to allow a single instrument to replace several others which are usually more expensive than the Auto-Z in the first place.

5. Production line analyzers fight tolerance build-up

The efficiency of a production line analyzer is usually quite high after the production line has been running for a few days. Many of the same problems are seen again and again, so the analyzer begins to remember the cause of the problem in the last unit and applies it to the one on his bench. Tolerances on different batches of parts, however, can cause the analyzer's efficiency to suddenly drop.

Capacitors and inductors are usually purchased in large volumes. The delivery of parts may be spread out over several months for a large production run. A batch of components that comes in one week may have a slightly different tolerance than those received another week. Both may be within the component manufacturer's limits but the analyzer is faced with the fact that two or more component tolerances may be at their limits in opposite directions. Suddenly, he is faced with a backlog of units with the same defect.

The Auto-Z lets the production line analyzer confirm that the tolerances of different components have not suddenly changed. The Auto-Z does not require any more time to check the value of a capacitor or coil than required for checking the value of a resistor with an ohmmeter. All that is necessary is to connect the component, press the CAPACITANCE VALUE or INDUCTANCE VALUE button, and read the value. Many technicians report that the Auto-Z is as basic a troubleshooting tool and necessary as a digital voltmeter.

The Auto-Z can also reduce the tendency of some analyzers to "shotgun" a problem. Some, for example, may change a part and then run the unit back through the test position to see

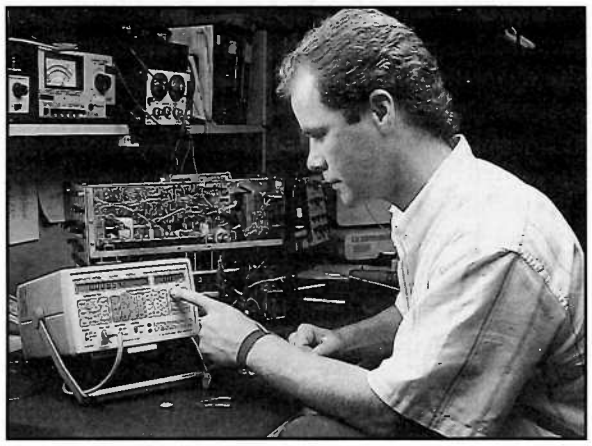


Fig. 6: The Auto-Z helps the production analyzer locate problems caused by bad parts or by tolerance build-up in batches of parts.

if the problem has been corrected. If not, he may change one or two more parts and try again. Eventually, the defective part is located and the unit goes through the test. His pride usually prevents him from going back and having the other parts (that were not the problem) put back into the unit.

This can be particularly embarrassing to the Quality Department when the "defective" parts left at the end of the production run are returned to the supplier for credit. They will, of course, check perfectly good because they were returned in error. The extra reject components may also play havoc with the records kept about the reliability of a supplier's quality because an excessive number of parts have been called "defective".

6. Industrial Engineering affects dozens of jobs

Modern production facilities depend heavily on automated equipment to simplify manufacturing. An automated conveyor assembly or numerically controlled punch press, for example, may provide the sub-assemblies needed by dozens or hundreds of other production workers. The industrial engineer must be able to get right to the problem and repair the unit as quickly as possible or all of the other people on the production line may find themselves standing idle or, in extreme cases, on layoff.

The power supply section of production equipment is often the cause of breakdown. Power supplies found in this equipment are often "brute force" types. They typically include large transformers, filter capacitors, chokes, high current rectifiers, and SCR control circuits. Power supply components are very bulky and difficult to ship which may delay replacements several days or even weeks. One power supply manufacturer in Atlanta told us it costs over $50 to ship a power supply module because a power transformer, which weighs more than 20 pounds, is included in the shipping weight. If the problem in the supply happens to be a bad filter, do you think the shipping cost and downtime is necessary?

The Auto-Z allows the entire power supply to be analyzed so that individual components are identified as the cause of the defect. This allows the supply to be repaired on the spot rather than waiting for the new supply to arrive by air-freight or truck. The wide capacitance range of the Auto-Z allows capacitors up to 20 farads to be tested accurately. Power transformers, inductors, and chokes to 20 henries are also accurately tested. The Auto-Z even tests rectifiers and SCRs so all parts of the power supply can be analyzed with a single instrument.

The Auto-Z is a valuable tool for keeping large industrial equipment running with the least amount of downtime. Problems in circuits other than the power supply can also be isolated since they usually include capacitors, coils, diodes, and SCRs.

Fig. 7: The Auto-Z helps the industrial technician keep the equipment on the production line operating properly to prevent costly downtime.

7. Production line quality assurance must isolate defects

The QA engineer is the final quality testing point before the finished product is shipped to the customer. The QA engineer is often thought of as a "policeman" who makes sure everyone on the production line is doing his or her job. But this is only part of the job. There are times when the specified procedures and tests were made on the production line but some defect goes undetected because of the type of test performed or the way in which it is specified.

QA rejects of this type are often tricky to document. The product usually works but does not meet some specification under a given set of conditions. The QA engineer must often locate the component that is responsible for improper operation in order to turn the information over to Engineering to find a solution. The component may be affected by a tolerance build-up similar to that we discussed on the production line itself. Other times, a component may change value during aging or "burn-in".

The Auto-Z is an effective tool in determining exactly what did go wrong. Individual components, for example, may be tested before and after an aging period to see if they are changing in value. The Auto-Z helps provide the data that proves there actually is a problem that must be further researched by another department.

8. Test Equipment Lab works with a small component inventory

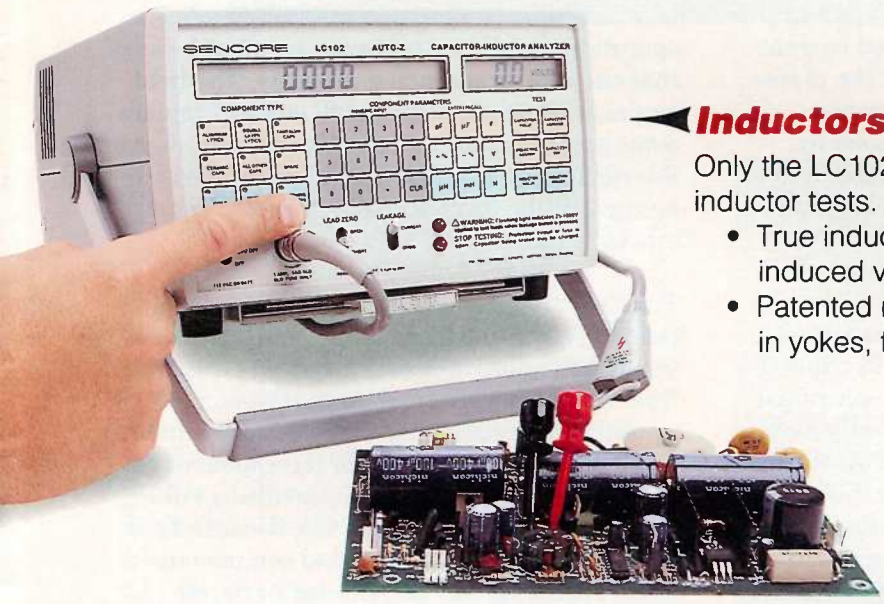
The test equipment technician maintains the equipment used by all of the other departments. The equipment being serviced may be a one-of-a-kind instrument designed in-house

What Components Are Causing You To Lose Valuable Servicing Time...

Capacitors?

Only the patented LC102 Auto-Z allows you to catch all capacitor defects.

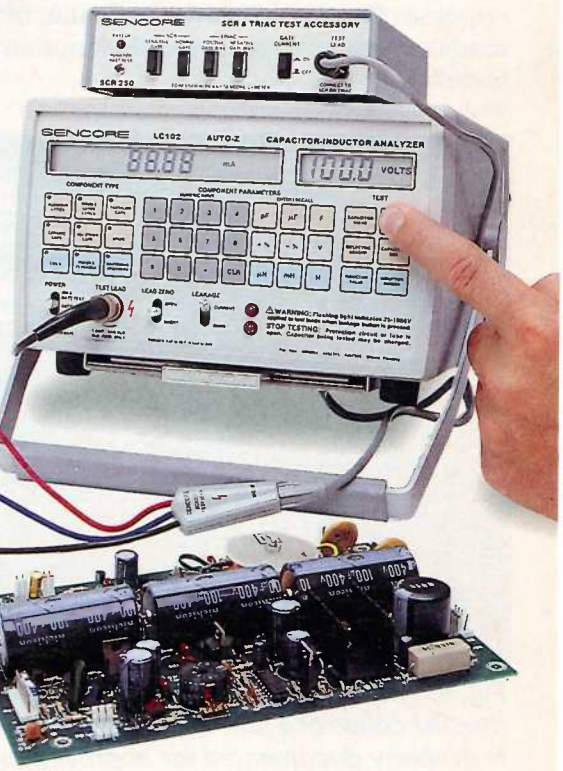
- Capacitor value to 20 farads to test even memory back-up and storage caps.
- Leakage with up to 1,000 volts applied simulates actual circuit operation.
- Dielectric Absorption (voltage recovery) shows you how the cap responds in-circuit.
- Equivalent Series Resistance (resistance of the leads, plates, solder connections, etc.) especially important in newer high frequency circuits.



Inductors?

Only the LC102 Auto-Z provides two patented inductor tests.

- True inductance value to 20 Henries measures the induced voltage versus the inductive reactance.
- Patented ringer test catches even single shorted turns in yokes, flybacks, and many other coils.

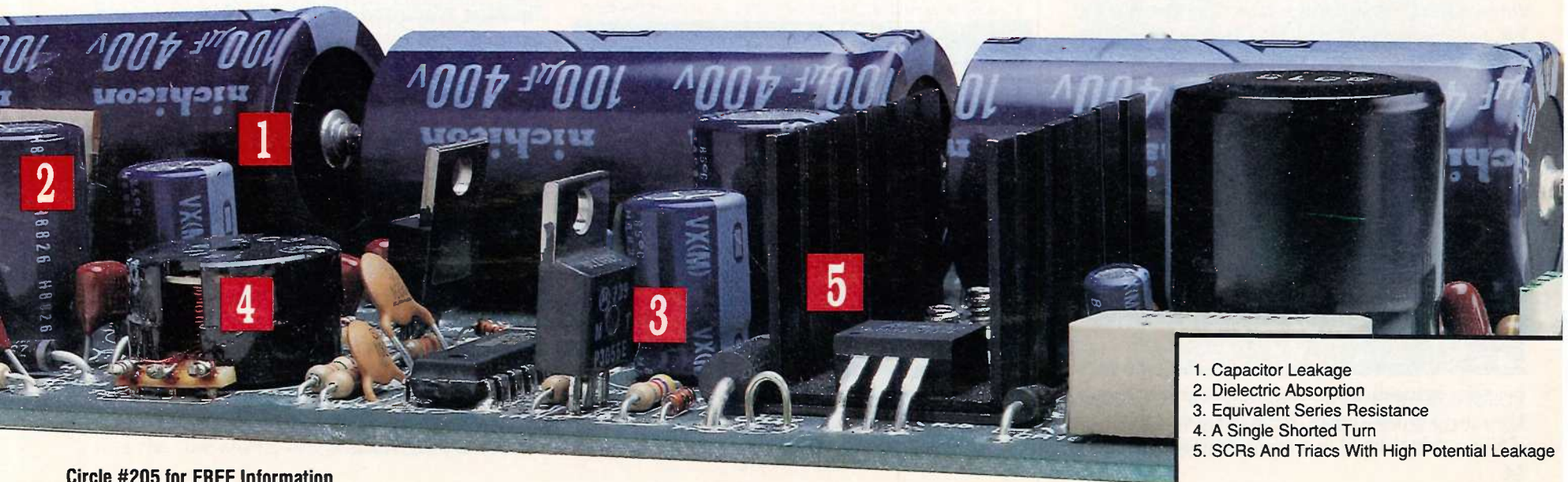


SCRs, Triacs, And Other Components?

Only the LC102 Auto-Z allows you to dynamically test special components with 100% reliability.

- Test SCRs and triacs for turn-on and leakage with up to 1,000 volts applied eliminating swapping.
- Hi-Pot breakdown testing to catch arcing and hidden failures.
- Cable and transmission line tests pinpoints the distance to opens and shorts, even in buried cable.
- Hi-Voltage diode test checks for leakage at full operating voltage.
- Plus, you get portable on-site use for all tests.

If You're Unable To Find All Five Of These Defects Below, Call 1-800-SENCORE For Free Technical Information!



1. Capacitor Leakage
2. Dielectric Absorption
3. Equivalent Series Resistance
4. A Single Shorted Turn
5. SCRs And Triacs With High Potential Leakage

Circle #205 for FREE Information

for a special test or it may be an instrument purchased from an outside vendor as a basic calibration or service tool. One of the test equipment technician's biggest problems is a lack of replacement parts needed to keep the instruments working properly.

Equipment that is purchased from other suppliers often has special parts that are only available from the original manufacturer. A stock of one of the most common parts may be maintained, but many of the components, especially capacitors, tend to go bad sitting on the shelf. The technician needs to confirm the part's condition before the labor of installing it is expended, and the cost of analyzing the induced problem is spent.

Many parts are not kept in stock and must be special ordered from the original supplier. Here again, the technician should confirm that the suspected part is actually bad so there is a high confidence level that replacing the part will correct the problem. This prevents building an expensive inventory of special parts that are ordered and not needed.

Special parts can also be substituted with standard replacement parts in many cases. Here, the replacement part should be tested first to make sure that it is going to perform properly in the circuit. The correct value may require a series or parallel combination of standard parts to meet the special value required. The Auto-Z allows the value of these combinations to be confirmed before they are installed.

Fig. 8: The Auto-Z helps the QA engineer confirm the cause of a problem so the information is properly documented for improvement.

The test equipment lab often takes older equipment apart to save special parts such as transformers, coils, and capacitors for help in maintaining other equipment. The Auto-Z plays an important role here because every salvaged part can be tested before being placed into stock. Then, when the part is eventually needed, it should be tested again to make sure that it has not gone bad while sitting on the shelf.

9. Service Department must confirm that parts are good

The service technician, like other technicians, must be able to confirm a part as being defective. The efficiency of the technician is greatly reduced when it is necessary to guess the cause of the defect. This is especially true if the product has been subjected to some sort of unusual condition such as a power supply surge. Many components which don't normally fail may be damaged. It is just as important to be able to confirm which components are good. The efficiency of the technician may be greatly reduced if many extra parts are changed which have no defect. The Auto-Z lets the technician identify both the good and the bad parts to confirm the repair was done correctly.

The Service Department has a special problem that is not seen by the other departments in the company. Many of the replacement parts the department uses have been sitting in stock since the unit was originally produced. Several years may pass before the product is actually serviced and requires parts. Many of these parts, especially electrolytic capacitors, will go bad sitting on the shelf. The two most common electrolytic problems caused by aging are excessive leakage and dielectric absorption.

Leakage can often be corrected by application of the full rated voltage with limited current until the aluminum oxide layer on the plates of the capacitor is built up to the proper thickness. This cannot always be done by installing the capacitor into the circuit it is to be used, because too much current may cause permanent damage to the capacitor or, in some cases, cause the capacitor to explode.

The limited current supplied by the Auto-Z leakage power supply, however, will allow the capacitor to be reformed at a safe, controlled rate. The leakage current is constantly monitored with the current meter of the Auto-Z so you can tell when the reforming process is completed. If the leakage does not drop below the GOOD/BAD point for that size capacitor after several hours of reforming, the capacitor should be discarded as it is not reforming properly.

The Auto-Z is supplied with the special button holder accessory shown in Fig. 10. This accessory is simply placed between the handle and the leakage button to supply the reforming voltage. This procedure is much safer than using a locking type button. The technician knows that there is the potential of a shock hazard while reforming high voltage capacitors because the handle is placed in front of the Auto-Z to hold the button. There is also a warning light that flashes when more than 25 volts is applied to the test leads.

