



Benchmark test

Industrial PCs

Date: 20 September 2010

Project Number:

We reserve the right to change the content of this manual without prior notice. The information contained herein is believed to be accurate as of the date of publication, however, B&R makes no warranty, expressed or implied, with regards to the products or the documentation contained within this document. B&R shall not be liable in the event if incidental or consequential damages in connection with or arising from the furnishing, performance or use of these products. The software names, hardware names and trademarks used in this document are registered by the respective companies.

I Versions

Version	Date	Comment	Edited by
2.0	08.06.2005	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 - Document upgrade with APC810 (SiSoft Sandra 2007) tests	EBB
2.4	06.02.2009	Benchmark enhancements with PP300/400 (LX800-500)	MIK
2.5	28.04.2009	- Benchmark enhancements with APC810 (Intel Atom N270 + 945GME) - Benchmark enhancements with APC810 (Intel T9400 + GM45).	MIK
2.6	20.05.2009	- Benchmark enhancements with APC810 (Intel Atom N270 + 945GME) - Upgrade the document with Sisoft Sandra Pro Business 2007 benchmarkresults „Removeable Storage“.	RAM
2.7	23.06.2009	Benchmark enhancements with APC620 (Intel Atom N270 + 945GME)	MIK
2.8	11.08.2009	Benchmark enhancements with APC810 (Intel P8400 + GM45).	MIK
2.9	16.10.2009	Benchmark enhancements with INTEL Evalboard (Intel Z530 + US15W Chipset).	MIK
3.0	20.09.2010	Benchmark enhancements with PP500 (Intel Z520 + US15W Chipset).	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?	5
2 Hardware	6
2.1 Devices being tested	6
2.2 Hard disks / removeable devices	7
3 Software	9
3.1 Benchmark programs	9
3.2 Operating system	9
4 Results	10
4.1 Sisoft Sandra 2002 Prof.	10
4.1.1 CPU arithmetic	10
4.1.2 CPU multimedia	12
4.1.3 Memory bandwidth	15
4.2 Sisoft Sandra 2005 SR1	17
4.2.1 CPU arithmetic	17
4.2.2 CPU multimedia	19
4.2.3 Memory bandwidth	21
4.3 PCMark2002	23
4.4 PCMark04	25
4.5 Winbench99	27
4.5.1 CPUMark99	27
4.5.2 FPUWinMark	29
4.5.3 Direct Draw	31
4.5.4 Disk Inspection Test	33
4.5.5 High End Disk WinMark99	35
4.5.6 Business Disk WinMark99	37
4.6 HDTACH Version 2.70	39
4.6.1 HDTACH read speed	39
4.6.2 HDTACH access time measurement	40
4.7 3D Mark 2000	41
4.8 3D Mark 2001SE	43
4.9 B&R Automation Runtime AR010 Version E2.82	45
4.10 B&R Automation Runtime AR106 Version B2.83	47
4.10.1 Structure of the test	47
4.10.2 Test procedure	47
4.10.3 Results	48
4.11 Sisoft Sandra Pro Business 2007	50
4.11.1 CPU arithmetic	50
4.11.2 CPU multimedia	52
4.11.3 Memory bandwidth	54
4.11.4 Cache and memory bandwidth	56
4.11.5 Physical devices / removeable devices	58
5 Figure Index	60
6 Table Index	61
7 Index	62

1 What's it all about?

This document is meant to show how the performance of different B&R industrial PCs to each other. 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 be 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

Benchmark test Industrial PCs

#	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
APC810 with Intel 945GME chipset + Intel Atom N270				
29	Intel Atom N270 1,6GHz, 533MHz FSB, 512KB Cache	2 x 2048MB DDR2-SDRAM	Intel Graphics Media Accelerator 950 max. 224MB	B&R
APC810 with Intel GM45 chipset + Intel T9400				
30	Core 2 Duo 2,53GHz, 1066 MHz FSB, 6MB Cache	2 x 2048MB DDR3-SODIMM	Intel GM45	B&R
APC620 with Intel 945GME chipset + Intel Atom N270				
31	Intel Atom N270 1,6GHz, 533MHz FSB, 512KB Cache	1024MB DDR2-SDRAM	Intel Graphics Media Accelerator 950 max. 224MB	B&R
APC810 with Intel GM45 chipset + Intel P8400				
32	Core 2 Duo 2,26GHz, 1066 MHz FSB, 3MB Cache	2 x 2048MB DDR3-SODIMM	Intel GM45	B&R
INTEL Evalboard with INTEL US15W Chipsatz + INTEL Atom Z530				
33	Intel Atom Z530 1,6GHz, 533MHz FSB, 512KB Cache	1024MB DDR2-SDRAM	Intel US15W	INTEL
Power Panel 500 (5PP520.1505-00 + 5PP5CP.US15-01)				
34	Intel Atom Z520 1,33GHz, 533MHz FSB, 512KB Cache	2048MB DDR2-SDRAM	Intel US15W	B&R

Table 5: Devices being tested

2.2 Hard disks / removeable devices

#	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) / 2 MB	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
Compact Flash cards				
1	5CFCRD.1024-03	1 GB	-	B&R
2	5CFCRD.1043-04	1 GB	-	B&R

Table 6: Hard disks and removeable devices 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 Coporation	http://www.futuremark.com/
5	WinBench99	ZD Net/Ziff-Davis	http://www.zdnet.de/
6	HDTACH V2.70	Simpli Software	http://www.simplissoftware.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			
3	Geode 266 MHz, 128 MB RAM	329	202
IPC2001 computer			
4	AMD 486DX2 66 MHz 8 MB DRAM	85	30
5	AMD 486DX5 133 MHz 32 MB DRAM	169	60
IPC5000C computer			
6	Celeron 3 566 MHz, 256 MB SDRAM	1513	765
7	Celeron 3 850 MHz, 256 MB SDRAM	2267	1149
8	Pentium 3 600 MHz, 256 MB SDRAM	1614	810
9	Pentium 3 850 MHz, 256 MB SDRAM	2267	1149
APC680 with INTEL 815E chipset			
10	Celeron 3 850 MHz, 256 MB SDRAM	2283	1147
11	Pentium 3 1.26 GHz, 256 MB SDRAM	3482	1697
APC620 with INTEL 815E chipset			
12	Celeron 3 400 MHz, 256 MB SDRAM	1086	529
13	Celeron 3 733 MHz, 512 MB SDRAM	2002	976
14	Celeron 3 1 GHz, 256 MB SDRAM	2751	1340
APC620 with INTEL 855GME chipset			
15	Celeron M 600 MHz, 256 MB DDR-SDRAM	2008	1170
16	Celeron M 1 GHz, 256 MB DDR-SDRAM	3533	1948
17	Pentium M 1.1 GHz, 1GB DDR-SDRAM	4580	2149
18	Pentium M 1.4 GHz, 512 MB DDR-SDRAM	4945	2732
19	Pentium M 1.6 GHz, 1GB DDR-SDRAM	5363	3124
20	Pentium M 1.8 GHz, 512 MB DDR-SDRAM	6370	3511
Other test computers			
21	Pentium 4 2.4 GHz, 512 MB DDR-SDRAM	4634	2955
22	Pentium 4 2.6 GHz, 512 MB DDR-SDRAM	5168	3305

