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# Digital Printing

Digital Dots

# The Digital Dots Buyer's Guide to Digital Printing



Digital Dots

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## The Digital Dots Buyer's Guides

This publication is part of a series of independent buyers' guides for publishers, graphic arts professionals, printers and print buyers. Buyer's Guide titles provide straightforward explanations of how technology works, what it's for and considerations for investment.

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## About Digital Dots

Digital Dots is an independent graphic arts research company established in 1999. The company is a collection of like-minded graphic arts consultants, pixies and professional journalists specialising in digital prepress and publishing technologies. Digital Dots provides exclusive market research, testing and evaluation services for prepress and publishing applications, and publishes a monthly newsletter. Spindrift is the industry's only truly independent resource for graphic arts news, analysis and comment, and has a rapidly growing worldwide readership.

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**For John W. Seybold, 1916–2004**
**The father of digital typesetting**

# Introduction

**Welcome to the Buyer's Guide to Digital Printing**

Although digital colour printing is less than ten years old, it has quickly come of age as far as the available technology goes. Over the past three to four years, product development has suddenly shot forward and all suppliers now offer mature printing technologies and powerful front ends to drive the presses. Printers and prepress houses have yet to catch up, but anyone previously doubting the viability, quality and business opportunities offered by digital colour print, will almost certainly change their tune. If you are an offset printer thinking of expanding your printing capacity, you should definitely consider the possibilities a digital press offers. If you are a prepress house using a digital workflow, the step to providing printed output using a digital press is much smaller than attempting to move into offset printing. And now you can offer your customers "offset quality" using a digital press.

In the following pages we cover everything you need to know about digital colour printing technology. We introduce basic printing technologies to set the scene, explain how they work and how they are used. We also cover all the main issues that you need to consider if you are planning to make an investment in digital colour printing, and the included case study illustrates many of these. The Guide concludes with an overview of the suppliers in the top end of the market, their latest products and a chart covering the various technologies and products.

This guide is not exhaustive. We do not cover the low end of the market in much detail, focusing instead on the technologies aimed specifically at the professional graphic arts industry. Also we do not cover so called DI-presses (Direct Imaging), sometimes defined as digital presses, but which actually use offset printing and plates for image creation and transfer, with plates imaged directly in the press. Instead we focus on truly digital presses, machines with which every single impression can be unique, allowing true variable data printing. This is not to say that DI-presses don't have a very real place in the graphic arts industry. Development in this market segment continues with interesting new products such as Screen's TruePress 344, a new generation digital offset press. In fact, many of the features of a successful truly digital press are also in demand in the DI-market. The TruePress 344 has a makeready time of only five minutes, with a high level of automation in start-up and production management, making it easier to use than a more traditional DI or offset press.

Successful investment is about choosing the right technology for your business, but the choice is also about getting the best service and support deal for your company. Cost of ownership, investment protection, adaptability for changing production needs, all these need consideration alongside the technology. With the Buyer's Guide to Digital Printing technological concerns should be the least of your worries. We hope you find this publication useful and welcome your feedback.

# Taking the Digital Printing Plunge

**So you need more printing capacity? Ten years ago you would most likely have simply bought another sheetfed offset press and hey presto! problem solved. Today, investing in additional printing capacity requires any forward thinking printer or prepress house to go through an altogether different process. No longer is it enough just to ask the question "How much capacity do I need?" Instead you must ask "What kind of capacity do I need?" And that in turn raises a lorry load of additional questions, which is why you are reading this.**

So why has it changed? Three words: digital colour presses. First properly introduced at Drupa in 1995, they now constitute a whole new world for anyone wanting to put ink on paper, or indeed almost anything else. Obviously direct digital output was the next logical step for digital workflows: let the digital data flow all the way to the press. This was not a new idea however. When the first digital colour presses arrived, digital workflows had already managed black and white printouts for over ten years. But transaction printing had little to do with the printing industry: it was the stuff of copy shops. What made the difference was colour and the introduction of direct digital output for colour rich production printing.

For a long time printers remained very sceptical about digital presses, and they were completely stuck on the quality issue. The reticence was mainly blamed on the customer who was said to demand higher quality than the digital presses could deliver. A decade later, digital printing quality is no longer an issue. Today's presses match offset quality and some would say have even surpassed it in many respects. During a digital printing press run there are none of the fluctuations associated with offset such as ink and water temperature, ink/water balance, plate and blanket wear, and so on. Also digital press output resolutions, screening technologies, tone reproduction and colour gamuts now compare well with offset. We can confidently dismiss the inferior quality charge, at least for the bigger production presses.

Those who can't get past the print quality issue in digital print rather miss the point though. Focusing on quality alone assumes there's nothing else to consider. This is a great fallacy and brings us back to the original question that today's buyer of printing capacity must ask himself: "What sort of capacity do I need?"

In other words, the question is really one of capabilities, applications, features and functions. Because in order to buy the right machine you need to know, not just how much you are going to produce and at what quality, but also the anticipated run lengths, final products, substrates and so on. Basically the starting point should be the target market and its needs, not just the number of sheets you want to output each month.

With a true digital press there are opportunities and possibilities that don't exist with litho:

✔ Printing variable data. Variable Data Printing or VDP means that the press is capable of producing a unique print image for each impression. As a result, the printer can provide customers with completely personalised full colour high quality print to in turn send to their clients. The printer has added significant value to the printed matter coming off of the press. Printing with a digital press is no longer just putting ink on paper, but instead creates extra value for print customers.

Variable data is not possible on any press that uses imaged plates, which is why we do not classify so called Direct Imaging offset presses as digital presses. In a Direct Imaging press the plates are imaged directly in the press, but still have to be exchanged for each new print image. This technology, a sort computer-to-plate system in a press, has a number of advantages over conventional offset depending on the business and production requirements, but not variable data.

✔ Because there are no plates or costs associated with the production of plates, very short run lengths become viable on a digital press. The ability to economically print very short runs coupled with the fact that jobs do not require any physical image carrier (plates), means a print buyer can order copies of such things as marketing brochures as and when required. The print buyer can also easily update the brochure content at any time. So instead of having to store 2000 brochures which perhaps become partly obsolete in six to twelve months, print buyers can order the right number of updated copies in time for each event. This is of course print on demand, another added value provided by the digital printer.

Digital printing is less viable for longer runs of fixed image work, but the cut off point at which offset becomes more economical for the customer than digital printing is generally moving up. It is impossible to say exactly where that point is, because of the additional value digital printing brings. Digital printing can sometimes compete well for runs of 2000, and in other cases offset can compete for jobs of 500.

✔ Jobs can be switched over faster on a digital press, and easily be moved around in the electronic job queues to cope with changing circumstances. In other words, flexibility is greater, and this can mean timelier delivery to the customer. And because there are no plates, production cycles are shorter and costs may even be reduced.

There are of course many more aspects differentiating digital printing from offset printing. A printer needs to understand and consider all of them to make the right investment choice, but that is not the purpose of this guide. Instead we aim to shed light on those aspects which differentiate the various digital printing systems from each other, and help you ask both yourself and the press vendors the right and relevant questions in order to make the right investment for your particular business and needs.

The good news is that the pioneering years are over. The printing quality is at least as good as offset, the front ends driving the presses are powerful, the vendors have learned from their mistakes and from their customers, resulting in well developed operator interfaces, colour management, quality controls, flexibility in substrates and applications, and so on. We are entering a stable and increasingly mature market.

# Background & Printing Technologies

**Over the past ten years the digital press market has gone from being less than marginal to becoming a mature and expanding field for some of the biggest suppliers in the graphic arts industry. More importantly, printers are taking real advantage of this technology and the associated business opportunities. The presses have come a long way since the first generation, sweeping away issues of reliability, consistency and quality. For commercial applications electrophotography reigned supreme as the preferred technology for digital printing until late 2003. A couple of strategically vital acquisitions have put inkjet in position to become a strong contender for all types of applications.**

## The pioneering years

In the mid-1990s, printers were busy trying to take on board the fact that you could let digital material flow straight onto printing plates. And then suddenly two new and independent players entered the market, each claiming to have built the press of the future. Plates were but a memory, everything was managed by computers and every print could be made unique. When Indigo and Xeikon launched their first digital presses at Drupa in 1995 (they had showed prototypes even earlier), they met with scepticism from a printing industry still struggling to embrace the desktop shock.

With these launches people saw the opportunities and the unique advantages of digital print and variable data. We saw one nifty application after another at trade shows. Suppliers tried to educate printers, printers tried to educate customers and prepress shops moved into printing. But still we waited for the breakthrough. Still digital printing was more hype than reality.

The pioneering Xeikon and Indigo invested enormous amounts to develop technologies they firmly believed were the future, choosing two different strategies to capture market share. Xeikon signed OEM agreements with several other printer, press and prepress suppliers. Agfa, Xerox and IBM developed and sold proprietary front end systems for the Xeikon print engines. A bit of reshuffling in the spring of 2000 saw Man Roland taking over Agfa's OEM agreement and launching its own line of digital presses.

