# HP UPS Best Practices

## Abstract

This document describes best practices to properly deploy a HP Uninterruptible Power System (UPS) in order to deliver maximum functionality at minimum cost. All HP UPSs are designed to provide superior power protection to servers and other critical electronic equipment, with Rackmount UPS models also preserving valuable rack space. HP UPSs safeguard sensitive equipment against damaging and costly power anomalies including blackouts, brownouts, spikes, surges, overvoltages, line noise and frequency variations.

## Introduction

To provide protection for servers, computer systems and other critical network equipment, HP has developed a series of UPSs, ranging from 750VA to 12000VA. These UPSs enhance reliability and ensure high availability and uptime, while accompanying power management software continuously monitors and manages the UPS

## The Importance of Power Protection

Designed to protect critical equipment from power disturbances and ensure system reliability and data integrity, a UPS is the single most cost-effective measure to assure system safety, security and uptime. Consider these facts:

- The greatest risks of data loss are preventable or can be highly mitigated. Only 3% of data loss incidents are caused by a natural disaster, according to Price Waterhouse research. Rather, the following issues account for the majority of destructive influences:

  - Software error (14%)

  - Human error (32%)

  - Hardware failure (44%), often triggered by power problems

- According to Price Waterhouse research, after a power outage disrupts IT systems:

  - More than 33% of companies require more than one day to recover

  - 10% of companies take more than one week

  - It can take up to 48 hours to reconfigure a network

  - It can take days or weeks to re-enter lost data

## Recommended Duration of Use

Although tests and a multitude of customer experiences have shown no noticeable performance issues with UPS's for significant time periods after expiration of the 3-year limited warranty, we strongly recommend considering replacing UPS's after a maximum of 5 to 6 years of use to assure full functionality and a safe operating environment. This recommendation does not extend or in any way alter the warranty for UPS's which is limited to a time period of 3 years and a coverage as stated in the applicable warranty statement.

# Battery Replacement

It is best practice to replace the batteries every three years to ensure that the load will be properly supported during power outages, especially during high load conditions.

There are a number of conditions that affect battery life, including temperature and the depth and frequency of battery discharges. The "shelf life" of batteries decreases with increased ambient temperature. This is particularly important if the UPS is to be stored without periodically recharging the batteries. For example, at a 40ºC (104ºF) ambient, battery life is reduced approximately 70 percent from what would be expected at 25ºC (77ºF). Even when the UPS is in use and the batteries are fully charged, higher ambient conditions will reduce "float" service life. Battery life is also affected by depth and frequency of discharges.

This symbol indicates that you should not discard the UPS or the UPS batteries in the trash. The UPS may contain sealed, lead-acid batteries. Batteries must be recycled. For proper disposal, contact your local recycling/reuse or hazardous waste center.

# Select Load Appropriately / Sizing A UPS

For configurations involving multiple servers and/or additional critical storage/option products, simply add up the total watts of the equipment that will be plugged into the UPS and select the UPS model with a watt rating higher than the equipment load. To allow for future system growth and for power on inrush current, a good rule of thumb is that the computer load should be about 60 to 80 percent of the UPS watt capacity. Power supplies have the ability to support a high-wattage rating in a high-line (200V - 250V) environment versus a low-line environment (100V - 120V).

To facilitate the sizing of a UPS HP has provided a sizing tool that can be accessed at: www,upssizer.com

# Select Application Voltage / High volt VS Low Volt (120V or 208V)

In America one can choose a low voltage system or high voltage system. Low voltage ranges from 100V-120V, commonly known as 120V. High voltage ranges from 200V-240V.

Most servers have an auto-sensing feature that allows the device to automatically adjust to voltage levels ranging from 100V-240V. Therefore, most servers can be powered from low voltage or high voltage system.

A high volt system is inherently more efficient in that less current is used, and can help save the datacenter money. Consider an R3000 UPS which is available as both high volt and low volt. Current = Watts / Voltage. The current for an R3000 at 120V = 22.5 amps; at 220V = 12.27 amps. From this example, the current carrying capability for the wire on the low volt (120V) R3000 must be selected to carry nearly twice the current…bigger wire…bigger breaker…all costing more money in equipment like additional Power Distribution Units (PDUs) and subsequently additional cooling for the datacenter.

In sizing a datacenter, one must determine how much power the equipment requires, and how much power is available in the existing room. It is important to note that for safety reasons, one should not use more than 80 percent of available power in the data center in order to keep breakers from tripping and outlets from overloading.
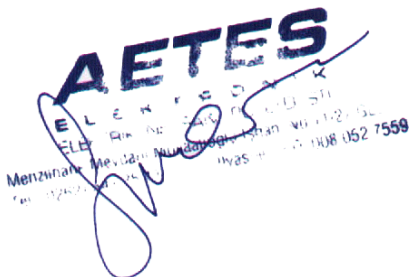
# HP UPS Management

## *HP Power Manager Software*

HP Power Manager is a web-based application that enables administrators to manage an HP UPS from a browser-based management console. Administrators can monitor, manage and control a single UPS locally and remotely. Use HP Power Manager 4.2.5 or higher.



http://h18004.www1.hp.com/products/servers/proliantstorage/power-protection/software/power-manager/index.html

## **Power Management Software is a Must on All UPS**

### *Allows for Graceful Shutdown*

In addition to providing an excellent USB, Serial or Web enable management capability, power management software allows the graceful shutdown of the attached load, as well as provides load segment control (available on select UPS models). The UPS management software will also provide a complete log of events and of UPS utility data, which is invaluable when debugging a power anomaly. Without management software, a UPS will still protect the attached load; however it will not gracefully shut down the attached equipment. Instead, the UPS will run until the batteries are depleted and then drop the attached load.

Used in conjunction with a HP UPS, HP Power Management Software provides the best possible protection for valuable data. During an extended power event, HP Power Management Software facilitates a graceful, remote shutdown to ensure that all network devices are powered down in an orderly, sequential manner, saving all work-in-progress. Network administrators can even define their own shutdown process, with an organization's most critical equipment being shut down last, after work-in-progress has been saved from client workstations through hubs, switches, routers and communication servers.

In addition to preventing system crashes and data loss, HP Power Management Software also helps users stay informed with UPS alarms sent via network broadcasts, SNMP, email, pager or mobile phone. Network administrators can also use the software to manage all UPSs on the network, check battery health and perform other valuable functions.

### *Load Segment Control*

Using HP Power Management Software with most HP Rackmount UPSs, network administrators can manage scheduled shutdowns and sequential startups of protected loads by independently controlled load segments, which are groups of receptacles on the rear panel of the UPS. In this manner, the HP UPS can be configured to extend runtimes for critical devices. By powering down one load segment of less critical devices, the runtime for more critical servers and systems is extended on the other load segment. HP Power Management Software also facilitates a prioritized startup of connected equipment. Furthermore, the power scheduling feature allows for scheduled on-and-off times, promoting energy and power conservation.

## HP Management Module (AF401A)

The HP UPS Management Module enables you to monitor, manage, and control power environments of up to five devices through the serial connectors located on the front of the management module (local direct connection) and more remote devices over the network connection. The management module can be configured to send alert traps to HP Systems Insight Manager and other SNMP management programs or used as a stand-alone management system.