¹ Source: Tolly Group

Benchmark test Industrial PCs

#	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

Sisoft Sandra 2002 Prof. CPU Arithmetic Test

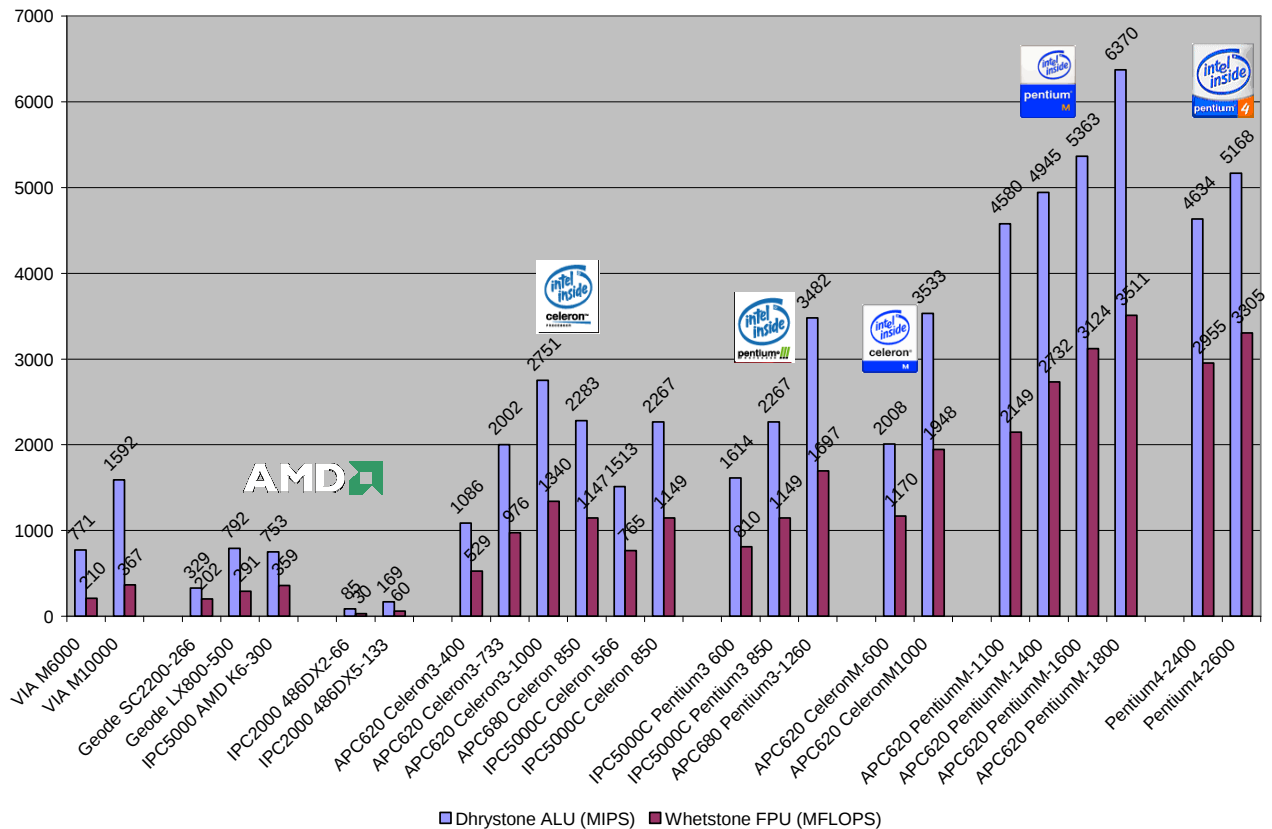


Figure 1 - Results for Sisoft Sandra 2002 Prof. CPU arithmetic

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

Sisoft Sandra 2002 Prof. CPU Multimedia

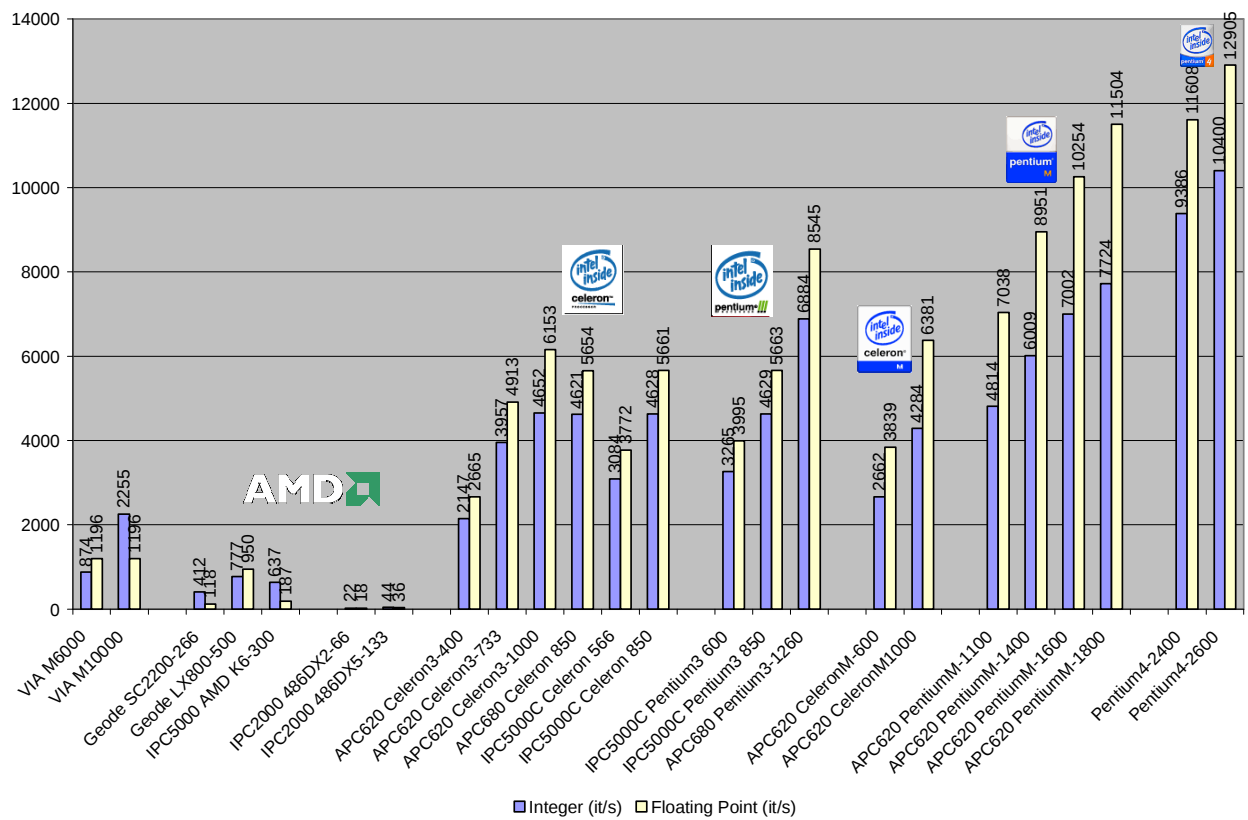


Figure 2 – Results for Sisoft Sandra 2002 Prof. CPU multimedia

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

Sisoft Sandra 2002 Prof. Memory Bandwidth

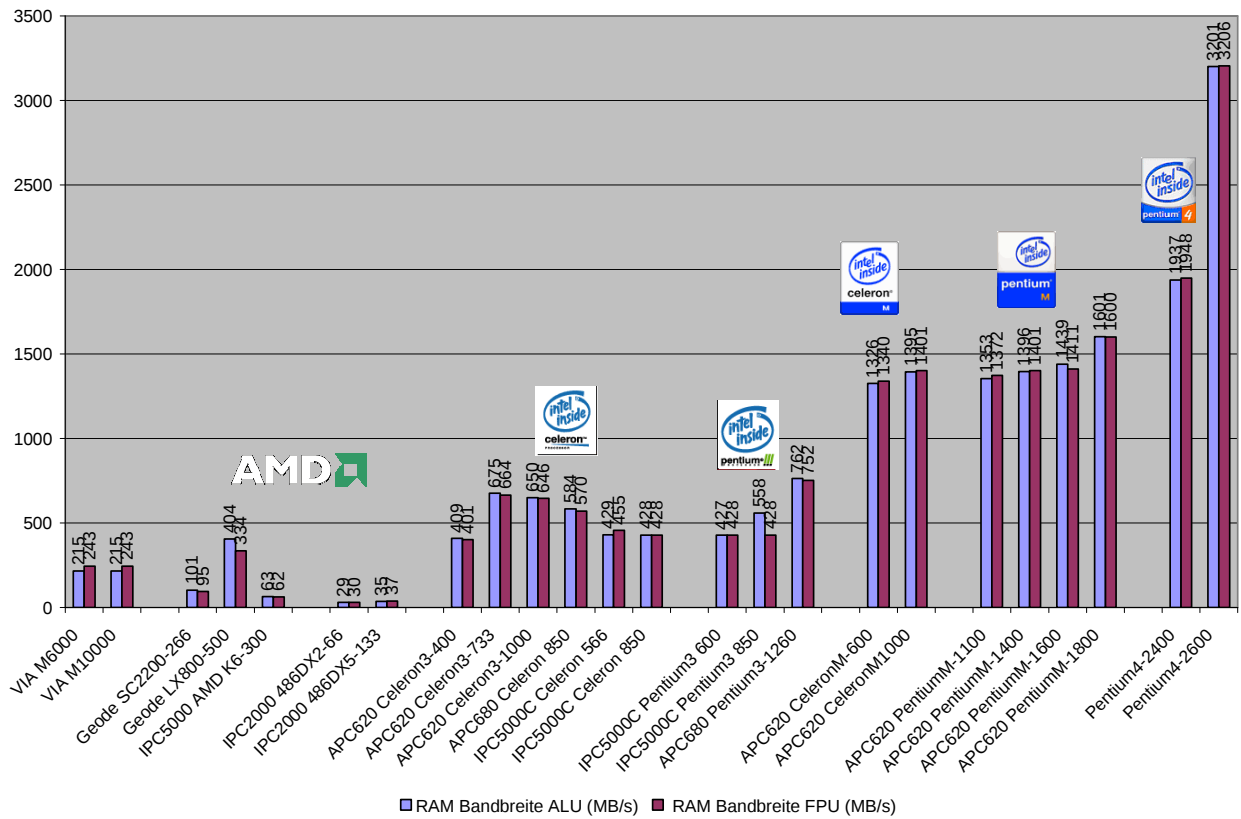


Figure 3 – Results for Sisoft Sandra 2002 Prof memory bandwidth

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

Sisoft Sandra 2005 SR1 CPU Arithmetic

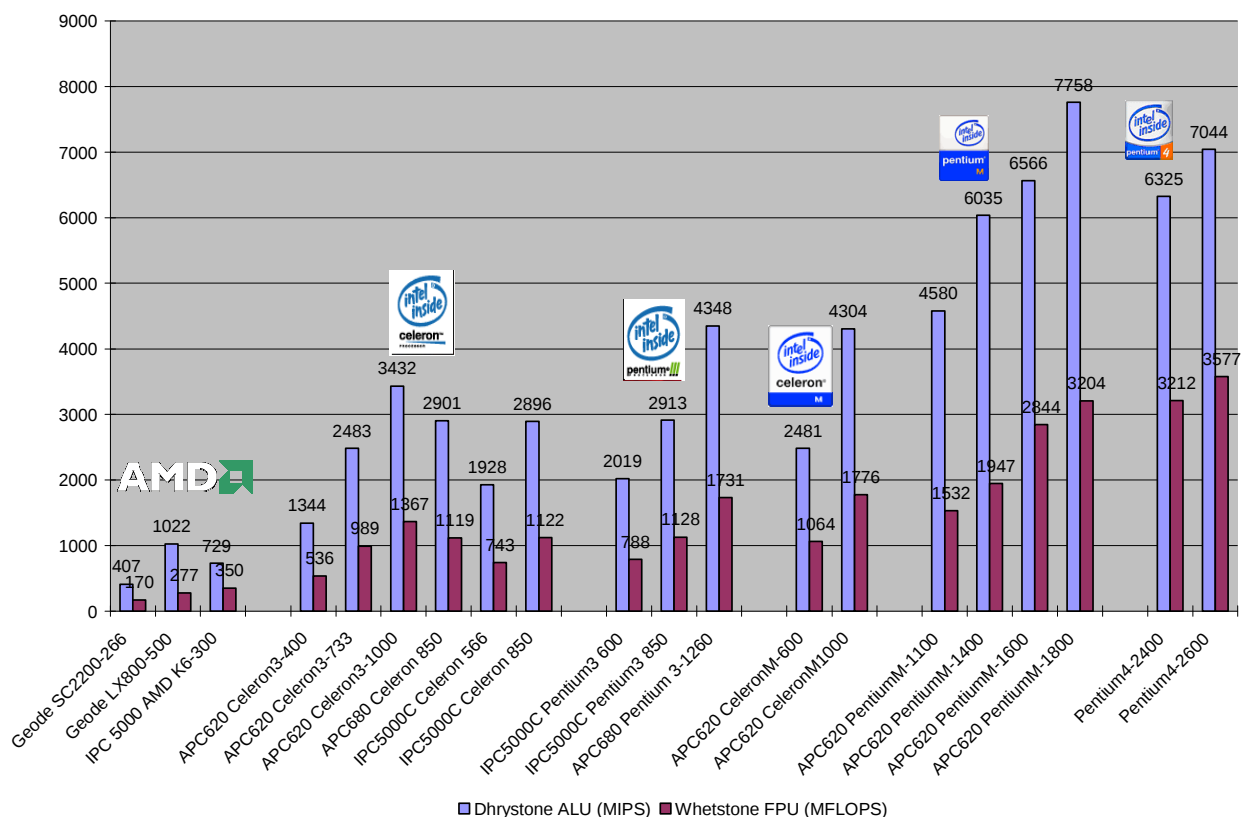


