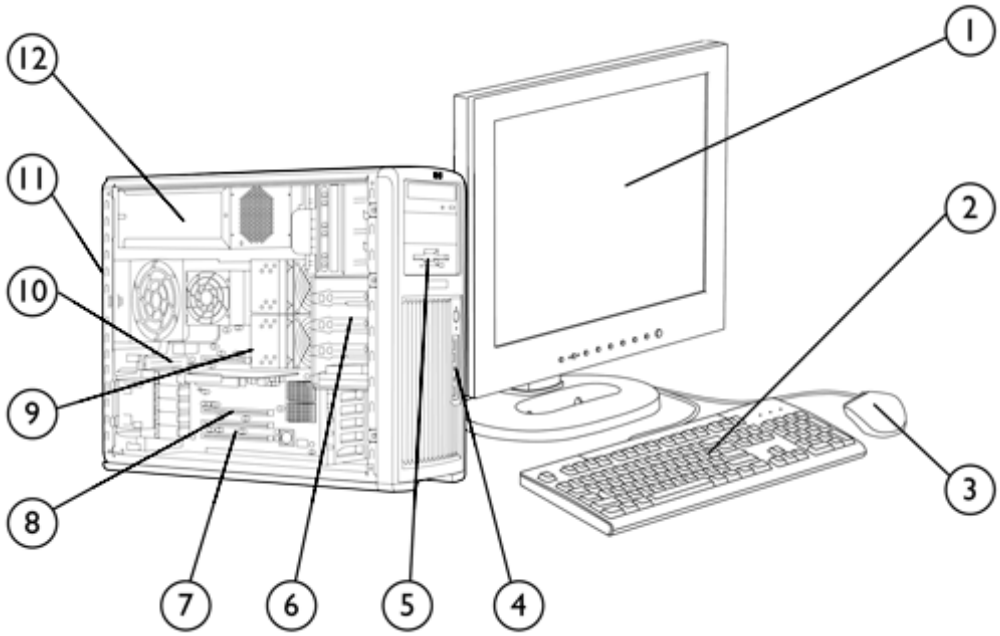
Overview

HP recommends Windows Vista® Business



1. Monitor (sold separately)
2. Standard Keyboard (USB or PS/2)
3. Mouse (USB or PS/2)
4. Front IO: 2 USB 2.0, IEEE-1394 (standard), headphone and microphone
5. 5.25" external bay for optional diskette drive, optical drive or additional 5.25"/3.5" device
6. 5 internal 3.5" bays, 3 external 5.25" bays
7. 1 PCI, 2 PCI-X slots, 2 PCI Express x8 slots
8. 2 PCI Express x16 Graphics slots
9. Dual-Core AMD Opteron™ Processors 2200 series
10. 8 DIMM slots for DDR2 memory
11. 6 USB 2.0, 1 standard serial port, 1 IEEE 1394, 2 PS/2, 2 RJ-45, SPDIF out, audio in/out, microphone
12. 1050 w 80+ power supply

Overview

Form Factor	Minitower
Compatible Operating Systems	HP Linux Installer Kit for Linux (includes drivers for both 32-bit & 64-bit OS versions of Red Hat Enterprise Linux WS4 and WS5 - see: http://www.hp.com/workstations/software/linux) Red Hat Enterprise Linux(RHEL) 5 Desktop/Workstation preload - 64 bit version For detailed OS/hardware support information for Linux, see: http://www.hp.com/support/linux_hardware_matrix
Available Processors	Dual-Core AMD Opteron 2220/ 2.8 GHz, 1 MB L2 cache per core Dual-Core AMD Opteron 2222/ 3.0 GHz, 1 MB L2 cache per core Quad-Core AMD Opteron 2378/ 2.4 GHz, 512 KB L2 cache per core, 6MB shared L3 Quad-Core AMD Opteron 2380/ 2.5 GHz, 512 KB L2 cache per core, 6MB shared L3 Quad-Core AMD Opteron 2387/ 2.8 GHz, 512 KB L2 cache per core, 6MB shared L3 Quad-Core AMD Opteron 2389/ 2.9 GHz, 512 KB L2 cache per core, 6MB shared L3 Quad-Core AMD Opteron 2393SE/ 3.1 GHz, 512 KB L2 cache per core, 6MB shared L3 (AVAILABLE JUNE 2009)
Additional Details	• Up to 64 GB of DDR memory, with dual CPUs and 8 GB DIMMs, using integrated CPU memory controllers • Dual PCI Express x16 graphics slots • Support for NVIDIA Scalable Link Interface to link dual graphics cards • Dual integrated NVIDIA Gigabit ethernet • Six channel SATA 3 Gb/s and 8 channel SAS controller, with factory-configured RAID* • Integrated HD audio with internal speaker • Pre-loaded Manageability tools (Microsoft Windows only) • Protected by HP Services, including a 3 years parts, 3 years labor, and 3 years onsite service (3/3/3) standard warranty. Terms and conditions vary by country. Certain restrictions and exclusions apply. NOTE: Factory integrated SATA RAID is Microsoft Windows only. Specific user-configured hardware SAS RAID configurations are supported on this Linux system. Please visit: http://www.hp.com/support/linux_hardware_matrix for details.

Supported Components

Processors

	Factory Configured	Option Kit	Option Kit Part Number	Support Notes
Quad-Core AMD Opteron™ 2300 Series Processors with AMD64 and AMD Virtualization				
Quad-Core AMD Opteron 2378/ 2.4 GHz, 512 KB L2 cache per core, 6MB shared L3	Y	Y	FZ810AA	
Quad-Core AMD Opteron 2380/ 2.5 GHz, 512 KB L2 cache per core, 6MB shared L3	Y	Y	FZ811AA	
Quad-Core AMD Opteron 2387/ 2.8 GHz, 512 KB L2 cache per core, 6MB shared L3	Y	Y	NH256AA	
Quad-Core AMD Opteron 2389/ 2.9 GHz, 512 KB L2 cache per core, 6MB shared L3	Y	Y	NT236AA	
Quad-Core AMD Opteron 2393SE/ 3.1 GHz, 512 KB L2 cache per core, 6MB shared L3 (AVAILABLE JUNE 2009)	Y	Y		
Dual-Core AMD Opteron Processor 2200 Series				
AMD Opteron Processor Model 2220 / 2.80 GHz, 1 MB L2 cache per core	Y	Y	RC403AA	
AMD Opteron Processor Model 2222 / 3.0 GHz, 1 MB L2 cache per core	Y	Y	RM697AA	

Dual- and Quad-Core are new technologies designed to improve performance of multithreaded software products and hardware-aware multitasking operating systems and may require appropriate operating system software for full benefit. Not all customers or software applications will necessarily benefit from use of this technology.

AMD's numbering is not a measurement of clock speed.

Actual bus clock rate is less for the 1 GHz AMD HyperTransport technology. Listed bus speed represents the effective data transfer rate.

Memory

Configure To Order (CTO)	Support Notes
PC2-5300 (DDR2-667 MHz) Memory Configurations	
HP 1GB (2x512) DDR2-667 ECC reg SingProc	
HP 2GB (2x1GB) DDR2-667 ECC reg SingProc	
HP 4GB (4x1GB) DDR2-667 ECC reg SingProc	
HP 4GB (2x2GB) DDR2-667 ECC reg SingProc	
HP 8GB (4x2GB) DDR2-667 ECC reg SingProc	
HP 2GB (4x512MB) DDR2-667 ECC reg	
HP 4GB (4x1GB) DDR2-667 ECC reg	
HP 6GB (4x1GB+4x512) DDR2-667 ECC reg	
HP 8GB (8x1GB) DDR2-667 ECC reg	
HP 12GB (4x2+4x1) DDR2-667 ECC reg	
HP 16GB (4x4GB) DDR2-667 ECC reg	
HP 16GB (8x2GB) DDR2-667 ECC reg	
HP 32GB (8x4GB) DDR2-667 ECC reg	

PC2-4200 (DDR2-533 MHz) Memory Configurations

HP 64GB (8x8GB) DDR2-533 ECC reg

Sub-Section Description/Notes: Dual Channel is only supported when the system is configured with DDR2 symmetric memory (i.e. 2 x 256).

After Market Options (AMO)

PC2-5300 (DDR2-667 MHz) Memory Modules

HP 512MB (1x512MB) DDR2-667 ECC Reg RAM

HP 1GB (1x1GB) DDR2-667 ECC Reg RAM

HP 2GB (1x2GB) DDR2-667 ECC Reg RAM

HP 4GB (1x4GB) DDR2-667 ECC Reg RAM

PC2-4200 (DDR2-533 MHz) Memory Modules

HP 8GB (1x8GB) DDR2-533 ECC Reg RAM

PCI Express Graphics

	Factory Configured	Option Kit	Option Kit Part Number	Support Notes	Supported Multi Mixed
Professional 2D					
NVIDIA Quadro NVS 290 256 MB PCIe Graphics Card with 'DMS-59 to Dual DVI cable' included – for Workstations	Y	Y	GN502AA	See support note 1	1
NVIDIA Quadro NVS 295 256MB PCIe Graphics Card	Y	Y	FY943AA	Available June 2009	1
Entry 3D					
NVIDIA Quadro FX 570 256 MB PCIe Graphics Card	Y	Y	GR521AA	See support note 1	1
NVIDIA Quadro FX 580 512MB PCIe Graphics Card	Y	Y	FY945AA	Available June 2009	1
Mid-range 3D					
NVIDIA Quadro FX 1700 512 MB PCIe Graphics Card	Y	Y	GP529AA	See support note 1	1
NVIDIA Quadro FX 1800 768MB PCIe Graphics Card	Y	Y	FY946AA	Available June 2009	1
High-end 3D					
NVIDIA Quadro FX 3700 512MB PCI-Express Graphics Card	Y	Y	KD506AA	See support note 1	1
NVIDIA Quadro FX 3800 1.0GB PCIe Graphics Card (AVAILABLE JUNE 2009)	Y	Y	FY949AA	Available June 2009	1

Supported Components

NVIDIA Quadro FX 5600 (PCI Express x16, 1.5 GB, Dual Dual-Link DVI, Stereo) Graphics Card	Y	Y	GU095AA		1
NVIDIA Quadro FX 4800 1.5GB PCIe Graphics Card	Y	Y	FQ138AA		1
NVIDIA Quadro FX 5800 4GB PCIe Graphics Card	Y	Y	FZ559AA	Available June 2009	1
NVIDIA Quadro CX – The Accelerator for Creative Suite	Y	Y		Available June 2009	1

NOTE To run the accelerated graphics driver on RHEL3 U4, download the latest driver. Please refer to the Release Notes Chapter in http://www.hp.com/support/linux_user_manual.

SUPPORT NOTE 1: May use two graphics cards. Must use matching graphics cards and order a second processor.

SAS Hard Drives

	Factory Configured	Option Kit	Option Kit Part Number	Support Notes
HP SAS (Serial Attached SCSI) Hard Drives for HP Workstations				
73 GB SAS 15K rpm 3Gb/s HDD	Y	Y	EA329AA	
146GB SAS 15K rpm 3Gb/s 3.5" HDD	Y	Y	EA330AA	
300GB SAS 15K rpm 3Gb/s 3.5" HDD	Y	Y	EM174AA	
450GB SAS 15K rpm 3Gb/s 3.5" HDD	Y	Y	FM803AA	

Sub-Section Description/Notes: * NCQ (Native Command Queuing) not supported in Red Hat Enterprise Linux
1 GB = 1 billion bytes. Actual formatted capacity is less. Up to 8 GB of hard drive (or system disk) is reserved for system recovery software (XP and XP Pro). Up to 12 GB of system disk is reserved for system recovery software (Vista).

SATA Hard Drives

SATA (Serial ATA) Hard Drives for HP Workstations				
80GB SATA 7200 rpm 3Gb/s 3.5" HDD	Y	Y	PY276AA	
160GB SATA 7200 rpm 3Gb/s 3.5" HDD	Y	Y	PV944A	
250GB SATA 7200 rpm 3Gb/s 3.5" HDD (for HP xw-Workstations)	Y	Y	EA788AA	
500GB SATA 7200 rpm 3Gb/s 3.5" HDD	Y	Y	PV943A	
1000GB (1TB) SATA 7200 rpm 3.0Gb/s 3.5" HDD	Y	Y	GE262AA	
80GB SATA 10K rpm SFF in 3.5" Frame HDD	Y	Y	EM172AA	
160GB SATA 10K rpm SFF in 3.5" Frame HDD	Y	Y	EW222AA	
300GB SATA 10K rpm SFF in 3.5" Frame HDD	Y	Y	FM802AA	

Sub-Section Description/Notes: 1 GB = 1 billion bytes. Actual formatted capacity is less. Up to 8 GB of hard drive (or system disk) is reserved for system recovery software (XP and XP Pro). Up to 12 GB of system disk is reserved for system recovery software (Vista).

