



ColorSync® 2.1

The Color Management Work Flow Standard



Masters of Media

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This white paper presents an overview of color management provided by Apple Computer's ColorSync system software. An accompanying CD-ROM entitled the ColorSync Starter Kit includes work flow suggestions, sample color profiles from a number of vendors, software and instructions on how to use ColorSync on your Macintosh computer to take control of color.

Several of Apple's partners in color management have contributed to the CD-ROM with profiles and demonstration versions of their software.

These partners include:

- LinoColor*
- Radius*
- TruMatch*
- X-Rite*
- Rochester Institute of Technology*
- Color Partnership*

The color profiles provided on the CD-ROM were tested thoroughly by the Graphic Arts Technical Foundation.

To purchase additional copies of this paper and the CD-ROM, contact Apple Starting Line at 800 825-2145. Mention Catalog No. L02331AZ



Brian Lawler is a consultant to the graphic arts industry.

Photo: Dean Collins

An industry perspective on color management

by Brian P. Lawler

I have been in the prepress industry for many years, and have wrestled with the difficulties of delivering customer-pleasing color for all types of printing processes.

The way my employees and I handled color was to work with a tightly-controlled color prepress system. This meant that we almost never changed any of our procedures. Variables were introduced at our peril. As a result of this, we kept our fingers crossed a lot of the time – because that’s the way color was “managed.” The truth is that our system managed us.

The Macintosh computer became our tool-of-choice for design and page production, and along with it the popular software products that have shaped our industry. For the first few years we stripped-in any color that was included in our jobs, and only when there was a reliable way to get color signals from our scanner to the Mac did we begin to include color as a part of a complete set of color separations.

Still, the color was not consistent, and it certainly wasn’t repeatable!

When Apple shipped the original ColorSync in 1993, I gathered all I could find on the technology and read it with the anticipation of being able to work with color more effectively. Version 1.0 was not robust enough, and the computers of 1993 were not fast enough to handle ColorSync efficiently. So, I set it aside.

A lot has changed since then – the PowerPC processor has made Macintoshes many times faster, and ColorSync 2.0 (which shipped in 1995) has empowered color management to the point where software publishers have responded with some great products.

On the last two pages of this paper are listings of software that is shipping today that supports ColorSync. There are numerous color measurement instruments, an impressive array of profiling software, and a good selection of production tools – page make-up, image editing, illustration, image databases, Photo CD applications and more.

ColorSync has received the endorsement of the industry. It works, and it works well.

For the past 18 months I have been working with ColorSync software, several measurement instruments, and a variety of proofing and printing machines, and I am pleased to report that I have seen success on printing presses in a number of locations.

My own monitor and scanner are now calibrated; they're impressively accurate. The color output of my scanner is stunning, and I have learned to trust the color I see on my monitor!

When I convert my photographs into digital files, I am quite sure the color on the computer is an accurate reflection of the original.

I can make a proof on my Color LaserWriter, and know that the printing I simulate is extraordinarily close to the final product. I have these tools at my disposal now, yet I think back occasionally to the days when I made a color shift with trepidation, expecting it to cause a catastrophe later.

As a consultant, I have been working to guide my clients into the world of managed color, and the results are excellent. Color management is really here, and as more and more designers and printing firms adopt a color managed process, it will become a way of doing business. I am confident that ColorSync is making an impact very much like the Macintosh did in the 1980s.

Microsoft recently announced their intention to include color management in a future version of their Windows operating system. At first I was concerned that Microsoft would try to force a new standard on the industry, but I was relieved to learn that Microsoft's plans are to include the same Color Management Method that is used by Apple ColorSync.

Like Apple's QuickTime, which is the universal standard for time-based media – audio, video, 3-D and animation – ColorSync sets a new standard for managing color in cross-platform development.

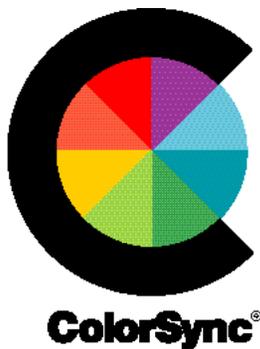
The hundreds of thousands of designers and artists who use Macintosh computers to create artwork the world over know it's best to develop on Macintosh for cross-platform publishing. ColorSync makes their efforts more effective by adding managed color to their toolbox.

CMM – Color Management Method.

ColorSync uses a CMM developed by Apple and Linotype-Hell, one of the world's leading developers of prepress technology. The CMM represents the mathematical methods by which color conversions and modifications are made.

Linotype-Hell is a subsidiary of Heidelberg AG, a German printing press manufacturer; the color software subsidiary is known as LinoColor.

LinoColor supplies the color management core software to Apple, and will be providing their color science to Microsoft Corporation for inclusion in future versions of the Windows operating system.



Desktop publishing: the process of designing and producing professional quality graphic art projects using a personal computer and a variety of software applications.

Though it had humble beginnings, it is a multi-billion-dollar industry today.

We're proud to say that the Macintosh computer made it all possible.

The desktop publishing revolution was begun by the three powerful graphic arts tools – the Macintosh computer, Aldus² PageMaker software, and the Apple LaserWriter printer using Adobe PostScript.

These tools were great emancipators; they freed creative professionals from the bonds of drafting tables and galleys of type, from wax and X-Acto knives.

Managed color

Promised for years, color management was touted by many manufacturers as the “push-button solution” to maintaining color accuracy in the world of computer-generated art.

In 1995, Apple Computer delivered color management that works. Apple's ColorSync is color management so effective and easy to use that today the industry is following with support of the Apple color management standard.

ColorSync is System-level color management¹ and is now supported by over 60 products that work to help you manage color.

Supplied with every copy of the Macintosh Operating System, ColorSync can help artists, designers and prepress experts to achieve repeatable, reliable and consistent color on-screen, in print, and for electronic delivery – multimedia and the World Wide Web.

