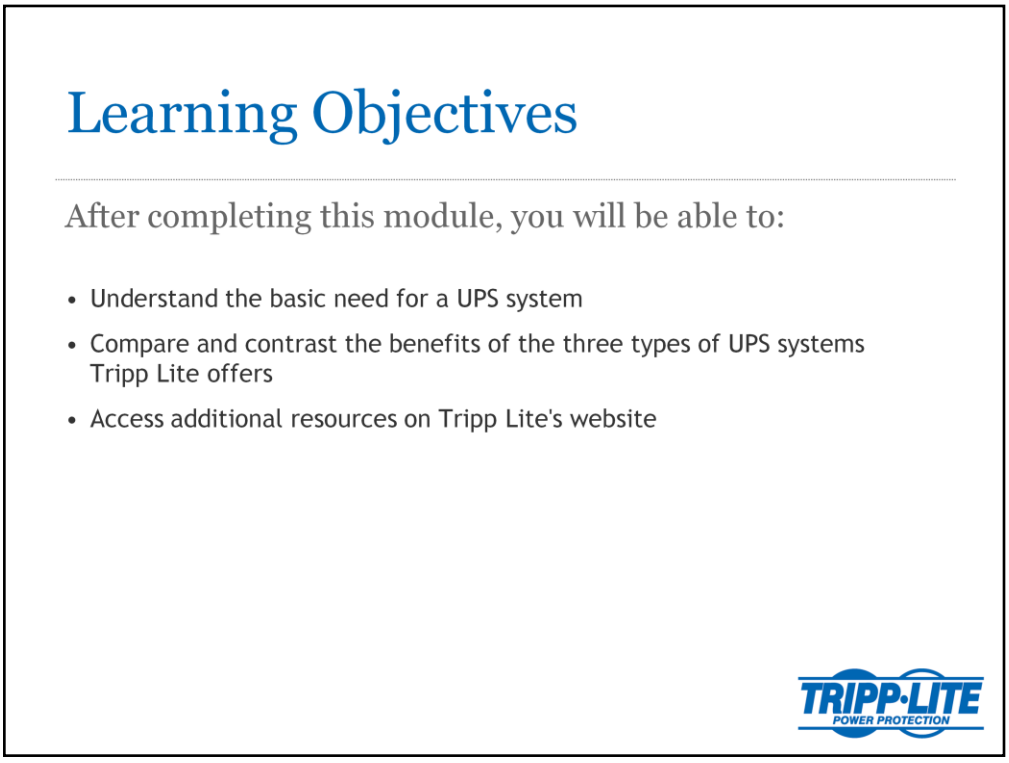
UPS System Basics

A module within Tripp Lite's
"Product Expert" training course

Welcome to the Tripp Lite UPS Systems Basics training module, part of Tripp Lite's "Products Expert" training course. The policy of Tripp Lite is one of continuous improvement. Specifications subject to change without notice.

