# Chapter 13 - Building Digital Negatives

# Chapter 13 - Building Digital Negatives

## Building Digital Negatives for the Pt/Pd Process

created April 2001, updated 3/2005



Introduction:

The nature of the platinum/palladium process requires that a contact print be made. Thus the size of the print is restricted to being the same size as the negative. To make a larger print, a larger negative must be made. As always, there are many ways that this can be accomplished. The methods described here are preliminary but are expected to met the rigorous criteria for a negative suitable for the Pt/Pd process once ink on transparent substrate contains enough bit depth to render the tonal quality needed.

The two general methods available for building negatives are digital and analog. The Analog Method consists of enlarging and exposing by optical means onto photographic film and is the subject of Chapter 12. The Digital Method involves optically scanning an original into data bits electronically stored by a computer, manipulating the data by software, and printing a negative with ink on a transparent substrate using a printer. The digital method is discussed in this chapter.

There are several approaches to making a digital negative and many factors are involved with the building of a digital negative. A decision was made to utilize readily available equipment designed for the home office that could get the job done and avoid depending on services from others. The two methods described below have merit but have fallen short of producing negatives suitable for the Pt/Pd process. The primary deficiency is with producing enough tones so as to avoid noticeable posterization and capture the tonal ability of the Pt/Pd process. This is directly related to having enough bit depth represented in the inks printed on the transparent substrate.

These methods require the evaluation of Pt/Pd prints to calibrate and determine adjustments; one must already be proficient with the Pt/Pd process.

Considerations:

Resolution: Resolution of the scanner and the printer must be able to provide the minimum of detail printable on the selected paper (see Resolution Appendix). A rough surface paper can allow for a lower resolution, while a smooth paper may require a resolution greater than available. A diffuse light source and a rougher paper may hide the loss of resolution when contact printing. If more detail is desired from a detailed negative, the sun can be utilized as the light source and a smooth paper can be selected.

Ink Density: Ink Density of the digital negatives must be great enough to allow a maximum white

in the print while producing a maximum black. This is a major consideration since most printers will not deposit enough ink at the resolution desired and most inks are not opaque enough with the spectrum of light used to expose the Pt/Pd coating. This may be resolved by building a stack of several negatives (as with the Stack Method) or by using ink or multiple inks that can achieve the necessary opaqueness.

Registration: Registration is important and is related to the particular method of negative building. When several exposures are given to a single coating from several negatives, each negative must be accurately registered with the coating. This can be accomplished by aligning two adjacent sides of the negatives and the print substrate.

When several negatives are to be stacked together, they can have registration marks added to facilitate alignment.

Registration details can be found in the Registration Appendix.

Posterization: Posterization is the clumping of closely related continuos tones into discrete steps. All tones can be considered posterized to some level. What is important is the threshold level of posterization at which the eye can discern a difference. Below this threshold the tones appear continuous. Above this threshold steps may become detectable, fine texture or subtle variances of tonality may be lost, or a sterile un-photographic look may result.

There must be a sufficient number of individual tones usefully spread throughout the printable range of the negative so as to avoid noticeable posterization. At this time, it is not known how many tones are necessary or what the distribution should be. The number of tones per Zone (density ranges of the Zone System) likely varies as well with a greater number of tones required in the mid Zones.

An increased number of tones can be achieved when several negatives from several scans are stacked or individually exposed onto the Pt/Pd coating. However, 16-bit data scanned, manipulated, stored, and printed seems the best solution. This can provide 14-bit real data with 2-bits of noise separation.

Currently scanners are available that provide 16-bit data. Some 16-bit software exists and some trends seem to be moving in this direction. However, reasonably priced printers have yet to come close.

Calibration: Calibration address several concerns and is a vital and useful part of building negatives. All calibrations are evaluated using Pt/Pd prints. The negative building parameters set by calibration may vary with the original negative, Pt/Pd printing parameters, and desired results. The calibrations are performed in the following order.

**Color Mix Calibration** selects colors and inks and their mixture to determine the control of the tones and keep colors within gamut of the printer and ink combination.

**Maximum Black Calibration** has two parts. Part 1 is dependent on the negative substrate and the total exposure given (Total Printing Exposure). Part 2 involves the minimum amount of ink to produce a discernible threshold above Maximum Black, is termed the Maximum Black Threshold, and occurs after the Maximum White Calibration.

**Maximum White Calibration** determines the maximum amount of ink (subtractive) and/or the minimum exposure (additive) that must be controlled so as to provide the lowest print density. With multiple exposures, this may require an adjustment to the Total Printing Exposure producing an Adjusted Total Printing Exposure.

**Maximum Black Threshold** (see Maximum Black Calibration above)

**Base Curve Calibration** produces a set of standard curves to be applied to every negative set. One purpose is to adjust the Maximum Black Threshold without losing the Maximum Black and provide the desired shadow detail. Another is to normalize the distribution of data throughout the full range so as to produce the tones (both values and amounts), local contrasts, and range desired in the print for a typical original. It is important to distinguish Base Curve Calibration from Creative Control. It is likely that every image will require tweaking (Creative Control) to arrive at a desired result. The first draft should have a standard applied (Base Curve Calibration) so as to provide for a starting point having minimum influence of the equipment and materials used to get from the original negative to the negatives producing the Pt/Pd print. Base Curve Calibration can be thought of as the tuning of a piano.

Boundary Conditions:

Boundary Conditions characterize the limits of a particular function and provide insight as to the control of that function. Several follow which are useful with building digital negatives and on which the calibration procedures are based.

Resolution - The resolution of the final print should be limited by the substrate used. The scanner, software, and printer should have resolution capability at or better than the substrate offers. A lack of resolution may not be apparent as a loss of detail in the final print without magnification, however it is likely that the lack of resolution will be apparent as a lessening of texture, tactile quality, and tonal discrimination. The resolution must be actual physical resolution of the devices and not interpolated.

Selection of Ink (and/or printer) - It would be most desirable to have a multi-shade UV/blue light blocking ink with high resolution print head.

Maximum White - Enough density of ink must be built up in the digital negative(s) so as to produce a complete absence of print density (paper white). Too little ink will result in an inability to obtain a pure white in the print while maintaining the Maximum Black. Too much ink will result in a merger of the upper values into pure white and a reduction of the total number of independent tones. (Too much ink may also cause puddling and a loss of resolution or fine discrimination of detail; see Puddling Appendix.)

Printing Exposure (Maximum Black) - Enough exposure must be given to the Pt/Pd print so as to achieve a Maximum Black with a given negative substrate (includes base plus fog). Too little exposure will result in a Maximum Black which is noticeably too light and an image which may be muddy, have a loss of range, lack detail in the dark values, or be without a black anchor to reference other dark values. Too much exposure will result in the dark values merging into the Maximum Black and a lowering of all values, and the contrast of the Pt/Pd print may also be reduced, but with the sacrifice of lower density negative information.

Maximum Black Threshold - There is a certain density (ink amount) which will provide a shade of black in the print which is noticeably lighter than maximum black. This value is a function of personal preference as well as the discrimination provided by the materials used. Too low of a threshold (lower ink amount) will cause the lower values to merge into Maximum Black. Too high of a threshold (higher ink amount) will cause less range of ink density and a reduction in the total number of independent tones.

Number of Tones (Posterization) - There are a certain number of tones in the total range and in specific sub-ranges (Zones) of the final print which are required to avoid detecting posterization. The number of tones produced in the print are a function of the number of tones in the digital negative minus those below the Maximum Black Threshold, assuming correct Printing Exposure and Maximum White Calibration. Too few tones will result in noticable posterization. Too many tones will result in excessive information to be stored and handled. The number of tones can dramatically be restricted by the scanner, software, and printer. If the equipment has shortcomings, procedures might be able to overcome them. The Number of Tones may also be lessened by any software operations including, but not limited to, curve adjustment and sharpening.

Methods:

Two methods described have been fully developed and carried out, however only a summary is given as neither method has produced prints of acceptable quality. The primary deficiency is too great a level of posterization. Each method has significant merits and could be useful with the proper reduction of posterization. A complete description of the Stack Method has been added.

Stack Method:
This method produces three negatives separating the low-mid, high, and upper densities of the original which are then stacked together and exposed as a single negative to the Pt/Pd coating. The Stack Method, in effect, produces a single density from which to expose a Pt/Pd coating.

Each range of density is scanned from the original negative, the data manipulted, and each printed. Then the printed negatives are registered and fastened together and used as if they were one negative.

Multiple or Tri-Negative Method:
This method produces three negatives emphasizing the low, medium, and high density ranges of the original which are then exposed one at a time onto the Pt/Pd coating. The Tri-negative Method produces three full range negatives which emphasize the low, mid, and high ranges of the original and then exposes them onto a single Pt/Pd coating one at a time.

