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Professional Excellence*



Basic Power System Protection

Who Should Attend?

Technical personnel who are new to the areas of protection design (or presently have minimal or limited knowledge of power system protection design and principles), and are involved in the design, installation, operation and maintenance of protection systems for electricity networks, such as

- ◇ Power System Planners
- ◇ Power System Protection Engineers
- ◇ Field Technicians
- ◇ Circuitry and Automation Engineers
- ◇ Power System Managers and Technical Officers
- ◇ Communication Engineers
- ◇ Construction and Project Managers
- ◇ Power System O&M Engineers

Basic Power System Protection

Introduction

Reliable protection systems are integral to electricity networks whether they be within industrial, distribution or transmission networks. The requirements of safety, minimisation of damage to faulted plant, minimisation of consequential damage to healthy plant and maintenance of a stable and secure supply of electricity are paramount to all protection designs. A reliable protection scheme needs to be both dependable and secure. A dependable scheme thus has a very high level of certainty of operating correctly for all faults within its zone of coverage. Conversely, a secure scheme has a very high level of certainty of not operating incorrectly under any circumstances, especially in the presence of faults and disturbances external to its zone of coverage. These two requirements of dependability and security are thus conflicting.



To meet both of these requirements, the protection systems need, simultaneously, to be coordinated, fast operating, secure and dependable. The provision of these conflicting requirements is fundamental to the National Electricity Rules (NER) which regulates the performance of protection systems and ensures inter-regional power flows are not constrained and that power system stability is maintained.

Thus the task, not only of the protection engineer, but of all engineers and technicians associated with power systems, is to ensure that planning, design, coordination, implementation, commissioning, operation and maintenance of protection systems optimises both the dependability and security of these schemes.

Seminar Overview

This is an “Entry Level” seminar specifically designed to provide a basic, but nevertheless comprehensive, understanding of power system protection design. It is ideally suited to meet the learning requirements of those who are new to the areas of protection design, or presently have minimal or limited knowledge of power system protection design and principles.

It will assist those whose day-to-day work directly involves them in the applications of protection design, scheme coordination and relay settings. In addition, it will also provide a valuable and necessary insight into these principles for those in the many associated areas of electricity power system design.

The seminar focus particularly on the basic and high level principles of protection design. The more complex and mathematical aspects of protection design have thus been purposely excluded. The technical discussions and principles are reinforced with many real life examples and experiences from the seminar leader's professional experience, covering 3 decades.

This seminar has been specifically prepared to meet the requirements of :

- ◇ **Project Managers**, to ensure the project execution process optimises coordination between the protection design and the overall project implementation.
- ◇ **Planning Engineers**, to identify the difficulties in providing protection for various power system configurations under review
- ◇ **Maintenance Engineers**, to ensure that system protection is not compromised as plant is removed from service during maintenance
- ◇ **Circuitry Design Engineers**, to ensure that protective schemes are implemented in a manner to provide optimum performance
- ◇ **Commissioning Engineers**, to ensure the actual field installation of the protection scheme and associated relay settings meets the design requirements.
- ◇ **Field Technicians**, to understand the importance of their role in installing, testing and maintaining effective, reliable, dependable and secure protection systems.
- ◇ **Protection Design Engineers**, to identify protection implications and to ensure design, coordination and relay setting principles provide the necessary levels of speed, security, dependability and safety.

Seminar Leader's Profile



Barrie Moor has been involved in the design, coordination and implementation of protection schemes associated with Queensland's HV & EHV Transmission Systems since 1981. He has held various positions relating to the protection of the Southern, Central & Northern regions of the Queensland Transmission system.

Barrie also has extensive experience with the protection of large generating plants. From 2000 to 2007, Barrie filled the role of Senior Engineer Protection Design as team leader of Powerlink's Protection Design Team. Now in the role of Principal Consultant Substation Protection, Barrie provides specialist Protection Design and Fault Analysis services to support the Substation Design, Asset Management, and Asset Maintenance Teams within Powerlink.

Barrie has more than 20 years experience within Australia and internationally in the provision of university post graduate training on the design and implementation of HV & EHV Transmission Protection Systems. He has presented a number of papers on specialised aspects of protection design at conferences both within Australia and internationally.

Barrie has represented Powerlink on CIGRE committee APB5, Power System Protection & Automation, and as a corresponding member of Cigre and IEE working groups on Protection Systems. Barrie has RPEQ registration with the Board of Professional Engineers Queensland.

CPD Recognition

This training program is designed to meet the Continuing Professional Development (CPD) needs of participants. A Certificate of Attendance will be awarded at the end of the program. This serves as evidence of your personal and professional commitment to building your career.

Course Contents

1. Fundamental Concepts of Power System Protection

- ◇ Reliability, Dependability and Security
- ◇ Redundancy & Duplication
- ◇ National Electricity Rule Requirements
- ◇ Zones of Protection
- ◇ Unit and Non-unit Schemes
- ◇ Local & Remote Back up
- ◇ CB Fail and Blind Spot Protection
- ◇ Trip Circuit Monitoring

2. Fault Calculations & Sequence Components

- ◇ Basic Considerations for 1, 2 & 3 Phase Faults
- ◇ Classical Fault Study

3. Fuses, Over Current & Earth Fault Protection

- ◇ Fuses
- ◇ IDMT Over Current Relays
- ◇ Time & Current Discrimination
- ◇ Relay Characteristics to IEC60255
- ◇ Coordination Procedure
- ◇ Parallel Elements and OC Protection Grading
- ◇ Earth Fault Protection

4. Voltage and Current Transformers

- ◇ AS60044 Specification of VTs
- ◇ Capacitor VTs
- ◇ Transient Performance of VTs & CVTs
- ◇ Class P & PX CTs to AS60044
- ◇ Transient Performance of CTs

5. Introduction to Distance Protection

- ◇ Relay Zones of Operation
- ◇ Phase Angle Comparators
- ◇ Mho and Quadrilateral Characteristics

6. Introduction to Protection Signalling

- ◇ Distance Relay Permissive Schemes
- ◇ Distance Relay Blocking Schemes
- ◇ Direct and Series Intertripping

7. Introduction to High Impedance Differential Protection

- ◇ Stability for external faults
- ◇ Operation during in-zone faults

8. Introduction to Transformer Protection

- ◇ Buchholz and Pressure Relief Devices
- ◇ Biased Differential Protection
 - Inrush and Magnetising Currents
 - CT Connections for Phase Correction
 - CT Connections for Neutral Current Compensation
- Microprocessor Based Relay Applications

9. Introduction to Low Impedance Busbar Differential Protection

- ◇ Multiple Bus Zones
- ◇ Dynamically Switched Bus Zones
- ◇ Bus Zone CB Fail Schemes

10. Introduction to Feeder Differential Protection

- ◇ Pilot Wire Protection
 - Summation Transformer Techniques
- ◇ Current Differential Protection
 - Digital Signalling
 - Data Synchronisation
 - Alpha Plane Philosophy

11. Auto Reclosing Concepts

- ◇ Dead Time and Reclaim Time
- ◇ Single and Three Pole Schemes
- ◇ Sectionalisers

12. Protection of Capacitor Banks

- ◇ Over Current Protection and In-rush Current Considerations
- ◇ Capacitor Can and Bank Components and Design Considerations
- ◇ Balance Protection Schemes
- ◇ Over Voltage Protection

Customised In-House Course Available

This program can be customised to suit the specific needs of your organisation at significant savings.

Please contact us on (02) 8448 2078 or email Enquiry@cpdint.com.au for more details.