Monitor the status of the UPS and manage a graceful shutdown of attached equipments during a utility power failure.

Manage redundant UPS configurations

Ideal for large centrally located Data Centers

Provide access to multiple users

Include a web interface management software that can be accessed with a web browser

Include a Service Menu, a text-based menu that can be accessed through telnet or hyperterminal emulation session

Use HP Management Module Software version 2.0 or higher.
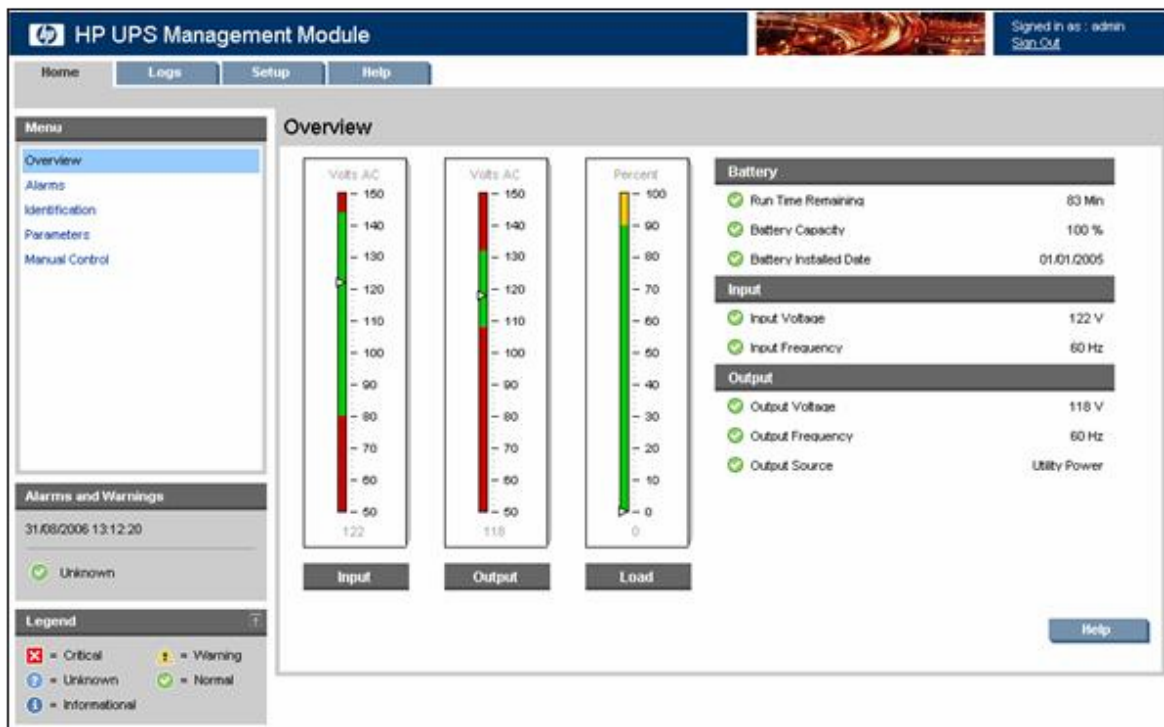


HP UPS Management Module web interface

http://h18004.www1.hp.com/products/servers/proliantstorage/power-protection/software/module/ups/index.html

## HP UPS Models Available

| Rackmount UPS Model Numbers | |
|---|---|
| AF419A | R1500 G2 NA |
| AF418A | R1500 G2 INTL |
| AF421A | R1500 G2 JPN/TWN |
| AF422A | R3000 Low Volt NA |
| AF423A | R3000 High Volt NA |
| AF425A | R3000 Low Volt JPN |
| AF424A | R3000 High Volt JPN |
| AF414A | R3000 High Volt INTL |
| AF452A | R/T3000 Low Volt NA/JPN |
| AF453A | R/T3000 High Volt NA/JPN |
| AF454A | R/T3000 High Volt INTL |
| AF416A | R5500 INTL |
| AF426A | R5500 NA/JPN |
| AF431A | R8000/3 NA |
| AF432A | R8000/3 INTL |
| AF429A | R12000/3 NA |
| AF430A | R12000/3 INTL |
| AF438A | RP36000/3 NA |
| AF439A | RP36000/3 INTL |

| Tower UPS Model Numbers | |
|---|---|
| AF446A | T750 G2 NA |
| AF447A | T750 G2 INTL |
| AF456A | T750 JAPAN |
| AF448A | T1000 G3 NA |
| AF449A | T1000 G3 INTL |
| AF457A | T1000 JAPAN |
| AF450A | T1500 G3 NA |
| AF451A | T1500 G3 INTL |
| AF458A | T1500 JAPAN |

| UPS Options | |
|---|---|
| AF401A | UPS Management Module |
| AF402A | Management Module Serial Adapter – 5 pack |
| AF415A | R3000 ERM |
| AF455A | R/T3000 ERM |
| AF417A | R5500 ERM |
| AF442A | R5500 Tower Conversion Kit |
| AF434A | R8000/3 and R12000/3 ERM |
| AF436A | HP R12000/3 EXPANSION MODULE FOR RP36000/3 NA |
| AF437A | HP R12000/3 EXPANSION MODULE FOR RP36000/3 INTL |
| AF440A | HP OUTPUT MODULE FOR R12000/3 NA |
| AF441A | HP OUTPUT MODULE FOR R12000/3 INTL |

## HP Rackmount UPS Advantages

Designed for dense data-center environments, HP rackmount UPS solutions provide powerful performance while occupying minimal rack space. With benefits such as industry-leading power density and more true power in a smaller form factor, HP rackmount UPSs deliver maximum uptime with a host of competitive advantages including:

*Enhanced Battery Management (EBM)*
- Doubles battery service life

- Provides the fastest, safest recharge time

- Provides up to 60-day advanced notification when batteries are approaching the end of useful life

### Preserves Valuable Rack Space
- R1500 G2 occupies just 1U (1.75 inches) of rack space; R3000 models occupy just 2U (3.5 inches); and R5500 occupies only 3U (5.25 inches), leaving more space for server and storage equipment

### Industry-leading Power Density
- The R1500 G2 packs 1340 Watts into just 1U, while the R3000 delivers an unprecedented 2700 watts in a 2U form factor. The R5500 model features an impressive 1500 watts per U (4500 watts total).

### Individual Load Segments
- Provides orderly shutdown of non-critical devices and extends battery backup for critical systems

- Enables independent control, startup and shutdown of individual receptacle groups

### Exceptional Voltage Regulation
- Enhanced design of HP Rackmount UPSs shield connected equipment with exceptional voltage regulation. The UPS automatically boosts input utility voltage up or moderates it down as needed, prior to allowing it to pass to the protected equipment

- If input voltage varies as much as 20 percent over nominal voltage or 30 percent under --- which can easily happen when running on generator power --- the UPS accepts this inconsistent voltage and delivers clean, consistent output, without using the battery

### Power Management Software
- Bundled free with every UPS, the software allows easy UPS management and monitoring, while providing prioritized, sequential shutdown of all network devices

- Provides details of current system status

- Enables users to schedule shutdowns at predetermined times, as well as define responses to alarm conditions

### UPS Options
- UPS Option Card - HP UPS Management Module The HP UPS Management Module enables you to monitor and manage power environments through comprehensive control of HP UPSs. The HP UPS Management Module can support either a single UPS configuration or provides additional power protection with support for dual redundant UPS configuration for no-single-point-of-failure. The additional serial ports will provide greater power management control and flexible monitoring.

