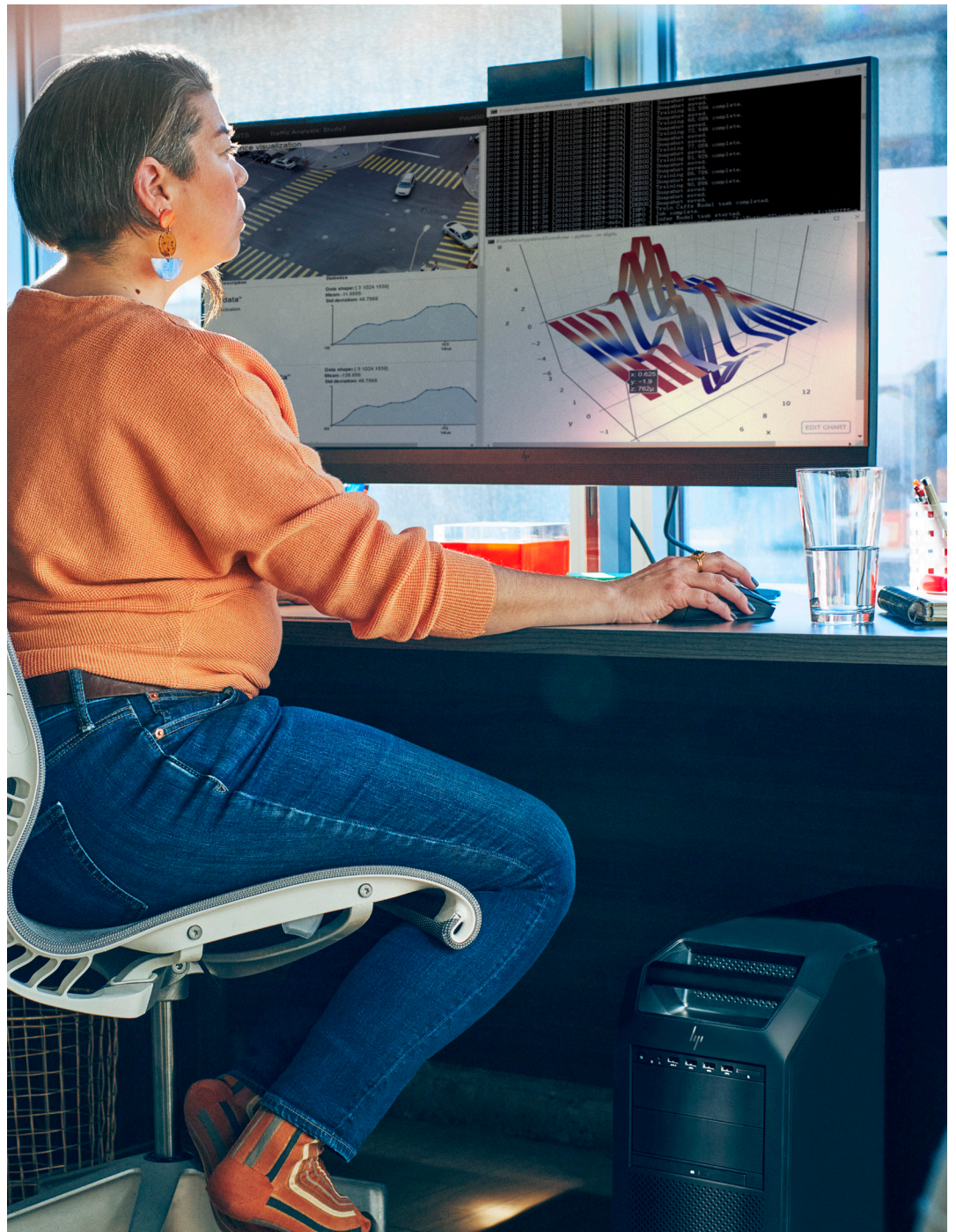




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Introduction

The HP Z8 G5 Workstation is the successor to the HP Z8 G4 Workstation. Its architecture introduces several of the latest functionalities and technologies. These include DDR5 memory architecture, higher speed PCIe slots with PCIe Gen5, and other I/O performance improvements.



