Illustration by Simon Downs

Feel the

force

We pitch the solid, reliable Pentium II head to head against the exciting but unproven Pentium III, in ten systems from five manufacturers.

Intel's launch of the Pentium III placed a large question mark over the future of the Pentium II, as the natural evolutionary process dictated its demotion in the processor ranks. With the focus placed on the shiny Katmai New Instructions (KNI) sported by the Pentium III, and the Celeron firmly positioned as the budget choice, what does the Pentium II have left to offer? This is what we have asked PC vendors to consider, by inviting them to submit both a Pentium II and a Pentium III, priced at £1,500 (ex VAT) and with 128Mb system RAM and a minimum 17in monitor. We were looking for machines pitched for a business user with a stress on graphics, including 3D image rendering. This very much left the forum open to promote the trusted Pentium II machines bolstered with money not spent on the latest and greatest from Intel.

The Pentium III machines were tested blind and unoptimised initially, but we also ran optimised tests to bring out the performance benefits of KNI. With software vendors producing plug-ins or patches to upgrade their existing products in support of KNI, will these benefits really champion the Pentium III?

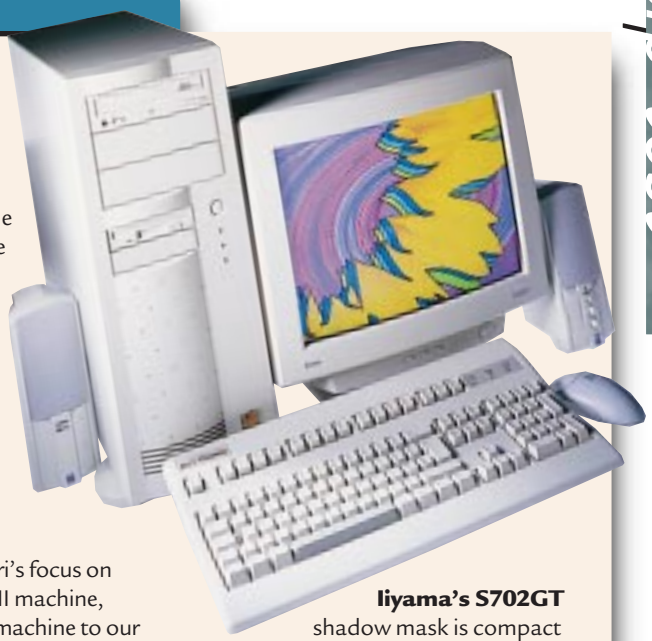
Contents

PCs reviewed by Ian Robson

Ratings

★★★★★ **Buy while stocks last**
★★★★ **Great buy**
★★★ **Good buy**
★★ **Shop around**
★ **Not recommended**

Armari MBX-450e, NBX-K500

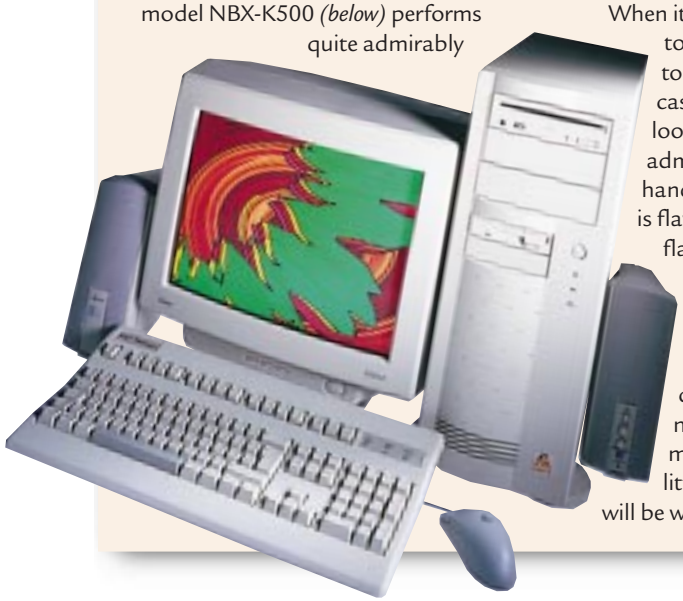


Armari has a reputation for supplying powerful PC monsters, possibly stemming from its roots as a high-end workstation and server-class system manufacturer. It deals with its on-site maintenance requirements through a contract with Computer Maintenance Direct. And although the technical support section consists of just three staff, by some mean feat Armari still manages to produce an impressive service record: it won our Editor's Choice award for technical support in our last 'blind buying' group test [*December '98*].

At first glance, there was little difference between the two systems supplied. Both had an excellent 56Kbps PCI modem from Diamond and a quality 17in monitor from Iiyama. However, both systems had relatively limited storage compared to other PCs in this test, each making do with a 10.1Gb EIDE hard disk. It's not necessarily the applications but their by-products and end results that dictate massive requirements and with no removable storage media, 10.1Gb will quickly fill up.

The 450MHz Pentium II machine, MBX-450e *(shown above)* is a little better endowed than first impressions would have you believe. Armari has had the foresight to extend its lifespan by supplying a dual processor board, opening up possibilities not just for an extra Pentium II, but, when your budget can stretch to it, a leap up to tandem Pentium III processing.

The 500MHz Pentium III machine, model NBX-K500 *(below)* performs quite admirably with its 16Mb ATi Xpert 128 graphics subsystem, but Armari had a little something left in the pot to fork out for the fuller 32Mb ATi Rage Fury on the PII. This gives it the massive boost in multimedia performance that makes it one of the top PII systems and even above its own PIII counterpart.



Judging from Armari's focus on performance in the PII machine, the company built a machine to our direct specifications, which is very reassuring when you consider that other vendors tend to dictate what they think you may require. Still, a shortfall in money has left a standard CD-ROM media drive, albeit a 40X, an economy version of Creative Labs' SoundBlaster 64V PCI sound card and a pair of quite unbearably tinny speakers. All these areas would no doubt have been addressed more seriously if we had specified, but as it stands, they are not beyond an end-user's means to deal with at a later date.

There was evidently money to spare on the PIII machine after the core expenditure on Intel's latest processor. Sporting a Pioneer 6X DVD-ROM drive and with audio produced by Diamond's PCI Sonic Impact, the marginal speaker upgrade is the only let-down.

When it comes to piecing its kit together, Armari still tends to plump for older-style cases with six screws to loosen before you can admire the internal handywork. The construction is flawless, with an inspired flair here and there. All cables are unobtrusive, with ample future drive-bay additions assisted by power supply clippings in close proximity. This is not a modular design, so maintenance will take a little time, but the effort will be worth it.

Iiyama's S702GT shadow mask is compact compared to most 17in monitors. It produces exquisitely bright and warm colours with a fully refresh-supported sharpness right up to impressive resolutions. While it saves space on your desk, it is the display controls that really shine: a few front-mounted buttons take you into graphical-level indicators for efficient user control. You can perfect your display settings within seconds.

