



ALL-TEST Pro, LLC Training and Technical Department



2021 Course Catalog

Continuing Education and Training in the Field of
Motor Diagnostics and Predictive Maintenance



ALL-TEST Pro, LLC is an Accredited Provider by the International Association for Continuing Education and Training (IACET).

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The contents of this catalog were as accurate as possible at the time of printing. This catalog is for informational purposes only and does not constitute a contract. ALL-TEST Pro, LLC reserves the right to change, at any time, without notice course offerings, fees and other charges, curriculum, course structure and content, and other such matters as may be within its control, notwithstanding any information set forth in this Catalog. Students should consult ALL-TEST Pro, LLC to confirm all information prior to registration.



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Mission Statement: Training and Technical Department

It is the mission of the ALL-TEST Pro, LLC, Training and Technical Department to design and deliver a comprehensive learning experience that incorporates theory, new technology and practical field applications to educate attendees in the scope of Motor Diagnostics and Testing as it relates to Improved Electrical Reliability.

Diversity Statement

ALL-TEST Pro, LLC (the Company) recognizes its talented and diverse workforce as a key competitive advantage. Our business success is a reflection of the quality and skill of our people. The Company is committed to seeking out and retaining the finest human talent to ensure top business growth and performance.

Diversity management benefits individuals, teams, our company as a whole, and our customers. We recognize that each employee brings their own unique capabilities, experiences and characteristics to their work. We value such diversity at all levels of the company in all that we do.

The Company believes in treating all people (employees, vendors and customers) with respect and dignity. We strive to create and foster a supportive and understanding environment in which all individuals realize their maximum potential within the company, regardless of their differences. We are committed to employing the best people to do the best job possible. We recognize the importance of reflecting the diversity of our customers and markets in our workforce. The diverse capabilities that reside within our talented workforce, positions the Company to anticipate and fulfill the needs of our diverse customers, both domestically and internationally, providing high quality products, services and training.

ALL-TEST Pro, LLC accepts diversity. Diversity includes differences in ethnicity, gender, language, age, sexual orientation, religion, socio-economic status, physical and mental ability, thinking styles, experience, and education. We believe that the wide array of perspectives that results from such diversity promotes innovation and business success. Managing diversity makes us more creative, flexible, productive and competitive. We work to create working and learning environment in which everyone is respected, welcomed and appreciated.

Career Development and Promotion

ALL-TEST Pro, LLC rewards excellence and all employees are promoted on the basis of their performance. We have clear reporting procedures for any type of discrimination or harassment combined with follow-up procedures to prevent future incidents.

Diversity Practices

All employees of the Company undergo diversity training. Diversity training encompasses raising awareness about issues surrounding diversity and developing diversity management skills. The Company encourages the staff to commit to continued growth in understanding of diversity issues and strive to integrate awareness into all aspects of their position. We encourage professional and self-development.

Personnel

- Vice President and Acting Director of Training and Technical Department.....Jorgen Bjorkman
- Training Manager.....William Kruger
- Training Coordinator.....Eric Winzer
- Inside Sales.....Simon Young

All inquiries regarding Continuing Education and Training Events including registration, payment, logistics and other



administrative inquiries should be directed to our Corporate Office (860) 399.4222 or CE@alltestpro.com. Our office is available 8:15am – 5:00pm EST Monday – Friday, with the exception of holiday closings and weather emergencies.

Inquiries regarding Technical Support including assistance with post course exercises, software or hardware questions, and application questions should be directed to support@alltestpro.com. A member of our Technical Support Team will respond to your request within 24 hours.

Continuing Education Units (CEU)

A Continuing Education Unit (CEU) is defined as 10 contact hours of participation in an organized continuing education experience under responsible sponsorship, capable direction, and qualified instruction. This includes classroom, self-paced instruction, pre/post assignments, and/or homework in support of a learning outcome.

Authority

The ALL-TEST Pro, LLC Training and Technical Department, located at PO Box 1139 Old Saybrook CT 06475, is the authority responsible for the design and delivery of all Continuing Education and Training Events hosted and certified by ALL-TEST Pro, LLC.

Accreditation

ALL-TEST Pro, LLC is an Accredited Provider by the International Association for Continuing Education and Training (IACET). In obtaining this accreditation, ALL-TEST Pro, LLC has demonstrated that it complies with the ANSI/IACET Standard which is recognized internationally as a standard of good practice. As a result of their Accredited Provider status, ALL-TEST Pro, LLC is authorized to offer IACET CEUs for its programs that qualify under the ANSI/IACET Standard.

How CEU's are Calculated and Awarded

Continuing Education Units (CEU's) will be awarded on the basis of 1 CEU for each 10 hours of qualified instruction. CEU's will be awarded in increments of 0.10 CEU. The CEU award for each event is predetermined and will be announced prior to the start of each event and detailed on all event advertisements. You will also find all CEU award calculations listed in the Course Offerings section of this Course Catalog.

Sessions greater than 30 minutes but less than 60 minutes will be calculated as 1 contact hour or 0.1 CEU. Sessions lasting less than 30 minutes will not be awarded any qualified contact hours or CEU.

All students/attendees who successfully fulfill the requirements of a CEU qualified event will be notified in writing via email or standard mail, depending on preference, within 30 days of their completion. This notification will include a Certificate along with transcript record detailing the number of CEU's earned/awarded.

IF COURSEWORK IS MODIFIED OR SHORTENED DUE TO EXTRAORDINARY CIRCUMSTANCES* BY ALL-TEST Pro, LLC, COMPANY SHALL HAVE THE RIGHT TO MODIFY THE COURSE AND CEU CREDITS WILL BE AWARDED BASED ON COMPLETED WORK. SHORTENED COURSE EVENTS WILL BE FINANCIALLY CREDITED ACCORDING TO COST OF COURSE EVENT AS COMPARED TO TIME SHORTENED.

***Example: Natural disaster, instructor illness or accident, etc.**



Privacy Policy – For Customer Personally Identifiable Information

The following policy will be provided to all customers in regard to completion of Website “Contact Us” forms, and/or registrations for Training seminars, webinars, product information and product services.

Your privacy is important to us. This privacy policy (“Privacy Policy”) covers privacy practices with respect to “Personally Identifiable Information” that is transmitted electronically to or collected via the web, telephone, mail and other sources:

- How we collect and use your information
- With whom we may share your information.
- Choices available to you regarding collection, use and sharing of Personally Identifiable Information

In giving us your Personally Identifiable Information when registering on our website, and/or other services, you agree to the terms of this Privacy Policy as they may be amended from time to time. As we update and expand our services, this Privacy Policy may change. You may opt out of our sharing of your Personally Identifiable Information with third parties for marketing purposes, by following the directions in “Sharing Personally Identifiable Information”.

Collection and Use:

We do not collect any Personally Identifiable Information from you except when you expressly volunteer the information. This includes when you:

- Register for a seminar, become a customer by purchasing or downloading service or information from our website.
- Request information (electronically) about products, services, or enter a promotional contest.
- Use or participate in various services or features made available on the web.
- Request contact with a sales representative or support team member.
- Provide comments, questions or feedback about products and services.

“Personally Identifiable Information” includes, for example, your name, home or business address, email address, telephone, wireless and/or fax number; any other device address, credit card and other payment information, employment information and work experience, demographic information and /or other information that may identify you as an individual or allow energized/de-energized contact with you as an individual. Additional information that is protected under this privacy policy and will only be shared directly to you includes:

- Courses you have attended
- Dates and durations
- CEUs awarded to you

We will not sell, rent or share Personally Identifiable Information other than as disclosed below in the “Sharing” section of this Privacy Policy. We do not sell, rent to or share with others email addresses solely for the purpose of third-party marketing, other than as disclosed below in the “Sharing” section, which may include third party advertisements within emails that we may send to you.

Personally Identifiable Information may be utilized to respond to your requests and inquiries and to provide you with the services and products offered on or through our website. We may also use your Personally Identifiable Information to communicate timely information and special offers (for example, in form of emails, mailings and the like) about products, services, companies and events, sponsored by us and others, that we think might interest you.

If you register for a seminar or pay for products and services using a credit card, Personally Identifiable Information (such as your name and shipping address) and financial information (credit card number, expiration date and CVV) may be required. This information may be used for billing purposes and to fill orders. If we have trouble processing an order, this contact information may be used to get in touch with you. Personally Identifiable Information also may be collected when you apply for a position with us or a program sponsored by us. In these cases, Personally Identifiable Information is used only for the purpose of processing and evaluating the application.