Figure 4 – Results for Sisoft Sandra 2005 SR1. CPU arithmetic

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

Sisoft Sandra 2005 SR1 CPU Multimedia

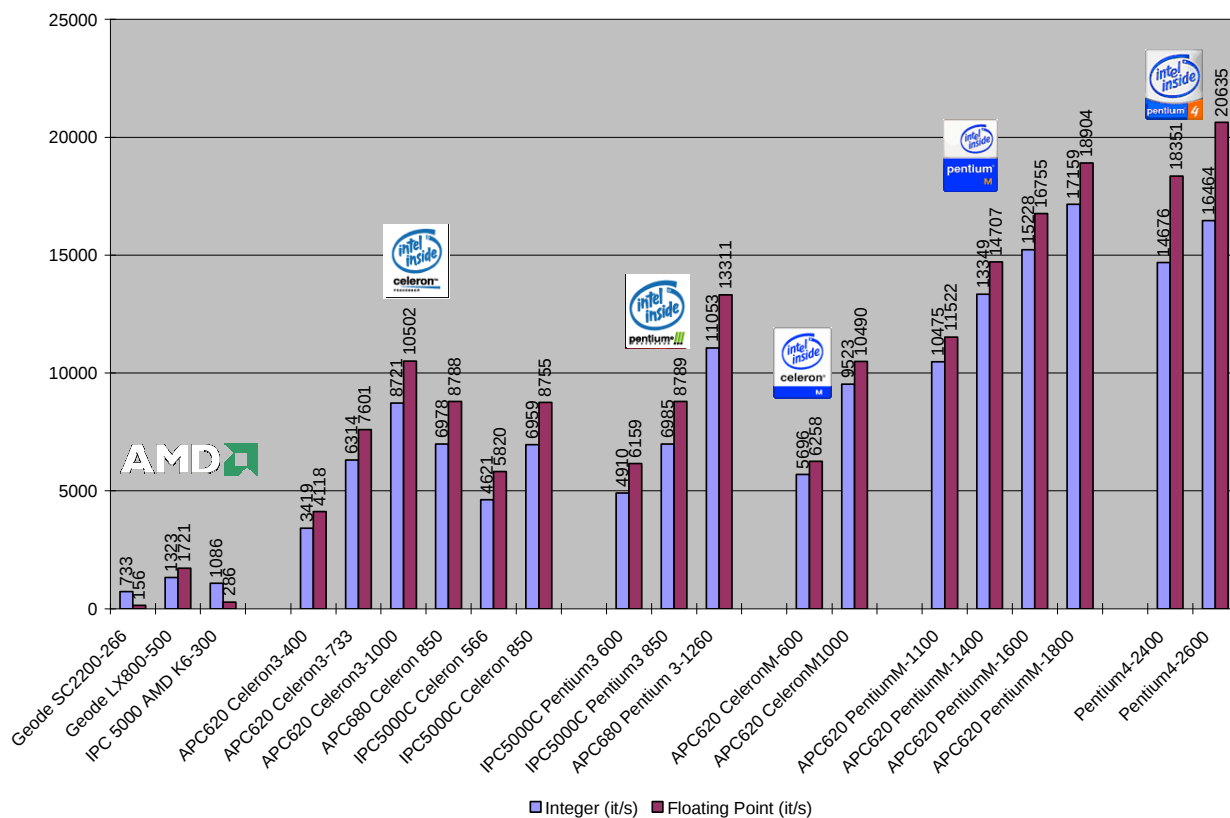


Figure 5 – Results for SiSoft Sandra 2005 SR1. CPU multimedia

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

Sisoft Sandra 2005 SR1 Memory Bandwidth

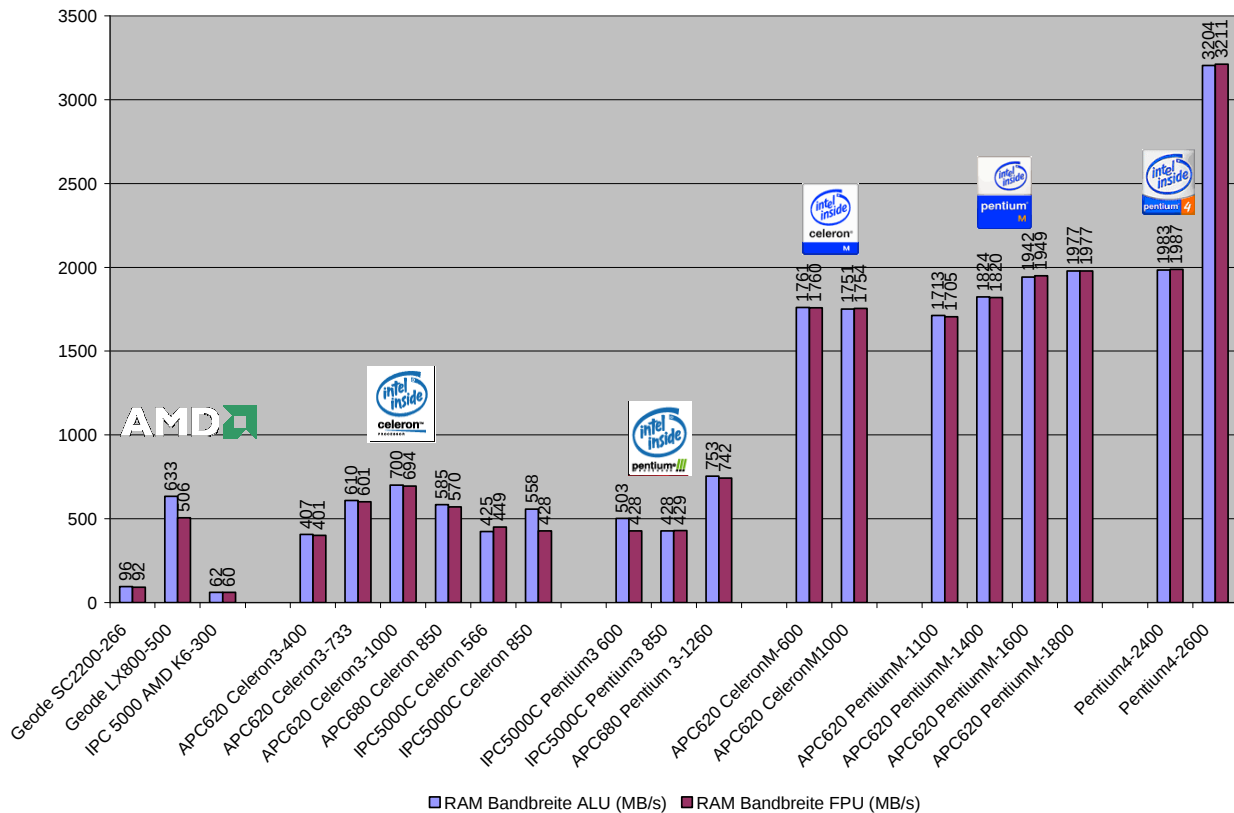


Figure 6 – Results for SiSoft Sandra 2005 SR1. Memory bandwidth

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

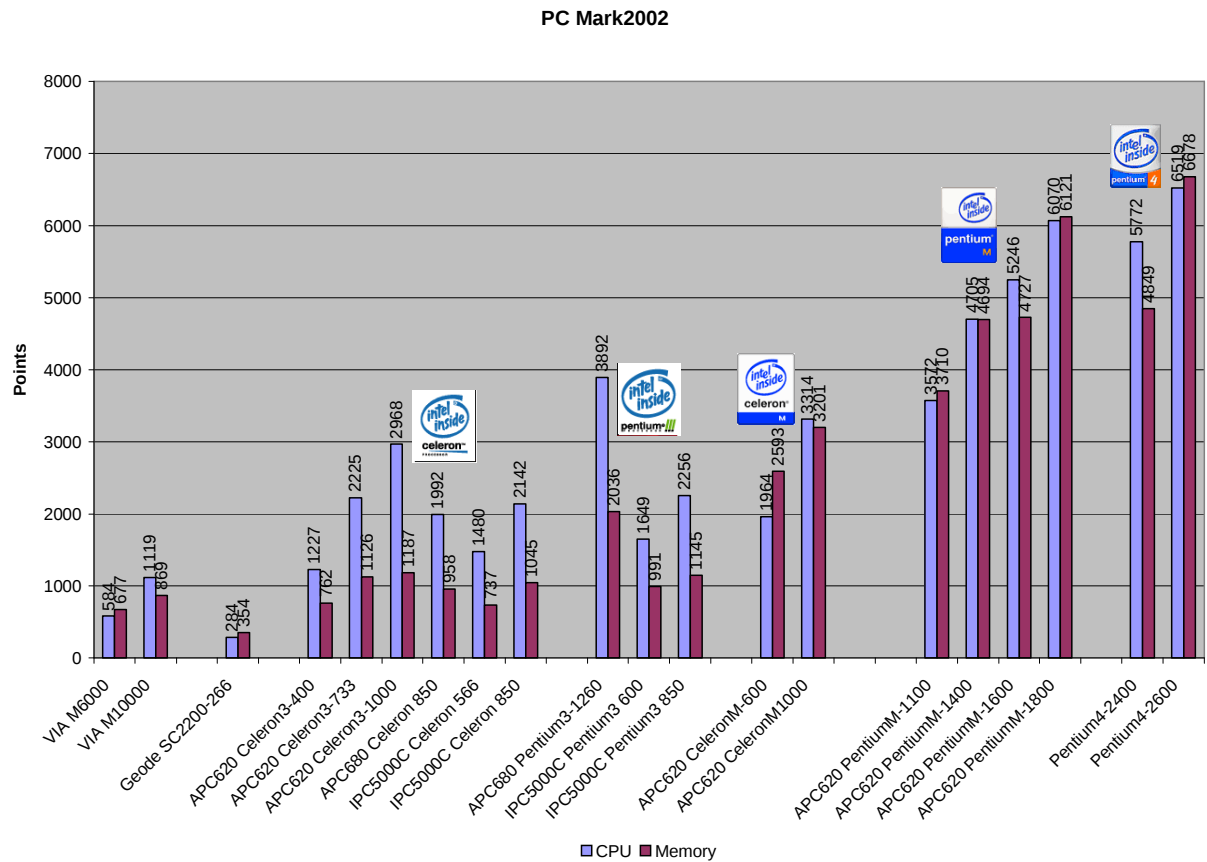


Figure 7 – Results for PCMark2002

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 PCMark2004, 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 PCMark04 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

