

Experience iX

White paper varioPRINT iX-series proposition and technology



Contents

1	Summary	3
2	General commercial printing	3
3	Proposition: Experience iX	5
4	iQuarius^{ix} technologies	6
5	Technology explained	7
5.1	Paper feeding	7
5.2	Sheet entry control	7
5.3	Precision sheet control	8
5.4	Sheet monitor system	8
5.5	Registration	9
5.6	1200 dpi	9
5.7	Inline quality control	10
5.7.1	Nozzle activity control (NAC)	10
5.7.2	Nozzle uniformity control (NUC)	10
5.8	Printhead maintenance	11
5.9	Inks and ColorGrip	12
5.10	Drying and cooling	13
5.11	Output and finishing	14
5.12	PRISMAsync print server	14
5.13	Service innovation	15
6	Specifications	16

1 Summary

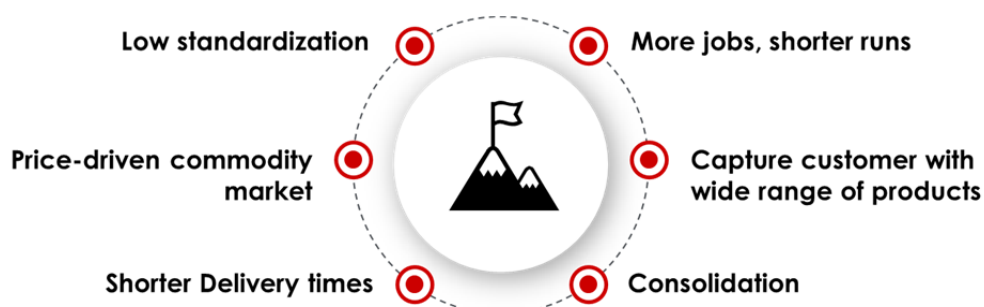
Today, commercial printers are confronted with tighter deadlines, more jobs and shorter print runs. They need to keep up, offer quality products, stay competitive and grow their business with more and value-driven applications to maintain margins and keep attracting customers. The varioPRINT iX-series revolutionises the commercial printing business experience. Thanks to its stunning image quality and wide media range, commercial printers can say "Yes" to virtually any job, based on the agreed turnaround time and price. And then print it with the productivity and cost efficiency of inkjet for more profit and more business.

A glossy brochure, a sturdy postcard, a catalogue – and so much more. Prepare it, personalise it, print it and finish it with the highest image quality on a wide range of mixed media. Switch jobs quickly and efficiently. Run jobs at high speed and an attractive price. As the global market leader in sheetfed inkjet, no vendor offers more experience in this segment than Canon. So commercial printers can invest with confidence to expand their profit and business!

2 General commercial printing

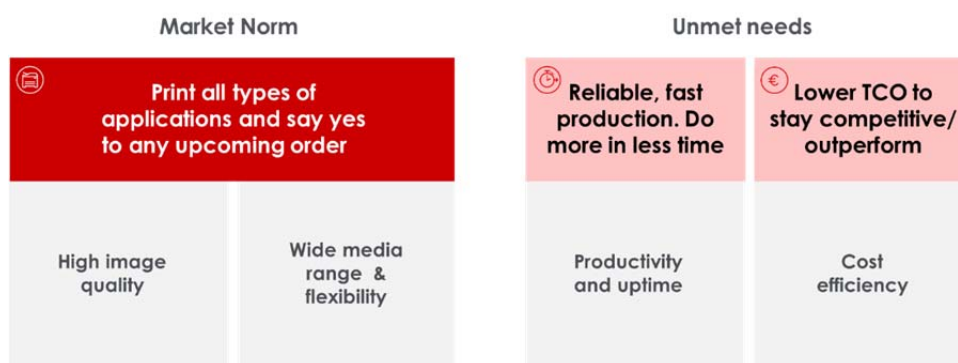
Life is not without challenges for general commercial printers. This is what we have learned:

- General commercial printers may face a growing number of jobs, but the volumes per job are trending downwards, resulting in fewer pages per print job.
- Job sizes tend to decrease because of versioning and targeted communication. For instance, while in the past, one million brochures were ordered for mass marketing, today it is more likely to be ten orders of 100,000 targeted brochures.
- Along with the smaller job size, we see a higher frequency of print job orders, with customers wanting those jobs delivered almost instantly.
- Consequently, overall print volumes are likely to decline, meaning more customers and more jobs are needed just to stay at the same level in terms of print volumes.
- The customers of general commercial printers may be looking for different print applications than they used to order. Marketing budgets are not growing nor is the percentage spent on print. In order to keep those customers spending money with them, commercial printers are looking for applications with impact.
- As price competition is fierce, the cost of applications is under pressure. As always, cost optimisation focuses on the entire application chain, not just the printing part.
- With more job and application diversity comes more diversity in pre-press, paper and finishing to meet customer demand, and less opportunity for standardisation and economy of scale.
- General commercial printers are consolidating, since the smaller establishments are often not able to cope with all of these challenges.



