SENCORE NEWS

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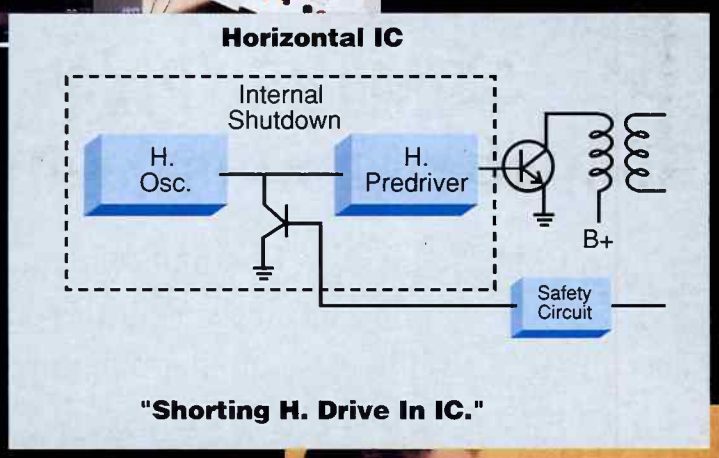

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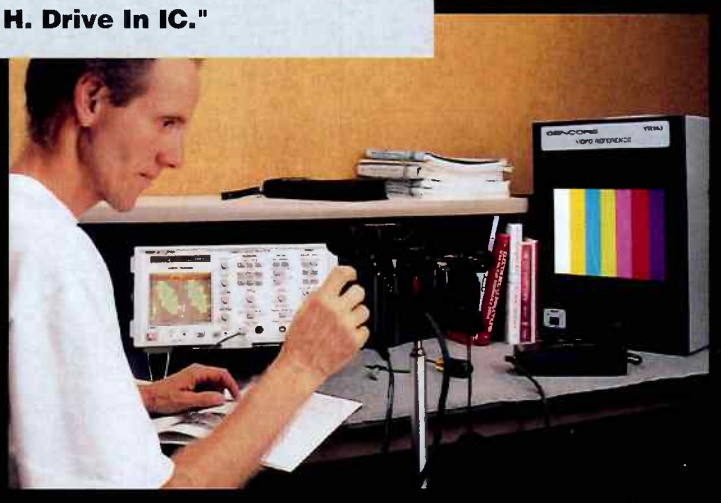

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CM125 "Pix Pak"™ Computer Monitor Signal Generator

The new CM125 "Pix Pak" Computer Monitor Signal Generator provides you with full computer monitor testing capabilities on the bench, in the field or wherever you service and test computer monitors. The new "Pix Pak" provides you with a fully programmable RGB scan frequency and pixel generator (video bandwidth to 125 MHz and 2048 x 2048 pixel resolution) plus, a complete set of troubleshooting and performance testing video patterns to help you identify all types of monitor defects.

PiXPak

To find out more on how the new CM125 "Pix Pak" Computer Monitor Signal Generator will enhance your servicing operation, simply call 1-800-SENCORE (736-2673) today.

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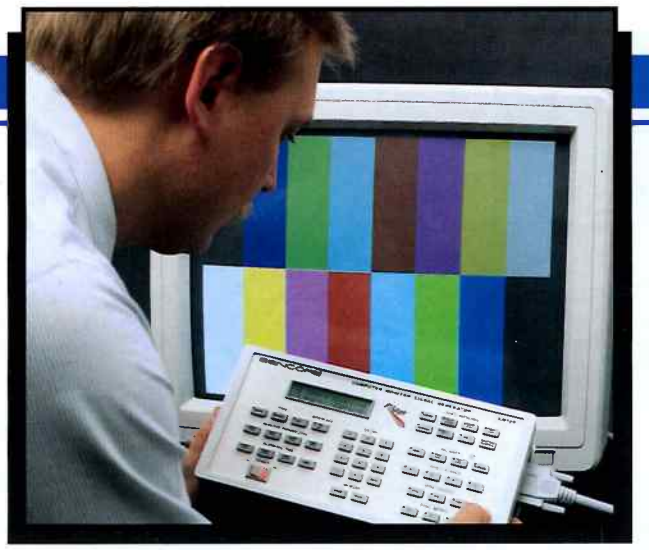

Introducing The New CM125 "Pix Pak" Computer Monitor Signal Generator

By Stan Warner, Application Engineer

The new CM125 "Pix Pak" provides all the test signals you need for computer monitor testing on the bench, on the test rack, or field calls. Check out the complete story of the "Pix Pak" in the article starting on page 3.

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Get ready for the opportunity that exists with computer monitor servicing. The future has never looked brighter for established and aspiring computer monitor servicers. Consider these facts:

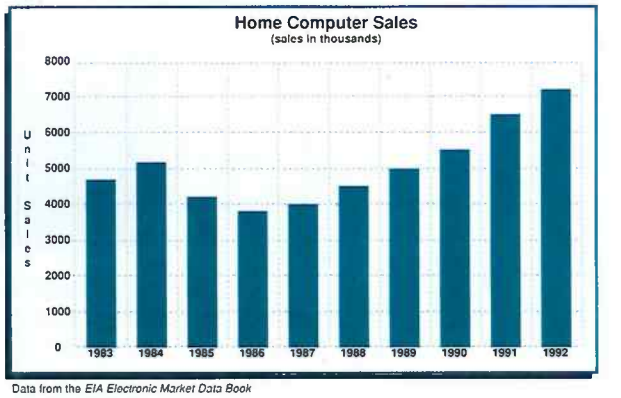
- Price declines have catapulted the personal computer into the mainstream consumer market (the computer monitor is one of the highest cost components in the personal computer system, and is the most likely to fail). Consumers that once brought only TVs, VCRs, and camcorders into your service center can be seen carrying in computer monitors as well.

- Over the past ten years the computer has become the "backbone" tool for most commercial operations opening the way for lucrative computer monitor repair contract accounts at hospitals, factories, office complexes, and universities.

- Consumers are upgrading from medium resolution to high resolution computer monitors...a trend that equates to tidy per unit bottom line margins for the resourceful servicer.

For the last year, we've offered the CM2125 Computer Monitor Analyzer to meet the needs of the servicers expanding into this growing field. The CM2125 delivers complete RGB video generating capabilities as well as the analyzing features that take you inside the computer monitor and help you troubleshoot the problem down to a single stage.

But as we've studied the business of computer monitor repair and listened to your input, we realized there were other times and places when servicers needed to test computer monitors without the full analyzing capabilities. We found areas in the service operation where only an RGB video source was needed. We found times when the servicer needed the RGB signals in portable applications. These findings led us to the development of the new



Data from the *EIA Electronic Market Data Book*

Fig. 1: Home computer sales are increasing as prices decline and consumers upgrade to better systems.

CM125 "Pix Pak" Computer Monitor Signal Generator.

Use The CM125 "Pix Pak" Wherever You Test Computer Monitors!

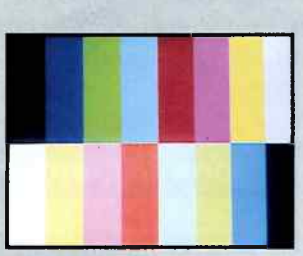
The CM125 "Pix Pak" Computer Monitor Signal Generator is an easy-to-use, portable, and lightweight RGB video generator. It weighs less than five pounds making it perfect for the bench, the test rack, or field calls.

The CM125 "Pix Pak" lets you test computer monitors and RGB projectors on-site, on the factory floor, in the engineering lab, in the data processing department, in the biomedical department, in the boardroom, in the

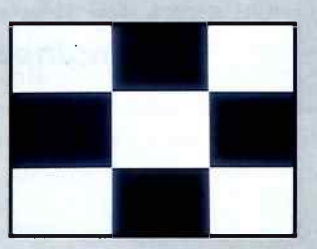
Fig. 2: Use the new CM125 "Pix Pak" for testing and aligning computer monitors in the field.

Tech Talk

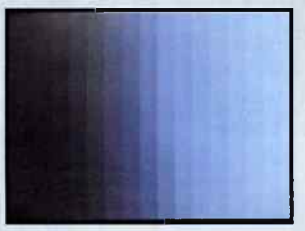
The CM125 Is An Innovative Performance Testing Pattern Generator



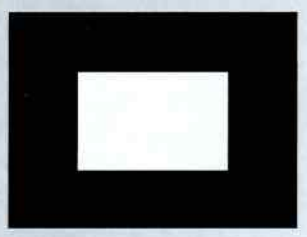
Color Bars: Use this pattern to test the monitor's ability to produce proper color. Check that each color bar is present. Check that the colors are uniform in intensity from top to bottom and left to right to catch possible video amplifier defects.



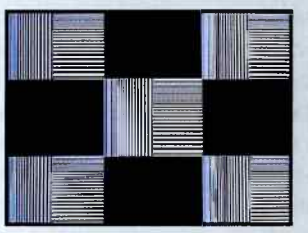
Windows: Use this pattern to test the monitor's power supply regulation. Check for a clear, distinct transition between the black and white portions. All the white boxes should be the same brightness level and the entire screen should be free of any ripple.



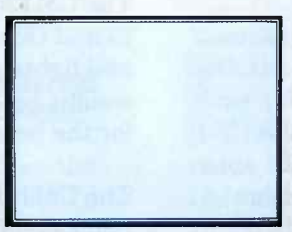
Staircase: This pattern tests the brightness and contrast linearity of analog and monochrome digital monitors. A properly working and adjusted analog or monochrome digital monitor will display 16 evenly spaced bars ranging from black to 100% white.



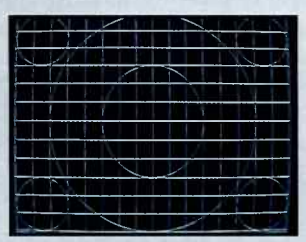
Window: Monitor manufacturers often require the WINDOW pattern for making internal contrast and brightness adjustments. The WINDOW pattern is also helpful for brightness and color adjustments when the CM125 is used together with a CRT color analyzer.



Multiburst: This pattern tests monitor resolution and bandwidth. The vertical lines test the horizontal pixel resolution and the horizontal lines test the vertical resolution. The one pixel wide line should be discernible on a properly operating monitor.



Raster: The raster pattern produces a box surrounded by a 1 pixel-wide border. Use this pattern to check color purity and high voltage power supply regulation.



Circle/Cross: The circles & boxes provide a test of the monitor's linearity. Check that each line is straight, that each box is square & the circles are round with no visible distortion. Use the dots for static convergence & the dots & lines for dynamic convergence.

Text: Use this pattern to make a final performance test on the monitor. This pattern fills the screen with upper and lower case text characters that duplicate user conditions. All the characters on the screen should be focused and easy to read.

Fig. 3: Use the CM125 on your burn-in rack or monitor display to thoroughly test monitors without phosphor burn.

home...or wherever computers monitors are used.

In your service center, use the CM125 "Pix Pak" on your burn-in rack, in the quality assurance department, on your monitor display rack, in the front lobby, or as a customer convincer at your front service desk.

The "Pix Pak" also works great on the service bench. Its small size helps open up precious real estate on your bench and the full RGB video generating capabilities will help you conquer the high resolution computer monitors that come through your service center. Use a CM2125 Computer Monitor Analyzer on your tough dog bench and CM125 "Pix Pak" for your "easy" repairs.

Powerful, Programmable RGB Video Generating Source In A Small Package

Pixels & Bandwidth For High Resolution Monitors

If you've followed the developments in the computer monitor market, one trend has become immediately apparent: new monitors have faster scanning frequencies and display more pixels. The higher scan frequencies and increased number of pixels have made vast improvements in the clarity and crispness of the displayed picture.

Technically speaking, faster horizontal scan frequencies and more displayed pixels equate to a greater video bandwidth. More pixels in

Fig. 4: The CM125's compact design saves you precious bench space.

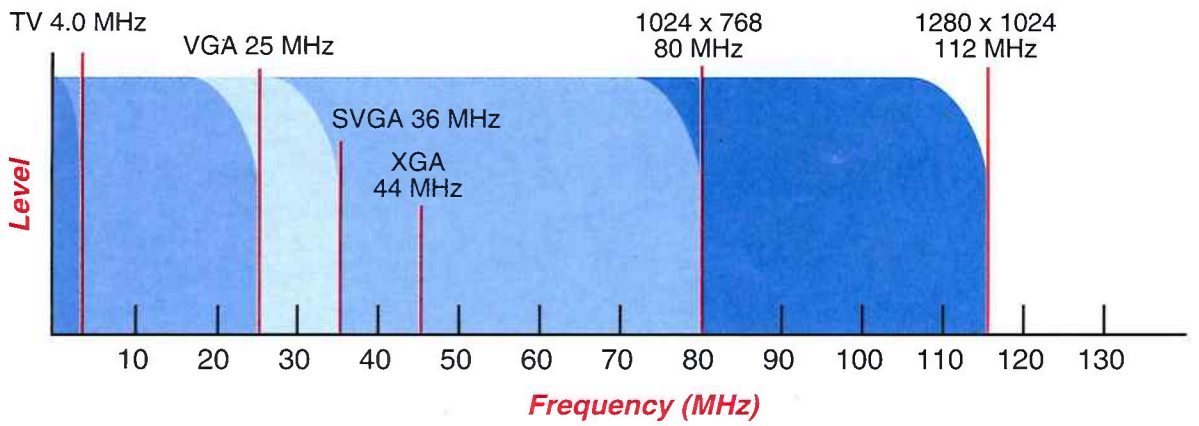


Fig. 5: The video bandwidth in computer monitors has increased dramatically in the last decade as the horizontal scan frequency and the number of displayed pixels have increased.

less time mean the video amplifier circuits and CRT in the computer monitor must "resolve" narrower pixel pulses. A computer monitor with a defective video amplifier may not be able to display the fine detail sent by the video source. A symptom of this may be fuzzy detail on high frequency graphics images.

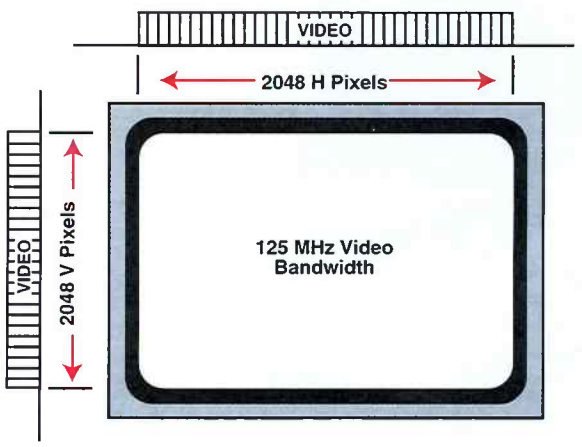


Fig. 6: Video bandwidth to 125 MHz and 2048 x 2048 pixel resolution make the CM125 "Pix Pak" excellent for testing and troubleshooting high resolution computer monitors.

As a servicer, you need a means for testing a computer monitor at its high video bandwidth and pixel resolution. This lets you know if there will be a problem with fine picture detail when the monitor is put back into the user's computer system.

Even though the CM125 "Pix Pak" is small, it packs a powerful pixel punch with 125 MHz video bandwidth and 2048 x 2048 pixel resolution. These capabilities let you test most of the high-end computer monitors at or near their full video bandwidth. When you send a repaired computer monitor back to the user, you'll have the confidence the display looks excellent, even on fine detail pictures.

Sync, Pixel, and Blanking Time Programmability

Computer monitor manufacturers are not bound to any format standards like television manufacturers (NTSC). The video card in the computer (signal broadcaster) and the computer monitor (the receiver) form a closed loop system. Computer and monitor manufacturers have the liberty to set their computer video scanning frequency and timing parameters at whatever value they deem necessary.

And what liberties they've taken. Figure 8 shows the scanning frequencies, pixel resolutions, and porch and sync times of some common computer monitor types. Can you see many similarities between the formats? None – if any. Sencore has produced a Computer Monitor Reference guide that contains many more formats. Call your Area Sales Representative at **1-800-SENCORE** for details.

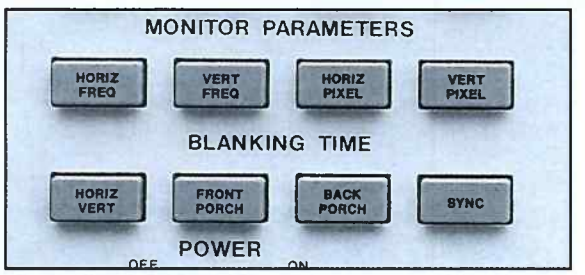


Fig. 7: The CM125 provides full programmability of scan frequencies, pixel resolution, and blanking times.

To achieve success in computer monitor repair, the servicer needs an instrument that generates the scan frequencies, pixel resolutions, and sync and porch times of the many computer monitor formats on the market. The servicer needs an instrument that generates the signals required on the monitors used in the past and in the future.

The CM125 "Pix Pak" is also fully programmable. This means you can adjust the horizontal and vertical scan frequencies, pixels, and porch timings (front porch, back porch, and sync) to match the computer monitor under test. This means the CM125 will test and troubleshoot the computer monitors on the market today as well as those that hit the market in the future.

Compatible With TTL, Analog, And ECL Video Types

Computer monitors receive one of three video formats: digital, analog, or ECL. As a computer monitor servicer, you need the capability to test each of these computer monitor types or risk losing business to your competition.

While most of the computer monitors sold today in the mainstream personal computer market use the analog video format, high end CAD/CAM monitors may use the ECL format. Most monitor manufacturers no longer sell the digital monitor type but many people still use digital monitors and you may need to service them from time to time.

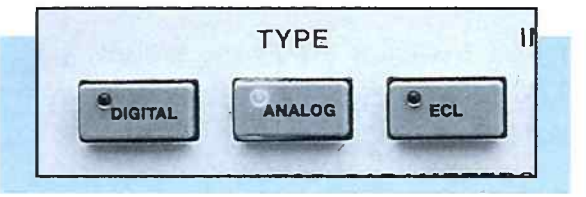


Fig. 9: The CM125 "Pix Pak" generates the digital, analog, and ECL video types for troubleshooting and aligning computer monitors.

The CM125 Computer Monitor Signal Generator provides the digital, analog, and ECL video types for troubleshooting and aligning these monitor types. Just select the video type from the front panel and the CM125 generates the proper video levels.

Storage Locations For 100 Computer Monitor Formats

Speed and efficiency in computer monitor servicing are of the utmost importance in today's competitive business world. To make maximum profit, you must quickly identify the symptom, get inside, isolate the defective component, and get back out.

