NETA®

TRAINING TALK

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TRAINING TO TACKLE NEW CHALLENGES

BY ED KHAN, Doble Engineering

Relay protection has been going through a period of significant changes and enhancements. These changes began a long time ago with the introduction of microprocessor-based relays. Since their introduction, the landscape of the protection field has been under a constant evolutionary process. However, microprocessor relays have not replaced the entire fleet of old electromechanical and solid-state relays at various electric utilities and industrial facilities. Even today we have a significant percentage of relays in the field that are electromechanical and solid state. Hence, the training arena to be covered by engineers and technicians in the United States is doubled.

This is only one aspect of the challenges we face when it comes to training people on the application and testing of protective relays. In addition, rapid technological advancement, government regulations, the introduction of renewables, an aging workforce, and the lack of appropriate education have created a daunting task for engineers — and technicians in particular.

The issues facing the protection field are in two areas: relay application and testing. In both areas, rigorous training is needed.

When it comes to relay applications, relay engineers must keep up with the technological changes in microprocessor relays and their application in the new areas of renewables and grid automation.

TESTING

In the area of testing, we have bigger issues.

Application Field

The layout of the electrical power system is undergoing dramatic changes. Conventional generation using steam and gas turbines is being replaced by wind and solar power. These forms of generation are changing the dynamics of the power system. Reduction in the availability of short circuit current and system inertia are big issues that are being tackled. A move towards making huge leaps in grid automation is adding another dimension to the overall protection philosophy. From a protective relaying perspective, new requirements require modification of design philosophies that are in some ways different from conventional philosophies. Relay application engineers must keep themselves abreast of all of these changes, and technicians performing relay testing must be well informed on newer relay designs that are being introduced to fit the evolving electrical power system.

Depleting Talent

The area of power systems was neglected in the 1980s when very few students opted to pursue electrical engineering degrees in the area of power systems. Electronic, digital, and other related electrical fields appeared much more attractive than the power system, which appeared to students as being a stagnant field. We are now paying the price of that neglect: a depleting pool of talented engineers and technicians.

Even today very few universities and technical colleges are prepared to turn out engineers and technicians who can face these challenges. This has resulted in a huge shortage of experienced technicians and engineers. In addition, the fast-paced retirement of experienced individuals and very low injection of new individuals have compounded the problem. We are in a drought-like situation. There is no other way out but to introduce well-coordinated and accelerated training programs. Utilities do not have resources that can

be expended on this endeavor. Hence, one option available to them is to hire reputable services to perform these tasks.

Government Regulations

NERC and FERC are making sure utilities follow their mandatory requirements regarding the testing of protective relays in a timely manner. Non-compliance with their mandatory requirements can lead to heavy fines. This has placed tremendous strain on utilities to meet deadlines. There simply are not enough qualified technicians to cope with this situation.

Advancing Technology

The relays being applied are becoming very sophisticated. The settings prepared by engineering are becoming complicated to utilize all the features present in the relays. These enhancements in settings are creating issues with technicians who are not equipped with enough knowledge to understand and make test plans to test these relays.

SOLUTIONS

The solution at several utilities is to have engineers create the test plan. This means the technician's task is to simply connect the relay to the test set and click the Run button. If the relay passes the test, it is the end of the process. If it does not, engineering gets involved and necessary changes are made and the test is rerun. This has made the role of technicians very limited in its scope. They do not learn, and hence they cannot expand their knowledge and be able to perform debugging and troubleshooting tasks.

Several utilities are adopting a different approach by using programs that do not involve any technical involvement by technicians. The program reads the relay settings and creates test plans. The technician has to simply press the right buttons. These programs are being used by utilities with settings that are generally not very complicated. In this case, as in the previous situation, the technician does not learn about relaying and will not grow in his career and be able to perform troubleshooting and other tasks. This situation is not desirable.

One solution to these issues is being handled by educating engineers on new relay algorithms so they can apply the relays appropriately, but there is still a vacuum in the engineering departments because these engineers are not familiar with electromechanical relays. Engineers with knowledge about electromechanical relays are retiring at a fast pace, and newly hired engineers are not inclined to work on older electromechanical relays. They love working with microprocessor relays. However, the reality is that the landscape of relay protection shows that a large percentage of relays are still electromechanical relays. Therefore, engineers must learn about microprocessor and electromechanical relays.

Technical colleges must attract new students, and they must be taught protective relay testing in a formal and rigorous manner.

