Colour Management for Digital Photography

Guide 2: Post-Production — Monitor Profiling & Print Profiling

Note 1. This Guide is based on Adobe programs, it will be similar on any other ICC aware software. It is also based on the Calibrite Profiler software and devices

Note 2. **Hardware calibration** adjusts the monitor's internal circuitry or lookup table (LUT). A calibration device measures the screen, then calibration software writes corrections into the display itself. This usually preserves more tonal detail and can provide more consistent results across the display's brightness range. However this is only available on high end monitors.

Software calibration applies corrections through the computer's graphics card, using a video LUT and a monitor profile. It works with almost any display, but large corrections can reduce the available tonal steps and may be less consistent.

Both methods typically use a measuring device to create an ICC profile so colour-managed apps can display images accurately. The key difference is **where the calibration corrections are applied**: inside the monitor or in the computer's graphics output.

The Colour management Chain

Consistent colour from screen to print depends on every link in the chain being characterised and managed:

Camera → RAW Processor (Lightroom Classic)-(Camera Raw Photoshop) ICC aware → Calibrated Monitor → Photoshop and Lightroom Classic→ Print (ICC Profile)

If any link is unmanaged, you lose predictability. The most common source of frustration prints that look darker, less saturated, or colour-shifted compared to screen, it almost always comes down to either an uncalibrated monitor or missing/incorrect ICC profiles at the print stage.

Part 1: Monitor Profiling and Calibration

Why Monitor Calibration is Essential

Your monitor is your editing reference. If it displays colour inaccurately, every decision you make, exposure, colour balance, saturation is based on false information. A warm, red-shifted screen leads you to cool your images unnecessarily. A bright screen leads to dark prints.

Calibration brings your monitor to known, standardised targets. Profiling measures its actual characteristics and creates an ICC profile that tells your operating system and colour-managed applications how to compensate for any deviations.

Calibrators

Calibration using your eye and sliders is insufficiently accurate for serious work. You need a colorimeter or spectrophotometer.

Recommended devices (2026):

Device	Type	Best for
Calibrite ColorChecker Display	Colorimeter	Excellent all-round; Glyn Dewis's recommended tool
Calibrite ColorChecker Display Pro	Colorimeter	Wider monitor support including wide-gamut
X-Rite i1Display Pro Plus	Colorimeter	Professional; wide-gamut and HDR monitors
Calibrite ColorChecker Studio	Spectrophotometer	Monitors and printers; combined workflow
X-Rite i1Pro 3	Spectrophotometer	Professional print + monitor; top accuracy

A colorimeter is sufficient for most photographers. A spectrophotometer adds the ability to profile your own printer.

Calibration Targets

When setting up your calibrator software (Calibrite PROFILER, i1Profiler, etc.), use these standard targets for photography:

Setting	Recommended value	Notes
White point	D65 (6500K)	Industry standard for photography and print
Gamma	2.2	Standard for Windows and modern macOS
Luminance	80–120 cd/m²	Lower end (80) for print work; higher for bright environments
Black Level	As low as monitor allows	

Note 3. luminance: A common cause of dark prints is editing on a screen that is too bright. A monitor set to 200 cd/m² makes images look bright and punchy; the resulting print — viewed under normal lighting — appears disappointingly dark. For print-focused work, reduce luminance to around 80–100 cd/m² and calibrate to that target.
In practice most people find that the lower level of 60-80 cd/m,sq is a better range. I in fact use 60.

Step-by-Step: Calibrating with Calibrite PROFILER

1. Warm up your monitor for at least 30 minutes before calibrating
2. Set your room lighting to the conditions you normally edit in — consistency matters more than perfection
3. Open Calibrite PROFILER and select your device
4. Choose your targets (D65, Gamma 2.2, luminance as above)
5. Follow the on-screen instructions — the software will guide you through attaching the colorimeter to the screen
6. The software measures a series of colour patches, builds a profile, and installs it as your monitor's ICC profile
7. Recalibrate every 2–4 weeks — monitor characteristics drift over time, and more frequently with a new monitor during its first few months

The resulting ICC profile is installed automatically and used by your OS and colour-managed apps (Lightroom, Photoshop, Chrome, etc.) to display colours correctly.

Verifying Your Calibration

After calibrating, check using known reference images — portraits with known skin tones work well. You can also use the Soft Proofing feature in Lightroom Classic or Photoshop to cross-check how your image would look on sRGB or in print.

In Lightroom Classic, to check your profile is active: go to View menu and confirm Use Color Profile is enabled (it should be by default).

Note 4. Calibration adjusts the monitor's hardware to hit target values.
Profiling measures the result and creates the ICC profile that the colour-managed software uses. Most calibrators perform both steps in sequence.

