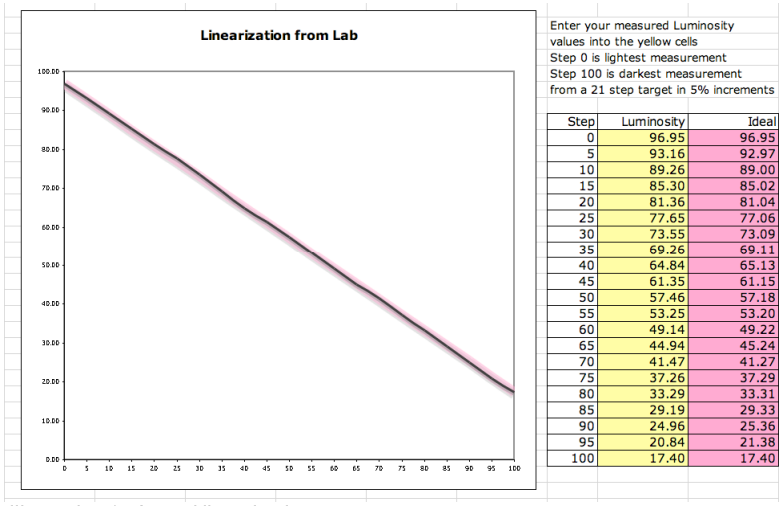
Piezography K7 & K6

Linearization

Version 1.0



Step	Luminosity	Ideal
0	96.95	96.95
5	93.16	92.97
10	89.26	89.00
15	85.30	85.02
20	81.36	81.04
25	77.65	77.06
30	73.55	73.09
35	69.26	69.11
40	64.84	65.13
45	61.35	61.15
50	57.46	57.18
55	53.25	53.20
60	49.14	49.22
65	44.94	45.24
70	41.47	41.27
75	37.26	37.29
80	33.29	33.31
85	29.19	29.33
90	24.96	25.36
95	20.84	21.38
100	17.40	17.40

illustration 1. A good linearization.

Checking Linearization

You can check the quality of your own linearization with a tool that I have provided in the form of an Excel spreadsheet called "Linearization_Checker.xls". This spreadsheet has a form for entering in the measurements of a 21 step density chart that has values from 0 to 100% ink in 5% increments. You can enter either Luminosity values (L of Lab) or Density values if your instrument is a densitometer. After entering in the values, a chart is generated that shows the IDEAL linearization and your current linearization.

You must have Microsoft Excel or a compatible spreadsheet shareware or software in order to use this tool. You would also have to have a densitometer or a spectrophotometer or spectrocolorimeter in order to read the 21 step file. The 21 step file is printed through a K7 profile, measured and the resultant data checked in this tool. Instructions for use are next.

In illustrations 1 and 4 you can see the results of both a good linearization and a poor linearization. An ideal linearization will be within the pink horizontal line. The Ideal measurements are computed from your measured dMin (paper white) and dMax (black).

I have included a 21 step gradation file for you to check and measure on your own. The name of the file is 21-step and is available in a variety of formats for your supported instruments and is part of our custom profiling kit. Before I cover custom profiling I will demonstrate how to print and measure a target to determine if a Piezography K7 profile is producing linear results by performing a confirmation of linearization.

Confirmation of Linearization Procedure

The goal in this exercise is to print and measure a 21 step strip for linearization. It is important to print the target with the correct Piezography QTR workflow (which is different from QTR's recommended workflow). Because Piezography made K7/K6 curves are not designed nor made with QTR Tools, they must be used according to our own Users Manual (A quick Mac QTR tutorial, A quick Windows QTR tutorial) which are found on the Learn Piezography tab of the InkjetMall website in the Piezography Guides and Manuals section.

Linearization Check Printing Instructions

1) Select the appropriate 21-step test image according to your measurement device

   As of this writing we have:
   21steps-DTP20.tif for x-rite DTP20
   21steps-DTP22.tif for x-rite DTP22
   21steps-DTP41-45.tif for x-rite DTP41 and DTP45
   21steps-Eye1.tif for x-rite EyeOne
   21steps-DTP70.tif for x-rite DTP70

   You can use the Step-21-gray.tif file that is found in the Eye-One folder of your QuadTone RIP. Contact us for any of the above files as per your needs.

2) Before printing the target, print a nozzle check and make sure all nozzles are printing correctly.

3) For Mac Users printing from Photoshop, do not convert the image when opening. It is advisable to print it with the same workflow you use for printing images from Photoshop to QuadTone RIP. We recommend our own workflow that is free of conversions and is an assigned Gamma 2.2 workplace from Print with Preview where no color management is taking place, or printer is determining colors. It is documented in our guide. Windows users simply open the image into the stand alone QTR application.