Identifying the computer monitor type and

FORMAT		HORIZ FREQ (kHz)	VERT FREQ (Hz)	HORIZ PIX	VERT PIX	VERT FP	VERT BP	VERT SYNC	HORIZ FP	HORIZ BP	HORIZ SYNC
CGA, EGA Lo	640x200/60Hz	15.8	60.5	640	200	1.580	2.150	0.190	6.600	7.200	4.200
MDA, Hercules	720x350/50Hz	18.4	50.0	720	350	0.001	0.200	0.900	0.600	1.100	8.300
EGA Hi	640x350/60Hz	21.8	60.0	640	350	0.001	0.080	0.600	0.001	1.600	4.900
VGA 1	640x350/70Hz	31.5	70.1	640	350	1.180	1.910	0.060	0.640	1.910	3.810
MAC	640x480/67Hz	35.0	67.0	640	480	0.086	1.120	0.086	2.120	3.170	2.120
SVGA	800x600/56Hz	35.2	56.0	800	600	0.030	0.630	0.060	0.670	3.560	2.000
8514A, XGA	1024x768/87Hz	35.5	87.0	1024	768	0.030	0.563	0.113	0.180	1.250	3.920
VESA	640x480/72Hz	37.9	72.0	640	480	0.238	0.740	0.079	0.762	4.063	1.270
XGA-2	720x350/88Hz	39.4	87.9	720	350	0.811	1.344	0.051	0.254	1.268	3.042
Sony	1024x768/60Hz	48.8	60.0	1024	768	0.062	0.800	0.062	1.000	1.500	2.000
DEC	1024x864/60Hz	54.0	60.0	1024	864	0.001	0.629	0.056	0.160	1.680	1.850
Samsung	1006x1048/60Hz	62.8	59.8	1006	1048	0.001	0.542	0.127	0.150	1.580	1.880
Radius	1152x882/72Hz	66.0	72.0	1152	882	0.001	0.380	0.200	0.138	2.420	1.280
Radius/MAC	640x870/75Hz	68.9	75.0	640	870	0.044	0.610	0.044	0.559	1.120	1.680
DEC	1280x1024/60Hz	70.7	66.5	1280	1024	0.042	0.467	0.042	0.267	1.870	1.330
Sun	1600x1280/67Hz	89.2	66.9	1600	1280	0.011	0.471	0.112	0.001	1.400	2.030

Fig. 8: The scan frequencies, pixel resolutions, and porch and sync times of the most common high resolution computer monitors are stored in the CM125's memory locations.

providing the proper signal for driving the monitor can be time consuming tasks. As a computer monitor servicer, you need an RGB signal source that automatically provides you with the setups of the most common types of computer monitors. This lets you spend your time repairing monitors and not researching monitor formats.

The CM125 "Pix Pak" has 100 computer monitor setup storage locations for fast setup and testing. Forty-three of the locations are preprogrammed with the complete setups of the most popular monitor types on the market (including setups for many high resolution computer monitors). Just recall the "Pix Pak" storage location, hook up the monitor, and start testing.

We've left 57 of the storage locations open for storing your unique computer monitor formats. This prevents the CM125 from becoming obsolete as new computer monitor formats are introduced.

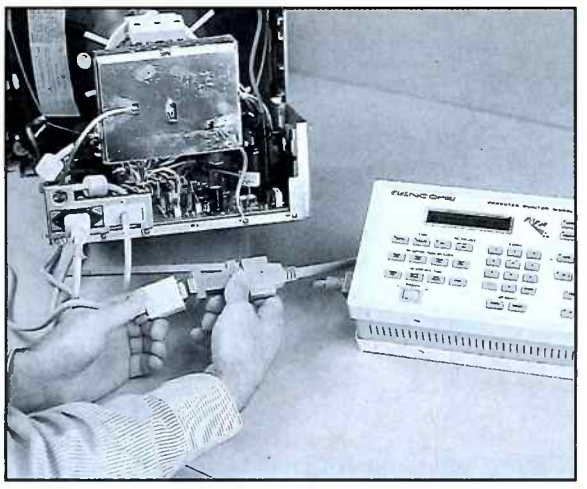


Fig. 10: The CM125's special hook-up adapters make connecting to a computer monitor a breeze.

Building connectors for all computer monitor types could be a time consuming task. You'd need to find a source for the connectors, you'd need to find out the wiring configurations, and you'd need to wire up the connector. If you're like most servicers, you don't have that kind of time.

The CM125 "Pix Pak" has adaptors available that match the output of the CM125 to the input of the computer monitor under test. These connectors are available for all of the common computer monitor types. You simply hook up the monitor with these connectors and start the tests. It even comes with a handy universal adaptor for all those one-of-a-kind and seemingly incompatible computer monitors.

How could the new CM125 help your computer monitor analyzing? Do you like what you see with the CM125? Call us today toll-free at **1-800-SENCORE** so we can set you up with a new CM125 "Pix Pak". Ask your Area Sales Representative about our special introductory offer on the "Pix Pak". Be one of the first to use this exciting new product. Just give us a call. ■

Complete Set Of Video Patterns Help Computer Monitor Testing And Troubleshooting

The patterns on the CRT provide you with a wealth of troubleshooting information about the circuit performance inside the computer monitor. A problem disguised with one pattern may become readily apparent with another.

As a computer monitor servicer, you need all the patterns that expose problems with computer monitor purity, convergence, linearity, resolution, and power supply regulation. Often the correct video pattern helps you quickly pinpoint the defect to an individual block or circuit just by analyzing the symptoms on the screen.

The CM125 Computer Monitor Signal Generator provides all of the patterns you'll need for complete troubleshooting and performance testing (see the Tech Talk box on page 4). You get patterns that dynamically test the operation of a computer monitor while exposing monitor defects that point you toward the defective circuits.

These video patterns let you do a final performance test on the computer monitor before you return it to the end user. A special pattern sequence feature lets you automatically cycle the video patterns several times a minute to prevent phosphor burns.

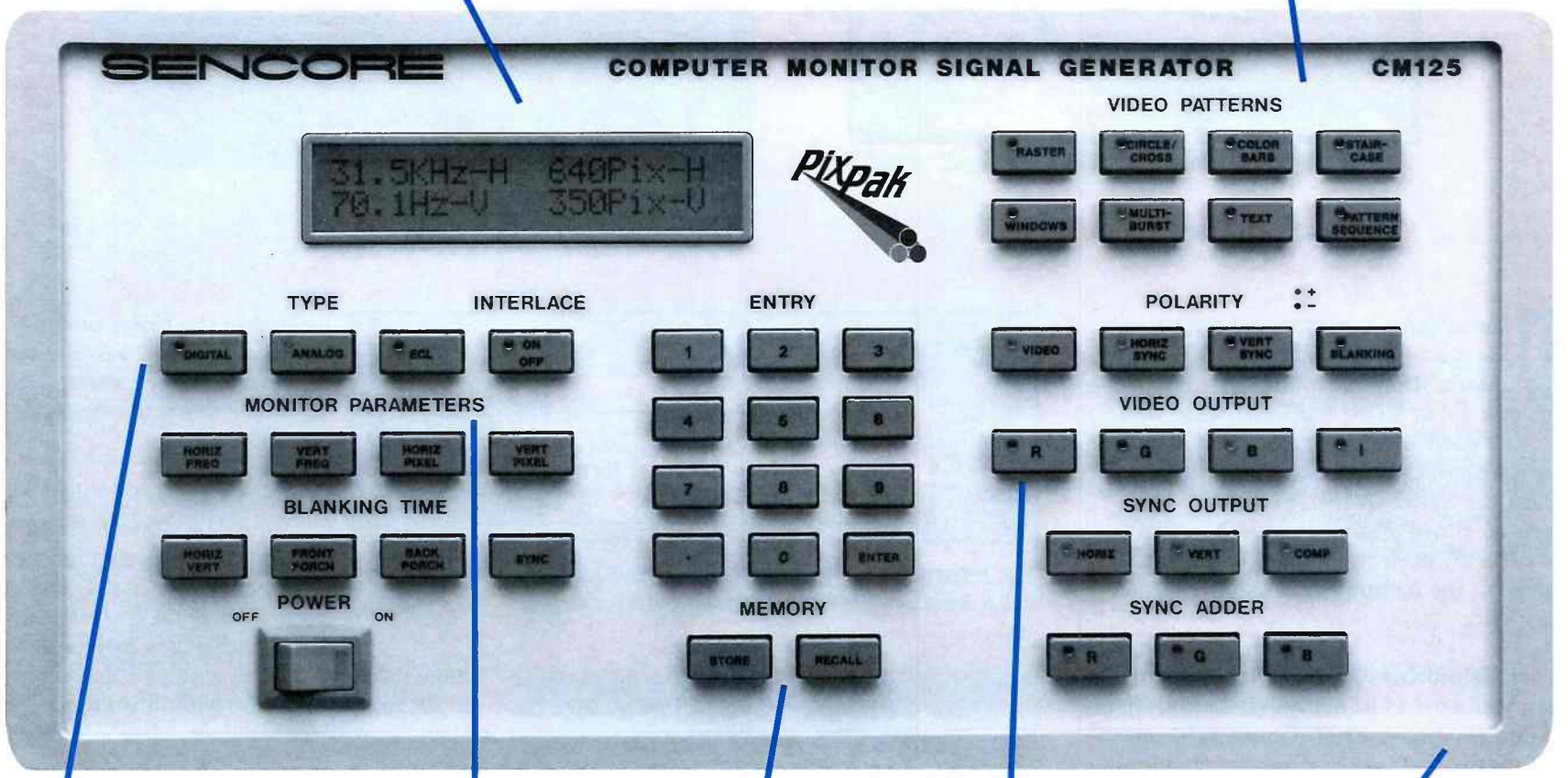
Hook Up Adaptors Make The CM125 "Pix Pak" Easy To Use

Just as there are a variety of computer monitor types, there are also a variety of input connectors: 9 pin d-sub, 15 pin d-sub, 15 pin high-density d-sub, BNC, etc. Some computer monitors have identical connector types but with different wiring configurations.

CM125 "Pix Pak"™
Computer Monitor Signal Generator

Monitor Parameters Readout – Shows the scan frequency, pixel resolution, and blanking timing of the signals generated by the CM125.

Video Patterns – The CM125's video patterns help you quickly troubleshoot, test and align computer monitors. Use the PATTERN SEQUENCE feature for doing monitor "burn-in."



Monitor Type – The CM125 lets you test analog, digital, and ECL computer monitor types with either progressive or interlace scanning formats.

Fully Programmable Monitor Parameters – Full control of scan frequencies, pixel resolution (up to 2048 x 2048) and blanking time parameters let you setup the output of the CM125 to match the input requirements of your monitor under test.

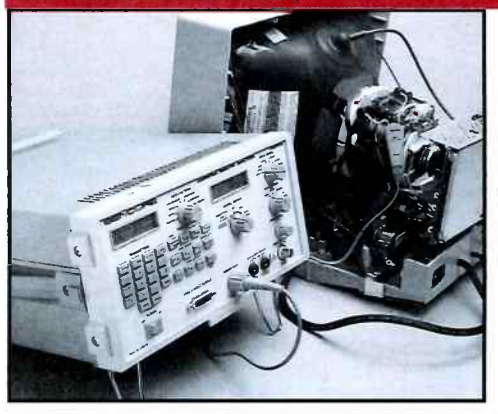
Storage Locations – 100 storage locations (43 preprogrammed) let you quickly store and recall the most common monitor formats you test.

Video and Sync Output Control – Turn on and off the video and sync outputs to help you test the power management circuitry in today's new computer monitors

Lightweight and Portable – The CM125 is small so it fits nicely on your bench or burn-in rack. It weighs less that 5 pounds so you can take it wherever you do monitor testing.

Sencore Computer Monitor Test Instrument Family

CM2125 Computer Monitor Analyzer



Complete computer monitor analyzing features that help you quickly narrow problems down to a single stage.

When do I need a CM2125?

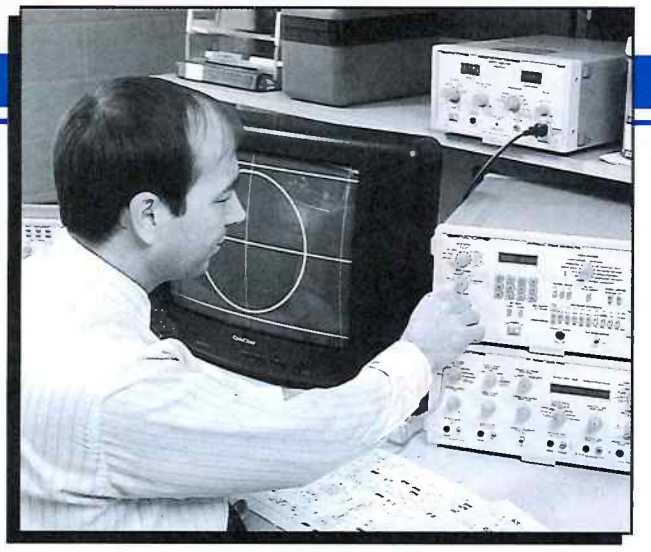
- Monitors requiring more than 30 min. to repair
- Tough dog monitor bench
- Low volume (component level repair)
- Many different monitor brands serviced
- Classroom training

CM125 Computer Monitor Signal Generator

Portable computer monitor signal generator for monitor testing at the bench, the burn-in rack or in the field.

When do I need a CM125?

- High volume (symptom cure)
- Field Testing
- Test rack (burn-in)
- Quality assurance
- Monitor showcase or display area



How To Isolate Video-IF Problems In A Goldstar GCT2064 Chassis

By Glen Kropuenske, Application Engineer

Other than a symptom-cure approach, most manufacturers provide little information on troubleshooting the IF stages of a TV or VCR. That's because there aren't any good ways to find IF troubles without a special IF analyzer like the one found in the VG91 Universal Video Generator. Since manufacturers hesitate to write procedures around a single piece of equipment, the technician is usually left on his/her own.

This article provides you with all the information you need to understand, troubleshoot, and align IF stages. First it covers the operation of video-IF stages and relates their operation to a Goldstar TV model GCT2064. Secondly it covers how to use signal substitution from the VG91's IF troubleshooting generator when troubleshooting video-IF stages. Then it shows you how the VG91 can isolate actual problems in these circuits.

The IF stages in the Goldstar TV chosen for this article are typical of today's TVs and VCRs. Most manufacturers use a similar IF design. Therefore, the VG91 troubleshooting and alignment techniques covered in this article can be applied directly to other brands and models.

Understanding The Video-IF Circuits And The Goldstar GCT2064

The IF signal from the tuner is comprised of video sidebands containing the luminance and color information. These video sideband frequencies extend in the range of 41.5 MHz to 46 MHz. Also present is the channel's audio carrier and accompanying audio sidebands at 41.25 MHz.

The video-IF is responsible for producing good receiver sensitivity and selectivity. Sensitivity is the ability of the receiver to produce a good picture with a weak input signal (500-1000 μV). Proper IF signal amplification is required to achieve noise-free pictures at this level. Selectivity defines how well the receiver passes the desired IF sideband frequencies while rejecting other interfering signals.

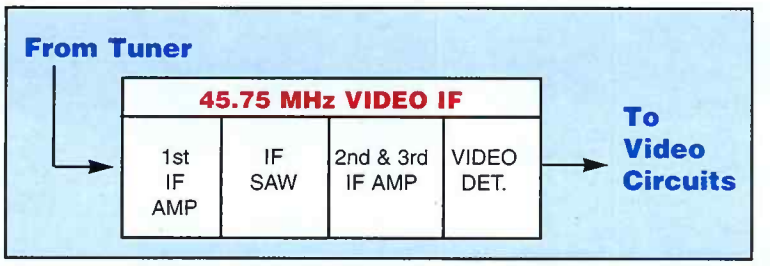


Fig. 1: Today's video-IF circuits include a 1st IF amplifier, SAW filter, 2nd & 3rd IF amplifiers and detector stages.

Today's video-IF circuits include a 1st IF amplifier, SAW filter, 2nd & 3rd IF amplifiers, and detector stages. The 2nd & 3rd IF amplifiers and detector stages are commonly part of a signal processing IC. For a thorough understanding of video-IF circuits, let's examine the individual IF stages and relate them to a Goldstar model GCT2064. A simplified block diagram is shown in Fig. 2.

IF Preamplifier

An initial 1st IF amplifier stage amplifies the IF signal. This amplifier stage may be called an IF preamplifier or SAW driver stage. This 1st IF amplifier is needed to make up for the normal insertion signal loss of the SAW filter.

The IF preamplifier stage may be found on the main chassis circuit board or inside the tuner enclosure. Many modern tuners include the 1st IF preamplifier stage as part of an IC located in the tuner module. When not included in the tuner enclosure, the IF preamplifier stage is a discrete transistor amplifier stage.

In the Goldstar GCT2064, the IF output of the tuner module is applied to a discrete transistor IF pre-amplifier stage. The stage consists of Q101 and associated components. The pre-amplifier stage provides a fixed gain of approximately 20 dB increasing the signal level to the SAW filter input (Z101) to approximately 20,000 microvolts.

The collector output of the predriver transistor Q101 feeds the video signals through C103. Transistor Q160 and associated components provide initial amplification and buffering for the audio IF signals around 41.25 MHz. These signals are input to a separate SAW filter input.

SAW Filter

Receiver selectivity is accomplished by using a surface acoustic wave filter (SAW filter). The SAW filter is a bandpass filter with sharp cutoff skirts. It provides an IF signal bandpass response that is much closer to ideal than was possible with interstage tuning transformers and traps. The SAW

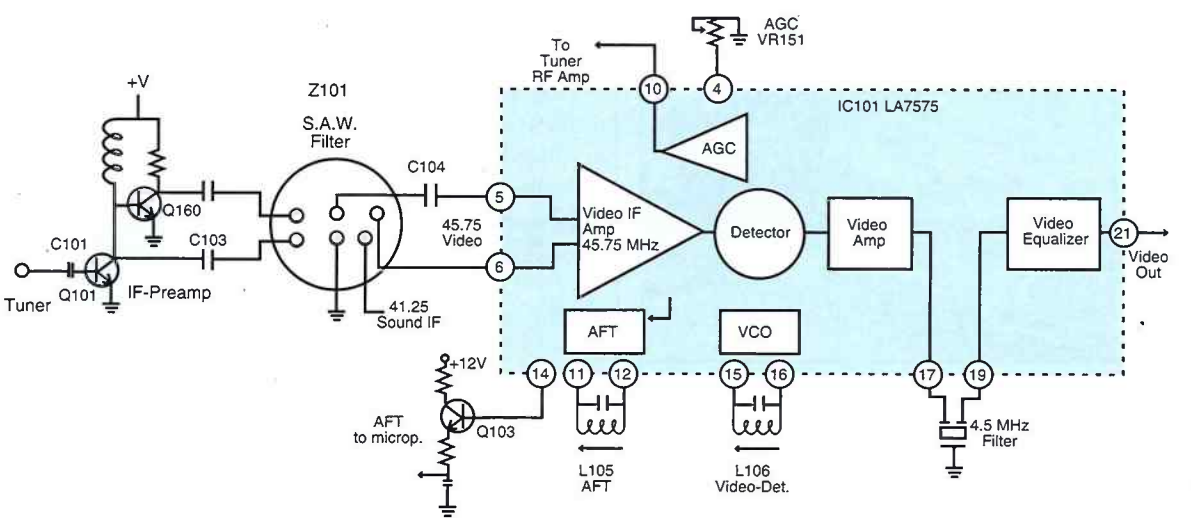


Fig. 2: Simplified diagram of the video-IF stage of a Goldstar GCT2064.

filter response is fixed during manufacturing and cannot be adjusted.

The heart of a SAW filter is a piezoelectric material with an input and output transducer plated onto the material. The input transducer converts the incoming electrical signal to mechanical vibrations. The mechanical vibrations (acoustical waves) travel across the surface of the material to the output transducer. The output transducer converts the mechanical energy back to an electrical signal.

