



The chief aim of colour should be to serve expression as well as possible.

– Henri Matisse, 1908

## Dear Reader,

Managing digital colour was supposed to get easier once the ICC had got its collective teeth into the subject. However, the unabated onward march of digital technologies keeps us all on razor's edge.

What started as a relatively simple proposition based on device calibration, ICC profiles, and colour space conversions has morphed into something altogether more complex. Now we need colour profiles as well as the base ICC data to give us the metadata that describes what was going on when the ICC profile was created. This metadata gives us the RIP settings, substrate information and device settings, in addition to the ICC profile, so that it is possible to recreate a piece of print.

As the boundaries between media continue to erode this colour metadata will necessarily get more complicated. Understanding how colour works in print is hard enough. Printers without this foundation have no hope of competing as the media industry atomises and colour gets ever wilder.

Enjoy!

Laurel, Nessian, Paul and Todd



## In This Issue

### Raising standards

The American company Graphic Measures International is bringing its brand of quality control to Europe so we wanted to find out how it works. The GMI system is designed to give brand retailers confidence in the quality of packaging print, as Laurel Brunner explains in this story.

**see page 12**

### Between the lines

Staying with the packaging theme, Nessian Cleary has been looking at some of the security printing solutions that are around. Of course security printing can apply to many different areas, but much of the growing interest in this area comes from brand owners looking to protect their products against counterfeiters.

**see page 16**

### Innovations in colour measurements

Paul Lindström has been looking at two new spectrophotometers from Konica Minolta, which to be strictly accurate, are best described as spectrodensitometers. Either way, the FD-7 and FD-5 devices have impressive technical specifications and deserve more attention.

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## News Focus

As we predicted, **EFI** is to develop a DFE based on its Fiery technology for the Landa Nanographic presses. This new DFE will integrate into a printer's existing prepress, production, and business management workflow and finishing equipment as well as with EFI's MIS/ERP systems. It will start beta testing alongside the first Landa presses later this year.

**Chromasens GmbH** has introduced a vision-based inspection system that incorporates spectral image capture with 12 individual colour channels per pixel instead of just the three RGB channels. It can be used in-line or off-line in offset, gravure, flexo, or digital printing, as well as in the colour analysis of printed products such as sheets, stickers, brochures, and wallpaper.

**Heidelberg** has shown off a new DryStar low energy UV drying technology, with new Saphira Ink Low Energy UV 100 and 400 inks. These are said to be ideal for printing on paper, cardboard, and non-absorbent materials. They have good gloss properties and screen dot quality. Both enable printing to ISO 12647-2. Sheets printed with Saphira Ink LE UV are ready for finishing straight away as they are already dry on exiting the press.

### Spindrift

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**DirectSmile** has been updated to v6 with improved links to CRM systems. There's a new HTML-based web to print editor for online design of print documents. It also allows for search engine optimisation of websites. Another new feature, Professional Workflow, helps users to individually schedule the distribution of print data that are generated through web applications.

**EFI** has released version 7 of its Digital StoreFront Web to Print program. This now has advanced HTML5 tools for optimised web-to-print storefront access across desktop, tablet and mobile devices. Users choose from a variety of pre-built layouts and themes and can easily customise storefronts. Version 7 integrates with EFI's MIS and Fiery platforms.

EFI has also acquired SmartLinc, an American company that develops shipping software. This software allows users to select the best carrier for their shipments and can be integrated with other software systems such as MIS.

**Xerox** has signed an agreement to buy the German-based company Invoco Holding GmbH, which has expertise in the cable industry. The move will strengthen Xerox Europe with German language customer care services, and give Xerox the chance to sell its solutions to Invoco's existing customers.

**Google** has bought the British firm DeepMind Technologies, which specialises in developing artificial intelligence solutions. It has concentrated on deep learning algorithms, that allow machines to learn in a similar fashion to humans, using experiential learning. Google is said to have paid around €485m, making it one of Google's largest European acquisitions.

**Ibis** has launched a new Smart Binder X for the newspaper market. The new system has been stretched to increase maximum booklet format size to 18 x 11 inches. It can produce 10,000 A5 portrait booklets 2-up per hour.

**Solar Inks** has developed a range of environmentally friendly water-based flexographic and screen printing inks called Earthinks. They've been developed from sustainable resources including soy, starch, and cellulose with natural waxes and oils for near-zero VOC levels.

▶ They are suitable for a range of substrates from flexible packaging to paper bags.

**Stratus Packaging** has developed the IXcode label to protect pin codes from detection whilst in transit to customers. It uses a laminate component that acts like a stretchable 'tongue', which is then covered by tiny particles of black ink. By stretching the tongue, the customer can make the pin number appear as the tiny ink particles are dispersed and disappear.

**Axaio** has released a free update to its MadeToPrint Auto and Server programs, with new features including the ability to define different hot folders to automatically produce output from InDesign jobs dropped into those hot folders. It also includes the recently updated pdfToolbox 7 preflighting.

**Adobe** has announced v5 of the Technical Communication Suite, an authoring and publishing toolkit for technical writers and instructional designers. This latest version streamlines the creation of standards-compliant technical content by leveraging best-in-class XML/DITA authoring with complete Document Type Definition (DTD) support.

**The Ghent Workgroup** has developed new specifications for digital photography, which are available to download free of charge. These are based on those of GWG member association Medibel+, and give photographers and publishers a compact set of digital photography guidelines for print production. There are two versions available: News Photography, for newspaper production; and Shootings, for magazine and studio-quality production.

**Xerox** has named Jeff Jacobson as chief operating officer of its Global Technology Business, responsible for broadening and strengthening the hardware and software portfolio, and Andrew Copley as president of its Graphic Communications Operations. Jacobson will report to Armando Zagalo de Lima, president, Xerox Technology; Copley will report to Jacobson.

**EFI** has appointed David Reeder as Chief Financial Officer, following the departure of Vincent Pilette last August.

Until recently Reeder was the head of finance for Cisco's Enterprise Networking Group. In addition, Marc Olin has been promoted to the newly created position of Chief Operating Officer.

**HP** is to cut a further 5,000 jobs this year, on top of the 29,000 that it shed last year, in a bid to rebalance the company. Much of HP's problems are due to a slump in the market for PCs. Instead it is concentrating on services, including cloud storage, as well as servers and enterprise computers, where it has seen some growth in the last quarter.

**Paperlinx** has announced further cuts to its European operations. This includes the closure of leased premises in Nottingham, Sheffield and Leeds in the UK with the loss of 65 jobs. In Germany Paperlinx will consolidate a number of existing logistics warehouses and sales offices into the central warehouse in Biebesheim with the Hannover and Leipzig sites closed in the first quarter of 2014 and the loss of 75 jobs.

**Heidelberg UK** has announced its 2020 Vision open day, which will take place at the Brentford demo centre in West London at the end of the Ipex week, 27-28th March. The event will include a range of suppliers covering MIS, postpress and financial services.

**Adobe** has updated the 3D printing capabilities of Photoshop CC, making it easier to design 3D objects in a print-ready format. The new features include automated mesh repair and support structure generation for more robust models, while accurate previews allow creatives to submit print jobs with confidence.

**Mutoh** is to unify its EMEA warehousing and logistics activities from April this year in an effort to strengthen its supply chains. Mutoh's European country offices will continue to handle sales and servicing, but core marketing and parts supply will be handled by Mutoh Belgium.

**Global Inkjet Systems** has developed a new low power regenerative Head Interface Board (HIB) for the Fujifilm Dimatix SG1024 StarFire printheads. This generates the high voltage fire pulses and recovers energy from the printhead after each pulse, using only a low cost



▶ 24V power supply obviating the need for an expensive high voltage external power supply. GIS specialises in developing software, drivers, firmware and electronics for industrial inkjet printheads.

