Perfection in Automation
www.br-automation.com

# Benchmark test
## Industrial PCs

Date: 12 March 2009

Project Number:

# I Versions

| Version | Date | Comment | Edited by |
|---|---|---|---|
| 2.0 | June, 8 2005 | First edition | GIA |
| 2.1 | 26.09.2005 | Document upgrade with B&R Automation Runtime (AR010 Version E2.82) tests | GIA |
| 2.2 | 29.11.2005 | Document upgrade with B&R Automation Runtime (AR106 Version B2.83) tests | GIA |
| 2.3 | 19.03.2008 | • Document changeover to BrManualTech V2.6 guideline<br>• Document upgrade with APC810 (SiSoft Sandra 2007) tests | EBB |
| 2.4 | 06.02.2009 | • Benchmark enhancements with PP300/400 (LX800-500) | MIK |

**Table 1: Versions**

# II Distribution

| Name | Company, Department | Amount | Remarks |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

**Table 2: Distribution**

# III Safety notices

Safety notices in this document are organized as follows:

| Safety notice | Description |
|---|---|
| Danger! | Disregarding the safety regulations and guidelines can be life-threatening. |
| Warning! | Disregarding the safety regulations and guidelines can result in severe injury or heavy damage to material. |
| Caution! | Disregarding the safety regulations and guidelines can result in injury or damage to material. |
| Information: | Important information used to prevent errors. |

**Table 3: Safety notices**

# IV Test location

| # | Company | Street | Postal code | City | Telephone | Contact |
|---|---|---|---|---|---|---|
| 1 | B&R | B&R Strasse 1 | A-5142 | Eggelsberg | | |

**Table 4: Test location**

# V Table of Contents

# 1 What's it all about?

This document is meant to show how the performance of an APC620 matches up to other available systems (including the leading systems).
Programs from various manufacturers were used to determine the results. The selection was made so that the most extensive and clearest representation of the performance is provided in the end.
The setup of information provided was based on a setup used by many popular magazines and web pages (e.g. Techchannel).

## Information:

**All results provided cannot be interpreted and used as absolute values. They should considered comparison values that can vary slightly depending on the operating system and computer being used.**

# 2 Hardware

The following hardware was used for the benchmark tests:

## 2.1 Devices being tested

| # | CPU | RAM | VGA controller | Manuf. |
|---|---|---|---|---|
| **Power Panel 100/200 (5PP120.1505-37)** | | | | |
| 1 | Geode SC2200 266 MHz | 128 MB SD RAM | Geode SC2200 4MB (Shared) | B&R |
| **IPC2001** | | | | |
| 2 | AMD 486DX2-66 MHz | 8 MB DRAM | Chips & Technologies 65535 1MB | B&R |
| 3 | AMD 486DX5-133 MHz | 32 MB DRAM | Chips & Technologies 65535 1MB | B&R |
| **IPC5000C** | | | | |
| 4 | Intel Celeron 3 566 MHz 66 MHz FSB | 256 MB SDRAM 100 MHz | Chips & Technologies 69000 2MB | B&R |
| 5 | Intel Celeron 3 850 MHz 66 MHz FSB | 256 MB SDRAM 100 MHz | Chips & Technologies 69000 2MB | B&R |
| 6 | Intel Pentium 3 600 MHz 100 MHz FSB | 256 MB SDRAM 100 MHz | Chips & Technologies 69000 2MB | B&R |
| 7 | Intel Pentium 3 850 MHz 100 MHz FSB | 256 MB SDRAM 100 MHz | ATI Rage Mobility 4MB | B&R |
| **APC680** | | | | |
| 8 | Intel Celeron 3 850 MHz 100 MHz FSB | 256 MB SDRAM 133 MHz | Intel 815E Graphics Controller 32 MB | B&R |
| 9 | Intel Pentium 3 1.26 GHz 133 MHz FSB | 512 MB SDRAM 133 MHz | Intel 815E Graphics Controller 32 MB | B&R |
| **APC620 with INTEL 815E chipset** | | | | |
| 10 | Intel Celeron 3 400 MHz 100 MHz FSB | 256 MD SDRAM 133 MHz | Intel 82815 Graphics Controller 32 MB | B&R |
| 11 | Intel Celeron 3 733 MHz 133 MHz FSB | 512 MB SDRAM 133 MHz | Intel 82815 Graphics Controller 32 MB | B&R |
| 12 | Intel Celeron 3 1000 MHz 133 MHz FSB | 512 MB SDRAM 133 MHz | Intel 82815 Graphics Controller 32 MB | B&R |
| **APC620 with INTEL 855GME chipset** | | | | |
| 13 | Intel Celeron M 600 MHz 400 MHz FSB | 256 MB DDR-SDRAM PC2700 333 MHz | Intel 82855 GME Graphic Controller 64 MB | B&R |
| 14 | Intel Celeron M 1000 MHz 400 MHz FSB | 256 MB DDR-SDRAM PC2700 333MHz | Intel 82855 GME Graphic Controller 64 MB | B&R |
| 15 | Intel Pentium M 1.1 GHz 400 MHz FSB | 1 GB DDR-SDRAM PC2700 333 MHz | Intel 82855 GME Graphic Controller 64 MB | B&R |
| 16 | Intel Pentium M 1.4 GHz 400 MHz FSB | 512 MB DDR-SDRAM PC2700 333 MHz | Intel 82855 GME Graphic Controller 64 MB | B&R |
| 17 | Intel Pentium M 1.6 GHz 400 MHz FSB | 1 GB DDR-SDRAM PC2700 333 MHz | Intel 82855 GME Graphic Controller 64 MB | B&R |
| 18 | Intel Pentium M 1.8 GHz 400 MHz FSB | 512 MB DDR-SDRAM PC2700 333 MHz | Intel 82855 GME Graphic Controller 64 MB | B&R |
| **Other test computers** | | | | |
| 19 | Intel Pentium 4 2.4 GHz 533 MHz FSB | 512 MB DDR-SDRAM 333 MHz | Intel 82865G Graphics Controller 96 MB | HP |
| 20 | Intel Pentium 4 2.6 GHz 533 MHz FSB | 512 MB DDR-SDRAM 333 MHz | Sapphire ATI Radeon 9600 Atlantis 256 MB DDR | HP |
| **APC810 with INTEL 945GME chipset** | | | | |
| 21 | Celeron M 1.06 GHz 533 MHz FSB | 512MB DDR2-SDRAM | Intel Graphics Media Accelerator 950 max. 224MB | B&R |
| 22 | Celeron M 1.06 GHz 533 MHz FSB | 2x512MB DDR2-SDRAM | Intel Graphics Media Accelerator 950 max. 224MB | B&R |

| # | CPU | RAM | VGA controller | Manuf. |
|---|---|---|---|---|
| 23 | Core 2 Duo 1.06 GHz 533 MHz FSB | 2x1024MB DDR2-SDRAM | Intel Graphics Media Accelerator 950 max. 224MB | B&R |
| 24 | Core 2 Duo 1.50 GHz 667MHz FSB | 2x512MB DDR2-SDRAM | Intel Graphics Media Accelerator 950 max. 224MB | B&R |
| 25 | Core Duo 1.66 GHz 667MHz FSB | 2x1024MB DDR2-SDRAM | Intel Graphics Media Accelerator 950 max. 224MB | B&R |
| 26 | Core 2 Duo 2.16 GHz 667MHz FSB | 1024MB DDR2-SDRAM | Intel Graphics Media Accelerator 950 max. 224MB | B&R |
| 27 | Core 2 Duo 2.16 GHz 667MHz FSB | 2x1024MB DDR2-SDRAM | Intel Graphics Media Accelerator 950 max. 224MB | B&R |
| **Power Panel 300/400 (5PP320.1214-39)** | | | | |
| 28 | AMD Geode LX800-500 | 256MB DDR-SDRAM 333MHz | AMD Geode LX800 4MB | B&R |

**Table 5: Devices being tested**

## 2.2 Hard disks

| # | Name | Storage capacity | Rotary speed / cache | Manufacturer |
|---|---|---|---|---|
| **ICP5000C hard disks** | | | | |
| 1 | Slide-In HD MHK2060AT | 5.6 GB | 4200 (rpm) / 512 KB | Fujitsu/B&R |
| **APC620 hard disks** | | | | |
| 2 | Add-On HD MHT2020AC | 20 GB | 4200 (rpm) / 2MB | Fujitsu/B&R |
| 3 | Add-On HD MHT2030AR | 30 GB | 4200 (rpm) / 2 MB | Fujitsu/B&R |
| 4 | Slide-In HD MHT2020AC | 20 GB | 4200 (rpm) / 2 MB | Fujitsu/B&R |
| 5 | Slide-In HD MHT2030AR | 30 GB | 4200 (rpm) / 2 MB | Fujitsu/B&R |
| 6 | Travelstar | 40 GB | 7200 (rpm) / 8 MB | Hitachi |
| **Reference hard disk** | | | | |
| 7 | ST340014A | 40 GB | 7200 (rpm) / 2 MB | Seagate |
| **APC810 hard disks** | | | | |
| 8 | ST940817SM | 40GB | 5400 (U/min) / 8 MB | Seagate |

**Table 6: Hard disks used**

# 3 Software

The following software products were used for the tests:

## 3.1 Benchmark programs

| # | Name | Manufacturer | WEB link |
|---|---|---|---|
| 1 | Sandra 2002 Prof | Sisoft | http://www.sisoftware.net/ |
| 2 | Sandra 2005 SR1 Lite | Sisoft | http://www.sisoftware.net/ |
| 3 | PC Mark 2002 | MadOnion.com Inc. | http://www.futuremark.com/ |
| 4 | PC Mark04 | Futuremark Coperation | http://www.futuremark.com/ |
| 5 | WinBench99 | ZD Net/Ziff-Davis | http://www.zdnet.de/ |
| 6 | HDTACH V2.70 | Simpli Software | http://www.simplisoftware.com/ |
| 7 | 3D Mark 2000 | MadOnion.com Inc. | http://www.futuremark.com/ |
| 8 | 3D Mark 2001SE | MadOnion.com Inc. | http://www.futuremark.com/ |
| 9 | B&R Automation Runtime | B&R | http://www.br-automation.com |
| 10 | B&R Automation Runtime AR106 | B&R | http://www.br-automation.com |
| 11 | Sandra Pro Business 2007 | Sisoft | http://www.sisoftware.net/ |

**Table 7: Benchmark programs used and the corresponding WEB links**

## 3.2 Operating system

Windows 98 was used as the operating system for IPC2001 computers.
Microsoft Windows XP Professional SP2 was used for all other computers.

# 4 Results

## 4.1 Sisoft Sandra 2002 Prof.

Sisoft Sandra provides many different tests.
For this reason, Sandra has become a very popular benchmark program and is used in nearly all performance tests.

### 4.1.1 CPU arithmetic

Here, the program determines the maximum number of operations per second. The result is output in MIPS (Million Instructions per Second).
At the same time, the maximum number of floating point operations per second is also determined. The result is shown in MFLOPS (Million Floating Point Operations per Second).

| # | Test device | Dhrystone ALU (MIPS) | Whetstone FPU (MFLOPS) |
|---|---|---|---|
| **VIA CPUs** | | | |
| | VIA M6000, 600MHz | 771[1] | 210[1] |
| | VIA M10000, 1000 MHz | 1592[1] | 367[1] |
| **Power Panel 100/200** | | | |
| 1 | Geode 266 MHz, 128 MB RAM | 329 | 202 |
| **IPC2001 computer** | | | |
| 2 | AMD 486DX2 66 MHz 8 MB DRAM | 85 | 30 |
| 3 | AMD 486DX5 133 MHz 32 MB DRAM | 169 | 60 |
| **IPC5000C computer** | | | |
| 4 | Celeron 3 566 MHz, 256 MB SDRAM | 1513 | 765 |
| 5 | Celeron 3 850 MHz, 256 MB SDRAM | 2267 | 1149 |
| 6 | Pentium 3 600 MHz, 256 MB SDRAM | 1614 | 810 |
| 7 | Pentium 3 850 MHz, 256 MB SDRAM | 2267 | 1149 |
| **APC680 with INTEL 815E chipset** | | | |
| 8 | Celeron 3 850 MHz, 256 MB SDRAM | 2283 | 1147 |
| 9 | Pentium 3 1.26 GHz, 256 MB SDRAM | 3482 | 1697 |
| **APC620 with INTEL 815E chipset** | | | |
| 10 | Celeron 3 400 MHz, 256 MB SDRAM | 1086 | 529 |
| 11 | Celeron 3 733 MHz, 512 MB SDRAM | 2002 | 976 |
| 12 | Celeron 3 1 GHz, 256 MB SDRAM | 2751 | 1340 |
| **APC620 with INTEL 855GME chipset** | | | |
| 13 | Celeron M 600 MHz, 256 MB DDR-SDRAM | 2008 | 1170 |
| 14 | Celeron M 1 GHz, 256 MB DDR-SDRAM | 3533 | 1948 |
| 15 | Pentium M 1.1 GHz, 1GB DDR-SDRAM | 4580 | 2149 |
| 16 | Pentium M 1.4 GHz, 512 MB DDR-SDRAM | 4945 | 2732 |
| 17 | Pentium M 1.6 GHz, 1GB DDR-SDRAM | 5363 | 3124 |
| 18 | Pentium M 1.8 GHz, 512 MB DDR-SDRAM | 6370 | 3511 |
| **Other test computers** | | | |
| 19 | Pentium 4 2.4 GHz, 512 MB DDR-SDRAM | 4634 | 2955 |
| 20 | Pentium 4 2.6 GHz, 512 MB DDR-SDRAM | 5168 | 3305 |

[1] Source: Tolly Group

| # | Test device | Dhrystone ALU (MIPS) | Whetstone FPU (MFLOPS) |
|---|---|---|---|
| **Power Panel 300/400** | | | |
| 28 | AMD Geode LX800, 256 MB DDR-SDRAM | 792 | 291 |

**Table 8: Results for Sisoft Sandra 2002 Prof. CPU arithmetic**

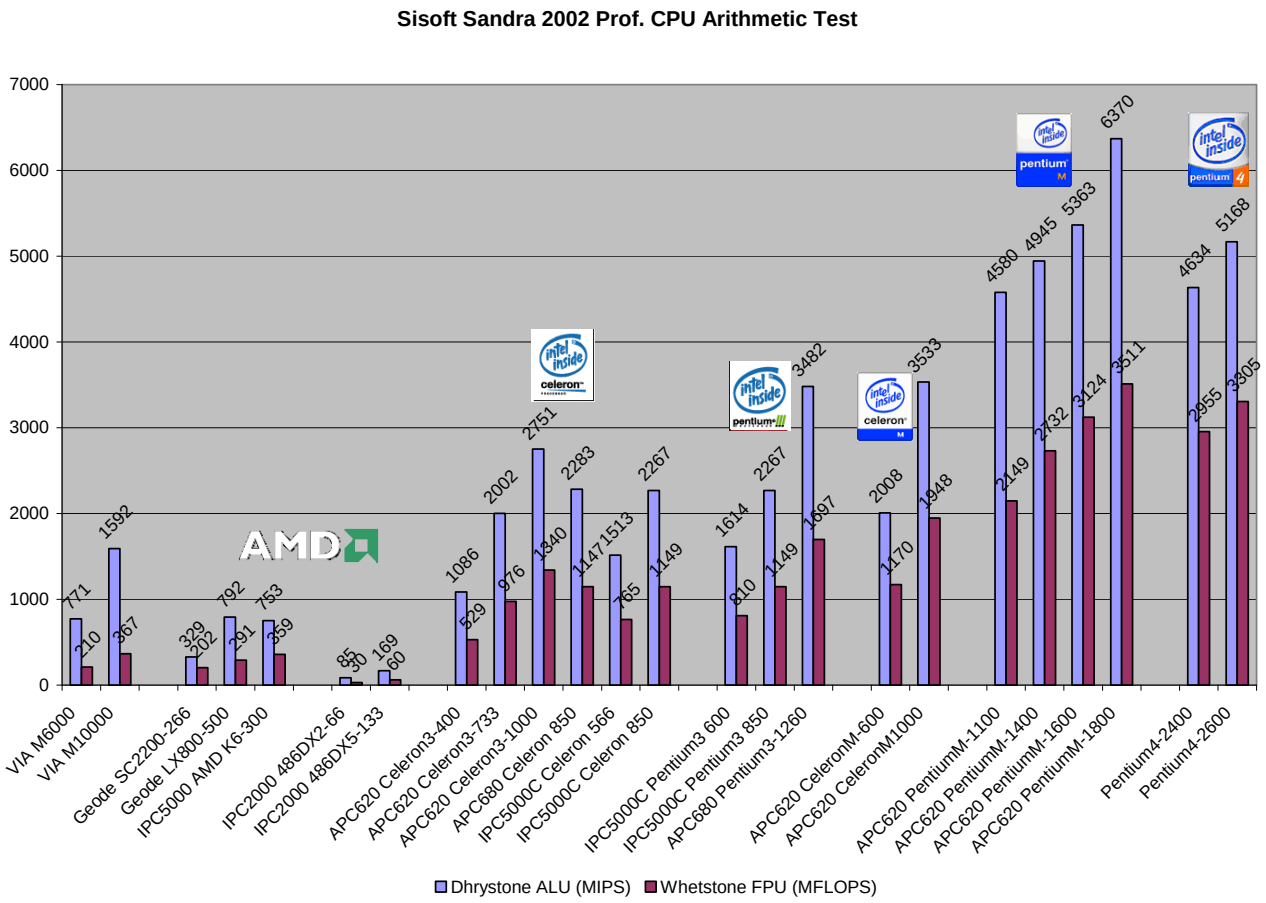



**Figure 1 - Results for Sisoft Sandra 2002 Prof. CPU arithmetic**

### 4.1.2 CPU multimedia

This test determines the multimedia performance of the CPU. During this test, the speed and performance are checked for the technologies used, such as MMX, SSE, SSE2 (depending on the processor).

