A technique for calibrating desktop computer systems

by Brian P. Lawler

Here is a procedure for calibrating and standardizing electronic prepress systems. Each of these steps will bring you closer to having true WYSIWYG performance with your desktop computer system.

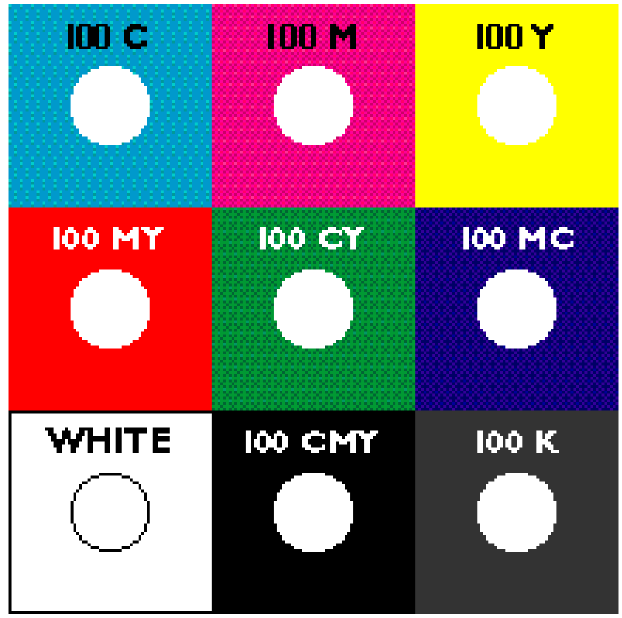
- Adjust the monitor for brightness and contrast with its manual controls. Lock-down these controls down after completing this step.
- Set the background color of the monitor to neutral gray while working on color-critical jobs (Photoshop has a button to do this)
- Adjust the performance of desktop scanners to get the best interpretation of a standard reflective gray scale.
- Create a test file to measure the linearity of the imagesetter.
- Measure imagesetter linearity and react if necessary.
- Once imagesetter linearity is acceptable, make a test film for plate, processing and press gain measurements.
- Measure the performance of the printing press.
- Build compensating curves in Photoshop
- Apply the compensating curve to all images destined for the same printing process.

Adjust monitor brightness and contrast

Most monitors have analog controls on the case. These are usually knobs, though recently we have seen buttons arriving on the scene. The technique is to center the setting for contrast, then increase the brightness to the extreme.

Reduce the brightness control again until the black mask outside the image area on the screen shows the best, crispest contrast relative to the image area.

After this step, adjust the contrast control until the quality of the image on-screen is pleasing to you. This is obviously a subjective setting, but an important one.



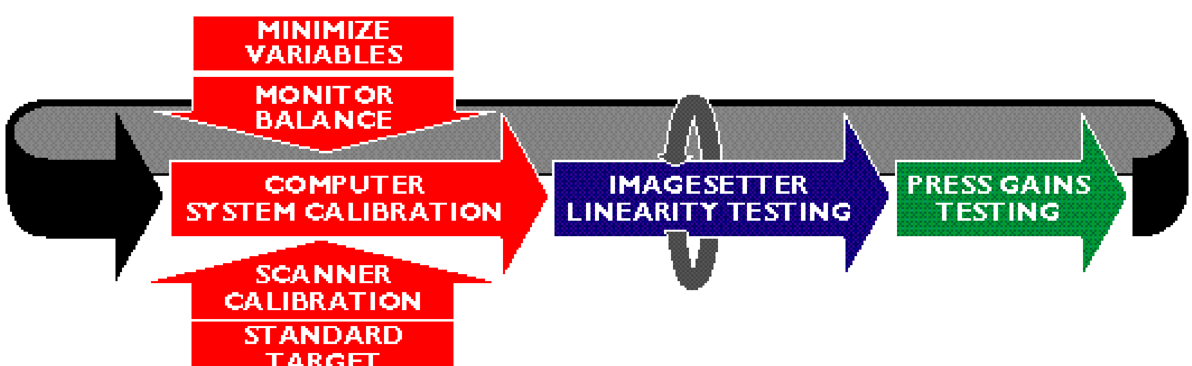
This is the PPCC. Each square is made-up of solids of process primary colors C-M-Y. In combination, these yield process secondaries – red, green, and blue. At the bottom are white, a three-color black, and black alone.