**Screen** has officially launched the JetW3200UV, which was shown as a prototype at last year's Fespa show in London. It's a mid-range flatbed that can take rigid board or paper sheets up to 3.2 x 1.6m format and up to 50mm thick, or multiple smaller sheets at once. There's a choice of colour options: CMYK + LcLm, +LcLmWW or +WW.



## News Analysis

### **Konica Minolta invests in MGI**

Konica Minolta has bought a minority 10 percent stake in MGI Digital Graphic Technology. The deal has cost Konica Minolta €13.7m, which it says is part of a common long term vision to establish a stronger presence in the professional digital printing market.

The two companies already have some history, with MGI being an OEM customer as Etienne Van Damme, deputy general manager for international marketing, pointed out: "They buy print engines from us which they then integrate with their own added value on the Meteor range."

However, Van Damme says that there are no immediate plans for the two companies to cross-sell each other's products. Rather the current OEM deal is a technology agreement between the headquarters with no regional support.

Konica Minolta has been open about its 'genre-top' strategy of concentrating on specific niches, which is something that MGI has proven very good at, having

developed printers for producing cards and calendars as well as document printers.

And as Van Damme noted: "If Konica Minolta has invested a significant amount of money into a company that we are already doing business with then it's for a good reason." Hopefully we'll find out more on this at Ipex, where Konica Minolta is one of the few digital print vendors exhibiting.

It's also worth noting that Konica Minolta has experimented in the industrial textile market, showing off a wide format inkjet textile printer at last year's Fespa London show. Konica Minolta has also collaborated with Miyakoshi to develop an entry-level label printer using a Konica Minolta dry toner print engine. This was shown as a prototype at the last Label Expo and Van Damme says that it generated some good feedback.







## Green Shoots

*Our Verdigris blogs have addressed a range of topics over the last few weeks from deinking through to new technologies for paper making. If you missed them during the seasonal rush, you can peruse them here.*

### Deinking

Most people accept that recycling is a good thing. Take paper for instance: in 2011 70% of European waste paper was recycled. Logistics and sorting can be complex, but of equal concern is how waste paper gets prepared for its reincarnation and a new life. The removal of printing ink from substrates, the deinking process, is key to waste paper's reuse. However there are lots of ways of doing it and limited consensus on how it should be done.

Deinking has to be thorough if the pulp is to be useful for different applications. Recovered paper pulps must have the optical characteristics required for different market sectors, from newspapers to high grade tissues. It probably doesn't matter much if the recycled pulp used to produce cardboard boxes is a bit drab and dingy, but lack of brightness is a serious problem for graphic papers. Recycled papers and board can be deinked and turned into something useful, but there is no standard method to provide benchmark quality control that ensures pulp meets the needs of different target uses.

Around the world regions and plants use their own deinking methods according to the type of pulp the plant is producing. Some digital, flexo and UV inks cannot be easily removed and so require a far more vigorous deinking process than is required for offset inks, and this may not be environmentally or economically worthwhile.

Successful deinking for all end uses inevitably depends on the technology and chemical recipes involved. Not all methods work for all printing inks. Ingede, a European association representing 33 paper companies, including many European paper mills and one from Pakistan, has developed various methods relating to paper deinking.

## Verdigris

The Verdigris project is supported by Agfa Graphics, Digital Dots, drupa, EFI, Fespa, Heidelberg, Kodak, Mondi, Pragati, Ricoh, Shimizu Printing, Splash PR, Unity Publishing, and Xeikon.

There's a method to measure the optical characteristics of pulps and one for assessing amounts of adhesive residues in a batch of recycled pulp.

Ingede's highest profile method is its Method 11, a deinkability test used to assess a print product's recyclability. Ingede's Method 11 outlines how to evaluate a print's deinkability using alkaline flotation, a widely used deinking method using a standard deinking recipe. However alternatives abound because not all inks can be removed with Method 11.

There is some degree of consensus on the basics such as flotation tanks for the pulp that gets mixed up with chemicals to remove the ink, dirt and glues, but little else. As the quality of the raw material entering the recycling streams gets more diverse, with higher proportions of inks that cannot be easily deinked, matters are getting complicated. The market might appreciate ISO standards that help account for the diversity of raw materials and facilitate the labelling of recycled papers according to their deinkability. We are working with Verdigris members, Ingede and the Digital Printing Deinking Alliance to explore how this might be achieved.

### Stepping Up to the Plate

Agfa has introduced a new chemistry-free plate, the Azura TU with a tonal range of 1-99% supporting linescreens of up to 240lpi, holding a 20 micron spot and run lengths of up to 150,000. This is quite a leap up in durability so this plate will be attractive to volume offset printers, not least because it will last on press.

▶ Processless and chemistry-free plates are often cited as examples of progress in print towards an improved environmental impact. And with good reason. Doing away with film and imaging straight to plate has had a profound impact on the economics of print over the last couple of decades, and getting rid of a whole processing stage in prepress has also reduced carbon footprints for print media.

Doing away with plate processing chemistry removes another source of pollutants and reduces plate processing emissions. However processless plate technology has

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largely been used for relatively short run work, say 50,000 to 60,000 impressions although plates are available for runs of up to 200,000 at a price.

Azura TU is daylight stable and positioned for commercial sheetfed applications which account for about half of all commercial and packaging print. In this sector plates have to be quick to process, stable, robust, easy to use and deliver high image quality. They should also be more sustainable than the previous generation technology and able to work on harsher substrates.

Part of the sustainability message is speed of imaging: more speed means less energy. Azura TU meets all of these requirements, and images at the rated speed of most thermal platesetters. The plate requires no chemical process to fuse the image and is compatible with and accredited for most digital 830 nm platesetters on the market.

Processless and chemistry-free plates are good news for print. Reducing the amount of hazardous waste in the print media production process has to be good news, as

does the reduced disposal costs. Waste is reduced because of the elimination of processing variables which are hard to control. The Azura CX clean-out unit is good for 7000 m<sup>2</sup> of plates and can be washed out with water, using 95% less water than is required for conventional thermal plate processing.

The Azura TU is a third generation plate that meets the needs of most commercial printers around the world. It is an excellent answer for offset printers asked about the sustainability of print.

## A Thing of Beauty is an Ancient Book

We hear a lot about the wonders of digital media and for several years it has had print in a more than mild state of panic. The Bay Psalm Book is just the latest addition to the list of reasons to choose print over electronic media. This slender volume is the first book ever printed in America, using a press especially (and very slowly) shipped in from England. This little book of 150 sacred poems is extremely rare, with only eleven copies still extant. But at least there are copies of the work. In four hundred years will we be able to say the same of this year's edition of Wikipedia, or your Facebook timelines?

The story begins with the Puritan pilgrims who arrived in America from England in 1630 in search of religious and political freedom. These settlers decided they needed a new version of the Hebrew Book of Psalms, tailored to their own reformist requirements. Various folk got stuck in to translate the psalms from the original Hebrew, rewriting them in verse so that they could sing the psalms as rhymes, using traditional melodies.

The settlers typeset and printed 1700 copies of the 300 page books on the newly arrived 240 reams of paper and press, some nine or so years after they reached America's shores. Now one of the remaining copies of this amazing book has just made over \$14 million at auction, courtesy of financier and philanthropist David M. Rubenstein. Mr Rubenstein also has the last privately owned copy of the Magna Carta - quite a collection.

▶ The Bay Psalm Book is an extremely rare edition, of course, full of flaws and foibles which enhance its specialness. The book is also a symbol of identity for America, because it embodies the spirit of the United States. It is an independent version of the Book of Psalms created for and by the congregation for whom it was intended. Those 1700 copies were so well used that most of them actually wore out and the book got reprinted over 50 times in the following centuries.

