

Epson 7800 B&W Setup¹

MIS Eboni MK Hewlett Packard PK

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(Draft)

The purpose of this effort is to optimize the Epson 7800 printer for black and white printing, with maximum print longevity a primary objective. This setup uses a combination of Eboni-based inks for medium-warm, 100% carbon printing on matte paper, and Hewlett Packard Z3100/3200 Vivera PK-based inks for more neutral matte prints and neutral-cool glossy prints.²

Using 100% carbon pigments is the most lightfast, tonally stable printing approach we have for practical black and white photography today.³

MIS Associates' Eboni MK is the most neutral 100% carbon pigment available for inkjet printing, and was selected due to that characteristic as well as its very good dmax. The Eboni dilutions are warmer than the straight MK, but less warm than the other dilute 100% carbon inks. The Eboni-based inks are for matte paper only.

The Hewlett Packard Z3100/3200 Photo black ("HpPK") appears to be the best neutral carbon-color blended ink we have available. It can print on many different types of paper with a neutral-cool image tone, and it appears from fade tests to be very stable.⁴ Thus for more neutral matte printing than Eboni can achieve and for glossy printing, HpPK-based inks will be added to this 7800 setup.

¹ This is version 2. Version 1, Eboni only, is summarized at <http://www.paulroark.com/BW-Info/7800-Carbon-6.pdf>.

² For very warmer matte printing, I recommend Jon Cone's K6 Carbon Sepia. For very warm 100% carbon glossy printing various MIS B&W inksets can be used. See <http://www.paulroark.com/BW-Info/> for a list of MIS B&W inksets.

³ See <http://www.paulroark.com/BW-Info/R1800-Lightfastness.pdf> for information on carbon ink lightfastness.

⁴ See <http://www.paulroark.com/BW-Info/HP-Neutral-Aa1-80MLH.jpg>, which shows Aardenburg-Imaging test results after 80 MLux Hrs. of fade. The inks received a top rating. See also <http://www.paulroark.com/BW-Info/Carb-v-Blended-Neutral-20MLH.jpg>, which compares Eboni to the neutral blended inks. See <http://www.aardenburg-imaging.com/> for the source material. See also <http://www.wilhelm-research.com/hp/Z3200.html>.

The dilute Eboni and HP positions will use the open source C6c clear base suspension medium to dilute the concentrated commercial pigments.⁵ “Eboni-6” inks are the commercially available equivalent alternatives for the user-mixed version I use in this setup. HP sells the HpPK as well as dilute neutral gray pigments that are roughly equivalent to the dilutions made with the open source base. Thus this approach is available to those who prefer to use only commercially available inks. Users must, however, load the inks into 7800 cartridges.⁶

Inks & Positions – Eboni & HpPK, with C6c Dilutions⁷

The ink dilutions and placements in the 7800 are listed below. While I will be using the C6c generic base,⁸ I have listed the MIS Eboni-6 equivalents in parentheses.

Carbon/Eboni-6 medium warm matte inks:⁹

K = 100% Eboni

LK = 30% Eboni (Eb6-C, similar to MIS UT-C in density)

LLK = 9% Eb (Eb6-LC, similar to MIS UT-LC in density)

M = 18% Eb (Eb6-M, similar to LK in density)

LM = 6% Eboni (Eb6-LM, similar to LLK in density)

HP Z3100/3200 Vivera Neutral-Cool PK-based inks:¹⁰

C = HP Z3100/3200 Vivera Photo Black (“HpPK”)

LC = 30% HpPK (similar to HP Vivera gray [LK])

Y = 9% HpPK (similar to HP Vivera light gray [LLK])

⁵ See <http://www.paulroark.com/BW-Info/Ink-Mixing.pdf> for general information on the C6 base, and <http://www.paulroark.com/BW-Info/Eboni-6.pdf> for more on Eboni-6. Carbon-6 and Eboni-6 are essentially interchangeable, using the same profiles.

⁶ I currently use MIS (\$18 each, empty). See

http://www.inksupply.com/inkjet_cartridges.cfm?search_getmodel=460

⁷ Eboni-6 and HP PK have been installed and very successful in my 1400 for more than one year.

