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Issue #148 Jan./Feb. 1990

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New SG80 AM Stereo - FM Stereo Analyzer™ page 3

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Introducing The SG80 — Your Receiver Testing Solution Of The 90s

by Rick Meyer, Applications Engineer

- **Learn Why Your Present RF Generator May No Longer Be Adequate For Today's Receivers**
- **See How The SG80 Simplifies AM And FM Receiver Servicing**
- **Learn How Signal Injection Troubleshooting Can Simplify Receiver Servicing**

The SG80 AM Stereo - FM Stereo Analyzer™ — Designed To Service Yesterday's, Today's, And Tomorrow's Receivers

In This Issue

C-QUAM is a registered trademark of Motorola, Inc.

To be profitable in today's service environment, you are faced with many problems. New advances in receiver design place stronger requirements on you and your equipment. In addition, profits only come through efficient service techniques. Let's look at some specific trends and what they mean to you (Fig. 1):

1. FM tuners now have super sensitivity. They can pick up even the weakest stations. Do you have an instrument that will produce the quality low level signals needed to check these receivers?

2. Many receivers now have digital tuning. These receivers are more accurate than manually tuned RF generators. How can you confirm the receiver works correctly with your present RF generator?

3. Advances in solid state devices produce quieter receivers than ever before. Do you have a low noise, low distortion generator that can supply the signals needed to test these receivers?

4. Intermediate Frequency (IF) stages now use ceramic filters to minimize drift and maximize performance. These filters don't always use exactly 10.7 MHz as the center frequency. Does your IF generator easily let you check these IF stages?

5. Digital decoders improve stereo separation to keep pace with the capabilities of the CD. Can you confirm that these new receivers are working at their best?

6. One-third of all factory-installed car radios now have Motorola C-QUAM AM stereo. Can you test and troubleshoot these new car radios?

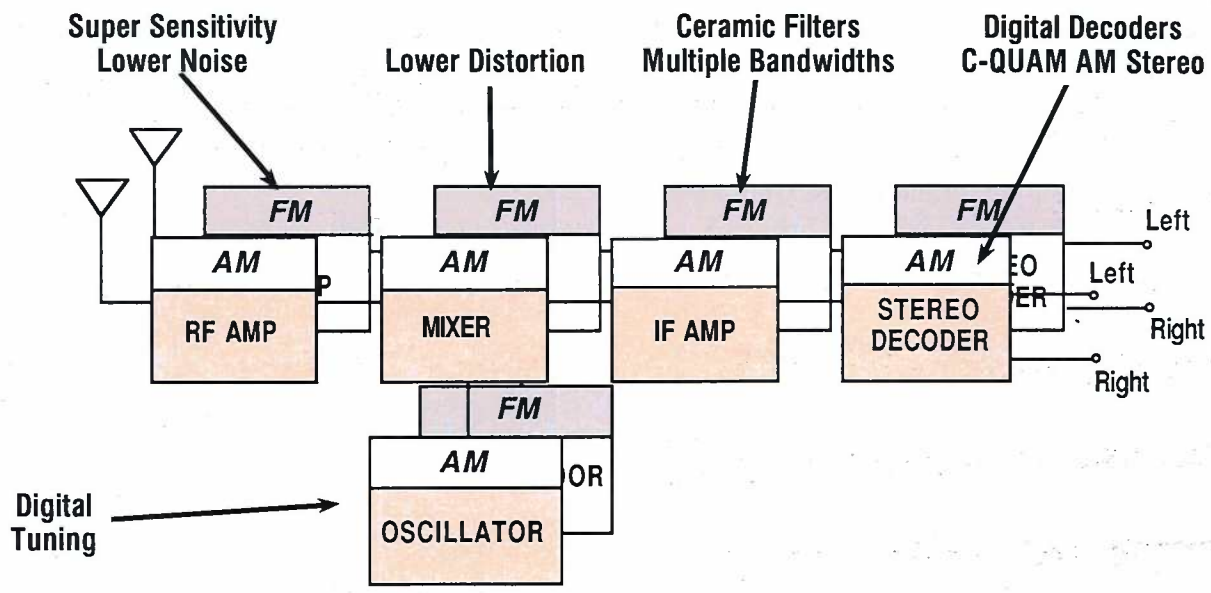


Fig. 1 : Your audio customer expects better performance, because the latest circuit improvements bring "CD-quality" sound to every circuit.

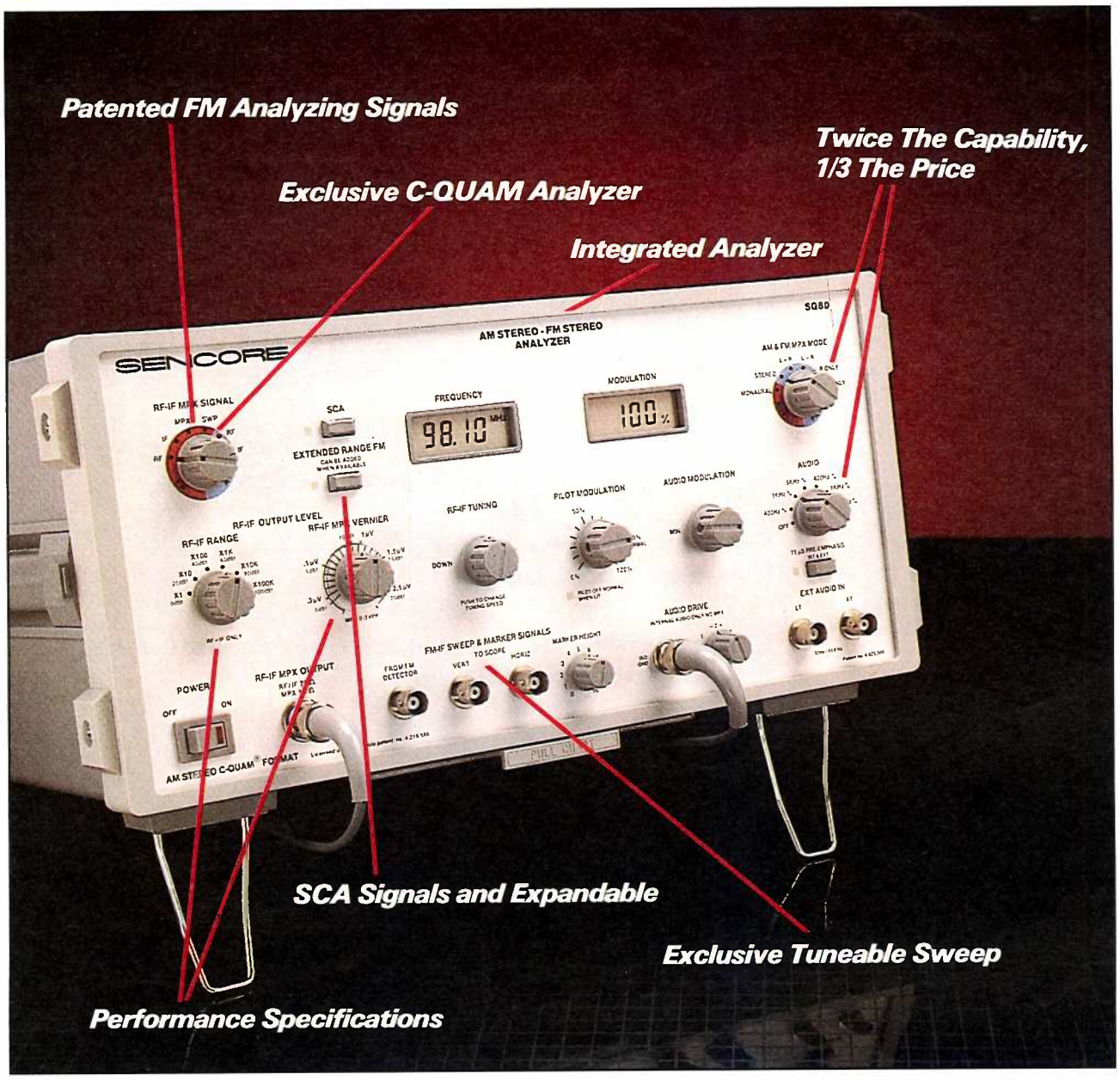


Fig. 2 : The SG80 provides everything you need for AM stereo and FM stereo troubleshooting in a single, integrated analyzer.

7. Receivers no longer use generic parts. Most parts must be special ordered when you need to replace them. Does your present equipment let you order parts with the confidence that they will fix the problem?

Each of these changes means more opportunities in audio servicing—if you have the equipment and tools to do the job to your customers' expectations. That's why Sencore designed a new AM Stereo - FM Stereo Analyzer for your testing needs in the 90s. Let's look at some of these issues and how the SG80 solves the problems associated with them.

Briefly, How Can The SG80 AM Stereo - FM Stereo Analyzer Help Me?

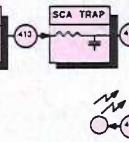
Sencore's all new SG80 AM Stereo - FM Stereo Analyzer (Fig. 2) meets all of your receiver testing needs on today's high-performance receivers and tuners, while preparing you for tomorrow. In a nutshell, the SG80 AM Stereo - FM Stereo Analyzer:

- Is one fully integrated AM/FM Stereo Analyzer that meets or exceeds manufacturers' requirements for every testing and servicing need.
- Has patented FM analyzing signals that let you quickly divide and conquer any FM receiver defect.
- Is an exclusive AM Stereo C-QUAM analyzer, for the first time totally integrated into one complete unit.
- Will completely performance test the receiver's specifications with digital accuracy to manufacturers' and EIA/IHF requirements.
- Has exclusive, tuneable FM-IF sweep and markers to let you positively test and align all IF stages as well as verify the operation of multi-bandwidth and ceramic filter IFs.
- Has expandable FM features for your future service needs, plus is SCA compatible.
- Has twice the capability for less than 1/3 the cost of stand-alone test instruments.

The SG80 AM Stereo - FM Stereo Analyzer is like having a high-performance broadcast transmitter in your own shop. It lets you know your service work is done right the first time, every time. What's more, its unique signal injection troubleshooting signals help walk problems out of even the most advanced receiver. Let's take a closer look at the SG80 and what it will do for you.

My Present RF Generator Has An FM Signal Only. Many Of The Receivers I Service Are Both AM And FM

How many AM-only or FM-only receivers have you seen lately? There aren't many. Most modern receivers cover both the AM and FM band. Then, why do most test equipment manufacturers make you buy one generator for AM and the other one for FM? Sencore provides one analyzer with all the signals you need to test and troubleshoot both the AM and FM parts of any receiver.



I Have Both An AM And An FM Generator But They Are Made By Different Companies And Work Differently. I Waste Time Just Looking For Controls And Function Buttons Each Time I Change Generators

The SG80 AM Stereo - FM Stereo Analyzer simplifies AM/FM receiver testing and troubleshooting by making the AM and FM part of a receiver look alike (Fig. 3). How does it do this? The SG80 supplies the same test signal and modulation options for both AM and FM from the same jack. Furthermore, the same controls are used to select the desired signals.

When you look at a receiver, you find that the AM tuner has the same stages as the FM tuner. Both have a front end which amplifies and converts the over-the-air broadcast signal to a fixed intermediate frequency (IF) signal. Both have IF stages to amplify and filter the AM or FM signal. They are much alike—only the frequencies and bandwidths

Fig. 3 : The SG80 makes AM and FM troubleshooting look alike, by supplying the signals needed to test or align any stage from the antenna to the output.

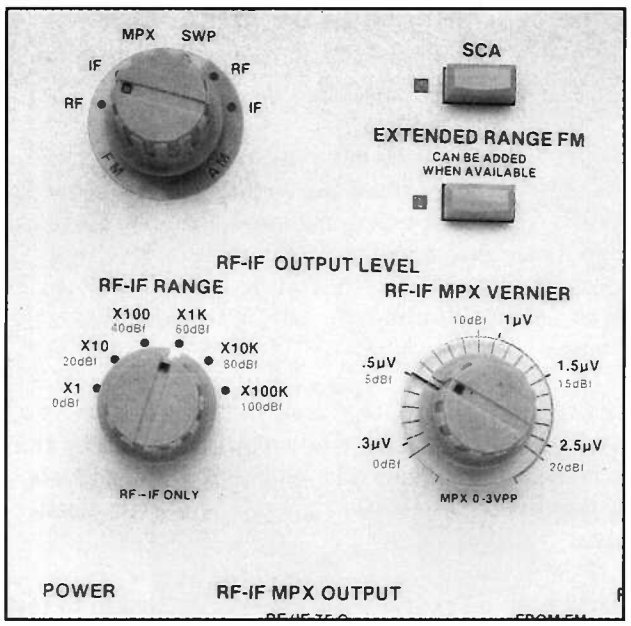


Fig. 4 : The SG80's microprocessor-controlled attenuator is calibrated in both microvolts and dBf (dB referenced to a femtowatt) to match all manufacturers' specifications.

differ. In fact, some receivers use the same IF amplifiers for both AM and FM signals with different tuning components switched in as needed.

At the detector, the AM or FM signal is converted back to the basic audio signal.

Altogether, there are three types of signals: RF, IF, and audio. The SG80 supplies these signals from the same output jack and uses the same controls for both AM and FM. You simply turn the RF-IF MPX SIGNAL switch for the signal you want.

Once you have chosen the signal, you use one signal output jack for all your test signals. The SG80 eliminates the need to learn special setups or hunt for the correct front panel jack. This makes the operation of the SG80 easy to understand and easy to use. It makes AM and FM troubleshooting look alike.

Some Performance Tests Require Precise RF Levels

Performance testing is an important part of receiver servicing. It tells you what is working and what is not working before you begin troubleshooting. Once the repair is complete, a second performance test ensures that the repair was done correctly and that the receiver works to manufacturers' specifications.

Performance tests like receiver sensitivity, 50 dB quieting, and auto seek level need precise RF signal levels (Fig. 4). The SG80 provides these precise signals. You can drop the signal down to a tiny three-tenths of a microvolt for your sensitivity tests. Or, boost the signal to a whopping 250,000 microvolts for testing the receiver's response to overload conditions or to service high level IF stages. The six step course attenuator gives the wide output range you need. The computer-compensated vernier attenuator supplies the accuracy you need for setting exact levels between steps.

Many Receiver Specs Are Given In dBf Or uV. How Can I Eliminate The Time And Confusion Of Converting From One Level Designation To Another?

The SG80 has level indicators calibrated in dBf and uV. As you notice, some receiver specifications are listed in "dBf" while others are listed in microvolts (uV). Some generators are calibrated with only one output level. Many others are calibrated with dB levels that differ from the published specifications such as "dBm" or

Fig. 5 : The 75 ohm output of the SG80 connects directly to the receiver input, without needing matching pads or conversion formulas.

"dBemf." You have to do time-consuming conversions to compare the generator setting to the levels in the service literature. This is not the case with the SG80. The RF signal output is calibrated in both standard IHF specifications: microvolts into 75 ohms and dBf.

Fig. 6 : The new digital tuners need an accurate signal source to confirm the tuners work correctly.

Why Do I Need To Match The Impedance Of My Generator To The Receiver?

Tests such as sensitivity, 50 dB quieting, and auto-scan thresholds require precise RF levels. In order to know what level you are feeding into the receiver, you must match the impedance of the generator to the receiver. This provides the maximum, and correct, transfer of energy between the generator and the receiver.

Most testing you will do is done on AC-operated FM receivers. Nearly all these receivers have a 75 ohm antenna input. So, why do most FM generators have a 50 ohm output? Most general purpose lab generators have a 50 ohm output for use in communications equipment, such as two-way and CB radios. On other instruments, using a 50 ohm generator with a 75 ohm FM receiver calls for impedance conversion pads and correction factors for "dBf" or microvolt levels—not so with the SG80.

The SG80 RF output is calibrated at 75 ohms. You hook directly to a standard FM receiver, without special matching pads or calculations (Fig. 5). If your receiver has a 300 ohm or 50 ohm

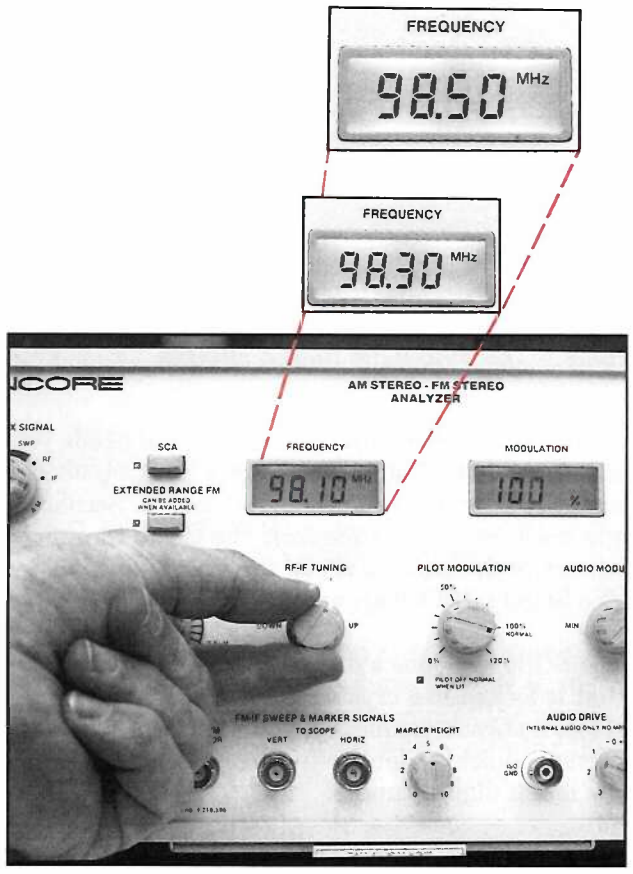


Fig. 7 : The SG80 starts at the IHF test frequency of 98.1 MHz, and tunes one channel at a time as you turn the knob.

input, adapters supplied with the SG80 quickly match up the impedance of your receiver. But, since most of your work will need 75 ohms, most testing is done with a direct connection.

Most Receivers I Work On Now Have Digital Tuners. How Can I Be Sure These Digital Tuners Work Correctly?

In the days of analog tuned receivers, receiver tuning was not precise. The consumer "tweaked" in the receiver until the sound was good or looked at a tuning indicator to fine-tune the receiver. The servicer only needed a signal source with enough accuracy to roughly calibrate the tuning dial to the correct frequency.

Those days are gone. Modern receivers now use digital tuners (Fig. 6). Now, the customer tunes the receiver to the assigned station frequency. There is little, or no, ability to fine tune the receiver. Tuning relies on the accuracy of the tuner and its internal fine tuning circuits to properly receive the desired station.

Digital tuners can become non-linear. The tuning indicator may not correspond to the tuned station.

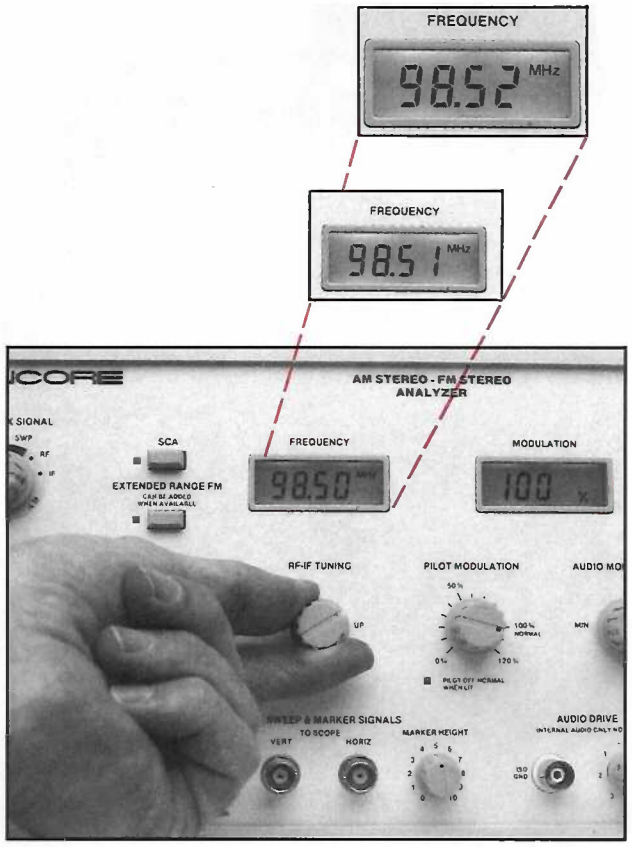


Fig. 8 : Pressing the tuning knob moves the SG80 tuner to fine tuning steps of 10 kHz (0.01 MHz) for tests of the automatic tuning circuits.

Digital receivers result in two servicing needs you did not have with analog tuning. First, you need a digitally accurate AM/FM signal source. Second, you need to quickly tune from the top to the bottom of the band to check the tuning linearity. The SG80 fulfills both needs.

The SG80 provides a digitally accurate signal that is locked to a crystal reference. When you select a station frequency, you know the signal is correct. Quickly identify tuning problems in even the latest digital tuners.

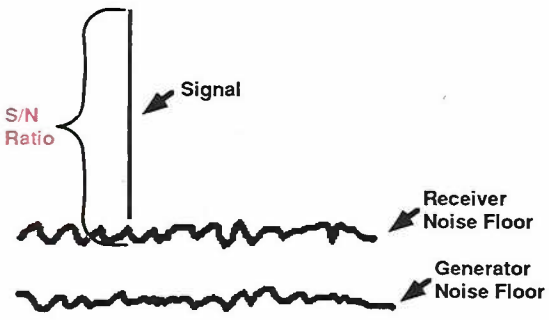


Fig. 9 : The SG80 provides very low background noise, allowing you to make accurate sensitivity and S/N tests on low-noise receivers. Other generators have higher noise levels, which causes the tests to be in error.

The SG80 tuning was designed specifically for testing and troubleshooting AM and FM receivers. The SG80 tunes in steps identical to the FCC station spacings. The SG80 tunes FM in 200 kHz steps (Fig. 7). It tunes AM in 10 kHz channel steps. Turn the knob to walk through the assigned FCC station frequencies. It's that simple.

But, what if you suspect the receiver is tuned slightly off channel? How do you check the FM AFT circuits? The SG80 lets you fine tune the signal source for these special needs. Simply push in on the RF-IF TUNING knob, and the SG80 changes to the fine-tuning mode (Fig. 8). In FM, the fine tuning steps are 10 kHz apart. In AM, you can fine tune the SG80 in 1 kHz steps.

How Do You Move From The Top To The Bottom Of The Band To Check The Linearity Of A Digital Tuner?

With many RF generators, you must tune through the entire band. The SG80 has "wrap-around" tuning. Tune instantly from the top to the bottom of the band in a single step, similar to

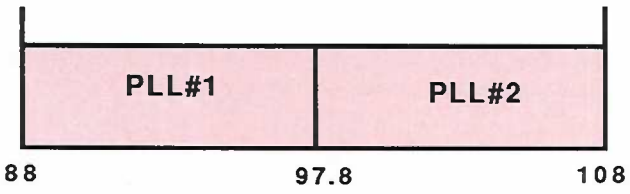


Fig. 10 : The SG80 uses two PLL oscillators to cover the FM baud to keep correction errors below the noise floor of the receiver under test.

the way most receivers tune. This saves valuable time on tuning linearity tests.

Most Receiver Tests Are Done At A Specified Frequency. Do I Need To Look Up And Tune In These Test Frequencies All The Time?

The SG80 is preset to standard IEEE/IHF test frequencies. When you apply power, the SG80 automatically tunes to the standard test frequencies. The startup conditions are 98.10 MHz for FM and 1100 kHz for AM. These frequencies cover most testing, but you can change the frequencies any time you want to.

The SG80 tunes through the entire FM band from 87.3 MHz to 108.0 MHz. In AM, it tunes from 520 kHz to 1720 kHz. This includes the new expanded AM band, which will be required in 1990.

Modern Receivers Introduce Very Little Internal Noise To The Signal

Many receivers now have improved tuner and IF circuits for lower noise performance than ever before. Most FM test generators are no longer capable of supplying signals clean enough to test these modern receivers. To understand why this is so, lets look at how the signal to noise test is done:

As Figure 9 shows, the noise in the test generator must be less than the noise generated by the receiver. If the generator has higher noise levels, it will make the receiver appear to be less sensitive.

The SG80 RF circuits have a special design to test these low noise receivers, while supplying the accuracy of digital tuning.

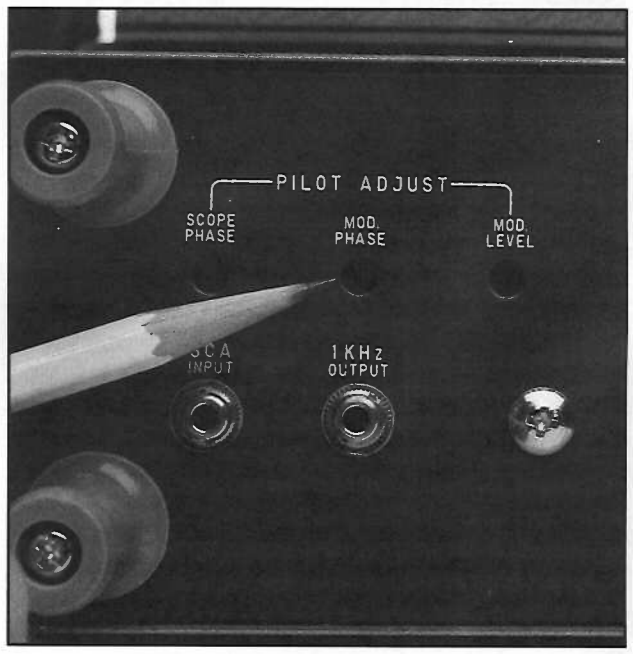


Fig. 11 : Other FM stereo generators have phase adjustments which affect separation. The patented Sencore system holds proper phases all the time, without controls which can drift.

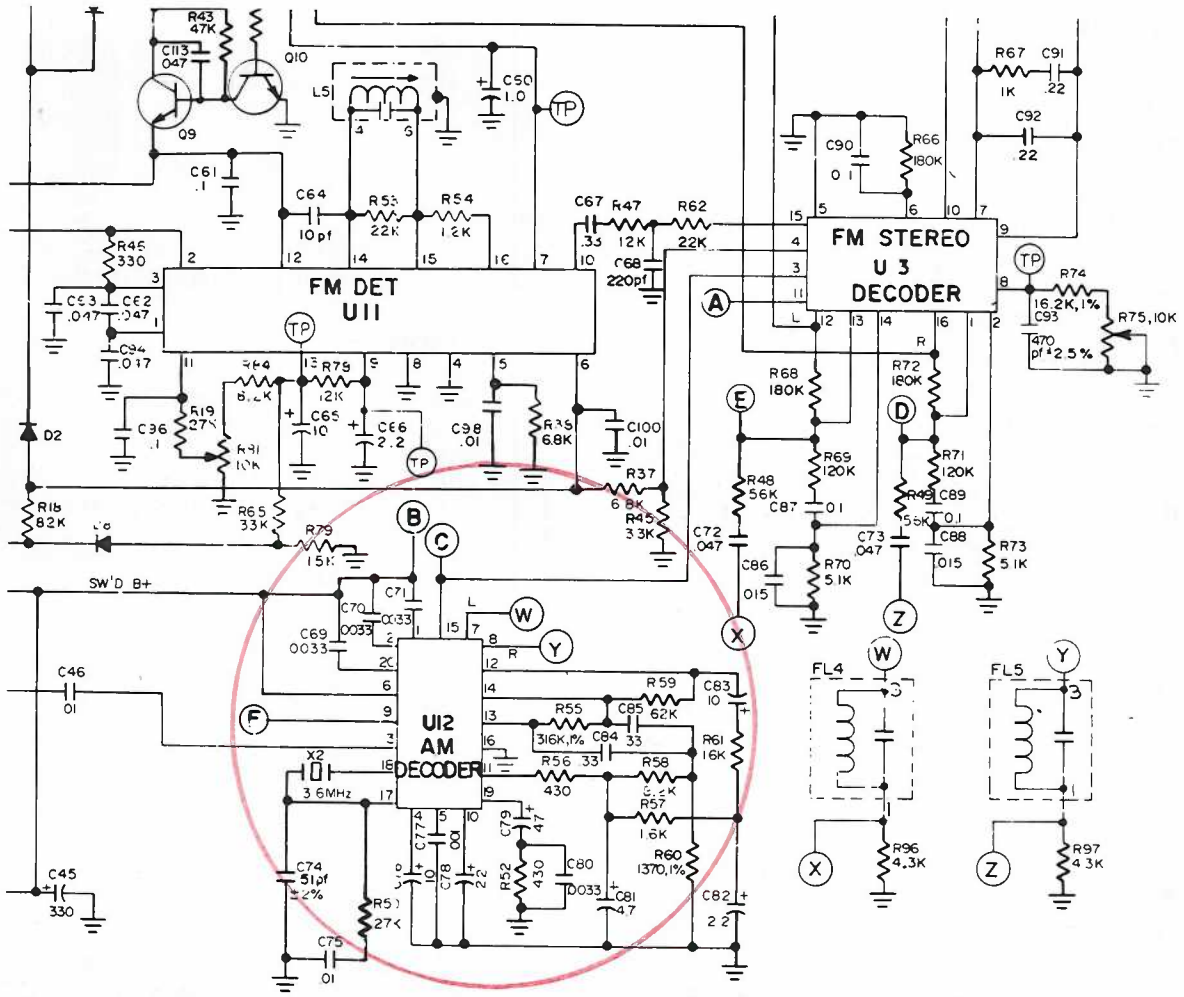


Fig. 12: The SG80's C-QUAM stereo signals let you service all the high-peformance receivers included in one out of three new cars this year.