Excessive leakage can often be corrected, but dielectric absorption is a different matter because it indicates that the capacitor is beginning to physically dry out. Our lab tests show that a capacitor with dielectric absorption cannot be successfully restored and should not be used in a critical circuit.

Fig. 9: The service technician must often use parts that have been sitting in stock for several years. The Auto-Z allows each to be tested before it is used in the circuit.

The test is simple to perform with the Auto-Z. You simply push the DIELECTRIC ABSORPTION button and read the percentage on the LCD display. A "BAD" reading indicates the capacitor's effective capacitance will be much lower than specified when a DC voltage is applied. Knowing this, the technician can avoid the trouble of putting a bad capacitor into the circuit which can cause new symptoms and reduce the overall troubleshooting efficiency.

10. Field service engineers have limited replacement inventory

The function of the field service engineer often involves operational questions. Before the field engineer can answer the customer's operation questions, however, he must be sure that the unit is operating properly. The field engineer often carries a small stock of replacement parts but most companies cannot afford the expense of supplying a full set of parts because of the limited space available in tool kits or vehicles.

The field engineer must be able to confirm that a given component is the actual cause of the defect before ordering a special component from the factory. A problem that appears to be caused by one component may actually involve more than one component or a component in another circuit. The Auto-Z provides a valuable tool for this technician too, because he is able to test all of the suspected components to make sure that only the needed parts are ordered and to make sure that every needed part is on the order.

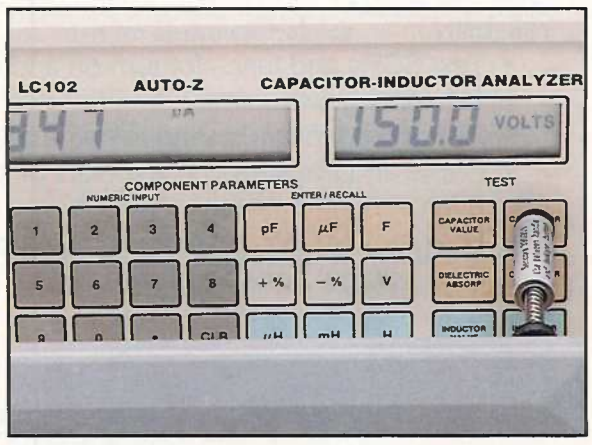
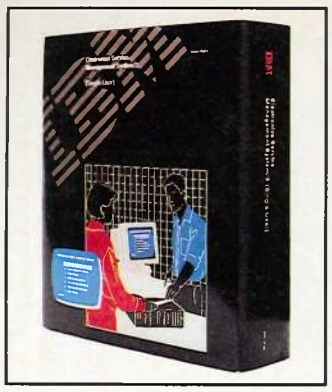


Fig. 10: The Button Holder Accessory, supplied with the Auto-Z, allows you to reform high leakage electrolytics with the leakage power supply.

How Do You Find Out More About The LC102 Auto-Z?

Your Area Sales Engineer can help you answer specific questions about your own applications. Call the factory directly for additional technical details or information about ordering your own Auto-Z. Simply call toll-free **1-800-SENCORE**. We'll listen to your needs and help come up with a solution. ■

Circle Fast Facts #252 for more information on the LC102 Auto-Z.



Sencore And IBM Join Forces To Bring You IBM ESMS/2

(Electronics Service Management System)

By Bill Godwin, Application Engineer

Sencore and IBM have teamed up to bring you the most complete, customized, and easy-to-use Service Management System on the market today. Before you discover the many benefits of ESMS/2 ask yourself these questions:

• Have you ever been embarrassed to admit to a customer that you don't know where their unit is in the repair process?

• Have you ever had a customer pick up their unit because it has been sitting waiting for parts you thought were ordered?

• Do you ever wish you had the right information to better operate your business in areas such as parts usage, technician efficiency, and job assignments, to name just a few.

• Wouldn't it be nice to be able to have a letter sent to your customers on the status of their repairs?

• Do you get frustrated waiting for your warranty claims to be paid knowing that you have dollars tied up in a repair?

IBM Has The Answer To These Questions And It's Available Through Sencore. . .

The Answer Is IBM ESMS/2

Sencore has been dedicated to the electronic service industry for over 40 years. We've earned the reputation of bringing you innovative test instruments backed by training, service, and support unmatched in the industry.

Now partners with IBM, Sencore offers you an innovative, time saving, **business tool** that will help you manage your service center more effectively.

IBM ESMS/2 is an electronics service management software system that will improve the overall efficiency of your service center. This easy-to-use software system helps your business in several ways to increase your bottom line profits. Discover some of the IBM ESMS/2 features in the illustration below:

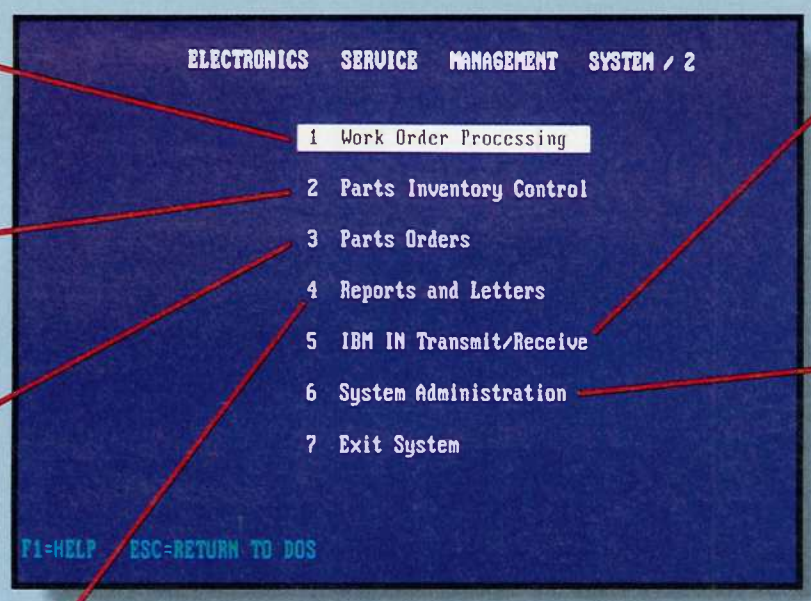
IBM ESMS/2 . . .

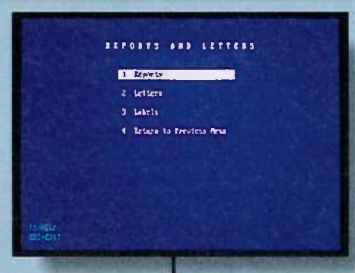
Improves work order handling by reducing paperwork and improved tracking of the job as it moves through your service center. You will see improved efficiency in assigning jobs, more accurate productivity reports, and parts usage information.

Improves parts inventory management. Easy-to-understand IBM ESMS/2 screens simplify parts ordering, tracking, and allocation of inventory parts. Automatic stock level ordering helps you reduce your inventory costs and assures that you have the right parts on hand.

Gives you better quality information to manage your business. This information includes daily/weekly/monthly reports on aged accounts receivable, cash drawer deposit, parts inventory and usage, technician performance, and sales register.

In addition, you can improve your customer service with customized letters for service authorization, estimates, unclaimed merchandise, repair status, not to mention mailing labels.





System Administration

Makes processing warranty claims with manufacturers faster with increased accuracy. The system uses the work order tracking process to automatically create a warranty claim. ESMS/2 then allows you to send the information to the proper manufacturer using X12 ANS EIA standard format. Because this is all done electronically, your processing time improves greatly which results in improved cash flow.

Last but not least, the IBM ESMS/2 *is easy-to-use and ready-to-use*. The system requires virtually no computer experience and features easy-to-follow menus and help screens.

How To Order Or Learn More About IBM ESMS/2:

It's as simple as calling **1-800-SENCORE** and asking for our ESMS/2 representative. We have financing available or you can add it to your current Sencore account. Either way it's as easy as ordering a piece of test equipment. In addition, Sencore has a trained specialist ready to help you with questions that you may have once you receive your IBM ESMS/2 system. We also have hardware solutions if you do not have a computer.

Call 1-800-SENCORE today and ask for our IBM ESMS/2 representative. You will be taking an important step towards better managing your service business.

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CR70 "BEAM BUILDER"® Universal CRT Analyzer And Restorer

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

- **Test Every CRT (Old Or New) On The Market—No Need To Buy Additional Sockets**
- **Exclusive Tests Cover CRT's Full Dynamic Range, From Cutoff To Peak Emission—For Highest Test Reliability**
- **Guaranteed To Safely Restore 9 Out Of 10 Weak Or Shorted CRTs—Or Your Money Back**
- **Guaranteed To Be Totally Protected From Damage From Charged CRTs—Keeps Your Investment Working For You**

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NSN 6625-01-187-4395
Circle #210 for more information

PR57 "POWERITE"® Variable Isolation Transformer And Safety Analyzer

One Totally Integrated Supply Lets You Know Your AC Power Is Right And Safe

- **Variable Isolated 470 Watt Power Transformer To Isolate Your AC Line And Vary Your Output Voltage From 0 To 140 Volts**
- **Voltage, Current, And Wattage Power Monitor To Determine That The Equipment Under Test Is Not Drawing Excessive Current (Or Wattage) At Any Voltage Setting**
- **AC Line Leakage Safety Tester To Assure That Excessive Leakage Current Is Not Present On Any Exposed Part On The Equipment Being Tested**

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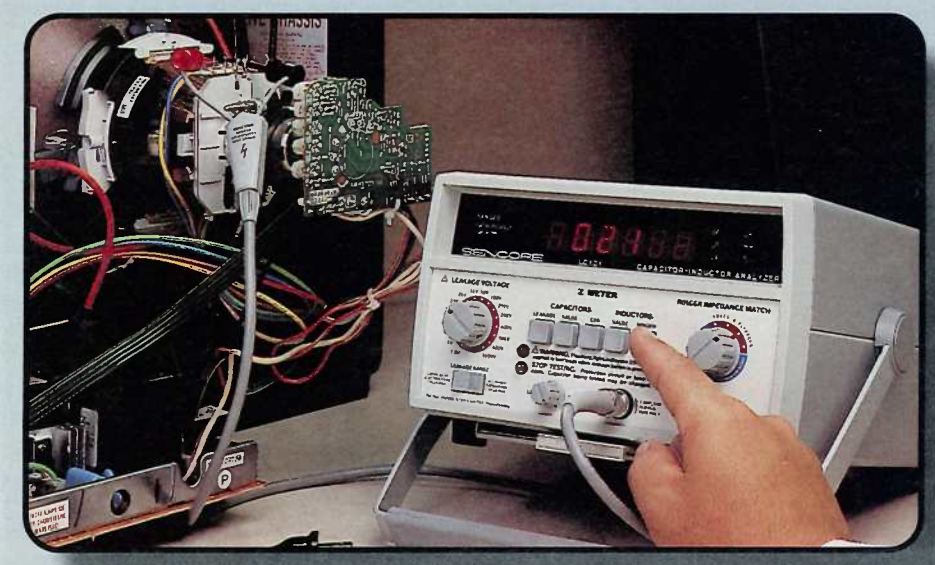
LC101 Z Meter™ Capacitor-Inductor Analyzer



Dynamically Analyzes Capacitors And Inductors With 100% Reliability For Defects That All Other Testers Miss, Guaranteed Or Your Money Back!

- **Exclusive Dynamic Tests Analyze Capacitors For:**
  - Value - Dielectric Absorption
  - Leakage - Equivalent Series Resistance (ESR)
- **Dynamically Analyzes True Inductance Value And Effective "Q" (Quality) With A Patented Ringer Test**
- **Dynamically Analyzes SCRs, Triacs, High Voltage Diodes, And Transmission Lines**
- **Checks Leakage As Low As One Microamp With Up To 1000 Volts Applied In Cables, Switches, PC Boards, And Connectors**

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Four Patents
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SG80 AM Stereo - FM Stereo Analyzer

Pinpoint AM Stereo And FM Stereo Receiver Problems From The Antenna To The Output With The Only AM Stereo - FM Stereo Analyzer

- **Every AM And FM Signal You Need To Troubleshoot And Performance Test Any AM Stereo Or FM Stereo Receiver**
- **Rock Solid Digital Tuning Gives You Fast, Accurate, Channel-By-Channel Control**
- **Microprocessor Calibrated Attenuator Provides Accurate Signal Levels**
- **Patented Analyzing Signals – For Both AM Stereo And FM Stereo Receivers**
- **Exclusive Tuneable IF Sweep**
- **Isolated Audio Drive Signal**
- **High Quality Signals Tell You The Receiver Is Operating At Peak Performance**
- **Automate Your Testing With IEEE Or RS232 Interface**

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Patented
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PA81 Stereo Power Amplifier Analyzer

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

- **Twin, Frequency Compensated Autoranged Wattmeters Make The Job A Snap**
- **Built-In EIA/IHF Testing Components At Your Fingertips**
- **Monitor Sound Quality At Every Step To Prevent Backtracking**
- **RMS And dB Audio Signal Tracing Ability Ties Down Troubles In Any Driver Stage**
- **Prevent Amplifier Damage And Save Time With The DC Balance Test**
- **Audio Line Test Ensures The Input Signal To The Amplifier Is "OK"**
- **Stereo Separation Tests To 126 dB**

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FC71 Portable 10 Hz to 1 GHz Frequency Counter™

The Only Portable Counter Designed To Measure 10 Hz To 1 GHz At .5 PPM Accuracy In High RF Environments

- **Exceeds FCC Accuracy Requirements; .5 Parts Per Million**
- **Exclusive Microprocessor Time Base For Super Stability From 12° F to 122° F**
- **Measures All Signals, Even Noisy Signals**
- **Super 5 mV Average Sensitivity Over Full Range**
- **Automatic Crystal Check Tests The Fundamental Frequency Of Any Crystal**
- **Gives Nine Hours Of Continuous Battery Operation On One Charge**
- **Double Shielded For Interference-Free Frequency Measurements Anywhere**
- **Automatic Readings With IEEE 488 Computer Interface Or RS232**

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Patented
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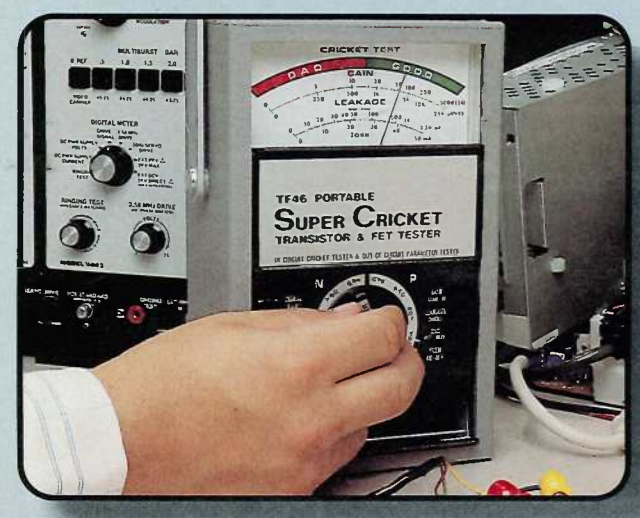

TF46 Portable Super Cricket Transistor/FET Tester

Test Any Transistor Or FET With 99% Reliability In Less Than 15 Seconds—In Or Out Of Circuit

