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Issue #158 Nov./Dec. 1992

# Introducing The Only "AUTO TRACKER"

MODEL SC3100

CRT MODE

CH CASE CASE VECTOR SEAN FINDER

AUTO TRACKER AUTOMATIC 100MHz WAVEFORM & CIRCUIT ANALYZER

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

CHANNEL B

POCY EVAN PRACO

ACV 484

VERTICAL

PUT COUPLING

CH B INPUT

Get The Full Waveform And Circuit Ine roll traveloritien See Page 4

CHANNEL A

DEV VPP FIRED

ACY Com

VERTICAL

COUPLING

INPUT CH A

OHMS / DC AMPS

OHMS AMPS

OHME

SOURCE AC LINE . EX

GER LEVE



SENCORE

POWER

ent No's 4323972,

OFF I

CH A CH B

4473857. 450

CALL 1-800-SENCORE TODAY! (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"<sup>TM</sup> 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.



INCO



## **Presenting The Newest Concept In Innovative Test Instruments!**

By Brian Phelps, Product Marketing Specialist

he "Tech Choice System" is our latest concept in complete test equipment development. When you see the "Tech Choice System" symbol you're guaranteed accuracy, reliability, ease-of-use, and full system compatibility.

#### **On The Cover**

Introducing the SC3100 "AUTO TRACKER". As part of Sencore's "Tech Choice System" design concepts, you'll find that the SC3100 is truly revolutionary. Fully automatic and autoranging features are just part of the benefits offered. (See page 4 for the full story.)

#### **In This Issue**

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Business Management Systems. See How You Can Reap The Benefits – page 20

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Visit A Successful CM2000 Owner – page 26

New ECL Adapter Available For The CM2000 – page 28 Sencore's new "Tech Choice System" instruments are designed by servicers, like yourself, who know that test instruments are an essential part of any successful service center. Never before has there been one test instrument system designed specifically for the service industry.

There are single instruments that do a good job for the specific area they were designed to help you service. And there have been instruments designed to offer various options to fit your individual needs. Now, Sencore's new "Tech Choice System" instruments are setting new standards in test equipment.

With the "Tech Choice System" you receive:

Fully compatible and complementary design – designed by servicers like yourself.

Stand-alone ability to fit your service needs – build your service bench as your business grows.

Patented and innovative instruments – ensuring specific testing ability to help guarantee fast and profitable repairs.

Investment protection – each instrument is backed by Sencore's established reputation for supporting the service industry.

#### "Tech Choice System" is a result of the industry's only joint design effort. Here's how:

Sencore's Application Engineering Department is in constant contact with customers and manufacturers surveying them in order to best define the critical instruments needed for the service industry. The results are then reviewed by experi-

enced servicers, manufacturers, and test equipment specialists for specific features, functions, and benefits for you – the servicer – thus beginning the design process.

Once this designing process begins, input from the servicer isn't over. All prototypes are sent into the field to be tested and used in order to verify that the product does what it should do – make your job easier and more profitable than ever before.

From this valuable input, Sencore custom designs extensive manuals, tech tips, and technical video tapes, addressing your needs. Sencore's highly trained Product Sales Representatives, backed by Application Engineers, are ready to offer assistance in the use of each instrument. No one else comes close to Sencore's customer driven support!

Best of All – You cannot make a wrong decision when you invest in a "Tech Choice System" instrument. Backed by Sencore's 100% Lifetime Made-Right Guarantee and Extended One Year Parts And Labor Warranty, you can be sure that you are investing in high quality and highly reliable instruments. In addition, Sencore's 30 Day Money Back Guarantee ensures that you are investing in the right instrument for your application – or your money back.

"Tech Choice System" is your choice for easyto-use, reliable and high quality instruments that are designed with your service needs in mind. Designed by servicers just like yourself, built right here in the USA and backed by a company with over 40 years of experience in the service industry – backed by Sencore.

#### Ask For "Tech Choice System" Compatibility!



"Tech Choice System" Units Are The Only Analyzing Instruments Designed Through A Joint Venture Between Sencore And The Service Industry!



## Introducing - The SC3100 "AUTO TRACKER"™ Automatic 100 MHz Waveform & Circuit Analyzer

#### By: The SC3100 "AUTO TRACKER" Product Development Team

- New Autoranging Timebase And Attenuators For Hands Free Circuit Analyzing!
- New Integrated Measurements Of All Circuit Parameters!

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Of course you want to make these measurements as quickly and as accurately as possible. But often you must use an oscilloscope to make measurements, and unfortunately conventional oscilloscopes simply don't allow you to make measurements quickly and accurately. It seems like you are always fiddling with an oscilloscope's Timebase and Volts/Division controls to display the waveform so that you can make a measurement. Sencore has always known there had to be a better method that allowed the technician to make waveform and circuit measurements.

When Sencore introduced the "Waveform Analyzer," we completely revolutionized the oscilloscope and the way that electronic servicers made measurements. Servicers could now make DC voltage, peak-to-peak, and frequency measurements at the push of a button – through a single probe connection to the circuit. There was no more time consuming graticule counting because the measurements were made digitally and independently of the CRT circuits and the readings were accurate and error-free.

Well, we all know times have changed. You still need to make fast and accurate measurements, in fact, more so than ever before. But, each day also brings new circuits and with them the need for additional and updated tests. Today's circuits are faster; they often contain low level signals; and because digital is so widespread, logic level measurements are critical.

Introducing The New SC3100 Automatic 100 MHz Waveform & Circuit Analyzer . . . Now Touch And Test Any Circuit Test Point And Make Autoranged Error Free Measurements In A Fraction Of The Time!

#### The SC3100 "AUTO TRACKER" Product Development Team Presents Sencore's Newest Innovation!

We're the SC3100 "AUTO TRACKER" Automatic 100 MHz Waveform And Circuit Analyzer Product Development Team for Sencore, Inc. We have been working together for the past 16 months studying the needs of service professionals - your needs - in order to design the best Waveform And Circuit Analyzer on the market. Our research included several test and evaluation sites, and we'd like to thank all of the servicers who worked hard with us and provided valuable input for our research.

Today, on November 1, 1992, we celebrate a change in the way servicers will analyze waveforms and circuits. We celebrate the introduction of the best and most diversified "Waveform And Circuit Analyzer" on the market.

In this article (starting on page 4), you will find a complete description of our new SC3100 "AUTO TRACK-ER" Automatic 100 MHz Waveform And Circuit Analyzer. You'll find new and innovative features exclusive to Sencore, including the "Touch And Test" analyzing concept, Circuit Analyzing, Autoranging, Delta DC Volt Measurement, etc. All of these features are the result of work done with the service industry under the guidelines of our new "Tech Choice System" concept - an idea that was developed by working with service professionals. This concept has produced instruments such as the VC93 All Format VCR Analyzer, the CM2000 Computer Monitor Analyzer, the VG91 Universal Video Generator, and the TVA92 TV Video Analyzer.

We're confident that we have produced the best Waveform Analyzer on the market, and we'd like you to see our work for yourself.

Thank you for your help and support.

| SC3100 Product Development Team                             | And And  |
|---|--|
| Harry Sanchez: Product 7                                    | Team Chairman/Design Team Leader                                 |
| Chris Kirkus: Director Of Operations                        | Brian Phelps: Product Marketing Specialist                       |
| Chuck Robertson: Chief Application Engineer<br>Jerry Lehner | Dave Drewes: Production Manager                                  |
| Jerry Lehner: Test Engineer                                 | Otto Wilczek: Manufacturing Engineering Manager<br>Larry Golfson |
| Sanjev Mahtaney: Component Engineer                         | Larry Rolfson: Production Analyzer                               |

We developed the SC3100 Waveform & Circuit Analyzer to meet today's servicing needs. Service literature provides many important circuit parameters critical to your troubleshooting and alignments. You need to make these measurements accurately, and as quickly as possible. But to do this, you need the right tests at your finger tips. The "AUTO TRACKER" is a complete waveform and circuit analyzing system for all your waveform and circuit analyzing measurements. Here's how the "AUTO TRACKER" will increase your troubleshooting effectiveness.

#### Auto-Tracking<sup>™</sup> Digital Readout Of Voltage and Frequency

Oscilloscopes are analog devices which are

time consuming, inaccurate, and laced with errors. Sencore changed all this by adding the speed, accuracy, and push button ease of digital readings to every waveform voltage and frequency measurement. You simply connect one probe to the circuit and push a button to read the DC volts, peak-to-peak volts, frequency, RMS AC voltage, or dBm level. You'll keep your mind on the circuit, not on making the measurement.

These tests are called "Auto-Tracking" because they automatically follow the signal that is displayed on the CRT, for either channel A or B. If the signal's level or frequency changes, the digital reading immediately shows the new value.



#### **Auto-Tracking Is Faster**

Talk about timesavings – you don't even need to have the waveform locked or displayed to make an Auto-Tracking test. Each test is autoranged for hands-off measurements, and all tests are made through a single probe.

#### **Auto-Tracking Is More Accurate**

The SC3100's .5% DCV accuracy is nearly 60 times more accurate than a conventional oscilloscope or competitive digital readout scope, and the frequency measurements are over 1,000 time more accurate. Because all of the measurements are made through a single, low-capacitance probe you don't need to worry about circuit loading either.

#### **Auto-Tracking Is Error-Free**

The digital Auto-Tracking tests are fully independent of the CRT circuits. This means that you'll never make another measurement error because you forgot to set one of the verniers to "CAL," or select "AC" or "DC" input coupling.



Fig. 2: Push a button to read the DC voltage, peakto-peak voltage, and frequency of the signal at any test point.

#### Integrated Measurements Of All Circuit Parameters

Have you ever found yourself searching for a DVM to make a resistance or current check? Well, with the Waveform & Circuit Analyzer on your bench, you'll never need to stop your troubleshooting to hunt for another meter.



Fig. 3: Integrated ohms, continuity and DC current tests make the SC3100 the complete answer for your measurement needs.

We've integrated ohms and DC current tests making the "AUTO TRACKER" a complete answer for your measurement needs. The SC3100 Waveform & Circuit Analyzer is the only instrument you need to make the measurements shown in service literature.

These circuit parameter tests are made through a separate input to protect the sensitive scope input circuits. Each function is fuse protected so that you can't damage your "AUTO TRACKER", even if you make a mistake and try to measure resistance in a live circuit!

Connect the leads and push the DC amp button to make bias current and power checks from 1  $\mu$ A to 1.99 amps. Like all the other digital tests, the current test is fully autoranged.



Fig. 4: Read bias current from 1  $\mu A$  to 1.99 amps with the Waveform & Circuit Analyzer's integrated DC current test.

Does your troubleshooting point to a defective resistor? You can check any resistor from .01 ohm to 100 megohms with the "AUTO TRACKER's" integrated ohmmeter.

Many times you just need to know if there is a good electrical connection between point A and point B. That's why we've also included a continuity test that provides a near-instantaneous visual and audible indication.



Fig. 5: With the "AUTO TRACKER" you don't need to hunt for a DVM just to check a resistor value or confirm continuity.

#### Full Performance, 100 MHz, Dual Trace Oscilloscope

Fast, accurate digital measurements are great. But let's face it, sometimes you just need to look at the waveform, like when you are checking for distortion, overall waveshape, or making adjustments. The "AUTO TRACKER" contains a 100 MHz, Dual Trace Oscilloscope that meets all of your waveform viewing and analyzing needs.

#### **View Waveforms Accurately**

Chances are that you don't work on too many circuits that are operating at 100 MHz. But what many servicers do not realize is that to effectively troubleshoot digital circuits, your oscilloscope must have a bandwidth that is at least three times faster than the signal that you are viewing. This is because digital signals are squarewaves and, as Figure 6 illustrates, a square wave is actually made up of a fundamental sine wave and odd harmonics.

Your oscilloscope must have a bandwidth that is capable of passing at least the 3rd harmonic, and preferably the 5th harmonic of the squarewave. Otherwise, you may not see glitches and overshoots that cause digital circuits to malfunction.

The "AUTO TRACKER" provides a vertical and digital PPV bandwidth of 100 MHz (useable to 120 MHz) to accurately analyze and view digital waveforms in circuits that are running at today's higher frequencies.



Fundamental 81.17%



3rd Harmonic 9.02%



3.24%

Fig. 6: A square wave signal contains odd harmonics of the fundamental frequency. You need sufficient bandwidth to display these harmonics.

#### Lock Any Waveform Quickly And Easily

What good is wide bandwidth if you can't trigger the signal? The SC3100 has just four trigger controls, and its "fiddle free" trigger circuits provide fast, rock-solid viewing of any signal. Once you've locked the waveform, you don't need to reset the trigger controls just because the signal level changed.

Video signals represent a special triggering challenge. These signals are a complex waveform of constantly changing levels and frequencies. The SC3100 contains special sync separators that feed only clean sync pulses to the trigger circuits. The result is a stable waveform, even when viewing "live video."

Two video presets allow you to quickly lock a video waveform and automatically view two fields (one frame) or two horizontal lines. But sometimes you need to see more detail, such as when setting up VCR headswitching or making camera adjustments. If so, simply select the "TV" trigger mode and adjust the TIME/DIV control for the desired detail.

