SINGLE PASS TECHNOLOGY REVOLUTIONISES COLOUR PRINTING

All Colour, All the Time

Look around. It's a colour world. The video, movies, billboards, computer displays, and advertising we encounter every day are in colour. In fact, colour is so much the standard, that black-and-white in most media is used for its shock effect. Colour is not merely decoration. Colour informs, organizes, emphasizes and identifies. Colour reduces complex information to a single image that is understood with a glance.

A home computer isn't complete these days without an inexpensive, liquid inkjet printer. For the kids' book reports and printing emailed pictures of the party you missed, ink jet printing is fine. If two pages take 15 minutes each to print, it doesn't matter. But in the office, colour printing is just starting to come on strong.

When a business's image, an important sale – or that first sale – is on the line, inkjets aren't up to snuff. The only alternatives for high quality colour, up until now, have been expensive and slow. Older technologies and four-pass laser printers all produce near-photographic colour. But they are all slow for the same reason: each of them must apply four colours of ink, one at a time, with microscopic precision. This greatly increases the printing time for colour compared to black-and-white and also increases the chance of badly aligned colours. The complexity of the apparatus also adds to the cost and maintenance of the printers.

Single Pass Colour Technology

Fortunately, there are now three answers to the complexity of four-pass colour printers. Each uses a different method to put four colours on a page, but what they all have in common is that they are *single pass printers*. Each of them applies four colours to a page simultaneously. Single pass colour printing provides inexpensive, fast, and superior quality colour printing that transforms the look and capabilities of everything from an annual report to a last-minute presentation to an everyday memo.

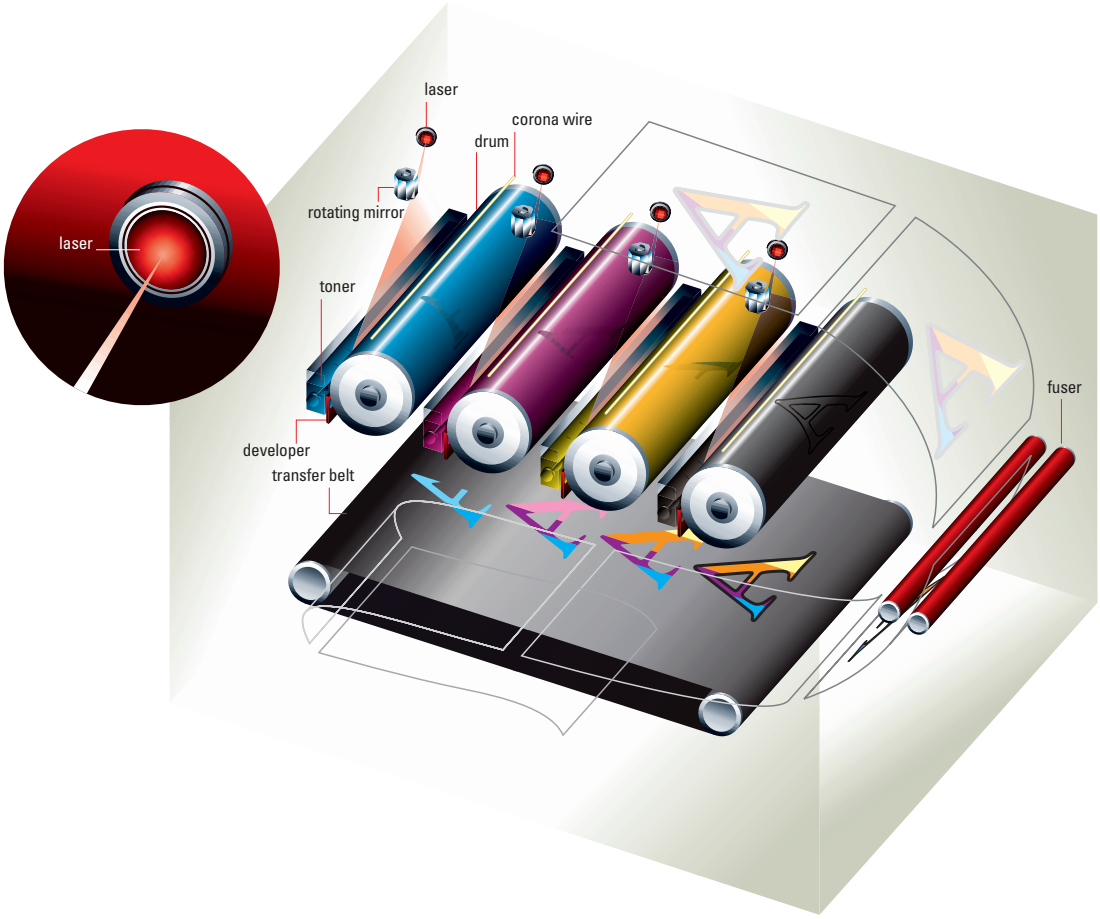
One of the three technologies is the *single pass colour laser* –also called *tandem laser* colour printing. It is a clever adaptation of the old black-and-white laser printer. The second is a similar printer that uses LEDs – light-emitting diodes – instead of lasers. The third, the solid ink colour printer, forgoes traditional inks and toners for ink that comes in solid blocks. Despite their different methods of putting four colours on a page, they have in common one important characteristic. The three technologies get four colours on a paper all at once.

