



HP Common Slot power supply technology

3rd edition

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Abstract

Energy directly consumed by data center equipment, the resulting heat produced and the energy that it takes to provide cooling can account for a majority of overall operating costs in today's data centers, making it a top concern for IT and facilities managers worldwide. Energy efficiency is also a driver of overall data center utilization as inefficient systems cannot be deployed as densely due to available power per rack and requisite airflow, reducing the expectations of longevity for the facility. Utilized across ProLiant, Integrity, BladeSystem and even certain HP Storage platforms, HP Common Slot power supplies help IT data centers to achieve optimum power efficiencies by right-sizing the power output for each system. Additionally, HP Common Slot power supplies reduce administrative costs by improving power management and providing a common form factor that reduces operational costs for spares when deploying a mix of HP Server and Storage solutions. This technology brief describes how HP Common Slot power supplies help to increase compute capacity and reduce operating costs by improving power efficiency in the data center.

Introduction

The demand for computing, storage, and networking capacity has been continuously increasing. For many organizations, this has created an IT resource sprawl that can be costly in terms of energy consumption and management. With Converged Infrastructure, HP is transforming IT technology silos into interoperable, shared pools of resources. A key component of this is the next-generation HP ProLiant servers with the ProActive Insight architecture and its technologies for automated energy optimization.

These technologies reduce the power and airflow needed to operate ProLiant Gen8 servers, enabling you to reclaim limited space, power, and cooling resources for needed workloads. Additionally, they reduce the need for error-prone manual processes associated with asset tracking, checking, and documenting with regards to power and rack configurations. The automated energy optimization capabilities in the new ProLiant family are enabled by HP 3D Sea of Sensor technologies. With embedded intelligence across three dimensions—sense of location, power utilization, and thermal demand—you gain a unique level of visibility and control over the energy efficiency of your data center. With the addition of HP's new high-efficiency Platinum Plus Common Slot power supplies, energy savings at the processing level (server, storage and networking equipment) can result in the greatest reduction in power requirements making the power supply a key element in achieving energy-efficient IT operations.

HP Common Slot power supplies

HP Common Slot (CS) power supplies are designed to allow IT administrators to implement a Converged Infrastructure using energy-efficient, inter-changeable, and manageable components. HP CS power supplies are available in three power ratings; 460 watts, 750 watts, and 1200 watts (Table 1), allowing you to "right-size" a power supply to a specific server or storage configuration. HP's latest set of CS power options, Platinum Plus, meet 80 PLUS requirements for Platinum certification.

Table 1: HP CS power supplies

Name	Input	80 PLUS Certification
HP 460W CS Gold Power Supply	100-240 VAC	Gold
HP 460W CS Platinum Power Supply	100-240 VAC	Platinum
HP 460W CS Platinum Plus Power Supply	100-240 VAC	Platinum
HP 750W CS Gold Power Supply	100-240 VAC	Gold
HP 750W CS Platinum Power Supply	100-240 VAC	Platinum
HP 750W CS Platinum Plus Power Supply	100-240 VAC	Platinum
HP 750W CS -48VDC Power Supply	-48VDC	n/a ¹
HP 1200W CS Silver Power Supply	100-240 VAC	Silver
HP 1200W CS Platinum Power Supply	100-240 VAC	Platinum
HP 1200W CS Platinum Plus Power Supply	100-240 VAC	Platinum
HP 1200W CS -48-VDC Power Supply	-48 VDC	n/a ¹

