

Production Inkjet: Making the Right Choice

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Abstract

With a growing number of production inkjet presses on the market using a variety of technologies and inks, it has become a more complex investment decision-making process for print service providers wishing to enter the production inkjet market. This white paper will discuss the various technologies, including their pros and cons, and offer questions the potential investors can ask themselves to help them make a better investment decision.

Introduction

Production inkjet printing technologies are well on their way to becoming mainstream. Since the so-called “inkjet drupa” in 2008, a variety of options have come on the market and found their way into the industry’s installed base. And more are on their way.

With so many options on the market, printing operations—including commercial printers, packaging converters, transactional and direct mail printers, book printers, in-plant printers and more—now must undergo a more rigorous due diligence as they determine the best technology, and the best partner, for their needs.

This white paper will discuss the primary classes of production inkjet presses available today and the pros and cons of each. In addition, it will discuss the importance of the surrounding software and service offerings. In today’s competitive marketplace, it is not sufficient to simply acquire a new press. This type of investment requires significant research and planning to ensure a profitable outcome. It also requires a business partner who is in the business for the long haul and who can provide the pre-and post-sales support, tools, ongoing enhancements and workflow components required for success. It also requires a clear understanding of the total cost of ownership, covering everything from the initial purchase to the cost of ink, substrates and other consumables, as well as techniques and tools for effectively managing these expenses.

The Production Inkjet Landscape

Today, production inkjet consists primarily of two technologies: aqueous (water-based) and waterless. Each will be discussed separately. There are also different imaging technologies including piezo drop-on-demand, thermal drop-on-demand and continuous inkjet. Those technologies will also be briefly addressed.

Production inkjet presses are primarily web-fed, although there are a small number of sheetfed presses available. This white paper will focus on web-fed solutions.

Imaging Technologies

First, a brief discussion of imaging technologies as a basis for the rest of the paper. As mentioned above, there are three primary technologies used in production inkjet: Piezo drop-on-demand, thermal drop-on-demand and continuous inkjet.

- Piezo drop-on-demand heads use a piezoelectric material in an ink-filled chamber behind each nozzle. When voltage is applied the piezoelectric material changes shape, which generates a pressure pulse in the fluid forcing a droplet of ink from the nozzle. Software controls the number of droplets of ink per dot as well as the size of each droplet. Impika, recently acquired by Xerox, uses piezo drop-on-demand technology.

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- Thermal drop-on-demand uses print cartridges that contain a series of tiny chambers, each containing a heater. To eject a droplet, a pulse of current is passed through the heating element in the chamber, causing rapid vaporization of the ink to form a bubble that propels a droplet of ink onto the substrate. Inks are usually water-based and can be pigment or dye. Thermal drop-on-demand inkjet is used by Canon, HP and others
- With continuous inkjet technology, a high pressure pump directs liquid ink from a reservoir through the nozzles, creating a continuous stream of liquid to break into charged droplets at regular intervals. Droplets are either direct to the substrate or deflected to a collection gutter for re-use. Kodak uses continuous inkjet technology

Within the production inkjet ecosphere, drop-on-demand is the technology used by the majority of the manufacturers. While there are pros and cons to each of these technologies, that discussion is beyond the scope of this paper.

Aqueous Inkjet

The majority of the production inkjet solutions in the market today use aqueous, or water-based, inks. This category was established a number of years ago with the transaction market as its primary target. The transaction market was ideal for the technology for two reasons: In the early days, it was monochrome only, and billers could use preprinted stock, overprinting the variable information in black. Secondly, the quality was not sufficient to replace other technologies, including toner, for most other applications.

Over time, the quality has improved, and there are now a number of full-color presses on the market. This eliminates the need for preprinted stock, since logos and other color elements can be printed along with the variable information in a single pass; and it broadens the range of applications that can be addressed. This includes short-run books, direct mail, and even some shorter run applications that might otherwise have been produced using offset. As quality continues to improve, there will be increased offset transfer of impressions as well as new applications that could not effectively be produced in the past. Production inkjet is also syphoning off volume from toner-based presses for lower volume applications that include books, direct mail and transactional printing.

