UNDERSTANDING THE VALUE OF WHOLE-SIGN CALIBRATION

watchFire® BY TIME-O-MATIC

1015 Maple Street, Danville, IL 61832 :: 800-637-2645 :: www.watchfiresigns.com

Whether you're considering a digital billboard or an LED sign with full video capability, you've probably shopped around and looked at examples that have been installed for a while. And what you found may have both surprised and concerned you — some of the signs may have a "tiled" or "quilted" appearance, and some may have unnatural coloring.

All LEDs lose brightness over time, and that's normal. But at Watchfire, we've developed a whole-sign brightness and color calibration process that prevents the uneven aging that leads to tiled, quilted or otherwise distorted images. In recent years, technology has advanced far enough to eliminate many of the issues that uneven LED aging can cause, and we were the first LED sign manufacturer to incorporate this cutting-edge technology into our production process.

WHAT SETS WATCHFIRE APART

It's easy to spot brand new signs that do not use whole-sign color calibration because they display unnatural representation of the original artwork, patchy brightness between modules, or mottled coloring – especially while displaying white. In addition, we've witnessed that these types of digital signs and billboards show significant signs of aging less than a year after installation. We use a unique process on all of our XVS signs and digital billboards that demonstrates why Watchfire is an industry leader.

The whole-sign calibration process we use adjusts both color and brightness of the LEDs within each pixel to optimize the visual performance of the sign and to eliminate uneven brightness and splotchy colors. This makes each sign look its absolute best on Day One — and for the life of the sign.

Most low-priced LED sign manufacturers skip calibration all together. Others calibrate for brightness or intensity only. And, as of now, only one other company performs both color and brightness calibration, but they have just begun doing it, while we've been doing it for years and on many thousands of signs. According to Radiant Imaging, as of July 2011, Watchfire is the only LED sign manufacturer to have built whole-sign calibration into the production process, leading to a sign that is fully calibrated and ready to go on Day One.

THE HISTORY OF WATCHFIRE WHOLE-SIGN CALIBRATION

We've made a science out of color calibration, and we pride ourselves on being on the cutting edge of technology. The first Watchfire LED signs built in 1998 relied solely on binning and batching technology. LED suppliers sorted groups of LEDs by common qualities and dropped them into bins. Watchfire would then create batches of each color — red, green and blue — identified by numerical code. Signs were comprised entirely of LEDs from a common batch, which minimized color variations across the display. Although that process was the best available at the time, it isn't satisfactory by today's standards to produce the smoothest, most life-like colors with the longest-lasting color balance.

Batching and binning was the standard process for several years. But we continued our search for better methods of improving image quality. Within a few years, we incorporated a basic module-by-module color calibration process that dramatically improved sign images on our XVS signs and digital billboards rather than relying on the batching process alone.

Since 2007, we've been honing our whole-sign color calibration process, which we developed with the help of Radiant Imaging, a world-leading provider of light and color measurement systems. Because we adapted their software into our production process, each digital billboard and XVS sign leaving our factory looks its absolute best.

THE WHOLE-SIGN CALIBRATION PROCESS

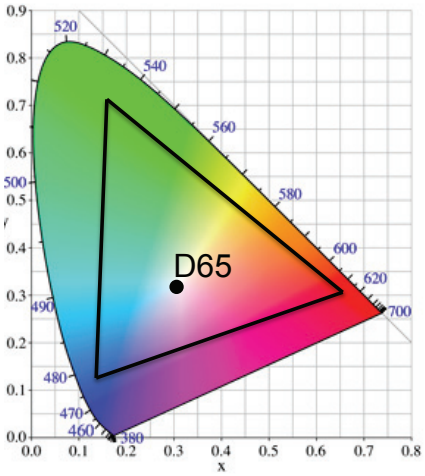
We don't intend to explain our entire calibration process here, but we'd like to share an overview with you so you'll have a better understanding of the care we take with our video displays and digital billboard.

Depending on the size of the XVS sign or billboard, it can take more than four hours to complete the entire sign calibration process. Watchfire engineers start by carefully selecting single binned LEDs from top-tier suppliers that are already grouped by light intensity and color wavelength. This helps reduce variation among the LEDs and allows for a deeper color palette, which results in superior image quality.

Here is an overview of our whole-sign calibration process.

- **Step 1 – Calibrate Equipment**

  For every sign calibration, our first step is to calibrate our equipment, making sure it is measuring accurately. We begin with a colorimeter that takes high resolution digital images of the sign. We then use a spectroradiometer to take very accurate, large spot color and brightness measurements of the sign to calibrate the colorimeter. We also use a uniform light source to adjust for the curvature of our zoom lens, which ensures the colorimeter accurately measures color and brightness across the entire sign.



