

# **Controls**

Listed Alphabetically

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# Introduction

Controls are the building blocks from which a user interface is constructed. They provide tools and methods you can use to enter data and adjust settings. In addition to the standard Windows controls such as edit controls for entering text, check boxes and radio buttons, popup menus and drop-down lists, Picture Window has its own unique set of custom controls that are shared across transformations.

## **Amount**

Amount controls are used to adjust the strength with which transformations are applied and to create masks.

## **Color Cast**

The Color Cast control lets you pick a color to use for color balancing.

## **Color Line**

The Color Line control lets you select a starting and ending color and define how the transition is made from one to the other. It is used to define gradients and for tinting black and white images.

## **Color Picker**

The Color Picker is a separate window that pops up to let you select colors. It supports a variety of color selection methods.

## **Curve**

The Curve control is a very powerful tool for applying curves to images and displaying their histograms.

## **Dynamic Range Slider**

The Dynamic Range Slider control lets you specify a black and a white point for an image.

## **Hue Saturation**

The Hue Saturation control lets you base a brightness or brightness change on hue and saturation.

## **Image Picker**

The Image Picker control lets you select auxiliary images for use with transformations.

## **Range**

The Range control lets you specify a brightness or hue range.

## **Selective Color Correction**

The Selective Color Correction control lets you specify a set of color corrections to be applied to an image.

## **Slider**

Slider controls are used to adjust the values of settings. Both single and double sliders are supported.

## **Text**

Text controls let you enter text and specify its properties such as font, size, alignment, color, background, border, etc.

## **Threshold Slider**

Threshold sliders are specialized controls used to adjust sharpening thresholds.

## Amount

Most transformations that produce an output image the same size as their input image have one or more Amount controls. Initially, the amount control slider is set to 100% and there is a white square to the right of the slider.



As you reduce the amount slider down from 100%, more and more of the input image is blended with the output image to water down the effect of the transformation until at 0% you just get a copy of the input image. Here is an example using the Tint transformation applied at different amounts:



0%



50%



100%

As you reduce the amount percentage, the white square changes to gray and eventually to black when it gets to 0%.



Mathematically, the output image is computed as a weighted average of the input image and the transformation applied at full strength. To simplify the formula, assume that pixel values are scaled from 0.0 (black) to 1.0 (white), and that Amount percentages are also scaled from 0.0 (0%) to 1.0 (100%).

$$O = I * (1 - A) + R * A$$

Where O is the output value, I is the input value, A is the Amount setting, and R is the full-strength transformation value. As you can see, if Amount is 0.0, the output image is a copy of the input image. If Amount is 1.0, the output image is the full-strength transformation. For intermediate Amounts, the output image is a weighted average of the two images.

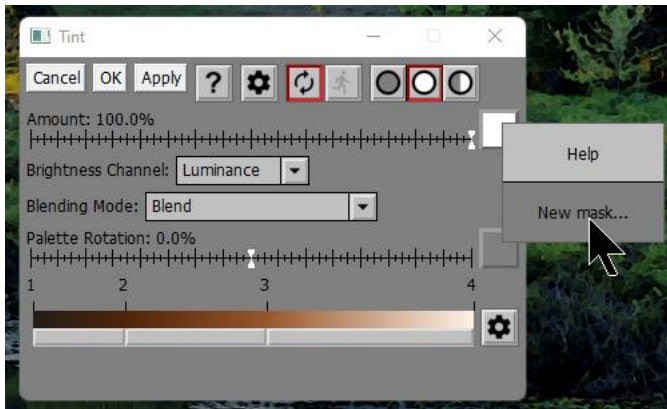
## Zero-centered Amount controls

Some Amount controls run from -100% at the left end of their scale to +100% at the right end, with 0% in the center. In this case, -100% corresponds to a black square, 0% to a gray square and +100% to a white square.

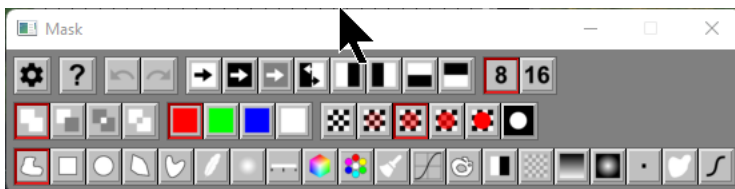


## Using an Amount control to create a mask

To localize the effect of the Tint transformation by creating a mask, click on the amount square and select New mask... from the menu.



This brings up the Mask dialog box which is the primary tool for creating and editing masks.



Skipping over the actual mask creation process, which is detailed in a separate document (Creating and Using Masks.pdf), let's assume we have already created a mask. At this point, the Amount control changes in two ways:



- The amount square is filled with a miniature version of the mask image. This lets you know there is a mask and gives you a rough idea of its shape.
- The amount slider splits into two parts—a black slider and a white slider, initially set to 0% and 100%. The readout also indicates the current values of the two sliders, with the black slider value first and the white slider value second.

Where the mask is white, the transformation is applied by an amount determined by the white slider. Where the mask is black, the amount is controlled by the black slider. So, assuming you leave the black and white sliders alone, where the mask is white the transformation is applied at full strength and where the mask is black, the input image remains unchanged. In between, you get a partial effect.



Mask



Tint with Mask

Adjusting the black and white sliders varies the amounts corresponding to where the mask is black or white. In the following example, where the mask is black, the amount is about 75% and where the mask is white the amount is about 25%:



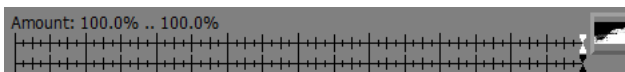
Mathematically, the effective Amount value at a given pixel location is determined by the mask pixel value and the values of the black and white sliders:

$$A = B + (W - B) * M$$

Where A is the effective Amount value, B is the black slider value, W is the white slider value, and M is the mask image value. Thus, if the mask is black (0.0), the effective amount is equal to the black slider value, and if the mask is white (1.0), the amount is equal to the white slider value. For intermediate mask gray levels, the effective amount is a weighted average of the black and white slider values.

## Dual Amount controls

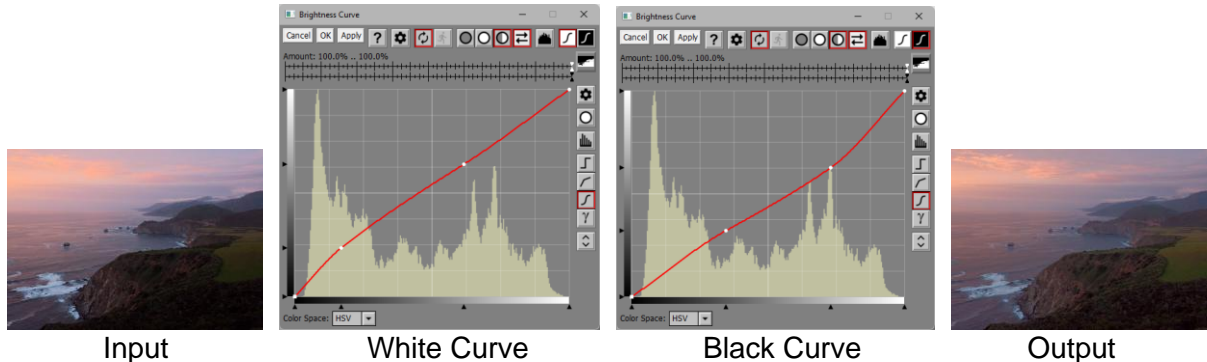
A dual Amount control is the same as a basic Amount control, except when used with a mask. This type of Amount control is used with transformations such as Brightness Curve that have two independent groups of settings – one for where the mask is white and one for where it is black. When you create an Amount mask, the Amount slider splits into two separate sliders, one black and one white.



The white slider controls how much of the white settings are applied where the mask is white, and the black slider controls how much of the black settings are applied where the mask is black.

For example, when you use the Brightness Curve transformation with a mask, you can apply one curve to the masked area and a different curve to the un-masked area. You might use this to lighten one area while darkening everything else or to increase the contrast in one area while decreasing it elsewhere.

In this example, the white curve is used to bring out shadow detail and the black curve it used to accentuate detail in the clouds:



Once you have set up the different white and black curves, you can then use the white and black amount sliders to scale back the effects of either curve to fine tune the effect.

If you only want to adjust the masked area, you can ignore the black curve -- either leave it as a diagonal from the lower left to upper right or set the black amount slider to 0%.

## Editing an existing mask

If you have already created an Amount mask and you want to modify that mask or perform some other mask operation, click the amount square and select Re-open Mask Dialog Box from the menu. This restores the previous Mask dialog box and lets you pick up working on the mask where you left off.

## Resetting a mask

To remove a mask from an Amount control, click on the amount square and select Reset from the menu. This clears the mask and restores the amount control back to a single slider.

## Reversing the black and white sliders

Clicking on the amount square and selecting Reverse Black and White Sliders from the menu swaps the positions of the black and white sliders. This has the same effect as inverting the mask without having to go into the Mask dialog box. This option is not available for dual amount controls.

## Selecting an existing black and white image as a mask

When you click on the amount square, if any 8- or 16-bit black and white images of the correct size are open and available, their names are appended to the menu. Masks from other



transformations also appear in the menu if they are the correct size. Selecting one of these images converts it for use as the initial mask. You can use the mask as is, or you can further refine it if you wish. This technique lets you create masks by opening them from saved image files or from some other image in the image tree.

### **Temporary Reset**

Shift-clicking the amount square temporarily resets the amount to 0% which effectively disables the transformation. This is a quick way to compare before and after versions of the transformation.

Ctrl-clicking the amount square temporarily resets the amount to 100% which enables the transformation at full strength over the entire input image, even if it has a mask.

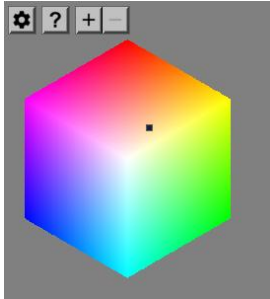
For zero-centered amount controls, both Shift- and Ctrl-clicking reset the amount to 0% which is the center of the amount scale.

### **Double Click Shortcuts**

Double-clicking the amount square is a quick way to create or edit an Amount mask. If there is no Amount mask, it selects New Mask... from the menu. If there is already a mask but no Mask dialog box, it selects Re-open Mask Dialog Box. Finally, if there is already a mask and a Mask dialog box is open, it selects Close Mask Dialog Box.

## Color Cast

The color cast control lets you select a color based on the HSV color space with V fixed at 100%. It is similar to the color picker control, but without a brightness slider. You can set a color either by using the controls described below or by clicking on the input image in the main image area.



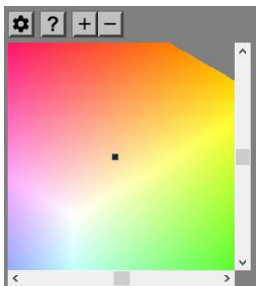
## Color Wheel

Clicking on the color wheel sets the current color.

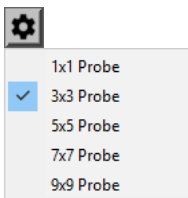
## Zoom Tool Bar



The zoom buttons let you zoom in or out on the color wheel. When you zoom in, the color wheel is enlarged centered on the current control point, if any, and scroll bars are displayed next to the color wheel to let you move around as illustrated below. Zooming in makes it easier to make fine adjustments to the control points; zooming out lets you see more of the color wheel at once. You can zoom in a maximum of four levels.



## Settings Menu



These settings determine the size of the probe used to select colors for new control points. Larger probes are less sensitive to noise while smaller probes can select finer detail.

# Color Line

Color Line controls let you define a sequence of colors that vary along a line. They are used by the Adjust, Gradient, Monochrome, Texture, Tint and Wave transformations and also for creating Masks.

Here is what a Color Line control looks like when it starts up:



The band across the center of the control shows you what color is assigned to each position along the line.

## Control Points

The numbered tic marks above the band identify control points along the color line. You can create additional control points between the first two by shift-clicking on or above the central band.

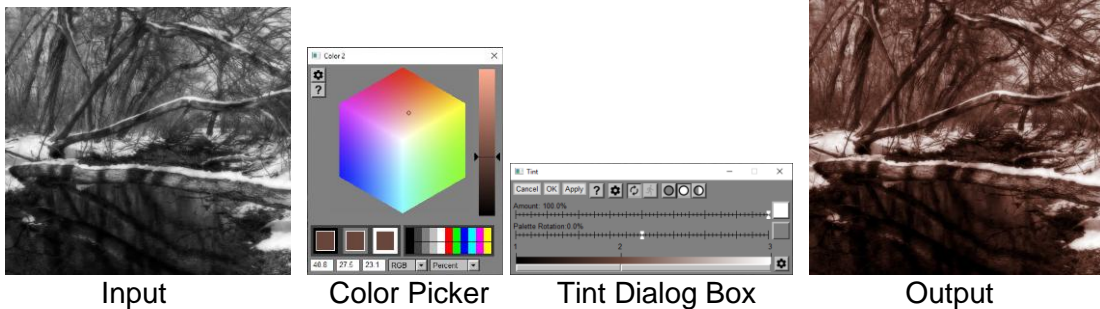


This adds a new control point and renumbers the existing ones. The initial color of the new control point is taken from the color of the center band at the point you shift-clicked.

