

# table of contents

## overview

why buy hp power management products .....	A1
why do you need the protection of a hp UPS? – power facts .....	A4
protecting enterprise environments with hp UPSs.....	A7
ease of serviceability with hot-swappable batteries .....	A9
extended backup with load segment control .....	A10
high-line (208V) versus low-line (120V) – what’s best for your customer?.....	A11
which hp UPS is right for you?.....	A13
worldwide power requirements .....	A14
UPS front panel configuration .....	A15

## new products

UPS r12000 xr, n+x .....	B1
--------------------------	----

## tower UPS

hp tower UPS models .....	C1
rear panels.....	C2
tower xr datasheet	

## rackmountable UPSs

hp rackmountable UPSs .....	D1
rear panels.....	D3
high-availability with hot-swappable batteries and electronics modules (r3000 xr & r12000 xr) .....	D8
digital signal processor technology advances UPS design (r3000 xr) .....	D9
wireless paralleling technology (r12000 xr) .....	D12
rackmountable UPS backup times .....	D13
rackmountable UPS datasheet	
hp UPS r12000 xr data sheet	
EE Times reprint r12000 xr	

## hp UPS options

UPS options .....	E1
power cord matrix	
power distribution units datasheet	
modular pdu datasheet	
dual input pdu datasheet	

## hp power management software

hp power management software .....	F1
------------------------------------	----

## competitive analyses

hp UPS i700 vs. APC SmartUPS 700.....	G1
hp UPS i1000 xr, i1500 xr & i2200 xr vs. APC SmartUPS 1000 VA, 1500 VA & 2200 VA.....	G2
hp UPS r1500 xr vs. APC SmartUPS 1400 Rackmount 2U & 3U .....	G3
hp UPS r3000 xr vs. APC SmartUPS 3000 Rackmount 3U X .....	G4
hp UPS r6000 vs APC SmartUPS 5000 VA RM 5U XL.....	G5
hp UPS r12000 xr vs. APC Symmetra RM 12 kVA .....	G6

# why buy hp power management products?

HP has developed a full range of power management products that protect and manage computer systems ranging from individual workstations to distributed enterprises. HP offers a wide range of uninterruptible power systems (UPSs) from 500 VA to 12 kVA in both tower and rack form factors. The bundled power management software continuously manages and monitors HP UPSs.



## competitive advantages:

### ultimate, long-term battery reliability with enhanced battery management

Batteries that are constantly trickle-charged reach the end of their useful life in less than half the time of those charged using advanced techniques such as enhanced battery management technology. HP understands that the battery reliability of your UPS is essential to ensuring network server protection. Hewlett-Packard's enhanced battery management, standard with all HP UPSs 700 VA and above, incorporates an advanced battery three-stage charging technique that doubles battery service life, optimizes battery recharge time and provides up to a 60-day advanced notification of the end of useful battery life. This innovative technology is comprised of three components:

#### • double battery service life with intelligent battery charging

All UPS batteries need charging. Extended charging, however, significantly shortens battery life. The HP UPS utilizes a three-stage charging process that ultimately doubles battery service life. First, the HP UPS rapid charges the battery to 90 percent. A constant voltage (float charge) continues until the battery reaches full capacity. The charger is then turned off and the HP UPS goes into a rest mode, enabling the battery to be preserved for future power failures. Most manufacturers use a trickle-charging method (a constant voltage feeding a low current to the battery) which dries the electrolyte and corrodes the plates, reducing potential battery life by up to 50 percent.

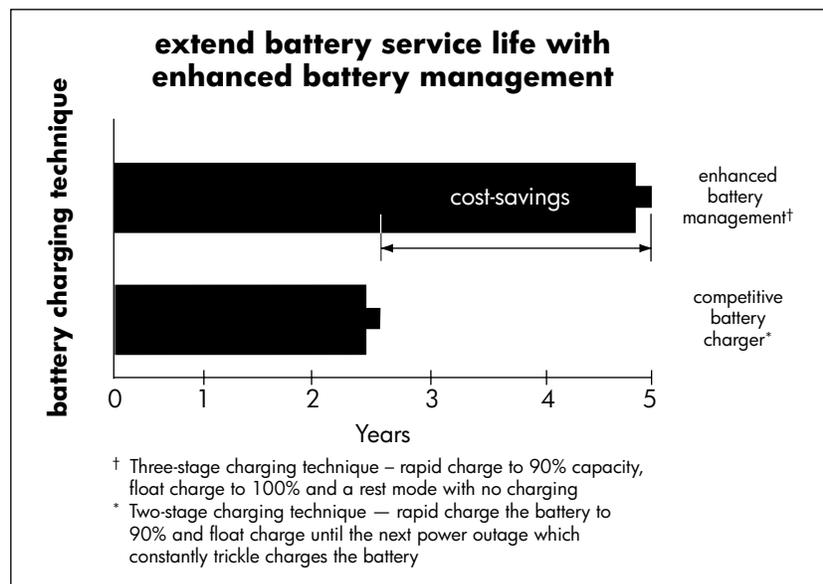
# why buy hp power management products? (cont.)

- **advance notification of battery replacement with sophisticated monitoring techniques**

All batteries will eventually fail. Because UPS batteries are valve-regulated, sealed, lead-acid cells, there has not been a practical way to provide users with advance notification of battery failure. The only way to determine that batteries needed replacing was to wait until the power failed, taking the servers and computers down with it. HP's enhanced battery management is the only technology available that reliably provides advance notification prior to battery failure. The HP UPS microprocessor tracks the charge and discharge characteristics of the battery. These characteristics are compared to an ideal battery state. By monitoring the battery, the user receives prior notice when battery replacement is necessary.

- **minimize battery use with superior voltage regulation**

Most manufacturers' UPSs correct input voltage variations as low as -25 percent, but transfer to battery when a surge or a sag needs to be filtered in the system. This type of voltage regulation shortens the battery service life of the UPS. Innovative Buck/Double Boost voltage regulation ensures consistent input voltage to the load by automatically "bucking" it if it is too high, or "boosting" it if it is too low. Voltage variations as low as -35 percent or as high as +20 percent of nominal voltage are corrected — without transferring to battery. As a result, the number of charge/recharge cycles is reduced and the life of the HP UPS battery is extended.



# why buy hp power management products? (cont.)

## **intelligent manageability with hp power management software**

HP power management software allows for diagnostics, monitoring, user notification, and — when necessary during an extended blackout — unattended, prioritized shutdown of multiple servers and client workstations. For ultimate, intelligent manageability, HP UPSs have been designed to schedule startups and shutdowns of connected equipment and control separate receptacle groups (load segments).

## **preserve valuable rack space with hp 0U/1U power distribution unit**

Designed for use in high-volume rack deployments, HP power distribution units help optimize power distribution, cable management, and space efficiency in the rack. Available in a wide range of models, ranging from 16 to 40A, HP PDUs provide up to 32 circuit breaker protected outlets.

## **hp quality**

Having built its reputation on providing the highest quality products, the HP hardware qualification process is the toughest in the industry. Extensive evaluation, testing, and product improvement guarantee the highest level of system protection, electrical performance, product construction, and compatibility.

## **superior UPS warranty**

To back up the wide range of features offered with our UPSs, HP provides a three-year limited warranty, as well as an additional \$25,000 computer load protection guarantee. The pre-failure battery warranty ensures that when the power management software notifies customers that the battery may fail, the battery or UPS is replaced free of charge under the warranty, reducing the total cost of ownership and system downtime.

# why do you need the protection of a hp UPS? - power facts

Here is some powerful information that makes you think twice about not having power protection.

## did you know...?

The amount of power required to push a single byte of information across the World Wide Web is cut in half every 18 months, but the number of bytes traveling the Web is doubling every 12 months.

A data center uses as much electricity in one day as 12 typical houses use in a year.

Cost of server downtime —

Each minute a server is down, it costs

\$108,000 in lost brokerage operations

\$43,000 in lost credit card operations

\$11,500 in lost airline reservation operations

\$16,200 in lost telephone ticket sales operations

50% of U.S. corporations rate their internet downtime costs at more than \$10,000 per hour

9% of U.S. corporations rate their internet downtime costs at more than \$50,000 per hour

Sources: *Contingency Planning Research, Eagle Rock Alliance; Yankee Group;*

*Contingency Planning and Management Online, Ernst & Young*

Cost of downtime per industry:

Energy: \$2.8M per hour

Telecomm: \$2M per hour

Financial: \$1.5M per hour

Retail: \$1M per hour

Chemicals: \$704K per hour

Health Care: \$636K per hour

Media: \$340K per hour

Average: \$1M per hour

Source: *Network Computing, March 5, 2001*

A split-second deviation in the voltage of the electricity serving a fabrication plant can crash a sensitive component, causing downtime, missed deliveries and lost product — interruptions that can cost the [semiconductor] industry as much as \$2 million per day.

Source: *EPR (Electric Power Research Institute), which manages science and technology for the energy industry, March 3, 2000*

You are 45 times more likely to have a power related problem than have a virus.

Source: *Dataquest*

Luggage lost: 1.2 in 100

Car stolen: 0.6 in 100

Burglary: 1 in 100

IRS Audit: 1.3 in 100

Power Problems: 24 in 100

Source: *"What are the chances..." FBI*

# why do you need the protection of a hp UPS? - power facts (cont.)

Power outages are the top reason for data loss.

Power failure/surge 45.3%

Storm Damage 9.4%

Fire or Explosion 8.2%

Hardware/Software Error 8.2%

Flood & Water Damage 6.7%

Earthquake 5.5%

Network Outage 4.5%

Human Error/Sabotage 3.2%

HVAC Failure 2.3%

Other 6.7%

Source: *Contingency Planning*

In some data centers, air conditioning consumes 40 percent of the total power. Keeping all of this equipment running smoothly is a daunting technical and logistical task. For a major Internet site, even a tiny glitch in the power is unacceptable.

Source: "Austin, Texas, Energy Company Tries to Meet Demand for Tech Companies", *Austin American-Statesman*, December 14, 2000

...The firms feeding the high-tech boom are increasingly dependent on a fragile power grid. At the same time, these very businesses are a big part of the problem, consuming electricity in amounts no one would have predicted even a few years ago. "The current electrical system was not ever designed for the Internet economy," said Karl E. Stahlkopf, vice president for power delivery at the Electric Power Research Institute in Palo Alto. "Anything chip related is a tremendous Achilles' heel." Power failures nationally cost more than \$50 billion a year in lost productivity, Stahlkopf said, citing a study conducted for Business Week. "Those costs will only rise as our economy becomes more silicon based," he added.

Source: "Tech Companies a Drain on Power Grid Energy: Electricity demand in Silicon Valley has grown at four times overall U.S. rate, experts estimate." *Los Angeles Times* via *DowVision*, December 12, 2000

...High-tech workers are famously workaholic but the power drain in Silicon Valley is not just a matter of employees burning the midnight oil. Far more consumption comes from the machines behind the Internet and the backup systems behind those machines, which are rapidly being deployed to insure things like e-mail services and online stock brokerages do not crash.

Source: "New Economy Puts Strain on Old Power Plants", *Reuters*, December 13, 2000

# why do you need the protection of a hp UPS? - power facts (cont.)

...An unprotected microprocessor will malfunction if power is interrupted for even a single AC cycle — 1/60th of a second. The average reliability of power “at the plug,” however, is not nearly this reliable, so an additional combination of technologies — some applied to the grid, others on the customer premises — will be required to prevent malfunction of computers and other microprocessor-based equipment.

Source: *Power Quality*, December 14, 2000

...The U.S. power grid is about 99.9 percent reliable. That means the lights are out for more than eight hours a year.

Reliability Percentage	Number of Nines	Yearly Downtime in Hours*	Equal To
99%	2	87.6 hours	3 days, 15 hours, 36 minutes
99.9%	3	8.76 hours	8 hours, 45 minutes, 36 seconds
99.99%	4	.876 hours	52 minutes, 34 seconds
99.999%	5	.0876 hours	5 minutes, 15 seconds
99.9999%	6	.00876 hours	31.54 seconds
99.99999%	7	.000876 hours	5.26 seconds
99.999999%	8	.0000876 hours	.53 seconds

\*(Based on 8,760 hours in a calendar year).

Source: *“Power and Pain: Dollars & Sense”*, Sm@rt Partner (magazine), September 18, 2000

...It is estimated that the overall impact of power-related problems can cost U.S. companies more than \$26 billion per year.

Source: *Frost & Sullivan, Power Conditioner Market (US) February, 2000*

...A split-second deviation in the voltage of the electricity serving a fabrication plant can crash a sensitive component, causing downtime, missed deliveries and lost product — interruptions that can cost the [semiconductor] industry as much as \$2 million per day.

Source: *EPRI (Electric Power Research Institute), March 3, 2000*

...ASPs, ISPs, Web hosting firms and telecoms account for about 70 percent of the UPS market.

Source: *Venture Development Corp, 2000*

...In just five years, the electricity consumed by the computer and networking systems that power e-commerce has risen from a tiny fraction of the overall electricity pool to close to 13 percent, according to RDI. That could rise to as much as 25 percent by 2010.