- Power Distribution Units (PDUs) manage power distribution in rack environments without consuming valuable rack space. HP Modular and Monitored PDUs have a unique architecture designed specifically for data center customers who want to maximize power distribution and space efficiencies in the rack.
*http://h18004.www1.hp.com/products/servers/proliantstorage/power-protection/pdu.html*

- Extended Runtime Modules (ERMs) extend runtime and enable work to continue even during prolonged outages

*Best-in-class Warranty*

- 3-year limited warranty is among the longest in the industry, reducing total cost of ownership and system downtime

- HP pre-failure warranty replaces batteries free of charge within 3-year period

- $250,000 computer load protection guarantee provides additional peace of mind

# HP Rackmount UPS Models

## HP R1500 G2 Rackmount UPS

The HP R1500 G2 UPS is a high power-density solution designed for customers desiring power protection in space-constrained rack environments. Offering 1500VA/1050Watts of protection, the R1500 G2 occupies just 1U of valuable rack space, while delivering key benefits such as Enhanced Battery Management, Load Segment Control, and serial and USB ports for data exchange.
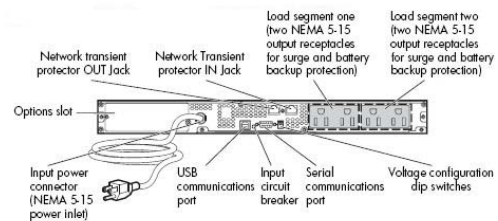


## HP R3000 Rackmount UPS

The HP R3000 UPS is a high power-density solution designed for customers desiring superior power protection in space-constrained rack enterprise environments. This leading-edge UPS features a space-saving 2U design that delivers up to 2700 watts of true power for unprecedented power density. The R3000 uses a unique transformer-less technology to provide key advantages including increased power efficiency and a smaller footprint with less weight. The HP R3000 UPS also has the capability to be connected to optional Extended Runtime Modules (ERMs), allowing customers to increase runtime. The densest, most power-packed UPS available, the HP R3000 delivers more watts per U than any other UPS, enabling more valuable rack space to be utilized by servers, storage and networking equipment.
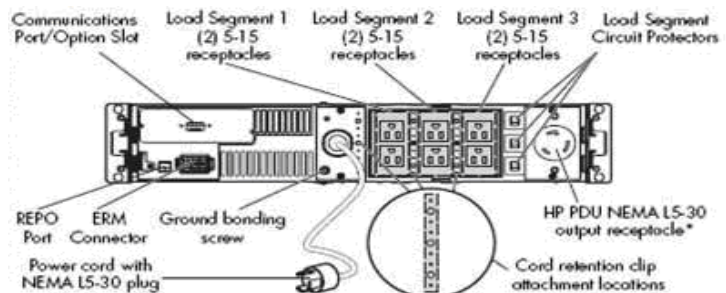
## HP R/T3000 Rackmount UPS

The new HP R/T3000 Uninterruptible Power System (UPS) packs up to 3000 watts into a space saving 2U design. Proven Digital Signal Processor (DSP) technology clean, reliable power protection in an energy efficient transformer-less design while reducing generated heat. The HP R/T3000 UPS includes a Rack to Tower Conversion Kit for non rack applications outside the data center or to support multiple tower servers, wiring closets, and blade enclosures such as the HP c3000 BladeSystem.
An industry leading 3 year warranty and enhanced battery management with pre-failure warning insures that the HP R/T3000 will protect your power needs.





R/T3000 shown with tower conversion kit installed
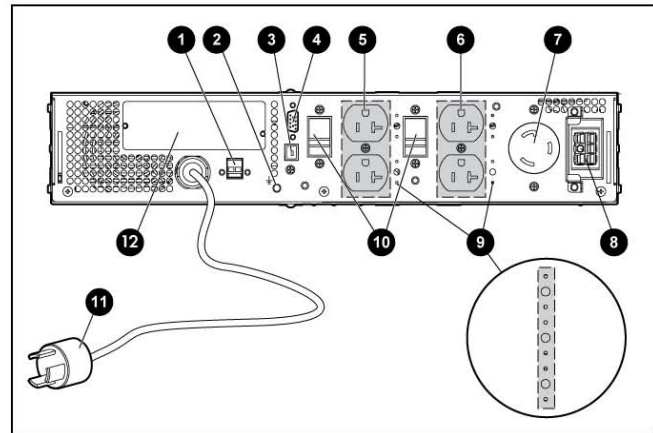
| Item | Description |
|------|-------------|
| 1 | REPO port |
| 2 | Ground bonding screw |
| 3 | USB communications port |
| 4 | Serial communications port |
| 5 | Load segment 1 (two NEMA 5-20T receptacles) |
| 6 | Load segment 2 (two NEMA 5-20T receptacles) |
| 7 | PDU output (NEMA L6-20R) receptacle (load segment 1) |
| 8 | ERM connector |
| 9 | Cord retention clip attachment locations |
| 10 | Load segment circuit breakers |
| 11 | Power cord with L5-30 plug |
| 12 | Option slot |

## HP R5500 Rackmount UPS

The R5500 UPS provides more power protection per U than any other HP UPS, and supports any rackmount server application requiring up to 4500 watts of power protection. With two load segments and free HP power management software, it is easy to customize this UPS to specific applications, as well as manage systems remotely. The R5500 UPS also offers extra-long battery life with Enhanced Battery Management (EBM); longer runtime with Digital Signal Processing technology (DSP); extended battery runtime with optional Extended Runtime Modules (now supports up to 4 ERMs with FW version 2.08 or higher); and easy serviceability with hot-swappable electronics and batteries.
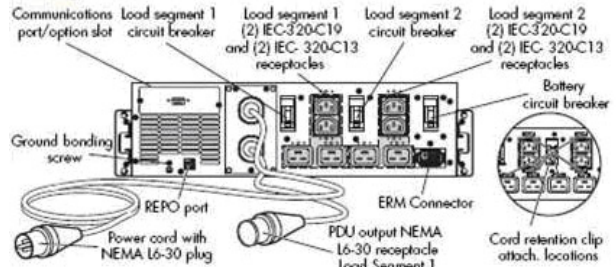
R5500 shown with optional tower conversion kit

## HP Three-phase Rack-mountable UPS

The HP three-phase, UPS line delivers industry-leading energy efficiency, scalability and flexibility.  With 12kVA/12kW modules that occupy just 6U of valuable rack space, the HP three-phase UPS line features twice the power density of any comparable product on the market. Furthermore, the scalable design of the UPS helps customers meet the changing demands of their data centers, as it can expand from the RP36KW model to RP60kW N+1 redundant system. The HP three-phase UPS line is available in several models to accommodate varied application needs and expanding IT environments, including:

● 8kVA/8kW stand-alone UPS

● 12kVA/12kW stand-alone UPS

● 36kVA/36kW parallel UPS (optional 12kVA/12kW modules allow upgrade up to a 60kVA/60kW n+1 configuration)



