

# High and Medium Voltage Power System Design and Protection

Practically Enhance Your Knowledge on Power System Design and Significant Skill  
on Protection

24 – 26 Aug. 2015 • Myrtle Beach, South Carolina



## Course Facilitator:

### Eric Stark

Senior Engineering Consultant  
& Trainer

RNI Technology (Protection)

### Highlight

- IEEE senior research & engineering
- A sought after expert and trainer for Protection & Control, Engineering and Project management.
- Expert knowledge in Protection & Control relays and SCADA.

## TESTIMONIALS

*“Eric has deep knowledge and wide experience in power system analysis and protection.”*

~ Senior Tech. Instructor, ABB OH, USA

*“Excellent job was done here. Exactly what I needed.”*

~ Application Engineer, R&PS

*“Eric did a giant job! And get across the information needed and was very helpful and willing to make the class useful for us.”*

~ Engineer, Protection & Maintenance, Elko, NV. USA

*“Very good course, exactly what we needed, a great step up for my team.”*

~ Head Engineer, IEC

*“Very satisfied, excellent course, excellent instructor.”*

~ Engineer, BC, CA

*“Great course, excellent examples and case analysis. It really made a difference for us. Thank you, Eric.”*

~ Senior Manager, PT GUNAEL ELECTRO, Jakarta, Indonesia

## MAJOR BENEFITS OF ATTENDING – YOU WILL:

**REFRESH** your knowledge of power systems design, planning, analysis, protective device applications, protective relay schemes, and relay coordination for safe and efficient operation of electrical power systems and equipment

**DEVELOP** your own relay settings and thoroughly understand the philosophy of protective systems

**LEARN** actual cases illustrating various techniques in present use and highlighting particular approaches used by experienced system designers

**ENHANCE** your experience with power system protection problems generally faced and solutions successfully adopted by industry

**UNDERSTAND** how to apply microprocessor-based multi-function relays on **PROTECTION** of various power system equipment and apparatus

**GAIN** valuable experience from an instructor who spent more than three decades of consulting work around the world to various utility and industrial power systems

Proudly Organized by:



RNI training courses are thoroughly researched and carefully structured to provide practical and exclusive training applicable to your organization.

Benefits include:

- Thorough and customized programs to address current market concerns
- Illustrations of real life case studies
- Comprehensive course documentation
- Strictly limited numbers

## Workshop Overview

Power system protection of various electrical equipment and apparatus requires good understanding of phase and ground short circuit currents, detection, and safe clearing of the faulted equipment. This course is ideal for engineers shifting into the field of protection and control. This program starts with an overview of power system fundamentals, design and short circuit calculations which lead to the understanding of protection scheme requirements and its applications.

Protection requirements for industrial plants, cogeneration, and interconnection with utility power system are explained in detail. This course covers the subject of power system protection from a practical perspective, and includes important functional specs such as testing and coordination of protection systems. This course is designed for individuals who are involved with industries and utilities to learn how to design and protect personnel and equipment.

## WHO SHOULD ATTEND

This training program is uniquely designed to provide valuable insight for:

- ✓ Electrical Power Distribution Engineers
- ✓ Electrical Power System Planners
- ✓ Electrical Power System Engineers
- ✓ Plant Managers
- ✓ Consulting Engineers
- ✓ Electrical Engineers and Technical Staff entering the protection field
- ✓ And any other engineers and technical personnel involved with design, operation, maintenance, testing, and troubleshooting of high and medium voltage electrical systems and equipment.

## WHY YOU CANNOT MISS THIS EVENT

Good design of electric power distribution systems is vital to safety, maintenance, troubleshooting and efficient operation of electrical systems and modern industrial plants. This course is designed to address all aspects of industrial and utility power systems, including system planning, equipment selection, specification and application, system grounding, protection and conformity with electrical code requirements, etc. Typical one line and relaying diagrams will be discussed for various applications.

Leading trainer and consultant, Eric Stark, will be sharing his knowledge and experience of more than 30 years with industry practitioners. The training will be presented with a practical approach in mind. The learning will be conducted along with relevant case studies and industry best practices. Delegates will be encouraged to participate and contribute their cases to the discussion.

Delegates will be able to immediately apply the knowledge gained in the workshop to improve coordination and relay setting files and prevent power system protection problems.

