

"MONITOR CALIBRATION – WHAT IS IT AND WHY WE NEED IT" BY MICHAEL SMYTH

This tutorial discusses monitor calibration and the how's and whys of implementing and using it in our digital imaging workflow.

INTRODUCTION

Monitor calibration is a necessary step in establishing a reliable and consistent digital imaging workflow. All monitors display colours differently and working environments also differ, resulting in very different outcomes from processing digital image information. This is especially true where the image displayed on one screen is going to be viewed on another screen. Without a consistent standard for colour and brightness, there is virtually no chance that any given image will look the same on two devices.

Monitor calibration is also critical when the final step in the imaging process is to produce a fine quality print. Without correct settings, there is no way that a print is going to appear correctly rendered.

Preparing images for display online, via a web page or other methods can be fraught with difficulty as there is no way of knowing how your viewer's display has been set up and calibrated (if at all). It goes without saying that most non photographers will not be working on a high quality display that has been calibrated, ever.

Therefore, in any digital imaging environment where a photographer wants to display their work either online or in printed form, correct monitor calibration (and colour management) is fundamental to the process. The best we can do is ensure that our end of the workflow is managed and hope that our viewers are seeing something close to what we intended.

Colour management is another topic that requires careful management during the digital workflow, but this will be covered in a separate tutorial.

MONITOR CALIBRATION STANDARDS

There are two ISO Standards applicable to digital imaging. One is for editing images that are intended for display on digital devices such as monitors, TV screens and data projectors. The second standard is applicable to preparing images for digital printing.

The ISO standard for image display is ISO 3664

The ISO standard for soft proofing prior to printing is ISO 12646

Looking at **ISO 3664** first, the important settings to work with are:

- White point **6500 Degrees Kelvin** (Daylight white balance)
- Brightness **80 Candelas** (although this can vary depending on lighting conditions) up to 140-160
- Gamma **2.2**
- Working environment of 32 Lux or lower.

The important thing here is to consider the working environment. A brighter ambient lighting condition will require the brightness setting of the monitor to be set at a higher level. ISO 3664 nominates a lighting level of 32 Lux or lower. As most people don't have access to a lux meter, a simple way to check your lighting level is to first calibrate your monitor to 80 Candelas, then check the comparative brightness of a sheet of white paper on your desktop compared to a white document on screen (using a blank document in Word, for example). If the screen is darker than your sheet of paper, your working environment is brighter than the standard and you either need to lower your ambient light or adjust your calibration to a higher brightness level. See the attached document **"Are you seeing correct colour?"**

Most home working environments are at more than 32 lux, so it is a better option to start with a level of 100 Candelas and work from there.

Looking at **ISO 12646**, this is a standard designed to soft proof images to be printed. It is based on mimicking the characteristics of photographic paper and the relative brightness of ink on paper.

The important settings to work with for soft proofing are:

White point **5000 Degrees Kelvin** (closely replicates the whiteness of a neutral toned paper)
 Brightness of **80 Candelas**
 Contrast ratio of **200:1** (using a black point of 0.4 Candelas x 200 = 80 Candelas)
 Gamma **2.2**

The contrast ratio of 200:1 closely replicates the maximum contrast available with ink on paper (or darkroom prints) so will give an accurate representation of the printed image.