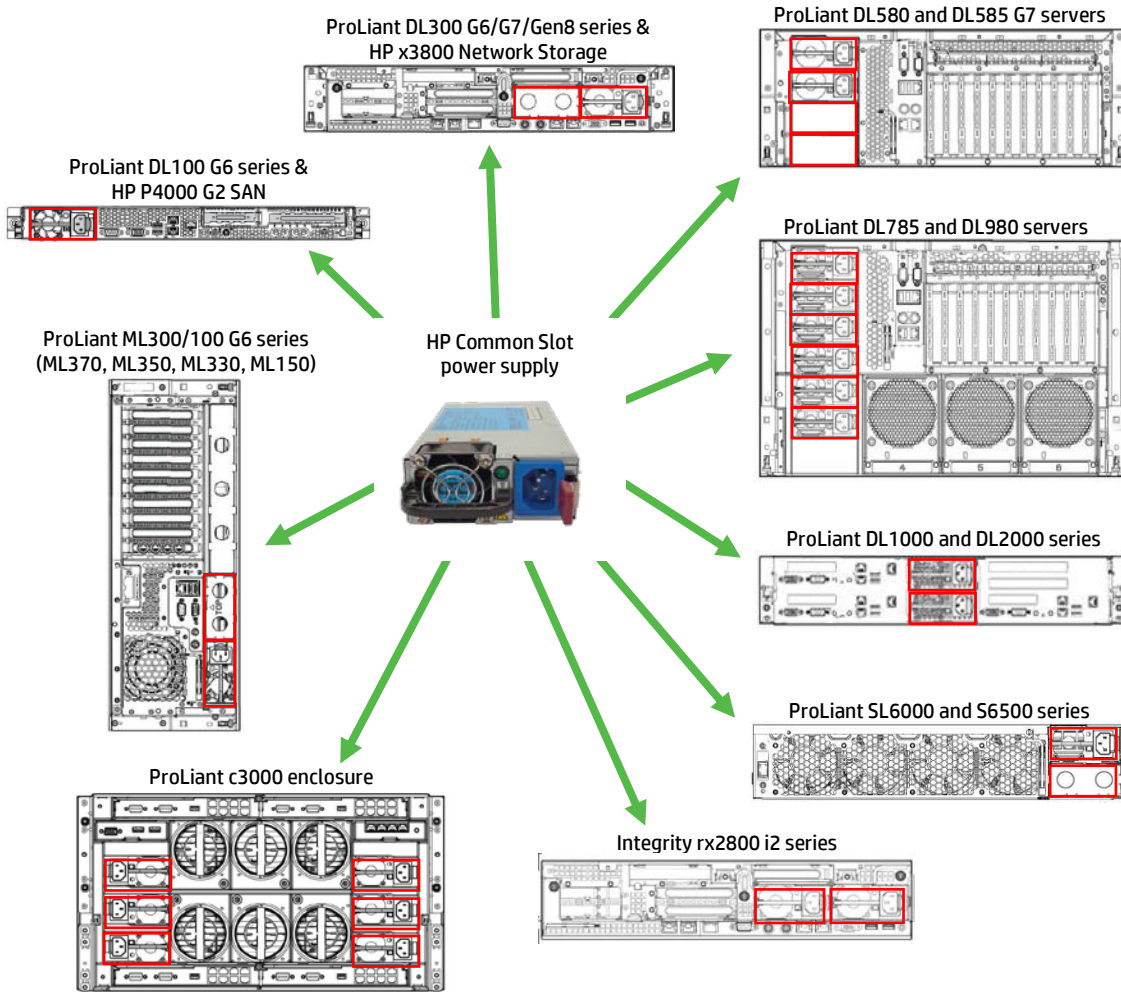
Note

All HP CS power supplies designed for AC input are 80 PLUS certified. To earn 80 PLUS certification, a power supply must be proven through independent testing to be 80% (or greater) energy efficient when delivering 20, 50, and 100% of the rated load capacity with a true power factor of 0.9 or greater. Power supply ratings include 80 PLUS Bronze, 80 PLUS Silver, 80 PLUS Gold, and 80 PLUS Platinum certification.

HP Common Slot power supplies share a common electrical and physical design that allows for installation into server and storage platforms with a Common Slot power supply bay (Figure 1). HP Common Slot power supplies are compatible with over 90% of HP ProLiant G6 and G7/Gen 8 servers, as well as with select HP Integrity and HP storage systems.

¹ DC-DC power supplies such as the HP 1200-W CS 48-VDC power supply do not receive 80 PLUS certification.

