Tips for Digital Photographers

Common Sense Colour Management

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by Norm Whyte

Monitor Colour Profiles - Introduction

Obtaining predictable color reproduction in the digital darkroom (your computer and equipment) can be a challenge because each device-- digital camera, scanner, monitor, or printer-- responds to or produces color differently.

If you limit your operations to your own well-characterized equipment and follow the following procedures outlined in Monitor , Printer and Scanner calibration, you can get reasonably good results without full ICC color management.

But you may want to go further-- to push the envelope. You may want to:

- improve the color match between your monitor and printer.
- work with fine art papers or nonstandard inks, for example, archival pigment-based inks from independent manufacturers.
- send out an image to be printed, for example, on a large format printer.
- reproduce color as precisely as possible-

To meet these goals you'll need to get involved with the set of software packages and procedures known as color management involving the use of ICC profiles (files that describe the color response of a device or a color space).

Color management, and creating a workflow to get from your scanner to the printer can be a little tricky.

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Monitor Colour Profiles - Colour Temperature, Display & Contrast

Your monitor should be operated in subdued light; strong direct light should not reach the screen. Dark areas of the screen should appear dark to the eye. I work in a semi-darkened room with a lamp above my screen (positoned so no direct light reaches the screen). Total darkness is unnecessary.

Set your monitor's color temperature (white point) to 6500K, D65, or sRGB, which is equivalent to 6500K. Older monitors with no color temperature setting default to around 9000-9300K, which is far too blue to comfortably match prints viewed under incandescent light, which has color temperatures between 2600 and 4200K. The 5000K setting appears too dull and yellow on most CRT monitors. LCDs render more accurate colour.

Your display adaptor software should be set to 24 or 32 bit color (True Color). To see the setting, right-click on the Windows wallpaper (the background outside any open windows), then click on Properties, Settings. I use 24.

Use a daylight bulb lighting in the room. Your room should ideally be evenly lit all day with 5000° K light. Your monitor should have a plain mid-grey background. I have two daylight compact fluro bulbs overhead.

Set the Contrast to maximum unless the image is too bright or harsh.

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Monitor Colour Profiles– Gamma Adjustment (Adobe)

Adjust gamma, the parameter that describes the nonlinear relationship between image pixels and monitor brightness.

There is some interaction between brightness and gamma adjustments, so you may have to go back and forth between them.

There are two basic approaches to adjusting gamma: the **Visual** approach, which uses a special pattern, and the **Calibrator** approach, which uses a colorimeter or "Spyder™

If you are starting out I recommend the visual approach. It's fast, simple, and provides good results in most cases.

Visual – Using Adobe Gamma Control Panel

Many professional and amateur laboratories will supply you with a properly balanced Calibration Patch file, and a copy of the same image as a print, to aid in calibration of your monitor.

Basic calibration is not difficult. The aim is to get an image on the monitor matching as closely as possible to the same image on a print. (Gamma 2.2)

Use the Adobe Gamma Control Panel supplied with Photoshop, and follow the instructions.

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Go to Control Panel and open Adobe Gamma.

• Follow the instructions for setting Contrast and Brightness on your monitor. *TIP: After this adjustment, place tape over the controls to stop subsequent adjustment.*

• In Profile Description click load and choose the profile that most closely matches your monitor. *TIP:If you don't know, choose Adobe RGB 1998 or similar RGB profile. It's only a starting point.* Next

• Set Brightness and Contrast, and then go to Phosphors. *TIP: Change it only if you know it's wrong.* Next.

• Choose Windows Gamma or Mac Gamma, and View Single Gamma only. Adjust the slider as described. *TIP: It helps when viewing this box if you half close your eyes to blur the outlines.*

• Now unclick Single Gamma to reveal the sliders for colour. Theoretically these should not need adjusting – the Single Gamma control will have set them all equally. It is best not to touch them at this stage. Wait until the last paragraph in this section, which is where you can double-check your settings.

• Click Measure to set your Hardware White Point as described. *TIP: 6500K is a good starting point on both Macs and PCs.* Next: Choose Same as Hardware.

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Monitor Colour Profiles – Gamma Adjustment (Adobe)

Save this new ICC profile. *TIP: USE A name like My-Monitor-ICC-date. Then you can find it if you want to reload it* later.

