Color Management Roundup 1999

# A Gamut of Solutions

By Andrew Rodney

One of the most significant forces driving the color management market today came with the release of Adobe Photoshop 5.0. More than a year later (and after the release of Version 5.5), the industry is looking far more seriously at color management systems (CMSs) for input and output devices. Clearly, any CMS worth considering will be based on the industry-standard, cross-platform ICC/ICM technology.

Virtually every device in imaging deals with color in its own fashion. For example, each digital printer has its own recipe, or set of numeric values, that makes up their RGB or CMYK color spaces. This variation in output is called *device-dependent color*. The recipe for an RGB color mix doesn't describe how the colors look, only the recipes of the mix. Each device renders these recipes uniquely. Color management, among other things, is an attempt to reconcile this variation.

Another variable that differs from device to device is color gamut. Simply put, it is the device gamut that describes the colors an output device can reproduce. The color gamuts of ink-jet printers, four-color presses, and color monitors are all vastly different. Let's say you are going to output a file with a wide gamut to a printer with a small gamut. The colors that fall outside the gamut of the output device will produce results different from your expectations. A good CMS will deal with the differing device gamuts and map them so that the printed piece will meet your expectations. Further, the CMS should allow the user to accurately visualize the gamut mapping.

CMSs today are based on the use of ICC device profiles, or for Windows users, ICM device profiles. These small profile files describe the unique conditions of each device we wish to use. Because the quality and accuracy of these small profiles are key to making a CMS work, the user must calibrate and profile each device in his system.

Establishing an ICC profile is not the same as calibrating a system. An ICC profile describes the condition of the device; calibration is the process of placing a device into a known, correct, and accurate condition. As an example, let's look at the common calibration of an imagesetter used to make film negatives for halftone output. When we specify that we want a 50 percent dot to show up on the film, a calibrated imagesetter would indeed produce a dot that has a density of 50 percent, not 45 or 51 percent. Once the imagesetter is calibrated (the output is what we expect it to be), we can create an ICC profile that describes or "fingerprints" the output so we can predict how it will look.

An example of calibrating *and* profiling a device would be using a hardware colorimeter and software on a color monitor. Once the user specifies how he wishes the display to be set (e.g., Gamma 1.8, 5,000°K), the software and hardware work in tandem to set that display to the desired condition. The final step would be to measure the condition and create an ICC profile to describe it.

Most CMS packages create profiles in a similar fashion, whether they profile cameras, scanners, monitors, or output devices. The goal of the CMS is to send known, device-independent colors to the device and measure the results. By using device-independent colors (like CIE-LAB), which are not affected by the device itself, we can send a large sample of known values to a device, measure the resulting colors, and use software to create a profile that describes the device's fingerprint, or how it interacts with those colors. Thanks to Photoshop 5.0 and its unique method of dealing with monitor profiles, the actual profile is far more important than the calibration.

In the overview that follows, the products create color profiles in the same way, although each of the products uses a proprietary target and algorithm to create output profiles. For scanner profiling, the

industry standard is the IT8/Q60 target, which is available in both reflective and transmissive versions. The industry is still seeking a standard target for profiling digital cameras, but the MacBeth color checker and the IT8 are the most commonly used. In profiling scanners and digital cameras, the user simply photographs or scans the target, being careful to make note of the settings used. The resulting file is fed into the CMS package to generate the profile.

For output profiles, targets are read into the software using a spectrophotometer, hardware that can read spectral data (see sidebar on page 34). Spectrophotometers range in price from less than $1,000 to more than $8,000, which keeps many users from making their own profiles. A few products on the market allow you to use a scanner to read the printed output and create a profile. These products are meant for less demanding users, because scanners still cannot produce profiles as accurately as a dedicated spectrophotometer.

Another tool common to CMS packages is one that allows you to finetune or alter ICC profiles. You can use them to tweak the profile to your liking, or use a canned profile provided by the manufacturer that represents an average, along with modification for a specific device. Using finetuning software, the user can alter the supplied profile to produce the best possible output without creating a custom profile from scratch.

CMSs that use ICC profiles have several important advantages. When all the devices are calibrated and profiled, you can expect excellent monitor-to-print matching. You can trust the display for image editing and use it for soft proofing. Grays should print without color cast, and the tonal range should be the best the printer is able to produce. CMSs also enable highly accurate RGB-to-CMYK conversions when you are working with CMYK output devices. They make the conversions based on empirical data measured from hundreds of color patches from the final output device.

