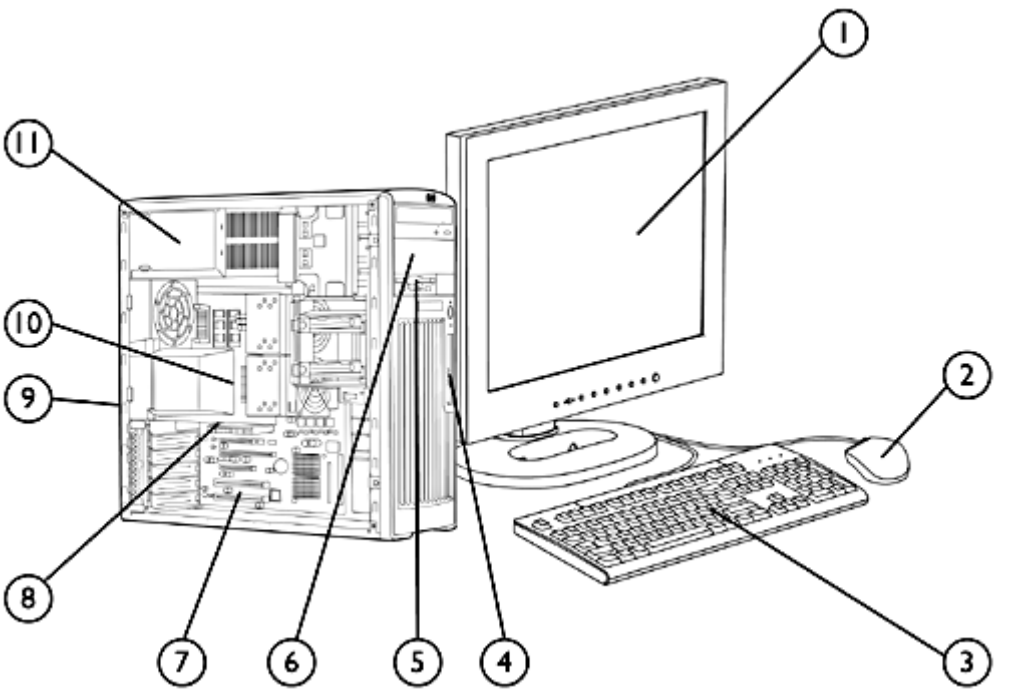
Overview



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 (optional), headphone and microphone
5. 3.5" external bay for optional diskette drive or other 3.5" device
6. 2 internal 3.5" bays, 2 external 5.25" bays
7. 2 PCI, 1 PCI Express x16 mechanical/x4 electrical, 2 PCI Express x8 mechanical/x4 electrical
8. 1 PCI Express x16 Graphics Bus
9. 5 USB 2.0 (rear), 1 USB 2.0 (internal), 1 standard serial port, 1 parallel port, 2 PS/2, 1 RJ-45, audio in/out
10. Dual 64-Bit Intel® Xeon® series 5100 processors
11. 575 watt power supply

Overview

At A Glance

- Choice of operating systems:
  Microsoft Windows XP Professional
  Microsoft Windows XP Professional x64 Edition (see http://www.hp.com/workstations/pws/windowsxp64/ for details)
- Red Hat Enterprise Linux Workstation 3 (32- or 64-Bit version as an after market option)
- Red Hat Enterprise Linux Workstation 4 (32- or 64-Bit version)
- HP Linux Installer Kit (see http://www.hp.com/workstations/software/linux/ for details)
- 64-Bit Dual-Core Intel® Xeon® Processor 5100 Series
- 1066 and 1333 MHz Front Side Bus support
- 4-channel 667 MHz FB-DIMM Memory Subsystem
- Up to 16 GB Memory capacity
- PCI Express I/O and Graphics
- Integrated Broadcom 5752 Gigabit Ethernet
- 4 channels of Serial ATA (SATA) 3.0Gb/s natively supported internally; RAID level 0, 1 available on motherboard (HW RAID functionality not supported by Linux)
- High Definition integrated audio with internal speaker
- Pre-loaded Manageability Tools
- Energy Star Compliance with energy-saving features (Not supported by Linux)
- Protected by HP Services, including a 3 years next business day onsite standard warranty. Terms and conditions vary by country. Certain restrictions and exclusions apply.

Standard Features - Custom Components

Processor and Speed – Up to 2 of the following

Dual-Core Intel Xeon Processor with EM64T

One or two Dual-Core Intel Xeon Processor 5100 Series, 4 MB shared L2 cache*

Intel Xeon 5110 1.60 GHz/1066 MHz FSB
Intel Xeon 5120 1.86 GHz/1066 MHz FSB
Intel Xeon 5130 2.00 GHz/1333 MHz FSB
Intel Xeon 5140 2.33 GHz/1333 MHz FSB
Intel Xeon 5150 2.66 GHz/1333 MHz FSB
Intel Xeon 5160 3.00 GHz/1333 MHz FSB

NOTE* Dual-Core Intel Xeon Processor 5100 Sequence expected availability in Q3 2006. When ordering two processors, the second processor must be the same as the first.

Operating System – One of the following

Genuine Windows XP Professional SP2

Genuine Windows XP Professional x64 Edition

HP Linux Installer CD Box Set for Red Hat Linux 7.2, 7.3 and Workstation 3 (64-Bit)

Red Hat Enterprise Linux Workstation 3 (32- & 64-Bit available only as an After Market Option)

Red Hat Enterprise Linux Workstation 4 (32- & 64-Bit available as pre-load and as an After Market Option)

NOTE: See http://www.hp.com/workstations/software/linux/
Click on "Hardware support matrix" under "Related links" for details.

1-3 Hard Disk Drives – Up to 3 of the following SATA drives, or 3 of the following SAS drives. (The third HDD would occupy an external 5.25" bay and require a bracket.)

SATA Hard Drive	Windows XP	Red Hat Linux
80 GB 7200 rpm SATA 3.0Gb/s drive	32-Bit, 64-Bit	WS3, WS4
160 GB 7200 rpm SATA 3.0Gb/s NCQ drive	32-Bit, 64-Bit	WS3, WS4
250 GB 7200 rpm SATA 3.0Gb/s NCQ drive	32-Bit, 64-Bit	WS3, WS4
500 GB 7200 rpm SATA 3.0Gb/s NCQ drive	32-Bit, 64-Bit	WS3, WS4
80 GB 10K rpm SATA 1.5Gb/s NCQ drive	32-Bit, 64-Bit	WS3, WS4
160 GB 10K rpm SATA 1.5Gb/s NCQ drive	32-Bit, 64-Bit	WS3, WS4
SAS Hard Drive (SAS Controller is required)		
146 GB 10K rpm SAS 3.0Gb/s drive	32-Bit, 64-Bit	WS3, WS4
73 GB 15K rpm SAS 3.0Gb/s drive	32-Bit, 64-Bit	WS3, WS4
146 GB 15K rpm SAS 3.0Gb/s drive	32-Bit, 64-Bit	WS3, WS4
300 GB 15K rpm SAS 3.0Gb/s drive	32-Bit, 64-Bit	WS3, WS4

Factory integrated RAID on motherboard for SATA drives

	Windows XP	Red Hat Linux
RAID 0 Configuration – Striped Array	32-Bit, 64-Bit	Not supported
RAID 1 Configuration – Mirrored Array	32-Bit, 64-Bit	Not supported

NOTE: Requires 2 identical hard drives (speeds, capacity, interface). SATA controller does not support RAID. No Linux support. 64-Bit not supported with Serial ATA Drives.

Standard Features - Custom Components

Drive controllers		Windows XP	Red Hat Linux
	Integrated SATA 3.0Gb/s Controller, RAID level 0, 1, 10, 5 supported	32-Bit, 64-Bit	WS3, WS4 (HW RAID functionality not supported by Linux)
	LSI SAS3041E Serial Attach SCSI (SAS) Host Bus Adapter (HBA)	32-Bit, 64-Bit	Not supported

Memory - One of the following		Windows XP	Red Hat Linux
	512 MB PC2-5300F ECC registered DDR2 (667 MHz) FB-DIMM (1 x 512 MB)	32-Bit, 64-Bit	WS3, WS4
	1 GB PC2-5300F ECC registered DDR2 (667 MHz) FB-DIMM (2 x 512 MB)	32-Bit, 64-Bit	WS3, WS4
	2 GB PC2-5300F ECC registered DDR2 (667 MHz) FB-DIMM (4 x 512 MB)	32-Bit, 64-Bit	WS3, WS4
	2 GB PC2-5300F ECC registered DDR2 (667 MHz) FB-DIMM (2 x 1 GB)	32-Bit, 64-Bit	WS3, WS4
	3 GB PC2-5300F ECC registered DDR2 (667 MHz) FB-DIMM (2 x 1GB + 2 x 512 MB)	32-Bit, 64-Bit	WS3, WS4
	4 GB PC2-5300F ECC registered DDR2 (667 MHz) FB-DIMM (4 x 1 GB)	32-Bit, 64-Bit	WS3, WS4
	4 GB PC2-5300F ECC registered DDR2 (667 MHz) FB-DIMM (2 x 2 GB)	32-Bit, 64-Bit	WS3, WS4
	6 GB PC2-5300F ECC registered DDR2 (667 MHz) FB-DIMM (2 x 2 GB + 2 x 1 GB)	32-Bit, 64-Bit	WS3, WS4
	8 GB PC2-5300F ECC registered DDR2 (667 MHz) FB-DIMM (4 x 2 GB)	32-Bit, 64-Bit	WS3, WS4

1 -2 Removable storage (Up to 2 of the following)		Windows XP	Red Hat Linux
	No Floppy Drive option	N/A	N/A
	1.44-MB Diskette Drive	32-Bit, 64-Bit	WS3, WS4
	No Optical Drive option	N/A	N/A
	48X CD-ROM Drive*	32-Bit, 64-Bit	WS3, WS4
	16X/48X DVD-ROM Drive	32-Bit, 64-Bit	WS3, WS4
	HP 48X CD-RW/DVD-ROM Combo Drive	32-Bit, 64-Bit	WS3, WS4
	16X DVD+/-RW, Dual-Layer, LightScribe (Windows**)	32-Bit, 64-Bit	WS3, WS4

NOTES:*Not supported as a 2nd Optical Drive. **LightScribe software works with Windows only.

Keyboard – One of the following*		Windows XP	Red Hat Linux
	No Keyboard option	N/A	N/A
	PS/2 Standard Keyboard	32-Bit, 64-Bit	WS3, WS4
	USB Standard Keyboard	32-Bit, 64-Bit	WS3, WS4

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

Standard Features - Custom Components

Mouse – One of the following*		Windows XP	Red Hat Linux
	No Mouse option	N/A	N/A
	PS/2 2-Button Scroll Mouse	32-Bit, 64-Bit	WS3, WS4
	USB 2-Button Optical Scroll Mouse	32-Bit, 64-Bit	WS3, WS4
	USB 3-Button Optical Mouse	32-Bit, 64-Bit	WS3, WS4
	NOTE:* Mixing PS/2 and USB Keyboards and Mice are not supported with Linux OS.		

Audio		Windows XP	Red Hat Linux
	Integrated High Definition Audio with Internal Speaker	32-Bit, 64-Bit	WS3*, WS4
	HP Optical Drive Internal Audio Cable (Not supported with X-FI audio card or no optical drive option)	32-Bit, 64-Bit	Not Supported
	SoundBlaster® X-Fi™ XtremeMusic PCI Audio Card	32-Bit, 64-Bit	Not Supported
	NOTE:* Via Linux drivers on HP support website that are not part of RHEL WS3		

NIC		Windows XP	Red Hat Linux
	Integrated Broadcom BCM5752 Gigabit LOM,	32-Bit, 64-Bit	WS3, WS4
	Broadcom BCM5751 NetXtreme™ Gigabit Ethernet Controller (PCI-E)	32-Bit, 64-Bit	WS3, WS4

PCI Express Graphics		Windows XP	Red Hat Linux
	No Graphics option	N/A	N/A
	NVIDIA Quadro NVS 285 (128 MB) (may order 2)	32-Bit, 64-Bit	WS3, WS4
	NVIDIA Quadro NVS 440 (256 MB) (may order 2)	32-Bit, 64-Bit	WS3, WS4
	NVIDIA Quadro FX 560 (128 MB)	32-Bit, 64-Bit	WS3, WS4
	ATI FireGL V3300 (128 MB)	32-Bit, 64-Bit	WS3, WS4
	NVIDIA Quadro FX 1500 (256 MB)	32-Bit, 64-Bit	WS3, WS4
	NVIDIA Quadro FX 3500 (256 MB)	32-Bit, 64-Bit	WS3, WS4
	ATI FireGL V7200 (256 MB)	32-Bit, 64-Bit	WS3, WS4
	NVIDIA Quadro FX 4500 (512 MB)	32-Bit, 64-Bit	WS3, WS4
	NVIDIA Quadro G-Sync Card (only supported when ordered with the FX 4500 graphics card)	32-Bit, 64-Bit	WS3, WS4

Miscellaneous		Windows XP	Red Hat Linux
	IEEE 1394a FireWire 400 4-Port PCI Card	32-Bit, 64-Bit	Not Supported
	IEEE 1394b FireWire 800 3-Port PCI Card	32-Bit, 64-Bit	Not Supported
	HP Energy Star Enabled Configuration	32-Bit	Not Supported
	HP Workstation Mouse Pad	N/A	N/A
	Solenoid Hood Lock & Hood Sensor	All	All

Standard Features - Custom Components

Software	Windows XP	Red Hat Linux
Optional Symantec Norton AntiVirus (optional)	32-Bit, 64-Bit	Not supported
CA eTrust 64-Bit Anti-Virus Software	64-Bit	Not supported
Optional Microsoft Office 2003 Basic Software	32-Bit	Not supported
Optional Microsoft Office 2003 Personal Software	32-Bit	Not supported
Optional Microsoft Office 2003 Professional Software	32-Bit, 64-Bit	Not supported
Optional Microsoft Office 2003 Small Business	32-Bit	Not supported
HP Performance Tuning Framework	32-Bit, 64-Bit	Not supported
HP Client Manager Software v6.0	32-Bit, 64-Bit	Not supported

Standard Features - Specs

Operating System (choice)	Genuine Windows XP Professional SP2
	Genuine Windows XP Professional x64 Edition
	OR Red Hat Enterprise Linux Workstation 4 64-Bit preload (32-Bit version included on recovery CD or as after market option)
	OR Red Hat Enterprise Linux Workstation 3 (32-Bit & 64-Bit) available as an after market option.
	OR HP Installer Kit for Linux (includes drivers for both 32-Bit & 64-Bit OS versions of RHEL WS3 and RHEL WS4)
Form Factor	Minitower
Color	Carbonite/Alloy metallic
System Board Form Factor	12"x9.8"
Processor	1 or 2 Dual-Core Intel Xeon Processor 5100 Series with EM64T
CPU FSB	1066, 1333 MHz
Standard L2 Cache	4 MB total shared cache per processor
Chipset	Intel 5000X
Memory Expansion Slots	4 DIMMs
Memory Type Supported	DDR2 Registered ECC FB-DIMMs
Memory Speed Supported	667 MHz
Maximum Memory	16 GB (4 DIMMs slots with 4 GB DIMMS)
Network Controller	Integrated Broadcom 5752 Gigabit Ethernet LAN-On-Motherboard
Audio	Integrated high definition digital audio with S/PDIF 6-channel pass-through, stereo microphone, and Yamaha XG Lite Softsynth support. If using RHEL WS3, the audio drivers are not included as part of the standard RHEL WS3 operating system. Use the ALSA audio drivers included on the HP Driver CD or from the HP support website. See http://www.hp.com/support/linux_hardware_matrix and http://www.hp.com/support/linux_user_manual for details.
PCI Slots	2 PCI slots (full-length) 2 PCI Express (x8 mechanically, x4 electrically) 1 PCI Express (x16 mechanically/x4 electrically) 1 PCI Express x16 graphics
Bays	Total Bays = 5
Internal Bays	Two 3.5 inch HDD bays with acoustic dampening rail assemblies
External Bays	Two 5.25 inch bays - 203 mm maximum device depth (top bay is limited to 198 mm depth when optional smart cover solenoid lock is installed). Bottom bay can be converted to an internal 3.5 inch 3rd Hard Drive bay using optional bracket One 3.5 inch bay for optional floppy drive
Front I/O	2 USB 2.0, Headphone, Microphone, optional IEEE 1394 NOTE: Although HP Personal Workstations can be ordered with the HP Installer Kit for Linux and an IEEE 1394 card, HP cannot provide customer support for this configuration. Please refer to the Linux Hardware Support Matrix (http://www.hp.com/support/linux_hardware_matrix) for details, and to the Linux User Manual (http://www.hp.com/support/linux_user_manual) for tips on user-enablement of the IEEE 1394 Card.
Internal I/O	1 USB 2.0 header
Rear I/O	5 USB 2.0, 1 standard serial port, 1 parallel port, PS/2 keyboard and mouse, 1 RJ-45 to integrated Gigabit LAN, Audio In, Audio Out, Microphone In
Choice of PS/2 or USB Keyboard	1
Choice of PS/2 or USB Mouse	1
Chassis Dimensions (H x W x D)	17.3 x 6.5 X 17.3 in (44.1 x 16.5 x 44.0 cm)