System Highlights

Extreme Workstation Performance

Z by HP innovations start with the customer to deliver the performance benefits needed whether it's importing and working with large models and assemblies, running complex, simulations, or training complex deep learning and machine learning models faster. The HP Z8 G5 is designed for users who demand the most processing compute for CPU-intensive workflows to accelerate rendering with real-time ray tracing, data visualization, and model training while also providing plenty of room to expand as demands change. With a dual-socket workstation, designed to utilize 5th Gen Intel® Xeon®, it delivers up to 64 system cores in addition to supporting 2x high-end double-wide graphics cards with 1TB of DDR5 memory.

HP Z8 G5 product benefits include:

- 1) Remarkable Performance. Whisper-quiet Acoustics.**
 Tackle processor-intensive workflows with up to 64 cores¹ across 2 Intel® Xeon® CPUs, 2 high-end GPUs, and 1 TB DDR5 RAM²—all while running quietly. With a world class acoustic design, you can push this desktop workstation to the max without disruptive noise.
- 2) Upgrade. Expand. Evolve.**
 Need to upgrade your device? Go for it. Easily expand and add components as your work evolves with room for up to 2 high-end graphics cards, 1 TB memory, 120 TB storage, 2 front accessible NVMe bays, 7 PCIe slots (up to Gen 5), and tool-less access.³
- 3) Comprehensive Security. Reliability You Can Trust.**
 Get peace of mind with a workstation that's built to endure. The Z8 undergoes 360K hours of rigorous testing, military-standards testing⁴ and is certified for pro apps. With HP Wolf Security for Business⁵, it's protected below, in and above the OS.
- 4) Maximize Your IT Lifecycle.**
 Designed for simpler IT management, the Z8 is built for longevity with a 3-year lifecycle—longer than entry workstations. Plan for the future and avoid re-qualifying devices every year, saving you serious time and money.

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HP and Sustainability

HP continues to be a dedicated player in the world of technology and sustainability in order to help protect our shared future. Sustainably built, this product contains 40%* recycled plastics, 80% recycled packaging content, and is EPEAT® Gold** and TCOV9 Certified. The production of this workstation prevented materials from ending up in the ocean or a landfill, as its fans contain ocean-bound plastic*** and all G5 products contain 10% post-industrial recycled metal. HP has also taken steps to minimize the amount of polyvinyl chloride in our products, as it is now only present in external power cables and keyboard/mouse cables.

*Recycled plastic content percentage is based on the definition set in the IEEE 1680.1-2018 EPEAT standard.

**Based on US EPEAT® registration according to IEEE 1680.1-2018 EPEAT®. EPEAT® status varies by country. Visit www.epeat.net for more information.

***Fans contain up to 25% ocean-bound plastic by weight.

Latest Technologies

The Latest Intel® Processor

The HP Z8 G5 Workstation uses the Intel® C741 chipset to support the 5th generation Intel® Xeon® Scalable processor⁶ family, with two CPU sockets. The system can support up to 2 CPUs (max 32C each). The 5th generation Intel® Xeon® Scalable processors feature a new micro-architecture with new Intel® AMX (Intel® Advanced Matrix Extensions) instructions, all new memory architecture, Intel® Ultra Path Interconnect (Intel® UPI), up to 64 PCIe lanes per processor operating up to Gen5. The 5th generation Intel® Xeon® Scalable processors feature four integrated memory controllers each supporting two DDR5 channels that increase the memory capacity. There are three Intel® Ultra Path Interconnect (Intel® UPI) between the two processors supports data transfers up to 16GT/s increasing peak data transfers and bandwidth over the HP Z8 G4.

Next Generation Intel® Active Management Technology

Fresh features for Intel® AMT 15.20 include:

- Upgrade to Boot Guard Gen 1.1.
- PCHC Firmware Component.
- Intel® Total Memory Encryption (Intel® TME).

DDR5 Memory Technology

The HP Z8 G5 Workstation introduces support for DDR5 Registered DIMMs up to 5200MHz in a 1 DIMM per channel architecture. The speed that the memory runs is determined by the processors and is limited to 5200MHz for the 5th generation Intel® Xeon® Scalable processor generation (depending on CPU configured, memory may be limited to up to 4800MHz or 4400MHz). The HP Z8 G5 supports up to 1TB of memory. NUMA and Non-NUMA modes are supported. ECC memory is supported.