AUTO TRACKER AUTOMATIC 100MHz WAVEFORM & CIRCUIT ANALYZER

AUTO TRACKER AUTOMATIC 100MHz WAVEFORM & CIRCUIT ANALYZER

CRT MODE

You encounter a wide range of signal levels

in your service work, from the tiny millivolt

the large 700 to 1100 VPP pulse at the collector of the horizontal output transistor. No

signal is too large or too small for the "AUTO

TRACKER's" exclusive 2 mV to 2 kV input

signals at the output of a playback head to

stable viewing of video signals.

View The Smallest And

Largest Signals

Fig. 7: Special sync separators and video presets provide fast,

POWER

range. You can confidently measure any signal knowing that you won't damage sensitive input circuits.

#### Exclusive Autoranged Timebase And Vertical Attenuators

Have you ever wished that you could just connect the probe to a test point and look up to see a locked-in CRT display? It sure would be a timesaver if your oscilloscope automatically adjusted itself and showed the proper waveform without manually resetting the timebase and vertical attenuator controls each time you move to another test point.

Well, you don't need to wish any longer! Simply set the TIME/DIV and VOLTS/DIV controls to "AUTO" and the waveform dis-

DELTA MARKER

POLARITY

EXT TRIGG

PROBE

DELTA MARKER

PROBE

EXT TRIGG

BEG

played by the SC3100 "AUTO TRACKER" will follow as you move the probe from test point to test point.

However, sometimes you may not want the waveform to autorange completely. Instead, you may want to manually set the TIME/DIV or the VOLTS/DIV controls to match the setting listed in the service literature. That's why we made the timebase and channel A and B vertical attenuators autorange independently of one another. The "AUTO TRACKER" lets you choose autorange for fast, easy operation, or full manual control when you need it.

#### Digital Delta Measurements Analyze Any Portion Of A Waveform

The Auto-Tracking tests measure the entire waveform. But what about those times that you need to analyze just a portion of the waveform, such as when you need to know the

color burst amplitude, the width of a pulse, or the logic level? Wouldn't it be nice to make these measurements with the same speed and digital accuracy of the other Auto-Tracking tests? Well, you can with the Waveform & Circuit Analyzer's Delta Measurement tests.

You simply highlight the desired portion of the waveform with Sencore's exclusive Delta Bar, select the desired test, and read the digi-



Fig. 8: The "AUTO TRACKER" provides an exclusive and fully autoranged CRT waveform display.



Fig. 9: The Delta Measurements allow you to measure any portion of a waveform quickly, with digital accuracy.

tal display. No graticule counting or cursor settings to guess at or cause errors. Here's how the Delta Tests work.

#### Measure The Amplitude Of Any Waveform Portion

Forget the tedious, error prone method of counting graticules to determine the peak-topeak amplitude of any portion of any waveform. Now, you simply press either the Channel A or Channel B Delta VPP button, and adjust the intensified Delta measurement bar until it covers the desired portion of the waveform, as shown in Figure 10. The bar can be set anywhere on the waveform using the Delta "Begin" and Delta "End" controls.

#### Measure The Time Or Frequency Of Any Waveform Portion

Measuring time is just as easy. Now, to measure pulse widths, or to determine the delay between two signals, press the Delta Time button. Then set the intensified Delta Bar until it covers only the desired portion of the waveform, and read the time directly in the digital LCD readout. You'll never count CRT graticules again.



Fig. 10: Set the Delta Bar and make time measurements quickly and accurately.

What about finding the frequency of an interfering signal? You simply press the Delta Frequency button and adjust the Delta Bar until it covers just one cycle of the signal. The digital display shows the frequency. That's all you need to do when determining the approximate frequency of glitches, ringing, or any waveform portion. TTL Logic



Fig. 11: Logic levels must be correct in order for digital circuits to operate properly.

#### Analog CRT Section

#### Vertical Amplifiers:

- DISPLAY MODES: Ch. A, Ch. B, -A, A & B, A + B, B A, X Y. INPUT COUPLING MODES: AC, DC, and ground. CALIBRATION ACCURACY: ±4% at 1 kHz.
- FREQUENCY RESPONSE: ±3dB of 1 kHz level from 10 Hz to 100 MHz, useable to 150 MHz.
- RISE TIME: 4 nanoseconds. DEFLECTION FACTORS: 13 calibrated ranges, 1-2-5 sequence, plus Autorange. Vernier variable between ranges. Autorange position automatically selects attenuator to show approximate ly 2-4 divisions of amplitude. SENSITIVITY: 20 mV/div. to 200 V/div. with supplied 39G292
- New York, New
- VECTOR: Channel A is Y axis, channel B is X axis. Bandwidth: ±3 dB DC to 2 MHz.

#### Horizontal Sweep:

- TIMEBASE RANGES: 21 calibrated ranges, 1-2-5 sequence, plus Autorange, TVV and TVH. Vernier variable between steps.
- SWEEP RATES: 100 milliseconds/division to 20 nanosecond/div. Autorange automatically selects range to show 2 to 5 cycles. ACCURACY +3%
- VIDEO PRESETS: Automatically displays 2 horizontal lines
- (TVH) or 2 vertical fields (TVV). 10X EXPAND: Expands sweep 10 times. Accuracy: ±5%.

#### **Trigger Circuits:**

- TRIGGER SOURCE: CH A, CH B, AC power line, or EXT. TRIGGER MODES: NORM: provides trace only when
- triggered. AUTO: provides trace at all times. TV: same as AUTO with sync separators to trigger on
- vertical or horizontal sync. LEVEL SENSITIVITY: Maximum of 0.5 CRT divisions 10 Hz to
- 50 MHz AC coupled; maximum 1 CRT division 50 MHz to 100 MHz AC coupled. TRIGGER BANDWIDTH: DC to 120 MHz.

#### Auto-Tracking<sup>™</sup> Digital Tests

#### **DC Volts:**

DCV FUNCTION: Provides direct reading of DC voltage RANGES and RESOLUTION: Four ranges automatically select

ed; 0.001 to 1999. Direct reading. ACCURACY: ±0.5% ±2 digits using supplied 39G292 10X probes. INPUT IMPEDANCE: 15 megohms through supplied 10X probes. MAXIMUM INPUT PROTECTION: 2500 volts (DC + Peak AC).

#### **Peak-to-Peak Volts:**

- VPP FUNCTION: Provides direct reading of peak-to-peak voltage
- on selected channel with either X10 or direct probes. RANGES and RESOLUTION: 4 ranges determined by Ch. A or B input attenuator setting (unaffected by vertical vernier); 0.00

#### Measure The Instantaneous DC Level

Digital circuits, and microprocessors in particular, operate with logic high and logic low signal levels. These logic levels must be distinct or the microprocessor will confuse one for another. In your troubleshooting, you must confirm proper high and low levels.

Now you can quickly and automatically check the instantaneous DC level at any point on the waveform to confirm the correct logic level. Simply press either the Channel A or Channel B Delta DC button. Then position the exclusive Delta DC Marker at the desired level on the waveform and read the digital display. It doesn't matter if you have selected "AC" or "DC" Input Coupling or if you have the vertical vernier control calibrated. You get a fast, accurate reading.

#### All Functions Microprocessor **Integrated For Ease Of Use**

The SC3100's ease-of-use is unmatched by any other instrument. All measurements are based on digital circuits, not the analog CRT. This means 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.

#### - Abbreviated Specifications -

to 2000 volts with supplied 39G292 10X Probe. ACCURACY: ±2% ±4 counts including probes at 1 kHz. FREQUENCY RESPONSE: ±0.5dB from 20 Hz to 30 MHz, 1dB

- from 30MHz to 50MHz, -3dB at 100 MHz.

#### AC Volts:

Logic Low

- ACV FUNCTION: Calculates RMS sinewave value from PPV measurement. (.707 x peak) Direct readout of selected A or B channel with either X10 or direct probes.
- RANGES and RESOLUTION: 4 ranges determined by Ch. A or B input attenuator; resolution automatically selected.
- ACCURACY & FREQUENCY RESPONSE: Same as PPV.

#### dBm:

- FUNCTION: Calculates dBm from PPV sinewave measurement, (0 dBm =.7746 volts RMS). Direct readout of selected A or B channel with either X10 or direct probes.
- RANGES and RESOLUTION: 4 ranges determined by Ch. A or B input attenuator; resolution automatically selected. ACCURACY & FREQUENCY RESPONSE: Same as PPV.

#### Frequency

FUNCTION: Automatic frequency readout of selected channel. RANGES & RESOLUTION: 7 ranges automatically selected; 10.00 Hz to 150 MHz.

ACCURACY: .001% ±1 digit temperature; Aging: .001% per year. SENSITIVITY: same as trigger circuits, except 1.5 division maximum in.02 volts/div. range. READ RATE: <.5 seconds .

#### **Delta Digital Tests**

- All Tests: FUNCTION: Provides measurement of the intensified portion of the displayed waveform. DELTA MEASUREMENT BAR (all tests except Delta DC): Delta
- Begin and Delta End controls set intensified area. SETABILITY: 5 nanoseconds typical.

#### **Delta Peak-to-Peak:**

FUNCTION: Measures amplitude of intensified area. RANGE AND SPECIFICATIONS: Same as VPP function.

#### Delta Time:

FUNCTION: Measures time of intensified waveform portion. ACCURACY: Same as frequency counter function. RANGE: 5 nanoseconds to 1 second.

#### **Delta Frequency:**

FUNCTION: Converts Delta Time to equivalent frequency. ACCURACY: Same as Delta Time function. RANGE: 1 Hz to 200 MHz.

Delta DC Volts FUNCTION: Measures DC voltage level of marked waveform point in respect to ground using the PPV and DCV functions. MARKER: Fully adjustable over entire range of waveform. RANGES and RESOLUTION: Same as VPP.

8



Fig. 12: Press Delta DC, set the Delta DC marker, and read logic levels automatically.

If you'd like to learn more about the SC3100 "AUTO TRACKER"™ Automatic 100 MHz Waveform & Circuit Analyzer, or prove to yourself how much easier your troubleshooting can be, call you Area Phone Sales Representative today at 1-800-SENCORE But hurry! Special introductory pricing, new easy investment terms, and the "AUTO TRACKER's" exclusive features guarantee backorder well into 1993.

For More Information, Circle Fast Fact #401.

ACCURACY: Better than 2.5% ±5 digits at 1 kHz. FREQUENCY RESPONSE: ±.5dB 20 Hz to 10 MHz.

#### **Circuit Parameter Tests:**

- FUNCTION: Provides in- or out-of-circuit ohms and
- continuity test using OHMS/DC AMPS INPUT. RANGES and RESOLUTION: 5 ranges, automatically selected;
- 0.00  $\Omega$  to 100 M $\Omega$ . ACCURACY: 0.2% ±2 digits except 0.5% ±3 digits > 2 M $\Omega$ .
- MAXIMUM TEST CURRENT: 1 mA. MAXIMUM TEST VOLTAGE: 200 mV in the 3 lowest ranges; 2 volts in top two ranges . INPUT PROTECTION: Fuse protected; 1500 volts (DC + Peak
- AC) between input jack and from either jack to chassis

**Continuity Test** FUNCTION: Provides audible tone of continuity. RANGE: 0 to 210  $\Omega.$  Audible tone turns on if resistance is <10  $\Omega$ and turns off if resistance is >15  $\Omega$ ,  $\pm 2\Omega$ .

#### **DC** Current

- FUNCTION: Provides measurement of DC current using OHMS/DC AMPS INPUT.
- RANGES and RESOLUTION: 5 ranges, automatically selected: .001 mA to 1.99 amp.
- ACCURACY: 0.3% ±2 digits. VOLTAGE BURDEN: <1.5 volts at 2 amps; <750 mV typical for currents below 1 amp. OVER VOLTAGE PROTECTION: 1500 volts (DC + Peak AC)
- between input jack and from either jack to chassis with internal high voltage fuse.
- OVER CURRENT PROTECTION: 2 A, 250 volt externally accessible fuse and 3 A, 600 volt internal fuse.

#### **Digital Display:**

TYPE: 6-digit high contrast liquid crystal with back lighting. ANUNCIATORS: Automatically placement for each function, with channel indicator.

#### CRT Display:

- SIZE: 96.4 x 120 mm. TYPE: High brightness phosphor GH (P31 blue-green).
- ACCELERATING VOLTAGE: 14 kV. GRATICULES: 8 x 10 grid on CRT faceplate with 0, 10, 90, and 100% markings. BEAMFINDER: Disables trigger and intensity controls, and
- reduces vertical and horizontal gain to locate beam. WARM UP TIME: Operational upon turn on. Fully meets specifications after 20 minute
- OPERATING TEMPERATURE: -10° to 45° C (14° to 113° F). CASE: Vinyl-clad aluminum. Full EMI shielding. SIZE: 7.25" x 13.75" x 15" HWD (18.4 x 34.9 x 38.1 cm. WEIGHT: 25 lbs (9.33 kg.) POWER: 105-125 VAC 50/60 Hz. Factory convertible to 210-250

- VAC 50/60 Hz operation. POWER CONSUMPTION: 80 watts maximum.
- Specifications subject to change.