| # | Test device | Integer (it/s) | Floating Point (it/s) |
|---|---|---|---|
| **VIA CPUs** | | | |
| | VIA M6000, 600MHz | 874[2] | 1196[2] |
| | VIA M10000, 1000 MHz | 2255[2] | 1196[2] |
| **Power Panel 100/200** | | | |
| 1 | Geode 266 MHz, 128 MB RAM | 412 | 118 |
| **IPC2001 computer** | | | |
| 2 | AMD 486DX2 66 MHz 8 MB DRAM | 22 | 18 |
| 3 | AMD 486DX5 133 MHz 32 MB DRAM | 44 | 36 |
| **IPC5000C computer** | | | |
| 4 | Celeron 3 566 MHz, 256 MB SDRAM | 3084 | 3772 |
| 5 | Celeron 3 850 MHz, 256 MB SDRAM | 4628 | 5661 |
| 6 | Pentium 3 600 MHz, 256 MB SDRAM | 3265 | 3995 |
| 7 | Pentium 3 850 MHz, 256 MB SDRAM | 4629 | 5663 |
| **APC680 with INTEL 815E chipset** | | | |
| 8 | Celeron 3 850 MHz, 256 MB SDRAM | 4621 | 5654 |
| 9 | Pentium 3 1.26 GHz, 256 MB SDRAM | 6884 | 8545 |
| **APC620 with INTEL 815E chipset** | | | |
| 10 | Celeron 3 400 MHz, 256 MB SDRAM | 2147 | 2665 |
| 11 | Celeron 3 733 MHz, 512 MB SDRAM | 3957 | 4913 |
| 12 | Celeron 3 1 GHz, 256 MB SDRAM | 4652 | 6153 |
| **APC620 with INTEL 855GME chipset** | | | |
| 13 | Celeron M 600 MHz, 256 MB DDR-SDRAM | 2662 | 3839 |
| 14 | Celeron M 1 GHz, 256 MB DDR-SDRAM | 4284 | 6381 |
| 15 | Pentium M 1.1 GHz, 1GB DDR-SDRAM | 4814 | 7038 |
| 16 | Pentium M 1.4 GHz, 512 MB DDR-SDRAM | 6009 | 8951 |
| 17 | Pentium M 1.6 GHz, 1GB DDR-SDRAM | 7002 | 10254 |
| 18 | Pentium M 1.8 GHz, 512 MB DDR-SDRAM | 7724 | 11504 |
| **Other test computers** | | | |
| 19 | Pentium 4 2.4 GHz, 512 MB DDR-SDRAM | 9386 | 11608 |
| 20 | Pentium 4 2.6 GHz, 512 MB DDR-SDRAM | 10400 | 12905 |
| **Power Panel 300/400** | | | |
| 28 | AMD Geode LX800, 256 MB DDR-SDRAM | 777 | 950 |

**Table 9: Results for Sisoft Sandra 2002 Prof CPU multimedia**

[2] Source: Tolly Group

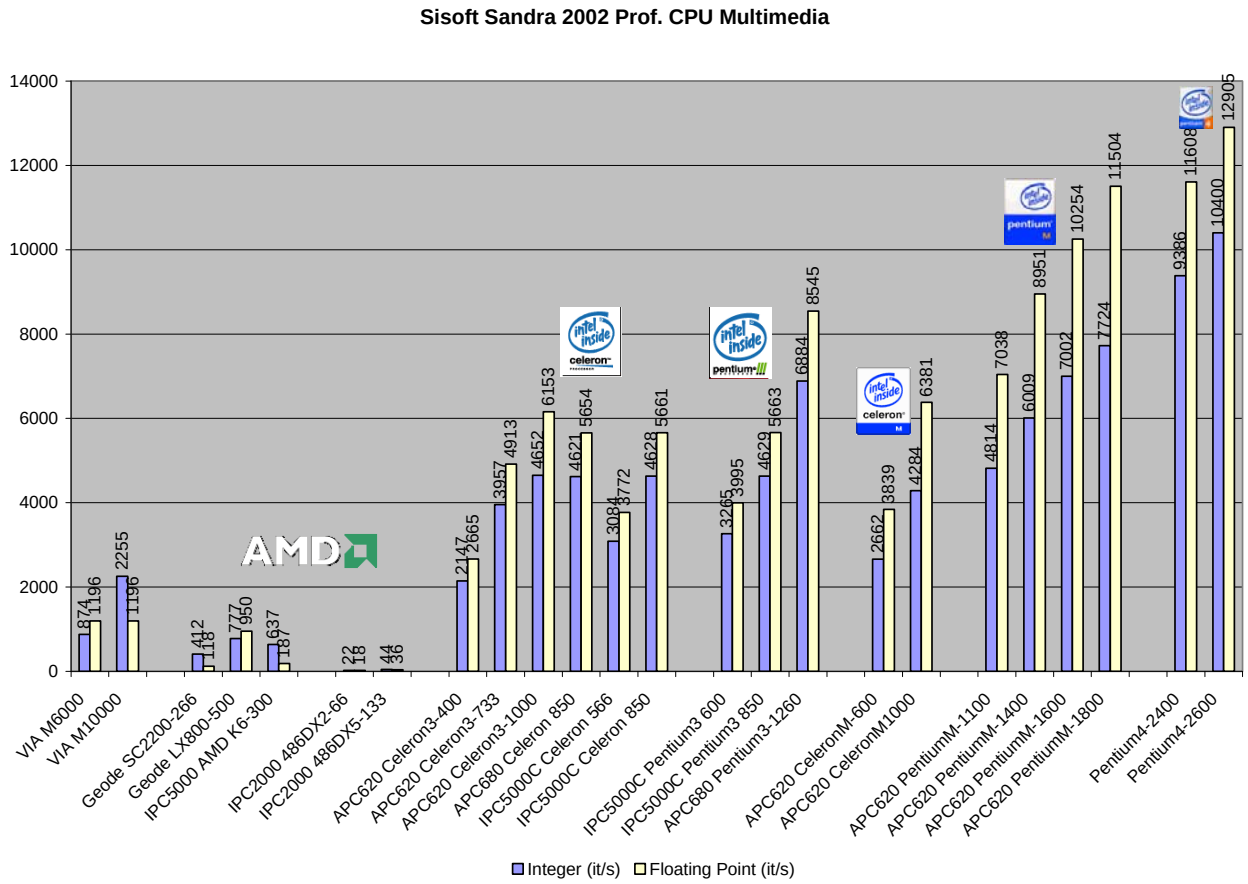



**Figure 2 – Results for Sisoft Sandra 2002 Prof. CPU multimedia**

### 4.1.3 Memory bandwidth

The performance of the system memory (main memory) is determined here. This is done by transferring a large amount of data. The result is the maximum "memory throughput" in MB/s.

| # | Test device | RAM Bandwidth ALU (MB/s) | RAM Bandwidth FPU (MB/s) |
|---|---|---|---|
| **VIA CPUs** | | | |
| | VIA M6000, 600MHz | 215[3] | 243[3] |
| | VIA M10000, 1000 MHz | 215[3] | 243[3] |
| **Power Panel 100/200** | | | |
| 1 | Geode 266 MHz, 128 MB RAM | 101 | 95 |
| **IPC2001 Rechner** | | | |
| 2 | AMD 486DX2 66 MHz 8 MB DRAM | 29 | 30 |
| 3 | AMD 486DX5 133 MHz 32 MB DRAM | 35 | 37 |
| **IPC5000C computer** | | | |
| 4 | Celeron 3 566 MHz, 256 MB SDRAM | 429 | 455 |
| 5 | Celeron 3 850 MHz, 256 MB SDRAM | 428 | 428 |
| 6 | Pentium 3 600 MHz, 256 MB SDRAM | 427 | 428 |
| 7 | Pentium 3 850 MHz, 256 MB SDRAM | 558 | 428 |
| **APC680 with INTEL 815E chipset** | | | |
| 8 | Celeron 3 850 MHz, 256 MB SDRAM | 584 | 570 |
| 9 | Pentium 3 1.26 GHz, 256 MB SDRAM | 762 | 752 |
| **APC620 with INTEL 815E chipset** | | | |
| 10 | Celeron 3 400 MHz, 256 MB SDRAM | 409 | 401 |
| 11 | Celeron 3 733 MHz, 512 MB SDRAM | 675 | 664 |
| 12 | Celeron 3 1 GHz, 256 MB SDRAM | 650 | 646 |
| **APC620 with INTEL 855GME chipset** | | | |
| 13 | Celeron M 600 MHz, 256 MB DDR-SDRAM | 1326 | 1340 |
| 14 | Celeron M 1 GHz, 256 MB DDR-SDRAM | 1395 | 1401 |
| 15 | Pentium M 1.1 GHz, 1GB DDR-SDRAM | 1353 | 1372 |
| 16 | Pentium M 1.4 GHz, 512 MB DDR-SDRAM | 1396 | 1401 |
| 17 | Pentium M 1.6 GHz, 1GB DDR-SDRAM | 1439 | 1411 |
| 18 | Pentium M 1.8 GHz, 512 MB DDR-SDRAM | 1601 | 1600 |
| **Other test computers** | | | |
| 19 | Pentium 4 2.4 GHz, 512 MB DDR-SDRAM | 1973 | 1948 |
| 20 | Pentium 4 2.6 GHz, 512 MB DDR-SDRAM | 3201 | 3206 |
| **Power Panel 300/400** | | | |
| 28 | AMD Geode LX800, 256 MB DDR-SDRAM | 404 | 334 |

**Table 10: Results for Sisoft Sandra 2002 Prof CPU memory bandwidth**

[3] Source: Tolly Group

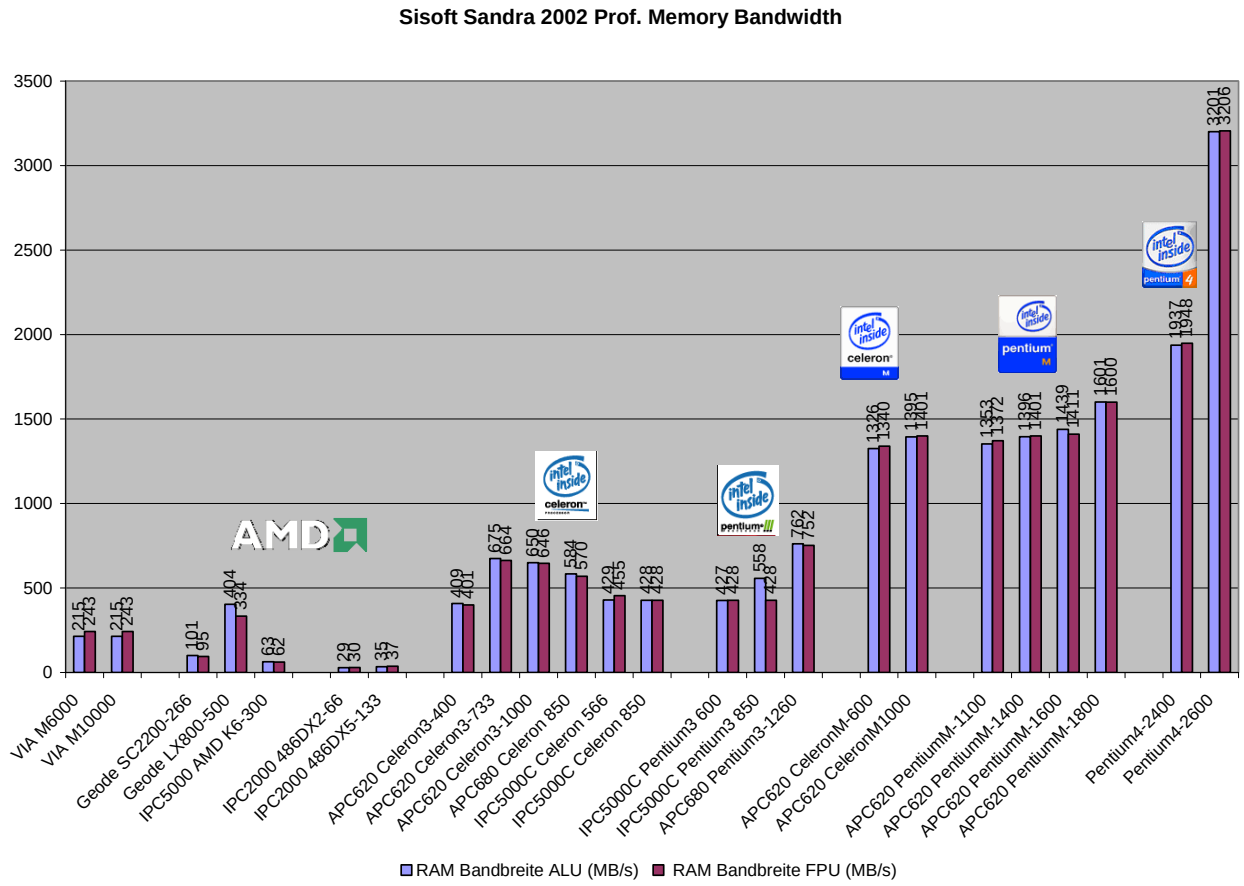



**Figure 3 – Results for Sisoft Sandra 2002 Prof memory bandwidth**

## 4.2 Sisoft Sandra 2005 SR1

Sisoft Sandra 2005 is the most current version of Sandra and supports the newest technologies (such as SSE3).

### 4.2.1 CPU arithmetic

Here, the program determines the maximum number of operations per second. The result is output in MIPS (Million Instructions per Second).
At the same time, the maximum number of floating point operations per second is also determined. The result is shown in MFLOPS (Million Floating Point Operations per Second).

| # | Test device | Dhrystone ALU (MIPS) | Whetstone FPU (MFLOPS) |
|---|---|---|---|
| **Power Panel 100/200** | | | |
| 1 | Geode 266 MHz, 128 MB RAM | 407 | 170 |
| **IPC5000C computer** | | | |
| 4 | Celeron 3 566 MHz, 256 MB SDRAM | 1928 | 743 |
| 5 | Celeron 3 850 MHz, 256 MB SDRAM | 2896 | 1122 |
| 6 | Pentium 3 600 MHz, 256 MB SDRAM | 2019 | 788 |
| 7 | Pentium 3 850 MHz, 256 MB SDRAM | 2913 | 1128 |
| **APC680 with INTEL 815E chipset** | | | |
| 8 | Celeron 3 850 MHz, 256 MB SDRAM | 2901 | 1119 |
| 9 | Pentium 3 1.26 GHz, 256 MB SDRAM | 4348 | 1731 |
| **APC620 with INTEL 815E chipset** | | | |
| 10 | Celeron 3 400 MHz, 256 MB SDRAM | 1344 | 536 |
| 11 | Celeron 3 733 MHz, 512 MB SDRAM | 2483 | 989 |
| 12 | Celeron 3 1 GHz, 256 MB SDRAM | 3432 | 1367 |
| **APC620 with INTEL 855GME chipset** | | | |
| 13 | Celeron M 600 MHz, 256 MB DDR-SDRAM | 2481 | 1064 |
| 14 | Celeron M 1 GHz, 256 MB DDR-SDRAM | 4304 | 1776 |
| 15 | Pentium M 1.1 GHz, 1GB DDR-SDRAM | 4580 | 1532 |
| 16 | Pentium M 1.4 GHz, 512 MB DDR-SDRAM | 6035 | 1947 |
| 17 | Pentium M 1.6 GHz, 1GB DDR-SDRAM | 6566 | 2844 |
| 18 | Pentium M 1.8 GHz, 512 MB DDR-SDRAM | 7758 | 3204 |
| **Other test computers** | | | |
| 19 | Pentium 4 2.4 GHz, 512 MB DDR-SDRAM | 6325 | 3212 |
| 20 | Pentium 4 2.6 GHz, 512 MB DDR-SDRAM | 7044 | 3577 |
| **Power Panel 300/400** | | | |
| 28 | AMD Geode LX800, 256 MB DDR-SDRAM | 1022 | 277 |

**Table 11: Results for Sisoft Sandra 2005 SR1. CPU arithmetic**

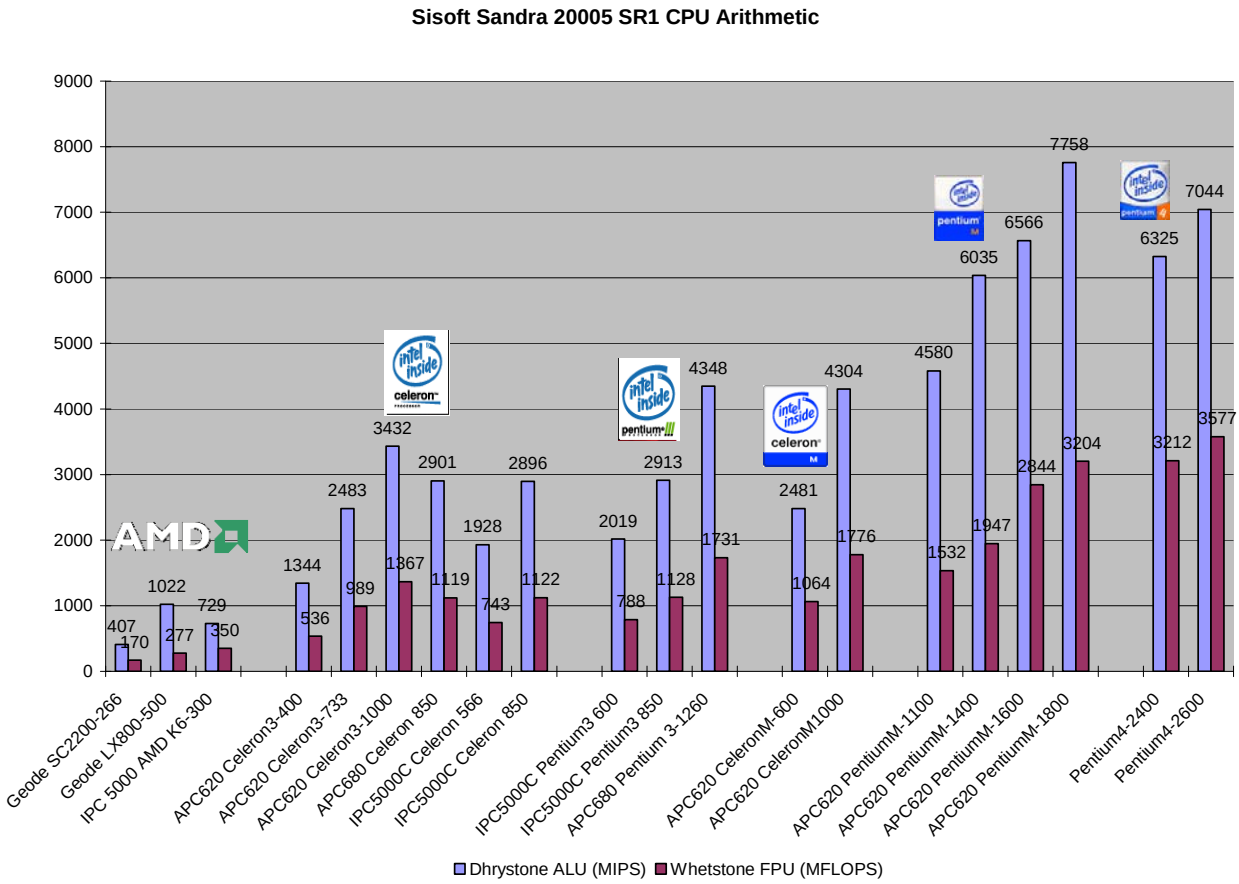



**Figure 4 – Results for Sisoft Sandra 2005 SR1. CPU arithmetic**

# Information:

**IPC2001 computers are not included in this test because Sisoft Sandra 2005 SR1 is not supported by Windows 98.**

### 4.2.2 CPU multimedia

This test determines the multimedia performance of the CPU. During this test, the speed and performance are checked for the technologies used, such as MMX, SSE, SSE2, SSE3 (depending on the processor).