Three scans with various gamma adjustment are made from the original negative, the data manipulated, and each printed. Then the printed negatives are used one at a time, in registration, to expose the Pt/Pd coating.

Comparison of Methods for producing Digital Negatives

| Topic | Stack Method | Tri-Negative Method |
|---|---|---|
| Equipment | same | same |
| Original negative | same (optimized for scanner) | same (optimized for scanner) |
| Scanning | separate density ranges | full range with different gamma values |
| Normalization and/or curve adjustment to augment scan | Normalization done with scanner exposure adjustment, curve adjustment not necessary | May be needed if the gamma value cannot select the desired emphasis (some scanners may have this capability) |
| Calibration effort | straight forward | complicated due to interrelationship of negatives |
| Ink & Color Mixing | straight forward | straight forward (values may differ from the stack method as more ink is used); However, the ink may not provide enough density for one of the single negatives. |

| | | |
|---|---|---|
| Total Printing Exposure (Maximum Black) | determined using three films, stacked together | determined using one film and will likely require adjustment maximum ink amount |
| (Maximum White) | easily achieved as the amount is divided amongst three films | difficult to achieve enough ink to produce the Maximum White (for at least one of the negatives) as the maximum amount must be applied to each film (the inks and printer selected can influence this) |
| Maximum Black Threshold | easily achieved with curves adjusting ink levels on the base tone negative | easily achieved with curves adjusting the sum of ink levels on all three negatives |
| Standard Curves | straight forward trial and error | curves and exposure times must be adjusted together (intuition and familiarity may help with rough calibration and fine tuning is tedious) |
| digital substrate restrictions | thin | none |
| print substrate restrictions | none | rigid so as to keep registration |
| registration operations | once to index image; once to assemble stack | once to index two adjacent edges, then each time an exposure is made |
| contact when printing | some physical distance of the negatives may cause a reduction in sharpness when using lamps, but may be corrected by using sun | good contact, registration must be accurate |
| printing exposures | one (same as exposure to give Maximum Black) | three, interrelated (each as determined by calibration and creative manipulation) |

# Stack Method

created August 2000, updated April 2001

Note: This method is presented so as to demonstrate the procedure used. Much of this method related to the particular equipment may require modification. It is expected that the entire portion involving Color Mixing and ink selection will radically change with the use of proper inks, software, and printer. Although much of the other calibration procedure are expected to remain.



PROCEDURE to Build a Digital Negative by the Stack Method:
This method produces three negative elements (a low to mid tone range Base Negative, a high tone range High Negative, and a upper tone range Upper Negative) which are stacked together and printed as a single negative. Three scans are made, one for each tone range, and three digital negatives are printed and used with one exposure to the Pt/Pd coating.

The resulting prints from this method have failed to be of acceptable quality due to:
- posterization - likely restricted by printer, driver, and inks and perhaps 8-bit software
- lack of detail - likely restricted by printer, driver, and the physical stack exposed using UV lamps
- lack of texture - likely restricted by posterization and lack of detail

However, it is felt that this method can succeed with proper printer, inks, and software.

ORIGINAL NEGATIVE:
It is imperative that the original negative be optimized for the scanner used. Basically the negative should have the greatest dynamic range of densities and the maximum density should permit a scan signal uninfluenced by noise. Click here for a study of scanner noise and optimizing negatives. A typical negative for use with the Pt/Pd process will likely require a 16-bit scanner, assuming 2-bits are relegated to noise suppression and 14-bits are accurate data. If less bits are available, then the negative must be processed with less of a total range.

Figure 1:
Full scan of an original negative.

SCANNING:
Scanning reads the information contained in the original negative and places it into a digital data file. It is important to scan in full color with the color saturation set to zero, at maximum pixel depth, with the selected exposure range (see below), and at a resolution suitable for the final print size (see Resolution Appendix). Sharpening should be set to none.

✓ Position original negative on the scanner as for a transparency scan, tape to glass, and mask all area except negative with opaque material.

✓ Perform preliminary scan.

✓ Set the Exposure Adjustment, Input Levels for one of the three scans:

1023 to 4095 for the Base Negative
255 to 1023 for the High Negative
0 to 255 for the Upper Negative

Notes: Setting the levels should normalize the data as described below in Normalization. Normalization equates the range of the original negative and the scanner.

The division between Base and High Negative (1023 value) may be altered during creative manipulation.

The upper range may be set at values larger than 0, if the dynamic range and maximum density of the original negative is lower than the capability of the scanner, but keep the range width of 256.

The base range may be set at values lower than 4095, if the dynamic range of the negative is lower than the capability of the scanner or in situations of much base plus fog.

If data is eventually converted to 8-bit (as with Photoshop V and most printers), keep any additions or subtractions of the range values to multiples of 16. The will help avoid some round-off errors.

Carefully selecting the exposure adjustments can normalize the data here instead of in the software (see Normalization below).

✓ Negative is scanned (using the settings above and in Equipment Setup) by the scanner stand alone software and saved as a tiff file (include some film edge and some opaque area when doing calibrations). Stand alone operation will better assure that the scanner settings remain constant and each scan mechanically proceeds from and over the same position. Include a boarder for easier registration (see Registration Appendix).

✓ Save as a tiff file.

✓ Perform the other two scans changing only the Exposure Adjustment, Input Levels.

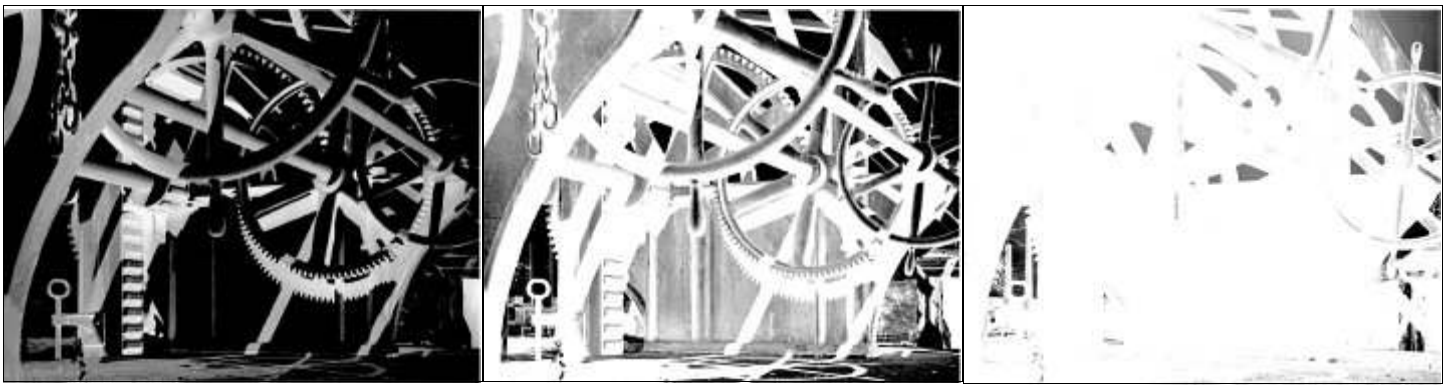


Figure 2: Base 1023-4095 (left), High 255-1023 (center), and Upper 0-255 (right) Negatives as scanned.

Figure 3: Prints from original sister negative (left) and digital negatives with base/high split of 1023 (center) and base/high split of 1278 (right).

Note lesser local contrast in the high values (Zones V to VIII) of the print at right compared with the center print. Note that in the prints from digital negatives (center & right), the upper negative provides more local contrast than the original sister. In all of the actual prints there is better shadow detail, but even more in the prints using digital negatives (not seen reproduced). Note that the original sister negative is a negative made for Pt/Pd printing while the original negative is of lower contrast being optimized for the scanner. Note also that the prints from digital negatives show posterization, and a loss of detail (branches in lower right) and texture (large metal areas). Because the sister negative was exposed at different moment, the lighting has moved.

Software Manipulation: (for each of the three negatives):

✓ Open file

✓ Change Mode to 16-bit
Note: 16-bit mode will avoid round off errors causing a loss of data when changing modes or applying calculations.

✓ Change Mode to CMYK
Note: The proper CMYK color setting (GCR Maximum) should place all the data in the K channel.