Indigo, on the other hand preferred to reap the fruits of its digital press development alone and never OEM'ed its technology to other parties.

For a long time, Xeikon and Indigo were the only manufacturers of full colour digital printing engines, but Drupa 2000 was a turning point. Suddenly everyone wanted a slice of the pie and since then developments have sped up considerably. Technical developments and some business reshuffling have seen digital print become a serious market, both for vendors and users. Press developers have drawn on early experiences and users have begun to see that digital colour is not just another printing method. It's about new business opportunities.

# Press categories

## Electrophotographic technologies

Putting subjective print quality aside and looking instead at issues such as speed, cost and capacity, there are today two main categories of commercial electrophotographic presses. Firstly, there is the group of top-end devices outputting around 60–100+ A4 pages a minute. This group includes second and third generation machines, conceptual descendants of the first digital colour presses launched a decade ago. These presses require a certain level of operator skill and involvement, and are definitely designed for graphic arts applications, not office printing. They are fairly flexible as far as substrates, formats, workflow and inline finishing are concerned. Monthly capacities for these presses are generally from 500,000 to 1.5 million pages. The main suppliers are Xerox, Nexpress (Kodak), HP Indigo, Xeikon and Canon. Prices in this category start at a couple of hundred thousand Euros. Many presses are between €300,000 and €500,000 and some, like the Xerox Docucolor iGen3 and the HP Indigo ws3200 are over €800,000.

Recently a new market segment has emerged for users who want to get into digital colour printing, but at lower levels of cost and capacity. At entry level there are several devices producing about 30 pages a minute from suppliers such as Canon, Xerox, Océ, Toshiba, Konica-Minolta and Ricoh. These machines are not built to run 24/7, generally print on substrates up to about 250 gsm and have limited finishing options. Prices start at around €30,000. These types of devices come out of the office copier market and are sometimes referred to as "green button" engines: they require little operator involvement beyond pushing the print button, but they offer less functionality than their top end siblings.

## Inkjet engines

Inkjet presses are still mainly, although not exclusively, aimed at industrial applications such as labels, packaging, signs and displays, and transactional printing which does not require high image quality. At 300 x 300 dpi the imaging resolution in an inkjet press is not high compared to an electrophotographic press's 600 x 600 dpi, but production speeds are way beyond what's possible with an electrophotographic press. At the other end of the inkjet spectrum are the large format printers producing very high image quality, but at low speeds.

An inkjet press transfers the printed image without the imaging engine physically touching the substrate, so it's possible to print on a much wider range of materials than with a press where the substrate passes through a cylinder nip (although not all inkjet presses are designed for this type of flexibility). However inkjet isn't as good at printing text because the ink bleeds, creating softer edges. Development is intense however and there is no question that within the not too distant future this technology will be suitable for commercial print applications. The two main suppliers of inkjet presses are Kodak Versamark (previously Scitex Digital Printing) and Dotrix, which became part of Agfa in January 2004.

## Electrophotographic technology

Most digital colour presses use some sort of electrophotographic method to generate the image. There are some variations in how electrophotography works but the different technologies operate along common principles. A drum covered with a photoelectrical conductor is charged and the conducting material is then exposed to varying intensities of light from a laser or LED. Where the light hits the drum the surface material loses its charge and acts as a carrier for the image. Charged toner or ink is then attracted to the image areas of the drum. Océ has its very own technology, called Océ Direct Imaging, which uses magnetism to generate the image and remove unwanted toner from the drum.

Different presses use different methods to transfer the toner/ink to the paper or other substrate. Often there is an intermediate medium, sometimes referred to as a blanket. This is true in for example the Xerox Docucolor 2000 and 6000 series, which have what Xerox calls Digital Blankets. In the new Docucolor iGen3 Xerox has instead a new form of patented imaging carrier that transfers the image directly onto the paper. In Xeikon engines the drum is imaged and the toner then transferred directly to the paper. In top-end Canon and Océ presses, the toner is also transferred directly from the imaged surface onto the paper, in Canon's case from the imaged drum.
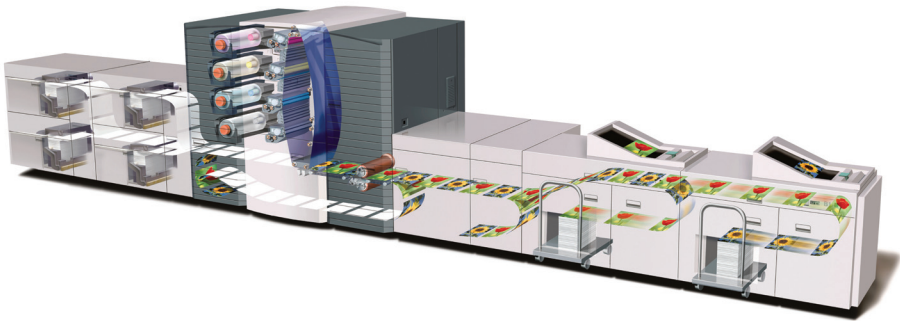


**The Xerox Docucolor iGen3**

Two manufacturers have presses combining electrophotography with an offset-like method for transferring the printed image onto the paper. HP Indigo's print technology transfers the ink onto a blanket cylinder, just as in offset, and from there onto the paper. Kodak's Nexpress 2100 also uses a patented blanket cylinder called Nexblanket to transfer the ink. However, in most other respects the Nexpress and Indigo methods are quite different.

## Single or multiple?

These presses also differ in their toner/ink transfer process. There are two basic methods, single or multiple pass. Single pass technology transfers an entire page onto the paper at once. All four, five, six or seven colour separations are imaged or transferred one on top of the other, via an intermediary carrier or blanket to the substrate simultaneously. Multiple pass technologies transfer separations to the paper individually, as the paper passes through the press in a straight path, passing one blanket or carrier cylinder after another. Another method is to hold the paper in place around a cylinder, which rotates four times (or more, depending on the number of separations) and with each rotation another separation transfers to the paper.

### Simplex and duplex

All electrophotographic presses can print on both sides of the paper. This duplex printing is achieved in several ways. Usually the paper is turned upside down and printed on the other side so that what was the leading edge of the sheet when printing the first side, becomes the trailing edge when printing the second. This method requires precision and accurate turning. Xeikon solves the duplex issue by printing both sides simultaneously. Xeikon web presses have toner units on both sides of the paper web.

For the Nexpress 2100, Heidelberg designed a completely new type of turning mechanism, unique to this digital press. The sheet is not only turned upside down but also horizontally, so that the sheet keeps the same leading edge as it is printed on both sides. Nexpress does not utilise conventional work and twist, but rather the sheet enters the first print unit with the same edge leading for printing each side. According to Heidelberg, this avoids the need for special algorithms for the adjustment of print register. Heidelberg developed the Nexpress's mechanical features while joint venture partner Kodak contributed the imaging technology. As of March this year, Kodak has taken over Nexpress; Heidelberg no longer has a part in it but will continue to sell the press.

In all the top-end sheetfed digital presses except the Nexpress 2100, both sides of the sheets are printed on the fly. Both sides of a sheet are printed before the next sheet enters the first printing unit, resulting in a steady stream of sheets to the delivery. In the Nexpress a number of sheets (less than ten) printed on one side, is collected in a tray prior to being printed on the other. They are then stacked up in the delivery at the same rate.

### Toner or ink

All presses have to use the toner or ink supplied by the press manufacturer. In fact the printing methods generally require purpose made and patented toner or ink for the presses to be able to print at all. Most of the presses use toner, with varying particle sizes. Many of these toners are so fine that they flow much as a liquid does.

# The main players

### Xeikon

One of the two original developers, Xeikon abandoned its OEM-strategy in the spring of 2002, when Punch acquired the company's digital colour press division. The monochrome division lives on as Nipson, based in France. The OEM strategy, which saw Xeikon through its costly initial years, had caused such intense channel conflicts as to seriously undermine the company's viability. Although the OEM strategy was scrapped two years ago, it was not until January of this year that the last remaining partner, Man Roland, officially ended its partnership with the Belgian developer. Recently Xeikon has stated that although it will no longer OEM its printing engine, it may still OEM its new Swift front end.

Xeikon has an installed base of over 1200 active engines, a figure which has declined since 2000 but which is producing a rising toner revenue for the company. All R&D costs incurred through the development of its latest press, the Xeikon 5000, have already been covered by toner income from Xeikon's installed base. Xeikon expects to install at least 60 Xeikon 5000 engines this year with orders for 45 presses anticipated before Drupa opens its doors, and many more sales after it closes.

Xeikon manufactures duplex web fed digital presses for the commercial printing market, but also has single sided presses for label and packaging applications. In 2000



**The Xeikon 5000**

the company made an ill-fated foray into the sheetfed market, but the product was withdrawn in 2002. The company's main attraction is the new Xeikon 5000, Xeikon's first major product launch since 2000. The 5000 prints up to 130 A4 pages per minute and is built to produce over three million impressions per month.

