

## **Step-by-Step Guide: CREATING AND USING THE PRINTER ADJUSTMENT CURVE When Making DIGITAL Photogravure Positives using the Epson Stylus Pro 7800**

Version 4.0 © 2014 – Marlene MacCallum and David Morrish

NOTE: The following data was developed without using RIP software. Density and curve data would be different for the Canon IPF Series Printers.

### **Background:**

The film used to create continuous tone photogravure positives and wet darkroom techniques (i.e. lith film) has a potential density range of 4 when measured by a transmission densitometer. Traditionally, the desirable densities of tones for a photogravure positive are a density reading of 2.0 for blacks, 1.85 for shadow detail and 0.34 for highlight detail giving you an image with a shadow – highlight density range of 1.5. These density ranges are achieved through a combination of film exposure and development.

The tool historically used to monitor and control the progression of the etch is the 21-step Stouffer Stepscale. Step #1 has a density of 0.04 (film base plus fog), step #3 has a density of 0.34 (highlight detail), Step #11 has a density of 1.55, Step #13 has a density of 1.85 (shadow detail) and Step #14 has a density of 1.99. The density difference between each step is approximately 0.15 and is consistent along the entire scale.

### **Digital media output:**

The information in this document is based on our experience with an Epson Stylus Pro 7800 inkjet printer with Photo Black (pK) using Pictorico Premium OHP Transparency Film (a transparent media) as the output media. Each digital/print studio will have a range equipment options and each gravure practitioner will have a range of background experience. We have explored three different methods of using digital film positives in conjunction with copper photogravure. The first method uses a greyscale file that is printed in colour and involved creating two adjustment curves. One curve was a stepscale curve and was used to create an #11-step stepscale with densities that corresponded to steps #1 – #11 of the Stouffer Stepscale. The second curve was a printer adjustment curve for the image file. This method is viable for those who have a densitometer and have familiarity with using the Stouffer Stepscale as the etching control. The second method uses a greyscale file that is printed in colour and uses one adjustment curve only, the printer adjustment curve. With this method, we create a 0 – 100% greyscale stepscale. This method does not require a densitometer and uses tools available within Photoshop. The etching control is still the stepscale but uses a different timing method. This is the method we currently employ. The third method is an adaptation of the Precision Digital Negative developed by Mark Nelson. This method uses a coloured positive and produces an extended tonal range. As this is a proprietary

method, it would not be appropriate to include the information in this document. The link for this method can be found at <http://www.precisiondigitalnegatives.com>.

In our digital print studio, our Epson is used for a variety of print applications and is not dedicated to producing positives. For studios that use the inkjet printer solely to print positives, it is possible to adapt the printer so that only black and grey cartridges are used. This will result in denser positives. Using our printer, when we generate an image that represents the tonal range from 100% black to 0% black (clear), we find that our maximum density is 1.55 for 100% black and our film base plus fog is 0.07 for 0%. Thus, we are operating with a greatly reduced potential density range when compared to that of traditional film/wet darkroom techniques. In addition, if we create and print out an 11-step stepscale, we find that the densities appropriate for photogravure are compressed and that the density differences between each step do not correlate with the density differences in a Stouffer Stepscale, the standard we used with silver-based film positives. This means the image density range is compressed and we do not have the same etching control tool as used with lith film positives.

At a workshop with Lothar Osterburg, he introduced us to his method of creating printing curves to address this issue and we gratefully acknowledge his contribution to our learning process. We have evolved a methodology and set of adjustments specific to our situation. We had originally developed two adjustment curves (method one described above). A stepscale curve was used to create an 11-step stepscale with densities that approximated #1 – #11 of the Stouffer Stepscale. A printer adjustment curve was created to ensure correct densities on the positive image. A transmission densitometer is needed to create the stepscale curve. As this is not a readily available tool, we have since adjusted our method to use tools available in Photoshop.

Currently, we use a printer adjustment curve to establish our desired tonal densities on the inkjet positive. We work towards generating positives that have the stated percentage tonalities when scanned and read. In other words, the curve ensures that a 10% grey will, when printed and scanned, measure as 10%. This method was informed by Mitch Mitchell's research in polymer photogravure and we gratefully acknowledge his input and the opportunity to adapt his method for copper photogravure.

When preparing the image file, prior to applying the printer adjustment curve, we use the shadow/highlight image adjustment feature in Photoshop to visually adjust the densities for shadow detail and highlight detail. This ensures appropriate separation at each end of the tonal scale when etching copper plates made from digital positives. This step is covered in the document Shadow-Highlight-Adjustment.