PCW DETAILS

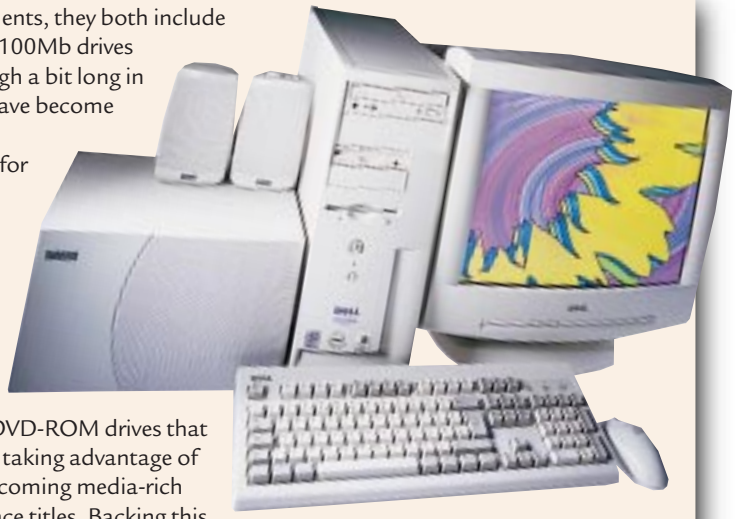
MBX-450e Pentium II
Price *£1,761.33 (£1,499 ex VAT)*
Contact *Armari 0181 810 7441*
www.armari.com
Good Points *Future proofed: dual-processor motherboard.*
Bad Points *Modest hard disk. Lack of removable storage.*
Conclusion *Exceptionally well built and powerful machine, but lack of removable storage lets it down.*

Build Quality	★★★★★
Performance	★★★★★
Value for Money	★★★★
Overall Rating	★★★★

NBX-K500 Pentium III
Good Points *Well balanced configuration...*
Bad Points *...let down by storage.*
Conclusion *Optimal graphics workstation, let down by performance.*

Build Quality	★★★★★
Performance	★★★
Value for Money	★★★★
Overall Rating	★★★

Dell Dimension V400, Dimension XPS T500



Dell is the largest of the five vendors invited to participate in this month's group test, in all respects. The company boasts 300 technical support staff to complement its premium service options including up to four years on-site maintenance. You'll be buying more than just a computer from Dell, and this, in part, accounts for the more modest on-paper specifications.

The Dimension V400 *(shown, right)* is based around a 400MHz Pentium II processor and, with peripherals such as an on-board local area network adapter, is pitched as an office workstation. The 500MHz Pentium III Dimension XPS T500 *(shown below)* is a far more graphically orientated workstation. Whereas the PII machine has a rather basic on-board AGP version of ATI's 8Mb Rage Pro, the PIII storms ahead, bolstered by its 16Mb STB TNT-based AGP graphics adapter. Performance is on a par with the best here.

For the PII machine, the supporting peripherals start off quite respectably, with some of the extra cash saved on the choice of processor most evidently spent on a decent Hewlett-Packard DeskJet 420C colour printer. Dell was the only vendor to opt for such an inclusion, and it will certainly be of use in any office environment. But the specific environment that we dictated might not warrant this choice over other areas, such as the graphics card and the monitor, that may have needed better attention.

Both machines have reasonable quotas of EIDE hard-disk storage with the PIII machine sporting 14.4Gb over the PII's 12.9Gb. For any large back-up requirements, they both include Iomega Zip 100Mb drives that, although a bit long in the tooth, have become quite widespread for compatible transfers. Both machines' budgets have also managed to squeeze in Toshiba DVD-ROM drives that will soon be taking advantage of the up-and-coming media-rich large reference titles. Backing this up is a decent sound card from Turtle Beach which made it into both machines, but the PIII's money ran out when it came to speakers. Only the PII machine features the rich tones that emanate from the Altec Lansing ACS 295 set-up.

One advantage of buying from a large, respected vendor is evident in the construction of its systems. Both Dell machines are built to exacting standards, with innovative approaches drawn from all areas of the market that Dell has a hand in.

Access to the system boxes is via a simple thumbscrew, with the side-panel easing off gently. Once inside, you immediately eye the impressive but simple ducting placed over the processor, focusing airflow from the chassis fan across the CPU's ample heatsink. Its two-clip arrangement allows for a quick release should any access be required.

Other areas are equally accessible, with pinned back cables revealing space for some upgrading of peripheral cards and bay devices.

Price constraints seem to have been overlooked when it comes to the choice of monitors, with both machines displaying through 19in models. The PIII's D1626 monitor is a Philips 1200HS shadow mask, a fairly standard affair with adequate refresh support as the resolution is increased. The colour quality is good, with a sharp, non-bloomed representation of the finest details across the whole screen. The Pentium II has the flatscreen CRT P990 monitor, a Sony Trinitron MultiScan 400PS that by virtue of its shape had a marginally better quality display than its counterpart. Both monitors had very similar OSD controls that proved responsive to our requests through the easily navigable consoles.

PCW DETAILS

Dimension V400 Pentium II

Price *£1,761.33 (£1,499 ex VAT); plus £1 for PIII machine*

Contact *Dell 0870 152 4850*
www.dell.co.uk

Good Points *Air ventilation duct system. Excellent 19in monitor.*

Bad Points *Lack of spare PCI slots. Very poor performance.*

Conclusion *Perfect for your general office requirements but lacks bite.*

Build Quality	★★★★
Performance	★★
Value for Money	★★★★
Overall Rating	★★★

Dimension XPS T500 Pentium III

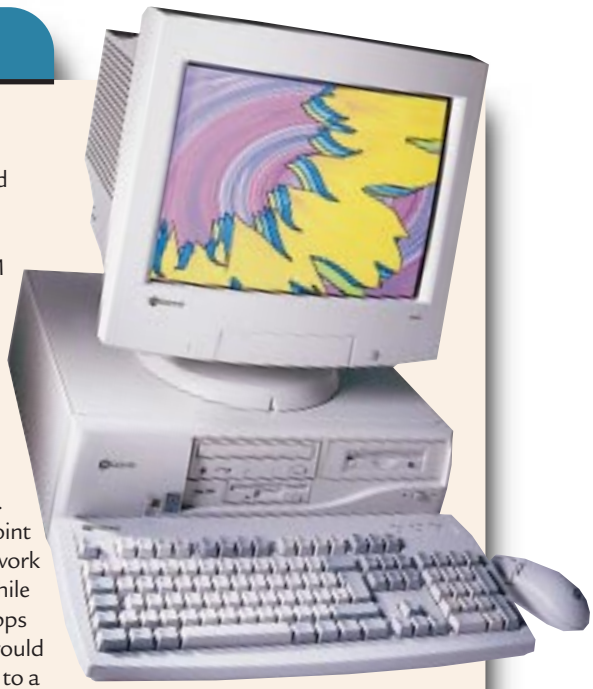
Good Points *19in monitor squeezed into this budget.*

Bad Points *Just lacking the venom of its contenders.*

Conclusion *Very impressive. A good-value package.*

Build Quality	★★★★
Performance	★★★★
Value for Money	★★★★★
Overall Rating	★★★★

Gateway GP6-400, GP7-500



Founded in 1985, Gateway has grown into a sizeable international player currently addressing the UK market from its manufacturing facilities in Ireland. Years in the business have not left the company with a complacent view of the marketplace however, and we have consistently received eye-opening equipment. For this particular group test we weren't disappointed, as the two systems could not be more different from each other with regard to style and, more importantly, performance.

