



# Hard disks

We put a dozen of the best internal and external hard disks through their paces

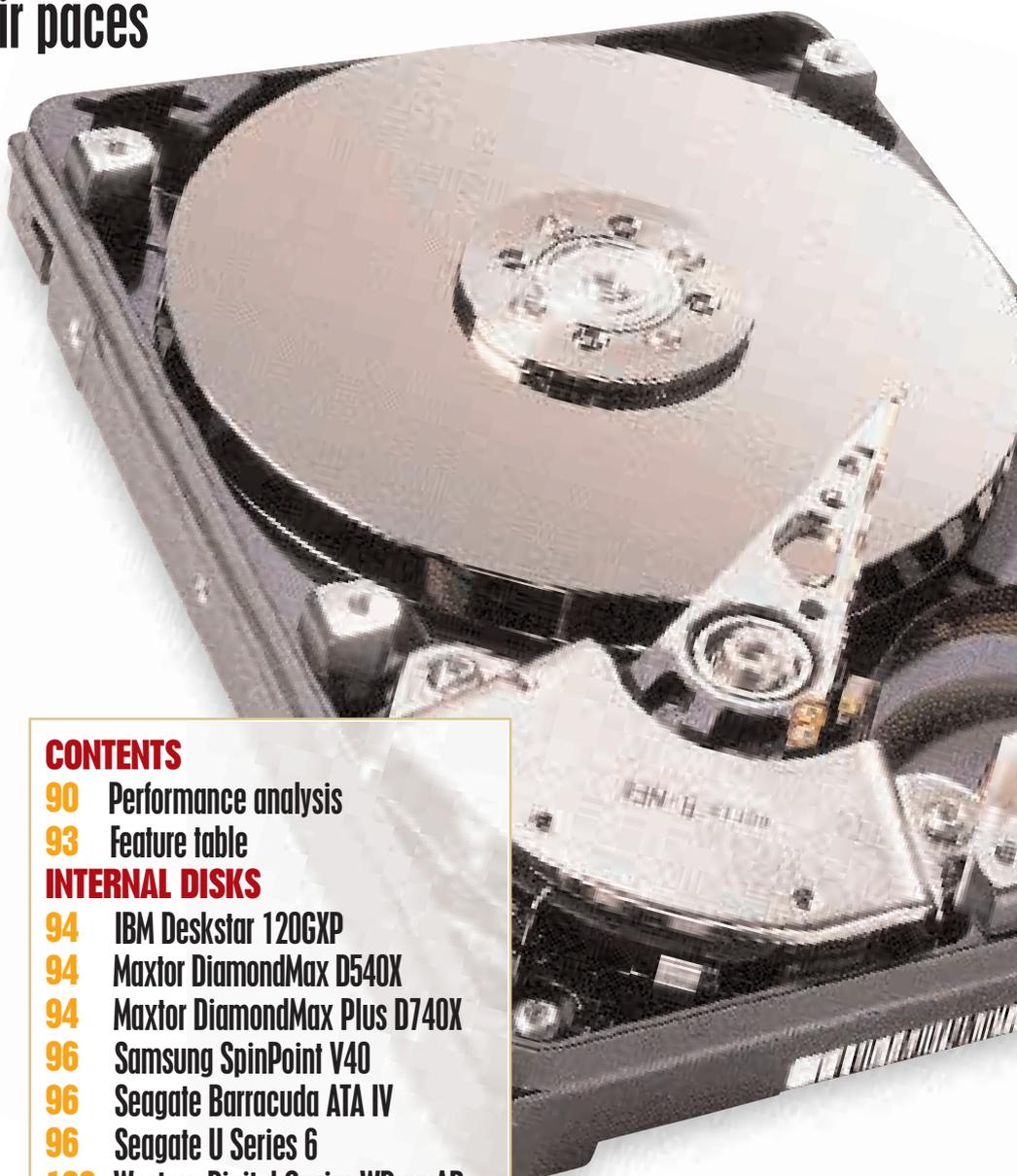
**M**any people upgrade their PCs by adding the latest CPU or more memory, but leave their old hard disk in place. But the humble hard disk is one of the slowest components inside a PC (in fact, only optical drives are slower), so it's imperative that your PC is equipped with a fast disk to minimise this potential data bottleneck. We found the difference in speed between the fastest and slowest disks on test to be around 15 per cent, so imagine what the difference would be if you replaced your old hard disk with the fastest disk here.

Data storage technology has advanced considerably over the last two years, such that the fastest EIDE disks can outperform their SCSI counterparts in a desktop or workstation environment. Western Digital's Special Edition Caviar, for example, has a peak transfer rate of almost 46Mbytes/sec, putting many SCSI disks to shame.

For the first time in Labs, we're also covering external hard disks. Although performance is sacrificed by using a USB 2 or IEEE-1394 interface, external disks hold several advantages over their internal cousins. First, they're portable, so you can transfer large files to other PCs or notebooks without resorting to multiple CD-Rs or investing in an expensive DVD burner. Second, they're simple to install. And lastly, they're the only solution if you have no free internal bays left.

With prices per gigabyte starting from just £1.19 for the largest disks, there's little reason to buy a small disk any more – they tend to offer less value for money anyway. We've rounded up the latest disks from all the major manufacturers and put them through their paces with our exhaustive suite of tests.

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## CONTENTS

**90** Performance analysis

**93** Feature table

## INTERNAL DISKS

**94** IBM Deskstar 120GXP

**94** Maxtor DiamondMax D540X

**94** Maxtor DiamondMax Plus D740X

**96** Samsung SpinPoint V40

**96** Seagate Barracuda ATA IV

**96** Seagate U Series 6

**100** Western Digital Caviar WDxxxAB

**100** Western Digital Special Edition Caviar WDxxxxJB

## EXTERNAL DISKS

**100** Ikebana Fireblaster

**101** Maxtor Personal Storage 3000LE

**101** Maxtor Personal Storage 3000XT

**101** Western Digital External Hard Drive



We want your opinions on reliability and service. Make your vote count – and win prizes!  
See p46



# Performance analysis

## How we put a dozen hard disks through their paces, and what to look for when buying

Unlike other peripherals we test at *PC Pro*, hard disks are fairly straightforward to test. Their features don't differ hugely, so our primary concern is with their performance. To give an accurate measurement, we use our usual *PC Pro* test rigs, based on 1GHz Athlon CPUs with 256Mb of PC133 Crucial SDRAM. EuroTech (0870 458 0011) kindly supplied the Promise Ultra133TX2 controllers for this Labs, as the AOpen AK33 motherboards only feature UltraDMA/66 support.