To change the color assigned to a control point, double-click on its number to bring up a color picker whose title identifies the control point it goes with.

For example, the Tint transformation uses a color line control to let you convert black and white images to color. The color at the left end of the color line is assigned to black and the color at the right end is assigned to white. Intermediate grays are assigned to colors along the color line.

Here is what happens when you double-click on control point 2 and change its color when it is used with the Tint transformation:



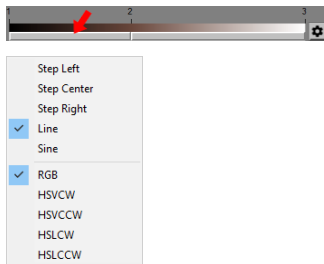
The colors on the color line between each control point make a linear transition from one color to the next. These intermediate colors are then used to fill in the gaps between control points.

You can drag control points left or right along the color line with two limitations: you can't move the first or last control point and you can't move one control point past another. The cursor changes shape when you hover over a control point so you know when you can drag it.

If you right click on a color line, you get a popup menu that lets you add or remove a control point at the location where you clicked. The remove option only shows up if you right click near an existing control point other than the first or last.

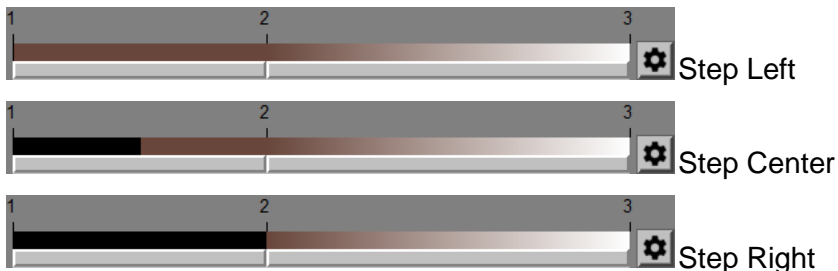
## Transitions

Between each pair of control points, below the central color band is a long, thin button. Clicking one of these buttons displays a menu you can use to alter the way the colors transition between the control points.



### Step Left/Center/Right

These options make an abrupt transition between the two color at the left control point, halfway between the two control points, or at the right control point



### Line/Sine

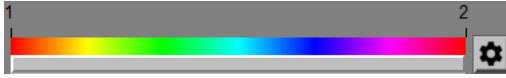
These options make the transition curve between the two control points either a straight line or an S-curve. The S-curve makes a slower transition at the endpoints and a faster in the middle.




## RGB / HSVCW / HSVCCW / HSLCW / HSLCCW

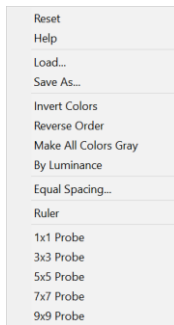
The normal setting for this group of options is RGB.

The HSV or HSL clockwise (CW) or counter-clockwise (CCW) options are a special case for making rainbow-like transitions. In this case, the colors between the two control points transition by rotating their hue either clockwise or counter-clockwise. For example:



## Settings Menu

Clicking the  button at the right hand end of the color line displays the Settings Menu:



### Reset

This returns the Color Line control to its initial configuration.

### Help

This displays the Color Line help topic.

### Load...

This lets you load a previously saved color line from a file. A number of pre-defined color line files are distributed with Picture Window.

### Save As...

This lets you save the current color line to a file.

### Invert Colors

This inverts the colors of all the control points.

### Reverse Order

This reverses the control points to make the color line run in the opposite direction.

### Make All Colors Gray

This replaces each color with a gray of the same luminance.

**By Luminance**

This sorts the current colors by luminance and positions each one on the color line such that luminance varies linearly from one end to the other. If one of the colors is black and another one is white, this produces a linear luminance color line that can be used to false color black and white images without altering their perceived brightness (see below for more on this topic).

**Equal Spacing**

This adjusts all the control points so they are evenly spaced.

**Ruler**


This toggles the display of a scale that can help you place control points accurately at specific locations along the color line.

## Linear Luminance Color Lines

Luminance is the perceived brightness of a color. Since the sensitivity of the human visual system is different for the three primary colors red, green and blue, luminance is computed as a weighted average of these three channels. A series of colors that varies from black to white in equal steps in luminance is called a linear luminance gradient. The simplest one is simply a set of neutral grays that vary uniformly from black to white.



These sorts of gradient are sometimes called false color maps and are useful, for example, when converting a black and white image to color in such a way as to preserve its perceived brightness while using color to help identify different tonal values as is done for example in weather maps.

There are many ways to add color to a neutral gradient without changing its luminance. A number of these gradients, in the form of color line files, have been pre-computed and are distributed with Picture Window. You can apply them to an image using the Tint transformation and loading the color line files by clicking the  button just to the right of the color line control and then selecting Load... from the options menu.

You can also create your own linear luminance color lines using the By Luminance command in the color line settings menu, if the list of colors includes pure black and pure white.

Below are illustrated the effects of applying these color lines to a uniform neutral gradient:

Red Luminance.color line



Green Luminance.color line



Blue Luminance.color line



Blue-Red-Green Luminance.color line



Blue-Red-Green-Yellow Luminance.color line



Magenta-Cyan-Green-Yellow Luminance.color line



Blue-Magenta-Cyan-Green-Yellow Luminance.color line



Blue-Orange-Pink.color line



Brown-Green.color line



Indigo-Purple-Pink.color line

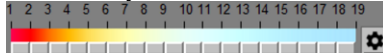


Indigo-Green-Pink.color line



## Other Color Lines Included with Picture Window

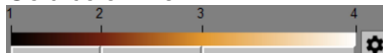
Black Body1.color line



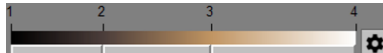
Color Bars.color line



Gold.color line



Monkstadt House Thiocarbamide v2.color line



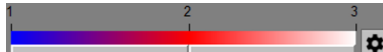
Rainbow.color line



Rannoch Moor Thiocarbamide v2.color line



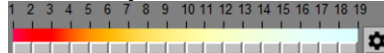
RWB2.color line



Wistman's Blue-Tone.color line



Black Body2.color line



Cyanotype.color line



Metal.color line



Monkstadt House Thiocarbamide v3.color line



Rannoch Moor Thiocarbamide v1.color line



RWB1.color line



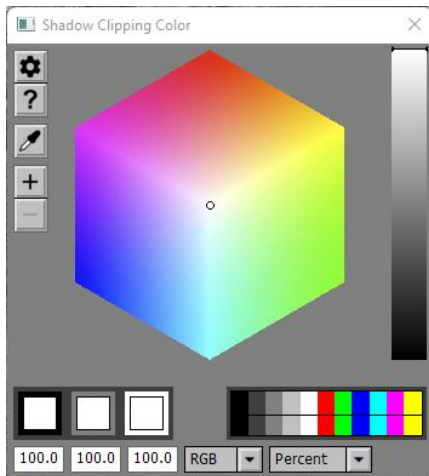
Sepia.color line





# Color Picker

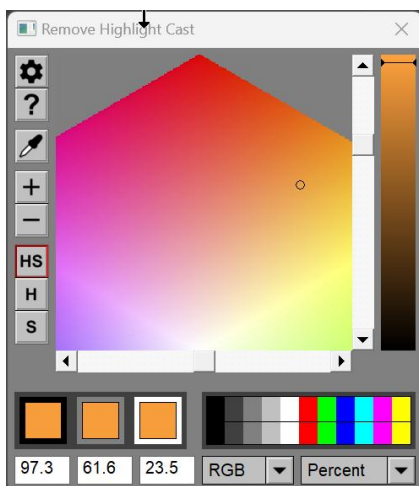
The color picker control lets you select colors. If you want to make it larger, the window can be resized by dragging its sides or corners. The title bar of the window identifies the setting the color picker is adjusting – this is useful in case multiple color pickers are open simultaneously.



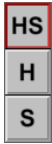
## Zooming and Scrolling the Color Wheel



This tool bar lets you zoom the color wheel display in or out up to 4X magnification so you can make very precise color selections or color changes. You can also zoom in or out using the mouse wheel. When the color wheel is zoomed in, scroll bars are displayed to let you reposition the color wheel image horizontally or vertically. If one of the buttons is grayed out, it means you have reached the limit for scrolling in or out.




## Hue Saturation Tool Bar



Normally, you can move the control point freely within the color wheel. To adjust just the hue or just the saturation, click the corresponding button. If you select hue-only, the control point will only move along a hexagon centered in the color wheel. If you select saturation-only, the control point will only move along a radial line.

## Probe

The  (eyedropper) button turns the probe on and off. Initially, the probe is disabled to prevent control from being diverted from the current transformation dialog box.

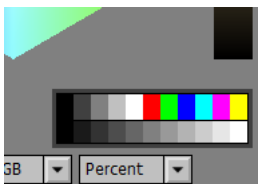
When the probe is on, you can set a color by clicking on the input or output image in the main image area. This samples the color of the image at the point where you clicked and sets the color picker accordingly. When you turn the probe off, control reverts to the current transformation dialog box, if any.

## Color Hexagon and Brightness Slider

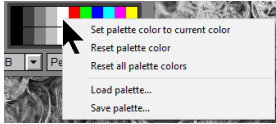
The color hexagon in the center of the color picker lets you select hue and saturation based on the HSV color model. The primary and secondary colors red, yellow, green, cyan, blue and magenta are found at the vertices of the hexagon, while white is located dead center. Saturation increases as you move from the center towards the edges. Hue varies with the angle about the center. Clicking on the color hexagon selects hue and saturation. Some versions of the color picker do not have a slider. If one is present, adjusting the slider brightness. You can set the brightness slider by clicking anywhere along its length. You can bump the brightness value up or down slightly by Ctrl-clicking to one side of the current slider position or the other. A Ctrl-click increments or decrements the brightness by 4 (out of 255) – if you Ctrl-Shift click instead, the brightness setting is incremented or decremented by 1 (out of 255).

## Color Bars and Custom Palettes

Clicking on one of the color bars at the lower right selects black, 25% gray, 50% gray, 75% gray, white, red, green, blue, cyan, magenta or yellow. If you have a custom palette defined using the palette tool, the bottom halves of these color bars are replaced with the custom palette and you can select custom palette colors by clicking on them. To illustrate this, a custom gray palette has been loaded in the following example:



You can also set or reset palette colors from within the color picker. When you right-click on a palette slot, a popup menu is displayed to let you set the palette color to the currently selected color, reset the palette color to its default, reset all the palette colors, load a new palette or save the current palette in a file.



## Color Sample

The three color patches to the left of the color bars display the currently selected color against black, gray, and white backgrounds.



## Color Readouts

At the lower left corner of the color picker dialog box, Picture Window displays the values of the three color channels of the currently selected color in the current color space. The value of each component is displayed in the current units (see below). You can enter numeric values into these controls to select colors directly – after a short delay, Picture Window changes the numbers you enter to those that correspond to the closest matching color. You can also display values in different units via the Settings Menu.

## Color Space

**RGB** -- color channel readouts are Red, Green and Blue

**HSV** -- color channel readouts are Hue, Saturation and Value

**HSL** -- color channel readouts are Hue Saturation and Lightness

## Units

**Percent** -- color channel readouts are scaled from 0.0 to 100.0

**Decimal** -- values are displayed in decimal (0..255)

**Hex** -- values are displayed in hexadecimal (0..ff)

## Settings Menu

**Color Wheel** -- displays the color wheel as shown above

**Filter Pack** -- lets you select colors by Wratten or CC filter designations (see below)

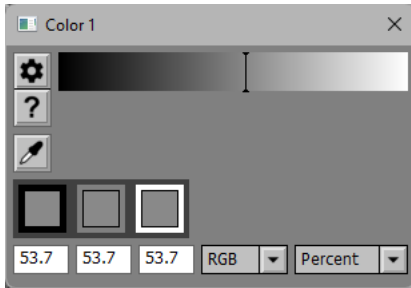
**Color Temperature** -- lets you select colors by color temperature (see below)

**Probe Size** -- determines the size of the area sampled by the probe

**Set Readout Defaults** -- sets the current color space (RGB / HSV / HSL) and units (Percent / Decimal / Hex) for the numerical readouts at the bottom of the window as the default to use the next time a color picker is created.

## Gray Color Picker

A special version of the color picker is displayed in circumstances where a gray level is being specified instead of a color. This color picker has no color wheel, only a brightness slider.



## Filter Pack -- Using CC and Wratten Filters

### Wratten Filters

Back in the days of black and white film, photographers used Wratten filters to emphasize different scene colors. Each filter has its own unique spectral characteristics. Picture Window's color picker includes a mode that lets you select colors based on standard Wratten filter numbers.