If you can trust that no one will change these settings, you should then leave them alone indefinitely. If you have co-workers or others around who might change a setting, put tape over the controls.

Setting monitor background color

Setting the background color of the monitor is the next step. Choose a neutral gray color for the background of the screen, or simply use Photoshop's center-bottom toolbox button to set the background to gray.

You don't want paisley patterns to conflict with color images when making critical color decisions on the computer. This setting will help.



Balancing the monitor

We're going to adjust the monitor's performance to project colors most accurately. There are some difficulties in doing this, but it is possible to get close.

To adjust the monitor's performance, create a file like the one shown on the front page of this document.

It's important to build this file yourself, and to print it using the processes and pigments you will be using in production.

All the squares are solids, and the file is easily built in an illustration program or in Photoshop. Make separations and print a proof, if possible, using the inks and printing press that will be used for normal production. After producing this test device, cut holes in the center of each color patch. This will become the device I call the PPCC – *Poor Person's Color Calibrator.*

Return to the computer system, and open the file that created the PPCC in Photoshop. Then, using Knoll Software's Gamma software, go through the following steps in balancing the monitor:

1. Adjust monitor gamma to neutralize gray bars at the top of the Gamma control panel.
2. Adjust white point point. Holding the PPCC over the monitor, adjust the three RGB controls until the screen's white patch and the proof's white patch are closest in hue. You will never get the brightness to match; work only on hue.
3. Next, adjust the black point using the three RGB pointers on the left side of the Gamma control panel.
4. Finally, adjust color Balance by sliding the pointers in the center of the control panel. Watch the color through the holes in the PPCC while comparing to the colors on the surface of the PPCC.
5. Save your settings so that the computer will use them when restarting.

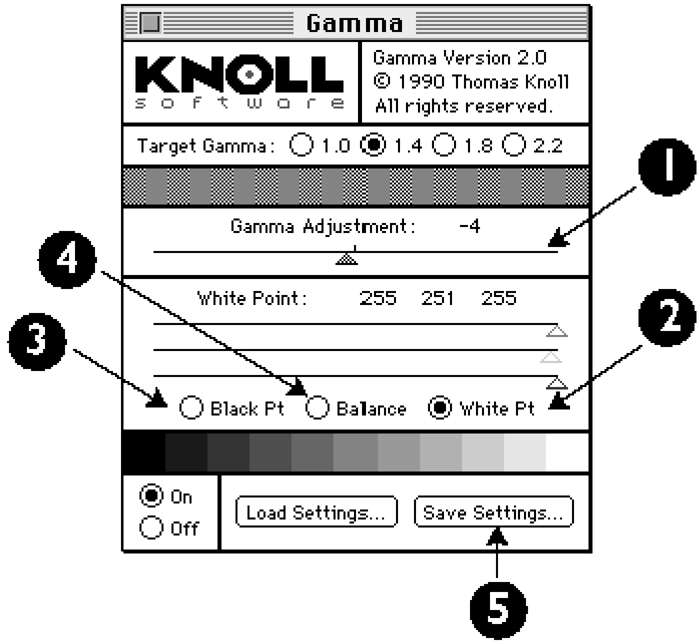
A note on room lighting

We don't read – or work – in caves. Nor do we normally curl up to read a book under 5000K lamps. When making all these adjustments, work under "normal" room lighting. Attempt to reduce the variables in lighting in the work area, while making the room lighting as consistent as possible.

If you have windows or skylights, try to reduce their effect on the monitor by placing the monitor off-axis to windows, and not directly under skylights, or add a glare shield to reduce the effect of such light.