- **Patented IN-CIRCUIT "Go/No-Go" Transistor/FET Test**
- **Now More Automatic Than Ever**
- **Needs No Setup Book Or Instructions**
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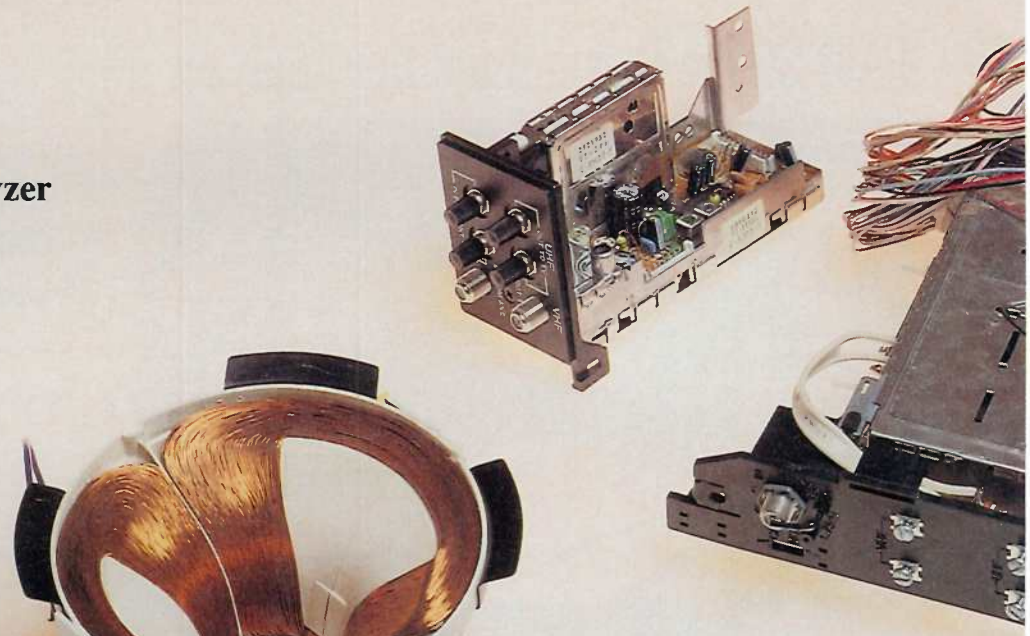
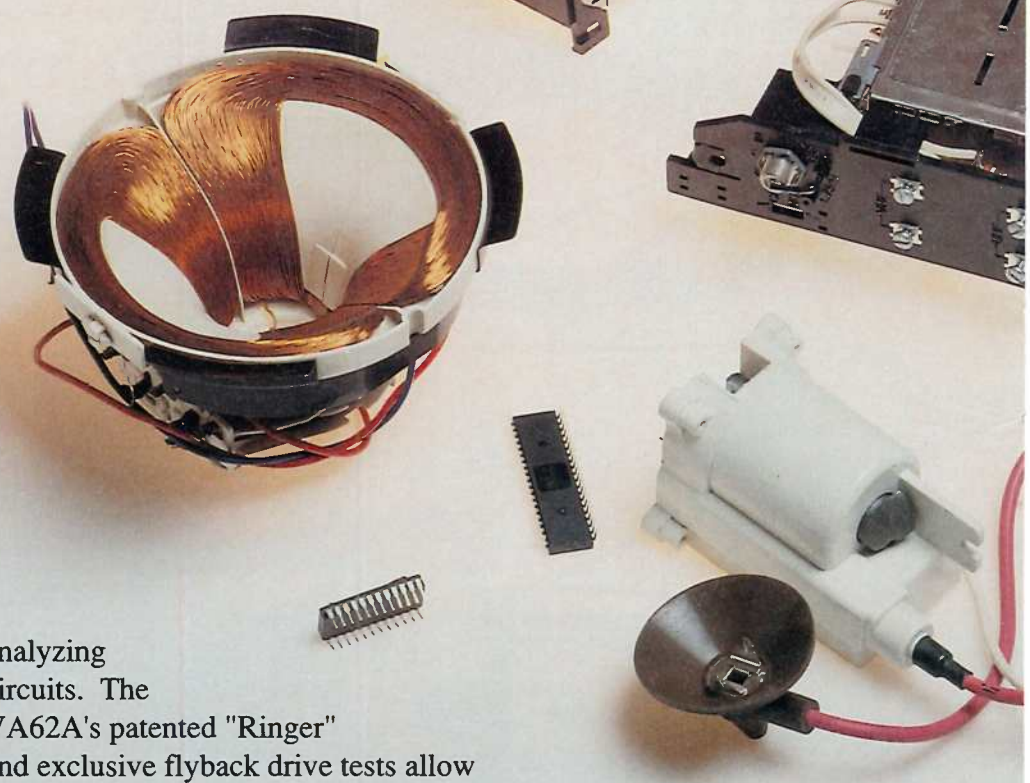
Isolate These And Other Major Components In All TVs And VCRs—

Guaranteed Or Your Money Back!

VA62A Universal Video Analyzer





Plus, Cut Your Video Troubleshooting Time By 54%* With The Patented VA62A Universal Video Analyzer!

Identify tuner problems with the only integrated all-channel, VHF, UHF, and cable RF generator. Standard TV, standard cable (2-99), and exclusive programmable cable channels eliminate the question "Is it the TV or is it the cable?"

Pinpoint IF troubles with modulated troubleshooting signals and exclusive programmable IF generator. How do you presently identify if the suspected defect is in the AGC, IF/Detector IC, or caused by the tuner? Wouldn't you like to know exactly where the defect is before you order the part or pull the tuner. With the VA62A you will!

Exclusive video patterns completely performance test TVs, VCRs, and monitors — without removing the cover. Is there a picture, is it locked in, is the bandwidth correct, is the brightness and contrast correct, and is the color tint and saturation correct? You'll know in less than 60 seconds using the VA62A's exclusive video patterns.

Find defective stages, without disconnecting parts, with exclusive phase-locked drive signals. "Swamp out" the suspect signal and replace it with a known-good signal. You'll isolate the problem to a bad stage in minutes, guaranteed.

Test yokes and flybacks with the patented "Ringer". Most shops are forced to substitute yokes and flybacks instead of analyzing circuits. The VA62A's patented "Ringer" and exclusive flyback drive tests allow you to completely analyze all yokes, flybacks, and IHVTs before you order a new one.

Measure signal levels with a fully autoranged PPV and DCV digital meter. The VA62A's built-in meter shows when you are driving into a shorted circuit and prevents you from overdriving critical stages. Plus, measure bias voltages and signal levels throughout the entire TV and VCR.

It's obsolete proof: Update for new technology with exclusive phase-locked accessories. We'll provide new companion units as the manufacturers announce new formats, test patterns, etc. This makes your VA62A a protected investment.

* Based on a nationwide survey of users who reported an average time savings of 54% compared to their previous test equipment.

For More Details Call 1-800-SENCORE

(736-2673)

Circle #207 for FREE information

Increase Your Productivity And Reap Big Dividends With The VA62A Universal Video Analyzer

By Glen Kropuenske, Application Engineer

- **Duplicate any channel or signal strength**
- **Test high performance circuits with dynamic patterns**
- **Identify defective IHVTs and yokes with exclusive tests**

The consumer video service business is in a continuous state of change. The new and improved video products needing service include large-screen color TVs, projection TVs, stereo TVs, VCRs, camcorders, and the list goes on. These products have improved video circuits, digital tuners, comb filters, integrated components, and specialty parts – all posing new servicing challenges. These new challenges seem overwhelming as the old familiar profitable circuits and components become less common.

Out With The Old – In With The New

As old technology slips away, so must many of our entrenched business practices and troubleshooting techniques. A basic scope, transistor tester, and multimeter can no longer serve as the mainstay of the test bench.

New technology brings more opportunity than at any time in electronic servicing history. But the new technology requires an investment in greater understanding and troubleshooting capabilities. The proper knowledge coupled with good test equipment provides the capabilities needed to take advantage of these new opportunities. It expands our capability and ensures a bright future in the ever-changing video service business.

The Sencore VA62A Universal Video Analyzer can insure a bright future for you in video service. The VA62A solves video problems quickly and builds your confidence to a new level so you can tackle new circuits and technology advancements. Let's take a closer look.

Test Digital Tuners With Any VHF/UHF Or Cable Channel

Cable companies continue to increase system bandwidth and cable channels. Most of the TVs and VCRs sold today tune to any cable or off-air broadcast channel. When a cable-ready TV or VCR comes in for repair, it is often necessary to duplicate a specific channel, cable channel shifts, and signal strengths to verify the customer's complaints. When the repair is complete, you must guarantee that it operates correctly on all cable channels.

Fig. 1: The VA62A duplicates any broadcast or cable TV channel at fringe or local signal strengths right in your shop.

The VA62A Universal Video Analyzer lets you duplicate any NTSC broadcast or cable TV channel right in your shop. The signal level can be varied from 5 μV to 5,000 μV to duplicate any signal strength from fringe to strongest local reception.

The channels are fully modulated with any of the VA62A's exclusive video patterns and audio tones. The dynamic video patterns let you analyze the receiver's gain and frequency performance. You'll get right to the problem, and never make a repeat service call due to hidden tuner problems, AGC signal overload, or marginal picture performance.

Substitute For The Tuner And Pinpoint IF Troubles

Video and IF transformers-coils and discrete transistors have been replaced by SAW filters, synchronous detectors, and integrated ICs in modern circuitry. Problems in the video-IF circuits may alter tuner operation or cause picture snow, smear, or poor contrast. Schematics generally show no waveforms in video-IF circuits because signals are below the sensitivity of scopes and the modulated carrier is not easy to interpret.

The VA62A's special IF troubleshooting generator substitutes for the tuner, isolates video IF problems, and makes AFT, synchronous detector, and other IF alignments a snap. The crystal-controlled 45.75 MHz IF carrier can be modulated with any of the VA62A's video patterns. You can substitute for the tuner input or directly inject into points through the IF circuits to isolate a bad stage. You can also vary the 45.75 MHz signal level from .5 mV to 500 mV to match the normal circuit level at the IF input, SAW filter, or IC.

When broadcast TV was the only signal option, very few receivers had a problem with adjacent channels. Broadcast channels were spaced far enough apart to prevent this type of interference.

Now that cable signals put TV channels side-by-side, adjacent channel interference has become a problem. Proper IF trap alignment is crucial toward minimizing adjacent channel interference. But how do you do it?

The exclusive IF trap setting signals of the VA62A reproduce the interferences the traps are designed to eliminate. To peak the trap

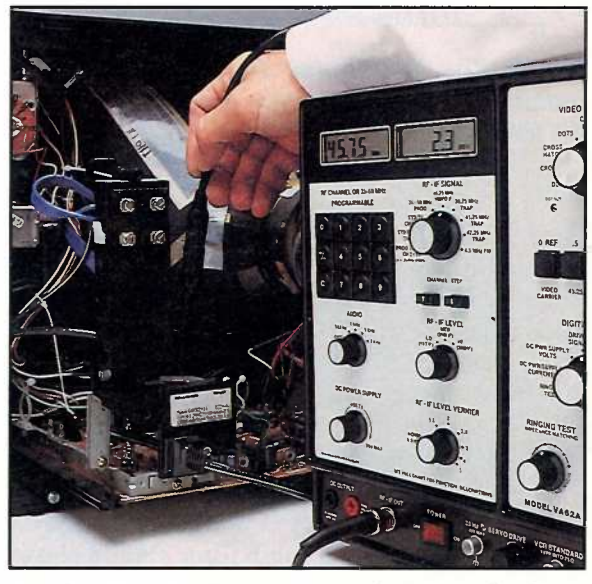


Fig. 2: The VA62A lets you directly substitute for the tuner so you can give your customer an accurate estimate.

adjustments with the VA62A, you watch the CRT and simply adjust the trap for minimum interference.

Test High Performance Video Circuits With Exclusive Test Patterns

Troubles in video systems such as smear, weak contrast, or poor detail are tougher to find than total circuit failures. These marginal problems result from circuits that aren't amplifying the full bandwidth of video or color frequencies. Or, the circuits may cause the normal black to white (dynamic) range of video signals to distort.

These video problems affect the TV picture but don't cause a noticeable change in circuit DC bias or signal voltages. To make matters worse, the problem could be in the video IF stages, detector, luminance/chroma processor, or CRT. These marginal problems seem insignificant, but cause customer dissatisfaction and service callbacks.

Each digitally generated video pattern of the VA62A Universal Video Analyzer provides important information for analyzing circuit performance. The Multiburst Bar Sweep and Chroma Bar Sweep patterns are especially useful for analyzing and troubleshooting marginal video performance problems. These patterns, found only on the VA62A, provide sample frequencies over the full range of video or chroma signal frequencies.

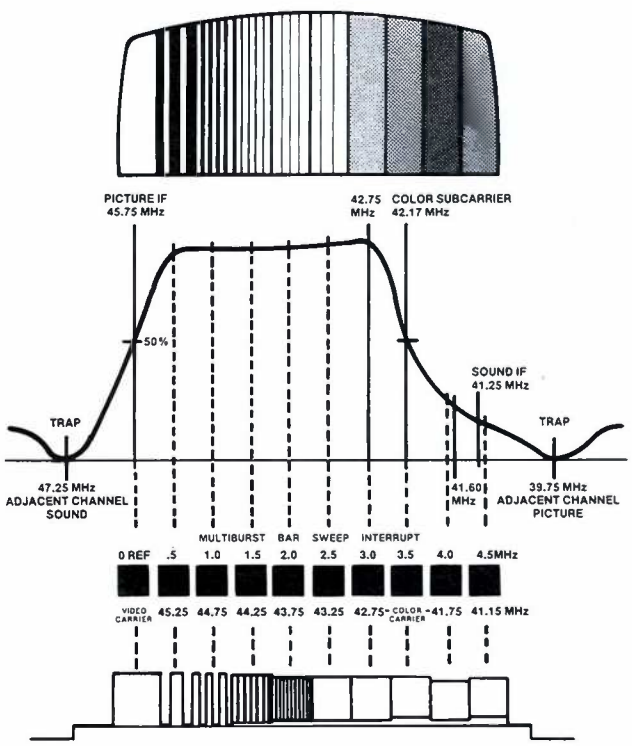


Fig. 3: The Multiburst Bar Sweep pattern indicates video frequency response to a full 4.5 MHz.

The bar frequencies of the Multiburst Bar Sweep pattern sweeps the full range of video frequencies from 0 to 4.5 MHz in 500 kHz steps (Fig. 3). The frequencies are squarewaves designed to simplify IF alignment and improve receiver analyzing. On the CRT, the frequency steps should show distinct white and black stripes of various sizes. A frequency step with blurry or missing stripes indicates that frequency is not being passed properly. A TV with a comb filter should show detail from .5 to 4.0 MHz while a conventional TV shows detailed stripes to the 2.5 or 3.0 MHz bars.

The bar frequencies of the Chroma Bar Sweep pattern sample the full range of chroma frequencies. The pattern consists of a 3.58 MHz cyan reference, 3.0 and 4.0 MHz color frequency steps, and 100% white border. The cyan signal duplicates the highest amplitude color signal the color circuits must pass. The 3.0 and 4.0 MHz signals represent the highest and lowest color sideband frequencies the chroma circuits must pass. If the color circuits are reproducing the full range of color signals properly, you should see vertical color stripes in both the 3.0 and 4.0 MHz bars (Fig. 4).

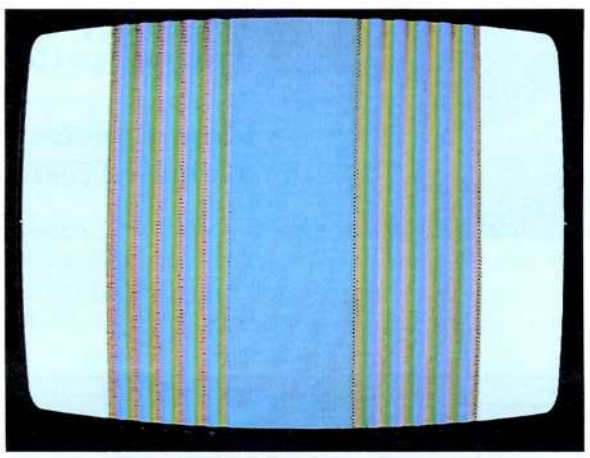


Fig. 4: Use the Chroma Bar Sweep pattern to identify any chroma bandpass problems.

Substitute Good Signals Into Suspect Circuits For Fast Results

Signal tracing in modern video circuits often leaves you guessing. Slight changes in waveshapes may greatly alter the operation of processor ICs. Failures in circuits with feedback loops often leave all voltages and waveforms in the loop bad with no means to narrow in on the problem.