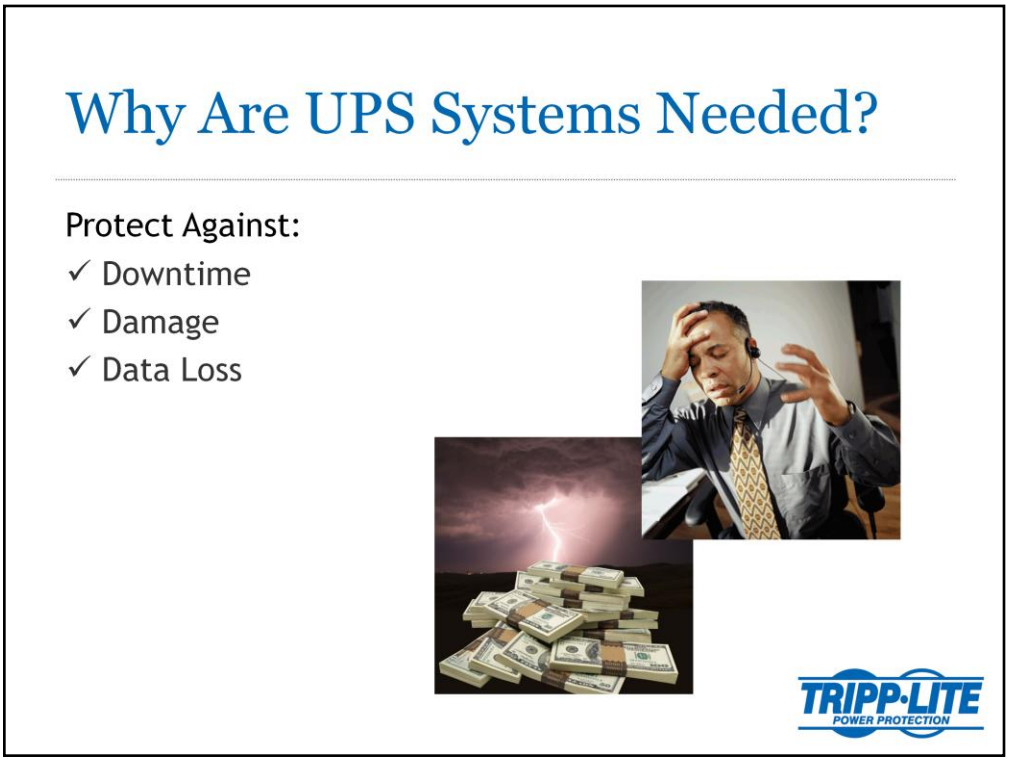


Like other modules in the training course, this one provides you with a solid foundation of basic product knowledge. It will help you understand basic UPS system topics: why they're needed, how the different types of UPSs work, etc. Once you have a basic understanding, it will be easier to take other, more technical, course modules. The test at the end of the module is designed to help you gauge how well you have mastered the material.

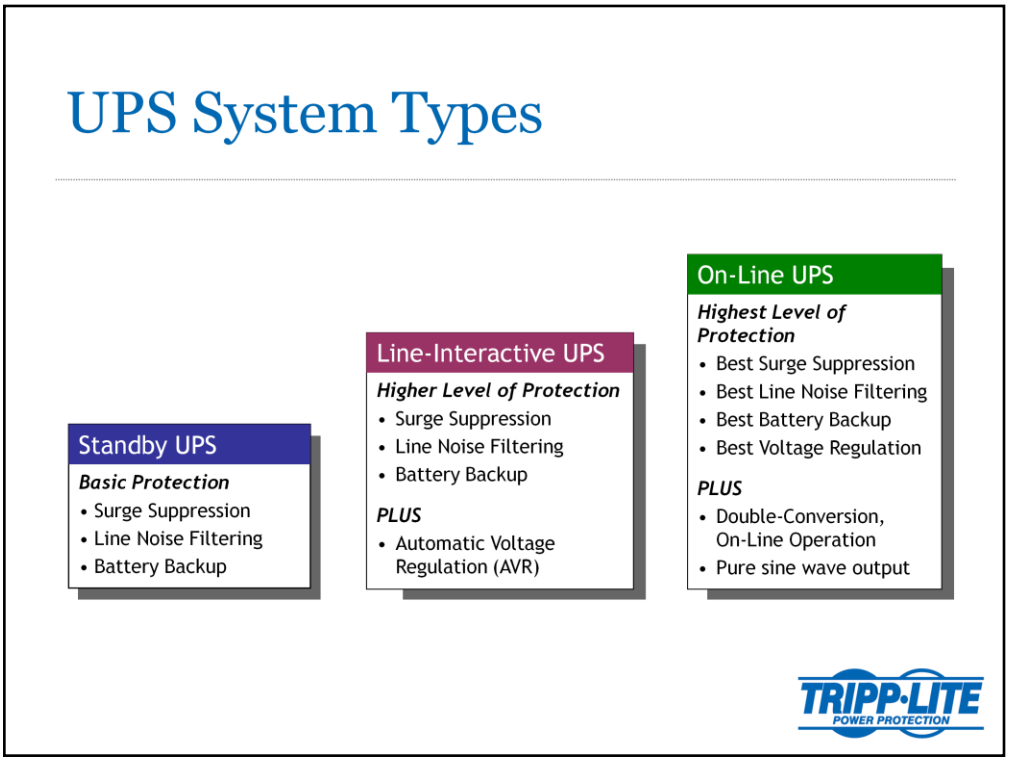
Outline

- Why Are UPS Systems Needed?
- UPS System Types
  - Standby
    - How Do They Work?
    - How Effective Are They?
    - Tripp Lite Models
  - Line-Interactive
    - How Do They Work?
    - How Effective Are They?
    - Tripp Lite Models
  - On-Line
    - How Do They Work?
    - How Effective Are They?
    - Tripp Lite Models
- On-Line vs. Line-Interactive Comparisons
- Complementary Products
- Resource Links

