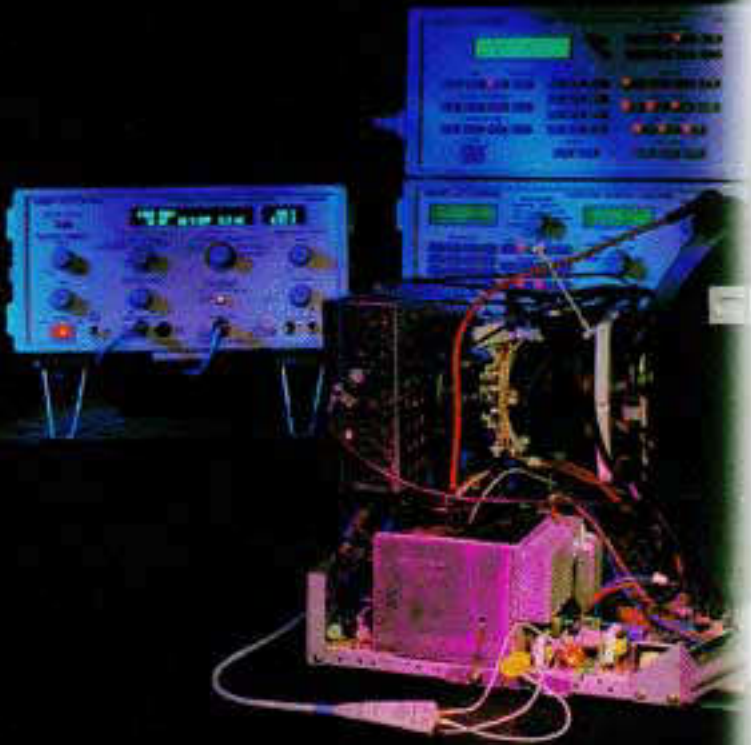


THE HA2500

# Horizontal Circuit Analyzing

*Real Answers- Real Profits- Real Fast!*



*HA2500 Universal  
Horizontal Analyzer*



TECH CHOICE

Patented With Other Patents Pending  
- A Sencore Exclusive -

SENCORE

## Why A Universal Horizontal Analyzer For Your Business?

Today's CRT video display monitors support computer, medical, security, design, and industrial applications, to name a few. They operate at many different horizontal scanning frequencies and picture resolutions. Plus, all video display monitors have horizontal stages to produce CRT high voltage and horizontal yoke current.

### Reduce The Number Of Damaged Horizontal Outputs...



*Horizontal output stages are among the most common computer monitor failures.*



Horizontal and related stages account for many computer monitor failures and cause the most difficult-to-troubleshoot symptoms. Many symptoms are difficult to troubleshoot because the horizontal stages interact so closely with other circuits such as the switch mode power supply X-ray shutdown, high voltage/deflection regulator, and mode control circuits.

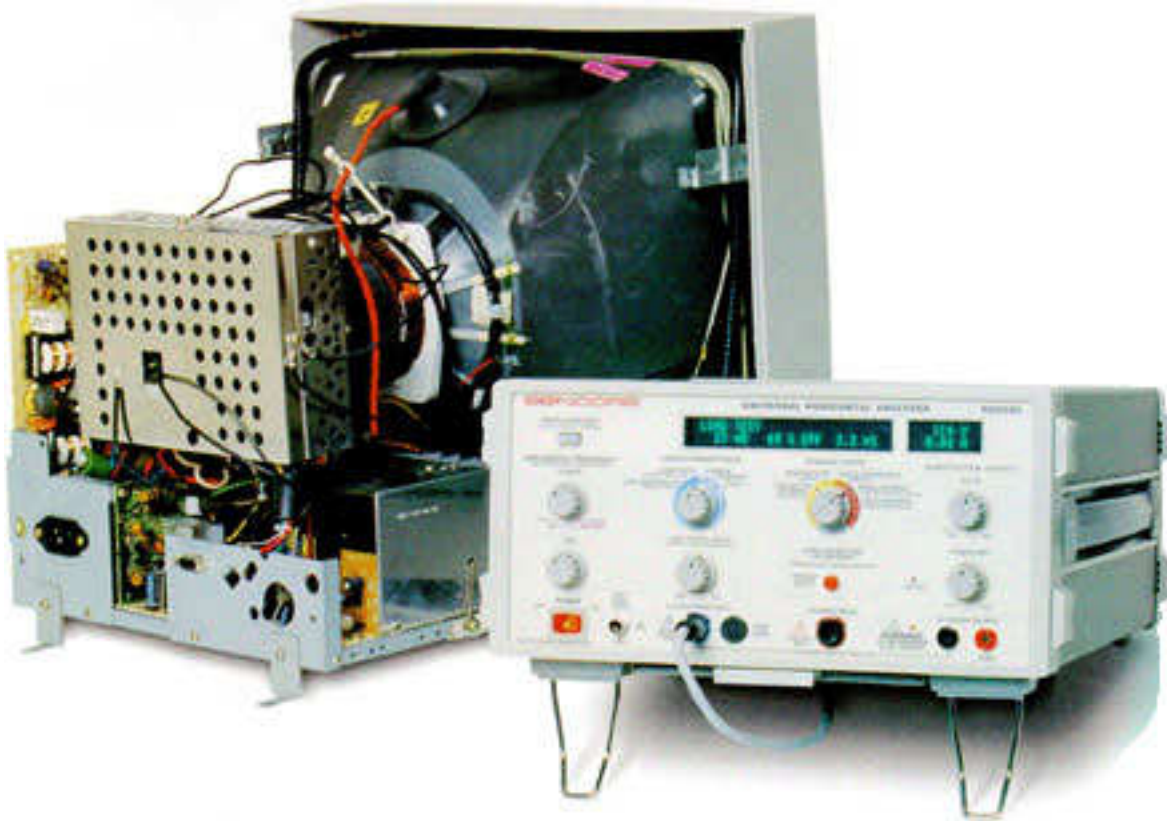
It is not uncommon to replace burnt components, then see them overheat or burn out again from the remaining defects when AC power is applied. You may have measured low voltages or momentary-only voltages on a meter or scope telling you little about where to look for the problem. And, you've probably replaced components only to discover you have the same unusual symptoms such as distorted or insufficient horizontal deflection, interference in the CRT picture, or noise radiating from the flyback transformer.