A CMS ensures that multiple devices mimic one another consistently, providing reliable gamut mapping from device to device, so that color shifts are eliminated and even the most vibrant colors are output accurately. When we embed the ICC profiles into our files as Photoshop does, we know the exact condition of files passed among users.

Implementing a CMS isn't inexpensive or simple. The products below work very well, but they require a commitment from the user—a small price, however, for accurate, predictable color.

## ColorBlind MatchBox

ColorBlind Pro, from Imaging Technologies Corporation (formerly Color Solutions), creates ICC profiles for cameras, scanners, monitors, and output devices. Imaging Technologies (ITEC) recently introduced ColorBlind MatchBox, an affordable package with many of the same capabilities of ColorBlind Pro. The $999 package ships with its own spectrophotometer, the Color Mouse, and reflective and transmissive IT8 targets. These features make MatchBox one of the most affordable, full-featured packages on the market.

Because the Color Mouse is handheld, users have to measure color patches one at a time, a process that takes about 40 minutes. First, MatchBox prints out a 120-patch linearization target. The readings from those patches are used to create the subsequent 300 patches that must be measured to generate the actual ICC profile. The two-step process improves the quality of the profiles, and an existing profile can be updated by reprinting and re-measuring the linearization target—a very nice feature for devices that drift.

MatchBox doesn't have as many options for dealing with black generation (UCR/GCR) as the full-blown Pro package, so it may not be your best choice if you deal with four-color presses. But for desktop output devices, MatchBox really shines. I recently made excellent profiles for both a Fuji Pictrography 3000 and an Epson 5000 for a photographer in Utah, and an excellent profile for a Leaf DCB digital camera, using the IT8 target

"Virtually every device in imaging deals with color in its own fashion. For example, each digital printer has its own recipe, or set of numeric values, that makes up the RGB or CMYK color spaces."

and MatchBox. The package also ships with ColorBlind Edit for tweaking profiles.

It takes time to master the program's edit function, but it's time well spent. The product has most of the tools necessary to alter color profiles to the user's requirements. You can even edit input profiles in individual files, which works nicely in RGB workflows where the edits are applied as images are RIPped to CMYK.

ColorBlind Spot is an application for building color libraries for output devices that deal with spot colors. There is a nominal upgrade that allows you to use virtually any spectrophotometer. MatchBox even has a useful diagnostic feature for comparing and analyzing the profiles it creates.

ColorBlind MatchBox is a great product for the price. My only reservation is that the interface, especially in ColorBlind Edit, is somewhat crude and lacks intuition. However, the quality of the resulting profiles is excellent. MatchBox requires a Power Macintosh.

**More info? Circle PEInfo No. 90**

## Praxisoft CompassProfile

CompassProfile, from Praxisoft LLC, contains applications for both scanner and output profiles. I've produced some of my best output profiles with this package, especially for RGB devices. It's the profile I use with my Epson 1200 printer. The easy-to-use CompassProfile Printer has a Spartan—but certainly usable—interface. It creates output profiles for CMYK, CMY, and RGB devices. You can specify the number of patches to use in the test print, from 81 to 4,096 in CMYK, and 125 to 4,096 in RGB. Naturally, there is a point of diminishing return, especially if you have a handheld spectrophotometer.

The CompassProfile Printer gives you the option of printing a linearization target prior to printing out and measuring a large sample patch—another valuable two-step process. In the first step, the small printed sample is used to gauge the linearality of the output device. The resulting data is used to generate a large patch sample file that in turn will be used to produce the final ICC profile.

Another impressive feature in CompassProfile Printer is the ability to finetune profiles by importing a standard Photoshop curve. Simply open a representative image, call up Photoshop's curve dialog, alter a curve to your liking, and click the Save button. The resulting saved file can be imported into CompassProfile, and a new profile generated using the alteration from the curve. It's not full-featured profile editing, but considering what you can do with curves (tonal and color corrections), it's very useful.

The software has its share of esoteric optional controls, such as "Table Smoothing" and "Hue Shift," which in the right hands, allow further alterations. However, I've never had to resort to these features. Out of the box, the profiles I've generated have been outstanding. The latest version generates profiles using a scanner, with rather impressive results (yet still not on par with using a spectrophotometer).