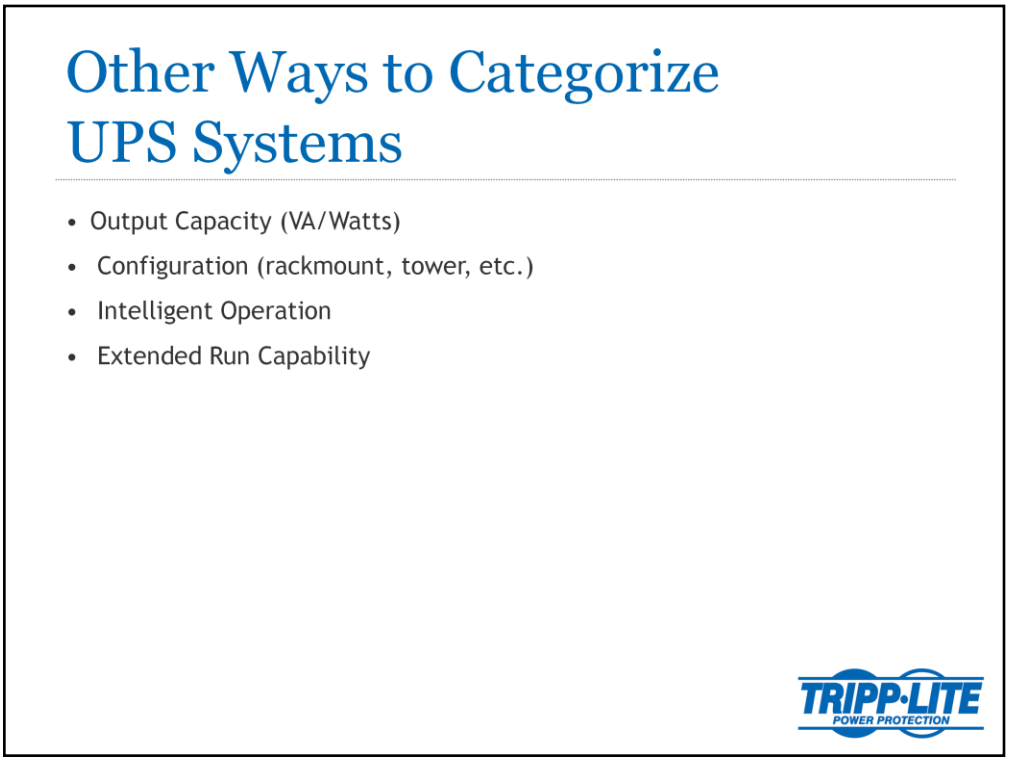
This module starts by recognizing the need for UPS systems. It then reviews the three types of UPS systems. It finishes with an overview of complementary products that Tripp Lite offers to enhance the operation or manageability of its UPS Systems.



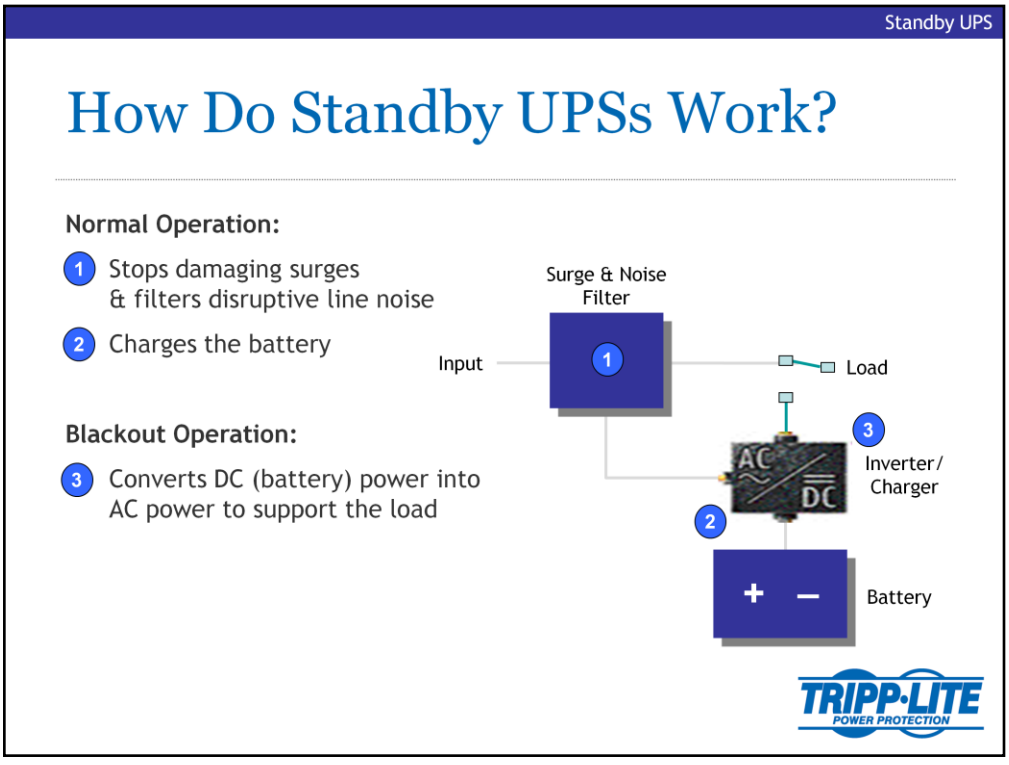
Downtime: blackouts and brownouts (low voltage) shut down equipment. UPS Systems supply battery backup power to support equipment through blackouts. Select models feature automatic voltage regulation to correct incoming power without relying on UPS batteries. **Damage**: surges and line noise can damage internal components in a single devastating event or slowly over time. UPS Systems feature surge suppression and line noise filtering to guard equipment against potential damage. **Data Loss**: when power problems shut down equipment, valuable data is often lost. UPS Systems feature battery backup power to allow enough time for data to be saved manually or automatically (using FREE PowerAlert Software).



