

SENCORE NEWS

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Issue #145 July/August 1989
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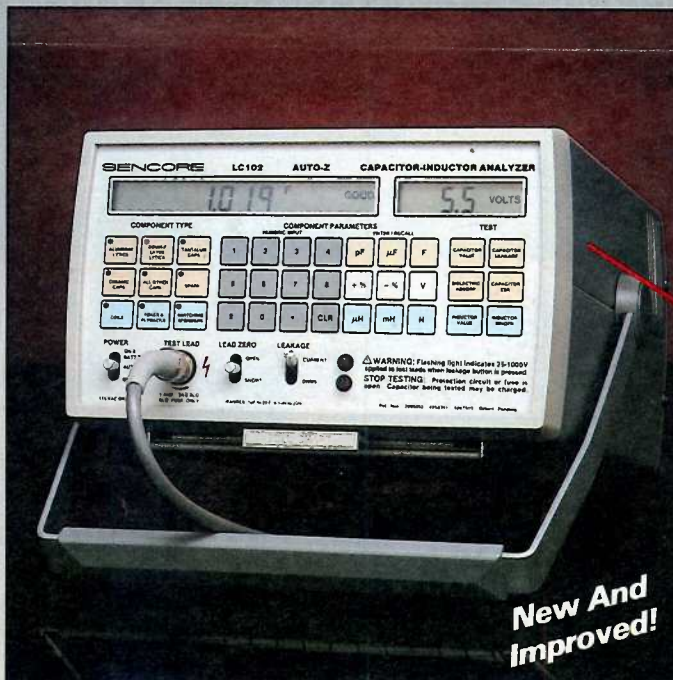
The Missing Link In Audio
Analyzing—Everything You Need For
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Dynamically Pinpoint Defective Caps And Coils
Faster And More Reliably Than Ever Before . . .



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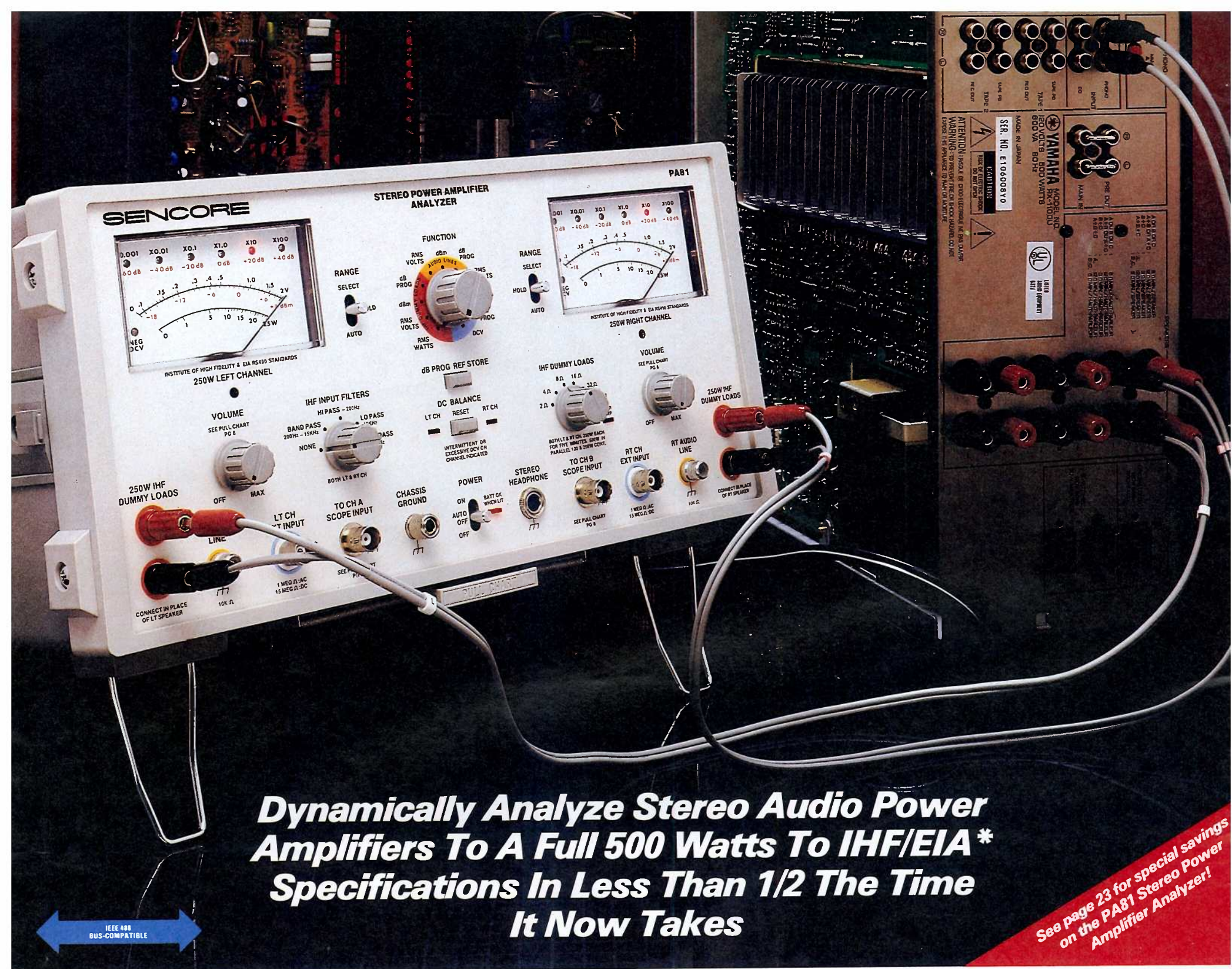
LC102 AUTO-Z™

Pinpoint Defective Caps/Coils And Special
Components Automatically — Without
Guesswork, Look-up Charts, Or Calculation
Errors . . .

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**Labor Day
Specials . . . Page 22**



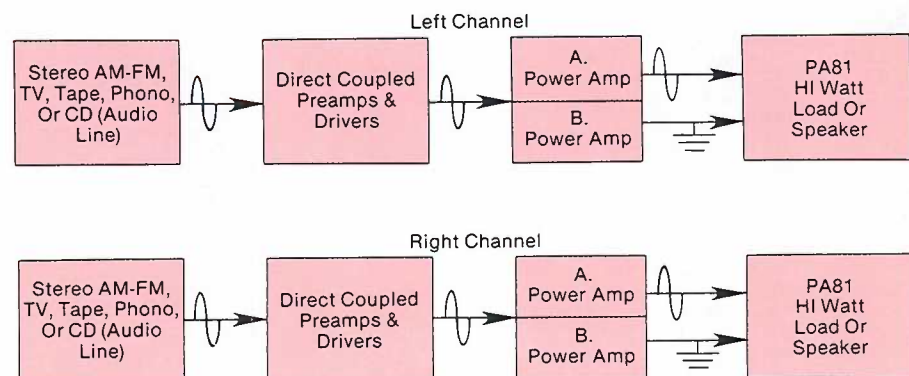
Dynamically Analyze Stereo Audio Power Amplifiers To A Full 500 Watts To IHF/EIA* Specifications In Less Than 1/2 The Time It Now Takes

See page 23 for special savings on the PA81 Stereo Power Amplifier Analyzer!

With The PA81 Stereo Power Amplifier Analyzer™

Introducing the "Missing Link In Audio Servicing," with the NEW PA81 Stereo Power Amplifier Analyzer™ from Sencore Electronics. The PA81 provides everything you need for power amplifier analyzing integrated into one complete package, with:

- **Twin Frequency Compensated Autoranged Wattmeters:** 250 watts per channel (500 watts if paralleled), and listen to audio clarity with built-in volume control.
- **Built-in IHF/EIA Testing Components At Your Fingertips:** 2, 4, 8, 16, and 32 ohm-zero reactance loads, and all specified bandpass audio filters.
- **Measure RMS Volts And dB As You Trace Through Circuits:** Plus, programmable dB to measure stage gain.
- **Test Intermittents To Prevent Amplifier Damage:** Built-in DC balance test, automatically opens loads.
- **Test Audio Line Levels To Make Sure The Driver Input Signal Is Correct:** Check turntables, AM tuners, FM tuners, TV stereo demodulator outputs, CD players, etc. for standard line levels.
- **Monitor Stereo Separation To 126 dB:** Monitor, troubleshoot, or align AM-FM or TV Stereo separation circuits.



Walk troubles out of any power amplifier stage, step by step, with the PA81.

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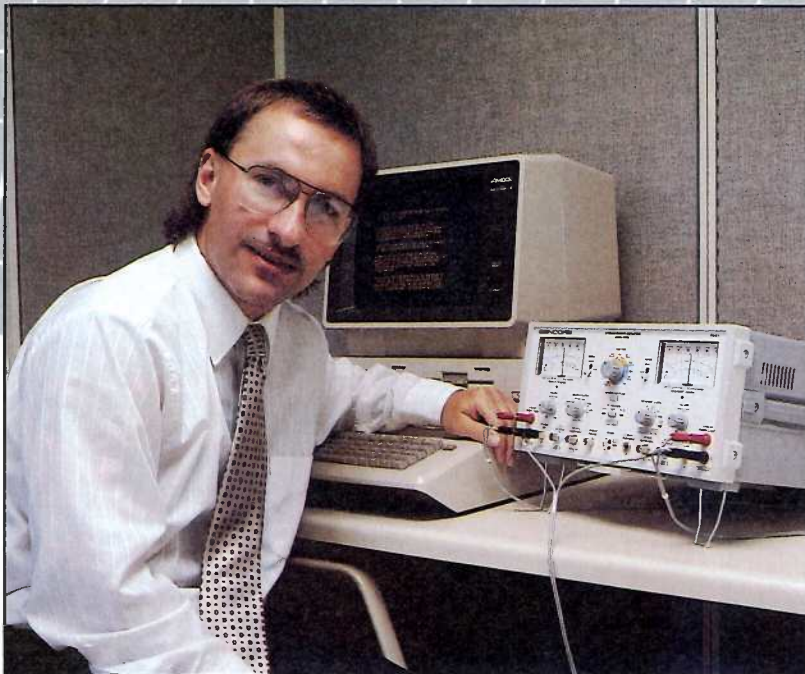
* IHF—Institute Of High Fidelity
EIA—Electronics Industries Association

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How The PA81 Stereo Power Amplifier Analyzer™ Fills In The Missing Link For All Audio Analyzing

by Larry Schnabel, Technical Writer

I had seen that type of smile before. Mary, one of our secretaries, was walking toward us in the hall with a sincere, but exaggerated smile on her face. It was one of those smiles that said she wanted us to repair something for her.

I was right. She wanted somebody to take a look at her cassette deck. Seems it had started acting up the day before.

We asked her what kind of deck it was, but she didn't know exactly, although she said it was only about a year old. Then, we asked her exactly what the problem was. She didn't know that either. All she knew was that it wasn't playing her Linda Ronstadt tapes right.

The next morning, the Friday before Memorial Day, she brought it in for us to look at. It was a Panasonic deck in mint condition. Before she left it in our hands, Mary left us with this little surprise, "I brought this deck to you guys because all of the shops in town were busy. I hope you can have it ready for me by this afternoon!"

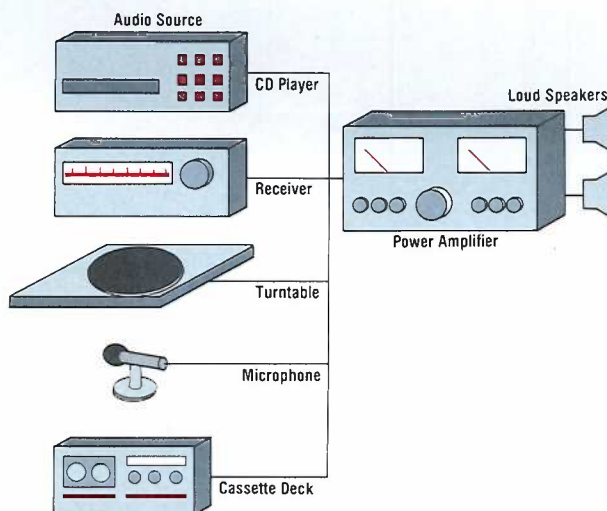


Fig. 1: The PA81 Stereo Power Amplifier Analyzer lets you pinpoint audio troubles anywhere in the system.

At first, we were more than a little concerned. Finding time to just work on Mary's deck was going to be hard enough. But to have it repaired by the weekend was quite a feat for a problem yet unknown.

You Can Fix Any Problem With The Right Test Equipment

Our only hope was a little bit of luck and the right test equipment. Luckily, our audio bench was set up with a PA81 Stereo Power Amplifier Analyzer. The PA81 fills the missing link in audio analyzing, something every servicer needs. The PA81 not only eliminates wasted time and confusion in audio amplifier analyzing, but it is the total answer for all audio analyzing, including cassette decks.

Over the lunch hour we decided we'd better look at the deck so we at least knew what the problem was. As we walked up to the audio bench with Mary's tape deck, we noticed an amplifier on the bench hooked up to the PA81.

The application engineers were doing a burn-in test of an amplifier using the PA81's IHF DUMMY LOADS. The PA81 measures audio power signals up to 250 watts per channel with all of the common load impedances.

(continued on page 8)

Record Number Of Patents Awarded



Sencore has recently been awarded their sixth U.S. patent in the last twelve months. According to chairman Herb Bowden, on the left, this brings the total patents owned by Sencore to 28. Sencore innovation is now being recognized with a patent issued approximately every other month, which means real market protection in

the United States and foreign countries. Sencore patents and unique designs have virtually eliminated worldwide competition in their niche market, explained Mr. Bowden.

These patents ensure Sencore product owners, both now and in the future, of innovative, time saving tests that other manufacturers can't provide.

The most recent patent was issued for the modulation method on the SG80 AM Stereo/FM Stereo Analyzer. Sencore is supporting the new C-QUAM AM Stereo market with the introduction of this unit. Motorola, who holds patents on the new AM Stereo system, has approved this exclusive product for worldwide distribution. Availability on the SG80 is targeted for late 1989.

Look for more information about what these exclusive patents mean for the servicing professional in future issues of the Sencore News. ■

Contents

Using Your PA81 Stereo Power Amplifier Analyzer—page 3

Record Number of Patents Awarded to Sencore—page 3

All New LC101 Z METER Capacitor-Inductor Analyzer—page 5

Applications For Your VA62A Universal Video Analyzer—page 11

Using Your CHANNELIZER To Analyze Carrier Offset—page 15

Signal Analyzing With The SC61 Waveform Analyzer—page 17

Sencore Instruments—Your First Step To Success—page 18

Introducing The All New And Improved LC101 Capacitor-Inductor Analyzer

Dynamically Pinpoints Defective Caps And Coils Faster And More Reliably Than Ever Before . . .

Capacitor Analyzing

The LC101 speeds troubleshooting in high frequency, high current circuits like switching power supplies, flyback-powered TV receivers, keyed ACG and all other critical circuits. Only Z Meters test for all modes of capacitor failure:

- Capacitor value
- Dynamic leakage at full operating voltage to 1000V
- Dielectric Absorption (patented)
- Equivalent Series Resistance (ESR) (patented)

Inductor Analyzing

Gives you exclusive patented tests that eliminate the frequency-dependent variations seen with inductance bridge type instruments—has improved accuracy on high DC resistance coils. The LC101's exclusive dynamic Ringer™ test detects even one shorted turn. The LC101 Z Meter even proves most coils good or bad in-circuit.

Plus, You Get These Special Tests:

- Test SCRs, TRIACs, and high-voltage diodes with up to 1000 volts applied with the easy to use SCR250 SCR and Triac Test Accessory.
- Pinpoint distance to a short or open, to within feet, in any transmission line. Great for communications, broadcast, and avionics work.
- "Hi-Pot" dielectric leakage test to 1000 volts. It's like getting a special tester FREE.



New And Improved

LC101 Z Meter™ Four Patents

Call 1-800-SENCORE (736-2673)

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See page 23 for special savings
on the All New LC101 Z Meter!



Introducing The All New LC101 Z Meter Capacitor-Inductor Analyzer

by Larry Schnabel, Technical Writer

Even though capacitors and inductors are essential parts of modern electronic circuits, many servicers seem to overlook their importance since they're so common and appear so simple. How many times have one of these "simple" components caused a problem in one of your circuits? I'll bet the problems caused by these "simple" components turned out to be far more complicated than they could have been.

The New LC101 Z Meter Gives You Results You Can Trust

To eliminate complicated problems from even arising, you need a reliable method of proving capacitors and inductors good or bad. With accurate testing methods, you can totally eliminate guesswork, plus stop the expensive habit of stocking parts for substitution.