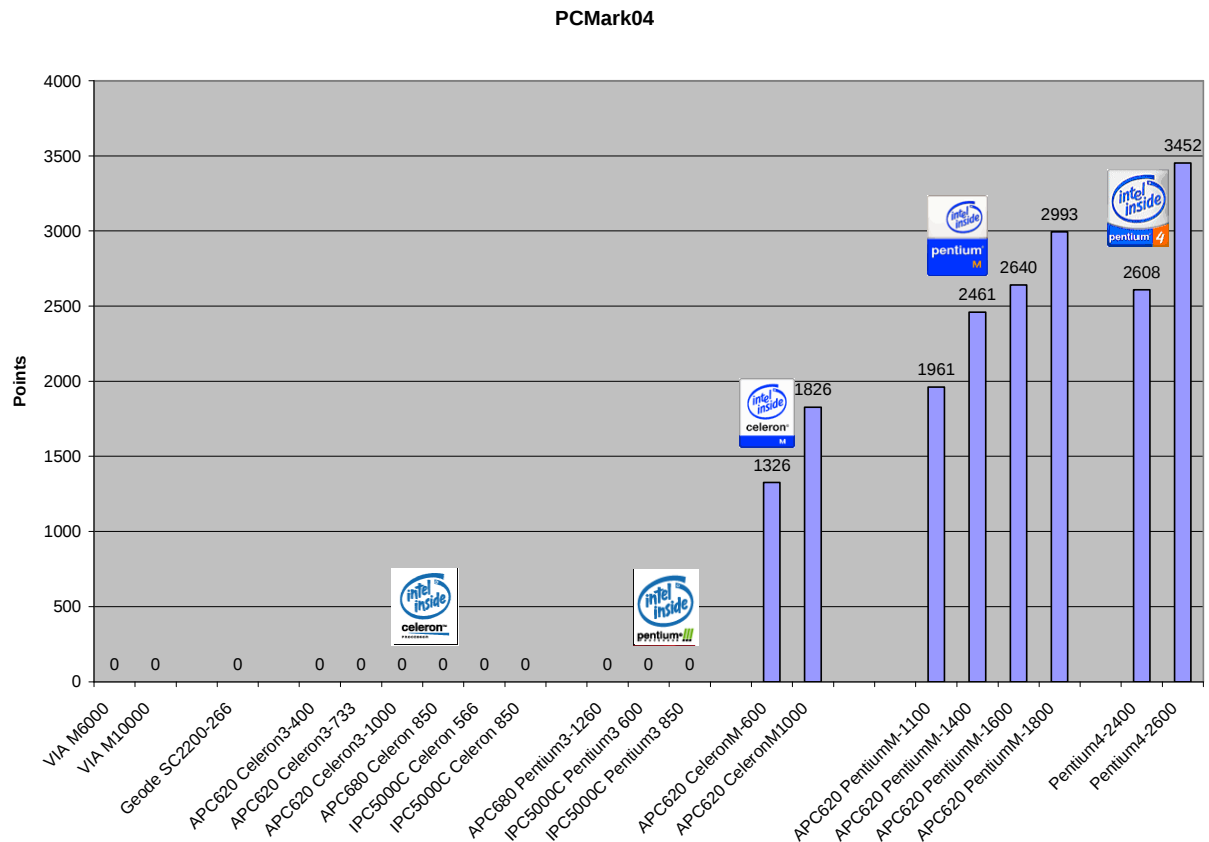


Figure 8 – Results for PCMark04

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

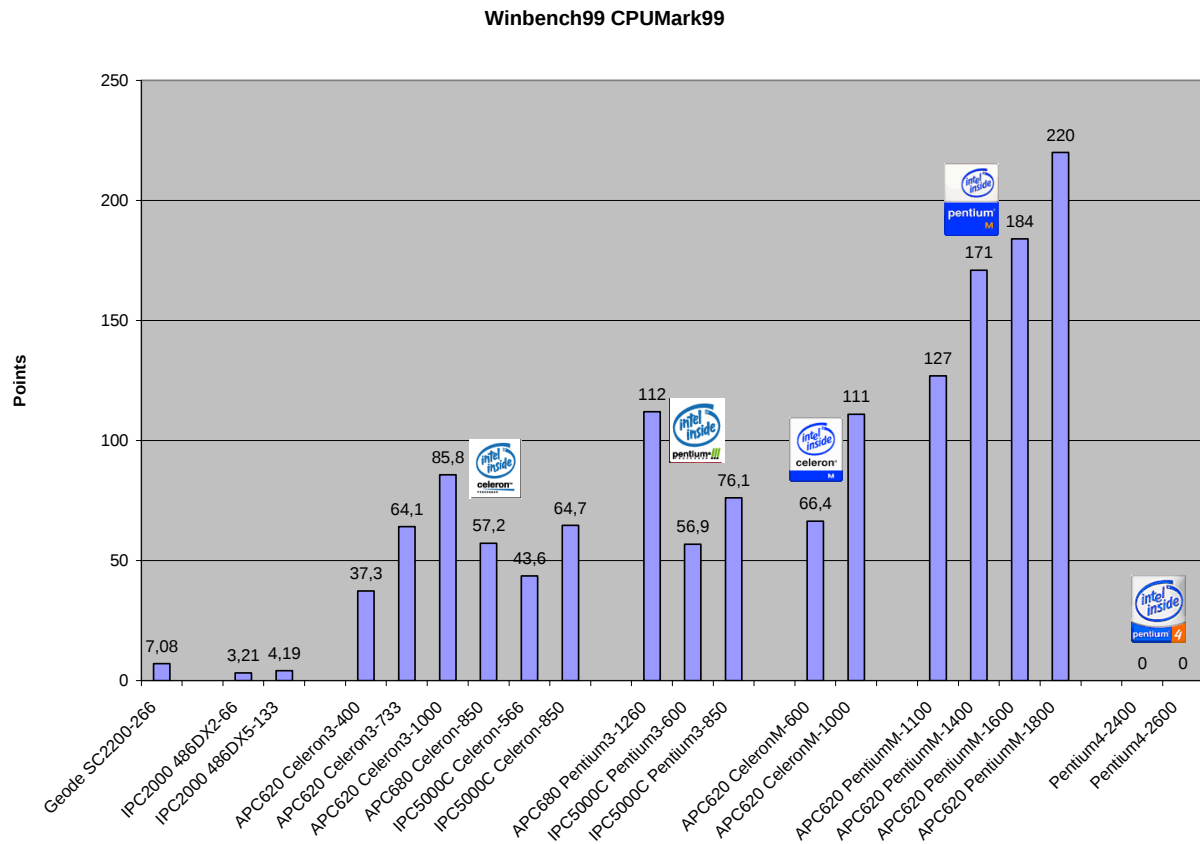


Figure 9 – Results for WinBench99 CPUMark99

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

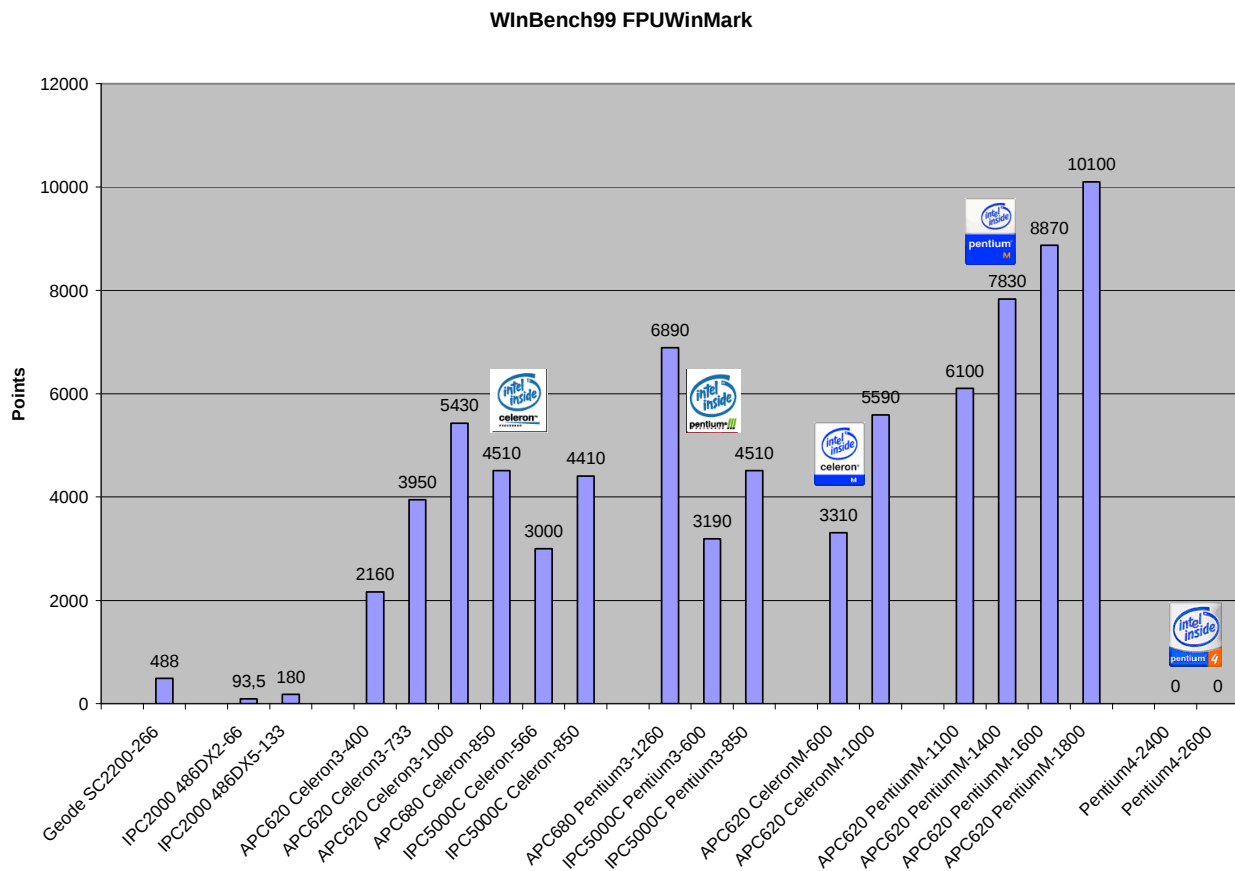


Figure 10 – Results for WinBench99 FPUWinMark

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

WinBench99 Direct Draw Test

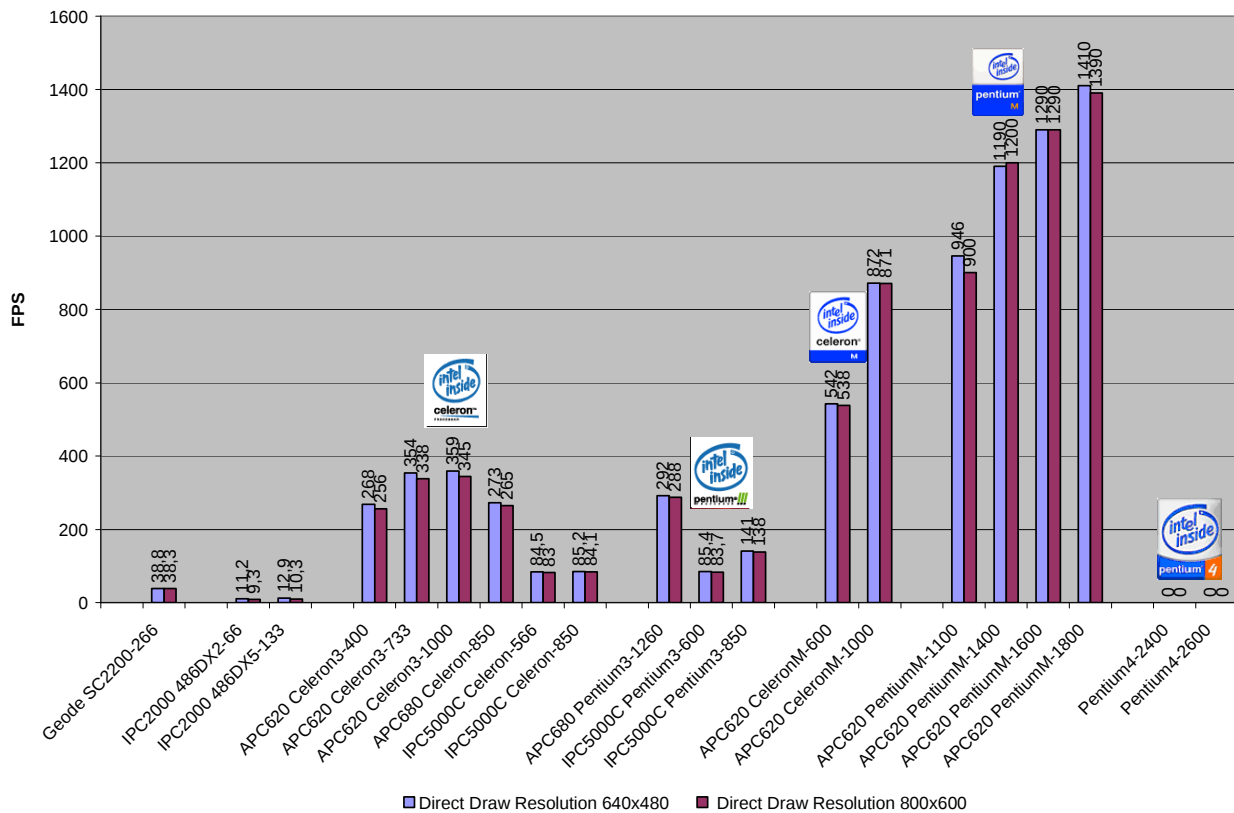


Figure 11 – Results for WinBench99 Direct Draw

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

WinBench99 Disk Inspection Test

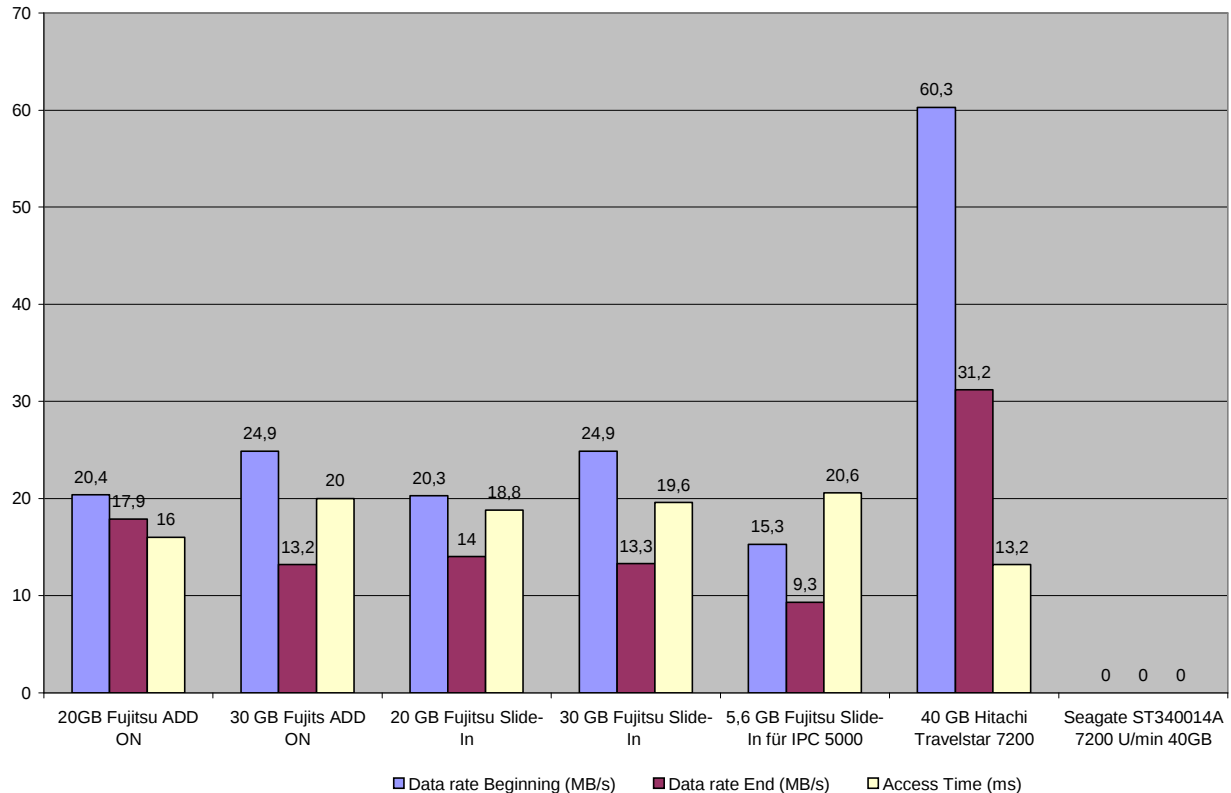


Figure 12 - Results for WinBench99 Disc Inspection Test

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

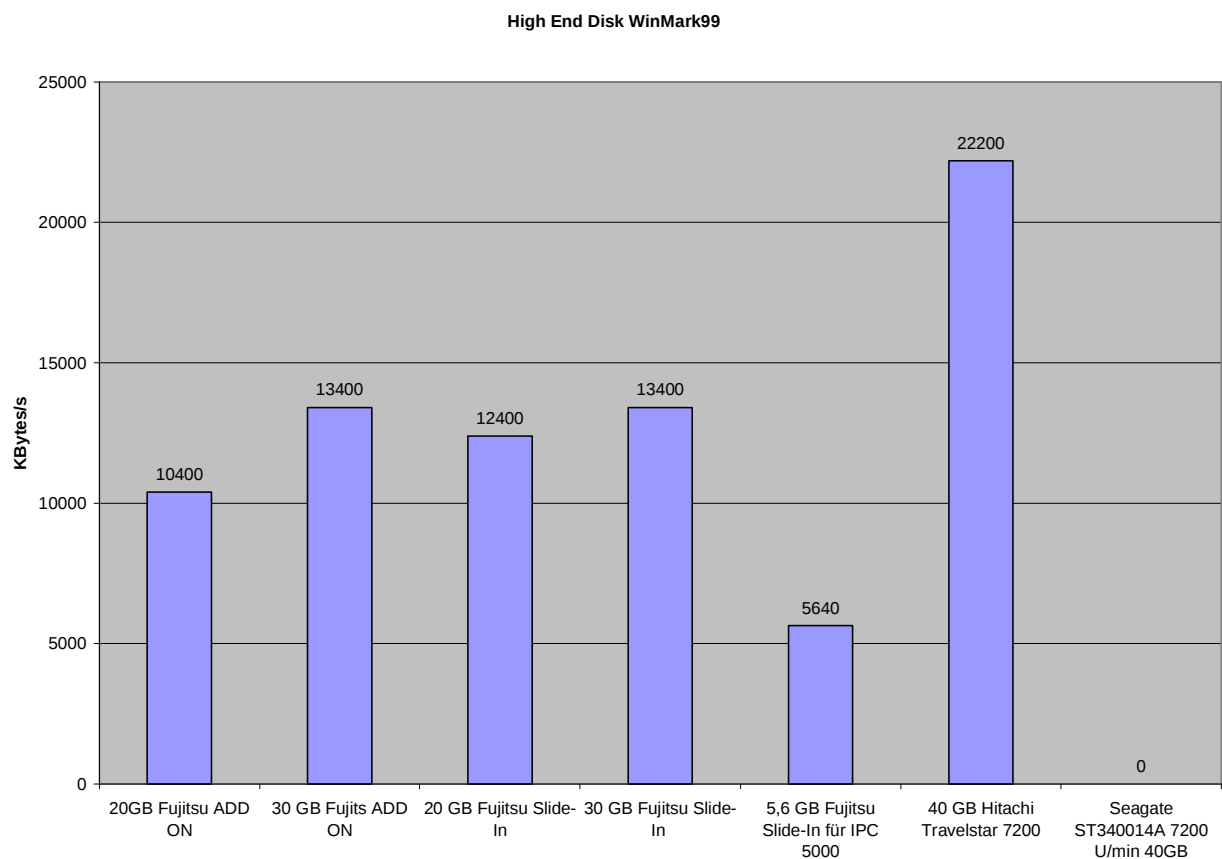


Figure 13 – Results for WinBench99 High End Disk WinMark99

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

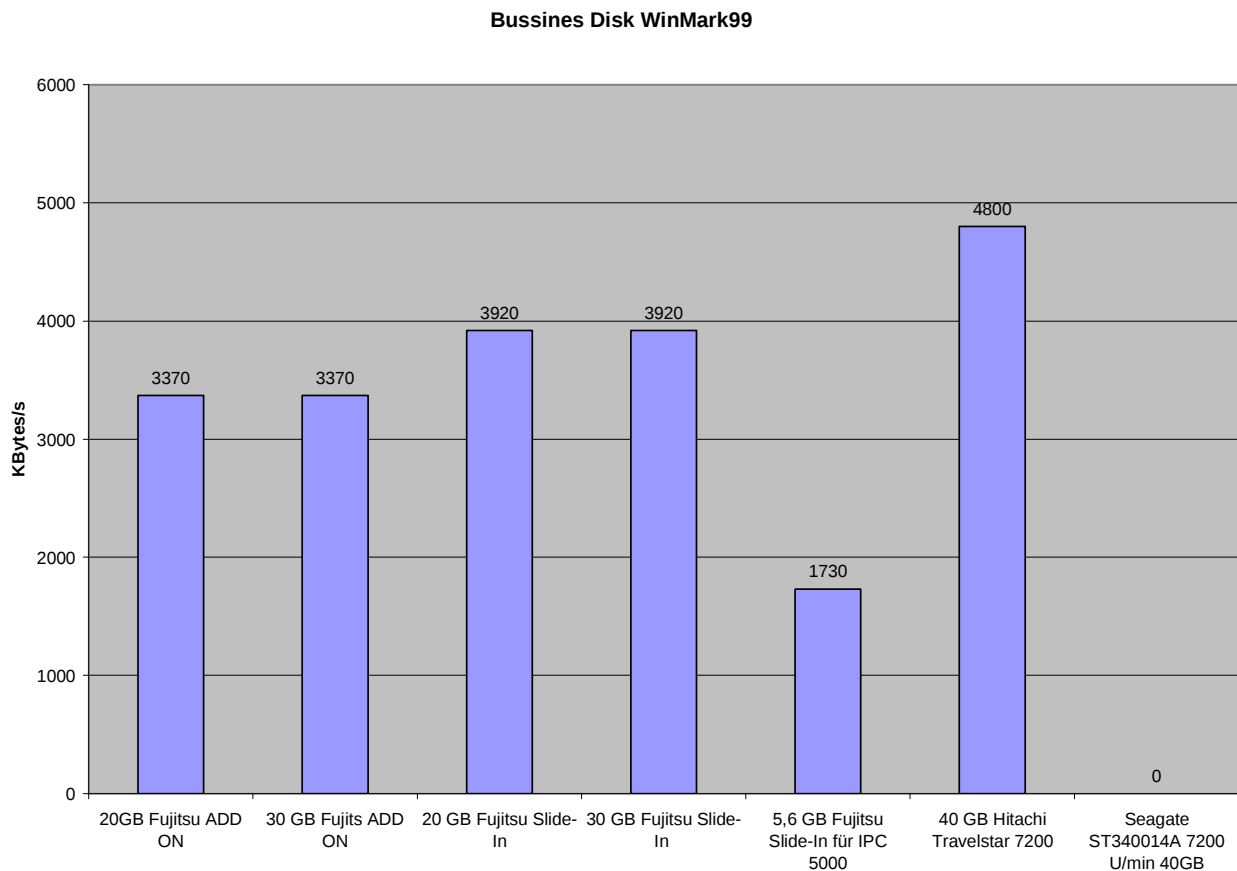


Figure 14 – Results for WinBench99 Business Disk WinMark99

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

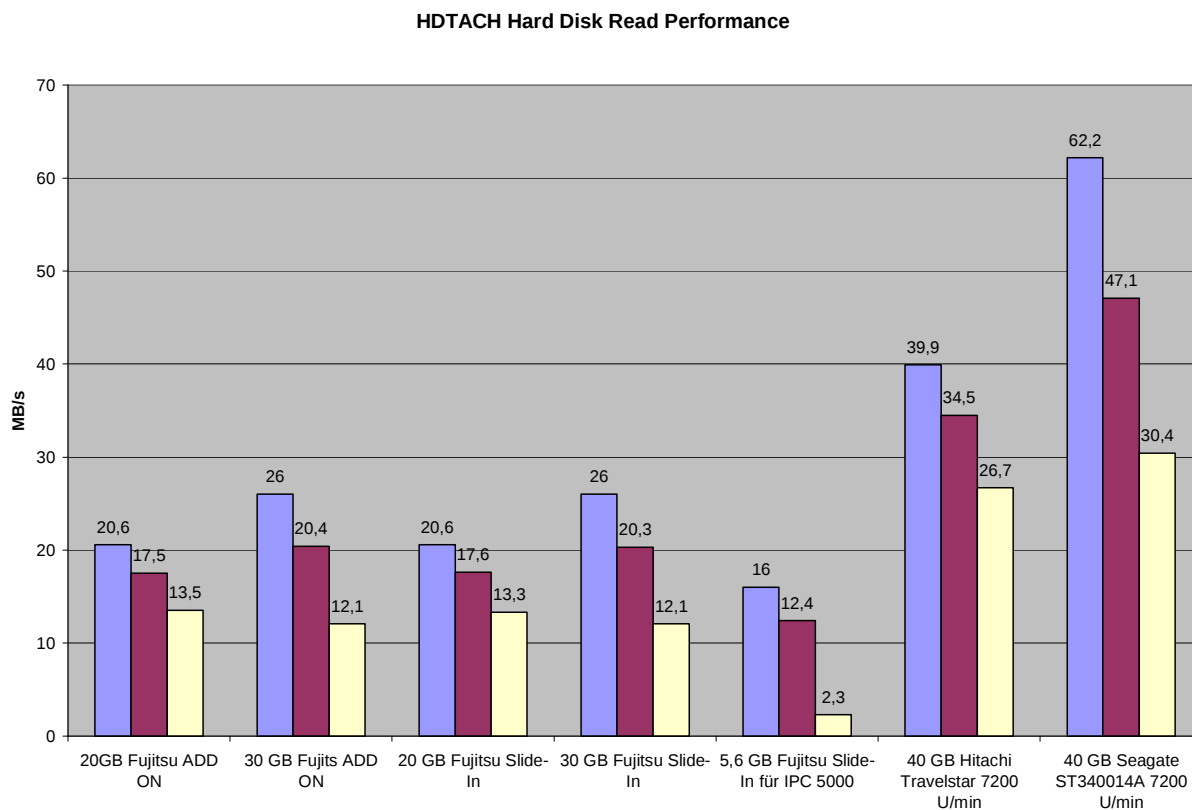


Figure 15 – Results for HDTACH read speed

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