Most horizontal related defects cannot be isolated with a DVM and scope measurements or with troubleshooting methods used effectively by technicians in the past. This frustrates technicians and disappoints service managers or owners who see time and components being invested without return.

The new Sencore HA2500 Universal Horizontal Analyzer provides exclusive analyzing tests and substitution capabilities to localize switch mode power supply loading and defects among horizontal output, horizontal driver, X-ray shutdown, high voltage/deflection regulators, and other horizontal related stages.

Now you can confidently isolate horizontal defects in computer monitors in a fraction of the time it takes using conventional tests, plus you can reduce replacement parts costs too!

# Now Everything You Need To Estimate Repair Costs And Localize Horizontal Stage Defects In Computer Monitors Less Time And More Profitably Than Ever Before!



- Unique frequency lock and variable horizontal frequency allows you to quickly service all horizontal circuits - no matter the frequency
- Exclusive “Horizontal Output Load Test” makes setup and testing a snap - even without applying AC power for more accurate estimates, fewer damaged replacement parts, and faster diagnosis and repair
- Patented “Ringer Test” proves the condition of flybacks and yokes in seconds - even a single shorted turn
- Exclusive “Dynamic Tests” help you analyze the horizontal circuit in a powered-up condition to catch even subtle defects in the power supply and drive signal
- Variable-current limited & protected B+ substitute power supply permits testing of horizontal stages even when the power supply is dead
- Portable and field rugged to go on location when bringing the defective product to your bench isn't feasible