Normalization (optional):
This step is optional at this position and should have been performed during the scanning (Setting the Exposure Adjustment, Input Levels). Normalization equates the range of the original negative and the scanner. Normalization selects the maximum black and white points of the print while selecting a range of values contained in the original negative. The end points and range selected may differ from the range of the negative. End points selected beyond the range of the negative will result in maximum tonal values in the print which are gray. End points selected within the range of the negative will result in a print with values from black to white but will include only the selected portion of the negative. (NOTE: It is important to select the exact limits of printable white and black. This is an important part of this procedure which likely differs from other methods.)

This step should be used to fine tune exposure which has been properly scanned. Most films will produce densities exceeding the requirement of Pt/Pd coatings so over exposure can be corrected without a loss of total tonal range in the print. However, underexposure may result in an unrecoverable loss of information from the shadows. To adjust for over exposure use the white point dropper to select a value in the negative to be set to the limit of maximum black in the print.

Selecting the unexposed film edge with the white point dropper automatically compensates for any film base plus fog.

Alteration of contrast (overall or local) should be accomplished by the use of curves or layers later.

To reduce the overall tonal range in the print (end points selected beyond the range of the original negative), it is suggested that new calibrations be used instead. This will help keep the number of individual tones maximized and provide for better tonal discrimination in the print. Note that normalization may also be performed with the scanner and may provide better data. Normalization will allow for a standard set of calibration and curves to be applied to produce a consistent standard print with a standard range of values ready for any desired optional creative control.

✓ Image, Adjust, Levels - set white point dropper to 0%C, 0%M, 0%Y, 0%K and set black point dropper to 0%C, 0%M, 0%Y, 100%K.

✓ Use the white point dropper to select the lowest negative density which should represent the maximum printable black (film edge or as desired and may be used to alter the original exposure).

✓ Use the black point dropper to select the highest negative density which should represent pure white or paper base in the print (opaque area or as desired and may be used to adjust the range of values).

✓ Apply the levels after optionally saving the level information. It is likely that each original will require unique levels.

Color Mixing:
Color Mixing is a simple but important step that selects the inks to be used. It is very important that colors are selected so that the entire range of values/colors will be within gamut of the printer. If not within gamut, the color may be arbitrarily changed or assigned the same value as another. (See Calibration Procedure.)

✓ Image, Adjust, Channel Mixer
✓ Load the saved Mixer data.
✓ Apply
✓ SAVE as a psd file. This file is a backup of the unmanipulated data.

Figure 4: Base (left), High (center), and Upper (right) Negatives after Color Mixing.

Standard Curve Adjustment:
Curve adjustment performs several tasks. For the Base Negative, it provides a steep ramp to bring ink densities to a level which provide discernible tones while maintaining a Maximum Black. For all negatives, it provides for contrast control and local creative control. A separate standard curve should be applied first producing a standard print from which creative control may depart.

✓ Image, Adjust, Curves

✓ Load the appropriate standard curve.

✓ Base Curve as determined by the Base Curve Calibration. This should provide the lower values (about Zone 0 through Zone V) for a full range print.

✓ Curve for the High Negative (may be omitted).
In Cyan and Black channels, change all output to 0.
In CMYK and Magenta and Yellow channels, leave as straight 1:1 line.
This should provide the high values (about Zone VI to Zone VIII) for a full range print.

✓ Curve for the Upper Negative.
In CMYK, leave as straight 1:1 line.
In Cyan and Black channels, change all output to 0.
In Magenta and Yellow channels, enter the curve formed when a point is added for input=80 output=93.
This should provide the upper values (Zone VIII to Zone XII and beyond) for a full range print.

✓ Apply the curve.
Note: The standard curves should be used for every corresponding negative. For each original an additional curve may be added specific to that particular image.

✓ Image, Adjust, Curves

✓ Make any creative modifications, adjustments, or refinements, save this curve information separately, then apply the curve. The step may be repeated after a print is made. This is the reason for saving the curve information.

Figure 5: Base (left), High (center), and Upper (right) Negatives after standard curves are applied.

CLICK HERE to compare figures 4 and 5 (before and after the standard curves are applied).

Optional Creative Control:
This is the best place for creative control with other 16-bit tools.

✓ Save file first.

Printing Preparation & Output:

✓ Change Mode to RGB
✓ Change Mode to 8-bit
✓ Optional Creative Control: Save file first.
✓ Sharpen with the unsharp mask.

Note: How to do this can be found from many sources. Sharpening is highly likely to further posterize the image, reducing the number of tones. Be cautious to keep sharpening to a minimum (see Sharpening Appendix).

✓ SAVE the final file.
✓ Print on substrate with the settings determined by calibration.

Pt/Pd Printing:

The resulting negative is assembled and printed with the materials and technique used for calibration and the exposure determined during calibration.

✓ Position the negatives on a light table and tape together in the following order.
✓ With ink side down, place Base Negative on light table,
✓ register the High Negative to the Base Negative and tape,
✓ register the Upper Negative to the others and tape,
✓ use the stack of three as a single negative.
✓ Print with the settings indicated above and from calibration.

Note: For best resolution use a collimated light source such as the sun. With a diffuse light source (such as a bank of BL bulbs), papers with a rougher surface will show a lower resolution than that lost from not having complete contact, as do the High and Upper Negatives. Paper selection should take the resolution into account.

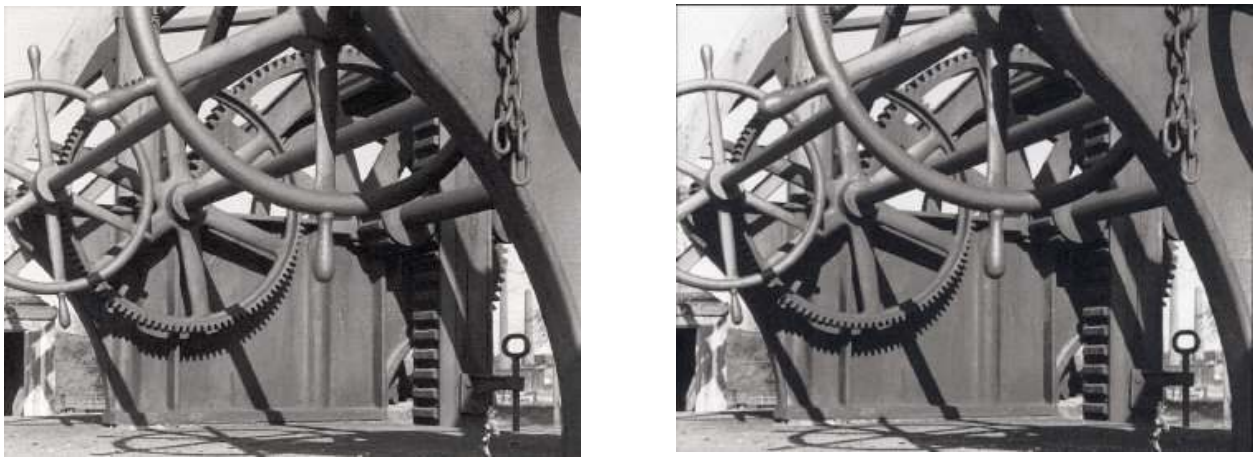


Figure 6: Pt/Pd prints from the sister original in camera negative (left) and from a digital negative stack without correction other than calibration (right).
Note that the print from the digital negative shows posterization, and a loss of detail (branches in lower right) and texture (large metal areas). Because the sister negative was exposed at different moment, the lighting has moved in the image.

CALIBRATION PROCEDURE:

These calibrations should be completed in the same order that they are presented here. The calibration is based on an already determined Pt/Pd procedure of fixed materials and methods. Any deviations from this fixed Pt/Pd procedure may require a new calibration or adjustments. The examples and actual values given are specific to the materials, equipment, and settings used for this procedure and may differ. It is imperative that one do their own calibration.

Only the final Pt/Pd print can accurately depict results, and only final Pt/Pd prints are used to make decisions concerning calibration and the procedure. Calibration of the monitor is only necessary with a desire to preview the image on screen and may be beneficial to preview creative manipulations. The monitor should not be used for calibration.

It is important that all equipment be synchronized so as to not arbitrarily alter selected color values. This can be accomplished through color management selections. All equipment used was set to function under sRGB color management as default. Also, some Photoshop parameters and settings must be carefully controlled.

Important NOTE: This procedure and examples herein discussed produce a full range print. If another range is desired, modifications should be made and calibrations and settings should be altered accordingly. For example, if one wishes a limited range print (such as restricted to Zones IV to VI), the maximum black threshold can be raised and the maximum ink density lowered which would preserve achieving the most individual tones.

Color Mix Calibration:
The purpose of the Color Mix Calibration is to utilize more than one ink for a more diverse set of printable ink tones while making sure that colors (tones) do not become altered by being out of gamut. Most printer drivers and Photoshop will change an out of gamut color to a closest color within gamut. This can cause several tones to be represented as a single tone.

