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## Power Quality Training

Contact us Today for a FREE quotation to deliver this course at your company's location.

<https://www.electricityforum.com/onsite-training-rfq>

Our power quality seminar discusses the concepts of proper power quality as well as the negative effects of poor power quality.

Students will learn what power quality entails and who all the relevant stakeholders are. Furthermore, students will learn what the possible effects are of poor power quality and what the direct and indirect costs are of poor power quality on industrial power systems.

From microwave towers feeding data to corporate offices, modern data management centres, telecommunications networks, industrial, commercial and institutional power systems all demand uninterrupted, uncorrupted electrical electricity. As much as 40 per cent of electrical maintenance issues can be attributed to transient voltage spikes, voltage dips, brownouts and outages. Did you know that the average computer site experiences 38 power interruptions per year, and that 94 per cent of those interruptions are less than five minutes in duration.

Microprocessor-based industrial controls - PLCs, industrial computers, HMI, drives, motion controllers and sensors - are the foundation of high productivity, quality and competitiveness. If there is one universal factor that can and will disrupt microprocessor-

based controls and cause downtime, it is power quality. Since industrial electrical systems frequently experience voltage fluctuations, harmonic distortions, noise and short- or long-term power outages, it is essential to ensure maximum uptime. The ability to quickly identify and remedy power quality problems will help ensure metering accuracy, lengthen the life of electrical equipment and improve power system availability.

Power quality failures are expensive and can significantly impact the bottom line of an organization. Electrical engineering and maintenance personnel have long been aware that identifying, monitoring and correcting power quality problems is vital to keeping facilities and processes running smoothly. This forum offers electrical professionals the opportunity to keep abreast of the latest technologies and techniques available in this area. It also offers an excellent opportunity for delegates to ask specific questions and exchange ideas relating to their own applications. This is designed to be an interactive, problem-solving, learning environment for delegates of all disciplines.

#### **Harmonics Problems Cause:**

- Increased losses, e.g. machines will operate at increased temperature and can be overheated
- Resonance problems between the inductive and capacitive parts of the power network
- Malfunctioning of control systems since electronic meters, relays, etc. are matched to the fundamental frequency
- Overloading of capacitors, leading to malfunctioning and premature aging
- Interference with telecommunications and computers
- Disturbances in ripple control systems
- High currents in neutral conductors.

#### **LEARNING OBJECTIVES**

- Recognize symptoms of power quality problems including sags, swells, under or overvoltage, harmonics, transients, electrical noise (EMI/RFI/EMF), interruptions, wiring and grounding issues
- Classify power quality events according to IEEE, ITIC (CEBNA) and public utility

standards

- Collect the required data to perform a detailed coordination study
- Explain proper application and interpret results of power quality monitoring equipment
- Recommend viable solutions including UPS, line voltage regulators, transient (surge) suppressors, harmonic filters, line filters, power conditioners, k-rated, isolation and zig-zag transformers, proper wiring and grounding, etc.

### WHO SHOULD ATTEND

This **Power Quality Training** course is intended for engineers, electricians and technicians that install, maintain, repair and/or troubleshoot power and auxiliary systems.

### STUDENTS RECEIVE

- **FREE** Electricity Forum 120-page Digital Power Quality Handbook (Value \$20.00)
- **\$100 Coupon** Toward any Future Electricity Forum Event (Restrictions Apply)
- 1.4 Continuing Education Unit (CEU) Credits
- **FREE** Magazine Subscription (Value \$20.00)
- Course Materials in Paper Format

### *Related Course*

[Power Quality Troubleshooting Training](#)

### COURSE OUTLINE

#### **Instructor**

**Pablo Diaz**, *Power Quality & Grounding Consultant, The Electricity Forum*

## **DAY ONE**

### **Session 1: Power Quality - Definitions according to Canadian Electrical Code, IEEE STD 1100, IEEE STD 519**

- The Sine Wave
- Faraday Law
- Lenz Law
- Power Waveform
- Electromagnetic Fields
- Phase Angle
- Tolerance Limits

### **Session 2: Sine Wave Disturbances**

- Voltage Fluctuations
- Voltage Fluctuations Effects
- Subcycle Disturbances
- Energy Interruption
- Electrical Noise
- Electromagnetic Interference (EMI)
- Radio Frequency Interference (RFI)
- Harmonics
- Electrostatic Discharge (ESD)

### **Session 3: Transient Overvoltage Problems**

- Troubleshooting Transient Overvoltage Problems

- Technical Criteria
- IEEE C62.41 Guidelines
- Transient Overvoltage Suppressors
- Suppression Technologies
- IEE Location Categories
- Gas Tubes
- Silicon Avalanche Diodes
- Metal Oxide Varistors

#### **Session 4: Harmonics in the Power System**

- Tha Harmonic Factor
- Harmonic Waveforms
- Voltage Harmonics
- Current Harmonics
- Total Harmonic Distortion
- DC Power Supplies
- Harmonic Generators

#### **Session 5: Harmonics in the Power System - Part 2**

- Sources of Harmonics
- Symptoms and Effect on Equipment
- Power Factor Capacitors and Resonance
- Harmonic Limitations (IEEE Standard 519)
- Series Resonance and Filter Design
- Third Harmonic Neutral Current

#### **Session 6: Separately Derived Systems**

- Control & Solutions for PQ Problems
- Power Enhancement Devices
- LC Filter

- Harmonic Filter
- Transformers and Harmonics
- Stand-by Power Systems

## **DAY TWO**

### **Session 7: Measurement Techniques**

- IEEE Emerald Book -Conducting Site Surveys
- Manufacturers' Terminology
- Grounding Measurements
- Disturbance Measurements
- Waveform Signatures

### **Session 8: Site Survey & Power Analysis**

- The Site Survey
- Receptacle Branch Circuit
- Recording the Findings
- Flat-Topped Voltage
- Neutral-Ground Voltage Test
- Current in the Neutral Conductor
- Shared Neutrals
- Performance Wiring

### **Session 9: Site Survey on Service Panels**

- Troubleshooting Procedures to Perform a Site Audit
- Feeder Neutral Current
- Effective Wiring

- Power Consumption
- A Line-up of Power Quality Culprits
- Transformer Measurements
- Motors Measurements
- Critical Electronic Equipment Measurements
- Cabling Systems Troubleshooting
- Electromagnetic Fields Measurements

### **Session 10: Measurements on Transformers**

- Transformer Loads
- Transformer Primary & Secondary
- Step-up and Step-down Transformers
- Transformers Power Losses
- Transformers Efficiency
- Transformers Turns-Ratio
- Delta-Delta Transformers
- Delta Wye Transformers

### **Session 11: Measurements on Motors**

- Motor Starting & Running Current
- Motor Speed Control
- AC Motors
- DC Motors
- Synchronous Motors
- Wound Rotor Motors
- Motor V-A Calculations
- Motor VA for Three-Phase Motors
- Voltage & Current Unbalance

### **Session 12: Mitigation Techniques**

- K-Factor Transformers

- Power Line Conditioners
- Harmonic Filters
- Lightning/Surge Protection
- Redundant Electrical Supply/Automatic Switching
- Standby/Emergency Power Generation

## Questions and Answers

## COURSE TIMETABLE

**Both days:**

**Start: 8:00 a.m.**

**Coffee Break: 10:00 a.m.**

**Lunch: 12:00 noon**

**Restart: 1:15 p.m.**

**Finish: 4:30 p.m.**

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