ColorSync is a scientific standard for managing color on computer monitors, scanners, and a variety of output and printing devices. ColorSync provides the color management engine which can control color through device-independent mathematics to deliver real managed color to the desktop.

ColorSync works at all levels of production – from the individual designer's Macintosh, to the prepress house, to the multimedia production firm, to the high-quality printing firm.

The evolution of color as a commodity

In 1984, desktop publishing started a revolution in the production of artwork for printing.

As creative people began adopting the Macintosh, their artistic abilities blossomed. They used more images and better type fonts; they added graphics to their documents to make everyday work look dramatically better. Because quality work was achieved more easily than ever before, the business of design flourished.

1. The Apple Macintosh is the only computer shipping with a successful color management system as part of its Operating System software.

2. Aldus Corporation later merged with Adobe Systems, Inc. The product lives-on as Adobe PageMaker, and it supports Apple ColorSync.

Along with this growth has come an added interest in images, in illustrations and in high-quality color.

Where a document would have been typed in 1984, it was typeset in 1985, illustrated with compelling graphics in 1986, had photos added in 1989, and was printed in full color in 1991.

We have learned that color commands attention and gets better results. Color is very much a part of the fabric of commerce. Yet, color alone is not satisfactory. We want quality color, color that matches the original, color that is reliable, color that is affordable.

To achieve these goals, we can now turn to ColorSync, the software that makes color work for us, rather than making us work for color.

With ColorSync we are able to manage color – to cause color to be a salable commodity, a product as viable as a sweater or a sports car. Color is business, and that business is now under our control.

When you add ColorSync to your production methods, you are turning the management of color into a new business. With this new business, you'll meet new customers and be able to do more work for your existing customers.

Managed color makes for work that is more profitable, more repeatable, and much easier to achieve than ever before.

Why we need color management

Mail order firms that trade in garments and household goods report that the most common reason that a consumer returns an item is color. The customer expected the color to be different than it was when it arrived, but the catalog colors didn't match the product faithfully enough to be effective.

In a world of managed color, we can ensure that the film will be scanned accurately, the monitor will display the color correctly,³ and that the customer will see the color as accurately as they can see color.⁴

Without a doubt, the success of any design, prepress or printing operation is measured in productivity. The greatest concerns are

PostScript is a device-independent page description language used by most graphic arts quality printers.

PostScript was the invention of John Warnock and Charles Geschke, founders of Adobe Systems, Inc.

PostScript is one of the most significant tools in graphic arts history.

Most people involved in the World Wide Web must eventually deal with the difficulties of doing business over the Internet.

Called electronic commerce, the process involves selling and exchanging products and services in an all-electronic environment.

Color is just one problem facing those wishing to do business on the Web, but ColorSync makes the process easier.

3. Some monitors, due to their age or condition, cannot be calibrated.

4. Unfortunately a small percentage of the population is colorblind; ColorSync can't fix that.

reduction of waste, and getting more quality work completed during the business day. When this works, productivity enhances profitability.

Companies are always concerned with return-on-investment, as they should be. The greatest return possible from any investment in technology is to have more work get through production without difficulty. Apple ColorSync can make this easier. ColorSync can correct for color shifts on a scanner, it can adjust color to display on a monitor with great accuracy, and it can make proofing, printing and viewing of color more accurate than ever before.

Companies that incorporate color management see immediate gains in productivity. Basic ideas, like trusting the image on the monitor, become routine business in the color-managed operation.

And, working with color-managed proof printers and printing presses helps to build customer confidence, which results in increased business. Clearly, investing in color management is wise because it helps creative professionals and their suppliers work within the capabilities of technology to deliver more reliable work – more often.

ICC – the International Color Consortium.

Apple was a charter member of the consortium of software and hardware manufacturers who believe color management is critically important.

The ICC has developed a standard for color management profiles, one which works on all computers, and provides the necessary elbow-room for growth and expansion.

Apple ColorSync abides by the standard, and works with all ICC profiles – the software files that describe the color capabilities of an individual device. This allows for the cross-platform communication of color so that when other computers add color management, these files can be exchanged freely.

Apple has led an industry revolution in color

Just as Apple led the revolution in desktop technologies, Apple is leading the way again with color management.

With over 60 products shipping today⁵ that support ColorSync, Macintosh is the only computer with a successful color management system and software in place. There are image manipulation programs, page layout programs, image database programs, remote viewing programs, color palette builders, monitor calibrators, and a host of other products that are all built with ColorSync at their core.

Apple has worked with developers all over the world to get ColorSync to the level where it provides a solution to everyday color needs. And Apple was instrumental in establishing the International Color Consortium, the standards committee for color management.

With ColorSync we've started another revolution!

5. Check pages 22-23 for the complete listings.

How color management works

Color management is a scientific approach to matching the color of the original (film, print, painting, digital illustration, etc.) to the colors visible on the computer monitor, then to the proof, and ultimately to the printed page.

Of course, in today's diverse multimedia world, the printed page may not be the ultimate destination for an image – or it may be just one of several destinations for an image.

ColorSync acknowledges the diversity of uses that an image might endure, and allows for the easy conversion from one color process to another for any publishing purpose.

What we see versus what we can see

The human eye is a very sensitive and subtle measurement device. It sees a broad range of colors in the spectrum of electromagnetic radiation that falls between infrared and ultraviolet light.

We measure what the eye can see on a chart called a chromaticity chart. Devised by the Commission Internationale de l'Eclairage (called the CIE by color scientists), this chart shows what a large average of humans can see. We'll call it a spectrum for this analysis.

The chart shown here shows just two dimensions of that spectrum. The third dimension, lightness, would project outward to describe how "light" a color is. The hue component of the chart is a good measure of fully-saturated colors, and is an excellent method for comparing the color capabilities of various devices.

