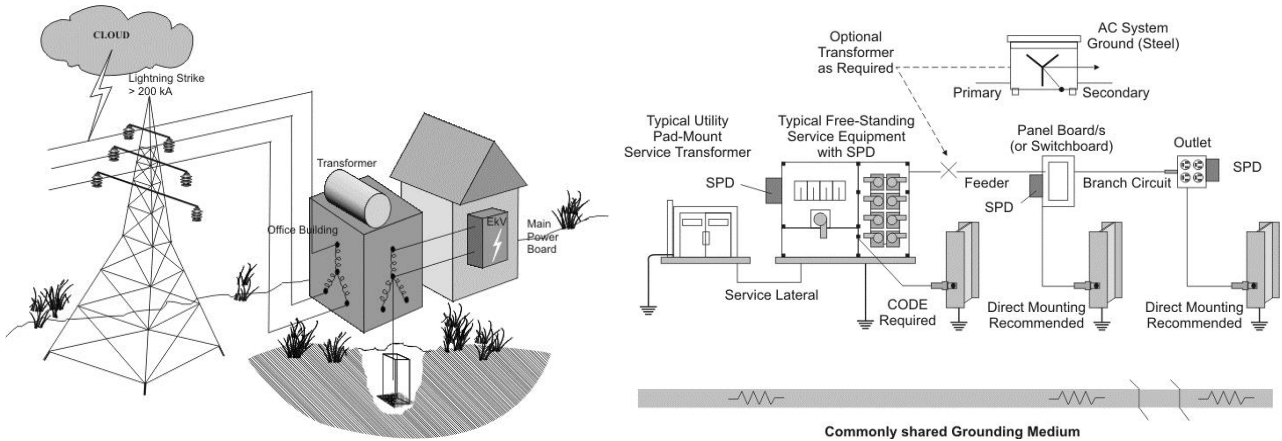




Technology Training that Works

# Earthing of Utility and Industrial Distribution Systems



## 4 hour live, practical online course

### YOU WILL LEARN:

- The basic principles of grounding of electrical systems
- The function of power system grounding and the various options available
- Fundamental principles in the design of grounding systems in substations
- How to solve static electricity-related hazards by grounding and bonding

### WHAT'S INCLUDED?

- Four 50 minute live, practical sessions with your instructor and attendees
- The full technical eBook manual for "Earthing of Utility and Industrial Distribution Systems" which includes course slides, cases studies, calculations and practical exercises
- Four hours of additional in-depth video sessions covering many additional areas – yours to keep and watch at your convenience

### THE COURSE

Few topics generate as much controversy and argument as that of grounding or earthing and the associated topics of lightning and surge protection of electrical and electronic systems. Any engineer dealing with power supply networks needs to understand the basic principles of grounding system design and its role in ensuring safety of equipment and personnel. A correct understanding of the basic principles involved will help to avoid mistakes in grounding system design, mistakes that could lead to expensive failures and long downtime.

In this course, we will try to demystify the concepts of grounding as applicable to utility networks and industrial plant distribution systems as well as their associated control equipment. In fact, a lot of myths have been built around this subject, although it is quite a simple one when approached from basic principles. Our endeavour will therefore be to explain the fundamentals of grounding, which we hope will enable the participants to gain a correct perspective of the subject and give them the knowledge needed to solve real life grounding problems.



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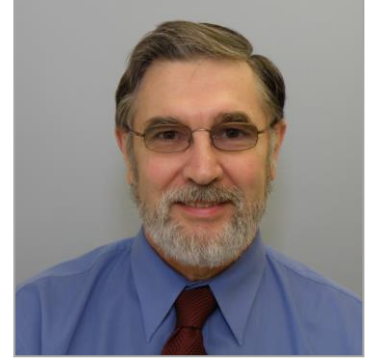
## **ONLINE COURSE PRESENTER**

**Roger Royal**

**Dip EE (C&G) Grad.Dip Rob.**

Roger has built up a solid 40 years of hard won experience in the electrical power industry and this is apparent in his instructing. He has a passion for teaching and has achieved outstanding results over the past ten years with his courses on circuit breakers and switchgear, earthing, bonding, lightning, surge protection, power systems protection and transformers throughout the world.

He commenced his career in the design and construction of transformers, power cables and switchgear with Alstom (GEC); this work included a significant degree of R&D. Roger has since worked for numerous blue chip companies in the classical design of power systems, transformers and switchgear. More recently, he has spent considerable time in maintenance operations of electrical engineering assets.



Roger has carefully prepared for the presentation of this workshop, to ensure that you will walk away with the skills you can immediately apply to your work. He is looking forward to meeting all participants and being able to pass on his experience and knowledge.

