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tech tips

Calibrating White Balance in CRT Projection Displays Using the Sencore CP291 Color Analyzer

The popularity of front and rear projection displays in home theater and commercial applications is surging, lead by decreasing costs and dramatic improvements in picture quality. Many projection displays provide near cinema quality and some are THX certified - a sign of their high performance. Most systems are also HDTV and provide larger than life 16 x 9 images.

To achieve maximum performance, front and rear projection displays require periodic, on-site white balance calibration. Viewers expect optimum brightness, contrast, and life-like color. Correct white balance, or color temperature, is critical for a good picture image. Other picture characteristics and setup adjustments including black level, white level, color tint, and color saturation depend on proper white balance. Aligning a picture by eye is no longer acceptable - a color-analyzer is a necessary tool.

A properly white balanced projector produces images where the low luminance gray levels have the same color temperature as the high luminance white levels.

Incorrect white balance causes a visible color tint in the shades of gray. Since the color temperature is calibrated to track from black to white through all shades of gray, white balance is sometimes called gray scale tracking.

Calibrating white balance involves adjusting the bias or cutoff controls and the gain or drive controls of the individual red, green and blue CRTs. The bias/cutoff controls are adjusted at low luminance levels (20 or 30 IRE), and the drive/gain controls are adjusted at high luminance levels (80 or 90 IRE).

What is Needed to Set White Balance

The following tech tip explains how to use the Sencore CP291 to white balance front projectors to ensure they produce optimum color. To correctly adjust white balance you will need:

- Access to the chassis service menu (to adjust the CRT bias/cutoff and drive/gain controls)
- A video pattern generator that provides selectable IRE window patterns
- A color analyzer to read the x, y, Y or color temperature of the displayed image



Fig. 1: Use the CP291 to quickly and accurately measure color temperature and use the VP300 to provide adjustable IRE level Window patterns.

The VP300 provides special Window patterns that include two pluge bars on the left side of the screen, as shown in Figure 2. These pluge bars allow you to maintain proper black level as you make the white balance adjustments.

Adjust the Brightness (black level) control on the projection system so that only the lighter of the two bars (the left bar) is visible. The second bar is "blacker than black" and should be lost in the background when the display is properly calibrated.

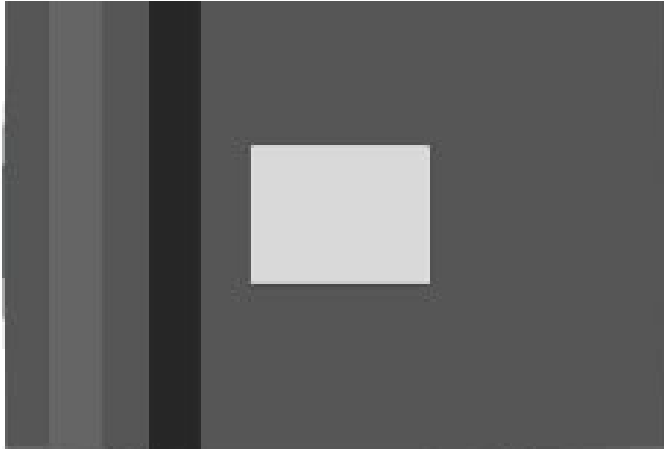


Fig. 2: The VP300 Window patterns contain 2 pluge bars. Set the display's Brightness so only the left bar is visible.

Note: Figure 2 shows the Window pattern with the black level adjusted too high, so both black bars can be viewed.

Calibrating White Balance with the CP291 Color Analyzer

Unlike direct view CRT displays where the measurement pod attaches to the glass screen with a suction cup, with front and rear projection displays you will need to manually hold the pod in front of the screen. With front projectors the pod must be pointed back towards the projector, for rear projection displays the pod is pointed towards the screen. To make positioning of the ColorPro measuring pod easier, it can be mounted on a tripod using the optional CH51 accessory as shown in Figure 3.

Note: The following procedure assumes that you have a basic understanding of the operation of the VP300 and CP291. If you require more information on how to use these units refer to their operation manuals.



Fig. 3: The optional CH51 allows the ColorPro pod to be mounted on a tripod so it can be easily positioned in front of projection screens.

1. Connect the VP300 to the projector using the appropriate connection and select a format that matches the projector.
2. Select the Window1 pattern by pressing the IRE Adjust button in the second pattern screen. Set the pattern to 30 IRE using the up/down arrow keys.