Technicians are in a worse situation. Due to increased demand for technicians, utilities are hiring from various fields such as communications, IT, etc. This approach may be fine but extensive training must be conducted to bring these individuals up to par with the required knowledge about power systems and relaying. Management believes that if test plans created by engineers or canned programs are being used for testing, technicians do not need to know much. This is a very sad situation.

Technical colleges must attract new students, and they must be taught protective relay testing in a formal and rigorous manner. The curriculum of the technical schools is not at par with what is required in the field. On the other side of the equation, management at the utilities is creating technicians who cannot do more than just push the right button. Canned programs are useful but the technicians must know what they are testing, why they are testing, and how the testing algorithm is working.

In the past, the application of protective schemes was hardwired using relays, timers, auxiliary relays, etc. Technicians were able to read wiring prints and perform troubleshooting. This is not true with the application of microprocessor relays. The protection logic is built using tools such as various logic gates, etc. There is very little hard wiring to create protective logic, so technicians need to become very familiar with the logic built within the relay. As relays become more sophisticated, more of these logics are being used.

Relay applications utilizing the IEC 61850 standard will make matters worse. This standard eliminates wiring completely by making use of local area networks. Hence, engineers and technicians must become very familiar with digital communication. This new approach to protective relaying using the IEC 61850 standard will require specialized training. It is becoming quite popular in the United States, and this requires a sense of urgency.

CONCLUSION

There is a need to teach technicians the basics of protection and the setting up of logic within microprocessor relays for various applications. This will help by making them capable of preparing test plans and conducting the tests. In addition, it will take them to the next level of knowledge and understanding. Technical schools must update their curriculum to accommodate the changing times. Similarly, management at utilities and industrial facilities must realize that a technical force performing testing is an asset that must be groomed to take on tasks beyond simple button-pushing. They must be able to contribute effectively towards creating test plans and troubleshooting tasks. This will help them become effective contributors.

ED KHAN *has been with Doble Engineering Company for 14 years working in various capacities including Product Manager for protection testing-related instruments. He is currently the Director of Protection R&D and Protection Training at Doble. In this capacity, he manages and conducts the relay protection training program. Prior to Doble, Ed worked for GE, ABB, SEL, KEMA, and others in various capacities. He has 38 years of experience in system studies, protection applications, relay design, power plant design, teaching, and product management. He has a thorough knowledge of product development, protection, harmonic analysis, harmonic filter design, stability studies, real-time digital simulations, generator protection, and more. Ed has written several articles and has made presentations at several venues. He holds an MS in electrical engineering from Texas A&M University.*

AUDITING ELECTRICAL SAFETY

BY KEN SELLARS,
e-Hazard Management, LLC

As with any important task, checking on progress is critical. The same concept applies to auditing electrical safety. An audit that is utilized to determine a site's electrical safety behavior is referred to as an electrical safety audit. This audit is an opportunity to assess the company's status in regard to adherence to specific electrical safety regulations, NFPA 70E, and electrical best practice behaviors. These audits can be voluntary but are often mandated by law per OSHA regulations or, in the case of government or military bases, by the Department of Defense or other military regulations (i.e., OPNAV and UFC 3-560-01).

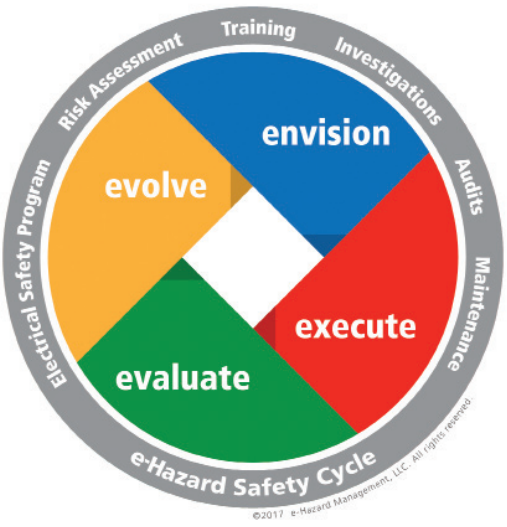
WHAT IS INVOLVED IN AN ELECTRICAL SAFETY AUDIT?

