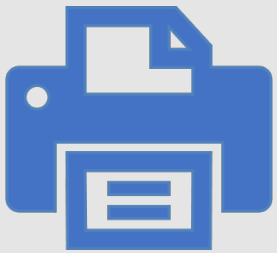
Achieving Consistent Colour

From Capture to Computer Screen to Final Print



Starting with the Basics

There are three basic requirements for producing a final print that looks the same as it does when viewed on a computer screen.

- **'Colour Space' or 'Colour Gamut' (in simple terms 'a box of colours') needs to match throughout the process of taking the image and final printing of the image e.g. ProPhoto RGB (having the largest colour gamut), Adobe RGB (1998) or sRGB. The last two options can be set in most modern digital cameras.**
  (This applies if you shoot in JPEG or JPEG + RAW but if you shoot in RAW only, the Colour Space setting has no effect as RAW files do not have a colour space, so in theory any colour space can be set.)
- **The display, whether a laptop screen or monitor needs to accurately replicate the colours and tones of the image produced in the camera.**
- **The printer then needs to print the correct colours and tones onto photo inkjet paper.**

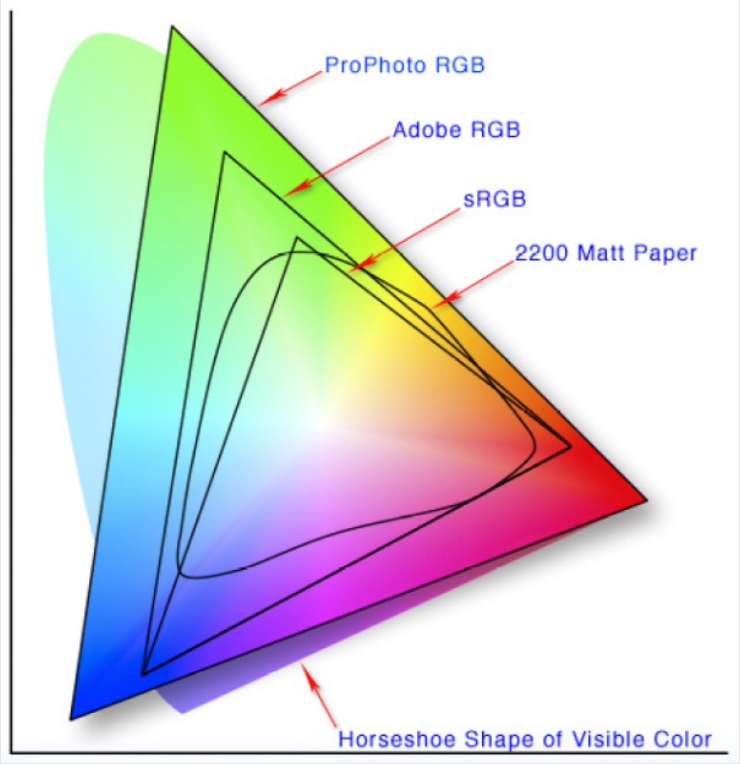
Setting Colour Space

- There are lots of different views expressed on this, but unless you are taking and processing images for commercial purposes, Colour Space Adobe RGB or sRGB should probably be the default setting in your camera. Bear in mind though that some consumer computer screens and printers/paper combinations are only capable of showing/printing in the sRGB Colour Space anyway, so check your monitor and printer colour space capability before deciding which colour space to set on your camera. If both will show/print the Adobe RGB colour space, then select this option.
- **The most important thing is to ensure that you are using the same Colour Space throughout your process.**
- Adobe Photoshop, Lightroom and Elements and most other commonly used photo editing software will automatically detect Colour Space from the JPEG image file metadata. The output Colour Space for RAW images can be set in your editing software 'Preferences'.

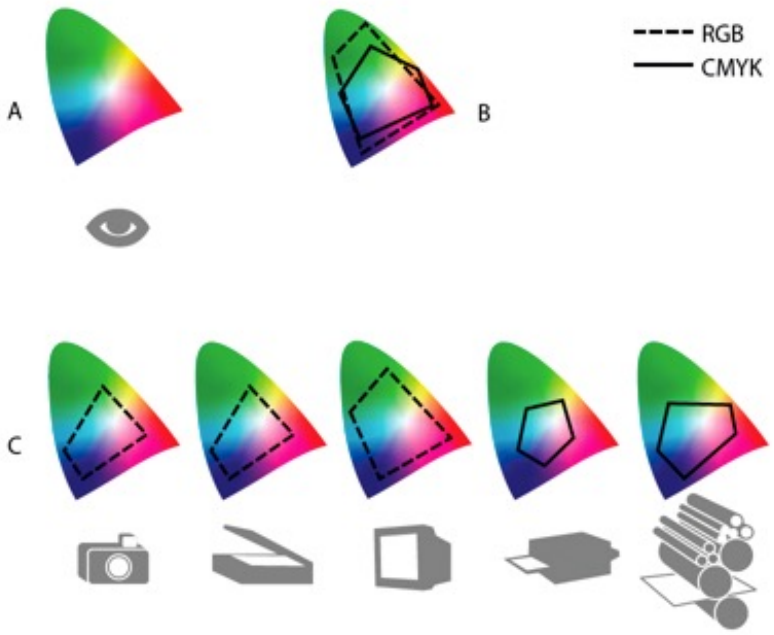
Setting Colour Space

- One thing to bear in mind is that images used for club PDI competitions will need to be in the sRGB Colour Space, so if your camera is set to record e.g. Adobe RGB then you will need to convert the Colour Space of your image to sRGB when saving or exporting your final .jpeg image.
- Note: Whilst you can ‘downsize’ from the ‘start’ Colour Space, i.e. from Adobe RGB to sRGB you cannot upsize.

Colour Space or Gamut



Colour Space Image & Devices



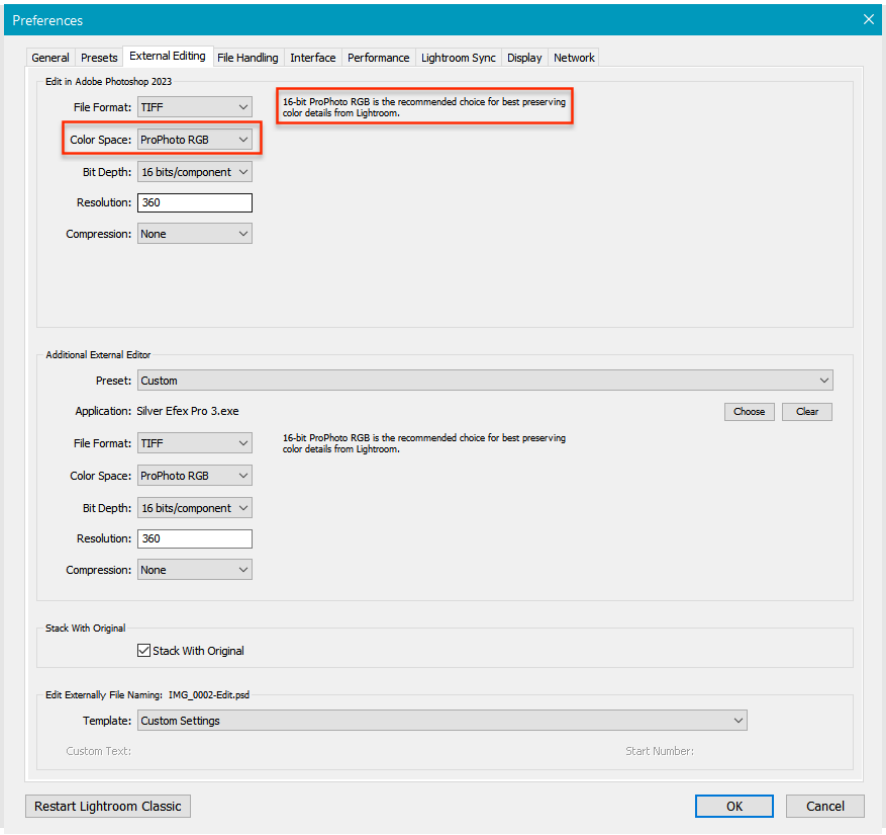
Color gamuts of various devices and images

A. Lab color space **B.** An image's color spaces **C.** Device color spaces

Colour Space Lightroom

- **Lightroom Classic CC uses Adobe RGB** for previews in the Library, Map, Book, Slideshow, Print, and Web modules.
- In the Develop module, by default, Lightroom Classic CC displays **previews** using the ProPhoto RGB colour space. ProPhoto RGB contains all of the colours that digital cameras can capture, making it an excellent choice for editing images. In the Develop module, you can also use the Soft Proofing panel to preview how colour looks under various colour-managed printing conditions.
- When you export or print photos from Lightroom Classic, you can choose a profile or a colour space to determine how the colours you see in Lightroom Classic will appear on the device you're sending the photo to. For example, you can export using sRGB if you're going to share photos online. If you're printing (other than Draft mode), you can choose a custom colour profile for your device.

Setting Editing Colour Space in Lightroom



8 Bit or 16 Bit Processing

- **Bit Depth determines the number of steps between each tone and obviously the more the better in order to achieve the most accurate colour representation in an image.**
- **8 bits/channel – has 256 shades/colour giving a total of 16.8 Million colours.**
- **16 bits/channel – has 65536 shades/colour giving a total of 281 Trillion colours.**
- **Most modern digital cameras record in 14 Bit**
- **No brainer🤔**

Optimize Colours for Screen and Viewing

- **Make sure you are viewing the best representation of colours on your screen by telling your photo editing software to ‘Optimize Colours for your Screen’.**
- **In Adobe Photoshop Elements go to Edit > Color Settings and click on: ‘Always Optimize Colours for Computer Screens’**
- **No adjustments are necessary in Photoshop CS, or CC or Lightroom.**

Viewing Prints & Images on Screen

- What also affects our perception of the final print colours is the light in which we view our screen and print. For viewing prints, it is best to do it in daylight or under ‘daylight’ bulbs i.e. ones with a colour temperature of around 5500/6500 degrees Kelvin.
- Ideally shade your monitor screen with a hood to avoid stray light hitting the screen and ideally try to view your prints under consistent lighting conditions e.g. half close blinds/curtains, so direct sunlight is not entering your workspace.

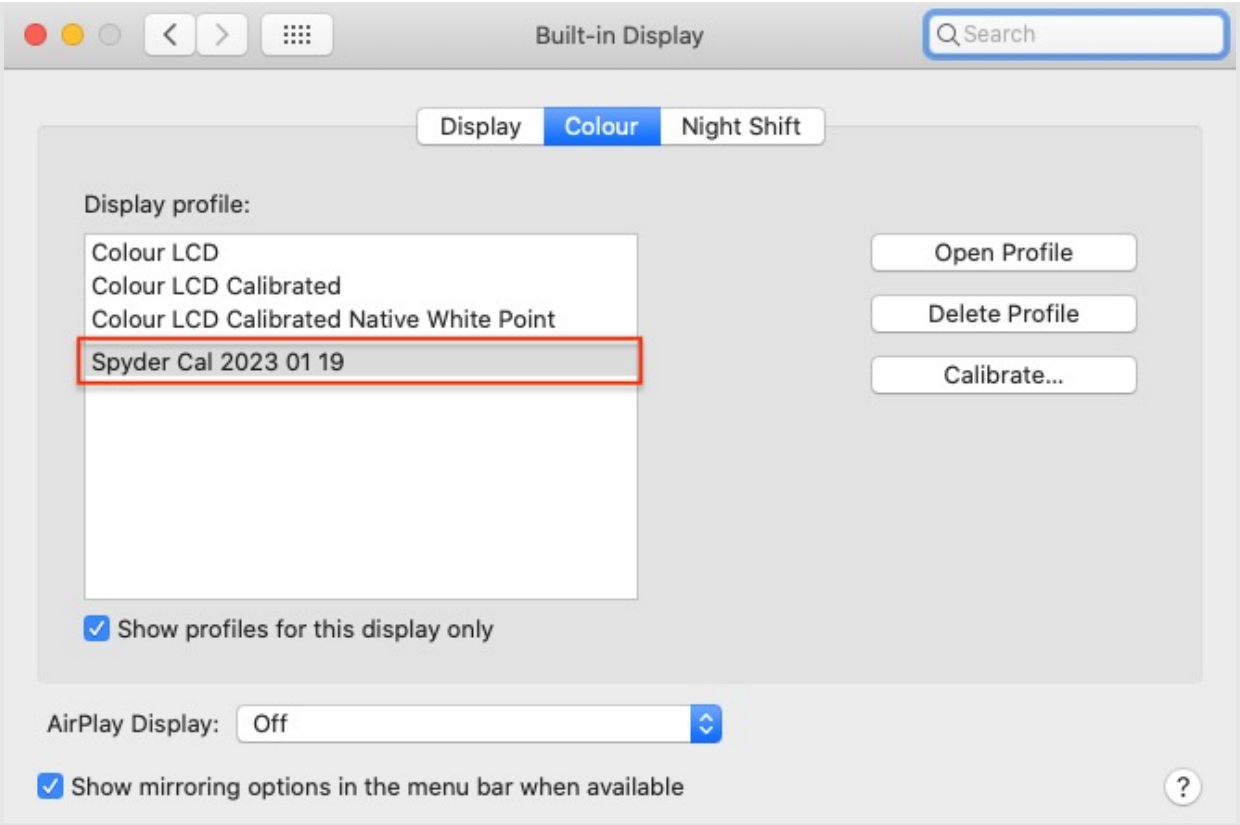
Monitor/Laptop Screen Calibration

- Your screen needs to match the colours in your image as best as possible, otherwise it will be extremely difficult to achieve consistent colours in your prints.
- The best way to achieve this is to calibrate your screen using a proprietary calibration device e.g. ColorMunki or Spyder etc. Prices range from £100 to £400.
- During calibration of the screen the ambient light will be measured, so this is taken care of.