What you need is a capacitor and inductor analyzer that gives you results you can trust, an analyzer that finds good and bad components quickly. The all new LC101 Z Meter does all of that, automatically. The LC101's 100 percent dynamic and accurate tests for both capacitors and inductors combine advanced component testing with simple methods and procedures.

The new LC101 Z Meter provides the same time-

“Many servicers overlook the importance of analyzing capacitors and inductors. These "simple" components turn out to be far more complicated . . . **”**

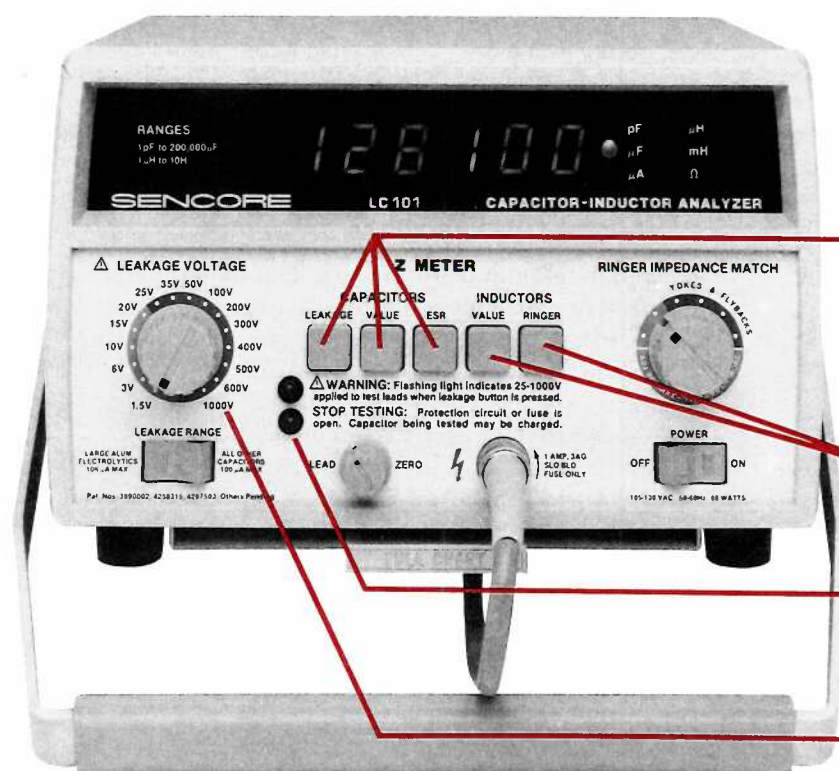
Are you still guessing at capacitor and inductor values? Are you trying to keep costly replacements in stock for substitution only? Are you struggling with a bridge and its tests to find bad components?

If you answered yes to any one of these questions, you're not alone. Many servicers still do not have a reliable method of testing capacitors or inductors. Some people use value-only testers or bridges for their testing. Servicers tell us this works good for a lab, but not for troubleshooting or finding bad parts.

Other servicers use substitution for most or all of their component analyzing. The problem with this method is two-fold, at least. First, you must keep stock of every kind of capacitor and inductor you run across. That's impractical for most people. Secondly, how do you know your substitute part is good? What if it's bad, and you don't know it?

**New
And
Improved**

**Send For A 10 Day
Video Preview On
The LC101!**



Exclusive Capacitor Tests Analyze:

- Value
- Dielectric Absorption
- Leakage
- Equivalent Series Resistance (ESR)

Exclusive Inductor Tests Analyze:

- True Inductance Value
- Inductors For Shorted Turns

New Alert System:

- Warns you if your Z Meter's fuse is open, and potential is present at test leads.

Leakage Voltage Up To 1000 Volts:

- Tests even the largest electrolytics
- Checks leakage in cables, switches, PC boards, and connectors.

Fig. 1: Introducing the all-new LC101 Z Meter.

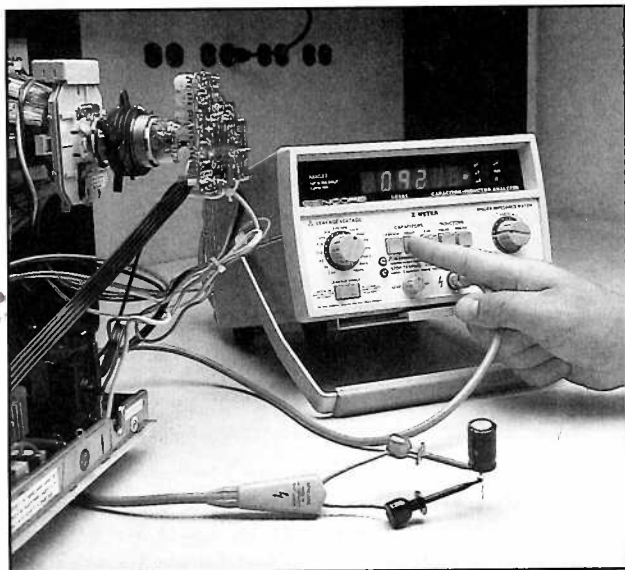


Fig. 2: Just push the LC101's VALUE button for an autoranged and accurate capacitance value reading.

proven tests that have made the Z Meters famous. The Z Meter tests capacitors dynamically for all four defects: value, leakage, dielectric absorption, and equivalent series resistance. And now, you can test for capacitor leakage all the way up to 1000 volts to catch failures on even the largest capacitors.

The LC101 gives you the reliable and patented Z Meter inductor tests, too. The Z Meter measures inductance, not inductive reactance, like bridges do. Plus, you can eliminate any doubt about a coil's condition with the Z Meter's exclusive ringing test. One push of the button tells you if the coil has a shorted turn.

You get special tests with the LC101 too. Test SCRs, triacs, and high voltage diodes with up to 1000 volts applied to give you the confidence you need in today's high powered circuits. "Hi-Pot" tests let you pinpoint any kind of leakage in seconds.

The special transmission line tests let you pinpoint the distance to an open or short to within feet. This time-saving test helps you avoid digging up entire lengths of good cable.

The new LC101 Z Meter has a new feature to warn you of the presence of a charged capacitor. If the LC101 fuse has blown or if there is an excessive charge on the Z Meter's test leads, the LC101 lets you know with an audible and visual alert system. This protects your test equipment from damage and warns you of possible shock hazards.

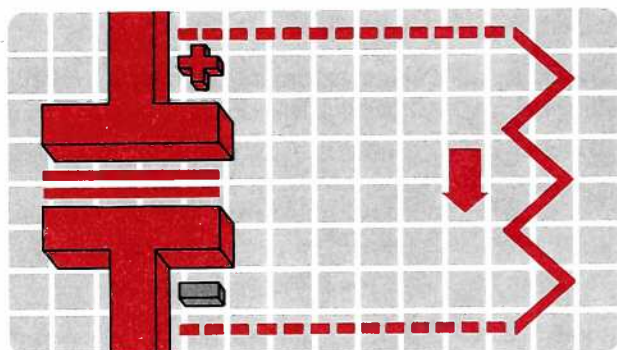


Fig. 3: Capacitor leakage is the most common failure of capacitors, but cannot be tested by other testers. The LC101 Z Meter tests capacitor leakage up to 1000 volts.

Here's What You Can Do With The New LC101 Z Meter

You Can Analyze Capacitor Value At The Push Of A Button

Capacitors can change value in a circuit or while sitting on a shelf. When a capacitor changes value, it usually goes down. A decrease in value is most common in aluminum electrolytics, which is caused by the dielectric solution drying out.

The LC101 Z Meter measures capacitance value from 1 picofarad up to 200,000 microfarads with the push of a button. The LC101 reads value directly, with no confusing millifarad or nanofarad readings to throw you off track.

All you do is connect the capacitor, push the VALUE button and read the LED readout. There's no manual ranging, decimal moving, or zero counting. The LC101 simply reads the actual capacitance value with no chance of error.

You Can Analyze Capacitors For Leakage, Under Full Load, Now With Up To 1000 Volts Applied

Most capacitor defects don't affect the static value of the capacitor. Dielectric leakage is the most common defect associated with capacitors, yet the

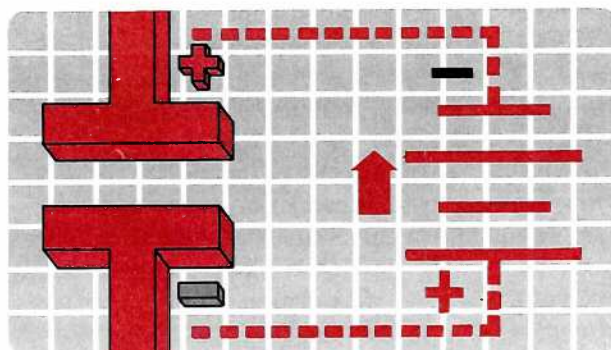


Fig. 4: Dielectric absorption prevents a capacitor from fully discharging because it acts like a small battery is inside.

Z Meter is the only tester that dynamically tests for it. Most alternative methods involve tedious and inaccurate circuit analysis, or simple substitution of the suspect capacitor.

The Z Meters are the only capacitor testers on the market that supply the voltage necessary for the leakage test, up to 1000 volts. The LC101 catches defective capacitors that are just beginning to leak too, by measuring leakage current as low as one tenth of a microamp.

To measure leakage, all you do is match the Z Meter's leakage voltage to the capacitor's voltage rating, and push the LEAKAGE button. Then you read the leakage current directly on the LED readout without calculations. The handy pull-chart at the bottom of the LC101 tells you how much leakage is excessive for the capacitor you are testing.

You Can Analyze Capacitor Dielectric Absorption With Dynamic, Patented Test

Have you found an entire batch of filter capacitors that didn't filter out AC ripple like they

should? Have you replaced an electrolytic capacitor with an "exact replacement" only to find that the stage bias was even worse than with the original capacitor? These are just two indications of excessive dielectric absorption.

Dielectric absorption (DA) is the inability of a capacitor to fully discharge between pulses or cycles. Dielectric absorption acts like a small DC battery inside a capacitor, most often electrolytics. This "effective battery" leaves a residual DC level across the capacitor, which upsets the DC bias on the stage or simply reduces the filtering capabilities of the capacitor.

All capacitors have a small amount of dielectric absorption, but it often becomes excessive in electrolytics.

To test for dielectric absorption, you first check value and leakage as you normally would. Then, you retest the value. If the value has changed excessively, the Z Meter has told you that dielectric absorption is causing the capacitor to hold an extra charge, which effectively changes the capacitor's value when charged.

You Can Analyze For Equivalent Series Resistance (ESR) With The Push Of A Button

A good capacitor should immediately begin charging at the RC time constant made up of the capacitance value and the output of the supply charging the capacitor. If there is any excessive resistance in series with the capacitor, the charging curve is affected and a heat build-up will occur inside the capacitor causing premature failure. This excessive resistance is called equivalent series resistance (ESR).

ESR is simply the resistances in series with a capacitor. An ohmmeter cannot measure ESR because it is impossible to connect an ohmmeter across the resistance inside the capacitor. The capacitor also blocks any attempts at a DC measurement.

The LC101 Z Meter tests for ESR by simply charging the capacitor while measuring the instantaneous rise in voltage caused by the resistances inside the capacitor. The instantaneous voltage step is automatically calculated into a resistance reading for you inside the Z Meter and displayed on the LED readout.

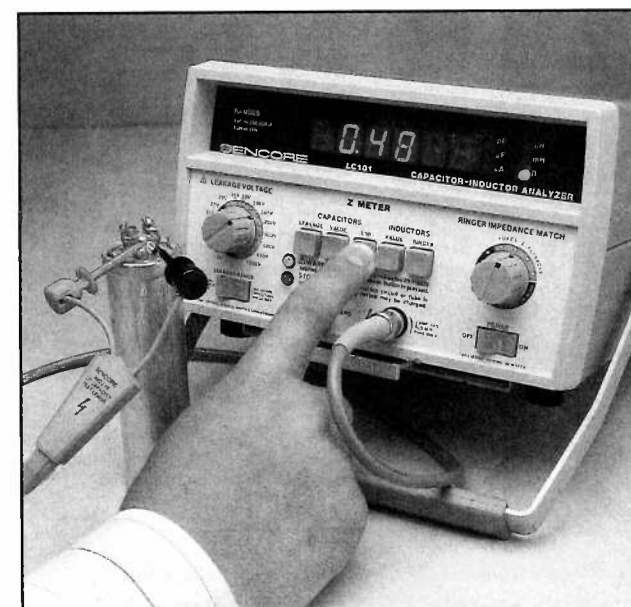


Fig. 5: One push of the LC101's ESR button helps you isolate capacitor ESR problems.

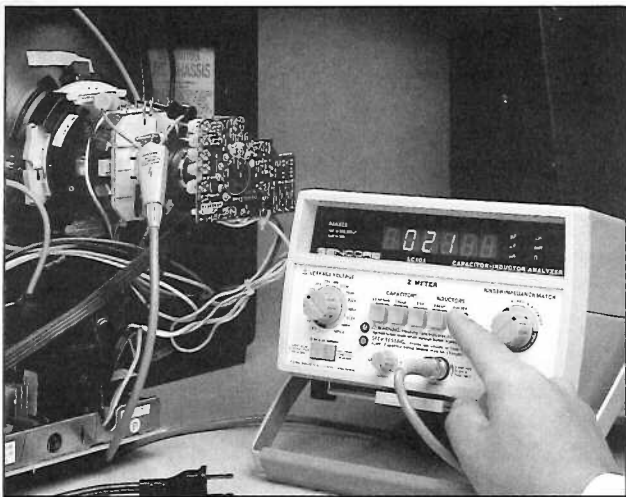


Fig. 6: The LC101 Ringing Test finds even a single shorted turn in an inductor.

You Can Analyze Inductor Value Automatically From A Tiny 1 Microhenry To A Huge 10 Henrys

The LC101 Z Meter measures true inductance, not inductive reactance as is done with impedance bridges. The patented inductance value test uses the basic definition of inductance, which defines inductance in reference to the voltage induced when applying a constantly changing current. This determines the inductance without regard to frequency, which is the average value over the total operating frequency range of the coil.

Simply connect the LC101 to the inductor and push the VALUE button. The Z Meter will automatically calculate the inductance value and display it directly in uH or mH, so you don't have to move decimal points or interpret the readings.

You Can Analyze Inductors For Even One Shorted Turn

The most common problem with inductors is one or several shorted turns in the windings of wire. Even a single shorted turn will lower the "Q" of a coil and affect its circuit performance greatly.



Fig. 7: Find leakage in capacitors, SCRs, triacs, or hi-pot applications with the LC101 leakage voltage extending all the way up to 1000 volts.

A shorted turn doesn't affect the resistance or the value of the coil enough to tell if the coil is bad. Therefore, value-only testers or ohmmeters can't find this type of defect.

The LC101 Z Meter patented ringing test puts a capacitor in parallel with the inductor under test,

then applies a sharp pulse to the tank circuit. The LC101 automatically counts and displays the resultant rings until they deteriorate to a preset level. If the ringing reading is 10 or more, the coil is good. If the reading is less than 10, the coil has a shorted turn and is defective.

All you do is push a button and read the meter. Ten is the only number you need to know. No more wondering if your yokes, flybacks, and other coils are good or bad. The ringing test, which you can perform in- or out-of-circuit, tells you automatically.

You Can Analyze SCRs And Triacs With Dynamic Tests

Most analyzers and technicians don't have a method to test SCRs and triacs. They rely on luck most of the time or substitution if there is nothing left in the circuit to test.

The LC101's current-limited power supply along with the optional SCR250 SCR & Triac Test Accessory lets you test SCRs and triacs for turn-on, turn-off, and leakage with up to 1000 volts applied. The SCR250 was built to hookup to the Z Meter to check even industrial SCRs with high-current capabilities.

