WHY DOESN'T MY PRINT MATCH MY SCREEN?

Steve Brabner
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This is the most common question that I get asked and the answer is complex. The guidance below has evolved over several years and has been found to be successful by members of Amersham Photographic Society (APS). Epson printers, Photoshop and Photoshop Elements are used for illustration purposes and because they are the most popular amongst our members. Note that the exact screen wording and layout varies from version to version of Photoshop and Epson software but the principles still apply.

1. VIEWING CONDITIONS

- prints change colour and density as they dry so allow at least half an hour before assessing them. There is a chemical reaction between ink and paper and using a hairdryer on the print will not speed it up!
- prints should be viewed in daylight. Tungsten bulbs emit extremely yellow light and normal florescent tubes do not emit the full white light spectrum. Blue craft or grow-light bulbs are better than nothing but a specialised bulb or tube rated not less than 5000 deg K is best. I can recommend the Colour Confidence *Grafilite*.
- a screen should be viewed in a room with low ambient light. It should be the brightest source of light in the room.

2. SCREEN SET UP

LCD or TFT flat screens are pretty stable but avoid the cheapest generic models. The latest IPS technology gives the best colour quality and viewing angles for photographic use but is prohibitively expensive for most of us.

Screens normally have user-adjustable settings and the appropriate values for Windows computers are sRGB, 6500K and Gamma 2.2. If your screen is set up correctly, applying *Enhance>Adjust Colour>Remove Colour* to a colour image in Photoshop should produce a greyscale image with no visible colour cast. There is a useful test image of known quality on the APS website http://www.amershamphotosoc.com/ on the *Digital Group* page. This should look neutral, crisp and fresh on your screen, not dulled by an overall colour cast or excessive density.

Although they are fine for general use, it is our experience that all flat screens need individual profiling for photography (see Para 4.3). Also ensure in *Start>All Programs>Startup* (XP/Vista/Win7) you do not have a program called Adobe Gamma. Delete it if you do.

3. PRINTER DRIVER SETTINGS

Out of the box, with default settings, colour management rarely works successfully. Colour management can be applied by both Photoshop and the printer driver. The crucial trick is to ensure that only one is active. Which one to choose depends upon the circumstances;

3.1 Let Photoshop Control the Colours - *Recommended*
- suitable for any printer for which you have a generic profile (eg recent Epson Photo Printers R800, 1400, R1800, R1900, R2100, R2400, R2880 using Epson ink and paper), or a custom profile;

In this case we have a profile (or preferably, a set of profiles) for the printer. A profile can only be employed when Photoshop handles the colour management. See Para 4 for a description of the various types of Printer Profile.

• **For Photoshop** (illustrated right): Choose *File>Print*. Color Management is selected by default. Select *Document* and for Color Handling *Photoshop Manages Colors* is the appropriate setting. In Printer Profile choose the profile for
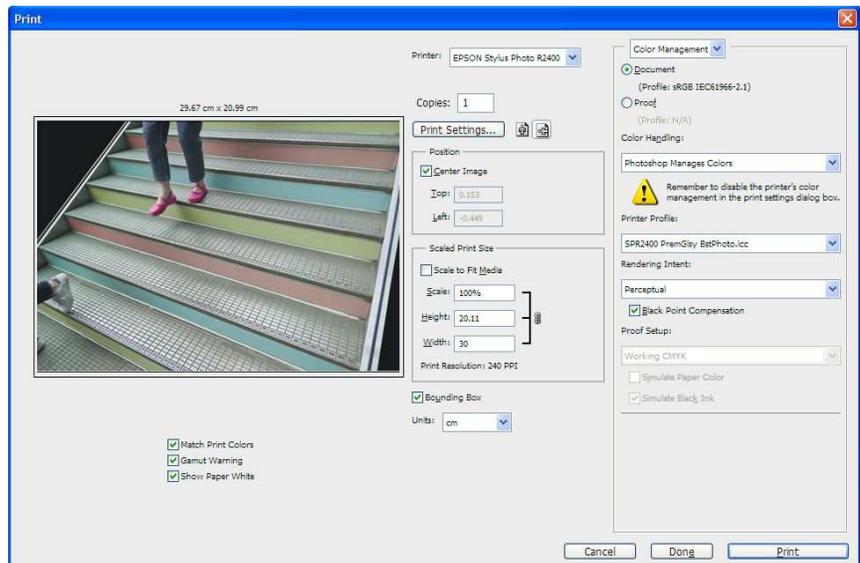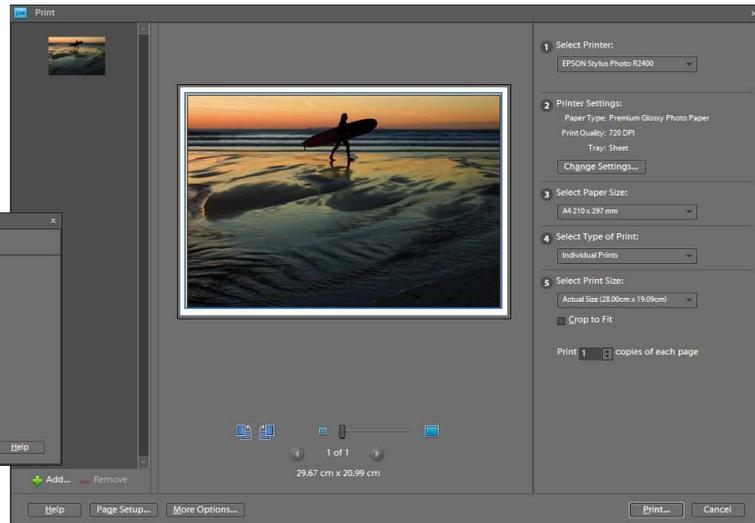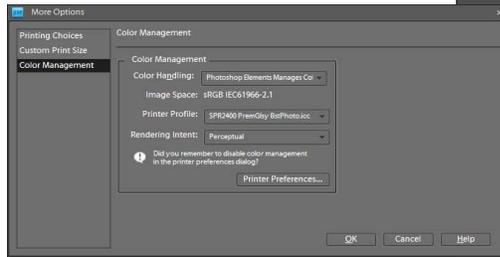
your printer model and paper type from the list.

