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**Family Basics**

**What is a workstation and how is it different from a high-end business PC?**

Workstations are powerful computers designed for professional applications and usage, and generally offer faster performance, more expandability and more reliability choices than business PCs. The extent varies by model and individual components chosen. HP offers a wide range of workstation models to suit every need and including desktop, all-in-one, mobile and virtual workstations. HP Workstations are designed for 24x7x365 usage, and are fully tested with and certified for a broad variety of professional applications in Product Development, Architecture, Engineering and Construction, Financial Services, Media and Entertainment, and many other vertical segments.

For more details, refer to Why a Workstation.

**What are HP Workstations?**

The revolutionary HP Workstations are designed to outperform, so you can outperform. Combining bold design, world-class engineering, robust tools and visual collaboration solutions, the HP Workstation Family—the HP Z1, HP Z230 SFF, HP Z230 Tower, HP Z420, HP Z620, HP Z820, HP ZBook 14, HP ZBook 15, HP ZBook 17 and HP DL380z Gen8 Virtual Workstation—takes innovation, performance, and reliability to the next level to help give you and your business a competitive edge. HP Workstations are engineered to optimize the way processor, memory, graphics, OS, and software components work together, to deliver massive, whole-system computational power that helps you accomplish more with every minute of your time.

For more details, refer to the HP Workstations Solutions Brochure.

**How are HP Workstations sold and distributed?**

HP Workstations are sold on hp.com, via distributor/VARs (indirect/direct channels), and HP sales force.

For more details, visit hp.com/zworkstations

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**HP Z1 G2 Workstation**

**What's special about the HP Z1 G2 Workstation?**

The HP Z1 G2 Workstation is HP’s most innovative all-in-one workstation with a brilliant display in an elegant, easily customizable design. Take computing performance to another level with the latest Intel® processors and a wide range of professional 3D graphics from NVIDIA. Connect in a flash and increase productivity with optional, easily accessible Thunderbolt™ 2 ports. See your ideas shine on the brilliant, next generation IPS display or the optional 10-point touchscreen.

**What are the at-a-glance features of the HP Z1 G2 Workstation?**

- Windows 8.1 Pro 64-bit and other editions available
- Intel® C226 chipset
- Intel® Xeon® processor E3-1200 v3 family (quad-core) and 4th Generation Intel® Core™ i3, i5 Processors
- Intel® Turbo Boost Technology
- Intel® vPro™ Technology
- Professional 3D NVIDIA Quadro Graphics
- 2 Thunderbolt™ 2 ports for up to 4x bandwidth of USB 3.0 (optional, side access)
- Up to 32 GB of total DDR3-1866 MHz ECC or non-ECC system memory
- Optional 10-point touchscreen
- 27" Diagonal IPS display with 2560 x 1440 resolution

For more details, refer to the HP Z1 G2 Datasheet and QuickSpecs.

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**HP Z230 Workstations**

**What are the HP Z230 Workstations?**

Designed for 24x7 usage, the new HP Z230 Workstations raise the bar for entry workstations with next generation processors and graphics technologies combined with an all new, redesigned chassis. These systems introduce significant improvements in performance, flexibility and energy efficiency for entry workstations, along with greater lifecycle stability (over 2 years). The HP Z230s offer more power and reliability than a business PC through Intel® Xeon® processor E3 version 3 series and error correction code (ECC) memory options. Choose between a surprisingly capable Small Form Factor (SFF) for constrained spaces, or a new compact yet impressively expandable Tower design.
**HP Z230 SFF Workstations**

**What's special about the HP Z230 SFF Workstation?**

As HP’s most affordable workstation, the Z230 SFF is fully revamped from its predecessor, the HP Z220 SFF, with improved flexibility and plenty of workstation performance and reliability choices at a great value, at starting prices that rival commercial desktops.

It’s a great example of HP innovation: even though it is about 57% less in volume size of the Tower version, the Z230 SFF packs plenty of workstation punch. The chassis is re-designed for improved rigidity and flexibility. Inside the compact chassis, intuitive green touch points indicate tool-less access for serviceable and upgradeable components. Even more flexibility for such a compact product—there are a total of 4 storage bays! There is now an additional 2.5” drive bay compared to the Z220 SFF, ideal for adding a storage SSD or a disk cache SSD. The Z230 SFF also features greater flexibility in IO—with three DisplayPort outputs for integrated graphics, and two USB 3.0 ports moved out to the front of the chassis.

The Z230 pushes the entry workstation envelope further with next generation Intel processors. The Z230 includes a choice of the cost effective 4th generation Intel® Core™ processors or the more powerful and reliable server/workstation class Intel® Xeon® E3 version 3 family. The next generation of standard and professional graphics (available on specific processors) are offered. Energy efficiency gets a boost too with the new 92% efficiency, 240W power supply.

**What are the at-a-glance features of the HP Z230 SFF Workstation?**

- HxWxD: 10.5 x 33.83 x 38.15 cm (3.95 x 13.3 x 15.0 in)
- Windows 8.1 Pro 64-bit and other editions available
- Intel® C226 Workstation Chipset
- Intel® Xeon® processor E3-1200v3 family and 4th generation Intel® Core™ i3/i5/i7 processors
- Next generation integrated Intel® HD Graphics 4600/ P4600
- Choice of several new 2D and professional 3D graphics cards from NVIDIA and AMD
- Optional high-performance Thunderbolt™ Z port for up to 4x bandwidth of USB 3.0
- Five integrated USB 3.0 ports: 2 front, 2 rear, 1 internal
- HP Z Turbo Drive PCIe SSD for double the performance of SATA SSDs
- 240W 92% efficient power supply

For more details, refer to the HP Z230 SFF Datasheet and QuickSpecs.

**HP Z230 Tower Workstations**

**What's special about the HP Z230 Tower Workstation?**

The HP Z230 Tower replaces the existing HP Z220 CMT, and like the HP Z230 SFF, comes with many improvements. The chassis is more compact and flexible, which is better suited for office spaces and cubicles that seem to be getting smaller. It also now neatly fits into a 4U rack space including the shelf kit. Another improvement is a rear ledge, which functions as a secondary handle in addition to the optional front optical bay handle. Another change in this generation is the introduction of a slim ODD bay to complement the two half-height bays, instead of a third half-height bay.

As on the HP Z230 SFF, next generation Intel® processors bring greater performance and power management, and energy efficiency gets a boost with a 92% efficiency power supply with a generous 400W capacity to tackle more demanding configurations.

In terms of IO ports, the HP Z230 Tower also features greater flexibility - with two DisplayPort and one DVI output for integrated graphics, and a USB 2.0 charging port at the front.

**What are the at-a-glance features of the HP Z230 Tower Workstation?**

- HxWxD (399mm x 170mm x 442mm) (15.7” x 6.7” x 17.4”)
- Windows 8.1 Professional 64-bit and other editions available
- Intel® C226 Workstation Chipset
- Intel® Xeon® processor E3-1200v3 family and 4th generation Intel® Core™ i3/i5/i7 processors
- 6 storage bays (2x HH 5.25”, 1x slim ODD, 2x 3.5”, 1x 2.5”)
- Next generation integrated Intel® HD Graphics 4600/ P4600
- Choice of several new 2D and professional 3D graphics cards from NVIDIA and AMD
- Optional high-performance Thunderbolt™ Z port for up to 4x bandwidth of USB 3.0
- Five integrated USB 3.0 ports: 2 front, 2 rear, 1 internal
- HP Z Turbo Drive PCIe SSD for double the performance of SATA SSDs
- 400W 92% efficient power supply

For more details, refer to the HP Z230 Tower Datasheet and QuickSpecs.
HP Z420 Tower Workstations

What’s special about the HP Z420 Workstation?
The HP Z420 Workstation is the performance single-processor workstation platform from HP and is positioned above the HP Z230 Workstation. It brings a higher level of performance and expandability to the mainstream workstation space with support for higher-end quad-core, six-core, and eight-core Intel® Xeon® processors, greater memory bandwidth with four-channel memory architecture, and enhancements that support up to 64 GB of memory. This is complemented by a range of new graphics cards from both AMD and NVIDIA, along with expandability up to 6 drive bays, 6 I/O slots, and integrated front and rear IEEE 1394a port access. A new-look, tool-less chassis also includes acoustic enhancements, easier accessibility, more internal expandability, and an optional handle for the top optical bay.

