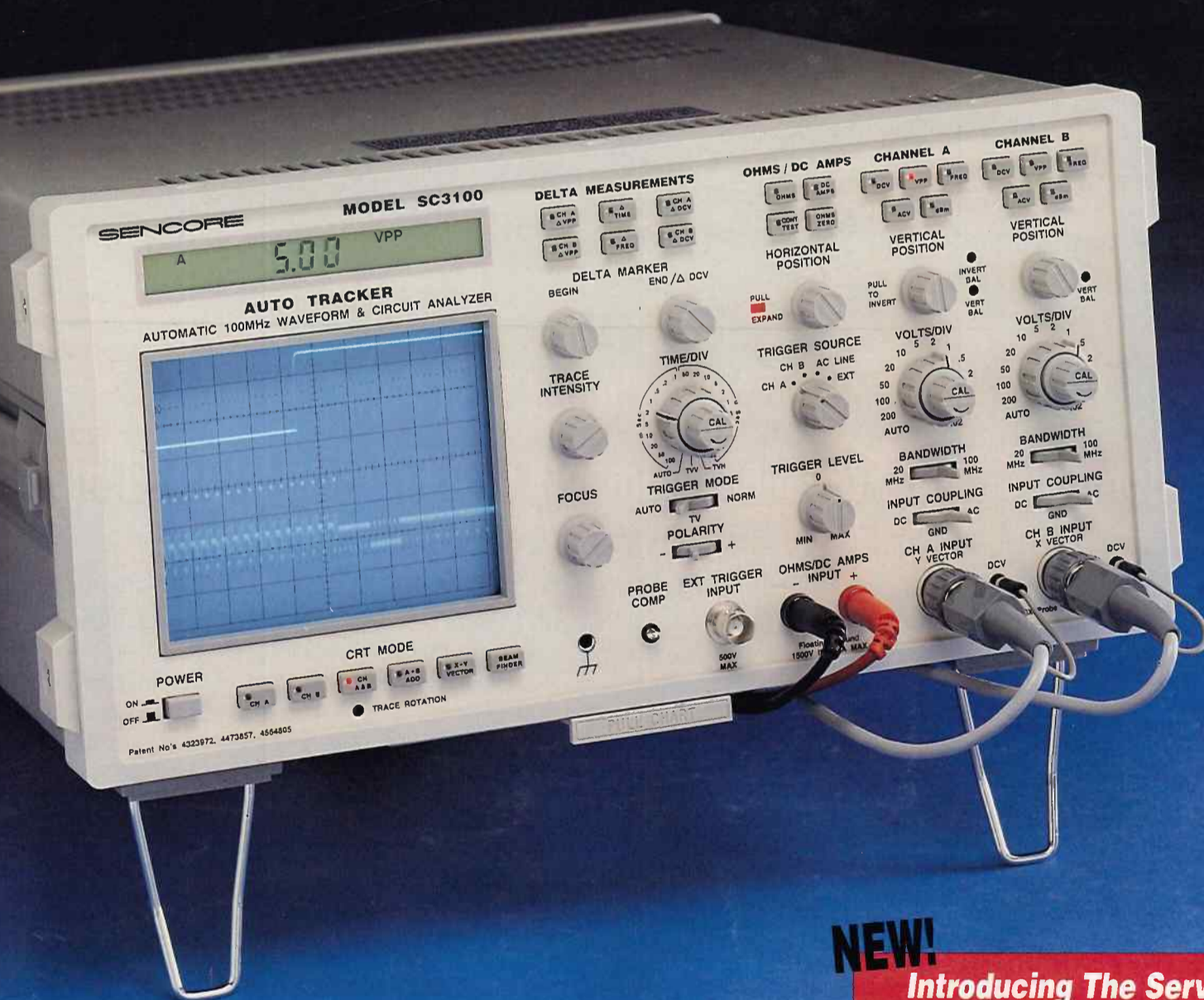
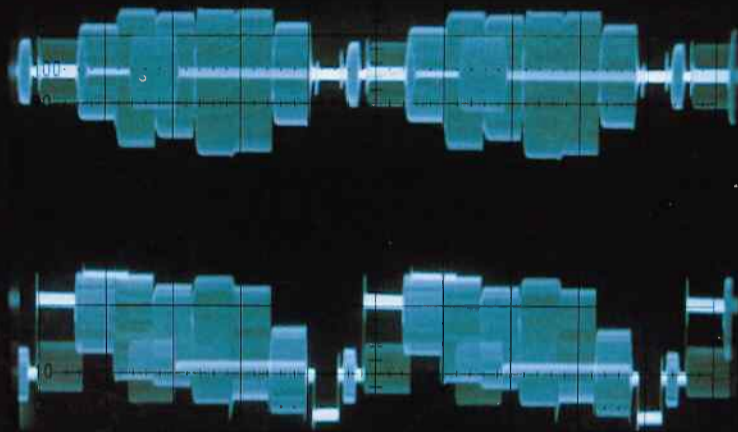


Hands-Free Waveform Analyzing . . . Autoranging Or Auto-Setup?

see page 3

Increase Your Revenue

see page 10



NEW!

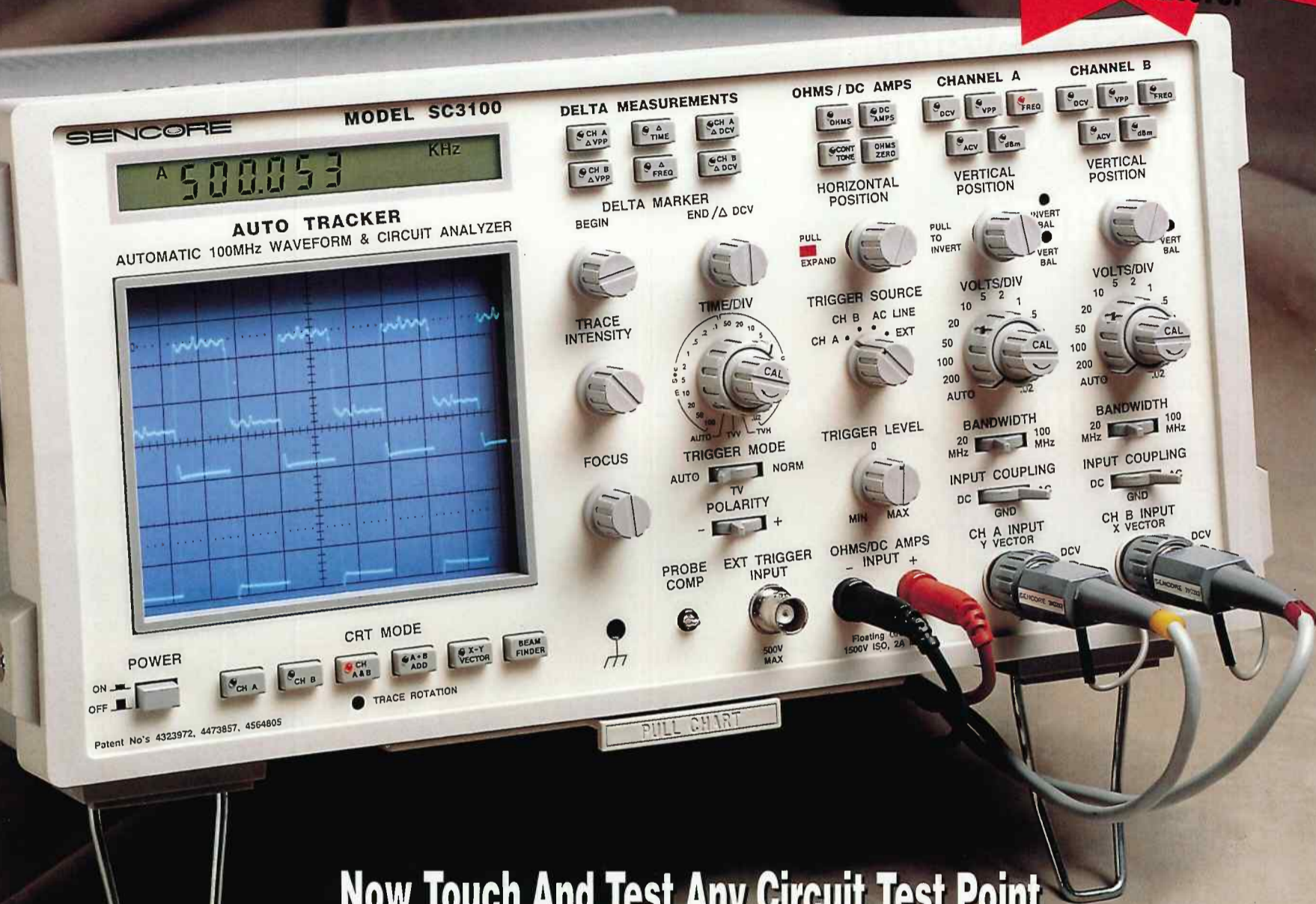
Introducing The Service Center Manager!
(Business Management Software) . . . see page 29



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(736-2673)

Introducing the SC3100 "AUTO TRACKER"

NEW!
Integrated Measurements Of
All Circuit Parameters
With Autoranging Timebase
And Attenuators!



**Now Touch And Test Any Circuit Test Point
And Make Autoranged Error Free Measurements In A Fraction Of The Time!**

The SC3100 "AUTO TRACKER"™ Automatic 100 MHz Waveform & Circuit Analyzer Offers:

A Complete Waveform And Circuit Analyzing System

Measure circuit parameters and view all of the waveforms shown in any service literature with one complete unit. The SC3100 is guaranteed to increase your analyzing capabilities with the push of a button.

Auto-Tracking Digital Readout Of Waveform Voltage And Frequency

Measure the key parameters of any waveform with one probe connection, at the push of a button, for fast and accurate troubleshooting.

Integrated Measurements Of All Circuit Parameters

There's no need for a separate DVM to analyze the rest of the circuit parameters. Measure ohms and current with an integrated, complete circuit analyzer that provides you with troubleshooting answers.

Full Performance, 100 MHz, Dual Trace Oscilloscope

View any waveform quickly, easily, and more accurately. The "fiddle free" trigger controls provide rock solid viewing of any signal and include a special TV mode for complex video waveforms. No signal is too large or too small with our exclusive 2 mV to 2 kV input range.

Exclusive Autoranged Timebase And Vertical Attenuators

No more time wasted turning knobs. Simply set the Timebase and channel attenuators to Auto and view the waveform without resetting the controls as you step through the circuit. This allows you to concentrate on the circuit - not the equipment.

Digital Delta Measurements To Analyze Every Portion Of Any Waveform

Highlight any part of a waveform with Sencore's exclusive Delta Bar and analyze the amplitude, absolute DC, time, or frequency. No more wasting time on graticule counting or setting cursors.

All Functions Microprocessor Integrated For Ease Of Use

The SC3100's analyzing speed will increase your servicing capability. All measurements are based on digital circuits, not the analog CRT, for fast, easy and accurate readings. There are no hidden menus, no multiple function buttons, no complicated setups and no confusing on screen displays. Just push a button and read the results on the LCD display. Eliminates any chance of measurement errors.

**For More Information,
Call 1-800-SENCORE
(736-2673)**

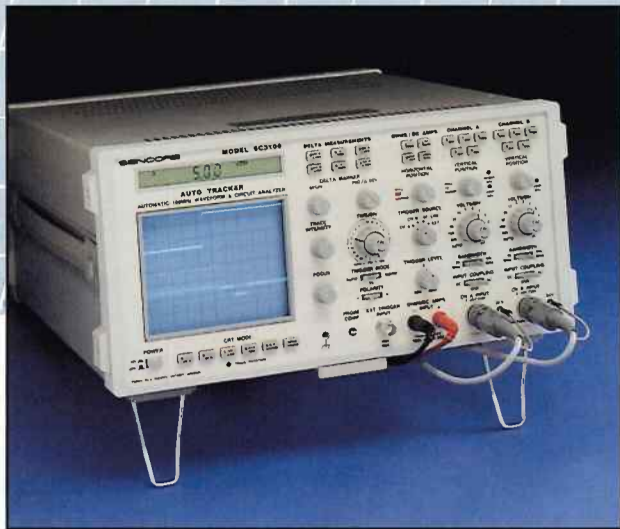
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SPECIAL LIMITED INTRODUCTORY PRICING AVAILABLE - CALL TODAY!

How To Make Hands-Free Waveform Measurements With The NEW SC3100 "AUTO TRACKER"™

By Paul Nies, Application Engineer



On The Cover

The NEW SC3100 "AUTO TRACKER" gives you "hands-free" waveform analyzing capabilities. See page 3 for the feature article.

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Introducing The "SM2001 Service Center Manager" Business Management Software - page 29

Using an oscilloscope has always been a job that requires at least two hands. With the first hand you move the oscilloscope probe from one circuit test point to another, and with the second hand you constantly adjust the oscilloscope's controls, such as the volts/division, time/division, vertical position, and input coupling controls. Of course, an additional hand(s) is necessary if you need to make any adjustments to the circuit!

But did you ever stop to think why you need all those hands? Why is one hand constantly fiddling with setting the oscilloscope's controls? Why do you need to readjust your oscilloscope each time you move to a different test point? Is your mind on making the measurement, rather than on the circuit?

Using the SC3100 "AUTO TRACKER"™ Automatic 100 MHz Waveform & Circuit Analyzer is like having an extra hand built into the unit. You connect the probe to the circuit and let the "AUTO TRACKER" do the measuring for you with its Auto-Tracking digital measurements. Simply push a button and read the desired signal parameter on the

digital readout: DC voltage, peak-to-peak voltage, frequency, or AC voltage. The SC3100's Auto-Tracking measurements are fast and error-free for quick, confident troubleshooting.

Auto-Tracking And Autoranging

But sometimes you need more than a digital measurement of signal parameters. Often times you need to view the waveform to make sure that it's correct; that it has the proper shape; that there's no distortion or noise; and that the timing of two signals is correct.

That's why, in addition to the Auto-Tracking digital parameter measurements, we've made the SC3100's timebase and attenuator controls autoranged. You simply set the SC3100's VOLTS/DIV and TIME/DIV controls to their "AUTO" positions, and the "AUTO TRACKER" automatically sets these controls to the proper range to show a proper waveform display on the CRT. Because its circuits are fully autoranged, you get a proper waveform every time as you move from test point to test point.

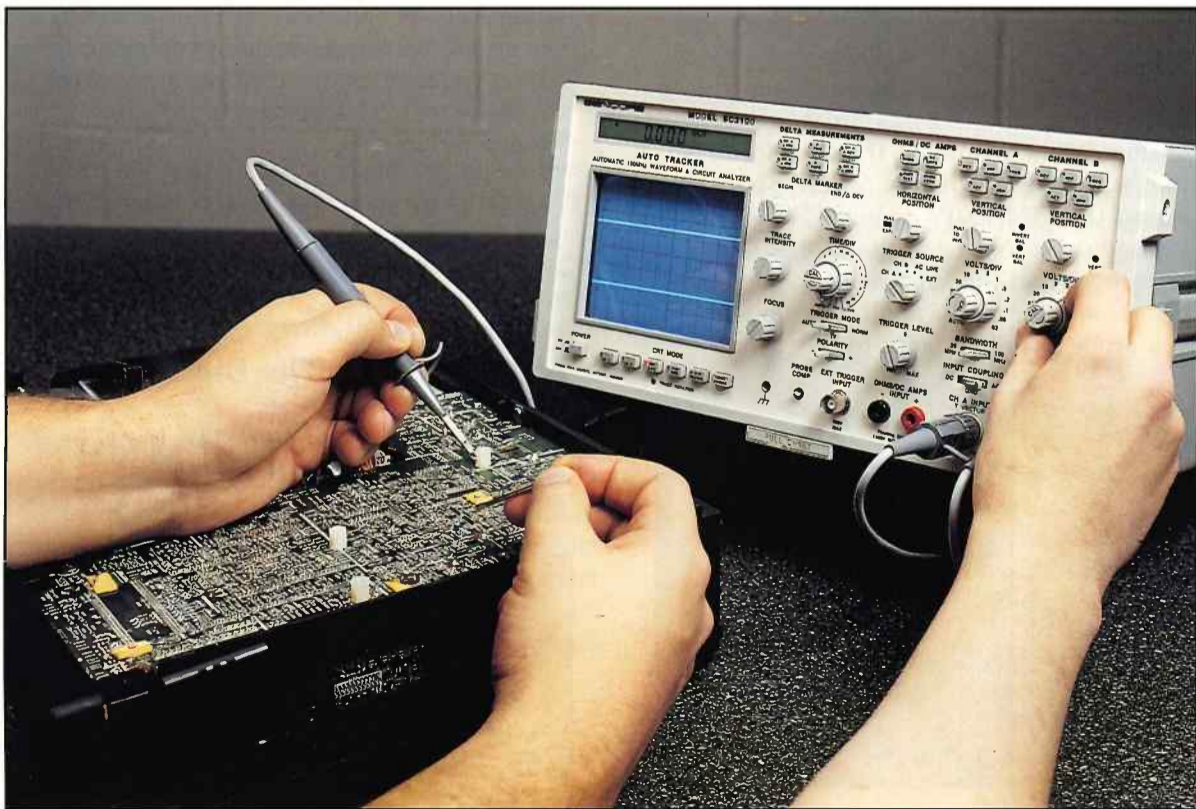


Fig. 1: The SC3100 "AUTO TRACKER" gives you an "extra hand" in your troubleshooting.

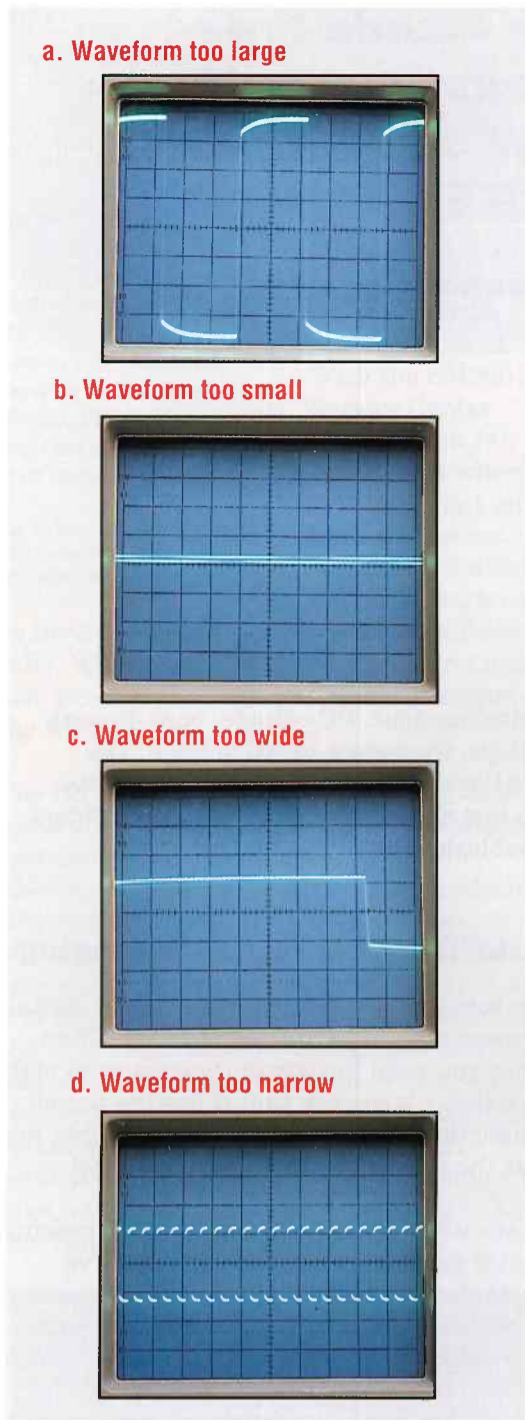


Fig. 2: Each of these waveform displays is the result of one misadjusted oscilloscope control. What control should be adjusted to correct the display?

The waveform displays in Fig. 2 don't look quite right, do they? That's because in each example one of the oscilloscope's controls is misadjusted. In these examples, it's difficult or impossible to analyze the waveform. All that's needed to fix these displays is to simply adjust the TIME/DIV or VOLTS/DIV control, but unless you're using the SC3100 Automatic Waveform and Circuit Analyzer, you'll probably see similar displays all too frequently as you probe from test point to test point.

Have you ever considered how much fiddling with your oscilloscope's controls costs?

1. First you need to think about which control to adjust. Is the top trace Channel A or Channel B?
2. Next you need to think about where to set the control. Does turning the control clockwise make the display larger or smaller?
3. Now you need to take your eyes off the circuit and locate the control on

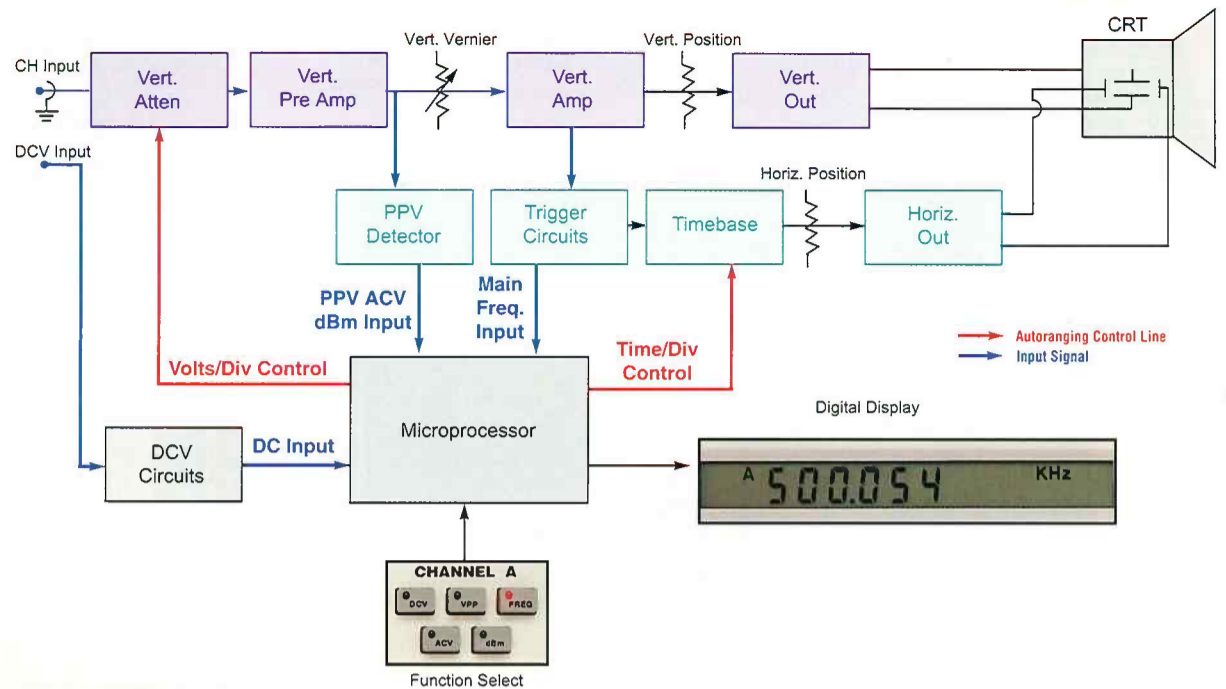


Fig. 3: The input signal is routed to the SC3100's digital measuring circuits ahead of the CRT controls. The microprocessor determines the signal's parameters and automatically sets the vertical attenuator and horizontal timebase for a proper CRT display.

the scope's front panel. Be careful not to let the probe slip off the test point.

