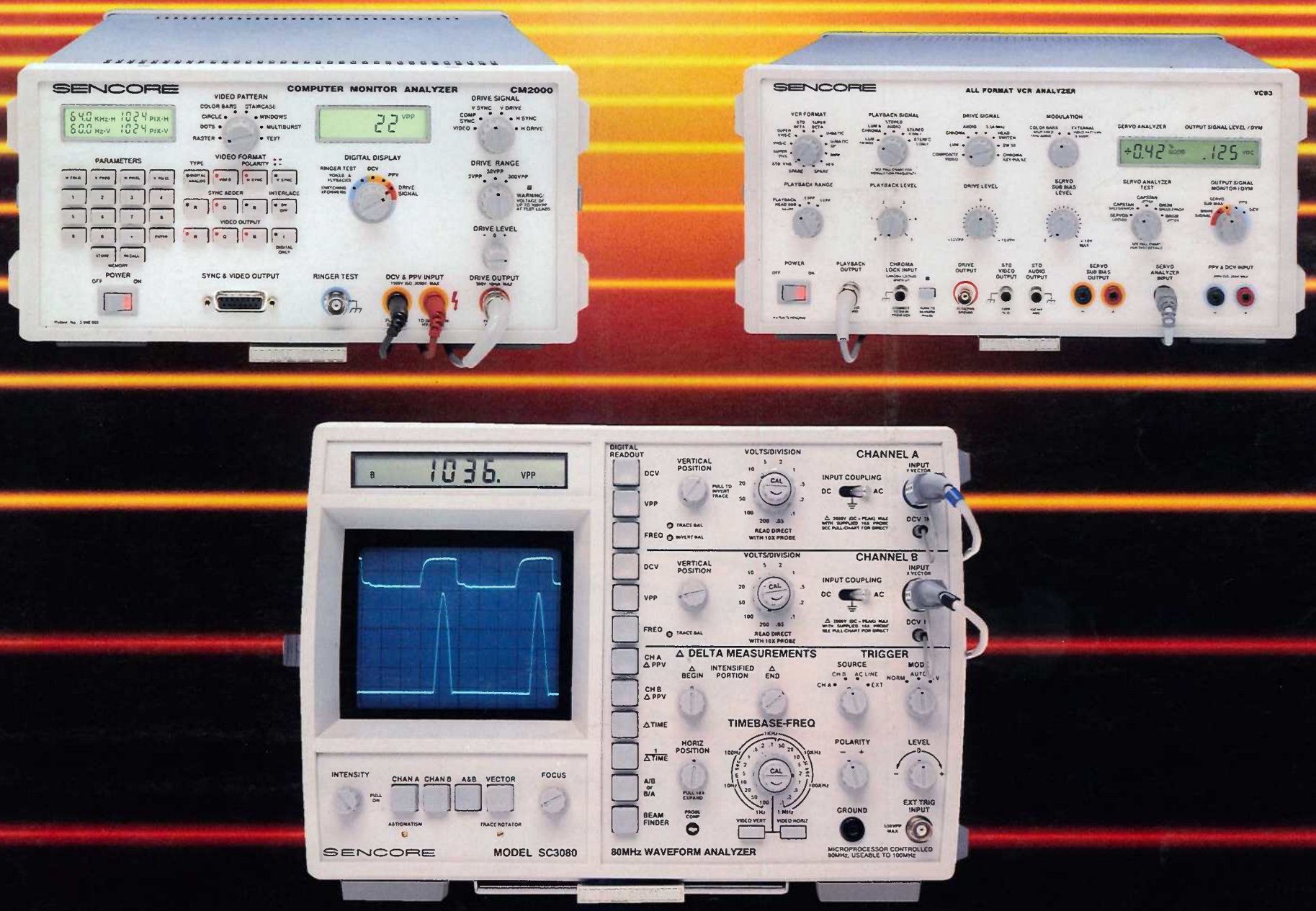
SENCORE NEWS

Issue #156 Jan./Feb. 1992



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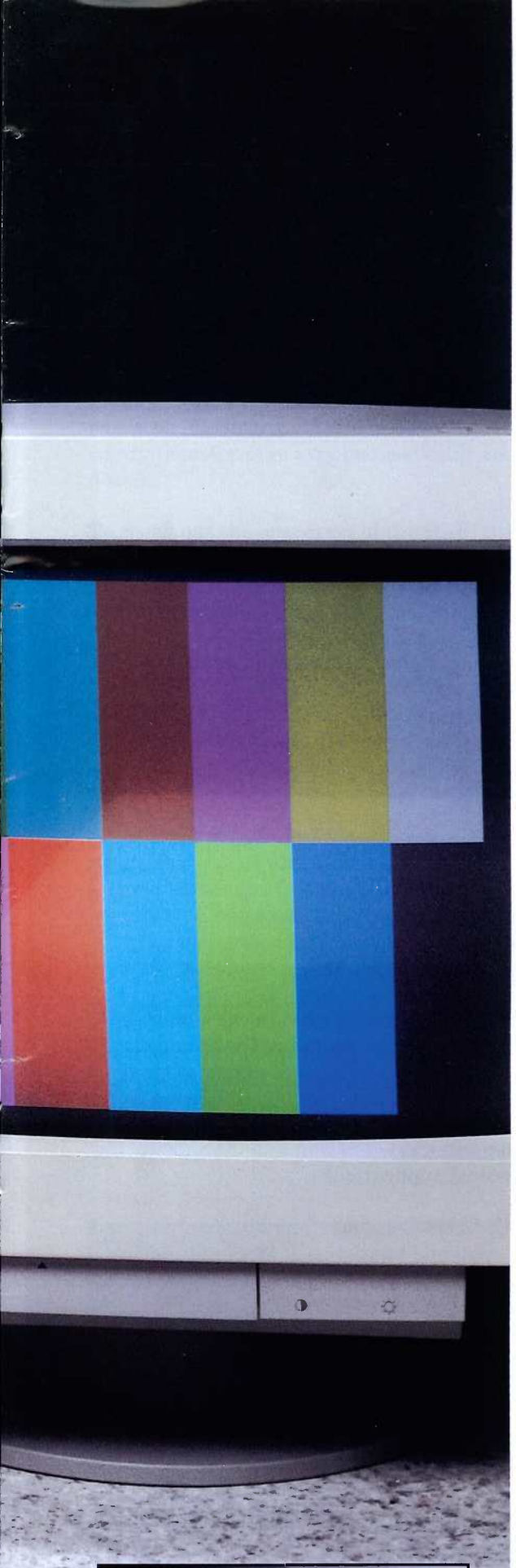

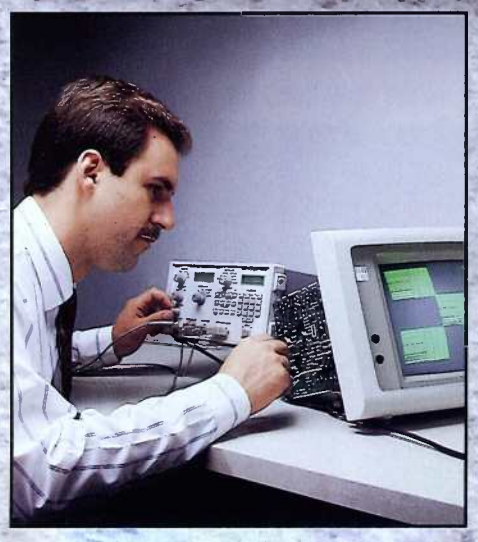

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Connecting The CM2000 To A Computer Monitor

By Stan Warner, Application Engineer

In This Issue

Computer monitor manufacturers are continually working to improve graphic clarity and resolution of their products. The CGA (color graphics adapter) monitors of the early 80's had poor resolution and rather fuzzy graphics as compared to the new monitors presently on the market. Today's mainstream monitors are capable of displaying crisp graphics and text. High-end monitors can produce fabulous pictures with crystal clear resolution.

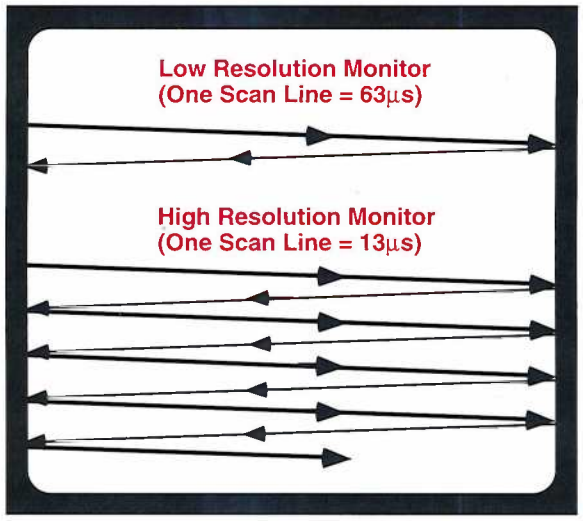


Fig. 1: A high resolution monitor scans across the screen over four and half times in the time a low resolution monitor scans across the screen once.

The improvements in computer monitor picture resolution have been made through a number of technological advancements. First, with the newer computer monitors, the horizontal scanning frequency has been increased so the electron beam travels across the screen much faster (the electron beam of a CGA monitor takes about 63 µSec to travel across the screen and back, while a new high resolution monitor takes about 13 µSec).

Second, more pixels are being displayed on a single horizontal line and more lines are being displayed in each field. While the CGA computer monitor has 640 horizontal pixels and 200 lines, today it's not uncommon for computer monitors to have 1,024 horizontal pixels and 1,024 lines (or more). When faster scan rates are combined with more pixels, it's easy to see that many more pixels are displayed in less time, creating a higher resolution display.

As a servicer, you will need to work on a wide variety of computer monitors that come into your service shop. While one repair job may be a low resolution text monitor, the next one may be a super high resolution monitor used for computer aided design and manufacturing or medical applications.

The CM2000 Computer Monitor Analyzer has been designed to analyze low resolution monitors, high resolution monitors, and all the monitors in between. If you don't have this flexibility, you could be forced to turn away potentially profitable service business.

The first step in servicing a computer monitor is hooking up the monitor to the CM2000 and getting a pattern on the screen (if the defective monitor is capable of displaying video). From this point you can recreate the customer's complaint and assess the nature of the problem.

Fig. 2: The first step in servicing computer monitors is trying to recreate the customer's complaint. This will help you assess the nature of the problem.

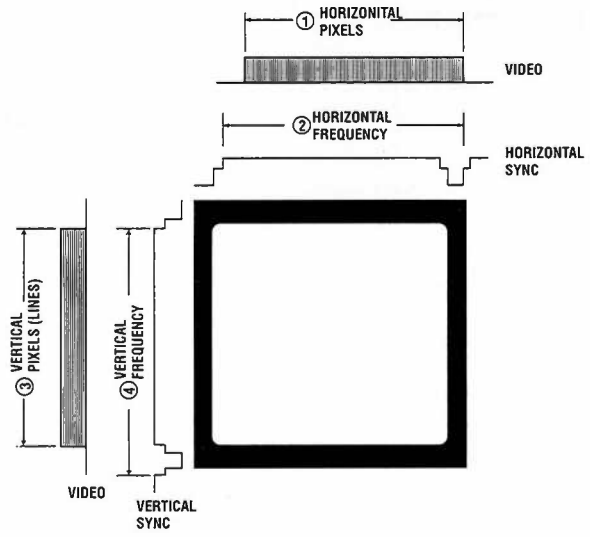


Fig. 3: A computer monitor's performance capabilities can be defined by four parameters: (1) horizontal pixels, (2) horizontal frequency, (3) vertical pixels, and (4) vertical frequency.

Hooking up a computer monitor and getting a pattern on the display with the CM2000 Computer Monitor Analyzer can be completed in three simple steps (or less).

They are:

1. Setting the parameters
2. Setting the video format
3. Hooking up the correct connector

This article covers each of these three steps. It will also show how the setup process can be simplified when you use the CM2000's RECALL memory function.

Setting The Parameters

Four main parameters determine the performance capabilities of a computer monitor: horizontal pixels, horizontal frequency, vertical pixels (lines), and vertical frequency. Here is a brief explanation of each (see Figure 3):

Computer Monitor Formats

Monitor Type	H FREQ	V FREQ	H PIXEL	V PIXEL	DIGITAL ANALOG	H SYNC	V SYNC	Sync Adder	Interlace
CGA	15.7	60.0	640	200	DIGITAL	+	+	OFF	OFF
NEC DH	16.0	60.3	640	200	DIGITAL	+	-	OFF	OFF
HITACHI 2	17.3	62.4	512	512	ANALOG	+	-	OFF	ON
HERCULES	18.4	50.0	720	350	DIGITAL	+	-	OFF	OFF
MDA	18.4	50.0	720	350	DIGITAL	+	-	OFF	OFF
EGA	21.8	60.0	640	350	DIGITAL	+	-	OFF	OFF
NEC P2	24.8	56.4	640	400	DIGITAL	-	-	OFF	OFF
		60.0	640	400		COMPOSITE SYNC		OFF	

Fig. 4: A portion of the chart that contains the setup information of common computer monitor types. The full chart appears on the CM2000 Pull Chart and in the CM2000 manual Appendix D.

① **Horizontal Pixels** are the number of dots or picture elements that can be displayed horizontally. A pixel is the smallest dot or picture element the monitor can produce.

② **Horizontal Frequency** is the number of times per second the electron beam travels horizontally across the CRT and back (horizontal scan).

③ **Vertical Pixels** are the number of picture elements that are displayed vertically on the CRT. Vertical pixels are also referred to as "lines."

④ **Vertical Frequency** is the number of times per second the electron beam travels from the top of the CRT to the bottom and back (vertical scan).

These four parameters are generally found in the computer monitor's service literature. If you do not have the service literature, you can identify the computer monitor type and find the parameter information in the CM2000 Pull Chart, or Appendix D of the CM2000 manual.

For an example, let's walk through the steps that would be needed to set the parameters for an EGA computer monitor.

1. Find the parameters for an EGA monitor in the monitor's service literature, CM2000 Pull Chart, or in Appendix D of the CM2000 manual.

2. Press [H FREQ] [2] [1] [.] [8] [ENTER]
3. Press [V FREQ] [6] [0] [ENTER]
4. Press [H PIXEL] [6] [4] [0] [ENTER]
5. Press [V PIXEL] [3] [5] [0] [ENTER]

After you have completed the five steps, the CM2000 is generating the horizontal and vertical sync frequencies and pixel resolutions required by an EGA computer monitor. The numbers in the PARAMETERS display should match those shown in Figure 5.

Setting The Video Format

The second step to hooking up to a computer monitor is setting the correct video format. This includes setting the monitor type, the polarity of the video, horizontal, and vertical sync signals, the sync adder, interlace, and the video outputs. Again this information is found in the service literature, the CM2000 Pull Chart, or in Appendix D of the CM2000 manual.

Here's is a brief explanation of each of these settings:

Type - Monitors require either digital or analog input signals. This button sets all the SYNC & VIDEO OUTPUT video signals to digital levels (LED "on") or analog levels (LED "off").

Polarity - The POLARITY format buttons establish the polarity of the video, horizontal sync, and the vertical sync signals at the SYNC & VIDEO OUTPUT jack. The LED indicator lights for "+" polarity and is not lit for "-" polarity. Most monitors require "+" video polarity. Incorrect sync polarities may have no effect on some monitors and may cause loss of sync in others. Some monitors use different sync polarity combinations to select operating modes.

Sync Adder - The SYNC ADDER buttons select the video line to which the sync information is added. Selecting R, G, or B adds both the vertical and horizontal sync (composite sync) to that signal line. Sync is added to a line when the corresponding LED indicator is lit. Sync can only be added to analog monitors.

Interlace - This button switches the vertical sync between interlaced scan (LED "on") and progressive scan (LED "off"). Set it to match the monitor type you are servicing. Most monitor types use progressive scan.

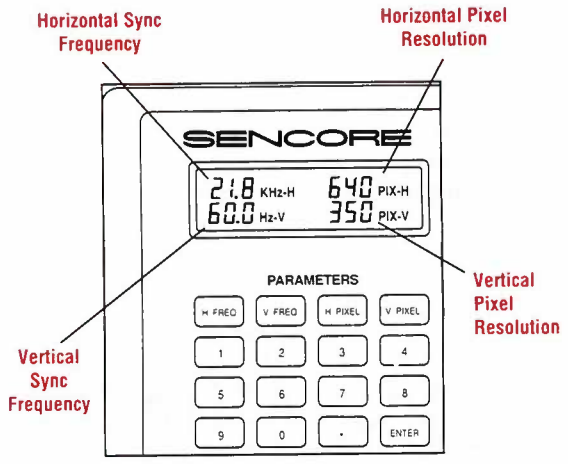


Fig. 5: This is how the display should look after you've entered the parameters for an EGA computer monitor.

Video Output - Use these buttons to make the R,G,B, and I output lines active (LED "on") or inactive. The "I" (intensity) line is used by some digital monitors to provide an additional signal level step between on and off.

To continue with our example, let's walk through the steps needed for setting the video format of an EGA computer monitor.

1. Find the video format information for an EGA monitor in the monitor's service literature, CM2000 Pull Chart, or in Appendix D of the CM2000 manual.

2. Set [DIGITAL ANALOG] to DIGITAL.
3. Set [VIDEO] to "+".
4. Set [H SYNC] to "+".
5. Set [V SYNC] to "–".
6. Set SYNC ADDERS [R] [G] [B] to "off".
7. Set INTERLACE [ON OFF] to OFF.
8. Set VIDEO OUTPUT [R] [G] [B] [I] to "on".

After you have completed the eight steps, the format of the signals generated by the CM2000 will match those required by an EGA computer monitor. The LED indicators on the VIDEO FORMAT buttons should match those shown in Figure 6.

Using The Memory STORE And RECALL Functions

The parameter values and video format settings of the most common computer monitor types are stored in the CM2000's permanent memory. This memory function saves you the hassle of having to enter all of the setup data on each monitor you service. It allows you to quickly recall complete monitor setups, by entering the storage location of the desired setup.

The memory presets consist of three groups:

1. Standard Setups
2. User Setups
3. Computer Interface Setups

All the setups can be recalled from the front panel keypad, but only the "User Setups" can be programmed from the front panel.

Standard Setups: Presets 0 through 19 are the setups for the most common monitor types. They are listed in Appendix E, and in the pull chart beneath the CM2000. These setups are preprogrammed into the permanent memory and cannot be erased or changed by the user.

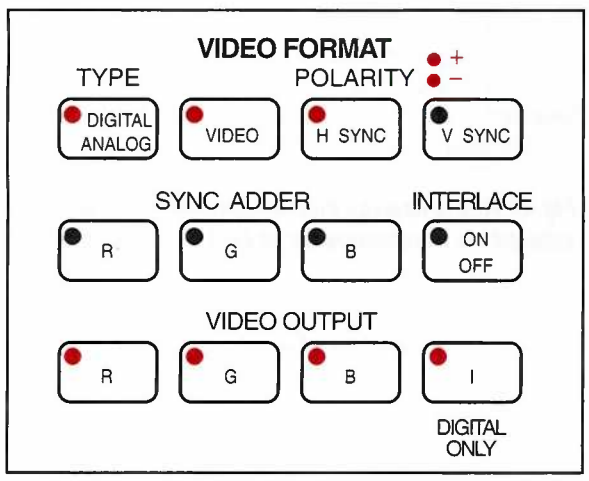


Fig. 6: Here's how the VIDEO FORMAT buttons should look for an EGA computer monitor.

User Setups: Presets 20 through 39 can be programmed from the front panel keypad using the STORE button. Use these presets to store special setups used in your servicing. The setups will not be lost when power is turned off.

Computer Interface Setups: Presets 40 through 59 can only be programmed via the INTERFACE ACCESSORY jack, but can be recalled from the front panel RECALL button. The setups will not be lost when power is turned off.

Recalling the setup for an EGA computer monitor.

1. Find the memory storage location of the EGA monitor from the table in the CM2000 Pull Chart or Appendix E in the CM2000 manual.

2. Press RECALL 2 ENTER

The CM2000 is now generating the correct parameters and the video format required for an EGA computer monitor. The PARAMATERS display and the LEDs on the VIDEO FORMAT buttons should be the same as those in Figures 5 and 6.

CM2000
COMPUTER MONITOR SETUP
STORAGE LOCATIONS

Format	Storage Location	Connector
CGA	0	1
Hercules, MDA	1	1
EGA	2	2
PGC 1	3	3
PGC 2	4	3
MCGA 1, VGA 1	5	4
VGA 2	6	4

Fig. 7: A portion of the chart that contains the storage location of common computer monitor setups. The full chart appears on the CM2000 Pull Chart and in Appdendix E in the CM2000 manual.

Hooking Up The Correct Connector

Now that the CM2000 is generating the correct signals out of the SYNC & VIDEO OUTPUT jack, you are ready to hook it up to the computer monitor.