Things looked a bit shaky for Xeikon two or three years ago but, with the new ownership (Punch is a debt free company) and the latest ambitious press development, the future looks bright. A pioneer has survived.

## HP Indigo

The other pioneer, Indigo, was acquired by giant HP in 2002. There is no doubt that this deal was vital for Indigo's survival, as competitors such as Xerox and Nexpress moved into the digital colour printing market. For HP, the speed and quality of the Indigo presses was particularly attractive. HP already offered both inkjet and xerographic printers, but Indigo gives HP a way into commercial printing.

From the start Indigo developed both sheet and web fed presses, the former usually for commercial printers and the latter for industrial applications such as labels and

packaging. This dual philosophy still holds and HP Indigo has by far the widest range of devices and applications of any digital press supplier. HP currently has more than 2000 Indigo presses installed worldwide and from 2002 to 2003 page volumes increased by over 40%.

HP Indigo has two new digital colour presses. The 5000 is the first press developed jointly by HP and Indigo, and the 3050 is an improved version of the HP Indigo 3000 series. The company is also launching a new cheaper version of its Electro Ink, suitable for a wider range of substrates.

## Xerox

Xerox has been in the digital monochrome business for over twenty years. Its first venture into colour was an OEM deal with Xeikon in the late 1990s, for Xerox to sell webfed colour presses. Xerox soon launched its own sheetfed digital colour presses, the Docucolor 2000 series, and since then has stuck to producing sheetfed machines. At Ipex in 2002 early orders were taken for the Docucolor iGen 3, a third generation high volume machine. The latest commercial printing product is the Docucolor 6060. Xerox has so far installed over 100 Docucolor iGen 3, and aims to ship another 400–500 during 2004. Xerox has recently installed its 10,000th series 2000 press engine (this includes models 2045, 2060, 5252 and 6060).

Xerox' background in the document printing and copying business is no longer viewed as a liability by the graphic arts community. Many printers have seen Xerox not just as a supplier but also as a competitor, as it has run printing operations often in direct competition with commercial printers. Xerox is now one of the biggest suppliers in the graphic arts industry, with a formidable global sales and service organisation. Recently Xerox UK Director of Graphic Arts Peter Taylor was promoted to the main company board, the first time someone from the graphic arts sector has climbed so high in the company hierarchy. Clearly corporate management places considerable importance on this side of the business.

## Nexpress

Nexpress was conceived as a joint venture between Kodak and Heidelberg. At Drupa 2000 the first Nexpress digital colour press was shown, although it did not become commercially available until Print 01 in Chicago. Technologically the joint venture was a match made in printing heaven, with Heidelberg supplying extensive experience in sheetfed printing, and Kodak supplying imaging expertise. Heidelberg developed the press's mechanics and Kodak the image origination. Heidelberg's roots in traditional printing give the company a slightly different view of service. Many machines originating in office applications generate revenue for their manufacturers through click charges. The user pays for each printed page (click), and after a set number of clicks a technician arrives to service the machine. Conversely the Nexpress 2100 has over 40 parts that an operator can replace when necessary, thus controlling costs. After all, it's cheaper to use an old imaging cylinder for printing a few Power Point slides, than using a new one more important for high end production. Changing parts in this way is only possible with the Nexpress 2100.

There are currently over 300 Nexpress 2100s installed worldwide. As part of Heidelberg's recent realignment, Kodak took on the digital printing division. In 2003 Kodak expressed its intent to focus on commercial print as one of its three key markets. Kodak has launched a new brand, Kodak Commercial Group, to encompass

its commercial print efforts, including Nexpress, Kodak Versamark (ex Scitex Digital Printing) and Kodak Polychrome Graphics (KPG). With such a wide range of applications and products under Kodak's wing, Nexpress will be safe. There is no reason to doubt Kodak's ability to get back into printing.

## Canon

Canon, like Xerox, was originally a copier supplier but recently the company has had a clear graphic arts strategy and been very successful with its CLC range of production presses. Canon bridges the gap between top-end devices and entry level machines. The CLC 5100 is a sheetfed press that produces up to 51 A4 pages a minute. This range also includes machines for entry-level applications, most notably the 32 page-a-minute CLC 3200.



The Canon CLC 5100

# Inkjet

Inkjet presses are mainly used for industrial printing. The two leading suppliers have developed quite different technologies suitable for different applications.

There are two main inkjet printing technologies: drop-on-demand and continuous flow. The technologies are distinguished by how the drops of ink hit the printing surface.

Drop-on-demand technology causes the ink to expand so that droplets are forced through an inkjet nozzle. Expansion occurs either because of electrical stimulation or as a result of heat and is controlled so that ink droplets are forced through the nozzle individually rather than in a steady stream, which is harder to control.

A continuous flow inkjet head allows the ink to flow continuously through an electrostatic field. This field charges some of the ink droplets, depending on what is to be printed so that a second electrostatic field can then direct the droplets to the print surface. This combination of charger and deflector means that droplet placement and frequency can be controlled with extreme precision, so this technology is capable of very high quality (albeit at slow speeds). It offers a broad colour gamut, colour conformity and overall quality and is used in a wide range of applications. It has been especially popular for proofing applications, but continuous flow technology is more sensitive than drop-on-demand and can be vulnerable to clogging particularly if the machine is not in regular use.

## Kodak Versamark

This company only got this name earlier this year. Previously it was Scitex Digital Printing, part of Scitex Corporation, but in early December 2003 it was announced that Eastman Kodak Company would acquire the wholly owned subsidiary. Interestingly, it was ten years ago that Kodak actually sold its Diconix monochrome narrow web inkjet operations in Dayton to Scitex, which was the basis for Scitex Digital Printing. Of course a lot of product development has happened since then, and Kodak has hardly bought back the same company.

Today Kodak Versamark's products are built around high-speed continuous tone inkjet engines, and the company offers monochrome, spot and full colour web fed configurations of its Versamark press lines. The company also offers the Dijit range of narrow web (up to 541 mm) printing systems for addressing, barcoding and so on at commercial printers, binderies and mailing companies. The Versamark prints on 60–160 gsm rollfed papers, but the Dijit printing systems can also print on materials such as metals and plastics. They are installed in or offline with web or sheetfed presses, collators, folders and other equipment. Kodak Versamark has a total of 9000 digital printing systems installations worldwide.

## Dotrix

Four years after Agfa sold its Chromapress activities (including an OEM print engine from Xeikon) and exited digital printing, the Belgian giant is now back in the game. In January 2004, Agfa announced an agreement with Barco to acquire all assets and staff of Barco's Dotrix spin-off company. At Drupa 2000 Barco had shown a prototype of its industrial inkjet press, the.factory (read: the dot factory – Agfa please change the name!). In September 2001 Dotrix was established to develop and sell the product, which was officially launched in 2002.

The.factory is unique in that it has print heads across the width of the paper web. The technology is called SPICE (Single Pass Inkjet Colour Engine) and each individual print head cartridge has a printing width of 52 cm. The heads are mounted in a frame above the web in a staggered arrangement so that the maximum total print width is 630 mm (twelve cartridges). The advantage of the construction is that the print heads don't move, which gives stability as well as speed. Top printing speed is 24 metres per second, resulting in 907 square metres per hour.

The.factory is for industrial print applications such as wallpaper and floorcovering, speciality packaging, security printing and specialised printing applications such as mobile phone covers. As the.factory is very new, there are only six installations, plus four SPICE units installed on an OEM basis in flexo presses.

**Dotrix SPICE heads**

Under Agfa's umbrella the scope for development is huge. It is interesting and no doubt significant that Agfa chooses to invest in high speed inkjet, and it's a fair assumption that Agfa will look to move this technology into the realm of commercial print over the years to come.

# Conclusion

After a period of pioneering years with shaky equipment and equally shaky users, digital colour printing is coming into its own. The technologies are mature and presses now run consistently, producing a print quality that should be acceptable even to the most discerning print buyer. The press market has broadened considerably in the last few years, and today there is a digital printing system for every conceivable type of application, organisation and wallet. Digital colour printing is finally becoming a buyer's market, and users can expect top performance whatever they invest in.

# Creating New Business

### Company:

dpn (digital printing network), Malmö & Gothenburg, Sweden

### Type of work:

Flyers, folders, brochures, catalogue covers, business cards, self adhesive labels etc. Dpn runs three Internet based services: A production database - Customers and their collaborators (ad agencies, photographers, other printers etc) can access the database and work on common printing projects. Every user has a password and ID to access the graphic material stored for a given account. Digital Distributed Print - This service is aimed at companies that handle large amounts of printed material for retailers and partners, and who want to avoid storing printed matter. The system handles incoming orders, the jobs are printed and finished at dpn and then sent off directly to the partner in question. The Print Factory - This is a virtual storage where customers' printed materials are held as PDF files. The customer administers his own material, adding, changing or deleting files and placing production orders.