The Personally Identifiable Information you give us via secured fax and information order may be combined with other Personally Identifiable Information (such as demographic information and past purchase history) available from our records. This information may be used to make our future marketing efforts more efficient and will help us to improve the operations and maintenance of our website and business.



Sharing Personally Identifiable Information

We may share Personally Identifiable Information collected in the following ways:

- With our Qualified Distributors

Notification of Changes

If we decide to change our Privacy Policy, we will post those changes in the Privacy Policy section accessible from the home page of our website so that you are always aware of what information we collect, how we use it, and under what circumstances, if any, we disclose it. Any changes or updates will be effective when posted. Under certain circumstances, we may also elect to notify you of changes or updates to our Privacy Policy by additional means, such as posting a notice on the front page of our website or sending you an email.

Problems or Complaints

If you believe that there has been a violation of this Privacy Policy, please contact us at info@alltestpro.com. We will investigate and take appropriate action and report back to you within a reasonable period of time.

Requesting Copies of Records

Any student requesting past records must complete a Release of Records Form in accordance with the Company's Privacy Policy (no record or information will be released to other parties, other than the student). All records will be mailed via First Class mail using US Postal Services to the address provided on completed forms.

Notification of Technology Requirements

Students/Attendees will be notified of all Technology Requirements for a Continuing Education and Training Event prior to or during the registration process. For more information about the requirements of specific learning events please refer to the Course Offerings section of this book.

Proprietary Interest Policy

Any proprietary interests of providers will be disclosed during contractual arrangements and/or agreements between Provider, developer and/or instructor and Training Department. Provider must list all interests prior to contract execution.

ALL-TEST Pro, LLC, maintains a policy on intellectual property rights for all event materials.

Intellectual Property Policy

Unless otherwise agreed to in writing by ALL-TEST Pro, LLC any work produced, including but not limited to event materials, inventions, methods, art, or literature, by an ALL-TEST Pro, LLC employee as a part of doing the job for which they are employed and paid by ALL-TEST Pro, LLC shall be the sole property of ALL-TEST Pro, LLC and any and all financial proceeds including royalties from such work shall inure to ALL-TEST Pro, LLC.

Types of Continuing Education and Training Events Offered

Public Classroom

A public classroom is defined as any CE/T Event that is open for registration by the general public. These types of courses are held on a periodic basis within the United States and as requested internationally. Please see our Event Schedule on our website www.alltestpro.com for the latest public classroom schedule. Domestic dates and locations are available in the Course Offerings section of this catalog.



Virtual Classroom

A Virtual Classroom is defined as a CE/T Event that is held virtually, on-line with a live instructor. Attendees must have their own computers. Course workbooks and worksheets will be available for download. Currently we are sending instruments, demo motors, induction coils & workbooks for up to ten people. More can be accommodated more for an additional charge per person.

On-Site Classroom

An On-Site Classroom is defined as a CE/T Event that is held on the customer's premises and is not available for public registration. Schedules for On-Site Classrooms are not published to the public. Interested companies should contact our Training Coordinator for availability.

On-Line Courses

An On-Line course is defined as any CE/T course that is available for purchase, off the internet, which is pre-recorded and is open for registration by the general public. Please see our website www.alltestpro.com for available courses.

Registration

How to Register

Students/Attendees will be required to submit their registration form for all public classrooms. Registration forms are available on our website www.alltestpro.com or by contacting our office at (860) 399.4222.

Registration forms can be submitted directly to our office by emailing CE@alltestpro.com or faxing (860) 399.3180. Registration information will not be taken over the phone.

For all On-Site Classrooms & Virtual Training, a company purchase order is required to hold and book training dates. Registration will be available to all Students/Attendees prior to the start of class on the first day of the CE/T Event.

Payment

Payment in full is required for all Public Classrooms prior to the start of the CE/T Event. A 50% deposit is required to hold dates for all On-Site Classrooms or Consulting. The remaining balance is due and payable within the terms listed on the customer's invoice.

Acceptable forms of payment include MasterCard, Visa, Discover, American Express, Check or Money Order. Checks and Money Orders should be made payable to ALL-TEST Pro, LLC. Cash payments will not be accepted.

Refunds/Cancellations

ALL Public course events:

- Refunds will not be issued.
- Open credit for unattended or uncompleted (specific requirements must be met to qualify) public course event is valid for one year from the course event.

On-Site & Virtual customer scheduled coursework events:

- Customers who need to cancel the scheduled date course dates must contact our office (30) thirty days prior to the start of the course event to reschedule with no penalty.
- Cancellations of a scheduled course event less than (30) thirty days of the event will result in a loss of the 50% deposit.
- For rescheduling a course event that has been postponed less than (30) days prior to the event will result in a \$2500.00 USD reschedule fee.



Travel Policy

Domestic Travel

Instructor Travel Expenses for all CE/T Events located within the United States and Canada are included in the cost of the event. Learners must supply their own transportation to and from the site location.

International Travel

Instructor travel expenses for all CE/T Events located outside of the United States and Canada are not included in the cost of the event, with the exception of International Public Classrooms. Please contact your sales agent for details. Please contact our Inside Sales Dept. for more information regarding international travel expenses. Learners must supply their own transportation to and from the site location.



Virtual Individual Attendee Public Motor Diagnostic Workshop

Level I

Level II

Course Type: Virtual Classroom. Live Instructor.

Pre-Requisites: None

Technology Requirements: Students attending this course must have their own laptop. Laptop must have administrative rights to install software. Minimum operating system and software to be installed on the laptop should be Windows XP, with Microsoft Word and Excel 2003.

Format: Blended, Self-Paced and Instructor Lead
Virtual Classroom

Assessment Style: Graded Test, Pass/Fail

Duration:

3 Day MCA™ Level I: 3 Days/22 Instructor Led Hours, 2 Self-Paced Hours

2.5 Day ESA Level I: 2 Days/14 Instructor Led Hours, 2 Self-Paced Hours

5 Day MCA & ESA Level I: 5 Days/36 Instructor Led Hours, 4 Self-Paced Hours

CEU Award: ALL-TEST Pro, LLC is authorized by IACET to offer:

1.6 CEUs for 2 Day MDW

2.4 CEUs for 3 Day MDW

4.0 CEUs for 5 Day MDW

As an IACET Accredited Provider, ALL-TEST Pro, LLC offers CEUs for its programs that qualify under the ANSI/IACET Standard.

Instructor: William Kruger

Course Type: Virtual Classroom. Live Instructor.

Pre-Requisites: MDW Level I or previous ATP MDW, 5 Day MCA & ESA MDW Level I, MCA™ Level I or a previous 3-day MCA™ course and ESA Introductory Course or previous ATP ESA course.

Technology Requirements: Students attending this course must have their own laptop. Laptop must have administrative rights to install software or have software previously installed. Minimum operating system and software to be installed on the laptop should be Windows XP, with Microsoft Word and Excel 2003.

Format: Blended, Self-Paced and Instructor Lead
Virtual Classroom

Assessment Style: Graded Test, Pass/Fail

Duration:

3 Day MCA™ Level II: 3 Days/22 Instructor Led Hours, 2 Self-Paced Hours

2 Day ESA Level II: 2 Days/14 Instructor Led Hours, 2 Self-Paced Hours

5 Day MCA & ESA Level II: 5 Days/36 Instructor Led Hours, 4 Self-Paced Hours

CEU Award: ALL-TEST Pro, LLC is authorized by IACET to offer:

1.6 CEUs for 2 Day MDW

2.4 CEUs for 3 Day MDW

4.0 CEUs for 5 Day MDW

As an IACET Accredited Provider, ALL-TEST Pro, LLC offers CEUs for its programs that qualify under the ANSI/IACET Standard.

