SENCORE®
Means Success in Electronic Servicing
tech tips

Making Horizontal Output Dynamic Measurements With The TVA92

Because the horizontal output stage operates under considerable stress from high currents and voltages it has the highest failure rate of any television or monitor stage. Troubleshooting the horizontal output stage is difficult. The flyback and yoke currents are not easily analyzed with conventional methods and many test instruments can be damaged by measurmg the high voltage pulses that are present in the output circuit.

The Sencore TVA92 TV VIDEO ANALYZER is specially designed to provide fast, automatic voltage and waveform measurements in the horizontal output stage. These measurements quickly identify B+ power supply problems, startup or shutdown conditions, intermittents, or improper circuit parameters and guide you to the suspected circuits or components. This Tech Tip covers how to use and interpret the "DCV", "PPV", "Pulse Time µS" and "Input Drive" Dynamic Tests provided by the TVA92.

When To Use The Dynamic Tests

Use the Dynamic Tests to isolate symptoms of a blank raster, low or missing high voltage and startup or shutdown in a television receiver or NTSC video monitor. Before performing any of the Dynamic Tests, use the TVA92's Horizontal Output Load Tests to identify and troubleshoot any severe loading or timing problems. Using the Dynamic Tests on an output stage that has a severe load or timing problem could stress components.

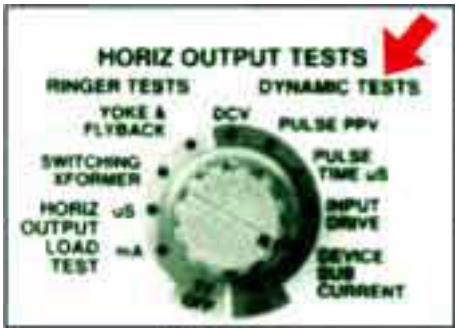

Fig. 1 - Use the Dynamic Tests to isolate blank raster, low or missing high voltage and startup or shutdown symptoms.

The Dynamic Tests analyze the horizontal output circuits at full operating potential. All of the tests are made through three connections to the horizontal output transistor (HOT): emitter, base, and collector. The tests may be used while the chassis horizontal output transistor is operating to confirm proper output circuit operation.

The Dynamic Tests may also be used with the chassis horizontal output transistor removed. This is important when the output transistor is defective and you need to confirm the circuit's operation before replacing the transistor. The output stage will not operate with the HOT removed. However, you may still use the Dynamic Tests to check the B+ voltage and to confirm the presence of horizontal drive. With the HOT removed the Pulse PPV and Pulse Time µS tests will produce "000" readouts.

A more important application is to use the Dynamic Tests along with the Horiz Output Device Sub & Drive capability of the TVA92. This allows you to check the operating parameters of the horizontal output and high voltage stages at full operating potentials while the horizontal output transistor is removed. The Horiz Output Device Sub & Drive substitutes for the chassis horizontal output transistor and replaces the drive with a known good horizontal drive signal.

Using the Dynamic Tests With The Horiz Output Device Sub & Drive

The HORIZ OUTPUT DEVICE SUB & DRIVE Control determines if the chassis transistor is allowed to operate or if the TVA92's sub transistor is driving the output stage. In the "off" position the chassis output transistor is active and the output stage is permitted to operate normally. Turning the HORIZ OUTPUT DEVICE SUB & DRIVE Control out of the "off" detent position removes the base drive from the chassis HOT and defeats its operation.

Use the "Off" positron of the HORIZ OUTPUT DEVICE SUB & DRIVE Control when you want to analyze the output stage operation with the chassis transistor active. Turn the control out of the off position to drive the output stage when the chassis output transistor IS removed or IS defective.

Refer to the TVA92 Operations & Application manual, or to Tech Tip # 210 "Understanding The TVA92's Horizontal Output Device Sub & Drive" for more information on using the Horiz Output Sub & Drive.

Connecting The Dynamic Test Lead

The Dynamic Tests require three simple connections to the horizontal output stage. These three connections are the base, emitter, and collector of the horizontal output transistor (or the gate, source and drain if a FET is used). Connect the Dynamic Test Lead to the corresponding circuit board points if you are making the tests with the horizontal output transistor removed.

The test clips of the Dynamic Test Lead are labeled and color coded for easy connection. Always remove power to the chassis before connecting the test lead to the chassis.