There are three main types of UPS Systems, categorized by how they work: standby, line-interactive and on-line. Standby UPSs provide **basic** protection from power problems. Line-Interactive UPSs provide a **higher level** of protection from power problems. On-line UPSs provide the **highest level** of protection from power problems.

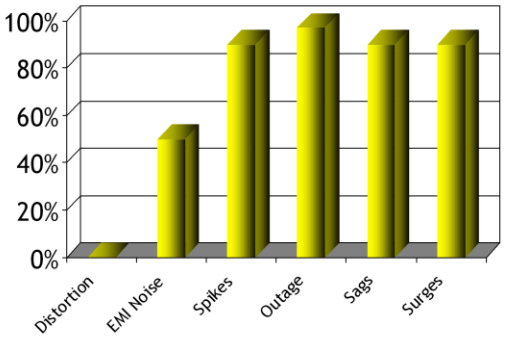


In addition to categorizing UPS Systems by how they work, they can also be further subdivided. **Output Capacity:** UPSs can be ranked by the maximum amount of power (expressed in both VA and watts) that equipment is able draw from the UPS's outlets or hardwire output terminals. "VA" stands for "volt-amps." The VA of a device can be determined by multiplying its operating voltage by its amperage rating. For example, a 120V, 2.5 amp device would draw 300VA from a UPS's output (120 x 2.5 = 300). **Configuration:** UPSs can also be subdivided by the types of cabinets they are housed in—rackmount, tower, low-profile, undermonitor, etc. **Intelligent Operation:** Within the line-interactive category, there are two subcategories—those that feature intelligent operation and those that do not. UPSs that feature intelligent operation include a microprocessor that allows the UPS to relay more detailed operating conditions through PowerAlert power management software. All on-line UPSs feature intelligent operation. **Extended Run Capability:** Within the line-interactive and on-line categories, there are two subcategories—those that accept connection of additional internal or external batteries and those that do not. Those that accept additional batteries allow users to extend battery backup runtime for critical systems during a blackout.



Standby UPS Systems have three main components: 1) a surge/noise filter, 2) a battery and 3) an inverter/charger. During operation under normal voltage conditions, the UPS passes input voltage through the surge/noise filter before delivering it to connected equipment. It also uses its inverter/charger to charge the battery, preparing it for use during a blackout or brownout. During operation under blackout conditions, the UPS converts DC power from the battery into AC power to support connected equipment.

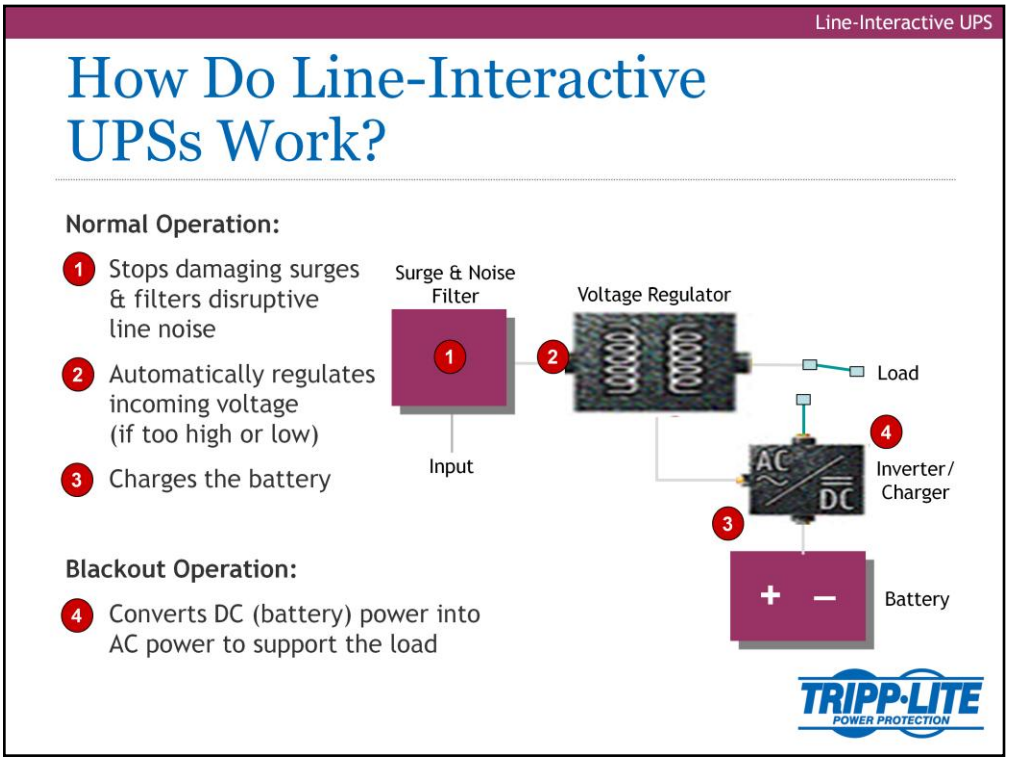
How Effective Are Standby UPSs at Stopping Power Problems?