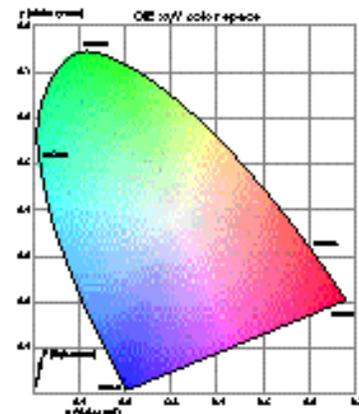
In any discussion of color management we must address the inabilities of devices to display or print color. These inabilities are called gamut reductions. If we superimpose a plot of the colors that can be shown on a computer monitor, we see immediately that the monitor can display only a fraction of the visible spectrum. The plot of this is shown at the top of the next page.

If we carry this to its extreme, and superimpose the plot of

Source color	Destination color
Monochrome	Monochrome
RGB	RGB
CMYK	CMYK
LAB	Hexachrome ⁶
	Hi-Fi color ⁷

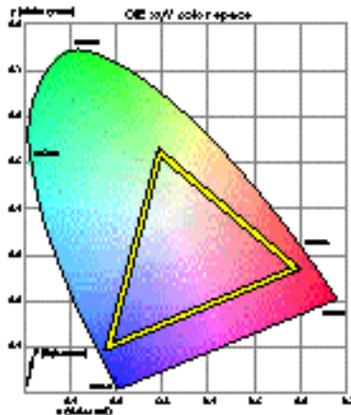
ColorSync can support input in four color modes, and can convert that color (as appropriate) into any color space for which there is an output profile – in as many as eight colors.

The Chromaticity Chart, below, shows the spectrum of colors visible by the average human eye. Lightness, the third dimension of the chart, is not shown.

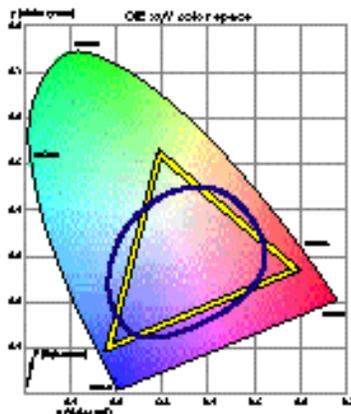


6. Hexachrome is Pantone's tradename for six-color printing. The expanded gamut of the Hexachrome process produces more vibrant color than conventional process color printing.
 7. Hi-Fi printing includes Hexachrome, but may have more colors; ColorSync supports up to 8.

The Chromaticity Chart, below, now shows the spectrum of colors that can be displayed on a computer monitor. It is a significantly smaller spectrum than the visible colors of the overall chart.



When we superimpose the chart of printable (CMYK) colors on the chart, it is evident that printing process produces a much more limited – and slightly different – spectrum of colors than the visible or displayable.



printable colors on top of the chart, we can see that the printing press does no justice to the visible spectrum, as shown in the chart at the bottom of this page.

It is the function of color management software to convert the color from a source device to a destination device with as little loss of color as possible, while taking into account the color qualities of each device in the chain of processes between the original and the final product.

Color management means calculated color compensation

A color management system, under the best of circumstances, must compensate and arbitrate between the spectra that are possible on various devices.

In order to do this effectively, ColorSync converts all the colors it deals with into yet another measurement system called LAB color (see diagram on the opposite page). This color measurement system allows ColorSync to make calculations and conversions between devices without damaging the color values.

The LAB space can be equated to that of a master translator. It understands many languages of color, and speaks many more. Any limitations could be equated to limited vocabularies.

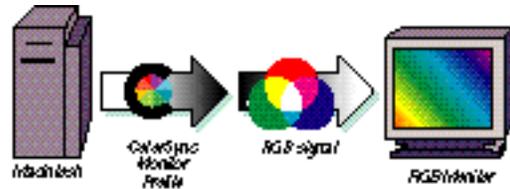
Once inside the LAB color space, the color of a scanner can be corrected and adjusted to the best degree, and the color of a monitor can be adjusted for the best possible display. Color for any destination device can be processed as well, making the whole system work in a unified way. Only System-level color management can fulfill these complex objectives.

Monitor calibration and profiling⁸

Monitors are red-green-blue devices that create light on the face of a picture tube. It's important to understand that the colors possible on a computer monitor are different than those printable on a printing press (the chart at left shows this). A monitor can be calibrated, and it will display color with impressive accuracy, but it will never match the printed page perfectly because of the physics of color involved.

8. Profiles are the tools of ColorSync. Each device is measured, and a profile made to describe its particular color capabilities. The Profiles are then used to modify the color from that device to correct for its inherent inaccuracies.

Monitor calibration and profiling is done with software and an instrument, called a spectrophotometer,⁹ that attaches to the face of the picture tube.



The monitor profile controls the color from the Macintosh to the monitor. Called the "System Profile," it manages all color displayed on the monitor, regardless of the source application.

Monitors should be calibrated on a regular basis. Once each month is usually adequate.

Two Apple monitors will recalibrate themselves automatically under software control. Both the 1710 and 1710AV monitors feature internal white point sensors.

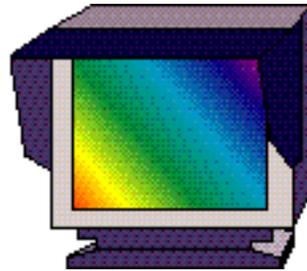
These do not take the place of the calibration instrument, but supplement it.

The software sends a series of colors to the screen, and the instrument reports back the value of the colors that actually arrive there.

The profiling software then builds a corrective profile that is used by ColorSync to drive the monitor.

Practical steps to make color on the monitor better

There are other things that can be done to ensure quality color. Some solutions are low-tech or no-tech. When calibrating a monitor for color-managed computer processing, it's wise to eliminate as many variables from the monitor's environment as possible.



Room glare, and natural light from windows and skylights can be as much a problem as an uncalibrated monitor. To reduce the problem of glare, construct a glare hood out of black mat board and affix it to the monitor, as shown above, with Velcro hook-and-loop tape.