Note: The RGB color setting and profile must be set to sRGB which is the default factory setting for the HP DeskJet 970 printer. If another printer is used with a different color setting, use that color setting throughout.

✓ open original gradient (see Gradient Appendix);

✓ change to 16-bit mode;

✓ View, New View to create a new view;
- ✓ For the new view: select View, Gamut Warning and View, Preview, Cyan.
- ✓ Make sure the preference setting for gamut color is cyan.

✓ change to CMYK mode;

✓ Image, Adjust, Channel Mixer - adjust as follows:

| Output | Source |
|---|---|
| Cyan | Cyan=0, Magenta=0, Yellow=0, Black=0 |
| Magenta | Cyan=0, Magenta=0, Yellow=0, Black=+100 |
| Yellow | Cyan=0, Magenta=0, Yellow=0, Black=+100 |
| Black | Cyan=0, Magenta=0, Yellow=0, Black=0 |

Note: This mix of color should produce some out of gamut steps on the gradient for a sRGB color setting.

✓ change to RGB mode;

✓ check the new view image for any out of gamut indication (any cyan, even slight);
Note: The gamut can only be checked in RGB mode.

✓ change to CMYK mode;

✓ Image, Adjust, Channel Mixer - Vary the Black source amount for outputs Magenta or Yellow, switch to RGB mode, check gamut, and repeat until the entire gradient is within gamut (no Cyan on the new view);

✓ change to 8-bit mode;

✓ print.

✓ Repeat with another mixture until the color mixture producing the smoothest and most complete gradient is found. The goal should be to use as much ink as possible while remaining within gamut and producing a gentle gradient.

Note: This example settled on the following mixture:

| Output | Source |
|---|---|
| Cyan | Cyan=0, Magenta=0, Yellow=0, Black=0 |
| Magenta | Cyan=0, Magenta=0, Yellow=0, Black=+90 |
| Yellow | Cyan=0, Magenta=0, Yellow=0, Black=+100 |
| Black | Cyan=0, Magenta=0, Yellow=0, Black=0 |

✓ Save the Channel Mixer settings for easy recall as these will be applied as a standard to every negative.

Note: It may be necessary to start over and redetermine the Color Mix, if the Base Curve applied later throws the colors out of gamut.

✓ Save the color mixed gradient for use in the calibration of the Maximum White and Maximum Black Threshold calibrations.

Figure 7: Original gradient (top) - Gradient after Color Mixing (bottom).

Maximum Black Calibration (1st of 2 parts):
Calibration of Printing Exposure:

✓ Make a Pt/Pd print using a stack of three pieces of blank substrate intended for the digital negative covering half the coated area. Expose at various times incremented by 0.5 stop intervals (steps). Choose times so that at least two steps are identical between the areas covered and uncovered by the substrate;

✓ Select the step with the longest exposure that is identical between the areas covered and uncovered by the substrate;

✓ Including and starting with the selected step, make another print with at least five exposures at increasing increments of 0.1 stops;

✓ Select the step with the longest exposure that is identical between the areas covered and uncovered by the substrate. The exposure of this step is the Printing Exposure. This will assure that Maximum Black is possible in the print with the shortest exposure. The black chosen for Maximum Black will likely not be the absolute black the materials are capable of producing, but should be reasonably close.

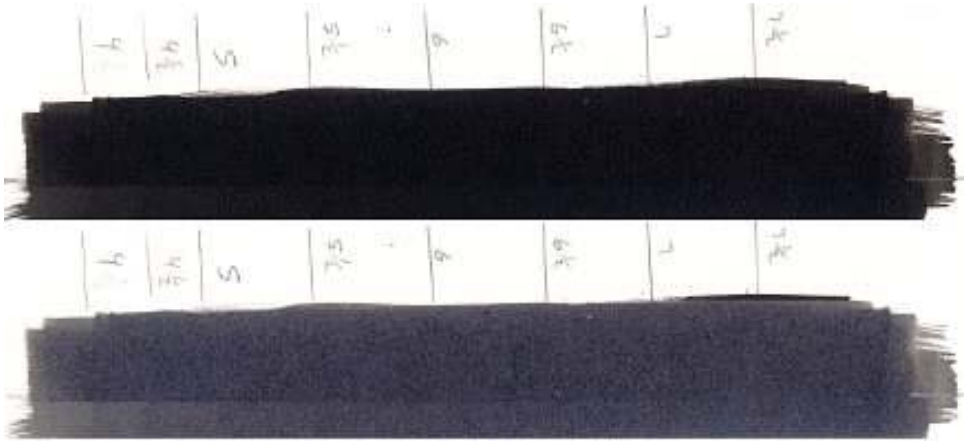


Figure 8: Determining Printing Exposure to give Maximum Black for the substrate used. The bottom is an enhanced copy of the top in order to better discern differences. Note the horizontal pencil marks on the sides indicating the edge of the substrates. For the example, the Printing Exposure is determined to be at most 6.5 minutes (as 6.0 minutes shows slightly lighter, and 7.5 minutes is about the same). Note that the materials may produce even more density beyond Maximum Black.

Maximum White Calibration:
This will adjust the maximum amount of ink the printer will be set to print which will govern the Maximum White produced for the determined Printing Exposure.

✓ In Photoshop, Open the gradient produced in the Color Mix Calibration;
Note: The densest portion of the gradient should produce Maximum White in the Pt/Pd print.

✓ Increase the Canvas Size, Copy, and Paste so that three gradients are on the page;

✓ Print (using settings indicated in setup above).

✓ Separate and register the three gradients and tape together.

✓ Place an opaque sheet adjacent to and along one side of the composite gradient.

✓ Make a Pt/Pd print with the coating behind the gradient and opaque sheet, exposed for the Printing Exposure determined above.
Note: One of the final gradients will be used later for the Maximum Black.

Threshold and Base Curve calibrations.
Using the Pt/Pd print, find the position on the gradient at which there is only the slightest difference between the gradient and the opaque sheet. If this position is not adjacent to the end of the gradient (highest density), then go to "DECREASE" below. If there is no white on the gradient, go to "INCREASE" below.

INCREASE:

✓ In Photoshop, in the Printer Setup, set the Ink Volume heavier or select a paper that is setup to use more ink (matte or plain papers are generally set by HP to use more ink).

Note: Finer control is achieved by going heavier than necessary and then reducing the ink by the Transfer Function in Page Setup. To do so reduce the 100% value to a lesser value.

DECREASE:

✓ In Photoshop, in the Printer Setup, set the Ink Volume lighter or select a paper that is setup to use less ink.

Note: For fine adjustment, in Page Setup, use the Transfer Function to reduce the maximum amount of ink. To do so reduce the 100% value to a lesser value.

✓ Repeat the above until the Pt/Pd print shows Maximum White (paper white) only at the densest step of the gradient.

Note: Too much ink can result in the ink puddling which may cause defects in the highlights of the print. These defects can be spotted if desired. Too little ink will prevent a pure white from being produced in the print. The elimination of the unused inks, cyan and black, helps to reduce the total volume of ink and helps prevent puddling. Puddling can be checked as outlined in the Puddling Appendix.

Figure 9: Using Pt/Pd print of the gradient to determine Maximum White (red indicator) for adjusting maximum deposition of printer inks. This example used the equipment settings described above.

Maximum Black Calibration (2nd of 2 parts):
Calibration of Maximum Black Threshold:

✓ Retrieve one of the final gradients also containing blank substrate from the Maximum White Calibration above and use it, stacked with two blank substrates, to make a Pt/Pt print using the Printing Exposure determined above.

✓ Using this Pt/Pd print, find the position on the gradient at which there is discernible difference between the gradient and the blank substrate. The step, at this position, is the Maximum Black Threshold.

✓ Measure the distance from one end of the gradient.

✓ Using Photoshop's Dropper Tool, find the step in the gradient which corresponds to this position. Set dropper to the position and read Magenta and Yellow values. These are the Maximum Black Threshold values. This relates to the minimum amount of ink necessary to properly print the built negatives. Any amount of ink density less than this value will not contribute to tonal separation in the print. A threshold placed too low will cause lower shadow values to merge into Maximum Black and also result is a loss of the total number of tones available. A threshold placed too high will result in a loss or lessening of the Maximum Black available in the print. Keep in mind that all inks do not transmit identically and perhaps not even linearly.

The Maximum Black Threshold, for this example, is achieved with color values of 38% Magenta and 42% Yellow.

✓ The Maximum Black Threshold is applied in the Base Curve Calibration (below).

