

Eboni-1400

100% Carbon Pigment + PKN for Glossy & Toning

Epson 1400 Printer

www.PaulRoark.com

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A. Overview

This inkset is a variant of MIS Associates' Eboni-6 inkset.¹ Eboni-6 ("Eb6") is a hextone,² monotone,³ 100% carbon pigment, black and white inkset for matte papers that runs on most Epson printers. The Eboni-1400 inkset adds a single neutral photo black ("PKN") ink for glossy printing and when cooler matte prints are needed.⁴

Wikipedia states with respect to carbon inks, "The carbon particles do not fade over time even when in sunlight or bleached."⁵ The most sophisticated third-party fade testing that we have available to us is by Aardenburg Imaging & Archives.⁶ In these tests 100% carbon inks show very minor fade and result in the most lightfast and stable images tested.⁷

All neutral-tone inks include color pigments to offset the natural carbon warmth, even if the inks are referred to as "carbon inks." Even if the colors are blended with the carbon so that no color dots show on close inspection, the color inks compromise the lightfastness and tonal stability of the prints.⁸

Eboni is the most neutral carbon pigment I've tested that can be used in inkjet printers. With some printers, profiles, and papers it is near neutral. On the other hand, with many papers it is distinctly warm. With the Epson 1400 printer it is

¹ See <http://www.paulroark.com/BW-Info/Eboni-6.pdf> for full information on Eboni-6.

² There are 6 ink densities – full strength Eboni MK and 5 dilutions.

³ In a monotone inkset all inks are the same color. Print tone can be varied somewhat by paper choice.

⁴ The 2% Eboni (Eb6-Y) is removed from this version of the inkset.

⁵ See http://en.wikipedia.org/wiki/Ink#Carbon_Inks. See <http://www.paulroark.com/BW-Info/R1800-Lightfastness.pdf> for more information on carbon ink stability. Note that not all forms of carbon are this stable.

⁶ See <http://www.aardenburg-imaging.com/>

⁷ I have summarized the 30 MLux Hours Aardenburg Imaging results here:

<http://www.paulroark.com/BW-Info/AaI-30MLuxHr.jpg>

In a different AaI test, after 70 MLux hours of exposure, the 100% Eboni MK patch showed no fade at all. This second test was for the equivalent of 35 years of display using the standards of Wilhelm Research. The paper used was Red River Polar Matte.

⁸ In general, color pigments fade faster and at different rates, causing tone shifting. They also cause artifacts like metamerism.

always slightly warm, but with some papers and when framed with a natural paper mat board, the image can appear quite neutral.

If color pigments are needed to cool the carbon pigments more than paper choice allows, it is still advantageous to start with the most neutral carbon pigment – Eboni – so that the least amount of colorant is needed. Where lightfastness and image stability are high priorities, the very best color pigments should be used. This inkset provides a choice of PKN inks for this purpose. Because the neutral PKN inks are pre-mixed carbon-color blends, controlling print tones and profiling is much easier than with high-gamut inks or toners, and there are never color dots on the print.

The PKN ink is for both toning matte paper and printing on glossy papers.⁹ The 1400's tiny 1.5 picoliter droplets result in quite smooth neutral-cool prints.¹⁰ The choice of PKN inks includes the highly acclaimed Hewlett Packard Z3100 PK and the pre-loaded MIS UT14-C.

B. Ink Positions

The inks are as follows (from left to right in the 1400):¹¹

Y = Eb6-LM (6% Eboni, 94% clear base; LLK density)

K = Eboni MK (MIS Associates carbon matte black ink)

LC = Eb6-M (18% Eboni; LK density)

LM = Eb6-LC (9% Eboni)

M = Eb6-C (30% Eboni)¹²

C = PKN (Neutralized photo black: HP Z3100 PK¹³ or MIS UT14-C)

⁹ Note that I'm oriented to matte printing with 100% carbon pigments for my serious work. If I were more oriented to glossy work, I might want to include a dilute neutral in (LKN) and gloss optimizer, such as in inkset "1400-NC2." See <http://www.paulroark.com/BW-Info/1400-NC2.pdf>

¹⁰ While my 1400 does not band visibly with a single Hewlett Packard Z3100 PK in the C-position, not all 1400s may be made as well. See the Image Structure section of this PDF, below.

¹¹ If MIS carts are used, be sure to remove the tabs – usually yellow – that block the air intakes before installing the cartridges. If CIS/CFS units are used, they must be agitated relatively frequently. While all pigments settle with time, settlement with the dilutions of Eboni is faster than average. Normal printing will agitate the carts. If you refill the carts, agitate the bulk ink bottles periodically and before filling.

¹² All of the above inks can be ordered from MIS. See <http://www.inksupply.com/eb6.cfm> for bulk inks. For pre-loaded carts, see <http://www.inksupply.com/product-details.cfm?pn=EB6-1400-SET>. The chips on these carts slide out sideways, allowing the positions of the carts to be easily changed.

¹³ HP Vivera PK is considered by many and claimed by HP to be the best neutral black pigment. HP color pigments are more stable than Epson pigments or any third party color inks. In Wilhelm Research fade tests the HP B&W prints were rated at over 275 years on all matte papers if displayed under glass.

<http://www.wilhelm-research.com/hp/Z3200.html> In <http://aardenburg-imaging.com/index.html> fade tests

C. Printing Workflow Options – Epson Driver

While the ultimate in control will come with a rip like QuadToneRip (“QTR”),¹⁴ the Epson driver can make excellent matte prints. These prints will have some of the PKN in them, and thus some color pigments. Nonetheless, they will still be more stable than any commercially available alternative of similar tone.¹⁵ Printing on matte paper with the Epson driver is a good place for a novice to start.

