TRAINING PROGRAMS

QUALU

QUALUS UNIVERSITY

A Letter From The Director of Training & Development

Welcome to Qualus University!

Qualus University, also known as QualU, is your source for our external comprehensive training programs. We created QualU to combine the technical expertise and training excellence within our operating companies, building dynamic programs for our employees, the power systems industry, and professionals from other industries that could benefit from our depth of knowledge.

As the Director of Training & Development for Qualus, I am pleased to share the robust catalog of training offerings that QualU has available. Ongoing training in both technical and safety skills is vital to the success of our organizations and the power industry as a whole. We are committed to providing and being part of the success of not only our employees, but our peers, competitors, and clients.

QualU's portfolio offerings include our Power Systems Seminars series, which shares our experience, knowledge, and passion of power systems with industry professionals. Many of our Power Systems Seminars and SCADA and Communications focus on protection and control, however, Industrial Fundamentals and Protection Fundamentals address professionals in the industrial power setting.

The final component of our QualU portfolio is the Safety and Technical Training series. This series of programs helps keep employees and equipment safe from electrical hazards by delivering up to date practices, standards, and compliance courses. Trainings are based on industry standards, such as IEEE, ASME, NESC, NFPA, OSHA, ANSI, NETA, and NEMA. These essential training programs provide regulatory and safety content and can also be customized to meet each participant's needs. We welcome you to explore our training offerings, learn about the benefits provided by our distinctive programs, and to attend one of QualU's courses, training programs, and seminar series.

Sincerely,

Sarah Salgueiro
Director, Training & Development
Qualus

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Why QualU

QualU is proud to deliver the highest quality training to you and your team. Our training programs offer:

- Subject matter expert instructors
- Small class sizes with dynamic classroom discussion
- Networking with other industry professionals
- Customizable content to meet your company's training needs
- Continuing education credits to maintain your professional certifications and licenses
- Content based on industry standards such as IEEE, ASME, NESC, NFPA, OSHA, ANSI, NETA and NEMA

TABLE OF CONTENTS

QUALU

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Who Should Attend

Our training programs are open to industry professionals interested in furthering their technical knowledge. Typical attendees include:

- Service Technicians
- Relay Technicians
- Test Engineers
- Electric Power Utility Engineers
- Protection & Control Engineers
- Project Managers
- Power System Educators
- Graduate Students
- Professionals Seeking CEHs
- Design Engineers
- Safety Professionals

How to Attend

Visit **qualuspowerservices.com** to view our calendar.

Ready to Set Up Training?

We can work with you to choose the training that best fits your goals, tailor our courses to your needs, and bring them to a location of your choice.

BENEFITS, CREDITS, REGISTRATION & ON-SITE PROGRAMS

Earn Credits

QualU courses support your professional development and the credits to maintain your industry certifications. All courses provide a certificate of completion with the number of contact hours in the classroom. Additional credits, including Continuing Education Hours (CEHs) and NETA Technical Development Credits (CTDs), may be earned as outlined below.

Continuing Education Hours (CEHs)	NETA CTDs
The Power Systems Seminars have been approved by the Florida Board of Professional Engineers for CEHs. Five-day courses earn 40 CEHs, four-day courses earn 32 CEHs, and three-day courses earn 24 CEHs. For attendees seeking PE credits for other states, please check your state's regulations.	The Power Systems 101, Protection Considerations and Communications, Relay Testing and Commissioning, and Protection Fundamentals courses are eligible for 32 NETA CTDs. Relay Schemes and Testing Calculations and Industrial Fundamentals are eligible for 24 NETA CTDs. Level II NETA Certified Technicians are required to earn 24 CTDs, while Level III and Level IV are required to earn a minimum of 48 CTDs every three years to maintain their certification. For more information about the CTD program and requirements, please contact the NETA office at neta@netaworld.org or 888-300-6382.

Registration

QualU offers many of our training courses in an open enrollment format with sessions scheduled throughout the year in a variety of cities. Contact **QualU@QualusMail.com** or visit us online at **qualuspowerservices.com** for our current schedule.

On-Site Programs

Seeking customized training for your team? We can work with you to choose a course and tailor the topics to your needs. In addition to professional development opportunities for your team, benefits of an on-site course include:

- Expert facilitators come to you
- Train your team in one location
- Reduce travel expenses
- Choose dates and schedules that are optimal for your team
- Build comradery amongst the team during training
- Customize the topics that fit the needs of your organization
- Tailor questions and discussions to situations your organization experiences

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Power Systems Seminars

The Power Systems Seminars series, shares our experience, knowledge and excitement about power systems with industry professionals.

Power Systems 101:
Relay Philosophies

Power Systems:
Protection Considerations and Communications

Power Systems:
Relay Testing and Commissioning

Power Systems:
Relay Schemes and Testing Calculations

Power Systems:
Industrial Fundamentals

Power Systems:
SCADA and Communications

Power Systems:
Protection Fundamentals

Power Systems:
Electrical Documents

POWER SYSTEMS 101 RELAY PHILOSOPHIES

Power Systems 101.....*4 Day Class, 32 Credit Hours*

Power Systems 101 is has been specifically developed for engineers, engineering technicians, and field relay technicians. This class aims to provide attendees with a strong basis of knowledge in relay protection philosophy and design theory.

Substation Layouts & Protection Zone Diagrams

- Transmission System Overview • Types of Generation • What Is a Fault? • Substation Layouts
- Protection Zone Diagrams

Functional Diagram Exercise

- Hands-on Functional Diagram • Line Protection • Bus Protection • Transformer Protection
- Breaker Failure • Lockouts

Current Transformers

- CT Basics • Ratios • CT Classes T&C • CT Ratings • Saturation Current and Curves
- Equivalent Circuits • CT Testing • IEEE Standards

Breaker Control

- Mechanical Operation • Trip circuits • Close Circuits • Anti-Pump Circuits
- Reclosing • Specifications and Ratings • Alarms • IEEE Standards

Differential

- Bus Differentials • KCL Theory • Differential CT Circuits
- Calculating Current In Differential Circuits • Mismatched CTs • Rolled CTs • CT Polarity
- High Impedance Differential Application • IEEE Standards

TESTIMONIAL

"Michael has an excellent grasp of the material he teaches and provides an in-depth look at most aspects of protection and control."

