

Customizing MIS Ultratone Curves

The MIS Ultratone inks allow an unprecedented range of toning effects for black and white printing on both matte and glossy papers. The system basically works by taking a grayscale image in Photoshop, converting that image to a 24 bit RGB file, applying Photoshop image adjustment curves for printing, and then printing according to specific driver settings. With this system, one can achieve a range of tones from warm to cool. Photoshop curves to achieve this range of tones are available on the MIS website. Curves are also available in the Files section of the Yahoo Groups Black & White Digital Print Forum and from individuals who make the curves. However, there are situations in which one might wish to alter these curves to suit a specific paper. This document serves to direct users on how to customize available curves for use with the MIS Ultratone inkset. In order to accomplish this, one needs an appropriate Epson printer, Ultratone inks, a paper of choice, a grayscale step-wedge image file, and, for best results, a densitometer/spectrophotometer. Although a densitometer is ideal, scanners or even visual evaluations of test strips can be used to make adjustments to the curves.

The Ultratone Photoshop image adjustment curves are designed to accomplish two tasks in achieving a smooth and consistent grayscale image. First, the curves “partition” the gray inks such that the light gray inks print in the highlights and the darker gray inks print in the midtones and shadows. Second, they evenly distribute toner in the amounts needed to make various image tones, ranging from a natural warm carbon pigment tone to a neutral or cool gelatin silver print tone.

By default, the gray inks are quite warm. Partitioning the warm gray inks distributes them such that there is a smooth, consistent grayscale “ramp” from the pure paper white (0% ink) to the deepest black (100% ink). To accomplish this, only the lightest of the gray inks is used in the highlights to avoid dots. At the 100% black point, the black ink is poured on as heavily as possible while allowing the paper to hold the ink without artifacts. This gives the greatest dmax.

The toner ink, also controlled by the image adjustment curves, determines whether the image is, at the one end of the range, a warm carbon-pigment tone or, as more toner is added, a neutral or cool tone. One might use the warm curve to make the “carbon on cotton” prints for old photo restorations. Alternatively, one might choose a neutral tone to replicate a lightly selenium toned silver print. The options are essentially endless.

Unfortunately, the ink positions are not the same for hextone (such as the Epson 1200, 1280, and 7500) and quadtone (such as the Epson 1160 or 3000) printers. The following tables shows which ink positions in a cartridge hold which gray or toner Ultratone ink:

Quadtone printers:

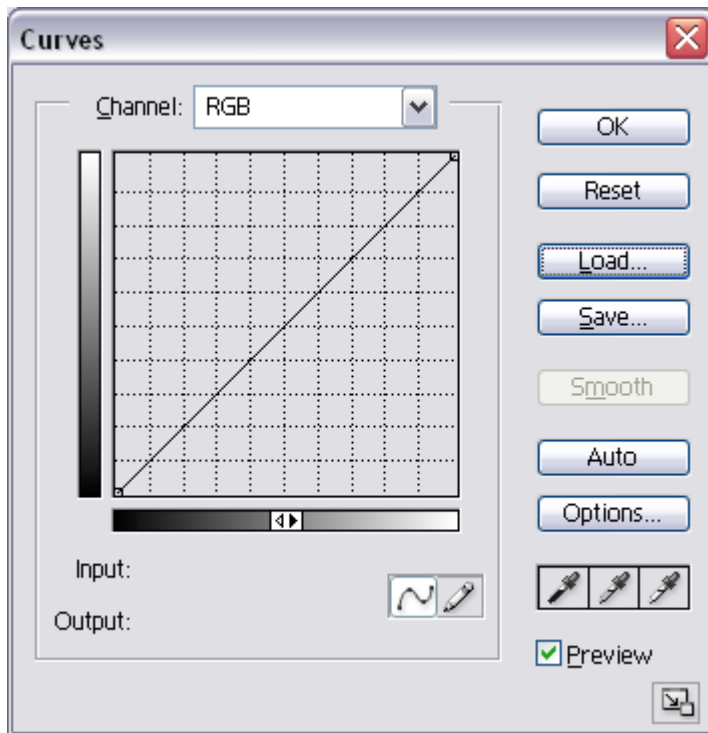
CARTRIDGE POSITION	ULTRATONE INK COMPONENT
Cyan	Dark Gray Ink
Magenta	Light Gray Ink
Yellow	Blue Toner
Black	Photo Black or Eboni/Matte Black

Hextone printers:

CARTRIDGE POSITION	ULTRATONE INK COMPONENT
Cyan	Dark Gray Ink
Photo/Light Cyan	Medium Gray Ink
Magenta	Blue Toner
Photo/Light Magenta	Light Blue Toner
Yellow	Light Gray Ink
Black	Photo Black or Eboni/Matte Black

Note that in both hextone and quadtone printers, the cyan position holds the dark gray ink. This is the main gray ink and is most useful in adjusting densities below the highlights. To adjust highlight densities, one would adjust the light gray ink.

