

# Noritsu-based B&W Inkset

## Variable-Tone

### Epson 4000 Printer (Among others)

[www.PaulRoark.com](http://www.PaulRoark.com)

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This PDF describes an inkset, workflows and profiles for using the Epson-Noritsu advanced dyes to make a black and white inkset for printing with the wide format Epson Stylus Pro 4000 printer. The approach should work in many similar printers.<sup>1</sup>

The general inkset design and workflows build on those of the variable-tone inksets I have designed over the years.<sup>2</sup> I have used Claria and Noritsu dyes in various formats as well as in conjunction with Eboni-6 carbon pigments in the Epson 1400 for several years with excellent reliability and success.<sup>3</sup>

The Epson-Noritsu advanced dyes are similar to the Claria dyes that Epson sells for its desktop printers.<sup>4</sup> Noritsu sells the Epson dyes to the “dry lab” market that uses the latest Noritsu mini-lab printers. The supply chain for this commercial photo printing market appears to be a good source of dyes in bulk. The cost of ink on a per-milliliter basis is about 1/3 the cost of Claria carts. The Noritsu ink prices are generally consistent with Epson’s large format pricing structure on a per-volume basis.

When modified to be a B&W inkset, these dyes are capable of making visually stunning B&W high gloss images that do not have the artifacts, including bronzing, that have limited the quality of glossy printing with popular pigment inksets. Not being on the surface, dyes do not rub off the way pigments do. Dyes do not have particles and binders to clog, nor do they settle.

While these dye-based prints are not as lightfast or archival as 100% carbon prints, for most uses they are stable enough – better than some third party pigments. Wilhelm-Research rates Claria color prints as having a display life, under glass, of 98 years, and over 200 years in dark storage.<sup>5</sup> Aardenburg Imaging and Archives<sup>6</sup> has tested color Claria as well as black-only Claria. Of particular note is the black-only Claria that was treated with a protective spray. Its

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<sup>1</sup> The best 13” printer for B&W Claria-Noritsu printing is the 1400 (or 1430 now). See <http://www.paulroark.com/BW-Info/1400-Claria-Noritsu-2K2LK.pdf> ; The 1400 setup is much easier and the primary recommended approach if wide format is not needed.

<sup>2</sup> The inkset is a direct second generation of the B&W dye inkset I demonstrated for the Epson 220. See <http://www.paulroark.com/BW-Info/N-BW-VT-1-220.pdf>

<sup>3</sup> See, e.g., <http://www.paulroark.com/BW-Info/Eboni-4-Plus.pdf> , <http://www.paulroark.com/BW-Info/BW-Dye.pdf> , <http://www.paulroark.com/BW-Info/1400-Claria-Noritsu-2K2LK.pdf>

<sup>4</sup> Lab A and B measures of the Claria and Noritsu black inks suggests they are identical. See <http://www.paulroark.com/BW-Info/Noritsu-Claria-BO-Lab.jpg> .

<sup>5</sup> See <http://www.wilhelm-research.com/>

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

performance was similar to what one would expect from Epson's color UltraChrome pigment inkset, with a Conservation Display Rating many times that of the un-treated Claria color print.<sup>7</sup>

"Carbon on cotton" (100% carbon pigments on cotton-based paper) will remain the top, collectible medium. However, prints based on these advanced dyes allow for outstanding high gloss cards and display prints. At the same time it is a medium that is clearly distinguishable from the high end, museum quality, collectible carbon on cotton prints.

**The ink arrangement for the "NVT" inkset** is as follows:

K (NK) = Noritsu K<sup>8</sup>

C (NVT-C) = 33.3% Noritsu K + 66.7% dilution base<sup>9</sup> (1:2 mix ratio)

LC (NVT-LC) = 33.3% NVT-C (1 part NVT-C to 2 parts dilution base)

M (NVT-M) = 33.3% (25% Noritsu Magenta + 75% Noritsu K [1:3 mix ratio])  
+ 66.7% dilution base (1:2 mix ratio)

LM (NVT-LM) = 33.3% NVT-M + 66.7% dilution base (1:2 mix ratio)

Y = Noritsu Yellow<sup>10</sup>

LK = 50% NVT-C + 50% NVT-M (1:1 mix ratio).

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<sup>7</sup> See <http://www.aardenburg-imaging.com/cgi-bin/mrk/4899c2hvd19kb2NfbGlzdC80>; The data can be arranged by column in ascending or descending order to see better how the coated Claria black only compares to UltraChrome.