There are quite a number of different monitor input connectors and wiring configurations. Some take a 9 pin D-sub, others a 15 pin D-sub, others a 15 pin high-density D-sub, and still others BNC connectors. Building a connector for each computer monitor type can be a time consuming task.

Along with the CM2000, there are connectors available for hooking to the most common computer monitor types. A listing of the available connectors is shown in Figure 9. This chart also appears on the CM2000 PULL CHART and Appendix A in the CM2000 manual. These connectors convert the output of the CM2000 to match the required input of the monitor you are servicing.*

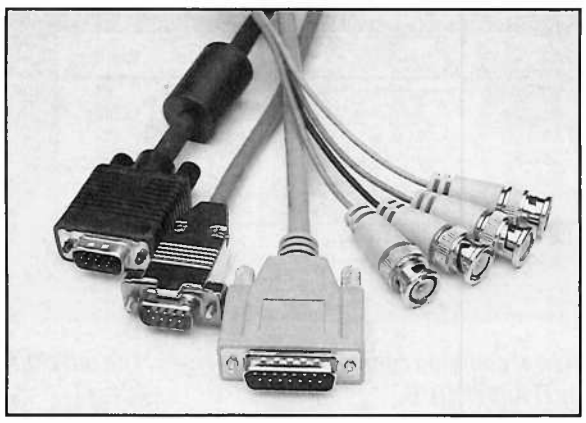


Fig. 8: Computer monitors have a variety of input adaptors.

Choosing the correct connector for an EGA computer monitor.

1. Find the type of monitor to be serviced on the CM2000 Pull Chart or Appendix in the CM2000 manual and note the necessary connector.

2. For an EGA computer monitor, hook up the monitor cable to Connector #2 and the connector to the SYNC & VIDEO OUTPUT jack of the CM2000 as seen in Figure 10.

You should now have a pattern on the computer monitor screen. If you do not, make sure

CM2000
Connector Chart

Connector	*Computer Monitor Type*
1	CGA, MDA, Hercules
2	EGA
3	PGC
4	VGA, PS/S SVGC, XGA
5	Apple or Mac
6	BNC Input
Universal	Adapts to match any computer monitor type

Fig. 9: Connectors are available for hooking the most common computer monitor types to the CM2000.

the CM2000 is generating the correct signals for the computer monitor being tested. Also make sure you are using the correct connector.

Now, and in the future, in order to be profitable in the computer monitor servicing business, you'll need an instrument that is capable of analyzing all of the different types of monitors that come into your service center. The CM2000 Computer Monitor Analyzer has been designed for analyzing low, medium, and high resolution monitors.

Hooking up the CM2000 to a computer monitor can be completed in three simple steps: (1) set the parameters, (2) set the video format and (3) hook up the correct connector. If the monitor setup is stored in one of the CM2000 memory locations, steps (1) and (2) can be completed by just recalling the storage location. The CM2000 will automatically be setup to generate the signals needed by the monitor under test.

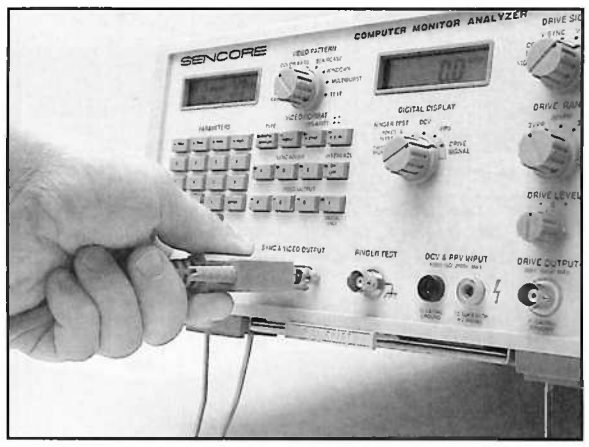


Fig. 10: Plug one end of the connector into the end of the computer monitor's cable and the other end into the CM2000's SYNC & VIDEO OUTPUT jack.

If you are interested in finding out for yourself how easy it is to get a pattern on the monitor with the CM2000 Computer Monitor Analyzer, just give us a call at **1-800- SENCORE**. You'll be amazed how the CM2000 will help you quickly get up and running in the profitable computer monitor servicing market. ■

For more information on using the CM2000 Computer Monitor Analyzer, circle FAST FACT #250.

**Note: The interface connectors may be ordered through the Sencore Service Department. Contact the Service Department at:*

Sencore Service Department
3200 Sencore Drive, Sioux Falls, SD 57107
1-800-736-2673

LETTERS To The Editor

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

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

Block Diagrams Simplify Troubleshooting

I just received your latest edition of the Sencore News and found the articles enlightening. The article on the CM2000 gave a good account on what the unit can do using a block diagram. I'm sure that writing more articles such as this could make this unit a good sales item. In the future you could place sections out of your CM2000 Instruction Manual in the news regarding the set up and service of computer monitors using the block diagram as a reference. I also think that the Sencore News would be much better in a pocket size or magazine format, so that it would be easier to store for future reference.

Frank Blaskovich
Eggersville, NY

Editor's note: Thanks Frank. Your request for information on using the CM2000 is featured in this issue. As for size of the Sencore News, it's definitely something to be considered and has been requested by other servicers. We'll discuss it with our printing vendors.

Just Ask Me!

I would like to tell you just how happy I am with this Sencore equipment. I really don't know how any shop can service properly without it. I check every FM envelope on every VCR that comes through my shop. The very first day I received the equipment I was able to put it to work for me.

The bottom line is, if you ever need a recommendation to a possible customer, please feel free to either supply them with a copy of this letter or have them call me.

Don W. Cox
Lodi, OH

Don, to save us both some time we decided the Sencore News was the place to publish your letter. Thanks.

Quick Fixes

I was pretty excited about my initial experience with the CM2000 so I thought I would drop you a note to tell you about it.

I had spent the best part of the day on an IBM EGA monitor that had failed following a previous repair to the power supply. The horizontal sweep output and driver were now bad. When I replaced the failed components, the symptoms were low B+ and over temperature. In the horizontal driver section I found reduced width. After replacing and testing all the related semiconductors and components, I seemed to be chasing my tail. This was THE longest that I had ever spent on a monitor! I was starting to wonder about the real meaning of life when the door bell rang. It was the UPS driver with the CM2000. (Now comes the good part.)

While I was glad for the diversion, I was not sure that the CM2000 would be of any assistance with this problem. (Just goes to show you how wrong first impressions can be.) After opening the box, I was up and running in less than 10 minutes.

I had been wondering if the high voltage driver might be loading down the system and creating the problem. One measurement of the peak-to-peak on the collector of the flyback driver with the CM2000, showed that it was correct (780Vp-p). In less than one minute I eliminated most of the high voltage section. Next, a few measurements of the peak-to-peak voltages in the horizontal sweep section eliminated most of it. I had already substituted a yoke, but since I now had a good way of testing inductors, (the Ringing Test) I tested the original one. It was good. Five minutes had now passed, and there were only three other coils in the horizontal sweep circuit. The first two I checked were okay, the last one, (why is it always the last one?) was bad. The CM2000 had left no doubt about it. A quick search of my spare parts turned up a replacement, and in another 2 minutes, the monitor was running. A total of 15 minutes was all that I needed to repair the monitor. I'm not sure if I would have ever found the problem without the CM2000. In the hundreds of monitors that I've repaired, I have never seen a failure of a simple inductor. Perhaps a better technician could have achieved the same results quicker and without the CM2000, but I doubt it. Of course, I used the CM2000 to set up the monitor with the available test patterns. It was a snap.

You folks have created an excellent piece of test equipment, and I'm looking forward to working with it more.

Chuck Miller
Duluth, GA

Chuck, thanks for the story. This is exactly the material we're looking for when putting the "Letters To The Editor" section together.

P.S. Wouldn't it have been nice if you could have received your new CM2000 a day earlier?

We Invite Your Letters

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

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

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

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

(Electronics Service Management System)

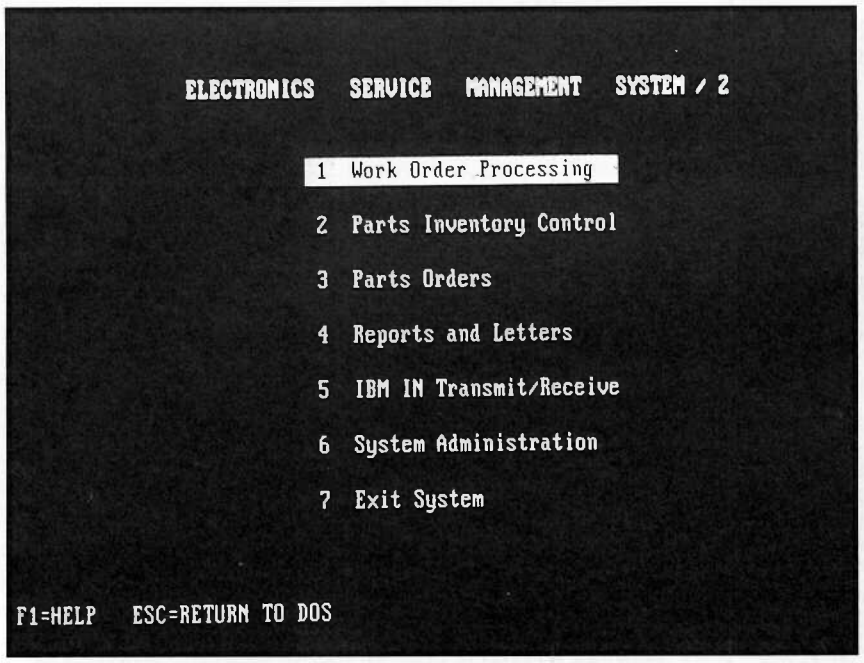
By Brad Johnson

" . . . we know exactly what's happening with the customer's set, and they really like that!"

Brenda Godwin
Bill's Electronics

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

- Have you ever been embarrassed to admit to a customer that you don't know where their unit is in the repair process?
- Have you ever had a customer pick up their unit because it has been sitting waiting for parts you thought were ordered?
- Do you ever wish you had the right information to better operate your business in areas such as parts usage, technician efficiency, and job assignments, to name just a few?
- Wouldn't it be nice to be able to have a letter sent to your customers on the status of their repairs?
- Do you get frustrated waiting for your warranty claims to be paid knowing that you have dollars tied up in a repair?



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

The Answer Is IBM ESMS/2

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

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

IBM ESMS/2 is an Electronics Service Management software system that will improve the overall efficiency of your service center. This easy-to-use software system helps your business in several ways to increase your bottom line profits.

Here is what Brenda Godwin of Bill's Electronics has to say about her experience using the ESMS/2 software:

"The ESMS system allows us to keep up with the work that has been done on a customer's set. When they call to find out if their unit is repaired, we can look the unit up in the system and tell them if the work is or is not completed. The system will also inform us if we have ordered the parts and which parts have not been received — so, we know exactly what's happening with the customer's set and they really like that.

The billing process streamlines so much of the warranty paperwork because the information is recorded — there are no questions as to if the customer's unit is within or not within warranty claims. We are generally getting paid within 30 days of the time they are submitted. In knowing what is being accepted or rejected, we have the advantage to do something before it's too late.

We have tried at least four other Management Systems and this is the most user friendly system we have ever seen."

Here's how the IBM ESMS/2 helps you organize your:

Work Order Processing

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

Parts Inventory Control

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

Parts Order

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

Reports and Letters

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

IBM IN Transmit/Receive

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

System Administration

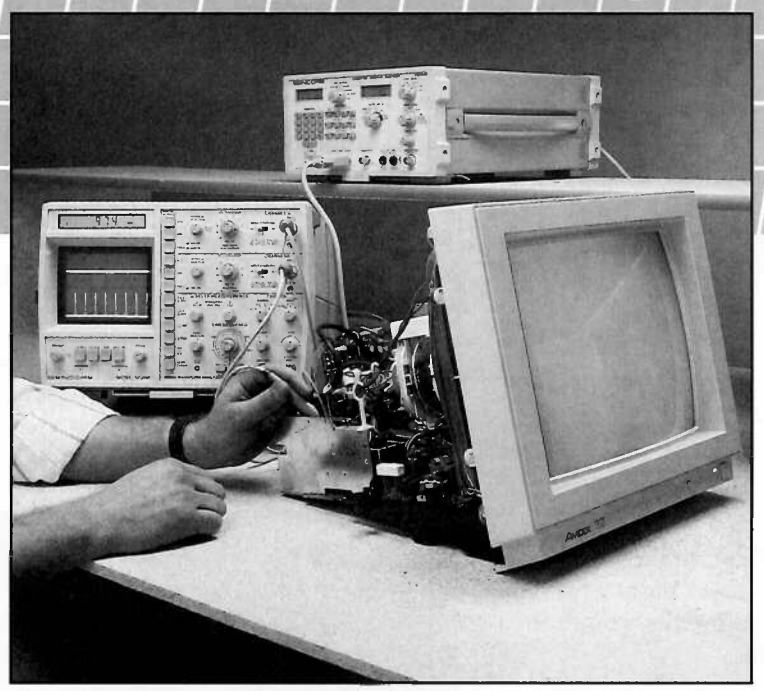
Last but not least, the IBM ESMS/2 is easy to use and ready to use. The system requires virtually no computer experience and features easy-to-follow menus and help screens.

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

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

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

Introducing: The New SC3080 Waveform Analyzer!



By Brian Phelps, Product Marketing Specialist

- **Auto-Tracking ™ digital readout**
- **Dual trace with rock solid sync**
- **5 times the measuring capability**
- **80 MHz (useable to 100 MHz) high performance**
- **Plus many extra, exclusive features**

When preparing to introduce Sencore's new SC3080 Waveform Analyzer, we found ourselves wondering how we could get the true benefits to really shine. We decided the best way to get the entire SC3080 story across was to walk you through the very thought process that we went through which resulted in the SC61 Waveform Analyzer and now the SC3080 Waveform Analyzer design. After reading the SC3080 story, we invite you to give us a call to discuss your specific applications. We feel the SC3080 could be the best investment you make this year.

Why did Sencore design the SC3080?

We designed the SC3080 because the industry as a whole could no longer afford the time it took to make routine measurements with a conventional scope. This "time issue" was a problem with conventional scopes as seen through the great acceptance of our previous 60 MHz scope–the SC61 Waveform Analyzer.

The Sencore engineering team finished designing the first waveform analyzer approximately ten years ago. It was during our original design work that we became aware that the basic scope had not been updated for over 50 years. Scopes had been made faster, more sensitive, and included special features like storage or delayed sweep, single shot triggering, and so on. But, there had been no basic improvement in the measuring methods since the first scope was introduced. They were still analog devices.

We say it's an analog device because every measurement requires interpretation of the waveform (which is not very accurate) and calculations can be confusing and time consuming.

Exactly what measurements are we talking about? Well, most schematics show three key parameters you may need to measure to determine if the circuit is working properly: the DC voltage, the peak-to-peak swing, and the frequency of the signal. You may only need to measure one of these parameters at one test point, or all three at others, depending on what is wrong with the circuit.

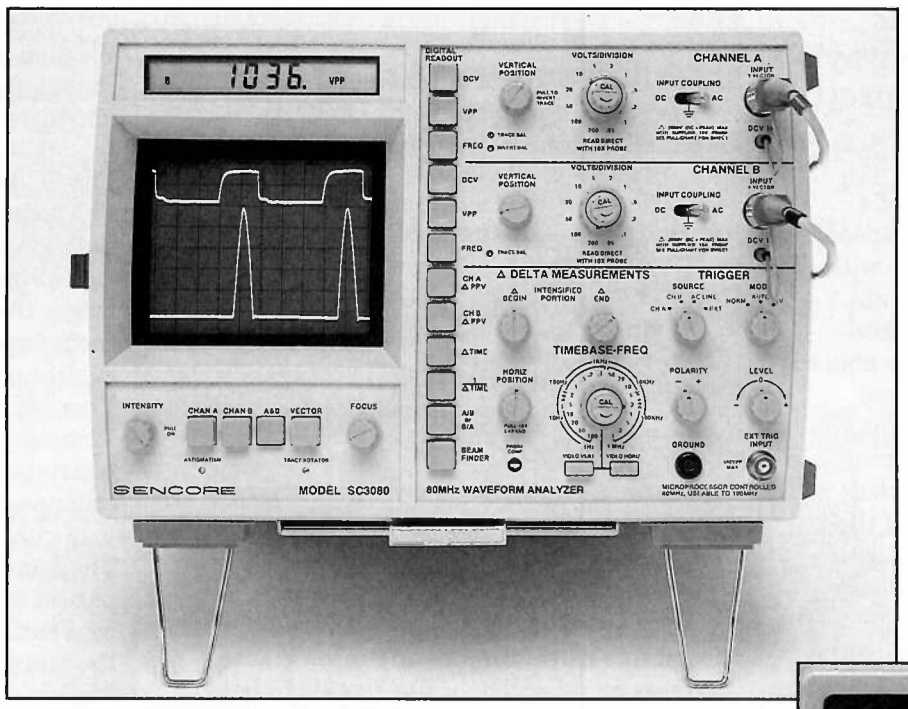


Fig. 1: Presenting our new SC3080 Waveform Analyzer.

How accurate is a conventional scope?

A conventional scope is simply not accurate enough for today's circuits. This may surprise some people, but a scope, any scope, is not very accurate.

The advertised accuracy of most scopes is between three and four percent. But this specification does not include interpretation error, which is far greater than any published spec. Let's use the waveform in Figure 2 as an example.

First, you have to decide whether to measure the signal to the top of the trace, the middle of the trace, or the bottom of the trace. Then, how closely can you estimate the waveform relative to the graticule marks? If you miss your guess by only one small division because of parallax or a minor overshoot, you could increase the measuring error to an astounding fifteen percent!

Errors this large can send you chasing down dead ends and wasting even more time. Yet these errors are minor compared to operator errors.

Operator error is the real time killer!

How would you like to have every dollar back from time wasted chasing "phantom" circuit problems that never did exist? Would you like to eliminate those time wasting problems like finding the vertical "cal" control was not set before making a reading...or the horizontal control was out of cal...or you forgot about the times ten probe...or you made a simple

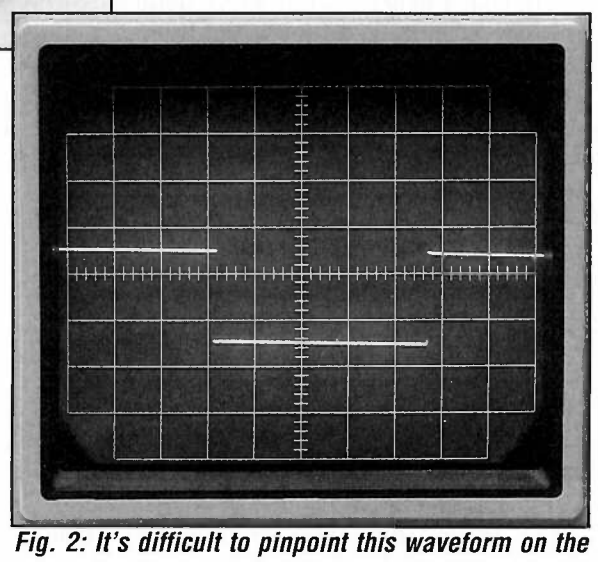


Fig. 2: It's difficult to pinpoint this waveform on the graticules. A small error here can end in as much as a 15% error.

math error? Any analog device is subject to these operator errors and it's a real problem.

Now many of you may be asking, if the problem is simply the fact that the scope is an analog device, why not just use a DVM and frequency counter?

Why not just stick a DVM and frequency counter right next to the scope?

Good question. Many techs try it. The only problem is it doesn't seem to work very well. Why?

First, you often can't keep all the equipment right there at your fingertips. Someone else grabs the meter. Or you use the counter on a different job and don't put it back. Or you have your scope on a cart and the other equipment is always at the wrong end of the bench. Whatever the reason, you still end up using your scope by itself most of the time and you're right back where you started.

Also, you may have tried to save time by connecting the meter to a test point without disconnecting the scope. This leads to a brand new problem...LOADING. The capacity of the extra probes will load the circuit, some circuits worse than others. This is especially true in high frequency circuits where too much loading can actually shut down an oscillator all together. You think you've spotted a problem and waste time "chasing electrons" until you realize the problem is in the measurements, not the circuit! And from a standpoint of errors, just look at all those leads, knobs, and controls.

There just has to be a better way! We agree, and the answer is pretty simple.

You would need to integrate the CRT of a scope (to view the waveform) with the speed, accuracy, and reliability made possible with today's digital technology, not as separate instruments in one box, but as a fully integrated measuring system. You must be able to make all measurements through just one probe so you can hook it to any test point you want, view the waveform for basic shaping, and then punch up the measurement you want. A microcomputer should do all of the calculations that normally require graticule counting for you, 100 percent automatically.

Well, that's exactly what we've done with the all new SC3080 Waveform Analyzer.

Why do we say the SC3080 is a breakthrough?