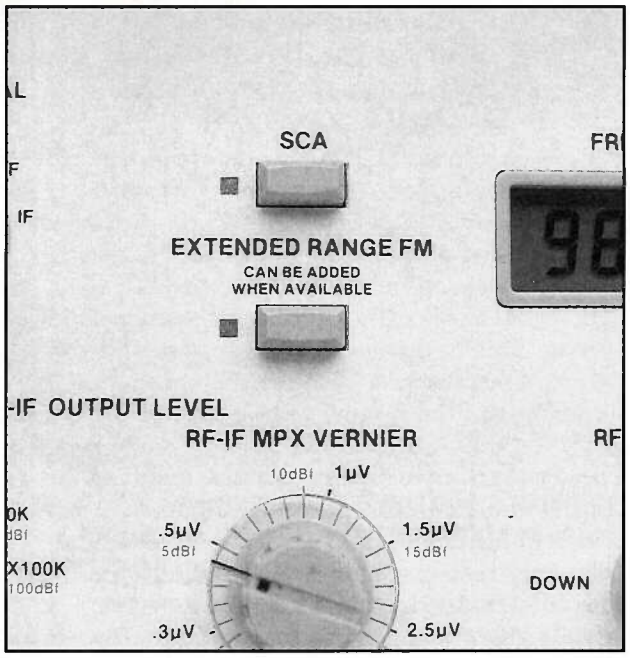


Fig. 13: The SG80's SCA signal lets you dynamically test and set SCA traps. The Extended Range FM button allows for later updates if and when new FM modulation schemes are accepted.

Digital signal generation techniques use a circuit called a PLL (Phase Lock Loop). A PLL compares a voltage controlled oscillator (VCO) to a reference, typically a stable crystal oscillator. Any difference in the VCO frequency results in a correction voltage that brings the VCO back to the correct frequency. The process causes a slight variation in the RF frequency. The correction is actually a small amount of frequency modulation, seen by FM detectors as noise.

This is the reason most low-noise generators use older technology L/C tuning instead of true digital tuning. L/C tuning produces low noise, but has the offsetting problem of carrier frequency drift.

The SG80 solves this problem (Fig. 11) using four separate PLL oscillators, two of which are for the FM band (Fig. 10). By dividing the FM band in half, the PLLs need smaller corrections. The result is an FM noise floor that is more than 85 dB below the carrier, for accurate tests on any receiver.

Some Manufacturers Require A Low Distortion Signal To Test And Align Their Receivers

The SG80 provides a low distortion test signal you can connect right up to the antenna terminals of the receiver. Ideally, a receiver should not introduce distortion into the output audio. Modern AM and FM receivers introduce much less distortion than their older counterparts. Distortion levels as low as 0.02% total harmonic distortion (THD) are becoming common. To check these receivers, you need a signal source that has even lower levels of distortion.

The generator's modulator limits the quality of the signal. The SG80 modulator and RF section produces less than 0.01% distortion. You can connect a distortion meter to the output of the receiver and check the distortion from the antenna terminal to the speaker or line output terminals.

Why Do I Need To Check The Stereo Separation Of A Receiver?

The stereo separation gives a degree of quality to the audio the customer is listening to. Stereo has become almost standard in audio. It gives the illusion of the audio source being in the room along with the listeners. The degree of stereo separation defines how well the receiver can make the customer feel he is really at the source.

Many of today's FM receivers work so well that they exceed the performance of a typical broadcast transmitter. That's why Sencore had to invent a brand new way to generate stereo signals. The signals needed to check these modern receivers must be better than broadcast quality.

To eliminate any doubt, Sencore developed an advanced FM stereo multiplex system using the accuracy of digital circuits. The method is such a breakthrough that it is patented.

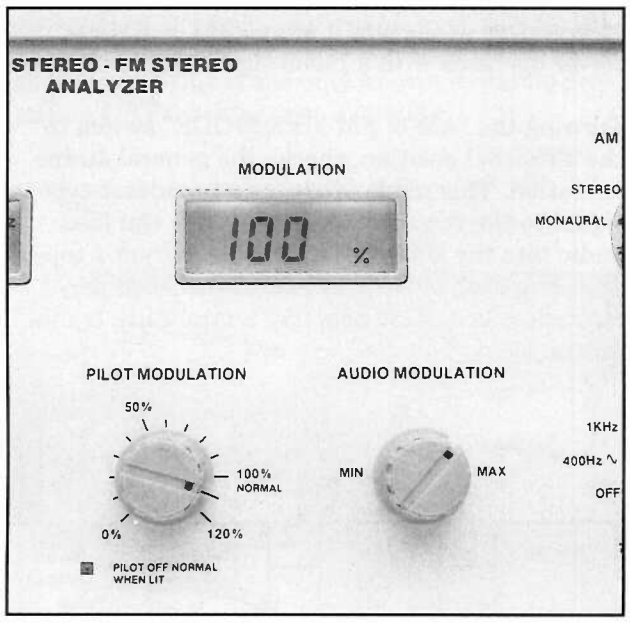


Fig. 14: The SG80 has separate modulation controls for the stereo pilot and the audio signal. The digital modulation meter indicates the total modulation, for reliable tests every time.

Analog stereo multiplex generators have user-adjustable phase compensation controls to correct for phase errors resulting from circuit changes. These controls must be periodically checked and "tweaked" to ensure the best performance. Sencore's patented FM multiplex system eliminates these calibrations.

In the patented system, the signals are created from digital code stored in a memory IC. These signals were computer generated to ensure that they have the correct mathematical relationships between the pilot, subcarrier and sidebands. This eliminates doubt. The stereo signals are always correct.

I See That Many New Cars Are Coming With AM Stereo. What Can I Do If I Need To Service One Of These Radios?

Motorola's C-QUAM AM stereo format has become the defacto standard of AM stereo. The need to test AM stereo increases as more radios find their way to the market. You need a signal source that will allow you to test and troubleshoot these new radios (Fig. 12).

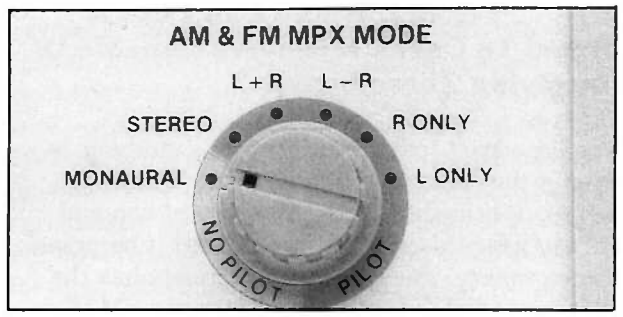
The SG80 produces AM stereo signals that meet Motorola's exacting standards. What's more, the AM stereo signals are as easy to use as the FM stereo signals. You use the same controls to pick the various modulation frequencies and modes as you do when you are testing and troubleshooting FM receivers. You simply place the RF-IF MPX SIGNAL switch in either the AM RF or IF position and inject your signal into C-QUAM stereo radios.

How Can I Know If My Local Stations' SCA Signals Are Not Affecting The Operation Of The Receivers My Customers Bring Me To Service?

SCA (Subsidiary Communication Authorization) signals have been broadcast with the FM stereo signal for many years. Originally, the FCC placed SCA on a 67 kHz subcarrier, above the FM stereo subchannel (Fig. 13).

Some receivers have an adjustable SCA trap to prevent interference with the stereo signal. The SG80's SCA signal lets you quickly set these traps for best SCA rejection.

The SG80 SCA circuits are preset at the factory to 67 kHz. This signal is internally adjustable from 53 to 95 kHz, if you work on SCA receivers with subcarriers other than 67 kHz.



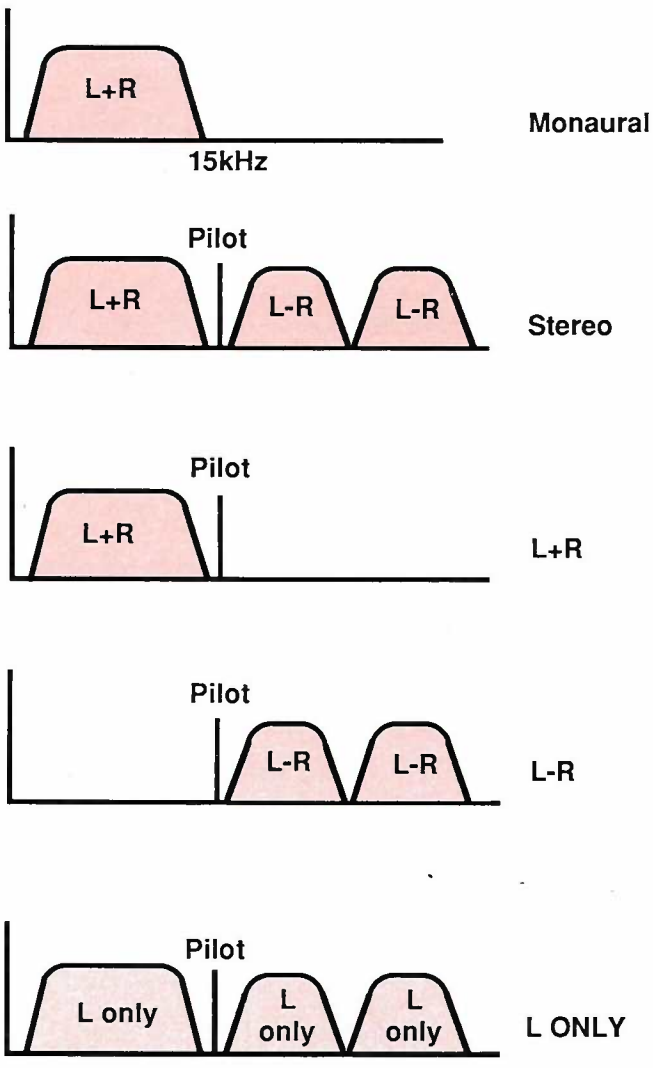


Fig. 15: Each setting of the AM & FM MPX MODE switch produces a different set of modulation conditions to dynamically test each part of the stereo decoder.

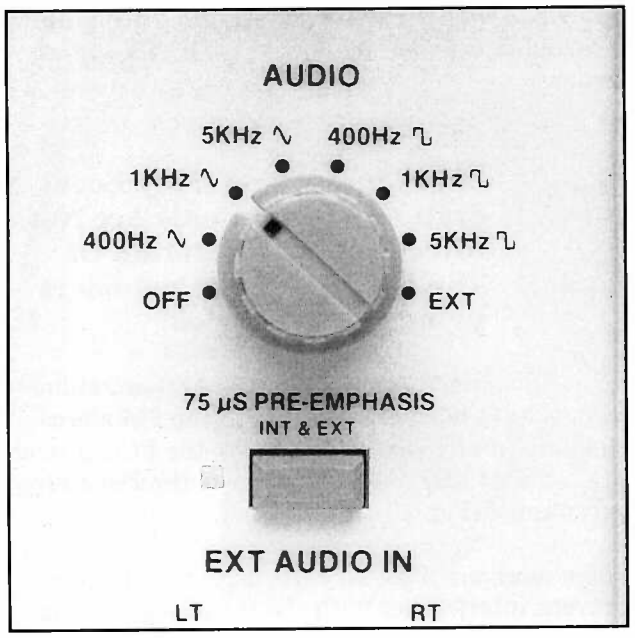


Fig. 16: The internal audio generator produces low distortion sinewaves, and harmonically-rich square waves for fast, reliable testing. Standard 75 microsecond pre-emphasis can be added when needed.

I've Heard Something About A New Extended Range FM Format. If This Format Gets Going, Where Can I Get A Signal To Check Receivers Capable Of Receiving These Signals?

The broadcast industry is studying methods to extend the range and quality of the FM stereo signal. Sencore's Service Department can add circuitry for this system when and if it becomes commonplace. The front panel already has the switch needed to control the Extended FM (Fig. 13). This keeps the SG80 up to date for future expansion.

Some Tests Call For 100% Modulation, Some For 50%, And Others 30%. How Can I Test Receivers At These Different Modulation Levels?

Standard receiver tests specify several different modulation levels. AM stereo tests, for instance, are typically done at 30% and at 50% modulation. FM tests are done at 75% or 100% (Fig. 14).

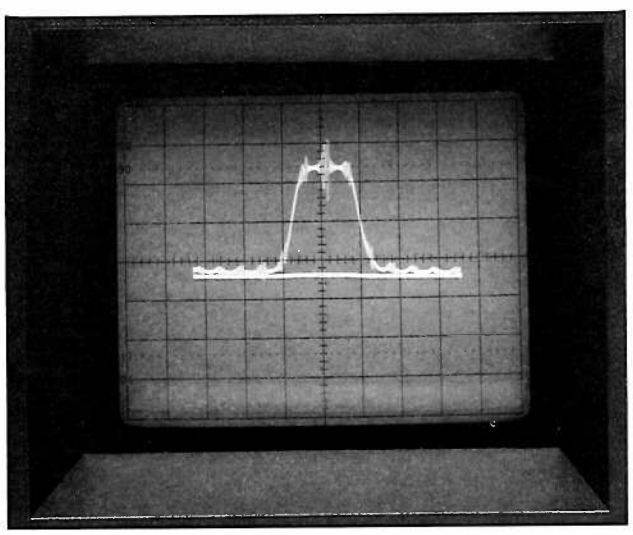


Fig. 17: Only the SG80 lets you tune the center marker of the sweep system to whatever frequency you need to match the circuits under test. Here, a center-marker frequency of 10.65 MHz matches the fixed-tuned IF stages.

Separate PILOT MODULATION and AUDIO MODULATION controls let you adjust the modulation level anywhere between 0% and 125%. The total modulation is shown in a back lit LCD digital display to give you total control.

How Can I Identify Problems In An AM Stereo Or FM Stereo Receiver?

Unlike over-the-air signals, the SG80 gives full control of the modulating signal. The SG80's "AM & FM MPX MODE" switch lets you tailor the signal to your testing needs (Fig. 15).

The first mode is "MONAURAL." Use this mode to check the operation of mono AM and FM receivers or to see how a stereo AM or FM receiver operates with a mono signal.

Turning the "AM & FM MPX MODE" switch to the STEREO position, checks the general stereo operation. This mode produces a broadcast-type signal to the receiver under test. You can feed audio into the EXT AUDIO IN jacks from a tape deck or a CD player to dynamically check performance. The SG80 acts like a miniature transmitter.

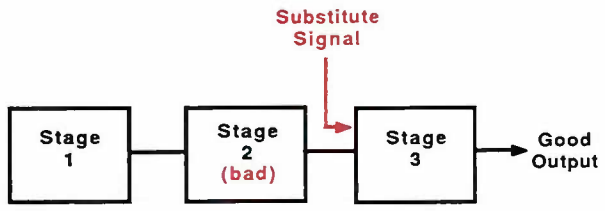


Fig. 18: Signal injection troubleshooting requires a substitute for every signal. The bad stage shows a normal operation when substituting at its output, and bad results when injecting at its input.

The next modes check the stereo decoders in AM and FM receivers. One mode is the "L+R" mode. This checks the main channel of the stereo decoder. In this mode, an identical signal is applied to both the left and the right channels. A pilot ensures that the stereo circuits in the receiver are turned on. If no output is obtained when this mode is chosen, you should troubleshoot the L+R channel in the decoder.

The next decoder test signal is the "L-R" signal. This signal checks the stereo subchannel in the stereo decoder. In this mode, the right channel signal is opposite in phase to the left channel signal. Again, a pilot signal is present to ensure that the stereo decoder is turned on. If the receiver produces poor output, troubleshoot the L-R signal path.

The last two modes test stereo separation. These modes apply audio to the right or left channels only, to check for crosstalk between the left and right channels.

Some Service Literature Calls For A 1 kHz Audio Test Signal, Others A 400 Hz Signal

The SG80 provides three low-distortion audio sinewave signals for performance tests and troubleshooting (Fig. 16). The 400 Hz signal tests the lower end of the audio response. This frequency is needed for most AM audio tests. A 1 kHz signal checks the middle of the audio response. This frequency is often specified for FM performance tests. A 5 kHz signal checks the higher end of the frequency response.

Three squarewave signals are also supplied for testing and troubleshooting. A squarewave signal is rich in harmonics and tests the whole audio frequency response of both AM and FM receivers. The 400 Hz, 1 kHz, and 5 kHz squarewave signals give you a good selection of squarewave signals.

Besides the internal audio signals, the SG80 can be used with an external audio source. Two external audio input jacks accept audio from external audio generators, CD players, or whatever audio source you have. When the Stereo mode is selected, the SG80 becomes a mini-transmitter to check AM and FM receivers with actual audio signals.

How Can I Be Sure The Receiver De-Emphasis Circuits Are Working Properly?

The FCC calls for broadcasters to add 75 microseconds of pre-emphasis to the audio for better fidelity. Pre-emphasis boosts the high frequencies to keep them above the noise floor. The SG80 lets you add pre-emphasis to the audio to check the de-emphasis circuits in the receiver.

Being able to remove the internal pre-emphasis lets you use special signal sources which have their own pre-emphasis or have special compression for noise reduction. Your choice is made with the push of a button.

Some Receivers Now Have Multiple Width IFs. How Can I Prove These IFs Are Working Correctly?

The SG80's exclusive, tuneable FM sweep generator lets you positively test and align all IF stages, including those with variable bandwidths

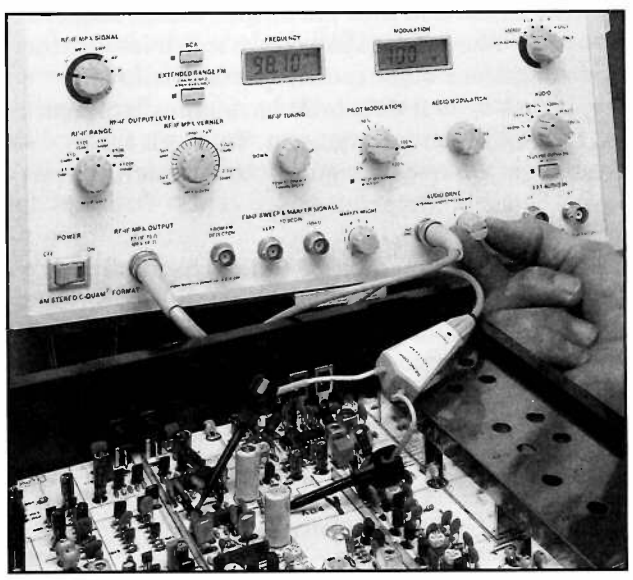


Fig. 19: The SG80 substitute signals "swamp" out the signal in the circuit, so you don't have to disconnect components when troubleshooting.

(Fig. 17). The SG80's new IF sweep signal tests all FM IF circuits from the older tuned circuits to the latest ceramic IF circuits.

First, the SG80 can be used like a conventional FM sweep generator with a fixed 10.7 center marker and side markers at 10.6 and 10.8 MHz. But, today's receivers limit the use of conventional sweep signals. Ceramic IF filters often have center frequencies other than at 10.7 MHz. The tuneable sweep and marker system in the SG80 allows you to fine tune the markers to determine the frequency of these non-standard IFs. By simply turning the RF-IF TUNING control, the markers can be tuned higher or lower in frequency. The center marker can be tuned from 9.7 to 11.7 MHz to tune to the frequency of any IF filter.

Some newer receivers have multiple bandwidth IFs. The SG80 tuneable sweep and marker system lets you quickly determine the bandwidth of each IF selection. By tuning the marker from one side of the response curve to the other, you can positively measure the width of the IF response. You can read the corner frequencies of the IF response curves directly from the lighted LCD display.

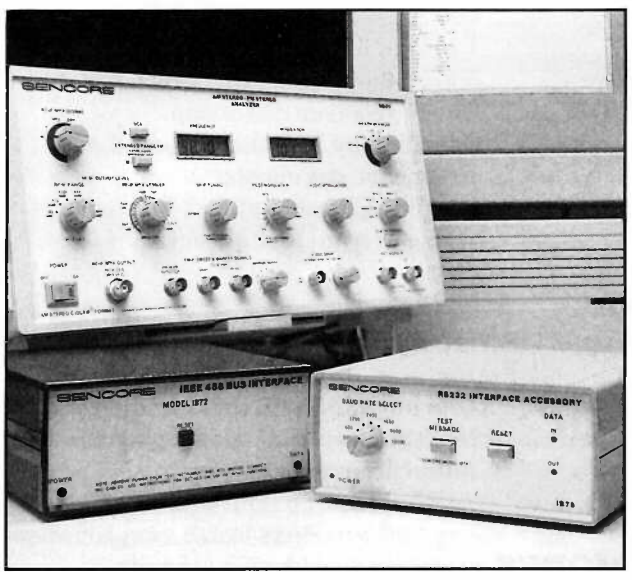


Fig. 20: Two computer interface accessories give you the choice of IEEE-488 (GPIB) or RS232 if you want to automate your testing.

How Can I Quickly Locate The Reason For Poor Receiver Performance?

Up to now, we have mainly talked about the performance testing capabilities of the SG80. This is only part of the story. The SG80 AM Stereo - FM Stereo Analyzer is a complete analyzer that lets you walk problems out of defective AM and FM receivers using time proven signal injection techniques.

The SG80 provides patented FM analyzing signals, that let you quickly divide and conquer any FM receiver defect. Inject these signals into any RF, IF, or multiplex decoder stage to isolate defects quickly (Fig. 18). The SG80 also provides AM analyzing signals to let you use the same techniques in AM receivers.

The signal injection methods used in the SG80 have been time-proven by over 15 years of success with the Sencore SG165 AM-FM Stereo Analyzer. To understand how these signals can help you, let's look at each one in more detail.

How Does Signal Injection Work? How Can It Identify A Bad Stage In A Receiver?

Signal injection swamps out the signal in the circuit so you don't have to disconnect the components. You inject a known-good replacement signal into any point from the antenna to the output to isolate receiver troubles (Fig. 19). By monitoring the results of each signal injection, you can quickly identify the bad stage. The bad stage is the one which provides a good output when injecting at the stage's output, and a poor audio signal when injecting at its input.

The first injection signal needed is for the IF circuits. The SG80 provides a universal IF injection signal. If the receiver works when you inject into the IF stages, but does not when you inject an RF signal into the front end, you know that the front end is bad. If you see no improvement when injecting into an IF stage, you have confirmed the problem is in a stage closer to the output.

How Do I Test Ceramic Filter IF Stages?

Since many FM receivers use ceramic IF filters that might not be tuned to 10.7 MHz, you need an injection signal that can be tuned to the IF frequency used in the receiver. When you first turn on the SG80, its IF generator tunes to the nominal 10.7 MHz frequency. But, you can quickly tune it to any other FM IF frequency (from 9.7 to 11.7 MHz) to match IF stages with other frequencies. Simply "rock" the SG80 IF frequency for the best audio output, while injecting into an IF stage. This matches the generator to the tuned IF frequency.

Don't AM IFs Have Several Different Standard Frequencies?

AM IFs use two primary IF signal frequencies: 262 kHz and 455 kHz. 455 kHz is common in home receivers and in some automotive radios. 262 kHz is used in many car radios. The SG80 is pre-programmed to tune to 455 kHz. The SG80 lets you choose any other AM IF frequency from 200 kHz to 500 kHz using the RF-IF TUNING knob.

How Can I Identify A Problem In An FM Stereo Decoder?

The SG80 also provides an MPX signal for troubleshooting FM stereo decoder circuits. Inject after the FM detector, and watch the output of the receiver for correct stereo performance.

What If I Suspect A Problem In Some Of The Circuits After The Decoder?

The SG80 doesn't stop at the detector. Its exclusive audio drive signal lets you inject into any audio stage. The signal's phase can be reversed for tests in the stereo matrix. This drive signal uses the "swamping" method used successfully in Sencore video analyzers for more than a decade. Swamping lets you feed the good signal into a stage, swamping out the original, questionable signal without needing to disconnect components in the circuit. The result is fast, reliable circuit analyzing.

A Computer Could Sure Speed Up Performance Testing Of A Receiver. Is There A Way I Can Use A Computer To Help Me?

The SG80 includes the exclusive Sencore computer interface port. This allows you to tie the SG80 into any computer with either of two Sencore accessories (Fig. 20). The IB72 connects to computers with an IEEE-488 (GPIB) interface jack while the IB78 works with RS232 systems. Computer control makes full automation a possibility.

How Does The Price Of The SG80 Compare To Other Generators?

There's another thing you should know about the SG80. You get all its performance for less than one-third the prices of comparable functions from competitive companies. Take a look at these figures to see what we mean:

Digital RF Generator	3,000
AM Stereo C-Quam Generator	4,200
FM Stereo MPX Generator	1,000
Sweep and Marker IF Generator	1,000
Low Distortion Audio Generator	800
Function Generator	500
RF Level/Modulation Meter	1,000
TOTAL	*$11,500*
SG80	***$3,995***

Fig. 21: The SG80 costs one-third the price of equipment from competing manufacturers, and gives better performance, since all tests are designed to work together.

You would need seven separate instruments to get the equivalent functions of the SG80. You would need an accurately controlled RF generator, an AM generator with C-QUAM, an FM multiplex generator, a sweep and marker generator, a low distortion audio generator, a function generator, and an RF level meter. The minimum cost of these units is $11,500. The price of the SG80 is only $3995, or one-third the investment.

Not only do you save money, the SG80 gives you better efficiency than seven separate pieces. You get full analyzing capabilities with only one cable hookup, to isolate bad stages faster.

For more information about the SG80, or any of Sencore's audio servicing instruments, call your Sencore Sales Engineer. He can get an SG80 on its way to you. And remember: after you get it, you have 30 full days to decide if it does everything we say. If you are not convinced, just return it for a full refund under our standard 30-day, money-back guarantee. Just pick up the phone and dial **1-800-SENCORE**, from the United States or from Canada, for complete details. ❐

SG80 AM Stereo-FM Stereo Analyzer Specifications

The Signals You Need To Performance Test, Troubleshoot, And Align Any AM Stereo - FM Stereo Receiver

FM RF

Tuning Range: 87.3 to 108 MHz	Covers entire FM broadcast range.
Coarse Tuning Steps: 200 kHz	Same steps as FM station spacing.
Fine Tuning Steps: 10 kHz	Checks AFT circuits.
Preset Frequency: 98.1 MHz	EIA/IHF standard test frequency.
Modulation Percentage: 0 to 125% fully adjustable	Lets you match any test requirement.
Distortion: < 0.01% @ 1 kHz	Needed to test and align modern receivers from antenna terminals.
Residual Noise: < 86 dB	Checks S/N on modern receivers.
Stereo Separation > 63 dB @ 1 kHz	Exceeds receiver specs.
RF Level: 0 to 120 dBf 0.3 to 250,000 uV	Full range and calibrated in same units as receiver specs.
Output Impedance: 75 ohms	Input impedance of most receivers.
Protection: +/- 400 volts (DC + Peak AC)	Don't worry about damaging output of SG80.