Figure 1: HP platforms that support HP Common Slot power supplies over several generations of products



The ability to use HP CS power supplies across multiple platforms simplifies maintenance for an IT department. Using a common power supply form factor requires fewer maintenance spares and decreases inventory costs and facility space requirements. Common Slot power supplies are qualified with specific HP products based on actual power output requirements. These qualifications are defined in the section "[Installation consideration with Common Slot power supplies.](#)"

Table 2 and Figures 2A, 2B, and 2C compares and illustrates the efficiency of HP Platinum Plus, HP Platinum, and HP Gold CS power supplies as tested internally with the internal fans as part of the efficiency calculation. The 80 Plus certification agency data reflected in Table 2 does not include power consumed by the fans as part of the efficiency calculation.

Table 2: Operating efficiencies of 80 PLUS certified HP CS power supplies

Power supply type	Percent of efficiency			
	@ 10% load	@ 20% load	@ 50% load	@ 100% load
HP 460W CS Gold	85.02%	90.39%	92.43%	91.57%
HP 460W CS Platinum	86.50%	91.20%	94.37%	93.91%
HP 460W CS Platinum Plus	88.58%	92.05%	94.42%	93.07%
HP 750W CS Gold	87.58%	90.58%	92.90%	91.54%
HP 750W CS Platinum	88.85%	92.04%	94.55%	93.67%
HP 750W CS Platinum Plus	89.37%	92.47%	94.69%	93.41%
HP 1200W CS Silver	78.43%	86.84%	91.75%	91.19%
HP 1200W CS Platinum	88.74%	92.53%	94.34%	93.21%
HP 1200W CS Platinum Plus	90.37%	93.24%	94.44%	91.92%