System Weight	Minimum config – 14.60 kg (32.30 lbs) Maximum config – 18.11 kg (39.94 lbs)	
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 (nonpressurized)	Operating	10,000 ft (3,000 m)
	Non-operating	30,000 ft (9,100 m)
Power Supply	575W wide-ranging, active Power Factor Correction	
Interfaces Supported	4-channel SATA interface (4 Serial-ATA connectors each), 2 EIDE interface (2 EIDE connectors) supported for optical drives, USB 2.0, IEEE 1394 (optional)	
Hard Drive Controller Supported	SATA (integrated) or optional SAS (PCIe) controllers	

Standard Features - Preconfigured Global Models

xw6400X/XG1.60/ F80/R1.0/285d/p RD687AW#ABA	OS	Genuine Windows XP Professional 32-bit
	Base unit	HP xw6400 Workstation base unit
	Localization kit	HP xw6400 Workstation localization kits
	Processor 1	Intel Xeon 5110 1.60 GHz/1066 MHz FSB
	Processor 2	NA
	Memory	HP 1 GB (2x512 MB) DDR2 667 MHz ECC registered FB-DIMMs
	Hard Drive	HP 80 GB SATA 3 Gb/s 7200 rpm
	Controller	NA
	Optical Drive	HP 16X DVD-ROM
	Graphics	NVIDIA Quadro NVS 285 128 MB PCI Express (PCIe)
	Floppy disk drive	NA
	Keyboard	HP USB standard keyboard
	Mouse	HP USB optical scroll mouse

xw6400X/XG2.00+/ F80/R2.0/285d/p RD688AW#ABA	OS	Genuine Windows XP Professional 32-bit
	Base unit	HP xw6400 Workstation base unit
	Localization kit	HP xw6400 Workstation localization kits
	Processor 1	Intel Xeon 5130 2 GHz/1333 MHz FSB
	Processor 2	Intel Xeon 5130 2 GHz/1333 MHz FSB
	Memory	HP 2 GB (2x 1 GB) DDR2 667 MHz ECC registered FB-DIMMs
	Hard Drive	HP 80 GB SATA 3 Gb/s 7200 rpm
	Controller	NA
	Optical Drive	HP 16X DVD-ROM
	Graphics	NVIDIA Quadro NVS 285 128 MB PCI Express (PCIe)
	Floppy disk drive	NA
	Keyboard	HP USB standard keyboard
	Mouse	HP USB optical scroll mouse

Standard Features - Preconfigured Global Models

xw6400X/XG1.60/ F80/R1.0/285d/p RD689AW#ABA	OS	Genuine Windows XP Professional 32-bit
	Base unit	HP xw6400 Workstation base unit
	Localization kit	HP xw6400 Workstation localization kits
	Processor 1	Intel Xeon 5140 2 GHz/1333 MHz FSB
	Processor 2	Intel Xeon 5140 2 GHz/1333 MHz FSB
	Memory	HP 2 GB (2x 1 GB) DDR2 667 MHz ECC registered FB-DIMMs
	Hard Drive	HP 80 GB SATA 3 Gb/s 7200 rpm
	Controller	NA
	Optical Drive	HP 16X DVD-ROM
	Graphics	NVIDIA Quadro NVS 285 128 MB PCI Express (PCIe)
	Floppy disk drive	NA
	Keyboard	HP USB standard keyboard
	Mouse	HP USB optical scroll mouse

xw6400X/XG1.60/ F80/R1.0/285d/p RD690AW#ABA	OS	Genuine Windows XP Professional 32-bit
	Base unit	HP xw6400 Workstation base unit
	Localization kit	HP xw6400 Workstation localization kits
	Processor 1	Intel Xeon 5140 2 GHz/1333 MHz FSB
	Processor 2	Intel Xeon 5140 2 GHz/1333 MHz FSB
	Memory	HP 4 GB (2x 4 GB) DDR2 667 MHz ECC registered FB-DIMMs
	Hard Drive	HP 73 GB SAS 3 Gb/s 15,000 rpm
	Controller	LSI 3041E 4-port SAS/SATA RAID card
	Optical Drive	HP 16X DVD-ROM
	Graphics	NVIDIA Quadro NVS 285 128 MB PCI Express (PCIe)
	Floppy disk drive	NA
	Keyboard	HP USB standard keyboard
	Mouse	HP USB optical scroll mouse

Standard Features - Preconfigured Global Models

xw6400X/XG2.00/ F80/R1.0/Xv/p RB275UA#ABA	OS	Genuine Windows XP Professional 32-bit
	Base unit	HP xw6400 Workstation base unit
	Localization kit	HP xw6400 Workstation localization kits
	Processor 1	Intel Xeon 5130 2 GHz/1333 MHz FSB
	Processor 2	none
	Memory	1GB (2x512) DDR2-667 FBD
	Hard Drive	80GB SATA 3Gb/s 7200
	Controller	LSI 3041E 4-port SAS/SATA RAID card
	Optical Drive	48X DVD-ROM/CD-RW Combo
	Graphics	No Graphics Option
	Floppy disk drive	NA
	Keyboard	HP USB standard keyboard
	Mouse	HP USB optical scroll mouse

xw6400X/XG2.33/ F160/R1.0/Xv/p RB276UA#ABA	OS	Genuine Windows XP Professional 32-bit
	Base unit	HP xw6400 Workstation base unit
	Localization kit	HP xw6400 Workstation localization kits
	Processor 1	Intel Xeon 5140 2.33 GHz/1333 MHz FSB
	Processor 2	none
	Memory	1GB (2x512) DDR2-667 FBD
	Hard Drive	160GB SATA 3Gb/s NCQ 7200
	Controller	LSI 3041E 4-port SAS/SATA RAID card
	Optical Drive	48X DVD-ROM/CD-RW Combo
	Graphics	No Graphics Option
	Floppy disk drive	NA
	Keyboard	HP USB standard keyboard
	Mouse	HP USB optical scroll mouse

Standard Features - Preconfigured Global Models

xw6400X/XG2.66/ A146a/R1.0/Xv/p RB277UA#ABA	OS	Genuine Windows XP Professional 32-bit
	Base unit	HP xw6400 Workstation base unit
	Localization kit	HP xw6400 Workstation localization kits
	Processor 1	Intel Xeon 5150 2.66 GHz/1333 MHz FSB
	Processor 2	none
	Memory	1GB (2x512) DDR2-667 FBD
	Hard Drive	146GB SAS 3Gb/s 10K
	Controller	LSI 3041E 4-port SAS/SATA RAID card
	Optical Drive	48X DVD-ROM/CD-RW Combo
	Graphics	No Graphics Option
	Floppy disk drive	NA
	Keyboard	HP USB standard keyboard
	Mouse	HP USB optical scroll mouse

xw6400X/XG3.00+/ B146a/R2.0/Xv/p RB278UA#ABA	OS	Genuine Windows XP Professional 32-bit
	Base unit	HP xw6400 Workstation base unit
	Localization kit	HP xw6400 Workstation localization kits
	Processor 1	Intel Xeon 5160 3.00 GHz/1333 MHz FSB
	Processor 2	Intel Xeon 5160 3.00 GHz/1333 MHz FSB
	Memory	2GB (2x1GB) DDR2-667 ECC FBD
	Hard Drive	146GB SAS 3Gb/s 10K
	Controller	LSI 3041E 4-port SAS/SATA RAID card
	Optical Drive	48X DVD-ROM/CD-RW Combo
	Graphics	No Graphics Option
	Floppy disk drive	NA
	Keyboard	HP USB standard keyboard
	Mouse	HP USB optical scroll mouse

After-Market Options

Processors	2nd Dual-Core Intel Xeon processor 5100 Series with EM64T, and 4 MB of Shared L2 cache	Part Number
	1.60 GHz with 1066 MHz FSB	EY012AA
	1.86 GHz with 1066 MHz FSB	EY013AA
	2.00 GHz with 1333 MHz FSB	EY014AA
	2.33 GHz with 1333 MHz FSB	EY015AA
	2.66 GHz with 1333 MHz FSB	EY016AA
	3.00 GHz with 1333 MHz FSB	EY017AA
	NOTE:* Dual-Core Intel Xeon Processor 5100 Sequence expected availability in Q3 2006. When ordering two processors, the second processor must be the same as the first.	

Graphics (PCI Express)	Multi display solutions	Windows XP	Red Hat Linux	Part Number
	NVIDIA Quadro NVS 285 (128 MB, VGA & DVI)	32-Bit, 64-Bit	WS3, WS4	RD069AA
	NVIDIA Quadro FX 560 (128 MB)	32-Bit, 64-Bit	WS3, WS4	ES354AA
	ATI FireGL V3300 (128 MB)	32-Bit, 64-Bit	WS3, WS4	ES353AA
	NVIDIA Quadro NVS 440 (256 MB)	32-Bit, 64-Bit	WS3, WS4	PT453A
	NVIDIA Quadro FX 1500 (256 MB)	32-Bit, 64-Bit	WS3, WS4	ES355AA
	NVIDIA Quadro FX 3500 (256 MB)	32-Bit, 64-Bit	WS3, WS4	ES357AA
	ATI FireGL V7200 (256 MB)	32-Bit, 64-Bit	WS3, WS4	ES356AA

Hard Drives	SATA Hard Drives	Windows XP	Red Hat Linux	Part Number
	80 GB 7200 rpm SATA 3.0Gb/s drive	32-Bit, 64-Bit	WS3, WS4	PY276AA
	160 GB 7200 rpm SATA 3.0Gb/s NCQ drive	32-Bit, 64-Bit	WS3, WS4	PV944A
	250 GB 7200 rpm SATA 3.0Gb/s NCQ drive	32-Bit, 64-Bit	WS3, WS4	EA788AA
	500 GB 7200 rpm SATA 3.0Gb/s NCQ drive	32-Bit, 64-Bit	WS3, WS4	PV943A
	80 GB 10K rpm SATA NCQ drive	32-Bit, 64-Bit	WS3, WS4	EM172AA
	160 GB 10K rpm SATA NCQ drive	32-Bit, 64-Bit	WS3, WS4	EW222AA
	SAS Hard Drives			
	146 GB 10K rpm SAS 3.0Gb/s drive	32-Bit, 64-Bit	WS3, WS4	EM173AA
	73 GB 15K rpm SAS 3.0Gb/s drive	32-Bit, 64-Bit	WS3, WS4	EA329AA
	146 GB 15K rpm SAS 3.0Gb/s drive	32-Bit, 64-Bit	WS3, WS4	EA330AA
	HP SAS Back Panel Connector	N/A	N/A	EM164AA

Controllers		PCI	PCI-X	Windows XP	Red Hat Linux	Part Number
	LSI SAS3041E 4-Port, Host Bus Adapter (NCQ (Native Command Queuing) is not supported on this card at this time.)			32-Bit, 64-Bit		EH417AA

After-Market Options

1394 PCI Cards		PCI	PCI-X	Windows XP	Red Hat Linux	Part Number
	IEEE 1394a FireWire 400 4-Port PCI Card	X		32-Bit, 64-Bit	Not supported	PA997A
	IEEE 1394b FireWire 800 3-Port PCI Card	X		32-Bit, 64-Bit	Not supported	EA327AA

Input/Output Devices*	Keyboards	Windows XP	Red Hat Linux	Part Number
	HP PS/2 Standard Keyboard (Carbonite/Silver)	32-Bit, 64-Bit	WS3, WS4	DT527A
	HP USB Standard Keyboard (Carbonite/Silver)	32-Bit, 64-Bit	WS3, WS4	DT528A
	HP USB Smartcard Keyboard - available Q3	32-Bit, 64-Bit	Not supported	ED707AA
	Pointing Devices			
	HP PS/2 2-Button Scroll Mouse (Carbonite)	32-Bit, 64-Bit	WS3, WS4	DD440B
	HP USB 2-Button Optical Scroll Mouse (Carbonite/Silver)	32-Bit, 64-Bit	WS3, WS4	DC172B
	HP USB Optical 3-Button Mouse	32-Bit, 64-Bit	WS3, WS4	DY651A
	USB Spaceball 5000	32-Bit, 64-Bit	Not supported	DV675A
	USB SpaceMouse	32-Bit, 64-Bit	Not supported	DZ203A
	USB SpacePilot	32-Bit, 64-Bit	Not supported	EF390AA

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

Networking	NICs	PCI	PCI-X	Windows XP	Red Hat Linux	Part Number
	Broadcom BCM5751 NetXtreme Gigabit Ethernet Controller (PCIe)		X	32-Bit, 64-Bit	WS3, WS4	EA833AA

Memory modules	667 MHz	Windows XP	Red Hat Linux	Part Number
	512 MB PC2-5300F ECC Registered DDR2 667 MHz FB-DIMM	32-Bit, 64-Bit	WS3, WS4	EM159AA
	1 GB PC2-5300F ECC Registered DDR2 667 MHz FB-DIMM	32-Bit, 64-Bit	WS3, WS4	EM160AA
	2 GB PC2-5300F ECC Registered DDR2 667 MHz FB-DIMM	32-Bit, 64-Bit	WS3, WS4	EM161AA

Monitors (Supported by all Operating Systems available from HP)	TFT display	Part Number
	HP Flat Panel Monitor TFT LP2465 (24-inch)	EF224A4
	HP Flat Panel Monitor TFT L2065 (20.1-inch)	EF227A4
	HP Flat Panel Monitor TFT L1955 (19.1-inch)	PD974A5

After-Market Options

Optical drives	DVD-ROM Drive	Windows XP	Red Hat Linux	Part Number
	HP 16X/48X DVD-ROM Drive	32-Bit, 64-Bit	WS3, WS4	AA620B
	CD-ROM Drive			
	HP 48X Max CD-ROM Drive (only available as first optical drive)	32-Bit, 64-Bit	WS3, WS4	DC143B
	Combo Drive			
	HP 48X CD-RW/DVD-ROM Combo Drive	32-Bit, 64-Bit	WS3, WS4	DE206B
	DVD+/-RW Drive			
	HP 16X DVD+/-RW, Dual-Layer, LightScribe*	32-Bit	WS3, WS4 (LightScribe functionality not supported)	DZ555B
	NOTE:* LightScribe software supported with Windows 2K and XP only)			

Removable Storage		Windows XP	Red Hat Linux	Part Number
	StorCase DX115 SAS Removable Enclosure	N/A	N/A	EA333AA
	StorCase DX115 SATA/SAS HDD Carrier Tray	N/A	N/A	RA697AA
	StorCase DX115 SATA Removable Enclosure (1 additional HD in a 5.25 inch bay)	N/A	N/A	EA332AA
	HP 512 MB USB 2.0 Drive Key	32-Bit, 64-Bit	WS3, WS4	ED516AA
	HP 1 GB USB 2.0 Drive Key	32-Bit, 64-Bit	WS3, WS4	AG382AA
	1.44 MB Internal Floppy Drive	32-Bit	WS3, WS4	DY670A
	HP 16-In-1 Media Card Reader with PCI Card 3Q			EM718AA

Audio		Windows XP	Red Hat Linux	Part Number
	HP Satellite Stereo Speakers			ZD929AA
	SoundBlaster X-Fi XtremeMusic Audio Card	32-Bit, 64-Bit	Not supported	EA326AA

Brackets/Rack Kits		Part Number
	xw64 Depth Adjustable Sliding Rail Rack Kit	DY663A
	HP Optical Bay HDD Mounting Bracket	DY659A

Other Devices		Part Number
	HP Internal USB Port Kit	EM165AA
	HP Power Cord Kit	DM293A

Security features		Part Number
	HP Business PC Security Lock Kit	PV606AA
	Kensington Security Cable & Lock	PC766A
	HP Solenoid Hood Lock/Sensor Kit	DE618A

After-Market Options

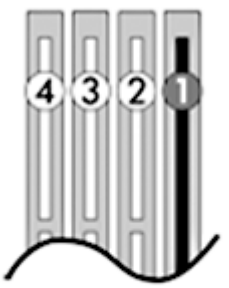
Operating Systems	Part Number
Red Hat Enterprise Linux Workstation 4 (64-Bit preload)	EA700AA

Operating Systems	Part Number
HP Remote SW for HP 1yr Update Subscription	PN680A
HP Remote SW Receiver 1y Update Subscription	PN682A
HP Remote Graphics SW V3 for HP Systems LTU	PY682AA
HP Remote Graphics SW V3 Receiver LTU	PY684AA
HP Remote Graphics SW V3 CD-ROM Media	PY685AA
HP ProtectTools Quantity 1 Software (available beginning January 2007)	EM530AA
HP ProtectTools Quantity 25 Software (available beginning January 2007)	EM531AA
HP ProtectTools Quantity 500 Software (available beginning January 2007)	EM532AA

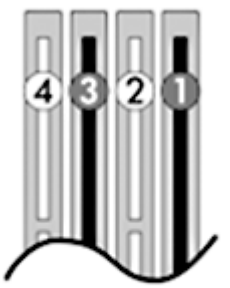
Intel 5000X Chipset

PC2-5300F ECC Registered DDR2 667 MHz FB-DIMM

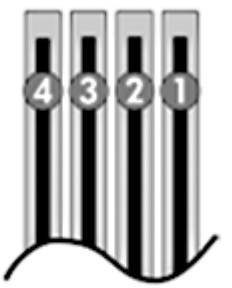
The Intel 5000X chipset supports ECC Registered DDR2 667 MHz FB-DIMMs only. The motherboard has 4 DIMM slots. Use only fully buffered, PC2-5300F DIMMs. Match multiple DIMMs by size and type. Use HP memory only.



single DIMM configuration



two DIMM configuration



four DIMM configuration

If only using 1 DIMM, install in socket 1. If using 2 DIMMs, install them in sockets 1 & 3. If using 4 DIMMs, install them in all sockets.