That's it. You have set Brightness and Contrast, White point and Gamma. It takes longer to read about how to calibrate a monitor than it does to do the actual job.

Now to double check. Open the Sample Calibration Patch in your editing program.

Now re-open Adobe Gamma Control Panel and this time choose Control Panel (Same controls, but all on one panel). View the Sample Calibration print in good light next to the monitor. It should match the image on the monitor in hue.

The monitor will of course be brighter, with light transmitted through the image, than the print with only reflected light and the limited colour gamut range of photographic paper. However, the greys should display a full range from white to black, with no colour cast, and the colours should all look pure.

You may feel a little tweaking of brightness and colour would help. When satisfied, you can save your new setting with the same name, which will replace the previous one.

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Monitor Colour Profiles – Gamma Adjustment (Adobe)

What to Do If You do not have Adobe Gamma in your Control Panel

If Adobe Gamma is not visible in the Control Panel (it is loaded automatically when photopshop is loaded) you can load and activate by the following process.

Download the file (Adobe gamma loader) from the internet free software site.

Now, install the file on your computer as follows……

- Navigate to the following folder: *C:\Program Files\Common Files\Control Panels*
- *"Copy" the file "Adobe Gamma.cpl"*
- Navigate to this folder: *C:\WINDOWS\system32*
- *"Paste" the "Adobe Gamma.cpl" file* into the system32 folder.
- Launch the Windows Control Panel: *Start Button -> Control Panel (Choose "Classic View" if not already set) you should see Adobe Gamma listed as an available control panel.*
- Use Adobe Gamma as you normally would to create a custom profile ICC

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Monitor Colour Profiles – Gamma Adjustment (QuickGamma)

If you do not have Adobe Gamma and prefer to use another software then I suggest you try QuickGamma which is a particularly nice little Windows utility (FREE) for visual calibration.

If you use Photoshop (or some other editing software)

In Photoshop, open *Edit>Color Settings and set all Colour Management options to Off.* Leave Working Spaces as is.

Note: *You will still be using Colour Management with ICC profiles. All we have done here is turn off the software that can automatically adjust your images, causing problems when moving files.*

Here are a couple of checks for your settings. *(Acknowledgement to Dry Creek Photo)*

The first image below is based on a test developed by Bruce Fraser and detailed in his book Real World Color Management. The primary goals are to determine if the monitor black point is set correctly and find the minimum shadow level your monitor can display.

This test works best if your browser window is set to full screen mode, as that minimizes the amount of pure white showing.

The second image will help you to evaluate you monitor's grayscale sensitivity across the full tonal range.

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Monitor Black Points – Check Your Settings *(acknowledgement to Dry Creek Photo)*

If this does not work please download file
please download

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Monitor Black Points – Check Your Settings

The animated gif ramps the monitor output up in steps of 1 RGB unit 'patches'. The starting point is pure black: RGB = (0, 0, 0). The first step highlights the central square. Each following step increases the output level by one unit.

A top quality monitor using an excellent calibration system can show the difference between levels 0 and 1. Average monitors will not show any increase in output until level 5 to 8

If you do not see anything until level 11 or 12, one of several problems is at fault. The most common culprit is overly bright ambient lighting.

Even with today's bright LCD screens, working under subdued lighting is necessary for seeing shadow details. Also, monitor calibrators are affected by ambient light to some extent. Recalibrate your display in dimmer light; this often solves many a problem.

Assuming the lighting is good, try calibrating your monitor to a higher black point. The selected point may simply be too low for your screen to resolve differences in shadow levels.

It is better to have the black level set slightly too high than too low. The goal is to be able to distinguish pure black from nearly black. A low setting clips shadow details and places your monitor in an unstable state.

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Monitor Black Points – Check Your Settings

On a CRT monitor, the black level can be adjusted directly using the Brightness control. On LCD systems, the only hardware adjustment is the backlight. Increasing the backlight luminance increases both white and black levels. A balancing act may be required with less capable calibration systems.

Also pay attention to your ambient lighting. CRT monitors need a darkened room for top performance. The higher luminance of LCD screens gives more flexibility here. If *all* the lower steps are visible but no difference is seen between steps, the screen brightness or calibration point is set too high.

A second check is for how neutral the visible patches are.