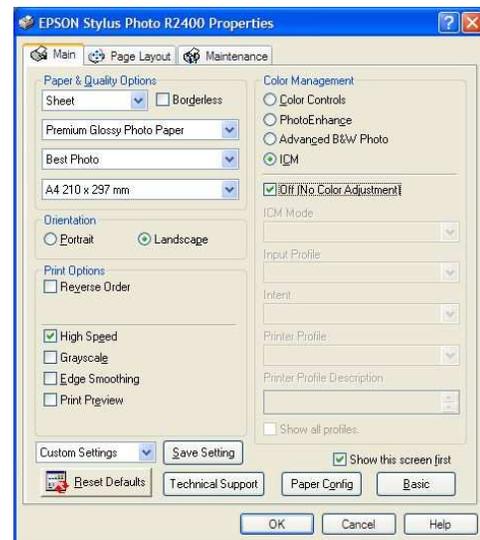• **For Photoshop Elements** (illustrated right)**:**
Choose *File/Print > More Options >
Colour Management.* For Color Handling
select *Photoshop Elements Manages
Colors.* In Printer Profile choose the
profile for your printer model and paper
type from the list.

• **All Versions :** Finally set Rendering
Intent to *Perceptual* and ensure that Use
Black Point Compensation is on (if offered). All of these settings ensure that colour management is being applied by
Photoshop.

Next we need to access the Epson printer driver screens. Eg click
Print Settings in CS5 or *Change Settings>Advanced Settings* in
Elements 8. On the Epson Properties screen go straight to the
Advanced button. On the Advanced screen select your paper type,
Best Photo, paper size and orientation then tick *High Speed* and
untick *Edge Smoothing.* Under Color Management select *ICM* and
then *Off (No Color Adjustment).* If you save and name these settings,
you will be able to call them up in future with a single click. These
settings ensure that the printer receives an appropriate amount of ink
for the paper type but that no further colour management is applied
by the printer driver. Click *OK* three times and print the image.

In theory an improvement in quality should result in choosing *Photo
RPM* instead of *Best Photo* and unticking *High Speed.*
Experimentation is necessary here, especially if your particular
printer driver has other options, but with my R2400 I cannot see any
difference in quality and the printing time is dramatically increased
so *Best Photo* and *High Speed* have become my defaults. With some
paper types you will not be offered any higher quality settings.

3.2 Let the Printer Control the Colours – *Which Can Sometimes Produce Acceptable Results*
**- suitable for printers and printer manufacturer's own inks and papers for which there are no Printer Profiles
available;**

In this case we do not have any profiles for the printer so we need to let it handle the colours for itself.

• **For Photoshop:** Choose *File>Print.* Color Management is selected by default. Select *Document* and for Color
Handling: *Printer Manages Colors* is the appropriate setting.