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

## Unique Frequency Lock And Variable Horizontal Frequency

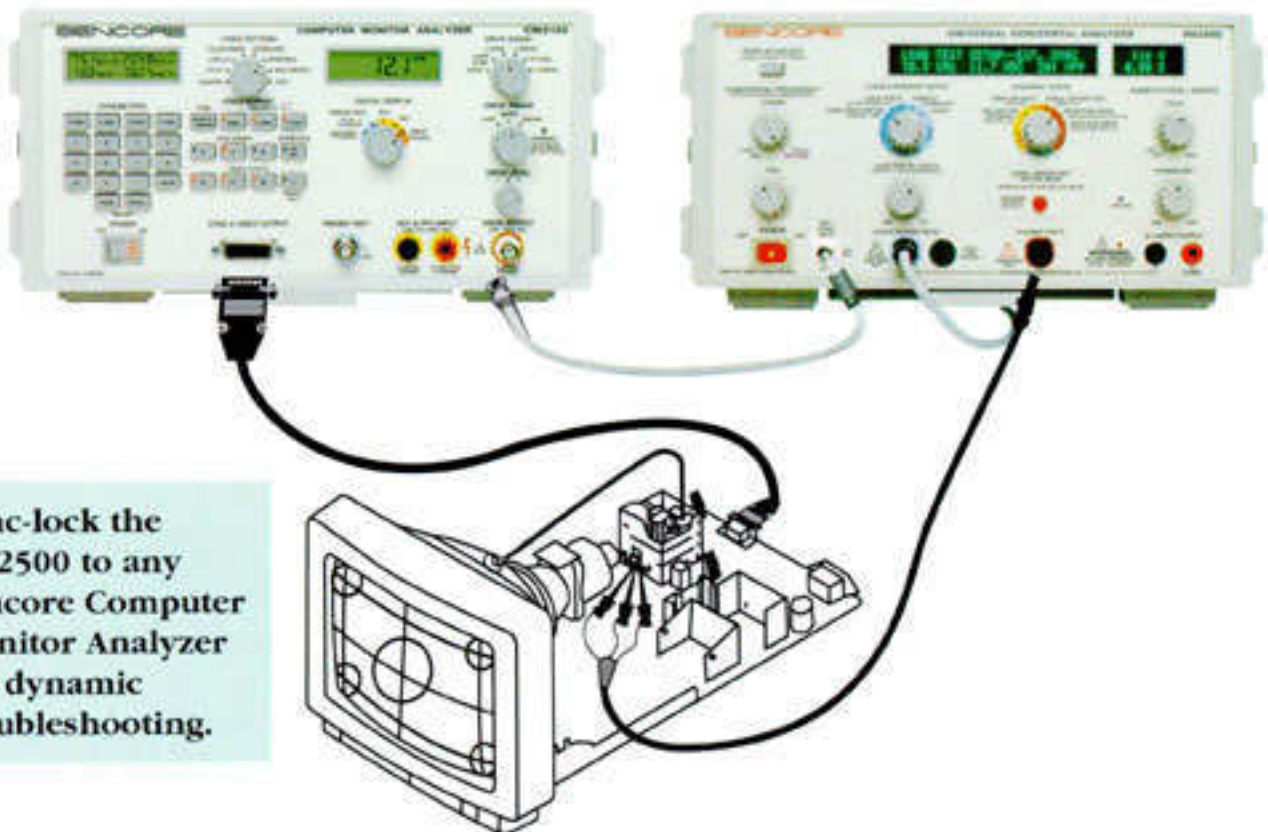


The HA2500 contains a unique frequency generator with two modes of operation. First you can simply adjust the coarse and fine controls to the horizontal circuit's highest operating frequency for stand-alone operation. Or, the horizontal analyzing capabilities of the HA2500 can be teamed up with a video or RGB generator. The HA2500's Est. Sync Input enables it to produce a horizontal test signal at the same horizontal frequency and phase as a video or RGB test signal generator. This saves time and reduces the chance of using an improper horizontal test frequency when troubleshooting. With the video

or RGB generator applied to the input of a functioning video display, a visible and stationary video test pattern is produced on the CRT when subbing in the horizontal circuit. This permits analyzing of the high voltage, signal processing, deflection, mode control, CRT, and other major circuits of the video display.



The HA2500 is designed to sync to most Sencore Computer Monitor Analyzers or Signal Generators including the Sencore CM2000, CM2125, and CM125 to provide comprehensive testing and troubleshooting of computer monitors.



**Sync-lock the  
HA2500 to any  
Sencore Computer  
Monitor Analyzer  
for dynamic  
troubleshooting.**

# Patented Load Test Isolates Horizontal Output Defects With The Chassis "Off"



Many monitor defects start with a dead power supply or burnt or shorted components in the SMPS or horizontal related stages. To get started troubleshooting means you have to replace the damaged components or install a parts or upgrade kit. When hidden problems are missed by resistance or component tests, the replacement components heat up or burn out quickly when AC voltage is applied. Your investment of time and component costs are lost.

The HA2500's Load Test is designed to isolate horizontal defects which prevent chassis "on" troubleshooting. The Load Test functionally tests the horizontal output stage with no ACV to the chassis. It isolates horizontal output stage timing and loading defects that cannot be found with resistance and component tests. These defects

commonly load or damage the switch mode power supply or cause startup and shutdown symptoms.