The basics of any electrical safety audit will cover the following topics:

1. Training, including site interviews to determine the level of electrical safety knowledge
2. Electrical qualification process, including task qualification (if used at the site)
3. PPE – selection and proper usage
4. Shock hazard awareness
   - Understanding the application of safety rules in shock prevention
   - Understanding the various boundaries, including limited approach, restricted approach, public safety, and minimum approach distances
5. Arc flash hazard awareness
   - Labeling of site equipment
   - If using NFPA 70E® tables, local understanding of how to properly interpret
6. Boundary determination (shock and arc flash) and proper setup
7. Electrical safety tools, including 1,000-volt and tools specific to higher voltage applications (shot-gun sticks, insulating blankets, etc.)
8. Personnel and program auditing as required by applicable regulations or site policies

A typical small- to medium-sized location can complete a thorough electrical safety audit in one day, with some time taken that evening for report writing as required. A larger facility may take two to three days for an audit, especially at sites that have an unusually large number of electrical employees (150 or more).

The process involves a full review of electrical program records, including training schedules, qualifications, electrical maintenance, and self-assessments. A typical audit report ranges from five pages to upwards of 30 pages for a larger facility.



ENVISION: SET SCOPE, FREQUENCY, AND TYPES OF AUDITS

An organizational policy is the first step to managing incident investigations. This document should identify the following:

- Develop a plan for your site(s) to cover all necessary electrical audit categories.
- Ensure the plan provides an easy-to-use format to perform the audit, including audit documentation, appropriate checklists, and a format for the written report.
- Include a site periodicity for the electrical safety audit, and be sure to schedule the required personnel to conduct the audit efficiently.

EXECUTE: PERFORM AUDITS, BASED ON ESP PROTOCOLS

Perform the audit in a systemic process as arranged in the planning stage. Stick to the plan; do not allow distractions to divert attention from the audit process. A suggested format might look like this:

- Kickoff meeting: 30 minutes
- Document review: 30 –90 minutes, based on employee/equipment count
- Site inspection: 30–60 minutes based on location size/complexity
- Personnel and management interviews: 30-90 minutes based on the number of qualified and task-qualified personnel
- Closing meeting: 30 minutes

EVALUATE: REVIEW AUDIT PROCEDURES EVOLVE: UPDATE AUDIT POLICIES

In NFPA 70E, the overall electrical safety program requires a three-year audit to *"verify the principles and procedures"* of the electrical program are still in compliance with the newest NFPA 70E standard.

A periodic review of the electrical audit process must be completed to ensure every part of this process is going as planned. This is sometimes referred to as a confidence check. This review should include a trend analysis based on all previous audits and should look at improvements already implemented, missed opportunities, and electrical injury rate trends (specifically shock, burns, and electrical near-misses).

SUMMARY

By taking time to review the audit process, the location prepares mentally for the next audit with specific targets in mind: reducing injuries, correcting unsafe behaviors, and leading personnel to the ultimate goal — a zero-electrical-injury work environment. Only then can the electrical safety cycle truly be called complete.

KEN SELLARS *is a partner at e-Hazard Management, LLC. He is an electrical consultant with the company and teaches electrical safety, NEC, NESC, OSHA, grounding/bonding, and arc flash safety courses nationwide. He obtained his electrical training in the U.S. Navy, where he served on a nuclear ballistic submarine from 1985 to 1991. Ken worked at Alcoa Warrick Operations in Newburgh, Indiana, for 16 years, where he was a founding member of Alcoa's Electrical Safety Lead Team, responsible for electrical safety, regulatory, and electrical code compliance, including OSHA, NEC, NESC, and Alcoa Warrick Operations electrical policies and engineering procedures. Since joining e-Hazard in 2006, Ken has trained thousands in electrical safety across the United States and internationally. He holds a Master (unrestricted) electrical license in the state of Georgia and a BA in Business Management.*

KEEPING WORKFORCE DEVELOPMENT FROM FIZZLING OR FAILING

BY TOM SANDRI,
Protec Equipment Resources

Workforce development is an interconnected set of solutions to meet employment needs. It can include changes to culture, changes to attitudes, and changes to people's potential that help to positively influence a business's future success. It is also sometimes referred to as employee development and is considered an important aspect of business success.

Workforce development works by preparing workers with the skills necessary for a specific type of job. It promotes a culture that values ongoing workplace education and skills development. The goal of workplace development is to place workers in jobs where there are career development opportunities — and to nurture that development. Through workforce development, a company can ensure they have an adequate supply of qualified individuals for their needs.