For EIDE disks, we conduct several low-level tests that isolate each disk's performance, using Intel's IPEAK SPT (Storage Performance Toolkit). This is capable of measuring every conceivable aspect of a storage subsystem's performance, and we make use of it to assess both read and write access times. IPEAK runs 25,000 random single-sector seeks across the whole disk, so the final result is highly accurate. Before carrying out the write tests we disable Write Caching in Windows XP – the results would otherwise be meaningless.

A hard disk's performance is determined by three main factors: seek time, spindle speed and data density. The average seek time – for both reading and writing – is the average time taken for the head to arrive at the correct track on the disk. Obviously, the faster a disk's heads can arrive at the right track, the quicker it can perform the read or write operation.

The spindle speed determines the average rotational latency. A 5,400rpm disk has a latency of 5.6ms (the average time taken for the required sector to arrive under

the read/write head), while 7,200rpm reduces this to 4.2ms. It might not sound like a big difference, but it can translate into seconds when the disk has to read or write scores of megabytes.

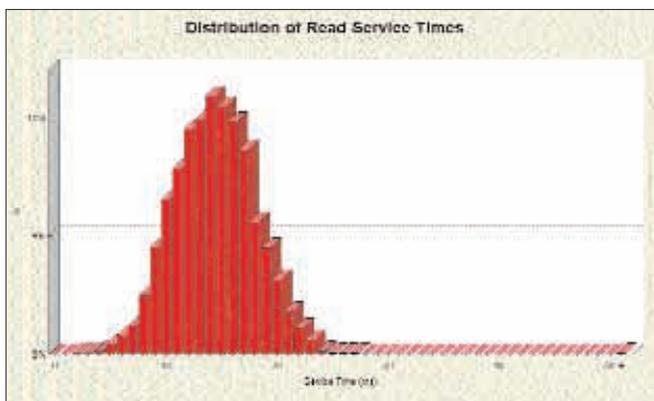
Combining the latency and seek times gives an average access time, and this varies considerably between all the disks on test. Data density is another factor, and all but one disk on test cram 40Gb onto each platter – 20Gb on each side. The closer data is packed onto the disk, the less distance it has to rotate – and the head has to seek – before the data is reached.

Our last low-level test involves testing the STR (sequential transfer rate). This measures the rate at which the disk can transfer

data sequentially from multiple tracks and cylinders on the platters. Transfer rates are quicker in the outer zones since the cylinders are larger – and thus hold more data – than the smaller inner cylinders.

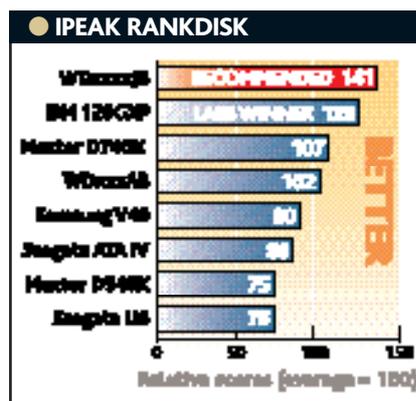
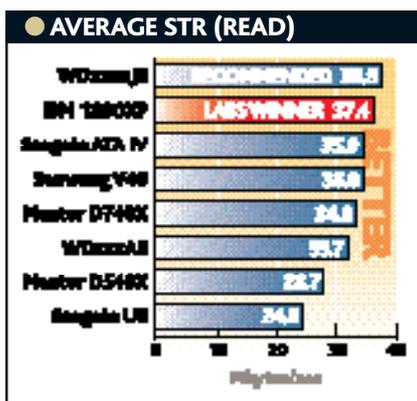
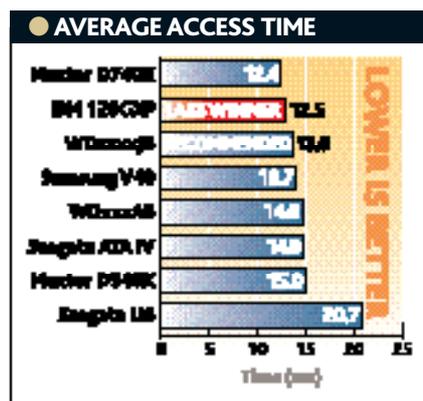
As this is a test of sequential transfers, it gives an indication of how a disk copes with large files. So, if you regularly use your PC for content-creation applications such as video editing, which uses large files, you should be looking for a disk with a fast STR.

Although sequential transfer rate is a good measure of performance, a disk's buffer memory also plays a part, as do access time and data density. As most data is read sequentially on the disk, caching the data stored in sequential sectors and cylinders is an extremely effective method of increasing performance – both throughput and access times. Regularly defragmenting your hard disk is also a good habit to get into for this very reason – a file stored contiguously on the disk can be accessed much more quickly than if it's fragmented in various places.



Intel's IPEAK SPT accurately measures each disk's average access time using 25,000 random single-sector seeks.

### INTERNAL DISKS





**PERFORMANCE: IN THE REAL WORLD**

Real-world performance is arguably more important than low-level testing, as it gives a more realistic idea of how each disk will perform in real applications. Therefore, we use IPEAK's RankDisk to isolate each disk's real-world performance. RankDisk is one of IPEAK's most useful utilities – it's able to exactly play back a pre-recorded set of disk access requests from the controller downwards. This means that it's possible to compare each hard disk's average response time to a request.