FM IF

Tuning Range: 9.7 to 11.7 MHz	Covers all FM IF frequencies.
Coarse Tuning Steps: 200 kHz	Quickly tune to IF.
Fine Tuning Steps: 10 kHz	Fine tune IF frequency.
Preset Frequency: 10.7 MHz	Most common FM IF frequency.
IF Level: 0 to 120 dBf 0.3 to 250,000 uV	Full range of troubleshooting injection signals.
Output Impedance: 75 ohms	Low impedance to drive IF stages.
Sweep Center Marker Frequency: 9.7 to 11.7 adjustable	Tuneable markers let you check and identify all FM IFs.
Side Marker Spacing: 100 kHz	Needed bandwidth for low distortion.
Sweep Width: +/- 600 kHz	Confirm adjacent channel rejection.
Protection: +/- 400 Volts (DC + Peak AC)	Don't worry about damaging SG80 output signal.

FM MPX OUTPUT

Pilot Frequency: 19 kHz	FCC specified.
Pilot Level: 0 to 11 % variable	Check pilot detect sensitivity.
Stereo Separation: > 65 dB @ 1 kHz	Check stereo separation at decoder.
Level Range: 0 to 3 VPP	Inject into and stereo decoder stage.
Output Impedance: 1 kohm	Won't load down decoder.
Protection: +/- 400 Volts (DC + Peak AC)	Don't worry about damaging output of SG80.

SCA

Frequency: 53 to 95 kHz internally adjustable	Adjust to any SCA frequency.
Preset Frequency: 67 kHz	EIA/IHF recommended test.
Modulation: 2.5 kHz audio tone	EIA/IHF recommended test.

EXTENDED FM

Option	Allows expansion for future enhanced FM formats.

AM RF

Tuning Range: 520 - 1720 kHz	Covers new expanded AM band.
Coarse Tuning Steps: 10 kHz	Same as AM station spacing.
Fine Tuning Steps: 1 kHz	Check tuner accuracy.
Preset Frequency: 1100 kHz	Most often used test frequency.
Modulation Percentage: 0 to 125% variable	Match any testing requirement.
Distortion: < 0.5%	Exceeds receiver performance.
Residual Noise: < 70 dB	Check S/N on modern receivers.
RF Level: 0 to 120 dBf 0.3 to 250,000 uV	Meets full input range of receiver.
Output Impedance: 75 ohms	Same as for FM receivers.
Protection: +/- 400 Volts (DC + Peak AC)	Don't worry about damaging output of SG80.

AM IF

Tuning Range: 200 - 500 kHz	Covers IF bands.
Coarse Tuning Steps: 10 kHz	Fast tuning.
Fine Tuning Steps: 1 kHz	Fine tune IF for troubleshooting.
Preset Frequency: 455 kHz	Most common IF frequency.
IF Level: 0 to 120 dBf 0.3 to 250,000 uV	Range needed for injection troubleshooting.
Output Impedance: 75 ohms	Same as for FM.
Protection: +/- 400 Volts (DC + Peak AC)	Don't worry about damaging output of SG80.

C-QUAM STEREO

Main Channel Distortion: < 0.5% at 1 kHz	Low distortion signals for testing modern receivers.
Sub-Channel Distortion: < 0.5% at 1 kHz	
Stereo Separation: > 35 dB	Exceeds receiver separation specs.
ID Pilot Frequency: 25 Hz +/- 0.25 Hz	C-QUAM specified pilot.
Pilot Level: 0 to 6% fully adjustable	Test for proper stereo switching.

AUDIO MODULATION

Frequencies:	400 Hz is for most AM tests.
400 Hz, 1 kHz, & 5 KHz	1 kHz is for most FM tests.
Sinewave and squarewave	5 kHz checks top end of receiver.
Sinewave Distortion: < 0.01%	Check receiver distortion.
Pre-emphasis: 75 usec	Specified by FM and proposed AM broadcast standards.
External Inputs:	L and R Channel allows full testing with external signal source.

AUDIO DRIVE SIGNAL

Output Amplitude: 0 to 3Vpp continuously variable	Troubleshooting audio stages.
Output Impedance: 100 ohms	Low impedance to drive audio stages.
Protection: +/- 500 volts (DC+Peak AC)	Don't worry about blowing up the audio drive outputs.

AM & FM TESTING MODES

Mono	Check mono and automatic switching stages of AM and FM receivers.
Stereo	Check full stereo operation of AM Stereo or FM Stereo Receivers.
L+R	Check L+R portion of AM Stereo or FM Stereo decoder.
L-R	Check L-R portion of AM Stereo or FM Stereo decoder.
L Only	Check left channel separation.
R Only	Check right channel separation.

COMPUTER INTERFACE

IEEE or RS232 with optional accessory.

GENERAL SPECIFICATIONS

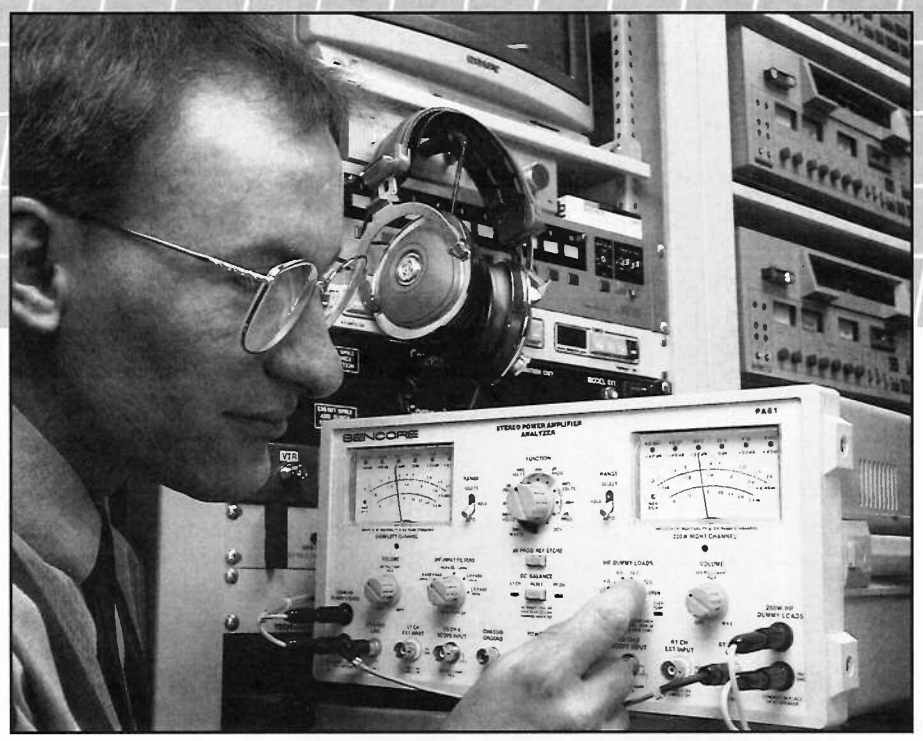
Operating Temperature: 15 to 35 degrees C 59 to 95 degrees F	Covers normal temperature range of service center.
AC Power:	105 to 130 VAC Standard AC line input.
Size: 7 1/4" X 13 3/4" X 15"	Same size as other Sencore products in new audio testing line.
Weight: 20 pounds	Lightweight for easy movement from bench to bench.

Compare For Yourself And See How The SG80 AM Stereo - FM Stereo Analyzer Gives You Everything You Need To Service AM Stereo And FM Stereo Receivers . . .

	Tuning						FM Features														AM Features								Audio				Misc.
	Digital Tuning	Digital Readout	Wrap-around Tuning	Preset IHF Test Frequencies	Standard Channel Tuning	Tuning Range	Fine Tuning	Level In dBf	Level in uV 75 ohm output	Stereo Separation @ 1 KHz	Maximum Distortion (THD)	Maximum Signal-to-Noise	Modulation Modes	Adjustable Modulation Levels	Adjustable Stereo Pilot SCA	Extended Range FM	Tuneable IF Frequencies	Tuneable IF Sweep Tuning Range	Fine Tuning	Level in dBf	Level in uV	C-QUAM Stereo Separation	Maximum Distortion	Maximum Signal-to-Noise	Modulation Modes	Adjustable Modulation Levels	Adjustable Stereo Pilot	Audio Drive	Internal Audio Frequencies	External Audio Input	Selectable 75 usec pre-emphasis	Computer IEEE Interface	Computer RS232 Interface	Total Price
SENCORE SG80 AM Stereo - FM Stereo Analyzer	●	●	●	●	●	87.3-108 MHz	●	●	●	●	>63 dB	0.01%	>83 dB	mono stereo L+R L–R L,R	0-125%	●	●	○	●	●	520 kHz – 1720 kHz	●	●	●	>35 dB	<0.5%	>70 dB	mono stereo L+R L–R L,R	●	●	0 to 3VPP variable	400 Hz 1 KHz 5 KHz sine & square	●	●	○	○	$3,995
SOUND TECHNOLOGY 1000A						88-108 MHz	●		●		>50 dB	<.1%	>70 dB	L+R L–R L,R	0-150%	●	●															2 V fixed	400 Hz optional 1KHz	●				Discontinued
SOUND TECHNOLOGY 1020A		●				88-108 MHz	●	●	●		>60 dB	0.01%	>83 dB	L+R L–R L,R	0-150%	●	●															2.5 V fixed	100 1 K 6 K 10 K	●	●			Discontinued
LEADER LSG-231						100 MHz Fixed				●	>50 dB	<.5%	not listed	L–R L+R L,R	0-100% coarse																	1 KHz	●	●			$545
LEADER 3216	●	●				100 kHz - 140 MHz	●	○			>55 dB	<.05%	>73 dB	L+R L–R L,R	0-99 KHz	●	○		●		100 kHz - 140 MHz	●	○			<0.5%	>55 dB	mono	●			400 Hz 1 KHz	●	○	○		$2,995
LEADER LSG-245	●	●																			200-1800 KHz	●			>35 dB	<1% L–R	>65 dB	L+R L–R L,R	●	●		400 Hz 1 KHz	●		○		$3,495
Panasonic VP-8725	●	●																			200 kHz - 2000 KHz	●			>36 dB	<1%	>65 dB	L+R L–R L,R	●	●		400 Hz 1 KHz	●		●		$4,380

***NOTE**: All information is taken from manufacturers' published specifications. No claim is made to their accuracy. Specifications subject to change by individual manufacturer.*

○ option not included in total price



Increase Service Profits With Your PA81 Stereo Power Amplifier Analyzer™

by Larry Schnabel, Marketing Communications Writer

- **The PA81 Is 100% Portable—Use It In The Shop Or In The Field**
- **Built-in Speakers Build Confidence And Help Troubleshooting Efficiency**
- **Several Integrated Tests Help The PA81 Narrow Down Problems**

That's Where The PA81 Is At Its Best—When You Need Several Different Tests To Narrow The Problem Down

For the past several issues of the Sencore News, we've been telling you what a valuable troubleshooting asset the PA81 Stereo Power Amplifier Analyzer is to any service shop. We've told you how it replaces several pieces of test equipment and how it can save you a lot of time and money.

But it's also nice to have a customer tell his side of the story. Having another servicer share his experiences and applications with a piece of test equipment can be very helpful and informative.

Lamar Robison owns and operates L & V Computers out of Royse City, Texas. Lamar specializes in selling and servicing computers and accessories, although he does service other electronic equipment on occasion (including professional audio and video equipment).

Fig. 1: The PA81 Stereo Power Amplifier Analyzer is securely packed with foam inserts so it won't be damaged during shipment.

Lamar received a PA81 Stereo Power Amplifier Analyzer on a 10 day evaluation in August of '89. The PA81 performed so well for him in the first 10 days, he decided to keep it. Lamar tells us the PA81 is now an essential part of his service bench, and he doesn't know how he got along without it. We've been in touch with Lamar several times following up on his progress with the PA81. From the time he took the PA81 out of the box, he's been finding more uses for it every day.

Lamar said he was flooded with business when his PA81 arrived at his door. He said, "For two days I reluctantly let the box sit on the floor with the package that contained the battery for portable use."

Finally, Lamar couldn't stand the anticipation any longer. After work one night, he sat down and opened up the box with his PA81. He said he removed only the papers and operation manual and took it along with him to his house. Lamar said, "Many business owners will understand what I did next. I read through the manual during Carson and M*A*S*H*. That was about the only chance I had!"

The next day, the PA81 Stereo Power Amplifier Analyzer came out of the box. He commented that the packaging was sturdy and there was no way the mail carriers could possibly damage any unit packed in the center of all that padding (Figure 1).

As Lamar removed the PA81 from its shipping box, he noticed how attractive the PA81 looked to him. "Now don't get me wrong," Lamar said, "Just

Fig. 2: You can easily keep track of each stereo channel with the clearly marked supplied cables of the PA81.

because I say that a unit is good looking doesn't mean I go out and buy the prettiest box I see. I attended two Sencore seminars that demonstrated the PA81 in several different applications. I saw how the PA81 could help my business, so I decided right then and there that I had to at least try it for myself."

After unpacking the PA81, Lamar took out the leads and cables that are supplied with the unit. Lamar commented, "The leads were great. I was really impressed with the left and right indicators on the cables. Now, I can keep track of what lead goes where." (Figure 2.)

Lamar had seen and heard all the cost justifications for the PA81, but he was still skeptical. Once Lamar put his PA81 to use, however, his doubts were quickly answered. He soon found himself taking the PA81 along on every service call that involved any kind of audio work at all. He found that having so much capability in one box saved him a lot of time.

Since L & V Computers does so much professional repair work, many of the devices Lamar repairs are rather expensive. Lamar puts it, "When a customer calls me for any kind of audio service on a $7000 piece of equipment, they want it fixed *now*!" Lamar says he takes his PA81 on virtually every service call now, since it does so much in one integrated unit.

Fig. 3: The portable PA81 is ready to go with you on any service call to help you monitor signals or track problems down.

The PA81 Stereo Power Amplifier Analyzer is the first and only audio analyzer that is 100% portable. You can operate the PA81 from the AC line for bench use, or you can use it for five hours or more on one battery charge. The battery life of the PA81 is safeguarded by an Auto-Off circuit that automatically turns off the PA81 in case you forget.

Lamar told us he always uses the PA81 under battery power rather than AC power. He does charge the rechargeable lead-acid batteries overnight, but during work hours the PA81 is always ready for portable use. He told us, "I've yet to run the batteries down, and I use it all day sometimes. I'm always on the go and the PA81 is always ready to go with me."

Lamar occasionally works on audio systems such as intercoms at various businesses. He said, "When you're working on an intercom or speaker at a business, you just can't turn up the volume of the system full blast. The same goes with my shop. Whether anybody else is around or even if I'm working alone, I don't like to turn the volume up so loud. The PA81 lets me turn the volume up as loud as I want without hurting my ears or annoying anyone else."

The PA81 internal speakers are high-quality and autoranged to increase your troubleshooting confidence and efficiency. You have the option of leaving the speakers at full volume or switching them to the autoranged position for hands-off operation. Each channel (L and R) has its own volume control so you can listen to one or both channels depending on your application.

Lamar also told us how he uses the PA81's speakers instead of using speakers meant for some other use. "Why should I yank the speakers off my stereo to run tests on some other repair job? The PA81 has the two speakers built-in, ready to use. I just hook them up and turn up the volume."

Analog meters were a big selling point of the PA81 to Lamar. He has worked on audio for many years and says, "If you've ever tried to align or balance an audio system with digital readouts, you know how frustrating it can be. First you have to try and read numbers jumping around all the time, and then you've got the decimals moving back and forth to confuse you even more." (See Figure 4.)

"The PA81's analog meters are a whole different ball game. I can make adjustments without having to think so hard about what I'm doing. Now I can watch both meters at the same time, too, since there's one for each channel."

The PA81 uses the more expensive, frequency compensated dual analog wattmeters. The analog meters let you make stereo adjustments or set up controls while you monitor one or both meters for levels or balance. The metered display lets you see any sudden or gradual change in level and lets you monitor both channels at once for tracking and linearity.

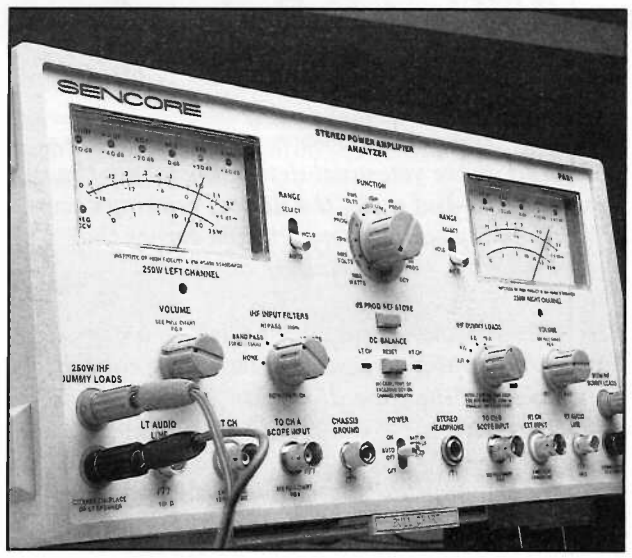


Fig. 4: Analog meter displays let you monitor audio levels or balance without the frustration of bouncing digital displays.

When we asked Lamar what his favorite feature of the PA81 was, he said the PA81 had too many time-saving features to narrow them to one. He told us that the major advantage of using the PA81 was the overall time-savings that it gave him. The fact that the PA81 did so much in one box, and that it was portable, saved him the time of carrying around a lot of test equipment that wouldn't help fix the problem anyway.

"The PA81 saves me a lot of time repairing modern audio equipment," Lamar told us. "Since most audio equipment has almost every circuit on one board, you have to troubleshoot the problem down to the single component. That's where the PA81 is at its best — when you need several different tests to narrow the problem down. The PA81 lets me do all that with one box!" (See Figure 5.)

"Many technicians were spoiled throughout the years by swapping modules or boards to fix the problem," Lamar went on. "The day of shotgunning parts or entire boards is gone. I'm glad I've got the PA81 now. I can trace the problem down to the component without tying up a lot of test gear in the process."

Another Satisfied Customer

The fact that Lamar made the effort to tell us how impressed he is with his PA81 says a lot about how valuable it really is as a troubleshooting tool. The PA81 Stereo Power Amplifier Analyzer gives you a battery operated, integrated system to reduce analyzing time, eliminate costly callbacks, and prove to your customers that their system or audio component is serviced right.

If you have a success story you'd like to share with us, we'd like to hear from you. If this first-hand experience has interested you, or if you'd like to try a PA81 of your own on your bench, call **1-800-SENCORE** and talk to your Area Sales Representative. He'll listen to your needs and recommend the best test equipment for your applications.

***NOTE**: Lamar also owns a Sencore LC102 AUTO-Z he specifically bought to service computer power supplies. See the Tech Talk box on page 21 and see how the AUTO-Z will help repair your computer power supplies.*

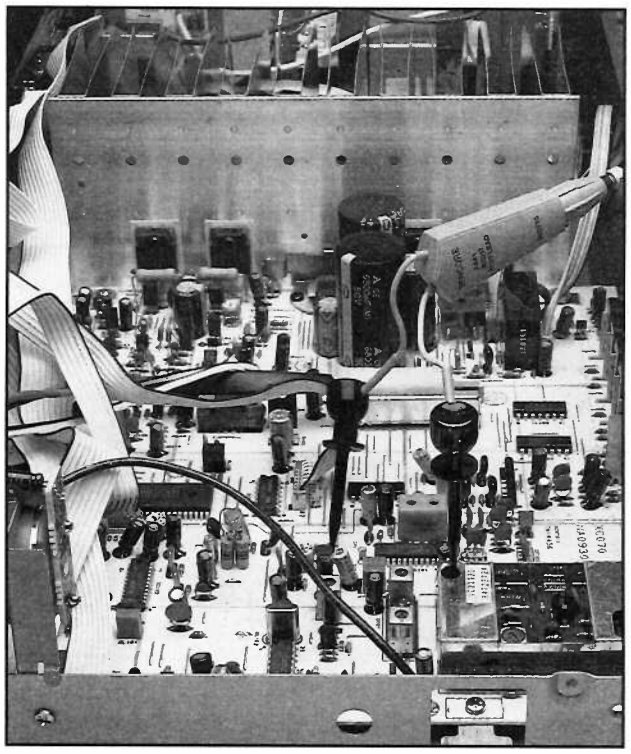
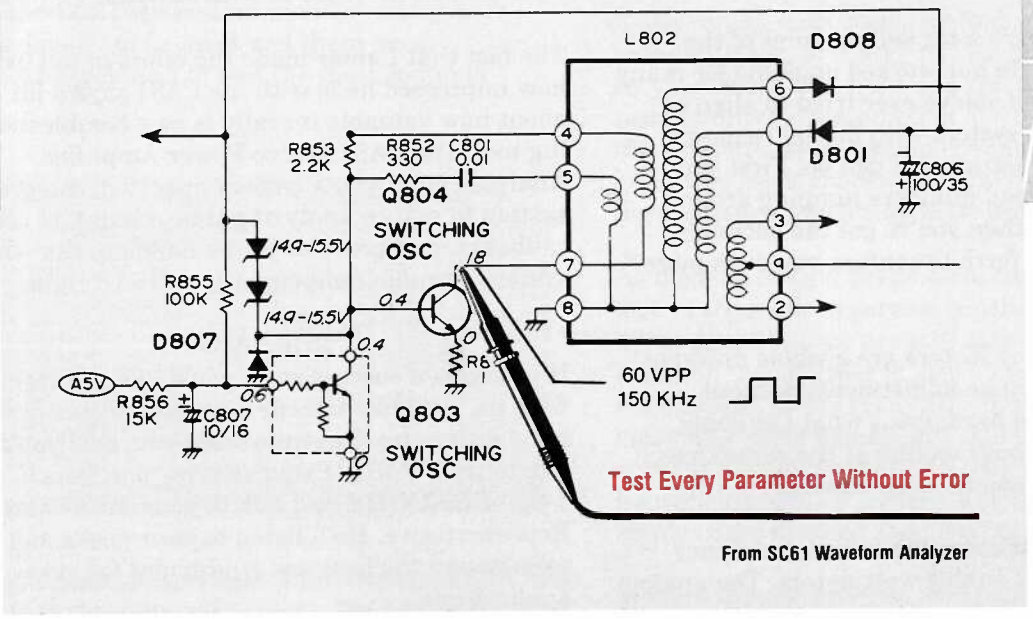


Fig. 5: The PA81 helps you trace audio problems down to the component so you can avoid swapping boards or shotgunning parts.

Call **1-800-SENCORE** and ask your Area Sales Engineer how you can receive a copy of our new Video Tech Tape, "The Missing Link In Audio Service" , or your own copy of "Taking The Mystery Out Of Audio", a book written by Sencore's Applications Engineers. ❐

Call For A 10 Day Video Preview



How The SC61 Waveform Analyzer™ Compares To Scopes With Digital Readouts

by Greg Carey, CET

- **Tests DCV, PPV, And Frequency, Whether Or Not You Have A Waveform Displayed**
- **The Easiest To Use Waveform Display, With Rock-Solid Sync To 100 MHz**
- **Delta Digital Tests, Faster And More Accurate Than Cursor-Based Testing**
- **Maximum Protection From Overloads; Test To 3000 VPP**

If You Plan To Purchase A Scope, Try The SC61 For 30 Days — Prove To Yourself That It Outperforms All Others

Since Sencore introduced the SC61 Waveform Analyzer, many scopes with digital readouts have come on the scene. It might seem these digital readout scopes do pretty much the same thing as the SC61, but side-by-side comparisons show major differences. These differences affect your work in major ways.

The best way to decide which helps you the most is to use the SC61 along with a competitive unit to test signals in your own circuits during Sencore's 30-day money-back guarantee period. Make your tests with your future time in mind. Your decision will affect you every time you make a measurement for years to come. Isn't it worth a little testing time now?

The SC61 Is Different Than A Digital Readout Scope

Why is the SC61 different than digital readout scopes? Because Sencore designers understand how you make measurements in your daily testing. We know you don't need waveshape every time you make a test. It's often more important to know the DC, peak-to-peak, or frequency of the signal.

If you don't want waveshape, why should your test equipment force you to lock in the CRT display every time you want a parameter? Others do because they base their digital readings on the displayed CRT waveform. Look at what you have to do with other units:

Others: CRT Based Cursors (Figure 1) — *Most digital readout scopes use CRT-based cursors to make every reading. Most cursors are manually operated. You adjust one cursor to the top and a second cursor to the bottom of the waveform for every test of signal amplitude. Manually controlled cursor measurements are slow. And, since you must determine where the signal begins and ends, the digital readings are affected by the same interpretation errors that plague manual calculations.*

Because cursors depend on the CRT, you are forced to keep the vertical vernier in the calibrated position all of the time. If not, an error message appears.

Worst of all, manually positioned cursors don't follow changes in signal amplitude (Figure 2). Their digital reading shows the same peak-to-peak reading if the signal changes in amplitude or disappears altogether.

Sencore: Autotracking™ Peak-to-Peak — To test peak-to-peak with the SC61, just connect either test probe to the circuit and press the "PPV" button. The digital readings are accurate if the CRT displays the waveform, but are just as accurate if the waveform is not displayed. The verniers may be left uncalibrated without affecting accuracy. In fact, it's even accurate if the trigger circuits are misadjusted, and the signal is free-running.

Others: Not All Measure DCV — *Not all competitive scopes can measure DC voltages. If they can, you often must use cursors again. You position one cursor to the "ground" reference point, and then move the other to the average signal level. Since the average level depends on the waveshape, you must decide where to set the cursor.*

DC measurements also require you to set the input coupling to the "DC" position. If not, the DC reading will be in error. Plus, the vernier must be calibrated.

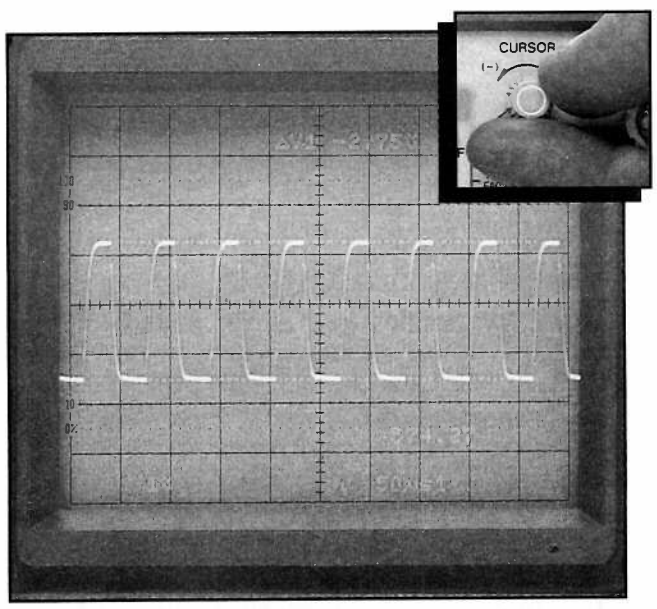


Fig. 1: Cursor-based digital readings force you to lock a waveform and manually determine the signal limits.