Monitor Choice for Photography

Not all monitors are equal for colour-managed work. Key considerations:

- Wide-gamut panel — covers Adobe RGB or DCI-P3 (preferable for print-oriented work)
- Factory calibration — better panels are factory calibrated to a known state
- Hardware LUT — higher-end monitors (BenQ SW series, Eizo ColorEdge) have a hardware look-up table, giving more accurate calibration than a software-only LUT

Good options at different price points: BenQ SW272U (Glyn Dewis uses this), Eizo ColorEdge CS2740, NEC MultiSync PA series.

Part 2: Colour Management in Lightroom Classic and Photoshop

Lightroom Classic's Colour Management

Lightroom Classic works entirely internally in a wide-gamut ProPhoto RGB space at 16-bit. You don't assign or change the working space inside Lightroom — it's always managed for you. What you do control is the colour space of your exported files.

Export settings (File > Export):

Destination	Recommended colour space	Bit depth
Web / social media	sRGB	8-bit
Professional print lab	sRGB or Adobe RGB (ask your lab)	8-bit minimum; 16-bit TIFF if lab accepts it
Photoshop for further editing	ProPhoto RGB	16-bit
Direct printing from Lightroom	Managed by Lightroom (see below)	—

Printing Directly from Lightroom Classic

Lightroom Classic's Print module has a well-implemented colour management workflow:

1. Open the Print module (keyboard shortcut: Cmd/Ctrl + Alt + P)
2. In the right panel, scroll to Color Management
3. Click the Profile dropdown

You Have two options

1. Managed by Printer, Lightroom sends the file without applying the ICC profile; the printer driver manages colour. This is simpler but less accurate - suitable for quick proofing only.

2. Using a specific ICC profile (recommended for print accuracy) Select the ICC profile for your printer/paper combination. Lightroom then converts the image data to match that profile's colour space before sending to the printer. When using this method, you must turn colour management off in the printer driver (set to "No Color Adjustment" or equivalent) — otherwise colour is managed twice, which destroys accuracy.

Rendering Intent:

- Perceptual — compresses the entire gamut proportionally; best for images with a wide range of saturated colours. This is the most commonly recommended for photographic printing.
- Relative Colorimetric — keeps in-gamut colours exactly; maps out-of-gamut colours to the gamut boundary. Best for images where most colours are within the profile's gamut.
- Black Point Compensation: leave on in most cases.

Note 5. I find Relative Calorimetric is better for black and white images when printing with a colour ICC profile

Colour Management in Photoshop

Colour Settings (Edit > Color Settings)

This is the most important setup step in Photoshop. Recommended settings for photography:

Setting	Recommended value
RGB Working Space	Adobe RGB (1998)
CMYK	Coated FOGRA39 (or your print provider's profile)
Gray	Dot Gain 20%

Colour Management Policies (RGB)	Preserve Embedded Profiles
Profile Mismatches	Ask When Opening / Ask When Pasting
Missing Profiles	Ask When Opening

Setting RGB to Adobe RGB (1998) or Pro Photo RGB means new documents default to this space. Files tagged with a different profile (e.g. sRGB) will be handled according to the mismatch policy — "Preserve Embedded Profiles" keeps the file in its own space rather than converting it. It's better to set Missing and Mismatched profiles to Ask When Opening and Ask When Pasting to remain in control.

Soft Proofing in Photoshop

Soft proofing simulates how your image will appear when printed with a specific ICC profile, before you commit to paper.

1. Go to View > Proof Setup > Custom
2. Select your printer/paper ICC profile under Device to Simulate
3. Set Rendering Intent to Relative Colorimetric (or Perceptual for saturated images)
4. Check Black Point Compensation
5. Check Simulate Paper Color — this is the most revealing setting; it simulates the white point of the paper, which is rarely a pure white, and also shows the monitor brightness relative to print

Press Cmd/Ctrl + Y to toggle soft proofing on and off.

You can create a Proof Copy (Image > Duplicate, or use the Soft Proof button in Lightroom) to make targeted adjustments specifically for print without altering your master file.

Part 3: ICC Profiles for Printing

What is an ICC Profile?

An ICC profile is a data file (typically `.icc` or `.icm`) that describes the colour characteristics of a specific device — in this case, your printer combined with a specific paper. It acts as a translation table: "to reproduce colour X on screen, send ink value Y to this printer on this paper."

Without the correct ICC profile, there is no reliable way to predict what your print will look like.

Types of ICC Profile

OEM (manufacturer) profiles Supplied by your printer manufacturer (Epson, Canon) for their own branded papers. Usually accurate and a good starting point. Typically installed with your printer driver or downloadable from the manufacturer's website.

Third-party paper manufacturer profiles Companies like Hahnemühle, Canson Infinity, Ilford, PermaJet, and Breathing Color supply free ICC profiles for their papers on specific printer models. Download from the paper manufacturer's website — they have a profiles section where you select your printer model and paper.

Custom ICC profiles The most accurate option, created specifically for your printer, your inks (OEM or third-party), and a specific paper batch. See below.

Installing ICC Profiles

macOS: Drag the `.icc` / `.icm` file to `/Library/ColorSync/Profiles/` (for all users) or in - User name`~/Library/ColorSync/Profiles/` (current user only). Or double-click the profile and click Install Profile.