Note
 Most common load point

Figure 2A: Efficiency curves for HP CS Platinum Plus power supplies

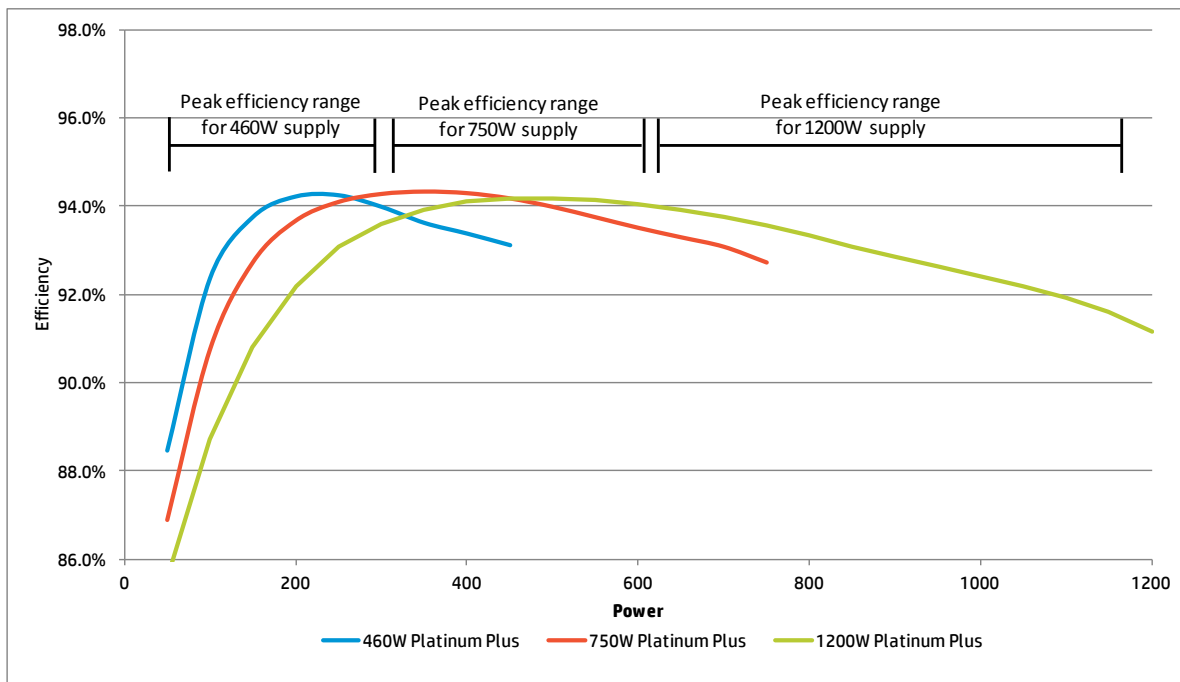


Figure 2B: Efficiency curves for HP CS Platinum power supplies

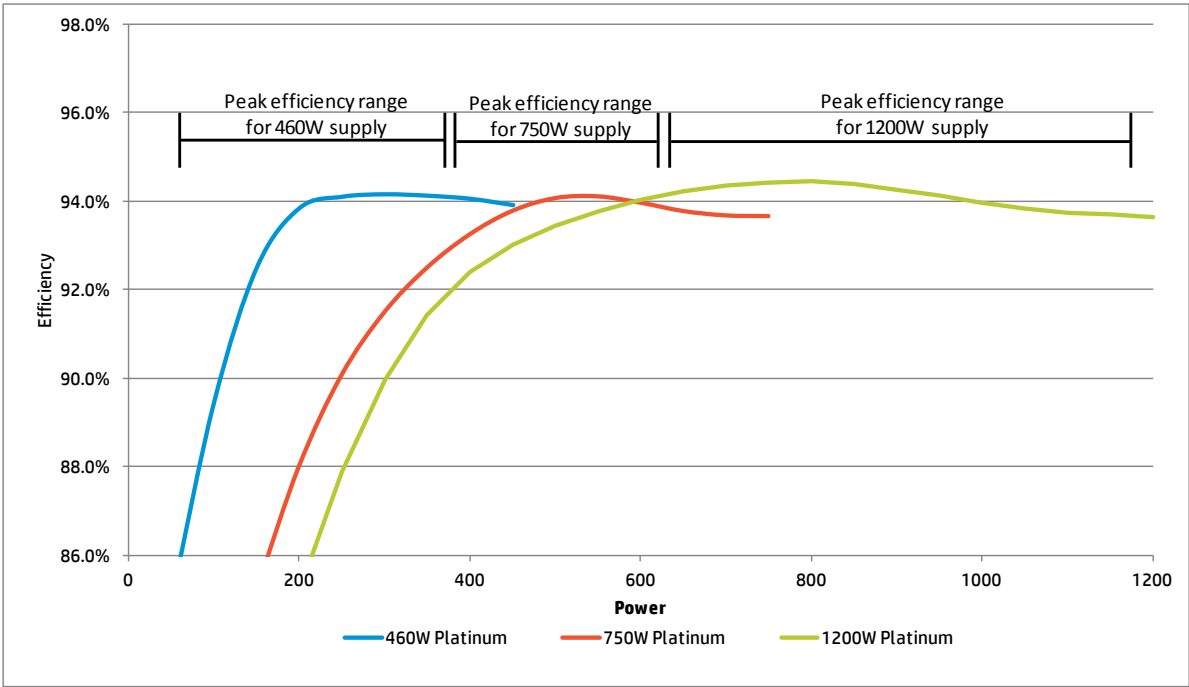
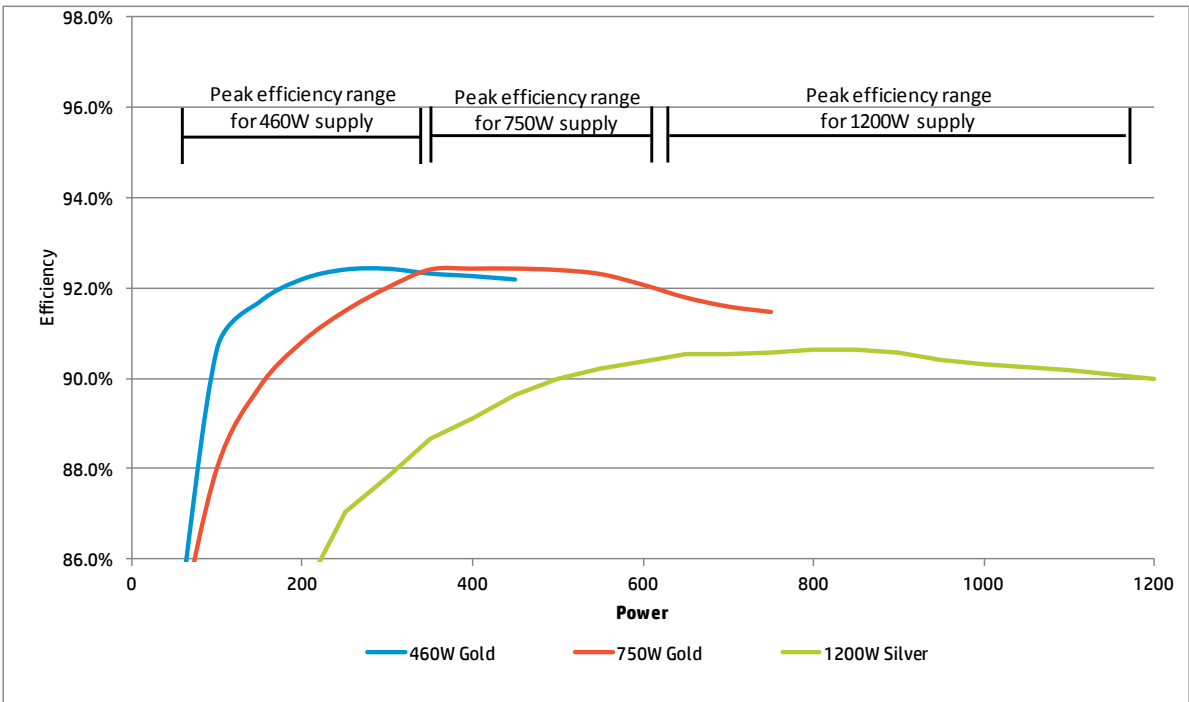