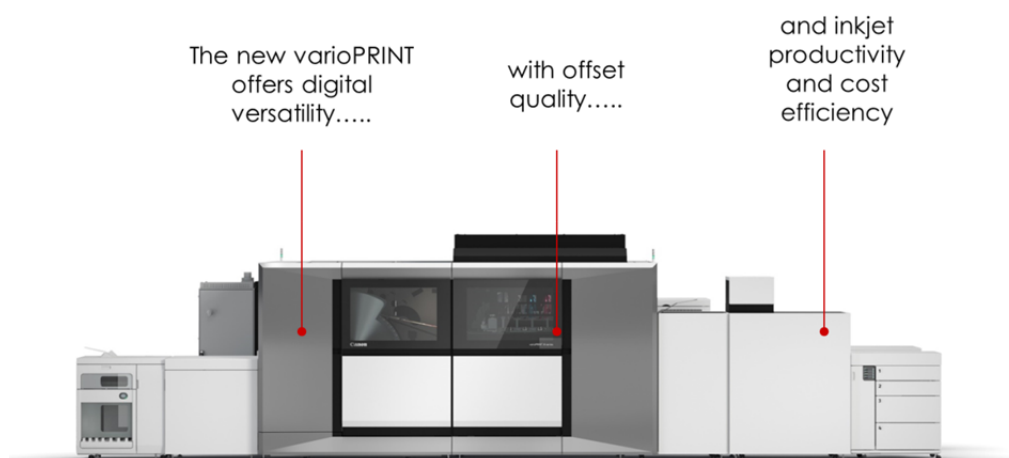
By moving from offset to digital printing (or complementing offset with digital) over the last years, general commercial printers have been able to right-size run lengths to true on-demand printing for any job count, and provide value-add applications (driven by digital capabilities) with high quality on a wide range of substrates. That is why general commercial printers generally have no comments about the print quality or paper range supported by their cutsheet digital presses: the norm is set and met.

However, limited productivity and high running costs weigh heavily on general commercial print when it comes to digital on-demand cutsheet printing (nowadays mostly toner-based), ultrashort turnaround times and competitive prices. This technology compromise that many general commercial printers are facing is the driving force behind the new varioPRINT iX-series.



While the first-generation of sheetfed inkjet presses like the VarioPrint i-series are highly productive and cost efficient, they do not meet the quality level and wide media range required for the wide variety of commercial printing applications.

The new varioPRINT iX-series revolutionises the commercial printing business experience. It is designed for general commercial printers looking for an all-round device that offers great print quality on a wide media range with no concessions to productivity and cost efficiency.



The power of sheetfed inkjet in commercial print environments for more profit and more business

3 Proposition: Experience iX

The varioPRINT iX-series brings new printing power to commercial printers. Thanks to Canon's proven iQuarius^{iX} technology, commercial printers can take on virtually any job and print it with the required quality, but faster and at lower cost – for more profit and more business. The proposition is based on four pillars:

- *Experience productivity*
Highest productivity, throughput and uptime with 320ipm A4 or 312ipm LTR or >9,000 4/4 sheets per hour on all media, with more than 94% average uptime.
- *Experience cost efficiency*
Driven by reduced labour and processing costs, with considerably lower running costs than other sheetfed production print technologies.
- *Experience quality excellence*
With innovative printhead technology and image processing, and high-end nozzle maintenance technologies.
- *Experience application versatility*
Thanks to wide media range support including offset coated paper of up to 350gsm/130# cover.



4 iQuarius^{ix} technologies

Inkjet printing is extremely productive and reliable, and less costly than toner-based printing. However, combining high-speed inkjet with true sheetfed printing comes with challenges:

