

Ultra-Capacitor DC UPS: Your Best Choice to Ensure that Critical Information and Functions Remain Available When Supply Voltage Drops Out

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Backup power systems are an integral part of installations as varied as data centers, wind turbine farms, telecommunications networks and industrial plant operations—all of which rely on the continuous availability of power.

Ultra-capacitors are best suited to these and other mission-critical applications that require seamless transition to backup power (UPS) over relatively short periods of time. In the event of a main power supply interruption, the energy stored in the ultra-capacitors is released. High energy batteries also have been developed for single use or rechargeable UPS applications, but they typically require minutes to discharge, not seconds. Unlike a battery, an ultra-capacitor doesn't depend on a chemical reaction to charge or discharge so it's capable of fast response and the charge-discharge cycle life of a supercapacitor can be, typically, 15 years or more (depending on how many charges or discharges are involved).

Quick response is only one of the advantages of DC-UPS ultra-capacitor technology can claim versus battery-based alternatives. Here are some others:

- Ultra-capacitors are environmentally-friendly and constructed of sealed packages. Since the capacitors do not develop gases, it is possible to install an Altech C-tech UPS system in an IP66 housing made of V2A stainless steel for use in chemical plants or in animal feeding systems on farms, where a reliable function of the equipment is essential. Battery UPS solutions cannot be fully sealed because acid-based batteries will give off a small amount of gas as it charges and discharges; hydrogen and oxygen form during discharge and float charging--these gases escape through vents provided in the battery case. When the battery is weak and/or failing, the electrolyte can overheat and the battery can give off a large amount of a different gas, much of it comprised of vaporized sulfuric acid and hydrogen.
- With ultra-capacitors there are no disposal issues at the end of its service life. The European WEEE directive, for instance, requires companies to recover and recycle Lithium batteries if these are used for back-up. Similar regulations are either in place or are being considered in other regions of the globe as well.
- Ultra-capacitors have a wide temperature range of +65-80C down to -40C (without de-rating). Batteries, on the other hand, are vulnerable to the extreme temperatures that ultra-capacitors can endure. As a rule of thumb batteries lose power when the temperature drops. Harsh environmental conditions and continuous cycling take a heavy toll on batteries, too, and they often need replacement every two to four years. On the other hand ultra-capacitor UPS systems are designed so that they're able to be cooled via convection (normal air flow).
- Designed to be stone-cold reliable, UPS systems based on Altech ultra-capacitor modules require minimal installation and have virtually no maintenance cost. When you have a battery backup system, after a few years the battery starts losing its capacity. Soon thereafter it needs to be replaced, and that can involve a great deal of maintenance work and cost; consider an offshore wind farm (more on this shortly) for example. It's an arduous process to send a repair person out to this type of facility for battery maintenance.
- Ultra-capacitors are fast- charging. Charging an ultra-capacitor is similar to charging a battery except that a completely discharged capacitor can be charged at full current for the whole charge cycle, whereas a battery needs to be trickle charged until the battery reaches a specified minimum voltage. Altech C-Tec units provide microcontroller based charging and discharging of the ultra-capacitors.
- Different voltages are available. Altech's ultra-capacitor modules (DC/UPS) are DIN-rail mountable and come in 12 volt, 24 volt, and 48 volt systems from 1,000 to 10,000 watts of energy in a standard unit. Its ultra-capacitor modules offer five times the lifespan of a traditional battery. The company offers a wide variety of products for DC-UPS systems from 2A and up to 900A or larger, as well as monitoring and set up software and comprehensive support.
- Ultra-capacitor UPS modules are vibration and shock resistant (necessary in many industrial plants using vibrating equipment). An ultra-capacitor-based system requires fewer components and has simpler mechanical mounting and vibration damping than batteries.



Example Applications

Wind power turbines now incorporate what's called blade-pitch control that allows the individual blades to turn. This is done to maximize the angle to the wind for each specific blade; the orientation of the rotor blades influences how much wind energy is captured so it can get the most spin out of each turbine creating the most electricity. The pitch control system in this way helps prevent mechanical stress to the wind turbine by continuously adjusting the blade pitch in line with the operation strategy of the wind turbine. But if the winds are really high or uneven operators have to stop the wind turbine. Pitch control allows them to move the blades to a fail-safe position so the wind doesn't damage the turbine. The pitch control system in a wind turbine is located in the rotor hub and controls the rotor blades.



If the energy grid happens to fail, the turbines need an emergency backup plan. There are two types of energy storage systems used for electric wind turbine pitch control: ultra-capacitor-based and battery-based. About 85% of electric pitch systems now use ultra-capacitors because ultra-capacitors have several advantages when it comes to supporting a wind turbine's electric pitch control system. For one thing, unlike batteries, ultra-capacitors provide the burst of energy that is needed to return the turbine blades to a neutral position in the event of a grid power failure. Also important is the fact that battery-based energy storage systems often have to be oversized to accommodate peak power demands—even if this demand occurs only for a few seconds. As a result, battery systems are bulkier and weigh more. Ultra-capacitors are significantly lighter—about one-fifth the weight of a battery. Also, a lot of these wind turbines are in remote locations – atop hills for example, so it's hard to get to them. If they use batteries, which are very heavy, they'd have to replace them every 18 to 24 months and it becomes a difficult and costly maintenance item. The ultra-capacitor, on the other hand, is light enough that it actually goes in the hub of the blade. So, it's a much more efficient design.

What's more, if the wind turbine is not turning the ultra-capacitor UPS system can provide power to communicate messages as to what is going on and what needs to be done. Most facilities use a communications system in conjunction with an industrial PC tracking the health and operation of critical wind turbine elements.

Wind turbine systems also use ultra-capacitor UPS systems for the warning/signal lights on the towers themselves. Regulations specify that the warning lights on a wind turbine – even if the turbine is not operating--have to be on to warn aircraft as to the presence of the tower.

Altech's UCC-TEC (ultra-capacitor charger) is a charger for ultra-capacitor modules. The device was developed for a wind turbine applications. The UCC-TEC is installed in the rotating part on top of the wind turbine and has to withstand hard mechanical stresses and high temperature variations. Serial interface ports are provided for connecting a PC (RS485) for data exchange, service functions, remote monitoring, etc. and for further connections to other UCC-TEC devices.

In data centers capacitors excel at providing controlled shutdown, protecting computer systems. In a data center if the power goes down for a few seconds, then all the PCs and all the equipment goes down with it and it can take a very long time to restart everything. Or if there's a computer process that's ongoing, and it needs another second or two to finish the task before closing down the PC, without a backup system the data is gone and you have to restart and redo everything. An ultra-capacitor based UPS can take over for that short period of time ensuring that the critical volatile memory or alarm sections of the systems remain powered so you don't have a loss of data. Once the required data has been saved and the power fail alarms have been properly issued, the power restoration time becomes much less important.

On a modern farm automated systems ensure that the farm animals are fed on a regular schedule. So if the power goes down the animals are not going to be fed creating a lot of problems. Unlike batteries you can place an ultra-capacitor UPS system in a completely sealed enclosure so that food and feeding applications materials will not enter the enclosure, and there are no noxious gases being released. With a battery system you can't just put it in a sealed enclosure because you need some form of venting because of the gases that are produced.

For more information go to <http://www.altechcorp.com/power/DC-UPS.html>.

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