

# QuadToneRIP 2.5 Calibration

## Quad Ink Descriptor File

Start with one of the existing printer and ink combinations in the Example-Inks folder. Duplicate the file and edit it to produce a complete quadtone curve set. This is a simple plain text file that has a very simple format. Lines beginning with # are just comments and are ignored. All the important lines are simply VARIABLE=value. The variables are all given, the only changes that you should make are the values. The lines should not have any spaces or special characters. Many of the variables are self explanatory, but see the **GettingStarted** document for full information.

## The Ink Separation Test Page

The ink separation test page "inkseparation.psd" is a very special file. Printing it out and using it is different than all the normal printing you will do with QuadToneRIP. The idea with this test page is to be able to print all the inks separately in raw uncorrected steps. I.e. you will see what each ink is doing on a separate 21 step graduated wedge. The first thing you will notice upon opening the file is that it is a RGB file instead of a grayscale. It's very important that you **NOT color manage** this file when you open it or when you print it (Print Space must always be Same As Source). You also must not resample or resize it -- it's set at 360ppi and fits on an 8.5 x 11 sheet of paper. The colors of the file will look strange because the R channel is selecting which ink and the G channel is the data.

Printing it is simple but there are a few differences.

Photoshop CS2 Print with Preview:

**Color Handling = No Color Management**

Earlier versions:

**Print Space = Same As Source**

centered and filling the page is correct. Note that this one file handles 4, 6, 7 and 8 ink printers.

Under QuadTone RIP print dialog:

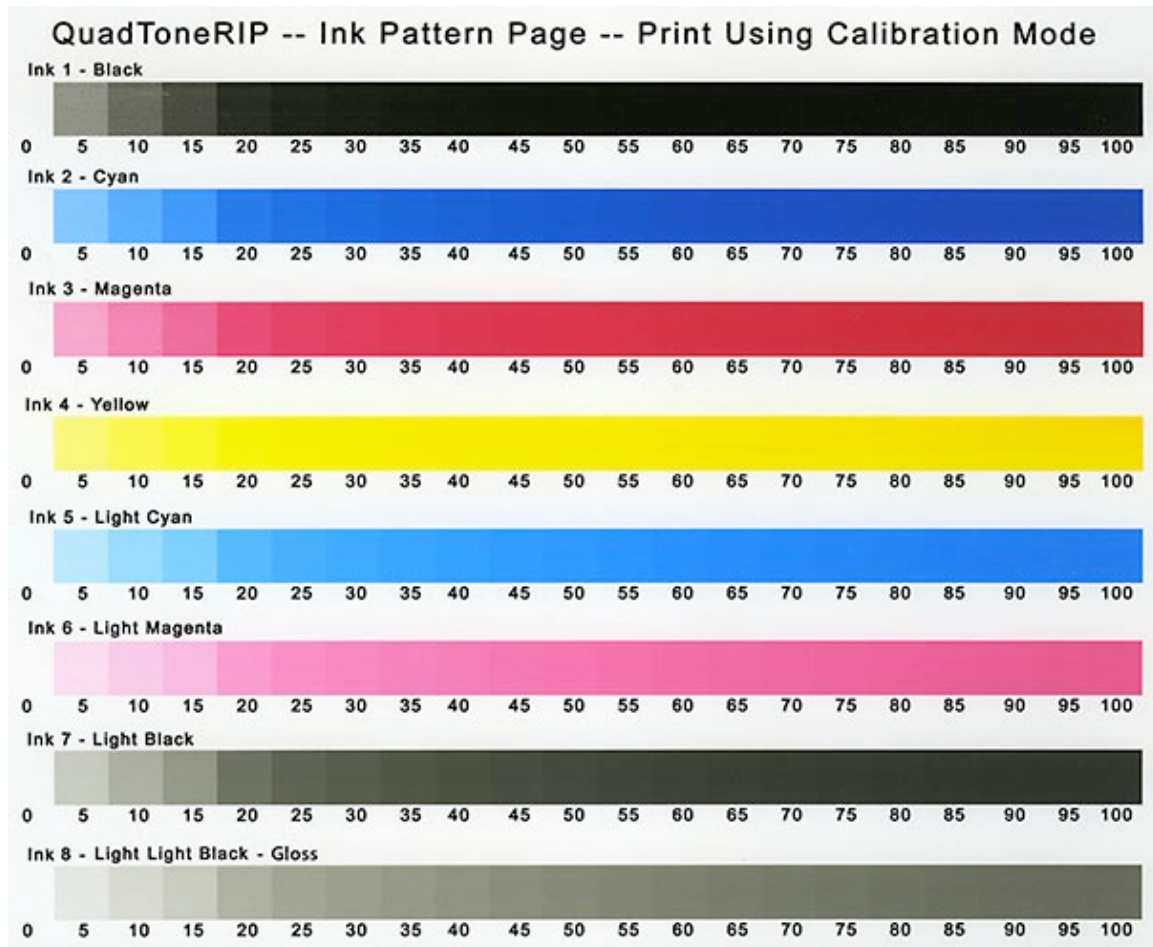
Mode must be **QuadToneRIP Calibration** \*\*\*\*\* very important and the only place you do this \*\*\*\*\*

This will bring up a special **Calibration Ink Limit** slider. Use this to set all of the inks at the same ink limit.