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

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

#### **Horizontal Stage Made Easy!**

Dear Editor,

I have recently purchased the new "Tech Choice" equipment. I was amazed how fast the TVA92 helped me diagnose a horizontal problem. The television I was repairing had no horizontal output. Here's the procedure I followed. I first checked the horiz. drive collector for B+, and it was okay. I then switched to the AC PPV meter of the TVA92, but I had no AC on the horiz. driver collector. I replaced the H.O.T., and the set powered right up, for about 30 seconds and shut off. I went back and checked the AC PPV again and it was okay on the collector of the driver, but I had zero at the base of the H.O.T.. I decided to inject a horiz. drive signal to the H.O.T. the set powered up. Then I moved the injection signal to the output of the horiz. drive transformer, no voltage. I did some careful inspection and found that the PC board had a hairline crack in it. I repaired the crack and the set worked great. The amazing part of all this is that it took 9 minutes to repair the set. I'm convinced that no shop can afford to be without these units.

Dwight Abbott Salida, CO

Editor's Note: Thank you for your input on the new "Tech Choice" instruments. We hope to hear more stories like this in the future. The only thing that I'm wondering about is what will you do with all your extra time after you've repaired everything!

#### Other Uses ...

Dear Editor,

This is just a quick servicing tip that I have found to be very helpful in my VCR servicing. Quite often customers bring their VCR into the shop with a VCR tape stuck in the machine, and of course the machine will not power up to get the tape out. Rather than removing the entire tape basket, I've found that by using the DC power supply from my VA62A, I can drive the loading motor and get the VCR to eject the tape. This saves me a lot of time in my VCR servicing. Hopefully this tip will help someone else.

Larry Golden N. Hollywood, CA

Editor's Note: Thanks for the servicing tip. Maybe this will spur more quick servicing tips and other uses for Sencore instruments.

#### A BIG HELP!

Dear Editor,

I am writing this letter to commend your company policy in furnishing repair technicians with valuable troubleshooting hints, such as the Tech Tips, etc. I find this information extremely helpful in my education as a repair technician. It also is one of the reasons I continue to purchase my test equipment from Sencore. Of course, the quality of the instruments is the most important.

I am not going to get too lengthy on this, but I came into this business rather late in life after retiring from another career. I had to learn about electronics and electronic repair entirely on my own. I did not have an experienced technician available to answer questions for me when I was stumped on something. Right in the beginning, I found that one of the most important things a repair technician had to learn was how to properly use the test equipment. I live in a state where there is a major test equipment manufacturer, and started my electronics career out with a purchase from them. Other than the operations manual, I had no information on how to use the equipment to its fullest capabilities. I contacted the company and they wanted to charge to instruct me on how to use their equipment.

I don't have to say it, but this left a bad taste in my mouth.

I have learned a lot from your Tech Tips and from the kind technicians and sales engineers on your staff. Keep up the good work.

Frank Farey Bend, OR

Editor's Note: Frank, thanks so much for the kind letter. We're glad to know people appreciate the hard work.

#### Servicing Made Easier.

Dear Editor,

A month before I started using the CM2000 Computer Monitor Analyzer you may not have convinced me it would be worth the money. But, I thought I would give your offer a try and I began doing monitor repair. The CM2000 has saved a lot of time in the set-up for different monitors. By being able to switch from one pattern to another, I'm able to localize input switching problems a lot faster than ever before. Sencore, you really did it this time!

John Fryer Merrian, KS

Editor's Note: John, one thing that we would like to know, is how much more money is servicing computer monitors adding to the bottom line of your service business? Please write us again so we can do a full story on your success.

## WE INVITE YOUR LETTERS

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

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

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



## Introducing The All New VG91 Universal Video Generator

By: Glen Kropuenske, Application Engineer



Wideo is experiencing revolutionary changes. From technical improvements in circuit design, display sizes, delivery systems to growing applications in business, education, and entertainment. These changes mean new opportunity and growing demands on those who maintain and service today's high-tech NTSC video systems.

Presently, servicing today's video systems can require multiple test instruments. Low cost video generators provide several TV channels, basic video patterns, and one audio tone at best. But they fall short of what's needed to isolate most video problems. You can add an RF channel converter, MTS generator, audio generator, and high performance video pattern generator, but still be short of what you need.

Technicians suggest an all-purpose video generator with all the accurate test signals combined into one easy-to-use instrument. This is what the new "Tech Choice" VG91 Universal Video Generator gives you. The VG91 is the only Universal Video Generator with all the channels, IF analyzing signals, video patterns, and mono/MTS/SAP audio signals needed to performance test and isolate defects in any NTSC video systems.

#### Fully Performance Test Video Systems

Today's video systems can be divided into three basic sections: 1) Tuner/IF, 2) Video, and 3) Audio. A video product may contain variations of one, two, or all three of these basic sections. The VG91 provides accurate reference test signals and adjustable levels to fully test video systems. You can observe the operation of the video system by viewing the CRT, or by using an external video monitor or "Waveform Analyzer" to monitor the video output.

The VG91's tests fall into two general categories: 1) Testing tuner/IF circuits, and 2) Testing video and audio processing circuits. If you are testing tuner/IF circuits, apply the VG91's RF signals to the tuner input. To test audio and video processing circuits, apply the VG91's standard output signals to the corresponding Y/C, video, or audio input jacks.

#### Fully Analyze Any Video Tuning System

Cable ready tuners require extensive testing to ensure correct operation. Cable TV systems shift channel frequencies as much as 2 MHz from standard broadcast or conventional cable frequencies. Therefore, cable ready tuners must perform a tuning search to locate these shifted carriers. This digitally controlled search occurs when a channel is selected. A cable ready tuner may have problems tuning to either off-air or cable channels, have trouble tuning to shifted cable channels, or have trouble tuning to specific channels.

Imagine how much easier it would be to diagnose and troubleshoot TV tuning systems if you had access to every TV channel. Imagine having these channels with analyzing video test patterns and mono/stereo SAP audio test signals. This is really what the VG91's RF Generator is all about. The VG91 has 4 RF functions: STD TV, STD CABLE, HRC CABLE, and ICC CABLE.

Use the "STD TV" position of the VG91's RF-IF SIGNAL switch to test single channel or non-cable ready tuning systems. Use the "STD CABLE," "HRC CABLE," or "ICC CABLE" positions to duplicate the cable system that the tuner must receive or to test the tuning search function of the digital tuner.

To test a TV tuner, 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  $1000 \ \mu$ V. Select the tuner channel to match the VG91 and observe the video ouput to confirm proper reception. The tuner should produce a good picture and audio output. Switch through various channels and tuning bands for a thorough test.

#### Test Tuner/IF Sensitivity And AGC

Defective RF or IF amplifiers, or AGC circuit problems can cause snowy reception or overload problems. In some cases, the receiver may work fine with a strong cable signal  $(5,000 \ \mu\text{V})$  but be snowy with a weaker but adequate cable signal  $(1,000 \ \mu\text{V})$ .

An important part of testing video tuner/IF stages is to vary the signal level to duplicate fringe or overdriving signals. This lets you analyze the tuner/IF circuits for proper gain or overall receiver sensitivity. It further lets you check for proper AGC circuit action needed during strong signal reception to prevent overdriving tuner or IF circuits.

To test tuner/IF sensitivity, set the VG91 and tuner to corresponding channels. If properly tuned, the tuner/IF stages should produce a snow free picture at 1,000  $\mu$ V. Starting at 1000  $\mu$ V, decrease the RF output to 500  $\mu$ V and observe the monitor or display. Most TV tuner/IFs begin to show slight snow between these levels but should maintain good sync and color. Snowy reception at 1000  $\mu$ V or above indicates insufficient RF or IF gain.

The VG91's RF-IF attenuator equips you to output and vary RF-TV signal levels to test television channel receivers, cable distribution systems and equipment, or other TV video applications requiring a variable TV-RF channel signal source.

#### Test and Align AFT Circuits

Tuner/IF stages include an automatic fine tuning circuit (AFT). AFT circuits monitor the 45.75 MHz IF carrier frequency. When the tuner's oscillator is at the correct frequency, the 45.75 MHz video-IF carrier is centered within the IF passband. If the oscillator drifts in either direction, so does the video-IF carrier. The AFT circuit detects the frequency change and outputs a voltage to the oscillator or digital control circuits to move the oscillator back on frequency.

The AFT circuits found in video receivers can be tested using a common test. All receivers compensate the tuner's oscillator to cover a carrier shift of up to approximately 500 kHz. The AFT circuits can be tested by shifting the incoming TV signal and observing if the AFT circuits restore proper video.

#### To test the AFT circuits, set the

VG91 and tuning system to properly receive a TV channel. Using the EIA Color Bar pattern, observe the video output as you push and hold one of the AFT TEST buttons. Pushing either of the AFT TEST buttons causes the RF carrier of the VG91 to shift 0.5 MHz above or below the selected carrier. The video should momentarily degrade when you first push in the button but recover as the AFT action restores proper tuning. Release and repeat the test using the second AFT TEST button.

To test or align the AFT circuits, use the VG91's 45.75 MHz Video IF signal along with the AFT TEST buttons. The AFT TEST buttons permit you to shift the 45.75 MHz carrier + or -500 kHz as you substitute into the receiver's video IF stage. Monitor the AFT voltage with a DVM as you push the AFT TEST buttons. The AFT voltage should shift near equal amounts but in opposite polarity to the carrier shifts.

# Isolate IF Problems To The Defective Stage

IF stages amplify the video-IF from the tuner and reject adjacent signals. Improper gain or response causes snowy video pictures, loss of picture detail, interference from adjacent cable channels, or poor sound. IF problems produce symptoms similar to those of tuner problems misleading many servicers.

The VG91 provides modulated IF signals to troubleshoot or align video-IF or audio-IF stages. The VG91's IF Generator has three main sections: 1) 45.75 MHz video IF, 2) Video IF Trap setting signals, and 3) 4.5 MHz sound IF generator. The IF signals are fully adjustable and modulated with video and/or audio.

To isolate tuner or IF problems, use the VG91's 45.75 MHz Video IF signal to



Fig. 2: The 45.75 MHz Video-IF signal may be used to sub for the tuner, inject into the IF stages to isolate defects, or to align video IF stages.

substitute into the first IF stage. Adjust the IF output of the VG91 to match the level of the IF stage, and monitor the results by viewing the CRT or VIDEO OUTPUT jack with a scope. If the video output is good with the proper frequency response, the IF stages beyond the point of injection are good. If bad, continue to substitute the 45.75 MHz Video IF signal into latter IF stages to isolate the defect.

The VG91's IF trap signals insure proper rejection to adjacent channel signals to eliminate interference on receivers hooked to cable systems. Use the VG91's IF trap signals to recreate the interfering carrier when testing or aligning the IF traps. Observe the CRT and/or oscilloscope display as you adjust the appropriate trap coil for the least interference or noise.

To troubleshoot audio problems, use the VG91's 4.5 MHz FM signal to inject into the audio IF stages. Adjust the output level of the VG91 to match the level of the IF stage. If proper audio is heard from the speaker, the IF stages beyond the point of injection are good. Continue to substitute the 45.75 MHz Video IF signal to isolate the defective stage.

#### Analyze The Performance Of Video Stages

The VG91 provides industry standard and exclusive video test patterns. Each pattern provides specific information concerning the performance and alignment of the video circuits. The VG91 offers video patterns to specifically test the luminance stages, while others test chroma stages, synchronous detectors, comb filters, or deflection circuits. In many cases, you can pinpoint a defect just by viewing the video pattern. Here are the video patterns you get with the VG91: **RASTER** – The Raster pattern provides a blank color raster of any primary or secondary color. The color is selected with the RASTER COLOR



switches. The RASTER COLOR switches also add or delete colors to the Raster, Dot, Dots, Window Circle, Crosshatch and EIA Color pattern. Use the Raster pattern to evaluate the operation of each color gun, and to test and align color purity. For each color selected, the CRT should display a uniform color display.

#### $\mathbf{DOT}$ – The Dot pattern

provides a single dot centered within the raster. It is used to set the static convergence of a color receiver or monitor to produce a white dot without color



white dot without color shading in the center of the display.

**DOTS** – The Dots pattern provides the standard dynamic convergence pattern recommended by most manufacturers. It is used to set the dynamic

used to set the dynamic convergence of a color receiver or monitor to produce white dots without color shading throughout the display.

WINDOW CIRCLE – The Window Circle pattern consists of several patterns combined into one useful pattern; a cross, a box, and a circle all centered within



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the raster. This pattern is used for evaluating or adjusting centering, width, height, linearity, pincushion, and other deflection circuits.



**CROSSHATCH** – The Crosshatch pattern produces 21 vertical and 15 horizontal lines that form squares on the screen. This pattern is used for the entire convergence procedure on one gun CRTs or in-line gun CRTs.

10 BAR STAIRCASE – The 10 Bar Staircase pattern consists of 10 evenly-spaced bars, with video levels ranging from black to 100% white. Use it to test the video circuits for proper dynamic range and for alignment of the synchronous video detector and color tracking controls. When properly aligned, each bar should show a distinct change in brightness level with no hint of color.