• **For Photoshop Elements:** Choose *File>Print > More Options > Colour Management* and then *Printer Manages
Colors* for Color Handling.

These settings will ensure that no printer colour management is applied by Photoshop.

• **All Versions :** On the Epson Properties screen select *Advanced* then your paper type, *Best Photo* and *High Speed.* Under Color Management select *ICM*. If you save and name these settings, you will be able to call them up in future with a single click. These settings ensure that the printer driver colour management is active. Click *OK* three times and print the image.

4 COLOUR PROFILES

Colour Profiles (or ICC Profiles) are tables of figures which adjust colour values. They may be associated with any photographic element such as cameras, printers, screens, scanners, projectors and images themselves. Usually they are employed to adjust colours to match a particular colour standard of which there are many. They are necessary because different devices are capable of reproducing a different range of colours (or 'Gamut') and to compensate for individual manufacturing tolerances.

4.1 Generic Printer Profiles

A Printer Profile is designed to adjust the colours for a single printer/paper/ink combination. If you have printer profiles you will use the procedure in 3.1 above. If not, then you will use the procedure in 3.2 above.

During printer driver installation, a set of generic printer profiles may be installed on your computer. If so, these will appear in the list of printer profiles available for selection in 3.1 above and each profile may consist of the printer model and one paper type eg *SPR2400 PremiumGlossy.* These profiles assume that you are using the printer manufacturer's own ink. If you see a profile for the printer with no paper type then this will be of little value and should be ignored.

It is strongly recommended to check periodically on the manufacturers websites for updated ICC profiles as these are likely to give superior results over the ones in the box with the printer. For example updated profiles for a wide range of Epson papers in Best Photo and Photo RPM modes are available for most Epson photo printers. Google something like; *Epson Premium ICC Printer Profiles R2400.*

Because of the complex chemistry involved between paper and ink, they must be compatible. Materials from the printer manufacturer always give good results but beware of the vast array of 'compatible' inksets. They are very cheap but unfortunately <u>totally unsuitable</u> for colour-critical work such as competitive photography. Nevertheless there are a few specialist manufactures who make inks and papers specifically for photographic use and several excellent paper manufacturers. Any non-standard ink/paper combination will need a printer profile and reputable manufacturers such as Ilford, Lyson and Permajet will make these available to download.

Having downloaded a profile to a known location such as the Desktop, right-click it and select *Install Profile*. This simply moves it to a special folder eg for Windows XP, Vista and Win7; *C:\WINDOWS\system 32\spool\drivers\color.* To use the profile, select it by the procedure in 3.1 above.

When using a third party paper, it will not be listed for selection in the Epson printer driver and you must choose the nearest Epson paper. This should be specified by the third party paper manufacturer and is an important part of the profiling process because it will determine the ink flow and head height settings.

4.2 Permajet Colour Profiles

As an example of a commercial profile that can be downloaded from a paper-manufacturer's website, Permajet provide profiles for several combinations of printer, paper and ink. In my experience these are very good. If needed, they also offer an excellent free custom profiling service for any of their own papers and will even profile non-Permajet papers for a very reasonable price. This is done by posting off a couple of printed test charts and only takes 48 hours.

The free downloaded profiles have a complex naming structure which conveys important information; Here is a typical profile;

APJOEM2400PKOYSTERPGPP #1.ICC

Key;
A = No significance other than to put the profile at the top of an alphabetic list.
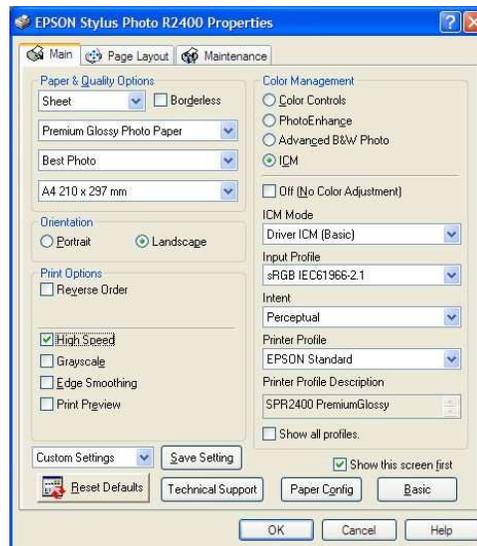
PJ = Permajet
OEM = Printer Manufacturer's Own Ink (eg Epson)
2400 = Printer Type (Epson R2400)
PK = Gloss Black (MK = Matte Black) which must be installed when using the profile
OYSTER = Permajet Paper Type
PGPP = Paper Setting in Driver (eg Epson's Premium Glossy Photo Paper) when using the profile
#1 = Profile Version No.
.ICC = the file type for a colour profile

4.3 Custom Screen and Printer Profiles

Even when you have followed all of the above advice to the letter it is quite likely that your screen and print will still differ significantly in colour or density. So far we have covered generic solutions. You must now consider custom solutions for your particular equipment and materials. **Most people will need a custom screen profile** but conversely, most people will **not** need a custom printer profile unless they have an older printer or non-standard materials.