Signal tracing provides no means to test circuits beyond the failure point. For example, if a vertical or horizontal oscillator or countdown vert/horiz IC is bad, there is no way to test the output amplifiers, flyback, or other failure-prone circuits with signal tracing. Startup/shutdown problems totally disable circuits leaving no time to make voltage or waveform measurements.

Substituting known good signals provides the added capabilities to overcome these signal tracing stumpers. The VA62A methodically walks troubles out by proving which circuits function properly. The VA62A provides a warehouse of known good drive signals common to all NTSC receivers to substitute into suspect circuits. The drive signals are synced to the antenna signals to keep all circuits locked and enable viewing of test results on the CRT.

The VA62A drive signals are fully adjustable to match the signal levels of the circuit. You simply watch the screen as you substitute signals. If the CRT returns a normal display, you know the circuits leading to the CRT are working properly.

The best part of using the VA62A's drive signals is that you seldom need to unsolder components or circuit paths. The low output impedance of the VA62A's Drive Output

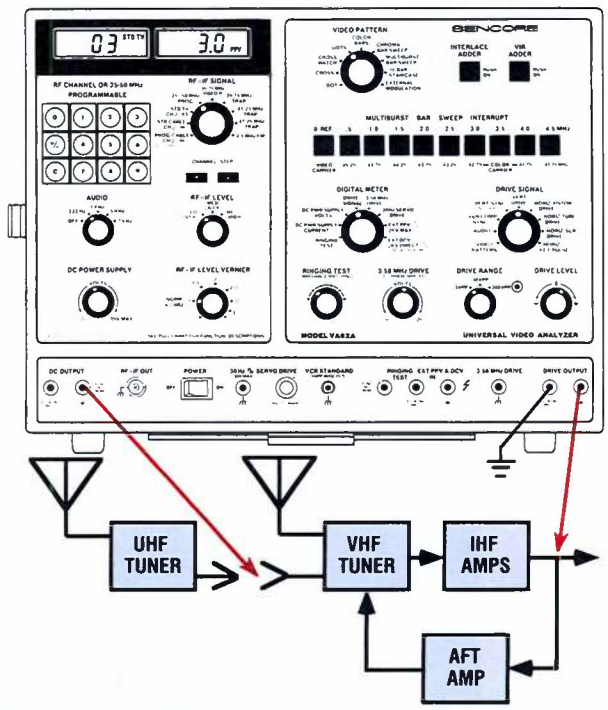


Fig. 5: Use the VA62A's Drive Signals to inject into any stage after the video detector, while the RF signal (connected to the antenna) holds all of the other circuits in sync.

effectively swamps the signal and replaces it with a good substitute. Signal substitution in modern video circuits provides the extra capability you need to tackle startup/shutdown or other tough dog problems. Combined with your knowledge and troubleshooting techniques, the VA62A's substitution signals can keep the tough ones profitable.

Test Flyback Transformers And Yokes With The Ringing Test

A shorted turn is the most common yoke or flyback failure and the most difficult to diagnose. A shorted turn causes only a few hundredths of an ohm change in the winding resistance compared to the schematic. Therefore, a coil with a shorted turn goes undetected with an ohmmeter check.

The VA62A's Ringing Test measures the quality of the coil and easily spots a single shorted turn. When you connect the yoke or flyback coil winding to the RINGING TEST terminals, the coil is included in a circuit that oscillates. The impedance of the Ringing Test circuit is adjusted for the longest oscillation or number of rings.

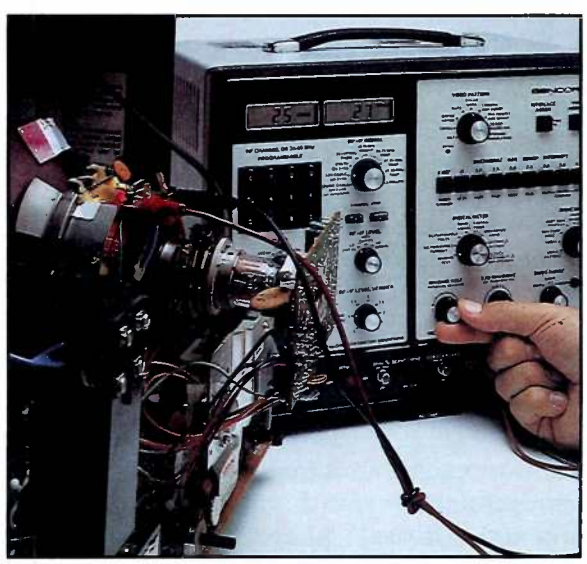


Fig. 6: Verify the condition of yokes and flybacks with the VA62A's patented and dynamic Ringing Test.

A good coil, yoke, or flyback will show 10 or more rings in at least one of the VA62A's Ringing Test positions. It's a simple and 100% accurate good/bad test for a shorted turn in all flybacks or yokes. If in doubt, simply wrap a single loop of wire closely around the coil, flyback or yoke core, twist it together to make a shorted turn, and recheck the rings. A good flyback or yoke will exhibit a large change in the number of rings (usually below 10 in all ringing positions) while one with an existing shorted turn will not be affected.

Isolate Problems Fast With The External PP And DC Voltmeter

The highest troubleshooting efficiency comes when you combine signal substitution with signal tracing using the VA62A's peak-to-peak meter. The VA62A's peak-to-peak meter has a frequency response of 5 MHz and is fully autoranged to measure any video signal.

The DIGITAL METER switch makes the fully autoranged peak-to-peak digital meter available to monitor signals both internal and external to the VA62A. Using the same peak-to-peak meter to monitor the VA62A's drive signals lets you match the signal level shown on the schematic and observe loading on the drive signals.

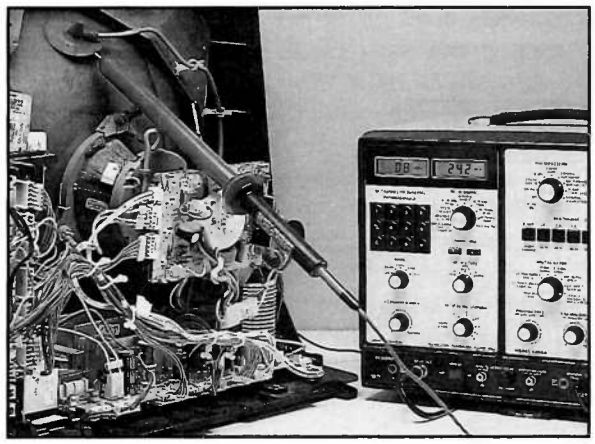


Fig. 7: The HP200 High Voltage Probe extends the measuring range of the VA62A's DC voltmeter to 50 kV allowing you to measure even CRT high voltage.

Conventional DC meters or oscilloscopes cannot be used in circuits such as horizontal output stages that have very large signals present. These instruments are damaged with input voltages exceeding 500 volts and often load the circuit giving you misleading readings.

The VA62A Universal Video Analyzer includes a highly accurate 3 1/2 digit DC meter, completely autoranged, with 15 megohm input impedance. The meter provides fast and accurate DC readings on the collector of the horizontal output transistor or any other test point while keeping circuit loading to a minimum.

The DC meter can be extended to measure voltages to 10,000 volts with the Sencore TP212 Transient Protector Probe or 50,000 volts with the HP200 High Voltage Probe. These probes extend the VA62A's digital DC meter range and input impedance to accurately measure CRT anodes, focus, and G2 voltages with minimal circuit loading.

Prove IHVTs Good Or Bad

An IHVT (integrated high voltage transformer) is similar to a flyback used in an older TV except that it combines the high voltage diodes, multipliers, and sometimes focus divider circuits into one assembly. Like older flybacks, the most common IHVT failure is a shorted turn – but failures due to cracked cores, open windings, leakage between windings, open or shorted HV diodes, or failures of voltage multiplier and focus components are also common.

To thoroughly test an IHVT, you'll need to check for shorted turns (Ringing Test), and actually operate the IHVT to dynamically test the high voltage diodes, multiplier, and focus components (Drive Test & Digital Meter). The VA62A provides both these capabilities.

By driving the primary winding with the VA62A, you can dynamically operate the IHVT to prove the pulses are rectified and multiplied. A bad diode, winding, or core will reduce the IHVT's output voltage as metered by the VA62A's external DCV meter. Using the same drive voltage each time gives you a stable reference to instantly recognize good IHVTs from bad ones. Then, the high voltage to the focus voltage ratio for the chassis enables you to check the focus divider using the same drive procedure.

Update Or Expand To New Future Analyzing Challenges

The VA62A is designed to troubleshoot in any video system and to resist obsolescence. The VA62A's signals are based on TV transmitter signals, National Television System Committee (NTSC) video standards, and basic blocks of a receiver. These signals will be with us for many years. You're assured of many years of servicing with the VA62A.

The VA62A is completely expandable. An external modulation jack and external accessory jack allow you to update whenever a new accessory is introduced to meet the challenges of the changing video industry. There are many accessory units that expand the VA62 or VA62A for additional servicing opportunities including EIA color patterns for warranty service, Multi-Television Sound (MTS) servicing, RGB monitor servicing, and VCR servicing.

The newest enhancement to the VA62A is the VC93 All Format VCR Analyzer featured in this issue. New companion analyzers or accessories will be added as manufacturers announce new formats, test patterns, etc. This makes your VA62A a protected investment.

Reap Big Dividends With A VA62A Investment

Whether troubleshooting video, sync, scan, color, audio, or high voltage circuits, the VA62A provides the best combination of video analyzing tests ever developed. The patented and special test features of the VA62A are now considered standards of the industry. Use these features daily to speed your troubleshooting and they will become routine and essential to your video repair efforts.

The VA62A is guaranteed to increase your capability now and in the future. A survey of over 3,000 technicians using the VA62A's "Divide And Conquer" troubleshooting method indicated an average 54% increase in productivity. If you're a service manager, that means faster repairs and satisfied customers. If you're a technician, it means more finished repairs, less rework, and more money in your pocket. If you're an independent servicer, it means more accurate estimates, additional profits, and fewer evening and Saturday hours.

The VA62A pays you big dividends on your investment. If it helps you increase your productivity by just 25%, or 1 repair each day based on NESDA figures for an average technician, that's additional profit for you. Compare these earnings to Sencore's variety of financing options and cash discounts. The potential for return on your investment will amaze you. Don't forget to consult your accountant on additional depreciation and tax benefits. In fact, if you're like many service pros, you'll see how it's costing you by not owning a VA62A.

The real proof comes when you put the VA62A to work right on your own bench. Call your Sencore Area Sales Engineer today, toll-free **1-800-SENCORE,** for more information on Sencore's financing options or to order your VA62A. You'll be glad you called. ■

Circle Fast Facts #257 for more information on the VA62A Universal Video Analyzer.

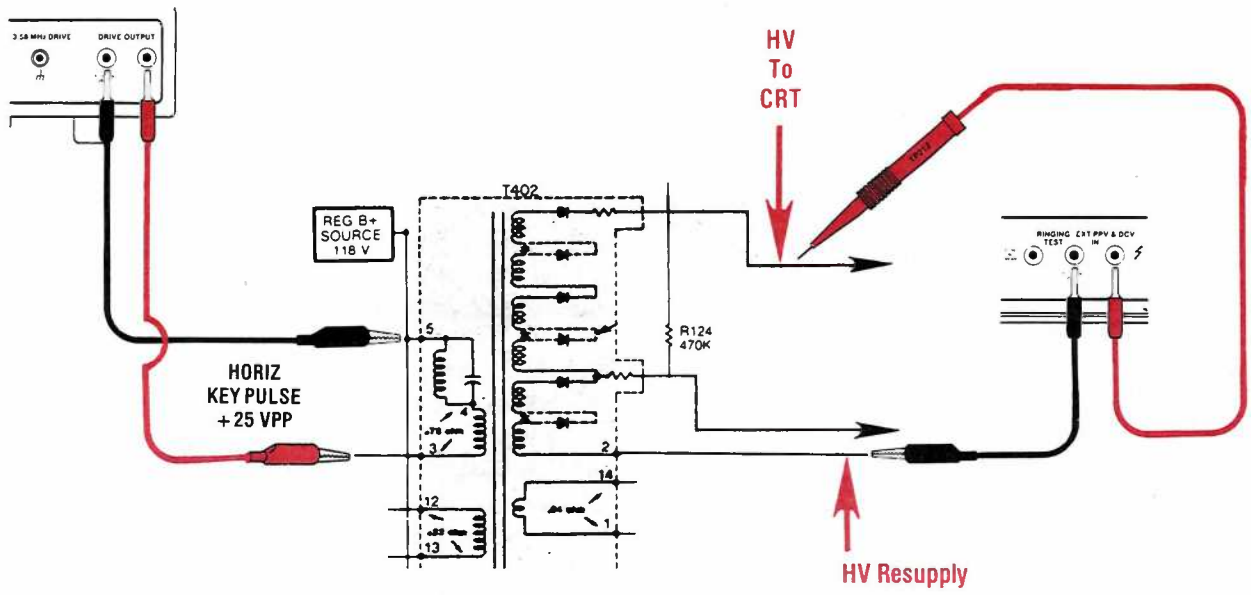
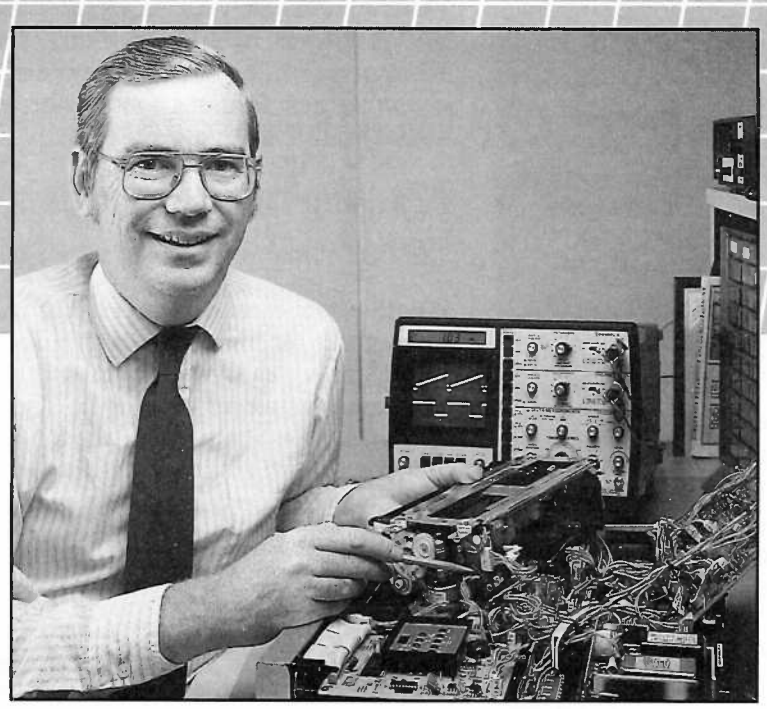


Fig. 8: The IHVT drive test dynamically tests the IHVT by substituting for the horizontal pulse and measuring the resulting DC voltage at the second anode lead. (Ask for Tech Tip #117)



How To Troubleshoot VCR Sensor And System Control Problems With Your SC61 Waveform Analyzer

by Rick Meyer, Application Engineer

- **Monitor seven key VCR safety circuits**
- **Check the microprocessor in five steps**
- **Speed up system control troubleshooting**

VCR servicers tell us that system control problems are one of their most frequent VCR servicing problems. The microprocessor is the heart, or mind, of the VCR system control. Failures, however, are more often associated with circuits external to the microprocessor (attested to by servicers who have replaced the micro unnecessarily). The VCR safety circuits are often the culprit in the dead or non-functioning VCR. Many of these safety circuits use sensors that either fail entirely or appear to be intermittent. In this article we will show you how to troubleshoot some typical system control problems using your SC61 Waveform Analyzer.