HP R8000/3 &    HP R36000/3
HP R12000/3

# HP Tower UPS Advantages

Providing advanced power protection and increased uptime for servers, storage devices, computer equipment, and other network environments, HP's Tower UPS models are designed with a host of key benefits including:

- Increased power rating to protect more equipment than competitive UPSs

- Ease of Configuration with an enhanced front panel display. LED display lights and switch membrane is integrated into the front panel, which can be configured through a four button control

- Prioritized shutdown to ensure all data is saved during an extended blackout

- Serial and USB ports for data exchange with the host computer

- Hot-swappable batteries for simplified service without powering down the UPS

- Power Management Software

  o Bundled free with every UPS, the software allows easy UPS management and monitoring, while providing prioritized, sequential shutdown of all network devices

  o Provides details of current system status

  o Enables users to schedule shutdowns at predetermined times, as well as define responses to alarm conditions

## Best-in-class Warranty
- 3-year limited warranty is among the longest in the industry, reducing total cost of ownership and system downtime

- HP pre-failure warranty replaces batteries free of charge within 3-year period

- $250,000 computer load protection guarantee provides additional peace of mind

# HP Tower UPS Models

## HP T750 G2 UPS

Ideal for small and medium businesses and desktop/workstation environments with power requirements of 750VA/500 watts and less, the HP T750 G2 delivers reliable protection for entry level servers, desktops, work stations and small peripherals. With serial and USB connectivity for multiple configuration options, the HP T750 G2 UPS provides four output receptacles.

## HP T1000 G3 and T1500 G3 UPSs

Providing advanced power protection and increased uptime for servers, storage devices, computer equipment, and other network environments, HP's T1000 and T1500 G3 models (1000VA/670 Watts and 1400VA/950 Watts) are designed with a host of  key benefits including increased power rating, intuitive front panel display, hot-swappable batteries and prioritized shutdown using bundled HP Power Manager management software. These UPSs also feature serial and USB ports for data exchange with the host computer.

## HP T750 Japan T1000 Japan and T1500 Japan UPSs

Providing advanced power protection and increased uptime for servers, storage devices, computer equipment, and other network environments, HP's T750 Japan, T1000 Japan, and T1500 Japan UPS models (750VA/500 Watts, 1000VA/670 Watts and 1400VA/950 Watts) are designed with a host of  key benefits including increased power rating, intuitive front panel display, hot-swappable batteries and prioritized shutdown using bundled HP Power Manager management software. These UPSs also feature serial and USB ports for data exchange with the host computer.

# Run Time per HP UPS Model

Backup times** (in minutes)

| T750 G2 and T750 Japan | | |
|---|---|---|
| Load, percent | Load, Watts | Estimated battery runtime at 100% battery charge |
| 50% | 250 | 15 minutes |
| 100% | 500 | 5 minutes |

| T1000 G3 and T1000 Japan | | |
|---|---|---|
| Load, percent | Load, Watts | Estimated battery runtime at 100% battery charge |
| 50% | 335 | 15 minutes |
| 100% | 670 | 5 minutes |

| T1500 G3 and T1500 Japan | | |
|---|---|---|
| Load, percent | Load, Watts | Estimated battery runtime at 100% battery charge |
| 50% | 475 | 15 minutes |
| 100% | 950 | 5 minutes |

| R3000 | | | |
|---|---|---|---|
| Load, percent | With Standby Battery | With 1 ERM | With 2 ERMs |
| 20% | 40 minutes | 120 minutes | 250 minutes |
| 50% | 12 minutes | 45 minutes | 100 minutes |
| 80% | 6.5 minutes | 30 minutes | 60 minutes |
| 100% | 5 minutes | 20 minutes | 40 minutes |

| R/T3000 Low Volt Models | | | |
|---|---|---|---|
| Load, percent | With Standby Battery | With 1 ERM | With 2 ERMs |
| 20% | 45 minutes | 142 minutes | 256 minutes |
| 50% | 15 minutes | 55 minutes | 99 minutes |
| 80% | 7 minutes | 34 minutes | 60 minutes |
| 100% | 5 minutes | 26 minutes | 47 minutes |

| R/T3000 High Volt Models | | | |
|---|---|---|---|
| Load, percent | With Standby Battery | With 1 ERM | With 2 ERMs |
| 20% | 40 minutes | 125 minutes | 225 minutes |
| 50% | 12 minutes | 50 minutes | 99 minutes |
| 80% | 6 minutes | 30 minutes | 60 minutes |
| 100% | 4 minutes | 24 minutes | 47 minutes |

| R5500 | | | | | |
|---|---|---|---|---|---|
| Load (VA/W) | With Standby Battery | With 1 ERM | With 2 ERMs | †With 3 ERMs | †With 4 ERMs |
| 1000/900 | 59 minutes | 160 minutes | 273 minutes | 406 minutes | 520 minutes |
| 2000/1800 | 26 minutes | 75 minutes | 124 minutes | 183 minutes | 233 minutes |
| 2200/1980 | 21 minutes | 62 minutes | 100 minutes | 147 minutes | 190 minutes |
| 2500/2250 | 19 minutes | 58 minutes | 95 minutes | 140 minutes | 179 minutes |
| 2700/2430 | 17 minutes | 49 minutes | 80 minutes | 118 minutes | 153 minutes |
| 3000/2700 | 15 minutes | 46 minutes | 75 minutes | 112 minutes | 143 minutes |
| 3500/3150 | 13 minutes | 41 minutes | 65 minutes | 99 minutes | 120 minutes |
| 4500/4050 | 8 minutes | 25 minutes | 47 minutes | 68 minutes | 87 minutes |
| 5000/4500 | 7 minutes | 23 minutes | 41 minutes | 60 minutes | 76 minutes |
| *5500/4950 | 6 minutes | 21 minutes | 37 minutes | 54 minutes | 69 minutes |
| *6000/5400 | 5 minutes | 18 minutes | 32 minutes | 47 minutes | 60 minutes |

* International model only.
†Requires firmware v2.08 or higher


Three Phase UPS

| Battery Runtime Chart | | | | | | | |
|---|---|---|---|---|---|---|---|
| | kW | % | Internal | +1 ERM | +2 ERM | +3 ERM | +4 ERM |
| **Load per R8000/3** | 1.6 | 20% | 55 | 118 | 183 | 253 | 329 |
| | 2.4 | 30% | 37 | 78 | 119 | 163 | 211 |
| | 4 | 50% | 23 | 46 | 69 | 94 | 120 |
| | 6 | 75% | 13 | 30 | 44 | 59 | 76 |
| | 8 | 100% | 9 | 21 | 32 | 43 | 54 |

| Battery Runtime Chart | | | | | | | |
|---|---|---|---|---|---|---|---|
| | kW | % | Internal | +1 ERM | +2 ERM | +3 ERM | +4 ERM |
| **Load per R12000/3 UPS** | 1.6 | 13% | 55 | 118 | 183 | 253 | 329 |
| | 2.4 | 20% | 37 | 78 | 119 | 163 | 211 |
| | 4 | 33% | 23 | 46 | 69 | 94 | 120 |
| | 6 | 50% | 13 | 30 | 44 | 59 | 76 |
| | 8 | 67% | 9 | 21 | 32 | 43 | 54 |
| | 9.6 | 80% | 6.9 | 17 | 26 | 34 | 44 |
| | 12 | 100% | 4.8 | 12 | 20 | 27 | 34 |

| | Number of UPS Modules | Total load kW | Internal | +1 ERM | +2 ERM | +3 ERM | +4 ERM | Configuration |
|---|---|---|---|---|---|---|---|---|
| **Parallel Systems** | 6 | 60 | 6 | 15 | 22 | 29 | 37 | N+1 |
| | 5 | 48 | 6.9 | 17 | 26 | 34 | 44 | N+1 |
| | 4 | 36 | 7.7 | 18 | 28 | 37 | 47 | N+1 |
| | 3 | 24 | 9 | 21 | 32 | 43 | 54 | N+1 |
| | 2 | 12 | 13 | 30 | 44 | 59 | 76 | N+1 |

** **NOTE:** Backup times are estimated for typical applications. Actual performance will depend on load and battery conditions.

