

A brief introduction to power quality problems.

1. Voltage dips/sags & momentary interruptions defined.

An interconnected power system will, in the normal course of operation, experience short duration voltage dips/sags and momentary interruptions. A momentary voltage dip or sag can be defined as a reduction in the rms value of the supply voltage with duration of up to 3 seconds. A momentary interruption can be defined as a complete loss of supply voltage with duration of up to 3 seconds.

2. Causes of momentary Voltage Dips/Sags & Interruptions.

These events may occur naturally as a result of lightning strikes on high tension lines, flashovers caused by fires under the line, dirty insulators, snow storms, overgrown vegetation or animals. Disconnecting the supply to extinguish the arc and then reconnecting normally clears these types of fault. This process is known as auto re-closing and results in a momentary supply interruption. The most common artificial causes are heavy load switching, starting large motors and internal short circuits.

3. SEMI F47 standard.

The semiconductor industry formulated the F47 standard in order to define a common level of voltage sag immunity for semiconductor manufacturing equipment. The standard requires the equipment to function correctly when subjected to a variable depth supply voltage sag with a maximum depth of 50% and a duration of 1 second. Manufacturers of semiconductor tools design the equipment to meet the F47 sag immunity standard.

4. The ITIC Curve

The Computer and Business Equipment Manufacturers Association (CBEMA) collected data and a curve was developed as a reference for the ride through capability of data processing equipment. Subsequently The Information Technology Industry Council (ITIC) updated this curve. The curve shows that a voltage sag of 30% (supply drops to 70% of nominal value) will adversely affect equipment operation.

5. Problem overview

Power Quality studies have been carried out for some time and a large volume of data has been collected and analyzed. Briefly, the data shows that a distribution customer experiences over 50 events per annum where the supply voltage sags below 90% of nominal. The majority of sags have a duration of 166ms (10Hz) or less with a depth of 20 to 30% (supply drops to 80-70% of nominal value). It should be noted that the number and magnitude of events experienced can vary greatly from one location to another also distribution customers will be subjected to considerably more events than a customer fed directly from the transmission grid or via a premium grid. It is important to note that even premium grid users experience momentary sags and interruptions. Faults anywhere in the power system will cause momentary sags with a duration determined by fault clearing devices. Circuit breakers can take up to 100ms to clear a fault in a transmission system and auto re closing from 300ms to 3 seconds. Fault clearing in a distribution system can take considerably longer, the actual time depending on the substation protection equipment settings. It is clear that all power users will experience power quality events and if their business depends on continuous production processes they can expect process disruptions due to voltage dips and momentary interruptions.

We offer cost effective solutions to these problems!