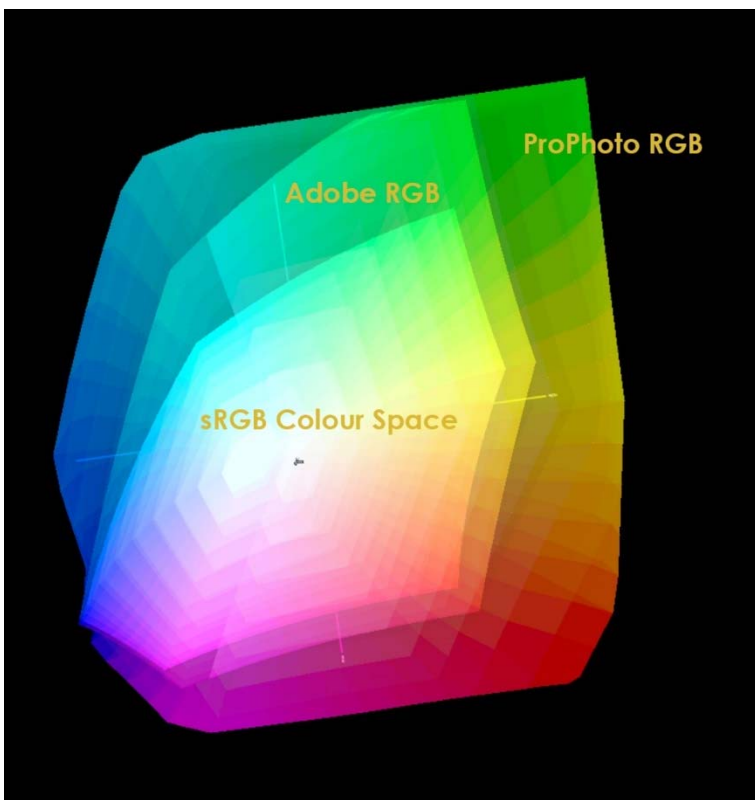
Gamma is the compression of the tones captured in a digital image to replicate the way human eyes perceive brightness. Digital cameras capture brightness in strictly linear fashion, but our eyes become increasingly less sensitive to brighter luminance values.

When editing digital images, it is usual to work in an ISO 3664 calibrated environment to ensure the image information is edited to a known standard. When you are preparing an image for printing it is necessary to change environments and (possibly) make changes to the image settings in order to produce a satisfactory print. There are several considerations necessary prior to printing, including adjustments for the specific paper being used that we cover in our *Printing Master Class*.

WHAT ABOUT COLOUR ?

All monitors reproduce colour slightly differently, so part of the calibration process is to set a consistent white point. Graphics quality monitors (such as Eizo) have an inherently greater colour gamut that approaches that of Adobe RGB, whereas cheaper monitors can only reproduce sRGB colour space.

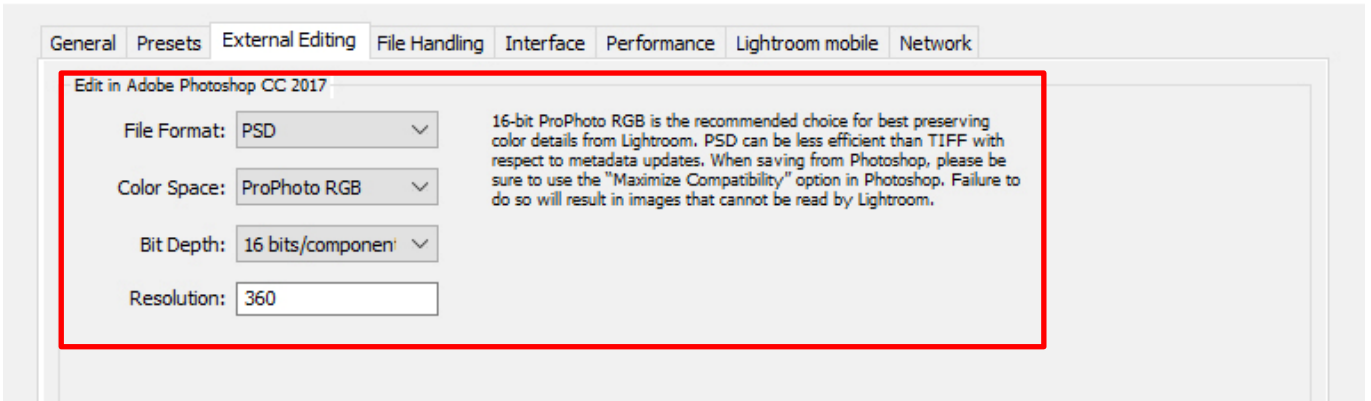
If you are only preparing images for web use, being able to see and adjust colours outside the sRGB (Small RGB – or *Satanic* RGB colour space) is of lesser importance, but if you are considering printing an image, the recommended working colour space is ProPhoto RGB colour space. sRGB is a very small colour space that can be considered to be the lowest common denominator for colour viewing on devices, whereas ProPhoto RGB closely reproduces the extent of human vision.