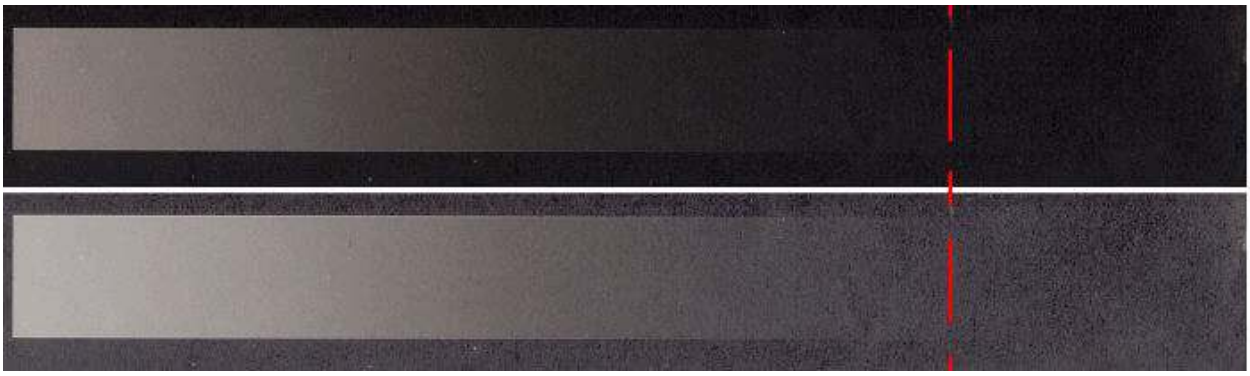


Figure 10: Comparison of the Pt/Pd print of the gradient with Maximum Black to determine the Maximum Black Threshold. The Maximum Black Threshold is measured, in this case to be 7.60 inches from the left edge (red indicator) of the Maximum White final gradient. The bottom of the figure is a copy of the top with levels adjusted so as to better discern the Maximum Black Threshold point.

Figure 11: The values of the Maximum Black step are determined using Photoshop's Dropper Tool with the Color Mixed gradient. The 7.60 inch position (red indicator) of the Maximum White final gradient has color values of 38% Magenta and 42% Yellow. For this example, these color settings on the Base Negative will provide the Maximum Black Threshold in the Pt/Pd print.

Base Curve Calibration:
This produces a standard curve to be applied to every Base Negative. The purpose is to set the Maximum Black Threshold without losing the Maximum Black and provide the desired shadow detail. There are three ways to accomplish this. This method guarantees not losing the Maximum Black in the print.

The selection of the value to place at the Maximum Black Threshold is an important choice. This value along with the selected Maximum Black Threshold are a personal preference of each photographer. Once selected and maintained constant, they will provide a consistent calibration. One should consider a value which is low but should also consider that better separation will come from values denser than the toe of the film used for the original negative. The placement of a Maximum Black Threshold at a certain density value of the film will influence how that film is used to store the image information. Remember that any densities less than the Maximum Black Threshold are merged with Maximum Black. For a print tone to be lighter than Maximum Black, the corresponding original negative portion must receive enough exposure to produce a density above the Maximum Black Threshold.

The following are the three options to generate the calibrated Base Curve.

OPTION A: (using Color Mixed gradient)
OPTION B: (using an original negative) recommended
OPTION C: (using a 21-step original)

OPTION A: (using Color Mixed gradient)
This option is straight forward and the easiest and assumes that perfect, optimized original negatives will be used.

✓ Begin with the Photoshop file of the final gradient from the Maximum White Calibration.

✓ In Photoshop, Image, Adjust, Curves;

✓ For CMYK, leave as straight 1:1 line.

✓ In Cyan and Black channels, change all output to 0.

✓ In Magenta and Yellow channels, enter a curve such that:

✓ Leave 0 and 100% points as they are.

✓ Enter the Magenta and Yellow values of the Maximum Black Threshold as the output values for the input values of 5%.

✓ Add two points above the Maximum Black Value so that the curve above this value is forced, as much as practical, into a straight line.

This will provide for discernible shadow tones while maintaining the Maximum Black, at a minimum expense of the 256 data steps available. The input value of 5% is used in order to work with a manageable curve. Input values less than 5% may require several more points to keep a straight line and may not provide enough opportunity for Maximum Black to appear in the print.

✓ Apply the curve after saving the curve information;

✓ change to RGB, 8-bit;

✓ check to make sure the entire image is within gamut (using View, Gamut Warning and View, Preview, Cyan);
Note: If the image is out of gamut, the Color Mix should be reselected and all calibrations repeated except for the Printing Exposure.

✓ Print the file.

✓ Make a Pt/Pd print of this gradient stacked with two blank substrates.

✓ Evaluate the Pt/Pd print.
The steps of the printed gradient should all be discernibly lighter than Maximum black except for the densest end step which should be Maximum Black.

✓ Adjust the Base Curve as needed to change any base values, reprint, and reevaluate.

✓ Save the final Base Curve as the standard Base Curve to apply to all Base Negatives.

Figure 12a: Color Mixed gradient. The red mark identifies the Maximum Black Threshold.

Figure 12b: Color Mixed gradient with Base Curve applied. The red mark identifies the Maximum Black Threshold.

CLICK HERE to view the Base Negatives and Pt/Pd prints comparing the three Base Curve Options.

OPTION B: (using an original negative) recommended
This option is a little more difficult than Option A and customizes the curve to an original negative. The original negative should be typical of other original negatives to be used, as the Base Curve produced will be customized for this original negative only.

✓ Follow the procedure, through Channel Mixing, to make only the digital Base Negative using an original negative typical of others to be used. As a standard use a full range original negative that has been optimized for the scanner. (The High and Upper Negatives are not needed at this time.)

✓ In Photoshop, Image, Adjust, Curves;

✓ For CMYK, leave as straight 1:1 line;

✓ In Cyan and Black channels, change all output to 0;

✓ In Magenta and Yellow channels, enter a curve such that:

✓ Leave 0 and 100% points as they are.

‣ The lowest density of the original negative that will print just discernibly lighter than black should have an output value of the Maximum Black Threshold, Magenta and Yellow components. Use the dropper to select the portion of image to identify the input values and their position on curve, then enter the Magenta and Yellow output values for that curve input. This requires a decision to select the values of the original negative to be set to the Maximum Black Threshold. Keep in mind that the decision at this point is to generate a standard condition to be applied to all similar originals; other decisions can be made later during creative control.

✓ Add two points above the Maximum Black Value so that the curve above this value is forced, as much as practical, into a straight line.

This will provide for discernible shadow tones while maintaining the Maximum Black, but likely at the expense of several of the 256 data steps available. In comparing Figure 14a with 14b, it is observed that the selection of the density to place at the Maximum Black Threshold will have some basic results.

- ‣ The lesser the original negative density chosen for Maximum Black Threshold, the lower the local contrast of the base values will be in the print. Note that the contrast of the base may also be changed by selecting a different base/high split during scanning, however this split may also affect (or trade off for) contrast in the high and upper areas.

- ‣ The higher the original negative density chosen for Maximum Black Threshold, the

more information of the original negative and the more number of tones in the final print will be lost.

✓ Apply the curve after saving the curve information;

✓ change to RGB, 8-bit;

✓ check to make sure the entire image is within gamut (using View, Gamut Warning and View, Preview, Cyan);
Note: If the image is out of gamut, the Color Mix should be re-selected and all calibrations repeated except for the Printing Exposure.

✓ Print the file.

✓ Make a Pt/Pd print of the Base Negative stacked with two blank substrates.

✓ Evaluate the Pt/Pd print.
Any potion of the print to be discernibly lighter than Maximum Black must be placed at or above the Maximum Black Threshold.

✓ Adjust the Base Curve as needed to change any base values, reprint, and reevaluate.

✓ Save the final Base Curve as the standard Base Curve to apply to all Base Negatives for similar original negatives.

Figure 14a: A higher lower density is selected from the original. The tone selected from the Color Mixed Base Negative to be set to the Maximum Black Threshold (circled in blue on left) has color values of 35%M 40%Y. These values are adjusted to the Maximum Black Threshold values of 38%M 42%Y (determined by calibration above) in creating the Base Curve adjusted Base Negative (middle). This Base Negative produces the Pt/Pd print detail at right.

Figure 14b: A lower lower density is selected from the original. The tone selected from the Color Mixed Base Negative to be set to the Maximum Black Threshold (circled in blue on left) has color values of 19%M 21%Y. These values are adjusted to the Maximum Black Threshold values of 38%M 42%Y (determined by calibration above) in creating the Base Curve adjusted Base Negative (middle). This Base Negative produces the Pt/Pd print detail at right. Note the better discrimination of dark values using the lower lower density.