In order to run RankDisk, we first prepare a raw trace file for it to play. We use WinTrace32, another IPEAK component, which is a memory-resident program that captures all operating system calls to a disk controller's driver and records them in a file for later use. We record one hour of our usual work pattern, which includes running applications such as Microsoft Excel, Word and Internet Explorer, Windows Media Player, Nero Burning ROM and FirstClass for email.

RankDisk only measures the disk's performance, so we also run our usual PC Pro 2D benchmarks (see p56) to assess how much each disk affects the overall system performance. This benchmark is much more disk-intensive than our WinTrace32 trace.

While the results only vary between 0.80 and 0.91, there's a considerable difference between the fastest and slowest disks in the FileMaker, Access and Photoshop tests. The biggest gap we saw was in Access where the Western Digital Special Edition Caviar completed in 353 seconds while the Maxtor DiamondMax D540X took over three minutes longer at 557 seconds.

To ensure the fairest conditions, each disk is imaged from a master image file and then defragmented before any tests are run. We now use Windows XP Professional as the testing platform, but ensure that no other applications are running in the background, since these would affect test results.

Although each review is a family review

– covering all capacities – we only tested one capacity. Since it's widely accepted that each model in a given family performs identically, the results we quote will apply to any capacity on offer, and not simply to the disk we tested.

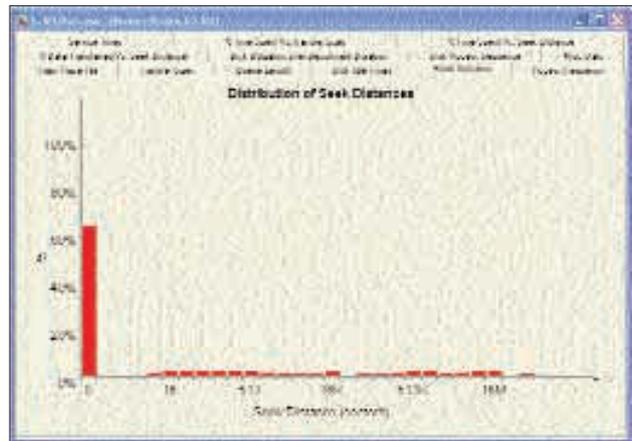
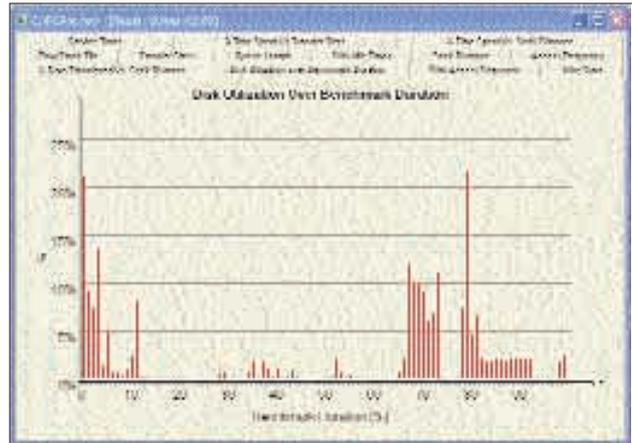
**ENVIRONMENT CONSIDERATIONS**

Knowing hard disk usage patterns in different environments is an important factor when choosing a disk. Attempting to use a desktop EIDE disk in a server may be cost effective, but a SCSI disk – which is optimised for multiple user access – will almost always deliver a much better performance.

Conversely, unless you regularly use disk-intensive applications (such as Photoshop for editing large images, or running complex queries on a database) on your single-user PC, you're much less likely to notice the difference in performance between the fastest and slowest disks on test.

Although performance is a key consideration, reliability is arguably as important. While it's impossible for us to meaningfully test reliability in the Labs, we would advise all those people whose data is crucial to purchase two hard disks and configure them in a mirrored RAID. You will, of course, need a RAID-equipped motherboard or PCI card as well.

On the other hand, if performance is more important, you should consider using a striped RAID configuration, which not only uses the full capacity of all the disks used but will boost performance by some margin. Watch this space for a future test of RAID controllers.

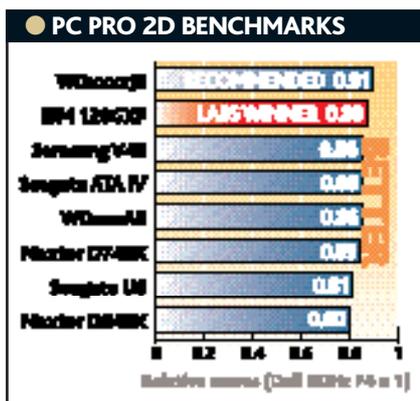


The top graph shows how the hard disk is used during our hour-long RankDisk test. The bottom graph shows how over 60 per cent of disk accesses are sequential.

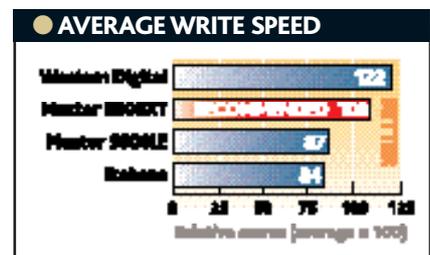
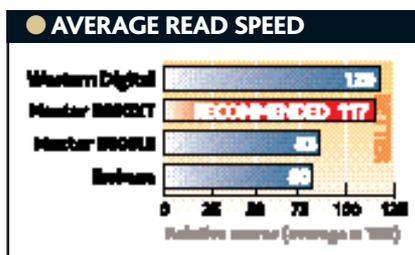
**EXTERNAL DISKS**

For the external disks with FireWire and USB 2 interfaces, we use Adaptec's DuoConnect PCI card, since our test rig only has USB 1.1 ports. As external disks are mainly used for storing data rather than applications, we use a different set of tests to the internal disks. They consist of writing different-sized files to the disk and then reading them back to measure transfer rates.

The first test involves writing 416Mb of TGA screen shots to see how the disks cope with small files. Next, we copy all 321Mb of the Windows XP CAB files as an assorted file size test. We then write 650Mb of MP3s, before finally writing a single 650Mb PowerQuest Drive Image file. Once all the files are on the disk, we read them all back off to obtain the four read rates.