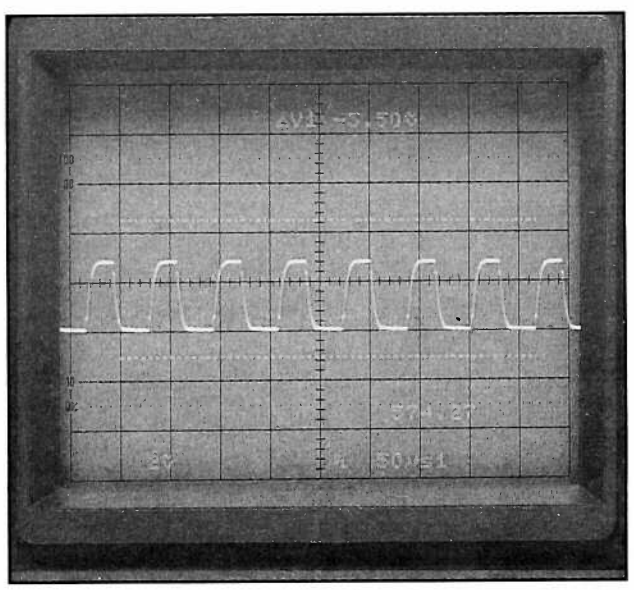


Fig. 2: Manual cursors don't follow the signal, so the reading remains the same if the signal changes amplitude—or disappears altogether.

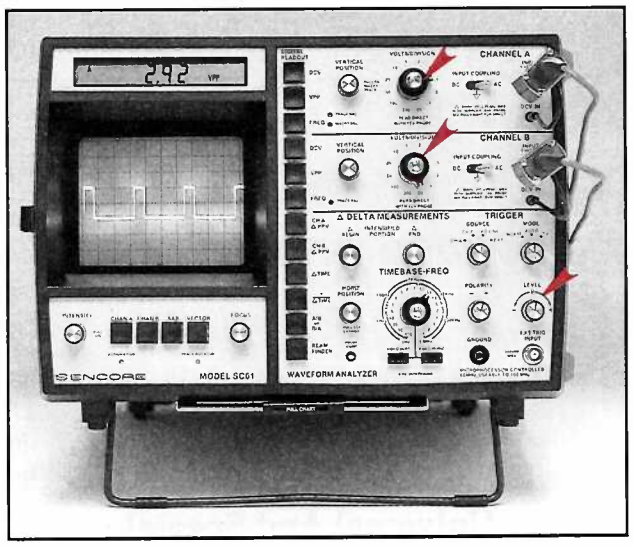


Fig. 3: Only the SC61 gives accurate peak-to-peak readings if the vertical vernier is uncalibrated or if the triggering circuits are out of lock.

Sencore: Autotracking DCV — By comparison, the SC61 provides two DC channels. It doesn't matter whether you have the signal displayed, the sweep circuits in sync, the verniers calibrated, or whether you have the input coupling switch in the "DC" position. The autoranged, Autotracking DC test tracks along with the signal, automatically and error-free (Figure 3).

Others: Delta Time and Frequency — *Most digital readout scopes do have a Delta Time function, so it would seem they are the same as the SC61. But this is far from true. All others base time readings on the calibration of the CRT's horizontal circuits. Once again, you must keep the horizontal vernier calibrated or get a reading error (Figure 4).*

Sencore: Delta Time And Frequency — The SC61 Delta Time readings are crystal-referenced, whether you have the vernier in or out of the calibrated position. The same thing is true of Delta Frequency.

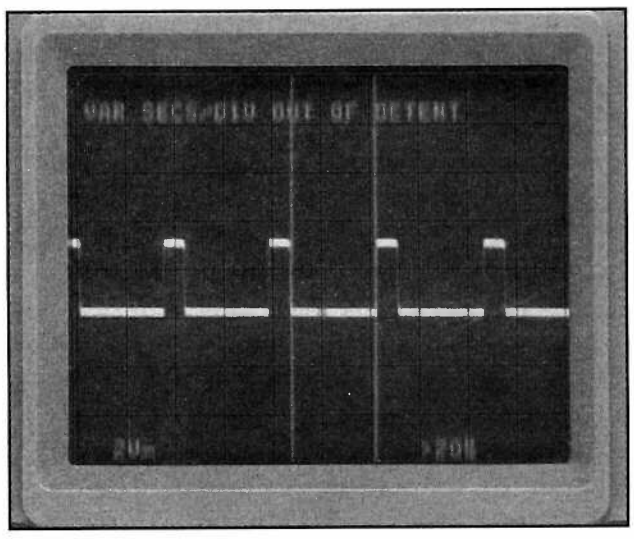


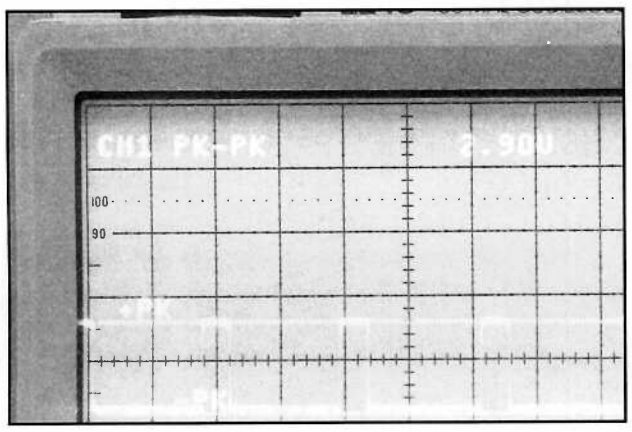
Fig. 4: Competitive scopes give errors when the horizontal or vertical vernier controls are "uncalibrated."

Others: Delta Time And Frequency — *Many digital-readout scopes have a "one-over-delta-time" function similar to the SC61's. This only works when the horizontal vernier is calibrated. But, there's an even bigger problem.*

The others do not have a separate frequency function for the times you need more accuracy. Since every frequency test is based on a manually set time measurement, the accuracy is limited by how closely you can estimate the starting and stopping point of one complete cycle of the signal.

Sencore: Delta Time And Frequency — The SC61 gives you both frequency tests. Press a button and the SC61 calculates frequency from the Delta test. When you need more accuracy, press the Autotracking frequency button for Channel A or B. The SC61 automatically displays the frequency with up to 6 digits of resolution. It is accurate to 0.001%, compared to 1% to 5% for a delta test. It's 100% autoranged and error-free.

Others: On-Screen Digital Readings — *Finally, let's compare the readouts. Most digital readout scopes print the digital readings on the CRT, using the same electron beam that draws the waveform. This method often causes flicker or holes to appear in the scope waveform, during the time the electron beam draws the digital readings. Figure 5 shows the biggest problem with on-screen displays; their size. The actual-size photographs compare an on-screen display with the large, easy-to-read SC61 display.*



Display shown actual size

Fig. 5: The SC61 digital readings are more than three times larger than on-screen displays, making them easier to read.

Sencore: LCD Readout — The SC61's digits are more than three times larger than the on-screen displays. You can see how much easier the SC61 display is to read, even if you are viewing it from some distance. But there's even more to the story.

Others: Hard To Operate — *Most scopes scatter the readings all over the CRT. Channel A readings are in one place. Channel B readings are in another place. A different area tells you where you've set your vertical attenuator for channel A and B. Another display tells you where you've set your horizontal sweep speed. Another might tell you about delayed sweep, while another might tell you something about the trigger circuits.*

Pretty soon, the CRT gets so full of numbers that you have trouble remembering where the reading you want should be located.

To make matters worse, some of the readings are on the screen part of the time, and gone at others. Just when you thought you knew what to expect, you find yourself pushing buttons to bring back the reading you want (Figure 6).

For more complication, many pushbuttons have 3, 4, or 5 completely different uses, depending on which menu or sub-menu, or sub-sub-menu you have selected. Backing out of these menus often takes several extra button pushes, to change functions.

When you are using these units to troubleshoot, these operations take your mind off your circuit. You have to stop and hunt for the function, and then hunt again for where the reading is located on the screen. When you move your probe, the process starts all over again.

Sencore: Designed With Your Time In Mind — The SC61 gives you each reading you want, when you want it. You look at the same spot every time. You press the one button that defines the test (and that button has only one function), and then look at the single direct-reading, liquid-crystal display.You keep your mind on the circuit you are testing.

The SC61 does all of the calculating for you. The SC61 lets you spend your time troubleshooting your circuit, not your test equipment.

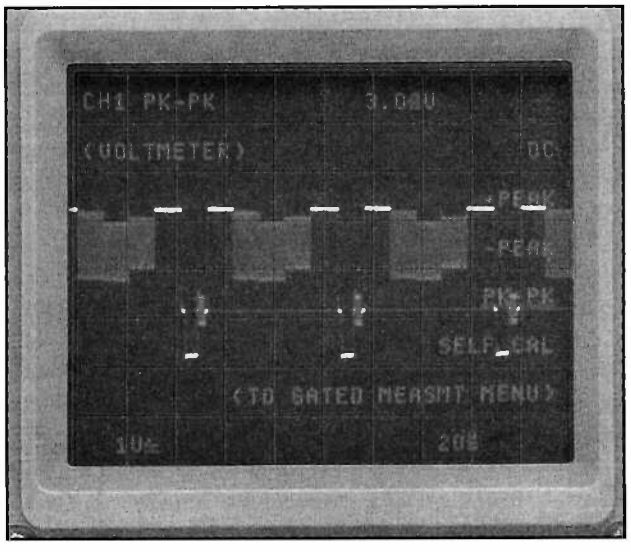
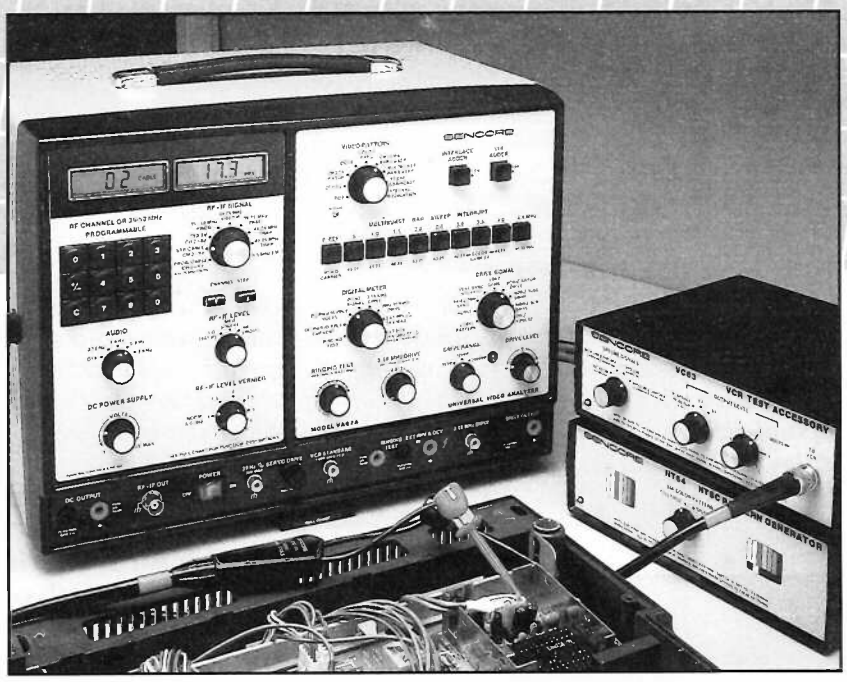


Fig. 6: Multiple readings can be complicated, and some readings disappear for certain setups, making even more confusion—they take your mind off your circuit.

Its Autotracking tests are accurate, whether or not you have a waveform on the CRT. Its CRT is usable to 100 MHz and 3000 volts, and is easier to use than any other. Its Delta tests are accurate, whether or not you have the CRT verniers calibrated.

What's the bottom line to all of 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.

All of these points are dynamically demonstrated in a Sencore Tech Tape™ video program. For a free 10-day viewing, ask for tape number VT874 on the enclosed response card. Or, call Toll Free **1-800-SENCORE.** ❐



Servicing VCRs With Your VA62A Universal Video Analyzer™

by Cherlan Coffman, Editor

- **Your VA62A Provides Universal And Special Substitute Signals For VCR Functional Analyzing**
- **Substitute The VA62A's VCR Standard Signal To Analyze Record Circuits**
- **Make Your Own VCR Test Tapes Using Your VA62A's Video Patterns**
- **Even Isolate Bad IC's By Signal Substitution At Inputs And Outputs**

The Opportunity And The Profit Is There . . . Once You Understand How VCRs Function And Learn To Use Your VA62A's Substitute Signals, You're On Your Way To Success

Adding VCR service is a natural way to expand your TV business, especially since many of the signals are familiar. Fortunately, most of the troublesome VCR circuits have been replaced by integrated circuits, giving consumers a better product while opening the door of opportunity for servicers who use the VA62A Universal Video Analyzer.

The IC has allowed engineers to *add* features and functions and protection circuits and capabilities that would never fit in a conventional VCR chassis. So much circuitry is "needed" in today's VCR, that the circuit boards are overcrowded with parts. You've got more circuits to trace, transistors to test, resistors to measure, and capacitors to analyze than ever before. The opportunity (and the profit) is there for the taking. So, how can you expand into VCR service . . . successfully?

First, you need to understand how VCRs function so you can relate the symptom to the problem area. Second, you need a way to isolate the problem down to the non-functioning stage or IC. Third, since you can't analyze the signals *inside an IC,* you need a proven method of analyzing the signals on the outside. The only sure way is for *you* to provide the signals needed to make the IC function. A known good signal injected at the *output* of an IC can prove whether a good IC would restore normal operation. Likewise, a known good signal injected at the *input* of that IC can prove the IC good or bad. But, where can you find these signals?

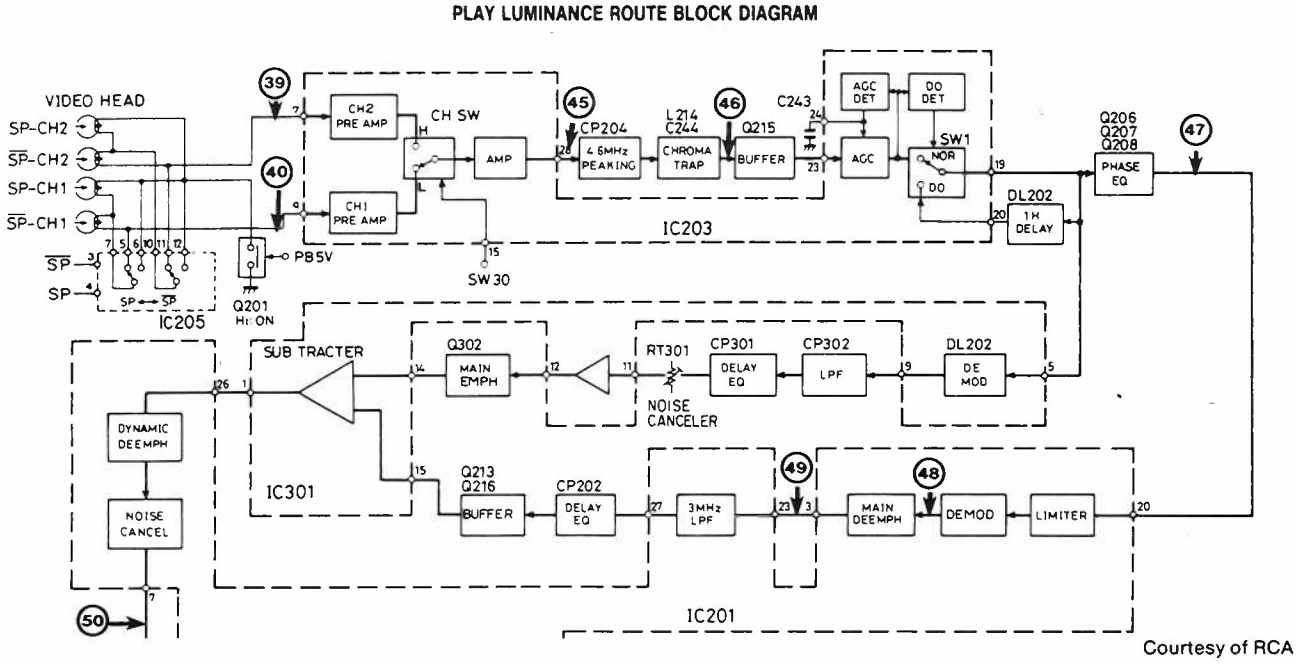
Your VA62A and its accessories provides the universal and special substitute signals you need for VCR functional analyzing. Once you understand how VCRs function and learn how to use your VA62A's substitute signals, you're on your way to success. Your first step, however, is to make a couple of "work" tapes. Let's start with the tapes.

Off the air and pre-recorded video tapes can't give you the necessary stable signals—and manufacturer's test tapes are too expensive to use for troubleshooting. By making your own "work" tapes, you can preserve your manufacturers tapes for fine alignments and compatibility testing.

Make your own "work" test tapes using your VA62A's one volt peak-to-peak video signal. You'll need the peak-white picture this signal provides to test VCR record circuits—plus it provides the white reference needed during playback. Follow the directions in your VA62A manual to make your work tapes, or call **1-800-SENCORE** and ask for Tech Tip #107. Your Area Sales Engineer will be glad to clear up any questions you have on making these important tapes. You'll get plenty of value out of using these work tapes, but for now, let's concentrate on how your VA62A helps you solve VCR troubles.

Understanding The VA62A Features

VA62A VCR service features fall into two groups. Features which are *universal to all VCRs* are built into the *main analyzer.* Features which



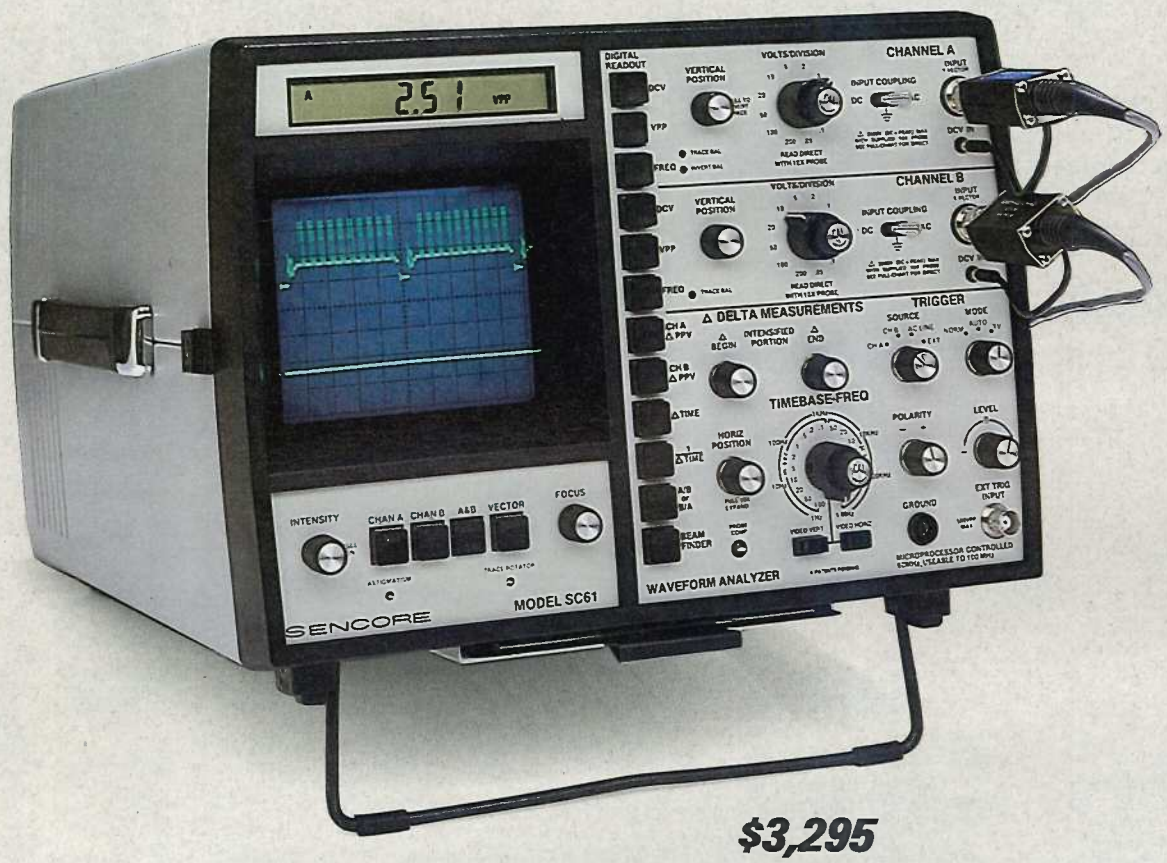
Courtesy of RCA

Fig. 1: You can use your Sencore block diagram to locate corresponding test points on any manufacturers' block diagram—as is shown above on the RCA VLPG25HF block diagram.

All New Buyer's Guide

SC61 Waveform Analyzer™

60 MHz (usable to 100 MHz) Dual Trace Waveform Analyzer



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Analyze Waveforms Easily:

- Accurate Waveform Display
- Rock-Solid Sync For Fiddle-Free Operation
- Four Times The Measuring Range (to 3000V)
- Human Engineered For Ease Of Use

AUTOTRACKING™ Digital Readings Analyzes The Whole Signal:

- Autoranging DC Volts Through Single Probe
- Automatic Peak-To-Peak Volts
- Automatic Frequency Measurements

Delta Digital Tests Analyze Any Part Of The Signal:

- Delta Peak-To-Peak Volts Of Any Part Of The Signal
- Delta Time For Any Time Reading
- 1/Delta Time—Frequency Of Any Part Of The Signal

Frequency Ratio Test For Multiply And Divide Circuits

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Analyze Any Waveform to 100 MHz, 10 Times Faster, 10 Times More Accurate, Absolutely Error Free . . . Or Your Money Back

A Real Troubleshooting Confidence Builder. There are other digital readout oscilloscopes, but none completely eliminates graticule counting and calculations like the SC61 Waveform Analyzer. The SC61 gives you high performance, dual trace capability with 60 MHz bandwidth (usable to 100MHz). The innovative, time saving auto-tracking digital readout automatically gives you every waveform parameter you need for fast troubleshooting.

Fiddle-Free Operation. Spend your valuable time troubleshooting rather than fiddling with trigger controls. Innovative ECL (Emitter Coupled Logic) sync circuits allow you to quickly lock onto any waveform, and keep it locked.

Handle Four Times The Signal Level Compared To Any Scope. Safely and without worry measure from a small 5 mV all the way up to 2000 Volts Peak-To-Peak or DC, with protection to 3000 volts. No need to worry about expensive repair bills caused by excessive high voltage.

Human Engineered For Ease Of Use. Most scopes waste valuable time with complex set up procedures and interpretation errors. The SC61's innovative design allows you to quickly lock onto a waveform, and read DC volts, Peak-To-Peak volts, and frequency simply with the push of a button.

Call For A 10 Day Video Preview.

AUTOTRACKING™ Digital Accuracy. You can completely analyze any waveform up to 100 MHz 10 times more accurately than conventional oscilloscopes. The AUTOTRACKING™ digital display instantly gives you DC volts, Peak-to-Peak volts, , and frequency to accurately analyze any waveform parameter.

Innovative Delta Functions. Isolate interfering ripple on power supply lines, or analyze the frequency of a glitch on the leading edge of a squarewave with the exclusive Delta features. Measure Peak-To-Peak voltage, time, and frequency of just a portion of the waveform to quickly isolate problem areas.

Automatic Frequency Ratio Test. Just connect one probe to the input and the other to the output of multiply or divide stages, push the ratio button, and instantly read the ratio between the two frequencies.

Plus Many Extra High Performance Features• Dual delayed signal trace so you see the leading edge of the waveform on both channels. • Add, subtract or view both channels separately. • Post deflection, high intensity, blue phosphor 8 × 10 cm CRT provides (easy-to-view) trace, even under high ambient lighting conditions. • IEEE 488 Bus Compatible • Push button X-Y vector display with 4 MHz response for accurate phase comparisons. • Z-Axis input. • Beam finder. • TV VERTICAL and TV HORIZONTAL video preset positions with sync separators.

The SC61 Waveform Analyzer is a technological breakthrough. It's as simple as pushing a button and reading the value—without guesswork or errors. Call **1-800-SENCORE** for more information, or send for a ''10 Day Video Preview'' on the SC61.

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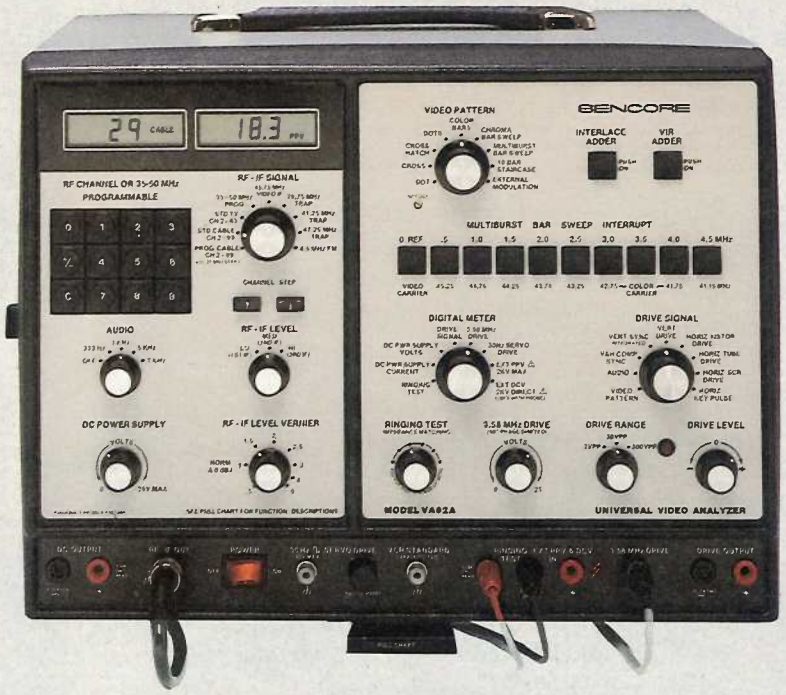
VA62A Universal Video Analyzer™



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- Pinpoint IF troubles with modulated troubleshooting signal and exclusive programmable IF/RF generators.
- Isolate any problem with patented video and standard color-bar patterns.
- Find defective stages, without disconnecting parts, using exclusive phase-locked drive signals.
- Test yokes and flybacks, plus measure signal levels with autoranged digital meter.
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The Only NTSC Video Servicing System Guaranteed To Cut Your Servicing Time By 54% Or Your Money Back.*

The VA62A Universal Video Analyzer equips you for successful servicing in the expanding video market. It ends expensive parts substitution and eliminates embarrassing call-backs.

Eliminate Aggravating Tuner Questions. Tests for every VHF, UHF and cable channel to confirm the tuner is working correctly. Also lets you duplicate any cable carrier shift.

Dynamically Isolates IF Troubles. Patented signals let you set IF traps—a must for cable—by simply looking at the CRT. Plus, the VA62A lets you do full IF alignments without confusing cables or complicated adjustments.

Improved phase-locked video patterns simplify troubleshooting and alignment in convergence, color, and luminance stages:

- **Patented Multiburst Bar Sweep.** Shows video smear, reduced resolution, harsh picture edges, and ghosting, right on the CRT.
- **Ten Bar Staircase.** Isolates brightness and contrast problems; helps you align synchronous detectors.
- **Convergence patterns.** Quickly identifies the electrical center to save time when working on vertical troubles.
- **Improved Color Bars.** Phase-locked chroma and sync signals test comb filters dynamically. Precise color-burst frequency, amplitude and color saturation give better results in VCR service.
- **Patented chroma bar sweep.** Identifies color bandwidth restrictions, duplicates the NTSC pattern's cyan bar for correct VCR testing. Pure white edges reference VHS AGC circuits.
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Digital Meter. Monitor true peak-to-peak level of signal (peak-to-peak and DC) to a full 2 kV.

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Accessory Jack. Prevents obsolescence; lets you add new technology as you need it.

The VA62A Universal Video Analyzer lets you isolate video troubles in half the time. Call **1-800-SENCORE** for more information, or send for a "10 Day Video Preview" on the VA62A.