1. Epson Driver – Color Controls, Gamma 2.2

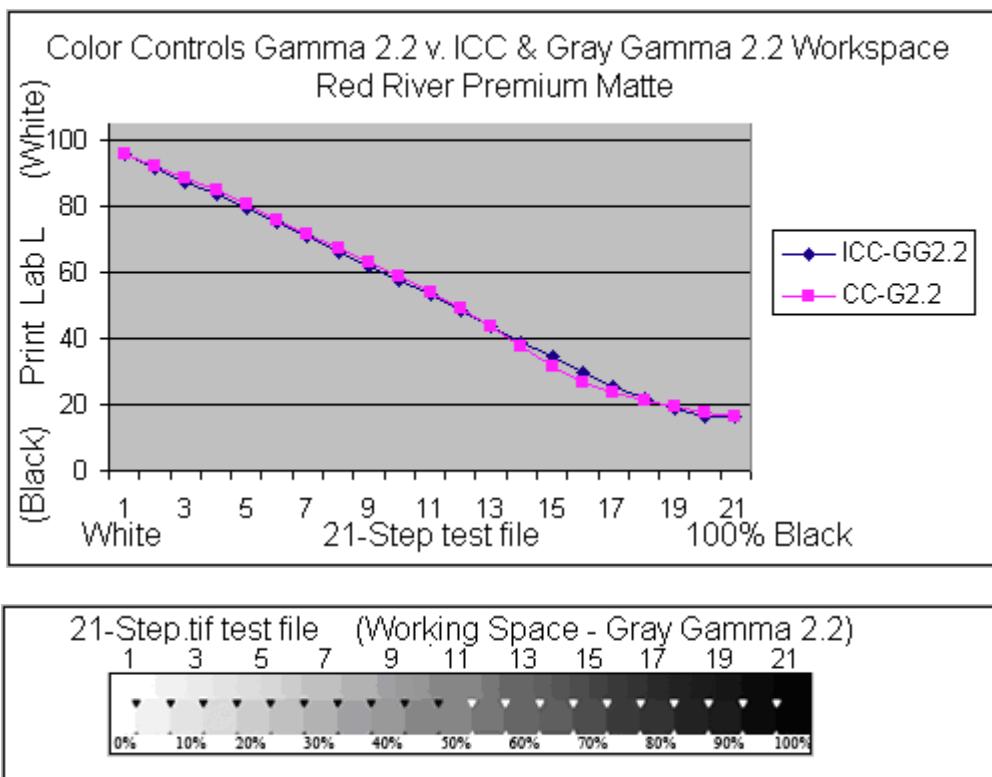
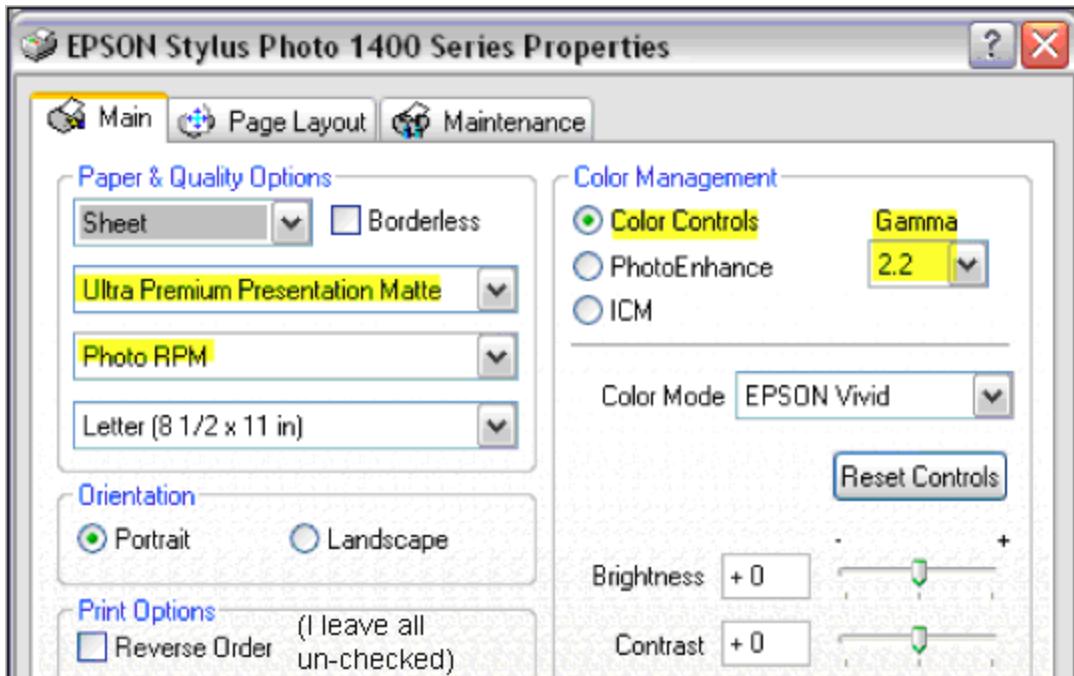
Often the Epson driver with appropriate settings will produce matte prints that match a calibrated monitor’s relative densities. This assumes that the working space of the image file is Gray Gamma 2.2. This working space is the most common gray space, being a subset of Adobe RGB and sRGB. It is used by the internet and is the default setting, directly or indirectly, in many image editing and other programs, such as scanners and digital cameras.

See the screen grab of the Epson Driver Properties dialog box and the resulting Lab L (luminosity) or characteristic curve (Kodak’s terminology from the film era) compared to the ideal Gray Gamma 2.2 characteristic curve, below.

after 40 Mlux hours of exposure (about 20 Wilhelm years) the HP-PK faded an average 0.53 Lab L units on the 3 papers tested. <http://www.paulroark.com/BW-Info/HP-PK.pdf> shows how to remove the HP-PK ink from its large carts. For the 1400 cart, buy an empty 1400 yellow position cart for the chip, which will be swapped with the other carts above to get the inks in the positions recommended. No special tools or chip resetters are needed to deal with these auto-reset chips.

¹⁴ <http://www.quadtonerip.com/html/QTROverview.html>

¹⁵ Particularly if the HP-PK is used, these prints will have less color pigment in them than any equal or cooler toned inkjet print, and the HP PK and color inks have tested as more stable than any similar inks.



As can be seen by the above graph, the Epson driver set to Color Controls with Gamma 2.2 reasonably matches the densities¹⁶ of a color-managed workflow using a custom ICC when the grayscale image file is Gray Gamma 2.2. The

¹⁶ I use the term “density” loosely and informally here. The luminosity scale is in Lab L.

monitor is always color managed. As such, if the file is using or edited in the usual Gray Gamma 2.2 space (or RGB or sRGB, as with most digital cameras) the print relative densities will match those of the monitor, which is very desirable.