Instructor: William Kruger



3 Day Motor Circuit Analysis Motor Diagnostic Workshop – Level I

Course Number: 10010

Three days of MCA™ (deenergized) virtual training introduces you to MCA™ (deenergized low voltage winding insulation testing). This course presents the basic theories and principles necessary to understand the concepts and principles associated with this technology. It identifies the types of faults, and guidelines that can be detected with this motor testing method. This course uses a combination of theory and hands on exercises using the instruments to provide the student with a basic understanding of this very powerful de-energized winding testing method. This course prepares you to test & troubleshoot single phase and 3 phase AC electric motors, coils, and windings, and improve the reliability and uptime of your plant. *Course materials include Workbook and Motor Circuit Analysis Manual.*

Upon Completion of this course, participants should be able to:

- Understand why most winding insulation degradation remain undetected until catastrophic failure occurs!
- Describe the main types of failures associated with AC Motors
- Develop a basic understanding of how the chemical composition of the electrical insulations can affect its response to injected low voltage signals
- Understand the basic laws & principles of Electro-magnetism
- Review the basic physics principles such as the Oersted's & Faraday's law, combined with the theory of relativity & Maxwell's equation & other atomic & electrical laws that have led to the development our modern electrical machinery and learn how these principles combine to affect the electrical response of signals injected to the machines winding system
- Describe how changes in the insulation systems affect the R, L, Z, and I/F of the winding system
- Explain how Joule's Law, Ohms Law, and Faraday's Law affect the various measurement used in MCA
- Identify the components in the winding system; factors that determine Resistance (R), Inductance (L), Capacitance (C), and Impedance (I/F)
- Use the AT7™ to establish a machines condition using static testing & to manually measure R, L, Z, Fi and I/F
- List the different types of AC Motors, identify their components and describe the purpose of each component
- Understand how the major components are assembled and how different configurations affect motor operation, efficiency, and response to low voltage injected signals
- Review how the rotating magnetic field and torque are developed in an AC induction motor
- Understand how motor shaft speed is affected by Voltage, Current, Nameplate Speed and Rated Power
- Learn how electrical insulation fails, the various failure stages and how to use MCA™ to identify the failure stages
- Review the various techniques available to identify electrical insulation failures in winding systems
- Familiarize themselves with the various measurements and guidelines associated with MCA™
- Use MCA™ measurements to evaluate a motor's winding insulation condition
- Learn how to recognize when to correct MCA™ readings caused by "Rotor Position"
- Learn how to verify & correct for winding insulation alarms caused by "Rotor Position"
- Understand the most common faults associated squirrel cage
- Learn how to perform a dynamic test using the AT7™
- Learn to perform, interpret & evaluate an AC squirrel cage Induction motor's winding & rotor condition using the AT7™ DYN test
- Learn how to set-up & operate the MCA™ Basic software
- Understand how to connect AT7™ to host computer, upload MCA™ tests stored in an AT7™ to MCA Basic™ software input buffer
- Learn how to map data from input buffer to permanent machine data base
- Learn how to create & print reports from the MCA Basic™ software

Cost: \$2,200.00



3 Day Motor Circuit Analysis Motor Diagnostic Workshop - Level II

Course Number: 10041

Three days of MCA™ (deenergized) virtual training picks up where the MCA™ Level I course leaves off. This course prepares you to troubleshoot all types of electric motors, coils, and windings. This course combines a review of the principles and guidelines presented in the MCA™ Basic course with the new principles necessary to perform MCA™ on all types of electrical machines, including, but not limited to Synchronous motors, DC motors & Generators, Transformers, Wound Rotor motors & Asynchronous Generators. Also presents all the function and features of the AT7™ and the MCA PRO™ software. This course requires the use of computers with the MCA™ demo software installed, or administrative rights on your computer. *Course materials include Workbook and Motor Circuit Analysis Manual.*

Upon Completion of this course, participants should be able to:

- Use all features & functions of the AT7™ for all machines & winding types
- Determine which feature or function to use for evaluating all different machine and winding types
- Understand the atomic & electrical theories presented in MCA Level I course
- Perform and understand the guidelines for determining the condition of the ground wall insulation systems Insulation Resistance to Ground (IRG),
- Define MCA™ measurements of resistance (R), Inductance (L), Impedance (Z), Phase Angle (Fi) & Current Frequency Response (I/F)
- Manually measure: R, L, Z, Fi and I/F using the AT7™
- Establish a reference value to define the condition of a motor's winding condition using the Static motor test
- Explain the construction of most common types of industrial electrical equipment, identify their major components and define the purposes of each major component
- Explain the various designs of squirrel cage rotors, and understand the speed vs torque curves
- Define the bearing failure stages of rolling element bearings
- Explain the development of torque & the rotating magnetic field in an AC Induction motor
- Understand the most causes squirrel cage motors exhibit an impedance unbalance and how to obtain the correct values
- Calculate the correct speed of an operating AC Induction motor by using common measured variables
- Explain the operation of AC Wound rotor Induction motors
- Explain the construction and operation of AC synchronous motors and define their operating characteristics
- Understand the operation & construction of three phase transformers
- Explain the construction and operation and construction DC Motors & Generators
- Identify the major components and their purpose for DC
- Describe the operation of the different types of DC motors and identify their applications
- Describe the stages of electrical insulation failures
- Use all features & functions of the AT7™
- Perform a Rotor Inductance Test (RIT) on a squirrel cage induction motor, create rotor signature using a spread sheet such as Microsoft® Excel for windows
- Evaluate the condition of a squirrel cage rotor based on the RIT
- Perform an MCA™ dynamic test and evaluate both the stator and rotor signature on a squirrel cage motor and compare them to recommended guidelines
- Take MCA™ on an AC wound rotor induction motor
- Perform MCA™ measurements on AC Synchronous motors, on both the Stator and the Rotor
- Explain how to identify faults on single phase coils or DC motors
- Perform individual coil tests on Synchronous motor rotors or DC field coils
- Perform MCA™ tests on three phase transformers and evaluate their condition based on recommended guidelines
- Use the AT7™ to perform MCA™ tests on DC Machines from the controller or directly at the motor
- Perform an armature inductance test using the MOTOR GENIE® with the armature installed the machine or the armature removed.
- Load the MCA PRO™ software onto a computer



- Create a machine hierarchy
- Create MCA™ routes from machine hierarchy
- Perform MCA™ tests using the route function as well as IND, DC Machines, and Z/ψ functions
- Upload the test data stored in the AT7™
- Map uploaded test data from the input buffer to permanent data base
- Generate and print various reports from MCA PRO software
- Setup up a monitoring schedule for your plant's motors based on criticality of motor

Cost: \$2,200.00 USD

3 Day Electrical Signature Analysis Motor Diagnostic Workshop – Level I

Course Number: 10011

3 days of Electrical Signature Analysis (ESA), Energized virtual training. This training introduces you to ESA (Energized Motor Testing). This course presents the basic theories and principles necessary to understand the concepts and principles associated with this technology. How ESA uses the motors supply voltage and operating current to detect & identify faults in the motor system. It teaches guidelines and the types of faults, which can and can't be detected with this motor testing method.

This course uses real world machinery data to teach the students how to operate and understand the basic principles of the ESA software. The principles presented include but are not limited to the development and interpretation of the Fast Fourier Transform (FFT), including an understanding of the importance of spectral resolution, causes and interpretation of sidebands and harmonics in the voltage & current spectrum. It provides an introduction into using the 3 phase PQ measurements and how to combine with the FFT displays to quickly and accurately identify faults in the motor system. It prepares you to evaluate single phase and three phase AC Induction motor systems to improve the reliability and uptime of your plant using the ATPOL II™ analyzer, Power System Manager (PSM) & ALL-TEST Pro ESA software.

This course uses the ALL-TEST Pro instruments, but the theories and principles presented are applicable for all energized motor testing systems.

Course materials include Workbook, ESA 5.0 Software, & ESA Exercise Disk. PC (Laptop) with administrative access (Must run Windows XP or later) provided by the student.

Upon Completion of this course, participants should be able to:

- Understand how to integrate ESA into a new or existing predictive maintenance programs (PdM) to identify & evaluate developing faults or existing faults
- Identify which electrical machines ESA can be performed on
- Understand the safety precautions associated with collecting ESA data
- Take data using the ATPOL II™ analyzer both locally and remotely on AC motors
- Create the ESA data base and upload from the ATPOL II™ to the host computer
- Describe the major components and purpose of these components in AC squirrel cage induction motors
- Explain how AC three phase power creates a rotating magnetic field and develops torque
- Calculate shaft rotating speed based on measure value of volt, current and name plate power and speed
- Describe the stages of rolling element bearing failure
- Explain the importance of spectral band width, center frequency and how to calculate bandwidth and center frequency in a frequency spectrum
- Change the spectral resolution in both the high and low frequency spectrum
- List which electrical & mechanical faults appear in the low frequency spectrum
- List which electrical & mechanical faults appear in the high frequency spectrum



- Explain the benefits of using the logarithmic display in the ESA spectral displays
- Change the resolution in both the high and low frequency
- Explain the types of signal modulation and they present themselves in the electrical spectrum
- Describe how to determine if a fault is the result of incoming power or an actual fault in the motor or driven machine
- Be able to create sideband and harmonic markers in the voltage and current spectra to accurately determine faults in the motor system
- Organize a motor system's important operating characteristics and customize each data set to each specific machine
- To create the files necessary to auto populate each machine's data sets with the machine detail's necessary for custom and automatic analysis on newly collected data.
- Explain the dynamic forces that occur with mechanical anomalies on the rotor such as unbalance, misalignment, eccentric rotor, bent shaft, etc.
- Identify which faults can be automatically analyzed using ESA
- Understand the limits and guidelines that are used in fault detection for various faults
- Using available tools, verify automatic analysis generate automatic analysis report
- Define the various failure stages associated with rolling element bearing and identify which failure stage a bearing is currently experiencing
- Describe the causes of static eccentricity, and how to identify this fault in ESA
- List the most common faults associated with squirrel cage rotor
- Determine the severity condition of rotor bars degradation using ESA
- Ability to set classify motors based on critically and establish testing intervals

Cost: \$2,200.00 USD

3 Day Electrical Signature Analysis Motor Diagnostic Workshop – Level II

Course Number: 10042

3 days of Electrical Signature Analysis (ESA) Energized virtual training. This course picks up where the ESA Level I course leaves off. It begins with a brief review of the basic FFT theory, with the addition of more advanced FFT theories as it progresses. The course continues to use a hands-on approach to introduce the use of shaping & aliasing filters in the FFT to gain a better understanding of the presented signal for more accurate analysis. It also covers many of the advanced features of the ATPOL II™ software such as advanced data base setup, SD card operation for routes and trending.