Transformer Protection

- Transformer Theory • Equivalent Circuit • Types of Transformers • Transformer Losses
- Transformer Ratings • Tap Changes • IEEE Standards

Line Protection

- Physical Characteristics of Transmission Lines • Mho Circle • Theory of Impedance Protection
- Zones of Protection • POTT, PUTT, DCB, & DCUB End-to-End Schemes • Reliability and Security
- IEEE Standards

Breaker Failure

- Breaker Failure Initiates • Current Requirements • Breaker Position • Critical Clearing Time
- System Stability • Various Breaker Failure Logic Schemes • Trip and Lockout Theory
- IEEE Standards

POWER SYSTEMS PROTECTION CONSIDERATIONS AND COMMUNICATIONS

Protection Considerations and Communications.....*4 Day Class, 32 Credit Hours*

Protection Considerations and Communications has been specifically developed for engineers, engineering technicians and field relay technicians. It aims to provide attendees with a strong basis of knowledge in relay protection philosophy and design theory. This will focus on protection considerations related to generators, capacitor banks, underfrequency, DC systems, distribution and utility communications.

Power Systems Overview

- What Is a Power System • Grid Component Relationships • System Stability Considerations

Generator Theory

- Generator Types • AC & DC Current • Right Hand Rule & Establishing A Field
- Establishing Voltage, Current & Frequency
- Stator, Rotor & Synchronous Machines

Generator Protection

- Unit One Line Diagram • Device Codes • Protection Elements • Tripping Modes

Generator Protection Upgrade

- Before Protection • After Upgrade Protection • Sample Drawings Review

> TESTIMONIAL
>
> *"I like the stories and practical application. I appreciate the experience and knowing what to look for in the field."*

Capacitor Bank Fundamentals

- Understanding VARs • Capacitor Bank Function In a Power System
- Capacitor Bank Types, Configurations & Designs • Power Factor Correction Calculation
- Protection of a Capacitor Bank • Example Applications

Reactor Bank Fundamentals

- Reactor Banks In a Power System • Distribution Applications • Transmission Applications

Underfrequency Fundamentals

- Power and Load Balanced With Speed • Underfrequency Protection Function
- Power System Dynamic When Generation Doesn't Equal Load • NERC & Its Role
- Accomplishing Underfrequency Load Shedding • Historic Examples
- Introduction of Synchrophasor Technology

DC Systems

- History & Theory of Batteries • DC Systems Overview • Battery & Charger Sizing
- Types of Batteries • PPE For Battery Work • DC Systems Installation Examples

Distribution Systems

- Utility Distribution Systems Overview • Substation Equipment
- Substation Layouts for Reliability or Cost • Distribution Protection • IEEE C37.230-2007
- Coordinating Protection • Reclosing • Distribution Automation & “Smart Grid”

Overview of Electric Utility Communication Systems

- Communication Needs – Then and Now • Enterprise vs Mission Critical (IT vs OT) Applications
- Media Types • Fiber and Wireless Communications • Leased Services

Power Line Carrier Systems

- Power Line Carrier System View & Components • Common Applications
- Performance Considerations – IEEE 643-2004 • Design Considerations
- Exercise In System Performance • Performance – Beyond The Design

SCADA Systems

- SCADA Background & History • SCADA System Functional Component Overview
- Connecting The RTU to The SCADA Master • Field Sensors & Non-Traditional Applications
- Common Protocols • Regulatory Influences

Fiber Systems – OSP & ISP

- What It Takes to Design a Successful Fiber Network • Outside Plant Considerations
- Inside Plant Considerations

POWER SYSTEMS RELAY TESTING AND COMMISSIONING

Relay Testing and Commissioning.....*4 Day Class, 32 Credit Hours*

Relay Testing and Commissioning is geared toward answering fundamental questions about field commissioning of protection and control equipment. This class is beneficial for hands-on field technicians, new protection and control engineers, and other utility company staff that want to know more about field testing.

Introduction to Power Systems and Protective Relaying

- Power System Faults and Abnormal Conditions • Basic Fault Calculations and Relay Settings
- Relay Applications • Standards, References, and Documentation

Technical Tools

- Trigonometry • Phasors In Relay Circuits • Power System Grounding

Instrument Transformers

- Potential Transformers • Grounding and Shielding of Instrument Transformer Circuits
- Current Transformer Testing

Relay Design & Basic Elements

- Operational Features • Ratings • 15 Basic Element Characteristics

Control Circuits

- Contacts • Sneak Circuits • Battery Testing • Finding Grounds

Transformer Protection & Control

- Testing Overcurrent, Differential and Sudden Pressure
- Testing Voltage Regulation and Paralleling
- Emergency Replacement of Transformers

TESTIMONIAL

"I liked the interactive exercises because they helped drive the content home."