I/O and Storage

Internal I/O

The HP Z8 G5 provides a total of seven high-performance Graphics and I/O slots.

In a single processor configuration, the HP Z8 G5 provides one PCIe Gen5 x16, one PCIe4 x16, one PCIe3 x8, and two PCIe3 x4 dedicated electrical slots. It also provides one PCIe4 x8 electrical slot for two internal M.2 PCIe-attached storage devices. The Z8 G5 also supports an optional Front Removable NVME storage and has two PCIe4 x4 buses to support two Front removeable M.2.

In a dual processor configuration, the HP Z8 G5 provides one additional PCIe4 x16 and one additional PCIe3 x16 dedicated electrical slot. There is also an additional PCIe4 x8 electrical slot for internal M.2 PCIe-attached storage devices.



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The HP Z8 G5 provides an internal 1-port USB3.0 header, an internal 2-port USB2.0 header and an internal 1-port USB2.0 header.

Storage

The Intel® C741 chipset in this platform only supports sSATA controller ports and operates in AHCI or RAID modes. tSATA controller is disabled in BIOS. The HP Z8 G5 supports six 6 Gb/s ports and RAID modes 0, 1, 10 and 5. There are no accessible ports under the primary SATA controller.

A header is provided for installation of an Intel® VROC Upgrade Module to enable NVMe RAID.

External I/O

- On the front I/O area, the HP Z8 G5 provides 4 USB 3.1 Gen1 (5Gbs) Type-A ports (the left-most supports battery charging), combo headset/microphone jack, and the option for an SD card reader.
- In the rear I/O area, the HP Z8 G5 provides 6 USB 3.1 Gen1 ports, 2 gigabit Ethernet LAN ports, audio Line-In, audio Line-Out, PS/2, and a serial port. Additional rear I/O ports can be added via PCIe add-in cards.

Graphics

With the 1125W/15A power supply, certain system configurations can support up to four 75W cards, or up to three 180W cards or up to two 250W cards. With the optional 1450W/20A supply, certain configurations can support up to four 75 W cards, or up to three 180W cards or up to three 250W cards.

Other Features

- 1125W/15A power supply, 90% efficient
- Optional 1450W/20A power supply, 90% efficient
- Rear panel power on/off switch and LED for easier rack maintenance
- ENERGY STAR® certified configurations, China's Energy Conservation Program (CECP) configurations, European Union's ErP LOT6 2013 power limit of 0.5W in off mode.
- Intel® vPro™ requires Windows 10 Pro 64 bit or higher, a vPro supported processor, vPro enabled chipset, vPro enabled wired LAN and/or Wi-Fi 6E WLAN and TPM 2.0. Some functionality requires additional 3rd party software in order to run. Features of vPro® Essentials and Enterprise vary. See <http://intel.com/vpro>
- Intel® vPro™ manageability with support both for DASH and Intel® AMT (Advanced Manageability Technology) on all the Xeon® processors. IT managers have increased flexibility in optimizing their Enterprise manageability strategy across HP's Commercial Laptops, Desktops and Workstations.



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HP Z8 G5 vs HP Z8 G4 Feature Comparison

Figure 1. Z8 G5 vs Z8 G4 Feature Comparison

	HP Z8 G5	HP Z8 G4
Processors	5th Generation Intel® Xeon® Scalable Processor supporting up to 270W	Intel® Xeon® Scalable Processor
New Instruction Set	AMX (Advanced Matrix Extensions)	AVX-512 AES-NI
Memory Technology	DDR5: Registered Up to 5200MHz	DDR4: Registered and LR-DIMMs Up to 2933MHz
PCIe Support	Up to PCIe Gen5	PCIe Gen3
USB 3.1 Gen1 Ports	6 Rear, 4 Front (Entry Front I/O), 1 Internal	6 Rear, 4 Front (Entry Front I/O) or 2 Front (Premium Front I/O), 1 Internal
USB Charging Ports	1 Front Type A port supports 1.5A@5V in S5, S4, S3, S0 states	1 Front Type A port supports 1.5A@5V in S5, S4, S3, S0 states Premium Front I/O: Type-C® ports support 3A @5V in S0 state
Manageability	Intel® ME15.20, Intel® vPro™	Intel® ME11, Intel® vPro™
Operating System	Windows 11 Pro for Workstations 64-bit Windows 10 Pro for Workstations 64-bit	Windows 11 Pro for Workstations 64-bit Windows 10 Pro for Workstations 64-bit