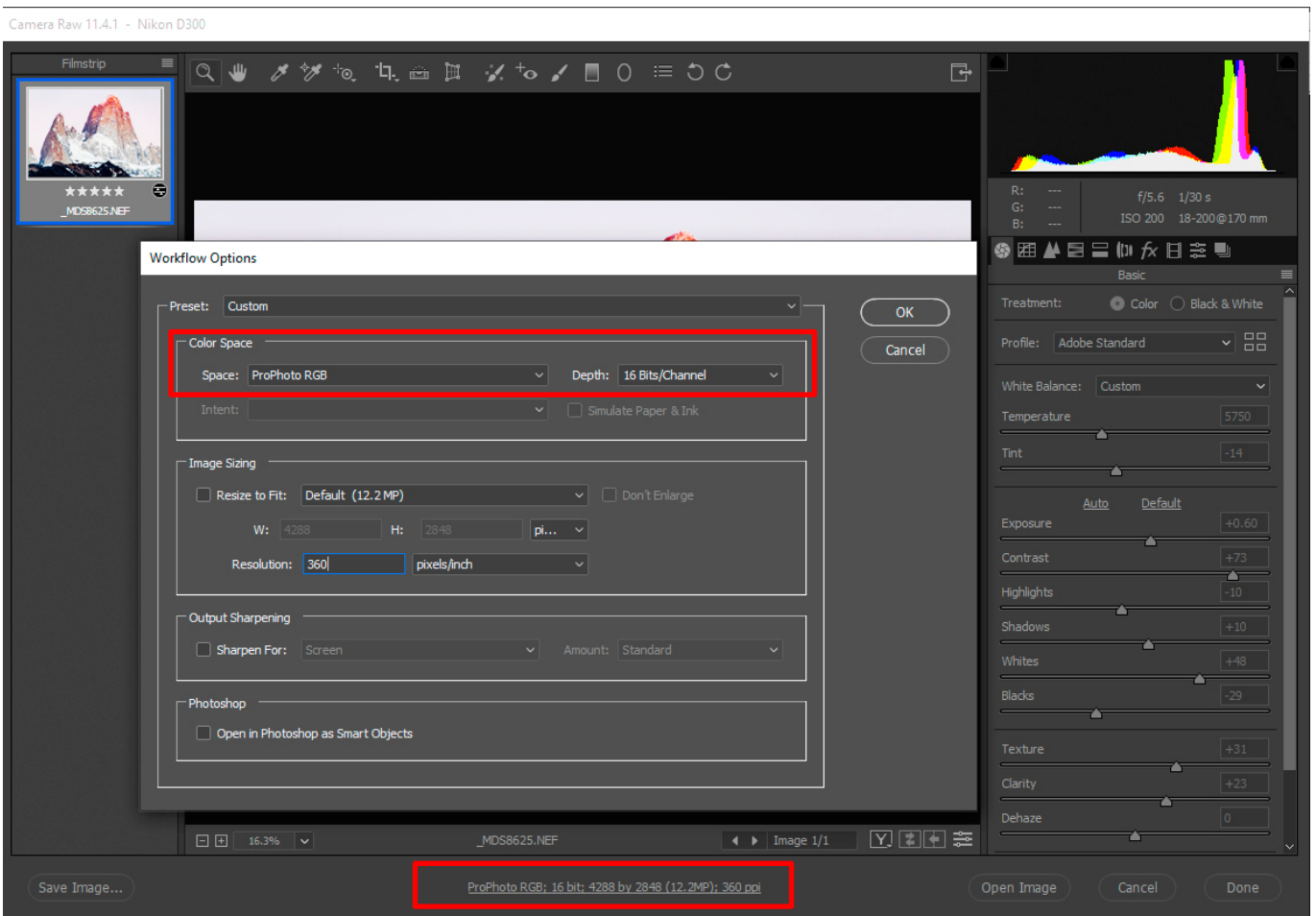
Left: A comparison of Colour Spaces. sRGB is the smallest, ProPhoto RGB is the largest.