Because it uses the proven concept of totally integrating a digital readout with a scope, through one probe, so you can make any and all measurements with only one connection.

One probe is used to view and analyze any waveform up to 100 megahertz with direct digital readout of DC volts, peak-to-peak volts, and frequency – with ten times the speed and ten times the accuracy of any conventional scope or multiple pieces you might be using. You can do all this without any graticule counting or lead switching to virtually eliminate your operator errors. You make one connection and analyze any test point at the push of a button. It's truly a breakthrough in electronic instrumentation.

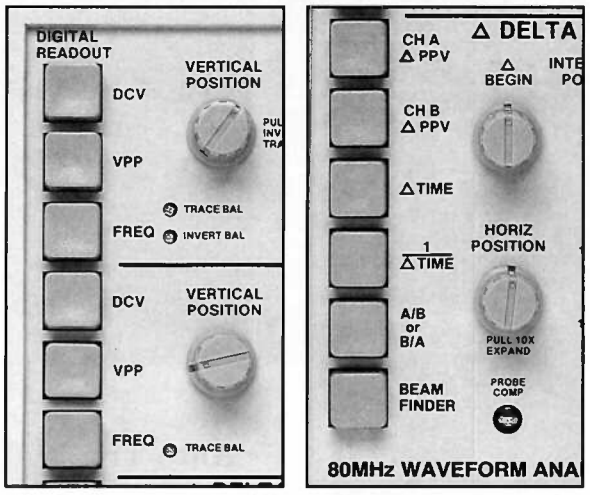


Fig. 3: You can make all these tests with just one probe connection and the push of a button.

How important is stable sync on a scope?

Stable sync is as important as the "Auto-Tracking" digital meter. The SC3080 sync circuits are guaranteed to be the most stable circuits you can buy. How can we say this? First, it uses Emitter Coupled Logic instead of TTL circuits.

ECL stages have eight times more operating range than TTL circuits, meaning you don't have to readjust the trigger controls as often as you do with conventional scopes, each time a different level signal comes on the screen.

Second, the SC3080 uses differential amplifiers in every single sync stage. Differential amplifiers eliminate internal noise that leads to unstable waveforms as any interference produces equal and opposite signals in both amplifier legs, which cancel each other. The SC3080 is the only scope in its price range that has ECL circuitry with differential amps so you can get a solid signal every time.

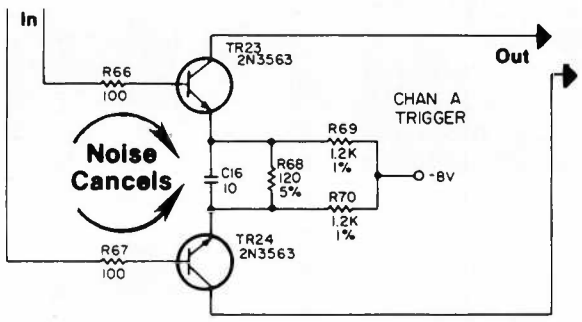


Fig. 4: The SC3080 uses Sencore's special ECL and diffential amps for the best possible triggering circuits.

Does the SC3080 have enough measuring range?

The SC3080 has four times the measuring range of most conventional scopes. The SC3080 will measure signals as small as 5 millivolts, or as large as 2,500 volts peak-to-peak. The 5 millivolt low end (using the direct probe) is adequate to measure the output of a TV tuner or the tiny chroma signals in a video cassette recorder. (When would you truly need any more sensitivity?)

Some competitive wideband scopes are only able to measure signals to 250 volts peak-to-peak, with 600 volts being the highest protection in any of the competition. The SC3080 has four times the measuring range with a full 2,500 volt rating (using the supplied probe).

Sony, Magnavox, and other manufacturers recommend that this point be measured when you have high voltage problems. Wouldn't you feel more confident working around high voltage test points with the extra capability offered by the SC3080?

In Figure 5, for example, is the 1,038 volt signal at the horizontal output transistor of a video monitor.

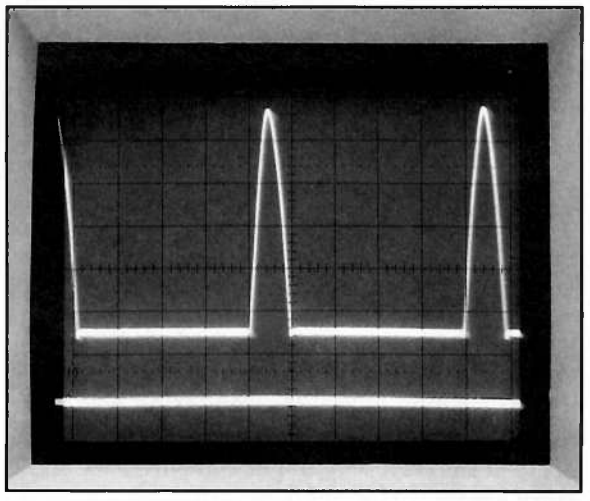


Fig. 5: A 1,038 volt signal demonstrates the versatile range of the SC3080.

Is the SC3080 easy to operate?

We guarantee it's the easiest to use scope on the market or you get your money back (during the first 30 days).

The SC3080 CRT display is super easy to use. The controls are all grouped according to function so each waveform is locked in with a logical procedure. The size of the front panel is larger than field scopes so you have plenty of room for clear nomenclature around each control, and large finger-sized push buttons. There is room to operate each control easily. There are no "knuckle busters" or cramped quarters like you find on the panels of most other scopes.

The features we've covered to this point are all part of the display section. If you had a conventional scope, that would be the end of the story, but with the SC3080, it's only the beginning! Let's look at the "Auto-Tracking" digital functions and see how we can really speed your troubleshooting and maintenance work.

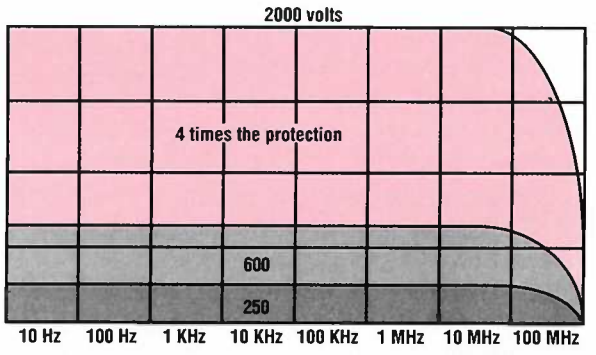


Fig. 6: This graph shows the dynamic difference between the SC3080's measuring capabilities and that of other scopes.

What is an "Auto-Tracking" digital display?

The problem with conventional scopes is they are analog devices which prove to be very time consuming, inaccurate, and laced with errors, just like the old-fashioned analog meters. We said the answer was to somehow add the speed, accuracy, and ease of operation of digital measurements to the waveform, all through one probe. That's what we have done with the SC3080 Waveform Analyzer's "Auto-Tracking" digital functions. You are about to see something that you've never seen before in a conventional scope or piggyback system.

We call these tests "Auto-Tracking" because each one tracks the signal displayed on the CRT – automatically. The microcomputer inside the SC3080 constantly monitors the input circuits and is ready to display the value you want as soon as you press one of the three "Auto-Tracking" selector buttons for channel A or channel B. Let's see how this works as we analyze this simple square-wave signal.

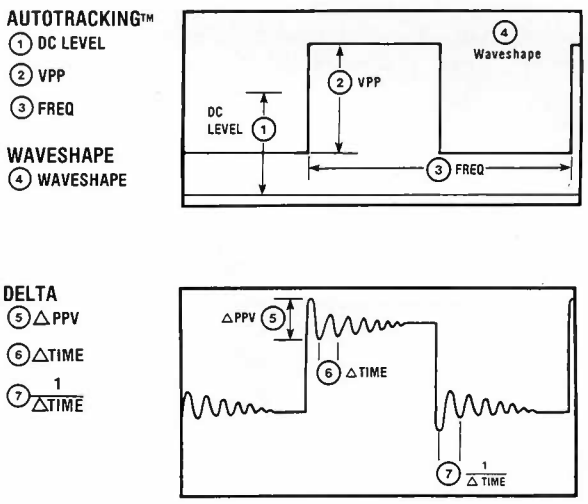


Fig. 7: Measure this typical square wave in half the time.

The "Auto-Tracking" function is at least 10 times faster than using an analog scope or separate instrument because the SC3080 tests are 100 percent automatically ranged. All tests are routed through the same probe for simple one-probe hook up that speeds every measurement.

"Auto-Tracking" is ten times more accurate

How do you think the accuracy of this reading compares to a conventional scope or piggyback system? The .5 percent digital accuracy is up to 60 times more accurate than using a scope for DC measurements. When using the special low capacity probe, the capacitance of the measuring circuits is totally isolated from any high impedance circuit you are testing, resulting in even more accurate readings than those received with a separate meter.

It's more reliable, too!

What about the chances of making a measurement error? We've already mentioned that the test is auto-ranging, so you never have to select a range. How's that for speed, accuracy, and ease of use?

It's almost fool-proof!

The "Auto-Tracking" digital display always gives the correct readings, no matter where any of the verniers or switches are set. How is this possible? The reference signals are routed to the internal microcomputer directly from the vertical and horizontal circuits, ahead of any of the CRT function controls.

The verniers and position controls are not involved in the digital readout, so there is no chance for all the errors common to an analog scope to slip into a measurement and ruin your day.

The "Auto-Tracking" tests, however, are only half the story of the Waveform Analyzer.

What About Analyzing Portions Of A Waveform?

The "Auto-Tracking" tests measure the entire waveform. But what do you do when you need to analyze part of a waveform? Let's look at some typical applications that require part of a waveform to be measured, starting with peak-to-peak voltage.

- VCR or video chassis service may require that you know the peak-to-peak level of the color burst riding on the composite video signal. Or you may need to know the amplitude of the sync pulse when troubleshooting a sync problem.

- Communications work sometimes requires a test of AM modulation, requiring the peak and trough of the modulation signal to be measured and compared to the carrier amplitude.

- The complex output of a switching power supply is made of several parts, each of which has a different effect on the output filter network to produce the final DC output.

- Pulses from mechanical position detectors in VCRs often have different positive and negative voltage swings. The negative part of the waveform is the only one that must be measured to ensure correct servo operation.

Then, there are times when the "time" of part of a waveform is important. For example...you may need to know the spacing between bits of data in a digital pulse train. You may need to know the duty cycle of a pulse, such as in a switching power supply. Other applications require that you measure the delay between two signals, such as the propagation delay of an IC, the delay of a video delay line, or the phase delay of two signals applied to the phase detector of a phase-locked loop.

You often want to know the frequency of some signal buried in the middle of some other waveform, such as interference. The extra signal may be coming from a power supply or from a stage adjacent to the one you are testing. Knowing the frequency can help you track the interference back to its source. At other times, an overshoot, a glitch, or ringing may be caused by an open component or a poor impedance match. Knowing the interfering frequency simplifies isolating the components that may be at fault. You may want to know whether an amplifier is capable of passing a square wave or pulse properly. You can measure the risetime of the signal, determine its equivalent frequency, and compare it to the frequency response of the amplifier to see if it will pass the signal.

Wouldn't it be nice to be able to make any of these measurements with the same speed and accuracy of the "Auto-Tracking" tests we covered earlier? You can – with the exclusive SC3080 Delta measurements.

You simply press any of the Delta buttons and adjust the intensified Delta measurement bar until it covers the portion of the waveform you wish to analyze. The bar may be positioned anywhere on the trace with the "Delta begin" and "Delta end" controls. Then, read the digital display. It's that easy!

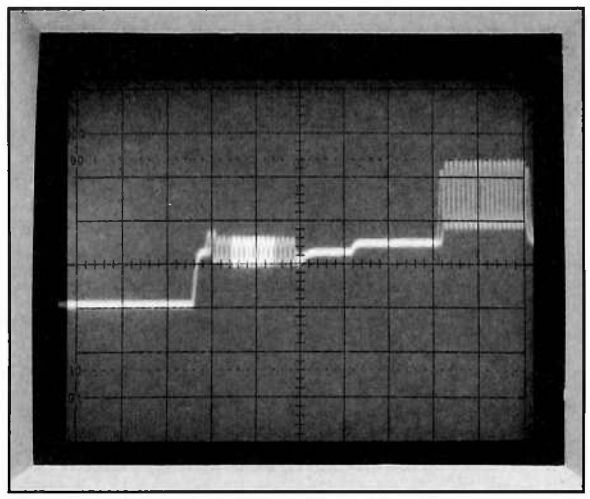


Fig. 8: Some VCR manuals require that you measure the PPV of the color burst.

Who should own an SC3080?

You should own an SC3080 if you currently use a scope and want to significantly increase your productivity. Specifically because...

The one man shop won't find an easier way to keep up with today's ever rising labor costs. The SC3080 can help get more out the door without adding personnel.

Good techs are at a premium. Whether you're working for yourself, or working for somebody, you want maximum output from these talented (and often-times expensive) techs. Why not double your output with the SC3080 by automating all of their measurements?

The school instructor is going to be able to concentrate on his lectures and lab material, and not worry about the operation of the scope. Any student can use it within minutes after he picks up his first probe.

Production Managers can now put the SC3080 in a calibration position on a production line and let nontechnical personnel set the controls with digital speed and accuracy. You get more out of nontechnical people while training and retraining time are down to almost nothing.

Broadcast engineers can use the SC3080 to measure parts of a waveform which is something they encounter daily with complex video signals.

Anyone working in digital can now measure "on time", "off time", delay time, and many

other key digital parameters that are necessary for today's digital work...all with one probe and the push of a button.

Avionics and other communications technicians are interested in the SC3080 because of its ability to read parts of a signal, especially digital information in encoder and decoder stages.

The list goes on and on. The SC3080 has many time-saving features. Some will be used more than others. It is impossible to say exactly how much time the SC3080 will save you, but we are willing to make this guarantee: "The SC3080 will cut your waveform measuring time at least in half, or you may return it during the first 30 days for a full refund, including the freight."

Is all this time saving worth $2,995?

The real cost of any unit must be spread out over the useful life of the product. If you figure that you'll use any scope for a good five years, you end up with 10,000 working hours (based on a forty hour week, fifty weeks a year). That means the SC3080 will cost you less than 30 cents a working hour, which seems like a very small investment in order to double the productivity of a tech who is costing you $5 to $10 an hour in wages and is billing out $30 an hour or more.

That's the SC3080 story. . . the SC3080 is a breakthrough. It obsoletes conventional scopes. If you are interested in better productivity, you should begin plans today to update all of your scopes with the SC3080.

Call us today toll-free, at **1-800-SENCORE** for details or to place an order. It could be the most productive phone call you make this year. ■

If you are interested in trying an SC3080 Waveform Analyzer on your bench, circle FAST FACT #258

1 Autoranging DC Volts Through A Single Probe

Read DC volts regardless of how the SC3080 is set, AC or DC coupled. Even with the input coupling to ground, you can still measure the DC voltage. Simply connect the probe and push the DCV button. Read all the way to 2500 volts. Speeds troubleshooting bias problems, calibration, and alignments, plus much more.

2 Automatic Peak-to-Peak Volts

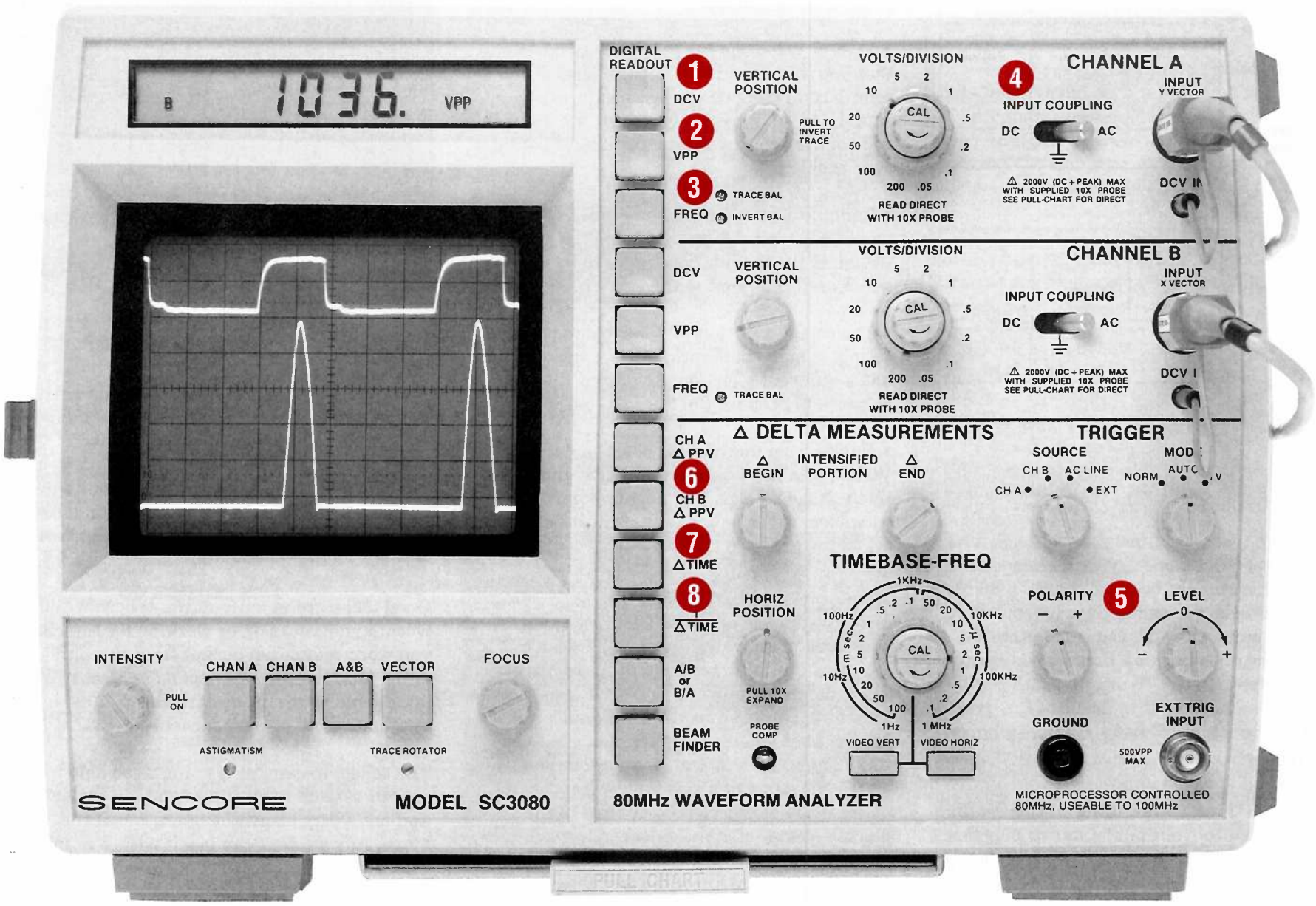
Exclusive measuring circuits provide digital readout of peak-to-peak volts. Read the amplitude of even the most complex waveforms simply by pressing the VPP button. Catch elusive high frequency glitches and spikes by comparing the digital readout to the CRT waveform amplitude.

3 Automatic Frequency Measurements – Patented

The SC3080 reads frequencies to 100 MHz at the push of a button. The readings are fast and digitally accurate. (10,000 times more accurate than frequency measurements on a conventional scope.)

4 Four Times The Measuring Range – Patented

Patented circuitry inside the SC3080 gives you a full 2500 volts (DC + Peak AC) over the entire bandwidth of the SC3080. Protected to 2500 volts (DC + Peak AC). This means you can now measure in more circuits than ever before, with the confidence that your scope's front end is safe from damage.



5 Rock Solid Sync

Triggering to waveforms is one of the biggest problems we hear from servicers. That's why the SC3080 uses extremely fast Emitter Coupled Logic and differential amps throughout the trigger circuits. Together they provide triggering all the way to 100 MHz and cancel noise to eliminate "sync jitter" delivering the most solid sync you've ever seen or used. Special video sync separators provide rock-solid triggering on hard to hold composite video signals.

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

Measure the peak-to-peak voltage of any part of a waveform on either channel A or B. Select the DELTA PPV button, and intensify the section of the waveform you wish to measure. The amplitude of just that section will appear on the digital display. Great for troubleshooting or aligning complex waveforms found in broadcast, VCRs, video monitors, cameras, and much more.

7 Delta Time For Any Time Reading

Measure the time of portions of any waveform. Select DELTA TIME and intensify any portion of the waveform. Time reads directly in milli- or microseconds. Use this feature for measuring digital pulse widths, pulse spacing, time delays, etc. . .

8 1/DELTA TIME — Frequency Of Any Part Of The Signal

Measure any interfering frequencies riding on top of another signal. Press the 1/DELTA TIME button and intensify one cycle of the interfering signal. The frequency of the signal is displayed on the digital readout.

Test Every CRT On The Market – Plus, Safely Restore 9 Out Of 10 Weak Or Shorted CRTs With The CR70 "Beam Builder"™ . . . Guaranteed!

