

# Top dog inkjets

**After the PC itself, the inkjet printer has become an essential and increasingly affordable piece of equipment. So, if you need to produce professional-quality photos, or just want to print that important word-processing document, then we've got eight of the best to help you on your way.**

**T**he Internet has changed the way a lot of documents are published – traditionally it was print and distribute. Now it's distribute and print as companies and individuals put their information online and we, the users, print it, so it's not surprising that after the PC itself, the relatively inexpensive inkjet printer is perhaps the most common IT purchase. There are just four key players – Canon, Epson, Lexmark and Hewlett-Packard, and our brief was simple. We asked each to submit two printers – one for home users and another for higher-end colour professionals.

We wanted to be able to print photos, plain text and a range of content in between, including vector images and a university dissertation. For the full document rundown and what we were hoping to see, take a look at 'How we did the tests' on p210. Some models did better than others, as is always the case, but remember that quality is not the be all and end all. While you need professional results you certainly don't want to end up waiting all night for a job to complete. We also looked at how the printers performed on both proprietary inkjet paper and standard photocopier paper. After all, you don't want to be shelling out for inkjet paper when all you want to print is a word-processed document.

If you had preconceptions about who is top dog in the printer arena, you may find yourself thinking again because, as our exhaustive tests showed, advances in technology have brought the four contenders closer together than ever before.



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• *Printers reviewed and tested by  
Nik Rawlinson and Jalal Werfalli.*

## ratings

- ★★★★★ **EXCELLENT**
- ★★★★ **VERY GOOD**
- ★★★ **AVERAGE**
- ★★ **BELOW AVERAGE**
- ★ **POOR**

## Canon BJC-3000

HOME USER



Connection is by USB or parallel. Data cables are not included. You can extend its functionality with an optional scanner cartridge. It boasts the same resolution of 1,440 x 720 as Epson's Stylus Colour 760.

The driver is well organised, but can only tell you when your ink is low using text – the ink display is static. There is also a growing bar to indicate progress.

It caters for nine media types, five output quality options and eight

**THE FIRST THING** you will notice about Canon's BJC-3000 is the amount of packaging it comes in. It couldn't possibly get damaged in transit, but we were concerned at the amount of tape, foam and plastic we ended up with.

Ink wells are individually dropped into the head, which should cut down on replacement costs, but they are not keyed so it is possible to drop the wrong colour into the wrong place, which would have disastrous results.

media sizes supplemented by a custom setting. Other options cover scaling, banner printing, poster printing across multiple sheets, changing the print order and watermarking output.

Plain text on photocopy paper was well reproduced but, in our mixed text and graphics output, the greyscales had been rendered as a composite grey and took on a pinkish hue.

The 3000 made a fair stab at photo. Colours were generally realistic,

although the black resembled a dark charcoal grey and the output was grainy in parts. It also lacked definition in shaded areas, particularly on darker skin tones. The photo's graininess carried through into the vector image, although colours were bright and vibrant.

Sadly, it let itself down somewhat when printing the PowerPoint slides. Even on inkjet paper, these were badly banded and vertical lines that should have been straight were kinked in places.

It will not break any speed records, but it managed to shave 17 per cent off the Lexmark Z31's time for printing the photo and half the Z31's time to complete the 50-page Acrobat PDF document. Overall, it performed well, producing good output for home use.

### DETAILS

**PRICE** £108.10 (£92 ex VAT)

**CONTACT** Dabs 0800 558 866

[www.dabs.com](http://www.dabs.com)

**PROS** Small, good photo quality

**CONS** Fairly slow

**OVERALL** Outperformed by some of the other printers seen here

TEXT QUALITY	★★★★
IMAGE QUALITY	★★
SPEED	★★★
OVERALL	★★★

## Epson Stylus Color 760

HOME USER



The printer holds two cartridges, one black and one CMY, and installing them is a simple case of pressing a button to move the holsters to the centre of the carriage and then snapping them in. The Piezo technology used by Epson's inkjets still requires a certain amount of priming. There's a generous software bundle thrown in – Epson Print Adventure for making stickers and cards, Adobe PhotoDeluxe 3.1 Home Edition, stock photos and a media sample pack.

**THE 760 BENEFITS** from an excellent driver layout. A constantly updated on-screen monitor shows the progress and the amount of ink remaining, and an indicator tells you the number of minutes left to completion, saving you the trouble of waiting for a long job and ensuring you will not run out of ink midstream.

It has parallel and USB ports for PC or Mac connection, yet the only cable in the box is the power lead. A foldout setup sheet supplements the user manual.

The print driver dialog has a slider, allowing you to set the balance between quality and speed. If you would rather not fiddle, you can set it to automatic and let the driver decide for itself. It caters for seven media types and 25 paper sizes, supplemented by a custom option.

Other options take care of rotation, two or four pages on a single sheet and poster printing, as well as the option to reverse the print order if this is not built into your application.

The 760 was fairly speedy, beating Hewlett-Packard's Deskjet 930C in all categories. In the past, Epson printers have trailed behind in many tests but, in this instance, the photo was particularly quick, completing in just two minutes 10 seconds. However, the result was grainy and there was slight stepping in places where there should have been smooth fades. That said, there was no bleed from darker colours into lighter areas.

On photocopy paper text was less feathered than that produced by the 870 and our PowerPoint presentation was less saturated on inkjet paper. The colours were also noticeably brighter than those produced by the 870.

### DETAILS

**PRICE** £121.03 (£103 ex VAT)

**CONTACT** Dabs 0800 558 866

[www.dabs.com](http://www.dabs.com)

**PROS** Excellent vector art output, fairly fast

**CONS** Some graininess creeping into photo output

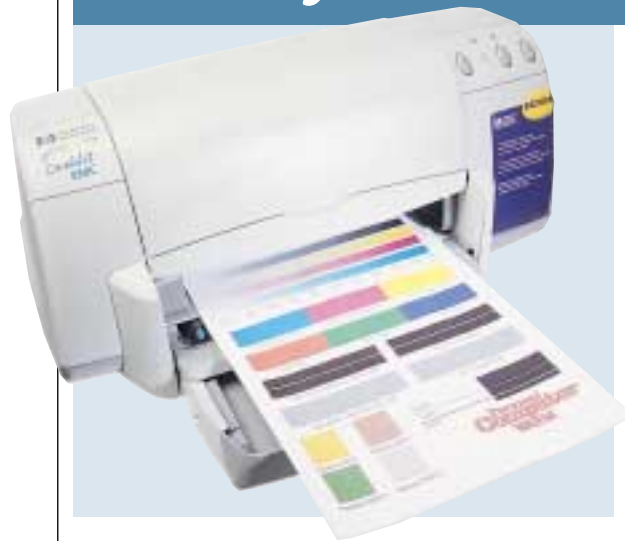
**OVERALL** A good all-round printer for general use

TEXT QUALITY	★★
IMAGE QUALITY	★★★★
SPEED	★★★★
OVERALL	★★★★



## HP Deskjet 930C

HOME USER



USB or Mac connection. The in-box bundle comes with a small media sample pack, but the only discs included were the drivers.

Problems can be easily diagnosed. The printer uses an arrow on top of the cartridge cradle to point at a series of icons at the back of the body, indicating where the problem lies.

The driver was easy to navigate. A series of tabs running along the top of each section guides you through the functions, which even included

**THE DESKJET 930C** employs the same engine as the higher spec P1100 but, without some of the enhancements, it's aimed more at the home user.

Installation was easy. Once we had installed the cartridges it ran through a head alignment process and was then ready to use. Connection is by parallel or USB interface, but there were no bundled data cables. The instruction manual is supplemented by three foldout, quick-start sheets for parallel,

settings to optimise the output for photocopying and faxing.

Brightness and saturation were set on a series of sliders. In common with its big brother the P1100, it lets you adjust the printed page drying time. There are no facilities to monitor print progress, the level of ink remaining in the cartridge or how much time remained for completion.