When working in Lightroom, you are looking at a ***simulation*** of an image represented by ProPhoto RGB colour space. When you export a file for final editing (and printing) in Photoshop, the colour space is set according to the preferences settings in Lightroom. In Adobe Camera RAW, these settings are found at the bottom of the working window.

Preferences



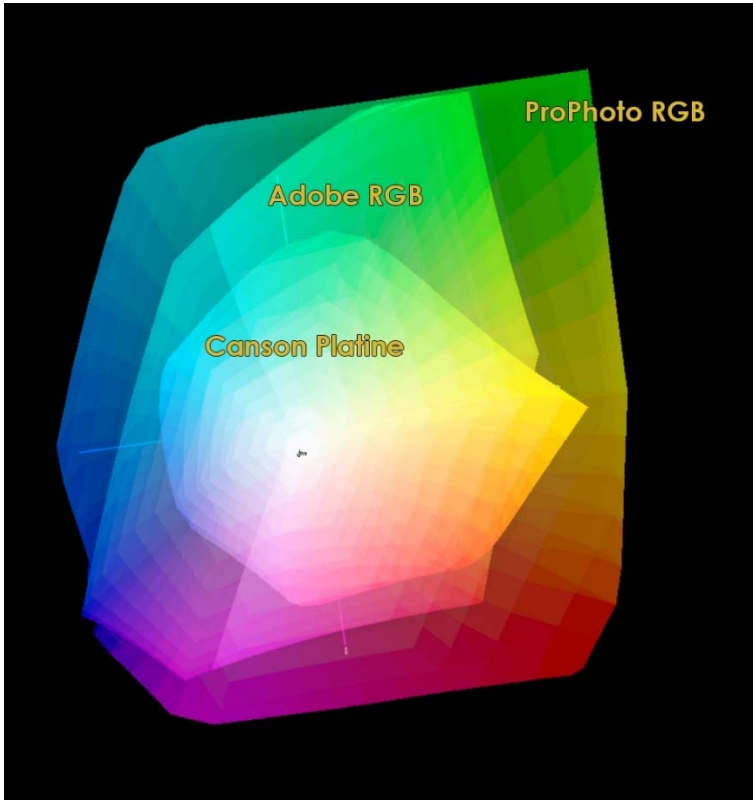
Above: the preferences settings in Lightroom. When working in ProPhoto RGB, always use 16 bit data.



Above: The preferences settings in Camera RAW. The settings are accessed via the hyperlink at the bottom of the menu screen.

You might ask why you should work in ProPhoto RGB colour space when the best monitors can only display Adobe RGB colour space? The answer is that we can print colours outside Adobe RGB colour space, so by rendering images in Adobe RGB we are potentially throwing away valuable colour information. When working in Photoshop, any colours outside the Adobe RGB colour space are adjusted to be visible via the rendering intent of the working colour space in Photoshop (more about this in Colour management).

It also should be noted that all laptops (regardless of brand) have lower quality displays than a good desktop monitor, and considerably less than a studio quality graphics monitor. If you are working from a laptop as your main, or only computer, the best thing you can do is invest in a good quality external monitor. These range in price from around \$1,000.00 to over \$3,000.00. It is just not possible to get reliable and wide gamut colour from a laptop display.



Left: A comparison of a typical fine art printing paper (Canson Platine) with Adobe RGB and ProPhoto RGB colour spaces. You can clearly see how the paper can print colours outside the Adobe RGB Gamut.

Note: These representations of colour spaces are 2D when the colour models are actually 3D. By rotating and viewing the model from different angles, the true extent of the difference in Gamut is much wider than shown here.

Regardless of the type of monitor being used, the full extent of the colours that can be represented will vary from manufacturer to manufacturer. ***So, even after calibration, you may not be able to see the full range of colour in your image. You will, however, be able to see the best representation that your monitor is capable of when correctly calibrated.***

WHY IMAGES LOOK DIFFERENT WHEN PROJECTED OR IN ZOOM MEETINGS

When images are exported as JPEGs for use with a projector, it is important that you also set the colour space to sRGB, as well as sharpening the image after resizing. When you take a 24 MP or larger image and reduce it to projection size (a maximum of 1920 x 1080 pixels), you are discarding up to 90 % of the image data, so it is critical that you re sharpen the image before saving. If exporting from Lightroom, you can do this from the Export menu, but if resizing in Photoshop you will need to resize first, then re sharpen, then save as a JPEG.