Apart from the fact that this story demonstrates the durability of print, it's clear that books have value as objects, not just for the content they deliver. The carbon in the Bay Psalm Book has been locked up for hundreds of years and is unlikely to be released any time soon. The content is accessible today as it was in 1640 when the book was printed. No electronics, no batteries, no servers, no RAID arrays have sustained it, only the paper and ink used to create it. It's a zero carbon footprint-archived reminder of those early settlers' work and desires. Because it is printed the Bay Psalm book is a tangible and accessible, if tiny, slice of history. Can we say the same of Lynx and Bernoulli cartridges, or an iPad?

## Paper Tigers Hear them Roar

The paper industry has often been the target of chippy greens looking to offload their eco-anger. If past practise is anything to go by, they have some justification, but it is time to start cutting paper companies a lot more slack. Pulp and paper manufacturers have made massive improvements to their environmental footprint over the last few years, not least substantial reductions in energy usage and waste. The Confederation of European Paper Industries (CEPI), is now taking steps to improve it even more.

The CEPI Two Team competition was set up to identify potential technologies that would help CEPI fulfil the requirements of its 2050 Roadmap. This requires an 80% reduction in fossil based CO<sub>2</sub> emissions by 2050. In the words of Teresa Prensa, CEPI's director general, the goal is to: "change the way we operate, reduce costs, revolutionize technology, add value and lower our energy consumption and carbon emissions". The Two Team

competition produced eight finalists and one clear winner, a biochemical technology that could replace current methods of pulp production.

Paper pulp is produced either mechanically by grinding wood chips into mush to separate the raw fibres from the lignin which binds them together, or chemically. This involves stewing the wood chips with various chemicals and is generally more expensive. The resulting pulp is however, strong with good brightness and can be used in combination with some mechanical pulp, for instance, to produce lightweight publication stocks. Both methods involve a lot of energy and water: the World Resources Institute estimates that pulp and paper production produces 500 million tonnes of CO<sub>2</sub> per year.

CEPI's Two Team winner involves neither mechanics nor chemicals, but instead uses the principles of biochemistry. The favoured solution is to use Deep Eutectic Solvents (DES), naturally occurring chemical compounds that can

## CEPI's Two Team winner involves neither mechanics nor chemicals, but instead uses the principles of biochemistry.

dissolve the lignin out of wood. Potentially, these solvents could make it possible to produce pulp at lower, more energy efficient temperatures for reduced emissions and waste volumes. DES are essentially designer solvents based on combinations of chemicals that work on any type of biomass, dissolving it into lignin, cellulose and hemicellulose (somewhere between cellulose and sugar).

These clever chemicals may also be able to recover cellulose from waste as well as melt ink residues in recovered paper, so they have potential use in deinking too. When combined with wood, DES separate the fibres producing pure lignin and cellulose as by-products. Biochemists can use both of these as raw materials for other chemical products. The DES method does away with the huge amounts of water and subsequent drying

▶ required to make paper. This is a massive source of energy savings. None of this is commercially viable yet, but it is an indication of how seriously the pulp and paper industries now take sustainability. It's a matter of survival.

For more green news, check out  
The Verdigris Project:

**Verdigris** 

<http://verdigrisproject.com>







## A Review

### Measuring tricky substrates

While there are plenty of options when measuring print on paper, choosing one for more unusual substrates like plastics, textiles, or wood can be more difficult.

To help with this, X-Rite has announced its new generation of handheld sphere spectrophotometers, and we have tested the Ci64L model. The 'L' at the end of the name indicates a fixed Large aperture of 14mm.

Most spectrophotometers used in the printing industry work according to the 0/45° geometry for the light source, which works well for thin ink layers on paper. But for high gloss materials, or plastics and textiles, or metallic inks for that matter, this type of measurement becomes quite unpredictable. Measurements made by a light source using the Sphere Geometry take samples from several viewing points, which can result in a more relevant measurement with much better repeatability.

X-Rite calls the material used for sphere measurements Spectralon, a highly reflective and durable material, which can be found in the existing benchtop 8000-series of spectrophotometers, among others.

As with other recent handheld spectrophotometers from X-Rite, the Ci6x-series uses a high-resolution colour touch screen together with a selection wheel for the user interface, similar to that of some types of MPEG-players. This makes the interaction with the built-in computer and control software very easy and intuitive. The usability is further enhanced by two small LED lamps at the top of the instrument, which indicate the status of the measurements: green light means a successful measurement, while amber indicates that measurements are in progress, and errors trigger a red light.

While on the topic of usability the wireless connection should be mentioned. Measurement data can be instantly transferred via Bluetooth to the central colour database, control software or Quality Control solution. One such solution is the one offered from X-Rite called Color iQC.

In this test we haven't explored this software, but focussed on the instrument itself. A review of the Color iQC system would be a whole article on its own, and we might come back to that at another time.

There are several models in the Ci6x-series, with different features and options. Essentially, the base versions have a slightly lower accuracy and repeatability, but there are also different models for UV-measurements. For example



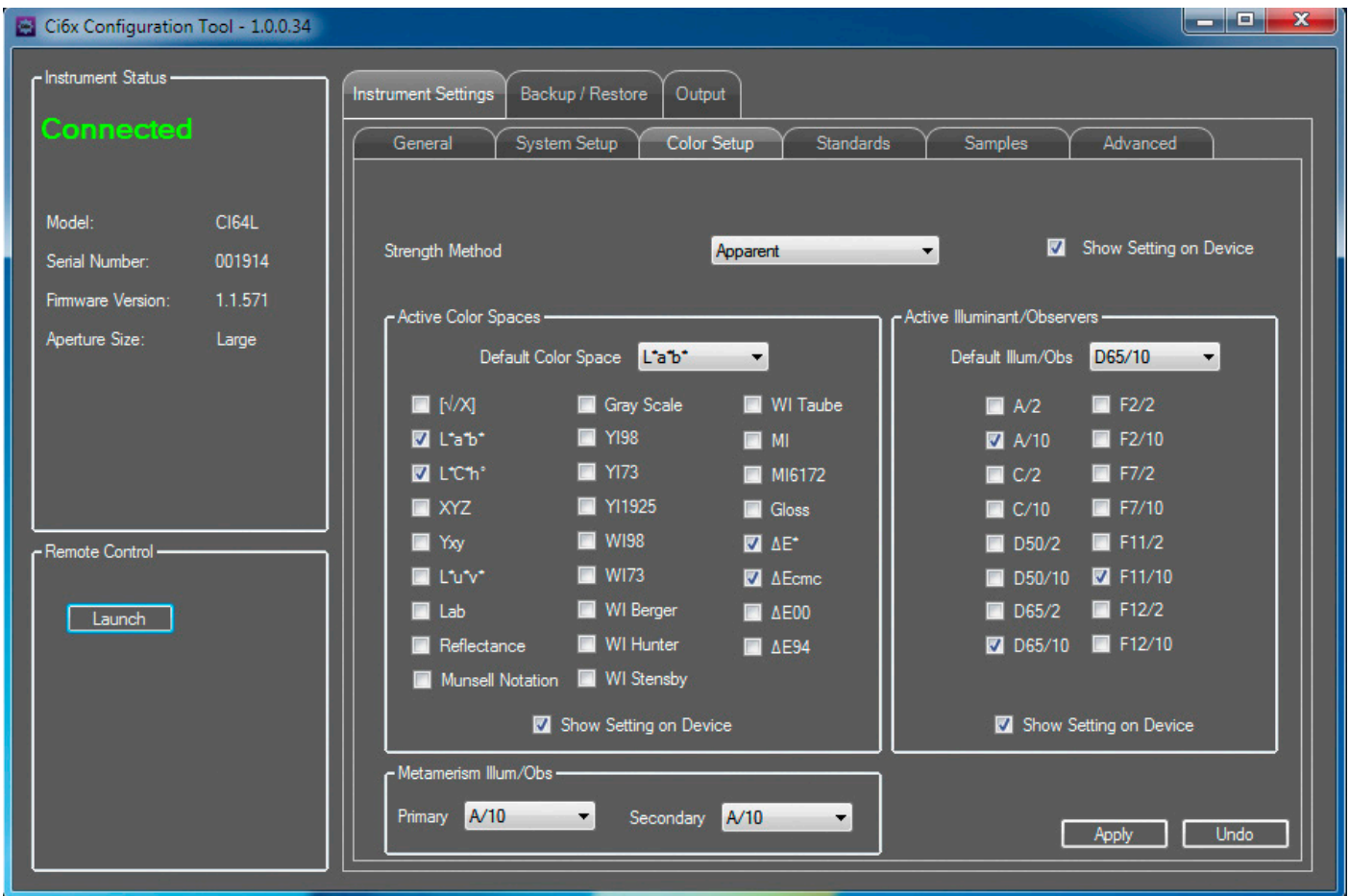
*The X-Rite Ci6x-series of spectrophotometers use Sphere Geometry for measurements, which is especially suitable for high gloss ink coats or substrates, as well as metallic inks.*