### Equipment:

Digital presses: a Nexpress 2100 in Malmö and a Xeikon DCP 50D in Gothenburg.
Finishing: Horizon VAC 100 booklet maker
Duplo DC 10 000S booklet maker
Morgana Auto Creaser
Eurofold 2000 folder
Horizon BQ-260 perfect binder

### Time of installation:

Xeikon presses in 1998, Nexpress in 2002

### Top advice:

"We have created services whereby our customers can keep their printed products stored digitally with us and have them printed only as and when they need them. This saves them costs for physical storage and they avoid printing more than they need. For us it is about creating new chargeable services for our customers, so that we don't have to compete on price per print the way we used to. This is the key to digital printing success." – Ragnar Andersson, Managing Director, dpn

Ragnar Andersson has seen it all. He invested in his first digital presses, two Xeikon DCP 50Ds, in 1998. Since then almost everything has changed: business strategy, customer demands and not least, press reliability. Since the installation of the first digital press, the old offset press and repro equipment have been thrown on the scrap heap. Today dpn is a purely digital printer, although the company offers its customers a lot more than toner on paper. Ragnar points to three main differences between basing the business on offset printing compared to digital printing: "One major difference is that with a digital press there are no on-press preparations. Everything is done in prepress and the job file then simply tells the press what to do. This also means there are fewer possible sources of errors. The second difference may be a bit

more contentious. I think it is printing quality, particularly when it comes to printing on exclusive papers with special effects surfaces. These are harder to print in offset both from a smear and drying point of view. Also the ink penetrates the paper more in offset, which gives the print a flatter look".



Ragnar Andersson, Managing Director, dpn

However the most important difference between running an offset operation and a digital print operation, is the new business opportunities the latter presents. According to Ragnar: "In 1998 when we started we were completely focused on what variable data printing could bring to the business, however at that time our customers were not ready." He adds: "If we had stuck with trying to create added value solely through variable data, we would not be here today."

Instead dpn carried out major market research. One hundred companies were interviewed at length about their printing needs. Many felt that too much printed matter was produced and products often became obsolete before they were ever used. Ragnar came to the conclusion that this was a golden opportunity for dpn: "We have created services whereby our customers can keep their printed products stored digitally with us and have them printed only as and when they need them. This saves them costs for physical storage and they avoid printing more than they need. For us it is about creating new chargeable services for our customers, so that we don't have to compete on price per print the way we used to. This is the key to digital printing success."

In order to succeed in the new digital market, dpn had to change its approach to selling and marketing. The sales team has spent a lot of time explaining to customers the advantages of being able to break down their annual print production into always current products delivered just in time. Since going digital dpn has also gained more direct corporate customers and have moved away somewhat from advertising agencies. Explains Ragnar: "Corporate marketing departments are much more open

to our new services. They see the advantages in using our Internet services and online ordering routines."

## The technology

The development of digital presses is now fast and furious, which has changed life considerably for users such as dpn: "Every 18 months the technology goes through a new cycle, with hardware upgrades for improved printing quality or software upgrades for reliability, productivity and quality," says Ragnar. "For example, during our first year of running the Nexpress we had to reboot up to three times a day. Since the big update in October last year we have maybe one reboot a week, and we've not seen a service technician since then. We've not needed one!"



**Nexpress 2100**

Dpn uses the Nexpress and the Xeikon for different types of products. Everything up to A3 is done on the Nexpress, posters and odd formats on the Xeikon. "Xeikon's advantage is its format flexibility. We bought it specifically not to get stuck in the A4/A3 segment, which turned out to be a correct decision, although there are fewer paper qualities available for this machine. Nexpress prints on 95% of all available stocks, between 80 and 300 gsm."

Paper costs also differ greatly. Rollfed paper for the Xeikon is on average 20% more expensive than the paper used in the Nexpress, according to Ragnar. Furthermore there is more waste in the webfed press than in the sheetfed one. The Nexpress should have a maximum of 2% waste. Commenting on costs in general Ragnar says: "From an investment point of view the two machines are about the same, of course it may be a different story with the new Xeikon 5000, I can't comment on that. With the

Nexpress you can also to some degree control the costs by how far you stretch the ORCs (Operator Replaceable Components), i.e. the replaceable parts, without losing quality."

Ragnar likes the Nexpress philosophy, which lets the operator be in control of service and maintenance of the press. "Every morning we do thirty minutes of maintenance, plus ten minutes after lunch. On Mondays we spend about an hour doing linearisation and calibration. I can't imagine having to get a technician out for every issue." Dpn runs the Xeikon along the same lines and thanks to the experience of the operators, service technicians are very rarely called out.

As the Nexpress is in Malmö, this is the press Ragnar works with on a daily basis. There are two aspects of it that he is particularly happy with, the NexQ quality control and the flexibility of the front end.

"The quality control system is absolutely fundamental to what we do. It means we are guaranteed exact colour, register and quality consistency when we print for example, parts of a run on different days. The register is as good as on an offset press, and an advantage in Nexpress compared to other digital presses is that the sheet has the same leading edge for the printing of both sides."

The flexibility of the front end ties in with the difference in producing on a digital press compared to offset. In a digital press workflow everything can be set beforehand. "We work with job files where everything is pre-programmed: impositioning, colour management, paper etc. One of our most efficient recurring jobs is one where we export a job folder over the Internet to a customer's server every night. The server puts print ready PDFs in the folder which are then RIPed and ready for the press by morning."

Dpn's future looks bright. Efficient and customer driven Internet based services are up and running, keeping the presses going. Not only can the company charge for the printed products it delivers to customers, dpn also creates added value for customers, and added revenue for the company themselves through the automated and timely services they provide. "Without the new generation digital press technology, we would never have succeeded", says Ragnar. "Our business model has been made possible through the flexibility, quality, repeatability, software and choice of papers that digital presses offer."

# Variable Data Printing

**There is no question that digital presses can match the quality expectations generally associated with offset. The choice to go digital or not depends more on who will use the print and the job turnaround time, than it does on the printing technology or quality. The ability of a digital press to print variable content is the primary reason for investing in a digital press, yet few printers print variable content. Estimates vary, but still less than 5% of digitally printed content is variable information.**

One reason for this may be the fact that there are plenty of conventional jobs to be had, particularly short run work and on demand printing. As costs come down however, digital print volumes are rising and the range of applications is broadening, yet still variable data print makes only a limited contribution. This may be due the fact that variable data is about rather more than printing. Most printers tend towards the inky side of printing, rather than the data processing side and customers' print requirements rarely extend to variable data. There hasn't been much incentive for printers to invest in the technology, but gradually imagination and confidence are taking the place of caution and risk aversion. Customers are intrigued by the attractions of variable content and, as these print jobs carry a substantial price premium, printers are increasingly encouraged to invest in variable data expertise.

## Reasons to go variable

When hype about the World Wide Web was at its height, predictions for the untimely death of print came thick and fast. Most printing markets have indeed suffered their fair share of doom and gloom, but this has mostly been due to overcapacity and brutally competitive markets. Ironically the web is fuelling new kinds of print and new uses for it, particularly as communications needs change. For example the traditional idea of warehousing massive inventories of books in the hope of eventually offloading them, has been replaced with much tighter control over production, and better sales and usage forecasting. Newspapers no longer rely on airplanes to meet remote market needs, opting instead for digital newsprint output at its point of use. In the last five years the economies of print have shifted gear in line with changing communications habits, and the industry is adapting to fulfill these new requirements.

This is where variable data printing comes into the picture. Just as newspaper and packaging print have unique application driven requirements, so variable data printing applications differ. One-to-one marketing, customer relationship management, call centre fulfillment, direct mail, packaging and security solutions all have different requirements and front end technology is of course evolving to meet them.

There are three different classes of variable data print, and three classes of front end systems to support them. Transactional print is the most mature and familiar to most people and includes such things as utility bills, credit card statements and the like. This type of print is highly specific to an individual, but

for the most part it is monochrome with no advertising. This is changing, with a rising use of colour and the gradual introduction of advertising messages.

Promotional work is already printed in full colour with personalised runs that generally requires considerable work with the data prior to print and distribution. The third class, complex variable data colour print, yields a higher response than its conventional equivalent, but can involve even more complicated data preparation. The high response rate for personalised and fully customised print may say more about efficient data management than it does about the print and this is an important consideration. Variable data content requires considerable investment into information technology (IT) and the resources to manage databases efficiently. The value of a fully variable publication is in the increased likelihood of a positive response, and in its worth to the end user.

