



Flatbed SCANNERS

We round up 14 of the current crop of scanners, covering a wide range of budgets

CONTRIBUTORS Jim Martin, Alyn Sparkes
PHOTOGRAPHY Hugh Threlfall, Julian Hawkins

In the not too distant future, some say, everyone will be taking digital photos. But even if you've already gone digital, you'll have a collection of memories on silver halide that need preserving. A colour flatbed scanner is the best solution for turning those collections into organised digital libraries for easily sharing them with family and friends, and you'll also be able to edit, enlarge or reprint them. And, as we see in Digital dilemma (see p92), many professionals think the combination of film camera and scanner is still the best solution.

A scanner also makes the ideal partner to a printer for quick copying or faxing documents. OCR software, as bundled with all the scanners on test, means you can turn a printed page into editable text for emailing or editing without the need to retype.

This Labs brings together 14 of the best

scanners currently available. Since our last group test (see Labs, issue 82, p110), it's clear that optical resolutions are on the up. Two scanners here – the Canon D2400UF and Epson Perfection 2450 Photo – boast a resolution of 2,400 x 4,800ppi, with HP's older Scanjet 7400c on 2,400 x 2,400ppi. Previously, this was a resolution more commonly associated with dedicated film scanners, but with integrated transparency units on all three you can now obtain superb results without needing two separate peripherals.

Another minor shift concerns interfaces. Higher optical resolutions demand greater bandwidths to transfer the data more quickly to the PC. This month, we see scanners equipped with USB 2, IEEE-1394 and SCSI interfaces significantly outperforming USB 1.1 devices.

If you're on a tight budget, some of the cheapest scanners could look tempting, but image quality varies considerably between them, and for the ultimate image quality you'll have to dig deeper into your wallet. Just make sure you don't spend a penny before you've read our definitive verdicts. ▶

CONTENTS

- 78 How we test
- 80 Feature table
- 92 Digital dilemma
- 100 Scanning technology
- 83 BenQ S2W 5300U
- 83 Black Widow 1248
- 85 Canon CanoScan D1250U2F SE
- 85 Canon CanoScan D2400UF
- 88 Epson Perfection 1650
- 88 Epson Perfection 2450 Photo
- 90 Genius ColorPage-HR6X
- 90 HP Scanjet 4400c
- 95 HP Scanjet 7400c
- 95 Microtek ScanMaker 3800
- 98 Microtek ScanMaker 5700
- 98 Trust Direct WebScan 19200
- 101 Umax Astra 6400
- 101 Visioneer OneTouch 8920 USB





How we test

Flatbed scanners must be evaluated on both image quality and speed, but as the resulting image is ultimately all that's required, quality is of utmost importance. Image quality is assessed by our panel of judges as well as by the scientific analysis of a professional scanner target.

We use our standard test rig for the tests, but install 768Mb of RAM and any USB 2 or FireWire interface cards bundled with the scanners. We also use an Adaptec SCSI card for scanners with this interface. Flat 19in CRT monitors are employed to ensure accurate colour reproduction and sharp focus when making the subjective judgments. We use Windows XP Professional

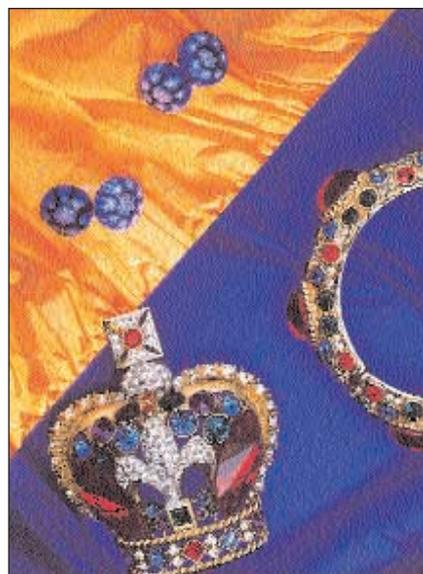


as the testing platform, with Adobe Photoshop for viewing and manipulating scans.

REAL-WORLD TESTS

Our first scan is of an A4 glossy print showing a pair of mounted candles, patterned cloth and holly against a green material background (see above). We scan at 300ppi, which is sufficiently detailed without creating a huge file size. We pay careful attention to small details such as the shading on the brass candle stands, texture of the cloth and the petals of the yellow flower.

The most demanding test is the scan of a 10 x 8in glossy print at maximum optical resolution showing highly detailed jewellery (see left). It stresses



performance and consequently takes the longest time and creates the largest image file size (as much as 1.3Gb for 2,400ppi scanners). We check for colour fidelity compared to the original and also how well a scanner is able to represent reflection of light on shiny surfaces.

Our most real-world test is a 6 x 4in matte print of three people, scanned at 150ppi (see below). Most photographic prints are produced in this format and the content is mainly of – and for – friends and family. Here we check for faithful representation of skin tones to the original.

A PC Pro text test is also conducted at 150dpi, which shows that some scanners are better able to handle text than others. We zoom in to view the sharp edges of the Times New Roman font to discern sharpness and completeness.

For scanners that come with transparency covers, we use a 5 x 4in transparency featuring seafood on a bed of ice (see opposite) and a 35mm portrait transparency. These transmissive scans are performed at maximum optical resolution to achieve the highest detail possible. In particular, we check for texture detail on the shell of the crab and



RESULTS TABLE

	BenQ 52W 5300U	Black Widow 1248	Canon CanoScan D1250U2F SE	Canon CanoScan D2400UF	Epson Perfection 1650	Epson Perfection 2450 Photo
REAL-WORLD TESTS						
A4 candles print (out of 10)	6	5	8	9	9	10
10 x 8in crown jewels print (out of 10)	5	4	6	10	8	10
6 x 4in skin tones print (out of 10)	5	4	6	8	6	10
A4 page of text (out of 10)	7	6	8	7	7	7
Transparency (out of 10)	N/A	N/A	6	8	N/A	7
SCIENTIFIC TESTS						
Signal-to-noise ratio (:1)	27	41	44	59	110	123
Sharpness (MTF)	1.07	0.82	0.68	1.21	1.06	1.15
TIMED RESULTS						
A4 photo (seconds)	164	74	U2: 32, U1.1: 125	25	50	I: 23, U2: 22, U1.1: 52
10 x 8in photo* (seconds)	2,008	167	U2: 184, U1.1: 972	1,297	1,249	I: 1,166, U2: 1,087, U1.1: 2,767
6 x 4in photo (seconds)	35	12	U2: 12, U1.1: 19	9	10	I: 9, U2: 9, U1.1: 9
A4 text (seconds)	37	19	U2: 20, U1.1: 20	19	9	I: 7, U2: 7, U1.1: 7

*Scanned at each scanner's optical resolution. Key: U1.1 = USB 1.1, U2 = USB 2, I = IEEE-1394, S = SCSI



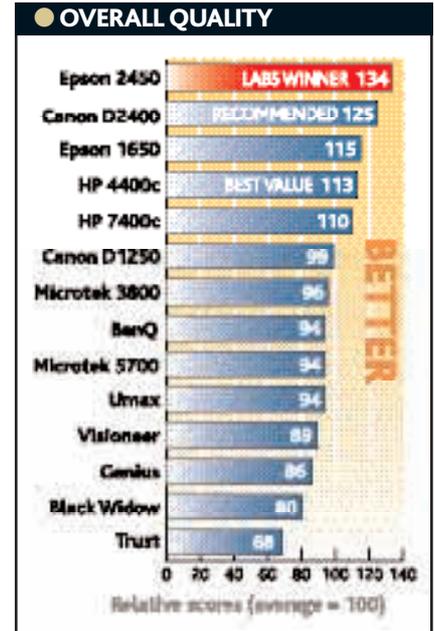
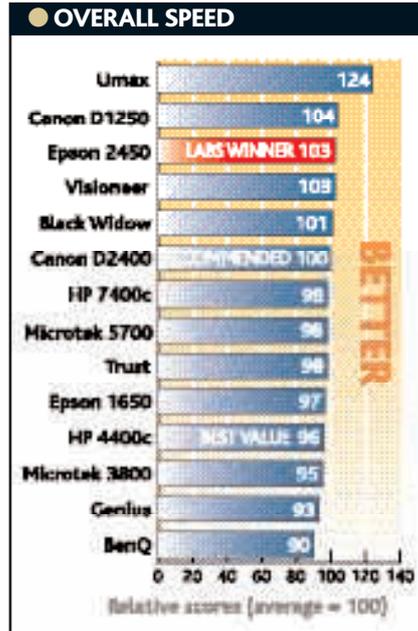
tonal gradient on the face. We also look at the scans at 100 per cent in Photoshop to check for detail capture and also banding or noise that may not be visible at lower magnification.

All times are recorded from when the scan command is sent, to the point when the captured image is displayed on screen in Photoshop. All the photos are scanned with the scanner set to its default 'photo' settings for colour and exposure to ensure the image is optimally scanned with the manufacturer's settings.

SCIENTIFIC TESTS

We also carry out scientific tests to objectively judge the image quality of the scanners. These are based around the Applied Images scanner target. Specifically, we use the blocks of closely spaced lines for our MTF (Mean Transform Function) test and the greyscale strip for determining the signal-to-noise ratio.

