

# HP UPS Best Practices



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## 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 500VA 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 average cost to a customer for a 15-second power interruption is \$70,000 (PG&E)
- The average location will experience 107 power events (spikes, sags, surges and blackouts) per month (NPL)
- Of 450 Fortune 100 companies surveyed by Find FVP, each suffered an average of nine IT failures per year, with about 28% of those caused by power problems.
- According to AFCOM, over the next 5 years, one out of every four data centers will experience a business disruption serious enough to affect the entire company's ability to continue business as usual. The cost of downtime for these businesses ranges from \$50,000 to \$5 million per hour.
- 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

- 90 percent of companies that experience a computer disaster and don't have a survival plan go out of business within 18 months
- The U.S. Department of Energy estimates that when a power failure disrupts IT systems:
  - 33% of companies lose \$20,00-\$500,000
  - 20% lose \$500,00 to \$2 million
  - 15% lose more than \$2 million

Some specific instances that demonstrate the staging cost of power disturbances include the following:

- Sun Microsystems estimated a loss of \$1 million per minute of power outage. (Source: ABC news story, January 2001)
- Ebay's 22-hour crash cost the company more than \$5 million in returned auction fees. (Source: PlanetIT.com "The Cost of Downtime" by Tim Wilson )
- ESPN, which lost its fantasy baseball site for three days, conceded that it will have to compensate some of its 260,000 online players, who pay \$30 each to play in the league. (Source: PlanetIT.com "The Cost of Downtime" by Tim Wilson (8/5/99))

## 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](http://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.  $\text{Current} = \text{Watts} / \text{Voltage}$ . 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 pdu's 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.

## Power Management Software is a Must on All UPS

### *Allows for Graceful Shutdown*

In addition to providing an excellent 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 Power Manager*

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 4.1 or higher.



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

## Battery Replacement

All HP UPS batteries include a standard 3-year warranty. It is best practice to replace the batteries every four 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 40°C (104°F) ambient, battery life is reduced approximately 70 percent from what would be expected at 25°C (77°F). 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.

### HP UPS Models Available

#### Rackmount UPS

AF419A	R1500 G2 1U NA
AF418A	R1500 G2 1U INTL
AF421A	R1500 G2 1U JPN/TWN
AF422A	R3000 Low Volt NA
AF423A	R3000 High Volt NA
AF425A	R3000 Low Volt JPN
AF424A	R3000 High Volt JPN
AF414A	R3000 INTL
AF416A	R5500 INTL
AF426A	R5500 NA/JPN
AF431A	R8000/3 NA
AF432A	R8000/3 INTL
AF429A	R12000/3 NA
AF430A	R12000/3 INTL

#### ERM'S

AF415A	KIT, OPT, ERM, 3KVA
AF417A	KIT, OPT, R5500, ERM
AF412A	R/T2200 G2 ERM
AF434A	KIT, OPT, ERM, HP 3 PHASE UPS

#### UPS Options

AF410A	HP UPS Management Module
AF402A	Serial Adaptor

#### Tower UPS

361475-001	T500
378439-D71	T750
AF403A	T1000 G2 NA
AF404A	T1000 G2 JPN/TWN
AF405A	T1000 G2 INTL
AF406A	T1500 G2 NA
AF407A	T1500 G2 JPN/TWN
AF408A	T1500 G2 INTL
AF409A	R/T2200 G2 NA
AF410A	R/T2200 G2 JPN/TWN
AF411A	R/T2200 G2 INTL

## Run Time per HP UPS Model

### Backup Times\* (in minutes)

Tower UPS Models		Load								
	100W	200W	300W	400W	500W	600W	800W	900W	1000W	1100W
T500	29	9	6							
T750	46	23	15	9	5					
T1000 G2	81	35	22	14	11	8				
T1500 G2	126	54	34	24	20	14	10	8		
R/T2200	231	108	65	44	35	26	18	14	12	10
R/T2200 + 1 ERM	601	282	203	128	104	82	57	48	43	37