With the Epson driver, the PKN is used as well as the Eboni carbon inks from approximately 50% to 85%. This reduces the Lab B by about 1 to 2 Lab B units in this range. That is, the PKN cools the shadows a bit relative to 100% carbon. This results in more of a “split tone” with relatively warm midtones and cooler shadows. Print tones are discussed below.

2. Epson Driver – ICC in Photoshop Print Preview

The use of an ICC in the Photoshop or Elements Print Preview “color manages” the workflow, in the sense that a calibrated monitor will automatically give a good match to the print’s relative densities even if Gray Gamma 2.2 is not the working space.¹⁷ It may also give a slightly better match than the Epson driver without an ICC if the paper used does not produce the results shown above.

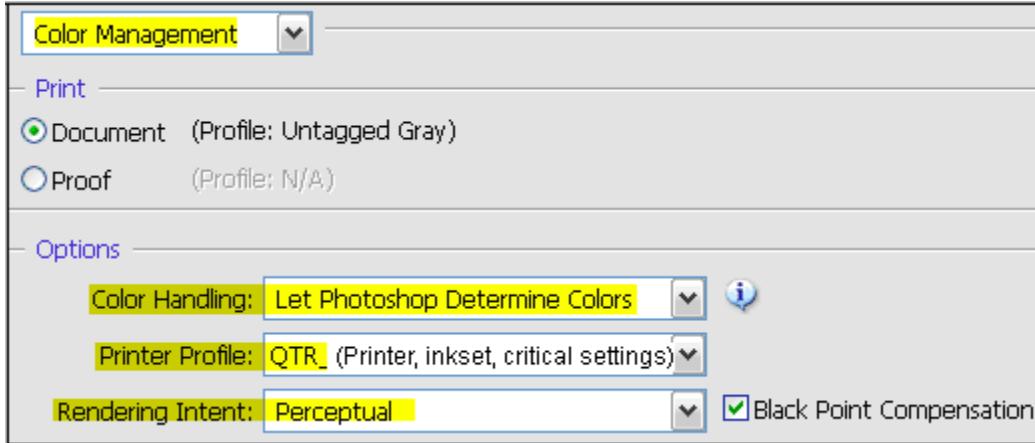
Custom Grayscale ICCs are easy to make using QTR’s “Create ICC.” This program is part of the QTR download. Briefly, ICCs are made with Create-ICC by printing a 21-step test strip and taking the Lab L readings from that test strip to, in effect, tell the printer how to match the monitor. With Create-ICC on the desktop, a text (Notepad) file¹⁸ of the Lab L information from a test strip is simply dragged to the Create-ICC icon, and an ICC will pop out onto the desktop. That then needs to be placed in the appropriate folder.¹⁹

The ICCs are inserted in the Print Preview, as shown in the screen grab, below.

¹⁷ ICCs can also be used to “soft proof” the print tones, but that is beyond the scope of this article.

¹⁸ ICCs are made for specific printers, papers and inksets, and the printer drivers must use the same settings as were used when the original test strip was made. Thus, the name of the text file, which will be reflected in the ICC name, should include this information.

¹⁹ The ICC location varies for different computer OS’s: (1) Windows XP or Vista folder: c:\windows\system32\spool\drivers\color\; (2) Mac OS 9.x: Systems Folder/ColorSync Profiles; (3) Mac OS X: User Library/ColorSync/Profiles; (4) Windows 98/M: \Windows\System\Color; (5) Windows NT/2000 or XP upgrade from NT/2000: \Winnt\system32\spool\drivers\color.



When one makes an ICC the use of a spectrophotometer to read the test strip is ideal, but one can also use a flatbed scanner for this purpose.

See http://www.paulroark.com/BW-Info/Making_B-W_ICCs.htm for some tips on using Create-ICC with a flatbed scanner. I use a ColorVision Print Fix Pro spectro.

D. QuadToneRip (QTR)²⁰

The QTR rip provides the most control of the printer because it gives direct control of each ink position. With this Eboni-1400 inkset, QTR allows 100% carbon on cotton-matte as well as glossy black-only printing.²¹

I use Windows, so the following is based on the Windows QTR interfaces/GUIs.

With Windows, QTR must be used as a separate program as opposed to printing directly from Photoshop. The QTR rip is also not “color managed.” As such, some way to match the monitor to the “straight-line” or “linear” output of QTR is needed. Novices should probably first become comfortable with the Epson driver printing before learning QTR. B&W enthusiasts will find QTR a very useful tool.

1. Making QTR Profiles

a. Glossy Paper – “Black Only”

Glossy papers are printed using only the C-position PKN ink. This is a type of “black only” or “BO” printing and is the easiest type of profile to make with QTR. Basically, all this takes is to (1) determine the ink limit (maximum ink output) that

²⁰ <http://www.quadtonerip.com/html/QTRoverview.html>

²¹ I've experimented with several different alternatives using Eboni and PKN inks. See, e.g., <http://www.paulroark.com/BW-Info/NC3.PDF> and <http://www.paulroark.com/BW-Info/1400-NC2.pdf>. The Eboni-1400 inkset discussed here seems the most convenient for my uses.

results in the best black (dmax), (2) print a 21-step test print with an appropriate black-only curve with this ink limit set, and then (3) linearize the profile.²²

(1) Determine the Ink Limit

Ink limits are usually determined when using QTR by printing a “Calibration Mode” print on the paper to be profiled.²³ This will print a 21-step test print of each ink in the printer. This is usually the appropriate first step. However, with only one ink being glossy-compatible in this inkset, printing an entire page is slow and wastes of a sheet of paper.

A faster alternative to the Calibration Mode print is to print a 21-step test file²⁴ with a simple QTR straight-line curve than simply goes from 0 to 100. For this inkset, I call such a curve “C-0-100.” To make a curve like this, open the Curve Creator (Tools>Curve Creation). In the box under “Cyan,” scroll down to “Load Curve.” Push the “Curve” button that will appear at the right. This brings up a box that has 2 tabs. Click on the “Point List” tab. In the “Curve Points” boxes enter (0, 0) and (100, 100) as the only coordinates. You can press the “Preview Curve” button to verify the curve is a simple straight line between the bottom left and top right corners. Press OK on the Point List box. Check that the ink limit is set to 100. The ink limit can be either in the “Default Ink Limit” box or the Limit box specific to Cyan. Save this in the 1400-MIS folder.