Monitor/Laptop Screen Calibration

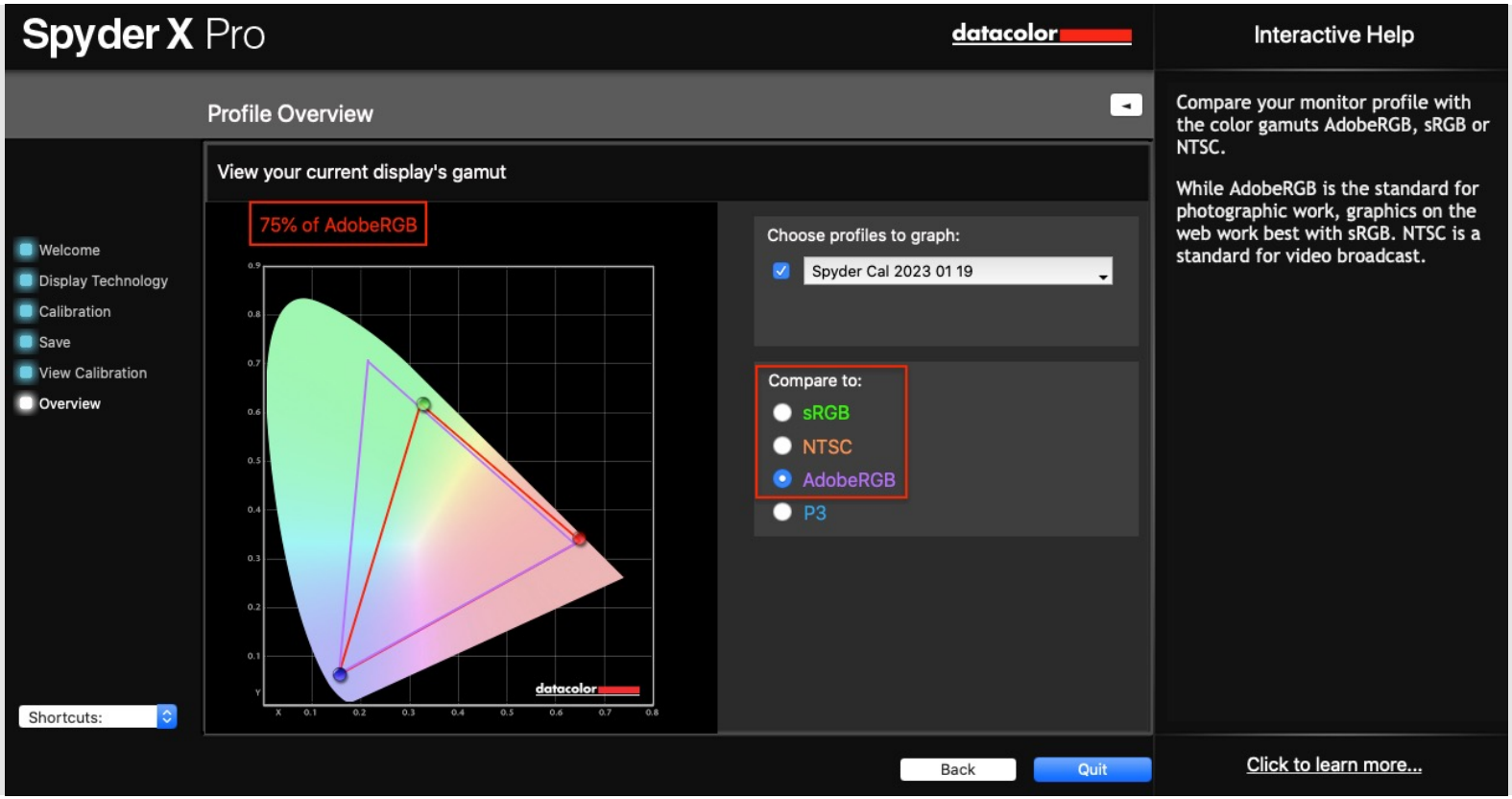
- The final stage of the calibration process will produce an ICC Profile for your display.
- Once calibrated a monitor will still need re-calibrating say every 3/6 months to ensure consistency of colours when viewing/printing.
- However, it may still be necessary to adjust the brightness of the screen slightly as most monitors are a bit too bright by default. If prints are too dark, turn down the monitor brightness.

Display Settings
Mac

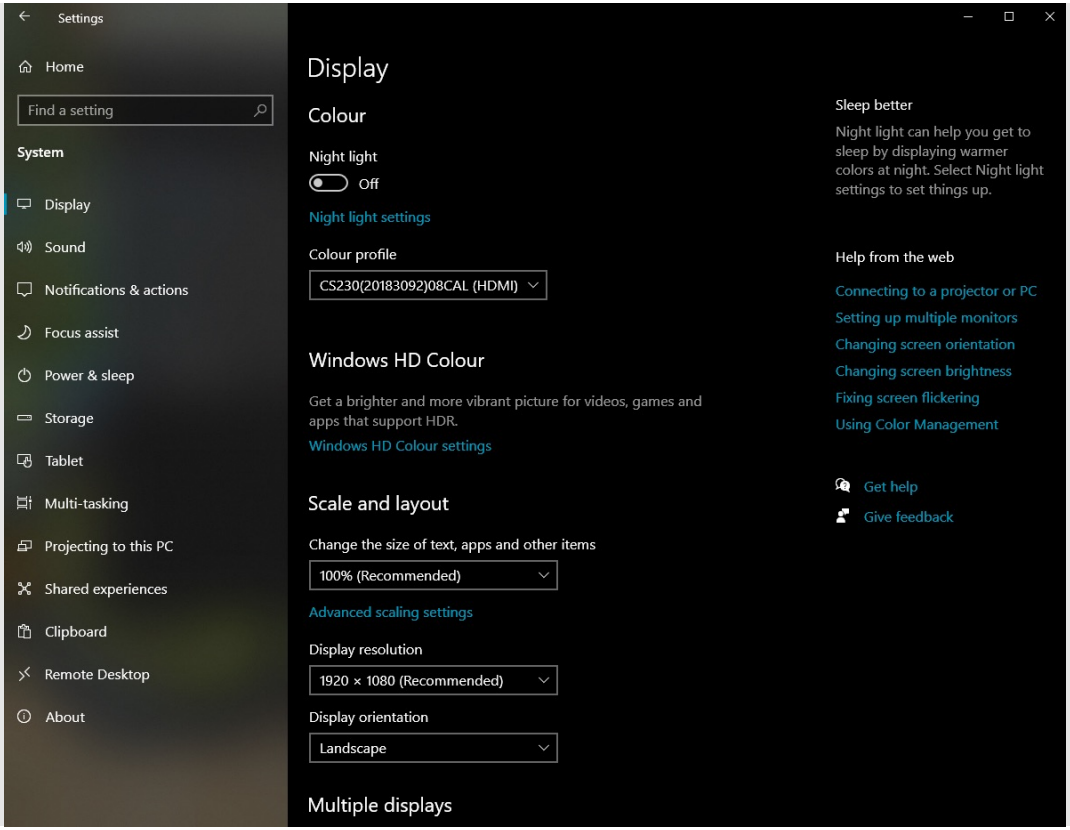


Display Settings
sRGB v Adobe RGB

Display Settings
sRGB v Adobe RGB



Display Settings
PC (Windows 10)



Printer Settings

- **Most printer drivers by default will be set so the printer manages the colour, and the user can then adjust parameters such as tone, brightness, contrast etc. Unfortunately, this does not provide consistency for printing in colour. Printing B & W images is a different story and more on that later!**
- **For colour images it is generally best to let your photo editing software manage the colours, thus effectively turning off 'Printer Manages Colour'.**
- **The method of achieving this varies according to the printer manufacturer and whether your computer is using Windows or Mac operating systems, but basically you are adjusting Printing Preferences in the printer driver, which is accessed via Photoshop/Lightroom etc. once you select 'Print'.**
- **However here are two other very important parameters that need to be set correctly to ensure the printer accurately replicates the screen colour. These are Media Type and the ICC Profile (International Colour Consortium) for the printer/paper being used.**

Printer Media and ICC Profiles

- During the laying down of ink, the printer needs to know the type of media that is being used e.g. semi-gloss photo paper, matte photo paper, canvas etc. to ensure the correct amount of ink is applied.
- Media/Paper Type settings are usually to be found in the 'Printer Preferences' section of the printer driver for your particular printer/application.
- If you are using paper from the printer manufacturer then common settings available will be e.g. Epson Premium Photo Glossy, Epson Semi Matte/Lustre, Epson Archival Matte.
- Most third-party photo paper suppliers will tell you what Media/Paper Type settings to use for each of their papers.
- Correct Media settings will provide basic settings, but these need to be refined further using paper specific ICC Printer Profiles.

ICC Profiles

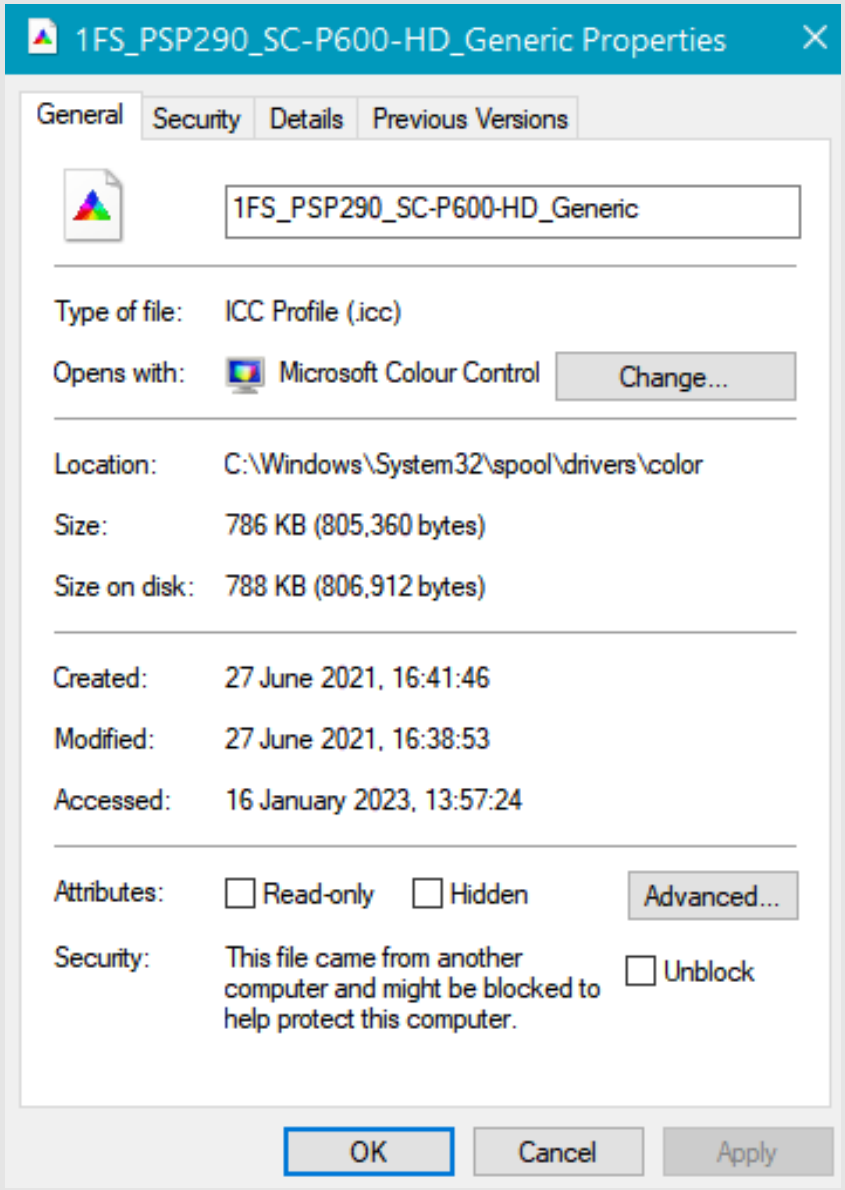
- **ICC Profiles are small files which are produced by photo paper manufacturers which contain colour adjustments based on the paper type, coating, printer type and inks used.**
- **These 'Generic' files are available for download from all the major photo paper manufacturer's/supplier's websites and are copied into your photo editing software. A typical ICC profile name would be: FS_PSP290_P600-K3_Generic.icc**

FS:	**Fotospeed (paper supplier)**
PSP290:	**Photo Smooth Pearl (paper type)**
P600:	**Epson P600 (printer make/model)**
K3:	**Genuine Epson Inks**
Generic:	**Generic Profile (created by Fotospeed)**

- **Instructions for installing these profiles are also available from the same websites. The profiles are then used by the photo editing software to fine tune the colour output information to the printer.**

