SMITHERS PIRA

KONICA MINOLTA

SMITHERS PIRA WHITE PAPER:
KONICA MINOLTA ACCURIOJET KM-1 INKJET PRESS

A white paper from Smithers Pira, commissioned by Konica Minolta

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INKJET SHEETFED PRESSES CHANGING THE COMMERCIAL AND PUBLICATION SECTOR

Colour digital printing has been steadily growing since the first industrial toner presses were introduced to the print for profit sector in 1993. The reliability and quality from these machines has improved over the years as more press suppliers (including Konica Minolta, of course) joined the market, but the productivity has not developed at the same rate. In 1993 the rated press speed was 67 x A4 colour pages per minute for an SRA3+ format; today the fastest machines will deliver 150 x A4 page prints per minute, with many lower performance presses available. Inkjet printing was developing, used in proofing on speciality papers giving very good quality at very low speed, while wide-format printers opened new markets in signage and display. The quality was good for these applications that are viewed from distance – but up close the print not good enough to pass commercial print tolerances.

High-speed inkjet in colour was launched in 2000, in the form of web presses using water-based inks onto uncoated papers. The technology was taken up in transactional, direct mail, books and newspapers. Again, the print quality was limited. While good enough for these applications, it was not sufficient for commercial print applications in magazines, catalogues and other marketing collateral. The developers have made significant improvements in printhead technology, in ink and drying technology, and improved substrate handling, all of which has enabled the quality to get better.

In 2008 the first sheetfed inkjet colour presses were launched, but there was little uptake by print companies. The first larger format toner presses followed in 2012. In 2017 the B2 digital press segment is flourishing, as print service providers see the potential for higher productivity digital presses to reduce the cost and time of digital printing.

Konica Minolta showed the KM-1 press as a concept at drupa in 2012. It was then thoroughly updated and launched as the AccurioJet KM-1 at drupa in 2016. The first installations took place in 2016 in Japan, and at PLS (Print Logistic Services) in Markkleeberg, near Leipzig in Germany. There has been a steady stream of sales as the machine has become commercially available.

THE CHANGING COMMERCIAL PRINT MARKET

Print for profit markets are changing radically, as the industry comes to terms with the new channels of communication that are being taken up by end users, who are the consumers of print. The changing communication preferences mean some printed products are declining – most notably physical newspapers, as more people get their news from alternative sources. As readership falls, so does the attractiveness of the medium for advertisers. This is evidenced by the rapid growth of Internet advertising in search, and across various social media platforms, led by Facebook.

Most magazines have websites; there are e-books for readers on Kindle, iPad and other devices; while catalogues are now often used in conjunction with an e-commerce storefront. Directory use is falling, while many consumers choose to receive bills and statements electronically rather than be sent physical bills through the mail. Cheques and even printed banknotes are being replaced by electronic payments and mobile phone contactless payments.

The print markets have responded to these changes with shorter runs for some products, and this has significant implications for the printing processes involved. The table below details the Western European printing markets, segmented by the print process in use.

DEVELOPMENT FROM 2012 TO 2022

Western European print and printed packaging markets 2012-22, by value and volume (€ billion, constant 2015 values and A4 billion prints, or equivalent)

€ billion	2012	2016	2017	2018	2022	CAGR % 2017-22
Sheetfed litho	30.4	27.2	26.8	26.6	24.6	-1.7
Heatset web offset	20.9	16.2	15.5	14.9	12.5	-4.3
Coldset web offset	14.8	10.7	9.9	9.1	6.6	-7.7
Gravure	12.1	10.4	10.2	10.1	9.2	-2.0
Flexo	31.2	32.2	32.9	33.6	33.8	0.6
Screen	3.1	2.4	2.3	2.1	1.6	-6.4
Letterpress	0.2	0.1	0.1	0.1	0.1	-7.1
Other	14.3	14.7	15.0	15.2	15.5	0.7
Electrophotography	9.9	11.6	11.7	11.3	10.2	-2.7
Inkjet	8.5	11.5	12.5	13.5	19.4	9.2
Total	**145.4**	**137.1**	**136.7**	**136.4**	**133.5**	**-0.5**

A4 prints (billion)						
Sheetfed litho	1.163	978	951	928	828	-2.7
Heatset web offset	2.546	2.029	1.972	1.909	1.707	-2.8
Coldset web offset	5.944	4.762	4.497	4.259	3.473	-5.0
Gravure	1.118	870	846	831	749	-2.4
Flexo	1.628	1.614	1.646	1.685	1.740	1.1
Screen	46	38	37	36	30	-4.1
Letterpress	16	12	11	11	9	-3.8
Other	306	292	292	293	284	-0.6
Electrophotography	164	152	147	140	124	-3.3
Inkjet	83	136	159	179	298	13.4
Total	**13.015**	**10.882**	**10.559**	**10.272**	**9.244**	**-2.6**

SOURCE: Smithers Pira

The fastest growing process in Western Europe is inkjet, with the market growing from €8.5 billion sales in 2012 to €12.5 billion, with a forecast of €19.4 billion by 2022. Over the next five years there will be a 9.2% CAGR (compound annual growth rate) in value which is 13.4% in print volume terms to reach the equivalent of 298 billion A4 prints. This is the only print process showing growth in publication and graphics applications. Flexo is also growing, but most of this is in packaging or label printing. Electrophotography (toner print) is falling in volume across the period, and in value terms after 2017. Part of this is the falling mono toner overprinting in transaction and direct mail; but there are also falls in colour cut sheet digital toner print and one of the reasons for this is the arrival of B2 digital machines, particularly the high-quality inkjet presses.