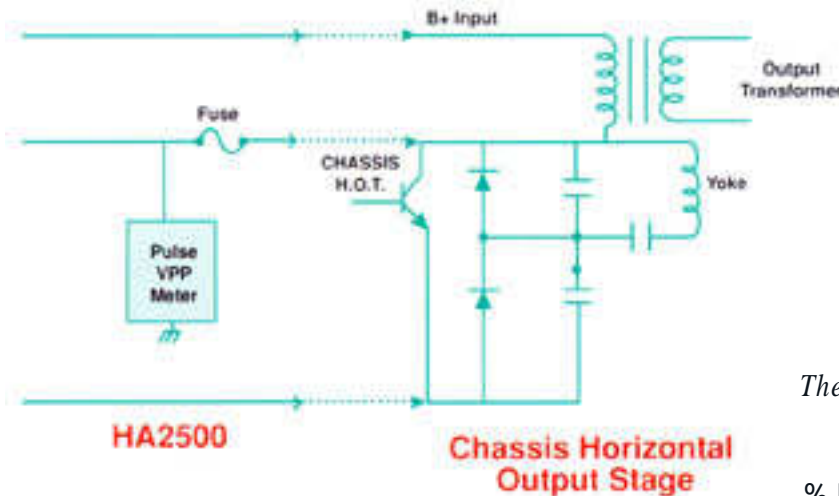


If the chassis horizontal output stage contains a defect, the Load Test accurately reproduces the faulty horizontal output stage operation. Since the Load Test operates at reduced voltage levels, it can be applied for long durations into problem horizontal output stages without component or instrument damage. This test alone will reduce your estimating time, save you from damaging replacement components, and add profit back directly into your business.

**When to Use the Load Tests**

**What It Tells You**

|  |   |
|--|---|
| <ul style="list-style-type: none"> <li>  Full AC volts cannot be applied without component damage</li> <li>  B+ supply is dead or bad</li> <li>  Horiz. output dead or suspect</li> <li>  H.O.T heats or falls</li> <li>  Display dead or won't start</li> <li>  B+ supply squeals, burns-up components or blows fuses</li> <li>  X-ray shutdown symptom</li> <li>  Estimating repair costs</li> </ul> | <ul style="list-style-type: none"> <li>  If horiz. output stage function is normal or abnormal</li> <li>  If short or high current load exists on B+ power supply</li> <li>  If horiz. output stage pulse timing is normal or abnormal</li> <li>  If horiz. output stage is efficient or inefficient (high losses)</li> </ul> |
|--|---|



The HA2500 Automatically Measures:  
 mA = current being drawn by the horizontal output stage  
 % EFF = percent of energy to the horiz. output returned to the B+  
 μs = readings of the LC timing of

# Patented "Ringer" Proves The Condition Of Flybacks, Yokes, And Coils In Seconds



The Ringer Test is used to isolate a shorted turn within flybacks, yokes, or coils when the Load Test indicates a horizontal output stage defect. A shorted turn or turns greatly alters the component's function and circuit's operation, but does not change the winding's resistance or its inductance when you measure it.

The HA2500 Ringer Test quickly confirms a shorted turn defect saving you from replacing a good flyback, yoke, or horizontal coil; or worst yet, mistakenly concluding it's defective and losing the repair and revenue opportunity.



The Ringer Test may be used effectively to isolate shorted turns among other coils and transformers abundant in today's multi-frequency CRT displays. Coils in the B+ voltage path commonly develop shorted turns when a horizontal output stage defect produces high current through them. The Ringer Test quickly identifies when these coils have been damaged and need to be replaced.



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# Dynamic Tests Analyze The Horizontal Output Stage With Automatic Measurements

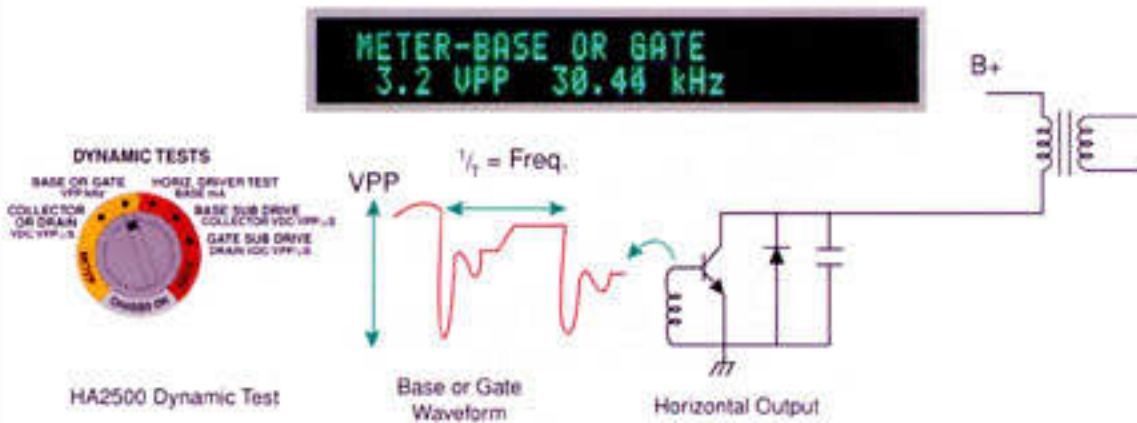
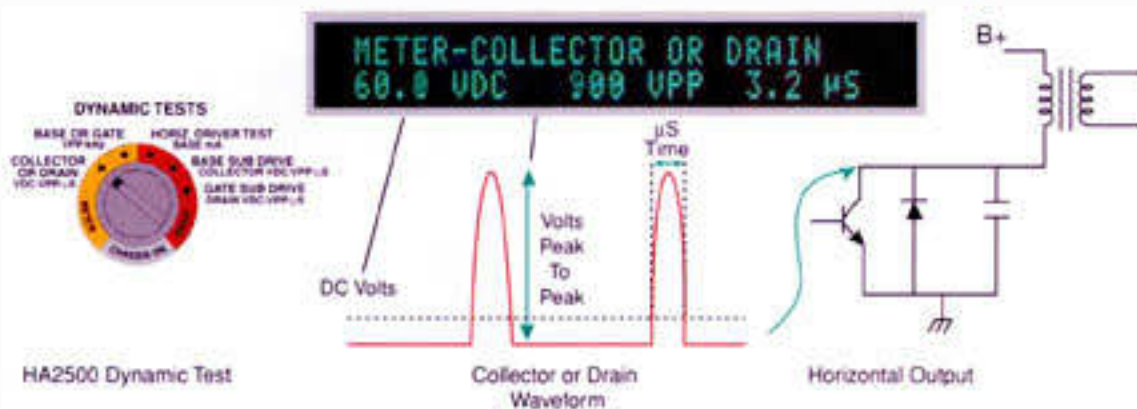