Once a C-0-100 profile is made, print a 21-step test print with it.²⁵ Dry the print thoroughly, and determine which patch is the darkest. For this, a spectrophotometer (“spectro”) is best, but a flatbed scanner can be used. If, for example, the 65% patch on the test strip is the darkest one, then 65 is the ink limit for this ink on the paper tested.

(2) Find or Make a Starting Curve or Profile

For a single-ink, black-only type profile, there are several ways to find an appropriate starting curve. The easiest way is to simply label the C-position ink as a “Gray” ink in the QTR Curve Creator and put “100” in the Density box. Set the ink limit to the level found in the above step. Save the curve with an

²² The profiles I’ve made were made with HP-PK in the printer. See <http://www.paulroark.com/BW-Info/Eb-1400-Profiles.zip> to download there profiles. If MIS PKN is used, they should be re-linearized.

²³ To print a Calibration Mode print, in the main QTR GUI, click on Tools>Options>Calibration Mode. Center the image, be sure the “Ink Calibration” slider is set to 100, and the paper type is “matte” even though this is for glossy paper. I always print at 2880 resolution and uni-directional.

²⁴ See <http://www.paulroark.com/BW-Info/21-Step.jpg> for a Jpeg of the one I use. Save this as a Tiff file.

²⁵ For this purpose I use just $\frac{1}{2}$ ” border at the top of the page, even though for actual prints a larger border is recommended. I cut the printed test strips off the full sheet of paper, so that the paper can be used for the next test strip without the risk that the black ink will be transferred to the printer feed roller. The 1400, typical of many modern printers, bands if top and bottom borders are too narrow. Both sets of printer rollers are needed to give the best paper transport.

appropriate name, showing the inkset and PKN used. Push the “Show Curve” button and the starting black only curve will be shown.

(3) Linearize the Curve/Profile

Print a 21-step test file with this starting curve/profile. Measure the dry test strip with a spectro or, if a spectro is not available, flatbed scanner.²⁶ The Lab L readings, from paper white to 100% black, are then entered into the Linearization tab of the Curve Creator. Press the “Show Curve” button and the file will be saved and the final curve shown.

b. Making Partitioned Profiles for Matte Paper

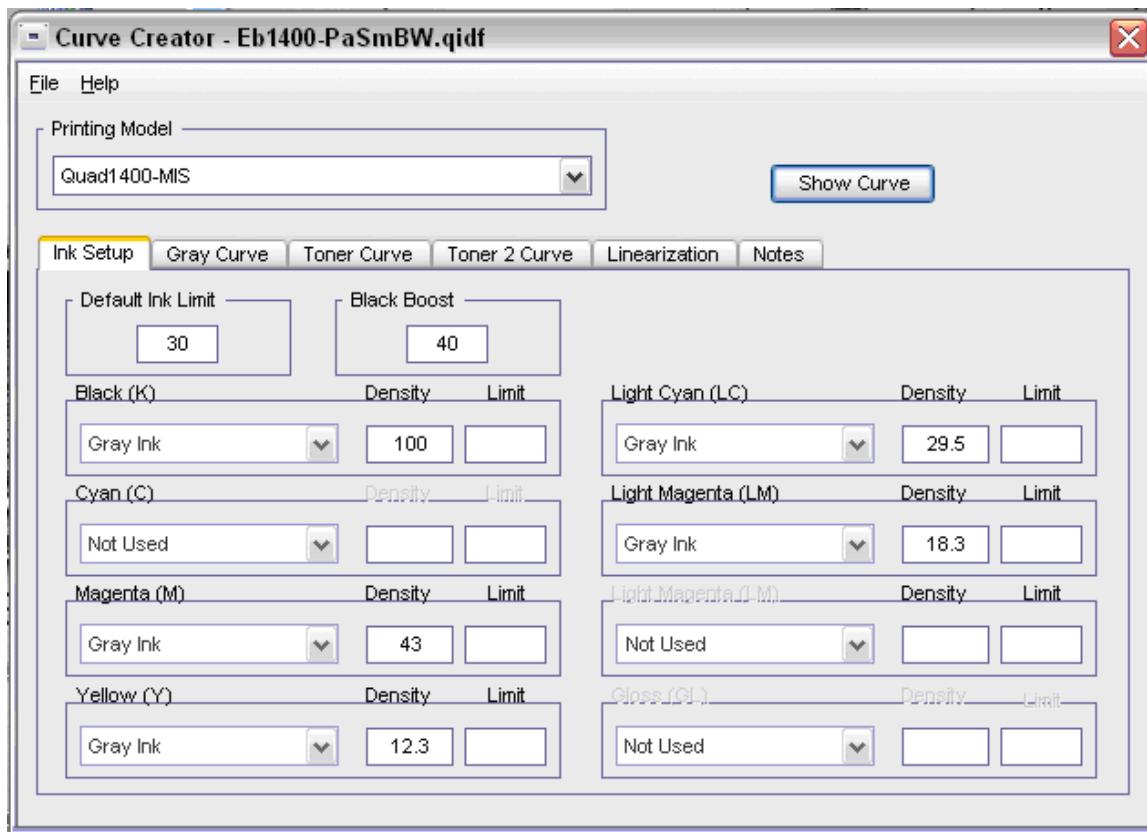
For 100% carbon pigment prints on matte paper, all of the ink positions are used except the Cyan (PKN) to make the smoothest carbon print. Additionally, an Eboni black-only (“BO”) curve can be made using the procedures outlined above. Finally, a neutral-cool profile can be made using the Cyan-PKN ink in combination with the Eboni MK. These profiles can be blended with QTR sliders to make intermediate tones and split tones.

Where multiple inks are used, they are “partitioned” such that only the lightest inks are used to print the lightest image values. QTR includes a system to do this based on the relative print densities of the inks. To use this system, the black ink and the midtone inks that are to be partitioned are labeled as “Gray” inks. The ink limits must be determined and then the relative densities found.