4. Finally, you set the control.

If you are an experienced oscilloscope user who is familiar with your unit, the steps above may take only a couple of seconds each time you connect to a different test point. But don't forget step 5:

5. Refocus your attention back on the circuit . . . Now, what did the signal at that other test point look like again?

When you're thinking about how to set the oscilloscope controls, your mind is not on the circuit, and if your mind is not on the circuit your troubleshooting is not effective.

Wouldn't it be great if your oscilloscope automatically adjusted itself and showed the proper waveform without you needing to adjust the oscilloscope controls such as the timebase and vertical attenuator? Sure it would, and that's what the SC3100 "AUTO TRACKER" does for you. Let's take a look inside the SC3100 and see how the "AUTO TRACKER" increases your troubleshooting efficiency.

Autoranging - The Big Timesaver

Figure 3 shows a simplified functional block diagram of the "AUTO TRACKER's" autoranging circuitry. Notice that the key to

the SC3100's autoranging lies in its Auto-Tracking digital measurement circuits.

The SC3100's digital measuring circuits were designed to provide accurate readings of the waveform's parameters - no matter how you set the CRT display, TIME/DIV, VOLTS/DIV, Input Coupling, or variable vernier controls. The digital readout and CRT display share a few input circuits, but then separate into different paths as shown in Fig. 3. Both paths use the same probe, input connection, and input vertical amp.

The digital readings remain independent, however, because the signals for the digital measurements are routed to the microprocessor before the vertical and timebase vernier controls and deflection amplifiers. The DC voltage function uses a separate connection to completely bypass the input coupling switch and vertical circuits. This allows you to measure signals that have a large DC offset and a small AC signal.

As you can see, these inputs to the microprocessor provide the Auto-Tracking digital readings of the waveform's DC voltage, PP voltage, frequency, and AC voltage. But notice the control lines going from the microprocessor to the vertical attenuator and timebase (shown in Fig. 3). These control lines allow the microprocessor to automatically select the setting of the vertical attenuator and timebase.

When any of the VOLTS/DIV or TIME/DIV switches are set to "AUTO", the microprocessor uses the digital peak-to-peak reading or

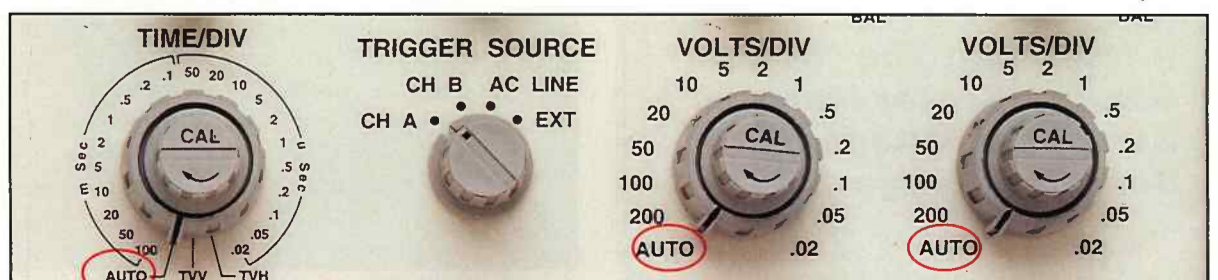


Fig. 4: The Ch. A and Ch. B attenuators and the timebase autorange independently of each other.

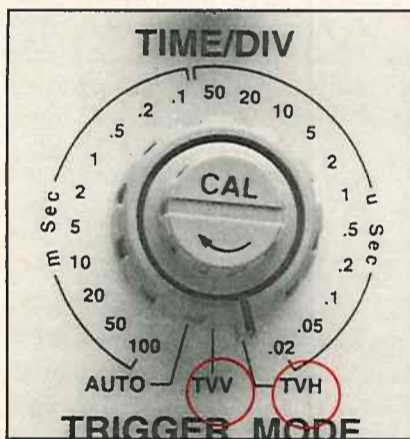
frequency to determine where to set the CRT controls for the best waveform display. The switch settings, which the microprocessor automatically selects, are the same as those which you can manually select from the front panel.

Because the signal to the microprocessor is taken off ahead of the vernier controls, you can use the verniers to "fine tune" the waveform display without affecting the autoranging or the accuracy of the digital readings. The Channel A and Channel B attenuators and the timebase autorange independently of each other. You can choose to autorange just one control, or set all three to "AUTO" for hands-off, error-free automation as you move between test points.

Our goal for the "AUTO TRACKER" was to automate the tedious control settings, but to keep you in full control. The SC3100 won't go off on its own and set controls or make adjustments that you aren't aware of. That's because there are three conditions where you'll want to manually set the timebase:

1. "TV" Trigger Mode – When viewing composite video, you may wish to view the video at either the horizontal or vertical rate. That's why we've included special video presets to set up these waveforms automatically. Select TVV to see two fields or TVH to view two horizontal lines, as shown in Fig. 5b.

5a.



5b.

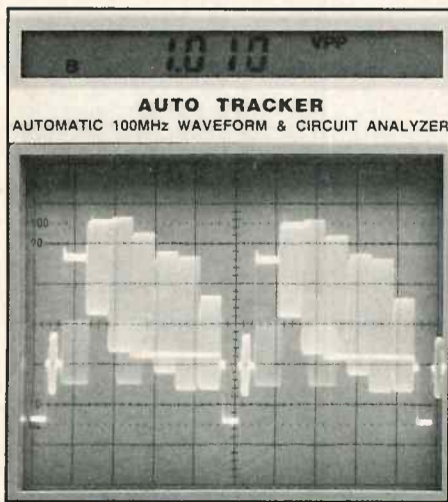


Fig. 5: Set the timebase control to TVV to automatically view two vertical fields of video information, or to TVH to view two horizontal lines as shown here.

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LC102 "AUTO-Z"TM Capacitor & Inductor Analyzer

Five Patents - Only From Sencore!



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

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

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

2. Complex signals – Complex signals such as composite video and FM waveforms contain many different and changing frequencies. You may need to analyze different parts of the waveform at several oscilloscope settings. That's why we've given you the ability to take the timebase out of the autorange function while allowing the vertical input to still fully autorange.

3. Trigger circuits not locked – The SC3100's frequency counter and autoranging timebase circuits lock to the digital pulses produced by the trigger circuits. This insures that you get an accurate frequency reading and waveform display, rather than some random or incorrect reading caused by an unseen signal. So, if the Trigger Level or Source control is not set, the frequency display simply reads "0000." The timebase then remains set, rather than randomly autoranging.

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

plus

Watch Out For "On-Shelf" Leakage

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

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

Quickly Lock Any Signal

If you have used an oscilloscope for any length of time, you know that good trigger circuits are critical to waveform viewing. That's why we've given the SC3100 the best possible, yet the most user friendly trigger circuits. The SC3100 has just four trigger controls, but these four controls allow you to quickly and easily lock in the signals that you encounter.

The Trigger Source control selects which input is directed to the trigger circuits. Set it to either "A" or "B" to match the input.

The Trigger Level and Polarity controls set the waveform point that triggers the circuits. You simply adjust the Level control close to "0" until the waveform locks in. Once it's set, you shouldn't need to reset it. Most signals lock equally well in either the "+" or "-" polarity, except composite video. You'll need to set the Polarity control to match the sync polarity of the video signals you're measuring.

The Trigger Mode switch determines how the trigger circuits operate. In the "AUTO" mode, the sweep circuits always provide a trace, even if the trigger circuits are not locked. This is the trigger mode you will use most of the time, since it allows you to quickly view the waveform size and frequency. If the trace is not locked, simply adjust the Level control. The "NORM" trigger mode only produces a trace on the CRT when the waveform is locked or triggered. Without a locked waveform, the CRT is blank.



Fig. 6: Set the SC3100 TRIGGER MODE switch to "AUTO" so you always see a trace on the CRT – even when the trigger circuits aren't locked.

The "TV" position of the Trigger Mode switch selects the "AUTO TRACKER's" internal sync separators. This provides a stable display when viewing composite video signals. As you change the setting of the timebase control, you'll see the vertical portion of the signal ("mSec" positions) or the horizontal portion ("µSec" positions) in more detail.

There's Only One "AUTO TRACKER"

There are several other digital reading oscilloscopes on the market. But don't be mistaken – there's only one "AUTO TRACKER." Only the "AUTO TRACKER" gives you fast, error-free measurements at the push of a button, plus a hands-free waveform display.

But don't take our word for it. Take a look at Fig. 7. These are some of the displays that you'll get on other digital readout scopes when you attempt to make a measurement.

You can't just push a button and take a reading – you've got to select the measure-

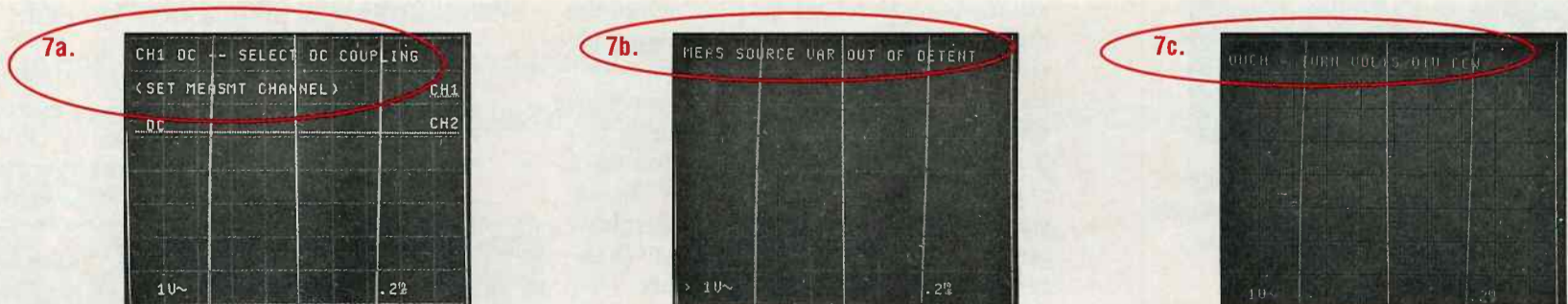
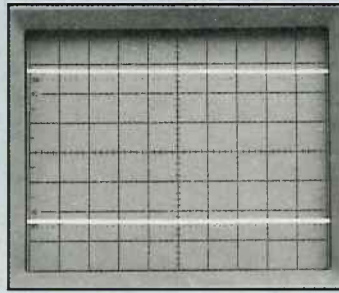


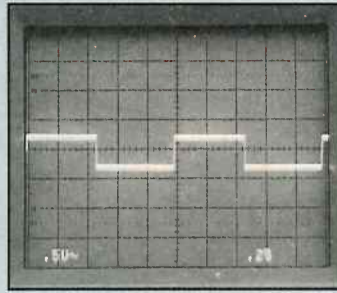
Fig. 7: Push a button to make a measurement using a competitive digital readout scope and this is what you'll get....

AUTO SETUP

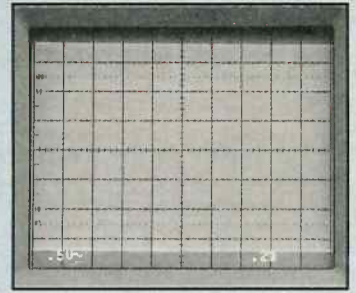
8a. Before pressing auto setup.



8b. After pressing auto setup.

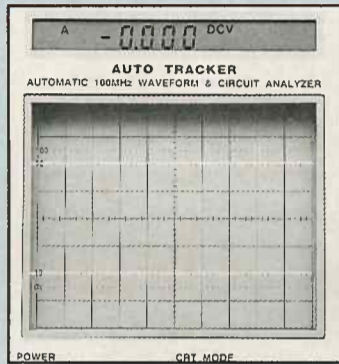


8c. After moving probe to the next test point.

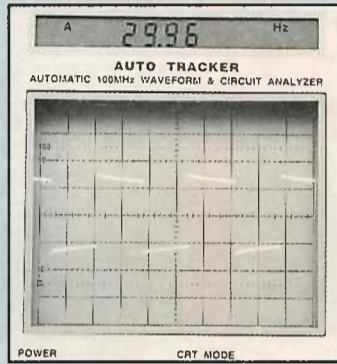


AUTORANGING

8a. Before setting to Autorange.



8b. Using Autorange.



8c. Same waveform as above but autoranged with the "AUTO TRACKER."

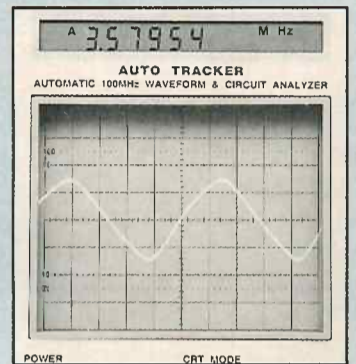


Fig. 8: These waveforms show the difference between Auto Setup and the SC3100's autoranging as you move from test point to test point.

ment channel; (and go through a 3-step menu process to select the other channel); make sure you are DC (or AC) coupled; make sure the variable verniers are set to "CAL" (and never uncal them); set the timebase control; set the vertical controls – you've got to take your mind off of the circuit!

And what about those "auto setup" buttons that a couple other competitive models have? Well, auto setup is great to get a waveform display when you first turn on your scope, or if you're in a production environment looking at the same sequence of test points over and over. But if you're moving from test point to test point troubleshooting a circuit, you simply can't afford the time (or patience) to use auto setup. You don't have that extra hand you sometimes need. You need the SC3100's Auto-Tracking, autoranged performance.

Here's why:

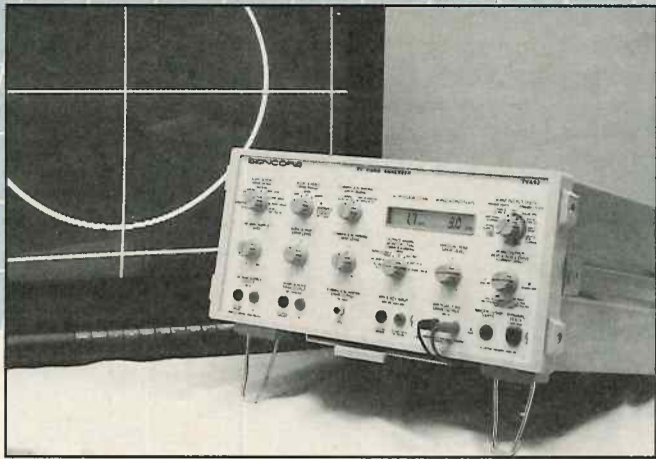
We'll connect the Channel A input of the "AUTO TRACKER" and a competitive unit having auto setup to a test point. As the photos in Fig. 8a show, neither unit is displaying a locked-in waveform. This is because we haven't pressed the "auto setup" button yet, nor have we set the SC3100 controls to "AUTO." Let's do this now and see what happens.

Both units automatically range to display the waveform, as the photos in Fig. 8b show. So far it looks like the SC3100's autoranging and the competitor's auto setup are the same. But let's now move the probes to a different test point. The photos in Fig. 8c tell the story.

The SC3100 automatically autoranged and continues to display the new waveform. The competitor? Well, it looks like we'll need to push auto setup again. (Oh, by the way, when you do, the competitive unit will default to a preset condition and you'll need to reselect the measurement all over again).

As you can see, there's only one Automatic Waveform And Circuit Analyzer – the SC3100 "AUTO TRACKER." If you'd like to learn more about the "AUTO TRACKER", call your Area Sales Representative toll-free at **1-800-SENCORE**. Easy investment terms and easy-to-use features guarantee increased bottom-line profit.

Call us today. We'll help put the SC3100 "AUTO TRACKER" on your bench. The best way to learn is to try it for yourself. ■



Isolating "Power Up" Problems With The TVA92's Horizontal Output Load Test

By Glen Kropuenske, Application Engineer

How do you troubleshoot a TV when the circuits won't come on or are shut down right away? You can't measure any voltages or look at any waveforms! And what about those chassis that instantly burn up components? How do you isolate those chassis problems without spending a fortune on parts?

These are only a few of the TV servicing questions presented to Sencore's Field Representatives and Application Engineers. When these questions were relayed back to the Product Design Team of our TVA92 TV Video Analyzer, we immediately went to work to identify the causes and find solutions. Here's what we found.

Relationship Of B+ Supply, Horizontal Output, And High Voltage Shutdown Circuits

After studying schematics and performing service procedures on many chassis based on your input, we identified the most common servicing problems. It became clear that troubleshooting TV "power up" problems involved testing more circuits than just the power supply. Figure 1 shows the relationship between the switching mode power supply, horizontal output/flyback, safety circuits, and control circuits. When the TV will not power-up properly or parts are instantly damaged, there is no procedure to make measurements to isolate the problem.

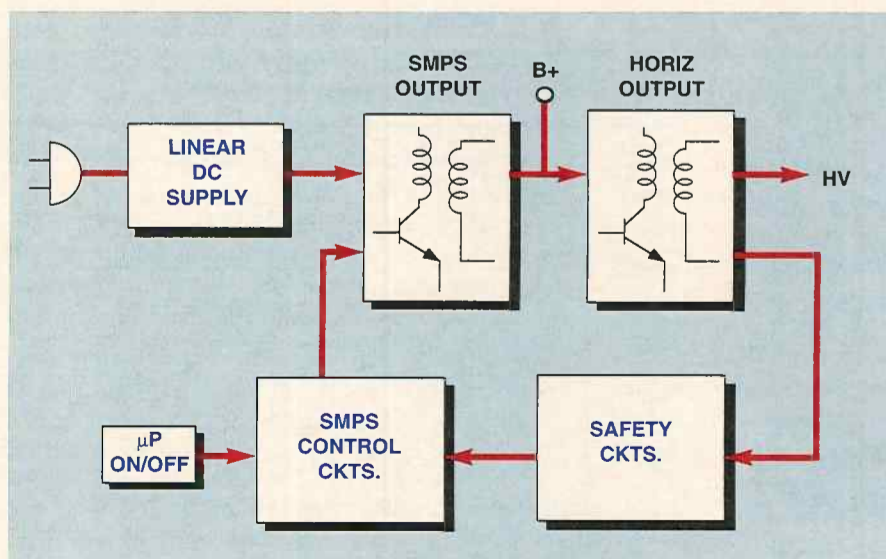


Fig. 1: Problems in the horizontal output, flyback secondaries, safety shutdown, or control circuits may prevent normal power supply operation.

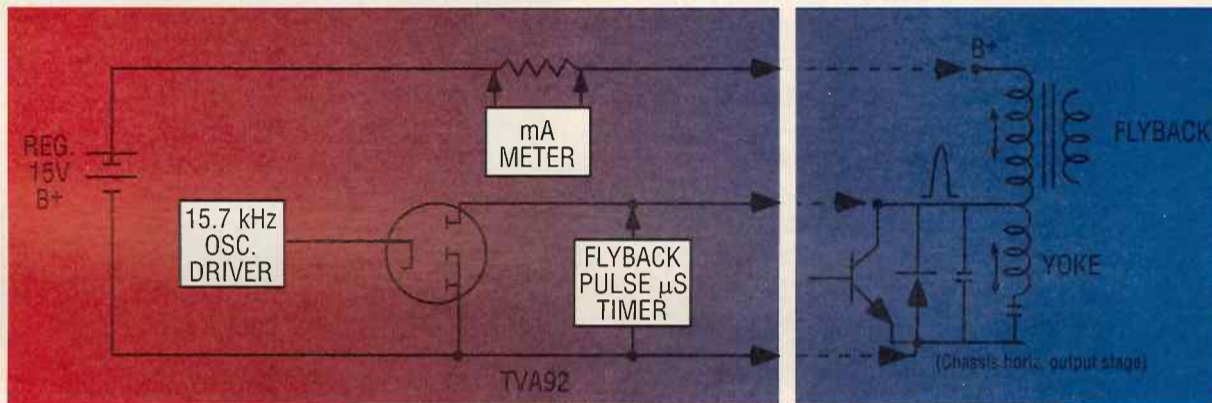


Fig. 2: The TVA92's Horizontal Output Load Test simulates the normal action of the TV's horizontal output stage without applying AC power to the TV.

Our research showed the horizontal output stage was the key to detecting power supply loading and "power up" problems. The horizontal output stage is responsible for taking current (power) from the B+ supply and transferring it to much of the TV circuitry via the flyback transformer. Furthermore, the timing or resonant action of the horizontal output stage determines the amplitude of the flyback pulse used to develop normal high voltage.

After months of intensive study and testing, the TVA92's Horizontal Output Load Test was developed to fill these power supply servicing voids. This test checks the horizontal output circuit and associated loads with no power applied to the set. Let's look at how this test works and how you can use it to troubleshoot B+ power supply loading, horizontal output stage problems, and shutdown problems.

transistor switch that switches flyback primary current to ground at a 15.7 kHz rate with a 30 μ S on-time.

The TVA92's Horizontal Output Load Test fulfills these requirements with a 15 volt B+ substitute supply and a power transistor switched at the proper rate and time simulating the action of the horizontal output stage. During the load test, alternating currents are produced in the TV's flyback and yoke, closely matching the full power operation of the horizontal output stage.

The TVA92's Horizontal Output Load Test requires three simple connections to the TV chassis. The B+ test lead is connected to the TV's B+ test point either at the power supply or at the B+ terminal of the flyback transformer primary. The other two connections are made to the emitter and collector of the horizontal output transistor.

The TV "OFF" Horizontal Output Load Test

The TVA92's Horizontal Output Load Test enables you to simulate the normal operation of the TV's horizontal output stage with no AC power applied to the TV. Simulating the operation of the horizontal output stage requires: 1) B+ voltage to the flyback primary, and 2) a

GOOD/BAD mA and μ S Readouts Indicate B+ Loading Or Horizontal Timing Problems

The Horizontal Output Load Test checks the operation of the horizontal output stage and monitors the current load demanded of the TV's B+ supply. Separate mA and μ S readouts are provided to detect abnormal conditions with GOOD/BAD indicators for each.

The TVA92 uses 15 volts as a substitute for the TV's B+ supply which is approximately 1/10 of the normal B+ voltage found in most TVs. At this reduced B+ level, the TV's horizontal output stage operates similarly as it would if the full B+ voltage was applied, but

with approximately 1/10 the current and voltage amplitudes.

The TVA92 measures and displays the current supplied by the Horizontal Output Load Test's 15 volt supply. Readouts between 5-80 mA represent a normal range of current for a wide variety of horizontal output stages and are displayed as "GOOD" by the TVA92. Current levels less than 5 mA indicate improper test lead connections or an open in the horizontal output circuits. Readings greater than 80 mA indicate heavy current load demands from the horizontal output, flyback, or other B+ circuits. Readings outside the 5-80 mA range are shown as "BAD" by the TVA92.