If you see a color cast to the darker patches, this indicates a problem with either the calibration or a monitor that is not controllable in dark shadows.

Many older monitor measurement pucks do not have sufficient resolution to fine tune shadow performance. A reasonably good quality monitor will produce shadow values that are very close to neutral.

Laptop monitors rarely show truly neutral colors for the first one or two visible patches. If color casts are seen in lighter tones, or if color crossovers appear, the calibration is at fault. Reset your monitor to a default color setting and re-calibrate and profile.

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Monitor Black Points & Grey Scale – Check Your Settings

Do not be surprised if your monitor can not show the darkest patches or if several successive steps appear equally bright.

Only the best monitors that are also well calibrated will distinguish between all patches. As mentioned above, a typical monitor in a dimly lit room will not show anything until level 5-8.

Note: The image is an animated gif. If your browser uses an ad-blocker that filters out animated images, you will need to disable the filter or save the image to view in a different program. In Internet Explorer, the "Play animations in web pages" (Advanced options) setting must also be enabled.

The image below is useful for evaluating your overall monitor calibration.

The first check, obviously, is of overall neutrality. Some monitor calibration systems do a better job at this than others.

The second check is a subjective evaluation of how well your calibration gamma matches with your monitor's native performance. The ideal is smooth gradients from black to white with no banding.

A top-notch monitor that is well calibrated can produce this. Most, however, show some level of banding.

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Monitor Grey Scale – Check Your Settings

By matching your calibration gamma value to your monitor, you can significantly reduce banding. This is a good thing for digital image editing, as it allows you to distinguish image flaws from calibration artifacts

Note: For best results, view the image without passing it through your monitor profile. This is easy on Windows systems, as internet browsers are not color managed by default.

Neutrality:

If the entire gradient has a color cast, your monitor is not calibrated adequately. Set the controls to factory defaults, and run your calibration software again. If the problem persists, the calibration hardware may need repair.

If color crossovers are seen – alternating regions of red, green, or blue – the display calibration is broken. It is possible to create crossovers by tweaking the RGB gun settings on a CRT monitor.

Reset your monitor to its factory defaults and calibrate again. If no improvement is seen, your monitor calibrator is incapable of giving good results with your monitor.

Some software packages allow building a monitor profile with a single gamma curve rather than individual curves. This can help with lesser quality laptop or other LCD screens. Before chucking your calibration system, however, make absolutely sure you are not viewing the image through a profile.

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Monitor Grey Scale – Check Your Settings

Banding/Monitor Gamma:

A very few displays can show the full black to white gradient with no posterisation or banding. Most can not. Typically there is some banding in shadows and darker midtones.

If the image shows bands throughout the range, either your calibration gamma is not well matched to how your monitor behaves, or you simply have a poor quality display.

Most modern monitors – Mac or PC – have a native gamma near 2.2. Your graphics editing environment will benefit from changing to a gamma near 2.2.

If you see significant banding and your calibration software allows it, try increasing the gamma by 0.1.

There is no hard and fast rule here; if increasing gamma creates more banding, reduce the setting. Most monitors tested have a native gamma of between 1.8 and 2.5.

(See gradient image next page)

With acknowledgement to

Dry Creek Photo Digital Imaging Resources for Photographers by Photographers. Great site for information on colour management.