The 930C's photo was impressive – less grainy than that produced by the Epson Stylus Color 760. Skin tones were

realistic and transitional fades between light and dark tones were smooth. Darker colours did not bleed into light areas along lines of high contrast. Similarly, the PowerPoint output was well rendered, with vibrant colours on HP's inkjet paper and small inverse fonts very clearly presented. But while this was more appealing than the 760's output, its vector image was dull. Text on photocopy paper could not be faulted, with dark blacks and sharp, crisp edges.

When it came to printing images, the Deskjet 930C was beaten every time by Epson's 760C, but it streaked ahead of Lexmark's Z31. Text speed performance was good. HP has a reputation to live up to and the 930C will do it no harm.

### DETAILS

**PRICE** £130.43 (£111 ex VAT)

**CONTACT** Watford 0870 7295600

[www.watford.co.uk](http://www.watford.co.uk)

**PROS** Excellent text and photo output

**CONS** Outclassed when it came to printing vector art

**OVERALL** A competent printer worthy of Hewlett-Packard's good name

TEXT QUALITY	★★★★★
IMAGE QUALITY	★★★★
SPEED	★★★
OVERALL	★★★★



## Lexmark Color Jetprinter Z31

HOME USER



CD-ROM drive. It connects to the PC via parallel port only, which is not a problem, but we didn't like the way that the installation CDs have been tucked into pockets in the front of the owner kit wallet. By the time the package had arrived, they had fallen out and were badly scuffed.

The maximum resolution of 1,200 x 1,200 is higher than the 1,440 x 720 offered by either of the Epson printers tested here, but this did not help when it

**THE Z31 IS LEXMARK'S** midrange printer. It takes up very little desk space and its paper output tray slides away when not in use. It's unable to receive many completed pages, topping out at 25 sheets. As a result, we ended up with pages all over the floor.

Installation was simple enough and included the option of creating a set of installation floppies that could come in handy if you also want to use this printer on a notebook that doesn't have a

came to photo printing.

Using Lexmark's own photo paper, the output was dark, grainy and slightly banded. That said, there was no bleeding from darker into lighter colours and transitions between different tones were smooth, with no discernable steps.

Banding was again evident in the solid grey areas of our Acrobat PDF, but text was rendered well. Edges were sharp and unfeathered, and characters

were dark and solid, even on standard photocopy paper. Unfortunately, the Z31 performed poorly when printing the vector image and was beaten by its competitors.

In terms of speed, the Z31 didn't shine. At over 24 minutes it was around half the speed of Epson's Stylus Color 760, but not too far behind Hewlett-Packard's Deskjet 930C when it came to printing 50 pages of solid text. This difference was accentuated when it came to printing the photograph. In the time it took the Z31 to complete the test, the Epson 760 could have printed four full A4 pictures.

Overall, the Z31 had some impressive stats, but in the final analysis it failed to impress.

### DETAILS

**PRICE** £93.99 (£79.99 ex VAT)

**CONTACT** Simply 020 8523 4020

[www.simply.co.uk](http://www.simply.co.uk)

**PROS** Very good text quality

**CONS** Fairly slow, poor photo reproduction

**OVERALL** Worthy of consideration only if your main use will be text printing

TEXT QUALITY	★★★★
IMAGE QUALITY	★★
SPEED	★★
OVERALL	★★★



## The technology of colour

**L**ook closely at this page. If you have good eyesight, you'll notice that every picture, logo and letter is made up of just four colours – cyan, magenta, yellow and black (CMYK). By placing tiny dots of these colours very closely together, the eye is fooled into believing it can see every colour of the spectrum.

Inkjets work in a similar way, either placing dots very close to each other or making them smaller and dropping several dots on to exactly the same spot. Because the inks used are transparent, unlike paint which will obliterate any colour already in place when the next coat is applied, light shines through and what you see is a composite tone.

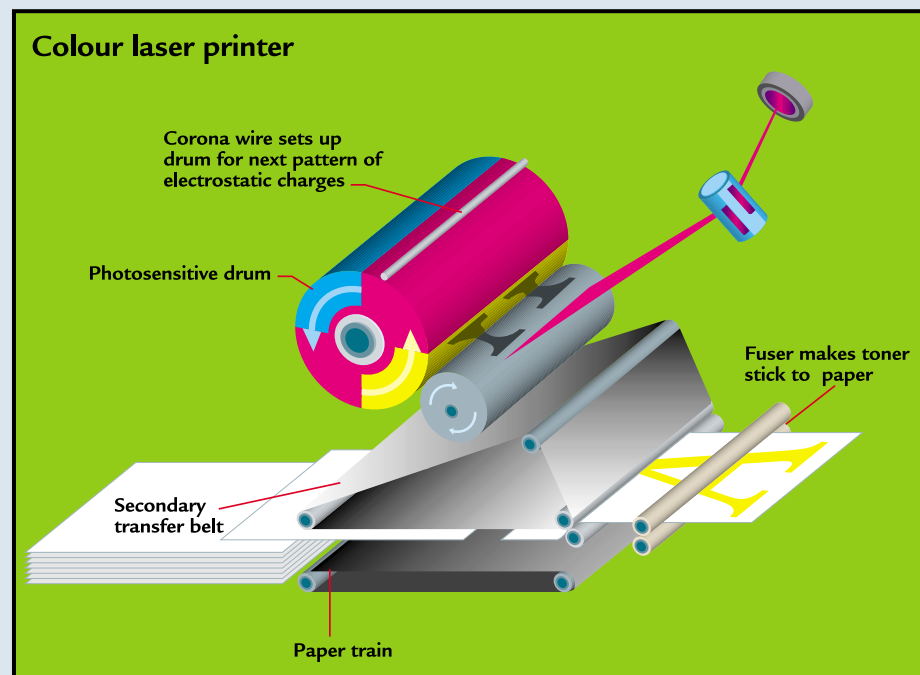
The ideal situation, of course, would be to mix the colours in the chamber before they are ejected, giving the printer more control over the colour laid down. But the technology is not yet in place to make this happen on a commercial scale.

No magazine is printed at a resolution that comes anywhere close to that offered by even inexpensive inkjets. *PCW*, for example, is printed at 300dpi (dots per inch), and many experts believe that the naked eye can't detect the individual dots on anything printed above 130dpi, so they instead appear to merge into a single shade. And even if a printer is able to boast the highest resolution it doesn't necessarily produce the best photo, as is the case with some of the photos printed in *PCW*'s tests.

Every inkjet print head, no matter which company manufactured the printer, is built around either thermal or Piezo technology. Basically, if you're not using an Epson printer, you're a member of the thermal gang. So how do they work?

### Thermal inkjet

Thermal printing came about by chance. Back in the 1970s, a scientist had carelessly left a hypodermic needle sitting



Colour laser printers burn an image onto the drum before placing toner onto the page

above the flame of a Bunsen burner. This caused the liquid within the needle to rapidly expand and eject from the open end. Thinking laterally, he wondered how he could put this to good use, and thus the thermal print head was born.

Of course, it all happens on a smaller and quicker scale these days. Ink fills a tiny chamber, at the bottom of which is a small resistor that heats to almost 500 degrees Celsius for just a few millionths of a second. This causes the ink to expand through the open nozzle. When the drop is large enough – about a millionth the volume of a drop of water from an eyedropper – its weight becomes too much for the natural tension of the liquid's surface to hold back and so breaks free, flying toward the page. Thermal inkjet manufacturers claim their technology is more tolerant and can easily overcome obstacles such as air bubbles in the chamber.

### Piezo electric

Epson is the only manufacturer to use Piezo electric print heads and claims that because it

doesn't need to engineer its inks to withstand high temperatures it can concentrate on the ink's reaction to paper and the way this affects the colours produced.

Instead of a heating element, the floor of a Piezo electric chamber is made up of a thin strip of metal and Piezo crystals. When a current is passed through the crystals they oscillate, physically changing the size of the chamber which, in turn, pushes ink out through the nozzle and towards the page. By adjusting the voltage, the head is able to eject droplets of different sizes, thereby varying the density of the coverage and the tone of the colour laid down.

