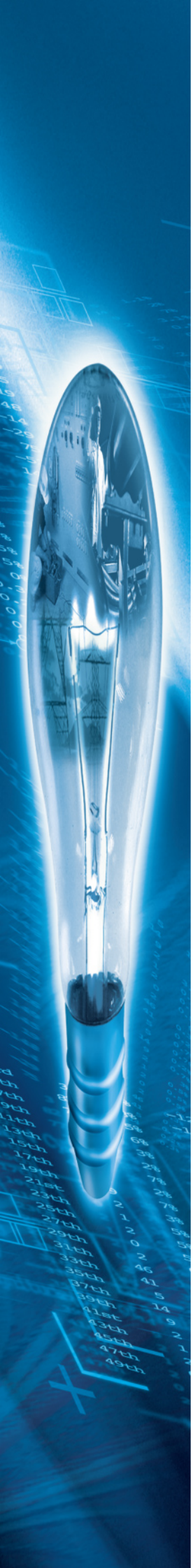


Case Study:

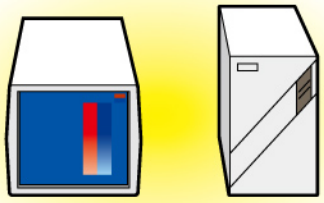
Choosing among Voltage-dip-compensation Devices on the Market

Introduction

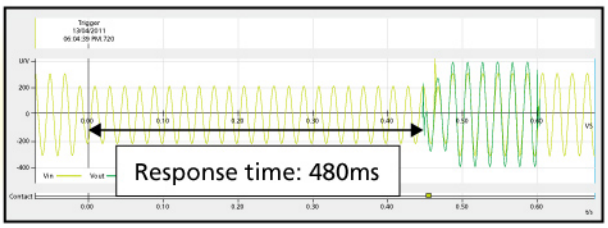
Many types of voltage-dip-compensation device are available on the market, but their performance in voltage-dip compensation varies from product to product. Tests show that not all of them have the capability to compensate for voltage dips effectively. So, how do we choose a good voltage-dip-compensation device? What factors do we need to know? Our advice on evaluating various compensation devices is illustrated as follows:

Voltage Stabilizer and Automatic Voltage Regulator (AVR)

Usually, switch-type voltage-compensation devices employ auto-transformers or electronic voltage regulators to regulate the output voltage. There is no energy storage (i.e., no battery or capacitor) and the devices need time to process from voltage detection to compensation. According to test results, their response time can be very long and their performance in voltage-dip compensation is poor.

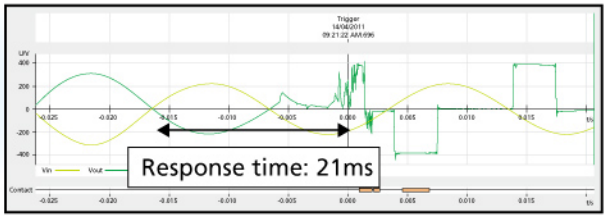


Voltage Stabilizer *AVR*



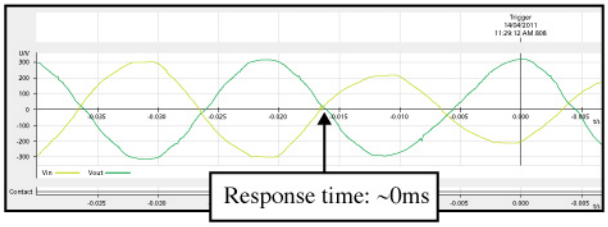
Battery Back-up Socket Outlet

This switch-type voltage-compensation device uses a transfer switch which, under abnormal voltage conditions, switches from the main supply source to the battery supply source. According to the test results, the response time is long and its performance in terms of voltage-dip compensation is unsatisfactory.



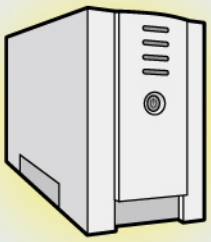
Constant Voltage Transformer (CVT)

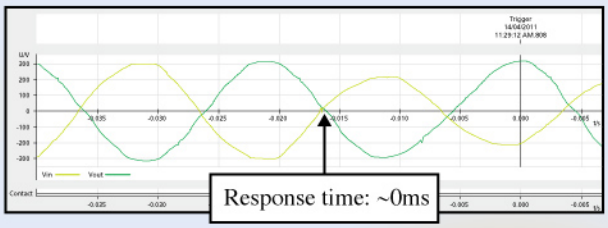
A CVT employs the ferro-resonant method to compensate for voltage fluctuations. It contains passive components for energy storage (but no battery is installed). It operates in on-line mode so it is able to instantly compensate for any voltage fluctuations. According to the test results, it can compensate for voltage dips down to 30% nominal voltage.



Battery Type True On-line UPS

A true on-line UPS employs 'double-conversion' technology in which the load is supplied from inverter path during normal situation. When there is voltage dip, no switching is required so that the response time is negligible. According to the test results, it can compensate for voltage dips down to 0% nominal voltage.

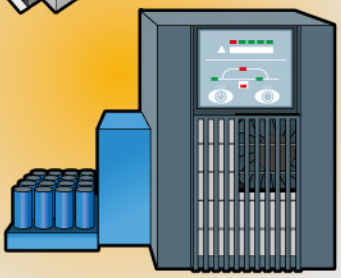




Battery-less Type UPS

Dip Proofing Inverter (DPI) and Super-capacitor UPS (SC-UPS) are treated as battery-less type UPS. Some DPI can operate in a very short response time (<3ms) in off-line mode while SC-UPS operate in true on-line mode. The output waveform of DPI is a square-wave while the SC-UPS is a sine-wave. Both of them can compensate for very deep voltage dips down to 0% nominal voltage. They have good performance in protecting control circuits during voltage dips.

DPI



SC-UPS

Product Comparison

Item	Voltage Stabilizer	AVR	Battery Back-up Socket Outlet	CVT	Battery Type True On-line UPS	DPI	SC-UPS
Response Time to Voltage Dip Correction	Very Long	Long	Long	Instantly	Instantly	Very Short (<3ms)	Instantly
Voltage Compensation Performance	Poor	Poor	Not Satisfactory	Fair	Excellent	Excellent	Excellent
Typical Compensation Time Design	NA	NA	Hours	NA	Hours	2-3s	2-3s
Battery Installation	No	No	Yes	No	Yes	No	No
Estimated Life Time (Years)	10	10	2-3	10	2-3	10	10
Equipment Cost ($k)	High	Low	Medium	High	Medium	High	Medium to High
Overall Score*	☺	☺	☺	☺☺☺	☺☺☺	☺☺☺☺☺	☺☺☺☺☺

* The more ☺ the higher the score

Conclusion

1. According to the comparison above, a voltage-dip-compensation device with good voltage-dip compensation performance, battery-less, and at a reasonable price may be a good choice.
2. Incorporating the requirements for voltage-dip compensation in the tender specification for critical equipment during the project-design stage could be more cost effective and offer higher system integrity.