CLICK HERE to view Pt/Pd prints comparing the three Base Curve Options.

OPTION C: (using a 21-step original)
This option is a good way to investigate how the steps may be manipulated or for comparing original negatives of various theoretical dynamic ranges. However, it is only useful for establishing a Base Curve based on a theoretical original and is the most difficult of the options.

✓ Use a 21-step in place of the original negative.

✓ Make a Base Negative following the procedure stopping after Color Mixing.

✓ Save this 21-step Base Negative.

✓ Change to RGB, 8-bit, and Print.

✓ Make a Pt/Pd print of the Base Negative stacked with two blank substrates and the 21-step.

✓ Evaluate the Pt/Pd print.
The lower density steps of the base tone negative should be identical to the respective steps of the 21-step with step 2 slightly discernible from step 1 (Maximum Black)

✓ Calculate or guess a factor to bring each Base Negative step to match the 21-step in the print. Only do this for the lower density steps. Only an approximation is needed at this point.

✓ In Photoshop, Open the Color Mixed Base Negative, and use the curve adjustment (Image, Adjust, Curves) as follows:
- ✓ For CMYK, leave as straight 1:1 line.
- ✓ In Cyan and Black channels, change all output to 0.
- ✓ In Magenta and Yellow channels, enter a curve such that:
- ✓ Leave 0 and 100% points as they are.
- ✓ Use the dropper to select steps of the 21-step to identify position on curve, then enter the Magenta and Yellow output values for that curve input that was assumed above to produce identical values when printed again with the 21-step.

✓ apply the curve after saving the curve information;

✓ change to RGB, 8-bit;

✓ check to make sure the entire image is within gamut (using View, Gamut Warning and View, Preview, Cyan);
Note: If the image is out of gamut, the Color Mix should be re-selected and all calibrations repeated except for the Printing Exposure.

✓ Print the file.

✓ Make a Pt/Pd print of the Base Negative stacked with two blank substrates and the 21-step.

✓ Evaluate the Pt/Pd print.

✓ Repeat adjustments of the curve until the print shows no difference between the digital Base Negative and the 21-step for the darker values only. Do not consider how the negatives compare, only the Pt/Pd prints.

✓ When identical, save as the 21-Step Base Curve. The 21-Step Base Curve may be used as the Base Curve, if it is assumed that the film and processing used for the original negative respond identical to the 21-step. With the 21-step, one has an entire set of fixed density steps to investigate variations throughout the entire digital negative procedure. High and Upper tones can be investigated as well. For many investigations, it is simple to compare tone steps.

Figure 15a: 21-step after Color Mixing

Figure 15b: 21-step after setting step 2 to the values of the Maximum Black Threshold.

CLICK HERE to view Pt/Pd prints comparing the three Base Curve Options.

# Appendices to Building Digital Negatives

created September 2000, updated April 2001



## Building Density Steps:

Density Steps are used during Curve Calibration in place of an original negative. It is important that Density Steps be built using the same film, chemistry, equipment, processing, and exposure as would a typical original negative.

The steps are exposed as follows:

Step 1 - no exposure
Step 2 - exposure that will produce the Maximum Black Threshold
Step 3 - metered to produce Zone I
Step 4 - metered to produce Zone II
Step 5 - metered to produce Zone III
Step 6 - metered to produce Zone IV
Step 7 - metered to produce Zone V
Step 8 - metered to produce Zone VI
Step 9 - metered to produce Zone VII
Step 10 - metered to produce Zone VIII
Step 11 - metered to produce Zone IX
Step 12 - metered to produce Zone X
Step 13 - metered to produce Zone XI
Step 14 - metered to produce Zone XII

Note that there may not be a one stop difference from Step 1 to Step 2 or from Step 2 to Step 3 and there is a one stop difference between the other steps. The Maximum Black Threshold is selected by personal preference, keeping in mind the ramifications outlined in the Calibration Procedures. There are many ways to accomplish the exposures including individual frames or the positioning of a film holder slide.

Processing and exposure must be that given for a typical for a full range negative with typical normal contrast and as would be used to scan and produce digital negatives. This includes accounting for Optimizing the Original Negative for Scanner Noise.

## Building a Gradient:

The gradient and step bars built here are used throughout the digital negative calibration procedure. The 1% step gradient will be the most useful during calibration.

- ✓ In Photoshop, Open a new image 10 inches high by 0.5 inch wide at 600 ppi in RGB mode;
- ✓ set the background color to C0-M0-Y0-K0;
- ✓ set the foreground color to C0-M0-Y0-K100;
- ✓ build a 0.5 inch wide, 10 inch vertical gradient bar using the Gradient Tool;
- ✓ save this as the Photoshop gradient;
- ✓ change the canvas to 10 inch by 1.5 inch keeping the gradient to one side;
- ✓ Open a new image 10 inches high by 0.5 inch wide at 600 ppi in RGB mode;
- ✓ in the new area select 100 adjacent areas of 0.1 inch by 0.5 inch and fill with 1% increments of density with the paint bucket, one at a time.
- ✓ save this as the 1% gradient;
- ✓ select all, copy, paste, and move opposite the Photoshop gradient;
- ✓ using the 1% gradient select five blocks at a time and fill with 5% increments of density;
- ✓ save this as the 5% gradient;
- ✓ select all, copy, paste, and move between the other gradients;
- ✓ flatten and save as the Original Gradient.

Figure adn1: Photoshop gradient, 5% step gradient, and 1% step gradient subsequently called Original Gradient

## Optimizing the Original Negative for Scanner Noise:

Just as it is so very important to customize the original negative for the selected printing process, so too it is important to produce the proper negative for scanning. Those who have used a scanner to record the information from a negative should be familiar with the relationship that bit depth of the scanner must be increased as the dynamic range of the negative increases. If the bit depth does not increase, vital information from the negative will be omitted from the scan. This information likely first disappears under a level of noise. Next the information becomes limited because a certain number of bits can only provide a certain number of tones and the image requires a certain number of tones be present so that posterization effects are kept hidden. Posterization is not eliminated in a digital negative, only minimized to a fine enough level. (The actual desirable number of tones is not known at this point.)

To determine proper dynamic range and processing requirements of the negative, several negatives were made at the following developments. The film used was 4x5 Kodak Tri-X exposed at 200ASA. The first number is development time in minutes with continuous gentile agitation in a tray (one negative at a time). The second number is the concentration of the HC-110 developer in ml/litter. A Zone VI temperature compensating timer was used.

3@32
4@32
5@32
6@32
4@64
5@64
6@64
7@64

A typical full range Pt/Pd print would have the negative processed at 5@64 (this may vary with the use of different equipment, Pt/Pd materials, or procedures). The dynamic range of these negatives increases as one moves down the list. This is the usable, practical dynamic range. Any range adjustment due to base plus fog is considered negligible for this study. Any density beyond that related to Zone XII is dismissed as not practical to use. Zone XII is considered because a palladium print can easily produce all those zones.

Each of the negatives was scanned with 12-bit pixel depth and converted and stored as 8-bit (the way of the HP ScanJet 6300). The closest negative with the highest dynamic range and without noise in the highlights was found to be 5@32 (this is about half the processing given to a typical Pt/Pd negative). The noise would appear at the same density, so as each negative that had more dynamic range, more of the upper end would consist of noisy data.

Data from two of the negatives can be found below in Figure adn2.

It is true that the noise can be smoothed out with various software techniques, but regardless the original data covered by the noise is corrupted and lost.

A similar evaluation can be made by scanning a Stouffer 21-step. Find the densest step that does not show noise and that density will relate to the maximum density of a film processed a certain way. Note that the actual film used is a better test as the characteristics of the Stouffer 21-step may be different, however densities can be evaluated fairly easily with the Two Hole Method. An example using the 21-step can be found below in Figures adn3 and adn4.

CONCLUSION:
In order to get optimum results it is recommended to match the negative's dynamic range with the scanning equipment used. A dynamic range too high will result in the loss of information, most likely from the highlights. A dynamic range too low will result in wasted data capacity. It would be preferable to error too low so as to maintain image integrity.

Notes: One must test their own negatives as many parameters are capable of influencing the results.

One must keep in mind that the examples here only deal with the noise level and that actual prints must also be made and evaluated from digital negatives produced by a consistent procedure.

Just to give something additional to ponder:
It is guesstimated that a typical negative made for Pt/Pd printing would require 14-bit data without noise. If it is assumed that 2 bits will contain noise (typical), then a 16-bit scanner should be sought if one wishes to scan negatives that also typically are used to print with the Pt/Pd process.