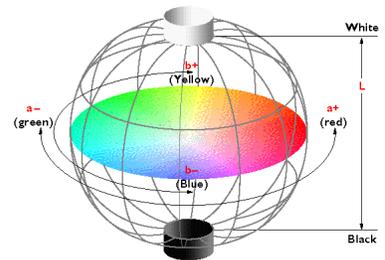


And, you can make the room lighting consistent by removing dimmer switches from the circuits. Lighting should be either on or off to maintain consistency. Color experts recommend diffuse fluorescent lighting with "complete spectrum" tubes (though even these do not have a complete spectrum in reality). Egg-crate diffusers are nice for computer areas.

This diagram of the LAB color space shows how the values of LAB fit into a theoretical spherical shape. The colors of the spectrum charts on the previous pages are all within the available space of the LAB system.

The benefit of LAB color is its ability to describe the color position of any color without mathematical error.

Conversions inside the LAB space are mathematically efficient, which makes it possible for ColorSync to convert between color spaces more easily and more quickly.



9. A spectrophotometer is an instrument that reads the spectral signature of a color. Several inexpensive, yet highly effective instruments of this type have arrived on the publishing scene in the past few years.

Device-independent color describes color that has not been set to a particular printing or imaging technology. Scanned files begin their lives as independent color, but are quickly made dependent as they are converted to process colors. Trends in imaging are encouraging us to use color modes like LAB and scanner RGB to store our original files so that the color in those files remains independent. With such color images, ColorSync can be used to convert to color for any purpose, maximizing the quality according to the ability of that device to print color.

Scanner calibration and profiling

When a file is created on a scanner, ColorSync can modify the color produced by the scanner using a profile that has been created by measuring the color performance of that scanner.

The method for calibrating and profiling a scanner is to scan a standard color target. Known in the photographic industry as an IT-8, this target contains rows of color patches that are “seen” by the color scanner to create a file for analysis.

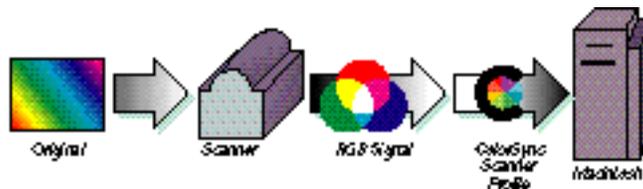
It’s important to set all the controls of the scanner to neutral points before making this scan test. With neutral settings, one can return to the same starting point later to make successful scans time and time again.

Profiling software is then used to analyze the scanner test file. This software compares an IT-8 data file to the values in the scanned file and determines the characteristics of the scanner. The results are used to create a scanner profile that is used for all future scans to correct the color of images made on that device. The scanner profile is used as a filter through which images are passed as they enter the process of reproduction.

Scanning in RGB vs. scanning in CMYK

The most flexible application of color management requires a scanned file that is in a device-independent color space. CMYK is not an independent color space, as the process of making a file in these four colors requires the conversion of the scanner’s RGB signal (all scanners start with an RGB signal¹⁰) to a specific CMYK gamut.

RGB, as the scanner delivers it to the computer, is device-independent, and provides maximum flexibility for the image scanned.



Scanned originals can be imported through an input profile to the Macintosh. The input profile corrects for the inherent color inaccuracies of the scanner. Input profiles can be created for scanners and for many digital cameras.

10. All scanners work with a white light source and red, green and blue filters. The filters actually make the color separation photomechanically, and the resulting signals represent the red, green and blue elements in the original. Some scanners convert to CMYK as the scan is made.

A single image can be converted from RGB to CMYK for gloss sheet-fed offset, and again for an uncoated off-white paper. Each of these conversions creates a different CMYK separation.

The same RGB file can then be prepared for Hi-Fi color printing in up to eight colors using another ColorSync profile.



Some scanners convert from the RGB scan signal to CMYK on-the-fly, creating a color separated file from the original image. This is a less desirable approach to scanning in RGB because it makes the file device-dependent, and limits the potential uses to which the image can be put.

And, when the customer wants to move the image to the World Wide Web for an electronic version of the printed materials, that same image can be processed through a different RGB ColorSync profile to prepare it for the Web.

CMYK files are locked-in to the color gamut of the process for which they are separated. This makes the conversion to other CMYK spaces difficult or impossible, and causes the conversion back to RGB to result in a less-than-optimum image for RGB purposes.

ColorSync is capable of making CMYK-to-RGB conversions, but the color qualities of these conversions are usually compromised because the original scan was made to a reduced-gamut CMYK space.

If possible, scans should be saved in the original RGB scanner file format in order to preserve the maximum amount of color, and to ensure that the image can be used for a number of different purposes.

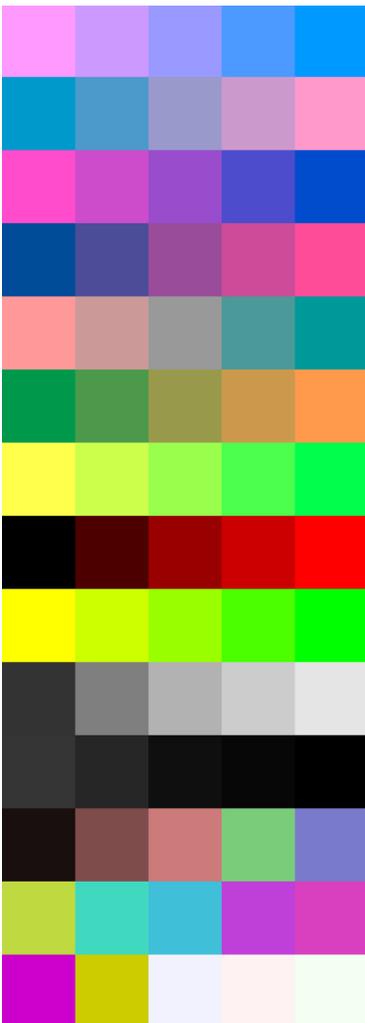
Other reasons to scan and save in device-independent color (RGB or LAB)

Color correction and color modification are dramatically easier to accomplish in the RGB mode than in CMYK – where color gamut reduction has already taken place.