**COLOR BARS** – The Color Bars pattern is similar to the industry accepted 10 Bar Gated Rainbow pattern used by video servicers for years and still referenced on schematics. Each color bar represents a phase shift of approximately 30 degrees, resulting in 10 visible bars of different color hues.

There are three improvements to the VG91's Color Bars pattern to insure proper performance with today's color circuits: 1) a true color burst, 2) color information phase-locked to the horizontal sync, and 3) the color information at a 100% saturated level.

EIA COLOR (Full Field) - The EIA Color Bars pattern meets the industry-standard color pattern specified by manufacturers for video equipment testing. It consists of two distinct amplitude portions - luminance (brightness) and color level (saturation). The luminance portion of the signal forms an uneven. seven-level stairstep. The color saturation is 75%, which brings the top of the yellow and cyan bars to the 100% white level. The EIA COLOR pattern can be used with a conventional vectorscope and waveform monitor to analyze the relative amplitudes and phase of the color signals. The EIA SPLIT FIELD ADDER switch adds a -I, white, Q and black reference test signals to the bottom quarter of the EIA COLOR pattern.

**MULTIBURST BAR SWEEP** – The Multiburst Bar Sweep pattern consists of ten reference frequency bars beginning with a solid white "0 MHz" reference bar, and increasing in .5 MHz steps to 4.5 MHz. This pattern isolates frequency response problems in video IFs, comb filters, and luminance processing circuits. A stage that is restricting video signals will reduce the amplitude or distort the shape of one or more frequency bars.

**CHROMA BAR SWEEP** – The Chroma Bar Sweep pattern consists of three frequency bars at 3.0 MHz, 3.5 MHz, and 4.0 MHz. This pattern is used to isolate chroma response problems in IF, comb filters, and chroma processing circuits. Video stages which may be restricting the 1 MHz band of color signals required for good color reproduction will reduce the amplitude of one or more of the frequency bars.

LUMA/CHROMA BAR SWEEP - The Luma/Chroma Bar Sweep pattern combines luminance and chroma test frequencies. The pattern consists of six luminance frequency bars (0 MHz reference white, 2.0 MHz, 3.28 MHz, 3.88 MHz, 4.2 MHz, and 4.5 MHz), and four chroma frequency bars (2.28 MHz, 3.08 MHz, 3.58 MHz, and 4.08 MHz). This pattern simplifies testing and alignment of comb filters and may be used to analyze today's wideband I color decoding circuits and Y/C (S-Video) inputs. Proper comb filter separation should produce luminance without color interference. When testing wideband color circuits or Y/C inputs, use the 2.28 MHz bar to test the color response.

#### Test Audio/MTS Stereo/SAP

Many Video systems receive and process the audio portion of the TV signal. The audio circuits may detect and amplify only the monaural portion or include an MTS decoder to recover the MTS stereo and SAP audio signals. MTS decoder circuits, once a luxury item, are now standard.



The VG91 integrates an MTS Stereo/SAP generator with an all-channel RF and IF generator. This lets you isolate individual channel problems or audio defects to IF stages.

#### Take The Portable VG91 Wherever You Analyze Video

The VG91 was designed for your on-site video service needs. The VG91 has a rugged case complete with carrying handles. An optional PC259 Front Panel Protection Cover snaps over the front panel to protect the knobs and switches. The cover includes a convenient lead storage pouch. By accurately testing and isolating video equipment problems right at the job site, you avoid costly mistakes and transporting expenses.

#### Expand The VG91 With Companion Analyzers Or Accessories

The VG91 is designed to resist obsolescence. Its signals are common to current FCC and NTSC specifications. The FCC has mandated that any future video format be compatible with these existing standards. Therefore, the VG91's signals can be used on video products for years to come.

The VG91 provides you with flexibility to meet new video servicing challenges. A rear Synchronizing Signal Output jack and 1 VPP Video Output provide DC voltages, video, audio, and sync signals. These signals are available to design companion analyzers or accessories to the VG91 as future servicing needs arise. Presently the VG91 has two companion analyzers: The Sencore VC93 All Format VCR Analyzer and the TVA92 TV Video Analyzer.

The VG91 is the only all-channel, all-pattern, all-purpose, universal video generator which lets you accurately performance test, align, or isolate defects in any NTSC video system. For complete information on the VG91 Universal Video Generator or the "Tech Choice Systems," call your Sencore Area Sales Engineer at **1-800-SENCORE (736-2673).** 

For More Information, Circle Fast Fact Card # 402.

Fig. 6: Exclusive "BAR SWEEP" analyzing video patterns test the performance of video and chroma circuits.

# The VG91 Universal Video Generator



# A Complete All Channel RF/IF/MTS Universal Video Generator Designed To Performance Test And Isolate Defects In Any NTSC Video System!

- All Channel TV-RF Generator For Complete Tuner Analyzing that simulates any "off-air" or cable channel to completely analyze all tuners. Fully modulated with video and MTS audio signals with a wide range attenuator for simulating weak or strong signal levels.
- Variable Level 45.75 MHz Video-IF Troubleshooting And Alignment Generator that isolates problems to the tuner or IF stage, permits easy AFT alignment, and allows for IF trap setting using patented IF signals.
- Exclusive and Dynamic NTSC Video Test Signals for complete analyzing of IF, luminance, and chroma circuits.
- **Proof-Positive Test For MTS Stereo/SAP On All-Channels.** Four stereo modes and audio test tones ensure complete performance tests and alignments.

- Standard Y/C, Composite Video, And Audio Line Output for quick and reliable testing of all standard NTSC video equipment.
- Spare Video Output And Exclusive Interconnect Design That Permits Future Updates Or Expansion. Add the TVA92 to increase your TV analyzing capabilities and the VC93 All-Format VCR Analyzer for exclusive VCR playback and record troubleshooting.
- Portable And Easy-To-Use. Use the VG91 in the shop or in the field — take it with you wherever you analyze video.

Call today for a complete detailed explanation of each of these benefits of the VG91. We will send you a free instrument support package.





# 1 Day Tech Schools



## Hands-On Switch Mode Power Supply Troubleshooting

| November |                        |   |
|----------|------------------------|---|
| State    | City                   | Date  |
| Illinois | Springfield<br>Chicago | Nov. 3, 4, or 5<br>Nov. 17, 18,19,<br>or 20 |
| Missouri | St. Louis              | Nov. 10, 11, 12,<br>or 13                   |
| Indiana  | Elkhart                | Nov. 30                                     |

| December |         |             |
|----------|---------|-------------|
| State    | City    | Date        |
| Michigan | Lansing | Dec. 2 or 3 |

#### January

Call 1-800-SENCORE for January Tech School information and dates.

#### What You Will Learn:

- The different types of SMPS, where they are used, why they are used, how they fail, and how to troubleshoot them.
- How to use the "4-MICs" to quickly isolate a SMPS problem to the right area.
- A 6 step SMPS troubleshooting technique that cuts SMPS troubleshooting time in half.
- How to test switch mode supply components.

Your workstation will be equipped with Sencore's SC3100 "AUTO TRACKER", LC102 Auto-Z, PR57 "POWERITE", and special Switch Mode Power Supply Trainer.

Circle Fast Fact Card # 303 for more information on Hands-On Power Supply Troubleshooting.

#### What:

A one day workshop on Switch Mode Power Supplies or VCR "Tough Dog" troubleshooting. Check your city and state for the Tech School in your area.

#### When:

Each one day Tech School runs from 9:00 am - 4:00 pm.

Who: Sponsored by Sencore.

# What It Costs:

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

# How To Register:

Call 1-800-SENCORE.

Registration is based on first come, first serve. If possible, use the 6 digit number above your name on the mailing label to speed your registration.

# What You Need To Bring:

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

#### What You Will Get:

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

(All Tech Schools are smoke free.)

For More Details, Call 1-800-SENORE (736-2673)



# Hands-On VCR "Tough Dog" Troubleshooting Techniques

| State      | City         | Date                      |
|------------|--------------|---------------------------|
| Texas      | San Antonio  | Nov. 3, 4, or 5           |
| Arizona    | Scottsdale   | Nov. 10, 11, 12,<br>or 13 |
| Indiana    | Indianapolis | Nov. 16 or 17             |
| California | Diamond Bar  | Nov. 17, 18,19,<br>or 20  |

| December                           |                                     |  |
|------------------------------------|-------------------------------------|--|
| State                              | City                                | Date   |
| Washington                         | Spokane                             | Dec. 1, 2, or 3  |
| Idaho                              | Boise                               | Dec. 7   |
|                                    | Pocatello                           | Dec. 9   |
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#### January

Call 1-800-SENCORE for January Tech School information and dates.

#### "Tough Dog" Troubleshooting Techniques Will Show You:

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

Your work station will be equipped with Sencore's VC93 All Format VCR Analyzer, SC3100 "AUTO TRACKER", PR57 "POWERITE", and a specially modified VCR trainer.

Circle Fast Fact Card # 304 for more information on Hands-On VCR "Tough Dog" Troubleshooting Techniques.

# **Only One VCR Analyzing Instrument Costs Under \$2,995** And Can Easily Generate Over \$6,500 In Extra VCR Servicing Income Each Year From Only One Knob!

All The Signals You Need To Isolate All Playback Or Record Problems In All VCRs ... Now And In The Future!

#### It's an:

- All format VCR analyzer
  Dynamic VCR head signal substituter for all formats
  Exclusive Hi-Fi stereo all-format head signal substituter
- Innovative VCR luminance, chroma, and audio analyzer
  Automatic servo analyzer

- Stand-alone or companion to the "Tech Choice System"
  Complete all-format troubleshooting tool, including:
  - servo bias supply
  - standard video and audio line outputs
     autoranging DCV and PPV meter
- output signal monitor
  Obsolete-proof and expandable

#### VC93 All Format VCR Analyzer - Patented

SENCORE VC93 ALL FORMAT VCR ANALYZER CREORMAT PLAYBACK SIGNAL 111.04 ERVO ANALYZER OUTPUT SIGNAL LEVEL / DVN BETA BETA LUMA . STERE SUPER CASH . UNAT 2.48 000 ITER SERVO ANALYZER OUTPUT SIGNA PLAYBACK BANGE HEAD SUB CAPSTAN . OUTPUT VIDEO GUARANTEE OF PERFORMANCE! Normal (Not Exceeding) Your Machine 1.5% Guarantee the operation of every VCR you service or clean with Servos Locker ±0.5% the patented VC93's servo analyzing tests. Two simple connections Speed Erro 0.5% and you'll:

- 1. Verify the VCR servos are operating correctly.
- 2. Ensure the video and audio signals are good.
- 3. Lock-in repeat business the next time the VCR fails or needs cleaning.
- 4. Add an additional \$2-\$5 in extra income per VCR.
- 5. Rest easy by knowing the VCR will work when your customer gets it home.

For more details on the VC93's servo tests and complete line of analyzing features, or to receive a free sample of the "Guarantee of Performance" stickers, contact your Sencore Sales Engineer or circle Fast Fact Card #305.

=0.1%

Speed Error Jitter

0.1%

FORM #4979

Call 1-800-SENCORE, Today! (736-2673)



# ST66 TV Analyzer

Stereo

- It's a complete, portable MTS Stereo analyzer with all the signals needed for MTS Stereo troubleshooting.
- Completely analyze all MTS Stereo TVs and VCRs from the antenna to the speakers, with one simple connection.
- Exclusive video patterns for total analysis.

**Exclusive Phase-Locked Analyzer:** Test any Stereo TV with dynamic drive signals that are phase-locked to the RF and IF signals. Now you can test all stereo circuits.

Analyze The Entire Stereo TV System: You'll find challenging MTS Stereo and Secondary Audio Program (SAP) problems right down to the defective stage.

Video And Audio Tests In One Package: Correct convergence and interference problems with the portable ST66.

Solutions To Tough Challenges: Success is enhanced by the ST66's capability; its handy pullchart guides you through each

ST66

profitable test; the isolated chassis provides safe error-free troubleshooting; and automatic shut-off to conserve battery life.

For More Information, Circle Fast Fact Card #500.

JCORE



STEREO TV ANALYZER

#### **PR57** "POWERITE"<sup>®</sup> Variable Isolation Transformer And Safety Analyzer

- Isolation Transformer
- Variable AC Supply
- Power Line Monitor
- A Amp/Watt Meter
- Safety Leakage Tester

The PR57 "POWERITE" isolates your AC line and varies the output voltage from 0 to 150 volts. Monitors voltage, current, and wattage to prove that the equipment under test isn't drawing too much current at any voltage setting.

**Eliminates Callbacks:** Lower the line voltage to solve tough shut down problems. Raise the line voltage to sweat out intermittents or sensitive parts. Test every set at high and low line voltage to avoid embarrassing call-backs. Identify AC line related problems such as picture width, sync, and intermittents.

Build Profits With Safety Leakage Checks: Safety checks are easy with the PR57's patented test. Simply push a button and touch

all exposed metal parts with the PR57 probe. Any leakage reads on the meter. All manufacturers require this safety test. You get security, safety, and profit when you service AC operated equipment with a POWERITE.

For More Information, Circle Fast Fact Card #501.