What are the at-a-glance features of the HP Z420 Workstation?
• Windows 8.1 Professional 64-bit and other editions available
• Intel® C602 chipset
• Choice of Intel® Xeon® processor E5-1600 v2 and E5-2600 families supporting 4-8 cores of processing power
• Improved Intel® Hyper-Threading® and Intel® Turbo Boost Technologies
• Intel® vPro™ Technology
• 8 DIMM slots, up to 64 GB of total DDR3 1866 MHz system memory
• Optional high-performance Thunderbolt™ 2 port for up to 4x bandwidth of USB 3.0
• USB 3.0 ports
• PCI Express Gen3 lanes for faster and better I/O capacity
• HP Z Turbo Drive PCIe SSD for double the performance of SATA SSDs
• Standard 600W 90% efficient power supply

For more details, refer to the HP Z420 Datasheet and QuickSpecs.

HP Z620 Tower Workstations

What’s special about the HP Z620 Workstation?
With up to 24 discrete processor cores, the HP Z620 Workstation packs a lot of compute and visualization power into a quiet, compact footprint. This dual-socket system helps you boost productivity with the performance of next-generation Intel® Xeon® processors and support for up to eight displays.

What are the at-a-glance features of the HP Z620 Workstation?
• Windows 8.1 Professional 64-bit and other editions available
• Intel® C602 chipset
• Support for both Dual Intel® Xeon® E5-2600 v2 and E5-1600 v2 processor families up to 135W
• Dual integrated LAN connections with Intel® vPro™ Technology
• Optional high-performance Thunderbolt™ 2 port for up to 4x bandwidth of USB 3.0
• Up to 12 DIMM slots, up to 192 GB of total DDR3 1866 MHz system memory
• Four-channel memory architecture (8-channels with 2 CPUs installed)
• Integrated USB 3.0 ports (2 front, 2 rear)
• Support for PCI Express Gen1
• HP Z Turbo Drive PCIe SSD for double the performance of SATA SSDs
• Standard 800W 90% efficient power supply
• 300W graphics power budget

For more details, refer to the HP Z620 Datasheet and QuickSpecs.

HP Z820 Tower Workstations

What’s special about the HP Z820 Workstation?
The HP Z820 Workstation is HP’s Intel® Xeon®-based, high-end workstation. The HP Z820 is a highly expandable, rack mountable box, with the latest, high-performance, I/O technologies for ultimate performance. Only HP can provide the breadth of products that customers require in the form of Windows and Linux. The HP Z820 Workstation continues HP’s tradition of outstanding quality and thorough ISV qualification. Easily deploy HP Z820 Workstations into your mission-critical design, analysis, and content creation environments knowing that HP is there to support you every step of the way.
What are the at-a-glance features of the HP Z820 Workstation?
- Windows 8.1 Pro 64-bit and other editions available
- Intel® C602 chipset
- Support for Intel® Xeon® processor E5-2600 v2 family
- Dual integrated LAN connections with Intel® vPro™ Technology
- Optional high-performance Thunderbolt™ Z port for up to 4x bandwidth of USB 3.0
- 16 DIMM slots, up to 512 GB, 8 channel ECC of total DDR3 1866 MHz system memory
- Integrated USB 3.0 ports (2 front, 2 rear)
- Support for PCI Express Gen
- HP Z Turbo Drive PCIe SSD for double the performance of SATA SSDs
- Standard 850W 88% efficient power supply

For more details, refer to the HP Z820 Datasheet and QuickSpecs.

What features do the Intel® Xeon® processor E5-2600 series support?
The HP Z820 Workstation supports a broad array of Intel® Xeon® processor E5-2600v2 series. This processor series provides PCI Express connections directly from the processor. The processor series also provides dual QuickPath Interconnects (QPI) between processors increasing the processor-to-processor communication speeds for dual processor systems. The Intel® Xeon® processor E5-2600v2 series supports the following features:

Processors
- 40 lanes of PCIe Gen 3 I/O (for each processor)
- For the HP Z820, the 1st processor will provide two PCIe3 x16 slots and one PCIe3 x4 slot.
  The 2nd HP Z820 processor will provide one PCIe3 x16 slot and one PCIe3 x8 slot
- Turbo Mode (allows processor to run faster under certain conditions)
- Intel® Hyper-Threading Technology
- 32nm Silicon Process Technology
- 2.5M of Last-Level (L3) Cache per core
- 6.4GT/s, 7.2GT/s and 8.0GT/s QPI links
- The speed of the QPI is dependent on processor frequency.
- 80W, 95W, 115W, 135W and 150W parts
- Integrated DDR3 memory controller
- 4 channel 1066MHz, 1333MHz, 1600MHz or 1866MHz DDR3 memory subsystem
- Memory frequency is dependent on processor frequency.
- 512 GB memory capacity
- 2.7x improvement over the HP Z800 (maximum memory offered on HP Z800 is 192 GB)

Core Chipset
The HP Z820 Workstation is based on Intel's C600 series chipset. The C600 series chipset supports the following new features (compared to the HP Z800):
- QuickPath Interconnect (QPI). Up to 8GT/sec throughput
- 25 percent improvement over the HP Z800
- Additional (to that provided by the processor(s)) PCI Express Gen 2 I/O
- In addition to the PCIe3 I/O provided by the E5-2600 processors, the HP Z820 has 1 PCIe Gen2 x4 slot and 1 Legacy PCI (32bit/33MHz) slot.
- 2 channels of Serial ATA 6Gb/s interface
- 2x the available throughput of the channels provided on the HP Z800
- 4 channels of Serial ATA 3Gb/s interface
- 8 channels of 6Gb/s Serial Attached SCSI (SAS) interface provided by an LSI SAS2308 controller (outside the C600 chipset)
- 2x the available throughput per channel as provided on the HP Z800.
- Same number of SAS channels as the HP Z800.
- The HP Z820 allows for all 8 SAS channels to be available externally, when configured with the external cable assembly(ies).
HP ZBook 14 Mobile Workstation

What’s special about the HP ZBook 14 Mobile Workstation?
Everything you’d expect of the world’s first workstation Ultrabook™. HP’s lightest mobile workstation—the HP ZBook 14 utilizes impressive professional 3D graphics. This exceptionally thin, customizable workstation is light enough to carry when you’re on the go—and powerful and reliable enough to carry you through the workday. And with the optional, intuitive 10-point multi-touch screen, you can navigate designs, pan and zoom photos, or touch your technical applications with the swipe of your finger. 

*Not all configurations qualify as an Ultrabook™

What are the at-a-glance features of the HP ZBook 14 Mobile Workstation?
- Windows 8.1 Professional 64-bit and other editions available
- Intel® Core™ i5 and i7 processors
- 14.0” (35.6 cm) diagonal display and 3.57 lbs (1.62 kg) for easy mobility
- Latest AMD FirePro™ graphics feature ISV certifications
- Intuitive 10-point multi-touch screen option
- Optional secondary battery support (6-cell slice)

For more details, refer to the HP ZBook 14 Datasheet and QuickSpecs

HP ZBook 15 Mobile Workstation

What’s special about the HP ZBook 15 Mobile Workstation?
Unleash your creativity and break free from your desktop with a sleek HP ZBook 15 Mobile Workstation that keeps you productive in the field. Take advantage of powerful processing and graphics, consistent color throughout your workflow, simple scalability, and the blazing-fast connectivity your team needs to perform and collaborate at the speed of creativity.

What are the at-a-glance features of the HP ZBook 15 Mobile Workstation?
- Windows 8 Professional 64-bit and other editions available
- Intel® Core™ i5 and i7 processors
- 15.6” (39.6 cm) diagonal display in your choice of FHD resolutions or HP DreamColor panel
- Drive up to five displays with NVIDIA Graphics
- NVIDIA Optimus Technology
- Up to 1.87 TB of storage and up to four SODIMMS supporting up to 32 GB of memory
- Thunderbolt™ 2 technology for up to 4x bandwidth of USB 3.0
- Tool-less hard drive release
- Two secondary external battery options
- Common docking station options

For more details, refer to the HP ZBook 15 Datasheet and QuickSpecs

HP ZBook 17 Mobile Workstation

What’s special about the HP ZBook 17 Mobile Workstation?
Creativity knows no limits. Showcase your best work in the office or on the go. With the new HP ZBook 17 Mobile Workstation, take advantage of HP’s most powerful processing and graphics, consistent color throughout your workflow, simple scalability, and the blazing-fast connectivity your team needs to perform and collaborate at the speed of creativity.