## Hardware Ink Limit Calibration

Here we figure out the overall hardware ink limit for the printer. This can be done visually by just seeing the test print and deciding where the inks seem to max out -- i.e. fill the patch. Start with a calibration ink limit = 100. Print out the Ink Separation page.

Below is an example of the ink test on an R2400 with UltraChrome K3 inks.

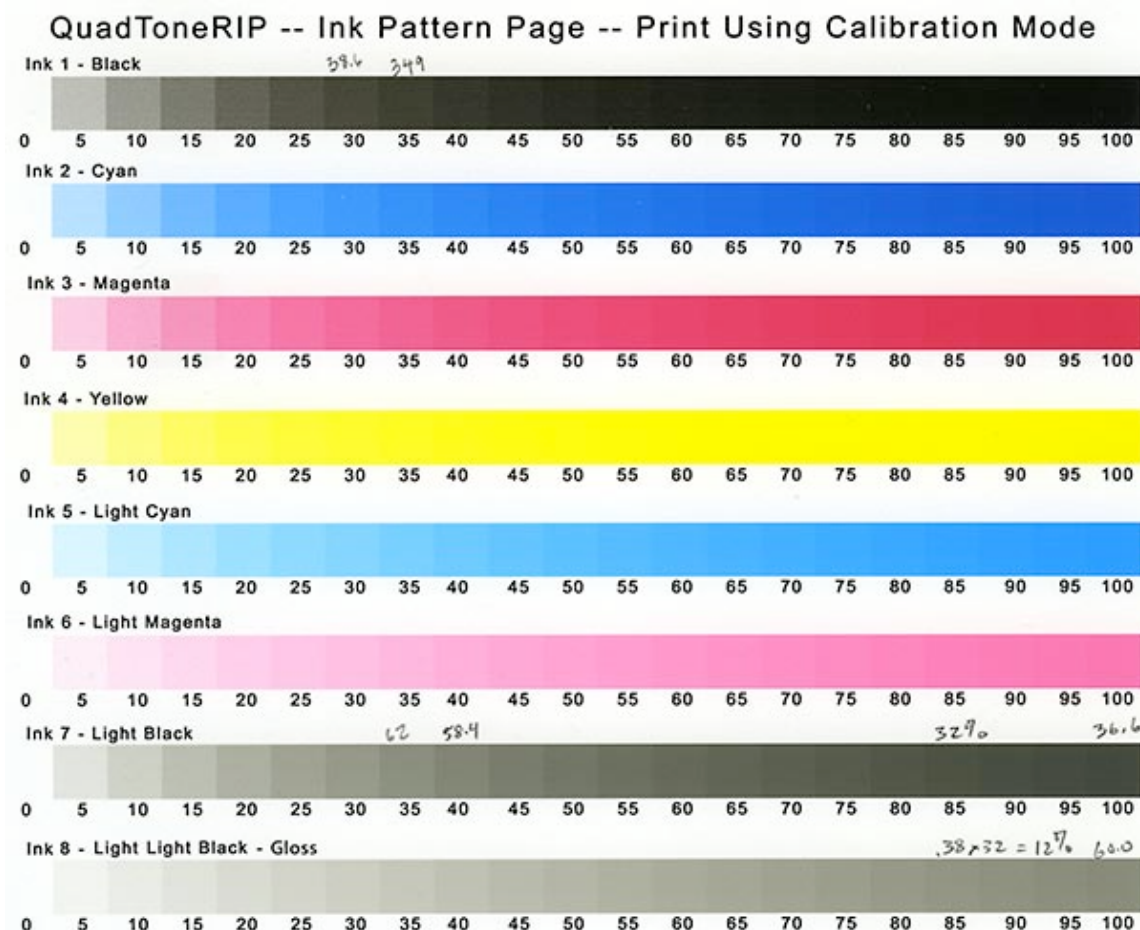


With a loupe you look for a patch where it appears that all the paper is covered with ink. In this particular case it is at about 50% on each ink. There is a very gradual increase in density after this level but when adding inks together we don't want to overload too much. For this example 50% picked for the basic ink limit.