### Alternative technologies

As prices continue to fall, so alternative technologies become more affordable. Even colour laser printers have dropped in price. Tally's T8004, for example, can be yours for a little over £800, and boasts a print speed of up to eight colour pages a minute – faster than an inkjet.

Colour laser printers work in a similar way to their

monochrome counterparts, but this is rather different to inkjet technology, and the image is not placed directly on to the page from the outset. There are two common methods in use, but the first employs a series of mirrors or a pyramid. The printer first directs a single laser beam on to the surface of a drum, which causes a static charge that matches the pattern of output. It does this four times – once for each CMYK colour. Next, the drum passes over toner cartridges of the same colours, and the static charge drags toner from the appropriate cartridge on to the drum. The drum continues to turn, eventually coming into contact with a moving belt that takes the toner off the drum. The image has now effectively been mirrored, and it is pressed on to a sheet of paper. If that were the end of the process, the charge would soon be lost and the toner would fall from the page, so a second set of heated rollers fuses it on to the paper, creating a permanent print.

*Continued overleaf*

## The technology of colour (cont)

The second method is similar to the first, except that it uses four separate lasers, drums and toner cartridges to transfer the four colours onto the moving belt. The advantage of this is obvious: split the work four ways and cut down on the time to completion. But it often works out more expensive because of the duplication of components inside the machine.

Two other technologies are worth mentioning. The first is solid ink printing. The

two great advantages here are that it is fast and the ink is easy to store because it looks and feels like a wax crayon at room temperature. The disadvantages, though, are that it takes some time to warm up each morning and moving it while the ink is still liquid can cause potentially damaging spills.

Once the inks have been loaded into the top of the printer they are heated until a portion of each block melts. This is fed through the printer to four rows of

nozzles that stretch across the full width of the page. Each nozzle is the opening on the front of a chamber, at the back of which is a Piezo arrangement similar to that found in an Epson print head. This is used to push ink out of the chamber and onto the page which is then fed through a series of rollers to first press the ink on to the page and then cool it before it has a chance to run.

The final technology is that employed by Alps Electric,

called MicroDry. Alps Electric has developed a range of printers that use a series of coloured tape, much like old-fashioned typewriter ribbons. Four of these are loaded into the printer at once and, as the paper passes through the body of the unit, the colours are pressed on to the page. The paper needs to pass through once for each colour, but this takes no longer than a single page on the average colour inkjet.

The unique selling point for this sort of technology is that you're not restricted to the traditional CMYK colours so, by using white, fluorescent or metallic, tapes can produce impressive results on even dark media.

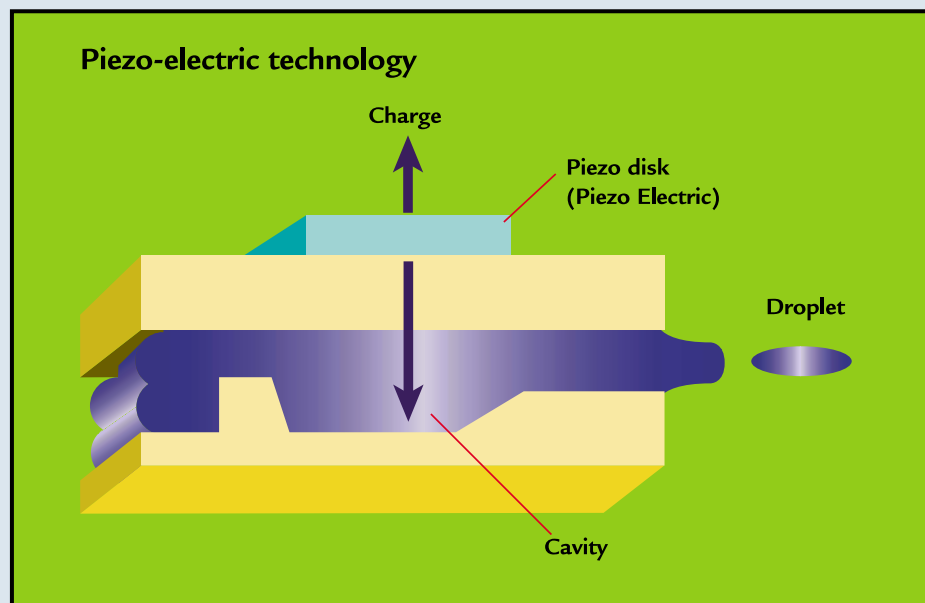
### What next?

The future of printing is by no means set in stone and you would be hard pressed to find anyone willing to make a prediction. What is obvious, though, is that the shift from print and distribute, to distribute and print, is gathering momentum every day.

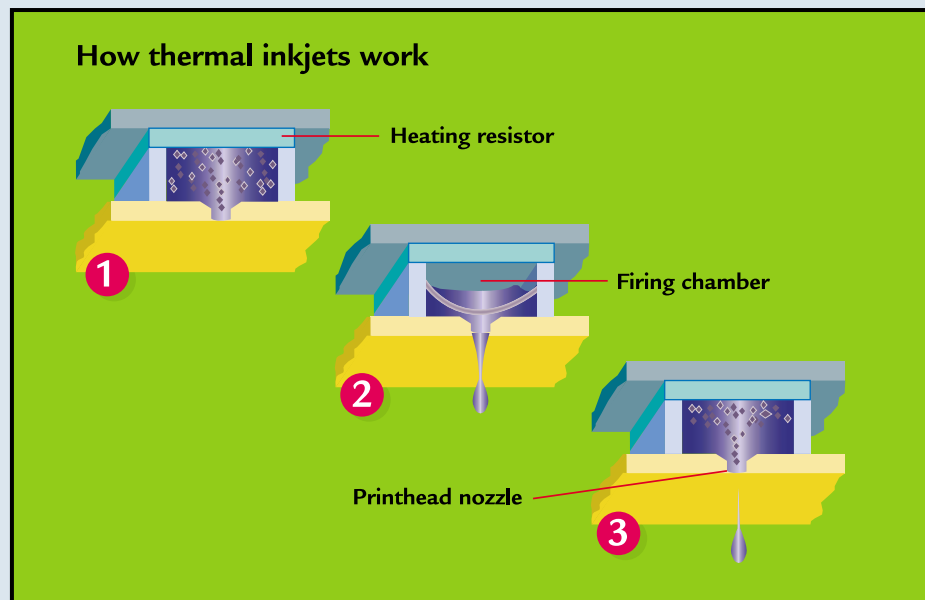
Greater adoption of the Internet and related technologies will, with luck, lead to a reduction in the amount of wasted print. As more companies put their catalogues and publications online, we will print out only those parts that are of interest or relevant to us.

Even book publishers are now toying with the idea of electronic distribution. Stephen King, just a few months ago, became the first mainstream author to release his work in a purely electronic format. Of course, the majority of those who paid to download it will have undoubtedly printed it before settling down to read it, and so inexpensive methods of achieving high-quality output are still likely to be as important in the future as they are today – at least until the e-book truly takes off.

NIK RAWLINSON



Piezo-electric print heads vibrate a disk of crystals to eject the ink onto the next page



Thermal inkjet print heads use a heated resistor to expand the ink until it bursts onto the page

## Canon BJC-8200 Photo

COLOUR PROFESSIONALS



the cartridges into the separate print head in any order. As with the 3000, there is a choice of parallel or USB connection, but no leads. A small media pack, together with a colourful setup booklet and user guide, were included.

The driver is one of the best we've seen, with five print mode options, including one for DTP and a setting for digital camera shots. Print quality can be similarly adjusted, affecting print speed. In addition, you

**THE BJC-8200 PHOTO** is Canon's latest top-of-the-range bubblejet printer. Designed with the imaging professional in mind, it comes with six cartridges. These can all be replaced individually, eliminating the need to dump a single CMY unit when only one colour has run dry.