In 2012 inkjet accounted for just 0.6% of all print volume in Western Europe, but 5.9% of the value (display and signage are high value print products). In 2017 the growth means inkjet is 9.1% of the value and 1.5% of volume and this rises to 3.2% by 2022 when it will be 14.5% of all print value.

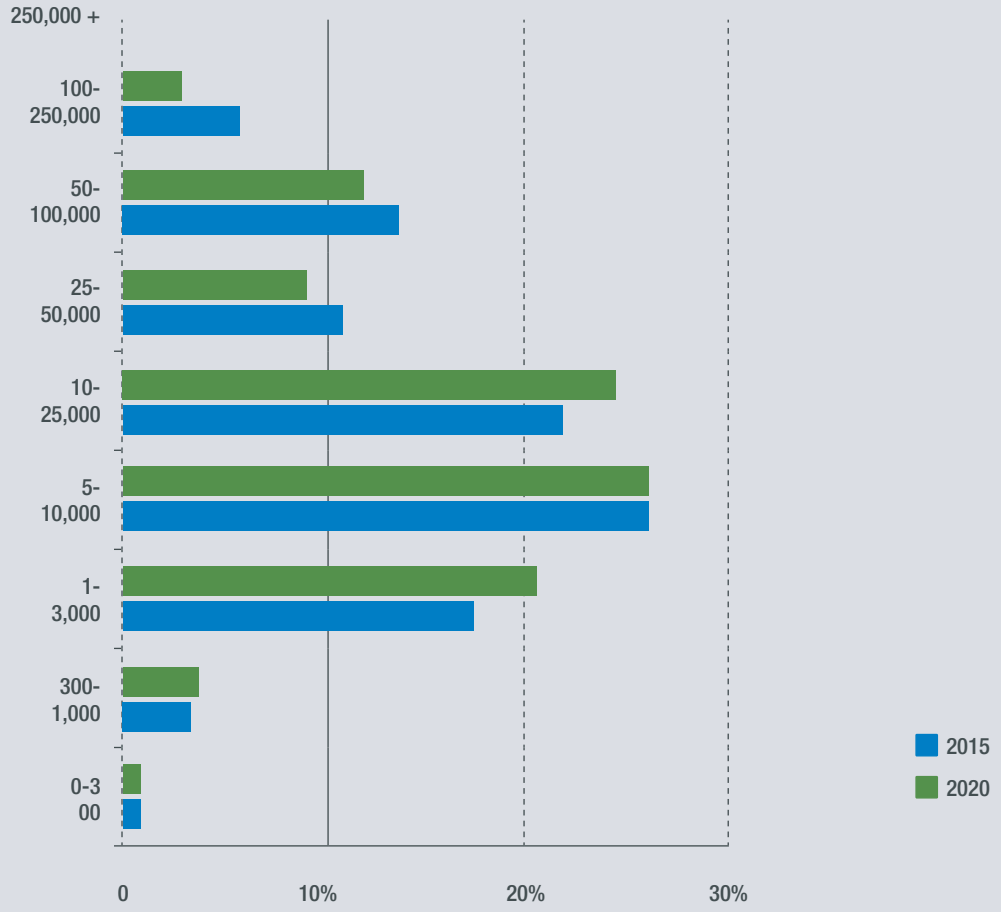
Inkjet is grabbing share because it is well suited to the changing market requirements of print buyers. Smithers Pira regularly conducts surveys on print markets, one of the questions asked covers run lengths. In 2016 several hundred commercial print suppliers and buyers were surveyed and asked about the average run length of jobs produced or bought in 2015, with a prediction of the lengths required in 2020. The results are shown in the table and figure below.

Commercial print run lengths reported by printers and buyers

	% GE OF JOBS		% GE SHARE CONVERTED	
Run length	**2015**	**2020**	**2015**	**2020**
0-300	0.8	0.9	0.0	0.0
300-1,000	3.5	3.7	0.2	0.2
1-3,000	17.5	20.6	1.9	2.8
3-5,000	26.0	26.1	6.7	8.4
5-10,000	21.8	24.5	12.0	16.9
10-25,000	10.9	9.1	12.1	12.6
25-50,000	13.7	12.0	35.2	38.5
50-100,000	5.8	3.0	32.0	20.6
100-250,000	0.0	0.0	0.0	0.0
250,000+	0.0	0.0	0.0	0.0

SOURCE: Smithers Pira Survey, summer 2016

Run lengths of jobs reported - by commercial print prividers



SOURCE: Smithers Pira Survey, summer 2016

This shows that 47.8% of all commercial jobs are under 5,000 copies in 2015, rising to 51.3% in 2020, as the trend toward shorter runs continues – with customers demanding more relevance in their jobs, and seeking to minimise waste. The push toward lower runs is a major driver for digital print, with larger format presses taking share from the smaller ones as the technology is proven and the economics of the new presses provide benefits over smaller, less productive systems.