the Ci60 base model (without Bluetooth and NetProfiler) costs around €3,845 ex VAT and has a repeatability of 0.1 E when reading the white tile, while the Ci64, at a cost of around €8,720 (Bluetooth and NetProfiler included) has a repeatability of 0.04 ΔE.

Other features are embedded support for centralised calibration through the NetProfiler 3.0 solution, changeable apertures and, of course, a whole range of measurement options such as instant reporting on measurements of both specular readings included or excluded, in order to determine what measurements to use. This is especially important when measuring highly glossy materials.

Since the Ci6x series can handle such a wide range of measuring modes and substrates, X-Rite provides a series of training modules. These help the user to both understand the colour theory and the handling of the instrument.





To change configurations and settings you use the Config Tool (Windows only), and for some of the models you can transfer data using wireless Bluetooth-connection for this.

While most of the Ci6x series of instruments will find their way to colour labs and industrial production facilities outside the printing industry, we believe that digital large format and screen printing users would benefit from measurements using the Sphere technology. Measuring high gloss, glass and metallic inks is always a challenge, but with the right type of instrument you have a better chance of success.





# Boomerangs

*Here's a note from our publisher:*

Dear Nessian,  
We forgot the two Boomerangs in the issue! Please make sure they get into the next one.  
Happy Christmas!!  
xx  
Laurel.

Laurel,  
Yes, I realised over the weekend that I'd forgotten the boomerangs but I'll put them aside for the next issue.  
Nessian

*Oops.*



*Paul Sherfield of The Missing Horse Consultancy writes:*

Re: Spindrift Nov 5th 2013-Riso Comcolor 9150 piece

Hi Laurel,  
Don't mean to be picky about this interesting article, but I am sure that on page 21, first para in 'Result in Numbers' you mean Fogra 47 rather than Fogra 27 re the uncoated dataset?  
Paul

*And indeed, Mr Sherfield was quite right:*

FOGRA 27 was the very old char set for coated, now replaced by FOGRA 39. Yes, it should say FOGRA 47, and this is what I've used in my analysis. A silly slip in typing, possibly an unconscious slip back to the days when FOGRA 27 was the most common referenced char set. Well spotted Paul, and thanks.  
Paul Lindström



*Axel Fischer of Ingede sent us this email:*

Dear Laurel,  
Someone sent me questions about our cooperation with Landa that relate to an article you wrote in Spindrift, saying Landa "has successfully deinked the prints, working with Arjo Wiggins and Ingede."

I do not know of us doing any successful (or unsuccessful) deinking together with Landa. We have not deinked nor even seen a single print sample yet. On the contrary, there are some concerns that it might become a problem – if it wasn't, Landa might actually have done what you report? If I was them and had a deinkable product, I would dump a pile on my feet saying: Go ahead, test it, and tell the world about it!

I do have a sincere contact with Gilad Tzori whom I meet at various occasions and with whom I exchange some friendly words every now and then, but there is nothing beyond that. Nor with anybody else from INGEDE.

Best regards  
Axel Fischer.

Dear Axel,  
Thanks for the clarification. We will run this in our next issue.  
Regards,  
Laurel.



# Raising standards

**We bang on a lot about the need for quality management in print media production. This is because control of processes, colour, substrates et al is fundamentally important if printers want to attract and retain new, high margin business. Getting the attention of big brand owners and retailers can be hard, but Graphic Measures International (GMI) is making that conversation a lot easier.**

GMI is a young company that has grown quickly over a five year period to develop a worldwide presence, with offices in the USA, Shenzhen and Hong Kong in China, Tamil Nadu in India and Costa Rica in Central America. GMI is now expanding into Europe. Its business is to provide the missing link between brands and printing companies



*GMI founder Tim Curtin.*

who want to offer those retailers their services. GMI is not a print broker. Rather it provides brands and retailers with a way of specifying standard print production parameters

together with a service that checks and certifies if the brand's production expectations have been met.

The company has its origins in volume packaging production. Founder Tim Curtin worked for many years for Cenveo, a printing and related resources company, and as president of Cenveo Colorhouse he learned a lot about packaging production. GMI grew out of a project to provide Target, the fourth largest American retailer, with predictable production results for around 200 brand colours.

## On Target

Target's print quality control and packaging quality assurance had previously been in the hands of various print brokers who worked with 70 printers on Target's behalf. Target had limited control over processes or production targets and wanted the flexibility to work with a longer list of printers, without risking a compromise in quality. But Target feared that increasing the number of printers through print brokers would have made quality assurance even more chaotic. Instead Target chose to work with GMI to increase the number of print service providers and to ensure manageable and controlled production.

Target has a high number of its own brands so it was important to develop processes that would work for all of them. It's been a great success: there are now 300 printers in the scheme GMI developed for Target, a scheme which Tim Curtin says "allows [Target] product vendors to work with 300 instead of 70 printers". Also "because of our success with Target we got referred into several more [retailers] ... to reach into the national brands". Now in its fifth year of business GMI has "close to 100 employees around the world". Its US clients are all pretty big, including Walgreen, Lowes, Target and BestBuy, with average turnovers of \$30 million to \$40 million.

## Quality Control

This is a services company focused on packaging quality control, a collective of experts in packaging process control with offices in US, India and Europe. GMI offers services to assure brand protection and integrity throughout the packaging supply chain through a





*Justin Lewis, GMI's Business Development Director for Europe.*

combination of standards deployment, certification and supply chain audits.

The new European push is headed by Justin Lewis, ex Heidelberg, who explains that “we’re just doing print quality management [which] helps us keep a position of neutrality”.

## Brand Police

GMI's service begins with a conversation with a brand owner or retailer to establish production quality expectations for a given print media product. The minimum production requirements are the basis for certifying packaging suppliers and ensuring conformance to an agreed bespoke standard. GMI agrees with each customer precisely defined minimum targets and requirements for performance measurements which are visible to all stakeholders.

The specifications and tolerances that GMI defines in a scheme are bespoke to a particular client, so they can include requirements to follow ISO 12647-2 or IDEAlliance G7 or anything else the client chooses. Schemes have been developed for litho and flexo (spot and process colour) printing, vinyl and poly bag production and polyfilm production. The cost of each scheme development is obviously subjective however, Justin Lewis notes: “the average cost is coming down as much of the development work has already been implemented by our technical teams over the past five years. We find

that our clients and prospects share a very similar set of challenges, so we are able to create new programmes out of existing ones without the need to reinvent the wheel each time.”