The Microprocessor Is The Mind Of The VCR

The microprocessor controls all of the functions of the VCR. It receives data from the front panel keys identifying what the customer wants the VCR to do. It uses this information to tell the various motors, servos, and electronic circuits when and how they should operate.

The microprocessor also collects data from various safety circuits which monitor the operation of the VCR and the status of the video tape. These safety circuits use sensors to monitor what is happening inside the VCR. You could say that these sensors are the "eyes" of the microprocessor. The sensors serve as an interface between the mechanical world of the video tape and the electronic world of the microprocessor. If any one of these sensors fails, the microprocessor receives incorrect data about the functioning of the VCR. In most cases, the program in the microprocessor takes the safety course of action; it shuts the VCR off.

Seven Key Safety Circuits Tell The Microprocessor How The VCR Is Functioning

There are seven basic safety circuits that monitor the operation of the VCR.

1. CYLINDER LOCK – Checks for rotation of video heads.

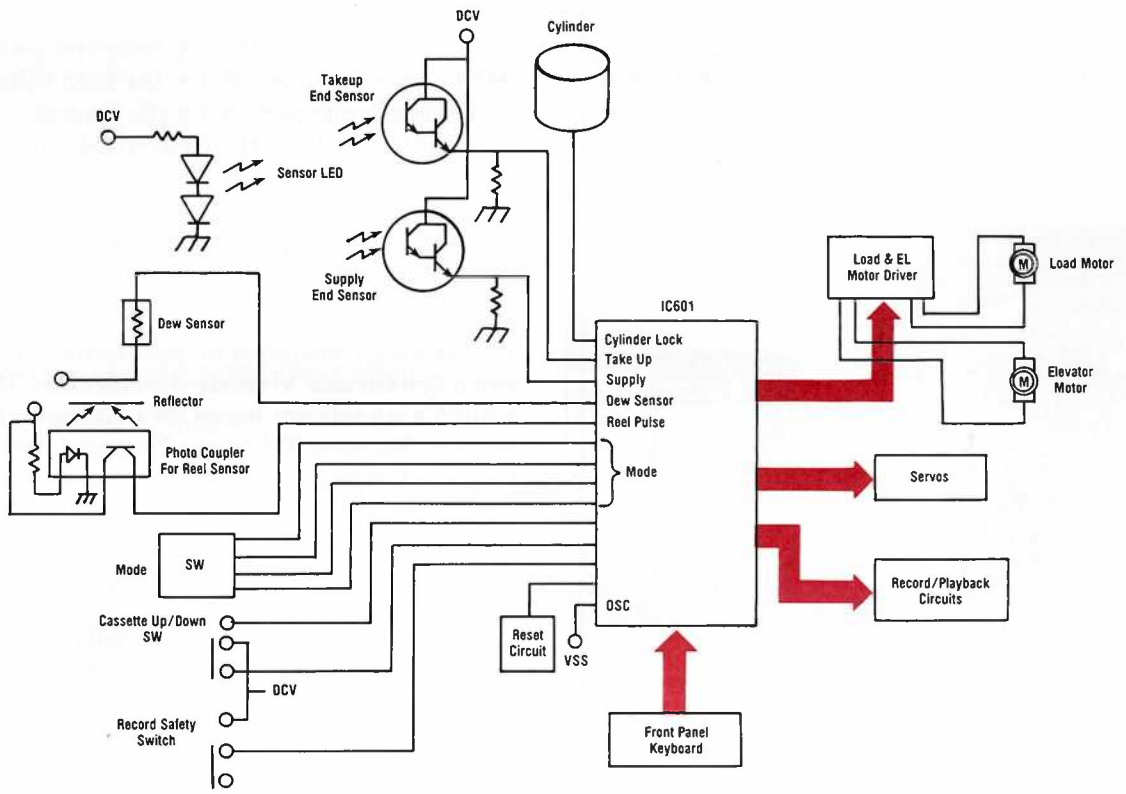


Fig. 1: The system control microprocessor takes data from the safety circuits and front panel controls and uses this data to control the operation of the VCR.

2. CASSETTE SWITCHES – Verify the position of the cassette.

3. END SENSORS AND LIGHT TOWER – Check for end of tape.

4. REEL SENSORS – Check for rotation of take-up reel.

5. MODE SWITCH – Makes sure tape is properly loaded around drum.

6. DEW SENSOR – Checks for excessive moisture.

7. RECORD SAFETY SWITCH – Prevents recording on protected tapes.

An incorrect signal, from an operational problem in the VCR or a defective sensing circuit, will cause the microprocessor to turn the VCR off.

A Five Step Process Verifies If The Problem Is In The Microprocessor Or In The Safety Circuits

System control problems cause the VCR to either malfunction, or more often, not function at all. We often immediately suspect the microprocessor as the reason for a system control problem. In most cases, however, the problem is associated with the safety circuits.

There is a fool-proof five step process for troubleshooting microprocessors to determine if a microprocessor is good or bad. These five steps are:

1. Check the power supply
2. Check the clock
3. Check the data in/data out lines
4. Check for a reset pulse
5. Check for bad grounds

A more detailed description of how to do these five steps is found in the Sencore Tech Tip #109. You can get this Tech Tip by calling our toll-free number **1-800-SENCORE**.

In many cases the cause of the system control problem will be found in step three of this five step microprocessor troubleshooting method. Steps 1 and 2 should be done first, however, since a properly operating power supply and correct clock frequencies are essential for any operation of the microprocessor.

The Symptoms Can Often Identify Where The Problem Is

If the VCR functions, at least in part, its operation can often give important clues to the cause of the problem. For instance, a VCR that loads the tape, begins to play, and then shuts off, often has a reel sensor problem. The reason for shutdown is that the microprocessor senses that tape is not being taken up by the take-up reel and assumes that it is piling up inside the VCR. Its best course of action is to shut off. Of course, the microprocessor can not distinguish between a reel that is not turning and a sensor that is no longer working. In either case, the microprocessor assumes that something is wrong.

Let's look at another example, a VCR that loads the cassette but won't wrap the tape around the video drum. This symptom can be caused by an end sensor problem, or the cylinder may not be turning. The specific symptoms that occur may be somewhat different from one VCR to another. By looking at the symptom and doing some reasoning, we can usually get a good idea of where to look.

The cause of a specific symptom can often be identified by looking at a system control timing chart or a flow chart. These charts show the actions taken when the VCR is placed in each mode. Each action in the VCR is preceded by a testing of various sensors. If the test shows that everything is in order, the microprocessor sends the appropriate signals to perform the next operation.

Troubleshooting of a system control problem can be speeded up by testing the sensor inputs that are monitored by the microprocessor just prior to shutdown. For instance, if the VCR loads the cassette but won't load the tape, we should check the data line telling the microprocessor that the cylinder is rotating. If this signal is good, we should look at the flow chart and check the output from the end sensors. We continue this process until we locate the defect.

The Microprocessor Must Have The Correct Logic Levels To Operate Properly

Digital circuits, and in particular microprocessors, operate with logic high and logic low signal levels. These logic levels must be distinct or the microprocessor will confuse one for another. (See Tech Tip #109.)

The characteristics of a defective sensor can often result in an output that is in the questionable voltage area (neither high nor low). In the case of mechanical switches, high contact resistance can cause a voltage to either not go to ground or not come completely up to the power supply voltage, depending on the design of the circuit. If the voltage fed to the switch is low, the voltage output from the switch will also be low and a logic high may fall in the questionable area. In the case of photo-coupler and hall-effect sensors, the power supply voltage may be low, the sensor may be leaky, or the sensor may not completely turn on. In any one of these conditions, the output voltage can end up in the questionable area.

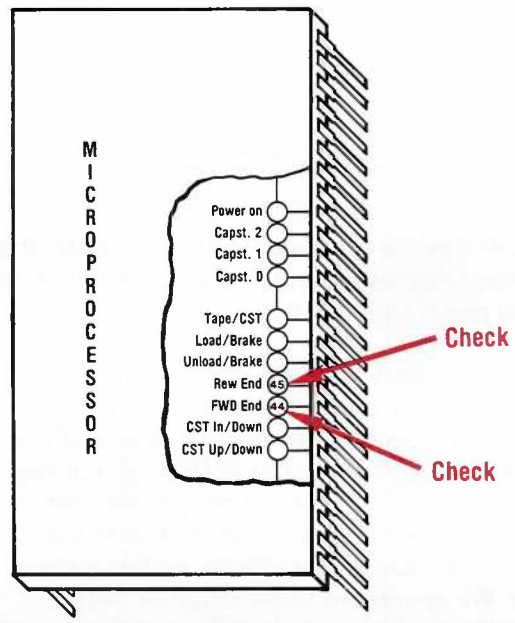


Fig. 2: The input signals were tested at the microprocessor control pins to check for their presence as well as proper level.

Your SC61 Waveform Analyzer Can Speed System Control Troubleshooting

Several types of measurements need to be made to troubleshoot system control problems.

1. DC voltage measurements
2. AC voltage measurements
3. Frequency measurements
4. Viewing of complex waveforms

With your SC61 Waveform Analyzer you can make all of these measurements with one probe hookup. Let's look at a couple of examples of actual VCR system control problems and see how fast they were troubleshot using the SC61 Waveform Analyzer.

The Case Of The Ejecting VCR

Recently we were setting up our equipment for a Sencore VCR seminar. After the equipment was set up, we checked everything out to make sure it was working properly. When we pushed a video cassette into our demonstrator VCR, an RCA model 625, it loaded the cassette and then immediately unloaded it. We didn't get too concerned because this often happens. Our demonstrator had all the covers removed and often exhibited this condition due to stray room light hitting the sensors. We confidently placed a box over the sensor to cut out the room light and pushed the video cassette back in. The VCR loaded the tape and promptly unloaded it again. Our confidence turned to concern. There was only an hour before the seminar was to start and the success of the seminar depended upon the use of our demonstrator VCR.

Whatever we were to do at this point had to be done fast. We immediately reached for the SC61 Waveform Analyzer and a schematic. Since this was a system control problem, we decided to practice what we teach. We went through the five step microprocessor troubleshooting method.

We first checked the power supply. The SC61 Waveform Analyzer gave us all the capability we needed to completely and quickly analyze the power supply. We placed the SC61 test probe on the power pin of the microprocessor, and pressed the DCV button on the SC61. The digital LCD display promptly read out 10.30 volts (CMOS logic). We had power to the microprocessor. We looked at the CRT on the SC61 and observed a straight line. Visually, it looked like the power supply line was clean. Just to be sure, however, we pressed the SC61's VPP button. The display now read 0.067 VPP. This verified to us that there were no high frequency spikes on the power supply that we could have overlooked by simply observing a CRT trace. Both the DC voltage and peak-to-peak voltage readings were well within limits and we could rest assured that the microprocessor was not being upset by power supply spikes.

We next checked the clock. We moved the SC61 test probe to the clock pin on the microprocessor and pressed the FREQ button. The display read out 479.541 kHz, well within the normal frequency range for this VCR. Step two of the five step microprocessor troubleshooting procedure passed with flying colors. Less than one minute had passed.

Our next step in the five step troubleshooting procedure was to check the data in/data out lines on the microprocessor. We suspected that one of the safety circuits was causing the eject problem. Since the symptom looked identical to the symptom of too much light on the end sensor, we decided to check these sensors first. A quick review of the schematic showed that the forward end sensor was connected to pin 44 of the microprocessor and the rewind end sensor was connected to pin 45 (Fig. 2). We connected the A channel probe to pin 44 and the B channel probe to pin 45. We pressed the A channel DCV button on the SC61 and the digital display read out 9.91 volts, a good healthy logic high. When we pressed the B channel DCV button, the digital meter quickly displayed 9.89 volts, again, a good healthy logic high. This made sense. The VCR was on, and the cassette was out. Both sensors were receiving light from the light tower and should be at a logic high level.

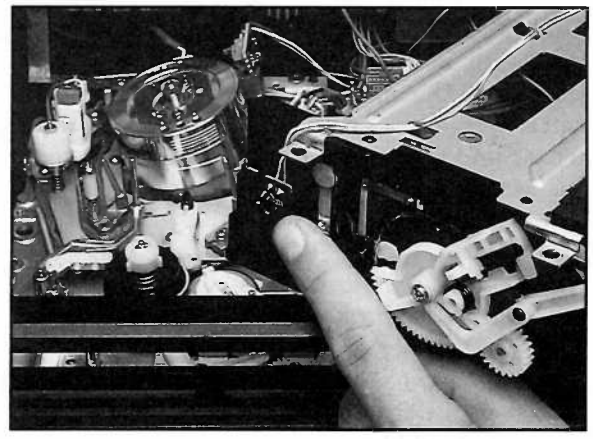


Fig. 3: A quick check of the VCR circuits using the SC61 Waveform Analyzer showed that one end sensor was leaky.

We covered the forward sensor so that no light could strike it. The A channel trace immediately dropped to a lower level on the CRT. But was it low enough? Was it below the questionable area for a logic low? We quickly found out by using the digital DC voltmeter on the SC61. We simply pressed the A channel DCV button and read 0.06 volt; well below the questionable logic level.

We next covered the rewind sensor and looked at the CRT on the SC61. The logic level did not change. When we pressed the B channel DCV button, we found that the voltage was still over 9 volts. We unsoldered the wire from the rewind end sensor and grounded it. When we now inserted the video cassette into the VCR it stayed in. Pressing the play button confirmed that all other functions were working properly.

We gave our seminar that night with the rewind sensor line grounded. The next day we stopped by a parts house and got a replacement sensor. Thanks to the SC61 Waveform Analyzer, this system control problem was quickly solved. The day, or rather, the night was saved.

Another VCR, Another End Sensor?

A few weeks later we were getting ready for another VCR seminar. We set up our Panasonic PV-1330 VCR which we used to show video tapes. When we inserted the video cassette, the VCR loaded the tape and then unloaded it again. We had just fixed a similar problem in our demonstrator VCR a few weeks ago and expected this to be a quick fix. We'll just go in, find the bad end sensor, and jumper it out.

We took the cover off the VCR and looked for the end sensors. We weren't sure which one was defective so we simply hooked up the SC61 test probe to one of the end sensors. We observed the CRT and found digital pulses on the end sensor output signals. A digital voltmeter wouldn't work here. We looked at the schematic and found that the LED light tower was being modulated with pulses. The light hitting the end sensor should have a similar pulse; it did. This verified that the end sensor was working. Just to be sure it was good, however, we checked the amplitude of the pulse using the peak-to-peak meter on the SC61. We pressed the VPP button and the LCD display read out 2.91 VPP, a good healthy pulse. We next placed our finger over the sensor and the output dropped to 0.19 VPP. The sensor was definitely good.

Aha! The other sensor must be defective. Just to be sure, however, we hooked the SC61 probe onto the other sensor. This sensor also had a healthy pulse on it. We covered up the sensor and the pulse disappeared. It was good, too. Maybe this won't be so simple after all, we thought to ourselves. Time to regroup.

We went back to our five step troubleshooting procedure and checked the power supply and clock on the microprocessor using the DC volts, peak-to-peak volts, and frequency functions of the SC61. Everything was working as it should be.

We were, again, to step three of our five step microprocessor troubleshooting procedure. We needed to check the data in/data out lines. What, besides the end sensors, could be causing the cassette to eject? A review of the block diagrams for the VCR showed that the only other sensors that were operating when the video cassette was pushed in were the cassette in, cassette up/down, and dew sensors. We monitored these switches as the cassette went in and out and everything looked normal. What could the trouble be?

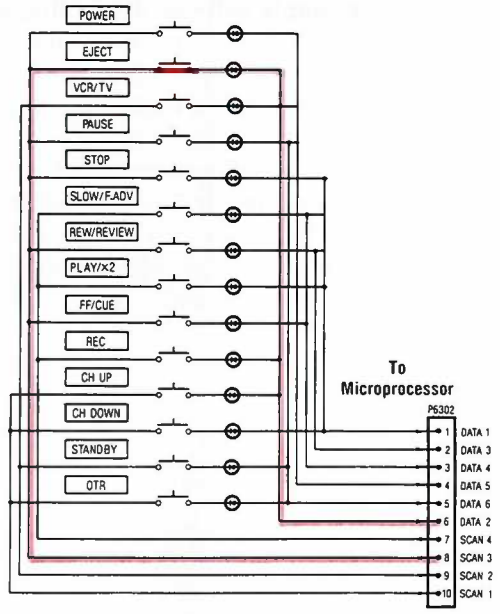


Fig. 4: A pulse on one of the data lines with no buttons depressed indicated a problem in the front panel keyswitches.