Most data projectors are only capable of reproducing sRGB colour space, so it is essential that you look at the final image before uploading for projection. ***Merely converting to sRGB colour space will not guarantee the colours are OK and some further adjustments may be necessary.*** The data projector used by LCCP has been calibrated accurately to within the limits of the device, but there will still be some variance in colour reproduction, regardless. This is because all devices cannot represent all colours to the same degree, so you need to allow for some variance.

The most common issue with images that are being projected or viewed on another device is that they appear lighter or darker than they do on your monitor. This is usually because the brightness setting on your display do not match those of the projector or other screen. It is more difficult to calibrate a projector than a display as a projector is designed to operate in a darkened room, so the brightness settings are different from a monitor.

Using software like Zoom (as has been the norm during Covid 19 restrictions) the images being shared go through some form of video compression that is not clearly explained, but any time that data is compressed, there is the likelihood of quality loss. Nevertheless, experience to date is that the reproduction is pretty good overall.

MONITOR CALIBRATION IN PRACTICE

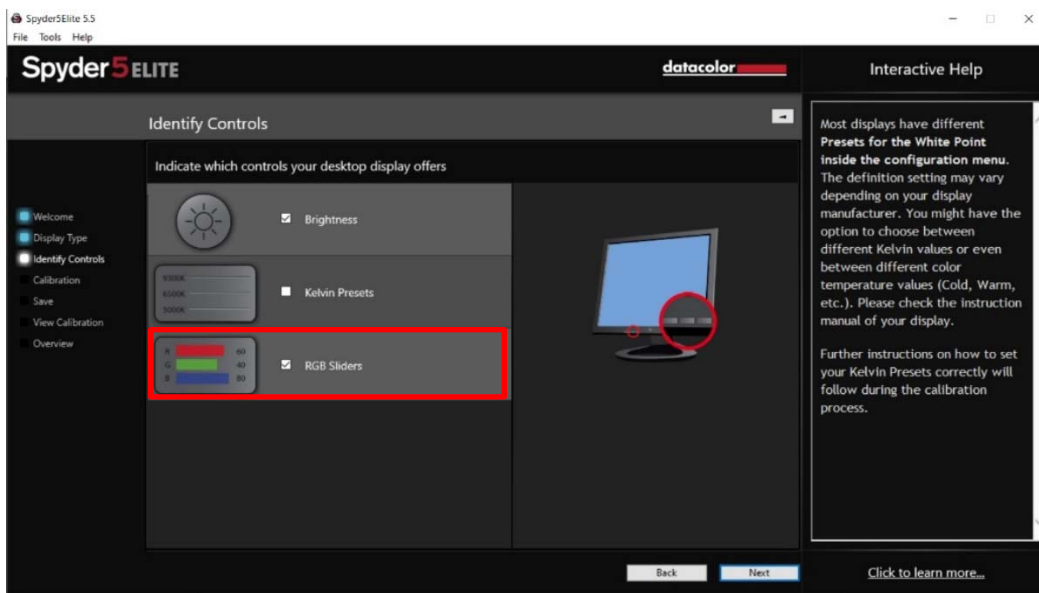
It goes without saying that you can't calibrate a monitor with the appropriate software and measuring device, but we'll say it anyway.

There are many devices available for monitor calibration, such as Spyder, Color Monkey and X-Rite. Using Windows or Mac inbuilt monitor calibration does not give good enough results for digital photography, so investing or sharing a device is a must. We will use the Spyder as an example.

