

Troubleshooting Monitor High Voltage Regulation Problems With The CM2000

Computer monitors require excellent high voltage regulation to prevent the raster from changing in size as the display brightness levels change. This Tech Tip describes how to use your CM2000 Computer Monitor Analyzer to test a monitor's high voltage regulation and how to troubleshoot the monitor to locate the source of regulation problems.

Why High Voltage Regulation Is Needed

The brightness of a monitor's display is controlled by the signals sent to the monitor from the computer. These signals control the CRT bias, which in turn controls the amount of current flowing from the CRT cathodes to the phosphor screen. This current is supplied by the high voltage supply, which is driven from the horizontal scan circuit.

A brighter CRT display draws more current from the high voltage supply, tending to load down the high voltage. If the high voltage decreases, the raster size increases because the electrons flowing from the cathodes to the phosphor screen move slower and are more easily deflected by the yoke's magnetic field. Regulation is needed to hold the high voltage and raster size constant at all CRT brightness levels.

How Regulation Is Accomplished

Horizontal scan circuits use a switching transistor (the horizontal device) to convert the low supply voltage (generally 65 to 120 volts) into an AC signal. This AC signal is stepped up by the output transformer (flyback) and rectified to produce the CRT high voltage (generally 15 to 25 thousand volts). As long as the low voltage supply to the horizontal circuit is held constant and the flyback circuit is functioning properly, the high voltage output remains fairly constant over a wide range of brightness levels. The

circuit used to regulate the low voltage supply to the horizontal circuit is usually a switching regulator.

Testing High Voltage Regulation

The best way to test high voltage regulation is to switch the display between the extremes of brightness, black and white, and note how much the raster changes size. The CM2000 RASTER pattern, which includes a white border, makes this very easy to see.

To test high voltage regulation:

1. Connect your CM2000 to the monitor-under-test as described in the CM2000 Operation Manual, Pull Chart, or Tech Tip #183 "Learning To Use The CM2000 Computer Monitor Analyzer".

2. Select the RASTER pattern.
3. Adjust the monitor's brightness control for maximum brightness without blooming.
4. Switch the "VIDEO POLARITY" button between "+" and "-". This causes the raster to alternate between white (maximum load) and black (minimum load). See Figure 1.
5. Note the size of the raster, defined by the surrounding white border line.

On a monitor with perfect high voltage regulation, the raster size would not change at all

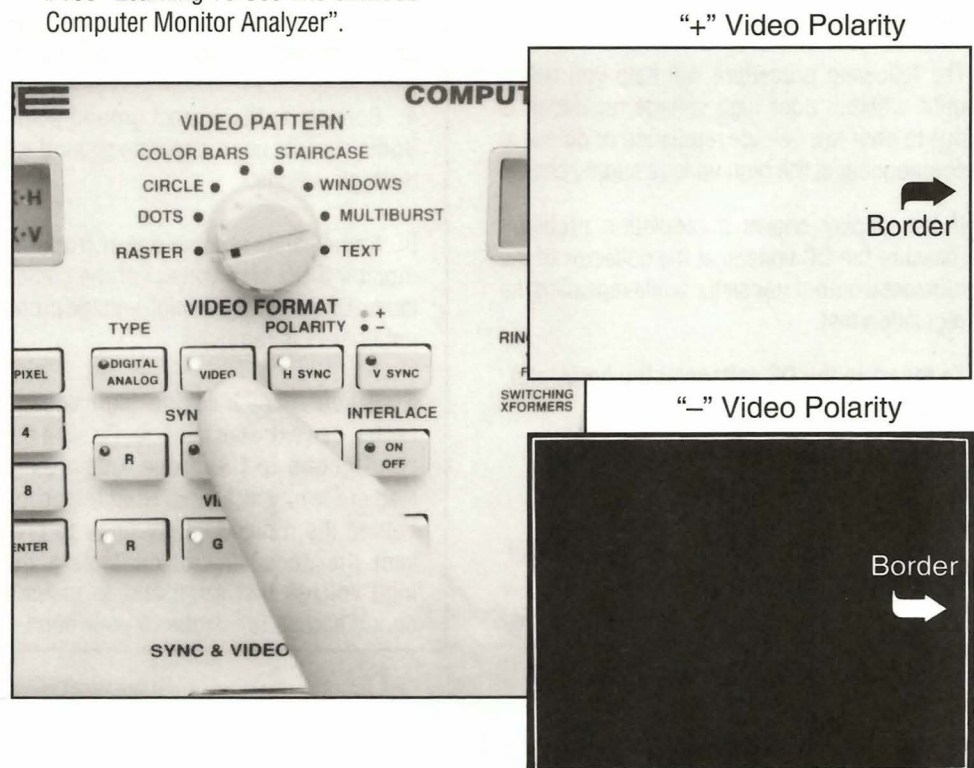


Fig. 1: Note any change in raster size as you switch from black to white raster.