NOTE: The RHEL3 U4 (x86) OS will operate correctly after some manual configuration steps. Please refer to the Release Notes Chapter in http://www.hp.com/support/linux_user_manual.

Hard Drive Controllers	Factory Configured	Option Kit	Option Kit Part Number	Support Notes
Integrated SATA 3.0 Gb/s Controller, RAID 0, 1, 10, 5 supported	Y	Y		
Integrated LSI SAS 1068E Controller with RAID 0 (IS), RAID 1(IM), RAID 10(IME) capability	Y	Y		
Factory integrated RAID on motherboard for SATA drives				
RAID 0 Data Configuration -- Boot/OS Drive + 2 Drive Striped Array	Y	Y		4th HD Drive can't be 750 GB. 5th HD Drive can't be 500 GB
RAID 0 Configuration - Striped Array	Y	Y		750 GB HD Drive not supported. 3rd HD Drive can not be 500 GB.
RAID 1 Configuration - Mirrored Array	Y	Y		2 HD Drives only
LSI MegaRAID® SAS 8888ELP Host Bus Adapter (HBA)				
LSI 8888ELP 8-port SAS HW RAID Card	Y	Y	GE258AA	

LSI RAID Definitions:
* IS: Striping of 2 or more HDDs into a single logical volume
**IM: Mirroring of 2 HDDs into a single logical volume
***IME: Mirroring of 3 or more HDDs into a single logical volume

NOTE: Specific user-configured hardware SAS RAID configurations are supported on this Linux system. Please visit http://www.hp.com/support/linux_hardware_matrix for details.

NOTE: RAID 0, 1 requires 2 identical hard drives (speeds, capacity, interface); SATA RAID 0, 1 and SAS RAID 0, 1 available as options. Specific user-configured hardware SAS RAID configurations are supported on this Linux system. Please visit http://www.hp.com/support/linux_hardware_matrix for details.

Hardware RAID is not supported on Linux systems. The Linux kernel, with built-in software RAID, provides excellent functionality and performance. It is a good alternative to hardware-based RAID. Please visit http://h20000.www2.hp.com/bc/docs/support/SupportManual/c00060684/c00060684.pdf for RAID capabilities with Linux.

Supported Components

Multimedia and Audio Devices	Factory Configured	Option Kit	Option Kit Part Number	Support Notes
HP Thin USB Powered Speakers	Y	Y	KK912AA	
Integrated High Definition audio with internal speaker	Y	Y		
HP Satellite Speakers	Y	Y	ZD929AA	

Optical and Removable Storage	Factory Configured	Option Kit	Option Kit Part Number	Support Notes
1.44 MB Diskette Drive (1 only)	Y	Y	DY670A	
HP 16X DVD+-RW SuperMulti SATA Drive	Y	Y	EW269AA	1, 2
HP 16X DVD-ROM SATA Drive	Y	Y	EW268AA	2
HP 16-In-1 Media Card Reader with PCI Card	Y	Y	EM718AA	
HP StorageWorks DAT 40 USB internal tape drive	Y	Y	DW022A	
HP StorageWorks DAT 72 USB internal tape drive	Y	Y	DW026A	
HP StorageWorks DAT 160 USB internal tape drive	Y	Y	Q1580A	

SUPPORT NOTE 1: LightScribe creates a grayscale image similar to black and white photography. LightScribe media required and sold separately. Double-layer discs can store more data than single layer discs. However, double-layer discs burned with this drive may not be compatible with many existing single-layer DVD drives and players.

SUPPORT NOTE 2: Actual speeds may vary. Does not permit copying of commercially available DVD movies or other copy-right protected materials. Intended for creation and storage of your original material and other lawful uses. Note that DVD-RAM cannot read or write to 2.6 GB single sided/5.2 GB double sided - version 1.0 media.

Networking and Communications	Factory Configured	Option Kit	Option Kit Part Number	Support Notes
Integrated dual NVIDIA 10/100/1000 LAN	Y	Y		

The term "10/100/1000" or "Gigabit" Ethernet indicates compliance with IEEE standard 802.3ab for Gigabit Ethernet, and does not connote actual operating speed of 1 Gb/sec. For high speed transmission, connection to a Gigabit Ethernet server and network infrastructure is required.

Controller Cards	Factory Configured	Option Kit	Option Kit Part Number	Support Notes
HP FireWire 800 IEEE-1394b 3-Port PCI Card	Y	Y	EA327AA	(1-port 1394a & 2-ports 1394b)

Supported Components

Input Devices

	Factory Configured	Option Kit	Option Kit Part Number	Support Notes
HP PS/2 Optical Scroll Mouse	Y	Y	EY703AA	
HP USB Laser Mouse	Y	Y	GW405AA	
HP USB Optical 3-Button Mouse	Y	Y	DY651A	
HP USB 2-Button Optical Scroll Mouse	Y	Y	DC172B	
HP USB Optical 3-Button 2.9M OEM Mouse	Y	Y	ET424AA	
HP SpacePilot 3D USB Intelligent Controller	Y	Y	EF390AA	
HP USB Standard Keyboard	Y	Y	DT528A	
HP PS/2 Standard Keyboard	Y	Y	DT527A	
HP USB Smart Card Keyboard	Y	Y	ED707AA	

NOTE: Mixing PS/2 and USB Keyboards and Mice are not supported with Linux OS.

Racking and Physical Security

	Factory Configured	Option Kit	Option Kit Part Number	Support Notes
HP xw8/9 PCI Hold Down Kit, Bulk 10 Pack	Y	Y	EN764AA	
HP Business PC Security Lock Kit	Y	Y	PV606AA	
Security Cable with Kensington Lock	Y	Y	PC766A	
HP xw8/9 Sliding Rail Rack Kit	Y	Y	DY664A	

Monitors

	Factory Configured	Option Kit	Option Kit Part Number	Support Notes
HP LP3065 30-inch Widescreen LCD Monitor	Y	Y	EZ320A4	
HP LP2465 24-inch Widescreen LCD Monitor	Y	Y	EF224A4	
HP LP2065 20-inch LCD Monitor	Y	Y	EF227A4	
HP LP1965 19-inch LCD Monitor	Y	Y	RA373AA	

Other Hardware

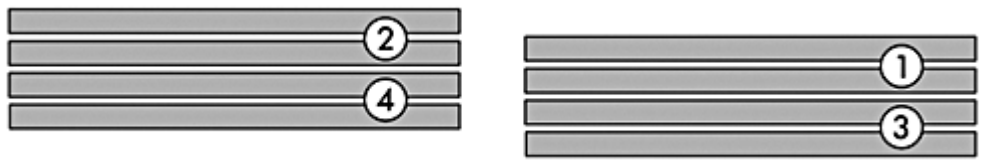
	Factory Configured	Option Kit	Option Kit Part Number	Support Notes
HP Power Cord Kit	Y	Y	DM293A	See Note 1
HP SAS Back Panel Connector Kit	Y	Y	EM164AA	
HP Internal USB Port Kit	Y	Y	EM165AA	

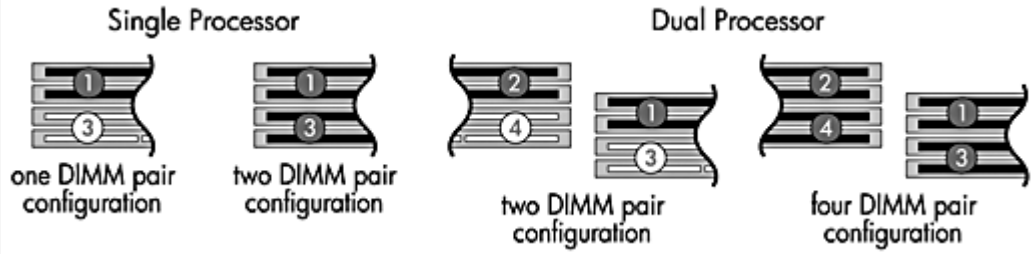
SUPPORT NOTE 1: Use only Power Supply Cord supplied with the HP xw9400 workstation. This is a specially rated power cord.

Supported Components

Software	Factory Configured	Option Kit	Option Kit Part Number	Support Notes
HP ProtectTools Security	Y	Y		
Microsoft Office 2007 Small Business Edition	Y	Y		
Microsoft Office 2007 Trial Edition	Y	Y		
HP Performance Tuning Framework	Y	Y		
PDF Complete	Y	Y		
HP Client Manager Software v6.2 (optional download)	Y	Y		

Operating Systems	Support Notes
Genuine Windows Vista® Business 64-bit	Certain Windows Vista product features require advanced or additional hardware. See http://www.microsoft.com/windowsvista/getready/hardwarereqs.mspx and http://www.microsoft.com/windowsvista/getready/capable.mspx for details. Windows Vista Upgrade Advisor can help you determine which features of Windows Vista will run on your computer. To download the tool, visit http://www.windowsvista.com/upgradeadvisor. (See para below which also applies)
Genuine Windows Vista® Business 32-bit	Certain Windows Vista product features require advanced or additional hardware. See http://www.microsoft.com/windowsvista/getready/hardwarereqs.mspx and http://www.microsoft.com/windowsvista/getready/capable.mspx for details. Windows Vista Upgrade Advisor can help you determine which features of Windows Vista will run on your computer. To download the tool, visit http://www.windowsvista.com/upgradeadvisor. (See para below which also applies)
Genuine Windows Vista® Business 64-bit with downgrade to Windows® XP Professional x64 custom installed	To qualify for this downgrade, an end user must be a business (including governmental or educational institutions) and is expected to order at least 25 customer systems with the same custom image.
Genuine Windows Vista® Business 32-bit with downgrade to Windows® XP Professional 32-bit custom installed	To qualify for this downgrade, an end user must be a business (including governmental or educational institutions) and is expected to order at least 25 customer systems with the same custom image.
Red Hat Enterprise Linux WS 4 (32-bit/64-bit)	NOTE: The RHEL3 U4 (x86) OS will operate correctly with most options after some manual configuration steps. Please refer to the Release Notes Chapter in http://www.hp.com/support/linux_user_manual.
HP Installer CD for Red Hat Enterprise Linux WS 4	See http://www.hp.com/workstations/software/linux/

System Board	
Expansion Slots	2 PCI Express (PCIe) x16 75W+EXT75W (Graphics) slots 2 PCIe x16 (8,4,1) slots Full-height PCI-X slots at 100 MHz, or 1 slot at 133 MHz, exclusive1 full-length PCI
Bays	Five 3.5 inch bays Three 5.25 inch bays
Front I/O	4 ports: 2 USB 2.0, 1 headphone, 1 microphone, 1 IEEE 1394
Rear I/O	16 ports: 6 USB 2.0, 1 standard serial 9-pin port, 1 IEEE 1394, 1 PS/2 keyboard, 1 PS/2 mouse, 2 RJ-45 to integrated Gigabit LAN, 1 Audio In, 1 Audio Line Out, 1 Mic In, S/PDIF OUT coax
USB Keyboard	Optional
USB Mouse	Optional
PS/2 Keyboard	1
PS/2 Mouse	1
Memory	
Maximum Memory	Supports up to 64 GB of DDR2 SDRAM, in a configuration of 32 GB per processor (over 32 GB requires dual CPUs and Quad Ranked DIMMS when supported). NVIDIA Nforce Professional 3000 Series DDR2 SDRAM ECC REGISTERED MEMORY This chart does not represent all possible memory configurations. Each AMD Opteron processor has an integrated memory controller that supports ECC Registered 667 MHz (PC2 5300P) DDR2 or ECC Registered 533 MHz (PC2 4200) DDR2 memory. Main memory is directly connected to the processor through the Direct Connect Architecture. There are 8 DIMM slots in total, with 4 DIMM slots per processor, each processor offering a memory bandwidth transfer rate up to 10.2 GB/s. Over 32 GB requires dual CPUs, and will require 8 GB DIMMS (when available) Memory must be added in pairs. Match DIMM pairs by size and type. Use only HP tested and validated memory In a single processor configuration, install the first DIMM pair in socket set 1 (blue sockets), and the 2nd DIMM pair in socket set 3 (black socket). In a dual processor configuration, install the first DIMM pair in socket set 1 (blue sockets), the 2nd DIMM pair in socket set 2 (blue sockets) and, if required, the 3rd pair in socket set 3 (black sockets) and the 4th pair in socket set 4 (black sockets). The memory sockets are laid out on the mainboard as below:
	
	Memory configurations for the HP xw9400 Workstation:



Possible Memory Configurations

	CPU 1				CPU 2			
	Socket set 2		Socket set 4		Socket set 1		Socket set 3	
1 GB					512 MB	512 MB		
2 GB					1 GB	1 GB		
2 GB					512 MB	512 MB		
2 GB					512 MB	512 MB		
4 GB					1 GB	1 GB		
8 GB					2 GB	2 GB		
2 GB (dual)	512 MB	512 MB			512 MB	512 MB		
4 GB (dual)	1 GB	1 GB			1 GB	1 GB		
4 GB (dual)	512 MB	512 MB	512 MB	512 MB	512 MB	512 MB	512 MB	512 MB
6 GB (dual)	1 GB	1 GB	512 MB	512 MB	1 GB	1 GB	512 MB	512 MB
8 GB (dual)	2 GB	2 GB			2 GB	2 GB		
8 GB (dual)	1 GB	1 GB	1 GB	1 GB	1 GB	1 GB	1 GB	1 GB
12 GB (dual)	2 GB	2 GB	1 GB	1 GB	2 GB	2 GB	1 GB	1 GB
16 GB (dual)	4 GB	4 GB			4 GB	4 GB		
16 GB (dual)	2 GB	2 GB	2 GB	2 GB	2 GB	2 GB	2 GB	2 GB
32 GB (dual)	4 GB	4 GB	4 GB	4 GB	4 GB	4 GB	4 GB	4 GB
64 GB (dual)	8 GB	8 GB	8 GB	8 GB	8 GB	8 GB	8 GB	8 GB

Interfaces Supported	SATA	6 SATA interface (6 serial-ATA connectors), 8 SAS interface, 2 EIDE interface (1 EIDE connectors) supported for optical drives.
Serial Attached SCSI	Serial Attached SCSI (RAID 0, 1, IME) or SATA 3 Gb/s (RAID 0, 1)	
Chassis Fan Header	Front: One 3.15 x 0.98 inches; 80 x 25 mm) Rear: One 4.72 x 0.98 inches; 120 x 25 mm (standard)	
Power Supply	1050W custom power supply - (Wide Ranging, Active PFC)	
Operating Voltage Range	1050W: 90 - 269 VAC	
Rated Voltage Range	1050W: 100 - 240 VAC; 118 VAC	
Rated Line Frequency	1050W: 50/60 Hz; 400Hz	
Operating Line Frequency Range	1050W: 47 - 66 Hz; 393-407 Hz	
Rated Input Current	1050W: 13.2 A @ 100-120VAC / 12.0A @ 118 VAC; 6.6 A @ 200-240 VAC	
Heat Dissipation	1050W: Typical 3136 btu/hr (791 kg-cal/hr) ; Maximum 4480 btu/hr (1129 kg-cal/hr)	
Power Supply Fan	92x32 mm variable speed	
ENERGY STAR® qualified (Config Dependent)	YES	
80 PLUS Compliant	YES	

System Technical Specifications

FEMP Standby Power Compliant 115V (Wake-on LAN disabled) (<2W in S5 - Power Off)	NO
Power consumption in sleep mode (as defined by ENERGY STAR) - Suspend to RAM (S3)	1050W: <25W
Built-in Self Test (BIST) LED	YES
Surge Tolerant Full Ranging Power Supply (withstands power surges up to 2000V)	YES

System Configurations		
Example Configuration #1	Processor Info	2x Opteron 2220 2.8GHz 1MB
	Memory Info	1xFX1700
	Graphics Info	1xFX1700
	Disks/Optical/Floppy	1x160GB SATA / 2 Optical / 1 Floppy

Energy Consumption		115 VAC LAN Enabled	115 VAC LAN Disabled	230 VAC LAN Enabled	230 VAC LAN Disabled	100 VAC LAN Enabled	100 VAC LAN Disabled
	Windows Idle (S0)	141.7W	141.7W	138.0W	138.0W	142.1W	142.1W
	Windows Busy Typ(S0)	356.5W	356.5W	384.7W	384.7W	379.4W	379.4W
	Windows Busy Max (S0)	402.2W	402.2W	413.6W	413.6W	406.7W	406.7W
	Sleep (S3)	10.5W	5.8W	11.1W	6.4W	10.5W	5.8W
	Off (S5)	7.5W	2.4W	3.29W	8.1W	7.5W	2.4W

Heat Dissipation		115 VAC LAN Enabled	115 VAC LAN Disabled	230 VAC LAN Enabled	230 VAC LAN Disabled	100 VAC LAN Enabled	100 VAC LAN Disabled
	Windows Idle (S0)	483.6 btu/hr	483.6 btu/hr	470.9 btu/hr	470.9 btu/hr	484.9 btu/hr	484.9 btu/hr
	Windows Busy Typ(S0)	1216.7 btu/hr	1216.7 btu/hr	1312.9 btu/hr	1312.9 btu/hr	1294.9 btu/hr	1294.9 btu/hr
	Windows Busy Max (S0)	1372.7 btu/hr	1372.7 btu/hr	1411.6 btu/hr	1411.6 btu/hr	1388.1 btu/hr	1388.1 btu/hr
	Sleep (S3)	35.8 btu/hr	19.8 btu/hr	37.9 btu/hr	21.8 btu/hr	35.9 btu/hr	19.8 btu/hr
	Off (S5)	25.6 btu/hr	8.19 btu/hr	27.6 btu/hr	10.2 btu/hr	25.6 btu/hr	8.19 btu/hr

Example Configuration #2	Processor Info	2xOpteron 2224SE 3.2GHz 1MB
	Memory Info	8x1GB DR 667MHz
	Graphics Info	2xFX4600
	Disks/Optical/Floppy	2x146GB 15k SAS / 2 Optical / 1 Floppy

System Technical Specifications

Energy Consumption		115 VAC LAN Enabled	115 VAC LAN Disabled	230 VAC LAN Enabled	230 VAC LAN Disabled	100 VAC LAN Enabled	100 VAC LAN Disabled
	Windows Idle (S0)	283.1W	283.1W	277.5W	277.5W	283.8W	283.8W
	Windows Busy Typ(S0)	604.5W	604.5W	602.4W	602.4W	569.0W	569.0W
	Windows Busy Max (S0)	791.4W	791.4W	770.3W	770.3W	787.2W	787.2W
	Sleep (S3)	11.3W	6.4W	11.9W	7.2W	11.3W	6.4W
	Off (S5)	7.5W	2.2W	8.1W	2.9W	7.5W	2.2W
Heat Dissipation		115 VAC LAN Enabled	115 VAC LAN Disabled	230 VAC LAN Enabled	230 VAC LAN Disabled	100 VAC LAN Enabled	100 VAC LAN Disabled
	Windows Idle (S0)	966.2 btu/hr	966.2 btu/hr	947.1 btu/hr	947.1 btu/hr	968.6 btu/hr	968.6 btu/hr
	Windows Busy Typ(S0)	2063.2 btu/hr	2063.2 btu/hr	2055.9 btu/hr	2055.9 btu/hr	1941.9 btu/hr	1941.9 btu/hr
	Windows Busy Max (S0)	2701.1 btu/hr	2701.1 btu/hr	2629.1 btu/hr	2629.1 btu/hr	2686.7 btu/hr	2686.7 btu/hr
	Sleep (S3)	35.6 btu/hr	21.8 btu/hr	40.6 btu/hr	24.6 btu/hr	38.6 btu/hr	21.8 btu/hr
	Off (S5)	25.6 btu/hr	7.51 btu/hr	27.6 btu/hr	9.89 btu/hr	25.6 btu/hr	7.51 btu/hr

Declared Noise Emissions (Entry-level and High-end configurations)			
System Configuration (Entry level)	Processor Info	2x 2.4 GHz AMD Opteron processors	
	Disks/Optical/Floppy	1x 80 GB 7200 rpm SATA / 1 DVD-ROM/ 1 Floppy	
Declared Noise Emissions (in accordance with ISO 7779 and ISO 9296)		Sound Power (LWAd, bels)	Deskside Sound Pressure (LpAm, decibels)
	Idle	4.4 Bels	26 dB
	SATA Hard drive Operating (random reads)	4.4 Bels	26 dB
	Floppy Drive Operating (continuous copy)	4.8 Bels	32 dB
	DVD-ROM Operating (sequential reads)	5.0 Bels	33 dB
System Configuration (High-end)	Processor Info	2x 2.8 GHz AMD Opteron processors	
	Graphics Info	Quadro FX 3500 with active heatsink	
	Disks/Optical/Floppy	1x 72 GB 15K rpm SAS / 1 DVD-ROM / 1 Floppy	
Declared Noise Emissions (in accordance with ISO 7779 and ISO 9296)		Sound Power (LWAd, bels)	Deskside Sound Pressure (LpAm, decibels)
	Idle	4.5 Bels	26 dB
	SATA Hard drive Operating (random reads)	4.9 Bels	33 dB
	Floppy Drive Operating (continuous copy)	4.8 Bels	32 dB
	DVD-ROM Operating (sequential reads)	5.0 Bels	34 dB

Chassis and Mechanical	Dimensions(H x W x D): 17.9 x 8.3 x 20.7 inches; 45.4 x 21.0 x 52.5 cm
Environmental Requirements	
Temperature	Operating: -40° to 95° F (5° to 35° C) Non-operating: -40° to 140° F (-40° to 60° C)
Humidity	Operating: 8% to 85% Non-operating: 8% to 90%
Maximum Altitude	Operating: 10,000 feet; 3,000 m Non-operating: 30,000 feet; 9,100 m

Physical Security and Serviceability	
Access Panel	Tool-less, one-handed
Optical Drive	Tool-less
Floppy Drive	Drive requires screws to attach to bracket, once attached to mounting bracket, it latches tool-lessly to chassis
Hard Drives	Tool-less
Expansion Cards	Tool-less
Green User Touch Points	Yes, on tool-free internal chassis mechanisms
Color-coordinated Cables and Connectors	Yes
Memory	Tool-less, can be upgraded without removing any internal components
System Board	Tool-less, can be upgraded without removing any internal components
Dual Color Power and HD LED on Front of Computer	green - normal red - fault
Configuration Record SW	Yes
Over-Temp Warning on Screen	Yes
Restore CD Set	Restores the computer to its original factory shipping image
Dual Function Front Power Switch	Yes. Causes a fail-safe power off when held for 4 seconds
Padlock Support	Prevents entire system theft and discourages access panel removal. 7mm diameter padlock loop at rear of system.
Universal Chassis Clamp Lock Support	The version without a cable discourages access panel removal and prevents theft of IO devices. The version with a cable additionally prevents entire system theft and allows multiple systems to be secured with a single cable.
Serial, Parallel, USB, Audio, Network, Enable/Disable Port Control	Enable or disables serial, parallel, USB, audio, and network ports
Removable Media Write/Boot Control	Prevents ability to boot from removable media on supported devices (and can disable writes to media)
Power-On Password	Prevents an unauthorized person from booting up the workstation

System Technical Specifications

Setup Password	Prevents an unauthorized person from changing the workstation configuration
3.3V Aux Power LED on System PCA	Yes
NIC LEDs (integrated) (Green & Amber)	Used to determine NIC status
Power supply diagnostic LED	Yes, dual function: AC OK & power OK
Power Button	Yes, ACPI multi-function
Power LED	Yes, dual color LED indicates normal operation and faults
Hard drive activity LED	Yes
Internal speaker	Yes, used for pre-boot diagnostic beep codes
System/Emergency ROM Flash Recovery	Recovers corrupted system BIOS
OS CD (Restore OS CD)	Restores computer to its original factory shipping Operating System
Power Supply Fans	3.62 x 0.98 inches; 92 x 25 mm
CPU Heatsink Fan(s)	3.15 x 0.59 inches; 80 x 15 mm
Chassis Fans	Front: One 3.15 x 0.98 inches; 80x 25 mm) Rear: One 4.72 x 0.98 inches; 120 mm x 25 mm (standard)
Memory Fans	2.75 x 0.59 inches; 70 x 15 mm
Access Panel Key Lock	Prevents removal of the access panel and all internal components including optical and floppy drives
Flash ROM	Yes
Diagnostic Power Switch LED on board	Yes
Clear Password Jumper	Yes
Clear CMOS Button	Yes
CMOS Battery Holder for easy Replacement	Yes
DIMM Connectors for easy Upgrade	Yes