(1) Ink Limits

For this, a Calibration Mode print is made (Tools>Options>Calibration mode). The “Ink Calibration” slider should be at 100. I use 2880 Uni-directional for the quality settings. Once the print is thoroughly dry, measure the Eboni MK steps to see which one is darkest. That determines where the dmax is reached. One can use this number or, if there is a relatively low final slope, one might use 10% less as the ink limit and set the “Black Boost” to the patch number that resulted in the maximum density. For example, in the Curve Creator shown below the densities increased only slightly from the 30% to 40% patch. So, 30 was set as the ink limit for the black ink. This often results in a straighter initial curve.

²⁶ See http://www.paulroark.com/BW-Info/Making_B-W_ICCs-GrayCard.pdf for how to use a flatbed scanner to linearize QTR.



For the midtone inks, the ink limits are a judgment call. Inspect each one carefully to see where artifacts start to appear. Too much ink will bleed and can cause microbanding. In general, I try to keep the midtone ink limits low enough that the inks are still well separated and not into the final, relatively flat parts of their curves. With a printer like the 1400, heavy use of the midtone inks is not needed for smoothness. It often works well to simply use the K ink limit or dmax point as the midtone ink limit. That is, just set that as the default ink limit and leave the midtone ink limit boxes blank.

(2) Densities

Densities entered in the Curve Creator are the midtone ink densities at their ink limits relative to the black ink densities when the black ink is printed at its ink limit with a straight line curve. The black ink density is always 100. To find the black ink densities print a 21-step test strip with the black ink at its ink limit (not the Black Boost amount, if any), using a straight line curve/profile. A second Calibration Mode print can be made with it's slider at the black ink limit, but a faster method is to simply print a 21-step test file with, for example, a K-0-30 curve if the black ink limit was 30.²⁷

²⁷ See D.1.a.(1), page 6, above for how to make these straight line curves.

Another reason to use an ink limit that is less than the ultimate dmax is that it spreads the values of this K test strip better, making it easier to more accurately determine the relative midtone densities.

Measure the black test strip and mark the densities next to the test patches. I also write down the change in density per unit. That is, find the difference between the adjacent patches and divide it by 5. This helps determine the relative densities when the value being compared is not exactly the same as one of the 21 patches – which is normally the case.

Measure the densities of the midtone inks at the limits selected for them. These densities are compared to the K densities. The number entered in the Curve Creator is the K test strip patch number or, usually, a number between patches that is derived by estimating what K percentage would have resulted in the density that matched the midtone ink's density at its ink limit. For example, in the sample above the LC ink at default ink limit 30 was just slightly below the K density at its 30% patch. So, "29.5" was entered as the density number for the LC ink.²⁸

When all the relative densities have been filled in, and the profile is saved with an appropriate name (inkset and paper indicated in the name), the partitioned curves can be seen by clicking on the "Show Curve" button on the Curve Creator.

(3) Linearizing

The final step in this profile building is to linearize the initial curves set. To do this a 21-step test file is printed with the profile, and the Lab L values from this test strip are entered into the Curve Creator's Linearization tab boxes. With the numbers and methods in the sample, above, the pre-linearized 21-step test strip was already quite straight and smooth. A relatively smooth initial curve usually results in a smoother final curve.

Note that I use a ColorVision/DataColor Print Fix Pro spectro to read test strips. It outputs a text file that I can simply copy and paste into QTR's linearization tab. I usually open the text file with Excel so that I can graph (Insert>Chart>Line) the results to see if the profile curve is relatively smooth. A sharp bend in the graph often means the linearization will not be very good. Also, ample deep shadow information (i.e., compressed shadows) helps the program result in a smooth final curve. The shadows are often where most difficulties exist; actual information down there, as opposed to interpolation, helps.

²⁸ I have not measured the accuracy that QTR requires in these relative density calculations. The system appears to be rather tolerant of estimates. I suspect 2-digit accuracy is sufficient.

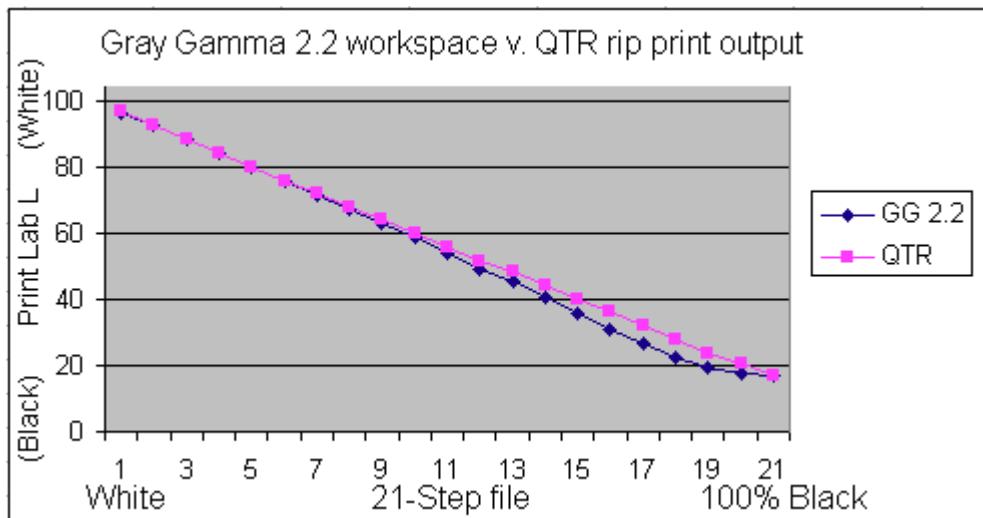
2. Printing with QTR – Windows

I use exclusively Windows computers. Macs can print directly from Photoshop, whereas with Windows QTR acts as an independent printer utility.

a. Matching the Monitor and Print

QTR is not, in and of itself, “color managed.” That is, it does not automatically adjust the output to match the working space or embedded profile of the image file such that the relative densities displayed on the monitor will be reflected in the print.²⁹ QTR prints with a straight-line response or characteristic curve. None of the common working color spaces use this density distribution. I usually save a Tiff file to the desktop that has the print size and other final printing adjustments to it. QTR prints only grayscale Tiff files. Files are flattened, profiles ignored, and 16 bit files are converted to 8 bit for printing.