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- Dynamic tests you can trust
- Safely restore 9 out of 10 weak or shorted CRTs
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Have You Ever —

- ☐ 1. Wasted time checking everything else in a TV, data display, or scope, because your CRT tester wasn't able to check the CRT?
- ☐ 2. Doubted whether a CRT tester was telling you the truth about the condition of a tube?
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- ☐ 4. Damaged your CRT tester from a CRT that wasn't totally discharged?

Well, Now You Can —

- ☑ 1. Reliably test every CRT on the market, including: video, projection, computer, camera, scope, radar, and others — without carrying a box full of expensive adaptors.
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- ☑ 3. Be more profitable and build your business by confidently restoring your customers' weak CRTs.
- ☑ 4. Avoid expensive equipment downtime; the CR70 is totally protected from charged CRTs.

The CR70 "BEAM BUILDER" Is Exclusive!

The CR70 is a design breakthrough in CRT testers and restorers. No other tester/restorer provides you with this much confidence and capability. But you'll want to prove that to yourself. Here's our offer . . .

MONEY BACK GUARANTEE

Put the CR70 to the test on your bench for thirty days. During this time, you'll be able to check every single CRT that you run into, you'll believe every one of your test results as being reliable, and you'll restore at least 90% of all the CRTs you check with shorts or low emission — or Sencore will cheerfully give you a refund, including freight both ways.

The CR70 is designed to make money for you in today's expanding video, computer monitor, and scope market. Cash in on the tremendous profit potential of this lucrative market with the CR70 "BEAM BUILDER"™.

Find out what goes wrong with CRTs and how you can reliably and profitably test and restore them; call your area Sales Engineer and ask for a free copy of the video tape "Universal CRT Analyzing."

To review the tape, arrange a 10 Day Self Demo, or to order your own CR70 Universal CRT Analyzer and Restorer so you can start profitably testing and restoring CRTs, call **1-800-SENCORE(736-2673).**

For more information on the CR70 and how it will help build your business profits, circle FAST FACT #209

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Reliable Capacitor, Coil, Testing Essential for Servicing Success

By Glen Kropuenske, Application Engineer

No matter what your electronic servicing specialty is, you will encounter many suspected and bad capacitor and inductors this year. Are you using effective test methods? The lack of a method to reliably test these components may impede your troubleshooting technique and impact your business success. Let's take a closer look at how these components fail and what is needed for a reliable cost effective good/bad test.

More Capacitors & Inductors Used in Hi-Tech Circuits

Try as hard as you can to name 10 electronic products that don't use capacitors or inductors. One glance inside a VCR, Computer Monitor or other modern electronic product reveals many capacitors, coils and transformers. In fact, there is a higher percentage of these components on circuit boards than ever before. According to statistics, compiled by the EIA, sales of discrete capacitors and inductors actually increased over the last decade. Last year U.S. component factories delivered 17.2 billion capacitors and sold over 1 billion dollars worth of inductive components.

There are several reasons why discrete capacitors and inductors are still thriving in this time of integration: 1) Capacitor values, inductor values, and characteristics cannot be duplicated inside ICs. 2) As ICs grow in complexity more capacitors and coils are needed. 3) Modern hi-tech circuitry, such as switch mode power supplies, high frequency video/chroma processing circuits, deflection, and high voltage circuits require better filtering, bypassing, and coupling, than previous designs.

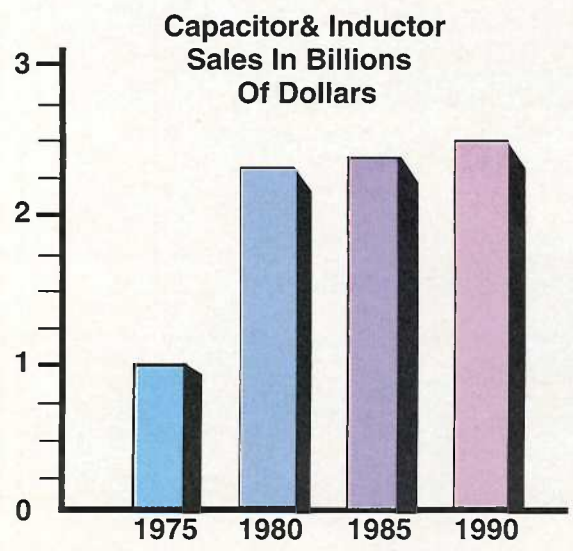


Fig. 1: Capacitor and Inductor sales are thriving in this time of hi-tech circuits and component integration.

Fig. 2: Capacitors and inductors are abundant in modern circuits because they cannot be contained in ICs.

What Goes Wrong With Capacitors

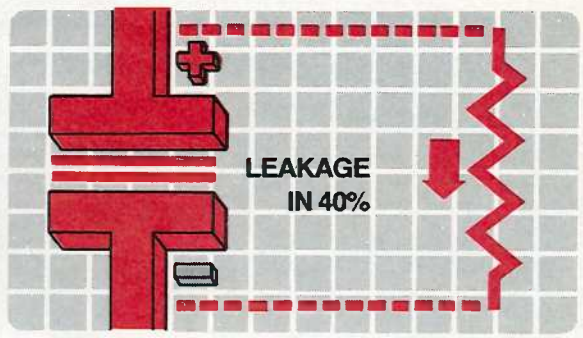
Capacitors will contribute to more circuit failures as circuits become more dependent on them. Many of these components are destined to failure by virtue of their construction while others will fail from manufacturing defects, heat, humidity, voltage transients, aging and a host of other reasons. Lets take a closer look at how these components fail and what's needed for a reliable good/bad test.

Capacitors are nothing more than two metal plates separated by an insulator called the dielectric. There are really 4 different types of capacitor failures.

1. Current leaking through the dielectric
2. A change in capacity value
3. An increase in Dielectric Absorption (DA)
4. An increase in Equivalent Series Resistance (ESR)

Leakage is the Most Common Capacitor Failure

The most common capacitor failure is current leaking through the dielectric. This failure accounts for nearly half of all capacitor defects. A good capacitor should pass AC while blocking any DC current. A leaky capacitor passes DC current in the circuit, which will upset DC biases and load down power supplies.



Leakage among aluminum electrolytic capacitors is extremely common due to the thin layer of oxide insulating dielectric. The oxide is maintained by a liquid paste called the "electrolyte". When voltage is applied a chemical reaction in the electrolyte replenishes the oxide insulating film. Aging of the electrolyte and heat will reduce the capacitor's ability to maintain the oxide. Over long periods of time, the oxide will deteriorate without applied voltages to the capacitor.

Leakage can also become excessive in paper, film, and ceramic capacitors if the encapsulating material cracks and allows moisture to penetrate the dielectric. Any type of capacitor may develop leakage if the capacitor is subjected to excessive voltage spikes. Voltage overloads may puncture the dielectric and produce a short or a high resistance path.

To test a capacitor for leakage, you would need to charge the capacitor to its full rated voltage and measure for small levels of DC current leaking through the dielectric. This will

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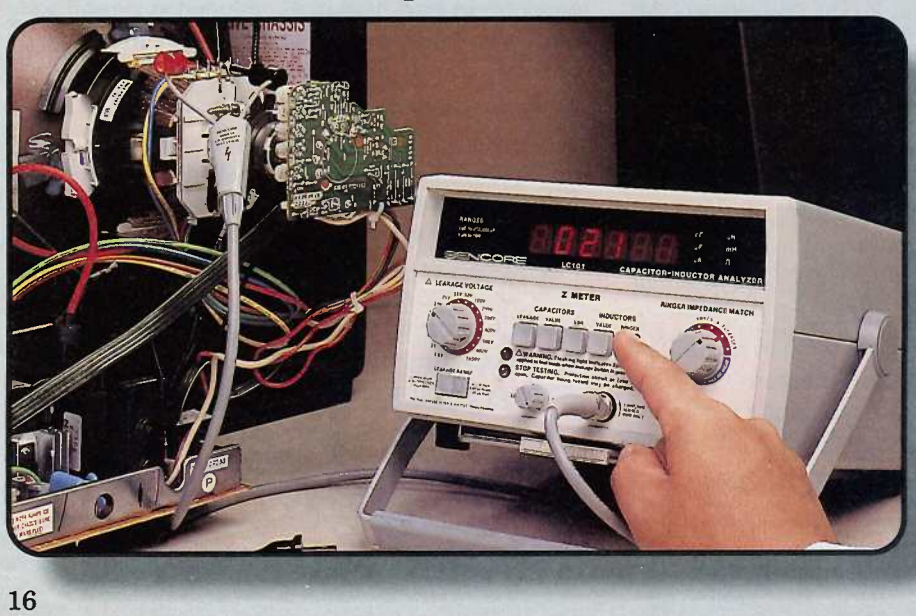
LC101 Z Meter™ Capacitor-Inductor Analyzer



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

On GSA Contract
Four Patents
NSN 6625-01-321-3993
Circle # 212 for more information

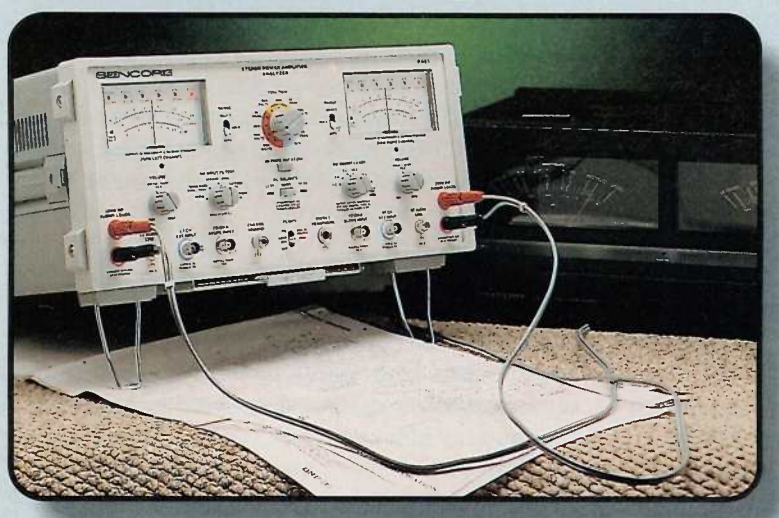
SG80 AM Stereo - FM Stereo Analyzer

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

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

On GSA Contract
Patented
Circle #213 for more information

PA81 Stereo Power Amplifier Analyzer



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

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

On GSA Contract
Circle #214 for more information

FC71 Portable 10 Hz to 1 GHz Frequency Counter™

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

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

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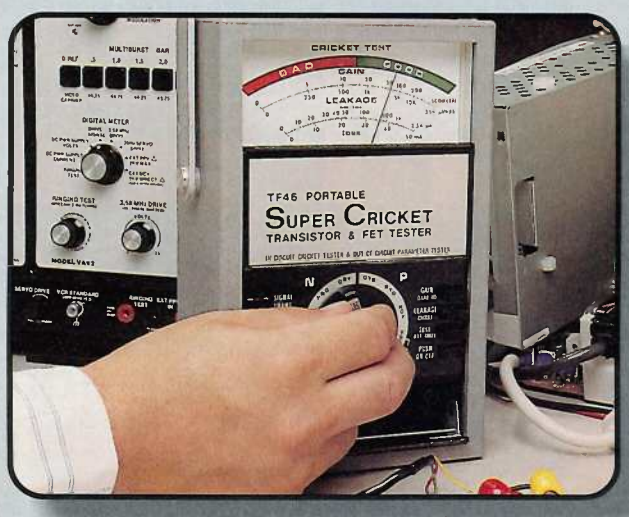
Patented
Circle # 215 for more information



TF46 Portable Super Cricket Transistor/FET Tester

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

- Patented IN-CIRCUIT "Go/No-Go" Transistor/FET Test
- Now More Automatic Than Ever
- Needs No Setup Book Or Instructions
- Portable Operation With Auto Shut Off To Save Your Batteries

On GSA Contract
Patented
NSN 6625-01-058-9564
Circle # 216 for more information

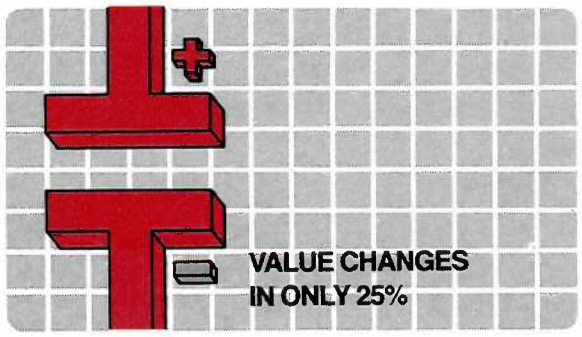
require a power supply of several hundred volts and a sensitive current meter to measure currents ranging from 10 μA to 1 amp.

Most good capacitors will have no leakage at their rated value. Tantalum and aluminum electrolytics however, have some normal allowable leakage. The maximum allowable leakage of these capacitors is established by manufacturers through standards of the E.I.A. Some electrolytics will show a linear increase in leakage with applied voltages while others will change rapidly or short out. For example, a 450 volt capacitor may not show leakage until over 250 volts is across it. Therefore, it is important to test capacitors for leakage near the circuit's operating voltage or the rated voltage of the capacitor to identify all failures.

Many technicians will attempt to measure leakage with an ohmmeter. This method applies only a few volts to the capacitor and will find only extremely shorted capacitors. Sometimes an ohmmeter will mislead technicians to conclude the capacitor is shorted when it is good. This happens, because an ohmmeter's current is limited, resulting in a long charge time and initially low resistance readings on large value capacitors.

Some technicians bridge a good capacitor across a leaky capacitor in-circuit. This method does not change the leakage path as it is effectively in parallel with the capacitors. If the circuit operation does not change the technician may conclude the capacitor is good, when it's really bad. On the other hand, since electrolytic capacitors rarely change capacitance value with leakage, bridging effectively doubles the capacitance of the circuit. This may alter the circuit's operation and symptoms, causing uncertainty of whether the capacitor is good or bad.

Capacitor Value Change

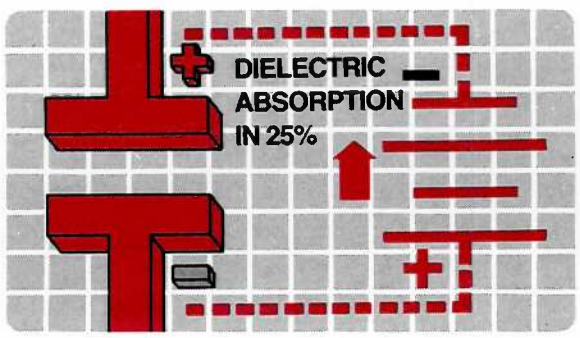


Capacitors can fail by changing value. This failure is uncommon and accounts for only about 1 out of 4 bad capacitors. A value change will shift the operating parameters of the circuit from normal operation.

The most common capacitor to change value is a ceramic capacitor. The ceramic material may age or develop small cracks from heat and cold stress. These problems will reduce the capacitor's value to a small portion of the original. On some multi-layer foil capacitors, the stress of voltage or temperature may cause poor welds or soldering of the foils to the leads. This can reduce the capacitance to a fraction of the capacitor's marked value.

Electrolytic capacitors may change value in circuit, or on the shelf. As these capacitors dry out, they eventually lose their capacitance due to the failure of the oxide layer that makes up the dielectric. A change in value in an electrolytic capacitor is usually preceded by other defects, such as high leakage, high dielectric absorption and/or high equivalent series resistance. These problems usually alter the circuit's operation before a value change occurs. Some technicians use an instrument that tests only capacitance value. Many of these testers do not measure the larger electrolytic capacitors which are suspected in some electronic circuits. Since only 1 out of 4 capacitors fail from a value change, the reliability of a value tester is questionable at best. In locating defective capacitors, their limited testing capability will make them wrong more often than they are right. Substitution would still be needed for 3/4 of the suspected capacitor problems.

Excessive Capacitor Dielectric Absorption



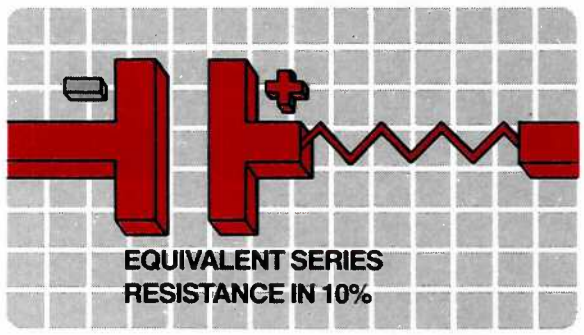
Capacitor theory tells us that the charge is held in the dielectric of the capacitor. Dielectric absorption is the inability of a capacitor to release all its stored energy, even if a dead short is applied across its leads. The condition is due to the inability of the dielectric to return to its original uncharged state. In doing so it retains some of the original energy that is stored when the capacitor is charged.

Excessive dielectric absorption, referred to as "battery action" or "capacitor memory", is a common failure of electrolytic capacitors. Electrolytics with excessive dielectric absorption may not show excessive leakage or value change but will not work in circuit. Almost 25% of these capacitor failures are due to excessive dielectric absorption. The most common circuit problems caused by dielectric absorption are inaccurate DC voltage levels, increased power supply ripple, and distortion.

To test for dielectric absorption, capacitor manufacturers suggest that the capacitor be fully charged. Then the capacitor must be discharged for a predetermined time and allowed to sit for a minimum of 30 minutes. After this time the residual voltage created by the dielectric absorption is to be measured with an electrostatic voltmeter and the dielectric absorption calculated.

Because most technicians lack the time and equipment to test D/A, they substitute suspected capacitors to isolate circuit problems caused by D/A. Often electrolytic capacitors exhibit excessive dielectric absorption from days of nonuse sitting on stock shelves. These defective replacements are often mistaken by technicians as good substitutes causing many more hours of head scratching, and troubleshooting time. Value testers alone provide no help in isolating D/A problems as electrolytic capacitors with high D/A rarely change value.

Excessive Capacitor Equivalent Series Resistance



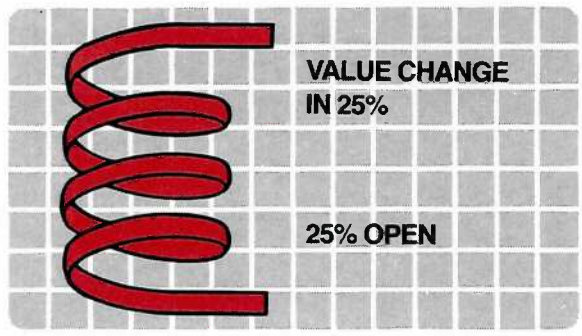
Equivalent Series Resistance is all the electrical resistances of the capacitor in series with the plates of the capacitor. This includes the leads, plates, connections, and electrolyte conductive paths within the capacitor. Normally small amounts of ESR are tolerated by the capacitor and the circuit in which it is used. Defects increase the series resistances inside the capacitor effectively placing a more resistance in series with the capacitor. The resistor dissipates power and develops heat. Excessive ESR may change circuit timing, cause less filtering, and upset DC biasing. It contributes to about 10% all of capacitor failures.

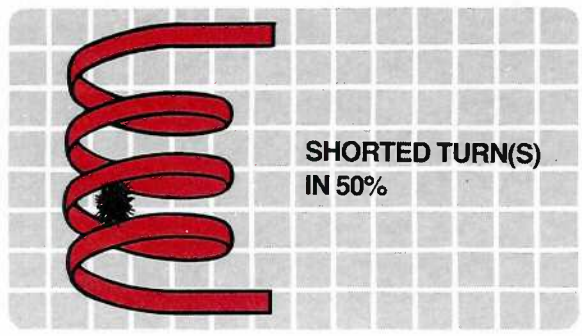
To test a capacitor for ESR requires a test instrument with an ESR measuring function. An ohmmeter cannot be used to measure ESR because it is impossible to connect an ohmmeter across the resistances inside the capacitor. A capacitor blocks any DC current through the dielectric. Again, most technicians are forced to substitute suspected capacitors to troubleshoot the problem.

What Goes Wrong With Inductors

Inductance is the ability of a conductor to produce induced voltage when the current varies. Inductors are simply insulated wires wound around hollow forms or magnetic cores. Even though inductors are just coils of wires around a core, they still can develop defects. Inductors develop four kinds of failures.

1. Open
2. Complete short
3. Excessive value change
4. A single shorted turn





Open, shorted or an excessive value change in an inductor are results of a major problem within the coil. An open coil maybe the result of a physical intermittent, manufacturing defect, or excessive current flow causing the inductor to open. A shorted coil essentially replaces the inductance with a piece of wire that will not oppose any change in current. Open or shorted coils would result in little or no inductance. Inductors may also change inductance values from core breakage, or physical altering the coil's windings.

The most common failure with inductors are single shorted turns. A shorted turn results if the insulation of two adjacent wires breaks down or melts. This short acts like a small secondary winding on a transformer, absorbing energy and converting it to heat. The shorted turn usually has little impact on the inductance value of the coil but will drastically lower the efficiency or Q of the coil. A shorted turn will usually cause a major change in the operation of a circuit.