The shape of the SAW filter material allows it to mechanically vibrate at the desired IF frequencies and resist vibrating at frequencies outside the desired IF bandpass. Therefore, IF sideband frequencies pass through the SAW filter while frequencies outside the IF bandpass are attenuated.

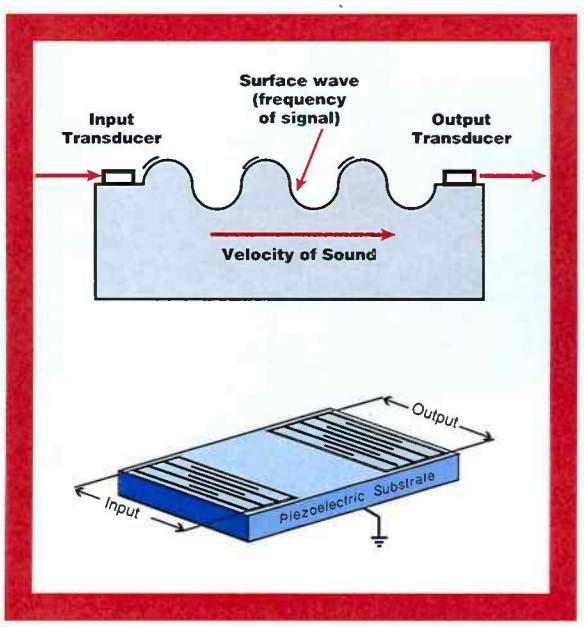


Fig. 3: The SAW filter passes IF sideband frequencies while rejecting unwanted adjacent channel signals.

There are four variations of IF SAW filters used among TVs and VCRs. The variations relate to the bandpass response and outputs. The most common type has a bandpass from 41 to 47 MHz passing the channel's video and audio IF signals to a single output. Other variations have a bandpass response to pass only the video (41.5 to 47 MHz) or the audio (41.25 MHz) signal to a single output. Another type has two outputs, one output for the video (41.5 to 47 MHz) and a second for the audio (41.25 MHz).

The SAW filter used in the Goldstar chassis has two outputs. One output is the 41.25 MHz sound carrier and sidebands. The other SAW filter output contains the video IF signals from 41.5 to 47 MHz including the 45.75 MHz IF picture carrier signal. This balanced output is coupled to pins 5 & 6 of the PIF/SIF processing IC (IC101).

IC Video IF/Detector Operation

The 45.75 MHz output of the SAW filter is applied differentially to an "IF processor" IC input. The IF signal first passes through several stages of IF amplification in the IC and then to a synchronous video detector. The detector removes the video information from the IF carrier and outputs a composite video signal. Some "IF processor" ICs contain a video amplifier to amplify the composite video output from the synchronous detector.

The synchronous video detector stage contains a carrier generator and balance detector bridge. The balanced detector bridge receives two inputs. The 45.75 MHz picture IF carrier is applied to the balanced bridge and a 45.75 MHz carrier generated by a tank circuit. Only the signals that are in phase with the 45.75 picture carrier are detected and output from the bridge.

The synchronous detector has three advantages over diode detectors: 1) increased IF signal gain, (less distortion); 2) good rejection of interfering signals: and 3) excellent linearity (better black, white, & gray shades). These benefits are only realized when the synchronous detector's tuning coil external to the IC is properly adjusted.

The IF processing IC (IC101) in the Goldstar chassis contains an IF amplifier, synchronous video detector and video amplifier stage. The differential IF signal is input to the IC at pins 5 and 6. The signal feeds an IF amplifier and is output to the synchronous detector. The synchronous detector's external tank circuit, connected to pins 15 and 16, must be tuned to 45.75 MHz for proper operation.

Composite video is output from the synchronous detector to pin 17. The video is fed to a 4.5 MHz trap at pin 17. This trap completely removes any sound signal that could cause a beat in the picture. The composite video signal re-enters the IC at pin 19, is buffered, and comes back out at pin 21.

AFT and AGC Operation

The IF processing IC contains an automatic fine tuning (AFT) and automatic gain control (AGC) circuit. The AFT circuit monitors the 45.75 MHz IF carrier frequency and outputs a DC correction voltage to the microprocessor which corrects the frequency of the tuner's local oscillator.

In the Goldstar chassis, the IF processing IC (IC101) produces the AFT correction voltage. An external circuit at IC pins 11 and 12 is tuned to 45.75 MHz. The internal AFT stages compare the frequency of the 45.75 picture IF at the SAW filter output to the tuned circuit. A DC correction voltage appears at pin 14 when the frequencies differ.

The AFC correction voltage at pin 14 is filtered to remove fast changes. Then it is buffered by Q103 and fed to the microprocessor (IC1) pin 20. Data sent by the micro to the tuner corrects the mixer frequency in the tuner to bring the IF carrier 45.75 MHz back on frequency.

The gain of the IF amplifiers is varied by the IF AGC to provide a constant level of 45.75 MHz IF signal at the video detector input. AGC is developed by monitoring the amplitude of the sync pulses at the video detector output. The gain of the IF amplifiers (and the RF amp if necessary) is adjusted continuously to maintain a pre-determined output level.

In the Goldstar chassis, AGC is developed inside IC101 by monitoring the video detector output. An RF AGC control voltage is delivered to the tuner from IC101 pin 10. The level of the RF AGC action is controlled by VR151. The external components at pins 3 and 13 filter the AGC voltage.

Subbing The Video/IF Signal Provides Positive Troubleshooting Results

Signal tracing is not a practical way to isolate problems in the video-IF stages for several reasons. First, schematics do not provide IF waveforms because signal levels (1-10 mV) are below the viewing sensitivity and bandwidth (45 MHz) of most scopes. Secondly, a modulated IF scope waveform is not easy to interpret and circuit loading by the test probe makes waveforms even more useless. Finally, the IF signal from the tuner is dependent on the AFT circuit. A problem in the tuner or video-IF AFT stage results in improper tuning and abnormal IF waveforms.

Signal substitution provides reliable troubleshooting results to isolate IF problems. With signal substitution, you inject a known-good IF substitution signal at the input of a stage. If you are injecting before the defective stage, you'll see little or no improvement in the video displayed on the CRT. If you are injecting after the defective stage, the signal passes through all the good stages producing a noticeable improvement on the CRT. To isolate the defective stage, you inject stage-by-stage until your original symptom appears on the CRT. You then know you are injecting at the input of the defective stage.

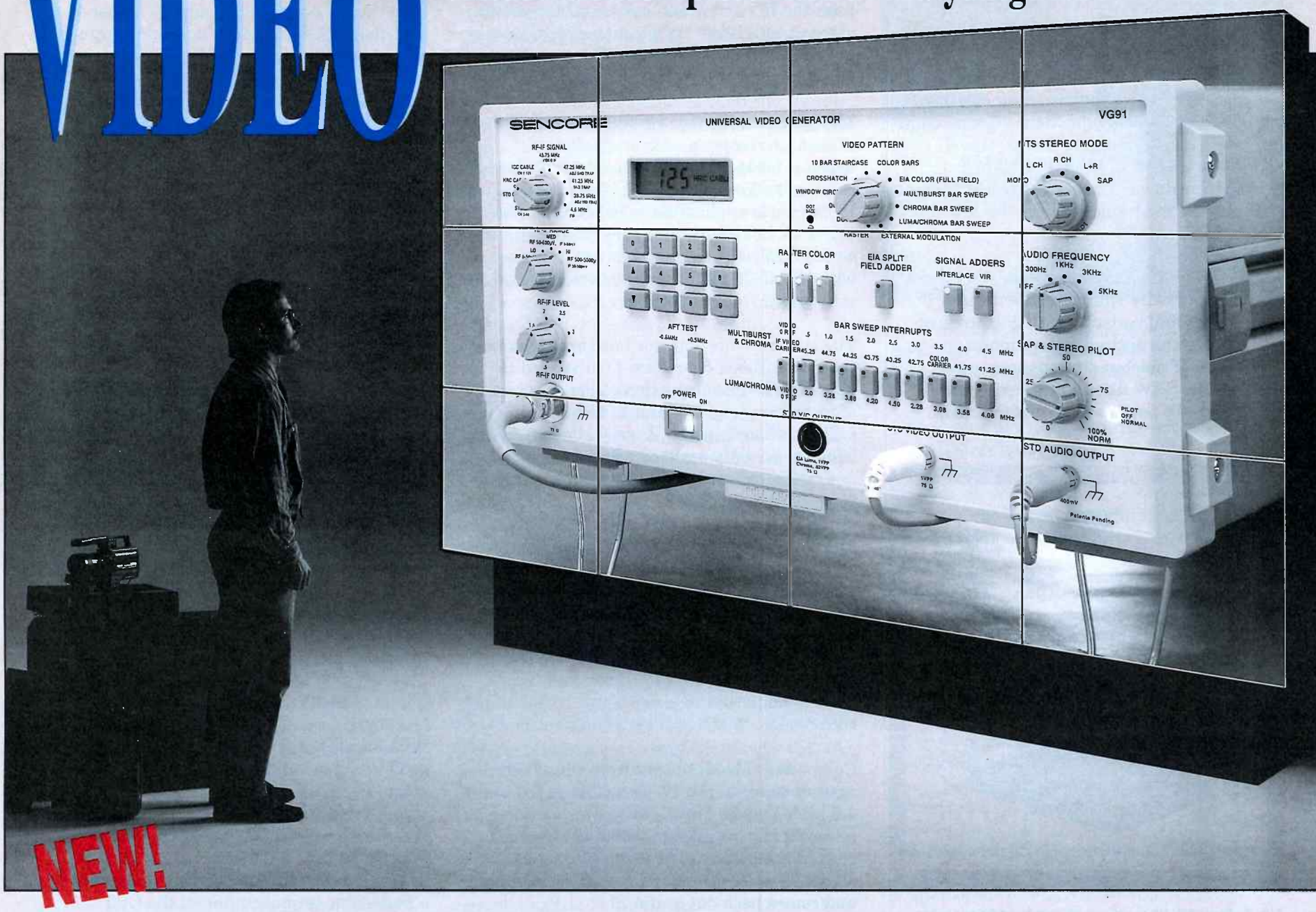
The VG91 provides a substitution 45.75 MHz video-IF signal. Three features of the VG91 IF generator make signal substitution into modern IF circuits possible. First the VG91 IF carrier is a stable and accurate IF carrier frequency. An accurate IF carrier is needed to pass properly through the SAW filter and for normal synchronous detector operation. Other tuner subbers or channel converters may shift the IF carrier causing frequency errors.

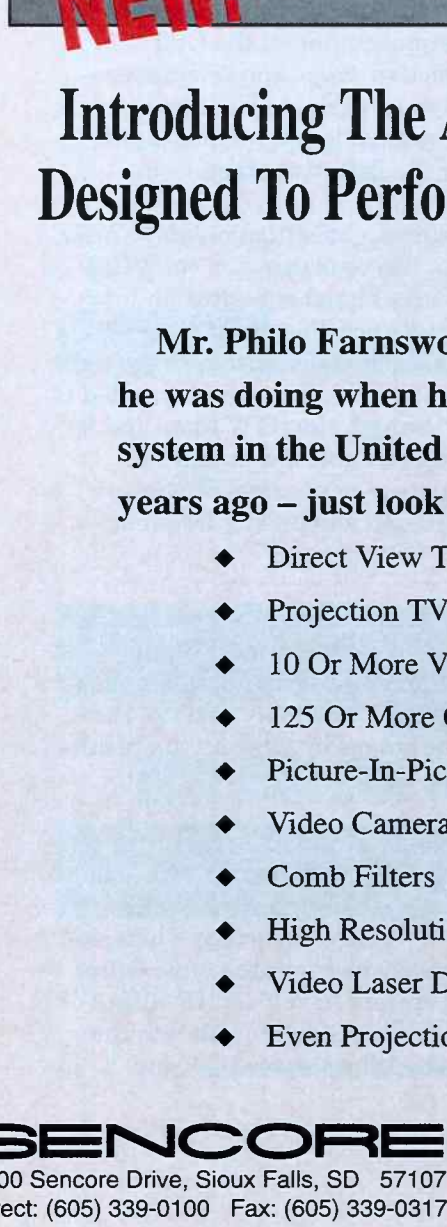
Secondly, the VG91's video-IF signal has full video and/or audio modulation so the IF, detector and AGC circuits all operate under normal conditions. You simply observe the operation of the stages by viewing the resulting video on the CRT.

Finally, the IF output signal level is fully variable from 0.5 mV to 500 mV so you can match the signal level found in any video-IF stage. This is especially important when isolating gain or noisy picture problems. Other subbers or generators have fixed IF output levels below what is needed to sub into the SAW filter or the IF processor IC.

VIDEO

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





NEW!

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

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Substituting The Correct Signal Level To The Three Key Test Points

There are three key test points used for troubleshooting in video-IF stages. The first key test point is the connection leading from the tuner module to the IF pre-amplifier. The second test point is the input to the SAW filter. The third test point is the input to the IF processor IC. Each test point requires a different input signal level and connection procedure.

The first key test point is the input to the 1st IF amplifier. Since most tuner modules are now mounted on the main board, this point can be found by tracing the circuit path from the "IF" pin of the tuner module through a capacitor to the base of the pre-amplifier or SAW driver transistor. ***Note:*** *This test point may not be accessible if the IF pre-amplifier stage is inside the tuner module. In these chassis, the "IF" pin from the tuner feeds signal directly to the SAW filter input.*

In many older model television receivers, a link cable connects the tuner to the video-IF circuits. The link cable usually has an RCA connector on one end. To connect the VG91's IF signal to these chassis, disconnect one end of this link cable and use one of the RCA adapters supplied with the VG91 Universal Video Generator.

A special IF Troubleshooting Balun is used to deliver signals from the VG91 to IF circuit test points when an RCA adapter cannot be used. Unlike CATV baluns, the IF Troubleshooting Balun capacitively couples the output signal. This prevents upsetting the circuit's normal DC bias voltages. The IF Troubleshooting Balun lets you substitute into both unbalanced and balanced signal inputs.

A third wire ground lead is included on the Troubleshooting Balun. When injecting IF signals, connect the third wire ground lead to the RF connector side of the balun. Connect the ground wire's alligator clip to the video-IF circuit ground. The ground connection eliminates interference and noise when subbing the 45.75 MHz video-IF signal.

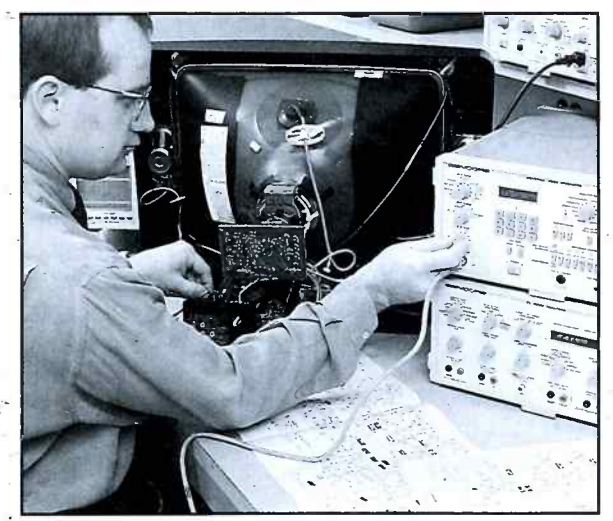

Fig. 4: Signal substitution provides reliable troubleshooting results to isolate IF problems.

Special Note: ***Make sure the TV chassis is plugged into an isolation transformer. Failure to use an isolation transformer will likely result in TV power supply or circuit board damage.***

To substitute the VG91 into the first IF test point (input of the IF pre-amplifier), use the RF/IF cable and RF/IF Troubleshooting Balun. Connect one of the balun's miniature test clips to the base of the IF preamplifier transistor. The ground clip of the balun should be connected to the IF circuit ground.

When substituting IF signals, the signal level input to a test point is important. You can sometimes feed so much signal into a defective IF stage that it essentially forces its way through. Therefore, you need to know what the normal signal level is for the stage and the level of the sub signal you're applying.

The normal signal level to the input of the IF pre-amplifier ranges from 1-4 mV. This corresponds to the "LO" position of the RF-IF Range switch of the VG91. Typically the noise disappears from the video displayed on the CRT as the RF-IF Level control is increased from 1-3 corresponding to 1-3 mV.

Circuitry inside the tuner module may occasionally pull down the VG91's IF signal when applied to IF test points connected to the tuner's "IF" pin. To eliminate the chance of tuner loading, unsolder and remove one leg of the capacitor leading from the tuner's "IF" pin to the base of the IF preamplifier transistor or SAW filter. Inject the signal again to the base of the pre-amplifier or SAW filter at the proper level and check for a noise free video display.

To substitute into the IF pre-amplifier stage of the Goldstar chassis, the RF-IF Troubleshooting Balun is connected to the base of Q101 and the ground clip is connected to the circuit ground. With the VG91 set to the "LOW" RF-IF range, increasing the RF-IF Level from 1 to 5 (1-5 mV) results in a snowy video pattern on the CRT. When a lead of C104 is unsoldered and removed, a good picture results at the "LO" range and "2.5" setting of the RF-IF Level control.

The second key test point in the video-IF is the output of the IF pre-amplifier transistor or the input to the SAW filter. This test point can be found by tracing the signal path from the collector of the pre-amplifier transistor through a coupling capacitor to an input pin of the SAW filter.

To substitute the VG91's IF signal to the input of the SAW filter, connect one of the IF Troubleshooting Balun's miniature clips to the input pin of the SAW filter. Connect the balun ground clip to the IF circuit ground.

The normal signal level to the input of the SAW filter ranges from 10-15 mV. This corresponds to the "MED" position of the RF-IF Range switch of the VG91. Typically the RF-IF Level control produces a noise free picture on the CRT when the RF-IF Level control is increased to 2 or 3 corresponding to 20 or 30 mV. When the VG91's IF signal is input to the SAW filter in the Goldstar GCT2064, a good picture results at the "2" setting.

The third key test point in the video-IF is the input to the IF processor IC. This test point can be found by tracing the signal paths from the SAW filter to the two input pins of the IF processor IC. IF processor ICs commonly contain balanced differential inputs (neither input connected to ground). Two input pins feed the IC a differential signal, meaning that the IC amplifies the voltage difference between the two SAW filters' output pins rather than the voltage between a single test point and ground.

Use the IF Troubleshooting Balun to inject the VG91's 45.75 MHz signal to the IF input of the IC. Connect the two miniature test clips of the IF Troubleshooting Balun to the IF input pins. Attach the third wire ground clip from the RF-IF Troubleshooting Balun to the IF circuit ground.

The normal signal level to the differential input of the IF processor IC is 1-3 mV. This corresponds to the "LO" position of the RF-IF Range switch of the VG91. Typically the RF-IF Level control produces a noise free picture on the CRT when the RF-IF Level control is increased to 2 or 3 corresponding to 2 or 3 mV. When the VG91's IF signal is injected into pins 5 & 6 of IC101 in the Goldstar GCT2064, a good picture results at the 1 (1 mv) setting.

Isolating Actual Problems

So far the information needed to isolate IF problems using the VG91 Universal Video Generator has been explained. But, the best way to see how effective signal substitution can be in troubleshooting video-IF problems is to look at several practical examples. We will insert three IF problems, one at a time into each IF stage of a modern chassis and observe the results of signal injection with the VG91.