Call Your Area Representative At 1-800-SENCORE And Ask About Our "Proof Of Performance," Risk-Free Trial Guarantee.

#### TF46 Portable Super Cricket Transistor/FET Tester

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

- Patented In-Circuit "Go/No-Go" Transistor/FET Test
- Automatically Identifies Transistor Leads
- Tests For All Possible Leakage Paths
- Dynamic Gain Test For Thorough
- Analyzing
- Portable Operation With Auto
- Shut-Off To Save Your Batteries
- Needs Not Set-Up Book Or Instructions

**Ends Transistor Time-Wasting "Substitution":** If you've experienced transistor, diode, and FET "substitution" problems, you're ready for a fast guaranteed tester.

**Patented In-Circuit Test:** The "Cricket" has a patented "go/no-go" in or out of circuit test for all transistors and FETs to quickly identify bad components. It's proven 99% reliable in circuit and 99.9% reliable out of circuit.

Leakage Test: Find those transistors that show good gain, but are still leaky.

**Gain Test:** Helpful in troubleshooting as well as matching transistors and FETs.



For More Information, Circle Fast Fact Card #502.

### FC71 Portable 1 GHz Frequency Counter

- Five Times More Accurate Than FCC Requirements Even On The Toughest Job; .5 Parts Per Million
- Exclusive Microprocessor Time Base For Super Stability From -12 F To 122 F
- Measures All Signals, Even Complex And Noisy Signals, With Exclusive Sensitivity Control
- Super 5 mV Average Sensitivity Over Full Range
- Automatic Crystal Check Tests The Fundamental Frequency Of Any Crystal
- Frequency Ratio Compares Two Frequencies And Displays The Ratio Directly
- Automatic Readings With IEEE 488 Or RS232 Computer Interface

**Microprocessor-Controlled Timebase Eliminates Power Robbing Oven:** This patented counter provides .5 ppm accuracy from 10 Hz to 1 GHz. You get superior accuracy on the high end while allowing .01 Hz resolution for low end audio work. The FC71 gives nine hours of continuous battery operation.

**Take It Wherever It's Needed:** Broadcast towers for FCC documentation, repeater shacks for troubleshooting or cockpits for avionics tests.

The Most Sensitive Frequency Counter Available -- Counts Signals Other Counters Miss: The 5 mV input sensitivity lets you count signals in more circuits than with any other counter.

The Highest Stability Available To Count Signals That Drive Other Counters Crazy: It counts signals others can't, like AM or FM signals, digital signals with ringing, or audio signals with noise. You have to try it to believe it.



For More Information, Circle Fast Fact Card #503.

#### LC101 Z Meter<sup>TM</sup> Capacitor-Inductor Analyzer

Exclusive Dynamic Tests Analyze Capacitors For:

- Value
- Dielectric Absorption
- Leakage Equivalent Series Resistance

Dynamically Analyzes True Inductance Value And Effective Q (Quality) With A Patented Ringer Test

Finds Distance To Within Feet Of Open Or Shorted Transmission Lines

Dynamically Analyzes SCRs, Triacs, Hi-Voltage Rectifiers, And Diodes

Checks Leakage As Low As One Microamp With Up To 1000V Applied In Cables, Switches, PC Boards, And Connectors

Analyze Capacitors With Speed And Confidence: The LC101 lets you analyze capacitors at their rated voltage for Value from 1.0 pF to 199,900  $\mu$ F, leakage to 1000V, Dielectric Absorption, and Equivalent Series Resistance (ESR).

Analyze Inductors In Or Out Of Circuit: Read value from 1  $\mu$ H to 10 H Patented Ringer method lets you detect even one shorted turn.

**Find Troublesome Leakage Paths:** Read leakage from one microamp, with voltages to 1000V, to find hidden leakage path.

**Test Sensitive Gate SCRs and Triacs:** Add the optional SCR250 accessory to test for turn-on, leakage, shorts, and opens of high voltage diodes and sensitive/normal gate SCRs and Triacs.



For More Information, Circle Fast Fact Card #504.





# Introducing The New TVA92 TV Video Analyzer!

By: Glen Kropuenske, Application Engineer

Reaping profits in TV servicing is tough business. Technology advancements cause servicing problems, and there is no margin for error when quoting repair estimates or ordering suspected bad parts. Yet, the sales of nearly 250 million color televisions over the past 15 years represents a bonanza of TV servicing potential. Nearly every place you go you find an NTSC television receiver.

The Sencore TVA92 TV Video Analyzer is a new product designed to exclusively isolate modern TV defects, test expensive TV components, and improve your TV servicing efforts. The TVA92 is designed to accompany the Sencore VG91 Universal Video Generator for complete TV analyzing. This article shows you how to troubleshoot modern TVs using the exclusive analyzing capabilities of the TVA92.

#### Guide To The TVA92's Horizontal Output Tests

Many difficult-to-troubleshoot TV symptoms directly or indirectly involve the horizontal output stage. Startup, shutdown, dead set, or B+ loading problems may or may not be caused by the horizontal output stage. Yet, these symptoms often do not permit you to make measurements to isolate the problem. The TVA92 provides special analyzing tests to isolate difficult symptoms, analyze the horizontal output/flyback circuits for defects, and test expensive high voltage and switch mode power supply components. These tests include: "Horizontal Output Load Tests," "Ringer Tests," "Dynamic Tests," and the "Horizontal Output Sub & Drive." Table 1 summarizes when to use each of these tests and what it tells you when troubleshooting TV defects.

#### Test For B+ Supply Shorts Or Abnormal Loading With The TV "OFF"

B+ power supply loading problems or severe shorts have always been TV servicing challenges. The TV's B+ power supply feeds the horizontal output stage and powers the flyback secondary circuits of the TV.

A severe short on the B+ supply results in high current through the B+ supply, horizontal output components burning-up parts, and leaves little time for circuit measurements.

| Guide to Horizontal Output Tests  |   |  |
|---|---|--|
| HORIZONTAL OUTPUT TEST  | WHEN TO USE   | WHAT IT TELLS YOU  |
| Horizontal Output Load Test   | <ul> <li>Full AC Volts Cannot Be Applied Because:</li> <li>Draws Hi Current.</li> <li>Burns-Up Components.</li> <li>Safety Shutdown.</li> <li>H.O.T. Gets Hot.</li> </ul> | <ul> <li>Output Stage Functions.</li> <li>Short Or Loading On B<sup>+</sup>.</li> <li>Timing Of Horizontal Output<br/>Stage Normal Or Abnormal.</li> </ul> |
| Ringer Tests  | <ul> <li>Horizontal Output Load Test Readout "BAD."</li> <li>Suspect Bad Flyback, Yoke, Or Transformer.</li> </ul>  | • If Component Is Bad From A Shorted Turn(s).  |
| <b>Dynamic Tests</b><br>(DCV, PULSE PPV, PULSE<br>TIME μS, INPUT DRIVE) | <ul> <li>Horizontal Output Load Test Readout "GOOD."</li> <li>Test Parameters At Horizontal Output.</li> </ul>  | <ul> <li>B<sup>+</sup> Supply Volts.</li> <li>Flyback Pulse PPV &amp; Time.</li> <li>Input Drive Status To H.O.T.</li> </ul>                               |
| Horizontal Output Device Sub<br>& Drive (DEVICE CURRENT)                | • Test Horizontal Output HV Circuits<br>When H.O.T. Is "BAD" And Horizontal<br>Output Load Test Readout "GOOD".   | <ul> <li>If HV Components Good.</li> <li>If H.O.T. Can Be Replaced.</li> <li>Accurate Repair Estimate.</li> </ul>  |
|   |   | H.O.T. = Horizontal Output Transistor<br>HV = High Voltage   |

Many new switch mode power supply designs regulate so well that you cannot reduce the TV's B+ voltage with a variable AC supply. This eliminates any chance for measurements.

The TVA92 provides a TV "OFF" Horizontal Output Load Test to detect high current loading or shorted conditions on the TV's main B+ power supply. The Horizontal Output Load Test works by supplying a low voltage (15 volts) to substitute for the TV's B+ supply, and by simulating the switching action of the chassis horizontal output transistor (H.O.T.). During the test, flyback and yoke currents are produced at approximately 1/10 of the horizontal output circuit's normal levels. Since the horizontal output stage is being energized as it would be by the TV's B+ supply and horizontal output transistor, its operation closely mirrors its full power operation.

During the Horizontal Output Load Test, the horizontal output circuit induces power to the flyback secondary circuits. This draws current from the Horizontal Output Load Test power supply, and reflects the current demand of the horizontal output and flyback secondary circuits powered from the TV's B+ power supply.

To test for B+ power supply loading with the TVA92's Horizontal Output Load Test, three simple connections to the TV chassis need to be made. Connect the Ringer/Load Test lead clips to B+ and the horizontal output transistor's collector and emitter. Switch to the "mA" position of the Horizontal Output Load Test position. The "mA" position of the TVA92's Horizontal Output Load Test switch shows how much B+ current is being drawn from the TVA92's B+ Horizontal Output Load Test supply.

Current levels less than 5 mA indicate an invalid test condition, such as an improper test lead connection or an open in the horizontal output circuit. Readings greater than 80 mA indicate a heavy current load, such as a shorted output transistor, flyback winding, or defective secondary circuit. These high readings represent a B+ current demand of 1 amp or greater if full TV B+ voltage were applied.

... continued on page 21.

Table 1: Guide to the TVA92's Horizontal Output/HV Circuit Tests

# The TVA92 TV Video Analyzer

Sub

VERTICAL YOU

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• Exclusive Horizontal Output Load Test allows you to test and troubleshoot abnormal loading and timing problems that prevent TV "On" troubleshooting. (i.e. shutdown, overloaded SMPS).

DRIVE SIGNAL

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UDIO & VIDEO

- Dynamic Tests Through A Simple 3 Lead Hook-up To The H.O.T. allow you to quickly diagnose B<sup>+</sup> supply, start-up/shutdown, and horizontal output circuits.
- Horizontal Output Transistor Sub & Drive lets you substitute for a defective H.O.T. with a known good drive signal to test high voltage circuits for full voltage operation.
- Universal Substitute TV Signals allow you to isolate defective stages of the television 100% dynamically.
- Pinpoint Shorted Turns In Flybacks, IHVTs, Yokes, And Switching Transformers with the tried and proven patented "Ringer" test.

- An Exclusive Yoke Drive Signal allows you to dynamically test vertical yokes for full linear deflection as you monitor the CRT.
- Simplify Biasing, Alignment, And Troubleshooting with the built-in "current sinking" DC power supply that delivers up to 30 volts for a wide range of voltage requirements.
- Monitor All Sub-Signal Results And Make DCV Or PPV Measurements for accurate and easy analyzing that's unmatched by any TV test instrument.

The TVA92 combined with the VG91 Universal Video Generator makes up part of the new "Tech Choice System" designed to make your television servicing easier and more profitable than ever before. To find out more on how Tech Choice fits into your service center, call us today!





VG91 Universal Video Generator

# "My interest is in the future because I'm going to spend the rest of my life there."

Charles F. Kettering

W elcome to the future! Not long ago it was said "Transistors will be the future of electronics." They are – hundreds or thousands of transistors are in today's integrated circuits. A few years ago you heard people say, "The only way small and medium size service centers will survive is through the use of sophisticated management systems. This will permit them to remain competitive and profitable in a high technology environment." And, with today's falling prices and razor thin margins, you can see they were right!

To be successful in today's electronics service industry, you need to provide your customers with fast and accurate service at a fair price. To accomplish this, all the areas of your business must function like a fine tuned machine for taking units in, ordering parts, tracking repairs, controlling inventory, and determining how your business is performing. This is the only way a modern service center can keep their customers and control operating expenses; while increasing customer satisfaction and profits.

Effective management of a service center in today's business environment calls for automating your work order handling, parts ordering, and inventory control. You also need detailed management reports at your fingertips to help you make sensible, well informed business decisions. What's needed is a sophisticated management tool. That tool is a complete software package that is customized for the electronic service industry. The software program you choose needs to perform the following tasks:

#### WORK ORDER PROCESSING

Whether you're scanning for a serial number, searching inventory for parts, checking the status of a repair for a customer, or printing an invoice, your program needs to handle these tasks – automatically! Automation lets you give quick and accurate responses to customer inquiries. In addition, it helps you manage the product flow through your repair process.

#### PARTS ORDER PROCESSING

Parts Order Processing needs to go hand in hand with Work Order Processing – automatically! When a part is ordered, the program needs to update the work order with the part order number and order date. In addition, this information needs to be displayed on the work order screen in your computer. Automating part orders in conjunction with work orders, lets you know exactly what status of the repair process a unit is in, within seconds.

#### **INVENTORY CONTROL**

Most programs do basic functions like add, edit, and search for parts in inventory. But you also need: various pricing levels, cross referencing, reverse cross referencing, and automatic part level ordering in order to help you truly manage your inventory more efficiently and effectively.

#### MANAGEMENT REPORTS

Technician assignments, work in progress, outstanding part orders, parts usage, part reordering advice, technician productivity, gross profits, sales tax and accounts receivables are reports your program needs to be able to run. Your program will have a warehouse of information about your business stored in it. You need to be able to access this information quickly and easily to help you make wise, well informed business decisions.

