

# Uninterruptable Power Supply Specifications and Installation Guide

## Introduction

Protecting your critical systems and data is the first objective for all personal computer (PC) and other microprocessing operations. Properly matching the protection equipment to your needs is of utmost importance. This brochure is designed to help you do just that. Uninterruptable Power Supply (UPS) technologies provide a significant benefit in protecting microprocessor operations during power outages. The focus of this brochure is 120-volt single-phase application of UPS systems. Larger three-phase UPS systems require engineering design.

The prevailing theory of application for UPS equipment is to utilize UPS ride-through time to effectively shut down critical microprocessor operations without damage or loss until normal supply is restored. Based on this theory of application, UPS systems are normally configured to provide operating time during an interruption from five to 20 minutes, depending on requirements and UPS loading characteristics. Be aware that all manufacturers' specifications are somewhat different. Configuring UPSs with greater run time for extended operations greatly increases the cost of the UPS and the associated UPS maintenance.

## UPS configurations and selection criteria

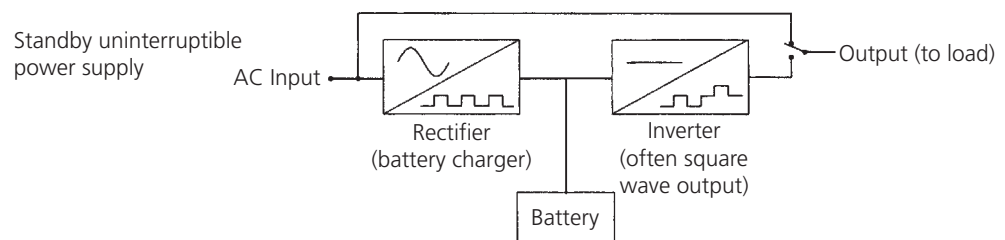
There are several basic methodologies used by manufacturers in the design of UPS systems. Each methodology has key benefits and drawbacks, which are important to understand when making a purchase decision.

The three main types of UPS systems are illustrated below.

### Standby or off-line system

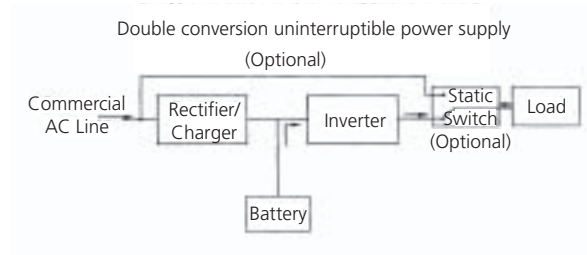
In a static off-line UPS system in normal operation, mains power is supplied directly to the load. Should a voltage drop occur, the UPS then switches on instantaneously by means of a static switch to a battery-powered inverter, providing back-up power to the load.

The rectifier/charge regulator converts mains supply AC to DC, keeping the battery charged to full capacity. The charge regulator protects the battery bank from overcharge and prevents excessive discharge. Most off-line UPS systems employ a square-wave inverter output, or modified square-wave output. This is the lowest-cost type of inverter, but is sufficient for most stand-alone home-office computers.



### Double conversion on-line system

The double conversion on-line system provides complete isolation of the load from mains service, thus providing high-quality conditioned power to the loads. The disadvantage of on-line systems is the increased cost, and as all power in both normal and backup modes of operation is channelled through the UPS, there is a decrease in efficiency, resulting in an increase in heat output.



Comparison of UPS configurations			
Technology Type	Benefits	Drawbacks	
Standby Off-Line	Lower purchase cost. Provides basic protection.	May not have power conditioning. Transfers to backup may interrupt load.	150 – 1,250 VA \$150 – \$1,000
On Line/ Double Conversion	No interruption to loads. Provides power conditioning.	Highest purchase cost. Slightly lower efficiencies. Complex internal electronics.	600 – 2,000 VA \$500 – \$3000
Line Interactive	Continuously regulates power to load.	More sensitive to line disturbances. May have shorter battery life.	250 – 2,000 VA \$200 – \$2,500

Once you have determined which system suits your needs, make a note of it on the back page.