**EXTERNAL DISKS**





● SPECIFICATIONS AND FEATURES



	IBM Deskstar 120GXP	Maxtor DiamondMax D540X	Maxtor DiamondMax Plus D740X	Samsung SpinPoint V40	Seagate Barracuda ATA IV U Series 6	Seagate Caviar WDxxxxJB	Western Digital Caviar WDxxxxAB Special Edition	Western Digital Caviar WDxxxxJB	Maxtor Personal Storage 3000LE	Maxtor Personal Storage 3000XT	Western Digital External Hard Drive	
<b>Overall score</b>	111	96	96	87	98	109	88	91	109	96	91	
Model tested	IC135L120AV/A07-0	4C160JB	6L080J4	SP8004H	ST380021A	ST380020A	WD120JB-75CRA0	X15FWRA160	X15USB2120	X15FWRA160	80Cb	
Street price of model tested* (inc VAT)	£151 (£177)	£193 (£227)	£96 (£113)	£82 (£96)	£97 (£114)	£86 (£101)	£167 (£196)	£258 (£303)	£200 (£235)	£258 (£303)	£240 (£282)	
Average price per Gb across family (inc VAT)	£1.29 (£1.52)	£1.19 (£1.40)	£1.73 (£2.03)	£1.48 (£1.74)	£1.36 (£1.60)	£1.53 (£1.80)	£1.45 (£1.70)	£1.61 (£1.89)	£1.67 (£1.96)	£1.61 (£1.89)	£3 (£3.53)	
Postage (small order charge) (inc VAT)	*	*	*	*	*	*	*	*	*	*	£10 (£12)	
Supplier	dbs.com	dbs.com	dbs.com	dbs.com	dbs.com	dbs.com	dbs.com	dbs.com	dbs.com	dbs.com	Pursu-IT	
Supplier's Web site	www.dbs.com	www.dbs.com	www.dbs.com	www.dbs.com	www.dbs.com	www.dbs.com	www.dbs.com	www.dbs.com	www.dbs.com	www.dbs.com	0800 138 5182	
Manufacturer's Web site	www.ibm.com/harddrive	www.maxtor.com	www.maxtor.com	www.samsung-electronics.co.uk	www.seagate.com	www.seagate.com	www.westemdigital.com	www.wes.temdigital.com	www.dbs.com	www.dbs.com	0800 138 5182	
Warranty	3yrs RTB	3yrs RTB	3yrs RTB	3yrs RTB	3yrs RTB	3yrs RTB	3yrs RTB	3yrs RTB	3yrs swapout	2yrs swapout	1yr RTB	
<b>SPECIFICATION OF FAMILY</b>												
Interface	UltraDMA/100	UltraDMA/133	UltraDMA/133	UltraDMA/100	UltraDMA/100	UltraDMA/100	UltraDMA/100	UltraDMA/100	USB 2	IEEE-1394	IEEE-1394	
Capacities in family (Gb and price (inc VAT))	40 (£61), 60 (£72), 80 (£95), 120 (£151)	120 (£150), 160 (£193), 60 (£78), 80 (£96)	20 (£57), 40 (£63), 60 (£78), 80 (£96)	20 (£49), 40 (£55), 60 (£68), 80 (£82)	20 (£51), 40 (£55), 60 (£67), 80 (£86)	20 (£54), 40 (£63), 60 (£72), 80 (£89), 100 (£143), 120 (£151)	20 (£54), 40 (£63), 60 (£72), 80 (£89), 120 (£167)	20 (£54), 40 (£63), 60 (£72), 80 (£89), 120 (£167)	120 (£200)	160 (£258)	160 (£258)	80 (£240)
Spindle speed (rpm)	7200	5400	7200	5400	5400	5400	7200	7200	5400	5400	7200	
Buffer size (Mb)	2	2	2	2	2	2	8	2	2	2	2	
Read head technology	GMR	GMR	GMR	GMR	GMR	GMR	GMR	GMR	GMR	GMR	GMR	
Read channel technology	PRML	PRML	PRML	PRML	PRML	PRML	PRML	PRML	PRML	PRML	PRML	
Gb per platter	40	40	40	40	40	40	40	40	40	40	27	
Track density (tracks per in)	57,000	60,000	60,000	56,500	50,000	50,000	Not supplied	50,000	57,000	57,000	Not supplied	
Maximum areal density (Gbits/in <sup>2</sup> )	29.7	28.8	30	31.3	32.6	32.6	Not supplied	31.3	27.7	27.7	Not supplied	
Time to ready (s)	11	5	5	7	6.5	6.5	9	10	5	5	8	
<b>SPECIFICATION OF MODEL TESTED</b>												
Nominal capacity (Gb)	123.5	80	80	80	80	80	120	80	120	160	80	
Formatted capacity in NIFS (Gb)	118	74.6	74.6	74.5	74.5	74.5	112	74.5	111	153	74.5	
Heads	6	4	4	4	4	4	6	6	4	6	6	
Platters	3	2	2	2	2	2	3	3	3	4	3	
Power consumption when idle (W)	6.7	7.4	5.8	8	5	8	8	8	3.75	3.75	8	
<b>CHARACTERISTICS</b>												
Dimensions (W x D x H, mm)	102 x 147 x 26	102 x 147 x 26	102 x 147 x 26	102 x 147 x 26	102 x 147 x 26	102 x 147 x 26	102 x 147 x 26	102 x 147 x 26	152 x 219 x 41	152 x 219 x 41	155 x 220 x 43	
Typical sound output when idle (Bels)	3.1	3	2.9	2.5	3	3.5	2.5	3.5	3.3	3.3	3.5	
SMART capable	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Bearing technology	Ceramic	Fluid dynamic bearing/ball bearing	Fluid dynamic bearing	Fluid dynamic bearing	Fluid dynamic bearing	Fluid dynamic bearing	Ball bearing	Fluid dynamic bearing	Ball bearing	Ball bearing	Ball bearing	
<b>PERFORMANCE (MANUFACTURER'S FIGURES)</b>												
Average seek time (ms)	8.5	8.5	8.9	9.5	8.9	8.9	9.5	9.5	9.6	9.6	8.9	
Average latency (ms)	4.2	4.2	5.6	4.2	5.6	5.6	4.2	4.2	5.6	5.6	4.2	
Track-to-track write (ms)	1.1	0.8	0.8	1.2	2	2	1.2	1.2	2	2	2	
Full stroke (ms)	15	16.9	22	21	21	21	Not supplied	21	24	24	21	
Disk-to-buffer data transfer rate (Mbits/sec)	592	434	443	555	436	525	602	555	434	434	525	
MTBF (POH)	Not supplied	> 1% annualised failure rate	800,000	600,000	600,000	500,000	500,000	600,000	> 1% annualised failure rate	> 1% annualised failure rate	500,000	
<b>ACCESSORIES</b>												
Bundled accessories	*	Max Blast Plus II, 80-wire cable, 5.25in bay card for 160Gb drive	Max Blast Plus II, 80-wire cable, 5.25in bay converter	*	*	*	*	*	1.8m USB cable, power supply, installation software	1.8m FireWire cable, power supply, installation software	1.8m FireWire cable, power supply, installation software	