The only other signals to the microprocessor were the front panel switches. This type of VCR used a scanning method of checking the front panel switches. Data was output on four scan lines and received on six data lines. With no buttons pushed, there should be no activity on the data input lines. We pressed the VPP button on the SC61 and quickly probed the six data lines with the SC61. When we got to data input line 2, the digital meter suddenly displayed 3.2 VPP. Slowing down the timebase on the SC61 verified that there were pulses on the data line. But should those pulses be there? We left the probe hooked onto data input line 2 and probed the four scan lines with the other probe. When we got to scan line 3, the pulses lined up. Looking at the schematic, we followed scan line 3 and data line 2 back to the switches and they came together at the eject switch. A careful examination showed a shorted eject switch. So much for symptom/cure this time!

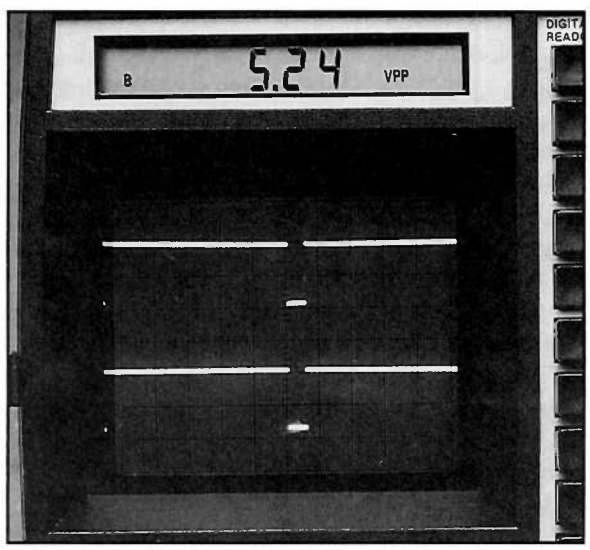


Fig. 5: The scan lines for the front panel switches were checked with the SC61 to find out which line was being fed through a switch. It was then a simple matter to verify that the eject switch was defective.

Troubleshooting An Intermittent VCR

An employee brought in a Marta model MVR2000 VCR that would play for a while and then unload the tape from the video drum and quit. No one in particular was excited about working on it! Oh well, everyone needs a challenge now and then.

We first hooked up the VCR to a television, inserted a tape, and pressed play. Sure enough it played. We let it play and after about a half hour passed, it unloaded the tape from the video drum and quit. Well, we had confirmed the symptom anyhow.

We decided to go through the five step troubleshooting procedure. We hooked up the SC61 probe to the power supply pin and quickly checked for both DC voltage and ripple. The DC voltage was good and the ripple was minimal. We next started checking the data in/data out lines. The output of the end sensors was good. They both read below 0.2 volts giving a definite logic low as they should. We next looked at the reel sensor output. A pulse was observed on the output of the reel sensor. But it looked pretty small. We stopped the VCR and placed it in fast forward.

When we selected the VPP function we found that the reel sensor pulse was just slightly over 2 volts, quite close to the questionable logic area. (See Tech Tip #109.) A quick check

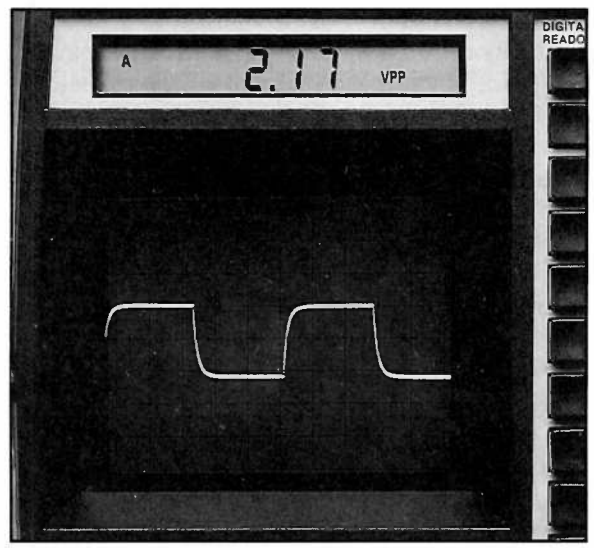


Fig. 6: The SC61 quickly verified that the pulses from the backup reel sensor were too small to be identified by the microprocessor.

of the DC voltage going to the reel sensor showed a healthy 4.8 volts. The photosensor used to sense rotation of the reel was not completely turning off. We removed the sensor and checked it with the TF46 Super Cricket. Sure enough. The sensor was leaky. Replacement of the sensor brought the reel pulses back up to 4.2 volts PP.

You have just seen how to troubleshoot several typical sensor-type system control problems. Sensor problems are not difficult when you understand how they work, and use modern troubleshooting equipment like your SC61 Waveform Analyzer. If you have questions about this article or need information on expanding your VCR service, call your Area Sales Engineer at **1-800-SENCORE.** ■

Circle Fast Facts #258 for more information on the SC61 Waveform Analyzer.

Modern Test Equipment Investments — As Important As Schematics And A Front Door

By: Brian Phelps, Marketing Communications Writer

Electronic servicing has evolved into one of this nation's most interesting and exciting businesses. We're now analyzing products ranging from basic audio amplifiers to cellular phones; from black and white TVs to high resolution computer monitors; from VHS VCRs to the newest camcorder with all the extras.

But what do you do when it comes time to address those growing pains that develop from an increase of consumer equipment needing service, new demands from modern circuits, or wanting to capitalize on new service potentials? You may have customers walking through your front door and you may have a full supply of schematics, but that doesn't mean much unless you have the proper test equipment. Many service centers aren't sure where they can turn for help. This article will help you to get a good understanding of how Sencore can help. We'll point you towards a logical thought process while highlighting some key areas to investigate before you make any investment into your service business.

Always Start With The Broadest Picture First, Then Narrow It Down To The Specific Product Required To Meet That Challenge!

Many service centers will look at test equipment in the reverse order of how a correct investment decision should be made. They'll call and say, "I need a scope. What do you have?" They may assume that they need a scope, but unless they start with the broadest levels first, they could be making a premature or incorrect investment.

Fig. 1: The Electronic Industries Association and most manufacturers provide recommended test equipment listings and market data to help you select the proper instruments to repair consumer electronics. It's up to you to choose the instruments that will make you the most profitable.

For example, let's say you're having difficulty testing transistors. Is the difficulty really with testing the transistors, or is it that you're unable to identify (in-circuit) where the true defect lies before you start pulling suspect components?

If you've been considering a test instrument investment, or have been looking at what it will take to add profits to your service business, here's a quick seven step process that will help you identify the proper fit of any test instrument to your business.

Seven Steps To The Best Investment Decision You'll Ever Make!

Step #1: Determine Your Test Equipment Needs!

Typically this step should take longer than any other to develop the correct answers. Once you've established your needs, the rest should come fairly easy. When looking at your needs, try asking yourself the following four questions. (These questions will get you started in determining your test equipment needs, but you shouldn't limit yourself to only these questions.)

- Where am I having the most difficulty?
- What is the main reason I invest in test instruments? (profits, productivity, customer satisfaction, etc.)
- Do I need to service more or service more profitably?
- Am I hoping to expand my business into new areas or am I currently getting requests to provide a particular service to present customers?

If you're into video, audio, component, or communications, Sencore has the instruments that can fit your true needs. Our instruments are guaranteed to increase your efficiency and profits in all areas of electronic servicing.

Step #2: What Specific Type Of Test Instrument Will Best Fit Your Needs?

There are many types of test instruments on the market. You've probably noticed the features vary as wide as the pricing. In an effort to keep yourself pointed in the direction set in step #1, ask yourself, "What tasks do I need an instrument to perform on my bench? Do I need signal tracing, signal injection, or component analyzing? Or, do I need a combination of all three?"

Sencore offers a complete line of patented test equipment for all your troubleshooting needs. Our instruments are exclusive and allow you to easily match troubleshooting equipment to the needs of your service bench.

Step #3: Directly Compare All Possible Test Equipment!

Some companies, such as Sencore, offer risk-free trials of their equipment. If a trial is available, take advantage of it. Check out the ease-of-use and find out if the instrument helps make you profitable. Set the instruments you're considering side-by-side. Perform some troubleshooting procedures with each. Then compare the time it takes.

As a 40 year old company that has been working with electronic servicers, we believe Sencore's the best. In fact, Sencore allows you to prove it for yourself on your bench and at no risk or obligation with our instrument trial programs.

Step #4: What Support Is Available After The Investment?

With all the challenges you face, you don't need a challenge from your test equipment. Once you know the type of equipment you'll be needing, look at the other things the company can provide. Will you receive training? What if you have application questions? And, does the company stand behind every test you'll make with the instrument?

Sencore offers a complete line of support after a test equipment investment, including: Tech Tips, Tech Tapes, Tech Schools, direct contact with the entire factory, factory direct service, and much more. And they're all just a toll-free call away (**1-800-SENCORE**).

Step #5: Can You Cost Justify Your Total Investment?

We all know that good test equipment doesn't cost, it pays. You need to be confident that the return on your investment will exceed the actual monthly investment. If monthly investments work best for your business, check to see what the lowest possible payment could be. This will make your cost justification much easier.

To find the easiest method of cost justification for yourself, call your Area Representative at Sencore. We offer tips on making better profits with your instruments. And we can discuss the flexible methods of payment available with Sencore equipment purchases. Call us and let us show you how test instruments can pay instead of cost.

***Step #6:* Is The Test Equipment Fully Guaranteed For A Protected Investment?**

When you decide to make an investment in test equipment, there's nothing better than knowing your investment is fully protected. Not only protected from damage, but also protected from you making an incorrect investment decision. When you're ready to invest, look at the following key areas:

– a 30 day money back guarantee
– parts and labor warranty
– factory direct service
– a made-right guarantee
– obsolete-proof features

Sencore provides the best investment protection available. We'll help you fit the correct instrument to your needs, back the instrument against any defects, and guarantee many years of use from the instrument.

***Step #7:* Simply call 1-800-SENCORE and let us help with all your test instrument questions and needs.**

7 Steps To The Best Investment Decision You'll Ever Make!

1 Determine Your Test Equipment Needs!

- Having troubleshooting difficulty?
- Increased profit or productivity needs
- Expansion into new servicing and business opportunities

2 What Specific Type Of Test Instrument Will Best Fit Your Needs?

- Signal tracing
- Signal injection
- Component analyzing
- A combination of all three!

3 Directly Compare All Possible Test Equipment!

- Risk-free trial
- Side-by-side comparisons
- How long will it take for me to become more profitable?
- Ease-of-use

4 What Support Is Available After The Investment?

- Technical Literature
- Video Tape Support
- Toll-Free Support
- Technical Field Training

5 Can You Cost Justify Your Total Investment?

- What increase in productivity will be required to pay for the investment?
- What other instruments would be required to match the features offered?

6 Is The Test Equipment Fully Guaranteed For A Protected Investment?

- Does the company stand behind their product?
- Factory direct service
- Can't make a bad decision – "Money Back Guarantee"
- Parts & labor warranty
- Obsolete-proof

7 Call 1-800-SENCORE!

(736-2673)

Test Equipment Doesn't Cost — It Pays

The "Business" Of Test Equipment

Some technicians think of test equipment as an expense. But they should think of the investment in test equipment as a step towards greater profits and capabilities for the future. A man is only as good as his tools and the tools only as good as the knowledge and know-how of the man. Test equipment is the tool that enables the knowledgeable to do things that he couldn't do before and thus expand his capability. It is this expanded capability that insures a bright future for the bright technician.

Why Instruments "Cost" Just Pennies!

Let's have a realistic look at the cost of instrumentation. Suppose you purchased a complete bench setup so you were totally prepared for the future. Your total investment would be somewhere around $10,000. But what is a $10,000 investment for an entire service bench? It's no more than the cost of popular communication test equipment, no more than the cost of a production line calibration tester, and no more than a pick-up and delivery van.

Typically, you won't write off your test equipment expenses in only one year. Normal test equipment investments are written off in four years or more. Likewise, you don't save up all your pennies to buy the new service van outright, do you? That's why many Sencore owners finance their test equipment the same way they do with the van. Makes real good sense (and cents), doesn't it? What's more, the interest is tax deductible, lowering your real cost even further.

Okay, so over a four-year period, your new service bench costs you approximately $2,500 a year (interest and all). Is that so much for all the tools that you really need to do a job? If you put in 300 working days with your equipment, you are spending only $8.30 a day or $1 per hour. Imagine that, an entire new bench for $1 per hour. That's less than 1/10 the cost of a new technician.

A Well Equipped Shop Adds Profit Dollars!

Most technicians' labor is billed or calculated anywhere from $20 to $35 an hour. Just how much would you guess a new bench of up-to-date equipment would save you in efficiency? Would you estimate 50 percent? Would you estimate 25 percent? If you were presently servicing 6 sets per day, a 25 percent increase would mean an additional 1.5 repairs each day. That's $60 to $120 additional billings per day.

You're Paying For It, Why Not Own It?

Isn't it pretty obvious that you are already paying for the equipment that you don't have? If you are paying for it every single day, why don't you own it? Think about it and then think about the Sencore line of time-saving test instruments. Get out a sharp pencil and perhaps you will see why the progressive technician always seems to be up to date on the latest circuit technology and has the latest in test equipment as well.

Which do you think came first, the knowledge or the instrument?

Build Your Business With Sencore's Business/Profit Builders!

Do you use electronic test equipment? Would you be interested in making profits with this test equipment? Could you use the extra business and income these instruments can generate?

Sencore provides the equipment necessary to build your business and your profits. First, the PR57 "POWERITE" ® Variable Isolation Transformer And Safety Analyzer gives you the safety leakage test to generate profits. The safety leakage test gives your customer peace of mind and almost eliminates your chances of shock liability. Just perform the test on each chassis that passes over your bench, add a nominal charge ($2, $5, maybe $10), and watch your profits grow while you ensure repeat business with satisfied customers.

Second, let CRT restoration be the other profit builder with the CR70 "BEAM BUILDER" ® Universal CRT Analyzer And Restorer. The CR70 has taken the concept of CRT restoration and refined it with a process called "progressive restoration. "Progressive restoration improves the CRT without the risk of permanent damage. Add a set charge ($25-$50) per restoration, and watch your bottom line increase almost immediately.

Either way, Sencore guarantees the PR57 and CR70 will return your company's investment many times over. If it doesn't, return the instrument to Sencore for a full refund. We make this claim with confidence because we already have thousands of customers cashing in on the PR57 and CR70 each year.

Take a look at how the numbers work below. Then pick up the phone and call **1-800-SENCORE**. Your Area Sales Engineer will help put one or both business builders on your bench as soon as possible. The profits are there for the making.

