QTR Curve Creation & Calibration Procedure for Piezotone inks James Haney v01

- **Overview**
  - This document represents my advice and collective wisdom over three years of creating my own QTR profiles for printing on Epson 7600, 2200 and 4800 printers using third party inks.
  - It does not describe a process for OEM inks or Gray inks plus toned inks.
  - It specifically applies to using QTR tools to create profiles for multi-component grayscale inksets. Piezotone, or custom mix grayscale
  - Why would you do this?
    - You believe that pure carbon inksets yield the best prints
    - You want some degree of tonal variation
    - You want the advantage of truly dotless hilights.
- **Start Here**
  - Read this entire document **TWICE** before doing anything!
    - Trust me on this - it will save you lots of wasted time, paper, ink and frustration if you are **VERY** clear on the process before you proceed
    - Items in **Bold RED** are values that you need to record and are used for calculations.
    - Values in **Bold Green** are values that are the result of calculations that will end up in the ink descriptor file.
    - Items in **Bold Black** are especially important to pay attention to. Basically they are things that have caused me problems in the past and I want to save you the agony.
    - Bear with me, sometimes I am intentionally redundant in the instructions. (i.e. reminding you to dry the print after each print and prior to reading values) because if they aren't in there, you might forget something that was only mentioned in the introduction. I know it happens to me far too often.
- **Step One**
  - Install QTR if you have not already done so
  - You have some homework to do - you absolutely **MUST** read the documentation in the QTR folders. I know, it is disorganized and confusing. It needs to be rewritten as it contains information that is so old that it doesn't even apply to most work flows, but You MUST read it.
    - Here is my recommendation: Read the QTR documentation **IN THIS ORDER**!
      - **Tutorial.pdf** (by Roy Harrington)
      - **User Guide.pdf** (by Tom Moore) This is designed for PC users, but contains valuable insight and overview that is very important to understand
      - **Calibration.pdf** (by Roy Harrington)
      - If you have an Eye-One spectrophotometer then read **Eye-One-ReadMe.pdf** (by Roy Harrington)
      - **Other QTR documentation**
        - **For the time being you can skip reading these files**
          - gray-readme - about using supplied gray profiles. In the process below, if you have an Eye-One, we are going to create our own custom profile
            - **GettingStarted** (by Roy Harrington)
          - ideal_density.pdf
          - ICC-ACV-Readme.rtf
      - Now, finish reading this document, it brings the content of the other documents into context relative to developing a set of curves.
- **Print Initial Calibration Print**
  - Open **inkseparation.psd**
    - Do not color manage document
  - **Print with Preview** with following settings
    - Print with preview dialog box
      - **No color management**
    - Print dialog box
      - **QTR Calibration Mode**
      - **ink density 100%**
  - Dry Print
    - **IMPORTANT**
      - When prints come out of the printer, the ink is still wet and does not represent the final density of the print on paper. This is highly variable based upon the inks, the paper, and the humidity in the environment.
      - Let print dry 3-4 hours or dry in microwave 20-30 seconds (With my microwave 20 seconds results in densities that equal the dry-down of an overnight drying cycle. However, 40 seconds equals brown burn spots on the print!)
- **Determine Maximum Ink Density**
  - Read the density values of the Black ink ramp
  - Find first occurrence of maximum black
    - **IMPORTANT:**
      - Don't favor a slightly higher value thinking that you want to get as much density as possible. here are ways to increase max density later. It is important that you choose the FIRST value that gives max density. Choosing too high a value will compress the separation of tones in the shadows, cause later linearization processes to fail and often create a very hard drop off to max black in the high 90% range. I once spent two weeks trying to wrestle my ink set into linearization by trying to use 50% as my black ink limit to try to get a to 1.7 max black density. It never worked. I settled for 40% at 1.66 density and was linearized within 2 hours. Live and learn.
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      - Let print dry 3-4 hours or dry in microwave 20-30 seconds (With my microwave 20 seconds results in densities that equal the dry-down of an overnight drying cycle. However, 40 seconds equals brown burn spots on the print!)
  - This carefully chosen value is your **Default Ink Limit percentage**
- **Print Ilmited Calibration Print**
  - Now print the **inkseparation.psd** file again
  - **Print with Preview** with following settings
    - Print with preview dialog box
      - **No color management**

- Print dialog box
  - **QTR Calibration Mode**
  - **ink density** set to **Default Ink Limit percentage**
  - **IMPORTANT:**
    - Let print dry 3-4 hours or dry in microwave 20-30 seconds