CHANGING INKJET MARKET DYNAMICS

Inkjet is broadening into more applications in publication, advertising and commercial print, enabled by improvements in print quality. Inkjet was used in print for proofing, on a special paper with the file colour managed to emulate offset printing. The quality was fine, but the productivity and cost of the output was far too high. The first inkjet products were in display and signage: viewed from distance the quality was fine, but up close it was not good enough for most publishing or commercial applications.

Single-pass inkjet systems were introduced around the turn of the century. These provided benefits in productivity, but quality was limited, and there were many noticeable imperfections and lines seen in the product. For transactional printing this was not too much of a problem as the content was the key element; and this was also seen as acceptable in mono book printing and in newspapers. Suppliers pushed the quality, and succeeded in eliminating many of the print faults. This opened the possibility of more applications, and the arriving sheetfed colour presses were firmly aimed at the markets served by sheetfed offset litho.

This is enabling a significant change in the printing process mix, with inkjet growing faster than any other process, across a range of applications detailed in the table below.

West European print inkjet printing markets by application 2012-22 - by volume (A4 million prints, or equivalent)

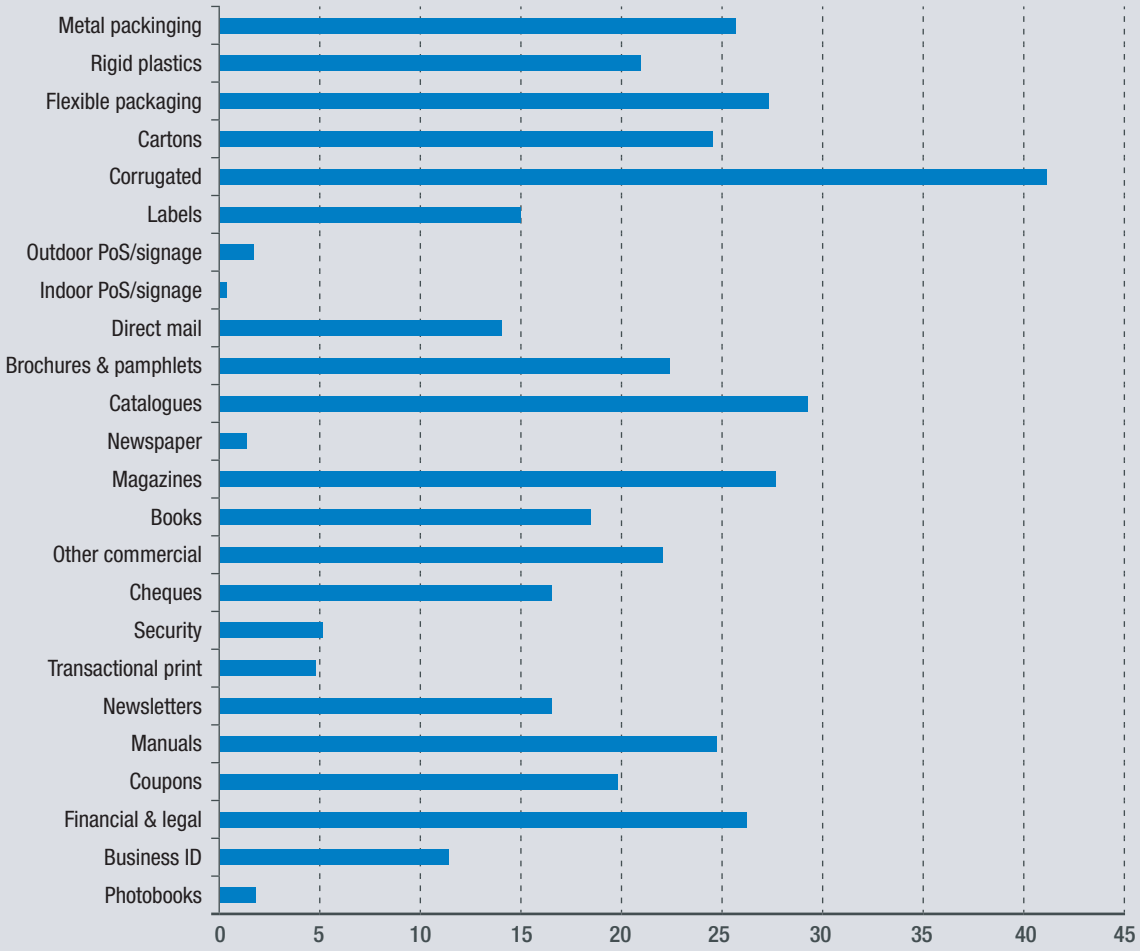
A4 million prints	2012	2016	2017	CAGR % 2012-17	2018	2022	CAGR % 2017-22
Photobooks	527	617	634	3.7	643	691	1.7
Business forms	5.568	6.089	6.696	3.8	7.329	10.020	8.4
Business ID	581	979	1.118	14.0	1.262	1.917	11.4
Financial & legal	18	151	220	64.5	298	702	26.1
Coupons	913	990	1.172	5.1	1.388	2.886	19.7
Manuals	20	69	92	35.3	117	273	24.4
Newsletters	17	29	34	15.3	40	72	15.8
Transactional print	23.991	33.673	35.959	8.4	38.005	45.563	4.8
Security	1.711	2.497	2.639	9.1	2.783	3.370	5.0
Cheques	8	49	64	50.1	79	136	16.3
Other commercial	2.550	5.029	5.896	18.3	6.872	15.852	21.9
Books	3.513	7.565	9.362	21.7	11.442	21.787	18.4
Magazines	1	55	83	152.7	114	281	27.6
Newspapers	2.743	2.921	2.959	1.5	3.003	3.168	1.4
Catalogues	4	74	106	93.4	148	383	29.2
Brochures & pamphlets	0	212	279	na	358	762	22.3
Direct mail	22.116	46.285	55.566	20.2	65.101	106.324	13.9
Indoor PoS/signage	10.721	11.025	11.035	0.6	11.058	11.217	0.3
Outdoor PoS/signage	2.373	3.033	3.077	5.3	3.123	3.326	1.6
Labels	4.748	11.913	14.365	24.8	17.188	28.705	14.9
Corrugated	728	2.258	6.882	56.7	7.882	38.492	41.1
Cartons	63	200	271	33.9	366	809	24.5
Flexible packaging	58	190	270	36.1	383	899	27.2
Rigid plastics	64	159	202	26.0	258	523	20.9
Metal packaging	4	10	14	31.9	19	44	25.6
Total	**83.038**	**136.073**	**158.995**	**13.9**	**179.261**	**298.202**	**13.4**