## Recommended Power Distribution Units (PDU)

| UPS Model Number | UPS Description | PDU Model Number | PDU Description |
|---|---|---|---|
| AF419A | R1500 G2 NA | NA | NA |
| AF418A | R1500 G2 INTL | NA | NA |
| AF421A | R1500 G2 JPN/TWN | NA | NA |
| AF422A | R3000 Low Volt NA | 252663-D71 | Single Phase Modular 2.8 kVA PDU + 4 extension bars |
| AF423A | R3000 High Volt NA | 252663-B24 | Single Phase Modular 3.6 kVA PDU + 2 extension bars |
| AF425A | R3000 Low Volt JPN | 252663-D71 | Single Phase Modular 2.8 kVA PDU + 4 extension bars |
| AF424A | R3000 High Volt JPN | 252663-B24 | Single Phase Modular 3.6 kVA PDU + 2 extension bars |
| AF414A | R3000 High Volt INTL | 252663-B24 | Single Phase Modular 3.6 kVA PDU + 2 extension bars |
| AF452A | R/T3000 Low Volt NA/JPN | 252663-D71 | Single Phase Modular 2.8 kVA PDU + 4 extension bars |
| AF453A | R/T3000 High Volt NA/JPN | 252663-B24 | Single Phase Modular 3.6 kVA PDU + 2 extension bars |
| AF454A | R/T3000 High Volt INTL | 252663-B24 | Single Phase Modular 3.6 kVA PDU + 2 extension bars |
| AF416A | R5500 INTL | 252663-B31 | Single Phase Modular 7.3 kVA PDU + 4 extension bars |
|  |  | AF915A | Single Phase Monitored 7.3 kVA Single Input Half Rack Height |
| AF426A | R5500 NA/JPN | 252663-D72 | Single Phase Modular 4.9 kVA PDU + 4 extension bars |
|  |  | AF914A | Single Phase Monitored 4.9 kVA  PDU Single Input Half Rack Height |
| AF431A | R8000/3 NA | AF512A | Three Phase Modular 8.6 kVA PDU |
|  |  | AF504A | Three Phase Monitored 8.6 kVA Single Input Full Rack Height |
| AF432A | R8000/3 INTL | AF513A | Three Phase Modular 11 kVA PDU |
|  |  | AF508A | Three Phase Monitored 11 kVA Single Input Full Rack Height |

| UPS Model Number | UPS Description | PDU Model Number | PDU Description |
|---|---|---|---|
| AF429A | R12000/3 NA | AF512A | Three Phase Modular 8.6 kVA PDU |
| | | AF504A | Three Phase Monitored 8.6 kVA Single Input Full Rack Height |
| | | AF503A | Three Phase Monitored 17.3 kVA Dual Input Full Rack Height |
| AF430A | R12000/3 INTL | AF513A x 2 | Three Phase Modular 11 kVA PDU |
| | | AF508A x 2 | Three Phase Monitored 11 kVA Single Input Full Rack Height |
| | | AF507A | Three Phase Monitored 22.1 kVA Dual Input Full Rack Height |
| AF438A | RP36000/3 NA | AF512A | Three Phase Modular 8.6 kVA PDU |
| | | AF504A | Three Phase Monitored 8.6 kVA Single Input Full Rack Height |
| AF439A | RP36000/3 INTL | AF513A | Three Phase Modular 11 kVA PDU |
| | | AF508A | Three Phase Monitored 11 kVA Single Input Full Rack Height |
| | | AF507A | Three Phase Monitored 22.1 kVA Dual Input Full Rack Height |

| UPS Model Number | UPS Description | PDU Model Number | PDU Description |
|---|---|---|---|
| AF446A | T750 G2 NA | NA | NA |
| AF447A | T750 G2 INTL | NA | NA |
| AF456A | T750 JAPAN | NA | NA |
| AF448A | T1000 G3 NA | NA | NA |
| AF449A | T1000 G3 INTL | NA | NA |
| AF457A | T1000 JAPAN | NA | NA |
| AF450A | T1500 G3 NA | NA | NA |
| AF451A | T1500 G3 INTL | NA | NA |
| AF458A | T1500 JAPAN | NA | NA |

# Avoiding Potential Glitches

## 1. Configuring the HP software for delay before shutdown

One must consider the run time required to gracefully shut down a system. Every server with its configured operating system (OS) and subsequent attached storage has a required time for shutdown, which must be taken into account when configuring the UPS software so sufficient battery life is allotted for the graceful shutdown of the attached equipment. However, it is recommended that the software be configured with a small delay before shutdown (30 seconds). If an event were to occur that would cause the UPS to revert to battery, the delay would provide enough time to check if utility power returns and then abort the planned shutdown. If a delay is not set, then every time the UPS goes on battery to protect from a power anomaly, the UPS software will direct the attached load to shut down. For detailed information and a step-by-step process to configure this, please refer to your Owner's Manual.

## 2. When Performing a Hot Swap Electronics Module Replacement on the R3000 UPS electronics module

When installing or replacing the electronics module on the HP R3000 UPS, the Test/Reset button must be held in while seating electronics module for at least 5 seconds otherwise it is possible that the load will shut down. Please refer to your Owner's Manual for further instructions.

## 3. Installing Extended Runtime Modules (ERMs)

Depending on the UPS model, you may need to manually inform the UPS when an ERM has been added. On many models this can be done via the front panel. However, with some UPSs you may need to run a ERM configuration utility that can be found on hp.com  If this process is not completed, the ERM will still provide backup time to the equipment;  however, proper runtimes and data will not be correctly reported. For more information, please refer to the documentation at http://h18004.www1.hp.com/products/servers/platforms/rackandpower.html.

## 4. Do not load a UPS past 80%

Although it is acceptable to load a UPS to 100% capacity, it is not recommended. Load devices, like servers and storage, have an initial inrush current that exceeds their normal operating current. If a UPS is loaded to 100% capacity, the initial inrush current of powering on the load devices could cause an overload condition.

Additionally, as batteries age, the runtime is often adversely affected. When a UPS is loaded to 100% with older batteries, there may not be sufficient runtime to gracefully shut down the load.