VC63 VCR Test Accessory™

The VC63 Solves The VCR Service Challenge With Substitute VCR Signals, Phase-locked To Your VA62A

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Updates Your VA48 or VA62A Video Analyzer To Expand Into Analog/Digital Monitor Service

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- Exclusive Phase-locked Generator Locks The ST65 To Your VA48 Or VA62A For Rock-Solid Analyzing
- E-Z HOOK™ Leads For Fast Hookup To Separate R,G,B,I Inputs

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- Variable Isolated 470 Watt Power Transformer To Isolate Your AC Line And Vary Your Output Voltage From 0 To 140 Volts
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- AC Line Leakage Safety Tester To Assure That Excessive Leakage Current Is Not Present On Any Exposed Part On The Equipment Being Tested

Avoid Embarrassment And Risk—Know Beyond Doubt That Your AC Power (And The Equipment You Service) Is Right And Safe. The PR57 "POWERITE" is an integrated supply that lets you know your AC power is right and safe. It includes a variable isolated 470 Watt power transformer to isolate your AC line and vary the output voltage from 0 to 150 volts. Monitors voltage, current, and wattage to determine that the equipment under test is not drawing excessive current at any voltage setting.

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- It's A Complete Portable, Battery Operated MTS Stereo TV And VCR Analyzer
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- Quickly Eliminates The RF/IF Section As A Source Of Trouble—Test From The Antenna To The Speakers/CRT With One Simple Connection

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Dynamically Analyze Stereo Power Amplifiers Anywhere, In Less Than 1/2 The Time You Now Take, With Superior Accuracy And Reduced Measurement Errors, To An Unbelievable 5000 Watts And To IHF/EIA Specifications*

End Confusion In Audio Amplifier Analyzing. Measure audio signals from milliwatts to the highest kilowatt power found in amplifier systems. Dual meters assure accuracy in RMS, dB or watts, at all levels, so you can follow any schematic or service procedure.

Assures Stereo Power Amplifier Balancing. Sensitive meters let you trace, balance, and compare the signals and bias of each stage with its opposite, to speed troubleshooting in direct coupled stages. Analyze push-pull amplifiers dynamically at all power levels to isolate defective stages and compensation networks that affect tracking and output quality.

Analyze Separation At Every Stage. Measures the small audio signals from CDs, turntables, tape decks, microphones or AM/FM stereo systems, at their correct impedances. Tracks alignment and automatically shows separation to over 100 dB at all power levels, to confirm that troubleshooting is necessary.

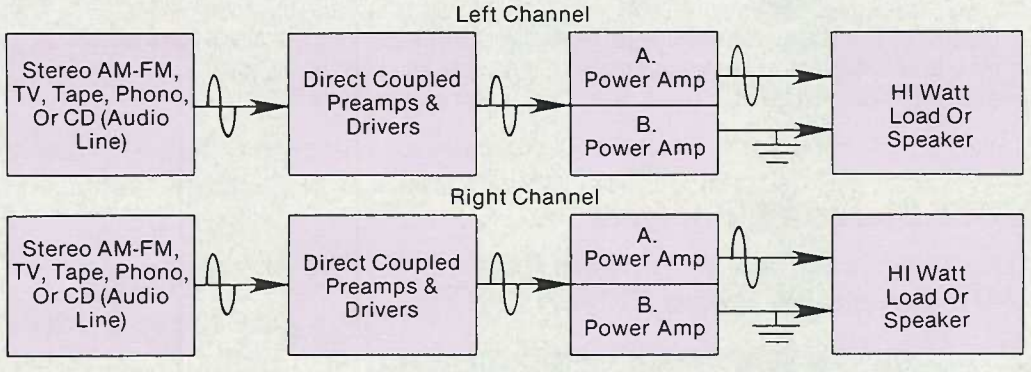
Guaranteed Accurate Measurements. Includes Institute of High Fidelity (IHF) and Electronic Industries Association (EIA) dummy loads to substitute for the speakers—avoids annoying audio and gives accurate, standard measurements. Custom made zero reactance, high wattage dummy loads test both channels in any system at the correct impedance. Built-in IHF/EIA audio filters block out hum and eliminate such frequencies as the 19 kHz pilot and CD clock signals; avoids time-consuming connections and measurement errors.

* From 500 Watts (250 Watts/Channel) to 5000 Watts (2500 Watts/Channel) with optional accessory.

Find Costly, Time-Consuming Intermittents. Monitors power amplifiers for DC balance continuously during tests, burn in, or troubleshooting—immediately disconnects the loads and indicates which channel failed. Prevents excessive currents and costly destroyed components.

Monitor Sound Quality At All Power Levels. Automatically adjusts scope outputs, earphones, and internal speakers—no more fiddling with scope levels or blasting out shop speakers as the power is "cranked-up".

Analyze All Audio Power Amplifier Systems Anywhere. Gives you one, approved, battery-operated, integrated system to reduce analyzing time, eliminate costly call-backs, and prove to your customers that their system or audio component is serviced right.



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

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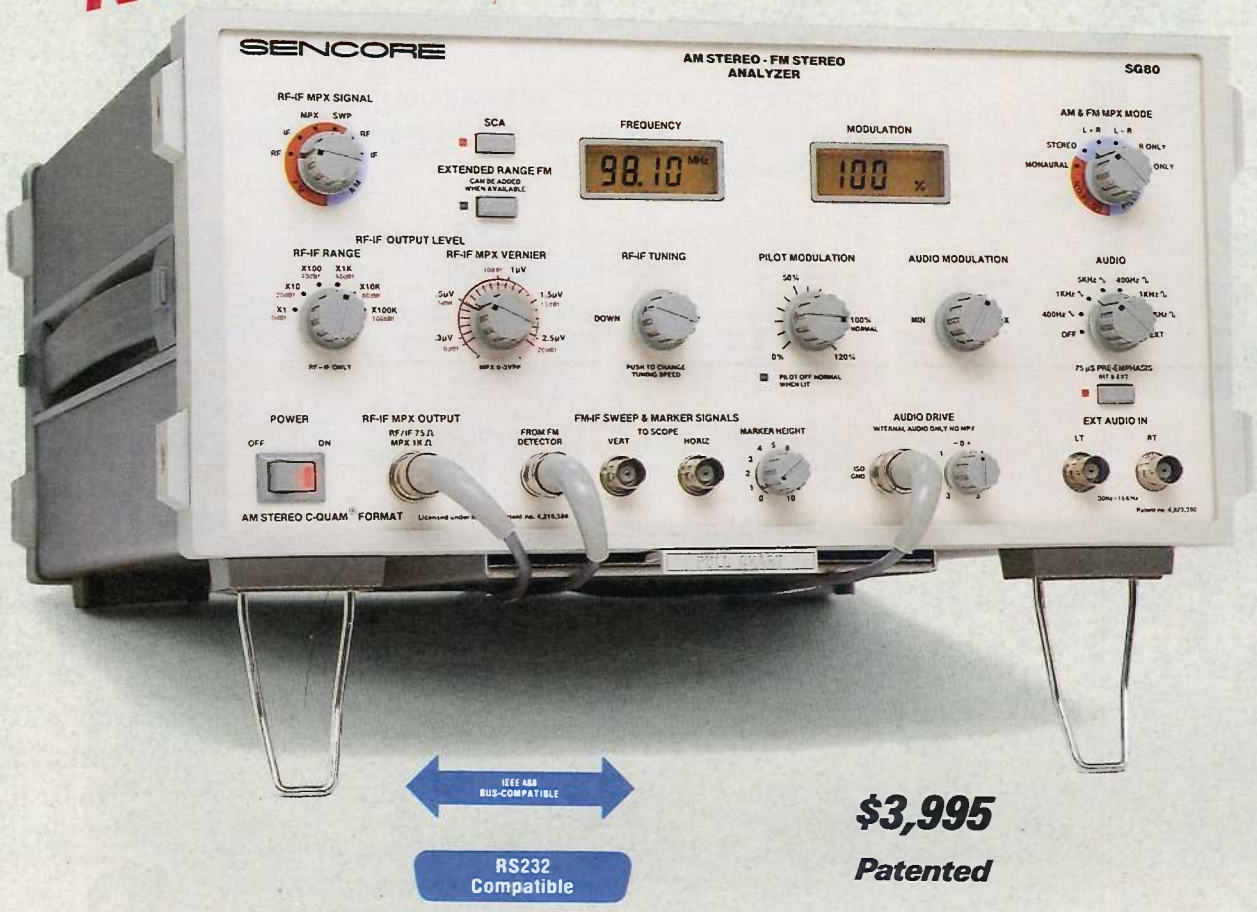

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- Twice The Capability For Less Than 1/2 The Cost Of Stand-Alone Test Instruments

Now For The First Time, A High-Performance AM Stereo (C-QUAM)-FM Stereo Analyzer, Integrated Into One Unit, Allowing You To Performance Test, Troubleshoot, And Align To Manufacturers' Requirements

You'll never turn away stereo service work again, or be embarassed because you aren't equipped to handle the new AM stereo receivers; no more wasted time fiddling with generators that drift, or guessing at sensitivity, selectivity or separation. No more hassle with multiple instrument setups and tangled cables to perform alignments or make performance tests. Your new SG80 AM Stereo—FM Stereo Analyzer eliminates these problems, plus cuts your service time on every receiver repair, from the earliest mono model to the newest hi-tech stereo.

The SG80 AM Stereo-FM Stereo Analyzer meets or exceeds manufacturers' requirements for every testing and servicing need. You get every substitute signal needed to completely performance test (to the tightest industry specs) or quickly service the entire AM Stereo-FM Stereo receiver.

Patented FM analyzing signals allow you to quickly divide and conquer any FM receiver defect. Conventional generators lack the accuracy, stability, and purity to meet the service demands of today's receivers. Only by developing an entirely new patented method were we able to generate the signals necessary to quickly prove modern receiver stages good or bad to the most demanding specifications. Use the SG80's substitute signals to isolate any RF, IF, or stereo decoder defect.

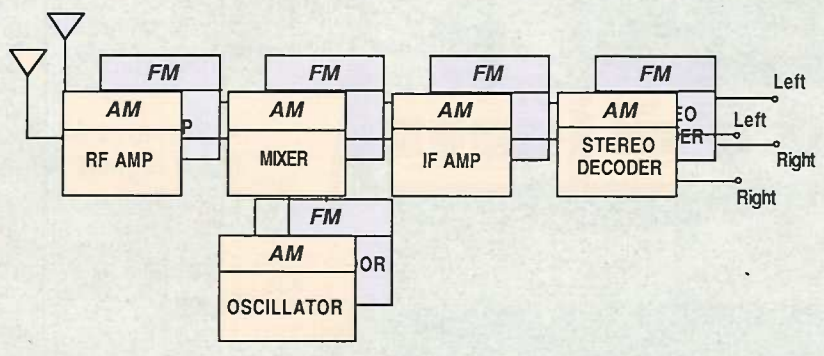
Exclusive AM Stereo C-QUAM analyzer, for the first time totally integrated into one complete unit. The SG80 incorporates AM Stereo servicing capabilities with all the signals and specifications needed for complete testing, aligning, and troubleshooting of the new AM Stereo receivers.

Digital accuracy for complete performance testing of receiver specifications to manufacturer and EIA/IHF requirements. Digital accuracy reduces errors and speeds servicing; full capability, and precision control give you 100% confidence on every repair.

Exclusive, tunable FM-IF Sweep and Markers allow you to positively match and align all IF stages, including ceramic filters. In just minutes, you can confidently analyze and align FM-IF stages for the proper bandwidth and shape, plus prove that you are using the correct replacement ceramic filters—solves "tough dog" IF troubles fast.

Expandable FM features for future service needs, plus SCA compatible. The SG80 provides a modulated SCA signal (internally adjustable—factory set at 67 kHz), for complete performance testing and adjustment of FM receiver SCA traps. Plus, you can expand your SG80 to service the new extended range FM when available.

Twice the capability for less than 1/2 the cost of stand-alone test instruments. It would take seven separate instruments at more than twice the cost (and many more cable hookups) to even approach the capabilities of the SG80 AM Stereo-FM Stereo Analyzer. With innovation, time savings, superior capability, error-free digital accuracy, and Sencore support, your SG80 is unbeatable—at less than half the cost.



"Makes AM Stereo and FM Stereo look alike—simplify servicing with the SG80"

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FS73 CHANNELIZER JR.™ *TV-RF Performance Tester*

- All Channel Digital Tuner—Tunes In Any Cable, HRC, ICC, VHF, UHF, And FM Channel
- Exclusive 5 Microvolt (–46 dB) Sensitivity With Automatic Attenuation And Ranging For Fast Hands-Off Operation
- Exclusive Automatic Hum And Signal-to-Noise Tests On Any In-Use Channel
- Microprocessor Controlled Fine Tuning With Readout Of Frequency Offset

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Completely Performance Tests Every Single TV Channel, In Any RF Distribution System, To FCC Specifications, 100% Automatically And 100% Faster Than Ever Before

Finally, automatic readings at the touch of a switch. No more tuning, measuring, and calculating to find audio-to-video ratios, signal-to-noise, and hum. The FS73's microprocessor does these performance tests (and more) on any channel automatically.

Microprocessor Controlled Digital Tuner Covers Every Channel. Check any system—UHF, VHF, all cable channels (plus the 5-50 MHz channels), and the FM broadcast band. The FS73's digital tuner uses PLLs throughout for fast, accurate results.

Super 5 Microvolt Sensitivity And Autoranged Attenuator Leaves Hands Free To Make Critical Adjustments. Measure the lowest signal levels at an antenna, to the strongest signals at the output of an amplifier automatically.

Exclusive, Automatic Fine Tuning With LCD Readout Of Off-Channel Frequency Locates Shifted Channels Fast. Tests non-standard shifted channels, too. AFT circuits lock the FS73 to the carrier and tell you how far the carrier is from its assigned frequency.

Tune To Standard Cable Shifted Channels In Seconds. Select between HRC, ICC or non-shifted cable systems and the microprocessor automatically offsets the tuner the correct amount for each channel and displays the deviation from the standard frequency on the LCD readout.

Exclusive Signal-To-Noise Test (Even On In-Use Channels) Simplifies Testing And Saves Time. Compares the signal on any channel to the noise level on that same in-use channel. The FS73 measures the actual noise within the channel and automatically calculates the S/N ratio.

Eliminate Tedious Pilot And Carrier Measurements—Read Audio-To-Video Ratio And Hum On Any Channel (While It's In Use) Automatically. No more calculations! Simply tune the channel, select the A/V or Hum tests, and the microprocessor does the rest. It's fast, easy, and error free.

Perform All Tests Under Computer Control With IEEE 488. Allows hands-off performance checks of all channels, and continuous, unattended monitoring for interference when used with a computer.

FC71 Portable 10 Hz to 1 GHz Frequency Counter™

- Five Times More Accurate Than FCC Requirements Even On The Toughest Job; .5 Parts Per Million
- Exclusive Microprocessor Time Base For Super Stability From –12 F to 122 F
- Measures All Signals, Even Complex And Noisy Signals, With Exclusive Sensitivity Control
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FS74 CHANNELIZER SR.™

TV-RF Signal Analyzer

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- All Channel Digital Tuner—Tunes In Any Cable, HRC, ICC, VHF, UHF, And FM Channel
- Exclusive 5 Microvolt (–46 dB) Sensitivity With Automatic Attenuation And Ranging For Fast Hands-Off Operation
- Exclusive Automatic Tests, Even On Fully Modulated Channels:
  - Audio-to-Video Carrier Ratio Test
  - Hum Test On Any In-Use Channel
  - On-Channel Signal-to-Noise Test
  - Digital Readout Of Frequency Offset
- Exclusive Picture Quality Check With Integrated Wide Band Video Monitor—Isolates Problems Meters Can't Show
- Exclusive ACV/DCV Measurements Through RF Input Or Special DVM Input—No Need To Carry Additional Test Instruments

IEEE 488 BUS-COMPATIBLE

RS232 Compatible

Thoroughly Analyze And Pinpoint Any RF Video Trouble In Any RF Video Distribution System, Accurately And Automatically, In 1/2 The Time, Or Your Money Back

Locate Problems Quickly And Accurately. Whether the problem involves abnormal signal levels, excessive hum, elusive ghosts, unwanted signal interference or some other system defect, the FS74 is guaranteed to help you pinpoint the trouble fast, accurately, and 100% automatically.

Tune All Standard Off-Air, Cable, And FM Channels Quickly And Accurately. The FS74's microprocessor is a field strength meter exclusive. Quickly tune the FS74 to the exact carrier frequency. The LCD displays channel number and frequency offset to 10 kHz resolution. Select HRC, ICC or non-shifted cable systems with microprocessor speed and accuracy.

Bring In Weak Signals With The Best Sensitivity Available. Super sensitive, 5 microvolt (–46 dBmV) sensitivity on all frequencies means you can analyze signals all the way back to the receiving antenna. No more fiddling with attenuator inputs or undependable range switches either. The RF input to the FS74 is fully autoranged. Simply connect a cable to the input and measure signals to a full volt (+60 dBmV) automatically.

Microprocessor Control Makes All Tests Fast And Simple. All tests can be made on an in-use channel without removing or decreasing modulation, or adding special carriers.

Exclusive Built-In Wide Band Monitor Makes Tough Picture Quality Checks In A Snap. The wideband monitor is an intergal part of the FS74. Just turn on the monitor and view any of the television channels in full detail on the CRT. Its full 4 MHz bandwidth helps you isolate problems that affect large-screen receivers, but will go unnoticed on portable televisions.

Built-In Autoranging AC/DC Voltmeter And Ohmmeter Means You'll Never Be Caught Short. Your troubleshooting capabilities are rounded out with AC and DC voltage measurements and a special low resistance ohmmeter right at your fingertips. Measure to 200 volts, right through the RF input. Or, measure the resistance applied to the EXT DVM input up to 200 ohms.

The FS74 CHANNELIZER SR. is guaranteed to pinpoint TV-RF trouble quickly. Call **1-800-SENCORE** for more information. Or send for a "10 Day Video Preview" on the FS74.

Call For A 10 Day Video Preview.

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LC102 AUTO-Z™

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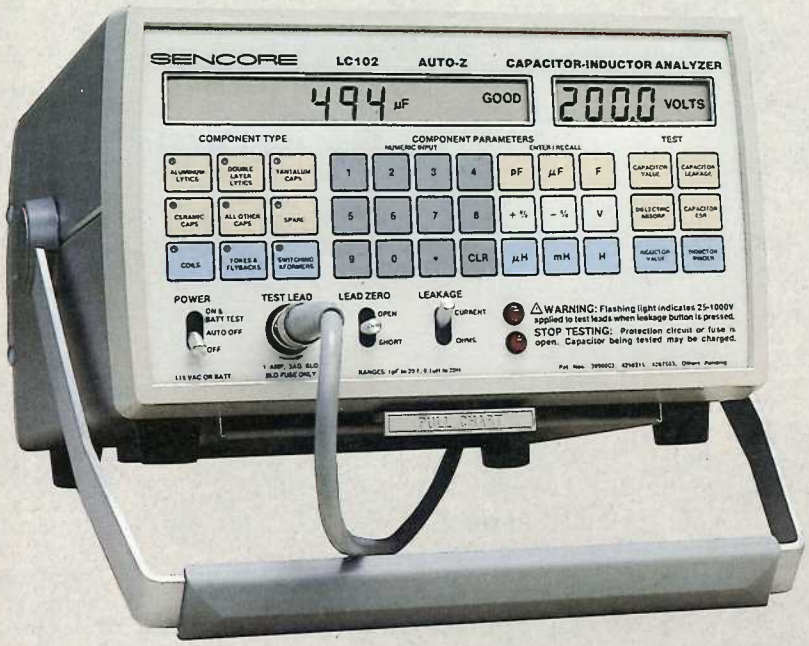
And Improved!



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LC101 Z Meter™ *Capacitor-Inductor Analyzer*

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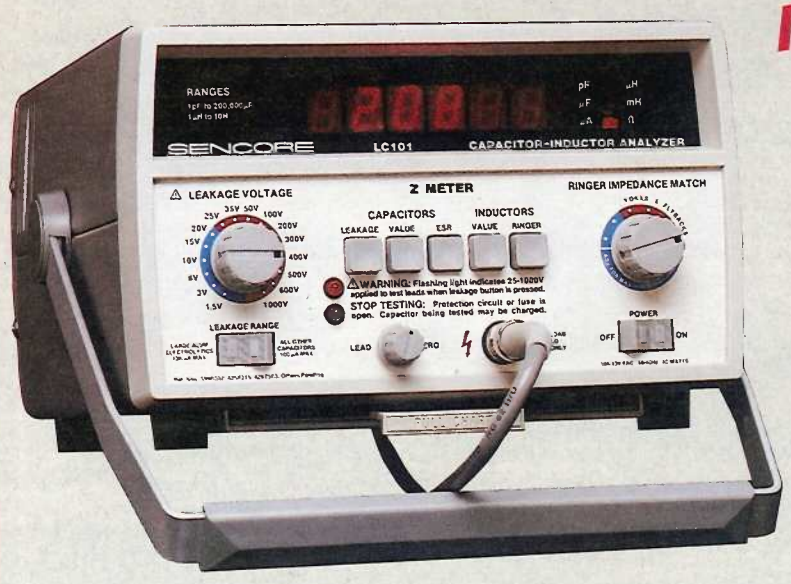

- Exclusive Dynamic Tests Analyze Capacitors For:
  - Value
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  - Equivalent Series Resistance (ESR)
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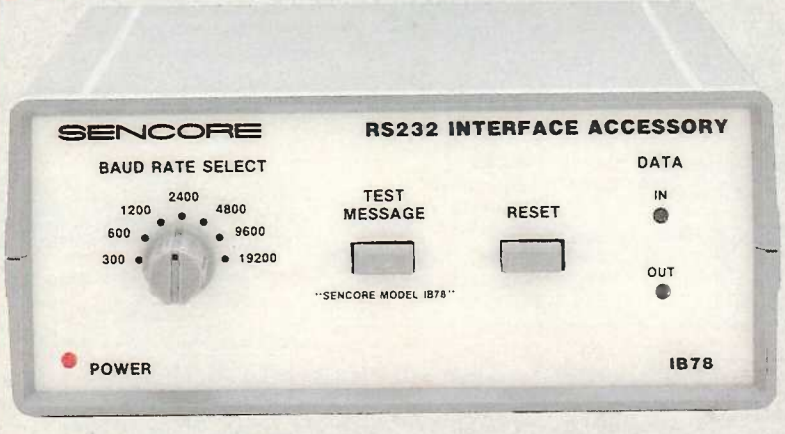
IB78 RS232 Interface Accessory

New!



- Adapts Your Interface-Ready Sencore Instrument To Any Personal Computer, Without Costly Modifications
- Allows You To Perform Computer-Accurate Analyzing And Storage For Permanent Records
- Lets You Modem Your Tests And Measurements, Eliminating Unnecessary Trips To Remote Locations
- Exclusive Automatic Setup And Test Message Simplifies Use With Any RS232 Compatible Computer Or Controller
- Selectable Baud Rates Along With Data, Parity, And Echo Settings Match Any RS232 Configuration
- Data Indicator Lights Inform You When Data Is Being Sent Or Received

$395

U.S. Funds

RS232 Compatible

only apply to certain formats are supplied by *VA62A accessories* to allow updating when desired.

The "VCR STANDARD" jack supplies the main reference signal. This jack provides a standard one volt peak-to-peak composite video signal into a 75 ohm load, just as needed by standard video inputs. This allows the signal, chosen by the VIDEO PATTERN switch, to be fed directly to the video input, bypassing the tuner and IF stages. The signal is sync and phase-locked to all the other VA62A signals to allow the use of signal substitution.

The 30 Hz SERVO DRIVE signal is built into the VA62A because all VCRs use the same 30 Hz servo signal. The signal can be adjusted in amplitude with the 30 HZ SERVO DRIVE control, and the phase can be reversed by pulling the SERVO DRIVE control to its "out" position to match the phase of signals in the servo circuits.

The VA62A ACCESSORIES JACK is in the lead storage compartment in the rear of the unit. This jack carries signals (such as power, separated vertical and horizontal sync, audio, keying pulses, 3.58 MHz color, etc.) to the accessories connected to it. The accessories combine these signals as needed for special tests. Since all the signals come from the VA62A, the accessory signals are phase-locked to the internal VA62A signals. The result is an integrated testing system.

The VC63 VCR Test Accessory provides signals for the three most common VCR formats: Beta, VHS, and U-Matic. The VC63 produces FM luminance and down-converted chroma signals, so that you can inject into the circuits unique to each format. The luminance signal modulates a 3.4 MHz carrier for VHS or a 3.6 MHz carrier for Beta and U-Matic. The color signals convert to the 629 kHz signal needed for VHS decks and the 688 kHz signal needed for Beta or U-Matic, including the special phase shifting used to reduce color crosstalk. The VA62A output signal is fully adjustable from less than a millivolt to 5 volts peak-to-peak to allow injection into any stage from the video heads, right up to the FM detector.

The final accessory is the NT64 NTSC Pattern Generator. This accessory produces the two standard EIA RS189 color bar patterns called for by some manufacturers: "Full-Field" (the bars extend from the top to the bottom of the CRT) and "Split-Field" (the bottom fourth of the screen contains additional reference bars). These patterns *meet all manufacturer's requirements* for an NTSC color bar generator.

The NT64 signals offer two advantages over a separate, stand-alone "NTSC" generator. First, the NT64 costs only about 20% as much as a stand-alone generator because it gets its sync, timing, and power supply signals from the VA62A. Second, its patterns are locked to all the other signals supplied by the VA62A. This lets you use the video pattern exactly the same as though the patterns were coming from inside the VA62A.

Let's see how these VCR troubleshooting features are used. We will begin by looking at problems in the recording circuits.

Isolating Recording Problems

Signal tracing should be your first approach to troubleshooting recording problems. Simply inject the VCR STANDARD signal at the VCR's video input and trace the signal through the record circuits using your SC61 Waveform Analyzer.

Use the Universal Block Diagram provided with your VA62A—or call **1-800-SENCORE** and ask for a copy. *All brands and all models of VCRs follow this same block diagram.* You can use the same troubleshooting procedures each time. Use the Sencore block diagram to find corresponding test points on the manufacturer's block diagram for the VCR you're servicing (Figure 1). If the block diagram doesn't give enough information to isolate the trouble, use it to find specific test points on the schematic.

The scope waveforms accompanying the Sencore block diagram show typical waveforms for Beta and VHS tape decks. Each picture shows two different VA62A video patterns for comparison. These waveforms appear at test points representing *major transitions* in the circuits. All the waveforms between these key test points will have the same general waveshape as the examples shown.

Although the waveshape is the same from one deck to the next, the signal levels vary. Refer to the manufacturer's service literature to determine the peak-to-peak level of the waveforms.

Fig. 2: Compare the results obtained when injecting at the output (A) and the input (B) of a suspected stage or IC.

Isolating Playback Luminance Problems

Signal substitution simplifies playback troubleshooting. Use the VC63 VCR Test Accessory signals when you inject into circuits *ahead of the FM video detector; use your VA62A drive signals to inject into stages after the detector.*

The calibration of the VC63 output circuit lets you match the level of the test signal with the peak-to-peak amplitude shown on the schematic for each test point. For example, if you need a 0.3 volt signal, set the switch to the "X.1" position and the control to "3". If you need 2 volts, set the switch to the "X1" position and the control to "2".

You must remember to use the test leads supplied with the VC63 when injecting signals. These leads have a special matching network which swamps out the signals already in the circuit. If you use a plain coaxial cable, the capacitance of the cable often causes a circuit to go into oscillation, making interpretation difficult.

Using Signal Substitution In A VCR

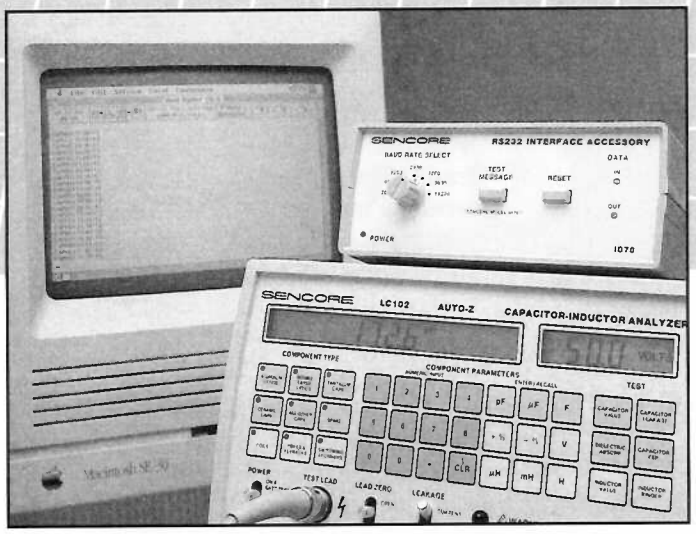
Let's see how to use signal substitution in a typical VCR by injecting signals into an RCA model VLT625HF. *All the circuits work normally,* so that we can see the results of signal substitution when we've injected the signal into normally operating circuits.