Installing these took a little longer, partly because there are six, and partly because they are heavily packaged. We were also concerned that you could fit

have a choice of 10 media types and can cut printer power from the driver. There is no graphical ink level monitor, but it will warn you when reserves are low.

The 8200 is a quiet printer. It was still louder than HP's P1100, but low enough for use in an office. Text quality printing fell short of that by HP's P1100 and Lexmark's Z51 – characters were paler and feathered around the edges. However, this is a printer designed for photo output, so we were eager to look

at how the true 1,200 x 1,200 resolution handled our test photo. Overall, colour balance was good, with no obvious stepping, while skin tones were realistic. Unfortunately, this was somewhat spoiled by underlying blotches covering the entire photo. That said, we were impressed by the print quality on Canon's own inkjet paper. Both the PowerPoint and vector image results were vibrant and sharp.

The BJC-8200 was the slowest in all but the single page of text test, lagging behind at 65 minutes 18 seconds for the mixed text dissertation and 56 minutes 36 seconds for the Acrobat PDF document.

Overall, it is a capable bubblejet, albeit slow, and even doubles as scanner if you install the optional cartridge.

### DETAILS

**PRICE** £270.25 (£230 ex VAT)

**CONTACT** Dabs 0800 558 866

[www.dabs.com](http://www.dabs.com)

**PROS** Excellent vector art quality

**CONS** Very slow, poor photo performance

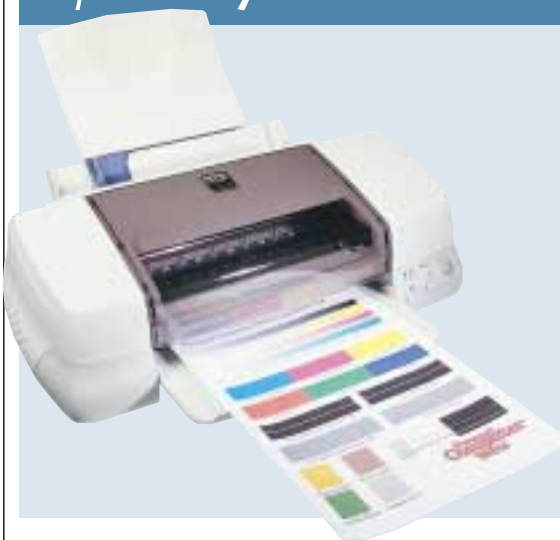
**OVERALL** Versatile, but much too slow

TEXT QUALITY ★★  
IMAGE QUALITY ★★★★★  
SPEED ★  
OVERALL ★★★★★



## Epson Stylus Photo 870

COLOUR PROFESSIONALS



and MGI LivePix 2.1 deluxe for Windows (version 1.5 for Mac). The interesting thing, though, is a toilet paper-sized eight metre roll of photo paper and an attachment for fixing it to the back of the unit. This allows you to print 10cm high photo banners. As with the 760, there is a choice of USB or parallel connection, but no data cables for either. It holds two cartridges – one black and one CMY.

The 870 was slower than its sibling when it came to printing text. At

**LARGER THAN THE 760**, the 870 is aimed at the more professional imaging user. It is just as easy to set up, and goes through the same priming process. The driver looks and works the same way too, with familiar ink reservoir gauges and time-to-completion countdowns. In this instance, however, the in-box bundle is more generous.

As well as the media sample pack, you'll find Epson Photo Reproduction Lab software, a disc of sample images

30 minutes 51 seconds, our 50-page Word file took twice as long, as did the mixed text and graphics document.

The difference when it came to the Acrobat PDF was less obvious. In only two tests did it take less time: vector art printing and the PowerPoint slides. It was, however, faster than HP's high-end machine in all but text printing. Speed is less important where the 870 is concerned; its primary focus is on printing photo-quality output, and here

it excels. Our test photo was beautifully rendered, with sharp, pure colours and no bleed from darker into lighter tones. There was no evidence of undesirable banding and skin tones were accurately reproduced. Light to dark transitional fades were smooth and we could see no stepping. It had no problem printing one of our PowerPoint slides on a transparency, but the colours in our vector art image were not as bright as those from some of the other printers.

We were a bit disappointed that the output from the PowerPoint slides test was somewhat saturated, even though we were using inkjet paper. On standard photocopy paper, text output was slightly feathered and we preferred that produced by the Hewlett-Packards.

### DETAILS

**PRICE** £207.98 (£177 ex VAT)

**CONTACT** Simply 020 8523 4020

[www.simply.co.uk](http://www.simply.co.uk)

**PROS** Excellent photo output

**CONS** Disappointing text performance

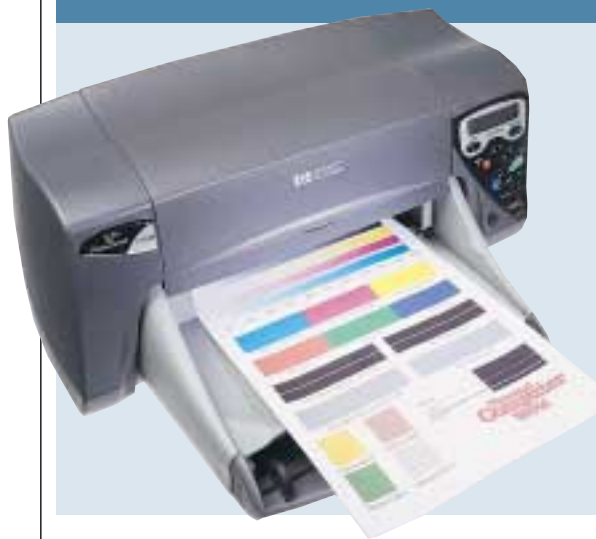
**OVERALL** If photo printing is the be all and end all, look this way

TEXT QUALITY ★★  
IMAGE QUALITY ★★★★★  
SPEED ★★★★★  
OVERALL ★★★★★



## HP Photosmart P1100

COLOUR PROFESSIONALS



way you can use it to vary the amount of ink that hits the paper and how long the printer will keep hold of your printout to allow for drying.

In use, the P1100 is whisper quiet. It's quick, too, ahead of the others in this test in the plain text and mixed content tests. Quality was exceptional, with good dark characters and sharp, unfeathered edges that put even Epson's Stylus Photo 870 in the shade.

In terms of graphics output, results were

**AIMED AT THE** imaging enthusiast, this printer has integrated SmartMedia and Compact Flash slots. Hardware options allow you to adjust paper and photo size or print a thumbnail preview. Connecting the printer to the PC turns the cards into mini hard drives.

The driver was less informative than those bundled with the other high-end printers in this test as, while it had more paper options, it lacked any indication of progress. What we did like was the

something of a mixed bag. On photocopy paper, the icons in our Acrobat PDF file looked slightly washed out when compared to those produced by the Epson Stylus Photo 870. We were also unable to print our vector art image at the highest quality setting. It worked fine when we dropped the quality to 'normal' and put this error down to memory problems.

It didn't set any speed records in the photo test, being beaten into third place

by both the Epson 870 and Lexmark Z51, but we felt the wait was worth it when we saw the output. Colours were vibrant and skin tones were accurately reproduced. Small details were clear and tonal gradients were smooth, with no visible stepping.

That the P1100 is a high-end printer is reflected in the price but, for the extra money, you get a bundled duplexing unit, a separate 4 x 6in sheet feeder and an IR port that makes good use of HP's JetSend technology to communicate with similarly equipped cameras and scanners. If you have a digital camera and want a printer that will do your photos justice, then this one's for you.

