

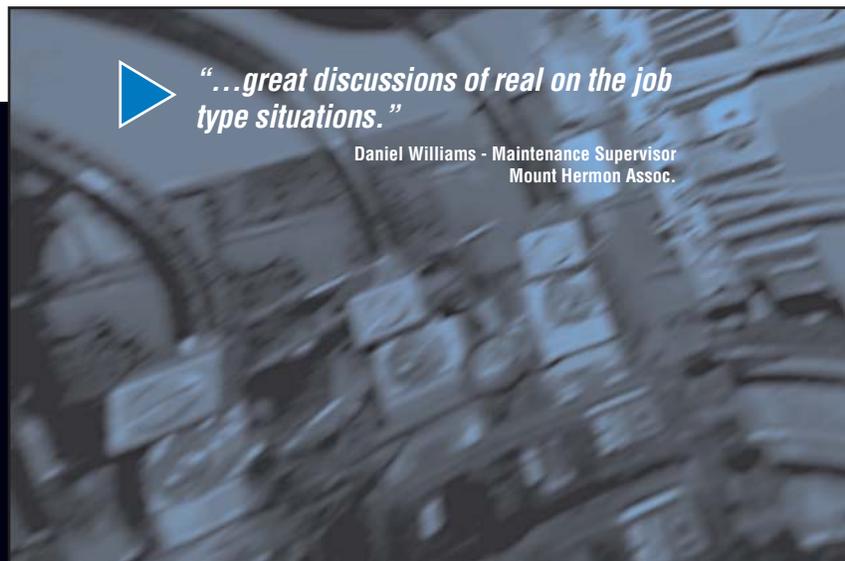
**Learning Objectives:**

- Common-sense electrical troubleshooting techniques
- How to save big money by performing common electrical maintenance tasks
- When and where to use CAT III industrial meters for troubleshooting
- How to troubleshoot pushbutton, relay, motor starter and other common component problems
- How to wire basic electrical circuits using wiring diagrams and then troubleshoot faults inserted by the instructor.
- How to use phase-rotation meter, Megohmmeter and different types of multimeters and voltage testers for different troubleshooting needs
- How to measure three-phase power values and understand what those readings mean.
- What PPE to wear while troubleshooting

**“Hands-On”**

# Electrical Troubleshooting & Preventive Maintenance™

**A 2-Day Course for Everyday Building, Plant and Facility Maintenance**



**Day 1 - Electrical Circuits, Motors and Power Distribution**

**Day 2 - Power Quality, Lighting, PLCs and VFDs**

- This seminar can also be presented at your facility for larger groups
- Reserve your space now! **CALL 1-877-978-7246**
- Check us out online at **www.TPCTrainco.com** for a complete listing of all seminars coming to your area



▶ **“A cure for spending big dollars on electrical safety & maintenance”**

Kevin Halbig - Electrical Tradesman - Sandia National Labs

**“Hands-On”**

# Electrical Troubleshooting & Preventive Maintenance™

## PURPOSE OF SEMINAR

Working with real world components and instruments found at their facility, attendees in this “hands-on” course will learn how to fix electrical problems plain and simple. It was created to bring students up to speed in their electrical troubleshooting skills as quickly and safely as possible and designed to cover the more commonly performed electrical troubleshooting tasks a maintenance technician faces in his job every day. For the novice or experienced electrician, this training course provides a no-nonsense, practical and real world systematic approach to electrical troubleshooting.

Students' specific needs and concerns are also addressed during the class so that they can go back to their workplace and immediately apply what they've learned. This course can also be adopted as part of a company's regular Qualified Electrical Worker program.

## WHO SHOULD TAKE THIS COURSE?

This seminar is designed for anyone who needs to sharpen their electrical troubleshooting skills in order to increase efficiencies and uptime at their industrial plant or building facility. If you work with electrical equipment and systems at industrial plants, commercial building, or private facilities, whether as general maintenance personnel, in cross-training programs, an electrician, or an engineer, you will find this course extremely useful. As long as you work with electricity and troubleshoot electrical problems, this course is for you.