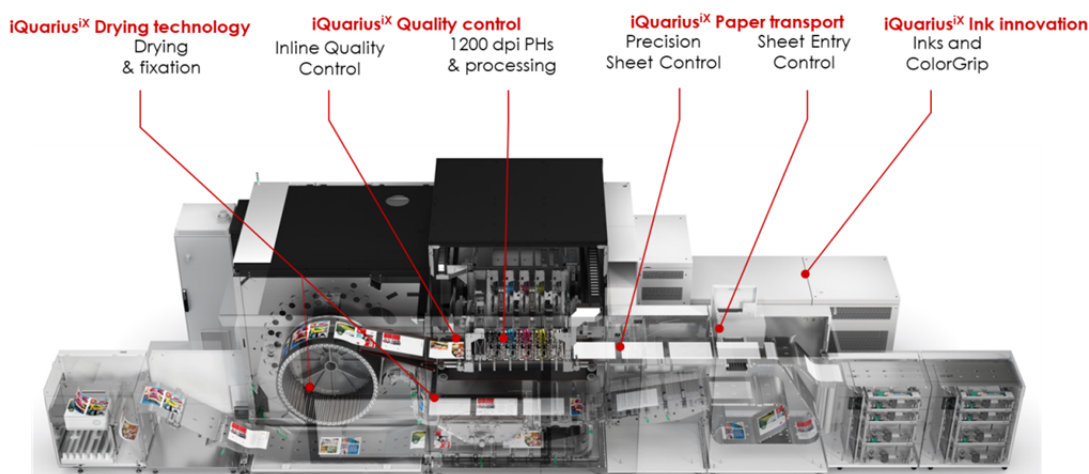
- Transporting sheets – of different type, size and weight – at high speeds from feeding to printing to drying to stacking in a productive and reliable way.
- Managing media variety and inkjet printing interaction dynamically, so that the output has the required quality level for all used media.

With these challenges solved, sheetfed inkjet printing should mean unlimited flexibility: for high volumes and media choices that suit a wide range of applications. Media can be switched quickly depending on job requirements, even using mixed media within a job. All handled with productivity, reliability and the required quality.

All the Canon intelligence and innovations that ensure that media and ink perform reliably, productively and with the required quality for the chosen application fall under the umbrella of iQuarius^{ix} technologies: a set of connected and innovative technologies that facilitate high-speed inkjet on any type of paper. Productive, reliable and with constant, high quality. Each of these iQuarius^{ix} innovations plays an essential part in making the promise of the varioPRINT iX-series come true.

iQuarius^{ix} consists of four main technologies that can be found everywhere in the system.

- iQuarius^{ix} paper transport
- iQuarius^{ix} quality control
- iQuarius^{ix} ink innovation
- iQuarius^{ix} drying technology



5 Technology explained

This chapter explains the technologies and innovations in the varioPRINT iX-series.

5.1 Paper feeding

The standard varioPRINT iX-series configuration includes a paper input module (PIM) with four trays, holding a total of 4,500 sheets (80 gsm/50# text). Up to 3 PIMs can be connected, providing a capacity of 13,500 sheets over 12 trays. They can be used for feeding different media, or linked for a large paper feed capacity per substrate. All trays can be used for all supported media weights, making paper loading easy and quick for operators. Paper loading can be even done while the press is in operation, ensuring uninterrupted productivity.

Each PIM is equipped with a moisture control unit, which maintains the relative humidity level in the trays at a constant level to prevent the media from waving or curling. Paper sheets are separated in the trays by a flow of air. Light-weight papers need low air speed, while heavier papers require high air speed. The PIM fan adapts its speed automatically, depending on the assigned paper characteristics. After separation, the sheets are fed into the press by vacuum, which ensures reliable feeding and high-speed performance for a range of media in all sizes and weights, even when switching media within a job.

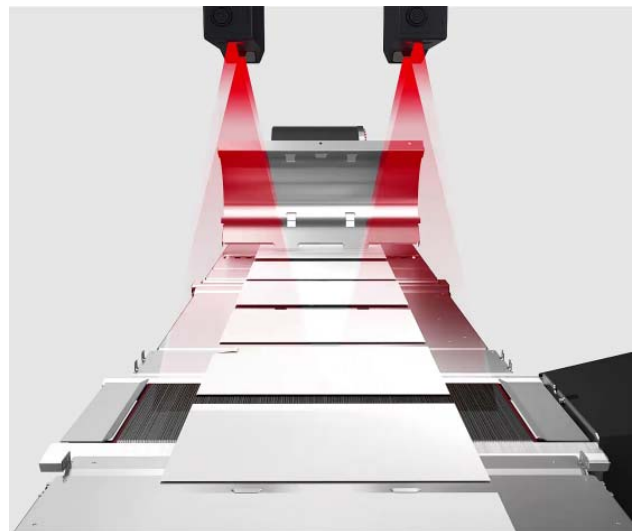
Key words: versatility, productivity, reliability

5.2 Sheet entry control

For reasons of print quality, the varioPRINT iX-series keeps the print gap between the sheet and the printhead at a minimum while printing: the smaller the print gap, the better and more controlled the drops that are jetted. However, a small print gap means that damaged, wavy or curled sheets of paper risk printhead collisions and cannot pass the print step.