Commissioning Tests; Safety, Manual & Automatic Testing of CTs & Relays

- Testing Methodology • Field Testing Philosophies • Field Checks on Instrument Transformers
- Relay Programming and Testing • RTS and Protection Suite

Commissioning Tests; Testing Circuits, Wiring & Functional Tests

- Hands-on Drawing Review with Classroom Handouts • Wire Checking
- AC Circuit Testing • Functional Tests

Commissioning Tests; In Service Readings

- Phasing Tests • In Service Readings

Commissioning Tests; Commissioning Numerical Relays

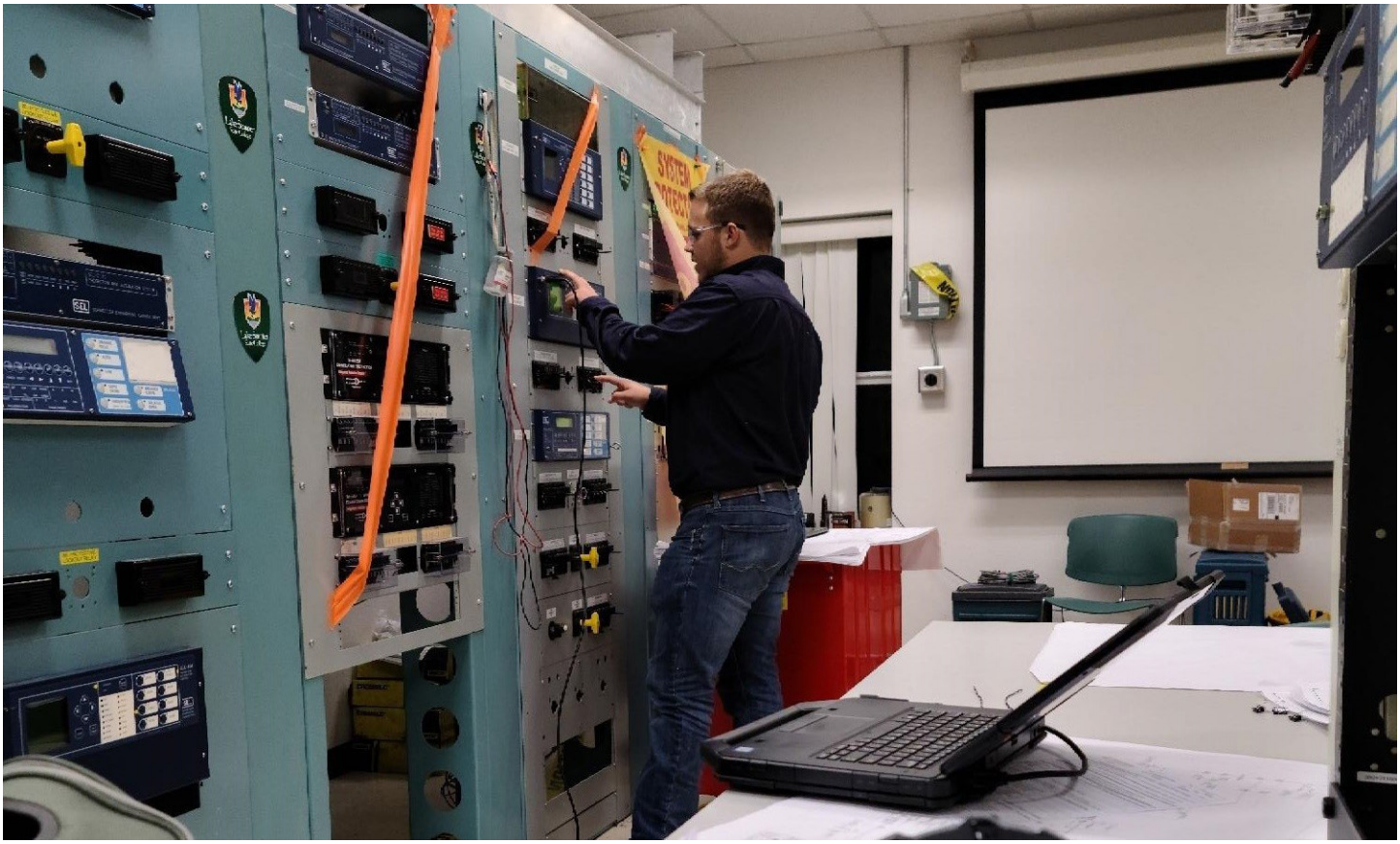
- Dynamic Characteristics • Programmable Logic • In Service Readings
- Diagnosing Abnormal Conditions

Commissioning; Project Management

- Pre-job Engineering • Critical Path • Outage Planning • Typical Jobs

Testing Power Line Carrier

- Test Procedures for Line Traps, Tuners, Transmitters and Receivers



POWER SYSTEMS RELAY SCHEMES AND TESTING CALCULATIONS

Relay Schemes and Testing Calculations.....*3 Day Class, 24 Credit Hours*

Relay Schemes and Testing Calculations is developed for Relay Technicians by a Relay Technician, Rick Ashton. While the seminar is directed toward relay technicians, engineers and technicians from many other disciplines have also taken this seminar. This seminar provides students with in-depth knowledge of how protective relays work so the relay technician can better understand how protective relay tests must work when executing testing & commissioning activities.

Applying Trig Functions to the World Of Relays

- Trig Functions Used for Meter and Relay Calculations
- Law of Sines Used to Find The Boundary of a Lens Characteristic
- Law of Cosines Used to Find “Delta-V” In Sync Check Relays

Introduction to Basic Logic Functions

- AND Gate and Its Equivalent Circuit • OR Gate and Its Equivalent Circuit
- NOT Gate and Its Equivalent Circuit

Discovering Transformers

- Polarity of Transformers • Current Transformers
- VA of Transformers Is The Same on HV and LV Sides
- 87T Relay Schemes Need to Compensate for Equal VA on Both Sides of The Transformer
- Delta-Y or Y-Delta Transformers Have a 30 Degree Shift, Where Does It Come From?
- 87T Relay Schemes Need to Compensate for That 30 Degree Shift

Quadrant Diagrams, Math Operators and Directionality

- When to Use X-Y Diagrams • When to Use R-X Diagrams • When to Use P-Q Diagrams
- Discussion of Power System Events and Faults

Converting Values for Relay Tests

- Primary Ohms to Secondary Ohms Conversion • Polar Coordinates to Rectangular Coordinates Conversions

Calculating Phase-to-Phase Values

- Step Distance Concept • Errors In Protection Systems
- When to Use The Square Root of Three and When Not To
- Calculate Any Phase-to-Phase Value Without the Square Root of Three