Many of the creative tools in programs like Adobe Photoshop and

A segment of a test target, showing rows of color patches. By reading the color generated by proofing and printing machines, a profile is generated that later corrects for color inaccuracies of the device.

Using the profile, ColorSync can be instructed to make a color-correct separation that takes all qualities of the device into account.



the LivePicture application require that the file be in RGB to work. Adobe's Gallery Effects creative filters, for example, will work only on RGB files.

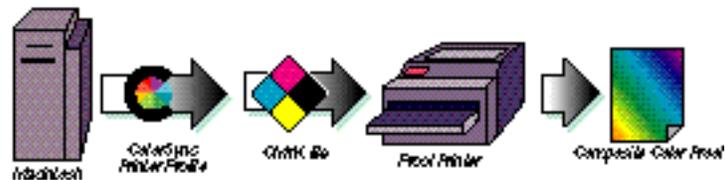
Another practical reason to save your files and work in RGB or LAB is that the file size of a three-channel color file is 25 percent smaller than the same image saved as CMYK.

Photoshop has a feature called CMYK Preview that allows you to preview in CMYK and still keep the file in RGB or LAB color. And, while we're on the subject, Adobe Photoshop version 4.0 has the ability to build a color separation table from a ColorSync profile. This makes it possible for Photoshop to make a color separation through the Mode change function that is almost exactly the same as the separation that will be made by the ColorSync profile.¹¹

Use this ColorSync profile function after you have established a process color profile for the printing technology you have chosen.

Proofing and printing with color management

Proofing devices, printing presses and film recorders are the final opportunity to put ColorSync to work.

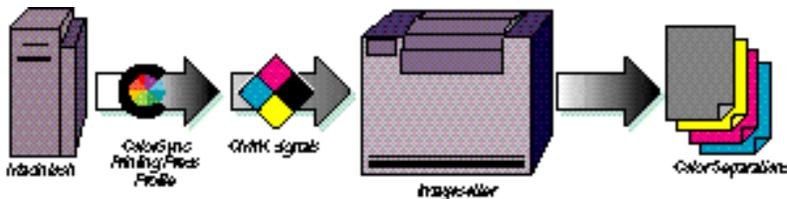


When proofing a job to a digital color printer, an output profile can be applied. The output profile can correct for color inaccuracies in the printer, or can be combined with a printing press profile to simulate the effect of the press on the proof printer.

The process requires the creation of a target file that is appropriate to the printing process. A four-color file is made for a printing press (part of one is shown at left), an RGB file is made for a color film recorder that produces transparent film.

The target file is printed on the device, then measured with a color spectrophotometer. After the target is printed and evaluated, the profiling software makes a ColorSync profile that describes the color

11. Apple provides a set of three free plug-ins for Adobe Photoshop that handle ColorSync functions. One is a filter, the other two are Import and Export plug-ins which apply ColorSync to images as they are imported or exported: <http://www.colorsinc.apple.com>



Output of separation film on an imagesetter is made with a ColorSync profile for the printing press. For this to be successful, the imagesetter's output must be linear, and the printing press able to deliver consistent results.

capabilities of the device. This profile then becomes the output profile which adjusts the color of the file as it is output from the Macintosh.

Using this output profile, a proof printer can be called into action to make a proof to show the client – in advance of making film and plates – what the job will look like when printed on a printing press.

A number of digital proofing devices are becoming popular as substitutes for the conventional film-generated contact proofing materials that have been used for decades.

Dye-sublimation printers and ink-jet printers are stepping in to fill the demand for all-digital proofs for today's printing processes. These machines produce dotless color images that can simulate the press sheet quite closely (when controlled by a ColorSync profile), and at tremendously lower cost than the conventional materials.

Some printers insist that there must be halftone dots on the proof for the press operators to accept the proof as a legitimate indication of color and quality. For those who must have dots, there is one very high resolution printer¹² that delivers not only accurate color but accurate screen simulation, too.

A number of electrostatic printers are also pushing the boundaries of color proofing. Desktop printers like the Apple Color LaserWriter 12/660 can be profiled to simulate the printing inks of a press with impressive results.

Other devices push the boundaries even further. High-quality color printer/copiers can now be used for the production of proofs as well as short-run impressions of finished color printing.

The nature of imagesetting has changed since the revolution began in 1984.

Where all printing was done from film in that long-ago era, a good percentage of printing is now done with images exposed direct-to-plate.

Direct-digital presses exist now that use no plates, or expose the plates right on the press!

ColorSync is an essential component of these trends, because you can't abandon film without a precise and reliable method for managing color.

12. The Kodak Digital Approval uses dye-sublimation technology at an impressive 1,800 ppi. The machine can be connected to the same RIP that runs the imagesetter. This results in halftone patterns that are virtually identical to those on the final sheet.

What about dot gain?

Some people accept the idea of color management, but don't understand that color management systems make a profile of the total performance of the printing press.

Not only is the hue of the inks taken into account, but also the contamination of colors, press gains and losses, all plate gains and losses, any changes due to non-linearity of the imagesetter – the whole picture. The profile also accounts for the color of the paper on which the printing is done. Paper absorptivity is measured as part of the tonal readings of each profiling software process.

From this harvest of information about the performance of a printing press, the ColorSync profile compensates for all of these factors, to the extent that it can, while working within the gamut of the inks and the condition of the equipment.

Publishing beyond the world of CMYK

A tremendous amount of publishing is done these days in media that are not printed. Publishing on the World Wide Web, as described earlier, is an option for virtually every customer. The material that is printed in a brochure will almost always end up in electronic form in today's Internet-centered economy.