- All Building Maintenance Personnel
- All Plant & Facility Maintenance Technicians
- Electricians
- Mechanics
- HVAC Technicians
- Boiler Operators
- Machine Operators
- Apprentices
- Alarm Technicians
- Non-Electrical Engineers
- Building Engineers
- Stationary Engineers
- Low Voltage Specialists
- Multi-craft & Cross Training Personnel

## TRAINING OUTCOMES

1. Interpret the OSHA requirements for troubleshooting and working on energized circuits
2. Safely and correctly verify a circuit is de-energized.
3. Perform basic circuit checks for shorts, opens and ground faults
4. Troubleshoot problems using ladder drawings and schematic diagrams.
5. Perform continuity and resistance checks on relay coils and contacts, overloads, fuses, circuit breakers, switches and other control circuit components.
6. Wire and troubleshoot basic electrical control circuits to develop a logical, systematic approach to troubleshooting
7. Troubleshoot 3-phase circuits by taking and interpreting clamp-on ammeter readings
8. Measure voltage on 3-phase Wye and Delta connected circuits and calculate percent phase imbalance as part of troubleshooting motors
9. Test and troubleshoot single-phase power distribution systems for correct wiring.
10. Use a Megohmmeter to perform the following insulation resistance tests used on motors and distribution systems.
11. Observe power quality problems and troubleshooting techniques for facility distribution systems, three-phase loads and commercial lighting.
12. Measure and observe VFD output characteristics and operation.
13. Apply troubleshooting skills to your facility one-line electrical drawings and electrical floor plans.
14. Identify components of a successful electrical preventive maintenance program.

## WHAT YOU WILL TAKE HOME

- An ATMT® Reference Guide detailing all the “must-know” information covered in the class. Keep this with you while on the job for immediate knowledge recall.
- A comprehensive Study Guide
- A Personalized Training Certificate with 0.8 TPC Trainco Continuing Education Units for each day attended, 1.6 for both days.
- All the information you need from asking our instructors specific questions about your own unique equipment or facility.

## ABOUT OUR INSTRUCTORS

We only hire industry experts, and many of our instructors have written books and industry articles, are accomplished conference speakers and webinar presenters, and sit on organizational boards. We can provide biographies and credentials for specific instructors upon request. Even though they are the best in their fields, TPC Trainco instructors keep themselves current on technology and industry trends by attending their own seminars and workshops, and by visiting new industrial sites to get to know the tools. They are simply the best instructors in the industrial maintenance and management training industry.

## HIGH QUALITY PRESENTATIONS

All our seminars include a complete, general education on the subject matter, and include enough flexibility to give our instructors the room then need to tailor the courses to address students' individual needs, concerns, and experience levels. Our instructors deliver content with hands-on exercises, instructor demonstrations, interactive student quizzes, problem solving exercises, role-playing, lectures, videos, graphics, and case study discussions. Their delivery emphasizes practicable learning that makes our seminars some of the most high-impact days most of our students experience.

## ATMT CERTIFICATION® TESTING

An optional ATMT® Certification exam is available for this and some of our electrical courses. Students may take it online or as a written test any time after the class is over. Please visit ATMT® Testing and Certification for more information.

## CONTINUING EDUCATION

Upon completion of this seminar, the student will receive a Certification of Completion and .8 TPC Trainco CEUs per day attended. Most employers and many government agencies accept TPC Trainco CEUs to fulfill their continuing education requirements. If the student needs CEUs to renew a state license, please contact us at 303-867-5035 to ensure the state licensing board has approved the seminar. If we are currently not approved by your state licensing board, we are happy to begin the process as long as we receive your request at least one month before the training date.

Reserve Your Space Now!

**CALL 1-877-978-7246**

or Online at [www.TPCTrainco.com](http://www.TPCTrainco.com)

## C O U R S E O V E R V I E W

Attendees in this course will not be playing with trainers built for a classroom, but instead will be working with real world industrial components found in their facility, and they will be using real CAT III industrial meters to troubleshoot - just as they should in their facility.

The course will start with a quick review of safety before moving into a discussion on electrical symbols where students will learn to create their own electrical drawings to be used for troubleshooting.

From here attendees will learn to troubleshoot industrial components. They will physically wire basic electrical circuits and then once they understand how they operate, they will troubleshoot faults. Discussions and hands-on exercises will also show how to troubleshoot common electrical motors.

A discussion of what electrical PPE should be worn for different tasks will take place as students try on different sizes and types of electrically rated rubber gloves so that they can see the importance of having a proper fit when working.

Power distribution problems will be discussed as well as testing for power quality issues and troubleshooting the different types of lighting circuits. A brief introduction to variable frequency drives and how to troubleshoot their most common problems will wrap up the course along with a final review of basic electrical preventive maintenance practices to keep your equipment from failing in the first place.