Figure 2C: Efficiency curves for HP CS 460W Gold, 750W Gold and 1200W Silver power supplies



Load Balanced and High Efficiency Modes

An HP ProLiant server configured with the HP 460-watt, 750-watt, or 1200-watt CS power supply supports the following three scenarios:

A: Operating with a single supply

B: Operating with redundant supplies in Load Balanced Mode

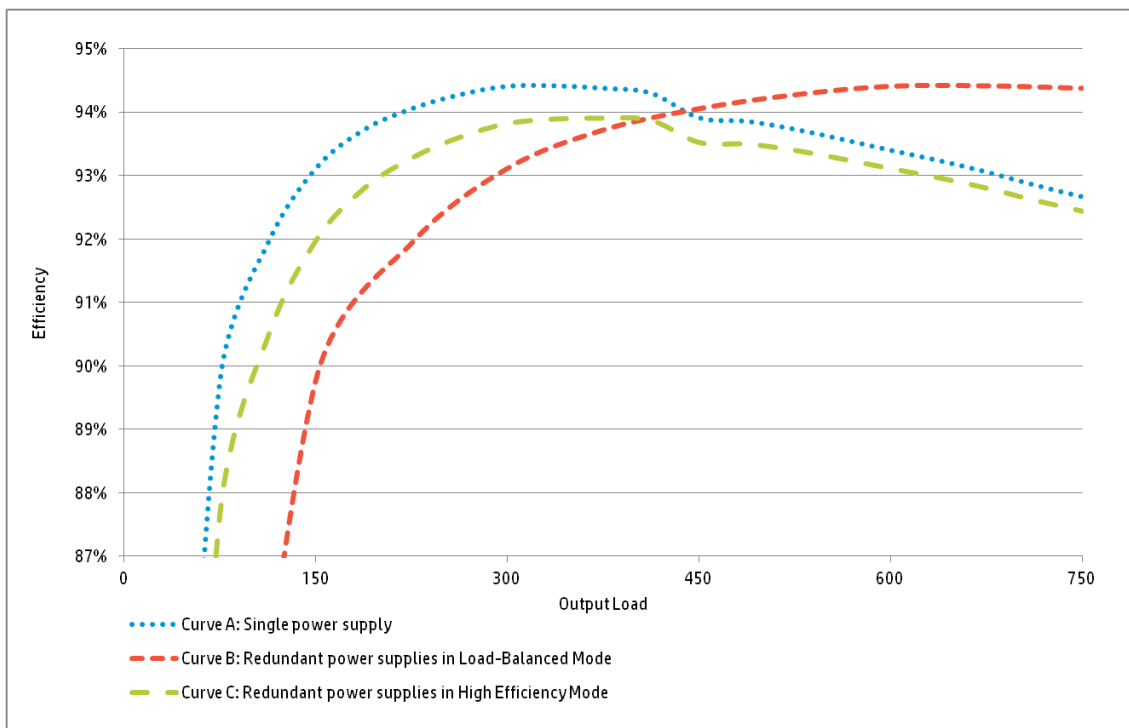
C: Operating with redundant supplies in High Efficiency Mode