Figure 5 summarizes the amount of signal we have to inject into the three IF test points of the Goldstar chassis to produce a good output as we isolate each problem. The same figure also shows the normal signal levels for comparison so you can see how the substitution levels change from normal.

For the first defect, a short is inserted between the base and emitter of Q101, the pre-amplifier transistor. Applying a normal 1000 μV signal to the antenna produces a noisy picture as expected. Surprisingly, when the RF signal level from the VG91 is increased to 4,000 μV (VG91 settings of "4" and "HI"), enough signal sneaks through to produce a noise-free picture.

When injecting the VG91's 45.75 MHz signal to the IF preamplifier input, 100 mV (Hi, 1) is needed to produce a noise-free picture. This

Problem	1st IF Input	SAW Input	IC Input
Normal Level No problem	Lo, 2.5 (2.5 mV)	Med, 2.5 (25 mV)	Lo, 1 (1 mV)
Short BE 1st IF Transistor	Hi, 1 (100 mV)	Med, 2.5 (25 mV)	Lo, 1 (1 mV)
Open C104, Bad SAW filter	Med, 1.5 (150 mV)	Hi, 1.5 (150 mV)	Lo, 1 (1 mV)
Defect IC101 Pin 15 short to ground	Hi, 5 (500 mV) *	Hi, 5 (500 mV) *	Hi 5 (500 mV) *

* Picture still not stable or clear

Fig. 5: Signal levels injected at key IF test points for good output under normal and problem conditions.

is almost 100 times the normal level of 2.5 mV (Lo, 2.5). Moving the injection point to the SAW filter input shows that a normal amount of signal clears up the symptom. And the latter test point or IF input to the IC requires a normal input signal level. Injection clearly shows the problem is in the first IF amplifier stage.

Removing the defect from the first IF amplifier stage, we introduce a problem into the SAW filter. One lead of capacitor C104 is unsoldered and removed from the circuit board to simulate a defective SAW filter. When applying a normal 1000 μV signal to the antenna, no picture or video is seen on the CRT. When the RF signal level is increased to 5,000 μV (VG91 settings of "5" and "HI"), a noisy picture is produced.

As with the first problem, a considerably higher than normal signal level must be injected to the IF preamplifier to produce a noise-free picture. But the signal level needed at the SAW filter input is 150 mV compared to the normal signal level of only 25 mV. Moving to the IC input, however, returns a clear picture with the normal signal level of 1 mV. These injection results indicate the problem is between the SAW filter input and the IC input, leaving the SAW filter as the likely bad component.

Finally, we correct the SAW filter problem by soldering C104 back into the circuit and simulate a defect with the IF processor IC by shorting pin 15 to ground. Shorting pin 15 disables the synchronous detector stage of the IC.

With this problem, substituting the 45.75 MHz into the three key test points did not restore a picture to the CRT. To isolate the defect to the IF processor IC, the SC3100 "AUTO TRACKER" was connected to pin 17 and set to view a video waveform. When subbing the 45.75 MHz signal to the IC input at the proper level, no output was seen on the "AUTO TRACKER". This isolated the problem between the IC input and the IC's video output at pin 17.

In each case, the VG91's IF generator accurately indicated which stage was defective. To isolate the defect, you simply watched the CRT or Waveform Analyzer connected to the video test point as the signal was injected into each IF test point. You adjusted the VG91's output level controls to produce a noise-free picture or trace. Then you read the VG91's RF-IF Range and RF-IF Level control settings and compared the injected signal level to the normal level found in these stages.

As you can see, IF troubleshooting can be very challenging. Even the most experienced technicians tell us some of their tougher problems end to up to be IF problems. And without the right tools, these problems just get tougher.

Do you have questions? Do you need more information on troubleshooting IF sections? Call us toll-free at **1-800-SENCORE** today. Your Area Sales Representative can help set you up with the tools and the knowledge you need to tackle even the toughest IF problems. Whether it's theory, troubleshooting, or alignment, we're here to help. ■

Build Your Business With The VC93 All Format VCR Analyzer

By Brian Phelps, Product Marketing Specialist

Why is VCR servicing more profitable than ever? First let's consider that there are more VCRs in use today than ever before. In fact, the latest EIA statistics show VCR and camcorder sales up by almost 6% over 1993.

Now, consider that consumers today are expecting (and paying for) a superior quality picture from their "hi fidelity video systems". With the new designs that are appearing with better picture reproduction, better sound quality, and a seemingly endless list of features, customers will be more willing to have their VCRs repaired rather than replace them.

This all means that more VCRs than ever will need to be serviced as each day passes. So it's easy to see why VCR service is a profitable and growing market for the servicing professional who sees it as a big opportunity and has the proper tools and technical knowledge to handle it.

How To Cash In On This Big Profit Potential

So, what do you need to handle these advancements and cash in on this big market potential? Well, first you need the technical knowledge of just what makes a VCR tick. It's knowledge that a sharp video professional like yourself has probably already mastered. Then you need an advanced instrument that will allow you to handle the influx of new technology with confidence – and without becoming obsolete or requiring additional accessories or add-ons.

This advanced instrument will need to have the versatility to check the multitude of VCRs you'll be seeing – from BETA to 8mm. And, most importantly, this advanced instrument will need to be one you can use with confidence, without worrying about damaging the instrument or the VCR you're servicing. Is such an advanced instrument available, you ask? You bet – meet the patented VC93 All Format VCR Analyzer – the only total answer to VCR analyzing and profitable servicing.

Here's How The VC93 Can Help You Cash In On The Big VCR Servicing Market!

The VC93 Is Guaranteed To Help Troubleshoot Every VCR You'll Ever Want To Test -

Have you ever been caught short in front of a customer? You'll never be embarrassed by not being able to accept a VCR format because your test equipment wasn't designed to be operated with the particular format.

The point is, if you're interested in providing complete customer service for all of your customers' VCRs, then you need to be ready for all the various formats that may come into your service center. The VC93 All Format VCR Analyzer matches the signals found in all consumer VCRs and camcorders as well as any other formats using a "color under" scheme. Even though each format has major signal variations compared to the others, you don't need to worry about them when you use the VC93. Selecting the correct format with the VCR Format switch converts every signal and every test to the correct type needed for the deck you are servicing. This makes every test work the same, no matter which VCR you want to test or repair.

The VC93 prepares you for whatever format that enters your service center. Simply set the VCR Format switch to match the VCR type, and the VC93 will properly match all the luminance, chroma, and Hi-Fi signals that you need for proof-positive troubleshooting. Now your customers can count on you to be their one stop service center for all their needs. After all, isn't that what you want to be to your customers?

Fig. 1: The VC93 All Format VCR Analyzer is the only total answer to analyzing all VCR formats.

Guaranteed To Be The Most Versatile/Complete VCR Analyzer On The Market -

The VC93 ensures your capability to accurately and quickly test all stages of a VCR. The patented Servo Analyzing Tests quickly identify if there is a servo (capstan or cylinder) defect in less than 5 minutes. Combined with the exclusive signal injection troubleshooting signals, the VC93 will become your best confidence builder for all VCRs.

Are the heads really bad? Or is it the tape path, preamps, modulator or another part that is causing the snowy picture? If the modulator where receiving a good signal, would it work correctly? Is the signal coming into the IC correct, and if it were, would the IC function correctly? How you answer these questions could be the difference if the new part stays in the VCR or ends up on your parts shelf.

One sure fire method of isolating defects is through signal injection. For those of you who are not familiar with signal injection as a troubleshooting tool, here's a quick and easy example. Imagine if you had an extra set of video heads you could use to see if the heads in any VCR were bad. Well that's what signal injection is. You simply inject a known-good signal for the suspect bad signal.

The VC93 All Format VCR Analyzer is the instrument that supplies signal injection for troubleshooting VCRs. With the VC93, you can signal inject into every circuit inside the VCR, from the heads to the output jacks. This includes the head circuits, luminance, video, color, audio, and servo circuits. And the beauty of the VC93's signal injection capabilities is that you don't need to disconnect any components or use fancy test jigs.

Simple, easy-clip connections to existing test points or directly to components is all it takes.

The other beauty of signal injection is that it makes all VCR makes and models look the same. All of your troubleshooting will follow the Universal Block Diagram approach. This approach simplifies your troubleshooting because you'll be working with standard signals and test points that are common in every VCR. For example, every VCR will have a head switcher, luminance circuit, chroma input and output, and baseband audio stages. Also, the inputs and outputs of these stages are the same in every VCR. By injecting at the inputs and outputs, you'll easily isolate the defect between the injection points – typically an IC, transistor, or reactive component.

Only the VC93 All Format VCR Analyzer allows you to prove the condition of expensive VCR components before ordering new ones. With the VC93, you can reduce inventory while decreasing your analyzing time, which adds profits to your business.

Guaranteed To Eliminate Guesswork With Dynamic VCR Head Signal Substitution For All Consumer Formats – Remember the last time you spent hours servicing a suspected servo defect, with an invoice that would have amounted to about $125, only to find that when the idler tire went bad, it took the heads out also by allowing the tape to come in contact and snagging the heads? Will the customer go another $60 for a new set of heads? Chances are they won't.

With the VC93 All Format VCR Analyzer, you actually have another set of heads available at your fingertips that you can use to verify the condition of the existing heads. The VC93's exclusive signal injection capabilities allow you to substitute for the signal being picked up by the video and audio heads. This allows you to quickly identify if the heads are not picking up the signal or if the remainder of the circuits are not processing the signal correctly. Only the VC93 offers this capability on all consumer formats – you'll never again be caught short, no matter what VCR format comes into your service center. ■

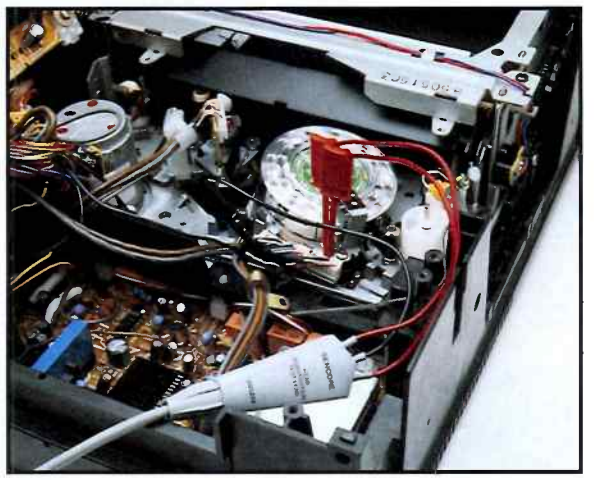

Fig. 2: The VC93 lets you substitute signals in any format to isolate problems in any circuit in the VCR.

6 Ways The VC93 Can Help You Cash In On Big Profits & Customer Satisfaction

We've listed six of the many ways you can use the VC93 All Format VCR Analyzer to help add profits to your service center. This information is simply a brief explanation of the techniques used by successful service centers. Let Sencore and the VC93 help your service business.

#1 Accurate Efficient Repairs

The VC93 All Format VCR Analyzer is specially designed to prove the condition of a VCR before you order any parts. It does this by verifying which circuits are working and which are not working. And by using signal injection and functional analyzing, you can quickly step through a VCR and isolate the true defects as well as determine if there are multiple defects.

#2 Like-New Certification

What if we showed you a way that you could make money by guaranteeing your service work has returned the VCR to like-new condition? A number of our video servicers charge a nominal $5 for a "Proof of Performance Guarantee" and come out way ahead with big profits in the till. Here's how it works:

5	VCRs service per day average
x $5	added income from "Proof Of Performance"
$25	extra profit per day
x 20	working days per month
$500	profit added to your business per month

You test the VCR with the patented Servo Performance Tests and record the results on the stickers offered by Sencore, then attach the test results to the VCR.

No matter how you look at it, you're coming out ahead. In fact, if you look at the simple math behind the "Proof Of Performance Guarantee" you'll see your investment quickly pays off. (Call **1-800-SENCORE** for details)

#3 Advertise To Bring In Business

Do you remember the "Mr. Goodwrench" commercials? These commercials were advertising the fact that the service technicians were fully trained and had the proper tools for servicing GM products. It's all in marketing your business and services. You're probably already advertising in various formats, yet you may not have the edge to sway the customers to come to your service center.

You'll have the edge you need with the VC93 All Format VCR Analyzer. Advertise that you have the latest in diagnostic equipment to bring the VCR to like-new condition. Advertise that you have a complete service facility to properly handle all VCR defects in a timely manner. And advertise that you can work on all formats.

#4 Contact Schools & Hospitals For Added Revenue

Schools and hospitals can be an untapped resource for profits. The number of electronic products used by these facilities can be quite large and are typically used very frequently. You can lock in your business as the servicer for these potential customers by simply making a contact, offering a token discount to ensure the business, and providing quality service. However, once you've landed these accounts, you'll want to ensure you keep them by servicing the account and providing them with priority customer service. The VC93 can help in this area as well.

Perhaps you can negotiate a routine maintenance agreement. Use the VC93 to go on location and check the operation of all the VCRs in use. Your time investment is minimal, yet your profits can be high.

#5 VCR Repair Clinics With Same Day Estimates

Advertise a quick-check repair clinic. Let potential customers know that in less than five minutes, you'll provide them with an estimate or repair the product the same day. Invite people to bring in the VCRs that have been sitting in their closet, VCRs they may want for a spare, or to have their VCR checked before they go buy a new one.

You'll be spreading your business name, meeting potential customers, and adding potential profits to your business. You can come out looking like a hero if you can save the customer from buying a new VCR, as well as setting yourself up as the servicer for other products the customer may need to have repaired in the future.

#6 Offer Free Estimates

Pull in those "closet VCRs" with a free estimate promotion. You know most defective VCRs in the closet, basement, or garage are there because the customer feels it will cost too much to have it repaired. Most customers think the heads are bad because they've heard that they fail and can be expensive to replace. With the VC93, you can quickly verify if the heads are defective, the servos are causing the problem, or if there is no defect at all.

Now's the time to cash in on VCR testing. Call **1-800-SENCORE** today and let us put a VC93 All Format VCR Analyzer on your bench risk free for 30 days. Let the VC93 become your newest avenue to more efficient troubleshooting and increased profits.

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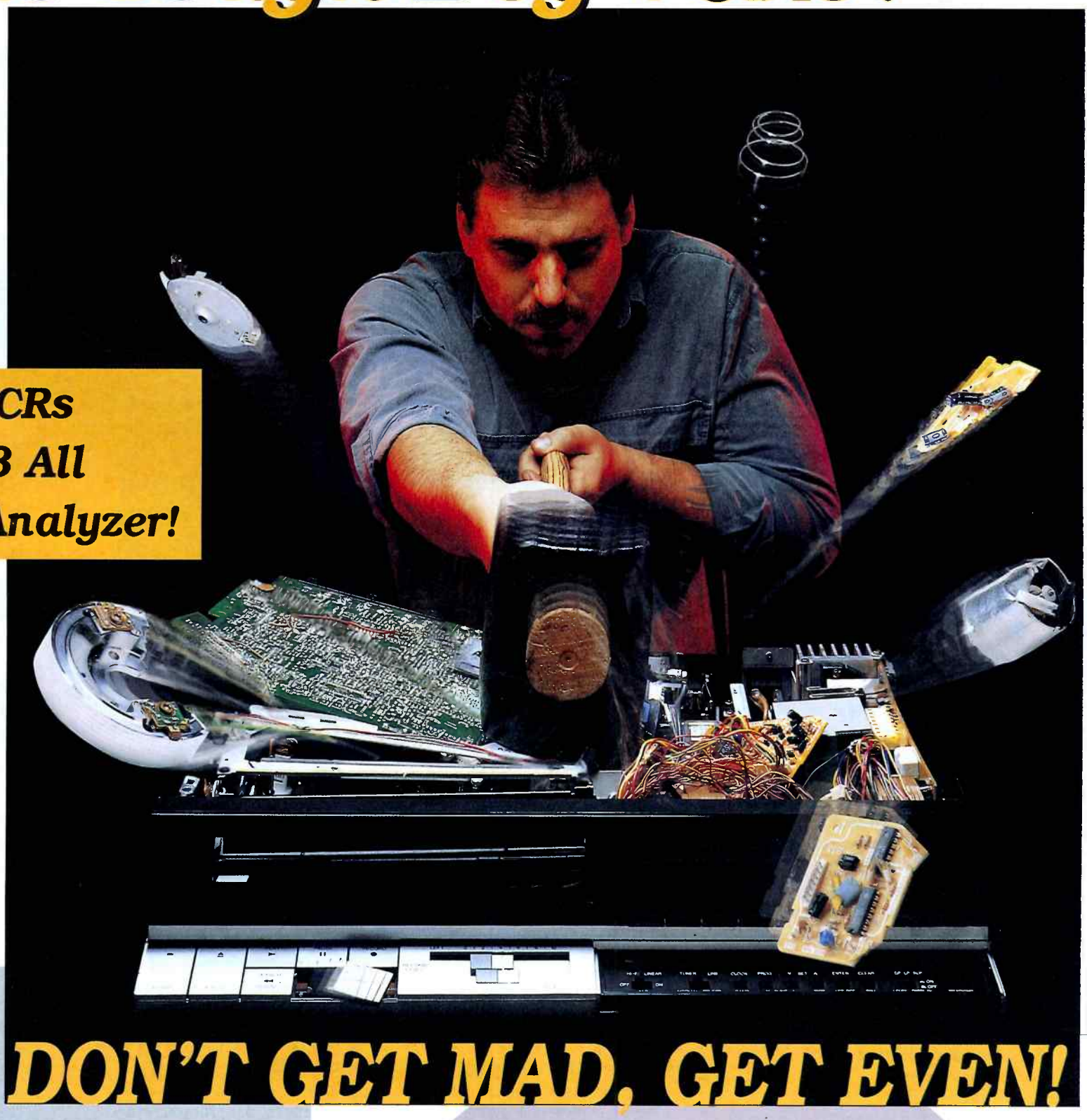

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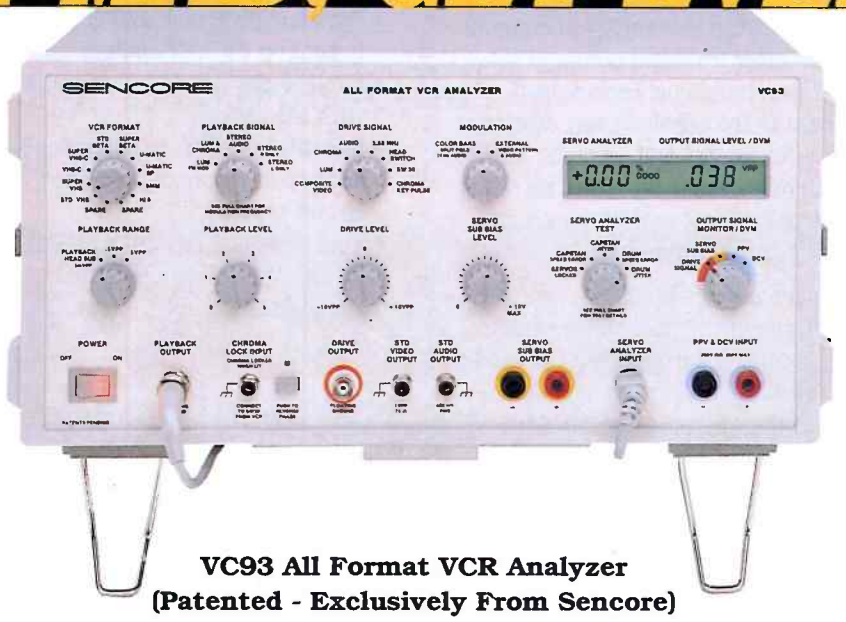

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Sencore "Tech Choice" Technical Troubleshooting Demonstrations

Sencore has announced it will begin holding six new troubleshooting Tech Schools and seminars starting this fall at various locations around the U.S. and Canada. Each Tech School and seminar concentrates on a special subject providing technical troubleshooting information with demonstrations and/or hands-on activities.