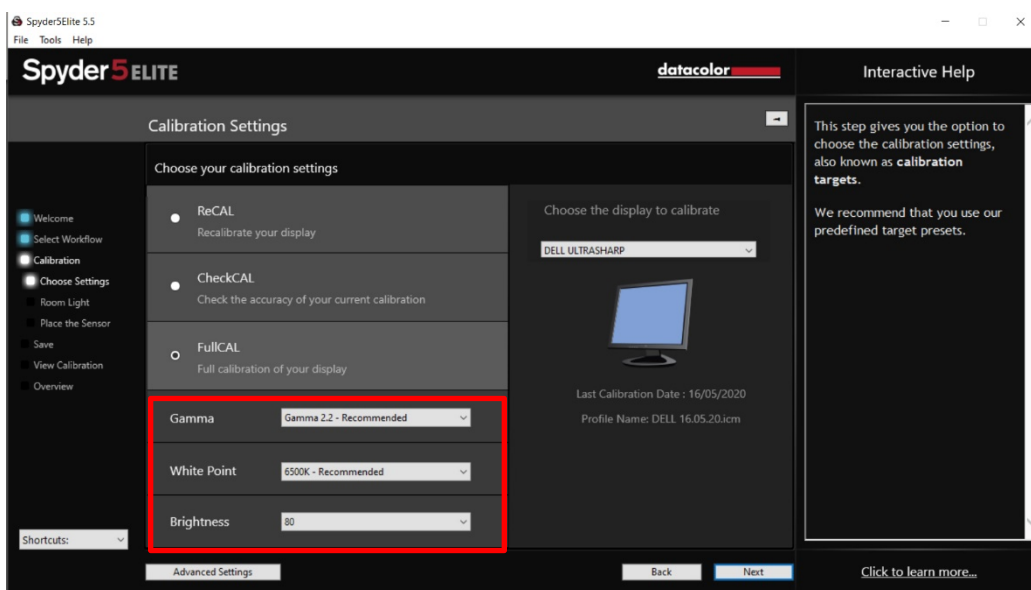
Firstly, your monitor should be warmed up in order to stabilise the colour reproduction.

Next, in order to proceed with the calibration process, make sure you know the settings you want to use by referring to the ISO standards above. Most software will try to set the brightness to 120 Candelas or higher. You will need to manually set the Brightness to 80 or 100 Candelas before proceeding.

If calibrating a desktop monitor, it is also important to check what controls you have, especially if your monitor has separate controls for R, G and B channels. Having these controls available will give a more accurate result.

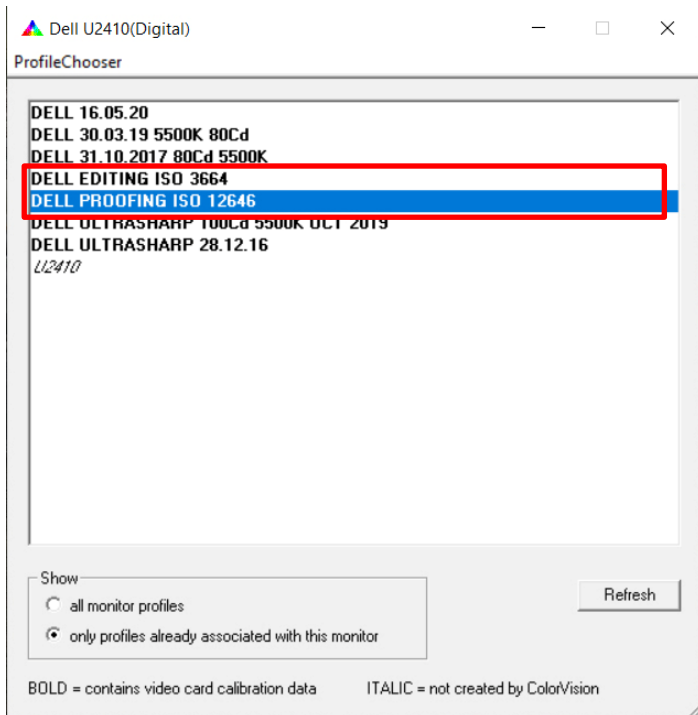


Left: The Spyder Controls page – if you have R,G and B controls on your monitor, use these settings.



Left: The calibration settings window.