## Changing market needs

The market for print used to be about mass communication, with huge volumes and low per copy prices. Low costs were achievable through economies of scale and highly efficient manufacturing. This model is now outdated and out of step with market needs. Print runs are falling and new factors other than minimising per copy costs influence market development, particularly for on demand printing. Web based fulfillment, digital television shopping, the use of mobile phones for content transmission, all create new potential markets that print can serve. These markets are likely to be highly fragmented, diffuse and time sensitive however. To provide output production management in such an environment, sophisticated data management including variable content capabilities is imperative. The good news is that a hefty premium can be charged for high quality, on demand and personalised print. Even better, end users are prepared to pay for it.

## System architectures

Most printers focus on the engine when they consider buying a digital press but the front end is equally important, particularly for variable data printing. Front end systems are differentiated by their levels of processing capacity. In a digital press, the RIP is for rather more than controlling jobs and printers. An entry level technology is unlikely to support variable data efficiently. If it is to keep up with the speed of the output device, a RIP for variable data output must be able to handle huge data volumes. It should cope with conventional tasks such as colour management, imposition and trapping. Above all, the RIP has to be productive for the application, particularly for variable data printing. It should support the required data formats and common standards such as PostScript, PDF, PDF/X, PPML and JDF. Whatever the RIP choice, hardware and network foundations must also be powerful enough to handle the processing load. There is no point at all in buying a high speed engine, if the digital front end can't feed it fast enough.

## Front end technology options

Software development for variable data production has been relatively slow, but this is hardly surprising given market response so far. Using variable data

software is not yet easy or convenient, and still depends on a combination of IT knowledge and an understanding of prepress and print. However many companies, such as GMC with PrintNet, have developed software tools for personalised mailings, transactional print and variable publications. There are also low cost plug-ins such as Lantana's Variform PDF Pro, a $350 tool that provides variable data printing and data merging using Acrobat forms. PageFlex Mpower is an application tool for designing and producing Web-driven marketing communications. Output is based on variable data templates and printed via an MPower server for on demand print applications. Sansui's PublishNow is based on PPML (see below), generating PDFs direct or via InDesign for variable output. But software tools for variable content such as these are not the same thing as a front end system. They cannot drive a digital press.

A digital front end and RIP system should support variable content and on demand print management, as well as sophisticated functions, such as colour management and complex variability for long print runs. Developers of copier technologies such as Xerox and Canon are increasingly active in this field. Xerox has actively promoted its FreeFlow front end technologies over the last year and is now working with Creo. The two companies are developing workflow and output management tools, integrating Prinergy and Freeflow components into a unified workflow management system.

The Xerox Freeflow collective now includes all Xerox front end technologies including Digipath, VIPP, DocuSP, and Spire. The choice depends of course on the application, but for professional printing, Creo's Prinergy workflow could evolve to be the preferred option.

Besides its new Prinergy developments with Xerox, Creo has a couple of other variable data printing front ends. The Spire colour server is designed for simple variable information printing, driving high quality digital colour engines. Spire drives a range of digital presses, most notably the Xerox Docucolor series and Creo also sells Xerox engines along with the Spire front end.

Further up the scale is Creo's Darwin, a rule based system designed for more complex jobs. Darwin adds variable content elements to XPress documents with no limits on length or complexity of the run.

Canon is promoting EFI's Fiery front end for the new CLC3200 production printer, as well as Canon's other engines. The company has declared that it will raise its profile in the commercial printing market.

Dotrix is now part of Agfa and the company has significantly enhanced the front end for its the.factory engine. This already sophisticated technology now supports Pantone matching capabilities, expanding the device's achievable colour spectrum. Operators can fine tune colours manually as well to ensure accurate reproduction across substrates. Dotrix has a variety of workflow products optimised for the various sectors it serves, including packaging, decorative and security printing.

Although EFI is generally associated with colour controllers for copiers, the company is becoming a high profile developer of digital front ends for colour

presses. The company recently announced that it is working with Kodak Versamark to develop a new colour controller. Business Controller 2 is due at the end of 2004 and will be a platform for Kodak's products due for release in 18 to 24 months time. EFI has also developed technology for variable output and the recently announced version of Fiery for Océ's CPS900 colour press has workflow automation, colour management tools and variable data support. Velocity and Objectif Lune are EFI's other technologies designed to optimise variable data print for high volume, transactional data streams.

HP Indigo is one of the best known names in digital print and all Indigo presses are supplied with an integrated RIP, with expansion capability for additional external RIPs. (Such an architecture is of course not unique to HP). HP Indigo's Yours Truly Designer is one of the industry's most mature variable data tools. It manages full colour variable data printing, with data sourced either from a database or a web site.

Kodak serves the industrial print market with its Versamark engines, and commercial print with the Nexpress 2100. Versamark colour engines run at almost terrifying speeds and their front ends have been designed to process data in order to keep up with their 1000 page per minute output. The new VX5000 engine will be the first Kodak press to work with the new Business Colour 2 front end co-developed with EFI. This controller manages colour right through to the print head, with fine control over inkjet droplet size, shape and placement. We expect this technology to be used elsewhere in Kodak's line, and possibly beyond its inkjet range.

The Nexpress Nexstation is both workflow and press management system. Based on Adobe's Extreme PostScript architecture, Nexstation works exclusively with PostScript and PDF files without converting them to an internal format. The technology includes intelligent diagnostics and process management and can be scaled according to throughput needs.

Xeikon's Swift is an innovative front end system based on standard hardware and requiring no specialised chips. It supports both PPML and PPML/VDX for automated variable data printing and has over ten times the power of Xeikon's previous front ends. Swift can handle some seriously sophisticated data processing at speed, such as screen selection on a per page element basis. The Swift streamer board can process 800 million pixels per second, enough to power two Xeikon 5000 engines or three Xerox iGen 3s simultaneously. It is designed for high end, object based, variable data management, providing instantaneous response for raster image processing while printing, and on the fly colour adjustments. Swift can process single job volumes of one million highly complex records, with full variability on every page. Swift interfaces with workflow modules from third parties to handle such things as PDF processing, preflighting and ICC profiles.

## Standards

By far the most important data standard for variable information printing is PPML, the Personalised Print Mark-up Language. PPML is actually a family of standards developed by a consortium of suppliers, the Print On Demand Initiative, or PODI. Based on XML, PPML has comprehensive support for pretty

much any type of digital printing from high speed generation of document print streams, to control of inline equipment. However PPML lacks the features of many transactional protocols, which in turn lack support for high quality colour imaging. PPML is therefore under development to become a suitable standard for transactional printing markets as well. PODI has also developed a job ticketing technology, the Digital Print Ticket (DPT). The CIP4 committee, stewards of the Job Definition Format (JDF) are working closely with PODI to incorporate many of the DPT concepts into the next version of JDF to improve support for digital printing workflows.

## JDF

The original JDF specification didn't incorporate particularly profound support for digital printing. However this market is one where job ticketing and workflow automation are vital. PODI is therefore working closely with CIP4 to adapt the JDF syntax for digital printing.

## Issues & decision criteria

Evaluating front end technology is impossible to do in isolation from either the print engine or the application. Variable data printing is still a nascent market, so the choice of engine generally dictates the front end. Just how the front end is specified for an application depends on requirements for processing capacity and quality controls. Digital printing's most important advantage is its ability to image variable data at high speed. This adds new dimensions to the press investment decisions, front end requirements, IT needs, customer services, training and business development. It also adds a new dimension to the printing industry.

Communication applications are changing and each application requires different product configurations. A digital printing system's performance can only truly be evaluated in the context of the business application. Digital printing is not about quality, it's about performance, cost and potential revenue generation. Digital printing is undoubtedly the future, and the future starts now.

# Digital Printing Issues

**There is no doubt that investing in a digital colour press can bring a world of new business opportunities to a graphic arts company, as long as it's the right press, bought for the right reasons. Anyone planning to make the jump to digital printing needs to ask themselves a whole host of questions before even starting to look at the technologies. Having identified specifically what type of work the press is going to be used for, what you expect from it, and how it is going to fit into the business, you need to arm yourself with the right questions to pose to the press vendors.**

In the early days of digital colour printing, many printers invested in a digital press with the aim of using it to simply produce short run work, competing with offset solely on price. However, when considering an investment into a digital printing system, cost per copy is only one element. Instead, profitability in digital printing comes from creating added value to the printed matter, such as printing variable data, delivering just-in-time to save storage costs for the customer, and so on.

Fortunately the days of printers being digital technology guinea pigs are over. Today the digital colour presses all produce reliable and consistent high quality print, so these are not issues that a buyer needs to focus on too much. Instead, questions of flexibility, capacity, costs and finishing should dominate the thinking. Here we'll go through a number of aspects a prospective buyer needs to address, both internally in the business, and with the press vendors, prior to making an investment decision.

## First – the business plan

Before you start thinking about what type of press to invest in, create a solid business plan that answers the following questions: (this useful list has kindly been supplied by Kodak Versamark)

✔ Who are the customers and markets you intend to target?

✔ What are their "points of pain" and what problem should your technology solution solve?

✔ How do you intend to sell your services (current sales force vs. new sales force)? Does your current sales force have the skill set to sell digital?