Figure 2A shows the TV screen when we replace the tape signal by injecting the VC63 signal at the *output* of the video head switcher—test point 45 on the Sencore block diagram. The signal produces *close to normal results.* We can easily tell that the signal is passing from our injection point to the TV screen, which is what we need to know when troubleshooting (see Figure 1).

Look at the difference when we add a problem into IC 201, which contains the FM demodulator. When injecting at test point 45, we see that the picture has nearly all noise and no contrast (Figure 2B). We know the problem is in a later circuit, so we move closer to the output. Injecting at test point 47 produces nearly similar results, showing the problem is still later in the circuits. To confirm that the problem is not in one of the circuits after the detector, we inject the VIDEO PATTERN signal at test point 48, the output of the video detector. This improves the symptom and pinpoints the trouble. Since we get a *bad signal when injecting at the input* of the FM demodulator, and a good signal when injecting at its output, we have confirmed that the defect is between these two points, or in the FM demodulator.

Now, compare signal substitution to trying to isolate the same problem with a scope. First, if you connect your scope to the detector output, you see that the signal is noisy, just as you see on the CRT of the monitor connected to the VCR output. Moving to test point 47 (the detector input, Figure 1), takes you to that unknown land of FM signals. You can confirm that there's a signal present, but you can't tell a good signal from noise using your scope. The scope's peak-to-peak amplitude reading could be mostly noise. Signal substitution, on the other hand, eliminates these questions because you replace the circuit's signal with a known-good signal and then watch to see if the stage processes the signal correctly.

Do you have questions or need additional information? Call **1-800-SENCORE** and ask for your Area Sales Engineer. ❐



New IB78 RS232 Interface Accessory Automates Your Sencore Instrument Using Popular RS232 Bus

by Tom Schulte, Applications Engineer

- **Enables Computer Automated (RS232) Instrument Operation—Expands Testing Capability**
- **Lets You Connect Sencore Instruments To Modems—Allows Remote Testing**

If you want to take advantage of the automated testing benefits of your computer-ready Sencore instrument, we have good news for you. The new IB78 RS232 Interface Accessory makes your Sencore test equipment easier than ever to automate using the popular RS232 serial communications bus.

Automated Local Or Portable Operation

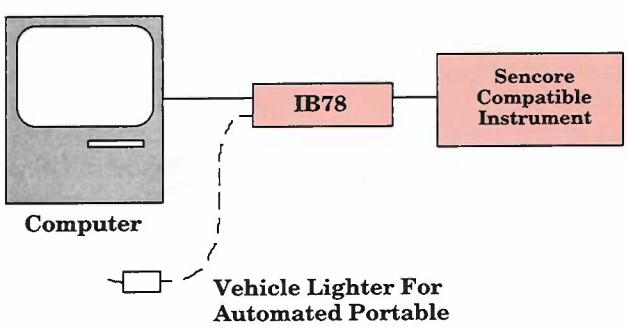


Fig. 1: Easily automate your Sencore instrument with RS232 control using the new IB78.

The highly capable RS232 interface scheme is more a "suggestion" than a standard. Manufacturers implement RS232 in slightly different ways — so, to interconnect different manufacturers' RS232 devices (computers, printers, modems, etc.), you have to use a "breakout box" to determine the location and status of the data and handshake lines in each manufacturer's connector. Once your testing is complete, you have to set internal switches or wire a special cable to interface the two pieces of equipment. To end the confusion and time-wasting RS232 setup hassle, Sencore Engineers included an automatic setup and exclusive test message feature in the IB78 RS232 Interface Accessory design.

Simplifies RS232 Operation

The automatic setup circuits determine if the computer uses software or hardware handshaking and automatically matches it.

- Automatically configures to DCE or DTE equipment — NO special cables or null modem adaptors required.
- Provides a test message to guide setup of data format, baud rate, parity, and echo — EVEN TELLS you which selections match your computer configuration.
- Takes all the trouble and confusion out of the initial setup — ELIMINATES the need for a breakout box.

Automated Local Operation

In this mode of operation you would automate your Sencore instrument to collect test data, simplify repeated tests, or perform unattended tests over long periods of time (Figure 1). Typical uses include:

- LC77 or LC102 AUTO-Z Meters for automated testing and data collection on large lots of components.
- FC71 Frequency Counter or the FS73 or FS74 Channelizers for long-term, unattended testing of communication transmitters or cable systems.
- FS73 or FS74 Channelizers for daily automated cable system performance tests.
- SC61 Waveform Analyzer or PA81 Stereo Power Amplifier Analyzer for long-term testing or intermittent identification during service work.

Automated Remote Operation

In this mode of operation you would automate your Sencore instrument to perform remote/multiple location testing using modems—from one or more fixed locations, or using a laptop computer with an internal modem from any location with a telephone (Figure 2). Typical uses include:

- FC71 Frequency Counter for monitoring remote communications transmitters.
- FS73 or FS74 Channelizers for automated monitoring, performance testing, or troubleshooting of one or more remote cable system headends.
- SC61 Waveform Analyzer for remote monitoring of any electronic equipment.

Automated Portable Operation

In this mode of operation you would automate your Sencore instrument to collect test data from various physical locations. You would do this testing with a laptop computer from a vehicle (Figure 1). Typical uses include:

- FS73 or FS74 Channelizers for data collection for updating cable plant records or for CLI testing.

To expand the uses of your Sencore instruments through automation for more confident testing, time and money savings, and computer records of your test results, call **1-800-SENCORE** today. Ask your Sales Engineer how easy it is to begin enjoying the benefits of instrument automation with the IB78 RS232 Interface Accessory. ❐

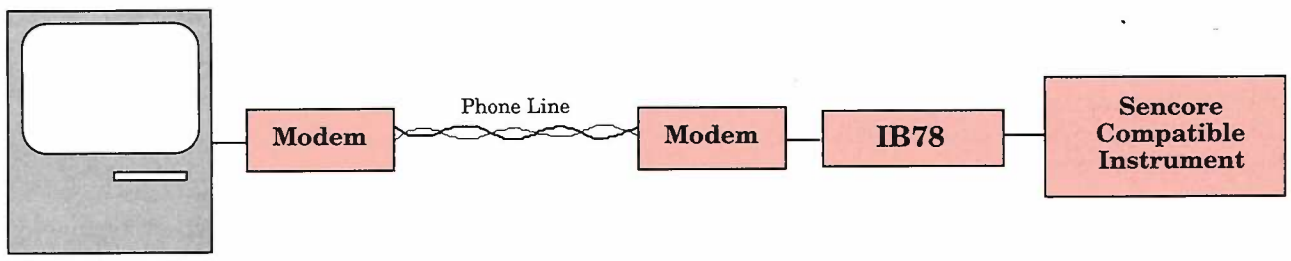
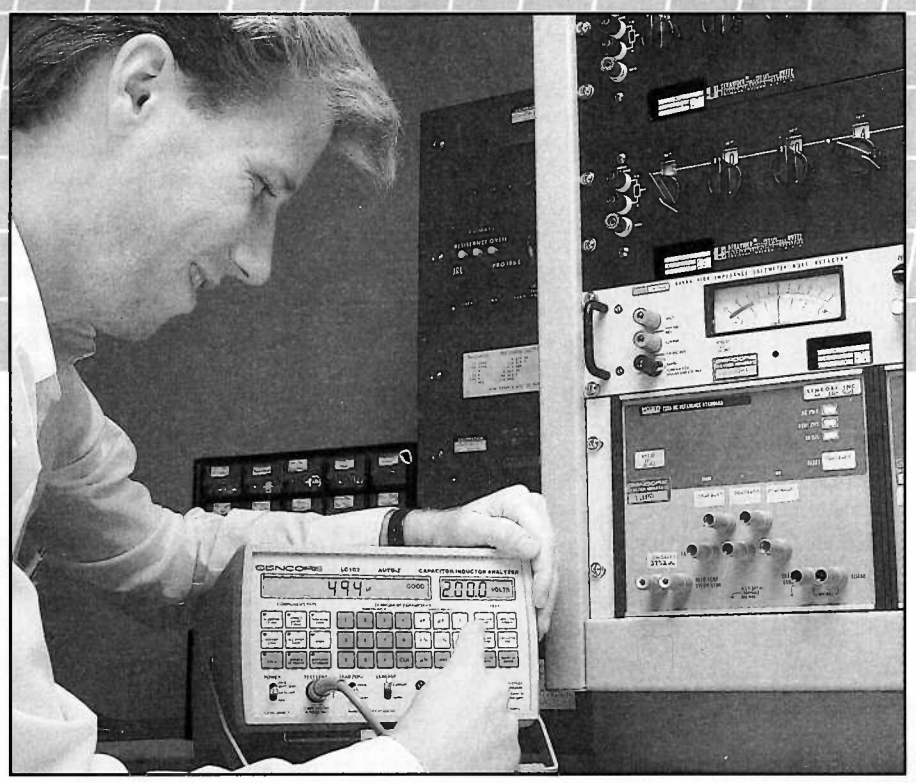


Fig. 2: Use your Sencore instrument for remote location testing or automatic monitoring with modems and a dial-up phone line.



Add The LC102 AUTO-Z ™ To Your List Of Bench-Standard Equipment

by Larry Schnabel, Marketing Communications Writer

- **The Standard Service Bench Is Changing With New Technology**
- **Dynamic Tests Eliminate The Guesswork In Capacitor And Coil Analyzing**
- **Z Meter Brings Extra Capability To Your Bench—Helps You Service Profitably**

Functional Analyzing Combined With Voltage And Component Checks Can Turn A Blind Service Challenge Into A Tidy Profit

Tim finally called my bluff. I always told my neighbor if he ever had any problem with his television set or VCR, I would be glad to look at it for him. After all, I told him many times how I could effortlessly repair TVs and VCRs with my Sencore test equipment.

Well, one day after work Tim carried his 19 inch television over to my house and told me it was time for me to "effortlessly" repair his set. He said the top and bottom of the picture was pulled in and the picture was "scrunched in the middle."

As I sat down to work on the set, I noticed the TV was an older model with a foreign brand name. Service literature was hard to find on this kind of set, I remembered, but I hoped maybe a local shop would have it.

After searching through all of my sources and making several phone calls, the best I came up with was a 6 to 8 week delivery time. If I had gone back to Tim and told him it would take 6 to 8 weeks he would have laughed at me, so I decided to go ahead and take a try at it without the service literature.

My bench was well-equipped with Sencore equipment, so I knew my chances at repairing the set were good. First, I used functional analyzing to confirm the symptom. With the VA62A Universal Video Analyzer RF signals, I confirmed that the TV had limited vertical deflection on both the bottom and the top of the screen. The sound worked fine and all the channels seemed to work the same, so I concluded that the problem must lie in the vertical circuits. Now all I had to do was find the vertical circuits.

As I took the back off the set, I noticed the TV was equipped with individual plug-in modules. After a short search, I located the vertical board toward the bottom of the motherboard near the horizontal section. If luck was with me, the problem would be located somewhere on this vertical board.

My first step was performing some simple voltage checks with my SC61 Waveform Analyzer. If there was a power supply missing or some exces-

Fig. 1: Increased use of capacitors and coils has prompted servicers to select the LC102 AUTO-Z.

sive ripple on one of the lines, I may be on the right track to the repair.

I first plugged the set into the PR57 "POWER-ITE" in case the set had a hot chassis. The PR57 protects you and your test equipment from shock or damage. Testing the TV's power supply lines with the SC61 showed no unusual voltages or ripple levels, so I considered them good.
My next check was to test the most common

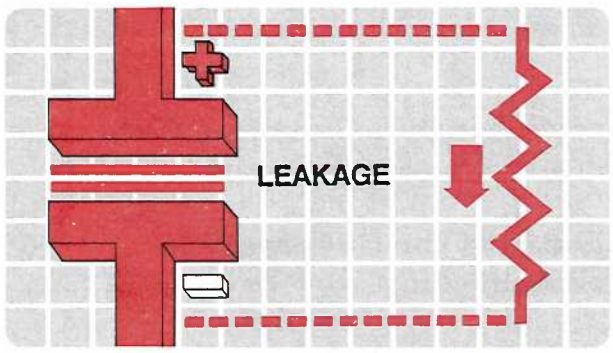


Fig. 2: Leakage develops when the capacitor has an internal parallel resistance. The LC102 tests for leakage with voltages up to 1000 volts.

failures for this type of problem, the vertical output and driver transistors. I powered the set down and hooked the TF46 Super Cricket to the transistors in-circuit one at a time looking for a possible shorted or leaky transistor.

No luck. All the transistors tested good leaving me wondering what else could be causing the problem. Servicing without a schematic can be a real challenge.

Four electrolytic coupling or filter capacitors near the vertical output section aroused my curiosity, so I decided to test them. These were the only electrolytics on the board, and besides, electrolytics are a fairly common failure, especially in older sets.

One-by-one I removed the capacitors and tested them with my LC102 AUTO-Z. To my delight, three out of the four capacitor failed the leakage test. The capacitors were 150 volt capacitors, so an ohmmeter or value-only tester would have missed this defect. My experiences told me if three out of the four capacitors were bad, the other one was about to fail, so I decided to change all four.

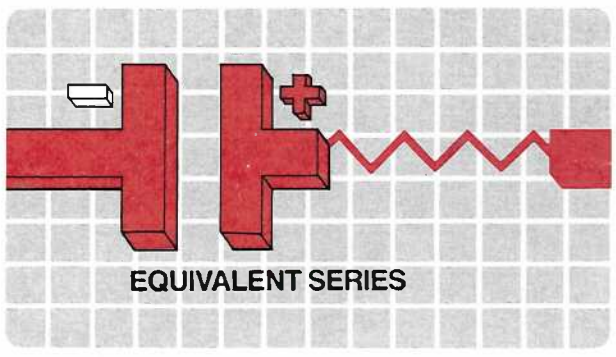


Fig. 3: Capacitor ESR is the resistance of its leads and dielectric. The LC102 automatically calculates capacitor ESR and displays it on the LCD readout.

I replaced the capacitors with new ones, turned the set on, and it worked good as new. When I returned the set to Tim the next day, I told him how I slaved to find the leaky capacitors that caused the deflection problem. What I didn't tell him was how the LC102 saved me many hours of troubleshooting time, and maybe months of waiting for the schematics.

The Standard Bench—Changing With Technology

If you're like most servicers and you don't have a schematic, you probably use the test equipment on your bench like I did and run some standard tests to narrow the problem down, if possible. A little functional analyzing combined with voltage and component checks often turns a blind servicing challenge into a tidy little profit in no-time.

As modern testing needs have changed, so has the look of the modern service bench. A volt-ohmmeter and oscilloscope are still standard, but now an isolation transformer is also necessary because of hot chassis'. Cable ready RF signals along with video analyzing signals are also needed on today's standard bench as cable TV penetrates more households and TV circuits are incorporated into single boards rather than modules.

Modern service benches also include instruments to test capacitors and inductors on an everyday basis. As other components decline in numbers, capacitor and inductor use is at an all-time high. The increased use is due to better filtering needs and advanced technology.

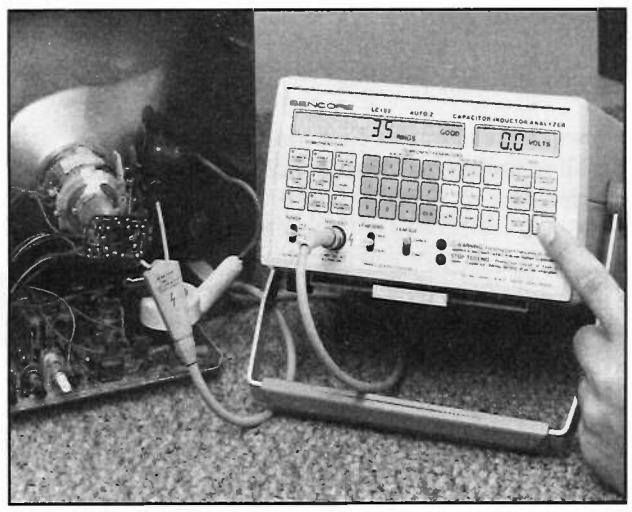


Fig. 4: The LC102 finds inductors with shorted turns using the exclusive in- or out-of-circuit Ringer Test.

The LC102 AUTO-Z — A Necessary Part Of Today's Modern Bench

Many servicers are adding the LC102 AUTO-Z as a piece of standard test equipment to their bench. The LC102 combines capacitor/inductor analyzing capabilities with the specialized tests needed for today's modern technology.

You simply cannot get by without a Z Meter any longer in the service business. Since capacitors and inductors are used in virtually every unit you service, you need a fast and accurate method of testing these components. The LC102 answers all these questions with fast, error-proof, and dynamic tests at your fingertips—always within reach on *your* modern bench.

The LC102 Tests Capacitors With Four Dynamic And Exclusive Tests

The LC102 AUTO-Z thoroughly tests capacitors with four easy-to perform, yet dynamic tests. The VALUE test tells you the capacitor's true capacitance value. If the value is too low (or even shorted), the capacitor will not filter voltage properly, possibly causing circuit malfunction.

Leakage in a capacitor acts like a resistor in parallel with the capacitor. The LC102 tests the leakage of a capacitor at its rated voltage up to 1000 volts. This test also catches the capacitors that don't go bad until a voltage load is placed on them.

Some capacitors don't have the ability to discharge completely after a charge cycle. The LC102 measures this capacitor defect as a percentage of dielectric absorption. This dynamic test is made with only one hookup and is displayed automatically.

ESR is the Equivalent Series Resistance in a capacitor's leads and dielectric that worsens as the capacitor ages. ESR can cause problems in high frequency circuits such as switching power supplies. The LC102 AUTO-Z automatically measures and displays capacitor ESR for you with the push of a button.

Eliminate Guesswork And Substitution With Dynamic Inductor Tests

Testing inductors in the past has involved a lot of guesswork, substitution, and wasted time. Many servicers substituted suspect inductors or didn't test them at all, hoping they wouldn't fail.

The LC102 AUTO-Z tracks down inductor failures with two patented tests. The INDUCTANCE VALUE test measures true inductance, not inductive reactance, as many harder-to-use testers measure. You simply push one button, and the inductance value is automatically displayed without the need to move decimal points.

Inductors with shorted turns are difficult to locate even with the most expensive of testers. The LC102 uses the patented, dynamic Ringing Test to find even one shorted turn in an inductor. You'll have a standard GOOD or BAD test for inductors so you don't have to rely on substitution anymore.

Add Extra Testing Capabilities To Your Bench With The LC102

In addition to its exclusive capacitor/inductor tests, the LC102 AUTO-Z brings extra capabilities and tests to your bench without adding extra

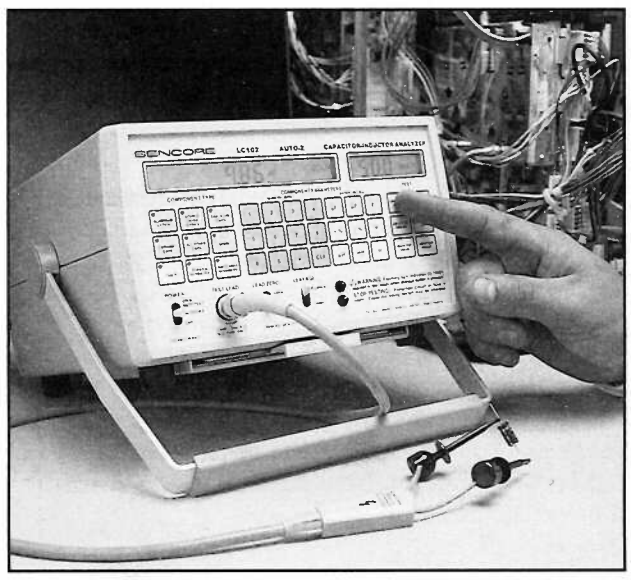


Fig. 5: The LC102's memory capabilities and GOOD/BAD readings are like having a standards engineer with you at all times.

boxes or taking up extra space. The LC102 is a total analyzing package that you'll use on every repair that crosses your bench.

Reliably Test SCRs And Triacs At The Working Voltage

As SCRs and triacs become more popular, test fixtures become more expensive leaving many servicers out of the picture. When you're sitting at your bench looking at a suspect SCR or triac, you don't want an engineering tool or diagnostic device to test the part. You simply want a way to test if the part is good or bad.

You can use the LC102 AUTO-Z along with its accessory, the SCR250 SCR and Triac Test Accessory to test SCRs and triacs for turn-on capability and leakage. The leakage voltage from the LC102 tests the component under load, while the separate SCR250 controlled trigger supply protects sensitive gates from damage.

Press A Button — Read Good Or Bad — It's That Simple

Many component testers are complicated and just plain hard to use. When you do get a reading, you still don't know if the part is good or bad, the ultimate test for a servicer like yourself.

The LC102 lets you test components GOOD or BAD with the simple push of a button. You simply program the component's parameters and tolerances into the LC102's built-in microcomputer, and the measured values are compared against industry standards stored in the LC102's memory. The result is a GOOD or BAD display reading.

Measure Resistance Up To 1000 Megohms

Most benches don't have any method of testing high voltage components or measuring resistances above 20 megohms. They either have to buy special testers for these tests or they just guess at the results.

Fig. 6: The portable LC102 AUTO-Z lets you extend your testing capabilities to areas where a 120V wall outlet isn't available.

The LC102 applies up to 1000 volts for high voltage tests on boards, switches, diodes, high value resistors, and other high voltage components. You can read the display in either ohms or current, it's your choice with the flip of a switch.

With readings up to 1000 megohms, and voltages up to 1000 volts, there's no need to grab another piece of test equipment in your shop. Your LC102 AUTO-Z does the job of several different testers, dynamically, and all in one box.

Use The LC102 AUTO-Z On The Bench — Or In The Field!

Occasionally you need to perform some tests at a remote site or a customer's home. Most capacitor/inductor testers are bench-only type units that aren't useable out in the field.

The LC102 AUTO-Z operates on 120 VAC *or* with the optional rechargeable battery pack so you can take it with you wherever you do component testing. The LC102 works all day on one charge so you can identify defective components with confidence. The LC102 even lets you perform dynamic tests with its 1000 volt leakage supply in the field. That's what you call portable use.

A well-equipped bench today includes a Z Meter. Take a look at your bench. Would you like to add an LC102 AUTO-Z to it? Just call your Area Sales Engineer at **1-800-SENCORE** and he'll help you put a Z Meter where it belongs—on your bench! ❐

Sencore Tech Talk

Troubleshoot Computer Power Supplies With The LC102 AUTO-Z

Computers were one of the first devices to use the switched mode power supply. The switched mode power supply is lightweight, efficient, and smaller in size making them ideal for computer applications. Other electronic devices such as TVs, VCRs, and cameras also use these circuits.

A major advantage of switched mode power supplies is their ability to operate over large load variations. In addition, their 60% to 90% efficiency far outperforms standard power supplies that typically operate with 40% to 50% efficiency. The increased efficiency of switched mode power supplies has made their use desirable in a wide variety of devices — from units that draw large currents to a battery-operated TV.

Even though the switched mode power supplies are highly efficient and very reliable, they do fail occasionally. The dynamic and exclusive tests of the LC102 AUTO-Z make it an essential part of your bench when troubleshooting switched mode power supplies.

Switching Transformers

Switched mode power supplies use a transformer similar to the flyback transformer used in scan-derived power supplies. The LC102 AUTO-Z Ringer test quickly checks switching transformers for shorted turns, even if it's only one shorted turn.

To test the transformer, connect the LC102's leads to the primary winding. If the transformer rings 10 rings or more, the transformer has no shorted turns in any winding.

If the transformer rings less than 10, and is still in-circuit, pull the transformer out-of-circuit and perform the Ringer test on the primary winding again. If it rings more than 10 out-of-circuit, the transformer is good. Be sure to check the loads connected to other windings for a short.

If the transformer still rings bad out-of-circuit, try ringing the other windings of the transformer. If any of the windings on the transformer ring 10 or more, the transformer is good. If all the windings ring less than 10, the transformer is shorted and should be replaced.

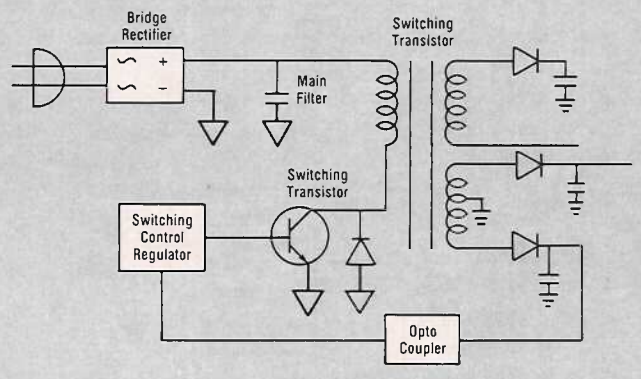


Fig. 1: A typical switched mode power supply contains a switching transformer and several filter capacitors that the LC102 can dynamically analyze.

NOTE: *If you find a shorted transistor in a switched mode power supply, there's a good chance a shorted switching transformer caused it to fail. Be sure to perform the Ringer test on the transformer before applying power to the device after you've changed a switching transistor.*

Capacitors

Another common failure in switched mode power supplies is the filter capacitors used in the various DC power supply outputs. These capacitors are typically aluminum electrolytics that can fail because of age, stress, or manufacturing defects.

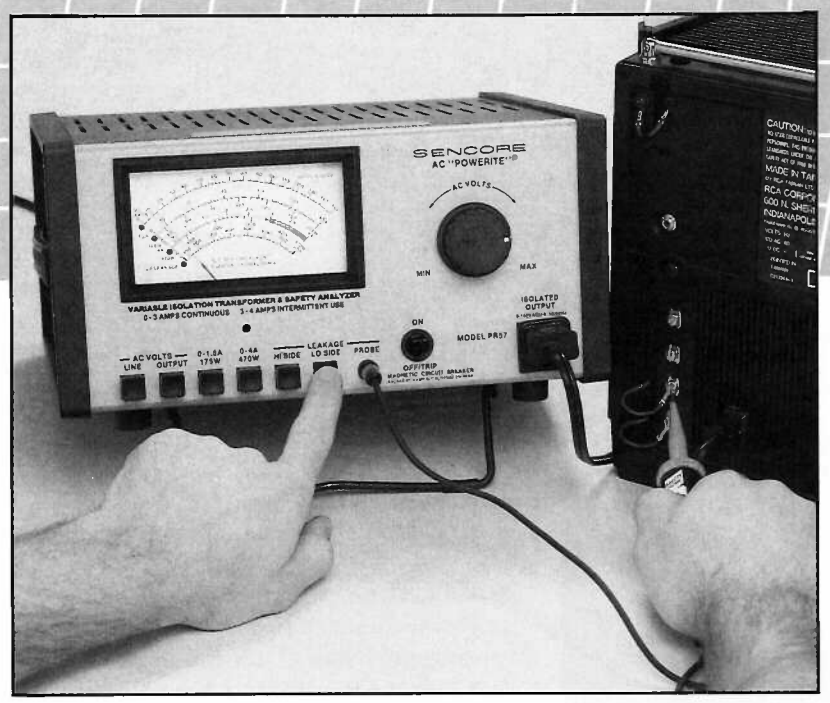
Be sure to test these filter capacitors with all four LC102 capacitor tests. The four tests to perform are:

1. *Value*
2. *Leakage*
3. *Dielectric Absorption*
4. *ESR*

Since switched mode power supplies run at higher frequencies (up to 100 kHz), small imperfections in a filter capacitor will be more critical than in 60 Hz or 120 Hz power supply circuits. You must be extra critical when you perform any of the four capacitor tests, although the internal LC102 memory will tell you if the capacitor is GOOD or BAD, automatically. ❐

Learn How The PR57 "POWERITE"® Will Protect You, Your Customer And Your Equipment, Plus Earn Over 1000% Return On Your Investment The First Year

by Don Multerer, Telemarketing Manager



- **Isolation Transformer; Your "Down Time" Eliminator**
- **Variable AC Source; Your "Time Saver"**
- **AC Line Monitor; Your "Phantom Problem" Eliminator**
- **Power Monitor; Your "Parts Saver"**
- **Safety Leakage Test; Your "Business Protector"**

After The First Month, Your "POWERITE" Becomes An Income Producing Source . . . A Business Builder

If your banker called today and told you about a $495 investment where you were guaranteed to earn a minimum of 1040% return the very first year, you would be most interested wouldn't you? In fact, you would probably say "this sounds too good to be true, tell me what to do!" The PR57 "POWERITE" not only is guaranteed to provide more than 1000% return on your investment the very first year, but this amazing benefit is just one of the five ways the PR57 is guaranteed to put even more profits right back into your business. Here's how:

The "POWERITE" Is An Isolation Transformer To 470 Watts Peak

An Isolation Transformer puts profits into your business by eliminating down time—down time of your test instruments or the customer's set, damaged because they were not properly isolated from the chassis under test. Damaged sets and instruments have to be replaced or repaired. That takes profits right out of your profit till. Why can lack of isolation cause damage?

