



Colour Control

Colour the key to efficient and cost effective print



KONICA MINOLTA



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PRINT
FUTURE

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Introduction to Colour Control

Colour is now the life-blood of every print business and is critical to its continued growth and success. The world of print has moved to full colour, we have seen a dramatic transition from mono print to full colour in office documents and commercial print applications. This is partly due to a reduction in the cost of full colour printing but also because of our natural response to colour imagery. Colour grabs attention, is more emotive and generates a greater sense of engagement and response from the viewer. Colour can convey a feeling of quality and vibrancy in printed products, which can result in increased sales and higher margins.

Everywhere we look from books to catalogues, flyers, to direct mail or billboards, in store merchandising and packaging; full colour is essential to marketing, promotions and sales activity. The widespread use of colour in printed products has made it important not only to match colour for individually branded products, but to match it consistently across a range of products, marketing collateral, different substrates and print output devices.

There is a lot talked about the importance of colour control or colour management as it is often referred to and how essential it is to a modern printing business, however the dynamics behind effectively managing colour output have changed. In the days when press operators visually matched colour to a proof or sample and manually balanced ink deposition and fount solution with roller pressures and running speeds, there was undoubtedly an art to managing colour. An operator's skill and a company's reputation, was built from years of experience producing work, which was perceived to be colour consistent and accurate. In those days the ability to match colour was a valuable USP (unique selling point) and could easily differentiate your business as a "better printer" than

the competition.

When Production Digital colour printing was introduced in the late 1990's the technology was unable to provide accurate colour matching to offset prints or maintain consistent colour throughout a print run, so it was never considered as a viable alternative to offset for high quality colour critical jobs. This dynamic has changed over the past 20 years; digitization has accelerated and made the process of managing colour simpler, with buyers now able to prepare artwork themselves and obtain consistent quality results.

Even though colour management is more important than ever many printers still do not have a good understanding of colour control and this will be costing them far more than they realize and will be having a significant impact on their bottom line

Printers need to be able to communicate the colour of an object. A subjective description of colour is insufficient; it is not precise enough to convey the exact colour for defining and ordering most printed products. To describe the colour accurately, an objective system that defines colour is needed. Three terms can be used to define a colour: hue, lightness and Chroma (saturation).

Hue is used to describe a colour. Hue is how most humans perceive colour to be. Chroma is red, green, blue, etc. and lightness then describes the luminous intensity of a colour. Human colour vision is complex, it involves physical, physiological and psychological measurement influences, and an individual's experience can change over time as eyes age and

deteriorate. A system for colour measurement must consider these influences. In practice there are three basic factors, vital to the appearance of colour, which form the basis for systems of colour measurement:

- A source of light;
- An object that will absorb some wavelengths of light and reflect others;
- A visual system that can provide the required sensation in the brain when appropriate wavelengths of light are received.

A useful colour measurement system must consider:

- A definition of the spectral output of the illuminates
- The measurement of the spectral reflectance of the sample
- A definition of 'normal' human colour vision (a standard observer).

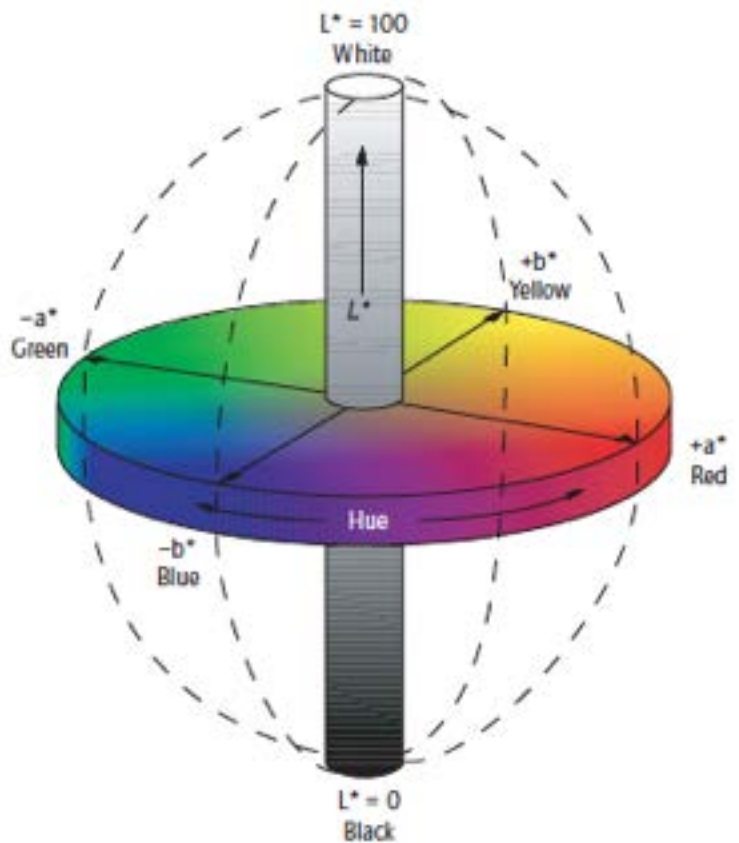


Illustration of the CIE Lab colour space
Source Pira International

The methods used today for colour measurement are based on systems and standards that have been developed through the Commission Internationale de l'Eclairage (CIE), the international body responsible for recommendations for photometry and colorimetry. Standards have been defined for a range of illuminates and the standard observer, the basis of a mathematical description of colour that converts a spectral reflectance measurement into a colour description that can be represented by a colour space model. The colour of an object or a print depends on the absorption of certain wavelengths of light and the reflection or transmission of others. A measurement of the amount of light reflected by the sample at different wavelengths provides an indication of its colour. This measurement may be used to provide a graphical representation of the colour, in the form of a curve on a graph.