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HP Z8 G5 - CPUs Supported

Figure 2. Intel® Xeon® 5th Gen Scalable Processors supported at CPU Refresh

Name	Cores	Clock Speed (GHz)	Cache (MB)	Memory Speed (MHz)	UPI Speed (GT/s)	UPI Ports Supported	TDP (W)
Intel® Xeon® 6530	2.1	32	160	4800*	270W	3	270W
Intel® Xeon® 6548Y+	2.5	32	60	5200*	250W	3	150W
Intel® Xeon® 6434 processor	8	3.7	22.5	4800	16	3	195W
Intel® Xeon® 4410Y processor	12	2.0	30	4000	16	2	150W
Intel® Xeon® 6426Y processor	16	2.5	37.5	4800	16	3	185W
Intel® Xeon® 4416+ processor	20	2.0	37.5	4000	16	2	165W
Intel® Xeon® 5418Y processor	24	2.0	45	4400	16	3	185W
Intel® Xeon® 6442Y processor	24	2.6	60	4800	16	3	225W
Intel® Xeon® 5420+ processor	28	2.0	52.5	4400	16	3	205W
Intel® Xeon® 6438Y+ processor	32	2.0	60	4800	16	3	205
Intel® Xeon® 6448Y processor	32	2.1	60	4800	16	3	225
Intel® Xeon® 6444Y processor	16	3.6	45	4800	16	3	270
Intel® Xeon® 5416S processor	16	2.0	30	4400	16	3	150

Figure 3. Intel® Xeon® 4th Gen Scalable Processors supported at introduction

Name	Cores	Clock Speed (GHz)	Cache (MB)	Memory Speed (MHz)	UPI Speed (GT/s)	UPI Ports Supported	TDP (W)
Intel® Xeon® 6430 processor	32	1.9	60	4400	16	3	270W
Intel® Xeon® 5415+ processor	8	2.9	22.5	4400	16	3	150W
Intel® Xeon® 6434 processor	8	3.7	22.5	4800	16	3	195W
Intel® Xeon® 4410Y processor	12	2.0	30	4000	16	2	150W
Intel® Xeon® 6426Y processor	16	2.5	37.5	4800	16	3	185W
Intel® Xeon® 4416+ processor	20	2.0	37.5	4000	16	2	165W
Intel® Xeon® 5418Y processor	24	2.0	45	4400	16	3	185W
Intel® Xeon® 6442Y processor	24	2.6	60	4800	16	3	225W
Intel® Xeon® 5420+ processor	28	2.0	52.5	4400	16	3	205W
Intel® Xeon® 6438Y+ processor	32	2.0	60	4800	16	3	205
Intel® Xeon® 6448Y processor	32	2.1	60	4800	16	3	225
Intel® Xeon® 6444Y processor	16	3.6	45	4800	16	3	270
Intel® Xeon® 5416S processor	16	2.0	30	4400	16	3	150