First, we scan the whole target at the maximum optical resolution on each scanner both horizontally and vertically. We then scan the greyscale strips twice at 150ppi over identical areas. To calculate the signal-to-



noise ratio, we load these two strips into Adobe Photoshop and perform a 'subtract' calculation on them so that any dust specks are removed. This leaves one image untouched and one as a subtraction of the other – a single grey strip.

We then calculate the ratio by taking the median of a patch in the original scan and the standard deviation of the same patch in the subtracted image, and dividing one by the other. This is repeated for several patches along the scale. The results are averaged, giving the signal-to-noise ratio of the scanner.

The MTF test essentially measures the sharpness of a scanner. We repeat this test twice, once with the horizontal and once with the vertical scan. By selecting the first set of lines and then using the Histogram tool in Photoshop, we're able to find the highest and

lowest values generated – how black and how white the lines were. This gives a reference value, which is compared to the figures given by the other line sets. The better a scanner is, the closer it scores to a value of one. Combining the vertical and horizontal scores makes the ideal value two.

See the images yourself

The scanned images will be available on the PC Pro Web site (www.pcpro.co.uk) from Thursday 25 July. Click on the Labs link, select the scanners group test and there's a link to the relevant files. Since some of the files measure more than 1Gb, we cropped them to focus in on the most appropriate area.



Genius ColorPage-HR6X	HP Scanjet 4400c	HP Scanjet 7400c	Microtek ScanMaker 3800	Microtek ScanMaker 5700	Trust Direct WebScan 19200	Umax Astra 6400	Visioneer OneTouch 8920 USB
6	8	7	7	5	3	7	5
3	8	7	6	7	3	7	6
6	8	7	4	5	1	5	4
6	6	8	5	6	6	5	4
5	N/A	6	N/A	3	N/A	N/A	3
32	54	40	94	40	55	47	83
0.9	1.12	1.14	1.13	1.04	0.9	0.87	1.16
107	58	S: 15, U1.1: 49	94	25	71	26	32
650	232	S: 1,664, U1.1: 8,400	469	810	218	52	514
16	10	S: 5, U1.1: 6	14	12	25	12	5
15	18	S: 5, U1.1: 6	16	19	18	19	9



● SPECIFICATIONS AND FEATURES



	BenQ S2W 5300U	Black Widow 1248	Canon CanoScan D1250U2F SE	Canon CanoScan D2400UF	Epson Perfection 1650	Epson Perfection 2450 Photo	Genius ColorPage-HR6X
OVERALL SCORE	94	89	103	115	106	121	94
Street price* (inc VAT)	£59 (£69)	£54 (£63)	£132 (£155)	£229 (£269)	£112 (£132)	£224 (£263)	£60 (£71)
Supplier	redstore.com 0870 870 4457	Micro Direct 0870 444 4456	dabs.com 0800 138 5182	dabs.com 0800 138 5182	Jungle.com 0870 727 1771	Jungle.com 0870 727 1771	Micro Direct 0870 444 4456
Supplier's Web site	www.redstore.com	www.microdirect.co.uk	www.dabs.com	www.dabs.com	www.jungle.com	www.jungle.com	www.microdirect.co.uk
Manufacturer's Web site	www.benq.co.uk	www.blackwidow.co.uk	www.canon.co.uk	www.canon.co.uk	www.epson.co.uk	www.epson.co.uk	www.kye.co.uk
Basic warranty	2yrs RTB	1yr swap-out, 1yr RTB	1yr on-site	1yr on-site	1yr swap-out	1yr swap-out	1yr RTB
PHYSICAL CHARACTERISTICS							
Dimensions (W x D x H, mm)	286 x 449 x 93	261 x 436 x 70	257 x 460 x 71	286 x 461 x 93	276 x 450 x 93	304 x 476 x 122	254 x 422 x 95
Maximum power consumption (W)	25	15	15	17	15	23	13
Separate power adaptor	✓	✓	✓	✓	✓	✘, integrated	✓
Fascia buttons	Scan, scan to Palm, scan to Web, OCR, copy	Open driver, scan, fax, copy, email	Scan, copy, email, film	Scan, film	Open SmartPanel, copy, email, scan to Web	Open SmartPanel	Scan, copy, fax, email, OCR
OPTICS							
Maximum scanning area (W x D, mm)	216 x 297	216 x 297	216 x 297	216 x 297	216 x 297	216 x 297	216 x 297
Optical density range	1.9D	3.4D	3.0D	3.3D	3.2D	3.3D	3.0D
Light source	Cold cathode lamp	Cold cathode lamp	Cold cathode lamp	Cold cathode lamp	Cold cathode lamp	Cold cathode lamp	Cold cathode lamp
Sensor type	CCD	CCD	CCD	CCD	CCD	CCD	CCD
Scanning method	One pass	One pass	One pass	One pass	One pass	One pass	One pass
Transparency adaptor	✘	✘	35mm	35mm, 120 format**, 4 x 5in	✘	35mm, 120 format**, 4 x 5in	35mm
INTERFACE							
Interface	USB 1.1	USB 1.1	USB 2	USB 1.1	USB 1.1	IEEE-1394, USB 2	USB 1.1
Cables supplied	USB	Captive USB	USB	USB	USB	USB	USB
Interface card supplied	✘	✘	USB 2	✘	✘	✘	✘
RESOLUTION AND COLOUR DEPTH							
Optical resolution (ppi)	1,200 x 2,400	600 x 1,200	1,200 x 2,400	2,400 x 4,800	1,600 x 3,200	2,400 x 4,800	600 x 1,200
Maximum interpolated resolution (ppi)	19,200 x 19,200	19,200 x 19,200	9,600 x 9,600	9,600 x 9,600	12,800 x 12,800	12,800 x 12,800	19,200 x 19,200
Input greyscale bit-depth	16	16	16	16	16	16	12
Input colour bit-depth	48	48	48	48	48	48	48
DRIVERS INCLUDED							
Windows XP	✓	✓	✓	✓	✓	✓	✓
Windows 98/ME	✓	✓	✓ (98 is USB 1.1 only)	✓	✓	✓	✓
Windows 2000	✓	✓	✓	✓	✓	✓	✓
TWAIN compatible	✓	✓	✓	✓	✓	✓	✓
Other	✘	Mac OS 9 +	✘	Mac OS 8.5 +	Mac OS 8.5 +	Mac OS 8.5 +	✘
DRIVER OPTIONS							
Colour mode switching (CMYK to RGB)	✘	✘	✘	✘	✘	✘	✘
Manual colour adjustment	✓	✓	✓	✓	✓	✓	✓
Automatic colour correction	✘	✘	✓	✓	✓	✓	✓
Descreen	✓	✓	✓	✓	✘	✘	✓
Resolution switching	✓	✓	✓	✓	✓	✓	✓
Original document presets	✘	✘	✓	✓	✓	✓	✘
Output device presets	✘	✘	✘	✘	✓	✓	✘
Scale	✓	✓	✓	✓	✓	✓	✓
Autocrop	✘	✓	✘	✘	✓	✓	✓
Brightness	✓	✓	✓	✓	✓	✓	✓
Contrast	✓	✓	✓	✓	✓	✓	✓
Gamma correction	✓	✓	✓	✓	✓	✓	✓
Tone map	✓	✓	✓	✓	✘	✘	✘
Histogram	✓	✓	✓	✓	✘	✘	✘
Highlight	✓	✓	✓	✓	✓	✓	✓
Shadow	✓	✓	✓	✓	✓	✓	✓
Eyedropper for highlight/shadow	✘	✓	✓	✓	✓	✓	✘
Sharpen/blur/soften	✓	✓	✘	✘	✘	✘	✘
Automatic mode	✓	✘	✓	✓	✓	✓	✘
SOFTWARE SUPPLIED							
Image editing	ArcSoft PhotoImpression	Adobe Photoshop 5 LE	Adobe Photoshop Elements	Adobe Photoshop 5 LE	ArcSoft PhotoImpression 3	Adobe Photoshop Elements	NewSoft ImageFolio
OCR	ABBYY FineReader Sprint	ABBYY FineReader 4	ScanSoft OmniPage Pro 9	ScanSoft OmniPage Pro 9	Integrated into SmartPanel	Integrated into SmartPanel	ABBYY FineReader Sprint
Other	ArcSoft PhotoBase	Ulead PhotoExpress SE	Canon PhotoRecord, ArcSoft PhotoBase	Canon PhotoRecord, ArcSoft PhotoBase	✘	✘	NewSoft Presto! PageManager, NewSoft Mr Photo, Bridgewell Page abc
OPTIONS							
Transparency adaptor (price exc VAT)	✘	35mm (£39)	Integrated	Integrated	4 x 5in (£69)	Integrated	Integrated
Automatic document feeder (price exc VAT)	✘	✘	✘	✘	✘	✘	✘

*All prices were correct at time of going to press. **Up to 12 x 6cm.