This independent certification of colour allows print suppliers to prove their capability in managing colour.

One of the effects of increased standardization is it makes it easier for print buyers to supply files and receive a job with exactly the right colour result, which increases competition in many markets to the advantage of printers who can manage and control colour effectively.

Colour control is a mainstream topic for most printers who produce work for publishing and commercial print customers. Colour-managed workflows provide the reassurance that monitor, proof and final product will match to the approval of all parties. In four-colour process printing quality standards are in place that result in colour consistency across a range of suppliers and print processes which is very important to brand owners and advertisers.

Why is Colour Control so important?

Apart from the cost savings and production efficiencies colour control is vital because it simplifies a lot of complex problems created from using a variety of image capture devices. Colour control provides a uniform standard for replicating colour, by creating colour profiles for individual presses, it ensures that the correct colour is printed regardless of the press used. In an ideal colour reproduction system, the proof supplied to the client for assessment should accurately duplicate the production-printing characteristic. If the proofing process uses the same system, it allows good-quality contract proofs to be produced remotely on relatively low-cost inkjet devices, often at the clients' office, this can reduce the cost and time needed for approval. This is really important when we consider the high number of low value jobs that are in a typical digital print workflow at any one time.

There has been an increase in the certification of proofs to agreed standards to ensure that the digital proof is produced in accordance with an accredited procedure to link RIP and proofing engine. A good example is the pass4press proof4press initiative. These provide independent verification of the quality and consistency of proofs produced from various engines.

Colour management can also be automatically applied to images that are to be used on the web, as it can work across all media generating lower- resolution RGB files to minimize download time.

This is really important as a lot of customer approvals are now done online through web to print systems or on a printer's ftp site. In addition a lot of content that is used in printed format like brochures and reports is often loaded directly into web pages or used as downloadable PDF files.

Without a robust colour management system a digital printer cannot process individual jobs quickly enough to make them economically viable and at the same time, guarantee the quality of the final printed result

A further benefit of colour management for printers is creating a uniform print condition, based on their own printing environment and equipment, this can be used to reduce press set-up and waste, providing economic benefits that can be passed on to the client. Controlling colour is vital and provides the following key benefits:

- Standardizes proofing output
- Guarantees the quality of the printed output
- Reduces cost and waste for the printer
- Reduces the number of reprints and lead-time for the customer
- Efficiency is improved by "getting it right" first time.

What is colour control and how has Colour Control Changed?

Over recent years, times have changed dramatically and in the current operating climate there is no place for poor colour control or inconsistent print results in offset or digital. These factors are now basic entry-level requirements and a prerequisite for modern presses with automated workflows and closed loop control systems. So the conclusion is that managing colour across output devices that include offset and digital presses is critical but can be achieved relatively easily by every printer no matter how large or small. Simple, integrated solutions can now provide all the digital hardware and software necessary to produce colour profiles that are fully compliant with the International Colour Consortium (ICC) standards.

Perception and assessment of colour is down to many different factors from the light source and viewing conditions to an individual's own subjectivity. In digital imaging systems, color management is the controlled conversion between the colour representations of various devices, such as image scanners, digital cameras, monitors, TV screens, computer printers, offset presses, and corresponding media.

The primary goal of colour management is to obtain an accurate match across colour devices; for example, the colours of a photograph from a digital camera should appear the same on a computer LCD monitor, a printed proof or on the final printed page in a brochure or magazine. Colour management helps to achieve the same appearance on all of these devices and printed outputs provided the devices are capable of delivering the required colour intensities.

Apart from the technical aspects of producing consistent colour, there are also sound business reasons as to why colour management makes good financial sense. Having an automated workflow with colour control systems built into it creates efficiency, allows for hard copy or online proofing options to reduce cost and lead times. Colour Profiling in prepress creates efficiencies and reduces errors and on press it minimizes set up time and generates less waste. These savings can be significant, in a recent workflow and colour management review; savings of in excess of 60,000 euros were identified for a commercial printer with digital and offset capability.

In today's hectic print environment where 24 hour turnaround times are the norm, being able to calibrate colour output between offset and digital presses to achieve consistent print results, maximize productivity and manufacturing flexibility is absolutely essential

A typical imaging system consists of input and output devices, for example: scanners, digital cameras, monitors, and printers. With such a diverse range of output devices, technologies, and gamut limitations, it's inevitable that each will reproduce the same color differently as colour is device dependent. Obviously, this creates significant problems when working with files originating from different sources, and is further complicated when the same file is sent to different types of output device. Therefore, some means of ensuring that color data is reproduced in a predictable way throughout the entire imaging system is essential. This is the purpose of a Color Management System (CMS), which comprises of three basic components:

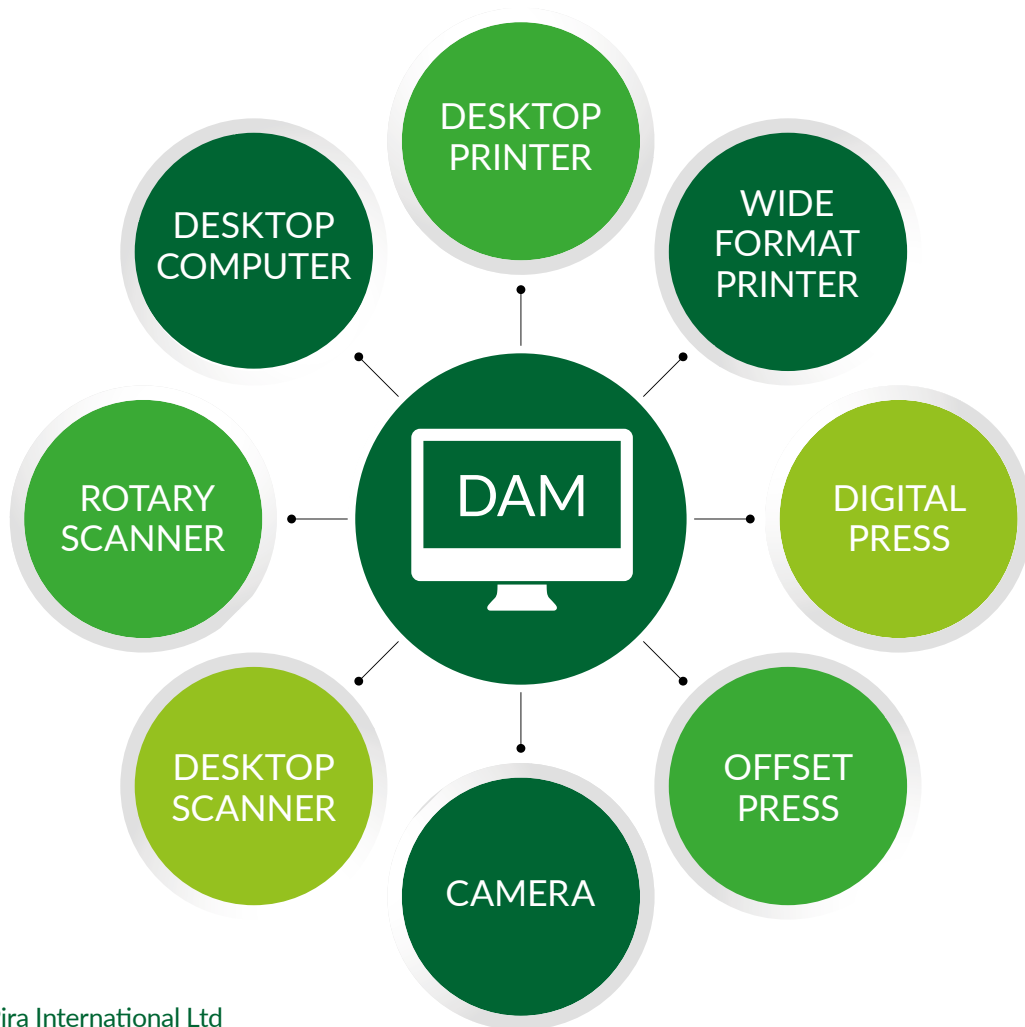
- A device-independent color space - this is usually referred to as the Working or Reference color space.
- ICC profiles for each device (i.e. printer, scanner, monitor, digital camera, etc.) that will accurately describe the unique color characteristics of each device.
- A Color Matching Module (CMM) that will interpret the information contained within the device profiles to carry out the instructions on how the color characteristics of each device should be treated.

If we look at a typical workflow in the illustration below we can see that there are 8 independent devices all interpreting colour in different ways. The chain usually starts with digital photography, which captures RGB images and concludes with the final print, but may include a number of different display or output devices in between. Many other imaging chains exist, but in general, any device that attempts to reproduce color, can benefit from a color control process.

Color management cannot guarantee identical color reproduction, as this is rarely possible, but it can at least give you more control over any changes that may occur

Managing colour is the ability to take display monitors and output devices, such as inkjet printers, that display or print colour differently and standardize the colour output. Otherwise, if the same file is displayed on two different monitors they are likely to appear different, and if the same file is sent to two different digital print engines the result may also look different.

Illustration of device dependent colour workflows



Source Pira International Ltd

Each of the devices in the workflow has a characteristic that defines the range of colours it can see or reproduce. Assuming the characteristic is reproducible and stable, it can be determined by colour measurement and communicated to other elements in the workflow, thereby allowing the appropriate translation of colour between devices.

There are two ways to approach this – device-dependent transformation or a device-independent transformation. With the former approach, each device requires dedicated transformations with which it must communicate.

If the workflow has to cope with numerous inputs, display and output devices, such an approach becomes time consuming, expensive and unmanageable

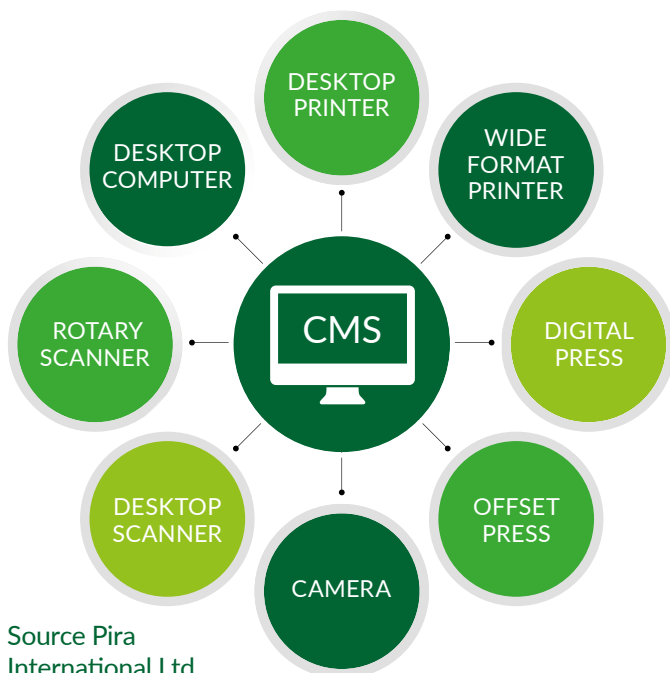
Device profiles come in two basic forms, Input and