Aqueous inkjet printing is a delicate balance between head performance, density of ink lay-down, substrate and the drying capacity of the press.

Since these presses run at multiple hundreds of feet per minute, and there is a significant amount of water content in the inks, the drying capability is extremely important. This becomes even more critical as ink coverage percentages increase. Drying must be fast enough that the ink wicks into the substrate as little as possible and paper curl or other substrate deformity is minimized or eliminated. But temperatures need to be such that they do not damage the substrate with excessive heat. Early entrants into the market found themselves having to upgrade drying capability in their presses because they were initially designed for low ink coverage; users now want much higher quality, full color output with much higher ink coverage.

Head performance is important for any production inkjet solution. This includes head life, the cost and time associated with replacing heads if and when they fail, and the ability to manage head nozzles in such a way that if one fails or becomes clogged, another nearby nozzle will take over imaging on its behalf so that there is no disruption in quality during the print run.

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Substrates are also an important consideration in making a production inkjet decision. As the quality of inkjet presses continues to improve and the range of applications expands, so, too does the need for a wider variety of affordable substrates.

With most, if not all, aqueous inkjet presses, the best quality, especially for higher percentages of ink coverage, is achieved using substrates optimized for inkjet, either in the manufacturing process or by means of pre-treatment with a bonding agent, either inline or offline. Inkjet-optimized or treated substrates allow ink droplets to adhere to the substrate without excessive wicking, which causes dots to blur and quality to decline. While the cost of inkjet-optimized substrates is declining as the number of suppliers and the number of images being produced both increase and the range of substrates available is growing, they can still carry a high premium of as much as 50% or more when compared to standard papers used with offset or toner-based presses. Thus, the cost of substrates is a critical consideration when choosing a production inkjet solution. It can be a significant contribution to total cost per piece, and in many of the target markets for inkjet applications, especially transactional printing, the buyers can be extremely cost-sensitive.

There are also two primary ink types for aqueous inkjet production presses: pigment and dye.

Dye-based inks are designed to be absorbed into the paper when printing, while pigment-based inks are designed to offer more vibrancy and light fastness as they tend to leave more ink particles on the surface while still using water as the carrier into the paper fibers. Dye inks are generally less expensive to manufacture than pigment inks and therefore less costly to purchase. Pigment inks, however, are more resistant to compromise when exposed to water and sunlight. The Impika iPrint line can use either dye-based or Impika's new HD pigment inks.

Some presses can run either dye or pigment inks; others are restricted to one type or the other. Thus, the type of ink being used is another important factor to consider when making an investment decision in production inkjet since it can be complex, time consuming and costly to switch from one ink type to another once the system is installed. This decision will be application- and customer-driven, and will require a balance of price and performance based on specific application or customer requirements.

Waterless Inkjet

As of this writing, the Xerox CiPress 500 and 325 are the only production inkjet presses on the market using waterless inkjet technology. As you might imagine from the discussion above, a primary benefit of waterless inkjet is the ability to utilize a wider range of substrates and eliminate or minimize the challenges of managing water content in the paper.

Waterless inkjet printing begins with solid ink granules that are fed from drums. Ink granules are melted to a liquid form and the molten ink is jetted directly on to a cleaned and warmed web (about 106 degrees F) of substrate, where it hardens instantly. The web is then cooled, and an Intelligent Scan Bar scans the web for image quality consistency and uniformity and to detect missing or malfunctioning jets. The web is again warmed with a low temperature ceramic heater and the ink is pressure-fixed onto the web. This process occurs at a printing throughput speed of up to 500 feet per minute.

In this process, the ink bonds to the surface of the paper but does not wick into the paper, with the result that dots hold their shape to produce sharp edges, excellent bar code readability, and crisp fonts, images and graphics. Inkjet heads are less likely to clog than with water-based inks, since inks are not affected by evaporation, the most frequent cause for

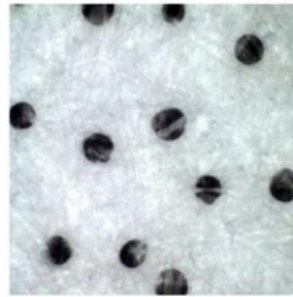
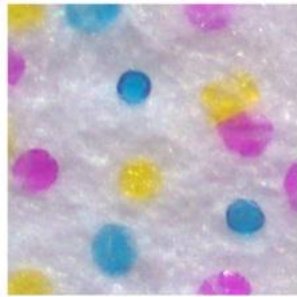
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print head clogging and failure. The open time of these waterless inks and heads can be days or weeks compared to water based inks where heads must be capped after a few minutes in standby mode so they don't dry out.