Source: *Resource Data International, 2000, as quoted in the InternetWeek (June 26, 2000) “E-Comm Short On Juice – Looming electricity shortages threaten Internet economy” story.*

...One in four Local Area Networks (LANs) is completely vulnerable to disaster or disruption. And 64% of organizations do not have an effective plan to protect their Wide Area Networks (WANs).

Source: *FEMA (Federal Emergency Management Association) Disaster Statistics Fact Sheet, March, 2000*

# protecting enterprise environments with hp UPSs

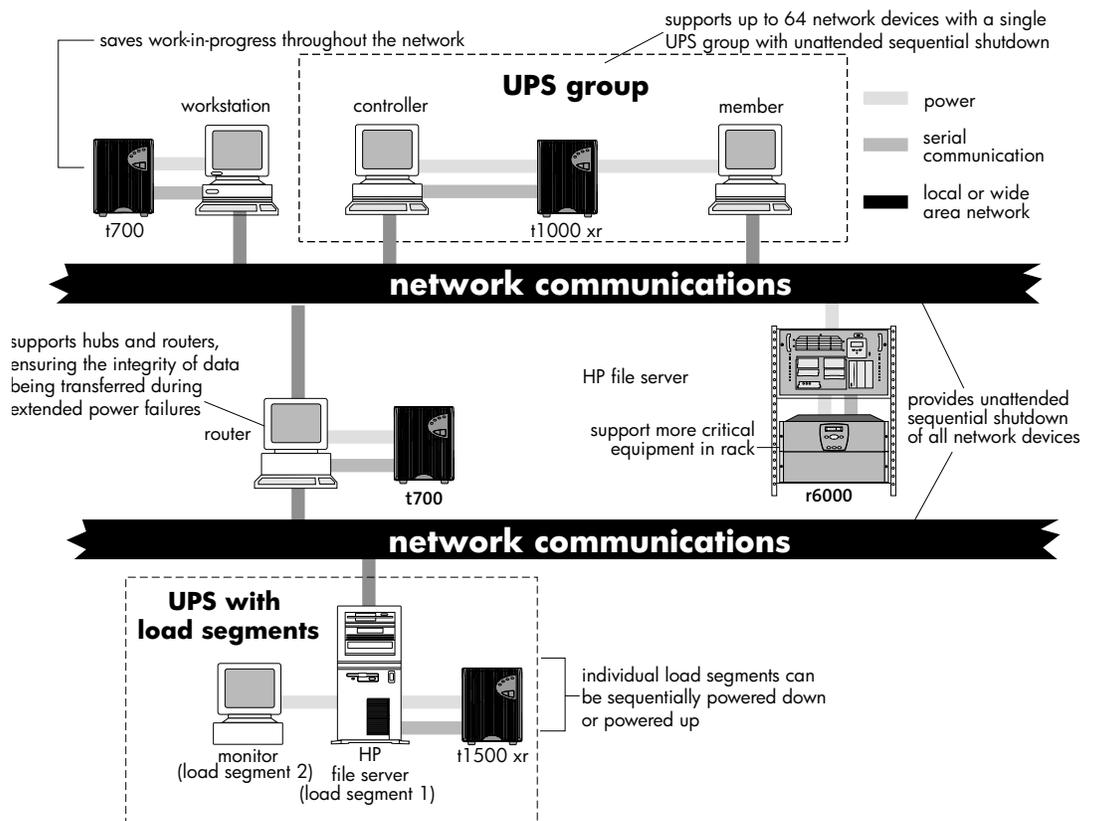
## the costly effects of power problems in an enterprise environment

The effects of blackouts and other power problems in an enterprise environment can be devastating and costly. Using an HP UPS to protect servers and other critical equipment prevents unnecessary downtime, loss of data, and damage to your hardware. Maximum data integrity and system uptime require a prioritized shutdown plan which is managed by the bundled power management software. Preserving data is an increasingly complex issue in today's enterprise environments. Communication systems are required to transfer and store information within internal computer networks and must also provide critical links to the enterprise-wide networks.

## ensure data integrity system-wide with the bundled power management software

A prioritized shutdown ensures that all network devices are shut down in an orderly, sequential manner, saving all work-in-progress throughout the network. The power management software empowers network administrators by allowing them to define their own shutdown process. Thus, a company's most critical equipment (such as a database or file server) can be shut down last, after work-in-progress has been saved from client workstations through hubs, switches, routers, and communication servers.

complete network power protection with HP power management software and HP UPSs



# protecting enterprise environments with hp UPSs (cont.)

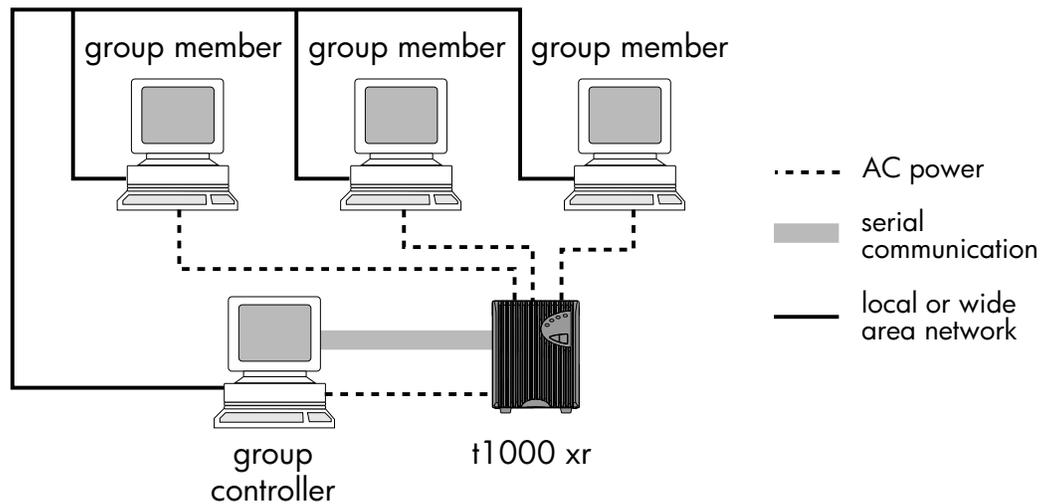
When power quality is compromised, so are a company's vital data files including data entry, orders, records, e-mail messages, and other critical business information. The power management software used in conjunction with HP UPSs plays a vital role in ensuring data integrity and the protection of your business's critical network servers and systems.

## UPS groups

When a single UPS supports more than one server or workstation, the resultant system is called a UPS group. The power management software and LanSafe III support up to 64 network devices in a single UPS group, and provides unattended, sequential shutdown of every device in that group, regardless of the operating system.

Of the servers or workstations in a UPS group, only one is connected via a serial communication cable to the UPS. This workstation or server is called the UPS group controller, while the group's other workstations or servers are called UPS group members. If the UPS group controller shuts down, its group members must shut down. UPS group members may not have a longer shutdown time than the UPS group controller.

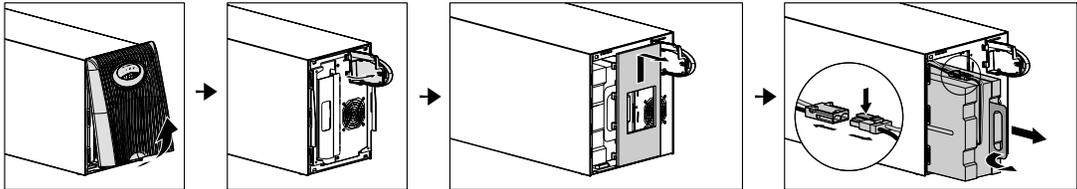
## UPS group configuration



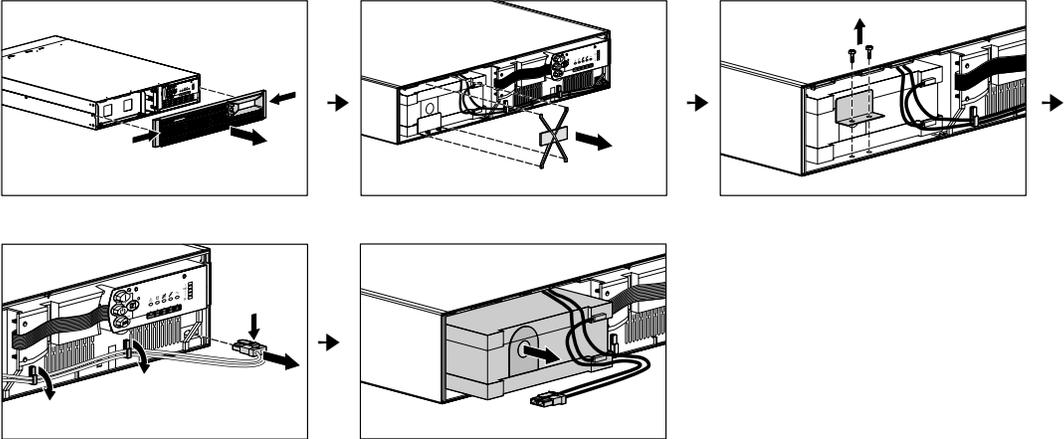
# ease of serviceability with hot-swappable batteries

While enhanced battery management has the ability to double battery service life, it cannot prevent inevitable battery failure. When your batteries reach the end of their useful life, replacement is easy with hot-swappable batteries. Simple access through the front panel allows you to safely install new batteries without ever powering down the connected equipment.

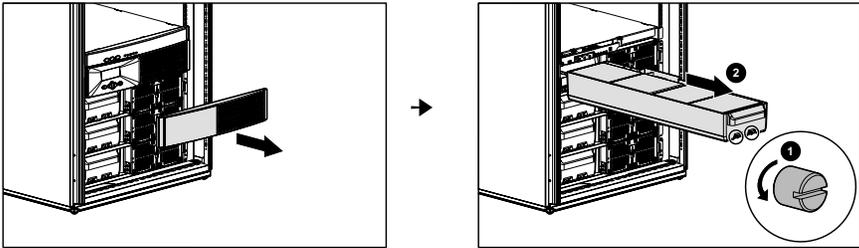
tower UPSs: t700, t1000 xr, t1500 xr & t2200 xr



rackmountable UPSs: r1500 xr & r3000 xr



rackmountable UPS: r12000 xr



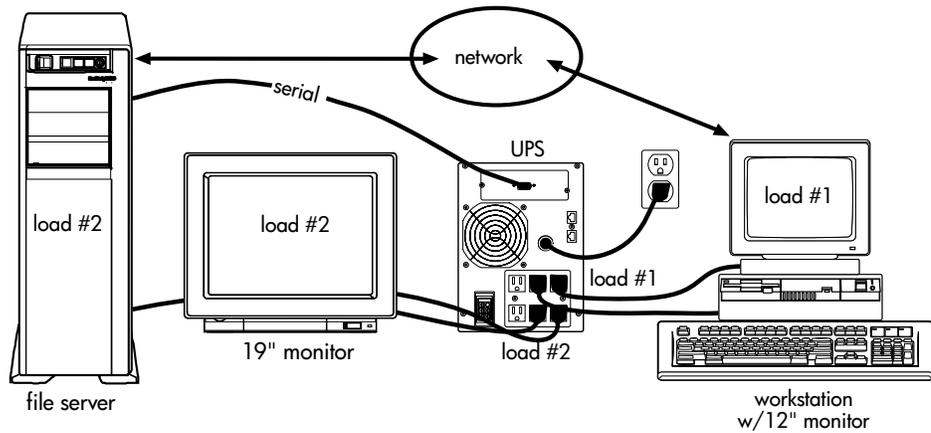
# extended backup with load segment control

With HP UPS load segment control, users have the flexibility to configure scheduled startups and shutdowns of their equipment, as well as to independently control load segments. Multiple load segmentation is available in UPSs ranging from 1000 - 6000 VA.

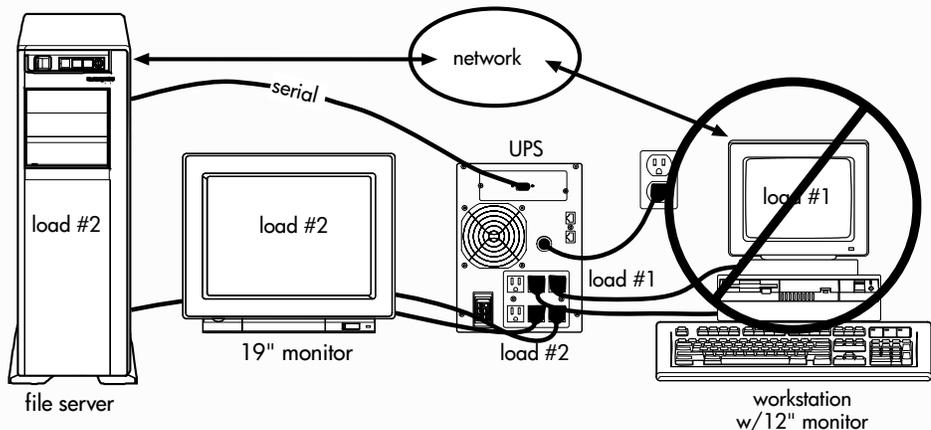
Working in conjunction with the power management software, the HP UPS can be configured to extend runtimes for critical devices. Because the receptacles on the back of the HP UPS are divided into two or more groups — called load segments — each load can be controlled independently.\* By shutting down one load segment, the runtime for more critical servers and systems is extended on the other load segment, providing additional protection by shutting down less critical servers and systems first.

