

# Resolving Power Quality Problems with Medical Imaging Systems

## Improve Medical Imaging System Performance: Characterize the Power Quality Delivered to Your System—Good PQ Enhanced Image Quality

Hospitals, clinics and imaging centers rely on imaging systems 24 hours per day, 365 days per year. When a system is down, patients in need of imaging can't receive the care they need in a timely manner. Magnetic resonance imaging (MRI), computed tomography (CT), digital X-ray and ultrasound to name a few modalities all rely on quality power to produce quality images. Healthcare providers rely on systems that work to help meet budgetary requirements for operating imaging departments.

Imaging system problems are frequently reported to manufacturers and service contract companies. Many

problems are found to be caused by poor PQ. The PQ in hospitals and clinics is often a problem, because of the number of non-linear loads operating in one facility. Utility PQ often causes problems for hospitals as well.

New imaging system designs, which produce images with higher resolution, also require higher power levels and better PQ. Voltage anomalies like capacitor switching transients, impulsive transients, high distortion and notching are likely to cause serious system problems. Problems range from burning out gradient amplifiers, burning out power supplies and introducing arti-

facts in images that physicians won't accept as quality images.

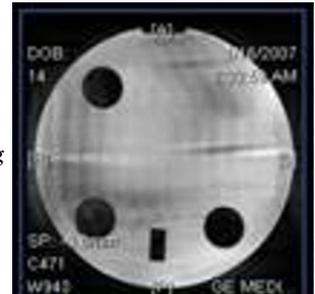
The imaging artifact below shows vertical bars across the phantom test image when a voltage sag of 75% of nominal voltage (480 volts) was applied to an MRI system in a PQ test laboratory.

Voltage sags, the most common PQ disturbance, were injected into this MRI system to determine its response to sags. Imaging artifacts showed up at a 90% sag voltage and were more pronounced as the sags were deeper with increased duration.

Imaging technicians often report unresolvable artifacts in their images as well as

system shutdowns and reboots.

In one hospital in New Mexico, an MRI system was rendered inoperable for over 30 days due to sags generated internally to a new hospital. A sag mitigation technology has to be installed to solve the problems.



Vertical artifact bars in image caused by an A to C voltage sag to 75% of nominal voltage.

## Imaging Systems also Require Exceptional Grounding for Good Performance

Electronic equipment not only requires good PQ, but also requires a low-impedance ground to operate correctly. Imaging systems require grounds that are even lower than the low impedance of 25 ohms at 60 Hz. This is because they require low-impedance grounds even at high frequencies above 1

MHz. High-frequency currents that try to flow out of the system must find an easy path back to Earth ground. If not, transient voltages are reflected back into the systems power distribution unit (PDU) and cause problems with the digital circuitry in the system.

Electrotek's approach for conducting a PQ audit on an electrical system powering imaging systems not only characterizes the PQ delivered to each system, but we also characterize the wiring and grounding system from the switchgear to each system modality—MRI, CT, digital X-ray and ultra-

sound among others. Electrotek typically finds five to 10 electrical problems each time it visits a hospital or clinic reporting poor imaging system performance. Our audit includes identification of loads that can cause imaging system problems and shorten the life of their critical components.

Electrotek Concepts, Inc.  
Software Development Center  
100 Cummings Center  
Suite 130G  
Beverly, MA 01915-6177  
United States of America  
Telephone: +1-978-927-8755  
Fax: +1-617-848-0088  
E-mail: [pqview@electrotek.com](mailto:pqview@electrotek.com)  
Website: [www.electrotek.com](http://www.electrotek.com)

Electrotek Concepts, Inc.  
Engineering Services Center  
9041 Executive Park Blvd.  
Suites 136 & 142  
Knoxville, TN 37923-4664  
United States of America  
Telephone: +1-865-470-9222  
Fax: +1-865-247-5984  
E-mail:  
[pqengineering@electrotek.com](mailto:pqengineering@electrotek.com)  
Website: [www.electrotek.com](http://www.electrotek.com)

Electrotek's Power Quality Engineering Services Center is a world-renowned center for power systems and power quality engineering. Our Center includes an Advanced Power Quality Testing & Research Laboratory.

Learn about our Center by visiting: [www.pqengineering.com](http://www.pqengineering.com)

Email: [pqengineering@electrotek.com](mailto:pqengineering@electrotek.com) for more information.

General Manager: Brian Todd, [btodd@electrotek.com](mailto:btodd@electrotek.com); Telephone: +1-732-248-4281

Copyright © 2017, Electrotek Concepts, Inc. All rights reserved. Electrotek Concepts is a registered service mark of Electrotek Concepts, Inc.

## Benefits of Characterizing Power Quality for Medical Imaging Systems

Electrotek PQ monitoring and investigation approach, customized for resolving PQ problems in hospitals and clinics with medical imaging departments, has improved the technical and economical performance of 100's of imaging centers. This offers financial and technical benefits including:

- Minimize imaging system downtime to avoid cancellation of patient scans and physicians having to re-schedule patients at competing hospitals and clinics.
- Minimize use of service calls and spare parts from Service Contract, making it available for service when PQ is not the problem.
- Maintain image quality and avoid image artifacts caused by PQ disturbances and wiring and grounding problems—eliminate repeat scans.
- Maximize life of critical imaging system components by ensuring acceptable PQ is delivered to power distribution unit (PDU) and other imaging support equipment.
- Allow expert Electrotek PQ engineers to identify needed maintenance of feeder to imaging suite and AC circuitry to and from PDU to avoid imaging artifacts and imaging system downtime.
- Ensure good scoring on Joint Commission on Accreditation of Healthcare Organizations.

## About Electrotek

Founded in 1984, Electrotek Concepts, Inc. is world renowned for its research, developmental, applications and problem-solving work in understanding, identifying, analyzing and preventing power quality (PQ) problems. Our expertise extends from the utility generators to inside the electrical/electronic load inside a customers' facility. The experience of Electrotek's team of PQ engineers extends from experts in utility power systems to participants on IEEE and IEC standards boards regarding PQ standards and to designers of end-use electronic equipment. Our engineers are armed to address any PQ problem at any level. The future of reliable and available power and customer equipment in today's modern technological society depends on compatibility between utility power, the customer's facility electrical system and the end-use equipment customers depend on to carry out their day-to-day business activities.