More to ponder:
It is not known if or what differences a Pt/Pd print may exhibit between using a 16-bit scan from appropriate negative and a 12-bit scan from appropriate negative. It is suspected that a negative with a higher dynamic range may enable a higher print quality. It is not known, but could be possible that this is part of the reason for a Pt/Pd print to have better tonal separation than some other processes. This comparison could also be made controlling built analog negatives.

Scanner Noise in scanned negatives:

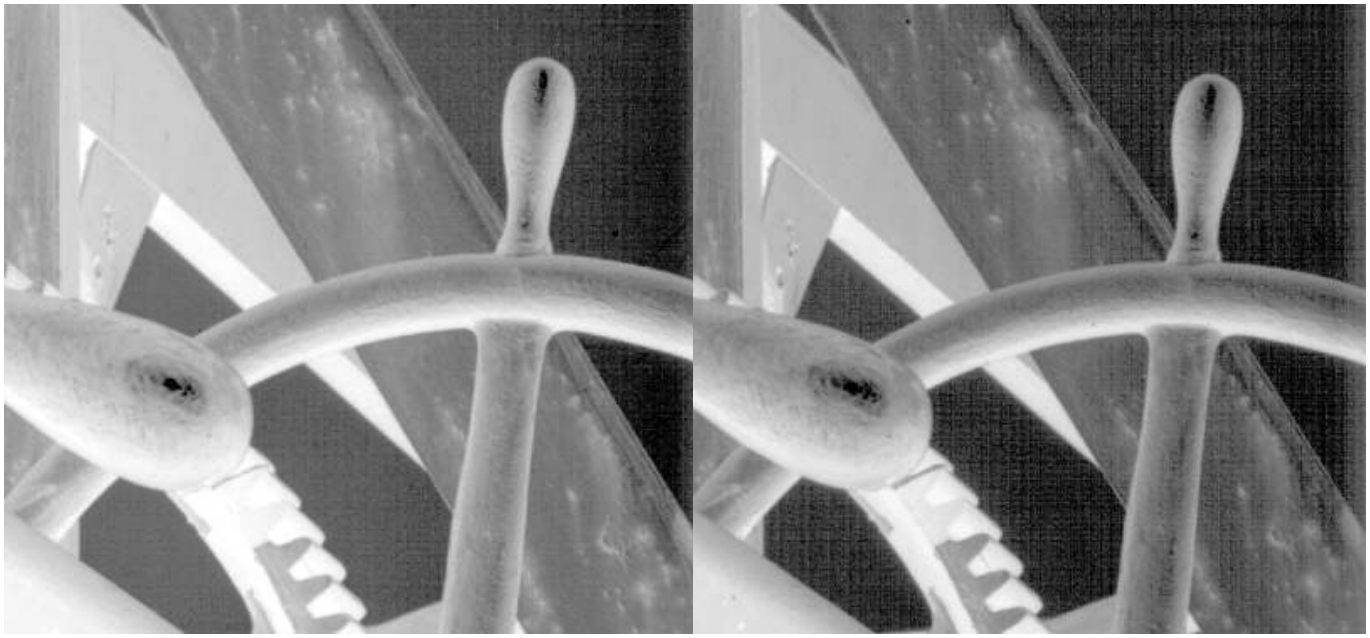


Figure adn1: Negative (5@32) processed at half that typical for Pt/Pd (left). Negative (5@64) processed as typical for Pt/Pd (right). Note corruption of critical highlights (not pure white sky). The two 4x5 negatives are scanned with a 12-bit scanner, with all features such as noise reduction and sharpening turned off, and the exposure adjustment set full range, and at 1200 ppi, full color with zero saturation. A portion of each negative containing some critical highlight values is cropped and compared. The levels are then adjusted to better view the noise. The banding patterns are an indicator of noise, likely due to a low signal level of the detectors.

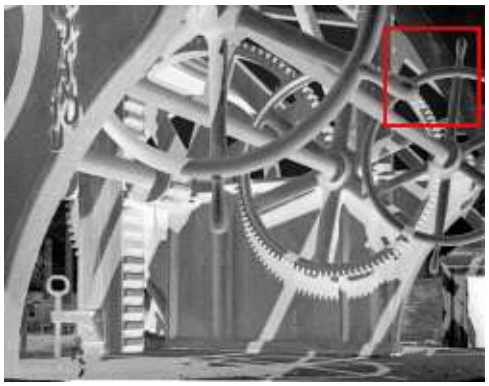


Figure adn1b: Full 4x5 negative indicating the portion in the upper right selected for the detail.

Scanner noise in Stouffer™ steps:

Figure adn3: A 21-step is scanned with a 12-bit scanner, with all features such as noise reduction and sharpening turned off, and the exposure adjustment set full range, and at 1200 ppi, full color with zero saturation.

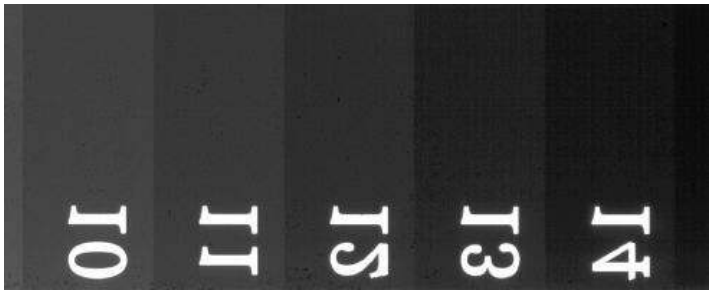



Figure adn4a: The lowest density step containing noise is identified.

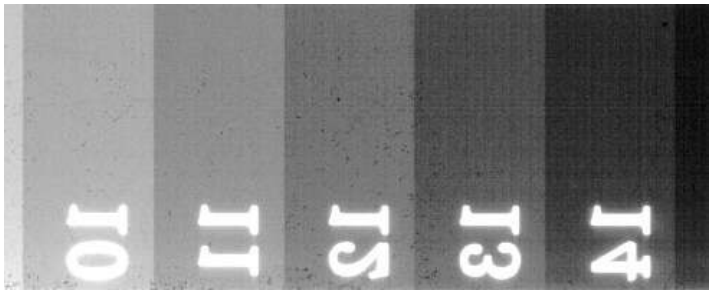



Figure adn4b: The levels are adjusted to better view the region around this step.

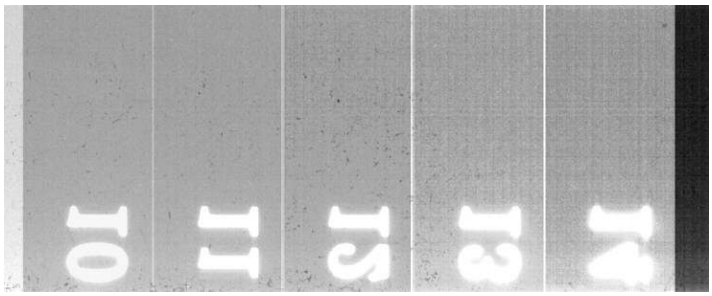



Figure adn4c: Each step is adjusted to a similar brightness so that the texture may be clearly seen. The banding patterns are an indicator of noise, likely due to a low signal level of the detectors. In this example, step 12 is the density at which the noise level just begins to cover subtle tone variations.

## Puddling:

Puddling is the result of ink flowing on the substrate in areas significantly larger than the desired resolution. The follow is used to check both Puddling and resolving ability.

✓ Make some resolution targets as in the Resolution Appendix.

✓ The target is then printed and the output studied for puddling.

[figure to be added]

Figure adn5: Printed targets demonstrating no puddling (left) and puddling (right).

## Registration:

The following are registration procedures for two methods of digital negative building.

Stacked Negative registration begins with the formation of alignment marks on the negatives.

- ✓ A boarder is formed around the original when the three scans are made. It is important that all scans are made over the exact same area.
- ✓ In Photoshop, all scans are opened and a new blank layer is opened for one of the scans;
- ✓ 1 pixel width lines are made along each edge with the line tool so that they cross at the corners.
- ✓ The layer is selected (all) and copied.
- ✓ For each of the other scans, they are selected (all) and the layer pasted into the selection.
- ✓ Each of the three scan images is flattened and saved as the original .tif file.
- ✓ The three negatives are printed as per procedure.

Figure adn6: Detail showing a corner of a scan with registration marks added.

Next the negatives are stacked in registration.

- ✓ Place the base negative on the light table (ink side down).
- ✓ Place the high negative on the other, allign (using a magnifier), and tape.
- ✓ Place the upper negative on the stack, allign (using a magnifier), and tape.

The negatives are now ready to use for exposure.

- ✓ After coating the paper in the appropriate area, the stack is place over the coating as would be done with a single negative and placed into the contact print frame.