What are the at-a-glance features of the HP ZBook 17 Mobile Workstation?
- Windows 8 Professional 64-bit and other editions available
- Intel® Core™ i5 and i7 processors
- 17.3” (43.9 cm) diagonal display in your choice of HD+, FHD resolutions or HP DreamColor panel
- Drive up to five displays with NVIDIA Graphics
- NVIDIA Optimus Technology
- Up to 2.87 TB of storage and up to 32 GB of memory
- Thunderbolt™ 2 technology for up to 4x bandwidth of USB 3.0
- Tool-less hard drive release
- Two secondary external battery options
- Common docking station options

For more details, refer to the HP ZBook 17 Datasheet and QuickSpecs
**HP DL380z Gen8 Virtual Workstation**

**What is a virtual workstation?**
A virtual workstation moves the processing/graphics/storage into the more secure datacenter. The workstation hardware can be accessed in these modes:

- 1:1 Remote Workstation
- Virtualized System / Pass-Thru GPU
- Virtualize the System / Virtualize the GPU

**What are the benefits of moving the workstation into the datacenter:**

**Performance** – Faster project load times
- Advanced users with large terabyte data sets will see model load times decrease from hours to minutes as HP collocates the compute node with data array.

**Security** – Valuable IP never leaves the data center
- Sensitive content never leaves the data center. Only encrypted screen images are sent to the endpoints.

**Increased Reliability** – Server-class redundancy
- Customers get mission-critical reliability with server-class technology including redundant power supplies, fans, networking, fail-over technology.

**Centralized Management** – Leadership remote management
- Take advantage of the advanced HP Integrated Lights Out (iLO) remote management solutions.

**Mobility** – Work anywhere, anytime
- Users can access the high-performance, reliable, secure workstation resource from anywhere, anytime—whether in the office, at home, on the road at the clients office.

**Resource sharing** – put the power to use 24x7
- The powerful HP DL380z Gen8 Virtual Workstation compute resources can be utilized for other workloads when not in use for virtual workstation sessions.

**Cooler, quieter workspace** – increased productivity and comfort
- By keeping the compute and storage in the data center, workspaces are quieter and cooler.

**How does the HP DL380z Gen8 Virtual Workstation differ from a blade workstation? (technology, customers, usage model, etc)**
The HP DL380z Gen8 Virtual Workstation uses the industry standard 2U form factor. The HP Blade Graphics Server uses the HP Blade chassis form factor. The HP Blade Graphics Server has all of the features and advantages of HP’s blade solutions with the addition of a selection of graphics accelerators. The HP DL380z Gen8 Virtual Workstation has the flexibility of the 2U standard form factor and can be configured with two high-end graphics cards.

**How does the HP DL380z Gen8 Virtual Workstation differ from a traditional workstation?**
The HP DL380z Gen8 Virtual Workstation differs from a traditional workstation in these ways:
- Rack mount only
- Denser – 2U form factor for a 2-socket solution with two dual-wide graphics cards
- High-availability features
  - Redundant power supplies
  - Redundant cooling fans
- Out of band management
  - iLO (Integrated Lights Out) remote management is included in the HP DL380z Gen8 Virtual Workstation. This allows IT to remotely manage every aspect of the system from anywhere in the world

For more details, refer to the HP DL380z Gen8 Virtual workstation Datasheet and QuickSpecs

**HP Workstations innovations**

**HP Z Turbo Drive**

**What is the HP Z Turbo Drive?**
The HP Z Turbo drive is a PCIe connected SSD. It is a PCIe card form factor that requires a PCIe x4 slot for maximum performance. It is available in capacities of 256 GB and 512 GB.
How does the performance of the HP Z Turbo Drive compare to a SATA SSD?
The HP Z Turbo Drive is capable of significantly faster read and write speeds, both sequential and random. The HP Z Turbo Drive is not constrained by the 6Gb/s SATA bus, and therefore can perform at greater speeds than a standard SATA SSD. Some specific performance data include the following:

<table>
<thead>
<tr>
<th></th>
<th>Z Turbo Drive (PCIe SSD)</th>
<th>SATA SSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequential Red</td>
<td>1,170 MB/s</td>
<td>550 MB/s</td>
</tr>
<tr>
<td>Sequential White</td>
<td>930 MB/s</td>
<td>500 MB/s</td>
</tr>
<tr>
<td>Random Read</td>
<td>122K IOPS</td>
<td>80K IOPS</td>
</tr>
</tbody>
</table>

How does the HP Z Turbo Drive compare to a commercial-grade HDD?
The HP Z Turbo Drive is incredibly faster than a commercial-grade HDD demonstrating sequential read performance that is more than six times faster.

Will the platform support both HP Z Turbo Drive and other SATA/SAS drives?
Yes, you can use additional SATA drives as data drives with the HP Z Turbo Drive. On the Z820 you can use both SAS and SATA drives as data drives with the HP Z Turbo Drive. It is technically feasible to support other SAS controllers in addition to the HP Z Turbo Drive. Some of the PCIe M.2 modules supported with the HP Z Turbo Drive may have discreet OROMs that would need to coexist with the SAS controller’s OROM. If there are issues, the OROMs can be disabled for specific slots that are not being used for boot devices.

Which HP Workstation platforms will support the HP Z Turbo Drive?
The HP Z Turbo Drive is supported on the Z230 SFF, Z230 Tower, Z420, Z620, and Z820 Workstations.

Will this technology be supported on Z1 AiO and ZBook platforms?
Yes. It is expected that PCIe Storage devices will be supported on these platforms. While it is likely that other workstation platforms will add support for PCIe storage devices, the specific details are not available at this time.

Can I use the HP Z Turbo Drive in other HP Systems?
The HP Z Turbo Drive has been developed exclusively for support in the stated HP Workstation platforms.

How does the HP Z Turbo Drive compare to the Fusion ioFX PCIe SSD?
The HP Z Turbo Drive benefits from the high speed connection to PCIe, and thus has excellent performance, with speeds greater than 1GB/s, and a cost similar to SATA SSDs. In addition, the HP Z Turbo Drive can be used as a Boot drive and/or Data drive. The Fusion ioFX device has greater performance, 1.5GB/s and lower latency, and higher cost, comparable to Enterprise class devices. It can only be used as a Data drive, but excels in this capacity. Fusion ioFX requires use of their proprietary driver to achieve some of their performance gains.

Remote Graphics Software

What is HP RGS?
HP RGS or Remote Graphics Software is software that allows you to connect to and use your workstation when you are sitting at a different computer or tablet. It is a remote desktop solution designed to provide a seamless, just like local, feel for even the most demanding 3D graphics-heavy professional applications. It is also a great way to share your screen and collaborate with other remote coworkers. HP RGS is ideal for connecting to virtual workstations hosted in the data center or even the cloud.

Does HP RGS work on non-HP hardware?
HP RGS should work on any hardware/software combo that meets the system requirements and support matrix in the QuickSpecs. For support purposes, customers must be able to reproduce any issue on an HP system listed in the support matrix with an HP factory installed image.

Who uses HP RGS?
HP RGS has been used as the gold standard for remote workstations and collaboration in many industries including architecture, engineering and construction, education, financial services, geospatial, media and entertainment, oil and gas, product development, and more.

What is the sender or receiver for HP RGS?
There are two parts to HP RGS. The sender software, which gets installed on the workstation that is running your professional applications, and the receiver part, which gets installed on the thin client, tablet or PC you will be connecting from. The receiver is a free download for Windows and Linux.
How does HP RGS work?
HP RGS works by analyzing the image of the remote workstation and sending an encrypted and encoded stream to the client devices. The keyboard, mouse and USB devices on the client devices are sent back to the remote workstation. The end result is complete control of a remote or virtual workstation that looks and feels as though you were physically working from your workstation, with all of its applications, data, graphics and processing power.

What's new in HP RGS 7?
HP RGS 7 brings the workstation productivity to Windows 8 tablets. Features like gesture to hotkey mapping, zoom, virtual mouse, HP Velocity and touch controls give you touch controls to Windows 7 and Linux applications that are not programed for touch.

How can I know if I will benefit from a new version of RGS?
HP posts the release notes for each version at hp.com/go/rgs. HP also offers a trial license on the same web page so you can test out new versions of HP RGS in your environment. HP offers Care Pack Services to help you setup RGS in your environment. Also remember that patch and minor updates are available for free.

For more details, refer to the RGS Datasheet and QuickSpecs.