An introduction to the power quality issues that can result in high energy usage, costs or high maintenance costs. PQ issues can lead to equipment instability or eventual failure. It discusses some of the adverse effects that PQ has on electrical equipment operation. Discussions will include power quality issues such as harmonics, voltage unbalance, dips & swells and transients. It also presents the use of additional electrical displays such as time waves & polar graphs for better understanding of any issues or anomalies of the incoming current and voltage signals.

Electrical machine construction and operating principles are discussed focusing on the construction, assembly & operating principles, AC 1 & 3 phase induction & synchronous motors, 1 & 3 phase transformers, DC motors & generators, wound rotor motors & asynchronous generators. This review focuses on the operating principles and manufacturing or assembly errors that create the dynamic forces, which result in higher operating or maintenance cost. These principles help the attendees understand the source or cause of these faults, how they occur in the motor system & what can be done to correct them.



Further discussion is presented involving the failures of the bearings that separate the rotating and stationary components, the common failure modes, & how to identify them using ESA. It will discuss faults and malfunctions associated with all types of rolling element as well as fluid film type or plain bearings.

The course continues with discussions about additional electrical and mechanical faults that are encountered by electrical machines as well as mechanical faults that occur within mechanical machines driven by electric motors. This includes gear boxes, fans, generators, wind turbines, horizontal & vertical pumps, or any other machine driven by any electrical machine. A brief discussion of hydraulic issues that occur in fluid systems, such as cavitation, recirculation and flow related resonance will be presented.

The course finishes with a discussion on testing and identifying faults on motors driven by specific electrical controllers such as VFD's & DC Controllers. And an introduction to the use of advanced ESA s/w features such as waterfall displays, torque ripple, and spectral comparison and trending. This course prepares you to evaluate all types of electrical machinery systems and look for electrical and mechanical existing or developing problems, anywhere in the motor system. Course uses the ALL-TEST Pro instruments, but the theories and principles presented are applicable for all Energized motor testing systems.

Course materials Required: Attendee Workbook, ESA 5.0 Software, & ESA Exercise Disk, provided by ALL-TEST Pro, LLC. Laptop with administrative access (must run Windows XP or later) provided by the student.

Upon completion of this course the participants should be able to:

- Take data using the ATPOL II™ analyzer both locally and remotely on electrical equipment
- Transfer data captured from an SD card to a host computer route-based machine hierarchy
- Use the advanced features of the ESA software such as waterfall displays, torque signatures, and comparative analysis
- Define Power Quality and discuss the impact of PQ issues towards electrical efficiency, electrical reliability, and energy costs
- List the different types of electrical equipment, identify their components and describe the purpose of each component
- Explain the operation of the different types of Electric equipment
- Describe the stages of rolling element bearing failure and explain how ESA identifies the condition of these types of bearings
- What is meant by pole pass frequency (PPF) & understand where it comes from and how it's calculated.
- Determine Motor Shaft Speed based on Measured Values of Voltage, Current, Nameplate Speed and Rated Power and calculated PPF
- Describe the electrical & mechanical faults that can be analyzed with ESA and what causes these faults & guidelines on how to correct them
- Discuss the relationship of Dynamic Load and bearing life
- Discuss the effects of Resonance in a mechanical system and what it will do to the electrical spectrum
- Discuss guidelines on how to confirm and correct mechanical resonance issues
- Explain what gear faults or issues create dynamic forces between gears during operation under fault conditions
- Discuss how to determine which gear is at fault when gear problems are diagnosed using ESA
- Understand and define the terms used in ESA
- Evaluate the condition of a squirrel cage rotor using the ESA spectrum and determine severity of the fault and most likely causes
- Explain the faults that causes Static Eccentricity
- Define a thermally sensitive rotor and explain how it affects the Electrical Signature
- Identify which displays, Hi Frequency, Lo Frequency or Demod spectrum faults will be used to identify all of the electrical and mechanical faults
- Understand how to set up ATPOL II™ for various electrical testing, such as transients and PQ studies
- Reprogram the ATPOL II™ using an SD card



- Discuss the types of DC motor controller faults that will be identified from the electrical spectrum
- Discuss the types of VFD faults that can be identified using the energized motor data captured by the ATPOL II™
- Demonstrate the ability to set up and perform predictive maintenance routes and upload the test data using the ATPOL II™
- Set-up and implement an energized motor testing program using the ATPOL II™

Cost: \$2,200.00 USD

5 Day Motor Circuit Analysis & Electrical Signature Analysis Motor Diagnostic Workshop – Level I

Course Number: 10012

This course is a combination of the (3) day MCA™ (deenergized Training) and the (2.5) day ESA (Energized Training) Level I. See those course descriptions for details.

Course materials include Workbook, Motor Circuit Analysis manual, ESA 5.0 software & ESA exercise Disk. PC (Laptop) with administrative access (Must run Windows XP or later) provided by the student.

Cost: \$ 3,000.00 USD

5 Day Motor Circuit Analysis & Electrical Signature Analysis Motor Diagnostic Workshop – Level II

Course Number: 10038

This course is a combination of the (3) day MCA™ (deenergized Training) and the (2.5) day ESA (Energized Training) Level II. See those course descriptions for details.

Course materials include Workbook, Motor Circuit Analysis manual, ESA 5.0 software & ESA exercise Disk. PC (Laptop) with administrative access (Must run Windows XP or later) provided by the student.

Cost: \$3,000.00 USD



Domestic On-Site Training Course for 10 Attendees

Level I

Course Type: On-Site Classroom

Pre-Requisites: None

Technology Requirements: Students attending this course must bring their own laptop. Laptop must have administrative rights to install software. Minimum operating system and software to be installed on the laptop should be Windows XP, with Microsoft Word and Excel 2003.

Format: Blended, Self-Paced and Instructor Lead Classroom

Assessment Style: Graded Test, Pass/Fail

Duration:

3 Day MCA™ Level I: 3 Days/22 Instructor Led Hours, 2 Self-Paced Hours

3 Day ESA Level I: 3 Days/22 Instructor Led Hours, 2 Self-Paced Hours

5 Day MCA & ESA Level I: 5 Days/36 Instructor Led Hours, 4 Self-Paced Hours

CEU Award: ALL-TEST Pro, LLC is authorized by IACET to offer:

2.4 CEUs for 3 Day Courses

4.0 CEUs for 5 Day Courses

As an IACET Accredited Provider, ALL-TEST Pro, LLC offers CEUs for its programs that qualify under the ANSI/IACET Standard.

Instructor: William Kruger

Level II

Course Type: On-Site Classroom

Pre-Requisites: MDW Level I or previous ATP MDW, 5 Day MCA & ESA MDW Level I, MCA™ Level I or a previous 3 day MCA™ course and ESA Introductory Course or previous ATP ESA course.

Technology Requirements: Students attending this course must bring their own laptop. Laptop must have administrative rights to install software or have software previously installed. Minimum operating system and software to be installed on the laptop should be Windows XP, with Microsoft Word and Excel 2003.

Format: Blended, Self-Paced and Instructor Lead Classroom

Assessment Style: Graded Test, Pass/Fail

Duration:

3 Day MCA™ Level II: 3 Days/22 Instructor Led Hours, 2 Self-Paced Hours

3 Day ESA Level II: 3 Days/22 Instructor Led Hours, 2 Self-Paced Hours

5 Day MCA & ESA Level II: 5 Days/36 Instructor Led Hours, 4 Self-Paced Hours

CEU Award: ALL-TEST Pro, LLC is authorized by IACET to offer:

2.4 CEUs for 3 Day Courses

4.0 CEUs for 5 Day Courses

As an IACET Accredited Provider, ALL-TEST Pro, LLC offers CEUs for its programs that qualify under the ANSI/IACET Standard.