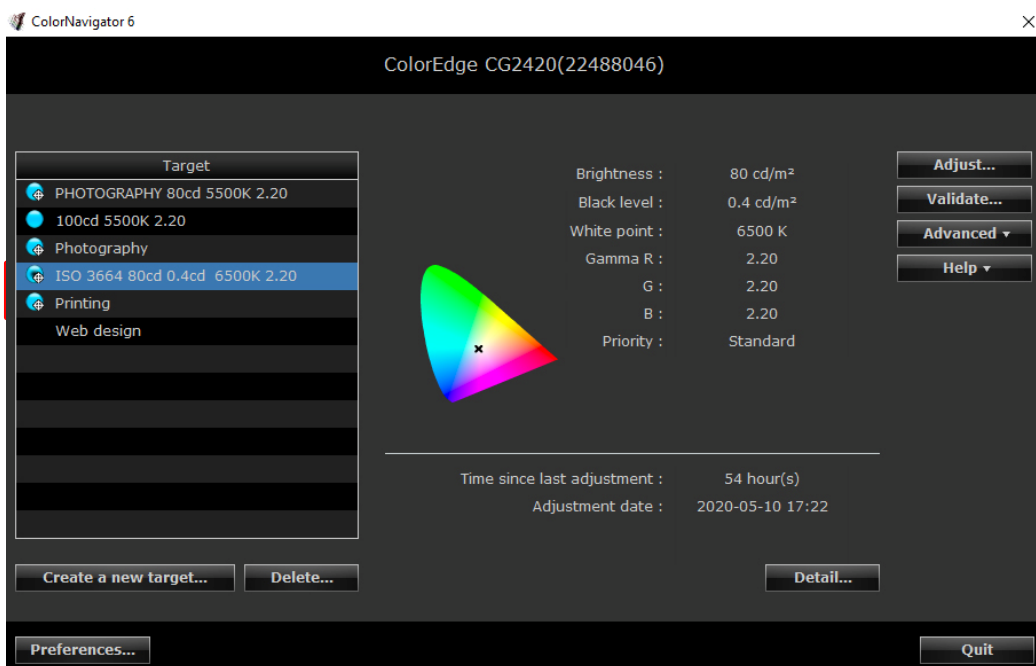
For photographers who will be printing, make a second calibration using the proofing settings and save this with a name that you can recognise.



Left: Using the Profile Chooser for the Spyder, change the profile when preparing to print.

If using an Eizo or similar monitor, prepare two profiles as noted above.

See below.



Left: The Eizo Color Navigator settings panel with two profiles set up. Some Eizo monitors have inbuilt calibration, so it is a case of "set and forget"

CONCLUSION

Setting up monitor profiling and calibration is an essential part of the digital photography workflow. Without a properly calibrated monitor you are literally working in the dark.

If printing as well as producing images for screens, a second d proofing profile is necessary to make the most of the paper and printing settings available. Once set up, monitor calibration need not be too complicated and combined with a colour managed workflow will give high quality and consistent results worthy of the effort we put into producing beautiful images.

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Following page: "Are you seeing correct colour" courtesy of Dr Les Walking.

Are you seeing correct colour?

Different monitors will display colours differently as will different viewing environments.

Here are two tests you can use to determine whether your monitor and viewing conditions are displaying correct brightness and colour.

TEST 1 - CORRECT BRIGHTNESS

Comparing your monitor's white point to a sheet of white paper will indicate whether your monitor is set to the correct brightness for **your viewing environment**.

- Hold a sheet of white paper under your normal room lighting.
- Compare the colour and brightness of the paper with this page.
 - If the screen is brighter, the print will appear darker.
 - If the screen is cooler (bluish), the print will appear warmer (yellowish).

TEST 2 - CORRECT COLOUR

If you can clearly distinguish every step in the following greyscale, and if each step appears relatively neutral (not colour tinted) then your monitor is adequately calibrated.



If this is not the case you should re calibrate, and/or invest in a better monitor.

ADDENDUM:

Professionally calibrated monitors and viewing/working environments will minimise the worst of these appearance discrepancies and errors.

ISO 3664:2009 Graphic technology and photography - viewing conditions (P2) recommends calibrating monitors to a white point of CIE D65 and luminance between 80cd/m² and 160cd/m² in a neutral ambient environment less than 32 lux.

For example, a sheet of white paper viewed under 400 lux illumination is a close visual match to a monitor's white point at 80cd/m².

For critical colour evaluation a profiled professional graphics monitor must be used.

For more information please see: www.leswalking.com/words/the-theory-of-practice/