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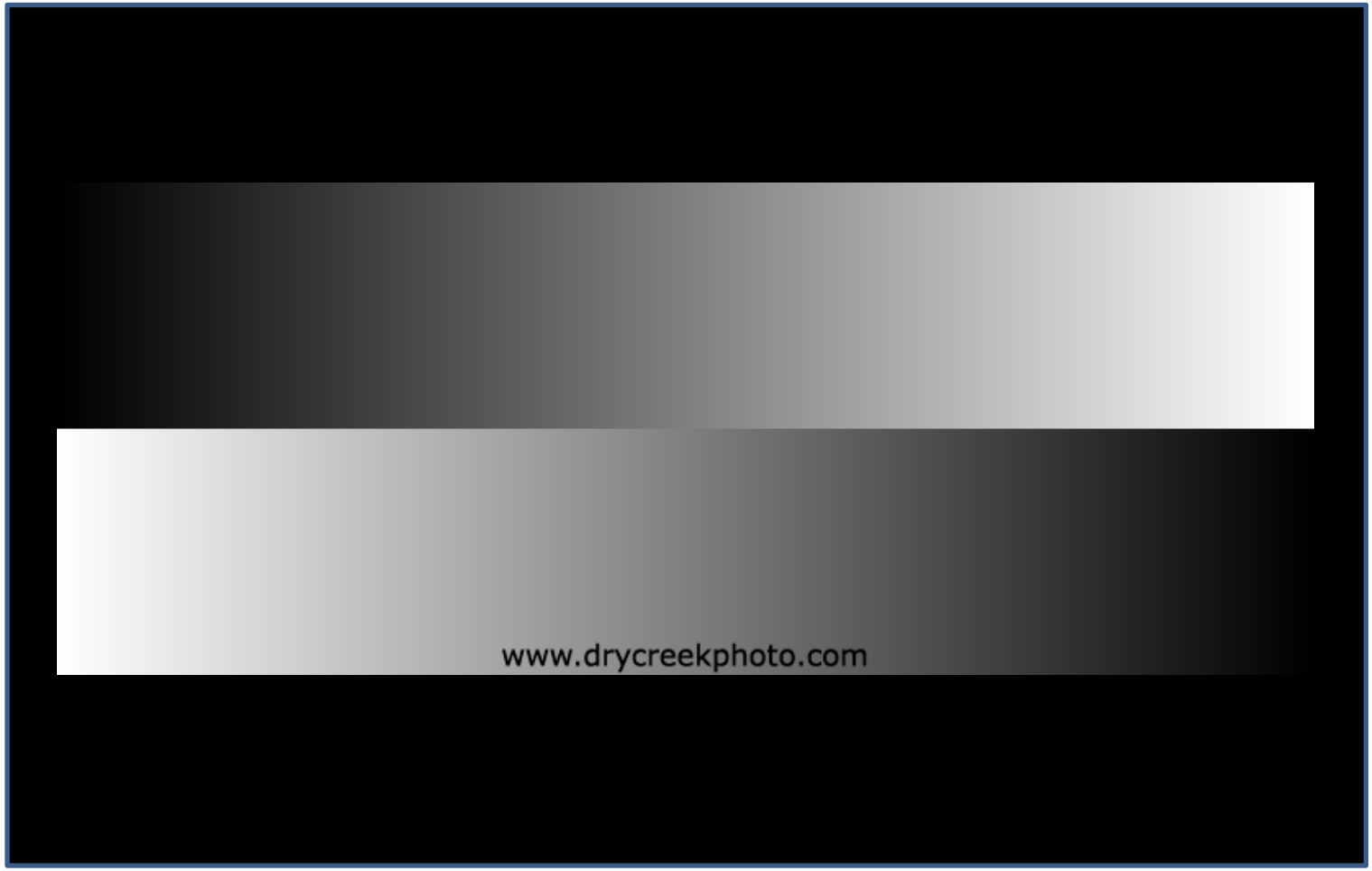

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Monitor Colour Profiles – Turning off Colour Management Software

You are still using ICC profiles with the monitor, and you will still use them to set up your own scanners and printers. We have only turned off the software that can adjust your images between computers. Colour Management will try to keep your images constant on all combinations of computers, monitors, scanners and printers.

It is a valuable tool for pre-press houses dealing with the complexities of CMYK four colour printing on various machines with different characteristics, various inks, dot gain, separations etc. It is also necessary in large corporations, where different portions of a job may be done on several computers and sent out to commercial four colour printers, often overseas.

BUT for Photographers, Colour Management can create more problems than it cures at present, although the technology is gradually improving.

It is expensive and time consuming to set up. It can change the colours of your images when moved to a different computer, (e.g. for printing) and you won't be aware of these changes until your job has been printed.

It is preferable to maintain control yourself, rather than trust an automatic system.

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Monitor Colour Profiles – Use of Hardware Calibrators

Isn't it better to calibrate your monitor with a hardware calibrator that reads directly from the monitor?

Yes, it is more accurate, but be very careful. For one thing it is an expensive service, and monitors can change from month to month. "Consumer" style monitors can be difficult to calibrate properly with or without equipment.