The PIM's humidity control supports keeping sheets perfectly flat, and sheet entry control provides the last quality gatekeeping function before the sheet moves towards print. The sheet entry control, also known as 'sentry', scans every incoming sheet for deformations (curl, waves, dog ears, wrong cutting edges, incorrect size) with an inline height camera. Deformations that would lead to issues with respect to the print gap are immediately purged without interrupting printing, after which the sheet is replaced. The operator is informed of these sentry rejects and the reason for the rejection, so that media quality countermeasures can be taken. Sheet entry control delivers uninterrupted productivity and quality for all sheets by avoiding potential printhead collisions.

Key words: reliability, quality, productivity

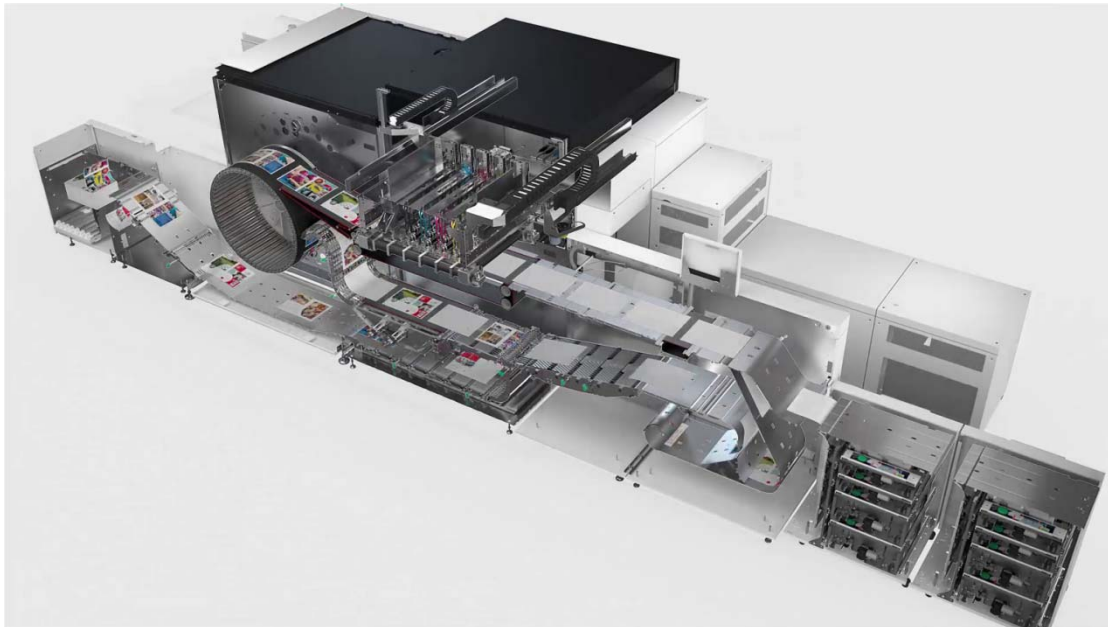


5.3 Precision sheet control

Sheetfed printing means transporting loose sheets through the printing process: sheets of any size, weight and type, printed and unprinted. Paper transport needs to be flexible (to accommodate a range of paper formats and weights), reliable (to pass the sheets along the print functions at high speed) and accurate (for good quality and front-to-back and colour registration). The varioPRINT iX-series uses air to manage the sheets in transport, all through the paper path. Air is applied to hold the sheet flat and accurately in place on a rigid belt, made out of stainless steel for unparalleled precision. Vacuum suction holds light-weight and heavy papers of any type and format in place. Because no mechanical switches are involved in media changes, this can be done while keeping high levels of productivity.

Key words: reliability, productivity, flexibility, quality

5.4 Sheet monitor system



One of the ways the varioPRINT iX-series leverages the productivity of inkjet printing is interweaving: alternating sheets that have already been printed on the front side with empty sheets, just fed from the PIM and ready to be printed on the front side. However, this also results in a challenge. Many sheets are transported through the print process simultaneously, about 37 A4 sheets when in full process. With interweaving, the front side of sheet 20 may be printed, followed by the back of sheet 3, followed by the front of sheet 21, the back side of sheet 4, and so forth. This juggling requires a 100% guarantee that the right images end up on the right side of the right sheet.

The varioPRINT iX-series has a sheet monitoring system that keeps track of every single sheet. Before a sheet is even separated from the paper stack in the PIM, an individual state machine – consider it a personal traffic controller for every sheet – is assigned to it. This state machine gives the sheet a unique identifier, applies a precise timetable and downloads the bitmaps for the sheet; one bitmap for a simplex sheet, two for a duplex sheet.

The state machine then constantly monitors the movement of the sheet through the process by crosschecking the expected time of arrival with the actual arrival time, 120 times through the entire paper path. When a deviation is noticed, a follow-up action is initiated: slow down, speed up, or start an error recovery scenario. At the next sensor, the state machine checks if the adaptations

result in the correct timing. If not, it instigates another correction. The state machine also manages linking of the bitmap to the sheet. Once the sheet enters the paper path, the state machine retrieves the bitmap and sends it to the printheads. When the sheet reaches the start-of-page position, the nozzles start to eject ink onto that sheet.