### DETAILS

**PRICE** £289.05 (£246 ex VAT)

**CONTACT** Watford 0870 729 5600

[www.watford.co.uk](http://www.watford.co.uk)

**PROS** Integrated CF and SmartMedia slots, duplexing option, excellent text

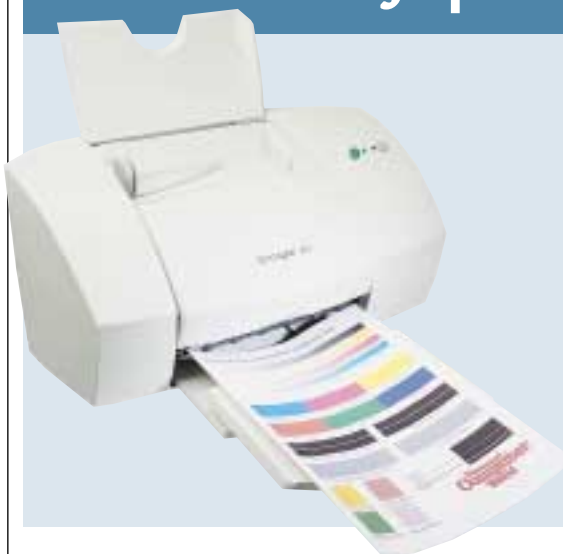
**CONS** Poor vector art performance, competing products had more informative drivers

**OVERALL** Versatile contender

TEXT QUALITY	★★★★
IMAGE QUALITY	★★★
SPEED	★★★★
OVERALL	★★★★

## Lexmark Color Jetprinter Z51

COLOUR PROFESSIONALS



become so scratched that our test machine was unable to read the data. As a result, we resorted to making a series of installation floppies on a PC with a more forgiving CD-ROM drive. Although realistically, for most users, this would not be an option.

Although it shares a top resolution of 1,200 x 1,200 with the Z31, the difference in print quality was immediately apparent. Even though the image was still

**AS FAR AS LEXMARK** goes, the Z51 sits on the top branches of the inkjet tree. It is larger than its siblings and has a more impressive output paper tray that, in our tests, didn't throw paper on the floor in the same way that the Z31 did.

The Z51 had the same installation disc storage problem though. It was tucked into a pocket in the front of the owner's kit and had fallen out during transit. In the process, it had

somewhat grainy, and the colours were not as pure as those produced by the Epson Stylus Photo 870, the banding had gone and skin tones were more realistic.

The test photo was still a little gloomy and there was a step between blue and green where there should have been a smooth transition, but we were glad to see that dark and light colours had not run into one another.

The vector image printed well. Detail was sharp and fades were smooth but the colours were just a little too bright, giving the whole image a slightly cartoonish feel.

Using standard photocopy paper, text output was excellent. Characters were dark and solid, with crisp, sharp edges. Even very small fonts were well rendered. Unfortunately, the banding reappeared in the solid grey areas of our Acrobat PDF.

If you definitely have your heart set on buying a Lexmark, then it's probably worth paying that bit extra to upgrade to this from the Z31. But if all you are looking for is a high-end printer, then there are several better options on test here.

### DETAILS

**PRICE** £136.29 (£115.99 ex VAT)

**CONTACT** Simply 020 8523 4020

[www.simply.co.uk](http://www.simply.co.uk)

**PROS** Good-quality text output, inexpensive

**CONS** Poor photo quality

**OVERALL** A good high-end printer for those less interested in photo printing

TEXT QUALITY	★★★★★
IMAGE QUALITY	★★★
SPEED	★★★
OVERALL	★★★★





## How we did the tests

**T**esting inkjets is a lengthy process involving mountains of paper, buckets of spent ink and days spent with a set of bright lights and a magnifying glass. We tested not only the speed and usability but also the quality of the printers and what they print. In testing these eight units we designed a range of tests that would push each printer to its limits and quickly show up any areas in which they fell down. These were split into three key areas – text printing, image printing and mixed output printing.

### Text printing

Many people who buy printers have one use in mind: printing letters and documents produced by their word processor or spreadsheet. They want good-looking results quickly and, perhaps more important, cheaply. With this in mind, we printed 50 pages of what in the PCW office constitutes fairly typical output – old group tests. The time it took each printer to complete these entirely text-based documents was recorded for comparison.

Next came the examination. Because most people want to print using standard office paper rather than the more expensive coated inkjet paper, we used packs of photocopier paper to simulate everyday use. We wanted to see, therefore, whether the printers could cope with this more fibrous, lower quality paper and still produce solid

dark characters with sharp edges. Some printers did well while others feathered the output and produced the sort of pages we would not be happy using in a business environment.

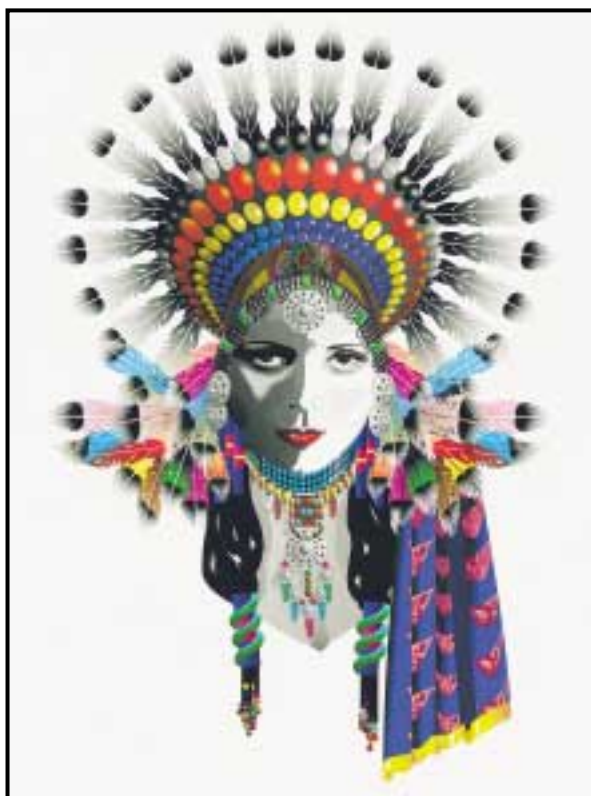
### Image printing

Scanners and even digital cameras are now becoming so affordable that they are among the most frequently purchased computer peripherals for home users, and are even more prevalent in the business market. Estate agents are putting cameras to good use, eliminating developing costs when putting together house specs, and scanners are becoming almost as common as the ubiquitous photocopier as a cheap means of copying and archiving research and important documents in universities, libraries and offices.

But it's no good restricting your images to your hard drive or website – once in a while you'll want to print them, and with many printers now boasting 'photo quality' output we wanted to see what this meant in use.

For this test, we opted to use real photo paper, and to be totally fair we made sure that we were using each manufacturer's own brand of paper, because many tailor the chemicals in their inks to react in a particular way to certain paper types.

We used PaintShop Pro to print a copy of our standard test photo, the veteran of



*Smooth fills with no undesirable jaggies scored highly*

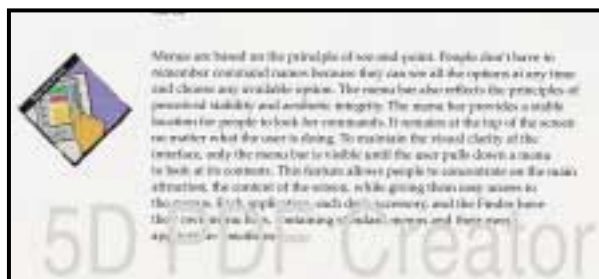
many inkjet group tests, which tests each of the four main composite colours individually. These are red, green, blue and composite black since inkjets use cyan, magenta and yellow to make up these tones. To ensure a solid black, many also use their black cartridge or the black chamber of a photo cartridge to supplement the composite black shades.

Here we were looking for realistic skin tones, which are traditionally difficult for an inkjet to reproduce and smooth shading between varying tones of a similar colour. A good quality printer will make the transition from dark to light without any detectable edges.

We also didn't want to see any horizontal banding. This is where you get darker stripes running across the image as the top row of nozzles overlaps the area printed by the lowest set of

nozzles on the previous pass. A good printer will never show banding like this. Another equally undesirable form of banding is that caused by a blocked nozzle or a tiny gap between each pass of the print head. Rather than a dark band this will cause a thin white stripe, and again it was something we were looking out for in our tests.