The HA2500's Dynamic Tests "METER" provides automatic measurements of voltages and waveforms to quickly analyze the horizontal output stage without complicated setup, probing multiple circuit points, selecting multiple test functions, or worry of test equipment damage.

Measurements confirm normal or abnormal horizontal output stage operation and guide you to suspect stages or defects in either bipolar or MOSFET type horizontal output transistor stages.

The Collector Or Drain Meter provides three automatic "chassis on" measurements of voltages and waveforms produced by the horizontal output stage at the collector or drain of the horizontal output transistor. These measurements include the DC voltage, the flyback pulse peak-to-peak voltage, and the flyback pulse duration or time in microseconds.

The BASE OR GATE Meter provides two automatic measurements of the drive waveform at the base or gate of the horizontal output transistor.



# HA2500

## UNIVERSAL HORIZONTAL ANALYZER

New Fluorescent Display: Now you can clearly view all measurements - even in low light conditions

Exclusive Substitute B+ Supply: Variable 30-180 volts, so now you can take control and substitute for the B+ power supply

Power Limit: Provides power limiting for substitute B+ supply to protect the circuit and components

Horizontal Driver Test: Measures current output of horizontal driver stage to detect weak or intermittent horizontal drive

Dynamic Tests "DRIVE": Substitutes horizontal drive to base or gate of horizontal output transistor to test Horiz. output and isolate drive defects

Dynamic Tests "METER": Performs automatic "chassis on" measurements through 3 lead hook-up to the horizontal output transistor to analyze the horizontal output stages for defective horizontal drive and B+ voltages

Patent Pending Load And Ringer Tests: These tests will help localize horizontal circuit defects - with the chassis turned "off"

Simplified Display Select: Allows you to switch easily between Load and Dynamic Tests

Universal Horizontal Frequency: Two modes of operation (internal generator or externally synced to a generator) allow the HA2500 to analyze all circuits from 15 kHz to 125 kHz.



**Patented With Other Patents Pending**  
**-A Sencore Exclusive -**

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**(736-2673)**



# Exclusive Horiz. Driver Test Detects Weak Or Intermittent Horizontal Base Drive



Horizontal output stage symptoms and component failures are often caused by defects in the horizontal drive stage. Yet, the driver stage is seldom suspected and often when it does have a defect, scope waveforms and peak-to-peak measurements at the base of the horizontal output transistor appear normal.

Horizontal driver stage defects and symptoms are difficult to diagnose for several reasons.

1. The symptoms are the same as horizontal output stage defects.
2. Horizontal output transistors may burn-out quickly leaving no time for measurements.
3. Horizontal output transistors may run hotter than normal and burn-out after several minutes, hours, or days while waveforms and horizontal output stage functions appear normal.

The HA2500's Horiz. Driver Test is an exclusive analyzing test designed to identify horizontal driver stage defects. The Horiz. Driver Test analyzes horizontal driver stages that produce base drive for bipolar horizontal output transistors. The test identifies horizontal driver stages which are not producing an adequate current drive for proper operation of a bipolar type horizontal output transistor.



By isolating horizontal driver stage defects with the HA2500, you prevent wasted time troubleshooting the horizontal output stage, save money replacing repeat horizontal output transistor failures and make revenue from monitors with inexpensive drive stage problems you may have missed before.



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(736-2673)**

# H.O.T. Base Or Gate Sub Drive Enables Horizontal Output Stage Analyzing

Horizontal drive defects can cause the horizontal output stage to be dead or appear defective. Symptoms include missing or reduced high voltage and/or deflection, audible noises, picture interference, and reduced HV or deflection. The only way to determine if the problem is caused by a horizontal drive signal defect or more expensive defects in the horizontal output stage is to accurately substitute the horizontal drive at the base or gate of the horizontal output transistor.