Single pass colour laser printers use four lasers, four separate toner cartridges, and four rotating photo conductor drums. The toner cartridges and drums are placed along the path the paper follows as it moves through the printer. In quick succession the drum picks up all four colours of toner before transferring them at the same time to the paper. This provides printing speeds that have never been seen before in desktop or workgroup printers. (The single pass laser is not the first time laser technology has been used to produce full colour. An older *four-pass colour laser* uses a single laser sweeping across the surface of just one drum to draw the pattern of dots to be created for one colour. Then the drum transfers the powder to a sheet of paper or an intermediate belt. To add the other three colours, the process must be repeated three times. Not only does this take more time (an average four-pass colour laser printer delivers 4 ppm, while Xerox's latest single pass colour laser delivers 22 ppm), but it also risks poor colour alignment because of the paper's or belt's repeated movement forward and back to reposition itself for each different colour).

The *LED colour printer* is similar to single pass laser colour – except for the lasers. In their place are four strips made up of thousands of individual light-emitting diodes. They perform the same function as the lasers, drawing patterns on four separate drums, one for each toner colour. The drums hand off their toner to a moving belt that travels on to meet the paper and apply all the toner at once.

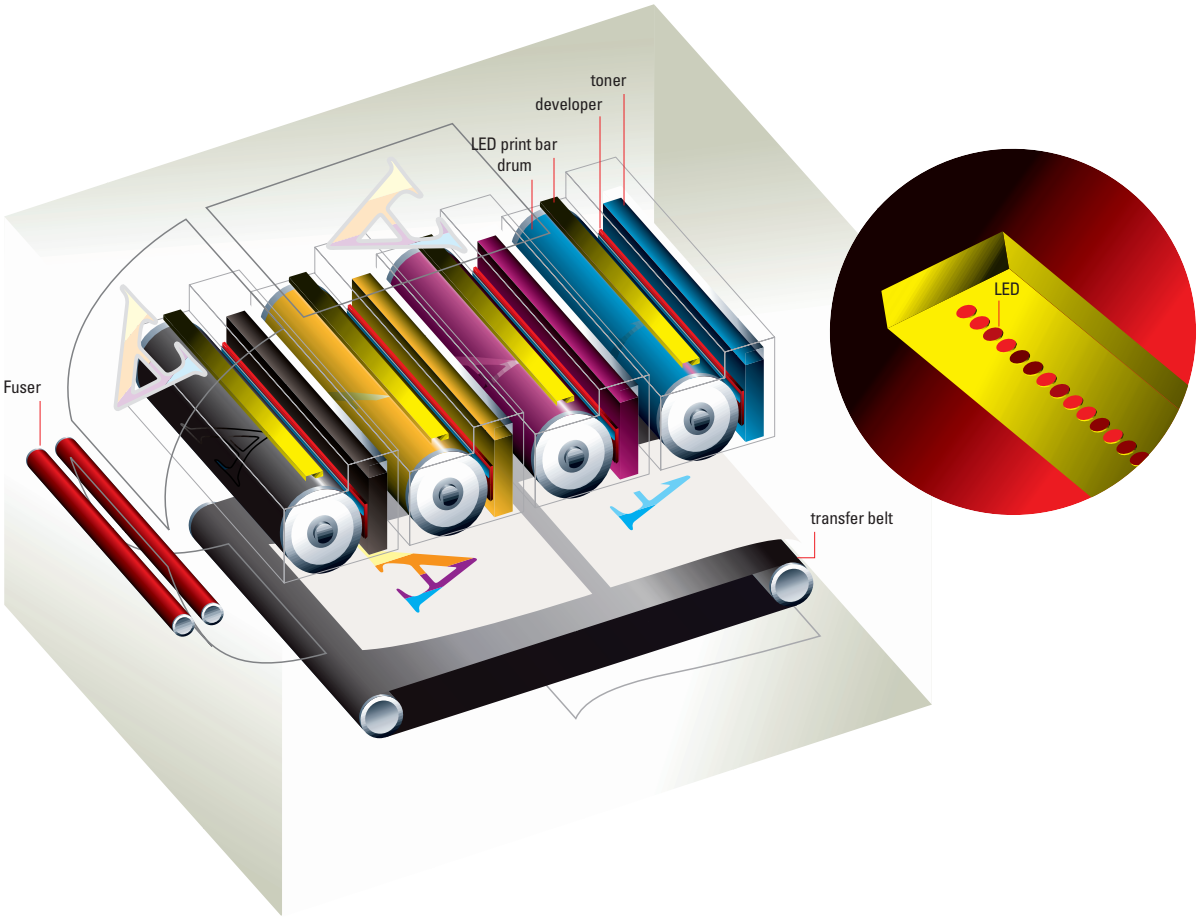
A remarkably different technology is used in the *solid ink colour printer*. Instead of toner or liquid ink, the colours come in the form of solid blocks of resin-based ink. The printer melts the ink blocks and sprays miniscule dots of all four colours (which solidify instantly) simultaneously onto a single drum – similar to the mechanics of an offset press. The method is similar in its simplicity to that of liquid inkjet printers, but without the slow speeds. Solid ink printing is also as fast or faster than four-pass laser printers, without the complexity. And the result is brilliant, saturated colour that doesn't fade or smear if it gets wet, as liquid colour does.