## 5. Considerations when configuring a redundant system

When configuring a UPS in a redundant configuration --- in which one UPS would assume the load of a second UPS if needed --- the UPS should not be loaded past 40%. Therefore, in the event that the second load was assumed, the combined total would not exceed the recommended maximum capacity of 80% (as described in #4 above). Additionally in order to configure a UPS in a redundant configuration one must purchase and install an HP Management Module (www.hp.com/products/ups) in each UPS.

## 6. Battery Testing

The battery test function in HP Power Manager does not initiate a battery test on the rackmount UPS models, nor does it represent the results of the internal UPS battery tests.

The rackmount UPS automatically performs a battery test each time it enters into rest mode, which is reached after the battery charge cycle is complete and the charger is turned off, usually within 72 hours of the beginning of the charge cycle. At the beginning of each rest mode, the UPS will measure the battery voltage degradation over a 10-day period. If after 10 days the voltage has degraded more than what the algorithm allows, then the battery alarm will indicate a bad battery. The purpose of this continual testing is to provide an advanced warning of a potentially failing battery.
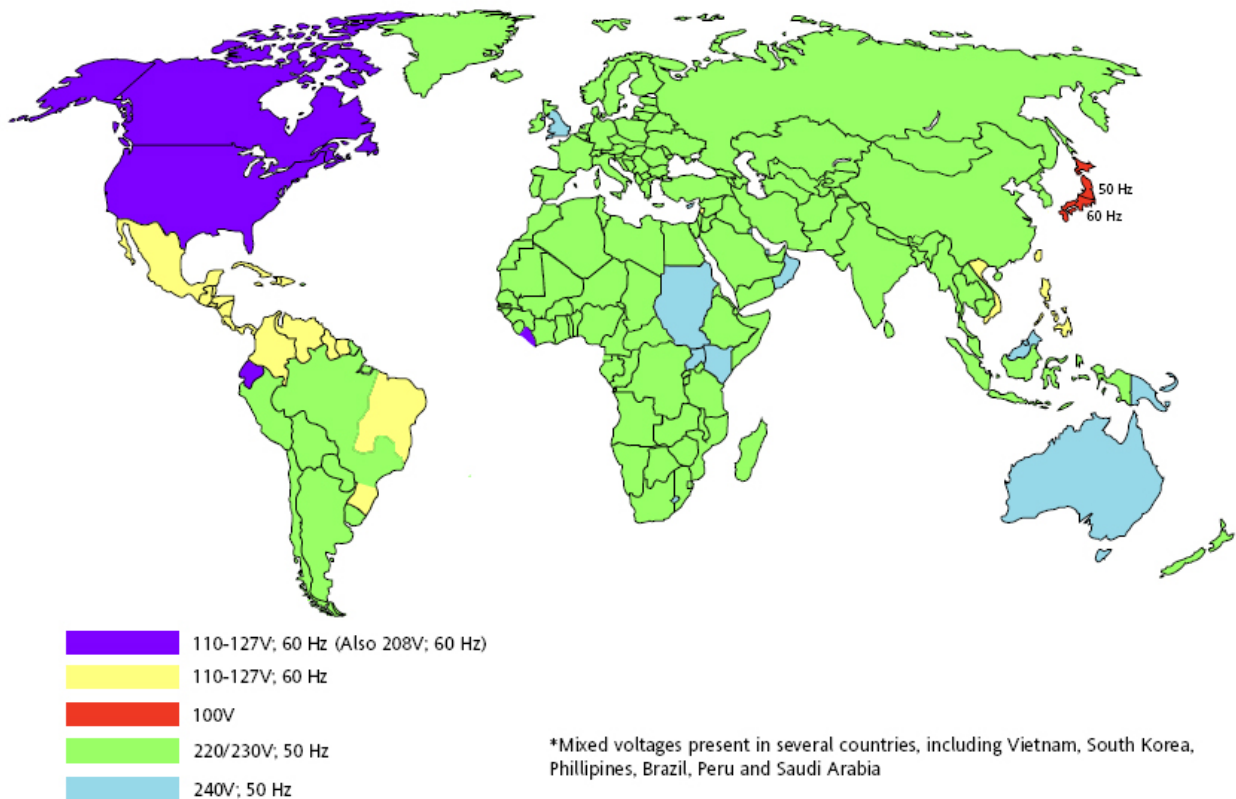
### 7. R12000/3 and the NC REPO connector

This UPS has two kinds of REPO (remote emergency power off) options, NO (normally open) and NC (normally closed). The NC REPO connector must be installed for the UPS to function properly. Not installing the NC REPO is equivalent of a REPO signal being sent to the UPS. Please refer to the users guide detailed installation instructions.

### 8. R12000/3 and A-B-C clockwise phase rotation

The HP three phase UPS require A-B-C clockwise phase rotation for the input wiring. The unit detects and reports this Phase Rotation Error if condition exists on initial start up. To resolve this condition, the electrician needs to swap any two input feed conductors. Ideally, the electrician should validate phase rotation on install using the metering device specific for this purpose. It would be recommended that the electrician be on call (or on site) at the time of startup to make the correction if required.

## Worldwide Power Requirements



**Worldwide Voltages***

110-127V; 60 Hz (Also 208V; 60 Hz)
110-127V; 60 Hz
100V
220/230V; 50 Hz
240V; 50 Hz

*Mixed voltages present in several countries, including Vietnam, South Korea, Phillipines, Brazil, Peru and Saudi Arabia