Registration in this manner is as accurate as the printer and the magnifier allow.

Tri-Negative registration begins with the formation of alignment marks on the negatives as above. Follow the seven steps above figure Reg1.

- ✓ Next the negatives and paper are indexed and registered. After the three negatives are printed, they will be stacked on a light table and aligned using a magnifier, again similar to above. Tape is used to hold them in place.
- ✓ A sheet of paper (to which the Pt/Pd coating will later be applied) is placed together with the

stack (ink sides toward paper), the approximate area to be coated is marked, and the stack is taped to the paper.

✓ The stack of negatives along with the piece of paper will have two adjacent sides trimmed at a right angle. The dimensions of the negative stack and paper must be less than the contact print frame.

✓ All tape is removed and all pieces separated.

The negatives are now ready to use for exposure.

✓ After coating the paper in the appropriate marked area, the first negative and paper are placed into the contact frame with the cut sides contacting the printing frame. The printing frame can be modified by installing two small metal or wood stops on each of the sides (this is only neccessary if the sides of the printing frame sides are not straight and square).

✓ After exposure of the first negative, that negative is removed and the second negative inserted with the cut sides contacting the same sides of the printing frame.

✓ After exposure of the second negative, that negative is removed and the third negative inserted with the cut sides contacting the same sides of the printing frame.

Registration in this manner is as accurate as the printer, cutting, contact frame, and the placement of paper and negatives into the frame. However, the substrate used for the Pt/Pd coating must be rigid. If a fabric or thin paper is used, it should be taped to a rigid card or paper that is indexed to the printing frame.

## Resolution:

The resolution should be ultimately determined by the substrate selected for the Pt/Pd print, it is important to have enough resolution in the scans of the original negative as well as the prints of the negatives. Look below for a comparison of prints using digital negatives as a function of the resolution at which the digital negative is printed. A resolution of 600 ppi for the final print size seems to be a good choice.

- ✓ In Photoshop open a new file with a resolution of 600 ppi (or higher, if the equipment is capable).
- ✓ Using the line tool draw several lines with a width of 1 pixel and spaced 1 pixel.
- ✓ Using the line tool draw several lines with a width of 2 pixels and spaced 2 pixels.
- ✓ Using the line tool draw several lines with a width of 4 pixels and spaced 4 pixels.
- ✓ This will produce targets of 600 lpi, 300 lpi, and 150 lpi respectively. (lpi = lines per inch, lines are both black and white).

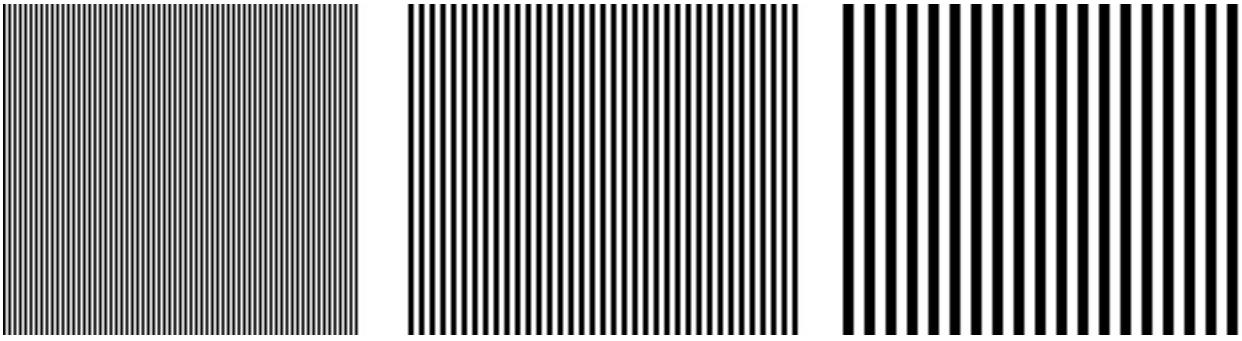
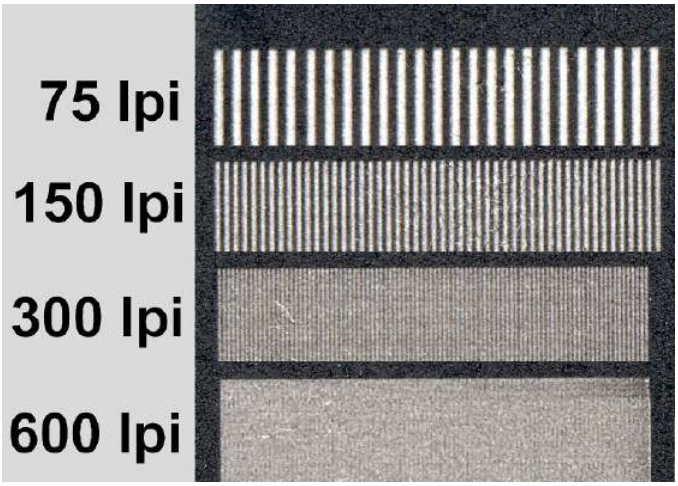


Figure adn7: Targets of 600 lpi, 300 lpi, and 150 lpi (enlarged)

- ✓ Print the targets as a digital negative.
- ✓ Use the negative to make a Pt/Pd print.
- ✓ Compare.

Figure adn8:
1200 ppi scan of Pt/Pd printed targets (enlarged to 72 ppi) The substrate is Crane's "Cover-90" paper. The Hewlett Packard DeskJet 970 (used to print the digital negative) has a benefit of being capable of printing the same lpi (lines per inch) as the dpi (dots per inch). When this paper is to be used with a negative from this printer, scan resolution should be 600 ppi and printer resolution 600 lpi.



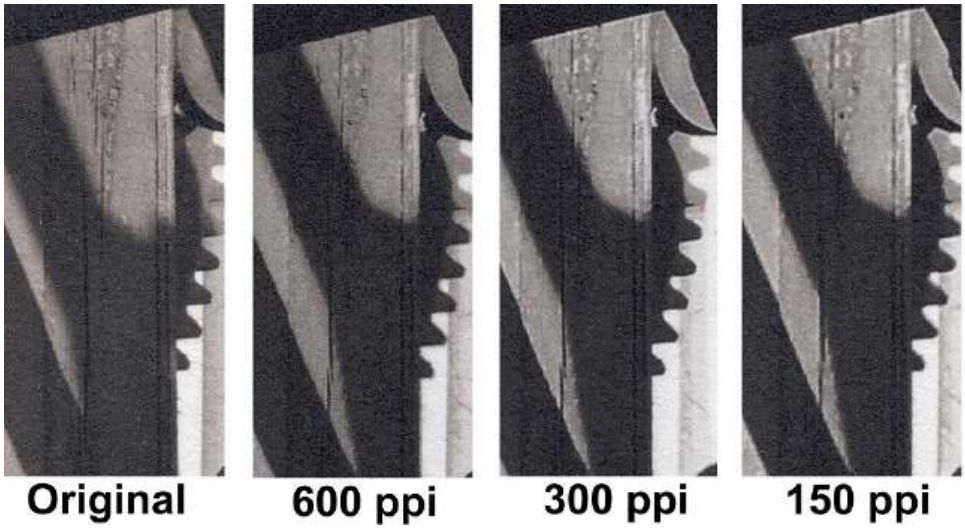



Figure adn9: Comparison of Pt/Pd prints from digital negatives printed at various resolutions.

The original Pt/Pd print detail (left) is from a print of the sister original negative. The others are details of the Pt/Pd prints from digital negatives printed at the indicated resolutions. The original negative scan was at a resolution of 600 ppi. The Pt/Pd print details were all scanned at 1200 ppi and sharpened an equivalent amount.

Note that the original contains much more detail. This level of detail may be hard to discern when viewing the actual 4x5 print. However, there is a noticeable difference in texture and tactile quality amongst the prints. It is possible that some lack of detail may be due to slight registration misalignment of the negative stacks. The higher resolution negatives were easier to register. The 300 ppi and 150 ppi negatives had more sharpening applied than those of 600 ppi (some bar effect is noticeable). [It is recommended to use minimal sharpening for actual negatives.]

It is also noted that the printer may not have been producing the 600 lpi it is supposed to, which could likely be due to dot gain. Although tests at the maximum ink levels showed the printer to print lines at 600 lpi resolution without puddling or blotches.

## Sharpening:

Sharpening should be kept to a minimum and an adequate sharpening threshold level used to help avoid posterization. It seems that any amount of sharpening will tend to encourage posterization. Setting the sharpening threshold to higher values may help reduce posterization. It might be best to not apply any sharpening.