The mA readout of the Horizontal Output Load Test may be used to anticipate the TV's B+ power supply current at full operating voltages. To approximate the load current, simply multiply the mA readout of the Horizontal Output Load Test by 10. In most receivers, the TV's actual B+ current at full voltage will be slightly higher due to additional CRT current. Readings higher than 80 mA relate to excessive B+ power supply current demands of 1 amp or more at full B+ operating voltages.

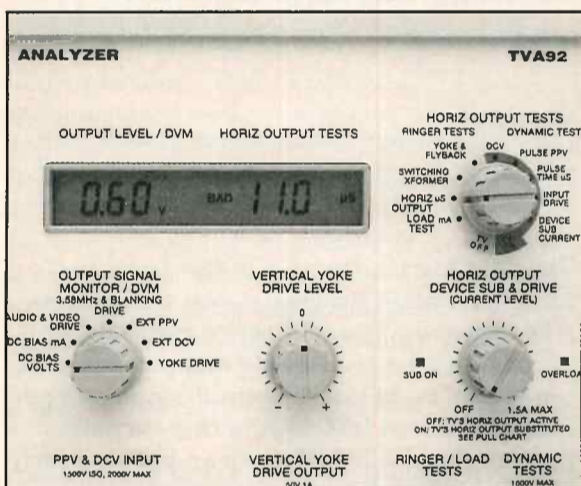


Fig. 3: Horizontal Output Load Test readouts of less than 11.3 μS indicate abnormally fast retrace timing which produces excessive high voltage and shutdown symptoms.

During the Horizontal Output Load Test, a flyback pulse is produced at the collector of the horizontal output transistor. The TVA92 measures and displays the μS duration of this flyback pulse. The duration or on-time of the flyback pulse is dependent on the operation of the horizontal output circuits of the TV – primarily the flyback, retrace timing capacitors, yoke, and yoke capacitor.

The pulse time readout indicates if proper timing and resonant action are occurring in the flyback and yoke circuits. Readings between 11.3 and 15.9 μS represent a normal range for horizontal output stages and are considered "GOOD." If the μS readout indicates "GOOD", you can be assured that the horizontal output stage is developing normal flyback pulses. Readings above or below this range are considered "BAD" and indicate improper timing, flyback defects, or severe loading problems.

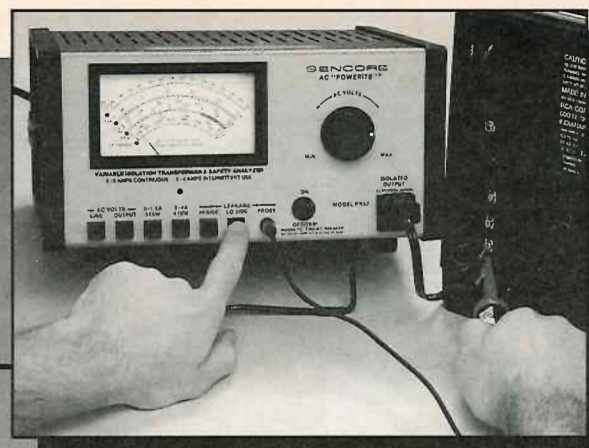
When both the mA and μS readouts indicate "GOOD", the horizontal output stage and

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PR57 AC "POWERITE"®

Variable Isolation Transformer & Safety Analyzer

Patented - You Can't Get This Anywhere Else!



Avoid Embarrassment And Risk - Know Beyond A Doubt That Your AC Power (And The Equipment You Service) Is Right And Safe!

The PR57 "POWERITE" lets you know that your AC power is right. Its output is isolated and variable from 0 to 150 volts or 470 Watts. You can continuously monitor voltage, current, or wattage to prove that the equipment under test isn't drawing too much current at any voltage setting.

The PR57's AC line leakage safety test assures that excessive leakage is not present on any exposed part of the equipment being tested. Perform this important safety test on every electronic product for your customer's security and your peace of mind.

Conquer challenging shutdown problems and eliminate callbacks. Lower the line voltage to solve tough shutdown problems; raise the line voltage to sweat out intermittents or sensitive parts. Test every set at high and low line voltage catching stressed power supply components. Identify AC line related problems like picture width, sync, and intermittents in the customer's home, or test in the shop at their line voltage.

Five Ways To Make Sure Your Power Is Right And Safe

- It's an isolation transformer.
- It's a variable AC supply.
- It's a power line monitor.
- It's an amp/watt meter.
- It's a safety leakage tester.



What Causes Leakage?

Any path that will place the customer into either direct or indirect contact with the AC line is dangerous. There are many different ways in which this can happen. The following is a list of some of the most common causes of leakage:

- Shorted/leaky antenna bypass capacitors
- Improperly installed tuner
- Conductive knobs
- Defective isolation transformers
- AC bypass capacitors
- Bent rabbit ears
- Improper installation of parts
- Foreign objects touching the AC line
- A broken safety ground
- Using long metal screws
- Adding an earphone
- Connecting an external speaker
- Replacing a plastic shaft pot with one that has a metal shaft

The PR57 allows you to check for dangerous AC leakage in just seconds.

flyback secondaries are operating within a normal range. In the majority of cases, this indicates a 100% problem-free horizontal output stage.

A "BAD" reading in one or both of the Horizontal Output Load Test parameters indicates a problem in the horizontal output circuit, flyback, or flyback secondaries. Use the "BAD" readout to help determine the cause when isolating the problem. Figure 4 outlines "likely causes" for different combinations of the GOOD/BAD Horizontal Output Load Test readouts.

Troubleshooting B+ Shorts Or Loading With The mA Readout

The Horizontal Output Load Test mA readout can be used to determine the severity of the loading problem. There

are three common types of B+ supply shorts or leakage problems:

1. Short (low resistance DC current path to ground)

HORIZ LOAD mA	TEST READOUTS μS	MOST LIKELY CAUSES
---	---	IMPROPER CONNECTIONS, OPEN FLYBACK, OPEN HORIZ OUTPUT STAGE CIRCUIT PATHS
GOOD	GOOD	NO SEVERE LOADING OR TIMING DEFECTS
BAD	---	SEVERE B+ SUPPLY SHORT OR LEAKAGE PATH, < 5 mA = OPEN FLYBACK OR HORIZ CIRCUIT PATH
GOOD	---	OPEN FLYBACK, IMPROPER "COLLECTOR" CONNECTION, OPEN RINGER/LOAD FUSE
BAD	GOOD	SEVERE B+ LEAKAGE AND/OR FLYBACK SECONDARY SHORT OR LEAKAGE PATH, FLYBACK TRANSFORMER
GOOD	BAD	DEFECTIVE HORIZ OUTPUT TIMING COMPONENTS, FLYBACK TRANSFORMER, OR SEVERE FLYBACK SECONDARY SHORT OR LEAKAGE PATH
BAD	BAD	SEVERE B+ LEAKAGE AND/OR FLYBACK SECONDARY SHORT OR LEAKAGE PATH, FLYBACK TRANSFORMER, DEFECTIVE HORIZ OUTPUT TIMING COMPONENTS

NOTE: Fluctuating readings in the μS readout values indicate abnormal flyback pulse ringing or timing.

Fig. 4: Possible Horizontal Output Load Test results and likely causes.

2. DC leakage (higher resistance DC current path to ground)
3. AC short or leakage (added AC current or power demand due to a shorted turn in the yoke/flyback or a defect in the flyback secondary circuits).

The maximum current output by the TVA92's Horizontal Output Load Test is 250 mA. A readout near 250 mA during the Horizontal Output Load Test indicates a low resistance short on the B+ power supply. A likely cause of a B+ short is a shorted horizontal output transistor. The horizontal output transistor and/or damper, if good, will not draw excessive current affecting the Horizontal Output Load Test results. If the mA readout changes to "GOOD" after removing the horizontal output transistor, you have confirmed the horizontal output transistor is shorted. If the mA readout remains "BAD" after removing the horizontal output transistor, continue to open possible DC short paths to isolate the short.

Loading problems consisting of higher-resistance shorts produce readouts on the Horizontal Output Load Test ranging from 80 mA to 200 mA. The first step in isolating a loading problem is to determine if the added load current is caused by DC loading or AC loading (see Fig. 5). You can determine this by disconnecting the yellow test lead (collector). This stops the switching action in the horizontal output stage by removing any alternating currents to the flyback and yoke.

The remaining current indicated by the Horizontal Output Load Test display is DC current to the horizontal output stage, driver, and other B+ powered circuits. If the current is higher than 5 mA, suspect a DC short or leakage path on the B+ power supply. To isolate DC short or leakage paths, open circuit paths while comparing mA readouts to earlier readings.

If the current readout is greater than 80 mA during the Horizontal Output Load Test but is less than 5 mA when the yellow (collector) lead is removed, the high current is a result of a severe AC current load in the horizontal output stage. The current demand may be caused by shorted turns in the flyback/yoke or by a short or leakage on any of the secondary circuits of the flyback.

To isolate an AC loading problem, use the EXT PPV & DCV INPUT of the TVA92 to measure DC voltages and peak-to-peak flyback pulse amplitudes on the secondary windings of the flyback. The voltage and current levels should be approximately 1/10 of the normal values indicated by the schematic. Waveforms or DC voltages which are missing or considerably lower indicate a possible problem associated with that flyback winding. Open the current path by unsoldering a flyback lead, scan-diode, etc. Repeat the Horizontal Output Load Test and compare the mA readout to the previous value. A large decrease in the mA readout confirms a problem with the load on that flyback winding.

If all the secondary voltages appear normal or equally reduced, the problem is likely caused by a shorted turn in the flyback/yoke, or a component is breaking down in the horizontal output stage. Use the patented Ringer test of the TVA92 to check the flyback and yoke for even a single shorted turn.

Troubleshoot Horizontal Timing Problems With The μ S Readout

The Horiz Output Load Test μ S readout provides an indication of the resonant timing change in the horizontal output stage or problems affecting the flyback pulse waveshape. There are three common types of problems in the horizontal output flyback circuits which will be evident on the μ S readout of the TVA92's Horizontal Output Load Test.

1. Open B+, flyback primary, ground path, or component in the horizontal output stage.
2. Change in value of the critical timing components in the horizontal output stage.
3. Short or leakage in the horizontal output stage or flyback secondaries. (Often accompanied by higher than normal mA readout of the Horizontal Output Load Test.)

A " - - - " (blank) μ S readout indicates that flyback pulses normally produced during the Horizontal Output Load Test are not present. This readout can be an indication of improper

test lead connections or an open circuit path from B+ through the flyback primary to ground. The open may be in the flyback primary, B+ path, or emitter ground path. A " - - - " μ S readout may also be caused by a short in the horizontal output stage. A short is indicated when this blank readout is accompanied by a "BAD" mA readout.

A steady "BAD" μ S readout indicates a value change in one of the critical timing components in the horizontal output stage. A μ S readout greater than 16 μ S usually indicates a problem with the yoke components. Check the yoke, yoke series capacitor, and other components associated with the yoke.

If the μ S readout is below 11.3 μ S, check the retrace timing capacitors and use the TVA92's Ringer test to test the flyback and yoke. In some cases, a short on a flyback secondary will effectively decrease the flyback transformer's inductance value causing the μ S readout to fall below 11.3 μ S. If the Ringer test shows the flyback and yoke OK, check for abnormal loading of the flyback secondaries.

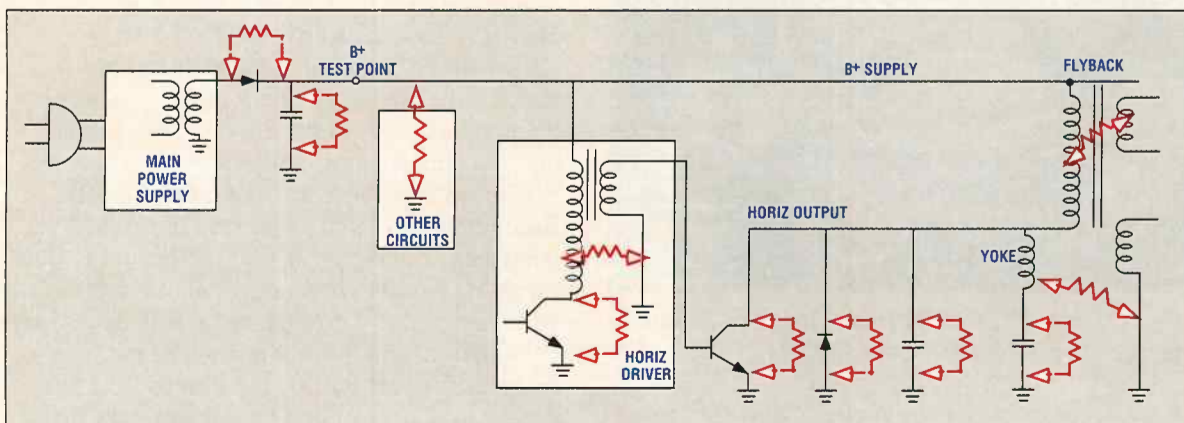
Readouts that vary by several μ S or more indicate an abnormal flyback pulse waveshape. Varying μ S readouts may be caused by multiple flyback pulses or abnormal flyback pulse ringing. This symptom is typical of loading problems in the flyback secondary or horizontal output stage.

Boost Your Confidence

The TVA92 TV Video Analyzer is your answer to tough TV powering and shutdown servicing problems. In addition to the patent pending Horizontal Output Load Test, the TVA92 provides you with many other exclusive TV analyzing features which we'll discuss in future issues.

Let the TVA92 boost your TV servicing confidence and increase your profits in 1993 and beyond. For complete information or a video demonstration on the TVA92 TV Video Analyzer, call your Sencore Area Sales Representative at 1-800-SENCORE (736-2673) today. ■

DC LEAKAGE PATHS



AC LEAKAGE PATHS

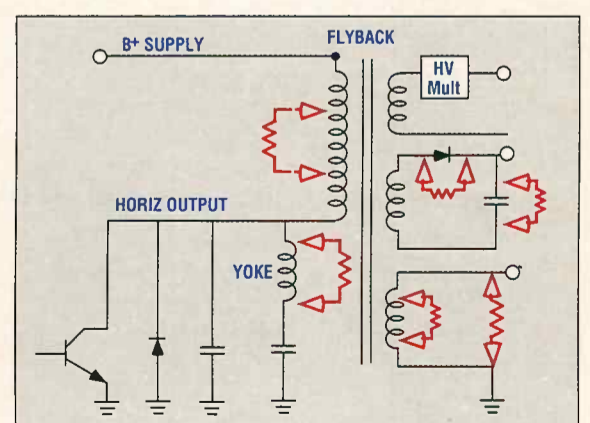


Fig. 5: Possible short or leakage paths which can load down the TV's B+ power supply.



Strategies For Increasing Revenue

By Al Bowden, Owner and President, Sencore, Inc.

In the last issue of the Sencore News (#159), we looked into some basic business concepts: Inventory, Revenue, Operating Expenses and Profit. We defined these concepts and finally discussed the relationship between them and the effect they can have on a service business. In this issue, the subject of "Increasing Revenue" is being explored, specifically:

How can a Service Center embark on a mission of increasing revenue?

Where can we find new sources of revenue?

What are some sure/proven methods that we can use to get additional business in our Service Center?

NOTE: Before we embark on a mission to increase revenue, we need to make sure that we have the means (the capacity) to handle the increased revenue. (Remember Steve's problems? We do not want to cause them in your business).

What Are Your Revenue Channels?

Most servicers want to increase their revenue. But before we can do a good job of planning our revenue-increasing activities (our merchandising strategy), we need to understand and categorize the sources of revenue:

- A. Existing Customers
- B. New Customers/Walk Ins
- C. Major Accounts

Bottom line, these are the three areas where we can expect revenue. We can implement programs that are specifically targeted to each customer group in order to:

1. Insure the maintenance of the existing customer base, and
2. Increase the customer base.

Before we start spending money on a revenue increasing program, however, let's find out how to prepare ourselves and make sure our money is well spent.

What's Important Before We Implement Any Revenue-Increasing Program?

One of the most important aspects of any business is customer satisfaction – before and after the repair is done. We, as professional service technicians, need to project an image that:

- ◆ Portrays Professionalism
- ◆ Projects Excitement About Our Profession
- ◆ Values The Relationship With Our Customer
- ◆ Builds Trust And Projects Our Ability To Getting The Job Done

Portray A Professional Image: Whatever traffic your advertisement or revenue-increasing program brings to your shop is considered an investment. It represents the investment you made in a program that brought this potential customer into your shop. This individual is the customer and is ultimately paying the bills – he/she is the boss! We, as professional repair people, need to show this individual the quality of our work. We need to show our quality workmanship aspect, but also in the overall business quality. After all, his first impression is your shop and you – not your repair work.



Fig. 1: Portraying a professional image gives your customers confidence in your abilities.

A neat, organized shop, a clean waiting area, an organized paperwork system, and a friendly person at the front desk are the first aspects of your business that your customer

sees. If he is dropping off a \$500 VCR, he needs to feel secure that he is handing his equipment to a competent shop with a clean, neat environment that has the means to protect and repair his investment. Keep in mind that a customer will pay more to deal with what he perceives is a competent shop. He will pay more for peace of mind and for the assurance that the repair will be done right.

Project Excitement About Your Job/Profession: Some service centers view a walk-in as an interruption and may inadvertently pass that feeling on to their customer. A customer should always feel welcome in your shop – you are the only person that can make this happen. Bottom line, treat a customer that walks in your shop the same way you would treat an old friend walking in your living room.

The person or people responsible for handling customers should be top-notch. They should be well-dressed, or uniformed (if possible) with a name tag and a smile on their face. They should project the image of being happy to see the customer and being excited to work on his equipment. A little discussion on the "value" of the customer's equipment always helps. If the customer has a state-of-the-art VCR, praise its features. As a service professional, your praising of his investment only builds additional trust. If it happens to be an old TV set, talk about the "ol' reliable." This will help project an image of being a customer service oriented, serious service shop with the desire to get the job done.

Build A Relationship With Your Customer: Time permitting, learn more about your customer. Talk about where he lives, what he does for a living, the latest neighborhood news, politics, . . . whatever. Strike up a conversation and be friendly. Remember, the more you find out about your customer, the easier it will be for you to determine his comfort level of repair (determining whether or not a down payment is necessary). In addition, the more sincere you get, the more difficult it will be for him to take the repair to another shop or to haggle on price.

Project Trust: Always provide an approximate estimate and assure your customer that

you will call him if the bill exceeds your estimate. Show him that staying within your quote is as important to you as it is to him. Talk to him a little about the repair process and the equipment you will be using for the repair, assuring him that you have the right tools and information to get the job done. Even if he understands nothing about the repair or the equipment, he will appreciate the fact that you took the time to tell him a little about the process and your shop's abilities. Provide a delivery date that you can meet (even if you delay it a little) and deliver early. Condition your customers to believe that your word is as good as gold.

Why Should We Treat The Customer Like A King?

Like it or not, the shop down the street or the part-timer out of his basement can repair the customer's electronics just as well as you can. You need to build a relationship. You need to be different than the shop down the street. Many times, the only difference between service centers may be the level of customer service. If customer satisfaction is high, price is almost never an issue.

To give you an example, Mike, a Sencore customer for 15 years, called me the other day with a question on the new VC93 All Format VCR Analyzer. In our conversation, he mentioned how he made three new customers by going the extra step in customer service. One of his customers (call him Mr. Smith), brought in a VCR for repair. Mike called Mr. Smith's home three days later to let him know the VCR was repaired. Mr. Smith was away on a business trip and Mrs. Smith answered the phone (with two screaming children in the background). Mrs. Smith wanted the VCR but it was hard for her to pick it up with two children in her arms.

That afternoon, Mike went four miles out of his way and personally delivered the VCR. Since then, Mike has had three new customers walk in and drop their equipment off for repair. Mrs. Smith had referred them to him. Ask yourself one question: The next time Mr. Smith or their neighbors have a set for repair, will they go to Mike even if his shop is a little out of the way or a little more expensive? I believe they will.

Increasing Revenue

Now that we have our shop set up to portray a professional image, project enthusiasm, and increase customer satisfaction, we need customers. We need them in our shop so that we can treat them right and get business going. Here's some ideas on how we can accomplish this:

EXISTING CUSTOMERS

Our existing customers are a valuable resource. For starters, we need them to keep coming back. Our professional attitude toward them and our extensive customer

service should keep them coming back to us. Here's some additional methods that help insure that they keep coming back.

REPAIR ALL EQUIPMENT: Never turn down a repair from a good customer. Even if you are not equipped to do the repair, offer to subcontract his unit out to someone else. Your customer will appreciate the honesty and will not mind paying a small handling fee for you to handle the repair (after all he trusts you and your judgement). Conversely, you get to keep the customer dealing with your shop only, and you avoid the possibility of losing him to the service shop down the street.

STICKER ALL REPAIRS: If your shop has repaired a unit – a TV, a VCR, an amplifier – it deserves your stamp of quality. It deserves a sticker from your shop (showing your shop's name, address and phone number) with the date of the repair, a repair reference number, and the initials of the technician who repaired it. The sticker can be used as a tracking mechanism in the event the customer is having problems with his unit. But more importantly, it is a reminder for the customer to call you in the event he has problems with this or any other piece of equipment.

In order to increase the revenue per repair, we need to offer extra services in order to increase the amount of the invoice – thus increasing revenue. Here's a couple of ideas on how to do this:

PROVIDE EXTENDED WARRANTY: One of the surest ways of increasing revenue from your existing customer base is to provide an extension of warranty on your service work. If you presently provide a 90 day warranty on parts and labor on your service work, what would it cost to increase the warranty period to one year? How many repairs do you see back within one year? How much do you think a customer is willing to pay to extend the warranty period you already provide?



Fig. 2: Repairing everything that comes in your door builds trust and keeps your customer coming back.

NOTE: State and local laws on warranty policies vary. When you decide to do this, give your attorney or accountant a call. They should be able to advise you and possibly provide the proper forms that need to be used.

SAFETY LEAKAGE TEST: You may have heard about this profit-maker from your Sencore Area Sales Engineer. A large number of Sencore's customers provide a safety leakage test for about an extra five dollars. This test insures that the exposed portions of the TV chassis are not energized, minimizing any chance of electrical shock at the customer's home. Sencore provides Safety Leakage stickers for this purpose at a very reasonable price. Call your Area Sales Representative for details.

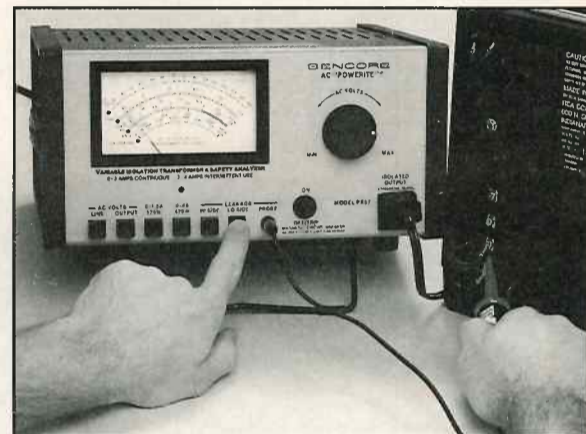


Fig. 3: Increase your revenue with the PR57 AC "POWERITE's" Safety Leakage Test.