SOURCE: Smithers Pira

Over the next five years to 2022 the total print market in Western Europe will almost double in print volume terms. Packaging will grow most rapidly, as new presses capable of handling the formats demanded are introduced to the market.

In publishing and commercial print there are very high growth rates seen from 2017 to 2022 – in catalogues, magazines, brochures, manuals, financial printing, coupons, and sundry other applications that are new for inkjet. In books inkjet will start to be used for high-quality colour covers and sleeves, as well as mono text sections.

West European inkjet print average CAGR 2017-22 - by print volume



SOURCE: Smithers Pira Survey, summer 2016

It is the arrival of flexible high-quality inkjet presses that boost the adoption to 2022: with affordable machines that fit into the established workflow, materials and (importantly) the finishing equipment that many sheetfed litho print houses operate. The Konica Minolta AccurioJet KM-1 press is very much at the forefront of this changing market.

ACCURIOJET KM-1 TECHNOLOGY

The B2 AccurioJet KM-1 inkjet press from Konica Minolta delivers high-quality print results. Colours are bright, clean and smooth, with crisp and clear text and linework. This is a result of the press design, a combination of the printheads, inks and drying, with the substrate transport and control, as well as the digital front end and associated workflow.

PRINTHEADS

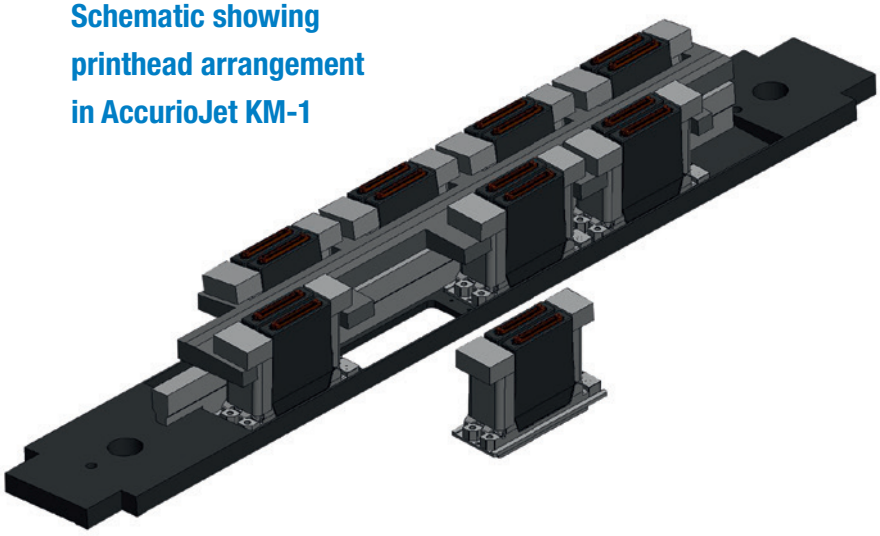
The AccurioJet KM-1 uses KM1800iSHC printheads from Konica Minolta. These have a native resolution of 600dpi, with 1,800 nozzles arranged in two rows across the 75.5mm print width. These are arranged in a compact print bar, with 16 heads across the 585mm print width, to deliver a resolution of 1,200dpi in a simple and rigid chassis. Individual heads are easily positioned accurately to provide seamless joins that deliver smooth tones with no apparent inkjet artefacts, even under magnification.

Two heads are mounted into a module with eight of these in the print bar for each colour, with a total of 64 heads in the press. Konica Minolta developed a new drive waveform, with a new structure of independent pressure chambers, to enable high productivity and stable jetting property at firing rates of 41kHz, using a dual drop size.

The heads operate at an elevated temperature when jetting, to reduce the viscosity of the ink at the jetting stage, and this provides a significant advantage to the image quality by design. The effect is to freeze the drops in flight before they hit the paper or substrate surface, controlling unwanted effects of dot spread and coalescence effects.