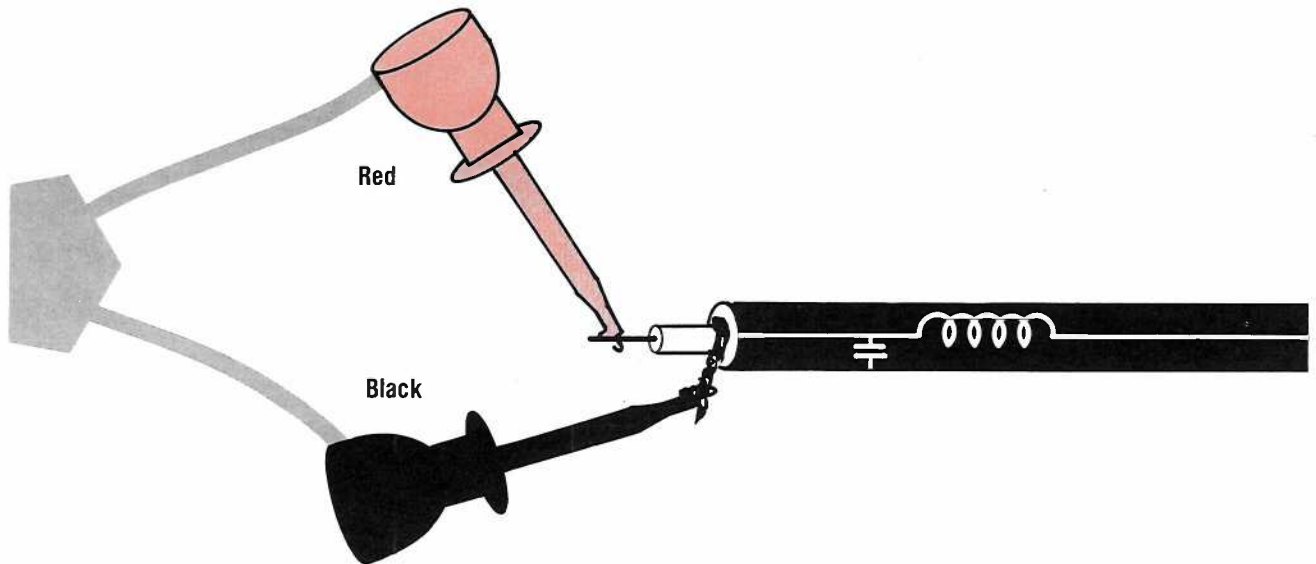


Fig. 8: The LC101 Z Meter isolates distances to opens and shorts in transmission lines by measuring the capacity or inductance of the defective cable.

Simply hook the SCR250 to the LC101 and connect the three test clips to the SCR or triac. You set the Z Meter's leakage voltage and the SCR250 supplies the gate current. You won't have to guess if these components are good or bad anymore.

You Can Analyze Transmission Lines For Opens Or Shorts

If you've ever repaired transmission line, you certainly appreciate clues to the location of the defect. If the clue could tell you where the problem is within feet of the problem, you would know exactly where to dig without tearing out massive amounts of cable that was good in the first place. The same holds true if the cable is behind a wall or in a tunnel. You would love to zero in on the defect as soon as possible.

The LC101 Z Meter finds transmission line defects by testing the cable like an inductor or capacitor. To determine the distance to a short, you simply measure the total inductance of the transmission line, and divide the measured

inductance by the normal inductance per foot. The result is the distance to the short in feet.

Finding an open in a transmission line is done similarly. You measure the total capacitance of the cable and divide it by the normal capacitance per foot. You take that number in feet, and measure from the end of the cable you are measuring. The LC101 helps you pinpoint these defects so you can get to the source of the problem quicker.

Try The New LC101 Z Meter For Yourself

The LC101 combines the proven capacitor and inductor tests with the special tests to make a total analyzing system. In short, here is what the LC101 helps you do:

• Analyze Capacitors With Exclusive Tests:

- Value
- Leakage
- Dielectric Absorption
- Equivalent Series Resistance (ESR)

• Analyze Inductors With True Inductance Value And Ringing Test

• Find Distance To Within Feet Of Open Or Shorted Transmission Lines

• Test SCRs, Triacs, Hi-Voltage Rectifiers, Diodes, With Optional SCR250 Accessory

• Check Leakage As Low As One Microamp With Up To 1000 Volts Applied To Cables, Switches, PC Boards, And Connectors

Call today toll-free at **1-800-SENCORE** (in Canada call toll free 1-800-851-8866) and arrange to have the LC101 Z Meter added to your bench today. You'll be glad you did. ■



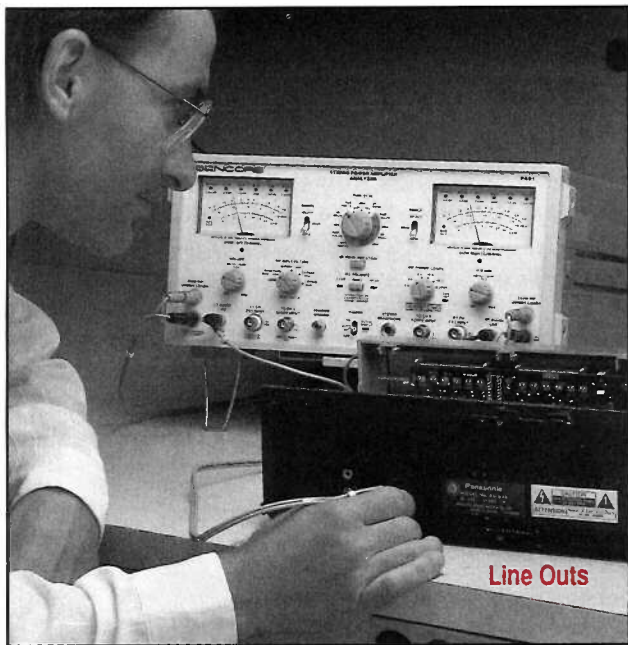


Fig. 2 You can completely analyze line outputs with the PA81.

(continued from page 3)

They said they were testing for an intermittent problem with the amplifier. They had found and fixed the problem, but they were checking for possible weakened parts. They were also monitoring the PA81's DC BALANCE LED's for a DC balance problem. If either the LT CH or RT CH LED comes on, it indicates which channel has an excessive DC voltage present.

They weren't going to work at the bench for a while, and they said we could use the PA81 if we wanted to. The dummy loads stay connected no matter which PA81 function you are using, so we were able to use any function we wanted. They were safe by leaving the amp and PA81 unattended, too, because if a DC balance problem occurs, the PA81 automatically disconnects the loads to protect the amplifier from damage.

Analyze 'Line Out' Signals With The PA81 Stereo Power Amplifier Analyzer

The first thing we did was plug the LINE OUT jacks from the cassette deck into the AUDIO LINE jacks on the PA81 Stereo Power Amplifier Analyzer. The PA81 lets you completely analyze the line-level audio signals of cassette decks, CD players, VCRs, and tuners. You can even listen to the audio with the PA81's built-in high quality speakers or by hooking up a set of headphones to the STEREO HEADPHONE jack. You can also view the audio by hooking an oscilloscope to the TO SCOPE INPUT jacks on the PA81's front panel. An oscilloscope lets you analyze the audio waveform for further defects.

We decided to pull the Linda Ronstadt tape out of Mary's deck and use our test tape with a 1 kHz tone recorded on it. We didn't want to face the wrath of Mary if her tape would somehow get damaged.

With the line out's hooked up to the PA81 and the test tape in place, we powered the cassette deck up ready to test. The power light and indicator LED's all lit up in a normal fashion. But, when we pushed the PLAY button, nothing happened. I mean nothing happened.

The tape didn't budge. We tried the fast-forward and rewind buttons, and got the same result. The tape just wouldn't move.

We took the case off the deck and started looking for an obvious defect like a dislodged belt or a loose connector. A major failure like this is often a mechanical type of problem which can be fixed without a schematic. A thorough inspection of mechanical parts and assemblies, however, yielded no such cure. A search for the schematics for this deck also went in vain.

That left us with the PA81, our experience, and the rest of our audio bench to fix this deck. I had the feeling the PA81 would be our biggest asset.

Use The PA81's External Inputs To Track Level Problems Down

Common sense told us to measure the DC voltage getting to the motor. If there was no DC voltage present, we could trace the line back to try and pinpoint the problem. Using the DCV function of the PA81 Stereo Power Amplifier Analyzer, we hooked directly across the two leads leading to the motor. Since the grounds of the PA81's EXT INPUTs are isolated, we didn't need to worry about isolation. A quick look at the autoranged meter reading showed what we suspected. Zero volts.

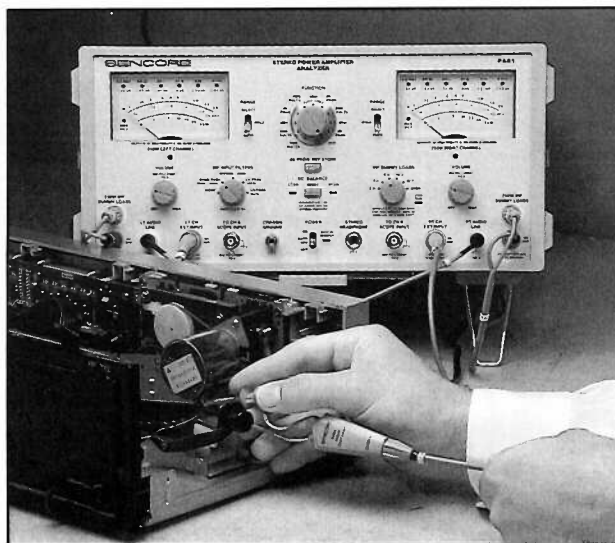


Fig. 3: Use the PA81 signal tracing meter to help pinpoint troubles down to a component. The autoranged PA81 DC meter showed 0 volts meaning there was a problem before the motor.

Our first suspect was the power supply circuit. If the motor wasn't getting any DC voltage, either the power supply was bad or some component between the motor and power supply was blocking the voltage. We followed the AC line cord and located the rectifier diodes on one corner of the board. Somewhere between this corner of the board and the motor laid our problem.

We followed the motor path back toward the power supply with the PA81's DC meter. It read zero volts all the way. Then we traced up to a resistor that was mounted off the board farther than the rest of the resistors. Our experience told us that this was done probably because of two reasons. One was to dissipate heat better. The other reason for the sky-mount was to make it easier to change in case it fails, as in the case of a fuseable resistor. Manufacturers occasionally do

this to components that have failed more often than others.

If this resistor was a common failure point, maybe this repair wouldn't be so hard after all. We measured the DC on the motor side of the resistor and got zero volts. Then we moved the probe to the other side of the resistor, and the PA81's autoranged meter immediately came to life. It read a full 12 volts DC.

That opened our eyes. A resistance check proved the resistor was open. The resistor's color code was yellow-violet-gold, or 4.7 ohm. We temporarily jumpered a replacement resistor in place of the open resistor and pushed the PLAY button again.

There it went! The motor was turning beautifully. We tried fast-forward and rewind to double-check the circuits and they proved to be working too. We turned up the PA81's internal autoranged speakers and listened to the audio tone. It played smoothly without any distortion.

The PA81's speakers are autoranged with the meter circuits. So it doesn't matter if you're measuring hundreds of watts of audio power or just millivolts from a line output, the speaker won't blow you away, nor will it be too quiet.

Since we didn't have any service literature or calibration procedure, about the only measurement we could do was to measure the LINE OUT voltage to be certain the deck put out enough voltage for Mary's amplifier.

I just reached up and turned the PA81's function switch to RMS VOLTS in the color-coded AUDIO LINES section. The dual-meters autoranged and showed readings of 250 mV, plenty of voltage necessary for most amplifiers.

We patted each other on the back as we put the case top back on Mary's cassette deck. We almost wished she had brought in something a little more challenging.

You Can Actually Listen To Any Audio Level With The PA81 Stereo Power Amplifier Analyzer

After lunch, Mary came back to see how we were doing. We proudly proclaimed that we had the

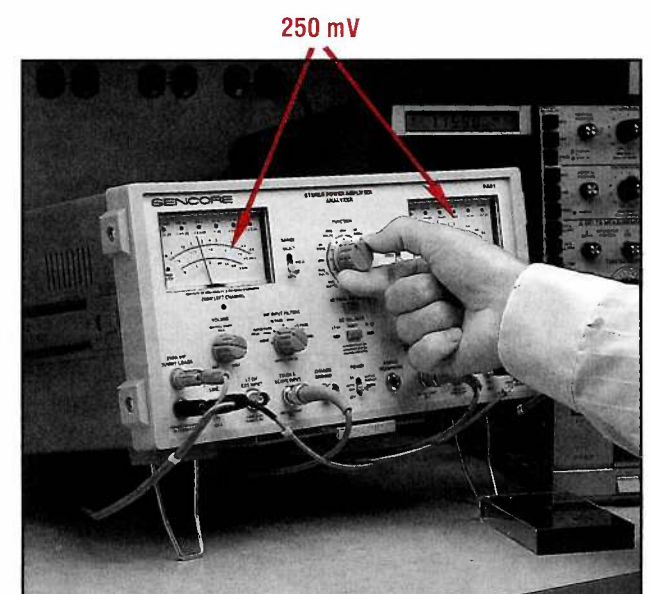


Fig. 4: Measure the RMS volts of line outputs with the PA81 Stereo Power Amplifier Analyzer to make sure the level is sufficient for an amplifier.

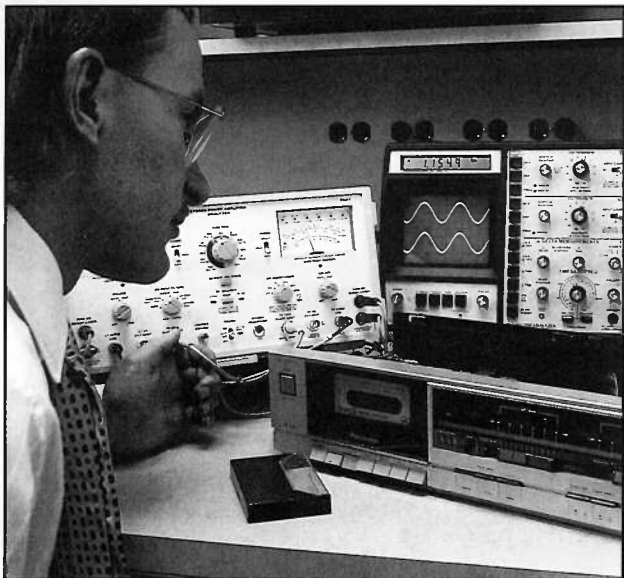


Fig. 5: The PA81 lets you analyze the audio waveform even further by providing scope hookup jacks to connect to your oscilloscope.

problem already solved. We boasted how we carefully walked through the circuits with the PA81 Stereo Power Amplifier Analyzer's DC meter and found the open resistor. We also explained to her that the deck's outputs were good since we were able to measure them using the PA81's line output analyzing capabilities.

Then she decided she wanted to hear how it sounded, the ultimate test of any audio system. We had done that once before by playing the test tape and listening to the tone with the PA81 speakers, but anything to satisfy a customer.

With the deck still hooked up to the PA81's AUDIO LINE inputs, we put the Linda Ronstadt tape in and turned the power on. We watched Mary's face with great anticipation as we pushed the PLAY button.

Mary's anxious face suddenly turned to a frown, however. Either we got her tape mixed up with a Walt Disney tape, or Linda Ronstadt's voice suddenly sounded like Donald Duck. We knew that Linda Ronstadt's lark-like voice was nothing like Donald Duck, so we came to the slightly embarrassing conclusion that Mary's cassette deck still had a slight problem: the motor was running too fast.

It was a good thing we had the PA81 to listen to the actual audio that the cassette deck was putting out. Without that proof-positive test, we would have sent the deck home with Mary for the weekend, still with a problem.

We took off the case again wondering what we could do to fix this type of problem. We decided to first measure the frequency of the 1 kHz tone to see just how far off we were.

The PA81 Lets You Use Your Scope To Analyze The Audio Signal—Even Further

The PA81 Stereo Power Amplifier Analyzer provides a left channel and a right channel jack to let you further analyze the audio signal with an oscilloscope for clipping, distortion, or, in this case, frequency. We hooked up the SC61 Waveform Analyzer to the TO SCOPE INPUT jacks

and pushed the channel A FREQ button to get a direct frequency readout.

We put the test tape back in the deck and turned it on. The SC61's display came up with a reading of 1.15 kHz. That was over a 10 % error in speed, certainly enough change to notice a problem on any brand of music, but difficult for the human ear to notice on a single tone.

Now all we had to do was slow the motor down. The first thing we checked for was the proper DC voltage level being supplied to the motor assembly. As long as the motor is getting a constant voltage of the correct magnitude, it should run at the right speed.

We hooked the PA81's DC meter back up to the two wires leading to the motor assembly. The analog meter reading showed a very steady 12 volts feeding the motor. That agreed with the "DC12V" printed on the back of the motor housing assembly. The PA81 DC meter eliminated the DC voltage as a problem.

We checked for and found a speed control adjustment for the motor. Perhaps a simple adjustment would take care of this untimely speed problem. Adjusting the motor speed until the tone frequency reads 1 kHz on the SC61 should put us back in business.