Calculating Symmetrical Components

- Positive Sequence Calculation • Negative Sequence Calculation • Zero Sequence Calculation
- Fuse Failure/Loss of Potential Circuits • Forcing Neutral Current • Directional Units
- Zero Sequence Detector Circuits

Calculating Apparent Fault Impedance

- Phase-to-Phase Fault Calculation • Introduction to Zero Sequence Compensation Factor Coupling
- Phase-to-Ground Fault Calculation • 3-Phase Fault Calculation

Reactance Changes Everything

- Watts Calculation • VARS Calculation • Line Angle and Power Factor
- Line Constants, Operating Quantities, Angle of Max Torque and Operating Characteristics

Impedance Plots

- Draw Load Vectors or Fault Vectors on X-Y Diagram • Perform the Math From Ohm's Law
- Draw Load Z or Fault Z Plot on R-X Diagram

Views of a Fault

- Phase Vectors on X-Y Diagram • Impedance Plots on R-X Diagram
- Symmetrical Component Vector Comparisons • Sine Waves Can Be Examined
- Harmonics Can Be Examined

Relays by the Numbers

- Relays by IEEE Device Number • Discussion of Mho Circles and Testing Device 21 Relay
- Discussion of 87T Tests
- Discussion of Generic Testing Requirements for Other Relays by IEEE Device Number
- Discussion of NERC PRC 5 Requirements of Microprocessor Relays

POWER SYSTEMS
INDUSTRIAL FUNDAMENTALS

Industrial Fundamentals.....*4 Day Class, 32 Credit Hours*

Power Systems: Industrial Fundamentals is geared toward answering some of the foundational questions for industrial and institutional power systems. This course is beneficial for hands-on field technicians, new engineers and industry professionals that want to know more about the critical elements of an industrial power system. Through classroom learning, exercises, and hands-on activities, attendees will gain both a theoretical and practical understandings of the fundamentals that govern electrical power distribution use. The class will cover the following topics in depth:

The Modern Electrical Grid
- Key Terms and Requisite Math
- Industry Overview

Industrial and Institutional Power Systems
- Typical Configurations
- Voltage Levels and Application

Electrical Equipment and Gear
- Typical Construction and Specification
- Limits and Requirements

Protection and Control Engineering
- Relay Systems and Support Infrastructure
- Protection Design Philosophy

Instrumentation and Telemetry
- Instrument Transformers and Application
- Protection and Telemetry Troubleshooting

Emergency Systems
- Life/Safety Requirements
- Power Criticality and Coordination

Power System Documentation
- System One-Lines, Three-Lines, Schematics, and More
- System Modelling

Power System Studies
- Short Circuit, Coordination, and Arc flash
- Load Flow, Feasibility, and Engineering

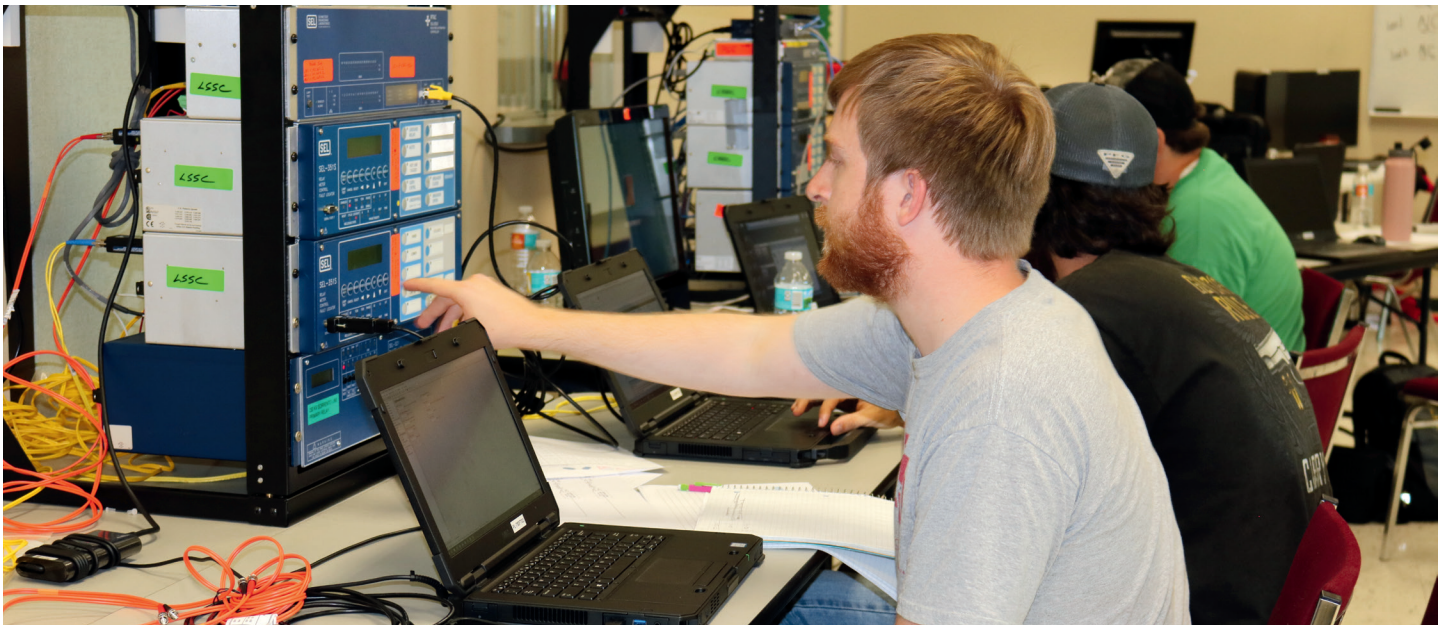
Electrical Safety and Qualification
- Energized work and lock-out/tag-out
- PPE, Human Performance, and Situational Awareness

POWER SYSTEMS
SCADA AND COMMUNICATIONS

SCADA and Communications.....*5 Day Class, 40 Credit Hours*

The SCADA and Communications course is intended for field technicians and engineers working in the power industry. This training combines history and theory with hands on components for a better understanding of equipment and scenarios that may be encountered in the field. This program includes lectures, interactive breakout sessions, problem solving and discussion.