Flat screens are usually set to an excessive level of brightness in the factory. This is usually the greatest source of mismatch between screen and print. Colorimeters such as the Spyder or Eye-One can create a custom screen profile and APS have purchased a ColorMunki for use by members which can profile both screens and printers. Profiling the screen gives immediate and dramatic improvements and is usually all that it required. For those with older printers or non-standard materials, printer profiling is a straightforward second step.

Custom screen profiles always require the use of a colorimeter on site but custom printer profiles can be done by post and are available from many sources at a reasonable price (eg Permajet - see above)

5. MONOCHROME PRINTS ON THE EPSON R2400 and R2880

The R2400 and R2880 have the benefit of two additional ink cartridges containing greyscale inks (curiously called Light Black and Light Light Black). These enable this printer to produce exceptional monochrome prints in both neutral tones and colour tints when coupled with suitable papers.

To achieve best results, this printer requires a slightly different approach to colour management. It is necessary to let the printer control the colours by turning off Photoshop colour management (Para 3.2 above). However in the printer driver, select the *Advanced* screen and then *Advanced B&W Photo* (Note that this setting is only available for certain paper and quality settings). Under the *Settings* button, preferences for tint and density can be adjusted. The default Tone setting is *Darker* although some have found that *Normal* gives better screen matching.

A feature of these printers is that gloss paper requires Photo Black ink but matte paper requires Matte Black ink. Unfortunately these inks cannot co-exist in the printer simultaneously and indeed it won't even allow you to select what it considers an inappropriate paper for the installed ink cartridge. Although changing between the two blacks is very easy, it does initiate a wasteful ink purging process which further increases the already high running costs, estimates for which are up to £3 per A3 print.

6. CONCLUSION

Screens emit light and paper reflects light. These very different processes can never produce identical results but the objective is to eliminate test prints and wasted material. By working systematically through the above recommendations most APS members have now achieved a good match. When they have failed, it is usually an error in the process or faulty hardware or software.

The next step is to maintain this colour consistency between your system and others, including the club projector for competition purposes. To achieve this, read the separate handout *Achieving Consistent Colour – sRGB vs. Adobe RGB.*

Amersham Photographic Society

APPENDIX

COLOUR MANAGEMENT CHECKLIST

If your print and screen don't match, check the following;

☐ The printer manufacturer's recommended ink and paper are being used (otherwise you're into uncertain territory)

☐ You have made the appropriate settings in the Photoshop Print dialogue box (see above)

☐ You have made the appropriate settings in the Printer Driver (see above)

☐ Double Check: colour management is only set in Photoshop or the Printer Driver, NOT both

If you use a generic printer profile;

☐ You are using the exact paper quoted in the profile (terms can be misleading eg Epson Archival Matte and Enhanced Matte are the same paper but Epson Matte Heavyweight is a different paper)
☐ You are using the quality setting in the printer driver for which the profile was designed
☐ You are using the latest available printer profiles

☐ All the ink cartridges and ink nozzles are working (print a nozzle check pattern)

☐ The print is at least 30 minutes old and you are viewing it in daylight

☐ The paper is in the printer with the front side forwards (!)

☐ View/Proof Colours is not ticked (Photoshop only)

If you already have a screen profile;

☐ It is the active Windows default profile (Start>Control Panel>Display>Settings>Advanced>Colour Management)
☐ You have not updated your graphics card or driver since having the screen profiled
☐ The On Screen Display (OSD) settings for your screen have not been changed since the profile was created

☐ Any colour management software installed with the screen or graphics card is switched off or uninstalled including Adobe Gamma (check Start/All Programs/Startup for anything relevant)

☐ Any colour management hardware associated with the screen (eg a light-level sensor) is switched off

☐ Your screen is not more than five years old

☐ Get your screen individually profiled

☐ Get your printer/paper/ink combination individually profiled

☐ Your screen matches your prints

☐ Relax.