Today, most TV chassis use transformerless or "Hot chassis" for energy savings and lower prices. The three types of transformerless chassis illustrated below require isolation transformer protection:

The half wave rectifier chassis: One side of the AC line is connected directly to the chassis in a half-wave, hot ground power supply.

Bridge rectifier chassis: There is a 67 volt potential between the TV chassis and earth ground in today's bridge rectifier power supplies.

Switching power supply: Similar to a bridge rectifier chassis; the switching transistor converts the bridge's DC output into a square wave which is in turn filtered for a DC output. Switching power supplies are found in many new TV and VCR chassis.

There's no problem with connecting grounded test equipment to the half wave rectifier chassis (Figure 1A). Many servicers make the proper connection by measuring the voltage between the chassis and the grounded test equipment. A high AC voltage reading shows the "Hot" side of the line is feeding the chassis. If so, they simply reverse the AC plug.

Unfortunately this approach doesn't work with bridge and switching power supplies (Figure 1B). In these power supplies the metal chassis is at half the AC line, no matter how the AC plug is connected. Here is where costly damage affects your test equipment and the customer's set. Connecting your scope, or any other grounded test instrument to the television receiver or VCR chassis shorts out half of the power supply (Figure 2). Damage results from excessive current flowing through the power supply's input choke and rectifier diodes. Chances are the high current will "fry" your common test lead or scope probe, too.

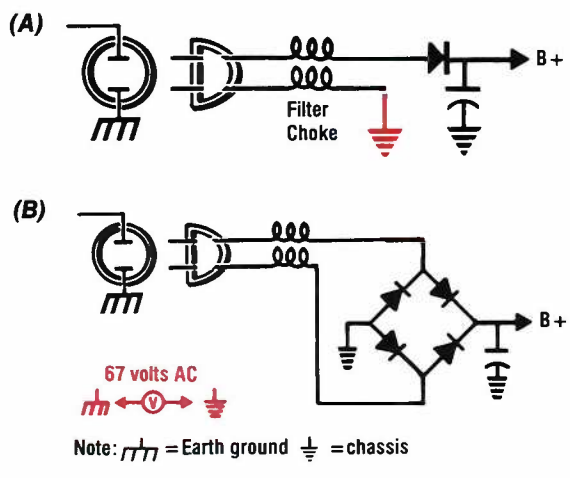


Fig. 1: (A) One side of the AC line is connected directly to the chassis in the half wave supply. (B) There is always 67 volts between the chassis and earth ground in a bridge rectifier supply.

An answer would seem to be to break the ground path that causes the short circuit. But breaking the test instruments third wire safety ground by cutting off the AC plug ground pin, or using a 3 wire adapter plug, leads to two other problems. First, the instrument's 3rd wire ground return is often necessary to properly shield sensitive circuits such as microprocessors and high impedance amps to prevent erroneous readings. Defeating the shield causes you to spend profitless time chasing electrons up the wrong path.

The second problem, with defeating the 3rd wire ground, is that a serious shock hazard is formed between the instrument's metal case and any metal object connected to earth ground. Accidentally getting your body between these two AC points can cause more down time.

Both of these problems can be eliminated if you make it a Golden Rule to ALWAYS plug every television, VCR, or any other chassis into the "POWERITE" isolation transformer before servicing it.

The "POWERITE" Is An AC Supply Continuously Variable From 0-140 VAC

How can a variable AC supply add profits to your business? An adjustable AC supply is a

tremendous *time saver* and a "must have" piece of equipment.

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

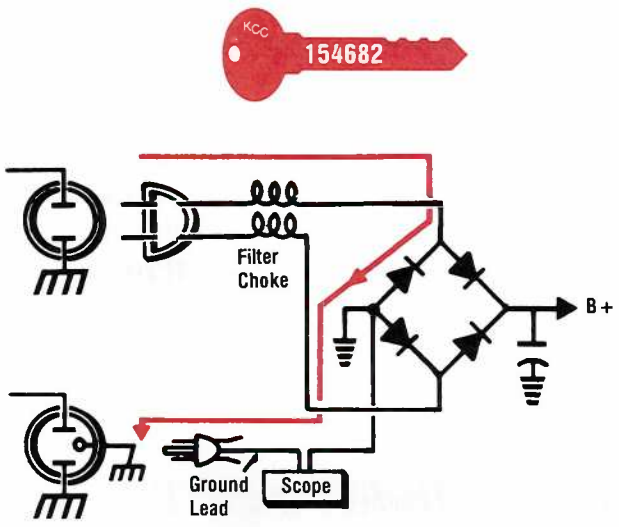


Fig. 2: Connecting a ground lead to a bridge rectifier chassis without using an isolation transformer will short out half the power supply.

The "POWERITE" Is An AC Line Voltage Monitor

The AC line monitor is another "POWERITE" feature and profit builder. It eliminates those phantom problems that send you off on a wild goose chase, tracking down problems that often do not exist. Low line voltages can cause picture width, sync, and intermittent problems. High line voltages may cause excessive 2nd anode high voltage, shutdown problems, or intermittent operation. You need to know what voltage is being supplied to your service bench at all times. With the PR57 it's easy, just reach up and push the AC VOLTS - OUTPUT button. The "POWERITE" voltage monitor swings into action to measure from 0-150 VAC and has a calibrated 117 VAC meter mark. At the push of a button, you can build your shop's profits.

The "POWERITE" Has A Built-in Power Monitor To 4 Amps And 470 Watts — The Best Parts Saver Money Can Buy

How often have you replaced the horizontal output transistor, the driver transistor and the power supply regulator . . . and powered up the chassis, only to have all those parts self destruct because you couldn't monitor the current drawn by the chassis?

Replacing horizontal output transistors can be an expensive experience, because you can only charge the customer for the first one, not the one you blew up. The next replacement transistors come out of your own pocket. If the chassis fails after a few days or a few weeks of operation, it becomes an even more expensive repair as you now have the extra parts expense plus a costly and time-consuming, needless callback expense. It only takes one of the horizontal output transistor's tuned capacitors to change value and change the timing of the horizontal flyback pulse (Figure 3). A shortened flyback time means increased horizontal trace time, increased duty cycle, and increased current drawn. More current for a longer period of time means that more heat is generated than the horizontal output transistor is designed to dissipate. Result: thermal runaway and eventual part failure. The "POWERITE" can be your "horizontal output parts saver" by letting you monitor current to 4 amps and wattage to 470 watts, at the push of a button.

A good Golden Rule of Service, that can add profit for your business, is ***never*** fire up a repaired solid state receiver at full line voltage. Manufacturers recommend that you start with the line voltage at 90 VAC. The "POWERITE" power monitor saves expensive parts so you can put those dollars in your profit till.

The "POWERITE" Is A Safety Leakage Tester

The "POWERITE" safety leakage test protects you, your instruments, and your customer. It's the best profit builder of all. Safety engineers from the TV manufacturers we have interviewed all tell the same story — "too many servicers still do not make the safety leakage tests."

One reason for not making the test is that the present procedure is too complicated. It requires a good ground, a resistor/capacitor combination "made up" or located among the multitude of shop parts, and the chassis disconnected from the bench isolation. The "POWERITE" Safety Leakage test eliminates this time-consuming procedure. Simply plug the chassis under test into the "POWERITE" and use the supplied safety probe to touch and test all exposed (through the cabinet) metal parts. Any leakage in excess of 500 microamps is a hot chassis problem that you should correct before the set is returned to the customer.

It Only Takes One

Many servicers confess they feel guilty about not performing a leakage test on every chassis that leaves their shop. One technician told us "I can't justify the time of testing every set when only one out of a hundred will have a shock hazard." But that's the very reason you need to safety test every chassis that leaves your shop. It only takes one to put you out of commission so you are unable to work. It only takes one to zap your expensive test instruments or the customer's unit before you realize that it costs you more *not* to make the leakage test on every chassis.

The "POWERITE"— Your Best Profit Builder of All

By now you are beginning see how the PR57 can be one of the best profit builders for your business. Let's review the five ways the "POWERITE" can put profits back into your business:

1) Isolation Transformer; your "down time" eliminator
2) Variable AC Source; your "time saver"
3) AC Line Monitor; your "phantom problem" eliminator
4) Power Monitor; your "parts saver"
5) Safety Leakage Test; your "business protector"

How do you get that 1040% return for the $495 investment? Once you decide to safety test every chassis that leaves your shop, simply add a service charge for the "Safety Leakage Test". Surveys taken by Sencore Field Sales Engineers at recent VCR clinics found service shops charge $4.00 to $6.00 for the PR57 Safety Leakage test. Our same survey showed that not one service technician got any "flack" for adding the safety check and others who worded the charge as a benefit to the customer's family, received thank you letters and phone calls. Let's see how fast a simple $4.95 safety check adds up.

The National Electronics Sales and Service Dealers Association reports that nationally, the average shop repairs 4 TV sets a day per technician. Using a little math we find that:

> 4 sets per day X 5 days a week = 20 sets per week X $4.95 per set = $99.00 extra service income per week.
>
> $99.00 X 52 weeks = $5,148 EXTRA SERVICE INCOME PER YEAR! (That's enough to equip your shop with at least 1 new piece of test equipment each year.)
>
> $5,148.00 divided by $495 (cost of PR57) = 1040% return on investment.

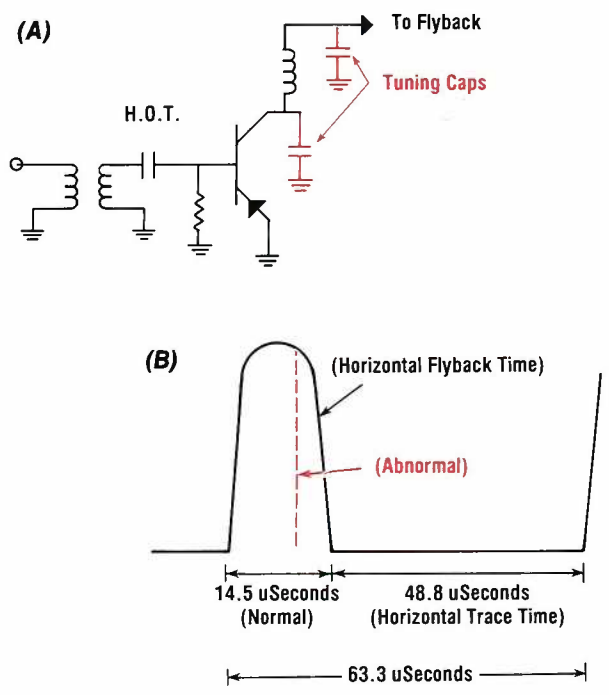


Fig. 3: Tuning capacitors (A) determine the horizontal flyback pulse timing. A shorter flyback pulse, (B) allows the horizontal output transistor to overheat.

In fact, the PR57 almost pays for itself the very first month you own it if you join your technician friends and start making this all important safety charge. Then, after the first month, the "POWERITE" becomes an income producing source . . . a "Business Builder". Many servicers set aside the safety charge money and use it to purchase all of their test equipment. Call Toll Free **1-800-SENCORE** for more information today! ❐

Your CR70 "BEAM BUILDER"® — Guaranteed To Restore 9 Out Of 10 Weak Or Shorted CRTs

by Norm Tipton, Field Sales Engineer

- **Wide Use Of CRTs Increases Opportunity To Expand Your Business**
- **CRT Restoration Can Be The Most Profitable Part Of Your Service Business**
- **You Can't Damage A CRT Using Your CR70's Auto-Restore Feature**

Your CR70 "BEAM BUILDER" Will Help You Cash In On Today's CRT Testing/Restoration . . . In Fact, It's The Only Complete Answer

Have you ever zapped a CRT? In a home? In front of the customer? If you were able to convince the customer it wasn't your fault and that the CRT was already weak and ready to go, you would probably be considered the greatest salesperson in the world! But, the chances are you just bought the CRT. Right? You also told yourself that's the last time you'll "shoot" a tube in the home. Or maybe you became a disbeliever in CRT restoration altogether. What about the time you replaced the IHVT, the horizontal output transistor, the regulator, and a few charred resistors totalling $175 parts and labor, then fired up that 19" portable only to find the picture tube was soft. Did the customer go another $130 for a rebuilt tube? Chances are they didn't. They could get a new 19" at their local discount store for your repair charges. You just bought another set.

How would you like *not* to have to own another CRT or TV because you couldn't restore the picture tube? How would you like 100% confidence and 100% assurance that every time you push the CR70's Restoration Button, you wouldn't zap the tube? (See Figure 1).

Well, you've got it! Only the CR70 is guaranteed to give you 100% safe automatic restoration. *You can't damage a CRT using auto-restore* because the CRT actually tells the CR70 how much current it needs. The internal resistance of the CRT (Rp) determines just the right amount of safe restoration current.

New Engineering Makes The CR70 Better And Tougher

You know the feeling when you accidently zap and damage a CRT using other types of CRT rejuvenators. But, how do you feel when you zap your own equipment? Ouch! Kind of disgusted? Most CRT testers are not immune to accidental discharge currents and transients—*except the CR70.* The CR70's exclusive protection circuits guarantee against accidental overload from charged CRTs.

The exclusive protection will save you hundreds of dollars in service bills from CRT discharge that normally damages other CRT testers. So, you can see the CR70 is actually a complete cathode ray tube analyzer that's designed to help you cash in on today's bountiful CRT testing/restoration market. In fact, it's the only complete answer. But, specifically what are these big opportunities that you can cash in on? Well, the possibilities are endless. However, let's review together seven big business-building opportunities and see just how the remarkable CR70 can help you cash in on them.

Restore Just Two CRTs A Week And You Can Earn An Extra $3,500 Per Year

For years, Sencore's CRT testers have been bringing in profits for thousands of professional video servicers, just like yourself. Our latest survey shows that most service centers charge an average of $35 for a CRT restoration. Restoring only two CRTs a week adds up to an extra $3,500 profit by year's end. Restoring two CRTs a day adds up to a whopping $15,000 the first year. Think of it, an extra $15,000 a year!

Now, can you see why the CRT testing and restoring business can be the most profitable part of your service business for years to come? But, what if the tube fails during the warranty period, you ask?

Well . . . each tube you send back should include a "television picture tube guarantee" like the sample shown in Figure 2. It states that if the tube should fail in warranty, you will credit the $35 (or your equivalent charge) towards the purchase of a new tube. So you see, you can't lose either way, and neither will your customer. Since you're assured of their repeat business and their

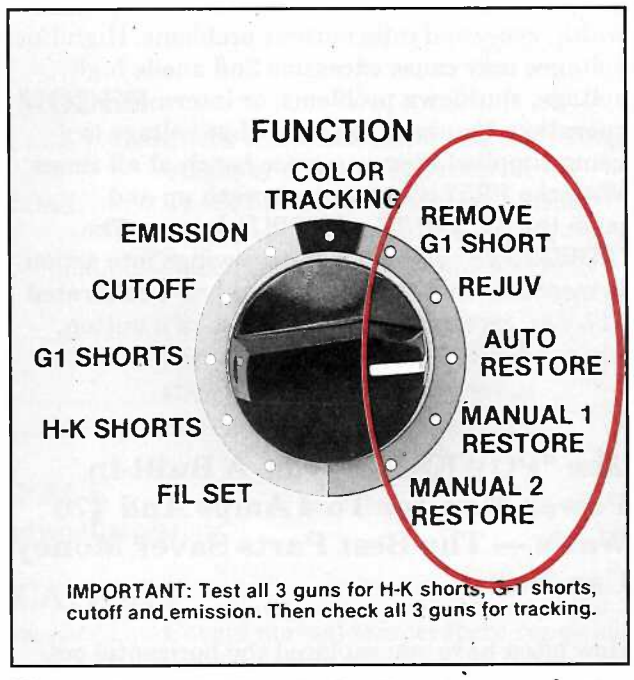


Fig. 1: The CR70's exclusive five step restoration process is guaranteed to give you 100% safe automatic restorations every time.

guaranteed satisfaction, you have a service you can bring right to the bank! There is no better way to build customer support and cash in on the lucrative CRT testing/restoration market.

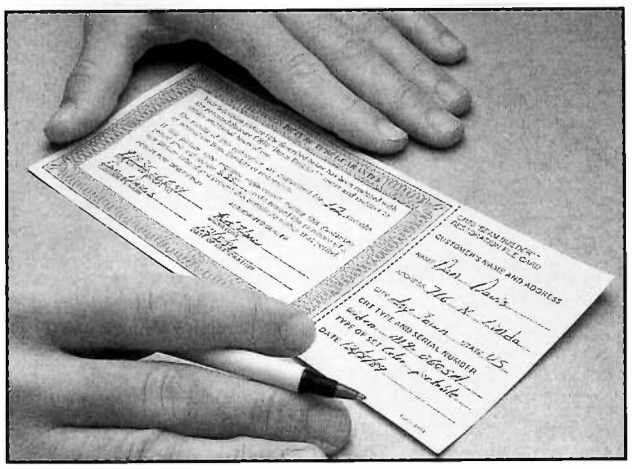


Fig. 2: The "Television Picture Tube Guarantee" assures you of repeat business and guaranteed satisfaction.

Why Not Guarantee Your CRT Restorations For A Lifetime?

What would you say if we told you, you could make money by guaranteeing your restorations for a lifetime? You'd probably think we were crazy, wouldn't you? Well, a number of our video servicers charge $50 or more for a lifetime restoration and come out way ahead with big profits in the till. Here's how it works: You guarantee your restoration for the lifetime of the set. If it fails, you'll credit the customer the full amount towards a new CRT replacement or a new set off your showroom floor.

Not only does your reputation skyrocket, but it guarantees the customer will come back to you when their CRT does fail.

Restoration Usually Results In One To Four Additional Years Of Useful CRT Life

Many new set dealers offer trade-in value on an older set to increase new set sales. One shop owner told us about two sets that were traded in on new models. The dealer gave each customer $75 for their old sets. The picture tubes in both sets were weak so the dealer restored them with his CR70. Both sets sold for $200 each. So, not only did he move two sets, but the CR70 quickly turned the $150 that the used trade-in sets cost him into $400. A $250 profit simply by restoring the weak tubes. How's that for smart business?

Along the same lines, consider increasing your profits by renting too. Many volume dealerships use a rental program to increase new set sales. A set is rented to a customer for several months with the agreement that the customer can use the rental money as a down payment on a new set if the customer makes a decision to buy a new set in a specific amount of time, such as three months. The secret to high profits is to keep the rental units running. You use the CR70 to help the rental sets along until they simply wear out. Restoration usually results in one to four additional years of useful life for each set as the set is restored as often as necessary to maintain a good picture.

You Can Dynamically Test And Restore All Projection CRTs

Contact your local hotels, lounges, and entertainment centers with big screen TVs. Offer to test and restore their expensive projection tubes for a fee. Projection CRTs operate at higher current levels than a standard CRT to provide higher levels of one color of light to project to a back or front screen. If one of the three CRTs is soft, you have one big crummy picture. Only the CR70 "BEAM BUILDER" can test and restore all projection CRTs just like a standard color CRT. It is able to do this by dynamically testing a projection CRT with the same high current it sees under normal operations. You can even use Sencore's patented color tracking test to see if all three separate projection CRTs are tracking together to produce a clean, sharp picture.

The exclusive Tracking Memory circuit will store each projection CRT's beam current level for 20 minutes (see Figure 3). You have plenty of time to test each projection CRT and to show the customer which CRT is causing the problem or let you know which one to restore. After restoration, simply compare the restored projection CRT against the last two projection CRT readings to see if the restored CRT will track properly. As far as we know, this is the only known dynamic projection CRT tracking test available.

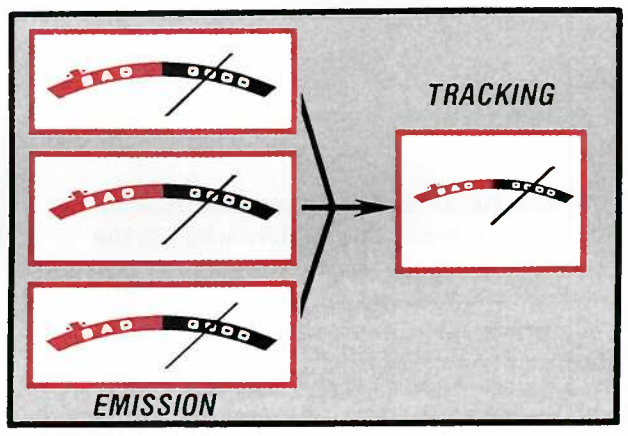


Fig. 3: The exclusive tracking memory circuit will store each projection CRT's beam current for up to 20 minutes. This allows you to show the customer which CRT needs to be restored.

Restore Expensive Oscilloscope Tubes Too!

Contact your local electronic manufacturers. They all use oscilloscopes. Scope tubes are expensive. Many are no longer available. Now you can accurately test and safely restore these tubes and put big bucks in your pocket. The CR70 "BEAM BUILDER" provides the 10 uA low level beam current needed to accurately test scope CRTs. Plus automatically restore the weak CRTs. You look like a hero, saving costly instrument down time or expensive replacement by another of the CR70 "BEAM BUILDER" exclusive features.

You Can Test And Restore Camera Tubes Right In The Camera

Contact all of your local TV broadcast stations. Broadcast color camera tubes are very expensive to replace and the camera down time is extremely costly. You and your CR70 can test and restore camera tubes for a fee right in the camera. The same opportunities are available in businesses that use cameras and monitors for security and surveillance: Casinos, Banks, Malls, Amusement Parks, etc. Many of these companies just have these camera and monitor tubes replaced when a quick and safe restoration of the vidicon, plumbicon, etc., *in the camera* can give them months of new life with no downtime! (See Figure 4).

Even If The CRT is Bad, You Have A 9-In-10 Chance Of Safely Restoring It

Pull in those "closet sets" with a free estimate promotion. You know most defective TVs in the closet, basement, or garage are there because the customer feels it will cost too much to get the set repaired. Most customers think the picture tube is bad because it suddenly went blank, or looked washed out, weak, etc. Even if the CRT is bad, you have a 9-in-10 chance of safely restoring the CRT . . . if you own a CR70 "BEAM BUILDER". Hit your local neighborhoods with local Shopper News ads or door hanger cards. It's inexpensive advertising, and it pays off in your business name recognition.

A Business-Building Opportunity You Won't Want To Miss

We're so convinced the CR70 "BEAM BUILDER" will build your business and earn you big profits that we will buy your old CRT restorer right off your bench. Unbelievable? Well . . . here's our offer:

Say yes by calling Toll Free **1-800-SENCORE** today, and we'll send you a CR70 to put to the test on your bench for 30 days. And since your profitable success is our business, we'll also include a specially designed $50 promotion package to help you advertise and promote your new, exclusive service so you can cash in on the testing/restoring business. You'll receive 2 large posters for your service center, 25 restoration certificates, and 1 ad slick for simplified newspaper advertising, all designed to increase your testing/restoration business.

Now comes the offer I told you you wouldn't want to miss. Take a look at your old, obsolete CRT restorer that you can no longer trust and picture one hundred dollars in its place. You heard us right ... one hundred dollars. Not only will you be getting a technically up-to-date CRT restorer that you can rely on, but you will also be receiving $100 for trading in your old out-of-date model (sorry, no other promotions apply to this trade-in special).

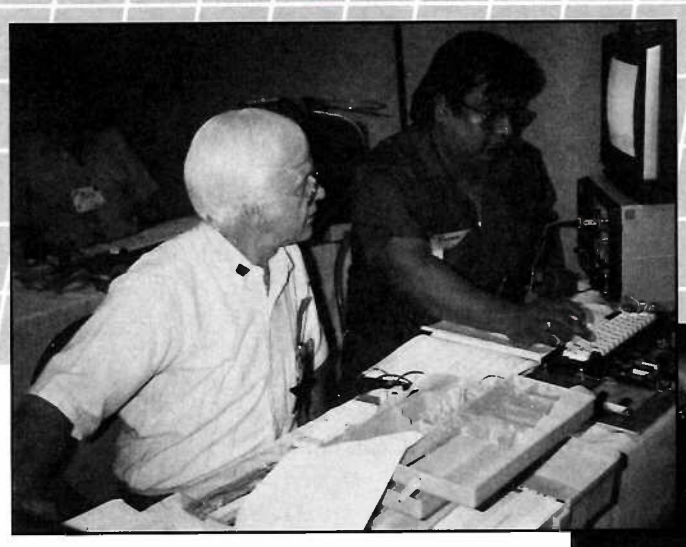
Think about it, how can you lose? The only way you can lose on this deal is by not taking us up on our trade-in offer. But you'll want to act today, **1-800-SENCORE**, because the trade-in offer absolutely ends February 28, 1990. ❐

Fig. 4: Test and restore camera vidicons using the CR70 "BEAM BUILDER" without the hassle of removing the vidicon from the camera.

Customer Support

Teamwork Makes Better Business

by Barbara Rubin, Director Of Member Services - NESDA



Technicians analyze the workings of a microprocessor at a NESDA Digital/Microprocessor school.

At NESDA's Meeting, dealers can discuss service problems with the top service decision makers at each manufacturer.

In world full of government bureaucracy, irritable consumers, inconsiderate manufacturers, and out-of-stock parts, the owner of a consumer service center sometimes feels alone against the world. The *National Electronics Sales and Service Dealers Association* is dedicated to the theory of strength through alliance by serving the needs of members and the industry. NESDA helps its members cope with the escalating demands of business management, keep pace with advancing technology, and recognize and meet the changing needs of the consumer.

Collectively, NESDA members sell and provide service on all types of electronic equipment. The size of member businesses varies from one-person shops to multi-personnel and multi-location establishments. NESDA helps its members become successful in the ever changing electronics industry.

The benefits of association can vary from member to member depending on that business' specific needs. However, every service center keeps a handy copy of the premier industry reference, the *Professional Electronics Yearbook.* Published annually in January, the 1990 directory lists 350 manufacturers (and in many cases the service manager, parts manager, and technical service personnel). It also lists 92 parts distributors, plus software providers, vendors of extended warranty service contracts, sources of professional education, commercial trade publications, toll free numbers, and key industry people (dealers, association leaders, educators, etc.).

Another benefit used regularly by all members is the regular informational publications, Professional Electronics Magazine, "Update" newsletters, and a news service for state and local associations called "Local Editors." The bimonthly magazine presents articles on business management, advance technology, new products, new servicing techniques, and advice from many sources on coping with changes in the world of electronics. The newsletters cover association activities and important industry happenings. This material is mailed automatically to all NESDA members. The dealers who get the maximum benefit from their annual membership are those who take advantage of some of the many programs that are offered to better the member's business climate.