CompassProfile supports virtually all measuring devices on the market. The program's scanner application produced very good input profiles for the scanners I tested. The process is as simple as importing a TIFF file of the scanned IT8, loading a Target Description File, and clicking on the Build Profile button. There are various options for altering how the profiles are generated, but once again, I've never needed these additional tools. The CompassProfile package runs on Macintosh only and lists for $1,949. The IT8 target is not included.

Praxisoft also has a number of useful products for working with ICC profiles *after* they're created. CompassPro XT, an XTension for QuarkXPress, is a must if you intend to use ICC profiles with Quark. The XTension allows you to specify output profiles with any rendering intent from within a Quark document. Without it, Quark will apply the same profile to every element in a page. The beauty of CompassPro XT is that you can specify a profile for a vector element using a rendering intent like Saturation, and use a completely different profile for a rendering intent like Perceptual (see Figure 1). The list price is $399 per desktop (multiple licenses are available).

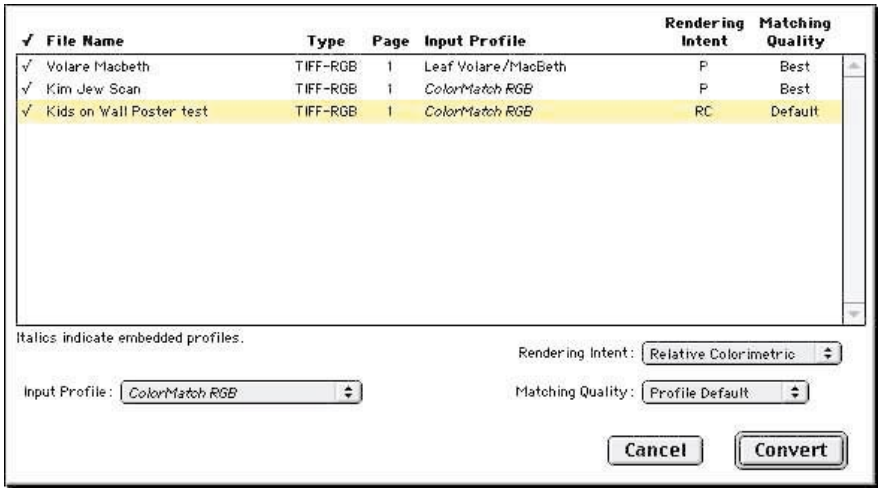


Figure 1. CompassXT lists elements in the Quark document. You can assign a different rendering intent and profile for each image or element that shows up in the list.

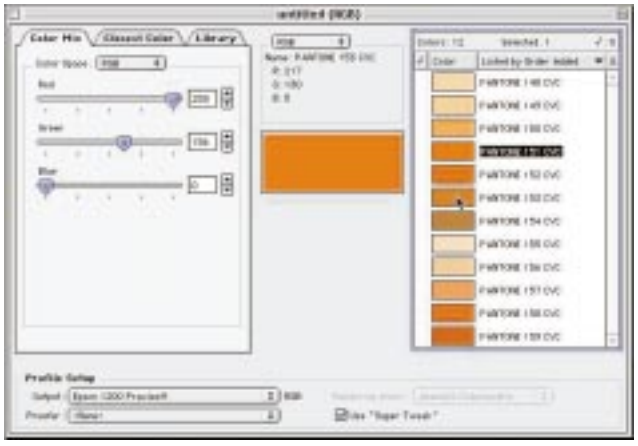

Figure 2. In this portion of the VectorPro interface, I dragged Pantone color 151 to the center, where I can read its RGB recipe for output to an Epson 1200 printer (notice the profile selected in the bottom left corner). The recipe is next to the sliders used to alter the colors. The second densitometer shows RGB values for any Pantone color under the mouse, in this case, Pantone 153.

Two newer packages from Praxisoft are ICC AutoFlow and VectorPro. ICC AutoFlow is a batching utility that allows the user to set up hot folders and instantly apply ICC profiles to the files. AutoFlow can embed or remove profiles, or apply profiles to vector or bitmap files (EPS, TIFF, JPEG). The user can create any number of "Sets," which specify a condition for the batch or conversions to be used. If you have hundreds of files to process using ICC profiles, this product can save an enormous amount of time. It is extremely fast and is available in a network version. The list price is $399 for a desktop version or $999 for the network.