Rack UPS Models		Load																
	200W	400W	600W	800W	1000W	1200W	1400W	1600W	1800W	2000W	2200W	2400W	2600W	2800W	3000W	4000W	5000W	5400W
R1500G2	58			8	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
R3000			43	32	22	17	13	11	9	8	7	6	5					
R3000 + 1 ERM	383	201	136	103	82	68	58	50	44	39	35	32	27					
R3000 + 2 ERM		342	232	175	140	116	99	86	75	67	61	55	50					
R5500	282	130	87	65	52	44	37	33	29	22	19	17	15	13	12	8	5.7	5
R5500 + 1 ERM		411	263	191	150	123	103	89	78	69	62	56	51	47	43	27	21	19
R5500 + 2 ERM			477	345	268	218	183	157	137	121	108	98	89	81	75	52	40	36

\* Backup times are estimated for typical applications. Actual performance will depend on environmental conditions, ambient temperature, battery age, and other factors.

Battery Runtime Chart							
Load per R12000/3 UPS	kW	%	Internal	+1 ERM	+2 ERM	+3 ERM	+4 ERM
	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

Battery Runtime Chart							
Load per R8000/3	kW	%	Internal	+1 ERM	+2 ERM	+3 ERM	+4 ERM
	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

Parallel Systems	Number of UPS Modules	Total load kW	Internal	+1 ERM	+2 ERM	+3 ERM	+4 ERM	Configuration
	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



## 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). The R/T2200 is available in a 2U form factor.

### *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 shields 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 Cards enhance communication and UPS capabilities, including scalability and network connectivity
- PDUs manage power distribution in rack environments without consuming valuable rack space

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

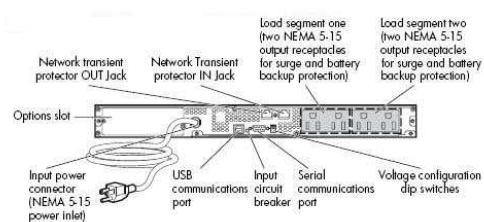
### *Best-in-class Warranty*

- 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

### *R1500 G2 Rackmount UPS*

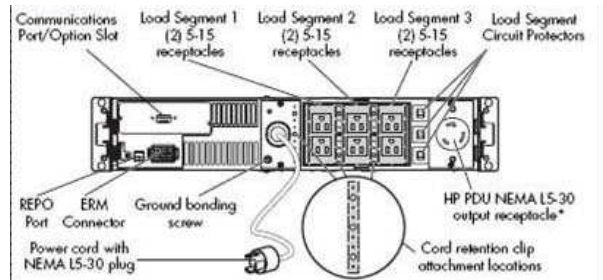
The HP R1500 G2 UPS is a high power-density solution designed for customers desiring power protection in space-constrained rack environments. Offering 1500VA/1050Watts of protection, the R1500 G2 occupies just 1U of valuable rack space, while delivering key benefits such as Enhanced Battery Management, Load Segment Control, and serial and USB ports for data exchange. The R1500 UPS is recommended for all DL servers except the 500 series.



### *HP R3000 Rackmount UPS*

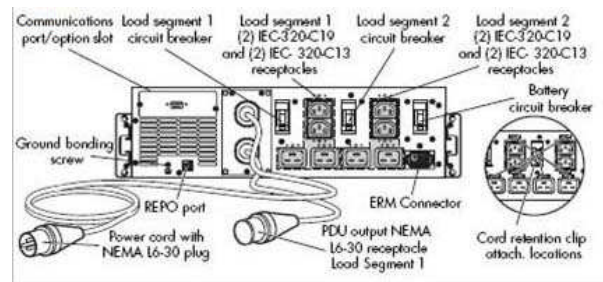
The HP R3000 UPS is a high power-density solution designed for customers desiring superior power protection in space-constrained rack enterprise environments. This leading-edge UPS features a space-saving 2U design that delivers up to 2700 watts of true power for unprecedented power density. The R3000 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. The R3000 UPS is recommended for all DL and ML servers.





### 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 (ERMs); and easy serviceability with hot-swappable electronics and batteries. The R5500 UPS is recommended for all DL and ML servers.



