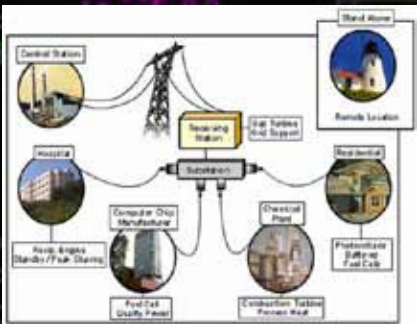


# DISTRIBUTION SYSTEM PROTECTION ENGINEERING

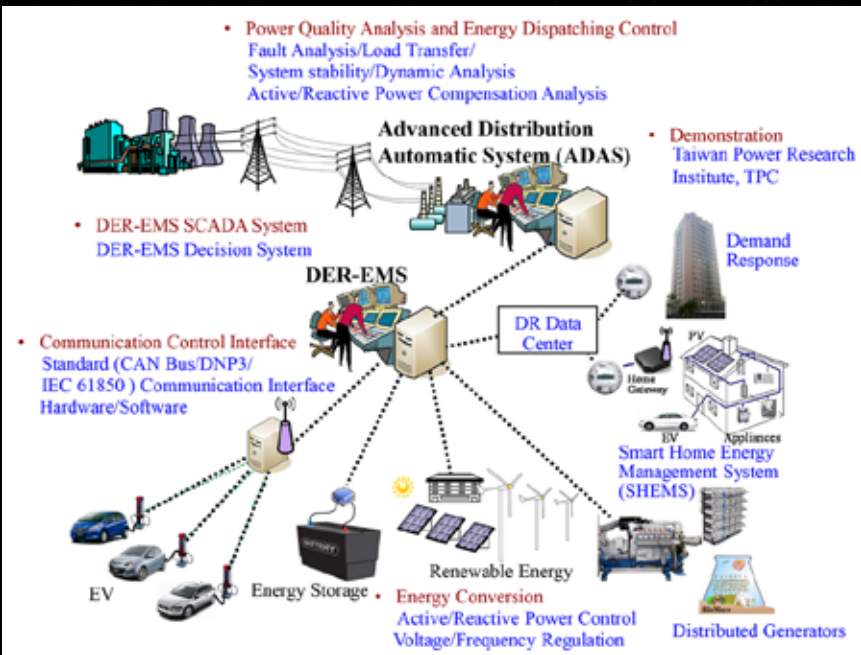
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## WHY YOU SHOULD TAKE THIS COURSE

This modern DER and bulk power integrated system protection training course will provide a practical understanding of protective device modern applications and protective relay schemes for electrical power systems and equipment.

DER Integrated Power System Protection and Coordination of various electrical equipment and apparatus requires a good understanding of phase and ground short circuit currents, detection, and safe clearing of the faulted equipment. This DER integrated Power System Protection and Coordination Training Course provides a practical and comprehensive description of the principles and concepts of analysis, application and operation of protection schemes for various power system elements such as feeders, transformers, motors, buses, generators, etc. The Power System Protection And Coordination Training course

starts with an overview of power system fundamentals, design and short circuit calculations which lead to the understanding of protection scheme requirements and their applications. Protection requirements for industrial plants, cogeneration, and interconnection with the utility power system are explained in detail.

This course covers the subject of power system protection from a practical perspective, and includes important functional aspects such as testing and coordination of protection systems. This course is designed for individuals who are involved with industries and utilities which depend on proper system protection for operational efficiency and minimizing damage to equipment.

## AGENDA - DAY 1

### SESSION 1: POWER SYSTEM FAULTS

- Different Types Of Faults
- Incidence Of Faults On Power System Equipment
- Effects Of Power System Faults
- Magnitude Of Fault Current, Short Circuit Calculations
- Detection Of Faults
- Clearance Of Faults
- Requirements Of Protective Relaying Systems

### SESSION 2: POWER SYSTEM CONFIGURATIONS

- Typical System Configurations
- Design Considerations
- Radial Systems, Loop Systems, Selective Systems
- DER And Integrated Bulk Power Configuratio

### SESSION 3: DER, RENEWABLES AND BULK POWER INTEGRATION

- Technology Issues In The Modern "Distributed Energy Resources" ("DER")
- From Smart Grid To Smart Energy Use
- The Smart Grid Vision And Roadmap For Canada
- Realizing The Potential Of Renewable And "Distributed Energy Resources" ("DER")
- Renewables Integration Through Direct Load Control And Demand Response
- The Florida/California Experience With DER And Outcome
- Energy Storage
- DER In Transmission And Distribution
- Case Study: Integrating 33% Renewables & DER Into The Power Grid