NEW CUSTOMERS

Now that we know how to get the most out of our existing customers, how do we get new ones? How do we expand our service base? Here's some ideas on how to get new customers into your service center:

START A CUSTOMER REFERRAL PROGRAM: Your existing, satisfied customers are your best reference and are possibly your least expensive means of getting new customers in your shop. When your existing customers are picking up their equipment, ask them if they were satisfied with the service they received. Explain to them how important it is to you and to your business that they are satisfied and ask them to refer you to their friends and colleagues.

Give your customer three of your business cards with the customer's name written on the back of the cards. Tell your customer to give these cards to friends or colleagues that may need your services and that you will provide a 5% discount on an invoice with one of these cards (this provides an incentive for your customer's friend to use your shop). Also let him know that when you get two of the three cards back, you will provide a free VCR checkup and cleaning for him. You'll be surprised how fast your cards will make it in the hands of people who need service work done. In the process you make money because the free VCR cleaning time is minimal and you'll have attracted several new customers that will hopefully keep coming back.

PROVIDE INEXPENSIVE/MAINTENANCE

SERVICE: Your store front is one of your best advertising mediums. Try hanging a sign in front reading:

"VCR Cleaning And Tune Up: \$19.95"
or
**"Free Estimates
Provided With All Service"**

It is a good and attractive deal. Using Sencore's VC93 All Format VCR Analyzer, you can check the servo section of the VCR in less than two minutes without even taking off the cover. Cleaning the heads will take less than five minutes and you'll have \$20 in your cash register in less than 10 minutes – not to mention the addition of a new satisfied customer in your clientele. If the VCR being checked and cleaned shows any sort of trouble, you can use the VC93 troubleshooting capabilities and provide an estimate within five minutes.

ADVERTISE IN LOCAL FREE PAPERS: Most cities have free newspaper advertising supplements. Advertising in these supplements is relatively inexpensive, and is a great way to help generate new business.

ADVERTISE ON BULLETIN BOARDS: Supermarkets, pharmacies, even shopping malls have free bulletin boards where you can hang your advertisement or cards (check with the store manager to make sure it is permitted for business – some of the stores only provide it for the public and not for businesses).

ADVERTISE IN VIDEO RENTAL STORES: The most avid users of VCRs and TVs are people who rent video tapes. Work out a deal with your local video tape rental store(s) and put your cards or advertising poster near the cash register. This is an inexpensive way of advertising and your message will be seen by qualified consumers.

MAJOR ACCOUNTS

Most small service centers never think of addressing the service needs of larger institutions because it is not clear and obvious what their needs are. Who are these major accounts? Here's a brief listing along with a description of their possible needs:

LOCAL VIDEO TAPE STORES: Along with video tape rentals, these establishments rent VCRs and video games. Who services these VCRs or video games when they become defective? You could.

You can work out a service contract with the store. For a certain price per month, you could maintain and clean their rental VCRs. Any failures that come up are covered under the service contract. No headaches for the video tape rental store, and no large invoices – just one invoice to pay to you per month and their service problems are over.

SCHOOLS AND UNIVERSITIES: In today's high technology education, computers, computer monitors, VCRs, and televisions are used in abundance. Most major universities and large

schools have their own in-house service department. Some of the smaller ones depend on outside service shops to get the job done. Visit the school and meet with the maintenance supervisor. Find out if there are any problems with the present service arrangements. Is there a backlog of equipment to be repaired that the in-house service department can't handle? Could you handle it for them on a temporary basis? Can you do it better, faster, cheaper than another shop? Can you provide services nobody else can? If so, you've got yourself a healthy account.

HOSPITALS: Who services all of those TVs in the patients' rooms? Who does the MATV system maintenance? Is this on a bid basis once a year? Find out what you have to do to take part in the bidding process and hopefully secure this account in the future.

Conclusion

Revenue increasing programs need to be supported by customer service and customer

satisfaction programs that make the customer yours for the long run. Anybody can hang a sign for VCR cleaning and get a customer to bring in his VCR for cleaning. The key is in treating the customer in such a way as to insure that the next time he has a service problem, he comes back to your shop and not to the one down the street.

In increasing revenue (and traffic through your shop) you will find that there are more problems than you anticipated. If you are already running a tight shop, an increase in workload will cause some serious bottlenecks in several areas of your operation.

Recognizing the causes and correcting bottlenecks in a service center is the next subject in this continuing series. Go ahead and try some of the ideas presented in this article today and increase your revenue and workload. Then watch for upcoming issues of the *Sencore News* and find out how you can process this work through without breaking your bank account or your back. ■

BUSINESS STRATEGIES

Will You Survive Or Succeed?

Survival in the service business takes hard work, long hours, good decision making, taking chances, paying your dues, and sometimes good old-fashioned luck.

Success takes more. To succeed in the service business we've got to be smart. In today's economy we must take advantage of every opportunity to succeed.

How many of your current repairs are audio? (Four out of ten? Two? None?) Wouldn't it be smart to take advantage of the additional business coming in your door from audio rather than turning it away? Servicing stereos and audio equipment can be easier than video service, yet most of us leave it to the local "audio specialists" who end up with all the added revenue. All too often this leaves us out of the

picture looking for a way to increase our business' profits.

If you realistically took a look at audio, you'd find that many low end repairs are super quick and easy – you can repair them fast and charge little. Middle and high end repairs are also simple (compare audio signals to video signals), and even better, they're profitable (a modern receiver can cost anywhere from \$200 to \$2,000).

How do you get audio repairs? The same way you get all others. If you use any kind of advertising, the addition of one word, "Stereo", will generate instant business. And if you work off word of mouth, tell somebody! Audio work is out there – car stereos, for example are the fastest growing consumer electronic sale item today.

Take advantage of the opportunity!

TAKE A NEW LOOK AT AUDIO SERVICING POTENTIAL!

PRODUCT	FACTORY SALES OF AUDIO EQUIPMENT					
	Nov. 1991	Nov. 1992	% Chg	11 Mo. '91	11 Mo. '92	% Chg
Portable Audio	\$230,798,000	\$240,939,000	+4.4	\$1,925,319,000	\$2,238,305,000	+16.3
Systems	\$135,872,000	\$144,811,000	+6.6	\$1,164,260,000	\$1,256,942,000	+8.0
Autosound (aftermarket)	\$ 91,012,000	\$125,466,000	+37.9	\$1,157,177,000	\$1,373,481,000	+18.7

Call 1-800-SENCORE, And We'll Discuss How Audio Can Be The Business Builder You've Been Looking For!



Analyzing TV Tuning Systems With the VG91 Universal Video Generator*

By Glen Kropuenske, Application Engineer

* This article is the first of a two-part article on troubleshooting tuners with the VG91 Universal Video Analyzer.

Have you recently paid for unnecessary tuner repair services? Have you ever had a set returned with tuning problems you may have overlooked? Or do you simply find yourself struggling with TV tuning system problems?

Today's sophisticated TV (and VCR) tuning systems are more reliable than the mechanical tuners of yesterday, yet they still fail. No reception, missing channel(s), poor color, poor audio, snowy picture, or herringbone interference can be caused by either the tuning system or a problem elsewhere in the chassis. Sometimes the tuner is mistakenly sent out for repair, only to discover the same problem still exists after it's reinstalled.

The Sencore VG91 Universal Video Generator provides all the accurate RF-IF TV signals and tests needed to fully analyze and troubleshoot TV tuning systems. This article looks at modern tuning systems and describes how to analyze and troubleshoot them with the VG91. Let's get started.

Today's Tuner

Today's TV tuning systems bring together three technologies: 1) varactor tuners, 2) frequency channel synthesis (phase lock loop - PLL), and 3) microprocessor control. Figure 1 illustrates the three different technologies which come together in a modern tuning system.

The varactor tuner selects and amplifies the selected channel and converts it to a lower IF carrier frequency (41.25 to 45.75 MHz). The varactor tuner contains a VHF and UHF section each consisting of an RF amp, a mixer, and an oscillator. Tuned LC circuits before and after the RF amp pass the selected channel. The oscillator mixes with the selected TV channel converting the channel to the IF carrier frequencies.

Today's varactor tuners no longer have moving parts or switch contacts to cause problems. Tuned circuits are formed with coils and varactor diodes. With specific DC voltages, the tuned circuits resonate to select the desired TV channel. "Switching diodes" transfer various coils in-circuit extending the frequency range of the tuned circuits. This makes it possible to tune through various bands to select VHF and cable channels.

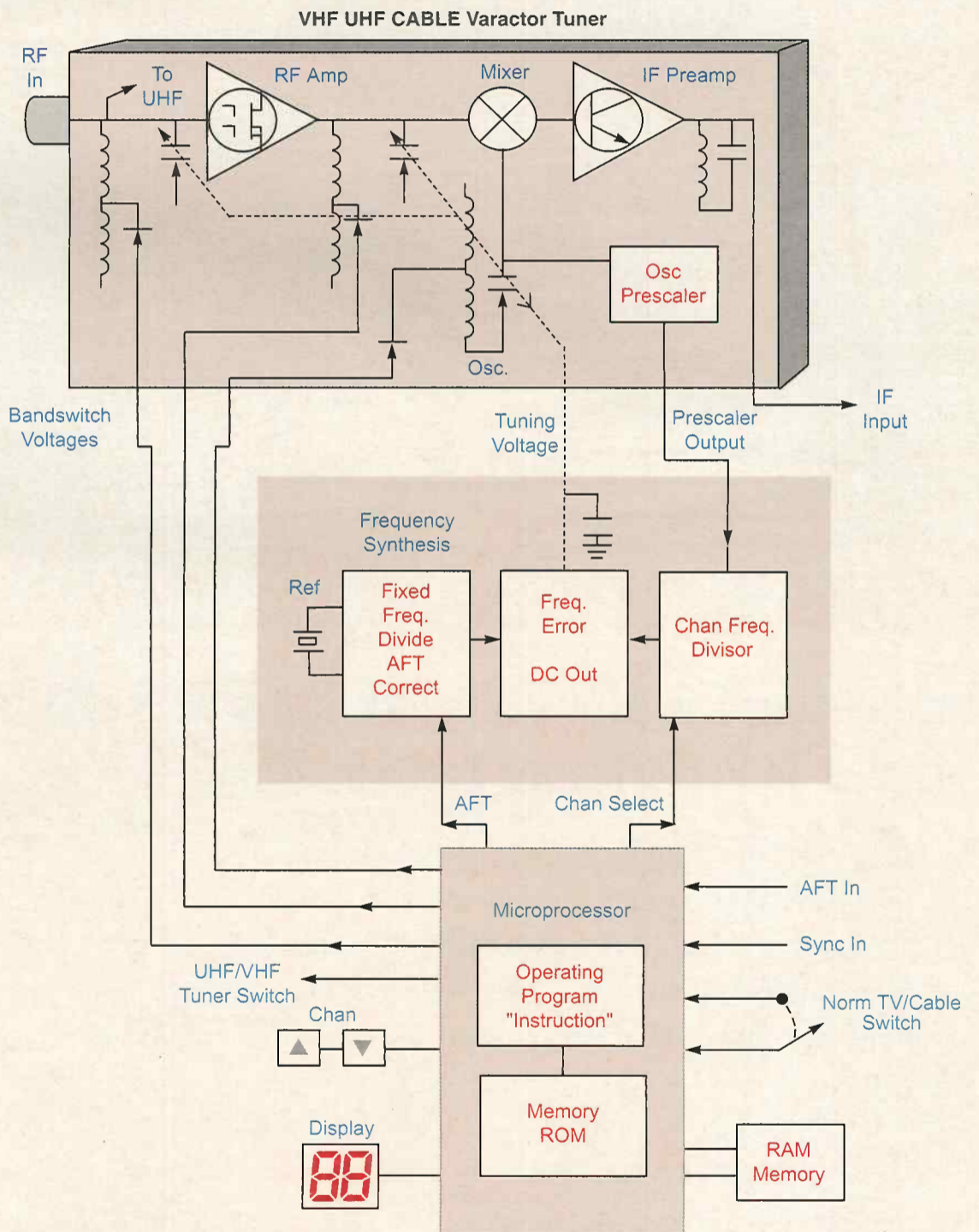


Fig. 1: A modern TV tuning system includes a varactor tuner, frequency synthesis (PLL), and microprocessor.

Channel Frequency Synthesis (PLL)

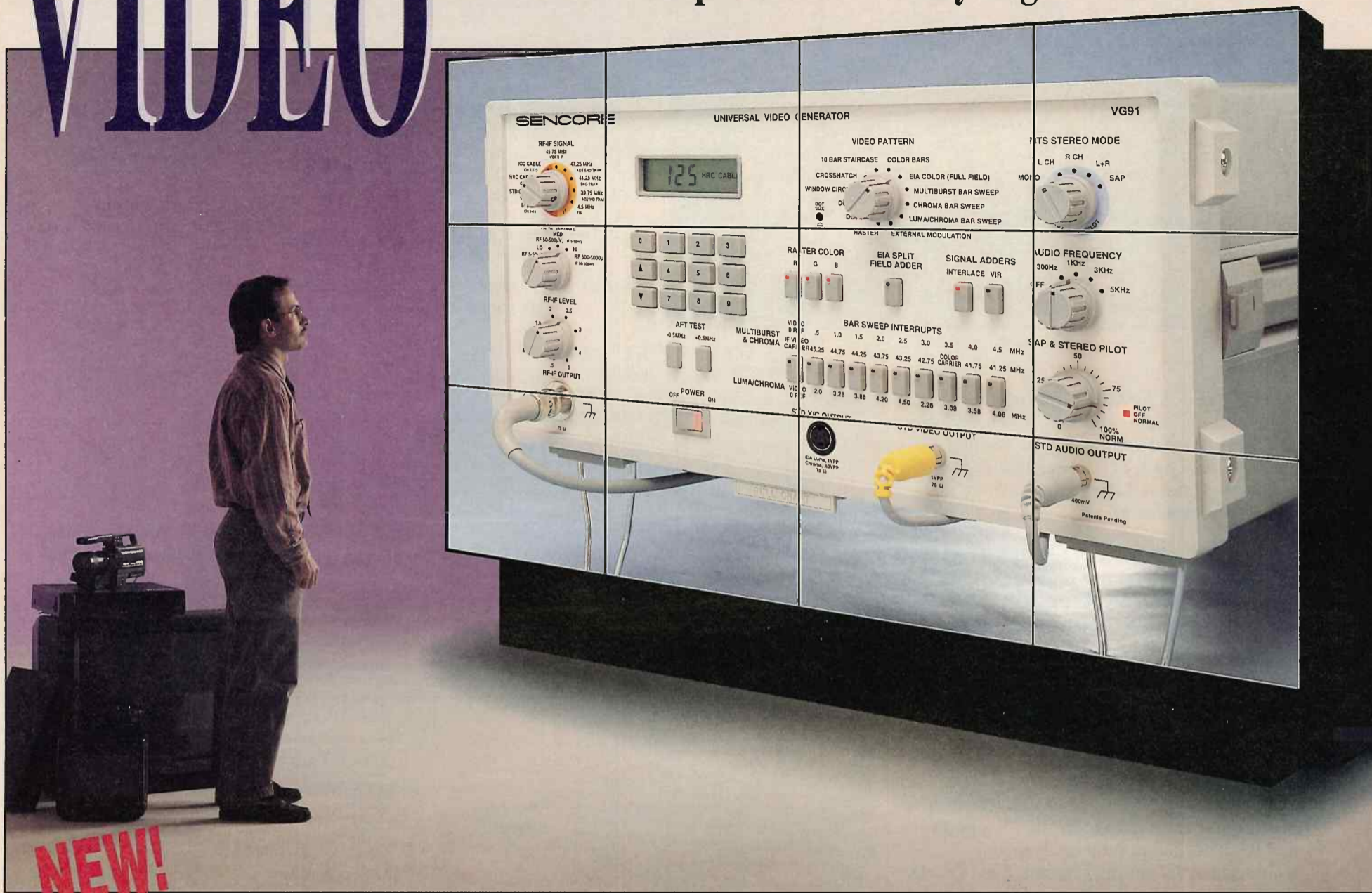
The tuner's oscillator frequency determines which TV channel is received. The oscillator is set 45.75 MHz above the desired channel, ranging from 100 to 850 MHz. Modern tuning systems use frequency synthesis (PLL) for precise control of the tuner's oscillator.

Frequency synthesis consists of the tuner's oscillator, a crystal reference oscillator, frequency dividers, and a frequency comparator. These stages may be found in the varactor tuner or as part of the microprocessor IC.

In a frequency synthesis system, the tuner's oscillator is divided down (prescaled) and then divided again by a factor for that specific

VIDEO

Look At The Big Picture And See The Future Of Complete Video Analyzing!



Introducing The All Channel RF/IF/MTS "VG91 Universal Video Generator" Designed To Performance Test And Isolate Defects In Any NTSC Video System!

Patented - A Sencore Exclusive

Mr. Philo Farnsworth must have known what he was doing when he invented the first television system in the United States. That was over 70 years ago - just look at video today!

- ◆ Direct View TVs As Big As 35 Inches
- ◆ Projection TV
- ◆ 10 Or More VCR Formats
- ◆ 125 Or More Cable Channels
- ◆ Picture-In-Picture
- ◆ Video Cameras
- ◆ Comb Filters
- ◆ High Resolution
- ◆ Video Laser Disc Machines
- ◆ Even Projection Cubes

The new age of video is upon us, and Sencore is here to meet your needs head-on with the only complete instrument that offers more than ordinary video generation. The VG91 Universal Video Generator is the only instrument that provides all the TV-RF and innovative NTSC video tests and signals in one expandable instrument that covers all your video servicing and alignment needs.

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channel. The resultant frequency is compared to the frequency of a reference oscillator. Any frequency error results in a DC correction voltage to the tuner's oscillator to restore the correct frequency.

Microprocessor Control Of TV Channel Tuning

A microprocessor controls the frequency synthesis, AFT, and all tuning functions. It also executes action directed by a program (step-by-step instructions) stored in permanent "read-only memory" (ROM). These memories provide instructions and data needed to control frequency synthesis.

When a channel is selected, the microprocessor retrieves and decodes channel information from memory. Then the microprocessor outputs the proper PLL divisors and bandswitching voltages. "Random-access-memory" (RAM) is used to store changing tuning information such as channel tuning offsets, channel scan memory, and last channel tuning information.

The receiver's Normal TV/Cable TV selection changes the microprocessor's tuning instructions. Off-air TV channels are always within 10 kHz of allocated frequencies, while cable channels may be shifted as far as 2 MHz according to HRC or ICC cable formats. To tune off-air TV channels, the microprocessor instructs the PLL to set the tuner's oscillator 45.75 MHz above the channel frequency. AFT voltage provides the precise tuning correction.

To tune cable channels, the microprocessor increments the tuner's oscillator through several searches 2 MHz above and below the cable channel's allocated carrier frequency. These searches are done when a channel is selected, or when AFT indicates the loss of an IF carrier (on some chassis). AFT and sync inputs to the microprocessor identify a video channel during the search.

Analyzing Symptoms With VG91 Performance Tests

Many technicians are quick to blame problem symptoms on the varactor tuner. But problems in the IF, video detector, sync, AGC, AFC, and frequency synthesis circuits can cause the same symptoms as a bad tuner. Before you begin troubleshooting, it's best to do a full tuning system performance test. A comprehensive performance test provides you with a clear understanding of all the symptoms so you can troubleshoot the real defect - saving time and money in the long run.

A full performance test confirms: 1) VHF/UHF reception, 2) Cable reception, 3) RF-IF sensitivity or gain, 4) AGC operation, and 5) AFT operation. The VG91 Universal Video Generator gives you all the signals you need for completely performance testing tuners. Let's see how it's done.

The first performance test checks the tuner's ability to receive standard off-air VHF and UHF TV channels. To test VHF/UHF

TUNER/IF PERFORMANCE TESTS			
TEST	INSTRUCTIONS	EXPECTED RESULTS	CIRCUITS TESTED
Standard TV Tuner Test	Input Each VHF/UHF Channel at 1000 μ V	Good Video Output On Each Channel	Tuner, Tuner Control
Cable Tuner Test	Input Each Cable Channel At 1000 μ V	Good Video Output On Each Channel	Tuner (Cable Channel Search Control)
RF-IF Sensitivity	Set RF Range To "MED." Reduce Level From 5-2.	Video Becomes Noisy, Sync & Color Locked	RF/IF Gain, Sync, & Color
AGC	Set Range To "HI". Increase Level To 5.	Little Or No Change To Video Level	AGC Circuits
AFT	Set Level To 1000 μ V, Select EIA Color, Perform AFT Tests	AFT Restores Proper Video To + Or - Shift	AFT Circuits
IF Video Frequency Response	Select Multiburst Bar Sweep	Stripes To 3.0 Bar, Stripes Fade In 3.5-4.0 Bars. Roll-Off In 3.0-4.5 Bars.	IF Alignment
IF Color Bandpass Response	Select Chroma Bar Sweep	Stripes Fade In 4.0 Bar. Roll-Off In 3.5 & 4.0 Bars	IF Alignment
Video Detector	Select 10 Bar Staircase	10 Linear Steps, No Compression	Video Detector Alignment
Audio	Select 300 Hz Audio, Select Mono Or L&R Stereo Mode	Good Audio Output On Both Channels, Stereo "ON" (MTS Receiver Only)	Audio IF, Det., MTS/Sap Decoder

Fig. 2: Performance testing the TV tuning system with the VG91 gives you a clear understanding of the symptoms and helps isolate the problem.

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PA81 Stereo Power Amplifier Analyzer

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

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

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



Introducing The Missing Link In Stereo Power Audio Amplifier Servicing

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

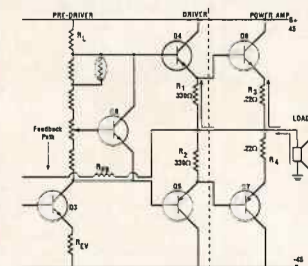


Anatomy Of An Imbalance

A deep bass note rocks a cold solder connection and causes a momentary loss of the -45 VDC supply. Q4 goes into full conduction along with Q6. Only the DC resistance of the speaker coil (7 ohms) and of R3 (.22 ohms) limit the current. Over 6 amps of current flows through Q6, causing it to quickly short from the power overload. This short places the full +45 V supply across Q4 and destroys it. R3 is also likely damaged by the excess current.

When the solder connection reconnects the -45 supply, a large current flows through Q5 to the +45 volt supply via either a B-E or E-C short in Q4. This current destroys Q5 and likely damages R2. Q7 is biased into full conduction and it, along with R4, is destroyed by the excessive current.

The DC Balance feature on the PA81 and PM82 sense the initial DC imbalance that occurs at the output when the -45 volt supply is lost. The PA81 dummy loads are immediately opened and the DC path is interrupted. Without a DC current path, the output components are protected. The DC dummy load path stays open until you manually reset it. An LED on the front panel of the PA81 indicates whether the left or the right channel suffered the intermittent.