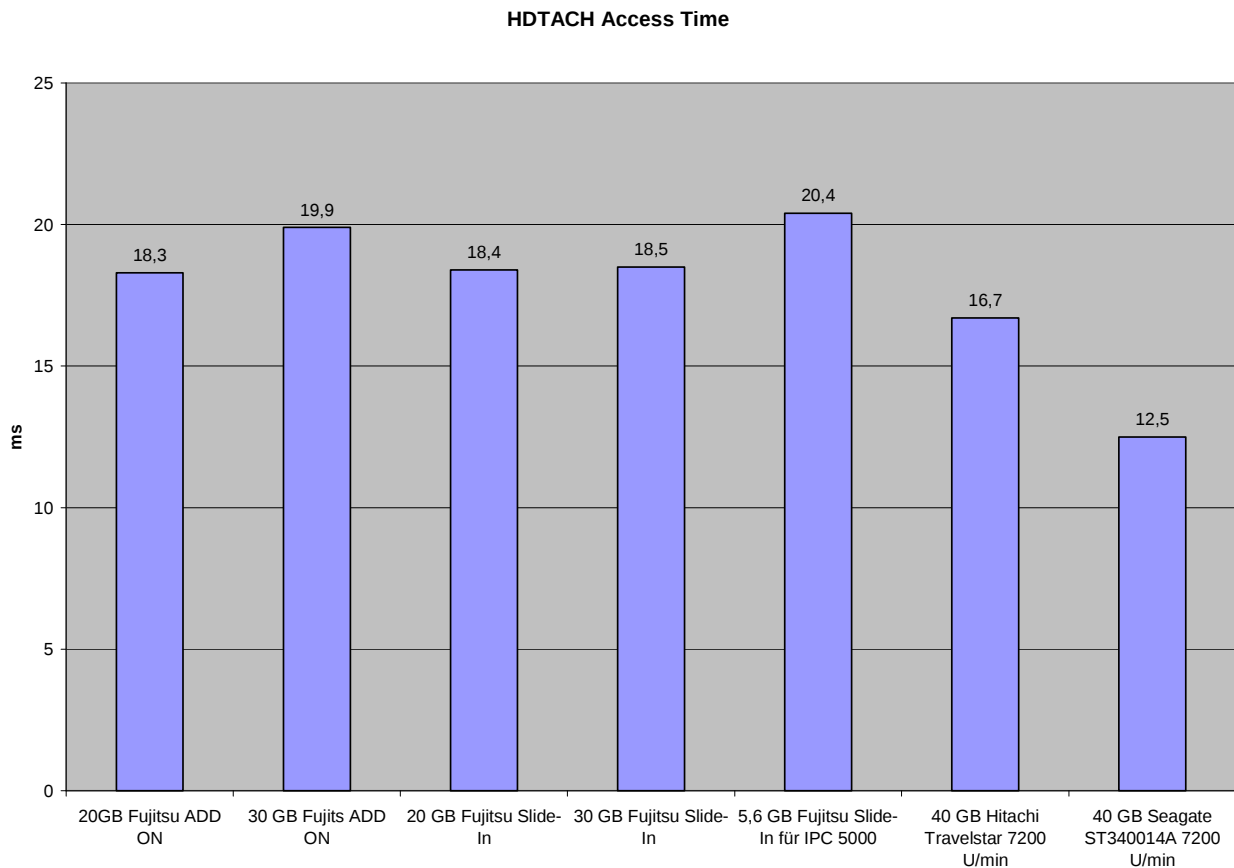


Figure 16 – Results for HDTACH access time measurement

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

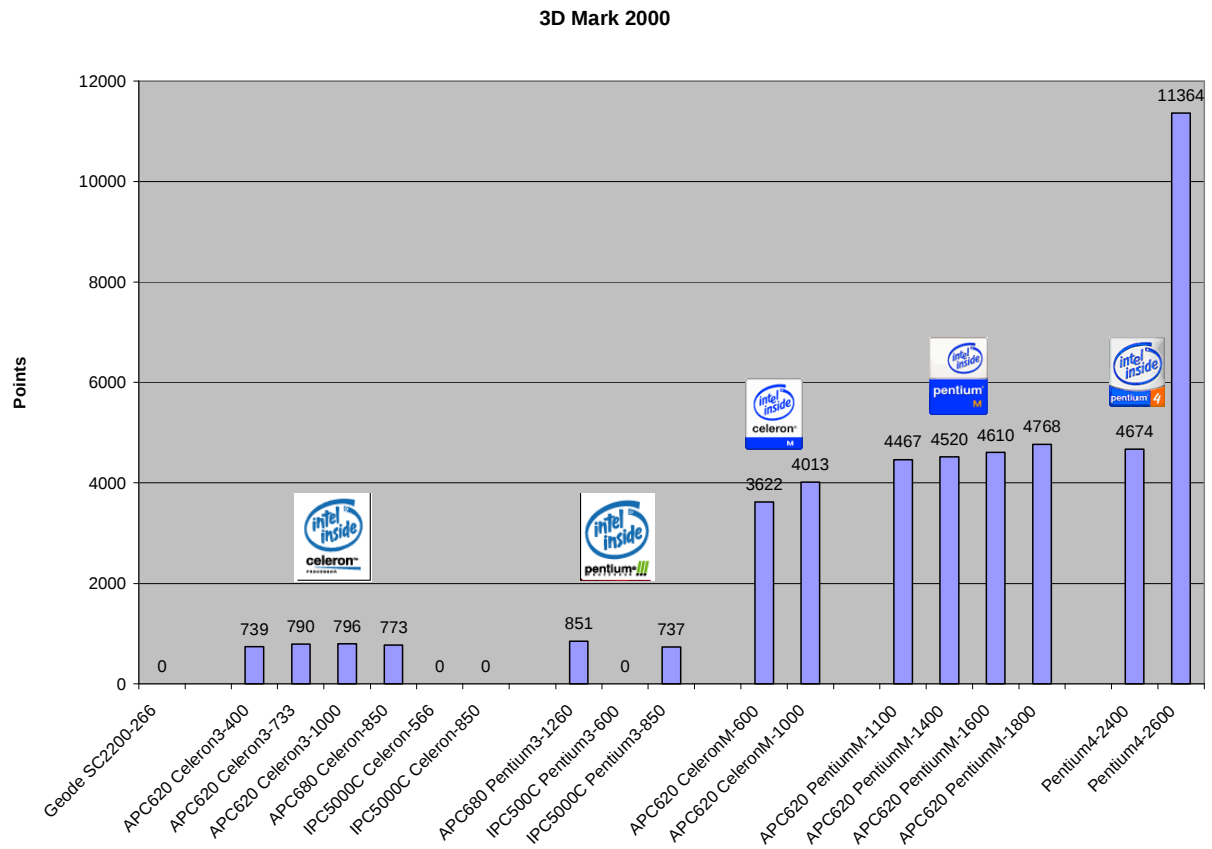


Figure 17 – Results for 3D Mark 2000

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

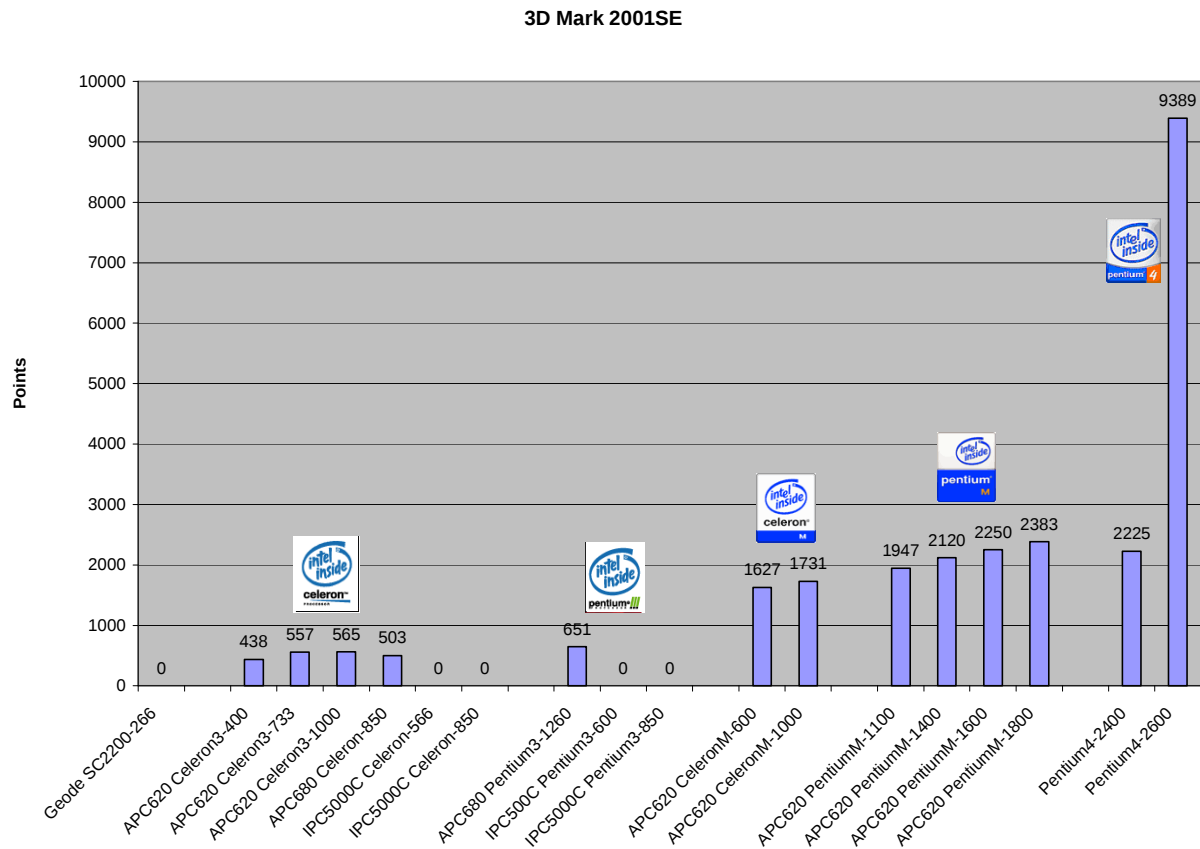


Figure 18 – Results for 3D Mark 2001SE

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

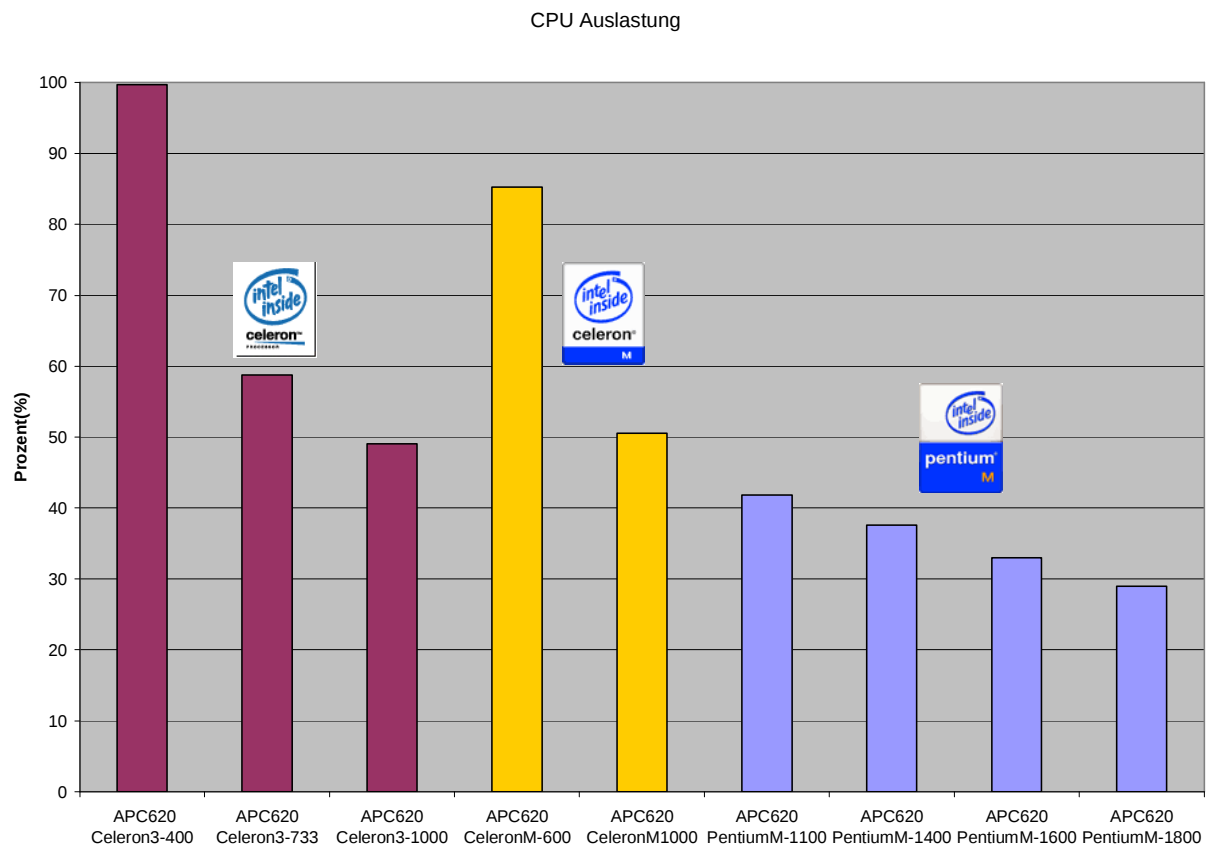
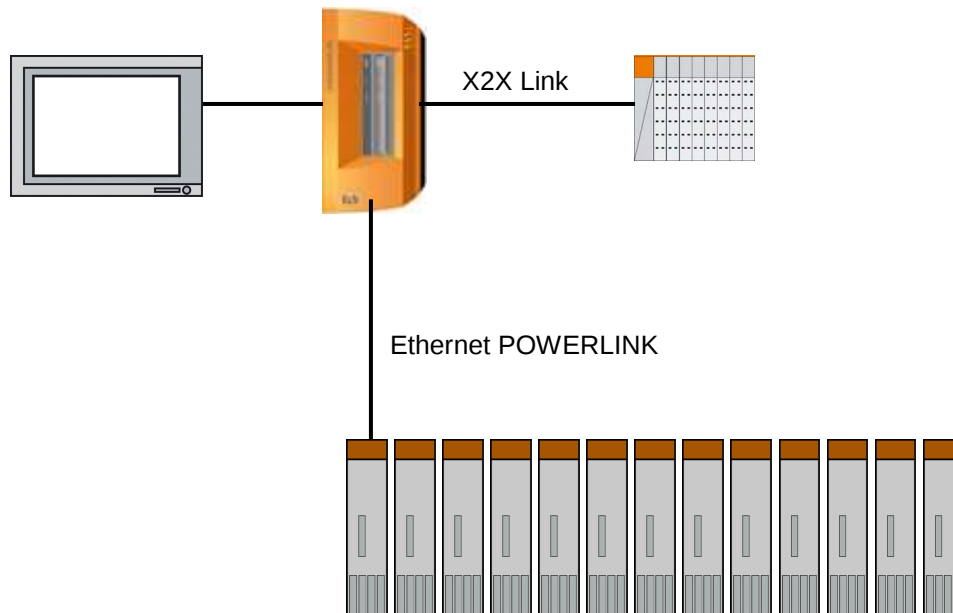


Figure 19 – B&R Automation Runtime AR010 Version E2.82

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 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 POWERLINK 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 sub-systems 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

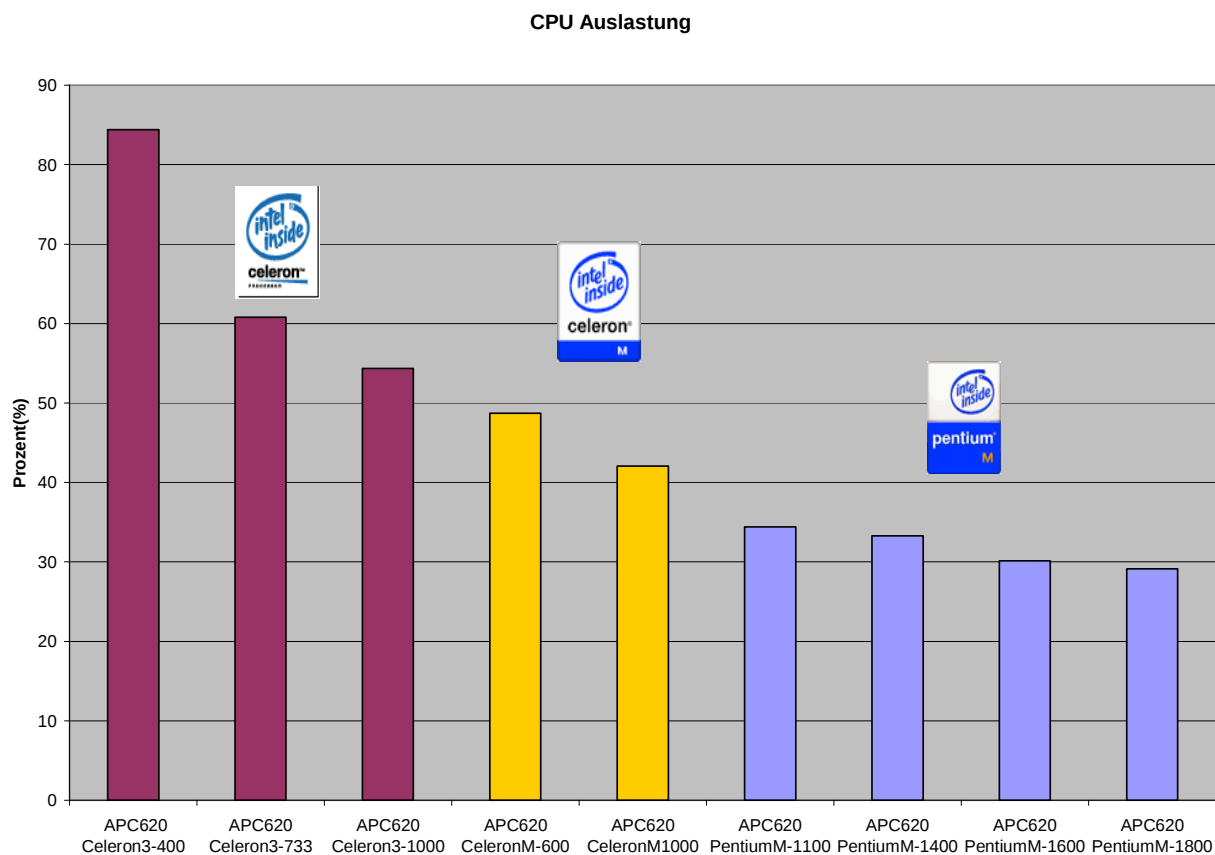


Figure 20 – B&R Automation Runtime AR106 Version B2.83

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
16	Pentium M 1,4 GHz, 512MB DDR-SDRAM	4563	3409
18	Pentium M 1.8 GHz, 1024MB DDR-SDRAM	5845	4383
APC810 with INTEL 945GME 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
29	Atom N270 1,6GHz, 2x2048MB DDR2-SDRAM	4035	3370