Thunderbolt™ 2 technology

What is Thunderbolt 2 technology?
Thunderbolt 2 technology is a transformational high-speed, dual protocol I/O that provides unmatched performance over current I/O technologies with 20 Gbps bi-directional transfer speeds. It provides flexibility and simplicity by supporting both data (PCIe) and video (DisplayPort) on a single cable connection that can daisy-chain up to six devices.

What are the key features of Thunderbolt 2 Technology?:
• Up to 20 Gbps bi-directional, dual channel data transfer
• Data and video on single-cable with dual-protocol (PCI Express and DisplayPort)
• Daisy chain up to six devices
• Compatible with existing DisplayPort devices
• Low latency with highly accurate time synchronization
• Uses native PCIe and DisplayPort protocol software drivers
• Power over cable for bus-powered devices (electrical cables only)

To learn more about Thunderbolt technology, visit thunderbolttechnology.net

What is HP Performance Advisor*?
This ultra-savvy software wizard will walk you through how to configure and customize your system, helping you get the most out of your HP Workstation from day one—and every day after. Designed by HP computer techies for non-techies to use and understand, HP Performance Advisor is the simplest and most effective way to make sure your computer is always operating at its optimum potential.

Just launch this program anytime you want to check in on the health of your system. With a few clicks of the mouse, you’ll find out what’s working great, what’s not, and the information you need to improve your system’s stability and performance. HP Performance Advisor also consolidates information on each new application, driver, font and widget you install, so you can re-allocate resources, maximize memory, eliminate conflicts, and keep your system running fast and smooth.

If you need to troubleshoot a hardware or system issue, you’ll find all the latest diagnostics pulled into one convenient screen. You can even e-mail the information directly to HP Technical Support for more effective analysis and repair.

*Available on Microsoft Windows-based systems. For more details, refer to HP Performance Advisor Datasheet and FAQs

Liquid Cooling

Will HP offer Liquid Cooling on the new HP Workstations?
HP Liquid Cooling is offered on both the HP Z420 and HP Z820. This liquid cooling solution will be implemented for the processors ONLY.

Why did HP choose to implement Liquid Cooling?
HP places a large priority on satisfying customer requirements. Achieving the lowest acoustics levels is a priority for HP Workstations. Implementing Liquid Cooling provides extremely efficient heat removal from the processors, allowing the remaining system fans to run at greatly reduced RPMs, which reduces the overall acoustic output levels. Configurations where the processor fans are not the dominant noise source will not significantly benefit from Liquid Cooling. Examples of possible configurations where processor fans are not the dominant noise source are memory configurations where all memory slots are filled or configurations with 15K SAS drives.
**How do I order Liquid Cooling?**
Liquid Cooling is a Configure-to-Order option. This provides you with a choice between Air Cooling and Liquid Cooling.

**Can I order Liquid Cooling as an After Market Option (AMO)?**
For the HP Z420 Liquid Cooling must be ordered at the time of purchase as a CTO item. There is no AMO offering for Liquid Cooling on the HP Z420.

For the HP Z820, Liquid Cooling is included with the E5-2687W and E5-2687W v2 processor AMOs. Liquid Cooling is not available as a standalone AMO. Liquid cooling is ONLY associated/included with the E5-2687W and E5-2687W v2 AMO processor kits.

**Where can I learn more about HP’s Liquid Cooling?**
Find additional information on the Liquid Cooling option in the Liquid Cooling on the HP Z420 and HP Z820 Workstations whitepaper.

**Intel® processors**

**Is the processor support the same for the HP Z620 and HP Z820?**
The HP Z620 supports processors that have a maximum power of up to 135W. The HP Z820 can support processors with power up to 150W, so it has a broader processor offering.

**Do I have to recompile my applications to see the performance advantages of the new Intel® Xeon® processors?**
No, testing and Intel® data indicate that technical applications show immediate performance increases due to the new processor and memory architecture.

**How do I add the second processor? Is a system board swap required?**
CPU upgrades are field and customer installable without system board swaps using the HP Workstations CPU upgrade kit. The second processor must be the same speed and stepping as the first.

**What is included in the After Market Option (AMO) kit for the 2nd processor on the HP Z620?**
The 2nd processor kit for the HP Z620 system includes the “2nd CPU & Memory Module”, the Intel® Xeon® E5-2600 series processor, and the heat-sink for the processor. Memory must be ordered separately, as it is done with previous generation systems.

**Do the HP Z620 and HP Z820 systems share the same AMO processor kits?**
No, these systems will have unique AMO processor kits, as the Z820 does not require the “2nd CPU & Memory Module” that is required for adding a 2nd processor to the HP Z620.

**If an Intel® Xeon® processor E5-1600v2 series processor is installed in the HP Z620 system, can a 2nd processor be added to the system?**
No, if the 1st processor installed is from the Intel® Xeon® processor E5-1600v2 series, a 2nd processor may NOT be installed. If two processors are desired, only Intel® Xeon® processor E5-2600v2 series processors may be used.

**What are the benefits of multi-core processors?**
Intel® multi-core processors provide greater processing resources. Multi-core processors are ideal for usage models requiring multi-tasking (running many applications or simulations at once); working on spreadsheet while listening to music with virus checkers and system backups running (power office); or using applications that can split a task across processors (multi-threaded), like animation/rendering in Digital Content Creation.

**Multi-core. Dual-socket. Dual-core. Quad-core. Six-Core. Eight-Core? What do these terms mean?**

<table>
<thead>
<tr>
<th>Dual-socket</th>
<th>Two physical CPU sockets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual-core</td>
<td>Each CPU package has exactly two processor cores</td>
</tr>
<tr>
<td>Quad-core</td>
<td>Each CPU package has exactly four processor cores</td>
</tr>
<tr>
<td>Six-core</td>
<td>Each CPU package has exactly six processor cores</td>
</tr>
<tr>
<td>Eight-core</td>
<td>Each CPU package has exactly eight processor cores</td>
</tr>
<tr>
<td>Multi-core</td>
<td>Each CPU package has multiple (2, 4, 6...) processors cores</td>
</tr>
<tr>
<td>Dual-processor</td>
<td>A system with two processors in two sockets</td>
</tr>
</tbody>
</table>

**What is Intel® Turbo Boost Technology 2.0?**
Intel® Turbo Boost Technology 2.0 is a way to automatically run the processor core faster than the marked frequency if the part is operating under power, temperature, and current specifications limits of the Thermal Design Power (TDP). This results in increased performance of both single and multi-threaded applications.
How much faster will my processor run with Intel® Turbo Boost 2.0 Technology?
The maximum frequency of Intel® Turbo Boost Technology 2.0 is dependent on the number of active cores. The amount of time the processor spends in the Intel® Turbo Boost Technology 2.0 state depends on the workload and operating environment. Any of the following can set the upper limit of Intel® Turbo Boost Technology 2.0 on a given workload:

- Number of active cores
- Estimated current consumption
- Estimated power consumption
- Processor temperature

When the processor is operating below these limits and the user’s workload demands additional performance, the processor frequency will dynamically increase until the upper limit of frequency is reached. Intel® Turbo Boost Technology 2.0 has multiple algorithms operating in parallel to manage current, power, and temperature to maximize performance and energy efficiency. Note: Intel® Turbo Boost Technology 2.0 allows the processor to operate at a power level that is higher than its rated upper power limit (TDP) for short durations to maximize performance.

As an independent and complementary feature, Intel® Hyper-Threading Technology (Intel® HT Technology) increases performance of both multi-threaded and single threaded workloads.

Graphics

Graphically, what is special with the HP Workstations?
HP Workstations support one of the widest ranges of professional 2D up to Ultra High-End 3D graphics from AMD and NVIDIA, for your most visually demanding applications. Depending on the workstation you choose, you can drive up to eight displays and take advantage of PCI Express Gen3 expansion slots. Please refer to the specific workstation for the I/O slot arrangements.

Does the PCI Express channel deliver any advantage beyond accommodating two graphics cards?
Yes. The PCI Express channels form highly efficient, high-performance general-purpose I/O busses that may be used for any device that is able to take advantage of the PCI Express interface.

What is meant by PCI Express (PCIe)?
PCIe is the latest generation of PCI architecture. PCI Express is a radically new implementation of the PCI computer bus that uses existing PCI programming concepts and communications standards, but is based on a much faster serial communications system. PCI Express x16 slots provides up to eight times the aggregate bandwidth of a PCI-X 133 MHz 64-bit slot (8 GB/s bidirectional).

