Uninterruptible Power Supplies - Advantages and Disadvantages of Various Configurations

An Online Continuing Education Course for Engineers

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Uninterruptible Power Supplies - Advantages and Disadvantages of Various Configurations

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Course Outline

- Why install a UPS?
- What types of loads should be placed on a UPS? How much is each minute of downtime costing you? How many 9's of reliability do you need?
- What types of UPS configurations are available?
- Advantages/Disadvantages to each type of configuration
- How to specify a UPS when ordering

Introduction

The purpose of this course is to instruct the reader as to the various advantages and disadvantages of installing a UPS system and to help guide him in ordering a system that is both technically feasible and cost effective.

Various factors are considered when making a decision as to whether or not a UPS system must be installed. The types of electrical loads must be considered as well as the appropriate amount of back-up time that is required for a safe and effective operational shutdown. This course will examine those loads and recommend the correct amount of backup time required.

This course will also examine the types of UPS systems that are available and will also look at the pros and cons of each type. Not all types of loads are required to be placed on the same type of UPS system. This course will make recommendations as to the appropriate system.

Finally, this course will guide the user through the steps required when specifying and purchasing a UPS system and provide recommendations as to the construction and installation of the UPS system.

Why Install a UPS?

Many of today's sensitive electronic equipment and computer loads require an alternate source of power in the event of a power system failure. These types of failures can vary from

something as little as a small power interruption (blip) to a large scale, long term power outage. Momentary blips can be caused by wind (storms), lightning, rodents coming in contact with overhead power lines, vehicles striking utility poles, etc. These types of incidents can cause the voltage to sag below a point where most sensitive electronic equipment will begin to be affected.

More severe outages can occur as a result of storms or other natural and man-made catastrophes such as equipment failures (transformers, high voltage cables, etc.) These types of outages tend to last anywhere from several minutes to several hours, if not several days. UPS systems need to be designed with the type of outages that the customer is likely to experience in mind.

What types of loads should be placed on a UPS system?
Typically, any type of electrical load that is sensitive to momentary and long-term power outages should be placed on a UPS system. Most user PC's, fax machines, computer servers, etc. are placed on a UPS system. In addition, fire alarm systems, security and telephone communication system are typical UPS loads. However, as of late, emergency egress lighting systems are being connected to the UPS system as opposed to having individual battery backup.

How much is each minute of downtime costing you?
When making the decision as to whether or not purchasing a UPS system is worthwhile, you need to consider the cost of not purchasing one. Each minute of lost production time costs your company money. In order to help justify the cost of a UPS system, a cost benefit analysis needs to be completed. This same analysis should also be used in determining the best type of UPS arrangement that meets your company's requirements.

How many 9's of reliability do you need?
System reliability is usually calculated in terms of the amount of availability in the system. The system availability is calculated and measured in terms of a percentage, with 100% being available all of the time. As we all know, nothing is perfect or available 100% of the time. Usually, the availability is calculated to anywhere in the range of 99.9% to 100%. The number of 9's determines how many decimal places we need to look for the availability. For example, 99.99% availability has two 9's worth of availability.

What Types of UPS Systems are Available?

Stand-By Power System (SPS)
A stand-by power system (SPS) is often referred to as an off-line UPS system. It uses a transfer switch for a system bypass between the utility power and the battery back up. They also include a rectifier (to convert AC to DC), a battery charger, a battery and an inverter (to convert DC to AC).

The system normally runs in bypass mode, i.e. no current running through the rectifier, battery and inverter. When it senses an anomaly, the transfer switch switches position and starts to draw power. In this scenario, protection is available only when the serving voltage dips to a predetermined level. In addition, the ride through time required for transfer to battery power can be significant.

Some off-line UPS come with integrated transient voltage surge suppressors (TVSS), and some have optional built-in power line conditioners to protect against electrical line noise, power brownouts and voltage sags only when the battery is delivering power to the critical loads. In a surge event, a SPS passes overvoltage directly to the critical load until the voltage reaches a predetermined level, typically at 115% to 120% of nominal voltage. It is often used to protect less critical applications.

The time required for the inverter to come online is typically called the switchover time. While some computer manufacturers indicate that their power supplies can handle a switching time of 50 to 100 milliseconds (ms), actual tolerances will vary. Switch power supplies should be able to handle a complete outage of supply vol st offline UPS claim a transfer time to battery of ab urve.

SPS offer the least am . However, systems effectiveness varies.

Additional features can line conditioners. A toroidal transformer wit f both normal and common mode noise.

Line Interactive Systen
A line-interactive UPS is r, the former typically includes buck-a ich adds voltage regulation to the UPS. As urce, the tap-changing transformer can

The line-interactive UPS u from the batteries when incoming power is o ner feature compensates for power sur nal incoming voltage level without requiring the use of the bat oltage. This provides a significant reduction in battery use.

Moreover, a line-interactive UPS typically has a few minutes of backup time when fully loaded, which is enough to ride through approximately 85% to 90% of utility power anomalies. In the event of a longer outage, software is available to provide an orderly shutdown of the critical loads. In addition, UPS software can monitor and log the status of the power supply, display voltage and current draw and provide alarms for certain error conditions.