| # | Test device | Integer (it/s) | Floating Point (it/s) |
|---|---|---|---|
| **Power Panel 100/200** | | | |
| 1 | Geode 266 MHz, 128 MB RAM | 733 | 156 |
| **IPC5000C computer** | | | |
| 4 | Celeron 3 566 MHz, 256 MB SDRAM | 4621 | 5820 |
| 5 | Celeron 3 850 MHz, 256 MB SDRAM | 6959 | 8755 |
| 6 | Pentium 3 600 MHz, 256 MB SDRAM | 4910 | 6159 |
| 7 | Pentium 3 850 MHz, 256 MB SDRAM | 6985 | 8789 |
| **APC680 with INTEL 815E chipset** | | | |
| 8 | Celeron 3 850 MHz, 256 MB SDRAM | 6978 | 8788 |
| 9 | Pentium 3 1.26 GHz, 256 MB SDRAM | 11053 | 13311 |
| **APC620 with INTEL 815E chipset** | | | |
| 10 | Celeron 3 400 MHz, 256 MB SDRAM | 3419 | 4118 |
| 11 | Celeron 3 733 MHz, 512 MB SDRAM | 6314 | 7601 |
| 12 | Celeron 3 1 GHz, 256 MB SDRAM | 8721 | 10502 |
| **APC620 with INTEL 855GME chipset** | | | |
| 13 | Celeron M 600 MHz, 256 MB DDR-SDRAM | 5696 | 6258 |
| 14 | Celeron M 1 GHz, 256 MB DDR-SDRAM | 9523 | 10490 |
| 15 | Pentium M 1.1 GHz, 1GB DDR-SDRAM | 10475 | 11522 |
| 16 | Pentium M 1.4 GHz, 512 MB DDR-SDRAM | 13349 | 14707 |
| 17 | Pentium M 1.6 GHz, 1GB DDR-SDRAM | 15228 | 16755 |
| 18 | Pentium M 1.8 GHz, 512 MB DDR-SDRAM | 17159 | 18904 |
| **Other test computers** | | | |
| 19 | Pentium 4 2.4 GHz, 512 MB DDR-SDRAM | 14676 | 18351 |
| 20 | Pentium 4 2.6 GHz, 512 MB DDR-SDRAM | 16464 | 20635 |
| **Power Panel 300/400** | | | |
| 28 | AMD Geode LX800, 256 MB DDR-SDRAM | 1323 | 1721 |

**Table 12: Results for Sisoft Sandra 2005 SR1. CPU multimedia**

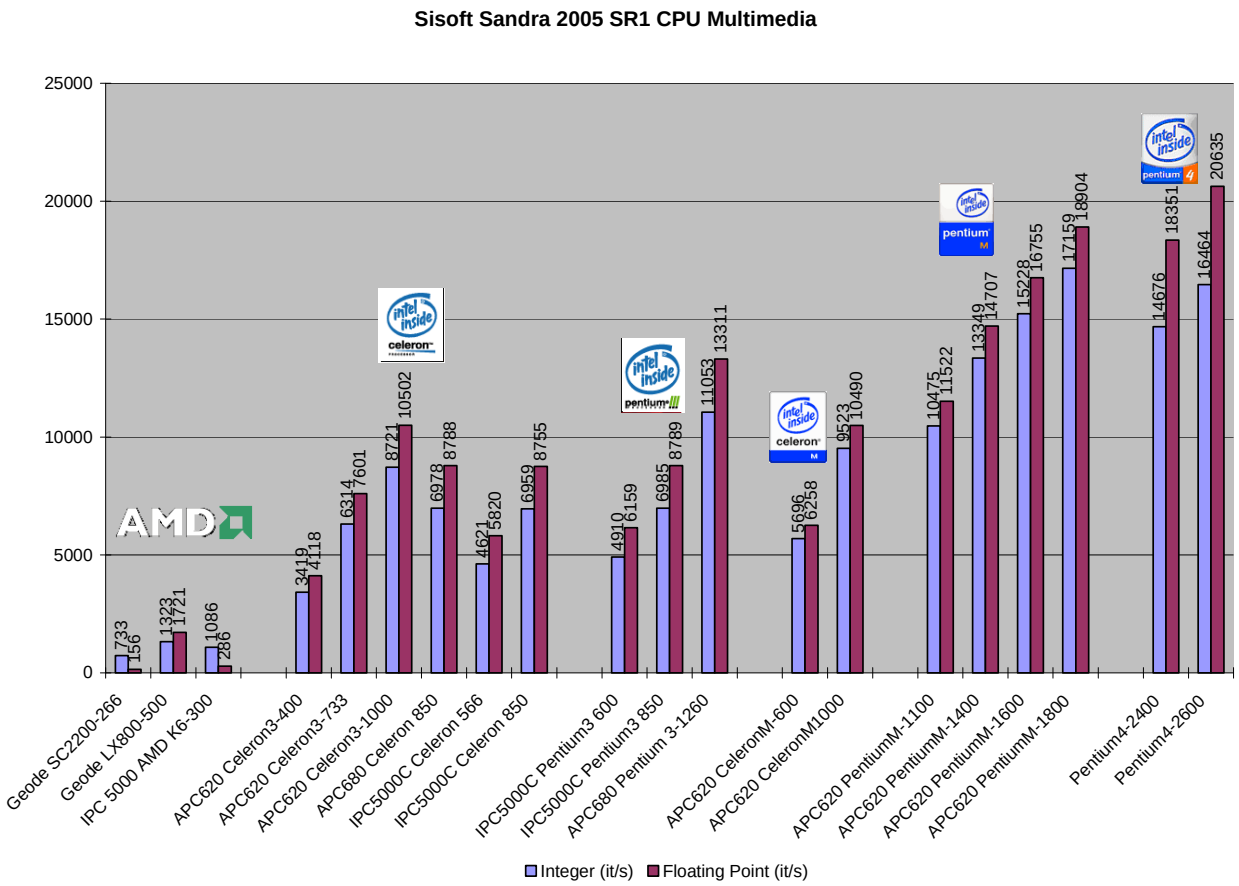



**Figure 5 – Results for Sisoft Sandra 2005 SR1. CPU multimedia**

# Information:

**IPC2001 computers are not included in this test because Sisoft Sandra 2005 SR1 is not supported by Windows 98.**

### 4.2.3 Memory bandwidth

The performance of the system memory (main memory) is determined here. This is done by transferring a large amount of data. The result is the maximum "memory throughput" in MB/s.

| # | Test device | RAM Bandwidth ALU (MB/s) | RAM Bandwidth FPU (MB/s) |
|---|---|---|---|
| **Power Panel 100/200** | | | |
| 1 | Geode 266 MHz, 128 MB RAM | 96 | 92 |
| **IPC5000C computer** | | | |
| 4 | Celeron 3 566 MHz, 256 MB SDRAM | 425 | 449 |
| 5 | Celeron 3 850 MHz, 256 MB SDRAM | 558 | 428 |
| 6 | Pentium 3 600 MHz, 256 MB SDRAM | 503 | 428 |
| 7 | Pentium 3 850 MHz, 256 MB SDRAM | 428 | 429 |
| **APC680 with INTEL 815E chipset** | | | |
| 8 | Celeron 3 850 MHz, 256 MB SDRAM | 585 | 570 |
| 9 | Pentium 3 1.26 GHz, 256 MB SDRAM | 753 | 742 |
| **APC620 with INTEL 815E chipset** | | | |
| 10 | Celeron 3 400 MHz, 256 MB SDRAM | 407 | 401 |
| 11 | Celeron 3 733 MHz, 512 MB SDRAM | 610 | 601 |
| 12 | Celeron 3 1 GHz, 256 MB SDRAM | 700 | 694 |
| **APC620 with INTEL 855GME chipset** | | | |
| 13 | Celeron M 600 MHz, 256 MB DDR-SDRAM | 1761 | 1761 |
| 14 | Celeron M 1 GHz, 256 MB DDR-SDRAM | 1751 | 1754 |
| 15 | Pentium M 1.1 GHz, 1GB DDR-SDRAM | 1713 | 1705 |
| 16 | Pentium M 1.4 GHz, 512 MB DDR-SDRAM | 1824 | 1820 |
| 17 | Pentium M 1.6 GHz, 1GB DDR-SDRAM | 1942 | 1949 |
| 18 | Pentium M 1.8 GHz, 512 MB DDR-SDRAM | 1977 | 1977 |
| **Other test computers** | | | |
| 19 | Pentium 4 2.4 GHz, 512 MB DDR-SDRAM | 1983 | 1987 |
| 20 | Pentium 4 2.6 GHz, 512 MB DDR-SDRAM | 3204 | 3211 |
| **Power Panel 300/400** | | | |
| 28 | AMD Geode LX800, 256 MB DDR-SDRAM | 633 | 506 |

**Table 13: Results for Sisoft Sandra 2005 SR1. CPU memory bandwidth**

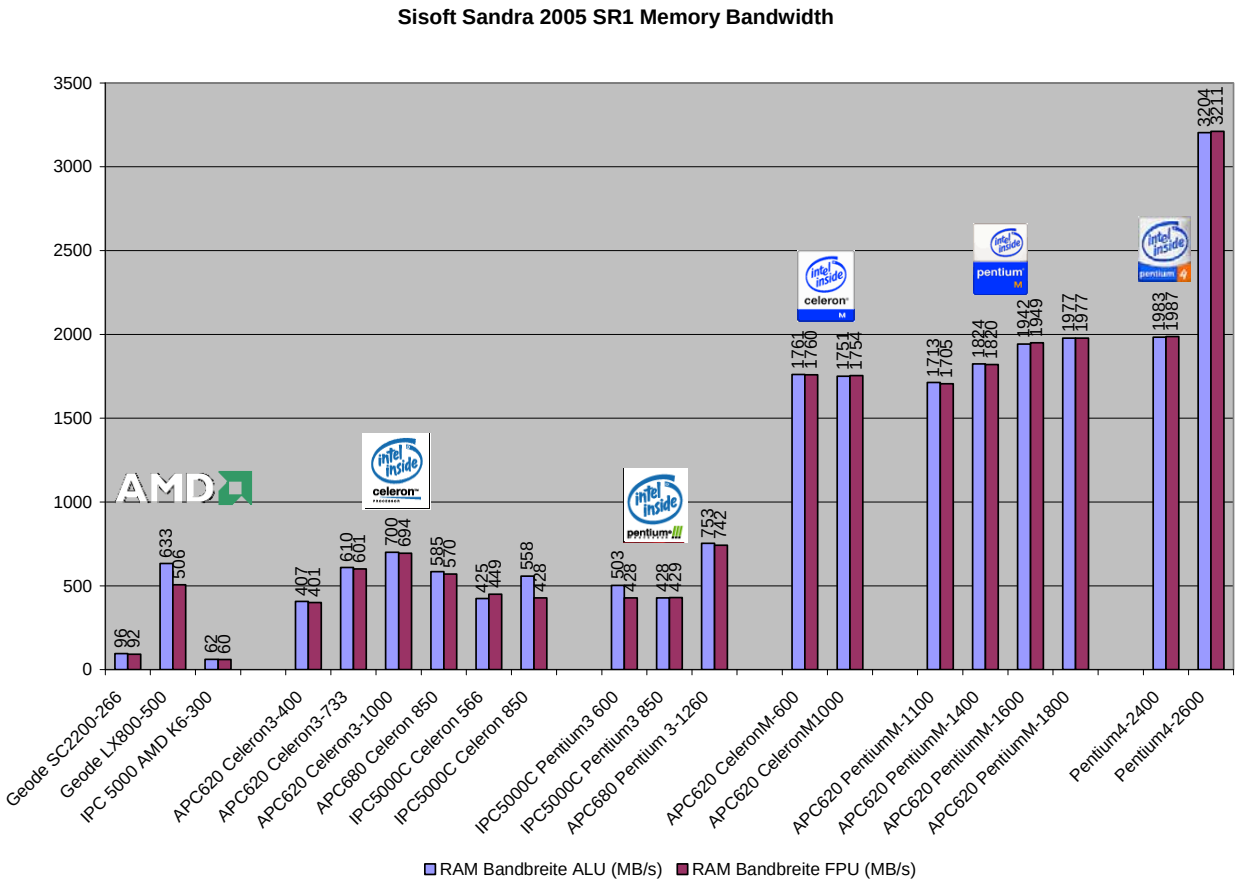



**Figure 6 – Results for Sisoft Sandra 2005 SR1. Memory bandwidth**

## Information:

**IPC2001 computers are not included in this test because Sisoft Sandra 2005 SR1 is not supported by Windows 98.**

## 4.3 PCMark2002

PCMark2002 is a current benchmark that has many users and is therefore very good for comparing PC systems. It supports both new and older processors and, for this reason, provides a very good overview of the performance of various systems.
PCMark2002 tests the following system components:

- The CPU => both Integer and FPU
- Memory subsystems => main memory, L1 & L2 cache
- Graphics card => graphics card memory and AGP bus
- Hard drive
- Microsoft Windows XP GUI (Graphic User Interface)
- Video performance and quality
- Laptop battery (if PC Mark is being used on a laptop)

| # | Test device | CPU (points) | Memory (points) |
|---|---|---|---|
| **VIA CPUs** | | | |
| | VIA M6000, 600MHz | 584[4] | 677[4] |
| | VIA M10000, 1000 MHz | 1119[4] | 869[4] |
| **Power Panel** | | | |
| 1 | Geode 266 MHz, 128 MB RAM | 284 | 354 |
| **IPC5000C computer** | | | |
| 4 | Celeron 3 566 MHz, 256 MB SDRAM | 1480 | 737 |
| 5 | Celeron 3 850 MHz, 256 MB SDRAM | 2142 | 1045 |
| 6 | Pentium 3 600 MHz, 256 MB SDRAM | 1649 | 991 |
| 7 | Pentium 3 850 MHz, 256 MB SDRAM | 2256 | 1145 |
| **APC680 with INTEL 815E chipset** | | | |
| 8 | Celeron 3 850 MHz, 256 MB SDRAM | 1992 | 958 |
| 9 | Pentium 3 1.26 GHz, 256 MB SDRAM | 3892 | 2036 |
| **APC620 with INTEL 815E chipset** | | | |
| 10 | Celeron 3 400 MHz, 256 MB SDRAM | 1227 | 762 |
| 11 | Celeron 3 733 MHz, 512 MB SDRAM | 2225 | 1126 |
| 12 | Celeron 3 1 GHz, 256 MB SDRAM | 2968 | 1187 |
| **APC620 with INTEL 855GME chipset** | | | |
| 13 | Celeron M 600 MHz, 256 MB DDR-SDRAM | 1964 | 2593 |
| 14 | Celeron M 1 GHz, 256 MB DDR-SDRAM | 3314 | 3201 |
| 15 | Pentium M 1.1 GHz, 1GB DDR-SDRAM | 3572 | 3710 |
| 16 | Pentium M 1.4 GHz, 512 MB DDR-SDRAM | 4705 | 4694 |
| 17 | Pentium M 1.6 GHz, 1GB DDR-SDRAM | 5246 | 4727 |
| 18 | Pentium M 1.8 GHz, 512 MB DDR-SDRAM | 6070 | 6121 |
| **Other test computers** | | | |
| 19 | Pentium 4 2.4 GHz, 512 MB DDR-SDRAM | 5772 | 4849 |
| 20 | Pentium 4 2.6 GHz, 512 MB DDR-SDRAM | 6519 | 6678 |

**Table 14: Results for PCMark2002**

[4] Source: Tolly Group

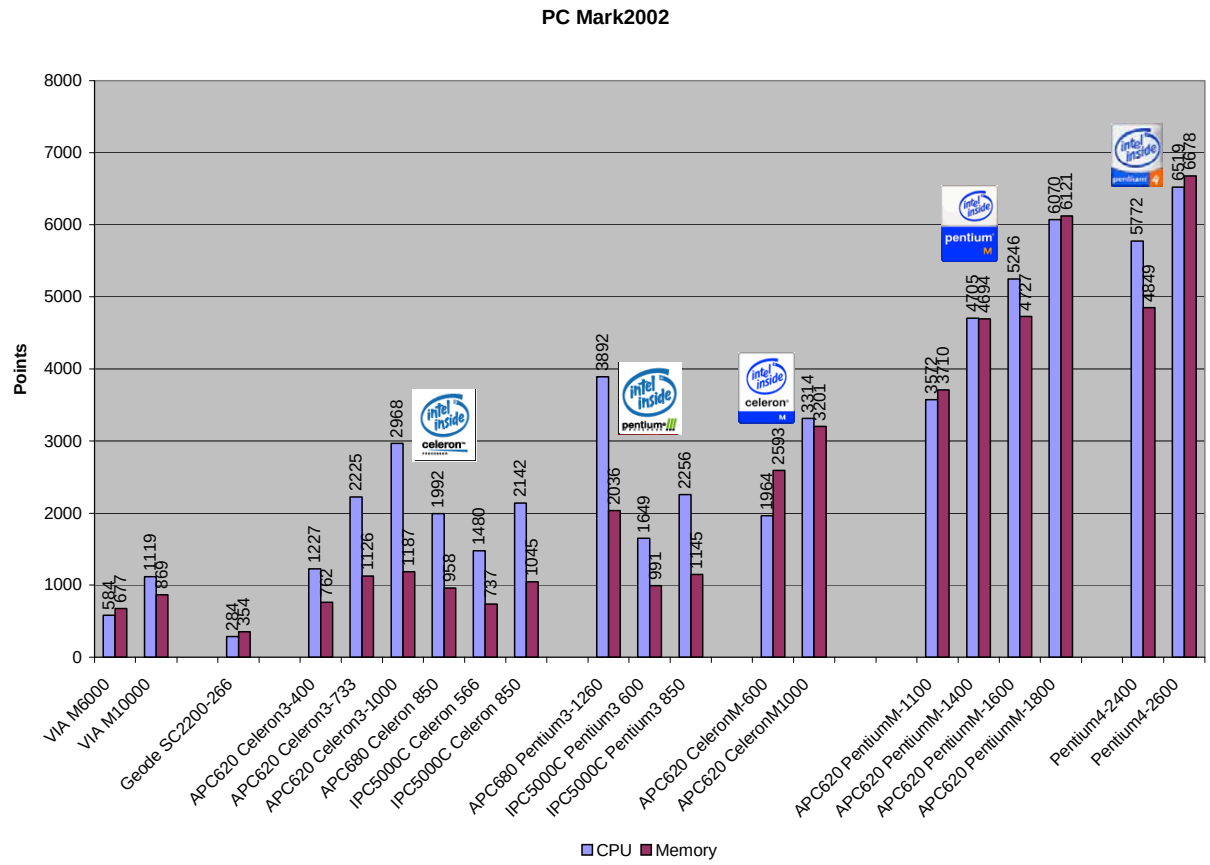



**Figure 7 – Results for PCMark2002**

# Information:

**IPC2001 computers are not included in this test because PC Mark 2002 requires at least a CPU with MMX technology.**

## 4.4 PCMark04

PCMark04 is a benchmark from the newest generation. This program tests and supports the newest technologies (e.g. HT, SSE3) and takes the system to the limit of its performance.
The test criteria for PCMark04 are similar to the ones for PCMark2002.
All components tested with PCMark2002 are also tested with PCMar2004, however PCMark2004 determines the results with the help of coding and decoding processes for the individual media codecs (e.g. DivX, WMV Codec, etc.)
The manufacturer explicitly states that the test results from PCMark2002 and PCMar04 are not (!!!) comparable!
In addition, all systems can no longer be tested with this program.