### CC Filters

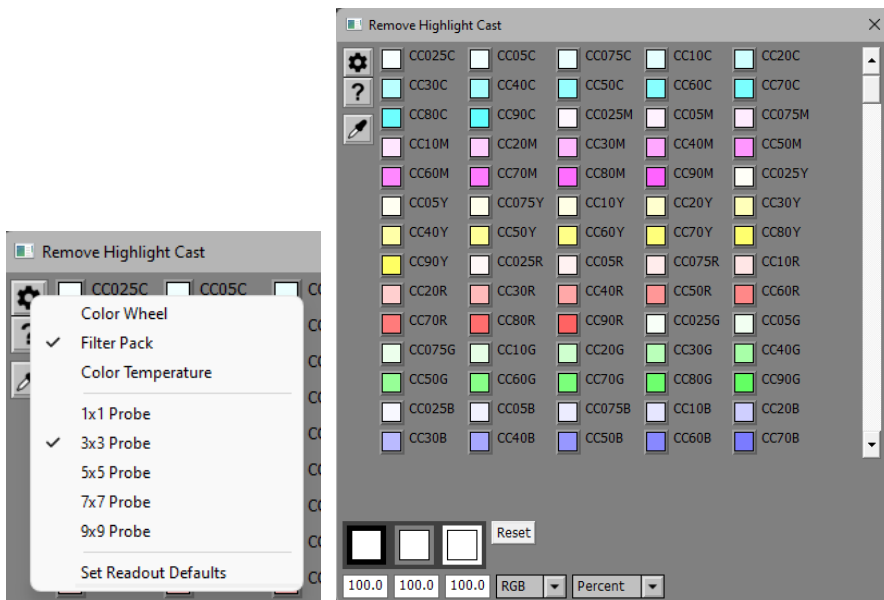
Also included are a full set of CC (color correcting) filters. CC filters come in a graduated set of each of the primary and secondary colors (red, green, blue, cyan, magenta, yellow). The filters are designated by their density and color. For example, a CC10M filter is a magenta color correcting filter with a density of 0.10. Filters with higher density transmit less light and are therefore darker and more intensely colored.

Color balancing an image using CC filters has two steps. First you identify the color cast of the image, and this takes a bit of practice. Then, to remove that color from the image, you must apply a filter whose color is the complement of the color you want to remove. For example, to remove the magenta cast in the image above, you would need to use a green filter since green is the complement of magenta. In addition, the density of the CC filter you need to use depends on the strength of the color cast in the original image.

### Filter Pack Mode

Picture Window's color picker lets you specify colors by either their Wratten filter number or CC filter designation. You can select more than one filter at a time which simulates stacking filters.

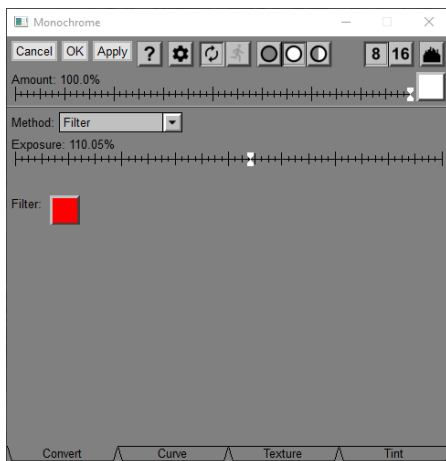
To activate the Filter Pack in the color picker, click the  button and then select Filter Pack from the menu.



This replaces the standard color hexagon with a set of colored buttons. Each button corresponds to a standard CC or Wratten filter, labeled with its filter number. You can use the scroll bar to bring more buttons into view.

Each time you click on a filter button, the corresponding filter color is added to the stack. You can combine as many different filters as you like. To deselect a filter button, simply click on it a second time. To deselect all the filter buttons, use the Reset button. If a filter button is selected, it is displayed as depressed.

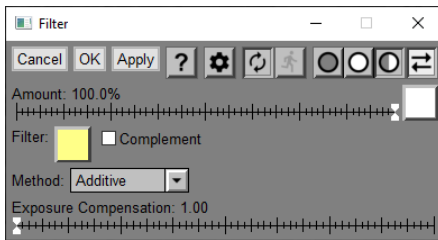
### Using Filters in the Monochrome transformation.



To use a filter in the Monochrome transformation, set the conversion method to Filter, click on the Filter control and select Select Solid Color from the menu. This brings up a color picker

which you can set to Filter Pack mode and then use to select the filter you want to use. If the image gets too dark, you can use the Exposure slider to compensate.


### Using Filters in the Filter transformation.

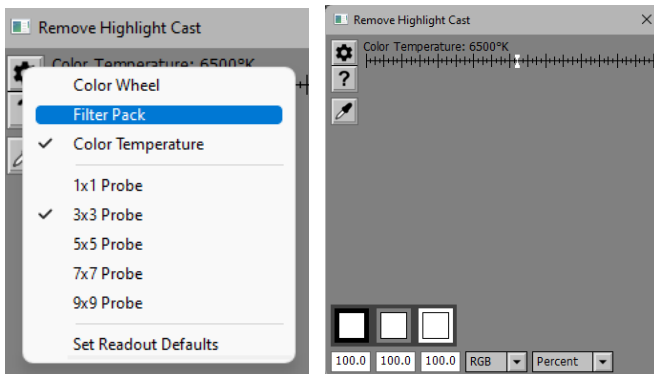


To use a filter in the Filter transformation, click on the Filter control and choose Select Solid Color from the menu. This brings up a color picker which you can set to Filter Pack mode and then use to select the filter you want to use. You can adjust the Exposure Compensation slider if the image gets too dark.

### Color Temperature

Picture Window's color picker can select colors by color temperature. This can be useful for adjusting the white point of an image.

To activate Color Temperature in the color picker, click the  button and then select Color Temperature from the menu.

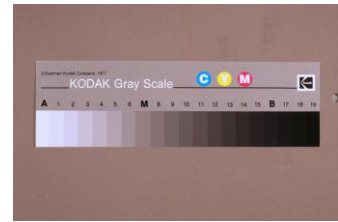
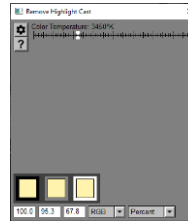
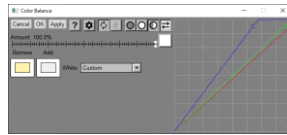
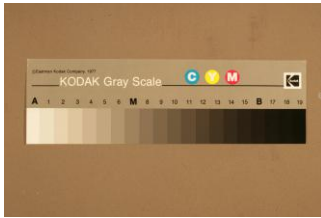


This replaces the standard color hexagon with a color temperature slider. Moving the slider left lowers the color temperature making the color more yellow/orange. Moving the slider right raises the color temperature towards blue.

Color temperature only applies to black body radiation like that produced by incandescent lighting. Lighting with different spectral characteristics such as fluorescent cannot be compensated for by adjusting color temperature.

Using the color temperature version of the color picker with the Color Balance transformation lets you change the color temperature of an image.

Here is an example of an image of a Kodak gray scale taken on a copy stand that used tungsten lights but with the camera white balance set to daylight.

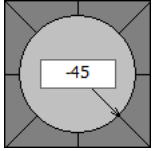


Using the Color Balance transformation and selecting the color to Remove using the color temperature slider can go a long way toward restoring the gray scale to neutral.

You can also get the same effect using the Filter transformation and setting the filter color to the same yellow, but then clicking the Complement checkbox.

# Compass

A compass control is used to specify an angle between -180 and +180 degrees.



To set an angle, click anywhere inside the control and drag to set the pointer. If you hold down the shift key while dragging, the angle is constrained to be a multiple of 15 degrees. The currently selected angle is displayed in degrees in the text control in the center of the compass. Or, if you prefer, you can enter a number of degrees directly into the edit control.

An angle of 0.0 degrees points horizontally to the right; angles increase as you rotate counter clockwise.



# Curve

Basic to the curve control are two important and related concepts, namely curves and histograms.

With a good understanding of curves and histograms, you can:

- Lighten images without losing highlight detail.
- Darken images without losing shadow detail.
- Adjust mid-tones without altering shadows or highlights
- Control brightness and contrast for each part of the tonal range.
- Evaluate image quality.
- Create many different special effects.

## What is a Histogram?

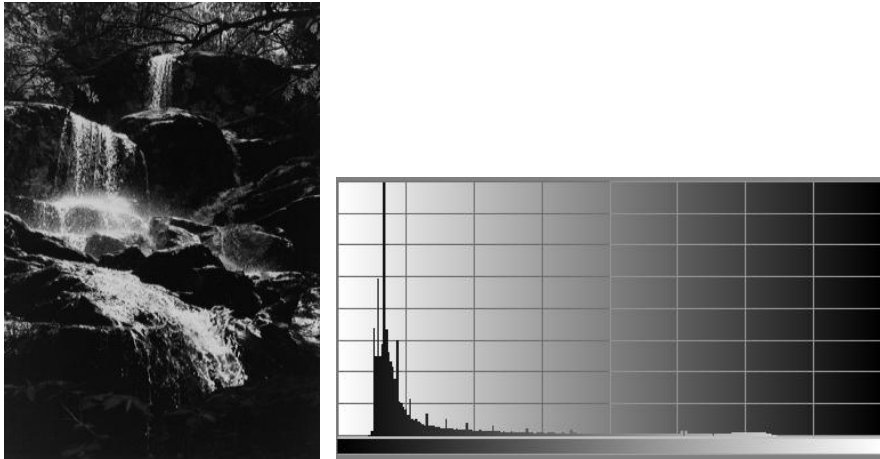
Thanks to digital cameras, most photographers have at least a passing understanding of histograms.

The term histogram has several meanings. Originally a graphical tool developed by statisticians to visualize frequency distributions, it has come to have a very specific meaning when used to characterize digital images.

To keep things simple, we'll start with black and white images; later we'll see how the same concepts work in color. In black and white images, each pixel has a specific brightness level between 0 and 255. Black corresponds to 0 and white corresponds to 255. Most observers, even under ideal conditions, can barely distinguish 200 different gray levels, so the 256 available gray levels in a digital image, if properly used, are more than adequate to represent even the most subtle variations in a black and white image.

## How histograms are computed

Imagine a row of 256 buckets, the first one labeled 0, the next one labeled 1, and so on up to 255. The histogram of an image such as the one shown below is computed by examining each of its pixels and tossing it into the bucket that corresponds to its brightness level. When we're done, we count how many pixels are in each bucket. Picture Window displays histograms as a graph that looks like this:



The gray scale along the bottom of the histogram indicates the brightness level of each bucket, starting with 0 at the far left (black) and progressing up to 255 on the far right (white). For each brightness level, there is a vertical white line that represents how many pixels in the image have the corresponding brightness level. To make the display fit the available space, pixel counts are scaled vertically so the tallest line runs all the way from the bottom to the top of the graph. This means you cannot directly compare the heights of peaks in two different histograms.

## How to Interpret Histograms

The basic idea is simple: where you see a tall line in a histogram display, it means there are a lot of pixels of the corresponding brightness level in the image. Where you see a short line or no line there are very few or no pixels of that brightness level.

## Determining Overall brightness

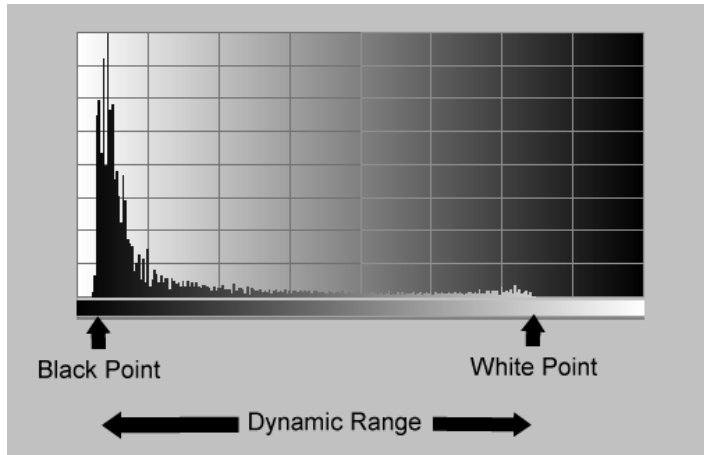
The first thing we can tell about the example image above based on its histogram is that most of it is dark since most of its pixels have relatively low brightness levels as indicated by the lines at the left of the histogram being much taller than those at the right.

Each image has its own unique distribution of light and dark tones—there is no right or wrong histogram. If an image is made up of all one shade of gray, then the histogram of that image consists of a single line corresponding to that gray level. If it is part one gray and part another, then it would have two lines, one for each gray level, and their relative heights would reflect how much area of the image is covered by each gray. If the image is a smooth gradient going all the way from black to white, each of the lines in the histogram would be the same height since there would be equal numbers of pixels of each brightness level.

The histogram says nothing about where the pixels are located within the image, just how many of them have a given brightness level. You get exactly the same histogram if you rearrange all the pixels as long as you don't change their brightness.