APC810 with INTEL GM45 chipset			
30	Core 2 Duo 2,53 GHz, 2x2048MB DDR3-SODIMM	23349	18754
32	Core 2 Duo 2,26 GHz, 2x2048MB DDR3-SODIMM	20881	16755
APC620 with INTEL 945GME chipset			
31	Atom N270 1,6GHz, 1024MB DDR2-SDRAM	4039	3361
INTEL Evalboard with INTEL US15W Chipsatz			
33	Atom Z530 1,6GHz, 1024MB DDR2-SDRAM	3998	3345
PP500 (5PP520.1505-00 + 5PP5CP.US15-01)			
34	Atom Z520 1,33GHz, 2048MB DDR2-SDRAM	3363	2809

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

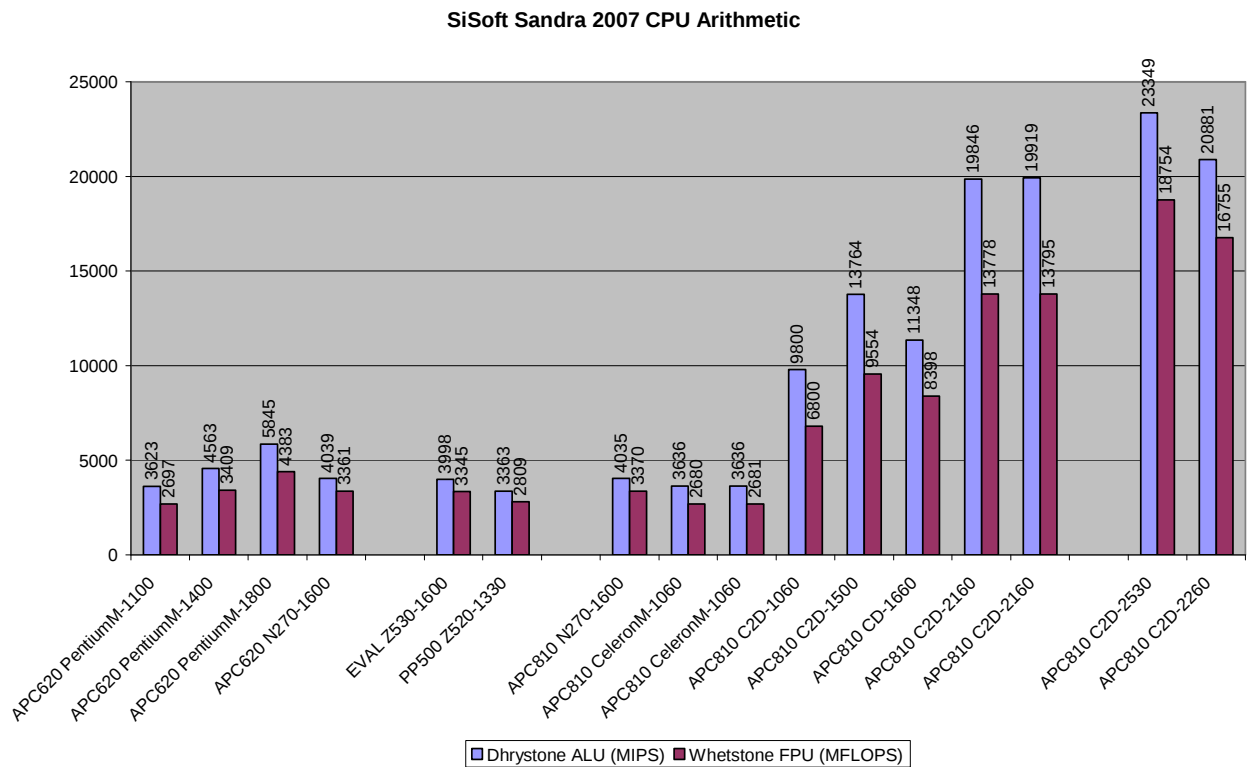


Figure 21 - Results for Sisoft Sandra Pro Business 2007 CPU Arithmetic

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
16	Pentium M 1,4 GHz, 512MB DDR-SDRAM	13044	14753
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
29	Atom N270 1,6GHz, 2x2048MB DDR2-SDRAM	29487	19806
APC810 with INTEL GM45 chipset			
30	Core 2 Duo 2,53 GHz, 2x2048MB DDR3-SODIMM	140199	75771
32	Core 2 Duo 2,26 GHz, 2x2048MB DDR3-SODIMM	125342	67757
APC620 with INTEL 945GME chipset			
31	Atom N270 1,6GHz, 1024MB DDR2-SDRAM	29569	19880
INTEL Evalboard with INTEL US15W Chipsatz			
33	Atom Z530 1,6GHz, 1024MB DDR2-SDRAM	29249	19650
PP500 (5PP520.1505-00 + 5PP5CP.US15-01)			
34	Atom Z520 1,33GHz, 2048MB DDR2-SDRAM	24634	16550