Standby UPS Systems are very effective at what they are designed to do: provide a basic level of protection and support for connected equipment. Unlike line-interactive UPSs, they rely on their battery to correct overvoltages and undervoltages. In areas that experience frequent voltage fluctuations, users should consider purchasing a line-interactive UPS instead of a standby UPS.

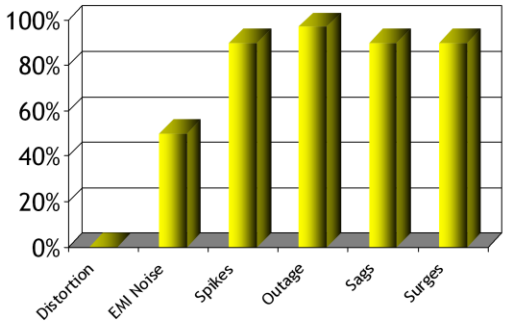
Tripp Lite offers a wide variety of cost-effective standby UPS systems for desktop applications. Available features on select models include . . .

- •Phone/DSL & Ethernet surge protection options—to safeguard equipment on Internet or network connections
- •Small-footprint tower, low profile and undermonitor cabinets—to save space in every application
- •Communication port and PowerAlert Software (FREE web download)—to automatically shut down unattended systems



Line-interactive UPS Systems have the same components as Standby UPSs (surge/noise filter, battery and inverter/charger); however, they include one component that Standby UPSs do not—a voltage regulator. By using its voltage regulator to adjust abnormally high or low voltage, line-interactive UPSs reduce reliance on the battery, lengthening its service life. During operation under normal voltage conditions, the UPS passes input voltage through the surge/noise filter and the voltage regulator before delivering it to connected equipment. It also uses its inverter/charger to charge the battery, preparing it for use during a blackout or brownout. During operation under blackout conditions, the UPS converts DC power from the battery into AC power to support connected equipment.

How Effective Are Line-Interactive UPSs at Stopping Power Problems?



Compared to Standby models, Line-Interactive UPSs provide a more effective means of protecting equipment against power problems. By using its voltage regulator to adjust abnormally high or low voltage, line-interactive UPSs reduce reliance on the battery, lengthening its service life. Compared to On-Line models, however, Line-Interactive UPSs do not remove harmonic distortion.