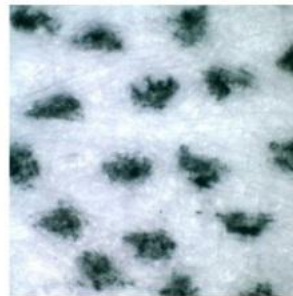
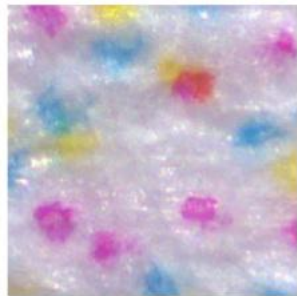
This process enables very high quality output with almost any paper substrate that can be used with either offset presses or toner-based devices. This means that less expensive plain papers can be used, and/or the same substrates used in other parts of the printing operation, reducing the amount of inventory a print shop would have to maintain and reducing the overall cost of production. Using lighter weight stocks also delivers higher yields per roll and involves less roll changes. Stocks as light as 30 gsm can be utilized. There is no need more expensive for pre-treated or inkjet optimized substrates.

The image below shows the difference in dot structures after both waterless and water-based inks have been jetted onto 75 gsm offset paper.

The images below are 10X enlargements of 75 gsm offset paper.



Xerox® Production Waterless Ink



Aqueous Ink

Beyond the Press

For many printing operations, acquisition of a production inkjet press will result in significant changes to workflow, cost structures and the range of products produced. For this reason, an extremely important element of the product selection process is to look beyond the press at the types of support and services each vendor provides, both pre- and post-sales. Below are some of the support services you should expect from your production inkjet press manufacturer.

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Pre-Sales Support

A production inkjet press is not a trivial investment. Buyers should expect a high level of support from vendors in the pre-sales process. This includes such things as detailed needs analyses and application testing, including cost analyses and sample output. It should also include assistance in determining how much current volume can be transferred from other processes and what volume might be expected from new applications. In some cases, this may require consultation with existing or prospective customers to ensure that volume estimates are as accurate as possible. Manufacturer's representatives may either assist with some of these discussions, or provide management with presentations and other materials to assure that discussions deliver as much value as possible. These services may be free or fee-based, depending upon their complexity. Either way, the manufacturer's representatives must have a deep knowledge of the application set your business expects to produce.

Post-Sales Support (Sales and Marketing)

Post-sales, buyers should expect a robust set of business development and financial analysis tools from the manufacturer. This can include such things as videos, presentations, brochure/sell sheet templates, sample application print kits, signage, estimating templates, and on-site or Internet-based training for sales, marketing and business personnel. The availability of pre-packaged marketing campaigns, newsletters and other materials that can be customized for your business are a plus.

Post-Sales (Technical Support)

Press uptime is a critical factor in the production-intensive environments in which production inkjet presses are typically installed. Make sure the manufacturer is prepared to provide the right level of technical support to ensure minimal downtime. Of course, a review of press reliability statistics prior to acquisition is a key element of the due diligence process, as is an analysis of downtime due to routine maintenance tasks.

In addition to exceptional field service, remote diagnostics and ready access via telephone or web chat with technical experts, manufacturers should also be expected to provide ongoing application development support, substrate testing and certification, color management support and training, assistance with workflow optimization (including data stream support), and assistance with data-related issues.