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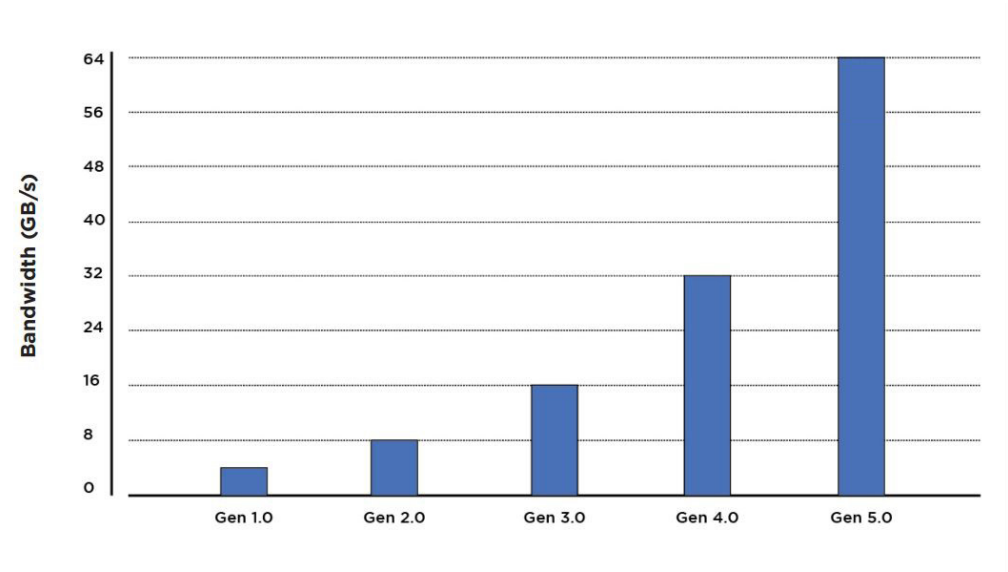


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Figure 3. x16 Peak Bandwidth per Direction (GB/s)



Recipe for Optimizing PCI-Express I/O Performance

For high I/O bandwidth applications, the choice of slot loading, processor, and memory configuration can be optimized to ensure maximum bandwidth available. Applications and cards sensitive to I/O latency may benefit as well from some of the tips below.

Recommended Configuration Steps

1. Place GPU and graphics cards first, following the slot order listed in Figure 4.
2. Place I/O cards next, from highest bandwidth to lowest, following the slot order listed in Figure 4. This is the optimal load order for most applications.
3. Additional I/O bandwidth refinements may be possible. If necessary, refer to the tips below

Figure 4. HP Z8 G5 I/O Slot Recommended Load Order

		Requires 2 nd CPU				Requires 2 nd CPU				Requires 2 nd CPU
Card Load	Card Description	Slot 1	Slot 2	Slot 3	Slot 4	Slot 5	Slot 6	Slot 7	Personality 1	Personality 2
		PCIe4-x16 CPU0	PCIe4-x16 CPU1	PCIe3-x4 CPU0	PCIe5-x16 CPU0	PCIe3-x8 CPU0	PCIe3-x16 CPU1	PCIe3-x4 PCH	PCIe4-x8 CPU0	PCIe4-x8 CPU1
1	1st Graphics				Only					
2	Thunderbolt-4 (2 ports)							Only		
3	2nd Graphics	1	2				3			
4	Z Turbo Drive Dual Pro (2x M.2 w/ Levers)								1	2
5	Z Turbo Drive Quad Pro (4x M.2 card)	1	2							



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			Requires 2 nd CPU				Requires 2 nd CPU			Requires 2 nd CPU
Card Load	Card Description	Slot 1	Slot 2	Slot 3	Slot 4	Slot 5	Slot 6	Slot 7	Personal-ity 1	Personal-ity 2
		PCIe4-x16 CPU0	PCIe4-x16 CPU1	PCIe3-x4 CPU0	PCIe5-x16 CPU0	PCIe3-x8 CPU0	PCIe3-x16 CPU1	PCIe3-x4 PCH	PCIe4-x8 CPU0	PCIe4-x8 CPU1
7	Z Turbo Drive Dual Pro (2x M.2 w/ Bracket)	1	2			3				
9	Network Interface (LAN, etc.)	1	2	5		4	3			
10	Network Interface (WLAN)			2		3	4	1		
11	Integrated Remote System Controller		5	4		3	2	1		
12	PS2/Serial Module		5	3		2	4	1		

Additional Tips

- For applications doing direct bus Peer-to-Peer transfers between cards, load the corresponding cards in slots located behind the same processor. For instance, load cards in slots 1, 3, 4, and 5, or in slots 2 and 6.
- For very high bandwidth applications in dual processor systems, select processor models with the highest UPI frequency (16 GT/s) and three or more UPI links.
- If possible, make sure all I/O cards are loaded in slots that have a PCI-Express Lane Width at least as wide as the card (see Figure 4).
- For predictable latencies, try disabling NUMA (Non-Uniform Memory Access) mode (BIOS setup menu -> Advanced -> Performance Options -> Non-Uniform Memory Access (NUMA) = Disable).
- For cards that are latency sensitive, load these cards in processor slots.
- Ensure Idle Power Savings BIOS setting is set to Normal (BIOS setup menu -> Advanced -> Power Options -> Idle Power Savings = Normal).
- Use the latest system BIOS version available on hp.com.
- Check for updates in the latest performance optimization white papers (link below).