HP Scanjet 4400c	HP Scanjet 7400c	Microtek ScanMaker 3800	Microtek ScanMaker 5700	Trust Direct WebScan 19200	Umax Astra 6400	Visioneer OneTouch 8920 USB
106	101	95	97	82	100	94
£72 (€85)	£289 (€340)	£59 (€69)	£289 (€340)	£50 (€59)	£72 (€85)	£114 (€134)
dabs.com	dabs.com	dabs.com	dabs.com	Ideal Computing	Simply	dabs.com
0800 138 5182	0800 138 5182	0800 138 5182	0800 138 5182	0870 748 1468	0870 727 2100	0800 138 5182
www.dabs.com	www.dabs.com	www.dabs.com	www.dabs.com	www.ideal-computing.co.uk	www.simply.co.uk	www.dabs.com
www.hp.co.uk	www.hp.co.uk	www.microtek.nl	www.microtek.nl	www.trust.com	www.umax.co.uk	www.visioneer.com
1yr RTB	1yr RTB	2yrs RTB	2yrs RTB	2yrs RTB	2yrs RTB	1yr RTB
305 x 505 x 72	311 x 575 x 115	288 x 435 x 80	290 x 500 x 114	398 x 279 x 38	312 x 471 x 110	424 x 297 x 114
14	32	Not stated	Not stated	2.5	20	Not stated
✓	✓	✓	✓	✘, bus-powered	✓	✓
Scan, copy, email, fax	Scan, copy, fax, email, OCR, open PrecisionScan Pro	Scan, copy, email, OCR, scan to Web	Scan, copy, email, OCR, scan to Web	Scan, email, fax, copy, open driver	Scan, copy, custom	Scan, copy, fax, OCR, email, custom, cancel
216 x 297	216 x 297	216 x 297	216 x 297	216 x 297	216 x 297	216 x 297
Not stated	Not stated	Not stated	3.0D	Not stated	2.6D	Not stated
Cold cathode lamp	Cold cathode lamp	Cold cathode lamp	Cold cathode lamp	LED	Cold cathode lamp	Cold cathode lamp
CCD	CCD	CCD	CCD	CIS	CCD	CCD
One pass	One pass	One pass	One pass	One pass	One pass	One pass
✘	35mm, 120 format**, 4 x 5in	✘	35mm, 120 format**, 4 x 5in	✘	✘	35mm
USB 1.1, parallel	USB 1.1, SCSI	USB 1.1	IEEE-1394, USB 1.1	USB 1.1	IEEE-1394	USB 1.1
USB, parallel	USB	USB	IEEE-1394, USB	USB	IEEE-1394	USB
✘	✘	✘	IEEE-1394	✘	IEEE-1394	✘
1,200 x 1,200	2,400 x 2,400	600 x 1,200	1,200 x 2,400	600 x 1,200	600 x 1,200	1,200 x 4,800
Unlimited	Unlimited	9,600 x 9,600	9,600 x 9,600	19,200 x 19,200	9,600 x 9,600	4,800 x 4,800
16	16	16	16	12	14	16
48	48	48	42	48	42	48
✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓
Mac OS 8.5 +	Mac OS 8.5 +	Mac OS 8.6 +	Mac OS 8.6 +	Mac OS 8.6 +	Mac OS 8.6 +	✘
✘	✘	✘	✘	✘	✘	✘
✓	✓	✓	✓	✓	✓	✓
✓	✓	✘	✘	✘	✘	✓
✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓
✘	✘	✘	✘	✘	✘	✓
✘	✘	✘	✘	✘	✘	✘
✓	✓	✓	✓	✓	✓	✓
✘	✘	✓	✓	✓	✓	✓
✘	✘	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✘	✓
Sharpen	Sharpen	✓	✓	✓	✓	✓
✓	✓	✓	✓	✘	✓	✘
ArcSoft PhotoImpression 3 Integrated into PrecisionScan Pro	Corel PrintOffice 2000 IRIS ReadIris 6	Adobe PhotoDeluxe ABBYY FineReader Sprint	Adobe Photoshop Elements Integrated into ScanWizard 5	Ulead PhotoExpress ABBYY FineReader Sprint	Adobe Photoshop 5 LE Caere OmniPage LE	Adobe Photoshop Elements ScanSoft TextBridge Pro 9
ACDSee, Trellix Web Express	ScanSoft OmniForm 4, Boomerang WebShop 2000	Ulead PhotoExplorer	Kodak Digital Science, Ulead PhotoExplorer, LANWizard, SilverFast Ai 5.5	✘	NewSoft Presto! Page Manager	ScanSoft PaperPort Deluxe 7
35mm (€62)	Integrated	35mm (€26)	Integrated	✘	35mm, 120 format**, 4 x 5in (€34)	Integrated
✘	✓ (€163)	✘	✘	✘	✘	✘



BenQ S2W 5300U

PRICE £59 (£69 inc VAT)

SUPPLIER redstore.com 0870 870 4457

VERDICT The 5300U boasts some impressive specifications but it also proved to be rather slow. And unfortunately, the results weren't worth the wait.

BenQ isn't a new company, but simply the latest name for Acer Peripherals. Standing for 'Bringing Enjoyment aNd Quality', the firm operates independently of Acer and claims the change will lead to better customer services, improved channel support and increased brand identity. Whether the name change will deliver on these promises is still open to question, but after testing the 5300U we're yet to be convinced about the bringing enjoyment and quality aspect of it.

The 5300U is a 1,200ppi scanner, which is quite an achievement for the price. Indeed, it's the cheapest 1,200ppi scanner here, undercutting the HP Scanjet 4400c by £13. The sparse rear panel gives its budget origins away, though, with the only ports being a USB 1.1 interface and



12V power input. However, there are several buttons on the front to invoke the relevant software for scanning and OCR documents. For instance, the S2W part of the model name refers to the ability to scan directly to the Web and automatically upload a scanned photo to a Web site for sharing.

On installing the 5300U on our Windows XP test rig, we discovered the installer couldn't locate a file and had to be pointed to it.

The driver isn't particularly intuitive either, but it's fairly comprehensive and usefully allows multiple areas of the bed to be scanned to separate images with their own settings. Unfortunately, things went downhill in our tough suite of tests. For

starters, the 5300U was the slowest on test by a long way. The A4 photo took 164 seconds to scan at 300ppi, while other USB 1.1 scanners produced it in a fraction of that time; the Visioneer 8920 USB was quickest at a blistering 32 seconds. The 10 x 8in photo was scanned at the 5300U's full optical resolution and took well over half an hour to be dropped into Photoshop. The HP Scanjet 4400c – also a 1,200ppi unit – took less than four minutes to complete the same task.

Sadly, the 5300U's results weren't worth the wait. The first quality test was the photo of candles. This suffered from a slight lack of contrast, which meant details were lost. For instance, the creases in the curtain almost disappeared. The 5300U's colour accuracy was respectable, but the jewellery test was slightly too dark and oversaturated. Focus wasn't as sharp as the HP 4400c's, but we found it to be better than the Trust and Black Widow's output.

It's this lack of image quality, combined with unimpressive speed, that prevents the BenQ S2W 5300U from challenging for the awards. It may be the cheapest 1,200ppi scanner here, and its bundled software is respectable enough, but HP's Scanjet 4400c is worth the extra £13.



Black Widow 1248

PRICE £54 (£63 inc VAT)

SUPPLIER Micro Direct 0870 444 4456

VERDICT It's fast in certain areas and the price is extremely competitive, but we recommend you avoid the 1248 due to its generally disappointing image quality.

We reviewed the 1248 Home in the last scanners group test (see *Labs, issue 82, p110*), but despite having almost the same name this 'next generation' model has a lower resolution. The name itself is rather misleading, as the 1248 has an optical resolution of just 600ppi, not the 1,200ppi you'd expect. The 1200 part of its name refers to the less important vertical resolution (see *Scanning technology, p100*).

The extent of the 1248's budget nature is apparent in its captive USB cable, flimsy build quality and cheap, membrane-type buttons. The TWAIN-compatible driver looks dated in Windows XP, with the design harking back to Windows 3.1. However, it has most bases covered, even incorporating tone map and histogram



functions. While there's an optional transparency adaptor, it's worth noting that this is a passive unit, taking its light source from the scanner's cold cathode lamp. We didn't have the opportunity to test one, but it's unlikely that its quality will match the integrated units in Canon's D2400UF or Epson's 2450 Photo.

Testing the 1248 revealed some passable traits considering the low price. Colour accuracy throughout wasn't too bad.

While scans tended to be undersaturated – resulting in washed-out colours – the surprising inclusion of Photoshop 5 LE meant that the original saturation could be restored with a little effort. However, its focus proved

disappointing. Our scientific tests showed a lowly 41:1 signal-to-noise ratio, while its sharpness of 0.82MTF was the second worst on test. This problem was highlighted in the quality scans, where we noticed that the Black Widow's focus was noticeably worse than other budget scanners like the BenQ and HP 4400c. Overall, only the Trust received poorer scores from our panel of judges.

As far as speed was concerned, the 1248 was unpredictable. It took an uninspiring 74 seconds to scan the A4 photo at 300ppi, but only 12 seconds for the 6 x 4in photo at 150ppi. Thanks in part to the scanner's low 600ppi optical resolution, the 10 x 8in jewellery photo just took 167 seconds to scan. This was faster than all the other 600ppi units, bar the exceptionally quick Umax. When it came to the A4 page of text at 150ppi, only the BenQ and the slow-starting Canon D1250U2F SE took longer, but the 1248 only made us wait for 19 seconds.

Just as we went to press, we heard that Devcom – the manufacturer of Black Widow – had gone into receivership. It's uncertain whether product support will continue in the future, but the 1248 is a scanner to avoid on its poor image quality alone.