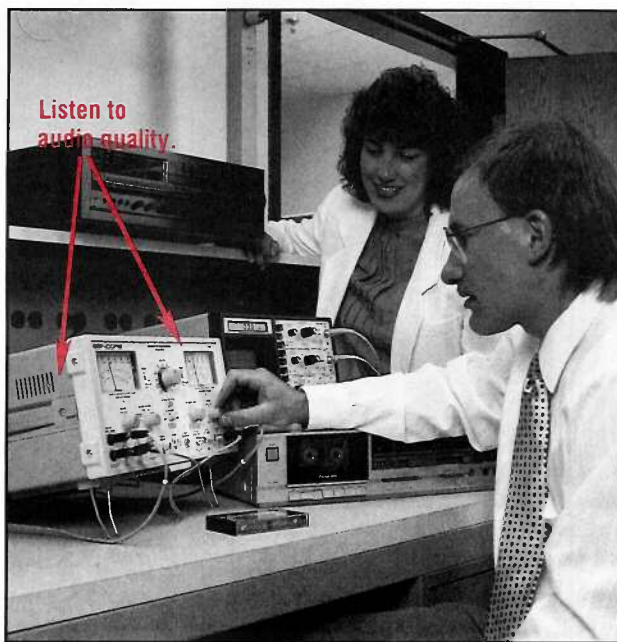


Fig. 6: Give the audio the ultimate test by listening to it with the PA81's internal speakers. Nothing else lets you listen to audio over such a wide range of levels.

As we adjusted the motor speed control, we monitored the frequency on the SC61's LCD readout. Throughout the entire adjustment range of the control, the frequency of the tone never changed.

If the motor DC voltage was OK, and the speed adjustment didn't change a thing, that must mean there's a problem with the speed adjust circuit, we deducted. So we shut the deck down and started an investigation into the motor assembly.

The back cover of the assembly popped off rather easily and exposed a miniature PC board. Hopefully our problem would be located on this board. We unsoldered the three lugs that were holding it in place and carefully removed the board. We found three resistors, two capacitors, the speed-

control pot, and a three-legged device which we assumed was the governor speed-control IC.

After a quick visual inspection, we quickly tested the capacitors with a Z Meter. They proved good so we turned our attention to the resistors and the pot. An ohmmeter proved them good leaving only the IC as suspect. The ohmmeter showed that all three legs were shorted to one another. We cautiously hoped that this was our only problem.

We crossed the number we found on the IC to one of our stock parts. After soldering the IC in place, we replaced the miniature PC board in the motor assembly ready for a preliminary test.

With the SC61 still monitoring the audio signal through the PA81, we put our test tape in for a frequency check of the motor speed. The SC61 read 1.05 kHz. We adjusted the speed control until the frequency read 1.00 kHz on the nose. It looked like the new IC was doing its job.

The Final Test—Customer Satisfaction

Then came the final test, the Linda Ronstadt test. We carefully inserted the tape hoping we wouldn't run across another problem. If this test worked, we would have Mary's deck back to her easily in time for the weekend.

Linda never sounded better. The internal PA81 speakers confirmed that the motor was going at the right speed as the cassette deck reproduced the music with the familiar pace and sound.

Well, I was right. The PA81 Stereo Power Amplifier Analyzer helped us get through that troubleshooting scare. We had nothing else to amplify the cassette deck's signal but the PA81. Without the AUDIO LINE inputs and the internal speakers, we would have sent this deck back to the customer improved but still unrepaired.

Most servicers run across the same thing. That's why the PA81 is called the missing link in audio analyzing. It bridges the gap in audio analyzing that most servicers just can't seem to cross.

Add portability and all the amplifier tests, and you've got a unit that is a must for all audio servicing. Mary was sure happy when she picked up her cassette deck that Friday afternoon. You're customer can be the same way.

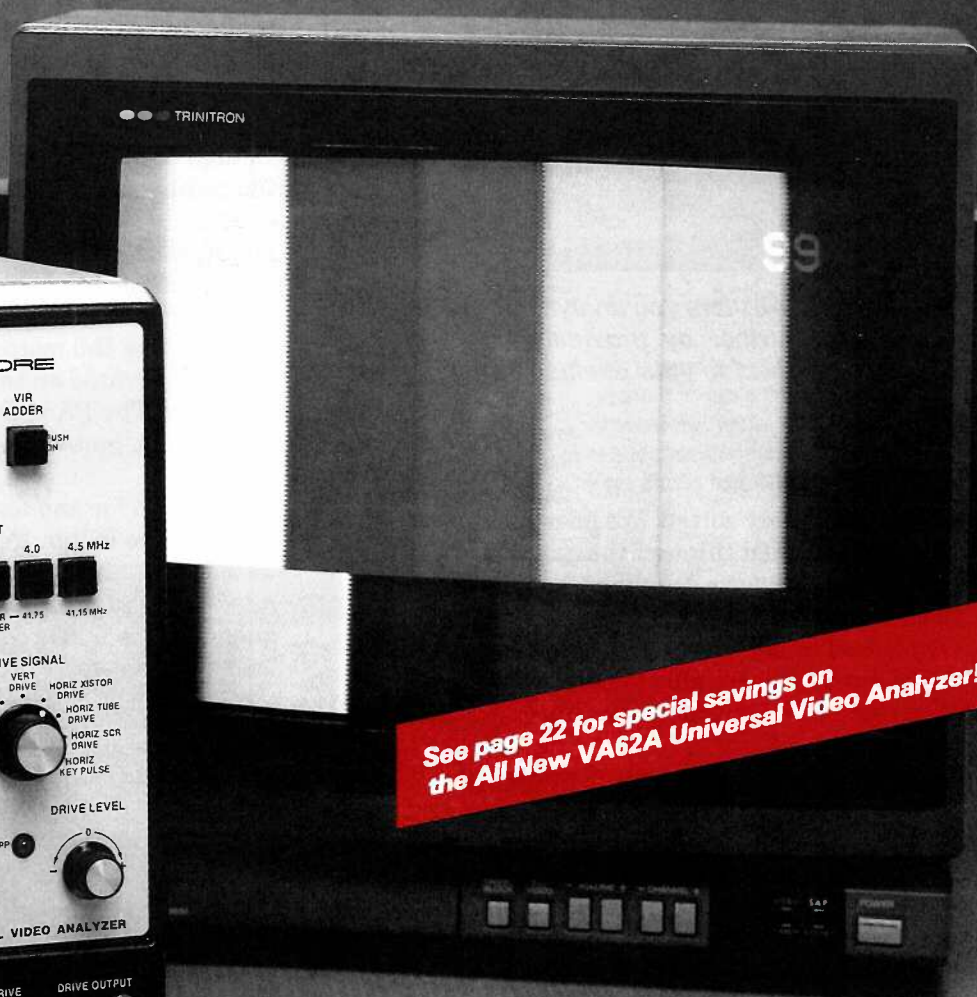
Oh, by the way. The application engineer's amplifier worked the whole time. The DC BALANCE LEDs never came on to indicate any kind of intermittent or DC balance problem. They had achieved success with the PA81, too!

Do you see how the PA81 Stereo Power Amplifier Analyzer can help you in your audio analyzing? Give Sencore a call at **1-800-SENCORE** (in Canada call toll free 1-800-851-8866) and talk with your Area Sales Engineer. Let the PA81 fill in your missing link in audio analyzing. Ask about our new book, "Taking The Mystery Out Of Audio Troubleshooting." ■



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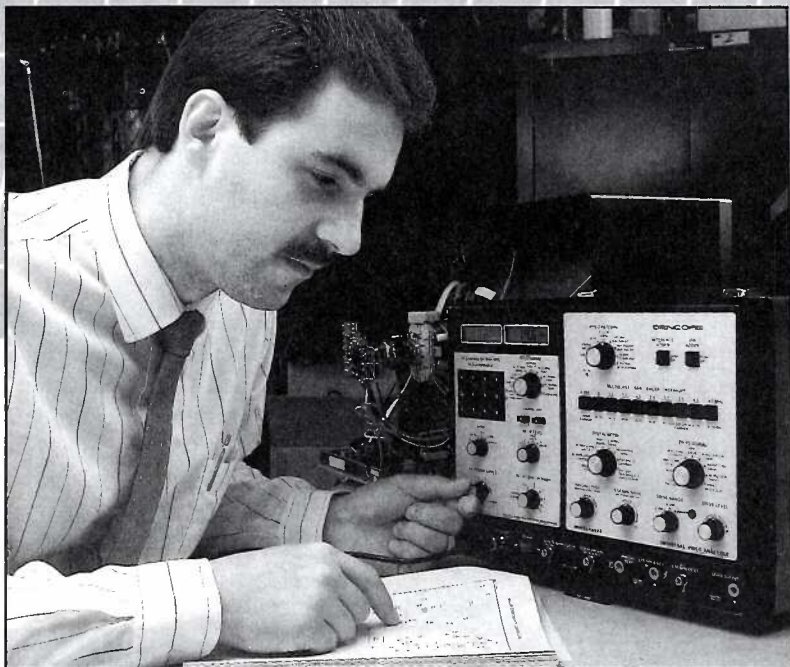


RG67 NTSC Video Monitor Adaptor

Expand into analog and digital video monitor service with phase-locked R, G, B and I signals.



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Popular Applications For Your VA62A Universal Video Analyzer TM — Speeds Troubleshooting And Increases Profits

by Brian Phelps, Technical Writer

“Technology will not stand still; you can look forward to new video products for years to come . . . that's why your VA62A Universal Video Analyzer is expandable.**”**

We had a great time at a recent Seminar, talking “technician talk” during the coffee breaks and comparing notes on tough service problems. We talked about testing cable-ready TVs and VCRs, setting preset channels for customers, fixing AFT problems, tweaking up a stereo TV, troubleshooting startup, shutdown, high voltage, etc. But, most of all, the servicers wanted to learn more about using their VA62A Universal Video Analyzer. Many servicers simply hadn't realized its potential.

The list of applications for the VA62A, discussed that evening, could easily fill this Sencore News issue. However, based on the questions asked at the Seminar, let's start with a quick look at the most popular applications for your VA62A Universal Video Analyzer.

Fully Analyze Cable-Ready TVs And VCRs, Plus Tune Preset Channels In Just Minutes

Many of the TVs and VCRs sold today are cable-ready. This simply means the tuner can receive

any of the low band VHF, mid band VHF, high band VHF, super band cable, and hyper band cable channels. When a cable-ready TV or VCR is in for repair, you must guarantee that it operates correctly on all cable channels from 2-99. The VA62A provides every VHF, UHF, and cable channel at FCC specifications to use as a shop standard.

60% of all American households now subscribe to cable. The VA62A allows you to generate any cable channel right in your shop. A wide range of RF and IF signal levels from 5 uV to 500 mV are used to duplicate any signal condition from the deepest fringe to the strongest overload. You'll never make another repeat service call because the set couldn't handle the signal level.

Analyze AFT Operation With Programmable RF Offsets

Most cable systems must shift some or all of the channel frequencies to eliminate interference from off-air stations. It is now necessary to check out every TV and VCR to make certain they work properly on the cable's carriers. Some cable companies use either the Harmonic Related Carrier (HRC) or the Incremental Coherent Carrier (ICC) shifting methods. The AFT circuits in the TV and VCR must have the dynamic lock-in range to capture any of these shifted carriers.

The VA62A provides cable channels at any standard or non-standard offset. You simply program in the offset you need to match the cable system. Now you can win the argument. “Is it the cable or the TV?”

Align IF Stages By Watching The CRT

It's the growth of the cable companies that have added to the requirements of the servicer. When the majority of the homes were receiving off-air stations, you very seldom would find two adjacent channels. Now the cable companies have provided several adjacent channels. The likelihood of the adjacent audio or video interference has increased.

VA62A exclusive trap setting signals reproduce the interferences the traps are designed to eliminate. You adjust them for the least interference on the CRT. Only with these exclusive signals can you performance test for cable operation, check alignment, and set traps if necessary.

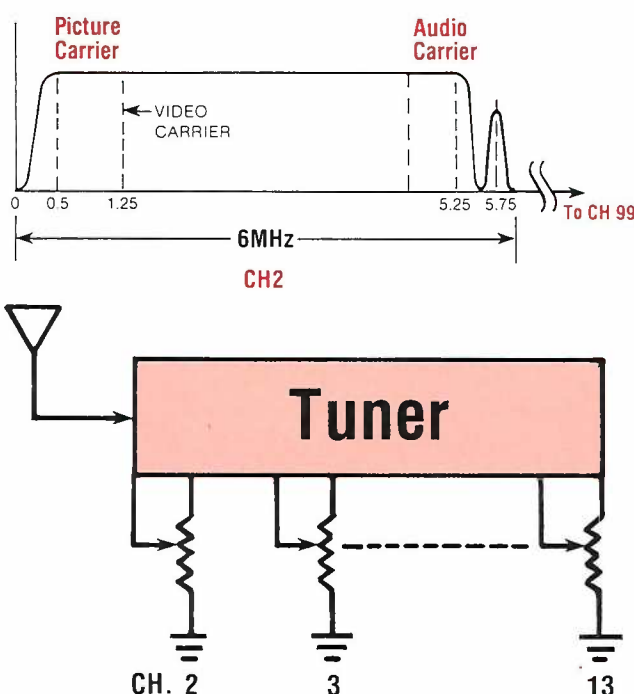


Fig. 1: Use the VA62A to analyze cable ready tuners, and preset VCR channels.

Send For A 10 Day Video Preview On The VA62A!



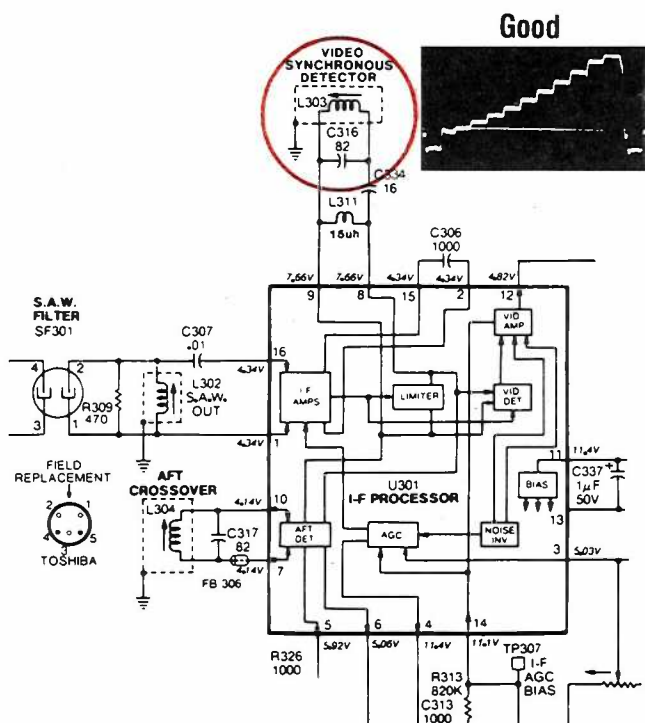


Fig. 2: Synchronous detector alignment is simplified using the 10 Bar Staircase pattern.

Align Synchronous Detectors For Minimum Ringing And Noise

Most televisions built today are using synchronous detectors to convert the IF signal to composite video. The synchronous detector provides gain, operates in its linear region, only detects signals in phase with the carrier, and doesn't have a threshold voltage to overcome, unlike the detector diodes previously used.

An exclusive 10 Bar Staircase pattern with steps from 100% black to 100% white allows you to dynamically check and align today's synchronous detectors. Conventional sweep and marker alignment won't even turn these detectors on because they don't simulate the normal signal found at the input. In fact, one manufacture, NAP, states in their service literature, "Due to the nature of the synchronous detector, a standard sweep generator set-up does not produce a true IF bandpass response curve. The curve illustrated is valid for adjustment purposes only."

Fully Analyze Audio Operation From The Tuner To The Speakers

The consumer entertainment industry is seeing a shift from video quality to audio quality. Many VCRs now come with Hi-Fi audio circuits, while many TVs and VCRs have the ability to receive stereo information.

The VA62A supplies audio signals to performance test and troubleshoot any television or VCR audio circuit. Only the VA62A provides a 4.5 MHz sound IF signal to inject before the sound detector in a TV, plus 4 audio frequencies to modulate with or inject after the detector in a TV or VCR. The ST65 Video Analyzer Stereo TV Adder accessory to the VA62A provides all needed signals to performance test and troubleshoot stereo TV and VCR circuits.

Isolate Video Defects With Time Proven Signal Substitution

Use divide and conquer troubleshooting to isolate any video defect between the video detector and

the CRT. Signal inject into a VCR luminance circuit from the FM detector to the modulator input.

Only the VA62A provides all the signals and levels to inject into any video circuit, including the CRT. All video signals are fully adjustable from 0 to 300 VPP.