HP Z8 G5 Memory Configurations and Optimization

The purpose of this section is to provide an overview of the memory configurations for the HP Z8 Fury G5 Workstation and to provide recommendations to optimize performance.

Supported Memory Modules

Types of memory supported on an HP Z8 G5 Workstation are:

- 16 GB, 32 GB and 64GB PC5-4800-R 4800 MHz and 5600MHz DDR5 Registered DIMMs
- 128 GB PC5-4800 3DS 4800 MHz and 5600MHz DDR5 3DS Registered DIMMs
- Single and dual rank DIMMs based on 16GB and 32Gb⁹ DRAMs are supported
- Quad and octal rank 3DS RDIMMs are supported
- 128GB PC5-5600 5600MHz DDR5 Registered DIMMs⁹

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Types of memory NOT supported on an HP Z8 G5 Workstation are:

- Unbuffered DIMMs
- Non-ECC DIMMs
- DDR, DDR2, DDR3, DDR4 DIMMs
- DDR5 3DS RDIMMs

See Memory Technology White Paper for more memory module technical information.

Platform Capabilities

Maximum Capacity: 2TB

- Total of 16 memory sockets
- 4 Memory controllers with 2 channels per memory controller for a total of 8 channels and 2 sockets per channel

Speed

- 4800MHz, 4400MHz, 4000MHz, and 5200 MHz memory speeds are supported in this platform
- Memory will operate at the speed of the slowest rated installed processor or DIMM

Mixing of DIMMs in a System

- Registered and 3DS LR DIMMs cannot be mixed in a system
- Mixing x4 DRAMs with x8 DRAMs is not supported.
 - 16GB and 32GB RDIMMs supported by HP are x8 and can be mixed in a system
 - 64GB RDIMMs supported by HP are x4 and cannot be mixed with other sized DIMMs in a system

Memory Features

This platform supports the new DDR5 technology:

- DDR5 supports higher bandwidths, capacities, and power efficiencies
- Improves reliability features
- DDR5 has increased technology efficiencies
- Adds support for on-die ECC
 - On-Die ECC is where the data stored on the memory module is monitored by the DRAM for errors
 - Only single-bit errors are automatically corrected, multi-bit errors are not detected
- But system ECC is still supported on all RDIMMs
 - Single-bit errors are automatically corrected
 - Multi-bit errors are detected and will cause the system to immediately reboot and halt with an F1 prompt error message
 - By way of comparison, non-ECC memory (not supported on this platform) does not detect or correct single-bit or multi-bit errors which can cause instability, or corruption of data, in the platform. See Memory Technology White Paper for more information.

Command and Address parity is supported

- Command and Address errors are detected and will cause the system to immediately reboot and halt with an F1 prompt error message.

This platform supports 4 memory controllers with 2 channels per memory controller for a total of 8 channels per processor that increases system performance



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Optimize Performance

System performance is largely based on the applications being used. Generally, to obtain the best performance, it is advised that you follow the following guidelines:

- For best performance, it is recommended to load memory into all memory controllers and channels. Since these platforms have 4 memory controllers and 8 channels per CPU, install memory in sets of 4 or 8 for single CPU configurations or 8 to 16 for dual CPU configurations.
- Proper individual DIMM capacity selection is essential to maximizing performance. Evenly distributing total desired memory across all operational channels, memory controllers and CPUs will deliver the best performance.
- To increase overall performance, install multiple ranks in each channel.
- Maximum performance can be achieved by changing the OS power mode to Ultimate Performance in BIOS.

