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continuous power availability

SWISS MADE

Centiel's DARA distributed active redundant architecture.

Article

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Ensuring a supply of continuous electrical power is vital in critical environments such as hospitals, data centres and commercial institutions where even the shortest interruption may cause significant financial losses or even endanger lives. An Uninterruptible Power Supply (UPS) system is used to provide power when the main source is interrupted or even fails, it also ensures a high level of power quality. Therefore, achieving the highest possible level of availability of a UPS system is of paramount importance.

Availability defines the degree to which a system will continue to operate at any given point in time. The simplest representation of Availability (A) is a ratio of the expected value of the uptime of a system to the aggregate of the expected values of up and down time. In other words, Availability is the most commonly used metric of measurement and is defined as the amount of time a system is operational during its expected lifetime.

Another well known representation of Availability in our industry is a ratio of the Mean Time Between Failure (MTBF) divided by MTBF plus Mean Time to Repair (MTTR).

$$A = \frac{MTBF}{MTBF + MTTR}$$

MTBF describes the expected time between two failures for a repairable system, whereas Mean Time to Repair is the average time needed for the repair.

To make the comparison between UPS architectures straight forward, Availability is usually expressed with a number of nines. For example "Five nines" availability means that the availability is 0.99999 or that 99.999% of the time, the system will continue to operate.

Over the years technological advances in architecture have increased the levels of availability that UPS solutions offer. The 4th Generation of modular UPS CumulusPowerTM designed and manufactured by CENTIEL now provides industry-leading availability of 9 nines (99.999999999%). On a practical level, this means downtime is reduced significantly from seconds to milliseconds. To put this number into perspective, the 3rd generation of modular UPS and most commonly used architectures offer 6 nines availability which represents a downtime per year in the level of seconds.

So how can CENTIEL achieve such high levels of availability? The answer lies in CENTIEL's innovative Distributed Active Redundant Architecture (DARA). So what exactly is DARA?

Distributed

Distributed means that a decentralised and distributed architecture is used. No single active component can be a potential single point of failure. No single control board, no single static bypass, no single parallel bus etc. Each module within the frame is a UPS in its own right. Each module is a fully independent UPS with self-isolating intelligent module technology (IMT), with all the building blocks of a complete UPS unit – rectifier, inverter, static bypass, battery charger, intelligence (CPU and communication logic) and control panel.

Think about taking a traditional monolithic multi-unit parallel system stacked horizontally, now flip this to stack the system vertically. In essence, this is what CENTIEL's modular system does.
Lesser quality modular UPS units use a single separate static bypass which is of concern, as it becomes a potential single point of failure.

Active

DARA's Distributed Decision Making (DDM) technology is a real differentiator, and it means there's no single component deciding for the complete UPS system. Instead, the sum of the single modules' decision determines the total system action or reaction to any issues.
In typical modular UPS architecture, where modules share a single system control logic when such a single decision-making point has a problem, it could signal all the system to transfer the load to static bypass. However, CENTIEL's true modular UPS with DARA makes distributed decision and majority load transfer decisions.

At module level, if a fault occurs, that module can decide whether the load should remain on its inverter or be transferred to its static bypass. However, this is not done in isolation as the module instantaneously communicates with the remaining modules to allow them to work together to share the load. The communication between the modules is accomplished by using a triple-mode parallel BUS and is key to the correct management of the load sharing to avoid crosscurrents between the modules. This automated process ensures that the system remains live and that the critical load is protected at all times.

Redundant

Building redundancy into a UPS system improves the reliability and availability of the system. By using modular technology, redundancy can be achieved by simply increasing the number of UPS modules over and above the number that is required to support the load. This added redundancy enables essential preventative maintenance works to take place without the need to switch the system to a state where the load is unprotected. This enhances the availability of the systems and reduces downtime. In addition, CumulusPower's ability to exchange UPS modules safely in a live system (safe-hot-swap) offers the lowest mean time to repair while mitigating the human error component.

Redundancy of UPS components such as the static bypass, must also apply to communication between modules. CumulusPower uses CENTIEL's proprietary technology called Triple Mode communication bus. As its name suggests, there are three paths of communication with triple-redundant electronic circuits. In this way, the control logic allows the communication between UPS units to be maintained even if one of the parallel buses has become disconnected or short-circuited, ensuring there is no single point of failure.