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

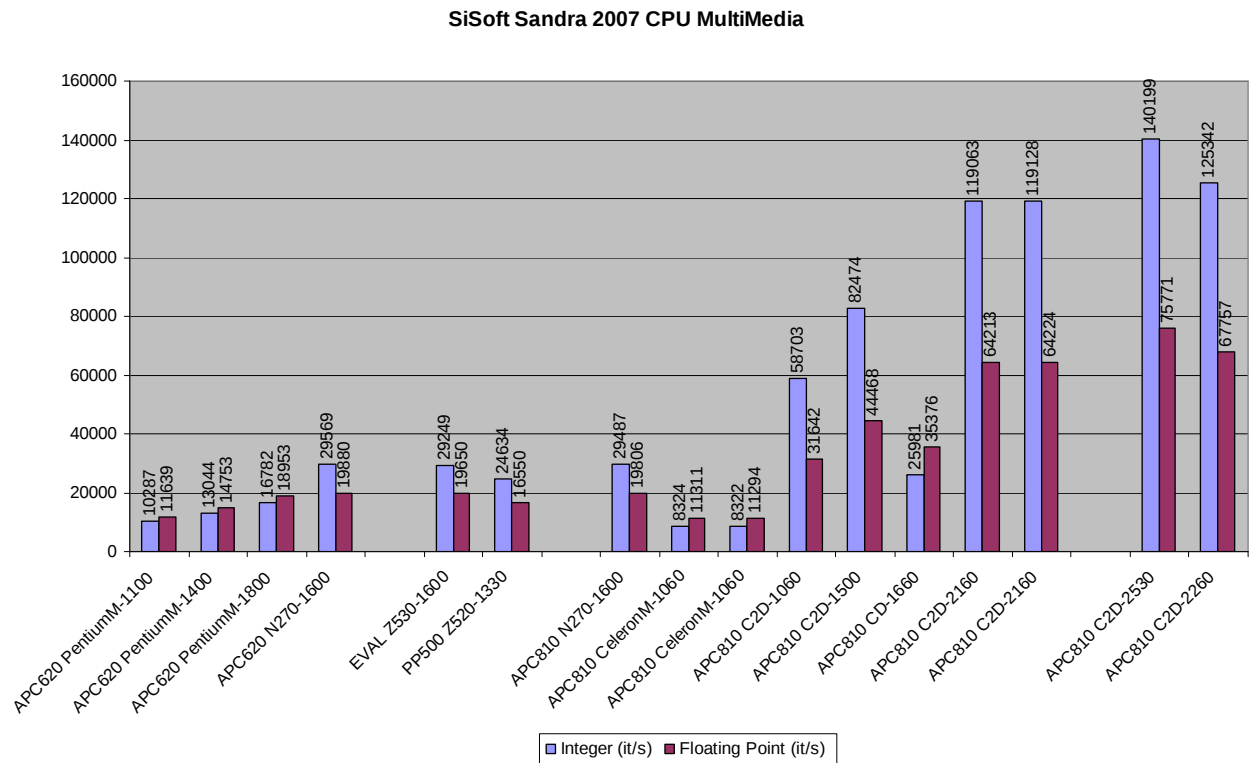


Figure 22 - Results for Sisoft Sandra Pro Business 2007, CPU Multi Media

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
16	Pentium M 1,4 GHz, 512MB DDR-SDRAM	1681	1694
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
29	Atom N270 1,6GHz, 2x2048MB DDR2-SDRAM	3224	2792
APC810 with INTEL GM45 chipset			
30	Core 2 Duo 2,53 GHz, 2x2048MB DDR3-SODIMM	5966	5957
32	Core 2 Duo 2,26 GHz, 2x2048MB DDR3-SODIMM	5819	5830
APC620 with INTEL 945GME chipset			
31	Atom N270 1,6GHz, 1024MB DDR2-SDRAM	2931	2587
INTEL Evalboard with INTEL US15W Chipsatz			
33	Atom Z530 1,6GHz, 1024MB DDR2-SDRAM	2863	2468
PP500 (5PP520.1505-00 + 5PP5CP.US15-01)			
34	Atom Z520 1,33GHz, 2048MB DDR2-SDRAM	2752	2407

1) See information

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

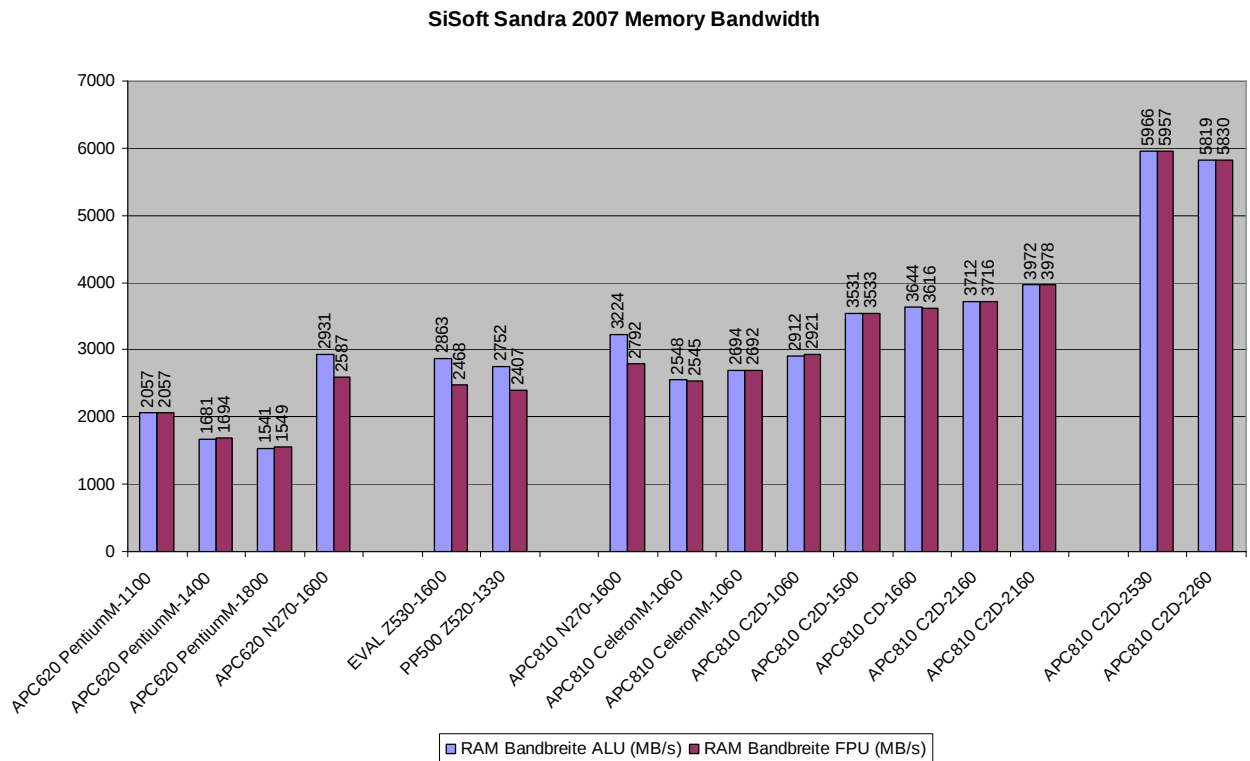


Figure 23 - Results for Sisoft Sandra Pro Business 2007, CPU Memory Bandwidth

Information:

The memory bandwidth test for the APC620 with PM-1100, PM-1400 and PM-1800 returns values that are "not plausible", since according to this test the PM-1100 would be faster than the PM-1400 and 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
16	Pentium M 1,4 GHz, 512MB DDR-SDRAM	4310	19,8
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
29	Atom N270 1,6GHz, 2x2048MB DDR2-SDRAM	4844	4,9
APC810 with INTEL GM45 chipset			
30	Core 2 Duo 2,53 GHz, 2x2048MB DDR3-SODIMM	26899	39
32	Core 2 Duo 2,26 GHz, 2x2048MB DDR3-SODIMM	24064	35,2
APC620 with INTEL 945GME chipset			
31	Atom N270 1,6GHz, 1024MB DDR2-SDRAM	4299	6,2
INTEL Evalboard mit INTEL US15W Chipsatz			
33	Atom Z530 1,6GHz, 1024MB DDR2-SDRAM	3766	7,4
PP500 (5PP520.1505-00 + 5PP5CP.US15-01)			
34	Atom Z520 1,33GHz, 2048MB DDR2-SDRAM	3714	6

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

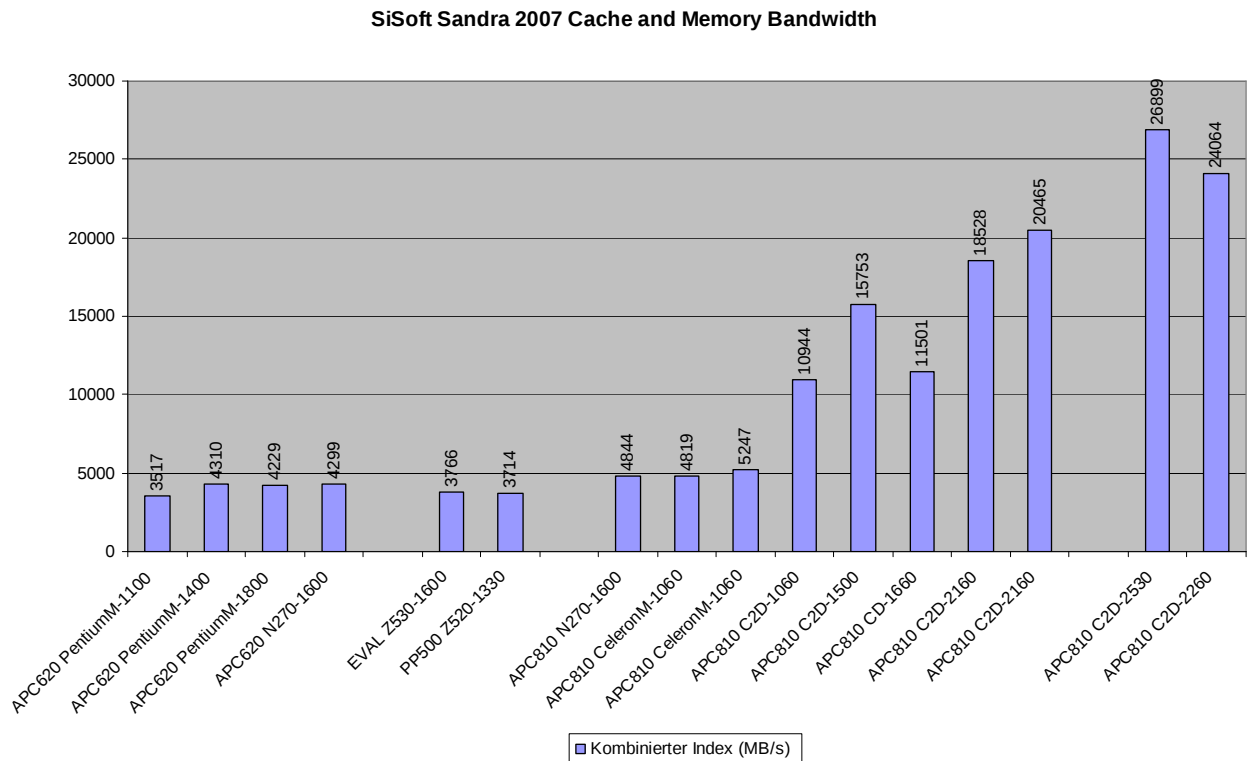


Figure 24 - Results for SiSoft Sandra Pro Business 2007, cache and memory bandwidth