To accomplish these adjustments, we need to look at how the Photoshop curves operate. (Please note that this document assumes a working knowledge of Photoshop curves.) The best place to begin is with an existing curve that comes closest to matching what you would like to see on your particular paper. This may be a curve that comes quite close to what you would like or almost totally misses the mark. Regardless, starting with an existing curve will simplify life either way. Below is a screen shot for an adjustment curve for the Ultratone inks:



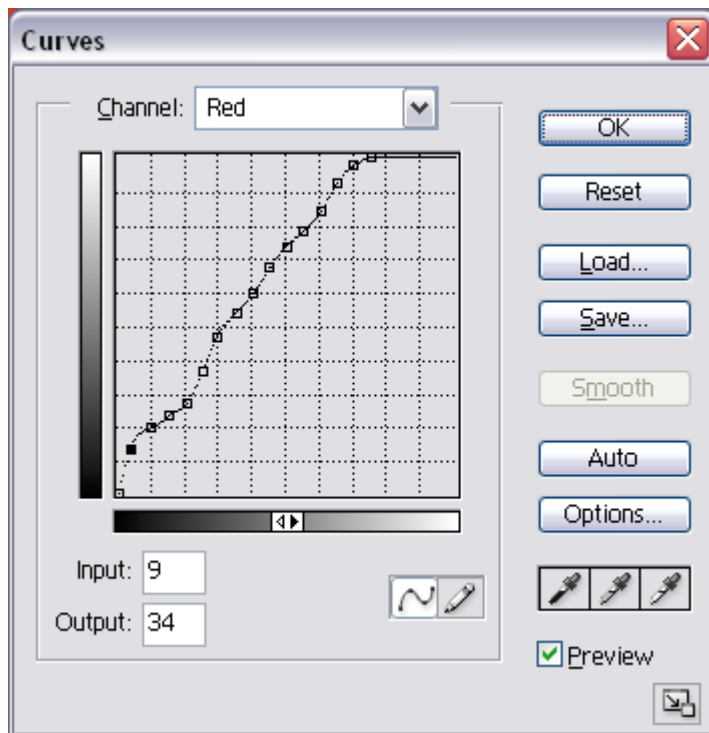
Curves display a graph that plots the relationship between input level (unaltered) and output level (altered). Input levels run along the bottom, and output levels run along the side. The above image shows the RGB channel. The input and output scale is an 8 bit light scale with 256 steps where 0 represents black and 255 represents white. Overlaid on the curve is a very useful grid. The grid lines can be thought of as showing where grayscale percentages fall. For example, the far left represents

100% black, the next line over 90%, the next line 80%, and so on and so forth until the end point of 0% black (i.e. pure white). Note that the arrows in the bottom bar/axis switch the scales for the 0 – 255 luminance scale to a 0% - 100% scale. It is recommended that you use the 0 – 255 scale for more accuracy.

All the adjustment curves have their ends at 0% and 100% ink (or 255 maximum luminance white to 0, no luminance, black). The input-output graph interfaces you with the printer jets. (You will most likely not have to make any adjustments to the RGB channel, but it is shown since this is what you will first see when you open the curves dialogue box. Altering points on this curve will make global adjustments to your final image, but may adversely affect the smoothness of the tone ramp.)

If you click on the drop down channel dialogue box, you will be able to select individual curves for the Red, Green, and Blue channels independent of each other. This is where the heart of the Ultratone adjustment curves lies. The following example will display how these individual curves operate. **Note: The following example is for a *hextone* printer. If you have a *quadtone* printer you will have to realize that some ink positions are switched according to the table previously shown. However, the methods are the same.**

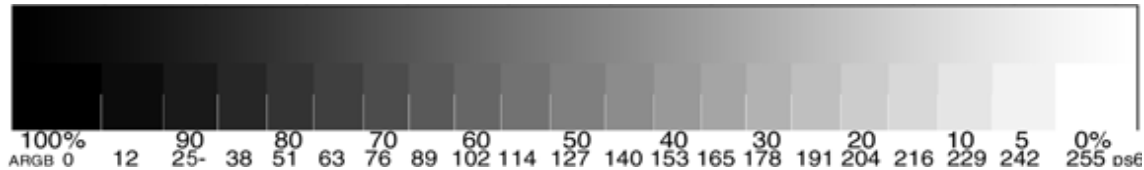
At this point, thinking graphically and in terms of complimentary colors is needed. We'll begin with the red channel, as shown below:



The red channel controls the cyan inkjet positions. Therefore, adjustments to the red channel curve will alter the distribution of the medium and dark gray inks. Notice above that this curve operates such that these inks are completely excluded from what would be 0% to about 25% on a grayscale wedge (the straight line section at the top right of the graph). This is important! It essentially keeps all of the darker gray inks out of the highlights so as to limit any appearance of dots. The medium

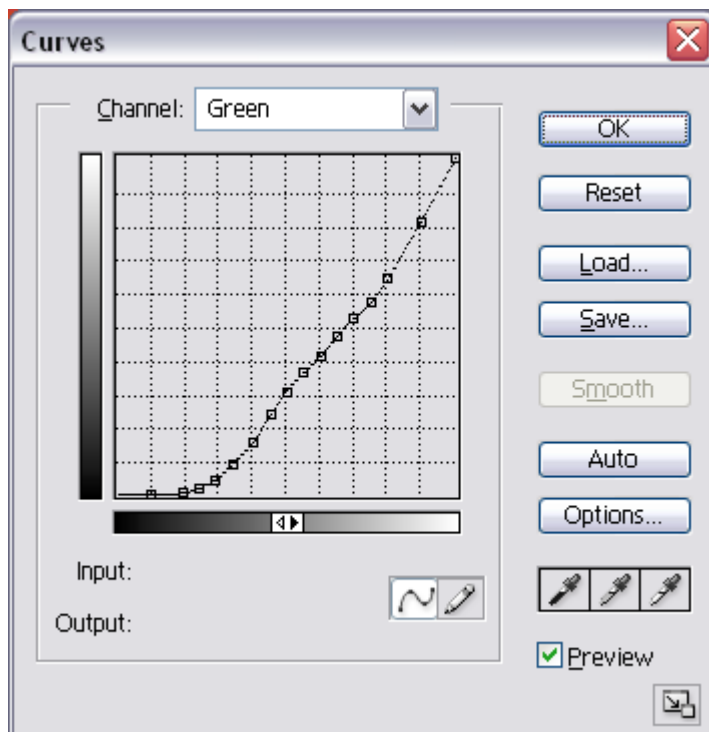
gray ink is then permitted to come in after 25%. With quadtone printers that do not have a medium gray (light cyan) ink, it is best to try to hold the cyan/dark gray ink back until about the 45% point.

Note that each point on the curve either falls on a grid line or halfway between grid lines. The reason for this is that the points on the graphs are usually on or around the 5% steps of a 21-step test file. This makes it easier to relate the graph to the test file. A typical test file is shown below:



Using Tab-CTRL or Tab-Shift-CTRL, you can navigate between the graphical points on the curve and raise or lower them as need using the numbers in the boxes for reference. You can also click on the lower number box and then use the up/down keys to change the numbers/move the points. Say, for simple example, that the 60% step on your grayscale wedge is printing too dark. You would open up the red channel in the curves dialogue box, navigate to the point that corresponds to 60%, and raise it as needed. Once you had made that change, you would want to hit the Save button to save the curve under a new name, print out your file, and measure the steps in your grayscale wedge with a densitometer. If the 60% step is now correct, you're done. If not, you would return to the curve and repeat the above steps making the appropriate adjustments. Essentially this is an iterative process that can be picked up reasonably quickly if one is comfortable with graphs.

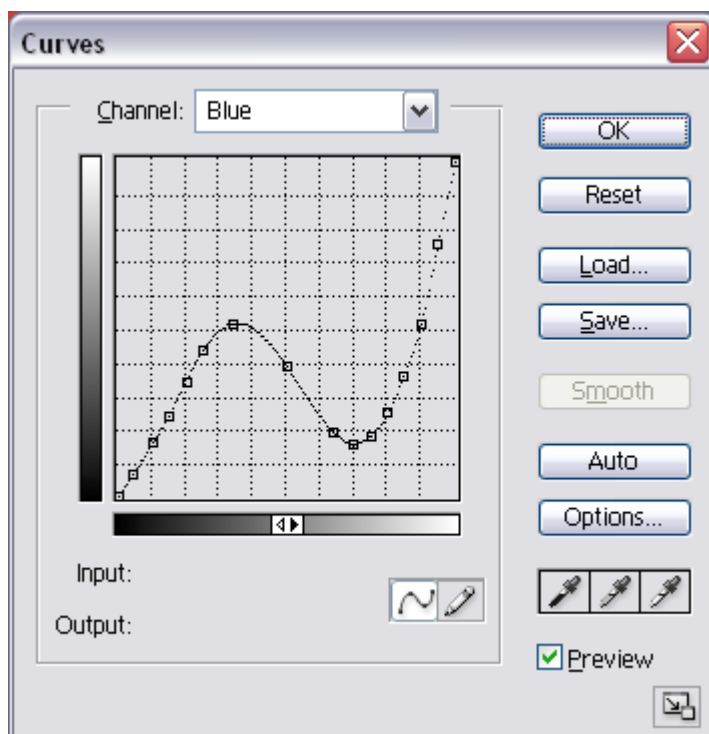
We now move to the green channel, as shown below:



The green channel controls the magenta inkjet positions. Therefore, adjustments to the green channel curve will alter the distribution of the toner in a hextone printer. The curve above is for a fairly cool tone on what happens to be Epson Professional Glossy Paper using an Epson 1280 printer. Notice that with this particular curve the toner is being fully applied in the deep shadows from 100% black to 80% (as seen in the lower left portion of the chart). This was done to counter the warm nature of the gray inks in this area of the grayscale spectrum.

It is worth noting here that adjustments to the green channel should generally be met with counter-adjustments in the blue or red channels in order to maintain a constant overall density. For example, if your 50% grayscale patch is too warm, you would want to adjust the 50% point in the green channel downwards to add toner to that patch. Once you have done this, you will most likely also need to raise the 50% point in one of the gray ink channels. The “yellow”/light gray ink is about the same density as the main (dark) toner ink. Therefore this can act as a 1:1 offset if the blue curve points are conveniently located. The red/cyan inks are denser, so a smaller counter-move is needed with the red curve.

We conclude with the last channel, the blue channel:



The blue channel controls the yellow inkjet position. Therefore, adjustments to the blue channel curve will alter the distribution of the light gray ink in a hextone printer. You can probably achieve 85% of all adjustments by focusing on just the red and green channels. However, every once in a while you will benefit from adjusting the blue channel, and this is especially true if you need to make highlight adjustments.

Recall that the red channel didn't allow for any dark gray ink to enter from 0% to 25% on the grayscale. That is because this is the turf of the light gray ink. Looking at the above curve, it is anything but intuitive as to what's going on. Let's take it apart, piece by piece.

First, look at the farthest right quarter of the curve. This is the section you will want to adjust to make highlight alterations. This is fairly straightforward. Notice at about 30%, the curve starts to swing upwards all of a sudden. Recall that this is about the same point at which the dark gray ink gets activated through the red channel. So essentially what is happening is that the light gray is being turned off as the dark gray ink comes in. The light gray ink is still adding some density, but it will be superceded by the effects of the dark gray ink. Because the Epson driver limits the total amount of ink that is put onto the paper, removing the light gray ink allows the dark gray/cyan ink to be more fully used, saving ink and holding back the black ink starting point as much as possible to increase shadow tone smoothness.

Moving onwards, the curve swings back down again as it goes to full black. One might reasonably ask, why not just shut off the light gray ink completely after it has served its purpose from 0% to 25% by swinging the curve back to the top of the chart? The answer lies in the fact that the only way that full black can be activated is when all three channels (red, green, and blue) converge at 100% black (i.e. the far left bottom corner of the chart). Since there is no direct black ink control in the Epson driver, it looks at the RGB curves and substitutes black ink for them as they all approach the 100% point. Hence, even the blue curve must swing back down if we are to reach the fullest dmax possible.

In some cases the green and red curves will be full on before the 100% black point is reached. In this case, the blue curve, ironically, becomes the, de facto, black ink curve.

A few final thoughts:

You should now be able to start experimenting with adjusting the curves yourself. A few final thoughts are worth mentioning. First, the Ultratone inks will print on both matte and glossy papers. When printing on matte papers, the Roark curves should suit your needs well. The Epson driver settings for matte paper printing that work well are as follows:

Media type: Photo Paper
Print Quality: Photo 1440 dpi
Color Management: No Color Adjustment

Printing on glossy papers benefits from the following Epson driver settings:

Media type: Photo Quality Glossy Film
Print Quality: SuperPhoto 2880 dpi
Color Management: No Color Adjustment

Curves for glossy papers will hopefully be available soon from the MIS website. Glossy prints generally benefit from an overspray. PremierArt spray is one option that will protect the final image and also add to its archival stability. Other fine products are available as well. When printing on certain glossy papers, it may be necessary to remove the printer's "pizza wheels" that can damage the final image. This is a topic left for other venues.

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