To thoroughly test a coil for failures you would need to test the inductance value for a single shorted turn. Inductance values can be measured with an inductance value tester and compared to the service values listed in the service literature. Detecting shorted turns requires a test of the effective Q of the coil.

Fig. 3: The Sencore "Auto-Z" tests all types of caps and coils for all types of failures in only seconds, without guesswork or costly errors.

Some technicians attempt to test coils with an ohmmeter. While an ohmmeter will detect coils that are completely open or shorted, it is not effective in isolating coils with value changes or a single shorted turn. A cracked core will alter the coils inductance value with no effect on the coil's resistance. A single shorted turn has little or no effect on the coil's inductance value and changes the coil's resistance by as little as .001 ohms. An ohmmeter is not capable of detecting this small change even if you knew what to compare it to.

Many technicians simply analyze the circuit parameters and components in the circuit and then, in desperation, order a replacement for the suspected coil or transformer. Exact replacements are often difficult to get, especially if the product is an import, and the entire product is tied up waiting for a replacement just to make a test. Worst yet, the technician may conclude that the part is bad and the repair of the product not feasible when the inductor may not have been the problem.

The LC102 "Auto Z" Complete L/C Analyzer

The best way to isolate capacitor or inductor defects in modern circuits is to use an L/C analyzer to test for all possible failures and verify the problem. Then, thoroughly test the replacement part to make certain it's good before installing it. For this purpose Sencore created a dedicated capacitor/inductor analyzer such as the model LC102 "Auto Z" Meter.

The Sencore "Auto-Z" will test all types of caps and coils automatically for all types of failures in only seconds, thus eliminating guesswork and costly errors. With the LC102 you don't need to select ranges, move decimal places, look-up good/bad parameters in reference charts, or calculate % tolerances. Parameter tolerances for all capacitor and inductor types and values, standardized by manufacturers with the EIA, are stored in electronic memory in the LC102. When a parameter is tested, the "Auto-Z" references this information and determines if it's good or bad. It's fast, automatic, and error free. Here's a closer look.

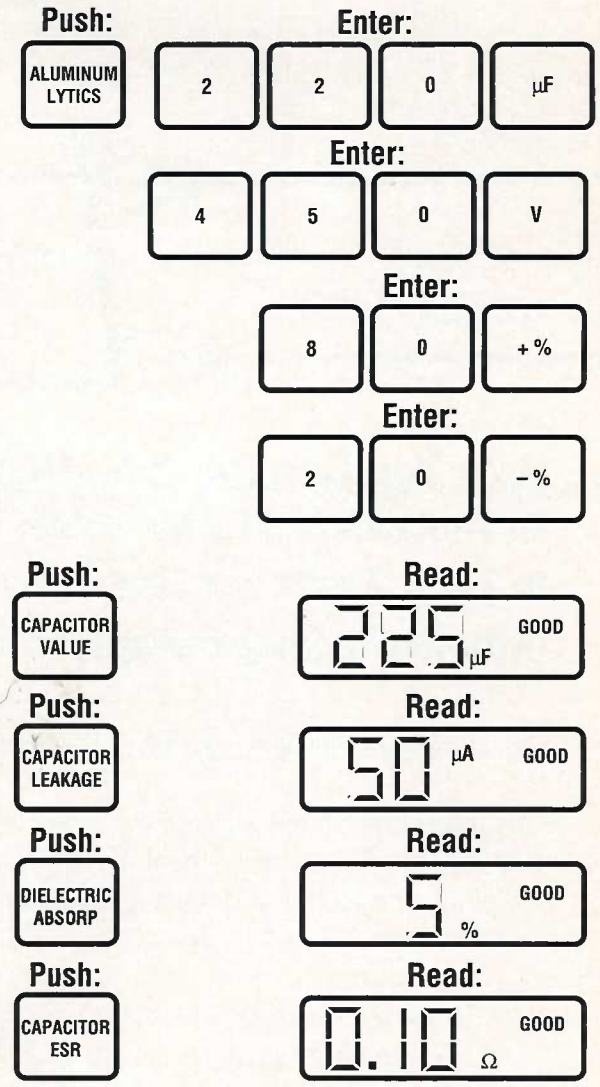
Analyze any capacitor from 1 pF to 20 F with four automatic good/bad tests

The Auto-Z makes four automatic good/bad capacitor tests (value, leakage, dielectric absorption, and ESR). Capacitors of any type from the smallest pF ceramics(1 pF), to the largest electrolytic types (20 F) found in modern power supplies can be tested. Value readings are displayed in µF and pF to match schematics and parts list.

Leakage tests with the "Auto Z" are performed at the capacitor's rated voltage up to 1000 volts. These will detect capacitors that are breaking down at circuit voltages. The leakage current is displayed with a good or bad indicator based on the EIA reference levels for that capacitor type and value. An audible and visible alarm is included with the Auto-Z, design to warn you if a fuse, test lead or internal discharge circuit should fail.

The Sencore "Auto Z" makes easy work out of difficult Dielectric Absorption (D/A) and ESR tests. The patented D/A and ESR tests of the "Auto Z" makes these measurements in a matter of seconds. The percentage of D/A or ESR resistance is displayed accompanied by a good or bad readout based on the EIA references. The tests are free of any calculations or interpretation errors.

The Auto-Z is easy to operate. Let's test a known good 220 µF, 450 volt electrolytic capacitor together. Apply power and zero the leads.



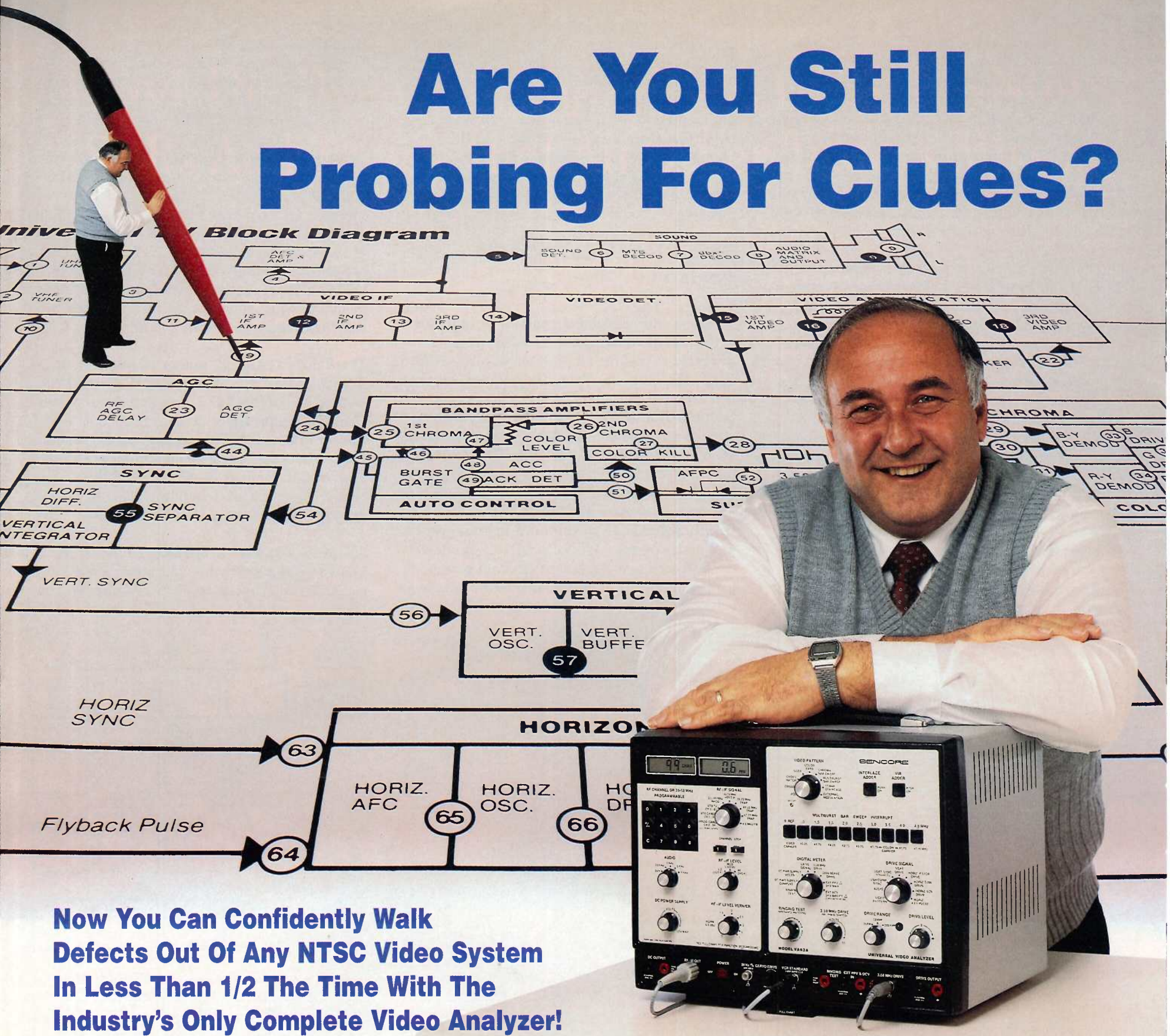
The test values are displayed along with a good/bad determination of each test based on industry standards. You know in seconds, whether to throw the capacitor in the garbage or solder it into the circuit.

Test any Inductor from .1 µH to 20 Henrys With Two Patented Tests

The LC102 Auto-Z tests inductors for shorts,

(continued on page 26)

Are You Still Probing For Clues?



Now You Can Confidently Walk Defects Out Of Any NTSC Video System In Less Than 1/2 The Time With The Industry's Only Complete Video Analyzer!

VA62A Universal Video Analyzer

This ad may seem like a dramatization, but is it really?

How many times have you found yourself mentally or physically exhausted because you've spent the day probing from test point to test point, and either everything looked bad or the circuit was dead with no signals?

Only the VA62A Universal Video Analyzer can provide:

1. A simplified understanding of the circuit you're troubleshooting through "Functional Analyzing" and the "Universal Block Diagrams", *and*
2. A better and more profitable troubleshooting method compared to your present techniques.

The VA62A Universal Video Analyzer is guaranteed to cut your video troubleshooting time by 54%* or you receive a complete refund during the first 30 days.

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

The VA62A Universal Video Analyzer Is Guaranteed To Help You:

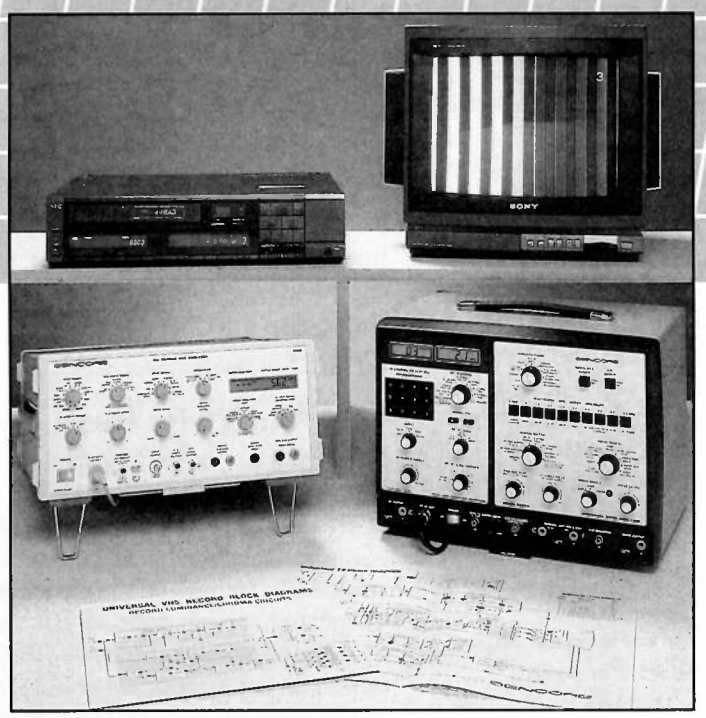
- Identify tuner problems with an all-channel, VHF, UHF, and cable RF generator.
- Pinpoint IF problems with modulated troubleshooting signals and exclusive, programmable RF/IF generators.
- Find defective stages without disconnecting parts, with the exclusive phase-locked drive signals.
- Test yokes and flybacks (IHVTs) with the patented "Ringer" and exclusive high-voltage multiplier drive test.
- Plus, analyze all signal levels with the built-in autoranged digital meter (to 2,000 volts).

Give us a call at 1-800-SENCORE, and we'll send you a custom designed answer to your video servicing challenges!

SENCORE

For more information on how the VA62A will help you in your daily troubleshooting, circle FAST FACT #207

Divide And Conquer VCRs And TVs With Your VC93 And VA62A



By George Gonos, Marketing Team Manager

Whether you are an experienced television servicer or have just graduated from technical school, your training and experience in television technology has prepared you to service VCRs.

The service business will remain a highly competitive field throughout 1992. The biggest competitor will be the clock. There is only so much time in a day. Once it is gone it can never be brought back. From a servicer's standpoint, the faster you can identify the problem in a VCR or television and repair it, the more money you can make. With lower prices on consumer products, you need efficient troubleshooting techniques to keep your repair work profitable.

One troubleshooting technique, called functional analyzing, will give you a logical step-by-step method to identify the problem and ultimately save time. Let's face it, those false starts and wrong troubleshooting trails are the ones that eat up your time. They complicate your work and reduce the amount of money that goes into your pockets.

Modern test equipment, such as the VA62A Video Analyzer, and VC93 All Format VCR Analyzer gives you the signals needed to positively walk problems out of televisions and VCRs respectively, using functional analyzing. In this article we will concentrate on VCRs and see how functional analyzing can save time and increase profits.

Many Analyzing Techniques Rely On Guesswork

There are several common troubleshooting techniques in use. One method, signal tracing, can be valuable in troubleshooting. But one problem with this method is that you must know exactly what the voltages and waveforms are at each test point. Unfortunately, all to often, you don't have the schematic or the schematic doesn't show the voltage readings or waveform at the point you want to look at. You often make a measurement and resort to guesswork because the exact data is not available. You can try to make an educated guess and decide that the voltage or waveform at that point is either good or bad. If your guess is correct, the next step can lead you towards the problem. If your guess is wrong, you're further away from the problem and a simple repair turns into a dog.

Another common troubleshooting method is component testing. This method relies heavily on educated guesses. In theory, if you test enough components, you'll eventually find the correct one, right? Remember the clock is ticking. . .

What's needed is a technique that will positively lead to the right path with little or no quesswork. That method is functional analyzing. Here's how it works.

Functional Analyzing Tests Circuits Rather Than Components

All systems are composed of subsystems that perform various functions. VCRs, as an example, have several systems that perform a variety of functions. Figure 1 shows a simplified functional block diagram of a typical VCR. The VCR luminance circuits process the black and white video information while the chrominance circuits process the color. The servos control the speed of the capstan and the video drum. Each set of circuits is designed to perform a specific function.

Functional analyzing is a troubleshooting method that uses a combination of signal injection, signal tracing, and component testing, all done in a logical sequence. Func-

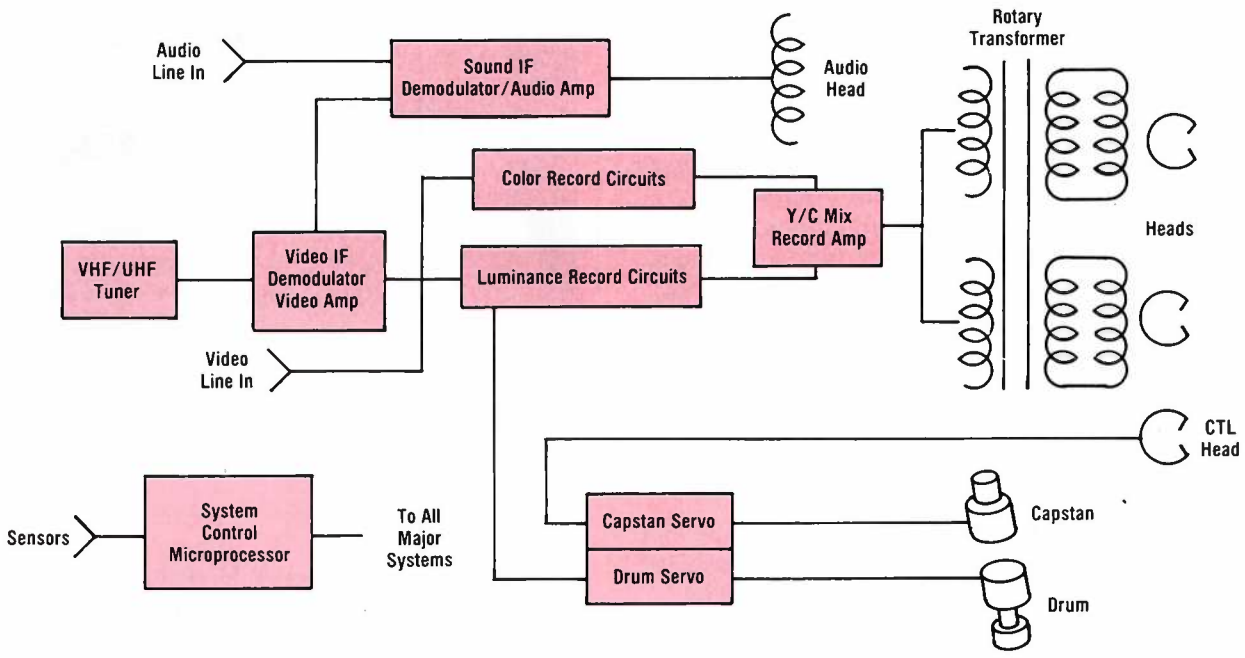


Fig. 1: A VCR uses different groups of circuits to perform specific functions. Your VA62A Universal Video Analyzer & VC93 All Format VCR Analyzer provide the signals needed to prove which circuits are good.

tional analyzing starts out by testing the functions of the major functional blocks rather than by testing individual components. By doing this, a large number of components can be quickly eliminated from suspicion. Functional analyzing differs from other types of troubleshooting techniques in that the first step is not proving which stages are bad, but what is actually working.

This is done in a logical, sequential manner. Once the good stages are confirmed, they are no longer of concern. The number of questionable stages are systematically reduced until the bad stage is positively identified. Once the bad stage is located, signal tracing and component testing can quickly identify the problem within a few remaining components.

Notice that the overall functional stages are tested rather than individual components. This will minimize the number of components that need to be pulled out for testing, only to find that they are good!!

Maximum efficiency in functional analyzing is achieved when the number of tests are kept to a minimum. Functional circuits can be divided into various levels. For instance, you can view the VCR luminance system as extending from the tuner to the video heads as shown in Figure 1, or you can break it down into smaller functional blocks as shown in Figure 2.

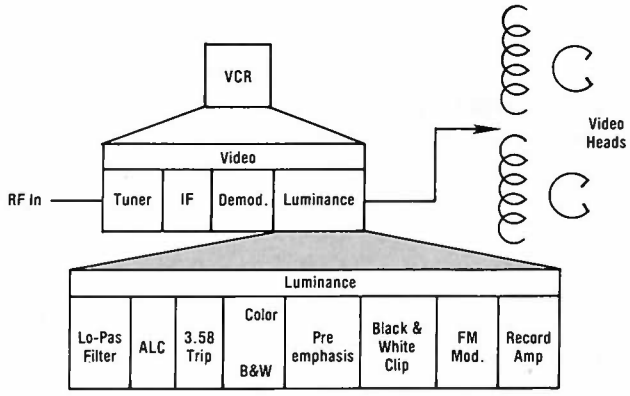


Fig. 2: You can troubleshoot faster by testing the largest functional block first – then test smaller functional circuits within the block.

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

The Divide & Conquer Technique Produces The Highest Troubleshooting Efficiency

You could troubleshoot by starting at one end of the VCR and testing each functional section, one at a time, finally locating the defective stage, but you would probably make more tests than are needed.

A technique called divide and conquer functional analyzing maximizes efficiency by minimizing the number of tests needed to make. Let's look at how the divide and conquer technique works.

To see why the divide and conquer technique minimizes your troubleshooting time, think of the defective stage as a worm and the VCR as an apple. Your job is to locate the worm in the fewest number of steps. The original "symptom" is a small hole on the outside of the apple. You don't know whether the worm turned to the left or right after it entered the apple. You also have no idea of whether it went only a short distance, or is on the other side of the apple.

If you were to use the "subtractive" method, you would start at the worm hole and slice out a small section of the apple. If the worm hole still exists in the remaining apple, then slice out another section. You would continue to make slices until you stumbled onto the worm. The number of slices needed would depend on where the worm was and how small you made the slices.

With the divide and conquer technique, the problem is approached differently. First, divide the apple in half. By looking at the two halves, determine which half has the worm. If you don't see a worm hole in the section that was sliced, you can safely assume that the worm is still in the half with a hole. Next cut the suspected piece in half, again. This process is repeated until the problem is localized, and you find the worm.