The GMI method is based on whatever its clients want. They commonly want compliance to ISO 12647 standards, often with G7 but with more emphasis on press behaviour. Pulling together a range of standards into a single implementation is an interesting approach to quality management and GMI has found it can be a tool for changing behaviour. According to David Krishnapillai director of south Asia operations, the “yellow ink in south



*David Krishnapillai, Director of South Asia Operations, GMI.*

Asia was way off from ISO 2846.” GMI's programme there provided a snapshot of how ISO standard conformance can improve quality control: it has encouraged better efforts amongst regional ink suppliers to comply with ISO 2846.

The GMI evaluation could include very specific requirements such as average Delta E variations of two in the course of a print run, or the requirement that measurements are done with an M0 or M1 device. Or it could be very loose. For instance, one client's print reference sample we looked at did not include what

▶ the required CIELa\*b\* values should be, just basic recommendations for how to measure the colours.

Once the specifications are fully developed a printer can implement the necessary processes for its production systems to meet the tolerances for a packaging brand's scheme and request a GMI audit. This costs \$3000 and is the basis for certification for compliance. Justin Lewis explains: "Printers and packaging suppliers pay a one-off charge for GMI Certification which, once achieved, brings them into our matrix of certified suppliers. This matrix is visible to all our Retail and Brand clients and their thousands of product vendors, who are able to

**Once the specifications are fully developed a printer can implement the necessary processes for its production systems to meet the tolerances for a packaging brand's scheme and request a GMI audit.**

make direct contact with suppliers, for bids, quotations or to place orders. The printer pays nothing for this, the visibility it gives them to some of the major retailers of the world is one of the key benefits of the GMI structure." The audit is a single plant and process certification for specific run lengths, so mixed environments need multiple certifications.

## Certificated

The print facility certificate can only be considered for printers which fulfil GMI's six basic criteria: process control and documentation; equipment maintenance; operator abilities; training programmes; facility attributes ie health and safety; and the general work atmosphere. At the very least a printer must have a five-colour press, CtP, finishing, running water and power. Product certificates are based on compliance for specific quantities of a package, so print vendors cannot claim capability for longer runs.

Most GMI certifications have gone to offset litho packaging printers with some to gravure and flexo printers. These

printers produce a wide range of products including cartons, film, bags, vinyls and hangtags. Schemes are also under development for transit packaging, which is more or less complete, for digital print, which GMI sees as a separate print method from analogue ones, and for online softproofing applications. A GMI specification could include any quality assurance parameters, which gives GMI considerable market scope.

As well as print facility certifications GMI provides production run sample measurement. Samples are sent to GMI's own evaluation centres located in Costa Rica, USA and India, and which measure colour, quality of print and materials, and can include screening for heavy metal content such as cadmium or lead. The sample gets a straight pass or fail result and a 48 hour turnaround on GMI's normal service means that evaluation does not hold up shipments of product. Around 97% of submissions from GMI certified printers now pass so there is less debate about problems or issues between the printer and its customer. The data stored online is available to retailers who are GMI clients.

GMI uses Bodoni System's pressSIGN software to measure, evaluate and track colour printing processes across different locations worldwide and the results are available online to all stakeholders. The evaluations check colour values and various other parameters in order to confirm or dismiss the likelihood that the printer will be able to produce the packaging to the required quality. The evaluation centres are doing "hundreds of thousands of print packaging sample measurements per year" according to Justin Lewis. GMI also does onsite press checks and instore checks of packages, actually measuring package colours on the shelf. These instore audits close the loop in GMI's total supply chain quality management.

## Rising Quality Worldwide

GMI has found that 15-20% of packaging generally failed its audits, primarily because of supply chain complexity and a lack of overall quality control. However, its customer results improve over time through a combination of sample testing, GMI's certification schemes and supply chain audits. The blend provides it with the tools to help clients control output quality at source and prevent poor

▶ packaging reaching a retailer's shelves. For instance, in 2011-12 GMI found a 4.6% sample failure rate for some 16,000 items. This dropped to 2.2% in 2013. The most common reason for failure in 2011-12 was for process colour problems at 25.4% and brand colour failures at 22%. These numbers dropped to 23.6% and 20.5% respectively in 2013. Tim Curtin reckons that "retailers who work with GMI will see their return on investment [in print] improve".

There are now 553 packaging suppliers certified to GMI schemes worldwide. The company is providing services to over 1200 product vendors (brands) and has tested and measured over 750,000 print and packaging items. Justin Lewis says "around 10 printers in Europe have already been certified and are exporting print to the US". He is working to get this number much higher in both Europe and the Middle East. Currently three of the certified printers are in Germany.

Of the worldwide base of certified printers, Lewis says "I believe this will get up to around 1,000 by 2015". The UK office is currently just a sales office however, GMI is working to create a European evaluation centre although the location has not yet been determined. In the meantime GMI wants to work with major European retailers such as Marks and Spencer and Carrefour, whom Justin Lewis considers to be where Target was five years ago, and of course with printers. He says that GMI has a particularly valuable service for them because "we will make you visible".

GMI's own quality control procedures are under development because so far its clients have been its gatekeepers. GMI also does its own random tests to check that it is living up to its own expectations. The company is in the process of getting ISO 9001 certification at its evaluation centres. It is also considering compliance to other ISO standards such as the ISO 17000 series for conformity assessment and the accreditation of certification bodies.

GMI has a wide range of programmes to support the different requirements of different brands. It is also launching its own GMI Prime certification, which is independent of brand or retailer. According to Justin

Lewis: "It will enable new clients to get started quickly with our standard service offerings, for a very reasonable one-time charge covering set-up and web access. Once onboard, GMI Prime users will be able to tailor the service to meet their needs, and build up to a customised programme if they wish".

Prime follows the same model as GMI uses for its bespoke services, to provide printers with a starting point for a possible certification. This saves them the cost of investing in a custom programme for a particular retailer and GMI hopes it will be a way to get into more retailers and brand owners. GMI has no constraints on who it can work with, so it has immense scope to develop the business into other print sectors.

The GMI model is easily scaleable because of the number of people and placement of their evaluation centres at points where the packaging industry is booming, such as India and China. They are doing a "test pilot right now for one of our retailers for signage because colour is critical" explains Tim Curtin. At the very least this company should put a rocket under those printers who think they can ignore print buyers' growing interest in quality control. As Justin Lewis says: "Brand is king and print buyers need to know that wherever in the world their packaging and related print is produced, quality does not need to be compromised". Printers take heed.

**- Laurel Brunner**





# Between the lines

**Until recently security printing has been a rather specialised niche, seen as something of limited use in applications such as producing currency or identity documents.**

But the issue of security printing is rapidly growing in importance as major brand owners realise the damage that counterfeit goods can do to their reputation. This is particularly important in the pharmaceutical sector where counterfeit drugs can pose a major health risk. According to one estimate, up to ten percent of all drugs may be counterfeit, which costs the drug industry billions of dollars each year. But it also includes other areas



such as foods and alcohol as well as luxury goods, toys, fireworks, car parts and even sun tan lotion. The result is an increasing number of security measures being applied to day to day packaging.

Recessions tend to lead to a rise in counterfeiting and the counterfeiters are becoming increasingly sophisticated so that the security products are having to constantly evolve to stay one step ahead. There are a number of techniques and most experts recommend a layered approach using

several different types of security. This makes it harder to counter the security systems in place, and pushes up the cost of breaking the security, which in itself can be a deterrent.

One such system is the use of microtext, which can be printed down to 1 point or 0.3528mm, so that it is impossible to read with the naked eye and therefore extremely hard to copy. Typically hidden messages or codes are embedded into the text, which can itself be added to illustrations within a layout so that it's easily missed by a counterfeiter, but easily readable to anyone who knows what to look for.