Typical power ratings for computers and peripheral equipment					
Typical Applications	VA*	Watts	Typical Application	VA*	Watts
Basic Desk-Top Terminal	250	150	Workstation	600	360
Basic Desk-Top PC	400	240	Web Server	1,200	900
Server†	395	275	Modem	100	60
Laser Jet Printer	800	560	Fax	1,150	690
Colour Monitor 17"	170	110			

\* Although listed in terms of VA (voltage amps), some manufacturers' standardized terms are referred to in kVA (1 kVA = 1,000 VA).

† For Local Area Networks (LAN), the file server is the most critical item needing protection.

Power requirements listed above are typical only and may not match your systems with all added optional features. Please consult the manufacturer's nameplate or operator's manual for actual requirements.

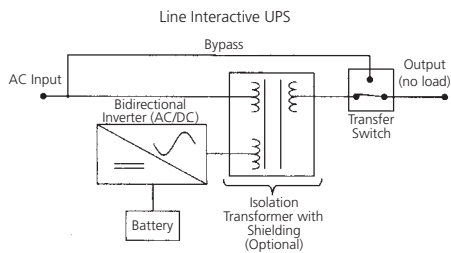
Typical UPS specifications by size						
VA	Watts	Weight (kg)	Typical Back-Up	Physical Size (cm)	Input Volts	Input Amps
250	150	5	10 min.	15x8x25	120	2.0
400	260	7	12 min.	10x10x46	120	3.3
600	390	7	6 min.	10x10x46	120	5
800	525	14	8 min.	25x25x41	120	7
1,000	640	14	8 min.	25x25x41	120	8
1,250	850	16	7 min.	25x25x41	120	10
1,500	1,050	16	5 min.	25x25x41	120	13
2,000	1,300	16	4 min.	25x25x41	120	16

### Line interactive system

In a line interactive UPS system, voltage is supplied directly from the mains service. The inverter supplies a degree of voltage conditioning. As the load is not isolated from the mains service, voltage conditioning is limited. However, this type of UPS system is competitively priced. They are available with ratings up to 10 kVA, allowing wide input voltage tolerances.

### Additional comments to selection criteria

1. Manual bypass switch. For many applications this feature may be useful, since – should the UPS be required – service power can continue to be supplied to the load.
2. Vendor support service. Purchase of high-quality equipment through a reputable dealer will likely include vendor support and maintenance service.
3. UPS system must be CSA approved.



### Equipment options

Most UPS equipment manufacturers have a range of feature options that can expand the UPS system's capability or ease of use. You must specify the desired options to your vendor to assure they are included in your UPS. Some examples include:

- **Automatic data network shut-down** – This option provides for systematic safe shut-down of all data operations.
- **UPS performance monitoring** – This option provides on-screen data relating to UPS system and battery conditions.
- **Battery extensions** – Provides additional battery capacity for extending ride-through time or maintaining ride-through times with additional loads.

- **Interfacing to other systems** – Provides simple On/Off interface to activate other systems (alarms, communication, etc.) when an outage occurs.

When purchasing your UPS system you may wish to discuss these and other optional features with your equipment supplier.

### How to determine the correct UPS size

Determining the correct UPS size is a six-step process. **A worksheet has been provided on the next page to assist you.**

1. Make a list of the equipment that needs protection. Include all individual items that have their own power cords, such as CPU, monitor, modem, etc. Caution: Printers should not be connected to the UPS with other equipment, as they can generate large voltage sags. **(Use section A of the worksheet to list your equipment.)**
2. Obtain the wattage rating of each device. This rating should be listed on the equipment nameplate or in the owner's/operator's manual or available from the equipment manufacturer. If specified in VA, multiply the VA by 0.85 to determine the watts. If given in amps, multiply the amps by 102 to obtain watts. **(Use section B of the worksheet to list wattages).**
3. **Add the total wattage ratings for all devices to be protected and record this total at the bottom of column B.** Choose a UPS unit with a wattage rating equal to or greater than the total wattage requirements. (Example: If you have determined the demand to be 1,100 watts and the equipment supplier you have selected has only a 1,000-watt machine with the next machine rated at 1,300 watts, select the 1,300-watt system. If in the sizing exercise the resultant value is greater than 2,800 watts, seek professional assistance.)
4. Determine the maximum back-up time needed to shut down critical equipment only, should an outage occur. **(Record your answer in section C.)**

5. Determine the type of UPS equipment you wish to purchase. See UPS comparison outlined on page 2.
6. Review and determine any optional equipment you may want to order.