The desktop-style GP6-400 *(shown, right)* is built around a 400MHz Pentium II, and would be a clear winner if the criterion for this group test was to provide a desktop space-saving PC. But it wasn't, and the on-board AGP 8Mb ATi Rage Pro graphics subsystem contributed to this system providing the poorest performance results. Even the addition of a 12Mb Voodoo2 graphics accelerator couldn't bolster performance.

The tower-style GP7-500 *(shown below)* was built around a 500MHz Pentium III with a 16Mb TNT-based AGP graphics card from STB. The Voodoo2 in the system seemed almost redundant, as the primary display card was more than powerful enough to achieve good performance results.

Both machines had removable storage courtesy of the Iomega Zip 100Mb drive that perfectly complemented the 16.8Gb EIDE hard disk provided for the PII machine. The PIII machine just scrapes through with a 10Gb hard disk, so the Zip in this case was a real necessity.

A standard 32-speed CD-ROM drive is present in each system, with Creative Labs providing its economy PCI sound card. However, there was enough money in the pot only for the PII machine to pump out the volume through the gloriously rich Boston Acoustics Media Theatre speakers. Another concession to the price point was the lack of any internet or network connectivity in the PIII machine, while the PII managed to provide a 56Kbps GVC Winmodem. Although you would expect any business PC to connect to a Local Area Network or at least to the internet through a modem, this is an area where the end-user's specific circumstances and resources is very difficult to predict, so the exclusion of internet and network connectivity in some cases may be appropriate.

The Goliath-sized case for the Pentium III system is impressive to the point of scary. Expansion is via masses of drive bays and peripheral card slots in its innards, or indeed, have a few friends round to play Boggle inside. It's a beast. The PII machine, on the other hand, is an impressively compact desktop that unfortunately suffers at its own hands. There are no bays available for extra devices, and replacing components is hindered by the reduced access through a plethora of cabling thrusting for space. The board has an impressive amount of slots available for peripheral cards, though, with no obtrusions.

The final angle with which to present an enticing PII package is by spending all available saved cash on the best possible monitor. This obviously was not an option for Gateway, as both machines came with a rebadged 17in EV700 shadow mask monitor from LG Electronics. This monitor was the only one supplied in this group test that failed to support resolutions as high as 1,600 x 1,200, with poor refresh at lower resolutions. When set at its recommended viewing mode, however, the monitor does stand its own ground, with a sharp, stable image right up to the bezel. Colours were not as bright as those presented by its competitors, but it did have the champion of OSD controls in the form of a one-finger press dial.

PCW DETAILS

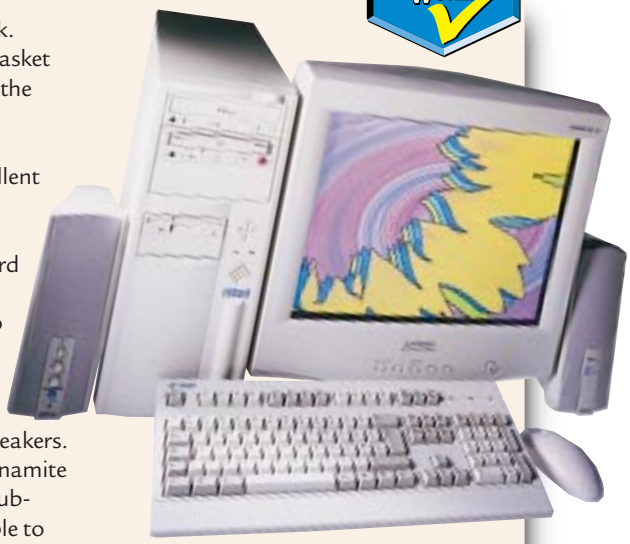
GP6-400 Pentium II
Price *£1,756.62 (£1,495 ex VAT)*
Contact *Gateway 0800 552000*
www.gateway.com/uk
Good Points *Space-saving desktop design. Excellent monitor dial controls.*
Bad Points *Very poor performance. Constrictive upgrade paths.*
Conclusion *Poor configuration for the price.*

Build Quality	★★★
Performance	★★
Value for Money	★★★
Overall Rating	★★★

GP7-500 Pentium III
Good Points *Excellent monitor dial controls. Many upgrade paths.*
Bad Points *Disappointing KNI- optimised performance.*
Conclusion *Good system let down by KNI performance.*

Build Quality	★★★★★
Performance	★★★
Value for Money	★★★
Overall Rating	★★★

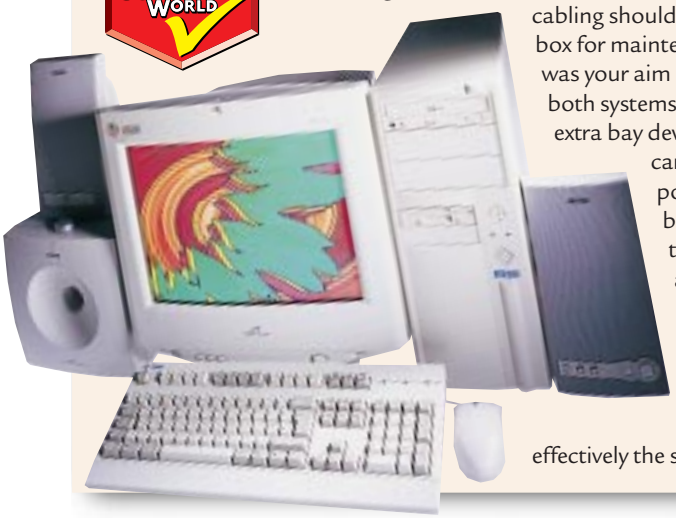
Mesh Pegasus 450CDR, Pegasus 500XL



Mesh has a keen eye for selecting components at the forefront of the industry, always striving to provide innovative approaches to its systems. From its beginnings in 1987, the company has grown steadily, accommodating 12 staff in technical support and eight in customer services. With control over its own production facility, Mesh has the perfect opportunity to provide quality kit and back it up with experienced service facilities.

The 450MHz Pentium II machine *(shown, right)* was supplied under the guise of model name Pegasus 450CDR. Perhaps it should have been called Pegasus 450CDR*W* because one of the first striking features to jump out from the system box was the fabulous Philips rewritable CD-ROM drive. Able to read all standard forms of CD media, it provides the end-user with the means to supply finished work on a rapid data transfer medium — ideal if the workstation is to be graphically orientated, resulting either in larger files or final CD-ROM products. In addition, this inclusion has not been at the expense of a 40X CD-ROM drive providing direct CD copying facilities. This feature succumbed to the extra premium required for the 500MHz PIII machine.

A 10Gb EIDE hard disk will prove adequate for the PII system as larger backups could easily be carted off on a rewritable CD-ROM. The PIII system, the Pegasus 500XL, *(shown, below)* compensates for its lack of removable storage by including a stonking 25Gb EIDE hard disk. Keeping all your eggs in one basket could prove costly, though, if the larger drive failed.



Both systems had the excellent 56Kbps PCI modem from Diamond and the very reasonable PCI 64V sound card from Creative Labs. However, where the PIII machine had to economise with the standard bundled Yamaha speakers, the PII machine sported some excellent Philips USB speakers.

A 16Mb AGP Hercules Dynamite was chosen for the graphics sub-systems in both machines. Able to support full 32-bit colour right up to 1,920 x 1,080 resolutions, the nVidia Riva TNT-based card is perfect for graphics work with its bright vibrant colours but only with the full co-operation of its display monitor. This is where a major distinction between the two systems was drawn.