# Worldwide Voltages

| Country | Voltage | Frequency (Hz) | Country | Voltage | Frequency (Hz) |
|---|---|---|---|---|---|
| Afghanistan | 220 | 50 | France | 220-230 | 50 |
| Algeria | 127/220 | 50 | French Guiana | 220 | 50 |
| American Samoa | 120/240 | 60 | Gabon | 220 | 50 |
| Angola | 220 | 50 | Gambia | 220 | 50 |
| Anguilla (U.K.) | 240 | 50 | Germany | 220-230 | 50 |
| Antigua | 230 | 60 | Ghana | 220 | 50 |
| Argentina | 220 | 50 | Gibraltar | 240 | 50 |
| Aruba | 115/127 | 60 | Greece | 220-230 | 50 |
| Australia | 240 | 50 | Greenland | 220 | 50 |
| Austria | 220-230 | 50 | Grenada | 230 | 50 |
| Azores (Portugal) | 220 | 50 | Guadeloupe | 220 | 50 |
| Bahamas | 120 | 60 | Guam | 110-120 | 60 |
| Bahrain | 220 | 50 | Gustemala | 120 | 60 |
| Bangladesh | 220 | 50 | Guinea | 220 | 50 |
| Barbados | 115 | 50 | Guinea-Bissau | 220 | 50 |
| Belgium | 220-230 | 50 | Guyana | 110 | 50-60 |
| Belize | 110 | 60 | Haiti | 110-120 | 50-60 |
| Benin | 220 | 50 | Honduras | 110 | 60 |
| Bermuda | 120 | 60 | Hong Kong | 200 | 50 |
| Bolivia | 110-115/220 | 50 | Hungary | 220 | 50 |
| Bosnia-Herzegovina | 220 | 50 | Iceland | 220 | 50 |
| Botswana | 220 | 50 | India | 220-250 | 50 |
| Brazil | 110 | 60 | Indonesia | 220 | 50 |
|  | 220 | 50 | Iran | 220 | 50 |
| Bulgaria | 220 | 50 | Iraq | 220 | 50 |
| Burkina Faso | 220 | 50 | Ireland | 220 | 50 |
| Burma (Myanmar) | 230 | 50 | Isle of Man | 240 | 50 |
| Burundi | 220 | 50 | Israel | 230 | 50 |
| Cambodia | 120/220 | 50 | Italy | 220-230 | 50 |
| Cameroon | 220-230 | 50 | Ivory Coast | 220 | 50 |
| Canada | 120 | 60 | Jamaica | 110 | 50 |
| Canary Islands (Spain) | 220 | 50 | Japan | 100 | 50 & 60 |
| Cape Verde | 220 | 50 | Jordan | 220 | 50 |
| Cayman Islands | 120 | 60 | Kazachstan | 220 | 50 |
| Central African Republic | 220 | 50 | Kenya | 240 | 50 |
| Chad | 220 | 50 | Korea, South | 220 | 50 & 60 |
| Channel Islands | 240 | 50 | Kuwait | 240 | 50 |
| Chile | 220 | 50 | Kyrgystan | 220 | 50 |
| China | 220 | 50 | Laos | 220 | 50 |
| Christmas Island | 240 | 50 | Lativia | 220 | 50 |
| Cocos Island | 240 | 50 | Lebanon | 110-220 | 50 |
| Colombia | 110-220 | 60 | Lesotho | 240 | 50 |
| Congo | 220 | 50 | Liberia | 120 | 60 |
| Cook Islands | 240 | 50 | Libya | 127-230 | 50 |
| Costa Rica | 120 | 60 | Liechtenstein | 220 | 50 |
| Croatia | 220 | 50 | Lithuania | 220 | 50 |
| Cuba | 120 | 60 | Luxembourg | 220-230 | 50 |
| Curacao Island | 110/220 | 60 | Macao | 220 | 50 |
| Cyprus | 240 | 50 | Madagascar | 220 | 50 |
| Czech Republic | 220 | 50 | Madeir (Portugal) | 220 | 50 |
| Denmark | 220-230 | 50 | Majorca | 220 | 50 |
| Djibouti | 220 | 50 | Malawi | 230 | 50 |
| Dominica | 230 | 50 | Malaysia | 240 | 50 |
| Dominican Republic | 110 | 60 | Maldives | 230 | 50 |
| Ecuador | 120 | 60 | Mali | 220 | 50 |
| Egypt | 220 | 50 | Malta | 240 | 50 |
| El Salvador | 115 | 60 | Martinique | 220 | 60 |
| England | 240 | 50 | Mauritania | 220 | - |
| Equatorial Guinea | 220 | 50 | Mauritius | 230 | 50 |
| Estonia | 220 | 50 | Mexico | 127 | 50 |
| Ethiopia | 220 | 50 | Moldova | 220 | 50 |
| Fiji | 240 | 50 | Monaco | 220 | - |
| Finland | 220-230 | 50 |  |  |  |

| Country | Voltage | Frequency (Hz) |
|---|---|---|
| Mongolia | 220 | - |
| Montserrat | 230 | 60 |
| Morocco | 220 | 50 |
| Mozambique | 220 | 50 |
| Namibia | 220-250 | 50 |
| Nepal | 220 | 50 |
| Netherland Antilles | 120-127/220 | 50/60 |
| Netherlands | 220-230 | 50 |
| New Caledonia | 220 | 50 |
| New Zealand | 230 | 50 |
| Nicaragua | 120 | 60 |
| Niger | 220 | 50 |
| Nigeria | 230 | 50 |
| Northern Ireland | 240 | 50 |
| North Mariana Island | 115 | 60 |
| Norfolk Island | 240 | 50 |
| Norway | 220-230 | 50 |
| Okinawa | 110-120 | 60 |
| Oman | 240 | 50 |
| Pakistan | 230 | 50 |
| Panama | 110-120 | 60 |
| Papua New Guinea | 240 | 50 |
| Paraguay | 220 | 50 |
| Peru | 110/220 | 50/60 |
| Philippines | 115 | 60 |
| Poland | 240 | 50 |
| Portugal | 220 | 50 |
| Puerto Rico | 220-230 | 50 |
| Qatar | 240 | 50 |
| Romania | 220 | 50 |
| Russia | 220 | 50 |
| Rwanda | 220 | 50 |
| Saudi Arabia | 127/220 | 50/60 |
| Scotland | 220 | 50 |
| Senegal | 220 | 50 |
| Seychelles | 240 | 50 |
| Sierra Leone | 230 | 50 |
| Singapore | 230 | 50 |
| Slovakia | 220 | 50 |
| Somalia | 110/220 | 50 |
| South Africa | 220-230 | 50 |
| Spain | 220-230 | 50 |
| Sri Lanka | 230 | 50 |
| St. Kitts & Nevis | 230 | 60 |
| St. Lucia | 240 | 50 |
| St. Pierre & Miquelon | 115 | 60 |
| St. Vincent | 230 | 50 |
| Sudan | 240 | 50 |
| Surinam | 115 | 60 |
| Svalbard | 220 | 50 |
| Swaziland | 230 | 50 |
| Sweden | 220-230 | 50 |
| Switzerland | 220-230 | 50 |
| Syria | 220 | 50 |
| Tahiti | 220 | 50 |
| Taiwan | 110 | 60 |
| Tajikistan | 220 | 50 |
| Tanzania | 230 | 50 |
| Thailand | 220/230 | 50 |
| Togo | 220 | 50 |
| Tonga | 115 | 60 |

| Country | Voltage | Frequency (Hz) |
|---|---|---|
| Trinidad & Tobago | 115/230 | 60 |
| Tunisia | 220 | 50 |
| Turkey | 220 | 50 |
| Uganda | 240 | 50 |
| Ukraine | 220 | 50 |
| United Arab Emirates | 220/230 | 50 |
| United Kingdom | 240 | 50 |
| United States | 120 | 60 |
| Uruguay | 220 | 50 |
| Uzbekistan | 220 | 50 |
| Venezuela | 120 | 60 |
| Vietnam | 120/220 | 50 |
| Virgin Islands | 120 | 60 |
| Wales | 220 | 50 |
| Western Samoa | 230 | 50 |
| Yemen | 220 | 50 |
| Yugoslavia | 220 | 50 |
| Zaire | 220 | 50 |
| Zambia | 220 | 50 |
| Zimbabwe | 220 | 50 |