Another approach is to use guillochés, which are irregular but highly precise patterns made up from line drawings that are extremely difficult to copy. They can only be replicated on good quality presses or some of the higher end digital printers. A variation on this is to blend spot colours into the designs, which show up if they are reproduced on a CMYK copier.

Yet another technique is to use Cryptoglyphs, which are patterns made up out of very small dots, typically around 20 microns - the human eye can't distinguish shapes smaller than 30 microns. Xeikon has demonstrated packaging with cryptoglyphs in which the dot pattern is overlaid on the packaging with light toner so that they blend into the design. They can be seen with a smartphone running an appropriate app, which checks the pattern against a master file.

Frank Jacobs, Xeikon's marketing communications manager, says that the 1200 dpi resolution of its 8000 series printers is particularly suited to those applications that rely on fine patterns and small dots.

Agfa sells a dedicated security design program called Fortuna, which can be used to create many of these design elements. It aims to replace more traditional mechanical patterns such as guillochés through design software. At its heart is the Fortuna Core design and assembly module, which acts as an editor for assembling and previewing designs. There are around 30 different modules covering the various techniques such as micro text and guillochés, and there's also a Rainbow tool that can subtly merge



colours, which can be difficult to replicate. Rather than buy the whole set most users mix and match modules according to the type of security they need. It's mainly used for printing secure documents such as identity cards.

The software is password controlled to determine which users can work on different functions. Agfa will also vet customers to protect the integrity of the software.

## Inks and toners

Sun Chemical has a number of security solutions which it has gathered together under the SunNote brand name and which cover almost all aspects of the banknote production process, including protecting the logistical movement of banknotes within the cash cycle. The range includes SunNote Shift, a collection of bespoke iridescent pigments and varnishes for banknote printing. Sun Chemical also recently added a new product, SunNote Arrest, which is a staining ink for the International Banknote Society, compatible with varnished banknotes.

Stefaan D'Hoore, Sun Chemical's security printing manager, claims that these inks will dry quicker than rival inks, leading to much faster productivity since there are often multiple production steps in creating bank notes.

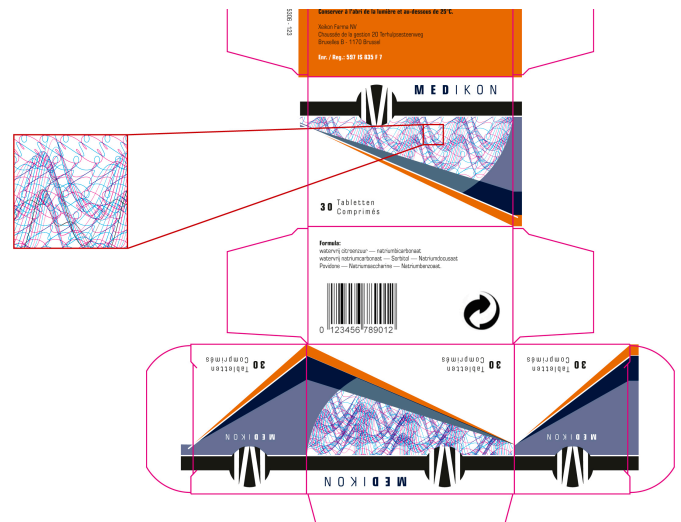
Another, more obvious approach, is to use UV-reactive inks to embed codes into documents that can only be seen under UV light. Nowadays UV readers are fairly ubiquitous so this offers a basic low cost check. Xeikon, for example, has demonstrated the use of clear toner to print codes that can show up under UV light.

Another approach is to add taggants - chemical markers - to inks and toners. Taggants have many advantages. They are usually fairly cheap, and invisible to the naked eye making them hard to detect, and to copy, and they are virtually impossible to remove.

Xeikon has partnered with BrandWatch Technologies to use its taggants, which can only be detected with a proprietary reader supplied by BrandWatch. These taggants are already used with conventional inks for applications such as bank notes and identification documents.

Xeikon adds the taggants to its toner, which is then only distributed by BrandWatch according to the ISO 28000 standard for chain of custody. The customer can then use the toner in the fifth colour station. It works with the QAD toner used by the 8000 series, and is suitable for short run and variable data applications such as tickets and identity documents. Jacobs says that although Xeikon has not tried it with the 3000-series narrow format presses, it should work in the same way.

Kodak has produced a range of solutions under the Traceless brand name, aimed at both documents and packaging. Perhaps the best known of these is Traceless Ultra Covert, which is another taggant system. Thaddeus Bowen, senior managing consultant for Kodak business



*Xeikon has demonstrated this carton with a number of security features including guillochés as shown here.*

solutions says: “We typically apply it through ink but it could be added as a varnish overcoat or we could extrude it into plastic or add it to threads for textiles.” One use has seen it included in the stitching used to bind passports together.

The marker is formulated to produce a specific signature, which is unique to each user. Bowen says: “With most systems you need to add a huge volume of the taggant but with this the volumes are minuscule. This means it's harder for anyone to find and reverse engineer.”

It's invisible to the human eye and won't show up under UV light. It can only be seen through a proprietary

reading device which Kodak loans to customers and must be returned when the contract is concluded. Kodak also carries out a security audit for any printer that's going to be using the system.

Bowen says that many brand owners now look for a mobile solution and so Kodak has a number of apps that can detect security markings, which obviate the need for a dedicated reader. The apps can be configured to only detect those marks relevant to individual users.



*Kodak's Ultra Covert Traceless taggant system relies on this reader to reveal the hidden code.*

The Ultra Covert system works with offset, gravure and flexo but not digital printing. However, Kodak has another system, Antidiversion, a clear ink that is suitable for continuous inkjet systems, including those supplied by Domino and VideoJet. It's typically used at the end of a packaging line to allow users to add a unique serialisation code to each product. Bowen notes: "It doesn't respond to ultraviolet light so it's harder for people to copy or remove

it." Kodak also has track and trace software that allows items to be tracked through the production and supply chain.

Kodak has another system, Traceless Reveal, which relies on messages hidden in artwork that can be seen through a lenticular lens, though users might need to tilt this to get the right viewing angle. It's invisible to the naked eye and very difficult to copy. It will also work with a mobile app, showing the hidden message on the screen. Bowen says that different versions of the app could show different parts of the message to different users.

There are also thermal reactive inks that disappear when heat is applied, such as when someone holds their thumb over the print, and reappear when the heat source is taken away.

In addition, Kodak has colour shifting inks, made with particular pigments that change colour when viewed at different angles. They can be used on solid backgrounds or as a semi-visible image over a label graphic. They work with flexographic printing and can also be combined with the Traceless markers.

## Serialisation

The pharmaceutical industry, with its obvious health implications, has been fairly proactive in securing its products. Many brands have made greater use of track and trace, also known as serialisation, whereby each batch of a given drug has its own serial code so that pharmacists can check not only that the drug is genuine, but also the date of manufacture. The European Union has adopted the Falsified Medicines Directive (FMD), which is due to come into force in 2016 and requires each individual pack to have its own unique code. Inevitably this will lead to a huge amount of data and the EU is still setting up appropriate systems to handle this, though its worth noting that Turkey already uses serialisation codes. The likelihood is that we will see serialisation used more widely in other applications as well.

Inevitably, all these techniques require a degree of balance. For example, it's relatively easy to embed hidden codes into a design, but if they are too easily spotted then there is a danger they can be copied, and if they're

▶ too well hidden then it will limit the number of people who can authenticate them. Consequently many of these techniques are designed to protect the integrity of the product barcodes. But most vendors agree that no single technique is 100 percent effective and so most brands combine several different security features that are designed to be authenticated at different stages in the supply chain.