Instructor: William Kruger



3 Day Motor Circuit Analysis Training Course – Level I

Course Number: 10014

Three days, at the customers' site, of MCA™ (deenergized) training introduces you to MCA™ (deenergized low voltage winding insulation testing). This course presents the basic theories and principles necessary to understand the concepts and principles associated with this technology. It identifies the types of faults, and guidelines that can be detected with this motor testing method. This course uses a combination of theory and hands on exercises using the instruments to provide the student with a basic understanding of this very powerful de-energized winding testing method. This course prepares you to test & troubleshoot single phase and 3 phase AC electric motors, coils, and windings, and improve the reliability and uptime of your plant. *Course materials include Workbook and Motor Circuit Analysis Manual.*

Upon Completion of this course, participants should be able to:

- Understand why most winding insulation degradation goes undetected until catastrophic failure occurs
- Describe the main types of failures associated with AC Motors
- Develop a basic understanding of how the chemical makeup of the electrical insulations can affect its response to injected low voltage signals
- Understand the basic laws & principles of Electro-magnetism
- Review the basic physics principles such as the Oersted's & Faraday's law, combined with the theory of relativity & Maxwell's equation & other atomic & electrical laws that have led to the development our modern electrical machinery & learn how these principles combine to affect the electrical response of signals injected to the machines winding system
- Describe how changes in the insulation systems affect the R, L, Z, and I/F of the winding system
- Explain how Joule's Law, Ohms Law, and Faraday's Law affect the various measurement used in MCA™
- Identify the components in the winding system; factors that determine Resistance (R), Inductance (L), Capacitance (C), and Impedance (I/F)
- Use the AT7™ to establish a machines condition using static testing & to manually measure R, L, Z, Fi and I/F
- List the different types of AC Motors, identify their components and describe the purpose of each component
- Understand how the major components are assembled and how different configurations affect motor operation, efficiency, and response to low voltage injected signals
- Review how the rotating magnetic field and torque are developed in an AC induction motor
- Understand how motor shaft speed is affected by Voltage, Current, Nameplate Speed and Rated Power
- Learn how electrical insulation fails & the various failure stages & how to use MCA™ to identify the failure stages
- Review the various techniques available to identify electrical insulation failures in winding systems
- Familiarize themselves with the various measurements and guidelines associated with MCA™
- Use MCA™ measurements to evaluate a motor's winding insulation condition
- Learn how to recognize when to correct MCA™ readings caused by "Rotor Position"
- Learn how to verify & correct for winding insulation alarms caused by "Rotor Position"
- Understand the most common faults associated squirrel cage motors
- Learn how to perform a dynamic test using the AT7™
- Learn to perform, interpret & evaluate an AC squirrel cage induction motor's winding & rotor condition using the AT7™ DYN test
- Learn how to set-up & operate the MCA™ Basic software
- Understand how to connect AT7™ to host computer, upload MCA™ tests stored in an AT7™ to MCA Basic software input buffer
- Learn how to map data from input buffer to permanent machine data base
- Learn how to create & print reports from the MCA Basic™ software

Cost: \$ 12,800.00 USD, Price includes course material for up to 10 attendees, instructor's travel & expenses in the USA & Canada. Prices may vary for events held outside the United States and Canada.



3 Day Motor Circuit Analysis Training Course - Level II

Course Number: 10043

Three days, at the customers' site, of MCA™ (deenergized) training picks up where the MCA™ Level I leaves off. It prepares you to troubleshoot all types of electric motors, coils, and windings. This course combines a review of the principles and guidelines presented in the MCA™ Level I course with the new principles necessary to perform MCA™ on all types of electrical machines, including, but not limited to Synchronous motors, DC motors & Generators, Transformers, Wound Rotor motors & Asynchronous Generators. Also presents all of the function and features of the AT7™ and the MCA PRO™ Software. This course requires the use of computers with the MCA™ demo software installed, or administrative rights on your computer. *Course materials include Workbook and Motor Circuit Analysis Manual.*

Upon Completion of this course, participants should be able to:

- Use all features & functions of the AT7™ for all machines & winding types
- Determine which feature or function is used to evaluate all various machine and winding types
- Understand the atomic & electrical theories presented in MCA Level I course
- Perform and understand the guidelines for determining the condition of the ground wall insulation systems Insulation Resistance to Ground (IRG),
- Define MCA™ measurements of resistance(R), Inductance (L), Impedance (Z), Phase Angle (Fi) & Current Frequency Response (I/F)
- Manually measure: R, L, Z, Fi and I/F using the AT7™
- Establish a reference value to define the condition of a motor's winding condition using the Static motor test
- Explain the construction of most common types of industrial electrical equipment, identify their major components and define the purposes of each major component
- Explain the various designs of squirrel cage rotors, and understand the speed vs torque curves
- Define the bearing failure stages of rolling element bearings
- Explain the development of torque & the rotating magnetic field in an AC Induction motor
- Understand the most common reason squirrel cage motors exhibit an impedance unbalance and how to obtain the correct values
- Calculate the correct speed of an operating AC Induction motor by using common measured variables
- Explain the operation of AC Wound rotor Induction motors
- Explain the construction and operation of AC synchronous motors and define their operating characteristics
- Understand the operation & construction of three phase transformers
- Explain the construction and operation and construction DC Motors & Generators
- Identify the major components and their purpose for DC
- Describe the operation of the different types of DC motors and identify their applications
- Describe the stages of electrical insulation failures
- Use all features & functions of the AT7™
- Perform a Rotor Inductance Test (RIT) on a squirrel cage induction motor, create rotor signature using a spread sheet such as Microsoft® Excel for windows
- Evaluate the condition of a squirrel cage rotor based on the RIT
- Perform an MCA™ dynamic test and evaluate both the stator and rotor signature on a squirrel cage motor and compare them to recommended guidelines
- Take MCA™ on an AC wound rotor induction motor
- Perform MCA™ measurements on AC Synchronous motors, on both the Stator and the Rotor
- Explain how to identify faults on single phase coils or DC motors
- Perform individual coil tests on Synchronous motor rotors or DC field coils
- Perform MCA™ tests on three phase transformers and evaluate their condition based on recommended guidelines
- Use the AT7™ to perform MCA™ tests on DC Machines from the controller or directly at the motor
- Perform an armature inductance test using the MOTOR GENIE® both with the armature installed the machine or the armature removed
- Load the MCA PRO™ Software onto a computer



- Create a machine hierarchy
- Create MCA™ routes from machine hierarchy
- Perform MCA™ tests using the route function as well as IND, DC Machines, and Z/ψ functions
- Upload the test data stored in the AT7™
- Map uploaded test data from the input buffer to permanent data base
- Generate and print various reports from MCA PRO™ Software
- Setup up a monitoring schedule for your plant's motors based on criticality of motor

Cost: \$ 12,800.00 USD, Price includes course material for up to 10 attendees, instructor's travel & expenses in the USA & Canada. Prices may vary for events held outside the United States and Canada.

3 Day Electrical Signature Analysis Motor Diagnostic Workshop – Level I

Course Number: 10015

Three days, at the customers' site, of Electrical Signature Analysis (ESA), Energized Motor Testing & Training. This training introduces you to ESA (energized motor testing). This course presents the basic theories and principles necessary to understand the concepts and principles associated with this technology. How ESA uses the motors supply voltage and operating current to detect & identifies faults in the motor system. It teaches the types of faults, and guidelines which can and can't be detected with this motor testing method.

This course uses real world machinery data to teach the students how to operate and understand the basic principles of the ESA software. The principles presented include but are not limited to the development and interpretation of the Fast Fourier Transform (FFT), including an understanding of the importance of spectral resolution, causes and interpretation of sidebands and harmonics in the voltage & current spectrum. It provides an introduction into using the 3 phase PQ measurements and how to combine with the FFT displays to quickly and accurately identify faults in the motor system. It prepares you to evaluate single phase and three phase AC Induction motor systems to improve the reliability and uptime of your plant using the ATPOL II™ analyzer, Power System Manager (PSM) & ALL-TEST Pro ESA software.

This course uses the ALL-TEST Pro instruments, but the theories and principles presented are applicable for all energized motor testing systems.

Course materials include Workbook, ESA 5.0 Software, & ESA Exercise Disk. PC (Laptop) with administrative access (Must run Windows XP or later) provided by the student.