Each seminar provides servicers with a better understanding and practical troubleshooting experience on each topic. Many valuable troubleshooting tips are demonstrated that help eliminate guesswork and reduce repair time. Plus, learn how the Sencore "Tech Choice" instruments will improve troubleshooting skills on today's modern circuits.

Hands-On Camcorder Troubleshooting - $79

(Attendance limited to first 20 registrants)

This full-day Tech School gives hands-on experience and techniques for troubleshooting and repairing camcorders. There's only one way to gain experience with camcorder troubleshooting - and that's by troubleshooting camcorders. Learn how to diagnose and isolate camcorder problems by using dynamic and exclusive tests in a bench setting.

The program includes:

- A 10 point dynamic camera video test procedure without taking the camera apart.
- How to accurately diagnose any camera video problem using IRE, millivolt, or percentage of burst.
- How to use the nine video reference charts to test, troubleshoot, and align cameras quickly and more profitably.
- How to quickly isolate camcorder servo problems using an exclusive two lead hookup test...without removing the camera case.
- A certificate of camcorder troubleshooting achievement.

Hands-On Computer Monitor Troubleshooting - $79

(Attendance limited to first 20 registrants)

Discover the technology of computer monitor troubleshooting at this full-day, hands-on Tech School. Learn to troubleshoot any computer monitor format and pinpoint defects with quick and easy tests. Be ready to troubleshoot real problems on real computer monitors.

The program includes:

- Dynamically troubleshoot any computer format from CGA to hi-resolution in three easy steps.
- Pinpoint circuit defects with special sync locked substitution signals without disconnecting any components.
- Dynamically analyze yokes, flybacks, IHVTs, and switching transformers.
- Troubleshoot any switch mode supply, using the 4-M.I.C.s (most important circuits).
- A certificate of computer troubleshooting achievement.

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Learn how to:

- Isolate UHF, VHF, cable, IF, and video problems in seconds.
- Dynamically check and accurately set any TV AFT system.
- Exclusively test H.O.T. circuits with the set off!
- Substitute H.O.T. to dynamically analyze any horizontal output circuit problem.
- Test flybacks, IHVTs, and SMPS transformers using patented ringing tests.

VCR Troubleshooting Demonstration - Free

Latest "head to servo" troubleshooting techniques that are guaranteed to turn estimates into revenue.

Learn how to:

- Accurately troubleshoot/test for bad heads fast.
- Dynamically isolate any luminance, chroma, or audio problem.
- Isolate any servo problem with exclusive two lead hook-up... without removing the VCR cover.
- Turn tough dogs into cash hounds.

Testing and Diagnosing Camcorders - Free

Want to get started in camcorder service? Then this afternoon demonstration is just the ticket.

Learn how to:

- Test camcorders and know what to look for.
- Take in the latest information on camera test procedures and diagnosing problems.
- See how to distinguish camera signal defects and isolate camcorder servo problems more profitably than ever before.

See how to test and diagnose camcorder problems.

Basic Computer Monitor Troubleshooting - Free

A secret servicing opportunity for a few good techs! This one night seminar gives all the basics needed to start troubleshooting computer monitors.

Learn how to:

- Troubleshoot different computer monitor problems using exclusive video patterns and dynamic drive signals.
- Diagnose the most expensive parts of a computer monitor - flybacks, yokes, and CRTs.
- Get a troubleshooting pattern on any monitor, CGA to the latest hi-resolution multi-sync.

Following is a partial list of the seminar sites scheduled for the near future. To find out if one of these fact-filled demonstrations or hands-on seminars is coming to your part of the country, give us a call at 1-800-SENCORE and ask for your Area Sales Representative.

Tech School Cities

Cleveland, OH	Raleigh, NC
Denver, CO	Seattle, WA
Las Vegas, NV	Nashville, TN
Los Angeles, CA	Canada (call for locations)
New York, NY	Atlanta, GA
San Francisco, CA	Orlando, FL
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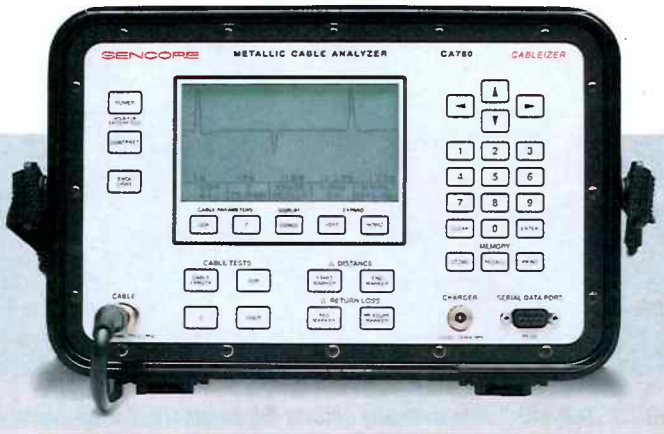

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Service Center Profile: Increasing Productivity With The SC3100 "AUTO TRACKER"™

By Brad Johnson, Product Marketing Specialist

Editor's Note: *The SC3100 "AUTO TRACKER" has become a very important piece of test equipment for technicians and engineers in all walks of the electronics field. This article will focus on how the "AUTO TRACKER" has helped Kurt Hanson of The Whitlock Group quickly analyze several different areas of computer and computer monitor repair.*

The Whitlock Group is an affiliate of a national organization that specializes in computer, television, audio/visual equipment, and computer monitor repair. With over 200 employees, they are one of the largest computer sales organizations in Virginia and expanding every day. Whitlock has five hub locations throughout the state that serve primarily as dropoff locations.

One of Whitlock's lead technicians, Kurt Hanson, tells us the majority of their monitor service work, including warranty work for most manufacturers, is handled by the Richmond office. They perform repair on all types of computer monitors ranging from 10" all the way to 45" direct view monitors used for presentations and software development demonstrations. Besides monitor repair, Kurt says The Whitlock Group is involved with the repair of computer boards down to component level. In addition to the computer side of the business, they also have a division that handles the sales and rental of all types of electronic devices ranging from television production systems to projector units.

Like many large companies, Kurt's division is run as a separate business inside the larger organization. According to Kurt, that means they need to be able to show a profit on everything they service. Does that sound familiar?

The Whitlock Group and Kurt believe that the right instruments can make the difference between a making a profit and wasting time on costly re-works. Kurt's service bench is covered with Sencore instruments including the CM2000 Computer Monitor Analyzer, VG91 Universal Video Generator, TVA92 TV Video Analyzer, CR70 "BEAM BUILDER" CRT Analyzer & Restorer, a PR570 AC "POWERITE II", and the original PR57 "POWERITE".

We asked Kurt why he chooses Sencore instruments for troubleshooting on his bench. Kurt's answer was simply, "I know that Sencore equipment was designed for technicians. Each unit is laid out so it is easy to use and gives me the measurements I need to know to diagnose the problem. And I can tell by using the instruments, it is all good quality equipment."

When asked about his preference in oscilloscopes, the answer was very clear. Kurt explained that he could have any scope he wanted, he basically had a "blank check" to buy equipment. But he felt that feature for feature, the SC3100 "AUTO TRACKER" was the best buy for the money. Kurt says it provides him with everything he needs to completely test and troubleshoot a variety of problems he faces on a daily basis. Here's why:

The SC3100 "AUTO TRACKER" Automatic 100 MHz Waveform & Circuit Analyzer was designed to simplify scope usage by automating the typical controls a technician uses when they are making sight and parameter measurements on any waveform, including DC volts, frequency, PPV, and ohms. To use the automatic features, you simply set the VOLTS/DIVISION and TIME/DIVISION switches to "Auto" and begin troubleshooting. There's no adjusting or readjusting to think about – just the circuit you're working on. The "AUTO TRACKER" provides you with the capability to move from 2 mV all the way up to 2,000 volts without touching a single control knob. Briefly, that's how the SC3100 has revolutionized scope usage.

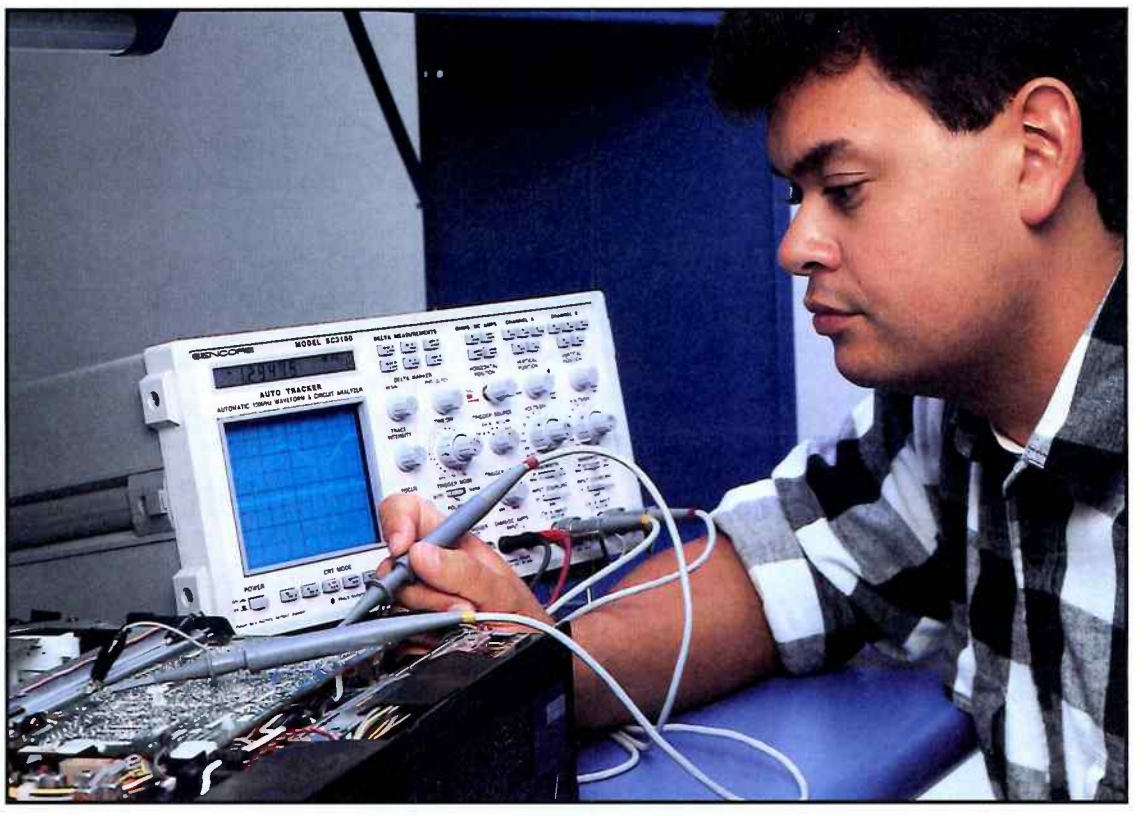

Fig. 1: The autoranging feature of the "AUTO TRACKER" automatically selects the horizontal sweep speed and displays two to five waveforms – without touching a single control.

Fig 2: The SC3100 "AUTO TRACKER's" error-free tests and easy-to-use features let you analyze more waveforms faster and increase your troubleshooting confidence

Kurt uses the "automatic" features of the SC3100 almost exclusively. He explained it is so easy to just set the controls to "Auto" and start troubleshooting. He moves easily from one test point to another without setting any controls, and without readjusting when he moves to another test point. He went on to say that using the "AUTO TRACKER" has made his job so much easier, he doesn't even think about the scope settings anymore, it's just become so natural to use.

As Kurt put it, "Horizontal output problems used to be a problem to troubleshoot accurately, but with the "AUTO TRACKER", I can now determine the problem in 30-60 seconds on most monitors after connecting the SC3100. He simply connects to the horizontal output transistor and is able to test the frequency (or timing), voltage, and waveshape. He feels that the horizontal waveform is the key to determining power supply problems in computer monitors.

The key for The Whitlock Group in meeting the customers' needs is providing quick turnaround and ensuring there are no units returned for the same symptom. As Kurt explained, people who send their monitors and computer boards to them for repair expect the unit to be repaired accurately and as quickly as possible. Some customers can't afford to be without their monitors for days on end. Some of these monitors are very specialized and spare monitors are not available.

Kurt says one of the biggest problems he faces is locating parts. Many of the manufacturers just don't have the parts available in stock for every unit. That's where parts networking can help (business software that links you with manufacturers and parts distributors, such as the Sencore SM2001 Service Center Manager). Kurt tells us it would help him immensely if he could know what parts are available, in stock, or discontinued.

The Whitlock Group has just recently started to see some very high end monitors coming in the door manufactured by Sigma Design. Kurt explained that these monitors are a reflection of what they will be seeing in the future. At present, these monitors run on a minimum of $375.00 to repair. The flat rate for the typical VGA type monitor is $80.00 per unit. According to Kurt, the cost of the common VGA monitor has come down, so in order to remain competitive they have had to reduce the cost of repairing these types of monitors. When asked how can they afford to reduce pricing, Kurt explained the only way possible is by increasing the volume and reducing the time it takes to repair them. And not by luck, the Sencore SC3100 "AUTO TRACKER" helps him do just that.

Sound too easy? Maybe it's easier than you think. When was the last time you reviewed your service operation to make sure there isn't a better method of troubleshooting? As you can see from this article, good test instruments can make the difference. If you would like to find how the SC3100 "AUTO TRACKER" Automatic 100 MHz Waveform & Circuit Analyzer can make a difference in how you troubleshoot all types of circuit problems, call your Area Sales Representative **1-800-SENCORE (736-2673)** today! ■

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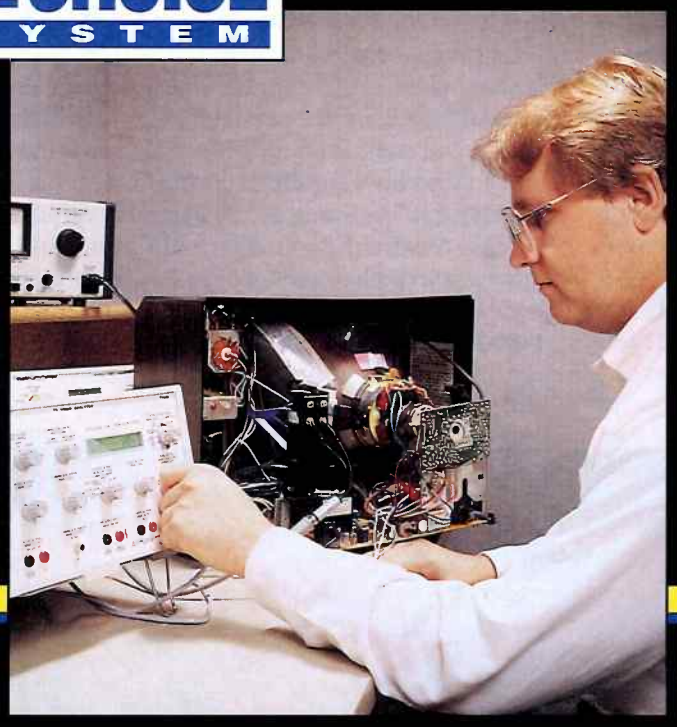

complete (kəm′ plēt) n.
1. Having all necessary or normal parts, components, or steps; entire, whole.

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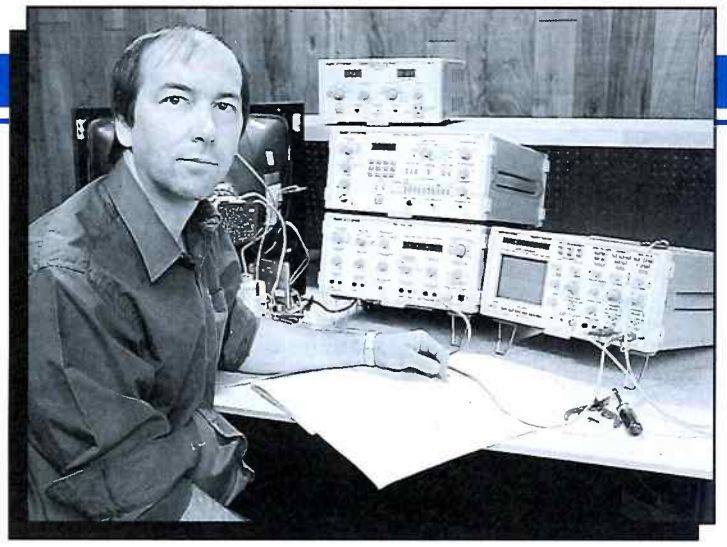


Understanding And Troubleshooting TV Shutdown Circuits

By Glen Kropuenske, Application Engineer

Oh no!! A "shutdown" problem!! For some reason, the term "shutdown" brings out our worst fears. Could it be the momentary waveforms and voltages that are impossible to measure? Could it be the circuit loops between the B+ supply, horizontal, and shutdown circuits? Is it the confusing variations of shutdown methods? Or could it be switch mode power supplies which do not permit chassis operation by lowering the AC line voltage?

Whatever our fear, safety shutdown circuits often interrupt our normal troubleshooting routines. Established methods of troubleshooting often prove ineffective, leading to confusion and frustration. Much of this confusion and frustration is from a lack of understanding regarding shutdown circuits and the lack of alternative test procedures and equipment to isolate the defect.

This article examines what TV shutdown circuits do, how they work, and how they interact with other TV stages. It further analyzes how they fail and how to isolate TV problems that involve TV shutdown circuits.

The Purpose Of TV Shutdown Circuits

The main purpose of the safety shutdown circuits is to prevent excessive high voltage to the anode of the CRT. Above normal high voltage poses an elevated health risk for the viewer. As the high voltage increases above normal, the level of harmful radiation from the CRT increases. A high voltage safety shutdown circuit, commonly called an X-ray protect circuit, is required. This shutdown circuit disables the operation of the horizontal/high voltage circuits when a chassis defect causes the high voltage to rise to dangerous levels.

In addition to the high voltage safety shutdown circuit, some TV chassis employ over-current shutdown protection. Overcurrent shutdown circuits guard critical components in the event of a circuit problem. The over-current shutdown circuit disables the horizontal stages when a circuit defect increases current in the CRT or high voltage stages to an excessive level.

How TV Shutdown Circuits Defeat Or Lower CRT High Voltage

The shutdown circuit indirectly disables the operation of the horizontal output/high voltage stages. There are two ways this can be accomplished without directly altering the horizontal output or high voltage circuits.

