# Color Correction & Matching

This document is for artists who want to color correct & match digital files of their art to the originals in order to create marketable reproductions. For those wishing to capture photos for their own records or other non-commercial purposes, these steps are probably overkill.

Many product photos in this PDF are hyperlinked to a site where you can buy the device. I do not get commissions from the purchase of these products. The links are strictly for the readers' convenience.

Color Management, the process of ensuring matching colors across disparate devices, is a HUGE field of study. If CM were a baseball stadium, this tiny, little article would be equal to about one seat in the bleachers. Many experts have spent decades studying color management and total mastery still eludes them.

Think of color management like the children's game, Telephone, where children sit in a circle. The first child whispers a word to the child to the right who then whispers it to the next child and so on until the last child, sitting to the left of the first child, says the word out loud. A word may have started as "ketchup" but end up as "sailboat" or some other equally bewildering transformation.
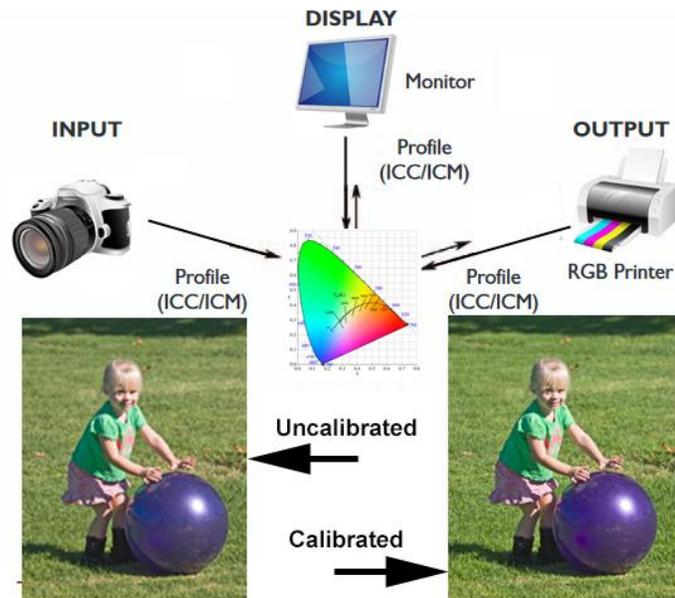
This is what happens in a non-color managed process. Colors may start as one value but end up as a very different value after going through disparate devices including the human eye. Click **HERE** to test your color perception.

Digital devices don't actually "see" objects and colors, they translate the detected light into numbers representing colors. In fact, camera sensors don't even "see" colors, just the amount of light that has passed through red, green and blue filters. So, if a lot of light passes through the red filter but very little through the green and blue filters, the sensor sends a signal that is eventually decoded as "red."

The most critical requirement for a color managed workflow is a color calibrated monitor. To do this, you need two things:

1. **Monitor** – Must have full calibration controls (brightness, contrast, RGB.)
2. **Colorimeter** – A device for measuring colors on a monitor.

The links above lead to devices I recommend but you can substitute anything that meets minimum requirements. Be aware that monitors are constantly updated and upgraded so the links may no longer be viable.

Not all monitors have full controls. Many only allow limited range of adjustments which can make them difficult to calibrate precisely. At a minimum, ensure the monitor has separate RGB controls, Brightness and Gamma. Don't waste money on wide gamut monitors capable of displaying 1 billion colors. Most photo editing software isn't capable of processing more than 16.77 million colors and most PCs aren't capable of handling that much data.

Once you have an appropriate monitor and a colorimeter, it's mainly a matter of following the instructions. Follow the instructions carefully, especially with regard to ensuring the colorimeter is flat against the monitor and no ambient light is getting in along the side of the instrument.
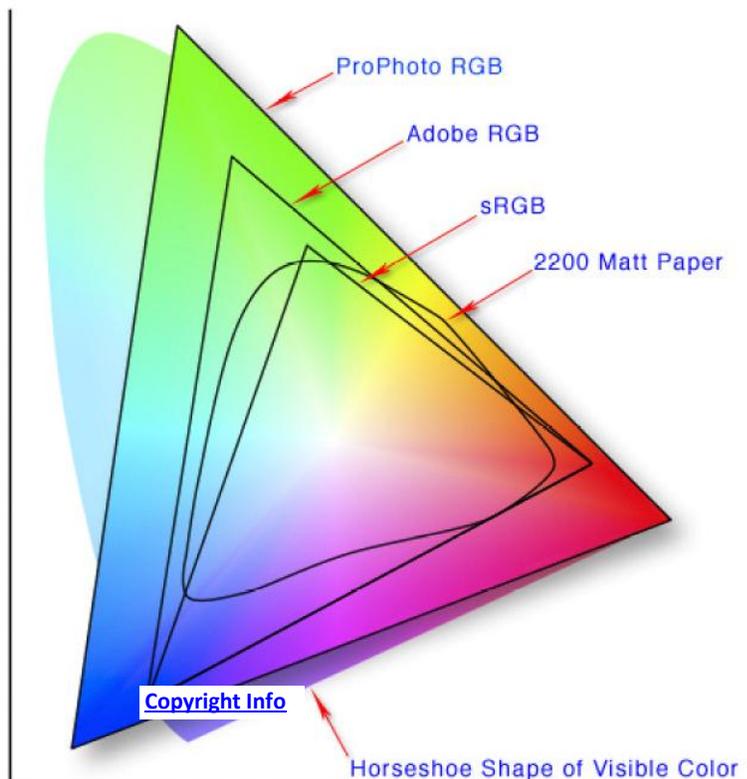
Speaking of ambient light, your photo editing room should be light enough to read a newspaper but no lighter. I bought black temporary paper window shades at Home Depot and attached them to the bottom of my cellular blinds. When I'm editing, I release the temporary shades and block off just the right amount of light to darken the room to the right level. The rest of the time, the temporary shades are clipped to the bottom of the cellular shades.

The Art of Color Correction & Matching

This is where a dollop of FM (freaking magic) comes into play. To understand, you must first understand that a color you see on a computer monitor can never truly match the color you see printed out of a printer. In simple terms, the monitor is a transmissive device that "fires" photons directly into eyes where it stimulates rods and cones in the retina. A print, on the other hand, is a reflective medium that reflects ambient light back to the rods and cones. The luminosity and gamut are completely different for each method.

Conversely, the image the camera captures can never truly match what is seen on a monitor. The color "seen" by the camera is reflected light, filtered by the colors on the artwork.

Here is a graphic that demonstrates these issues.

Labels in graphic: ProPhoto RGB, Adobe RGB, sRGB, 2200 Matt Paper, Copyright Info, Horseshoe Shape of Visible Color

Horseshoe shape illustrates all visible color. ProPhoto RGB encompasses some colors that exceed human vision. Most cameras use a variant of ProPhoto RGB.

Most monitors can display some gamut of colors between sRGB and Adobe RGB.

Inkjet printers are limited to the smallest gamut (range of colors.)

Color Management maps out of gamut colors to a visible and printable color while also maintaining its relationship with surrounding colors. Bottom line, the trick is packing 10 lbs of colors into a 5 lbs box.