Figure 3 compares the efficiency of the HP 750-W CS Platinum Plus power supply under these three scenarios. As indicated by Curve A, a single 750-watt power supply supporting the entire load of the server can achieve the highest efficiency when operating in the middle range of its capacity, although redundancy is not provided.

For redundant 750-watt supplies operating in Load-Balanced Mode (the default mode), the load is shared equally between the two supplies. As shown by Curve B, Load-Balanced Mode results in a significant efficiency penalty over much of the server's operating range compared to a single power supply supporting the entire load.

When High Efficiency Mode is enabled for redundant supplies, each power supply in the server is designated as either a primary or secondary supply and the entire server load is shifted to the primary power supply. This allows the primary power supply to operate at higher efficiency points on the load curve while the secondary power supply operates in idle mode, providing no output power and consuming very little energy (typically two to four watts per supply). The result, as shown by Curve C, is that High Efficiency Mode achieves efficiency levels that come close to those of a single supply system.

Figure 3: Efficiency comparison of single and redundant HP 750W CS Platinum Plus power supplies



As indicated in Figure 3, High Efficiency Mode with 750-watt supplies is beneficial for loads up to approximately 450 watts. In general, Load-Balanced Mode offers better efficiency for loads requiring more than 60% of the primary power supply capacity.

High Efficiency Mode is enabled through the server's ROM-Based Setup Utility (RBSU) under System options → Redundancy options. When enabling High Efficiency Mode, the user can specify that the odd or even power supplies will be designated manually or automatically as secondary supplies. This flexibility allows users to balance the load across a rack manually or automatically.

Right-sizing the power supply

The availability of HP CS power supplies in multiple capacities allows IT technicians to match the power supply capacity to the actual load of a server configuration; that is, to select the right-size power supply. In addition to increased efficiency, right-sizing the power supply also offers two immediate benefits: reducing hardware cost and avoiding trapped power capacity.

Reducing hardware cost

Smaller capacity supplies cost less to purchase than larger capacity supplies. Nevertheless, IT infrastructure designers often configure servers with larger-than-necessary supplies to allow for future expansion or upgrades. When purchasing a significant number of servers, the savings from ordering only the capacities actually required can be significant.

Avoiding trapped power capacity

The amount of equipment that can be deployed in a given location, such as a rack, is in direct relation to the size of the circuit that is provisioned. Often, more equipment can be deployed than nominally available through the use of power capping, but that can also result in performance capping when used aggressively. Additionally, depending on local regulations, large data centers may be required by law to size their power circuit (that is, their availability of power to the location) based on the servers' maximum power supply output rating or regulatory-plate rating. This method of provisioning can quickly use up the data center power budget. Most servers, even fully configured and operating at 100% utilization, will typically require only 70% of the power supply capacity. Even if only 70% of power (at the most) will ever be used, the data center will not be able to expand because the power circuit is trapped based on the required method of provisioning. When using power supplies that more closely match the required power, the trapped capacity can be reclaimed to power more equipment while staying in the same power budget.

HP Power Advisor

The HP Power Advisor utility removes much of the guesswork from estimating the power requirements of a particular HP server configuration. Developed from actual measurement data collected from HP servers running under heavy load, the Power Advisor allows the IT/facilities technician to build a virtual server system and accurately pre-calculate the power needs of the server configuration without having to assemble and run the hardware.

