COURSE OVERVIEW EE1118
Modern Power System Proactive Relaying

Course Title
Modern Power System Proactive Relaying

Course Reference
EE1118

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Date/Venue

Session(s)	Date	Venue
1	June 23-27, 2025	Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
2	August 31-Sep 04, 2025	Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE
3	November 10-14, 2025	Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
4	December 14-18, 2025	Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE

Course Description

This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

This course is designed to provide participants with a detailed and up-to-date overview of Modern Power System Proactive Relaying. It covers the types of power systems and power system components; the fundamentals of power system protection, relaying components and operation and proactive protection strategy; the power system faults and fault analysis and safety considerations in protection systems; the distance protection schemes, differential protection for power equipment and overcurrent protection and time coordination; the proactive relay settings optimization, communication in protection systems and digital relays and smart protection systems; and the phasor measurement units (PMU) in protection, fault detection using synchrophasors and self-healing grids and proactive relaying.

Further, the course will also discuss the artificial intelligence and machine learning in protection, cybersecurity in modern protection systems and transformer protection and relaying; the generator protection and control, busbar protection systems, feeder protection and coordination and motor protection systems; the arc flash risks in protection systems, protective measures against arc flash and standards and regulations for arc flash protection; the testing and commissioning of protection systems; and the proper maintenance of protection relays and equipment.

During this interactive course, participants will learn the proactive monitoring and real-time data analysis, data analysis for early detection of faults and cloud-based platforms for protection system monitoring; the emerging trends in power system protection, smart grids and the future of protection relays; the role of automation and robotics in power system protection and future advancements in protection technology; and the key performance indicators for protection systems, methods for evaluating protection system reliability and strategies for improving protection system performance.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain an in-depth knowledge on modern power system proactive relaying
- Identify the types of power systems and power system components
- Discuss the fundamentals of power system protection, relaying components and operation and proactive protection strategy
- Apply power system faults and fault analysis and safety considerations in protection systems
- Recognize distance protection schemes, differential protection for power equipment and overcurrent protection and time coordination
- Carryout proactive relay settings optimization and discuss communication in protection systems and digital relays and smart protection systems
- Apply phasor measurement units (PMU) in protection, fault detection using synchrophasors and self-healing grids and proactive relaying
- Determine artificial intelligence and machine learning in protection, cybersecurity in modern protection systems and transformer protection and relaying
- Carryout generator protection and control, busbar protection systems, feeder protection and coordination and motor protection systems
- Identify arc flash risks in protection systems, protective measures against arc flash and standards and regulations for arc flash protection
- Test and commission protection systems and apply proper maintenance of protection relays and equipment
- Employ proactive monitoring and real-time data analysis, data analysis for early detection of faults and cloud-based platforms for protection system monitoring
- Discuss the emerging trends in power system protection, smart grids and the future of protection relays, role of automation and robotics in power system protection and future advancements in protection technology
- Implement key performance indicators for protection systems, methods for evaluating protection system reliability and strategies for improving protection system performance

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of modern power system proactive relaying for electrical engineers, power system protection engineers, substation and transmission engineers, scada and automation engineers, control systems engineers, field service engineers, project managers, grid operators and planners, maintenance supervisors, substation technicians and relay technicians and other technical staff.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

- The International Accreditors for Continuing Education and Training (IACET - USA)

  Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Mr. Pan Marave, PE, MSc, BEng, is a **Senior Electrical & Instrumentation Engineer** with over **40 years** of extensive experience in **Oil**, **Gas**, **Petrochemical**, **Refinery** & **Power** industries. His expertise includes **Circuit Breaker**, **HV Switchgear Maintenance**, **HV/LV Electrical** Authorisation, Basic **Electricity**, **Electrical & Special Hazards**, **Personnel Protection**, **HV/LV Equipment**, **Motor Controllers**, **Electrical Switching** Practices, **Emergency Planning**, **Safety Management**, Safety Instrumented Systems (**SIS**), Safety Integrity Level (**SIL**), Emergency Shutdown (**ESD**); **DCS**, **SCADA** & **PLC**; **Measurement** (**Flow**, **Temperature**, **Pressure**); **Process Analyzers** & **Analytical Instrumentation**; **Process Control**, **Instrumentation** & **Safeguarding**; **Process Controller**, **Control Loop & Valve Tuning**; Industrial **Distribution Systems**; Industrial **Control & Control Systems**, Power Systems **Protection & Relaying**; **Earthing**, **Bonding**, **Grounding**, **Lightning & Surge Protection**; Electric Power **Substation** & **Systems**; Electrical Engineering Principles; **Motor Control Circuit**; **Electrical Fault Analysis**; Electrical Networks & Distribution **Cables**; **Circuit Breakers**, **Switchgears**, **Transformers**, **Hazardous Areas Classification** and **Detailed Engineering Drawings**, **Codes** & **Standards**. Furthermore, he is also well-versed in Microprocessors Structure, Lead Auditor (**ISO 9000:2000**), **ISO 9002**, Quality Assurance, and Projects & Contracts Management.