Tripp Lite Line-Interactive UPS Systems

120V & 208V Intelligent

- SmartPro®

120V

- OmniSmart™
- Digital, Smart USB, Omni VS and AVR

230V Intelligent

- SmartPro®

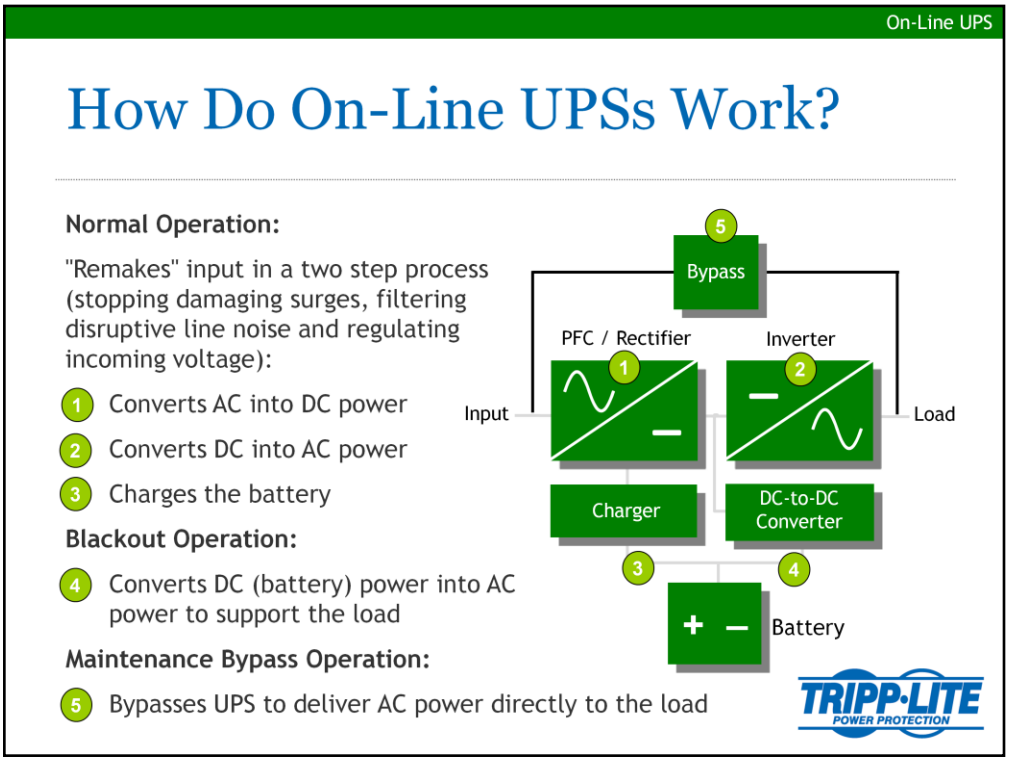
230V

- Digital, Omni VS and AVR

TRIPP·LITE POWER PROTECTION

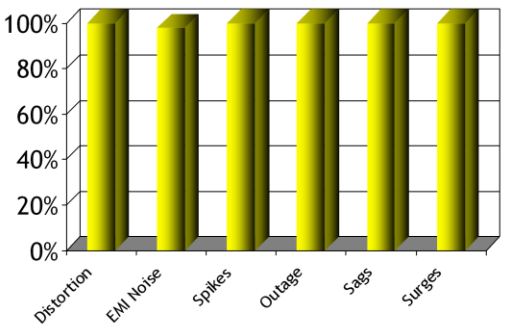
Tripp Lite provides a wider variety of line-interactive UPSs, compared to standby models. Available features on select models include . . .

- Intelligent operation—to allow the UPS to relay more detailed operating conditions through PowerAlert power management software
- Extended run capability—to allow extended battery backup runtime for critical systems during a blackout
- Phone/DSL, Ethernet & Coaxial surge protection options—to safeguard equipment on Internet, audio/visual or network connections
- Small-footprint rackmount, tower and low profile cabinets—to save space in every application
- Communication port(s) and PowerAlert Software (FREE, included or as a web download)—to automatically shut down unattended systems



On-Line UPS Systems work very differently compared to Standby or Line-Interactive UPSs. During normal operation, On-Line UPSs continuously "remake" input power in a two step process: first, converting AC power into DC power, and then converting DC power back into AC power with a pure sine wave. This two step process allows On-Line UPSs to supply connected equipment with the best quality output power available. During operation under blackout conditions, the UPS converts DC power from the battery into AC power to support connected equipment. Because its batteries are integrated into its normal operation, On-Line UPSs take no time at all to transfer between utility power and battery power—0 milliseconds. Zero transfer time allows On-Line UPSs to reliably support the widest range of devices, even those sensitive to slight transfer times. If an On-Line UPS experiences an internal fault or overload, it will automatically "bypass" its internal components and deliver power directly to connected equipment. In addition, On-Line UPSs feature an external bypass switch that allows users to perform the same function manually for scheduled maintenance.

How Effective Are On-Line UPSs at Stopping Power Problems?



TRIPP·LITE POWER PROTECTION

On-Line UPS Systems provide the highest level of power protection available. Constant double-conversion on-line operation completely isolates sensitive equipment from every power problem on the AC power line.

Tripp Lite On-Line UPS Systems

120V, 208/240V & 230V (Single Phase)

- SmartOnline™

120/208V, 220/380V, 277/480V (3 Phase)