The system must meet the following requirements (and others):

- Intel or AMD processor > 1 GHz
- At least 128 MB RAM
- Full DirectX 7 compatible graphics card
- Windows Media Player 9.0 + MS Encoder 9.0
- Microsoft Internet Explorer 6

| # | Test device | Points |
|---|---|---|
| **Power Panel** | | |
| 1 | Geode 266 MHz, 128 MB RAM | Not supported |
| **IPC5000C computer** | | |
| 4 | Celeron 3 566 MHz, 256 MB SDRAM | Not supported |
| 5 | Celeron 3 850 MHz, 256 MB SDRAM | Not supported |
| 6 | Pentium 3 600 MHz, 256 MB SDRAM | Not supported |
| 7 | Pentium 3 850 MHz, 256 MB SDRAM | Not supported |
| **APC680 computer** | | |
| 8 | Celeron 3 850 MHz, 256 MB SDRAM | Not supported |
| 9 | Pentium 3 1.26 GHz, 256 MB SDRAM | Not supported |
| **APC620 with INTEL 815 E chipset** | | |
| 10 | Celeron 3 400 MHz, 256 MB SDRAM | Not supported |
| 11 | Celeron 3 733 MHz, 512 MB SDRAM | Not supported |
| 12 | Celeron 3 1000 MHz, 256 MB SDRAM | Not supported |
| **APC620 with INTEL 855GME chipset** | | |
| 13 | Celeron M 600 MHz, 256 MB DDR-SDRAM | 1326 |
| 14 | Celeron M 1 GHz, 256 MB DDR-SDRAM | 1826 |
| 15 | Pentium M 1.1 GHz, 1 GB DDR-SDRAM | 1961 |
| 16 | Pentium M 1.4 GHz, 512 MB DDR-SDRAM | 2461 |
| 17 | Pentium M 1.6 GHz, 1GB DDR-SDRAM | 2640 |
| 18 | Pentium M 1.8 GHz, 512 MB DDR-SDRAM | 2993 |
| **Other test computers** | | |
| 19 | Pentium 4 2.4 GHz, 512 MB DDR-SDRAM | 2608 |
| 20 | Pentium 4 2.6 GHz, 512 MB DDR-SDRAM | 3452 |

**Table 15: Results for PCMark04**

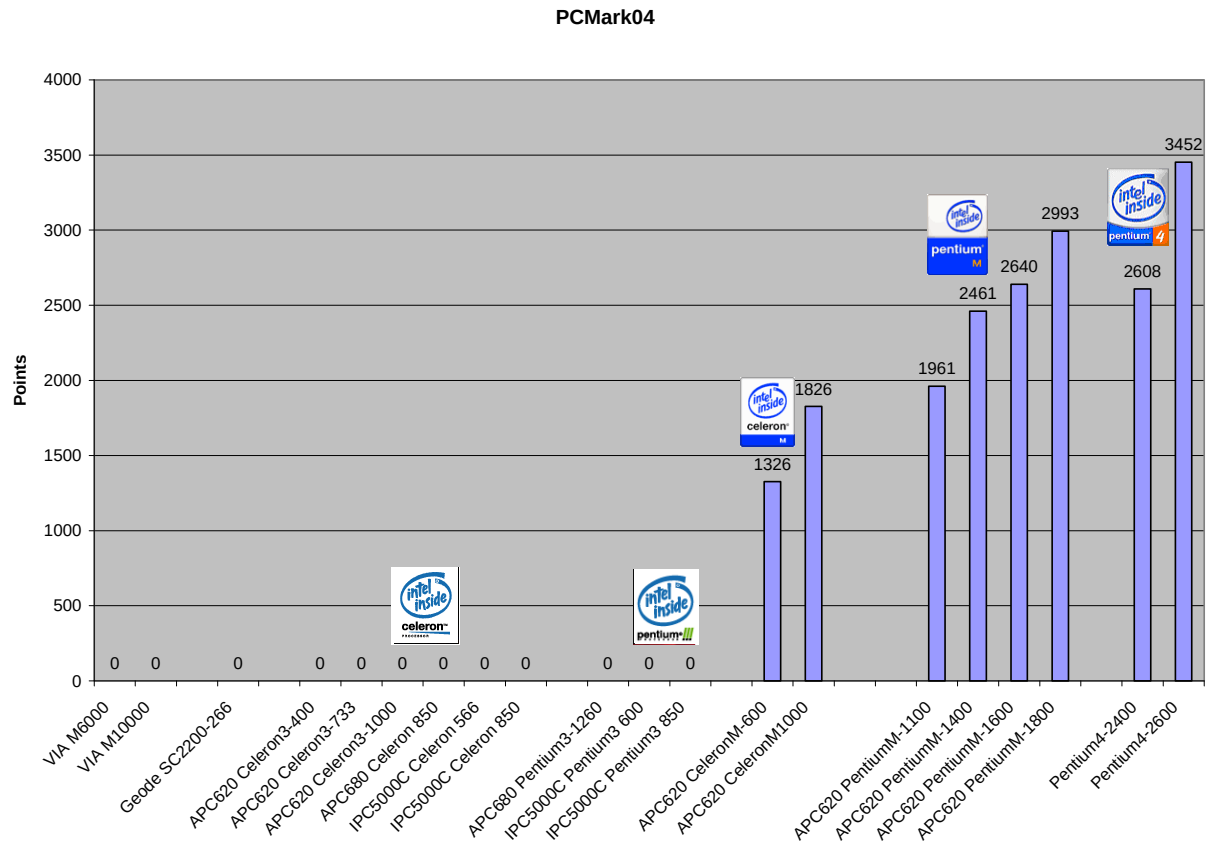



**Figure 8 – Results for PCMark04**

# Information:

**PCMark04 requires a graphics card that is fully DirectX7 compatible. This requirement is only met by the APC620 computers with an Intel 855GME chipset.**
**Therefore there are no test results for Power Panel, IPC2001, IPC5000C, APC680 and APC620 (with Intel 815 E).**

## 4.5 Winbench99

WinBench99 was developed together with ZD Net. However, the development was stopped in the middle of 2000.
Up to that point, WinBench was an important tool for comparing the performance measurements of PC systems. WinBench99 offers many subprograms that analyze certain aspects of the systems.
This program was used to create comparison values for "older" systems.

### 4.5.1 CPUMark99

CPUMark99 is a test that determines the computing power of the CPU. All arithmetic units on the CPU. As a result, the program calculates a number of points that can be used for further comparison.

| # | Test device | Points |
|---|---|---|
| **Power Panel** | | |
| 1 | Geode 266 MHz, 128 MB RAM | 7.08 |
| **IPC2001 computer** | | |
| 2 | AMD 486DX2 66MHz, 8MB DRAM | 3.21 |
| 3 | AMD 486DX5 133 MHz, 32 MB DRAM | 4.19 |
| **IPC5000C computer** | | |
| 4 | Celeron 3 566 MHz, 256 MB SDRAM | 43.6 |
| 5 | Celeron 3 850 MHz, 256 MB SDRAM | 64.7 |
| 6 | Pentium 3 600 MHz, 256 MB SDRAM | 56.9 |
| 7 | Pentium 3 850 MHz, 256 MB SDRAM | 76.1 |
| **APC680 computer** | | |
| 8 | Celeron 3 850 MHz, 256 MB SDRAM | 57.2 |
| 9 | Pentium 3 1.26 GHz, 256 MB SDRAM | 112 |
| **APC620 with INTEL 815 E chipset** | | |
| 10 | Celeron 3 400 MHz, 256 MB SDRAM | 37.3 |
| 11 | Celeron 3 733 MHz, 512 MB SDRAM | 64.1 |
| 12 | Celeron 3 1000 MHz, 256 MB SDRAM | 85.8 |
| **APC620 with INTEL 855GME chipset** | | |
| 13 | Celeron M 600 MHz, 256 MB DDR-SDRAM | 66.4 |
| 14 | Celeron M 1 GHz, 256 MB DDR-SDRAM | 111 |
| 15 | Pentium M 1.1 GHz, 1 GB DDR-SDRAM | 127 |
| 16 | Pentium M 1.4 GHz, 512 MB DDR-SDRAM | 171 |
| 17 | Pentium M 1.6 GHz, 1GB DDR-SDRAM | 184 |
| 18 | Pentium M 1.8 GHz, 512 MB DDR-SDRAM | 220 |
| **Other test computers** | | |
| 19 | Pentium 4 2.4 GHz, 512 MB DDR-SDRAM | Not supported |
| 20 | Pentium 4 2.6 GHz, 512 MB DDR-SDRAM | Not supported |

**Table 16: Results for WinBench99 CPUMark99**

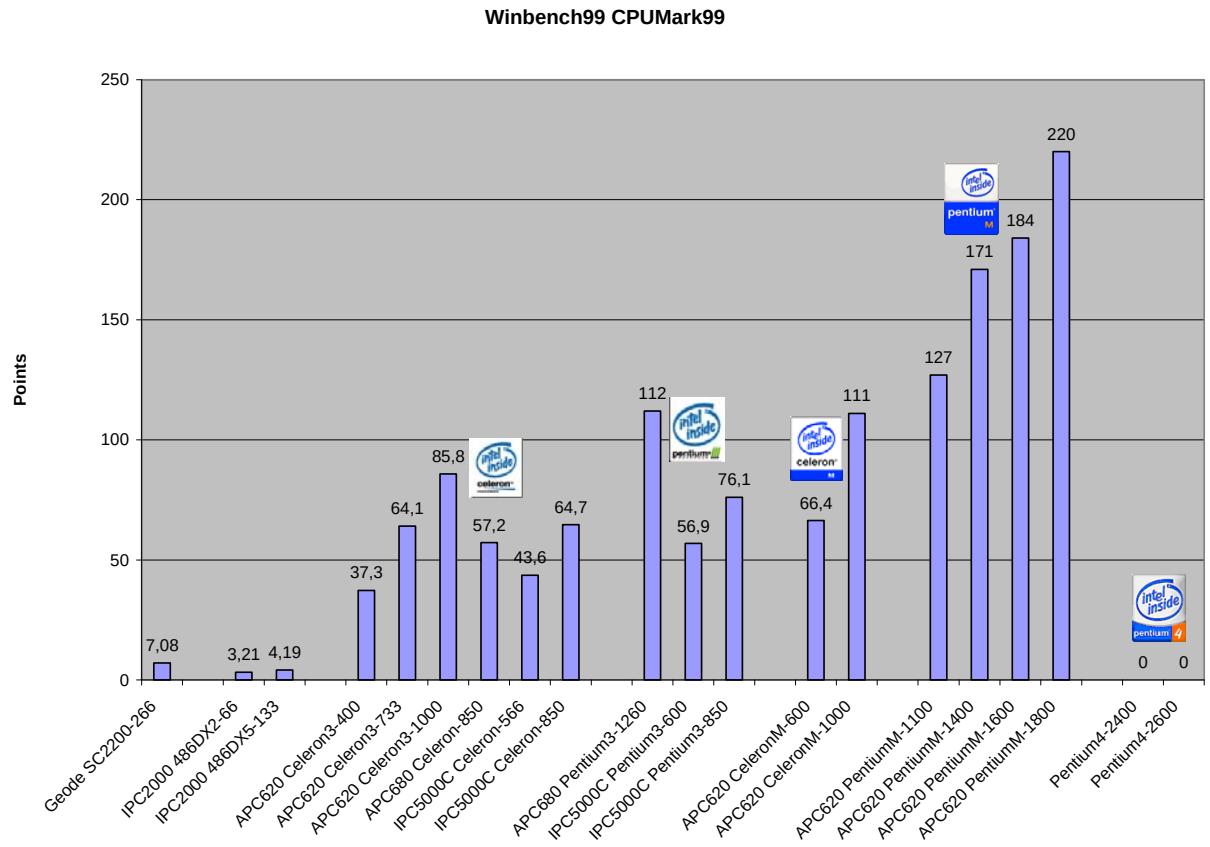



**Figure 9 – Results for WinBench99 CPUMark99**

# Information:

**Winbench99 could not be executed on Pentium 4 systems because the program had a problem with the CPU frequency.**

### 4.5.2 FPUWinMark

As a special feature, FPUWinMark tests the FPU of the CPU being used. The speed and computing power, among other things, are determined. As a test result, the program calculates a number of points that can be used for further comparison.

| # | Test device | Points |
|---|---|---|
| **Power Panel** | | |
| 1 | Geode 266 MHz, 128 MB RAM | 488 |
| **IPC2001 computer** | | |
| 2 | AMD 486DX2 66MHz, 8MB DRAM | 93.5 |
| 3 | AMD 486DX5 133 MHz, 32 MB DRAM | 180 |
| **IPC5000C computer** | | |
| 4 | Celeron 3 566 MHz, 256 MB SDRAM | 3000 |
| 5 | Celeron 3 850 MHz, 256 MB SDRAM | 4410 |
| 6 | Pentium 3 600 MHz, 256 MB SDRAM | 3190 |
| 7 | Pentium 3 850 MHz, 256 MB SDRAM | 4510 |
| **APC680 computer** | | |
| 8 | Celeron 3 850 MHz, 256 MB SDRAM | 4510 |
| 9 | Pentium 3 1.26 GHz, 256 MB SDRAM | 6890 |
| **APC620 with INTEL 815E chipset** | | |
| 10 | Celeron 3 400 MHz, 256 MB SDRAM | 2160 |
| 11 | Celeron 3 733 MHz, 512 MB SDRAM | 3950 |
| 12 | Celeron 3 1000 MHz, 256 MB SDRAM | 5430 |
| **APC620 with INTEL 855GME chipset** | | |
| 13 | Celeron M 600 MHz, 256 MB DDR-SDRAM | 3310 |
| 14 | Celeron M 1 GHz, 256 MB DDR-SDRAM | 5590 |
| 15 | Pentium M 1.1 GHz, 1 GB DDR-SDRAM | 6100 |
| 16 | Pentium M 1.4 GHz, 512 MB DDR-SDRAM | 7830 |
| 17 | Pentium M 1.6 GHz, 1GB DDR-SDRAM | 8870 |
| 18 | Pentium M 1.8 GHz, 512 MB DDR-SDRAM | 10100 |
| **Other test computers** | | |
| 19 | Pentium 4 2.4 GHz, 512 MB DDR-SDRAM | Not supported |
| 20 | Pentium 4 2.6 GHz, 512 MB DDR-SDRAM | Not supported |

**Table 17: Results for WinBench99 FPUWinMark**

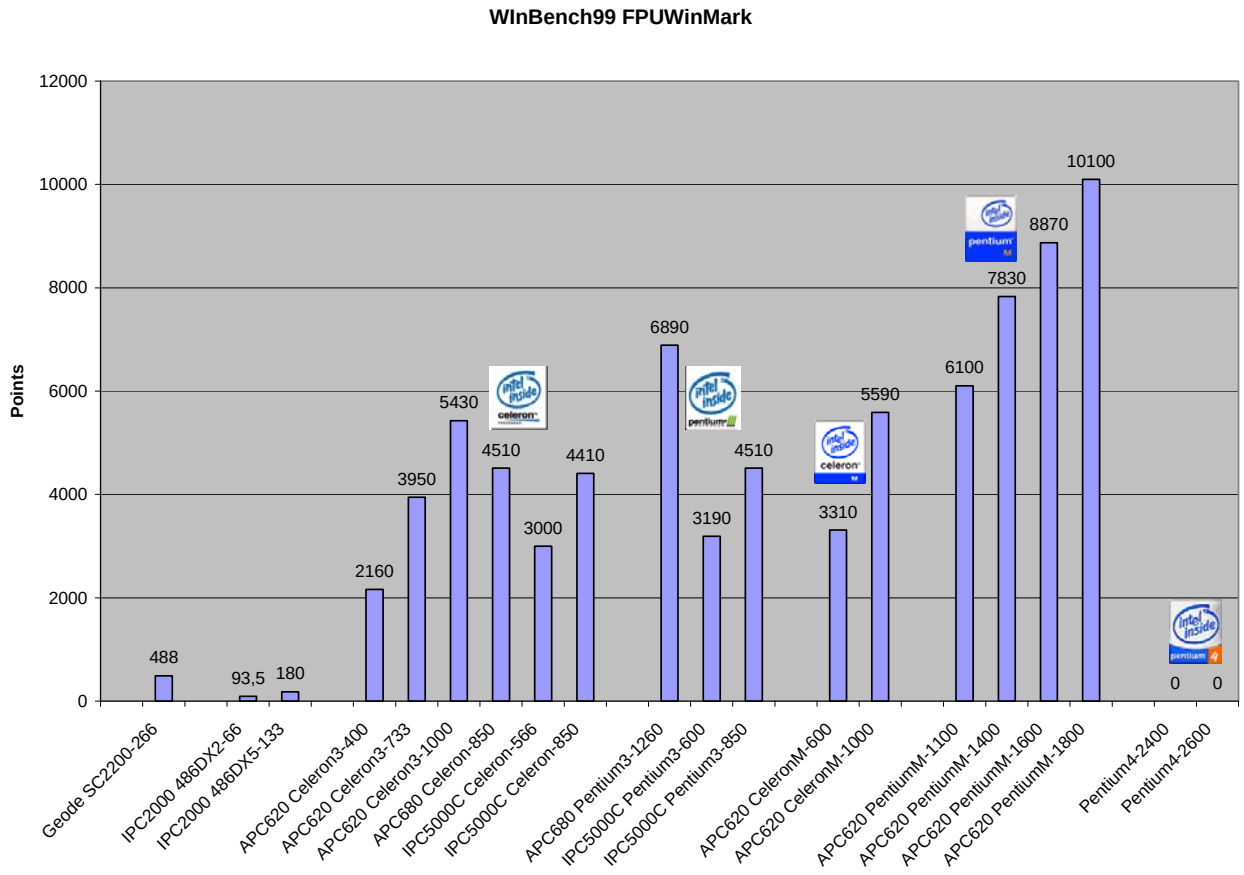



**Figure 10 – Results for WinBench99 FPUWinMark**

# Information:

**Winbench99 could not be executed on Pentium 4 systems because the program had a problem with the CPU frequency.**

### 4.5.3 Direct Draw

With this test, the system is continually checked to determine how fast and how correct moving 2D/3D graphics are animated. All supported resolutions and color depths are determined and tested.
The frames per second are measured. The maximum value reached is recorded at the end of the test report.

| # | Test device | Direct Draw resolution 640x480 | Direct Draw resolution 800x600 |
|---|---|---|---|
| **Power Panel** | | | |
| 1 | Geode 266 MHz, 128 MB RAM | 38.8 | 38.3 |
| **IPC2001 computer** | | | |
| 2 | AMD 486DX2 66 MHz 8 MB DRAM | 11.2 | 9.3 |
| 3 | AMD 486DX5 133 MHz 32 MB DRAM | 12.9 | 10.3 |
| **IPC5000C computer** | | | |
| 4 | Celeron 3 566 MHz, 256 MB SDRAM | 84.5 | 83 |
| 5 | Celeron 3 850 MHz, 256 MB SDRAM | 85.2 | 84.1 |
| 6 | Pentium 3 600 MHz, 256 MB SDRAM | 85.4 | 83.7 |
| 7 | Pentium 3 850 MHz, 256 MB SDRAM | 141 | 138 |
| **APC680 with INTEL 815E chipset** | | | |
| 8 | Celeron 3 850 MHz, 256 MB SDRAM | 273 | 265 |
| 9 | Pentium 3 1.26 GHz, 256 MB SDRAM | 292 | 288 |
| **APC620 with INTEL 815E chipset** | | | |
| 10 | Celeron 3 400 MHz, 256 MB SDRAM | 268 | 256 |
| 11 | Celeron 3 733 MHz, 512 MB SDRAM | 354 | 338 |
| 12 | Celeron 3 1 GHz, 256 MB SDRAM | 359 | 345 |
| **APC620 with INTEL 855GME chipset** | | | |
| 13 | Celeron M 600 MHz, 256 MB DDR-SDRAM | 542 | 538 |
| 14 | Celeron M 1 GHz, 256 MB DDR-SDRAM | 946 | 900 |
| 15 | Pentium M 1.1 GHz, 1GB DDR-SDRAM | 1190 | 1200 |
| 16 | Pentium M 1.4 GHz, 512 MB DDR-SDRAM | 1290 | 1290 |
| 17 | Pentium M 1.6 GHz, 1GB DDR-SDRAM | 1439 | 1411 |
| 18 | Pentium M 1.8 GHz, 512 MB DDR-SDRAM | 1410 | 1390 |
| **Other test computers** | | | |
| 19 | Pentium 4 2.4 GHz, 512 MB DDR-SDRAM | Not supported | Not supported |
| 20 | Pentium 4 2.6 GHz, 512 MB DDR-SDRAM | Not supported | Not supported |