What's the advantage of PCI Express for graphics? What are the differences?
PCI Express is the next generation interface not only for graphics cards, but also for I/O cards. PCI Express is a scalable interface, and depending on the chipset the system can have multiple PCI Express connections with various bandwidths. For graphics cards, the defined standard is “by sixteen” (or x16). This implementation of PCI Express provides twice the unidirectional bandwidth and four times the peak bandwidth as AGP 8X. The PCI Express specification also allows for 75 W from the motherboard to the graphics cards. This is three times as much power as the standard AGP 8X specification.

What size of graphics memory should I use?
Graphics performance is dependent upon many factors, including the amount of video memory. Higher performing cards also include bigger and faster GPUs, more memory bandwidth, and tend to have more features like dual-link connectors and support for stereo. The higher performance graphics cards will also have more memory (and a higher price). A dual display configuration at 1920 x 1200 pixels will allocate about 70 MB for the frame buffer. The remaining graphics memory will be used to store textures, display lists (graphics data sent by your applications), and other data specific to graphics. If your application would benefit from more storage space for these items, then you should purchase a graphics card with more memory.

What is NVIDIA Maximus technology?
NVIDIA Maximus technology is the highest performing GPU computing solution available for HP Workstations. It enables a simultaneous design and simulation workflow by distributing tasks to two GPUs: an NVIDIA Quadro® graphics card and an NVIDIA Tesla® companion processor, which in turn frees up CPU resources. The Quadro family is specifically developed for graphics-intensive applications like CAD, while Tesla is designed for the parallel-processing jobs commonly required in CAE, rendering, or structural/flow analysis and simulation. Maximus transparently and automatically assigns visualization and simulation or rendering work to the right processor, enabling engineers to simulate on the Tesla GPU without affecting their ability to design using the Quadro GPU.

Which HP Workstations support NVIDIA Maximus technology?
The HP Z420, Z620 and Z820 Workstations support NVIDIA Maximus technology.

For details on which graphics cards are supported on HP Workstations, refer to the HP Workstation Graphics Cards Quick Reference Guide.
Storage and optical drives

Do HP Workstations offer and support SATA-III 6.0 Gb/s hard drives? Y
es, we offer both SATA III 7200 rpm and 10K rpm drives. Most of the 7200 rpm drives are 3.5-inch, except for the 500 GB SED drive, which is a 2.5-inch form factor. Storage capacities for the 7200 rpm drives range up to a massive 3 TB.

The SATA 10K family of drives are high performance drives. They offer sustained data transfers to and from the drive up to 200MB/s, as compared with SATA 7200 rpm drives which offer sustained data transfers up to 130MB/s.

Do HP Workstations support Serial ATA (SATA) and serial attached SCSI (SAS) RAID? Yes. The chipset used on the HP Workstations has an integrated 6-channel SATA controller with RAID support for RAID 0 (striped), RAID 1 (mirrored), RAID 5 (parity), and RAID 10 (striped and mirrored). You can choose to have a high performance RAID 0 array of hard drives where data is striped across multiple hard drives (this RAID method greatly improves data access times and system performance). You can choose to have a highly reliable RAID 1 array of hard drives, where data is duplicated to multiple hard drives at once (this RAID method creates a backup copy of all your data in real time). You can choose to implement a RAID 5 array, which protects against data loss and provides faster throughput. Data is distributed across at least two hard disks, with error correction information stored on an additional disk. Finally, you can choose to implement a RAID 10 array, which offers the advantages of RAID 0 and RAID 1 by utilizing four hard disks.

Large data RAID arrays greater than 2 TB can now be configured on HP Workstations. These data RAID arrays are in addition to the Boot disk.

<table>
<thead>
<tr>
<th>Model</th>
<th>RAID 0: Max Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP Z420</td>
<td>12 TB Max</td>
</tr>
<tr>
<td>HP Z620</td>
<td>12 TB Max</td>
</tr>
<tr>
<td>HP Z820</td>
<td>15 TB Max (Connected to high-end SAS Controller)</td>
</tr>
</tbody>
</table>

What SAS hard drives and controllers are offered? We offer a wide selection of SAS disk drives and controllers on the HP Z420, HP Z620 and HP Z820 Workstations. The faster spindle speeds (15K rpm, 10K rpm) and the high bandwidth controllers (6.0 Gb/s) result in very fast access to your data. We offer two different PCIe Gen3 SAS controllers: an entry 4-channel SAS controller with basic hard drive connectivity/control and RAID functionality, and a full-featured 8-channel SAS RAID-on-Chip (ROC) controller with an external connector and comprehensive RAID functionality.

Do HP Workstations offer and support solid-state and self-encrypting drives? Yes, we offer and support a variety of both branded (Intel, Samsung Enterprise) and unbranded solid state drives (SSDs), self-encrypting drives (SED SSDs), mSATA SSDs, and PCIe SSDs.

You can choose from 2.5-inch SATA SSDs up to 512 GB; 2.5 SATA SED SSDs up to 256 GB; 3.5-inch SATA SED hard drives up to 500 GB; and mSATA SSDs up to 256 GB.

We also offer our PCIe SSD, the HP Z Turbo Drive, up to 256 GB on all our desktop workstations. Fusion IOFx up to up to 410 GB is also supported.

What optical drives are available with HP Workstations? HP offers a variety of optical drives including DVD-ROM, DVD +/-RW DL Super Multi, Blu-ray, and 14-in-1 Media Card Readers.

See the HP Workstations Quick Reference Guide at the end of this document for storage and optical drives options on both desktop and mobile workstations.
Operating systems

What operating systems are available HP Workstations?
A variety of operating systems (OS) are available, including the following. Please note that the exact OS carried by each workstation vary by product. For more information, see individual product data sheets and QuickSpecs.

- Windows 7 Professional 64-bit
- Windows 7 Ultimate 64-bit
- Windows 8.1 Pro 64-bit
- Windows 8.1 Pro Downgrade to Windows 7 Professional 64-bit
- HP Linux Installer Kit
- Red Hat Enterprise Linux Desktop/Workstation
  (1-year paper license; no preinstalled OS)

Is dual OS preload an option?
Dual OS preload will not be offered due to restrictions of licensing agreements.

Do HP Workstations support Linux?
Yes. Red Hat Enterprise Linux (RHEL) Desktop/Workstation is available as a “drop-in-the-box” 1-year paper license. RHEL 4 is not supported on new HP Workstations models. SUSE Linux Enterprise Desktop (SLED) 11 is available on all workstations except for the HP Z620 and HP Z820; however, it is supported on all workstations.

For a complete list of Linux supported hardware, go to hp.com/support/linux_hardware_matrix.

What is the HP Installer Kit for Linux?
The HP Installer Kit for Linux (HPIKL) is a set of HP-provided CDs to be used in conjunction with a RHEL or SLED installation to complete your Linux workstation installation. Included on the HPIKL are:

- HP Driver CD for Red Hat Enterprise Linux Desktop/Workstation and SUSE Linux Enterprise Desktop.
- NVIDIA and AMD accelerated graphics drivers that have passed HP quality standards and are compatible with the hardware platform and RHEL releases.
- HP Documentation links
- Additional hardware drivers provided by HP that are not part of the standard Linux distribution releases.

For information on how to use the HP Driver CD, refer to the HP Linux Workstation User manual at hp.com/support/linux_user_manual.

Does the HP Installer Kit for Linux actually contain the Red Hat Box OS?
No, you must obtain the Red Hat software bits from Red Hat. The HP Installer Kit for Linux is a CD set to be used in conjunction with an RHEL install. Red Hat requires that you purchase Red Hat Enterprise Linux Desktop license from either HP or Red Hat directly.

What value does HP bring to Linux on Personal Workstations?
- HP has a dedicated Linux R&D team with 25+ years of experience in OS and driver development
- HP has close relationship with multiple third-parties to enable the complete Linux workstation solution
- HP engineering provides extensive pre-sales technical support
- HP publishes detailed documents, drivers, and white papers on the support website regarding Linux on HP Workstations.

Where can I find technical information to guide my installation, configuring, or customizing of my Linux workstation solution?
At hp.com/go/linuxonworkstations you will find the latest drivers, OS certification matrices, and information on hardware component functionality.