The Epson printers seem to max out at different places. It's a very subjective judgment. You want to be able to get a decent dMax but not flood the paper with ink. Too much ink creates several problems. First is that the shadow separation becomes more difficult and surprisingly can also lead to a reduction in density. Certain combinations of ink type and paper actually show reduced density with overloading the quantity of ink. Most printers have some profiles already done and using the numbers there is a very reasonable starting point.

## Relative Ink Density Measurement

Here we measure the relative density of an ink in terms of the next darker ink. The nice thing about this is that the numbers are not important, you just have to match one patch with another one. You are also deciding the order of the grays to be used during this process. Here's the ink pattern page with the limited inks.



In this example we are looking at the three black or gray inks of Epson UltraChrome K3 ink. They are usually abbreviated black K, light-black LK and light-light-black LLK. I've written in some measurements expressed in  $L^*$  or Luminosity values to help show the procedure. The goal here is to partition the three inks, K, LK and LLK so they can be used optimally in the final prints. In order to make smooth transitions between them we need to find the relative densities of each ink. K being the darkest will be 100%, now we want to measure the relative density of LK ink. Match the density of the LK 100 step with one of the K steps. The LK 100 step measures  $L^* = 36.6$ , then look at the K steps to find a match. K 30 is  $L^* = 38.6$  and K 35 is  $L^* = 34.9$  so LK 100 falls between those two steps. What this means is that the LK ink is about 30 to 35% density of the K ink. In general you can probably just estimate the number -- the closest percent is just fine. In this case its almost right in the middle so 32 or 33% is good enough. The one thing that is confusing at first is that  $L^*$  values go the opposite direction of the step numbers. So when you are trying to find the matching value remember smaller steps yield higher  $L^*$  values.

If you are interested and mathematically inclined what you are doing above is called interpolating. To calculate the relative density use this formula:

$$\text{RelativeStep} = \text{StepLower} + 5 * (\text{ValueWanted} - \text{ValueLowerStep}) / (\text{ValueHigherStep} - \text{ValueLowerStep})$$

$$\text{RelativeStep} = 30 + 5 * (36.6 - 38.6) / (34.9 - 38.6)$$

$$\text{RelativeStep} = 30 + 5 * (-2.0) / (-3.7)$$

$$\text{RelativeStep} = 30 + 5 * 0.54$$

$$\text{RelativeStep} = 32.7$$

You can do this same procedure using a spectrophotometer like above, a simple densitometer or even just a flatbed scanner. The same formula works whether you use L\*, density values or scanned RGB/K values.

The next step is to get the relative density of the LLK using exactly the same procedure. Since the LLK will be transitioning to the LK ink in the profiles the comparison is most accurate by comparing the LLK ink to the LK ink not to the K ink. Take LLK 100 (L\* = 60.0) and match to the LK steps. Here LK 35 is L\* = 62.0 and LK 40 is L\* = 58.4 so LLK 100 falls between these steps. Estimating gives about 38%.

Now we have LK = 32.7% of K and LLK = 38% of LK. But it's necessary to have all the relative densities to a common value -- otherwise it would look like LLK = 38 is darker than LK = 32.7. Mathematically this is very simple, just a multiply:

$$\begin{aligned} &\text{LLK} = 38\% \text{ of } 32.7\% \text{ of } 100 \\ &\quad \text{is the same as} \\ &\text{LLK} = 38\% * 32.7\% = .38 * .327 = .124 = 12.4\% \end{aligned}$$

This example shows three inks but this technique can be used for any number of inks.

Now we get to enter these numbers in the curve descriptor file as follows:

N\_OF\_GRAY\_PARTS=4

GRAY\_INK\_1=K  
GRAY\_VAL\_1=100

GRAY\_INK\_2=LK  
GRAY\_VAL\_2=32.7

GRAY\_INK\_3=LLK  
GRAY\_VAL\_3=12.4

All other GRAY\_INK... values should be blank.

## Dot Gain Compensation Calibration

Note: There is now a **Linearization** Procedure that can greatly simplify fine tuning the curves to compensate for the dot gain issues. It requires a densitometer or the Eye-One Pro.

For most situations use GRAY\_HIGHLIGHT=6 and GRAY\_SHADOW=6 and GRAY\_GAMMA=1

Without compensation the densities rise way too fast and then level off, in fact if you look at the test pages from above this is quite obvious. The idea is to create a compensation curve to counteract this rapid initial rise and increase the slope in the dark area. A densitometer would certainly be convenient here but the compensation curve has been reduced to a few simple parameters. The first GRAY\_GAMMA is a simple gamma correction. Gamma is exactly the same as the middle number in the Photoshop Levels Command. 1 means no change and numbers greater than one make the image lighter. The recommended value is 1. GRAY\_HIGHLIGHT and GRAY\_SHADOW also make the image lighter but are more flexible since you can emphasize either end of the tonal scale. The starting values are 6 and 8.