



Power System Protection 2-day Course

Intent

This is an "expertise course" focusing on knowledge to competently apply protection systems for low-medium voltage applications.

Attendees of this course will gain the key knowledge to assess which vendor nuances/features are needed and/or appropriate to their applications. The course is specifically vendor-agnostic, leaving the vendors to provide their own hands-on "product-based courses" to explain the nuances of their software and features.

The course presents the core principles of protection and each of the applications associated with feeders, transformer, motors and busbar protection as well as the critical requirements for current transformer selection. The life cycle issues are included with the requirements for testing, records management and, as is a growing concern, cyber security for remote access to the devices.

The course is specifically designed as a short, but comprehensive course on common and typical LV-MV applications. Detailed power system analysis, generator, HV/EHV transmission line distance protection and signaling have been excluded under the time limitations.

Presenter: Rodney Hughes

Rod is a well known protection engineer and manager with over thirty years experience in the Australian, New Zealand and international power industry. He has a wide range of expertise in the strategic direction of substations, power system protection and communication design at both technical and commercial levels.

Rod is widely recognised as an industry leader in the move from electromechanical to electronic to digital to numeric devices.

Rod has worked in vendor, utility and consultant organisations, and now his own consultancy.

He has provided 1, 2, 3, 4, 5 and even 10-day protection training courses since 1985.

He is now also recognised as an industry guru and the leading provider of highly valued IEC 61850 training courses in Australia and New Zealand since 2008.

Rodney has played a leading role in CIGRE Study Committee B5, as an active member since 1985, AU Panel Convener (8 years), convener of an international Working Group, Special Reporter and frequent contributor for colloquia and discussion sessions, and instigator for the popular SEAPAC conference. He received the international CIGRE Technical Committee Award in 2011.

Who should attend?

This course is designed for people involved with Protection & Control as asset managers, engineering managers, engineers, technicians and project managers involved in substation secondary system design operation and maintenance.

Seminar outcomes.

- ◇ Understand what needs to be considered and specified in system/device/CT procurement
- ◇ Understand application principles - do and don't
- ◇ Understand implications of different technologies

Attendees will receive a comprehensive reference manual of course material and references for further learning on the subject and the areas for continued skill development (electronic copies are not provided).

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2-Day Course Content

The course program a series of structured learning modules to build attendees understanding of the objectives and principles of protection philosophy and applications.

The program itself has evolved based on many previous courses provided by Rod Hughes since 1985.

Core Principles

- * Objectives of applying protection systems
- * Analysing Symmetrical Components
- * Duplication vs Backup principles
- * Symbology & ANSI device Numbers

Applications 1: Feeder Overcurrent

- * Instantaneous relays
- * Definite Time relays
- * Inverse Definite Minimum Time relays
 - ◇ Curves
 - ◇ Time Multiplier
 - ◇ Grading Disc vs Electronic
 - ◇ Grading Reset characteristics
 - ◇ Grading with Fuses
- * Multiple in-feeds: Directional Protection
- * Ring protection: Directional vs Differential

Applications 2: Feeder Earth Fault

- * Setting of Earth Fault protection
- * Neutral connection
- * Residual connection
- * Setting of Sensitive Earth Fault protection
- * Core Balanced CT connection

Applications 3: Motors

- * Applying Settings for Motor Protection
- * Thermal curve
- * Starting conditions
- * Negative Phase Sequence conditions

Applications 4: Busbar

- * Arc Flash vs Current Differential protection
- * Frame Leakage system
- * High Impedance scheme
- * Low Impedance scheme

Applications 5: Transformer

- * Differential protection
- * Restricted Earth Fault protection
- * Correcting for Delta-Star transformers
- * Fault Current phase distribution analysis
- * HV-LV Overcurrent and earth fault grading

Associated Protection Functions

- * Circuit Breaker Fail protection
- * Auxiliary Supply
 - ◇ Ratings
 - ◇ Earth Fault protection
 - ◇ High Impedance protection
- * Trip Circuit Supervision

Current Transformers - the "engine" for protection schemes:

- * P class burden specification
- * PX class Knee Point Voltage specification
- * Holmgren connection
- * Merz-Price connection

System Life Cycle Management

- * Commissioning, Compliance Testing, Performance Testing
 - ◇ Objectives – why test
 - ◇ Procedures - what to test
 - ◇ Routine vs Event driven – when to test
- * Setting version management
- * Storing and Using event records
- * Engineering access – local/remote settings, diagnostics
 - ◇ Practical Cyber Security
 - ◇ Role Based Access Control
 - ◇ Managing centralised password obfuscation

Advanced Engineering Technology

- * Why consider IEC 61850