As discussed earlier, the most common gray working space is Gray Gamma 2.2. The graph below shows the difference in relative densities between how a Gray Gamma 2.2 (“GG 2.2”) file will look on the monitor and print with a color managed system, versus how it will print with QTR.



If a file is edited in Gray Gamma 2.2 it will not result in a print from QTR that looks like the monitor. Because the GG2.2 shadows are compressed and QTR shadows are linear, a GG2.2 file will appear lighter and perhaps lacking in good blacks when printed with QTR.

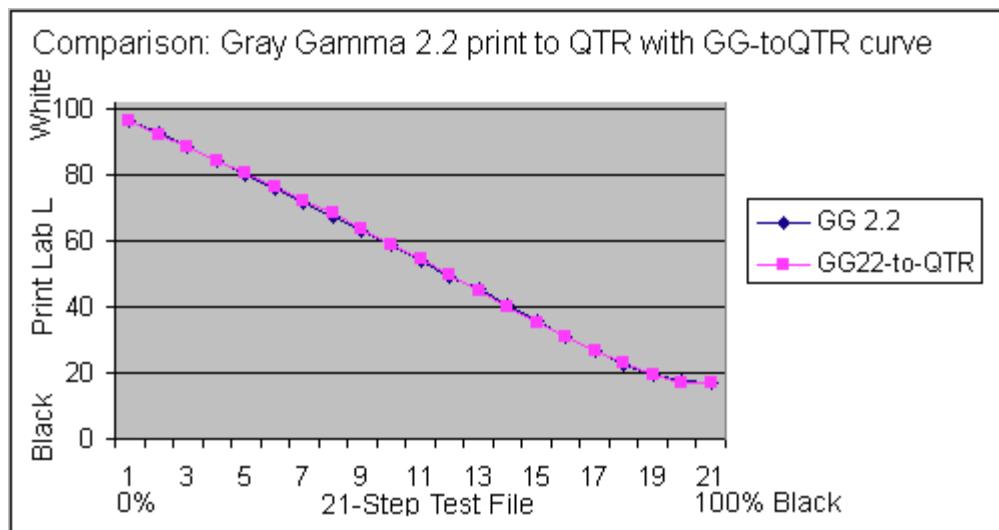
There are two basic approaches to matching the monitor’s display and QTR print. First, if QTR printing is the primary objective one has in editing a file, it may make sense to edit the file in a manner that it will print with QTR and look like it did on

²⁹ Mac users can insert matte or glossy QTR ICCs in the PS Print Preview to get the advantages of color management with QTR. Windows does not support this type of printing.

the monitor with no further conversions or modifications to the file. The QTR download includes ICCs that can be used for this purpose. These are located in the /QuadToneRip/ICC folder. There is also a Readme file in the /QTR/ICC folder that explains the use of the ICCs. When I was editing only for printing with a rip like QTR, I used the soft-proofing approach (View>Proof Setup>Custom). I no longer use these approaches.

Second, if QTR printing is just one of several expected uses of the file, it might make sense to edit the file using the, de facto, standard working space – Gray Gamma 2.2 – and then adjust a copy of the file as needed to print with QTR only when ready to print. One method of doing this is to convert the file (Edit>Convert to)³⁰ to the Gray Matte or Gray Photo spaces, for matte or glossy papers, respectively, with the QTR ICCs.

Alternatively, one can apply a Photoshop image adjustment curve that makes this conversion. This is what I do. The graph below compares the matte paper print densities (Lab L, technically) resulting from, first, a color-managed workflow where the file used the Gray Gamma 2.2 working space and the printer was color managed with a custom ICC with, second, a QTR workflow where the “GG22-to-QTR.avc” curve was applied to the file before printing with QTR. They are virtually identical. In short, the GG22-to-QTR curve replicates the Gray Gamma 2.2 output characteristics for matte papers, allowing one to edit in that standard working space and match the output to the monitor when QTR is used to print the file.



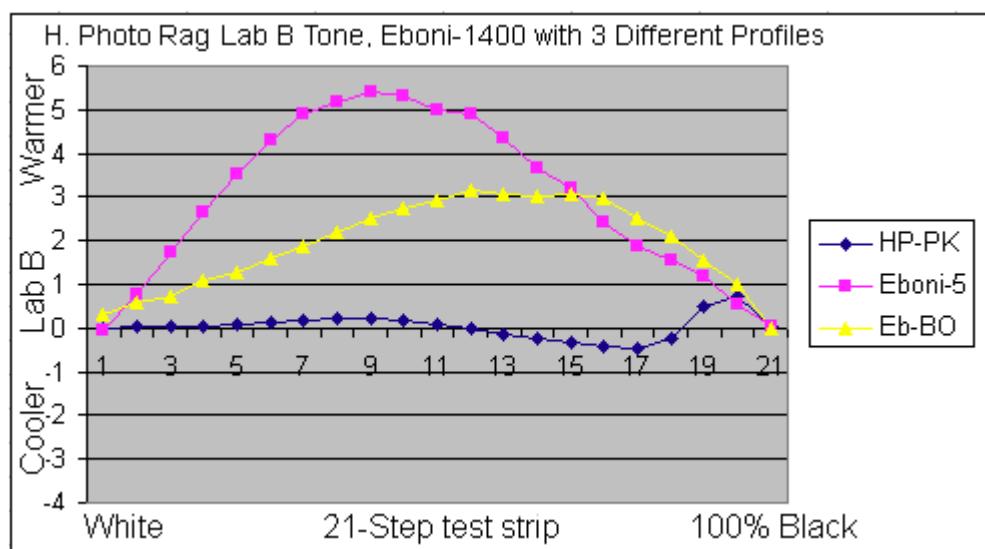
The “GG22-to-QTR.avc” curve can be downloaded along with various other relevant curves and profiles at <http://www.paulroark.com/BW-Info/Eb-1400-Profiles.zip>

³⁰ Use Perceptual and Black Point Compensation. Note that the dmax might be slightly affected.

Note that as good as color management is, variations in display lighting cannot all be accounted for. One advantage to using a PS image adjustment curve, which can be on a layer, is that the user can modify it to also account for individual lighting variables.