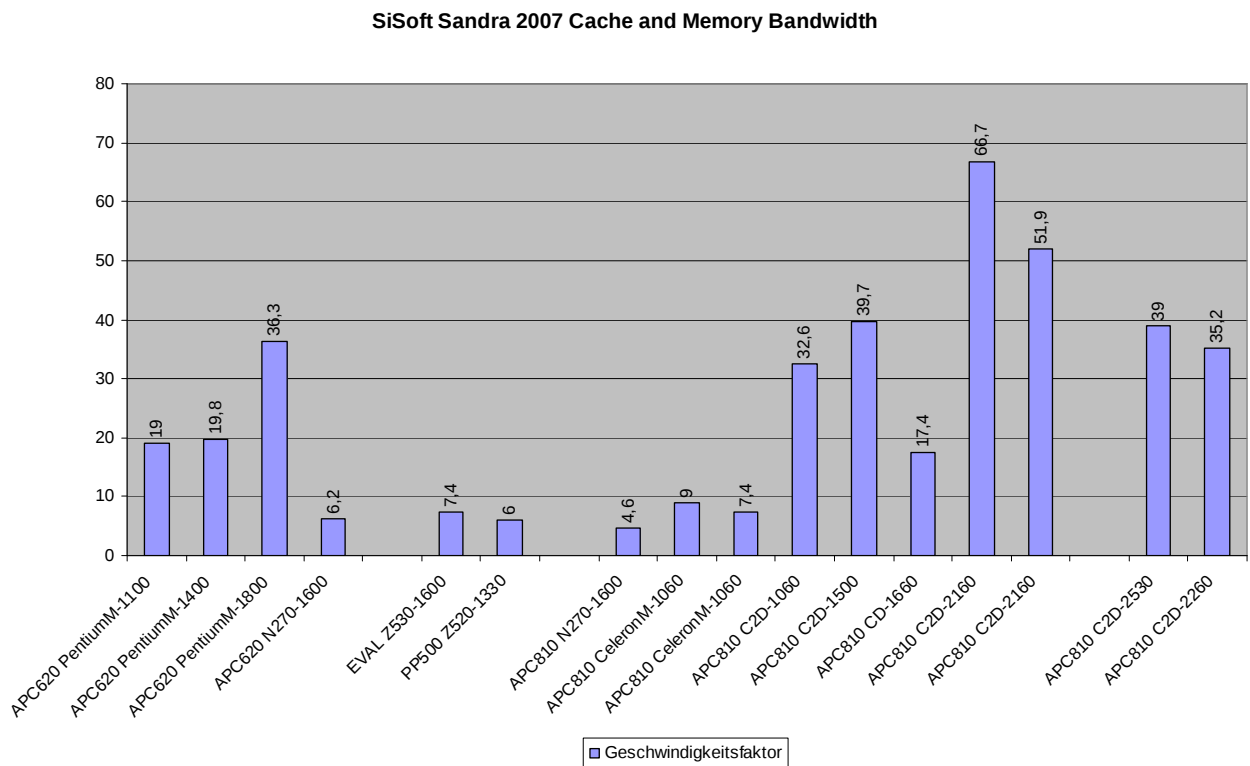


Figure 25 – Results for SiSoft Sandra Pro Business 2007, cache and memory bandwidth

4.11.5 Physical devices / removeable devices

This test determines the performance of physical devices (HDD) and removeable devices (compact flash, USB memory stick). Therefore big datapackages are being transferd (reading speed / writing speed). The result ist the maximal performance in MB/s.

#	Test device	Reading speed (MB/s)	Writing speed (MB/s)
APC620 with INTEL 855GME chipset			
30	Pentium M 1,4 GHz, 1024MB DDR-SDRAM Siliconsystems INC 1 GB card (NTFS)	9,83	4,36
30	Pentium M 1,4 GHz, 1024MB DDR-SDRAM B&R Compact Flash 1 GB card (NTFS)	37,13	9,83
APC810 with INTEL GM45 chipset			
29	Core 2 Duo 2,53 GHz, 2x2048MB DDR3-SODIMM Siliconsystems INC 1 GB card (NTFS)	9,83	4,36
29	Core 2 Duo 2,53 GHz, 2x2048MB DDR3-SODIMM B&R Compact Flash 1 GB card (NTFS)	37,13	9,83
APC810 with INTEL 945GME chipset			
24	Core 2 Duo 1,50 GHz, 2x512MB DDR2-SDRAM Siliconsystems INC 1 GB card (NTFS)	9,83	4,36
24	Core 2 Duo 1,50 GHz, 2x512MB DDR2-SDRAM B&R Compact Flash 1 GB card (NTFS)	37,13	9,83
24	Core 2 Duo 1,50 GHz, 2x512MB DDR2-SDRAM Compact Slide In SATA 40 GB HDD (NTFS)	41,52	38,23
24	Core 2 Duo 1,50 GHz, 2x512MB DDR2-SDRAM USB 2.0 Memory Stick 1 GB (5MMUSB.1024-01)	18,57	6,55

Table 32: Results for SiSoft Sandra Pro Business 2007, physical devices / removeable devices

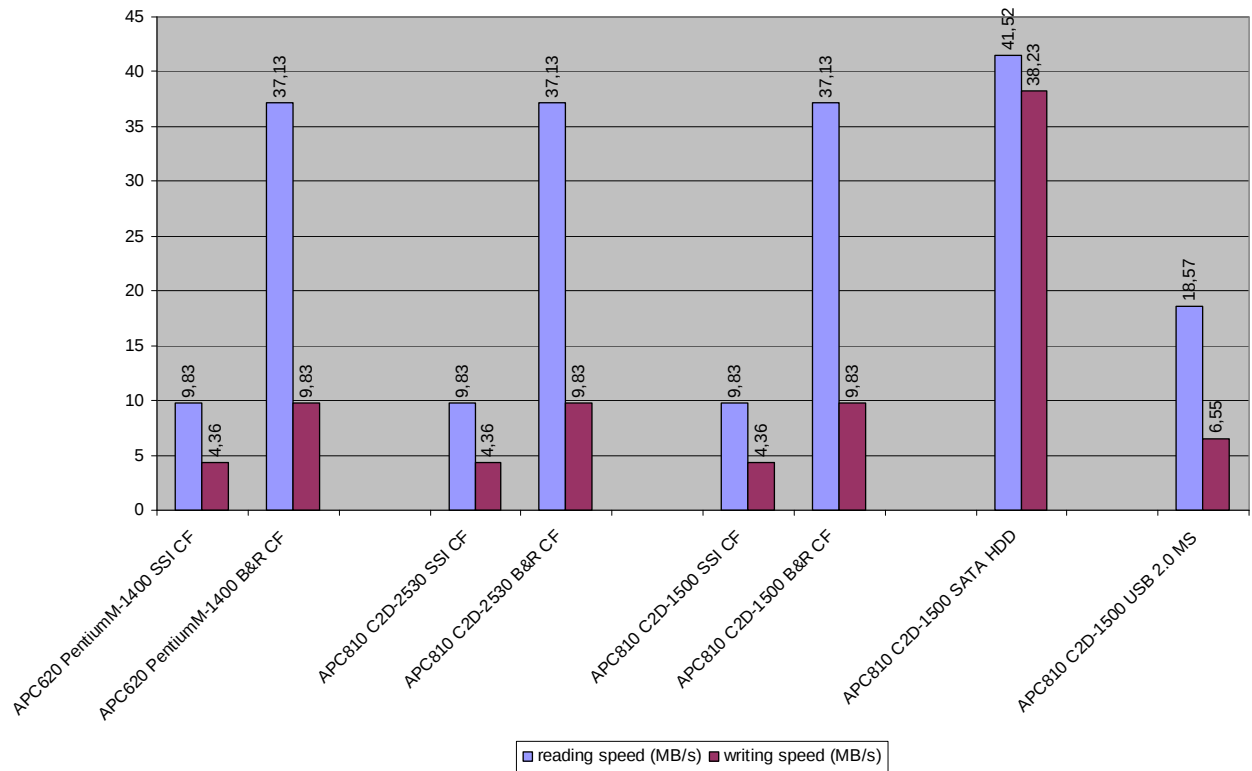


Figure 26 – Results for Sisoft Sandra Pro Business 2007, physical devices / removeable devices

5 Figure Index

Figure 1 - Results for Sisoft Sandra 2002 Prof. CPU arithmetic	11
Figure 2 – Results for Sisoft Sandra 2002 Prof. CPU multimedia.....	14
Figure 3 – Results for Sisoft Sandra 2002 Prof. memory bandwidth	16
Figure 4 – Results for Sisoft Sandra 2005 SR1. CPU arithmetic	18
Figure 5 – Results for Sisoft Sandra 2005 SR1. CPU multimedia	20
Figure 6 – Results for Sisoft Sandra 2005 SR1. Memory bandwidth	22
Figure 7 – Results for PCMark2002	24
Figure 8 – Results for PCMark04	26
Figure 9 – Results for WinBench99 CPUMark99	28
Figure 10 – Results for WinBench99 FPUWinMark	30
Figure 11 – Results for WinBench99 Direct Draw	32
Figure 12 - Results for WinBench99 Disc Inspection Test.....	33
Figure 13 – Results for WinBench99 High End Disk WinMark99	35
Figure 14 – Results for WinBench99 Business Disk WinMark99.....	37
Figure 15 – Results for HDTACH read speed	39
Figure 16 – Results for HDTACH access time measurement.....	40
Figure 17 – Results for 3D Mark 2000	42
Figure 18 – Results for 3D Mark 2001SE.....	44
Figure 19 – B&R Automation Runtime AR010 Version E2.82	46
Figure 20 – B&R Automation Runtime AR106 Version B2.83	49
Figure 21 - Results for Sisoft Sandra Pro Business 2007 CPU Arithmetic	51
Figure 22 - Results for Sisoft Sandra Pro Business 2007, CPU Multi Media.....	53
Figure 23 - Results for Sisoft Sandra Pro Business 2007, CPU Memory Bandwidth	55
Figure 24 - Results for Sisoft Sandra Pro Business 2007, cache and memory bandwidth	57
Figure 25 – Results for Sisoft Sandra Pro Business 2007, cache and memory bandwidth.....	57
Figure 26 – Results for Sisoft Sandra Pro Business 2007, physical devices / removeable devices	59

6 Table Index

Table 1: Versions.....	2
Table 2: Distribution.....	2
Table 3: Safety notices	2
Table 4: Test location	3
Table 5: Devices being tested	7
Table 6: Hard disks and removeable devices used.....	8
Table 7: Benchmark programs used and the corresponding WEB links.....	9
Table 8: Results for Sisoft Sandra 2002 Prof. CPU arithmetic.....	11
Table 9: Results for Sisoft Sandra 2002 Prof CPU multimedia.....	13
Table 10: Results for Sisoft Sandra 2002 Prof CPU memory bandwidth.....	16
Table 11: Results for Sisoft Sandra 2005 SR1. CPU arithmetic	18
Table 12: Results for Sisoft Sandra 2005 SR1. CPU multimedia	19
Table 13: Results for Sisoft Sandra 2005 SR1. CPU memory bandwidth	21
Table 14: Results for PCMark2002	24
Table 15: Results for PCMark04	26
Table 16: Results for WinBench99 CPUMark99	28
Table 17: Results for WinBench99 FPUWinMark	29
Table 18: Results for WinBench99 Direct Draw	32
Table 19: Results for WinBench99 Disk Inspection Test	33
Table 20: Results for WinBench99 High End Disk WinMark99.....	35
Table 21: Results for WinBench99 Business Disk Winmark99.....	37
Table 22: Results for HDTACH 2.70 read speed	39
Table 23: Results for HDTACH access time measurement	40
Table 24: Results for 3D Mark 2000.....	41
Table 25: Results for 3D Mark 2001SE	43
Table 26: Results for AR010 Version E2.82.....	45
Table 27: Results for B&R AR106 Version B2.83	48
Table 28: Results for Sisoft Sandra Pro Business 2007, CPU Arithmetic.....	50
Table 29: Results for Sisoft Sandra Pro Business 2007, CPU Multimedia	52
Table 30: Results for Sisoft Sandra Pro Business 2007, CPU Memory Bandwidth.....	54
Table 31: Results for Sisoft Sandra Pro Business 2007, cache and memory bandwidth.....	56
Table 32: Results for Sisoft Sandra Pro Business 2007, physical devices / removeable devices.....	58

7 Index

3

3D Mark 2000	9, 40, 41
3D Mark 2001SE	9, 42, 43

A

AMD 486DX2	6, 10, 12, 14, 26, 28, 30
AMD 486DX5	6, 10, 12, 14, 26, 28, 30
ATI	
Radeon 9600	6
Rage Mobility	6

B

B&R	
Automation Runtime AR010 Version E2.82....	44, 45, 47
Automation Runtime AR106 Version B2.83....	46

C

Chips & Technologies 65535	6
Chips & Technologies 69000	6

D

Devices being tested	6, 7
Distribution	2

F

Figure Index	58
--------------------	----

G

Geode6, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 40, 42	
--	--

H

Hardware	6
HDTach V2.70	9

I

Intel	
82815 Graphics	6
82855 GME Graphic	6
82865G Graphics	6
Celeron 3 ...	6, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 40, 42, 44, 47
Celeron M ..	6, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 40, 42, 44, 47
Pentium 3 ..	6, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 40, 42
Pentium 4 ..	6, 10, 12, 14, 16, 18, 20, 22, 24, 26, 27, 28, 29, 30, 31, 40, 42
Pentium M ..	6, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 40, 42, 44, 47, 48, 50, 52, 54

L

Listing Index	60
---------------------	----

P

PC Mark 2002	9, 23
PC Mark04	9

S

Safety Notices	2
Sisoft	
Sandra 2002 Prof	10, 11, 12, 13, 14, 15
Sandra 2005 SR1	16, 17, 18, 19, 20, 21

T

Table Index	59
-------------------	----

V

Versions	2
----------------	---

W

WinBench99 ...	9, 26, 28, 30, 32, 33, 34, 35, 36, 37
----------------	---------------------------------------