Output profiles. Input profiles typically describe the color characteristics of scanners and digital cameras, whereas Output profiles describe devices such as monitors, printers and film recorders. Input profiles are often referred to as one-way since they represent the source device. This means we can never convert a document into the color space of our scanner or digital camera. Output profiles, on the other hand, are two-way meaning we can convert from or to them. For example, we can convert a document with an embedded monitor profile into one that has a color profile describing a printer, or vice versa.

One issue is that many captured images are not ideal. They frequently exhibit colour casts, limited dynamic range, or poor tonal rendition, which may not be obvious on some media but will be when reproduced on others. Such 'errors' need correcting during the process of reproduction. Algorithms for automatically optimizing digital images have been developed, and are a part of many image capture, colour management or editing applications.

In fact they may often be applied without the user knowing. However, because of the subjective nature of colour reproduction such automatic algorithms may not suit every user, or every image. Thus, for high quality imaging, unless the user is confident in the quality of captured images, every image should be assessed and corrected as necessary

Illustration of an ICC colour managed workflow



In the illustration above we can see that using a standard colour space in a colour management system allows the calibration of all the devices by creating individual device profiles that provide the basis for its colour transformations. For example, it uses the input scanner profile and the profile of the computer display to convert the RGB values of the scan into a meaningful image in the RGB values of the display phosphors of the monitor. If the display is being used as a soft proof, the application will use the Colour management system to convert the RGB of the scan into the CMYK of the printing, and then back from that CMYK into the RGB of the phosphors to emulate the appearance of the print on screen.

Being able to achieve this consistency and accuracy is critical for branded products and marketing campaigns. Imagine the complexity and resources required to print a promotional campaign without any colour control, which had numerous SKU's printed by offset, flexo, digital and wide format on a range of

different substrates. Printers who could not automate the file delivery, colour control and proofing process would be uncompetitive on cost and lead time but also have a much greater risk of work being rejected because of inconsistent colour in the printed output.

Proofing

The aim of the contract proof is to match the production result. It is often the means of explaining to printers what they are expected to achieve. The contract proof can form a legally binding contract between the supplier and the customer. Visual assessment alone is too subjective the need for objective assessment – a meaningful control system – is one of the key characteristics. In digital workflows a quality standard that guarantees the integrity of the proof is a key requirement of a contract proof.

A control system and means of colour managing to an accepted standard can be applied to a cheap inkjet printer with suitable RIPs and calibration routines.

The only proof that faithfully duplicates the production print is one printed on the production press under production conditions, and with the same materials that will be used for the job

Any proof produced another way might be considered only as a target proof. So, in the context of proofing to match the production result, the terms 'contract' and 'target' is not helpful. All we can really say is that the proof should aim to achieve, as closely as possible, a simulation of the production print characteristics. What differentiates between contract and target, at this level, is the compromise accepted by the parties involved.

Most printers, still request proofs or they will generate digital proofs from the supplied files and run to that copy. Proofing has seen major changes with the development of digital workflow and the demise of film. Many commercial jobs do not use contract proofs to accompany digital jobs but use iterative proofs for content and follow colour management routines for the printer to follow standard set-up.

Soft proofing is gaining in popularity and is nothing more than using your monitor to simulate a printing device. However, accurate soft proofing is dependent

upon the quality and accuracy of the monitor profile and the media profiles for each printer/media/ink combination that you're attempting to proof.

Monitor calibration and characterization (profiling) is probably the most important aspect of a color managed workflow; yet many users seem oblivious to the issues poor monitor calibration can have on their documents.

Calibration is a process whereby a device is brought to a standard state (e.g. a color temperature of 6500K and gamma of 2.2), whereas characterizing the monitor is the process of determining how the monitor represents or reproduces color. We characterize the monitor by measuring how it displays known color values, then creating an ICC profile. The ICC profile is simply a data file that includes a description of the monitors' color handling characteristics

Color fidelity is moving to become a colour-managed system feature while proofs will be used to check content. This will see significant growth in soft proofing, and real time proofing where PDF files are distributed to interested parties over the web with deadlines for comments. Systems are being developed that permit the sampling of pixel data across a web connection, with collaboration and sign-off capability or remote output if required.

Hard copies will be printed remotely if they are needed, probably on colour- managed inkjet printers with simulated dots. Mark-up of proofs will be electronic with comments recorded in a digital asset management system that records the development of a printed item.

Increasing use of soft proofs means that monitors will be larger, with greater colour fidelity provided by suppliers who have technology to manage onscreen colour fidelity. This will be critical for businesses that use the web for displaying and selling products or supply print through web to print systems.

The proofing process is rapidly changing and it will be:

- Fast, for transmission and output;
- Both accurate and consistent, achieved through colour management and providing a hardcopy

option, probably on A3 inkjets using approved substrate and inks;

- Both predictable and traceable. File management is needed with receipts and job tracking across all parties with full audit trail.