ICC Profiles

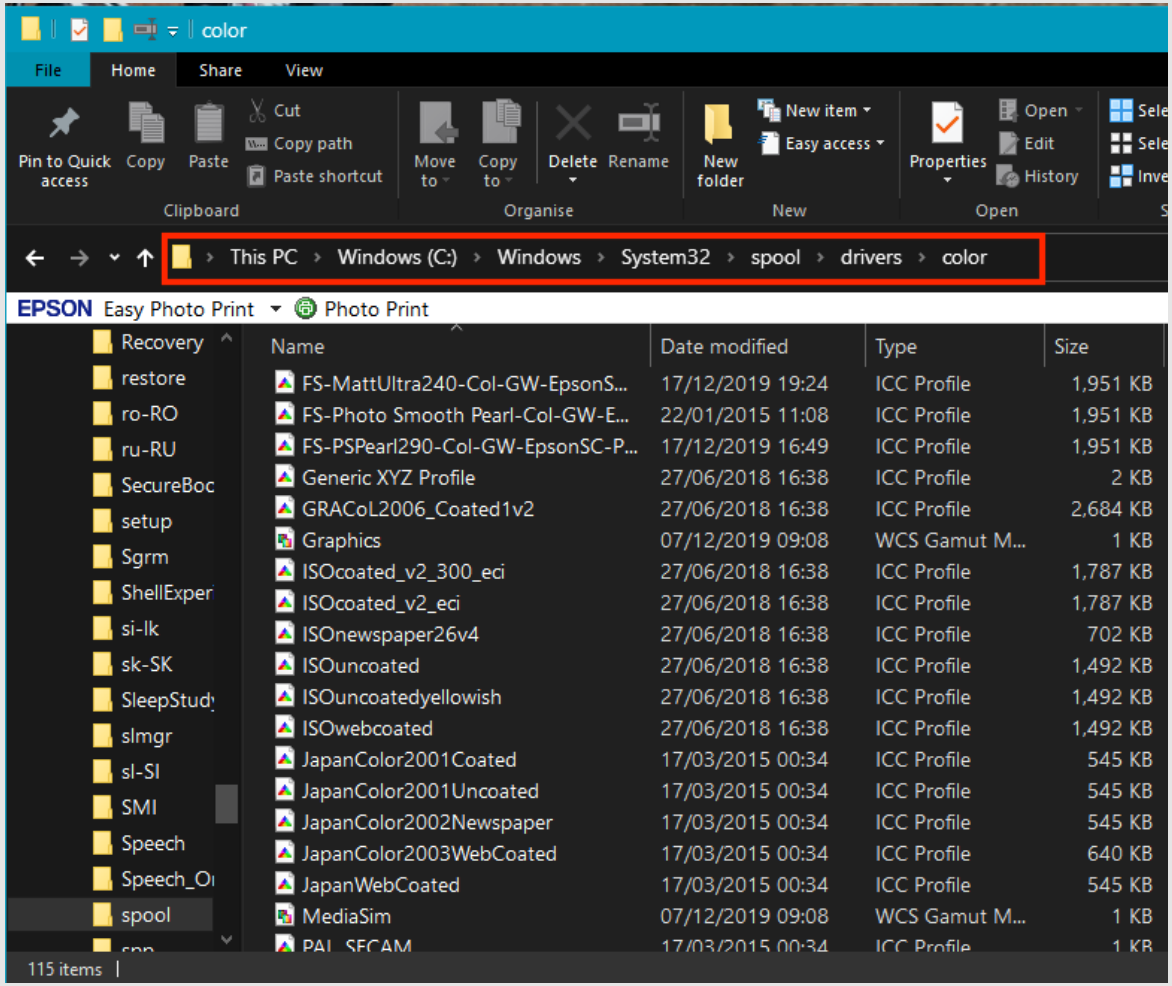
ICC Profile Properties



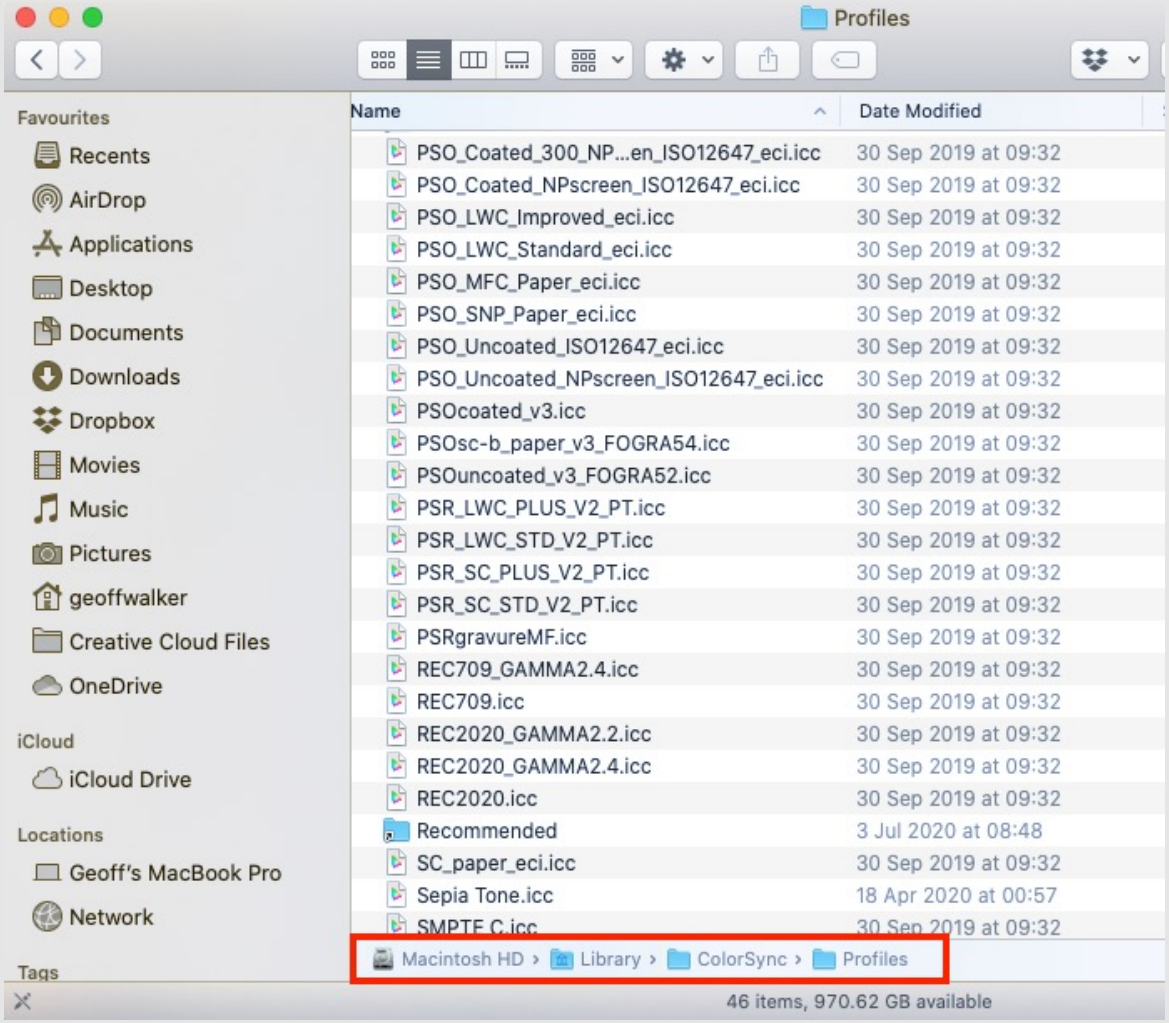
ICC Profiles

- For most purposes these ‘Generic’ profiles are generally more than adequate. But if you require absolute perfection then you need to have your printer specifically profiled for each type of paper you use. You can do this yourself by printing a test page from the paper supplier and scanning this using a calibration device (ColorMunki or Spyder etc).
- NB: Not all monitor calibration devices are suitable for producing printer profiles.
- The calibration device software will then produce an ICC profile, which you can name to suit the printer and paper used, and load into your photo editing software.
- Alternatively, most third-party photo paper suppliers e.g. Fotospeed and Permajet offer a free printer profiling service together with detailed instructions supplied in a Profiling Pack. The basic procedure is as follows:
- Download a Profiling Pack from their website, which will include a special colour test page file.
- Print the test page on each of the papers you wish to use following the provided instructions.
- Post these off to the paper supplier and they will create ICC profile(s) and email them to you.
- These are then installed onto your computer (automatically saved to correct folder) and will be available to use in your preferred editing software.

ICC Profile Location PC (Windows)



ICC Profile Location Mac OS

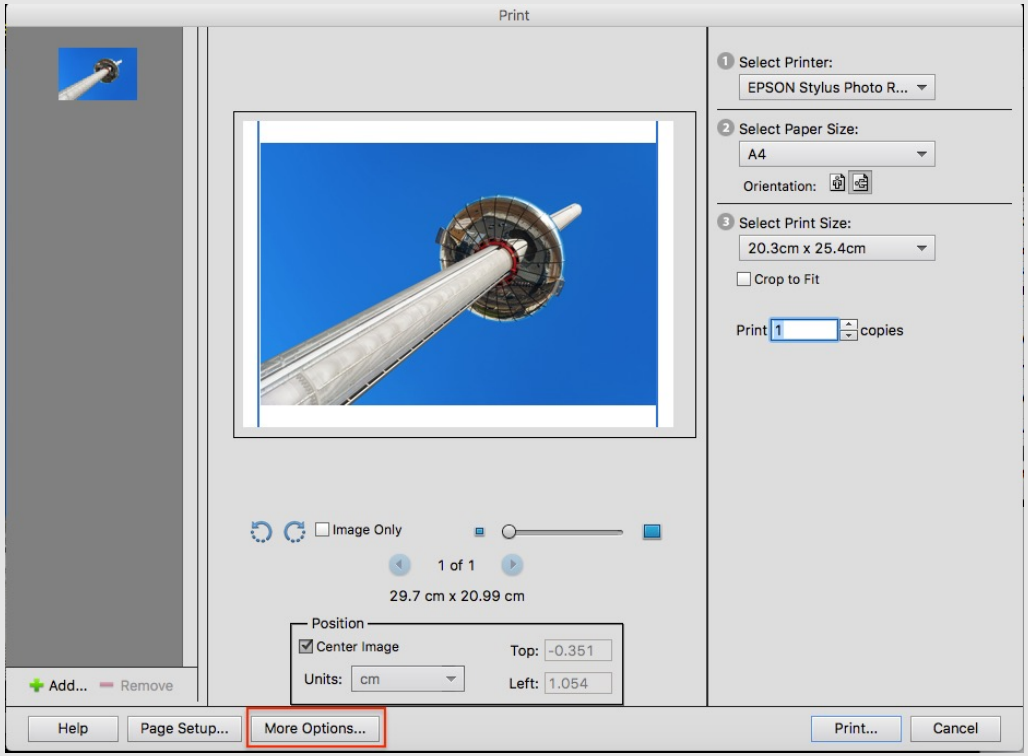


Setting Printer Preferences

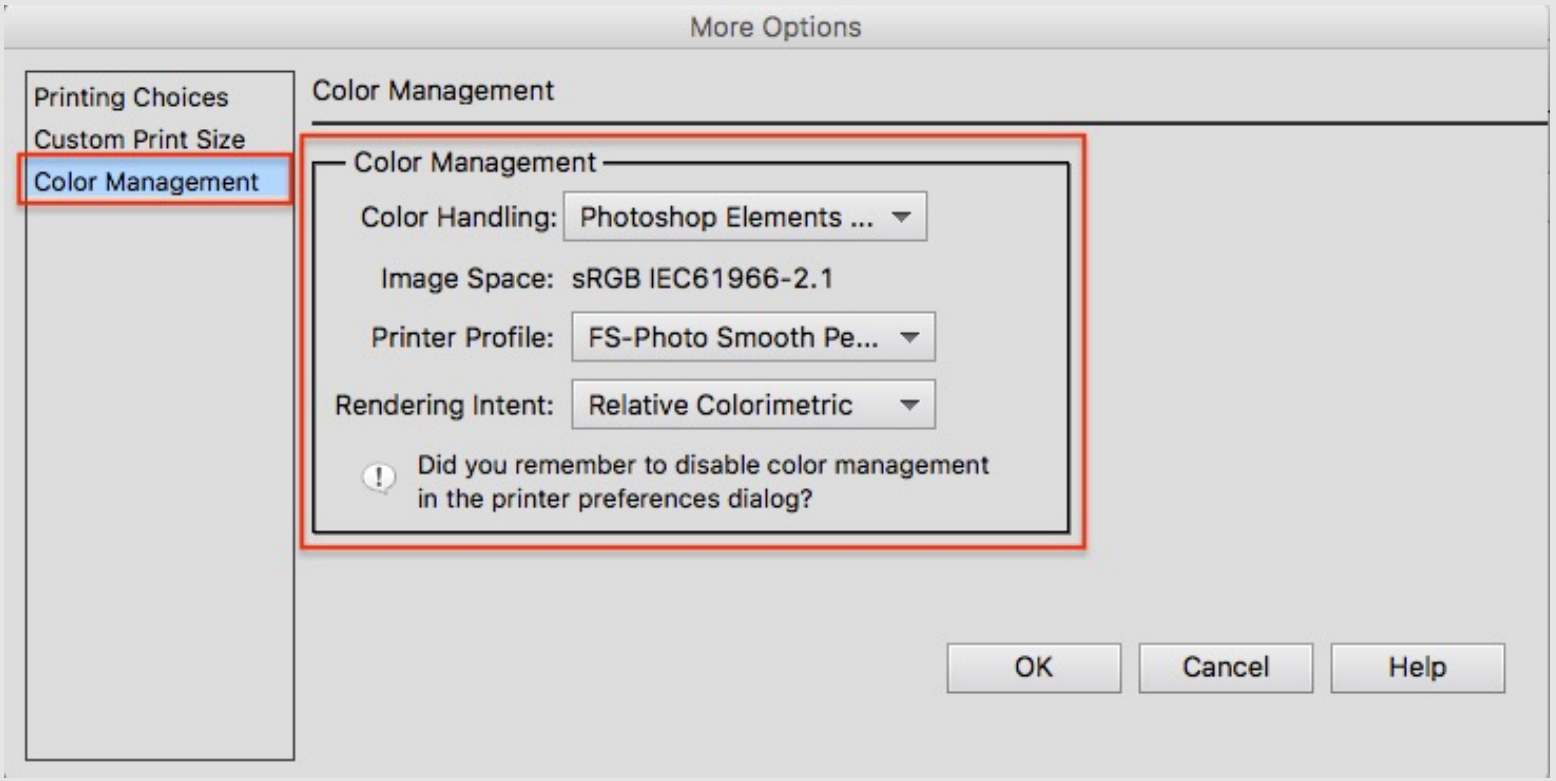
- **Similar process on both a PC and Mac and the ‘Printer Preferences’ dialogue box will appear in a similar format for the same printer type/model.**
- **Open image and click ‘Print’.**
- **Select ‘Printer’ if more than one connected.**
- **Go to ‘Color Management’ box.**
- **Click on ‘Color Handling’ and select ‘Photoshop Manages Color’**
- **Click on ‘Printer Preferences’ and set parameters.**
- **Click on ‘Printer Profile’ and select ICC Profile (some will already be available within the printer driver from the printer manufacturer, if they also manufacture their own branded paper).**
- **Click on ‘Rendering Intent’. Select either ‘Perceptual’ or ‘Relative Colorimetric’. There is no definitive rule which states which is best and it depends on the properties of each individual image e.g. dynamic range, colours, contrast etc. This is where the additional step of ‘Soft Proofing’ can help you make a decision. More on that later 😉.**
- **Save your settings to a pre-set for future use (optional).**

Photoshop Elements Print Menu (Mac)

(Click on ‘More Options’ for more settings)

