

Practical

# EARTHING OF UTILITY AND INDUSTRIAL DISTRIBUTION SYSTEMS

for Engineers and Technicians

## 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

Presented by:  
**MARC DEKENAH**

AMIEE Dip EE

**EDINBURGH**

5 & 6 December 2005

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**MANCHESTER**

8 & 9 December 2005

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**LONDON**

12 & 13 December 2005

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## The Workshop

Few topics generate as much controversy and argument as that of 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 earthing system design and its role in ensuring safety of equipment and personnel. A correct understanding of the basic principles involved will help him/her to avoid mistakes in earthing system design, mistakes that could lead to expensive failures and long downtime.

In this workshop, we will demystify the concepts of earthing 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 earthing, which we hope will enable you to gain a correct perspective of the subject and give them the knowledge needed to solve real life earthing problems.

Essentially this workshop is broken down into system earthing, protective earthing and surge/noise protection of power and electronics systems normally found in distribution networks. A brief introduction to the design of substation earthing has been included. Detailed information on earth electrodes and measurement of earth resistance is also available.

### Pre-requisites:

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

## Objectives

At the end of this workshop, participants will gain a clear understanding of:

- The basic principles of earthing of electrical systems
- The function of power system earthing and the various options available
- Role of protective earthing in ensuring safety; sizing of earthing conductors
- Importance of equipotential bonding in ensuring safety
- Design of earth electrodes, measurement of soil resistivity and earth electrode resistance
- Fundamental principles in the design of earthing systems in substations
- Solving static electricity-related hazards by earthing and bonding
- Role of earthing in protecting substation structures from lightning hazard
- Role of earthing in surge protection of power distribution equipment and sensitive systems
- Noise in electrical systems and the role of earthing in noise mitigation



## Your Instructor MARC DEKENAH

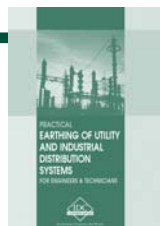
AMIEE Dip EE

*Fault Investigation and Analysis Consultant*

Marc's 25 year career in electronics included 15 years as an Electronics & Systems Designer. Of particular note are his designs of backbones for operational control rooms for the emergency services encompassing audio, radio and digital control. These required clean, noise free, uninterrupted power with superb earthing systems and transient protection to remain operational during all times, despite the daily onslaught of an array of network disturbances.

Marc is well known as a power quality specialist by a number of blue chip companies throughout the UK, especially for his 'wider view' approach that encompasses harmonics, lightning protection, ac power control and EMC compliance.

Marc has published numerous articles on this subject and has spoken at many relevant conferences. You will most certainly benefit from his experiences in earthing when delivered by this passionate and experienced instructor.



## Free Reference Manual (Valued at £69.95)

Every delegate receives a fully illustrated workshop manual with 600 pages of comprehensive reference material plus tables, charts, figures and handy hints.

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Jeff Futcher on (020) 8335 4014 or e-mail: [business@idc-online.com](mailto:business@idc-online.com)

# The Program

## Day One

### OVERVIEW

- Basics of earthing
- Bonding
- Role of earthing in lightning protection
- Earth electrodes and factors affecting their efficiency
- Earthing issues in outdoor substations
- Earthing for static charges
- Surge protection
- Importance of earthing in mitigation of noise in sensitive circuits
- Importance of local codes

### POWER SUPPLY SYSTEM EARTHING

- Types of system earthing
- Unearthed systems
- Solidly earthed systems
- Impedance earthing using neutral reactor
- Resonant earthing using neutral reactor
- Impedance earthing through neutral resistance
- Classification of supply systems based on earthing
- Point of earthing
- Other challenges

### PROTECTIVE EARTHING

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

### EARTH ELECTRODE SYSTEMS

- Soil resistance and factors affecting soil resistivity
- Measurement of soil resistivity
- Resistance of earth electrode and distribution of resistance in surrounding soil layers
- Electrode current capacity
- Earth electrode configurations
- Parallel electrodes
- Earth electrode resistance measurement
- Chemical electrodes
- Concrete encased electrodes and splicing methods
- Corrosion of buried electrodes
- Earthing system maintenance

### SUBSTATION EARTHING DESIGN

- Earthing practices
- Basic design approach
- Calculating the earth fault current
- Earth potential rise in HV systems
- Earthing design in LV and MV substations/installations
- Earthing grid design for HV/EHV substations - a step-by-step approach
- Introduction to 2-layer soil model
- Transferred potential and ways of avoiding
- Points needing special attention in substation earthing design and for GIS equipment
- Design of substations containing converter equipment feeding to HVDC transmission systems
- Ensuring effective substation earthing - important aspects

## Day Two

### 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

### EARTHING 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

### SURGES AND SURGE PROTECTION

- Surges, their causes and mitigation
- The ways by which surges couple into electrical circuits
- Bonding of earthing 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 earthing 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

### 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 earthing in reducing noise
- Noise control by proper earthing of UPS derived supplies

### SUMMARY, OPEN FORUM AND CLOSING

## ABOUT IDC TECHNOLOGIES

**IDC Technologies** is internationally recognised as the premier provider of practical, technical training for engineers and technicians.

We specialise in the fields of industrial data communications, telecommunications, automation and control, and are continually adding to our portfolio of over 100 different workshops. Our instructors are highly respected in their fields of expertise and in the last twelve years have trained over 95,000 engineers, scientists and technicians.

With offices conveniently located worldwide, IDC Technologies has an enthusiastic team of professional engineers, technicians and support staff who are committed to providing the highest quality of training and consultancy.