HP ProtectTools Security Manager	HP ProtectTools Security Manager can be configured to prevent unauthorized access using Smart Cards, TPM Embedded security chips, USB tokens and other security technologies. HP ProtectTools Security Manager is completely customizable, which gives customers the flexibility to choose the level of security that best meets their needs.
	• Smart Card security for HP ProtectTools
	  ○ Initialization and configuration of the Smart Card
	  ○ Manage Smart Card accounts and security settings
	• Embedded Security for HP ProtectTools
	  ○ TPM Embedded Security Chip configuration and management
	• Credential Manager for HP ProtectTools
	  ○ Multifactor Windows Authentication
	  ○ Single sign-on
	• BIOS configuration for HP ProtectTools
	  ○ BIOS configuration and security settings from within the HP ProtectTools Security Manager console

	Visit http://h18004.www1.hp.com/products/security/ for more information on HP ProtectTools

BIOS	
BIOS 32-bit Services	Standard BIOS 32-Bit Service Directory Proposal v0.4
ATAPI	ATAPI Removable Media Device BIOS Specification Version 1.0
BBS	BIOS Boot Specification v1.01
ROM Based Computer Setup Utility (F10)	Review and customize BIOS settings
System/Emergency ROM Flash Recovery with Video	Recovers corrupted system BIOS
Replicated Setup	Saves BIOS settings to diskette or USB disk-on-key in human readable file. Repset.exe utility can then replicate these settings on machines being deployed without entering ROM-based F10 setup
SMBIOS	System Management BIOS 2.5, previously known as DMI BIOS, for system management information
Memory Change Alert	Alerts management console if memory is removed or changed (requires HP Client Manager Software)
Thermal Alert	Monitors the temperature state within the chassis. Three modes: • NORMAL - normal temperature ranges • ALERTED - excessive temperatures are detected. Raises a flag so action can be taken to avoid shutdown or provide for a smoother system shutdown • SHUTDOWN - excessive temperatures are encountered. Automatically shuts down the computer without warning before hardware component damage occurs (requires HP Client Manager Software)
Remote ROM Flash	Provides secure, fail-safe ROM image management from a central network console
ACPI (Advanced Configuration and Power Management Interface)	• Allows the system to enter and resume from low power modes (sleep states) • Controls system power consumption, making it possible to place individual cards and peripherals in a low-power or powered-off state without affecting other elements of the system • Supports ACPI 2.0 for full compatibility with 64-bit operating systems
Ownership Tag	Allows user or MIS to set unique tag string in ROM
Remote Wakeup/Remote Shutdown	• System administrators can power on, restart, and power off a client computer from a remote location. • Enables cost-effective power consumption when the administrator needs to distribute software, perform security management, or update the ROM.
Instantly Available PC (Suspend to RAM - ACPI sleep state S3)	Allows for very low power consumption with quick resume time
Remote System Installation via F12 (PXE 2.1) (Remote Boot from Server)	Allows a new or existing system to boot over the network and download software, including the operating system
ROM revision levels	Identifies system BIOS revision level and reports in ROM-based F10 setup. Version is stored in an industry standard memory location (SMBIOS) so that management SW applications can use and report this information
System board revision level	Allows management SW to read the revision level of the system board

System Technical Specifications

Auto Setup when new hardware installed	System automatically detects addition of new hardware
Keyboard-less Operation	The system can be operated without a keyboard
Localized ROM Setup	Common BIOS image supports configuration (Setup) in 12 languages, with local keyboard mappings
Asset Tag	Allows user or MIS to set unique tag string in ROM
Per-slot Control	Allows individual slot configuration (option ROM, latency)
Adaptive Cooling	Fan control parameters are set according to detected hardware configuration for optimal acoustics
Pre-boot Diagnostics	Early (pre-video) critical errors are reported via beeps and blinks on the power
ACPI	Advanced Configuration and Power Management Interface, Version 2.0c
ASF	Alert Standard Format Specification, Version 2.0
ATA (IDE)	AT Attachment 6 with Packet Interface (ATA/ATAPI-6), Revision 3b
CD Boot	"El Torito" Bootable CD-ROM Format Specification Version 1.0
EDD	• Enhanced Disk Drive Specification Version 1.1 • BIOS Enhanced Disk Drive Specification Version 3.0
PCI	• PCI Local Bus Specification, Revision 2.3 • PCI Power Management Specification, Revision 1.1
PCI Express	PCI Express Base Specification, Revision 1.1
PMM	POST Memory Manager Specification, Version 1.01
SATA	• Serial ATA Specification, Revision 1.0a • Serial ATA 3.0Gb/s: Extensions to Serial ATA 1.5Gb/s, Revision 1.0 • SAS specification 1.1
SPD	PC SDRAM Serial Presence Detect (SPD) Specification, Revision 1.2B
USB 1.1	Universal Serial Bus Revision 1.1 Specification
USB 2.0	Universal Serial Bus Revision 2.0 Specification
SMBIOS	System Management BIOS Reference Specification, Version 2.5

System Software Management and Updating	
HP Client Management Solutions	HP Client Management Solutions help simplify management of Workstations and significantly reduce total ownership costs. HP has two distinct client management product lines: The first client management product line consists of HP OpenView Configuration Management Solutions and HP OpenView Client Configuration Manager. The second client management product line is comprised of the HP Client Premium Suite, HP Client Foundation Suite, and HP Client Manager To learn more about all of these solutions, visit http://www.hp.com/go/easydeploy
HP Client Manager	HP Client Manager is available for free for use with all HP business PCs, Notebooks, and Workstations. It enables central tracking, monitoring, and management of the hardware aspects of HP client systems: • Get valuable hardware inventory information such as CPU, memory, video, and security settings • Monitor system health to fix problems before they occur • Install drivers and BIOS updates without visiting each PC • Remotely configure BIOS and security settings • Automate processes to quickly resolve hardware problems

	Additional Altiris solutions (fee-based) are available to address Workstation management challenges through the entire IT lifecycle including: • Inventory assessment • Software license compliance • Personality migration • Software image deployment • Software distribution • Asset management • Problem resolution Visit http://www.hp.com/go/clientmanager for more information, to download HP Client Manager, and to evaluate the Altiris solutions
System Software Manager	A free utility that detects and updates BIOS, device drivers, and management agent versions on your networked PCs and workstations
Social and Environmental Responsibility	
Eco-Label Certifications & Declarations	This product has received or is in the process of being certified to the following approvals and may be labeled with one or more of these marks: • US Federal Energy Management Program (FEMP) • China Energy Conservation Program • IT ECO declaration • Japan PC Green label* * This product conforms to the examination standards (2003 version) under JEITA's 'PC Green Label System.'
Batteries	This product complies with ISO standards: • EU Directive 91/ 157/ EEC • EU Directive 93/ 86/ EEC • EU Directive 98/ 101/ EEC Batteries used in the product do not contain: • Mercury greater than 5ppm by weight • Cadmium greater than 10ppm by weight • Lead greater than 4000ppm by weight Battery size: CR2032 (coin cell) Battery type: Lithium
Restricted Material Usage	This product does not contain any of the following substances in excess of regulatory limits (refer to the HP General Specification for the Environment at http://www.hp.com/hpinfo/globalcitizenship/environment/supplychain/gen_specifications.html): • Asbestos • Certain Azo Colorants • Certain Brominated Flame Retardants - may not be used as flame retardants in plastics • Cadmium • Chlorinated Hydrocarbons • Chlorinated Paraffins • Formaldehyde

	• Halogenated Diphenyl Methanes • Lead carbonates and sulfates • Lead and Lead compounds • Mercuric Oxide Batteries • Nickel - finishes must not be used on the external surface designed to be frequently handled or carried by the user. • Ozone Depleting Substances • Polybrominated Biphenyls (PBBs) • Polybrominated Diphenyl Ethers (PBBEs) • Polybrominated Biphenyl Oxides (PBBOs) • Polychlorinated Biphenyl (PCB) • Polychlorinated Terphenyls (PCT) • Polyvinyl Chloride (PVC), except for wires and cables and certain retail packaging, has been voluntarily removed from most applications. • Radioactive Substances • Tributyl Tinches (TBT), Triphenyl Tinches (TPT), Tributyl Tin Oxide (TBTO)
Packaging	HP follows these guidelines to decrease the environmental impact of product packaging: • Eliminate the use of heavy metals such as lead, chromium, mercury, and cadmium in packaging materials. • Eliminate the use of ozone-depleting substances (ODS) in packaging materials. • Design packaging materials for ease of disassembly. • Maximize the use of post-consumer recycled content materials in packaging materials. • Use readily recyclable packaging materials such as paper and corrugated materials. • Reduce size and weight of packages to improve transportation fuel efficiency. • Plastic packaging materials are marked according to ISO 11469 and DIN 6120 standards.
Longevity and Upgrading	This product is designed to be upgraded, possibly extending its useful life by several years. Spare parts are available throughout the warranty period and for up to 5 years after the end of production. Upgradeability features contained in the product include: • Dual AMD socket F (aka L1, 1207 pins) • 8 USB ports • 1 PCI slot, 2 PCI-X slots and 4 PCI Express slots • 8 expansion bays • 8 memory slots
Packaging Materials	
External	Cardboard carton and insert: 2.70 kg
Internal	LDPE Foam: 0.35 kg
End-of-Life Management and Recycling	Hewlett-Packard offers end-of-life HP product return and recycling programs in many geographic areas. To recycle your product, please go to: http://www.hp.com/recycle or contact your nearest HP sales office. Products returned to HP will be recycled, recovered, or disposed of in a responsible manner.
Hewlett-Packard Corporate Environmental Information	For more information about HP's commitment to the environment: [link to new HP white paper now in progress] Global Citizenship Report: http://www.hp.com/hpinfo/globalcitizenship/gcreport/index.html Eco-label certifications: http://www.hp.com/hpinfo/globalcitizenship/environment/productdesign/ecolabels.html ISO 14001 certificates: http://www.hp.com/hpinfo/globalcitizenship/environment/operations/envmanagement.html
Service, Support and Warranty	On-site Warranty and Service (Note 1): This three-year, limited warranty and service offering delivers three years of on-site, next business-day (Note 2) service for parts and labor and includes free telephone support (Note 3) 8am - 5pm. Global coverage (Note 2) ensures that any product purchased in one country and

	transferred to another, non-restricted country will remain fully covered under the original warranty and service offering NOTE 1: Terms and conditions may vary by country. Certain restrictions and exclusions apply. NOTE 2: On-site service may be provided pursuant to a service contract between HP and an authorized HP third-party provider, and is not available in certain countries. Global service response times are based on commercially reasonable best effort and may vary by country. NOTE 3: Technical telephone support applies only to HP-configured, HP and HP-qualified, third-party hardware and software. Toll-free calling and 24 x 7 support may not be available in some countries.
Additional Information	• This product is in compliance with the Restrictions of Hazardous Substances (RoHS) directive - 2002/95/EC. • This HP product is designed to comply with the Waste Electrical and Electronic Equipment (WEEE) Directive - 2002/96/EC. • Plastics parts weighing over 25 grams used in the product are marked per ISO 11469 and ISO1043. • This product contains 0% recycled materials (by wt.) • This product is >90% recycle-able when properly disposed of at end of life.

Processors	Quad-Core AMD Opteron 2378/ 2.4 GHz, 512 KB L2 cache per core, 6MB shared L3	FZ810AA
	Quad-Core AMD Opteron 2380/ 2.5 GHz, 512 KB L2 cache per core, 6MB shared L3	FZ811AA
	Quad-Core AMD Opteron 2387/ 2.8 GHz, 512 KB L2 cache per core, 6MB shared L3	NH256AA
	Quad-Core AMD Opteron 2389/ 2.9 GHz, 512 KB L2 cache per core, 6MB shared L3	NT236AA
	Quad-Core AMD Opteron 2393SE/ 3.1 GHz, 512 KB L2 cache per core, 6MB shared L3 (AVAILABLE JUNE 2009)	

Introduction

AMD's latest Quad-Core AMD Opteron processors are designed on a 65mn process technology and features new core enhancements, including 128-bit large data bus supplying the Floating Point units, SSE4A advanced instructions, and support for dual-channel DDR2. The architecture also features improved branch prediction and three levels of memory cache as opposed to the two levels of cache on the Quad-Core Opteron, including 64 KB dedicated L1 cache per core, 512 KB dedicated L2 cache per core, and 2 MB of shared L3 cache between all four cores. The Quad-Core AMD Opteron 2300 series also supports Link unganging, doubled max sustained CPU-CPU data bandwidth in xw9400 at 16GB/s full duplex, thanks to xw9400's dual-HT link architecture.

NOTE: Quad-Core AMD Opteron processors offer 1 GHz HyperTransport™ interconnects.