In (for current user) you need to hold the Option Key and in the top left bar click Go to reveal the Library option.

Windows: Right-click the profile file > Install Profile. Alternatively, copy to `C:\Windows\System32\spool\drivers\color\ .`

Restart Lightroom or Photoshop after installing new profiles for them to appear in the profile drop downs.

Creating Custom ICC Profiles

For the highest accuracy — particularly when using third-party papers, older printers, or when you notice colour drift — you can create your own custom profiles.

What you need:

- A spectrophotometer (e.g. Calibrite ColorChecker Studio, X-Rite i1Pro 3, or a service)
- Profiling software (included with most spectrophotometers: i1Profiler, COLORLOGIC ColorAnt, or Calibrite PROFILER for Print)
- The target paper and printer at the settings you'll use for production printing

The process:

1. Print a profiling target (a chart of colour patches) on your target paper, using no colour management in the printer driver
2. Allow the print to dry fully (important — inks change as they oxidise, particularly with pigment inks)
3. Measure the printed patches with the spectrophotometer using the profiling software
4. The software compares measured output to the known patch values and builds an ICC profile
5. Install and apply as described above

Note 6. PermaJet profile service: PermaJet offer a custom profiling service — you print their target on your paper/printer, post it to them, and they return a custom ICC profile. A practical option if you don't own a spectrophotometer. Fotospeed I believe do a similar service. Keith Cooper of Northlight Images produces print profiles for many Printer/Paper combinations.

The Complete Print Workflow Summary

```
RAW file (ProPhoto internally in Lightroom)
        ↓
  Soft proof in Lightroom or Photoshop
  (View > Proof Setup > your printer ICC profile)
        ↓
  Adjust for print if needed (proof copy)
        ↓
  Print module (Lightroom) or Print dialog (Photoshop)
        ↓
  Select printer ICC profile manually
  Set Rendering Intent: Relative Colorimetric
  Black Point Compensation: On
        ↓
  Printer driver: Colour Management OFF
  (No Color Adjustment / ICM Disabled)
        ↓
  Print
```

Part 4: Common Problems and Solutions

Problem: Prints are too dark Most likely cause: monitor is too bright (luminance too high). Recalibrate with a luminance target of 80–100 cd/m². Also check your print room lighting — bright ambient light makes prints appear darker by comparison.

Problem: Prints are colour-shifted (too warm/cool/green) Most likely cause: incorrect or no ICC profile applied, or double colour management (profile applied in software AND printer driver both managing colour). Ensure colour management is turned OFF in the printer driver when using an ICC profile in Lightroom/Photoshop.

Problem: Prints look dull and desaturated Could be: out-of-gamut colours being clipped — the printed colours simply can't be achieved on that paper. Use soft proofing to identify out-of-gamut areas (View > Gamut Warning in Photoshop). Try switching rendering intent from Relative Colorimetric to Perceptual to compress the gamut rather than clip it.

Problem: Profile not appearing in Lightroom/Photoshop Ensure the profile is installed in the correct system folder (see above) and restart the application.

Problem: JPEG uploads to web look dull/desaturated You've uploaded an Adobe RGB or ProPhoto RGB file to a platform that ignores colour profiles and assumes sRGB. Always convert to sRGB before uploading to web or social media.

Note 7. As I mentioned in Note 3, 60-80 cd/m² is a more appropriate range, I use 60 cd/m²

Summary Checklist

- Monitor calibrated with hardware colorimeter (D65, Gamma 2.2, 80–120 cd/m²)(60-80cd/m²)
- Recalibration scheduled every 2–4 weeks. Modern Monitors every 6 months
- Photoshop Colour Settings: Adobe RGB, Preserve Embedded Profiles. (Try ProRGB 16Bit)
- Correct ICC profile downloaded and installed for printer/paper combination
- Soft proofing used before committing to print
- Printer driver colour management turned OFF when using ICC profile in Lightroom/Photoshop
- Rendering Intent: Perceptual for wide-gamut images or Relative Colorimetric my recommendation for Black and White images
- Black Point Compensation: On
- Exports to web/social: converted to sRGB

I repeat Note 1, A lot of the research I did confused these two processes and I had to go back and revise parts of this guide.

Note 8. **Hardware calibration** adjusts the monitor's internal circuitry or lookup table (LUT). A calibration device measures the screen, then calibration software writes corrections into the display itself. This usually preserves more tonal detail and can provide more consistent results across the display's brightness range.

Software calibration applies corrections through the computer's graphics card, using a video LUT and a monitor profile. It works with almost any display, but large corrections can reduce the available tonal steps and may be less consistent.

Both methods typically use a measuring device to create an ICC profile so colour-managed apps can display images accurately. The key difference is **where the calibration corrections are applied**: inside the monitor or in the computer's graphics output.

See also: Guide 1 — Camera Settings & Colour Profiles