VectorPro is a very useful product for those who need to work with vector files and output spot or process colors for artwork such as print logos, line art, and text. While Pantone colors have specific values that are supposed to create exact color matches on press, a recipe for Pantone 151 will not necessarily create a color that matches Pantone 151 at output or on our printer. By using an ICC profile, VectorPro determines the optimal RGB or CMYK recipe to produce Pantone colors on the profiled device, and the Super Tweak feature uses a patent-pending method to yield even more optimal values. As you can see in Figure 2, I've loaded an output ICC profile for an RGB printer and picked a Pantone color by name. VectorPro can now create custom palettes for this device and let me know how far off the colors will be from the original Pantone colors. The list price is $1,749.

VectorPro, CompassPro XT, ICC AutoFlow, and even CompassProfile all work in tandem, depending on the task at hand. For example, a user may create an ICC profile with CompassProfile and load that output profile into VectorPro to create custom palettes to specify Pantone colors for that output device. CompassPro XT can use these custom palettes to output Quark files. And ICC AutoFlow can be used to apply both profiles and palettes to elements automatically and quickly. The entire suite from Praxisoft runs on the Macintosh platform.

**More info?**
**Circle PEInfo No. 91**

## ColorFlow Profile Tools

Kodak's ColorFlow Profile Tools 2.1 is one of the most feature-laden products in this roundup. This one application creates profiles for scanners, digital cameras, monitors, and output devices. As if that weren't enough, it has a full-featured suite of profile editing tools. The original version of ColorFlow Profile Tools wouldn't win my accolades, but 2.0 was a major upgrade, and the new version creates excellent profiles.

ColorFlow Profile Tools 2.1, however, is a real Jekyll and Hyde in some respects. Making profiles is simple, with animated wizards that walk the user step-by-step through the process. The wizards make the process a snap the first time, with virtually no need to open the manual. When it comes time to modify and tune the profiles, however, the interface becomes Mr. Hyde. That's not to say the profile tuning portion isn't powerful or lacks useful tools. Just get ready to concentrate and expect

Figure 3. The edit list and evaluation image from ColorFlow Profile Tools 2.1. I've made three edits with the Saturation Tweak turned off. I can also make descriptions for the edits to keep track of the effects they provide.

some interface oddities along the way (see Figure 3).

Profile tuning in ColorFlow Profile Tools 2.1 is much like image editing. When you open a representative image, you can choose to alter tone, brightness/contrast, color balance, saturation, selective color, RGB curves, and output curves, UCR/GCR (with Black Printer Control). Kodak supplies a beautiful printed evaluation target and a matching digital file that you can open and examine while editing. You can then apply the edited profile to the evaluation file and output it with an eye toward matching the print to the target. The supplied target contains images with tricky color features, such as skin tones, saturated colors, pastels, and neutral tones. This file and target combo is a good tool for evaluating subtle color casts or other problems in output.

The editing portion of the software is a powerful tool that allows the user to tweak and tune profiles, then instantly double-click to modify or disable the effect (see Figure 4). ColorFlow Profile Tools has all the features you'll ever need for modifying a ICC profiles, and it runs on both Mac and Windows systems.

The software will easily tune input, display, and output profiles, and when the user is finished, generate a new profile with the tunes intact. The package comes with a large library of Kodak ICC profiles in case you want to immediately begin tuning away, without stopping to create profiles of your own. List price, $2,495.

**More info? Circle PEInfo No. 92**

## ColorFlow Custom Color Software ICC

When it comes to profile tuning products, Kodak's Custom Color ICC 2.0 tops my list. Why? Because this set of Photoshop plug-ins allows me to tune output profiles using the best editor in the world: Adobe Photoshop. Once ColorFlow Custom Color Software ICC is installed, simply invoke the Custom Color Import command from Photoshop's Acquire module. Select a profile to tune and navigate to a file you wish to use for the editing process. As the file opens, thousands of tiny colored patches are added to the bottom. This "tagger" file examines all the edits you produce in Photoshop and applies them to a new profile when you invoke the "Custom Color Export" in Photoshop's Export menu.

Once the file is open, you can use the Photoshop Adjustment Layers as your "edit list." If you want to alter the hue and saturation of a profile, make an adjustment layer, select Hue/Saturation, and modify the file as you would any other image. I continue to build edits on adjustment layers and save the file as a Photoshop document. If my test of the new profile indicates that I haven't adjusted it properly, I can double-click on the layer and continue to tune away. The beauty of Custom Color ICC is that if you know how to operate Photoshop, you know how to tune a profile, and you can use any global correction tool (Levels, Curves, Selective Color, etc.).