Whether you are a small, medium, or large service center, and if you feel you're organized or not, the future is calling for automation! Automating with computer software will help your business become more efficient, effective, and successful in today's as well as tomorrow's business environment. Remember, you will spend the rest of your life in the future. Whether you decide to take your business with you or not . . .



THE CHOICE IS YOURS.



For More Information On The Service Center Management Software Packages And Personal Computers Sencore Has To Offer, Return The Attached Card Or Call 1-800-SENCORE ext. 888.



Fig. 1: TV "OFF" Horizontal Output Load Test setup. Current readings exceeding 80 mA indicate a short or loading condition on the TV's B+ power supply.

The Horizontal Output Load Test mA readout may be used to detect shorts or abnormal current loading on the TV's B+ power supply without applying AC power to the TV. It lets you test and troubleshoot with less hazardous voltages and permits you to test and troubleshoot when TV circuit problems don't permit measurements.

#### Isolate Shutdown Problems With The TV "OFF" Horizontal Output Load Test

The horizontal output stage is in the center of the startup and shutdown operational loops of the TV. A problem in the horizontal output stage may prevent the TV from starting, even when the startup circuits are good. Other abnormal conditions in the horizontal output stage or B+ regulator stages may cause immediate shutdown and voltage measurements cannot be made.

A popular method now used by manufacturers in modern TV receivers to achieve high voltage shutdown is to defeat the switch mode power supply (SMPS). This removes the B+ voltage to the horizontal output stage when excessive high voltage is detected. This shutdown method makes it increasingly difficult to isolate shutdown problems as the DC voltage is not present long enough to measure.

Shutdown problems are sometimes caused by improper retrace timing in the horizontal output stage, defective shutdown detect, or latching circuits. The TVA92's horizontal Output Load Test lets you test the retrace timing of the Horizontal output stage and troubleshoot shutdown circuits – all without applying AC power to the TV.

During the Horizontal Output Load Test, flyback pulses are produced which accurately reflect the resonant timing of the horizontal output stage. The retrace timing of the flyback pulse is identical to the TV's normal full power operation.

The " $\mu$ S" Horizontal Output Load Test switch position automatically measures the duration (pulse width) of the flyback pulses generated during the Horizontal Output Load Test. Flyback pulse duration or retrace time is primarily determined by the flyback, retrace timing capacitors, yoke, and yoke series components. Readings between 11.3 and 15.9  $\mu$ S represent a normal range, and indicate the horizontal output stage is not the cause of shutdown symptoms. Readings of less than 11.3  $\mu$ S indicate a timing problem in the horizontal output stage that may be producing excessive high voltage and causing high voltage shutdown.



Fig. 2: Horizontal Output Load Test readouts of less than 11.3  $\mu$ S indicate abnormally fast retrace timing which produces excessive high voltage and shutdown symptoms.

If the timing readout is in the good range, you may use the TVA92's Horizontal Output Load Test to measure voltages in the HV shutdown detect and latch circuits. These circuits typically rectify flyback pulses from the flyback secondary producing a DC voltage which is compared to a reference. Since the Horizontal Output Load Test energizes the horizontal output stage at 1/10 its normal levels, waveforms and DC voltages in the circuit and flyback secondary circuits should measure approximately 1/10 of the levels indicated by the schematic.

#### Test Flybacks, SMPS Transformers, Or Yokes For Shorted Turns

Severe loading or timing problems indicated by the TVA92's Horizontal Output Load Test may lead you to suspect a bad flyback, yoke, or switching power supply transformer. These components are expensive to replace, and a quick and accurate diagnosis is essential. If you incorrectly estimate the component as bad, the high repair estimate could lose the repair job and any hopes for a profit. If you assume it's good and it's not, you'll waste time looking for other problems. A common failure of flyback, SMPS transformers, or yokes is a short between adjacent windings or turns. This failure is difficult to detect because circuit DC voltages change only slightly and ohmmeter measurements do not detect minor resistance changes.

The Ringer Test of the TVA92 is a TV "OFF" test which provides a fast and reliable means to check deflection yokes, flybacks, and switching transformers for shorted turn(s). The Ringer Test checks the coil's "Q" and locates shorted turns that cannot be detected by other troubleshooting methods.

The "Ringer" places capacitors in parallel with the coil and energizes the cap/coil combination. The TVA92 modifies the "Ringer" to accurately check switching transformers. A reading of "10" or more is "GOOD" and indicates that none of the coils which share the common core of the transformer have a shorted turn. Therefore, you simply need to ring one of the main windings (typically the primary), when testing a flyback or switch mode power supply transformer. A short in any of the windings will reflect back to the primary and cause the rings to drop below 10.



Fig. 3: A Ringer Test readout of less than "10" is "BAD" and indicates that one or more of the coils which share the common core of the transformer have a shorted turn.

The Ringer Test is a proven accurate test for detecting a shorted turn. Troubleshooting horizontal output, sweep, or switch mode power supply problems is simplified when you can accurately test the flyback, yoke, or switching transformer.

#### Diagnose B+, Horizontal Output Stage, Or Drive Problems With Three Lead Hookup To The Horizontal Output Transistor

The horizontal output stage is often considered the heart of a television receiver. It produces high voltages, deflection, keying signals, and scan-derived voltages to power much of the TV circuitry. Measurement in the horizontal output stage can tell you more about the operation of key TV circuits than any other TV test point. You can quickly analyze the operation of the B+ supply, startup, horizontal oscillator, horizontal driver, and horizontal output stages. The TVA92's Dynamic Tests analyze four parameters of an operating horizontal output stage: 1) B+ supply voltage, 2) flyback pulse PPV, 3) flyback pulse time, and 4) presence of input drive signal to the base. The Dynamic Tests are performed with the TV operating at full operating potentials. The Dynamic Tests are especially helpful to isolate symptoms of a blank raster, low or missing high voltage, startup, or shutdown problems. For most symptoms, you'll want to perform the Dynamic Tests in the order they appear around the HORIZ OUTPUT TESTS switch.

To make Dynamic Test measurements with the TVA92, connect the Dynamic Tests Lead to the emitter, base, and collector of the chassis horizontal output transistor. If the horizontal output transistor is removed, connect the TVA92's Dynamic Test Leads to the corresponding circuit points.

The Dynamic Test readouts guide you to suspect circuits or suspect components in the horizontal output stage. Compare the Dynamic Test's DCV and PPV readings to the levels shown on the schematic. Table 2 summarizes the symptoms using the Dynamic Tests of the TVA92, and lists the probable causes for each symptom.

| Dynamic Tests Readouts & Likely Causes |  |  |
|--|--|--|
| Symptom                                | Probable Causes  |  |
| B+ = 0 Volts                           | • Open Fuses<br>• Bad B+ Supply<br>• Shorted B+ Path   |  |
| Low B+ Volts                           | <ul> <li>B+ Power Supply Regulation</li> <li>Low AC Voltage</li> </ul>   |  |
| High B+ Volts                          | <ul> <li>B+ Power Supply Regulation</li> <li>Open Loads On B+ Supply</li> </ul>  |  |
| Pulse PPV = 0 V                        | <ul> <li>No B+</li> <li>No Input Drive</li> <li>Open H.O.T.</li> <li>Open Flyback Primary</li> </ul>   |  |
| Low Pulse PPV                          | <ul> <li>Leaky Retrace Capacitor Or H.O.T.</li> <li>Flyback Loading</li> <li>Reduced Value Of Yoke Capacitor</li> <li>Bad Yoke</li> <li>Low B+</li> <li>Insufficient Input Drive</li> </ul>        |  |
| High Pulse PPV                         | <ul> <li>Retrace Capacitors</li> <li>Flyback Shorted Turn</li> <li>High B+ (Regulator).</li> </ul>   |  |
| Pulse Time = 0 μS                      | • No B+<br>• No Input Drive<br>• Open H.O.T.<br>• Open Flyback Primary   |  |
| Pulse Time < 11.3 μS                   | <ul> <li>Flyback Loading</li> <li>Flyback Shorted Turn</li> <li>Retrace Capacitors</li> </ul>  |  |
| Pulse Time > 15.9 μS                   | <ul> <li>Yoke</li> <li>Yoke Series Capacitor</li> </ul>  |  |
| Multiple Pulse Times                   | <ul> <li>Flyback Loading</li> <li>Flyback Shorted Turn</li> <li>Leaky H.O.T. Damper Diode,<br/>Yoke, Retrace Capacitors, Yoke,<br/>Or Yoke Capacitor</li> <li>Bad Input Drive To H.O.T.</li> </ul> |  |
| Input Drive "ON"                       | • Drive Present To Base Of H.O.T.  |  |
| Input Drive "OFF"                      | • No Drive To Base Of H.O.T.   |  |

H.O.T. = Horizontal Output Transistor

Table 2: Symptoms and probable causes when using the TVA92's Dynamic Tests.



Fig. 4: The TVA92 provides a substitute horizontal output transistor switched by a variable drive.

#### Substitute The Horizontal Output Transistor And Input Drive To Test HV Circuits

In many cases, troubleshooting the horizontal/HV circuits begins with a shorted horizontal output transistor. Problems in the horizontal and high voltage circuits often lead to its failure. A replacement transistor is often destroyed, revealing additional chassis problems. You may discover arcing in the expensive high voltage components or other symptoms the owner may not pay to have you repair. These unexpected discoveries leave you without a way to recover your investment in time and parts.

The TVA92's Horizontal Output Device Sub & Drive Test guards you from the unexpected, and helps isolate those difficult horizontal circuit problems. The TVA92's Horizontal Output Device Sub & Drive provides a substitute horizontal output transistor, and can be used to substitute in any conventional transistor horizontal output circuit.

The TVA92's subbing transistor works just like the transistor in the TV chassis. The transistor switches on and off at a rate of 15.734 kHz – providing a conduction path for flyback and yoke currents. The sub transistor is switched by a drive signal generated inside the TVA92. The TVA92's Horizontal Output Sub & Drive control switches the subbing transistor on and varies the conduction time of the subbing transistor from approximately 10  $\mu$ S to 35  $\mu$ S maximum. This permits you to slowly increase the current level to the flyback and yoke.

To test the TV's horizontal output and high voltage circuits with the TVA92's Horizontal Output Device Sub & Drive, connect the Dynamic Test Leads to the chassis H.O.T. emitter, base, and collector circuit points. The TV's H.O.T. should be removed or the base lead opened. Start with the Horizontal Output Device Sub & Drive control "OFF" and apply power to the chassis. Confirm the B+ power supply is properly regulated to the Horizontal Output Stage using the Dynamic Tests DCV readout.

Slowly increase the TVA92's Horizontal Output Device Sub & Drive control as you monitor the Device Sub Current Readout. Increase the control while monitoring the CRT for proper raster and deflection. There will be a slight delay before a raster appears while the CRT filament heats up. Observe the center of the CRT raster and adjust the control slightly beyond the point were a normal video pattern occurs. If normal video is observed on the CRT, the horizontal output, high voltage, video, color, and deflection circuits are working.

The DEVICE SUB CURRENT position of the HORIZONTAL OUTPUT TESTS switch monitors the average current flowing through the collector of the TVA92's subbing transistor. The normal current readout will vary from 300 mA to near 1.5 amps depending on the CRT size, number of scan-derived circuits, and horizontal output stage efficiency. You may compare the readout to the emitter current of the H.O.T. indicated on some schematics.

The Horizontal Output Device Sub & Drive permits you to substitute for a TV's H.O.T. without soldering in a new one and risking damage to the replacement. It lets you test the horizontal output and high voltage circuits at full operating potential to find high voltage breakdown, arcing, and corona problems. It also lets you test the remaining circuits by viewing the CRT. Since the drive is synced to the video signal, the chassis will produce near normal high voltage, video, color, and deflection. You'll want to use the Horizontal Output Device Sub & Drive before you replace a horizontal output transistor or provide a repair estimate.

The Horizontal Output Device Sub & Drive can also be used to isolate problems with the drive signal to the H.O.T. It breaks the loop at the H.O.T. providing a known good substitute transistor and drive to the horizontal output/HV stages.

#### Apply Drive To The Vertical Yoke And Prove The Vertical Yoke "Good" Or "Bad"

Technicians list vertical problems as some of the most difficult to isolate. Vertical circuits are difficult for several reasons. They are DC coupled, have a broad low frequency response, and have waveshaping feedback. A problem in any of the vertical stages or the yoke causes the waveshape and often the DC voltages in all the stages to be bad. Often the changes are subtle waveshape changes making it difficult for the technician to isolate the problem. The TVA92 provides two tests for testing the vertical deflection yoke; the Vertical Yoke Drive signal and the Ringer Test. In most cases, the Vertical Yoke Drive test provides a simpler and faster test to confirm the condition of the vertical deflection yoke. The Yoke Drive provides the proper drive current needed to produce a near-linear deflection, and allows you to visually confirm the yoke's operation by viewing the CRT.

To test the vertical yoke with the TVA92's Vertical Yoke Drive, you simply disconnect the yoke plug from the chassis and connect the drive test leads. Turn the TV on and increase the VERTICAL YOKE DRIVE LEVEL control while monitoring the CRT.