Xerox provides all three technologies in its latest network colour printers. The Xerox Phaser 7700 is a single pass colour laser, while the Xerox Phaser 2135 and Xerox Phaser 1235 both utilize LED technology. The Xerox Phaser 860 is the latest solid ink printer. The printers provide different combinations of quality, speed, price, and ease of maintenance. But any of them produces full colour good enough for the fussiest art director, fast enough for the busiest staffer, and affordable enough for the stingiest business manager. And they do it with single pass technology.



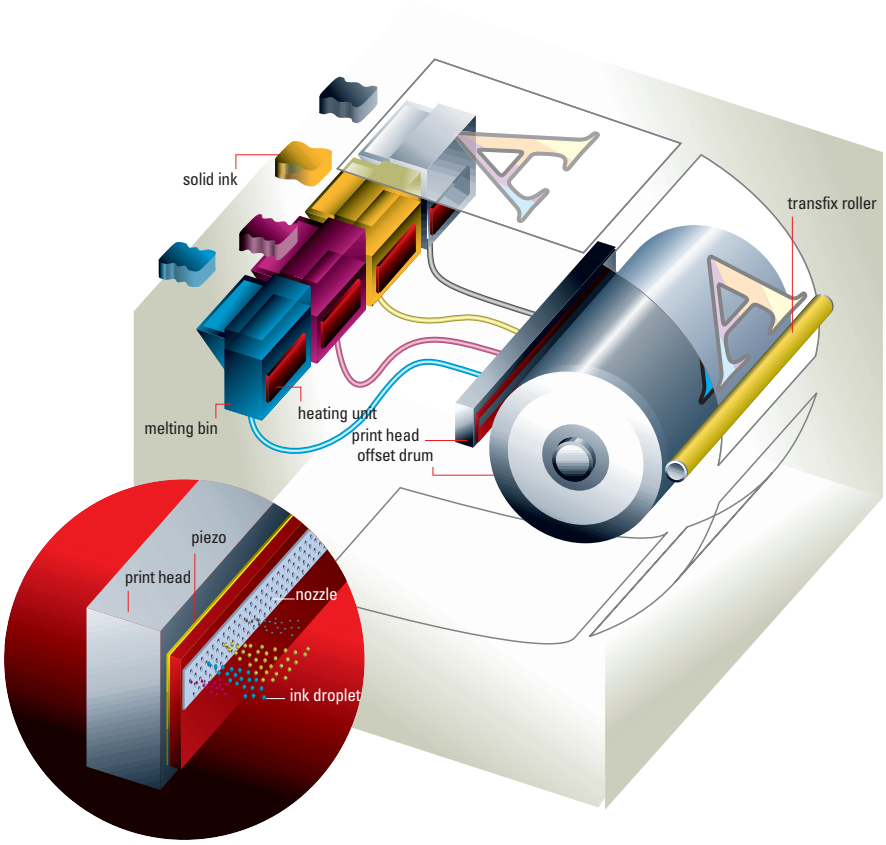
The Single Pass Colour Laser Printer

1. Four cylindrical *organic photoconducting cartridge drums*, coated with a material that is sensitive to light, rotate past four *corona wires*. The electrostatically charged wires create negative charges over the entire surfaces of the drums.
2. Four lasers direct beams of light at a rapidly rotating mirror that sends each of the laser beams on a separate path to a different drum, where the beams sweep across the width of each drum. Wherever light strikes the drum, it turns the negative charge into a positive one, creating the *latent image*, which will provide the basis for the final printed image.
3. Each of the drums is paired with a *developer*. Corkscrew-like augers move cyan, yellow, magenta, and black toner from four bins to the developers. The developers give the plastic-based, powdery toner a negative charge.
4. As the drums turn past the developers, the positively charged areas formed by the lasers attract colour toner to the drums.
5. The turning of the drums brings their toner-coated surfaces in contact with a negatively charged *intermediate transfer belt*. All the steps in the process so far have been timed so that each drum meets the moving belt a few moments after the preceding drum. This aligns all four colours of toner so the resulting image is registered to form a single four-colour image.
6. As the toner is being transferred to the belt, the paper train grabs a sheet of paper and moves it along a path that brings it into contact with the belt, now carrying the four colours of toner. The belt transfers its toner to the paper, which finally passes through a *fuser* where rollers and heat meld the toner into the paper.



The Single Pass LED Colour Printer

1. The single pass LED colour printer has similarities to a tandem laser colour printer. The process begins with separate drums that are fed the four colours of toner, as is the laser printer.
2. The negatively charged drums in the LED printer are combined with the bins and developer unit for cyan, yellow, magenta and black toner.