### DISCUSSION TOPICS

#### Basic Skills For Electrical Troubleshooting

- Safety First
- OSHA Requirements Regarding Troubleshooting and Qualified Persons
- Using Electrical Drawings
- Using Meters ( multimeters ) and Circuit Measurements
- Developing a Logical, Systematic Approach to Troubleshooting

#### Troubleshooting Control Circuits

- Relays, Motor Starters and Control Devices
- Reading and Interpreting Ladder Diagrams
- Power Loss
- Control Circuit Industrial Applications
- Electric Motor Drives
- Solenoid-Operated Valves
- Heating Elements

#### Troubleshooting Motors

- Most Common Motor Problems
- Electrical Problems
- Testing Windings for Shorts, Opens and Ground Faults
- Phase Unbalance
- Mechanical Problems
- Phase Rotation Testing

#### Troubleshooting Power Distribution

- Wye and Delta Systems
- Overcurrent Protection
- Branch Circuits

#### Troubleshooting Power Quality Problems

- Sources of Power Quality Problems
- Test Equipment for Troubleshooting Power Quality Problems
- Harmonics

#### Troubleshooting Lighting Circuits

- Lighting Terminology
- Types of Lighting Circuits
- Incandescent Lighting
- Fluorescent Lighting
- HID Lighting

#### Troubleshooting Programmable Logic Controllers (PLCs)

- Overview of PLCs
- Reading PLC Ladder Diagrams
- Status Indicators and Error Codes
- Force and Disable
- Startup Procedures

#### Troubleshooting Variable Frequency Drives (VFDs)

- VFD Terminology
- VFD Basic Operation
- Components
- Pulse Width Modulation
- Types of VFDs
- Common Problems and Corrective Action

#### Electrical Preventive Maintenance

- Why Perform Electrical Maintenance
- Overview of an Electrical Maintenance Program
- Building Your Own Walk-Through Inspection Checklist

***“All questions answered... great depth of information. Time and money well spent.”***

Robert L. Ecklund - Essilor Of America

***“Explained with good examples and exercises.”***

Adam Ransick - Rolls Royce

### SEMINAR AGENDA

7:30 am	Registration
8:00 am	Class Begins
12:00 -1:00 pm	Lunch (on your own)
4:30 pm	Class Ends

### SEMINAR FEE

\$1100 Both Days

### NO RISK REGISTRATION & MONEY-BACK GUARANTEE

If you're not yet sure you'll be able to attend this seminar, we can still hold a spot for you in the class. While payment is due prior to the start of the seminar, you may choose a full refund or credit for cancellations made at least 24 hours in advance. Substitutions are also freely allowed. Please register early!

### IN-HOUSE TRAINING

TPC Trainco offers an extensive list of courses available for convenient, in-house training at your facility. We can provide the same expert air conditioning, boilers, HVAC, facility and plant management, fluid hydraulics, piping, and electrical training courses at your facility that we offer in public seminars.

#### Advantages of On-Site Training

1. Modify the content to your specific needs
2. Protect company privacy
3. Workers remain on site in case of an emergency
4. Saves time and travel costs
5. Instructors can discuss your specific equipment
6. Problems can be openly discussed
7. Flexible scheduling
8. Increased price savings as the groups get larger
9. Promote teamwork & camaraderie among workers
10. More comfortable learning environment

**Contact us if you have any questions and to get a no-obligation quote.**

Reserve Your Space Now!

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**Still Only \$1100 for Both Days**

**PLEASE HELP OUR LOGISTICS TEAM AND REGISTER EARLY. CANCEL UP TO 24 HOURS IN ADVANCE WITHOUT PENALTY.**

ATTENDEE NAME	ATTENDEE EMAIL	COURSE TITLE	DATE(S)	CITY/STATE	PRICE
		Electrical Troubleshooting & Preventive Maintenance			

(\*See Public Seminar Pricing Schedule on Previous Page)

**TOTAL** \$ \_\_\_\_\_

**AUTHORIZING PERSON / SUPERVISOR:**

Name \_\_\_\_\_

Title \_\_\_\_\_ Company Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Phone \_\_\_\_\_ Fax \_\_\_\_\_ Email \_\_\_\_\_

*(Needed for Confirmation & Sending Pre-Reading Materials)*

**BILL TO:** *(If Different than Authorizing Person)*

Name \_\_\_\_\_

Title \_\_\_\_\_ Company Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Phone \_\_\_\_\_ Fax \_\_\_\_\_ Email \_\_\_\_\_

*(Needed for Confirmation & Sending Pre-Reading Materials)*

**PAYMENT METHOD:** *(Please make Checks Payable to TPC Trainco)*

Visa  MC  AMEX  Discover  Check Enclosed  Bill Purchase Order #: \_\_\_\_\_

Card Number \_\_\_\_\_ Card Authorization Code (CVC) \_\_\_\_\_ Expiration Date \_\_\_\_\_

Signature (Required) \_\_\_\_\_ Name on Card \_\_\_\_\_

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**QUESTIONS & HOW TO REGISTER**

Phone: 1-877-978-7246 | Website: www.TPCTrainco.com  
 Fax: (303) 531-4565 | E-mail: CustomerService@TPCTrainco.com  
 Send by Mail: TPC Trainco, P.O. Box 3397, Englewood, CO 80155