## **Dynamic Range -- Finding the darkest shadows and lightest highlights**

The next thing we can tell about an image from its histogram is its darkest shadow and lightest highlight, sometimes called the black point and the white point.



If the histogram is 0 there are no pixels of the corresponding brightness, so we can see that where the histogram drops to 0 on the left (marked Black Point), there are no pixels in the image darker than this. Similarly, where the histogram falls to zero on the right (marked White Point), there are no brighter pixels in the image. These two points define the dynamic range of the image—the range between its darkest and lightest parts. We can see from looking at the histogram of this image that its shadows do not go all the way to pure black and that its highlights also fall short of pure white. The greater the dynamic range of an image, the more contrast it has. If all the lines in the histogram fall in a narrow range, the image has only a small variation of gray levels and will consequently have very low contrast. Whether this is good or bad depends on the effect you want to achieve.

## **Shadow and Highlight Clipping**

A spike in the histogram at the black or white end is an indication that shadows or highlights have been clipped. This can be a legitimate creative choice, but usually it indicates under- or over-exposure with an associated loss of shadow or highlight detail. The best way to fix this is during raw file conversion when you have access of the full exposure range of the sensor.

## **Posterization -- How smooth is the histogram**

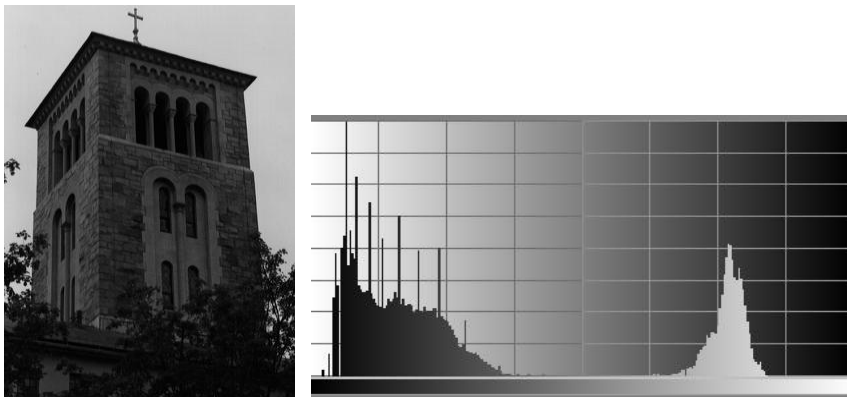
Posterization occurs when an image is rendered using a limited set of colors or gray levels. The smoothness of a histogram can tell you how well the image represents subtle tonal variations. The more the histogram consists of isolated spikes separated by empty spaces, the more the image is posterized. While intentional posterization can be a very striking special effect, in normal images excessive posterization of an image indicates a loss of subtle tonal detail which in turn

can mean lower image quality. Posterization can be caused by starting with a posterized original or by excessive or extreme image manipulation.

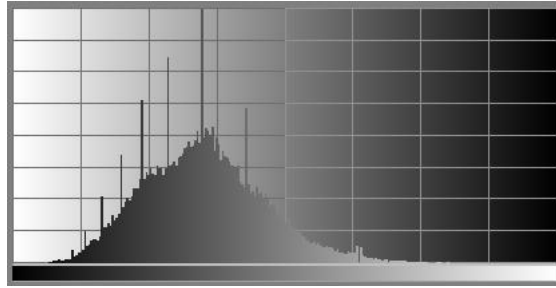
Even if you start with a digital image that has a nice smooth histogram that covers the entire tonal range, each time you perform operations on the image that change its brightness curve such as trying to bring out shadow, mid-tone, or highlight detail, you will unavoidably lose some brightness levels. The best way to keep this loss of tonal variation from becoming visible in the image is to work with 16-bit images derived from raw files. This gives you enough extra brightness levels that even after you lose some, the effects will usually be negligible. The more radical the changes you make, the more likely you are to introduce visible artifacts. For example, if you heavily brighten a severely under-exposed image to bring out shadow detail, in addition to amplifying image noise, you will also likely introduce some posterization.

## Examples -- Two Images and Their Histograms

To help you get a feel for the relationship between an image and its histogram, here are some more examples.

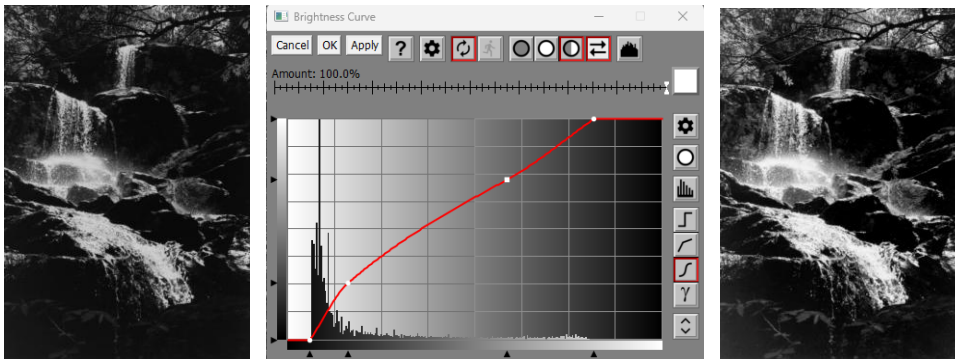


The histogram of this image has two peaks, a broad one in the shadow area and a narrower one in the light gray area. These correspond to the foreground and building which are large and dark and the background sky which is a fairly uniform light gray. The area under a peak is proportional to the percentage of the pixels in the input image that have a particular brightness range; the width of the peak indicates the brightness range it covers. As you can see, while this image has plenty of dark tones, it does not go all the way to white which makes it somewhat dingy. Also, there are essentially no mid-tones, which is typical of images that silhouette a dark subject against a light background or vice versa.



This image has a fairly smooth histogram. Note that it does not go all the way down to black or all the way to white, but that is normal for this type of image because the original scene lacked deep shadows or bright highlights.

## The Brightness Curve Transformation

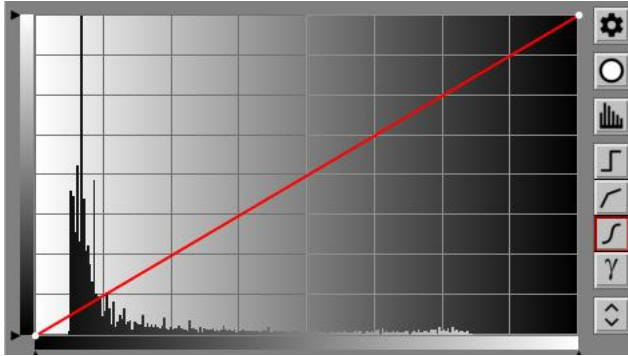


Picture Window's Brightness Curve transformation lets you work with curves and histograms to adjust the brightness and contrast of your images.

Within the Brightness Curve transformation, curves and histograms are adjusted using a Curve control. This same control is also incorporated into many other transformations, so once you master it you will also know how to use it in other contexts.

The Brightness Curve transformation is based on a very simple principle. Each pixel in the output image is computed by applying a curve to the corresponding value in the input image. The curve is just a table of 256 values, each corresponding to a brightness level from 0 to 255. For each input pixel, its brightness is changed to the value found in the corresponding table entry and the result is stored in the output image.

For example, suppose the table simply contains the sequence of numbers from 0 to 255. Then the output image will be an exact copy of the input image because brightness level 0 is set to 0 and so on up to 255. If we draw a graph of this table, we get a curve like this—a straight line running diagonally from the lower left corner (0,0) to the upper right corner (255,255):

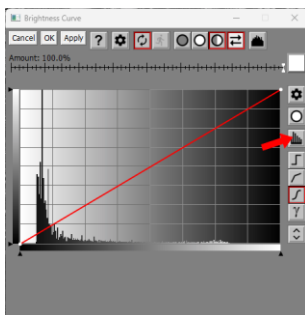


To see what the curve will do to a pixel of a given brightness, locate its gray level along the horizontal axis, run a vertical up from that point to the curve and then run a horizontal from the intersection point over to the vertical axis and read off the corresponding brightness value in the output image.

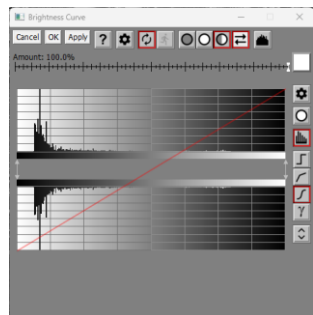
## Switching between Curve and Histogram

The Brightness Curve transformation lets you work with both the brightness curve and with the brightness histogram at the same time. You can view the curve in the foreground with the input image histogram displayed in the background, or you can view the input and output image histograms with the curve displayed in the background.


To switch from one view to the other, use the  button to the right of the curve display.



Curve Display



Histogram Display





When you click the  button, the display switches over to show you two histograms, one above the other. The top histogram is for the input image and remains unchanged for the duration of the transformation. The bottom histogram is displayed upside down and shows you what the histogram of the output image will be after applying the curve to it. This histogram changes as you experiment with different curves. For each control point (see below) on the curve, Picture Window displays a pair of arrowheads connected by a line. The top arrowhead defines a

brightness level in the input image and the bottom arrowhead the brightness level it will be changed to in the output image.

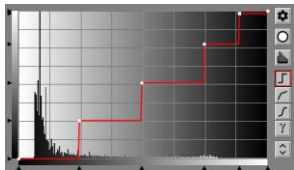
## Control points

There are several ways to alter a curve. The simplest is to click and drag one of the little circles that indicate control points on the curve. Initially, there are just two of these, one at either end. To create additional control points, shift-click on the curve where you want the new control point to appear. To remove a control point, position the cursor over it and ctrl-click. Neither the first nor the last control point can be removed.

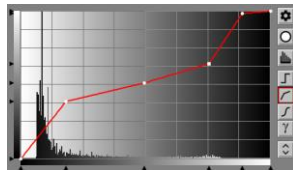
The current control point is displayed as a small square while the other control points are displayed as small circles. The current control point is usually the one you most recently added or moved.

-  The curve always passes through all the control points, no matter how many you create.
-  The more points you add, the more control you have over the shape of the curve. In practice, however, only a small number of control points are required for most operations.
-  There are many different shapes of curves that can be passed through the control points.
- 

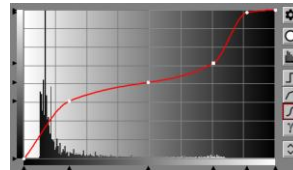
Here are some examples of the four different types of curves:



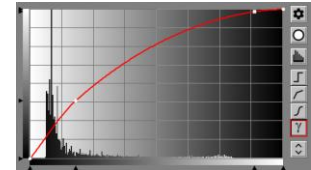
Stair Step



Broken Line



Smooth



Gamma

Gamma only applies if there are exactly three control points. If there are more than three, it switches to Smooth; if there are less than three, it switches to Broken Line.

For the most part, control points can be moved freely, but you cannot move one control point past another horizontally. To move a control point, simply position the cursor over it until the cursor changes to a crosshair and then click and drag it to the desired location. In the curve display, for each control point there are a pair of arrowheads displayed one along the bottom edge of the graph and one along the left edge. These arrowheads track the motion of the corresponding control point. You can move a control point in a single direction, either horizontally or vertically, by clicking and dragging the corresponding arrowhead.

Adjusting control points from the histogram display is even simpler. All you need to do is click and drag one of the upper or lower arrowheads. To insert a new control point, shift-click anywhere along the base of the upper histogram; to remove a control point, position the cursor over the upper arrowhead and control-click.

## Adjusting dynamic range

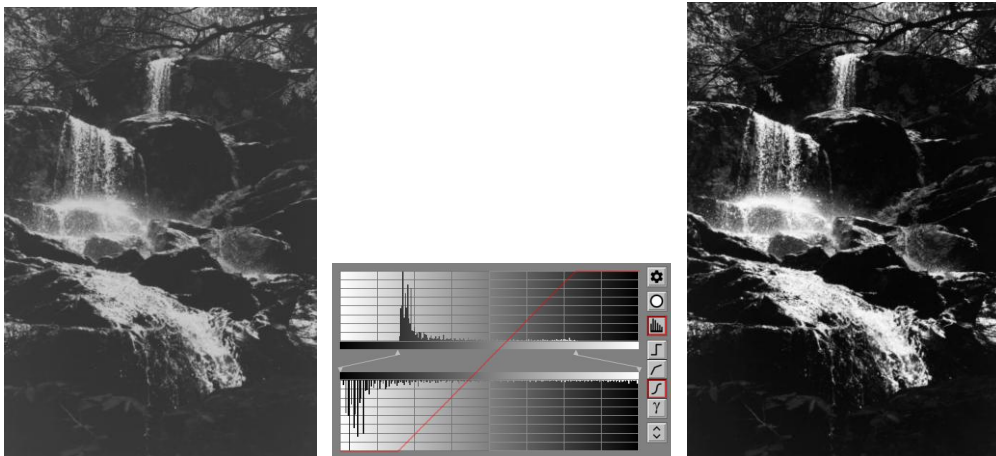
You can either increase or decrease the dynamic range of an image very easily using the double histogram display.