Figure 4 shows a typical screen from a Power Advisor calculation for a ProLiant DL380p Gen8 server. The Power Advisor allows the user to select precise configuration parameters such as processor type, memory size, and drives. As the configuration is being made, the Power Advisor continuously calculates the "Current Wattage" and "Circuit Sizing" requirements for the configuration. A Utilization slider control allows the user to set the projected degree of server utilization.

Note

The Power Advisor allows users to avoid initial configuration mistakes such as using an under-rated power supply. The Power Advisor should also be consulted before reconfiguring a server. The HP Power Advisor can be downloaded from the following URL: <http://www.hp.com/go/hppoweradvisor>.

As shown in Figure 4A, if a redundant supply has not been added, the Power Advisor generates a message suggesting a power supply addition. If the server configuration exceeds the capacity of the power supply, an error message is displayed (Figure 4B).

Figure 4A: Configuration display with redundancy reminder message

Configuration ProLiant DL380p Gen8

Idle: 169.62 Current Wattage Expected: 412.68 Circuit Sizing: 412.68 Utilization: 100 %

Storage

Type: Hard Drive
Interface: SFF SAS
Option: HP 500GB 6G SAS 7.2K 2.5in SC MDL HDD

Expansion

Card Type: FlexibleLOM
Expansion Type: FlexibleLOM
Option: HP 10GbE 2P 530FLR Adapter FIO Kit

Power Supply

Type: HP 460W Common Slot Platinum Gen8 Power Supply Kit

Model(s)	Quantity	Remove	RemoveAll
Processor			
HP DL380p Gen8 E5-2670 Kit	2	X	XX
Memory			
HP 16GB 2Rx4 PC3-12800R-11 Kit	12	X	XX
Storage			
HP 500GB 6G SAS 7.2K 2.5in SC MDL HDD	8	X	XX
Expansion			
HP 10GbE 2P 530FLR Adapter FIO Kit	1	X	XX
Power Supply			
HP 460W Common Slot Platinum Gen8 Power Supply Kit	1	X	XX

Note: Add power supplies for redundancy.

Figure 4B: Configuration display showing message when power supply capacities have been exceeded

Configuration ProLiant DL380p Gen8

Idle: #ERROR Current Wattage Expected: #ERROR Circuit Sizing: #ERROR Utilization: 100 %

Memory

Type: DDR-3
Model: HP 16GB 2Rx4 PC3-12800R-11 Kit

Storage

Type: Hard Drive
Interface: SFF SAS
Option: HP 500GB 6G SAS 7.2K 2.5in SC MDL HDD

Expansion

Card Type: FlexibleLOM
Expansion Type: FlexibleLOM
Option: HP 10GbE 2P 530FLR Adapter FIO Kit

Model(s)	Quantity	Remove	RemoveAll
Processor			
HP DL380p Gen8 E5-2670 Kit	2	X	XX
Memory			
HP 16GB 2Rx4 PC3-12800R-11 Kit	24	X	XX
Storage			
HP 500GB 6G SAS 7.2K 2.5in SC MDL HDD	12	X	XX
Expansion			
HP 10GbE 2P 530FLR Adapter FIO Kit	1	X	XX
Power Supply			
HP 460W Common Slot Platinum Gen8 Power Supply Kit	1	X	XX

Error: Inadequate power. Upgrade the power supply, add additional power supplies or reduce selected components.

The HP Power Advisor allows IT architects to choose the right size power supply for a given server configuration. This saves money in the initial acquisition by allowing the purchase of less expensive, smaller-capacity supplies. This efficient operation results in additional energy savings.

HP Power Discovery Services

As a feature of Automated Energy Optimization, HP Power Discovery Services (PDS), formerly HP Intelligent Power Discovery is the first technology to create an automated, energy-aware network between IT systems and facilities. HP PDS allows users to reclaim millions of dollars in wasted power capacity and downtime across data centers. HP PDS combines the HP Intelligent Power Distribution Unit (iPDU), HP CS Platinum or Platinum Plus power supplies and HP Insight Control software to automatically track new server installations and provide higher precision, control, and automation to power distribution. HP PDS automatically discovers newly deployed HP servers, maps them to the power source, verifies power redundancy and ensures all power sources are connected correctly.