### UPS system evaluation form

	A List equipment needing protection	B List watts for each	C List maximum back-up time needed
1			
2			
3			
4			
5			
6			
	<b>Total power cords</b>	<b>Total watts</b>	<b>Maximum back-up time</b>

Record total output receptacles required (transfer total from column A) \_\_\_\_\_

Record UPS size required (total from column B x 1.6) \_\_\_\_\_VA

Determine type of UPS needed \_\_\_\_\_

List options required \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Obtain quotes on equipment \$ \_\_\_\_\_  
 \$ \_\_\_\_\_  
 \$ \_\_\_\_\_

### Installation of a UPS system

**Installation of the UPS should always follow the manufacturer's recommended procedures contained within the owner's/operator's manual.**

Prior to initial power-up of the UPS, verify the correct receptacle type (three-prong including safety ground), verify the correct voltage output (120-volt nominal), correct hot/neutral/ground orientation (the receptacle prong holes are required to have a proper orientation in relation to the serving conductors), correct loading of the circuit when the UPS is powered up and verification of correct breaker size at the electrical panel for the circuit intended to serve the UPS receptacle. **Should you have any questions as to the correct power availability or receptacle configurations, consult a licensed electrician for verification of electrical requirements and installation assistance.**

When selecting a location for the UPS to serve the intended loads, a central location will allow for easier connection. **Do not use extension cords for loads or to feed the UPS.**

Connect any data cabling between the UPS and peripheral equipment prior to any powering of the units.

Individual critical loads can be plugged into the UPS unit in any order, as long as all loads' main power switches are in the "OFF" position.

**Printers, copy machines and non-critical office machines (coffee makers, space heaters, microwaves) should not be connected to the UPS unit or on the same circuit.**

The UPS may come equipped with ventilation fans for cooling purposes and require a location with adequate clearances to provide proper air circulation. **Do not restrict the air flow to the UPS unit.**

A Transient Voltage Surge Suppressor (TVSS) is always recommended ahead of the UPS unit. Even though many UPS units advertise TVSS/noise filtration, a high-quality TVSS with noise filtering provides protection from catastrophic hardware damage and electrical noise impacts and extends overall system life.

## Initial start-up

**Refer to the owner's/operator's manual for the specific directions concerning start-up of the UPS system.**

Prior to plugging the UPS system into the electrical receptacle, ensure that the UPS main power switch is in the "OFF" position and verify that any loads connected to the UPS are not switched on. Start-up and testing usually involves: plugging the unit in, turning the main power switch on, and observing any self-test indicator lights and any "NORMAL" indicator lights for any problem indications. **If the "NORMAL" indication does not appear during the start-up sequence, refer to the owner's/operator's manual or contact your vendor for further assistance.**

Allow the UPS unit to be powered on for a short period of time (10 to 15 minutes) prior to powering on the load units. Turn on the loads one at a time, verifying that the UPS unit continues a "NORMAL" operation status.

## Operations

With your critical equipment connected to the UPS, you should be effectively protected from power outages and significant low-voltage conditions.

When the UPS transfers to battery backup, due to a power outage or low-voltage condition, you may notice an audible and/or visual alarm. It is important to be aware that most UPS equipment will revert to battery backup when significant low-voltage situations occur. Transfers to battery in these situations will cause a drain on your battery system. It is important to identify the source of these types of low-voltage disturbances and correct them to ensure maximum UPS battery life. If your UPS alarms frequently, check for frequent low-voltage disturbances and correct them if possible.

## Maintenance

The ability of your UPS to effectively protect the critical loads from power interruptions is directly related to the health of the UPS battery system and continued trouble-free operation of the unit itself. The energy capacity of the battery will decrease over time as a result of use. An increase in ambient room temperature above normal (20°C) may also decrease energy capacity. It is important to periodically evaluate the condition of the UPS unit's batteries. Some manufacturers provide this capability built into the UPS unit; those without the capability would require a qualified technician for evaluation. **When a UPS unit's batteries fail, the unit will not provide the required backup to the critical loads when needed. This regular maintenance is of key importance.**

Periodic cleaning of the UPS air-flow vents is recommended to assure peak cooling capacity.

## Acknowledgement

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