For the PIII machine, a 17in ADI GT56 monitor (which has a Trinitron tube) was provided. Although of a high standard in its own right it had a tough contender in the form of its PII counterpart. Although able to match the refresh rates of the 19in Mitsubishi Diamondtron provided with the PII machine, the sharpness just wasn't apparent at the higher resolutions. The rich colours of the Mitsubishi monitor shamed the ADI and it had the added bonus of its less reflective flat face. The ADI proved to have a more manageable OSD, though.

Construction of both machines was equally impressive, with no obtrusive cabling should you venture into the box for maintenance. If upgrading was your aim then this is open to both systems also with room for extra bay devices and peripheral cards. It must also be pointed out that if your budget dictates choosing the enhanced package afforded to the PII machine you'll still be able to splash out later for a PIII. The most important components are effectively the same, with performance gains down to the processors. The unoptimised testing showed an increase in performance by the PIII machine in line with its extra 50MHz processor clock speed over its counterpart. Against other vendors' systems the PII machine performed admirably while the PIII machine was out in front. With KNI optimisation, the PIII machine decidedly put its foot down on the accelerator and leapt even further ahead of the competition.

PCW DETAILS

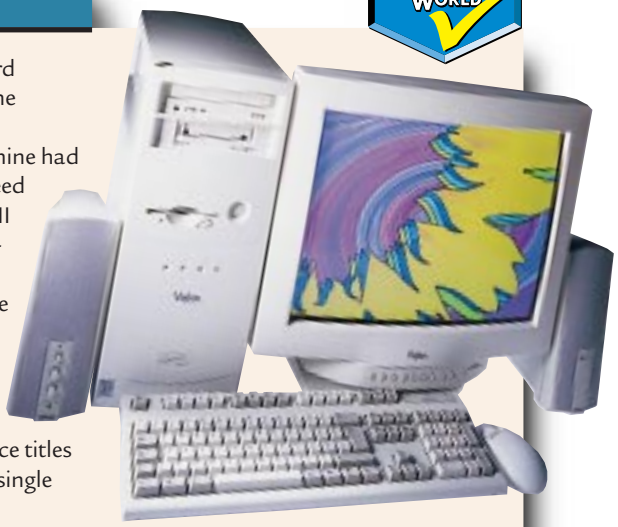
Pegasus 450CDR Pentium II
Price *£1,761.33 (£1,1,499 ex VAT)*
Contact *Mesh 0181 208 4706*
www.meshplc.com
Good Points *Excellent monitor. Re-writable CD-ROM drive.*
Bad Points *Left behind when the PIII system put its KNI skates on.*
Conclusion *An inspired package that oozes quality.*

Build Quality	★★★★★
Performance	★★★★
Value for Money	★★★★★
Overall Rating	★★★★

Pegasus 500XL Pentium III
Good Points *Massive hard disk. Storming performer.*
Bad Points *Lack of removable storage.*
Conclusion *Too beefy to argue with.*

Build Quality	★★★★★
Performance	★★★★★
Value for Money	★★★★
Overall Rating	★★★★★

Viglen C2-450GS, C3-500XS



Viglen is one of the few PC vendors who can claim to have been around since the beginning of the digital age. Since 1975, it has grown to become one of the largest and most successful UK direct PC manufacturers. Based in West London, Viglen currently employs 350 staff, 75 of whom are dedicated-customer technical support staff and engineers. One of the more stylish vendors, Viglen takes the approach that a system is a complete package and subsequently pays attention to every little detail.

The 450MHz Pentium II machine, model C2-450GS *(shown, right)*, is clothed in the same sleek casing as its counterpart the 500MHz Pentium III model C3-500XS *(pictured below)*. Initial impressions suggest that both systems were built alongside each other, wherever possible duplicating the components until the price forced the PIII machine to finally give up the race. However it comes as a pleasant surprise to discover that the PIII machine only makes minor concessions to its higher processor premium.

Both machines have excellent graphics sub-systems courtesy of STB's 16Mb TNT-based AGP card. And where other vendors have opted for the same basic card, Viglen upped the ante by selecting a TV-out version, thus offering a versatile presentation facility.

Full connectivity is catered for equally by both systems with the inclusion of a 56Kbps PCI modem and a 100Mbps network interface card. And, apart from the monitor, the final identical components are the sound system with Labway's PCI 3D Yamaha XG sound card pounding forlornly through the bundled Yamaha speakers.

At this point, the PIII machine had to concede a standard 32-speed CD-ROM drive whereas the PII machine proudly displays a 4-speed DVD-ROM drive in its top bay. When the DVD movie revolution finally stops overwhelming this versatile medium, the PC industry will begin to lock on to the huge benefits of media-rich reference titles which can be contained on a single DVD ROM disc.

The differences in storage were a tad more harsh, with the PII machine tucking in a healthy 16.9Gb EIDE hard disk and backing this up with a massive 8Gb HP Colorado tape drive. The PIII machine is more reserved with its 12.7Gb hard-disk and adequately caters for removable storage with an LS-120 drive. Much criticism falls on the 120Mb SuperDisk drive for its sluggish data transfers compared to the likes of Iomega's Zip 100 but as it is standard floppy compatible you do save on a bay and it's fine as a personal backup facility.

The case design suggested that your toolkit would be gathering dust as you set to work with just your nimble fingers. However, the plastic bolted side panel refused to come off without the removal of the system's top plate which required the loosening of just one screw. Then, remarkably, the side panel requires sliding downwards, meaning that you would have to tip the system over slightly to facilitate this manoeuvre or dangle your PC over the side of your desk. You're then able to see the fixing more clearly. When returning the panel, the top plate could in fact stay in its position. It was just all a bit stiff.

Once this challenge was over, one of the more innovative case designs was truly marvellous. The drive bays were modular and required the removal of just one screw before they could be levered out for maintenance or upgrading. The remainder of the internal construction was delightfully airy and invitations for hands-on activities were being cordially issued.

A pleasing feature of both systems was the inclusion of a 19in CTX Invar shadow mask model. It's certainly able to hold its own with the best of the rest, with extremely high refresh-supported resolutions. They even glow with warm colours and a clarity not lost upon highly-detailed characters. The no-nonsense front-mounted buttons provided perfect response to our user-defined settings via a perfectly negotiable OSD.