MAXIMUM MEMORY

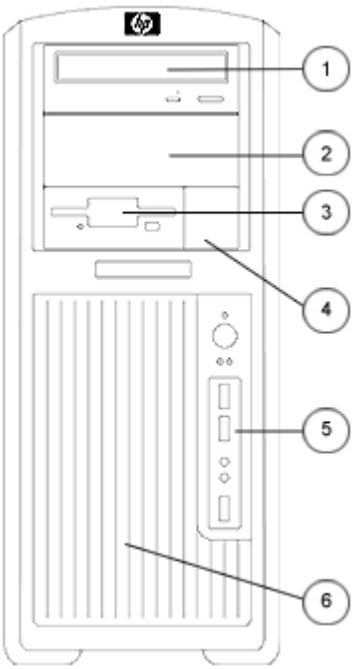
Supports up to 16 GB of DDR2 FB-DIMM SDRAM.

POSSIBLE MEMORY CONFIGURATIONS

Not all memory configurations possible are represented below.

DIMM Size	Slot			
	1	2	3	4
512 MB	512 MB			
1 GB	512 MB	512 MB		
2 GB	1 GB	1 GB		
2 GB	512 MB	512 MB	512 MB	512 MB
4 GB	1 GB	1 GB	1 GB	1 GB
8 GB	2 GB	2 GB	2 GB	2 GB
16 GB	4 GB	4 GB	4 GB	4 GB

Tower configuration



	Quantity Supported	Position Supported	Controller
Convertible Minitower			
Optional Diskette Drive	1	3	IDE
5.25" storage drive bays (position 1 drive bay is limited to 198 mm depth when optional smart cover solenoid lock is installed; position 2 drive bay can be converted to an internal 3.5" 3rd hard drive bay with optional bracket)	2	1, 2	IDE
3.5" storage drive bays with acoustic dampening rail assemblies	2 (3)	5 (and 2, for 3rd drive using optical bay)	SATA or optional SAS Factory Integrated RAID*

SATA and SAS may be mixed only in a Windows configuration and with the inclusion of an optional SAS controller. Here are the rules for mixing hard drives:

1. The boot/data drive must be SATA to load before any SAS drive.
2. Any size or speeds may be chosen for drives In non-mixed Microsoft Windows and Linux systems, rules 2 & 3 apply.

Configure-to-order RAID configs must all have the same size/speed hard drives.

Up to 4 channels of SATA can be supported natively.

NOTE*: Factory Integrated RAID 0 Configuration (Striped Array) and RAID 1 Configuration (Mirrored Array) requires 2 hard drives with identical speeds, capacity and interface. Also, HW RAID functionality or factory configured RAID not supported in Linux. For RAID functionality, use SW RAID provided in the Red Hat operating system instead.

System Board	
Processor Architecture	Dual-Core Intel® Xeon® Processor 5100 sequence
Chipset	Intel® 5000X
Super I/O Controller	SMSC SCH5307
System Board Form Factor	9.8"x12.0"
Processor Socket	Dual LGA 771
DIMM Connectors (FBD DDR2)	4
PCI Connectors (5.0V)	2 full length 33 MHz 32-Bit
PCI Express Connectors	1 PCI Express x16 graphics 2 PCI Express (x8 mechanically, x4 electrically) 1 PCI Express (x16 mechanical/x4 electrically)
Flash ROM	Yes
HD Integrated Audio	Yes
CD-ROM IN (audio)	No
AUX IN (audio)	Yes
Clear CMOS Button	Yes
CPU Fan Headers	Yes
Chassis Fan Headers	Yes
Chassis Speaker Header	Yes
Front Control Panel/Speaker Header	Yes
CMOS Battery Holder - Lithium	Yes
Hood Lock Header	No
Hood Sensor Header	No
Multibay Header	No
Integrated Gigabit Ethernet	Broadcom BCM5752
Wake on LAN	Yes
Integrated Trusted Platform Module	TPM 1.2 expected availability is for systems sold beginning in 2007
ASF 2.0 (Alert Standard Format)	Yes
Integrated SATA RAID	○ RAID 0, RAID 1, RAID 5 and RAID 10 ○ Supports one RAID array with 2-4 drives ○ RAID 0 configuration – striped array ○ RAID 1 configuration – mirrored array ○ RAID 5 parity striping ○ RAID 10 stripe of mirrors NOTE: HW RAID functionality not supported by Linux. Use SW RAID functionality provided in the Red Hat Operating system instead.
SATA Connectors	4 ports/connectors

IEEE 1394a or 1394b	No integrated 1394a or 1394b – optional PCI card required. Cable from Front IO can be plugged into PCI Card. Not supported in Linux
USB 2.0 Connectors	8 (5 rear, 2 on header for front, 1 internal)
Power Supply Headers	Yes
Power Switch, Power LED & Hard Drive LED Header	Yes
Password Clear Header	Yes

Cooling Solutions	
Power Supply Fan	92x25 mm variable speed
Processor Heatsink Fan(s)	80x15 mm
Rear Chassis Fan(s)	Two 92x32 mm

Power Supply		
Power Supply	575 watt custom power supply – (Wide Ranging, Active PFC)	
Operating Voltage Range	90 – 269 VAC	
Rated Voltage Range	100 – 240 VAC	118 VAC
Rated Line Frequency	50/60Hz	400Hz
Operating Line Frequency Range	47–66Hz	393–407Hz
Rated Input Current	7A @ 100-120VAC 3 A @ 200-240 VAC	6.7 @ 118 VAC
Heat Dissipation (configuration and software dependent)	Typical 699 btu/hr (176 kg-cal/hr) Maximum 2804 btu/hr (706 kg-cal/hr)	
Power Supply Fan	92x25 mm variable speed	
Energy Star Compliant	YES	
Blue Angel Compliant (<5w in S5 – power off)	N/A	
FEMP Standby Power compliant @ 115V (<2W in S5 – power off)	YES	
Power Consumption in ES mMode – Suspend to RAM (S3) (instantly available PC)	< 7 W	

ROM Features	Description
ROM Based F10 Setup and Diagnostics	Review and customize BIOS settings
Remote System Installation via F12 (PXE) (remote boot from server)	Allows a new or existing system to boot over the network and download software, including the operating system
System/Emergency ROM Flash Recovery with Video	Recovers corrupted system BIOS
ROM Revision Levels	• Identifies system ROM revision levels 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 • Revision level is digitally encoded into the hardware and cannot be modified
Auto Setup when new hardware installed	System automatically detects addition of new hardware
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 computer
Setup Password	Prevents an unauthorized person from changing the system configuration
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
Memory Change Alert (requires HP Client Manager Software)	Alerts management console if memory is removed or changed
Thermal Alert (requires HP Client Manager Software)	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
Master Boot Record Security	Detects changes to MBR and optional restoration, useful in protecting from viruses
Remote ROM Flash	Provides secure, fail-safe ROM image management from a central network console
Remote Wakeup/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
ACPI (Advanced Configuration and Power Interface)	• Allows the system to wake from a low power mode • 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
Keyboard-less Operation	The system can be operated without a keyboard
SMBIOS	System Management BIOS 2.3.5, previously known as DMI BIOS, for system management information
Localized ROM Setup	Common BIOS image supports configuration (Setup) in 11 languages, with local keyboard mappings
Asset Tag	Allows user or MIS to set unique tag string in ROM
Ownership Tag	Allows user or MIS to set unique tag string in ROM
Memory Scrubbing	Allows memory controller to transparently correct transient ECC errors in the background
Memory Remapping	Allows system memory lost to PCI devices to be reclaimed above 4 GB, for use with operating systems that support more than 4 GB (Windows XP 64-Bit edition, Linux)
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 LED

Technical Specifications

Industry Standard	Revision Supported by the BIOS
ACPI	Advanced Configuration and Power Management Interface, Version 2.0
ASF	Alert Standard Format Specification, Version 2.0
ATA (IDE)	AT Attachment 6 with Packet Interface (ATA/ATAPI-6), Revision 3b
ATAPI	ATAPI Removable Media Device BIOS Specification Version 1.0
BBS	BIOS Boot Specification v1.01
BIOS 32-Bit Services	Standard BIOS 32-Bit Service Directory Proposal
CD Boot	"El Torrito" Bootable CD-ROM Format Specification Version 1.0
EDD	• Enhanced Disk Drive Specification Version 1.1 • BIOS Enhanced Disk Drive Specification Version 3.0
EHCI	Enhanced Host Controller Interface for Universal Serial Bus, Revision 1.0
PCI	• PCI Local Bus Specification, Revision 2.3 • PCI Power Management Specification, Revision 1.1 • PCI Firmware Specification, Revision 3.0, Draft .7
PCI Express	PCI Express Base Specification, Revision 1.0a
PMM	POST Memory Manager Specification, Version 1.01
SATA	• Serial ATA Specification, Revision 1.0a • Serial ATA 3 Gb/s: Extensions to Serial ATA 1.5 Gb/s, Revision 1.0
SAS	SAS specification 1.1
SMBIOS	System Management BIOS Reference Specification, Version 2.4
SPD	PC SDRAM Serial Presence Detect (SPD) Specification, Revision 1.2B
UHCI	Universal Host Controller Interface Design Guide, Revision 1.1
USB 1.1	Universal Serial Bus Revision 1.1 Specification
USB 2.0	Universal Serial Bus Revision 2.0 Specification

Other Deployment & Management Features	
HP Client Management Solutions (Windows XP only)	HP Client Management Solutions help simplify management of Workstations and significantly reduce total ownership costs. These solutions share a common design and are highly integrated. HP Client Manager Software is included free with all HP business PCs and Workstations. It enables central tracking, monitoring, and management of the hardware aspects of HP client systems: • Get valuable hardware 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 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 • Client backup and recovery • Problem resolution Visit http://www.hp.com/go/clientmanager for more information, to download HP Client Manager

	Software.

HP ProtectTools (Windows XP only) available beginning January 2007	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.

System Software Manager (free - Windows XP only)	A free utility that detects and updates BIOS, device drivers, and management agent versions on your networked PCs and workstations
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
Software Restore CD	Restores computer to its original factory shipping image; No recovery CDs will ship with Linux - an ISO image will be available on an HD partition.
Asset Tag	• Repository for storing company-specific property asset numbers for easy tracking • Initially set equal to the system serial number • Stored in a protected section of non-volatile memory that can be accessed and modified with the F10 Setup program
DIMM Serial Presence Detect	Detects whether or not memory DIMMs are present and their type
Hard Drive Serial Number, Model, and Manufacturer	Hard drive manufacturer, model, and serial number is stored in the hard drive firmware and reported in ROM-based F10 setup
Memory Change Alert (Requires HP Client Manager Software - Windows XP only)	Alerts management console if memory is removed or changed
Ownership Tag	A user-defined string stored in non-volatile memory that is displayed in the BIOS splash screen
Protocol-level Integrity Monitoring (CRC checking)	A feature of SATA and SAS, Cyclic Redundancy Checking provides command, data and message transfer verification and proactive notification of problems with recommendations for enhancing system performance. It detects all the following errors types: • single bit errors • double bit errors • an odd number of errors • error bursts up to 32-Bits long

Drive Self Tests (DPS)	• Drive Protection System • A diagnostic hard drive self test. It scans critical physical components and every sector of the hard drive for physical faults and then reports any faults to the user. • Running independently of the operating system, it can be accessed through the computer's setup procedure. It produces an evaluation on whether the hard drive is the source of the problem and needs to be replaced. The system expands on the Self-Monitoring, Analysis, and Reporting Technology (SMART), a continuously running systems diagnostic that alerts the user to certain types of failures. DPS Access through F10 Setup during Boot (F10 diagnostic access not available with SCSI drives)
SMART Technology (Self-monitoring, analysis and reporting technology – Windows XP only)	Allows hard drives to monitor their own health and to raise flags if imminent failures were predicted Predicts failures before they occur. Tracks fault prediction and failure indication parameters such as re-allocated sector count, spin retry count, calibration retry count. By avoiding actual hard drive failures, SMART hard drives act as "insurance" against unplanned user downtime and potential data loss from hard drive failure. SMART I – Drive Failure Prediction SMART II – Off-Line Data Collection SMART III – Off-Line Read Scanning with Defect Reallocation

Serviceability Features of System	
Access panel	Tool-less, one-handed
Optical drives	Tool-less
Floppy drive	Tool-less
Hard drives	Tool-less
Expansion cards	Tool-less
Chassis fan removal	Tool-less
Green user touch points	Yes, on tool-free internal chassis mechanisms
Color-coordinated cables and connectors	Yes
Memory	Tool-less
CPUs	Requires T15 Torx driver, can be upgraded without removing any internal components except processor heat sink.
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
Dual Color Power and HD LED on Front of Computer (Indicates Normal Operations and Fault Conditions)	green – normal red – fault
System/Emergency ROM Flash Recovery with Video	Recovers corrupted system BIOS.
Configuration Record SW	Yes
Over-Temp Warning on Screen (Requires IM Agents)	Yes

OS CD (Restore OS CD)	Restores computer to its original factory shipping image; No recovery CDs will ship with Linux - an ISO image will be available on an HD partition.
Restore CD	Restores the computer to its original factory shipping image
Flash ROM	Yes
3.3V Aux Power LED on System PCA	No
Dual Function 5V Aux Power LED (ON)/PS_ON LED (OFF) on System PCA	No
Diagnostic Power Switch LED on board	No
Clear Password Jumper	Yes
Clear CMOS Button	Yes
CMOS Battery Holder for easy Replacement	Yes
Processor ZIF Socket for easy Upgrade	Yes
DIMM Connectors for easy Upgrade	Yes
NIC LEDs (integrated) (Green & Amber)	Used to determine NIC status
ASF 1.0 support (Alert Standard Format)	Industry-standard specification for network alerting in operating system-absent environments
Dual function front power switch	Also acts as a reset switch when held for 4 seconds

Security Features	
1I2 Trusted Platform Module Chip with optional ProtectTools Software	Expected availability in 2H 2006
Access Panel Key Lock (standard)	Prevents removal of the access panel and all internal components including optical and floppy drives
Padlock (optional)	Prevents entire system theft and discourages access panel removal. 7mm diameter padlock loop at rear of system.
Kensington Cable Lock (optional)	May prevent entire system theft; Kensington locks to tether systems to the desk. 3mm x 7mm slot at rear of system.
HP Solenoid Hood Lock/Sensor Kit (optional)	The Solenoid Hood Lock eliminates the need for a physical key by making the chassis lockable through software and a password. You can also lock and unlock the chassis remotely over the network. The Sensor Kit detects when the access panel has been removed.
Universal chassis clamp lock (optional)	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.

Technical Specifications

Service and Support	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) 24 x 7. 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.

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 Energy Star (Not in Linux) • US Federal Energy Management Program (FEMP) • China Energy Conservation Program • IT ECO declaration • Japan PC Green label*
	*NOTE: This product conforms to the examination standards (2003 version) under JEITA's 'PC Green Label System.'

Energy Consumption and Noise Emissions		
System Configuration	The configuration used for the Energy Consumption and Declared Noise Emissions data for the Convertible Mini tower Desktop model is based on a "Typically Configured Desktop"	
	Processor Info	2x2 GHz
	Memory Info	4x1 GB 667 MHz
	Graphics Info	FX 1500
	Disks/Optical/Floppy	2x 80 GB SATA / 1 Optical / 1 Floppy

Energy Consumption		115 VAC		230 VAC		100 VAC	
	LAN	Enabled	Disabled	Enabled	Disabled	Enabled	Disabled
	Windows Idle (S0)	180 W		176 W		180 W	
	Windows Busy (S0)	205 W		200 W		203 W	
	Sleep (S3)	4.1 W	4.3 W	4.8 W	3.9 W	4.1 W	3.2 W
	Off (S5)	2.4 W	2.0 W	3.0 W	3.0 W	2.3 W	2.0 W

Heat Dissipation**		115 VAC		230 VAC		100 VAC	
	LAN	Enabled	Disabled	Enabled	Disabled	Enabled	Disabled
	Windows Idle (S0)	180 W		176 W		180 W	
	Windows Busy (S0)	205 W		200 W		203 W	
	Sleep (S3)	4.1 W	14.3 W	4.8 W	4.1 W	4.3 W	4.8 W
	Off (S5)	2.4 W	2.0W	3.0 W	2.4 W	2.0W	3.0 W
	NOTES: * Energy Star low energy mode ** Heat dissipation is calculated based on the measured watts, assuming the service level is attained for one hour. This product is in compliance with US executive order 13221, WOL (wake on LAN) disabled.						

Declared Noise Emissions (in accordance with ISO 7779 and ISO 9296)		Sound Power (LWad, bels)	Deskside Sound Pressure (LpAm, decibels)
	Idle	TBD	TBD
	Fixed Disk (random writes)	TBD	TBD
	Optical Drive (sequential reads)	TBD	TBD

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: • Intel LGA771 processor socket • 8 USB ports • 2 PCI slots and 4 PCI Express slots • 5 storage bays • 4 memory slots

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 the 5ppm by weight • Cadmium greater than 10ppm by weight • Lead greater than 4000ppm by weight. Battery size: CR2032 (coin cell) Battery type: Lithium

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.		
	Packaging Materials		
	External	Cardboard carton and insert	2.70 kg
	Internal	LDPE Foam	0.35 kg

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 Tin (TBT), Triphenyl Tin (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.