E. Print Tones

The print tones produced by the Eboni-1400 inkset range from neutral-cool when the PKN is used to warm when the dilute carbon inks are used.



Neutral prints are easily made with blended carbon-color inks like the HP-PK. As shown in the graph above, dilute Eboni carbon inks print more warmly, with concentrated carbon black-only in between. When only 100% carbon pigments are used the tones can range from near neutral-warm to warm depending on the paper and profile used.

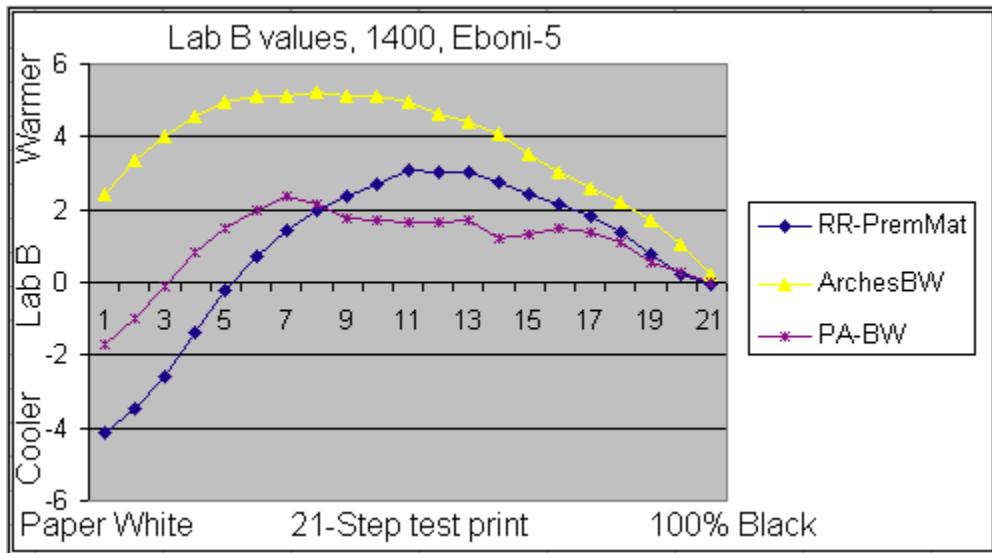
In general, the maximum Lab B value (yellow-blue axis) indicates the warmth of the print.³¹ The higher the Lab B value, the warmer the print will appear. The difference between the paper tone and the maximum midtone Lab B also affects the sense of warmth, as the eye tends to do an automatic white balance on the paper white or other white reference (like the mat board). Lab B values always rise from the paper white when 100% carbon is used. The maximum Lab B values with 100% carbon have ranged from about 2 to 6 with matte papers.³²

³¹ Lab A (red-green axis) also affects tone, but it is essentially set by the paper and remains relatively constant. A slightly positive Lab A (red/magenta) is generally preferred to avoid the print taking on a green tint; thus all of the papers show this characteristic to some extent.

³² Note that drop size affects carbon print tone. Larger drops produce more neutral prints, particularly on coated inkjet papers. With the old 7500 and Premier Art Smooth BW, the Eboni-6 Lab B rises from about negative 2 to 0.

With the 1400, the lowest Lab B change when the dilute Eboni inks are used is with Arches watercolor paper (2.8 units),³³ while the most neutral appearing 100% carbon print maybe on Premier Art Smooth Bright White³⁴ due to its brightened (cool) paper. There the Lab B range is approximately -2 to +2.

The choice of paper makes a significant difference in print tones with dilute Eboni inks. The graph below shows the tones for Red River Premium Matte, Arches (uncoated) watercolor paper, and Premier Art Smooth BW.



Other papers that print with relatively neutral print tones include Hawk Mountain's Condor BW, Moab Entrada BW, and Brightcube Eclipse. None are quite as neutral as the Premier Art Smooth BW, however.

Note that a mat board like Light Impressions Exeter "Gallery White" has a Lab B = 3. When displayed in these over-mats with no paper-white margin showing, the eye, in effect, uses the mat board as a white reference. When matted in this manner, the Premier Art Smooth BW will look quite neutral, with relatively cool highlights that appear to be brighter than the mat. This tends to pull the eye into the picture.

Many photographers believe that a split tone between the paper white, warmer midtone values, and then cooler shadows gives the image not only a pleasant warmth but also a sense of higher dynamic range. This is because the tonal (Lab B) differences as well as the luminance values may help to separate the image elements. Cooler shadows look blacker, particularly in warm indoor lighting. That was one of the secrets of the selenium toned silver prints. On the other hand, the eye sees cooler highlights as brighter even if they are not brighter according to spectro readings. This is one reason why most popular papers use

³³ On the 7500, this range is 2.6.

³⁴ See http://www.premierimagingproducts.com/pm_smoothbwfineart.php

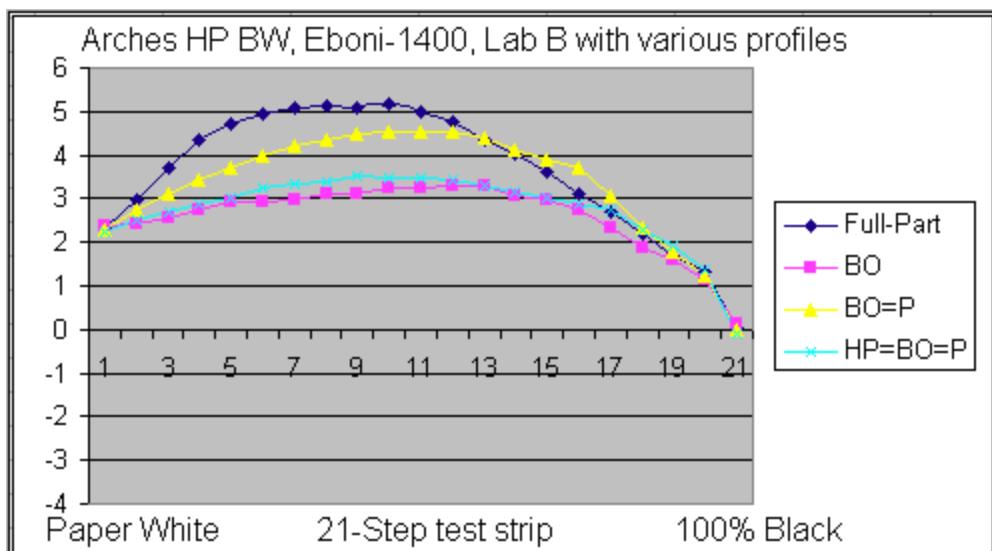
optical brighteners, which give the paper a slightly blue cast. Silver prints also used optical brighteners.