PCW DETAILS

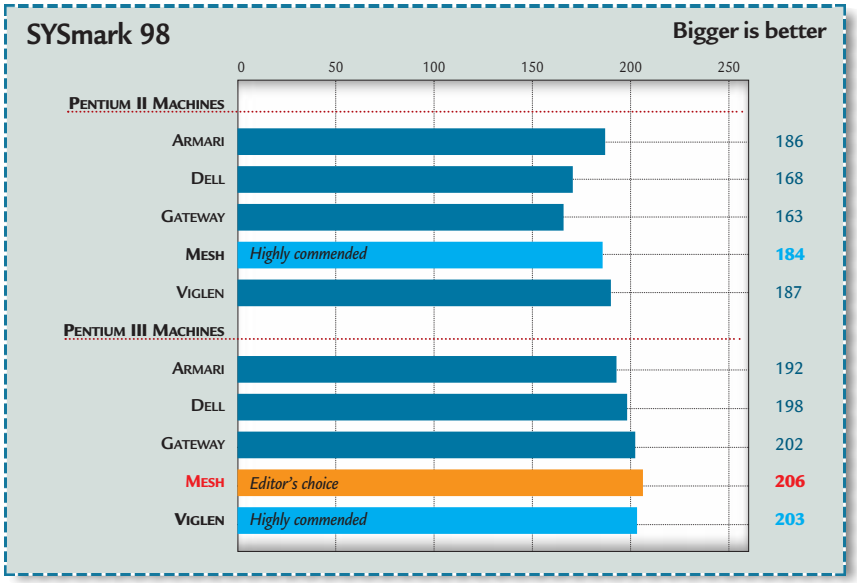
C2-450GS Pentium II Machine
Price *£1,761.33 (£1,499 ex VAT)*
Contact *Viglen 0181 758 7000*
www.viglen.co.uk
Good Points *Excellent modular construction. Huge backup device.*
Bad Points *Case entry is tricky.*
Conclusion *Well-balanced specification with attention to detail.*

Build Quality	★★★★
Performance	★★★★
Value for Money	★★★★★
Overall Rating	★★★★

C3-500XS Pentium III Machine
Good Points *Good performer. An excellent 19in monitor.*
Bad Points *Case entry is tricky.*
Conclusion *The price premium for the PIII is only marginally evident.*

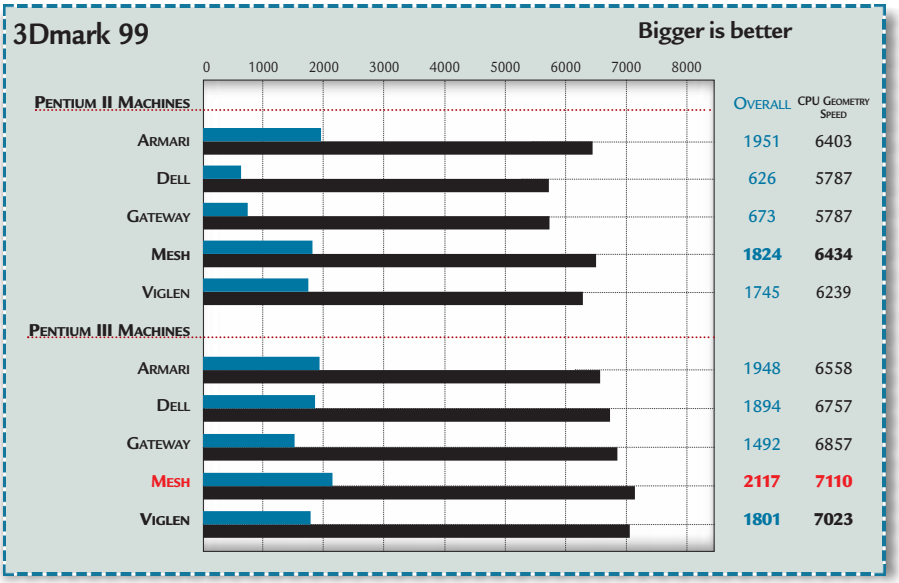
Build Quality	★★★★
Performance	★★★★
Value for Money	★★★★★
Overall Rating	★★★★★

PCW Labs Report



As all the other hardware conditions were fairly constant, all the results seemed to be directly related to the graphics sub-systems adopted by each machine. The low performance of the Pentium II machines offered by Gateway and Dell is mostly as a result of the reduced 8Mb video memory, with a small contribution from the fact that they contained the slowest processors in this group test. For Gateway's part, the inclusion of a VooDoo2-based card did little to help its performance. Of the Pentium III machines, the Armari suffered a low score as a consequence of being the only one not to sport a TNT-based card. While the remaining vendors opted for STB's TNT-based graphics adapter, Mesh preferred Hercules and stood head and shoulders above the rest of the entrants with its storming performance.

The reasons behind these 3Dmark 99 results were similar to those detailed *(above)* for SYSmark98, although the VooDoo2 3D accelerators included with the two Gateway machines gave them a bit of a boost in this area — less so for Gateway's Pentium III system as the majority of 3D will be dealt with quite adequately by the TNT-based primary display adapter. Although Mesh retained its performance crown for the Pentium III machines, Armari was no longer slouching. The overall 3D performance of ATI's Xpert 128 managed to push Armari up to a respectable second place.



How we did the tests

We ran two sets of tests on the PCs:

☛ **The SYSmark test** measures the speed of the PC running 14 common office and content creation applications and the time it takes to perform a variety of tasks in each application. Each test is run three times to ensure consistent results. The applications are divided into two categories.

Office productivity: CorelDraw 8, Excel 97, Dragon Systems NaturallySpeaking 2.02, Netscape Communicator 4.05 Standard edition, Caere OmniPage Pro 8.0, Corel Paradox 8, PowerPoint 97 and Word 97.

Content creation: MetaCreations Bryce 2, Avid Elastic Reality 3.1, Macromedia Extreme 3D 2, Photoshop 4.01, Premiere 4.2, and Xing Technology XingMPEG Encoder 2.1.

Performance depends on processor speed, RAM, graphics card and disk I/O.

☛ **3DMark99** from Futuremark Corporation is a suite of tests designed to examine the 3D performance of your PC. Designed by the 3D community, it uses a Real World DirectX6 3D game engine (MAX-FX) from Remedy Entertainment and 3D Realms. It produces one result from a balanced testing methodology which includes image quality, rendering speed and CPU capability. All 3Dmark99 bench tests are performed at a resolution of 1,024 x 768 in 16-bit colour depth with the test suites set to loop three times. The higher the score, the better the result.

☛ **You can get a taster** by downloading 3DMark99 Lite from www.3dmark.com.

KNI results

Instruction sets were in their infancy when Intel introduced MMX to its Pentium-class processors. An extra logic chip with 57 instructions was incorporated into the core architecture to make light work of complex but repetitive processor requests to perform multimedia-related tasks.

The principal of operation takes advantage of the CPU's tendency to process instructions sequentially, repeatedly applying the same instruction to similar data types, via Single Instruction Multiple Data-streams (SIMD).

The 70 Katmai New Instructions (KNI) advances upon MMX with their ability to process more complex floating-point numbers, augment media functions through enhanced integer calculations, and improve data cacheing.

Recognising the significance of improved floating-point performance to geometry calculations was the first step in improving multimedia related performance. However, MMX was using the same registers (or number holding areas) as the floating-point unit of the CPU, causing losses in clock cycles as it switched between the two. Subsequently, Intel's Pentium III has addressed this with the addition of eight 128-bit wide registers to enable KNI and the floating-point units to function in parallel.

Multimedia improvements will be apparent in applications performing video/audio compression and 3D graphical rendering. Less obvious are those that will benefit through methods of functionality which address the same improved resources. These areas include speech recognition, scientific visualisation through vast maths libraries (finite element analysis is a good example of this) and signal processing for geophysical analysis (for instance, the measurement of seismic activities or atmospheric pressures).

One major hurdle faced by Intel when implementing a new instruction set is to gain the support of the software industry. This is not egotistical but purely a functional relationship, because applications have to be specifically written or modified to take advantage of KNI. The software industry tends to comply quite peacefully, and mostly at its own expense. No company wants to be left out when providing opportunities for its customers to improve upon its existing products.