If you look closely at a traditionally produced silver halide print you should not be able to see any individual spots or dots making up the picture. We call this continuous tone and as far as inkjet manufacturers are concerned it is as close to the Holy Grail as you can get. We therefore marked down printers that produced grainy images where the individual drops of ink were easy to spot. Finally, we looked at the image as a whole to judge how well balanced it was in terms of brightness, saturation and



*Text should be clear and sharp even on lower quality paper*

contrast. Everybody has an idea of what makes a good picture but it is easy to spot a saturated or washed-out image or one where particularly harsh contrast screams at you from the page.

Next, we printed a vector image in Corel Draw. If you want to recreate this test yourself we used the Huntress sample included on the Corel Draw installation disc and resized it so that it would fit onto a single A4 page. We printed this on each manufacturer's own inkjet paper so that we could see how the printers coped with the colours, vector fills and curves that had been resized to fit on the page.

Being a vector image in which lines and edges are defined by mathematical points, this picture worked differently to the test photo, which is a TIFF format bitmap with only spot colour information. We wanted to see whether the printers and drivers could successfully render smooth fills and sharp, smooth edges with no undesirable jaggies even after the slight resizing necessary.

Finally, and sticking with the inkjet paper, we produced a fairly typical 10-page presentation in PowerPoint using the package's wizard function and adding a few graphics of our own. We printed this as a handout, with three slides to a page and room to take notes alongside each one. This tested each printer's colour reproduction abilities, whether or not it saturated the paper, and how well it coped with images that had been dramatically reduced in size. Then we printed slide seven of our sequence on a transparency, again using the media produced by each inkjet manufacturer, to see how well the ink adhered when not using paper.



*Continuous tone has always been a stumbling block for inkjet printers*

## Mixed output

The chances are that your printing will not always be restricted to either text or graphics, but instead encompass both on a single page. Our last two tests addressed this issue, mixing word-processed text and a range of images.

For both tests we switched back to using photocopier paper to more realistically simulate everyday conditions, and printed a 95-page university dissertation followed by a 50-page Acrobat format PDF.

The dissertation used multiple font faces and sizes

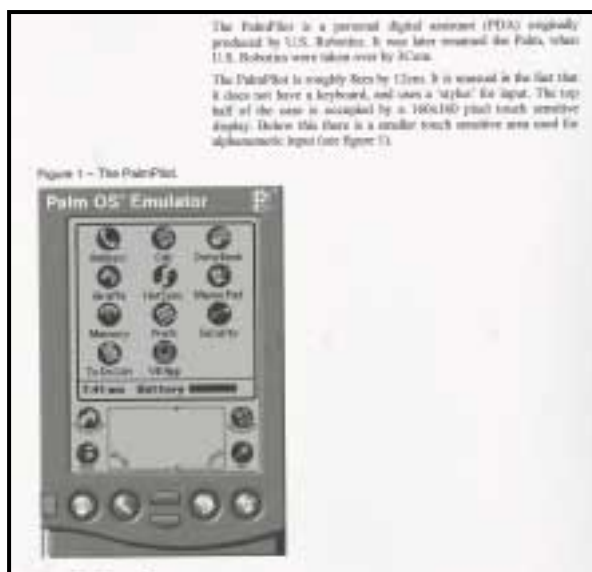
and regularly interspersed the paragraphs with monochrome screenshots. Whether the printer chose to render these using the black cartridge or in composite form from the CMY chambers instead was not totally relevant – we were more interested in clean sharp images. After all, this would have to be presented for marking at the end of the course and would count toward a final grade. We wanted to see output where the paper was not overly saturated and where the screenshots, many of which had a grey

background, remained legible.

The Acrobat PDF was the first 50 pages taken from Apple's interface design document. Again this included a range of screenshots, some of which had a lightly shaded background, but unlike the mixed content dissertation it also had a number of colour icons in the margins that acted as guides for the reader. This was the first time the printers had been asked to produce colour output on standard photocopier paper so we wanted to see how well they managed to reproduce their colours when denied higher quality media.

## Judging

Although speed is always important, it was more relevant to the lower-end printers than the models aimed at 'professional colour users'. In all instances we were looking for clean, sharp output but we didn't want to have to wait all day to get it. The more expensive printers, however, are generally more suited to photographic use and in this instance the quality of the output is more important than the speed at which it arrives, and this fact was reflected in our judging and the way in which prizes were awarded.



*Most people want to print text and pictures on the same page*



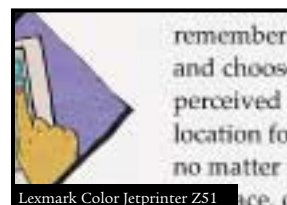
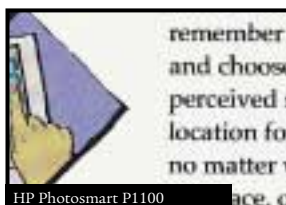
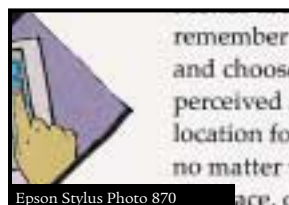
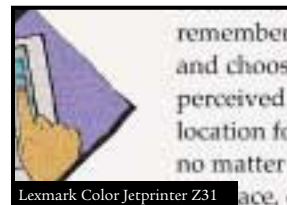
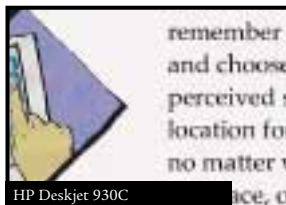
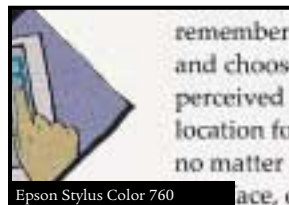
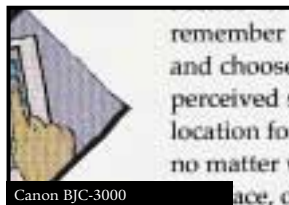
## Test results

The red box indicates the area examined in all cases.

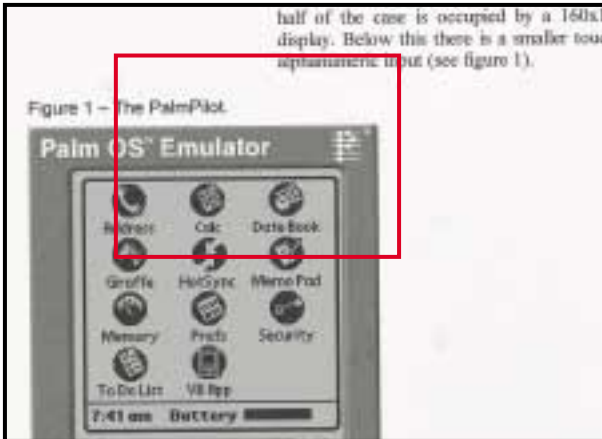
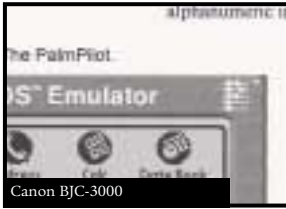


Vector art image: here, we're looking for realistic, bright colours and smooth fades.

Menus are based on the principle of see-and-point. People don't have to remember command names because they can see all the options at any time and choose any available option. The menu bar also reflects the principles of perceived stability and aesthetic integrity. The menu bar provides a stable location for people to look for commands. It remains at the top of the screen no matter what the user is doing. To maintain the visual clarity of the interface, only the menu bar is visible until the user pulls down a menu to look at its contents. This feature allows people to concentrate on the main



PDF document: should render smoothly in smaller scale. Colours should be good on photocopier paper.