### HP R/T 2200 G2 UPS

With a flexible rack-to-tower deployment option, this convertible UPS model features 2200VA/1600 Watts with an optional Extended Runtime Module (ERM), intuitive front panel display, hot-swappable batteries and prioritized shutdown using bundled HP Power Manager management software. Furthermore, the HP R/T 2200 G2 UPS includes both rails for rackmounting and feet for non-rack environments. The R/T 2200 UPS is recommended for all DL and ML servers.



### HP Three-phase Rack-mountable UPS Line

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 (available with 12kVA/12kW modules to parallel up to 60kVA/60kW)



## 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
  - 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

### *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

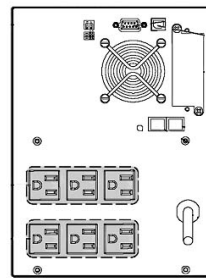
### *HP T500 UPS*

Designed for the SMB and desktop/workstation market, the HP T500 UPS provides protection from power outages and electrical line surges for equipment with power requirements of 500 VA/300 watts and less. Furthermore, the UPS's "surge-only" outlets completely protect non-critical peripherals without committing battery power to support them during a blackout. HP Power Manager software provides monitoring and control of the UPS locally or remotely, while enabling users to broadcast alarms, monitor power conditions and perform an orderly shutdown in the event of a power failure. Includes six NEMA 5-15R receptacles, three with UPS and surge suppression and three with surge suppression only. The T500 is recommended for the ML110 server.



### *HP T750 UPS*

Ideal for small and medium businesses and desktop/workstation environments with power requirements of 750VA/500 watts and less, the HP T750 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 UPS provides six output receptacles. The T750 is recommended for the ML150 server.



### *HP T1000 and T1500 UPSs*

Providing advanced power protection and increased uptime for servers, storage devices, computer equipment, and other network environments, HP's Tower UPS G2 models (1000VA/650 Watts and 1500VA/900 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. The T1000 UPS is recommended for all ML servers 330 and below. The T1500 UPS is recommended for all DL, ML servers except the 500 series.



## 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](http://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 [www.hprackandpower.com](http://www.hprackandpower.com).

### ***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](http://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***

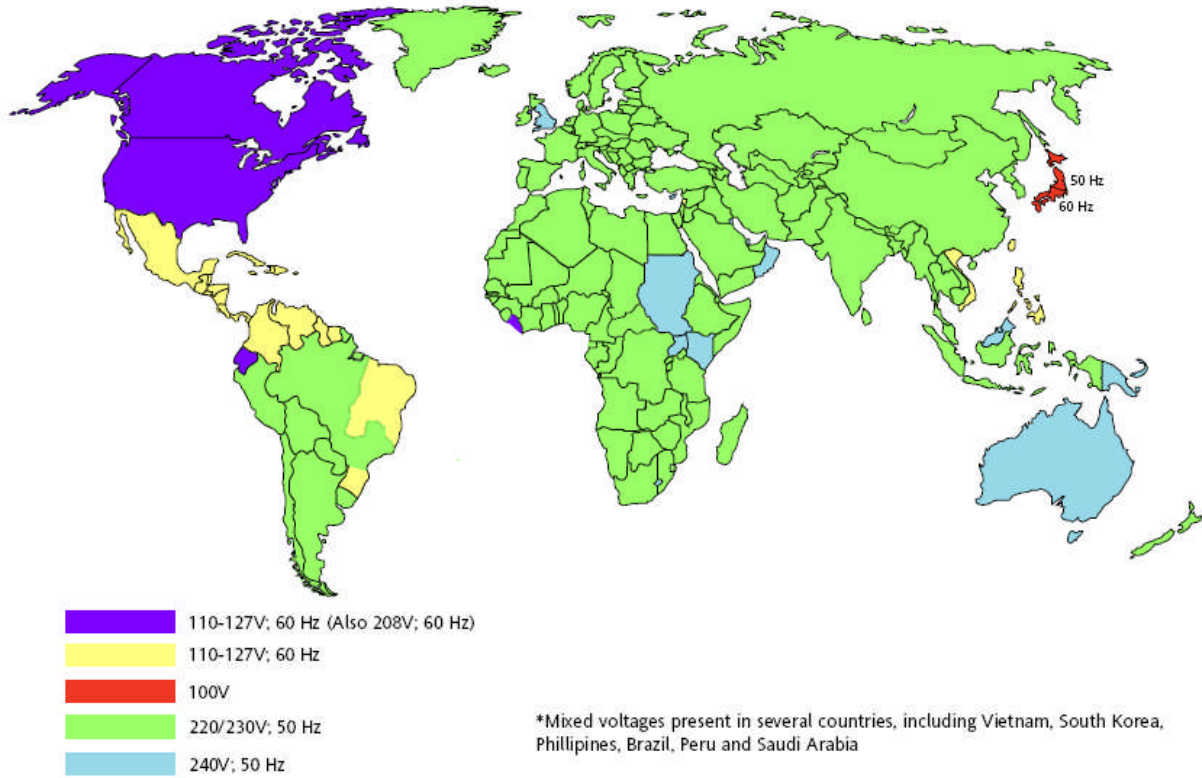
This UPS has two kinds of REPO (remote emergency power off) options, NO (normally open) and NC (normally closed). The NC REPO connector must be installed for the UPS to function properly. Not installing the NC REPO is equivalent of a REPO signal being sent to the UPS. Please refer to the users guide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