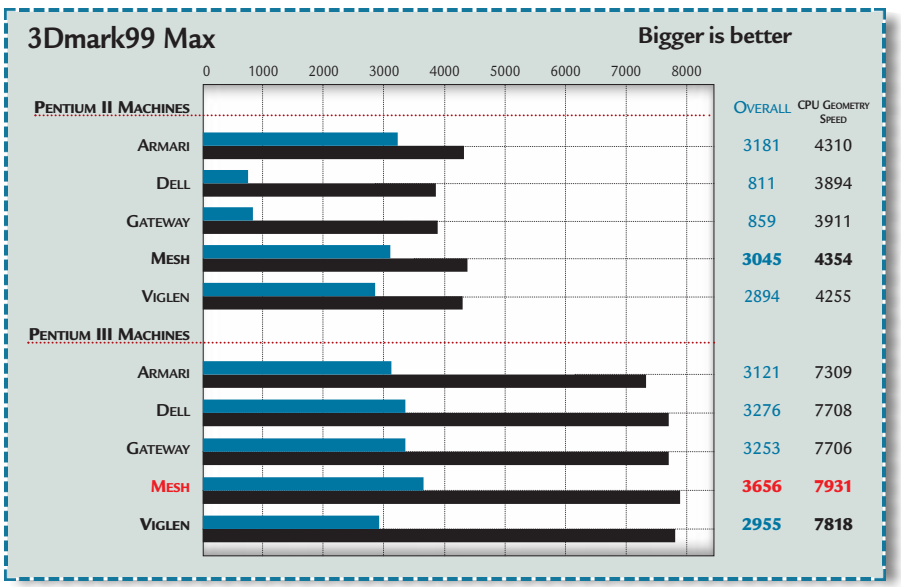
Applications have to be specifically written or modified to take advantage of KNI

Known KNI-optimised titles, at the time of writing, included: Adobe PhotoShop, IBM ViaVoice, Activision Battlezone2, Lotus SmartSuite Millennium Edition, Microsoft Office 2000, and Rage's Expendable.

When it came to testing the machines, we began by benchmarking in the traditional manner with 'blind' unoptimised software. These results show no potential performance improvements sported by the Pentium III machines. We would have liked to use some optimised 'real-world' applications such as Adobe's PhotoShop but at the time of testing there was no UK availability — not even for journalists!

Thankfully, though, FutureMark anticipated the significance of KNI and produced an optimised version of 3DMark99, the Max version. The original 3DMark99 suite of tests was also amended to include embossed bump-mapping, a texturing technique that enhances the visual realism of textures and objects in a 3D environment by giving the illusion of depth variation. Unfortunately, due to the implementation of instruction set optimisation no comparison can be made between the results from the original 3DMark99 and the Max version.

More details on 3DMark99 Max and the original un-optimised version can be found at www.3dmark.com along with downloadable lite versions of both.



The comparison between Pentium II and Pentium III PCs with unoptimised benchmarks such as SYSmark98 was disappointing. Performance gains were mostly due to the increased CPU clock frequencies of the PIII machines. The KNI-enabled 3DMark99 Max gave an entirely different picture. Even when the Pentium III machines had to economise on their graphics sub-systems, when KNI kicked in the systems kicked butt. Most impressive of all were the results achieved by the Mesh system which had a different flavour of TNT adapter than that favoured by most others. This is evidence of a graphics card manufacturer which had truly spent time and effort to optimise the driver files specific to its hardware.

Memory & performance

It was not long ago that the statement 'minimum system memory requirements' detailed actual bare minimums to perceive full functionality of your chosen application. Memory prices have dropped so far that we are now seeing systems shipped with memory quotas far in excess of what was once regarded as the minimum — it is a welcome result of the economics of mass production. But how far can you take this luxury? How much memory do you need to achieve optimum performance and are there upper limits that would adversely affect performance? The answers will vary, depending on your chosen operating system and/or the application being run at the time.

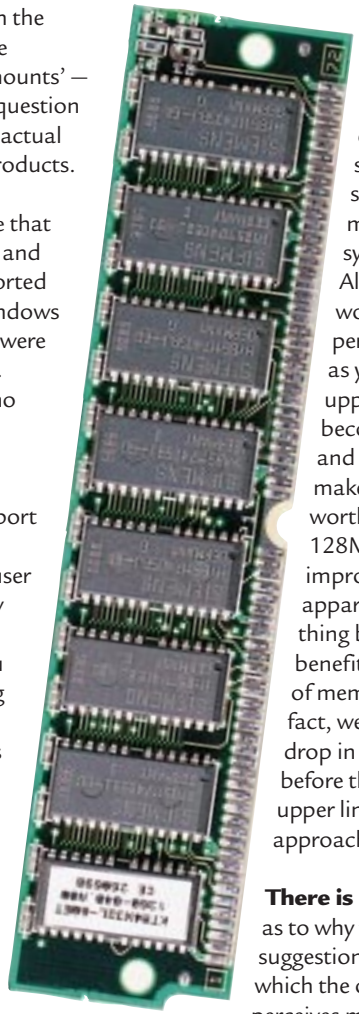
We asked Microsoft if there were actual limits to fully-supported memory quotas across their operating systems and whether amounts in excess of these limits would incur adverse effects? The answers were returned with the statement 'Note…these are theoretical MAXIMUM amounts' — possibly a reaction to our question suggesting that there were actual limitations to Microsoft products.

The values returned were that Windows 95 OSR1, OSR2 and Windows 98 all fully supported up to 512Mb and that Windows NT4 service packs 3 and 4 were able to support up to 4Gb. Unfortunately there were no figures quoted for the anticipated versions of Windows 2000, although presumably increased support will be planned.

For the average home user running standard but fairly demanding current office applications or games, you may possibly view anything above 128Mb as a tad excessive. To be fair, unless you're rendering asteroids at film resolution under NT, this is likely to be true.

We ran performance tests under Windows 98 using SYSmark98 (see *How we did the tests*, p144 for workload description) increasing the memory after each run.

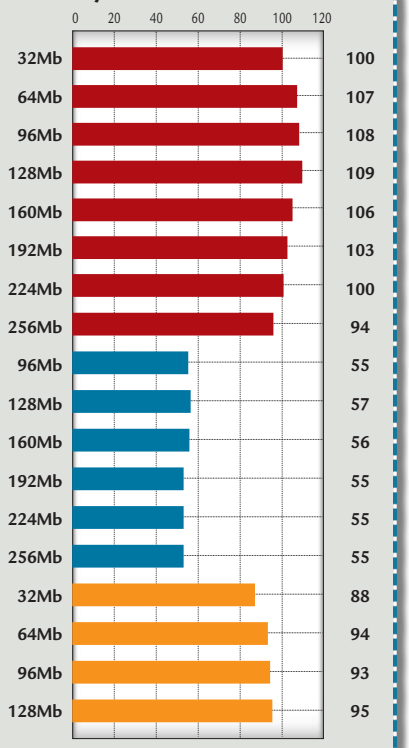
Further to these tests we increased the strain on the system resources by looping five 5Mb MPEG files simultaneously with SYSmark98.



The results were fairly conclusive and supported vendors in their decision to generally supply Windows 98 systems with a maximum of 128Mb system memory. Although under certain workloads the performance increases, as you approach this upper limit the increases become less apparent and the current prices still make any added RAM worthwhile. Above 128Mb, no performance improvements were apparent. Support is one thing but gaining any benefit out of an allocation of memory is another. In fact, we perceived an actual drop in performance well before the Windows 98 upper limit was even approached.