Performance and Features

- Quad-core processing
  - Significantly increases performance headroom over previous generation single core processors
  - Helps boost an operating system's ability to multitask
- High-performance (128-bit internal data path) floating point unit (per core) in product variations
- Advanced bit manipulation (ABM) instructions
- Increase in the number of large TLB page entries
- 1 GByte large paging supported
- Write burst and DRAM prefetching performance improvements
- Link unganging support
- Support for an L3 cache, shared between cores, in product variations
- Support for evenly distributed traffic in systems that connect multiple links between the same processors

Service and Support

The Quad-Core AMD Opteron processor has a one-year limited warranty or the remainder of the warranty of the HP product in which they are installed. Technical support is available seven days a week, 24 hours a day by phone, as well as online support forums. Certain restrictions and exclusions apply.

Technical Specifications - Processors

Maximum Virtual Memory	Limited by OS
SIMD Extensions Supported	SSE, SSE2, SSE3, SSE4A

Processors	AMD Opteron Processor Model 2222 / 3.0 GHz, 1 MB L2 cache per core	RM697AA
	AMD Opteron Processor Model 2220 / 2.80 GHz, 1 MB L2 cache per core	RC403AA

Introduction

Dual-Core AMD Opteron Processor 2200 series with 1 GHz HyperTransport™ Technology bus, 1 MB L2 cache per core, optional liquid cooling available.

Dual- and Quad-Core are new technologies designed to improve performance of multithreaded software products and hardware-aware multitasking operating systems and may require appropriate operating system software for full benefit. Not all customers or software applications will necessarily benefit from use of this technology.

Speeds	System Bus Frequency	Cache Type
3.0 GHz	1 GHz	1 MB L2 cache per core
2.80 GHz	1 GHz	1 MB L2 cache per core

Technical Specifications - Graphics

NVIDIA Quadro NVS 290 256 MB PCIe Graphics Card	Form Factor	Low Profile
	Bus Type	PCIe x16
	Memory	256 MB 400MHz DDR2 SDRAM unified frame buffer, Z-buffer and Texture storage
	Connectors	DMS-59, includes DMS-59 to Dual DVI-I cable. DMS-59 to Dual VGA cable available as an option.
	Maximum Resolution	Dual integrated analog display controllers supporting up to two analog displays at 2048x1536 @ 85Hz on both displays or dual digital displays at 1920x1200 (single-link). NVIEW advanced multi-display desktop and application management seamlessly integrated into Microsoft® Windows®
	RAMDAC	Integrated dual 400MHz
	Image Quality Features	Full-screen, full-frame video playback of HDTV and DVD content DVD-ready motion compensation for MPEG-2 Independent hardware color controls for video overlay Hardware color-space conversion (YUV 4:2:2 and 4:2:0) IDCT motion compensation 5-tap horizontal by 3-tap vertical filtering 8:1 up/down scaling
	Programmable Video Processor	Full-screen, full-frame video playback of HDTV and DVD content DVD-ready motion compensation for MPEG-2 Independent hardware color controls for video overlay Hardware color-space conversion (YUV 4:2:2 and 4:2:0) IDCT motion compensation 5-tap horizontal by 3-tap vertical filtering 8:1 up/down scaling
	Display Output	Dual integrated analog display controllers supporting up to two analog displays at 2048x1536 @ 85Hz on both displays or dual digital displays at 1920x1200 (single-link). NVIEW advanced multi-display desktop and application management seamlessly integrated into Microsoft® Windows®
	Supported Graphics APIs	OGL 2.1 & DX10 Support; Shader Model 4.0
	Available Graphics Drivers	Genuine Windows Vista Business(64-bit and 32-bit), Microsoft Windows XP Professional(64-bit and 32-bit)(Provides full native Dual View mode, Span or Big Desktop mode, and Clone mode) Red Hat Enterprise Linux(RHEL) WS3, WS4 & 5 Desktop/Workstation HP qualified drivers may be preloaded or available from the HP support web site: http://welcome.hp.com/country/us/eng/software_drivers.html. Novell SUSE Linux Enterprise drivers may be obtained from: ftp://download.nvidia.com/novell or http://www.nvidia.com
	High-Resolution AntiAliasing	Color planes: 32-bit color buffer Overlay planes: Hardware supported
	Option kit contents	NVIDIA Quadro NVS 290 (256 MB DH) PCIe Graphics Card with full height bracket attached, DMS-59 to Dual DVI cable, Workstation Software Driver CD, documentation.

Technical Specifications - Graphics

NVIDIA Quadro NVS 295 256MB Graphics Card	Form Factor	2.731 inches (H) × 6.600 inches (L), Half-Height
	Graphics Controller	NVIDIA Quadro NVS 295 Graphics Board
	Bus Type	PCI Express x16, Generation 2.0
	Memory	256 MB GDDR3 SDRAM unified graphics memory
	Connectors	2 DisplayPort Comes with 2 DisplayPort to DVI-D Adapters ('DisplayPort to VGA' and 'DisplayPort to DL DVI' adapters available as an accessory)
	Maximum Resolution	Two DisplayPort outputs drive two digital displays up to 2560 x 1600
	Display Output	• Drives DisplayPort enabled digital displays at resolutions up to 2560 × 1600 at 60 Hz with reduced blanking • Drives DVI enabled digital displays at resolutions up to 1920 × 1200 at 60 Hz with reduced blanking (through DisplayPort to DVI-D (single link) cable)
	Supported Graphics APIs	OpenGL 3.0 DirectX 10.0
	Available Graphics Drivers	Genuine Windows Vista Business (64-bit and 32-bit) Microsoft Windows XP Professional (64-bit and 32-bit) Red Hat Enterprise Linux(RHEL) WS4 & 5 Desktop/Workstation HP qualified drivers may be preloaded or available from the HP support Web site: http://welcome.hp.com/country/us/en/support.html Novell SUSE Linux Enterprise drivers may be obtained from: ftp://download.nvidia.com/novell or http://www.nvidia.com
	Power consumption	22.69 Watts

NVIDIA Quadro FX 570 256 MB PCIe Graphics Card	Form Factor	ATX
	Bus Type	PCI-Express x16
	Memory	256 MB 400MHz DDR2 SDRAM unified frame buffer, Z-buffer and Texture storage
	Connectors	DVI-I (dual-link) and DVI-I (dual-link)
	Maximum Resolution	Dual integrated analog display controllers supporting up to two analog displays at 2048x1536 @ 85Hz on both displays or dual digital displays at 1920x1200 (single-link) and 3840x2400 (dual-link). NVIEW advanced multi-display desktop and application management seamlessly integrated into Microsoft® Windows®
	RAMDAC	Integrated dual 400MHz
	Shading Architecture	Fully programmable GPU (OpenGL 2.1/DirectX 10 class) Vertex/Pixel Shader 4.0 Shading Support (HLSL, GLSL, CgFX)
	Supported Graphics APIs	OGL 2.1 & SM4.0 and DirectX10 Support
	Available Graphics Drivers	Genuine Windows Vista Business (64-bit and 32-bit) Microsoft Windows XP Professional (64-bit and 32-bit) Red Hat Enterprise Linux(RHEL) WS3, WS4 & 5 Desktop/Workstation

		Qualified drivers may be preloaded or available from the HP support Web site: http://welcome.hp.com/country/us/eng/software_drivers.html Novell SUSE Linux Enterprise drivers may be obtained from: ftp://download.nvidia.com/novell or http://www.nvidia.com
	High-Resolution AntiAliasing	High Resolution Anti-Aliasing PureVideo 2 engine supports AES 128-bit decryption GPU Computing (HW/SW including CUDA SDK 3D Textures LightSpeed Memory Architecture II 128-bit color precision Hardware accelerated anti-aliased points and lines Hardware OpenGL overlay planes H/W accelerrated pixel readback 3rd generation occlusion culling AA on scan-out
	Option kit contents	PCA with ATX bracket, DVI to VGA converters, HDTV dongle, CD and manual.
	Power consumption	<60 W
NVIDIA Quadro FX 580 512MB Graphics Card	Form Factor	4.376 inches (H) × 6.60 inches (L)
	Graphics Controller	NVIDIA Quadro FX 580 Graphics Board
	Bus Type	PCI Express x16, Generation 2.0
	Memory	512MB GDDR3 SDRAM unified graphics memory
	Connectors	2 DisplayPort, 1 Dual-Link DVI-I. One DisplayPort to DVI and one DVI to VGA adapter included ('DisplayPort to VGA' and 'DisplayPort to Dual Link DVI' adapters available as an accessory)
	Maximum Resolution	• Two DisplayPort outputs drive two digital displays up to 2560 x 1600 • One dual-link DVI-I output drives one digital display at resolutions up to 2560 x 1600 @ 60Hz or one analog display at resolutions up to 2048 x 1536 @ 85Hz
	RAMDAC	Single Internal 400 MHz DAC
	Shading architecture	Full Shader Model 4.0 (OpenGL 2.1/DirectX 10 class) • Long fragment programs (unlimited instructions) • Long vertex programs (unlimited instructions) • Looping and subroutines (up to 256 loops per vertex program) • Dynamic flow control • Conditional execution
	Supported graphics APIs	OpenGL 3.0 Direct X 10.0
	Available graphics drivers	Genuine Windows Vista Business(64-bit and 32-bit), Microsoft Windows XP Professional(64-bit and 32-bit) Red Hat Enterprise Linux(RHEL) WS4 & 5 Desktop/Workstation HP qualified drivers may be preloaded or available from the HP support Web site:

		http://welcome.hp.com/country/us/en/support.html Novell SUSE Linux Enterprise drivers may be obtained from: ftp://download.nvidia.com/novell or http://www.nvidia.com
	High-level Shader Languages	• Optimized compiler for Cg and Microsoft HLSL • OpenGL 2.1 and DirectX 10 support • Open source compiler
	CUDA™ Parallel Processor Cores	32
	Power consumption	40 Watts

NVIDIA Quadro NVS 440 256 MB Graphics Controller	Form Factor	ATX
	Graphics Controller	2 nv43 2D graphics processor units (GPUs)
	VGA controller	Integrated into the Quadro GPU
	Bus Type	PCI-E x16
	RAMDAC	Dual 350 MHz
	Memory	256 MB DDR frame buffer and Texture storage (128MB per GPU)
	Connector	Two DMS-59
	Controller clock speed	250 MHz
	Color planes	32-bit color buffer
	Overlay planes	1 16-bit Video overlay plane
	Maximum pixel clock	350 MHz
	Multi-Monitor Support	Up to 4 analog or digital monitors
	Single DVI Support	Yes
	Dual DVI Support	Yes
	High-definition Video Processor (HDVP)	Full-screen, full-frame video playback of HDTV and DVD content DVD-ready motion compensation for MPEG-2 Independent hardware color controls for video overlay Hardware color-space conversion (YUV 4:2:2 and 4:2:0) IDCT motion compensation 5-tap horizontal by 3-tap vertical filtering 8:1 up/down scaling
	Available graphics drivers	Microsoft Windows Vista Business 32 or 64, Microsoft Windows XP Professional, Microsoft Windows XP Professional x64 Edition, Linux - Full Open GL implementation, complete with NVIDIA and ARB extensions. HP qualified drivers may be preloaded or available from the HP support Web site: http://welcome.hp.com/country/us/eng/software_drivers.html.