Figure 5. Optimal configurations for the HP Z8 G5 single processor configuration (Note: the following tables do not include all available orderable configurations)

Configuration	CPU0-DIMM1	CPU0-DIMM2	CPU0-DIMM3	CPU0-DIMM4	CPU-0	CPU0-DIMM5	CPU0-DIMM6	CPU0-DIMM7	CPU0-DIMM8	Rating
16GB (1x16GB)	X									Good
32GB (2x16GB)	X								X	Good
32GB (1x32GB)	X									Good
64GB (4x16GB)	X		X				X		X	Better
64GB (2x32GB)	X								X	Good
64GB (1x64GB)	X									Good
128GB (8x16GB)	X	X	X	X		X	X	X	X	Best
128GB (4x32GB)	X		X				X		X	Better
128GB (2x64GB)	X								X	Good
256GB (8x32GB)	X	X	X	X		X	X	X	X	Best
256GB (4x64GB)	X		X				X		X	Better
512GB (8x64GB)	X	X	X	X		X	X	X	X	Best

Figure 6. Optimal configurations for the HP Z8 G5 dual processor configurations (Note: the following tables do not include all available orderable configurations)

Configuration	CPU0-DIMM1	CPU0-DIMM2	CPU0-DIMM3	CPU0-DIMM4	CPU-0	CPU0-DIMM5	CPU0-DIMM6	CPU0-DIMM7	CPU0-DIMM8	CPU1-DIMM1	CPU1-DIMM2	CPU1-DIMM3	CPU1-DIMM4	CPU-1	CPU1-DIMM5	CPU1-DIMM6	CPU1-DIMM7	CPU1-DIMM8	Rating
32GB (2x16GB)	X									X									Good
64GB (4x16GB)	X							X		X								X	Better
64GB (2x32GB)	X									X									Good
128GB (8x16GB)	X		X			X	X	X		X					X		X	X	Best

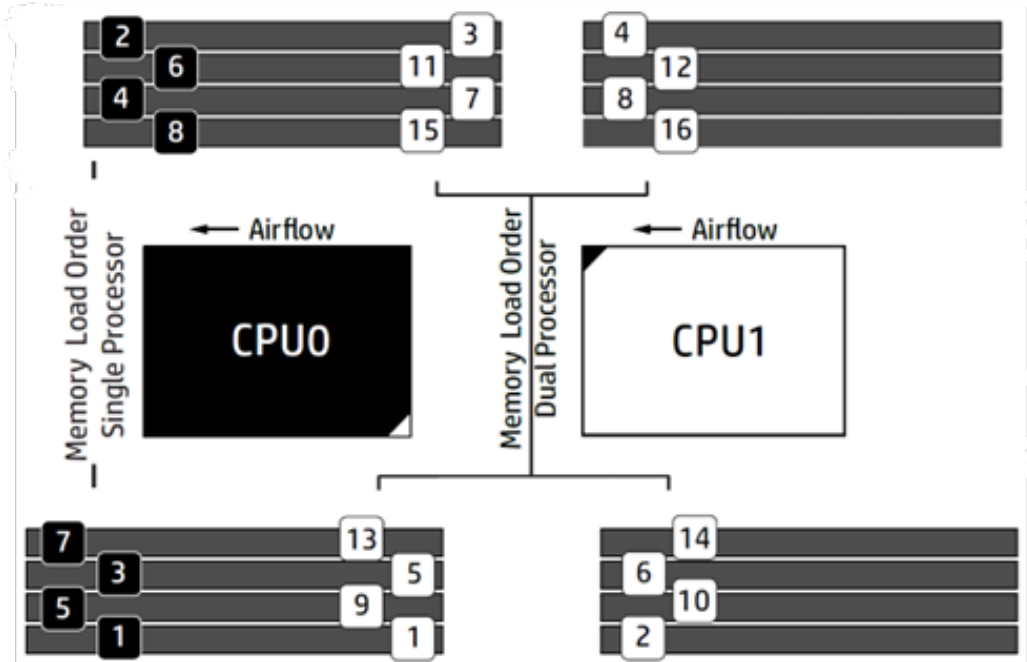
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Configuration	CPU0-DIMM1	CPU0-DIMM2	CPU0-DIMM3	CPU0-DIMM4	CPU0	CPU0-DIMM5	CPU0-DIMM6	CPU0-DIMM7	CPU0-DIMM8	CPU1-DIMM1	CPU1-DIMM2	CPU1-DIMM3	CPU1-DIMM4	CPU1	CPU1-DIMM5	CPU1-DIMM6	CPU1-DIMM7	CPU1-DIMM8	Rating
128GB (4x32GB)	X								X	X								X	Better
128GB (2x64GB)	X								X	X									Good
256GB (16x16GB)	X	X	X	X		X	X	X	X	X	X	X	X		X	X	X	X	Best
256GB (8x32GB)	X		X			X		X		X		X				X		X	Best
256GB (4x64GB)	X								X	X								X	Better
512GB (16x32GB)	X	X	X	X		X	X	X	X	X	X	X	X		X	X	X	X	Best
512GB (8x64GB)	X		X			X		X		X		X				X		X	Best
1TB (16x64GB)	X	X	X	X		X	X	X	X	X	X	X	X		X	X	X	X	Best