There is no definitive answer as to why these limits exist. As a suggestion, the method by which the operating system perceives memory through logical mapping may be most efficiently optimised for 128Mb or below and mapping for greater amounts may resource new instructions, dipping the performance slightly as a consequence.

Memory chart



FUTURE MEMORY

Advances in memory technology are just around the corner, with the main focus on the system bus speeds to which the modules will be connected. The first to emerge is likely to be the PC133 standard that, as the name suggests, will up the front-side bus speed support to 133MHz. There have already been announcements from major core logic manufacturers who will be implementing the technology capable of supporting the increased speeds. Look out for VIA's Apollo Pro133 chipset that will be the first in a generation with fully-integrated functions to smooth the migration of all connected peripherals to the new standard.

Towards the end of this year, we will see the introduction of AMD's Slot A processor with its Alpha EV6 based bus design likely to push the clocks through the 200MHz barrier. Of course memory will have to follow suit.

Table of features




Manufacturer	Armari	Dell	Gateway	Mesh	Viglen
Model Name	**MBX-450e**	**Dimension V400**	**GP6-400**	**Pegasus 450CDR**	**C2-450GS**
Price (ex VAT)	£1,499	£1,499 ex delivery	£1,495	£1,499	£1,499
Price (inc VAT)	£1,761.33	£1,802.45 incl delivery	£1,756.62	£1,761.33	£1,761.33
Telephone	0181 810 7441	0870 1524850	0800 552000	0181 208 4706	0181 758 7000
Fax	0181 810 8846	01344 723695	00353 1 8482022	0181 208 0966	0181 758 7080
Web address	www.armari.com	www.dell.co.uk	www.gateway.com/uk	www.meshplc.com	www.viglen.co.uk
Hardware Specs					
Processor	Intel 450MHz Pentium II	Intel 400MHz Pentium II	Intel 400MHz Pentium II	Intel 450MHz Pentium II	Intel 450MHz Pentium II
RAM/Type	128Mb/PC100 SDRAM	128Mb/PC100 SDRAM	128Mb/PC100 SDRAM	128Mb/PC100 SDRAM	128Mb/PC100 SDRAM
Occupied / Spare RAM slots	1/3	1/2	1/1	1/2	1/2
Hard Disk	IBM DeskstarGXP	Maxtor Diamondmax	IBM Deskstar	IBM DTTA-371010	Fujitsu MPD3173AT
HD Size/Interface	10.1Gb/EIDE	12.9Gb/EIDE	16.8Gb UDMA	10.1Gb/EIDE	16.9Gb/EIDE
Storage Drive	None supplied	Iomega Zip	Iomega Zip	Philips PCA362RW	HP Colorado Tape Drive
Size of storage drive media	n/a	100Mb	100Mb	Re-Writable 650Mb CD-ROM	8Gb
Storage drive interface	n/a	EIDE	EIDE	EIDE	EIDE
Motherboard	ASUS P2B-D	Dell/Intel E139761	Intel Tolstoy	ASUS P2B	Viglen 69M
Chipset	Intel 440BX	Intel440BX	Intel440BX	Intel 440BX	Intel 440BX
Expansion					
No of 3.5/5.25in bays	4/3	5/2	1/2	4/3	4/3
No of free 3.5/5.25in bays	2/2	2/1	0/0	2/1	2/1
No of PCI/ISA/shared slots	4/2/0	2/1/1	5/1/1	3/2/1	3/2/1
No of free PCI/ISA/shared slots	2/2/0	0/0/1	3/1/1	1/2/1	1/2/0
No of USB/Serial/Parallel/PS2	2/2/1/2	2/2/1/2	2/2/1/2	2/2/1/2	2/2/1/2
Multimedia					
CD-ROM	ASUS CD-S400	Toshiba SD-M1202 DVD	Mitsumi FX320s	Mida LTN-382	Hitachi GD-2500
CD-ROM Speed/Interface	40x/EIDE	4.8xDVD/ATAPI	32x/EIDE	40x/EIDE	4xDVD/24xCD/EIDE
Sound card	Creative Labs SB 64V PCI	Turtle Beach Montego II	Creative Labs Audio PCI 64D	Creative Labs PCI 64V	Labway PCI 3D Yamaha XG
Speakers	Yamaha YST-M8	Altec Lansing ACS 295	Boston Acoustics Media Theatre	Yamaha YST-M20DSP	Yamaha YST-M15
Graphics card	ATI Rage Fury	ATI Rage Pro	STB Velocity 128	Hercules TNT Dynamite	STB Vel. 4400 TNT w/TV-out
RAM/Max RAM and type	32Mb/32Mb/SDRAM	8Mb/8Mb/SDRAM	8Mb / 8Mb SGRAM	16Mb/16Mb/SDRAM	16Mb/16Mb/SDRAM
Graphics card interface	AGP	On-board AGP	On-board AGP	AGP	AGP
Monitor	Iiyama S702GT	Sony Ultrascan P990	LG EV700	Mitsubishi Diamond Pro 900u	CTX 19D
Monitor size/Max viewable diag	17in/15.7in	19in/18in	17in/15.9in	19in/18in	19in/18in
Max refresh rate at 1,024 x 768	100Hz	85Hz	85Hz	100Hz	100Hz
Max refresh rate at 1,280 x 1,024	85Hz	85Hz	60Hz	85Hz	85Hz
Max refresh rate at 1,600 x 1,200	75Hz	60Hz	n/a	75Hz	75Hz
Other Information					
Modem	Diamond SupraExpress 56I Pro PCI	USR V.90 Global	GVC Winmoden	Diamond SupraExpress 56I Pro PCI	CIS PCI
Highest supported standard	56K ITU (V.90) + K56 flex	V.90	56K ITU (V.90) + K56 flex	56K ITU (V.90) + K56 flex	56K ITU (V.90) + K56 flex
Misc Hardware	n/a	Intel 82558 Fast Ethernet on-board, HP Deskjet 420C Printer	STB Black Magic Voodoo2 12Mb	n/a	Intel Pro LAN Card 100Mbps
Bundled software		MS Office SBE 97 v2.0	MS Essentials for Business, Business Showcase	Lotus SmartSuite Millenium	MS Office SBE 97 v2.0 STB/Quadrant DVD Player
Sales and Support:					Cheyenne Bitware
Standard Warranty	1 yr RTB	3 yrs (yr 1 on-site)	1st yr on-site, next 2 yrs RTB	Yr 1 on-site, next 2 yrs RTB lab.	1 year collect and return
Warranty Options	3 yrs on-site	up to 4 yrs on-site	3yrs onsite @ £149 (ex VAT)	up to 5 yrs on-site	Up to 4-hr response OSM