The divide and conquer technique will keep the test sections as large as possible. It allows you to quickly whittle the sections down to the problem. In the example of the worm, if the worm was on the opposite side of the apple, the divide and conquer method located the worm in only 3 steps. The "subtractive" method, however, required 8 steps.

In either case of course, you could have cut the worm in half on the first try. This could be a messy solution to the problem, and is just like stumbling across the circuit defect in a VCR or television on the first try. You can always hope for a simple solution, but rarely get one.

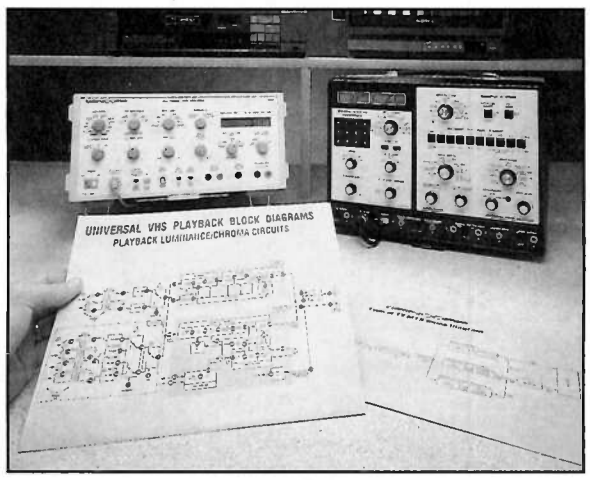


Fig. 3: Having the VA62A & VC93 can make the job so much easier.

Proper Tools And A Block Diagram Speed Functional Analyzing

To use divide and conquer functional analyzing to its best, you need a good functional block diagram. Fortunately, some VCR manufacturers now supply functional block diagrams in their service literature. If the service literature does not have a block diagram, a universal block diagram, such as Sencore's Universal VCR Block Diagram (Form 3038), is useful. You should always start with a block diagram to stay away from checking components too early. The individual parts are important only after they have positively been identified to the smallest bad functional stage.

Functional analyzing relies heavily on signal injection. By using a known good signal, you can positively determine if the circuits after the signal injection point are good.

TVs And VCRs Have Many Similar Signals

Both VCRs and TVs process video and audio signals. This is why VCR servicing is a natural for the television servicer. Both VCRs and TVs convert a modulated RF signal into the associated video and audio. Both process the video, including the color information, and audio for later use. In the case of a television, the video is displayed on a CRT and the audio is fed to the speakers. In the case of a VCR, the video and audio are recorded on the video tape for future playback.

Many of the signals available on the VA62A apply to servicing both televisions and VCRs. Other signals are available on the VA62A Video Analyzer or the companion VC93 All-Format VCR Analyzer, to troubleshoot circuits that are exclusive to VCRs.

To better understand what signals are needed to functional analyze a VCR, let's look at the different circuits or systems of a VCR and a television.

VCR	Television
1. RF demodulation	1. Tuner
2. Luminance processing	2. Video
3. Chroma processing	3. Color
4. Audio processing	4. Audio
5. Servo control of capstan and drum	5. Sweep and scan
6. Overall system control	6. Power supply

Figure 4 shows a simplified block diagram of a VCR identifying six major areas. Let's look at one of these areas so you can learn how to use the VA62A, or the VC93 to functional analyze it. Let's look at the path for the video and audio information from the tuner to the tape.

The VCR circuits from the tuner to the video and sound detectors are identical to those found in a television. The VCR contains an all channel tuner which converts the RF to an IF signal. The VA62A supplies all VHF, UHF, and cable channels to fully check the operation of these VCR tuners as well as television tuners.

After the tuner, the IF section amplifies the signal and feeds it to the video detector. These stages are identical to the circuits found in televisions.

After the detector, the signal is fed through various filters, preemphasis, and clipping circuits to prepare the signal for the FM modulator. After the video is modulated, it is further amplified and fed to the video heads.

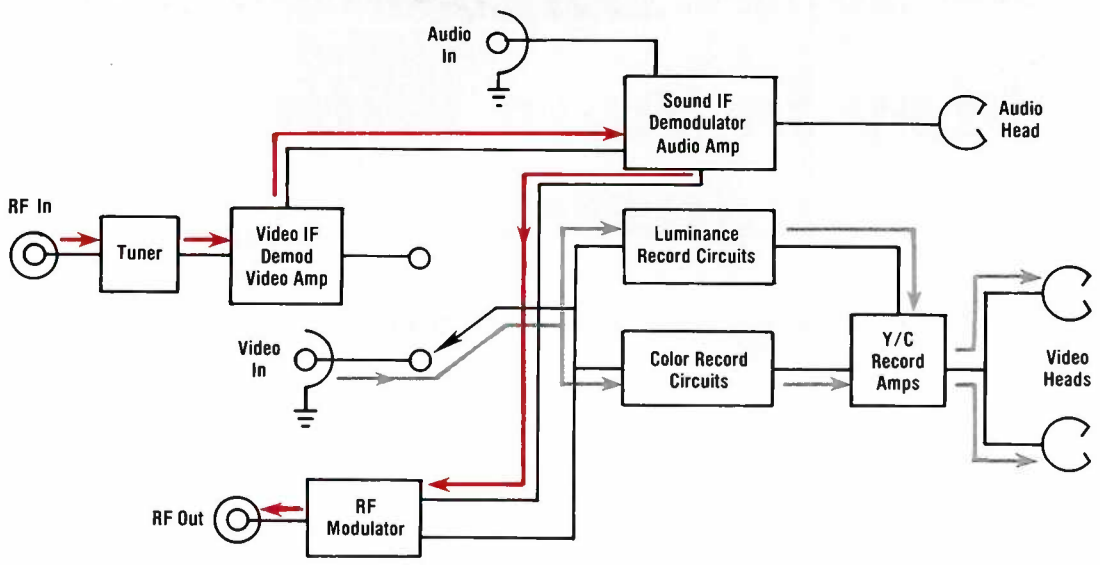


Fig. 4: An audio tone from the speaker verifies that the sound signal path is working, including the tuner and part of the IF signal path.

As you can see, the signals in the luminance path, up to the FM modulator, are similar to a television receiver. The VA62A signals allow you to functional analyze these circuits.

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

Let's look at a typical VCR troubleshooting problem and how divide and conquer functional analyzing can speed you through this problem.

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

To start with, hook up a TV to the VCR and play a prerecorded test tape. If the VCR plays back a prerecorded tape properly, this eliminates a number of systems from your list of suspects. In this case, the tape plays back properly. You have good video and color as well as audio coming from the speaker of the TV. This tells you the following circuits are good:

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

Now, connect the VA62A to the antenna input terminals on the VCR. Select channel 3 on the VA62A and channel 3 on the VCR. Also, make sure the TV/VCR switch is in the VCR mode. But wait! You can't tune in a picture on channel 3 on the VCR tuner. Turn on the audio on the VA62A. Now tune the tuner on the VCR and get a good audio tone coming from the tuner. What does this tell you? Apparently, the audio channel from the tuner to the output is working properly. Looking at the block diagram, you can see that the presence of audio tells that the tuner is on the right frequency and at least a part of the IF section must be working. It appears that you have a video problem.

Let's connect a cable from the VA62A's VCR STANDARD jack to the video input jack of the VCR. You already know that audio goes through part of the circuit. However, to be sure, simply connect the VC93's Audio Output signal to the audio input jack of the VCR.

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

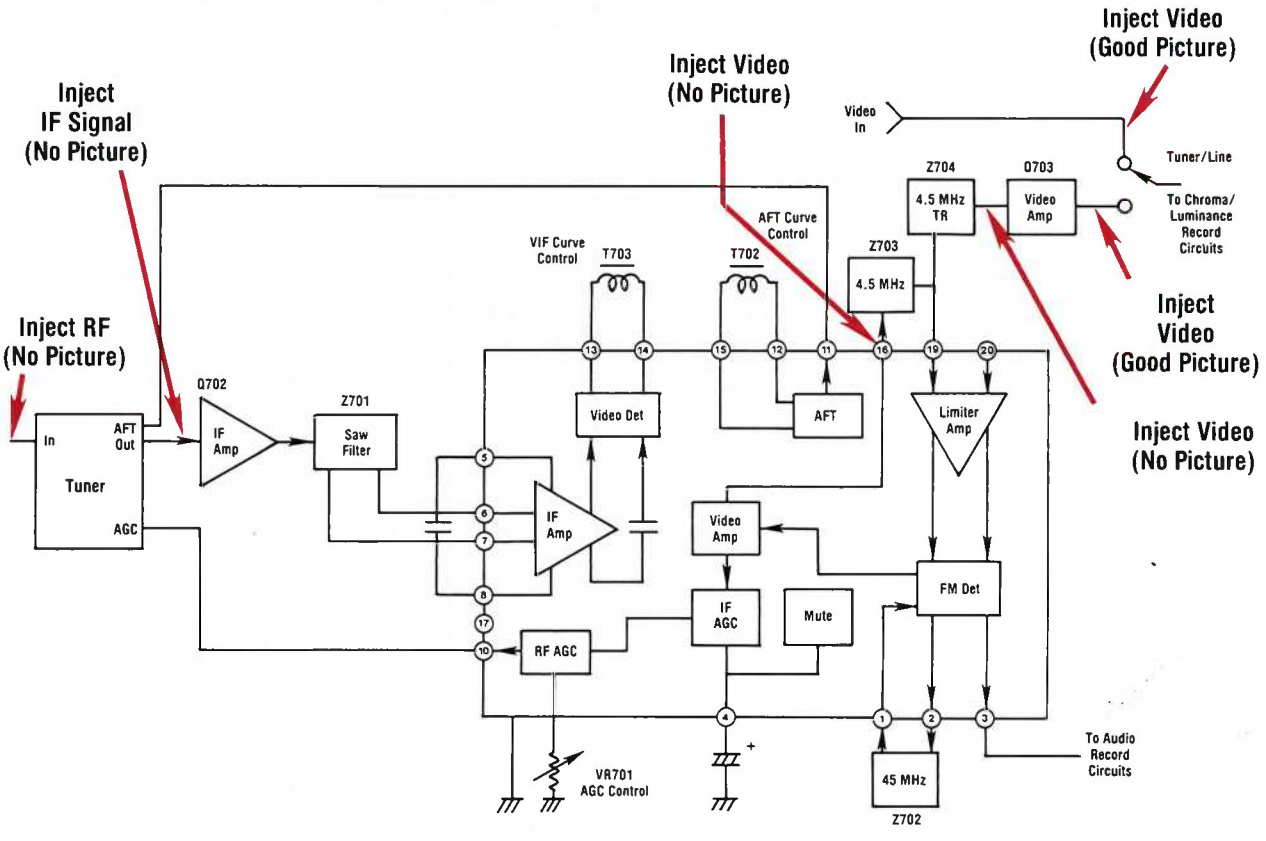


Fig. 5: A few final signal injections locate the smallest defective stage.

This test has already narrowed the problem down and eliminated a lot of circuits from suspicion. You have learned that a signal fed into the video input jack can be recorded onto a tape. A signal fed into the tuner can not, however. From the block diagram, you can see that the problem is somewhere between the RF input and the VCR input jacks. This includes the tuner, IF amplifiers, video detector or video amplifiers as the bad stage.

Notice how functional analyzing systematically cut this problem down to size just like the example of the worm in the apple. By using functional analyzing and divide and conquer techniques you narrowed the problem down to the defective stage.

If you haven't tried the VA62A on a television, or VC93 on VCRs, take a little time and try it. In order to get used to this technique, take a good TV or VCR and inject the VA62A, or VC93 signals into various stages.

If you don't have a VA62A or VC93 give us a call at **1-800-SENCORE**. Talk with your Area Sales Engineer who will be glad to set one or both of these units on your bench. Find out for yourself how functional analyzing will make your troubleshooting more efficient and profitable. ■

For more information on the VA62A, circle FAST FACT #257

Stay In Tune With The Industry!

By Don Multerer, Field Sales Manager

Electronic servicing is advancing at a tremendous rate, Circuit designs change from model to model and the techniques you use to troubleshoot need to change also.

In order to learn more about these changes and advancements in the industry, you'll need to attend some of the many service meetings or workshops being held by the EIA, Sencore, and the manufacturers. These meetings are some of the best sources to find out what is happening in the service industry. It should be a job priority of those supporting the service industry to stay abreast of the servicing techniques and other information that will make your job easier and more profitable.

Take Sencore for instance...

Typically a Sencore Application Engineer will talk with 15-20 servicers in a day, discussing the problems and solutions to best help the servicer. The information that he gains from talking with these customers is then passed along to our Field Engineers to help develop their field presentations. This allows us to present the most current and valuable information to you, the servicer. It also helps us to design the types of products that will do what you want them to, cut the time it takes to complete a job, and make you more profitable.

To help you to make your plans for the future, we have printed a schedule of Sencore and EIA's training meetings.

We hope this will help you plan your schedule and that you will attend one of these meetings. You will learn valuable "hands-on" information such as:

- The different types of SMPS, where they're used, and how they fail.
- How to test switch mode supply components.
- TV kick start and trickle start circuits and how they operate.
- How to isolate luminance/chrominance problems.
- Troubleshooting VCR servo circuits with functional analyzing.

The EIA is providing training on other important topics, such as basic VCR troubleshooting and video laser disc problems.

Remember, if you learn one concept from a training seminar that will help you in your daily troubleshooting, you could save hundreds of troubleshooting hours and make thousands of dollars. Isn't this the way you want to operate your business in 1992?

In order to accomplish these goals though, you've got to get out of the shop and be willing to invest in the your future by taking the time to attend.

EIA Workshop Calendar

Attend a free hands-on workshop on basic VCR troubleshooting or Video Laser Disc. These workshops are conducted by EIA-trained instructors. Technicians who wish to attend these workshops must be employed in private industry by consumer electronics sales and/or service businesses.

Requests to attend must be on company letterhead and mailed to: EIA/CEG, Product Services, 2001 Pennsylvania Avenue, N.W., Washington, D.C. 20006-1813. Please identify an alternative location and/or date, in the event your first choice cannot be met. Registration is limited to one registrant per business for each class requested.

EIA Headquarters
Washington, D.C.
January 20-24, 1992
March 2-6, 1992

Tampa Technical Institute (National Education Centers)
Tampa, Florida
April 6-10, 1992
July 6-10, 1992
October 5-9, 1992

NEC Commerce Campus (National Education Centers)
Commerce, California
April 6-10, 1992
July 6-10, 1992
October 5-9, 1992

Illinois Technical College
Chicago, Illinois
April 27-May 1, 1992
August 24-28, 1992

Art Institute of Dallas
Dallas, Texas
March 23-27, 1992
June 15-19, 1992
September 21-25, 1992

EIA will be conducting a three-day hands-on workshop for Videodisc Players at the Washington, D.C. Headquarters
February 11-13, 1992

1 Day Tech Schools

Hands-On Switch Mode Power Supply Troubleshooting

February

State	City	Date
Texas	Houston	Feb. 4-6
Texas	San Antonio	Feb. 18-20
Oklahoma	Tulsa	Feb. 25-27

March

State	City	Date
Texas	Arlington	Mar. 3-5
Missouri	Kansas City	Mar. 11-13
Colorado	Denver	Mar. 17-20
Utah	Salt Lake City	Mar. 25-27

What You Will Learn:

- The different types of SMPS, where they are used, why they are used, how they fail, and how to troubleshoot them.
- "Safe Troubleshooting Techniques" for any chassis.
- How to test switched mode supply components.
- TV kick start and trickle start circuit operation and troubleshooting.
- Simplified shutdown circuit servicing.

(Your workstation will be equipped with Sencore's SC61 Waveform Analyzer, LC102 Auto-Z, PR57 "POWERITE", and special demonstrators.)

What: A one day workshop on switch mode power supply or VCR "Tough Dog" troubleshooting. (Check your city and state for the Tech School in your area.)

When: Each one day Tech School runs from 9:00 AM - 4:00 PM.

Who: Sponsored by Sencore.

What It Costs:

$50.00 registration fee payable in advance. VISA, MasterCard, check, or purchase orders are accepted. Maximum attendance: *30 by preregistration only. (Cancellation policy: must call 48 hours in advance or fee is nonrefundable.)*

How To Register:

Call **1-800-SENCORE**. Registration is based on first-come, first-serve. Please use the 6 digit number above your name on the mailing label to speed your registration.

What You Need To Bring:

A fresh mind with room for a lot of useful information. Nothing else is required.

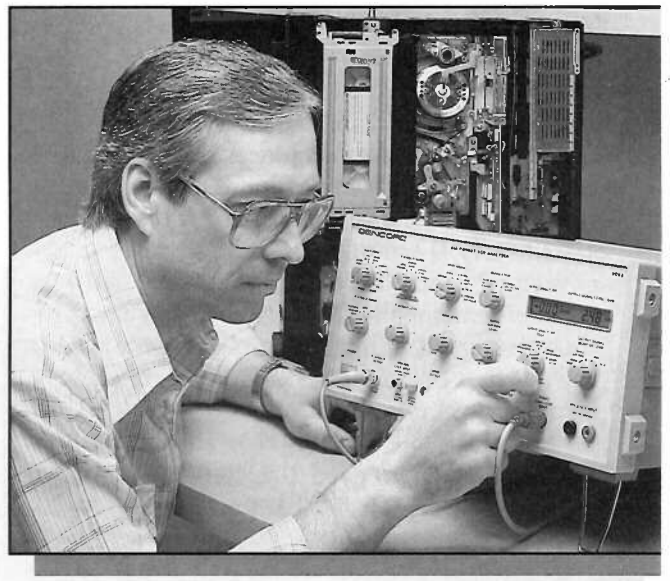
What You Will Get:

- Valuable information and troubleshooting tips that you can apply daily.
- Technical workbook (yours to keep).
- Certificate of Achievement.

(All Tech Schools are smoke-free.)

For More Details Call 1-800-SENCORE

(736-2673)



Hands-On Practical VCR Troubleshooting Techniques

with the VC93 All Format VCR Analyzer

January

State	City	Date
Nebraska	Omaha	Jan. 20
Kansas	Topeka	Jan. 22

February

State	City	Date
Arkansas	Little Rock	Feb. 18-20
Tennessee	Memphis	Feb. 25-27

March

State	City	Date
Kentucky	Louisville	Mar. 3-5
Tennessee	Nashville	Mar. 10-12
Alabama	Birmingham	Mar. 17-19
Georgia	Atlanta	Mar. 24-26

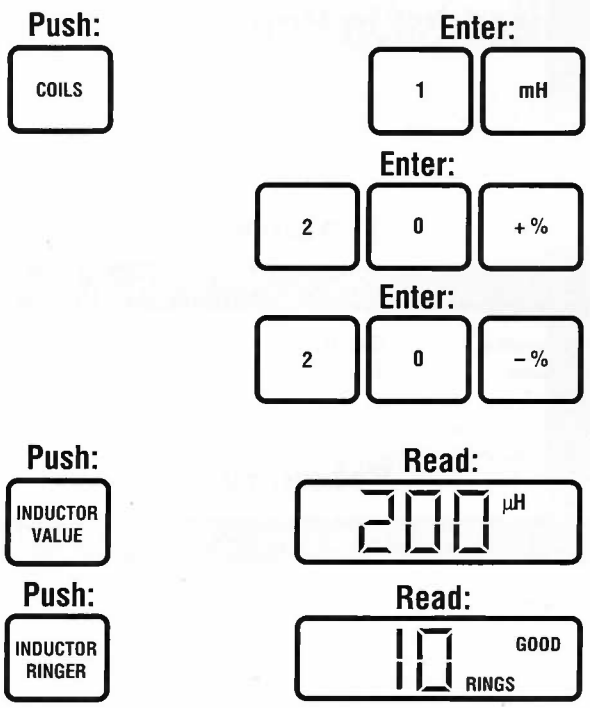
What You Will Learn:

- How to dynamically substitute for any format VCR head: VHS, Beta, U-Matic, VHS-C, S-VHS, Super Beta, U-Matic SP, 8 MM, Hi 8.
- How to dynamically substitute any VCR Stereo Hi-Fi head for all formats.
- How to isolate any VCR luminance/chroma problem with exclusive sync-lock trouble-shooting signals.
- How to isolate any VCR Servo problem in less than 30 seconds without taking off the VCR cover.

(continued from page 19)
opens, values, and for single shorted turns. The value test measures true inductance and displays readings in µH, mH, or H so you don't have to move decimal places or interpret the reading. Shorted or open inductors are indicated with direct display readouts.

The Ringer test checks the effective Q of the coil without the need to check with the manufacturer to know the original Q value. (Q is not normally published and is frequency dependant). The Auto-Z places a fixed capacitor in parallel with the coil and excites the resonant circuit into oscillation. A coil with a satisfactory Q will always oscillate or ring 10 or more times before being dampened. All you need to remember is 10 or more rings means the coil is good. The ringing test is automatically scaled to test yokes & flybacks or new switching transformers.

