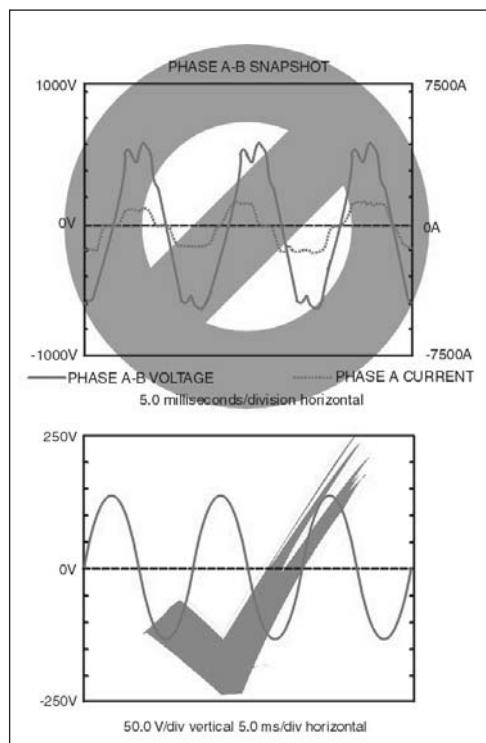


Practical

# POWER SYSTEM HARMONICS, EARTHING & POWER QUALITY

- Problems and Solutions for Engineers & Technicians



## YOU WILL LEARN HOW TO:

- Develop a sound working knowledge of earthing and harmonics
- Do a step-by-step site analysis on power quality and harmonics
- Gain practical knowledge on surge and transient protection
- Design electrical and electronic systems correctly by applying knowledge of harmonics and earthing principles
- Distinguish between harmonics and transients and how to minimise them
- Troubleshoot electrical and electronic systems for power quality and harmonic problems
- Isolate and rectify power quality and harmonic problems
- Network with your peers on solving these problems

## WHO SHOULD ATTEND:

- Instrumentation and Control Engineers
- Consulting Engineers
- Electrical Engineers
- Project Engineers
- Maintenance Engineers
- Power System Protection and Control Engineers
- Building Service Designers
- Data Systems Planners and Managers
- Electrical and Instrumentation Technicians



*Technology Training that Works*

## THE WORKSHOP

The workshop starts with the definition of power quality, the various indicators of power quality and the problems that are commonly encountered. Each of these problems are discussed in detail, the reasons analysed and corrective measures to resolve these problems are discussed. The problem of surges is discussed in detail as supply surges can cause extensive damage to power and sensitive equipment and the principles of surge protection discussed in detail.

Another topic that is explained in detail is that of harmonics as the problem is becoming increasingly important in today's systems with substantial non-linear loading. Discussions start from the first principles and the solutions discussed in an easy to understand manner. The importance of proper system planning in mitigating quality problems and the need for site studies in detecting and addressing power quality problems is also discussed in detail with example.

The material is covered by means of an interactive lecturing style, with plenty of practical examples and realistic case studies derived from real work performed in this area.

### PRE-REQUISITES

Some working knowledge of basic electrical engineering principles is required, although there will be a basic revision of the fundamentals. Real-life experience with earthing and harmonics problems will enable the workshop to be placed in context. If you bring along your power quality and harmonic problems to the workshop it will be beneficial to solve them in a group setting.

## ON-SITE TRAINING

- ✓ **SAVE** over 50% by having an IDC workshop presented at your premises.
- ✓ Customise the training to **YOUR** workplace.
- ✓ Have the training delivered when and where you need it.

Contact us for a **FREE** proposal.

## THE PROGRAM

### DAY ONE

#### POWER QUALITY OVERVIEW

- Limits on electrical parameters
- What is power quality?
- Power quality indicators
- Power quality problems and solutions

#### DEALING WITH POWER INTERRUPTIONS

- Needs of equipment
- Understanding failures
- Effect of power interruptions
- Planning for reliability
- Redundancy and automation
- Uninterrupted power supply systems
- Rotary UPS systems
- Advanced rotary UPS systems
- Hybrid UPS system
- Static UPS systems
- General configuration
- Types of static UPS systems
- Power quality and UPS
- UPS applications to computer loads
- Redundant UPS configuration

#### VOLTAGE VARIATIONS

- Variations in voltage amplitude
- Reasons for voltage amplitude changes
- Voltage Sag
- Effects of sags
- Swell and its effects
- Equipment sensitivity
- Handling voltage abnormalities
- Control measures for mitigation
- System changes for voltage improvements
- Tackling voltage fluctuations and flicker

#### SURGES AND SURGE PROTECTION

- Surges, their causes and mitigation
- Lightning-the external source of electrical surges
- How surges find their way into electrical circuits
- Bonding of grounding systems as a means of surge mitigation
- Basic principle of surge protection
- Surge Protection Devices
- Graded Surge protection
- Selection criteria of devices for surge protection
- Positioning and Selection of lightning/surge arrester
- Surge protection of sensitive circuits
- Hybrid SPDs for signal applications
- Protection of Instrumentation systems
- Surge Protection of Transmitters (General)
- Surge Protection of Transmitters at the Field End
- Comprehensive Loop Protection
- Protection of telemetry and Data Communication Systems
- SPD for Hazardous Applications
- Grounding of Intrinsically Safe circuits

#### VOLTAGE ASYMMETRY

- Reasons for asymmetry
- Analysis of asymmetrical quantities
- Effects of asymmetry
- Permissible limits of asymmetry
- Dealing with asymmetrical loads

### DAY TWO

#### HARMONICS IN POWER SYSTEMS

- Linear and non-linear loads
- Harmonic components
- Harmonic currents and voltage distortion
- Problems due to harmonics
- Limits of harmonic presence in a power system
- Measurement of current containing harmonics
- Analysis of harmonic components
- Methods of harmonic control

#### ELECTRICAL NOISE AND MITIGATION

- Definition of electrical noise
- How are sensitive circuits affected by noise?
- Time and frequency domain representation of noise
- Categories of noise
- Noise from nearby electrical equipment
- Ground Loop as a source of noise
- Control of noise in signal cables
- Electrostatic or capacitive coupling
- Importance of grounding in noise control
- Zero signal reference grid and signal transport ground plane

#### SYSTEM PLANNING AND INSTALLATION GUIDELINES

- Power interruptions
- Issues of location
- Commercial power
- Information from equipment vendors
- Power requirements and available power conditioning options
- Noise suppression sensitive loads by proper grounding
- Checking for redundancy requirement
- Signal/data cabling susceptibility
- Radio Frequency Interference (RFI) protection
- Static electricity related problems
- Lightning and surge protection
- Documentation
- Planned maintenance

#### SURVEY OF POWER QUALITY PROBLEMS AND SOLUTIONS

- Problems normally experienced
- Solutions normally adopted

#### POWER QUALITY SITE STUDY

- Site study objectives
- Defining the problem
- Coordination with other agencies
- Conducting the study
- Level 1 study
- Level 2 study
- List of instruments

#### CASE STUDIES

#### SUMMARY, OPEN FORUM & CLOSING