The NESDA Service Control System II program tracks customer records, prints NESDA or NARDA forms, and prints parts orders, to name just a few of its capabilities. It is available to NESDA members at a 20% discount.

When new members join, they receive the new member identification material for the business, a code of ethics, wall certificate, window decal, and an indexed notebook. This loose leaf manual itemizes each of the benefits available and also provides useful management and technical material that aids in business operation.

Customer relations materials, pamphlets about professional service, explanation of warranties, and parts return bags—each one ready for the business' own imprint—help improve the image of the business. Also at regional and/or national meetings, dealers have the opportunity to examine public relations materials from other businesses that can be adapted for use at their own service center.

NESDA has developed or purchased numerous business aids especially to improve the operation to its member service centers. These items, training tapes, management books, service management software, or invoice forms, may be purchased at special member discounts.

The annual National Professional Electronics Convention is a week-long industry "happening" featuring top notch technical and business management seminars, member-to-member information sharing, one-on-one with key manufacturing people, a giant Trade Show, association meetings, and several evenings of outstanding food and entertainment. Attendees often comment that profits resulting from new ideas and information received at the convention far exceed the cost of attending.

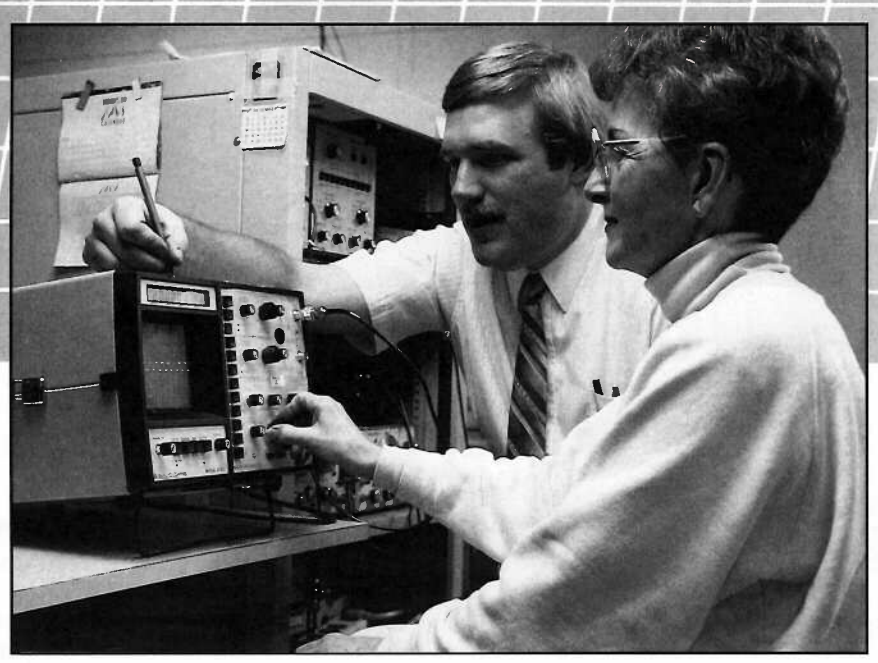
Other "available" programs include life, health, business, liability, and workmans' compensation insurance, special member discounts on all kinds of business forms and business equipment, professional aids and supplies, and management and technical exams and certification.

The helpful staff at the NESDA office maintains a library of offshore manufacturers, possible model and/or parts crosses, parts sources, and contact persons for consumer or servicer problems. The staff also fields questions about pending legislation and how it may affect the electronic sales or service profession.

Since NESDA is an alliance of state associations, members can frequently participate in local, state, and regional meetings and seminars. Each local chapter works independently to serve the members within its own area and provide group benefits and effective representation at the state and national level.

Anyone desiring more information about NESDA membership or NESDA services may contact the NESDA office at 2708 West Berry, Fort Worth, TX 76109-2397; (817) 921-9061 or FAX your request to (817) 921-3741. ❐

Customer Support



Quality Benefits Of Owning Sencore Products

by Dave Drewes, Quality Manager

- **Well-Placed Controls — Easy-To-Read Displays — Saves Time**
- **Protected Against Overloads — Worry-Free Operation**
- **Builds Confidence — 100% Lifetime Made Right Guarantee**

In this day and age, customers are no longer only satisfied with high-quality products. Rather, they are demanding it. If companies want customers to return, they must give the customer assurances that what he is buying is just what he wants. A high-quality product that will meet his needs — year after year.

Quality Designed In

Sencore products have always had certain characteristics designed into them that are beneficial to the user, but many times the user does not even realize it. A few of these characteristics and benefits are:

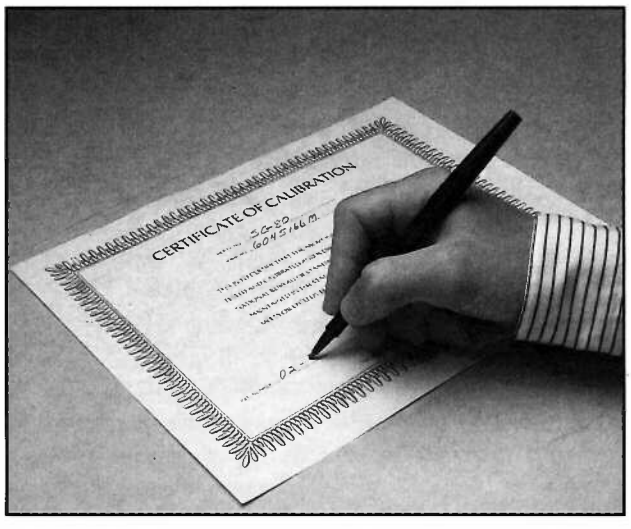


Fig. 1: Calibration is traceable to national standards—assuring every measurement you make.

• ***Human Engineering:*** Sencore products have always had good ergonomic design with well-placed controls and easy-to-read displays that save the user time.

• ***Withstand Overloads:*** We spend a lot of time designing and testing inputs and outputs so they can withstand overloads that far and above exceed the normal working conditions they are intended for. This allows a customer to make a mistake now and again without destroying a badly needed piece of equipment.

• ***Drop Tests:*** Our products are tested to withstand reasonable drops onto concrete floors. As with anything, if you drop it, one might expect it to get bent up a little. But we take pride in the fact that we can pick up our products from these tests and they still operate. In other words, they are still useable.

• ***Rust-Proof Guarantee***: All metal parts are designed with proper plating to avoid unsightly corrosion or rust. In fact we guarantee against rust for a minimum period of 5 years. This allows the product to be used in many adverse environments without the customer having to worry about what it may do to his instrument.

These items are ones that most customers can relate to even though you don't have to think about them much. These types of intrinsic design qualities avoid problems for our customers.

Quality Of Internal Processes

Benefits are not only dictated by design qualities. Through the maintenance and improvement of our manufacturing processes, we are able to bring even more benefits to our customers.

• ***ESD Control:*** We have a very good ESD (electro-static discharge) control system in place. This helps to safeguard the reliability of our designs by not allowing degradation of integrated circuits when they are installed. This greatly reduces the potential for infant mortality failures and down time.

• ***SPC:*** Through the use of statistical process control we concentrate on maintaining established process levels. This helps identify waste and reduce it which ultimately affects the cost of our products.

• ***Accuracy In Calibration:*** The calibration of all our products is traceable to national standards (NIST) through our prime standards lab. Documentation (calibration certificate) of this traceability is provided to any customer that requests it through our Service Department. Through a well maintained calibration system, we can give our customers the assurance that every measurement they take with a Sencore instrument is a reliable one.

• ***Burn-In:*** All Sencore products go through a burn-in process at the end of our production line prior to final testing. Our philosophy here is a simple one. We try to make the product fail at the factory by submitting it to hours and hours of high heat, power line fluctuations, and low-level vibration before we send it to anyone else. Again, by screening out infant mortality failures, we save our customers potential downtime (Figure 2).

All of the benefits mentioned are only a small sample of what Sencore products provide to our most important asset, our customers. We have such high confidence in what we are offering that we extend our quality into the field with further guarantees and warranties.

All of our products are covered by a standard one year warranty for any failure (other than abuse or acts of God) as well as a 100% Lifetime Made Right Guarantee that applies to any workmanship related defect from the factory.

Let's face it. There's more than what meets the eye when it comes to owning Sencore products. ❐

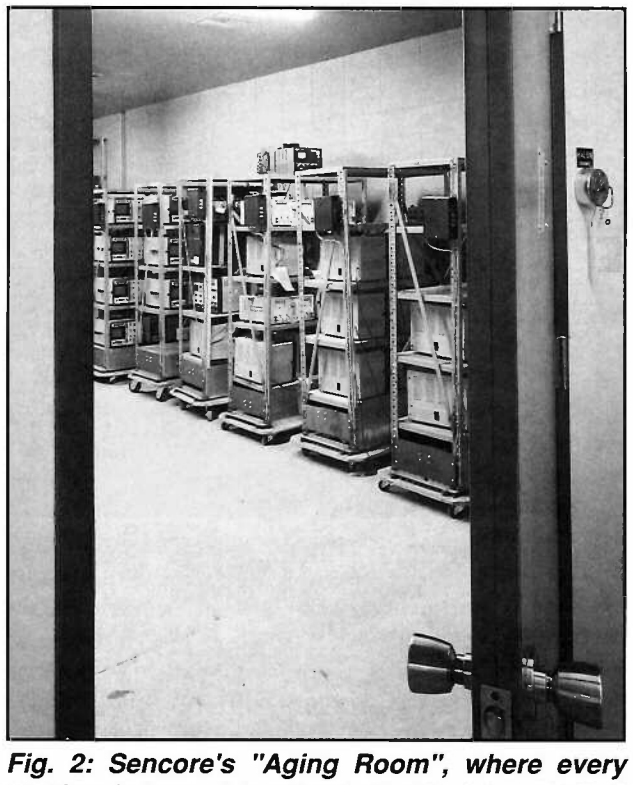


Fig. 2: Sencore's "Aging Room", where every product is burned-in prior to final test, to save you potential down time.

Customer Support

Sencore Service — Dedicated To Keeping Your Sencore Instruments Working And Earning For You . . .

by Bob Van Kirk, Service Manager

- **You Get Fast 72-Hour Service —No Extra Charge**
- **Your Instrument Is Updated With The Latest Safety, Protection, And Reliability Improve ments — No Extra Charge**
- **Toll Free Access To Service Professionals, To Help You With Instrument Repair Questions — No Extra Charge**

Special VA62 Update Offer — Through February 28, 1990!

The VA62 was first introduced seven years ago, and at that time it met all channel requirements. Since then, new cable channels have been added to TV sets and to cable systems. The VA62A now has cable channels 2 through 99. You can have the same channel capability with your VA62 if you send it in to be updated. For $295, your VA62 can have the new performance specifications of the VA62A. Besides having the same specifications, here is what you will receive in the update package.

Shipping Arrangements Made For You — At No Additional Cost

Because shipping facilities may not be convenient for you, we will have UPS pick up your VA62.

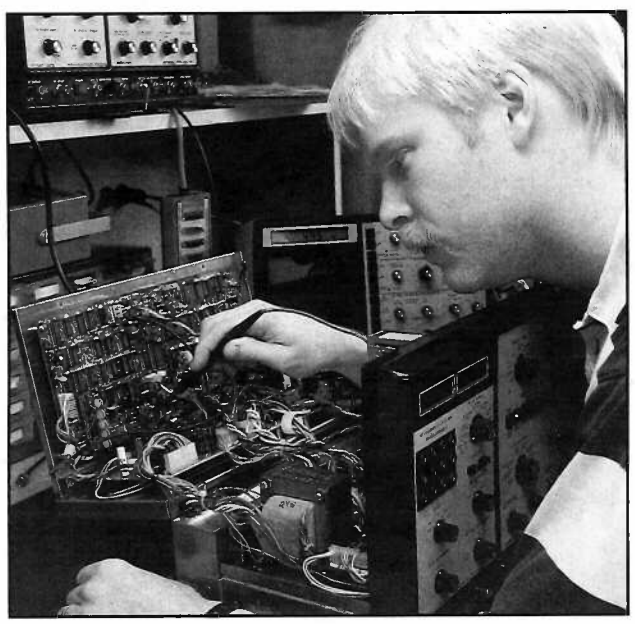


Fig. 1: Your serviced instrument is refurbished and quality checked like new units.

Then after it has been serviced, UPS will deliver it back to you. Total shipping time both ways should be less than ten days and will be at no additional cost to you.

Three Day Turnaround Keeps Down Time To A Minimum

Your VA62 will receive top priority and should be back on its way to you within three working days after we receive it. This will hold down time to a minimum and allow you to schedule your workload accordingly.

Additional Channels Equip You For Today's New TVs

Your VA62 generates cable channels 2 through 73. With the EPROM update, the VA62 is transformed into a generator that produces cable channels 2 through 99. Most new TVs have the capability to receive these channels and the update allows you to test these 26 additional channels.

Repair And Calibration — Plus Circuit Repairs At No Additional Charge

As part of this update, the VA62 needs to be recalibrated. Calibration assures you the instrument is operating at peak performance. Also if we notice there is a defective circuit, we will repair the problem at no additional charge. ***NOTE**: All Sencore instruments are calibrated with standards that are traceable to the National Institute of Standards and Technology (N.I.S.T.).*

Project Improvements Added — At No Additional Charge

From time to time, our Engineering Staff releases notices on how we can improve the reliability of our instruments. If your VA62 hasn't been returned within the last year, we will add these circuit improvements at no additional cost.

New Literature And Front Panel Completes The Update To A VA62A

A new manual, schematic, and channel sheet will be included with your VA62. The front panel will also look new after we install new escutcheons and pull chart. These finishing touches will complete the update of your VA62 to a VA62A.

If you cannot be without your VA62 the few days it would take to update, we do have a loaner program. These loaner instruments are available to you, for a small fee, while you have yours updated. However, if you are a member of the Sencore Key Customer Club, there is no loaner fee other than shipping. Call your Sencore Sales Engineer Toll Free **1-800-SENCORE** for more details on how you can qualify for a Key Customer Club membership.

Here's How To Order

To get the entire update for $295, just call the Service Department at **1-800-SENCORE**. We will schedule a pick-up order so you can enjoy the benefits or owning a VA62A. ❐

Fig. 2: Our standard 72-hour turnaround on service repairs and 48 hours on parts gives you maximum productivity from your test instruments.

Customer Support
Value-Added Services

Easy Access

One number, **1-800-SENCORE**, connects you 24 hours a day to a factory full of friendly folks dedicated to making you and your business more successful.

The same Toll Free success number that connects you to a fast, friendly Sales Engineer also connects you to our Applications Engineers for technical consultation and to Service Technicians for quick field repair tips—all at no added expense to you. You simply need to pick up the phone and ask.

Our receptionist will make sure your call is forwarded to your party promptly and accurately. Or, you can leave a message with our message center.

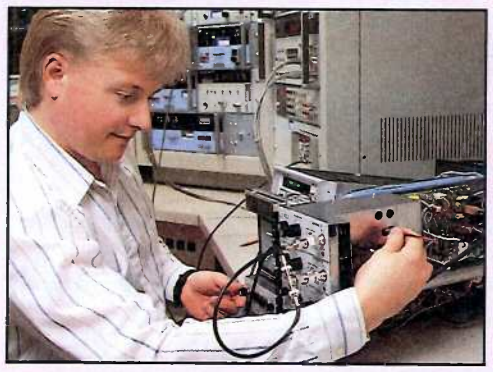
Sales Engineers

You have instant access to a friendly, technical Sales Engineer for technical, operational, or applications information on Sencore instruments, or assistance with consumer product servicing.

- Keep up-to-date with changing technology; find out what's happening in the industry.
- Get great deals on specials or pricing; set up your own "package" for instant savings.
- Make seminar reservations; get times, dates, and places for seminars in your area.
- Get help with instrument comparisons; compare Sencore instrument features with other manufacturers' equipment.

Quality

Traceable to National Institute of Science and Technology (NIST)



You can be sure your instrument is right, as each unit is calibrated against Sencore's NIST traceable prime standards.

Quality and NIST traceability give you extra value—you can buy Sencore instruments with confidence, knowing that:

- Measurements are 100% right and traceable;
- You'll receive a product that operates and functions correctly the first time, every time;
- Your instruments are protected with Sencore's exclusive Lifetime Made Right Guarantee;
- Sencore instruments are built in an environment focusing on continual improvement;
- Only the best components are approved for use in Sencore products — all are proved reliable.

Applications

Technical application support helps ensure your success in electronics servicing.

Applications Engineers help you use and operate your Sencore instruments by researching and writing:

- Simplified Guides
- Tech Tips
- Video Tapes
- Bulletins
- Sencore News

With a quick phone call, you can learn about new technology or get assistance using Sencore instruments.

Applications Engineers also hold technical training Seminars giving you "hands-on" opportunity to evaluate Sencore instruments. They listen to your questions and ideas and investigate servicing challenges.

Dedicated To Serving You . . .

Seminars

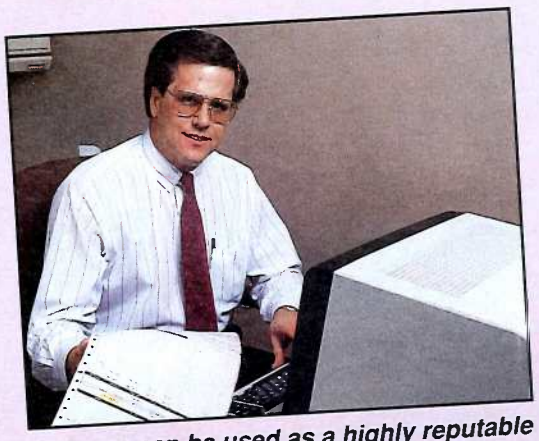
We offer exclusive Sencore Factory instrument demonstrations in your area on a regular basis. You can see first-hand how an investment in Sencore instruments will add value to your servicing capabilities by:

Talk with Application Engineers and get your questions answered . . . on the spot.

- Updating your electronic product technical knowledge and trouble-shooting techniques;
- Seeing how to dynamically walk tough dog problems out in half the time;
- Increasing your overall service projects through exclusive performance testing.

Call **1-800-SENCORE** for seminars in your area—ask your Area Sales Engineer to reserve a seat!

Finance



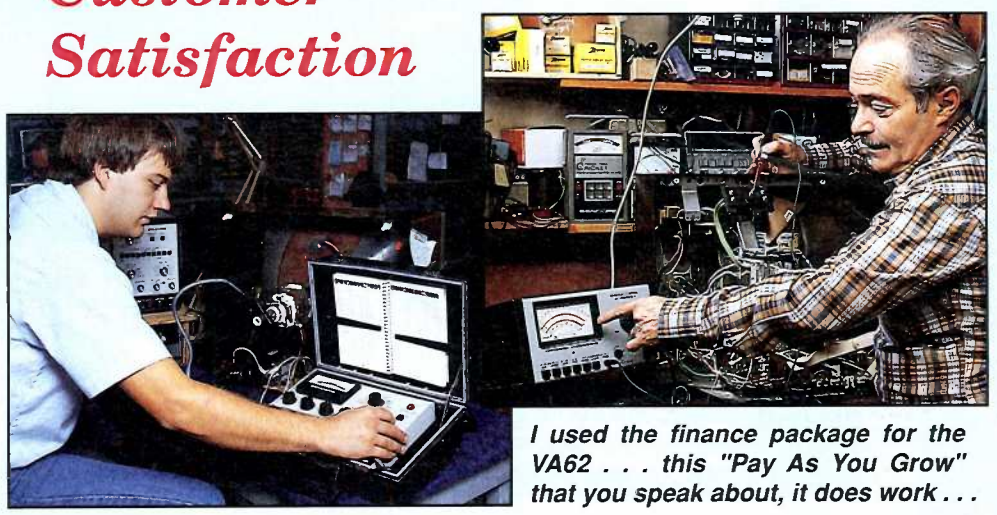
Sencore can be used as a highly reputable trade reference with other creditors.

Sencore's own finance division offers you a wide range of flexible purchasing terms at low rates:

- Choice of 6 to 48 month "Pay As You Grow" investment plans that include add-on plans with zero dollars down, with approved credit;
- 2 to 5 month split payment plan;
- 1% 10/Net 30;
- MasterCard or Visa;
- COD or cash in advance with free freight and a 2% discount.

Automatic bank checking program for your convenience; all credit transactions conducted in strict confidence; fast and accurate order processing — 95% order clearance within 24 hours; prompt and courteous response to customer inquiries.

Customer Satisfaction



I used the finance package for the VA62 . . . this "Pay As You Grow" that you speak about, it does work . . .

Only Sencore offers you a 100% Lifetime Made Right Guarantee. This exclusive Buyer Protection Plan assures you that your unit was engineered and manufactured right—or we'll make it right—for the lifetime of the instrument, at no cost to you.

You can't make a wrong buying decision when you say "yes" to investing in Sencore. You're not investing in just an instrument, you're investing in your own piece of an entire organization dedicated to making you more successful. You get more with Sencore; we like to call it *ADDED VALUE* . . .

Service

Your serviced instrument is refurbished and quality checked just like new units—then returned in new packaging, at no extra cost.

- You get fast 72-hour service turnaround at no extra charge.
- One Toll Free line links you to service professionals who can help you with instrument repair questions.
- Your serviced instrument is updated with the latest safety, protection, and reliability circuit improvements at no extra charge.
- Only original replacement parts are used to repair your instrument.
- Instruments are returned in fresh new boxes and packing inserts to insure your instrument isn't damaged in shipping.
- Any instrument serviced under the one year warranty is recalibrated FREE!

Call 1-800-SENCORE Today!

Cut Your Video Troubleshooting Time By 54%* With The VA62A Universal NTSC Video Analyzing System

New And Improved!

VA62A Universal Video Analyzer

Patented

- *Identify tuner problems with All-Channel, VHF, UHF, and Cable RF Generators.*
- *Pinpoint IF Problems with modulated troubleshooting signal and exclusive programmable IF/RF generators.*
- *Isolate any video problems with patented video and standard color-bar patterns.*
- *Find defective stages, without disconnecting parts, using exclusive phase-locked drive signals.*
- *Test yokes and flybacks, plus measure signal levels with autoranged digital meter.*

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

Call 1-800-SENCORE
(736-2673)

Update For New Technology With Exclusive Phase-Locked Accessories

VC63 VCR Test Accessory

Solve the VCR servicing challenge with substitute VCR signals, phase-locked to your VA62A.

ST65 Video Analyzer Stereo TV Adder

Easily test and troubleshoot today's new MTS Stereo TVs & VCRs.

NT64 NTSC Pattern Generator

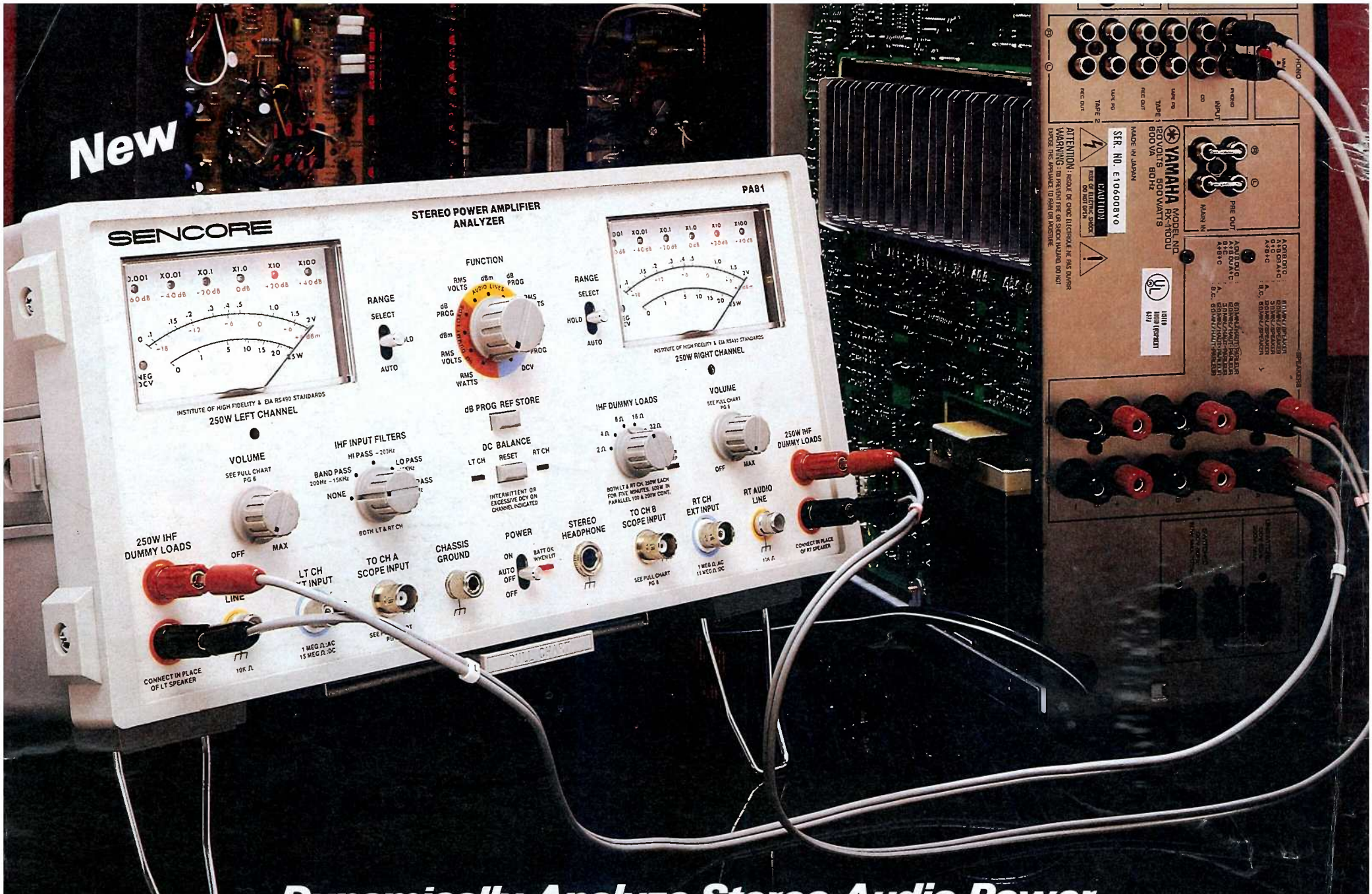
Meet all Warranty Requirements by adding the NTSC full-field and split-field patterns to your VA62A Universal Video Analyzer.

RG67 NTSC Video Monitor Adaptor

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

SENCORE

New



RS232 Compatible

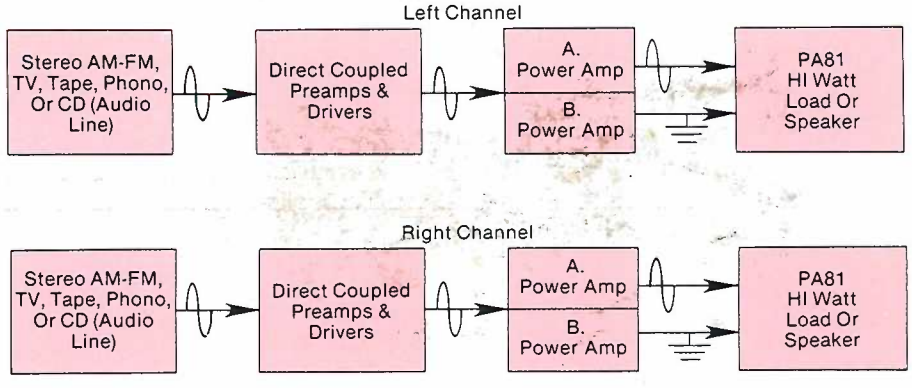
IEEE 488 BUS-COMPATIBLE

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

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.

SENCORE

3200 Sencore Drive, Sioux Falls, South Dakota 57107

Form 4305 Printed In U.S.A.

Call 1-800-SENCORE
(736-2673)

Ask About A 10 Day Video Preview

tech tape™