When configured with HP CS Platinum or Platinum Plus power supplies, which feature an embedded serial communication technology, HP servers can automatically provide identification information such as server name, UUID number, and IP address to the Intelligent PDU and to HP Insight Control power management software. This reduces the amount of time needed to configure the power distribution software and hardware. Additionally, HP PDS intuitively detects redundant power supplies to ensure they are running on different PDUs. This helps reduce unscheduled down time and the possibility of human error, the biggest challenges of data center management. For more information on HP PDS refer to the website referenced in the “For More Information” section of this document.

Installation considerations with HP Common Slot power supplies

Although the common slot power supply design is shared by a number of platforms enabling cross-platform power supply installation, HP has qualified select ProLiant, Integrity, and HP storage products to work with specific HP CS power supplies. An interactive online compatibility guide for HP products is referenced in the “For More Information” section of this document. Table 3 shows which HP CS power supplies support HP Power Discovery Services. All HP CS Platinum and Platinum Plus power supplies support HP PDS functionality.

Table 3: HP CS Power supply supporting HP Power Discovery Services

Power supply type	HP ProLiant server
460W CS Platinum	ProLiant G6/G7: DL160 , DL180 , DL360 , DL380 , DL385
460W CS Platinum Plus	ProLiant Gen8: DL160, DL320e, DL360e/DL360p, DL380e/DL380p, DL385p, ML350e/ML350p
750W CS Platinum	ProLiant G6/G7: DL180 , DL360 , DL380 , DL385
750W CS Platinum Plus	ProLiant Gen8: DL160, DL360e/DL360p, DL380e/DL380p, DL385p, ML350e/ML350p
1200W CS Platinum	ProLiant G7: DL380 , DL385 , DL580 , DL585 , DL980
1200W CS Platinum Plus	ProLiant Gen8: DL360e/DL360p, DL380e/DL380p, DL385p, DL560p, ML350p

HP ProLiant servers that support redundant power supplies only allow installation of same-type supplies. A power supply mismatch or an unsupported power supply will result in an error indication as described in Table 4.

Table 4: HP CS power supply compatibility with HP PDS

Condition	System insight display indication	Description
Power supply mismatch detected during boot	Power supply LED (all supplies) blinking amber	BIOS ROM will power up power supply #1 and then halt.
Power supply mismatch detected during runtime	Power supply LED (added supply only) blinking amber	iLO will detect the mismatch and not allow the added power supply to turn on.
Unsupported power supply detected during boot	Power supply LED (added supply only) blinking amber	BIOS ROM will detect an unsupported power supply installation. BIOS ROM will halt at POST with a failure message and will light the appropriate LED. The LED will reset when the unsupported supply has been removed and system is restarted.

HP CS power supplies are hot-pluggable/hot-swappable on ProLiant servers under the following conditions:

- The server must already be configured with redundant power supplies.
- The removed and replacement power supplies must be of the same type (same part number).

For all other situations, the ProLiant server should be powered down before a power supply is removed or installed.

Conclusion

The common slot power supply bay allows over 90% of the ProLiant server line to use 80 PLUS-certified power supplies. By using IT equipment that supports common-slot power supplies, IT and facilities administrators can reduce spares inventory costs and space requirements while reducing energy consumption costs and reclaiming data center power capacity.

For more information

Visit the URLs listed below if you need additional information.

Resource description	Web address
HP Power Supplies	http://h18004.www1.hp.com/products/servers/rackandpower/powersupplies/index.html
HP ProLiant servers	www.hp.com/go/proliant
HP ProLiant Energy Efficient Solutions	http://h71028.www7.hp.com/enterprise/cache/600307-0-0-0-121.html
Automated Energy Optimization	http://h20195.www2.hp.com/V2/GetPDF.aspx/4AA3-9650ENW.pdf
HP Power Advisor utility	www.hp.com/go/hppoweradvisor
80 PLUS program	www.80plus.org
HP interactive online compatibility guide	www.hpproliantoptions.com/index.aspx
HP Intelligent Power Discovery (Power Discovery Services)	www.hp.com/go/ipd

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