Upon Completion of this course, participants should be able to:

- Understand how to integrate ESA into a new or existing predictive maintenance programs (PdM) to identify & evaluate developing faults or existing faults
- Identify which electrical machines ESA can be performed on
- Understand the safety precautions associated with collecting ESA data
- Take data using the ATPOL II™ analyzer both locally and remotely on AC motors
- Create the ESA data base and upload from the ATPOL II™ to the host computer
- Describe the major components and purpose of these components in AC squirrel cage induction motors
- Explain how AC three phase power creates a rotating magnetic field and develops torque
- Calculate shaft rotating speed based on measure value of volt, current and name plate power and speed
- Describe the stages of rolling element bearing failure
- Explain the importance of spectral band width, center frequency and how to calculate bandwidth and center frequency in a frequency spectrum
- Change the spectral resolution in both the high and low frequency spectrum



- List which electrical & mechanical faults appear in the low frequency spectrum
- List which electrical & mechanical faults appear in the high frequency spectrum
- Explain the benefits of using the logarithmic display in the ESA spectral displays
- Change the resolution in both the high and low frequency
- Explain the types of signal modulation and they present themselves in the electrical spectrum
- Describe how to determine if a fault is the result of incoming power or an actual fault in the motor or driven machine
- Be able to create sideband and harmonic markers in the voltage and current spectra to accurately determine faults in the motor system
- Organize a motor system's important operating characteristics and customize each data set to each specific machine
- To create the files necessary to auto populate each machine's data sets with the machine detail's necessary for custom and automatic analysis on newly collected data
- Explain the dynamic forces that occur with mechanical anomalies on the rotor such as unbalance, misalignment, eccentric rotor, bent shaft, etc.
- Identify which faults can be automatically analyzed using ESA
- Understand the limits and guidelines that are used in fault detection for various faults
- Using available tools, verify automatic analysis generate automatic analysis report
- Define the various failure stages associated with rolling element bearing and identify which failure stage a bearing is currently experiencing
- Describe the causes of static eccentricity, and how to identify this fault in ESA
- List the most common faults associated with squirrel cage rotor
- Determine the severity condition of rotor bars degradation using ESA
- Ability to set classify motors based on critically and establish testing intervals

Cost: \$ 12,800.00 USD, Price includes course material for up to 10 attendees, instructor's travel & expenses in the USA & Canada. Prices may vary for events held outside the United States and Canada.

3 Day Electrical Signature Analysis Training Course – Level II

Course Number: 10044

Three days, at the customers' site, of ESA (Energized) training. This course picks up where the ESA Level I course leaves off. It begins with a brief review of the basic FFT theory, with the addition of more advanced FFT theories as it progresses. The course continues to use a hands-on approach to introduce the use of shaping & aliasing filters in the FFT to gain a better understanding of the presented signal for more accurate analysis. It also covers many of the advanced features of the ATPOL II™ software such as advanced data base setup, SD card operation for routes and trending.

An introduction to the power quality issues that can result in high energy usage, costs or high maintenance costs. PQ issues can lead to equipment instability or eventual failure. It discusses some of the adverse effects that PQ has on electrical equipment operation. Discussions will include power quality issues such as harmonics, voltage unbalance, dips & swells and transients. It also presents the use of additional electrical displays such as time waves & polar graphs for better understanding of any issues or anomalies of the incoming current and voltage signals.

Electrical Machine construction and operating principles are discussed focusing on the construction, assembly & operating principles. This includes AC 1 & 3 phase induction & synchronous motors, 1 & 3 phase transformers, DC motors & generators, wound rotor motors & asynchronous generators. This review focuses on the operating principles and manufacturing or assembly errors that create the dynamic forces, which result in higher operating or maintenance



cost. These principles help the attendees understand the source or cause of these faults, how they occur in the motor system & what can be done to correct them.

Further discussion is presented involving the failures of the bearings that separate the rotating and stationary components, the common failure modes, & how to identify them using ESA. It will discuss faults and malfunctions associated with all types of rolling element as well as fluid film type or plain bearings.

The course continues with discussions about additional electrical and mechanical faults that are encountered by electrical machines as well as mechanical faults that occur within mechanical machines driven by electric motors. This includes gear boxes, fans, generators, wind turbines, horizontal & vertical pumps, or any other machine driven by any electrical machine. A brief discussion of hydraulic issues that occur in fluid systems, such as cavitation, recirculation and flow related resonance will be presented.

The course finishes with a discussion on testing and identifying faults on motors driven by specific electrical controllers such as VFD's & DC Controllers. And an introduction to the use of advanced ESA s/w features such as waterfall displays, torque ripple, and spectral comparison and trending. This course prepares you to evaluate all types of electrical machinery systems and look for electrical and mechanical existing or developing problems, anywhere in the motor system. Course uses the ALL-TEST Pro instruments, but the theories and principles presented are applicable for all Energized motor testing systems.

Course materials Required: Attendee Workbook, ESA 5.0 Software, & ESA Exercise Disk, provided by ALL-TEST Pro, LLC. Laptop with administrative access (must run Windows XP or later) provided by the student.

Upon completion of this course the participants should be able to:

- Take data using the ATPOL II™ analyzer both locally and remotely on electrical equipment
- Transfer data captured from an SD card to a host computer route-based machine hierarchy
- Use the advanced features of the ESA software such as waterfall displays, torque signatures, and comparative analysis
- Define Power Quality and discuss the impact of PQ issues towards electrical efficiency, electrical reliability, and energy costs
- List the different types of electrical equipment, identify their components and describe the purpose of each component
- Explain the operation of the different types of electric equipment
- Describe the stages of rolling element bearing failure and explain how ESA identifies the condition of these types of bearings
- What is meant by pole pass frequency (PPF) & how is it calculated
- Determine Motor Shaft Speed based on Measured Values of Voltage, Current, Nameplate Speed and Rated Power and calculated PPF
- Describe the electrical & mechanical faults can be analyzed with ESA and what causes these faults & guidelines on how to correct them
- Discuss the relationship of Dynamic Load and bearing life
- Discuss the effects of Resonance in a mechanical system and what it will do to the electrical spectrum
- Discuss guidelines on how to confirm and correct mechanical resonance issues
- Explain what gear faults or issues create dynamic forces between gears during operation under fault conditions
- Discuss how to determine which gear is at fault when gear problems are diagnosed using ESA
- Understand and define the terms used in ESA
- Evaluate the condition of a squirrel cage rotor using the ESA spectrum and determine severity of the fault and most likely causes
- Explain the faults that causes Static Eccentricity
- Define a thermally sensitive rotor and explain how it affects the Electrical Signature



- Identify which displays, Hi Frequency, Lo Frequency or Demod spectrum faults will be used to identify all of the electrical and mechanical faults
- Understand how to set up ATPOL II™ for various electrical testing, such as transients & PQ studies
- Reprogram the ATPOL II™ using an SD card
- Discuss the types of DC motor controller faults that will be identified from the electrical spectrum
- Discuss the types of VFD faults that can be identified using the energized motor data captured by the ATPOL II™
- Demonstrate the ability to set up and perform predictive maintenance routes and upload the test data using the ATPOL II™
- Set-up and implement an energized motor testing program using the ATPOL II™

Cost: \$ 12,800.00 USD, Price includes course material for up to 10 attendees, instructor's travel & expenses in the USA & Canada. Prices may vary for events held outside the United States and Canada.

5 Day Motor Circuit Analysis & Electrical Signature Analysis Training Course – Level I

Course Number: 10034

This course is a combination of the (3) day MCA™ (deenergized Training) and the (2) day ESA (Energized Training) Level I. Course is performed at customers' site. See those course descriptions for details.

Course materials include Workbook, Motor Circuit Analysis manual, ESA 5.0 software & ESA exercise Disk. PC (Laptop) with administrative access (Must run Windows XP or later) provided by the student.

Cost: \$ 18,500.00 USD, Price includes course material for up to 10 attendees, instructor's travel & expenses in the USA & Canada. Prices may vary for events held outside the United States and Canada.

5 Day Motor Circuit Analysis & Electrical Signature Analysis Training Course – Level II

Course Number: 10039

This course is a combination of the (3) day MCA™ (deenergized Training) and the (2) day ESA (Energized Training) Level II. Course is performed at customers' site. See those course descriptions for details.

Course materials include Workbook, Motor Circuit Analysis manual, ESA 5.0 software & ESA exercise Disk. PC (Laptop) with administrative access (Must run Windows XP or later) provided by the student.