Key words: productivity

5.5 Registration

- Colour-to-colour

The varioPRINT iX-series has excellent and stable colour-to-colour registration, starting with careful adjustment when the machine is first installed and supported by highly accurate, vacuum-and-air-supported paper transport.

- Sheet-to-sheet and sheet-to-image

The following steps are in place to ensure accurate registration between sheets and front to back:

- The width and length of each sheet is measured when it is separated from the PIM.
- Each sheet is accurately positioned at the right-side leading edge by the input registration unit before entering the print process.
- Because printing, drying and cooling leads to shrinkage, the length and width of each printed sheet is measured again.
- The offset in image position and the shrinkage factor are calculated.
- The sheet is turned so leading edge becomes trailing edge, and the new leading edge is again positioned at the right side by the input registration unit.
- The back of the sheet is printed with an accurate front-to-back position.

If needed, the operator can optimise performance by performing a media-specific registration adjustment.

Keywords: quality, versatility

5.6 1200 dpi

The varioPRINT iX-series features 1200 dpi Kyocera printheads, which have been co-developed and optimised to provide an optimal fit with sheetfed printing in general and the iX-series in particular. For example, the ink is cooled before entering the printhead and while in the printhead, to manage and optimise printhead performance and stability.

1200 dpi printheads deliver a dizzying number of small droplets (2 or 5 pl), allowing the iX-series to use a wide colour gamut and deliver sharpness in fine details, lines and text.

However, image quality has many aspects, including ones that move beyond print resolution alone. A small droplet size will not necessarily guarantee quality.



Printheads, ink, hardware and firmware must accurately work together to deliver perfectly formed, accurately placed and effective drops onto a wide range of substrates.

Driven by innovations in printheads, image processing, quality control, inks and drying, the varioPRINT iX-series produces thousands and thousands of identical-quality prints in non-stop production. Intelligent technologies such as nozzle activity control, nozzle uniformity control and 1200 dpi processing and printing ensure consistent, stable, high-quality output.

Key words: quality, productivity

5.7 Inline quality control

The varioPRINT iX-series offers automated inline quality control routines to ensure consistent quality, without the need for regular manual checks. Two mechanisms are in place: nozzle activity control and nozzle uniformity control.

5.7.1 Nozzle activity control (NAC)

Print quality is safeguarded everywhere in the varioPRINT iX-series: by the ink, the innovations around the printhead, and the automated maintenance routines. Still, a nozzle might clog or perform poorly during printing, potentially resulting in a visible white line on the printed page. To avoid printing a large print job with a potentially unacceptable white line on every page, an automated quality check is built into the printing process.

The system regularly prints a quality assurance (QA) sheet that is inspected by an inline scanner to detect if nozzles are working properly and to take action if deviations are noticed. The frequency of printing the QA sheet can be set by the customer; the default setting is once every 100 sheets. The varioPRINT iX-series automatically corrects for insufficient nozzle performance by increasing the droplet size from neighbouring nozzles.

Intelligent mechanisms have been added to the NAC to further optimise it:

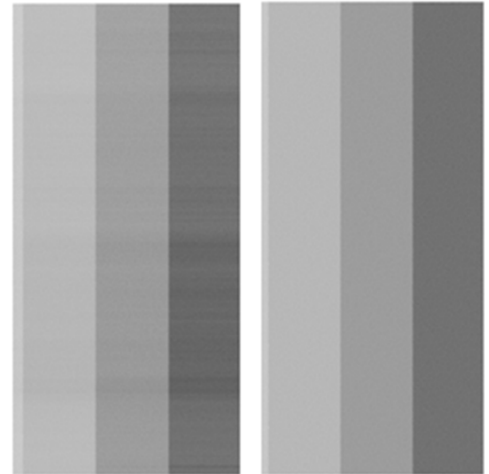
- If the 'Wait with first print' option is selected, all nozzles are inspected and potentially corrected before the system starts printing, ensuring correct output from print one.
- To effectively detect and correct intermittent failure (dynamic nozzle-outs), the system takes the history of the last 14 QA charts into account. If a nozzle has failed on two or more of these charts, it is corrected.

5.7.2 Nozzle uniformity control (NUC)

The many nozzles in a printhead may not perform in an identical way: some nozzles eject larger droplets than others. The same is true when comparing different printheads. To prevent this from leading to visible differences on the print, two fully automatic NUC procedures are done that use the inline scanner to measure the printed sheets.

- Static NUC is done by Canon service engineers during installation or after a printhead replacement. This procedure ensures that all nozzles perform at the same level for an equal colour gamut without streaking.