Architecture

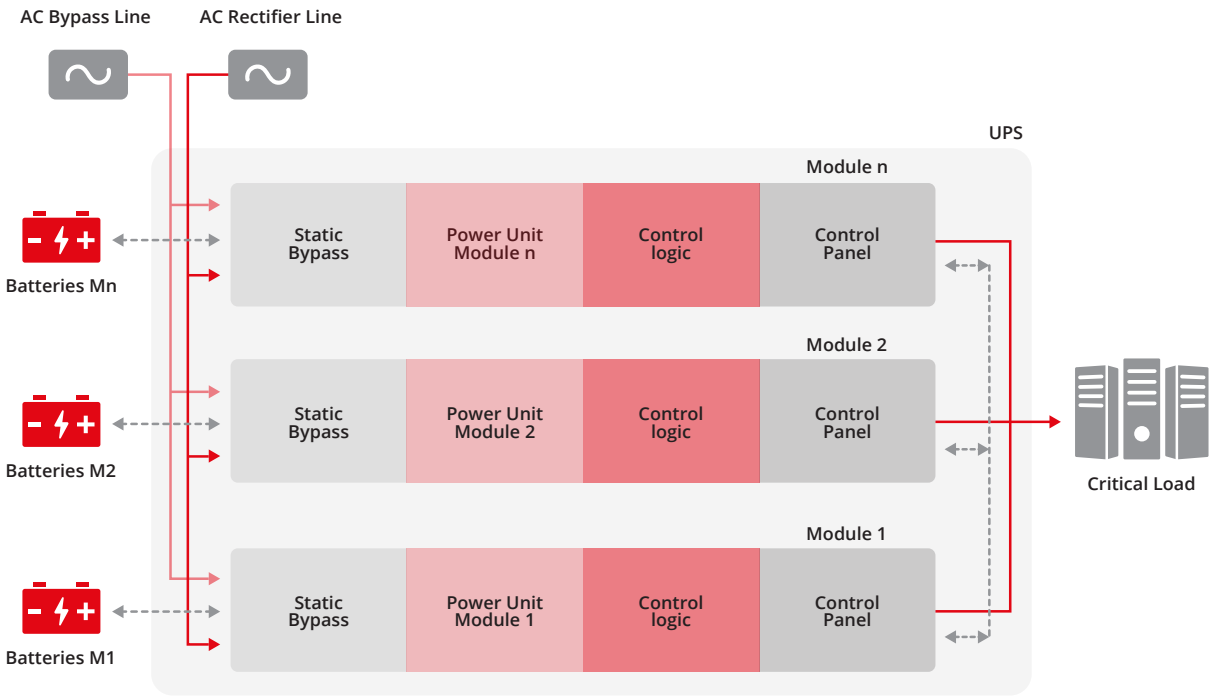
It is not just having the ability to exchange modules (hot-swap capability) seemlessley on a live system, it is the ability for this to be completed safely and to mitigate the human error which many other solutions don't have. CumulusPower's architecture ensures that any module being added to a system can be fully isolated and tested within a runing frame before it accepts any load, giving it the ability to identify any potential faults before integrating with the rest of the system. In a system without safe-hot-swap, any issue with a module going into a live system could have catastrophic consequences such as the load being lost. The overall concept of CENTIEL's true modular architecture is a completely decentralised and distributed one, where no common component can act as a potential single point of failure. Instead of one brain, there are multiple brains which work together to make the best decision for the whole.

At CENTIEL, our design team has been working at the forefront of technological development for many years. We are the trusted advisors to some of the world's leading institutions. We have developed our pioneering 4th generation true modular UPS system CumulusPowerTM which offers industry-leading availability of 99.9999999% (nine, nines) through its Distributed Active Redundant Architecture (DARA), combined with low total cost of ownership (TCO) through its Maximum Efficiency Management (MEM) and low losses of energy.

CumulusPowerTM has now been installed in data centres and comms rooms in over 60 countries across five continents. More and more critical power loads are now protected with CumulusPowerTM in locations across the world including: the UK, Singapore, Australia, Germany, Spain, México, Brazil, the Czech Republic and the Channel Islands.

For more information please see: **www.centiel.com**

DARA modular architecture



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