If the yoke is good, you will see a full and linear deflection on the CRT when viewing the Crosshatch or Window Circle pattern. Since the drive signal is synced to the antenna's video, a locked in video picture will be produced on the CRT. A linear deflection indicates a good vertical deflection yoke. Poor linearity defects indicate the yoke is the problem.

The TVA92's VERTICAL YOKE DRIVE takes the uncertainty out of vertical yoke testing. It tells you positively that the yoke is good or bad at full operating yoke current levels. If it's good, you can concentrate your troubleshooting efforts on the less expensive vertical circuit components, and be assured a profit. If it's bad, you'll prove it positively with this quick easy test, and avoid wasted hours of troubleshooting and testing vertical components.

#### Prove TV Stages Good And Isolate The Bad By Injecting TV Substitution Signals

The TVA92 provides signal substitution signals that can dramatically improve your present troubleshooting efficiency.

The TVA92 uses the troubleshooting technique called "Functional Analyzing". In this technique, you substitute known good signals from the TVA92 into the functional blocks of the TV. The substitute signals can be used with any brand or model. The TVA92's output drive circuits are designed to "swamp out" the signal at the injection point. This permits you to replace the circuit's defective signal with a known good one.



Fig. 6: The TVA92 provides troubleshooting signals that can be used from the video detector to CRT and speakers.

To substitute a signal into the chassis with the TVA92, apply a reference signal to the antenna, IF, or video input with the VG91 Universal Video Generator. Select the drive signal that matches the waveform at that circuit point. Increase the drive output level while monitoring the OUTPUT SIGNAL MONITOR/DVM. Adjust the level and polarity to match the level shown in the service literature.

Since the substitute signals are synced to the antenna's video, you simply watch the CRT to decide if the circuits from the point of injection to the CRT or speaker are good. If the output improves, all the stages from the injection point to the CRT or speaker are good. The TVA92 provides substitution signals to inject into any functional block from the detector to the CRT or speaker.



Fig. 5: The TVA92's VERTICAL YOKE DRIVE shows you if the yoke is good or bad at full operating yoke currents by viewing the CRT.

The TVA92 helps control TV servicing expenses by reducing unneeded parts ordering, installation time, and left over inventory. It equips you to retain business lost from sets thought to require major investments but didn't. It provides you with the tests needed to provide more accurate and timely repair estimates. The TVA92 improves your troubleshooting efficiency – increasing the number of service jobs completed daily to reap higher profits or more free time.

The TVA92 will pay for itself over and over again. If you fix one additional TV a day, (considering 250 work days a year and a conservative billing of \$60 on each TV), that is an additional yearly revenue of \$15,000. If you retain one TV repair each month that previously would have been rejected because the repair estimate was higher than your customer wanted to spend, that is another \$1,000. If you save one hour a week ordering unneeded parts, that is over \$500 a year in expenses. See how easily the TVA92 pays for itself! The question is, can your TV service business afford to be without the TVA92?

For complete information on the TVA92 TV Video Analyzer and the "Tech Choice Systems," call your Sencore Area Sales Engineer at **1-800-SENCORE (736-2673)**.

For More Information, Circle Fast Fact Card #403.



# **Testing VCR Servos With The VC93 All Format VCR Analyzer**

(Reprint of Tech Tip 186.)

his Tech Tip explains the VC93 Servo Analyzer Tests; how they work and how to localize a problem to the defective drum or capstan servo section. If you need additional information on how VCR servos work, ask for a copy of Tech Tip #176, which takes you through servo circuits.

#### Servo Functional Analyzing

The main difficulty in troubleshooting servo problems is determining which servo loop is at fault. Defects in one servo loop can produce symptoms that look like a problem elsewhere. In addition, non-servo related problems can sometimes appear as a servo problem.

#### Servo functional analyzing is a three step process:

- 1. Using the VC93 Servo Analyzer tests to determine if a problem is servo related.
- Using the same VC93 Servo Analyzer 2.tests to localize the problem to the defective drum or capstan servo section.
- 3. Using the SC3100 Automatic Waveform And Circuit Analyzer to check key signals to isolate the defective component or circuit within the bad servo section.

The first two steps of this three step process will be covered in this Tech Tip. The third step of the process is covered in Tech Tips #187 and #188, which pertain to isolating capstan and drum servo problems once they have been localized with the VC93.

#### **Understanding The** Servo Analyzer Tests

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

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

All applicable tests should be done before troubleshooting further. The Servo Analyzer tests prove if the problem is servo related, and localizes the problem to the capstan or drum

servo loop. The test results are displayed with a "Good/Bad" indication and a percent-of-error reading.



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

#### Servo Analyzer Test Leads

The five Servo Analyzer tests are performed using either the Servo Performance Test Lead or the Servo Troubleshooting Test Lead. The Servo Performance Test Lead connects to the VCRs' audio and video output jacks for a fast, easy, overall check of the servos. This test lead must be used with the SENCORE Servo Performance Test Tape. This tape is recorded with a 479.520 Hz audio tone (vertical frequency x 8) and a 10 Bar Staircase video pattern. The audio signal on this tape is locked to the vertical sync pulse of the video. The VC93 monitors the change in frequency and phase of the audio and video signals in the Servo Analyzer tests.



Fig. 2: The Servo Performance Test Lead easily connects to the VCR's video and audio output jacks for a quick check of the servos.

The VCR must produce an audio and video signal in order for the VC93 Servo

Performance Test Lead to work. A signal that has insufficient amplitude (or is missing) will give inconclusive results on the servo tests. If this happens, use the Servo Troubleshooting Test Lead.

The Servo Troubleshooting Test Lead connects to the key servo reference signals (CTL and SW30) to analyze the condition of the servos even if the audio and video signals are missing. SW30 and CTL are universal test points that are often marked in the VCR. You can usually find these signals without a schematic.

All servo tests should be done starting with the Servos Locked Test. The Servos Locked Test is the first test done to check the overall operation of the servos. Turn the Servo Analyzer switch to the next test and complete all servo tests for a complete check.

NOTE: Since 8 MM does not use a CTL pulse or linear audio, the capstan servo tests DO NOT APPLY, immediately go to the drum servo tests.

Servos Locked Test: The Servos Locked Test compares the change in phase of the CTL pulse to the SW30 pulse when using the Servo Troubleshooting Test Lead, or the phase of the audio signal to the video vertical sync pulses - when using the Servo Performance Test Lead and Sencore Servo Performance Test Tape.

VCRs lock the drum and capstan phase circuits to a common REF 30 source. The REF 30 signal is usually internal to the servo IC and can't be viewed or measured. Since the SW30 pulse is derived from the PG pulse and is more universal to VCRs, it is used to check servo locking. If both servos are operating properly, the capstan reference signal (CTL pulse) and drum signal (SW30 pulse) will be locked together. The VC93 compares these reference signals to each other to determine if the servos are locked to one other. If the servos are locked, then they must be locked to the internal reference signal. If either servo is not locked to the internal reference signal, either the capstan or the drum loop is bad.

The results of the Servos Locked Test are displayed as a percentage reading indicating how well the capstan and drum are locked.



Fig. 3: The capstan phase loop and drum phase loop must be locked to REF 30 for proper operation.

A reading greater than 1.5% will give you a "Bad" indication. A "Bad" servos locked reading indicates that either the capstan or the drum servo phase circuit is defective. A "Good" indication means that the servo phase circuits are operating properly.

The remaining Servo Analyzer tests further test the servo circuits and help localize problems to the capstan or drum servo loop.



Fig. 4: The Servo Analyzer tests localize the servo defect to the capstan or drum servo.

NOTE: The capstan tests should be done before the drum tests. If the test results indicate a capstan problem, refer to Tech Tip #187.

**Capstan Speed Error Test:** The Capstan Speed Error test checks how fast the tape is being pulled through the machine. The VC93 analyzes the frequency of the CTL pulse when using the Servo Troubleshooting Test Lead or the playback audio signal when using the Servo Performance Test Lead. This test checks the tape speed, not just the capstan motor speed. Mechanical problems such as tape drag or slippage, as well as capstan circuit problems, will cause this test to show a "Bad" indication.

The Capstan Speed Error reading shows how far off the actual tape speed is from the desired speed. A percentage error of more than +/- 0.5% will give you a "Bad" indication. This indicates a problem in either the capstan phase or speed circuit. If a large percentage (more than 10%) error is displayed, this most likely indicates a speed loop problem. If a small percentage (under 10%) error is displayed, this most likely indicates a phase loop or speed loop problem.

If this test produces a "Bad" indication, or no indication at all, the VCR has a problem in the capstan phase, speed loop, or it may be caused by a mechanical tape path problem. A capstan running at the wrong speed is often the result of a missing CTL or FG pulse, a bad motor or driver, or a bad control circuit.

**Capstan Jitter Test:** The Capstan Jitter Test analyzes for small speed variations. This test analyzes the short term variations in the capstan reference signal to determine how constant the capstan speed is. These short term variations are called jitter.

The Capstan Jitter readings indicate the amount of tape speed variation. All VCRs have some speed variation due to tape stretch, the tightness of the capstan phase loops, and other mechanical variations. A "Bad" indication shows that the capstan speed variations are greater than 0.5%. This will produce unacceptable audio and may also affect video performance. A "Good" indication means that the capstan circuits are working.

If the test produces a "Bad" indication, it means that there is a problem with the capstan electrical servo circuits or there is a mechanical problem. Excessive capstan jitter is often caused by a missing CTL pulse, excessive oxide buildup on the capstan or pinch roller, or a bad capstan servo control circuit.

**Drum Speed Error Test:** The Drum Speed Error test analyzes the frequency of the SW30 pulse when using the Servo Troubleshooting Test Lead, or the playback vertical sync pulses when using the Servo Performance Test Lead and Sencore Servo Performance Test Tape. It compares this signal to an internal 29.97 Hz reference signal. The SW30 signal is universal between VCRs and is derived from the drum PG signal that is used by the drum servo circuits.

The Drum Speed Error reading displays how far the drum speed is off from the desired speed. Incorrect drum speed will cause the horizontal sync pulses in the playback video to occur at the wrong time. If the drum speed is slightly off, the symptom appears as a misadjusted horizontal hold control on the playback monitor. Modern VCRs sometimes mute the playback video when the drum speed is off.

The "Good/Bad" indication is based on the amount of frequency offset that can be tolerated by most television receivers. Speed errors greater than +/-0.10% produce a "Bad" indication. A "Good" indication means that the drum speed circuits are working properly. A "Bad" indication is most likely caused by a missing FG pulse from the drum motor.

**Drum Jitter Test:** The Drum Jitter Test analyzes the frequency variation of the SW30 pulse when using the Servo Troubleshooting Test Lead, or the playback video vertical sync pulses when using the Servo Performance Test Lead. This test analyzes the drum servo reference signal for short term variations in the speed of the drum.

The percentage reading indicates how much speed variation there is in the revolving drum. A "Good" indication shows that the drum servo is working properly. A "Bad" indication shows that drum speed variations are greater than 0.10% which will give unacceptable picture quality. Excessive drum jitter is often caused by problems such as bad bearings, excessive oxide on the drum, a missing drum PG signal, or a defective drum servo control loop.

| MAXIN<br>TEST PERCI | IUM ALLOWABLE<br>ENTAGE READING |
|---------------------|---------------------------------|
| Servos Locked       | 1.5%                            |
| Capstan Speed Error | +/- 0.5%                        |
| Capstan Jitter      | 0.5%                            |
| Drum Speed Error    | +/- 0.1%                        |
| Drum Jitter         | 0.1%                            |

 Table 1: "Good/Bad" limits allowable for Servo
 Analyzer test.

We want you to try the VC93 on your VCR analyzing bench. Sencore's exclusive 30 Day Money Back Guarantee and Free 10 Day Trial ensure your satisfaction that the VC93 will do all you have read about.

Plus, give us a call at 1-800-SENCORE and we'll show you how to make an additional \$6,500 in profit each year with the VC93 All Format VCR Analyzer.

For More Information, Circle Fast Fact Card #404.



## Visit A Successful CM2000 Owner And See How You Can Benefit

By: Vince Gioia, Metro Electronics, Brooklyn, New York

Hello, my name is Vince Gioia. I am an electronics service technician and founder of Metro Electronics in Brooklyn, New York. I started my business directly out of technical school and have been repairing electronic products for 25 years. I have one service technician working for me.

Our business has evolved considerably over the past 25 years. We started with the repair of tube type television receivers. Today, we service a complete range of electronic products: TVs, microwave ovens, VCRs, CDs, receivers, tape decks, fax machines, boom boxes, computer monitors, and terminals.

| TIME FRAME               | METRO ELECTRONICS'<br>SERVICE OFFERING    |
|--------------------------|---|
| Late 60's/<br>Early 70's | Tube Type<br>Television Receivers         |
| Late 70's                | Added: Solid State<br>Receivers           |
| Early 80's               | Added: VCRs And<br>High End Audio         |
| Late 80's                | Added: CD Players And<br>Microwave Ovens  |
| Early 90's               | Added: Computer<br>Monitors And Terminals |

#### Business Expansion Into Computer Monitors

Our latest servicing expansion has been computer monitors and computer terminals. The idea to move in this direction came to me when I was out walking my dog. Every day I'd walk past a large computer sales and repair business and wonder, who was doing this person's repair work? When curiosity got the best of me, I stopped in and found the owner was having a difficult time getting quality and reliable computer monitor repairs. I dropped off my card, made a couple of more contacts, and soon had all of his monitor repair business.