- Dynamic NUC can be done by the customer to correct differences between nozzles within a printhead before a job is started or even during printing. The performance of individual nozzles, as measured by jet angles and drop size variations, can change mid-print due to contamination during long runs or printhead maintenance actions, which may result in visible striation. For a dynamic NUC, four QA charts are printed and scanned – one per colour. The frequency of dynamic NUC charts can be set by the customer; the default setting is once every 2000 sheets. Dynamic NUC is an optional fine-tuning step in addition to static NUC, controlling the system’s quality over time and over all media types.



Key words: quality, productivity, cost efficiency

5.8 Printhead maintenance

A crucial part of quality inkjet printing is keeping each nozzle ‘fit’. Nozzles that are clogged, dried out or otherwise affected can have a visible impact on quality. Several measures are taken in the varioPRINT iX-series to prevent this.

- The printheads in the print module and in the maintenance module reside in a conditioned chamber, to maintain print quality and consistency and for the reliable production of drops at the nozzle. This conditioned environment prevents moisture formation, drying of ink at the nozzle and long warm-up times.
- When the system is not printing, the printheads stay in the maintenance station where they are capped with a moist and sealed sleeve (see picture above).
- During the print process, automated nozzle maintenance routines ensure optimal nozzle condition and prevent risky manual cleaning that may impact the printhead negatively. These routines save considerable operator time over manual maintenance routines. Nozzle maintenance is performed at the start of printing after an idle situation, or every 3.5 hours when the press is in a long production run. The procedure involves two steps:
 - Purge and dry wipe. The printheads purge ink through each nozzle by applying air pressure. This action takes place with the printhead positioned above the capping unit, which collects the waste ink. This procedure removes air bubbles and pollution inside the nozzle. This brings all nozzles back to a ‘healthy’ situation. A purge is always followed by a wipe with a dry tissue, to remove the remaining ink on the nozzle plate.
 - Wet wipe. Then, the printheads are automatically cleaned with moist tissue material to remove dried residue around the edges of the nozzles, which cannot be removed by a purge and dry wipe.



No operator interaction is required for any of the above processes. The operator only needs to replace the tissue cassettes (see picture above) to provide the system with clean wiping tissue.

Key words: quality, productivity, cost efficiency

5.9 Inks and ColorGrip

The inks used in the varioPRINT iX-series – proprietary, developed and manufactured in-house, are key to the media versatility of the system. The water-based polymer pigment inks provide:

- Colour intensity and stability
- A robust layer on every supported media type
- Protection for the paper (together with the drying technology), for a flat end result for any ink load
- Stable jetting behaviour (together with the printheads, co-developed for these inks)
- A low environmental impact:
 - No hazardous disposables
 - Odourless prints
 - Excellent de-inking capabilities

The iX-series also uses ColorGrip, a conditioning liquid that helps deliver even more flexibility in media choice. ColorGrip instantly immobilises the pigments in the ink after printing, which results in print quality improvements for both uncoated paper (not treated for inkjet) and offset coated paper.

- ColorGrip prevents pigments from being absorbed in uncoated papers, resulting in:
 - High colour gamut and vibrant colours
 - Decreased or eliminated bleed-through
 - No feathering
 - Reduced or eliminated mottling in solid areas
- ColorGrip prevents pigments from moving around and bleeding together on coated materials, providing:
 - A solution for coalescence or de-wetting, since the pigments are immediately pinned to the paper surface
 - Elimination of colour-to-colour bleed
 - Reduced or eliminated mottling in solid areas



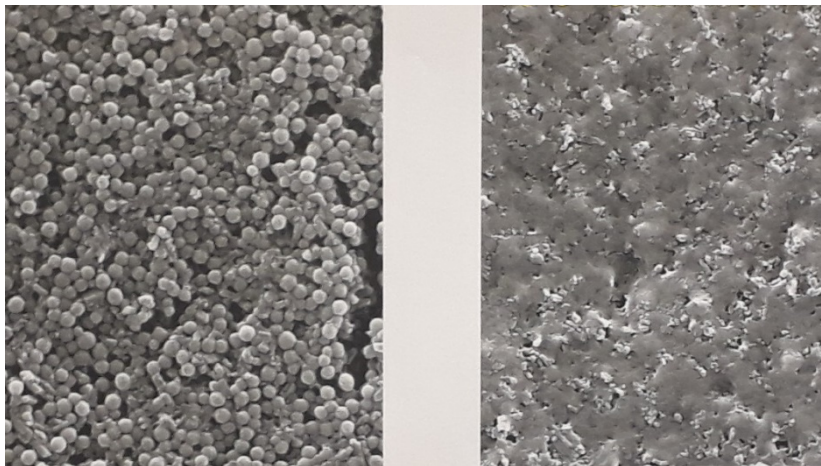
A set of 600 dpi printheads is used to apply ColorGrip moments before the ink is jetted onto the paper, printing a 'grid' of ColorGrip with small drop sizes. To control the amount of liquid on each sheet, ColorGrip application is based on the image to be printed.