\*Prices were correct at time of going to press. \*\*9.6ms with Acoustic Management disabled. \*\*\*No reseller found for this disk.



# IBM Deskstar 120GXP

AVERAGE PRICE PER GB £1.29 (£1.52 inc VAT)

SUPPLIER dabs.com 0800 138 5182

**VERDICT** A superb performer in all our tests and – even better – this family of disks offers a decent range of capacities at a bargain price.

IBM has a habit of winning awards at *PC Pro* with its hard disks, and the 120GXP continues this success. As per IBM's usual naming strategy, the 120GXP family offers capacities up to 120Gb, currently only beaten by Maxtor's D540X, which reaches 160Gb.

The 120GXP spins at 7,200rpm and has an average latency of 4.2ms. We used Intel's IPEAK SPT to record the average read access time, which turned out to be 12.5ms, giving an average



seek time of 8.3ms.

On top of this, the 120GXP's average sequential transfer rate was 37.4Mbytes/sec. Outer zone rates were fastest on test at an incredible 46Mbytes/sec. Inner zones trailed off at just over 22Mbytes/sec, slower than the Western Digital Special Edition Caviar's 25.7Mbytes/sec. IPEAK's RankDisk rated the 120GXP as second fastest overall in real-world use.

There has been much talk about IBM's recommendation of only 333 power-on hours per month, suggesting this family is unsuited to always-on server environments. However, IBM has now removed this specification from the family's datasheet and says the disks are suitable for round-the-clock operation.

The 120GXP has an average price per Gb across the family of only £1.29 – IBM yet again undercuts other manufacturers. Although the Special Edition Caviar is the fastest hard disk family around, its 8Mb buffer adds to the price – the 120GXP offers better value.

**PC PRO RATINGS**  
OVERALL  
**111**  
FEATURES | PERFORMANCE | VALUE  
98 | 114 | 125  
**100 IS THE AVERAGE**

# Maxtor DiamondMax D540X

AVERAGE PRICE PER GB £1.19 (£1.40 inc VAT)

SUPPLIER dabs.com 0800 138 5182

**VERDICT** The D540X offers the largest capacity on test and also the cheapest price per gigabyte. If you need masses of storage more than performance, it's a good choice.

Maxtor's D540X is aimed at those who need the maximum capacity at the lowest price. In fact, Maxtor goes one better than any of its rivals with a top capacity of 160Gb, 40Gb more than any other IDE family. It crams four 40Gb platters into the usual 1in-high body, so deserves even more credit for this feat of engineering.

With a spindle speed of 5,400rpm, the D540X also benefits from reduced heat generation and noise output. As standard, seek time is 12ms, but turning off Acoustic Management reduces this to around 9.4ms, as measured by IPEAK in our tests.

If you opt for the 160Gb model over the 120Gb, you'll get an UltraDMA/133 controller in the box, as UltraDMA/100 only supports 28-bit LBA (Logical Block Addressing), which can only handle capacities up to 137Gb. Capacities of 40Gb, 60Gb and 80Gb are also available under the D540X banner, but these disks have fluid dynamic bearings rather than the ball bearings of the bigger units, and also only have UltraDMA/100 interfaces, so we chose not to include them in this family review.

Performance, as expected, wasn't too sprightly. The average sequential transfer rate, while still respectable at 28.7Mbytes/sec, was the second slowest on test, only ahead of Seagate's U Series 6. The overall 2D score from the *PC Pro* benchmarks was just 0.80.

If you need a capacity greater than 120Gb in a single IDE disk, the D540X is your only choice. And while its performance couldn't match IBM or Western Digital's 120Gb offerings, the average price of £1.19 per gigabyte makes it the cheapest on test.

**PC PRO RATINGS**  
OVERALL  
**101**  
FEATURES | PERFORMANCE | VALUE  
107 | 85 | 106  
**100 IS THE AVERAGE**

# Maxtor DiamondMax Plus D740X

AVERAGE PRICE PER GB £1.73 (£2.03 inc VAT)

SUPPLIER dabs.com 0800 138 5182

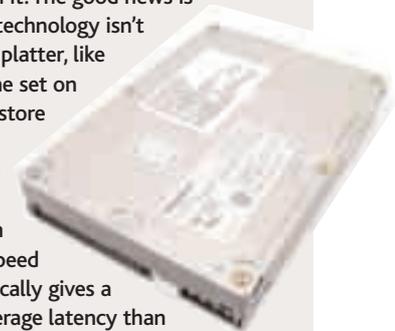
**VERDICT** Super-quick seek times, but the D740X couldn't match other disks on test for overall performance. It's not the cheapest family either.

After acquiring Quantum's hard disk business, Maxtor immediately put the company's technology to good use, even if the D740X looks uncannily like an old Quantum disk with a Maxtor sticker on it. The good news is that the technology isn't old. Each platter, like all but one set on test, can store 40Gb of data, and the 7,200rpm spindle speed automatically gives a lower average latency than 5,400rpm disks. The D740X's seek time of 8.5ms is highly respectable.