- History of Communications and SCADA • Building Blocks of SCADA Communications
- CIP Practices • Standard Communications Configurations • Communications Prints
- Hands on Testing Experience • Troubleshooting Techniques and Processes
- Fiber Principles and Theory • Fiber Testing and Cleaning
- Multi-Phase Project Testing Techniques
- Use of Ancillary (Clone) RTUs and IEDs in Multi-Phase Testing
- Testing Techniques for Use with IP Communications
- Testing Techniques for Use with Serial Communications
- HP Forms for Pre-Commissioning and Final Commissioning
- Proper Build and Test Techniques for Various Cabling Types
- Communications Protocols and Use of PC Centric Tools
- Settings Management and the Importance of the OSI Model
- 61850 and the Benefits in Substation Communications Environments
- Effects of ESD Damage on Equipment and Use of ESD Practices to Mitigate Damages



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POWER SYSTEMS PROTECTION FUNDAMENTALS

Protection Fundamentals.....*4 Day Class, 32 Credit Hours*

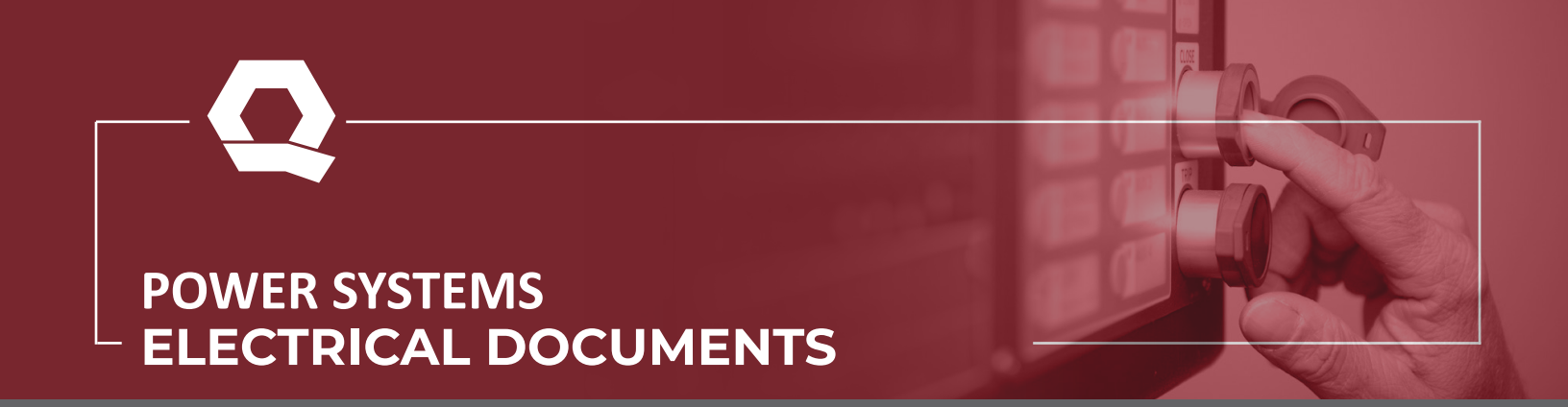
Power Systems: Protection Fundamentals is an interactive seminar designed to teach industrial power users the basics of electrical protection and control systems. The course is aimed at personnel with limited exposure and experience with electrical protection and control systems. The course combines in-class lecture, group activities, and hands on experience with protective relaying and system simulation equipment. This course is designed around Schweitzer Engineering Laboratory (SEL) style protective relaying but principles from the class can be applied to all protection systems. Attendees may bring a personal laptop to participate in course activities (attendees will need administrative rights to install manufacturer software) or use provided equipment to take full advantage of all course interactions.

Day 1
- Software Setup Instructions
- Foundational Power Math & Principles
- Basic Logic
- Overview of Protective Relaying
- Relaying Input & Output
- Introduction to Instrument Transformers
- Instrument Transformer Basic Calculations
- CT Burden and Saturation
- CT Circuit Readings

Day 2
- Introduction to Control
- Introduction to Protection
- Introduction to Protection Drawings
- Coordination of Protection Systems
- Communication Assisted Protection
- Hazard Mitigation Via Protective Relaying

Day 3 (Lab Day)
- Introduction to the SEL AcSELerator Software Suite
- Introduction to the Relay Human-Machine Interface
- Device Settings
- Protection Element Settings
- Relaying I/O Revisited
- Logic Settings
- Event Recording

Day 4 (Lab Day)
- The Total System View
- Coordination and Hazard Mitigation Revisited
- Indirect Protection
- Walkup Diagnostics



POWER SYSTEMS
ELECTRICAL DOCUMENTS

Electrical Documents.....*2 Day Class, 16 Credit Hours*

Power Systems: Electrical Documents is an interactive seminar designed to introduce industry persons to the wide variety of documents associated with electrical power systems. The course is aimed at personnel with limited exposure and experience with electrical power systems and are interested in learning more about how to identify, utilize, and create electrical system documentation. The course combines in-class lecture, group activities, and instructor guided workshops to teach and reinforce learning goals. This course does not require computer aided drafting software, and all activities will be carried out on paper.

This class is most beneficial to personnel starting a career in the electrical industry and want the tools necessary to identify the purpose and application of a variety of electrical system documents. Attendees will leave with the confidence to articulate documentation needs, the ability to read a variety of electrical system documents, and the fundamentals needed to create original documents of their own.