Let's test a known good 1 mH +/-20% coil to see just how easy it is with the LC102.



The Inductor Test Values are displayed along with a good or bad indication

L/C Analyzing VS. Substituting

There are still a number of technicians who feel the most economical method of troubleshooting circuits is to change component after component until the bad part is discovered. We have been told that it is cheaper to buy $1,000 worth of replacement parts vs. investing $1,895 for an L/C analyzer. From a business point of view, there are several logical errors to this view of thinking.

The high cost of specialty capacitors and coils in modern electronic products makes it more difficult to maintain a good inventory of all values and types. With the many component types, specialty parts, and wide assortment of products it's no longer feasible to stock a wide assortment of coils, caps, and transformers for substitution.

Secondly, maintaining a high inventory of parts to substitute does not consider six time-consuming factors when troubleshooting.

1. Running back and forth to your inventory of parts.
2. Checking and searching for the part in inventory.
3. Packaging and repackaging the substitute part.
4. Calculating time for cobbling up values and voltages needed for substituting.
5. The sluggish trial and error substitution technique itself.
6. Making trips back to the shop for parts if you're working in the field or across town to a parts supplier.

Thirdly, there are many hidden costs reflected to the business from having a high inventory volume and turn over. Order processing and inventory investment is reflected on the profit statements. Furthermore, charging customers for good parts that were swapped and adding an extra hour labor cost will have a negative impact on your business and drive customers to your competition.

There are several questionable technical assumptions with substituting. 1. You must assume that you have the correct value and type of capacitor to substitute into the circuit. 2. You must assume that the substitute capacitor is good in the first place. 3. You must assume that substituting in the circuit will correct the problem caused by the bad capacitor.

Modern circuits are not as tolerant of changing capacitor type and rating. For example, an aluminum electrolytic is not a suitable replacement for a tantalum capacitor. An aluminum electrolytic has higher leakage and a lower Q and would likely affect the circuit's operation. Similarly, film capacitors and disc capacitors should not be substituted with other types or the circuit's performance will be altered.

The second drawback to substitution is that capacitors go bad sitting on the shelf. Aluminum electrolytics may become leaky or develop D/A. Others may change value from mechanical shock, heat or moisture. Substituting a bad part with another bad part can lead technicians away from the real problem and hours away from a fix.

The third problem is bridging a supposedly good capacitor across a defective one that only corrects the circuit problem if the capacitor is open or very low in value. If the suspected capacitor has leakage, the leakage path is also in parallel with the bridged capacitor. If the capacitor has D/A it will also affect the bridging capacitor and mask the problem.

Despite all the problems associated with substitution, many technicians still use it as the only recourse when faced with a circuit problem that might involve a capacitor or inductor. But, there is a better way that saves money and time – a dedicated capacitor/inductor analyzer such as the "Auto-Z".

Try the "Auto Z" for Yourself

In addition to the patented automatic capacitor and inductor analyzing tests, the LC102 performs many specialized tests. You can calculate the distance to a short or open in a transmission line by measuring the capacitance and inductance. The same leakage supply of the Auto-Z that tests capacitor leakage also will let you reliably test high voltage components, transistors, transmission lines, transformers, switches, etc. You can test any component for leakage to 1000 volts DC and get the readout in current or ohms to 1,000 megohms.

The LC102 combined with the SCR250 SCR and Triac Test accessory gives you the added capability of dynamically testing SCRs and triacs. The SCR250 uses the LC102's DC

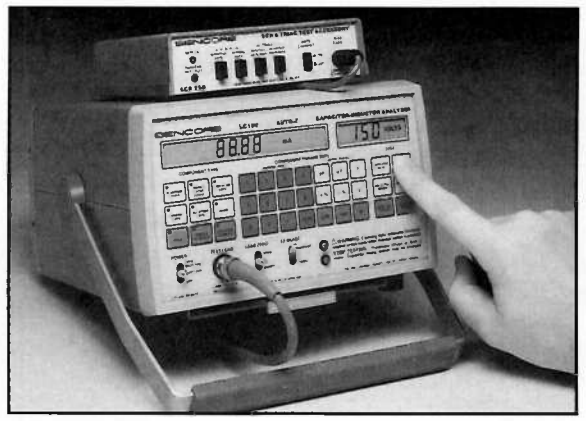


Fig. 4: The SCR250 SCR and Triac Test Accessory gives you added capability of testing SCRs and Triacs for leakage and turn-on.

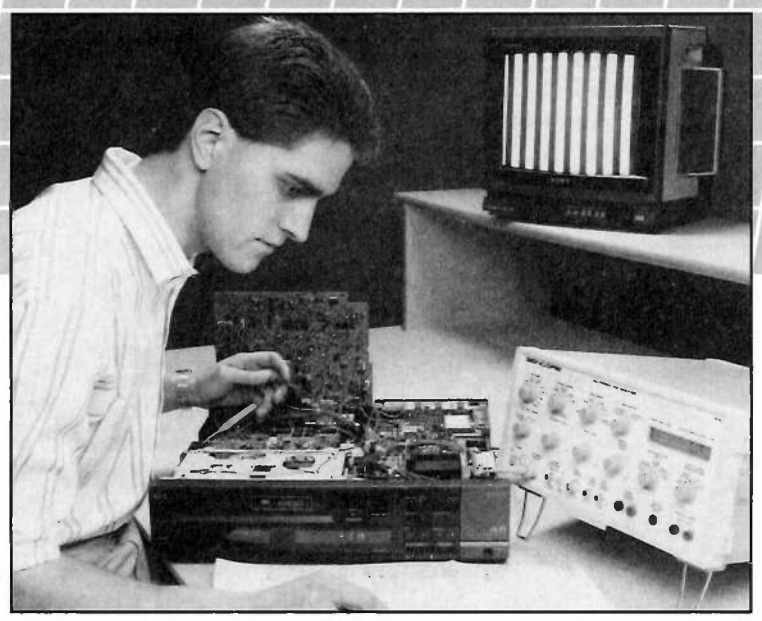
Leakage power supply to test SCRs and triacs for leakage (to 1,000 volts) and gate turn-on capability without complicated setups.

Can you still afford to stock thousands of different types, sizes, and values of capacitors, coils, and transformers for substitution? Can you afford the wasted time running to and from inventory searching through your stock? Can you afford the extra trips to the parts distributor, or added expense of paperwork, phone calls, minimum orders, and other hidden costs of ordering unneeded capacitors or inductors? Can you afford to guess at the condition of a replacement capacitor or risk wasted time putting a bad capacitor into the circuit?

No matter what type of electronic service work you do, VCRs, computer monitors, or audio amplifiers, the Sencore Auto-Z capacitor/inductor analyzer can take the guesswork out of your troubleshooting, saving valuable time and boosting your confidence. If you're the owner or service manager it means keeping inventory cost low, labor time to a minimum and increasing output. The real question is can you afford not to have a reliable capacitor/inductor analyzer?

Why not let the "Auto-Z" take all the expensive guesswork out of your capacitor and inductor troubleshooting? We invite you to try the "Auto-Z" absolutely risk-free for 10 days. We know the true test of any instrument is how it works for you. To request a risk-free trial or free technical information call (**1-800-SENCORE**) today and talk to your Area Technical Sales Engineer. ■

For additional information circle Fast Fact #252.



Simplify Hi-Fi VCR Servicing With The New VC93 All Format VCR Analyzer

By Rick Meyer, Project Engineer

If you or your customers want to watch some of the "block-buster" movies that are available on video tape, wouldn't you want the best theater effects you can have? Today's big screen TVs provide the visual effects and now Hi-Fi Stereo VCRs bring theater type sound into your living room. Almost all new prerecorded video tapes are now recorded in Hi-Fi Stereo. For most people, all that is left is to own a Hi-Fi Stereo VCR.

Consumers are purchasing more and more Hi-Fi VCRs for home use. According to the EIA (Electronics Industry Association) 20% of all the VCRs sold in 1990 were Hi-Fi Stereo. They predicted that 1991 would have seen even more Hi-Fi Stereo VCRs purchased. Hi-Fi Stereo is also included on many new models of camcorders.

You may already be working on Hi-Fi VCRs. If you aren't, you most likely will, based on the manufacturer's sales forecasts. Servicing of Hi-Fi VCRs can be profitable if you understand how they work and have the equipment needed to service them.

In this article we will learn how Hi-Fi VCRs work and what can go wrong with them. We will then see how the VC93 All Format VCR Analyzer can help you identify and trouble-shoot these problems.

Linear Audio Recording Has Several Drawbacks

We normally think of audio as being recorded linearily onto magnetic tape. This is how audio is recorded by a standard audio cassette tape recorder. We are also familiar with the linear audio systems used in VCRs. Linear recording in VCRs has several disadvantages, however. One disadvantage is the tape speed used in VCRs. Audio cassette recorders normally record audio at a tape speed of 1,875 inches per second. This provides sufficient tape-to-head movement to permit high quality audio with good frequency response. In VCRs, the tape speed is often much slower. As Figure 1 shows, the tape speed of SLP is as low as 0.4375 inches per second or less than 1/4 the speed used in audio cassette recorders. This has a drastic effect on frequency response. As can be seen, the frequency response of a recording made at SLP (the speed most consumers use to record at) is less than 1/2 the frequency response of that found in audio cassette recorders.

Another shortcoming of linear audio recording in VCRs is inherent to their design. In the case of audio cassette recorders, the speed of the tape is held constant by a speed control circuit, either inside the capstan motor or by an external speed control circuit. This ensures that the speed of the capstan and the speed of the tape is constant at all times. The results are low levels of wow and flutter. VCRs on the other hand, use servos to control the speed of the capstan. The prime emphasis is placed on positioning the tape correctly for the rotating video heads. The servo circuits constantly correct the speed of the capstan resulting in tape speed variations. The speed variations are readily heard as wow and flutter in the audio.

Tape Speed	Inches/Sec.	Freq. Response	Wow & Flutter
VCR: (SP)	1.3125	(–60dB) 50Hz - 8kHz	0.2%
(LP)	0.6562	50Hz - 6kHz	0.3%
(SLP)	0.4375	50Hz - 5kHz	0.3%
Cassette Deck	1.8750	30Hz - 13kHz	0.07%

Fig. 1: Linearily recorded VCR audio has much poorer performance than audio cassette decks and created the need for a better audio recording method.

These two major shortcomings of the linear recording in VCRs have been overcome with the development of a whole new method of recording audio onto the video tape. This system uses heads in the rotating drum to record the left and the right stereo audio signals onto the tape. By placing the audio heads in the drum, head to tape speed increases dramatically. This, along with FM modulation of the audio, greatly improves the frequency response of the Hi-Fi audio signal as well as reduces the wow and flutter.

How Hi-Fi Stereo Works

To understand how Hi-Fi Stereo works, we will briefly describe VHS Hi-Fi, since this system is the most widely used format. Beta and 8MM also have their own stereo schemes that are very similar to the VHS Hi-Fi system. The VC93 All Format VCR Analyzer is designed for all of these systems.

In the VHS Hi-Fi Stereo system, the audio is not directly recorded onto the tape. Instead, the left and right channel stereo signal is used to FM modulate two separate carriers. The left channel audio FM modulates a 1.3 MHz carrier. The right channel audio FM modulates a 1.7 MHz carrier. As Figure 3 shows, these frequencies were chosen so that they do not interfere with the chroma and luminance signals.

VHS Hi-Fi uses separate audio heads located in the drum assembly. The heads record the audio signals deep into the video tape. The video heads then record the chroma and luminance signals over the top of the audio signal, but not as deep into the tape. The recorded signals are retrieved from the tape using the same heads that recorded them. The azimuth angle of the video heads is different than that of the audio heads so that only the signal recorded at the correct azimuth is retrieved. Thus, the audio heads receive only the audio signals and the video heads receive only the video signals.

Head selection is as important for obtaining the audio information from the tape as it is for the video information. As you recall, a headswitching signal is used to turn on only the video head that is in contact with the tape, thereby minimizing noise that would be picked up by the head spinning through the air.

Likewise, the audio heads are selected using the audio headswitching signal. This signal is

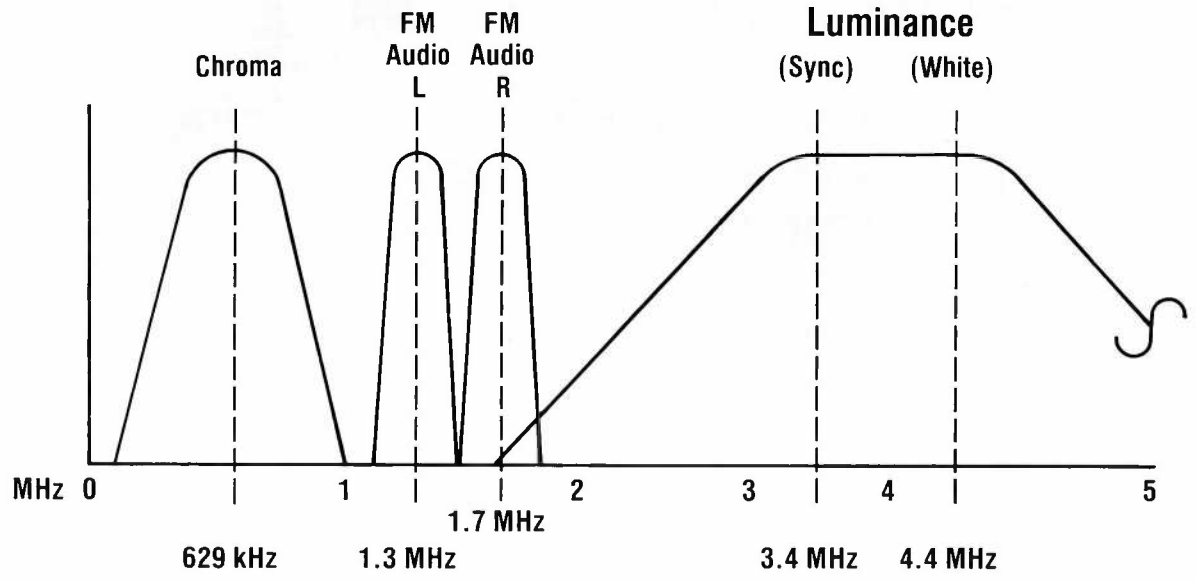


Fig. 2: The Hi-Fi Stereo carriers are located in an empty frequency spectrum between the chroma and luminance signals in the VCR formats.

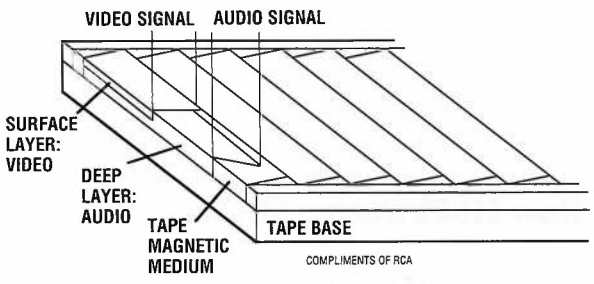


Fig. 3: The VHS Hi-Fi Stereo signal is deep recorded into the tape medium and then the video information is recorded over it.

derived from the video headswitching signal, but is delayed. As we will see later, proper selection of the audio heads is even more critical than that of the video heads.

Once the Hi-Fi Stereo signals are retrieved from the tape, they are decoded by the special Hi-Fi Stereo circuits. These circuits select the appropriate modulated carriers and retrieve the audio information. Muting circuits monitor the FM carrier signals being obtained from the tape and turn off the Hi-Fi circuits if the carriers are missing. Once the audio is decoded from the carriers, it is sent to the left and right channel audio amplifiers and out to a power amp and speakers just like in the case of linear audio.

How The VC93 Simplifies Hi-Fi VCR Servicing

The VC93 All Format VCR Analyzer contains substitution signals that are identical to those signals that are normally recorded onto the video tape. These signals let you troubleshoot Hi-Fi VCR problems using a known good signal. This is called functional analyzing (to find out more on functional analyzing, contact your Area Sales Representative). The VC93 makes selection of these signals simple. Just select the VCR format you are working with and place the PLAYBACK SIGNAL switch to STEREO AUDIO. The signals supplied from the VC93 PLAYBACK OUTPUT jack are now identical to the Hi-Fi Stereo signals that would normally come off the tape. To troubleshoot a Hi-Fi Stereo problem, you now simply inject the VC93 playback signals into the Hi-Fi Stereo VCR stages and listen for audio from the output.

Let's now look at some of the problems Hi-Fi Stereo VCRs have and how the VC93 will help you isolate these problems.

Hi-Fi Stereo Symptoms Don't Always Point To The Cause

When troubleshooting video problems, we can often look at the symptom on the monitor screen to get some clues to help us identify the cause of the video problem. Noise in the picture, whether in the form of snow or noise bars, can help in identifying the cause of the problem. You can then use the VC93 video troubleshooting signals to isolate the defective stages. Only recently are we beginning to see VCRs with video muting circuits that will turn off the video if there is a problem affecting the picture quality. Troubleshooting of these VCRs is more difficult because we no longer have the information we need to steer us along our troubleshooting paths. A similar situation exists when troubleshooting VCR Hi-Fi Stereo problems.

Troubleshooting Hi-Fi Stereo problems is often more difficult than troubleshooting video problems because we seldom have a clear symptom to lead us along the correct troubleshooting path. Noise in the audio heard from a VCR is even more objectionable to your customers than noisy video. Because of this, all Hi-Fi VCRs use muting circuits that turn off the Hi-Fi Stereo audio signal if there is a problem anywhere in the audio signal path, from the heads to the Hi-Fi Stereo decoder. This eliminates our ability to listen to the symptom and determine the cause. Only in cases of marginal audio operation do we hear a symptom such as, "sputtering" audio. In most cases, the audio is either turned off completely or the VCR switches over to the linear mono audio mode.

Signal substitution using the Sencore VC93 simplifies troubleshooting of these Hi-Fi Stereo circuits. The VC93's Hi-Fi substitution signals can be injected into each stage of the Hi-Fi signal path to isolate where the problem is to be able to walk problems out step by step. The VC93 contains the proper FM modulated Hi-Fi Stereo signals to inject into the various parts of the Hi-Fi stages. The VC93 signals automatically overcome audio muting problems.

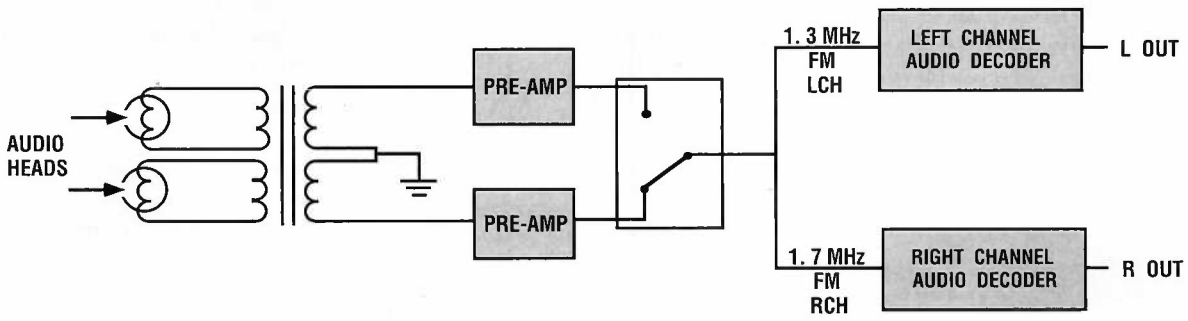


Fig. 5: Use signal injection with the VC93 to quickly walk out the problems in Hi-Fi Stereo circuits.

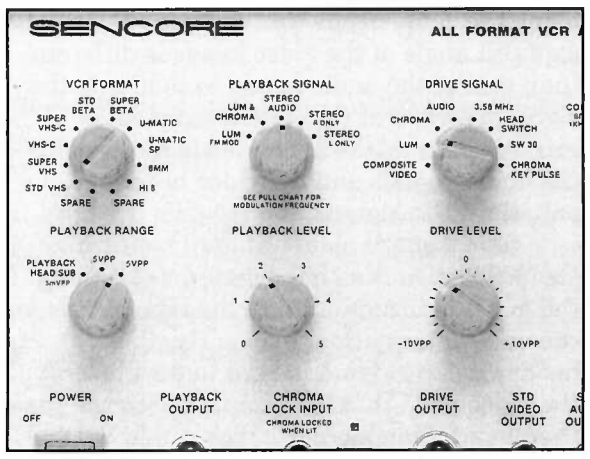


Fig. 4: Simply select the format of the VCR you are working on and set the PLAYBACK SIGNAL switch to STEREO AUDIO to set up the VC93 for Hi-Fi Stereo troubleshooting.

To understand how this troubleshooting method works, we need to understand what malfunctions in the Hi-Fi Stereo signal path. There are five major areas that can result in no, or intermittent Hi-Fi Stereo:

Stereo Decoder
Headswitcher
Preamps
Rotary Transformers
Audio Heads

Let's look at each potential problem area following the block diagram shown in Figure 5.