Note: The Dynamic Tests Lead is specially constructed and contains special components. Do not use a substitute lead.

Interpreting The Dynamic Test Results

Use the Dynamic Tests in the order that they appear around the HORIZ OUTPUT TESTS Switch. Following is a description of each of the Dynamic Tests and likely defects if the test produces an abnormal result. The symptoms and probable causes of bad readings are summarized in Table 1 at the end of this Tech Tip.

DCV (B+ Power Supply Voltage)

The "DCV" Dynamic Test measures the B+ power supply voltage to the horizontal output stage. The voltage is measured at the collector test point with respect to ground (emitter). The DCV Dynamic Test is designed for horizontal output stages that use positive B+ voltages, ranging from O-200 volts.

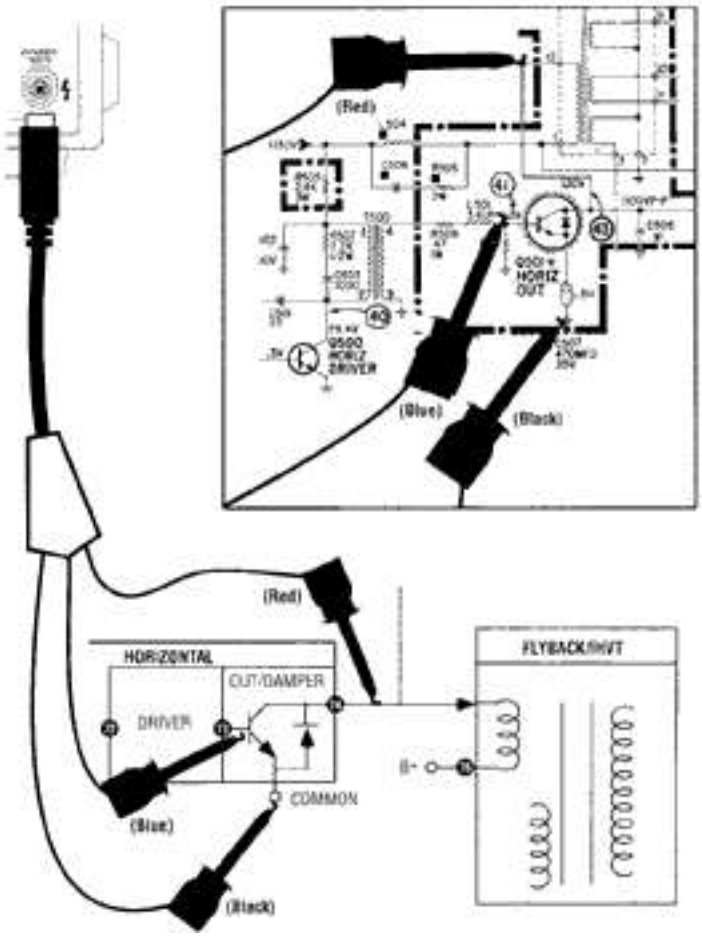

Fig. 2 - Connect the Dynamic Test Lead to the emitter, base and collector of the horizontal output transistor.

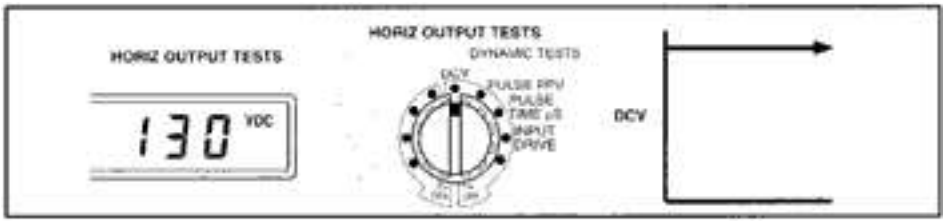

Fig. 3 - The DCV test measures the B+ power supply voltage to the horizontal output stage.

The DCV readout should closely agree with the value indicated in the schematic. Readings that vary considerably from normal indicate a change in the normal current load on the B+ supply or a problem with the B+ supply itself.

If the B+ voltage IS missing, the horizontal output stage will not produce flyback or yoke current. A F+ voltage that is lower than normal causes reduced high voltage and horizontal deflection. Low or missing B+ indicates a problem with the B+ power supply, or a possible direct short to ground. Use the TVA92's Horiz Output Load Test to identify and isolate the short or excessive load on the B+ supply. If the Horiz Output Load Test indicates normal load, analyze the B+ power supply for defects.