The two methods include:

1. Disabling the horizontal oscillator, IC predriver, or driver stage.
2. Disabling the B+ power supply.

Disabling any of these stages prevents the horizontal output stage from producing flyback pulses and high voltage.

One way to stop the operation of the horizontal output stage is to remove the drive signal feeding the base of the horizontal output transistor. This is done by shutting off the horizontal oscillator or shunting the drive signal to ground at the oscillator output, predriver, or driver stages.

Figure 1 shows some examples of common methods used to shut down the horizontal drive signal. An SCR or transistor latch is used to shunt the drive signal to ground at the base of the horizontal driver transistor. A variation of this would have the latch apply a higher than normal DC voltage to the driver transistor's base. This would saturate it preventing the drive signal from passing through the stage.

An SCR or transistor latch is used to shunt components associated with the horizontal oscillator. This shuts down the oscillator, preventing it from generating horizontal drive. A variation of this method would pull the horizontal oscillator considerably off frequency, reducing the high voltage.

More modern horizontal ICs contain provisions for disabling the horizontal drive output. An input pin of the IC controls a shutdown block inside the IC. The shutdown block is part of a predriver stage which shapes and amplifies the signal from the oscillator before it is output from the IC. When the voltage to the control pin activates the shutdown block, the horizontal drive output is disabled.

A second method used to stop the operation of the horizontal output stage is to shut down the B+ power supply. There are several ways that the B+ power supply voltage can be defeated. Figure 2 shows several examples of how the B+ power supply can be disabled by the shutdown circuit.

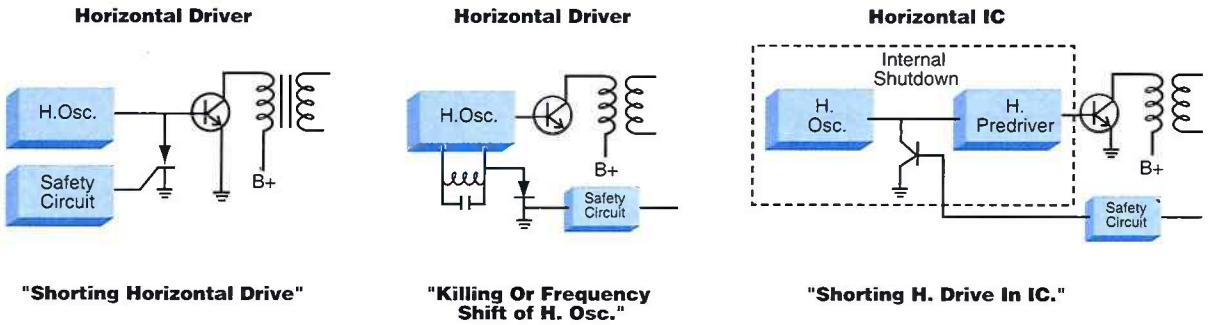


Fig. 1: Common methods of disabling the drive signal to achieve shutdown.

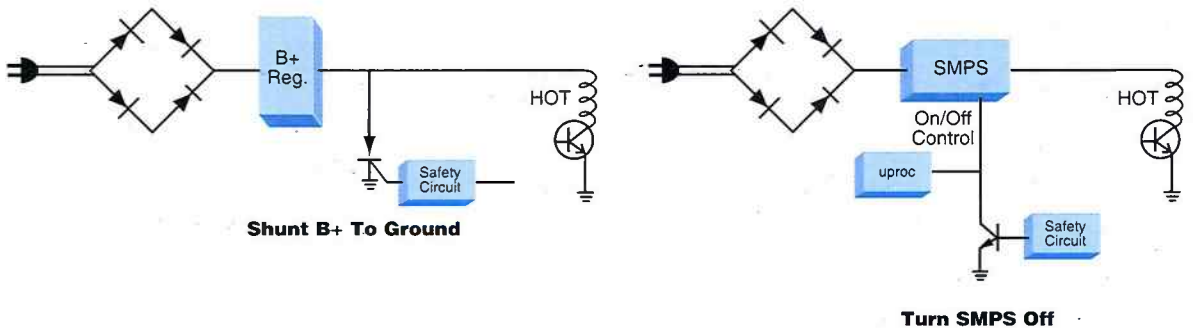


Fig. 2: Common methods of disabling B+ to achieve shutdown.

One method uses an SCR as the shutdown latch to shunt the B+ power supply voltage to ground. With this method, a fuse in the power supply or B+ voltage path opens when the SCR shorts the B+ voltage to ground. This opens the B+ supply disabling the horizontal output stage.

An increasingly popular method of defeating the B+ power supply is to integrate the shutdown latch with the TV's on/off control. With this method, a transistor latch is connected to the chassis on/off control line from the microprocessor. When the latch is activated, the voltage on the on/off control line is altered to turn the chassis B+ power supply off.

How TV Shutdown Circuits Fail

Defects in the HV safety shutdown circuit commonly cause one of three symptoms:

1. Inoperative B+ output, horizontal oscillator, predriver, or driver stage because of a defective shutdown circuit.

2. Momentary high voltage every time the chassis is powered on.

3. Random HV shutdown during TV operation.

If the SCR or transistor latch is shorted or triggered on continuously, it disables the circuit it is designed to defeat. This may latch the B+ supply to ground or defeat the normal operation of the horizontal oscillator, IC predriver or driver stage. This prevents the horizontal output stage from generating high voltage, resulting in a dead chassis.

If the reference zener or comparator circuit has a defect, it may cause the HV shutdown circuit to defeat the operation of the horizontal output circuit even when the high voltage and currents are normal. This unwarranted shutdown may occur every time the chassis is powered up.

Other marginal problems in the shutdown circuitry can cause nuisance shutdowns. These shutdowns may occur randomly and for no apparent reason as high voltage and currents fluctuate. Common causes include bad zener diodes, leaky capacitors, or a defective SCR or transistor.

How To Isolate Problems To The Shutdown Circuit

Many other chassis circuit problems exhibit the same symptoms as a defective shutdown circuit. A defect in the startup circuit, B+ supply, or horizontal stages can appear as shutdown symptoms. To isolate a problem to a shutdown circuit often requires testing these stages to confirm proper operation.

Many shutdown related problems happen so fast that you don't have time to take readings. This is why many tests must be done with the chassis power "off" or when the power is first applied. In many instances, you may only need to view momentary voltages or waveforms to determine if stages are functional.

Check the schematic before you begin troubleshooting to determine how the shutdown circuit defeats high voltage. Remember it either disables drive to the horizontal output stage or disables the B+ power supply.

When The Shutdown Circuit Defeats Horizontal Drive

If the shutdown circuit defeats horizontal drive, start by monitoring the base of the horizontal output transistor for drive as you turn on the chassis. If drive comes on and remains on, the shutdown circuit is permitting normal horizontal drive. Confirm the horizontal output stage is working by measuring the B+ voltage and flyback pulse peak-to-peak voltage at the collector. (Note: Be sure your test instrument has adequate input protection.) If the horizontal output stage is operating normally, the shutdown circuits are OK.

If no drive is observed when monitoring the base of the horizontal output transistor, a drive problem exists in the startup circuit, horizontal oscillator, IC predriver, or driver stage. The shutdown circuit latch could also be shorted. Make voltage and waveform measurements in the horizontal oscillator and drive stages to isolate the defect.

Note: If you suspect the SCR or transistor latch is shorted, remove it and test it. Do not remove the SCR or transistor and turn "on" the chassis, however, as an existing high voltage or current problem could damage components.

If momentary drive is seen when monitoring the base of the horizontal output transistor, investigate three possible causes.

1. The horizontal output stage or flyback derived power supply contains a defect which will not permit the chassis to turn "on" and operate.

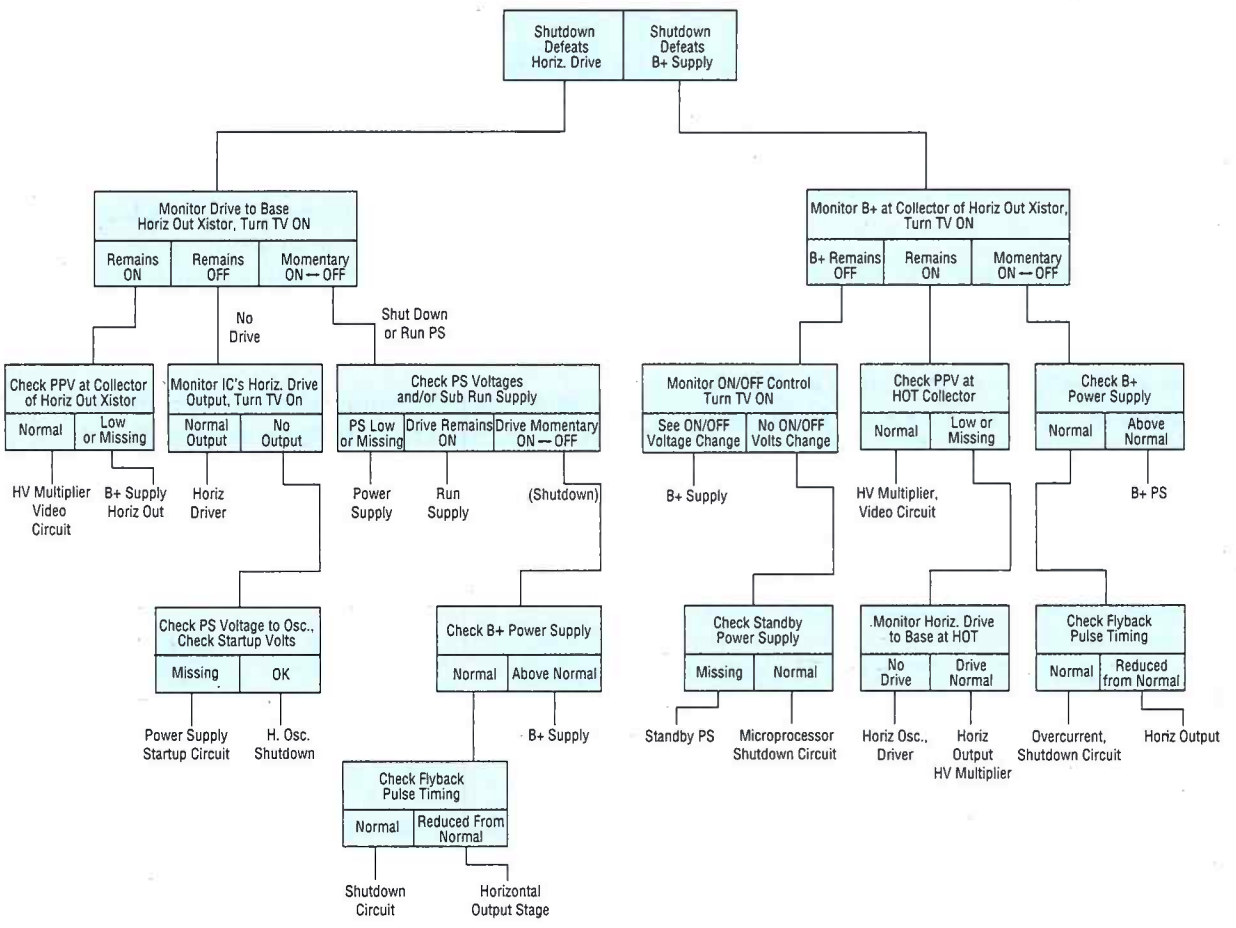


Fig. 3: The troubleshooting tree for isolating shutdown problems.

2. The shutdown circuit is properly shutting down the drive due to an excessive high voltage or current condition.

3. The shutdown circuit is improperly shutting down the drive due to a defect in the shutdown circuit itself. (No unsafe condition exists)

To isolate the problem, you must first determine if the problem is due to a flyback derived power supply problem or caused by the shutdown circuit. Check the schematic to see how the horizontal oscillator and driver stages are powered. Check for normal DC supply voltages or substitute for the flyback derived supply voltage as needed with a DC power supply. Once again, check for drive to the horizontal output. If horizontal drive is continuous, a power supply problem is indicated and the shutdown circuits are likely OK. If drive is momentary, the shutdown circuit is defeating drive.

If the shutdown circuit is disabling drive, you must determine if the shutdown circuit is responding properly to an excessive high voltage or current condition. To make this determination, you should check the two conditions that cause higher than normal high voltage, 1) higher than normal B+ supply voltage, or 2) reduced flyback pulse timing. Once you have proven B+ and timing OK, check for an overcurrent shutdown condition.

While it may seem simpler to just defeat the shutdown circuits and attempt to turn "on" the chassis, this is not a good idea. You are certain to damage parts in the horizontal output and B+ supply in the event an excessive high voltage or current problem exists.

When The Shutdown Circuit Defeats B+

If the shutdown circuit defeats B+, start by monitoring the B+ test point or voltage at the collector of the horizontal output transistor while you turn on the chassis. If B+ voltage is observed, the power supply is working and the shutdown circuit is likely OK. Confirm the horizontal output stage is working by measuring the flyback pulse peak-to-peak voltage at the collector. (Note: Be sure your test instrument has adequate input protection.) If the horizontal output stage is operating normally, the shutdown circuits are OK.

If no B+ voltage is observed, the chassis has a power supply or on/off control problem. The problem could be in the standby supply, main B+ power supply, or microprocessor. The shutdown circuit latch could also be shorted. Use voltage and waveform measurements to isolate the defect.

Note: If you suspect the SCR or transistor latch is shorted, remove it and test it. Do not remove the SCR or transistor and turn "on" the chassis, however, as an existing high voltage or current problem could damage components.

If you observe only a momentary B+ voltage and then 0 volts, a shutdown is indicated. If the shutdown circuit is disabling B+, you must determine if the shutdown circuit is responding properly to an excessive high voltage or current condition. This requires that you check the two conditions that cause higher than normal high voltage: 1) a higher than normal B+ supply voltage, and 2) reduced flyback pulse timing.

If B+ and timing are normal, check the service literature to see if the chassis has overcurrent shutdown protection. If no overcurrent problem exists, the shutdown circuit may have a defect.

Isolating A TV Shutdown Problem With The TVA92 TV Video Analyzer

The Sencore TVA92 TV Video Analyzer greatly simplifies troubleshooting shutdown symptoms. Lets look at how to use the Horiz Output Tests of the TVA92 to diagnose and troubleshoot a shutdown symptom in a Goldstar TV.

The schematic in Fig. 4 shows that the safety shutdown circuit works by defeating drive in the horizontal deflection IC. The first troubleshooting step is to monitor for drive to the base of the horizontal output transistor (Q402) when AC power is applied.

To monitor this drive signal, the TVA92's Dynamic Test clips are connected to the base, emitter, and collector of the horizontal output transistor. The TVA92's Horiz Output Tests switch is set to "INPUT DRIVE". The presence or lack of drive is indicated with an ON/OFF display readout.

Applying power to the Goldstar chassis results in a fast tick-ticking sound and the TVA92 readout alternates between "ON" and "OFF". This indicates horizontal drive is intermittently "on" and "off" to the base.

The first step in isolating the cause of the unusual "on" and "off" drive is to check the power supply voltages to the horizontal driver and deflection IC. The schematic shows a 39 volt supply from the switching regulator to the driver transistor. This voltage is reduced to 9.1 volts at IC pin 28 by a resistor/zener diode network.

To measure the voltage, the SC3100 "AUTO TRACKER" is connected to pin 28 and AC power is applied to the chassis. Pushing the "DCV" button of the SC3100 results in a 6.9 volt reading on the digital LCD. Pushing the "PPV" button shows about 2 VPP, indicating some AC ripple on the supply voltage.

The lower than normal voltage and high ripple certainly appears as a power supply problem. However, since the horizontal output stage is receiving intermittent drive, the current load on the switching power supply is random and could cause an unusual output from the supply.

If the power supply is causing the problem, substituting for it with the TVA92's DC Bias Supply should restore proper horizontal drive. To sub for the supply, a power supply diode for the 39 volt supply is unsoldered and a lead removed from the board. The TVA92's DC Bias Supply output is connected to the chassis ground and the junction of R412 and R409. When AC power is applied to the chassis and the Bias Supply set to maximum, the TVA92's input drive readout indicates the drive signal is again cycling "on" and "off".

Since drive could not be restored, a problem exists with the deflection IC or driver stage. Another possibility is that the shutdown block of the deflection IC is being activated from an excessive high voltage condition or a shutdown circuit defect.

A quick way to determine if the shutdown block of the IC is being activated is to defeat the chassis high voltage. This removes voltage to the shutdown circuit and to pin 12 of the IC. The supply voltage to the deflection IC and driver stage is subbed by the TVA92, so defeating high voltage is as simple as removing AC power to the chassis. This robs the horizontal output stage of B+ voltage, resulting in no flyback pulses.

With the AC power removed from the chassis and the DC Bias Supply applied, the TVA92's Input Drive Readout shows a continual "ON" readout. To confirm the drive waveform is at the proper frequency and duty cycle, the SC3100 "AUTO TRACKER" is used to view the output at IC pin 23. Pushing the "FREQ" button of the SC3100 shows 15,734 Hz, and a good squarewave is seen on the CRT. This confirms the deflection IC and driver stages are good and indicates that a shutdown problem exists.

To determine if a shutdown is warranted requires a test of the B+ power supply voltage and timing of the horizontal output stage. With the TVA92 Dynamic Test leads connected, we can measure the B+ supply voltage by selecting the "DCV" position of the Horiz Output Test switch. The "DCV" position meters the voltage at the collector of the horizontal output transistor. When AC power is again applied to the Goldstar chassis, the TVA92 digital display reads 109 volts. This indicates the B+ power supply is regulating near the 110 volts shown by the schematic.

The TVA92's Horiz Output Load test checks the horizontal output stage to determine if a timing problem is causing shutdown. To perform the Horiz Output Load test, the AC power to the chassis is disconnected and the Dynamic Test clips removed. The Ringer/Load Test leads are attached to the emitter, collector, and B+ input to the flyback in the horizontal output stage. When the "uS" position of the Horiz Output Tests switch is selected, the TVA92 readout displays 11.9 uS. This is in a normal range and indicates the timing of the Goldstar's horizontal output stage is not the cause of shutdown.

Since the B+ voltage and the timing of the horizontal output stage are normal, a high voltage shutdown is unwarranted. The shutdown circuit likely has a defect that is causing shutdown. The best way to protect the chassis and isolate the problem is to take control of the horizontal/shutdown circuit loop with the TVA92's Horiz Output Device Sub & Drive. This permits waveform and voltage measurements to isolate the defect.

Fig. 5: You can measure if the timing in the horizontal output stage is causing shutdown with the TVA92 TV Video Analyzer's Horiz Output Load tests.

To substitute for the chassis horizontal output transistor, the chassis transistor should be removed or drive to the base removed. In the Goldstar chassis, a leg of resistor R412 is unsoldered so the driver stage does not pass horizontal drive. Then the TVA92's Horiz Output Load Test leads are removed and the Dynamic Test leads connected.

Starting with the Horiz Output Device Sub & Drive control turned "on" slightly, AC power is applied to the chassis. At this reduced level, the chassis horizontal output stage operates at a fraction of the normal currents reducing flyback voltages below shutdown level. Connecting the SC3100 "AUTO TRACKER" probe to pin 2 of the flyback and pushing the "PPV" button results in a display of approximately 16 VPP. Connecting the probe to the cathode of ZD406 and selecting "DCV", the display reads 4.8 volts. These readings are normal considering the reduced operating level.