Canon CanoScan D1250U2F SE

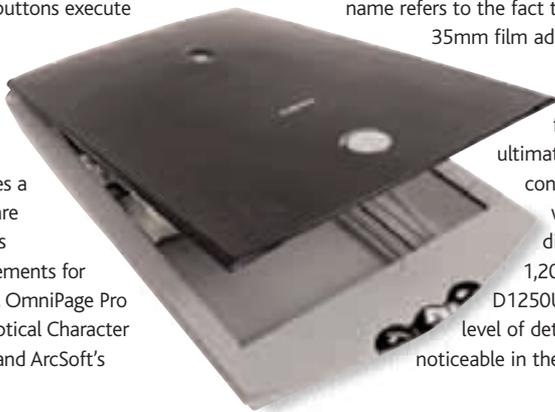
PRICE £132 (£155 inc VAT)

SUPPLIER dabs.com 0800 138 5182

VERDICT Respectable quality scans, a bundled USB 2 card and the bonus of a 35mm transparency unit all boost this scanner's claims.

This scanner is the most stylish on test by some way. It's one of the slimmest CCD scanners around, while the two-tone blue and grey exterior will add a touch of class to any office desk or study.

But this scanner isn't just about looks – it boasts some handy extras too. The Z-lid is a new feature of Canon's latest range of scanners, allowing thick documents or books to be easily scanned, thanks to two hinging points. Four quick-access buttons execute the scanning software with the relevant settings, and thankfully Canon includes a decent software bundle. There's Photoshop Elements for photo editing, OmniPage Pro 9 for OCR (Optical Character Recognition) and ArcSoft's



PhotoBase for managing and organising images. Although more advanced software is available for each of these tasks, this combination is one of the best here.

As the first of only two scanners on test – the other being Epson's 2450 Photo – to feature a USB 2 interface, the D1250U2F SE is bundled with a two-port Adaptec AUA-2000 PCI card, leaving a spare high-speed port free for any other peripherals. The final 'F' in the model name refers to the fact that there's a built-in 35mm film adaptor unit.

So the small Canon isn't lacking in features, but quality is ultimately the most important consideration. Fortunately, we weren't disappointed. With a 1,200ppi resolution, the D1250U2F SE delivered a good level of detail capture, particularly noticeable in the creases of the curtain

in our A4 test image. Colour accuracy was superb on the same test and, generally, scans didn't require any correction. The colours in the jewellery test were slightly undersaturated, but this is easily correctable using the copy of Photoshop Elements that Canon bundles.

We found the focus to be slightly worse than expected in the three test photos, but this wasn't detectable from normal viewing distances. The 35mm film scanner also produced acceptable-quality scans. They were oversaturated, but similarly correctable.

One slight annoyance was the fact that the D1250U2F SE felt the need to 'adjust' the lamp for 25 seconds before some scans. At higher resolutions, this warm-up time is insignificant, but if you're intending to scan images primarily for the Internet the D1250U2F SE can be frustrating. Despite this, the Canon was the second fastest scanner on test when all times over USB 2 were considered.

But this scanner is more suited to the demanding user, who wants to scan at high resolutions and occasionally scan film. If these are your two priorities, and you won't be zooming in too closely to examine focus, the Canon D1250U2F SE is certainly a good choice this month.



Canon CanoScan D2400UF

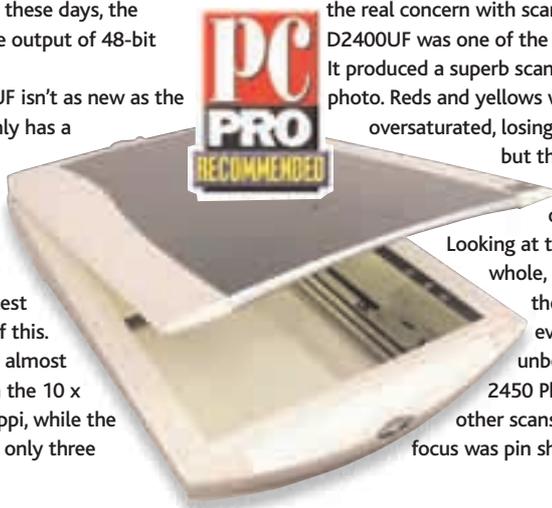
PRICE £229 (£269 inc VAT)

SUPPLIER dabs.com 0800 138 5182

VERDICT It's pricey, but the D2400UF's image quality is well worth the money. And it delivers the best transparency scans here too.

Canon's D2400UF is the firm's flagship flatbed scanner, and the solid construction is just one reassuring indication that it's worth the high price. The optical resolution of 2,400 x 4,800ppi is the current highest for mainstream flatbed scanners and, although a 48-bit internal colour depth isn't unusual these days, the software allows the output of 48-bit images as well.

As the D2400UF isn't as new as the D1250U2F SE, it only has a USB 1.1 interface. This can have a considerable impact on scan times, but only our optical resolution test showed evidence of this. The D2400UF took almost 22 minutes to scan the 10 x 8in photo at 2,400ppi, while the D1250U2F SE took only three



minutes to scan the same image at 1,200ppi. Clearly this isn't just because of its lower resolution. But, unless you need to scan the majority of your images at greater than 300ppi, the limiting USB 1.1 interface shouldn't bother you too much.

Although speed is important, quality is the real concern with scanners, and the D2400UF was one of the best we saw. It produced a superb scan of our candles photo. Reds and yellows were a little oversaturated, losing some detail, but the colour

accuracy was outstanding. Looking at the picture as a whole, it was closer to the original than even the seemingly unbeatable Epson 2450 Photo. Across the other scans, we noticed that focus was pin sharp, meaning

that intricate details were accurately captured.

Like the D1250U2F SE, the D2400UF has a film adaptor unit, only larger. It can handle slides up to 4 x 5in and produced the best results on test. We've been sceptical about the quality of non-dedicated film scanners in the past, but the two colour positives we used as tests showed great detail and colour accuracy.

However, the FARE (Film Automatic Retouching and Enhancement) technology made little difference to the quality of our two test scans. Canon claims it eliminates dust and scratches, but we could still see dust after using it. Plus, switching FARE on increases scanning times three-fold.

On paper, the D2400UF is virtually identical to the Epson 2450 Photo. The same is also true for their image quality. With such similar prices, choosing a winner was difficult, especially as the CanoScan includes Adobe Photoshop 5 LE, OmniPage Pro 9 and ArcSoft PhotoBase.

Overall, though, the Epson gave better-quality scans for reflective images, and its USB 2 and IEEE-1394 interfaces meant its quicker scan times helped give it the edge. But, for the best film results and slightly better colour accuracy, choose the Canon.





Epson Perfection 1650

PRICE £112 (£132 inc VAT)

SUPPLIER Jungle.com 0870 727 1771

VERDICT The 1650 offers high-quality scanning at a reasonable pace. The option of a 4 x 5in film adaptor further boosts its appeal.

We've come to expect great image quality from Epson's scanners, with the Perfection 2450 Photo a case in point. This shot onto the A List when we first reviewed it six months ago, and it successfully defends its position this month. The Perfection 1650 can't quite match the calibre of its sibling, being part of Epson's mid-range rather than the top end, but it's still a fine scanner.

The 1650 comes in two flavours. The first, as covered here, is the basic flatbed unit. There's also a Photo model, which is bundled with a six-frame 35mm transparency adaptor for approximately £20 more. Both models can be upgraded by adding a 4 x 5in transparency lid, which costs around £70.

Build quality is sturdy and the 1650's footprint is average for the group.

Its optical resolution is unusual at 1,600ppi, placing it between the 1,200 and 2,400ppi units on test. There's no USB 2 or IEEE-1394 interface to speed up high-resolution scans, though, with a standard USB 1.1 port at the rear.

Installation presented us with no problems and the new TWAIN driver was one of the most intuitive we saw this month. Also, the comprehensive array of options makes it a great choice for power users.

Speed-wise, the 1650 was slightly below average. It took 50 seconds to scan the A4 photo at 300ppi and almost 21 minutes for the 10 x 8in photo at its 1,600ppi optical resolution; this is where a faster interface would have helped.



But the resulting image quality was well worth the longer waiting times, with the 1650 living up to our high expectations. Our panel rated the candles photo highly, thanks to its good focus and colour accuracy compared to the original. True, colours were a tad oversaturated with yellows turning slightly orange, but this is an easily correctable fault.

The jewellery scan was almost as good. Colour accuracy was again true to the original, with particularly notable gold reproduction. Some minor lightness was again a forgivable problem. The 1650 excelled even more in our scientific tests, with the second best signal-to-noise ratio here of 110:1 and a decent sharpness score of 1.06MTF.

Competing with scanners like the Canon D1250U2F SE and the HP Scanjet 4400c, the Epson ultimately falls between the two. The Canon beats it on features due to the transparency adaptor, while the Epson fights back with better overall quality. But the HP, which also has an optional transparency adaptor, is as speedy as the 1650 and delivers equally good scans for significantly less outlay. Although the 1650 is another great advert for Epson scanners, it's just edged out of the awards this month.

PC PRO RATINGS		
OVERALL		
106		
QUALITY	FEATURES	VALUE
115	90	113
100 IS THE AVERAGE		

Epson Perfection 2450 Photo

PRICE £224 (£263 inc VAT)

SUPPLIER Jungle.com 0870 727 1771

VERDICT Practically faultless image quality and it also boasts USB 2 and IEEE-1394 interfaces. It's expensive, but worth every penny.