Higher than normal B+ voltage causes increased deflection and high voltage. If the voltage is considerably higher than normal, the safety shutdown circuits will "shutdown" the horizontal output stage. High B+ voltage indicates a possible power supply regulator problem or reduced load current due to an open circuit.

Pulse PPV (Flyback Pulse Amplitude)

The "Pulse PPV" position of the HORIZ OUTPUT TESTS Switch measures the amplitude of the flyback pulse at the collector of the horizontal output transistor. It is designed for horizontal outputs using positive B+ voltages and positive flyback pulses.

The horizontal output transistor switches current on and off to the primary of the flyback transformer. The rise and sudden fall of current caused by the resonant action of the output stage produces a large pulse at the collector of the horizontal output transistor. This flyback pulse provides useful information about the operation of the output stage.

Just the mere fact that a flyback pulse is present indicates that the horizontal output transistor is switching: it has drivd, the HOT is not shorted nor open, B+ is present and the current path IS complete. The amplitude of the pulse reflects the levels of flyback current and resonant action of the stage.

The PPV readout should agree closely with the schematic. But because PPV levels typically range from 500 - 1100 PPV, it is not unusual for levels to vary 50

Fig. 4 · The "Pulse PPV" test measures the amplitude of the flyback pulse at the collector of the horizontal output transistor.

VPP between chassis of the same model. However, PPV readings that vary considerable from the schematic indicate a change in the flyback primary current, resonant timing of the horizontal output stage, or indicate a leaky component or circuit loading.

The absence of flyback pulses indicates that the output stage is not providing a path for flyback current, or that there is no B+ voltage. If the "DCV" Dynamic Test shows proper DC voltage, the problem is an open horizontal output transistor or missing drive. Use the "Input Drive" Dynamic Test to verify drive.

The most likely cause of a flyback pulse that is considerably lower than normal is decreased flyback primary current. This can result from reduced B+ voltage, insufficient horizontal output transistor gain (beta), or insufficient base drive current. An increase in the flyback pulse duration, caused by a change in the resonant timing of the output stage, can also reduce the pulse amplitude. Use the "Pulse Time µS" Dynamic Test to check the timing of the output stage.

A slight reduction in the pulse amplitude may be caused by a leaky component, a defective flyback or yoke, or by loading on the secondary of the flyback transformer. Abnormal loading robs power from the circuit and reduces the charging current to the retrace capacitor. Look for an abnormal load on the flyback or leakage paths in parallel with the horizontal output transistor, such as the retrace capacitor.

Higher than normal flyback pulses result from above normal charging current to the retrace timing capacitor. This may be due to an increase in the B+ supply voltage or a decrease in retrace timing caused by decreased flyback transformer inductance or retrace capacitor capacitance.

Pulse Time µSec (Flyback Pulse Time)

The flyback pulse duration (time) measured by the "Pulse Time µSec" test is the charge/discharge time of the retrace capacitor. This duration is the retrace time of the circuit and is determined by the timing components. The retrace time provides useful information about the resonant operation of the output stage.

The TVA92 provides accurate, automatic pulse time readings in horizontal output stages having positive B+ voltages. The time readout is calculated from measurements at approximately the 10% amplitude points on the waveform. It is optimized for pulse amplitudes ranging in from 500-1200 VPP, which is typical of most color television receivers and NTSC video monitors. Chassis having normal flyback pulses less than 500 VPP will read less than 11.3 µS.

Normal flyback pulse times vary somewhat between chassis, ranging from approximately 11.3 µS to 15.9 µS. Schematics usually do not show the exact, normal pulse duration, so you may want to record the normal time on the chassis you service for future reference. A pulse time longer than 16 µS, or several microseconds longer than normal, indicates an open yoke circuit, or decreased yoke inductance or yoke series capacitance. Check for an open in the yoke series circuit path, or in the yoke itself. Also check the yoke series capacitor.

Pulse times shorter than 11.3 µS, or several microseconds less than normal, are caused by a decrease in the flyback inductance or in the value of the retrace timing capacitor. Reduced timing may also be caused by a shorted turn in the flyback or yoke, or by loading on the secondary of the flyback.