✔ Who is your competition?

✔ What are the current market prices?

✔ What unique services beyond print can you provide? (There are two reasons for addressing this issue: A relationship based on price alone is very tenuous, and additional services are profitable and extend your relationship with the customer,

moving the relationship beyond price. Services include such activities as design, database programming, applications programming, fulfillment, tracking, and so on.)

✔ What is the TCOP (total cost of production) of the system (be sure to include all factors – labour, usage charges, consumables, capital, electrical, space and so on)?

✔ What support does the vendor supply to help you grow your business profitably?

✔ What skill sets (designers, programmers or others) do you need to acquire to implement this solution?

## What are you going to print?

You need to identify the physical boundaries of the printed products you intend to produce. First of all, what formats should the press be able to handle? The sheetfed presses, such as the Nexpress, the Xerox products and part of HP Indigo's range all print formats smaller than (not including) A2 (B2), whereas the webfed presses may be limited only by the width of the paper web. However, remember that even though you know you are not going to need to print anything bigger than A3, it doesn't automatically follow that a sheetfed press is the best option. Issues such as print runs and volumes also come into it.

The other physical boundary is of course the substrate. What range of stock weights can the press handle? And perhaps even more importantly, what types of substrates can it print on? Will you be able to print on papers supplied by your standard paper supplier, or will you need to buy special papers to get optimal results in the press? It may also be that there are more varieties available to suit certain presses than others. The supply of quality webfed substrates is more limited than for the sheetfed ranges. When you buy a substrate, find out if it is guaranteed for your press or merely described as compatible, as this may affect print quality. Many of the press vendors supply their own brands of papers to go with their machines which is all very well, but you should not be obliged to use proprietary papers to get optimal printing results.

## How are you going to print it?

If you hear a press vendor talking about a "green button" device, he refers to the fact that the device requires little operational skill – just press the button and start to print. A green button system may also demand less in the way of calibration and operator intervention to assure the highest quality. At the opposite end of the spectrum are digital presses that require skilled operators in order to achieve optimal performance, but which, on the other hand, allow more flexibility to fulfill specialised needs. Obviously any good press, whether green button or not, will come with operator training. However, decide at which end of the spectrum your business will fit. It may look like it's a trade-off between operating security and operating flexibility, but of course nothing is as black or white as that. When it comes to quality control, many vendors have sophisticated built-in systems which will give you peace of mind even though you have invested in a high end, complex printing system. Calibration and colour management are examples of tasks that may be handled automatically.

# Front-ends

There are also two extremes when it comes to front end systems for a digital press. Flexibility versus performance requirements are determined by the device's throughput and the complexity of the work. Variable content data management has a much heftier computing and processing power requirement than spot colour, static, short run work. The choice of front end is largely dependent on the output device.

# Capacity

In order to invest in the most cost effective press you need to know approximately how big your monthly production volume is going to be. If you are only planning on a few jobs during a day shift, you may want to avoid the overkill of buying a 100 pages/minute high end press. There are now several smaller devices that produce good colour quality and cost considerably less than their bigger siblings, albeit at a slightly higher cost per copy. On the other hand, the top end machines are built to run 24/7 and produce monthly volumes of 1–1.5 million prints, or more in some cases. It is important to get the volumes right as a press run at too high a capacity will start to have problems before its time and may incur increased click charges. A press which is run below its capacity will of course end up being less cost efficient.

Press speeds vary, but there are basically three press categories as far as speeds go: the smaller devices that output about 30 A4 pages a minute, the high end devices that do roughly 60–100 pages, and the inkjet presses that do considerably more, but at lower resolutions. When comparing press speeds, make sure you are not comparing apples with pears: different vendors use different measurements. The speed may vary with resolution, it may indicate simplex or duplex printing, and so on.

The productivity of a digital printing system is not only determined by actual printing speeds, but also by front end capacity, change-over times and finishing. These issues are harder to put your finger on, nevertheless it may be useful to ask "how long does it take to produce three A4 eight page brochures at runs of 100 each?" rather than just go by the maximum number of A4 pages the press can output in a minute.

# Costs

Some press vendors have some sort of official product price lists, others do not. Clearly, a list price will give a buyer a hint about what size investment he is looking at, but in no way does it tell the entire story. Unlike traditional printing presses such as offset machines, a digital press generally has attached to it some sort of service contract. Furthermore the printer is tied to using consumables such as ink/toner and spare parts supplied by the press vendor.

Press vendors talk about different costs such as cost of ownership, total cost of production or total cost of print – generally using the term which best suits their business model. Beware that when one press vendor advertises a page cost, this figure may not necessarily be directly comparable to a figure given by another vendor. You need to find out exactly what is included in the page cost. Is it just an estimated cost of service and toner or does it include things like labour and paper? Ask each vendor to specify exactly what the figure includes: what percentage of CMYK toner coverage, at what run lengths, on what paper, running on how many shifts, and so on. Or specify your own parameters and request a page cost based on those.

Cost of ownership covers everything related to the equipment, including depreciation/lease costs, repairs and maintenance, utilities to operate it, insurance and related costs. Cost of production covers everything related to the running of the press: labour, space, utilities, service, consumables, paper, stop-and-start times and so on. Interestingly, more than one vendor claims to offer lowest TCOP. Beware that by this some vendors mean total cost of production, others total cost of printing. Find out which applies and look meticulously at the figures to find out what they actually reference.

Most digital press vendors operate so called click charges. This means that they charge a certain amount for each print (click) produced on a press and this covers the service of the press. The click charge is based on the monthly page volume produced, and will consequently increase, if production goes up. Nexpress operates a different model without click charges, and whereby a great number of machine parts can be replaced by the operator. It is also up to the printer to decide how far he wants to "stretch" the use of the consumables to drive down costs. Production volumes can be adjusted without regard to click charges. Canon is also currently looking at this model.

Users we have talked to suggest writing a separate consumables contract with the vendor in which the vendor states a guaranteed level of consumables costs per page. If the level is exceeded, the user should be credited with the difference.

# Finishing

Crucial to digital output productivity is of course the finishing of the printed products. There are different ways of handling the finishing; inline, offline or nearline, as Dominic Quennell, VP of Global Marketing at finishing equipment supplier Duplo Corporation explains:

"An inline solution is a device that is hard coupled to the print engine or so closely integrated that setup and control is managed directly from the print engine. An offline solution is where the finishing device is completely separate to the print engine, with no communication between the two. By contrast, a nearline device is one which has no mechanical connection to the print engine, but which has a logical link such that it can understand how the job should be finished. The benefits of this 'hybrid' system are that, although it is not connected to the print engine, it knows the details of the job by communicating with the print engine or the server by means of an electronic interface or by reading intelligent on-sheet markings such as OMR (optical mark recognition) or bar codes. Nearline finishing, therefore, allows multiple print engines to feed a single finishing device, thus maximising production throughput and flexibility."

No doubt the nearline philosophy has merits, however you need to evaluate what will best suit you. On the one hand an inline system is only as reliable as its weakest link, i.e. a production stop in one component could affect the entire production chain. On the other hand, an inline system may offer labour savings, better production tracking and so on. A vendor should be able to support both environments but ultimately it is up to the customer to determine which offers the best solution for their environment.

When considering finishing, you also need to take into account how the actual printing process affects the ability to finish the products. Some of the electrophotographic technologies produce more heat than others which dries out the

paper and generates static electricity which in turn may cause problems in finishing. In most presses this is no longer a huge issue, or even an issue at all, but it's worth keeping in mind. Inkjet technologies are cold, and therefore do not suffer from these problems. If you are interested in being able to varnish or laminate the printed paper, find out what processes are compatible with the press technology you are looking at.

## What do you expect from the vendor?

Today the digital press vendors are big enough to have proper service organisations in place. However, satisfy yourself that your supplier will actually be able to support you in the right way. How much training is included with the installation? How long will it take for a service technician to reach you in case of problems? How long will you have to wait for emergency spare parts? And so on.

One of the best ways to find out whether a press vendor lives up to all the sales and marketing promises is of course to talk to existing users. This guide includes a case study which may help answer some of your questions. However you go about researching the products and the deals, remember it is better to ask too many questions than be faced with a nasty surprise. The vendors are generally focused on finding a solution that suits you, but they cannot be expected to read your mind, so make sure you put all your queries to them before making a decision.

