

Workbench

HowTo – Calibrate Your Printer

This document is a step-by-step guide to the methods used to achieve ISO calibrated output, using Blackmagic Version 5+.

The setup described below is for an **Epson 7900**, being calibrated to a **Fogra 39** standard. Linerisation curves will be generated using L*a*b mode. If any terms or functions mentioned are unfamiliar, please refer to the Blackmagic v5 manual, also available on the Serendipity Software website.

To calibrate a printer, the following steps are involved:

- Configuring an Output, Media and Pagesetup
- Creating a Paper Profile
- Applying Ink Limits to the Paper Profile
- Linearisation
- Creating & Applying ICC Profiles

Note: Before beginning, make sure the printer is running at its optimal level. Check to make sure the heads are clean and printing correctly.

Configuring an Output

Create and save an Output data type in the Workbench for the Epson 7900 driver with the relevant settings for Queue, Destination and Collating you require.

Configuring a Media

The Epson 7900 will be setup as follows:

- Ink Type – Light Light Black + Light Black
- Resolution – 720 x 720dpi
- Colourspace – CMYK
- Use Light Inks – Enabled
- Direction Control – Uni-Directional
- Paper Type – Luster (260)

Make sure a CMYK ICC profile is selected for the Output ICC profile. Standard SWOP is fine, any one will do for this stage – it just needs to have the same colourspace as you are using.

Assign the above Output to the Media.

Configuring a Pagesetup

Create and save a Pagesetup data type in the Workbench for the Epson 7900 driver with the relevant settings. Assign the Output and Media created above.

Set the Press Match ICC Profile to an ISO/Fogra profile (in this case, ISOCoated_v2_eciF39) and Rendering Intent to Relative or Absolute Colourimetric. The rendering intent does not factor in at this point, but will later.

Configuring a Paper Profile

Correct paper profiling is integral to achieving a verifiable PASS for any ISO press standard.

Create a **Paper Profile** by selecting the Media created above. A list of the ink channels and dot sizes (represented by patches) available to the printer will appear in the Density Patches panel.

The profile will be using all the light inks, for a total of 8 inks. The Epson 7900 is a variable dot printer, having four (4) patches – or dot sizes – per ink (patch 1 – no dot, patch 2 – small 33% dot, patch 3 – medium 67% dot, patch 4 – large 100% dot).

Select **Print Density Chart (All Patches)** from the toolbar. When the chooser appears, select the Media and Pagesetup then Submit. The Density Chart will be printed. Allow a few minutes for it to dry once printed.

Measuring the Patches

Once the printed job has stabilised it will be ready for measuring.

1. Connect one of the supported online Spectrophotometers to the Client computer.
2. Select the **Measure Patches** option. This will display a list of supported instruments.
3. Select your device from the list and click OK to continue.

The Client will connect to the measurement instrument and display the measuring window, with the first patch highlighted and ready to measure. The first patch to be measured in each ink channel is the paper itself.

4. Measure each patch until complete.

The patches will highlight in turn and return to the first patch once the last has been read. If patches require re-measuring, simply click on the patch and read it again. If reading a chart with some patches turned off, make a dummy measurement for the absent patch, or skip it by clicking the next printed patch (the reading chart displayed in the Client shows all patches).

5. Click Apply when all patches have been read to close the measure window and store the measurements in the Paper Profile. L Values will appear in each patch.
6. Select File Menu > Save to save the measurements in the database.

Density Patch Selection

This is the process by which the dots fired when printing through this Paper Profile are chosen. Each density patch is a 100% coverage area, made up of the colour and dot size it represents. Patch selection is a process learned through time and experience with the printer. There is no set patch combination that works on every printer. Printer model, print mode, resolution and print media are all factors that can influence dot choice.

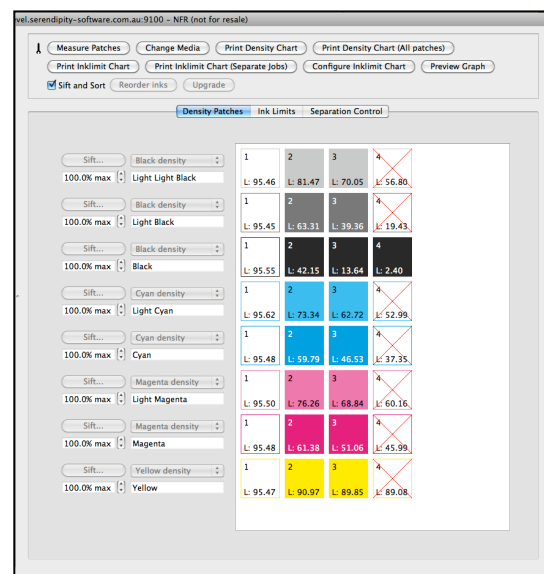
Patch selection is a balance of getting the required colour density on paper vs not putting down too much ink, causing flooding. Large dots (number 4 patches) can sometimes cause flooding.