Use The Multiburst Bar Sweep Pattern To Analyze High Resolution TVs And VCRs

Modern TVs and VCRs provide higher levels of video resolution with frequency response reaching 4 MHz. This level is reached by using comb filters, synchronous detectors, and improvements in electronic technology.

The VA62A Multiburst Bar Sweep pattern provides video signals to 4.5 MHz. This enables you to thoroughly check the video response of all the circuits from the antenna to the CRT. Only

connects it to his computer or video camera. An exclusive Interlace Adder checks the vertical countdown chip used in many of today's sets.

Only the VA62A provides signals to check the operation of the VIR circuits used by such manufacturers as Zenith, Sylvania, and GE, to automatically control color saturation and tint.

Troubleshoot Direct Coupled Vertical Deflection Stages

Vertical deflection circuits can be among the hardest to troubleshoot. Direct coupled stages and feedback loops can make even a minor defect appear dramatic on the output transistors. In order to isolate defects you need to be able to restore the DC biasing while driving the circuit into operation.

The VA62A's complete vertical drive signals allow you to substitute from the oscillator to the output stages, or any intermediate stage. Simply feed a DC voltage from the DC Power Supply to return any DC coupled vertical stage to operation.

Analyze Chroma Bandpass Circuits By Looking At The CRT

With the video resolution reaching towards 4.5 MHz, the color should also track. If the chroma bandpass circuits don't provide the full 1 MHz for the I and Q signals to pass, you can start losing color in smaller objects on the CRT. (color detail)

The VA62A's Chroma Bar Sweep pattern allows you to check color saturation, tint, and color frequency response right on the CRT. No other signal provides EIA levels and checks the full 1 MHz chroma bandwidth.

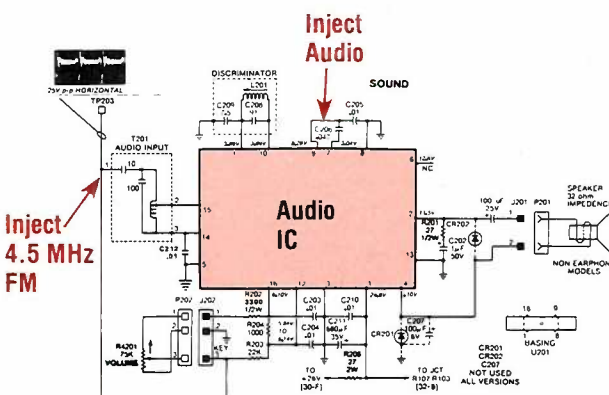


Fig. 3: Analyze and pinpoint audio defects from the tuner to the speakers.

this pattern allows you to check today's high resolution monitors, and comb filter televisions which have video bandwidths to 4 MHz and beyond. The exclusive Multiburst Bar Sweep pattern tests for signal amplification, linearity, frequency response, and circuit ringing.

Check All Keyed Stages With Variable Keying Pulse

Modern circuits are using more keying and phase locking than ever before. A TV uses a horizontal keying pulse to operate the tuner, detect color, operate the AGC, and many other uses.

The VA62A provides a horizontal keying pulse to signal inject into any stage. Variable amplitude from 0 to 300 volts peak-to-peak, allow injection from the horizontal reference to the sandcastle input. Never again be caught short because the keying signal is not timed correctly or is missing.

Analyze Vertical Countdown Chips With Interlaced Signals

Unless you check to see if the TV works with both interlaced and non-interlaced signals, you won't know that it will work when your customer

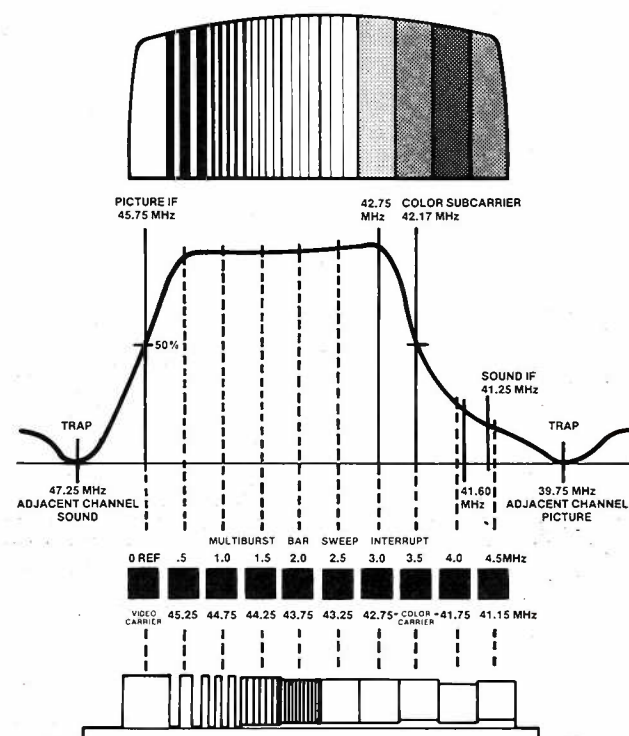


Fig. 4: The Multiburst Bar Sweep analyzes video frequency response to a full 4.5 MHz.

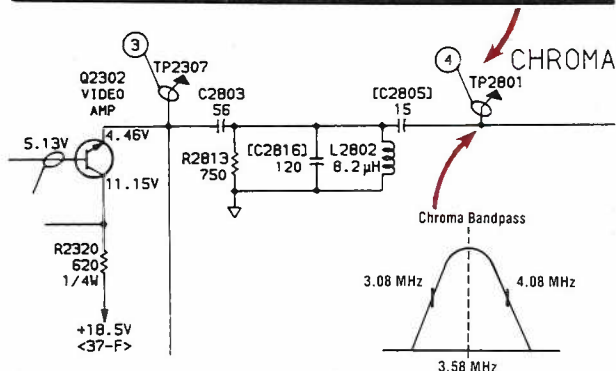
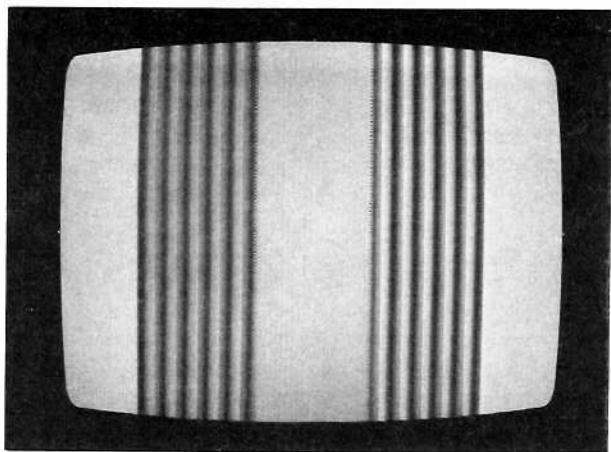


Figure 5: Use the Chroma Bar Sweep pattern to identify any chroma band pass problems.

you were to try to measure directly across a crystal oscillator you will distort the frequency or load the signal. Checking the oscillator's operation is as simple as substituting the crystal's signal.

Only the VA62A provides a separate 3.58 MHz drive in addition to the chroma drive signals. For the first time you can troubleshoot the entire color circuits. You can even troubleshoot the demodulators by injecting both chroma and the 3.58 MHz 90 degrees phase shifted color oscillator.

Exclusive, Patented Yoke And IHVT Analysis

Without the VA62A, you are unable to test two of the most expensive components in the TV, the yoke and IHVT. Yokes and IHVTs can develop several failures; open, complete short, change in value, or a single shorted turn. The ringing test is the only method of accurately testing for the single shorted turn.

An exclusive, patented ringing test dynamically checks yokes and flybacks (IHVT) for shorted or open turns. The VA62A is the only analyzer on the market today that allows you to check these components, saving you valuable troubleshooting time.

Solve Startup And Shutdown Problems By Signal Injecting

Modern televisions are almost completely dependent on the operation of the horizontal circuit for the rest of the TV to operate. If the horizontal stages develop a problem, the rest of the TV is affected. Startup and shutdown problems are ranked among the hardest to troubleshoot, because if the horizontal circuit is not working you are limited in your signal tracing ability.

The VA62A provides signals to drive any horizontal transistor, tube, or SCR chassis, including

chassis with split flyback. For the first time, one analyzer allows you to inject directly into any horizontal stage, from the oscillator to the flyback.

Fully Autoranged DVM Monitors Inputs And Outputs

An autoranged DVM digitally reads both Peak-to-Peak and DCV. For the first time a single unit not only allows you to measure power supplies, but using the DVM along with the drive signals you can even analyze triplers and integrated high voltage transformers. Now you can be sure the components are bad before you spend the time and money replacing them.

Pinpoint VCR Closed Loop Circuit Defects

More shops are servicing VCR now than ever before. VCRs are using closed loop circuits

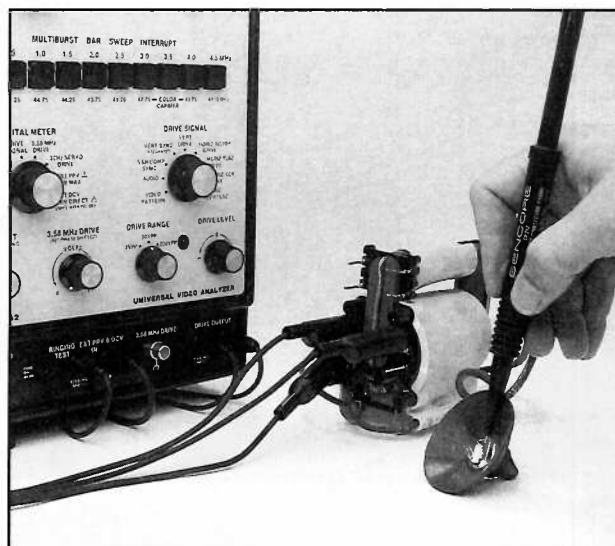


Figure 6: Analyze yokes and flybacks, in- or out-of-circuit, with the patented ringing test and IHVT drive test.

throughout the servo, microprocessor, chrominance, and luminance stages. Defects in any of these areas can cause the VCR to shutdown, or indicate defects in other circuits.

The VA62A provides an exclusive 30 Hz servo reference to aid in pinpointing difficult servo problems. Inject the 30 Hz signal and break the closed loop circuits. By referencing the circuit to a stable reference, you can then signal trace for any irregular operation. Substitute for any 30 Hz reference signal, in either the head switching, color jitter correction, or capstan and cylinder servo circuits.

Meet Warranty VCR Requirements

Many manufacturers require the use of the NTSC color bar pattern to receive warranty status. The VA62A is expandable to meet those needs. By adding the NT64 NTSC Pattern Generator to the VA62A you are able to use both the full-field and split-field patterns, either composite video or RF/IF modulated.

Together, the VA62A and the NT64 produce all the color patterns required to meet manufacturer's warranty service requirements. Only the VA62A provides patterns to match the waveforms

shown on manufacturers' schematics, as well as special patterns for troubleshooting.

Isolate Video Head Failures With Signal Injection

One of the major defects of VCRs is in the video head circuitry. The video heads are wear prone and limit the operation of the VCR. By using signal tracing many video head defects are impossible to identify because of the low level modulated signals.

Together with the VC63, the VA62A allows you to substitute directly for the video heads in a VCR. Simply watch the test monitor for improvement in picture as you step through the video stages. You know proof-positive if the heads, or any other chrominance or luminance stage is defective.

Expandable As Technology Changes

Technology will not stand still. We can look forward to new video products for servicing for years to come. That's why the VA62A is completely expandable. An external modulation jack and external accessory jack allows you to update whenever a new accessory is introduced to meet the changing video industry.

The VA62A Universal Video Analyzer can solve all your video analyzing needs. See exactly how the VA62A is used to service VCRs in the new VCR Simplified Operating Guide. To receive your free copy, contact your Area Sales Engineer to arrange a demonstration of the VA62A in your shop. ■

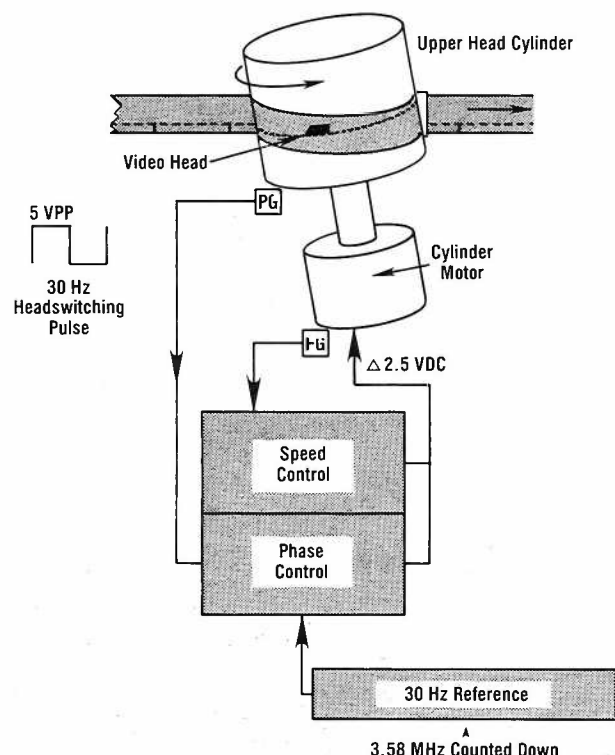
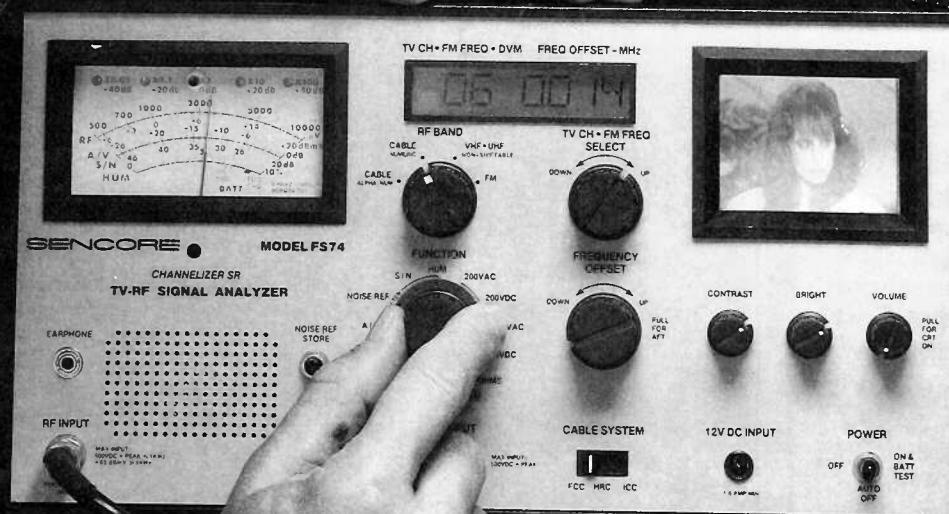


Figure 7: Isolate servo defects with time proven signal injection techniques.

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- Exclusive Frequency offset readout alerts you to carrier shifts.
- Integrated Wide-band monitor lets you see the system problems your customer sees that small, portable TVs don't.
- 5uV sensitivity (-46dB) with autoranged attenuators make CLI tests a snap.
- Patented Automatic S/N and Hum tests on any IN-USE channel.
- Built-in DVM tests AC/DC Voltage and resistance.

Pricing Note: All prices shown are U.S. dollars. Canada must add applicable Duty, Freight, and F.S.T.
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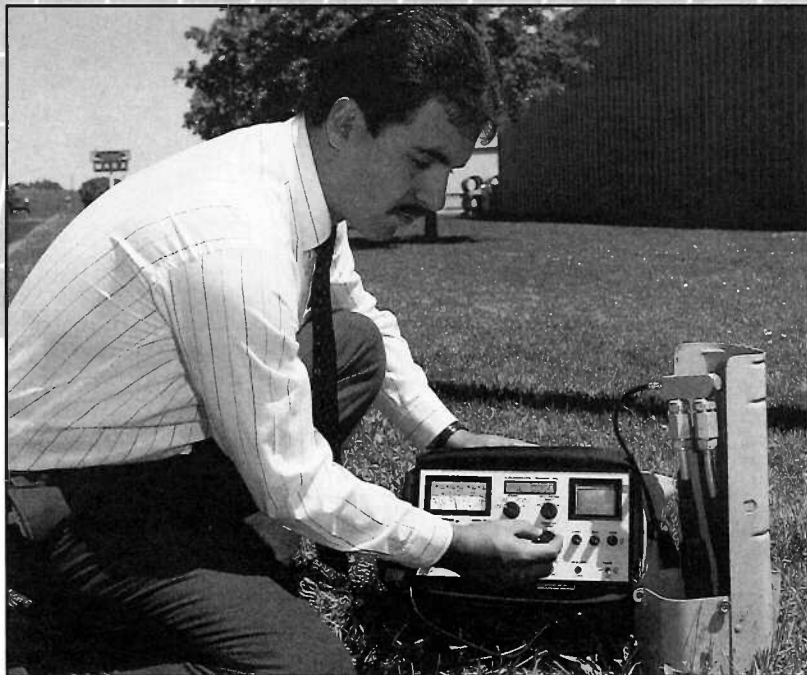


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How To Analyze Carrier Offset Frequencies With Your FS73 Or FS74 CHANNELIZER™

by Brian Phelps, Technical Writer

As more channels are being used in CATV and MATV systems, the need for a method to quickly and accurately test the channels is becoming increasingly important. Two tests that cause difficulty for many servicers are 1.) tuning to the cable channels and 2.) checking the channel's frequency—to confirm that the modulators and signal processors are working properly and are on frequency.

