Power Monitoring

Application Note - AN-9

The immediate response to a power problem is to hook up a *Power Monitor*. These devices, specifically developed to detect and report AC power disturbances, were needed to prove the existence of power quality problems. As technology has improved, the power monitor has gone from a simple text device to a very complex waveform capture and analysis instrument. However, a Power Monitor, whether simple or complex, is only one aspect of a comprehensive power quality program.

A Typical Power Problem

A power problem is rarely recognized immediately. Often, weeks of poor equipment performance and component failure precede the decision that "it must be power". Once *Power Quality* is identified as a potential cause, a power monitor is connected to the power source, in order to capture disturbances for a few days or weeks.

In a positive scenario, the power monitor captures a few examples of the power disturbances that are causing the problems. A power quality engineer can review this data, recommend a mitigating device such as a power conditioner, and the problem is resolved.

In a more likely scenario, the power monitor captures data, but it is unclear whether this is related to the equipment problems. Perhaps the monitor is set up improperly, or captures disturbances that are generated by the sensitive load itself. Finally, it is possible that the power monitor can detect a problem but additional study of the grounding system or facility wiring is required. In these cases, the power monitor data is inconclusive.

Power Monitors

There are many types of devices available which can be called "power monitors". The most simple devices are inexpensive boxes with latching lights to indicate that a power problem has occurred, with no amplitude, frequency, or time of occurrence data. More sophisticated devices indicate amplitude, time of event, and keep a running count of the number of events. Finally "state of the art" devices collect comprehensive event information (waveforms, current and voltage) and calculate the severity and amplitude of these events.

The differences in these devices are cost and thoroughness. A low cost device may help to identify that a power problem is occurring, but will not help to resolve this or identify the source. Similarly, an expensive device will capture very diagnostic data, but will also result in a large amount of data that may be difficult to sort through.

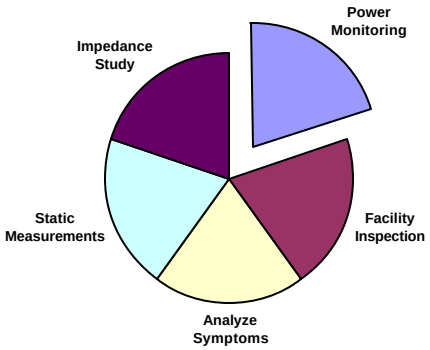
Any power monitor must recognize a power disturbance and trigger the data capture circuitry. The design philosophy behind these devices varies widely; it is critical that a power quality engineer who is familiar with the particular monitoring device evaluate the data from the power monitor. Some manufacturers have begun developing "Expert Systems", artificial intelligence systems specially designed to evaluate the data from a particular power monitor.

Power monitor designs are generally good at detecting outages, sags, and impulses. Graphic monitors provide detailed waveform information and may provide harmonic distortion information. However, no power monitor does a good job of quantitatively recording high frequency noise or grounding problems. The monitors simply identify that this type of problem is occurring and needs additional study.

The Power Survey

It is a common misconception that a Power Quality Survey consists of connecting a power monitor, and then analyzing the results. A true power survey contains many steps and processes in addition to connecting a power monitor. If these steps are not followed, the power monitor data may not be useful. In many cases, simple wiring problems such as loose wires, ungrounded sources, etc. can cause a large number of "nuisance" power disturbances, and mask more serious problems.

Power Survey Components



Limitations of Power Monitoring

A Power Survey is generally *Reactive*, that is, it occurs after a power problem is suspected or clearly indicated. As a result, the power survey is like First Aid - used to stop the bleeding after a problem occurs. *Service* and *Warranty Costs*, and *Customer Satisfaction* have already been affected.

A Power Survey that is conducted prior to installation as a *Pre-emptive* measure, is a better policy. In this way, disturbances can be uncovered prior to causing equipment problems and resulting expenses.

However, if power problems are uncovered at this stage, installation delays and increased installation costs to correct power problems can affect the customer relationships during the installation process.

Any power monitoring program, reactive or pre-emptive, is susceptible to the fickle nature of power problems. Some of these problems occur continuously and can be detected at any time. Others are seasonal (such a lightning caused impulses or voltage sags due to air conditioning) or dependent upon facility equipment operation. As a result, a power survey can be thought of as a snapshot, and may need to be repeated periodically to ensure that power quality remains consistent.

Recommendations for Power Monitoring

Power monitoring is not always an effective way to identify problems such as transient impulses, grounding problems, and high frequency noise. These disturbances are unpredictable, and are likely to cause equipment damage and disruption. As a result, a power survey to detect these is not cost effective if equipment damage has been experienced by the time the problems are detected.

It is a good practice to supply sensitive equipment with base-level power conditioning, made up of *isolation*, *filtering*, and *transient voltage surge suppression.* With these in place, power monitoring can be used as required to detect other power disturbances such as outages, sags, harmonic distortion, etc. These problems are disruptive, rather than damaging. As such, they can often be resolved reactively without incurring excessive service costs.