The 2450 Photo enters this Labs in defensive mode. It left other scanners for dust when we reviewed it seven months ago, but how does it fare against the other 13 contenders in this Labs? It was a close-run test, but the 2450 Photo emerges as a winner yet again.

It all starts with the fully laden feature set: USB 2 and IEEE-1394 interfaces plus the built-in transparency adaptor. With an optical resolution of 2,400ppi, the 2450 sits level with the forerunners, and Epson's claimed optical density range of 3.3D is one of the best

on test, equalling Canon's D2400UF.

Our scientific tests revealed an overall sharpness result of 1.15MTF, which was on a par with the best this month. A signal-to-noise ratio of 123:1 was another superb result, challenged only by its sibling, the 1650. But, these tests don't give as good a real-world indication of quality as our panel of subjective judges.

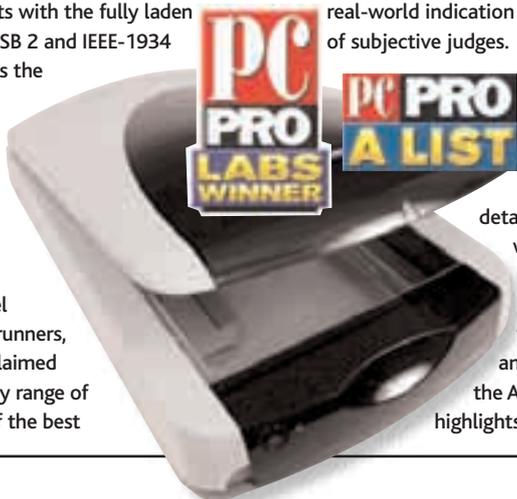
In all three photo tests, the 2450 Photo scored top marks. Skin tones were faithfully reproduced and intricate details of the jewellery image were captured. This was mainly thanks to the 2450's super-sharp focus, which was better than anything else we saw. In the A4 photo, both the highlights and shadows retained

good detail levels and the colour accuracy was nearly as good as the Canons' output.

The 2450 is also a capable film scanner. One neat touch is that when you preview a strip of 35mm film, the driver splits it up into frames, so you can easily select which ones to scan. Slides up to 4 x 5in can be scanned and, fortunately, the quality of both the shellfish and portrait transparency scans was more than acceptable – however, the Canon D2400UF beats it here.

Although it's possible to connect the 2450's USB 2 interface to a USB 1.1 port on a PC, it's advisable to buy a USB 2 or FireWire card. Up to 300ppi, you probably won't notice much difference between all three, but when scanning large images at high resolutions USB 1.1 will keep you waiting much longer. However, this scanner was still fast in the majority of our tests.

It's a shame Epson doesn't include a USB 2 or IEEE-1394 card, and we'd have liked a more comprehensive software bundle, but the 2450 Photo is still worth the money if you're after top-quality reflective scans.



PC PRO RATINGS		
OVERALL		
121		
QUALITY	FEATURES	VALUE
134	115	106
100 IS THE AVERAGE		

Genius ColorPage-HR6X

PRICE £60 (£71 inc VAT)

SUPPLIER Micro Direct 0870 444 4456

VERDICT The Genius boasts a transparency adaptor despite the low price, but image quality is very disappointing. Our advice: avoid it.

Bright images, blazing colours and amazingly quick. That's what Genius' Web site claims the HR6X is capable of. Unfortunately, we dispute all three, based on the results we obtained after testing the firm's most expensive colour flatbed.

While optical resolution isn't the overriding factor where quality is concerned, the HR6X's 600ppi pales in comparison with other offerings in this test –

most notably, BenQ's S2W 5300U is £1 cheaper yet boasts a 1,200ppi resolution. The ColorPage is also one of only two units to feature 12-bit greyscale input, which is odd since its 48-bit input colour depth is the current highest.

Coming straight from the beige-box design school, the Genius won't make the prettiest addition

to your desk. Usability was disappointing too. The under-featured driver had incomprehensible button designs and we had to rely on 'tool tips' to work out how to use it. The unit itself has five buttons, which offer quick access to common functions such as OCR and copying.

It wasn't a good start for the Genius, and unfortunately it turned out to be something of a slouch in our timed tests.

It took 107 seconds to scan our A4 photo at 300ppi, the second slowest we saw. The 6 x 4in photo was scanned in a reasonable 16 seconds, but upping the resolution to 600ppi meant we had to wait almost 11 minutes for the 10 x 8in photo.



Looking at the scans overall, it was obvious that the Genius couldn't compete with the best on test. The test photo of candles lacked contrast in darker areas such as the background curtain while burning out highlights on the yellow flower. Red colour accuracy was respectable, but yellows tended to turn orange. The jewellery test was noticeably undersaturated, and when zooming in on the image the HR6X clearly hadn't picked up the same amount of detail as its fellow 600ppi scanners. In the scientific tests, it achieved a reasonable sharpness score of 0.9MTF, but the signal-to-noise ratio of 32:1 was one of the worst we saw.

Amazingly for the price, Genius also includes a transparency adaptor. Less surprisingly, it was no match for the Canon or Epson models, but this is still a commendable inclusion.

Unfortunately for Genius, this bonus feature isn't enough for us to recommend it. The overall image quality is simply too disappointing. Either spend £12 more on the HP Scanjet 4400c if you don't need a transparency adaptor, or bite the bullet and opt for the Canon CanoScan D1250U2F SE at £132.



HP Scanjet 4400c

PRICE £72 (£85 inc VAT)

SUPPLIER dabs.com 0800 138 5182

VERDICT For under £100, the Scanjet 4400c provides amazingly good scans. If you don't have much money to spend but want quality, look no further.

The Scanjet 4400c is the only scanner this month to include support for older PCs, thanks to its parallel port and supplied cable. It also has a passthrough port for connecting a parallel printer. Thankfully, there's a USB 1.1 interface and cable for faster transfers, but there's no support for USB 2 or IEEE-1394.

The 4400c's optical resolution of 1,200ppi is more than adequate for most people's scanning needs; the 'unlimited' interpolated resolution is simply a marketing ploy, which only generates massive files without any extra detail. The 4400c can capture 48-bit RGB scans, but whether you can view them will depend on the image software used – the bundled ArcSoft

PhotoImpression 3 can't deal with them. But this was one of the few disappointments we had when testing this scanner.

In particular, the 4400c produced superb-quality images considering its price. Our only criticism was that photo scans were slightly too bright, but generally its colour accuracy was excellent – it coped with the golds on the jewellery scan particularly well.



Although reds turned slightly pink, this was actually less noticeable than on the scans from the 7400c. Another bonus was that its focus was sharp throughout, although we recommend scanning A4 text at 300ppi rather than 150ppi, as the letters weren't as defined as those from most of the other scanners.

The 4400c wasn't the fastest on test, but it

did have its moments. Scanning the jewellery photo was extremely fast, completing in less than four minutes despite the 1,200ppi resolution. However, it took nearly a minute to scan the A4 photo at 300ppi, while the Canon D2400UF managed it in 25 seconds over the same USB 1.1 interface.

The main weakness of both the Scanjet devices is the driver. It appears to be aimed at novices, and accessing advanced tools isn't as simple as it should be. Even worse, the driver closes after every scan unless doing OCR. This significantly increases the time taken to scan multiple photos, as the lamp is warmed up each time the driver opens.

Despite this, the Scanjet 4400c is a very capable image-capture device. Generally, we were more impressed with its scans than with the 7400c's, which is four times more expensive. The 4400c can't match the quality of the Epson 2450 Photo or Canon D2400UF, but then it isn't intended to compete with these monsters. At just £72, the 4400c is firmly aimed at the budget market

and, with the option of a transparency adaptor, its great image quality and a respectable turn of pace, the little HP puts every other budget scanner on test to shame.





Digital dilemma

We investigate the best way of getting an image onto your PC

They said the scanner was dead, that digital cameras would take over the computing world. But things aren't that simple. You may have all the software already on your PC for editing your photos, but what's the best way of getting an image into your PC? How do you digitise the visual world?

Digital cameras have certainly led the charge in this area of late, but studies and experts suggest the scanner isn't dead as

It's an issue that raises contention in photography circles, with two distinct schools of thought equally viable.

'It's a difficult decision and you could argue either way between a scanner and a digital camera,' said Jon Tarrant, editor of professional snappers' magazine *British Journal of Photography* (www.bjp.co.uk). 'Much of it comes down to a matter of personal preference.'

Much of the debate centres around the

Estimates vary widely, depending on the researcher's stance, but there are up to 14 million 'pixels' in a good-quality 35mm shot using a tripod and with good light and correct settings. That figure can drop to a million as poor light, hand shake and focusing problems come into play. The pixellation in digital pictures is likely to be more dramatic than chemical grain that can be seen when 35mm prints are blown up.



a method of importing images. Research shows that for every digital camera in the world there are millions of old photos. In archiving terms alone, the scanner has a place at the head table at the digital photography party.

Many people even argue that a scan from a print or transparency taken on a traditional camera is of better quality than a mid-range digital camera shot. The basis behind the argument is that the resolution of film is better than all but the very best (and expensive) digital cameras. Therefore the image-capture capability of film is better than most digital cameras.

Many photographers argue the image loss between scanner and computer is so minimal that scanning from film will produce sharper images, although as digital camera technology improves that argument will become more contentious.