Adjusting scanner input

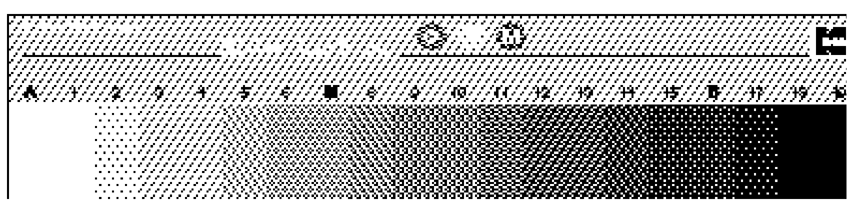
Scanners each have their own control software, and the quality of this software will vary from incredibly bad to surprisingly good. The objective of this part of our process is to get the greatest tonal information from the scanner. The process is to scan a test target and analyze the response of the scanner.



Then, we adjust the performance of the scanner until it most accurately reflects the test target. The best target to use is Kodak's Q14 reflective target. The Q14 is a screen-printed standard used worldwide to measure the performance of films and photosensitive devices.

Scanner performance is measured in the ability to scan accurately the white, black (19) and Step-3 points on the Q14 scale. With these steps scanned accurately, and the resulting image measured with Photoshop's on-screen densitometer, the scanner can be trusted to make an accurate scan every time.

The method for calibrating a reflective scanner is to scan the Q14 and evaluate the results. Then adjust the brightness, contrast – or better, the curve control (if your scanner control software features this control) until white is white, black is black, and Step 3 is 50 percent reflective in the scanned file.

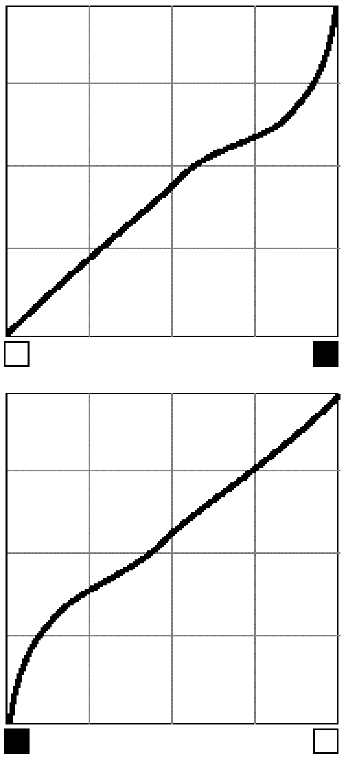


The Kodak Q14 gray scale makes a great target for calibrating a reflective scanner.

Usually the curve needs to be bent to favor the darker end of the gray scale. This is easily accomplished if the curve control is present, and quite difficult if there is no control for curve.

Usually a compromise is necessary. If you have to compromise on something, compromise on the shadow end of the gray scale. Losing highlight information is very damaging to the image, and will make scanned photos reproduce badly.

Once this is accomplished, the scanner settings can be left alone for *all* subsequent scans, for an *accurate* reflective scan is what we are seeking. If we can count on the scanner capturing *accurately* every original that is placed on its copy glass, then the quality adjustments that are often needed in photos can be added *after* the scan in Photoshop.



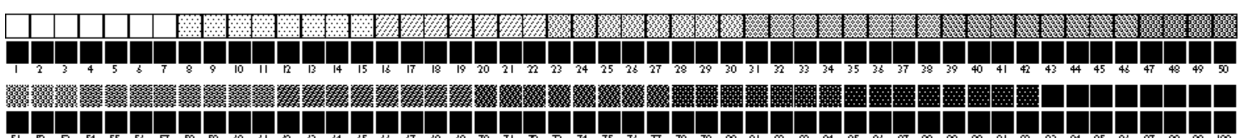
Software controls for desktop scanners often have a method for adjusting the response of the scanner with a curve like those illustrated here.