The correct tonal range in your final print is established through two separate steps. The first is achieved by creating a shadow/highlight adjustment in a duplicate layer. The second is through the application of the printer curve adjustment layer. The shadow/highlight layer and the amount of adjustment necessary will be unique to every image. The printer adjustment curve is a standardized adjustment that you create for your specific printer and output media. It is crucial that the difference between the two steps be understood. The shadow/highlight adjustment step opens up the shadow detail and adds density to the highlight detail, reducing the overall image contrast. This must be done because the etching and printing process will increase the contrast of the image. Therefore, in order to achieve the target image contrast, the positive requires a reduction in contrast range that is proportional to the increase that will happen at the etching/printing stages. In other words, the highlight/shadow adjustment is critical to

maintaining control during the etching and printing stages. The printer adjustment curve compensates for the varying light blocking capacity of the inkjet pigment and dyes so that the final print will achieve the desired tonal range. This adjustment is critical to maintaining control during the exposure stage.

The following describes the procedure we use and the results for our specific printer and media. Curves would have to be created for each printer/media combination. The same methodology, however, can be used. We have also included the information on creating an 11-step stepscale with densities equivalent to Stouffer Stepscale for those that have a densitometer and prefer to work with this etching control tool.

### **The role of the digitally generated stepscale:**

The stepscale is a tool for controlling and timing the progression of the etch. Step #11 represents the maximum density achievable with inkjet/transparent digital media and Step #1 represents the base fog or density of the clear media. Step #2 should have a density of 0.21, which represents our standard highlight detail density for a digital output photogravure positive. All of the steps between should have a difference of 0.14 – 0.15. Thus, when etching the plate, an even progression of tonal etching can be monitored and controlled by ensuring the steps etch at even intervals. It is crucial to understand that creating the appropriate digital output 11-step stepscale requires a different curve from the image. The 11-step stepscale with the stepscale curve applied has *mathematically* consistent differences between each step.

The 0-100% greyscale stepscale is created by applying the Printer Adjustment Curve to an eleven step stepscale. This is the same curve that is applied to your image. The printer adjustment curve is designed to create the appearance of *visually* even differences from step to step in the final print.

The timing of the etch will vary with these two methods. Please refer to the Exposure Etching Form for an example of our current etching method.

### **Making an 11-Step Stepscale for Timing the Etch of Photogravures:**

1. Open a new file in Photoshop and call it “21-step stepscale”. Set the Width to 6 inches, the Height to .5 inches, and the Resolution to 360 dpi (or 300 dpi if you are using a Canon printer). Set the Colour mode to Grayscale, 8 bit, and the Background contents to white. Hit OK.
2. Select the Gradient Tool and select linear gradient, black to white, mode normal, opacity 100%, the dither box should be checked (some of these are the Photoshop default settings). Place your cursor to the far left edge of your document and drag it across to the far right, create a straight line from short edge to short edge. Click and the image should now be filled with a gradient of tone from black to white.
3. In Image > Adjustments > Posterize..., set the levels to 21 and hit OK.

4. You will now have a 21-step stepscale with #21 being 100% and #1 being 0%. Save. If desired, you can clean up the division edges by selecting and dragging a duplicate of each tonal area to cover each rough edge (magnify to see clearly and set the selection tool to Feather: 0 px). Click on the Info palette. When you place your cursor over each of the steps, you will see the K: percentage reading in the upper left corner.

5. Print out this stepscale on your printer using your preferred transparent media. Print in colour at the highest resolution. Allow it to dry.

6. Using a transmission densitometer, read and make note of the densities of each step. In our situation, we discover that 100% gives a density of 1.55, 95% gives a density of 1.20, 90% = 0.99, and so on until 10% is 0.12. Use these readings to give the approximate percentage/desired densities when creating the curve in the next stepscale file. Note: your printer may result in different maximum density. In the this case, if the difference is slight, you may wish to adjust the increment differences for the steps, if the difference is significant, you may wish to create an 11-step stepscale instead.

7. In Photoshop create a new file and name it “11-step-scale”. Set the Width to 6 inches, the Height to .5 inches and the Resolution to 360 dpi (or 300 dpi if you are using a Canon printer). Set the Colour mode to Grayscale, 8 bit, with the Background contents to white. Hit OK.

8. Select the Gradient Tool and select linear gradient, black to white, mode normal, opacity 100%, the dither box should be checked off (some of these are the Photoshop default). Place your cursor to the far left edge of your document and drag it across to the far right, create a straight line. Click and the image should now be filled with a gradient of tone from black to white.