In printing, the final result will always be judged on the basis of how it looks. The need for subjective visual judgment is made inevitable because most reproductions are not an exact copy of the original. While it is possible to express some aspects of the relationship between original and reproduction in measurable terms, these are not capable of being interpreted as an indication of the overall acceptability of the reproduction.

An opportunity to make visual judgments, in addition to measurements is, therefore, a fundamental requirement in most colour reproduction systems.

Over the next few years there will be increasing automation and colour control built across all print workflows, and it will move from a highly skilled manual operation to an automated lights out process. Prepress and workflow systems will take PDFs and image files and optimize them automatically for the output method that will be used. New presses now incorporate closed loop colour control to improve the colour fidelity and consistency of many printed products. Calibration of offset and digital presses to achieve consistent printed results will be commonplace.

Automating and colour managing the whole process of file creation, proofing, approval, prepress and printing provides print companies with a major opportunity to streamline their resources, get things right first time, reduce cost and waste as well as giving customers shorter lead times and better service. This will be essential; as downward price pressure will inevitably continue along with expectations of improved quality.

In order to remain competitive, a major priority for print providers is to re-assess the way they manage colour in the workflow, making sure they are achieving maximum efficiency and cost benefit



Why Colour standards are essential

Predictability and repeatability have always been the holy grail of the printing industry but these criteria have established themselves as a critical part of the industry picture with globalization and high profile brands. It is unimaginable to think of a car, a computer, a table, or a food manufacturer that cannot produce two identical products on two different days or in two different plants?

Would you buy such a product if it existed, probably not? Then why would brand conscious print buyers buy prints from printers who are unable to produce good and stable print quality?

Because an operator and a device can work differently at two different times for various reasons, digital data can produce unpredictable and unstable output even with the most sophisticated systems and skilled operators. To remove this instability factor, each device and each operation in the production chain should be controlled, validated and reported for traceability.

There are numerous benefits for printers that standardisation, along with certification, brings.

- There is a common, understood systematic approach to colour including consistent and repeatable processes
- You have fewer colour failures in quality of service or product
- People are clear about what to do and what to look for and how to check the colour results
- You can grow your business through certification which distinguishes you in the marketplace

- You stop spending money or time on the same old colour problems, you now have a process and the resources and skills to identify & fix it. Faster, better, cheaper.
- Better management of colour quality control and reporting
- Reduced waste, improved efficiency and production

In a world of decreasing marketing budgets and on demand production it is essential that printers can react instantly, automate all their processes and above all “get it right first time”

Colour control is a critical component to ensuring all these things can be achieved, that waste is minimized, cost is reduced and that the quality of the final print product is consistent. Printers have to ask themselves the question “can they afford not to have efficient colour control in their business?”

Professional print buyers already take quality as a given in print products and are using colour standards and references as a way of guaranteeing colour consistency. Printers who have not invested in automated colour control and are not working to a recognized set of colour standards will be at a distinct disadvantage especially when producing branded colour critical work.

ISO 12647-2 is the benchmark colour quality standard for the graphics industry. It specifies data delivery requirements and colorimetric aim values for a range of different paper types. Meeting the ISO 12647-2 requirements can give digital printers an advantage

over offset competitors. It wasn't designed for direct digital output, and yet ISO 12647-2 supports the process automation that goes along with digital colour printing. The standard stipulates that incoming data should be in the PDF/X data format. If for some reason the work cannot be submitted in PDF/X, print buyers can instead provide an ICC output profile and specify the printing condition. Incoming jobs that comply with ISO 12647-2 can thus be processed automatically, hands-free direct to plate or digital press.

The 12647-2 International Organization for Standardization (ISO) standard provides standard process control aim points and tolerances for various printing methods and processes. The colour management standard aims to address all the issues of colour consistency, which have plagued print buyers in the past.

FOGRA is a German based committee working to create standard practices and tests for managing colour. This is particularly relevant to digital printing with Fogra PSD a standard for consistent print quality for small and large format digital printing.

GRACol is a largely American used standard set of press measurement data, which is used to create profiles for sheeted printing. It also has standards for creating curves for proofing, CTP systems and procedures for workflow calibration.

Achieving colour control on press is made possible by using a test forme that is printed and proofed, then measured to determine the appropriate adjustments that are required to achieve a standard like 12647-2. The forme should include a full range grey scale and tone scales of the primary and secondary colours. This will provide the press characterization profile used in the colour management routine. The RIP must first output a test file satisfactorily. This is followed by a comparative visual assessment of the proofs, which are judged against certain pre-set criteria. The final check is a spectrophotometric measurement of a test strip.

On the latest digital presses there is an inline photospectrometer, which provides closed loop tools and a density system for automatically controlling colour



This provides a major advantage for digital printers to accurately control colour throughout a production run.

For many printed products, colour is specified through the provision of a physical sample. This may be a previously printed job or a sample of another product, perhaps a fabric or plastic. It is normal to specify many special solid colours using a reference sample from a colour specification and matching system. The Pantone system is probably the most widely used and recognized. It provides a range of colours produced from 13 base colours, plus black and white, with a unique number to define each colour. There are additional metallic and fluorescent colours. Pantone notation is commonly found within computer-based graphic design software, which further widens its use in specifying the required colour.