DAY 1 | 24th September 2015

### OVERVIEW OF ELECTRICAL UTILITY AND INDUSTRIAL

### POWER SYSTEMS GRID FUNDAMENTALS

### SYSTEM DESIGN CONSIDERATIONS

- Safety
- Reliability and flexibility
- Sensitivity and speed
- Voltage considerations

### SYSTEM PLANNING

- Utility service and requirements
- Protection consideration
- Special loads

### POWER SYSTEM CONFIGURATION

### EQUIPMENT SELECTION

- Circuit breakers
- Buses
- Voltage transformers
- Current transformers
- Relays and protection schemes

### POWER SYSTEM ANALYSIS

### SHORT CIRCUIT CALCULATIONS

- Effects of short circuit
- Sources of fault currents
- Database and system modeling
- Limiting short circuit currents

### SYSTEM GROUNDING DESIGN

### POWER FLOW ANALYSIS AND RELAYING

### PRINCIPLES OF POWER SYSTEM PROTECTION

### GROUND FAULT PROTECTION

- System grounding methods
- Zero-sequence currents
- Ground fault concerns

### HIGH VOLTAGE SUBSTATION DESIGN AND PROTECTION

- Grounding and step / touch potentials
- Electrical apparatus layout
- Equipment protection
- Commissioning

### DIFFERENTIAL PROTECTION RELAYING

### SEQUENCE CURRENT COMPONENTS IN PROTECTION

## DAY 2 | 25th September 2015

### FEEDER PROTECTION

Fuse characteristics Time-current coordination curves  
Relay-fuse-relay TOC, IOC selectivity and coordination  
Main-Tie-Main transfer schemes  
Radial systems, loop systems, selective systems

### BUS PROTECTION

Principles  
Topologies  
Protection schemes  
Hi-Amp city current detection  
Hi-impedance relaying  
Bus-Feeder inter-relations

### TRANSFORMER PROTECTION

Substations components  
Protection philosophies  
Protection elements  
Ground fault protection  
Neutral grounding systems

## DAY 3 | 26th September 2015

### TRANSMISSION LINE PROTECTION

Line protection  
Line differential communication  
Distance protection relaying  
Non-pilot schemes  
Pilot wire and schemes

### MOTOR PROTECTION

Motor nameplates  
Thermal overload protection  
Thermal capacity relaying  
Acceleration limits  
Phase and ground fault protection  
Protection elements  
Setting considerations

### GENERATOR PROTECTION

Radial and loop systems  
Multi source systems  
Protection main elements  
Phase and ground fault protection  
Standby generation protection  
Backup protection relaying  
Volt per Hertz - under / over voltage and frequency

### Registration:

Register by email to:

[RNITECH@GMAIL.COM](mailto:RNITECH@GMAIL.COM)

- Registration fee of \$150 will guarantee your spot, and is part of the course fee by Credit Card or by bank transfer (Instruction will follow.)
- The balance of \$1350 can be paid by at the door by a bank certified check.
- ✓ Credit Card payment online on the course page.

### Program Schedule

#### (Day 1 - Day 3)

08:30	Registration
09:00	Morning Session Begins
10:30 - 10:45	Refreshments & Networking Break
12:00	Lunch break
13:00	Afternoon Session begins
14:30 - 14:45	Refreshments & Networking Break
16:30	Day Ends

### In-House Training

Cost effective In-house courses, tailored specifically to your organization's needs, can be arranged at your preferred location and time. If you would like to discuss further, please contact our In-house division at [eric@rnitechnology.com](mailto:eric@rnitechnology.com).

### PRE-COURSE QUESTIONNAIRE

To ensure that you gain maximum value from this course, a detailed questionnaire will be forwarded to you upon registration to establish your exact training needs and issues of concern. Your completed questionnaire will be analyzed by the course trainer prior to the event and addressed during the event. You will receive a comprehensive set of course documentation to enable you to digest the subject matter in your own time.

## ABOUT YOUR COURSE FACILITATOR

**Eric Stark** is a Senior Trainer and Consultant of RNltechnology. He has more than 26 years of consulting and training experience and practice in industrial applications, utilities and academics in North America and around the world.

Eric has extensive experience in power system design, studies and commissioning, special emphasis on protection, power quality, power system grounding, power flow, short circuit, arc flash, transient stability, transient switching analysis and harmonic studies.

Eric's recent work included several generation, micro-grid, subway and utility projects in North America and Middle East, including system and stability studies. Eric was involved in protective relay settings, transfer schemes, coordination, and load shedding schemes.

In addition to his vast professional experience, Eric is the author of technical papers for major players like General Electric, Institute of Technology, Digital Energy and has prepared and conducted numerous courses, workshops and tutorials in academics and industry, globally, for GE and RNltechnology clients.

His experience includes industries such as oil and gas, silver, gold and phosphate mining, cogeneration, utility systems, pulp and paper, and many application projects.

### Partial List of clients includes:

- ✓ GE Energy
- ✓ IEC Electrical Utility Corp.
- ✓ National Thermal Power Corporation (NTPC)
- ✓ Elect. Forum
- ✓ RCC Institute of Technology
- ✓ Texas International Oilfield Tools (TIOT)
- ✓ Dead Sea Industries
- ✓ Cusco Industries
- ✓ Petronas Oil
- ✓ GE numerous client list around the world
- ✓ NYPA Utilities
- ✓ PG&E
- ✓ NWT Utilities
- ✓ Shell Oil
- ✓ Chevron Oil
- ✓ Caterpillar
- ✓ Barrick Gold
- ✓ Oncor utilities