Technical Specifications - Graphics

NVIDIA Quadro FX 1700 512 MB PCIe Graphics Card	Form Factor	ATX
	Bus Type	PCI Express x16
	Memory	512 MB 400 MHz DDR2 SDRAM unified frame buffer, Z-buffer and Texture storage
	Connectors	DVI-I (dual-link) and DVI-I (dual-link) and HD-out (a separate cable - not included - is required to use HD TV monitors)
	Maximum Resolution	Dual integrated analog display controllers supporting up to two analog displays at 2048x1536 @ 85Hz on both displays or dual digital displays at 1920x1200 (single-link) and 3840x2400 (dual-link).
	RAMDAC	Integrated dual 400MHz
	Display Output	Dual integrated analog display controllers supporting up to two analog displays at 2048x1536 @ 85Hz on both displays or dual digital displays at 1920x1200 (single-link) and 3840x2400 (dual-link). NVIEW advanced multi-display desktop and application management seamlessly integrated into Microsoft® Windows®
	Shading Architecture	Fully programmable GPU (OpenGL 2.1/DirectX 10 class) Vertex/Pixel Shader 4.0 Shading Support (HLSL, GLSL, CgFX)
	Supported Graphics APIs	OGL 2.1 & SM4.0 and DirectX10 Support
	Available Graphics Drivers	Genuine Windows Vista Business (64-bit and 32-bit) Microsoft Windows XP Professional (64-bit and 32-bit) Red Hat Enterprise Linux(RHEL) WS3, WS4 & 5 Desktop/Workstation Qualified drivers may be preloaded or available from the HP support Web site: http://welcome.hp.com/country/us/eng/software_drivers.html Novell SUSE Linux Enterprise drivers may be obtained from: ftp://download.nvidia.com/novell or http://www.nvidia.com
	High-Resolution AntiAliasing	High Resolution Anti-Aliasing PureVideo 2 engine supports AES 128-bit decryption GPU Computing (HW/SW including CUDA SDK 3D Textures LightSpeed Memory Architecture II 128-bit color precision Hardware accelerated anti-aliased points and lines Hardware OpenGL overlay planes H/W accelerated pixel readback 3rd generation occlusion culling AA on scan-out
	Option kit contents	PCA with ATX bracket, DVI to VGA converters, CD and manual.
	Power consumption	<75 W

Technical Specifications - Graphics

NVIDIA Quadro FX 1800 768MB Graphics Card	Form Factor	4.376 inches (H) x 7.8 inches (L)
	Graphics Controller	NVIDIA Quadro FX 1800 Graphics Board
	Bus Type	PCI Express x16, Generation 2.0
	Memory	768MB GDDR3 SDRAM unified graphics memory
	Connectors	2 DisplayPort, 1 Dual-Link DVI-I. One DisplayPort to DVI-D and one DVI to VGA adapter included ('DisplayPort to VGA' and 'DisplayPort to Dual Link DVI' adapters available as an accessory)
	Maximum Resolution	• Two DisplayPort outputs drive two digital displays up to 2560 x 1600 • One dual-link DVI-I output drives one digital display at resolutions up to 2560 x 1600 @ 60Hz or one analog display at resolutions up to 2048 x 1536 @ 85Hz
	RAMDAC	Single Internal 400 MHz DAC
	Shading Architecture	Full Shader Model 4.0 (OpenGL 2.1/DirectX 10 class) • Long fragment programs (unlimited instructions) • Long vertex programs (unlimited instructions) • Looping and subroutines (up to 256 loops per vertex program) • Dynamic flow control • Conditional execution
	Supported Graphics APIs	OpenGL 3.0 Direct X 10.0
	Available Graphics Drivers	Genuine Windows Vista Business(64-bit and 32-bit), Microsoft Windows XP Professional(64-bit and 32-bit) Red Hat Enterprise Linux(RHEL) WS4 & 5 Desktop/Workstation HP qualified drivers may be preloaded or available from the HP support Web site: http://welcome.hp.com/country/us/en/support.html Novell SUSE Linux Enterprise drivers may be obtained from: ftp://download.nvidia.com/novell or http://www.nvidia.com
	High-level Shader Languages	• Optimized compiler for Cg and Microsoft HLSL • OpenGL 2.1 and DirectX 10 support • Open source compiler
	CUDA™ Parallel Processor Cores	64.
	Power consumption	59 Watts

Technical Specifications - Graphics

NVIDIA Quadro FX 3700 Graphics Card	Form Factor	ATX
	Graphics Controller	NVIDIA NV71GL-U
	Bus Type	PCI Express x16
	Memory	512MB 700MHz GDDR3 SDRAM unified frame buffer, Z-buffer and Texture storage
	Connectors	2 dual-link DVI-I + 3-pin Mini DIN stereo output
	Maximum Resolution	Dual DVI-I output - drives dual digital displays at resolutions up to 2560x1600 @ 60Hz Internal 400MHz RAMDACs - drives dual analog displays up to 2048x1536 @ 85Hz each
	RAMDAC	Dual 400MHz integrated
	Display Output	Dual integrated analog display controllers supporting up to two analog displays at 2048x1536 @ 85Hz on both displays or dual digital displays at 2560x1600 @ 60Hz. NVIEW advanced multi-display desktop and application management seamlessly integrated into Microsoft® Windows®
	Shading Architecture	Fully programmable GPU (OpenGL 2.0/DirectX 9.0c class) Long fragment programs (unlimited instructions) Long vertex programs (unlimited instructions) Looping and subroutines (up to 256 loops per vertex program) Dynamic flow control Conditional execution
	Supported Graphics APIs	OpenGL 2.1 DirectX 10.0
	Available Graphics Drivers	Genuine Windows Vista Business (64-bit and 32-bit) Microsoft Windows XP Professional (64-bit and 32-bit) Red Hat Enterprise Linux(RHEL) WS3, WS4 & 5 Desktop/Workstation Qualified drivers may be preloaded or available from the HP support Web site: http://welcome.hp.com/country/us/eng/software_drivers.html Novell SUSE Linux Enterprise drivers may be obtained from: ftp://download.nvidia.com/novell or http://www.nvidia.com
	High-Resolution AntiAliasing	256-bit memory interface 128-bit IEEE floating-point precision graphics pipeline 128-bit color precision 32x FSAA dramatically reduces visual aliasing artifacts at resolution up to 1920x1200 Hardware accelerated anti-aliased points and lines Hardware OpenGL overlay planes Hardware accelerated two-sided lighting Hardware accelerated clipping planes 3rd generation occlusion culling 3D volumetric texture support Quad-buffered stereo Dual Link DVI enabling driving digital displays up to 2560x1600 @ 60Hz SLI Link
	Option kit contents	PCA with ATX bracket, DVI to VGA converters, CD and manual

Technical Specifications - Graphics

NVIDIA Quadro FX 3800 1.0GB Graphics Card (AVAILABLE JUNE 2009)	Form Factor	4.376 inches (H) x 9.0 inches (L) Single slot card
	Graphics Controller	NVIDIA Quadro FX 3800 Graphics Board
	Bus Type	PCI Express x16, Generation 2.0
	Memory	1GB GDDR3 SDRAM unified graphics memory
	Connectors	2 DisplayPort, 1 Dual-Link DVI-I. One DisplayPort to DVI-D and one DVI to VGA adapter included ('DisplayPort to VGA' and 'DisplayPort to Dual Link DVI' adapters available as an accessory)
	Maximum Resolution	• Two DisplayPort outputs drive two digital displays up to 2560 x 1600 • One dual-link DVI-I output drives one digital display at resolutions up to 2560 x 1600 @ 60Hz or one analog display at resolutions up to 2048 x 1536 @ 85Hz
	RAMDAC	Single Internal 400 MHz DAC
	Shading architecture	Full Shader Model 4.0 (OpenGL 2.1/DirectX 10 class) • Long fragment programs (unlimited instructions) • Long vertex programs (unlimited instructions) • Looping and subroutines (up to 256 loops per vertex program) • Dynamic flow control • Conditional execution
	Supported graphics APIs	OpenGL 3.0 Direct X 10.0
	Available graphics drivers	Genuine Windows Vista Business(64-bit and 32-bit), Microsoft Windows XP Professional(64-bit and 32-bit) Red Hat Enterprise Linux(RHEL) WS4 & 5 Desktop/Workstation HP qualified drivers may be preloaded or available from the HP support Web site: http://welcome.hp.com/country/us/en/support.html Novell SUSE Linux Enterprise drivers may be obtained from: ftp://download.nvidia.com/novell or http://www.nvidia.com
	High-level Shader Languages	• Optimized compiler for Cg and Microsoft HLSL • OpenGL 2.1 and DirectX 10 support • Open source compiler
	CUDA™ Parallel Processor Cores	192
	Power consumption	107.9 Watts

NVIDIA Quadro FX 5600 PCIe Graphics Card	Graphics Controller	NVIDIA Quadro FX 5600 graphics card
	Bus Type	PCI Express x16
	Memory	1.5 GB GDDR3 SDRAM unified graphics memory
	Connectors	2 Dual-Link DVI-I analog/digital monitor outputs, 1 3-pin Mini DIN stereo output
	Maximum Resolution	2560x1600 @ 60Hz

Technical Specifications - Graphics

RAMDAC	Dual 400 MHz integrated
Image Quality Features	12-bit subpixel sampling precision enhances AA quality Rotated-grid full-scene antialiasing (RG FSAA) 32x FSAA dramatically reduces visual aliasing artifacts or "jaggies" at resolution up to 1920x1200
Avivo Video and Display Platform	nView Architecture - Advanced multi-display desktop & application management seamlessly integrated into Microsoft Windows®
Display Output	Dual dual-link DVI-I outputs support two digital displays at up to 2560x1600 @ 60Hz Internal 400 MHz DACs - Two analog displays up to 2560x1600 @ 60Hz
Shading Architecture	Fully programmable GPU (OpenGL 2.1/DirectX 10 class) Long fragment programs (unlimited instructions) Long vertex programs (unlimited instructions) Looping and subroutines (up to 256 loops per vertex program) Dynamic flow control Conditional execution
Supported Graphics APIs	OpenGL 2.1 ICD with immediate mode support for all OGL primitive types DirectX 10
Available Graphics Drivers	Genuine Windows Vista Business (64-bit and 32-bit) Microsoft Windows XP Professional (64-bit and 32-bit) Red Hat Enterprise Linux(RHEL) WS3, WS4 & 5 Desktop/Workstation HP qualified drivers may be preloaded or available from the HP support Web site: http://welcome.hp.com/country/us/en/support.html Novell SUSE Linux Enterprise drivers may be obtained from: ftp://download.nvidia.com/novell or http://www.nvidia.com
High-Resolution Antialiasing	The NVIDIA Quadro FX 5600 Architecture includes: 128-bit color precision Unlimited fragment instruction Unlimited vertex instruction 3D volumetric texture support Single-system powerwall 12 pixels per clock rendering engine Hardware accelerated antialiased points & lines Hardware OpenGL overlay planes Hardware accelerated two-sided lighting Hardware accelerated clipping planes 3rd-generation occlusion culling 16 textures per pixel in fragment programs Window ID clipping functionality Hardware accelerated line stippling
High-level Shader Languages	Optimized compiler for Cg and Microsoft® HLSL OpenGL 2.1 and DirectX 10 support Open source compiler

Technical Specifications - Graphics

NVIDIA Quadro FX 4800 1.5GB PCIe Graphics Card	Form Factor	4.36" (H) x 10.5" (L) Dual slot card
	Graphics Controller	NVIDIA Quadro FX 4800 graphics board
	Bus Type	PCI Express x16, Generation 2.0
	Memory	1.5 GB GDDR3 SDRAM unified graphics memory
	Connectors	2 DisplayPort, 1 Dual-Link DVI-I, 1 3-pin Mini DIN stereo output, Two DisplayPort to DVI-D adapters included ('DisplayPort to VGA' and 'DisplayPort to Dual Link DVI' adapters available as an accessory)
	Maximum Resolution	• 2 DisplayPort connectors support ultra-high-resolution panels (up to 2560 x 1600) • Dual-link DVI-I output drives one digital display at resolutions up to 2560 x 1600 @ 60Hz • Internal 400 MHz DACs-One analog display up to 2048 x 1536 @ 85Hz
	Shading Architecture	• Full Shader Model 4.0 (OpenGL 2.1/DirectX 10 class) • Long fragment programs (unlimited instructions) • Long vertex programs (unlimited instructions) • Looping and subroutines (up to 256 loops per vertex program) • Dynamic flow control • Conditional execution
	Supported Graphics APIs	OpenGL 3.0 Direct X 10.0
	Available Graphics Drivers	Genuine Windows Vista Business (64-bit and 32-bit) Microsoft Windows XP Professional (64-bit and 32-bit) Red Hat Enterprise Linux(RHEL) WS4 & 5 Desktop/Workstation Qualified drivers may be preloaded or available from the HP support Web site: http://welcome.hp.com/country/us/eng/software_drivers.html Novell SUSE Linux Enterprise drivers may be obtained from: ftp://download.nvidia.com/novell or http://www.nvidia.com
	High-Resolution AntiAliasing	• Rotated Grid Full-Scene Antialiasing (RG FSAA) • 32xFSAA dramatically reduces visual aliasing artifacts or "jaggies" at resolution up to 1920 x 1200 • 64x FSAA SLI Mode
	High-level Shader Languages	• Optimized compiler for Cg and Microsoft HLSL • OpenGL 2.1 and DirectX 10 support • Open source compiler
	Power consumption	146 Watts