**Table 18: Results for WinBench99 Direct Draw**

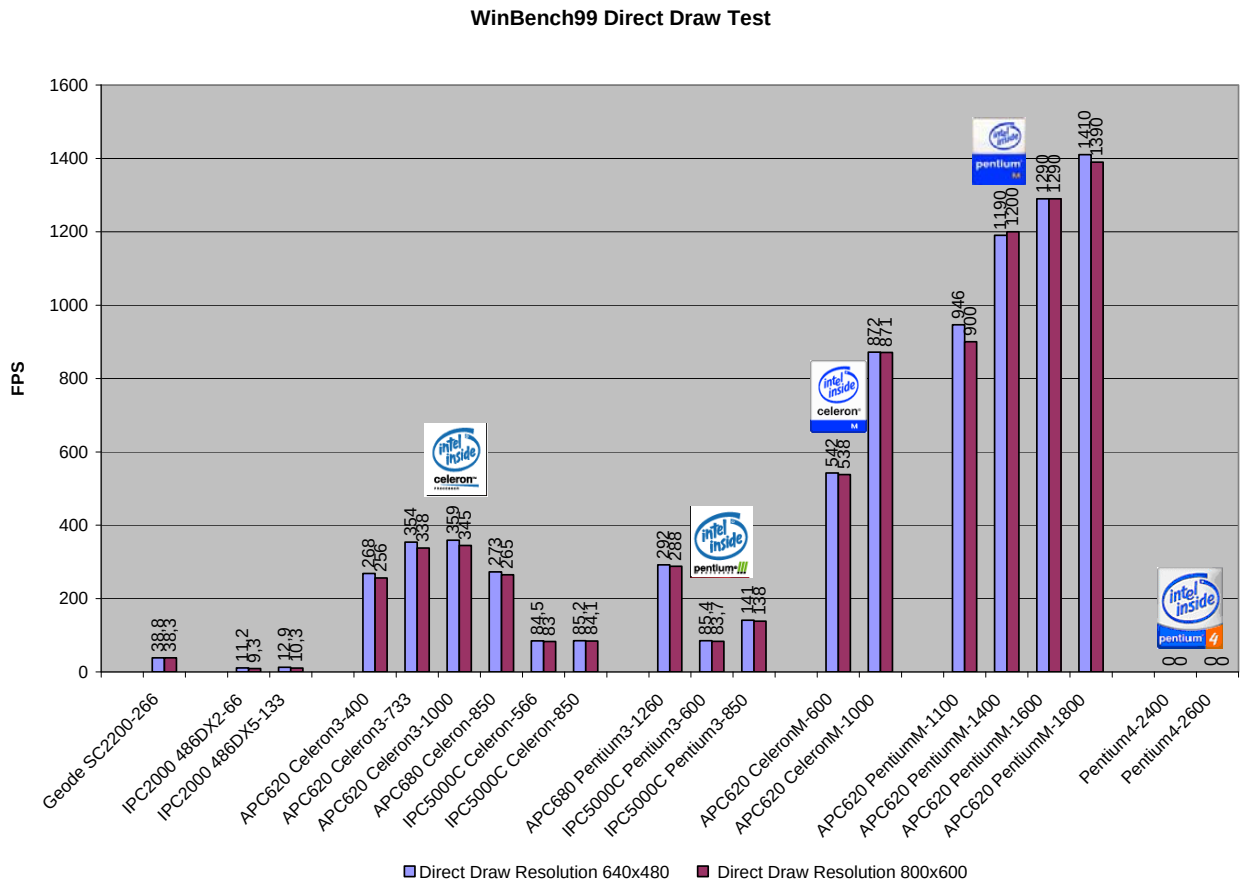



**Figure 11 – Results for WinBench99 Direct Draw**

# Information:

**Winbench99 could not be executed on Pentium 4 systems because the program had a problem with the CPU frequency.**

### 4.5.4 Disk Inspection Test

During this test, the speed of the memory media being used (hard disk, CF, etc.) is determined. When doing this, the program writes a large amount of data to the memory and determines the data transfer rates in the individual sectors. The transfer rates reached are shown in a diagram during the test. The final result contains the maximum and the minimum data transfer rate as well as the average access time.

| # | Test device | Data rate - start (MB/s) | Data rate - end (MB/s) | Access time (ms) |
|---|---|---|---|---|
| **ICP5000C hard disks** | | | | |
| 1 | 5.6 GB Fujitsu Slide-In (4200 rpm) | 15.3 | 9.3 | 20.6 |
| **APC620 hard disks** | | | | |
| 2 | 20 GB Fujitsu ADD ON (4200 rpm) | 20.4 | 17.9 | 16 |
| 3 | 30 GB Fujitsu ADD ON (4200 rpm) | 24.9 | 13.2 | 20 |
| 4 | 20 GB Fujitsu Slide-In (4200 rpm) | 20.3 | 14 | 18.8 |
| 5 | 30 GB Fujitsu Slide-In (4200 rpm) | 24.9 | 13.3 | 19.6 |
| 6 | 40 GB Hitachi Travelstar (7200 rpm) | 60.3 | 31.2 | 13.2 |
| **Reference HDD** | | | | |
| 7 | 40 GB Seagate ST340014A (7200 rpm) | Not supported | Not supported | Not supported |

**Table 19: Results for WinBench99 Disk Inspection Test**

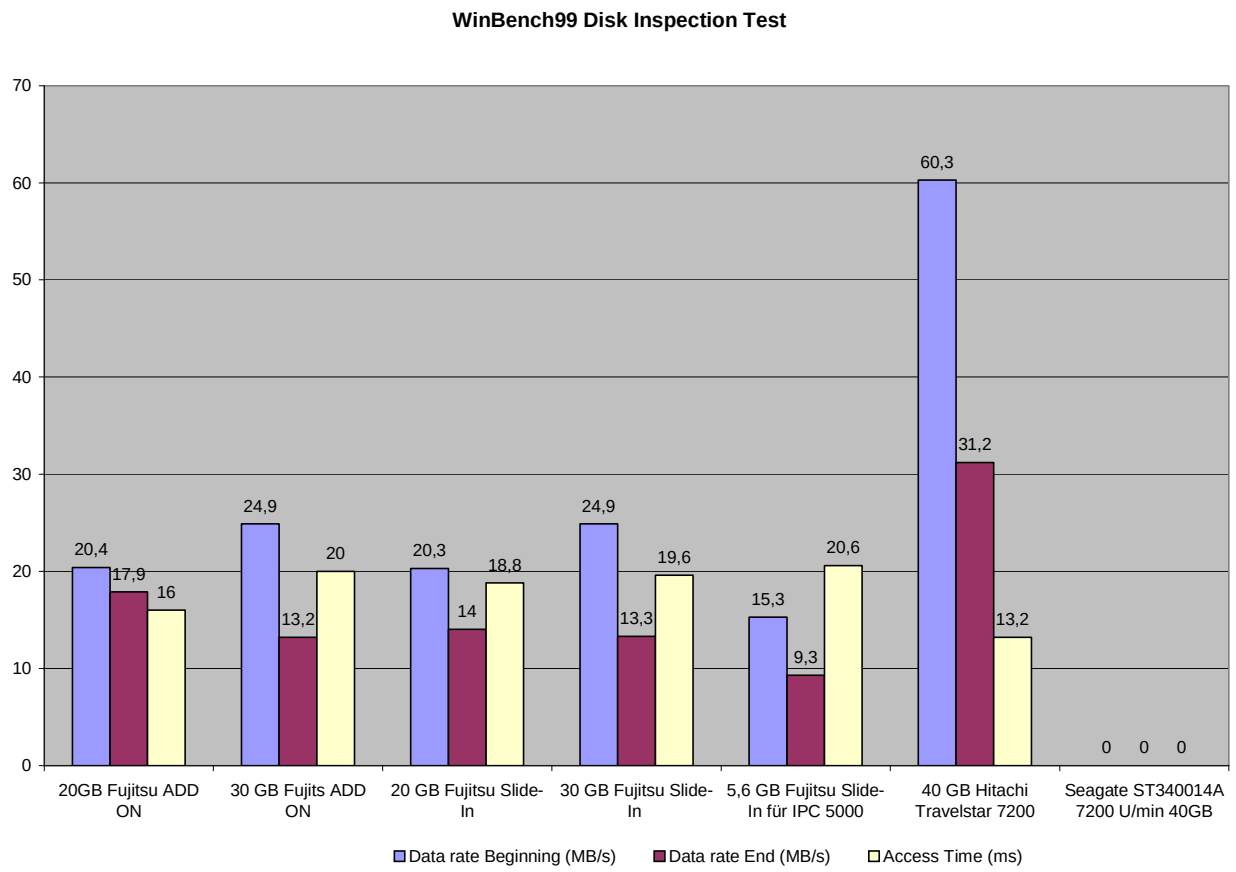



**Figure 12 - Results for WinBench99 Disc Inspection Test**

# Information:

**There are no results for the reference HDD because WinBench99 had a problem with the CPU frequency for the computer. Therefore the test could not be completed.**

### 4.5.5 High End Disk WinMark99

This test determines the performance of the memory media under certain conditions. The program simulates individual applications (e.g. Frontpage98, VisualC++ 5.0, etc.) and determines the maximum data transfer rate in the individual environments.
As test result, the program provides the average of the data transfer rates achieved. These values can be used for comparison.

| # | Test device | KBytes/s |
|---|---|---|
| **ICP5000C hard disks** | | |
| 1 | 5.6 GB Fujitsu Slide-In (4200 rpm) | 5640 |
| **APC620 hard disks** | | |
| 2 | 20 GB Fujitsu ADD ON (4200 rpm) | 10400 |
| 3 | 30 GB Fujitsu ADD ON (4200 rpm) | 12400 |
| 4 | 20 GB Fujitsu Slide-In (4200 rpm) | 12400 |
| 5 | 30 GB Fujitsu Slide-In (4200 rpm) | 13400 |
| 6 | 40 GB Hitachi Travelstar (7200 rpm) | 22200 |
| **Reference HDD** | | |
| 7 | 40 GB Seagate ST340014A (7200 rpm) | Not supported |

**Table 20: Results for WinBench99 High End Disk WinMark99**

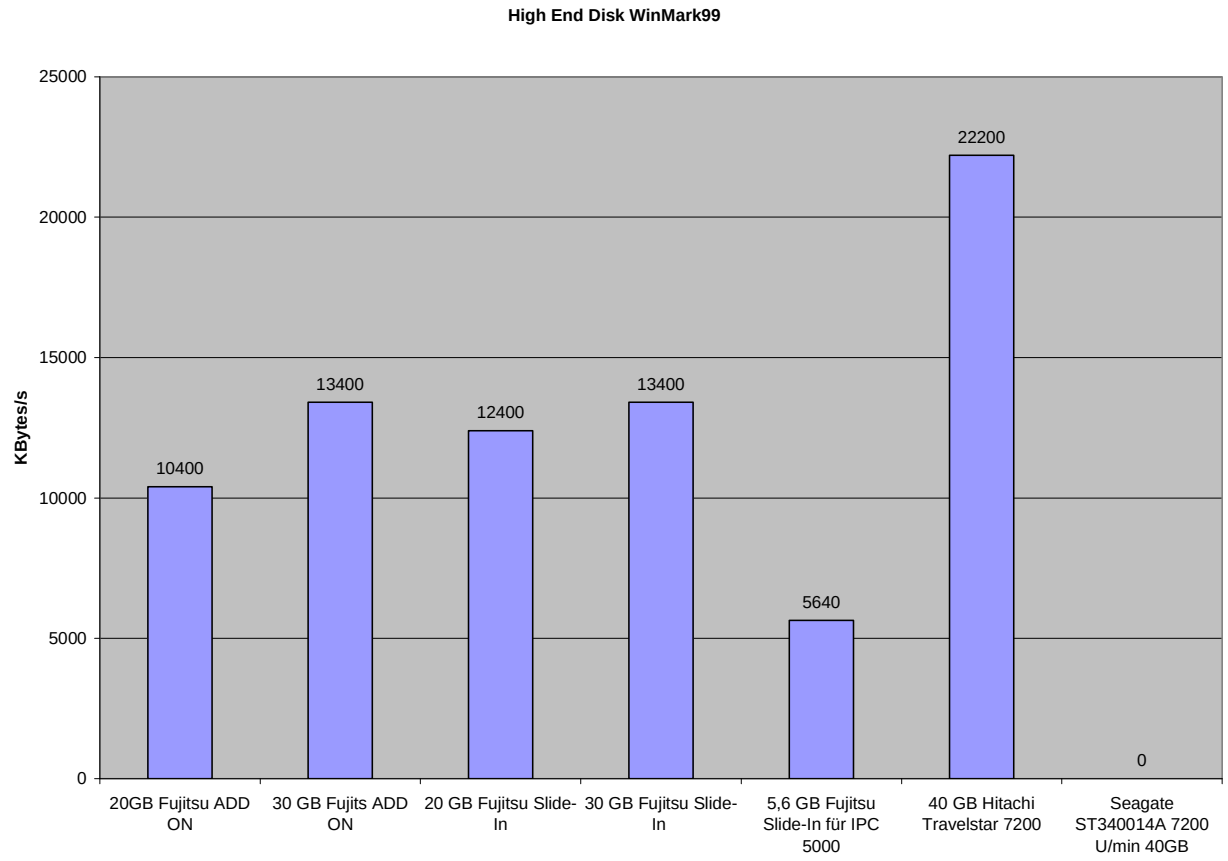



**Figure 13 – Results for WinBench99 High End Disk WinMark99**

# Information:

**There are no results for the reference HDD because WinBench99 had a problem with the CPU frequency for the computer. Therefore the test could not be completed.**

### 4.5.6 Business Disk WinMark99

During this test, the memory media is tested especially for the performance for office and business application. As a result, an average data rate is determined that can be used for comparison.

| # | Test device | KBytes/s |
|---|---|---|
| **ICP5000C hard disks** | | |
| 1 | 5.6 GB Fujitsu Slide-In (4200 rpm) | 1730 |
| **APC620 hard disks** | | |
| 2 | 20 GB Fujitsu ADD ON (4200 rpm) | 3370 |
| 3 | 30 GB Fujitsu ADD ON (4200 rpm) | 3370 |
| 4 | 20 GB Fujitsu Slide-In (4200 rpm) | 3920 |
| 5 | 30 GB Fujitsu Slide-In (4200 rpm) | 3920 |
| 6 | 40 GB Hitachi Travelstar (7200 rpm) | 4800 |
| **Reference HDD** | | |
| 7 | 40 GB Seagate ST340014A (7200 rpm) | Not supported |

**Table 21: Results for WinBench99 Business Disk Winmark99**

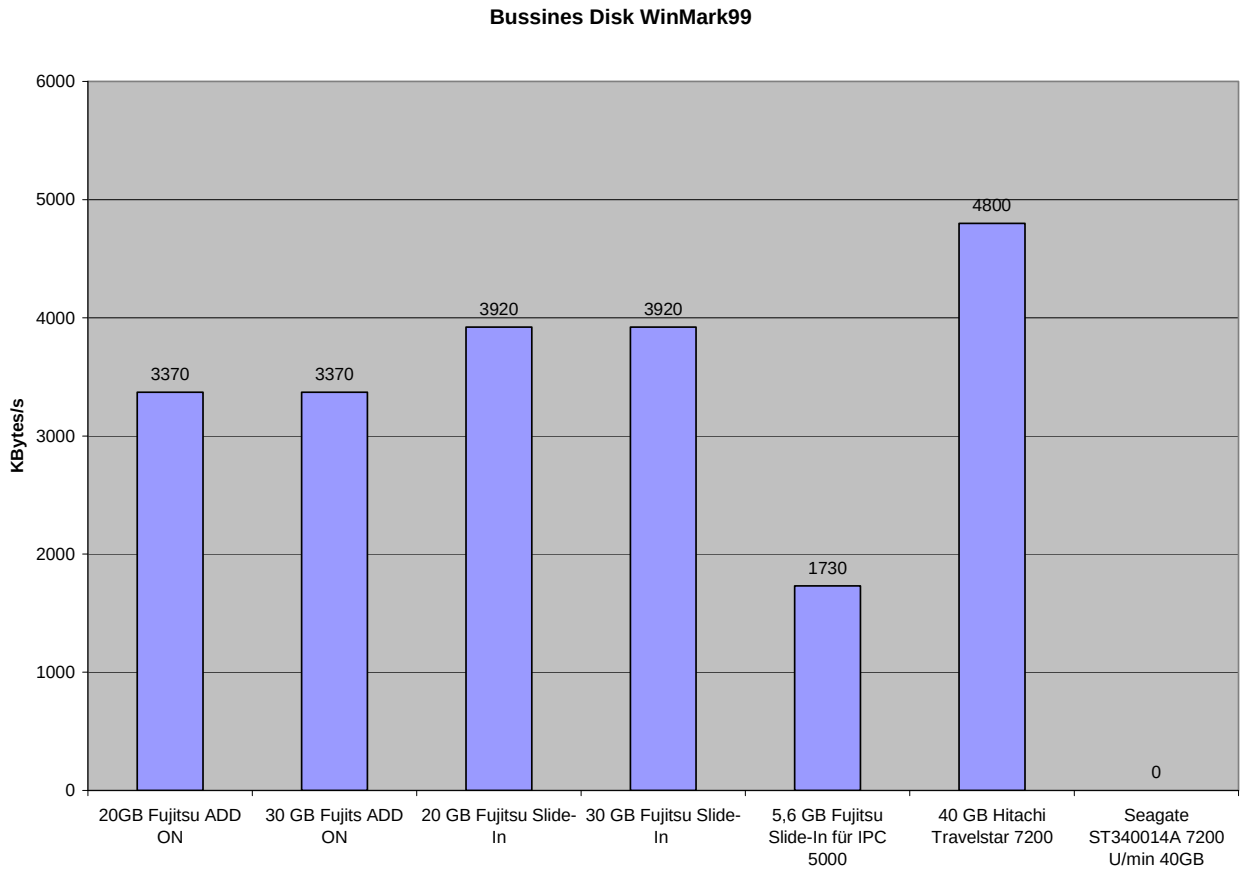



**Figure 14 – Results for WinBench99 Business Disk WinMark99**

# Information:

**There are no results for the reference HDD because WinBench99 had a problem with the CPU frequency for the computer. Therefore the test could not be completed.**

## 4.6 HDTACH Version 2.70

HDTACH is a tool that can be used to determine the data transfer rate of memory media (e.g. hard disk). When doing this, the data is read from the media and the maximum, minimum and average data rate is output as the result.