## WHY PREVIOUS DELEGATES HIGHLY RECOMMEND IDC TECHNOLOGIES

### WHAT YOU TAKE AWAY WITH YOU

- **Fully illustrated workshop manual** containing comprehensive workshop notes and slides
- **Certificate of Attendance** documenting your experience

### HANDS-ON APPROACH TO TRAINING

IDC Technologies' instructors understand the value of combining theoretical learning with practical application. All IDC Technologies workshops include practical, hands-on sessions where the delegates are given the opportunity to apply in practice the theory they have learnt.

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This program is designed to meet your continuing professional development requirements. A certificate of attendance documenting the number of CPD hours you have achieved, will be awarded at the end of the workshop. This serves as important evidence of your continuing professional commitment to your career.

### 100% MONEY BACK GUARANTEE

IDC Technologies' engineers have put considerable time and experience into ensuring that you derive the maximum value from each workshop.

If you feel by lunch time of the first day that the workshop is not appropriate, please let us know so that we can arrange a 100% refund of your fee.

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### ✓ **EARLY BIRD BOOKING OFFER**

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Don't delay - register today!

**(020) 8335 4014**

or see the registration form overleaf

*The fee for each workshop covers all materials including your workshop manual, lunches & refreshments*

# REGISTRATION FORM

## Practical EARTHING OF UTILITY AND INDUSTRIAL DISTRIBUTION SYSTEMS for Engineers and Technicians

## EARLY BIRD BOOKING OFFER\*

If you register by **11 November 2005** you will receive a **FREE IDC 2006 Engineering & Technical Diary**. All you have to do is complete the registration form and fax or mail it to IDC Technologies today!

### 1. DELEGATE DETAILS

CONTACT: \_\_\_\_\_

COMPANY NAME: \_\_\_\_\_

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PHONE: ( ) \_\_\_\_\_ FAX: ( ) \_\_\_\_\_

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ATTENDEES:

MR/MS: \_\_\_\_\_ JOB TITLE: \_\_\_\_\_

MR/MS: \_\_\_\_\_ JOB TITLE: \_\_\_\_\_

MR/MS: \_\_\_\_\_ JOB TITLE: \_\_\_\_\_

AREAS OF INTEREST (please tick)

- |  |   |   |
|--|---|---|
| <input type="checkbox"/> Data Communications & Networking              | <input type="checkbox"/> Electrical             | <input type="checkbox"/> Electronics                    |
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| <input type="checkbox"/> Mechanical Engineering                        | <input type="checkbox"/> Chemical Engineering   | <input type="checkbox"/> Civil Engineering              |

Should you have more people interested in attending this workshop, please contact  
Jeff Futcher on (020) 8335 4014 or e-mail: register@idc-online.com

### 2. WORKSHOP DETAILS

YES, I (WE) WOULD LIKE TO ATTEND THIS WORKSHOP: (Please tick the relevant box)

- |                                     |    |                       |    |                               |
|-------------------------------------|----|-----------------------|----|-------------------------------|
| <input type="checkbox"/> EDINBURGH  | on | 5 & 6 December 2005   | at | The Edinburgh Training Centre |
| <input type="checkbox"/> MANCHESTER | on | 8 & 9 December 2005   | at | Hotel Smokies Park            |
| <input type="checkbox"/> LONDON     | on | 12 & 13 December 2005 | at | Master Robert Hotel           |

### 3. PAYMENT DETAILS

PLEASE NOTE: Prices shown are exclusive of VAT

WORKSHOP FEE £595.00 x \_\_\_\_\_ delegates = £ \_\_\_\_\_

EARLY BIRD BOOKING OFFER (If booking on or before 11 November 2005)  
YES, I qualify and would like to receive my **FREE IDC 2006 Engineering & Technical Diary**

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Please Note: Full payment is required prior to the commencement of the workshop.

### 4. ON-SITE TRAINING & CONSULTATION

YES, I would like to find out more about IDC Technologies on-site training and consultation services:

- Practical Earthing of Utility and Industrial Distribution Systems for Engineers and Technicians  
 Other IDC Technologies workshops  IDC Engineering Consultancy Services

### 5. MORE INFORMATION

I am unable to attend this workshop but please rush me an IDC Technologies workshop directory.

BOOKING CODE: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

### WORKSHOP DETAILS

- Workshops start at 8:30am and finish at 5:00pm daily.
- Registration is from 8:00am on the first day.
- The workshop fees are per delegate and include a reference manual, handouts, lunches and all refreshments.
- Full payment is required prior to the commencement of the workshop.

### EARLY BIRD BOOKING OFFER\*

Please note that the Early Bird Booking Offer is only available to those registrations received by **11 November 2005** and paid prior to the commencement of the workshop.

\* This offer cannot be used in conjunction with any other discount or offer.

### CANCELLATION

A fee of 20% will apply for written cancellations received 7-14 days prior to the commencement of the workshop.

Cancellations received less than 7 days prior to the workshop are not refundable however substitutes are welcome.

### CONFIRMATION

Full confirmation details and workshop instructions will be sent to you upon receipt of booking.

### PLEASE NOTE

Venues to be confirmed upon registration. Instructors may change without notice.

IDC Technologies has no affiliation with suppliers or manufacturers and therefore presents a completely unbiased factual view of the industry.

### PRIVACY INFORMATION

If your address details are incorrect, or you wish to remove your name from our mailing list, please contact us by phone, fax or e-mail (see below).

At times we make use of lists that cannot be cross-checked against our own database and you may receive a duplicate. If so, please pass this on to an interested colleague.

### DIARY ORDERS

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### HOW TO REGISTER

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 **2. By Fax:**  
(020) 8335 4120

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KT4 8HY

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