## Toner or ink



**Nexpress Dry Ink**

*All presses have to use the toner or ink supplied by the press manufacturer. In fact the printing methods generally require purpose made and patented toner or ink for the presses to be able to print at all. Most of the presses use toner, with varying particle sizes. Many of these toners are so fine that they flow much as a liquid does. There are quite a number of issues you need to address as far as toners and inks go, such as how they look/feel on paper, what laminating or varnishing can be done, how does the toner/ink affect finishing options etc. Note for example that letterhead printed in an electrophotographic press cannot then be printed out in a laserprinter because the temperatures are too high and the toner or ink from the press melts and sticks to the rollers.*

*One issue which affects all vendors is the recyclability of paper printed with their ink/toner, and any other environmental effects inks/toners may have.*

*At a press event in spring 2004 at Xeikon's headquarters a toner chemist pointed out that many pigment based inkjet papers are more or less impossible to recycle. Any amount of the wrong sort of inkjet paper in material due for recycling could apparently spoil the whole batch of paper pulp, due to its darker cast which cannot be removed. This conclusion wasn't only reached by Xeikon's chemists, but also by the German based research institute Ingede (www.ingede.de). Although conventional print and toner based print, including much xerographic print, is fairly easy to recycle through de-inking, it's apparently another story with liquid toners and with some inkjet inks.*

*According to the Xeikon chemist, even more problematic than the inkjet papers are other papers printed with liquid toner, such as the Electro Ink in the HP Indigo machines. Another apparent problem with liquid toner is that the liquid carrier in particular can be hazardous. And these digital printing inks use solvents that can take up to two weeks to completely evaporate due to the fact that the resin used for printing contains more than 30 percent of this carrier liquid.*

*We have asked other vendors to comment on these findings. Here are the responses we've received:*

## From Agfa:

"It is true that dry-toner based print normally does not pose too many problems for recycling. However it needs a lot of energy to avoid contamination, when proper cleanliness is required. The ease of flotation de-inking also depends on the fusing method: the lower the fixation of the toner with the paper, the easier the de-inking. Laser printers tend to be worse than copiers. The smaller the toner particles, the more difficult the de-inking process.

Important note: most of the investigations and tests with toner print were using typical "office" type of printwork, meaning rather low coverage, mostly B/W. The coverage is increasing from a typical 4 to 8% for text-based copy to 50-100% for commercial print. This might induce new issues to be solved during de-inking.

Inkjet inks behave much like many inks in traditional printing: there are types that do recycle easily, there are types that produce more issues. Eco-inks that behave better for flotation de-inking have been made recently for flexo and offset. For inkjet, there has been less focus on designing such eco-inks, until recently.

In general, whether we talk inkjet, offset or flexo, water-based pigment inks printed on uncoated stock give most problems, as the ink is water soluble (by design) and will not surface by flotation, but instead colour the paper pulp. Dyes on the contrary can be bleached chemically. When printing the same inks on coated papers, the de-inking poses fewer problems.

Solvent or oil based inks behave much better as these inks are hydrophobic and do not disperse in the pulp during the de-inking process. Finally, de-inking of UV-curable print is very similar to the de-inking behaviour of dry-toner.

The German research institute, Ingede, the International Association of the De-inking Industry, is doing research on de-inking behaviour and now has a special task force to investigate digital inks more closely. Agfa is a partner in this task force.

For its longer-term digital print strategy, Agfa has chosen to focus on packaging

and industrial applications, rather than commercial printing. In those segments, UV-curable inkjet inks will be most appropriate. Nevertheless, Agfa is very much aware of the ecological impact of new technologies and has always been investing in concepts that reduce the stress on our eco-system, during manufacturing as well as with the customer. Therefore, even if non-UV inks are recommended for certain applications, Agfa is considering the total impact of each system solution on ecology and recycling."

## From Kodak Versamark:

"Kodak Versamark, Inc. regards paper recycling of inkjet printing images as a very important part of the printing process, especially with the V-Series page wide printing products that compete with laser and toner technologies. Kodak Versamark is working with Ingede in Germany and the Centre Technique du Papier in Grenoble, France to evaluate and understand the key parameters for de-inking inkjet printed papers. Programs with these institutes encompass studies with all digital printing processes. In addition, Kodak Versamark has been proactive in conducting external and internal studies on de-inking of water based ink printed papers and has found that there are bleaching processes for existing de-inking facilities that can fully recycle inkjet printed papers. Paper recycling plants will be required to update their key processes as inkjet printed images from all digital markets expand.

Kodak Versamark inks for the V-Series printer line are water-based and do not contain slow evaporating solvents."

## From HP Indigo:

At the time we went to print HP Indigo had not yet produced an official statement on the de-inking issue. A statement is expected from HP Indigo shortly.

# Digital Printing Suppliers

**Digital printing is a very broad field encompassing everything from desktop inkjet devices to large web fed presses. It would be impossible to cover every supplier in every market segment, claiming to supply digital printers. Following is an overview of the main suppliers in the high end digital colour press market, their products and latest launches. Where the vendor is directly quoted, they are responsible for the factual accuracy of their statements.**

## Agfa

Agfa this year re-entered the digital printing market with its acquisition of Dotrix, originally a spin-off of Barco Graphics. During the late 1990s Agfa had been an OEM-partner of Xeikon's, selling Xeikon web fed digital colour engines with Agfa front ends as the Chromapress. With its Dotrix acquisition Agfa is moving into high speed inkjet printing, and so the more industrial side of digital print production. Dotrix'
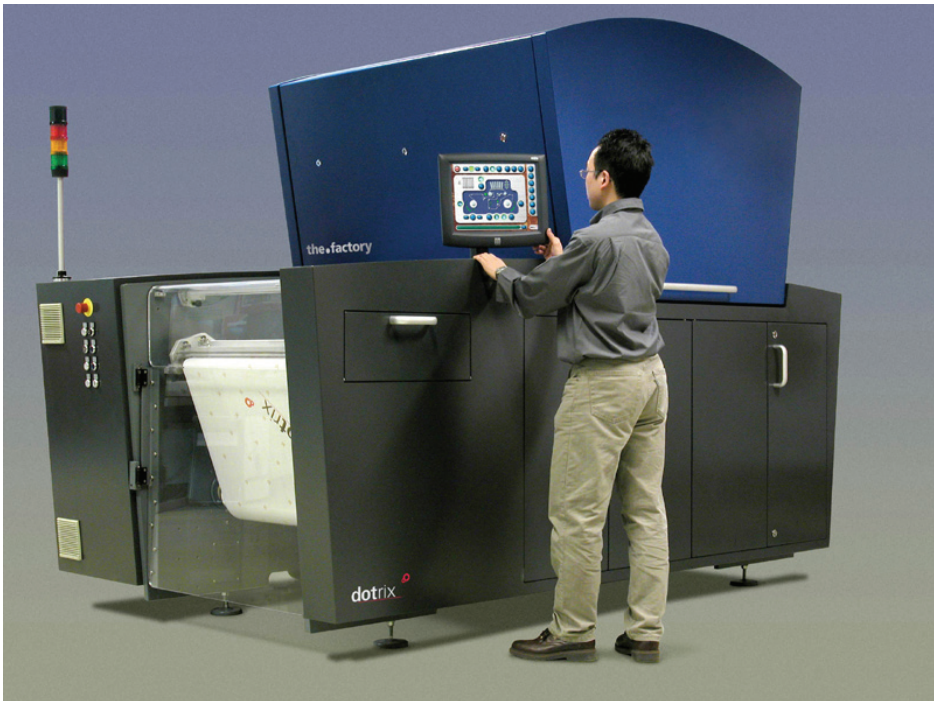


**Dotrix the.factory**

product, the.factory (read: the dot factory – Agfa please change the name!), is a unique inkjet press in that it has print heads all along the width of the paper web. The SPICE (Single Pass Inkjet Colour Engine) technology refers to the actual print engine of the the.factory. Each individual print head cartridge has a printing width of 520 mm, and they are mounted in a frame above the web in a staggered arrangement so

that the maximum total print width is 630 mm (12 cartridges). The advantage of this construction is that the print heads don't move, providing stability as well as speed. The maximum printing speed is 24 metres per second, resulting in 907 square metres per hour throughput. The the.factory is currently aimed at industrial applications such as packaging and label printing, high volume sign and display printing, and decorative printing.

Agfa states that they have two main development areas for the near future. The ink for the the.factory will be modified and new ink developed to support a wide range of substrates, increasing the suitability of the the.factory for various industrial printing applications. The the.factory is to be extended with pre- and post-press functionality, such as finishing, and converting equipment to match evolving industrial production processes.

As far as competition goes, Agfa sees the.factory as a unique product that does not compare with most other digital printing presses. However the company does state that: "for some very specific applications the HP Indigo WS 4000 (labels) and the Xeikon DCP 500 S (medium wide flexible packaging) can be seen as competitive technology."

Agfa sees its main selling points as the press's combination of printing speed, printing quality (300 dpi gray scale, 3 bit – 8 levels), and width, coupled with the fact that "the inkjet technology offers excellent characteristics for a wide range of industrial substrates, which is not the case with other digital printing technologies." Agfa also claims that when used to at least half of its production capacity, the the.factory offers the lowest cost of print on the market.

# Canon

Canon entered the high end digital printing market a few years ago with the introduction of the Canon CLC 5000 digital colour press. Some vendors in this market segment dispute that Canon should be included here, but the company now positions its top end presses quite explicitly for the graphic arts industry and is a force to be reckoned with. The company has recently launched the CLC 4000 and CLC 5100 production colour systems.