### 4.6.1 HDTACH read speed

| # | Test device | Maximum data rate (MB/s) | Average data rate (MB/s) | Minimum data rate (MB/s) |
|---|---|---|---|---|
| **ICP5000C hard disks** | | | | |
| 1 | 5.6 GB Fujitsu Slide-In (4200 rpm) | 16 | 12.4 | 2.3 |
| **APC620 hard disks** | | | | |
| 2 | 20 GB Fujitsu ADD ON (4200 rpm) | 20.6 | 17.5 | 13.5 |
| 3 | 30 GB Fujitsu ADD ON (4200 rpm) | 26 | 20.4 | 12.1 |
| 4 | 20 GB Fujitsu Slide-In (4200 rpm) | 20.6 | 17.6 | 13.3 |
| 5 | 30 GB Fujitsu Slide-In (4200 rpm) | 26 | 20.3 | 12.1 |
| 6 | 40 GB Hitachi Travelstar (7200 rpm) | 39.9 | 34.5 | 26.7 |
| **Reference HDD** | | | | |
| 7 | 40 GB Seagate ST340014A (7200 rpm) | 62.2 | 47.1 | 30.4 |

**Table 22: Results for HDTACH 2.70 read speed**

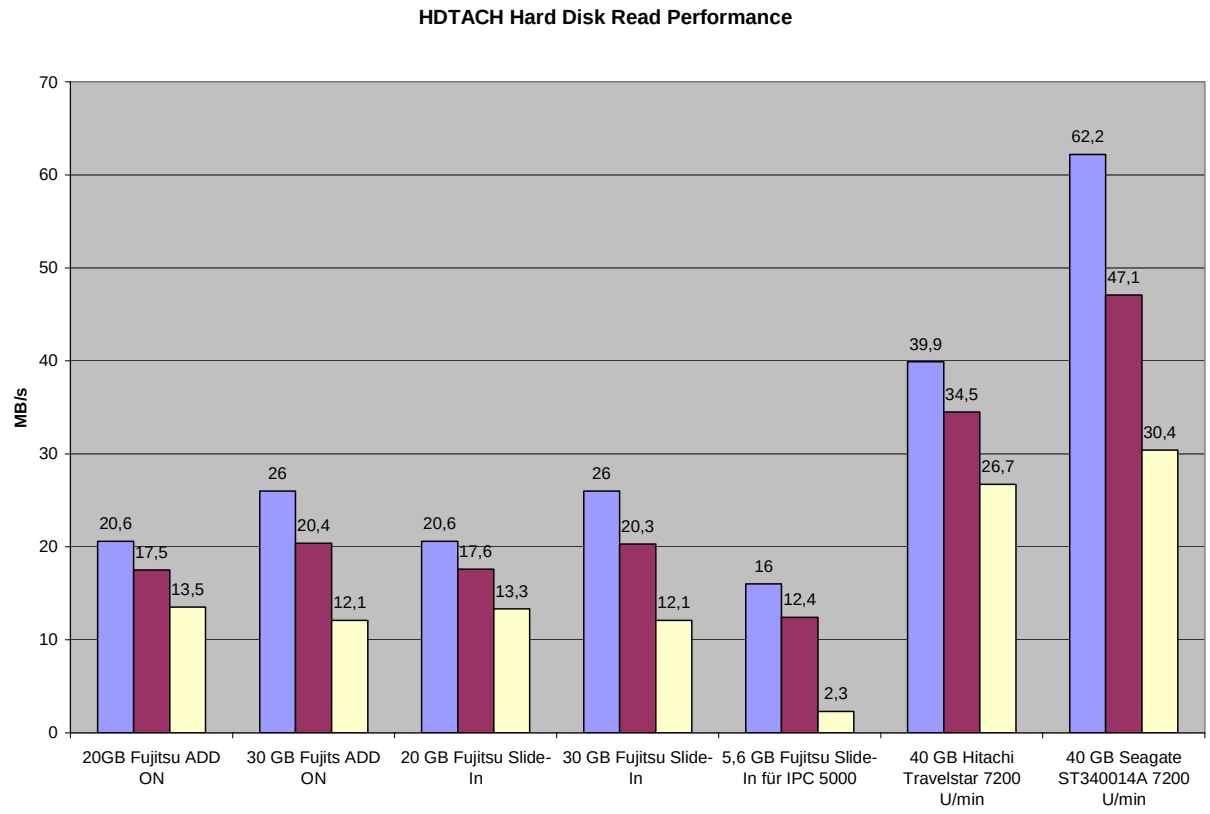



**Figure 15 – Results for HDTACH read speed**

### 4.6.2 HDTACH access time measurement

| # | Test device | Access time (ms) |
|---|---|---|
| **ICP5000C hard disks** | | |
| 1 | 5.6 GB Fujitsu Slide-In (4200 rpm) | 20.4 |
| **APC620 hard disks** | | |
| 2 | 20 GB Fujitsu ADD ON (4200 rpm) | 18.3 |
| 3 | 30 GB Fujitsu ADD ON (4200 rpm) | 19.9 |
| 4 | 20 GB Fujitsu Slide-In (4200 rpm) | 18.4 |
| 5 | 30 GB Fujitsu Slide-In (4200 rpm) | 18.5 |
| 6 | 40 GB Hitachi Travelstar (7200 rpm) | 16.7 |
| **Reference HDD** | | |
| 7 | 40 GB Seagate ST340014A (7200 rpm) | 12.5 |

**Table 23: Results for HDTACH access time measurement**

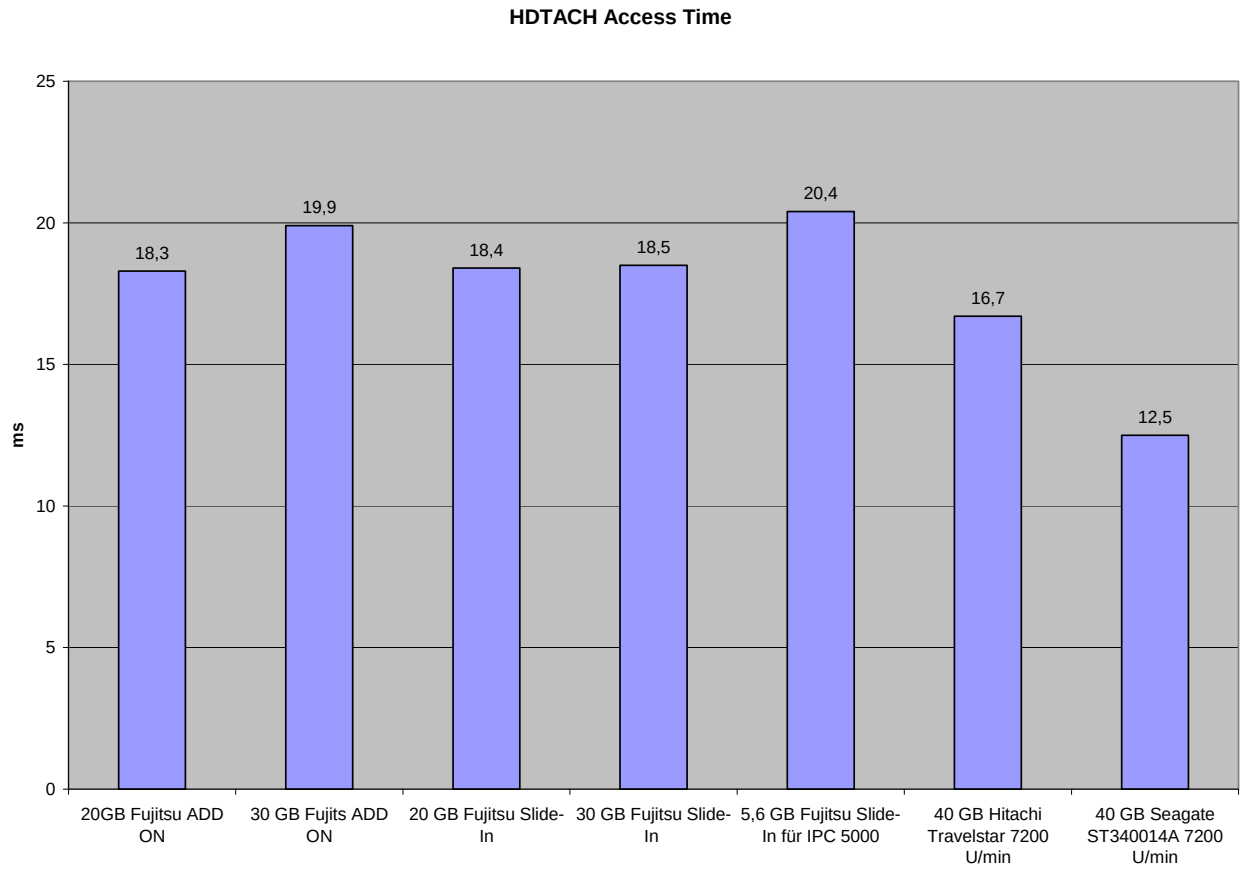



**Figure 16 – Results for HDTACH access time measurement**

## 4.7 3D Mark 2000

Originally, 3D Mark 2000 (like all later 3D Mark versions) was a benchmark that specialized on the performance of 3D games on PC systems.
However, this benchmark generally provides a very good representation of the 3D performance of a system.
For this reason, the 3D Mark line was also included in this performance test.
3D Mark 2000 does not have any special requirements (except for MMX technology) and supports a wide range of systems. This makes it possible to compare many systems and system types

| # | Test device | Points |
|---|---|---|
| **Power Panel** | | |
| 1 | Geode 266 MHz, 128 MB RAM | Not supported |
| **IPC5000C computer** | | |
| 4 | Celeron 3 566 MHz, 256 MB SDRAM | Not supported |
| 5 | Celeron 3 850 MHz, 256 MB SDRAM | Not supported |
| 6 | Pentium 3 600 MHz, 256 MB SDRAM | Not supported |
| 7 | Pentium 3 850 MHz, 256 MB SDRAM | 737 |
| **APC680 computer** | | |
| 8 | Celeron 3 850 MHz, 256 MB SDRAM | 773 |
| 9 | Pentium 3 1.26 GHz, 256 MB SDRAM | 851 |
| **APC620 with INTEL 815E chipset** | | |
| 10 | Celeron 3 400 MHz, 256 MB SDRAM | 739 |
| 11 | Celeron 3 733 MHz, 512 MB SDRAM | 790 |
| 12 | Celeron 3 1000 MHz, 256 MB SDRAM | 796 |
| **APC620 with INTEL 855GME chipset** | | |
| 13 | Celeron M 600 MHz, 256 MB DDR-SDRAM | 3622 |
| 14 | Celeron M 1 GHz, 256 MB DDR-SDRAM | 4013 |
| 15 | Pentium M 1.1 GHz, 1 GB DDR-SDRAM | 4467 |
| 16 | Pentium M 1.4 GHz, 512 MB DDR-SDRAM | 4520 |
| 17 | Pentium M 1.6 GHz, 1GB DDR-SDRAM | 4610 |
| 18 | Pentium M 1.8 GHz, 512 MB DDR-SDRAM | 4768 |
| **Other test computers** | | |
| 19 | Pentium 4 2.4 GHz, 512 MB DDR-SDRAM | 4674 |
| 20 | Pentium 4 2.6 GHz, 512 MB DDR-SDRAM | 11364 |

**Table 24: Results for 3D Mark 2000**

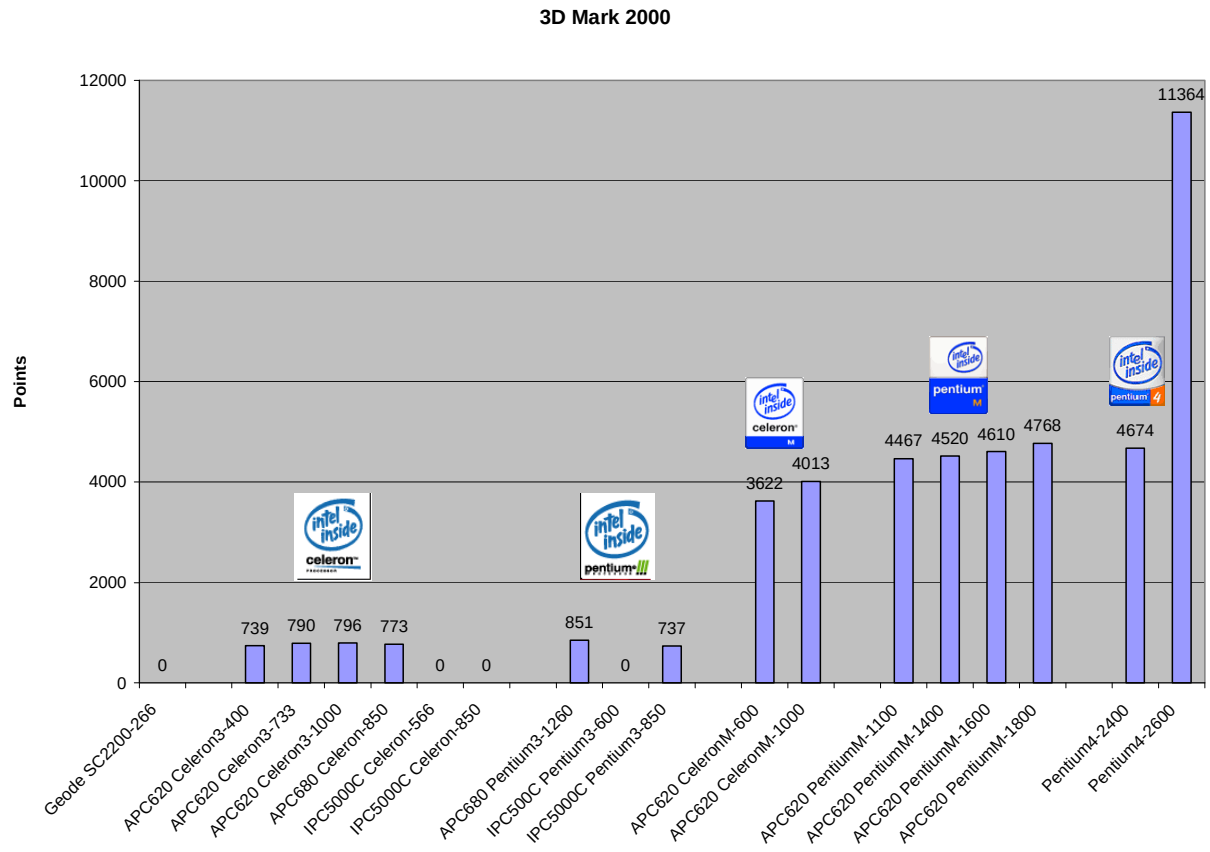



**Figure 17 – Results for 3D Mark 2000**

# Information:

**On computers without test results, the graphics controller does not meet the minimum requirements.**

## 4.8 3D Mark 2001SE

3D Mark2001 SE is a further development of 3D Mark 2000 and supports newer technologies (SSE2) and processors (P4, etc.). The test specializes on these new technologies and therefore the benchmark cannot be used for all systems.
The results achieved provide a good comparison of the 3D performance as compared to current systems (systems with Pentium 4, Pentium M, AMD AthlonXP, etc.).

| # | Test device | Points |
|---|---|---|
| **Power Panel** | | |
| 1 | Geode 266 MHz, 128 MB RAM | Not supported |
| **IPC5000C computer** | | |
| 4 | Celeron 3 566 MHz, 256 MB SDRAM | Not supported |
| 5 | Celeron 3 850 MHz, 256 MB SDRAM | Not supported |
| 6 | Pentium 3 600 MHz, 256 MB SDRAM | Not supported |
| 7 | Pentium 3 850 MHz, 256 MB SDRAM | Not supported |
| **APC680 computer** | | |
| 8 | Celeron 3 850 MHz, 256 MB SDRAM | 503 |
| 9 | Pentium 3 1.26 GHz, 256 MB SDRAM | 651 |
| **APC620 with INTEL 815E chipset** | | |
| 10 | Celeron 3 400 MHz, 256 MB SDRAM | 438 |
| 11 | Celeron 3 733 MHz, 512 MB SDRAM | 557 |
| 12 | Celeron 3 1000 MHz, 256 MB SDRAM | 565 |
| **APC620 with INTEL 855GME chipset** | | |
| 13 | Celeron M 600 MHz, 256 MB DDR-SDRAM | 1627 |
| 14 | Celeron M 1 GHz, 256 MB DDR-SDRAM | 1731 |
| 15 | Pentium M 1.1 GHz, 1 GB DDR-SDRAM | 1947 |
| 16 | Pentium M 1.4 GHz, 512 MB DDR-SDRAM | 2120 |
| 17 | Pentium M 1.6 GHz, 1GB DDR-SDRAM | 2250 |
| 18 | Pentium M 1.8 GHz, 512 MB DDR-SDRAM | 2383 |
| **Other test computers** | | |
| 19 | Pentium 4 2.4 GHz, 512 MB DDR-SDRAM | 2225 |
| 20 | Pentium 4 2.6 GHz, 512 MB DDR-SDRAM | 9389 |