The 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.

**BEFORE - total backup time = 20 minutes**



**AFTER shutting down load #1 - backup time = 28 minutes for file server and monitor**



Independently controlled load segments with HP UPSs are managed by power management software

# high-line (208V) versus low-line (120V) – what’s best for your customer?

Choosing between voltages is mainly a North American\* issue. What might be confusing is that some individuals make references to 120V power, others mention 110V power or even 117V power. These disparate figures are essentially the same. Additionally, 120V is sometimes described as low voltage. Low voltage in correct electrical specifications is a range from 100V-120V. Most homes and office spaces in North America are wired for 120V. For marketing purposes, HP chooses to use low voltage to mean 120V.

The other choices for North American single-phase voltage environments are generally 208V and 240V. These voltages are sometimes described as high voltage. High voltage in correct electrical specifications is a range from 200V-250V. For marketing purposes, HP chooses to use high voltage to mean 208V.

For commercial buildings, 208V is the high-line power available. For residential and some heavy-industrial buildings, high-line power is 240V. A typical example of residential high-line power is the household dryer that runs off of 240V.

Most servers have an auto-sensing feature that allows the server to automatically adjust to voltage levels ranging from 100V-240V. Therefore, they can be powered off of any of these voltages.

## how much power is needed?

A circuit wired for 208V will power almost twice as much equipment as 120V. However, in order to get the type of power your computer equipment needs, here are a few things to keep in mind. 120V and 208V power environments require different types of wall outlets/receptacles, circuit breakers, and plugs and power line cords.

How much power does the equipment require, and how much power is available in the existing computer room? Assume that within the computer room there is a single power outlet rated at 120V and 15 amps. This configuration is a standard and typical wall outlet, which is also found in most residential homes. The amount of power available would be calculated by taking 120V and multiplying it by 15 amps, giving a preliminary available power figure of 1,800 VA. A quick yet important safety note here: It is a safety regulation that you use only 80% of your available power in order to keep breakers from tripping and outlets from overloading. Keeping this safety regulation in mind reduces the safe available power to 1,440 VA.

Assume that there are three racks in the computer room that can hold eight servers in each of the racks, for a total of 24 servers. Those servers might be rated at 100 VA/100 watts each. The power equipment for those servers would then be 2,400 VA (24 servers \* 100 VA = 2,400 VA). 2,400 VA is too big of a power requirement given that there are only 1,440 VA currently available in the computer room. This power requirement presents a quandary.

Changing to 208V could be the answer to the dilemma. Almost twice the volts would nearly double the available power from 1,440 VA to 2,496 VA (208V \* 15 amps = 3,120 VA \* 80% = 2,496 VA) — enough to safely power the 24 servers.

\*This issue is prevalent in other regions. This article concentrates on North America.

# **high-line (208V) versus low-line (120V) – what’s best for your customer? (cont.)**

## **facilities review and advantages of 208V**

Before using 208V, a facilities review of the wiring infrastructure needs to take place to validate the feasibility of using 208V. Outcomes of this review could show that it is simple and cost effective to rewire the site for 208V. Sometimes the fix could be as easy as adding or “pulling” a 208V outlet from the local panel board or breaker. 208V is an efficient solution as it allows higher volts (more power) in the same amount of computer room space.

Circuit breakers and wall receptacles need to be upgraded to handle the new 208 voltage. Respectively, special plugs and power line cords are also needed for the server and other computer equipment. Although servers are auto-sensing, as a standard, servers ship only with 120V power cables. Plan ahead and order 208V (high voltage) power line cables for the servers and additional computer equipment. Also, note that HP UPSs and power distribution units (PDUs) are not auto-sensing but are available in high voltage models.

A facilities review of the wiring infrastructure could prove that 208V is a cost effective and efficient way to double the available power. To keep installations problem free, remember to plan ahead and match the computer equipment power cables, plugs, UPSs and PDUs to the 208V wall outlets and receptacles.

# which hp UPS is right for you?

## hp UPS product selector

HP has made it easy for you to select and buy the UPS that is right for your system. Just go to [www.upssizer.com](http://www.upssizer.com) and put the HP UPS product selector to work for you.

## determining the required UPS power rating

The table below shows which UPS models can be used with the various HP server and storage system models. This will vary with actual configurations, type of peripherals also protected by the UPS, and amount of backup time required. The VA/watts values shown on the adjacent chart are maximum values.

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, a good rule of thumb is that the computer load should be about 60% - 80% of the UPS capacity.

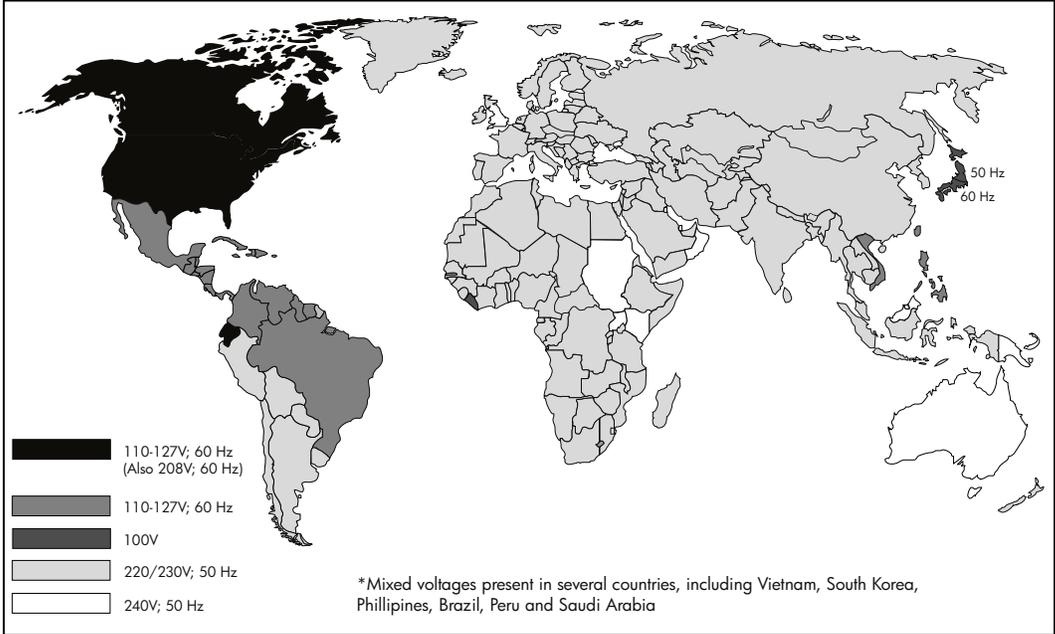
Power supplies have the ability to support high-wattage ratings in a high-line (200V - 250V) environment versus a low-line environment (100V - 120V). The high-line watt column refers to the output power in a 208V environment and low-line watt column refers to a 120V environment. These power ratings are name-plate ratings; actual ratings are typically lower than name-plate ratings and depend upon the server configuration. Use the power calculator on Activeanswers Systems Configurator ([www.compaq.com/activeanswers](http://www.compaq.com/activeanswers)) to determine power rating based on your configuration.\*

Description	Low-Line Watts	High-Line Watts	Description	Low-Line Watts	High-Line Watts
Up to 5 ProLiant BL10e	219	212	ProLiant ML530 G2	888	862
6 to 10 ProLiant BL10e	350	340	ProLiant ML570	630	612
11 to 15 ProLiant BL10e	477	465	ProLiant ML750	1344	1305
16 to 20 ProLiant BL10e	627	611	ProLiant 8000	662	643
ProLiant DL320	172	167	ProLiant 8500	495	481
ProLiant DL360	239	232	TaskSmart W2200 M10	129	125
ProLiant DL360 G2	275	267	TaskSmart W2200 M20	153	148
ProLiant DL380	338	328	TaskSmart W2200 M30	168	163
ProLiant DL380 G2	417	400	TaskSmart C4000 M30	159	154
ProLiant DL580	493	479	TaskSmart C4000 M40	161	156
ProLiant DL580 G2	917	880	TaskSmart C4000 M50	172	167
ProLiant DL590	1437	1387	TaskSmart C4000 M60	339	325
ProLiant DL760	781	758	TaskSmart C4000 M70	344	330
ProLiant ML310	270	262	TaskSmart C900	154	150
ProLiant ML330	226	220	TaskSmart C600	142	138
ProLiant ML330 G2	332	332	TaskSmart C1200	171	166
ProLiant ML350	297	288	TaskSmart C1500	190	184
ProLiant ML350 G2	425	412	TaskSmart C2000	253	245
ProLiant ML350 G3	549	534	Alpha DS10L	170	165
ProLiant ML370	393	381	Alpha DS10	210	205
ProLiant ML370 G2	309	305			
ProLiant ML370 G3	536	520			
ProLiant ML530	505	490			

\*Actual power rating may vary depending on configuration.

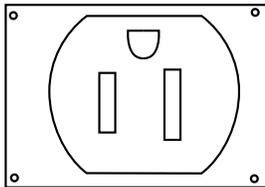
# worldwide power requirements

## worldwide voltages\*

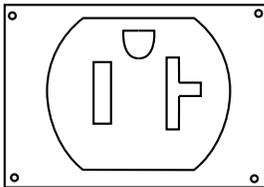


## output receptacles

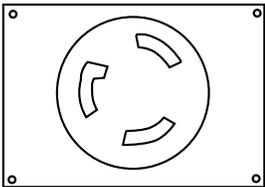
(100–127 VAC)



5-15R

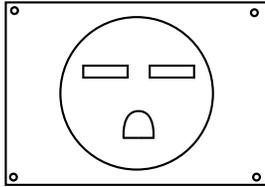


5-20R

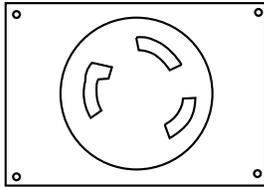


L5-30R

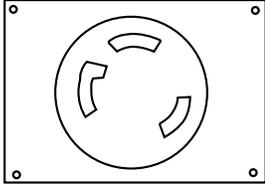
(208–240 VAC)



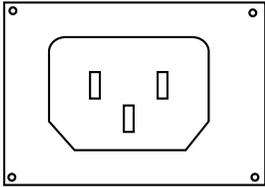
6-15R



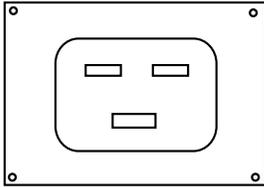
L6-20R



L6-30R



IEC-320, C13

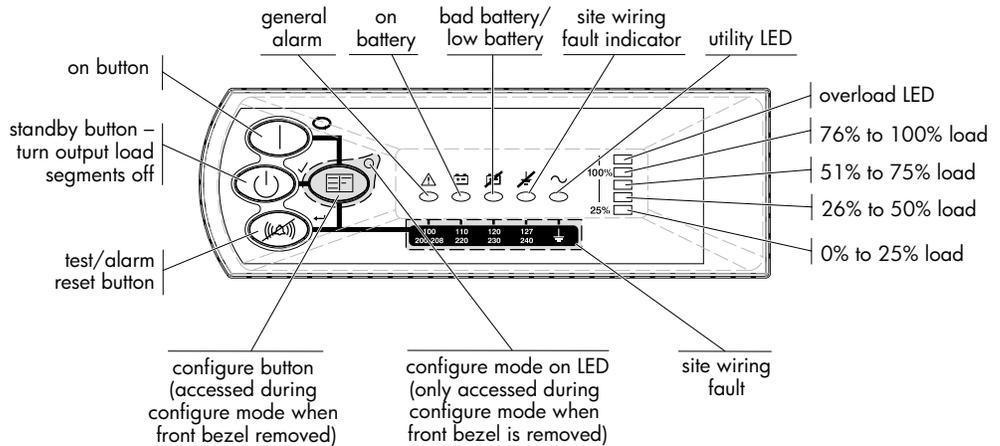


IEC-320, C19

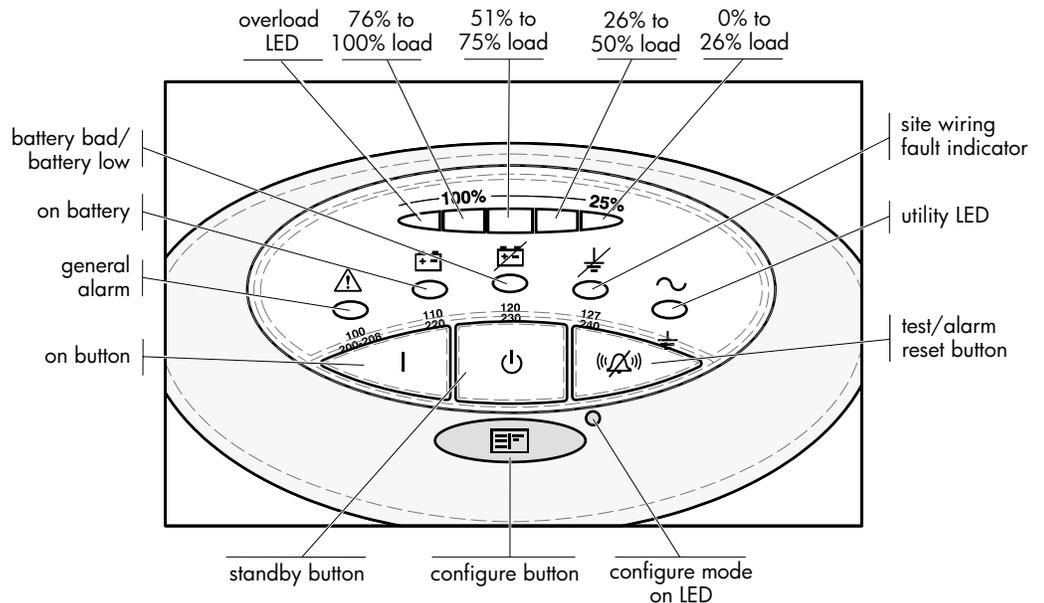
# UPS front panel configuration

HP UPS XR models feature an enhanced seven-language front panel display. LED display lights and switch membrane are integrated into the front panel that can be configured through a four-button control (three buttons for UPS control and one button under the front panel for voltage configuration).