4) In QuadTone RIP select the appropriate K7 Curve from the Curve 1 list which matches the media being tested. Select 'none' in the other curve pull down lists. Make NO changes to the Curve Blending or Advanced Adjustments sections (ink limit and gamma should remain at 0). Select Resolution: 2880dpi and Speed: Uni-directional. Print the target image at 100% scale.

5) You should dry the target with a hairdryer for 3 to 5 minutes before measuring, or wait overnight if you do not have a hairdryer.

Linearization Check Measuring Instructions

1. Launch MeasureTool (part of the x-rite software system, or available at the Support downloads section at the xrite.com website)

2. Select Measuring

3. Click the type of test chart to measure menu: Select “Open” and find the file 21steps.txt (supplied in our Piezography Custom Profiling download kit)

4. Click Start button and follow directions

5. Click Close button to work with the data

6. Click the Export Lab button to save the data.

7. Save with a name that uses the ink-paper-printer combo as in the following example:
   K7-HahnPhotoRag-R1800-Ltest.txt

8. Launch Microsoft Excel

9. Open the file you saved above. Excel will treat it as a text file and will launch the Text Import Wizard. This text file is a Delimited file type that uses Tab as the delimiter. These are the only two options that need to be checked on the 1st and 2nd step of the wizard.

10. The file will open and look something like the illustration 2. I have highlighted in yellow the only data that you need to be concerned with. These are the L values for the 21 gray patches that were measured using MeasureTool. They are in a column called LAB_L. Select this entire array of data (highlighted in yellow) and **Copy**.

	A	B	C	D	E	F	G	H	I
1	LGOROWLEN		1						
2	CREATED	2/29/2008	# Time: 10:22						
3	INSTRUMENT	eye-one							
4	MEASUREMEN	WhiteBase=Absolute	Filter=No						
5	KEYWORD	SampleID							
6	KEYWORD	SAMPLE_NAME							
7	NUMBER_OF_		9						
8	BEGIN_DATA_FORMAT								
9	SampleID	SAMPLE_NAM	GRAY	XYZ_X	XYZ_Y	XYZ_Z	LAB_L	LAB_A	LAB_B
10	END_DATA_FORMAT								
11	NUMBER_OF_		21						
12	BEGIN_DATA								
13	1	A1	0	89.41	92.36	75.46	96.97	0.65	0.62
14	2	B1	5	80.96	83.56	67.76	93.26	0.77	1.07
15	3	C1	10	72.57	74.84	60.27	89.32	0.85	1.45
16	4	D1	15	65.62	67.62	54.06	85.81	0.95	1.82
17	5	E1	20	58.18	59.9	47.62	81.78	1.03	2.07
18	6	F1	25	51.24	52.69	41.68	77.69	1.15	2.24
19	7	G1	30	44.51	45.72	36.02	73.36	1.24	2.35
20	8	H1	35	38.72	39.73	31.22	69.28	1.3	2.36
21	9	I1	40	32.99	33.84	26.59	64.83	1.28	2.23
22	10	J1	45	28.45	29.21	22.84	60.96	1.12	2.35
23	11	K1	50	23.9	24.58	19.17	56.67	0.87	2.34
24	12	L1	55	19.61	20.22	15.79	52.08	0.56	2.12
25	13	M1	60	16.16	16.7	13.06	47.88	0.35	1.95
26	14	N1	65	13.23	13.66	10.69	43.74	0.39	1.79
27	15	O1	70	10.8	11.12	8.75	39.79	0.56	1.5
28	16	P1	75	8.46	8.7	6.94	35.4	0.62	0.97
29	17	Q1	80	6.59	6.76	5.46	31.25	0.77	0.57
30	18	R1	85	5.04	5.16	4.11	27.2	0.8	0.9
31	19	S1	90	3.69	3.79	3.06	22.96	0.65	0.46
32	20	T1	95	2.78	2.84	2.23	19.38	0.78	0.94
33	21	U1	100	2.05	2.1	1.61	16.01	0.63	1.33
34	END_DATA								
35									
36									
37									

Illustration 2. Measured 21-step gradation text file opened in Excel.