We measured the access time at 12.4ms – the quickest on test. Subtracting the latency of 4.2ms gives an average seek time of 8.2ms – faster than quoted. But the average sequential transfer rate was only a shade over 34Mbytes/sec, which was way behind Western Digital's Special Edition Caviar.

There are essentially two choices at each capacity in the family. One is the ball-bearing model – denoted by a J near the end of the model name. The other uses fluid dynamic bearings, denoted by an L. The latter are quieter than the ball bearing units, according to Maxtor, but we only had the opportunity to listen to the ball-bearing version, which was slightly noisier than the two Seagates.

Despite its UltraDMA/133 interface and the quick seek time, the D740X didn't challenge for fastest disk on test, and its limited range of capacities also didn't work in its favour.



**PC PRO RATINGS**  
OVERALL  
**96**  
FEATURES | PERFORMANCE | VALUE  
102 | 106 | 87  
**100 IS THE AVERAGE**



## Samsung SpinPoint V40

**AVERAGE PRICE PER GB** £1.48 (£1.74 inc VAT)

**SUPPLIER** dabs.com 0800 138 5182

**VERDICT** One of the quietest disks around, the V40 offers decent performance. The 80Gb version is also excellent value for money.

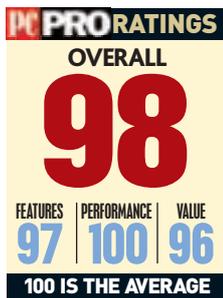
Samsung has concentrated on developing some of the quietest drives in the industry, and the SpinPoint V40 uses both SilentSeek and NoiseGuard technologies to keep noise output to a minimum.

Unlike the P40 series, which runs at 7,200rpm, the SpinPoint V40 uses a slower 5,400rpm spindle speed. This also helps to reduce noise, but in testing we found that both Seagate disks were slightly quieter. Of course, most PCs have several fans, so until these are substituted for alternative silent cooling solutions the hard disk isn't the most intrusive noise maker anyway.

With an average access time of 13.7ms as rated by IPEAK, the SpinPoint V40 has one of the quickest average seek times we've seen from an EIDE hard disk, at under 8.2ms. Samsung undersells the drive, only claiming a seek time of 8.9ms. In fact, the V40's access time is even quicker than Seagate's 7,200rpm Barracuda ATA IV.

The SpinPoint V40's overall performance was almost identical to the Barracuda, with an average STR of 35.8Mbytes/sec. What's more, its RankDisk result was a little faster than the Barracuda. By contrast, Seagate's U Series 6 – the more obvious rival to the V40 – could only manage an average STR of 24.3Mbytes/sec and a notably worse RankDisk result.

Samsung's SpinPoint V40 family isn't the most wide-ranging when it comes to capacity, with just 20Gb, 40Gb, 60Gb and 80Gb versions available. But there is one factor in the family's favour – at time of writing, the 80Gb version cost just £82, making it the best value disk on test.



## Seagate Barracuda ATA IV

**AVERAGE PRICE PER GB** £1.36 (£1.60 inc VAT)

**SUPPLIER** dabs.com 0800 138 5182

**VERDICT** Incredibly quiet, but the trade-off is reduced performance. A good choice if value and low sound output are important to you.

Seagate is probably most famous for its Cheetah X15 SCSI disk, which still holds its place as one of the fastest hard disks in existence. The Barracuda ATA IV is Seagate's premier EIDE family and was the first to market with 40Gb platters.

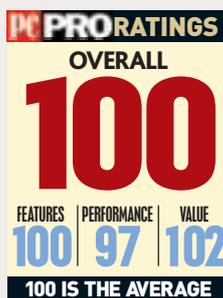
Thanks to fluid dynamic bearings, which Seagate terms SoftSonic, the Barracuda ATA IV is one of the quietest hard disks we've ever tested. A claimed 2.5Bels at idle, we had to put our ears

right against the top of the disk to tell if it was powered on. Seeks are also virtually undetectable.

Like Maxtor's D540X, the ATA IV features Automatic Acoustic Management, (AAM) which slows the seek time in order to reduce noise output. Seagate claims a 9.5ms seek time, but IPEAK clocked the average access time at 14.9ms, equating to a 10.7ms seek with AAM turned on – and, unfortunately, you can't turn it off. Average STR was 35.9Mbytes/sec – only a whisker ahead of the Samsung. A RankDisk result of 86 placed the ATA IV sixth overall – not a great result.

One of the most noticeable features is the ATA IV's SeaShield, which protects the disk's electronics and also dampens the acoustics. This handily includes installation instructions and a quick reference for jumper settings.

If you're after the quietest hard disk around, the ATA IV fits the bill perfectly, but at the expense of performance. However, at £1.36 per gigabyte, the Barracuda is easier on the wallet than most other families of disks.



## Seagate U Series 6

**AVERAGE PRICE PER GB** £1.53 (£1.80 inc VAT)

**SUPPLIER** dabs.com 0800 138 5182

**VERDICT** Sluggish performance, partially due to one of the slowest seek times around, means this family of disks can't compete in this Labs.

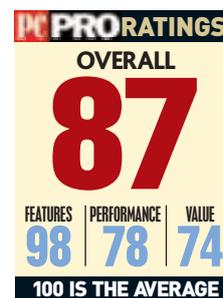
Seagate's second entry into this Labs is the 5,400rpm U Series 6. This family replaces the U Series 5 that we reviewed in the last hard disks group test (see *Labs, issue 77, p121*), but retains the unusual rubber cover that protects the disk and electronics from knocks and static.

Like the Barracuda ATA IV, the U Series 6 has jumper settings and basic installation instructions printed on it, which means they'll always be to hand. The range of disk sizes is also identical, varying from 20Gb to 80Gb.