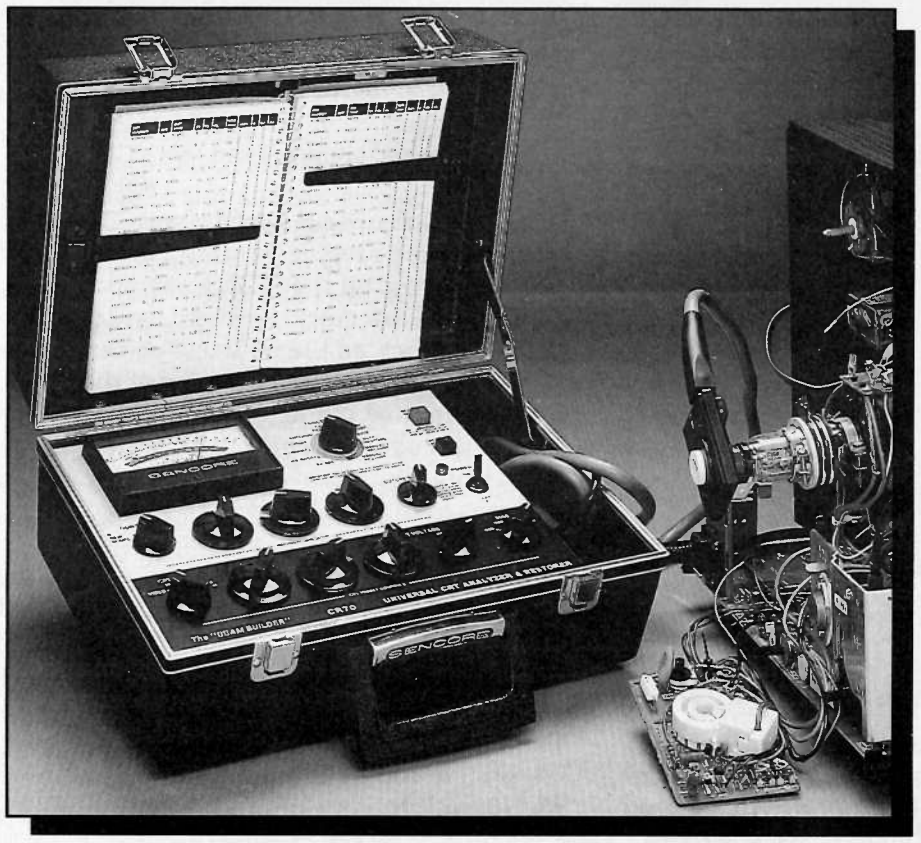
PR57 AC "POWERITE" ®

Patented

The PR57 Provides:

- **A Safety Leakage Test** – for added profits and protection
- **An Isolation Transformer** – required for modern power supplies
- **A Variable AC Source** – to sweat out intermittents & regulators
- **An AC Input Line Monitor** – pinpoints AC line related problems
- **A Power Monitor** – to measure the amps or watts being used

	(Profit Potentials)
Average of 5.5 sets per day x 5 days per week	_____ x _____
= 27.5 sets per week	=_____
x $2 per set (charge for leakage test)	x $_____
= $55 wk. extra income	=$_____
$55 x 4 wks. per month	$_____ x _____
= $220 extra income per month	=$_____
$55 x 52 wks. per year	_____ x _____
= $2,860 Extra Service Income Per Year!	=$_____



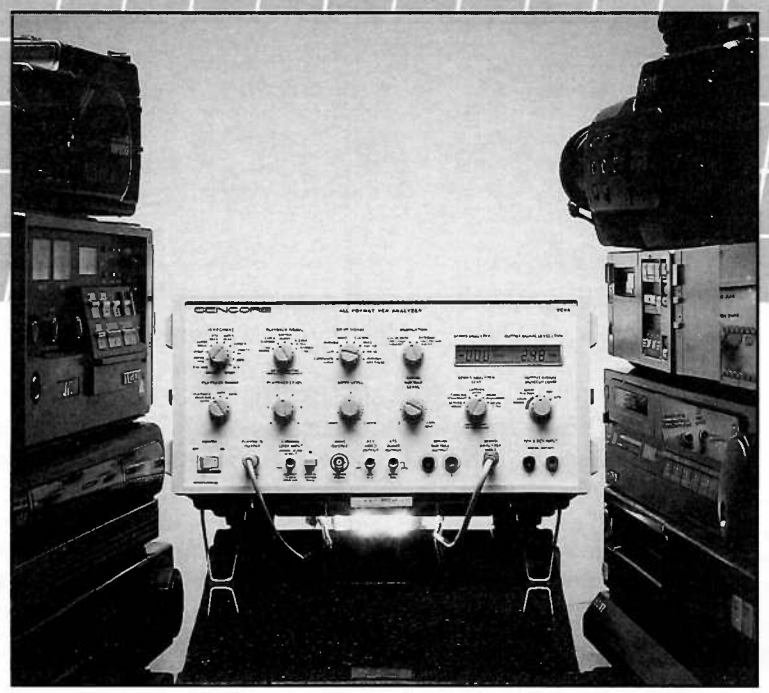
CR70 "BEAM BUILDER"®

Patented

The CR70 Allows You To:

- **Test Every CRT:** Video, Projection, Camera, Scope, Computer, Radar, *And Many More...*
- **Dynamically Test Every CRT**
- **Safely Restore 9 Out Of 10 CRTs**
- **Be Totally Protected From Charged CRTs**

	(Example)	(Your Numbers)
Average charge per restoration:	$35	$
Average # of restorations per week:	x 2	x_____
	$70	$
Total weekly extra income:	$70	$
Number of weeks per year:	x 52	x 52
	$3,640	$
Total yearly extra income:	**$3,640**	$_____



Conquering Those Confusing VCR Symptoms

By Rick Meyer, Application Engineer

- **Confirm proper servo operation**
- **Dynamically test the luminance and video head circuits**
- **Evaluate test results and narrow down the defect**

One of our first steps in troubleshooting a VCR is to verify the customer's complaint. We observe the operation of the VCR to determine what symptom or symptoms are apparent. This usually leads us to the problem. Sometimes, however, several different problems can produce similar symptoms. Valuable time is often lost trying to locate the true cause of these symptoms. This lost time cuts into the profits we made on the simpler repair jobs.

In *Sencore News* #154 we learned that problems in the tape movement (capstan servos), head positioning (drum servos), tape path alignment, video head circuitry, or FM luminance signal processing circuits can produce almost identical symptoms. In that article, we saw how the VC93 All Format VCR Analyzer's Servo Analyzer Tests quickly identified servo problems in two VCRs that had symptoms of noisy video.

In the *Sencore News Special Edition* we saw how the VC93 quickly isolated a video head problem (rotary transformer) in a VCR that had an identical symptom. In this issue, we will see how the VC93 locates yet another problem that has the same general symptom.

Identifying The Symptom

A VCR came in with a customer complaint of a bad picture. To confirm the symptom, we

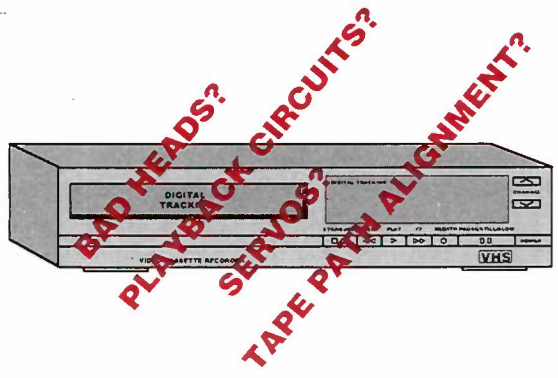


Fig. 1: Several VCR defects can cause the same symptoms making it difficult to troubleshoot without the proper equipment.

hooked up the VCR to a monitor and inserted a work tape. The tape loaded properly and the VCR began to play. The picture on the screen was exactly as the customer described it. The monitor had noise throughout the entire picture. We moved the VCR's tracking control but the noise remained unchanged. It looked like we had a typical situation of dirty or defective video heads.

We cleaned the heads and again tried our work tape. There was no improvement. We cleaned the heads once more to be sure, only to find the picture still full of noise. This confirmed the problem was not a dirty head. At this point, we realized this was not going to be a routine repair.

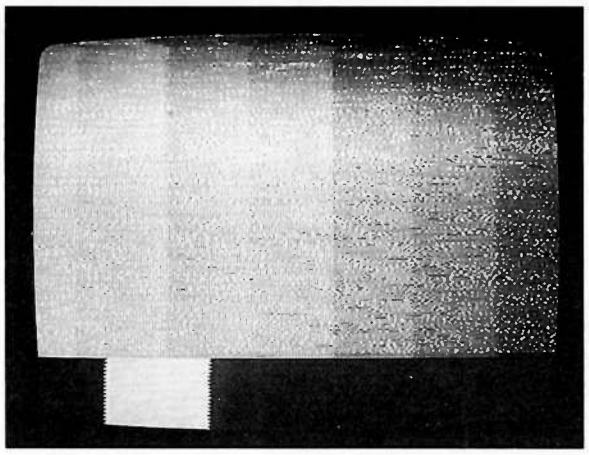


Fig. 2: Snow or noise was apparent over the entire screen and did not change. Is it a bad head, a servo problem, or something else?

From past experience, we realized that the noise was caused either by a defect in the luminance signal path, or a problem in the servos that was causing the heads to mistrack the information recorded on the tape. The VC93 was our solution to determine where the problem was. Our first move was to check the servos.

Confirming Proper Servo Operation

The VC93 comes with two servo analyzing leads: the Servo Performance Test Lead, and the Servo Troubleshooting Test Lead. The Servo Performance Test Lead uses the video and audio signals from the VCR to test the servos. Since the Servo Performance Test Lead analyzes the vertical sync pulses of the video signal and the linear audio tone from the Sencore Servo Performance Test Tape, the poor video we were obtaining from the VCR might not allow us to properly analyze the servos. But since the test is so fast and easy to hook up, we tried it first.

We connected the Servo Performance Test Lead to the VC93 and plugged the video and audio output plugs into the appropriate jacks on the back of the VCR. Then we inserted the Servo Performance Test Tape into the VCR and pressed the play button. The VCR sprang to life and yielded a noisy picture as before. We switched the Servo Analyzer Test switch on the VC93 to the SERVOS LOCKED position. The VC93's LCD display showed "—", meaning there was indeed too much noise in the video signal to effectively analyze it.

The Servo Troubleshooting Test Lead uses internal test signals instead of the video and audio output signals. We knew the tests with this cable would give us the results we needed, regardless of the quality of the audio and video signal coming from the VCR.

We replaced the Servo Performance Test Lead with the Servo Troubleshooting Test Lead and took the bottom off the VCR. Examining the circuit board, we quickly spotted the servo section and located the CTL test point. Checking around the luminance section of the PC board we located the RF switch (SW30) test point. We made our connections, including the ground clip, and again pressed the play button.

The VC93 Servo Analyzer display began to tell us the story. The Servos Locked test displayed 0.4% and a "GOOD" indicator appeared. We selected the Capstan Speed Error Test and the display produced numbers varying between 0 and 0.26%. After a few updates, a "GOOD" indicator also appeared. This is exactly what we expected to see if the capstan was running at the correct speed.

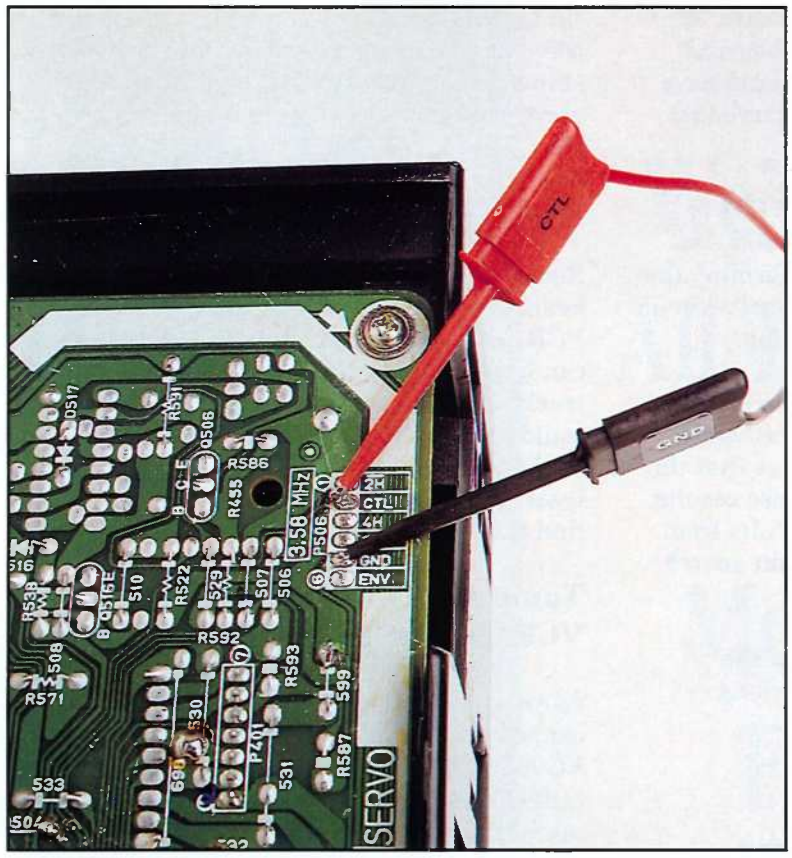


Fig. 3: Many VCRs have key test points identified on the board to help you make quick checks.

The Capstan Jitter test settled in with readings in the 0.08 to 0.11% range and, again, a "GOOD" indicator appeared. Both Drum Servo Tests also gave low percentage readings and "GOOD" indications. The VC93 had verified that the servos were running at the correct speed, did not have excessive jitter, and were locked to each other. The servos were good.

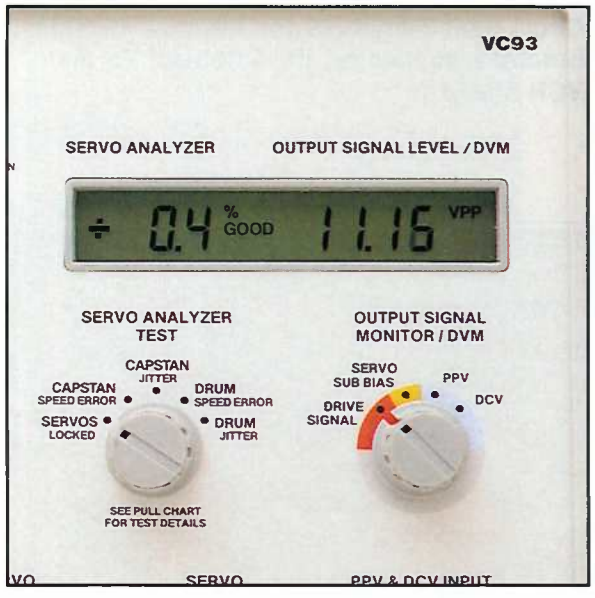


Fig. 4: The VC93 confirmed the servos were functioning properly.

A Quick Check Of The Luminance Channel

Our initial check had proved the servos were running properly. Our next check was the luminance channel. We pulled the schematic and located the output of the A/B headswitcher. Injecting the VC93 PLAYBACK signal at this point determines if the luminance circuits beyond this point operate properly.

We connected the Head Substitution Test Lead to the VC93 and hooked one of the red test clips to the output of the A/B headswitcher. We adjusted the level to approximately 1 VPP and again placed the VCR in the play mode. The picture on the monitor showed a good black-and-white pattern.

We located the head preamp board and identified the inputs of both preamps. We moved the Head Substitution Test Lead to the input of both preamps and again observed the monitor. Once again, the VCR produced a good picture. Everything after the preamps was proved to be good.

Removing the lead to one channel, we observed some of the tape test pattern in the background as well as the signal being injected into the VCR. This verified that one of the video heads was working properly. We replaced the clip lead and disconnected the other test clip. Again we observed some of the tape signal as well as the injected signal on the monitor. Both heads were good. The servos were good. Now what?

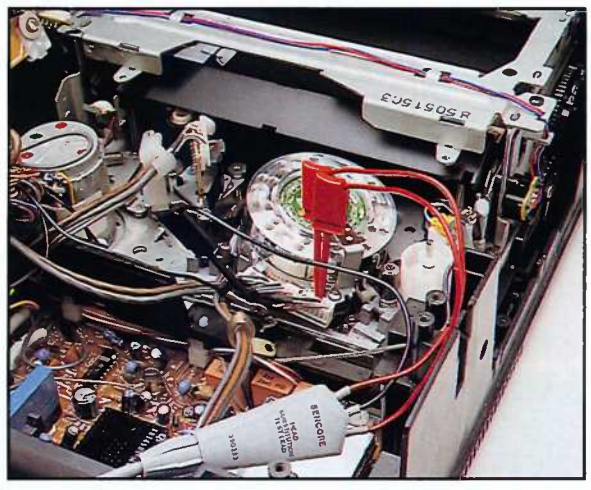


Fig. 5: We injected the VC93 Playback signal into the head preamps to verify the operation of the luminance circuits and the video heads.

