Practical

GROUNDING/EARTHING, BONDING, LIGHTNING & SURGE PROTECTION

YOU WILL LEARN HOW TO:

• Apply good earthing practice to your next installation
• Minimise electrical surge problems due to lightning and surges
• Protect sensitive electronic equipment from surges and lightning
• Correctly shield sensitive systems from noise and interference

WHO SHOULD ATTEND:

• Instrumentation and Control Engineers
• Consulting Engineers
• Electrical Engineers
• Project Engineers
• Maintenance Engineers
• Electrical Contractors
• Safety Professionals
• Consulting Engineers
• Electricians
• Electrical Inspectors
• Power System Protection and Control Engineers
• Building Service Designers
• Data Systems Planners and Managers
• Electrical and Instrumentation Technicians
**THE WORKSHOP**

Few topics generate as much controversy and argument as that of earthing and the associated topics of surge protection, shielding and lightning protection of electrical and electronic systems. Poor earthing practice can be the cause of continual and intermittent difficult-to-diagnose problems in a facility. This workshop looks at these issues from a fresh yet practical perspective and enables you to reduce expensive downtime on your plant and equipment to a minimum by correct application of these principles.

This workshop is designed to demystify the subject of earthing and presents the subject in a clear, straightforward manner. Installation, testing and inspection procedures for industrial and commercial power systems will be examined in detail. Essentially this workshop is broken down into earthing, shielding and surge protection for both power and electronics systems. Earthing and surge protection for telecommunications and IT systems are examined in detail. Finally, the impact of lightning is examined and simple techniques for minimising its impact are described.

**PRE-REQUISITES**

Some working knowledge of basic electrical engineering principles is required, although there will be a revision at the beginning of the workshop. Experience with earthing problems will enable the workshop to be placed in context.

**WORKSHOP OBJECTIVES**

At the end of this workshop participants will be able to:

- Apply the various methods of earthing electrical systems
- Detail the applicable national standards
- Describe the purposes of earthing and bonding
- List the types of systems that cannot be earthed
- Describe what systems can be operated unearthed
- Correctly shield sensitive communications cables from noise and interference
- Apply practical knowledge of surge and transient protection
- Troubleshoot and fix earthing and surge problems
- Design, install and test an effective earthing system for electronic equipment
- Understand lightning and how to minimise its impact on your facility
- Protect sensitive equipment from lightning

**PRACTICAL SESSIONS**

Workshop includes practical examples, case studies and four practical exercises

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**THE PROGRAM**

**DAY ONE**

**INTRODUCTION AND BASICS**

- Basics of earthing
- Bonding
- Lightning
- Static charges
- Surge protection
- Shielding
- UPS systems and their earthing practice

**EARTHING OF POWER SYSTEM NEUTRAL**

- Unearthed systems
- Solidly earthed systems
- Impedance earthed systems
- Resonant impedance earthed systems

**EQUIPMENT EARTHING**

- Shock hazards to the human body
- Earthing of equipment
- Operation of protective devices
- Thermal capacity of earthing wires
- Touch potential
- Induced voltages
- Multiple earthing connections
- Surge protection earthing

**LIGHTNING, ITS EFFECTS ON BUILDINGS AND ELECTRICAL SYSTEMS**

- The incidence of lightning
- Probability of a lightning strike
- Methods of lightning protection
- Planning for lightning protection
- Improvements to lightning protection
- Effects of lightning on overhead lines
- Factors governing the decision to protect or not

**STATIC ELECTRICITY AND PROTECTION**

- What is static?
- Generation of charge
- Common examples
- Energy of a spark
- Ignition capability of a spark
- Dangers of static build up
- Controlling static
- Assessment of risks and planning

**DAY TWO**

**GROUND ELECTRODE SYSTEM**

- Earthing electrodes
- Soil resistance
- Measuring soil resistivity
- Resistance of single rod electrodes
- Current carrying capacity of an electrode
- Measuring electrode resistance single and multiple rods
- Concrete encased electrodes
- Corrosion of electrode systems
- Maintenance of electrode systems
- Chemical electrodes

**SURGE PROTECTION OF ELECTRONIC EQUIPMENT**

- What is a surge?
- Bonding of different earthing systems
- Surge and surge protection
- Principles of surge protection
- Achieving graded surge protection
- Positioning and selecting surge protection

**ELECTRICAL NOISE AND MITIGATION**

- Definitions of electric noise
- Analysis and categories of noise
- Earth loops as a cause of noise
- Electrostatic coupling
- Electromagnetic coupling
- Shielded isolation transformer
- Insulated earth receptacle
- Zero signal reference grid
- Harmonics

**UPS SYSTEMS AND THEIR EARTHING PRACTICES**

- Power quality issues
- Abnormal voltage conditions
- Regulating transformers
- Standby sources
- Electro-mechanical UPS's
- Solid-state UPS's
- Multiple redundant systems
- Selection of a UPS
- Earthing practices

**CASE STUDIES**

**SUMMARY, OPEN FORUM & CLOSING**

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