

ANATOMY OF A "PROFILE"

Getting a particular output device, such as your desktop printer, to print colors that will approximate the final look of your file when printed on a press, requires creating a "profile."

It's accomplished with sophisticated profiling software and scanning equipment that compares the output of the press with the output of your printer – in both cases a test sheet containing the same imprinted patches of color.

In the process, the system may note, for example, that a certain green color available on your printer cannot be reproduced on the press. It records this data, including the closest match on the press, in a "lookup table." It's sort of like a dictionary.

When you want Pantone 619, it looks it up and finds the closest match that the four-color press profiled can deliver. Next, a Color Management Module or CMM acts as a translator. The CMM communicates the necessary information to your printer. It acts like an interpreter that knows how to speak to your printer. It tells it what color to print that will best match the final output of the printing press represented in the profile.

Color Management: Transforming the art of color into a science

Color management, what is it? The term "color management" is not easy to define. In fact, there have been literally volumes written on the subject, some so esoteric you might prefer to walk on hot coals. But put in simple terms, color management is a process by which leading printers attempt to assure that the color they print is what you expect.

Although it sounds simple, it is not.

In fact, high-quality commercial printers have been working on the challenges posed by color management for decades. It is a process that attempts to quantify color in such a way that it can be reproduced reliably – by a wide range of devices. One quick example might be if you were to manage the output of your color monitor in such a way that the colors it displayed were accurately reproduced by your desktop inkjet printer. That is to say, what you see is what you get. Those of you who have tried, however, know that even this simple objective is difficult, if not impossible, to achieve.

Another way of looking at it is that modern color management – using precise measurements of color and sophisticated software – attempts to automatically compensate for the characteristics of particular output devices so that the output of one device is consistent with that of another. Said yet another way, it's all about making color reproduction predictable.

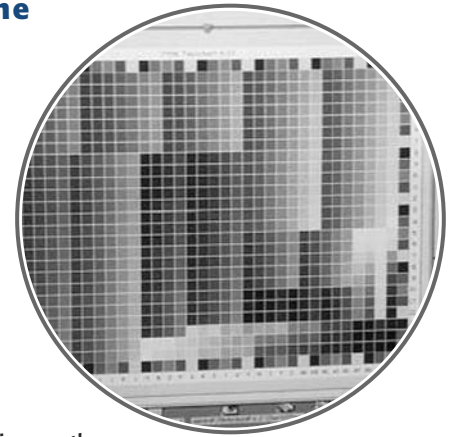
Why should we care?

All of the effort at color management begs a question. What difference does it make? The answer can be expressed in dollars and cents. Manufacturers of high-end consumer products, for example, depend on catalogs displaying their goods – in luscious color – to trigger consumer purchases.

This is particularly important when the color of the product itself is part of the appeal. Car manufacturers are a classic example. The color of the car depicted must match as closely as possible the actual car. In other words, the images must be deliverable as depicted. Anything less can mean lost sales.

There are other examples as well. Let's say you produce a catalog in spring and by fall you need to reprint – or include identical images in an updated version. Color management techniques can help assure the colors match while minimizing time and costs.

One might say the "holy grail" of color management is even more ambitious: to reach a level of control that would allow you to reproduce identical color images – say, in



Matching color from proof to press is moving from an art form to a science through use of new hardware and software tools. In this screen shot, new-generation software is comparing the color output of a press with that of a proofing device.

an advertising campaign — quickly and easily in a catalog, in newspaper advertising, at bus stops, on a Web site and on billboards. Each of these uses a different output device with different color reproduction characteristics.

What would you settle for?

Many might settle for a little less. Much of the time, graphic arts professionals would settle for the assurance that the printing press will deliver the same color as reflected on a proof that's been approved. Even that can be difficult — and time consuming — without careful color management techniques.

So what's the problem?

Actually, there are more problems than you can shake a stick at. For starters, the best modern four-color process printing press simply cannot reproduce anywhere near the number of colors displayed on a computer monitor, let alone the number of colors that can be perceived by the human eye.

But that's just the beginning. Controlling color requires managing the output of all of the widely varying output devices in the production process — from the monitor on which a given graphic is designed, to the local desktop proofing device, to high-end prepress proofing devices, to plate making equipment and finally, to the press itself.

The fact is each of these devices uses a different process to create color, so even given a particular color on a particular digital file, each will produce a slightly different color. The phosphorus that illuminates a monitor, for example, can reproduce certain orange colors that cannot be reproduced by the combining four process colors on a printing press. Making matter worse, the phosphors used on one monitor may differ greatly from those on another. Monitor calibrations can help approximate your inkjet printer's output, but monitors lose calibration easily.

Proofing devices yield greatly differing output depending on the pigments used in their colorants. Those pigments can vary widely between two ink jet printers, let alone between an ink jet and a Fuji proofing device. Another factor further complicating matters is that color output will vary depending on the paper used with a particular device. If that isn't enough, lighting conditions where the proof is viewed can also have a profound effect on the apparent color.

The printing press

Even the best modern presses, because they operate under the influence of gross mechanical forces, differ from each other in their output. Two similar sheetfed presses, all things being equal, will deliver somewhat different results with the same plates. The differences are even more pronounced between a sheetfed press and a high-speed, high volume web press. In the later case, the characteristics of inks used vary greatly, not to speak of the Web press heaters and chillers.



*Sophisticated
new software has
increased our
understanding
of color.*

The mechanical forces on a modern printing press (including pressure, heat and chemistry) are so much greater than the “upstream” devices (e.g., monitors, digital proofing devices, etc.) that, as you might expect, the output varies more as well. A well-maintained press, carefully monitored and adjusted during a given run may see dot gain vary by as much as three to four percent.