So far, so good, but the U Series 6 proved disappointing in our tests. Its average read access time of 20.7ms gives the U Series 6 one of the slowest access times we've seen on a modern EIDE disk. Subtracting 5.6ms for average rotational latency gives a seek time of 15.1ms – slower than most drives' access times, and a difference of 6.2ms from Seagate's claim of 8.9ms. Average STR was 24.3Mbytes/sec – slow even by last year's standards. Inner-zone transfer rates dropped off to a disappointing 13.6Mbytes/sec.

RankDisk and our 2D suite showed the effects that these poor low-level results had on real-world performance with scores of 75 and 0.81 respectively. Maxtor's D540X scored 75 in RankDisk and 0.80 in the *PC Pro 2D* benchmarks, but it just remained the faster disk overall.

Since performance is one of the main factors in choosing a hard disk, the U Series 6 is one to avoid on this basis alone. The relatively high cost per gigabyte also counts against it – for instance, the D540X has an average cost of just £1.19 per gigabyte.





## Western Digital Caviar WDxxxAB

**AVERAGE PRICE PER GB** £1.54 (£1.81 inc VAT)

**SUPPLIER** dabs.com 0800 138 5182

**VERDICT** The WDxxxAB offers a decent range of capacities, while its solid performance belies its 5,400rpm spin speed.

**W**estern Digital has recently been churning out new hard disks like they're going out of fashion. The Special Edition range (see right) is one of the most talked about in storage circles, but the Caviar WDxxxAB is a more established family.

It's a 5,400rpm affair with high-density 40Gb platters and sits mid-range in Western Digital's line-up. While most

5,400rpm disks are seen as value propositions, the WDxxxAB's disk-to-buffer transfer rate of 525Mbits/sec isn't far behind many 7,200rpm disks.

This is achieved with decent seek times and high data density, and IPEAK clocked our test 80Gb WD800AB at a read access time of 14.6ms. Taking away 5.6ms for the rotational latency equates to 9ms, almost matching Western Digital's claimed specification of 8.9ms. Using IPEAK's RankDisk showed the WD800AB had an average response time of 1.5ms in real-world usage, placing it fourth out of eight.

Average sequential transfer rate across the platters was 33.7Mbytes/sec, but this was over 2Mbytes/sec slower than Samsung's SpinPoint V40.

The Samsung edges ahead by being the quieter drive both when idle and seeking. Plus, the SpinPoint V40 is cheaper per gigabyte than the WDxxxAB. But the Caviar scores higher with its range of capacities of up to 120Gb – the SpinPoint V40 stops at 80Gb.

However, neither family is the best on test. IBM's Deskstar 120GXP is faster, cheaper and offers an equally good range of capacities.



**PC PRORATINGS**

**OVERALL**

**98**

FEATURES	PERFORMANCE	VALUE
99	101	94

**100 IS THE AVERAGE**

## Western Digital Special Edition Caviar WDxxxxJB

**AVERAGE PRICE PER GB** £1.45 (£1.70 inc VAT)

**SUPPLIER** dabs.com 0800 138 5182

**VERDICT** The fastest EIDE hard disk in existence, and it's cheaper than other 7,200rpm disks. If performance is most important to you, buy it.

**T**he Special Edition Caviar WD1200JB differs from the WD1200BB (see Labs, issue 88, p86) in having an extra 6Mb of buffer RAM and some firmware optimisations, making it a true power-user's hard disk.

And this is exactly who Western Digital is targeting with this family. Despite having a slower seek time than the IBM Deskstar 120GXP – 8.9ms vs 8.5ms – the Special Edition Caviar's



larger buffer takes up this slack.

Testing with DiskSpeed32 revealed an average sequential transfer rate of 38.9Mbytes/sec, making this the fastest hard disk we've ever seen at PC Pro. Outer zone rates started at 45.9Mbytes/sec, a whisker behind the Deskstar 120GXP, but finished on the inner zones at 25.7Mbytes/sec – 3.5Mbytes/sec faster than the IBM.

RankDisk also found the Special Edition Caviar to be faster than the 120GXP with scores of 141 and 123 respectively. IPEAK measured the Western Digital's access time at 13.6ms, equating to an average seek time of 9.4ms. Despite this, the Special Edition Caviar managed to score 0.91 in our 2D benchmarks.

However, offering four times more buffer memory than the 120GXP is reflected in the Caviar's higher price per gigabyte. Also in IBM's favour is the range of capacities.

If performance is the most important factor to you, buy the Special Edition Caviar – the 120Gb version is the best value proposition. Otherwise, IBM resumes its position as king of EIDE.

**PC PRORATINGS**

**OVERALL**

**109**

FEATURES	PERFORMANCE	VALUE
99	119	116

**100 IS THE AVERAGE**

## Ikebana Fireblaster

**AVERAGE PRICE PER GB** £2.03 (£2.39 inc VAT)

**SUPPLIER** Target Components 0870 700 1999

**VERDICT** Outperformed by the Maxtor 3000LE, the only things in the Fireblaster's favour are its carry case and the cost saving over the WD family.

**U**S-based Ikebana has only recently begun selling its products in the UK. As well as external hard disks, it rebrands EIDE Seagate hard disks, both internal and external CD writers, and interface cards.

The Fireblaster uses a Seagate Barracuda ATA IV disk. Any performance difference between the internal version and Ikebana's must be due to the bridge between the UltraDMA/100 interface on the disk and the USB 2 interface.

During the tests, the Ikebana wrote the 650Mb of MP3 files at 10.9Mbytes/sec – marginally quicker than the Maxtor 3000LE. The only other areas where it was faster were reading the TGA files and the Windows XP CAB files. When measuring sequential transfer rate, the Fireblaster was considerably slower than the Maxtor, with 12.2Mbytes/sec against the Maxtor's 16.4Mbytes/sec. This rate is sluggish compared with the internal Seagate, which managed an average of 35.9Mbytes/sec.

Since the Barracuda ATA IV is faster than the Maxtor 3000LE's D540X, it proves that Fireblaster's lower performance is due to the less optimised interface bridge design.

One of the Fireblaster's advantages is that it's the only external disk on test to come with a carry case – these are portable devices after all. But, with an average cost of £1.67 per gigabyte against the Fireblaster's £2.03, the 3000LE offers better value.