Moving the SC3100 probe to the anode of ZD406 results in a high reading of 4.7 volts. Reducing the TVA92's Horiz Output Device Sub & Drive to "OFF" and removing AC to the chassis lets us make an ohmmeter check of ZD406. The SC3100 "AUTO TRACKER's" ohmmeter confirms it is shorted. A replacement diode restores the chassis back to normal operation.

How does this problem compare with your experiences? If you would like more information on how the TVA92 TV Video Analyzer can calm your fears of shutdown problems, call us at **1-800-SENCORE** today. We can provide you with the information you need to conquer those questions on shutdown problems. ■

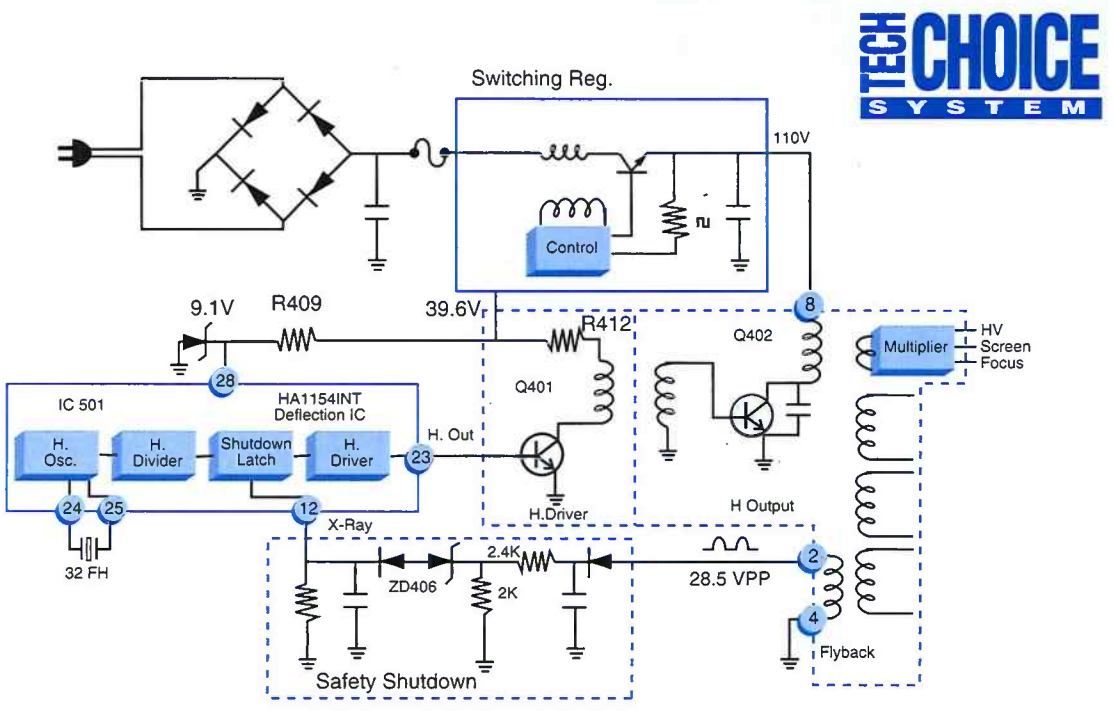
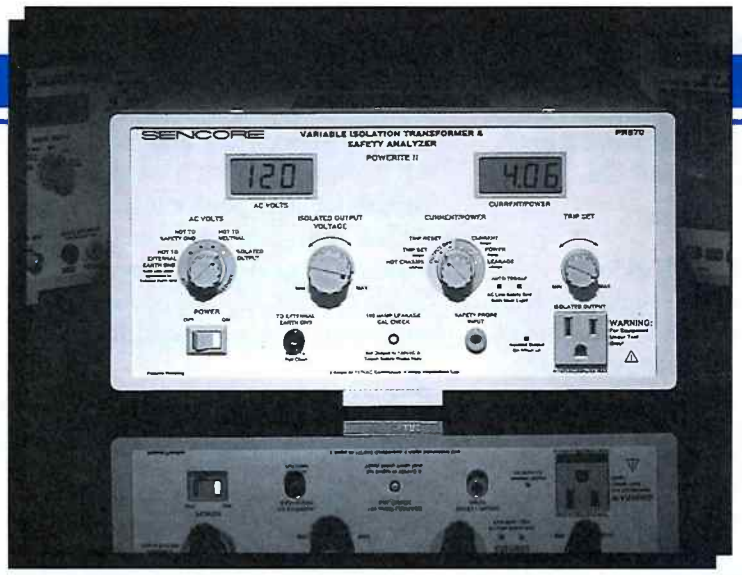


Fig. 4: Simplified Goldstar NC-37A safety shutdown, horizontal, & power supply circuit diagram.



Learn How The PR570 "POWERITE II"™ Will Build Your Profits While Protecting You, Your Customer, And Your Equipment!

By Larry Schnabel, Editor

How many pieces of test equipment can protect you, your test equipment, and your customer? What if you could earn thousands of dollars extra income per year and build good customer relations at the same time?

The new PR570 "POWERITE II" Variable Isolation Transformer & Safety Analyzer provides a very fast and accurate check of AC leakage between the AC line and the exposed metal on an AC-operated device. This article explains more about the leakage test and shows how the PR570 "POWERITE II" performs the test while generating extra income in the process.

What Is The Leakage Test?

Virtually all service literature today includes the safety leakage test as a recommended test. The safety leakage test assures when the TV set is returned to the customer, it does not have any metal parts that could give the customer a shock. This safety check applies to all consumer units that are connected to the a 120 volt AC line. Safety leakage can be present due to component failures, technician errors, customer modifications, etc.

The potential for shock hazard increases dramatically when the set has a hot chassis. And since isolation transformers are almost nonexistent in newer chassis, the number of hot chassis continues to grow along with the potential for shock hazards for you and your customer.

Why Don't All Servicers Make The Leakage Test?

Many technicians confess they feel guilty about not performing a safety leakage test on every chassis that leaves their service center. One reason for not making the safety leakage test is that the recommended procedure is too complicated. As Fig. 1 shows, it requires a good ground, a resistor/capacitor combination "made up" or located among the multitude of shop parts, and the chassis disconnected from the bench isolation.

They also tell us it is hard to justify taking the time to do the test when only one out of a hundred will have a shock hazard. But that one in a hundred is the precise reason you should always perform the test.

After reassembly of the set, always perform an AC leakage test on all exposed metallic parts of the cabinet, the channel selector knobs, antenna terminals, handle, and screws) to be sure the set is safe to operate without danger of electrical shock. DO NOT USE A LINE ISOLATION TRANSFORMER DURING THIS TEST. Use an AC voltmeter, having 5000 ohms per volt or more sensitivity, in the following manner. Connect a 1500 ohm 10 watt resistor (63-10401-76), paralleled by a .15 mfd 150V AC type capacitor (22-4384) between a known good earth ground (water pipe, conduit, etc.) and the exposed metallic parts, one at a time. Measure the AC voltage across the combination 1500 ohm resistor and .15 mfd capacitor. Reverse the AC plug and repeat AC voltage measurements for each exposed metallic part. Voltage measured must not exceed .75 volts RMS. This corresponds to 0.5 milliamp AC. Any value exceeding this limit constitutes a potential shock hazard & must be corrected immediately.

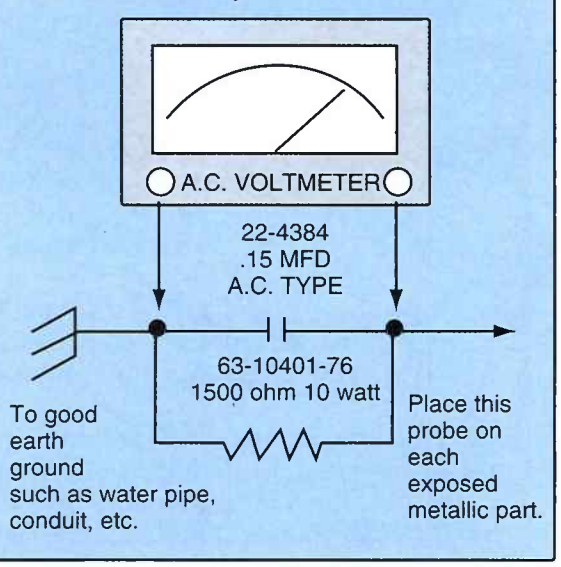


Fig. 1: Most technicians ignore this important leakage test shown in all service literature because it is difficult to set up and interpret.

It only takes one unsafe chassis to put you out of commission and unable to work. It only takes one hot chassis to zap your expensive test equipment to realize it's less expensive to perform the test in the first place. And most importantly, it only takes one chassis to shock or injure a customer who may take you to court for a costly lawsuit.

The PR570's Safety Leakage Test - Fast And Simple

Now we know how important it is that the repaired unit does not pose a shock hazard to the customer. The potential of AC leakage existing on a repaired product presents a serious safety problem. Any exposed metal needs to be thoroughly checked for any chance of leakage before it reaches the customers' hands.

The PR570 "POWERITE II" protects your customers from shock and shields your business from lawsuits with an automatic, auto-toggling AC line and safety ground leakage test. The PR570 "POWERITE II" lets you perform the recommended safety leakage tests in seconds with just one probe.

You simply plug the chassis into the PR570 and touch the probe to the exposed metal on the chassis (screws, antenna jacks, etc.). The "POWERITE II" automatically toggles between the high and low sides of the AC line in four separate power line conditions. The results are displayed directly on the PR570's LCD digital readout (leakage down to 10 microamps). There's even a leakage calibration check on the PR570's front panel to confirm the accuracy of your readings.

The PR570's AC line leakage safety test assures that excessive leakage is not present on any exposed part of the equipment being tested. Perform this important safety test on every electronic product for your customer's security and your peace of mind. There are no jerry-rigged setups or gimmicks – just results.

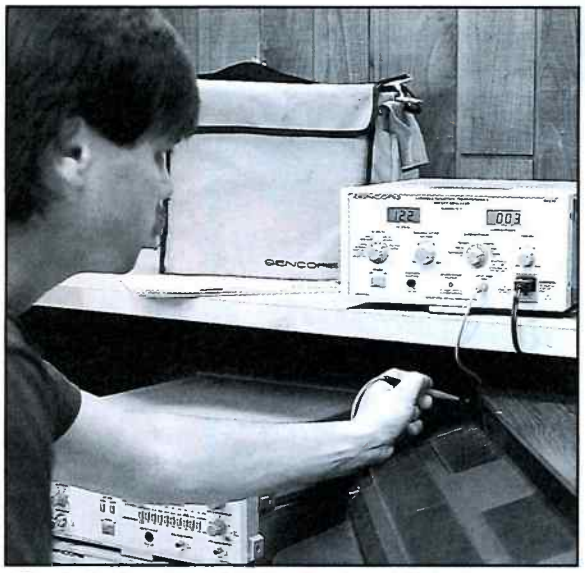


Fig. 2: Perform the PR570's simple safety leakage test with one probe and no calculations for the customer's safety and your peace of mind.

The PR570 "POWERITE II" - Your Best Profit Builder Of All

The safety leakage test protects your customers and builds profits at the same time. An isolation transformer alone may save money by preventing expensive damage to the TV and your test equipment, but does nothing to actually generate income. The simplified safety leakage test of the PR570 "POWERITE II" can actually generate additional income if you just add a small charge to every chassis you test with the "POWERITE II". In addition, this important safety test is usually ignored by other shops in your area and you should be able to advertise your ability to produce 100 percent safe repairs and generate new business as well.

Here's how to use the PR570 "POWERITE II" to generate extra income. Simply add a $5 safety leakage test service charge to each invoice. Let's see how quickly this minimal $5 charge adds up.

The National Electronic Service Dealer's Association (NESDA) indicates that the average number of sets serviced per day by a bench technician is five sets. Five sets per day times five working days is an average of 25 sets per week. Twenty-five times $5 per set is an additional income of $125 per week with only about a minute average labor per set. Extended over a full year, the PR570 will generate $6,500 of extra income. That's not bad for a test that takes less than one minute.

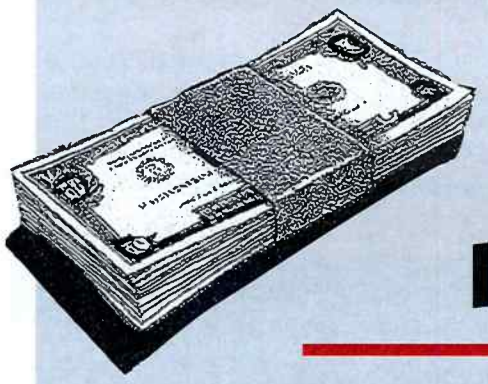
5	sets per day
x 5	days per week
= 25	sets per week
$5	safety leakage charge
x 25	sets per week
= $125	per week
52	weeks per year
x $125	per week
= $6,500	**added income per year**

In fact, the PR570 "POWERITE II" will quickly pay for itself if you start making this all important safety charge. Then the "POWERITE II" becomes an income producing source..... more of a "Business Builder". Many servicers set aside the safety leakage test money and use it to purchase all of their test equipment.

You may be already paying for a PR570 "POWERITE II" with damaged parts, damaged test equipment, increased liability, and poor customer relations when you send out an intermittent or dangerous chassis to a customer. And you're losing money every day by not charging for those important safety leakage tests. Why not invest in the "POWERITE II" and protect yourself, your customer, and your equipment?

Put a PR570 "POWERITE II" on every service bench in your shop. Call us toll-free **1-800-SENCORE** for more information today! ■

Tax Talk



Your Last Chance To Save In 1994!

It's time for your year-end tax planning for 1994. We're going to show you two ways to save big money before 1995 rolls around.

The IRS has provided you with two opportunities to save money on your 1994 income tax return. You can take advantage of either the $10,000 Write-Off Savings or the Depreciation Savings, depending on your business investments.

$10,000 Write-Off Savings

Under IRS code, you can write off up to $10,000 of business equipment purchases as an expense. This means your investment in Sencore test instruments can save thousands of dollars on your 1994 taxes.

What does this mean in dollars and cents? If you are in the 28% tax bracket, your net out-of-pocket cash for a $10,000 purchase is $7,200 ($8,500 for the 15% bracket). The only limitation is that your taxable income must be at least as much as the equipment cost. Assuming you meet the income requirement, if you do not take advantage of this write-off opportunity now, you lose it for 1994.

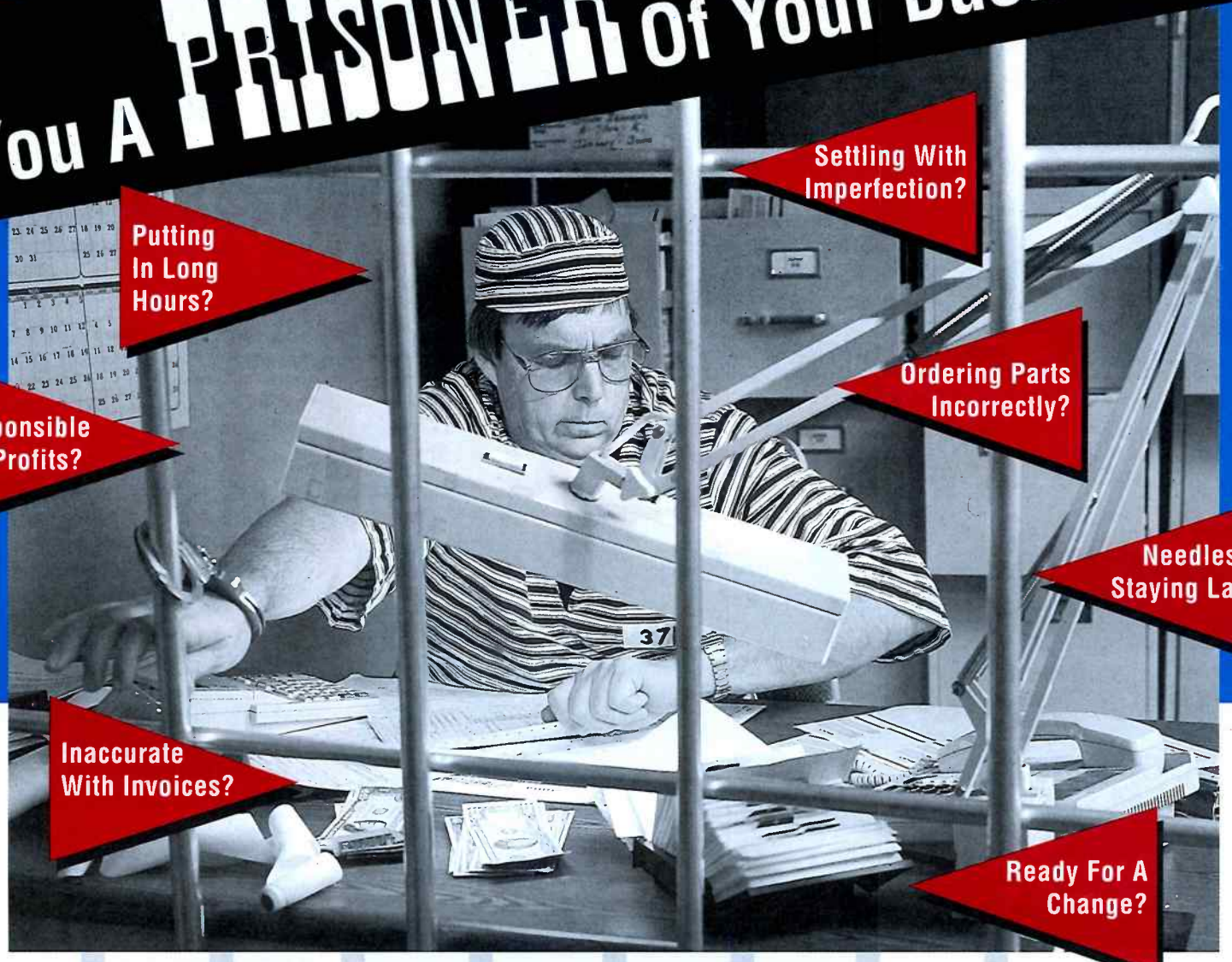
Depreciation Savings

If you have already used up your $10,000 capital equipment write-off for 1994, the IRS still lets you depreciate your business investments. This allows you to update your equipment, plus write off some of the expense.

Business equipment purchased above and beyond $10,000 can still be depreciated. Generally, first year depreciation is 20% of the purchase price. First year tax savings on $10,000 of test equipment is $560 in the 28% tax bracket ($300 in the 15% bracket).

Have questions? Call your Area Sales Representative at **1-800-SENCORE** to discuss your year-end tax savings opportunities.

Are You A PRISONER Of Your Business?



It's A Crime The Way Some Businesses Are Wasting Valuable Time

ARE YOU A PRISONER?

The fact is, you may be so wrapped-up in your current activities, that you're not aware of the damage you could be causing each day. You can save time, be more accurate, save money, and provide a better service to your customers – through automated business management.

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  - *and more . . .*
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The CVA94 "Video Tracker"™ Tackles Camcorder Toughy "It Still Doesn't Work As Good As It Use To!"