It used to be thought that by training an employee with better skills, they would be more likely to leave and take that investment with them, but this isn't necessarily the case. Research shows that skills development and opportunity for professional and personal growth are important aspects of employee retention, especially among millennial workers. When an employee feels their skills are being valued and nurtured, they are less likely to leave the company.

Workforce development is different from workplace training, in that workplace training is often focused on a specific job or skill that is necessary to know immediately to perform an employee's job. It is generally a compulsory component of employment and urgent in nature, whereas workforce development is considered a more long-term, ongoing strategy to help improve a workforce.

Workforce development helps to create a culture of learning and constructive attitudes that builds a workforce's tangible and intangible abilities to manage and deal with future challenges. Workforce development opportunities are often highly individual and can be completed at any time, through a variety of mediums. Workforce development can be self-selected in a way that training opportunities cannot.

STRATEGY

Given that workforce development has such positive effects on the employer and the employee, ensuring an effective strategy is key. One important aspect to consider is the delivery method.

While classroom learning may have been the traditional way of the past, eLearning development opportunities are the key to the future. Not only does

this not interrupt workflow, but it also helps remove obstacles to on-the-job learning and allows employees to choose the times that work best for their learning style. Discussion forums, videos, self-paced eLearning courses, webinars, and resource banks are just some of the development tools that can help employees.

So, who is part of the workforce development process…well, simply put…EVERYONE from the CEO to the employee!

The learners (managers, supervisors, and technicians) lead and set the **what, where**, and **how** of their development. The best subject matter experts are those doing the work. Who better for understanding their business and business needs?

An organization's success is dependent on an employee's ability to create new concepts and come up with innovative ideas.

MANAGER/SUPERVISOR ROLE

Employees need to be motivated to participate in training programs and employee development activities. You must make your employees realize the importance of employee development activities and how such initiatives will benefit them and the organization in the long run.

Managers play an essential role in motivating employees to enhance their skills and acquire new learnings over time.

An organization's success is dependent on an employee's ability to create new concepts and come up with innovative ideas. An employee is able to think out of the box only when they constantly upgrade their knowledge and abilities and know what is happening around them. An employee with a closed mind can't contribute much to their organization. Having the support of the CEO as well as a quantified aspiration makes it far easier for managers to encourage their team members to participate in learning opportunities.

As a manager, you need to provide ample opportunities for your team members to develop and polish themselves. Remember, you need to give your employees time so they can participate in employee development initiatives. If you are always after their lives for results, they will never bother to participate in training or self-development activities. Managers need to believe in employee development activities for themselves to convince and motivate their employees to participate with an open mind.

MOTIVATION

Motivation is one of the key factors that help extract the best out of employees. You really need to make your employees feel important in the system if you want them to perform well. Motivation plays an essential role in workforce development.

Encourage employees to participate in training, seminars, conferences, or any other initiatives that will help them acquire new learnings and skills. Human resource professionals or team managers need to convince employees how various training programs can help them develop their skills and will benefit them in the long run.

Human resource professionals and team managers also need to interact with employees and explain to them how training programs would help them grow professionally as well as personally. As corporate leaders, your role is not just to design training programs or employee development activities. It is also to motivate employees to attend willingly.

Don't expect everyone to be present at the venue just because you have sent an email or circulated a poster among employees. You really need to highlight the importance of training programs and what new skills, knowledge, or learnings an individual can acquire because of such training. Let employees come up with the problems and challenges they face in their daily work.

ENCOURAGE A LEARNING CULTURE

Employees should have the liberty of expressing their thoughts and sharing their ideas. Let them

come up with innovative ideas, concepts, and solutions. Do not underestimate any employee. You really do not know when someone might come up with a brilliant idea. Appreciate them whenever they perform any extraordinary task. Make them feel they are indispensable resources for the organization.

Be there for your team. You really need to make your employees feel you are always there with them. This way, an employee not only feels motivated to participate in various events and trainings, but also develops a sense of loyalty and attachment towards the organization.

Provide certificates of participation to employees who attend the training programs. Give them some kind of benefits in form of promotions, added responsibilities, monetary benefits, and so on. Make them feel a little special. Let others who did not attend trainings feel they missed out on something important.