64-megapixel question: 'How many pixels do you need in a digital camera to achieve the same clarity found in film?' It's an argument that's been circulating since digital cameras came to market ten years ago.

The problem with this question is that film is an analog medium and so doesn't have pixels that can easily be measured. Comparisons can and have been made, but these remain largely subjective.

However, it's almost universally accepted that even the best consumer digital cameras don't come close to replicating the image quality of a decent 35mm SLR camera. Only once you start getting into the 6-megapixel territory of the Canon EOS D60 (*see Reviews, issue 94, p132*) are professional images possible. Not many people, however, have £2,000 to spend unless they make their living from taking photographs.

Clearly, the top end of this scale is far higher than most readers' digital cameras, and another factor is that film isn't restricted by the 256 greyscale and the limited colours we find in digital cameras.

QUESTION OF COST

Personal preference is one issue, but part of that preference will always involve cost. One thing that's certain in this vague and subjective area is that, for image quality of digitising, you get a better deal, pound for pixel, with a scanner.

'If it's a question of quality, then, say you had £500 to spend, you'd get much better results from a £500 scanner than you would from a £500 digital camera,' said Tarrant.

However, if your decision is purely financial, there are many arguments for taking the digital camera route. Obviously, film and processing costs



disappear, allowing you to shoot to your heart's desire, capture more images and potentially better pictures.

'Do you want to be paying for processing pictures, then taking the time to scan them in, which many people find a chore – and time is money for many people,' said Tarrant. 'It really is six of one and half a dozen of the other.'

Many photography tutors recommend digital cameras as a way of learning composition cheaply, allowing budding David Baileys to keep shooting freely, but once these techniques are mastered students often revert to film to achieve greater clarity.

Not everyone, however, is convinced that digital cameras necessarily produce poorer qualities, except when printing to a larger format.

'The quality of an image from a good 3- or 4-megapixel digital camera, compared to the scanned image taken with a compact 35mm traditional camera, is similar, providing the picture isn't enlarged beyond A4,' said Tim Potter, HP Scanjet product manager.

'In fact, the digital camera image is more likely to be in focus, correctly exposed and composed because the image was checked directly after shooting. This is much more likely to have an effect on the quality of the image than the nuances between the two technologies.'

DATA ISSUES

Other considerations include the different ways the image data is treated by both the scanner and digital camera on its way to your hard disk.

'What's interesting is that if you had six million bits of data from a digital camera and six million bits from a scanned image, they wouldn't be the same data and that would affect the final image,' said Tarrant. 'At this stage, it's difficult to say which is better – much depends on the algorithms being used – but the final image won't be the same.'

This is because scanners try to mirror exactly the colours on the original with a pixel-by-pixel representation, while digital cameras still interpolate some of the image data.

On the scanner, even with only 8 bits per colour, you get 24 bits of data for every single pixel. Many digital cameras only get 8 bits of data for each pixel and interpolate the other 16. Colour accuracy on many scanners can therefore be much more accurate, although digital cameras are improving. There are, however, file-size considerations involved here and scanning at high resolutions can consume huge swathes of your hard disk.

CONCLUSIONS

Given that there are so many compelling arguments for both approaches to digitising your memories, the best solution

may be to opt for a combined approach. You might want to buy a scanner for high-quality images and archiving old pictures, but also carry a digital camera for holiday snaps and other occasions where simplicity is more important than quality.

With so many scanners in this month's Labs coming with film-scanning accessories, another consideration is whether you should be scanning from film or print. Much depends on the quality of your media.

'If you're going to scan, then whether you should scan from a negative or a print is another difficult question,' said Tarrant. 'The negative is obviously the original and so you could argue the print is already degraded, especially if the print was done in a high-street mini-lab more than ten years ago. They're better now, but the quality of picture processed on the high street more than a decade ago is poor and you might be better off scanning the negative.'

On the other hand, if the negative in question hasn't been well looked after, scanning from the print may be a better option.

'If there's a speck of dust on the original and it's a negative, there's a much higher percentage of the image lost or corrupted than if there was a bit of dust on a print.'

STEWART MITCHELL

Image conscious

Another key consideration to the choice between scanned and digital is your planned output method. Given that images posted to the Web, for bandwidth reasons, shouldn't exceed 72-100dpi and that most monitors only display at 100dpi, any higher resolution would be a waste. Here a low-end digital camera would suffice.

However, where scanners really come into their own is for copying or enlarging prints. The high optical resolution of many of the scanners in this month's Labs, up to 2,400ppi, can produce photos with virtually no quality loss.

Camera scanning

The argument between scanners and digital cameras is further clouded by the fact it's possible to use a good-quality digital camera, particularly one with macro capabilities, to copy from prints. Effectively, by taking a picture of a photo, a camera can act as a scanner.

'More and more professionals are now using a digital camera as a method of copying, instead of using a scanner,' said Tarrant. 'But for most people, actually doing this without getting reflections from around the room is difficult and time consuming.'

Antique images

There's been much debate regarding how much damage is done to old photographs by being exposed to the strong pulses of light the scanners use. According to Jon Tarrant from the *British Journal of Photography*, it's an important issue.

'Old pictures do suffer from being scanned, but because once you've scanned that image it can be locked away safely, archiving is worth the risk,' said Tarrant. 'Once it's out of the way, you have a permanent record and you can store the original somewhere safe.'



HP Scanjet 7400c

PRICE £289 (£340 inc VAT)

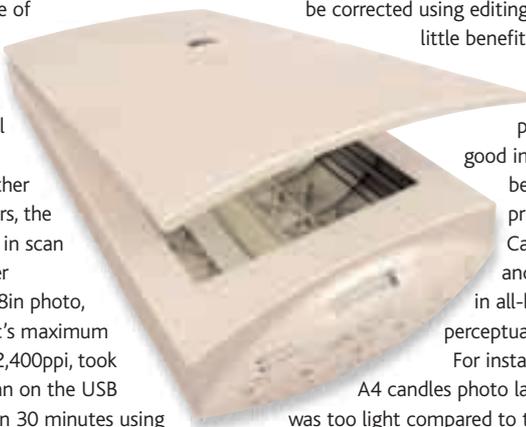
SUPPLIER dabs.com 0800 138 5182

VERDICT The sole bearer of the SCSI torch fails to outshine more modern scanners from Epson and Canon. Only those looking for batch OCR processing should investigate it.

In common with HP's 4400c, the 7400c possesses an 'outdated' interface. Other scanner manufacturers have all but abandoned SCSI connections, at least at this price point. Few PCs have SCSI interfaces these days, but if your PC is fitted with an external Ultra 2 port and a cable, the speed increase above the complementary USB 1.1 interface is worth the extra hassle of setting it up.

However, we'd have liked to see USB 2 or IEEE-1394 to cover all the high-speed bases.

As with all the other dual-interface scanners, the biggest improvement in scan times is seen at higher resolutions. The 10 x 8in photo, scanned at the 7400c's maximum optical resolution of 2,400ppi, took over two hours to scan on the USB interface, but less than 30 minutes using



SCSI. The A4 photo was similarly quicker, taking 15 seconds instead of 49 seconds with USB. However, only one second separated the times for the low-resolution A4 text and 6 x 4in photo scans, where the speed of the scanning carriage was the limiting factor.

However, speed isn't everything. If the resulting images are poor quality and can't be corrected using editing software, there's

little benefit in having them quickly. Although the 7400c produced generally good images, it lagged behind equivalently priced models from Canon and Epson, and even the 4400c in all-but-one of the perceptual tests.

For instance, the scan of the A4 candles photo lacked contrast and was too light compared to the original. We also

noticed that reds looked distinctly pink, denoting an excess of yellow in the scan. This same problem occurred in the scan of the jewellery, which also suffered from highlights being burnt out. We were again disappointed by the quality of the transparency scans when compared to the Epson and Canon – the images were comparatively noisy and oversaturated.

The 7400c uses the same driver as the 4400c and thus suffers from the same usability problems, although it does install quickly and easily. The other bundled software is Corel PrintOffice 2000, which includes image-editing tools and professional document-creation facilities, IRIS ReadIris 6 for OCR, ScanSoft OmniForm 4 for creating electronic forms and Boomerang WebShop 2000 for building an online shop with scanned images of products.

The 7400c is the only scanner to offer the option of an automatic document feeder, which costs £163. This allows up to 50 pages to be loaded and is ideal for batch OCR processing, especially as the Scanjet was one of the best on test for text scanning. But that's about all the Scanjet 7400c has going for it. The Epson Perfection 2450 Photo delivers better quality for £65 less, so the choice isn't difficult.



Microtek ScanMaker 3800

PRICE £59 (£69 inc VAT)

SUPPLIER dabs.com 0800 138 5182

VERDICT An excellent performer in our scientific tests, but overall image quality was slightly disappointing. For most people, it's worth spending a few pounds more.

The first of Microtek's two offerings this month is one of the cheapest scanners on test. At £59, the 3800 competes with models from BenQ, Black Widow and Genius at the budget end of the market. It doesn't include a transparency adaptor like the Genius ColorPage-HR6X, but you can buy a 35mm adaptor for just £26. The 3800's optical resolution of 600ppi is par for the budget course – although BenQ bucks this trend with its 1,200ppi S2W 5300U – but it was good to see a two-year warranty, albeit a return-to-base affair.

In the scientific tests, the 3800 actually performed better than its big brother. An overall sharpness score of 1.13MTF put it on a level with the two HPs,



and a signal-to-noise ratio of 94:1 was close to the best – only the two Epsoms scored higher this month.

