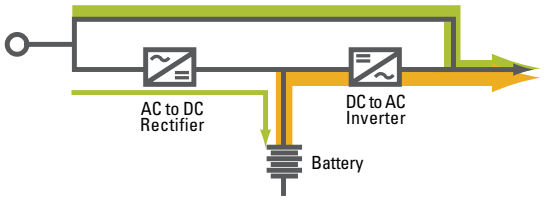
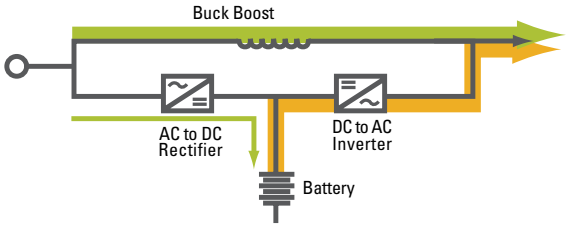
# UPS topologies

There are several different UPS topologies that provide varying degrees of protection. Selecting the best fit depends on several factors, including the level of reliability and availability you require, the type of equipment being protected and the application/environment. While all four of the most common UPS topologies outlined below meet the input voltage requirements for IT equipment, there are key differences in how the result is achieved, as well as the frequency and duration of demands on the battery.

**Standby UPSs** allow equipment to run off utility power until the UPS detects a problem, at which point the UPS switches to battery power to protect against sags, surges or outages. Because the band of normal operation is typically narrow, the UPS must resort to batteries frequently, which can reduce battery runtime and service life.




**Line-interactive UPSs** regulate voltage either by boosting or decreasing utility power as necessary before allowing it to pass to the protected equipment or by resorting to battery power. Line-interactive models typically switch to battery mode with a transfer time of 3-8 ms, which is within acceptable limits for most power supplies. Battery usage is lower than a standby UPS, but still higher than an online model.

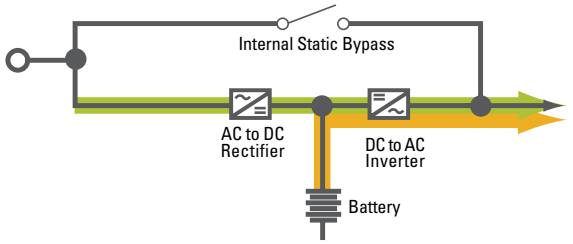



Normal Operation
Battery Power

**Online UPSs** provide the highest level of protection by isolating equipment from raw utility power—converting power from AC to DC and back to AC again. When input voltage is within preset UPS tolerances, the output is regulated without going to battery. In this manner, the UPS uses the batteries less often and for less time than either standby or line-interactive designs. Many online UPSs allow an even wider input acceptance window when the UPS is below 100% load.

High-efficiency mode UPSs are among the latest generation of UPS models, successfully combining the benefits of both single- and double-conversion technologies. Under normal conditions when power falls within acceptable limits, the multi-mode UPS operates as a high-efficiency, energy-saving system, regulating voltage and resolving common utility power anomalies.

During erratic power or fleeting disturbances when AC input power falls outside of preset tolerances for line-interactive mode, the UPS switches to online double-conversion mode, completely isolating equipment from incoming power. If power is lost altogether, or the input power exceeds the tolerances of the double-conversion rectifier, the UPS relies on the battery to keep loads operating, converting back to high-efficiency mode when it is safe.




**Ferroresonant UPSs** operate similarly to line-interactive models with the exception that a ferroresonant transformer is used to condition the output and hold energy long enough to cover the time between switching from line power to battery power which effectively means a no-break transfer. Many ferroresonant UPSs are 82-88 percent efficient and offer excellent isolation. Although no longer the dominant type of UPS, these robust units are still used in industrial settings such as oil and gas, petrochemical, chemical, utility and heavy industry markets.