

Reducing Downtime by Troubleshooting Power Quality Disturbances

Poor power quality is a potential source of problems in motors, lighting, IT networks and more. A pro-active approach to troubleshooting and solving power quality problems can save considerable time and money in terms of preventing unplanned downtime, damaged production, unnecessarily high energy bills, and even fines for ‘polluting’ the upstream supply.

Application Note

Prevent expensive downtime

Today’s industrial and commercial businesses that rely on precision electronics and computer-based equipment for their daily operations need to be aware of the potential cost of poor power quality. Sensitive electrical loads are vulnerable to power disturbances that affect overall power quality. Good power quality is absolutely critical for maintaining productivity and process consistency throughout an organization.

Recognize the signs!

Typical signs of a power quality problem include flickering lights, poor computer performance, lock-ups and data loss, nuisance tripping of breakers and variable speed drives, as well as overheating equipment such as motors and transformers. If these warning signs are ignored, power quality problems may quickly lead to unscheduled downtime, product waste, critical processes failure or damaged equipment – as well as risks to personal safety and excessive power costs.

When production is interrupted by a power disturbance, profit is lost on the products not manufactured and sold. Interruptions can also damage a partially completed product, causing the material to be scrapped. Reacting to a power disruption also ties up maintenance resources. And for computer-based or online businesses, the time taken to reboot workstations, and recover pending transactions or unsaved documents is significant. Lost time equates to lost revenue.

Avoid the problem in the first place

All these problems can be avoided by taking a pro-active approach to power quality, and this starts with awareness. Ensuring good power quality requires frequent inspection, good maintenance practices and the appropriate inspection equipment. Only tools specifically designed to troubleshoot, record and analyze power quality parameters, provide the detailed information you need to locate a variety of disturbance sources and to correctly diagnose the problem.

Some equipment may even inject undesirable events or power disturbances back into a facility’s electrical distribution system under normal operating circumstances. Equipment such as switched-mode power sup-

plies in IT equipment, variable speed drives in electrical motors, and high-frequency electronic-controlled lighting in offices are all good examples.

What are power disturbances?

Power disturbances are defined in terms of magnitude and duration. When a power disturbance falls outside of specified operating limits, equipment may be disrupted or damaged. Typical power quality disturbances include dips, swells, harmonic distortion, unbalance, flicker and transients.



Preventive maintenance in the fight against poor power quality

Much of the time and cost associated with power disturbances can be prevented by regular maintenance inspections. A good practice is to measure power quality as part of an overall preventive/predictive maintenance program. In doing so, a regularly implemented set of measurements can help predict problems before they harm equipment or shut down critical processes. These measurements can be taken without interrupting operations. Parameters such as voltage stability as well as levels of harmonic distortion and unbalance are good indicators of load and distribution system health.

This type of preventive maintenance is based on regular inspections, and in addition to power quality checks, involves the use of tools such as thermal imagers. This helps detect hot spots, or signs of overheating in electrical panels, wire connections and electrical motors.

When investigating disturbances, consider taking a bottom-up approach. It is advisable to start at the suspect load and work back to the service entrance. In doing this, it is possible to determine where the problem disappears and therefore to pinpoint the source.



Tools for power quality troubleshooting and analysis

Regular test tools cannot get to the bottom of many power quality issues. Only tools specifically designed to capture power quality parameters provide the detailed information required to draw conclusions and to execute the right corrective solutions. These tools include troubleshooters, analyzers, loggers and recorders that are used for:

- **Frontline troubleshooting:** Quickly diagnose problems on-screen to get your operation back up and running.
- **Predictive maintenance:** Detect and prevent power quality issues before they cause downtime.
- **Quality of service compliance:** Validate incoming power quality at the service entrance and evaluate voltage quality according to local standards.
- **Long-term analysis:** Uncover hard-to-find or intermittent power issues over time.
- **Load studies:** Determine if the existing power distribution system can cope with new loads, keep track of power factor, and to quantify energy consumption.

Troubleshooters and analyzers

These include portable instruments with clamp meters for frontline troubleshooting. They help you quickly see the presence of disturbances such as harmonics and voltage variations on single- and three-phase loads, and determine their magnitude on the spot. Measurement results are shown instantly in the display. Examples include single-phase and three-phase power quality analyzers for predictive maintenance, quality-of-service compliance and load studies.

Loggers and recorders

In contrast, portable power quality recording and logging tools are set up and left behind for a longer period of time, for example a week, to capture intermittent disturbances. They are used for validating incoming power quality at the service entrance. Captured events and trend data are subsequently evaluated and reports easily created using software.

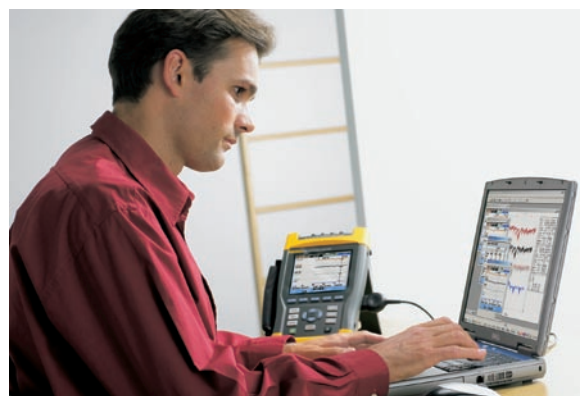
Such recording and analysis tools are also useful for conducting load studies to determine whether the existing electrical system can accommodate the addition of new loads. The measured results are analyzed later back in the office, and reports are created on a PC.



Power Quality Troubleshooting Tool



Power Quality Recording Tool



Power Quality Trending & Analysis

'Out-of-the-box' solutions for troubleshooting, recording & analyzing power quality in your facility:

Fluke offers professional state-of-the-art solutions for investigating power quality issues, ranging from portable single-phase and three-phase tools for troubleshooting, to advanced recorders for capturing even the fastest intermittent events. They are characterized by being easy to set up, and are supplied as complete solutions with software, probes, clamps and other accessories to get started immediately with power quality measurements. The comprehensive data-analysis software provides statistical summaries, trend diagrams, and helps generate professional 'customized' reports. For example:



Fluke 435 Class-A Power Quality Analyzer

The 435 three-phase power quality analyzer is fully Class-A compliant, and has advanced logging functions, user-configurable measurements, and a large memory for detailed long-term recording of events. It comes with instrument-powered flexible current probes and Power-Log software for analyzing data and creating reports.



Fluke 1740 Series Power Quality Loggers

The 1740 Series Power Quality Loggers are for everyday troubleshooting and analysis of power distribution systems. Three models offer a choice of functions for applications like disturbance analysis, load studies and 'quality-of-service' compliance. Voltage measurement accuracy is Class-A compliant. The easy-to-set-up instruments can capture events and log 500 parameters for 85 days.



Fluke 1760 Class-A Power Quality Recorder

Intended for utilities and industrial distribution systems in medium- and low-voltage networks, the 1760 Power Quality Recorder captures comprehensive details for disturbance analysis and 'quality-of-service' compliance testing in accordance with Class-A. It is quick to set up, has configurable thresholds and scale factors, GPS time synchronization, an uninterrupted power supply, and a 2 GB memory.

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