**Table 25: Results for 3D Mark 2001SE**

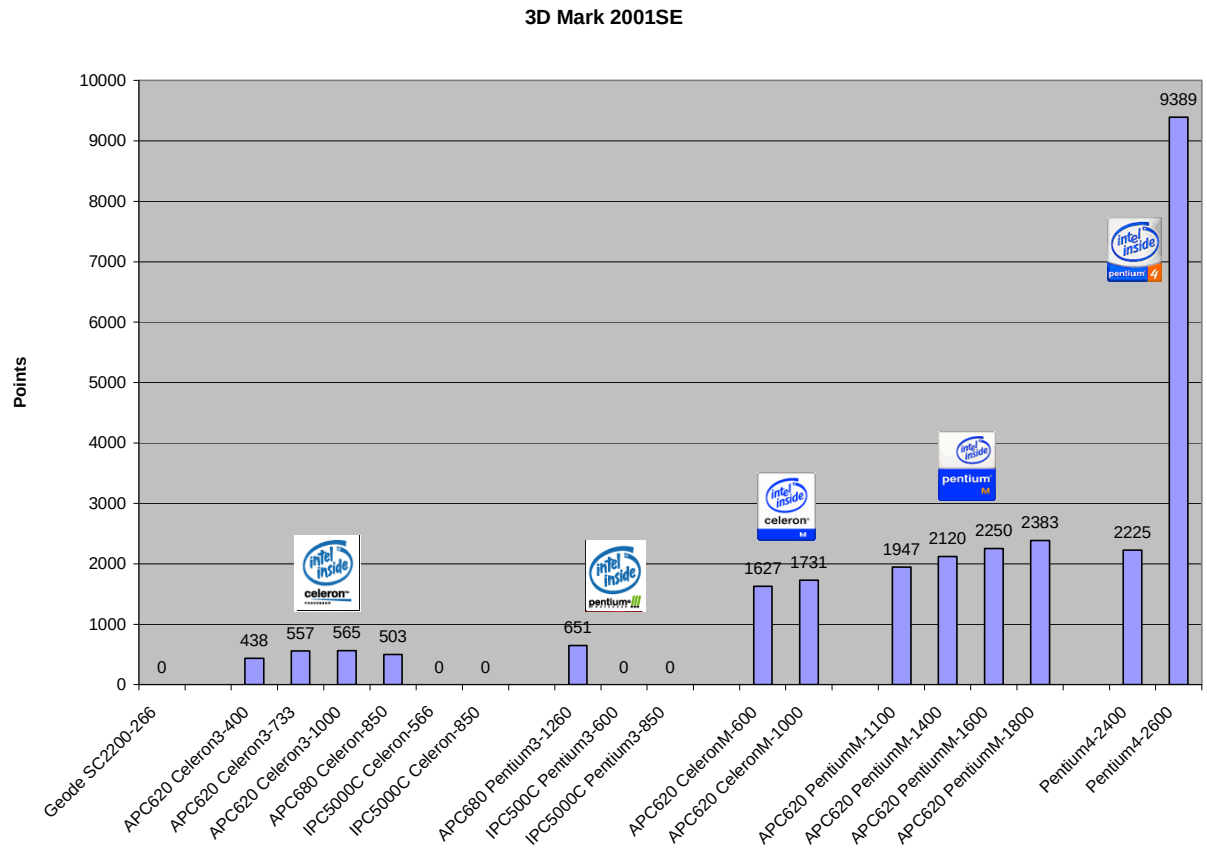



**Figure 18 – Results for 3D Mark 2001SE**

# Information:

**On computers without test results, the graphics controller does not meet the minimum requirements.**

## 4.9 B&R Automation Runtime AR010 Version E2.82

Since the APC620 is not only used as a Windows computer, it was necessary to determine the performance using Automation Runtime. The Windows-based system AR010 Version E2.82 was used. To determine the performance of the computer, a project was created containing intensive integer and floating point operations. A visualization application was also created, which was executed in a high priority class. All tasks were executed without(!!) tolerance times. This way, system overloads are recognized immediately.
The APC620 with Intel Celeron 3, 400 MHz was used as the reference device. The application was adjusted so that the computer ran at nearly 100% system load. In order to determine the system load, the B&R Profiler was used.
After the recording, only the hardware was exchanged, and the project was left the same. This allows the measurements to be easily compared with each other.

| # | Test device | CPU load in percent (%) |
|---|---|---|
| **APC620 with INTEL 815E chipset** | | |
| 10 | Celeron 3 400 MHz, 256 MB SDRAM | 99.72 |
| 11 | Celeron 3 733 MHz, 512 MB SDRAM | 58.75 |
| 12 | Celeron 3 1000 MHz, 256 MB SDRAM | 49.08 |
| **APC620 with INTEL 855GME chipset** | | |
| 13 | Celeron M 600 MHz, 256 MB DDR-SDRAM | 85.25 |
| 14 | Celeron M 1 GHz, 256 MB DDR-SDRAM | 50.53 |
| 15 | Pentium M 1.1 GHz, 1 GB DDR-SDRAM | 41.84 |
| 16 | Pentium M 1.4 GHz, 512 MB DDR-SDRAM | 37.58 |
| 17 | Pentium M 1.6 GHz, 1GB DDR-SDRAM | 32.96 |
| 18 | Pentium M 1.8 GHz, 512 MB DDR-SDRAM | 28.96 |

**Table 26: Results for AR010 Version E2.82**

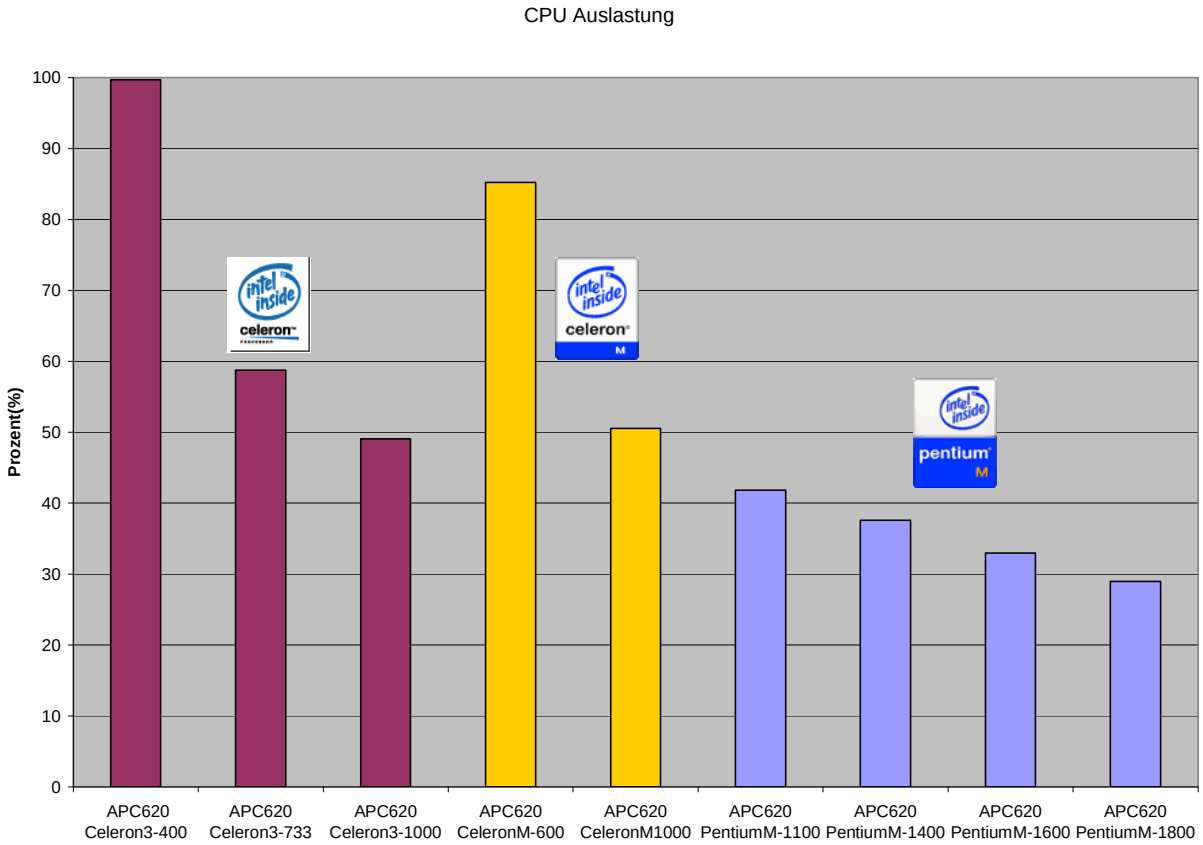
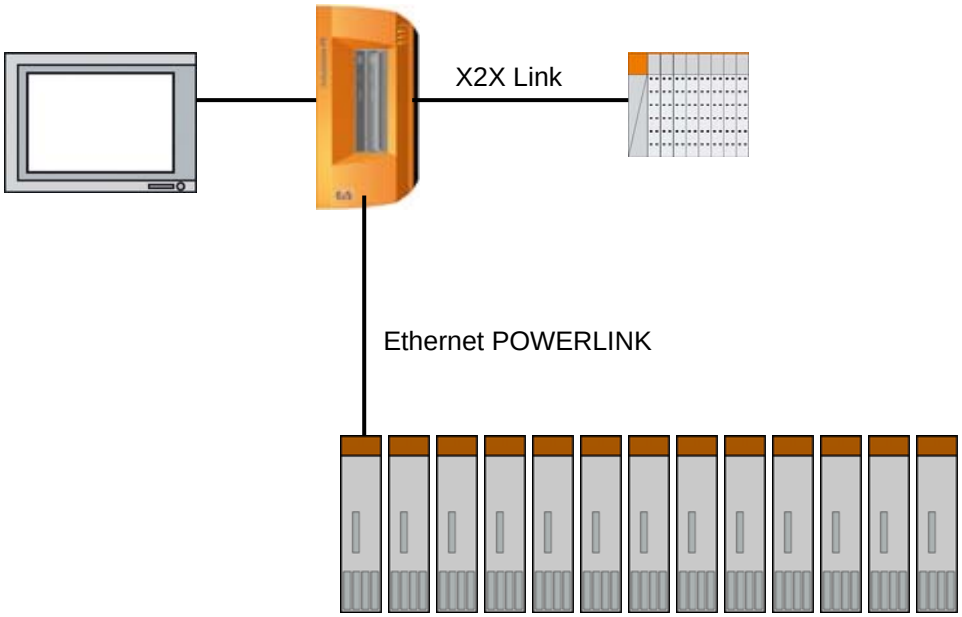



**Figure 19 – B&R Automation Runtime AR010 Version E2.82**

## 4.10 B&R Automation Runtime AR106 Version B2.83

### 4.10.1 Structure of the test




The following elements were used for the test:

#### 4.10.1.1 Automation Panel AP920.1505-01

The panel was used to check the that the visualization was displayed correctly

#### 4.10.1.2 36 ACOPOS 1045 axes

To create a high computation load, 36 ACOPOS axes were operated simultaneously. Ethernet POWER-LINK was used as the bus system

#### 4.10.1.3 26 X20IOs

Since real-time applications require operation of large numbers of I/Os, the X20 I/O system was used in order to make the test realistic. All available modules were used. These included analog/digital inputs and outputs, temperature modules, and encoder/counter modules.

### 4.10.2 Test procedure

During this test, emphasis was placed on demonstrating the performance of the APC series as realistically as possible. An application was created that reflects realistic demands placed on a system in the field. Not only computational performance is important, but also a large number of accesses to individual subsystems must also take place (e.g. PCI access for operating bus systems).
To create a complex load on the computer, 5 different task classes with different timings were used. Various cyclic programs were executed. The cycle times ranged from 1.6 ms in the highest priority task class #1 to 200 ms in task class #5.
A visualization application was also created containing a large number of pages.
As an additional load on the system, 36 ACOPOS axes were operated simultaneously via Ethernet POWERLINK.
The size of the project was adjusted in such a way that an APC620 with an INTEL Celeron3 400 MHz reaches a load of approximately 90%. Once the project is activated, a profiler measurement was started for a duration of one minute. Then the results of the measurement were evaluated and saved.
After the test, the CF was removed and another target system was connected. The project was left unchanged (same structure, same software) in order to achieve consistent results (the project „APC620p.pgp“ used can be found here in the benchmark folder).

### 4.10.3 Results

| # | Test device | CPU load in percent (%) |
|---|---|---|
| **APC620 with INTEL 815E chipset** | | |
| 10 | Celeron 3 400 MHz, 256 MB SDRAM | 84.39 |
| 11 | Celeron 3 733 MHz, 512 MB SDRAM | 60.8 |
| 12 | Celeron 3 1000 MHz, 256 MB SDRAM | 54.35 |
| **APC620 with INTEL 855GME chipset** | | |
| 13 | Celeron M 600 MHz, 256 MB DDR-SDRAM | 48.69 |
| 14 | Celeron M 1 GHz, 256 MB DDR-SDRAM | 42.07 |
| 15 | Pentium M 1.1 GHz, 1 GB DDR-SDRAM | 34.43 |
| 16 | Pentium M 1.4 GHz, 512 MB DDR-SDRAM | 33.29 |
| 17 | Pentium M 1.6 GHz, 1GB DDR-SDRAM | 30.14 |
| 18 | Pentium M 1.8 GHz, 512 MB DDR-SDRAM | 29.15 |

**Table 27: Results for B&R AR106 Version B2.83**

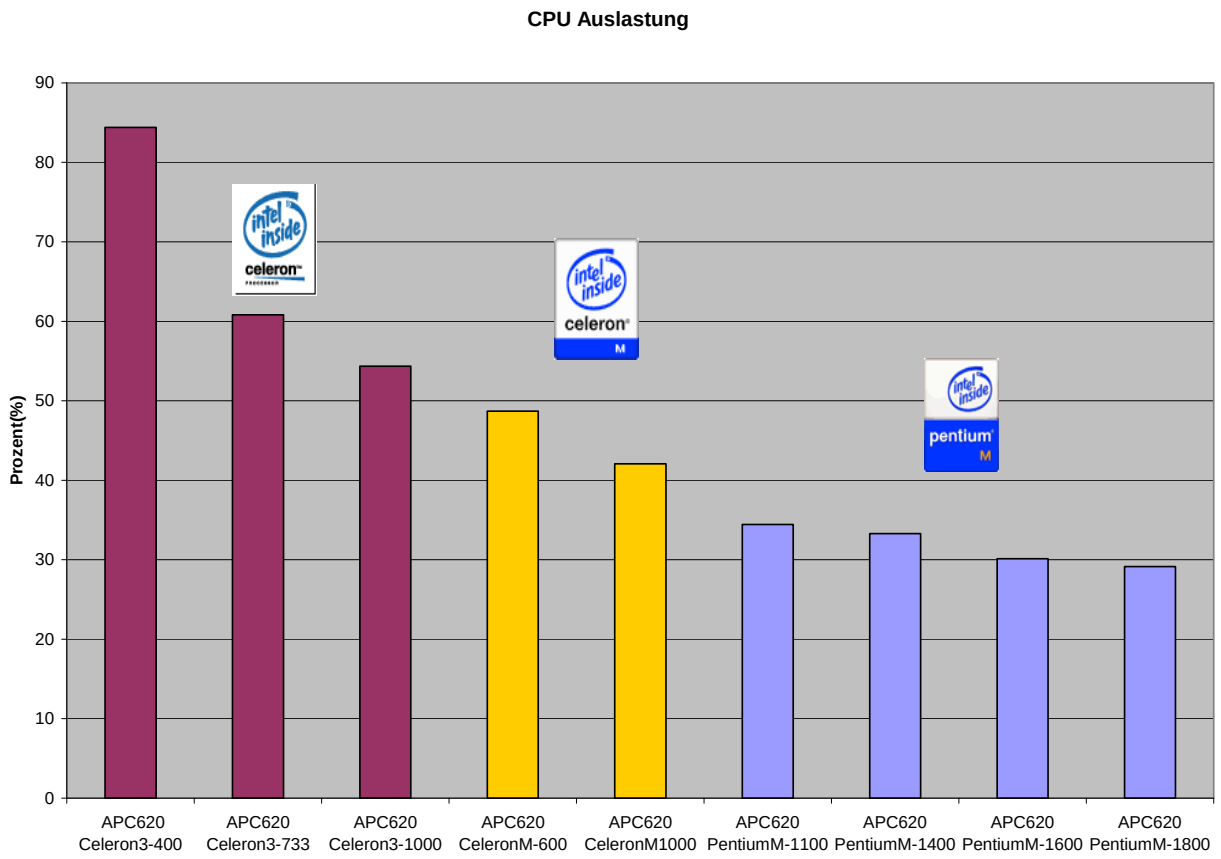



**Figure 20 – B&R Automation Runtime AR106 Version B2.83**

## 4.11 Sisoft Sandra Pro Business 2007

### 4.11.1 CPU arithmetic

Here, the program determines the maximum number of operations per second. The result is output in MIPS (Million Instructions per Second).
At the same time, the maximum number of floating point operations per second is also determined. The result is shown in MFLOPS (Million Floating Point Operations per Second).

| # | Test device | Dhrystone ALU (MIPS) | Whetstone FPU (MFLOPS) |
|---|---|---|---|
| **APC620 with INTEL 855GME chipset** | | | |
| 15 | Pentium M 1.1 GHz, 512MB DDR-SDRAM | 3623 | 2697 |
| 18 | Pentium M 1.8 GHz, 1024MB DDR-SDRAM | 5845 | 4383 |
| **APC810 with INTEL 945GM chipset** | | | |
| 21 | Celeron M 1.06 GHz, 512MB DDR2-SDRAM | 3636 | 2680 |
| 22 | Celeron M 1.06 GHz, 2x512MB DDR2-SDRAM | 3636 | 2681 |
| 23 | Core 2 Duo 1.06 GHz, 2x1024MB DDR2-SDRAM | 9800 | 6800 |
| 24 | Core 2 Duo 1.50 GHz, 2x512MB DDR2-SDRAM | 13764 | 9554 |
| 25 | Core Duo 1.66 GHz, 2x1024MB DDR2-SDRAM | 11348 | 8398 |
| 26 | Core 2 Duo 2.16 GHz, 1024MB DDR2-SDRAM | 19846 | 13778 |
| 27 | Core 2 Duo 2.16 GHz, 2x1024MB DDR2-SDRAM | 19919 | 13795 |

**Table 28: Results for Sisoft Sandra Pro Business 2007, CPU Arithmetic**

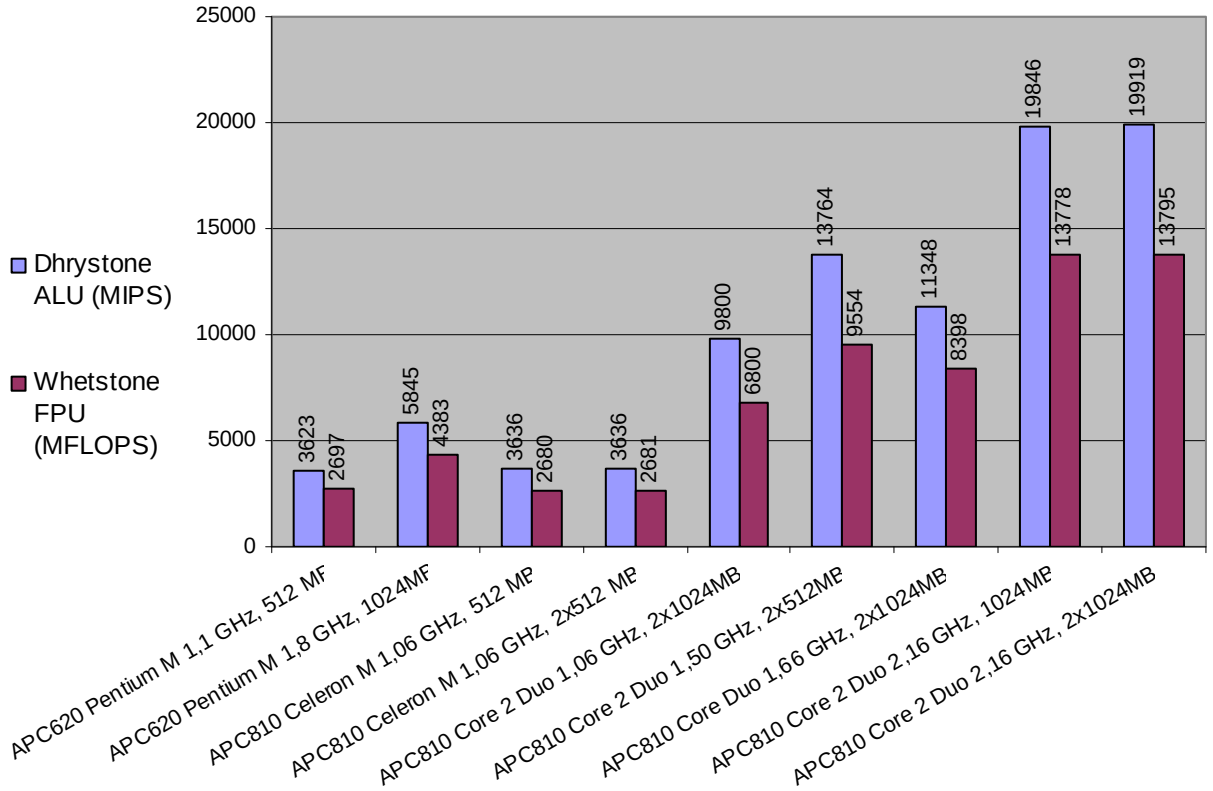



**Figure 21 - Results for Sisoft Sandra Pro Business 2007 CPU Arithmetic**

## 4.11.2 CPU multimedia

This test determines the multimedia performance of the CPU. During this test, the speed and performance are checked for the technologies used, such as MMX, SSE, SSE2 (depending on the processor).