<sup>8</sup> Dry lab photo finishing suppliers are numerous. This is a partial list of Noritsu suppliers.

<http://www.imagingspectrum.com/noritsu-d703-digital-dry-photo-printer-d703.html> (TX);

<http://serranorey.com/222-noritsu-dry-supplies.html> (FL);

[http://www.desktopdarkroom.com/noritsu\\_d701\\_ink.html](http://www.desktopdarkroom.com/noritsu_d701_ink.html) (FL);

<http://www.sgaimaging.com/catalog/printers-scanners/noritsu-compact-inkjet-printers> (GA & FL);

<http://www.southpointphoto.com/productcart/pc/viewPrd.asp?idcategory=115&idproduct=1064> (TX & TN);

<http://www.fotoclubinc.com/Departments/Printer-Media/Noritsu-Media/Noritsu-D701D703D1005-Inks.aspx> (Santa Fe Springs, CA); <http://www.pfsny.com/M/Noritsu/Noritsu-Dry-Lab/Noritsu-D703.html> (NY). If

purchasing on eBay and the price is less than \$187, check the expiration date.

<sup>9</sup> MIS sells the clear base pre-mixed at <http://www.inksupply.com/product-details.cfm?pn=PR-CLEARBASE-PT>.

The clear dilution base formula, by weight, is as follows:

- 10% glycerol,
- 10% Kodak Photo Flo,
- 10% Dow Butoxytriglycol,
- 1% Edwal LFN,
- 69% distilled water.

If mixed by volume, reduce the glycerol to 8%; the other ingredients are close enough to leave as is by volume or weight.

Dow Butoxytriglycol™ is \$50/quart from Chemical Marketing Concepts [Dow] at 860-354-2278

(See [http://www.dow.com/products/product\\_detail.page?display-mode=tds&product=1123830&application=1120800](http://www.dow.com/products/product_detail.page?display-mode=tds&product=1123830&application=1120800) for

technical information on the Dow Triethylene Glycol Monobutyl Ether [aka Cas # 143-22-6]; see also page 17 of

[http://www.dow.com/PublishedLiterature/dh\\_0032/0901b80380032bc8.pdf?filepath=oxy-solvents/pdfs/noreg/110-00965.pdf&fromPage=GetDoc](http://www.dow.com/PublishedLiterature/dh_0032/0901b80380032bc8.pdf?filepath=oxy-solvents/pdfs/noreg/110-00965.pdf&fromPage=GetDoc)) See

<http://www.paulroark.com/BW-Info/Noritsu-MSDSH086075-00-01-NA-E.pdf> for a copy of the Noritsu black ink MSDS.

<sup>10</sup> It may be that where the yellow is used *only* for offsetting OBAs, a weaker yellow dye would be preferable in that it would more closely match the OBA fade rate. More testing is needed here.

The ink mixing ratios of 1:1, 1:2 and 1:3 allow very easy mixing with syringes. Scales are not needed. Even the base, if mixed to make a 1000 ml pitcher full, is easily done without any scales; the small 1% Edwal LFN amount is simply a 10 ml syringe full.

The Noritsu K has a greenish tint. As such, toning with magenta is all that is needed to make neutral prints, although the yellow is also useful. Different papers need different amounts of toning. This inkset is designed so that most glossy papers print well with equal amounts of the cyan and magenta channels being used. Matte papers, however, require more magenta toning to print well. Additionally, most matte papers also have a weak dmax. The popular Hahnemuhle Photo Rag has an excellent dmax and needs twice as much magenta in the blend, relative to the average glossy paper, to look neutral. Photo Rag, when printed with these dyes, has the best dmax I've ever measured with matte papers.<sup>11</sup> The matte paper that may be the best combination of excellent dmax, low magenta toning requirement, and price is Red River Premium Matte.<sup>12</sup>

All papers tested that have a good dmax are within profiling range of this inkset from neutral to very warm, and otherwise within traditional B&W print tones.<sup>13</sup>

## Printing Workflows

Both the Epson driver and QuadToneRip ("QTR")<sup>14</sup> can be used to print this inkset. In general, for glossy papers I print through the Epson driver. With matte papers I only use QTR; matte papers tend to achieve a significantly higher dmax when the black ink can be controlled directly, as it can with QTR. On the other hand, where I want to print down brightened borders of glossy papers in a one-pass workflow, the Epson driver is required, and it does a very good job with glossy papers. Profiles for Hahnemuhle Photo Rag and Red River Premium Matte Plus are provided in the Zip file, noted below.<sup>15</sup> Most glossy papers are very easily profiled with QTR's Create ICC-RGB for use with the Epson driver. The Epson driver workflow for glossy papers is outlined below.