## models: r1500 xr and r3000 xr

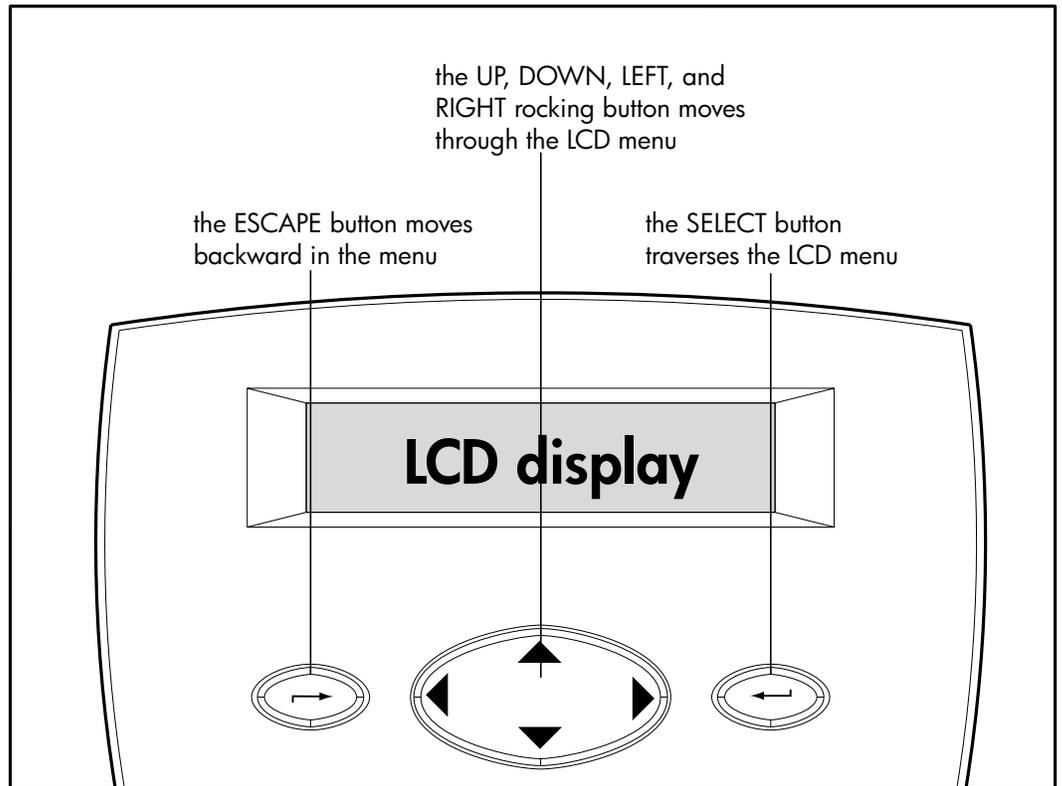


## models: t1000 xr, t1500 xr and t2200 xr

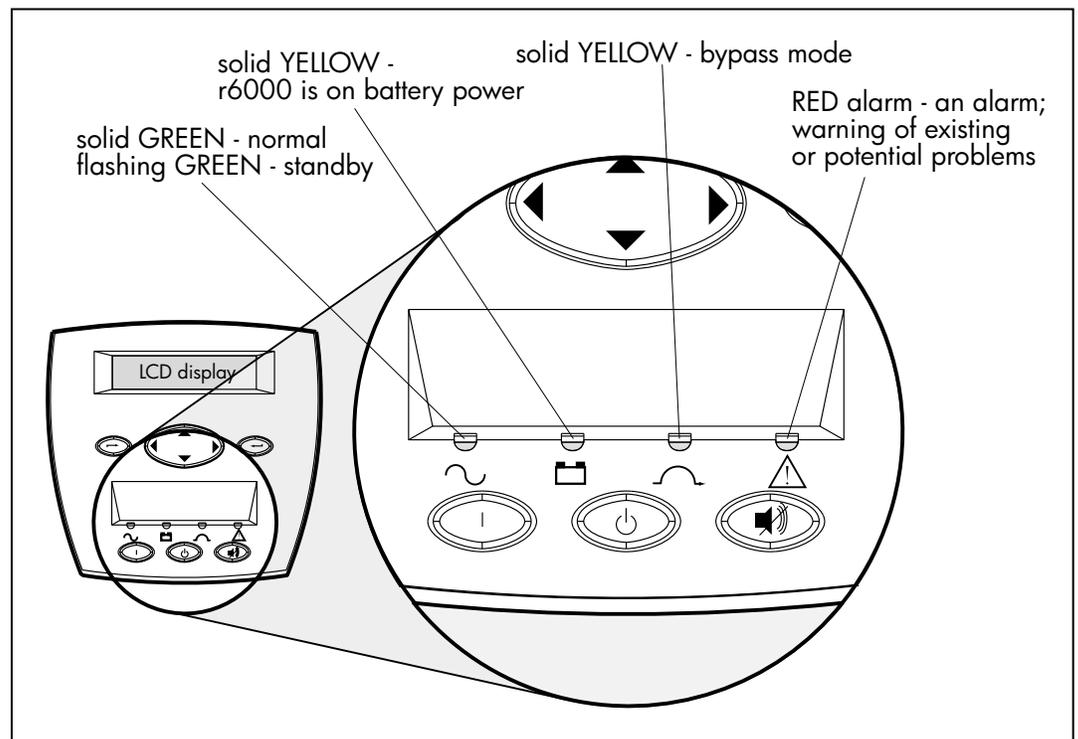


# UPS front panel configuration (cont.)

model: r6000



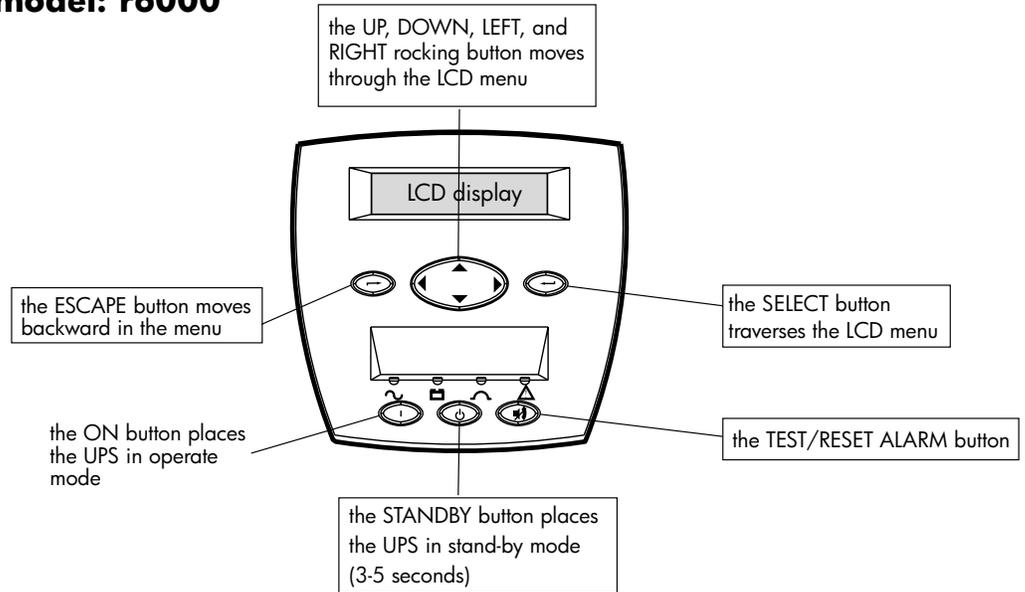
front panel buttons



front panel LEDs

# UPS front panel configuration (cont.)

model: r6000



the front control panel includes six push buttons to operate the r6000.

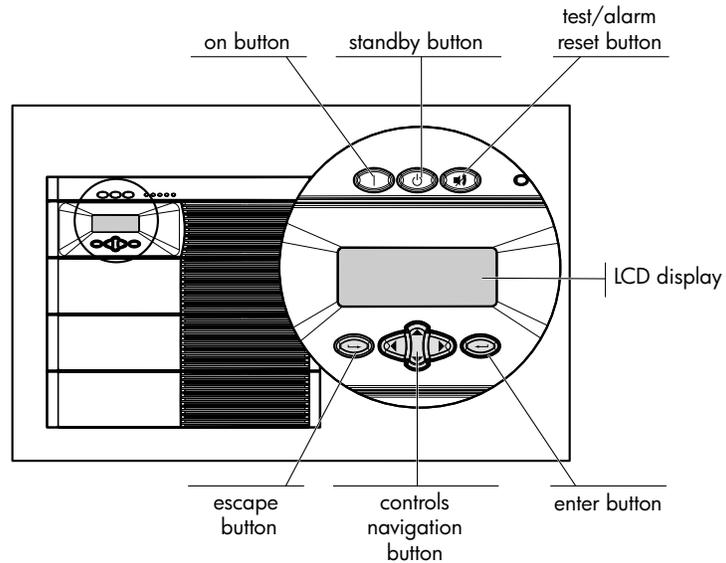
## These are the sub-menu configurations for the r6000

main menu	firmware version
status	control board
receptacle status	communication board
on battery	
on bypass	load control
load power off	adjust loads
normal	
overload	display test
	system setup-PASSWORD
meters	set hardware configuration
input volts	set language
output volts	set alarm horn
input frequency	set password (default is COMPAQ)
output frequency	set sync range $\pm$ Hertz
battery volts	comm setup
active alarms	serial port 1
input AC over voltage	baud rate
input AC over or under voltage	data bits
output overload	stop bits
inverter fault	parity
battery low	serial port 2
utility not present	baud rate
battery totally discharged	data bits
UPS on battery	stop bits
load power off	parity
battery data	set voltage
battery charge	set site fault
	set sleep mode

# UPS front panel configuration (cont.)

## models: r12000 xr

You can configure the redundancy level of the r12000 xr from 3 kVA to 12 kVA as well as view power and battery monitoring and status via the front panel LCD display. The LCD menu has a two-line LCD display with three-button control.



- 1 two-line LCD displays your menu position, showing UPS, electronics module and battery
- 2 navigates and deselects options in the LCD menu structure
- 3 large four-way rocking button; controls navigation through LCD menu structure
- 4 navigates and selects options in the LCD menu structure
- 5 on indicator - starts UPS powering the load
- 6 places UPS into standby mode/reset
- 7 resets alarm or initiates self-test

# new hp power management products

HP continuously strives to introduce new power management products with enhanced functionality to meet our customers needs.



ELECTRONIC ENGINEERING  
**EETIMES**

▶ **PRODUCT OF THE WEEK**

**July 2, 2002**

## UPSs r12000 xr, n+x

The UPS r12000 xr packs an amazing 12 kW/12 kVA worth of power into just 10U. This online rackmountable UPS is uniquely designed to meet the high-availability power protection demands of your mission-critical enterprise. Featuring an n+x modular architecture, each of the four 3 kVA modules run in parallel. A patented wireless paralleling technology built into the r12000 xr eliminates system-level single point of failure by allowing both the logic and the power to be housed in each 3 kVA module, and not in the enclosure as with most competitive UPSs. Online technology protects critical equipment against all types of power problems and creates clean, regulated power by continuous use of the inverter.

### Key Benefits:

- ultimate power protection with online technology
- more power per U than competitive UPSs (12 kW in 10U)
- patented wireless paralleling technology provides increased system reliability and flexibility
- modular design with four 3 kVA/3 kW independent modules
- n+x redundancy and scalability - 12 kW (N+0); 9 kW (N+1); 6 kW (N+2); 3 kW (N+3)
- industry leading power density with 10U rack form factor
- hot-swappable battery, electronics, and control electronics modules provides ease of maintenance and faster time to repair
- bundled power management software
- extended battery service life of 5 to 7 years with energy-dense pure lead-tin batteries and enhanced battery management technology
- easy field upgradeability with Flash ROM technology
- support for Remote Emergency Power Off (REPO)

UPS model	part number
UPS r12000 xr, n+x (High Voltage)	207552-B22
ERM, r12000 xr (High Voltage)	217800-B21

# hp tower UPS models



## pro UPS 500

HP Pro UPS 500 is a UPS for the SMB and desktop market providing protection from power outages for equipment with power requirements of 300 watts and less.