Start by positioning the upper arrowheads to the black and white points of the image. These correspond to the darkest and lightest points in the input image. Then move the bottom arrowheads to where you want the black and white points to be in the final image. In changing the histogram control points, you are simultaneously changing the control points of the curve. For reference, the curve is displayed in the background along with the histograms.

Moving the bottom arrowhead for the black point lightens or darkens the shadow areas. Moving the bottom arrowhead for the white point lightens or darkens the shadow areas. The farther apart you move the two arrowheads, the greater the spread of tonal values in the resulting image and hence the greater the contrast. The closer you move them to each other, the narrower the range and the lesser the contrast.

## **Making an image use the full dynamic range**

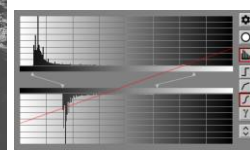
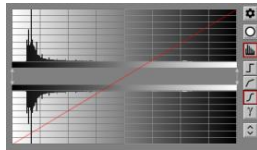
To make the result image use the entire available tonal range from black to white, without losing highlight or shadow detail, position the top arrowheads at the black and white points and the bottom arrowheads at the far left and far right of the brightness scale. Notice that the slope of the corresponding curve gets steeper the more the contrast is increased.



## **Reducing dynamic range**

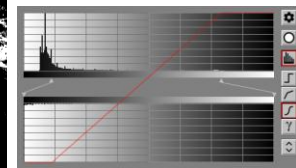
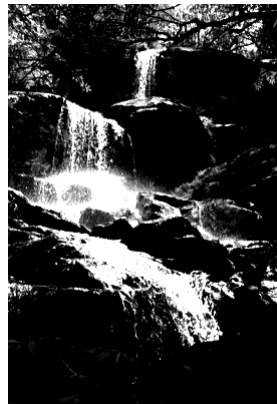
To reduce the dynamic range, move the bottom arrowheads closer together. Moving the lower left arrowhead to the right lightens the shadows; moving the lower right arrowhead to the left darkens the highlights. The closer together you move the bottom arrowheads, the lower the contrast. Notice that the slope of the corresponding curve gets smaller the more the contrast is reduced.





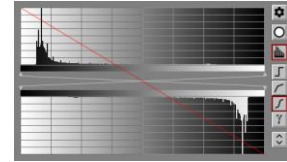
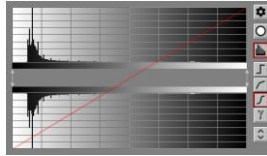
## Creating extreme contrast

If you move the upper left arrowhead right past the black point, you will continue to increase the contrast of the image but you will start to lose shadow detail; if you move the upper right arrowhead left past the white point, you will continue to increase the contrast of the image but you will start to lose highlight detail. You can tell this is happening because the bottom histogram will start to show a sharp spike at black or white. If you see an image with this kind of histogram it is a sign that it was either over- or under-exposed or that somewhere in the manipulation of the image it was lightened or darkened too much. Of course, if you want to create a dramatic high contrast image, this effect may be exactly what you want.



## Creating a negative image

If you reverse the positions of the bottom arrowheads, you get a negative image. The bottom arrowheads correspond to the brightness levels you want in the final image. If you move the lower left arrowhead all the way to the right, you are telling Picture Window to make the dark parts of the image light; if you move the lower right arrowhead all the way to the left, you are making the light areas dark. Changing dark to light and light to dark gives you a negative. Notice that the corresponding curve slopes downward instead of upward.



## Using Curves to adjust brightness and contrast

While histograms are a powerful tool for adjusting the dynamic range of an image, curves are sometimes better for adjusting its brightness and contrast. You can switch back and forth between the two methods at any time.

Here are a few very important things to keep in mind about curves:

- Where the curve lies above the diagonal line connecting the lower left corner to the upper right corner, it will lighten the image; where it lies below the main diagonal it will darken the image. The closer the curve lies to the main diagonal, the more subtle its effect on the image; the farther away, the stronger the effect.
- Where the curve rises steeply, it will increase the contrast of the image; where it rises slowly, it will decrease the contrast. Increasing the local contrast in one part of the tonal range always decreases it in another part.
- Where the curve is flat, the image will be posterized.
- Where the curve slopes downward, the image will be a negative or solarized.
- Kinks in the curve usually produce some kind of artefact in the image. Unless you are trying to create special effects deliberately, try to keep your curves smooth.

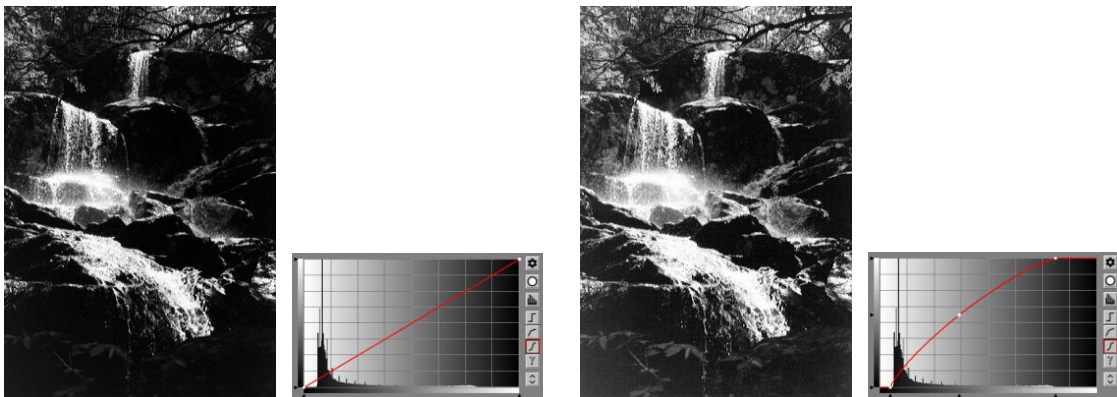
To fully control brightness and contrast, you will usually need to add control points to the curve. Additional control points give you more control over the shape of the curve since the curve always passes through each control point. To add a new control point, first position the cursor over the curve display where you want the new point to be and then shift-click (click the left mouse button while holding down the shift key with your other hand). To remove control points (except for the first and last point which cannot be removed), position the cursor over the control point and control click (click the left mouse button while holding down the Ctrl key).

## Lightening or darkening an image

Let's continue using the same image and assume that we have just used the histogram to increase its dynamic range to go all the way from black to white, but we still want to lighten it up to help bring out some of the shadow detail.

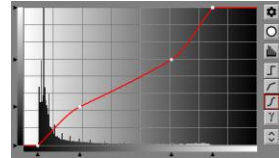
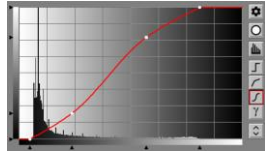
The first way you might think of to brighten an image is to add a fixed amount to each of its brightness values. This corresponds to shifting the entire curve upward or shifting the entire histogram to the right. The problem with this approach is that it can cause the darkest shadow areas to lighten up but it can cause loss of highlight detail. This shows up in the histogram as a blank space at the left end of the histogram and spike at the right hand end indicating that a number of different brightness levels at the lighter end of the scale have all been changed to the same maximum level. A similar problem occurs when attempting to darken an image by shifting its histogram to the left. To avoid this difficulty, we need to lighten or darken the intermediate brightness levels while leaving the black and the white points unchanged. To do this we need a curve that is not a straight line. Here's one way to do this:

First add two intermediate control points in the middle of the curve and then position them as illustrated below on the right. Make sure you leave the first and last control points fixed as these determine the dynamic range. Notice that since the curve lies above the main diagonal, it is lightening the image. Also notice that because it slopes steeply on the left that it is increasing the contrast in the shadows; since the slope is flattened in the highlight area we are reducing the highlight contrast. The result is a brighter image with a lot more shadow detail. To darken an image, arc the curve downward (below the main diagonal) instead of upward.




## Increasing or decreasing mid-tone contrast

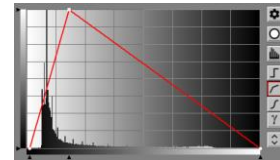
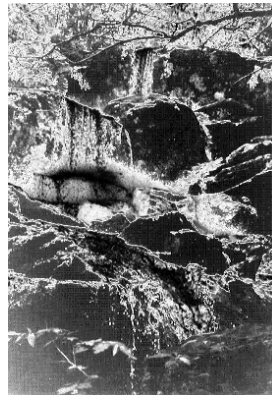
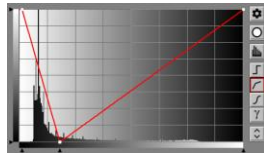
When people talk about increasing or decreasing the contrast of an image, they are usually talking about increasing or decreasing its mid-tone contrast. Bear in mind however that you cannot increase contrast in the mid-tones without decreasing either the shadow or highlight contrast or both. Increasing the mid-tone contrast involves lightening the highlights and darkening the shadows. Reducing the mid-tone contrast means lightening the shadows and darkening the highlights. The curves look like this:




## Special effects -- solarization

Solarization is a special effect where part of the tonal range is inverted. This creates an image which is part positive and part negative. To solarize, you need to make part of the curve slope upward and part slope downward.

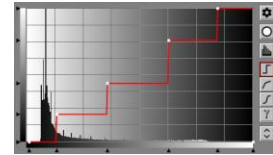
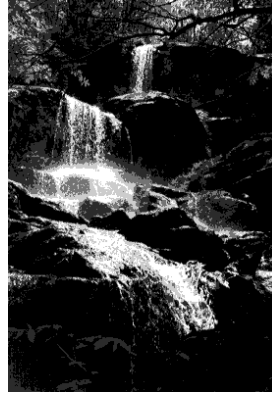
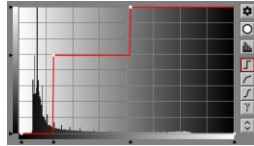
For solarizing, a broken line curve  often gives the best results. The following examples illustrate different types of solarization and the curves that produce them.



## Special effects -- posterization

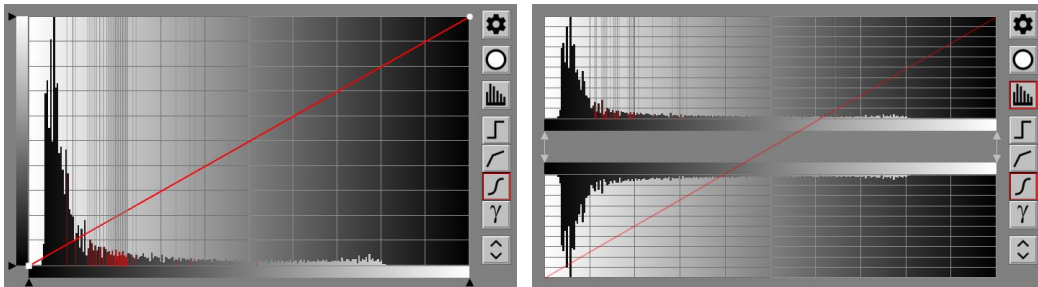
Posterization is the result of rendering an image using a limited number of gray levels. This creates an image made up of areas of solid color, something like a silk-screened poster. To posterize, you need to make a curve that has a series of stair steps . To create more gray levels, add more control points; the more levels you use, the more subtle the effect. If the stair step curve runs primarily above the main diagonal, the posterized image will be brighter than the original; if it runs below the diagonal, the result will be darker. You can combine posterization with solarization for additional effects. The following examples illustrate two different posterization curves and the effects they produce. The first example uses only three gray levels (black, white and a fairly light gray); the second uses five (black, white, and three intermediate grays).





## Using the probe

When the brightness curve transformation is active, its probe is enabled. This means that as you drag the cursor over the input image, red marker lines appear in the curve or histogram display to show you the brightness value of that part of the image. The marker lines highlight the input histogram display as illustrated below. The point where the vertical red line intersects the gray scale at the bottom of the curve or histogram is an indication of the brightness of the input image at the probe's location. The lines are erased when you release the mouse button.



The brightness probe is a very useful tool. For example, suppose there is one part of an image that you want to lighten or darken. Clicking and dragging the cursor over the region in the input image you want to alter and noting where the markers show up on the curve or histogram display, shows you what part of the tonal range needs to be changed. To lighten or darken that part of the tone scale, you can use either the curve or the histogram.

Either way, the first step is to create a new control point at the brightness level of the region you want to change. There are two ways to create a new control point:

- Shift-clicking over a part of the input or output image representative of the brightness level you want to modify automatically inserts a new control point at the corresponding point in the curve or histogram. You can always tell which control point you created since it becomes the current control point and is therefore displayed as a small square instead of a small circle.

- Shift-clicking over the curve or upper (input) histogram where you want the new control point to appear inserts a new control point at the cursor location. You can base the location on the results of previous probing of the image.

The next step is to apply brightness corrections using the curve or histogram.

If you are using the curve, then drag the new control point up to lighten or down to darken -- the farther you move it, the brighter or darker that part of the tonal range will become.