Input Drive (Output Transistor Base Drive)

The "Input Drive" position of the HORIZ OUTPUT TESTS Switch monitors the drive to the base of the horizontal output transistor to assist you in isolating startup, shutdown or intermittent symptoms. An "On" reading indicates that drive signal is present, while an "Off" reading indicates that drive is not present at the base of the horizontal output transistor. The test detects even a momentary change in the status of the input drive signal. If startup pulses are present for only a moment the digital readout indicates a brief "On" display followed by an "Off" reading. The opposite is true if the drive is interrupted briefly by an intermittent in the horizontal oscillator or driver stages.

The Input Drive test monitors for input

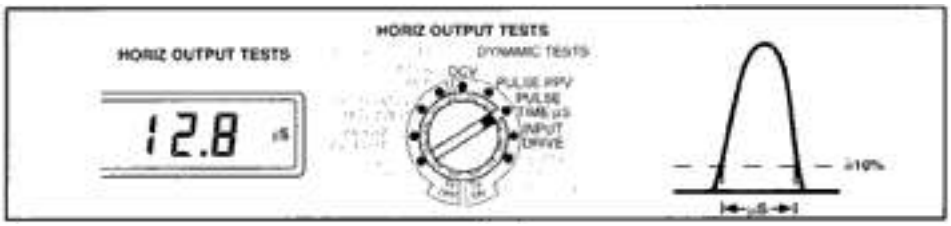

Fig. 5 · The "PULSE Time µS" test measures the flyback pulse duration at the collector of the horizontal output transistor.

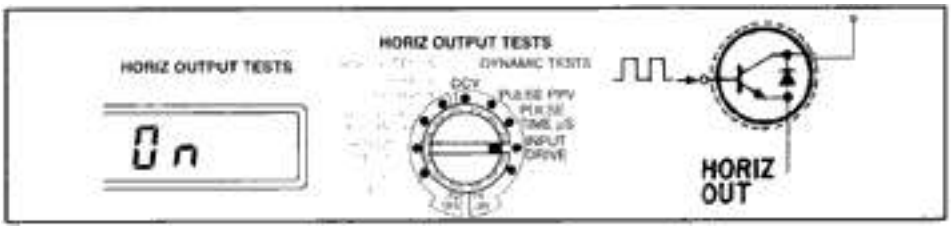

Fig. 6 · The Input Drive test checks for drive at the base of the horizontal output transistor.

drive only if the HORIZ OUTPUT DEVICE SUB & DRIVE Switch is set to "Off". When you sub with the Horiz Output Sub & Drive, the HORIZ OUTPUT TESTS Readout displays "SUB" to remind you that a known good drive is being substituted by the TVA92.

Symptom	Probable Causes
B+ = 0 volts	ı Open Fuses ı Bad B+ Supply ı Shorted B+ path
Low B+ volts	ı B+ Power Supply Regulation ı Low AC voltage
High B+ volts	ı B+ Power Supply Regulation ı Open loads on B+ Supply
Pulse PPV = 0 V	ı No B+ ı No Input Drive ı Open HOT ı Open flyback primary
Low Pulse PPV	ı Leaky retrace Capacitor or HOT ı Flyback Loading ı Reduced value of yoke capacitor ı Bad Yoke ı Low B+ ı Insufficient Input Drive
High Pulse PPV	ı Retrace Capacitors ı Flyback shorted turn ı High B+ (regulator).
Pulse Time = 0 µS	ı No B+ ı No Input Drive ı Open HOT ı Open flyback primary
Pulse Time < 11.3 µS	ı Flyback loading ı Flyback shorted turn ı Retrace capacitors
Pulse Time > 15.9 µS	ı Yoke ı Yoke series capacitor
Multiple pulse times	ı Flyback loading ı Flyback shorted turn ı Leaky HOT damper diode, yoke, retrace capacitors, yoke or yoke capacitor ı Bad input drive to HOT
Input Drive "On"	ı Drive present to base of HOT
Input Drive "OFF"	ı No drive to base of HOT
HOT = horizontal output transistor	

Table 1 - Probable causes of horizontal output stage symptoms.

SENCORE
3200 Sencore Drive, Sioux Falls, South Dakota 57107
Fax: 1-605-339-0317 www.sencore.com

Form 5082
Printed In U.S.A.

#208 802#