9. In Image > Adjustments > Posterize..., set the levels to 11 and hit OK.

10. You will now have an 11-step stepscale with #11 being 100% and #1 being 0%. Save.

11. Under Layer > New Adjustment Layer > Curves..., name as “stepscale curve”, hit OK.

12. In the Curves box, click Show Amount of: Pigment/Ink % (this can be found by selecting the Curve Display Option). The far right vertical line of the box represents the 100%. You will have a graph of nine grey vertical and horizontal lines. Each represents a 10% incremental change in tone. You will also have a black line at 45 degrees. This is your curve and it is *this* line that you will alter.

13. If you place the cursor over the upper right corner, you will see crosshairs and you should get a reading of Output: 100%. Leave this point as is. Move your cursor down and to the left till it sits over the point where the black, and two grey lines intersect. Your output should read 90%. Click on this. You will now have an active output box. Adjust the output number to the desired new %. Continue with this same procedure, making your way down the curve. You can also make the adjustments by activating clicking on and the output boxes. In our setting, the following information gave us the

desired stepscale curve. These are recommended starting points: (See Table One, at right.) You can also use the data you gathered by printing out the 21-step stepscale and the densities of these tonal increments. It will take some experimenting and proofing to fine tune the curve to get the desired densities.

Table One: Creating the Stepscale Curve			
Original % input	Original density	% used to modify output	Modified density
100	1.55	100	1.55
90	0.99	98	1.38
80	0.70	96	1.23
70	0.54	93	1.06
60	0.43	89	.93
50	0.35	83	.78
40	0.27	76	.62
30	0.21	66	.48
20	0.16	51	.35
10	0.12	31	.21
0	0.07	0	.07

14. Once you have completed the above process, click on the Save/Load box (the small box which is next to the Preset: Custom bar). The small box will open and give you the save or load preset option. Click on save, save as: stepscale curve01, save it to Applications > Adobe Photoshop > Presets > Curves.

15. Flatten the image. Save this new file as stepscale\_curve01.

16. Print this stepscale, let dry. Measure the densities.

17. If you have not achieved the desired densities, open the original 11-step stepscale as per point #10 above and then repeat the following steps but with the differences described below.

18. Repeat point #11 but name as stepscale curve02.

Table Two:			
From Stouffer 21-Stepscale		Our Etching Stepscale	
Step #	Density	Step #	Density
#11	1.55	#11	1.55
#10	1.39	#10	1.38
#9	1.25	#9	1.23
#8	1.09	#8	1.06
#7	.94	#7	.93
#6	.79	#6	.78
#5	.63	#5	.62
#4	.48	#4	.48
#3	.33	#3	.35
#2	.20	#2	.21
#1	.05	#1	.07

19. In the curves box, hit the save/load box and load your stepscale curve01.

20. Adjust the percentages to increase or decrease density as needed. When finished, save as stepscale curve02. Hit OK.

21. Save this new file, flatten and print a proof. In order to maintain consistent densities, you must print the proofs with all the same printer settings as your final print. Make new readings and compare with the readings on Table Two, at right.

22. Continue with this procedure until you have created a curve that gives you an 11-step stepscale with the desired tonal densities. We recommend the following densities for your stepscale because they match the regularity of the Stouffer 21-Step scale and are the best indicator of a smooth progression during an etch. (See Table Two at right.)

Once you have created your stepscale, save the final version in layers. We recommend that you then save a flattened version and this is what you will output for use as your stepscale. The flattened version can be added to the flattened version of image file. It is important to remember to flatten any image with adjustment layers before combining or you will inadvertently make undesired and additional adjustments to your image file.

We create our stepscale as a grayscale file but output it in colour so as to add the maximum amount of density.

### **Making the Printer Adjustment Curve for Photogravure Positives**

#### *The role of the printer adjustment curve:*

The printer adjustment curve compensates for the varying light blocking capacity of the inkjet pigment and dyes so that the final print will achieve the desired tonal range. This adjustment is critical to maintaining control during the exposure stage.

#### *Creating the printer adjustment curve:*

To create this curve, we use a 100% gradient step wedge. This stands-in for an image because it provides the full tonal range as would be represented by any image. This should not be confused with the etching control stepscale. The procedure for creating the printer adjustment curve requires a high quality scanner. We use a V750.

We recommend that you use a 100-step gradient step wedge. This can be found on-line at <http://www.botzilla.com/blog/archives/000544.html> or do a search for “ChartThrob”, Alternatively, you can make a gradient step-wedge using Photoshop. You will need a minimum of 30 steps to provide subtle enough increments.