UPS model	part number
North America	136386-001
International	136386-B31



## UPS t700

Rated at 700 VA/500 watts, the new HP UPS t700 features a unique design and hot-swappable batteries. The t700 is ideal for desktop, workstation, or entry-level server environment.

UPS model	part number
t700 na	204015-001
t700 jpn	204015-291
t700 intl	204015-B31



## hp UPS tower xr models

The HP UPS tower UPS xr models feature a unique design and Extended Runtime Modules to increase the runtime capability of the UPSs. These UPSs are ideal for workstations up to the high-end server environments that require maximum uptime in the event of a power problem.

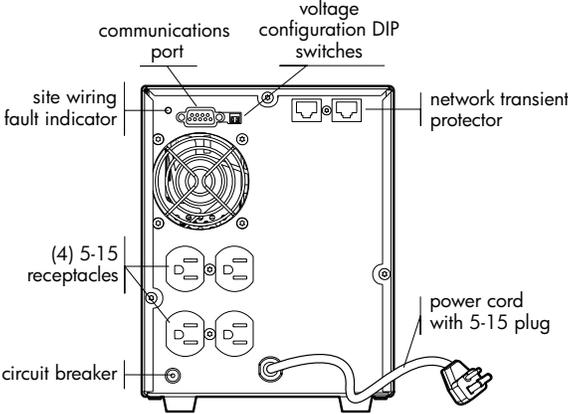
UPS model	part number
t1000 xr, na	204155-001
t1000 xr, intl	204155-B31
t1500 xr, na	204155-002
t1500 xr, jpn	204155-291
t1500 xr, intl	204155-B32
t2200 xr, na	204451-001
t2200 xr, na-high	204451-002
t2200 xr, jpn	204451-291
t2200 xr, intl	204451-B31
ERM, t1000 xr	218967-B21
ERM, t1500 xr/t2200 xr	218969-B21

**I.D. Magazine  
Annual Design  
Review  
Honorable Mention  
August 2002**

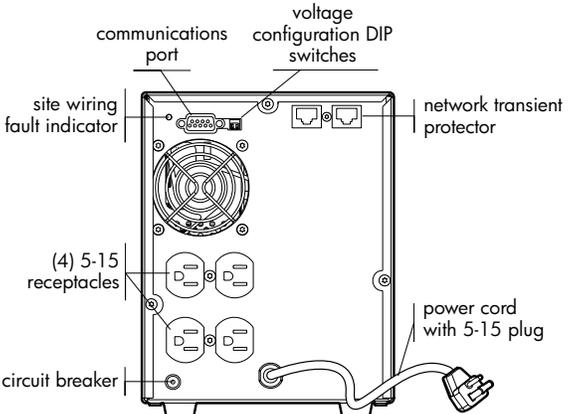
# rear panels (UPS t700)

## low voltage (100-127 VAC)

UPS t700, na

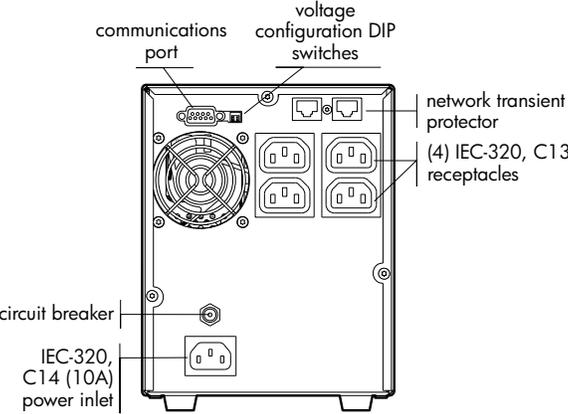


UPS t700, jpn



## high voltage (208-240 VAC)

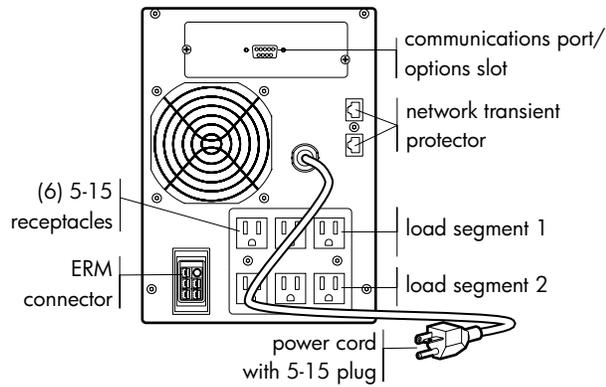
UPS t700, intl



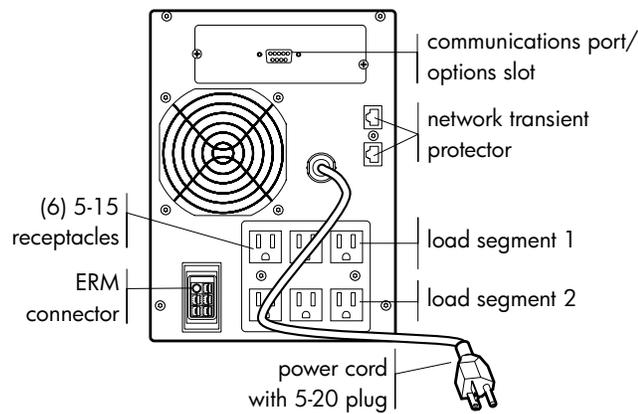
# rear panels (t1000 xr & t1500 xr)

## low voltage (100–127 VAC)

UPS t1000 xr, na & t1500 xr, na

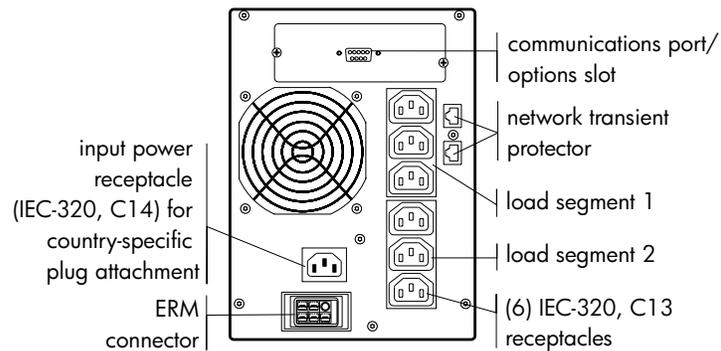


UPS t1500 xr, jpn



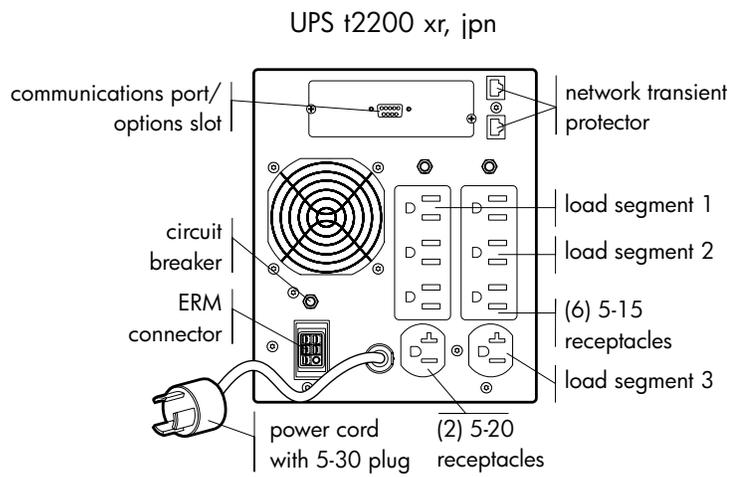
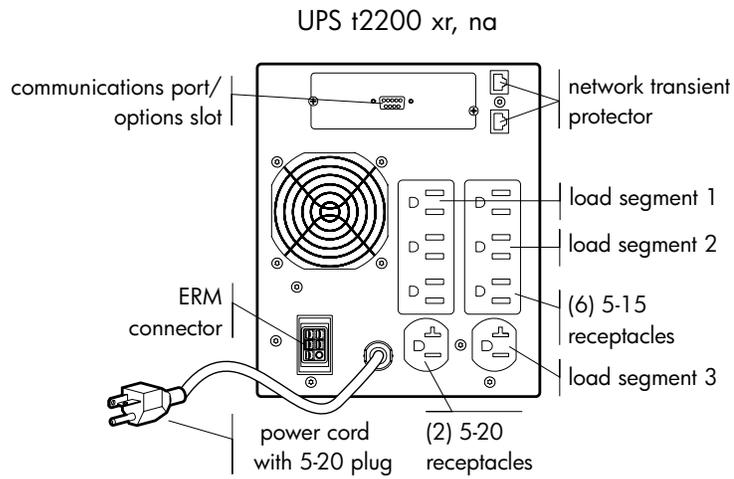
## high voltage (208–240 VAC)

UPS t1000 xr, intl & t1500 xr, intl



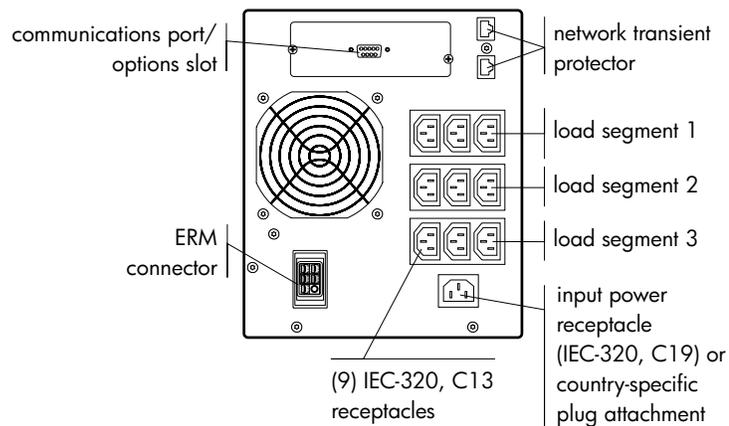
# rear panels (t2200 xr)

## low voltage (100–127 VAC)



## high voltage (208–240 VAC)

UPS t2200 xr, na high & t2200 xr, intl



# rackmountable UPSs

## UPS r1500 xr



Rated up to 1500 VA/1340 watts, the UPS r1500 xr features a compact 2U rackmountable design. The UPS r1500 xr is a high power density solution designed for customers who want to provide power protection in space-constrained rack enterprise environments. In addition, the UPS r1500 xr has the capability to be connected to up to two optional 2U extended runtime modules (ERM).

UPS model	part number
North America/Latin America	
r1500 xr, na	204404-001
r1500 xr, jpn	204404-291
r1500 xr, intl	204404-B31
ERM, r1500 xr	218971-B21

## UPS r3000 xr



The leading-edge UPS r3000 xr features the industry's first 2U rackmount unit offering up to 2700 watts of true power. Rated near unity at 3000 VA/2700W, you can support more critical equipment in space-constrained rack environments. The r3000 xr supports one optional 2U extended runtime module (ERM).

UPS model	part number
North America/Latin America	
r3000 xr, na low	192186-001
r3000 xr, na high	192186-002
Japan	
r3000 xr, jpn low	192186-291
r3000 xr, jpn high	192186-292
Europe, Middle East & Africa, Asia Pacific and China	
r3000 xr, detached cord	192186-B31
r3000 xr, IEC-309	192186-B32
r3000 xr, SCHUKO plug	192186-B33
r3000 xr, South Africa plug	192186-AR1
ERM, r3000 xr	192188-B21

ELECTRONIC EQUIPMENT  
**EETIMES**

▶ PRODUCT OF THE WEEK

October 9, 2000

**CEE** NEWS  
EDITOR'S CHOICE

December 2000



## extended runtime module (for use with xr models only)

With two battery strings, the extended runtime module provides additional runtime capacity for the UPS r3000 xr and r1500 xr in 2U of rack space.

model	part number
ERM, r1500 xr	218971-B21
ERM, r3000 xr	192188-B21

# rackmountable UPSs (cont.)

## UPS r6000



The UPS r6000 unity rating (6000 VA/6000W) provides a wider range of load support and a high level of power protection. The unique space-saving design occupies only 6U (10.5 inches) of valuable rack space.

UPS model	part number
r6000a	347207-001
r6000j	347207-291
r6000i	347207-B31
ERM, r6000	347224-B21

a = North American high voltage model

j = Japanese model

i = EMEA model

## UPS r12000 xr, n+x

The UPS r12000 xr packs an amazing 12 kW/12 kVA worth of power in just 10U. This online rackmountable UPS is uniquely designed to meet the high-availability power protection demands of your mission-critical enterprise. Featuring an n+x modular architecture, each of the four 3 kVA modules run in parallel. A patented wireless paralleling technology built into the r12000 xr eliminates system-level single point of failure by allowing both the logic and the power to be housed in each 3 kVA module, and not in the enclosure as with most competitive UPSs. Online technology protects critical equipment against all types of power problems and creates clean, regulated power by continuous use of the inverter.