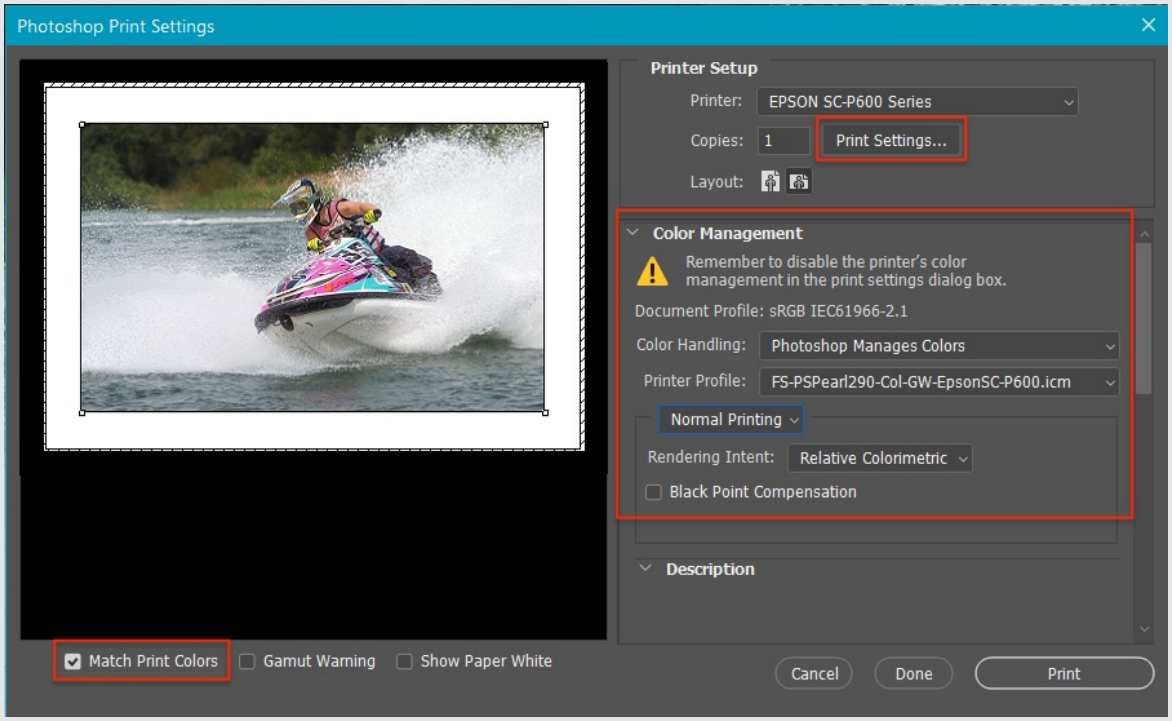


Photoshop Elements Printer Properties Menu (Mac)

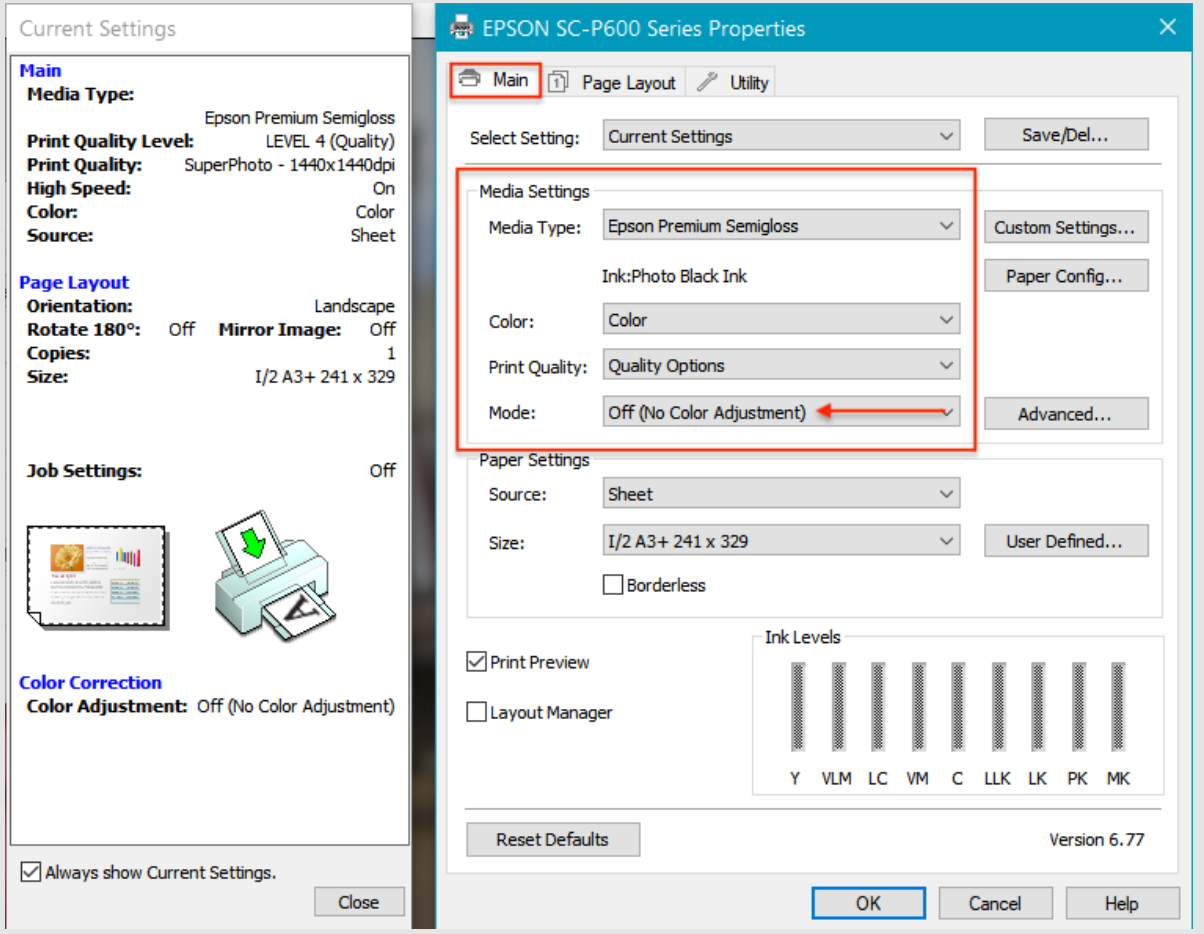


Photoshop CC Print Menu (Mac & PC)

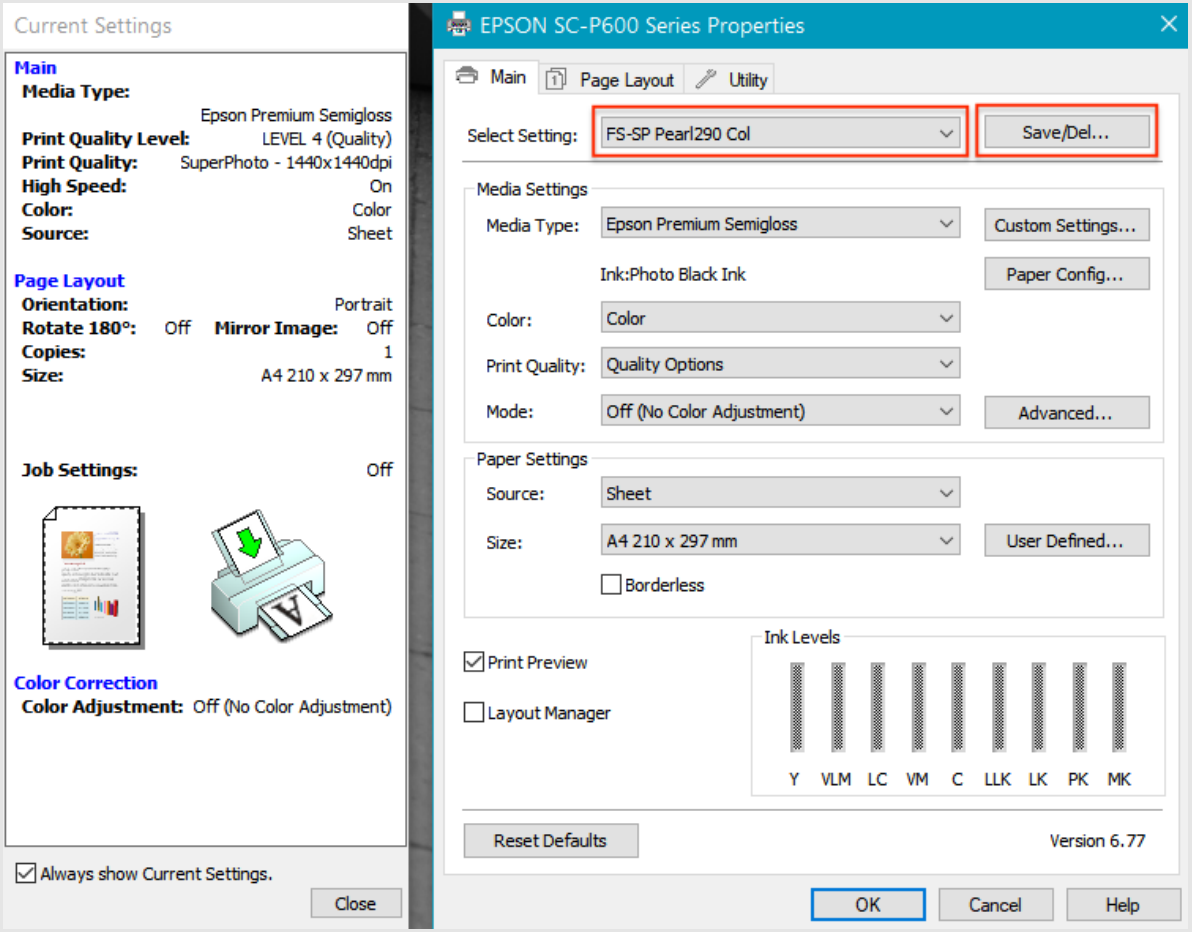
(Click on ‘Print Settings’ for more settings)



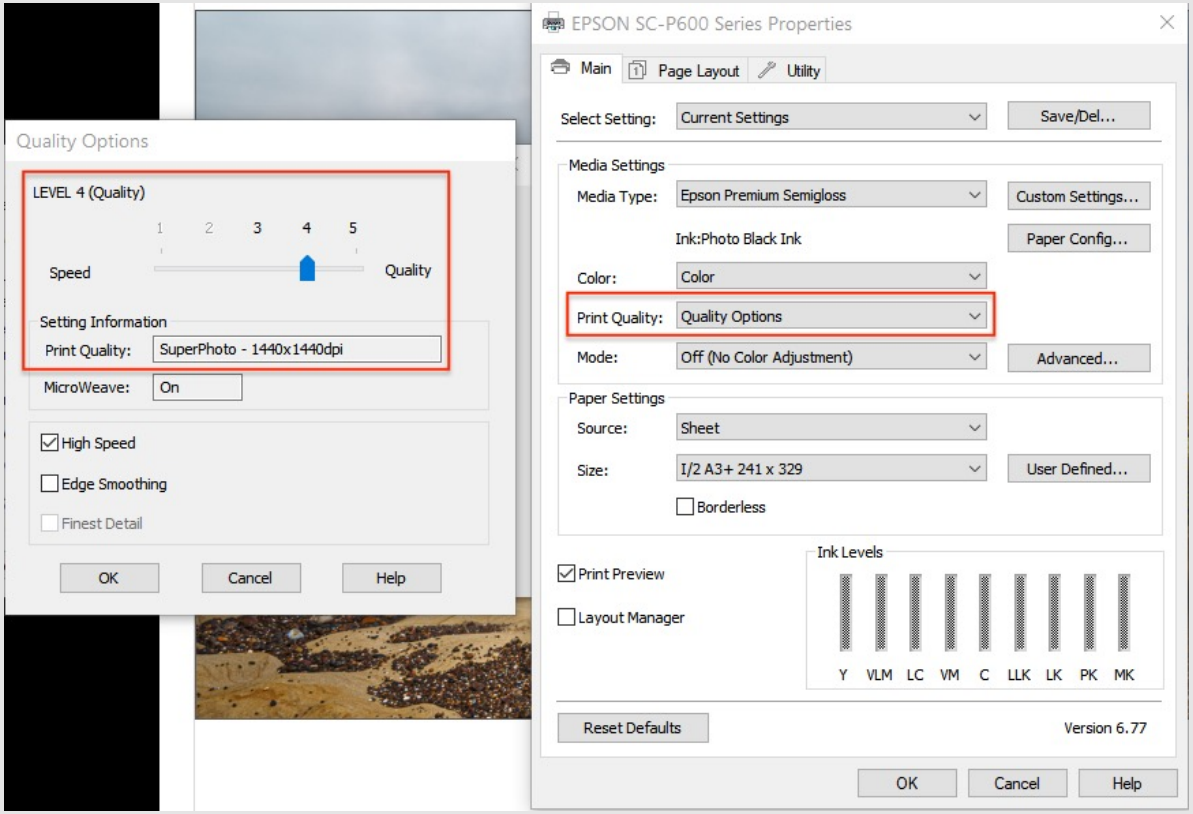
Photoshop Printer Properties Menu (PC)



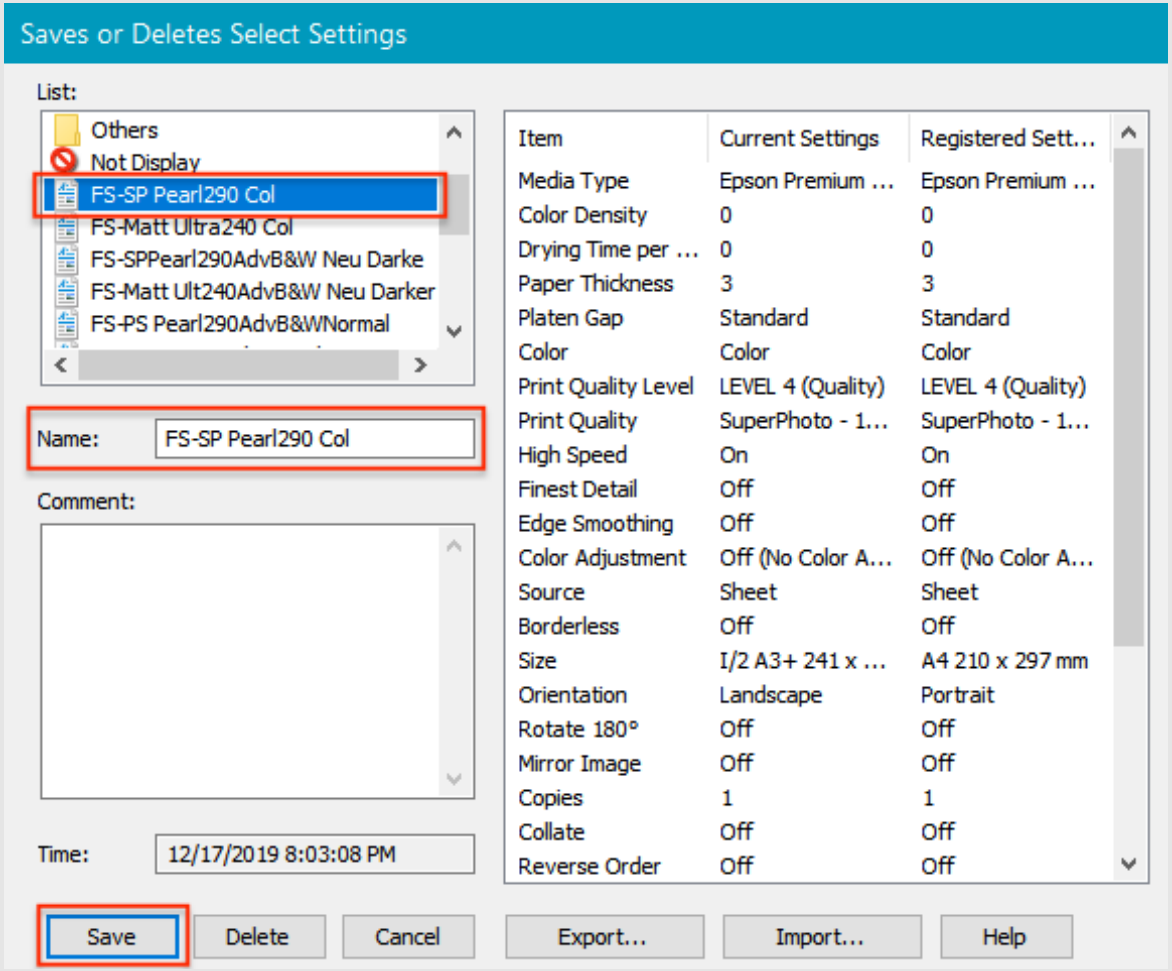
Photoshop & Lightroom Printer Properties Pre-Sets (PC)