Manageability

What manageability features are available on HP Personal Workstations*
All current HP Workstations (HP Z1 G2, HP Z230 SFF, HP Z230 Tower, HP Z420, HP Z620, and HP Z820) support DASH 1.1 manageability via the onboard Intel LAN. Additionally, these workstations feature Intel® vPro™ Technology when configured with the appropriate processor. These technologies, along with a manageability software solution or console, provide the ability to remotely manage these workstations. Remote management of HP Workstations platforms is recommended by HP on LANDesk Management Suite, but these platforms have also been tested on major software solutions including Microsoft System Center Configuration Manager and Altiris Client Management Suite.

*Available on Microsoft Windows-based systems.
Security

What security features are available on HP Desktop Workstations?

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<th>Security feature</th>
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<th>HP Z230 SFF</th>
<th>HP Z230 Tower</th>
<th>HP Z420</th>
<th>HP Z620</th>
<th>HP Z820</th>
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<tbody>
<tr>
<td>Padlock support (padlock optional)</td>
<td>•</td>
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<tr>
<td>Cable Lock support (cable optional)</td>
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<td>Serial, parallel, USB enable/disable</td>
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<td>Removable media write/booth control</td>
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<td>Power-on password</td>
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<td>Setup password</td>
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<td>Universal chassis clamp lock (optional)</td>
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<tr>
<td>Kensington cable lock (optional)</td>
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<td>Smart cover solenoid lock (optional)</td>
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<td>Chassis intrusion sensor (optional)</td>
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</table>

What security features are available on the HP ZBook Mobile Workstations?

<table>
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<tr>
<th>Security feature</th>
<th>HP ZBook 14</th>
<th>HP ZBook 15</th>
<th>HP ZBook 17</th>
</tr>
</thead>
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<tr>
<td>Integrated Smart Card Reader</td>
<td>•</td>
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<tr>
<td>HP Spare Key (requires initial user setup)</td>
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<tr>
<td>One-Step Logon</td>
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<tr>
<td>Common Criteria EAL4+ Augmented Certified Discrete TPM 1.2 Embedded Security Chip</td>
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<tr>
<td>Security lock slot</td>
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<tr>
<td>Support for Intel AT</td>
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<tr>
<td>HP Fingerprint Sensor (optional)</td>
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<tr>
<td>Computrace*</td>
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</tbody>
</table>

*The Computrace agent is shipped turned off, and must be activated by customers when they purchase a subscription. Subscriptions can be purchased for terms ranging multiple years. Service is limited, check with Absolute for availability outside the U.S.

Please see product QuickSpecs for more information on security features.

Options and modules

What options are available for HP Workstations?

For a complete list of all options for the HP Workstations, please visit hp.com/zworkstations.

Warranty and support

What is the warranty and support for HP Workstations with Windows?

The standard warranty for HP Personal Workstations is 3-3-3 limited warranty (three years parts, three years labor, and three years next business day on-site).

HP Care Pack Services extend service contracts beyond the standard warranties. Service starts from date of hardware purchase. To choose the right level of service for your HP product, use the HP Care Pack Services Lookup Tool at hp.com/go/lookuptool. Additional HP Care Pack Services information by product is available at hp.com/go/carepack.

Service levels and response times for HP Care Packs may vary depending on your geographic location.

What is the warranty and support for HP Workstations with Linux?

The warranty for HP Workstations with Linux is the standard 3-3-3 limited warranty with 90 days of OS configuration and installation assistance.

Will HP stand behind Linux when I have problems?

HP is the first place for support. Hardware and software warranties for the workstations with Linux will be the same as that of the Windows workstations. Extended hardware warranties and software support options will also be available for purchase for if you need extended coverage.
### HP Workstations FAQs

HP recommends Windows.

#### Compare Features

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<th>Feature</th>
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<th>HP Z230 SFF</th>
<th>HP Z230 Tower</th>
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<td>Windows 8.1 Pro 64-bit****</td>
<td>Windows 8.1 Pro 64-bit****</td>
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<tr>
<td></td>
<td>Windows 8.1 Pro 64-bit Downgrade to Windows 7 Pro 32-bit or 64-bit****</td>
<td>Windows 8.1 Pro 64-bit Downgrade to Windows 7 Pro 32-bit or 64-bit****</td>
<td>Windows 8.1 Pro 64-bit Downgrade to Windows 7 Pro 32-bit or 64-bit****</td>
</tr>
<tr>
<td></td>
<td>Windows 7 Professional 32-bit and other editions available*</td>
<td>HP Linux Installer Kit</td>
<td>Windows 8 Pro 64-bit****</td>
</tr>
<tr>
<td></td>
<td>SUSE Linux Enterprise Desktop 11 (90 day support)</td>
<td>SUSE Linux Enterprise Desktop 11 (90 day support)</td>
<td>Windows 8 Pro 64-bit****</td>
</tr>
<tr>
<td></td>
<td>Red Hat Enterprise Linux Desktop/Workstation (1 year support; no preinstalled OS)</td>
<td>Red Hat Enterprise Linux Desktop/Workstation (1 year support; no preinstalled OS)</td>
<td>Windows 8 Pro 64-bit****</td>
</tr>
<tr>
<td><strong>Processor/chipset</strong></td>
<td>Intel® Xeon® Processor E3-1200 v3 series1</td>
<td>Intel® Xeon® Processor E3-1200 v3 series1</td>
<td>Intel® Xeon® Processor E3-1200 v3 series1</td>
</tr>
<tr>
<td></td>
<td>Intel® Core™ i3/i5 processor family</td>
<td>Intel® Core™ i3/i5 processor family</td>
<td>Intel® Core™ i3/i5 processor family</td>
</tr>
<tr>
<td></td>
<td>NVIDIA Quadro K600M</td>
<td>NVIDIA Quadro K600M</td>
<td>NVIDIA Quadro K600M</td>
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<td></td>
<td>NVIDIA Quadro K2100M</td>
<td>NVIDIA Quadro K2100M</td>
<td>NVIDIA Quadro K2100M</td>
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<td>NVIDIA Quadro K4100M</td>
<td>NVIDIA Quadro K4100M</td>
<td>NVIDIA Quadro K4100M</td>
</tr>
<tr>
<td><strong>Slots available/maximum memory/number of memory channels</strong></td>
<td>4 DIMM slots, up to 32 GB or 16 GB non-ECC unbuffered DDR3</td>
<td>4 DIMM slots, up to 32 GB ECC/SDRAM ECC, DDR3 1600 MHz (ECC/non-ECC choice and actual memory speed dependent on processor capability)</td>
<td>4 DIMM slots, up to 32 GB ECC/SDRAM ECC, DDR3 1600 MHz (ECC/non-ECC choice and actual memory speed dependent on processor capability)</td>
</tr>
<tr>
<td><strong>Expansion slots</strong></td>
<td>1 MDM</td>
<td>1 PCIe Gen 3 x16</td>
<td>1 PCIe Gen 3 x16</td>
</tr>
<tr>
<td></td>
<td>2 mini PCIe/mSATA (full-length)</td>
<td>1 PCIe Gen 2 x16 slot/x16 connector</td>
<td>1 PCIe Gen 2 x16 slot/x16 connector</td>
</tr>
<tr>
<td></td>
<td>Optional Thunderbolt™ 2 in Micro-USB connector</td>
<td>1 PCIe Gen 2 x16 slot/x16 connector</td>
<td>1 PCIe Gen 2 x16 slot/x16 connector</td>
</tr>
<tr>
<td></td>
<td>1 MDM slot</td>
<td>1 PCIe Gen 2 x16 slot</td>
<td>1 PCIe Gen 2 x16 slot</td>
</tr>
<tr>
<td></td>
<td>1 PCIe Gen 2 x4 slot/x4 connector</td>
<td>All slots are Low Profile.</td>
<td>1 PCI 32-bit</td>
</tr>
<tr>
<td></td>
<td>1 PCIe Gen 2 x4 slot/x4 connector</td>
<td>Optional Thunderbolt™ 2 via PCIe card</td>
<td>Optional Thunderbolt™ 2 via PCIe card</td>
</tr>
<tr>
<td></td>
<td>NVIDIA Quadro K600M</td>
<td>NVIDIA Quadro K600M</td>
<td>NVIDIA Quadro K600M</td>
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<td>NVIDIA Quadro K2100M</td>
<td>NVIDIA Quadro K2100M</td>
<td>NVIDIA Quadro K2100M</td>
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<tr>
<td></td>
<td>NVIDIA Quadro K4100M</td>
<td>NVIDIA Quadro K4100M</td>
<td>NVIDIA Quadro K4100M</td>
</tr>
<tr>
<td><strong>Maximum supported displays</strong></td>
<td>One external display via display port15</td>
<td>6 displays1</td>
<td>6 displays1</td>
</tr>
<tr>
<td><strong>Controllers and HDDs</strong></td>
<td>Integrated Serial ATA controller: 500 GB–1 TB SATA (7200 rpm), 500 GB–3 TB SATA (7200 rpm), 2.5 Gb–512 GB SATA SSD, 128–256 GB Intel® SSD</td>
<td>Integrated SATA Controller; RAID 0, 1 supported: 5 ports, 6 Gb/s</td>
<td>Integrated SATA Controller; RAID 0, 1 supported: 5 ports, 6 Gb/s</td>
</tr>
<tr>
<td></td>
<td>Up to (2) 3.5-inch 7200 rpm SATA drives: 500 GB, 1, 2 or 3 TB (6 TB max)</td>
<td>Up to (2) 2.5-inch 10K rpm SATA drives: 250, 500 GB, 1 TB (2 TB max)</td>
<td>Up to (3) 5.1-inch SATA SSD drives: 500 GB, 1, 2 or 3 TB (9 TB max)</td>
</tr>
<tr>
<td></td>
<td>Up to (2) 2.5-inch 10K rpm SATA drives: 250, 500 GB, 1 TB (2 TB max)</td>
<td>Up to (2) 2.5-inch SATA SSD drives: 128, 256 GB (0.5 TB max)</td>
<td>Up to (1) 2.5-inch SATA self-encrypting solid state boot drive (SED SSD): 256 GB, 256 GB max</td>
</tr>
<tr>
<td></td>
<td>Up to (1) 2.5-inch SATA self-encrypting solid state boot drive (SED SSD): 256 GB, 256 GB max</td>
<td>Up to (1) 2.5-inch SATA self-encrypting solid state boot drive (SED SSD): 256 GB, 256 GB max</td>
<td>Up to (1) 2.5-inch SATA self-encrypting solid state boot drive (SED SSD): 500 GB, 500 GB max</td>
</tr>
<tr>
<td></td>
<td>Optional (1) 64 GB SSD Disk Cache Module can be used in conjunction with up to (2) SATA HDDs in RAID 0/RAID 1 using Intel® Smart Response Technology.</td>
<td>Up to (1) 2.5-inch SATA self-encrypting solid state boot drive (SED SSD): 256 GB, 256 GB max</td>
<td>Optional (1) 64 GB SSD Disk Cache Module can be used in conjunction with up to (2) SATA HDDs in RAID 0/RAID 1 using Intel® Smart Response Technology.</td>
</tr>
<tr>
<td><strong>Optical drives</strong></td>
<td>DVD-ROM Slim-Tray Drive; DVD-RW Super Multi Slim-Tray Drive; SATA Blu-ray Writer Slim-Tray</td>
<td>DVD-ROM</td>
<td>DVD-ROM</td>
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<tr>
<td></td>
<td>DVD+/-RW DL Super Multi</td>
<td>DVD+/-RW DL Super Multi</td>
<td>DVD+/-RW DL Super Multi</td>
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<td></td>
<td>HP Blu-ray Writer</td>
<td>HP Blu-ray Writer</td>
<td>HP Blu-ray Writer</td>
</tr>
<tr>
<td></td>
<td>HP 14-in-1 Media Card Reader</td>
<td>HP 14-in-1 Media Card Reader</td>
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<td>Integrated Intel dual-band AC 7260 802.11ax Wireless LAN &amp; Bluetooth 4 Combo Card</td>
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<td>Windows 7 Professional 32-bit or other editions available* HP Linux Installer Kit</td>
<td>SUSE Linux Enterprise Desktop 11 (90 day support)</td>
<td>Red Hat Enterprise Linux Desktop/Workstation (1 year support; no preinstalled OS)</td>
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*Hewlett-Packard recommends Windows.