Key words: versatility, quality

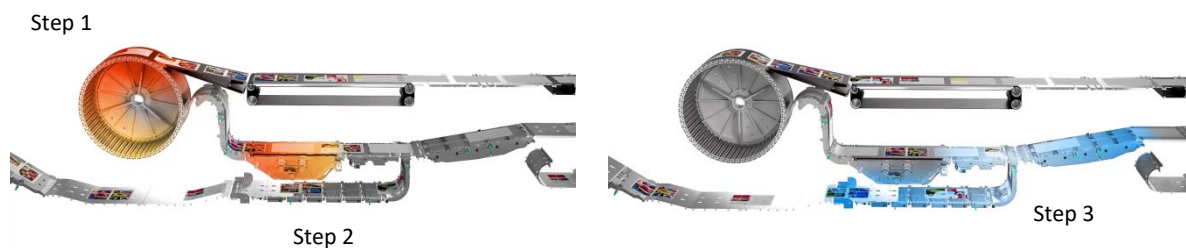
5.10 Drying and cooling

Inks are not the only important contributor to media versatility and support. Drying is at least as important. The innovative iQuarius^{ix} drying technology results in a robust print that is ready for further processing, at full productivity and for every media type and every ink load. Two consecutive drying steps are involved, followed by one cooling step.

- **Step 1: drying the ink**
The sheets are transported to a moderately heated drum and held to the drum using a vacuum, which prevents out-of-plane deformation (cockling) during drying. Hot air impingement – blowing hot air onto the drum at high velocity – is used to evaporate the water and dry the ink. These air jets result in faster water evaporation than natural airflow.
- **Step 2: fixating the ink**
Although the ink is dry after step one, not all sheets will have a robust ink layer yet. Especially heavy-weight offset coated media. During step two, the polymer particles in the iX inks (left picture) are exposed to a high temperature to melt the particles into a firm layer, protecting the printed image (right picture).



This post-fixation step is unique in the industry, delivering an instant high-humidity heat shot to the sheet. This allows for fast and effective formation of the ink film while avoiding over drying of the paper. The end result is a robust print on a flat sheet.



- **Step 3: cooling the sheets**
After the two drying steps, the sheets are cooled with cold air impingement and either moved into the print process again for rear-side printing or moved to the stacker or finisher for post-

processing. The cooling step ensures that the sheets have the right temperature for printing and for stable stacking.

Keywords: versatility, productivity, quality

5.11 Output and finishing

The varioPRINT iX-series high-capacity stacker (HCS) can stack up to 6,000 sheets (80gsm/50 #text) of all supported paper sizes and types. Up to two stackers can be supported, which can be addressed separately or linked for longer unattended print runs. An HCS can be unloaded while printing, for uninterrupted productivity. The unit provides highly accurate stacking for error-free post-processing of stacks.

The HCS provides an open finishing interface (DFD) for connection to third-party finishers that are compliant with DFD – the Canon standard – or with Xerox standard DFA. Several online partner finishing solutions have been validated for the varioPRINT iX-series, for a highly productive end-to-end automated workflow.

Keywords: versatility, productivity, cost effectiveness

5.12 PRISMAsync print server

The PRISMAsync server is the heart of varioPRINT iX-series, steering performance, usability, image quality and colour quality. PRISMAsync offers seamless workflow integration for both document-based and transaction-based print. The operating concept for print production is based on the following principles to maximise efficiency and productivity:

- Scalable architecture
 - Scalable architecture to support 320ipm full-colour processing needs
 - Two raster image processor (RIP) clients are standard, which can be expanded to four clients. This protects customer investment and performance with the varioPRINT iX-series, even when processing requirements grow over time
- Workflow support
 - Seamless integration in transactional and GA PRISMA workflows and third-party workflows
 - Integration with hybrid workflows (HP Prinect, Agfa Apogee, Kodak Prinergy)
- Higher integral productivity
 - Option to plan 8 hours of production with Scheduler
 - Smart Pre-RIP. This proprietary compression technology greatly reduces the amount of memory and processing time needed to generate and further process the output images for the print engine. This allows PRISMAsync to RIP and print at high speeds
- Better application quality
 - Tight integration with varioPRINT iX-series for best colour tooling and management
 - Unique media-based workflow with media management
- Lower integral cost
 - Automated workflows
 - Fewer operator hours needed

Key words: Productivity, quality, versatility

5.13 Service innovation

Proactive service uses sophisticated data analysis to increase uptime, significantly reduce service visits and allow these visits to be scheduled at the most advantageous time. This complete service concept is possible thanks to advanced data analysis technology and the secure connectivity of the engine. Intelligent use of data collected from every connected varioPRINT iX-series in the field gives this highly reliable production press a significant uptime boost.