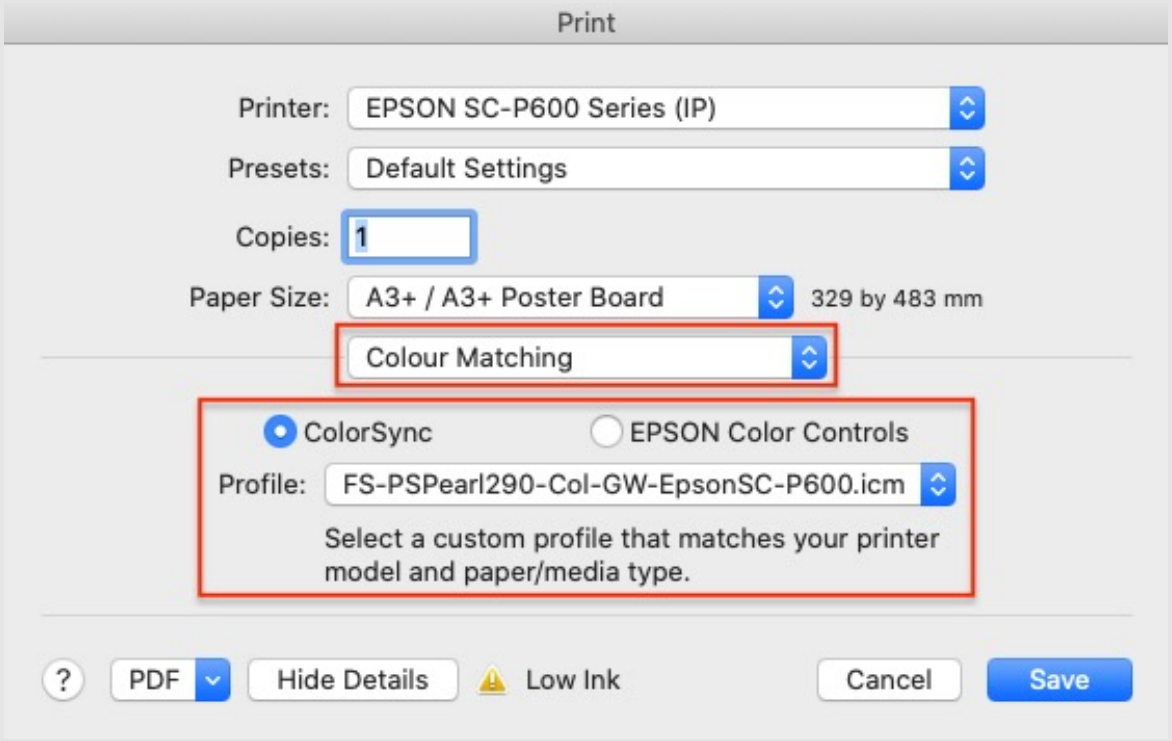
Photoshop & Lightroom Printer Properties Pre-Sets (PC)



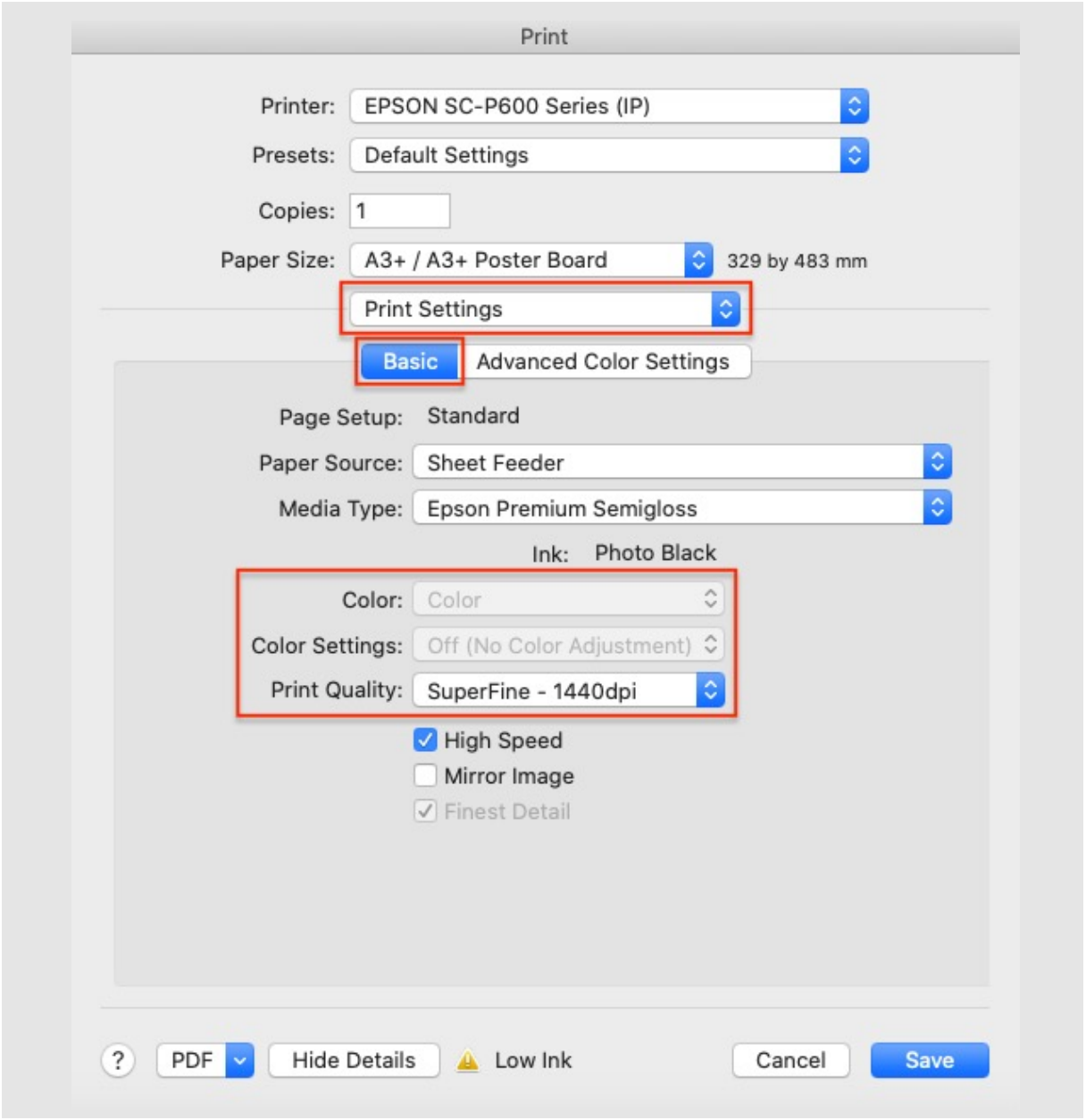
Photoshop & Lightroom Printer Properties Pre-Sets (PC)



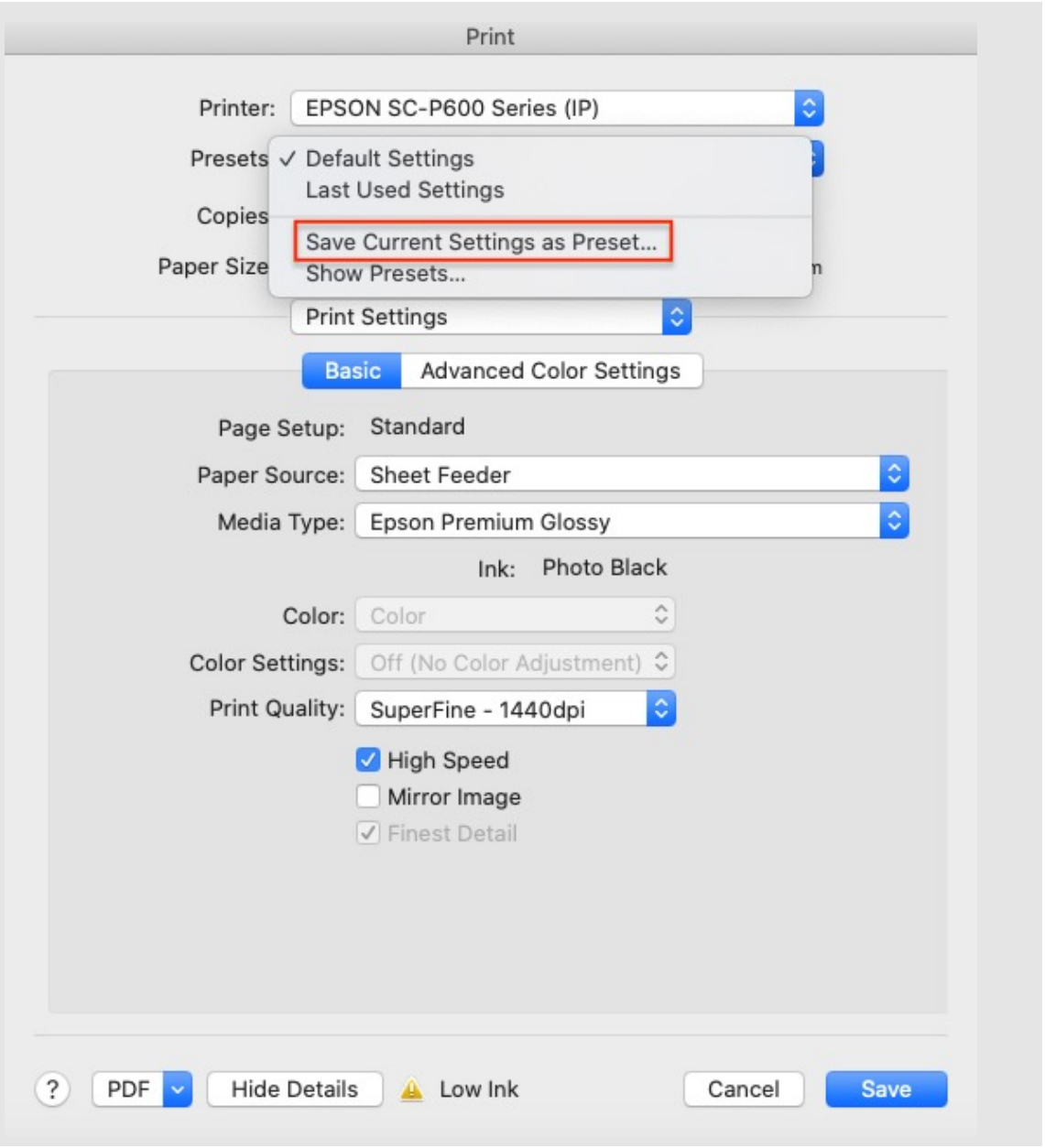
Photoshop & Lightroom Printer Properties Pre-Sets (Mac)



Photoshop & Lightroom Printer Properties Pre-Sets (Mac)

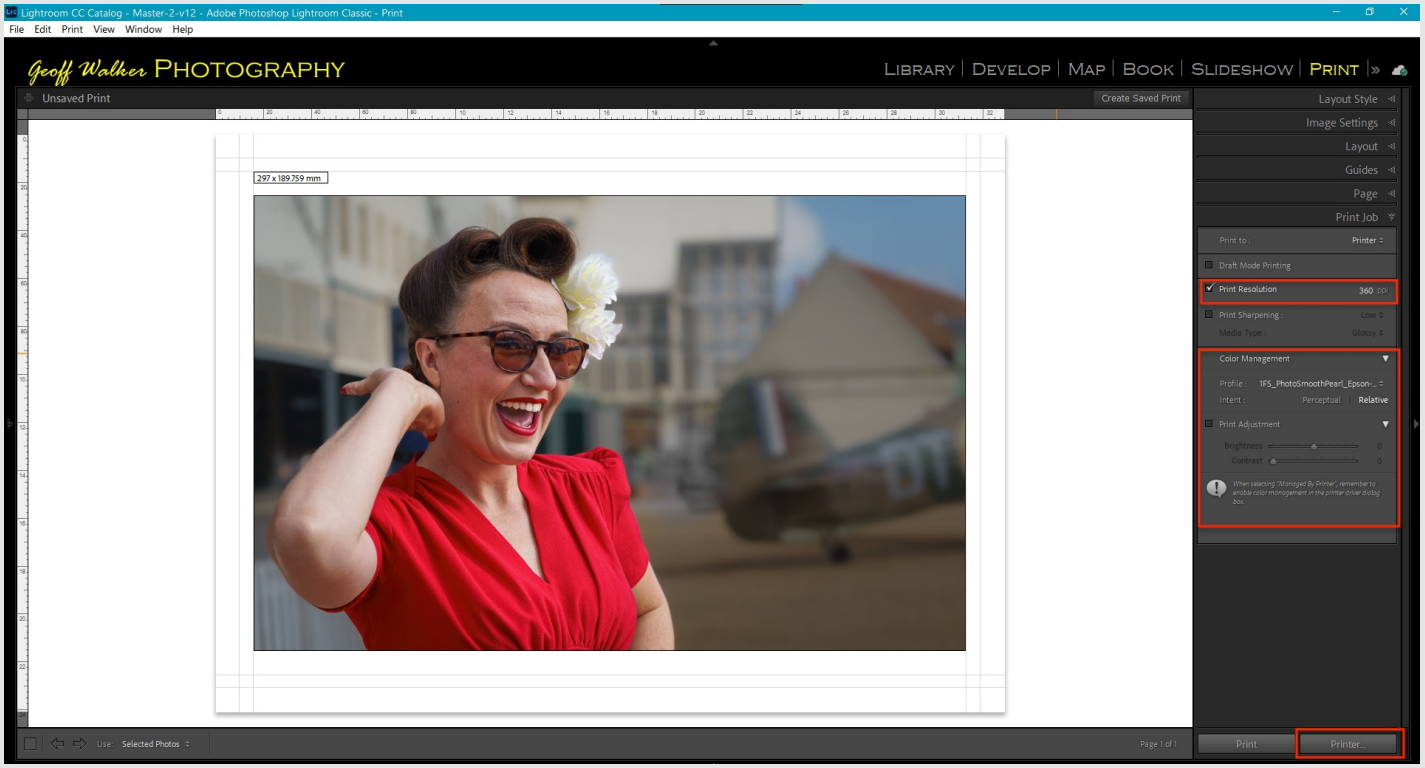


Photoshop & Lightroom Printer Properties Pre-Sets (Mac)