If you are using the histogram, then drag the control point's bottom arrowhead to the right to brighten or to the left to darken.

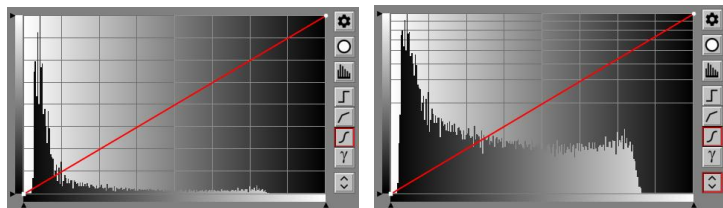
To increase or decrease the contrast for the part of the image corresponding to the new control point, adjust the curve to increase or decrease its slope as it passes through the control point.

If you start changing other parts of the image that you don't want to modify, you can probe them and create additional control points to control their brightness independently. If you end up creating a curve that is not fairly smooth, it will probably result in some kind of visual artifact in the result image since the local contrast will either be very low or very high in some parts of the brightness scale. If this happens, switch to the curve view and adjust the control points to make the curve smoother. If you can't get the effect you want on one region without adversely affecting other parts of the image, you will need to create a mask that isolates the region you want to adjust. This lets you restrict the transformation to a specific part of the input image.

## Histogram Expansion

When Picture Window displays a histogram, it is automatically scaled so the largest value fills the available space between the top and the bottom of the graph. If a histogram happens to contain one very tall spike, this can create a situation where the rest of the information in the histogram is scaled down so much that it disappears or becomes too small to interpret. Note that expanding the histogram only affects the histogram and the grid but does not affect the curve.

If this happens, you can use the  button to exaggerate small values and compress large values. This expanded scaling lets you see both the small histogram values and the large ones at the same time even if the large ones are huge and the small ones are tiny. However, when using histogram expansion, you must bear in mind that large values are really much larger than they appear and small values are smaller.

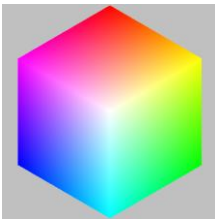


Histogram expansion is particularly useful to identify the true white and black points of an image when adjusting its dynamic range.

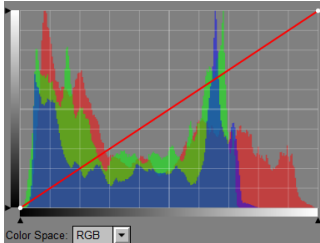
## Working with color images

Everything so far has dealt with black and white images, but what about color? For color images there are many different ways to compute histograms. We could compute separate histograms for the red, green, and blue components of the image or, what is often more useful, we can use the HSV or HSL color space and just histogram the brightness component, ignoring the hue and saturation. This lets us work with the brightness of the image without worrying about changing its color.

Interpreting a color brightness histogram requires some understanding of the underlying color model. In the HSL model, a brightness level of zero corresponds to black and a maximum brightness value corresponds to white. In the HSV model, zero brightness still corresponds to black, but the maximum brightness value corresponds to any color whose red, green, or blue component is maxed out at 255. This includes all the colors in the color hexagon.



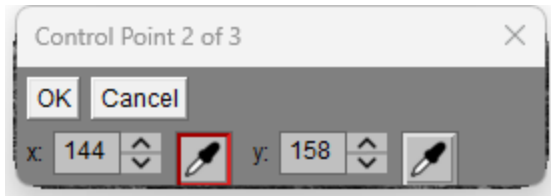
When you select the RGB color model, Picture Window displays superimposed histograms of each channel.



The main thing to remember about the difference between HSV and HSL color spaces is that when you lighten an image using HSV, the colors get brighter while remaining fully saturated, but they never reach pure white. As you lighten using HSL, colors all approach pure white but become progressively more washed out. Choose the color space according to the effect you want to achieve.

## Editing Control Point Locations

In addition to dragging control points, you can also change their location by entering numeric values or by sampling from the main image area. To edit the current control point's location, double-click on the curve control. The current control point is the last one you selected by clicking on it and is displayed as a square instead of a circle. This brings up a dialog box:



The title bar tells you which control point you are editing.

You can enter new values for the x- or y-coordinates of the control point directly. Coordinates run from 0 to 255. Or, you can select the probe to set either the x- or y-coordinate by clicking on an image in the main image area.

For hue curves, the y coordinate is positive or negative depending on whether the control point is above or below the horizontal mid-line. Hue curve y coordinates run from -128 to +127.

The x-coordinate must be between the previous and next control points since you cannot move one control point past another.

Canceling (or closing the dialog box) resets the control point to its original location.



## Examples – HSV vs HSL

In this example, the same image is lightened two different ways. The lightening is more extreme than what you might normally do, to make the difference between the two methods more pronounced.



Original Image



Lightened using HSV

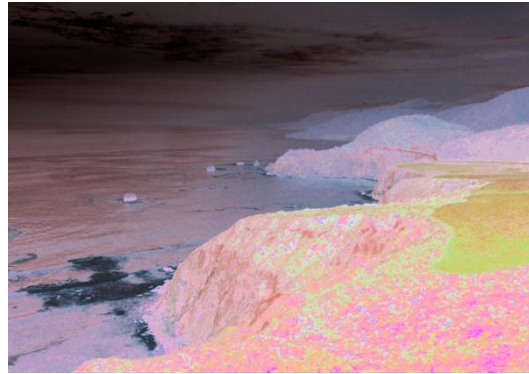


Lightened using HSL

RGB is not recommended for lightening or darkening images. When you use this color space, the same curve is applied to each of the three components of the image which can result in hue or saturation shifts in different parts of the image. Working in HSV or HSL avoids this problem. On the other hand, when using the Brightness Curve transformation to produce special effects like solarization and especially posterization of color images, sometimes the best results are obtained using the RGB color space instead of HSV or HSL. For example, creating a negative image using RGB yields an image where each color is replaced by its complement and light colors become dark and vice versa. The same effect applied in the HSV or HSL color space leaves the hue and saturation of each pixel the same and just inverts the brightness—the effect is very different:




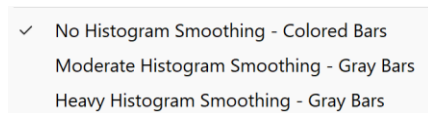
Negative using RGB



Negative using HSV

## Histogram Smoothing

The Curve control has its own Settings menu which you can access via its  button displayed just to the right of the curve area. The last group of three items in the menu let you select how much histogram smoothing (none, moderate, heavy) you want and whether to display solid or colored histogram bars.



Smoothing noisy histograms can make them easier to interpret since fluctuations from one brightness level to the next do not make much of a difference in the image. Turning histogram smoothing off makes it easier to evaluate how noisy the histogram is -- a noisy histogram can be a sign of reduced image quality.

When you select Colored Bars for HSV or HSL histograms of color images, the vertical histogram bars are colored to reflect the colors in the image.

For HS Each vertical bar corresponds to a brightness level in the input image. To create the histogram, each pixel in the input image is converted to HSV or HSL where brightness (V or L) is broken down into 256 levels and hue (H) is further broken down into 32 levels for each brightness level. For each of the 256 brightness levels, the histogram records the number of pixels of each of the 32 hue levels as well as their average saturation level (S). When displaying the histogram, each of the 256 vertical bars is divided into 32 colored segments whose height represents the relative amount of each hue. The brightness of the segment is set to its corresponding brightness level, and the saturation of the segment is the average saturation of pixels of that brightness and hue.

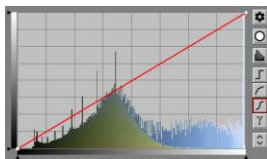
When you select Colored Bars for HSV-H and HSL-H histograms, each vertical bar corresponds to a hue level in the input image. To create the histogram, each pixel in the input image is converted to HSV or HSL where hue is broken down into 256 levels and brightness (V or L) is further broken down into 32 levels for each hue level. For each of the 256 hue levels, the histogram records the number of pixels of each of the 32 brightness levels as well as their

average saturation level (S). When displaying the histogram, each of the 256 vertical bars is divided into 32 colored segments whose height represents the relative amount of each brightness. The hue of the segment is set to its corresponding hue level, and the saturation of the segment is the average saturation of pixels of that brightness and hue.

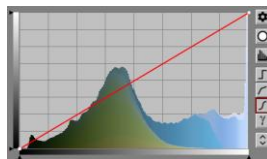
Using colored bars helps you see which parts of the image contribute to which parts of the histogram. Here is an example of an input image and the way its brightness histogram looks using each of the four settings:



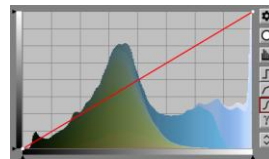
Input Image



No Smoothing



Moderate Smoothing





Heavy Smoothing

When Colored Bars are displayed, you can see how the blue sky and white clouds contribute mostly to the brighter parts of the histogram while the green foliage and shadows are concentrated on the dark side. To create a curve that affects mostly the sky or the shadows you can immediately see what parts of the brightness range you need to modify.

## Composing Curves

The idea behind composing two curves is to create a new curve whose effect is like applying the first curve to produce a temporary image and then applying the second curve to that temporary image.

Assume you have two curves: A and B, and that each one has been saved in its own curve file. To create a curve C that combines the effects of applying curve A followed by curve B:

- Click the  button in the curve control and select Load... from the settings menu. Then select curve B to load it.
- Click the  button in the curve control and select Exact Compose With... or Approximate Compose With... from the settings menu. Then select curve A to compose the two curves.
- This adjusts all the control points in the curve B according to curve A to produce curve C.

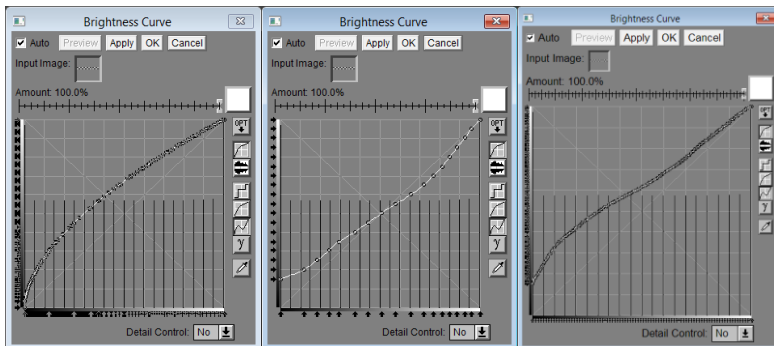
If you do an Exact Compose, the final curve C will have 256 control points, regardless of the number of points in the first curve or its style. Since a curve with this many control points is nearly impossible to edit, you can use Approximate Compose instead which creates a final curve C with fewer control points but which may be very slightly inaccurate.

To compose the A and B in the other order, simply start by loading the curve A and then compose with the curve B.

An example of composing two curves might be if you have two curves—one that lightens shadow detail and one that increases contrast. You can compose them to create a single curve that first lightens the image and then increases its contrast. Note that the composition order can make a big difference.

## Example

In the example below, the first curve lightens the image, particularly in the shadow areas. The second curve applies a calibration for an alternative printing process. The composed curve lightens the image and then applies the calibration in a single step.



Curve A

Curve B

Curve C

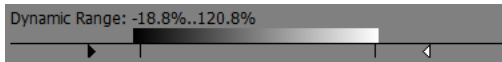
# Dynamic Range Slider

A dynamic range slider is a specialized control used to specify a black and a white point for an image. The slider includes a one-line readout that displays the current setting. Below that is a gray ramp that runs from pure black (corresponding to 0%) to pure white (corresponding to 100%). Next there is a line and below that the black and white markers showing the current locations of the black and white point. If present, the tick marks below the gray ramp indicate the black and white points of the input image.

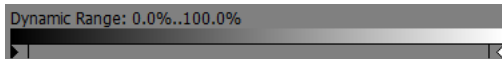
There are two forms of dynamic range sliders: extended and regular. The extended slider runs from -50% to +150% while the regular runs from 0% to 100%.

Here are some examples:

## Extended Dynamic Range Slider



## Regular Dynamic Range Slider



## Adjusting Dynamic Range Sliders

Dragging the black marker left or right sets the black point – this lightens or darkens the shadows. Dragging the white marker left or right sets the white point – this lightens or darkens the highlights.

Moving the black and white points away from each other increases contrast – moving them closer together reduces contrast. When using the extended dynamic range slider, dragging the black point below 0% makes the shadows darker, but starts to lose shadow detail. Similarly, dragging the white point above 100% makes the highlights brighter but loses highlight detail.

Shift-clicking on the slider sets the dynamic range to 0% ... 100%. Ctrl-clicking on the slider sets the black and white markers to line up with the tick marks (if any).

Resizing the transformation dialog box also resizes its sliders, and longer sliders are easier to adjust.