# UPS/PDU power cord plug/receptacle reference

*Rackmount UPS products*

| | | |
|---|---|---|
| **HP R1500 G2 NA/JPN/TWN**<br>**Part number: AF419A / AF421A** | **Input plug type**<br>**Low Voltage NEMA 5-15P** | **Output receptacles**<br>**4 - Low Voltage NEMA 5-15R** |
| **HP R1500 G2 UPS INTL**<br>**Part number: AF418A** | **Input receptacle type**<br>**High Voltage IEC320 C14** | **Output receptacles**<br>**4 - High Voltage IEC320 C13** |
| **HP R3000 low voltage UPS NA/JPN**<br>**Part number: AF422A / AF425A** | **Input plug type**<br>**Low Voltage NEMA L5-30P** | **Output receptacles**<br>**LS 1 -1 - L5-30R**<br>**LS 2 - 3 - NEMA 5-15R**<br>**LS 3 - 3 - NEMA 5-15R** |
| **HP R3000 high voltage UPS NA/JPN**<br>**Part number: AF423A / AF424A** | **Input plug type**<br>**High Voltage NEMA L6-20P** | **Output receptacles**<br>**LS 1 - 1 - L6-20R/**<br>**LS 1 - 3 – IEC320 C-13**<br>**LS 2 - 3 – IEC320 C-13**<br>**LS 3 - 3 – IEC320 C-13** |
| **HP R3000 high voltage UPS INTL**<br>**Part number: AF414A** | **Detachable Country Specific Cord plugs into High Voltage IEC320 C-19** | **Output receptacles**<br>**LS 1 - 1 – IEC320-C19**<br>**LS 1 - 3 – IEC320 C-13**<br>**LS 2 - 3 – IEC320 C-13**<br>**LS 3 - 3 – IEC320 C-13** |

| HP R/T3000 low voltage UPS NA/JPN<br>Part number: AF452A<br> | Input plug type<br>Low Voltage NEMA L5-30P<br> | Output receptacles<br>LS 1 - 2 - NEMA 5-20<br>LS 1 - 1 - NEMA L6-20R<br>LS 2 - 2 - NEMA 5-20<br> |
|---|---|---|
| HP R/T3000 high voltage UPS NA/JPN<br>Part number: AF453A<br> | Input plug type<br>High Voltage NEMA L6-20P<br> | Output receptacles<br>LS 1 - 3 - IEC320 C-13<br>LS 1 - 1 - IEC320-C19<br>LS 1 - 1 - L6-30R<br>LS 2 - 3 - IEC320 C-13<br>LS 2 - 1 - IEC320-C19<br> |
| HP R/T3000 high voltage UPS INTL<br>Part number: AF454A<br> | Detachable Country Specific Cord plugs into High Voltage IEC320 C-19<br> | Output receptacles<br>LS 1 - 3 - IEC320 C-13<br>LS 1 - 1 - IEC320-C19<br>LS 2 - 3 - IEC320 C-13<br>LS 2 - 1 - IEC320-C19<br> |
| HP R5500 high voltage UPS NA/JPN<br>Part number: AF426A<br> | Input plug type<br>High Voltage NEMA L6-30P<br> | Output receptacles<br>LS 1 - 1 L6-30R (on pigtail)<br>LS 1 - 2 - IEC C-19<br>LS 1 - 2 - IEC C-13<br>LS 2 - 2 - IEC C-19<br>LS 2 - 2 - IEC C-13<br> |
| HP R5500 high voltage UPS INTL<br>Part number: AF416A<br> | Input plug type<br>High Voltage IEC309 32A<br> | Output receptacles<br>LS 1 - 1 L6-30R (on pigtail)<br>LS 1 - 2 - IEC C-19<br>LS 1 - 2 - IEC C-13<br>LS 2 - 2 - IEC C-19<br>LS 2 - 2 - IEC C-13<br> |

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|---|---|---|
| **HP R8000/3 high voltage UPS NA**<br>**Part number: AF431A**<br> | **Input plug type**<br>**NEMA L21-30P**<br> | **Output receptacles**<br>**1 - NEMA  L15-30**<br> |
| **HP R8000/3 high voltage UPS INTL**<br>**Part number: AF432A**<br> | **Input plug type**<br>**IEC309 516P6 (16A)**<br> | **Output receptacles**<br>**1 - IEC309 516C6 (16A)**<br> |
| **HP R12000/3 high voltage UPS NA**<br>**Part number: AF429A**<br> | **Input plug type**<br>**IEC 560P9 (60A)**<br> | **Output receptacles**<br>**2 - NEMA  L15-30 - receptacle are on output module**<br> |
| **HP R12000/3 high voltage UPS INTL**<br>**Part number: AF430A**<br> | **Input plug type**<br>**IEC309 532P6 (32A)**<br> | **Receptacles on output modules**<br>**2 - IEC309 516C6 (16A)**<br> |

| | | |
|---|---|---|
| **HP RP36000/3 high voltage UPS NA**<br>**Part number: AF438A**<br> | **No Photo Available** | **Receptacles on output modules**<br>**2 - NEMA  L15-30**<br> |
| **HP RP36000/3 high voltage UPS INTL**<br>**Part number: AF439A**<br> | **No Photo Available** | **Receptacles on output modules**<br>**2 - IEC309 516C9 (16A)**<br> |

*Tower UPS products*

| HP T750 G2 UPS NA<br>Part number: AF446A<br> | Input plug type<br>Low Voltage NEMA 5-15P<br> | Output receptacles<br>4 - Low Voltage NEMA 5-15R<br> |
| --- | --- | --- |
| HP T750 G2 UPS INTL<br>Part number: AF447A<br> | Input receptacle type<br>High Voltage IEC320 C14<br> | Output receptacles<br>4 - High Voltage IEC320 C13<br> |
| HP T750 UPS JAPAN<br>Part number: AF456A<br> | Input plug type<br>Low Voltage NEMA 5-15P<br> | Output receptacles<br>6 - Low Voltage NEMA 5-15R<br> |
| HP T1000 G3 UPS NA<br>Part number: AF448A<br> | Input plug type<br>Low Voltage NEMA 5-15P<br> | Output receptacles<br>6 - Low Voltage NEMA 5-15R<br> |
| HP T1000 G3 UPS INTL<br>Part number: AF449A<br> | Input receptacle type<br>High Voltage IEC320 C14<br> | Output receptacles<br>4 - High Voltage IEC320 C13<br> |
| HP T1000 UPS JAPAN<br>Part number: AF457A<br> | Input plug type<br>Low Voltage NEMA 5-15P<br> | Output receptacles<br>6 - Low Voltage NEMA 5-15R<br> |

| | | |
|---|---|---|
| **HP T1500 G3 UPS NA**<br>**Part number: AF450A**<br> | **Input plug type**<br>**Low Voltage NEMA 5-15P**<br> | **Output receptacles**<br>**6 - Low Voltage NEMA 5-15R**<br> |
| **HP T1500 G3 UPS INTL**<br>**Part number: AF451A**<br> | **Input receptacle type**<br>**High Voltage IEC320 C14**<br> | **Output receptacles**<br>**4 - High Voltage IEC320 C13**<br> |
| **HP T1500 UPS JAPAN**<br>**Part number: AF458A**<br> | **Input plug type**<br>**Low Voltage NEMA 5-15P**<br> | **Output receptacles**<br>**6 - Low Voltage NEMA 5-15R**<br> |

## Additional Information

For more information on HP UPS solutions, please refer to the following web pages:

HP Power Manager:
http://h18004.www1.hp.com/products/servers/proliantstorage/power-protection/software/power-manager/index.html

HP UPSs:
http://h18004.www1.hp.com/products/servers/proliantstorage/power-protection/index.html#

UPS Sizing:
www.upssizer.com

For sales and technical questions or contacts, email: rackandpoweramericas@hp.com