Presently, Mr. Marave is the **Technical Advisor** of **Chamber of Industry & Commerce** in Greece. Prior to this, he gained his thorough practical experience through several positions as the **Technical Instructor**, **Engineering Manager**, **Electronics & Instruments Head**, **Electrical**, **Electronics & Instruments Maintenance Superintendent**, **Assistant General Technical Manager** and **Engineering Supervisor** of various international companies such as the **Alumil** Mylonas, **Athens Papermill**, **Astropol** and the **Science Technical Education**.

Mr. Marave is a **Registered Professional Engineer** and has **Master's** and **Bachelor's** degrees in **Electrical Engineering** from the **Polytechnic Institute of New York** and **Pratt Institute of New York** (**USA**) respectively. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**) and an active member of the **Technical Chamber** and the Institute of Electrical and Electronics Engineer (**IEEE**) in Greece. He has presented and delivered **numerous international** courses, conferences, trainings and workshops worldwide.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Course Fee

US$ 5,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Overview of Power Systems*** *Types of Power Systems (Generation, Transmission, Distribution) • Power System Components • Power Flow Concepts • Importance of Protection Systems*
0930 - 0945	*Break*
0945 – 1045	***Fundamentals of Power System Protection*** *Basic Protection Concepts • Protection Scheme Types (Overcurrent, Differential, Distance) • Protection Zones and Coordination • The Role of Protection Relays in System Stability*
1045 - 1145	***Relaying Components & Operation*** *Relay Types (Electromechanical, Solid-State, Microprocessor-Based) • Current Transformers (CT) and Voltage Transformers (VT) • Relay Settings and Adjustments • Functionality of Protection Relays*
1145 - 1230	***Proactive Protection Strategy*** *Defining Proactive Protection vs. Reactive Protection • Preventative Maintenance and Monitoring • Impact of Automation in Proactive Relaying • Techniques to Identify Potential Failures Before They Occur*
1230 – 1245	*Break*
1245 – 1330	***Power System Faults & Fault Analysis*** *Types of Faults (Short Circuit, Open Circuit, Ground Faults) • Symmetrical and Asymmetrical Faults • Fault Location and Fault Current Calculation • Protective Relay Response During Faults*

1330 - 1420	***Safety Considerations in Protection Systems*** *Safety Interlocks and Fail-Safe Mechanisms • Safety in Relay Settings and Configurations • Impact of Protection System Failure on Safety • Standards and Regulations for Protection System Safety*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2

0730 – 0830	***Distance Protection Schemes*** *Overview of Distance Protection • Impedance-Based Relay Schemes • Z1, Z2, and Z3 Protection Zones • Coordination with Other Protection Devices*
0830 – 0930	***Differential Protection for Power Equipment*** *Differential Protection Principles • Application for Transformers, Generators, and Busbars • Fault Detection and Prevention Through Differential Protection • Practical Challenges in Differential Protection*
0930 - 0945	*Break*
0945 – 1130	***Overcurrent Protection & Time Coordination*** *Types of Overcurrent Protection (Inverse, Definite Time) • Coordination Between Multiple Relays • Setting Overcurrent Protection for Various Equipment • Fault Clearing Time and Its Impact on System Stability*
1130 - 1230	***Proactive Relay Settings Optimization*** *Importance of Setting the Correct Parameters • Influence of System Configuration on Relay Settings • Techniques for Optimizing Relay Settings • Use of Relay Setting Software Tools*
1230 - 1245	*Break*
1245 - 1330	***Communication in Protection Systems*** *Role of Communication in Modern Protection Systems • Protocols Used in Protective Relaying (IEC 61850, DNP3) • Remote Monitoring and Control of Protection Systems • Data Exchange Between Relays and SCADA Systems*
1330 - 1420	***Case Studies: Protection System Failures*** *Analysis of Real-World Protection System Failures • Lessons Learned From Past Incidents • Importance of Continuous Monitoring and Testing • Strategies for Avoiding Common Failures*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3