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

Technical Specifications - Audio

High Definition Integrated Realtek ALC262 Audio	Type	Integrated
	High Definition Codec	Yes
	SPDIF	No
	External audio jacks	One front stereo analog microphone-in One front stereo headphone-out One rear line-in One rear line-out One rear stereo analog microphone-in
	Internal audio connectors	AUX-IN line-level analog input
	Retasking	NOTE: All external audio ports are retaskable as Line-In, Line-Out, Microphone-In, or Headphone-Out
	Sampling	44.1kHz/48 kHz/96kHz/192kHz (output only)
	Wavetable syntheses (software)	Yes - Uses OS soft wavetable
	Digital audio	Yes
	Analog audio	Yes
	Number of channels on Line-Out (mono/stereo)	Two independent stereo outputs (Left & Right channels)
	Internal audio speaker power rating	1.5 W
	Internal speaker	Yes
	Microphone features	Stereo Microphone supporting: Acoustic echo cancellation Noise suppression Beam forming

Sound Blaster X-Fi XtremeMusic Audio Card (Windows XP Only)	Audio Quality	Total Harmonic Distortion + Noise at 1kHz (20kHz Low-pass filter) = 0.004%
	Signal to Noise Ratio (SNR)	Signal-to-Noise Ratio (20kHz Low-pass filter, A-Weighted) • Stereo Output: 109dB • Front and Rear Channels: 109dB • Center, Subwoofer and Side Channels: 109dB
	Sound Conversion	24-bit Analog-to-Digital conversion of analog inputs at 96kHz sample rate 24-bit Digital-to-Analog conversion of digital sources at 96kHz to analog 7.1 speaker output 24-bit Digital-to-Analog conversion of stereo digital sources at 192kHz to stereo output
	Recording/Sampling Rate	44.1, 48 and 96kHz
	ASIO 2.0 support	16-bit/44.1kHz, 16-bit/48kHz, 24-bit/44.1kHz 24-bit/48kHz and 24-bit/96kHz with direct monitoring
	Enhanced SoundFont support	up to 24-bit resolution 24-bit/96kHz
	DACs	24-bit/192kHz

Technical Specifications - Audio

Voice Support	128 voices	
Max. Channels in 3D Positional Audio	7.1	
EAX® ADVANCED HD™ 5.0 support	Yes including EAX® MacroFX™, EAX® PurePath™ and Environment FlexiFX™	
Connectors	FlexiJack (Performing a 3-in-1 function, Digital In / Line In / Microphone) via 3.50 mm minijack	
	Line level out (Front / Rear / Center / Subwoofer / Rear Center) via 3.50 mm minijacks	
	AUX_IN line-level analog input via 4-pin Molex connector on card	
	One AD_Link (26 pin) connector for linking to the X-Fi I/O Console (upgrade option)	
Dimensions	7.25 x 5 x 0.9 in (18.42 x 12.7 x 2.29 cm)	
Additional product features	Movies	THX Certification Dolby Digital EX 6.1 Playback DTS-ES 6.1 Playback
	Music	X-Fi 24-bit Crystalizer CMSS-3D SuperRip
	Audio Creation	Pristine audio playback quality with a near transparent SRC engine Up to eight 24 bit hardware effects ASIO recording with latency as low as one millisecond 24-bit SoundFont® sampling 3D MIDI
	Gaming	EAX ADVANCED HD 5.0
	Software Bundle	Doom 3 Sound Blaster EAX patch Entertainment Mode Audio Creation Mode Game Mode Mode Switcher Audio Console Creative MediaSource Creative MediaSource DVD-Audio Player DTS Neo:6 Settings Karaoke Player Entertainment Center Smart Recorder SoundFont Bank Manager Speaker Connection Wizard THX Setup Console Vienna SoundFont Studio Volume Panel WaveStudio Console Launcher Creative Media Toolbox Creative Diagnostics

Minimum System Requirements	System RAM	256 MB
	Hard Disk	600MB free space Available PCI 2.1 slot for the audio card CD-ROM/CD-RW or CD/DVD-ROM required for software installation
	Operating System	Microsoft Windows XP Service Pack 2 (SP2)

Technical Specifications - Communications

Broadcom BCM5752 NetXtreme Gigabit Ethernet LOM (PCIe)	**Connector**	RJ-45
	Controller	Broadcom 5752 PCI-E LAN Controller
	Memory	Integrated 64KB receive buffer and 8KB transmit buffer
	Data rates supported	10/100/1000 Mbps
	Compliance	IEEE 802.3, 802.3AB and 802.3u compliant, 802.3x flow control
	Bus architecture	PCI-E 1.0a
	Data path width	X1
	Data path speed	2.5Gbit per sec per direction transfer rate
	Data transfer mode	Bus-master DMA
	Hardware certifications	
	Power requirement	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 XP Professional, Microsoft Windows XP Professional x64 Edition, Red Hat Enterprise Linux 3
	Management capabilities	WOL, PXE
	Alerting	ASF 2.0

Broadcom BCM5751 NetXtreme Gigabit Ethernet Controller (PCIe)	**Connector**	RJ-45	
	Controller	Broadcom 5751 PCI-E 1.0a LAN Controller	
	Memory	Integrated 96Kb frame buffer memory	
	Data rates supported	10/100/1000 Mbps	
	Compliance	IEEE 802.3, 802.3AB and 802.3u compliant, 802.3x flow control	
	Bus architecture	PCI-E 1.0a	
	Data path width	X1	
	Data path speed	2.5Gbit per sec per direction transfer rate	
	Data transfer mode	Bus-master DMA	
	Hardware certifications	FCC class B, NRTL Mark Canada and United States, C-Tick for Australia, BSMI for Taiwan, VCCI for Japan, MIC for Korea, GOST for Russia	
	Power requirement	3.1 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	
	Environmental	**Operating temperature**	32° to 131° F (0° to 55° C)
		Operating humidity	85% at 131° F (55° C)

Technical Specifications - Communications

Dimensions	4.4 x 2.2 x 0.08 in (11.2 x 5.5 x 0.2 cm)
Operating system driver support	Microsoft Windows 2000 and XP, Red Hat Linux 7.2, 7.3 and Red Hat Enterprise Linux 3
Management capabilities	WOL, PXE , Remote cable management
Alerting	ASF 2.0
Kit contents	Broadcom 5751, CD, Broadcom 5751 Netxtreme Gigabit PCIe NIC, drivers, quick install guide, product warranty statement

Technical Specifications - Controllers

LSI SAS3041E Serial Attach SCSI (SAS) **Host Bus Adapter** (HBA)	**PCI Bus**	PCI-Express x4 lanes	
	PCI Modes	Bus Master DMA	
	PCI data burst transfer rate	1.0 GBps (half duplex) 2.0 GBps (full duplex)	
	SAS Bandwidths	**Half Duplex** Single lane – 300 MBps Wide Port (2 lanes) – 600 MBps Wide Port (4 lanes) – 1200 MBps	**Full Duplex** Single SAS Lane – 600 MBps Wide Port (2 lanes) – 1200 MBps Wide Port (4 lanes) – 2400 MBps
	PCI Card Type	3.3 volt add-in card	
	PCI Voltage	12 V ± 10%	
	PCI Form Factor	6.6" x 2.731" (Low-profile)	
	PCI Power	7.5 Watts	
	Bracket	Full height and Low-profile	
	Certification Level	PCI-Express 1.0a	
	IO Bus	Four 3Gbps SAS / 1.5Gps SATA ports	
	SAS Processor	LSISAS1064E	
	Internal Connectors	Four- SATA x1 connectors	
	External Connectors	None	
	Max. Number of SCSI Devices	128	
	LED Indicators	On-board activity and fault LEDs	
	Integrated Mirroring	Integrated Mirroring option available	
	Environments	Operating	Storage
	Temperature	32° to 140° F (0° to 60° C)	-49° to +221° F (-45° to +105° C)
	Relative Humidity	5% to 90% non-condensing	5% to 90% non-condensing
	MTBF	>200,000 hours	
	Compliances	EMC: Class B-US (CFR 47, P15B); Canada (ICES-003); Japan (V-3/02.04);Europe (EN55022/EN55024); Australia/New Zealand (AS/NZS 3548); Safety: EN60950	
	Operating system support	Microsoft Windows XP Professional, XP Professional x64 Red Hat Linux 7.2, 7.3, WS3 and WS4	
	Kit contents	Controller card, driver CD, LED cables, user documentation and warranty card.	

Technical Specifications - Controllers

U320 SCSI Controller - LSI 20320AR RAID 0,1 including external connector (required with SCSI HDDs)	Bus architecture	PCI-X (backward compatible with PCI)
	Number of supported devices	Up to 15 SCSI devices
	Interface protocol	64 bit, 133MHz PCI-X
	Host bus transfer rate	Up to 1MB/s
	SCSI data transfer rate	Up to 320 MB/s per channel
	SCSI Bus	Wide Ultra320, Low Voltage Differential, and Ultra Wide Single-Ended
	Internal connector	68-pin HD
	External connector	68 pin
	Total connectors	2
	Plug and Play Support	No
	Dimensions (H x L)	6.6 x 2.5 in (16.9 x 6.4 cm)
	Approvals	CE, VCCI, Canada, C-Tick, FCC class B, UL 94VO
	Operating system support	Microsoft Windows XP Professional Windows XP Professional x64 Edition
	Kit contents	Controller card, driver CD, LED cables, user documentation and warranty card.

Adaptec SCSI RAID 2120S Card	Dimensions (H x D)	2.5 x 6.6 in (6.4 x 16.8 cm) Low profile card
	RAID level	0, 1, 10, 5, 50, JBOD
	Data Transfer Rate	Up to 320 MB/s
	Cache Memory	64 MB (onboard)
	Device Support	Up to 15 SCSI devices
	Bus Type	64-bit/66 MHz PCI (Also support 32-bit/33 MHz PCI)
	Internal Connectors	One 68-pin high-density
	External Connectors	One 68-pin VHDCI
	System Requirements	Intel PC or equivalent with available PCI slot
	Operating Temperature	32° to 131° F (0° to 55° C)
	Power Requirements	4 amps @ +5V
	Operating System Support	Windows 2000 Professional, Windows XP Professional, Windows XP Professional x64 Edition
	Other	Optimized disk utilization Online RAID Level Migration Online capacity expansion Immediate RAID availability (background initialization) S.M.A.R.T. support
	Kit Contents	Controller card, driver CD, LED cables, user documentation and warranty card.

Technical Specifications - Hard Drives

Serial ATA Hard Drives	500 GB (7,200 rpm)	Capacity	500,107,862,016 bytes	
		Height	1 in (2.54 cm)	
		Width	Media diameter: 3.5 in (8.89 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 3.0 Gb/s	
		Cache	16 MB	
		Seek Time (typical reads, includes controller overhead, including settling)	Single Track	1.3 ms
			Average	20.0 ms
			Full-Stroke	30 ms
		Rotational Speed	7,200 rpm	
		Logical Blocks	976,773,168	
		Operating Temperature	41° to 131°F (5° to 55°C)	
	250 GB (7,200 rpm)	Capacity	250,059,350,016 bytes	
		Height	1 in (2.54 cm)	
		Width	Media diameter: 3.5 in (8.89 cm) Physical size: 4 in (10.2 cm)	
		Interface	Serial ATA (3.0 Gb/s) Native Command Queuing enabled (Model EA788AA only)	
		Synchronous Transfer Rate (Maximum)	Up to 3.0 Gb/s	
		Cache	With NCQ (Model EA788AA):16 MB Without NCQ (Model PY278AA): 8MB	
		Seek Time (typical reads, includes controller overhead, including settling)	Single Track	1.0 ms
			Average	18.5 ms
			Full-Stroke	18 ms
		Rotational Speed	7,200 rpm	
		Logical Blocks	488,397,168	
		Operating Temperature	41° to 131°F (5° to 55°C)	

Technical Specifications - Hard Drives

160 GB (7,200 rpm)	**Capacity**	160,041,885,696 bytes	
	Height	1 in (2.54 cm)	
	Width	Media diameter: 3.5 in (8.89 cm) Physical size: 4 in (10.2 cm)	
	Interface	Serial ATA (3.0 Gb/s)	
	Synchronous Transfer Rate (Maximum)	Serial ATA (3.0 Gb/s), Native Command Queuing enabled	
	Cache	8 MB	
	Seek Time (typical reads, includes controller overhead, including settling)	**Single Track**	0.9 ms
		Average	9.3 ms
		Full-Stroke	18 ms
	Rotational Speed	7,200 rpm	
	Logical Blocks	312,581,808	
	Operating Temperature	41° to 131°F (5° to 55°C)	

80 GB (7,200 rpm)	**Capacity**	80,026,361,856 bytes	
	Height	1 in (2.54 cm)	
	Width	Media diameter: 3.5 in (8.89 cm) Physical size: 4 in (10.2 cm)	
	Interface	Serial ATA (3.0 Gb/s)	
	Synchronous Transfer Rate (Maximum)	Up to 3 Gb/s	
	Cache	8 MB	
	Seek Time (typical reads, includes controller overhead, including settling)	**Single Track**	2 ms
		Average	9.3 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)	

Technical Specifications - Hard Drives

160 GB (10k rpm)	**Capacity**	160,041,885,696 bytes	
	Height	1 in (2.54 cm)	
	Width	Media diameter: 3.0 in (7.62 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 1.5 Gb/s	
	Cache	16 Mbytes	
	Seek Time (typical reads, includes controller overhead, including settling)	**Single Track**	0.3 ms
		Average	4.6 ms
		Full-Stroke	10.2 ms
	Rotational Speed	10,000 rpm	
	Logical Blocks	312,581,808	
	Operating Temperature	41° to 131°F (5° to 55°C)	

80 GB (10k rpm)	**Capacity**	80,026,361,856 bytes	
	Height	1 in (2.54 cm)	
	Width	Media diameter: 3.0 in (7.62 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 1.5 Gb/s	
	Cache	16 Mbytes	
	Seek Time (typical reads, includes controller overhead, including settling)	**Single Track**	0.3 ms
		Average	4.6 ms
		Full-Stroke	10.2 ms
	Rotational Speed	10,000 rpm	
	Logical Blocks	156,301,488	
	Operating Temperature	41° to 131°F (5° to 55°C)	

Technical Specifications - Hard Drives

Serial Attached SCSI (SAS) Hard Drives	146 GB (10K rpm)	Capacity	146,815,737,856 bytes	
		Height	1.0 in (25.4mm)	
		Width	4.0 in (101.6mm)	
		Interface	SAS	
		Synchronous Transfer Rate (Maximum)	3.0 Gb/s	
		Buffer	8 MB	
		Seek Time (typical reads, includes controller overhead, including settling)	Single Track	0.3 msec
			Average	<4.5 msec
			Full-Stroke	<11.0 msec
		Rotational Speed	10,000 rpm	
		Logical Blocks	286,749,488 - 512 byte blocks	
		Operating Temperature	50° to 95° F (10° to 35° C)	
	73 GB (15K rpm)	Capacity	73,407,865,856 bytes	
		Height	1.0 in (2.54 cm)	
		Width	4.0 in (101.6mm)	
		Interface	SAS	
		Synchronous Transfer Rate (Maximum)	3.0 Gb/s	
		Buffer	8 MB	
		Seek Time (typical reads, includes controller overhead, including settling)	Single Track	0.27 ms
			Average	3.5 ms
			Full-Stroke	7.4 ms
		Rotational Speed	15,000 rpm	
		Logical Blocks	143,374,738 - 512 byte blocks	
		Operating Temperature	50° to 95° F (10° to 35° C)	
	146 GB (15K rpm)	Capacity	146,815,737,856 bytes	
		Height	1.0 in (25.4mm)	
		Width	4.0 in (101.6mm)	
		Interface	SAS	
		Synchronous Transfer Rate (Maximum)	3.0 Gb/s	
		Buffer	8 MB	
		Seek Time (typical reads, includes controller overhead, including settling)	Single Track	0.27 ms
			Average	3.5 ms
			Full-Stroke	7.4 ms
		Rotational Speed	15,000 rpm	
		Logical Blocks	286,749,488 - 512 byte blocks	
		Operating Temperature	50° to 95° F (10° to 35° C)	