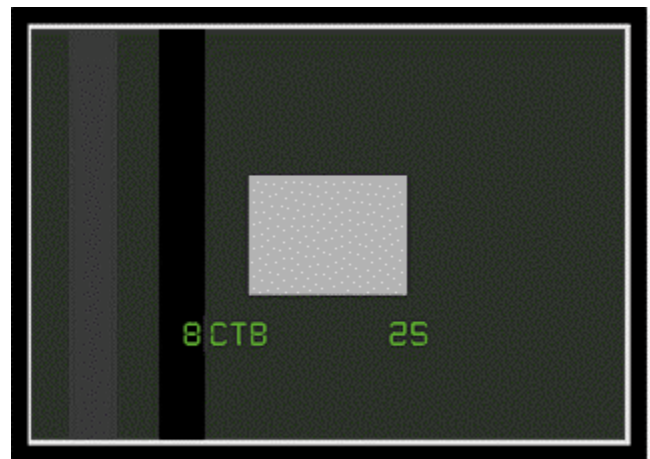


Fig. 4: Select the VP300 Window1 pattern and adjust the pattern to 30 IRE using the up/down arrow keys.

3. Position the measuring pod in front of the screen in such a way that it will not move during the test. You want to measure the direct light out of the projector - not the reflected screen light. **If you are working on a front projection system point the pod back at the projector** (See Figure 5) **if you are working on a rear projector point the pod towards the screen.** In either case locate the pod as close as possible to the screen.

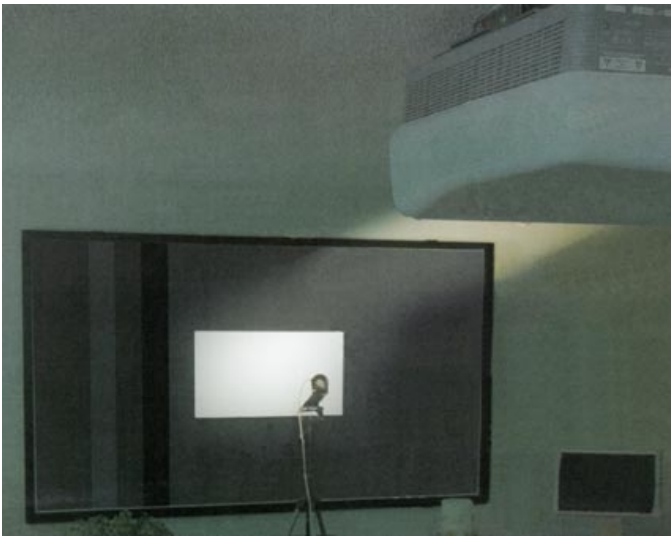


Fig. 5: Point the ColorPro pod at the light source; back toward the projector for front projectors, and towards the screen for rear projectors.

4. Open the ColorPro Setup window and choose the D65 White Reference, as shown in Figure 4.

Note: D65 is the most common white reference and is the standard for movies. Some video displays may also have "vivid", "sports" or "standard" modes that use different white references (refer to the display's

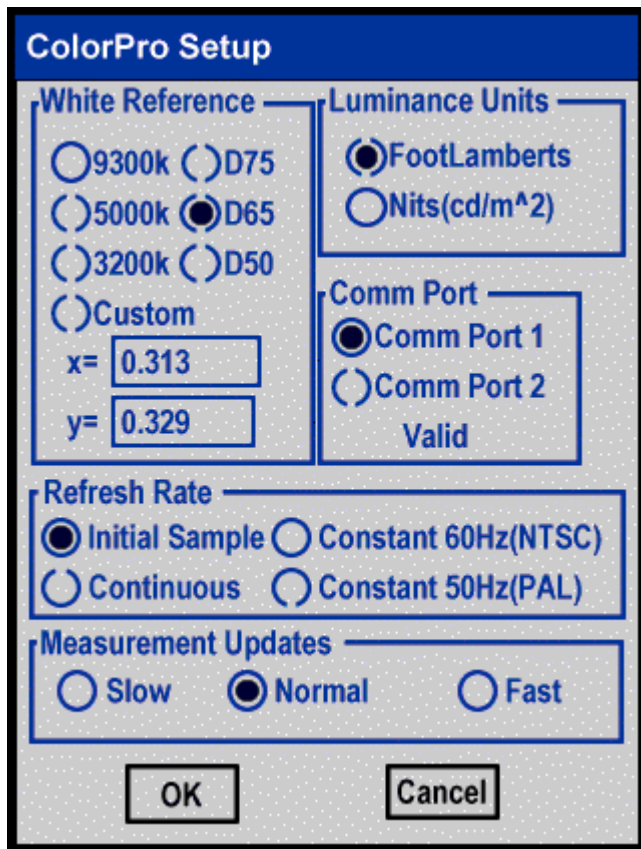


Fig. 6: The CP291 ColorPro Setup screen. Select the D65 White reference, the tap OK to advance to the measurement display window.

service manual). If so, use one of the ColorPro's pre-programmed white references, or select CUSTOM and enter the x y values as you calibrate each different mode.