Unfortunately, the 3800 couldn't continue this form in our subjective tests. There was a slight lack of contrast in the A4 and 10 x 8in scans, while too much yellow caused reds to turn pink. True, these problems can mostly be corrected using photo-editing software, but the bundled PhotoDeluxe is

more limiting and doesn't offer enough manual controls. We'd have preferred to see Adobe Photoshop 5 LE or Elements.

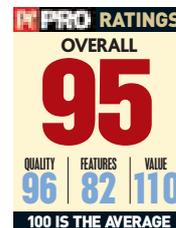
Even using Photoshop, we were unable to adjust the images to improve the focus, which was fuzzy despite the decent scientific sharpness score. The

3800 also struggled with skin tones and mono A4 text. The latter showed poor letter definition, while the former was grainy and an excess of yellow observed in the other tests gave lighter skin a jaundiced look.

The 3800 was one of the slower USB 1.1 scanners on test. It took 94 seconds to scan the A4 photo compared to the Canon D2400UF's 25 seconds. Similarly, scanning the jewellery photo took nearly eight minutes at 600ppi – the Black Widow and Trust managed this resolution much faster.

Aside from PhotoDeluxe, Microtek includes ABBYY FineReader Sprint for OCR, Ulead Photo Explorer for image cataloguing and, bizarrely, Panda AntiVirus Titanium. We don't know why Microtek thinks AntiVirus is relevant software for a scanner, and it's limited to three months anyway.

Overall, the Microtek ScanMaker 3800 isn't the bargain it initially appears to be. Its poor colour accuracy and focus prevent us from recommending it, despite its high scientific scores. A lack of pace and a lacklustre software bundle also count against it. If you can afford the HP Scanjet 4400c's price of £72, it's worth spending that little bit extra.





Microtek ScanMaker 5700

PRICE £289 (£340 inc VAT)

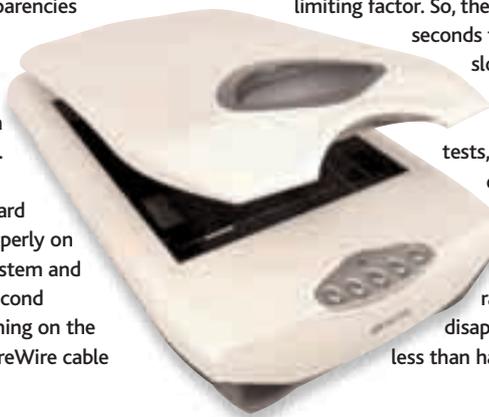
SUPPLIER dabs.com 0800 138 5182

VERDICT At this price, we expect excellent image quality, so the ScanMaker's relatively poor results let it down severely.

The ScanMaker 5700 fits neatly into the middle of Microtek's mid-range/corporate bracket, but is the joint most expensive on test along with HP's Scanjet 7400c.

Considering the price, its specification isn't overly impressive. It has an optical resolution of 1,200ppi where others boast 2,400ppi, and has a slightly lower input colour depth of 42-bit. Where it pulls back some kudos is the large-format, integrated transparency adaptor, which allows transparencies up to 4 x 5in to be scanned.

Installation presented us with a couple of problems. The drivers for the supplied FireWire card wouldn't install properly on our Windows XP system and this resulted in a second problem where turning on the scanner with the FireWire cable



connected caused the PC to reboot. We only managed to solve this by using drivers from our Adaptec FireWire PCI card.

Thanks to the FireWire connection, the 5700 was commendably fast when scanning images at 300ppi or greater, managing the A4 photo in 25 seconds – almost the quickest on test. However, at lower resolutions, the benefit of FireWire's huge bandwidth was lost, since the speed of the scanner's mechanics was the limiting factor. So, the 150ppi A4 text took 19 seconds to scan, three seconds

slower than the ScanMaker 3800.

In our scientific tests, the 5700 managed an overall sharpness score of 1.04MTF – a fair but not great result.

The signal-to-noise ratio was more disappointing. At 40:1, it was less than half that of its cheaper

sibling and way behind the similarly priced Epson Perfection 2450 Photo.

During the analysis of the scientific tests, we noticed a distinct shift towards green, and this also showed up clearly in our test photos. This problem was most evident on the 10 x 8in jewellery photo, but is correctable using the bundled Photoshop Elements. Despite this issue, the colour accuracy of the A4 photo wasn't too bad. However, there was a lot of banding in the darker areas – a fault unique to this scanner and disappointing given the high price.

The quality of the two transparency scans was also worse than we'd expected. Too much yellow made skin tones look jaundiced. Also, while the shellfish scan looked fine from a distance, zooming in revealed a disturbing amount of strange colour noise in the darker areas. The Canon D2400UF was superb in comparison.

Given the price, we expected a lot more from the 5700. Merely being quick wasn't enough and, since this is the Microtek's only real advantage over the Epson Perfection 2450 Photo and Canon D2400UF, we recommend either of these over the ScanMaker 5700.



Trust Direct WebScan 19200

PRICE £50 (£59 inc VAT)

SUPPLIER Ideal Computing 0870 748 1468

VERDICT A poor advert for CIS scanners. The Trust can't compete with the budget CCD-based opposition despite its extremely low price.

Anyone looking for a good-value scanner is sure to be distracted by the £50 Trust. Not only is it the cheapest scanner here, it also looks like a practical proposition. It's powered over the USB 1.1 bus, so requires just one cable connection, and it even comes with a support allowing it to be stored on its side. As the only scanner this month to use CIS technology in the scan head, its primary advantage is the low power requirement thanks to the LED light source (for more details, see Scanning technology on p100).

The 19200 in the name refers to the maximum interpolated resolution – a relatively meaningless figure, as this doesn't add any tangible quality to a scan – but this scanner has an optical resolution of just 600ppi. In our scientific tests, the Trust managed an overall sharpness score of only 0.9MTF. The signal-to-noise



ratio of 55:1 was far from stunning, but compared well to most of the budget scanners this month. Only Epson's scanners broke the 100 mark.

Unfortunately for Trust, the WebScan's image quality was the worst we saw, with very dark scans. The curtain creases on the A4 photo had almost completely disappeared and other details were lost due to the darkness. The jewellery scan was

similarly dark

using the automatic photo setting, but the TWAIN-compatible driver allows manual gamma correction. However, highlights in the scans were burnt out even

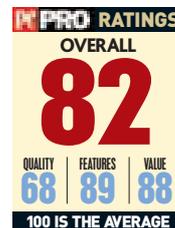
before brightening them. A small consolation was that colour accuracy was reasonable, but this really isn't compensation enough.

This isn't the quickest scanner around either, taking 71 seconds for the A4 photo at 300ppi and 18 for the A4 text. Canon's D2400UF was the fastest USB 1.1 scanner, taking just 25 seconds for the A4 photo.

Installing the drivers on our Windows XP test rig was a little awkward. Trust doesn't include any XP drivers, so we had to make do with the Windows 2000 drivers instead. Then the installer asks for the Windows CD despite the fact that the file is actually on the driver CD. The TWAIN driver must also be installed separately, but thankfully there's an XP version.

The other software included – Ulead PhotoExpress and ABBYY FineReader Sprint – are both basic packages that do their stated jobs well, but the former isn't up to serious image manipulation, with basic enhancement features only. However, Black Widow alone manages to bundle Adobe Photoshop 5 LE at a comparable price.

Ultimately, we can't recommend the Direct WebScan to anyone, even if you're on the tightest budget. The HP Scanjet 4400c is a far better buy, despite costing another £22.





Scanning technology

We investigate how scanners work and the key ingredients of an excellent unit

All but one of the scanners on test use a combination of a light source, a colour-separation method and an array of CCDs (Charge Coupled Devices) to capture an image. The light source is usually a cold-cathode bulb. This differs from a fluorescent bulb in that it has no filament, generates little heat and provides a consistent white light for longer, giving much better results. Some of the latest scanners use Xenon bulbs, which have similar characteristics to their cold-cathode counterparts.

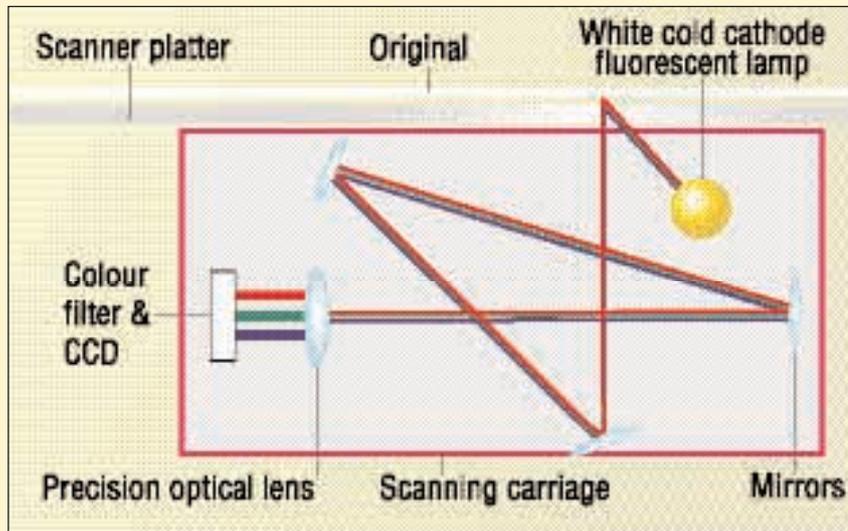
Colour separation is achieved through a lens that splits the incoming light into three channels: red, green and blue. These then pass through a colour filter onto a discrete section of the CCD array. The scanner combines all the data to form a single, full-colour image.