Colour guides are also available to indicate the range of colours achieved with halftone combinations of the process colours – cyan, magenta, yellow and black. Again Pantone is the most common system to allow process colour combinations to be compared to colours defined in the solid colour guide. While the range of colours in such systems is smaller, they are valuable where special colours cannot be used and it is necessary to define a colour within the gamut of the process inks and the halftone process. There are also colour guides available that are produced with extended process colour sets, such as Pantone Hexachrome (CMYK + orange and green) and Opaltone (CMYK + red, green and blue).

While these physical systems have been widely adopted and provide both an acceptable method for defining a colour and, in the case of Pantone, a colour mixing system, they are not without their limitations or problems, particularly when defining colour standards.

Why invest in Colour Control?

Some printers have a casual approach to colour control for a number of different reasons:

It's not really needed and I can get by without it

It's too complicated

It's too expensive

I don't have any problems with colour

My clients are not that bothered about colour

So let's think about some of the colour issues and questions that print suppliers face day-to-day to see if they apply to your business and this may change your views.

Do you need to view client's digital images and files accurately for colour?

Do you offer a colour retouching service for client's images?

Have you got a colour management policy and system covering all your workflows and devices?

Do you proof for colour and client approval? As a soft proof for viewing on screens, or as a contract colour proof?

Do you need to reproof due to client dissatisfaction?

Is your proofing system based on recognised printing conditions and ICC profiles, and if so can you validate to these?

Are you aware of the ISO 12647 range of printing standards and the process control method needed?

Are the ISO standards relevant to your work, and your clients?

Can you match proofs quickly on your presses with minimum waste and no manual corrections via the workflow or Digital Front End?

Does your digitally printed work match your offset litho work?

Do clients need your digital work to match their offset litho work? Think about Common Appearance, brand colours and images.

Do you have to reprint work due to clients rejecting it for poor colour?

When reprinting work a few weeks or months later, can you match the previous print quickly and accurately?

What all this comes down to, is there a return on investment from using colour management? The answer is – Yes there is a firm ROI from using colour management correctly within your workflow. The elements that will give you that return include:

Allowing accurate colour viewing of images and pages to ensure that correct decisions are made about colour within client's files and any corrections are made before going to press.

No manual correction of a client's files.

Less re-proofing due to your own proofing errors, which saves time, resources, money, and distribution costs.

Using the correct, or corrected, colour managed files to suit the press, ink and paper resulting in:

Faster make-readies and start up

Less paper wastage

Less ink or toner used

Faster ink drying for offset litho

Fast sheet back up for offset litho

Less marking and waste in the finishing process

Reduction in reprints due to your errors

Clients who trust your understanding of digital images and colour

Increased customer loyalty

The return on investment when implementing a fully colour-managed workflow is usually achieved in just a few months.

To make life really simple for digital printers, there is now an option to invest in Automated colour management via Konica Minolta's new IQ501 colour management system. The IQ-501 is an optional module installed after the print engine, which allows for in-line real-time scanning of both colour patches and registration marks to ensure both colour consistency and perfect registration during a production run.

In addition the IQ-501 is equipped with an in-line spectrophotometer, which can be used in conjunction with the in-line scanners for Fiery server calibration, colour profiling and other colour management tools. The IQ501 has a range of features designed to simplify and automate colour control:

- **Auto Image Adjustment:** This is an engine feature that constantly monitors both position and colour quality of a job. It prints both registration marks and colour bars on the inboard and outboard edges of the media to be scanned and analyzed by the IQ-501. The engine takes corrective action to ensure that both the position and colour quality is maintained throughout the job. Auto Image Adjustment is triggered from the Job Properties of the job on the Fiery server.
- When performing Fiery server calibration from the press control panel the IQ-501 can be engaged to simplify the calibration process. The calibration target is automatically read by the IQ-501 and the calibration is updated on the Fiery server.
- When creating an output profile from the Printer module of FCPS you can choose the IQ-501 to read both the calibration targets and printer profiler targets, simplifying and automating profile creation.
- The G7 gray balance calibration target selection when creating a new calibration setting will print and scan the target if the IQ-501 is selected, making G7 optimization a simple and touchless process.
- The FCPS Printer Match module allows you to use a common calibration method to build profiles that match multiple printers of the same model. Both the calibration targets and printer profiler pages are automatically read when choosing the IQ-501. This greatly facilitates and simplifies the process.
- If you set the FCPS verifier instrument preference to the IQ-501: Fiery Color Verifier will allow you to choose from three reference presets that are supported by the IQ-501: Fogra 2.2 media wedge, Fogra 3.0 media wedge and ISO12647-7 Control Wedge 2013.



The importance of colour for brands and agencies

We all know that colour matters, whether it is for brand continuity, making sure that a suite of collateral looks the very best it can, or accurately representing a product or scene to whet a potential customer's appetite for your offering. The designer and brand agencies role is to drive projects and ensure that everything they create for clients is both engaging and creatively exceptional. The second is to make sure that the products they produce are not only beautifully crafted, but are accurate and consistent; and this is where critical colour comes into play.

For a majority of print work, process printing (also known as CMYK or four colour) is perfectly fine, and for some jobs, which use a specific colour, we can use Pantone ink, or spot colour; however, this is more often for solid colour printing. Some jobs demand impeccable colour matching. We call this colour-critical printing. It's a precise science because there are so many ways that colour matches can go wrong. Things like lamination, specialty coatings, textures, UV, gloss finishes and textured stock can completely change the end results. It's important to think through the entire printing process to ensure the best results. Critical colour work may include food, automotive, and fashion photography, the overall theme of these jobs would be that the customer expectation is set when they see the product or service reproduced in print and that then sets their expectations. After all, we've all been there where you've ordered a product that "just doesn't look the same" as in the promotional images.