SOURCE: Konica Minolta

Schematic showing printhead arrangement in AccurioJet KM-1



INKS

Konica Minolta has developed a series of UV curing inks for use in the KM-1 press. Using UV curing without a need for a primer eliminates the presence of water that can be absorbed by paper, resulting in curl and dimensional instability that can adversely affect duplexing, paper stacking, and subsequent finishing processes. Inks are UV-LED cured, and are jetted at high temperature to optimise the performance in the head, and to deliver excellent print quality. The ingredients are chosen to ensure ink stability at high temperatures over a long shelf life, while providing fast through curing rate under UV-LED radiation. The technology is patent protected.

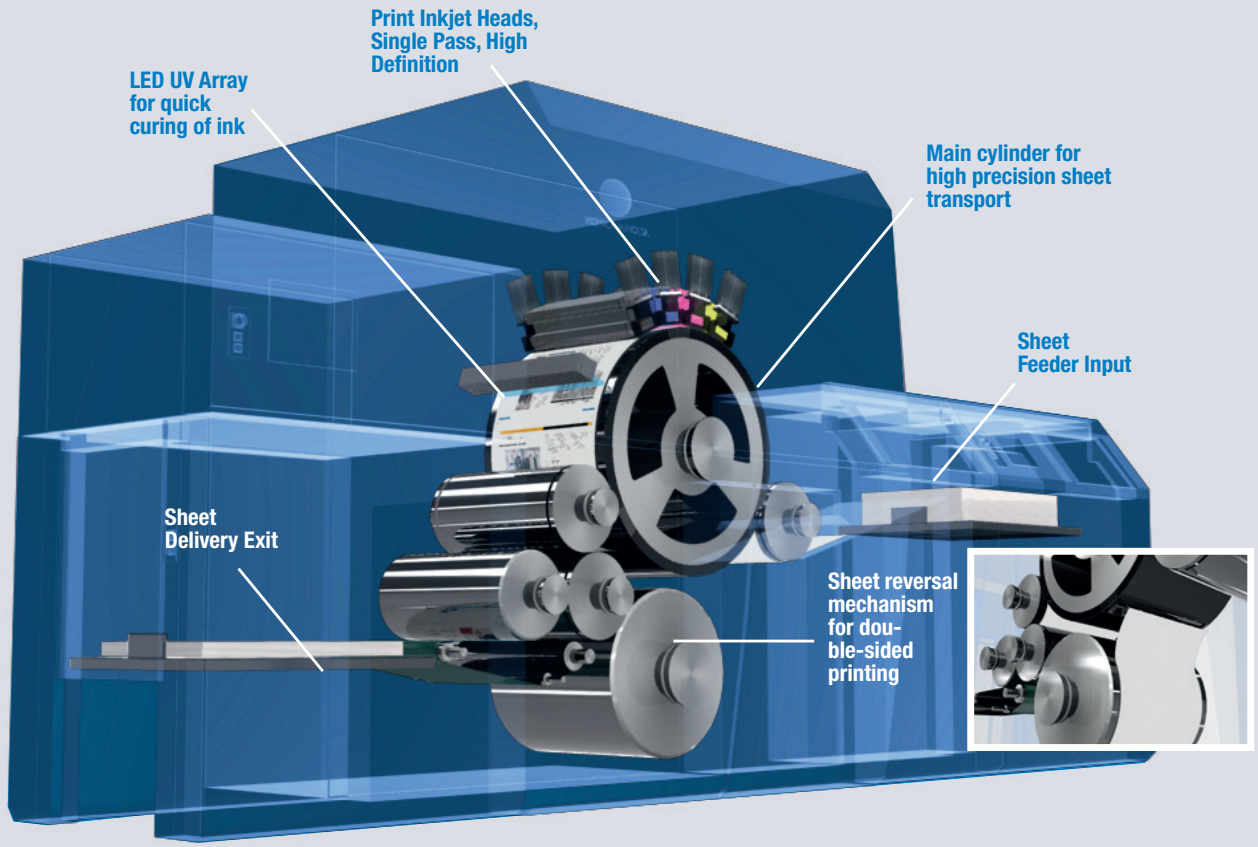
The patent covering the ink development explains the sol-gel behaviour of the ink. At high temperatures the ink acts as a sol (a liquid with viscosity between 3-20mPa); at lower temperatures it becomes a gel, with viscosity up to 1,000mPa at 25°C. Konica Minolta formulates the ink to transition into a gel (when viscosity rises to 200mPa) during the transit from the printhead nozzle to the surface of the substrate, both of which are carefully controlled in the press. This effectively immobilises each droplet of ink when it is printed, stopping neighbouring drops combining and coalescing, which can occur in uncontrolled inkjet printing. A side effect of this dot pinning mechanism could be an uneven print surface with variable gloss levels in machine and cross-machine direction. To overcome these effects Konica Minolta developed a novel screening process that controls the spatial frequency of the multi-sized dot pattern, to stabilise gloss levels in halftones.

The result is clear and crisp imagery, the pigment remaining at the surface to give bright, high saturation results on any substrate without the requirement for surface treatments. It looks like good litho printing.