## Worldwide Voltages

Country	Voltage	Frequency (Hz)
Afghanistan	220	50
Algeria	127/220	50
American Samoa	120/240	60
Angola	220	50
Anguilla (U.K.)	240	50
Antigua	230	60
Argentina	220	50
Aruba	115/127	60
Australia	240	50
Austria	220-230	50
Azores (Portugal)	220	50
Bahamas	120	60
Bahrain	220	50
Bangladesh	220	50
Barbados	115	50
Belgium	220-230	50
Belize	110	60
Benin	220	50
Bermuda	120	60
Bolivia	110-115/220	50
Bosnia-Herzegovina	220	50
Botswana	220	50
Brazil	110	60
	220	50
Bulgaria	220	50
Burkina Faso	220	50
Burma (Myanmar)	230	50
Burundi	220	50
Cambodia	120/220	50
Cameroon	220-230	50
Canada	120	60
Canary Islands (Spain)	220	50
Cape Verde	220	50
Cayman Islands	120	60
Central African Republic	220	50
Chad	220	50
Channel Islands	240	50
Chile	220	50
China	220	50
Christmas Island	240	50
Cocos Island	240	50
Colombia	110-220	60
Congo	220	50
Cook Islands	240	50
Costa Rica	120	60
Croatia	220	50
Cuba	120	60
Curacao Island	110/220	60
Cyprus	240	50
Czech Republic	220	50
Denmark	220-230	50
Djibouti	220	50
Dominica	230	50
Dominican Republic	110	60
Ecuador	120	60
Egypt	220	50
El Salvador	115	60
England	240	50
Equatorial Guinea	220	50
Estonia	220	50
Ethiopia	220	50
Fiji	240	50
Finland	220-230	50

Country	Voltage	Frequency (Hz)
France	220-230	50
French Guiana	220	50
Gabon	220	50
Gambia	220	50
Germany	220-230	50
Ghana	220	50
Gibraltar	240	50
Greece	220-230	50
Greenland	220	50
Grenada	230	50
Guadeloupe	220	50
Guam	110-120	60
Guatemala	120	60
Guinea	220	50
Guinea-Bissau	220	50
Guyana	110	50-60
Haiti	110-120	50-60
Honduras	110	60
Hong Kong	200	50
Hungary	220	50
Iceland	220	50
India	220-250	50
Indonesia	220	50
Iran	220	50
Iraq	220	50
Ireland	220	50
Isle of Man	240	50
Israel	230	50
Italy	220-230	50
Ivory Coast	220	50
Jamaica	110	50
Japan	100	50 & 60
Jordan	220	50
Kazakhstan	220	50
Kenya	240	50
Korea, South	220	50 & 60
Kuwait	240	50
Kyrgyzstan	220	50
Laos	220	50
Latvia	220	50
Lebanon	110-220	50
Lesotho	240	50
Liberia	120	60
Libya	127-230	50
Liechtenstein	220	50
Lithuania	220	50
Luxembourg	220-230	50
Macao	220	50
Madagascar	220	50
Madeira (Portugal)	220	50
Majorca	220	50
Malawi	230	50
Malaysia	240	50
Maldives	230	50
Mali	220	50
Malta	240	50
Martinique	220	60
Mauritania	220	-
Mauritius	230	50
Mexico	127	50
Moldova	220	50
Monaco	220	-