## **WHO SHOULD ATTEND?**

- Building service designers
- Consulting engineers
- Data systems planners and managers
- Electrical and instrumentation technicians
- Electrical engineers
- Instrumentation and control engineers
- Maintenance engineers
- Power system protection and control engineers
- Project engineers

## **PRE-REQUISITES:**

Some working knowledge of basic electrical equipment is required, although this will be covered at the beginning of the workshop. Real-life experience with such equipment and hands-on testing will enable the workshop to be placed in context.



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## **CONTENT SUMMARY**

### **INTRODUCTION**

*This is an intensive four (4) hour presentation; we will be emphasising sections marked in **BOLD** below. Full recordings will be provided for the lower intensity sessions (another four hours of video as detailed below) to review after the course.*

### **LIVE SESSIONS**

#### **SESSION ONE**

##### **STATIC ELECTRICITY AND PROTECTION**

- What is static electricity and how is it generated?
- Examples of static charge build up and its dangers
- Energy of spark due to static electricity
- Ways of controlling static build up
- Risk assessment and preventive measures

*Additional video session covered in-depth for review at anytime:*

- Basics of grounding & bonding
- Role of grounding in lightning protection
- Ground electrodes and factors affecting their efficacy
- Grounding issues in outdoor substations
- Grounding for static charges
- Surge protection
- Importance of grounding in mitigation of noise in sensitive circuits
- Importance of local codes

#### **SESSION TWO**

##### **GROUNDING FOR LIGHTNING PROTECTION OF BUILDINGS AND STRUCTURES**

- The physics of lightning
- Lightning incidence in different land masses
- Lightning strike probability
- Lightning protection
- Planning for protection and decision factors
- Improved approach to lightning protection and non-conventional systems
- Effect of lightning strikes on electrical installations

*Additional video session covered in-depth for review at anytime:*

- **POWER SUPPLY SYSTEM GROUNDING**
  - Types of system grounding
  - Ungrounded systems
  - Solidly grounded systems
  - Impedance grounding using neutral reactor
  - Resonant grounding using neutral reactor
  - Impedance grounding through neutral resistance
  - Classification of supply systems based on grounding
  - Point of grounding
  - Other challenges



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- PROTECTIVE GROUNDING
  - Electric shock, its cause and effects
  - Direct and indirect contact
  - Touch and step potential
  - Role of protective grounding in minimising the shock hazards
  - Equipotential bonding
  - Protective grounding conductors and installation
  - Ground fault protection
  - System classification based on system/protective grounding

### **SESSION THREE**

#### **SURGES AND SURGE PROTECTION**

- Surges, their causes and mitigation
- The ways by which surges couple into electrical circuits
- Bonding of grounding systems
- Basic principle of surge protection and commonly used surge protection devices
- Graded surge protection
- Selecting appropriate surge protective devices and their positioning in a system
- Importance of correct grounding practices for sensitive equipment
- Other ways and devices for mitigating surge problems
- Comparative merits of different types of SPDs for sensitive equipment
- Hybrid surge protective devices
- Surge protection of telemetry and data communication systems

*Additional video session covered in-depth for review at anytime:*

- GROUND ELECTRODE SYSTEMS
  - Soil resistance and factors affecting soil resistivity
  - Measurement of soil resistivity
  - Resistance of ground electrode and distribution of resistance in surrounding soil layers
  - Electrode current capacity
  - Ground electrode configurations
  - Parallel electrodes
  - Ground electrode resistance measurement
  - Chemical electrodes
  - Concrete encased electrodes and splicing methods
  - Corrosion of buried electrodes
  - Grounding system maintenance



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## **SESSION FOUR**

### **ELECTRICAL NOISE AND MITIGATION**

- Definition of electrical noise
- How are sensitive circuits affected?
- Noise categories
- Noise from power electrical equipment
- Noise coupling into signal circuits
- Noise mitigation measures
- Role of proper grounding in reducing noise
- Noise control by proper grounding of UPS derived supplies

*Additional video session covered in-depth for review at anytime:*

- SUBSTATION GROUNDING DESIGN
  - Grounding practices
  - Basic design approach
  - Calculating the ground fault current
  - Ground potential rise in HV systems
  - Grounding design in LV and MV substations/installations
  - Grounding grid design for HV/EHV substations - a step-by-step approach
  - Introduction to two-layer soil model
  - Transferred potential and ways of avoiding
  - Points needing special attention in substation grounding design and for GIS equipment
  - Design of substations containing converter equipment feeding to HVDC transmission systems
  - Ensuring effective substation grounding - important aspects

### **SUMMARY, OPEN FORUM**

### **CLOSING**

Registration form on next page!