See <http://www.paulroark.com/BW-Info/Eb1400.pdf>

⁸ This 3rd version of my C6 generic base is incrementally smoother than the previous version, particularly on Arches uncoated paper, which is a specific target of this effort. The previous versions of the C6 base continue to be viable alternatives for those who do not have the stronger surfactants readily available. See <http://www.paulroark.com/BW-Info/Ink-Mixing.pdf> for more information on these open source dilution bases.

⁹ This Carbon/Eboni-6 inkset omits only the 2% dilution, which is not needed in modern printers. All Eboni inks can be purchased pre-mixed from MIS as bulk Eboni-6.

See <http://www.inksupply.com/eb6.cfm>

¹⁰ I purchase HP Photo Black at http://www.atlex.com/hp_designjet/z3100.htm

Note that dilute Eboni pigments must be agitated more often than most other pigments.¹¹

Epson Driver Workflow

This ink arrangement is compatible with the Epson driver. While I often if not usually use QuadToneRip¹² for my fine art printing, it is very handy to have the Epson driver option available.

I work in Gray Gamma 2.2 space, which is a subset of Adobe RGB (1998) and sRGB, the most common color spaces. With the print preview setting “No Color Management” selected¹³ and the printer driver set to UltraSmooth Fine Art paper type, and the highest quality settings, matte papers should print with a good ramp. The Lab L distribution of such a print of a 21-step test file will be shown in the graph below.

[Lab L with just Epson driver]

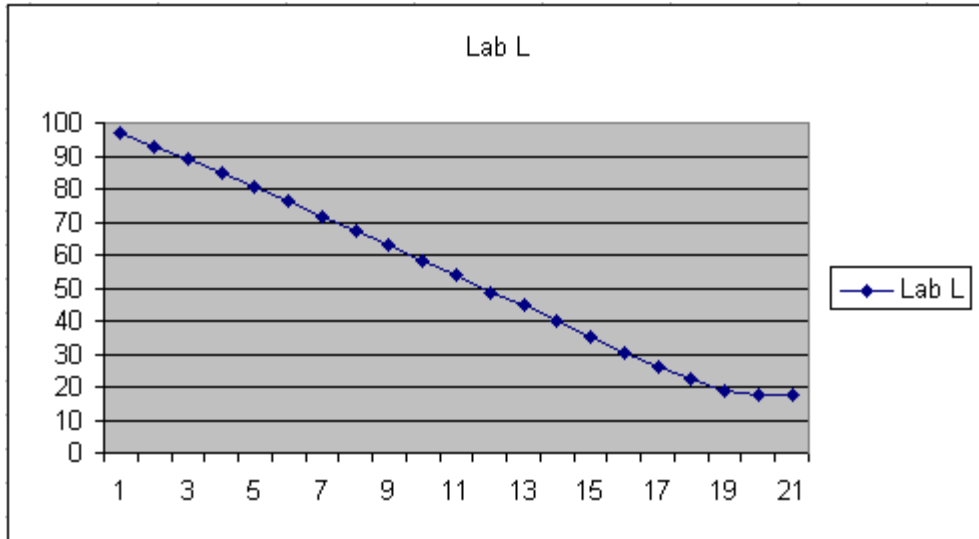
An ICC made with QTR’s Create-ICC usually is all that is needed for a very good, “color managed” workflow.¹⁴ The graph below shows the results of an ICC with Gray Gamma 2.2 workspace. This also shows the idealized Gray Gamma 2.2 relative density distribution that is shown on a calibrated monitor.

¹¹ The MIS or other standard carts are most easily agitated by removing and shaking them. How long the seals will last is unknown. A CIS system may be the easiest to agitate. See http://www.inksupply.com/cfs_7800_new.cfm Funnel fill carts are also available from MIS. See <http://www.inksupply.com/funnelfill.cfm>. Ink should be kept in the dark to avoid the possibility of algae, which has been reported to be a problem in some CISs in sunny climates. These clear carts might best be covered by a black plastic sheeting. Some “agitate” ink in them via syringe in the fill hole.

¹² See <http://www.quadtonerip.com/html/QTRoverview.htm>. “QTR” is shareware written by Roy Harrington.

¹³ With CS4 and a grayscale file have the print preview set to PS Manages Color with Print Profile = Working Space (Gray Gamma 2.2) or Printer Manages.

¹⁴ In this context a “color managed” workflow will result in print relative densities that match those seen on a calibrated monitor.