Day 1

- Introductions and Course Kickoff
- Overview of System Documents
- Titleblocks and Legends
- Deep Dive: One-Line & Riser Diagrams
- Deep Dive: Three-Line Diagrams
- Deep Dive: System Plans
- As Built Drawings and System Reconciliation

Day 2

- Deep Dive: Electrical Schematics
- Deep Dive: Wiring Diagrams
- Selected Topics on Schematics and Wiring Diagrams
- Deep Dive: Electrical Details and Schedules
- Deep Dive: Electrical Specifications
- Selected Miscellaneous Topics

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Technical and Safety Training

Technical and safety training courses offered are one of the highlights of QualU's course offerings. Courses such as NFPA 70E and Arc Flash, Lockout/Tagout, and Circuit Breakers and Transformers are taught by industry-recognized, subject matter experts to provide an understanding of technical theories, as well as safety regulations and compliance.

NFPA 70E Electrical Safety

Generation, Transmission, and Distribution

One-Line Diagram

Protective Grounding

Lockout/Tagout

TECHNICAL AND SAFETY TRAINING

NFPA 70E Electrical Safety ..... *4 or 8 Hour Class**

NFPA 70E Electrical Safety Training complies with NFPA 70E (2021 Edition), OSHA 29 CFR 1910.331-335 for safety related work practices and the National Electric Code (NEC). This training combines lecture, live demonstration and video presentations that apply to all required elements of the OSHA's Electrical Safety-Related Work Practices (Subpart S) for Electrical Safety in the Workplace.

OSHA Regulations and Other Electrical Standards

- 29 CFR 1910 Subpart S • NFPA 70E 2021 Edition Review • NFPA 70 NEC • NFPA 70B

Electrical and Worker Safety

- Understanding What an Arc Flash Is • Characteristics of an Arc Flash • What is an Arc Flash Hazard?
- Unsafe Conditions vs. Unsafe Acts • Effects of Electrical Shock/Arc Flash
- How Does This Affect You in the Workplace?
- Contact Release – Release from Potential Electrocution

Energized Equipment

- Qualified Person as Defined by OSHA and NFPA 70E • Lockout/Tagout Process (29 CFR 1920.147)
- OSHA/NFPA 70E Live Work Requirements • Voltage Sensors and Meters
- Determining Zero State of Energy • Working on Energized Equipment • Grounds and Grounding

Safe Work Practices

- Safe Approach Boundaries • Hazard Analysis • Safe Switching Practices
- Conductive Apparel and Insulated Tools
- How to Protect Yourself from Potential Electrical Energy
- Confined or Enclosed Workspaces • Caution vs. Warning vs. Danger
- Electrical Safety Program • Working alone •Engineering Controls

Equipment

- Tests Instruments and Equipment • How to Read Arc Flash Labels
- How to Minimize the Risk of Exposure

Personal Protective Equipment

- Selecting the Required PPE • Category of Hazards • Inspection of PPE
- Signs, Tags, and Barricades

TESTIMONIAL

"This was a very useful course. I can take this back to my organization and implement some new requirements that we aren't currently practicing."

**Program is available as a 4-or 8-hour course and can be customized with customer specific equipment, labels, and processes. The 4-hour course is also offered as an interactive virtual training.*

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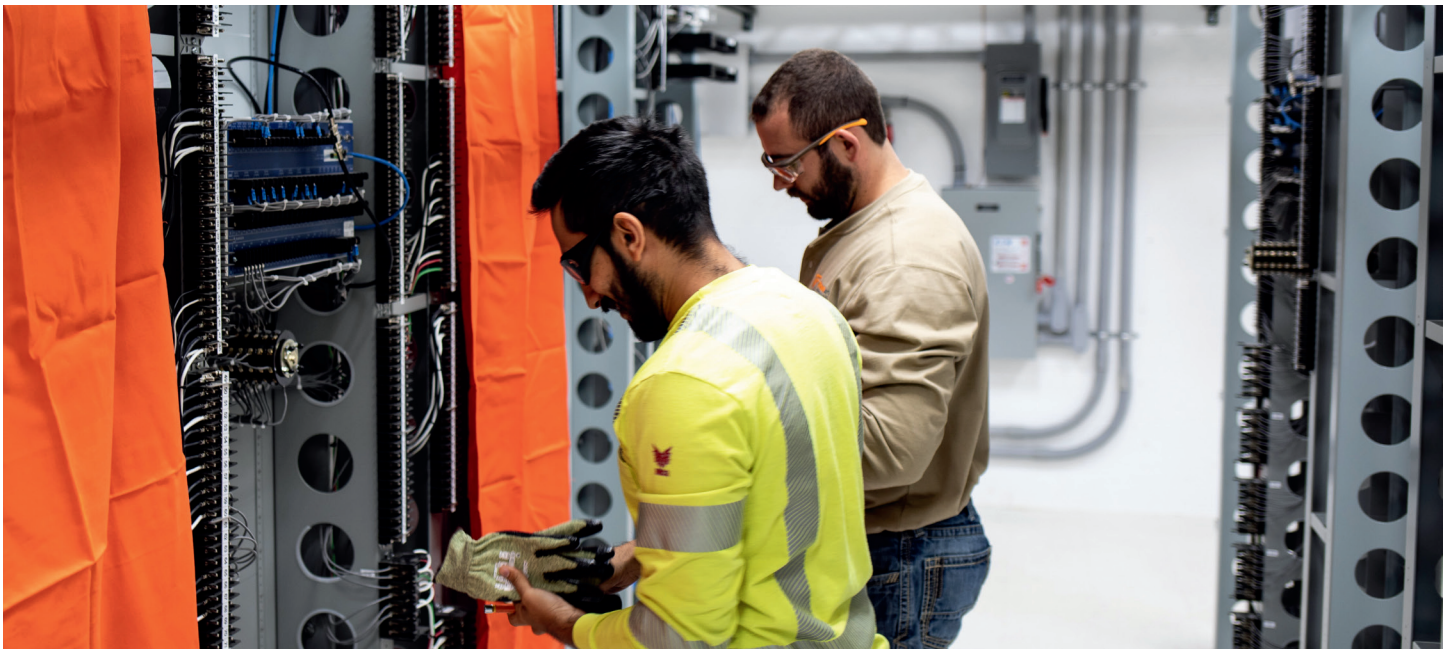
TECHNICAL AND SAFETY TRAINING