Diagnosing Our Test Results Leads Us To The Problem

Up to this point, we had not found any cause for the symptom we were seeing on the monitor. We had, however, determined the problem was not caused by either the head or servo circuits. It was time to evaluate our test results and see what they meant.

The VC93 Servo Analyzer Tests told us a lot about the condition of the servos. Here's what we learned:

Servos Locked Test: This test was designed to determine if the drum and the capstan are locked up. Since the test result was "GOOD", we knew that both phase loops were locking to the internal REF30 source as they should be.

Capstan Speed Error Test: A "GOOD" indication here verified that the capstan was running at the right speed and that the video tape was being pulled through the VCR at the right speed.

Capstan Jitter Test: A "GOOD" indication for this test proved to us the tape was running through the VCR at a constant speed with very little speed variation.

Drum Speed Error Test: This test confirmed that the video drum was turning at the correct speed.

Drum Jitter Test: This test proved that the drum was turning at a constant rate.

Our injection of the Playback signal from the VC93 also proved to us that all of the luminance circuits after the rotary transformer were working. Seeing some tape signal when we alternately removed the signal from one, and then the other head, confirmed the video heads were working.

So where was the problem? Remember that adjusting the tracking control made no difference in the amount of noise in the picture. Since a bad head or a servo problem could mask any change in picture quality when we adjust the tracking control, we had disregarded any possibility of a tracking problem when we first checked over the VCR.

Our VC93, however, had proved that the heads were good and the servo circuits were responding correctly. The tracking control, however, adjusts the phase relationship of the capstan servo to the drum servo. If it wasn't adjusted properly, it could cause noise in the picture. We hadn't checked this yet.

With the Servo Troubleshooting Test Lead still hooked up to the VC93, we decided to try one more test. We reconnected the test clips to the CTL and SW30 test points. We switched the Servo Analyzer Test switch on the VC93 to the Servos Locked test and again placed the VCR in the play mode.

The Servo Analyzer display soon stabilized at 0.4% as it did before. We turned the tracking control and watched the display on the VC93. The numbers didn't change! Changing the tracking control should change the phase relation between the CTL and SW30 signals. The VC93 would have seen this and given us

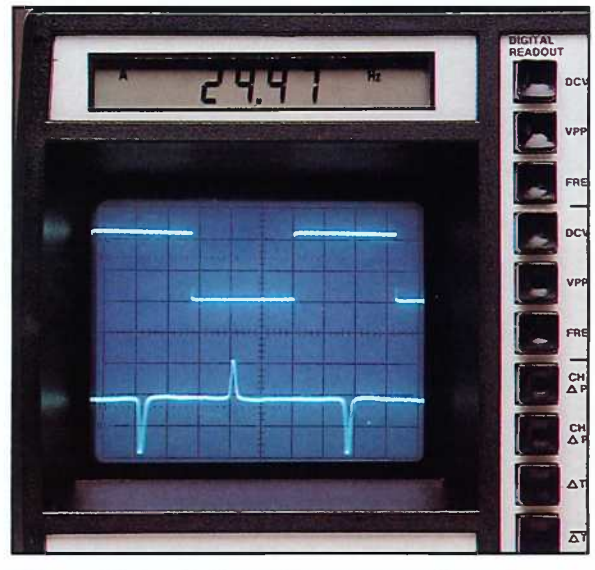


Fig. 6: The relationship between the CTL and SW30 signals did not change when the front panel tracking control was changed.

momentary bad readings. Since the readings remained unchanged, we had at least found the area of the problem.

We grabbed our SC61 Waveform Analyzer probe, connected onto the CTL and SW30 test points, and turned the tracking control. We saw no change in the relationship of the CTL pulse and the SW30 waveform displayed on the SC61. The tracking control was not affecting the signals at all.

We examined the circuit and checked a few components within the tracking control circuit. When we checked the tracking control itself, we found it to be open. The open tracking control simulated a tracking adjustment all the way to one side causing the noise on the monitor.

We might have found the problem using more conventional methods, but the VC93 helped locate the defect much faster and easier. We could have easily suspected bad heads and replaced them. But we didn't. We could have spent time checking all of the key servo test leads. But we didn't.

We used the exclusive tests of the VC93 to help determine where the problem was. We spent only a couple of minutes performing the servo tests, yet we were able to prove, without a doubt, that the servos were working.

We used the injection signals first to prove that the luminance circuits after the heads were good, then to prove to ourselves that the heads were good. By evaluating these results, we were able to eliminate most circuits from suspicion in the VCR and narrow our search down to the defect area.

But isn't the tracking circuit part of the servos? Yes, it is. However, the tracking circuit is external to the drum and the capstan servo and simply controls the timing relationship between the drum servo and the capstan servo. The servo loops were functioning as they should. The defective tracking control was simply telling the capstan servo to lock the tape movement to the wrong point.

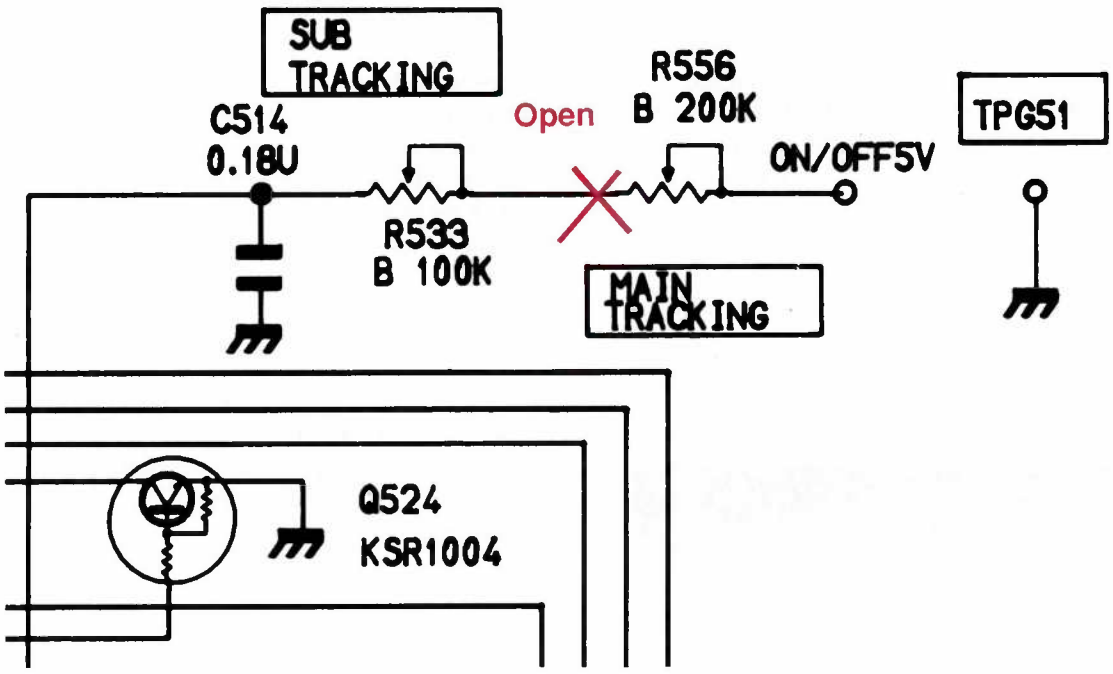


Fig. 7: The tracking control was open causing the bad picture.

Remember to check the tracking and headswitching alignments when you service a VCR. They are important to its operation and can lead you toward the real defect. A bad tracking circuit can cause a symptom that could cost you valuable time and effort. Unless you've got the VC93 All Format VCR Analyzer, you might search for hours trying to find this type of problem.

Tame All VCRs With The New VC93 All Format VCR Analyzer

As you've seen, a similar symptom can be caused by several different problems. Only the VC93 All Format VCR Analyzer tames these confusing symptoms in less time than other methods.

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Circle Fast Fact #259 for the new technical brochure explaining the VC93 All Format VCR Analyzer.

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$10,000 x 15% = $1,500 tax savings
$10,000 - $1,500 = $8,500 net instrument investment

If you're in the 28% tax bracket:
$10,000 x 28% = $2,800 tax savings
$10,000 - $2,800 = $7,200 net instrument investment

If you're in the 31% tax bracket:
$10,000 x 31% = $3,100 tax savings
$10,000 - $3,100 = $6,900 net instrument investment

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Method #2:

If you've already purchased over the $10,000 tax savings limit, you still have a tax savings opportunity. Business equipment purchased over the $10,000 ceiling can still be depreciated. Generally, first year depreciation is 20% of the purchase price. Here's how the first year depreciation works:

$10,000 x 20% = $2,000

$2,000 x 15% = $300 tax savings

$2,000 x 28% = $560 tax savings

$2,000 x 31% = $620 tax savings

Tax savings offer an excellent opportunity and incentive to improve your business' profits for the following year. Plan your business equipment purchases now to maximize your tax savings and minimize your costs. To take advantage of the 1991 tax advantages, call **1-800-SENCORE** today. Remember, to consult your local tax agent for your individual business situations and to talk with your Sencore test equipment representative to capitalize on the year-end specials and the lowest possible monthly investment.

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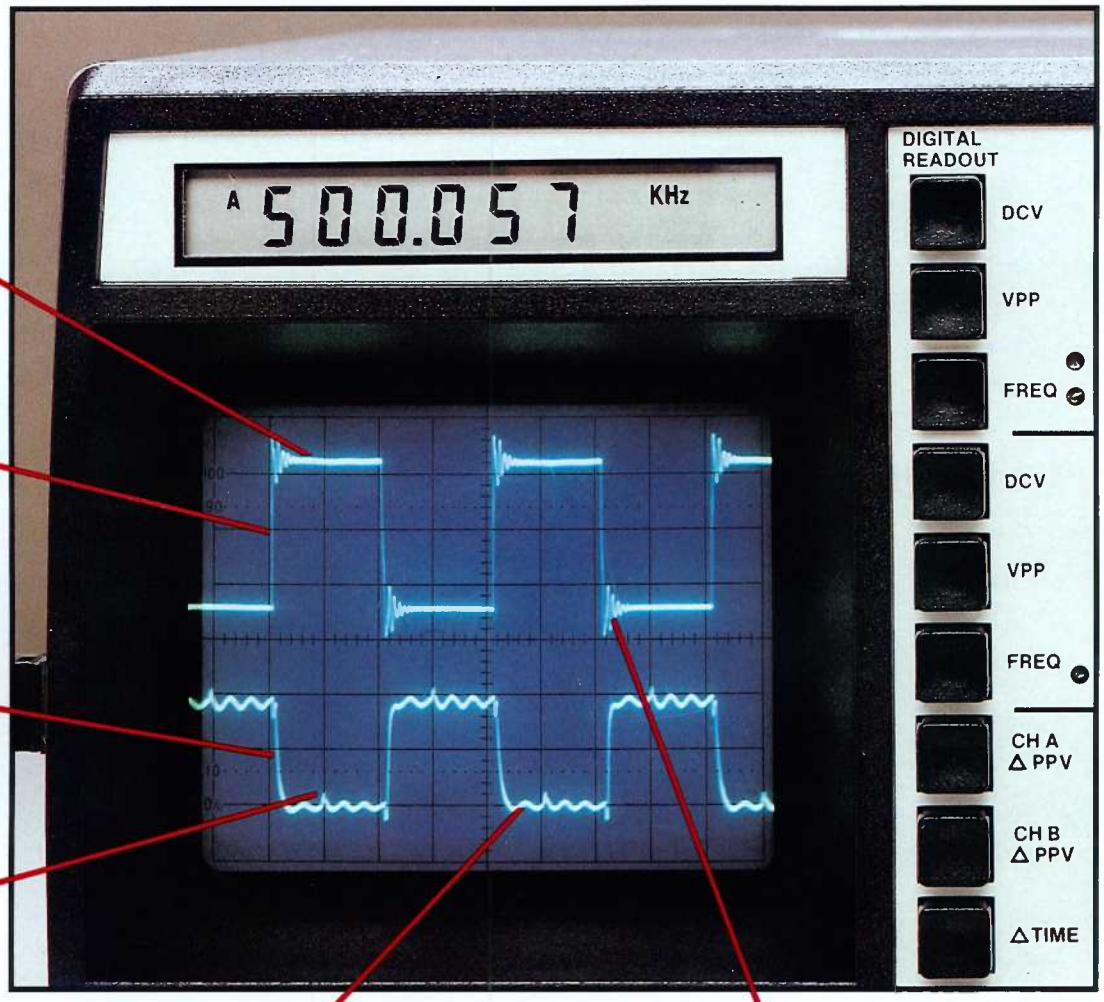
Push A Button To:

Analyze the true peak-to-peak level of any waveform.

Analyze DC through the same probe as all other tests.

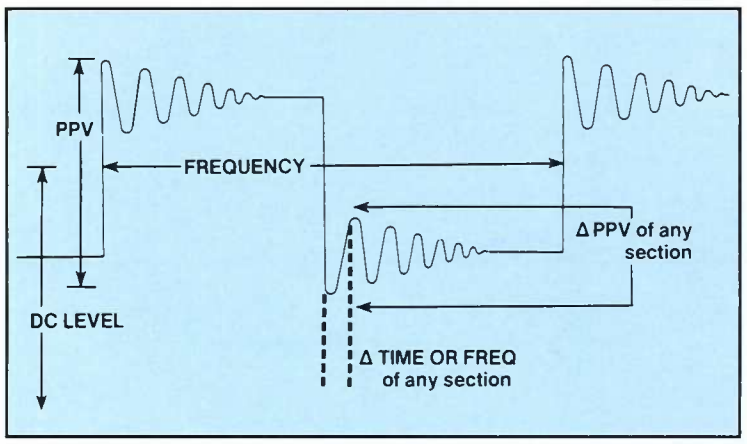
Analyze the frequency to a full 100 MHz, fully autoranged.

Analyze the true peak-to-peak level of any part of the waveform.



Analyze the time relationship of any waveform segment.

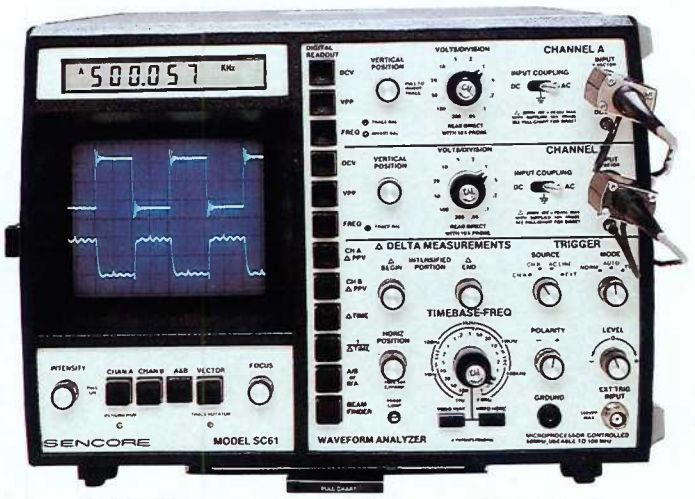
Analyze the frequency of interfering signals.



Only the SC61 measures all six parameters needed to fully analyze any waveform.

IEEE 488 BUS COMPATIBLE

RS232 COMPATIBLE



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Now, digitally analyze any waveform — 10 times faster — 10 times more accurately — and without the measuring errors associated with counting graticules on a conventional scope. How? By simply connecting either SC61 probe to your circuit test point and pushing a button. The SC61 is the only instrument that gives digital readouts of every waveform parameter to 60 MHz (useable to 100 MHz) at the push of a button. This added speed, accuracy, and reliability is guaranteed to double your trouble-shooting and testing productivity – or your money back.

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