I have found a number of scanners with the curve right-side up (top), and some with the curve upside-down. In either case the scanner can be adjusted, but take note of the direction of the black (indicated here by the black square).

These curves are mirrors of each other. They increase the sensitivity of the scanner to the shadows, opening-up the tones in the darker part of scanned images.

Testing the linearity of the imagesetter

We are building a *business partnership* when we use a desktop computer to scan images and the create artwork. We are the primary partner; the service bureau is the next member of the team, and the printer is the third.



The 100-step scale is created in an illustration program. It is used to evaluate the performance of an imagesetter, and later, the performance of a printing process. The solid squares create clear areas in the film that can be used to write density values when evaluating the film.

We have to test our business partners to determine their fitness to perform the tasks we need for the successful completion of our job. If the service bureau we use to generate our film is not producing accurate and consistent output, then the continued use of that firm is not recommended.

The device we use to measure the performance of both the service bureau and the printer is the 100-step gray scale (above). This is created in an illustration program (I used Adobe *Illustrator*) that has the ability to blend objects. Each step is one percent different from its neighbor; captions indicate the value of the gray scale step.

The process is to get the service bureau to generate a film negative halftone at the screen frequency you will be using in production (important!). Then, using a transmission densitometer, measure each and every step of the gray step chart and write the results on the film.

If any square is more than one percent off the desired value, the imagesetter needs to be recalibrated. Calibration software is readily available, and is very effective. If your service bureau isn't using some form of calibration software, talk to them about obtaining and using it. The investment is quickly returned in consistency and quality.

The background density of the imagesetter film is also an issue. This is a measurement of laser exposure and processing correctness. Typical background density readings should be between 3.75 and 4.0 on a transmission densitometer. Readings under the 3.75 value are cause for concern, as film with this density can cause plate and press trouble later in the printing process.

Measuring dot gain on the printing press

Once a correct gray step chart is created, and proven to be accurate with the densitometer, that film can be used to make a printing plate and the resulting printing measured to analyze dot gains and losses.

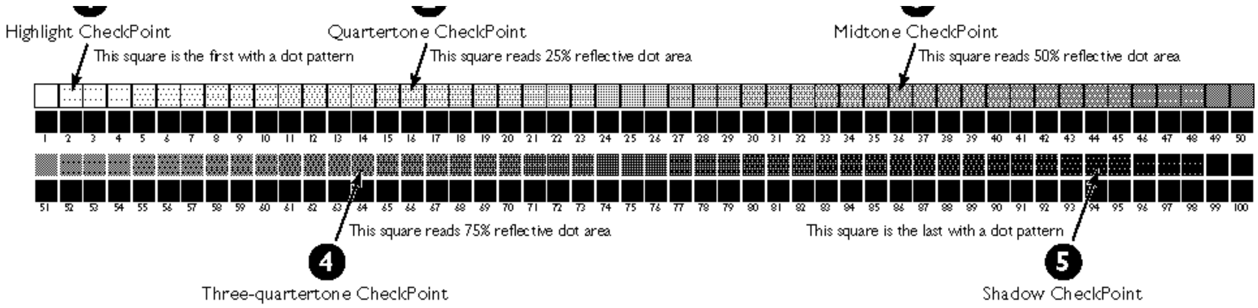
Ask your printer to print this negative on the edge of someone else's job (it's important for the gray scale to print *around* the cylinder), and save some sample sheets for your evaluation. It's also important that the film you provide not be duplicated by the printer; the original must be used to expose the plate or you will lose control of the test.

Dot gain is predictable and consistent on most printing presses. Measuring and controlling it is more elusive, and requires attention to detail. With the 100-step test we can determine the amount of gain to expect from any printing process, and we can react to reduce the impact of that gain on our work.