| # | Test device | Integer (it/s) | Floating Point (it/s) |
|---|---|---|---|
| **APC620 with INTEL 855GME chipset** | | | |
| 15 | Pentium M 1.1 GHz, 512MB DDR-SDRAM | 10287 | 11639 |
| 18 | Pentium M 1.8 GHz, 1024MB DDR-SDRAM | 16782 | 18953 |
| **APC810 with INTEL 945GM chipset** | | | |
| 21 | Celeron M 1.06 GHz, 512MB DDR2-SDRAM | 8324 | 11311 |
| 22 | Celeron M 1.06 GHz, 2x512MB DDR2-SDRAM | 8322 | 11294 |
| 23 | Core 2 Duo 1.06 GHz, 2x1024MB DDR2-SDRAM | 58703 | 31642 |
| 24 | Core 2 Duo 1.50 GHz, 2x512MB DDR2-SDRAM | 82474 | 44468 |
| 25 | Core Duo 1.66 GHz, 2x1024MB DDR2-SDRAM | 25981 | 35376 |
| 26 | Core 2 Duo 2.16 GHz, 1024MB DDR2-SDRAM | 119063 | 64213 |
| 27 | Core 2 Duo 2.16 GHz, 2x1024MB DDR2-SDRAM | 119128 | 64224 |

**Table 29: Results for Sisoft Sandra Pro Business 2007, CPU Multimedia**

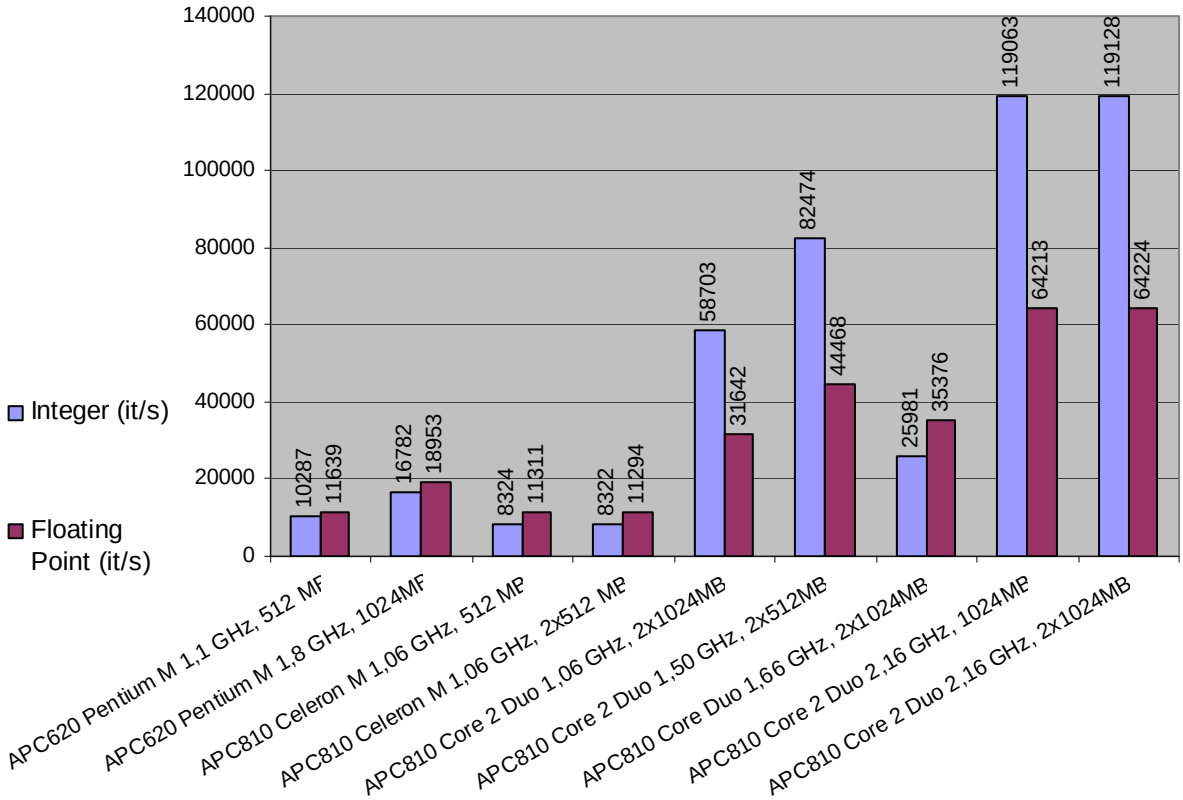



**Figure 22 - Results for Sisoft Sandra Pro Business 2007, CPU Multi Media**

## 4.11.3 Memory bandwidth

The performance of the system memory (main memory) is determined here. This is done by transferring a large amount of data. The result is the maximum "memory throughput" in MB/s.

| # | Test device | RAM Bandwidth ALU (MB/s) | RAM Bandwidth FPU (MB/s) |
|---|---|---|---|
| **APC620 with INTEL 855GME chipset** | | | |
| 15 | Pentium M 1.1 GHz, 512MB DDR-SDRAM[1] | 2057 | 2057 |
| 18 | Pentium M 1.8 GHz, 1024MB DDR-SDRAM[1] | 1541 | 1549 |
| **APC810 with INTEL 945GM chipset** | | | |
| 21 | Celeron M 1.06 GHz, 512MB DDR2-SDRAM | 2548 | 2545 |
| 22 | Celeron M 1.06 GHz, 2x512MB DDR2-SDRAM | 2694 | 2692 |
| 23 | Core 2 Duo 1.06 GHz, 2x1024MB DDR2-SDRAM | 2912 | 2921 |
| 24 | Core 2 Duo 1.50 GHz, 2x512MB DDR2-SDRAM | 3531 | 3533 |
| 25 | Core Duo 1.66 GHz, 2x1024MB DDR2-SDRAM | 3644 | 3616 |
| 26 | Core 2 Duo 2.16 GHz, 1024MB DDR2-SDRAM | 3712 | 3716 |
| 27 | Core 2 Duo 2.16 GHz, 2x1024MB DDR2-SDRAM | 3972 | 3978 |

1) See information

**Table 30: Results for Sisoft Sandra Pro Business 2007, CPU Memory Bandwidth**

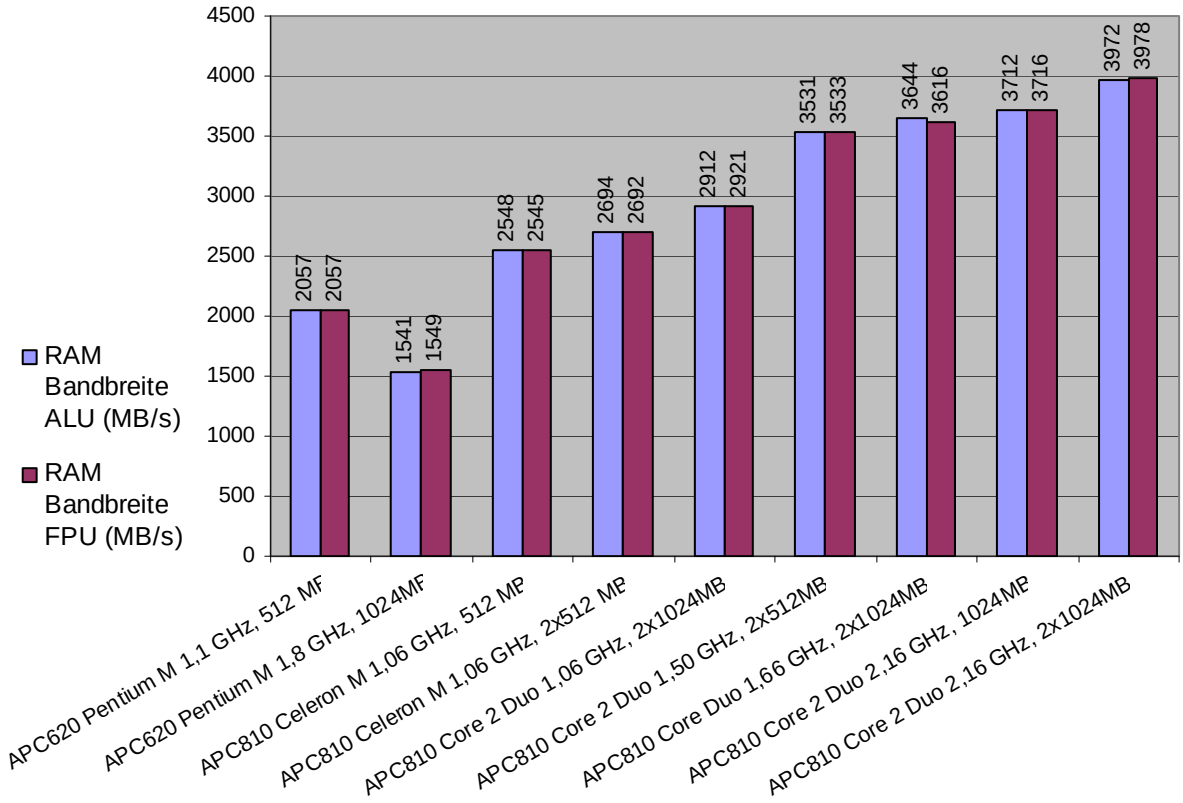



**Figure 23 - Results for Sisoft Sandra Pro Business 2007, CPU Memory Bandwidth**

**Information:**
**The memory bandwidth test for the APC620 with PM-1100 and PM-1800 returns values that are "not plausible", since according to this test the PM-1100 would be faster than the PM-1800. With the benchmark tests with Sisoft Sandra 2002 and 2005 the values are correct.**

## 4.11.4 Cache and memory bandwidth

| # | Test device | Combined index (MB/s) | Speed factor |
|---|---|---|---|
| **APC620 with INTEL 855GME chipset** | | | |
| 15 | Pentium M 1.1 GHz, 512MB DDR-SDRAM | 3517 | 19.0 |
| 18 | Pentium M 1.8 GHz, 1024MB DDR-SDRAM | 4229 | 36.3 |
| **APC810 with INTEL 945GM chipset** | | | |
| 21 | Celeron M 1.06 GHz, 512MB DDR2-SDRAM | 4819 | 9.0 |
| 22 | Celeron M 1.06 GHz, 2x512MB DDR2-SDRAM | 5247 | 7.4 |
| 23 | Core 2 Duo 1.06 GHz, 2x1024MB DDR2-SDRAM | 10944 | 32.6 |
| 24 | Core 2 Duo 1.50 GHz, 2x512MB DDR2-SDRAM | 15753 | 39.7 |
| 25 | Core Duo 1.66 GHz, 2x1024MB DDR2-SDRAM | 11501 | 17.4 |
| 26 | Core 2 Duo 2.16 GHz, 1024MB DDR2-SDRAM | 18528 | 66.7 |
| 27 | Core 2 Duo 2.16 GHz, 2x1024MB DDR2-SDRAM | 20465 | 51.9 |

**Table 31: Results for Sisoft Sandra Pro Business 2007, cache and memory bandwidth**

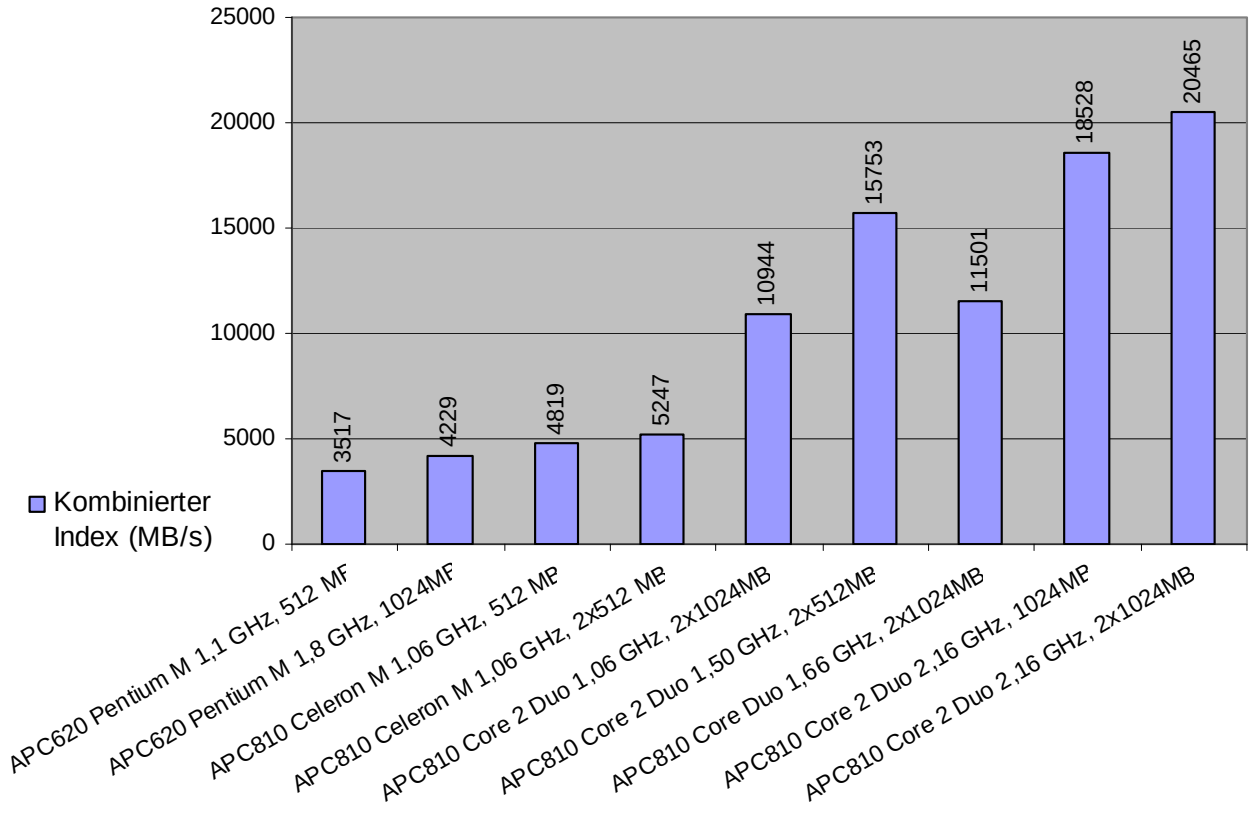



**Figure 24 - Results for Sisoft Sandra Pro Business 2007, cache and memory bandwidth**

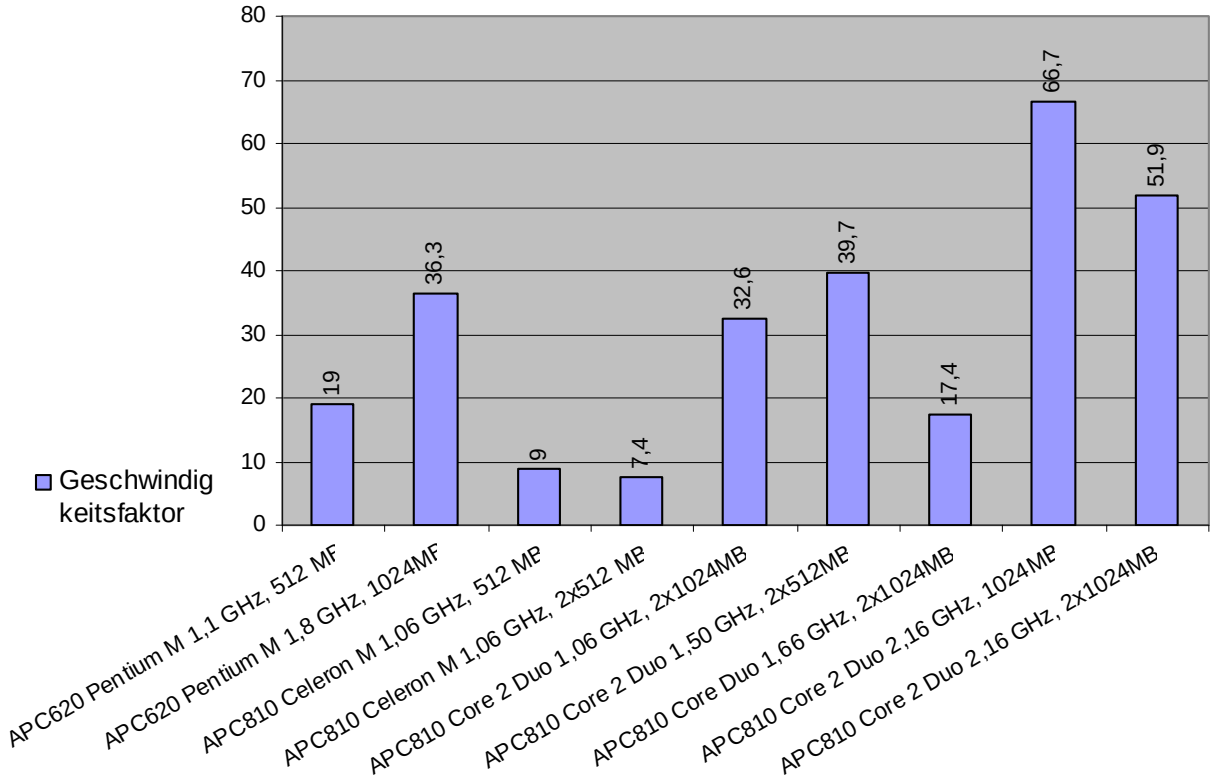



**Figure 25 – Results for Sisoft Sandra Pro Business 2007, cache and memory bandwidth**

# 5 Conclusion

The tests provided a clear picture of the industrial PCs' performance.
APC620 with Celeron M and Pentium M processors stood out considerably.

APC620 computers with these processors offer high computing performance allowing excellent handling of complex tasks.
When comparing this computer with desktop PCs that are equipped with Intel Pentium 4 processors, it becomes evident that they (especially the Pentium M processors) easily match up to the Pentium 4.
It is also apparent that the computing power is further increased (for both the Pentium M and the Pentium 4) when using the latest programs, which optimally support these processors.
It is generally the case that these groups of APCs (with Celeron M and Pentium M processors) are now the successors to the IPC5000C and offer considerably higher computing power.

After comparing the computing power of the APC620 (with Intel 815E chipset) with that of an IPC5000C, it appears that these two computers are equal. The APC620 has only minor performance advantages over the IPC5000C series. However, this series could be seen as a high-performance successor to the IPC2001 series.

The IPC2001 series is considerably outdated and has difficulty meeting the demands of the latest programs. This performance deficit is the result of the technological state of the processors (486er).

# 6 Figure Index

# 7 Table Index

# 8 Index