The CCD records the lightness of the reflected or transmitted light as an intensity, which can then be translated to a colour value. The intensity is proportional to the number of photons captured in a given time period. A higher intensity comes from more light being reflected, or transmitted in the case of film scans, by the original document or image. Black gives the lowest intensity, while white gives the highest.

When the scanner scans an image, the bulb illuminates a thin strip of the image called a raster line. The reflected or transmitted light is captured by the CCD array and converted to a set of digital values. In a 1,200ppi A4 flatbed scanner, where the scanning width is 216mm (or 8.5in), there are 10,200 (8.5 x 1,200) usable CCD elements in the array. As the array is a lot smaller than 8.5in wide, an optical system, comprising prisms, mirrors, lenses and other components, focuses the light from the raster line down to the appropriate size of the array.

This covers the horizontal resolution, but the smallest distance the scanning carriage can move determines the vertical resolution. In many of the scanners on test here, the carriage is able to move 1/2,400in, giving a 2,400ppi vertical resolution.

The quality of the optical system can vary considerably between scanners,



with high-quality models using colour-corrected glass optics, for example, while low-end models may use plastic components to save money.

CIS vs CCD

One scanner on test, the Trust Direct WebScan 19200, doesn't use an array of CCDs. Instead, it uses another technology called CIS. Standing for Contact Image Sensor, a CIS array consists of tightly packed arrays of red, green and blue LEDs, which are used to produce a white light.

The optics of a CCD-based scanner are replaced with a single row of sensors, which are mounted close to the source image. The benefits of CIS are that it allows thinner and lighter scanners to be produced, which are also more energy efficient, allowing them to be powered across USB without an additional power supply. However, this Labs' sole representative of CIS technology, Trust's WebScan, failed to match the quality of its rival CCD scanners.

BIG NUMBERS GAME

We've already covered the importance of resolution, but it's important to differentiate between optical and interpolated. Whereas optical resolutions are determined by the CCD and the distance the scan head moves, interpolated resolutions use algorithms to generate the extra pixels based on the colours of the existing pixels in the

actual scan. This leads to blurrier images that consume even more space – hardly worth the effort, except for the scanner manufacturer's marketing department.

Similar arguments apply to bit depths. This refers to how accurately a scanner can describe the intensity of each pixel. Theoretically, the higher the bit depth, the better the final scan. Most of the scanners on test boast 42- or 48-bit depths, which is 14- or 16-bit per colour – red, green and blue. Since most image-editing applications can only cope with 24-bit colour, having the extra six or eight bits per colour isn't that useful. However, applications can use the extra information to correct noise in the scan, and you can also more accurately set luminance values and other image settings in the scanner's driver.

Optical density range – or dynamic range – is similar to the bit depth. It refers to the range of tones that a scanner can recognise and record. This is most important when scanning transparencies, but is far less relevant for reflective scans.

Since manufacturers quote many of these near-meaningless figures on their packaging, it's important not to be persuaded that bigger is better. If you want to ensure that you buy the best-quality scanner, only exhaustive testing from independent sources such as *PC Pro* truly sorts the best from the merely good.

JIM MARTIN



Umax Astra 6400

PRICE £72 (£85 inc VAT)

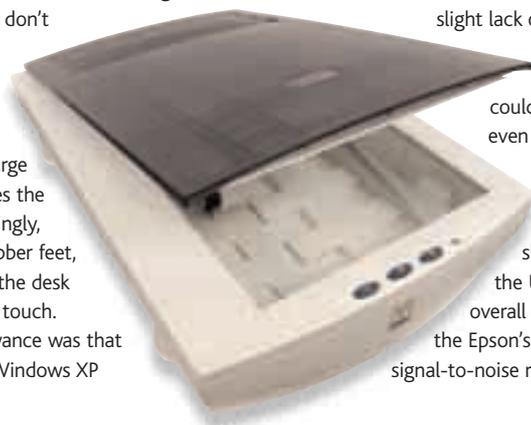
SUPPLIER Simply 0870 727 2100

VERDICT Thanks to a FireWire interface and the bundled card, the Astra 6400 is the fastest scanner on test. Only a lack of cutting-edge image quality lets it down.

We first looked at this scanner almost two years ago (see *Reviews, issue 74, p184*) when it cost £170. This shows that although scanner technology moves slowly compared to the rest of the IT industry, at least prices drop at a significant rate. In theory, this makes the Astra a bargain, since it comes bundled with a three-port OHCI FireWire card, which should be compatible with most other IEEE-1394 devices. Bear in mind, though, that FireWire cards don't cost a huge amount.

The scanner itself is starting to show its age; the large beige-box look gives the game away. Annoyingly, the base has no rubber feet, so it slides around the desk under the slightest touch.

Another annoyance was that installation under Windows XP



proved problematic. Unsurprisingly considering this scanner's age, XP drivers aren't provided, so we had to download them from the Web. Also, be warned that the Windows 2000 drivers don't work and can't be uninstalled.

After testing the 6400, we can safely say that its image quality is good rather than great. On both the photo scans, the reds came out slightly too pink, although this was correctable to some extent in Photoshop. However, the slight lack of focus, especially compared to the Epson 2450 Photo, couldn't be corrected even using sharpening tools. This problem also showed up in our scientific sharpness test, with the Umax scoring 0.87 overall compared to the Epson's 1.15. The signal-to-noise ratio was similar to

that of other similarly priced scanners at 47:1 – not a great result.

Thanks to the IEEE-1394 interface, the Umax was one of the fastest scanners on test. At 300dpi, it managed to scan the A4 photo in 26 seconds – a shade over the times of the other FireWire scanners. The A4 text took 19 seconds, which is limited by the scanner's mechanics rather than the interface.

Most impressive was the 52 seconds it took to scan the A4 jewellery photo, although this was at the Astra's relatively low optical resolution of 600ppi.

One of our gripes was the loud mechanical whirring accompanying every scan, something we didn't notice with other scanners. But we were highly impressed by the software bundle for the price. The inclusion of Adobe Photoshop 5 LE along with Caere OmniPage LE and Presto! Page Manager adds up to a comprehensive software package. The optional 35mm and 120 format transparency adaptor for £34 is also welcome on such a well-priced device.

When it comes to features-per-pound, the Astra is near-impossible to fault, especially considering its speed. But it's the lack of image quality compared to the best that prevents it from winning awards.

PRO RATINGS		
OVERALL		
100		
QUALITY	FEATURES	VALUE
94	105	109
100 IS THE AVERAGE		

Visioneer OneTouch 8920 USB

PRICE £114 (£134 inc VAT)

SUPPLIER dabs.com 0800 138 5182

VERDICT Generally disappointing image quality negates the benefits of quick scans and a good software bundle.

Visioneer's OneTouch 8920 uses the same landscape design as its previous models.

This gives it a shorter depth on your desktop, but means it's still one of the bulkier devices on test. It has an optical resolution of 1,200 x 4,800ppi, the high vertical resolution achieved in exactly the same way as other 4,800ppi units – a precise stepper motor moving the carriage tiny distances. But it's the 1,200ppi figure that means the most; for more technical information, see Scanning technology opposite.

The relatively high price can be partially attributed to the integrated transparency lid, but this can only scan 35mm film. Software comprises Photoshop Elements, TextBridge Pro 9 and



PaperPort Deluxe 7. This is one of the best bundles on test, with PaperPort being a particularly well-designed document-management application.

The driver itself is comprehensive yet simple to use; for instance, it allows batch scanning for separate areas of the scanning bed, with individual settings for each. Seven 'one-touch' buttons line the chunky, grey unit's front panel and include a cancel function that we found to be quite responsive.

Sadly, lacklustre image quality let the 8920 down. In all three of our test photo scans, colours were oversaturated. This can be corrected to a degree in Photoshop, but the colour accuracy itself wasn't overly impressive. The jewellery scan was the 8920's

best effort and the overall image looked much truer to the original than the other two tests. Gold proved difficult for the Visioneer though – it turned too yellow in the scan.

Our scientific tests indicated that the sharpness wasn't as bad as other scanners, with a score of 1.16MTF putting it ahead of most others on test. Generally, though, our panel found the scans to be slightly out of focus. A signal-to-noise ratio of 83:1 was good, but not outstanding.

Testing the 35mm film scanner capabilities proved a disappointment. Colours were way off, and checking the histogram revealed huge gaps in darker areas, making our portrait shot look blotchy; unfortunately, this couldn't be corrected even using Photoshop.

Visioneer usually places a big emphasis on the fact that its scanners are fast, so it was no surprise that the 8920 was above average in this Labs. It took 32 seconds to scan the A4 photo at 300ppi, and the 10 x 8in photo at 1,200ppi was delivered to Photoshop in under nine minutes.

Ultimately, as image quality is so important when buying a scanner, the OneTouch 8920 USB is disappointing. It has some nice features, but at this price we can't recommend it.

PRO RATINGS		
OVERALL		
94		
QUALITY	FEATURES	VALUE
89	101	90
100 IS THE AVERAGE		