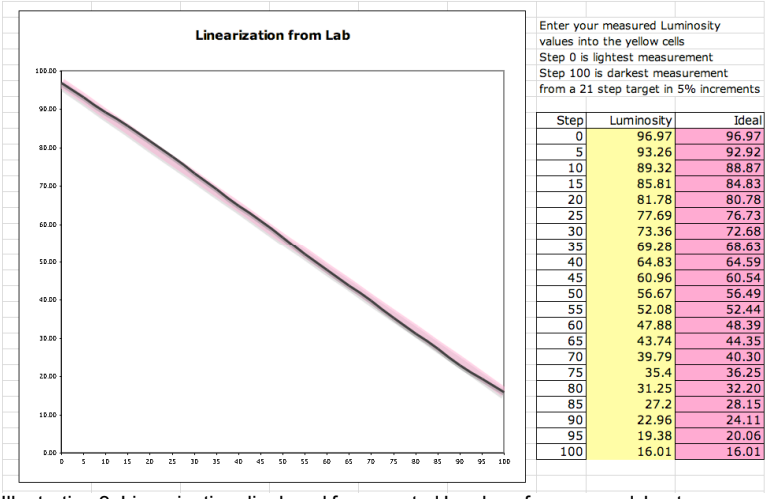
11. Now open the Excel file Linearization_Checker.xls

    a. Select the Linearization from Lab worksheet (there are two worksheets for Lab or Density)
    b. Select the yellow highlighted column under Luminosity and **Paste**.

    c. The chart will automatically update to your ideal linearization and your current

If you need support for using your Spyder 3 instrument to make linearizations – please contact us.

A perfect result would be within the pink borders of the chart line as in the example in illustration 3.



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35	69.28	68.63
40	64.83	64.59
45	60.96	60.54
50	56.67	56.49
55	52.08	52.44
60	47.88	48.39
65	43.74	44.35
70	39.79	40.30
75	35.4	36.25
80	31.25	32.20
85	27.2	28.15
90	22.96	24.11
95	19.38	20.06
100	16.01	16.01

Illustration 3. Linearization displayed from pasted L values from spreadsheet from illustration 2.

How far you let your system drift is up to you. But I believe the best output system will allow you to generate the best output. It is not a good idea to try and compensate through imaging. Piezography K7 is a very high fidelity system and should be in peak condition to get the best out of it.

The following example in illustration 4 will show you specific points to look out for in your output. If you have not printed with a perfect linearization you may not be printing at the standard you could be with a perfectly linearized system.

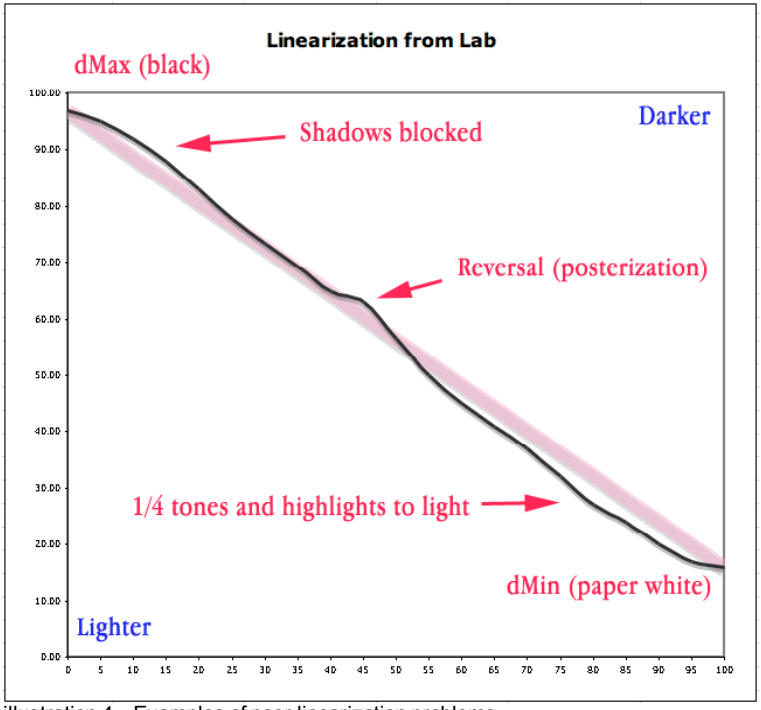

illustration 4 – Examples of poor linearization problems.

The graph chart in illustration 4 is separated by the diagonal linearization line. The pink represents the ideal linearization. The black line represents the measured linearization. If the black line rises above the pink line it indicates that part of the grayscale when printed is too dark. When the line tends to vertical or horizontal instead of diagonal, it represents a reversal and this is indicated in the print by posterization. If the black line falls below the pink line it indicates that part of the grayscale is printing too light. Naturally, a uniform diagonal line is preferred, but some wobble within the pink is acceptable.