As a team manager, your job is to provide adequate growth opportunities to your employees. Help employees in achieving more. Review their results on a regular basis. Give them the necessary feedback and tell them where they are lacking. Never, ever demotivate them. Criticism leads to frustration and kills a team's morale. Guide them and suggest how they can overcome the gap between the current stage and their desired stage. Motivate them to register for various online course materials and forums that could groom them and prepare them for the future.

CONCLUSION

The secret to successful workforce development is not difficult in concept. It does require dedication and discipline. It is often far too easy to get caught up in daily scheduling or profit/loss statements and lose sight of the most valued resource and product offering: our employees and their knowledge and skills.

THOMAS SANDRI *is Director of Training Services at Protec Equipment Resources, where his responsibilities include the design and development of learning courses. He has been active in the field of electrical power and telecommunications for over 35 years. During his career, Tom has developed numerous training aids and training courses, has been published in various industry guides, and has conducted seminars domestically and internationally. Thomas supports a wide range of electrical and telecommunication maintenance application disciplines. He has been directly involved with and supported test and measurement applications for over 25 years and is considered an authority in application disciplines including insulation system analysis, medium- and high-voltage cable, and partial discharge analysis, as well as battery and DC systems testing and maintenance. Tom received a BSEE from Thomas Edison University in Trenton, New Jersey.*

POWER SYSTEM MAINTENANCE

BY CHUCK BAKER, PowerPro 360

If you are responsible for maintaining a reliable power distribution system in your facility, I can empathize with the challenges you face. As someone with experience providing services related to power system maintenance, I have seen some illogical scenarios over the years. In this article, I share my experiences, highlight the importance of a reliable power distribution system, and offer some suggestions on how to achieve it.

My involvement is primarily on the service end. When a company provides a specification for power system maintenance service, I bid on what it will take to perform that service. The outcome is usually one of these options:

1. I win the bid and will provide the service.
2. I lose the bid to a competitor.
3. The project is set aside or postponed for a future date of service when the budget can provide funding.

Number 1 and Number 2 make perfect sense to me, but I find number 3 confusing.

To better understand this issue, let's consider a fictitious scenario. Let's say we have an industrial plant called Acme Manufacturing (not the one that manufactures for Wile E. Coyote) that manufactures widgets. They purchase primary power at 138 kV, use two power transformers in the main substation, and distribute the power throughout their plant. When we look at the one-line diagram, we see a significant number of feeders, and we realize that thousands of pieces of equipment are involved. To complicate matters further, there are 24 different equipment categories (e.g., circuit breakers and switches) with about 60 subcategories and three voltage classes.

Let's take those summary facts and run them through a scenario. Joe is the manager responsible for maintaining Acme Manufacturing's power distribution system. He generally knows how often to schedule service for each type of equipment and understands that there will be delays in accomplishing this work as outages and available budgets are constant restraints. Now there is a failure in the power system, and Joe and his manager Carolyn, head of plant maintenance, get called to meet with Carl, the VP of operations. "The tremendous impact of that power system failure was unacceptable, and it can't happen again," Carl says. "We are investigating this unplanned outage and will resolve the problem, so it won't happen again," Joe and Carolyn agreed. Then, with heads hanging low, they returned to their office.

Carolyn did some research on maintaining a reliable power distribution system. She is responsible for the maintenance of the entire plant, and this is the first time she has drilled down into power system maintenance. She comes up with two things Joe is assigned to do to build a more reliable power distribution program over the next six months.

1. Joe will attend the MaximoWorld event on ReliabilityWeb.com where his understanding of reliability-centered maintenance will be brought alive and he will be excited to look at his power system maintenance program.

2. The foundation of the maintenance program, ANSI/NETA MTS-2019, *Maintenance Testing Specifications for Electrical Power Equipment,* will specify maintenance needs for every piece of equipment. This standard will walk him

through the steps, detailing when to inspect, what mechanical maintenance to perform, and what electrical testing should be done to each piece of equipment — all to be able to prevent or detect potential problems in the power system.

Joe attended the event and spent three months studying the facilities, the purpose of each feeder, and the impact of the failure of each feeder. He interviewed area leaders and discovered the cost of an unplanned outage, including:

- Personnel safety
- Lost manufacturing material
- Damage to manufacturing equipment
- Lost product sales and potentially lost customers

Joe classified the equipment on each feeder using his criticality scale and looked at the history of electrical testing results on the equipment to classify its health. From this, he produced a strongly recommended maintenance program and maintenance that should happen as soon as possible. He reviewed the plan with Carolyn, who was pleased with the effort, logic, and outcome. She asked him to get quotes to perform the work on critical equipment that was in poor health.