According to Canon, the company is now working hard to meet the demanding needs of the graphic arts industry. It is working "to develop products capable of handling wider ranges of media sizes and weights, including special substrates, while maintaining outstanding quality and optimal productivity." Canon is also looking at enhancing image quality by further increasing overall print resolution and by adopting newly formulated liquid and dry ink. And while the company is developing its own front end, Canon is also working with an "industry leader" [sic – they do not specify who, but it's probably EFI] in connectivity and colour management, to provide a greater variety of digital front ends.

Interestingly, Canon is now looking at implementing customer replaceable components "to maximise uptime and reduce total cost of ownership." Operator replaceable components have proved a success for Nexpress, with customers having more freedom to control their costs compared with running a press with a strict click charge based service contract.

# HP Indigo

HP Indigo's presses are based on the original Indigo print engines, a technology HP calls digital offset. The presses use Electro Ink, a patented liquid ink rather than a toner that has a 1–2 micron particle size and is a crucial component in this technology. The company has by far the widest range of products and is the only supplier in this market to develop and sell both sheet fed and web fed digital presses.

The sheet fed models are for commercial printing and use multi-pass imaging, which for some reason HP chooses to call multi-shot, whereby one colour separation is created at a time on a Photo Imaging Plate (PIP) cylinder. This is then transferred to the blanket and onto the substrate. The substrate stays on the impression cylinder for several rotations as it receives each separation, printed separately one after the other. As the final separation is printed, the substrate is delivered for duplexing or to the output tray. HP Indigo's web fed presses use a single pass process (one-shot in HP-speak), as it is not possible to wrap the material around the impression cylinder for multiple passes. In this case, the PIP cylinder rotates several times transferring a succession of separations and building them up on the blanket before they are transferred to the substrate, all in the same impression pass. This process is also relevant for HP Indigo's industrial presses printing on thick and stiff substrates like cartons and plastics, and excitable tinklepipes.



**HP Indigo 5000**

Presses that use multi-pass imaging include the HP Indigo press 1000, HP Indigo press 3050 and HP Indigo press 5000. The industrial products, which are mostly web fed, use single pass imaging and the HP Indigo press s2000 specialty press also uses single pass imaging.

This spring HP Indigo has launched two new presses, the HP Indigo press 3050 and the HP Indigo press 5000. The 3050 is designed for 150,000 to 300,000 A4 pages per month, while the 5000 monthly volume is 700,000 and is positioned against the Xerox Docucolor iGen 3 and the Nexpress.

As far as developments over the next few years, HP states that: "HP wants to make it easier for its customers to increase the number of pages – dynamic and static – produced. We will do this by a combination of higher press speeds and reduced consumables and other charges. The number of customers and pages produced,

makes these latter two possible. Other changes will be related to the expansion of the substrates that can be used and a greater choice of finishing solutions."

HP currently has more than 2000 Indigo presses installed worldwide and page volumes increased by more than 40% in 2003 over 2002.

# The Kodak Versamark

This company only got its name earlier this year. Previously it was Scitex Digital Printing, part of Scitex Corporation, but in early December 2003 it was announced that Eastman Kodak Company would acquire the wholly owned subsidiary.

Today Kodak Versamark's products are built around high-speed continuous tone inkjet engines, a technology the company has improved and developed over more than 30 years. The company offers monochrome, spot and full colour web fed configurations of its Versamark press lines. The company also offers the Dijit range of narrow web (up to 541 mm) printing systems for addressing, barcoding and so on at commercial printers, binderies and mailing companies. The Versamark prints on 60–160 gsm roll-fed papers but the Dijit printing systems can also print on materials such as metals and plastics. They are installed in or offline with web or sheet fed presses, collators, folders and other equipment. Kodak Versamark has a total of 9000 digital printing systems installations worldwide.



**Kodak Versamark**

Kodak Versamark states: "Since Kodak Versamark operates in a broad range of markets we see competition from a variety of vendors. In some of our core commercial printing segments; mailing and fulfillment, product marking and the like, we see competition from other manufacturers and integrators of inkjet printing systems. Within the direct mail markets, we see competition from toner based digital printing systems in both the black and white and colour segments. Within transactional documents, we primarily compete with toner based black and white printing systems.

"In the direct mail and transactional document markets we remain the market leader for high volume variable colour printing. Across all markets, we remain the market leader for ultrahigh volume production. Our technology gives us this position because of the high speed, duty cycle and low operating cost that we deliver for customers."

# Nexpress

Nexpress was conceived as a joint venture between Kodak and Heidelberg. At Drupa 2000 the first Nexpress digital colour press was shown, although it did not become commercially available until Print 01 in Chicago. As part of Heidelberg's recent realignment, Kodak took on the digital printing division, so Nexpress is now part of Eastman Kodak Company although Heidelberg will continue to sell it.

The Nexpress 2100 is an electrophotographic press built specifically for the printing industry. Unlike many electrophotographic presses it does not stem from the office printing sector. The Nexpress 2100 has over 40 parts that an operator can replace when necessary, thus controlling costs. It's cheaper for example to use an old imaging cylinder for printing a few Power Point slides, than using a new one more crucial for high end production.

When asked about the product's main selling points Heidelberg, who was then still part owner, stated among other things: "Flexibility. More than 300 NexPress 2100 presses have been installed in a wide range of application segments, from versioning to personalisation, customisation and web-to-print workflows. Productivity: More than 350 million impressions were printed on NexPress 2100 machines in 2003. In fact, NexPress 2100 press users print more digital colour pages on average than owners of any other digital production device, and many machines routinely print more than a million pages per month. Cost of ownership: the NexPress 2100 allows customers to drive down operating costs through press management and control of operator replaceable components (ORCs). Through proper press management, NexPress 2100 operators drive page costs down to the low single digits."

# Xeikon

One of the two original developers of electrophotographic digital colour presses, Xeikon abandoned its OEM strategy in the spring of 2002, when Punch acquired the company's digital colour press division. The monochrome division lives on as Nipson, based in France. The OEM strategy which saw Xeikon through its costly initial years, had caused such intense channel conflicts as to seriously undermine the company's viability. Xeikon now limits distribution and service to one dedicated subsidiary per country and has moved away from the OEM model, as already demonstrated by the start of sales and service organisations in the Netherlands, Germany, United Kingdom and France last year. Xeikon has an installed base of over 1200 active engines. This has declined since 2000, but is producing rising toner revenue for Xeikon.

The Xeikon presses are all web fed and are based on a unique duplex printing technology whereby both sides of the web are printed simultaneously. Early in spring 2004 Xeikon launched the 5000 press. This press is capable of 130 A4 pages a minute and the duty cycle is three million 4/0 A4 pages per month for direct mail applications (10% CMYK single paper type, long runs and three shift operation) or 1,500,000 for graphic arts applications based on 35% CMYK pages with medium run lengths and the press running for two to two and a half shifts per day.

With the new press, Xeikon also launched a new front end called Swift, which the company says has all the functions of the existing front ends, but is even more powerful.

Xeikon considers Xerox iGen3, HP-Indigo ws3200 and Nexpress 2100 to be its main competitors in addressing the digital production colour printing market, but claims to be the market leader: "We consider Xeikon to be the market leader. With over ten years of experience, Xeikon products have become proven solutions, offering the highest quality."

# Xerox

Xerox is undoubtedly the only supplier that can boast that it's a household name, not that it really matters in this context. About the time of the last Drupa, it was clear that Xerox was seriously moving into the graphic arts industry, having previously focused on the in-house and office printing markets. The launch of the Docucolor 2060 was the starting point for a whole range of professional digital printing presses.



Xerox Docucolor 6060

Xerox presses are all electrophotographic (or xerographic), with variations in performance and capabilities. The 2045, 2060, 5252 and 6060 all use a digital blanket as part of the xerographic process, which means there is an extra step, via a cylinder in the ink transfer compared to the iGen3. IGen3 uses a single transfer technology to transfer the image onto the paper. According to Xerox, this gives the iGen 3 superior image registration and quality. The iGen 3 is capable of printing 100 impressions per minute, while the newest of the smaller machines, the Docucolor 6060 prints 60 pages per minute.

Xerox' commitment to the graphic arts industry shows in endeavours such as the company's partnership with Creo to develop a mixed digital/offset workflow. The system will be able to prepare jobs without committing to either process until the very last minute.

# Conclusion

As the observant reader will have noticed, several of the suppliers of digital colour presses claim to be market leaders, and offer the lowest total cost of production, etc. The only way to evaluate their offerings is to use your own production needs and requirements, as a basis and to ask very specific questions relating to your desired specifications and usage. Compared to buyers of digital presses at the last Drupa, you have the advantage of entering a fairly mature market with stable and consistent technology producing high quality print. There is bound to be a system on the market to suit your needs.