Multimedia discs are another form of publishing where the content of a printed piece ends up in electronic form.

Color film recorders are yet another example of a printing medium which does not use the printer's CMYK color system. ColorSync can handle output for all of these publishing opportunities, and will manage the color of the job according to the profiles applied to the raw files.

Many designers are working on artwork that is destined for videotape. Though it is similar in color requirements to that of multimedia, video for broadcast television has a different color space and contrast quality. Again, by characterizing the process, an output profile can be created that will correct the color for the process, making it as good as possible for this method of distribution.



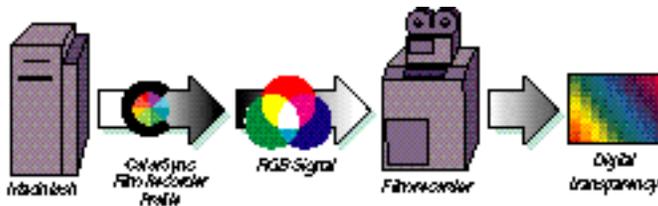
When preparing projects for Multimedia publishing on CD-ROM, an RGB monitor profile is set as the destination profile. Work destined for the World Wide Web, below, also requires an RGB profile for the colors of the multi-platform Web.



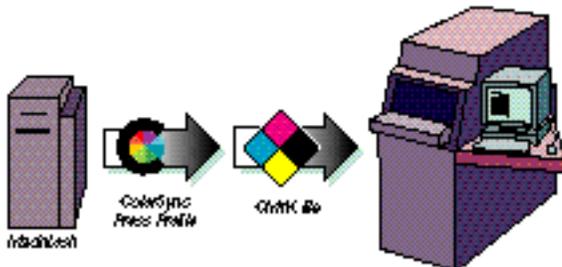
Color for the World Wide Web and for some multimedia productions is limited to a 256-color palette.

Called 8-bit color (2^8 colors), the palette can cross platforms – Macintosh, Unix and PC – while still showing the same colors.

Of course this assumes that the recipient has a monitor in good condition, and one that can display reasonable color.



Film recorders require accurate color files in RGB mode. With the appropriate ColorSync profile, the film recorder can be made to produce excellent color consistently.



Direct-digital printing presses, like the Heidelberg QuickMaster DI shown here, require a color management system to work most profitably. Since there is no film, and no conventional proof, the monitor and the electronically-generated proof must be trustworthy.

ColorSync fits the future of computer-to-plate and digital printing

As new printing processes are developed, and as the graphic arts industry moves farther away from film, the need for a “contract” proof that is generated with managed color is quite evident.

Computer-to-plate systems and direct-digital printing systems must rely on managed color to be successful. Apple’s ColorSync provides a solution to this problem – today.

Direct-digital printing is becoming a more important market segment in the printing industry. The ability to purchase a short run of high-quality full-color printing in a matter of hours is changing the perceptions of the business printing buyer.

With no time for re-runs, the purchaser of direct digital printing should invest the time and money necessary to implement a complete color managed system for artwork creation.

The popular digital printing systems on the market today are currently running with old-style color management – little or none. The operators of these impressive machines should be turning soon to Apple ColorSync on the front-end to aid in the expansion of this part of the printing industry.

The color management commitment

Color management has a reputation for being the domain of “rocket scientists,” but in fact is a lot easier than that. Companies that take the necessary time, and commit the needed resources to color management, gain the advantage of managed color.

The time necessary to establish color management standards in any shop depends on the complexity of the operation. To calibrate and profile a computer monitor takes just a few minutes, for example.

To calibrate and profile a scanner requires about two hours. This procedure need not be repeated often, as most scanners are stable performers.

Printing presses and proof printers require more time, as the number of color spot readings needed to build a profile is high. One of

the available color measurement instruments is fully-automated, which makes it capable of making hundreds of readings in a few minutes. For larger operations, those with four or more printing presses, this instrument is a must-have. The time saved in making the periodic color test chart readings will pay for such a device in short order.

Tip to printers: treat the test patches like any high-quality printing project

In numerous printing operations where tests of ColorSync profiling software have been made, the test patch sheet was printed without the commitment to quality that a commercial job would get. It's easy for production people to cast "experiments" like these aside, or to run them without care to bring the press up to speed or to full ink density.

These patch tests must be run to same level of quality as the best commercial printing done on this press. Only then will the color, densities and dot gain characteristics be measurable.

Expect to spend two or three days of intermittent testing to profile a four-color press, followed by a lifetime of successful color printing!

Making managed color fit the needs of production

The world of artwork production today is abuzz with the expression "work flow." The reason this term is so common is that people have discovered that the greatest advantage that technology brings to graphic arts is productivity. It means getting more work done in a shift, making fewer reruns, and getting quality output whenever the print button is pushed. Work flow describes how technology is applied in production.

Color management enhances productivity. When ColorSync profiles are applied in a quality-assured system, the percentage of successful work goes up. When color is reliable and consistent, profits also go up.

It's possible to employ managed color at any level, and those who use ColorSync to its fullest can reap the benefits.

Knight-Ridder Corporation has discovered the value of managed

Web-fed printing is printing from a roll of paper. Newspaper presses are almost always web-fed, while commercial printing is nearly always produced by sheet-fed machines.

Today's web-fed presses are capable of producing extraordinarily high quality printing.

color for their chain of 35 metropolitan newspapers. They have shown that the same color can be printed in different cities – on different presses – offset, flexographic and letterpress. Their objective: increased profits from national advertising. When all the Knight-Ridder papers are using ColorSync, consistent color will be a tool the entire chain of newspapers can use to increase ad revenues.

An ad printed in the Miami Herald will exhibit the same color as the ad printed in Duluth, Minnesota printed by flexography, and the same in the San Jose Mercury-News printed by lithography. These newspapers have already proved that Apple ColorSync works. Sheet-fed and web-fed commercial printers can reap the same benefits with ColorSync. Individual presses can be profiled using ColorSync so that the color off the press is known in advance.