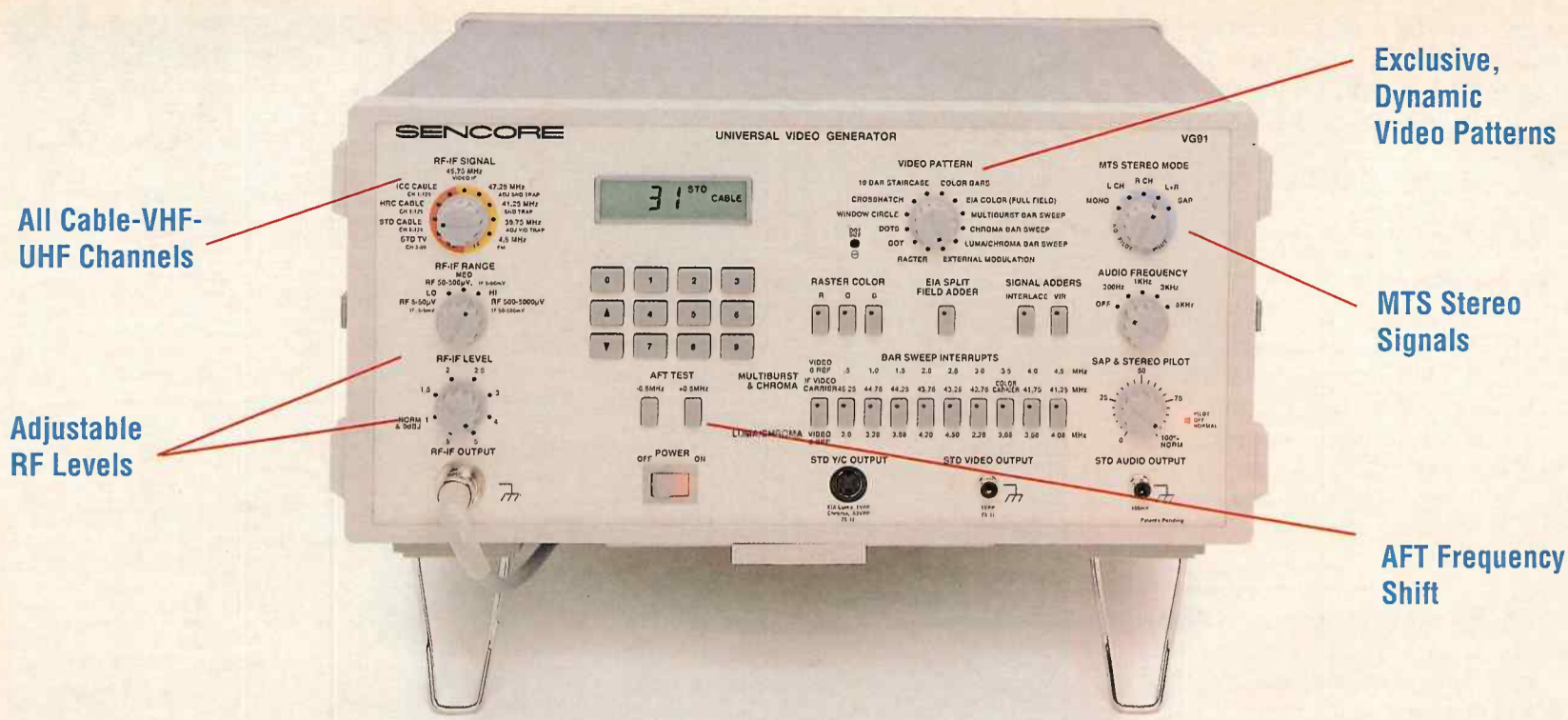


Fig. 3: The VG91 Universal Video Analyzer gives you all the channels, tests, and patterns to fully performance test any NTSC receiver.

reception using the VG91, hook the RF-IF cable to the antenna input, select the VG91 channel, select video and audio test signals, and adjust the RF output level to 1000 μ V. Now set the tuner channel to match the VG91 (select the "Normal TV" mode), observe the picture on the CRT, and listen to the audio. Do a quick check of channels in the bottom, middle, and top of the VHF-low, VHF-high, and UHF bands. Switch through channels, 2, 6, 7, 13, 14, 45, and 69 for a quick test. If you see problems with any of these channels, check all of the VHF and UHF channels.

Cable Reception

If the tuner is capable of receiving "all cable" channels, you should make several additional performance tests. Varactor tuners equipped to receive cable channels have several additional tuning bands, and need to locate and lock onto offset cable channels. It is possible for the tuner to receive VHF and UHF channels, but not receive some cable channels. You should always test these tuner capabilities to avoid overlooking hidden problems or unseen symptoms.

To test cable channel reception, set your VG91 to "STD CABLE," select the receiver's "Cable TV" mode, and match the tuner channel to the VG91. Then observe the video output again to confirm reception. You'll need to test cable channels in the middle and extreme edges within each cable tuning band. If you see tuning problems in the receiver, check all the channels and look for similar symptoms.

To check the tuner's ability to search and lock to cable channels, offset your VG91 to "HRC CABLE" or "ICC CABLE." When performing these tests, tune the channel on the VG91 before you select the receiver channel. This sequence is important because many tuning search routines return to the cable channel center frequency when no signal is detected. This causes improper tuning to HRC or ICC carriers.

The receiver should produce a good picture for each of the channels tested. Test all channels noting which ones are bad. Check the service

literature to see if channels relate to a particular band or location in each band.

RF-IF Sensitivity Or Gain

An important, but often overlooked receiver performance test is RF-IF sensitivity. The tuner must select and amplify TV signals to provide clear video pictures. Problems in the antenna input, RF amplifier, or AGC circuits can reduce tuner gain or cause excessive signal loss. Severe problems cause very snowy reception. Marginal problems can provide good pictures at higher than normal signal levels but cause snowy pictures at the customer's home with typical signal levels of 1000 μ V.

To test RF-IF sensitivity, set your VG91 and the tuner to the same channel. Starting with the VG91 output at 1000 μ V, decrease the RF output to 500 μ V and observe the CRT. All receivers should produce an acceptable video picture at the initial 1000 μ V level. Most receivers will begin to show snow at 500 μ V but should maintain proper sync and color. If the video is snowy at the 1000 μ V, the receiver has low gain or excessive signal loss in the RF or IF signal path.

Acceptable tuner input signal levels may vary from less than 500 μ V to over 5000 μ V. Many receivers use automatic gain control (AGC) to maintain a relatively constant video detector output and prevent overdriving of RF and IF stages. A strong input signal produces a DC voltage from the AGC circuits to reduce the gain of the RF and/or IF amplifier stages. Problems with the AGC circuits can improperly reduce gain causing snowy reception or fail to reduce gain with strong signals causing overloading problems.

To test AGC operations, once again set your VG91 and tuner to the same channel. Starting with the VG91 output at 1000 μ V, increase the RF output to 5000 μ V and observe the CRT. If the receiver's AGC is functioning properly, little or no change should be seen in the video display. A large change in picture brightness, contrast, or unstable sync indicates an AGC circuit problem.

AFT Operation

Proper alignment and operation of the AFT circuits are vital for proper tuning and operation of the receiver. AFT circuits monitor the 45.75 MHz video-IF carrier frequency. When the tuner's oscillator is at the correct frequency, the incoming TV channel mixes and produces a 45.75 MHz IF carrier.

The AFT circuit produces a specific DC voltage when the tuner's oscillator is properly set. If the oscillator drifts in either direction, so does the video-IF carrier frequency. The frequency change causes an AFT voltage change back to the PLL control. Based on the AFT voltage, the microprocessor moves the PLL (tuner's oscillator) accordingly to recover the 45.75 MHz IF frequency and normal AFT voltage. If the AFT circuit is defective or improperly aligned, tuning errors result.

To test the AFT circuits, set your VG91 and receiver to the same channel. Using the VG91's EIA Color Bar pattern, observe the CRT as you push and hold one of the VG91's AFT TEST buttons. Pushing either of the AFT TEST buttons causes the RF carrier of the VG91 to shift 500 kHz above or below the channel frequency. The video should momentarily degrade when you first push or release the button, but recover as the AFT action restores proper tuning.

All receivers should be capable of AFT action covering a carrier shift up to approximately 500 kHz. If the receiver fails to restore proper operation to either or both 500 kHz shifts, the AFT circuits are not functioning properly or alignment is needed. If the receiver restores proper operation in one shift direction but not the other, the AFT circuits are not aligned properly.

Look for part two of this article in the next Sencore News. The article will explore isolating tuning defects with the VG91 Universal Video Generator. If you have questions on this article or the VG91, call your Area Sales Representative at 1-800-SENCORE (736-2673). We'll help you prepare for the future of video analyzing. ■

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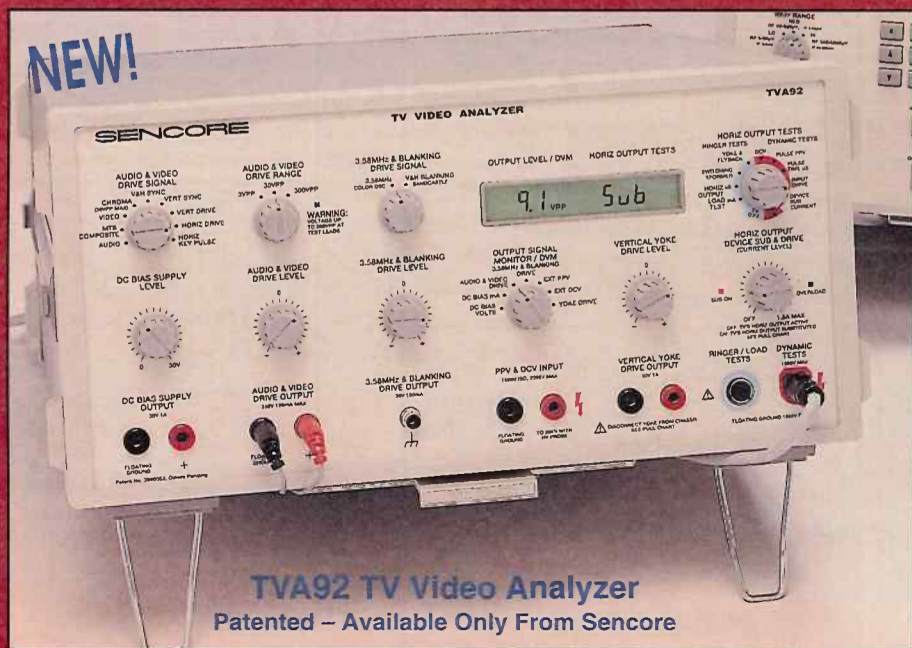
- Productivity would rise.
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Physically cutting the TV chassis into the functional blocks isn't practical, but there is a way you can electrically isolate them. There's a way that will help you determine defects by simply watching the CRT. And there's a way to isolate horizontal circuit (startup/shutdown) faults without risking damage to replacement components - or your pride.

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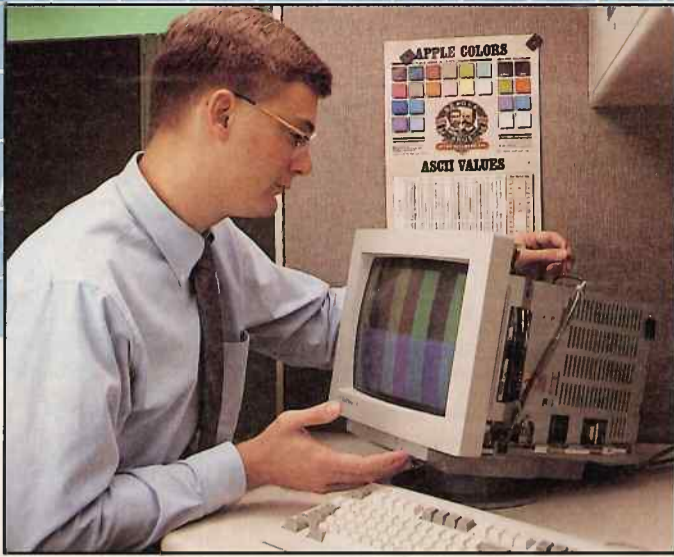


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Conquer Tough Horizontal Output And High Voltage Problems Using The CM2000 Computer Monitor Analyzer

By Stan Warner, Application Engineer

The horizontal output circuits are the heart of the computer monitor. The quickly-changing current in the output stages provides a practical, efficient source of operating voltages for use throughout the entire monitor. The horizontal output circuits are directly responsible for: 1) horizontal scanning; 2) CRT high voltage; 3) CRT focus voltage; 4) "scan-derived" low voltage supplies; and 5) feedback gating signals.

Failures in the horizontal output stages are common because the components are subjected to constant high current and high voltage stress. The most common failure areas include the horizontal output transistor (HOT), B+ supply, flyback transformer, and the high voltage multiplier. Without good troubleshooting procedures and test instruments, horizontal output problems can be difficult to isolate because the components interact so closely and the failure of any component often creates the same symptom: a dead monitor.

The CM2000 Computer Monitor Analyzer can help simplify troubleshooting horizontal output problems with the Ringer Test, the Horizontal Drive signal, and the DCV and PPV meters. This is the first part of a two-part article on using the troubleshooting features of the CM2000 Computer Monitor Analyzer to find problems in the horizontal output circuits (Note: One of the tests also features the use of the Sencore Z-Meter). In this article we'll discuss: (1) testing flyback transformers, (2) testing the high voltage diodes in the multiplier section of an integrated high voltage transformer (IHVT), and (3) measuring voltages at the collector of the horizontal output transistor.

Flyback Transformers - A Common Failure Item In Computer Monitors

Flyback transformers can develop one of three common failures. First, a winding in the primary or secondary may develop an open or shorted turn. Even a single shorted turn greatly affects the operation of a flyback, usually damaging other components and/or completely shutting the monitor down.

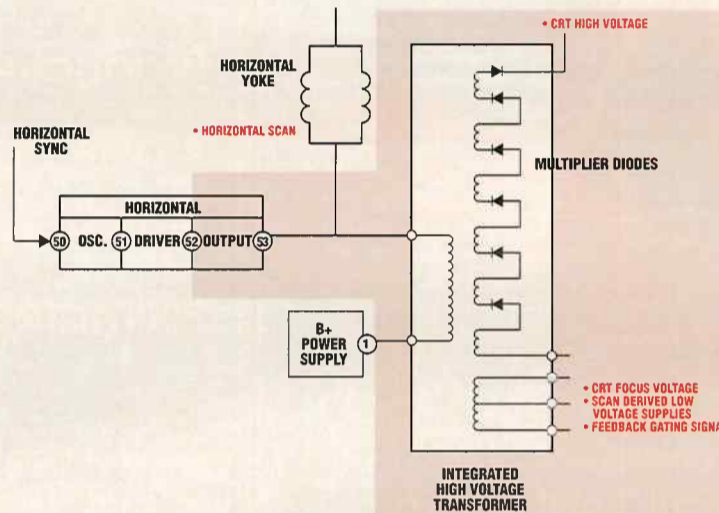


Fig. 1: The horizontal output circuits are the heart of the computer monitor.

Second, the high voltage multiplier diodes may fail. These diodes generate the high voltage for the CRT. If the multiplier portion of an IHVT fails, the high voltage and/or focus voltage will be low or missing. In some computer monitors, the multiplier diodes are not integrated into the flyback transformer but are contained in a stand-alone package. The same type of symptoms can be caused by failed diodes in these "stand-alone" multipliers.

A third failure occurs when a flyback transformer develops a leakage path between two windings, or between a winding and the transformer's core or mounting bracket. A high resistance leakage path often pulls down the B+ supply, even if the horizontal output

transistor is disconnected from the circuit. Usually the leakage path goes unnoticed until operating voltages are applied to the flyback.

Test 1: Ringing The Windings For Opens/Shorts

An open winding is usually easy to detect. You can measure the DC or PPV output with the CM2000's DVM if the chassis is operational, or check for continuity with an ohmmeter.

A shorted turn, however, can only be detected using the CM2000's Ringer Test. The change in resistance caused by one, or even several shorted turns, is too small to be detected with an ohmmeter.

The patented Sencore Ringer Test of the CM2000 checks the windings in the flyback transformer and locates shorted turns that cannot be located by other troubleshooting methods. The Ringer Test places a sharp pulse across the windings and automatically counts the resultant resonant "rings." A reading of 10 or more is "GOOD" and means the transformer does not contain a shorted winding. A reading of less than 10 is "BAD" and indicates a shorted turn somewhere in the flyback. You can perform the Ringer Test in or out of circuit.

... continued on page 20

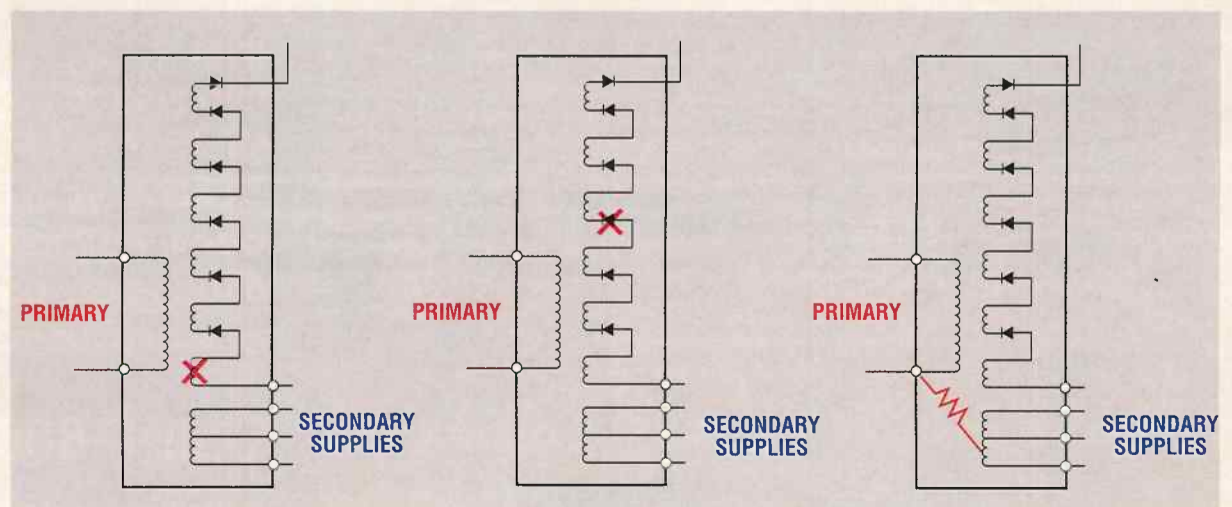


Fig. 2: Integrated high voltage transformers can fail three ways.

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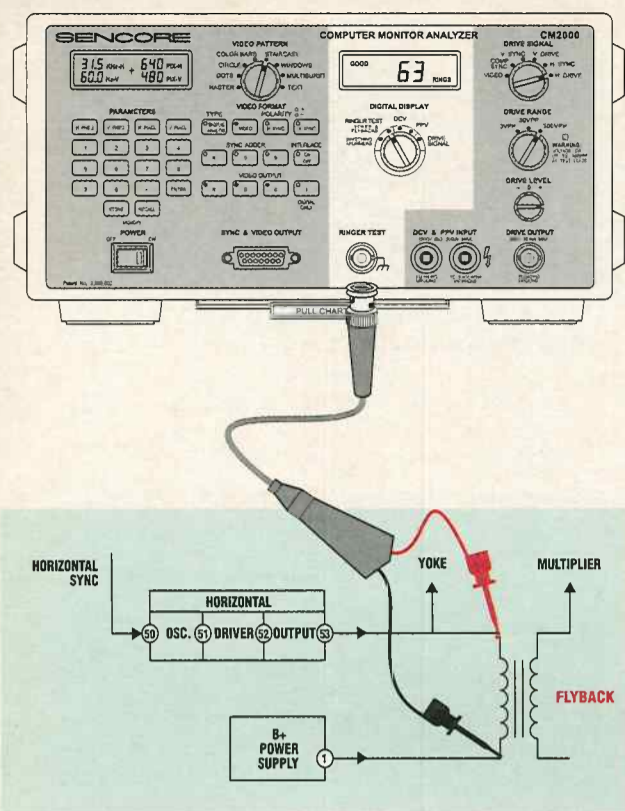


Fig. 3: The CM2000's Ringer Test finds shorted turns in flyback transformers.

Here's how to ring a flyback transformer:

1. Set the CM2000's DIGITAL DISPLAY switch to RINGER TEST "Yokes & Flybacks."
2. Connect the DIRECT TEST LEADS to the flyback's primary winding.
3. Read the test results in the CM2000's digital display readout.

What to expect: A "GOOD" reading (10 rings or more) means that none of the windings in the flyback are shorted. You do not need to ring any other winding if the primary rings "GOOD." A shorted turn in any other winding will cause the primary to ring "BAD."

A "BAD" reading (less than 10 rings) may be caused by a circuit connected to the flyback that is loading the Ringer Test. Disconnect the most likely loading circuits in the following order: 1) yoke; 2) CRT filament (unplug the CRT socket); 3) HOT collector; 4) scan derived supplies. Retest the flyback after you have disconnected each circuit. If the flyback rings "GOOD," it does not have a shorted winding.

If the flyback still tests bad after you've disconnected each of these circuits, unsolder the flyback and completely remove it from the circuit. If the flyback primary still rings less than 10, the flyback is bad and must be replaced.

Test 2: Isolating Defective High Voltage Multiplier Diodes

The multiplier diodes in a flyback transformer are difficult to troubleshoot using conventional troubleshooting methods because the problem usually occurs when the component is under a high voltage condition.

The CM2000 Computer Monitor Analyzer's high voltage multiplier diode test simulates

a flyback's in-circuit, high voltage condition – thus providing a dynamic test. The high voltage diodes are tested by feeding a horizontal drive signal into the primary winding and monitoring the generated voltage across the CRT high voltage line and the high voltage return.

NOTE: It is only necessary to perform this test if all of the following conditions are met:

- 1) The symptom is low or missing high voltage or focus voltage,
- 2) The B+ and PPV voltages at the HOT are normal, and
- 3) The flyback tests "GOOD" with the Ringer Test.

Here's how to test the multiplier section of an IHVT:

1. Remove the IHVT from the circuit.
2. Set the CM2000 DRIVE SIGNAL knob to H SYNC and the LEVEL to 25 VPP.
3. Feed the 25 VPP horizontal sync signal into the primary of the IHVT.
4. Set the DIGITAL DISPLAY knob to DCV and measure the generated voltage across the CRT high voltage lead and the high voltage return line (use the TP212 10 kV Transient Protector Probe to prevent loading).

What to expect: Compare the CM2000 DC voltage reading to values in Table 1. If the voltage reading is below the value shown, change the DRIVE LEVEL polarity to "- 25 VPP." If the reading is still low, the IHVT is bad. If the voltage reading is equal to or above the value shown in the chart, the IHVT is good. For example, if the monitor has a collector PPV of 900 V and a CRT high voltage of 30 kV, the measured DC voltage should be equal to or greater than 833 V.