†† Integrated 2-channel SATA controller: 6 ports, 16 Gb/s, 64 ports, RAID 0, 1, 5, 10 capable

††† Integrated 4-channel SAS controller: 4 ports, 48 Gb/s, RAID 0, 1, 5, 10 capable

**1TB boot drive (SED SSD): 256 GB, 256 GB max

†††† Integrated 8-channel SATA controller: 8 ports, 8 Gb/s, RAID 0, 1, 5, 10 capable

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<th><strong>Summary</strong></th>
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HP recommends Windows.
Technical white paper  |  HP Workstations FAQs  
HP recommends Windows.

Overview
Exceptional innovation. Innovative, sleek design.
Power to Perform.

Operating systems
Windows 7 Professional and other editions available*
Windows 8 Pro and other editions available**
Windows 8:1 Pro 64-bit***
SUSE Linux Enterprise Desktop 11
FreeDOS
Windows 7 Professional and other editions available*
Windows 8 Pro and other editions available**
SUSE Linux Enterprise Desktop 11
FreeDOS

Processor/chipset/system bus
Intel® Core™ i5 or i7 Mobile Processor Family with Intel® vPro Technology™††
Chipset is integrated with processor
Mobile Intel® Q67 chipset
Intel® Core™ i5 or i7 Mobile Processor Family with Intel® vPro Technology™
Mobile Intel® Q87 chipset

Maximum memory/ slots available†††
DDR3L SDRAM, 1600 MHz, 2 x 256GB, up to 16 GB
DDR3L SDRAM, 1600 MHz, 4 x 512GB, up to 32 GB
Two 512GB slots (dual-core processor) or four 512GB slots (quad-core processor) supporting dual-channel memory.
DDR3L SDRAM, 1600 MHz, 2 x 4 512GB, up to 32 GB
Two 512GB slots (dual-core processor) or four 512GB slots (quad-core processor) supporting dual-channel memory.

Expansion slots
1 Secure Digital; 1 Smart Card Reader
1 ExpressCard/54; 1 Secure Digital; 1 Smart Card Reader; Thunderbolt™ 2 integrated
1 ExpressCard/54; 1 Secure Digital; 1 Smart Card Reader; Thunderbolt™ 2 integrated

Graphics
Intel® HD Graphics 4600
AMD FirePro™ M4100
AMD Dynamic Swtichable Graphics supported
Intel® HD Graphics 4600
NVIDIA Quadro K1100M
NVIDIA Quadra K2100M
NVIDIA Optimus Technology supported
NVIDIA Quadro K1100M
NVIDIA Quadra K4100M
NVIDIA Quadra K1100M

Displays
14” diagonal LED-backlit HD SVA eDP anti-glare (1366 x 768)
14” diagonal LED-backlit HD SVA eDP anti-glare (1600 x 900)
14” diagonal LED-backlit HD SVA eDP anti-glare (1600 x 900)
14” diagonal LED-backlit FHD UWVA eDP anti-glare + PSR (1920 x 1080)
15.6” diagonal LED-backlit FHD SVA eDP anti-glare (1920 x 1080)
15.6” diagonal LED-backlit FHD UWVA eDP anti-glare + PSR (1920 x 1080)
15.6” diagonal LED-backlit FHD UWVA eDP anti-glare + PSR (1920 x 1080)
17.3” diagonal LED-backlit HD SVA anti-glare (1600 x 900)
17.3” diagonal LED-backlit FHD UWVA anti-glare (1920 x 1080)
17.3” diagonal LED-backlit FHD DreamColor UWVA eDP anti-glare (1920 x 1080)

Controllers and HDDs
SATA (7200 rpm), 320 GB, 750 GB
SATA (5400 rpm), 1 TB, SATA SED, 500 GB
SATA FIPS 140-2 SED (5400 rpm), 500 GB
SATA SSD, 180GB, 512 GB
SATA SE SSD, 256 GB
H2 SSD, 120 GB
SATA (7200 rpm), 320 GB, 750 GB
SATA (5400 rpm), 1 TB
SATA SED, 500 GB
SATA FIPS 140-2 SED (5400 rpm), 500 GB
SATA SSD, 128GB, 500 GB
SATA SE SSD, 256 GB
mSATA SSD, 128 GB
SATA (7200 rpm), 320 GB, 750 GB
SATA (5400 rpm), 1 TB
SATA SED, 500 GB
SATA FIPS 140-2 SED (5400 rpm), 500 GB
SATA SSD, 128GB, 500 GB
SATA SE SSD, 256 GB
mSATA SSD, 128 GB