### Key Benefits:

- ultimate power protection with online technology
- more power per U than competitive UPSs (12 kW in 10U)
- patented wireless paralleling technology provides increased system reliability and flexibility
- modular design with four 3 kVA/3 kW independent modules
- n+x redundancy and scalability - 12 kW (N+0); 9 kW (N+1); 6 kW (N+2); 3 kW (N+3)
- industry leading power density with 10U rack form factor
- hot-swappable battery, electronics, and control electronics modules provides ease of maintenance and faster time to repair
- bundled power management software
- extended battery service life of 5 to 7 years with energy-dense pure lead-tin batteries and enhanced battery management technology
- easy field upgradeability with Flash ROM technology
- support for Remote Emergency Power Off (REPO)

UPS model	part number
UPS r12000 xr, n+x (High Voltage)	207552-B22
ERM, r12000 xr (High Voltage)	217800-B21



ELECTRONIC ENGINEERING  
**EE TIMES**

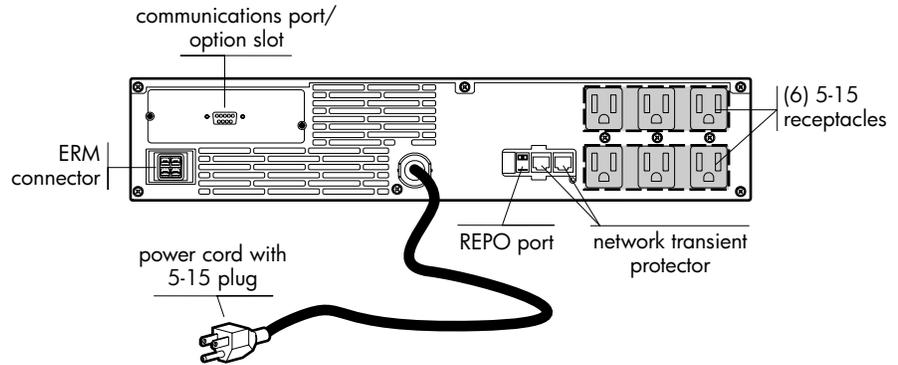
▶ **PRODUCT OF THE WEEK**

**July 2, 2002**

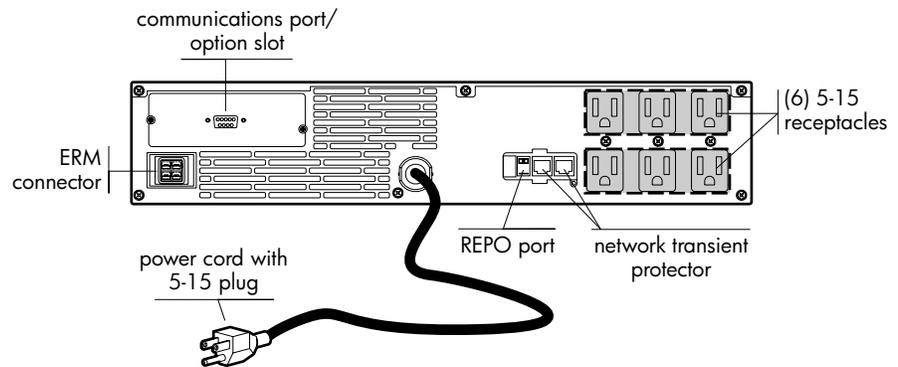
# rear panels (UPS r1500 xr)

## low voltage (100-127 VAC)

UPS r1500 xr, na

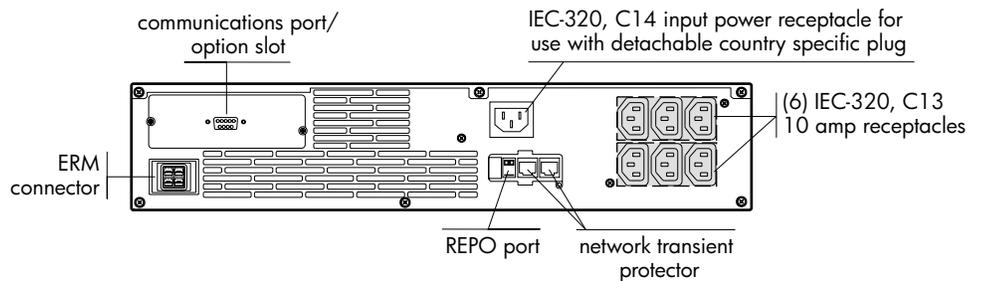


UPS r1500 xr, jpn



## high voltage (208-240 VAC)

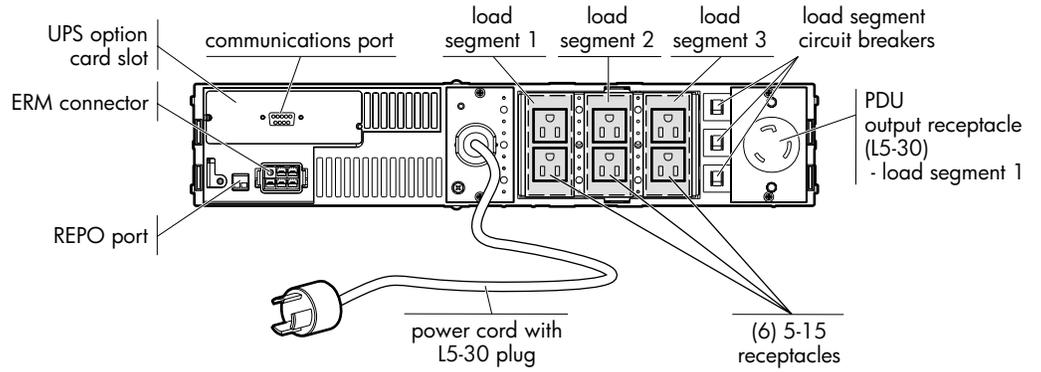
UPS r1500 xr, intl



# rear panels (UPS r3000 xr)

## low voltage (100–127 VAC)

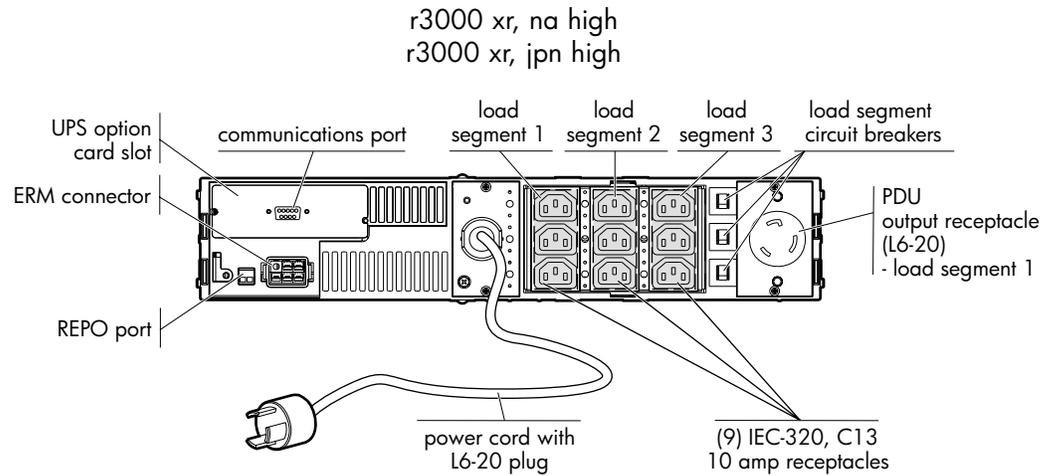
r3000 xr, na low  
r3000 xr, jpn low



na = North America/Latin America models  
jpn = Japan model

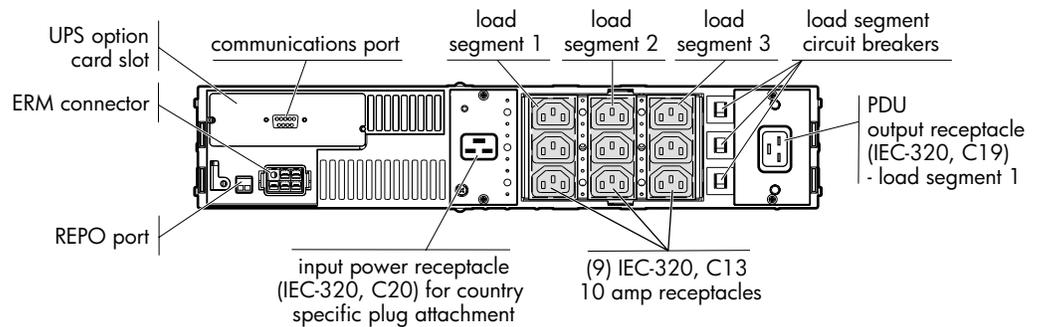
# rear panels (UPS r3000 xr) (cont.)

## high voltage (208-240 VAC)

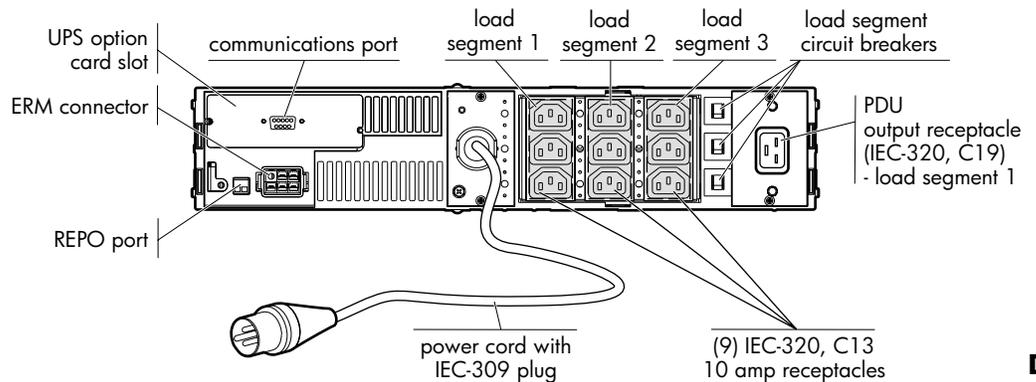


na = North America  
jpn = Japan

## r3000 xr, detachable cord



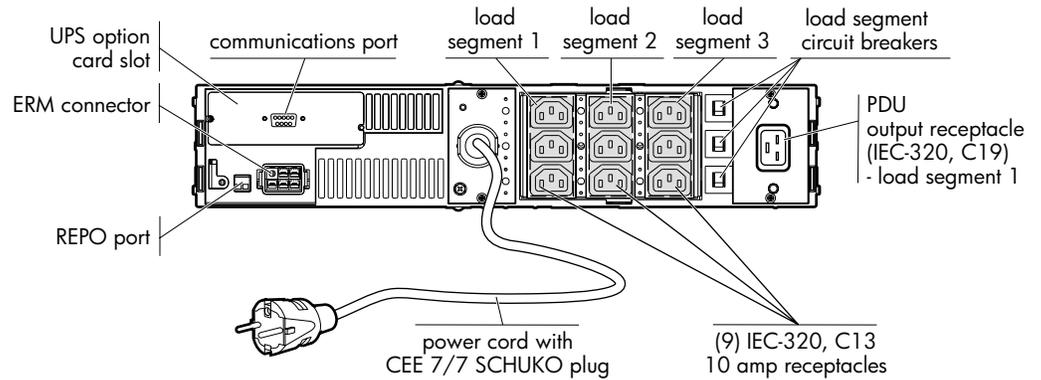
## r3000 xr, IEC-309



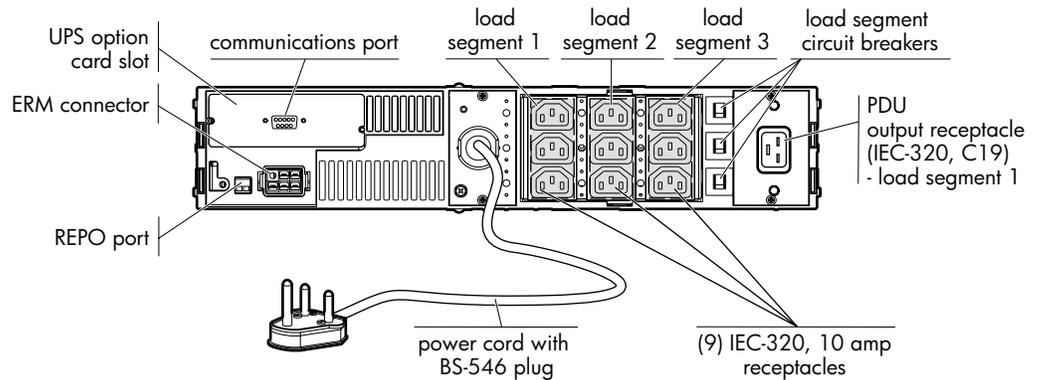
# rear panels (UPS r3000 xr) (cont.)