3. The significant difference between the LED and laser colour printers lies in the way light is generated to create the microscopically small dots used to attract toner. For each drum the printer uses 7,500 small light-emitting diodes laid in a tight row, hovering just above the surface of the drum.
4. Printing instructions cause specific LEDs to flash rapidly. Some bursts of light are stronger than others. The brighter and dimmer intensities of light, respectively create larger and smaller positively charged dots in the drums' latent images. Areas untouched by the LED lights are destined to remain the colour of the paper.
5. After passing under the LED *printbars*, the drums pick up their payloads of toner.
6. Instead of the transfer belt used by the laser colour printer, the single pass printer's drums transfer the toner directly to a sheet of paper or acetate that moves beneath all the drums on a transport belt. As with the colour laser printer, all the movements of the drums and paper are coordinated to ensure the colours are properly registered.



The Solid Ink Colour Printer

1. A solid ink colour printer, unlike the laser and LED colour printers, uses no light source or organic photoconducting cartridge. Instead, the printer uses *solid ink*, a combination of coloured resin and plastics. The printer's cyan, magenta, yellow, and black ink sticks are loaded through slots that have a different shape for each colour.
2. Separate heating units for each colour melt the sticks into liquids that collect in separate reservoirs.
3. The inks flow to a single print head that stretches nearly the width of a sheet of paper. The print head has 112 nozzles in each of four rows that stretch the width of the print head. The print head covers the entire width of the paper by moving back and forth horizontally by only a half inch. All four colours are applied at the same time.
4. At the back of each nozzle is a wall made of *piezo electric crystal*, a crystalline substance that flexes when electricity passes through it. The piezoelectric controller pushes ink into the nozzle from the reservoir by bending outward. The stronger the current, the more the piezo bends, allowing the printer to control the size of the ink droplet. When the current is turned off, the piezo snaps back into its original shape shooting the ink onto a turning *offset drum* that is kept warm so the ink does not completely solidify immediately.
5. After the image is formed on the drum, it revolves, coming into contact with a sheet of paper. With the help of a *transfix roller* on the opposite side of the paper, the drum presses the still ink into the paper. Before the printer ejects the paper, it moves the sheet between two rollers that fuse the ink to the paper.

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