The best Epson driver workflow uses QTR’s Create ICC-RGB with an embedded Photoshop curve. This provides not only a “color managed” workflow, but also results in a high bit depth pipeline to the printer, overcoming the 8 bit limitations of most B&W workflows.¹⁵ The curve below, by using the light 6% ink in the highlights, produces the smoothest prints and works with most matte papers. This curve and other profiles will be posted at <http://www.paulroark.com/BW-Info/7800-Eb-HP.zip>. The curve is intended to be used with Create ICC-RGB.¹⁶

[PS curve]

Arches Hot Press will also print with the Epson driver, but not well. The dmax with the Epson driver is a bit low, and the Epson driver midtone ink limits are too high. So, for the best results on Arches Hot Press I recommend the QTR rip.

QTR Profiling for Arches Watercolor Paper

Although coated papers can often be profiled to print with a very slightly higher dmax with QTR relative to the Epson driver, the final prints are so close that in actual images there will probably be no visible difference. As such, the advantages of using the Epson driver with an ICC will probably cause me to use that workflow for most coated papers.

¹⁵ Note that whether one needs more than 8 bits of printing information is questionable. What is important is that curves are applied in a 16 bit environment, and this is done in the QTR rip even though it restricts the input file to 8 bits. Always work with 16 bit per channel (or greater) files in Photoshop.

¹⁶ Briefly, one first prints an RGB version of the 21-step test file with this curve and reads the Lab L values of the test strip. These values and the curve, placed on a special file in the QTR download, are then dragged and dropped into the Create ICC-RGB app on the Desktop. This gives the program the information it needs to produce a custom ICC.

With Arches Hot Press uncoated watercolor paper, however, the QTR rip is much better. Arches is one of my primary targets for fine art printing due to its very good reputation, predicted long term stability, cost, availability in sheets, and other favorable characteristics.^{17 18}

I use Window XP, so the following is based on the Windows QTR interface.

Black Ink Limit & Boost

Ink limits can vary somewhat from paper batch to paper batch. As such, checking the Eboni ink limit for different paper batches may be advisable. In part to keep changes in the black ink limit from affecting the entire profile, I use the Black Boost. This puts a very steep slope on the very end of the black ink curve. The value put into the Black Boost box is that which gives the best d_{max} . When this Black Boost is changed, it does not affect the rest of the profile. In the Curve Creator K “ink limit” box I put the value where the additional density in adjacent patches is very small – that is, where the slope of the Lab L curve becomes very low. This point will be well below the d_{max} point used for the Black Boost and does not usually need to be changed from paper batch to paper batch.

For Arches HP I find the slope of the curve levels off substantially at about 70%. As such, that is where I’ve set the K ink limit, even though the d_{max} is usually not hit until 100.

Arches Midtone Ink Limits

Because it is an un-coated paper, Arches is prone to bleed and look “blotchy” (rough) at fairly low ink loads. This is hidden in the deep shadows, but for the midtone inks bleed can significantly reduce smoothness. As such, I opt for low midtone ink limits that reduce the bleed. An ink limit of about 30 for most midtones works well; 50 for the 30% ink seems to work well because the bleed is sufficiently hidden by the time those inks reach that level.

Arches Ink Densities

QTR ink densities are usually set by measuring the density of the midtones at their ink limits and comparing these densities to a black 21-step test print that was printed at its ink limit, here 70. If, for example, the cyan position ink at the limit selected for it is equal to the black (limit 70) ink test patch at 35%, then the cyan ink would have a density value of

¹⁷ Arches papers have been made and used by artists for close to 500 years. It is widely available at art stores in 22 x 30 sheets. I use “140 pound” (about 300 gsm) thickness “Hot Press” (smooth surface) “Bright White” (no OBAs and not much brighter than the standard Arches). A “cold press” with more of a texture prints the same as the hot press. There is also a “rough” surface available that I have not tried. I recommend <http://www.dickblick.com/categories/watercolorpapers/#artistwatercolorpapers> as a source.

¹⁸ Some of the material in this section is repeated at <http://www.paulroark.com/BW-Info/Arches.pdf>.