- SmartOnline™

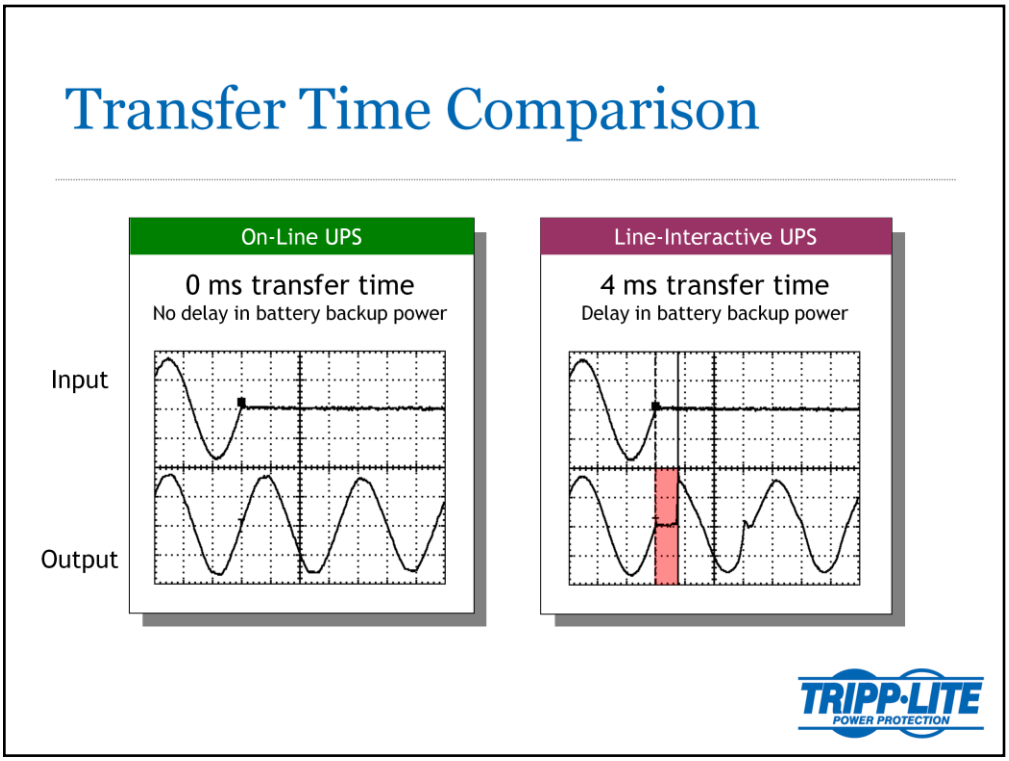
TRIPP·LITE POWER PROTECTION

Tripp Lite provides a wide variety of On-Line UPS Systems for every application. Models are available in both single-phase and 3-phase configurations. Customers require 3-phase UPSs when their power needs generally rise above 16 kVA. Available features on all models include . . .

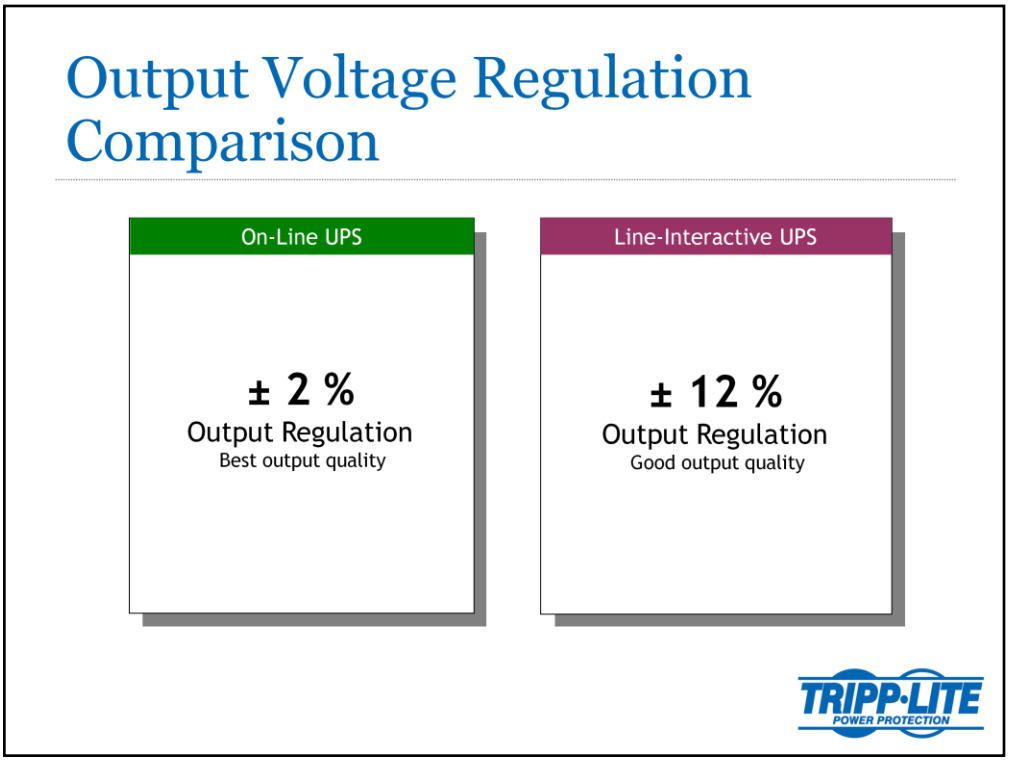
- •Zero transfer time, double-conversion operation—to provide connected equipment with the highest quality power
- •Intelligent operation—to allow the UPS to relay more detailed operating conditions through PowerAlert power management software
- •Extended run capability—to allow extended battery backup runtime for critical systems during a blackout
- •Small-footprint rackmount, tower and low profile cabinets—to save space in every application
- •Communication port(s) and PowerAlert Software (FREE, included)—to automatically shut down unattended systems

Available features on select models include . . .