Technical Specifications - Removable Storage

HP USB 2.0 Disk on Key	Dimensions (HxWxD)		0.9 x 0.7 x 3.9 in (2.3 x 1.8 x 9.8 cm)
	Weight		0.05 lb (0.02 kg)
	USB Specification		2.0
	Transfer Rate		Read-1023 KB/Sec; Write-850 KB/Sec
	Storage Media		Solid state flash memory, no moving parts
	Power Supply		USB Bus-powered, no external power required
	Capacity		512 MB or 1 GB
HP StorCase DX115 SATA and SAS Removable Enclosures (Part EA332AA for SATA drives, Part EA333AA for SAS drives)	Physical characteristics	Dimensions of carrier (H x W x D)	1.07 x 4.34 x 7.54 in (27.2 x 110.2 x 191.5 mm)
		Weight of carrier	1 lbs (0.45 kg)
		Dimensions of receiving frame (H x W x D)	1.62 x 5.75 x 7.88 in (41.1 x 146.1 x 200.2 mm)
		Weight of receiving frame	N/A
		Dimensions of receiving frame – including front bezel (H x W x D)	1.62 x 5.81 x 8.08 in (41.1 x 147.6 x 205.2 mm)
		Weight of receiving frame – including front bezel	2 lbs (0.91 kg) [1]
		Features	Allows you to mount a low-profile (up to 1 inch high) 3.5 inch form factor drive into any half-height, 5.25 inch peripheral bay Supports Serial Attached SCSI (SAS) or Serial ATA 3 Gb/s drives • Drive carrier key lock • Drive spin/power up/down button • Power, spin, and fan failure indicator • Drive activity indicator • Soft Start circuitry & anti-static device protection • Cable-less drive connector • 50K mating connector • Cooling fan
	Electrical	Input	+5V 9mA / +12V 20 μA
	Chassis reliability/ maintainability	MTBF (at 30° F)	600,000 hours
		MTTR	5 minutes

Environmental	Operating ambient temperature	32° to 122° F (0° to 50° C)
	Storage ambient temperature	-40° to 158° F (-40° to 70° C)
	Operating relative humidity [2]	5% to 95% 1000 to 10,000 ft (305 to 3048 m)
	Storage relative humidity [2]	50% to 95% -1000 to 40,000 ft (-305 to 12,192 ft)
	Operating altitude	-1000 to 10,000 ft (-305 to 3048 m)
	Storage altitude	-1000 to 40,000 ft (-305 to 12,195 m)
	Operating shock [3]	60g
	Storage shock [3]	30

NOTES:
[1] With carrier removed
[2] Non-condensing with maximum gradient of 10% per hour
[3] Half-sine wave shock pulses at 2ms

HP IEEE 1394a FireWire 400 4-Port PCI Card (Windows XP Only)	Device Interface Protocol	IEEE-1394a	
	Data Rate	400 Mbps	
	Devices Supported	IEEE-1394 compliant devices	
	Bus Interface	PCI	
	Physical	PCI card with brackets for low profile and full height PCI slots.	
	Environmental	Operating temperature	50° to 131° F (10° to 55° C)
		Non-operating temperature	-22° to 140° F (-30° to 60° C)
		Relative humidity	20% to 80%
	Ports	Two IEEE1394 6-Pin Connector (Rear)	
	Minimum System Requirements	Microsoft Windows XP Professional, Windows XP Home, not supported on Linux	
		Pentium II 266 or faster	
		128-MB RAM	
		1-GB Hard Drive	
		CD-ROM drive	
		Built in sound system	
		Available PCI slot	
	Regulatory Agency Approval	FCC Part 15B, cULus 60950, CE Mark EN55022B(1995)/EN55024-1998 STD, Taiwan BSMI CNS13438, Korea MIC	

HP IEEE 1394b FireWire 800 3-Port PCI Card (Windows XP Only)	Device Interface Protocol	IEEE-1394	
	Data Rate	800 Mbps	
	Devices Supported	IEEE-1394 compliant devices	
	Bus Interface	PCI	
	Physical	PCI card with brackets for low profile and full height PCI slots.	
	Environmental	Operating temperature	50° to 131° F (10° to 55° C)
		Non-operating temperature	-22° to 140° F (-30° to 60° C)
		Relative humidity	20% to 80%
	Ports	Two IEEE-1394b bilingual 9-Pin Connector (Rear)	
	Connectors	One 10-Pin header Custom Connector (Internal)	
	Minimum System Requirements	Microsoft Windows XP Professional, Windows XP Home, not supported on Linux	
		Pentium III	
		128-MB RAM	
		1-GB Hard Drive	
		CD-ROM drive	
		Built in sound system	
		Available PCI slot	
	Regulatory Agency Approval	FCC Part 15B, cULus 60950, CE Mark EN55022B(1995)/EN55024-1998 STD, Taiwan BSMI CNS13438, Korea MIC	

Technical Specifications - Input/Output Devices

PS/2 OR USB Standard Keyboard	Physical characteristics	Keys	104, 105, 106, 107, 109 layout (depending upon country)
		Dimensions (L x W x H)	18.0 x 6.4 x 0.98 in (45.8 x 16.3 x 2.5 cm)
		Weight	2 lb (0.9 kg) minimum
	Electrical	Operating voltage	+ 5VDC ± 5%
		Power consumption	50-mA maximum (with three LEDs ON)
		ESD	CE level 4, 15-kV air discharge
		EMI - RFI	Conforms to FCC rules for a Class B computing device
		MicrosoftPC 99 - 2001	Functionally compliant
	Mechanical	Languages	38 available
		Keycaps	Low-profile design
		Switch actuation	55-g nominal peak force with tactile feedback
		Switch life	20 million keystrokes (using Hasco modified tester)
		Switch type	Contamination-resistant switch membrane
		Key-leveling mechanisms	For all double-wide and greater-length keys
		Cable length	6 ft (1.8 m)
		Microsoft PC 99 - 2001	Mechanically compliant
		Acoustics	43-dBA maximum sound pressure level
	Environmental	Operating temperature	50° to 122° F (10° to 50° C)
		Non-operating temperature	-22° to 140° F (-30° to 60° C)
		Operating humidity	10% to 90% (non-condensing at ambient)
		Non-operating humidity	20% to 80% (non-condensing at ambient)
		Operating shock	40 g, six surfaces
		Non-operating shock	80 g, six surfaces
		Operating vibration	2-g peak acceleration
		Non-operating vibration	4-g peak acceleration
		Drop (out of box)	26 in (66 cm) on carpet, six-drop sequence
		Drop (in box)	42 in (107 cm) on concrete, 16-drop sequence
	Operating system support	Microsoft Windows XP Professional, Microsoft Windows XP Professional x64 Edition, Red Hat Enterprise Linux Workstation 3 and 4	
	Approvals	UL, CSA, FCC, CE Mark, TUV, TUV GS, VCCI, BSMI, C-Tick, MIC	
	Ergonomic compliance	ANSI HFS 100, ISO 9241-4, and TUVGS	
	Kit contents	Keyboard, keyboard software media, installation guide, warranty card, safety and comfort	

Technical Specifications - Input/Output Devices

HP PS/2 Scroll Mouse	Dimensions	3.8 x 6.3 x 11.6 cm (1.5 x 2.5 x 4.6 in)	
	Weight	4.44 oz (126 g)	
	Environmental	Operating temperature	50° to 122° F (10° to 50° C)
		Non-operating temperature	-22° to 140° F (-30° to 60° C)
		Operating humidity	10% to 90% (non-condensing at ambient)
		Non-operating humidity	20% to 80% (non-condensing at ambient)
		Operating shock	40 g, 6 surfaces
		Non-operating shock	80 g, 6 surfaces
		Operating vibration	2 g peak acceleration
		Non-operating vibration	4 g peak acceleration
		Drop (out-of-box)	26 in (66 cm) on carpet, 6-drop sequence
		Drop (out-of-box)	1 m on asphalt tile over concrete, 6-drop sequence
	Electrical	Operating voltage	5 VDC ± 10%
		Power consumption	15 mA
		System consumption	PS/2 mini-din connector
		ESD	CE level 4, 15 kV air discharge
		EMI-RFI	Conforms to FCC rules for a Class B computing device
		Microsoft PC99 - 2001	Functionally compliant
	Mechanical	Resolution	400 ± 20% DPI
		Tracking speed	10 in/s maximum
		Acceleration	100 in/s
		Switch actuation	65 g nominal peak force
		Switch life	1,000,000 operations (using Hasco modified tester)
		Switch type	Low force micro-switches
		Tracking mechanism life	155 mi (250 km) at average speed of 10 in/s
		Cable length	6 ft (1.8 m)
		Microsoft PC99 - 2001	Mechanically compliant
	Scroll wheel	Width	8 mm
		Diameter	0.99 in (25.2 mm)
		Maximum rotation speed	30 mm/s
		Switch type	Light force micro-switch
		Switch life	1 million operations
		Mechanical life	Minimum 200,000 revolutions
	Regulatory approvals	Compliant	UL, CSA, FCC, CE Mark, TUV, TUV GS, VCCI, BSMI, C-Tick, MIC
	Compatibility	Operating system support	Microsoft Windows XP Professional, Microsoft Windows XP Professional x64 Edition, Red Hat Enterprise Linux Workstation 3 and 4

Technical Specifications - Input/Output Devices

HP 2-button Optical Scroll Mouse (USB)	Dimensions (H x L x W)		1.5 x 4.5 x 2.5 in (3.8 x 11.6 x 6.3 cm)
	Weight		0.27 lb (0.12 kg)
	Cable length		72.8 in (185 cm)
	System requirements		Microsoft Windows XP Professional, Microsoft Windows XP Professional x64 Edition, Red Hat Enterprise Linux Workstation 3 and 4
HP Optical 3-Button Mouse (USB)	Dimensions/Weight	Height	1.5 in (3.76 cm)
		Length	4.5 in (11.56 cm)
		Width	2.4 in (6.19 cm)
		Weight	3.80 oz (108 g)
	Environmental	Operating temperature	32° to 104° F (0° to 40° C)
		Non-operating temperature	-4° to 140° F (-20° to 60° C)
		Operating humidity	10% to 90% (non condensing at ambient)
	Mechanical	Tracking speed	6 in/s Maximum
		Switch life	3,000,000 operations
		Switch type	Micro-switches
		Tracking mechanism life	155 miles (250 km) at average speed of 10 in/s
		Cable length	9.5 ft (2.9 m)
Spaceball 5000 USB (Windows XP only)	Physical characteristics	Dimensions (H x W x D)	3.0 x 6.0 x 8.4 in (7.6 x 15.2 x 21.3 cm)
		Ball Diameter	2.2 in (5.6 cm)
		Weight	2.1 lb (9.94 kg)
		Features	Six degrees of freedom motion control through the X, Y, Z axis (pitch, roll, yaw) Certified for leading CAD and DCC applications
	Environmental	Operating temperature	50° to 104° F (10° to 40° C)
		Non-operating temperature	43° to 140° F (6° to 60° C)
		Operating humidity	8% to 80% (non-condensing at ambient)
		Non-operating humidity	5% to 80% (non-condensing at ambient)
	Mechanical	Buttons	12 programmable (unshifted)
		Ball Force Range	0.5 - 8.2N/1.8 - 29.5 oz
		Ball Torque Range	0.085 – 0.33 oz-in. (6.91 Nmm)
		Resolution	10 bits
	Serial Specifications	Connector	USB 1.1 or greater
		Cable Length	12.8 ft. (3.9 m)
		Data Rate	USB model – 16 msec
		Flow Control	Xon/Xoff (on PS/2 model only)
	Software Drivers Available	USB model	Microsoft Windows XP Professional
	System Requirements	Disk Space	10 MB free disk space
	Regulatory Approvals		UL, cUL, EN 950, EN 60950, CSA, FCC, CE Mark, TUV, CISPR 22, EN 50082, IEC 1000 4-2, IEC 1000-4-3, AS/NZS, VCCI, BSMI, C-Tick

HP SpaceMouse Plus USB (Windows XP only)	Physical characteristics	Dimensions (H x W x D)	7.4 x 4.72 x 1.73 in (18.8 x 12.0 x 4.4 cm)
		Cap Diameter	2 x 6.5 x 6.6 mm
		Weight	1.5 lb (0.68 kg)
		Features	Six degrees of freedom motion control through the X, Y, Z axis (pitch, roll, yaw) Certified for leading CAD and DCC applications
	Environmental	Operating temperature	41° to 140° F (5° to 60° C)
		Non-operating temperature	-13° to 158° F (-25° to 70° C)
		Operating humidity	10 to 98 % RH (non-condensing)
		Non-operating humidity	10 to 98 % RH (non-condensing)
	Mechanical	Buttons	11 programmable (unshifted)
		Cap Force Range	0.2 N – 4.5 N
		Cap Torque Range	4 Nmm to 100 Nmm
		Resolution	8 bit
	USB Specifications	Connector	USB 1.1 or greater
		Cable Length	6.56 ft (2 m)
		Data Rate	16 msec
	Software Drivers Available	Microsoft Windows XP Professional	
	System Requirements	Disk Space	10 MB free disk space
	Regulatory Approvals	UL, cUL, EN 950, EN 60950, CSA, FCC, CE Mark, TUV, CISPR 22, EN 50082, IEC 1000 4-2, IEC 1000-4-3, AS/NZS, VCCI, BSMI, C-Tick	

HP SpacePilot 3D USB Intelligent Controller (model EF390AA)	Physical Characteristics	Dimensions (L x W x H)	9.3 x 5.6 x 2.0 in (236 x 143 x 53 mm)
		Weight	1.875 lb (0.85 kg)
		Palmrest	Sculpted
	Mechanical	Buttons	21+ programmable speed keys 15 reprogrammable
		LCD Viewing Area	(W x H) 4.1 x 1.2 in (102 x 30 mm)
		Active Area	(W x H) 3.9 x 1.0 in (98 x 26 mm)
		Display Format	240 x 64
		Motion Controller	Six degrees of freedom motion control through the X, Y, Z axis (pitch, roll, yaw)
		Device Sensitivity	Adjustable to preference
	System Requirements	Intel Pentium 4 or AMD Athlon processor based system	
		20 megabytes free disk space for driver and plug-in installation (CD-ROM device required)	
		USB 1.1 or 2.0	
	Operating System Supported	Microsoft Windows 2000 and XP	
	Regulatory Approvals	FCC, CE	

Technical Specifications - Optical Devices

48X CD-ROM Drive	Form Factor	5.25-in, half-height, tray load	
	Mounting Orientation	Horizontal or vertical	
	Interface	ATAPI/EIDE	
	Dimensions (HxWxD)	1.63 x 5.83 x 7.27 in (4.13 x 14.6 x 18.5 cm)	
	Weight	1.76 lb (0.8 kg)	
	Data Transfer Rates - Read	Digital audio extraction (minimum) – 1,200 KB/s (8X) CD read – up to 7,200 KB/s (48X)	
	Media and Formats - Read	CD Media	stamped, CD-R, CD-RW (LS, HS, US)
		CD Capacities	180 MB (mode 2, 8 cm); 540 MB (mode 1, 12 cm); 650 MB (mode 2, 12 cm); 700 MB (Mode 2, 12 cm, 80-minute)
		CD Formats	CD-DA, CD-ROM (Mode 1 and 2), CD-XA (Mode 2, Form 1 and 2), Photo CD (Single and Multi-session), Mixed Mode (Audio and Data combined), CD-I (Mode 2, Form 1 and 2, and CD-I Ready), CD-Extra, CD-Bridge, Video CD
	Access Times (typical reads, including settling)	CD-ROM Mode 1	< 125 ms
		Full Stroke CD	< 210 ms
		Start-up Time (typical)	< 7 s (single session), < 30 s (multi-session)
		Stop Time (typical)	< 4 s
		Write Buffer Size	128 KB (minimum)
		Data Transfer Modes	PIO Mode 4 (16.6 MB/s); Multi-word DMA mode 2 (16.6 MB/s); UltraDMA Mode 0 (16.7 MB/s); UltraDMA Mode 2 (33.3 MB/s)
	Power	Source	Four-pin, DC power receptacle
		DC Power Requirement	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
		Total Drive Power (standby mode)	< 2.5 Watt
	Audio Output	Line-Out	0.7 VRMS
		Signal-to-Noise Ratio	74 dB
		Channel Separation	65 dB
	Configuration Jumper Block	Master, slave, and cable select modes	
	Operating Conditions (all conditions non-condensing)	Temperature	41° to 122° F (5° to 50° C)
		Humidity	10% to 80%
	Certifications, Approvals	MMC-3 support, multi-read compliant, Microsoft WHQL certification, ACA AS/NZS 3548 class B, BSMI CNS 13438, CE Mark, C.I.S.P.R. Pub 22, TUV or VDE EN60950, EN 55022, EN55024, EMKO EN60950, EN 60825-1, UL 60950, CSA C22.2 60950-2000, CFR 21 part 1040 class 1, CFR 47 C.I.S.P.R. Pub 22 Class B, DHHS/FDA, ANSI C63.4-1992 (FCC Class B)	