The image here shows the patches selected for this profile.

The methodology for the patches selected is as follows:

Light Light Black – Patch 2 and 3 on, Patch 4 is turned off (by clicking in the upper half of the patch) as the large dot (4) can cause flooding when mixed with other inks at this resolution.

Light Black – Patch 2 and 3 on, Patch 4 is turned off, again because it is prone to flooding and because high levels of density coverage are best achieved using the Black ink channel.



Note: Given the choice between choosing a light ink patch 4 vs a dark ink patch 2, generally patch 2 of the dark is better as it gives similar density with less ink down.

Black – Patch 2, 3 and 4 on all on. While the measured L value of Black patch 3 (13.64) is lower than the L value of 16 required for the Fogra standard, the large black dot is useful for achieving good shadow density when needed. Also the large black is used only for the darkest areas of an image, and normally used on it's own, so flooding caused by mixing with other inks is not a factor.

Light Cyan – Patch 2, 3 on and 4 off.

Cyan – Patch 2 and patch 3 on, patch 4 off.

Note: The choice of Light Cyan and Cyan dots may differ if a paper profile is being created for a bi-directional media setup. Here is an example where experience with printers comes into play - when printing bi-directionally it is not uncommon for small Cyan dot to cause visible moire pattern in large areas printed of predominantly Cyan. This is common to many inkjet printers due to the small size of the dot, its placement, the white space left around it and how that is perceived by the eye.

Taking this into account, as a preventative measure, LC patch 4 could be left on and Cyan patch 2 turned off. The presence of the large Cyan may require the paper to be set lower ink limits to counteract flooding.

Why not leave LC patch 4 off as well? Looking at the print chart, there would be too much of a visual jump as the printer went from light cyan towards dark cyan areas. You can check these for jumps when you print the Linearisation charts later.

Light Magenta – Patch 2, 3 on, 4 off.

Magenta – Patch 2 and 3 on, patch 4 off – may flood, too pink/red, i.e., not magenta coloured.

Note: Light Magenta and Magenta dot choices for bi-directional media may be influenced for the same reasons as Cyan (above).

Yellow – Patch 2 on, patch 3 on, patch 4 off – big yellow patch often causes flooding and is visually almost no different to patch 3.

Note: The L* values between yellow patches vary very little. If you hover with the mouse pointer, the tooltip will show the a and b values shifting by larger amounts.

Once the patches are selected, **save the Paper Profile and assign it to the Media** (via the Paper Profile button in the Media created earlier).

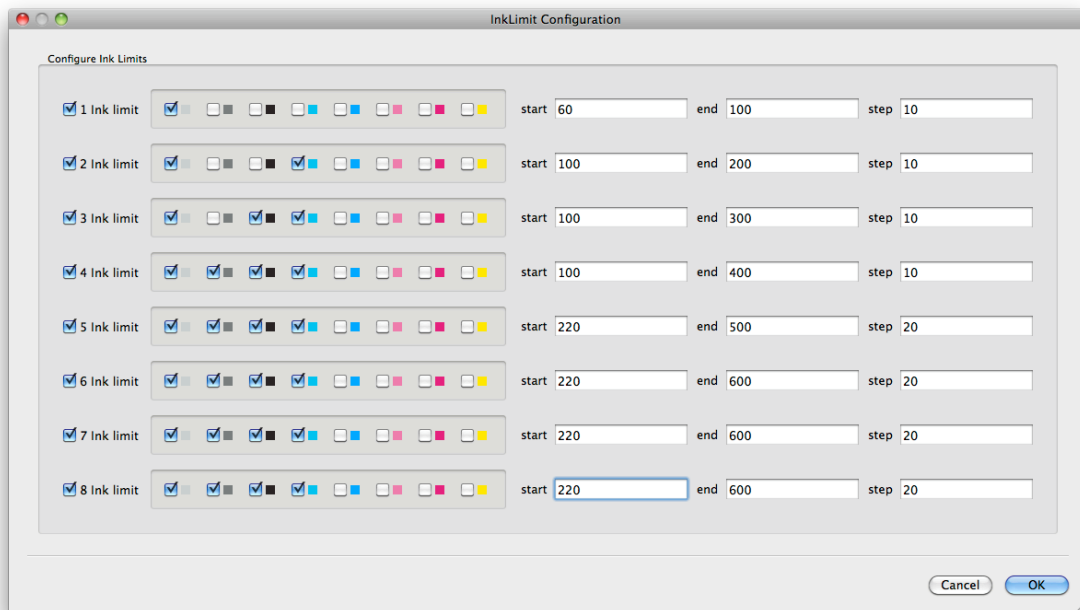
Once saved, return to the Paper Profile for the next stage of calibration.