Cost: \$ 18,650.00 USD, Price includes course material for up to 10 attendees, instructor's travel & expenses in the USA & Canada. Prices may vary for events held outside the United States and Canada.



Virtual Domestic and International On-Site Training Course For 10 Attendees

Level I

Course Type: Virtual Classroom. Live Instructor.

Pre-Requisites: None

Technology Requirements: Students attending this course must have their own laptop. Laptop must have administrative rights to install software. Minimum operating system and software to be installed on the laptop should be Windows XP, with Microsoft Word and Excel 2003.

Format: Blended, Self-Paced and Instructor Lead Virtual Classroom

Assessment Style: Graded Test, Pass/Fail

Duration:

3 Day MCA™ Level I: 3 Days/22 Instructor Led Hours, 2 Self-Paced Hours

3 Day ESA Level I: 3 Days/22 Instructor Led Hours, 2 Self-Paced Hours

5 Day MCA & ESA Level I: 5 Days/36 Instructor Led Hours, 4 Self-Paced Hours

CEU Award: ALL-TEST Pro, LLC is authorized by IACET to offer:

2.4 CEUs for 3 Day Courses

4.0 CEUs for 5 Day Courses

As an IACET Accredited Provider, ALL-TEST Pro, LLC offers CEUs for its programs that qualify under the ANSI/IACET Standard.

Instructor: William Kruger

Level II

Course Type: Virtual Classroom. Live Instructor.

Pre-Requisites: MDW Level I or previous ATP MDW, 5 Day MCA & ESA MDW Level I, MCA™ Level I or a previous 3-day MCA™ course and ESA Introductory Course or previous ATP ESA course.

Technology Requirements: Students attending this course must have their own laptop. Laptop must have administrative rights to install software or have software previously installed. Minimum operating system and software to be installed on the laptop should be Windows XP, with Microsoft Word and Excel 2003.

Format: Blended, Self-Paced and Instructor Lead Virtual Classroom

Assessment Style: Graded Test, Pass/Fail

Duration:

3 Day MCA™ Level II: 3 Days/22 Instructor Led Hours, 2 Self-Paced Hours

3 Day ESA Level II: 3 Days/22 Instructor Led Hours, 2 Self-Paced Hours

5 Day MCA & ESA Level II: 5 Days/36 Instructor Led Hours, 4 Self-Paced Hours

CEU Award: ALL-TEST Pro, LLC is authorized by IACET to offer:

2.4 CEUs for 3 Day Courses

4.0 CEUs for 5 Day Courses

As an IACET Accredited Provider, ALL-TEST Pro, LLC offers CEUs for its programs that qualify under the ANSI/IACET Standard.

Instructor: William Kruger



3 Day Motor Circuit Analysis Training Course – Level I

Course Number: 10058

Three days, virtual classroom, of MCA™ (deenergized) training introduces you to MCA™ (deenergized low voltage winding insulation testing). This course presents the basic theories and principles necessary to understand the concepts and principles associated with this technology. It identifies the types of faults, and guidelines that can be detected with this motor testing method. This course uses a combination of theory and hands on exercises using the instruments to provide the student with a basic understanding of this very powerful deenergized winding testing method. This course prepares you to test & troubleshoot single phase and 3 phase AC electric motors, coils, and windings, and improve the reliability and uptime of your plant. *Course materials include Workbook and Motor Circuit Analysis Manual.*

Upon Completion of this course, participants should be able to:

- Understand why most winding insulation degradation goes undetected until catastrophic failure occurs
- Describe the main types of failures associated with AC Motors
- Develop a basic understanding of how the chemical makeup of the electrical insulations can affect its response to injected low voltage signals
- Understand the basic laws & principles of Electro-magnetism
- Review the basic physics principles such as the Oersted's & Faraday's law, combined with the theory of relativity & Maxwell's equation & other atomic & electrical laws that have led to the development our modern electrical machinery & learn how these principles combine to affect the electrical response of signals injected to the machines winding system
- Describe how changes in the insulation systems affect the R, L, Z, and I/F of the winding system
- Explain how Joule's Law, Ohms Law, and Faraday's Law affect the various measurement used in MCA™
- Identify the components in the winding system; factors that determine Resistance (R), Inductance (L), Capacitance (C), and Impedance (I/F)
- Use the AT7™ to establish a machines condition using static testing & to manually measure R, L, Z, Fi and I/F
- List the different types of AC Motors, identify their components and describe the purpose of each component
- Understand how the major components are assembled and how different configurations affect motor operation, efficiency, and response to low voltage injected signals
- Review how the rotating magnetic field and torque are developed in an AC induction motor
- Understand how motor shaft speed is affected by Voltage, Current, Nameplate Speed and Rated Power
- Learn how electrical insulation fails & the various failure stages & how to use MCA™ to identify the failure stages
- Review the various techniques available to identify electrical insulation failures in winding systems
- Familiarize themselves with the various measurements and guidelines associated with MCA™
- Use MCA™ measurements to evaluate a motor's winding insulation condition
- Learn how to recognize when to correct MCA™ readings caused by "Rotor Position"
- Learn how to verify & correct for winding insulation alarms caused by "Rotor Position"
- Understand the most common faults associated squirrel cage motors
- Learn how to perform a dynamic test using the AT7™
- Learn to perform, interpret & evaluate an AC squirrel cage induction motor's winding & rotor condition using the AT7™ DYN test
- Learn how to set-up & operate the MCA™ Basic software
- Understand how to connect AT7™ to host computer, upload MCA™ tests stored in an AT7™ to MCA Basic software input buffer
- Learn how to map data from input buffer to permanent machine data base
- Learn how to create & print reports from the MCA Basic™ software

Cost: \$ 10,800.00 USD, Price includes course material for up to 10 attendees.



3 Day Motor Circuit Analysis Training Course - Level II

Course Number: 10059

Three days, virtual classroom, of MCA™ (deenergized) training picks up where the MCA™ Level I leaves off. It prepares you to troubleshoot all types of electric motors, coils, and windings. This course combines a review of the principles and guidelines presented in the MCA™ Level I course with the new principles necessary to perform MCA™ on all types of electrical machines, including, but not limited to Synchronous motors, DC motors & Generators, Transformers, Wound Rotor motors & Asynchronous Generators. Also presents all of the function and features of the AT7™ and the MCA PRO™ Software. This course requires the use of computers with the MCA™ demo software installed, or administrative rights on your computer. *Course materials include Workbook and Motor Circuit Analysis Manual.*

Upon Completion of this course, participants should be able to:

- Use all features & functions of the AT7™ for all machines & winding types
- Determine which feature or function is used to evaluate all various machine and winding types
- Understand the atomic & electrical theories presented in MCA Level I course
- Perform and understand the guidelines for determining the condition of the ground wall insulation systems Insulation Resistance to Ground (IRG),
- Define MCA™ measurements of resistance(R), Inductance (L), Impedance (Z), Phase Angle (Fi) & Current Frequency Response (I/F)
- Manually measure: R, L, Z, Fi and I/F using the AT7™
- Establish a reference value to define the condition of a motor's winding condition using the Static motor test
- Explain the construction of most common types of industrial electrical equipment, identify their major components and define the purposes of each major component
- Explain the various designs of squirrel cage rotors, and understand the speed vs torque curves
- Define the bearing failure stages of rolling element bearings
- Explain the development of torque & the rotating magnetic field in an AC Induction motor
- Understand the most common reason squirrel cage motors exhibit an impedance unbalance and how to obtain the correct values
- Calculate the correct speed of an operating AC Induction motor by using common measured variables
- Explain the operation of AC Wound rotor Induction motors
- Explain the construction and operation of AC synchronous motors and define their operating characteristics
- Understand the operation & construction of three phase transformers
- Explain the construction and operation and construction DC Motors & Generators
- Identify the major components and their purpose for DC
- Describe the operation of the different types of DC motors and identify their applications
- Describe the stages of electrical insulation failures
- Use all features & functions of the AT7™
- Perform a Rotor Inductance Test (RIT) on a squirrel cage induction motor, create rotor signature using a spread sheet such as Microsoft® Excel for windows
- Evaluate the condition of a squirrel cage rotor based on the RIT
- Perform an MCA™ dynamic test and evaluate both the stator and rotor signature on a squirrel cage motor and compare them to recommended guidelines
- Take MCA™ on an AC wound rotor induction motor
- Perform MCA™ measurements on AC Synchronous motors, on both the Stator and the Rotor
- Explain how to identify faults on single phase coils or DC motors
- Perform individual coil tests on Synchronous motor rotors or DC field coils
- Perform MCA™ tests on three phase transformers and evaluate their condition based on recommended guidelines
- Use the AT7™ to perform MCA™ tests on DC Machines from the controller or directly at the motor
- Perform an armature inductance test using the MOTOR GENIE® both with the armature installed the machine or the armature removed
- Load the MCA PRO™ Software onto a computer



- Create a machine hierarchy
- Create MCA™ routes from machine hierarchy
- Perform MCA™ tests using the route function as well as IND, DC Machines, and Z/ψ functions
- Upload the test data stored in the AT7™
- Map uploaded test data from the input buffer to permanent data base
- Generate and print various reports from MCA PRO™ Software
- Setup up a monitoring schedule for your plant's motors based on criticality of motor

Cost: \$ 10,800.00 USD, Price includes course material for up to 10 attendees.