In this tip, we will look at how the portable FS73 Channelizer Jr. and the FS74 Channelizer Sr. tune and display frequency offsets on all TV-RF cable channels from 5- 495 MHz and VHF/UHF channels from 54- 890 MHz, anywhere in your system, with digital readings, 1 kHz resolution, and 10 parts-per-million accuracy. Lets see how the Channelizers do the job for you.

Digital Offset Measuring Accuracy From The Channelizers On Assigned Channels

The Channelizers' digital tuner displays the numeric channel designation and the offset frequency. You simply look for a reading within the maximum allowable frequency shift. The Channelizers provide the frequency offset reading with 1 kHz resolution in the Automatic Fine Tuning (AFT) mode.

The Channelizers automatically include the proper offset in both the AFT and manual tuning modes when you place the CABLE SYSTEM switch into either the FCC, the HRC, or the ICC position.

How To Tune Your Channelizer To Any Assigned Channel.

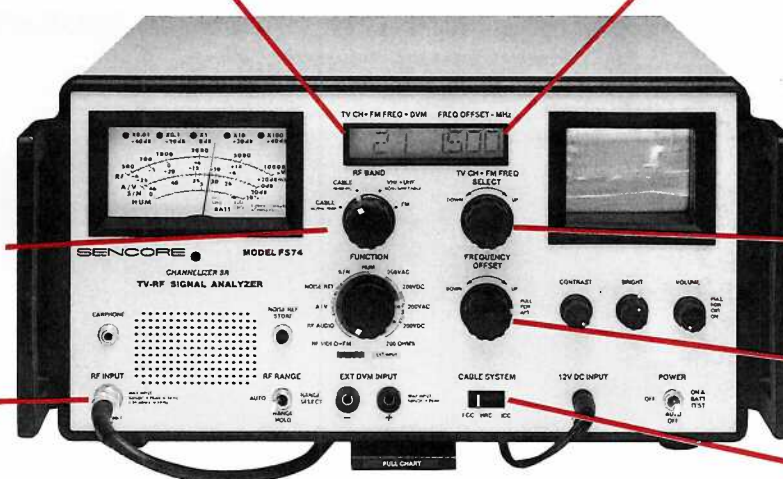
- 1 Connect the signal to the RF input.
- 2 Select the RF BAND which contains the desired channel. (alpha numeric, numeric, VHF-UHF, FM)
- 3 Select the proper CABLE SYSTEM type (FCC, HRC, or ICC).
- 4 Turn the TV CH • FM FREQ SELECT control until the desired TV channel number or FM frequency appears in the TV CH • FM FREQ

- 2 Select the RF Band to use as your reference.

- 1 Connect the signal.

- 4 Digital display of tuned channel in numeric or alpha numeric.

- 6 Read the OFFSET Frequency from an assigned carrier.



- 4 Set to the TV or FM reference channel.

- 5 Pull for AFT or press for manual tune.

- 3 Select CABLE SYSTEM type.

Figure 1: Tune the Channelizers to either an assigned channel or non-assigned channel in 6 easy steps.

• DVM display. Place the RF RANGE switch in the AUTO position for the fastest measurements.

- 5 If the offset frequency is within +/- 1.25 MHz of an assigned TV channel or 150 kHz of an assigned FM frequency, pull the FREQUENCY OFFSET control outward to use the AFT mode. If it isn't, follow the manual tune mode section below.

- 6 Read the frequency offset between the Channelizer's tuned frequency and the assigned carrier frequency in the FREQ OFFSET - MHZ readout.

Tune To Non-assigned Channels In The Manual Tune Mode

Some TV-RF distribution systems may use frequency allocations that are different from the programmed channels in the Channelizers. These channels are typically used for feeds to the distribution head end, communications, security surveillance systems, etc.

You can also tune either Channelizer to any non-assigned channel in the manual tune mode. The manual tune mode allows you to offset from the Channelizer's specified channels + or - 4 MHz in 50 kHz steps. Simply leave the FREQUENCY OFFSET control pressed in, and rotate the control to the proper offset reading.

Both the FS73 Channelizer Jr. and the FS74 Channelizer Sr. allow you to tune to any channel and then measure signal parameters of any TV-RF VHF and UHF frequency from 54- 890 MHz and cable from 5- 495 MHz, with digital accuracy, and 1 kHz resolution.

Contact your Area Sales Engineer for a complete description to the exclusive and patented Channelizer tests. Simply call 1-800-SENCORE (In Canada call 1-800-851-8866) and tell the receptionist your telephone area code. ■



Figure 2: The Channelizers let you manually tune in 50 kHz steps to any cable channel from 5 to 495 MHz.

Completely Analyze Any Waveform 10 Times Faster, 10 Times More Accurately With The Patented SC61 Waveform Analyzer™

Automatic Peak-to-Peak Volts

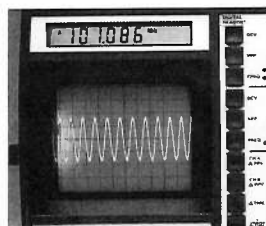
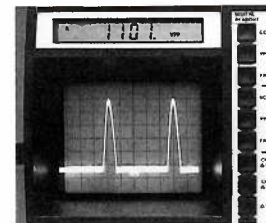
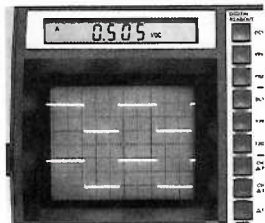
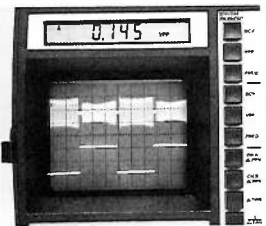
Catch elusive high frequency glitches and spikes by comparing the digital readout to the CRT waveform amplitude.

AUTOTRACKING™ Digital Measurements:

Speeds troubleshooting bias problems, calibration, and alignments; plus much more.

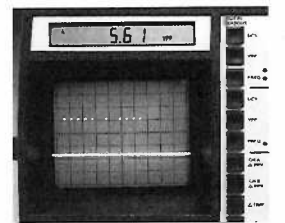
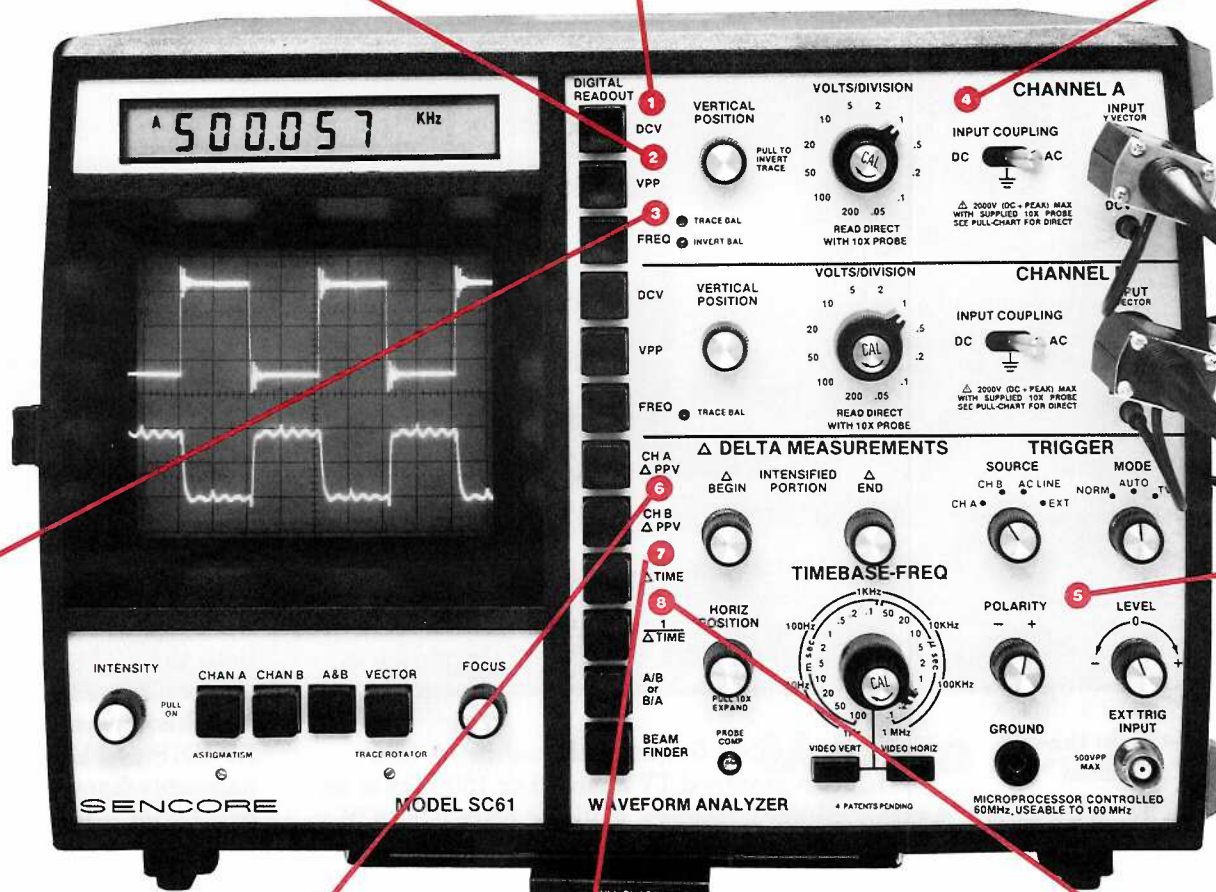
Four Times The Measuring Range - Patented

This means you can now measure in more circuits than ever before, with the confidence that your scope's front end is safe from damage.



Automatic Frequency Measurements - Patented

The readings are fast and digitally accurate to 100 MHz.



Rock-Solid Sync

The SC61 provides triggering all the way to 100 MHz and cancels noise to eliminate "sync jitter", delivering the most solid sync you've ever seen or used.

Delta Peak-to-Peak Volts Of Any Part Of The Signal

Great for troubleshooting or aligning complex waveforms found in broadcast, VCRs, video monitors, cameras, and much more.

Delta Time For Any Time Reading

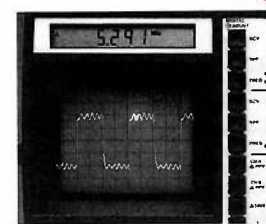
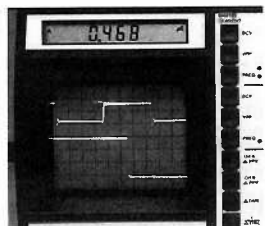
Use for measuring digital pulse widths, pulse spacing, time delays, etc...

1/Delta Time - Frequency Of Any Part Of The Signal

Measure any interfering frequencies riding on top of another signal.

Plus

Special video sync separators, video presets, automatic frequency ratio test, $\times 10$ expand, channel A invert, plus much, much more.



Send For The
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How To Analyze Signals; Easier, Faster, And Error-Free With The SC61 Waveform Analyzer™

by Greg Carey, CET

“The SC61 Waveform Analyzer makes most tests without even needing a waveform on the CRT—it makes waveform analyzing as simple as using a digital meter.”

As you look at Sencore's SC61 Waveform Analyzer, it's easy to think of it as an oscilloscope, because the CRT is the largest part of the front panel. But, we call it a waveform analyzer because its digital readout analyzes waveform parameters for you—even if you don't have a waveform displayed.

This difference might not sound like much, until you take a look at how you analyze signals. Look at Figure 1, to see what we mean.

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

- **DCV:** What percentage of the time will the DC voltage reading tell you whether the circuit or its power supply is working?
- **PPV:** How often does peak-to-peak tell you everything you need to know about stage gain?
- **Frequency:** When will a frequency reading confirm that an oscillator or a digital divider is working correctly?

- **Waveshape:** Then ask yourself how often you use a scope to look at waveshape without also needing to know one of these other parameters.

If you are like most servicers, waveshape is only used alone occasionally. The rest of the time, you either need a parameter without regard to the signal's waveshape, or else you need a parameter reading with the waveform. That's why the Waveform Analyzer is designed to be used differently than an oscilloscope.

(continued on page 20)

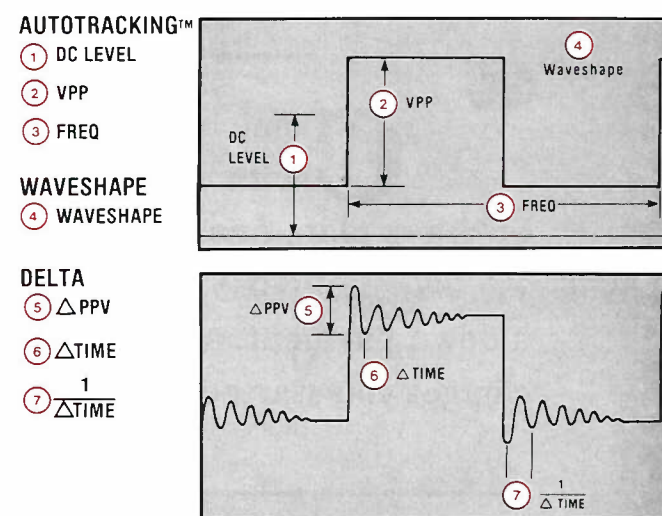


Fig. 2: The SC61 provides three different ways to analyze a signal, depending on how much detail you want: 1. Autotracking™ digital tests, 2. CRT display, and 3. Delta readings.

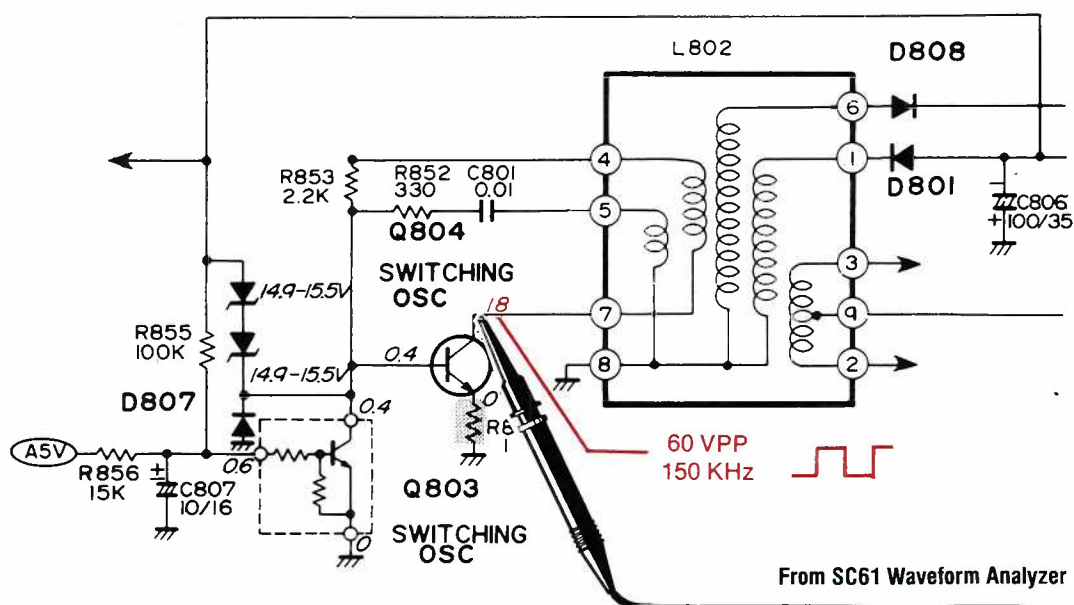
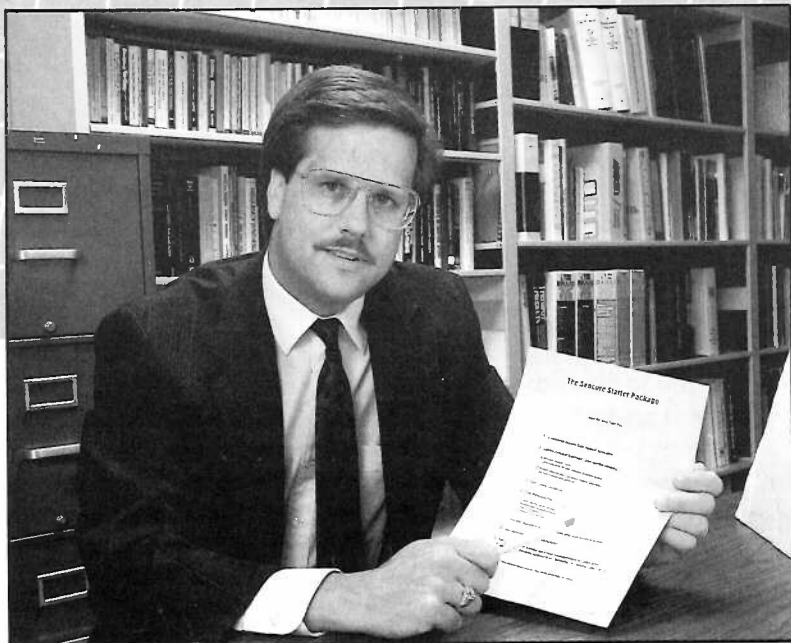


Fig. 1: Of the troubleshooting information on a typical schematic, DC voltage, peak-to-peak amplitude, and frequency are used more often than waveshape.