The plan was assembled, and budgetary bids were received for the work. A requisition for the services, which would be performed over the summer, was detailed and submitted for approval. About 30% of the request — $25,000 — was above the power system maintenance budget, but a summary of the probability and impact of potential failures was included in the requisition. What Joe had learned from his work provided sound logic and expertise in creating this requisition.

Carolyn reviewed the detail and approved the expenditure. Because it was 30% above budget, it also needed to be signed off by Carl, who read the request and made some comments before sending it back to Carolyn. “I understand the logic of this,” he stated, “but please reduce the expenditure to budget and include the additional cost in the next budget cycle.”

Carolyn sat down with Joe and relayed the reality of the situation. Joe understood and went through the maintenance request, paring it down to the budgeted amount allowed. He defaulted to the historical method that concentrated on equipment categories without health and criticality included.

Over the summer, maintenance work was performed during outages, reports were generated, and work that was required based on the traditional maintenance routine was completed. By September, the work approved for the year was complete, and Joe began working on the maintenance plan for next year, including the logic of all that was learned and with appropriate documentation of that logic.

However, in October, while working on maintaining equipment and planning for next year's maintenance plan, there was an incident. During an electrical short in the system, a low-voltage circuit breaker failed to open, and the overload damaged some key power distribution components, cutting power to the widget A assembly line. This failure caused significant damage to the distribution system, and contractors were called in to repair equipment, replace cables, and restore power to the widget A assembly line five days later. The estimated cost impact of this unplanned outage on a critical feeder was $225,000 including loss of revenue.

When the report was complete and submitted to Carl, things got expectedly serious. Carl scheduled a meeting with Brian, the VP of reliability, Carolyn, and Joe in the main conference room. In the meeting invitation, Carl asked Carolyn to include a root cause analysis (RCA) of the incident. He opened the meeting by summarizing the event and its impact on cash flow and customer delivery. He emphasized that the failure was preventable and unacceptable. He asked Carolyn to present the root cause analysis and explain the problem, including how it happened, who was responsible, and what changes would be made to prevent it in the future.

Carolyn agreed to present the RCA but asked Joe to give an event summary first. Joe, who was feeling stressed, explained the event from his perspective.

He explained that earlier in the year, he had taken steps to improve the maintenance strategy for their power management programs. "I attended a reliability program and incorporated reliability logic into my maintenance strategy. I looked at the critical equipment in every feeder and determined that some equipment needed to be serviced more frequently than others," he explained. Joe's list included a collection of air, low-voltage power circuit breakers that had been tested 2 years ago and were not due for testing for another year in the maintenance plan, even though they were in a critical production line and had been questionable on the last servicing. Joe pointed out that the detail for testing and servicing these breakers was included in the summer maintenance plan and budget request, which had been rejected.

Carl interrupted and said that this event had surfaced a fascinating scenario. "I understand that this year, we moved our power system maintenance to a more reliability-centered maintenance program," he said, "and now I can see that the cost of postponing this transition has hit home." He asked Joe to provide a presentation for the operations team to explain the foundation and logic for the proposed changes for maintaining the power distribution system. He asked Carolyn to submit her root cause analysis and look at this logic for all their maintenance programs.

CONCLUSION

Today, the person responsible for building and delivering a power system maintenance program has many challenges including financial, and historic trends, a lack of understanding of the criticality of equipment, and a reliability perspective on establishing a quality program. The tough step can be transitioning from old to new.

The successful maintenance manager today is researching and discovering the standards they will work from, prioritizing criticality and health in the calculation, and presenting a thorough and detailed plan showing the changes in the program. It is this person's responsibility to communicate the what and the why and be available for whatever resistance they may find, documenting everything along the way.

CHUCK BAKER *is President of PowerPro 360, a company offering power system reliability assessment and a CMMS designed for the maintenance of a power distribution system. Chuck entered the world of substation and power system maintenance 40 years ago and has spent the majority of his career on the operations side of power and distribution system maintenance and the development of power system maintenance programs.*

Doble Engineering Company

3-day Training—Relay Application and Hands-On Testing (Basic Level)

Learn to test simple overcurrent relays such as time overcurrent, under/overvoltage, and over/under frequency electromechanical relays. The course starts with the basic construction and principles of electromechanical / microprocessor relays and different components of the relay that need calibration and adjustments as part of testing. Operating principles for these relays will be followed by hands-on testing using Doble relay test sets and manual and automated test plans. Testing will include microprocessor and electromechanical relays.