Ultimately, though, the Maxtor 3000XT is the best external disk thanks to enhanced IEEE-1394 performance.



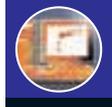
**PC PRORATINGS**

**OVERALL**

**88**

FEATURES	PERFORMANCE	VALUE
105	82	82

**100 IS THE AVERAGE**



# Maxtor Personal Storage 3000LE

AVERAGE PRICE PER GB £1.67 (£1.96 inc VAT)

SUPPLIER dabs.com 0800 138 5182

**VERDICT** With the USB 2 interface limiting performance, the 3000LE lags behind its FireWire cousin. But it's better value than the Ikebana.

Inside Maxtor's translucent red and white case resides a DiamondMax D540X disk. While it's not an outstanding performer – mainly due to the 5,400rpm spindle speed – it's more than capable.

But, like any external disk, the 3000LE requires a bridge to translate the hard disk's interface to either USB 2 or IEEE-1394. This led to a significant drop in performance, with sequential transfer rates particularly affected. Where the D540X managed an average of nearly 29Mbytes/sec when connected to the Promise Ultra133TX2 PCI card in our test rig, this dropped to 16.4Mbytes/sec once shifted onto the USB 2



interface. Considering USB 2 is capable of a maximum bandwidth of 480Mbits/sec – or 60Mbytes/sec – this is a disappointing state of affairs.

Moving large quantities of smaller files closed the gap to the IEEE-1394 disks somewhat, with the 3000LE reading 650Mb of MP3 files at 12.7Mbytes/sec. The 3000XT, which also employs a D540X disk, was only slightly quicker at 15.4Mbytes/sec. For backing up a hard disk, the two USB 2 disks on test will perform almost as well as the two IEEE-1394 units, but for DV or other work involving transfers of huge files, they lag a long way behind.

However, the 3000LE is slightly faster than the Ikebana, despite the fact that the Fireblaster uses a 7,200rpm disk. Also, price is in Maxtor's favour – the 3000LE costs 36p per gigabyte less than the Ikebana.

If USB 2 is your only option, the Maxtor 3000LE is the family to choose, but the Recommended award goes to the 3000XT due to its better performance.

**PC PRORATINGS**  
OVERALL  
**96**  
FEATURES | PERFORMANCE | VALUE  
100 | 85 | 103  
100 IS THE AVERAGE

# Maxtor Personal Storage 3000XT

AVERAGE PRICE PER GB £1.61 (£1.89 inc VAT)

SUPPLIER dabs.com 0800 138 5182

**VERDICT** With the cost per gigabyte nearly £1.40 less than Western Digital's 80Gb offering, the 3000XT is the best external family on test.

Given that both Maxtor Personal Storage families use the D540X disk, and USB 2 has a higher bandwidth than IEEE-1394, we were surprised to see the 3000XT significantly outperform the 3000LE. This is primarily because IEEE-1394 has matured significantly since its first specification in



1987. USB 2 is a new technology, and evidently the bridge circuitry in the back of the box is less efficient.

The biggest difference is in sequential transfer rate, where the 3000XT averaged 24.3Mbytes/sec compared to the 3000LE's 16.4Mbytes/sec. Transferring smaller files had much less impact, with 650Mb of MP3 files read at 15.4Mbytes/sec compared with 12.7Mbytes/sec over USB 2. When writing the XP CAB files, the 3000LE actually outperformed the 3000XT.

If you're thinking of using the 3000XT with your FireWire-equipped laptop, be aware that the disk requires mains power supply at all times, so you can't use it on the move.

With an average cost per gigabyte of £1.61, the 3000XT is almost identically priced to the 3000LE. However, the 3000XT performs better through its IEEE-1394 interface, so it's the one to choose.

The other IEEE-1394 disk on test is the 80Gb Western Digital, which is a slightly better performer thanks to the use of a 7,200rpm Caviar disk. But, at an average of £3 per gigabyte, the Western Digital offers relatively poor value for money.

**PC PRORATINGS**  
OVERALL  
**109**  
FEATURES | PERFORMANCE | VALUE  
102 | 112 | 123  
100 IS THE AVERAGE

# Western Digital External Hard Drive

AVERAGE PRICE PER GB £3.00 (£3.53 inc VAT)

SUPPLIER Pursu-IT 020 8288 8000

**VERDICT** Vastly overpriced compared with the other external hard disks, the Western Digital can't compete, despite its excellent performance.

As the most expensive external disk per gigabyte, the Western Digital starts this Labs with a large handicap. Maxtor's 3000XT, which also uses a IEEE-1394 interface, costs only £1.61 per gigabyte and offers double the capacity.

However, Western Digital's offering did excel in performance. It was noticeably better writing the Windows XP CAB files – 33 per cent faster than the 3000XT. This gap closed to 2 per cent when reading the 650Mb Drive Image file, with transfer rates of 25.6Mbytes/sec and 25.2Mbytes/sec respectively. These sequential transfer rates are considerably slower than most of the internal disks, but at least they're much faster than the two USB 2 disks.

Inside the silver casing is a Caviar WD800BB, with only 27Gb per platter, but we didn't test this internal family in this Labs, so we can't fully comment on the performance difference.



We did test it in the last hard disks group test (see *Labs*, issue 77, p121) and it managed a sustained transfer rate of 27.2Mbytes/sec. This isn't far ahead of the external version, although it wasn't tested on an UltraDMA/133 controller.

As with the 3000XT, the Western Digital disk needs to be plugged into the mains at all times and comes with a six-pin to six-pin FireWire cable. This makes it unusable with the majority of notebooks without buying a six-pin to four-pin cable for around £20.

Although it's a great performer, we can't recommend the Western Digital External Hard Drive. The Maxtor Personal Storage 3000XT offers far better value, greater capacity and almost the same performance. So the choice is an easy one.

**PC PRORATINGS**  
OVERALL  
**91**  
FEATURES | PERFORMANCE | VALUE  
94 | 121 | 78  
100 IS THE AVERAGE