There are so many things that can affect colour matches, even the types of ink used and which type of printing process has been employed. Agencies rely on strong relationships with their print partners to get a thorough understanding of how printing processes, coatings and substrates interact. It is so

important for creative and print professionals to work in a collaborative way in order to predict how each type of paper or board will hold colour. Even things like UV coating and film laminate can alter colour reproduction. If you do not account for these kinds of coatings beforehand it's difficult to accurately predict the end result. The combination of these specialisms and the understanding between printer and designer creates the best chance to get the perfect result for the client.

The proofing cycle for colour critical jobs is vital. Agencies usually work with highly experienced print operators who take extra measures to ensure colour integrity is maintained on every job. Because of the nature of critical colour jobs, it is essential that we get a physical proof to ensure that the reproduction on the final material is perfect, after all the Mac screen cannot always be 100% accurate. This means there will be fewer surprises with the end result.

There is also another factor that affects critical colour, metamerism. Metamerism is the term we use to describe a colour's ability to appear differently, not only under different lights, but also next to different colours. For example, if you are wearing red while proofing colour, the red in the shirt or blouse may bounce off the printed piece, affecting your perception of colour. The colours of walls, rugs, surfaces or clothes can bounce colour onto the printed piece or otherwise affect how you perceive colour.

We've all experienced the effects of metamerism and probably not known about it. Maybe you've picked up a paint swatch in store and it looked completely different when you looked at it again at home. Although we cannot control how users view the printed material, we can control metamerism in the proofing stages – so it is so important that this occurs in a consistent and controlled environment.

In terms of brand, colour consistency is essential. Especially for recognition and trust within marketing and consumerism

You would have seen this out there with Apple's limited colour use, McDonald's with the yellow arches and Starbucks with the green long-haired siren. Although I'm sure no one really notices the siren – they just see the green on the white packaging. This is because colour is the visual component and psychologically most people will recall colour first

regarding brand – then shapes, symbols, numbers and lastly words.

Colour association is key – it creates trusted association with brand and resonates familiarity. Some brands such as Thomas Pink and Tiffany have even gone as far as to own a specific colour to strengthen their brand presence. There must be a consideration through every part of a project lifecycle, from photographers, to designers having calibrated screens and colour profiles, through to the proofing process and finally the printed work. The bottom line for critical colour from a designer's perspective is this: Use suppliers you trust and who have the expertise to collaborate effectively.



Practical Steps to develop colour controls

Starting to implement colour control and working to colour standards can be less daunting than it sounds. Achieving colour consistency is about understanding what you are trying to achieve, exercising discipline and good working practices to carry it out. Out of the box Colour Control tools are now widely available and usually supplied with or built into new equipment as standard.

A lot of the mystique and technical understanding that was previously required has been replaced with lights out automation or standardized user friendly procedures for profiling and calibration of devices

These are the key things you need to think about and assess if you are serious about controlling colour.

Color Management and preflighting

PDF generation, reception and preflighting

Proof production, verification and control

RIP settings

Print production, verification and control

Viewing conditions

Measuring devices, calibration and certification

Staff training and knowledge

Records and documentation

Here are some practical steps to think about when introducing colour control:

The first step in colour management is to recognise your client's expectations in colour reproduction. Only then can a colour- managed system and workflow be implemented to meet these expectations.

Computer screens

We no longer have the comfort factor of viewing transparencies on a light box in order to make decisions on use, retouching or matching to proof or printed copy. The use of digital photography mandates the use of a computer screen to view images, and often pages. So the screen has to be seen as the transparency and light box combined. To do this it must be able to display the colours required by the ICC profile for the image. Sadly 'office level' screens cannot do this accurately as they are not able to display all the colours used for high-end professional photographic work. The screens will also need to be regularly calibrated and profiled to ensure accurate colour reproduction.

This can be done with a relatively inexpensive system, but a 24" colour accurate wide gamut screen to cover the AdobeRGB 1998 profile used by professional photography will cost around £500.00 rising to over £1000.00 for a 27" screen with in-built calibration. But if your work is colour critical this is a small price to pay in order to view, retouch and approve images and pages.

Colour management policy

This will be needed to control the colour-managed workflows from image and page to PDF to proof to press. It should be based on the presses and substrates used. Often these workflows will be based on the coated and uncoated ISO 12647/2 standard printing conditions and the associated ISO coated v2

and ISO uncoated v2 ICC profiles. The implementation of the colour management policy and workflows starts within the desktop DTP programmes, Adobe CS/CC and QuarkXPress. The chosen ICC profiles will need to be loaded in these programmes, as they are not included in the standard build. Custom colour setting files (.csf) can then be saved in Adobe CS/CC for the colour workflows. From these settings PDFs can be created correctly for each workflow. If your clients supply PDFs these colour settings files can be supplied for them to use, together with PDF job option files. This will ensure that clients supply PDFs optimised for your workflow.

Colour proofing

Using colour-managed screens will enable the use of colour accurate soft proofing on screen. Hard copy contract colour proofing should reflect the chosen colour workflows and ISO 12647 standard printing conditions, or your own ICC based printing condition. It is likely that digital cut sheet presses will be used for this process, so the calibration and profiling areas described later will apply. In addition proofs may need to be validated using the Fogra Media Wedge v3 and a pass sticker or report attached to the proof. Market requirements and clients will drive this requirement. However this is a good discipline for all proofs to ensure consistency, repeatability and printability.