One San Antonio-based commercial printer uses ColorSync to profile all their presses. By using color management on their Macintosh computers, the company has saved money while improving the consistency of their printing.

The firm produces a wide variety of high-quality printed products on four large Heidelberg presses. Using ColorSync profiles, the plant operators have reduced press make-ready by more than one hour per shift. The net result of this added efficiency is that on average, one more job can be run on each press in each eight-hour shift.

Translated into dollars, this adds-up to about \$300,000 per year in available press time. That's not small change, and it's possible because this printer is managing color using Apple's ColorSync technology.

Turning color management into profits

Once the reliability of color can be assured, then printers and prepress operators can promote new business by leveraging ColorSync profiles and processes.

By providing color profiles to design clients, those clients can preview the effect of a printing press on a job. They can build their color palettes so that spot colors chosen for the design will print correctly on the press-paper-and-ink combination available from their favorite printer.

Color management can help build customer loyalty. When a printer delivers consistent, reliable color, customers come back for more! When prepress suppliers show how they can deliver consistent color for all printing processes – gravure, flexography, screen printing – the client can rely on a single prepress supplier for all their film needs regardless of the printing process.

How does ColorSync fit into a quality prepress operation?

There is often resistance to change in our business. That resistance is often found in the scanning, retouching and film assembly areas of quality-conscious prepress operations. This is traditionally where quality is built into printing jobs.

Image preparation processes need not be compromised by color management. To the contrary, ColorSync provides a path that can be followed readily by color professionals.

If using ColorSync profiles on a conventional scanner is not workable in the production work flow of a shop, then color management can begin with the calibrated monitor. If the scanner operator or color retouching specialist is satisfied with the image as it appears on a calibrated monitor, then the monitor can substitute for the scanner as the source profile as the image enters production.

There is no compromise of quality necessary in using ColorSync. In fact, ColorSync fits snugly into total-quality¹³ systems because it relies on, and introduces consistency and repeatability into the process of image management. Firms that pride themselves on color quality will find improved marketability of their work with ColorSync.

Add up the benefits of managed color

First you get great color, and consistency, and repeatability.

Then you get the confidence that your color will work on the Web, in multimedia, and in print. You'll have fewer losses due to color error. Color changes made on the monitor will result in the same change occurring in the final product.

Letterpress printing is printing from metal or plastic relief plates.

Flexographic printing is printing from polymer printing plates. It is very common in the food packaging industry.

Offset printing uses a metal or plastic printing plate that has no relief, and transfers its image from the plate to a blanket cylinder that prints on the paper.

Gravure printing uses a copper cylinder as its plate, with the image engraved into the cylinder. This method of printing is common in packaging and in publications printing of very long runs.

Screen printing is done by imaging onto an emulsion coating on a fabric screen. When processed, the emulsion is removed from the image areas, allowing ink to pass-through the screen onto a substrate. Screen printing is commonly used for printing garments and other irregular surfaces.

13. W. Edwards Demming would be proud. ColorSync fits into TQM processes because it is a process based on quality, consistency, and repeatability. It makes business sense to introduce ColorSync into any quality-conscious operation.



In early 1997, Apple Computer acquired NeXT, Inc. Along with its impressive operating system, Apple acquired NeXT's object-oriented application development software.

Parts of the NeXT operating system are being incorporated into Apple's new operating system strategy.

ColorSync will be an important part of that operating system, as will Display PostScript. The quality of screen display provided by Display PostScript is unsurpassed. The screen shows the final image closer than any other display technology.

Customers are happier with the finished printing when ColorSync is used to manage color in production. It's easier to match the original with ColorSync in the production process.

Color business grows because the cost of good color is lower with ColorSync, and also because it's easier to get color into print successfully. And, images can be used for a variety of publishing tasks.

And this is all part of the revolution started by Apple back in 1984.

The Macintosh advantage with managed color

Color management is a fundamental part of the Macintosh Operating System. It is similarly a big part of our evolving operating system strategy. As Apple makes the transition from its current operating system to a new operating system based on technologies acquired from NeXT, Inc., ColorSync will remain a key feature of the operating system, offering customers the flexibility of using the many applications that support managed color in the preparation of artwork for any purpose.

As the Macintosh operating system moves to new levels, we will be adopting Display PostScript as the technique for displaying images and text on-screen. ColorSync will be incorporated into this display model.

More content creation is done on Mac

Statistics gathered in the computer industry show over and over again that the Macintosh is used by more content developers than any other computer.¹⁴

We think there is a simple reason for this: people get more accomplished on Macintosh computers. Even in all-Windows operations you'll often find that for the origination of artwork for publishing, and in the development of multimedia titles, the Macintosh reigns.

Cross-platform development is easier

Firms that develop materials for distribution in electronic form use the Macintosh because it is more flexible for cross-platform development. One recent study showed that the Macintosh is used for about half the

14. Macs are used for between 44 and 56 percent of content creation for the World Wide Web. Macintosh computers are used by about 13 percent of the computing population overall, and by about 25 percent of those using the World Wide Web.

content creation on the World Wide Web, this despite the fact that other computer platforms dominate the Internet.

Microsoft's announcement that they will support the same CMM as that used by Apple ColorSync makes cross-platform development more effective, as work prepared on Windows will fit into Apple's system of color management when Microsoft ships an operating system that supports color management.

Clearly the Macintosh represents a critical component in the world of artwork creation – for print, multimedia, WWW, videotape – everywhere!