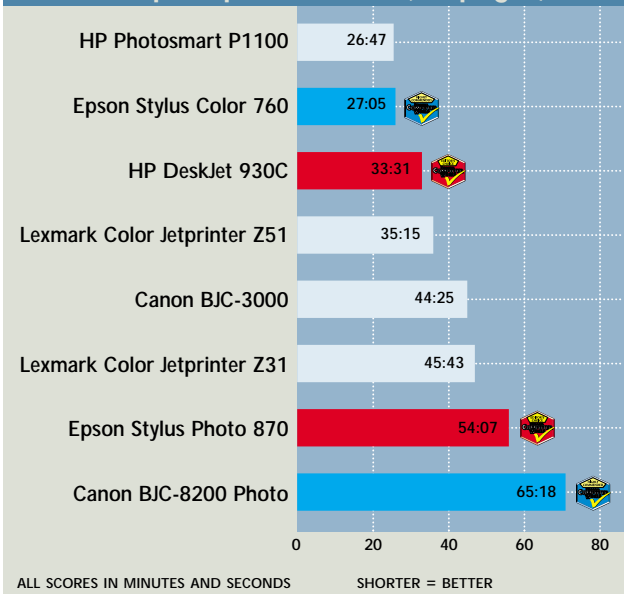
**Mixed text output: characters should be sharp on photocopier paper. Images should be an even grey.**



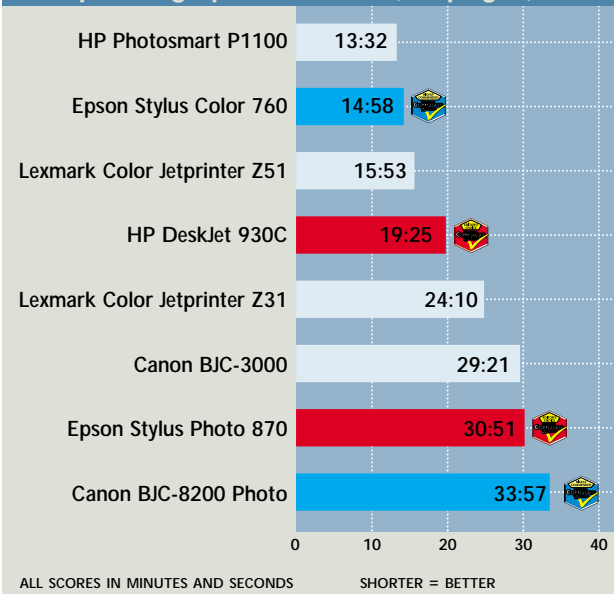
**Photo: colours and skin tones should be realistic. Contrasts should be sharp but not exaggerated.**



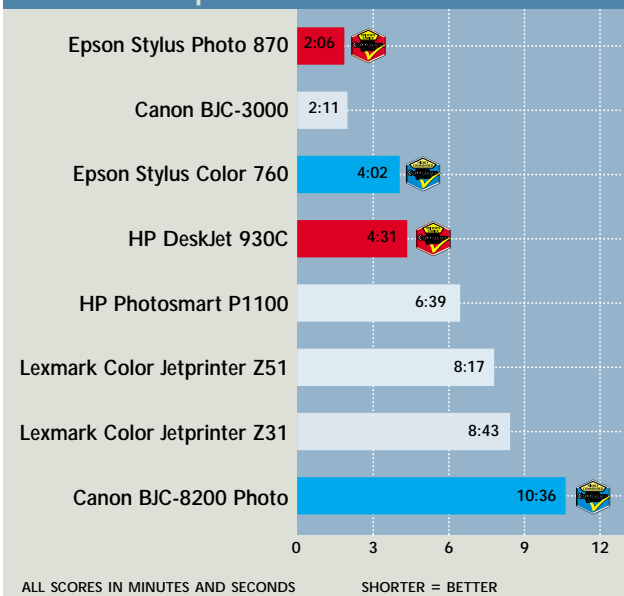
### Mixed output speed results (95 pages)



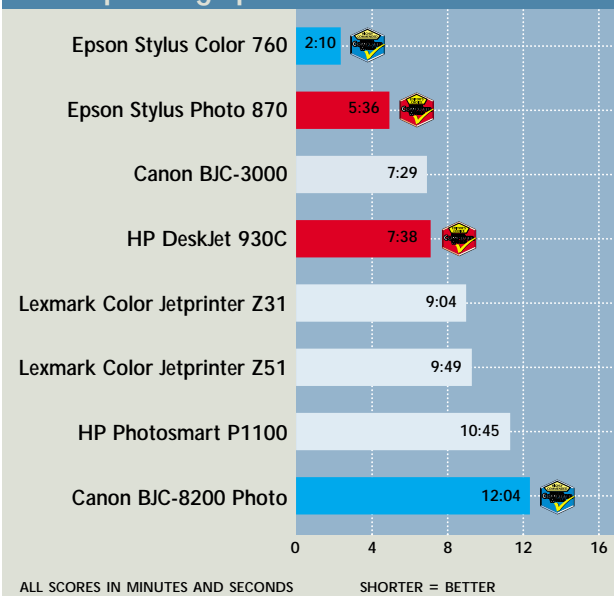
### Text printing speed results (50 pages)