Fig. 1: The CM2000 Computer Monitor Analyzer provides all of the signals and troubleshooting features needed for complete computer monitor servicing.

After my contact with the computer sales and repair organization, I got a call from Dave Buss, my Sencore Area Sales Representative. He told me about the CM2000 Computer Monitor Analyzer: an instrument that provides all of the signals and troubleshooting features needed for complete computer monitor servicing. I agreed to an evaluation of the CM2000 and as soon as I saw the service potential, I made the purchase on Sencore's "Pay As You Grow" program.

We saw the move into computer monitor repair as a hedge against the ups and downs of TV and VCR servicing in these recession filled times. A typical family may have two televisions and two VCRs. If one breaks down when the household budget is tight, they may hold off with the repair, and I lose the service revenue. It's a different story with computer monitors and terminals. Large mainframe computers and personal computers are used primarily by businesses. When a monitor fails, the business owner (or manager) does what it takes to get it repaired as quickly as possible. If he doesn't, he's got zero productivity until the repair is completed.

I also expanded into computer monitor and terminal repair as a hedge against the typical summertime slow period I have always seen in the television and VCR repair business. During the summer, my customers aren't watching as much TV. They're working, playing outdoors, or on vacation. My business would always slow down during the summer and then pick up again when school started. Computer monitor repair isn't seasonal. I haven't seen the dip in service revenue this summer; businesses need repair work throughout the year.

#### Financial Rewards Of Monitor Repair

The decision to get into computer monitor and terminal repair has already given me some nice rewards. Since I've started, my business has grown in both service volume and profit. The only way for us to grow further would necessitate adding more technicians to handle the added volume of business.

In the 80's, I was repairing 10 VCRs to every television. I've only been in the computer monitor and terminal repair business for five or six months and already I'm repairing 10 monitors to 1 of everything else.

#### **Marketing Strategy**

I used direct marketing to get into the computer monitor repair business. I went through the phone book and took down the addresses of all the people I considered to be in my target market: schools, businesses, computer sales, and repair centers. I entered their addresses into a database on my personal computer. I printed up promotional pieces that described my services and printed envelopes from my PC database, and included my card with each letter.

I also have an ad in the phone book yellow pages, but I don't think it's as effective. I believe the customers take my business card out of the direct mail piece and put it in their card file. When they need monitor servicing, they flip open their file and give me a call.

#### COMPUTER MONITOR AND TERMINAL SERVICING MARKETING STRATEGY

- Promotional mailing to target markets that described my repair services (included business card in the mailing):
  - Schools
  - Businesses
  - Computer Sales and Repair Centers
- Advertisement in phone book Yellow Pages.
- Personal visits to computer sales and service centers.

It took about three months to get the hang of the monitor service business. The main problem wasn't the technical end of things. The biggest problem was finding good service manuals and parts at reasonable prices. I remember having similar problems when starting into VCR servicing. It took awhile to find out where to buy parts and who gave the best deal.

#### Service All Monitor Formats With The CM2000

I service all brands of computer monitors. I'm able to do this, because the CM2000 is a universal computer monitor analyzer made to work with any monitor or terminal. The CM2000 enables me to bring up the monitor and diagnose the problem. I use the CM2000's DC and peak-to-peak digital meter and drive signals to find the faulty stage.

#### Conquer Tough Dogs With The CM2000

My most common computer monitor problems fall in this order: horizontal output, flyback, vertical output, and power supply. In the time I've used the CM2000 Computer Monitor Analyzer, I've found the "Ringer" test to be one of the most helpful features. It helps me find bad flyback transformers and yokes.

#### Quickly Recall Common Monitor Formats

The CM2000 has helped conquer some real tough dog problems. I had an EGA monitor that wouldn't produce a good picture in the EGA mode; it was shrunken and distorted, but it looked good in the CGA mode (most EGA monitors lock to both formats).

Because the picture looked good in one mode and not the other, I suspected something was wrong with the mode switching circuit. I put the CM2000's DC voltmeter lead on the output of the switching circuit. The output was supposed to be high in the CGA mode and low in the EGA mode. Using the CM2000, I recalled the CGA format. The DC reading was 6.3 volts, I then recalled the EGA format, the DC reading stayed frozen at 6.3 volts. The monitor wasn't switching into the EGA mode. It had a bad mode switch IC.

...continued on page 30.





# NEW!

Service ECL Computer Monitors With The CM2000 Computer Monitor Analyzer And The New ECL Adapter

#### By Stan Warner, Application Engineer

Many of the new high resolution computer monitors on the market use ECL (emitter coupled logic) video circuitry. ECL prevides the fast switching time needed to display crisp picture detail. ECL monitors are monochrome and display a set number of shades of gray. They generally have screen sizes of 19" or larger and horizontal resolutions of 1,024 pixels or greater.

The ECL computer monitor market has grown as a result of the needs for sharper



graphics resolution. Typically you find ECL monitors in high resolution applications such as CAD/CAM, medical imaging and design graphics.

ECL monitors provide excellent service potential. An ECL computer monitor may cost \$2,000 or more; so servicers find businesses willing to pay \$400 or more for a repair. The CM2000 Computer Monitor Analyzer provides signals for digital and analog computer monitors. With the new ECL Adapter the CM2000 also provides the signals needed for servicing ECL computer monitors.

The ECL adapter connects to the output of your CM2000 (just like the other connectors) and provides the signals you need for producing a pattern on the display. The ECL adapter converts the digital output to an ECL output. The same troubleshooting features you use on CM2000 to help you isolate defective circuits in digital and analog monitors work on ECL monitors as well.

This adapter costs \$89.95 and it pays for itself with one ECL computer monitor repair job. The rest is pure profit for you. To find out more about the ECL Adapter and this profitable servicing opportunity, call **1-800-SENCORE** (**736-2673**) and talk with your area sales representative.



# 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'd get every month from ELECTRONIC SERVICING & TECHNOLOGY?

For just \$2 a month, you can receive the magazine that grew up with the electronics business. You'll get the latest in new technologies, new equipment, manufacturers and servicing techniques for video, audio—even personal computers.

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# In Only 9 Short Months A New Standard Has Been Set For Monitor Servicing!

What do so many technicians and business owners know that you may not? <u>Why have these servicers already updated to the new CM2000?</u>



Maybe so many servicers are using the CM2000 Computer Monitor Analyzer because it allows them to completely test and troubleshoot all high resolution and multi-scan monitors from the input connector to the CRT?

Maybe it's because of the fully programmable scan rate and pixel resolution?

Or maybe it's the innovative performance testing patterns?

And perhaps they discovered the extra value in signal substitution and being able to accurately test yokes, IHVTs, and switching transformers?

Or could it be the easy-to-use design with built-in digital meter,

exclusive "Hook-up" adaptors, and portable troubleshooting for all field service needs?

Find out for yourself. Call 1-800-SENCORE and we'll send you a FREE video demonstration tape and information package. Or, if you'd like to get your hands on the CM2000 and use it on your bench, we can arrange for a "NO OBLIGATION" 10 day self demonstration.



#### ... continued from page 27.

#### Identify Bad Flyback Transformers

The ringer test works great for finding bad flyback transformers. I often get defective monitors into my shop that can't get a pattern on the display and have retrace lines. The pulse at the collector pulse doesn't look like it's supposed to either. I put my ringer test leads across the primary winding of the flyback and instantly I know if the flyback is good or bad (a defective flyback rings less than 10 rings).

Since the flyback transformer is one of the most expensive components in the monitor I like the confidence the ringer test gives me that the component is really bad when I go to order a new one. Over the years of using this test on television flybacks and now monitors I have complete trust in the test results.



Fig. 3: Use the CM2000's "Ringer" test to find bad flyback transformers, yokes, and switching transformers in computer monitors and terminals.

#### Quickly Isolate Monitor And Video Graphic Card Problems

A very good customer called up and said a computer monitor that I had repaired (a power supply problem) was acting up again. I went to the job site to examine the monitor connected to the customer's CPU. The monitor displayed the weirdest symptoms I have ever seen. The middle of the screen to the right edge had visible retrace lines, running from top to the bottom. The extreme right hand side (from the top to about half way down) was folded over about 1/2 inch.

Since I had just repaired the monitor, the client was claiming that it was still under warranty. I felt otherwise because in my experiences the monitor wasn't showing signs of a power supply problem.

Not wanting to argue with a customer, I decided to take the monitor into the shop for further testing. I hooked it up to my CM2000 and got a perfect picture. I checked some critical voltages and waveforms and also ran the unit for several hours, but still could not find anything wrong.



Fig. 4: With programmable scan frequencies and pixel rates, the CM2000 outputs can be set up to match the outputs of any video card. Use the CM2000 to determine if the symptoms on the monitor are caused by the graphics card or the computer monitor.

Due to the unusual symptoms displayed when the monitor was hooked up to the customer's CPU, as compared to the perfect screen displayed with the CM2000, I returned the monitor to the customer. I told him that in light of the test results, the video graphics card in that CPU, must be bad. He confirmed my findings by hooking up a known good monitor to the same CPU in question and it displayed the same weird symptoms. This confirmed the graphics card was bad.

#### The CM2000: A Troubleshooting Time Saver

The CM2000 has saved me a lot of troubleshooting time. It gives me rock solid test patterns to diagnose symptoms on all monitor formats. It also gives me quick and easy troubleshooting capabilities. With all the special tests and drive signals needed to nail down the problem. I can finally get down to the bad component. The CM2000 also gives me the patterns needed to burn-in a repair, and (if needed) make any adjustments to the display.

#### **Opportunities In Computer Monitor Servicing**

VCR's gave technicians service opportunities starting in the 80's. Computer monitors and terminal repairs will provide similar opportunities in the 90's and beyond. This is especially true given all the businesses, hotels, and schools, there are in a local area. The opportunities for service growth are tremendous. But only if a tech has the training and the right test instruments. In my opinion, the CM2000 is the right test instrument for successful computer monitor and terminal repair.

Give your Sencore Sales Representative a call today to set you up on a 30 day "Proof Of Performance" unit – allowing you to start getting the monitor business into your service center. Simply call **1-800-SENCORE.** 

For More Information, Circle Fast Fact Card #405.



Test Every CRT On The Market...

# Plus, Safely Restore 9 Out Of 10 Weak Or Shorted CRTs With The CR70 "Beam Builder"<sup>TM</sup>... Guaranteed!

- Reliably test every CRT on the market (old or new)
- Dynamic tests you can trust
- Safely restore 9 out of 10 weak or
- shorted CRTs
- Totally protected from damage by charged CRTs

#### Have You Ever -

- 1. Wasted time checking everything else in a TV, data display, or scope, because your CRT tester wasn't able to check the CRT?
- 2. Doubted whether a CRT tester was telling you the truth about the condition of a tube?
- 3. Lost \$35 or more that you could have charged for restoring a CRT and possibly thrown away an otherwise good TV?
- 4. Damaged your CRT tester from a CRT that wasn't totally discharged?

The CR70 "BEAM BUILDER" Is Exclusive!

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

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#### MONEY BACK GUARANTEE

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

#### Now You Can

1. Reliably test every CRT on the market including: video, projection, computer, camera, scope, radar, and others—without carrying a box full of expensive adapters.

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- 2. Trust the CR70's dynamic tests, which give a true measure of how the CRT actually performs in the circuit.
- 3. Be more profitable and build your business by confidently restoring your customers' weak CRTs.



Avoid expensive equipment downtime; the CR70 is totally protected from charged CRTs.

# The CR70 is designed to make money for you in today's expanding video, computer monitor, and scope market. Cash in on the tremendous profit

potential of this lucrative market with the CR70 "BEAM BUILDER". To find out what goes wrong with CRTs and how you can reliably and profitably test and restore them. Call your area Sales Engineer and ask for a free copy of the video tape "Universal CRT Analyzing."

To view the tape and arrange for a 10 Day Self Demo so you can start profitably testing and restoring CRTs, call

# 1-800-SENCORE (736-2673).

For More Information, Circle Fast Fact Card #310.

# INTRODUCING

The first <u>Signal Level Meter</u> designed to pinpoint RF/video problems and performance test any RF distribution system more accurately than any other Signal Level Meter.

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- Provides you with a quick test for analyzing ghosting, off-air pick-ups, and interference with a color LCD display.
  - Best of all, it's field and weather ready. The SL750A features a rugged, light-weight case with "a water run-in resistant" front panel.

#### Plus, these other exclusive features:

- External DVM inputs (with true-RMS)
- Automatic fine tuning
- .5 dB accuracy the best in the industry!



If you would like to know more, or are interested in seeing the SL750A work in your system, call 1-800-SENCORE (736-2673) ext. 735 for details.

For More Information, Circle Fast Fact Card #308

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