Identifying Stereo Decoder Problems

The VC93 allows you to quickly determine if a Hi-Fi Stereo problem is the result of a problem in the Hi-Fi Stereo decoder. Two signals are present on the VC93 to isolate Hi-Fi Stereo decoder problems: the **Stereo Audio Playback** signal and the **Audio Drive** signal.

A defective Hi-Fi Stereo decoder produces either no Hi-Fi Stereo audio or intermittent audio. Without a systematic troubleshooting method, a Hi-Fi Stereo decoder problem can easily be misdiagnosed and heads and /or rotary transformers may be needlessly replaced.

To check out the operation of the Hi-Fi Stereo decoder, inject the VC93 Stereo Audio Playback signal into the input of the Hi-Fi Stereo decoder and listen for an output. To do this, (1) set the VC93 VCR FORMAT switch to the VCR format you are working on, in this case, VHS. (2) Set the PLAYBACK SIGNAL switch to STEREO AUDIO. The VC93 is now set up to inject a signal identical to the Hi-Fi Stereo signal that would come from a Hi-Fi Stereo tape. (3) Connect the test lead to the PLAYBACK OUTPUT jack and connect the test lead to the input of the Hi-Fi Stereo decoder. (Note: Set the PLAYBACK RANGE to the 0.5VPP range and the PLAYBACK LEVEL control to the midrange position.) Listen for audio on the monitor connected to the output of the VCR. Adjust the PLAYBACK LEVEL control for the best audio.

**Be aware that the preamp stages are very sensitive, therefore you can over modulate these stages and go right over a problem.*

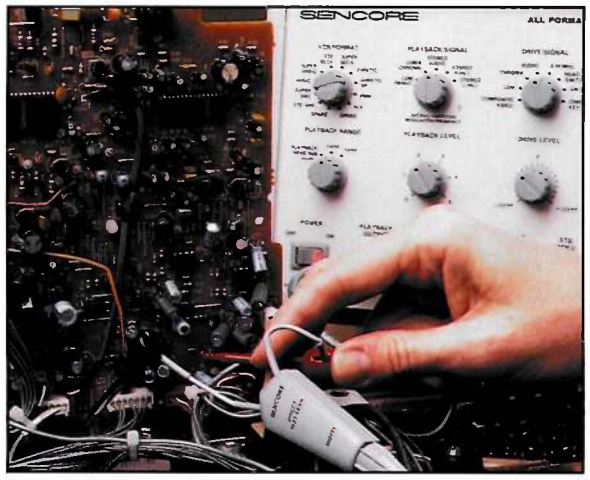


Fig. 6: Simply inject the VC93 Hi-Fi Stereo signal into the Hi-Fi circuits and listen for audio in the output.

If you hear audio when you inject the VC93 Hi-Fi Stereo substitution signal, then the Hi-Fi Stereo decoder is properly decoding the signal and the problem is before the injection point. If you do not hear audio, then check out the audio stages. The VC93 contains an audio drive signal that will let you check out the audio stages after the Hi-Fi Stereo decoder. Simply connect the test lead to the DRIVE OUTPUT jack and set the DRIVE SIGNAL switch to AUDIO. Adjust the DRIVE LEVEL control and listen for audio. If no audio is heard, then move the test lead closer to the audio output of the VCR and walk the problem out of the baseband audio stages.

Checking Headswitching and Preamp Problems

If injection of the VC93 Stereo Audio Playback signal proves that the Hi-Fi Stereo decoder in the VCR is working properly, then connect the test leads to the output of the rotary transformer. Since this is before the preamps, you should switch the PLAYBACK RANGE switch to the PLAYBACK setting. This provides a signal that is at the same low level that is normally found at the output of the rotary transformer. If the audio preamps are working properly, you should hear a good audio at some position of the PLAYBACK LEVEL control. If you have to switch the PLAYBACK RANGE control to the next higher range, then the audio preamps are not amplifying the signal and are defective.

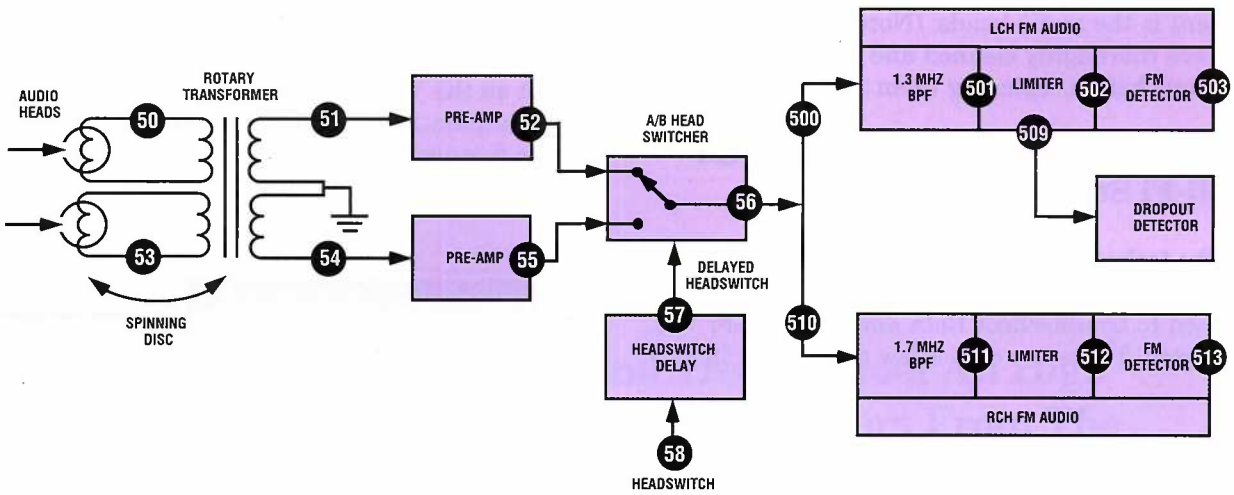


Fig. 7: A bad headswitching signal can also cause a loss of the Hi-Fi Stereo signal. Check the alignment of this signal according to manufacturer's instructions.

Headswitching is also very important to proper operation of the Hi-Fi Stereo circuits in the VCR. The VC93 Hi-Fi Stereo substitution signal supplies continuous signals for both the left and the right channel audio carrier frequencies. If the A/B audio headswitcher is misadjusted or stuck in one position, you should obtain good audio if the preamps and the Hi-Fi Stereo decoder are working properly. If you do obtain good audio with this signal injection, check the headswitching adjustment following the manufacturer's procedures.

Identifying Bad Heads And Rotary Transformers

The previous signal injection was actually the first step in determining if the problem is in the heads or the rotary transformer. If you obtain good audio when you inject the VC93 signal into the output of the rotary transformer and the headswitching proves to be correct, then the only remaining components that could be defective are the audio heads or the audio rotary transformer windings.

We can determine which one is defective by a process of elimination. We can do this by using the VC93 to test the rotary transformer. If it tests good, then the only remaining component is the audio heads.
Since separate audio heads are used in the VHS Hi-Fi, the rotary transformer contains additional windings for the audio heads. A defective rotary transformer winding will not pass the Hi-Fi signal picked up by the audio heads, and no audio will be heard from the speaker of the monitor connected to the VCR.

To perform the rotary transformer test, first turn off the VCR. Next, connect the VC93 test lead to the input connections of the rotary transformer, and turn the PLAYBACK SIGNAL switch to the STEREO HI-FI position. Use the digital peak-to-peak meter on the VC93 to record the level of the input signal you are feeding into the rotary transformer (a 2 to 3 VPP signal works well here). Finally, move the digital meter test leads to the output of the rotary transformer and read the results. The reading on the digital meter should be similar to the one you saw at the input. The

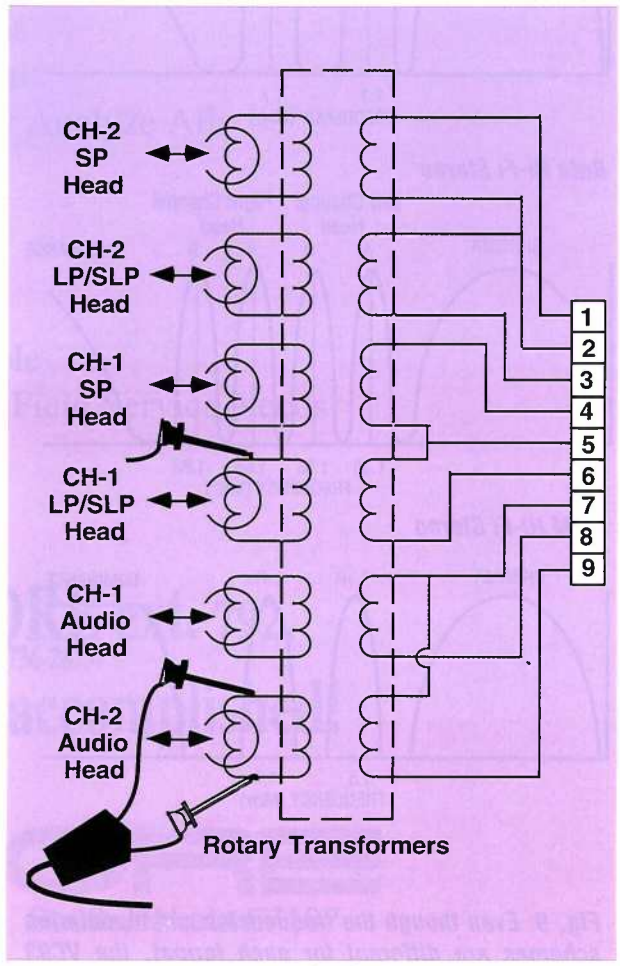


Fig. 8: Use the VC93 to check the rotary transformer windings in the VCR.

exact level will vary depending upon the design of the rotary transformer and its efficiency. The important thing to look for is an output signal. If a signal is obtained at the output of the rotary transformer, then it is properly passing the signal and is good.

If weak or no output is obtained, then disconnect the audio head from the input rotary transformer winding and recheck for an output signal.

If you still do not obtain a signal, then the rotary transformer is bad and should be replaced. (Note: The rotary transformer winding in a Hi-Fi VCR has many output connections for both the audio and the video heads. Make sure you are connected to the correct output winding during this test.) If you now obtain a reading after disconnecting the audio head, you should suspect a shorted audio head.

If all the VC93 tests give you a good audio at the output, then the only remaining component is the audio heads. (Note: Be sure you have thoroughly cleaned and inspected the heads before replacing them.)

Troubleshooting Beta And 8MM Hi-Fi Stereo

The techniques you have just learned for troubleshooting VHS Hi-Fi Stereo can also be used to troubleshoot Beta and 8MM Hi-Fi Stereo. There are only a few differences in these other formats. They include the head arrangement, carrier frequencies used, and modulation techniques. Let's look at each one briefly.

Beta and 8MM Heads: Beta and 8MM Hi-Fi Stereo VCRs use the same heads for the video and audio. This simplifies servicing since it eliminates separate heads, preamps, and headswitchers. In most cases, head related problems will also show up as video problems. Stereo Hi-Fi decoders can still go bad and the VC93 Hi-Fi Stereo substitution signals work equally as well here.

Carrier Frequencies and Modulation: Different carrier frequencies are used for Beta and 8MM. In the Beta format, four carriers are used. Two carriers are used for the left channel: 1.38 MHz for the A head and 1.53 MHz for the B head. Two additional carriers are used for the right channel: 1.68 MHz for the A head and 1.83 MHz for the B head. The Beta Hi-Fi Stereo decoder selects the appropriate carrier decoders for each head. From a servicing standpoint, however, you really don't need to worry about it. Simply select the Beta format on the VCR FORMAT switch and the VC93 automatically supplies the correct carrier frequencies.

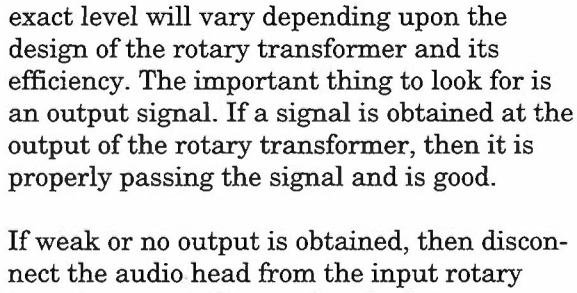
For 8MM, two carriers are used. These carriers are at 1.5 MHz and 1.7 MHz. 8MM needs only two carriers because it matrixes the left and right audio signals much like the matrixing done in FM Stereo. The mono L+R signal is used to FM modulate the 1.5 MHz carrier and the stereo difference L-R signal FM modulates the 1.7 MHz carrier. Again, your servicing is simplified since you don't need to worry about what the frequencies are or how they are matrixed. Simply select the Hi-8 format on the VCR FORMAT switch and inject the signal. (Note: Use the 8MM position for mono 8 MM troubleshooting even if you are working on a Hi-8 VCR.)

The VC93 Simplifies Hi-Fi Stereo Troubleshooting

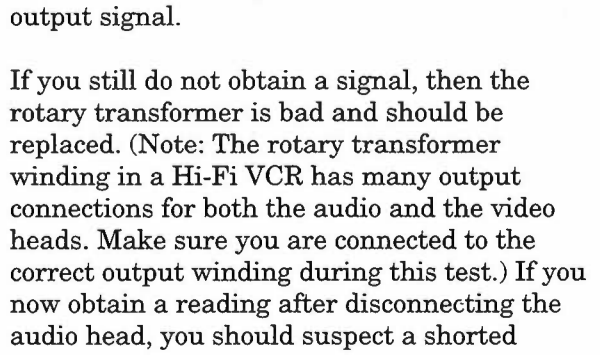
As you have seen Hi-Fi troubleshooting is as simple as selecting the signal on the VC93 and injecting it into the Hi-Fi stages. You don't need to worry about what frequencies to select, what modulation formats to use, or whether the headswitching is set correctly. Simply let the VC93 supply the signals you need and concentrate on troubleshooting the problem. To learn more about how the VC93 can help you speed up your VCR servicing, simply call **1-800-SENCORE.** ■

For information on getting a VC93 on your bench for a 10-day free trial circle FAST FACT #259.

VHS Hi-Fi Stereo



Beta Hi-Fi Stereo



8MM Hi-Fi Stereo

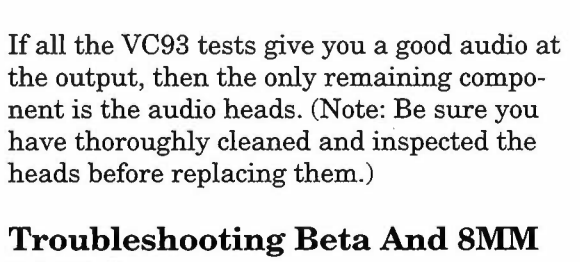


Fig. 9: Even though the frequencies and modulation schemes are different for each format, the VC93 simplifies servicing by automatically setting up these signals for you.

Sencore Tech Talk

Servo Functional Analyzing

Troubleshooting servo problems to determine which servo loop is causing the problem can be difficult. Defects in one servo loop can produce symptoms that look like a problem elsewhere. Plus, non-servo related problems can sometimes appear as a servo problem. Functional analyzing, using the VC93 Servo Analyzer tests and the SC3080 Waveform Analyzer, can take the guesswork out of servo analyzing.

Servo functional analyzing is a three step process:

1. Use the VC93 Servo Analyzer tests to determine if a problem is servo related.

2. Use the same VC93 Servo Analyzer tests to localize the problem to the defective drum or capstan servo section.

3. Use the SC3080 Waveform Analyzer to check key signals to isolate the defective component or circuit within the bad servo section.

The VC93 uses five Servo Analyzer tests to determine if the servos are at fault or if the problem exists elsewhere. These tests are the:

1. Servos Locked test
2. Capstan Speed Error test
3. Capstan Jitter test
4. Drum Speed Error test
5. Drum Jitter test

The Servo Analyzer test will prove if the problem is servo related and then localize the problem to the capstan or drum servo loop. Each test result is displayed as a "Good/Bad" indication and a percent-of-error reading. See Figure 1. If the signal being monitored by the VC93 is varying widely, no "Good/Bad" indication is displayed. Dashes displayed on the Servo Analyzer readout will indicate that the signal being monitored by the VC93 is missing.

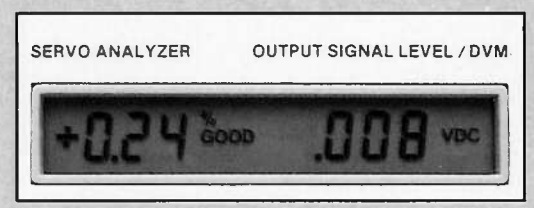


Fig. 1: The Servo Analyzer readout displays the test result as a percent-of-error reading and "Good/Bad" indication.

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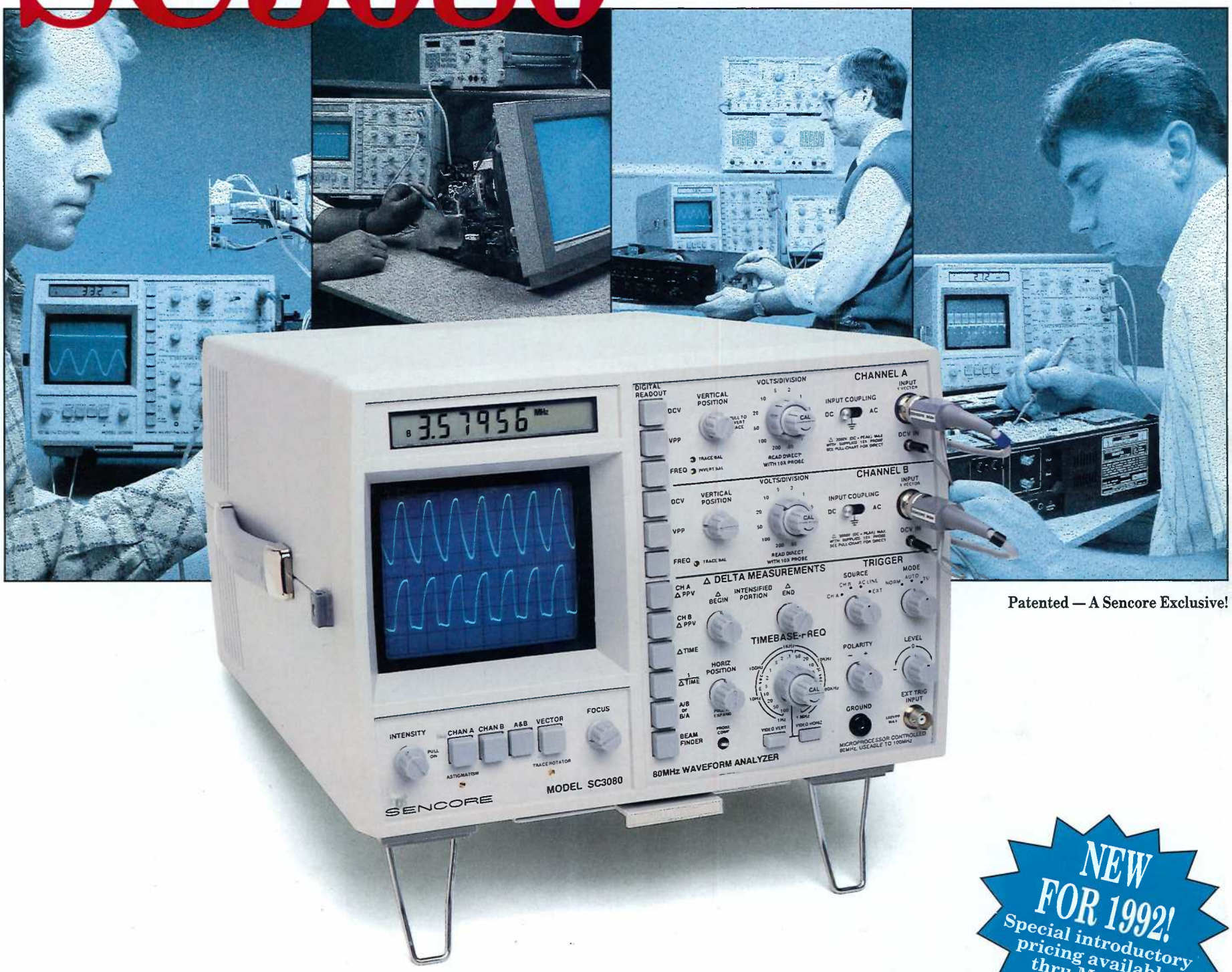
- Isolate video from servo defects!
- Pinpoint capstan and cylinder servo defects!
- Eliminate the guesswork associated with replacing video or audio Hi-Fi heads; before you order the new heads!
- Troubleshoot all VCR formats with the same procedures and confidence every time!

For More Information On The Patented VC93 All Format VCR Analyzer

Call 1-800-SENCORE ext. 792

Circle #208 for FREE information.

SC3080 WAVEFORM ANALYZER



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