### SESSION 4: FAULT STUDIES AND DER

#### COURSE INSTRUCTOR

**ERIC STARK**

Electricity Forum Protection and Control Consultant

- Equipment Ratings
- Asymmetric Factors
- Purposes Of Fault Calculations
- Types Of Faults
- Modeling Methods
- Fault Calculations
- Faults Where DER Is Fully Integrated

### SESSION 5: COMPONENTS OF POWER SYSTEM PROTECTION SCHEMES

- Fault Detecting Relays
- Tripping Relays And Other Auxiliary Relays
- Circuit Breakers - Bulk Oil, Air-Blast, Vacuum, SF6
- Current Transformers
- Voltage Transformers
- Ground Transformers
- Transition From Electro-Mechanical To Electronic And Microprocessor-Based Relays
- The Application Of Programmable Logic Controllers
- Modern Microprocessor-Based Relays: Review Of Types Available

### SESSION 6: CURRENT (CTS) & VOLTAGE TRANSFORMERS (VTS)

- Various Types Of CTs, VTs & CVTs
- Theory And Characteristics Of CTs
- Application Requirements Of CTs For Protective Relaying
- Accuracy Classifications
- Future Trends In CT Design
- Testing Of CTs And VTs

### SESSION 7: COORDINATION OF ELECTRICAL PROTECTION

#### COURSE TIMETABLE

BOTH DAYS

Start: 8:00 a.m.

Lunch: 12:00 noon

### SCHEMES

- Fuse To Fuse
- Circuit Breaker To Fuse
- Fuse To Circuit Breaker
- Back Up Protection
- Limitation Of Fault Current
- Selective Zones Of Protection
- Types Of Bus Protection Schemes
- Basic Concept Of Differential Protection
- Application To Various Bus Configurations
- Applications To Switchboards
- Testing Of Bus Protection Schemes

### SESSION 8: FEEDER OVERCURRENT PROTECTION

- Protective Relaying Requirements For Loop And Radial Systems
- Elements Of Feeder Protection Schemes
- High Set, Low Set, And Inverse -Timed Elements
- Co-Ordination With Other Devices And Fuses
- Auto-Reclosing Of Feeder Circuit Breakers
- Various Types Of Overcurrent Relays
- Electromechanical, Electronic & Digital Relays
- Relay Setting Criteria
- Testing Of Overcurrent Protection Schemes

### SESSION 9: TRANSFORMER PROTECTION

- Protection Characteristics
- Data Requirements
- Basic Protection Systems
- Factors Affecting Protection
- Overload Protection
- Phase And Ground Fault Protection
- Primary Fuse Protection
- Primary Breaker Protection

### SESSION 10: GENERATOR PROTECTION

- Voltage Restraint/Dependent Phase Overcurrent
- Ground Fault Protection
- Differential Protection
- Loss Of Field Protection

- Volts/Hertz Protection
- Frequency Protection
- Voltage Protection
- Thermal Protection

### SESSION 11 MOTOR PROTECTION

- NEC And ANSI/IEEE Standards
- Motor Nameplates
- ANSI/IEEE Device Numbers And Functions
- Motor TCC Curves
- MCP Low-Voltage Protection
- Medium-Voltage Motor Protection
- Thermal Overload Protection
- Thermal Locked Rotor Protection
- Phase And Ground Fault Protection
- Miscellaneous Protection (Undervoltage, Single-Phasing, Etc.)

### 4:00 pm -- Day 2 Wrap Up

- Review Quiz
- Questions and Discussions

#### WHO SHOULD ATTEND

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, Engineers and technicians involved with design, operation, maintenance, testing, and troubleshooting of high and medium voltage electrical systems and equipment. Technicians and technologists in the industrial, consulting, and utility fields involved in design, operation and maintenance who require knowledge of electrical system protection techniques.

## INTERESTED IN ONSITE ELECTRICAL TRAINING?

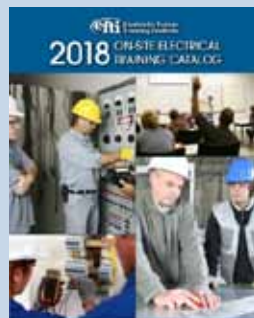
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The registration fee to attend this course is \$799.00 + Tax. The fee includes course material, a FREE magazine subscription, a \$100 coupon towards any future 2018/2019 Electricity Forum event (restrictions apply), refreshments. NOTE: LUNCH IS PROVIDED WITH THIS COURSE.

**WHEN & WHERE**

(Please check the date/location where you want to attend the course)

**DISTRIBUTION PROTECTION SYSTEM  
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