PRESS DESIGN

The AccurioJet KM-1 is a striking ergonomic design, combining form and function with the operator performing routine maintenance tasks including changing heads if needed with no need for a service call and the associated downtime. The paper transport is provided by a leading litho press manufacturer using standard feeding and stacking methods, with the sheets held by vacuum on the surface of a high circumference printing cylinder under the printheads and LED curing. There is an in-line sensor monitoring the print quality on each sheet, and the presses includes a reversing drum to allow duplex printing in-line before delivery.

Schematic showing printhead arrangement in AccurioJet KM-1



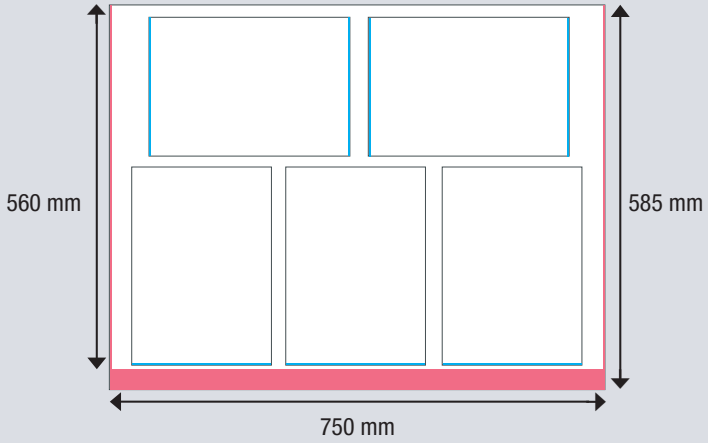
SOURCE: Konica Minolta

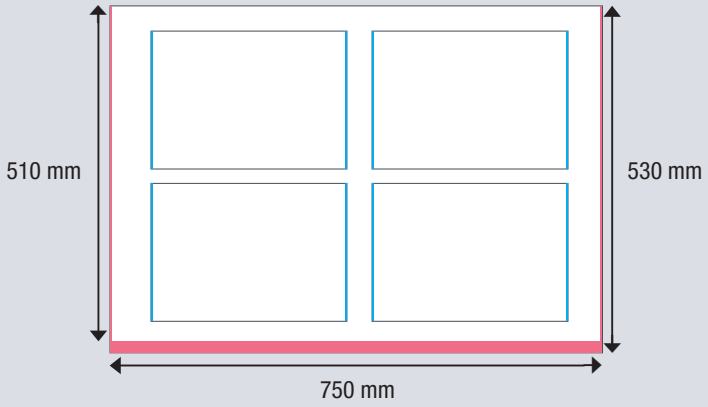
The press runs at 3,000 sheets per hour (1,500 duplex sheets) with high capacity infeed and delivery. The press handle stocks up to 600µ (0.6mm) in thickness, including textured sheets and plastics. It has a footprint of 5.4m x 3.0m, with the press weighing in at 9 tonnes. Warming up the press before printing is necessary, for the ink and print cylinder to get to the requisite temperatures to optimise print quality. The print surface is held at 30˚C, using LED curing means there is no significant heat transfer at curing meaning heat-sensitive substrates can be printed, and the lack of heat contributes to a flat pile read for subsequent processing in the delivery.

The press handle sheets up 585mm x 750mm, significantly larger than some of the competing digital B2 presses. This can yield advantages in productivity, with the capability of delivering 5 x A4s per impression in a “Stonehenge” imposition scheme, rather than the more usual 4 x A4s.

It could also deliver 10 x A5, but the bleed allowance would be reduced. The minimum print area size to allow this is 519mm x 648mm – although there are users of other “B2” digital presses that reduce the bleed to fit into 510mm depth. This can cause problems when pages bleed, but for designs with no coverage at the edge a single cut can work with no registration issues.

A4 print impositions on B2 and KM-1 (bottom) paper sizes





SOURCE: Konica Minolta

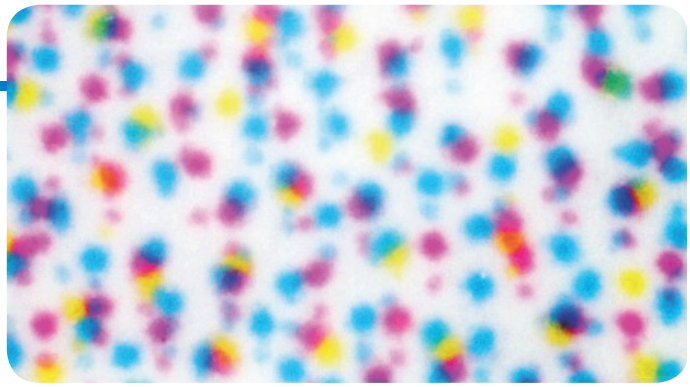
ACHIEVABLE PRINT QUALITY

The combination of print machines and ink delivers very good print quality on a range of substrates that do not require priming. The four colour machine delivers offset litho-like quality, with the output meeting many of the emerging commercial print colour standards, including the ISO12467-2 (sheetfed litho equivalent).

The first thing that printer will notice when examining the output is the lack of inkjet artefacts – particularly lines in the print direction – that are common in much inkjet printing.