	Operating Systems Supported	Microsoft Windows XP Professional, Microsoft Windows XP Professional x64 Edition, Red Hat Enterprise Linux Workstation 3	
	Supplied Software	None	
HP 16X/48X DVD-ROM Drive	Height	5.25-in, half-height, tray load	
	Interface Type	ATAPI/EIDE	
	Dimensions (W x H x D)	5.88 x 1.71 x 7.87 [max] in (149.5 x 43.25 x 200.0 [max] mm) (external, excluding bezel)	
	Disc Formats	DVD-ROM (single and dual layer); DVD-video; DVD-R version 1.0 and 2.0; DVD-RW version 1.0 and 1.1; DVD-R multi-border; DVD+RW; DVD+R ; CD-ROM Mode 1 and 2; CD-DA; CD-ROM XA Mode 2, Form 1 and 2; CD-extra; CD-text; CD-I Mode 2, Form 1 and 2; CD-I ready; video CD, CD-bridge; PhotoCD (single and multi-session); CD-R; CD-RW	
	Disc Capacity	DVD-ROM	4.7 GB (DVD-5), 8.54 GB (DVD-9), 9.4 GB (DVD-10), 3.95 GB (DVD-R version 1.0), 4.7 GB (DVD-R version 2.0), 4.7 GB (DVD-RW version 1.0 and 1.1), 4.7 GB (DVD+RW), 4.7G (DVD+R)
		CD-ROM	540 MB (Mode 1, 12 cm), 640 MB (Mode 2, 12 cm), 700 MB (80 minimum CD-R and CD-RW), 180 MB (8 cm)
	Access Times (typical reads, including settling)	DVD-ROM Single Layer	120 ms
		CD-ROM Mode 1	90 ms
		Full Stroke DVD	240 ms (seek)
		Full Stroke CD	160 ms (seek)
		Startup Time	< 10 seconds (typical)
		Stop Time	< 4 seconds
		Data Transfer Modes	PIO Mode 4 (16.6 MB/s); Multi-word DMA mode 2 (16.6 MB/s); UltraDMA Mode 3 (44.4 MB/s)
	Maximum Data Transfer Rates	CD-ROM Read	6000 KB/s (40X) Max
		DVD-ROM Read	21,600 KB/s (16X) Max
		Digital Audio Extraction	6000 KB/s (40X) Max
	Power	Source	Four-pin, DC power receptacle
		DC Power Requirement	5 VDC ± 5% – 100 mV ripple p-p
			12 VDC ± 5% – 200 mV ripple p-p
		DC Current	5 VDC – <800 mA typical, < 1000 mA maximum
			12 VDC – < 870 mA typical, <1800 mA maximum
	Audio Output	Line-Out	0.7 VRMS
		Signal-to-Noise Ratio	85 dB
		Channel Separation	65 dB
	Configuration Jumper Block	Master, slave, and cable select modes	
	Data Interface Connector	40-pin, shrouded and keyed, flat ribbon	

Technical Specifications - Optical Devices

	Operating Environmental (all conditions non-condensing)	**Temperature** (operating)	41° to 122° F (5° to 50° C)
		Relative Humidity (operating)	10% to 85%
		Maximum Wet Bulb Temperature (operating)	86° F (30° C)
	Certifications, Approvals	MMC II support, multi-read certification, Microsoft WHQL certification, ACA AS/NZS 3548 class B, CNS 13438, C.I.S.P.R. Pub 22, TUV or VDE EN60950, EN 55022, EN55024, EMKO EN60950, EN 60825-1, UL 60950, CSA C22.2 60950-2000, CFR 21 part 1040 class 1, CFR 47 C.I.S.P.R. Pub 22 Class B, DHHS/FDA, ANSI C63.4-1992	
	Operating Systems Supported	Microsoft Windows 2000, Windows XP Professional	
	Kit Contents	16X/48X DVD-ROM Drive, InterVideo WinDVD MPEG Movie Playback software, audio cable, and installation guide.	
HP 48X CD-RW/DVD-ROM Combo Drive	**Form Factor**	5.25-inch, half-height, tray-load	
	Mounting Orientation	Horizontal or vertical	
	Interface	ATAPI/EIDE	
	Dimensions (HxWxD)	5.77 x 1.71 x 7.87 [max] in (14.66 x 4.34 x 20.0 [max] cm) (external, excluding bezel)	
	Weight (max)	2.6 lb (1.2 kg)	
	Read Only Disc Parameters	**Data Transfer Rates - Read**	**CD read** - 7200 KB/s (48X) Max
			Digital audio extraction (minimum) - 1,800 KB/s (12X)
			DVD ROM read - 21,632 KB/s (16X) Max
		Media and Formats - Read	**CD Media**: stamped; CD-R; CD-RW (LS, HS, US)
			CD Capacities: 180 MB (mode 2, 8 cm); 540 MB (mode 1, 12 cm); 650 MB (mode 2, 12 cm); 700 MB (Mode 2, 12 cm, 80-minute)
			CD Formats: CD-DA, CD-ROM (Mode 1 and 2), CD-XA (Mode 2, Form 1 and 2), Photo CD (Single and Multi-session), Mixed Mode (Audio and Data combined), CD-I (Mode 2, Form 1 and 2, and CD-I Ready), CD-Extra, CD-Bridge, Video CD
			DVD Media: stamped (single and double layer); DVD+R; DVD+RW; DVD+R DL; DVD-R; DVD-RW
			DVD Capacities: 4.7 GB (DVD-5), 8.54 GB (DVD-9), 9.4 GB (DVD-10), 3.95 GB (DVD-R version 1.0), 4.7 GB (DVD-R version 2.0), 4.7 GB (DVD-RW version 1.0 and 1.1), 4.7 GB (DVD+RW), 4.7G (DVD+R)

		DVD Formats: DVD-ROM (single and dual layer); DVD-video; DVD-R version 1.0 and 2.0; DVD-RW version 1.0 and 1.1; DVD-R multi-border ; DVD+R version 1.2 (including multi-session); DVD+R DL version 1.0; DVD+RW version 1.2
Writeable Disc Parameters	Data Transfer Rates - Write	**CD-R write** - 2100 KB/s (14X) to 7200 KB/s (48X)
		CD-RW write - 600 KB/s (4X)
		CD-RW write (high speed) - 1500 KB/s (10X) to 1800 KB/s (12X)
		CD-RW write (ultra high speed) - 2400 KB/s (16X) to 4800 KB/s (32X)
	Media and Formats - Write	**CD Media:** CD-R; CD-RW (LS, HS, US)
		CD Capacities: 180 MB (mode 2, 8 cm); 540 MB (mode 1, 12 cm); 650 MB (mode 2, 12 cm); 700 MB (Mode 2, 12 cm, 80-minute)
		CD Formats: CD-DA, CD-ROM (Mode 1 and 2), CD-XA (Mode 2, Form 1 and 2), Photo CD (Single and Multi-session), Mixed Mode (Audio and Data combined), CD-I (Mode 2, Form 1 and 2, and CD-I Ready), CD-Extra, CD-Bridge, Video CD
	Write Methods	Disc-at-once, session-at-once, track-at-once, incremental fixed and variable packet, multi-session
Access Times (typical reads, including settling)	Random DVD	< 140 ms
	Random CD	< 125 ms, (typical)
	Full Stroke DVD	< 250 ms
	Full Stroke CD	< 210 ms
	Startup Time (single)	< 7 seconds (typical)
	Startup Time (multi-session)	< 30 seconds (typical)
	Stop Time (typical)	< 4 s
	Cache Buffer	2 MB (minimum)
	Data Transfer Modes	ATA PIO mode 4 (16.7 MB/s); ATA Multi-word DMA mode 2 (16.7 MB/s); ATA UltraDMA Mode 3 (44 Mbytes/s)
Power	Source	Four-pin, DC power receptacle
	DC Power Requirement	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)
	Total Drive Power (standby mode)	< 2.5 Watt

Technical Specifications - Optical Devices

	Audio Output	Line-Out	0.7 VRMS
		Signal-to-Noise Ratio	74 dB
		Channel Separation	65 dB
	Configuration Jumper Block	Master, slave, and cable select modes	
	Data Interface Connector	40-pin, shrouded and keyed, flat ribbon	
	Operating Conditions (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)
	Certifications, Approvals	MMC-3 support, multi-read compliant, Microsoft WHQL certification, ACA AS/NZS 3548 class B, BSMI CNS 13438, CE Mark, C.I.S.P.R. Pub 22, TUV or VDE EN60950, EN 55022, EN55024, EMKO EN60950, EN 60825-1, UL 60950, CSA C22.2 60950-2000, CFR 21 part 1040 class 1, CFR 47 C.I.S.P.R. Pub 22 Class B, DHHS/FDA, ANSI C63.4-1992 (FCC Class B)	
	Operating Systems Supported	Microsoft Windows XP Professional, Microsoft Windows XP Professional x64 Edition, Red Hat WS3 and WS4 Versions	
	Supplied Software (for Windows XP)	Roxio Cineplayer Movie Playback Roxio Digital Media Plus: Create or copy CDs and DVDs, including music and data CDs, and data DVDs	
16X DVD+/-RW, Dual-Layer, with LightScribe Direct Disc Labeling	Form Factor	5.25-inch, half-height, tray-load	
	Orientation	Horizontal or vertical	
	Interface	ATAPI/EIDE	
	Dimensions (HxWxD)	5.9 x 1.7 x 7.9 in (15.0 x 4.4 x 20.0 cm)	
	Weight (maximum)	2.6 lb (1.2 kg)	
	Read Only Disc Parameters	Data Transfer Rates - Read	DVD-ROM, DVD-video read - 5-16X (6750 - 21,600 KB/s CAV) DVD-video playback, DVD+R, DVD+RW, DVD-R, DVD-RW - 4-8X (5400 - 10,800 KB/s CAV) CD-audio playback - 8x (1200 KB/s CLV) Digital audio extraction (minimum) - 12X (1,800 KB/s CAV) CD-ROM, CD-R, CD-RW, CD-Audio read - 16-40X (2400 to 6000 KB/s CAV)

	Media and Formats - Read	**CD Media:** stamped; CD-R; CD-RW (supports AM2) (LS, HS, US) **CD Capacities:** 180 MB (mode 2, 8 cm); 540 MB (mode 1, 12 cm); 650 MB (mode 2, 12 cm); 700 MB (Mode 2, 12 cm, 80-minute) **CD Formats:** CD-DA, CD-ROM (Mode 1 and 2), CD-XA (Mode 2, Form 1 and 2), Photo CD (Single and Multi-session), Mixed Mode (Audio and Data combined), CD-I (Mode 2, Form 1 and 2, and CD-I Ready), CD-Extra, CD-Bridge, Video CD, UDF (1.02 and 1.50) **DVD Media:** stamped (single and double layer); DVD+R; DVD+RW; DVD+R DL; DVD-R; DVD-RW **DVD Capacities:** 4.7 GB (DVD-5), 8.54 GB (DVD-9), 9.4 GB (DVD-10), 14.1 GB (DVD-14), 17.0 GB (DVD-18), 3.95 GB (DVD-R version 1.0), 4.7 GB (DVD-R version 2.0), 4.7 GB (DVD-RW version 1.0 and 1.1), 4.7 GB (DVD+RW), 4.7G (DVD+R), 1.46 GB (DVD+R, 8cm), 1.46 GB (DVD+RW, 8cm) **DVD Formats:** DVD-ROM (single and dual layer); DVD-video; DVD-R version 1.0 and 2.0 (including multi-border); DVD-RW version 1.0 and 1.1; DVD+R version 1.3 (including multi-session); DVD+R DL version 1.0; DVD+RW version 1.2
Writeable Disc Parameters	Data Transfer Rates - Write	**CD-R write** - 16-40X (2400-6000 KB/s CAV) **CD-RW write** - 4X (600 KB/s CLV) **CD-RW write** (high speed) - 10X (1500 KB/s CLV) **CD-RW write** (ultra high speed) - 16-24X (2400-3600 KB/s ZCLV) **DVD+R** - 6-16X (8100-21,600 KB/s CAV), 8x (10,800 KB/s ZCLV), 2.4-4x (3250-5400 KB/s CLV) **DVD+R DL** - 2.4 (3250 KB/s CLV) **DVD+RW** - 2.4-4X (3250-5400 KB/s CLV) **DVD-R** - 2-4X (2700-5400 KB/s CLV), 8X (10,800 KB/s ZCLV) **DVD-RW** - 2-4X (2700-5400 KB/s CLV)

	Media and Formats - Write	**CD Media:** CD-R (OBII Vol2.0 Rev 1.2), CD-RW (LS, HS, US) **CD Capacities:** 180 MB (mode 1, 8 cm); 540 MB (mode 1, 12 cm); 650 MB (mode 2, 12 cm); 700 MB (Mode 2, 12 cm, 80-minute) **CD Formats:** CD-DA, CD-ROM (Mode 1 and 2), CD-XA (Mode 2, Form 1 and 2), Photo CD (Single and Multi-session), Mixed Mode (Audio and Data combined), CD-I (Mode 2, Form 1 and 2, and CD-I Ready), CD-Extra, CD-Bridge, Video CD, UDF (1.02 and 1.50) **DVD Media:** DVD+R, DVD+R DL, DVD+RW, DVD-R, DVD-RW **DVD Capacities:** 4.7 GB (DVD-5), 8.54 GB (DVD-9), 4.7 GB (DVD-R version 2.0), 4.7 GB (DVD-RW version 1.1), 4.7 GB (DVD+RW version 1.3), 4.7G (DVD+R version 1.2)), 1.46 GB (DVD+R, 8cm), 1.46 GB (DVD+RW, 8cm) **DVD Formats**: DVD-R version 1.0 and 2.0 (including multi-border); DVD-RW version 1.0 and 1.1; DVD+R version 1.3 (including multi-session); DVD+R DL version 1.0; DVD+RW version 1.2
	Write Methods	Disc-at-once, session-at-once, track-at-once, incremental fixed and variable packet, multi-session
LightScribe Direct Disc Labeling Parameters	Media Supported	**CD-R:** LightScribe Version 1.0 **DVD+R:** LightScribe Version 1.0
	Resolution	**Dots per inch:** 600 **Tracks per inch:** 500-1600 (mode dependent)
	Labeling Times	**Draft quality:** < 20 min **Normal quality:** < 28 min **Best quality:** < 36 min
Access Times (typical reads, including settling)	Random DVD	< 130 ms (typical)
	Random CD	< 120 ms (typical)
	Full Stroke DVD	< 240 ms
	Full Stroke CD	< 200 ms
	Startup Time (single)	< 7 seconds (typical)
	Startup Time (multi-session)	< 30 seconds (typical)
	Stop Time (typical)	< 4 s
	Cache Buffer	2 MB
	Data Transfer Modes	ATA PIO mode 4 (16.7 MB/s); ATA Multi-word DMA mode 2 (16.7 MB/s); ATA UltraDMA Mode 3 (44.4 MB/s) (default on most HP xw series workstations)

Power	**Source**	Four-pin, DC power receptacle
	DC Power Requirement	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)
	Total Drive Power (standby mode)	< 2.5 Watt
Audio Output	**Line-Out**	0.7 VRMS
	Signal-to-Noise Ratio	74 dB
	Channel Separation	65 dB
Operating Conditions (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)
Certifications, Approvals	MMC-4 compliant, multi-read compliant, Microsoft WHQL certification, ACA AS/NZS 3548 class B, BSMI CNS 13438, CE Mark, C.I.S.P.R. Pub 22, TUV or VDE EN60950, EN 55022, EN55024, EMKO EN60950, EN 60825-1, UL 60950, CSA C22.2 60950-2000, CFR 21 part 1040 class 1, CFR 47 C.I.S.P.R. Pub 22 Class B, DHHS/FDA, ANSI C63.4-1992 (FCC Class B), relevant parts of IEC 61000-4.	
Operating Systems Supported	Microsoft Windows XP Professional, Microsoft Windows XP Professional x64 Edition Red Hat Linux 7.3 WS3 and WS4 Versions (LightScribe labeling functionality not supported on Linux)	
Supplied Software (for Windows XP)	Roxio Cineplayer Movie Playback Roxio Digital Media Plus: Create or copy CDs and DVDs, including music and data CDs, and data DVDs Roxio MyDVD for DVD authoring NOTE: LightScribe Direct Disc Labeling is supported only on 32-bit Windows XP in the launch timeframe for the xw4300. Support for Windows XP Professional x64 Edition is anticipated to be available some time after the launch, and will require software updates. There is no support for LightScribe labeling under Linux. The drive will operate as a DVD writer under these other operating systems, but will not be available in software applications as a LightScribe "printer".	

NOTE: This DVD writer kit does not include any software for burning DVDs on Linux. DVD burning is supported with the 'growisofs' command. CD burning is supported with the 'cdrecord' command. Red Hat Enterprise Linux WS 3 distribution includes both 'cdrecord' and 'growisofs'. Red Hat Linux 8, 9.0 distributions only include 'cdrecord'. Therefore DVD burning is only supported on WS 3.

NVIDIA Quadro NVS 285 128MB PCIe Dual Display	Form Factor	Nvidia Quadro NVS 285 128MB PCIe Dual Display Low profile, both ATX and low profile brackets included
	Graphics Controller	Integrated Quadro 285 2D graphics processor unit (GPU)
	Bus Type	PCI-Express
	Memory	128 MB DDR2
	Connectors	Single high-density DMS-59 Flex Connector
	Dimensions	Low-profile, 2.586 x 6.6 in (6.57 x 16.76 cm)
	Multi-monitor support	Dual analog or digital monitors
	RAMDAC	Dual 350 MHz (integrated)
	Maximum pixel clock	350 MHz
	Overlay planes	One 16-bit Video overlay plane
	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 2000 and Microsoft Windows XP (Provides full native Dual View mode, Span or Big Desktop mode, and Clone mode) HP qualified drivers may be preloaded or available from the HP support Web site: http://www.hp.com/country/us/en/support.html?pageDisplay=drivers
	Option kit Contents	NVIDIA Quadro NVS 285 128MB PCIe Graphics Card with full height bracket attached, DMS 59 to dual DVI Y cable, DMS 59 to dual VGA Y cable, low profile bracket, Workstation Software Driver CD, Desktop Software Driver CD, documentation.