Country	Voltage	Frequency (Hz)
Mongolia	220	-
Montseumat	230	60
Morocco	220	50
Mozambique	220	50
Namibia	220-230	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	220	50
Yemen	220	50
Yugoslavia	220	50
Zaire	220	50
Zambia	220	50
Zimbabwe	220	50

## UPS/PDU power cord plug/receptacle reference

### *Tower UPS products*

#### **HP T500 UPS**

Part number: 361475-001



**Input plug type**  
Low Voltage NEMA 5-15P



**Output receptacles**  
6 - Low Voltage NEMA 5-15R  
3 battery/3 surge



#### **HP T750 UPS**

Part number: 378439-D71



**Input plug type**  
Low Voltage NEMA 5-15P



**Output receptacles**  
6 - Low Voltage NEMA 5-15R  
3 battery/3 surge



#### **HP T1000 G2 UPS**

Part number: AF403A



**Input plug type**  
Low Voltage NEMA 5-15P



**Output receptacles**  
8 - Low Voltage NEMA 5-15R



#### **HP T1500 G2 UPS**

Part number: AF406A



**Input plug type**  
Low Voltage NEMA 5-15P



**Output receptacles**  
8 - Low Voltage NEMA 5-15R



#### **HP R/T2200 G2**

Part number: AF409A



**Input plug type**  
Low Voltage NEMA 5-20P



**Output receptacles**  
LS 1 -1 - Nema 5-15R  
LS 2 -1 - Nema 5-15R  
LS 3 -1 - Nema 5-20R  
LS 4 -5 - Nema 5-15R



### *Rack mount UPS products*

#### **HP R1500 G2 UPS**

Part number: AF419A

**Input plug type**  
Low Voltage NEMA 5-15P

**Output receptacles**  
4 - Low Voltage NEMA 5-15R



**HP R3000 low voltage UPS**  
Part number: AF422A



**HP R3000 high voltage UPS**  
Part number: AF423A



**HP R5500 high voltage UPS**  
Part number: AF406A



**HP R8000/3 high voltage UPS**  
Part number: AF431A



**HP R12000/3 high voltage UPS**  
Part number: AF429A



**Input plug type**  
Low Voltage NEMA L5-30P



**Input plug type**  
High Voltage NEMA L6-20P



**Input plug type**  
High Voltage NEMA L6-30P



**Input plug type**  
NEMA L21-30P



**Input plug type**  
IEC 560P9



**Output receptacles**  
LS 1 - 1 - L5-30R  
LS 2 - 3 - NEMA 5-15R  
LS 3 - 3 - NEMA 5-15R



**Output receptacles**  
LS 1 - 1 - L6-20R/  
LS 1 - 3 - IEC320 C-13  
LS 2 - 3 - IEC320 C-13  
LS 3 - 3 - IEC320 C-13



**Output receptacles**  
LS 1 - 1 L6-30R  
LS 1 - 2 - IEC C-19  
LS 1 - 2 - IEC C-13  
LS 2 - 2 - IEC C-19  
LS 2 - 2 - IEC C-13



**Output receptacles**  
1 - NEMA L15-30



**Output receptacles**  
2 - NEMA L15-30



## Additional Information

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

**HP Rack and Power Manager:**

<http://h18004.www1.hp.com/products/servers/proliantstorage/power-protection/>

**HP UPSs:**

<http://www.hp.com/products/ups>

**UPS Sizing:**

[www.upssizer.com](http://www.upssizer.com)

For sales and technical questions or contacts, email: [rackandpoweramericas@hp.com](mailto:rackandpoweramericas@hp.com)