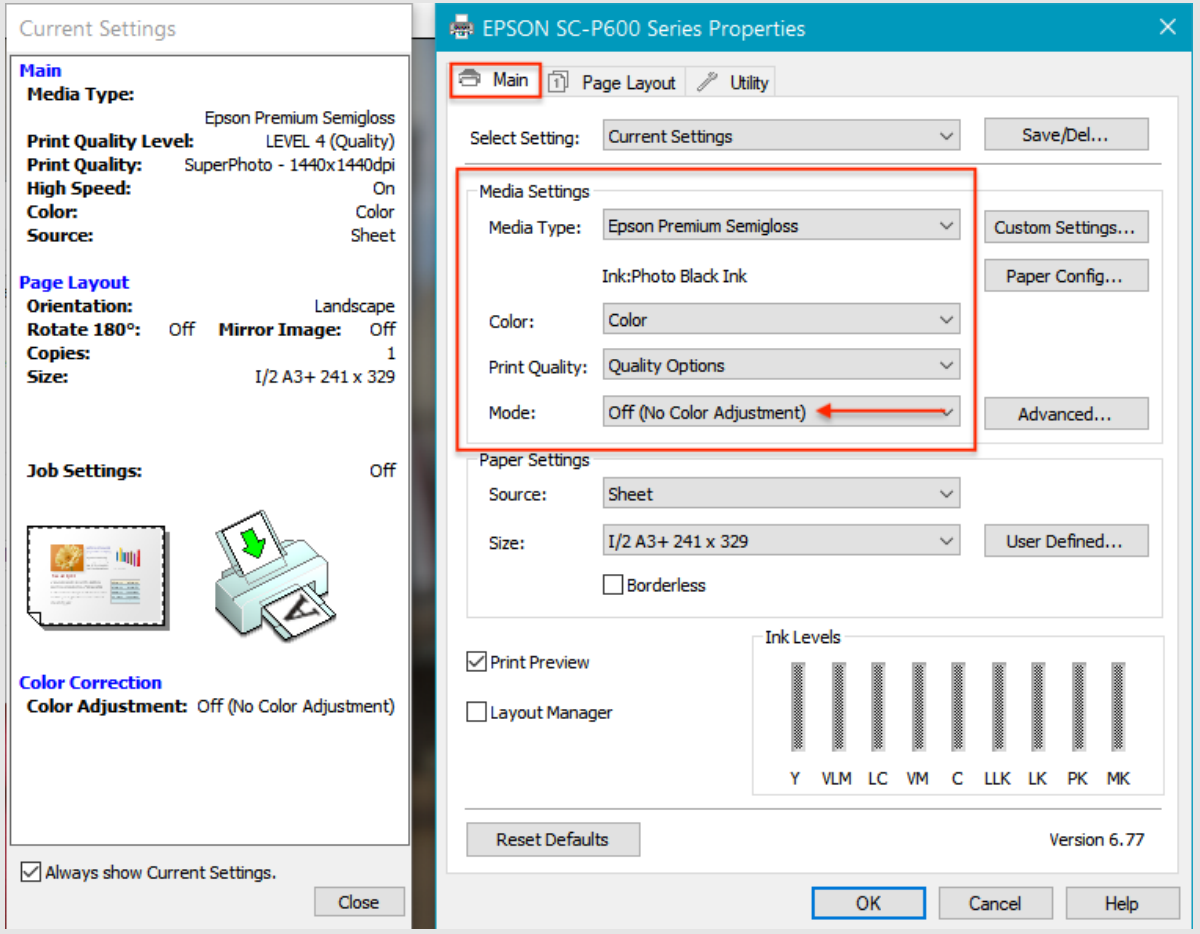


Lightroom Print Module Menu (Mac & PC)

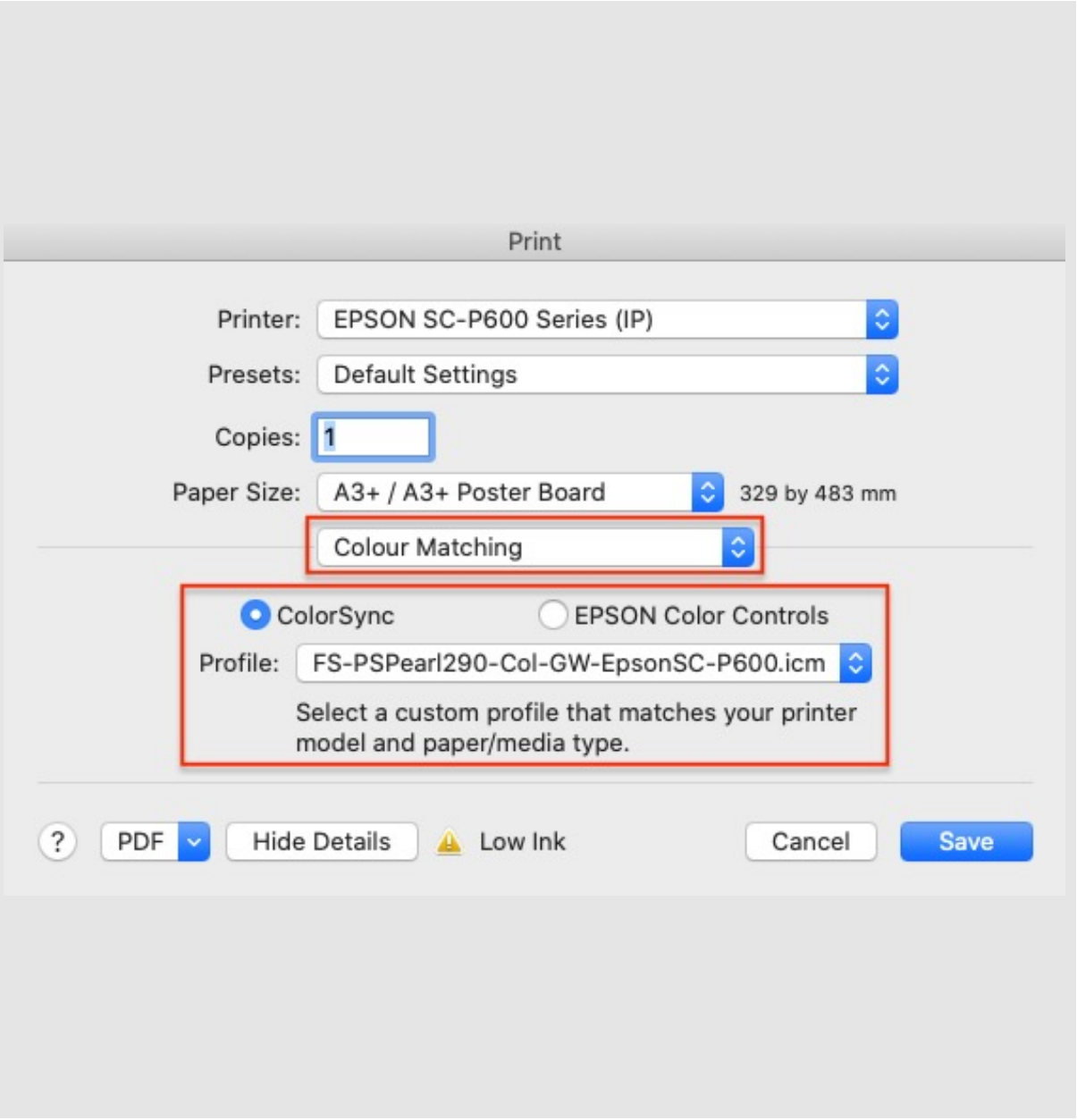
(Click on ‘Printer’ for more settings)



Lightroom Printer Properties Menu (Windows)



Lightroom Printer Properties Menu (Mac)



Print Resolution

- You also need to decide on the size of print and how it is going to be viewed.
- We'll assume it will be for club competitions or a distinction panel etc. so your print will be scrutinized at close quarters, say from 12" away.
- Table below shows what the human eye can see in terms of resolution at varying viewing distances.

Viewing distance (Inches from a print)	Resolution of the eye (PPI)
8	428
10	355
12	286
18	191
24	143

Print Resolution

- **Different printer makes/models have different maximum print resolutions, and the table below shows examples from Canon and Epson printers.**
- **When selecting print resolution either in Lightroom or Photoshop (in PS you will decide this when re-sizing your image for printing, rather than in the Print Module in Lightroom) it is best practice to select a resolution which is a whole fraction of the printer's maximum print resolution.**

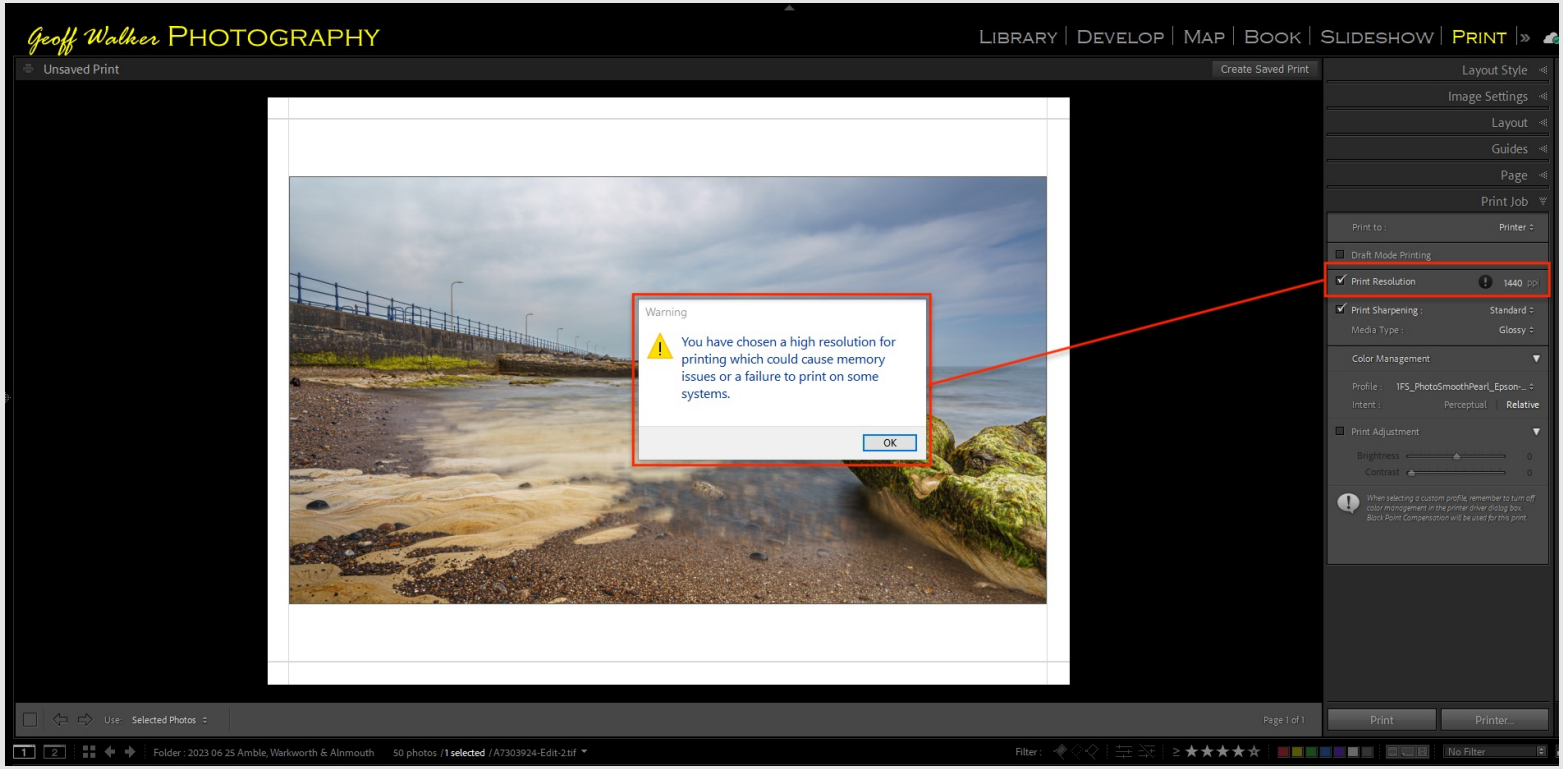
Canon	Epson
1200 dots of ink per inch (dpi)	1440 dots of ink per inch (dpi)
150	180
200	240
240	288
300	360
400	480
600	720

Print Resolution

More Thoughts on Print Resolution Settings Following Dr Ian Wilson's Presentation of 06 November 2023