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 XP (Provides full native Dual View mode, Span or Big Desktop mode, and Clone mode) HP qualified drivers may be preloaded or available from the HP support Web site: http://welcome.hp.com/country/us/eng/software_drivers.html.
NVIDIA Quadro FX 560 PCI-Express graphics controller	Form Factor	ATX
	Graphics Controller	NVIDIA NV73GL
	Bus Type	PCI Express x16
	Memory	128MB 600MHz GDDR3 SDRAM unified frame buffer, Z-buffer and Texture storage
	Connectors	2 DVI-I (one dual-link) + 9-pin HDTV output
	Display resolution support	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). HD-Out component Mode: YPrPB - SMPTE 1080i, 720p, 480p, 576p or composite Mode: NTSC/PAL 480i, 576i NVIEW advanced multi-display desktop and application management seamlessly integrated into Microsoft Windows
	RAMDAC	Dual 400MHz integrated
	Architecture features	128-bit memory interface 128-bit IEEE floating-point precision graphics pipeline 128-bit color precision 12-bit sub-pixel precision 8x FSAA at 1920x1200, 4x at 2048x1536, rotated grid FSAA sampling algorithm 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
	Shading architecture	Fully programmable GPU 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 2.0 DirectX 9.0

	Available graphics drivers	Microsoft Windows XP Professional qualified drivers may be preloaded or available from the HP support Web site: http://welcome.hp.com/country/us/eng/software_drivers.html.
ATI FireGL V3300 graphics card	Form factor	ATX
	Graphics controller	RV515
	Bus type	PCI-Express x16
	Memory	128MB DDR unified frame buffer, Z-buffer and Texture storage
	Connectors	Dual DVI-I analog/digital, dual VGA analog support with DVI-to-VGA adapters.
	Display resolution support	Analog support for 2048x1536 @ 85Hz on each output connector. Digital support for 1920x1200 @ 60Hz on each output connector.
	RAMDAC	Dual 10-bit per channel 400MHz
	Architecture features	• 2x/4x/6x Anti-aliasing modes; multi-sample algorithm with gamma correction, programmable sparse sample patterns, and centroid sampling • 2x/4x/8x/16x Anisotropic Filtering modes; up to 128-tap texture filtering • High resolution texture support (up to 4K x 4K) • Hardware supported overlays, anti-aliased points and lines, 2 sided lighting, occlusion culling
	Avivo video and display platform	• 64-bit per pixel floating point HDR supported throughout the pipeline, includes support for blending and multi-sample anti-aliasing • 32-bit integer HDR (10:10:10:2) format supported throughout the pipeline, includes support for blending and multi-sample anti-aliasing
	Programmable video processor	• Accelerated MPEG-2, MPEG-4, DiVX, WMV9, VC-1 and H.264 decoding and transcoding • Seamless pixel shader integration with video in real-time
	Display output	• 16-bit per channel floating point HDR and 10 bit per channel DVI output • Programmable piecewise linear gamma correction, color correction, and color space conversion (10-bits per color) • Complete independent color controls and video overlays for each display • High quality pre- and post-scaling engineers with underscan support for all outputs • Content-adaptive de-flicker filtering for interlaced displays • Spatial/temporal dithering enables 10-bit color quality on 8 and 6-bit displays • VGA mode support on all outputs
	Shading architecture	• Supports Microsoft DirectX 9.0 Shader Model 3.0 programmable vertex and pixel shaders in hardware • Full speed 128-bit floating point processing for all shader operations • Dedicated branch-execution units for high performance dynamic branching and flow control • Dedicated texture address units for improved efficiency • Up to 128 simultaneous pixel threads • Multiple Render Target (MRT) support • Render to vertex buffer support

	Supported graphics APIs	OpenGL 2.0 DirectX 9.0
	Available graphics drivers	Microsoft Windows XP Professional qualified drivers may be preloaded or available from the HP support Web site: http://welcome.hp.com/country/us/eng/software_drivers.html. HP-tested Windows XP and Linux
NVIDIA Quadro FX 1500 PCI-Express graphics controller	Form Factor	ATX
	Graphics Controller	NVIDIA NV71GL
	Bus Type	PCI Express x16
	Memory	256MB GDDR3 SDRAM unified frame buffer, Z-buffer and Texture storage
	Connectors	2 dual-link DVI-I + 9-pin HDTV output
	Display resolution support	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). HD-Out component Mode: YPrPB - SMPTE 1080i, 720p, 480p, 576p or composite Mode: NTSC/PAL 480i, 576i NVIEW advanced multi-display desktop and application management seamlessly integrated into Microsoft® Windows®
	RAMDAC	Dual 400MHz integrated
	Architecture features	256-bit memory interface 128-bit IEEE floating-point precision graphics pipeline 128-bit color precision 12-bit sub-pixel precision 8x FSAA at 1920x1200, 4x at 2048x1536, rotated grid FSAA sampling algorithm 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 3840x2400 (24Hz)
	Shading architecture	Fully programmable GPU 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 2.0 DirectX 9.0
	Available graphics drivers	Microsoft Windows XP Professional qualified drivers may be preloaded or available from the HP support Web site: http://welcome.hp.com/country/us/eng/software_drivers.html.
ATI FireGL V7200 graphics card	Form factor	ATX
	Graphics controller	R520
	Bus type	PCI-Express x16

Memory	256MB GDDR3 graphics memory with unified frame buffer, Z-buffer and Texture storage and a 512-bit Ring-Bus memory controller
Connectors	Dual DVI-I analog/digital, dual VGA analog support with DVI-to-VGA adapters. The DVI-I digital connectors are Dual Link capable. Stereoscopic 3D output connector with quad buffer support, HD Component Video (YPrPb) output with optional adapter.
Maximum Resolution	Analog support for 2048x1536 @ 85Hz on each output connector. Digital support for 1920x1200 @ 60Hz on each output connector. Dual Link digital support for 2560x1600 @ 60Hz. Ideal for 30-inch widescreen displays. NOTE: Stereo supported on single display only.
RAMDAC	Dual 10-bit per channel 400MHz
Ring Bus memory controller	• 512-bit internal ring bus for highly efficient memory reads • Programmable intelligent arbitration logic
Image quality features	• 2x/4x/6x Anti-aliasing modes; multi-sample algorithm with gamma correction, programmable sparse sample patterns, and centroid sampling • 2x/4x/8x/16x Anisotropic Filtering modes; up to 128-tap texture filtering • High resolution texture support (up to 4K x 4K) • Hardware supported overlays, anti-aliased points and lines, 2 sided lighting, occlusion culling
Avivo video and display platform	• 64-bit per pixel floating point HDR supported throughout the pipeline, includes support for blending and multi-sample anti-aliasing • 32-bit integer HDR (10:10:10:2) format supported throughout the pipeline, includes support for blending and multi-sample anti-aliasing
Programmable video processor	• Accelerated MPEG-2, MPEG-4, DiVX, WMV9, VC-1 and H.264 decoding and transcoding • Seamless pixel shader integration with video in real-tim
Display output	• 16-bit per channel floating point HDR and 10 bit per channel DVI output • Programmable piecewise linear gamma correction, color correction, and color space conversion (10-bits per color) • Complete independent color controls and video overlays for each display • High quality pre- and post-scaling engineers with underscan support for all outputs • Content-adaptive de-flicker filtering for interlaced displays • Xilleon TV encoder for high quality analog support • Spatial/temporal dithering enables 10-bit color quality on 8 and 6-bit displays • VGA mode support on all outputs
Shading architecture	• Supports Microsoft DirectX 9.0 Shader Model 3.0 programmable vertex and pixel shaders in hardware • Full speed 128-bit floating point processing for all shader operations • Dedicated branch-execution units for high performance dynamic branching and flow control • Dedicated texture address units for improved efficiency • Up to 512 simultaneous pixel threads • Multiple Render Target (MRT) support • Render to vertex buffer support

	Supported graphics APIs	OpenGL 2.0 DirectX 9.0
	Available graphics drivers	Microsoft Windows XP Professional qualified drivers may be preloaded or available from the HP support Web site: http://welcome.hp.com/country/us/eng/software_drivers.html. HP-tested Windows XP and Linux
NVIDIA Quadro FX 3500 PCI-Express graphics controller	Form Factor	ATX
	Graphics Controller	NVIDIA NV71GL-U
	Bus Type	PCI-Express x16
	Memory	256MB 700MHz GDDR3 SDRAM unified frame buffer, Z-buffer and Texture storage
	Connectors	2 dual-link DVI-I + 3-pin Mini DIN stereo output
	Display resolution support	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®
	Maximum Resolution	Dual DVI-I output - drives dual digital displays at resolutions up to 1920x1200 @ 60Hz (single-link) and 3840x2400 @ 24Hz (dual-link). Internal 400MHz RAMDACs - drives dual analog displays up to 2048x1536 @ 75Hz each
	RAMDAC	Dual 400MHz integrated
	Architecture Features	256-bit memory interface 128-bit IEEE floating-point precision graphics pipeline 128-bit color precision 12-bit sub-pixel precision 8x FSAA at 1920x1200, 4x at 2048x1536, rotated grid FSAA sampling algorithm 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 3840x2400 (24Hz) SLI Link
	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 2.0 ICD with immediate mode support for all OGL primitive types DirectX 9.0c

	Available Graphics Drivers	Microsoft Windows XP, 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.
NVIDIA Quadro FX 4500, 512 MB with optional G-Sync	Bus Type	PCI Express x16
	RAMDAC	Dual 400 MHz integrated
	Memory	512 MB GDDR3 SDRAM unified graphics memory
	Connectors	2 DVI-I analog/digital monitor outputs, 1 3-pin Mini DIN stereo output, DVI-I to VGA adapters included
	Display resolution support	Dual integrated display controllers supporting up to 2048x1536 @ 75Hz (analog) or 3840x2400 @ 41Hz (digital) on both displays
	NVIDIA Quadro FX 4500 architecture	256-bit memory interface 35.2GB/sec. memory bandwidth Full 128-bit floating point color precision 12-bit subpixel precision 65,536 fragment instruction 65,536 vertex instruction 3D volumetric textures 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 Hardware two-sided lighting 3rd-generation occlusion culling OpenGL quad-buffered stereo Hardware-Accelerated Pixel Read-Back
	Shading Architecture	16 textures per pixel in fragment programs Window ID clipping functionality Hardware accelerated line stippling Fully programmable GPU (OpenGL2.0/DirectX 9.0c class) Long fragment programs (up to 65,536 instructions) Long vertex programs (up to 65,536 instructions) Looping and subroutines (up to 256 loops per vertex program) Dynamic flow control Conditional execution
	High Level Shader Languages	Optimized compiler for Cg and Microsoft® HLSL OpenGL 2.0 and DirectX 9.0c support Open source compiler
	High-Resolution Antialiasing	12-bit subpixel sampling precision enhances AA quality Rotated-grid full-scene antialiasing (RG FSAA) 16x FSAA dramatically reduces visual aliasing artifacts or "jaggies" at resolution up to 1920x1200
	Display Resolution Support	Dual Dual Link DVI-I output-drives digital displays at resolutions up to 3840 x 2400 @ 41Hz Internal 400 MHz DACs - Two analog displays up to 2048x1536 @ 75 Hz each

nView Architecture	Advanced multi-display desktop & application management seamlessly integrated into Microsoft Windows®.
Optional G-Sync	Delivers Frame lock/Genlock functionality to unprecedented levels of industrial realism, visualization and collaborative capabilities. Frame lock allows the display channels from multiple workstations to be synchronized, thus creating one large "virtual display" that can be driven by a multisystem cluster for performance scalability, while Genlock allows the graphics output to be synchronized to an external source, typically for film and broadcast video applications. The NVIDIA Quadro G-Sync requires an NVIDIA Quadro FX 4500 graphics controller and an available expansion slot.
Supported Graphics APIs	OpenGL 2.0 ICD with immediate mode support for all OGL primitive types DirectX 9.0c
Available Graphics drivers	Microsoft Windows XP, 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

HP L1955 Flat Panel Monitor	Panel	Type	Active matrix, thin film transistor (TFT)
		Viewable Image Area (diagonal)	19 in (48.25 cm) maximum viewable
		Screen Opening (WxH)	14.9 x 12.0 in (38.0 x 30.5 cm)
		Viewing Angle (typical)	176 degrees horizontal/176 degrees vertical (10:1 minimum contrast ratio)
		Brightness (typical)	Up to 250 nits (cd/m^2)
		Contrast Ratio (typical)	Up to 1000:1 (typical)
		Response Rate (typical)	<16 ms (typical rise + fall)
		Pixel Pitch	0.294 mm
		Color Depth Support	16.7 million colors
	Video/Other Inputs	Plug and Play	Yes (supports VESA DDC2B; PC2001 compliant)
		Self Powered USB 2.0 Hub	One upstream, four downstream ports (cable included)
		Input Signal	Two connectors: one 15-pin mini D-sub analog VGA; and one DVI-I (VGA analog or digital)
		Input Impedance	75 ohms ± 2%
		Sync Input	Separate sync (HSYNC/VSYNC); composite sync, Sync on Green (activated through on-screen display)
		Video Cable	VGA to VGA, DVI-D to DVI-D, and DVI-I to VGA
		Video Cable Length	78 in (2.0 m)
	Signal Interface/ Performance	Horizontal Frequency	30 to 82 kHz
		Vertical Frequency	56 to 75 Hz
		Native Resolution	1280 x 1024 @ 75 Hz analog 1280 x 1024 @ 60 Hz digital
		Maximum Resolution (Analog)	1280 x 1024 @ 75 Hz analog
		Maximum Resolution (Digital)	1280 x 1024 @ 75 Hz digital
		Preset VESA Graphic Modes (non-interlaced)	640 x 480 @ 60 Hz, 72 Hz, 75 Hz 720 x 400 @ 70 Hz 800 x 600 @ 60 Hz, 72 Hz, 75 Hz 1024 x 768 @ 60 Hz, 70 Hz, 75 Hz 1280 x 1024 @ 60 Hz, 75 Hz
		Preset MAC Mode	832 x 624 @ 75 Hz 1152 x 870 @75 Hz
		Preset VGA Mode	640 x 480 @ 60 Hz, 72 Hz
		Preset SUN Mode	1152 x 900 @ 76 Hz
		Fail Safe Mode	Yes (limits out of range signal messages)
		Maximum Pixel Clock Speed	140 MHz
		User Programmable Modes	Yes, 15
		Anti-Glare	Yes

	Anti-Static	Yes
	AssetControl	Yes (accessible on HP Compaq Business Desktops featuring Intelligent Manageability)
	Default Color Temperature	Yes (6500k, 9300k, SRGB, Custom User)
On Screen Display (OSD) Controls	Buttons or Switches	Power on/off; 3-button OSD; second level OSD buttons include dual-input switch, dedicated auto adjust switch
	Languages	English, Spanish, French, German, Italian, Japanese, Simplified Chinese
	User Controls	Size and Positioning
		Contrast
		Brightness
		Clock, Clock Phase
		Selectable Color Temperature
		Serial Number
		Mode Displayed
		Sleep Timer
		Input Selection
		Factory Reset
		Individual Color Contrast
		Full-screen Resolution
Power	Power Supply	Auto-ranging, 90 to 265 VAC; internal power supply
	Input Power	100 ~ 240 VAC
	Nominal Current	1.5 A maximum
	Frequency	50 ~ 60 Hz
	Average	33 watts when displaying standard office software
	Typical Power Consumption	< 40 watts
	Maximum	< 60 watts
	Power Saving	< 2 watts
	Off Mode	0 watts (when master power switch is in the off position)
	Power Cable Length	70 in (1.8 m); non-captive

Mechanical	Dimensions (H x W x D)	Unpacked with stand	16.8 (minimum) to 22.3 (maximum) x 15.9 x 8.3 in (42.7 (minimum) to 56.6 (maximum) x 40.4 x 21.1 cm)
		Base Area (Footprint D x W)	8.3 x 12.2 in (21.1 x 30.9 cm)
		Panel only (without stand) (H x W x D)	13.2 x 15.9 x 3.1 in (33.5 x 40.4 x 7.9 cm)
	Weight	Unpacked with stand	16.5 lb (7.5 kg)
		Unpacked without stand	10.5 lb (4.75 kg)
		Packaged	23.5 lb (10.7 kg)
	Bezel Width	13 mm left and right, 14 mm top, and 15 mm bottom	
	Tilt Range	-5° to +35°	
	Swivel Range	± 50° horizontal swivel	
	Height Adjustable	Yes (5.1 in/13 cm adjustment range)	
	Pivot Rotation	Yes, 90 °	
	Base	Ships detached and is removable after installation	
Environmental	Temperature – Operating	41° to 95° F (5° to 35° C)	
	Temperature – Non-operating	-4° to 140° F (-20° to 60° C)	
	Humidity – Operating	20% to 80%	
	Humidity – Non-operating	5% to 95%	
	Altitude – Operating	0 to 13,000 ft (0 to 4,000 m)	
	Altitude – Non-operating	0 to 40,000 ft (0 to 12,192 m)	
Options	Desktop Access Center	Features integrated microphone/headset jacks, dual function headset for phone/PC support, a MultiBay slot for adding an optical drive (sold separately), and four USB ports for easy integration of third-party digital solutions. Sold separately; part number DK985A. For more information, refer to the HP Desktop Access Center QuickSpecs.	
	HP Flat Panel Speaker Bar	Powered directly by the monitor, seamlessly attaches to the monitor's bezel to bring full multimedia support to select HP flat panel monitors. Features dual speakers with full sound range and external jack for headphones. Sold separately, part number PF804AA. For more information, refer to the HP Flat Panel Speaker Bar QuickSpecs.	