The Base Sub Drive outputs the proper horizontal drive for the base of any bipolar type horizontal

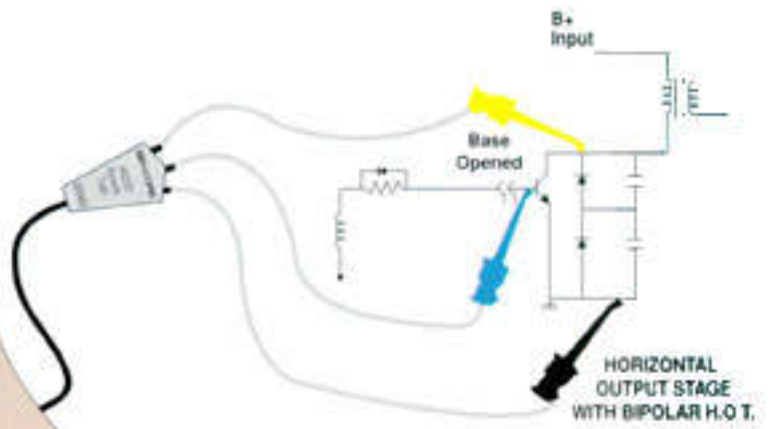
output transistor. The drive current is dynamically adjusted to produce the needed horizontal



output transistor collector current and best transistor switching efficiency. This enables the Base Sub Drive to drive any horizontal output bipolar transistor without excessive heating and/or transistor damage. The Gate Sub Drive outputs the proper horizontal drive for the gate of any MOSFET type horizontal output transistor.

When "Drive" is selected, the fluorescent display shows the HA2500's horizontal test frequency and the DCV at the chassis horizontal output transistor collector or drain. Pressing the Horiz. Driver Test Or Sub Drive push-button outputs drive to the chassis horizontal output transistor and is accompanied by Collector Or Drain measurements to analyze the operation of the horizontal output stage.

By substituting for missing or suspected bad horizontal drive, the HA2500 enables testing of expensive horizontal output stage components and power supply stages. It further helps isolate weak, intermittent, erratic, or noisy horizontal drive signal problems which cause improper horizontal output stage operation and/or results in output transistor failure.



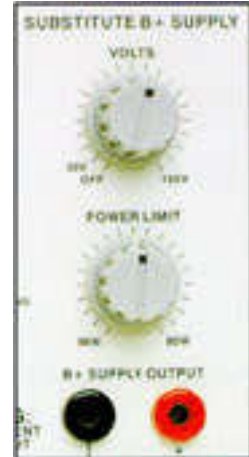
# Substitute B+ Power Supply Isolates HV Breakdown, Shutdown, & HV/Deflection Defects



The HA2500's Substitute B+ Supply substitutes for the chassis B+ power supply voltage. It enables you to power the horizontal output stage to full potential when the B+ supply or high voltage deflection regulator has damaged components. It lets you slowly increase the B+ voltage and limit the current to isolate horizontal component breakdown failures and X-ray shutdown symptoms. It provides an effective method of isolating B+ voltage defects to the B+ supply, HV/deflection regulator; or horizontal output stage.

The Substitute B+ Supply is variable from 30 - 180 volts to match a wide range of B+ voltages found in full sized CRT video displays. The voltage is switched off or adjusted through its range with the VOLTS

control. The maximum output power of the Substitute B+ Supply is adjustable from <3 watts to 80 watts with the Power Limit control providing circuit and component protection. A fluorescent display meters the voltage and current output of the Substitute B+ Supply simultaneously.



The Substitute B+ Supply eliminates the frustration of not knowing if the problem is in the power supply, high voltage/ deflection regulator; or horizontal output stage; and the uncertainty of how to isolate the defect. It eliminates the frustration of measuring momentary voltages or engaging in the time consuming process of swapping parts to isolate an X-ray shutdown symptom. It eliminates the hopeless feeling of not being able to isolate the cause of a component breakdown that destroys horizontal output and power supply components when normal B+ voltage is applied.



# Where Would You Use The HA2500 Universal Horizontal Analyzer?

Today's video display monitors support computer, medical, security, design, and industrial applications, to name a few. They operate at many different horizontal scanning frequencies and picture resolutions.