0730 – 0830	***Digital Relays & Smart Protection Systems*** *Introduction to Digital Relays • Benefits of Smart Protection Systems • Real-Time Data Analysis and Decision-Making • Trends in Digital Protection for Power Systems*
0830 – 0930	***Phasor Measurement Units (PMU) in Protection*** *Overview of PMUs and Their Role in Protection • Integration of PMUs With Relays for Enhanced Fault Detection • Real-Time Monitoring Using PMU Data • Advanced Applications of PMUs in Grid Management*

0930 - 0945	Break
0945 – 1130	***Fault Detection Using Synchrophasors*** *Synchrophasor Technology for Fault Detection • Fault Location Estimation Using Synchrophasors • Role of Synchrophasors in Stability Monitoring • Implementation Challenges and Solutions*
1130 - 1230	***Self-Healing Grids & Proactive Relaying*** *Concept of Self-Healing Grids • Role of Proactive Relaying in Grid Resilience • Automatic Restoration of Power Following Faults • Real-World Applications of Self-Healing Grids*
1230 - 1245	Break
1245 - 1330	***Artificial Intelligence & Machine Learning in Protection*** *Introduction to AI/ML in Protection Systems • Predictive Analytics for Fault Detection and Prevention • Machine Learning Models for Optimizing Relay Settings • Future Potential of AI/ML in Proactive Protection*
1330 - 1420	***Cybersecurity in Modern Protection Systems*** *Importance of Cybersecurity in Power System Protection • Potential Vulnerabilities in Digital Relays • Protective Measures Against Cyber Threats • Standards and Best Practices for Cybersecurity in Protection Systems*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	Lunch & End of Day Three

Day 4

0730 – 0830	***Transformer Protection & Relaying*** *Protection Schemes for Transformers • Buchholz Relay, Differential Protection • Fault Types in Transformers and Their Protection • Maintenance and Testing Practices for Transformer Protection*
0830 – 0930	***Generator Protection & Control*** *Protection Strategies for Generators • Generator Relay Settings and Coordination • Generator Protection Against Faults and Overloads • Advanced Fault Detection Techniques for Generators*
0930 - 0945	Break
0945 – 1130	***Busbar Protection Systems*** *Overview of Busbar Protection Principles • Differential Protection for Busbars • Fault Detection and Isolation in Busbar Systems • Maintenance Practices for Busbar Protection*
1130 - 1230	***Feeder Protection & Coordination*** *Protection Schemes for Distribution Feeders • Coordination of Protection Relays in Feeder Systems • Protection Settings for Different Types of Feeders • Fault Isolation and Restoration in Feeder Systems*
1230 - 1245	Break
1245 - 1330	***Motor Protection Systems*** *Motor Protection Principles • Thermal Overload Protection • Differential Protection for Motors • Advanced Motor Protection Techniques*