Fig. 2: Use the Digital Display functions to measure the DCV and PPV at the horizontal output transistor.

as the display brightness changed. On a typical monitor, however, the raster size increases as much as twice the width of the border line in all directions as the raster is switched from black to white. Any raster size increase greater than this indicates a problem with the monitor.

Troubleshooting Poor High Voltage Regulation

The following procedure will help you determine whether poor high voltage regulation is due to poor low voltage regulation or defective components in the high voltage supply circuit.

If the display shows a regulation problem, measure the DC voltage at the collector of the horizontal output transistor while repeating the regulation test.

To measure the DC voltage at the horizontal output collector:

1. Connect the DVM TEST LEADS to the DCV & PPV INPUT jacks.
2. Connect the black DCV & PPV INPUT test lead to ground.
3. Connect the red DCV & PPV INPUT test lead to the collector of the horizontal output transistor.
4. Set the DIGITAL DISPLAY control to "DCV".

5. Note the voltage readings on the LCD display as you switch the VIDEO POLARITY switch from "+" to "-".

If the horizontal output collector DC voltage changes more than 1% while changing the video pattern polarity, troubleshoot the low voltage regulator circuit.

If the PP and DC voltages remain stable, measure the CRT high voltage while repeating the regulation test.

WARNING

Measuring high voltage exposes you to the possibility of a severe shock hazard if you do not follow careful test methods. Do not measure the high voltage until you completely read and understand the following warnings and instructions.

1. Never measure more than 2,000 volts without a high voltage probe. Use the TP212/10 kV probe to measure voltages in the 2,000 to 10,000 volt range. Use the HP200 50 kV probe for voltages near or over 10,000 volts.
2. Remove power to the circuit before connecting or disconnecting the high voltage probe.
3. Connect the ground lead so that it cannot become detached during the test. If the ground lead comes loose, immediately remove the AC power to the monitor.
4. Connect to the correct ground point. Some chassis use a separate ground for the high voltage.
5. Immediately remove power from the monitor if the high voltage probe comes loose. Do not touch the high voltage probe until power is removed.
6. If you must hold the high voltage probe, use extreme caution. Be sure the connections to the probe and ground lead are firmly attached. Hold the probe behind the molded safety rings to prevent the possibility of contacting the high voltage test point and to prevent arcing across the probe to your hand.

To measure the monitor's high voltage:

1. Turn the monitor off.
2. Set the CM2000 DIGITAL DISPLAY switch to "DCV".
3. Connect the DVM TEST LEADS to the DCV & PPV INPUT jacks.
4. Slide the red DVM TEST LEAD into the optional HP200 50 kV High Voltage Probe.

NOTE: Be sure the tip is firmly seated in the connector inside the HV probe so that it will not detach during the measurement

5. Connect the black DVM TEST LEAD to the monitor's HV ground point.
6. Connect the HP200 HV probe to the CRT high voltage connection so that the HV probe doesn't need to be held during the measurement.
7. Turn on the monitor and note the voltage readings on the LCD display as you switch the video polarity switch from "+" to "-".
8. Multiply the readings by 100 when using the HP200 High Voltage Probe.
9. Turn off the monitor before disconnecting the HP200.

If the high voltage decreases more than 3% when you switch from black to white raster, but the DC voltage at the collector of the horizontal output transistor was stable, look for problems in the high voltage secondary of the horizontal output transformer.

A common problem is the ground return capacitor on the low end of the high voltage secondary winding, especially if an electrolytic is used (typically in the 1 µfd range). Check the cap for value, ESR, and dielectric absorption.

If the high voltage remains stable when you switch from black to white raster, but the raster size increases more than twice the width of the border line, check the video or sync circuits for changing levels.

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

SENCORE
3200 Sencore Drive, Sioux Falls, SD 57107