This is where the HA2500 helps the servicer. Because of the universal design of the HA2500, it

| Service Area:                  | Where To Use The HA2500:   |
|--------------------------------|--|
| Multi-Scan Horizontal Circuits | Computer Monitors (15 kHz - 125 kHz)   |
| Medical Equipment              | CRT Video Display Devices  |
| Industrial Equipment           | CRT Video Display Devices  |
| Video Gaming Industry          | CRT Video Display Devices  |
| NTSC 1575 kHz                  | Big Screens<br>In-home Servicing<br>Conventional TV<br><i>(The Sencore TVA92 TV Video Analyzer is, however, a more complete solution.)</i> |
| And Many Others                |  |

can be used in many different service areas. The universal features, such as variable horizontal frequency, direct display of test results, and variable B+ supply allow the HA2500 to service a wide array of products in an efficient and direct manner.

# Cost Justify Your Investment

The HA2500 provides many exclusive tests that isolate defects which previously required many hours of expensive troubleshooting or component

swapping. Use the section below to see exactly how the HA2500 can pay for itself.

## Methods of Cost Justification

*Add up yearly savings or increases in productivity.*

| Topics                                   | How it Cost Justifies  | \$ Amount |
|--|--|-----------|
| Time Savings                             | <ul style="list-style-type: none"> <li>Isolate defects up to 2X faster - more service or refurbish jobs completed</li> </ul> | \$ _____  |
| Parts Savings                            | <ul style="list-style-type: none"> <li>Prevent damage to replacement parts</li> </ul>  | \$ _____  |
|  | <ul style="list-style-type: none"> <li>Reduce number of replacement parts</li> </ul>   | \$ _____  |
|  | <ul style="list-style-type: none"> <li>Replace only bad parts - not entire kit</li> </ul>                                    | \$ _____  |
| Added Business                           | <ul style="list-style-type: none"> <li>Retain work with accurate estimates</li> </ul>  | \$ _____  |
|  | <ul style="list-style-type: none"> <li>Repair displays that the parts kit didn't fix</li> </ul>                              | \$ _____  |
|  | <ul style="list-style-type: none"> <li>More displays repaired</li> </ul>   | \$ _____  |
| Reduced Callbacks                        | <ul style="list-style-type: none"> <li>Test for marginal performance and find subtle stage degradation</li> </ul>            | \$ _____  |
|  | <ul style="list-style-type: none"> <li>Increase repair quality and longevity</li> </ul>                                      | \$ _____  |
| <b>Total Savings &amp; Added Revenue</b> |  | \$ _____  |

## Team-Up The HA2500 With A Sencore Computer Monitor Generator For Complete Monitor Analyzing

Regardless of whether you're using an existing generator or are looking at a New Sencore generator, the HA2500 will add to its functions to build an analyzing system. The HA2500 allows you to input a sync signal and sync-lock all the HA2500's tests to that signal.

The CM 125 Computer Monitor Generator, for example, provides an accessory output jack that connects directly to the HA2500. And by connecting the CM125 to the monitor's input cable, you'll be viewing the CRT for normal picture when performing many of the HA2500's tests - especially the base drive and dynamic tests.



**CM2125 Computer  
Monitor Analyzer**

**CM125 "Pix Pak" Computer  
Monitor Signal Generator**

# HA2500 SPECIFICATIONS

## HORIZONTAL FREQUENCY GENERATOR

### FUNCTION:

Squarewave generator for Load Tests and Sub Drive functions.

### FREQUENCY RANGE:

<15 kHz to >125 kHz

## EXTERNAL SYNC INPUT:

### INPUT SIGNALS:

Horizontal Sync, Composite Sync, Composite Analog Video ( $\pm$  Polarity)

### FREQUENCY RANGE:

15 kHz 125 kHz

### SENSITIVITY:

Composite Analog Video > .5 VPP  
Horiz. or Composite Sync > 2 VPP

## HORIZONTAL OUTPUT LOAD TEST B+ POWER SUPPLY

### VOLTAGE RANGE:

0 - 18 VDC  $\pm$  0.5 volts.

### CURRENT LIMIT:

250 mA  $\pm$  10%

## HORIZONTAL OUTPUT LOAD TEST SETUP

### EXCITATION DRIVE:

Squarewave

50% duty cycle  $\pm$  2%

### B+VOLTS RANGE:

0 - 19.9 volts

### VPP RANGE:

autoranged 0 - 400 VPP

## HORIZONTAL OUTPUT LOAD TESTS

### B+ mA RANGE:

0-250 mA

### TIME $\mu$ S RANGE:

0.1  $\mu$ S - 50  $\mu$ S

### TIME $\mu$ S TRIGGER LEVEL:

5%  $\pm$  1% of pos. pulses with

VPP > 10 VPP

## RINGER TEST

### FUNCTION:

Approximate coil "Q" determined by exciting the coil and counting ringing cycles to a damped level.

## DYNAMIC TESTS

### (COLLECTOR OR DRAIN METER)

#### VOC RANGE:

Autoranged.