Applying Ink Limits to the Paper Profile

Ink limits need to be set to prevent flowing of the page when multiple inks are printed on top of each other. This limiting is done because when using a Media and Paper Profile, Blackmagic is taking over control of the printer and it's printhead, meaning the printer's built-in ink limiting is not used.

1. Click on the Ink Limits tab above the patch display area.
2. Leave the 8 inks at their maximum (100%) for now and the Algorithm set to Linear 4.0. This is the default ink limit algorithm and the most appropriate for ISO proofing and this setup.
3. Click on the Configure Inklimit Chart. This will display a popup configuration window showing the number of ink limits in the configuration and inks used.

Configure the settings like this (see image) and OK when done:



There is no need to set the 1 ink limit as 100% coverage of a single ink should not be an issue after appropriate density patches have been chosen. The other inks are setup so that only one line prints on the ink limit chart for each ink combination. If you leave all the ticks enabled, the chart will print every available combination of inks which can make the chart very big. If paper use is not a factor, feel free to leave all ticks enabled.

The inks chosen for each ink combination above are generally in the order most likely to flood first.

4. Select Print Ink Limit Chart or Print Ink Limit Chart (Separate Jobs). This is a personal preference. Printing as separate jobs means the individual charts can be nested – using less paper. Keep in mind, when the charts print, areas of the charts will be very wet.
5. Examine each chart and select a limit for each number of inks. Look to use the highest ink coverage before the patches begin to flood, invert or look dull. 1 ink limit should always be 100% unless a lower coverage is necessary for a particular reason.

Separation Control

Separation control is handled automatically. The curves show the approximate points at which the paper profile will tell the printer to crossover from using light inks to darker inks for a colour channel and the amount of each ink used at various coverage levels. Process colours with only one ink (e.g. Yellow) do not appear on this graph.

Linearisation

Once the Paper Profile has been created and saved to the Media, the printer needs to be linearised. This brings the printer to a neutral, known state making sure, for example, that 30% Cyan actually prints at 30% Cyan. Linearisation also aids in gray balancing the printer.

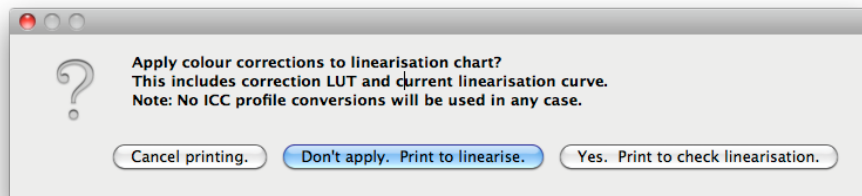
When the chart is printed, all other colour management (except for the Paper Profile) is disabled. This way, quick linearisation updates can be done without having to remember to disable ICC's, correction curves, etc.

The Linearisation Curve is updated (reprinted and measured) on a regular basis, bringing the printer back to the same point the ICC profiles were originally applied, so maintenance is quick and easy.

Here, we will print a chart, measure it, apply and continue.

Printing the Linearisation Chart

1. Launch the Linearisation application by selecting Application Menu > Lineariser.
2. Select your Media from the list of available items and check the Use Lab tickbox.
3. Select the instrument to be used (in this case an iSis) and print the chart. Before printing a popup will appear asking if you want to "Apply Colour Corrections to the Linearisation Chart". Choose the default "Don't Apply. Print to Linearise" option. Pick the appropriate Pagesetup from the print dialog and click Submit to print.
4. Once printed, allow the chart to dry and stabilise before reading begins.



Reading the Linearisation Chart

1. Ensure the correct instrument is selected, click the Measure button, follow the calibration instructions and begin measuring. Depending on the device used, the patch or strip to be measured will be highlighted.
2. Measure each patch or strip in turn, following the instructions at the bottom of the window.
3. To re-measure a strip, select it again and measure it.
4. When all readings have completed, click Submit.
5. If the Media does not already have a curve applied to it (as in this case), a save window will appear to enter a name for the curve.
6. Enter the name and OK to save.