Workflow Solutions

Efficient and profitable operation of a production inkjet press requires a streamlined workflow from estimating and quoting through prepress, color management, production, finishing, delivery and invoicing. Ensure that your vendor partner is able to address any gaps in your existing workflow with their own or certified third-party solutions. The vendor should also offer a scalable RIP that matches the complexity of the jobs you intend to produce—and that can be scaled as complexity and volumes grow. The importance of RIP performance cannot be underestimated given the higher area coverage, more sophisticated variable data and huge file sizes that are being created today. This is often overlooked in the due diligence process since buyers today expect printers to run at rated speed for most jobs. Unfortunately, this is not always the case. Prior to making a purchase decision and/or specifying a press configuration, RIP throughput performance must be tested for the initial suite of jobs to be run upon installation.

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Ink Optimization

In the world of inkjet printing, ink costs represent an important percentage of the overall cost of the job. Printing establishments must have a clear understanding of what ink costs will be for each and every job in order to accurately quote the job and ensure profitability. Look for ink optimization, estimating and monitoring tools that will help you better manage ink costs. These include:

- The ability to select from a range of ink optimization options that allow you to balance the amount of ink used with the job quality required. Heavier ink coverage can be selected for demanding applications, while less demanding applications can utilize less ink—often as much as 50% less ink—leveraging margins while meeting appropriate quality standards.
- The ability to analyze a post-RIP file prior to printing can deliver accurate ink consumption data and is significantly more reliable than estimating ink usage based on estimated area coverage. These tools measure the post-RIP file after all color management has been applied for calculation of precise ink usage at the droplet level.
- Depending on the technology and the specific press being used, the amount of ink waste during setup, registration, head alignment, and clean and purge operations can vary widely. This aspect of press operation should be carefully analyzed to fully understand both the time and cost associated with these processes.

Education and Training

Vendors should provide a range of training and educational opportunities across a range of disciplines, including sales and marketing, business, and operations. Where possible, training and educational options should include certification that the individual or the business has successfully completed the training or certification course. This includes on-site and off-site in-person training as well as e-learning. It can also include access to thought-leadership materials such as articles, books, workshops and more.

Networking with Peers

While vendor support is critical, it is also extremely valuable to network with peers who have already made the transition to production inkjet or are themselves in the decision process. Your production inkjet partner should have processes in place that facilitate this networking, including such things as webinars and conference calls, formal user group meetings, a referral strategy and more.

Making the Right Decision

With a broader competitive playing field in the production inkjet space, it is all about choice—making the right choice for your business and for your customers. At a high level, there is no right or wrong choice. But at the ground level, the choice you make will have a long-term impact on your business.

For some businesses and applications, aqueous inkjet will be the most appropriate choice; for others, waterless inkjet will be a better option. During the selection process, you should carefully consider all of the pros and cons that have been identified in this white paper. You should identify the key applications you will be producing on the press and have vendors produce those applications using your files. You should also consider the track record for support—both business development and technical—and workflow options that are available with the press.

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Most importantly, you should engage your key customers in the decision process. After all, if they don't send you work, the investment will be for naught. Get them excited about the possibilities that production inkjet offers, both from the perspective of a more efficient production supply chain and the ability to create new applications that were not possible or cost effective before.

Finally, carefully consider your choice of vendor. This will be a partner that is strategically relevant to your core business. The partner you choose when selecting a production inkjet solution is one you will need to work closely with over the long haul to be successful with the acquisition. Make sure they offer the right set of supporting solutions, are willing to work closely with you on application and business development, and are in the business for the long term. You should also select a vendor who has a demonstrated history of innovation and will be likely to continue to innovate in the production inkjet arena. In this highly competitive world, as Will Rodgers famously said, "Even if you are on the right track, you will get run over if you just sit there." Production inkjet will continue to evolve over the next several years. You want your installation to be able to evolve as well so that it remains state of the art and you remain competitive and profitable.

Conclusion

An investment in production inkjet is not a trivial decision and will have significant impact across the organization. With proper pre-sales analyses, implementation planning, and post-implementation support, an investment in a production inkjet press can revitalize your business and position you to address today's market realities—and those of tomorrow. The information contained in this white paper should help you make the right decisions—from choosing the right vendor partner, hardware and software to employee selection and training, business development and marketing initiatives, and more.

This white paper was sponsored by Xerox Corporation. For more information about production inkjet offerings from Xerox, visit www.Xerox.com/cf. To stay current with production inkjet trends and news, visit www.WhatTheyThink.com/inkjet.