## Epson Print Driver and Photoshop Settings

For glossy paper, I use Premium Glossy photo paper setting at the highest quality level, with "Color/B&W Photo" selected, and "No Color Adjustment" set.

When a Photoshop image adjustment curve is used either in a profile or for making an ICC, Adobe RGB is the profile loaded in the Photoshop print dialog box. My Photoshop relevant workspaces (Edit>Color Settings) are set to Gray Space Gray Gamma 2.2 and Adobe RGB (1998), which uses gamma 2.2.

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<sup>11</sup> A fully "cured" Photo Rag test strip made with an Epson C88 had a dmax of 2.05. Most "fresh" test strips with the 4000 and Photo Rag are in the high 1.8 range.

<sup>12</sup> See <http://www.redrivercatalog.com/>. Epson Ultra Premium Presentation Matte paper, typical of many matte papers, prints with a low dmax.

<sup>13</sup> The black ink has a cyan-green bias. That establishes the cyan-green limits on the inkset.

<sup>14</sup> See <http://www.quadtonerip.com/html/QTRoverview.html>

<sup>15</sup> Profiles are at <http://www.paulroark.com/BW-Info/4000-NVT-Profiles.zip>. For the 2 matte papers profiled manually-drawn QTR curves were needed to accurately profile the papers. These starting profiles may be the easiest way to profile other matte papers.

## Profiling Glossy Papers<sup>16</sup>

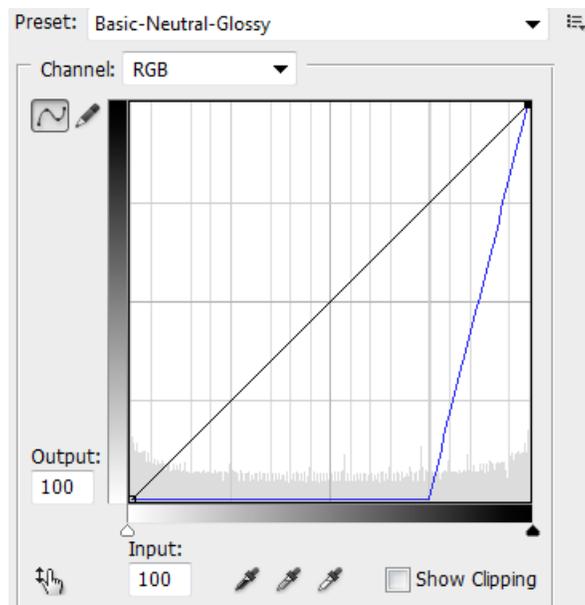
The inkset has been designed to work well with the Epson driver, and the Epson driver allows for a very easy ICC workflow.

Alternatively, I can also print with two profiles in the same image file if I simply use a Photoshop image adjustment curve for the profile. This dual profile approach and controlling OBAs are discussed further in a separate section, below.

### ICC Profiling

Profiling this inkset to make a relatively neutral B&W print using the Epson driver can be done rather easily with a Photoshop image adjustment curve linearized in an ICC with QTR's Create ICC-RGB.<sup>17</sup> Because there is yellow ink installed, a curve must be used that holds the yellow ink back until it is needed to turn on the black ink. Thus, the basic, simplified model for a neutral glossy print is that the Red and Green curves (Cyan and Magenta ink channels) are straight lines from 0 to 100. The Blue curve (yellow ink control) becomes the, de facto, black ink curve at the dark end of the graph, going from 75 on the horizontal axis to from 100 on the vertical axis. This basic straight-line curve for neutral glossy papers is in the Profiles Zip file.

Below is a screen grab of the simple straight-line model Photoshop curve.



<sup>16</sup> Profiles are at <http://www.paulroark.com/BW-Info/4000-NVT-Profiles.zip>

<sup>17</sup> Create ICC-RGB is part of the QTR download. The StepWedge-Tool is also very useful for linearization with a flatbed scanner if no spectrophotometer is available. See [http://www.paulroark.com/BW-Info/Embedding\\_Photoshop\\_Curves\\_in\\_ICCs.pdf](http://www.paulroark.com/BW-Info/Embedding_Photoshop_Curves_in_ICCs.pdf) for a brief description of how to embed Photoshop curves in ICCs.