The manual that comes with ColorFlow Custom Color Software ICC 2.0 is tiny—this product is a snap to use. Until Adobe implements some kind of profile tuning inside Photoshop, there's nothing easier. It's an excellent product if you have decent canned profiles and want better output based on your preferences. List price, $395.

**More info? Circle PEInfo No. 93**

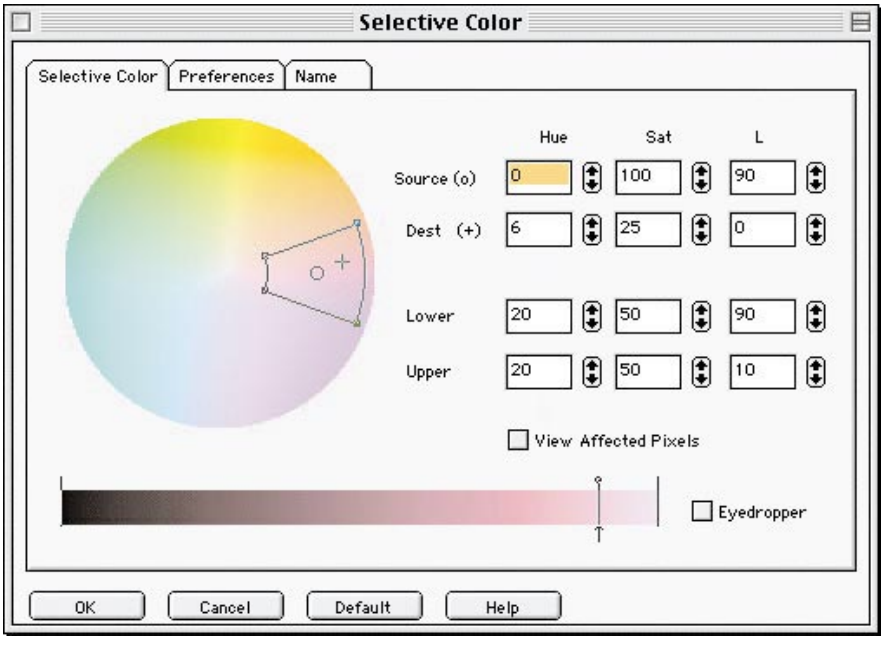


Figure 4. The Selective Color tool in ColorFlow Profile Tools isn't very intuitive.

## PrintOpen ICC 3/LinoColor 6

Two years ago, I reviewed PrintOpen ICC 2 from Heidelberg Color Publishing Solutions (formerly LinoColor). Version 3, available for Mac and Windows, has a few new features, such as expanded CMYK test prints (up to 800 patches) and the ability to average multiple profiles into one. Otherwise, the new package is quite similar to the older version, and continues to produce very good output profiles. The interface that supports the X-Rite DTP-41 is


Figure 5. The interface for accessing the X-Rite DTP-41 in PrintOpen ICC 3.1. The graphic shows exactly how the print target should be lined up and fed through the strip reader. The button above the letter "A" means this is the patch read first. Simply measure each row and generate the ICC profile.

particularly elegant (Figure 5). PrintOpen ICC 3 still lacks profile tuning features, but LinoColor 6 can now fully edit profiles or drive a Heidelberg Color Publishing Solutions scanner.

LinoColor 6, primarily a scanning interface, drives all of the Heidelberg Color Publishing Solutions scanners from the SAPHIR up, though it also supports the UMAX Powerlook II, Powerlook 2000, and the Microtek ScanMaker 3. It's very powerful and fully ICC-savvy. The product has many tools for correcting prescans and images using Luminance, Chroma, and Hue (LCH), a cousin of LAB but much easier to use. With LinoColor 6, you can open an existing file and use every correction tool the software offers; but instead of applying the corrections to the file, the corrections can be updated to a new tuned ICC profile.

If you are familiar with the powerful but hard-to-learn LinoColor, you'll find it an excellent profile tuning package. It's not only one of the most powerful scanning interfaces on the market, but also a complete profile tuning package. LinoColor 6 stand-alone version, $495.

**More info? Circle PEInfo No. 94**

## MonacoEZcolor

Monaco Systems' new MonacoEZcolor is intended for entry-level users and at $299, has a price to match. MonacoEZcolor creates ICC profiles for scanners and printers, and ships with a reflective IT8 target for creating output profiles with the aid of a flatbed scanner. The elegant interface is driven by a wizard-style, step-by-step process that makes the manual superfluous. It runs on Macintosh or Windows systems, and for $498, Monaco will bundle a version with a colorimeter for calibrating a display.