The two figures below are micrographs from a three-colour flat tint printed on the KM-1 at low and high magnification. When looking at the prints from the AccurioJet for the first time, observers will be struck by the bright and clean results, excellent registration and crispness of text and linework, and very smooth continuous tome imagery. Tints are very smooth and level, even across large areas. Under magnification there is none of the typical inkjet appearance seen from other printing systems, which have noticeable lines in the print direction.

High magnification of flat tint showing dot consistency

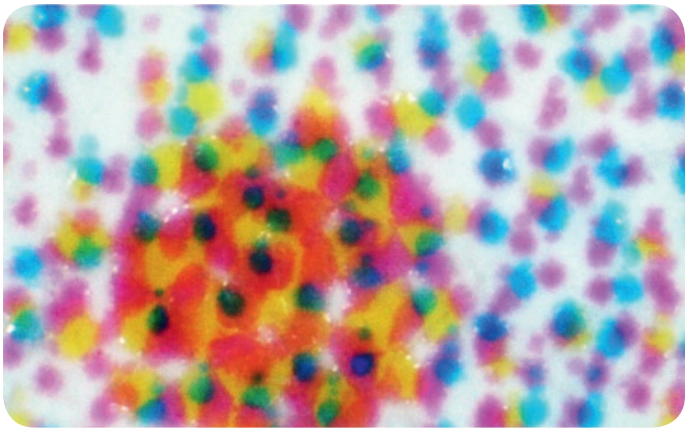


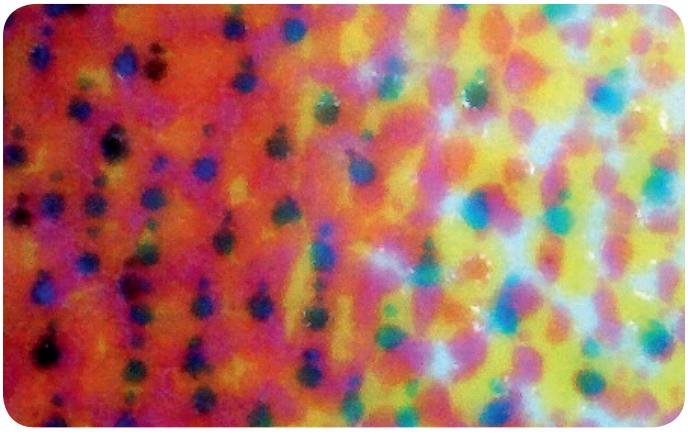
Low level magnification of flat tint on AccurioJet KM-1 showing no lines and artefacts and colour consistency

SOURCE: Konica Minolta

Print screening is a stochastic frequency modulated approach, using very small dots in “randomised” positions that avoid patterning from individual dots being seen by the naked eye. There is no sign of any coalescence where individual drops merge together when they are closely adjacent, the ink system design means droplets are cured where they land, meaning there is a very smooth gradation as the tonal weight increases. This results in prints that have very few defects, even under very high magnification. The Konica Minolta KM-1 is an inkjet press that certainly does not fear the loupe.

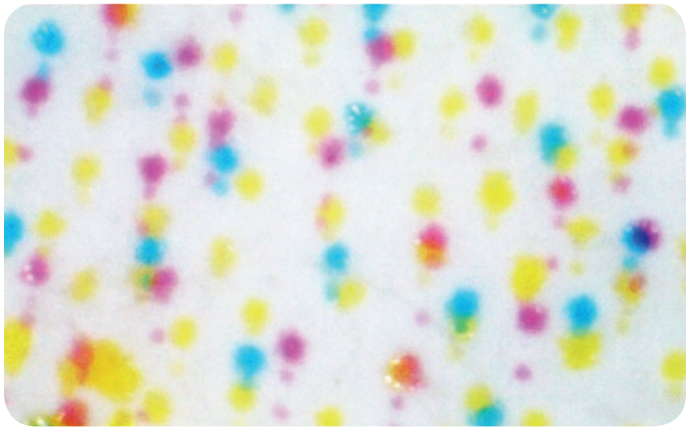
The following micrographs show the clarity and consistent dot formation of continuous tone printing on the AccurioJet KM-1 from a commercially printed sample, “Infinité” printed at a Japanese customer site. Even in midtone and more heavily inked areas there is no sign of uncontrolled coalescence and dot spread; every dot is frozen in the correct position at the surface of the paper.

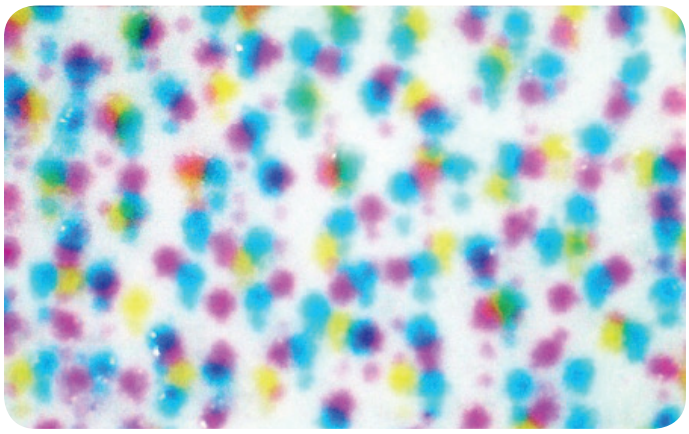




SOURCE: Konica Minolta

Micrographs showing the clarity and consistent dot formation of continuous tone printing on the AccurioJet KM-1





The comments of the early users of the Konica Minolta AccurioJet KM-1 all highlight the high achievable quality as one of the reasons for making the investment. Joy Gendusa, CEO of PostcardMania in the US, was one of the first users, saying: “The press allows us to produce high-quality, short run variable data jobs at up to 1,500 perfected sheets per hour.”