## high voltage (208-240 VAC)

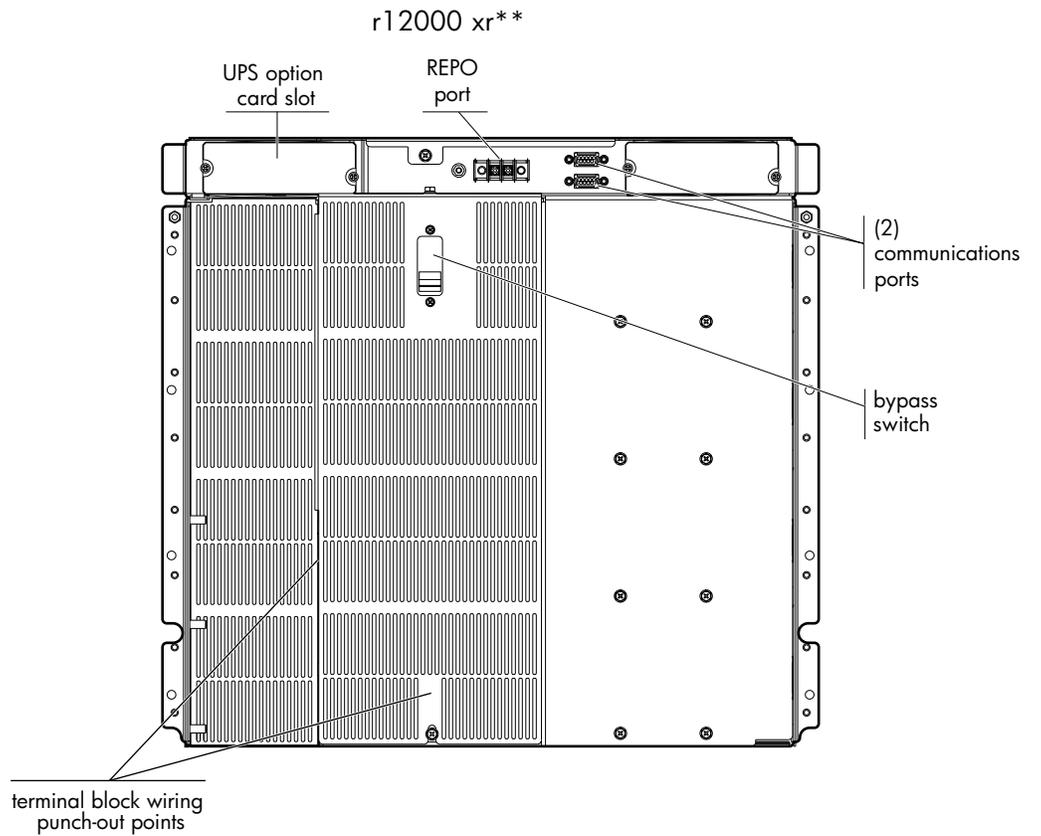
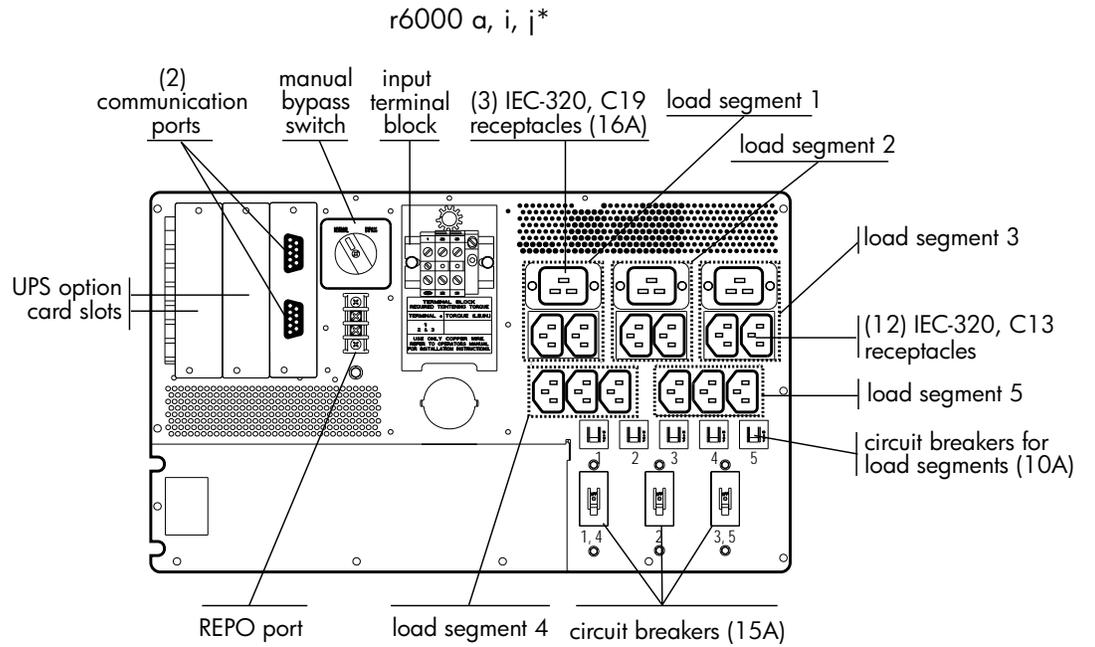
r3000i xr, SCHUKO plug



r3000 xr, South Africa plug



# rear panels (r6000 & r12000 xr)



\*hardwired on input

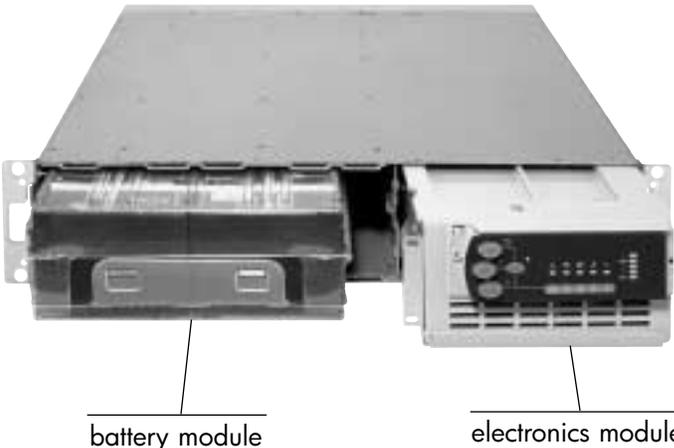
\*\*hardwired on input and output

# high availability with hot-swappable batteries and electronics modules (r3000 xr and r12000 xr)

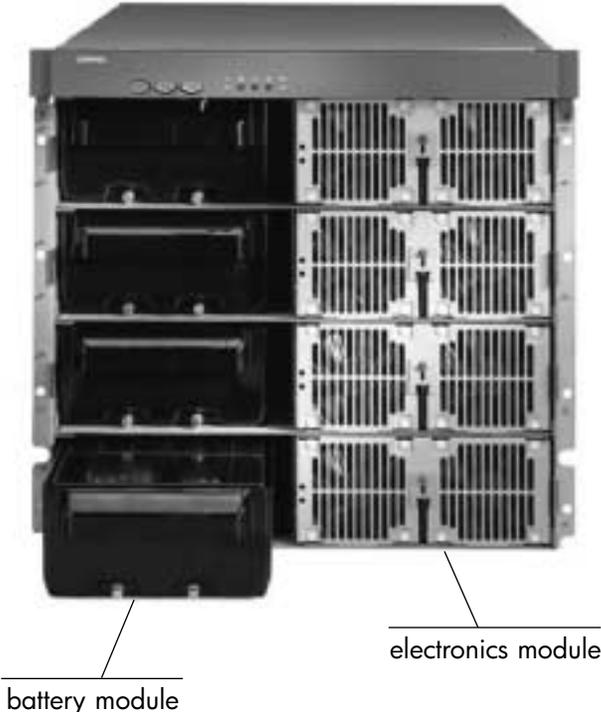
With hot-swappable battery and electronics modules, the UPS r3000 xr and r12000 xr brings ease of maintenance to new levels. When batteries reach the end of their useful life, replacement is easy with hot-swappable batteries. With simple access through the front panel, users can safely install new batteries and without ever powering down connected server and server options.

In addition, both UPSs incorporate an automatic bypass switch for servicing the UPS without powering down protected equipment. They feature a flashable microprocessor that allows firmware upgrades via the communications port. The field service personnel can upgrade the UPS without removing and replacing the hardware or bringing down the load.

r3000 xr



r12000 xr

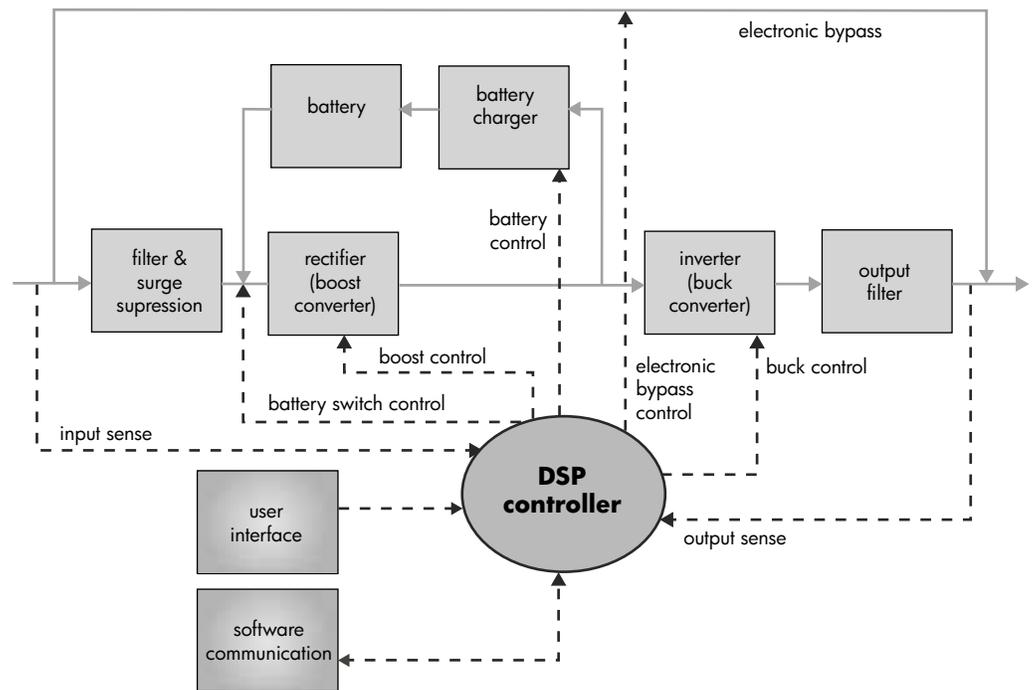


# digital signal processor technology advances UPS design (r3000 xr)

Crowded data centers and racks filled to capacity with storage devices, monitors, servers, communications devices and other equipment are driving the need for UPSs with increased power density and power efficiency. For end-users and facilities managers, “thin is in”, and so UPS designers continually strive for smaller products, fewer parts, lower cost, and less weight. Digital Signal Processor (DSP) controllers as featured in the r3000 xr UPS are an enabling technology to meet the challenge of such design requirements. DSPs are now propelling forward many of the advances in UPS design.

As illustrated in the block diagram, the DSP controller manages many UPS functions including:

- sensing and controlling input and output voltage and current levels
- setting and controlling the rectifier (a boost converter) for input power factor correction and for regulating the DC voltage into the inverter
- setting and controlling the inverter (a buck converter) for output voltage and frequency regulation
- controlling the battery charger
- interfacing with power management software through communication port cards
- switching to electronic bypass



**DSP controller block diagram**

# digital signal processor technology advances UPS design (cont.)

## quick history

Originally designed for mathematically and computationally intensive motor drive control processes, DSPs now have expanded capabilities such as faster machine-cycle speeds and enhanced programming instruction sets. DSPs now also offer peripheral functionality such as on-board counters/timers, analog-to-digital converters, pulse-width-modulation (PWM) outputs, flash memory, and controller-area-network (CAN) communications. The similarities between motor drive controls and UPS controls combined with the enhanced functionality of DSPs contribute to making UPS a natural application for DSPs.

Lower-cost, high-performance DSP controllers provide an improved and cost-effective solution for UPS design. DSPs allow UPS designers to replace bulky transformers, relays, and mechanical bypass switches with smaller, more intelligent functional equivalents. DSP implementations also facilitate other design benefits, including increased power efficiency and increased power density. As a result, UPSs with a smaller product footprint and less weight are produced. In space-constrained data centers these assets are extremely important.

In UPS applications, the DSP has integrated functions selected for sophisticated, embedded controls. These functions, previously available only through more expensive microcontrollers and off-board peripheral circuitry, include protection circuitry, clocks, and serial communications in addition to the peripheral DSP functionality mentioned previously. Except for signal conditioning and actuators that provide the interface between the DSP and the power circuitry, all of the control implementations become digital. Multiple control algorithms can execute almost simultaneously and at high machine-cycle speeds for unprecedented dynamic performance. The DSP implementation also has fewer parts, increased reliability, and greater immunity to noise than predecessor microcontroller implementations. Since the DSP feedback and control loops are implemented digitally, compensation for component tolerances and temperature variations of feedback elements is no longer necessary. DSP technology provides a cost-effective alternative to control multiple power converters, either individually or in combination, to meet the demands of advanced power topologies.

## enabling non-traditional UPS topologies

DSP technology enables the practical implementation of non-traditional topologies that were previously cost prohibitive. One such non-traditional topology described on the previous page utilizes three solid-state electronic power stages to replace the traditional mechanical transformer and tap-switching relays to regulate and condition power. The DSP controls the voltage to the critical load by operating these three electronic stages in combination to minimize power processing, which in turn increases efficiency.