# Hue Saturation

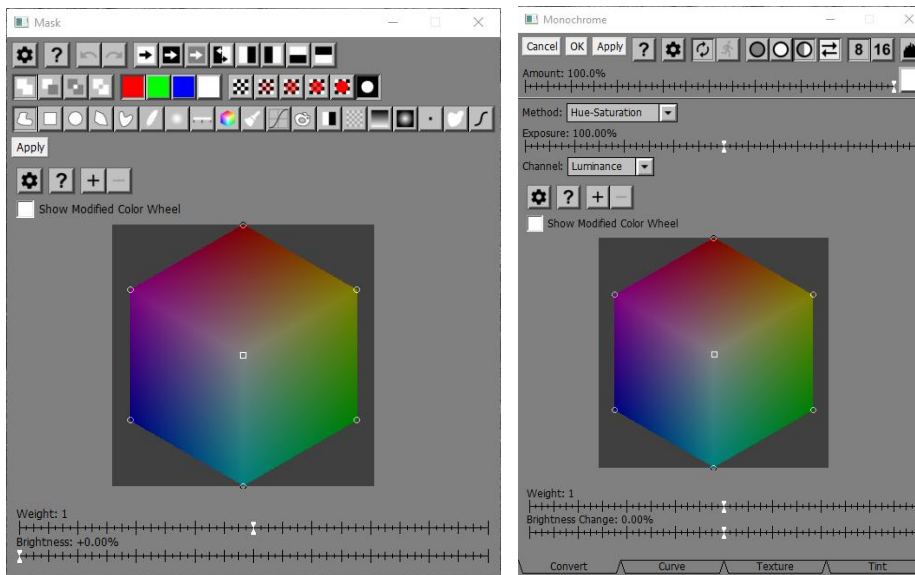
A hue saturation control is used to identify parts of an image based on its combined hue and saturation, without regard to its brightness. Currently the Hue Saturation control is only used in two places -- in the Hue Saturation Mask Tool and in the Monochrome Transformation.

There are slight differences in the way the control works in these two instances.

In Mask, there is a Brightness slider that runs from 0% to 100%. The Brightness slider lets you control the brightness of the mask (0% for black and 100% for white) for pixels whose hue and saturation match those of the control point.

In Monochrome, there is a Brightness Change slider runs from -100% to +100%. Monochrome starts by extracting a selected Channel from the input image to produce a black and white image, The Brightness Change slider causes this black and white image to be lightened or darkened for pixels whose hue and saturation match those of the control points.

Otherwise the control works in exactly the same way.



## Show Modified Color Wheel

When the Show Modified Color Wheel box is checked, the brightness adjustment is applied to the color wheel itself and the results of this are displayed in its place. This gives you a visual representation of which colors are being affected and by how much. To return to the normal color wheel display, uncheck the box.

## Color Wheel

The color wheel and the control points displayed over it are central to this control. Control points are displayed as small circles. All colors in the input image whose hue and saturation match the control point color are affected according to the Brightness or Brightness Change setting. Colors between control points are interpolated to make a smooth transition.



The control point you most recently added or clicked on is called the current control point. The current control point, if any, is displayed as a square instead of a circle. To make a control point the current control point, simply click on it.

Initially, there are 7 control points set on white, red, yellow, green, cyan, blue, and magenta. These control points ensure that white and the fully saturated primary and secondary colors in the input image are unaffected in the output image, which is often a good starting point if you just want to make a minor change. Using this initial configuration for Mask will result in a black mask. For Monochrome it leaves the selected channel unchanged.

**To add a new control point**, shift-click on the color wheel at the desired hue and saturation location. Or, you can add a control point by using the probe by clicking once on a color in the input image window you want to change. You can create up to 256 control points.

**To remove a control point**, control-click on it.

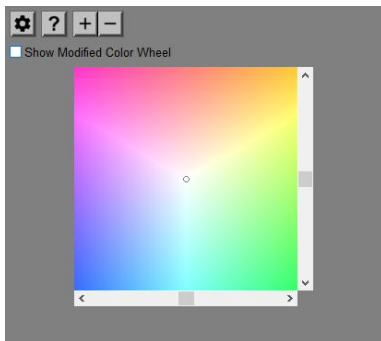
**To change the location of a control point**, click and drag its circle on the color wheel.

**To select a control point**, simply click on it. The selected control point is displayed on the color wheel as a filled square instead of a hollow circle.

## Zoom Tool Bar



The zoom buttons let you zoom in or out on the color wheel. When you zoom in, the color wheel is enlarged centered on the current control point, if any, and scroll bars are displayed next to the color wheel to let you move around. Zooming in makes it easier to make fine adjustments to the control points; zooming out lets you see more of the color wheel at once. You can zoom in a maximum of four levels.



## Weight Slider

The Weight slider lets you assign a greater or smaller weight to the current control point. If there is no current control point, this slider is not displayed.

The larger the weight (as compared to the weights of nearby control points), the more colors around the control point are affected. Reduce the weight to limit the effects to colors that closely match the control point or increase the weight to affect more colors.

## Brightness Slider (Mask only)

The Brightness slider lets you assign a brightness level to the current control point. If there is no current control point, this slider is not displayed.

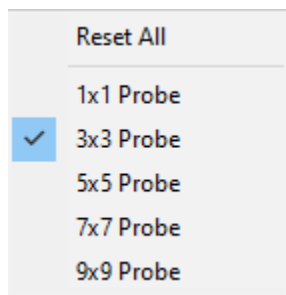
The values displayed in the slider run from 0% (black) to 100% (white) -- any changes you make to the slider alter the brightness setting for the current control point only.

## Brightness Change Slider (Monochrome only)

The Brightness Change slider lets you assign brightness adjustments to the current control point. If there is no current control point, this slider is not displayed.

The values displayed in the slider run from -100% to +100% -- any changes you make to the slider alter the brightness change setting for the current control point.

## Settings Menu



### Reset All

This command resets all the control points to their initial configuration.

### Probe Size

These settings determine the size of the probe used to select colors for new control points. Larger probes are less sensitive to noise while smaller probes can select finer detail.

## Tips

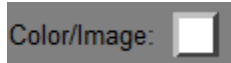
To prevent colors close to one you selected from being affected, create additional control points nearby.

If there are several elements in the image that have the same color, and you only want to adjust some of them, use a mask to isolate the parts you want to change.



# Image Picker

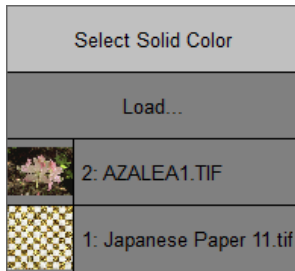
The image picker control lets you select an image or, if no image is selected, a solid color.



The text on the left describes what function the selected image will have once you select it. If an image is selected, the box on the right displays a miniature version of the image. If a solid color is selected, the box is filled with the selected color. In the example above, solid white is currently selected.

## Image Menu

Clicking the box brings up an image menu you can use to select an image or color:



Choosing the first menu item, **Select Solid Color**, brings up a color picker so you can select a solid color.

Choosing the second menu item, **Load...**, lets you open a file as a new top-level image and then selects that file.

Starting at the third menu item is a list of images that can be selected. Downstream images are always excluded from the image menu since selecting one of them would create a circular reference.

Image menus are sorted in descending order by image number. This places the most recently created images at the top.

Image menus highlight in red the names of any images currently selected as inputs for the current transformation.

Hovering the cursor over the thumbnail box displays the caption of the corresponding transformation, if any.

## Tips

As an alternative to selecting images by clicking on the image menu, you can also click on an image thumbnail in the image browser while the image menu is open. If you click on an image not listed in the menu, the selection is ignored.

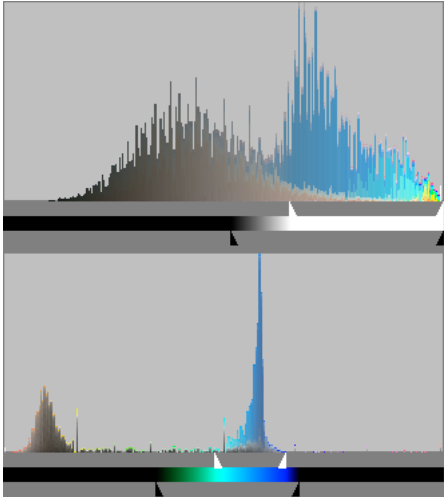
Depending on the context in which the image picker control appears, some or all of the current images may not show up in the image menu. In addition to excluding downstream images, some transformations may require the selected image to have a specific image type and/or dimensions or may exclude the input image.

If you press Esc, click outside the menu, or if you don't move the cursor over the image menu for 5 seconds, the menu is closed.

The image menu has scroll bars if there are more images in the list than can be displayed. You can use the Home, End, Up or Down arrow keys the list to scroll up or down.

# Range

A range control lets you select a brightness or hue range. As a rule, it is displayed just below a brightness or hue histogram to help you see what part of the image you are selecting.



A range control is a slider with two white and two black markers which you can drag independently. The part of the brightness or hue range between the two white markers is fully selected, while the part of the range between the black and white markers at either end of the range are partially selected as indicated by the horizontal stripe in the center of the control. Everything else is fully deselected.

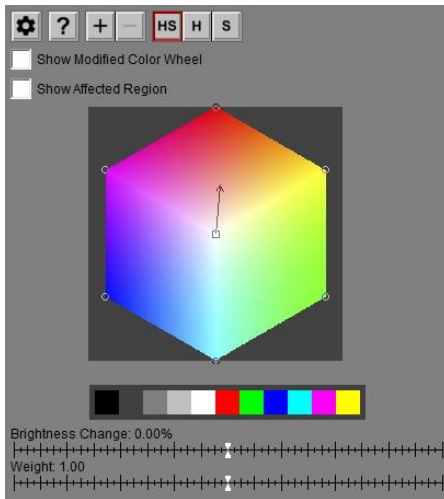
You can invert the selection by dragging one white marker past the other as shown below:



In this case, the range between the two white markers is fully deselected and the range between the black and white markers is partially selected. Everything else is fully selected.

# Selective Color Correction

The selective color correction control lets you specify a set of color corrections to be applied to an image. Currently this control is only used in the Adjust transformation.



## Show Modified Color Wheel

When this box is checked, selective color correction is applied to the color wheel itself and the results of this are displayed in its place. This gives you a visual representation of which colors are being changed and by how much. To return to the normal color wheel display, uncheck the box.

## Show Affected Region

When this box is checked (it is only displayed when a control point is selected), colors in the output image that are unaffected by the current control point are darkened to the extent they are unaffected. This can help you visualize what parts of the output image a given control point affects and to what extent. To avoid messing up the final output image, this setting is ignored when you click OK or Apply in any transformation that uses it.

## Color Wheel

The color wheel and the control points displayed over it are central to this control. A control point has two parts – an input color and an output color. If both are the same, the control point is displayed as a circle. If the output color differs from the input color, a smaller circle is displayed at the input color, connected by an arrow pointing to the output color. All colors in the input image whose hue and saturation match the input color are changed in the output image to the output color. Colors in between control points are interpolated to make a smooth transition.

The control point you most recently added or clicked on is called the current control point. The current control point, if any, is displayed as a filled square instead of a hollow circle. To make a control point the current control point, simply click on it.

Initially, there are 7 control points set on white, red, yellow, green, cyan, blue, and magenta. Each of these control points has both its input and output colors set the same. These control points

ensure that white and the fully saturated primary and secondary colors in the input image are left unchanged in the output image, which is often a good starting point if you just want to make a minor change. Applying selective color correction with this initial configuration, however, will have no effect on the input image as none of the output colors differs from its input color.

### Editing control points

To select a new, existing control point, click on it. The selected control point is displayed on the color wheel as a filled square instead of a hollow circle.

To add a new control point, shift-click on the color wheel at the desired input color location. Or, you can add a control point by using the probe by clicking once on a color in the input image window you want to change. You can create up to 256 control points.

To remove a control point, ctrl-click on it.

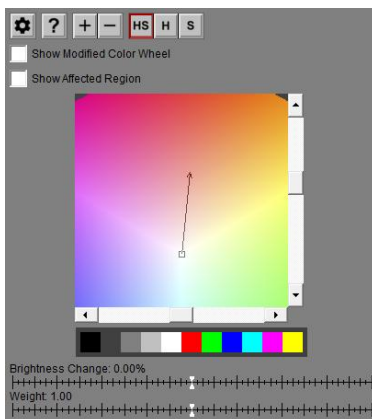
To change the output color of the current control point, click and drag its circle on the color wheel. This will extend an arrow from the control point to the desired output color. Once an arrow has been created, you can make additional changes to the output color by dragging the arrowhead.

To change the input color of the current control point, first make the output color different from the input color, if necessary. Then you can change the input color by dragging the small circle at the base of the arrow.

### Zoom Tool Bar



The zoom buttons let you zoom in or out on the color wheel. When you zoom in, the color wheel is enlarged centered on the current control point, if any, and scroll bars are displayed next to the color wheel to let you move around. Zooming in makes it easier to make fine adjustments to the control points; zooming out lets you see more of the color wheel at once. You can zoom in a maximum of four levels.