COLLECTOR PPV	CRT HIGH VOLTAGE					
	10000	15000	20000	25000	30000	35000
100	2500	3750	5000	6250	7500	8750
200	1250	1875	2500	3125	3750	4375
300	833	1250	1667	2083	2500	2917
400	625	938	1250	1563	1875	2188
500	500	750	1000	1250	1500	1750
600	417	625	833	1042	1250	1458
700	357	536	714	893	1071	1250
800	313	469	625	781	938	1094
900	278	417	556	694	833	972
1000	250	375	500	625	750	875
1100	227	341	455	568	682	795

Table 1: Compare the DC voltage reading to the values in the table. An HOT collector with 900 VPP and a CRT with 30 kV high voltage should yield 833 DCV or more.

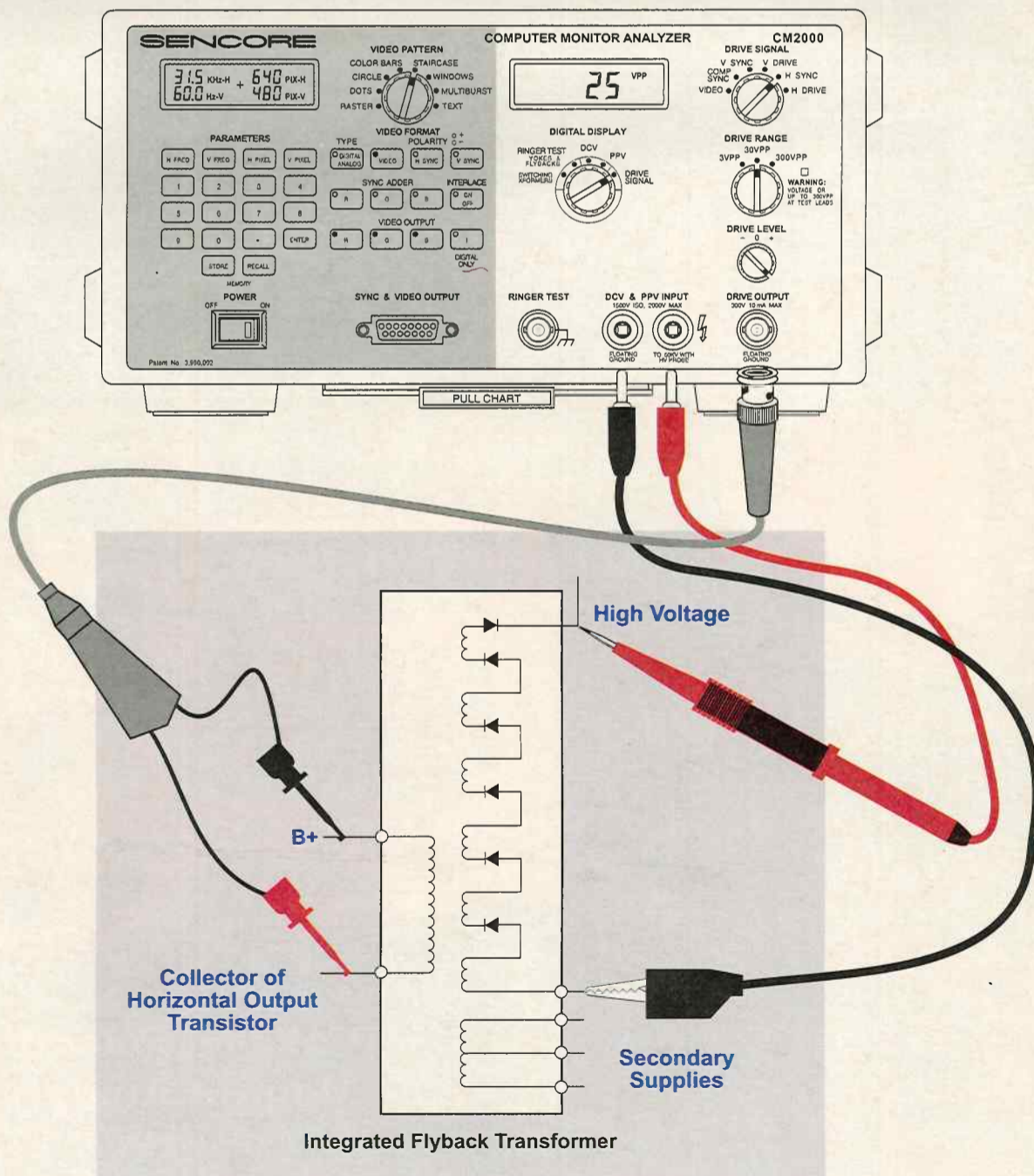


Fig. 4: Testing the high voltage multiplier diodes of an IHVT.

NOTE: To test the focus tap, measure the DC voltage on the focus output lead or pin. A good focus supply will produce 25-50% of the voltage measured at the HV lead.

Test 3: Measuring For Leakage Between Windings

A flyback transformer or IHVT may ring "GOOD" telling you the windings are not shorted or open, but the component may still be defective. Leakage paths occasionally develop between flyback windings or between a winding and the flyback's core or mounting bracket (this problem has become more prevalent as flybacks become more compact).

An ohmmeter cannot locate these leakage paths because most are highly resistive in nature and are only detectable under load. To find these leakage paths, you need a high potential tester to detect breakdown at the component's working voltage. The Sencore Z Meters provide up to 1,000 volts for dynamically testing the leakage between the flyback's windings (500 V is recommended).

Here's how to use the Z Meter leakage test to isolate leakage between windings:

1. Take the flyback out of the circuit.
2. Set the leakage voltage on the Z-Meter to 500 V.
3. Connect the Z Meter test leads between two windings (see Fig. 5).

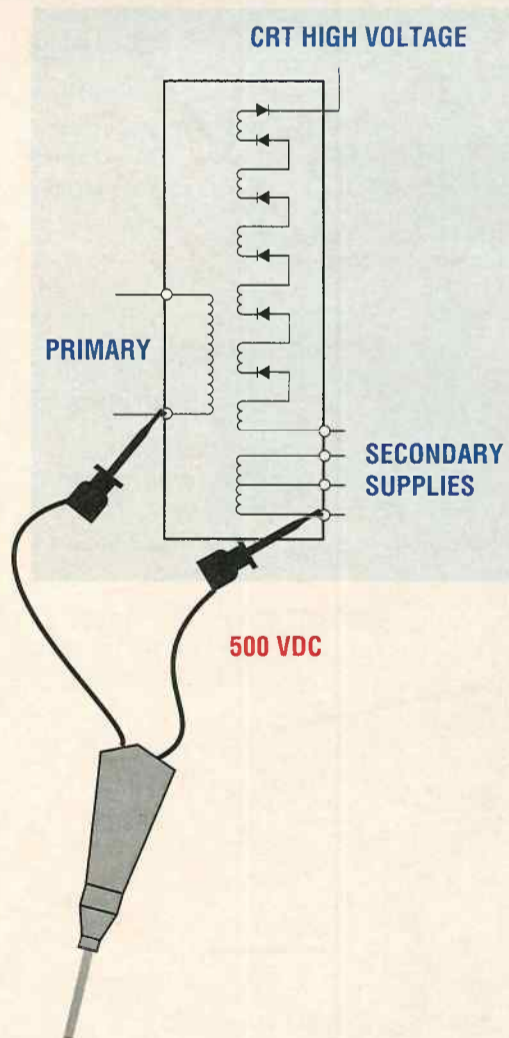


Fig. 5: Use a Sencore Z Meter to dynamically test flybacks for leakage between windings.

4. Press the CAPACITOR LEAKAGE button.
5. Read the leakage on the digital display.
6. Repeat the test (windings to core, windings to mounting bracket).

What to expect: The Z Meter display should read zero. This means there is no current flow between the two test points. If a leakage reading appears, this indicates leakage (current path) and the flyback should be replaced.

Go Where No Other Voltmeters Can Go - The Collector Of the Horizontal Output Transistor

A wealth of troubleshooting information can be gained about the monitor's operation by measuring the DC and peak-to-peak voltage at the collector of the horizontal output transistor. The DC reading tells you if the B+ supply is

working correctly, while the peak-to-peak reading tells you if the output circuits are creating the necessary high voltage.

NOTE: Do not attempt these measurements with competitive meters. Most do not have the needed 2000 VPP input protection which could cause serious damage.

Here's how to measure DC and peak-to-peak volts at the collector of the horizontal output transistor with your CM2000:

1. Set the CM2000's DIGITAL DISPLAY control to DCV.
2. Connect the test lead to the collector.
3. Read the DCV in the digital display.
4. Set the DIGITAL DISPLAY control to PPV.
5. Read the PPV in the digital display.

What to expect: Compare the voltage readings to those shown on the schematic. If the B+ voltage is low, unload the power supply by

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Symptoms Of A Bad CRT

Dark or dim picture: This could result from weak emission, a shorted gun element, or an open cathode (K). Other possibilities include wrong bias, insufficient second anode voltage, low/missing filament voltage, or problems in the video circuits.

Dark blacks and over-driven whites: When the gun in a monochrome tube, or all guns in a color CRT get weak, the result is bad "gamma" or non-linear light output. Similar symptoms are also caused by problems in the video amps, or wrong bias to the tube.

Bad color tracking or gray scale: A weak gun in a tri-color CRT (or a bad CRT in a 3 tube projection system) will produce a picture that cannot be color balanced. Instead of pure whites and gray shades, the picture may look reddish, greenish, etc. Misadjusted background or bias controls, or a defective chroma demodulator also produce these symptoms.

Only the CR70 "BEAM BUILDER" provides dynamic tests to find all these failures.

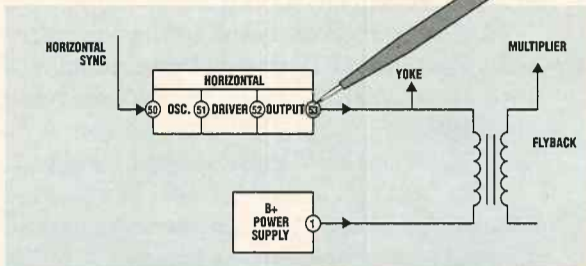
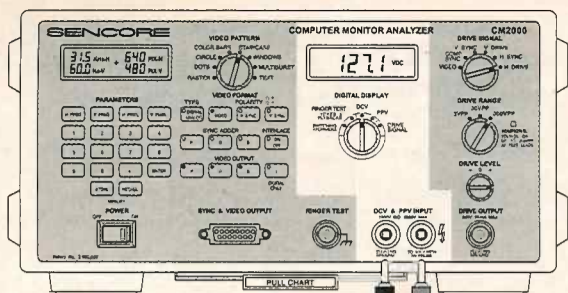


Fig. 6: The CM2000 lets you measure the voltage at the collector of the horizontal output transistor.

disconnecting the collector of the horizontal output transistor from the circuit. Then measure the voltage at the output of the power supply regulator again. If the voltage is still low or missing, troubleshoot the power supply. If the voltage returns to its schematic value, the supply is being loaded down. The first areas to troubleshoot would be the output transistor, flyback, or yoke.

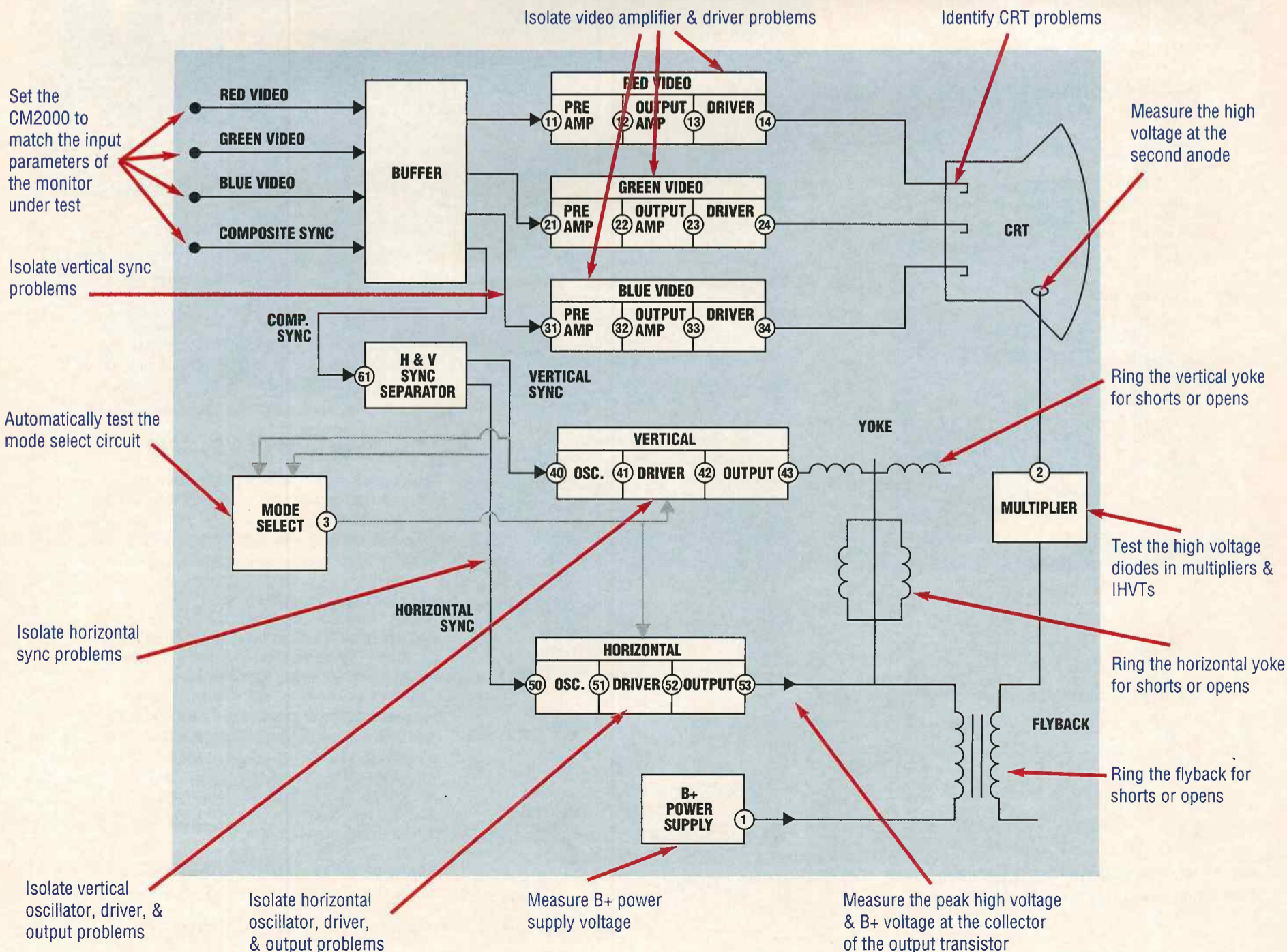
If the peak-to-peak voltage reading is missing or low, troubleshoot the output transistor, flyback, or yoke. If the peak-to-peak voltage is high, check the high voltage regulation circuit or the timing capacitors in the horizontal output circuit.

In the next issue of the Sencore News, we'll discuss: (1) Driving the output section from the base of the horizontal output transistor, (2) Measuring CRT high voltage, and (3) Testing high voltage regulation.

Try A CM2000 On Your Bench With No Obligation!

The CM2000 Computer Monitor Analyzer gives you all the features and tests necessary for computer monitor servicing in one complete easy-to-use instrument. Give your Area Sales Representative a call today at 1-800-SENCORE (736-2673) to set up a no obligation trial of the CM2000. Then see for yourself how the CM2000 fits your computer monitor servicing needs. ■

Troubleshoot A Computer Monitor From The Input Connector To The CRT With The CM2000





The Electronic Industry Report Card – See How Your Service Center Compares!

By Brian Phelps, Technical Product Marketing Specialist

For those of you who missed the last National Professional Electronics Convention (NPEC) in Fort Worth, Texas, it was quite a show. The NPEC provided a learning atmosphere for electronic servicers and a showplace for manufacturers like Sencore. We demonstrated four new products at the show and held information seminars to answer questions asked by the attendees.

We gathered valuable information from a demographic survey at the convention to aid our future test equipment design and insure you're getting the equipment you need. Sencore listens . . .

But more important is the information we gathered at the show to help dictate our (and your) test equipment future – information like demographic surveys. This information may prove to be vital to your particular service operation as we design test equipment. Sencore listens to servicers' needs and concerns because we're in business with you. Our success is dependent on your success.

Many of you associate the name Sencore with test instrumentation and the electronic servicing industry. This is in part because we continually stay involved with the service industry by supporting national and state associations. Sencore also keeps in touch with service centers through our exclusive one-on-one product support, Tech Schools, and the most helpful technical staff in the industry.

The NPEC is just one means of communicating with our customers and the rest of the industry. Let's take a look at the results taken from the show and how they compare to you.

NPEC Results

The service industry has seen extensive changes over the past decade, and it looks as though we will be experiencing more of the same during the '90s. NESDA is one organization that is attempting to assist the service industry by supplying the information service centers need to make smart business decisions. Let's take a look at how service centers are operating as compared to just two years ago (information taken from the 1990 and 1992 NPEC conventions).

Make Changes Now Or Quit?

Reprinted with permission from the TESA News, the official publication of the Television Electronic Service Association of St. Louis, Missouri. Written by Charles Varble, Jr.

Traditionally the first day of a new year is time to make changes and many people state what they are going to do different this new year. Frequently they make statements of how they will change their personal life, or will lose weight, or give up smoking, or some other change they know will benefit them in the coming year. In business it is also a good time to review the past year and make changes as needed to insure a good future.

A review is first in order because if you do not know how you have done in the past year you certainly do not know what changes will be necessary for the coming year. In the case of an Electronic Service Business a review will include how much business came from warranty work and for what brands, how much came from contract work, how much came from selling dealers, and of course how much came from regular COD work.

A good review will also include how much came from in-house service and what percentage was generated by carry-in work. You must also establish how much each category, i.e., VCRs, TVs, stereos, etcetera, provided of your total units and also the gross dollar volume. You may find that you were servicing a large volume of games or radios, but that they were providing a much smaller amount of your income for the overhead required. Careful review might disclose that you spent more for service data from a manufacturer than the entire gross receipts from warranty work. A careful analysis might show that you spent as much time putting the required "codes and reference numbers" on warranty invoices as you did servicing the products and you did not receive any added compensation for this effort.

Pricing is very critical and even though you had many complaints and comments on the cost of service, you might find that you have to increase it considerably if you are going to stay in business. If a careful review shows that because of the small volume and lack of experience on various types of products you lost money on some categories, you may have to discontinue service on these products as you can no longer afford to subsidize them with your other service work. Parts pricing will require a careful analysis and you might have to change the margins considerably

to continue to provide the service that you have provided in the past. Auto repair facilities, especially new car dealers, are stocking much less and rely on fast service from their vendors to meet their needs and reduce their investment in the replacement parts business. They all receive a considerable markup on the cost of parts used in warranty repairs, and you deserve the same consideration.

Time is much more critical and you will have to be very careful with how much time you spend talking to customers, and your time will have to be spent in productive work if you are going to survive this year. Many people will purchase a product from someone and expect you to spend much time on the telephone or at your counter and expect free advice and instructions on how to use the product. You may decide to still offer the service but at a cost of ten dollars for every fifteen minutes of time. If you examine a set and can not determine the failure within forty-five minutes, you will have to tell the customer that you will need an additional deposit before you can spend any more time with the set. You are not responsible for the odd designs and strange circuits that many sets have and you can not afford to spend hours determining the failure and work with inadequate service data, that has become the norm.

Changes must be implemented now if you are going to survive. Devote your time and effort to customers that are happy with your service and are willing to have you service it on your established terms. If you go out of business who will service your customer's needs? Changes are necessary for survival now.

Editor's Note: Sencore continually monitors the activity of the local and state associations to help us maintain our high level of understanding and support of the electronic service industry. As seen in this article reprint, the beginning of a new year is an excellent time to evaluate the status of your business. This is the time to decide the direction your business will take in the upcoming year, and to decide how you will remain profitable. Sencore is the only test equipment company that has a specific goal of helping to make you successful. Our new "Tech Choice System" instruments and exclusive SM2001 Service Center Manager software are only two of the ways we can help. If you'd like us to help with your 1993 planning, please give your Area Sales Representative a call at 1-800-SENCORE.

. . . continued on pg. 24

Businesses offering employee benefits:

Benefit	%	Benefit	%
Paid Vacation	85	Discounts	36
Partial Health Insurance	28	Retirement	11
Full Health Insurance	42	Unpaid Personal Leave	26
Family Health Insurance	11	Profit Sharing	6
Life Insurance	38	Sick Leave	6
Uniforms	32	Dental Insurance	2
Education	64	Service Vehicle Driven Home	2
Credit Union	13	Longevity Pay	--

Technicians' average hourly wage (not including commission employees):

- high - \$16.29
- low - \$8.08
- The median number of full-time technicians per business is 5.
- The number of businesses reporting the employment of at least one part-time technician is 35%.

Annual median revenue:

- Service revenue only: \$200,000 - \$499,000
- Overall, 24% had annual revenue over \$1 million.

Businesses with an estimate or deposit charge:

- 85%
- range: \$10 - \$80.00

Table 1: Average wages, benefit compensation, and revenue for service centers during 1992.

Technician Wages:

The stable hourly wage trend is not surprising. With the cost of living leveling out and many service centers employing entry level VCR techs as well as the highly trained service professional, this salary level did not see a large increase (see Table 1).

However, as the average wage paid has increased by nearly \$2 per hour in as many years and the cost of benefits is also increasing, an increase in productivity is in order for a business to remain competitive and highly profitable.

To meet these high productivity needs, many service centers are now employing specialized technicians with the proper troubleshooting tools to match the products they're servicing.

Service Revenue And Products Serviced:

With the increased supply of products needing service combined with tighter budgets, service centers are forced to cut out the excess while demanding greater performance. This situation explains the decrease in the number of full-time employees. Also, many businesses with steady or decreasing business volume are resorting to part-time help in the clerical/reception areas as well as altering the status of the technical staff. However, as the average service department revenue has remained unchanged over the past two years (\$200,000 - \$499,000), fewer techs are obviously servicing more. But what products are they servicing to maintain their revenues?

Again, the NPEC survey provides a source of industry comparison (see Table 2). The major shifts or increase were in the camera servicing area, with an increase of nearly 12% compared to just two years ago. As the survey shows, most service centers are remaining diversified by handling many kinds of products.

Proper equipment and training play a key role in producing the turnaround required on the wide array of products. A handful of consumer product manufacturers are providing training on their products, and Sencore remains the only test equipment company that offers full user support of their test instruments.

Items serviced or sold:

Product	Service %	Sales %
TV/Video	98	13
Cameras	81	11
Component Audio	85	9
Auto Sound	48	4
Office Equipment	29	2
Computers/Peripherals	37	6
Fax	42	--
Telephones	31	4
Appliances	21	4
Security Systems	6	4
Industrial Electronic	17	--
Mobile Phone	4	4
Satellite	10	4
Nintendo	2	--

Median number of jobs completed daily:

- by individual technicians: 5
- by business as a whole: 33
- Average charge per service invoice: \$84.16
- Median number of outside calls per day: 6
- Number of businesses computerized: 92%

Warranty Service:

- Percentage of work done under warranty: 25%
- Average percentage of regular rates paid by manufacturers for warranty service:
 - best pay: 82%
 - average pay: 63%
 - lowest pay: 44%

Table 2: Analysis of product sales, service, and productivity.