# digital signal processor technology advances UPS design (cont.)

## electronic power stage control

The first electronic power stage includes a front-end filter and surge protection section with a rectifier. The filter and surge section conditions the power by removing damaging spikes and surges. The DSP-controlled rectifier acts as an electronic power-factor-correcting AC-to-DC boost circuit, which provides dynamic output voltage regulation by boosting the internal DC voltage when the input utility voltage sags.

The second power stage (not shown in the simplified block diagram) functions as a balancing circuit for the DC voltage into the inverter during normal operation and as a DC-to-AC inverter during battery operation. The DSP-controlled balancing circuit also supplies energy for recharging the batteries.

The third power stage controlled by the DSP is the inverter, which acts as an electronic DC-to-AC converter circuit that tightly regulates the output voltage delivered to the load equipment. The buck action of this converter generates a maximum AC output voltage that is lower than the DC voltage input to the inverter.

The DSP controls the rectifier, balancer, and inverter in combination to provide superior output voltage regulation without having to use battery power unless utility power deteriorates so severely that reserve energy from the batteries is necessary to support the load equipment.

In addition to facilitating rapid recharge, the DSP maintains the battery in a charged state using advanced battery charging and monitoring algorithms. The enhanced battery management capability enabled by DSP technology results in increased battery life—perhaps the single most important factor in overall UPS reliability.

## electronic bypass

The DSP also monitors and controls the bypass circuitry that provides continuous power to the critical load when the UPS is undergoing maintenance or in the unlikely event of UPS equipment failure. The DSP-controlled integrated electronic bypass eliminates the need for a larger and more expensive mechanical bypass switch to provide wrap-around power to the load equipment.

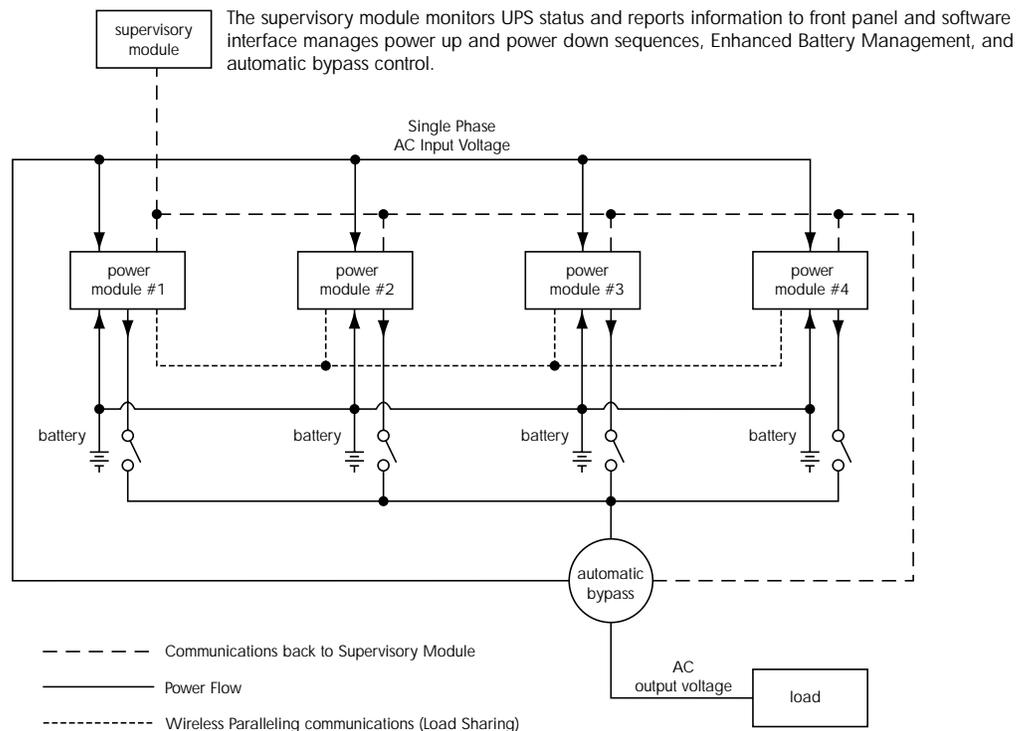
## conclusion

Today's DSP technology enables the practical implementation of sophisticated UPS topologies and controls. The DSP can simultaneously control multiple power converters to optimize system efficiency and other performance characteristics such as enhanced battery management for extended battery life, improved output voltage regulation, enhanced bypass capability, and communications with networks and with other equipment. The result is a higher performance UPS in smaller, lighter, more reliable designs, which is an advantage for space-constrained equipment racks and cost-conscious, co-located data center applications.

# wireless paralleling technology (r12000 xr, n+x)

With its high speed Digital Signal Processing (DSP) design, the r12000 xr enables paralleling for redundancy without inter-module communication. Via a patented wireless paralleling technology, all necessary information for paralleling is available using only the modules' output power waveform. By using a mathematical firmware approach to paralleling for redundancy, wireless paralleling eliminates any single points of failure such as in communication wiring and added circuitry between the modules. Therefore, the 100% mathematical firmware is more reliable than traditional paralleling that uses communication wiring between modules.

Each electronics module houses its own control logic. The load share control algorithms maintain synchronization and load balance by constantly making minute adjustments to variations in the output power requirements. There is no transfer time in shifting the load from one module to another, should a module go offline for any reason. By eliminating communication wiring and added circuitry between the modules, the r12000 xr provides the highest level of reliability and system availability.



**r12000 xr block diagram**

# rackmount UPS backup times

## backup times\* (in minutes)

### rackmount UPS models (r1500 xr, r3000 xr & r6000)

watts	r1500 xr	r1500 xr +1 ERM	r1500 xr +2 ERMs	r3000 xr	r3000 xr +1 ERM	r6000	r6000 +1 ERM	r6000 +2 ERMs
600W	17	68	182	33	104	87	169	261
800W	11	47	128	23	76	74	156	248
1000W	7	35	75	16	54	62	144	236
1200W	6	29	58	13	48	54	128	222
1400W	—	—	—	11	43	46	112	194
1600W	—	—	—	10	39	40	96	166
1800W	—	—	—	9	35	34	82	139
2000W	—	—	—	8	32	28	66	109
2200W	—	—	—	7	30	26	59	97
2400W	—	—	—	6	28	24	54	85
2600W	—	—	—	5	22	22	46	73
2800W	—	—	—	—	—	20	43	69
3000W	—	—	—	—	—	18	40	66
4000W	—	—	—	—	—	12	28	47
5000W	—	—	—	—	—	8	21	36
6000W	—	—	—	—	—	6	18	28

### rackmount UPS models (r12000 xr)

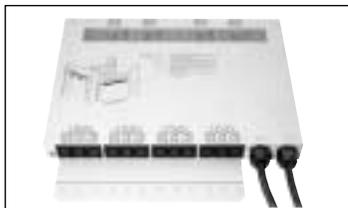
watts	r12000 xr	r12000 xr +1 ERM	r12000 xr +2 ERMs
600W	172	276	404
800W	144	230	337
1000W	114	184	268
1200W	86	138	202
1400W	78	126	184
1600W	71	116	169
1800W	65	104	152
2000W	57	92	134
2200W	50	80	118
2400W	43	69	101
2600W	40	65	96
2800W	38	62	93
3000W	36	59	86
4000W	29	49	71
5000W	21	38	56
6000W	14	28	41
7000W	12	25	37
8000W	11	22	33
9000W	9	18	28
10000W	7	15	24
11000W	6	13	21
12000W	5	11	18

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

# hp UPS options

## power distribution units (PDUs)

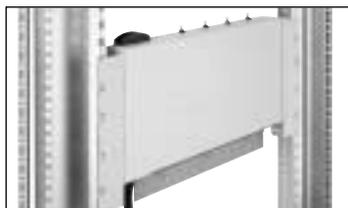
### dual input PDU



Fault tolerant power distribution unit with two input sources and a built-in AC transfer switch. The switch automatically transfers from one input source to the other, when the first power source goes down. Rated at 24A, offering 12 output receptacles, and equipped with 2 status LED indicators, the Dual Input PDU is ideal for customers that value fault-tolerant solutions.

model	high/low volt	output connections	part number
24A: NA - high	High	(12) IEC-320,C13	191186-001
24A: International	High	(12) IEC-320, C13	191186-B31

### 0U/1U PDU



Zero-U/1U PDUs offer unparalleled power protection and distribution for rack-mounted servers and server options. HP PDU products manage power distribution in rack environments without consuming valuable rack U-space. A unique "zero-U" or "1U" configuration provides up to 12 AC receptacles that distribute power requirements within rack cabinets.

model	high/low volt	output connections	part number
16A: Worldwide	High	(12) IEC-320,C13	207590-B21
24A: NA/LA/JPN - low	Low	(12) 5-15R	207590-D71
24A: NA/LA/JPN - high	High	(12) IEC-320,C13	207590-D72
32A: International	High	(12) IEC-320,C13	207590-B31
40A: Worldwide	High	(6) IEC-320,C13; (3) IEC-320,C19	207590-B23

\*For use with UPS r3000 xr, na high requires the purchase of power cord p/n 340653-001, which connects from the PDU to the UPS (IEC-320, C19 to L6-20P)

### modular PDU



The modular PDUs have a unique modular architecture, and are designed specifically for the dense data center customers who want to maximize their power distribution and space efficiencies in the rack. Ranging from 16 to 40A models, the modular PDUs offer unprecedented flexibility, increased outlet receptacles (up to 32), easier accessibility, superior cable management and power distribution.

model	high/low volt	output connections	part number
mPDU, 16A: Worldwide	High	(16) IEC-320, C13	252663-B24
mPDU, 24A: NA/JPN - low	Low	(32) 5-15R	252663-D71
mPDU, 24A: NA/JPN - high	High	(32) IEC-320,C13	252663-D72
mPDU, 32A: International	High	(32) IEC-320,C13	252663-B31
mPDU, 40A: Worldwide	High	(24) IEC-320,C13; (4) IEC-320, C19	252663-B21

# hp UPS options

## UPS options with xr models (ranging from 1000-3000 VA)

### SNMP/serial port card

The SNMP/serial port card gives network administrators the ability to perform simultaneous network and out-of-band communications. It provides SNMP functionality including power event alerts, network power diagnostics, and remote UPS reboot and testing. It also features out-of-band (modem) communications, meaning that alerts can be received even if the network is down. Via the bundled OnliNet power management software or SNMP-capable network management software, power related problems on the network are quickly discovered and remedied.

model	part number
SNMP/serial port card	192189-B21

### six port card

The six port card is an option card that fits in the option slot of the xr model UPS. This card can be used to connect up to three servers running different operating systems to the same UPS.

model	part number
six port card	192185-B21



# hp UPS options (cont.)

## UPS options with r6000 models

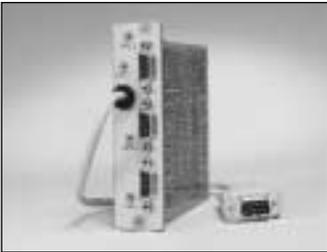
### multi-server card



The multi-server card is a UPS option that facilitates direct communication with up to three critical servers (each of which can run a different operating system) via individual serial communication ports, eliminating the need to purchase additional UPSs to support each server.

model	part number
worldwide	123508-B21

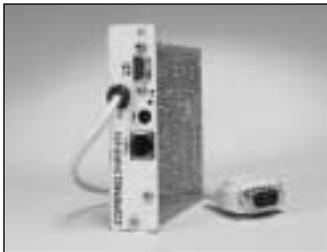
### scalable card



The scalable card, enables up to three HP UPSs to work together as one virtual UPS, providing scalability and field upgradeability.

model	part number
worldwide	123509-B21

### SNMP-EN Adapter



The SNMP-EN adapter provides SNMP functionality including power event alerts, network power diagnostics, and remote UPS reboot and testing. It also features out-of-band (modem) communications meaning that alerts can be received even if the network is down and pages can be sent in the event of an alarm condition. By using the SNMP-EN adapter to communicate with UPSs on a network running SNMP-capable network management system software or the bundled OnliNet power management software, power related problems on the network are quickly discovered and remedied.

model	part number
SNMP-EN adapter	347225-B21

### high to low voltage transformer



The high to low voltage transformer works with the high voltage rackmountable UPS models to provide 250 VA of low voltage support via two 5-15 receptacles. The sidewall mount form factor takes "zero-u" of valuable rack space.

model	part number
high to low voltage transformer	388643-B21

# hp power management software

## hp power management software



HP power management software enables system administrators to monitor and control HP UPSs locally or remotely. This versatile application provides system administrators with an overview of network power conditions, and enables them to configure shutdown timing, customize alert messages, and perform UPS diagnostic checks. HP Power Management Software is bundled with all HP UPS models.

model	part number
CD Spares Kit (Software as shipped with UPS)	340580-001

### Key Benefits:

- preserves data integrity system-wide via unattended, sequential shutdown of all network devices connected to a UPS – saving work-in-progress throughout the network
- schedule preventive maintenance checks to test the circuitry of all the UPSs on the network
- configure and regulate independent UPS load segments to provide separate power control of connected equipment
- control your power schedule by shutting down and reboot any UPS and attached equipment based on a user-specified schedule
- manage power recovery of load segments after a power outage by sequencing the startup of system components
- monitor your power environment via graphical displays