



*Technology Training that Works*

# ***Workshop Summary***

## **MAINTENANCE AND TROUBLESHOOTING OF UPS SYSTEMS (Uninterrupted Power Supply) AND BATTERY POWER SUPPLIES**

### **Objectives**

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

- Describe the basic building blocks of UPS Systems
- List typical Power Quality Problems
- Detail the operation of the popular UPS Systems
- Maintain and test Lead Acid and Nickel Cadmium Batteries
- Apply Safe working practice for UPS's and Batteries

### **Who should attend?**

Maintenance Tradespeople & Technicians  
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

### **Pre-requisites:**

Some working knowledge of basic electrical engineering principles is required, although this will be revised at the beginning of the course. Real-life experience in working with batteries and UPS systems will enable the workshop to be placed in context.

### **Accreditation**

Satisfactory completion of the two-day version of this course satisfies the requirements of the International Association for Continuing Education and Training for the award of 1.4 Continuing Educations Units. The course also satisfies criteria for Continuing Professional Development according to the requirements of the Institution of Electrical Engineers and Institution of Measurement and Control in the UK, Institution of Engineers in Australia, Institution of Engineers New Zealand, and others.

### **Companion courses:**

IDC courses which will enhance the knowledge gained from this workshop include:

- Practical Electrical Power Distribution
- Practical Variable Speed Drives for Instrumentation and Control Systems
- Practical Earthing/Grounding, Bonding, Lightning and Surge Protection of Electrical and Electronic Systems and Equipment
- Practical Power Quality: Problems and Solutions
- Practical EMC & EMI Control for Engineers and Technicians
- Practical Electrical Troubleshooting and Problem Solving



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## **Introduction**

- ◆ Overview of course
- ◆ Why have a UPS

## **Types and Duration of Power System Disturbances**

- ◆ Sags
- ◆ Surges and Spikes
- ◆ Power Quality

## **Review of Electronic Components**

- ◆ Volts/Ohms and Amps
- ◆ Phase Relationships
- ◆ Resistors/capacitors/inductors/RLC circuits in series and parallel
- ◆ Diodes/Transistors/Thyristors/SCR's/TRIACs/IGBT's/Op Amps

## **Introduction to UPS's**

- ◆ Power conditioners
- ◆ Uninterruptible power systems
- ◆ Power quality source alternatives
- ◆ Power disturbance cost comparisons

## **Three General Types of UPS's**

- ◆ Kinetic (Motor Generator Sets)
- ◆ Flywheel
- ◆ Static and Components
  - ◆ Rectifier
  - ◆ Batteries
  - ◆ Inverter

## **Three types of Static UPS's**

- ◆ Traditional UPS
- ◆ Static UPS
- ◆ Static UPS with Bypass

## **UPS Topologies**

- ◆ Single Phase Rectifiers
- ◆ Single Phase Inverters
- ◆ Three Phase Rectifiers
- ◆ Three Phase Inverters

## **Troubleshooting and Maintenance of UPS Systems**

- ◆ Manufacturers Recommendations
- ◆ Tools and Equipment
- ◆ Electrical Safety



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## **Introduction to Batteries**

- ◆ Primary Batteries
- ◆ Secondary Batteries

## **Lead Acid Batteries**

- ◆ Chemistry
- ◆ Different types
- ◆ Capacity Factors
- ◆ S-Curves
- ◆ Battery Safety and Maintenance
- ◆ Float and Equalize Voltages
- ◆ Load Testing

## **Nickel Cadmium**

- ◆ Chemistry
- ◆ Battery Types
- ◆ Capacity Factors
- ◆ Battery Safety and Maintenance
- ◆ Float and Equalize Voltages
- ◆ Load Testing

## **Case Studies**

- ◆ Selection and Sizing
- ◆ Batteries
- ◆ UPS's
- ◆ Batteries and UPS's

## **Summary, Open Forum and Closing**