The NPEC survey also shows that the number of repairs has actually decreased from 5.5 to 5 units per day, per tech. This drop may be attributed to the complexity of the products such as projection TVs, microprocessor controlled circuitry, and advanced technology in general. All too often servicers cannot find the technical support they need for the new products and designs, and must fall back on their training, test instruments, and good old fashioned servicing know-how.

Many Servicers Turn To Their Test Instruments To Help Them Succeed!

Sencore has continually ranked number one among test equipment manufacturers as producing the brand of instruments last purchased and as the brand of instruments to be purchased next. But, what does this say about the service industry and Sencore? To us it's saying that our support and dedication to the electronic service industry is truly appreciated by the servicers. It also says that our products are providing the tests and features that truly help you be as profitable as possible.

The other information gathered by the survey highlights the type of test instruments in which the service industry is investing. Again this year, the oscilloscope leads the list of both the last and next product to be purchased (with a video analyzer nudging the scope in 1993 future purchase plans). Information like this is exactly why Sencore has developed our new SC3100 "AUTO TRACKER"™ Automatic 100 MHz Waveform & Circuit Analyzer, part of the "Tech Choice System."

Sencore recognizes the requirements needed for modern servicing. We've seen the routine tests technicians make daily and how they troubleshoot circuits. Plus, thanks to the surveys like the ones done by NESDA, we can keep tabs on and plan ahead for the equipment demands of the service industry (see Table 3).

What Will Sencore Bring To The Service Industry In 1993?

Amid the ever changing service industry, there is one thing you can always count on - Sencore and our commitment to the servicing industry. We've worked hard to become the leader in American-Made electronic analyzing equipment - and we'll work even harder to remain on top. Our newly released "Tech Choice System" instruments are quickly proving to be the instruments that will take the service industry into the 1990s and beyond. If you'd like to see exactly how Sencore can support your servicing needs, please give us a call at 1-800-SENCORE. We're here to help. ■

Test Equipment Purchasing Patterns

Brand of last equipment purchase					Type of last equipment purchase				
Sencore	36%	Hitachi	10%	Tektronix	10%	Scope	36%	Generator	10%
B & K	14%	Beckman	5%	Philips	5%	Analyzer	26%	Soldering Station	12%
Leader	7%	Fluke	10%	Other	8%	Meter	14%	Isolation Transformer	7%
Brand of next equipment purchase					Type of next equipment purchase				
Sencore	13%	Other		10%	Scope	10%	Soldering Station	4%	
Hitachi	4%	Undecided		75%	Analyzer	11%	Transformer	2%	
Tektronix	4%				Meter	4%	Undecided	69%	

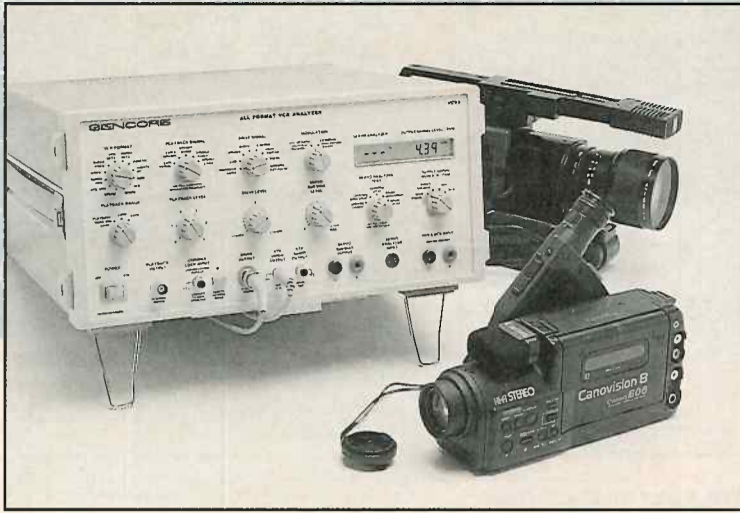
Original value of test equipment owned by 57% of respondents is equal to or greater than \$30,000.

Average amount of a business' equipment less than 5 years old is 41%.

Business last purchasing equipment in the year:

1992: 65% 1991: 21% 1989/90: 12% Prior years: 2%

Table 3: Test equipment investment trends.



Camcorder Service – Complete Service For Maximum Profits

By Tom Schulte, Application Engineer, CET

- Camcorder service opportunity growing steadily with sales
- Camcorder circuits an easy step from VCR and TV circuits
- Service both VCR and camera sections for maximum profits and customer satisfaction

Are you taking full advantage of the service profit potential that's been created by the large numbers of camcorders owned by your customers? According to the Electronic Industries Association figures, almost 9 million camcorders have been purchased in the last three years, and sales aren't likely to slow anytime soon. When these camcorders have problems, owners are very likely to repair, rather than replace them because of their cost. This has created a tremendous service opportunity for both present and future service growth.

Who Is Performing Camcorder Service?

Many service centers, especially those who previously serviced VCRs, already service camcorders. Some of these service centers perform all services required on camcorders. In many cases, however, they service only the VCR section of the camcorder. When there's a problem with the camcorder's camera section, they ship the unit back to the manufacturer, or to an independent service center which specializes in complete camcorder service. This creates extra shipping charges, service time, and surcharges which may displease their customers and put them at a competitive disadvantage with the area service centers which do perform complete camcorder service.

Also, these service centers which aren't equipped to fully evaluate camera performance may overlook marginal camera performance while servicing what appears to be only a camcorder VCR problem. Their camera test method may consist only of turning the camera on and watching for a picture as they point the camera across the room. They can't be certain the camera is performing fully to their customer's expectations or to specifications, or that it will provide a satisfactory picture under all operating conditions.

What do the service centers (both large and small) that already provide complete camcorder service know about profitable camera service that you might not? Let's take a look at what makes up a camcorder and what is involved in complete camcorder service for maximum profits.

What Is A Camcorder?

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

The VCR section of the camcorder is often the standard VHS format you are already familiar with. Even though a standard VHS camcorder is relatively large, this format has remained fairly popular due to the ease of playback of its recorded videotapes on standard home VCR decks.

The smaller VHS-C or 8MM format camcorders now available have become increasingly popular, however. These smaller formats have relatively similar electronic circuits and differ primarily in their tape drive mechanisms.

What Fails In A Camcorder?

The primary failures in camcorders are due to the mechanical nature of the VCR transport section and the camera lens assembly, plus the handheld, portable nature of the camcorder itself. The same mechanical failures that occur in standard home VCRs also occur in the VCR section of camcorders, but not as often due to less frequent use. Worn rubber and broken gears are common failures associated with camcorders. The camera lens assembly, including the iris, focus, and zoom control motors and gears, also has a high occurrence of failure.

These lens failures, as well as broken circuit boards and broken connections are primarily

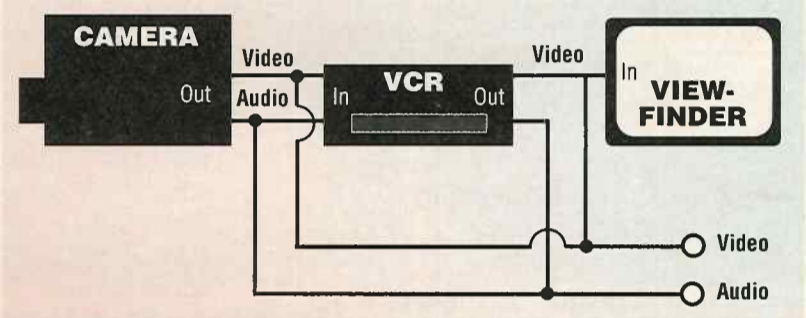


Fig. 1: A camcorder is a simple combination of a VCR and a camera with a viewfinder for monitoring their signals.

caused by the dropping and rough handling that goes along with handheld camcorder operation. A camcorder which has been dropped on the lens commonly exhibits lens, motor, and stripped gear problems. These mechanical failures in both the VCR and camera section of the camcorder are often relatively easy to diagnose and repair by an experienced technician.

The other major type of failure in both the VCR and camera section is electrical failure. In the VCR section, this includes servo, head, preamp, chroma, luma, power supply, and system control problems. In the camera section electrical failures include sync generator, CCD imager, chroma, luma, power supply, and system control problems.

Since these electrical failures occur less often than mechanical failures, even an experienced technician doesn't have much chance to become familiar with them. Without the proper service equipment and a thorough understanding of the circuit block diagram, these electrical failures can cause an otherwise efficient technician's servicing output to slow to a crawl.

What Camcorder Service Is Required?

The general categories of service required by both the VCR and camera section of a camcorder are very similar. These include:

Defect Localization And Repair Estimation – To determine whether the camcorder failure is related to the VCR,

camera, or electronic viewfinder and whether the failure is mechanical or electrical. Also, to determine the approximate cost of service required to restore the camcorder to normal operation.

Mechanical Troubleshooting – To isolate the worn or damaged mechanical component which is causing improper VCR or camera operation.

Electrical Troubleshooting – To isolate the defective electrical component which is causing improper VCR or camera operation.

Alignment – To readjust mechanical or electrical controls as needed to adjust for wear, drift, or replaced mechanical or electrical parts.

Performance Verification – To insure that both the VCR and camera section are operating to expected levels at the completion of the repair to increase customer satisfaction and reduce service callbacks.

How Do I Service Camcorder VCR Circuits?

The VC93 All Format VCR Analyzer is an excellent tool to serve as the foundation of your camcorder VCR test bench. The VC93 includes substitute troubleshooting signals tailored for all the camcorder formats including standard VHS, Super VHS, VHS-C, Super VHS-C, 8MM, and Hi 8. Plus, the VC93 includes the FM Hi-Fi audio signals used by many newer camcorders. The VC93 aids you in the service processes of defect localization and repair estimating, mechanical troubleshooting, electrical troubleshooting, alignment, and final performance verification.

The VC93 Servo Analyzer Test, FM head circuit substitution, and drive substitution signals work together to quickly localize both mechanical and electrical defects. This defect localization gets you started in the right direction as a preparation for more in-depth troubleshooting and allows you to give your customer more accurate repair estimates. The VC93 standard video and audio line outputs provide the first step in this defect localization by testing the record capabilities of the camcorder VCR with a known-good input for localizing the trouble to either the VCR or camera section.

Defect Localization And Repair Estimates

The VC93 Servo Analyzer Tests separate mechanical from electrical VCR problems for quick defect localization or repair estimates. Five quick and simple tests (Fig. 2) allow you to localize problems within the electrical and mechanical servo circuits. Or, if all the tests indicate "GOOD," you know the problem is in the signal circuits or tape path instead. All five tests take less than two minutes to perform and can save hours in needless, frustrating testing using conventional methods.

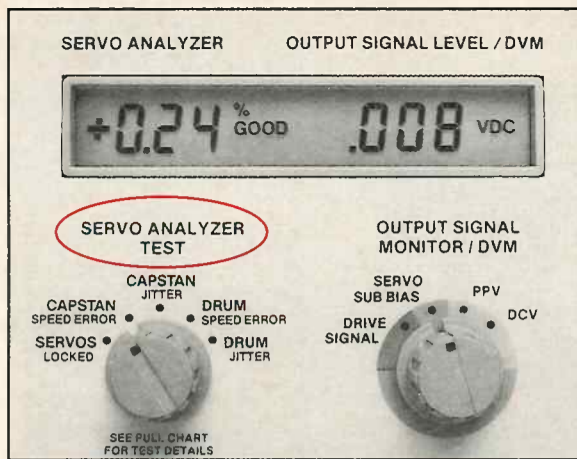


Fig. 2: The VC93 provides five servo analyzer tests to identify and localize servo problems.

To make things even easier, the VC93 lets you make the servo analyzer tests two ways. One way is to use the "Servo Performance Test Lead" and the special test tape. When you use this test lead and test tape, you don't even have to take the cover off the camcorder to determine the condition of the mechanical and electrical tape transport and rotary head system. This method uses the audio and video signals recorded on the "Servo Performance Test Tape" to analyze the condition of the mechanical and electrical drum and capstan servo circuits.

You just hook up the test lead to the audio and video output jacks on the outside of the camcorder and step through the five servo tests. The VC93 automatically determines if the camcorder VCR has a capstan servo, cylinder servo, or servo mechanical defect in virtually the time it takes to connect audio and video plugs (Fig. 3). You get a decisive "GOOD/BAD" reading without even taking the cover off the camcorder. These patent pending servo tests are Sencore exclusives – you won't find them anywhere else.



Fig. 3: The Servo Performance Test Lead and VC93 let you test the camcorder servos without even opening the camcorder.

If the audio or the video coming from the VCR is inadequate, the VC93 has that covered too. You simply remove the cover from the camcorder and use the "Servo Troubleshooting Test Lead" while playing back any good work tape. You make three simple hookups – ground, CTL, and SW30 test points. Then you perform the same five servo tests and compare your results to the troubleshooting chart (Fig. 4) included on the VC93 Pull Chart and in the Operator's Manual to quickly localize a mechanical or electrical servo problem.

NOTE: All the Servo Analyzer Tests apply to all camcorder VCR formats except 8MM. The

8MM format (both standard and Hi-8) does not use linear audio or a CTL track. Therefore only the "Drum Speed Error" and "Drum Jitter" Servo Analyzer Tests apply to 8MM format machines.

Servos Locked	Capstan Speed Error	Capstan Jitter	Drum Speed Error	Drum Jitter	Most Likely Defect
Good	Good	Good	Good	Good	No Servo Defects
Good	Good	Good	Good	Bad	Drum Mechanical
Good	Good	Good	Bad	N/A	Reference Frequency
Good	Good	Bad	Good	Good	Capstan Mechanical
Good	Bad	N/A	Good	Good	Reference Frequency
Good	Bad	N/A	Bad	N/A	Reference Frequency
Good	Bad	N/A	Good	Bad	Reference Frequency
Bad	Good	Good	Good	Good	Capstan Phase Loop Or Drum Phase Loop
Bad	Bad	N/A	Good	Good	Capstan Speed Loop Or Mechanical
Bad	Good	Bad	Good	Good	Capstan Phase Loop Or Mechanical
Bad	Good	Good	Bad	N/A	Drum Speed Loop Or Mechanical
Bad	Good	Good	Good	Bad	Drum Phase Loop Or Mechanical
Bad	Bad	N/A	Bad	N/A	Reference Frequency
Bad	Bad	N/A	Good	Bad	Reference Frequency

Fig. 4: This troubleshooting chart in the VC93's Pull Chart helps you localize servo problems with the "GOOD/BAD" readings from the servo tests.

To localize problems involving the camcorder video heads or FM playback circuit, the VC93 gives you FM Playback Signals to quickly determine whether a signal problem is due to bad video heads, defective signal circuits, or tape path alignment problems. For instance, when you want to make a quick repair estimate on a "snowy picture" symptom, the VC93 allows you to easily substitute known-good signals at the inputs of both head preamps. If a stable, noise-free picture doesn't return after these injections, you know there is a problem in the signal processing circuits rather than defective heads or rotary transformer.

Troubleshooting

Once you've localized a camcorder VCR problem and given your customer an estimate, the VC93 speeds your troubleshooting by helping you isolate the defect to a single circuit and identifying the defective component in just a few more minutes. Your troubleshooting tests are simply a continuation of the first quick tests that you performed to localize the problem.

To isolate an electrical servo problem that the Servo Analyzer Tests have localized to a particular servo loop, you'll use the VC93 Servo Sub Bias Output. The first step is to take control of the servo loop by using the Sub Bias Output to substitute for the servo correction voltage at the motor driver IC input. If the motor and motor driver IC are functioning properly, you'll be able to control the motor speed. Then you'll use the SC3100 "AUTO TRACKER" to signal trace the motor feedback signal back around the servo loop while you vary the motor speed slightly with the Sub Bias Level control. When you reach the circuit

block where the input responds to the changing motor speed but the output doesn't, you've isolated the defective servo stage.

To troubleshoot the video heads, rotary transformer, preamps, head switcher, and FM luminance stages, use the VC93 Playback Signals to substitute known-good signals to the input of each stage. You'll use the VC93 Drive Signals to troubleshoot baseband luma, chroma, and audio stages with signal substitution for quick defect isolation down to the defective circuit.

In both cases you'll be analyzing the function of the signal circuits, one portion at a time, to quickly isolate the defective stage. While watching the video monitor at the output of the camcorder VCR, you'll substitute known-good signals to match the signals which are normally present at each test point in the signal circuits. When you see picture improvement while substituting a known-good signal into a circuit input, you know that all the

stages after your substitution point are functioning properly. You continue by moving your substitute signal further from the VCR output until the substitution no longer improves the picture. The stage that doesn't function properly with a known-good signal at its input is the defective stage (see Fig. 5).

To troubleshoot the power supply, safety sensors, system control, and other non-signal circuits, use the SC3100 "AUTO TRACKER" for best signal tracing efficiency and easiest troubleshooting. The "AUTO TRACKER" simplifies the signal measurement process with autoranged timebase and attenuators for hands-free circuit analyzing. You get error-free, integrated measurements with no complicated setups or hidden menus.

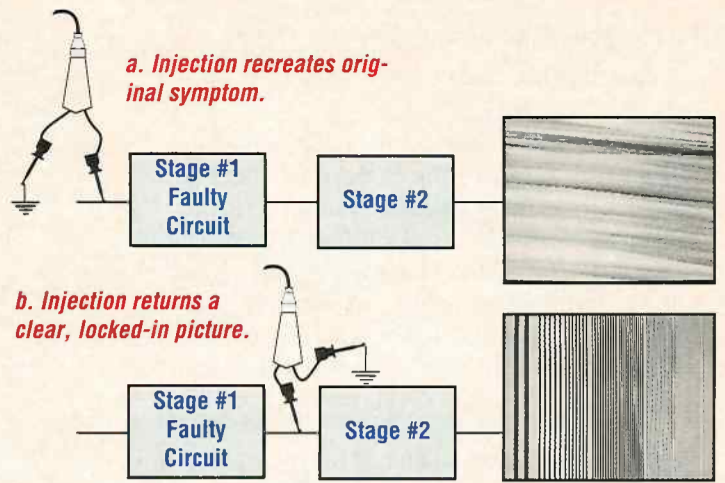


Fig. 5: Functional analysis with signal substitution helps you quickly isolate the defective stage.

Alignment

Camcorder VCR playback alignments are made with a factory alignment tape (be sure to play a work tape first in case the mechanism is damaging tapes). The SC3100 "AUTO TRACKER" is an excellent choice for simplifying the alignment measurements that need to be made while playing the alignment tape. The Delta PP and Delta Time functions, in particular, simplify the alignment measurements.

Camcorder VCR record alignments are made with the Color Bars composite video signal from the VC93's STD VIDEO OUTPUT being fed to the camcorder's video input. The Color Bars signal contains the proper white, sync, and cyan signals for adjusting the white and black clip circuits, FM modulator, and luma and chroma record currents. Again, the "AUTO TRACKER's" special measuring capabilities simplify the record alignment measurements.

NOTE: Mechanical interchangeability adjustments (guide post height, control head height, and control head X-adjustments) and electrical interchangeability adjustments (tracking preset and head switching) should be adjusted only with an original factory alignment tape. The VC93 Servo Performance Test Tape, copies of alignment tapes, and work tapes are not suitable as an interchangeability standard for making these adjustments.

Performance Verification

A primary defect that may be present in the camcorder VCR section and not be obvious during a quick examination is marginal servo operation. This may be caused by worn mechanical parts or marginal servo components. These are the kinds of problems that cause embarrassing callbacks and cost you money.

The VC93 All Format VCR Analyzer makes it simple to quickly check the entire mechanical and electrical servo circuit operation after mechanical or electrical repairs have been completed. This insures that your customer will be satisfied with your work and helps you minimize profit-draining callbacks.

SERVICING ^{plus}

SC3080 Waveform Analyzer

Triple Patented



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

What is the SC3080 Waveform Analyzer?

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

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

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

Meet The Triple Patented SC3080 Waveform Analyzer

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

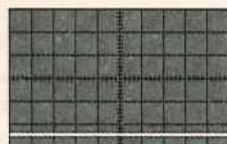


TV Shutdown, Start-up, Or Neither

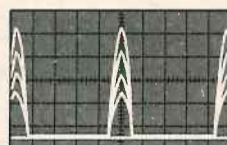
Pulses at collector of HOT:

Symptom:

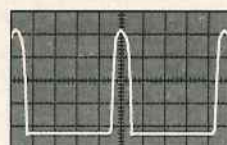
No Pulses-
Troubleshoot start-up circuits.



Momentary Pulses-
Follow shutdown troubleshooting procedures.



Normal Pulses-
Troubleshoot scan derived supplies or video circuits.



**Normal pulses may exceed 1,500 VPP. Do not attempt to measure the pulses with anything less than the SC3080 Waveform Analyzer!*

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How Do I Service Camcorder Camera Circuits?

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

You'll also need a method of totally evaluating the camera output to isolate defective operation. First, you'll need an oscilloscope or waveform display to accurately test video and sync levels produced by the camera. A disadvantage of oscilloscopes for this application is that they lack signal clamping, signal filters, and an IRE graticule for convenient camera video signal evaluation. A waveform monitor greatly simplifies the process.

A vector display with precision chroma demodulators will be needed to accurately test chroma saturation and hue. A frequency counter will be needed to test the accuracy of the master sync generator to insure camera compatibility with all TVs and video monitors.

Also, a method of judging camera signal quality will speed the troubleshooting process and assure you of customer satisfaction with the completed repair.

Finally, you'll need a method of signal tracing individual camera stages to isolate defects to the board or component level. The SC3100 "AUTO TRACKER" is ideal for this purpose, but an external trigger signal derived from the camera sync output will be required for signal tracing stages before the sync adder.

To efficiently service camcorder camera sections, you need an instrument (or instruments) with the following:

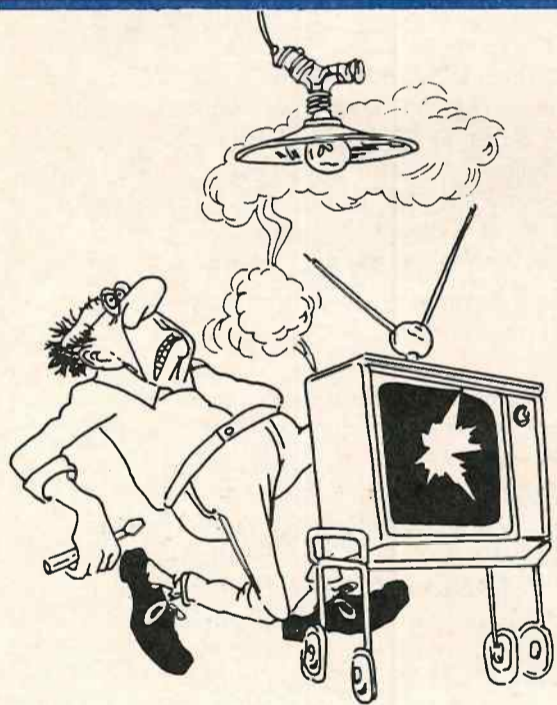
- Easy-to-use, accurate measurements of video and sync levels.
- Easy-to-use, accurate measurements of chroma saturation and hue.
- Complete video signal testing for quick, accurate troubleshooting.
- Convenient signal connection from all video cameras.
- Enhanced signal tracing troubleshooting capabilities.
- Simplified video monitor interface for maximum testing accuracy & versatility.
- Accurate test pattern signal source to serve as a reference for testing.