I have tended to use cooler papers with lower split tones like Premier Art Smooth Bright White for landscapes where there are clouds or snow, and use the warmer papers with more split tone for southwestern scenes. Many also prefer warm tones for images of people.

Arches Watercolor Paper

Most recently I've been exploring the use of Arches Hot Press Bright White (no optical brighteners) uncoated watercolor paper due to its excellent reputation in the painting field. Some conservators believe any coated substrate will separate with time due to differential expansion from temperature and humidity changes. In the old photo digital restoration work I've done the very old photos typically have cracked surfaces. Not only does Arches paper avoid coating the cracking issue, but it also can be washed to eliminate the non-image forming ink substances and loose carbon pigments. This results in what may be the most durable inkjet print I've experienced.

Below are the Lab B distributions for several profiles that this inkset allows on Arches HP BW. The fully-partitioned 100% carbon profile ("Full-Part") is the warmest and smoothest. The black-only profile ("BO") is more neutral; it is also rougher than many will like. Where the black-only profile is combined with the partitioned profile, in equal amounts, ("BO=P") one gets a 100% carbon print that is reasonably smooth. If HP-PK is used as the only midtone ink in a profile, the resulting tone curve (not shown) is flat. Of more interest, due to its higher use of carbon and more pleasing tone, is a print that combines three profiles – HP-PK, BO, and fully-partitioned – in equal amounts. The resulting print is quite neutral (relative to the natural paper) with much better smoothness than if just the BO profile is used.

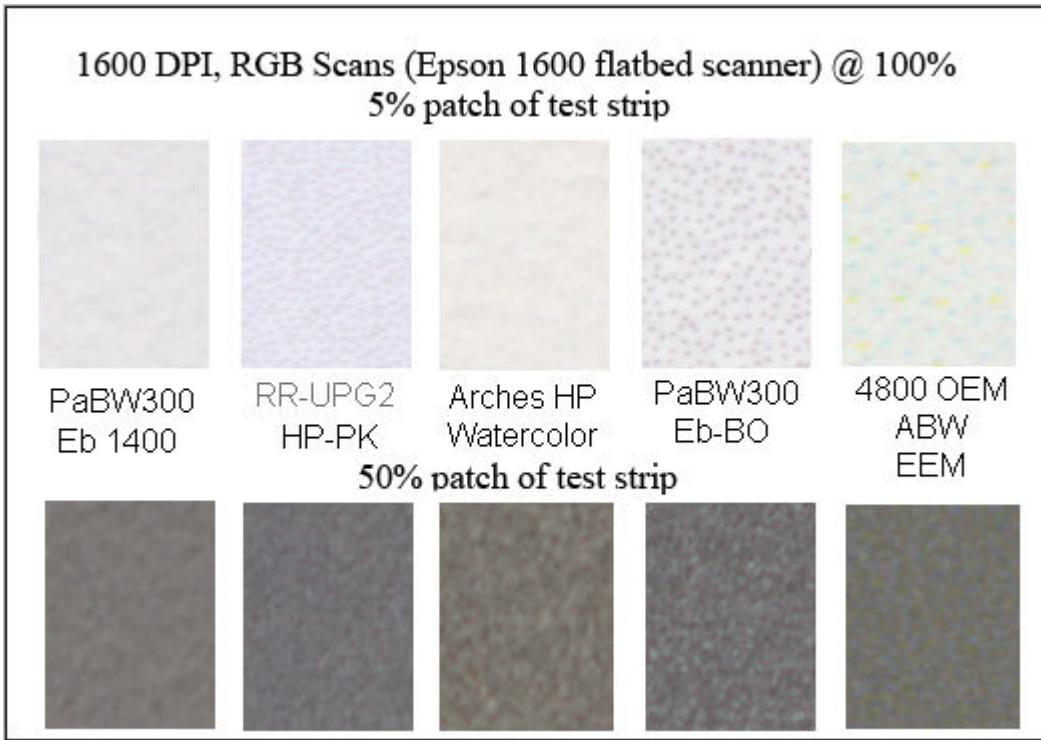


While the midtone smoothness of prints on Arches watercolor paper cannot equal the coated inkjet papers where partitioned, dilute inks are used, I suspect most will find it very satisfactory for 11 x 14 inch prints, making this paper an interesting alternative.

F. Image Structure

The image below shows small sections of prints scanned at 1600 dpi on an Epson flatbed scanner. The scans give an objective comparison of print smoothness. The papers used were the Premier Art Smooth Bright White 300 gsm (PaBW300), Red River UltraPro Glossy 2.0 (RR-UPG2), Arches HP BW watercolor paper, and Epson Enhanced Matte (EEM).³⁵

³⁵ With the Eboni-1400 inkset there are no color dots, unlike the Epson 4800 "Advanced B&W" mode print. The HP-PK ink is neutral black, but the Red River UltraPro Glossy 2.0 paper is quite cool (bluish), and it shows in this scan. The Premier Art and Arches prints are with 100% carbon. The PaSmBW print on the left used the dilute inks, whereas the one to the right was Black-Only (Eb-BO).



The test patches shown above are, on the print, only 1.75 mm high. So, to get a better idea of smoothness, adjust your viewing distance from the monitor. On my monitor the images are 35 mm high. So, if the normal print viewing distance is 14" (as stated by Kodak), I'd have to view my monitor from a bit more than 23 feet away to adjust for the magnification shown here.

G. Final Thoughts

The Epson 1400 is a very affordable 13" printer that can support a range of different inksets and workflows, particularly when QTR is used to control the inks.

A 100% carbon pigment printing workflow probably makes the most stable inkjet images possible with today's technology. The addition of the HP-PK, however, allows not only quite good glossy printing but also probably the most stable prints possible for the tones that are more neutral than 100% carbon can reach.

Enjoy the journey.

Paul
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