It’s in spite of these relatively large tolerances that GLS targets a key color management objective: to reduce onpress deviation error by four “reference points.” Reference points are simply a unit of measurement used in color management processes. Color deviations of less than four points are generally considered imperceptible by most people.

In search of precision

So, in the end, how is the printing industry pursuing precise, predictable color reproduction? At the core of it is measurement. Effective color management begins with painstaking measurement. To “understand” the typical or default output of a given device, its output has to be carefully quantified.

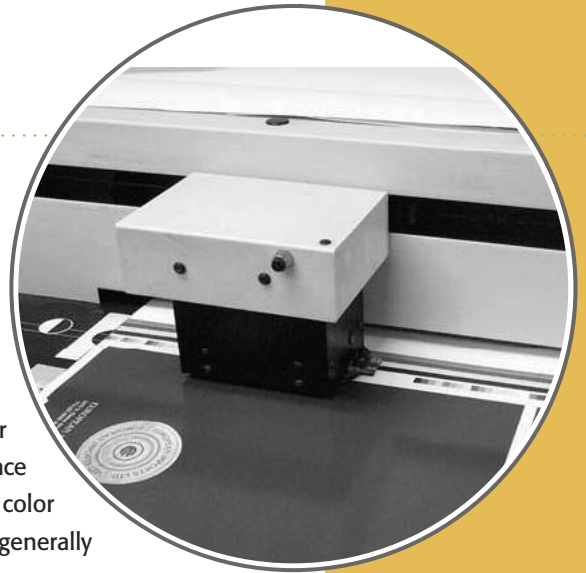
This is generally accomplished by feeding the device, let’s say an ink jet printer (it could be a printing press as well), a known “target” digital file depicting a range of colors. The output of the printer – a color printout – is then scanned and fed into software that creates a “profile” of the output. This profile is, essentially, a mathematical description of the colors the printer created. The software then compares the description of the output with the known values in the target file to create something called a “lookup table.” This lookup table is then used to adjust the output of the printer: When future files are fed into the printer, the software “looks up” the difference between input and output and sends the corrected commands needed to tell the printer how to better reproduce the colors requested.

One practical application for this process would be to create a profile for a client’s proofing printer so that it better reflects the actual reproduction capabilities of a given printing press. In this case, an in-house designer would be better able to visualize how a given file would look when printed on a four-color printing press.

Measuring the press

Effective color management ultimately relies on accurate information – quantifiable data – describing the output of a given printing press. Unless you know what the printing press is capable of producing, you can’t tell the upstream devices how to adjust their output.

At GLS and other commercial printers specializing in high-impact color reproduction, this means a concerted effort to quantify, or measure, its press output. In general terms, GLS has been measuring device outputs and processes for more than 20 years – everything from plate chemistry, to scanner lasers, to press characteristics. In recent years, GLS has been using a new generation of measurement instrumentation and software packages designed to establish precise color management throughout its digital workflow process.



At the core of effective color management is precise measurement. Here GLS Companies' scanning densitometer reads the color bar of a press sheet to determine a particular press' print characteristics.

Among the ongoing, scrupulous measurement efforts is one to establish reliable output standards for all of its presses. To do this, color bars printed by the presses under varying conditions are regularly scanned and converted to numeric descriptions of ink density. Dot gain is measured as well. All of these data are used as the foundation for creating profiles for proofing devices and creating plates that, when run, will produce a predictable result.

The clients' role

Clients working with printers committed to using modern color management procedures are, principally, beneficiaries. To the extent that your printer practices color management, you can expect press output to better match your final proofs, and when adjustments are necessary, they generally take less time. You will also benefit by a greater assurance that one print run will look like another with a minimum of setup. The result, of course, is cost effectiveness. But clients can also benefit simply by understanding that color is highly device dependent, that the color produced by a monitor or an in-house proofing device can almost always reproduce many more colors than the best four-color press. This understanding alone will help you develop realistic expectations.

Finally, be proactive by selecting a printer committed to color management processes. Request a tour of your printer's facility and ask about color management techniques.

Ask what equipment they profile, the software they use and how they measure. You might also ask to see printed samples and the digital proofs that preceded them.

Leading printers see expert color management as an opportunity to better satisfy their clients while increasing efficiency. It's an opportunity presented by digital prepress workflows and new, high-tech instrumentation and software systems. As the industry continues to improve these tools — and its color management processes — the outcome of your print project will become increasingly predictable.

COLOR MANAGEMENT BENEFITS

The benefits of selecting a printer with color management capabilities can be many. But remember, color management is an ongoing process involving constant measurement and adjustment of output devices throughout the digital workflow. Because of constantly changing variables, precision is difficult. The limited color pallet available in four-color process printing means that even the best color management can only come close to matching a CMYK color press to that of a device with a larger color gamut or pallet. Notwithstanding these inherent limitations, good color management practices can help achieve some of the following objectives:

Screen-to-print "match" — When a computer monitor and printer calibration attempts to depict on-screen what the final press output will look like.

Proof-to-press "match" — When a digital proofing device is controlled through a "profile" to deliver an output that is close to that of the final press.

Original-to-print "match" — When the final printed product needs to match the original photograph as closely as possible.

Screen-to-screen "match" — When two or more monitors are synchronized so that colors display the same on each.

Print-to-print "match" — When printed material is reproduced on another kind of device (e.g., a magazine advertisement printed out in large format for a billboard).

Re-print "match" — When reprinting a previous job to match the original job either on the same press or on another press.

Scanner-to-scanner "match" — When more than one scanner is setup to yield virtually identical outputs scanning a given input.