5. Tap on "OK" at the bottom of the ColorPro Setup when the D65 selection has been made.
6. Closing the Setup display automatically opens the measurement display. Select the Delta RGB display by tapping on "Display" in the menu bar, then tap the "Delta RGB" menu item. This will open the Delta RGB display, shown in Figure 7. (As you become more familiar with White Balance, you may choose to use either of the other two measurement displays options).

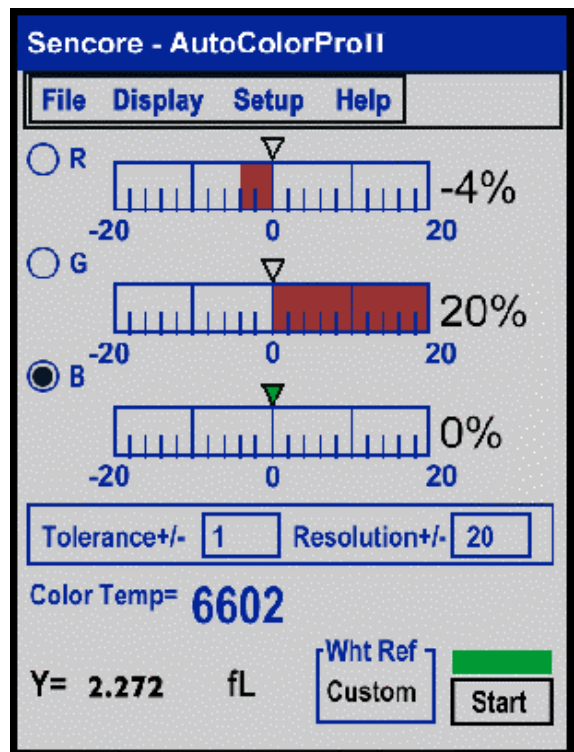


Fig. 7: The CP291 Delta RGB display shows the comparative levels of each CRT needed to obtain the selected color temperature.

7. Start taking measurements by tapping the Start button. The box above Start button flashes green when the CP291 is making measurements.
8. The Delta RGB display shows how much the output from each CRT must be adjusted to achieve the selected color temperature. Adjust the **cutoff/bias** controls for the red, green and blue

CRTs until all three bar graphs read at or as close to zero as possible.

The display in Figure 7 shows that the cutoff for the red CRT needs to be increased 4% and the cutoff for the green CRT control needs to be decreased 20%. The blue bar graph is at zero reference, as indicated by the highlighted circle to the left of it.

Note: If one of the adjustments in the chassis is at the end of its limit, tap the circle next to the desired CRT color to select it as the reference. The display then

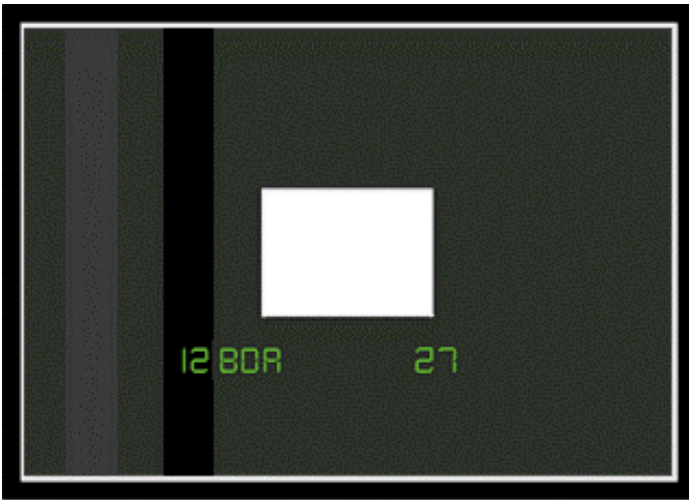


Fig. 8 - Select the VP300 Window 2 pattern and adjust the pattern to 90 IRE.

shows how much the other two colors need to be adjusted relative to this reference.

9. Select the VP300 Window2 pattern, and adjust the pattern to 90 IRE. The display should now appear as in Figure 8.
10. Adjust the **drive/gain** controls for the red, green, and blue CRTs until all the graphs read at or as close as possible to zero. **The drive/gain control should only be used on IRE pattern levels above 60 IRE.**
11. Adjust the VP300 Window pattern from 100 IRE to 10 IRE and check that the color temperature varies only slightly at all IRE levels. Some fine-tuning may be required to get the color temperature to track at all IRE levels.
12. All of the projection system's user controls should be adjusted after the white balance has been calibrated. These controls include contrast, brightness, sharpness, hue, and color. For more information on these adjustments see Tech Tip #242 "Using the VP300 to Adjust A Display's User Controls".
13. Calibration data from the CP291 may be captured and transferred to a host PC where it can be printed added to a customer database. For instructions on transferring data or printing a

**For more information,
Call Toll Free 1-800-SENCORE
(1-800-736-2673)**

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

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