35 in the QTR Curve Creator. Usually some interpolation is needed to hit the exact density value.¹⁹

Print Tones

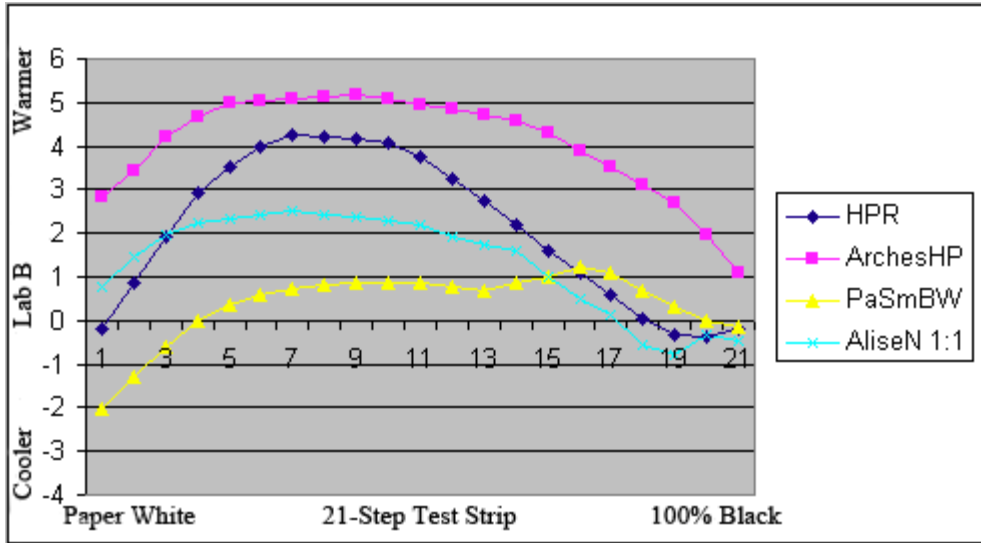
The print tones with Carbon-6, as is typical of all monotone inksets, are varied primarily by paper choice. The graph below shows the Lab B values for 21-step test strips.²⁰ Premier Art Smooth Bright White (PaSmBW) is my old standard paper for the most neutral-cool prints with dilute carbon inks. Since it has OBAs in it, I'll be phasing it out for fine art uses in favor of papers with no OBAs. Hahnemuhle Photo Rag (HPR) is a popular paper that prints with a distinct split tone and a high dmax. Premier Art's Generations Alise Museum or Natural (GenAliseN) prints similarly to HPR, has no OBAs in it, and is about the only paper that can top HPR's dmax. With a profile that is 50% Eboni and 50% HpPK, AliseN prints with a modest Lab B increase of only about 2 units and looks quite neutral.

A large split tone gives the appearance of greater warmth on these papers; some think it also gives the appearance of greater depth and tonal separation. A mild split tone combined with a rather bright but non-OBA paper (e.g., delta-B = 2, from Lab B=1 to Lab B=3, which is still less than the surrounding mat board) may be the best answer for a very stable neutral fine art print. AliseN with Eboni and HpPK can do this.

Arches Hot Press BW was printed with the QTR profile, above. Note that while its Lab B is relatively high, the delta-B is low. That is, from the paper white to the maximum Lab B is only about 2.3 units. Our perception of warmth is as much from the change in Lab B as the absolute values. The eye will do a "white balance" on whatever references are around. If no bright white reference is close to the Arches print, it will look only slightly warm, based on the white balance of the paper and matte board and the relatively low increase in Lab B within the image.

¹⁹ I am not certain how accurate these density figures need to be. I've found that often the "densities" of the identical inks used in, for example, the C and LK positions vary slightly. For simplicity I usually average them. On the other hand, having them be different might help with separating the starting points of some of some of the duplicated ink densities. I doubt more than 2 digit accuracy is ever needed here, and considerable slop appears to be tolerated by the QTR partitioning system.

²⁰ Lab B is the primary variable with respect to image tone. Lab A values are always positive and vary much less, following the trend of the Lab B values but with little actual change. As such, for simplicity, the Lab B values "show" the relative image tones of the various papers with good accuracy.



In general, the relative print tones of this approach are similar to those described with the other Eboni/Carbon-6 inks.²¹

[This is a work in progress. More will be added as I get more experience with the approach.]

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²¹ For more information on tones, see <http://www.paulroark.com/BW-Info/Eboni-6.pdf>, <http://www.paulroark.com/BW-Info/C88-C13-5.pdf>, and <http://www.paulroark.com/BW-Info/Eb1400.pdf>.