When the curve is saved, it is automatically applied and saved against the Media data type. If a curve does not exist, Cancel, Create New or Overwrite options are available.

Creating & Applying ICC Profiles

With the Media now linearised, the next step is to create an ICC profile.

1. Make sure there are no other colour management settings enabled, except for the Paper Profile and the Linearisation Curve.
2. Select ICC Target.. from the Submit menu. Use the file chooser to navigate to an ICC target of choice (in this case an IT8/7.4 Visual) and submit it to the Pagesetup and Media. Submitting using the ICC Target... option ensures all ICC, dot gain and colour correction is disabled for printing.
3. Once printed, check the ICC target. This is another indicator of your Paper Profile. If there are wet patches or dull (other than a few in the very dense areas), or if the chart is too light, you will need to go back to the Paper Profile and re-select patches or set new ink limits; re-linearise and print the target again until it looks OK.
4. Leave it to stabilise before measuring the values. This time will vary depending on the media and ink set. At least 30-60 minutes drying/curing time is recommended.
5. Once the chart is ready, measure it using your ICC profiling software and create the ICC profile.

Note: It is beyond the scope of this document to detail the process of creating an ICC profile. Consult the relevant profiling documentation on the creation of an ICC profile for the media type and print process standard.

Assigning the Profile

1. In the Workbench, select the Media being calibrated.
2. In the ICC Profiles (Output) panel, click the Choose ICC Profile button.
3. In the popup ICC selection window, click Upload File.
4. Navigate to the saved ICC profile, select Open, choose the Printers folder and click OK. The profile will be assigned to the Media.
5. Save the Media.
6. Turn on the Always Use ICC option in the ICC Profiles section of the Pagesetup and save it.
7. Open the Calcheck application (Application menu > Calcheck).
8. Submit and print a Calcheck Chart, either generated from your Press ICC profile or an imported chart. This can be printed using either Relative Colourimetric rendering intent if the paper has a white point close to the Fogra standard, or alternatively use Absolute Colourimetric intent.
9. Measure the chart using the Calcheck application.

If you get a PASS result – great!

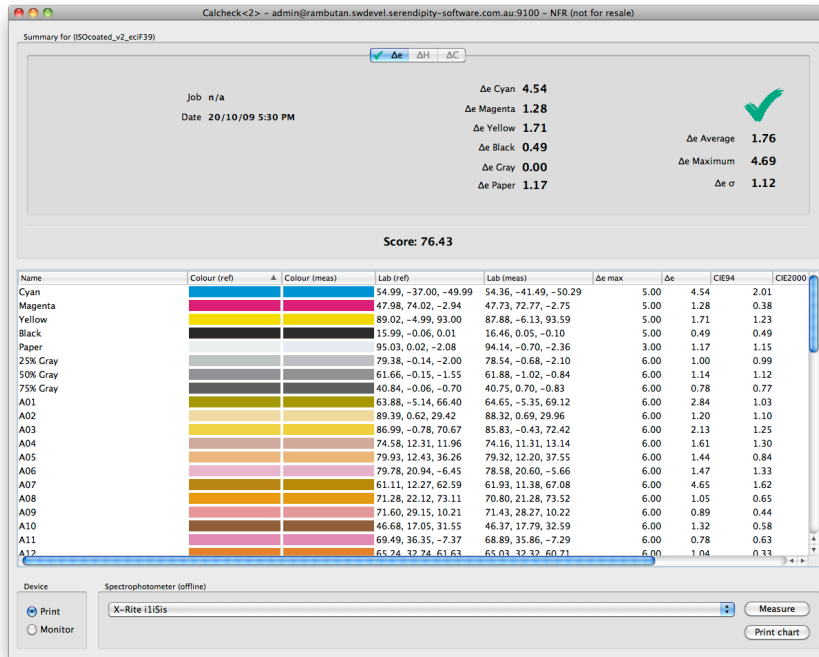
If the calibration FAILS slightly and you have iterative ICC software, you can iterate the profile to pull it into standard and try Calcheck again.

If you don't have such software or the calibration fails by a large Δe margin, it's back to the beginning to try different settings in the Paper Profile.

The Media created for this guide was calchecked with the charts printed using both relative and absolute colourimetric intent.

It PASSED the Fogra 39 standard in both cases. See the following page for example screenshots of the results.

Relative Colourimetric Rendering Intent



Absolute Colourimetric Rendering Intent