- **Determine partitioning**
  - Determine the number of inks and ink order for your needs and based upon the inks you use
    - Black is first = **Ink 1**
    - Next Darkest = **ink 2**
    - Next Darkest B = **ink 3**
    - Next Darkest C = **ink 4**
    - Etc.
  - Determine Max density of each ink using a densitometer or Eye-One spectrophotometer and write them down
    - Density of 100% patch of **ink 2** = **2 Max** (note which ink position this corresponds with i.e. 2 Max = 1.28 - Light Cyan position)
    - Density of 100% patch of **ink 3** = **3 Max** (note which ink position this corresponds with i.e. 2 Max = 0.80 - Magenta position)
    - Density of 100% patch of **ink 4** = **4 Max** (note which ink position this corresponds with i.e. 2 Max = 0.45 - Yellow position)
  - Determine intersection of curves
    - Find patch in **Black** that most closely equals **2 max**. We will call this the **2-K Overlap** (where second ink overlaps with K)
      if no patch exactly matches the density you can approximate by reading the two closest values, one higher, the other lower and either estimating or mathematically interpolating the value. You don't need to be exact.
      - **Example: Ink 2** has a **2 Max value** of 1.28. Find the patch in **ink 1** (black) that is closest to 1.28 and record the percentage value for this patch. for me 1.28 is usually in the 40% patch of black.
    - Find Percentage patch in ramp of **ink 2** that most closely matches **3 max.** We will call this the **3-2 Overlap** (where third ink overlaps with the second ink)
      if no patch exactly matches the density you can approximate by reading the two closest values, one higher, the other lower and either estimating or mathematically interpolating the value. You don't need to be exact.
    - Find Percentage patch in ramp of **ink 3** that most closely matches **4 max. We will call this the 4-3 Overlap (where fourth ink overlaps with third ink)**
      if no patch exactly matches the density you can approximate by reading the two closest values, one higher, the other lower and either estimating or mathematically interpolating the value. You don't need to be exact.
    - Etc. but the last (lightest) ink doesn't need to be read since the entire ramp will be used to produce your hilights
  - Determine partitioning values
    - We will now figure out where each of the inks will be used in an overall 0-100% scale.
    - Use this formula to determine the exact partitioning values for the curve
      - **Ink 2 VAL** = **2-K Overlap**
      - **Ink 3 value** = **2-K Overlap** x **3-2 Overlap**
      - **Ink 4 value** = **2-K Overlap** x **2-K Overlap**
    - Or, use provided Excel workbook **"LC QTR workbook"**
    - So, in my example I have determined the following values ink 1 always = 100%, ink 2 = 40%, ink 3 = 16% and ink 4 = 7%
      - If it is not obvious, these values represent where each ink will take over for the last.
        - Ink 1 will be used for values between 100% and 40%,
        - Ink 2 will be used for values between 40% and 16%
        - Ink 3 will be used for values between 16% and 7%
        - Ink 4 will be used for all values lighter than 7%

- **Creative QTR curves**
  - Describe how to create curve file
    - Leave out linearization
  - Install Curve file

- **Linearize**
  - Determine Linearization method
    - Densitometer
      - Print Linearization target
        - Open file: **QTR 2.5/CurveDesign/Images/21step.psd**
        - Do not Color Manage
        - Print Settings
          - Use curve you created
          - Calibration mode off
          - Settings
        - **IMPORTANT:**
          - Let print dry 3-4 hours or dry in microwave 20-30 seconds
        - Record values
        - Make an LINEARIZE= entry in your ink descriptor file
        - Save the ink descriptor file
        - Drop file on **Drop-Quad-Profile**
    - Eye-One Spectrophotometer
      - The process for using the Eye-One for linearization is clearly described in the documentation **Eye-One-ReadMe.pdf**
      - **IMPORTANT**:
        - Take the advice of Roy Harrington contained in the documentation (**Eye-One-ReadMe.pdf**) and generate linearization and Profiles using the QTR-21x4-random calibration file. In my experiments using the 51 step target delivers less smooth transitions of the tone ramp which looks like posterization or strange lines along areas of subtle tone transition (shadows on cheeks, sky, clouds and out of focus backgounds.) This is either because there are just too many data points on the linearization curve, thus creating flat spots, or due to the fact that there can be small inaccuracies in the readings of the Eye-One which results in an un-smooth curve.I have had several instances where the Eye-One delivered inaccurate readings that resulted in bad linearizations. If I sense that something is strange in the look of the sample display (two patches in the Measure Tool interface seem too close in tone and don't seem to correspond with the look of the test page, then I either re-read the patches, or save two output files from two different measurings of the

target, and then compare the data, even pasting the data into Excel and making a chart of the data to see the curves. This has been tedious, but very helpful in resolving issues and learning exactly what is going on. For this reason as well, I use the QTR-21-gray file and not the QTR-21-random target. It is easier to see if you are getting strange readings.

- In a classic example of doing what I say and not what I do. After wrestling with this issue for a week I re-read the **Eye-One-ReadMe.pdf** file and Roy clearly recommends says
  - **"The 21x4 target is recommended for the best accuracy. It has 4 patches for each step value and the QTR software will automatically average the 4 measurements which gives a more accurate result."**
- I am a believer now. Save yourself the pain, follow the instructions.
- Open file: **QTR 2.5/CurveDesign/Eye-One/QTR-21x4-random.tif**
  - Print using these settings
  - Dry Print
  - Read Values
  - Save File

- **Create icc profile**
  - You need an Eye-One spectrophotometer and the MeasureTool application that is part of Profile Maker Pro to do this step.
  - Follow the very clear information in the **Eye-One-ReadMe.pdf** (by Roy Harrington) for generating icc profiles.
- **Take Stock**
  - Either things will look great, or there will be strange issues
  - Common problems
    - Posterization in the gray ramp or in areas of gradual or subtle tonal transition.
      - This can be vexing because it shows up in images, but not necessarily in the test ramps if you don't know how to look for it.
      - Setting a default ink limit for all inks
    - Grey ramp is not smooth
    - Sudden transition to max density in the range of 90%=100%
    - Visible pixilation
    - Issues
      - Pigment can settle in the carts if they have been in the machine for a long period of time, even if you have been actively printing
        - Make a habit of removing, gently agitating, and replacing cartridges from time to time (every 2-3 weeks)
      - New batches of ink can vary from the density of your old inks
        - This is less of an issues than it was in past years as the process controls have gotten significantly better with the vendors who are still around.
      - Make habit of keeping your old initial Calibration prints around so you can determine if there has been a shift in max density. These prints show what the unlimited max density is for your inks at the time of the calibration
  - Tips
    - Have multiple test images
      - Gray ramps
      - Tyler Zs
      - proofofpiezography.tif
      - A reference image of your own that you know intimately