Technical Specifications - Graphics

NVIDIA Quadro FX 5800 4GB Graphics Card	Form Factor	4.36" (H) x 10.5" (L), Dual Slot
	Graphics Controller	NVIDIA Quadro FX 5800 Graphics Board
	Bus Type	PCI Express x16, Generation 2.0
	Memory	4GB GDDR3 SDRAM unified graphics memory
	Connectors	2 Dual-Link DVI-I, 1 DisplayPort, 1 3-pin Mini DIN stereo output Two DVI to VGA adapters included ('DisplayPort to VGA' and 'DisplayPort to Dual Link DVI' adapters available as an accessory)
	Maximum Resolution	• Two dual-link DVI-I outputs drive two digital displays at resolutions up to 2560 x 1600 @ 60Hz • One DisplayPort output drives an ultra-high-resolution panel (up to 2560 x 1600) • Internal 400 MHz DACs-Two analog displays up to 2048 x 1536 @ 85Hz
	Shading Architecture	• Full Shader Model 4.0 (OpenGL 2.1/DirectX 10 class) • Long fragment programs (unlimited instructions) • Long vertex programs (unlimited instructions) • Looping and subroutines (up to 256 loops per vertex program) • Dynamic flow control • Conditional execution
	Supported Graphics APIs	OpenGL 3.0 Direct X 10.0
	Available Graphics Drivers	Genuine Windows Vista Business (64-bit and 32-bit) Microsoft Windows XP Professional (64-bit and 32-bit) Red Hat Enterprise Linux(RHEL) WS4 & 5 Desktop/Workstation HP qualified drivers may be preloaded or available from the HP support Web site: http://welcome.hp.com/country/us/en/support.html Novell SUSE Linux Enterprise drivers may be obtained from: ftp://download.nvidia.com/novell or http://www.nvidia.com
	High-Resolution AntiAliasing	• Rotated Grid Full-Scene Antialiasing (RG FSAA) • 32x FSAA dramatically reduces visual aliasing artifacts or "jaggies" at resolution up to 1920x1200
	High-level Shader Languages	• Optimized compiler for Cg and Microsoft HLSL • OpenGL 2.1 and DirectX 10 support • Open source compiler
	CUDA™ Parallel Processor Cores	240
	Power consumption	225 Watts

Technical Specifications - Graphics

NVIDIA Quadro CX	Form Factor	4.36" (H) x 10.5" (L) Dual slot card
	Graphics Controller	NVIDIA Quadro CX 1.5GB Graphics Card
	Bus Type	PCI Express x16, Generation 2.0
	Memory	1.5 GB GDDR3 SDRAM unified graphics memory
	Connectors	2 DisplayPort, 1 Dual-Link DVI-I, 1 3-pin Mini DIN stereo output. Two DisplayPort to DVI-D adapters included ('DisplayPort to VGA' and 'DisplayPort to Dual Link DVI' adapters available as an accessory)
	Maximum Resolution	• 2 DisplayPort connectors support ultra-high-resolution panels (up to 2560 x 1600) • Dual-link DVI-I output drives one digital display at resolutions up to 2560 x 1600 @ 60Hz • Internal 400 MHz DACs-One analog display up to 2048 x 1536 @ 85Hz
	RAMDAC	400MHz
	Shading Architecture	• Full Shader Model 4.0 (OpenGL 2.1/DirectX 10 class) • Long fragment programs (unlimited instructions) • Long vertex programs (unlimited instructions) • Looping and subroutines (up to 256 loops per vertex program) • Dynamic flow control • Conditional execution
	Supported Graphics APIs	OpenGL 2.1 Direct X 10.0
	Available Graphics Drivers	Genuine Windows Vista Business (64-bit and 32-bit) Microsoft Windows XP Professional (64-bit and 32-bit) Qualified drivers may be preloaded or available from the HP support Web site: http://welcome.hp.com/country/us/eng/software_drivers.html
	High-Resolution AntiAliasing	• Rotated Grid Full-Scene Antialiasing (RG FSAA) • 32xFSAA dramatically reduces visual aliasing artifacts or "jaggies" at resolution up to 1920 x 1200 • 64x FSAA SLI Mode
	High-level Shader Languages	• Optimized compiler for Cg and Microsoft HLSL • OpenGL 2.1 and DirectX 10 support • Open source compiler
	Power consumption	146 Watts

HP SAS (Serial Attached SCSI) Hard Drives for HP Workstations	450GB SAS 15K rpm 3Gb/s 3.5" HDD	Capacity	450 GB	
		Height	1 in; 2.5 cm	
		Width	Media Diameter	3.5 in; 8.9 cm
			Physical Size	4 in; 10.2 cm
		Interface	SAS	
		Synchronous Transfer Rate (Maximum)	3.0 Gb/s	
		Buffer	16 MB	
		Seek Time (typical reads, includes controller overhead, including settling)	Single Track	0.2 ms
			Average	3.6 ms
			Full Stroke	6.6 ms
		Rotational Speed	15,000 rpm	
		Logical Blocks	879,097,968 - 512 byte blocks	
		Operating Temperature	50° to 95° F (10° to 35° C)	
	300GB SAS 15K rpm 3Gb/s 3.5" HDD	Capacity	300 GB	
		Height	1 in; 2.5 cm	
		Width	Media Diameter	3.5 in; 8.9 cm
			Physical Size	4 in; 10.2 cm
		Interface	SAS	
		Synchronous Transfer Rate (Maximum)	3.0 Gb/s	
		Buffer	16 MB	
		Seek Time (typical reads, includes controller overhead, including settling)	Single Track	0.2 ms
			Average	3.5 ms
			Full Stroke	6.7 ms
		Rotational Speed	15,000 rpm	
		Logical Blocks	585,937,500 - 512 byte blocks	
		Operating Temperature	50 to 95 F (10 to 35 C)	
	146GB SAS 15K rpm 3Gb/s 3.5" HDD	Capacity	146 GB	
		Height	1 in; 2.5 cm	
		Width	Media Diameter	3.5 in; 8.9 cm
			Physical Size	4 in; 10.2 cm
		Interface	SAS	
		Synchronous Transfer Rate (Maximum)	3.0 Gb/s	
		Buffer	16 MB	

		Seek Time (typical reads, includes controller overhead, including settling)	**Single Track**	0.2 ms
			Average	3.5 ms
			Full Stroke	6.7 ms
		Rotational Speed	15,000 rpm	
		Logical Blocks	86,749,488 - 512 byte blocks	
		Operating Temperature	50 to 95 F (10 to 35 C)	
	73 GB SAS 15K rpm 3Gb/s HDD	**Capacity**	73 GB	
		Height	1 in; 2.5 cm	
		Width	**Media Diameter**	3.5 in; 8.9 cm
			Physical Size	4 in; 10.2 cm
		Interface	SAS	
		Synchronous Transfer Rate (Maximum)	3.0 Gb/s	
		Buffer	16 Mbytes	
		Seek Time (typical reads, includes controller overhead, including settling)	**Single Track**	0.2 ms
			Average	3.5 ms
			Full Stroke	6.7 ms
		Rotational Speed	15,000 rpm	
		Logical Blocks	143,374,738 - 512 byte blocks	
		Operating Temperature	50 to 95 F (10 to 35 C)	
SATA (Serial ATA) Hard Drives for HP Workstations	300GB SATA 10K rpm SFF in 3.5" Frame HDD	**Capacity**	300,069,052,416 bytes	
		Height	1 in; 2.54 cm	
		Width	**Media Diameter**	2.5 in; 6.36 cm
			Physical Size	4 in; 10.17 cm
		Interface	Serial ATA (3.0 Gb/s), Native Command Queuing enabled	
		Synchronous Transfer Rate (Maximum)	Up to 300 MB/s	
		Cache	16 MB	
		Seek Time (typical reads, includes controller overhead, including settling)	**Single Track**	0.7 ms (maximum)
			Average	4.4 ms
			Full Stroke	9.5 ms
		Rotational Speed	10,000 rpm	
		Logical Blocks	586,072,368	
		Operating Temperature	41° to 131° F (5° to 55° C)	
	160GB SATA 10K rpm SFF	**Capacity**	160,041,885,696 bytes	
		Height	1 in; 2.5 cm	

in 3.5" Frame HDD	Width	Media Diameter	2.5 in; 6.36 cm
		Physical Size	4 in; 10.2 cm
	Interface	Serial ATA (1.5 Gb/s), Native Command Queuing enabled	
	Synchronous Transfer Rate (Maximum)	Up to 300 MB/s	
	Buffer	16 MB	
	Seek Time (typical reads, includes controller overhead, including settling)	Single Track	0.7 ms (maximum)
		Average	4.4 ms
		Full Stroke	9.5 ms
	Rotational Speed	10,000 rpm	
	Logical Blocks	312,581,808	
	Operating Temperature	41° to 131° F (5° to 55° C)	
80GB SATA 10K rpm SFF in 3.5" Frame HDD	Capacity	80,026,361,856 bytes	
	Height	1 in; 2.5 cm	
	Width	Media Diameter	2.5 in; 6.36 cm
		Physical Size	4 in; 10.2 cm
	Interface	Serial ATA (1.5 Gb/s), Native Command Queuing enabled	
	Synchronous Transfer Rate (Maximum)	Up to 300 MB/s	
	Buffer	16 Mbytes	
	Seek Time (typical reads, includes controller overhead, including settling)	Single Track	0.7 ms (maximum)
		Average	4.4 ms
		Full Stroke	19.5 ms
	Rotational Speed	10,000 rpm	
	Logical Blocks	156,301,488	
	Operating Temperature	41° to 131° F (5° to 55° C)	
1000GB (1TB) SATA 7200 rpm 3.0Gb/s 3.5" HDD	Capacity	1,000,204,886,016 bytes	
	Height	1 in; 2.5 cm	
	Width	Media Diameter	3.5 in; 8.9 cm
		Physical Size	4 in; 10.2 cm
	Interface	Serial ATA (3.0 Gb/s), Native Command Queuing enabled	
	Synchronous Transfer Rate (Maximum)	Up to 300 MB/s	
	Buffer	32 MB	
	Seek Time (typical reads, includes controller overhead, including settling)	Single Track	2 ms
		Average	11 ms
		Full Stroke	21 ms
	Rotational Speed	7,200 rpm	
	Logical Blocks	1,953,525,168	

	Operating Temperature	41° to 131° F (5° to 55° C)	
500GB SATA 7200 rpm 3Gb/s 3.5" HDD	**Capacity**	500,107,862,016 bytes	
	Height	1 in; 2.5 cm	
	Width	**Media Diameter**	3.5 in; 8.9 cm
		Physical Size	4 in; 10.2 cm
	Interface	Serial ATA (3.0 Gb/s), Native Command Queuing enabled	
	Synchronous Transfer Rate (Maximum)	300 MB/s	
	Buffer	16 MB	
	Seek Time (typical reads, includes controller overhead, including settling)	**Single Track**	2 ms
		Average	11 ms
		Full Stroke	21 ms
	Rotational Speed	7,200 rpm	
	Logical Blocks	976,773,168	
	Operating Temperature	41° to 131° F (5° to 55° C)	
250GB SATA 7200 rpm 3Gb/s 3.5" HDD (for HP xw-Workstations)	**Capacity**	250,059,350,016 bytes	
	Height	1 in; 2.5 cm	
	Width	**Media Diameter**	3.5 in; 8.9 cm
		Physical Size	4 in; 10.2 cm
	Interface	Serial ATA (3.0 Gb/s), Native Command Queuing enabled	
	Synchronous Transfer Rate (Maximum)	300 MB/s	
	Buffer	16 MB	
	Seek Time (typical reads, includes controller overhead, including settling)	**Single Track**	2 ms
		Average	11 ms
		Full Stroke	21 ms
	Rotational Speed	7,200 rpm	
	Logical Blocks	488,397,168	
	Operating Temperature	41° to 131° F (5° to 55° C)	
160GB SATA 7200 rpm 3Gb/s 3.5" HDD	**Capacity**	160,041,885,696 bytes	
	Height	1 in; 2.5 cm	
	Width	**Media Diameter**	3.5 in; 8.9 cm
		Physical Size	4 in; 10.2 cm
	Interface	Serial ATA (3.0 Gb/s), Native Command Queuing enabled	
	Synchronous Transfer Rate (Maximum)	300 MB/s	
	Buffer	8 MB	

	Seek Time (typical reads, includes controller overhead, including settling)	**Single Track**	2 ms
		Average	11 ms
		Full Stroke	21 ms
	Rotational Speed	7,200 rpm	
	Logical Blocks	312,581,808	
	Operating Temperature	41° to 131° F (5° to 55° C)	
80GB SATA 7200 rpm 3Gb/s 3.5" HDD	**Capacity**	80,026,361,856 bytes	
	Height	1 in; 2.5 cm	
	Width	**Media Diameter**	3.5 in; 8.9 cm
		Physical Size	4 in; 10.2 cm
	Interface	Serial ATA (3.0 Gb/s)	
	Synchronous Transfer Rate (Maximum)	300 MB/s	
	Buffer	8 MB	
	Seek Time (typical reads, includes controller overhead, including settling)	**Single Track**	2 ms
		Average	11 ms
		Full Stroke	21 ms
	Rotational Speed	7,200 rpm	
	Logical Blocks	156,301,488	
	Operating Temperature	41° to 131° F (5° to 55° C)	