1. Starting with the step wedge at 360 dpi (Epson file resolution), and greyscale, print at the highest printer resolution using the same settings that you will use for printing your digital film positive. Let it dry for 15 minutes. To see our settings, refer to the document on B&W Gravure Positives.
2. Scan the digital film positive. We use the following scanner settings, 300 dpi, 48 bit colour. Turn off auto features. In histogram we make sure there is no adjustment and then hit *scan*.
3. In Photoshop, change the image mode to greyscale, 16 bit and save. Click off embed color profile, no compression.
4. In info panel, in the palette options, switch everything to greyscale.
5. Using the marquee tool, select the 100 scale portion only.
6. Go to Image > Adjustment > Threshold. Starting with the black, move the slider over until the 100 % is solid black. Go to the white and move the slider till the 0% is white. Note the levels numbers. Cancel.
7. Go to Image > Adjustment > Levels and apply these numbers.
8. In the info panel, confirm that white reads 0 and black reads 100.
9. With the marquee tool, select a rectangle within the 100% box. Do not include border or number.
10. Go to Filter > Blur > Average. With the marquee still selected, move the rectangle to the next percentage, command F. This repeats the process.

11. Once you have completed this process, in the info panel, read the resulting percentage of each tone. Make note. This provides you with the density percentage of the unadjusted digital film positive.
12. The next step is to create a curve based on this information that will add or remove density until the digital film positive output matches the stated percentage value. In other words, you might discover that the original 80% results in a scan that measures at 90%.
13. By measuring the various tones, you will know which percentage produces a digital film positive of 90% or 10% in your output.
14. Create a curve layer in Layer > New Adjustment Layer > Curves. Name it PrinterAdjustmentCurve01.
15. In the Curves box, click Show Amount of: Pigment/Ink % (this can be found by selecting the Curve Display Option). The far right vertical line of the box represents the 100%. You will have a graph of nine grey vertical and horizontal lines. Each represents a 10% incremental change in tone. You will also have a black line at 45 degrees. This is your curve and it is *this* line that you will alter.
16. If you place the cursor over the upper right corner, you will see crosshairs and you should get a reading of Output: 100%. Leave this point as is. Move your cursor down and to the left till it sits over the point where the black, and two grey lines intersect. Your output should read 90%. Click on this. You will now have an active output box. Continue with this same procedure, making your way down the curve till you have set ten points. You can also make the adjustments by activating clicking on and the output boxes.
17. After establishing the points and using the results from the scan, click on the percentage you wish to adjust. For example, click on 90% or go to the output box and enter 90. In your scan, find out which original percentage had a reading of 90%, in our example we found that the original 80% resulted in a 90% output.
18. In the Curve panel, the input is the current reading, the output is the desired adjusted reading. Based on information found in the percentage readings, adjust the output. In our example, with the input as 90% we would adjust the output to 80.
19. Continue this process at 10% increments until you have adjusted the input/output along the entire curve.
20. Once you have completed the above process, click on the Save/Load box (the small box which is next to the Preset: Custom bar). The small box will open and give you the save or load preset option. Click on save, save as: stepscale curve01, save it to Applications > Adobe Photoshop > Presets > Curves.
21. Save this file as Printer Adjustment Curve 01. Close the file.
22. Open the original 100-step gradient step wedge. Add a curve adjustment layer and load the Printer Adjustment Curve 01.
23. Print this file.
24. Scan as per above and repeat the process so that you can measure the new percentage results. It is likely that you will have to make refinements and make a new curve. Save each curve, naming so that you can keep track of the evolution.
25. When you have created a curve that results in a digital film positive where the tones measure the stated percentages then you have created your printer adjustment curve.

26. The final refinement is done by making a copper gravure of this 100-step gradient wedge. After this is made and printed, you can scan and measure and make your final curve adjustments.

### **Making a 0-100% Greyscale Stepscale:**

1. In Photoshop create a new file and name it "0-100% Greyscale step-scale". Set the Width to 6 inches, the Height to .5 inches and the Resolution to 360 dpi (or 300 dpi if you are using a Canon printer). Set the Colour mode to Grayscale, 8 bit, with the Background contents to white. Hit OK.
2. Select the Gradient Tool and select linear gradient, black to white, mode normal, opacity 100%, the dither box should be checked off (some of these are the Photoshop default). Place your cursor to the far left edge of your document and drag it across to the far right, create a straight line. Click and the image should now be filled with a gradient of tone from black to white.
3. In Image > Adjustments > Posterize..., set the levels to 11 and hit OK.
4. You will now have a stepscale with 11 increments, starting at 100% with each successive increment being 10% less. Confirm this by opening the Info panel, place your cursor over the increments and confirm the percentage values.
5. Using the text tool, you can include the percentage amount in the increment. Flatten.
6. Select Layer > New Adjustment Layer > Curves...
7. In the Curves window in this new layer, under the Preset pull down options, select and apply the Printer Adjustment Curve. Flatten. Save. If you prefer to keep this file in layers, be sure to flatten before including with your image to avoid double application of the printer adjustment curve.