While the product can create monitor profiles visually without using a hardware colorimeter, Monaco suggests (and I concur) that using hardware is the way to go. Since the $299 version ships with only a target for making profiles for reflective scanners, Monaco sells a 35mm film IT8 ($80) and a 4x5 IT8 ($160) for profiling film scanners. A demo version is available on the Monaco Web site (*www.monacosystems.com*), where you can place orders as well.

The profiles I made using both an Imacon Flextight and Agfa Snapscan made satisfactory profiles for the Epson 1200. The color was excellent, but tonal range of the profiles was lacking. In comparison to the canned Epson profiles, the shadow and highlight detail were clipped. Naturally, the profile made with a spectrophotometer and 800 patches was superior, but with the MonacoEZcolor, the print was better than using no ICC profile at all and resorting to the Automatic mode in the Epson driver. The scanner profiles I created were excellent. MonacoEZ supports only RGB devices and it's intended for desktop printers, but it's easy to use with ink-jet printers as well, and it's an affordable entry into ICC profiling.

**More info? Circle PEInfo No. 95**

## Profile•Editor

Color Vision (formally The Color Partnership), makers of the excellent monitor calibration package, Opal, has a new, easy-to-use and inexpensive profile tuning package, Profile•Editor. This program enables you to tune RGB or CMYK output profiles by adjusting color cast, saturation (globally or by specific color), brightness, and contrast, with simple sliders and the included evaluation target file (Figure 6).

A before-and-after densitometer is available, but the suggested workflow is to correct visually and

Figure 6. The tools and palettes available in Profile•Editor, and the supplied evaluation file for profile tuning and printing. Notice that the cursor is over the gray wall, and a set of RGB values is supplied in the Color Meter.

generate a new print with the newly generated ICC profile. Even though it's easy to use and affordable, Profile•Editor could use more robust tools. The simple addition of a curve interface would allow greater control over tonal and color corrections than the linear sliders. However, if you're just starting to test the waters of ICC, Profile•Editor is an excellent way to improve output by tuning a canned profile or one made with an inexpensive profiling package that may require some tweaking. A demo version is available at *www.colorvisionus.com*. Profile•Editor runs on only the Macintosh OS, but a Windows version is in the works. List price, $199. ◀

**Circle PEInfo No. 96**

## Stop the Presses!

As this article goes to press, I am evaluating the new WiziWyg from Praxisoft. This product creates ICC profiles for scanners, monitors, printers, and digital cameras. Much like MonacoEZ, the software is wizard-driven and uses a scanner rather than an expensive spectrophotometer for making output profiles. The Beta version I tested came with a special Praxisoft reflective target that resembles an IT8 target. The quality of the profile I made from my Epson 1200 was astounding! I also used WiziWyg to make custom profiles for a scanner and a high-end digital camera—again, I was rewarded with excellent quality. For monitor profiling, the product will be compatible with many of the major colorimeters, such as X-Rite DTP-92. Praxisoft told me that several manufacturers of scanners and printers will bundle their products with WiziWyg. Price, $199.

**More info? Circle PEInfo No. 97**



## Spectrophotometers

A spectrophotometer is required to read the color patches created by the profiling packages discussed here. Two years ago, I was using Light Source Colortron II, an affordable hand-held device. Since then, X-Rite Inc. has acquired Light Source, and the Colortron is available for a suggested price of $995. X-Rite does have a low-cost spectrophotometer, the Digital Swatchbook, which is supported by virtually every profiling package on the market. At $1,345, it's much faster and more accurate than the old Colortron, and it ships with the excellent ColorShop software for measuring colors outside the computer.

If you don't relish the prospect of spending an hour measuring tiny color patches, look into the X-Rite DTP-41 AutoScan spectrophotometer. It's a strip reader, so you can place a portion of the printed target into the device. In about three seconds, it gives you an accurate reading of 15 patches after examining five sample points per patch. Using the DTP-41 for all of my testing has been a pleasure, and virtually all profiling packages support it. Without hesitation, I will use it to measure 800 patches, which it does in minutes.

The newer DTP41/T can measure both reflective and transmissive targets, so you can use it to make ICC profiles for film recorders and printers that produce transparent output such as Duratrans. X-Rite has an excellent PDF-format color management primer on its Web site: *www.xrite.com*. For a shop that makes lots of profiles or updates profiles on a regular basis, the speed of the DTP41/T will quickly justify the cost. List price, $2,500.

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