- **Ian's recommendation was to set the Printer Resolution to the Native Resolution of your printer (e.g. 1440 dpi for Epson printers, 1200 dpi for Canon) because this generates the highest resolution print obtainable from the printer. When setting a lower resolution (e.g. 360 dpi as shown in slide 37) this results in Lightroom re-sampling the image, which will degrade the final print quality (whether this is detectable will be down to the image subject/paper/ink and your eyesight!).**
- **According to several online forums/videos, unchecking the 'Print Resolution' box will force lightroom to print at your printer's native resolution i.e. maximum resolution and this is recommended by some 'experts!**
- **Important: If you set 'Resolution' to your printer's native resolution, a warning symbol will appear in Lightroom. Clicking on the symbol will reveal a message advising that this operation may cause memory issues or a failure to print on some systems. See next slide.**
- **My advice: make some test prints at different resolutions e.g. Epson at 360, 720 and 1440 dpi , Canon at 300, 600 and 1200 dpi and choose which you think is best!**

Print Resolution Lightroom Settings



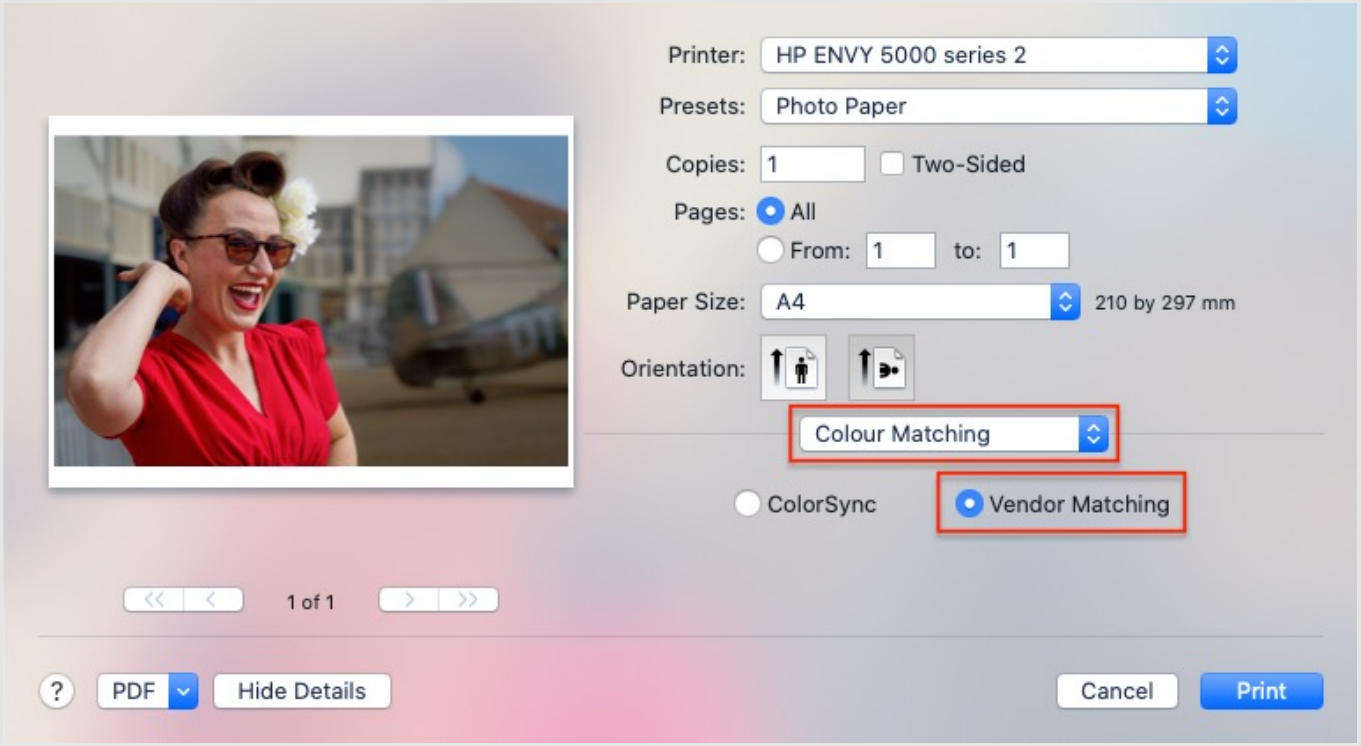
Other Photo Editing Software - PC

- **The printer options available for the two default Windows photo editing software i.e. Photos and Paint do not appear to offer the option of printing using ICC Profiles. However, the open-source photo viewer/editor FastStone uses the same printer driver as Photoshop & Lightroom and it is therefore possible to use ICC Profiles if using a dedicated photo quality printer.**
- **Note: A general-purpose printer with the ability to print on photo paper is unlikely to support ICC Profile printing.**

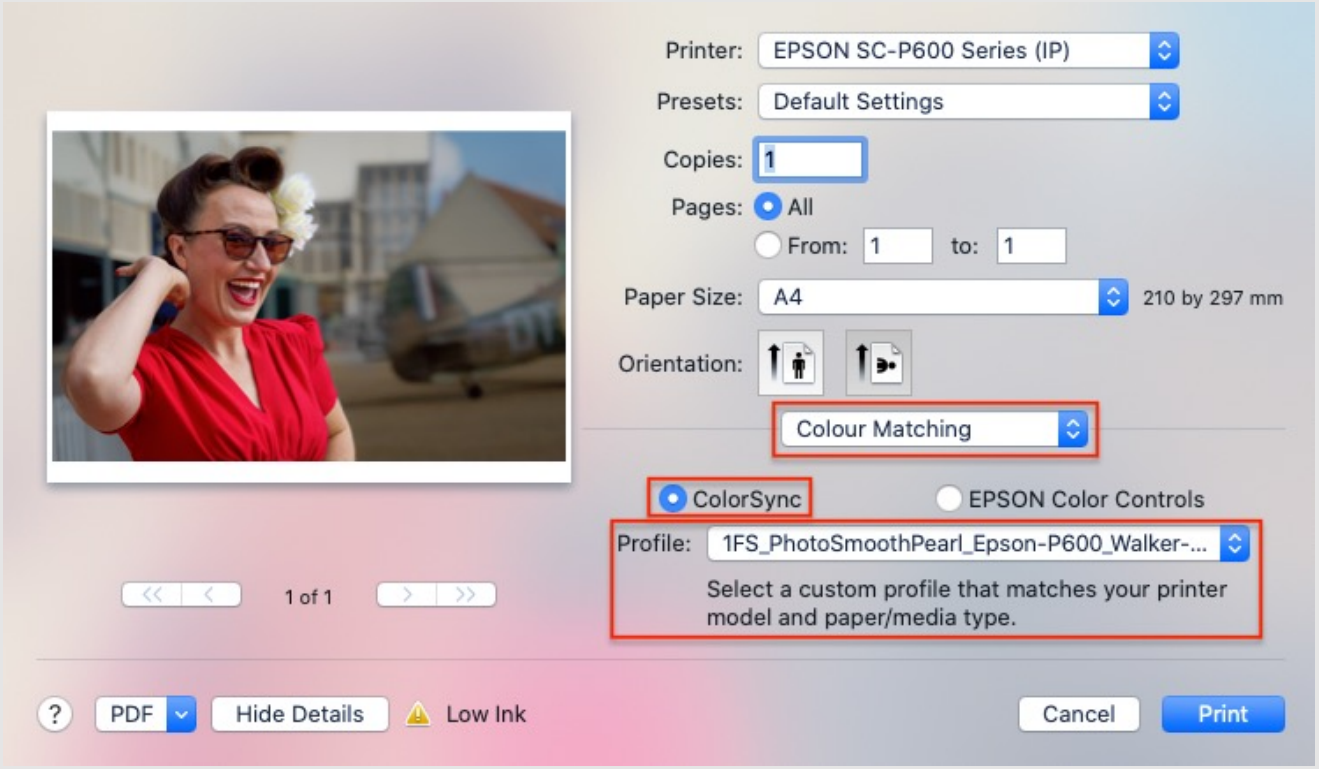
Other Photo Editing Software - Mac

- **The default photo viewer/editor ‘Photos’ appears not support ICC Profile printing even if a dedicated photo quality printer is connected.**
- **However, ‘Preview’ the default PDF viewer, which can also be used for viewing .jpg and .TIFF files, does support ICC Profile printing on photo printers where an ICC Profile is available to match the printer, paper and ink.**

‘Preview’ Print Menu Mac (Non-ICC Profile Printing)



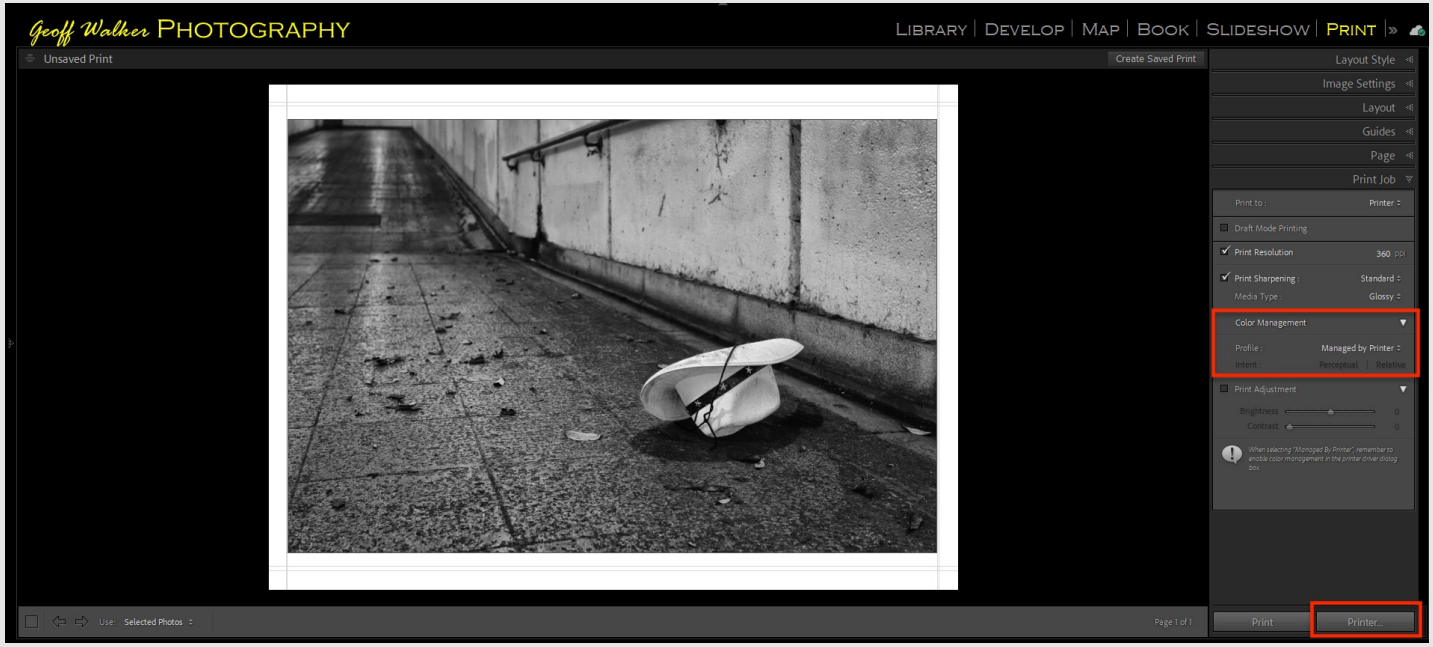
‘Preview’ Print Menu Mac (ICC Profile Printing)



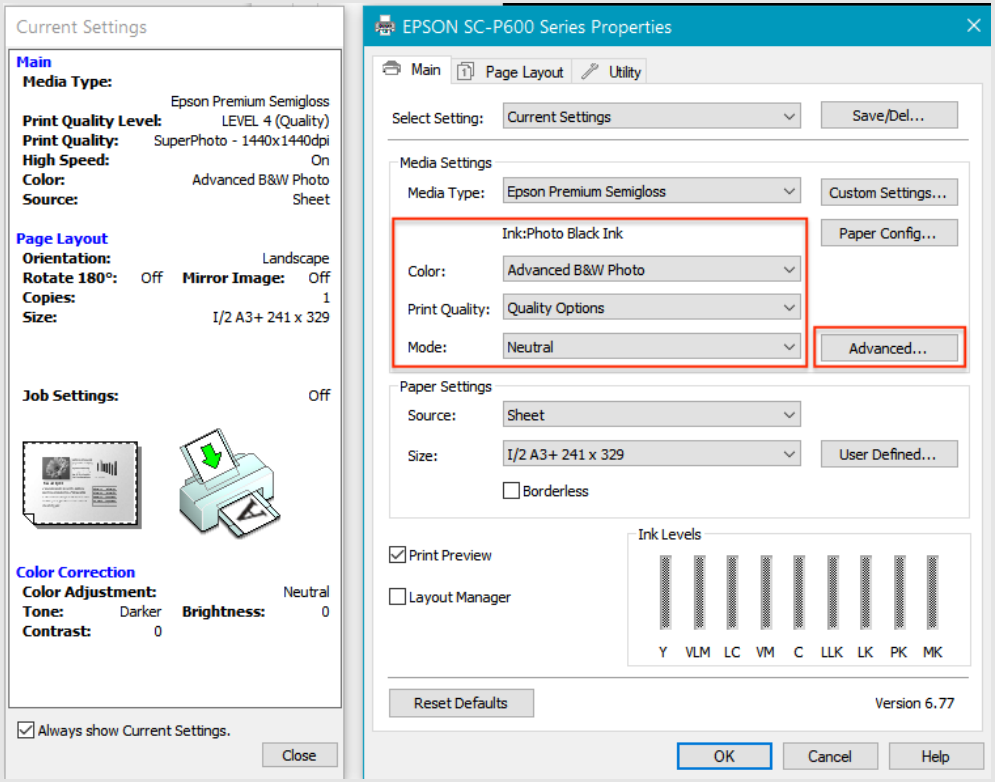
Black & White Printing (Epson Photo Printers)

- **This method uses Epson's 'Advanced Black & White' print setting and is designed for printers with a black ink and two or more grey inks.**
- **Set 'Color Handling' to 'Printer Manages Color'**
- **In 'Printer Preferences' select 'Advanced B&W Photo'**
- **Remember to still select the correct Media/Paper settings, but you will not have the option of selecting a printer profile as the printer will control ALL the colour options.**
- **Select 'Mode' and click on 'Colour Controls' then click 'Advanced' button to fine tune.**
- **Adjust settings by trial and error until you achieve the correct result and save the settings as a pre-set.**