Proactive service comprises three elements:

- Preventive maintenance

Preventive maintenance is a data-driven process that consists of two types of maintenance: usage-based and condition-based maintenance.

Usage-based maintenance involves a regular check-up for the press at a certain number of prints. The system is functioning perfectly at that time, and the goal is to make sure it continues to do so.

Condition-based maintenance is driven by sensor data. This data is used to identify if a part needs cleaning or is about to reach its wear limit, so maintenance can be done before the part breaks down.

- Corrective maintenance

Corrective maintenance is done in case of breakdowns and performance issues. This is what people normally think of as service – you call the service department, who send a technician to repair the machine.

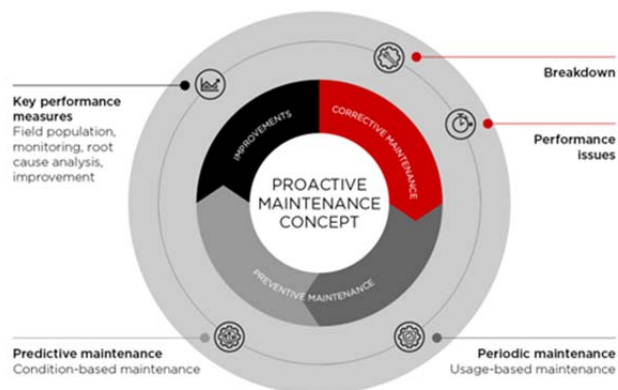
With unscheduled service calls like these, precious production time is often lost in the diagnostics step. Proactive service improves the efficiency of service visits through data analysis. Machine data help our service technicians prepare well in advance, so they have all the right parts and cleaning agents at hand. This prevents

second visits for the same issue and keeps the total number of service interruptions low. The data that helps prepare the service visit also helps technicians escalate an issue to someone with more expertise. A local service technician can call in the help of a local specialist, who can immediately look at the relevant data and advice. If necessary, the local specialist can enlist the aid of the global specialist in Canon Production Printing in the Netherlands and just as easily communicate about the issue. Because the data is already available in Remote Service, analysed and processed, it is far more powerful for solving issues.

- Improvements

The data from installed systems is also used to make improvements to our software and hardware. We monitor for trends such as increased wear for a specific part, increased error frequencies for specific machines, or an increased frequency of specific errors. Once we discover a certain trend, we do root cause analysis to attempt to find the reason this trend occurs. Then we address the root cause, for instance by redesigning the part.

Key words: Productivity



6 Specifications

Model	Sheetfed digital inkjet press
Inkjet	Drop-on-demand, piezoelectric
Ink	Water-based polymer pigment inks
Drop sizes (CMYK)	Variable, two drop sizes (2 and 5pl)
Printhead	Kyocera KJ4B-1200, optimised for varioPRINT iX-series
Colours	CMYK
Print resolution	1200 x 1200 dpi printheads and processing
Supported media sizes	203x203mm – 356x508mm 8"x 8" – 13.7"x 20"
Max printable area	337x504mm 13.3"x19.8"
Supported media weights	60 – 350gsm/40# text – 130# cover uncoated 90 – 350gsm/60# text – 130# cover offset coated
Print speed	<i>varioPRINT iX3200</i> 320ipm A4 4/4, 175ipm 4/1 312ipm Letter 4/4, 172ipm 4/1 <i>varioPRINT iX2100</i> 210ipm A4 4/4, 175ipm 4/1 206ipm Letter 4/4, 172ipm 4/1
Target volume	1M-10M A4/LTR per month
Maximum input capacity	13,500 sheets 80gsm/50# text
Maximum output capacity	12,000 sheets 80gsm/50# text

© 2020 Canon Production Printing

Canon is a registered trademark of Canon Inc. varioPRINT is a registered trademark of Canon Production Printing Netherlands B.V. All other trademarks are and hereby acknowledged.

No part of this publication may be copied, modified, reproduced or transmitted in any form or by any means, electronic, manual, or otherwise, without the prior written permission of Canon Production Printing. Illustrations and printer output images are simulated and do not necessarily apply to products and services offered in each local market. The content of this publication should neither be construed as any guarantee or warranty with regard to specific properties or specifications nor of technical performance or suitability for particular applications. The content of this publication may be subject to changes from time to time without notice. Canon Production Printing shall not be liable for any direct, indirect or consequential damages of any nature, or losses or expenses resulting from the use of the contents of this publication.

Canon