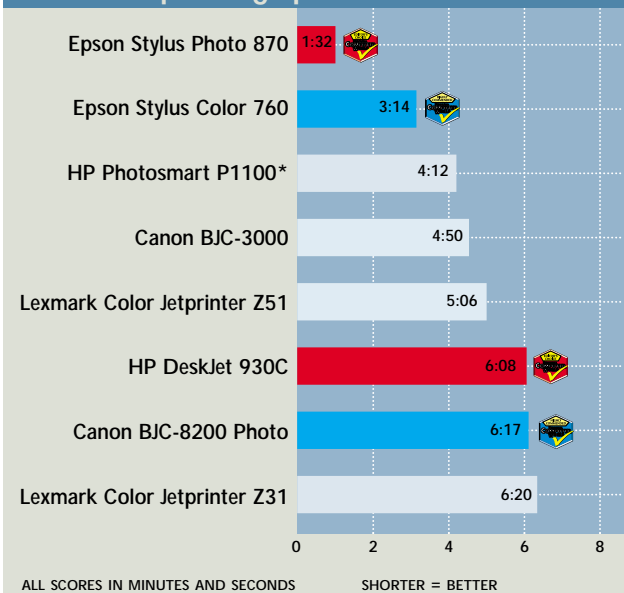
### PowerPoint speed results



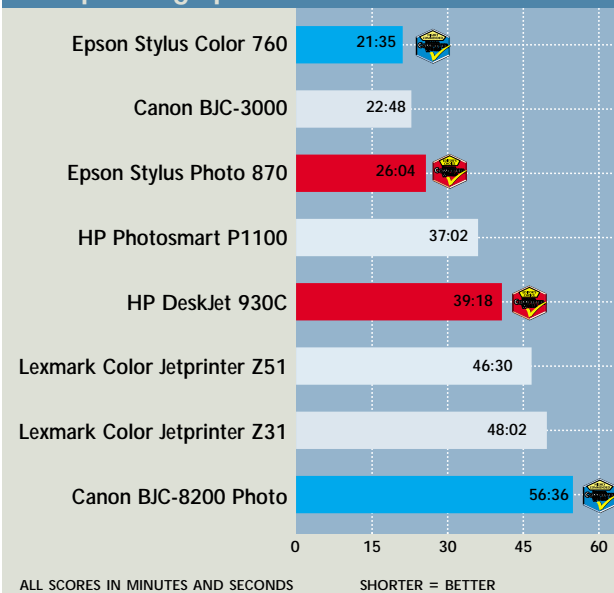
### Photo printing speed results



### Vector art printing speed results



### PDF printing speed results



\* HP P1100 WAS UNABLE TO PRINT AT BEST QUALITY AND SO THIS SPEED WAS OBTAINED ON THE STANDARD DEFAULT SETTING

Table of features				
MANUFACTURER	CANON	EPSON	HEWLETT-PACKARD	LEXMARK
MODEL	BJC-3000	STYLUS COLOR 760	DESKJET 930C	COLOR JETPRINTER Z31
Supplier & phone number	Dabs Direct 0800 558 866	Dabs Direct 0800 558 866	Watford 0870 729 5600	Simply 020 8523 4020
Price inc (ex VAT)	£108.10 (£92)	£121.03 (£103)	£130.43 (£111)	£93.99 (£79.99)
Maximum resolution (dpi)	1,440 x 720	1,440 x 720	2,400 x 1,200	1,200 x 1,200
Parallel interface	✓	✓	✓	✓
USB interface	✓	✓	✓	X
Input tray capacity	100 sheets	100 sheets	100 sheets	100 sheets
Output tray capacity	Not available	100 sheets	50 sheets	25 sheets
Internal memory	128KB	256KB	4MB	512KB
Cartridge types	Black, four-colour, photo, scanner	Black, three-colour	Black, three-colour	Black, three-colour, photo, waterproof black
Price of mono cartridge	*£8.21	£18.44 (£15.69)	£21.15 (£18)	£24.64 (£20.97)
Price of colour cartridge	**£8.21	£18.44 (£15.69)	£25.85 (£22)	£29.14 (£24.80)
Estimated life of mono/colour cartridge	500 pages/140 pages	900 pages/300 pages	830 pages/430 pages (860 for C6578A cartridge)	275 pages/450 pages
A4 print margin	3mm top, 5mm bottom	3mm top, 14mm bottom	Not supplied	1.7mm top, 12.7mm (black) 19.5mm (colour) bottom
Maximum paper weight	105gsm	194gsm	200gsm	270gsm
Operating system support	Windows 95/98/NT4, MacOS	Windows 3.1/95/98/NT4, MacOS	DOS 3.3, Windows 3.1/95/ 98/NT4/2000, MacOS	Windows 3.1/95/98/NT4, DOS in windows/OS/2 on demand
Printer weight	3.7Kg	5.8Kg	5.7Kg	3.6Kg
Printer dimensions w x h x d (mm)	418 x 169 x 306	450 x 269 x 175	440 x 196 x 400	461 x 293 x 520
Technology used	Thermal/drop modulation	Micro Piezo	Thermal inkjet	Thermal inkjet

Table of features				
MANUFACTURER	CANON	EPSON	HEWLETT-PACKARD	LEXMARK
MODEL	BJC-8200 PHOTO	STYLUS PHOTO 870	PHOTOSMART P1100	COLOR JETPRINTER Z51
Supplier & phone number	Dabs Direct 0800 558 866	Simply 020 8523 4020	Watford 0870 729 5600	Simply 020 8523 4020
Price inc (ex VAT)	£270.25 (£230)	£207.98 (£177)	£289.05 (£246)	£136.29 (£115.99)
Maximum resolution (dpi)	1,200 x 1,200	1,440 x 720	2,400 x 1,200 (photo)	1,200 x 1,200
Parallel interface	✓	✓	✓	✓
USB interface	✓	✓	✓	✓
Input tray capacity	100 sheets	100 sheets	150 sheets	100 sheets
Output tray capacity	100 sheets	100 sheets	50 sheets	50 sheets
Internal memory	80KB	256KB	8MB	512KB
Cartridge types	Black, five-colour	Black, five-colour	Black, three-colour	Black, three-colour, photo, waterproof black
Price of mono/colour cartridge	*£10.56	£14.68 (£12.49)	£21.15 (£18.00)	£24.64 (£20.97)
Price of colour cartridge	**£10.56	£11.89 (£10.12)	£25.85 (£22.00)	£29.14 (£24.80)
Estimated life of mono/colour cartridge	360 pages/360 pages	540 pages/220 pages	830 pages/430 pages (860 for C6578A cartridge)	275 pages/625 pages
A4 print margin	3mm top, 5mm bottom	3mm top, 14mm bottom	Not supplied	1.7mm top, 12.7mm (black) 19.5mm (colour) bottom
Maximum paper weight	200gsm	194gsm	200gsm	270gsm
Operating system support	Windows 95/98/NT4, MacOS	Windows 95/98/NT4, MacOS	Windows 3.1/95/98/ NT4/2000	Windows 3.1/95/98/NT4, DOS in Windows/OS/2 (some) host-based Windows Printing
Printer weight	5.9Kg	5.6Kg	5.9Kg (6.8Kg with duplex unit)	4.1Kg
Printer dimensions w x h x d (mm)	450 x 333 x 205	470 x 285 x 175	450 x 200 x 350	460 x 326 x 467
Technology used	Bubble Jet Advanced Microfine Droplet Technology	Micro Piezo	Thermal inkjet	Thermal inkjet

Note: cartridge life is estimated across A4 pages with five per cent coverage for black cartridges and 15 per cent coverage for colour cartridges (unless colour cartridge holds five colours, in which case 25 per cent coverage is assumed). \*Price for black ink well only (inc VAT). This fits into the re-usable cartridge. \*\*Price for individual colour ink wells (inc VAT). These fit into the re-usable cartridge.

# Editor's Choice

In years gone by it's been easy to pick a winner in the inkjet group test. This time things weren't so clear-cut. With advances in ink and paper technology, and the way the engine lays colour onto the page, it's no longer such an easy choice, and we were impressed by the overall standard of all of the printers submitted for review this time around. One thing that our tests showed is that it's generally no longer necessary to use special coated papers when all you want to print is text, but for graphics and photos the results are definitely worth the extra expense. Each printer excelled in a different area and so in judging we split the printers into their two defining groups – home or small office user printers and printers for colour professionals. We then looked at each

test in isolation and marked the printers in comparison to the other entrants in their group – four points for the top performer, and dropping one point for each position lower on the scale.

## The winners

Starting with the lower-end home and small office printers, we present our first **Editor's Choice** award to Hewlett-Packard's DeskJet 930C. Its photo printing performance was unbeatable. Skin tones were well defined and it demonstrated a smoother, less grainy continuous tone than any of its competitors, and produced more detail in shadow and mid-tone areas. Text was pin sharp. It was just beaten by the Epson Stylus Color 760 when it came to printing the vector image.

In the lower-end group, we award a **Highly Commended** accolade to Epson for the Stylus Color 760. Epson has always performed well when it comes to photo printing so we were a little disappointed that the 760's output was washed out and lacked definition in bright areas. However, it demonstrated excellent colour reproduction when tackling the vector art image and only just lost out to Hewlett-Packard when printing from PowerPoint because its colours were slightly less vibrant. Overall though, it fared well, positioned generally around the middle of the field, proving it to be a good all-round printer for everyday use.

The high-end printers were more difficult to judge. If it was to be decided on the quality of output across all areas it would have been a tie between Lexmark's Z51 and Canon's BJC-8200 Photo. However, we specified that we were looking for printers suited to colour professionals, and so in judging we put more emphasis on the quality of the photo and vector art image. This made it a dead heat between the Canon BJC-8200 Photo and Epson's Stylus Photo 870. The engineers at Canon will be kicking themselves for losing out on the Editor's Choice award this time around because it took so long to complete any job sent through. As the speed performance graphs show, in almost every instance this printer took far longer than any other in its class, sometimes taking twice as long. Although the results were excellent, we felt we couldn't justify waiting for them to arrive. The photo produced by the Epson Stylus Photo 870 was difficult to fault and arriving in a reasonable amount of time, wins Epson an **Editor's Choice** award. Detail was first class and transitions between shades were smooth. When it came to printing vector art, the Canon BJC-8200 Photo did well – its output was smooth and well rounded, and its colours were bright while not being garish, and so comes **Highly Commended**.

We're also giving an **honourable mention** to Lexmark's Z51. It performed poorly in the photo test. Its output was dark and a little unrealistic, but it scored well throughout the rest of the tests, coming either first or second in every other category. If you're after a general high-end inkjet and photos aren't as important the Z51 is definitely worth a look.



*The Hewlett-Packard 930C's photo printing was unbeatable for home users*



*Smooth transitions between shades earns Epson's Stylus Photo 870 the award*



*The Epson Stylus Color 760 is a top performer with excellent colour reproduction*



*Canon's BJC-8200 gave a well-rounded performance to come a close second*