This course/training is intended for the following audience:

1. Junior level technicians who are involved with testing of electro-mechanical/microprocessor relays
2. Technicians who wish to enhance their knowledge of testing simple relays/elements such as overcurrent, over/under voltage and over/under frequency relays
3. Technicians who wish to learn how automated testing is performed in addition to the manual testing that they are practicing presently

3-Day Training—Relay Application and Hands-On Testing (Intermediate Level)

Learn how to test distance, differential, negative sequence overcurrent, reclosing, sync check, and breaker failure in the application and hands-on course. The theory related to distance and differential functions followed by hands-on testing. A brief description of operating principles for these relays is followed by hands-on testing using Doble relay test sets and manual and automated test plans.

This course/training is intended for the following audience:

1. Senior and junior technicians who are involved with testing of electro-mechanical/microprocessor relays
2. Technicians who wish to enhance their knowledge of moderately complex relays
3. Technicians who wish to learn how automated testing is performed to test moderately complex

3-Day Training—Relay Application and Hands-On Testing (Advanced Level)

This course deals with advanced testing involving communication-assisted protection, analysis of event reports, COMTRADE and ss1 files, line current differential relays, bus differential protection, and out-of-step testing. Each testing section will be preceded by the theory on related relaying.

This course/training is intended for the following audience:

1. Senior level technicians who are involved with testing of electro-mechanical/microprocessor relays
2. Technicians who wish to enhance their knowledge of reading event reports, complex relaying, advanced testing techniques, end-to-end testing, out-of-step relaying, bus differential and line current differential

RTS Essentials Training Course

Periodic and regular testing of protective relays is not only essential for the proper operation of our electrical power system, it also is now required for many relays in the bulk electric system. RTS offers users a simple and efficient way to test protective relays and store test results and historical data. This 2-day course offers a good mix of theory and hands-on experience using the RTS software with test equipment and relays.

Learning Outcomes:

- Create system routines
- Communicate with test equipment and microprocessor relays
- Use RTS to test relays
- Save test results
- Create new FasTest tests
- Perform basic troubleshooting

RTS Developer

The RTS interface is built entirely for test manipulation. The RTS Developer Training course will expose attendees to the numerous tools and techniques available for creating or customizing any test routine. Moving beyond test plan modification, attendees will learn about RTS commands, gain insights that will be useful as they develop new test routines of their own, and learn basic troubleshooting techniques. This class is a primer for understanding and utilizing BASIC code as it relates to RTS test functionality. The class focuses on some of the most commonly used BASIC commands in RTS and proper syntax.

Learning Outcomes:

- Creating new test routines using the FasTest module
- Features within the FasTest module to assist in routine
- customization
- Methods to automate the population of settings into
- SETTINGS tab
- Introduction of RTS COMMANDS
- Displaying messages to Users
- Utilizing RTS COMMANDS to create intelligent routines
- Working with string variables
- Communication to the SEL relay

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Why Choose e-Hazard

We Are Experienced
Our team includes some of the top researchers in arc flash and many serve on key committees of the standards-setting bodies.

We Take a Practical Approach
Our electrical safety experts have walked in your shoes. We understand that if it's not practical, it's not applicable.

We Are Focused On You
Our approach is to understand your electrical safety needs and build a solution to address them.

Taking a Comprehensive Approach to Electrical Safety

Learn more about Audits and why they matter by reading Ken Sellars' article in this issue of NETA Training Talk!

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TESTER'S PARADISE

Excellence Through Education

Tired of being hot and sweaty while testing? Come to the OMICRON Academy in Houston, where you can practice all your tests in the comfort of air conditioning. It's a Tester's Paradise.

It's no mirage! We have a state-of-the-art indoor substation with a variety of apparatus to perform hands-on testing, including transformers, circuit breakers, protective relays, PD testing area, and our recently installed distribution automation wall. Our instructors also use this playground for our virtual training courses.

Training topics

- Protection Relays and Meters Testing
- Digital Substations and IEC 61850
- End-to-End Testing
- Generator Protection
- Protection Theory
- Reclosers and Distribution Automation
- Power Transformer Testing & Diagnostics
- Circuit Breaker/Switchgear Testing
- Instrument Transformer Testing
- Partial Discharge Testing
- And More...