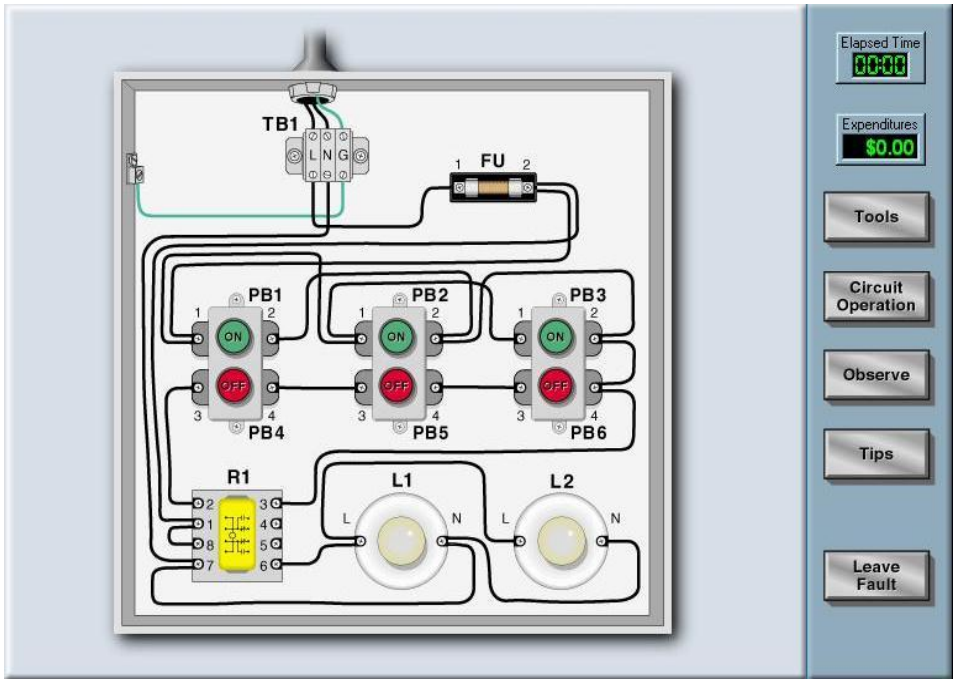
1330 - 1420	***Arc Flash Protection & Mitigation*** *Understanding Arc Flash Risks in Protection Systems • Protective Measures Against Arc Flash • Implementation of Arc Flash Relays • Standards and Regulations for Arc Flash Protection*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

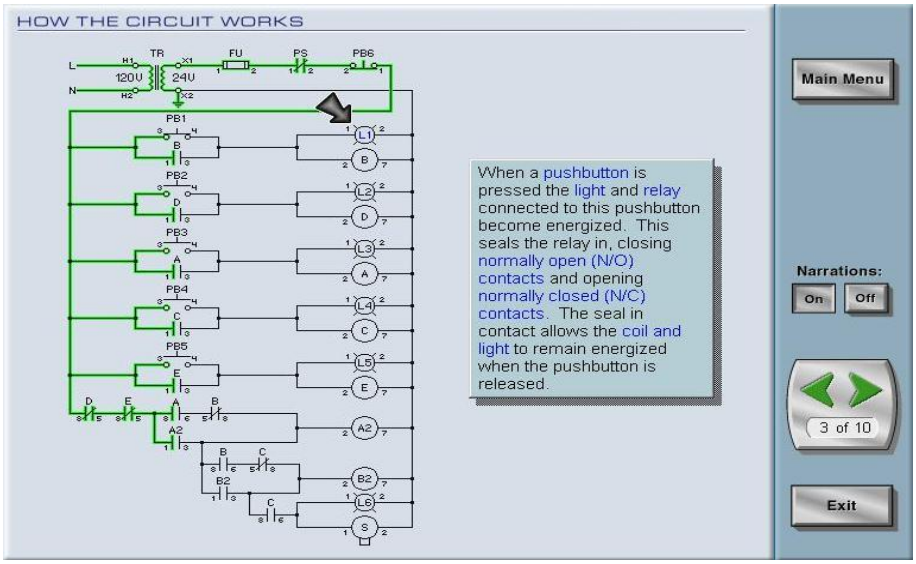
Day 5

0730 – 0930	***Testing & Commissioning of Protection Systems*** *Overview of Protection System Testing • Testing Methods for Relays and Protective Devices • Verification of Relay Settings and Coordination • Troubleshooting Protection System Issues During Commissioning*
0930 – 0945	*Break*
0945 - 1030	***Maintenance of Protection Relays & Equipment*** *Regular Maintenance Practices for Protection Systems • Importance of Periodic Testing and Calibration • Common Maintenance Issues and Solutions • Predictive Maintenance Techniques for Protection Systems*
1030 - 1130	***Proactive Monitoring & Real-Time Data Analysis*** *Tools for Real-Time Monitoring of Protection Systems • Role of SCADA and Remote Monitoring in Proactive Relaying • Data Analysis for Early Detection of Faults • Use of Cloud-Based Platforms for Protection System Monitoring*
1130 - 1230	***Emerging Trends in Power System Protection*** *Overview of the Latest Trends in Power System Protection • Smart Grids and the Future of Protection Relays • Role of Automation and Robotics in Power System Protection • Future Advancements in Protection Technology*
1230 - 1245	*Break*
1245 - 1345	***Reliability & Performance Evaluation*** *Key Performance Indicators for Protection Systems • Methods for Evaluating Protection System Reliability • Strategies for Improving Protection System Performance • Case Studies on Improving System Reliability*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1400 – 1415	***POST TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