When a 21-step test print<sup>18</sup> was made with this curve on a typical paper, such as Red River's UltraPro Glossy or Epson Premium Luster, an ICC can be made with this test strip and curve, and turn out quite good.

Some papers reach their dmax prior to the Blue curve (de facto black curve at the dark end of the scale) reaching 100%. To test for this and set the end point of the Blue curve, print a 21-step test file with a curve that keeps the Red and Green curves at the top (C and M full on) and the Blue curve running from 0 to 100%.<sup>19</sup> Where that test strip hits the dmax tells you where the top end of the Blue curve (the de facto black curve) should be.

I have refined this straight-line curve so that the pre-linearized Lab L curve (gray ramp) more closely matches the ideal Gray Gamma 2.2 Lab L curve.<sup>20</sup> The better the input curve is, the better the resulting ICC is likely to be. This "Modified Starting R=G Glossy.avc" curve is in the Profiles Zip file and is the recommended starting place for profiling traditional glossy papers.

While many papers will print very well with this starting R=G curve, some will need the Lab A to be modified. That is, the image will be a bit too greenish or a bit too magenta. To fine tune the Lab A values, one can make offsetting moves of the red and green curves at the points where the values need adjusting. I have included curves for several Red River papers in the Profile Zip file.

The yellow ink is also in the mix for a reason. Frequently a little yellow ink in the image improves it. In addition to controlling the warmth (Lab B) of the print, a little yellow in the image seems to help with the slight metamerism the dye images exhibit under fluorescent lighting. As discussed below, there is also a potential for yellow to offset OBA blueness and fade.

### **Controlling OBA Brightness With Yellow Dye**

Optical Brightening Agents (OBAs) are put in most papers because they give the print the impression of a brighter white and thus more dynamic range. In high UV lighting, the fluorescing of the dyes might actually raise the brightness above 100% -- that is, the white is actually brighter than a perfectly white paper. In indoor lighting the UV content is lower than outside, but the effect is still visually pleasing in many situations. In fact, what is usually happening with OBAs is that they are making the paper bluer, but we interpret this as brighter.

While brightened paper is the most popular (even typing paper is brightened), it has a few negative attributes. Most well-known is that the OBAs are dyes that fade rather quickly. The paper then goes to the color of a natural paper; it yellows a bit. This is not all that bad, but it will have the effect of the print warming up, and in addition to a visual change in the print, some

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<sup>18</sup> A Jpeg version of the 21-step test file I use with the DataColor Spyder3 Print spectro is at <http://www.paulroark.com/BW-Info/21-Step.jpg> (save it as a Tiff).

<sup>19</sup> Curve "Dmax-Test-Curve-CM100-Y-Blue-0-100.acv" in the Zip file. Apply this only to the test patches by selecting just the test file patches. The numbers below the test patches are hard to see if they are affected by the curve.

<sup>20</sup> See <http://www.paulroark.com/BW-Info/Manual-Linearization.pdf> for details on how I go about making a more perfect PS image adjustment curve to be used directly as a profile.

might see this as a sign that cheap, acidic paper was use, even though the paper may be very good, acid-free paper.

Additionally, OBAs make the paper so much brighter than the typical mat board that the eye is drawn to that difference when a paper border is displayed around the image. Such a border is typically where the image is signed by the photographer.

Yellow dye has the potential to ameliorate both of these problems. If the fade rates of the OBA and yellow dyes match, the yellow dye can largely eliminate the appearance that the paper and print are warming.<sup>21</sup>

My immediate goal is simply to replicate a mat board look on the paper. The image below illustrates, with some exaggeration of the yellow, what I am doing.



The glossy image, protected by a spray, can be displayed un-glazed with no mat board. This allows the full dynamic range of the image to be accessible to viewers, and the materials are much more resistant to physical damage than matte prints and mat board.

More experience is needed to know what the value of this B&W printing approach is, but initial display prints have sold better in competition with color paintings than any other approach I've tried. If nothing else, it is an interesting alternative to the carbon on cotton.

Enjoy.

Paul  
[www.PaulRoark.com](http://www.PaulRoark.com)

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<sup>21</sup> See the <http://aardenburg-imaging.com/> fade test results for Epson Claria on Epson Premium Photo Paper Glossy, Sample # Aa1\_20080619\_SN006. At 100 Mlux-hours of exposure the I\* Color for the paper base and the yellow dye were both 83. The Lab B values were going in opposite directions. At the "neutral 8" test patch (Lab L about 75) the I\* Color rating was 100.0. The yellow fades faster than the other colors and offsets the paper yellowing.



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