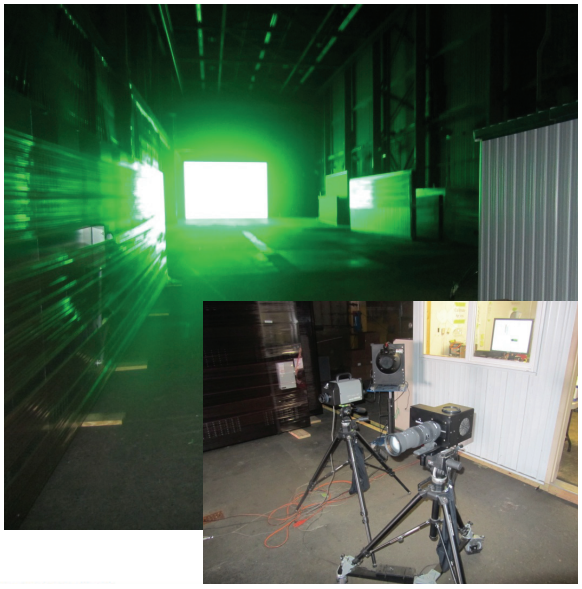
Watchfire calibrates to the television standard D65 White.

- **Step 2 – Calibrate Sections**

  After we properly calibrate the colorimeter, we measure the uncalibrated color and brightness of the entire sign by allowing the camera to focus on each individual LED. Then we adjust the LEDs within each pixel to produce a consistent red, green, blue, and white pixel color and brightness, resulting in a nine-value calibration matrix per pixel. We then store these values in the microprocessor's flash memory within the LED module rather than in the sign's onboard controller. This allows us to move our "smart module" anywhere on the sign without losing the uniform color and brightness. If the values were stored in the controller, a module moved to another position in the sign could be noticeably out of place, which would disrupt the continuity of the sign's images.

- **Step 3 – Calibrate Entire Board**

  Once we've adjusted the individual pixels, we analyze the entire sign as a whole and adjust each module's values so color and brightness are consistent across the sign. As the final step before shipment, we measure the quality of the sign's calibration with all of our equipment, looking for uniformity and accuracy of both color and brightness.



Our whole-sign calibration leads to the most accurate color and most uniform brightness on the market today, and we're very proud of the results. We take comfort and pride in knowing we've done everything possible to provide our customers with the best product available.

FUTURE MAINTENANCE OF A FULLY CALIBRATED SIGN

Once we've calibrated a digital billboard or XVS sign, we can switch LED modules from anywhere on the sign, and the picture will still look fantastic.

We understand that life is unpredictable — even the life of an LED sign. Sometimes replacement modules are needed for digital billboards and XVS signs due to service or vandalism.

Because of our unique process, we have the ability to replace a group of modules from a billboard or XVS sign that was manufactured and installed in the past with new modules that have been calibrated to match the rest of the billboard or sign. This drastically increases the time the billboard or sign will last without requiring field calibration, and it ensures that your advertising images will always look their best. We do this using two processes:

- **Balancing**

  In some cases, replacement modules may be brighter than the rest of the sign or billboard because the LEDs have dimmed over time, which is completely normal. We correct this by balancing the sign. Balancing involves adjusting an individual replacement module so that each of the primary colors is adjusted separately to match the brightness and intensity of the rest of your XVS sign or billboard.

- **Matching**

  If many modules must be replaced at one time due to an accident or vandalism, Watchfire can use an automated visual measurement tool in the field to adjust the base calibration of the newer modules to the rest of the digital billboard or XVS sign before they are installed. This ensures that the billboard or sign will look like new after replacement.

WATCHFIRE'S ONGOING COMMITMENT TO QUALITY

Whole-sign color calibration is a process that goes far beyond having the right equipment. It carries a steep learning curve — requiring time, dedication, and skill to perfect. Watchfire's experienced engineers and technicians have been through rigorous training, and they are constantly working to improve the quality of the calibration process, pushing the technology to new heights. This steadfast commitment to quality is why Watchfire produces the very best LED signs and digital billboards in the industry.

YOU'RE ALWAYS WELCOME HERE

We invite you to come to Danville and take a tour of our facilities. We'd be happy to show you around and explain our calibration process in detail. We're proud to say that we engineer and build all of our billboards and signs right here in Illinois. We welcome visitors who are interested in learning more about why our customers think we're the best LED sign and digital billboard manufacturer around.