0 - 400 volts

#### VPP RANGE:

Autoranged.

0 VPP to 1500 VPP

## TIME $\mu$ S RANGE: 0 - 50 $\mu$ S

## TIME $\mu$ S TRIGGER LEVEL:

5%  $\pm$  1% of pulse VPP >20 VPP

## DYNAMIC TESTS

### (BASE OR GATE METER)

VPP RANGE: 0 VPP to 50 VPP

## DYNAMIC TESTS

### (HORIZONTAL DRIVER TEST)

#### FUNCTION:

Measures the horizontal stage output current capability by simulating a low impedance base/emitter transistor junction.

#### BASE mA RANGE:

0-2000

## DYNAMIC TESTS (SUB DRIVE)

#### FUNCTION:

Substitute drive optimized to properly drive the base or gate of any horizontal output transistor.

#### BASE SUB OUTPUT:

Squarewave

50%, -2/+6% duty cycle

#### GATE SUB OUTPUT:

Squarewave,

50% duty cycle  $\pm$ 2%

## SUBSTITUTE B+ SUPPLY

### VOLTAGE RANGE:

< 30 volts to > 180 volts

### POWER OUTPUT:

2 amps  $\pm$  10% to 40 watts 80

watts  $\pm$  10% over 40 volts

### POWER LIMIT RANGE:

< 3 watt (min) to > 80 watt

## GENERAL

### FLOATING GROUND ISOLATION:

600 volts (DC + peak AC) from "-" terminal to chassis ground with < 500  $\mu$ A

### DIGITAL DISPLAY:

Vacuum fluorescent matrix 40 x 2

### AC POWER:

105 to 125 VAC 50/60 Hz. May be factory converted to 220 VAC.

### SIZE:

6" X 11.5" X 15.5"

(15.2 X 29.1 X 39.3 cm) HWD

### WEIGHT:

14 lbs. (6.4 kg.)

All specifications allow for 20 minutes of warm-up and are guaranteed at 15 to 35 degrees C.

## Accessories

### Supplied:

1. 39G470 Load & Ringer Test Lead
2. 39G469 Dynamic Test Lead
3. 39G481 B+ Supply Lead

### Optional:

4. 39B296:A Video Test Cable
5. 39G508 Composite Sync Cable
6. 39G348 Drive Sync Cable
7. 39G494 Dynamic DVM Test Lead
8. HP200 50 kV High Voltage Probe
9. TP212 10 kV Transient Protector Probe
10. PC263 Protective Cover



## Sencore's Exclusive After-The-Sale Support

### All Sencore Instruments Are Backed By Our Exclusive 30 Day Money Back Guarantee

"If you are not completely satisfied with any Sencore instrument, you may return it during the first 30 days, and we'll give you a full refund, including freight, no questions asked."

### Toll Free Access To the Entire Factory

Sencore does not stop providing assistance after you purchase one of our instruments. We provide free technical assistance on any instrument use questions, future purchase assistance, industry trend information, instrument service, or any question you may have or test instruments. Just call Sencore at our toll free 1-800-SENCORE number. Your Area Sales Engineer, an Application Engineer, or a Service Technician will be happy to assist you.

### Made Right Guarantee

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

### Extended Service Agreement Programs (ESA)

Sencore announces our new Extended Service Agreement Programs for your HA2500. These programs can be an extension of your warranty coverage or simply a method for you to have annual calibrations at a reduced rate. For further information regarding these programs, please contact your Area Sales Engineer or the Service Department.



### Here's How To Order Your HA2500 Universal Horizontal Analyzer

Ordering the HA2500 Universal Horizontal Analyzer is as simple as picking up your phone. Call **1-800-SENCORE** and talk directly with your Sales Engineer about the many programs available to help with your instrument investment.

### Sencore One Year Warranty

Every Sencore instrument is warranted for one year against defects of any cause except acts of God and abusive use. During this warranty period, Sencore will correct any covered defect without charge for parts, labor, or recalibration.

### Sencore Value Added Services

The HA2500 is certain to play an important role in helping you achieve maximum efficiency and profits in your video display refurbishing, repair, or maintenance operation.

To help you realize the maximum benefits offered by the HA2500, Sencore provides a full range of after-the-sale product support services. These services include:

1. *Sencore News* magazine publications featuring technical articles on the HA2500.
2. Technical Training Courses on horizontal & related stages.
3. Video Training Tapes
4. Application Engineers to answer HA2500 application questions.
5. Sencore Website for HA2500 service and support information.
6. Field Trainers holding technical training classes on computer monitors, horizontal stages and applying the HA2500.
7. A full factory service department for timely repairs and instrument updates.

**Call 1-800-SENCORE**  
(736-2673)

## SENCORE

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