	Other	Accessories Included	VGA to VGA cable, DVI-D to DVI-D cable, DVI-I to VGA cable, USB cable, user CD-ROM with Pivot Pro software
		Software	Pivot Pro software from Portrait Displays, Inc. interacts with your PC's native graphics driver to enable seamless portrait screen redraws with a simple mouse-click or keyboard command. Pivot Pro supports 90-degree portrait and landscape views. Language support is available in English, Japanese, French, German, Spanish, Italian, and Traditional and Simplified Chinese.
		Software	HP Display LiteSaver feature lets you schedule Sleep mode at preset times to help protect the display against image retention, drastically lower power consumption and energy costs, and extend the lifespan of the monitor.
		User Guide Languages	English
		Warranty Languages	English
		Color	Carbonite, two-tone carbonite and silver (EMEA only)
		VESA Mounting	Yes (swing arm/wall mount not included); base must be removed for mounting options)
		VESA External Mounting	Yes (standard 4 hole pattern, 100 mm)
		Kensington Lock-ready	Yes
	Certification and Compliance	Australian ACA Approval, Canadian Requirements/CSA, CE Marking, China CCIB/CCEE Approval, CISPR Requirements, Eastern European Approvals, Energy Star Compliant, FCC Approval, German Ergonomic (TUV and GS Mark), ISO 13406-2 Compliant (Pixel Defect Guidelines), Mexican NOM Approval, MPR-II Compliant, PC2001 Compliant, PC99 Certified, S. Korean MIC Approval, Taiwan BSMI Approval, TCO 99 or 03 depending on region (emissions, ergonomics, environment), TUV-Ergo, UL Listed, VCCI Approvals, Microsoft® Windows® Certification	
	Compatibility	VESA Video Signal Standard (VSIS) Compliant video cards have been tested and proven compatible for use with the HP L1955 Flat Panel Monitor. Recommended for use with HP products.	
	Service and Warranty	Limited three-year parts and repair labor, service provider labor, and on-site service. Next Business Day advanced exchange direct replacement service available during warranty period. Certain restrictions and exclusions apply. For details, contact HP Customer Support.	
HP Flat Panel Monitor LP2065	Panel	Type	20-inch Active Matrix TFT (thin film transistor)
		Viewable Image Area (diagonal)	20.1 in (51 cm)
		Screen Opening (W x H)	16.2 x 12.17 in (41.1 x 30.9 cm)
		Viewing Angle (typical)*	Up to 178° horizontal/178° vertical (10:1 minimum contrast ratio)
		Brightness (typical*	Up to 300 nits (cd/m2)
		Contrast Ratio (typical)*	Up to 800:1

	Response Rate (typical)*	8 ms (gray to gray), 16 ms (rise + fall)
	Pixel Pitch	0.255 mm
	Color Depth Support	16.7 million colors
	Backlight Lamp Life (to half brightness)	45K hours
On Screen Display (OSD) **Controls**	**Buttons or Switches**	Input select, auto adjust/OSD up, OSD down, OSD menu select, power
	Languages	English, French, German, Spanish, Italian, Dutch, and Japanese
	User Controls	Brightness, contrast, positioning, color temperature, individual color control, serial number display, full screen resolutions, clock, clock phase, input selection, image control (including scaling), and factory reset
Signal Interface/ Performance	**Horizontal Frequency**	30 to 94 kHz (VGA input); 30 to 92 KHz (DVI input for modes with pixel clock less than 157 MHz)
	Vertical Frequency	48 to 85 Hz (VGA input); 30 to 92 KHz (DVI input for modes with pixel clock less than 157 MHz)
	Native Resolution	1600 x 1200 @ 60 Hz (recommended)
	Preset VESA Graphic Modes (non-interlaced)	1600 x 1200 @ 60 Hz, 75 Hz (VGA input) 1280 x 1024 @ 60 Hz, 75 Hz, 85 Hz 1280 x 960 @ 60 Hz 1152 x 900 @ 66 Hz 1024 x 768 @ 60 Hz, 75 Hz, 85 Hz 800 x 600 @ 60 Hz, 85 Hz 640 x 480 @ 60 Hz, 75 Hz, 85 Hz
	Text Mode	720 x 400 @ 70 Hz
	Mac Mode	1152 x 870 @ 75 Hz and 832 x 624 @ 75 Hz
	Sun Mode	1152 x 900 @ 66 Hz
	Maximum Pixel Clock Speed	202 MHz (VGA input); 162 MHz (DVI input)
	User Programmable Modes	Yes, 10
	Anti-Glare	Yes
	Anti-Static	Yes
	Default Color Temperature	6500 K

Video Input	Plug and Play	Yes	
	Input Signal	Four connectors, including one 15-pin mini D-sub VGA, one DVI-I (VGA analog and digital input), one composite video, and one s-video	
	Self Powered USB 2.0 Hub	One upstream, four downstream ports (cable included)	
	Input Signal	Two DVI-I connectors (dual VGA analog or dual digital input possible)	
	Input Impedance	75 ohms ± 10%	
	Sync Input	Separate sync (HSYNC/VSYNC); composite sync, Sync on Green	
	Video Cable	Two VGA to DVI-I; two DVI-D to DVI-I	
	Video Cable Length	5.9 ft (1.8 m)	
Power	Input Power	Auto-Ranging, 90 to 132 VAC and 195 to 265 VAC; internal power supply, 50 Hz/60 Hz	
	Frequency	47.5 to 63 Hz	
	Typical Power Consumption	55 watts (without USB ports); 70 watts (USB ports fully loaded)	
	Maximum	< 75 W	
	Power Saving	< 2 watts	
	Power Cable Length	5.9 ft (1.8 m)	
Mechanical	Dimensions (H x W x D)	Unpacked with stand	16.7 to 21.8 x 17.4 x 8.67 in (42.5 to 55.5 x 44.3 x 22.0 cm)
		Unpacked w/o stand (head only)	13.58 x 17.4 x 3.42 in (34.5 x 44.3 x 8.7 cm)
		Packaged	11.77 x 22.2 x 16.77 in (29.9 x 56.4 x 42.6 cm)
	Weight	Unpacked	With stand: 20.28 lb (9.2 kg); Without stand: 12.35 lb (5.6 kg)
		Packaged	26.3 lb (11.95 kg)
	Tilt Range	-5° to + 25° vertical tilt	
	Swivel Range	-45° to + 45°	
	Height Adjustable	Yes, range 5.1 in (13.0 cm)	
	Pivot Rotation	Yes	
	Base	Detachable, ships attached	

Environmental	Temperature – Operating	46° to 95° F (10° to 35° C)
	Temperature – Non-operating	6° to 140° F (-10° to 60° C)
	Humidity – Operating	20% to 80% non-condensing
	Humidity – Non-operating	5% to 85%
	Altitude – Operating	+12,000 ft (+3,657.6 m)
	Altitude – Non-operating	+40,000 ft (+12,192 m)
Options	HP Silver Flat Panel Speaker Bar - Part number: EE418AA	Powered directly by the monitor or the PC, the Speaker Bar seamlessly attaches to the monitor's lower bezel to bring full audio support to select HP flat panel monitors. Features include dual speakers with full sound range and external jack for headphones. Sold separately. For more information, refer to the HP Silver Flat Panel Speaker Bar QuickSpec.
Other	Accessories Included	VGA to DVI-I cable – connects the graphic card's VGA connector to the monitor's input #1 or 2 (DVI-I analog) connector. DVI-D to DVI-I cable – connects the graphic card's DVI-D digital connector to the monitor's input #1 or #2 (DVI-I digital) connector.
	User Guide Languages	English, B. Portuguese, French, LA Spanish, Korean, S. Chinese, T. Chinese, Bahasa, Japanese, Danish, Finnish, German, Norwegian, Spanish, Swedish, Greek, Polish, Russian, Slovenian, Turkish
	Software	HP Display Assistant Utility makes it possible to adjust displays settings through the PC using two-way communication via DDCI. HP Display Lite Saver allows ability to power up and down display at predetermined hours of the day to safe power and backlight life. Pivot Pro software from Portrait Displays, Inc. interacts with your PC's native graphics driver to enable seamless portrait screen redraws with a simple mouse-click or keyboard command. Pivot Pro supports 90-degree portrait and landscape views. Language support is available in English, Japanese, French, German, Spanish, Italian, and Traditional and Simplified Chinese.
	User Guide Languages	English
	Warranty Languages	English
	Color	Carbonite/Silver
	VESA External Mounting	Yes (Standard 4 hole pattern, 100 mm)
	Kensington Lock-Ready	Yes

	Certification and Compliance	Canadian Requirements/CSA, CE Marking, CISPR Requirements, , Energy Star Compliant, FCC Approval, ISO 13406-2 Pixel Defect Guidelines, Mexican NOM Approval,, MPR-II Compliant, PC2001 Compliant, PC99 Certified, TCO 03 (emissions, ergonomics, environment), TUV-Ergo, UL Listed, VCCI Approvals, Microsoft Windows Certification (Microsoft Windows 98, Microsoft Windows 2000, and Microsoft Windows XP)
	Compatibility	Compatible with platforms using the VESA standard video modes. Recommended for use with HP products.
	Service and Warranty	Three years parts, labor, and on-site service. 24-hour 365-day 1-800 technical support. Replacement options include 2nd business day on-site service or next business day direct replacement. With direct replacement, HP will ship a replacement display product directly to you. Using the shipping labels provided, return your failed display to HP. Certain restrictions and exclusions apply. For details, contact HP Customer Support.

HP Flat Panel Monitor LP2465	**Panel**	**Type**	24-inch Active Matrix TFT (thin film transistor)
		Viewable Image Area (diagonal)	24 in (60.96 cm)
		Screen Opening (W x H)	20.47 x 12.83 in (52.0 x 32.6 cm)
		Viewing Angle (typical)*	178° H/ 178° V (10:1 minimum contrast ratio)
		Brightness (typical)*	500 nits (cd/m^2)
		Contrast Ratio (typical)*	1000:1
		Response Rate (typical)*	8 ms (typical gray to gray)
		Pixel Pitch	0.270 mm
		Color Depth Support	16.7 million colors
		Backlight Lamp Life (to half brightness)	50K hours
		*Response time 13 ms rise and fall, 6 ms gray to gray.	
	On Screen Display (OSD) Controls	**Buttons or Switches**	Input Select, Auto Adjust, OSD Up, OSD Down, OSD Menu Select, Power
		Languages	English, French, German, Spanish, Italian, Japanese, Dutch
		User Controls	Brightness, contrast, positioning, color temperature, individual color control, serial number display, full screen resolutions, clock, clock phase, input selection (includes separate direct access key for dedicated swap between inputs 1 and 2), factory reset

Signal Interface/ Performance	Horizontal Frequency	30 to 94 kHz (VGA input); 30 to 92 KHz (DVI input) (for modes with pixel clock less than 157 MHz)
	Vertical Frequency	48 to 85 Hz (VGA and DVI input)
	Native Resolution	1920 x 1200 @ 60 Hz (recommended) (native aspect ratio of 16:10)
	Preset VESA Graphic Modes (non-interlaced)	1920 x 1200 @ 60 Hz 1600 x 1200 @ 60 Hz, 75 Hz 1280 x 1024 @ 60 Hz, 75 Hz, 85 Hz 1280 x 960 @ 60 Hz 1152 x 900 @ 66 Hz 1024 x 768 @ 60 Hz, 75 Hz, 85 Hz 800 x 600 @ 60 Hz, 75 Hz 640 x 480 @ 60 Hz, 75 Hz
	Text Mode	720 x 400 @ 70 Hz
	Mac Mode	1152 x 870 @ 75 Hz and 832 x 624 @ 75 Hz
	Sun Mode	1152 x 900 @ 66 Hz
	Maximum Pixel Clock Speed	202 MHz (VGA input); 162 MHz (DVI input)
	User Programmable Modes	Yes, 20
	Anti-Glare	Yes
	Anti-Static	Yes
	Default Color Temperature	6500 K
Video/Other Inputs	Plug and Play	Yes
	Self Powered USB 2.0 Hub	One upstream, four downstream ports (located on side of monitor, cable included)
	Input Signal	Two DVI-I (VGA analog and digital) inputs
	Input Impedance	75 ohms ± 10%
	Sync Input	Separate sync (HSYNC/VSYNC); composite sync, Sync on Green
	Video Cable	VGA to DVI-I; DVI-D to DVI-D
	Video Cable Length	5.9 ft (1.8 m)
Power	Input Power	Auto-Ranging, 90 to 132 VAC and 195 to 265 VAC; internal power supply, 50 Hz/60 Hz
	Frequency	47.5 to 63 Hz
	Typical Power Consumption	75 watts
	Maximum	< 110 watts
	Power Saving	< 2 watts
	Power Cable Length	6.2 ft (1.9 m)

Technical Specifications - Monitors

Mechanical	Dimensions (H x W x D)	Unpacked w/ stand	14.6 (min) to 19.7 (max) x 22 x 9.1 in (37.1 (min) to 50.1 (max) x 55.4 x 23.2 cm)
		Unpacked w/o stand (head only)	14.4 x 22 x 3.7 in (36.6 x 55.84 x 9.2 cm)
		Packaged	11.7 x 22.1 x 25.6 in (29.8 x 56.0 x 65.1 cm)
	Weight	Unpacked	23.6 lbs (10.7 kg)
		Packaged	23.6 lbs (10.7 kg)
	Tilt Range	-5° to + 25° vertical	
	Swivel Range	-45° to + 45°	
	Height Adjustable	Yes, range 5.1 in (130 mm)	
	Pivot Rotation	Yes	
	Base	Detachable, ships detached	
Environmental	Temperature – Operating	46° to 95° F (10° to 35° C)	
	Temperature – Non-operating	6° to 140° F (-10° to 60° C)	
	Humidity – Operating	20% to 80% non-condensing	
	Humidity – Non-operating	5% to 85%	
	Altitude – Operating	+12,000 ft (+3,657.6 m)	
	Altitude – Non-operating	+40,000 ft (+12,192 m)	
Other	Accessories Included	VGA to DVI-I cable – connects the graphic card's VGA connector to the monitor's input #2 (DVI-I analog) connector DVI-D to DVI-D cable – connects the graphic card's DVI-D digital connector to the monitor's input #2 (DVI-I digital) connector	
	Software	Pivot Pro software from Portrait Displays, Inc. interacts with your PC's native graphics driver to enable seamless portrait screen redraws with a simple mouse-click or keyboard command. Pivot Pro supports 90-degree portrait and landscape views. Language support is available in English, Japanese, French, German, Spanish, Italian, and Traditional and Simplified Chinese. HP Display Assistant is a software utility that allows monitor adjustment, color calibration, and security/asset management using the Display Data Channel Command Interface (DDC/CI) protocol of the connected desktop PC. HP Display LiteSaver feature allows you to schedule Sleep mode at preset times to help protect the monitor against image retention, drastically lower power consumption and energy costs, and extend the lifespan of the monitor.	

	User Guide Languages	English, B. Portuguese, French, LA Spanish, Korean, S. Chinese, T. Chinese, Bahasa, Japanese, Danish, Finnish, German, Norwegian, Spanish, Swedish, Greek, Polish, Russian, Slovenian, Turkish
	Warranty Languages	English, Canadian French, LA Spanish, Brazilian Portuguese, Danish, German, Castilian Spanish, French, Italian, Dutch, Norwegian, Finnish, Swedish, Bahasa Indonesian, Korean, T. Chinese, S. Chinese
	Color	Carbonite/silver
	VESA External Mounting	Yes (Standard 4 hole pattern, 100 mm)
	Kensington Lock-Ready	Yes
Options	HP Silver Flat Panel Speaker Bar - Part number: EE418AA	Powered directly by the monitor or PC, the Speaker Bar seamlessly attaches to the monitor's lower bezel to bring full audio support to select HP flat panel monitors. Features include dual speakers with full sound range and an external jack for headphones. Sold separately. For more information, refer to the HP Flat Panel Speaker Bar QuickSpec.
Certification and Compliance		Australian ACA Approval, Canadian Requirements/CSA, CE Marking, China CCIB/CCEE Approval, CISPR Requirements, Eastern European Approvals, Energy Star Compliant, FCC Approval, German Ergonomic (TUV and GS Mark), ISO 9241-3,7,8 VDT Guidelines, ISO 13406-2 Pixel Defect Guidelines, Mexican NOM Approval, MIC Requirements (New Zealand), MPR-II Compliant, Nordic Approvals (Nemko, Fimko, Demko, Semko), PC2001 Compliant, PC99 Certified, S. Korean MIC Approval, Taiwan BSMI Approval, TCO 03 (emissions, ergonomics, environment), TUV-Ergo, UL Listed, VCCI Approvals, Microsoft Windows Certification (Microsoft Windows 98, Microsoft Windows 2000, and Microsoft Windows XP)
Compatibility		Compatible with platforms using the VESA standard video modes. Recommended for use with HP products.
Service and Warranty		Three years parts, labor, and on-site service. 24-hour, 90-day, toll-free technical support. Replacement options may include second business day on-site service, or next business day direct replacement, at HP's sole discretion. With direct replacement, HP will ship a replacement display product directly to you. Using the prepaid shipping labels provided, return your failed display to HP in the same packaging as the replacement. Certain restrictions and exclusions apply. For details see your product warranty or contact HP Customer Support.