## Hue Saturation Tool Bar



Normally, you can move control points freely within the color hexagon. To limit adjustments to hue-only or saturation-only, click the corresponding button.

## Palette



A set of palette colors is displayed just below the color wheel. These colors represent the current custom palette as defined using the Palette tool. Clicking on a palette color inserts a new control point in the color wheel at the corresponding color. Shift-Clicking on a palette color sets the output color of the current control point. This feature is useful if you want to match a color from an image other than the current input image. To do this, first click on the image you want to select from, activate the palette tool and select the color, and then edit the image you want to perform selective color correction on and select the color from the palette.

## Brightness Change

This control is hidden unless a control point is selected. Each control point has an associated color change as indicated by the size and direction of the arrow displayed on the color wheel. In addition, each control point also has an associated brightness change; positive settings make colors that match the input color of a control point brighter while negative values make matching colors darker using the HSV or HSL color space.

The Brightness Change slider lets you assign brightness adjustments to the current control point. To make a control point the current control point, simply click on it. This value displayed in the slider is the value of the brightness change setting for the current control point—any changes you make to the slider alter the brightness change setting for the current control point.

## Weight

This control is hidden unless a control point is selected. Each control point has an associated color change as indicated by the size and direction of the arrow displayed on the color wheel. In addition, each control point also has an associated weight. Larger weights cause a control point to affect more nearby colors on the color wheel. Reducing the weight limits the effect to those colors that more closely match the control point.

The Weight slider lets you assign a weight to the current control point. To make a control point the current control point, simply click on it. This value displayed in the slider is the value of the weight for the current control point—any changes you make to the slider alter the weight of the current control point.

## Right Button Menu

Clicking near one of the control points in the color wheel using the right mouse button selects the nearest control point and pops up a menu of options you can use to alter that control point. The menu contains the following items:

**Reset Color** – This clears any color change the control point specifies; the display for the control point reverts to a small circle with no arrowhead. Any brightness change or weight the control point may have is retained.

**Reset Brightness** – This clears any brightness change the control point specifies; the brightness change slider is returned to its center. Any color change or weight the control point may have is retained.

**Reset Weight** – This resets the weight of the current control point to 1.0; the weight slider is returned to its center. Any color or brightness change the control point may have is retained.

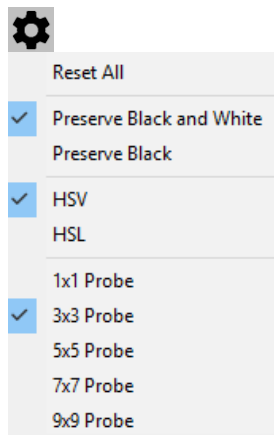
**Reset Brightness, Weight and Color** – This clears any color, weight change and brightness change the control point specifies.

**Remove Control Point** – This deletes the control point.

Right-clicking away from any of the control points in the color wheel pops up a single-item menu:

**Add New Control Point** – This creates a new control point at the location you clicked on the color wheel. This is the same as Shift-Clicking on the color wheel.

## Settings Menu

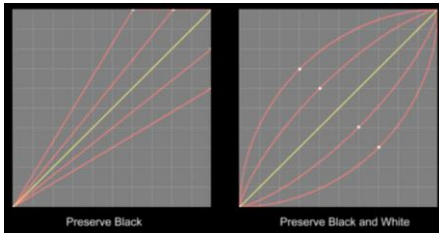


### Reset All

This command resets all the control points to their initial configuration.

### Preserve Black and White/Preserve Black

These options relate to brightness corrections. When Preserve Black and White is selected (the default setting), brightness corrections are made in such a way as to leave pure black and pure white unchanged—the primary effect is on the mid-tones. When Preserve Black is selected, an equal percentage brightness increase is applied to all brightness levels. This provides a more uniform brightening effect but can lead to a loss of highlight detail. The type of brightness curves used is illustrated below.



## HSV / HSL

These settings affect the color space used when the **Brightness Change** slider is used to lighten or darken colors.

## Probe Size

These settings determine the size of the probe used to select colors for new control points. Larger probes are less sensitive to noise while smaller probes can select finer detail.

## Tips

To make a correction of one color in an image, click on a part of the input image having the color you want to change. Next go to the color wheel and click and drag on the new control point you just created. To make the color more or less saturated, drag it toward the edge or toward the center of the color wheel. To adjust its hue, drag the control point either clockwise or counterclockwise about the center. To make further adjustments, click again on the input image to create additional control points.

If the transformation is changing colors close to one you selected and you want these to remain unchanged, create additional control points whose input and output colors are the same to prevent the nearby colors from being modified.

If there are several elements in the image that have the same color, and you only want to adjust some of them, create a mask to isolate the parts you want to change.



# Slider

A slider is a control used to specify either one or two numbers. Sliders are used by many different transformations and are also integral to the Amount control.

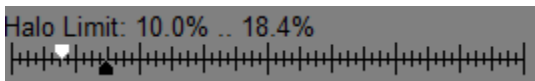
There are two forms of sliders: the single slider for entering one number and the double slider for entering two numbers. Both types include of a single line of text called a readout that describes what parameter is being adjusted by the slider and what its current value is. Below the readout is a scale with a marker at the current slider value. A single slider has one white marker -- a double slider has a white marker above the scale and a black marker below it.

Here are some examples of sliders from the Bilateral Sharpen transformation:

## Single Slider



## Double Slider



In most cases, resizing the transformation dialog box also resizes its sliders—longer sliders are easier to adjust.

## Adjusting Sliders

To adjust the value of a single slider, click anywhere along the scale to set the marker to that location and, if necessary, drag the marker left or right until you reach the desired value. The readout is updated as you move the marker. Adjusting a double slider is the same except you click either above or below the scale center line to set the white marker or the black marker—the two markers move independently.

Double-clicking on a slider resets it to its initial value(s).

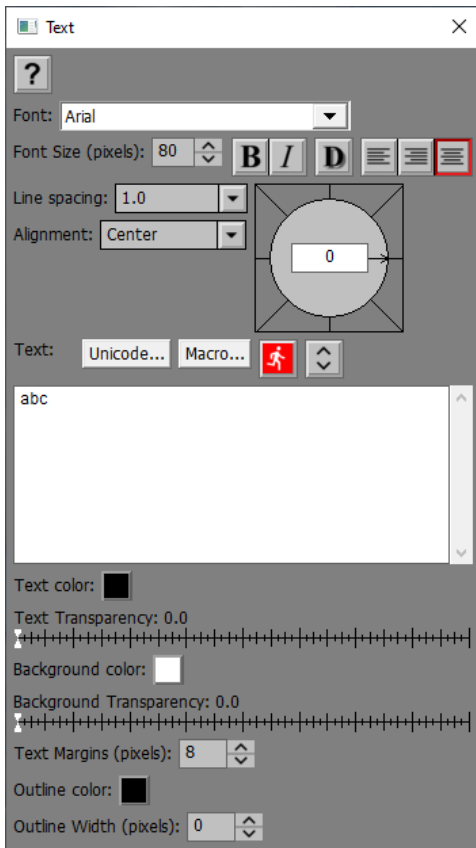
## Fine Tuning

The method above is good for quick but coarse slider adjustments, but it can be tricky to get exactly the value you want. To make fine adjustments to the location of a marker, hold the shift key down while dragging the marker left or right. This increases the resolution by a factor of 16, giving you very precise control over the slider setting at the expense of reduced range of motion. So, use coarse adjustment to get close and then hold down shift to make any necessary final tweaks.

Another way to adjust sliders in small increments is the hold down the Ctrl key down while clicking on the slider. This bumps the slider 4 pixels to the right or to the left, depending on whether you click to the right or left of the current position. If you hold down both Ctrl and Shift while clicking, the slider is moved by 1 pixel instead. This lets you make small changes to a slider without having to take your eyes off of the image being adjusted. If you make the slider longer by resizing the transformation dialog box, the slider value changes by a smaller amount per click since a pixel becomes a smaller fraction of the slider width.

# Text Control

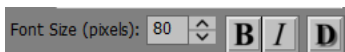
Text controls are used to specify a block of text to be applied to an image. Currently, text controls are only used by the Line, Arrow, Text tool. The settings are very similar to the controls in the Text transformation.



## Font

This lets you select the font name for the text. The menu includes all the fonts currently installed on your system. The **Text** control (see below) is displayed in the selected font.

## Font Size and Style



This lets you set the font height in pixels. Just to the right of the Font Size are three buttons - the first toggles Bold on and off, the second toggles Italic on and off, and the third brings up a drop shadow control.

## Justification of Multi-line Text



This 3-button tool bar lets you set how you want lines of multi-line text to be aligned – by their left edges, by their right edges, or centered horizontally.

## Line Spacing

This lets you adjust the spacing between lines of multi-line text. This setting is sometimes called leading, referring back to the days of typesetting using lead type. Larger numbers provide more space between lines.

## Alignment and Offset


The block of text is surrounded by an imaginary bounding box just large enough to hold all of the text. The alignment setting specifies what part of the bounding box is to be aligned with the location of the text on the image. When you choose Center, Left, Right, Top, Bottom, Upper Left, Upper Right, Lower Left, or Lower Right, the corresponding part of the bounding box is aligned with the point you position over the input image.

Setting an Offset lets you leave space between the text bounding box and the alignment point. If Alignment is set to Center, the Offset control is hidden as it does not apply in this case.

## Angle


The angle setting is a Compass control that lets you adjust the angle of the text and its surrounding background rectangle.

## Text

This is where you enter the text. Unlike other edit controls that auto-enter after a time delay, modified or new text is not processed until you click the  button (the button is grayed out if the text is up-to-date) or until you click OK or Apply. This lets you to take as much time as you need to enter the text string. Place carriage returns in the text where you want lines to break since there is no automatic word wrap. To paste a block of text from the clipboard, click on the Text control to select where you want to insert it, and press Ctrl-V.

To enter special characters, click the Unicode... button and select the character or symbol you want to insert.

To enter a macro, click the Macro... button.

Depending on the selected font, the text may be hard to read -- to display it in the dialog box using a larger font, click the  button. This displays the text twice as large but does not alter the Font Size setting. Click the button a second time to revert to small text.

## Text Color

This control lets you select the text color.

## Text Transparency

The Text Transparency slider lets you adjust the transparency of the text.

## Background Color

This control lets you select the color of the background rectangle. This setting is ignored if Background Transparency is set to 100% (see below).

## Background Transparency

The Background Transparency slider lets you adjust the transparency of the background rectangle.

## **Text Margins**

The background rectangle is made to fit around the text box with equal text margins (in pixels).

## **Outline Color**

This control lets you select the color of a border drawn just inside the background rectangle. This setting is ignored if Outline Width (see below) is set to 0.

## **Outline Width**

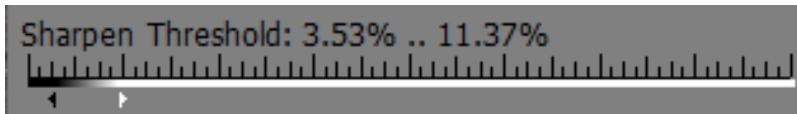
This controls sets the width (in pixels) of the outline drawn just inside the edges of the background rectangle. No outline is drawn if Outline Width is set to 0. If Outline Width is greater than or equal to the Text Margins setting, it is treated as though you entered the Text Margins setting minus one.

# Threshold Slider

Threshold slider controls are used in various sharpening transformations to specify what parts of the image are affected. First the entire input image is sharpened and the result is then compared to the input image. If the difference between the input and sharpened image is less than the threshold, no sharpening is performed. When set correctly, this reduces the amplification of noise in relatively smooth areas of the input image while still sharpening areas with distinct edges or texture.

Threshold sliders have an additional feature which lets you feather the boundary between the affected and unaffected areas of the image in order to make the effect look more natural. While you can create a sharp cutoff if you want one, you can also specify a transition region where the effects of the transformation are blended with the input image.

Here is what a threshold slider looks like:



The parts of the threshold slider from top to bottom are:

The readout indicates the current settings: the first number corresponds to the black slider and the second number corresponds to the white slider. Values run from 0% to 100%.

The ruler provides a visual reference for dragging the sliders.

The gray strip is a visual representation of what effect the threshold settings have on the transformation based on the difference between the input image and the sharpened image. Where the strip is black (to the left of the black marker), there is no sharpening. Where the strip is white (to the right of the white marker), there is full sharpening. Where the strip is gray, there is partial sharpening.

The black and white markers let you adjust the black and white threshold values. You can drag each marker individually, but you cannot drag one past the other -- both markers move together once they meet.

## Adjusting Thresholds

Setting both markers all the way to the left causes the threshold to be ignored and causes the input image to be fully sharpened. As you move the markers to the right, progressively less of the input image is sharpened, based on how similar the input image is to the sharpened image.

Double-clicking on a threshold slider returns it to its initial values.

## Fine Tuning

As with sliders, to make fine adjustments to the location of a marker, you can hold the shift key down while dragging the marker left or right. This increases the resolution by a factor of 16, giving you very precise control over the slider setting at the expense of reduced range of motion.