Even if you own the calibrator, you still have to check each image visually, and with the aid of various Photoshop colour measurement tools. You can do this just as well with a visually calibrated monitor - it is not an exact science. (I personally used this method in my studio for years)

Setting highlight and shadow values can be done with the help of the *info tool. Specific Pantone colours can be chosen* for products, although these vary with lighting, but generally contrast, density and colour is chosen by the operator.

Even with prints from film, the colour and density are selected by the analyser operator. Having said all this, excellent results can be attained by any competent person with a good eye for colour and detail, using any visually calibrated monitor and computer setup with which they are comfortable.

The price of hardware calibrators has reduced in recent years ($300 upwards)

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Printer Colour Profiles

If you have concerns about the print matching your display, first ensure that the monitor is accurately calibrated and profiled. As mentioned above, *the entire color-managed workflow hinges on your monitor's color accuracy.* Check that your monitor profile is actually being used by your editing program (Photoshop etc)

The leading cause of confusion and anxiety among photographers concerns printer settings.

"What are the correct settings for the dozens of buttons and dialogs in both the image editing program and printer driver?"

This must be the most common question that I'm asked at seminars, and by e-mail

But it does mirror the frustration that most people feel when confronted with the seemingly endless setting choices available.

Here then is a simplified and concise description of how to set your printing software to give the most reliable and accurate colour results.

It is based on using *Photoshop and an Epson printer, but should be comprehensible* with most other programs and printers.

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Printer Colour Profiles

Photoshop and Print Driver configurations

Before we get into Photoshop and Print Driver configurations let's clarify a couple of matters that still confuse some users.

The typical desktop inkjet printer from Canon, HP, Lexmark and Epson *requires that your image be in RGB mode and not CMYK mode.* The print drivers supplied with these printers are not designed to interpret CMYK image data and will therefore produce less than optimal results. This type of printer is often referred to as Non-Postscript although you may also see them referred to as GDI (Windows platform) or QuickDraw (Mac platform).

The colour gamut (range of colours) of an image displayed on a typical monitor whether it be a traditional 3 gun CRT or digital flat screen LCD cannot be fully replicated in print.

We can often get close, but never an exact match, that is unless we manipulate the image such that the colour gamut is significantly reduced, and even then it's questionable.

Remember that on the monitor the image is back lit and will always look brighter than the image on your paper where the colour is absorbed and is flatter.

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Printer Colour Profiles

Using Profiles

A profile is simply a file that describes how a given printer / ink / paper combination combine to accurately display colours.

Almost all contemporary printers ship with profiles for their inks and that manufacturer's popular papers. These are usually installed automatically when you install the printer driver. You can also buy third party profiles, or obtain them online from paper maker's web sites. A third method, and often the best, is to make them yourself, but this requires that you have quality equipment and software, which can cost several thousand dollars, and usually only makes sense if you are using odd combinations of inks and papers that no one has prepared profiles for.

Profiles have either an .ICC or .ICM extension, (depending on whether they are for a PC or a Mac), and you can easily find them on your computer by searching for files with either of those extensions.

Settings

You'll need to wade through several menus to get to the one that you need. This example uses Windows, but on the Mac it's similar. In Photoshop step through the following...

File / Page Set-up / Printer / Properties / Custom / Advanced

and then set Printer Color Management to *Off (No Color Adjustment)*

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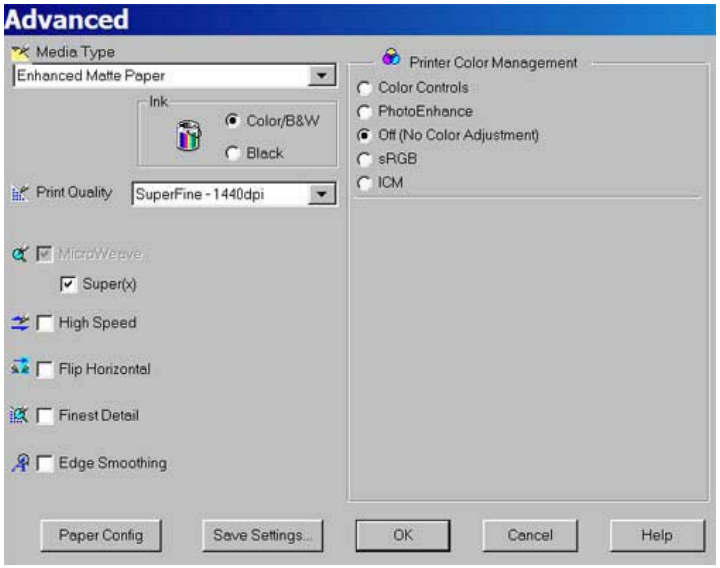

The reason for doing this is because *you don't want the Epson printer driver to be doing any colour management.*

The profile for your printer, ink set and paper will be what controls colour rendition, not the driver..