"Amazing! 10 out of 10. This was very very helpful and knowledgeable...
...Many thanks to OMICRON..."

- M. Shaik, webinar participant

SCAN ME FOR MORE INFORMATION!

OMICRON Academy

Protec Training Series 2023

Protec is hosting a series of training opportunities for the electrical testing industry. Join us for our free monthly "Third Thursday" webinar series on numerous practical learning topics. Receive additional fee-based training in **Electrical Safety, Electrical Maintenance, and Electrical Fundamentals**. For more information on training courses, visit **protecequip.com/training**.

QUALIFIED ELECTIRCAL WORKER (QEW) NFPA 70E TRAINING

Electrical Safety for the Qualified Worker training is aimed at qualified electrical workers to help them build capabilities, knowledge and safe work practices when working around energized electrical systems.

Protec Equipment Resources now offers a live online instructor-led 2.5-day course that meets the **NFPA 70E® 2021**, *Standard for Electrical Safety in the Workplace!*

- Live Instructor-Led
- Great Price
- Strongest Content Offering
- Conveniently Consistent and Flexible
- Reduces Travel Time and Costs
- High Level of Instruction

Open enrollment classes held monthly, every third Monday–Wednesday:

- May 15-17, 2023
- June 12-14, 2023
- July 17-19, 2023
- August 14-16, 2023

Bulk registration discounts and onboarding programs are available, email for more information: training@protecequip.com

Registration fee: $680

70E Training Registration:
protecequip.com/qew

UPCOMING WEBINARS

Testing the Saturation Curve of Current Transformers (2.0 NETA CTDs)
May 18, 2023 | Presenter: Tom Sandri | FREE

Locating Ground Faults (2.0 NETA CTDs)
June 15, 2023 | Presenter: Tom Sandri | FREE

PREVIOUS WEBINARS

View previous webinars on our YouTube Channel:
Youtube.com/ProtecEquipmentResources

HOW TO JOIN A WEBINAR

- Protec webinars are held on the 3rd Thursday of every month
- Time: 1:00pm CST
- Cost: Webinars are FREE

Webinar Registration:
protecequip.com/webinars

PROTEC EQUIPMENT RESOURCES

Since 2004, Protec has been an industry leader in electrical testing equipment rental, sales, calibration, and asset management. With eight locations across the United States, we are large enough to serve your needs, small enough to care! For more information on training opportunities, visit **protecequip.com/training**.

TRAIN AT FULL POWER

with the industry leader in electric power systems training

Courses for Every Level, Role, and Application

On-Demand Courses

- Transformer Management 1 Modules
- Dry-Type Transformers
- Electrical Skills Series
- Basic Skills Series
- Safety Skills Series
- Compliance Series
- Infrared Thermography and Ultrasound

Virtual Instructor-Led Courses

- Transformer Management 1, 2, & 3
- Inspection and Sampling of Transformers
- Dissolved Gas Analysis (DGA) Workshop
- If Not Mineral Oil, What Then?
- Wet or Not Wet?

In-Person Courses

- Transformer Management 1 & 2
- Dissolved Gas Analysis (DGA) Workshop

On-Demand Position-Specific Packages

- Electric Power Maintenance Foundation
- Technician Learning Plan
- Visual Inspection and Sampling of Transformers
- Electrician Level 1
- Electrician Level 2

Take control of your training with convenient course options in all formats. Learn at your own pace and train on your time, or learn in person in the classroom with expert instructors.

Take live-online classes, on-demand virtual courses, Spanish-led courses, or position-specific learning plans designed for technicians, electricians, and maintenance and inspection personnel.

Online Catalog

- **Enroll today** by visiting **courses.powerpro360.com** or call Trisha at 330.632.8650
- **Senior Training Advisor**
  Trisha Willig
  trisha.willig@powerpro360.com

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ACCREDITATION

Select courses are eligible for the NETA CTD units, Professional Development Hours (PDH), and Continuing Education Units (CEU) via Kent State University.

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> Take classes around your busy schedule
> Eliminate travel time / related expenses
> Ideal for basic skills or refresher training
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TRAIN AT FULL POWER

Take control of your training, and train at full power with **Electric Power Training.**

- *Convenient class format options*
- *Work at your own pace*
- *Earn CTDs, CEUs, and PDHs*
- *Learn from the trusted experts in the industry*

Course Catalog
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