By Don Multerer, CET

"His number is 26 - not 28!"

"I beg your pardon ma'am!" the Electronics Plus Service Manager responded both quizzically and half listening while filling out the service invoice form. Sam had not reached the customer complaint part of the service form when Mrs. Davidson started in. "It still doesn't work as good as it use to, you know, when it was new! This is the second time it's been in...and Friday night, when Jeremy made that long touchdown run, I couldn't tell it was Jeremy!"

"Oh", was all Sam could muster as a somewhat attentive response. "Well, you know Mrs. Davidson, don't you think you are asking an awful lot of your camcorder on an overcast night, under uneven outdoor lighting, shooting from the stands, while you're excited trying to pick out your son running flat out down a football field?" pressed Sam somewhat disturbed. He knew all too well he should not have come across that way, but it was too late. He had already spit it out.

"But his number is 26, not 28!" Mrs. Davidson blurted out more in self-defense than to acknowledge the possibility of Sam's practical points. "I've always been able to see his number. But it looks like 28 made the touchdown, not my Jeremy!"

"O.K.," sighed Sam reluctantly. "We'll go through your camcorder again, Mrs. Davidson, in case we did miss something." Deep down, however, Sam felt this was just another pilot error case he was going to have to weather through even though it was going to cost him and his company free callback checkout time.

How many servicers have found themselves in the same position as Sam? The customer claims the electronic device does not work, sound, or look as good as it used to. Yet the servicer may feel it's a matter of customer use, education, or error. In many cases, the servicer may not get a second chance to meet the customer's expectations. Even if it's a no-charge callback, the customer may still go to another servicer.

So, how can Sam's apparent no-win situation be turned into a win-win situation for both Sam and Mrs. Davidson? This time Sam must take the customer's input into account. There may be more to Mrs. Davidson's diagnosis then just the visual scene limitations coupled with an excited parent's erratic camcorder techniques of the moment. How could Jeremy's number 26 become a 28?

There are a multitude of possibilities that could make Jeremy's 26 look like a 28. Some of the possibilities are easily checked. Others are going to require the use of special instruments like the Sencore CVA94 "Video Tracker" Camera Video Analyzer and a video reference source (light box) with standard test charts like the Sencore VR940 Video Reference. Without the special instruments to test the important camcorder circuit functions as they process and develop the video scene signal, the odds of having Mrs. Davidson's camcorder working as good as it used to is slim or none.

Here's why:

Halogen light from the outdoor football stadium's light poles reflects wildly off Jeremy's glossy black jersey and the sometimes-visible, subdued gray number 26. The light too, reflects off the dark, short-cropped field grass, the white chalky marking lines, and the other players of mixed clothing coloration in hot pursuit of Jeremy.

All these variations of light and non-light constitutes a video scene. Mrs. Davidson expects her camcorder to capture and reproduce this video scene exactly as she saw it happen. To do this, the reflected light from Jeremy and the immediate area must be captured by the camcorder's multiple front lens, focused, and compensated based on zoom depth of field distance from Jeremy to his mother's position in the stadium stands. The light signal is presented to the camera's pickup device usually in a 1/3 square inch charged coupled array chip that converts the light energy to electronic pulses. The electronic pulses are amplified, sampled, and shaped into previdео analog information. Luminance processing brings the black and white composite information up to snuff while chrominance is processed separately and added later along with vertical and horizontal sync pulses and chroma burst. A balanced one volt peak to peak composite video signal exits the camera ready to ccurately terminate into a 75 ohm input impedance. In this case, it's the camcorder's VCR.

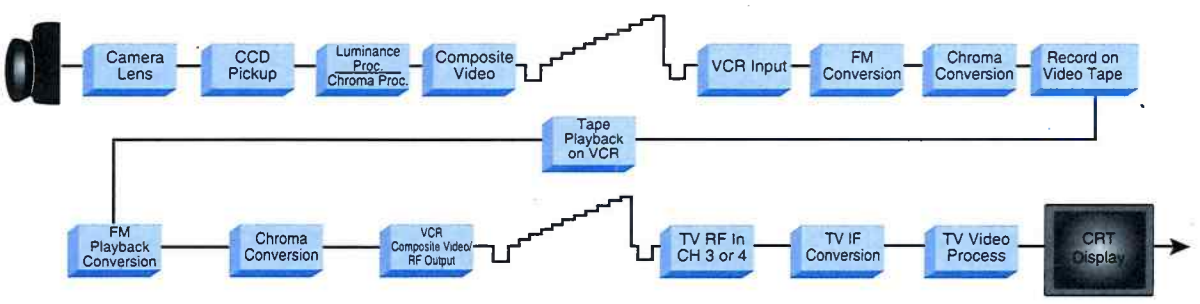

Fig. 1: The end-result video image goes through drastic changes before it appears in its final form.

Yet almost all camcorder tapes are played back on totally separate VCR machines. That means the possibilities of error increase. The reverse process can add more difficulties because the magnetic signal information picked off the video is just a fraction of the level of what the signal recorded. Special high gain FM amplifiers recover the signal and send it to FM demodulation to hopefully represent the exact gridiron scene in all its living detail and color again. All is not finished, though. Mrs. Davidson's moment of parental pride must go through several more electronic contortions before it can be viewed by all the neighbors.

Ideally, the camcorder VCR composite output signal could be coupled into a television composite video input for direct viewing. However, most VCRs are connected to the television antenna input. Jeremy's number 26 goes through more electronic changes before it becomes viewable. The composite video is amplitude modulated on a channel 3 or 4 RF carrier, fed to a TV, converted down to 45.75 MHz IF (intermediate frequency), amplitude modulation detected, and finally luminance and chrominance processed to a composite level that can be applied to a CRT.

Voila! Jeremy Davidson and his number 26! Or is it 28? It seems truly amazing a video scene of even reasonable clarity can actually make it through this electronic maze. Let alone a video scene Mrs. Davidson expects to look as good as it used to, but doesn't. So is it the scene itself? Is it Mrs. Davidson? Is it the camera? The lens? The camera circuits? The VCR circuits? The TV circuits? Actually, the culprit responsible for causing Jeremy's subdued gray number 26 to look like number 28 could even something different than the possibilities we had talked about previously. Functional analyzing and dividing and conquering will help determine if the electronic video signal is being altered during any of the processes. The points where the composite video signal goes through the most significant change are those points most suspected. The first function point easily checked is the camcorder composite video output. All of the electronic and mechanical video parameters can be checked in just minutes without taking the camera apart by using the CVA94 "Video Tracker's" waveform analyzer, vector analyzer, special tests, and the VR940 Video Reference signals.

There are four basic composite electronic video signal parameters that are absolutely important to accurately reproduce a video scene:

1. ***Enough Signal*** - meets standard amplitude specification
2. ***Balanced Signal*** - meets standard level ratios
3. ***Clean Signal*** - noise free
4. ***Correct Phased Signal*** - produces accurate color level and hue

A regular oscilloscope can check these signals. However, the "Video Tracker's" waveform monitor/vectorscope is specifically designed to analyze all the composite waveform parameters accurately, quickly, and into a standard 75 ohm load. It's just like a TV, VCR, or monitor will see the signal.

1.

One cable hook-up from Mrs. Davidson's camcorder video output to the CVA94 video input should display a one volt peak to peak signal of the NTSC color bar chart accurately illuminated by the VR940 Video Reference. Other waveform monitors require graticule counting to confirm enough composite video signal. The exclusive "Video Tracker" moveable delta bar feature is used to light up just the waveform portions that are to be measured. Just push the delta bar buttons to light up the entire composite waveform from the bottom of the sync pulse to the top of the highest color bar shown. One push of the CVA94 millivolt (MV) button gives a quick one volt readout on the large LCD.

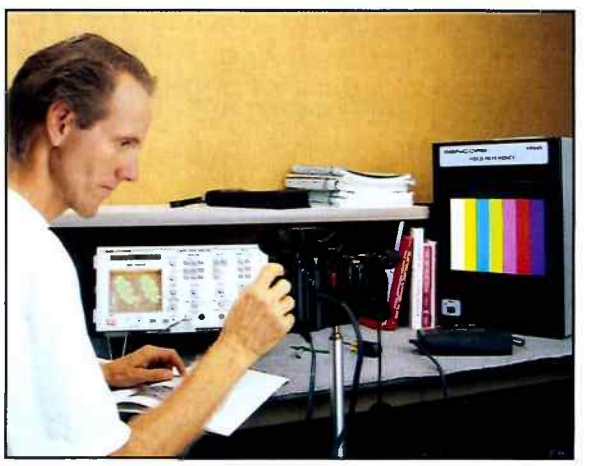

Fig. 2: The CVA94 "Video Tracker" automatically converts peak-to-peak readings to IRE units to help speed your troubleshooting.

Looks like there is enough signal generated by the camcorder to do the job. Some camera technicians prefer to work with IRE (Institute of Radio Engineers) parameters versus millivolts. No problem. Pushing the CVA94 IRE button quickly converts the one volt peak to peak reading to the equivalent 140 IRE. Push one more button and another often used measurement, standard Percentage of Burst (% burst), quickly replaces the IRE readout. In this case, a one volt peak to peak/140 IRE signal level equals 350% of burst. All these readings are digitally accurate and require no graticule counting.

2. Signal Balance

Just because there is enough total signal does not mean Sam can button up the camcorder and ship it back. Each of the composite video signal elements must maintain a specific maintenance of level balance or noise, loss of video, loss of video brightness, loss of color, unstable vertical or horizontal, or other symptoms can easily result. Sam can quickly check the individual levels as easily as the whole signal level. Moving the delta bar over the color burst pulse finds it right on: 40 IRE. The sync pulse should be the same 40 IRE,

Fig. 3: The "Video Tracker's" exclusive delta bar lets you measure any portion of the waveform you want.

which it is. The video signal level from the blanking level to maximum white is spec'd at 100 IRE. Again, right on! One final measurement that can cause video noise and make a number 26 difficult to read is the black setup level. If this level is set too high, video information can be lost or deteriorated. If it's set too low, video noise can mix with sync and cause jitter or poor sync. Mrs. Davidson's camcorder checks in at 8 IRE. That's close enough to meet the 7.5 IRE spec.

3. Clean Signal

Noise in a video scene can really make a mess. At night, at maximum zoom distance and uneven lighting, the Davidson's camcorder was working hard to preserve a difficult video scene with reasonable quality. The zoom was probably at maximum, the iris at full open, and the camcorder's AGC circuits cranked up to pull the signal in. As AGC increases to maximum, low level light scenes will tend to become grainy. Any noise on top of the camcorder's attempt to pull in the video scene could easily make a 26 look like a 28.

Using two exclusive signal-to-noise (S/N) video reference charts, Sam can quickly determine if Mrs. Davidson's camcorder is inducing additional noise causing the impaired performance.

The first VR940 S/N video reference chart checks luminance S/N with a 100% white bar to clamp the luminance AGC circuits and a 50% gray scale as an average video reference. A digital readout showing a S/N ratio of 40 dB is considered good. This camcorder is right at 40 dB and looking good.

The second S/N video reference chart checks for chroma saturation and hue noise using a full red raster chart. Sam pushes the "Video Tracker's" special test S/N buttons and confirms a good S/N ratio. The LCD shows a little over 40 dB for both chroma tests. The Davidson's camera is still looking good!

4. Correct Phase

So far, the CVA94 "Video Tracker" has proven the camcorder that didn't work is working pretty good. Sam is feeling pretty good about himself too! There seems to be enough signal. All composite video signal elements are balanced and the signal checks clean. Now a quick check on color phasing just to be sure a chroma processing problem is not masking a luminance problem, and Sam feels he is almost home free. Sliding in the standard NTSC color bar chart again, Sam punches up the CVA94 vector phase function. Red and yellow are the important color phases that determine proper color reproduction of the video scene.

Running the delta bar marker to the end of both the red and yellow color vector tentacle gives a digital phase readout in respect to the B-Y reference signal. Red reads 103°. Yellow reads 167°. Both are right on. A quick amplitude check of both red and yellow chroma signal shows 200% of burst for each. That's right where they should be! Sam is definitely feeling pretty smug. The camera's electronic composite video signal checks out good!

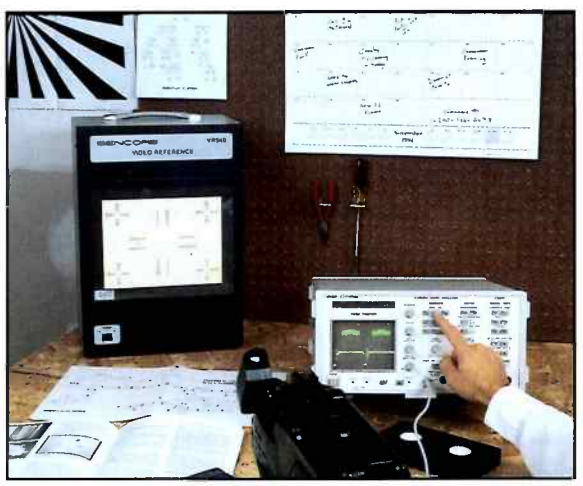

Fig. 4: Use the VR940's Registration/Response Chart to check and adjust a camera's registration and frequency response.

What's left? Two quick camera mechanical checks, resolution and focus, thinks Sam. Normally Sam would just make a "point and look" check on resolution and focus. If there was a problem with either focus or resolution, he would have noticed it during the composite signal analyzing. But because Mrs. Davidson is really giving his company a second chance to do it right, he felt he better do a little more than a cursory check.

Besides, the Sencore CVA94 and VR940 came in after the Davidson camcorder was last repaired. It is very satisfying to see how this equipment helps troubleshoot a tough video problem. The registration response chart just adds optimism to Sam's conclusion on the camcorder's performance. Typical camera frequency response is around 4 MHz or 320 lines of resolution. Mrs. Davidson's camcorder checks out just a little better. "Jeremy", said Sam smiling to himself, "your #26 should have shown through the night clear as a bell!"

"Last check - focus." said Sam, now mumbling out loud to himself, as he slips the Siemans star focus chart into the VR940. Like a well trained military cadet, the camcorder auto focus snaps to produce a razor sharp crisp pattern. "Thank you", says Sam verbally returning the salute. Then, as he normally does, a final camera auto focus checkout. Sam pans the inside of his service center while watching the monitor. Looks good, he feels, as the zoom moves in and out.

On the final zoom around the service room, the camcorder catches the shop calendar. But guess where. The 26th date! Surprised, Sam mutters to himself, "It doesn't look too bad", somewhat squinting. "I can still read the 26. Of course, it's not running flat out and carrying a football 50 yards away", said an internal needling voice. "Well, let's see how it looks on that large paper Siemans steer chart Sencore sent along with the VR940 Video Reference box."

Sam taped the chart at the farthest end of his service center. Swinging the camcorder to frame the chart and then running the zoom to maximum focal found the center to the Siemans star a little fuzzy. Not clear. Swinging the camcorder back to the Sieman's star chart in the VR940 saw the camcorder snap into focus again as the zoom lens was pulled back.

"Well I'll be", said Sam. "Looks like the auto focus adjust is a bit off." A quarter of a turn with an allen wrench while watching the Sieman's wall chart on the monitor cleared up the long distance stars center. Swinging the camera back to the wall calendar proved to Sam he now had a properly focused camcorder. "Wow!" exclaimed Sam to himself. "It's hard to believe I missed that last time. And I would have missed it again if I hadn't run through those standard Sencore CVA94 waveform and chart checks. Mrs. Davidson's camcorder still wouldn't have worked as good as it use to."

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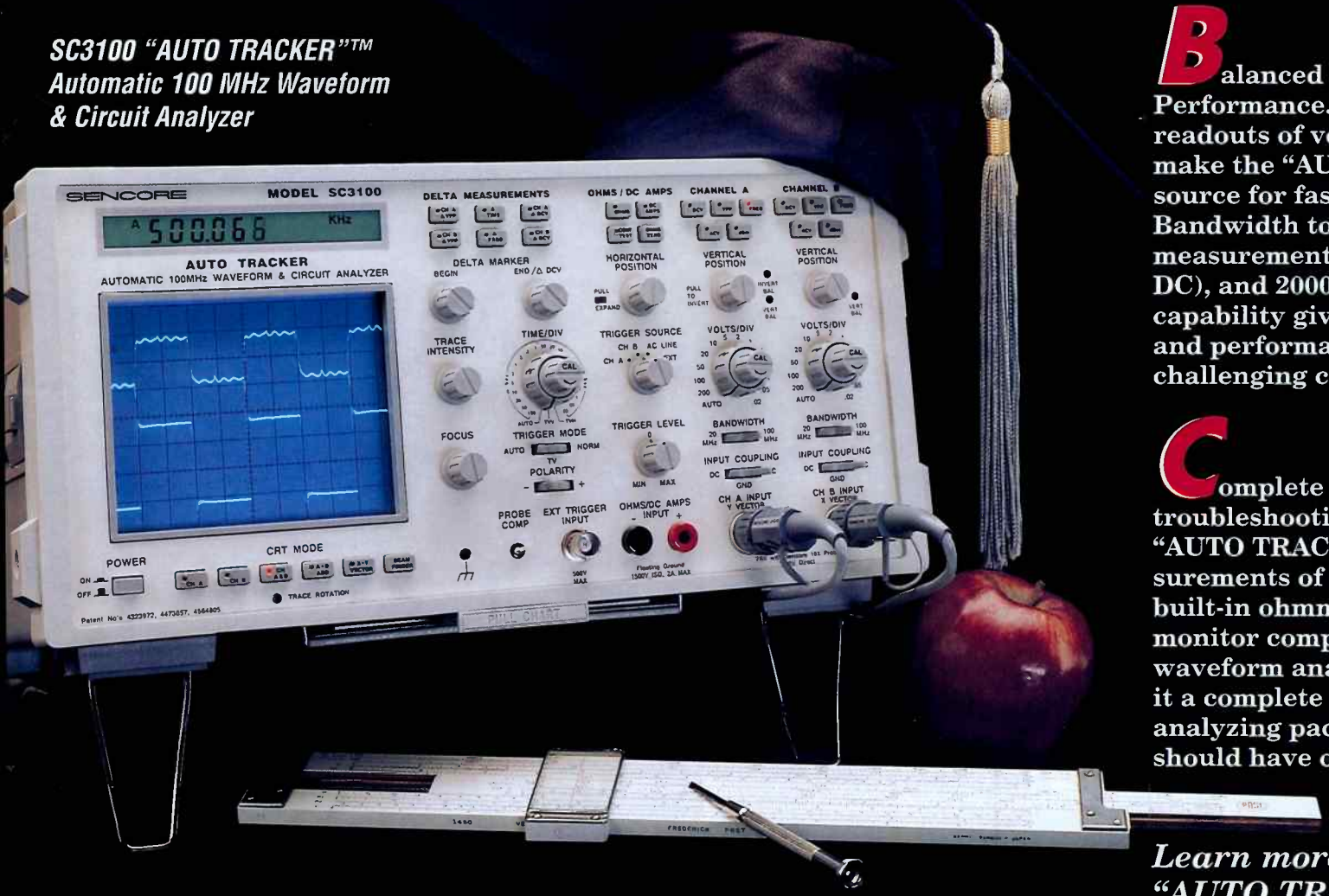

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