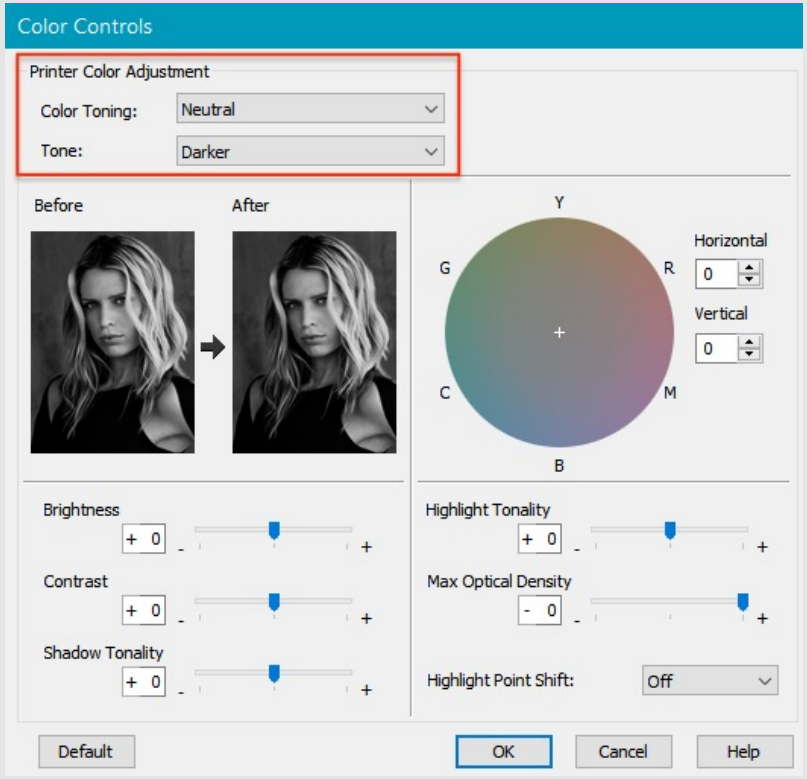
Black & White Printing (Epson Photo Printers)



Black & White Printing (Epson Photo Printers)



Black & White Printing (Epson Photo Printers)



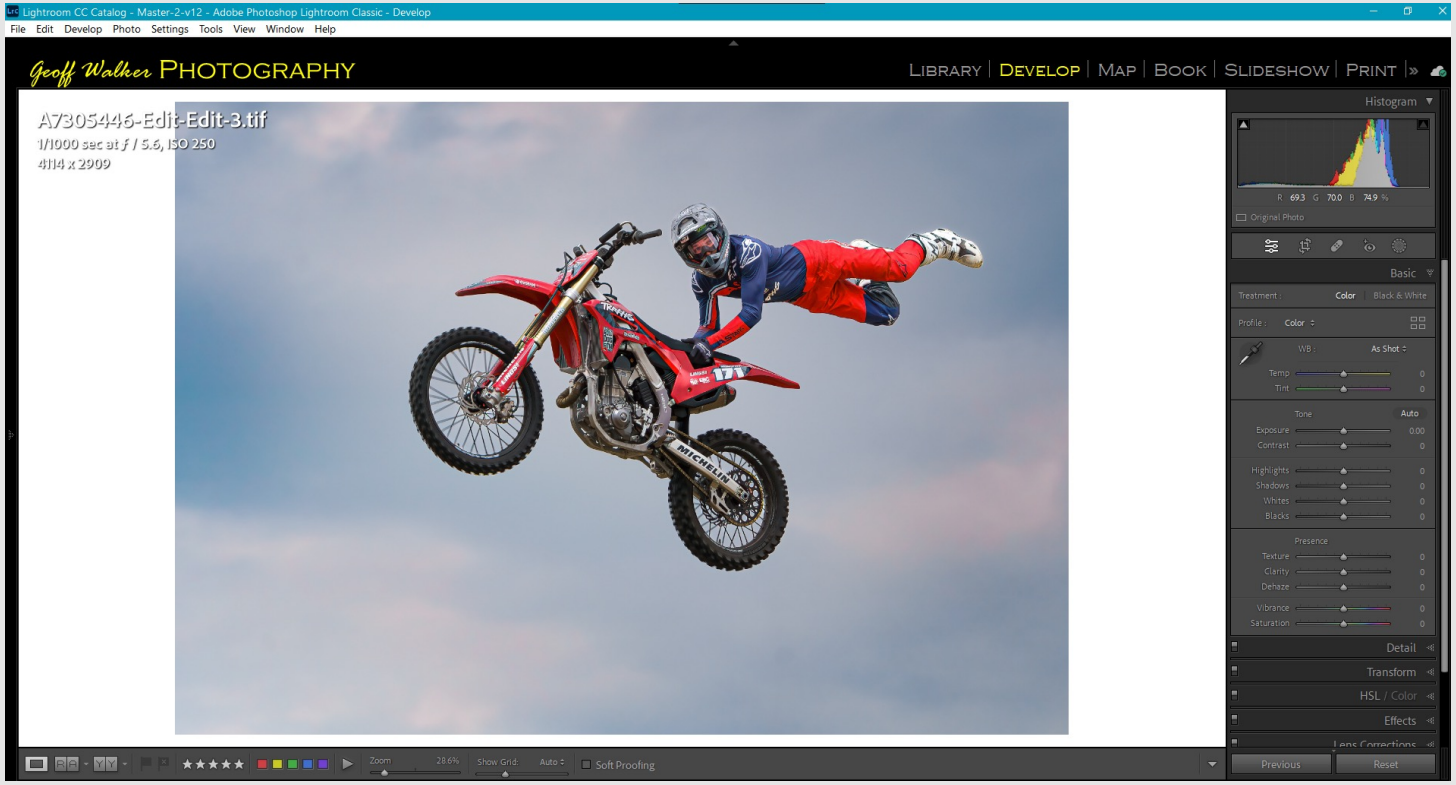
Printing in Black & White (Epson and other Photo Printers)

If your printer doesn't have separate grey inks an alternative method is to use all the colour inks and the same procedure as you would use to make a colour print i.e. letting Photoshop/Lightroom manage colour and using the ICC profile for your paper/printer/ink combination.

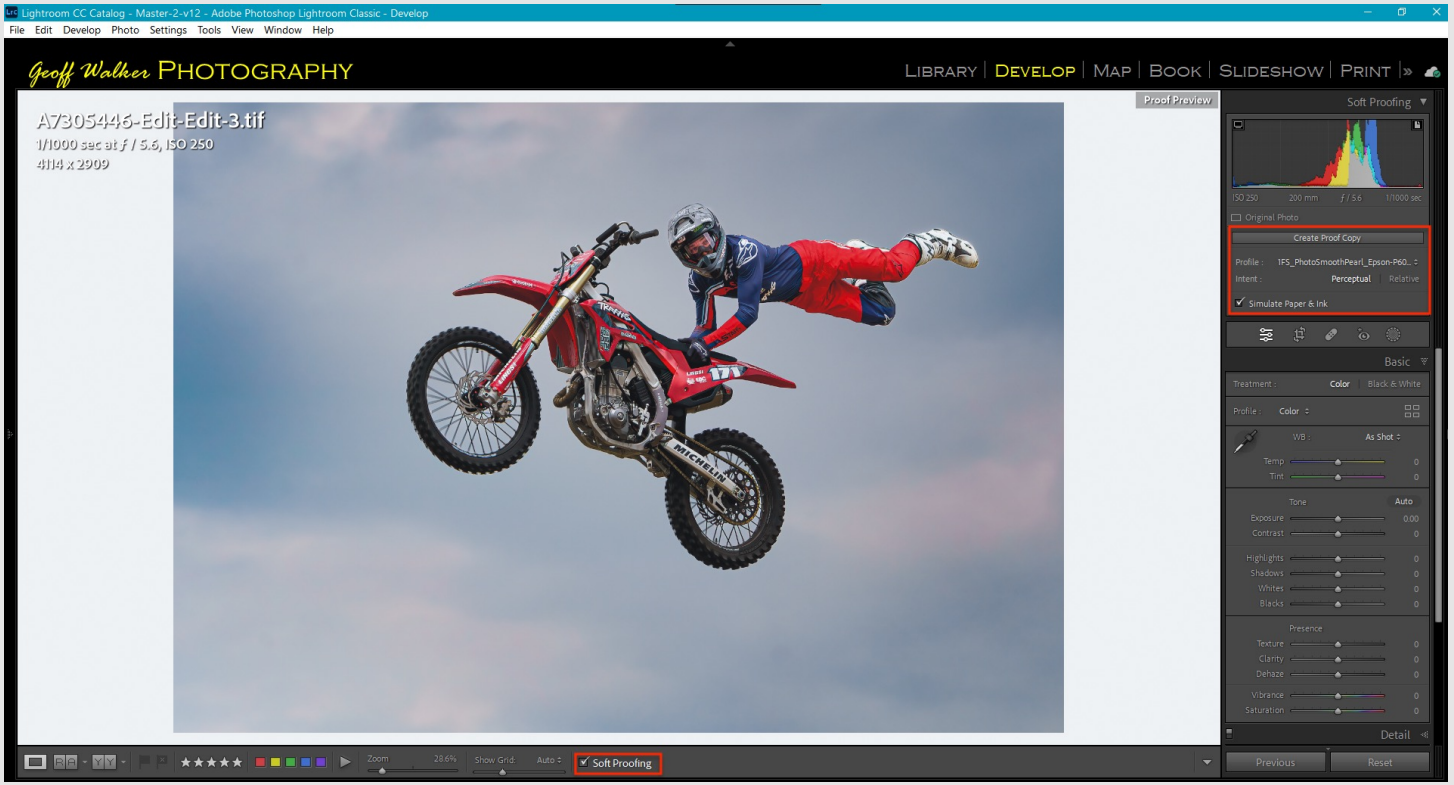
Soft Proofing

- There is yet another step that can help to ensure that your print exactly matches the colours on your screen, and this is a process known as ‘Soft Proofing’.
- Soft Proofing is the capability to preview how on-screen images appear when printed and optimize them for a particular output device (e.g. printer).
- This process also enables you to actually see the difference between the two alternative ‘Rendering Intents’: ‘Perceptual’ and ’Relative Colorimetric’
- Remember to set the same Rendering Intent in Lightroom Printer Module or Photoshop Printer Preferences as your proof copy.

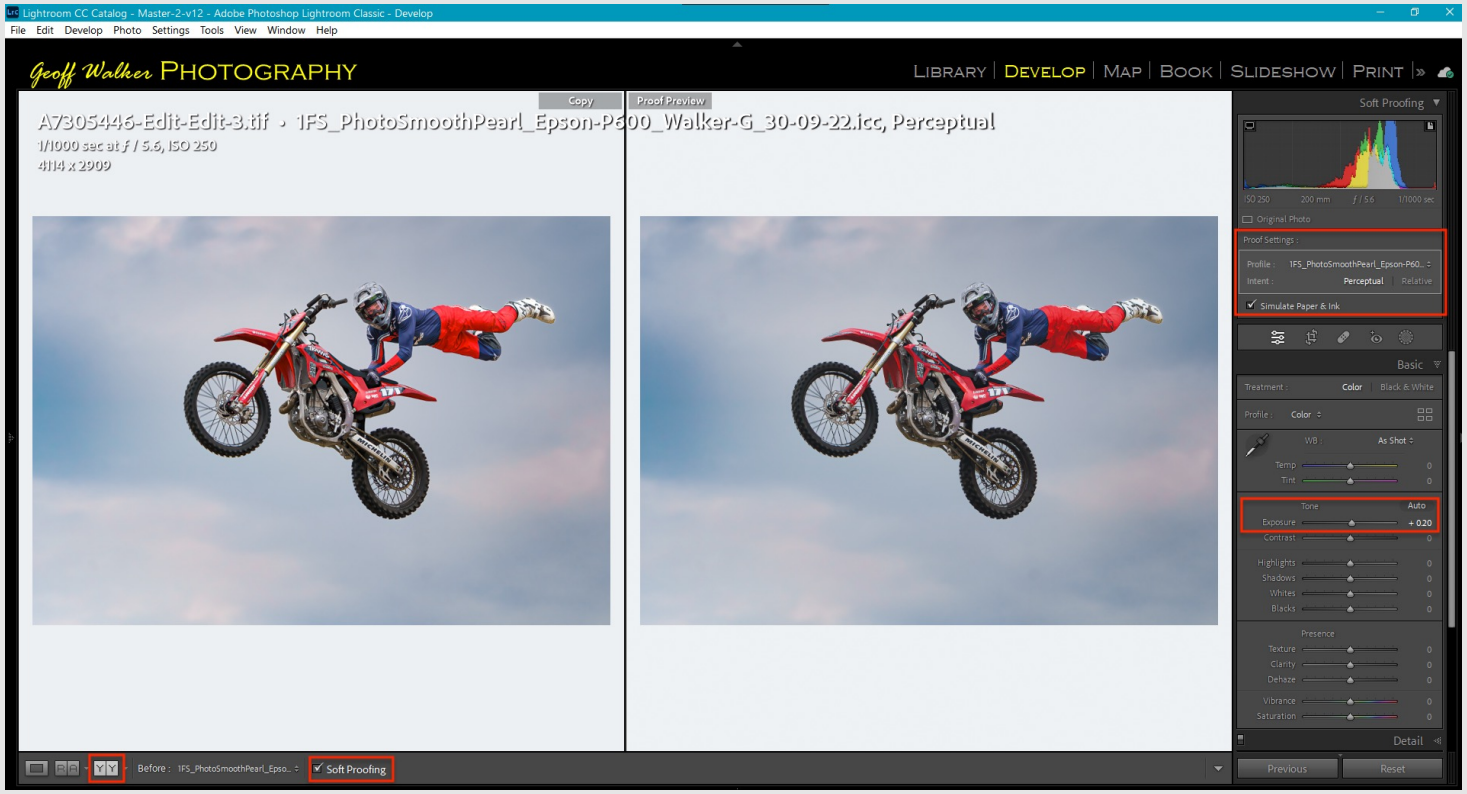
Lightroom Classic CC Develop Module Initial Screen



Lightroom Classic CC Develop Module Soft Proofing Screen



Lightroom Classic CC
Develop Module
Image Comparison Screen



Further Resource

Consistent Colour Achieved!

If you're still awake, thanks for persevering!