



Power Quality & Industrial Applications Laboratory

...providing industrially-oriented power quality research, development, solutions and education

Have you ever lost a file on your computer when the lights blinked? So have lots of others. Short-term depressions in voltage, called "voltage sags," are a common occurrence on the power system. Most voltage sags last less than ½ second and are caused by faults or short circuits on the power system due to lightning, animals and trees, and construction accidents. Other disturbances happen as well, such as harmonics, voltage swells and ringing due to capacitor switching, and dips due to large motor starting or load transfer. All of these disturbances are a part of normal power system operation and protection schemes. Unfortunately, the increase of sophisticated electronic equipment in industrial plants, such as computers, PLCs, and motor drives, have rendered many industrial processes extremely vulnerable to these disturbances. In fact, it is estimated that more than a *Billion Dollars* of lost production occurs annually in the United States just due to voltage sags.

Thanks to generous utility, industrial, and university support, Clemson University's Department of Electrical and Computer Engineering has one of the premiere programs in Power Quality in the United States. Our *Power Quality and Industrial Applications Laboratory (PQIA)* is known worldwide for its cutting edge research in the power quality area. Our researchers are actively pursuing advances in technology related to power quality phenomena and their effect on industrial processes. The research focus is on identification and quantification of power quality phenomena, utility-side mitigation of power quality variations, and load-side solutions for industrial and commercial applications.

Present research efforts include:

- Sag Generator to reproduce voltage sags in the laboratory.
- Characterization of voltage sag phenomena.
- Ride-through improvements for dc and ac adjustable speed drives (ASDs).
- Ride-through improvements for PLCs and Contactors.
- Studies to improve the behavior of industrial web-handling systems during voltage sags.
- Utility-side "Custom Power" applications for industrial loads.
- In-plant testing of industrial process equipment for voltage sag sensitivity using a mobile Sag Generator.
- Load-specific behavior of motors during voltage sags using a controllable dynamometer.
- Clamping circuit to prevent overvoltage trips on ac adjustable frequency drives due to utility capacitor switching.

Our present laboratory capabilities include:

- Dedicated 500kVA, 480V, three-phase source.
- Three-phase sag generator up to 75kVA, 480V.
- Mobile three-phase sag generator to 18kVA, 480V.
- Three-phase arbitrary waveform generator and linear power amplifiers.
- Programmable dynamometer for testing ASDs and motors dynamically.
- DC and AC motor drives of various types and capabilities.
- Capacitor switching test facility.
- Data acquisition systems and digital oscilloscopes.

Additionally, the PQIA laboratory is involved in research related to power electronics and power supplies. Recent projects have included UPS systems, aircraft wiring, and lighting controls. The PQIA Lab is seeking industrial partners for conducting mutually related research. Our interest areas include power electronics, analog and digital electronics, industrial electronics, signal processing, electric machines and motor drives as well as contemporary power systems. To learn more about our lab, opportunities as an industrial partner, or sponsorship of power quality research initiatives, please contact one of the faculty members listed below or visit our web page at: <http://ece.clemson.edu/power/pqia>

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