How Can I Take Advantage Of Camcorder Service Opportunities?

Watch upcoming issues of the *Sencore News* to learn more about the opportunities available in servicing cameras for your present and potentially future customers. Increase your profits and expand your customer base by servicing cameras for other servicers instead of sending your cameras out for service!

Call **1-800-SENCORE (736-2673)** and discuss how the VC93 VCR Analyzer fits into your camcorder analyzing plans. Your Area Sales Representative can help you get started. ■

EDITOR'S NOTE: We'd like to take a quick moment and apologize for forgetting to recognize Jeff Clark at Davison TV in Davison, Michigan for his help with an article in Sencore News #155. Jeff helped Sencore with the tracking control procedure outlined in the article using the VC93 All Format VCR Analyzer. Thanks Jeff.



Have you ever tried to fix a TV set in the dark?

Of course not!

You wouldn't fix a TV set in the dark. And you wouldn't tackle any tricky repair job without top-notch test equipment. So why would you attempt to service any consumer electronic product without the know-how that you get every month from *Electronic Servicing & Technology*?

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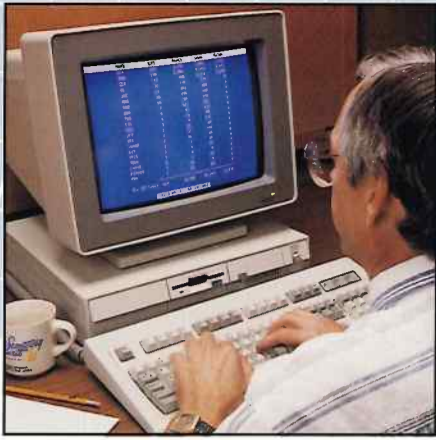
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Add To Your 1993 Business Management Success With The New SM2001 Service Center Manager!

By David Olps, Product Manager,
Business Management Group

"I've been in business for 14 years and have been unsuccessfully trying to automate for several years. I even worked directly with a programmer for six months to no avail. After using the SM2001, I could tell it was written by someone who has been living and breathing in the service industry for years. It has everything needed to manage and control my business in a fully integrated package. I'm extremely pleased."

Pete Ciabattoni
Salt City TV and Electronics

SM2001

Service Center Manager

We're proud to introduce today's premier business management software package, the New SM2001 Service Center Manager, part of Sencore's "Tech Choice System." The computer has made a huge impact over the past several years, but many servicers are not aware how the computer, along with business management software, can help fill their business management needs.



This article will show how the SM2001 can help your business with invoicing, parts ordering, inventory management, business management reports, tracking accounts receivables, plus many other benefits of automating your business. While reading this article, if you have any questions or if you'd like to learn more, please give your Sencore Software Sales Representative a call at 1-800-SENCORE ext. 238. We'd be glad to personally walk you through the program or send a full demonstration package.

Why Is Sencore Offering A Complete Software System?

For over 40 years, Sencore has been designing test instruments for the service industry that guarantee increased profits and total satisfaction – all based on your input. We've received thousands of requests from servicers, like yourself, to help manage and control their business functions more effectively. We were asked questions on how to help manage work flow, control inventory, automate parts ordering, develop business reports, and ultimately how to improve profitability.

After researching our customers' needs, we've discovered what's really needed to manage a service center is a computer software program to improve customer service, control operations, generate reports on business financials, and prepare you for the future. We had to be compatible with the demands of the service industry, and we knew it would take a pro-

gram written by a servicer who understands your specific needs.

The software we chose was written by Mr. Mack Blakely of Blakely's TV and Computer Support. Mr. Blakely is a long-time servicer with over 35 years of service experience, 14 years of programming experience, and a background in accounting. The business management program he developed has been in use by servicers for over five years. He even has a focus group of service center owners and managers that have been helping him fine tune the program on a continuing basis. This software program is currently being used in a number of service centers ranging in size from the one man shop to a 21-person operation. The program is a perfect match – a true "Tech Choice System."

Sencore Is Proud To Introduce The SM2001 Service Center Manager Software System!

The New SM2001 Service Center Manager is guaranteed to be the fastest, most complete, customized, and easy-to-use program on the market. The SM2001 is designed specifically to help you manage all aspects of your business more efficiently, effectively, and profitably. But we'll let you see that fact for yourself. Let's start with the invoice as shown in Fig. 1.

Invoicing:

When a product is taken in for service, you simply enter the customer's information and make a few selections to customize the invoice on how you want the unit processed. Once the information is saved, you can update the invoice and track the unit as it moves through your repair process.

With your list of invoices, you can run "Work In Progress" reports and "Technician Assignment" reports to help you manage your work flow. When the invoice is ready to be

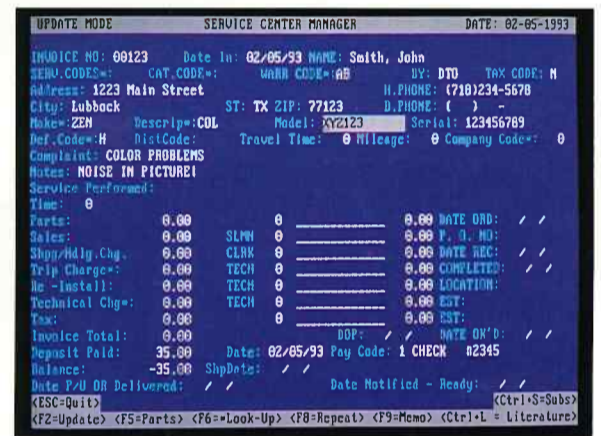


Fig. 1: The Service Center Manager lets you customize invoices for your business' and your customers' needs.

completed, you have the option of printing it on NESDA, NARDA, or plain paper invoices.

From the invoice screen, you can search inventory and look for cross-referenced parts, write additional notes about the repair in the memo pad, and even pull up a service literature file containing information on SAMS, microfiche, and service manuals.

The Service Center Manager is powerful enough to manage and control every aspect of your invoice processing. Yet it's so easy to use, you can jump in and start using it from the first day.



Fig. 2: Automated parts ordering processing saves you time and money while automatically updating your inventory and invoices.

Parts Ordering Processing:

Are you tired of ordering parts from your local distributor only to have to order parts again the next day from the same place and pay freight for each order? Do you have a quick

"Overall, the SM2001 is a superior software package which enables our company to control the work flow through our business which would otherwise be extremely difficult. I highly recommend this system to any size of business."

David R. Bond
Bond's Television & Electronics, Inc.

and reliable way to track parts orders for quantity discounts and your peace of mind?

With the SM2001 Service Center Manager, you can order parts whenever you want and from whomever you want. The SM2001 will even track them

by invoice number and by vendor – automatically. When you're ready to place parts orders, just punch a few keys and let the program do the work for you.

The Service Center Manager automates your parts order processing and ties the various functions of the program together. The SM2001 automatically places parts ordering information like part description, date ordered, purchase order number, and date received in the invoice screen. This interaction lets you know exactly what's happening with the repair and provides quick, accurate information for customer inquiries. When parts are received, the program will even update the inventory file with the cost of the part. Automating your parts order processing will save you effort, time, and money, not to mention headaches (see Fig. 2).

DATE:	INVENTORY FILE MAINTENANCE	EDIT MODE
02-05-1993		
*Part No: A0114606	Type: U Measure: EA	Min-Level: 20
Description: BELT	Re-Order Level: 25	Status: A
G/L (Cost) Code: 7 PARTS COST	Date Last Out: 02/01/93	
G/L (Inv) Code: 8 PARTS INV	Date Last In: 12/10/92	
Levels—Qty—Unit Cost—Dud Value—Total Cost—Retail Price:		5.25
A 10 2.65 0.00 26.50	Price Lvl 1: 4.73	
B 50 2.75 137.50	Price Lvl 2: 4.20	
C 3 0.00 0.00	Price Lvl 3: 3.00	
Totals 60 164.00 0.00 164.00		
Quantity Sold	MTD	YTD
Total Sales	40	60
Cost of Sales	210.00	262.50
Cost of Receipts	105.00	122.50
Gross Margin	132.50	132.50
	49.52%	53.33%
Alternate Part No:	Vendor Number	3
	Last Order Date	12/01/92
	Purchase Order No	125
	Quantity on Order	0
	Qty Committed	0
	Location Code	35
	Department Code	3

Fig. 3: The SM2001 lets you manage your inventory wisely, with updated parts usage, pricing levels, reordering advice, and more.

Inventory Management:

Do you always have frequently used parts in stock? Have you ever spent valuable time trying to match parts in stock to the parts you need for a repair? How much should you mark up a particular part to insure a good profit, yet not too high as to insult or lose your customer? Why order a new part if you have one in stock that will work? Again, the SM2001 is the program you need to manage and control your inventory challenges.

The Service Center Manager lets you manage and control your inventory with ease. You can perform simple functions like add, edit, search, sort, and cross reference items in inventory. You also have the power to track month-to-date and year-to-date figures, receive reordering advice, run a history of parts used report, and more.

DATE	P/U	UNITS	PARTS	SALES	SC	LABOR	P/U	LABOR	SHP	LABOR	TAX	TOTAL
05/10/91	27		343.35	759.95		264.65	20.00	1029.75		187.40		2605.10
05/11/91	13		132.00	1484.85		54.95	15.00	382.40		160.37		2229.57
05/13/91	13		158.25	437.71		39.95	0.00	10.00		50.08		695.99
05/14/91	16		469.97	799.95		184.75	20.00	357.69		134.41		1966.77
05/15/91	21		280.58	0.00		84.85	35.00	741.00		70.98		1212.41
05/16/91	16		182.73	329.95		169.75	50.00	636.25		99.12		1467.80
05/17/91	19		377.85	1518.85		302.53	24.95	435.00		196.43		2855.61
05/18/91	20		322.13	0.00		109.85	30.00	551.69		67.35		1086.02
05/20/91	9		54.04	959.95		89.90	0.00	209.95		89.90		1403.74
05/21/91	22		404.71	1524.95		189.75	110.00	564.90		216.56		3010.87
05/22/91	7		25.15	2250.00		134.85	0.00	119.95		196.07		2726.02
05/23/91	16		298.15	729.95		219.75	30.00	422.30		131.78		1831.93
05/24/91	19		227.66	2974.90		139.80	75.00	792.75		323.28		4533.39
05/25/91	17		206.85	2239.70		114.80	80.00	589.70		250.42		3481.47
05/28/91	10		152.70	1749.80		39.95	10.00	132.45		161.59		2246.49
05/29/91	12		207.65	-630.10		169.85	15.00	79.95		-12.20		-169.85
05/30/91	17		306.27	1550.00		339.65	30.00	233.46		151.86		2611.24
TOTALS	274		4150.04	18680.41		2649.58	544.95	7289.19		2475.40		35794.59
TOTAL LABOR												10483.72

Press Return for More or <ESC> to Quit:

Fig. 4: The Service Center Manager can show you dollar figures for parts, sales, labor, and taxes for any selected time period.

All inventory items are controlled on a first-in, first-out system to insure proper reporting on the gross profits report. You can even assign various pricing levels to match discount levels used in your business. The SM2001 Service Center Manager is the only program available that provides intelligent information to help you make wise inventory management decisions quickly and easily (see Fig. 3).

File Scanning And Searching:

Do you remember when a customer was inquiring on his repair, and how long it took you to run back to the technician or dig through the invoice drawer? Do you pay your technicians on a commission basis? If so, would you use a system that can be customized for calculating commission? Would you like a quick, easy way to calculate your sales tax monthly, quarterly, bi-annually, or annually? Or, would you simply like to monitor the business that has transpired in designated time increments to help you identify business trends?

The SM2001 Service Center Manager does this and more – it's what you've been waiting for. Information entered into the program can be used to generate customized reports that show you exactly what's happening in your business. And best of all, you don't need to understand computer programming to run a customized report. You can generate business reports by customer name, model number, serial number, date in, pick-up date, or date completed, all with just a few keystrokes. Now, you really can make well informed business decisions (see Fig. 4).

Accounts Receivable:

Do you know exactly where your money is and how your clients are paying you? Can you access this information in just a few seconds?

If not, the Service Center Manager can help you manage and control your accounts receivables. The SM2001 automates accounts receivable functions like posting payments and credits, invoice aging, month-end processing, and more. The accounts receivable functions work hand-in-hand with invoice processing to make managing your accounts

quick, easy, and accurate. Managing your cash flow has never been this easy (see Fig. 5).

ACCOUNTS RECEIVABLE		DATE: 02-05-1993
Customer Number:	Name:	
Address 1:		
Address 2:		
City:		
Contact:		
Telephone No:		
Fax No:		
Alt:		
Tax Code:		
Pricing Code:		
Category:		
Limit:		
Terms:	%	Due Days: From 1st Y/M:
Discount:		
Comments:		

Accumulated
Average Number of days to pay:
ate Charges:

F2 Update F6 Look-Up Key F7 Display Invoices F8 Repeat ESC Quit

Fig. 5: The Service Center Manager makes accounts receivables quick, easy, and accurate.

Transaction Register:

Do you balance your business on a daily basis? If so, how long does it take? Can you get the numbers you need in 10 seconds or less?

You can with the Service Center Manager. The SM2001's transaction register will provide you with detailed reports showing cost, sales price, and profit on a line-by-line basis in seconds. You can even run reports for end-of-month and end-of-year processing. What will this mean to you?

Utility Programs:

One difficulty many users have with software is the limitation of the parameters set by the software designer.

That's not a concern with the Service Center Manager. The SM2001 was designed by a servicer who understands your needs and knows that each business does things a little differently. That's why you are able to customize the SM2001, through the Utility Programs, for the way you run your business.

"We have been using the SM2001 for approximately two and one half years and have not once been without its use. I highly recommend this system, given its ease-of-use and its capability to handle our activity without any problems or malfunctions"

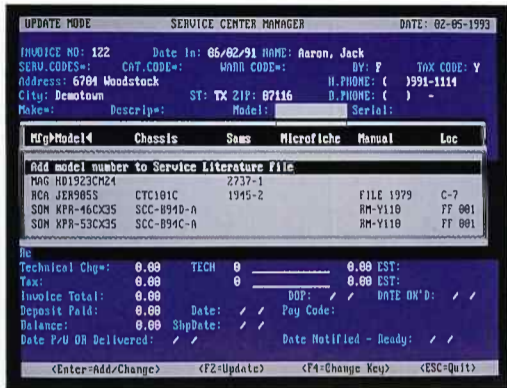
Larry W. Parnell
Larry's TV Service Inc.

"I find the system to be an asset to my company and a real 'support system.' I would highly recommend the SM2001 Service Center Manager."

Mike M. Floyd
T & M Electronics

You can also maintain and back up your program with various routines to insure your program runs as efficiently as possible and that your data is protected against failure. Only the Service Center Manager is

this flexible and easy to use – only the SM2001 Service Center Manager!



Literature File



Warranty Look-Up

Fig. 6: SM2001 gives you many extra capabilities such as tracking service literature and displaying manufacturer warranty rates.

Unique And Special Features:

Not only does the SM2001 assist you in managing and controlling your business functions, but it does so with extra features other programs haven't even considered. It goes further to cover your entire business. The SM2001 includes features like:

1 Literature File – track and control SAMS, microfiche, and manuals by manufacturer, model, and chassis number.

2 Blinking Messages – to emphasize specialized and important messages that need your attention or act as a reminder notice.

3 General Ledger Codes – customized to fit your business needs.

4 Automatic Pricing on Parts – streamlines your parts pricing and insures profits.

5 Memo Pad – allows you to enter additional notes about the repair or messages given to your customer.

6 Warranty Look-Up Table – automatically displays manufacturer warranty

rates and parts mark-up percentages on the product to be serviced.

7 Automatically calculates how many days have passed since the date of purchase – you'll know instantly if the unit is in or out of warranty.

8 Auto Search On Serial Number – upon entering a product for service, the SM2001 automatically scans the entire database to see if the product was previously in for service.

9 Repeat Key – providing fast operation and unparalleled ease of use when dealing with repetitive operations.

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

Johnny Owens
Homemakers Television Service

The SM2001 Can Help Build Your Business In 1993!

We're confident the SM2001 is absolutely the best program available. It's specifically designed for the service industry by the service industry and it's available exclusively from Sencore – the leader in American-Made Electronic Analyzing Equipment, and now Business Management Software.

For a limited time, Sencore is offering special introductory package pricing. For detailed information or a demonstration package on the SM2001 Service Center Manager, call 1-800-SENCORE ext. 238. ■

The SM2001 is also available in Canada.

NEW!

Service Center Manager

Business Management Software

MANE	CNT	Parts	Labor	Sales
RCA	159	2,737	7,001	7,123
SDA	169	2,951	4,845	6,641
ZEN	41	688	1,151	1,570
GE	22	730	539	0
JUC	21	353	603	0
MAG	10	474	603	0
PAN	7	117	215	0
QUA	4	73	265	0
TDS	4	0	135	0
FIS	3	39	60	0
SYL	2	32	140	0
JCP	2	46	45	0
TEX	2	5	75	0
SHARP	2	6	0	0
HIT	1	0	0	0
PHIL	1	2	25	0
TOSH	1	57	70	0
SHAYD	1	39	60	0
FISHER	1			
MIN	1			
Top 20 Total	404	8,765	17,643	17,529

The Fastest, Most Complete, Customized And Easy To Use Program On The Market! Designed Specifically To Help You Manage All Aspects Of Your Business More Efficiently And Effectively.

- Manage customer invoicing and work flow from creation to tracking and billing – automatically!
- Automatic generation, tracking and control of parts orders saves effort, time, and money.
- Gain inventory control through searching, cross referencing, pricing levels, ordering advice, general ledger codes, gross profit reports, and more.
- Customize business reports from any or all of the invoices you've ever processed.
- Automate accounts receivable functions such as posting payments & credits, aging, month end processing, and more, with just a few key strokes.
- Perform daily and end of month transaction reports showing cost, sale price, and profit in just seconds.
- Electronically file warranty claims through KeyPrestige Inc., the nations largest independent warranty claims processor, providing an automated link to many electronics manufacturers.
- Many unique and special features specifically designed for the servicing industry, with your time in mind.
- Rapid execution of reports and file searches provides you with information in just seconds. You never have to archive a file – ever!

To discover how you can improve your business management skills, mail in the card or call

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(736-2673)

SM2001

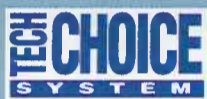
Service Center Manager

Business Is Not A Game Of Chance!

**You Either Win Or You Lose -
There's No Two Out Of Three!**

All too often a servicer is forced to place the profits on the line based solely on the flip of a coin or an educated guess. What happens to your productivity when you go down the wrong circuit, or spend time diagnosing the heads when the servos aren't tracking correctly? You lose the gamble, right?

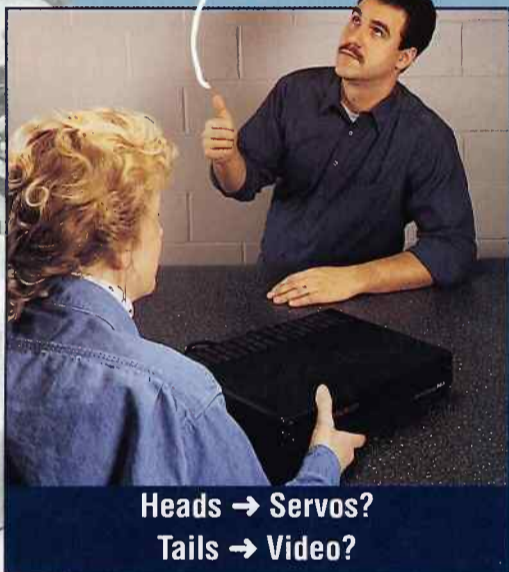
Don't take that chance! Here's the answer . . .



Thousands of satisfied customers have invested in the VC93 All Format VCR Analyzer for various reasons: servo analyzing, head checking, luminance/chrominance circuit troubleshooting, audio and Hi-Fi circuit analyzing, plus the simple ability to add an additional \$2-\$5 of profit on each VCR coming through their service center.

And they can do all of these things because the VC93 provides:

- ◆ Dynamic VCR head signal substitution
- ◆ Exclusive Hi-Fi Stereo head substitution
- ◆ Innovative VCR luminance, chrominance, and audio circuit analyzing
- ◆ Automatic servo analyzer
- ◆ Stand-alone ability or can be integrated with the new "Tech Choice System" instruments
- ◆ Complete all-format troubleshooting, including:
 - Servo bias supply
 - Standard video & audio line outputs
 - Autoranging DCV and PPV meter
 - Output signal monitor

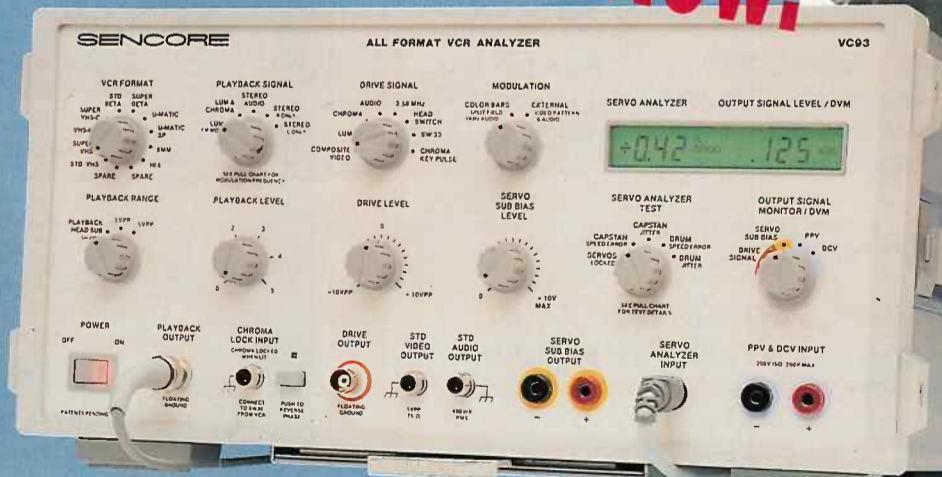


**Heads → Servos?
Tails → Video?**

New!

If you'd like to learn more about the VC93, call your Sencore Area Sales Representative today, and find out why the VC93 is one of the best investments you'll make in your 1993 VCR servicing.

**Call 1-800-SENCORE Ext. 510
(736-2673)**



**VC93 All Format VCR Analyzer
Patented - Exclusively From Sencore**

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