Investing In Sencore Instruments— The First Step To Success In Starting Or Expanding Your Service Business

by Mark Ilse, Credit Manager

- MasterCard/Visa (No credit check).
- COD (2% Discount)
- Special delayed billings (Delay payment for up to 90 days).

Are you new in business? Just starting out? Have no credit background and need test equipment to get your shop going? If this is you, Sencore wants to help. All we ask is for you to come up with a business plan, financial statement/balance sheet, a down payment, and we can get you started (ask your Area Sales Engineer for the details).

In addition, Sencore frequently offers *low* interest rates (below the cost of funds to us). At present, we are offering 9.9% financing on 6-24 month contracts and 11.9% on 30-60 month contracts. All contracts are serviced by Sencore employees, giving you the benefit of having all your service needs or questions handled under one roof.

“Come up with a business plan, financial statement/balance sheet, a down payment, and we can get you started ...”



Fig. 1: Easy buying terms help you get started, plus add more value to the already value added benefits of buying Sencore products.

Whether You're Just Starting Or Expanding Your Business, You'll Find A Sencore Analyzing Package That's Just Right For You

You Get Innovative, Time-Saving Instruments . . . Plus, You Get The Best Support In The Industry.

Fast Product Delivery: Most Sencore products are in stock and are shipped within 48 hours of receipt of your order, guaranteeing you maximum productivity from each instrument right from the start.

Friendly Follow Up Call: We also provide you with an exclusive follow-up call 30 days after the

Sencore's Exclusive Credit Plans Make It Easy For You To Buy

One key objective of our Credit Department is to make it easy for you to buy. With this theme in mind, we offer a variety of buying terms, of which you can choose to best meet your needs.

Easy buying terms help you get started, plus add more value to the already value added benefits of buying Sencore products:

- 6-60 month pay-as-you-grow investment plan (Simple interest installment contracts).
- Up to 5 monthly “split payments” (5 equal monthly payments).
- 1% 10/Net 30 (1% discount within 10 days; Net due in 30 days).

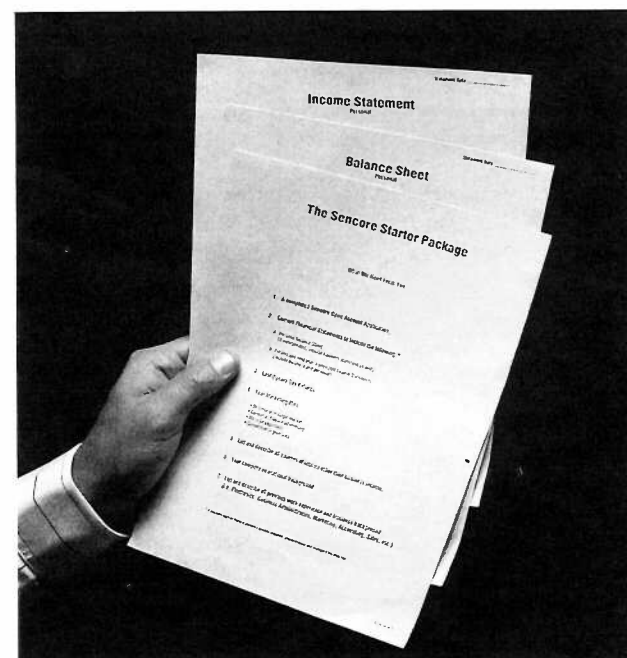
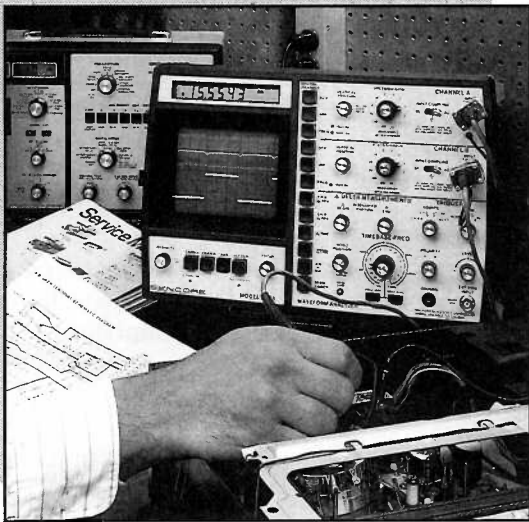
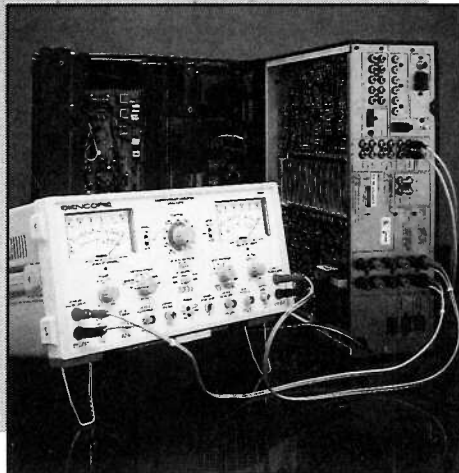


Fig. 2: All we ask is for you to come up with a business plan, financial statement/balance sheet, a down payment, and we can get you started.

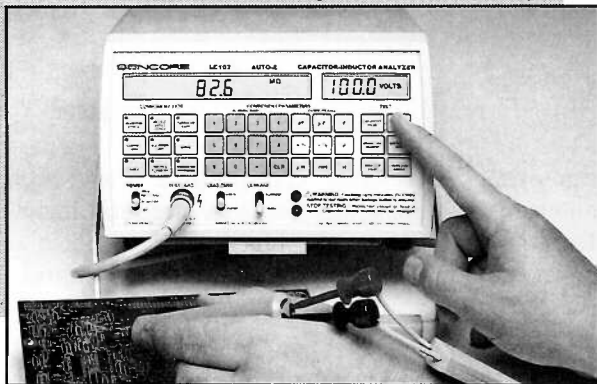
Waveform Analyzing



Audio Analyzing



Component Analyzing



Cable/MATV Analyzing



sale, to answer any questions you might have regarding your new instrument.

Unsurpassed After The Sale Support: Our Technical Applications Engineers show you how to use your Sencore instruments by researching and writing:

- Sencore News
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Technical Seminars: Instrument demonstra-

tions are regularly scheduled around the country, so you can see first hand how an investment in Sencore equipment will add value to your servicing capabilities.

Fast After-The-Sale Service: You get fast 72 hour turn-around time on service repairs, and 48 hours on parts delivery, guaranteeing you maximum up-time and minimum down-time. Or, call Toll-Free 1-800-SENCORE and talk to service professionals who will help you with instrument repair questions.

Exclusive Lifetime Made Right Guarantee: In addition to the 1 year warranty on parts and labor (less than 2% are returned for warranty service), Sencore offers you a 100% Lifetime Made Right Guarantee. We guarantee your instrument was engineered right the first time—or we'll make it right—for the lifetime of the instrument.

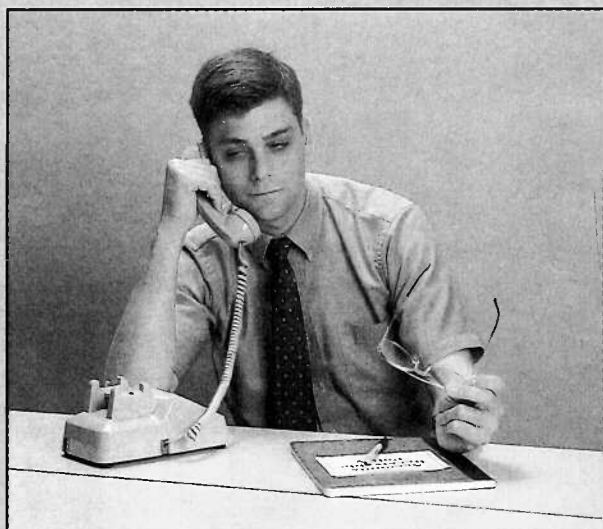
Easy Toll-Free Access: One number, **1-800-SENCORE**, connects you 24 hours a day, to a factory full of people dedicated to making you and your business more successful. (In Canada call toll free 1-800-851-8866.) The same Toll-Free number that connects you to your friendly Area Sales Engineer, also connects you to our Application Engineers for technical consultation, and to our Service Technicians for quick field repair tips—all at no added expense to you. Simply pick up the phone and ask. ■



Business Tip — Managing Accounts Receivable

Accounts Receivable are one of your company's most valuable assets and needs a particular amount of attention. Each day your customer has your money in his pockets, it costs *you*. Don't let it go and just hope it gets paid, instead, use the following proven method:

Develop a written policy: The best thing you can do to protect your valuable assets, is to develop a *written* policy regarding collections and *follow it*.



The following are a few tips that may help you develop an Accounts Receivable policy to fit your own specific needs:

Start your collection efforts promptly: Start your efforts *no later* than ten (10) days after the due date. Remember, each day costs you money.

Give the customer a call: The telephone is by far the *most effective* and *cost effective* tool you can use in collecting your past due receivables.

Overcome the customer's objections: To overcome objections for payment you must:

1. Get the customer to *agree* that the debt is just, and that it is his/her obligation.
2. Identify the *real* reason(s) for delinquency by asking fact finding questions. Lead with who, what, when, where, why.
3. Explain the positive benefits for meeting the obligation, i.e. positive credit report, future credit transactions, no late fees, reduced interest payments, etc.
4. Propose a payment plan.
5. Upon agreement, firm up the plan with *warning statements*, i.e., point out what will happen if the agreement is broken.

6. If there is no agreement:

- a. Identify the part(s) of the plan the customer *does agree* to.
- b. Identify the *specific objection(s)*.

Work with your customer to find a solution: If you know specifically what the objection is, hopefully, the problem can be worked out, and both you and your customer will experience the *positive benefits*.



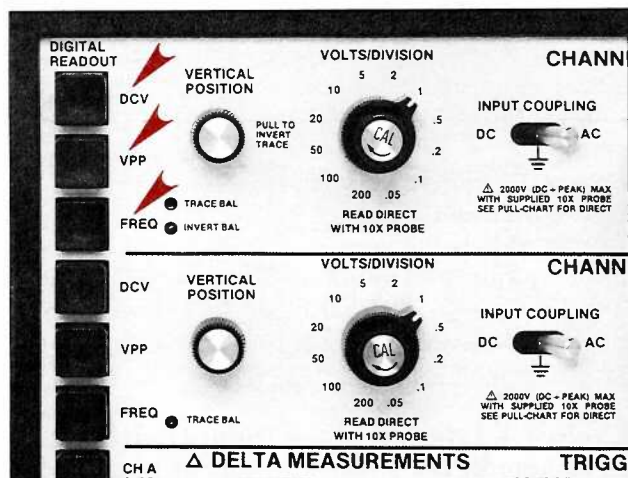


Fig. 3: Most signal tests are made with the Autotracking tests of DC volts, peak-to-peak, and frequency for channel A or B. You don't need a waveform on the CRT for any of the Autotracking tests.

(continued from page 17)

You see, other digital-readout scopes are still oscilloscopes. They require you to have a waveform locked onto the screen every time you take a reading, because all their tests are based on the displayed waveform.

Every time you set up a scope display to get a simple DC or peak-to-peak value, you break your train of thought. You risk backtracking and ineffective troubleshooting. If time weren't important in your work, you probably wouldn't mind the extra steps it takes to lock the waveform every time you measure a signal. But, time is important if you want your company to generate any profit. That's why the SC61 gives you parameter readings, even if you don't have a waveform displayed.

Just press a button and read the display. When you do want to analyze waveshape, the CRT is always ready to go—and easy to use. The rest of the time, you make the decision regarding whether you'll take the time to display the waveform, or whether you use the digital readout all alone.

Figure 2 shows how the SC61 gives you the choice of three ways to test a signal: 1. The "Autotracking" digital readouts, 2. The easy to use CRT, and 3. The "Delta" digital tests. What difference do these features make? They save you time on every signal you test. They give you measurements free from setup errors. And they make waveform analyzing as simple as using a digital meter.

The first group of tests is used similar to a meter. We call them the "Autotracking" digital tests.

The "Autotracking"™ Tests Work Without A Waveform Displayed

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

The SC61 has two matched channels, so that you can use the digital readout or the CRT to compare any two signals. The digital readout selector buttons are laid out in the sequence you use them, starting with DC volts.

Autotracking DC Volts: DC readings confirm that the power supplies are working correctly, and that stage biases are correct. Most technicians make DC voltage readings more frequently than any other. That's why the first Autotracking SC61 test is DC volts.

To measure DC with the SC61, just connect the analyzing probe, and press the "DCV" button for channel A or channel B. The test is fully autographed, so that you don't have to make any adjustments to the controls for signals from 1 millivolt all the way to 3000 volts.

The SC61 probe routes the DC around the CRT's input-coupling switch. This gives you error-free DC readings, even with the switch in the "AC" or

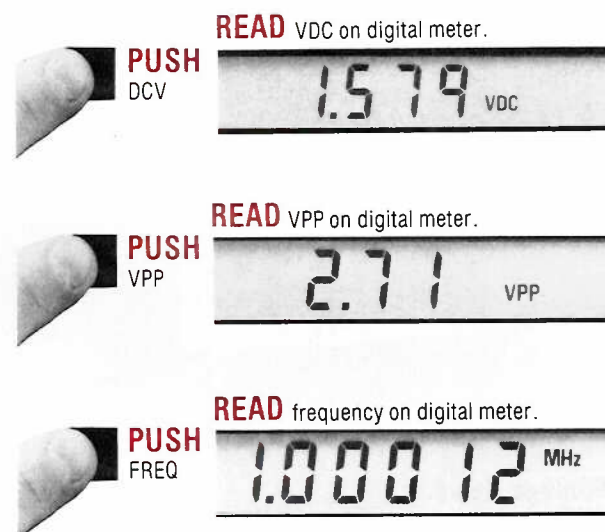


Fig. 4: The Autotracking tests work without a waveform displayed; simply push DCV, VPP or FREQ and read the digital display.

"Ground" position. The DC readings are fully independent of other tests, so you get accurate DC readings every time you press one of the "DCV" buttons.

Autotracking Peak-to-Peak: After DC, peak-to-peak voltage is the most important parameter. Amplitude confirms that each stage is processing the signal correctly. Tracing a weak or missing signal identifies poor coupling components, bad gain stages, and so on. That's why the second Autotracking SC61 test measures true peak-to-peak signal amplitude.

Each SC61 channel has four ranges, chosen by the "Volts Per Division" switch. Just press the "VPP" button and turn the switch until you have as many or as few digits in the display as you want.

The peak-to-peak circuits let you measure signals as large as 3000 volts. This gives you 5 to 15 times the measuring range of basic oscilloscopes, which are limited to 200 to 600 volts maximum.

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

Autotracking Frequency: Modern digital circuits have added frequency to the list of parameters needed to track down problems. Frequency confirms that oscillators, multipliers, and dividers are working the way they should. The third Autotracking SC61 test is frequency.

When you connect a waveform analyzer probe and press one of the two "frequency" buttons, the SC61 gives a fully autographed test. The 6-digit readout is referenced to a high accuracy crystal, and remains accurate even if you don't display the waveform, or if the horizontal vernier is uncalibrated.