- ***Nessan Cleary***



# Innovations in colour measurements

**Konica Minolta introduced two high-end spectrophotometers to be used within the graphic arts industry back in 2010, but they are still almost unknown to most printers.**

This is quite unfair, because the FD-7 and FD-5 spectrophotometers have impressive technical specifications, and were the first to offer measurements according to the M1 mode of ISO 13655, the ISO-standard for spectrophotometers.

Konica Minolta Sensing offers a whole range of spectrophotometers, which are better known outside the printing industry. One of the main design objectives



*The FD-7 spectrodensitometer from Konica Minolta Sensing supports measurements in ISO 13655 M1-mode, as well as scan mode and measurements of ambient light.*

for the FD-7 and FD-5 series of spectrophotometers for graphic art applications was to be able to detect OBA (Optical Brightening Agents), if present, in the printing substrates.

Another was to offer densitometric measurement functions, so they are actually branded as spectrodensitometers. On top of this they can also measure ambient light, by mounting a diffuser over the

measurement head. The accuracy of the instruments is impressive with a repeatability of  $<0.05 \Delta E_{00}$  when measuring the white calibration tile. Inter-instrument agreement is stated to be  $<0.3 \Delta E_{00}$ . The spectral range is 360-730 nm when measuring emitted light, and 380-730 nm when measuring reflected light.

In order to be able to measure in M1-mode, meaning using a light source compatible with D50 light, including the UV portion of the spectrum, the FDs contain three different types of LEDs. One of these LEDs creates the UV part of the spectrum, which is necessary to activate the OBAs (sometimes also called FWAs or Fluorescence Whitening Agents) if present in the paper. Older spectrophotometers normally only have a Tungsten lightsource, which doesn't produce much of the wavelengths in or near the UV part of the spectrum.

Since OBAs are used in more and more types of print production papers, it's important both to be able to detect OBA and to compensate for it correctly in the colour management process. If not, the colour appearance of the print will be wrong, or there will be a mismatch between final prints and the proofs.

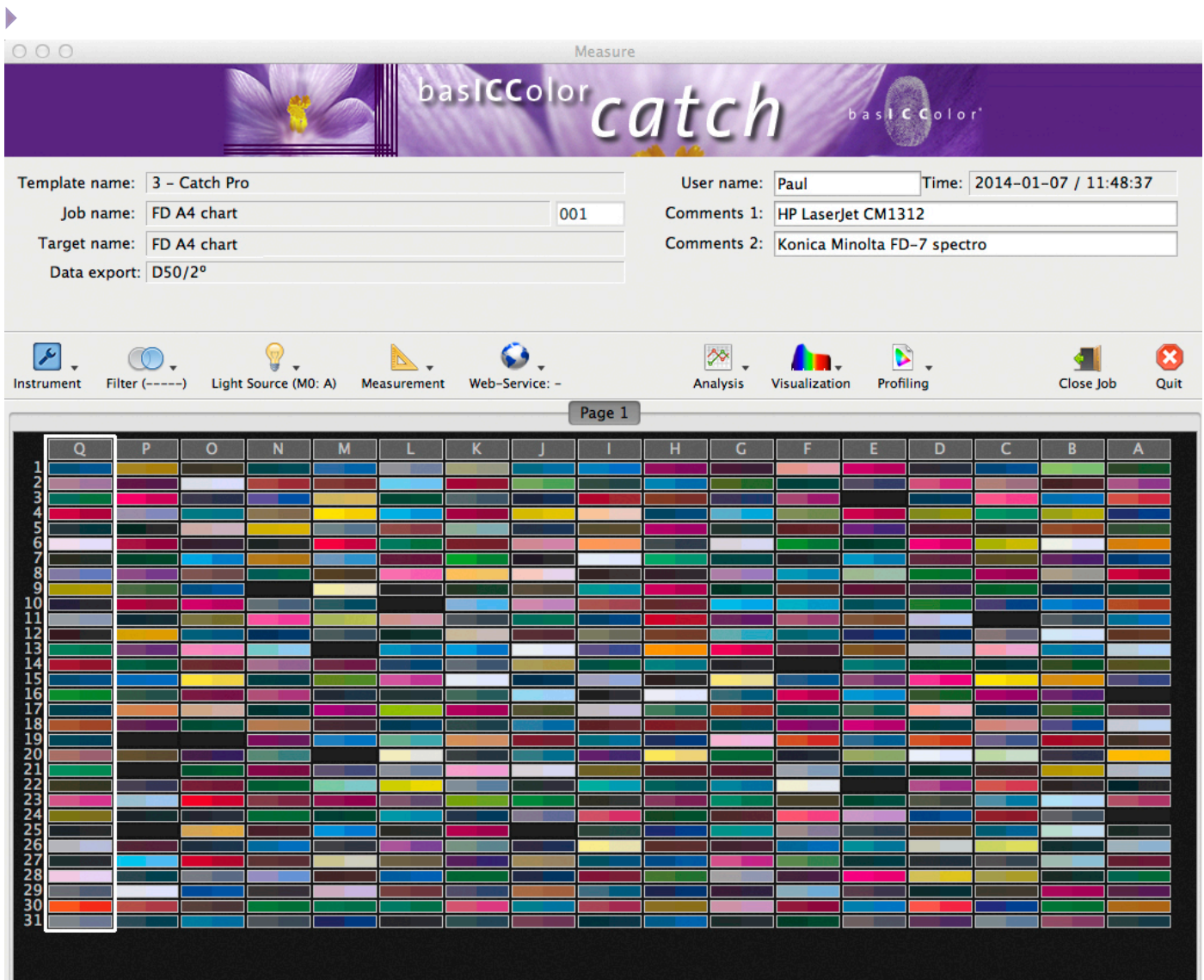
When the FDs are calibrated, they are automatically adjusted to take into account the UV part of the spectrum. Konica Minolta Sensing calls this an automatic Wavelength Calibration, which is part of the VFS technology (Virtual Fluorescence Standard) developed by Konica Minolta Sensing.

The main differences between the FD-7 and the FD-5 models is that the FD-7 can be used in scan mode and also measures irradiance (emitted light) while the FD-5 doesn't have those functions. The FD-5 is also limited to only report colorimetric data, not spectral data. To use the FD-7 in scan mode you need a plastic ruler to guide the spectrophotometer in the process. We tested the FD-7, and the ruler makes it easy and straightforward to perform measurements in scan mode.

## Colour Management Software

The FD-7 and FD-5 both have a built-in computer and small screen to perform a range of colour management functions. Konica Minolta also provides Windows-based





The FD-7 has many built-in functions but can also be remotely controlled by the BasicColor suite of software.

software to use for setup and data transfer. There is also Mac and Windows based software to create custom made colour charts, to fit different sized papers for different types of printers and presses. But when it comes to software to create and modify ICC profiles Konica Minolta Sensing cooperates with BasicColor (formerly known as Color Solutions) and uses the BasicColor suite of colour management modules for a range of different functions. BasicColor is a renowned pioneer in applied colour management, and is used by several other vendors to provide a 3rd party solution, often rebranded by the manufacturer.

Whether you use the built-in software or the external BasicColor software, you can perform a range of measurements and analysis. One of these functions is to check if your print or proofs are compliant to the commonly

used standards like ISO 12647, IDEAlliance GRACoL or Japancolor. Since the FDs are spectrodensitometers you can also measure and check TVI, trapping etc. With the FD-7 you can check if your viewing booth complies with ISO 3664 and D50 spectral illumination.

We have focused on testing the FD-7, mainly using the built-in software and some basic functionality in the BasicColor suite of software. In order to review the whole functionality of the BasicColor suite we would need to come back to this at another time, since this could be a whole article on its own.

In every day use the functions provided through the built-in software should provide the tools needed for advanced colour control, as well as features like being able to switch between black or white backing swiftly.