The way the screen should look is seen above in Figure. If you use profiles, and have anything set here other than *Off, you'll be double colour managing and will get unreliable and usually nasty results.*

Click OK and return to Photoshop.

Next select...

File / Print with Preview

You will then see a window similar to Figure below. Select...

Show More Options / Color Management

and then in the *Profile dialog box under Print Space select the profile for the printer and paper that you will be Using*.

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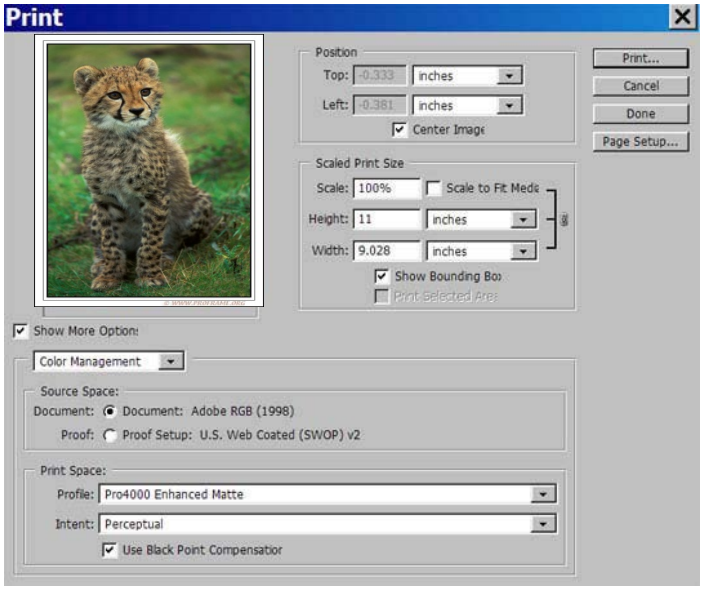
Printer Colour Profiles



That's all there is to it. I've skipped over quite a number of other settings, but these are described in your printer manual and would take a book to detail.

By the way, a very good book on colour printing is *Mastering Digital Printing, by Harald Johnson.* It is one of the single most up-to-date volumes on fine-art digital printing.

If you are having trouble with under-standing the tools and techniques available for making inkjet prints, this is the one book to own.

There are also many very informative websites - *try searching on colour management profiles*

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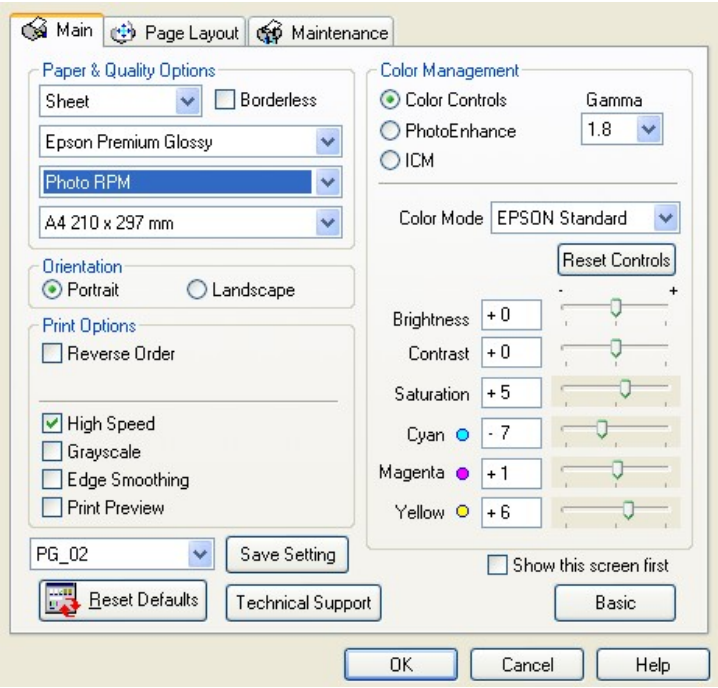
by Norm Whyte

Printer Colour Profiles

You can adjust all the colour pigments and save these print drivers for different papers on your printer. See next figure.