Often one can print a smooth grayscale gradation to see printing problems with Piezography. If your nozzle check shows that all the nozzles are firing correctly, and you are printing correctly according to the manuals I wrote for using Piezography K7 profiles with QTR, and you are using the correct K7 profile for the media you have selected – but a grayscale gradation does not print cleanly – then you probably have a linearization problem.

But before you go to the expense and time of having your system custom profiled, you may wish to determine that you have correctly set up your inking system and you do not have any ink problems. It is possible to accidentally put the wrong ink into a reusable cart or in the bottle of a CIS system. So here is a method to check for correct ink shades in your Piezography K7 or K6 system using the QuadTone RIP Calibration Tool.

Using QTR Calibration Tool to Check Ink Shades

Illustration 5 is a printout from the QTR Calibration Mode. This is actually part of the QTR Curve Creation process, although it is not part of the process I use to make K7 & K6 curves for QTR. In any case, it is very useful to check the integrity of your ink system, just in case you are experiencing very poor linearization qualities which in your prints visually can range from:

- “muddy looking”
- posterization
- “strange”
- unusual contrast
- normal in some parts of the image and then looking reversed in other parts of the same image

Inking issues can arise from:

- Misfiled carts or bottles.
- Pigment settling due to infrequent use.
- Placing one or more shades in the incorrect position.

By printing out the Calibration Mode target, you can measure the density or L value of the individual inks and determine if they are correct. Piezography follows a very specific ink order as specified in the Installation directions. If you are in doubt you can refresh your familiarity by looking at New User/New System in the Learn Piezography tab of the Inkjetmall.com

website. The K7 & K6 curves specifically expect each of the shades to be installed in their associated ink slots.

An “ink slot” is where normally an Epson color cartridge is installed. For example, in the 7880 printer there are eight ink slots: Black, Cyan, Magenta, Yellow, Light Cyan, Light Magenta, Light Black, and Light Light Black. With Piezography K7 the ink slots are filled in the following order:

Black = Shade 1
Cyan = Shade 2
Magenta = Shade 4
Yellow = Shade 7
Light Cyan = Shade 3
Light Magenta – Shade 5
Light Black = Shade 6
Light Light Black = unused (Piezography offers PiezoFlush in this position.)

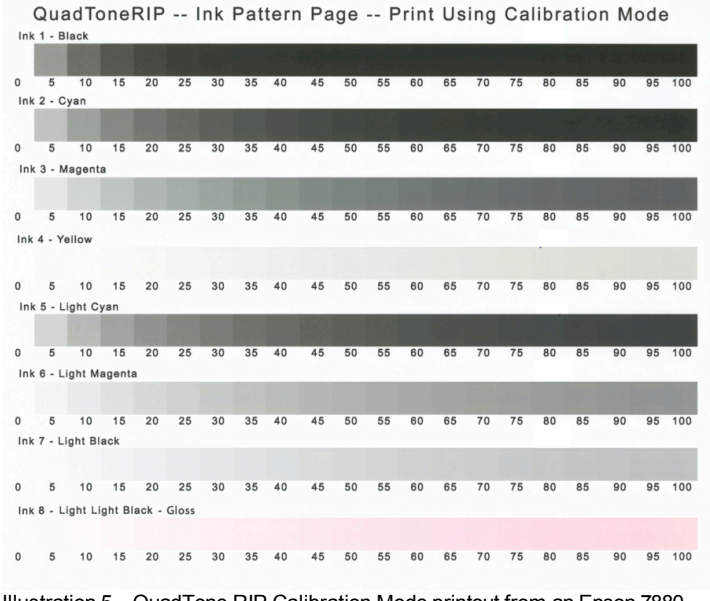

Illustration 5 QuadTone RIP Calibration Mode printout from an Epson 7880 Piezography K7 system

When the Calibration Mode target is printed out in QTR, it is possible to determine if the shades are in the correct order by a simple visual check. If you are uncertain, you can take a density or luminosity reading of the individual inks. I suggest you read at the 60% density patch. This is where I consider the density of the ink. I will seldom print more than 60% density of any one ink. If you can not determine visually that your inks are in the correct order, they probably are not. At this point you might consider contacting technical support for information on how to remedy or clean your system. If the inks are in the correct order, and you are still experiencing unusual printing results, and because your linearization check has proven to be poor, its time to make a custom Piezography K7 curve for your system.

You can double check the ink shade positions for your printer by consulting your installation instructions or visiting the Support website at www.inkjetmall.com

Piezography Neutral K7 ink densities on Epson Enhanced Matte at 60% (approx):
Shade1= 1.51
Shade 2= 1.41
Shade 3= 1.21
Shade 4= .90
Shade 5= .50
Shade 6= .29
Shade 7= .14