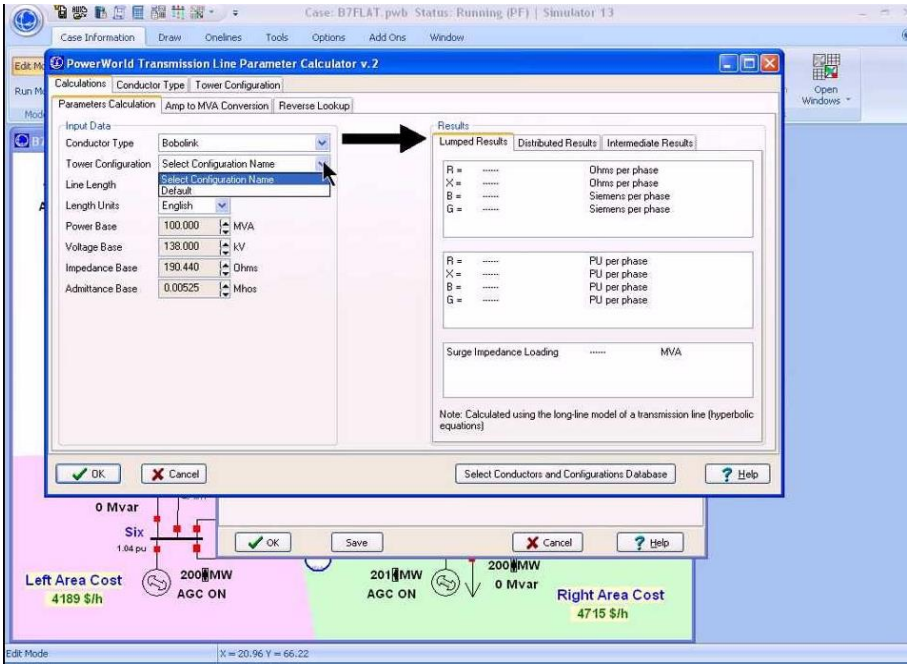
Simulator (Hands-on Practical Sessions)

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art simulator "Simutech Troubleshooting Electrical Circuits V4.1", Power World" and "ETAP software".

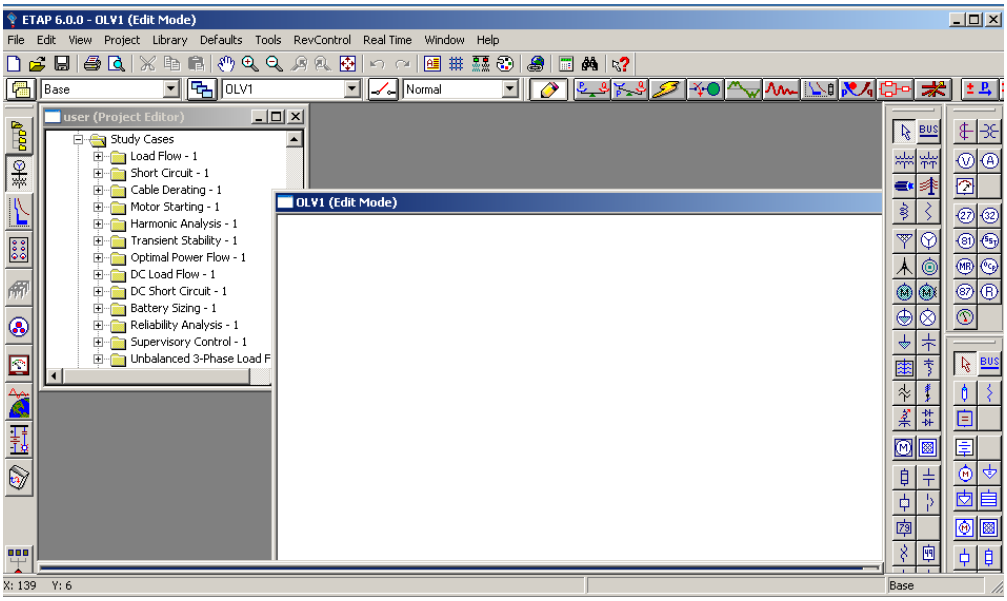




Simutech Troubleshooting Electrical Circuits V4.1



Power World Simulator



ETAP Software Simulator

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