*For more automated reading of colour charts the FD-series of spectrodensitometers from Konica Minolta Sensing can be mounted in this scanning table called ColourScout A+.*

For more automated measurements the FD-series of devices can be mounted in a scanning table called ColourScout A+. The user will then be able to have both M0, M1 and M2 reading with only one measurement session.

## General impressions

Testing the FD-7 was a pleasant experience – easy to use, and with a range of useful functions. Konica Minolta stress that it's a very light instrument, only 350g, which makes it easy to handle. All the important features are in place, M1-mode, scan mode, the robotic option ColourScoutA+ and the capacity to measure emitted light. If we would suggest any area of improvement to Konica Minolta Sensing it would be to add support for Bluetooth in order to provide wireless connection. But despite this minor shortcoming it deserves better recognition among printers since in every other respect it is a fully fledged high-end spectrodensitometer. The price, depending on options, starts below €3000 exclusive of VAT.

**- Paul Lindstrom**

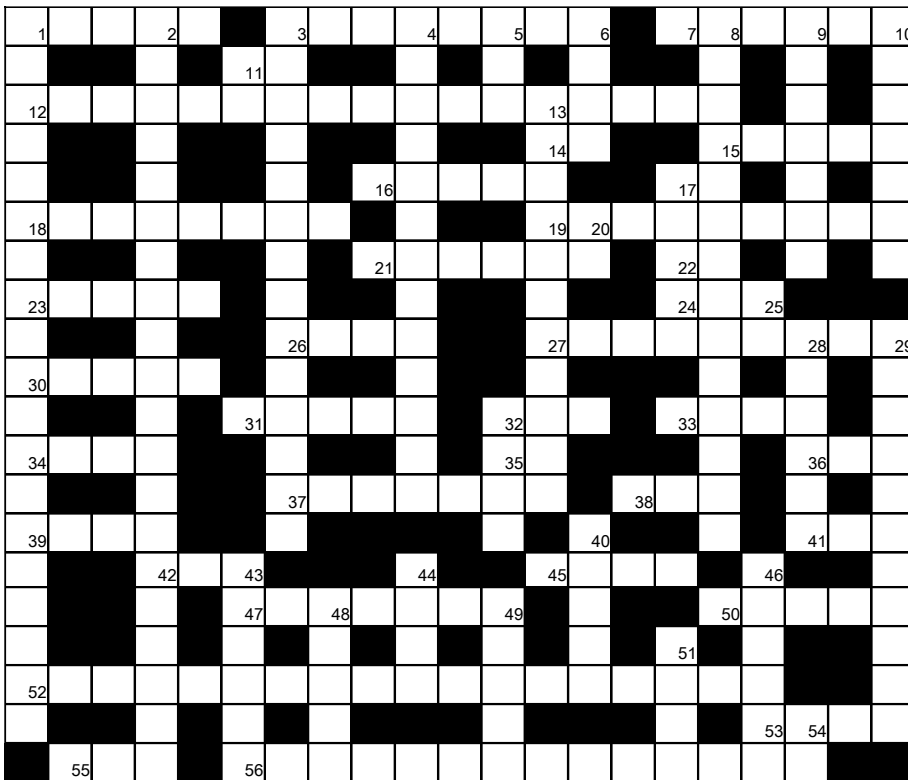




# X-word Puzzle

## Number 49\*

Our first puzzle of the year got a little out of hand so is much longer than usual. The good news is that it is also a lot simpler.



### Across

- 1. To position. (5)
- 3. Answer for a stagnant business, but useless for a wheel. (8)
- 7. Mistakes. (6)
- 11. First person singular male. (2)
- 12. Fast-track route to profitable prepress. (9, 8)
- 14. Just suppose? (2)
- 15. To lift up. (5)
- 16. He or she has information. (5)
- 17. Short for wireless. (2)
- 18. To use a hard way to protect book blocks. (8)
- 19. A cable commonly used to connect analogue AV equipment. (5, 4)
- 21. Dennis nickname to threaten or danger? (6)

- 22. @ (2)
- 23. An extra thing to pay more for. (3-2)
- 24. Short for Edward. (3)
- 26. Short for initialisation. (4)
- 27. The type of knowledge you need to apply tools. (9)
- 30. Stare intently at excessively bright light. (5)

- 31. Litho? (5)
- 32. To correct. (3)
- 33. Not fat. (4)
- 34. ?-matic. (4)
- 35. Fashionable. (2)
- 36. To pat gently. (3)
- 37. The process of getting files to the correct destination, usually via the internet. (7)
- 38. Dog, cat, bunny or type of plastic? (3)
- 39. Not a profit. (4)
- 41. End of the Line. (3)
- 42. Identifier in XML code. (3)
- 45. Repeat, repeat, repeat, repeat, often on a mountainside (4)
- 47. Occupied soon to be married. (7)
- 50. Protective material for walls and woodwork. (5)

- 52. When all else fails. (7, 3, 8)
- 53. On the 15th of March otherwise omens. (4)
- 55. Windows' predecessor. (3)
- 56. Process of losing wholeness, of fragmenting and falling apart. (14)

### Down

- 1. On the surface of some chemistry or process free plates. (5, 6, 8)
- 2. It's up to you, designers follow this instruction, to start sound colour management. (6, 4, 10)
- 3. Damp conditions causes paper to do this. (6, 8)
- 4. Secret of success for printers in cash or equipment. (3, 10)
- 5. It's the start of the process of of hearing. (3)



6. A file format long since bypassed but still widely used. (4)
8. The secret to excellent writing or a cheat? (9, 5)
9. Required. (7)
10. Layouts. (7)
11. Hindi for yes! (2)
13. Terribly gentle cut process used in labels. (4, 7)
17. Anger. (5)
20. Common Era. (2)
25. Direct Imaging. (2)
28. Origins of the base measure of luminosity. (6)
29. Commitments and limitations. (11)
32. To search or succeed in the search? (4)
40. Rubbish that could be used as something else. (5)
43. Indebted. (6)
44. Flu or cold with shivers. (4)
46. Slum neighbourhood. (6)
48. Windows erstwhile master. (5)
49. Two terminal conductor that can emit light. (5)
51. Leave it the same, proofreader. (4)
54. Domain Name (2)

\*Answers in the next issue

## Number 48 - Answers

D	E	I	N	K	A	B	I	L	I	T	Y		M	E	L	A	M	I	N	E	
R		M		N		R		A		H			E			W		N		X	
Y		P	S	O		U		P	A	R	T	I	C	U	L	A	T	E		P	
B	Y	O		W		S		S		O			H			R		R	U	E	
A		S		L		H	S	E		U		R	A	M		D	O	T		C	
C	R	E	M	E		E		D		G		N		A		P				T	
K				D		S			S	H	A	R	I	N	G	F	I	L	E	S	
C	H	A	R	G	E		I	P		P			C		R			E			
A		R		E			N		S	U	R	F	A	C	E		S	T	E	P	
L	U	C	K		S	A	M	E		T			L		E		A	T		I	
C		H			P		A				O		P			T		E		N	
U	N	I	Q	U	E		K	N	E	A	D		U	N	S	H	A	R	P		
L		V			C		E		D		D		L			I		S		F	
A	L	E	S		I		R	U	I	N	S		P	L	A	C	E			A	
T			E		A		E		T			A					K	R	A	F	T
I	N	S	T	A	L	L	A	T	I	O	N	S				E				I	
O			U		I		D		O			P	L	A	I	N			B	E	
N	O		P		N		Y		N	S		I							B	R	
	I				K				S	U	S	T	A	I	N	A	B	L	E		
B	L	A	C	K		I			E			R				L			U		
	S		E			T	A	R	G	E	T	A	I	M	V	A	L	U	E	S	