Loading Rules

- Load the memory modules in order of size, starting with the largest module and finishing with the smallest module.
- For the best performance, it is best to load the memory across the different memory controllers. The DIMMs should be installed in every other DIMM socket, starting with the DIMM furthest from the CPU, with the first DIMM loaded in the bottom most socket and alternating sides of the CPU. DIMMs should be loaded following the figure below
- For a dual processor configuration, follow the loading order above, but alternate between the 2 processors.
- See the figure below for loading order.

Figure 7. Loading order for single and dual CPU configurations



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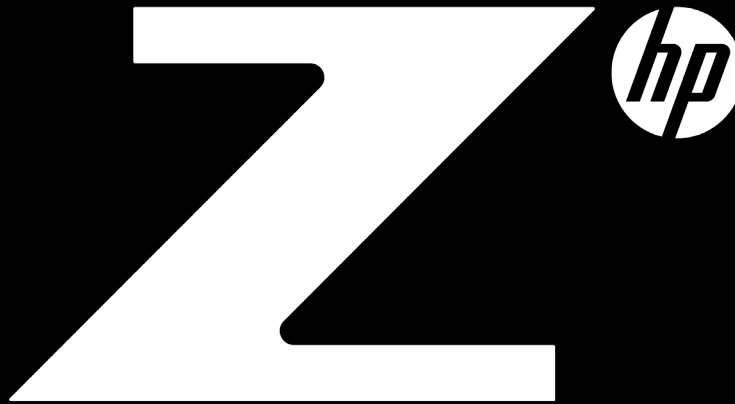
The memory configurations of the HP Z8 G5 Workstation have been specifically crafted to meet strict long-term reliability standards with an optimized performance that provides users with seamless functionality. Design, cooling, and power solutions were validated to ensure DIMMs met max performance. HP values product quality and end user productivity, which is why the products discussed in this document are backed by HP's warranty. For more information, visit <https://www.hp.com/us-en/workstations/desktop-workstation-pc.html>.

Resources, Contacts, or Additional Links

Visit **HP's White Paper site** to learn more about the innovation in HP Workstations and the latest technologies offered in the products.

Disclaimers

- 64 cores is enabled through installation of two CPUs. Multicore is designed to improve performance of certain software products. Not all customers or software applications will necessarily benefit from use of this technology. Performance and clock frequency will vary depending on application workload and your hardware and software configurations. Intel's numbering, branding and/or naming is not a measurement of higher performance.
- Optional, configurable features.
- Optional, configurable features. Configurations for 120TB storage and for front accessible NVME bays is planned to be available in the second half of 2023. Configuration for 120TB requires after-market purchase. For storage drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 35GB is reserved for system recovery software.
- MIL-STD testing is not intended to demonstrate fitness for U.S. Department of Defense contract requirements or for military use. Test results are not a guarantee of future performance under these test conditions. Accidental damage requires an optional HP Accidental Damage Protection Care Service.
- HP Wolf Security for Business requires Windows 10 or 11 Pro or higher, includes various HP security features and is available on HP Pro, Elite and Workstation products. See product details for included security features and OS requirement.
- Intel® Active Management Technology requires an Intel® AMT-enabled chipset, network hardware and software, as well as connection with a power source and a corporate network connection. Setup requires configuration by the purchaser and may require scripting with the management console or further integration into existing security frameworks to enable certain functionality. It may also require modifications of implementation of new business processes.



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