Generation, Transmission, and Distribution ..... *8 Hour Class*

Generation, Transmission, and Distribution (GTD) Training is intended for personnel that work on or around power generation, transmission, and distribution equipment operating at 600 volts or more. It is designed to familiarize participants with the latest "Final Rule for 1910.269 Electric Power Generation and Distribution." OSHA's electrical standards are designed to protect employees exposed to dangers such as electric shock, electrocution, fires, and explosions. As one of OSHA's "Fatal Four," electrical hazards cause hundreds of deaths and thousands of injuries in the workplace every year. OSHA requires training for all employees that perform work, which could put them at risk from electrical hazards. The language, interpreting and application of these OSHA standards can be difficult. A thorough understanding of OSHA electrical safety requirements, as they apply to your workplace, is essential for minimizing electrical accidents and ensuring compliance.

- What the Standards Say • How It Was Written • Interpretation of the Rules • Case Study
- Defining "Qualified" Worker • Electrical Hazards (Shock, Arc, Blast)
- Application of the Standards (1910.331, 335, 269 and NFPA 70E)
- Personal Protective Equipment (In Service Care and Use) • Training Requirements
- Hazards of Electricity and the Effects • Source of Electrical Regulations and Standards
- OSHA Requirements for First Aid, CPR, and Emergency Rescue
- Hazardous Energy Control Requirements of 1910.269(d) and (m)
- Correct Work Practices for Working on or Near Exposed Energized Parts

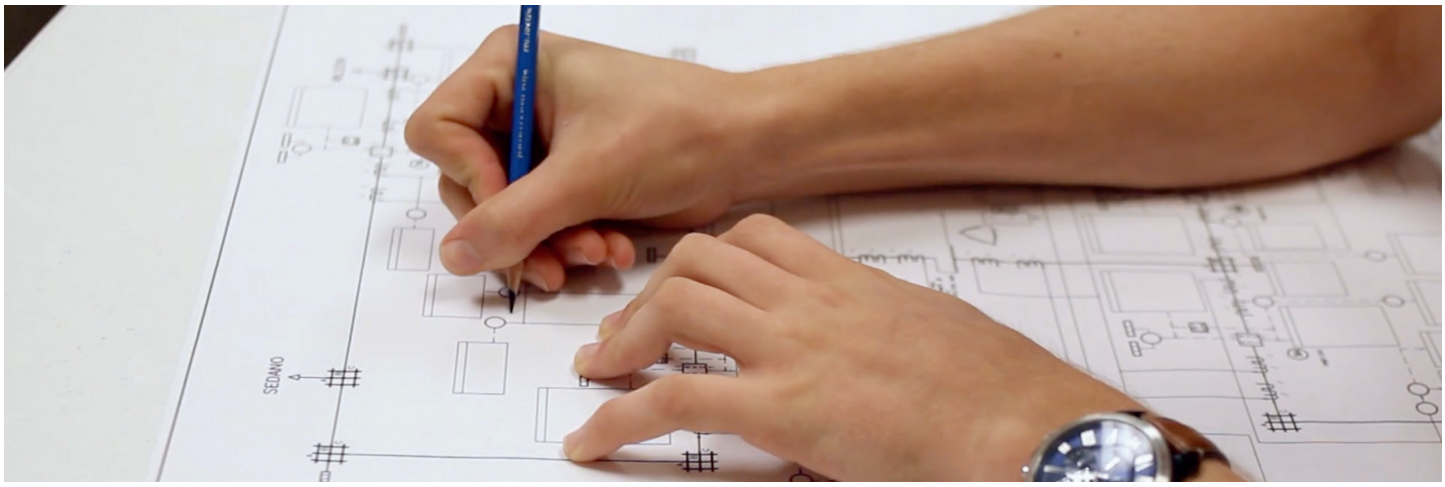


TECHNICAL AND SAFETY TRAINING

One-Line Diagram ..... *6 Hour Class*

One-Line Diagram Training promotes knowledge, understanding, and applications for a one-line diagram in a system operation. The single-line diagram is the blueprint for electrical system analysis. It is the first step in preparing a plan, which will allow you to identify system components with minimal details and become familiar with the electrical distribution system layout and design.

- Introduction to Print Reading
- Symbols
- Developing a One-Line Diagram
- Preliminary One-Line Diagram
- Partially Developed One-Line Diagram
- Developed One-Line Diagram
- Adapting One-Line Diagram to Equipment
- Adapting Three-Line Diagram to Equipment/System



TECHNICAL AND SAFETY TRAINING

Protective Grounding Training ..... *4 Hour Class*

Protective Grounding Training promotes knowledge, understanding, and applications of grounding devices as per OSHA and NFPA 70E Standards.

- Purpose • Scope • Responsibilities • Definitions/Abbreviations • General Grounding Application
- GFCI Applications • Guarding Rooms Containing Electrical Supply Equipment
- Guarding of Energized Parts • References

Lockout/Tagout ..... *4 Hour Class*

Lockout/Tagout (LOTO) Training promotes knowledge and understanding of OSHA 29 CFR 1910.147 lockout/tagout work practices and compliance with applicable OSHA and NFPA 70E standards.

- LOTO Policies and Procedures
- Practical Hands-On Job Site Hazard Analysis
- Scope, Application, and Purpose
- Equipment Isolation
- Locks, Tags, and Lock Box Procedure
- Verification of LOTO
- Release of LOTO
- OSHA Standard 29 CFR 1910.147 Best Practices

Michael J. Wright, PE

Michael Wright graduated from the University of Florida with a Bachelor's of Science in Electrical Engineering and from Rollins College with an MBA. In 2001, Wright began his engineering career at Duke Energy Florida in the Protection and Control Department where he began teaching protection & control philosophy classes to relay technicians in training and protection & control engineers. In 2003, Wright converted that training into a curriculum designed to explain the big picture of protection & control systems, which is now our Power Systems 101 seminar with continual refinements and additions. By 2005 Wright was a Lead Engineer, responsible for the protection and control systems in the transmission substations. In 2007, Wright founded Power Grid Engineering, LLC with partners Andre Uribe and William Glenn Durie. Now as the Chief Operating Officer of Qualus Power Services, Wright leads a team of over 600 employees who perform power engineering services throughout the United States.