Printing presses

The digital front ends (DFE) used by digital presses such as the EFI Friez and the Creo all have very good colour management controls. Also they can be supplied with a full colour profiling solution. The colour management menus can be set to convert RGB images and page elements to the CMYK profiles needed to match your chosen colour workflow. Even the more complex areas of colour management such as rendering intents and black point compensation can be matched to the desktop setting in Adobe CS/CC.

Whether to honour input or output CMYK GCR settings can be applied, as can PDF X output intents. These are quite high-end colour management areas, but it does demonstrate how sophisticated this area has become in driving digital presses. Colour management of digital presses is based on two CMYK ICC profiles. A profile that describes how the press prints on a chosen substrate and a simulation or reference CMYK profile to match an required printing condition. This is normally the profile used to

prepare the production files or the CMYK profile set in the colour management menu of the DFE. These two profiles interact within the colour management software of the DFE to produce the printed result to match the standard printing condition needed by the colour-managed workflow.

The level of colour management that is required for digital presses, is again, driven by markets requirements. So let's look at 3 levels of colour management for digital presses.

Level one

It is possible that the standard colour settings for the press, using the pre-installed substrate profiles may cover your needs. Of course the normal press calibrations will always be needed. This will use pre-loaded 'default' device and substrate profiles with no CMYK simulation profile to match a standard printing condition. Of course in this case the colour produced may be acceptable for your market, but will not match the values and numbers required by the colour managed workflow and standard printing condition.

Level two

Still using the 'default' device and substrate profiles, introduce the reference or simulation CMYK profile required into the colour management menu within the DFE. This should improve the colour reproduction, but it will still be dependent on how well the 'default' profile matches the characteristics of the press and substrate used.

Level three

This introduces custom-made ICC CMYK device and substrate profiles into the colour management workflow on the DFE. As the digital printer without a custom profile will print very differently on differing substrates this approach is needed for the most demanding work and clients. Especially if you are trying to match output from other printing methods! Using the colour profiling software, which is available with most of the DFEs it is relatively simple to create a substrate CMYK profile for each of the papers used. These can be loaded into the queues and colour management menus. Then used with the correct CMYK simulation profile colour correct to the colour managed workflow chosen will be possible.

With these steps in place it is important to think about compliance i.e. proving to customers that you can print to a consistent and repeatable standard. To demonstrate colour management compliance there are usually three options:

1. Self – compliance:

- Set up your own colour managed workflow
- Educate and train your workforce
- Ensure the use of consistent and compliant materials and create your own ISO compliant profile
- Monitor the results and issue your own product guarantee or compliance certificate.

2. Client driven.

Your clients demand samples of your product (proofs and press sheets). They submit them to tests and measurements. They may employ a third party to do it for them or, if they are large enough they may employ their own experts to enforce compliance on their suppliers. This is a major concern for large consumers of printed material that is sourced from a variety of printers.

3. Third party certification:

A third party (organization/service provider) offering certification, or its agent, is contracted to supervise the implementation of a workflow that produces ISO compliant product. In effect, the organization certifies the printer and the client accepts the certification as proof that the product is compliant.

Pathways to ISO Compliance

Self - Assessment Path

1. Acquire Standard

Purchase 12647-2 standard documentation

2. Audit Workflow

Test & measure materials, working environment, processes and procedures, file mgmt., profile handling, viewing conditions, instrumentation & printing conditions

3. Monitor supplies

Ensure consistent supply of paper, ink and other consumables

4. Print Trials

Run print trials using compliant materials to develop own characterization data with ISO standard

5. Proofing

Implement consistent monitoring at each stage of the process

6. Product Monitoring

Consistent measuring & monitoring of press sheets to remain in tolerance

7. Result

Consistent production of printed material compliant with ISO12647-2

Client Driven Path

1. Consultant Acquires Standard

Print buyer employs a consultant to introduce a consistent colour standard across a range of suppliers.

2. Performance criteria

Print suppliers have to conform to the ISO standard and the print buyer will measure and assess the printed product.

3. Implementation

Print suppliers implement 12647 as target for compliant print production and proofing. Submits proofs and test sheets for assessment.

4. Product monitoring

Client monitors print product against ISO standard. Accepts or rejects work on the basis of objective measurement of sample sheets. Proofing

Implement consistent monitoring at each stage of the process

5. Result

Consistent production of printed material compliant with ISO12647-2

Third Party Certified Path

1. Consultant Acquires Standard

Print buyer engages third party consultant with authority to oversee implementation of ISO standard/FOGRA/GRACol

2. Implement certification process

Consultant liaises with client and print suppliers on requirements. Audits workflow, tests and measures materials and processes, working environments, file mgt, profile handing, viewing conditions, instrumentation & printing conditions in accordance with certifier's requirements.

3. Monitoring

Consultant conducts ongoing monitoring on behalf of certifier to insist on compliance of ISO standard.

4. Certification

Third party consultant issues certification on behalf of the relevant certifying body.

5. Result

Consistent production of printed material compliant with ISO12647-2

With colour control being so critical to printers, it is essential that they review their current colour management routines. If they cannot achieve consistent and repeatable results they should seek further support and advice. The Digital 1234 Implementation Guides will provide the next level of educational information and practical help. They can be attained from Konica Minolta and their partners or independent experts.



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