Table of features




Manufacturer	Armari	Dell	Gateway	Mesh	Viglen
Model Name	**NBX-K500**	**Dimension XPS T500**	**GP7-500**	**Pegasus 500XL**	**C3-500XS**
Price (ex VAT)	£1,499	£1,500 ex delivery	£1,538	£1,499	£1,499
Price (inc VAT)	£1,761.33	£1,803.62 incl delivery	£1,807.15	£1,761.33	£1,761.33
Telephone	0181 810 7441	0870 1524850	0800 552000	0181 208 4706	0181 758 7000
Fax	0181 810 8846	01344 723695	00353 1 8482022	0181 208 0966	0181 758 7080
Web address	www.armari.com	www.dell.co.uk	www.gateway.com/uk	www.meshplc.com	www.viglen.co.uk
Hardware Specs					
Processor	Intel 500MHz Pentium III	Intel 500MHz Pentium III	Intel 500MHz Pentium III	Intel 500MHz Pentium III	Intel 500MHz Pentium III
RAM/Type	128Mb/PC100 SDRAM	128Mb/PC100 SDRAM	128Mb/PC100 SDRAM	128Mb/PC100 SDRAM	128Mb/PC100 SDRAM
Occupied / Spare RAM slots	1/2	1/2	1/2	1/2	1/2
Hard Disk	IBM DeskstarGXP	IBM Deskstar	Quantum Fireball	IBM DJNA-352500	Western Digital Caviar 313000
HD Size/Interface	10.1Gb/EIDE	14.4Gb/EIDE	10Gb/EIDE	25Gb/EIDE	12.7Gb/EIDE
Storage Drive	None supplied	Iomega Zip	Iomega Zip	None supplied	Matsushita LS-120 ver 4 07
Size of storage drive media	n/a	100Mb	100Mb	n/a	120Mb
Storage drive interface	n/a	EIDE	EIDE	n/a	EIDE
Motherboard	SuperMicro P6-SBA	Dell/Intel E139761	Intel Tabor II	ASUS P2B	Viglen 69M
Chipset	Intel 440BX	Intel440BX	Intel440BX	Intel440BX	Intel 440BX
Expansion					
No of 3.5/5.25in bays	4/3	5/2	6/4	4/3	4/3
No of free 3.5/5.25in bays	2/2	2/1	4/2	2/2	2/2
No of PCI/ISA/shared slots	2/3/1	4/0/1	5/1/1	3/2/1	3/2/1
No of free PCI/ISA/shared slots	1/2/1	2/0/1	3/1/1	1/2/1	1/1/0
No of USB/Serial/Parallel/PS2	2/2/1/2	2/2/1/2	2/2/1/2	2/2/1/2	2/2/1/2
Multimedia					
CD-ROM	Pioneer DVD-103	Toshiba SD-M1202 DVD	Mitsumi FX320s	Mida LTN-382	Samsung SCR3231
CD-ROM Speed/Interface	6xDVD/32xCD/EIDE	4.8x DVD / ATAPI	32x/EIDE	40x/EIDE	32x/EIDE
Sound card	Diamond Sonic Impact S90 (PCI)	Turtle Beach Montego II	Creative Labs Audio PCI 64D	Creative Labs PCI 64V	Labway PCI 3D Yamaha XG
Speakers	Yamaha YST-M20DSP	None supplied	None supplied	Philips DSS350 USB	Yamaha YST-M15
Graphics card	ATI Xpert 128	STB Velocity 4400	STB Velocity 4400	Hercules TNT Dynamite	STB Velocity 4400 TNT w/TV-out
RAM/Max RAM and type	16Mb/16Mb/SDRAM	16Mb/16Mb SGRAM	16Mb/16Mb SGRAM	16Mb/16Mb/SDRAM	16Mb/16Mb/SDRAM
Graphics card interface	AGP	AGP	AGP	AGP	AGP
Monitor	Iiyama S702GT	Philips 1200HS	LG EV700	ADI GT56	CTX 19D
Monitor size/Max viewable diag	17in/15.7in	19in/18in	17in/15.7in	17in/15.8in	19in/18in
Max refresh rate at 1,024 x 768	100Hz	85Hz	85Hz	100Hz	100Hz
Max refresh rate at 1,280 x 1,024	85Hz	85Hz	60Hz	85Hz	85Hz
Max refresh rate at 1,600 x 1,200	75Hz	75Hz	n/a	75Hz	75Hz
Other Information					
Modem	Diamond SupraExpress 56I Pro PCI	USR V.90 Global	None supplied	Diamond SupraExpress 56I Pro PCI	CIS PCI
Highest supported standard	56K ITU (V.90) + K56 flex	V.90	n/a	56K ITU (V.90) + K56 flex	56K ITU (V.90) + K56 flex
Misc Hardware	n/a		STB Black Magic Voodoo2 12Mb		Intel Pro LAN Card 100Mbps
Bundled software		MS Office SBE 97 v2.0	MS Office97 SBE v2.0, Business Showcase	Lotus SmartSuite Millenium	MS Office SBE 97 v2.0 Cheyenne Bitware
Sales and Support:					
Standard Warranty	1 yr RTB	3 yrs (yr 1 on-site)	1st yr on-site, next 2yrs RTB	Yr 1 on-site, next 2 yrs RTB lab.	1 yr collect and return
Warranty Options	3 yrs on-site	up to 4 yrs on-site	3yrs onsite @ £149 (ex VAT)	up to 5 yrs on-site	Up to 4hr response OSM

Editor's **Choice**

When it came to dishing out the awards, a number of issues were considered beyond the basic specifications and performance results. Each of the vendors is asking around £1,499 (ex VAT) for their systems — no small amount of money — so, along with good quality construction you would expect to receive good quality service. But this is less easy to judge, so we have tried to offer you some insight on this occasion so that you can draw your own opinions based on our views and the facts before you.

Reasons for choosing a system built around a Pentium III will obviously be dependent on you receiving any real benefits from the Katmai New Instructions. The processor alone provides very little in the way of improved performance over its predecessor so you must research the applications you will be running to ensure that they will be optimised for KNI.

Of course, the now-budget Pentium II systems can offer you a more complete package so you may be tempted to invest initially in a Pentium II before you venture into upgrading the machine yourself to a Pentium III standard.

The criteria of this group test did stipulate that a serious business user would need to be catered for but we also emphasised that a focus on graphics, and particularly 3D images, would also be considered. For this reason our **Editor's Choice** for the overall best possible machine goes to **Mesh's Pentium III-based Pegasus 500XL** *(shown, right)*. It did lack any removable storage device but it had a huge hard disk. The ADI 56GT monitor was not as impressive as the Mitsubishi Diamond Pro 900u on offer with Mesh's Pentium II counterpart, but to be fair the ADI monitor is in fact perfectly acceptable, it's just that by comparison the monitor provided with Mesh's Pentium II machine is just stunning. The main criteria have been excelled in all other areas with exceptional performance from a quality package. The only suggestion would be to fork out a bit more cash and take advantage of Mesh's optional five years on-site maintenance.

Exceptional performance from a quality package

There will be smiles all round at Mesh. We were particularly impressed by the **Mesh Pentium II-based Pegasus 450CDR** *(pictured below, left)* which receives our second **Highly Commended** award. As previously mentioned, the impressive quality of the Mitsubishi 19in monitor provided was a real eye-opener. The end user would also derive benefit from the added kudos of being able to use re-writable CD media as a backup medium, or for presenting finished work to their clients.

Viglen's Pentium III-based C3-500XS *(pictured, right)*. picks up our first **Highly Commended** award. Although it stumbles slightly with its specific 3D results, all the other areas are perfectly balanced in providing exceptional build quality with classy components. The monitor alone is enough to make this product stand out from its competitors and for this reason alone its Pentium II machine is worth a look.