CheckPoint measurements

I have developed a system, called *CheckPoint,* which makes the measurement and control of dot gain easier. Here's how it works:

We are interested in pinpointing five areas in the gray scale on the printed sheet. First, we want to look with a magnifier for the lightest dot pattern in the



A plot of the values actually read from the printed test scale shows a typical gain curve. We use the actual values read for 25, 50 and 75 percent, and observed patterns for the highlight and shadow points. With 5 CheckPoints, we can plot a corrective curve in Photoshop (below) that will make images printed by this process more effective in all subsequent reproductions.

highlight – the first square where there is a consistent dot pattern. This usually occurs between 1 and 4 percent; if it happens much later, there is a *significant* problem in plate exposure and processing that needs to be addressed. The value is noted as our highlight CheckPoint (number 1 on the scale, page 4).

Next, we look with the magnifier for the darkest dot at the shadow end of the scale where we can see a consistent pattern of tiny white dots reversed out of black. This will be our shadow CheckPoint (number 5 on the scale, page 4).

The next three points we want to identify are the 25 percent, 50 percent and 75 percent points on the scale. Unlike conventional dot gain readings, however, CheckPoint relies on the reading of the printed test sheet to measure which squares *generated* these values. So, we are interested in measuring the result of the printing, rather than the gain of a certain spot on the scale.

We look for the squares that *actually printed* at 25 percent, 50 percent, and 75 percent reflective dot area, and make note of those squares. Making note of the values under each of these three squares (2,3, and 4 on the scale, page 4), we have gathered the three additional CheckPoints we need to build a corrective curve for this printing process.

Build a curve in Photoshop

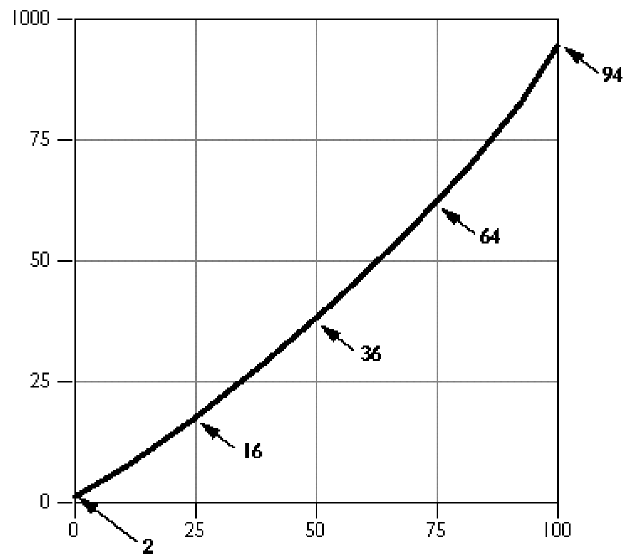
In Photoshop, we build a corrective curve (Image>Adjust>Curves) that is an approximate mirror of the gain values we measured. Save the curve, and apply it to every image that is to be reproduced by this same press and paper combination in the future.

The curve should be applied to a digital image as *the very last step* in production, and it is wise to Save As, so the original image remains unharmed.

If everything is working correctly, the image on the screen of your computer will appear lighter and quite "flat." This is the correct look for any image to be printed by halftone dots. The press gains that we measured will restore the contrast to the image when it is printed. This added contrast is *dot gain!*

File formats

Occasionally I get involved in a conversation with people in the trade, and someone will say that one file type is superior to another. They will say that TIFF



Translating the measured points on the 100-step printed test into a Photoshop curve is relatively easy. First, boost the highlight point on the curve to the highlight CheckPoint, slide the shadow point downward to the shadow CheckPoint, and place the 25, 50 and 75 percent points at their respective positions on the curve.

format files print with too much contrast, or EPS is the only way to reproduce four-color. In reality, TIFF, EPS, and Scitex CT formats are all compatible with most page layout programs and provide a good result.

There is no "correct" file format; all those mentioned are fine. EPS, Scitex CT and TIFF all yield the same image.

This essay…

is one of a series on the use of computers in the graphic arts. Other essays available include: Dot Gain, Photo CD, Black and White from Color, and Color Separation Set-up in Adobe Photoshop.

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