The colour of your monitor image will be initially transferred to your printer via your monitor profile.

By adjusting the sliders for brightness and contrast and saturation along with those for Cyan, Magenta and Yellow you can customise for printing on any paper and ink combinations. The settings can be saved and recalled.

For example a photo image reproduction on gloss Epson paper verses that for a brochure at lower quality on Canon paper.

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Scanner Colour Profiles

For the scanner profile you should use the sample photograph used for your monitor profile and reproduction in your printer

Profiling of the scanner involves scanning the image under the same conditions that will be used to scan other originals.

Any auto correction adjustments need to be turned off so the same conditions the profile gets generated under will apply to each consecutive scan.

At this point you will scan in the image, most likely at 200 dpi which is adequate for reproduction, and save the file.

Compare what your scanner sees to that from your monitor for corrected camera image as previously.

Now you will need to *adjust the scanner controls of hue, brightness, contrast and saturation to mimic your original image.* You are trying to get what you scan as near to what you need to save additional work.

The following figures show some of the controls on my Epson Photo RX590 scanner/ printer and will give you an idea what to look for on your scanner.

As for the printer, once you are satisfied of best match, *you can same the settings for future use* eg colour or black & white.

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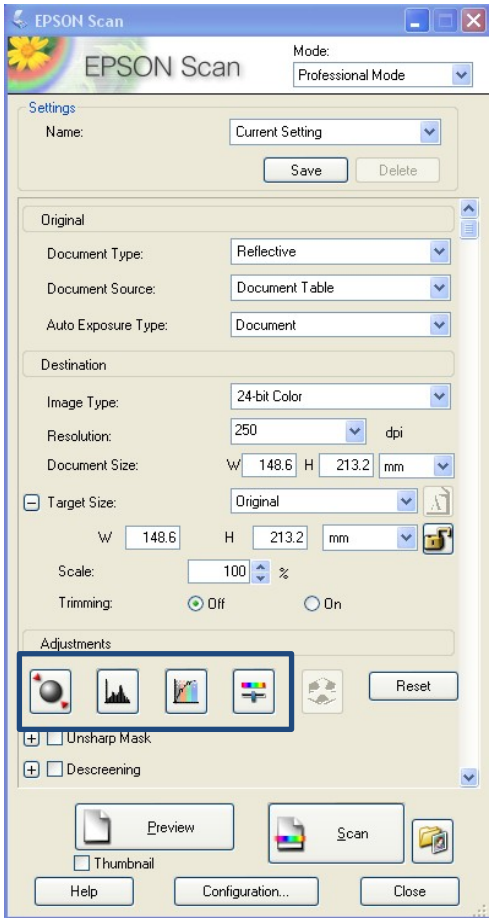
Remember that these processes are NOT full colour management which is much more complicated using industry standards and ICC profiles to colour match your monitor, scanner and printer.

However with up-front determination and selective settings you will be pleased with the outcome for general scanning and printing.

The controls indicated in the blue rectangle give you auto adjust (don't use), histogram adjustment, tone correction and image adjustment. (See follow figures)



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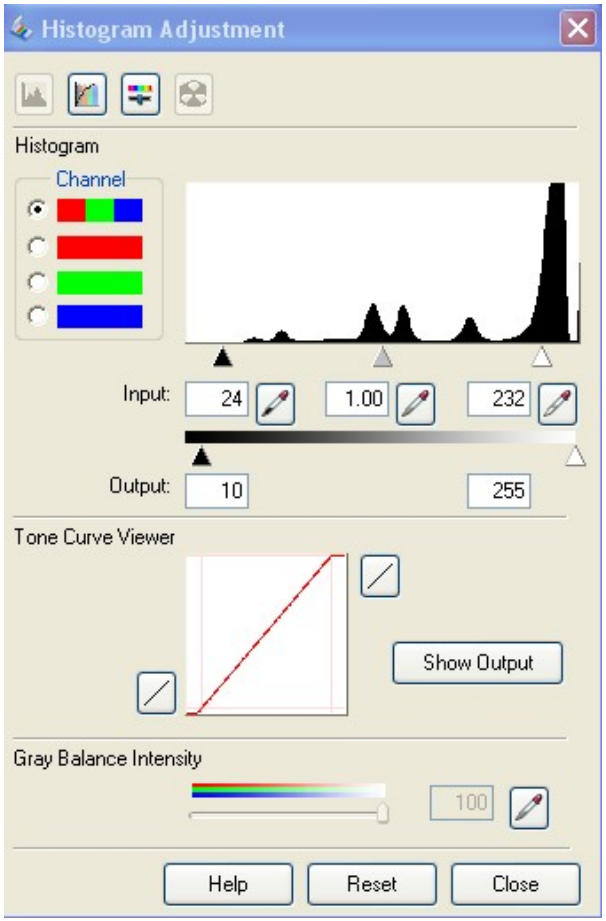