The three Autotracking tests, of DC, peak-to-peak, and frequency, give easy-to-use, error-free readings on either channel. You can do well over half of your signal analyzing by simply connecting an SC61 probe, pressing a button, and reading the digital display.

But, what about those times that waveshape is important? That's where the SC61's second feature—its easy to use CRT display—comes into the picture. You have the choice of using it alone, or with any of the Autotracking tests we've just covered. We'll look at it next.

The Easiest To Use CRT Display

Sometimes waveshape is important. Waveshape shows whether the circuits have properly formed the signal. It shows whether distortion, noise, or glitches have been added to the original signal. It also shows if signals are timed correctly. The SC61 lets you analyze the waveshape in two ways; with the CRT, and with the Delta digital tests.

Human Engineered Panel: The CRT displays the waveform like any high quality oscilloscope. It is usable all the way to 100 MHz to give accurate waveshaping. The bandwidth covers more than 99 percent of the circuits used today, including digital circuits.

The SC61 makes waveform testing easy. Its highly human engineered panel has 50 to 70 percent fewer knobs and switches than competitive units, yet provides you with more troubleshooting power. This logical panel layout lets you make tests without needing an instruction manual by your side every minute of the day. The simplified operation eliminates the chance of making setup errors.

The spacious panel gives plenty of room to operate each control without running your knuckle into another knob. Plus, you can press the large, finger-sized pushbuttons, without needing a pencil eraser, as needed with some others.

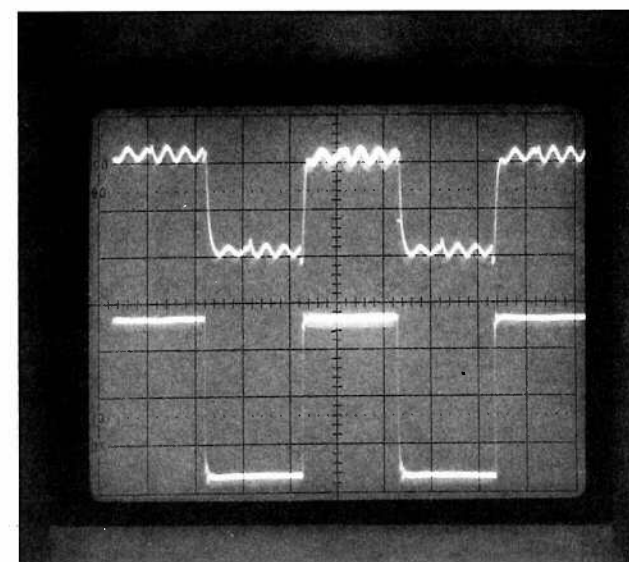


Fig. 5: The SC61 Waveform Analyzer's CRT displays waveforms to 100 MHz, covering 99% of the circuits used today—including digital.

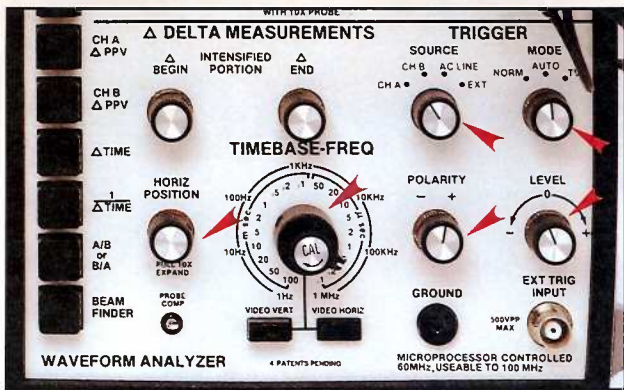


Fig. 6: The SC61's CRT setup is error-free too, with only 2 horizontal and 4 triggering controls needed to lock in any waveform with Sencore's famous rock-solid sync.

Fiddle-Free Sync: Rock-solid sync circuits give fiddle-free testing. In fact, the SC61 only needs 4 triggering controls. The rest of the circuits are automatic.

Testing composite video signals, found in computer displays, video monitors, and television equipment is simplified with video sync separators, and with sweep speed preset buttons.

3000 Volt Measuring Range: Just like the autotracking tests, the CRT lets you measure signals as large as 3000 volts peak-to-peak. Its patented input circuit extends the 3000 volt



Fig. 7: The 3000 volt peak-to-peak (or 2000 volt DC) measuring range of the SC61 lets you measure any signal; patented circuits protect the input for any attenuator setting.

protection to every attenuator setting. This protection lets you confidently analyze signals as extreme as the collector of the horizontal output transistor of a video monitor or TV receiver. It protects your SC61 from damage, preventing costly downtime.

Although the CRT works like a scope, you do not need to use the waveform when you need parameters of part of the signal. Instead, use the automatic "Delta" digital tests. These tests let you fully analyze any waveform segment you want.

Digital "Delta" Tests Analyze Waveform Segments

"Delta" means that you tell the Waveform Analyzer which part of the signal you want the digital circuits to measure. Pressing any of the four Delta buttons activates these two controls, called "Delta Begin" and "Delta End." The controls position an intensified area, called the "Delta Bar", on the waveform. The digital circuits then measure the signal in the highlighted area.

Delta Peak-to-Peak: The first Delta test is "Delta Peak-to-Peak", which measures the amplitude of any part of the signal. For example, you can measure the amplitude of a color burst signal, while ignoring the rest of the composite video signal by highlighting the color burst area. Or, you can see how much noise is riding on top of a digital signal by setting the Delta Bar to only highlight the signal's on-time.

The Delta Peak-to-Peak function has the same bandwidth as the Autotracking test, so that it accurately measures any highlighted signal. And just like the Autotracking test, it measures true signal level, so that you get error-free readings with the vertical verniers set anywhere you want.

Delta Time: The second Delta test is "Delta Time". Delta Time uses a crystal oscillator to determine the time of the Delta Bar. For example, you can adjust the Delta Bar to cover the starting

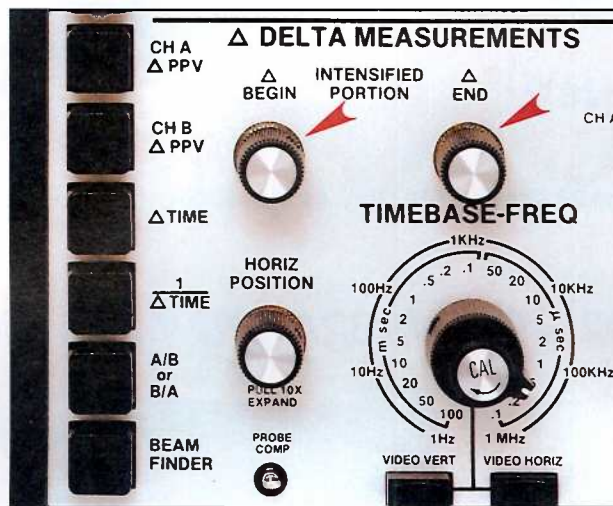


Fig. 8: The intensified portion of the waveform is set with "Delta Begin" and "Delta End" controls. These controls activate when any of the four Delta buttons are pressed.

and stopping point of a pulse to find its on-time. Or, you can compare on-time to total time to determine duty cycle.

The Delta Time function also lets you measure the delay between two signals. Just highlight the difference between them, and read the LCD display.

Or, you can use Delta Time to adjust a circuit. Preset the SC61 Delta controls until the digital display shows the correct amount of delay. Then adjust the circuit until the signals just touch the intensified area. Since the Delta Bar is crystal referenced, the measurements remain error-free, even when you have the horizontal vernier control uncalibrated.

Delta Frequency: The final Delta Test is Delta Frequency. This function uses time to find the equivalent frequency of any signal riding on the main signal. To calculate frequency, press the "One Over Delta Time" button, and adjust the Delta Bar until it exactly covers one cycle of the signal. Then, read the display.

Incidentally, the Autotracking frequency test is more accurate than a manually adjusted "One-Over-Delta-Time" test when you want to know the precise frequency of the signal. You need both, because the "Delta" method gives you the ability to determine frequency when a signal is riding with the main signal.

One final feature of the SC61 is its full automation option. Connect it to any computer using the

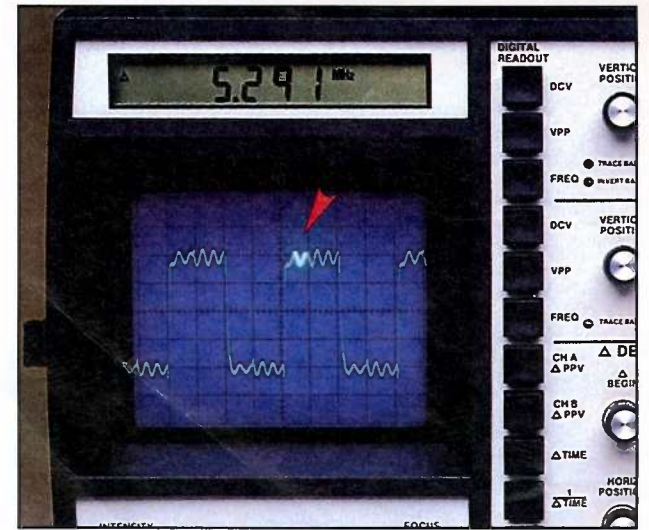


Fig. 9: The Delta Frequency test lets you find the frequency of a signal riding on top of the main signal.

IEEE-488 general purpose interface bus, or with RS232 serial communications. Optional accessories let you add automation at any time.

Briefly, those are the SC61's features. The Autotracking tests can be made with or without a waveform on the screen. The CRT lets you view waveshape with the easiest to use waveform display you can find. And, the Delta tests give you digital accuracy when you need to analyze any detail on a waveform, even if the CRT controls are uncalibrated.

What's the bottom line to these SC61 features? You use a single probe to test every signal. You press a button, and get the error-free reading you want—when you want it. Only the SC61 is so easy to use that you'll make it your main troubleshooting tool. Try it for yourself and see if you agree.

Get The Full Story On Video Tape

The printed page doesn't easily show just how easily the SC61 analyzes any signal. Call or write for a free viewing of the all new SC61 video tape, which takes you through full signal analyzing. The new tape also compares the SC61 to competitive oscilloscopes with digital readouts. For your copy, fill out the enclosed reply card, or dial toll free 1-800-SENCORE. (In Canada, dial toll free 1-800-851-8866.) ■

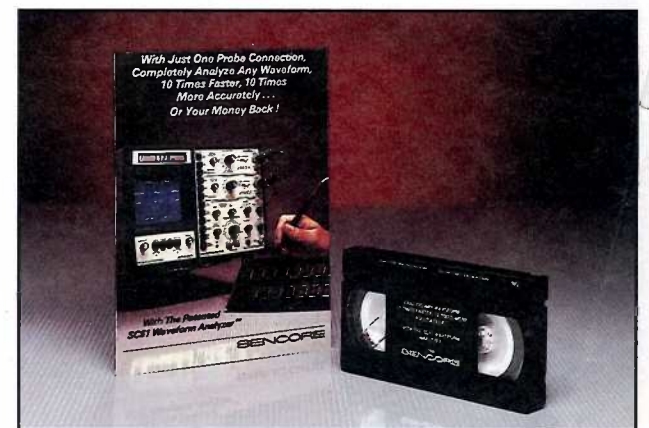


Fig. 10: See how easy the SC61 is to use (and see how it compares to competitive units), in the new video tape available through your area Telemarketing Engineer.

8.9%
"Pay As You
Grow" Investment Plans
On Any Sencore Instrument!
Offer Expires July 31st, 1989!

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Labor Day Specials #1 - The Video Update Bench



All New!

Buy The SC61 Waveform Analyzer, The VA62A Video Analyzer, And Get The VC63 VCR Test Accessory, NT64 NTSC Pattern Generator Accessory, And The EX231 Expander Jack - FREE! Equip your bench with the most cost effective Video Troubleshooting Team available. Guaranteed to cut your video servicing time by at least 54%!

Normally \$7,928

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Save \$1,138!

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Qualify for 6.9% "Pay As You Grow" Investment Plans On This Package!

Own This Package For Only \$288 Per Month With The 24 Month 6.9% "Pay As You Grow" Investment Plans, Or Only \$166 Per Month With The 48 Month 8.9% Investment Plans!

Labor Day Specials #2 - The VA62A Universal Video Analyzing System

You Receive The VA62A Video Analyzer, The VC63 VCR Test Accessory, NT64 NTSC Pattern Generator, ST65 MTS Stereo TV Adder, The RG67 NTSC Video Monitor Adaptor, The EX231 Expander Jack, And The All New EX261 Composite Video Expander. Handle the latest Video Systems with the ALL NEW VA62A Video Analyzer, and all optional accessories!

Normally \$6,617

Labor Day Specials Price - \$5,799!

Save \$818!

U.S. Funds

Qualify for 6.9% "Pay As You Grow" Investment Plans On This Package!

Own This Package For Only \$247 Per Month With The 24 Month 6.9% "Pay As You Grow" Investment Plans, Or Only \$142 Per Month With The 48 Month 8.9% Investment Plans!



All New!

Labor Day Specials #3 - The Audio Test Bench



All New!

Buy The SC61 Waveform Analyzer And The PA81 Stereo Power Amplifier Analyzer™. Now, the latest in Audio troubleshooting technology has teamed up with the SC61 Waveform Analyzer to help cut your Audio testing and troubleshooting time in half!

Normally \$5,290

Labor Day Specials Price - \$4,790!

Save \$500!

U.S. Funds

Own This Package For Only \$115 Per Month With The 48 Month 8.9% Investment Plans!

Call 1-800-SENCORE
(736-2673)

In Canada Call 1-800-851-8866

Labor Day Specials #4 - The Automated Test Bench



All New!

Buy The SC61 Waveform Analyzer And Get The LC102 AUTO-Z Meter For Only \$1,195! Now, completely analyze tough circuit and component problems 100% automatically and without interpretation errors! Now IEEE-488 and RS-232 Interfaceable!

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Labor Day Specials Price - \$4,490!

Save \$700!

U.S. Funds

Own This Package For Only \$113 Per Month With The 48 Month 8.9% Investment Plans!

Labor Day Specials #5 - The SC61 Waveform Analyzer™

Buy The SC61 Waveform Analyzer For Only \$2995! Back by popular demand! The SC61 is still the only 100% Automatic Waveform Analyzer available that guarantees measurements that are 10 times faster, 10 time more accurate than conventional oscilloscopes!

Normally \$3,295

Labor Day Specials Price - \$2,995!

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U.S. Funds



Now, Invest less for less time!

Own The SC61 For Only \$81 Per Month With The 42 Month 8.9% Investment Plans!

Labor Day Specials #6 - The PA81 Stereo Power Amplifier Analyzer™



Introductory Special Price Plus More! Now, dynamically analyze power amplifier to a full 500 Watts to IHF/EIA specifications in less than 1/2 the time you now take, and receive the optional PC259 Protective Cover and BY234 Battery Pack - FREE!

Normally \$2113.95

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Save \$118.95!

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Own The PA81 For Only \$87 Per Month With The 24 Month 8.9% Investment Plans!

Labor Day Specials #7 - The LC102 AUTO-Z™

Buy The LC102 For \$1895 and receive the SCR250 SCR/Triac Test Accessory, the CC254 Carrying Case, and the BY234 Battery Pack - FREE!

Normally \$2221.95

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Save \$326.95!

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New!



Own The LC102 For Only \$83 Per Month With The 24 Month 8.9% Investment Plans!

All New!

Labor Day Specials #8 - The ALL NEW LC101 Z-Meter™

Introductory Special!



Buy The LC101 For \$995, and Receive The SCR250 - FREE! Introducing the latest in Cap/Coil analyzing. The LC101 gives you patented Z-Meter test plus more!

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Find The Defective Capacitors, Coils, Resistors, SCRs And Triacs That All Other Testers Miss... With The All New LC102 AUTO-Z™ Automatic Capacitor-Inductor Analyzer

- Dynamically tests capacitors for value from 1 pF to 20 F, leakage with up to 1000 volts applied, dielectric absorption and equivalent series resistance (ESR).
- Dynamically tests inductors, in-or-out of circuit, from 1 uH to 20 Henrys for opens, shorts, value, and detects even one shorted turn.

- Dynamically tests SCRs, Triacs, High Value Resistors, and locates the distance to within feet of an open or short in a transmission line for an added bonus.

- Automatically makes all of the tests, compares them to EIA (Electronic Industries Association) standards and reads the results as Good or Bad. Enter all information right from the component without look-up charts, calculations, or errors.

- Extends your testing capability to places where an AC cord won't reach, with rechargeable 9-hour battery or AC operation.

- An added feature alerts you that the fuse has opened, and that there may be residual high voltage on the component under test.



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