In Australia the owners of three Minuteman Press franchises in Melbourne have bought the first KM-1, to use as the core production unit at a new central print hub they are creating to serve the stores. Owner Simon Crabtree says: “The quality is at an offset level, it prints on offset stocks with no pre-coat or post-coat, and has robust engineering. Our clients are demanding this level of quality, this enables us to meet that requirement, but without having to use offset presses. The speed and productivity of the KM-1 are impressive but it is the quality that we went for, it is at another level and will be warmly welcomed by our growing client base.”

SUMMARY

The AccurioJet KM-1 is very different to other large format digital presses coming onto the market. It is a robust press, designed to deliver very high-quality durable results on a wide variety of substrates. The simple paper path contributes to the high uptime, and the press will fit in with the traditional litho workflows operated in many commercial print companies, as well as providing print that can be easily finished on traditional bindery equipment in wide use.

As customers take delivery of their presses they are discovering many applications that the machine is well suited to deliver, with substrate and production flexibility and agility toward the top of the list.

PLS (PRINT LOGISTIC SERVICES) IN MARKKLEEBERG

The first European customer for the AccurioJet KM-1 is PLS, based near Leipzig in Germany. PLS is a subsidiary of the US online printing service OvernightPrints, providing rapid response and overnight printing service for a wide range of products, servicing clients through webshops.

Crucial to its double-digit annual growth is the expansion of its OvernightPrints product range – and the Konica Minolta AccurioJet KM-1 is playing a central role in the development of new services and offerings. In the past, PLS used both offset and toner printing to fulfil client requirements, due to the high expectations they place on quality, fast turnaround times and service. PLS's business model is based on an average run length of 160 sheets. Conventional offset printing became impractical for the company, because the quantity of wastage using this technology ranges from 70 to 150 sheets per job.

It has seen three major benefits of the KM-1 press for the business:

- Enhanced paper handling and workflow technologies
- Using UV inks enables the company to move work quickly and easily to finishing with offset quality on standard offset stock. This brings the advantage of not having to pre-coat or to use a special suitable digital stock
- Superior production capabilities compared to competitor models because of the Konica Minolta expertise in inkjet head design and inline controls that monitor quality

Visiting the facility – as Smithers Pira did in the research for this white paper – is instructive, with slick production workflows delivering many short run jobs on a wide variety of substrates.
Arndt Eschenlohr is president of PLS. He is a veteran of digital print, with the group also using B2 toner and inkjet presses as well as the AccurioJet. He says:

"I have never known a technology like this. It is better than offset printing – that is for sure. One of the added benefits is that wastage is kept to a minimum. The AccurioJet KM-1 has enabled us to move into new markets, such as packaging, which we are confident will be a major growth area for digital printing."

PLS has demanding requirements, which makes it exactly the right customer to really push the AccurioJet KM-1 to its limits. Mark Hinder, head of market development for Konica Minolta Business Solutions Europe, comments: "Through working closely in a successful business partnership focusing, not only have we proved the robustness of this industrial inkjet press, but we are proving to PLS customers that we can match offset quality to provide online printers like PLS a real alternative now. Our focus now is to push even further through testing plastics and packaging materials to allow PLS growing further its capabilities to capture new market opportunities that UV inkjet can create. We've worked closely with Arndt and his teams to identify and assess how the AccurioJet KM-1 will open up important new markets and grow business for PLS. This world-class digital production system is a highly flexible, adaptable platform for innovative customers looking to expand their capabilities."

INKJET VERSUS LITHO – THE CHALLENGE OF QUALITY

Offset lithography remains the process of choice for many applications including magazines, brochures, marketing collateral and promotional print. Continuing developments in inkjet technology mean inkjet can now compete on quality for most applications in commercial print and packaging, as the AccurioJet KM-1 amply demonstrates. Konica Minolta is also a key player in toner printing and owns the majority of shares in MGI, the French company that is reporting considerable success in print embellishment with spot UV varnishing, dimensional tactile results, and foiling to deliver stunning effects. Konica Minolta has produced a range of samples of commercial and packaging output, showcasing the fantastic effects that can be realised for luxury and premium printed products.

A significant advantage of the KM-1 press over competing digital machines and also much sheetfed litho is the flexibility of substrates, from lightweight papers to thick non-absorbent foiled boards and plastics. It is very good with textured stocks where the non-contact inkjet printing with frozen ink droplets perform very effectively. There are no issues of drying and marking on recycled papers and boards, or on non-absorbent films and foils. The UV curing inks provide excellent durability and scratch resistance, performing well in postal applications with no need for protective coating or lamination, and in carton production and use. Print service providers looking to broaden the ranges of substrates.

A white paper from Smithers Pira,
commissioned by Konica Minolta

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