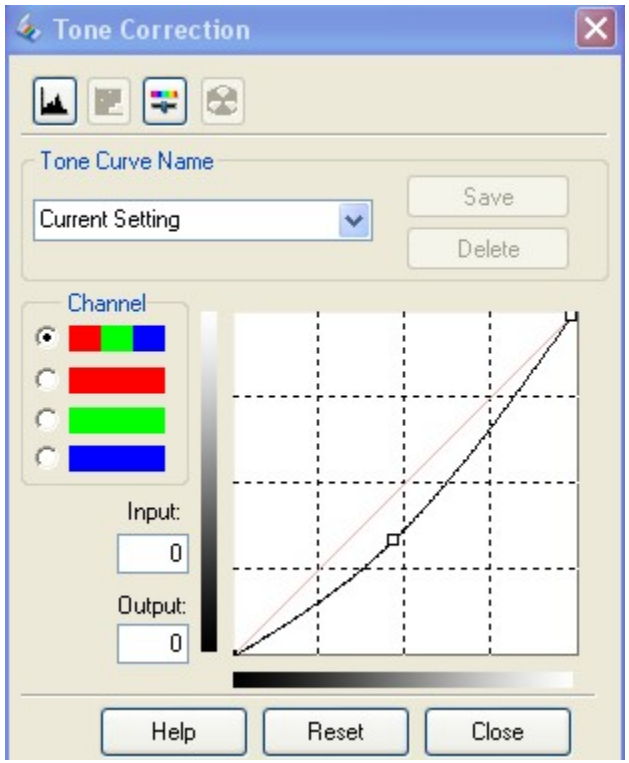

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Scanner Colour Profiles

Using all these tools, you are able to adjust your scanner to best represent the colour, tone and contrast of your original image used to set the monitor.

By recalling these saved settings, you will be able to scan an image directly from your scanner which will capture maximum colour pixels and reduce the amount of readjustment you need to carry out later to have it match your monitor and to print similarly on your printer.

Your scanner will have similar tools as discussed here. A little time investment in getting these processes correct will reap huge rewards and save you much time and frustration.

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Colour Management - Challenges

Challenge 1: Set up your monitor and create a monitor profile ICC file.

Hints:

- *Check lighting near your computer*
- *Set Colour temperature*
- *Set monitor display to true colour*
- *Set contrast*
- *Adjust Gamma*
- *Create ICC profile file for your monitor*
- *Turn off the colour management in editing software*

Challenge 2: Display colour image on your monitor and check that the digital camera image is the same as displayed on your monitor.

You will then see on your monitor what your camera sees.

Challenge 3: After obtaining a print, ensure the photograph colour matches the monitor (you may need a separate profile for different printers or labs)

Do the print colours match the monitor?

Challenge 4: Scan and colour match your scan to your monitor and printed image

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Colour Management - Studio Promo

How you will benefit as a photographer:

You will improve your images and become a more creative photographer through -

- attendance at **FREE Digital Photography Seminars** at local library
- reading up to date issues in my monthly **Newslettter**
- asking questions in our **Lifetime Photographer's email network**.
- my regular free **'Tips for Digital Photographers'** which will help you improve your skills.
- **'Challenges'** in Tips for Digital Photographers which accompany each issue to expand your creativity.
- prepaid **Practical Photography Workshops** including Basic, Travel and Available Light photography.
- Access to **Manuals of Practice**

"Sharing professional knowledge and skills of the photography industry and advancing photography as an art and science in the Community"

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