Integrated LSI SAS 1068E Controller with RAID 0, 1, 1E/10E	PCI Bus	PCI-Express x8 lanes
	PCI Modes	Bus Master DMA
	RAID Levels	RAID 0, 1, 1E and 10E
	PCI Data Burst Transfer Rate	8 PCI-Express lanes at 2.5Gbps in each direction for a total bandwidth of 5.0Gbps for each full duplex lane. Total aggregate bandwidth of up to 4GBps possible.
	Full Duplex	LSI's SAS1068E 8-port SAS/SATA controller supports 1.5 and 3.0Gb/s per port data transfer rates.
	PCI Card Type	N/A
	PCI Voltage	N/A
	PCI Power	N/A
	Bracket	N/A
	Certification Level	PCI-Express 1.0a
	IO Bus	Eight 3Gb/s SAS/SATA ports
	SAS Processor	LSISAS1068E
	Internal Connectors	Four- SATA x1 connectors
	External Connectors	None
	Maximum Number of SCSI Devices	32
	LED Indicators	On-board activity and fault LEDs
	Integrated Mirroring	Integrated Mirroring option available

LSI MegaRAID® SAS 8888ELP Host Bus Adapter (HBA)	PCI Bus	PCI-Express x8 lanes
	PCI Modes	Bus Master DMA
	RAID Levels	RAID 0, 1, and 5 RAID spans 10 and 50
	PCI Data Burst Transfer Rate	Up to 3Gb/s per port
	Full Duplex	Up to 1.5 GB/s
	PCI Voltage	+3.3V Add-in Card
	PCI Power	7.5 Watts
	Certification Level	PCI-Express 1.0a
	IO Bus	Eight 3Gb/s SAS/SATA ports
	Internal Connectors	Two SAS SFF8087 x4
	External Connectors	Two SAS SFF8088 x4
	Maximum Number of SCSI DeviceS	32
	LED Indicators	Connector LEDs indicate whether the internal or external connector is active for ports 0-3 and 4-7

Technical Specifications - Multimedia and Audio Devices

HP Thin USB Powered Speakers	Frequency Response (-3dB, 24-bit/96kHz input) Controls	FO to 20kHz
	Dimensions (H x W x D)	Speakers: 5.72 x 3.74 x 0.96 in (14.52 x 9.50 x 2.45 cm) per speaker
	On/Off/Volume Controls	Right side of right speaker
	Power LED	Front of right speaker (green)
	Watts	2/3 watt (normal/maximum)
	Net weight	0.68 lbs (0.31kg)
	Environmental (all conditions non-condensing)	Temperature (operating) 14° to 104° F (-10° to 40° C)
		Relative Humidity (operating) 40% to 90%
	Speaker cable length	Input cord: 5.91 ft (1800mm±35mm)
		L-channel cord: 3.28 ft (1000mm±35mm)
		USB cord: 5.91 ft (1800mm±35mm)
	Color	HP Carbonite
	Kit Contents	One pair of HP Thin USB Powered Speakers with attached audio signal and USB power cables for connecting to your PC HP Warranty documentation

Technical Specifications - Optical and Removable Storage

HP DVD+/-RW Drive	Description	5.25-inch, half-height, tray-load		
	Mounting Orientation	Either horizontal or vertical		
	Interface Type	SATA/ATAPI		
	Dimensions (WxHxD)	5.9 x 1.7 x 8.0 in (15.0 x 4.4 x 20.3 cm)		
	Disc Formats	DVD-RAM DVD+R DVD+RW DVD+R DL DVD-R DL DVD-R DVD-RW CD-R CD-RW		
	Disc Capacity	DVD-ROM	8.5 GB DL or 4.7 GB standard	
		Full Stroke DVD	< 250 ms (seek)	
		Full Stroke CD	< 210 ms (seek)	
	Maximum Data Transfer Rates	CD ROM Read	CD-ROM, CD-R Up to 40X CD-RW Up to 32X	
		DVD ROM Read	DVD-RAM	Up to 12X
			DVD+RW	Up to 8X
			DVD-RW	Up to 8X
			DVD+R DL	Up to 8X
			DVD-R DL	Up to 8X
			DVD-ROM	Up to 16X
			DVD-ROM DL	Up to 8X
			DVD+R	Up to 16X
			DVD-R	Up to 16X
	Power	Source	SATA DC power receptacle	
		DC Power Requirements	5 VDC ± 5%-100 mV ripple p-p 12 VDC ± 5%-200 mV ripple p-p	
		DC Current	5 VDC -1000 mA typical, 1600 mA maximum 12 VDC -600 mA typical, 1400 mA maximum	
	Operating Environmental (all conditions non-condensing)	Temperature	41° to 122° F (5° to 50° C)	
		Relative Humidity	10% to 90%	
		Maximum Wet Bulb Temperature	86° F (30° C)	
		Operating Systems Supported	Windows Vista Business 64*, Windows Vista Business 32*, Windows Vista Home Basic 32*, Windows 2000, Windows XP Professional or Windows XP Home 32*. Red Hat Enterprise Linux(RHEL) WS3, WS4, 5 Desktop/Workstation Novell SLES 9 & SLE 10 No driver is required for this device. Native	

			support is provided by the operating system. * Certain Windows Vista product features require advanced or additional hardware. Windows Vista Upgrade Advisor can help you determine which features of Windows Vista will run on your computer. To download the tool, visit: http://www.windowsvista.com/upgradeadvisor. For Windows Vista system requirements, visit: http://www.windowsvista.com/systemrequirements. * LightScribe functionality is not natively supported by Linux distributions. Customers may download LightScribe Linux drivers from: http://www.lightscribe.com/downloadSection/linux/index.aspx
	Kit Contents		HP SATA SuperMulti LightScribe DVD Writer drive, LightScribe software, Roxio Easy Media Creator software, Intervideo WinDVD Software, installation guide, and DVD+R media.
HP DVD-ROM Drive	Description		5.25-inch, half-height, tray-load
	Mounting Orientation		Either horizontal or vertical
	Interface Type		SATA/ATAPI
	Dimensions (WxHxD)		5.9 x 1.7 x 8.0 in (15.0 x 4.4 x 20.3 cm)
	Disc Capacity	DVD-ROM	Single layer: Up to 4.7 GB Double layer: Up to 8.5 GB
	Access Times	DVD-ROM Single Layer	< 140 ms (typical)
		CD-ROM Mode 1	< 125 ms (typical)
		Full Stroke DVD	< 250 ms (seek)
		Full Stroke CD	< 210 ms (seek)
	Power	Source	SATA DC power receptacle
		DC Power Requirements	5 VDC ± 5%-100 mV ripple p-p 12 VDC ± 5%-200 mV ripple p-p
		DC Current	5 VDC - <1000 mA typical, < 1600 mA maximum 12 VDC - < 600 mA typical, < 1400 mA maximum
	Operating Environmental (all conditions non-condensing)	Temperature	41° to 122° F (5° to 50° C)
		Relative Humidity	10% to 90%
		Maximum Wet Bulb Temperature	86° F (30° C)
		Operating Systems Supported	Windows Vista Business 64* Windows Vista Business 32*, Windows Vista Home Basic 32*, Windows 2000, Windows XP Professional or Windows XP Home 32*.

		Red Hat Enterprise Linux(RHEL) WS3, WS4, 5 Desktop/Workstation Novell SLES 9 & SLE 10 No driver is required for this device. Native support is provided by the operating system.
		* Certain Windows Vista product features require advanced or additional hardware. Windows Vista Upgrade Advisor can help you determine which features of Windows Vista will run on your computer. To download the tool, visit: http://www.windowsvista.com/upgradeadvisor. For Windows Vista system requirements, visit: http://www.windowsvista.com/systemrequirements.
HP 16-In-1 Media Card Reader with PCI Card	Interface Type	USB 2.0 High-speed device
	Dimensions (WxHxD)	5.7 x 5.86 x 1.68 in (145 x 148.9 x 42.7 mm)
	Supported Media Types	MicroSD (T-Flash, including MicroSD HC) Memory Stick Micro MS Micro (M2)
	Operating Environmental (all conditions non-condensing) Temperature	Operating Extremes Test Parameters/Conditions - Power applied, unit operating on system ±5% nominal supply voltage. 10°C 10% R.H. = 24 hours 10°C 90% R.H. = 24 hours 20°C 90% R.H. =24 hours 30°C 90% R.H. = 24 hours 40°C 90% R.H. = 24 hours 50°C 90% R.H. = 24 hours 50°C 10% R.H. = 24 hours Storage Extremes Test Parameters/Conditions 60°C @ 80% R.H. for 96 hours -30°C @ 20% R.H. for 48 hours No power applied Delta °C < 1.0°C/min Delta % R.H. < 1.5% R.H./min
	Certifications/Approvals	USB-IF, WHQL, Compliant with USB Mass Storage Class Bulk only Transport Specification Rev. 1.0, Compliant Intel Front Panel I/O Connectivity Design Guide V. 1.2 FCC, CE, BSMI, C-Tick, VCCI, MIC, cUL, TUV-T
	Operating Systems Supported	Windows Vista Business 64*, Windows Vista Business 32*, Windows Vista Home Basic 32*, Windows 2000, Windows XP Professional or Windows XP Home 32*. No driver is required for this device. Native support is provided by the operating system. * Certain Windows Vista product features require advanced or additional

	hardware. See http://www.microsoft.com/windowsvista/getready/hardwarereqs.mspx and http://www.microsoft.com/windowsvista/getready/capable.mspx for details. Windows Vista Upgrade Advisor can help you determine which features of Windows Vista will run on your computer. To download the tool, visit http://www.windowsvista.com/upgradeadvisor. Windows Vista Business disk also included for future upgrade if desired. For Windows Vista system requirements, visit http://www.windowsvista.com/systemrequirements.
Kit Contents	Media reader in 5.25" bracket with USB cable attached, PCI card with full height bracket attached, ½ height bracket for PCI card, Install Guide, IO & Security Software and Documentation CD
Weight	4 lbs (1.81 kg)
Advance Protocol Support	Supports hardware ECC (Error Correction Code) function Supports hardware CRC (Cyclic Redundancy Check) function Supports MS 4-bit parallel transfer mode Supports MS-PRO 4-bit parallel transfer mode Supports SD 4-bit parallel transfer mode Supports high-speed 50Mhz SD 4-bit card (version 1.1) Support high-speed 52Mhz MMC 8-bit card (version 4.x)

Integrated dual NVIDIA 10/100/1000 LAN	Connector	RJ-45
	Controller	NVIDIA Gigabit Controller with Marvell PHY
	Data Rates Supported	10/100/1000 Mbps
	Compliance	IEEE 802.3-2000
	Bus Architecture	Integrated plus RGMII interface
	Data Transfer Mode	DMA
	Hardware certifications	FCC, B, CE, TUV- cTUVus Mark Canada and United States, TUV- GS Mark for European Union
	Hardware Certifications	1.5 watts @ +3.3V AUX supply
	Boot ROM Support	Yes
	Network Transfer Rate	10BASE-T (half-duplex) 10 Mbps 10BASE-T (full-duplex) 20 Mbps 100BASE-TX (half-duplex) 100 Mbps 100BASE-TX (full-duplex) 200 Mbps 1000BASE-T, 1000 Mbps
	Operating System Driver Support	Microsoft Windows Vista Business 32 and 64, Microsoft Windows NT® 4.0, Microsoft Windows 98, Microsoft Windows 2000, Microsoft Windows XP, Linux 2.2, Linux 2.4
	Management Capabilities	WOL, PXE 2.1 and NVIDA control console

Technical Specifications - Controller Cards

HP FireWire® 800 IEEE-1394b 3-Port PCI Card	Data Transfer Rate	Supports up to 800 Mb/s
	Devices Supported	IEEE-1394 compliant devices
	Bus Type	PCI card with brackets for low profile and full height PCI slots
	Ports	Two IEEE-1394b bilingual 9-Pin Connectors (Rear)
	Internal Connectors	One 10-Pin header Custom Connector
	System Requirements	Microsoft® Windows® XP Professional, Windows XP Home Not supported on Linux. Pentium® III or higher processor 128 MB RAM 1 GB Hard Drive CD-ROM drive Built-in sound system Available PCI slot
	Temperature - Operating	50° to 131° F (10° to 55° C)
	Temperature - Storage	-22° to 140° F (-30° to 60° C)
	Relative Humidity - Operating	20% to 80%
	Compliances	FCC Part 15B, cULus 60950, CE Mark EN55022B(1995)/EN55024-1998 STD, Taiwan BSMI CNS13438, Korea MIC
	Operating Systems Supported	Microsoft Windows XP Only