Adrian Zvarych, PE

Adrian Zvarych began his career as a field Protection & Control Engineer, where he quickly began mentoring engineer interns. Since that point, he has been recognized as a bridge builder between IT-Telecom, Protection & Control, and Substation Design teams. He has developed training courses and presentation materials for the IEEE, the UTC, Georgia Tech, and Texas A&M Protective Relay Conferences, which have included topics in substation communications, power line carrier design and application, fiber optic network design, and grounding and bonding for communications equipment. He has prepared and delivered countless technical presentations to audiences including protection & control, SCADA, IT and Telecom engineers. Zvarych has actively contributed to the IEEE Working Group H09 and other groups related to substation communications. Zvarych has served as the UT&D segment of Qualus Power Services's Principal Communications Engineer and is currently a Field Services Regional Director.

Eric Goetz, PE

Mr. Goetz currently lives in Louisville, KY and is a graduate of the University of Louisville with a Bachelor of Science in Electrical Engineering and a Master of Engineering in Electrical Engineering. In addition to being a licensed Professional Engineer, Eric is NETA Level III certified. He began his career working at CE Power in their GAP Training Program as a Field Engineer and is currently serving as a Senior Level Field Engineer. In addition to his Engineer role, Eric facilitates QualU programs including Power Systems Training Seminars and other technical coursework to share his knowledge and experience with other industry professionals. He brings a wide depth of Power Systems knowledge with experiences ranging from industrial to generation facilities either commissioning new substations or upgrading Electromechanical and solid-state relays to microprocessor relays.

Dylan Davey

Dylan Davey graduated from The Ohio State University with a Bachelor's in Electrical and Computer Engineering with an emphasis in power systems and communications. After completing multiple internships with First Energy, Dylan went into the field full time as a Commissioning Engineer. Due to First Energy's Energizing the Future program, he was able to experience a substantial amount of capital projects that included countless transmission upgrades, up to 500kV, while still supporting the regional operation and maintenance teams. In order to move closer to home, Dylan began the next phase of his career as a Lead Field Engineer for Shermco Industries where he continued to develop his skills and knowledge on a variety of systems across the country including AEP, Entergy, Xcel, and other large industrial customers. After becoming a subject matter expert in line protection, end-to-end testing, power line carrier, SCADA systems, and other complex topics, Dylan joined Qualus Power Services as a Field Services Supervisor in November of 2020. Currently, Dylan's role as Field Services Supervisor supports Entergy, TVA, NextEra, and Alabama Power.

Matthew Robinson, PE

Matthew Robinson holds a BS in Electrical Engineering and a MS in Power Engineering, both from Northeastern University. His industry credentials include his professional engineering licensure and NCEES record standing, certification as a commissioning engineer, NETA Level IV Technician License, and over a decade of experience, including significant design work in large wastewater plants and DER facilities. As a commissioning engineer, Robinson developed his field engineering and electrical troubleshooting skills, serving roles as a commissioning engineer for new installations and as a forensics investigator for problematic power systems. Robinson has also taught the basics of power system engineering to undergraduate students at a local institution.

Juan Pena

Juan Peña began his technical career with Eaton Corporation in 2008. He devoted himself throughout the years to be the local safety representative for the Houston area, where he was then promoted to be the Gulf Region Safety Manager. Peña attended The University of Texas at Arlington and became a Certified Safety and Health Official in the general and construction industry, as well as an NFPA Certified Electrical Safety Compliance Professional. Peña started his career at CE Power in 2018 to assist operations in the development of the Gulf region. He was then promoted to the EHS department. Peña is responsible for updating safety programs and procedures, safety training, and working with operations managers to develop a safe workplace for employees.

Instructor Biographies

Jim Molter

Jim Molter brings 40 years of experience in the electrical industry to the classroom. Molter has been responsible for setting safety policies, training, and documentation for employees. Molter's knowledge has been instrumental in building Qualus's safety program as well as conducting training for our clients. His tenure in the industry includes 17 years with Louisville Gas & Electric as a Substation Maintenance Electrician, then 10 years with Square-D as a field technician and project manager, and finally joining CE Power in 2007 as a General Manager. Molter has been providing arc flash, technical, OSHA and CPR/First-Aid training to our clients and employees. He is a certified instructor for OSHA 10 and 30, CPR and First Aid, MSHA and holds a Certified Safety and Health Specialist Certificate. Molter currently serves at a Safety Training Leader at Qualus Power Services.

Michael Cunningham

Michael Cunningham has over 40 years of experience in the communications engineering field. Starting as a Senior Engineering Manager in product development and design with an AT&T Paradyne Corporation (a Bell Labs company), to extensive experience with Progress Telecom (a Carrier's Carrier), and working on two different Library of Congress projects in North Carolina. Over the last 12 years, Mr. Cunningham has been a Communications Engineering Consultant and Project Manager with a proven leadership record and extensive industry experience in the fields of power systems communications, telephony, fiber optic broadband, computer systems, grounding, engineering services, and new product development.

Vishal Patil, PE

Vishal Patil is a Protection and Control Engineer with diverse experience in the power system industry. He has Master of Engineering degree with focus on power system protection. Vishal has worked in Research and Development division at SEL. He has contributed in development of SEL 300 and 400 series SEL relays and is a patent owner of one of the protection function. He also worked in the Engineering Services division of SEL and has created design and settings for various electric utilities and co-ops. Vishal is licensed as a Professional Engineer in the State of North Carolina, and currently works as a Field Engineer with Qualus Power Services.

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