For more information

Visit the ColorSync web site <http://www.colorsync.apple.com>

Visit the Masters of Media web site
<http://www.masters.media.apple.com/color>

or Apple Computer's home page at <http://www.apple.com>

Order the ColorSync Starter Kit CD-ROM – available with this paper from Apple StartingLine 800 825-2145 – Catalog No. L02331AZ

Also, consult the Apple booklet entitled:
How to Create Color Profiles for ColorSync 2.0 – Catalog No. L01761A

ColorSync compatible software and hardware

ColorSync Profile Creation	<p>Candela, Inc. Color Partnership Color Solutions, Inc. Eastman Kodak Company Light Source, Inc. LinoColor</p> <p>LOGO GmbH Monaco Systems PraxiSoft Radius Color Savvy Systems, Inc.</p>	<p>ColorSynergy 2.1 Profile/80 ColorBlind ICC Print ColorFlow Profile Factory LinoColor CaptureProfiler LinoColor DisplayProfiler LinoColor PrintProfiler Deluxe LinoColor PrintProfiler ProfileMaker MonacoMATCH CompassProfile ColorMatch ProfileScanner ProfileMonitor ProfilePrinter SMPPro profiling software</p>
Profile Customizing and Editing	<p>Agfa Gevaert NV</p> <p>(Also allow for embedding of profiles in different file formats – TIFF, EPS, DCS, JPEG, PICT) Color Solutions, Inc. Eastman Kodak Co. LinoColor</p>	<p>ColorTune 3.0 ColorTune Pro 3.0 ColorBlind Edit ColorFlow LinoColor VisuaLab</p>
ColorSync Profile Averaging	<p>Candela, Inc. Color Solutions, Inc.</p>	<p>ColorSynergy ColorBlind Edit</p>
Calibration Devices	<p>Color Solutions, Inc. Splash</p>	<p>ColorBlind Professional ColorCal</p>
Calibration – Monitor	<p>Agfa Gevaert NV</p> <p>Color Partnership Color Solutions, Inc.</p> <p>Light Source LinoColor Radius Sonnetech</p>	<p>ColorTune 3.0 ColorTune Pro 3.0 OptiCal Colorblind ICC Print ColorBlind Pro Profile Factory DisplayProfiler ProSense Colorific</p>
Monitors – color accurate	<p>Apple Computer, Inc. Radius</p>	<p>1710 and 1710 AV Monitors PressView Monitors</p>
Viewing Boxes	<p>DTI MacBeth</p>	<p>Viewing Boxes Viewing Boxes</p>
Measurement Devices	<p>Color Savvy Systems, Inc. Gretag-MacBeth</p> <p>Light Source Radius X-Rite</p>	<p>Color Mouse SpectroLino SpectroScan Colortron II ProSense Digital Swatchbook Reflection Spectrophotometer DTP92 Monitor Optimizer DTP51 Strip-Reading Reflection Colorimeter</p>
Image Editing and Assigning Profiles	<p>Adobe Systems, Inc.</p> <p>Agfa Gevaert NV</p> <p>Apple Computer, Inc. Color Solutions, Inc. Digital Zone (Denmark) Helios Software GmbH</p> <p>LinoColor</p>	<p>Photoshop 4.01 PageMaker 6.5 Acrobat 3.0 ColorTune 3.0 ColorTune Pro 3.0 ColorSync Plug-ins to Photoshop ColorBlind Edit PhotoImpress (Photo CD software) ColorSync Quark XPress XT EtherShare OPI 2.0 LinoColor VisuaLab</p>

ColorSync compatible software and hardware

Image Editing and Assigning Profiles (continued)

Live Picture, Inc.	Live Picture 2.5, 2.6
Luminous (Imation)	ColorCentral
Macromedia	FreeHand 7.0
Monaco Color, Inc.	Plug-in for Photoshop
Pantone	ColorDrive
Praxisoft	CompassProXT XTension for QuarkXPress
Praxisoft	ColorCompass
X-Rite	Digital Swatchbook Software

(Assigns profiles with spectral data and ColorSync to deliver CMYK or RGB values)

Page Layout

Adobe Systems, Inc.	PageMaker 6.5
	Illustrator 7.0
Corel Corp.	CorelDraw
Helios Software GmbH	ColorSync 2 XTension QXP
Macromedia	FreeHand 7.0
Quark, Inc.	QuarkXPress 4.0
Multi-Ad	Creator 2

RIPs

Splash	Splash
PCC	RIPsystem II

(Uses ColorSync to color-correct proofs made from previously-rasterized data)

Self-Calibrating software

Imation	Rainbow ColorLock
ColorBus	
Splash	
TruMatch	ColorPrinter Software

Soft Proofing

Agfa Gevaert NV	ColorTune 3.0
	ColorTune Pro 3.0
Candela, Inc.	ColorSynergy 2.1
Canto	Cumulus 3.0
Color Partnership	SoftProof
Color Solutions, Inc.	ColorBlind Edit
	ColorBlind Parachute
Group Logic	ImagExpo
LinoColor	LinoColor VisuaLab
Pantone	ColorDrive with Web Tools
	ColorWeb
	Plug-in to Netscape

(ColorWeb deals with the selection of spot colors that will work cross-platform. It will affect raster data, and will preview an image.)

Praxisoft	CompassMaster
	ColorCompass
Radius	ColorMatch
X-Rite	Digital Swatchbook Software

(Soft proofing of solid colors with gamut alarms using spectral data, ICC profiles and ColorSync processing)

Batch Processing

Agfa Gevaert NV	ColorTune 3.0
	ColorTune Pro 3.0
Candela, Inc.	ColorCircuitQ
	(included with ColorSynergy 2.1 product)
Color Partnership	ColorBatch
Color Solutions, Inc.	ColorBlind Edit
	ColorBlind Parachute
Digital Zone (Denmark)	PhotoImpress (Photo CD software)
Helios Software GMBH	Helios OPI
	EtherShare OPI 2.0
LinoColor	LinoColor VisuaLab w/ Job Assistant
Luminous	ColorCentral with
	Color Solutions/ColorBlind Parachute
Praxisoft	CompassSwap
	CompassProXT XTension QXP

This listing is complete as of April 12, 1997



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