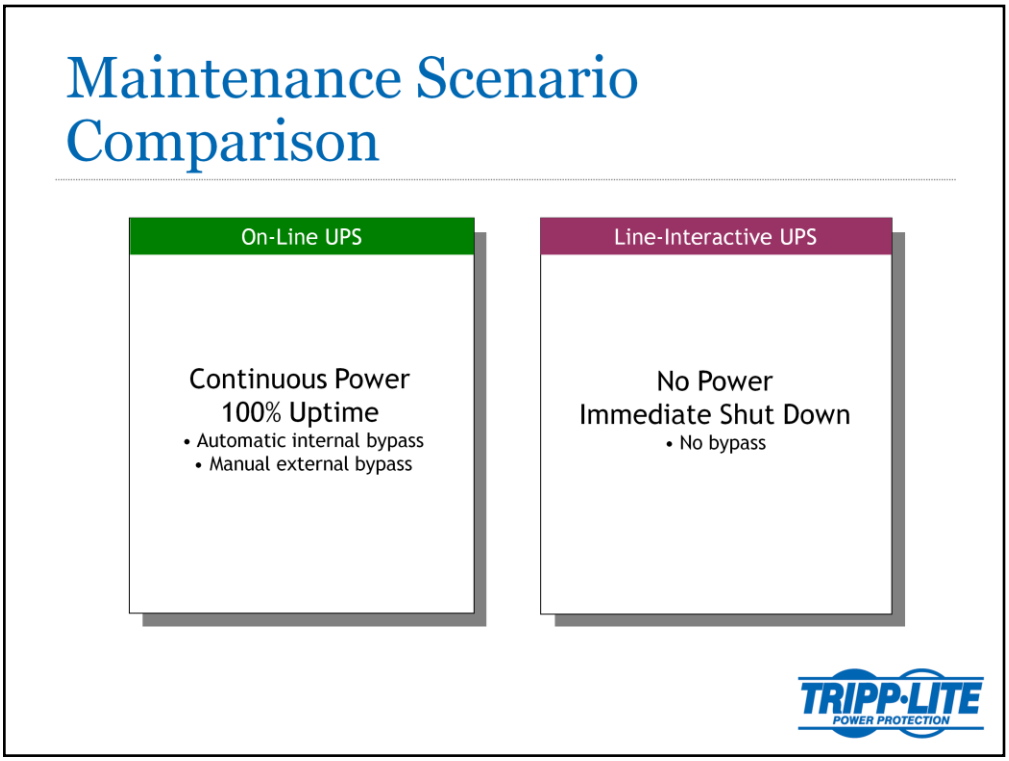
- •Hot-swappable modular design and N+1 redundancy—to provide 100% availability



Which performs better during a blackout, an On-Line UPS or a Line-interactive UPS? Both perform well, but On-Line UPSs provide a smoother transfer between utility and battery backup power. Because its batteries are integrated into its normal operation, On-Line UPSs take no time at all to transfer between utility power and battery power—0 milliseconds. Line-Interactive UPSs, on the other hand, provide a slight delay during the transfer between utility power and battery power—4 milliseconds. While the vast majority of equipment can tolerate such a transfer, On-Line UPSs set the highest standard.



Which UPS provides the best output quality when regulating voltage, an On-Line UPS or a Line-interactive UPS? Both perform well, but On-Line UPSs provide the best output quality available, regulating voltage within 2% +/- of nominal voltage. Line-Interactive UPS Systems, on the other hand, regulate voltage within 12% +/- of nominal voltage. While the vast majority of equipment can tolerate such a voltage range, On-Line UPSs set the highest standard.



What if the UPS requires maintenance, but the connected equipment cannot be turned off and must continue to receive power? On-Line UPSs can be safely maintained while still providing continuous power to connected equipment. Most Line-Interactive UPSs cannot. The difference is in the On-Line UPS's power bypass features. If an On-Line UPS experiences an internal fault or overload, it will automatically "bypass" its internal components and deliver power directly to connected equipment. In addition, On-Line UPSs feature an external bypass switch that allows users to perform the same function manually. While select Tripp Lite Line-Interactive UPS Systems are being introduced which feature an automatic internal bypass function, none feature a manual external bypass switch.

Tripp Lite offers a wide variety of complementary products that enhance the operation and manageability of its UPS systems. **PowerAlert UPS Power Management Software:** (included FREE as a CD or web download) provides remote and unattended power management for up to 250 UPS Systems or PDUs. It also provides graceful automatic system shut down in the event of an extended blackout. **Internal SNMP/Web Management Card (Model: SNMPWEBCARD):** Using an SNMP/Web Management Card (available separately from Tripp Lite), managers can make UPS systems and select switched PDUs fully manageable (monitored and controlled) nodes on their network. **External Environmental Sensor (Model: ENVIROSENSE):** Using an Environmental Sensor (available separately from Tripp Lite) and an SNMP/Web card, managers can monitor external temperature/humidity and contact-closure (security and fire-alarm) inputs. Perfect for monitoring remote racks. **External Battery Packs:** Select UPS Systems accept optional external battery packs (available separately from Tripp Lite) for additional runtime. **Power Distribution Units (PDUs):** Tripp Lite offers a complete line of PDUs, available separately. Connect PDUs to UPS systems in a variety of configurations to: increase the number of UPS outlets, convert UPS outlets from high-amperage to low-amperage output or to allow users to hot-swap the UPS during maintenance without interrupting power to connected equipment. **Rack Systems:** Tripp Lite offers a complete line of premium enclosures and open-frame racks to organize and secure rackmount equipment, including UPS systems.