Optical drives
Blu-ray/R/RD DVD+/-RW SuperMulti DL
Blu-ray ROM DVD+/-RW SuperMulti DL
Blu-ray/RE DVD+/-RW SuperMulti DL
Blu-ray/R/RD DVD+/-RW SuperMulti DL
Blu-ray ROM DVD+/-RW SuperMulti DL
Blu-ray/RE DVD+/-RW SuperMulti DL

Communications
Integrated Intel® I210-AM Gigabit Network Connection
Integrated Intel® I217-LM Gigabit Network Connection
Integrated Intel® I217-LM Gigabit Network Connection

Select screen images courtesy of Autodesk and Cannon Design
* This system may require upgraded and/or separately purchased hardware to take full advantage of Windows 7 functionality. Not all features are available in all editions of Windows 7. See microsoft.com/windows/windows-7 for more details.
** This system is preinstalled with Windows 7 Professional software and also comes with a license and media for Windows 8 Pro software. You may only use one version of the Windows software at a time. Switching between versions will require you to uninstall one version and install the other version.
*** This system is preinstalled with Windows 7 Professional software and also comes with a license and media for Windows 8.1 Pro software. You may only use one version of the Windows software at a time. Switching between versions will require you to uninstall one version and install the other version.
†† After-Market Option
††† Supported only in the Z420 600W power supply chassis.
1 Multi-Core is designed to improve performance of certain software products. Not all customers or software applications will necessarily benefit from use of this technology. 64-bit computing on an Intel® architecture requires a system with a 64-bit processor, chipset, operating system, device drivers, and applications enabled for Intel® 64 architecture. Processors will not operate (including 32-bit operation) without an Intel® 64 architecture-enabled BIOS. Performance may vary depending on your hardware and software configurations. Intel’s numbers are based on testing in specific systems and specific games and should be used for comparison purposes only.
2 Limited options on the Intel® Xeon® Processor E5-2600 Series. Please see HP 2420 Datasheet for details.
3 Each processor supports up to 2 channels (HP Z230 Tower/HP Z230 SF) or 4 channels (HP Z230 HP Z280 HPS 280) of DDR3 memory. To realize full performance at least 1 DIMM must be inserted into each channel. To get full 8 channel support, 2 processors must be installed. Maximum memory capacities assume Windows 64-bit operating systems or Linux. With Windows 32-bit operating systems, memory above 3 GB may not be available due to system resource requirements.
4 Support for external displays as a standard feature through integrated processor-based graphics is dependent upon the particular PC platform/graphics factor; the actual number of displays supported will vary. An optional discrete graphics solution will be required as a standard feature for additional displays. Additional cables required. DisplayPort with multi-stream through integrated graphics is planned to be available in fall 2013 as an integrated feature and as a web update in late summer 2013.
5 SATA hardWARE RAID is supported on Linux systems. The Linux kernel, with built-in software RAID, provides excellent functionality and performance. It is a good alternative to hardware-based RAID. Please visit linuxraid.org for system configuration details.
6 For hard drives, 1 GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 36 GB of hard drive (or system disk) is reserved for system recovery software for Windows 7.
7 Double Layer discs can store more data than single layer discs. However, double-layer discs burned with this drive may not be compatible with many existing single-layer DVD drives and players.
8 Blu-Ray contains new technologies, certain disc, digital connection, compatibility and/or performance issues may arise, and do not constitute defects in the product. Flawless playback on all systems is not guaranteed. In order for some Blu-ray titles to play, they may require a DVI or HDMI digital connection and your display may require HDCP support. HD-DVD movies cannot be played on this workstation.
9 Some functionality of this technology, such as Intel® Active management technology and Intel® Virtualization technology, requires additional 3rd party software in order to run. Availability of future “virtual appliances” applications for some Blu-ray titles to play, they may require a DVI or HDMI digital connection and your display may require HDCP support. HD-DVD movies cannot be played on this workstation.
10 The terms “10/100/1000” or “Gigabit” Ethernet indicates compliance with IEEE standard 802.3ab for Gigabit Ethernet, and does not connote actual operating speed of 1 Gb/sec. For high speed transmission, connection to a Gigabit Ethernet server and network infrastructure is required.
11 Some functionality of this technology, such as Intel® Active management technology and Intel® Virtualization technology, requires additional 3rd party software in order to run. Availability of future “virtual appliances” applications for Intel® vPro technology is dependent on 3rd party software providers. Microsoft Windows required.
12 This workstation does not support the Intel Core 2 Extreme processor over-clocking feature. See Intel’s technology/turbo boost for more information.
13 NVIDIA Optimus is enabled by default. If you choose to disable this functionality, Intel® integrated graphics will not be used.
14 The Z1 G2 can support up to four total displays with the use of Thunderbolt 2 and NVIDIA Professional graphics. Customers can use the built-in screen, a monitor attached to the rear DisplayPort and up to two additional Thunderbolt supported monitors or use the built-in screen with up to four additional monitors attached to a Thunderbolt port. The Z1 G2 can support up to three total displays with the use of Thunderbolt 2 and Intel HD graphics. Customers can use the built-in screen, a monitor attached to the rear DisplayPort and a Thunderbolt supported monitor or not use the built-in screen with up to three additional monitors attached to a Thunderbolt port.
15 Thunderbolt™ 2 is standard on HP ZBook 15 and 17 Mobile Workstations. Not available via an optional add-on card on HP Desktop Workstations. Thunderbolt™ is new technology. Thunderbolt cable and Thunderbolt device (sold separately) must be compatible with Windows. To determine whether your device is Thunderbolt Certified for Windows, see thunderbolttechnology.net/products.
Notes

1. Not all features are available in all editions of Windows 8. Systems may require upgraded and/or separately purchased hardware, drivers and/or software to take full advantage of Windows 8 functionality. See microsoft.com.

2. Multi-Core is designed to improve performance of certain software products. Not all customers or software applications will necessarily benefit from use of this technology. 64-bit computing on Intel® architecture requires a computer system with a processor, chipset, BIOS, operating system, device drivers, and applications enabled for Intel® 64 architecture. Processors will not operate (including 32-bit operation) without an Intel® 64 architecture-enabled BIOS. Performance will vary depending on your hardware and software configurations. Intel’s numbering is not a measurement of higher performance.

3. Intel® Turbo Boost technology requires a PC with a processor with Intel® Turbo Boost capability. Intel® Turbo Boost performance varies depending on hardware, software, and overall system configuration. See intel.com/technology/turboboost for more information.

4. Some functionality of this technology, such as Intel® Active management technology and Intel Virtualization technology, requires additional 3rd party software in order to run. Availability of future “virtual appliances” applications for Intel vPro technology is dependent on 3rd party software providers. Microsoft Windows required.

5. Maximum memory capacities assume Windows 64-bit operating systems or Linux. With Windows 32-bit operating systems, memory above 3 GB may not all be available due to system resource requirements.

6. For hard drives, 1 GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 20 GB is reserved for system recovery software.

7. 1.07 billion viewable colors through A-FRC technology. All specifications represent the typical specifications provided by HP's component manufacturers; actual performance may vary either higher or lower.

8. Intel Hyper-Threading Technology (HT) is designed to improve performance of multi-threaded software products and requires a computer system with a processor supporting HT and an HT-enabled chipset, BIOS and OS. Please contact your software provider to determine compatibility. Not all customers or software applications will benefit from the use of HT. See intel.com/info/hyperthreading for more information.

9. SATA hardware RAID is not supported on Linux systems. The Linux kernel, with built-in software RAID, provides excellent functionality and performance. It is a good alternative to hardware-based RAID. Please visit hp.com/bc/docs/supportSupportManual/c00060684/c00060684.pdf for RAID capabilities with Linux.

10. This system may require upgraded and/or separately purchased hardware and/or DVD drive to install the Windows 7 software and take full advantage of Windows 7 functionality. See microsoft.com/windows/windows7/ for details.

11. The power supply, graphics card, hard drives, optical drive, system cooling blower, and memory can be accessed, and removed without tools. Tools may be required for all other components.

12. Sold separately or as an optional feature.

13. Thunderbolt™ 2 is standard on HP ZBook 15 and 17 Mobile Workstations and is available via an optional add-in card on HP Desktop Workstations. Thunderbolt is new technology. Thunderbolt cable and Thunderbolt device (sold separately) must be compatible with Windows. To determine whether your device is Thunderbolt Certified for Windows, see thunderbolttechnology.net/products.

14. Care Packs are optional. Service levels and response times for HP Care Packs may vary depending on your geographic location. Service starts on date of hardware purchase. Restrictions and limitations apply. For details, visit hp.com/go/cpc.