3 Day Electrical Signature Analysis Motor Diagnostic Workshop – Level I

Course Number: 10060

Three days, virtual classroom, of Electrical Signature Analysis (ESA), Energized Motor Testing & Training. This training introduces you to ESA (energized motor testing). This course presents the basic theories and principles necessary to understand the concepts and principles associated with this technology. How ESA uses the motors supply voltage and operating current to detect & identifies faults in the motor system. It teaches the types of faults, and guidelines which can and can't be detected with this motor testing method.

This course uses real world machinery data to teach the students how to operate and understand the basic principles of the ESA software. The principles presented include but are not limited to the development and interpretation of the Fast Fourier Transform (FFT), including an understanding of the importance of spectral resolution, causes and interpretation of sidebands and harmonics in the voltage & current spectrum. It provides an introduction into using the 3 phase PQ measurements and how to combine with the FFT displays to quickly and accurately identify faults in the motor system. It prepares you to evaluate single phase and three phase AC Induction motor systems to improve the reliability and uptime of your plant using the ATPOL II™ analyzer, Power System Manager (PSM) & ALL-TEST Pro ESA software.

This course uses the ALL-TEST Pro instruments, but the theories and principles presented are applicable for all energized motor testing systems.

Course materials include Workbook, ESA 5.0 Software, & ESA Exercise Disk. PC (Laptop) with administrative access (Must run Windows XP or later) provided by the student.

Upon Completion of this course, participants should be able to:

- Understand how to integrate ESA into a new or existing predictive maintenance programs (PdM) to identify & evaluate developing faults or existing faults
- Identify which electrical machines ESA can be performed on
- Understand the safety precautions associated with collecting ESA data
- Take data using the ATPOL II™ analyzer both locally and remotely on AC motors
- Create the ESA data base and upload from the ATPOL II™ to the host computer
- Describe the major components and purpose of these components in AC squirrel cage induction motors
- Explain how AC three phase power creates a rotating magnetic field and develops torque
- Calculate shaft rotating speed based on measure value of volt, current and name plate power and speed
- Describe the stages of rolling element bearing failure
- Explain the importance of spectral band width, center frequency and how to calculate bandwidth and center frequency in a frequency spectrum
- Change the spectral resolution in both the high and low frequency spectrum
- List which electrical & mechanical faults appear in the low frequency spectrum
- List which electrical & mechanical faults appear in the high frequency spectrum



- Explain the benefits of using the logarithmic display in the ESA spectral displays
- Change the resolution in both the high and low frequency
- Explain the types of signal modulation and they present themselves in the electrical spectrum
- Describe how to determine if a fault is the result of incoming power or an actual fault in the motor or driven machine
- Be able to create sideband and harmonic markers in the voltage and current spectra to accurately determine faults in the motor system
- Organize a motor system's important operating characteristics and customize each data set to each specific machine
- To create the files necessary to auto populate each machine's data sets with the machine detail's necessary for custom and automatic analysis on newly collected data
- Explain the dynamic forces that occur with mechanical anomalies on the rotor such as unbalance, misalignment, eccentric rotor, bent shaft, etc.
- Identify which faults can be automatically analyzed using ESA
- Understand the limits and guidelines that are used in fault detection for various faults
- Using available tools, verify automatic analysis generate automatic analysis report
- Define the various failure stages associated with rolling element bearing and identify which failure stage a bearing is currently experiencing
- Describe the causes of static eccentricity, and how to identify this fault in ESA
- List the most common faults associated with squirrel cage rotor
- Determine the severity condition of rotor bars degradation using ESA
- Ability to set classify motors based on critically and establish testing intervals

Cost: \$ 10,800.00 USD, Price includes course material for up to 10 attendees.

3 Day Electrical Signature Analysis Training Course – Level II

Course Number: 10061

Three days, virtual classroom, of ESA (Energized) training. This course picks up where the ESA Level I course leaves off. It begins with a brief review of the basic FFT theory, with the addition of more advanced FFT theories as it progresses. The course continues to use a hands-on approach to introduce the use of shaping & aliasing filters in the FFT to gain a better understanding of the presented signal for more accurate analysis. It also covers many of the advanced features of the ATPOL II™ software such as advanced data base setup, SD card operation for routes and trending.

An introduction to the power quality issues that can result in high energy usage, costs or high maintenance costs. PQ issues can lead to equipment instability or eventual failure. It discusses some of the adverse effects that PQ has on electrical equipment operation. Discussions will include power quality issues such as harmonics, voltage unbalance, dips & swells and transients. It also presents the use of additional electrical displays such as time waves & polar graphs for better understanding of any issues or anomalies of the incoming current and voltage signals.

Electrical Machine construction and operating principles are discussed focusing on the construction, assembly & operating principles. This includes AC 1 & 3 phase induction & synchronous motors, 1 & 3 phase transformers, DC motors & generators, wound rotor motors & asynchronous generators. This review focuses on the operating principles and manufacturing or assembly errors that create the dynamic forces, which result in higher operating or maintenance cost. These principles help the attendees understand the source or cause of these faults, how they occur in the motor system & what can be done to correct them.



Further discussion is presented involving the failures of the bearings that separate the rotating and stationary components, the common failure modes, & how to identify them using ESA. It will discuss faults and malfunctions associated with all types of rolling element as well as fluid film type or plain bearings.

The course continues with discussions about additional electrical and mechanical faults that are encountered by electrical machines as well as mechanical faults that occur within mechanical machines driven by electric motors. This includes gear boxes, fans, generators, wind turbines, horizontal & vertical pumps, or any other machine driven by any electrical machine. A brief discussion of hydraulic issues that occur in fluid systems, such as cavitation, recirculation and flow related resonance will be presented.

The course finishes with a discussion on testing and identifying faults on motors driven by specific electrical controllers such as VFD's & DC Controllers. And an introduction to the use of advanced ESA s/w features such as waterfall displays, torque ripple, and spectral comparison and trending. This course prepares you to evaluate all types of electrical machinery systems and look for electrical and mechanical existing or developing problems, anywhere in the motor system. Course uses the ALL-TEST Pro instruments, but the theories and principles presented are applicable for all Energized motor testing systems.

Course materials Required: Attendee Workbook, ESA 5.0 Software, & ESA Exercise Disk, provided by ALL-TEST Pro, LLC. Laptop with administrative access (must run Windows XP or later) provided by the student.

Upon completion of this course the participants should be able to:

- Take data using the ATPOL II™ analyzer both locally and remotely on electrical equipment
- Transfer data captured from an SD card to a host computer route-based machine hierarchy
- Use the advanced features of the ESA software such as waterfall displays, torque signatures, and comparative analysis
- Define Power Quality and discuss the impact of PQ issues towards electrical efficiency, electrical reliability, and energy costs
- List the different types of electrical equipment, identify their components and describe the purpose of each component
- Explain the operation of the different types of electric equipment
- Describe the stages of rolling element bearing failure and explain how ESA identifies the condition of these types of bearings
- What is meant by pole pass frequency (PPF) & how is it calculated
- Determine Motor Shaft Speed based on Measured Values of Voltage, Current, Nameplate Speed and Rated Power and calculated PPF
- Describe the electrical & mechanical faults can be analyzed with ESA and what causes these faults & guidelines on how to correct them
- Discuss the relationship of Dynamic Load and bearing life
- Discuss the effects of Resonance in a mechanical system and what it will do to the electrical spectrum
- Discuss guidelines on how to confirm and correct mechanical resonance issues
- Explain what gear faults or issues create dynamic forces between gears during operation under fault conditions
- Discuss how to determine which gear is at fault when gear problems are diagnosed using ESA
- Understand and define the terms used in ESA
- Evaluate the condition of a squirrel cage rotor using the ESA spectrum and determine severity of the fault and most likely causes
- Explain the faults that causes Static Eccentricity
- Define a thermally sensitive rotor and explain how it affects the Electrical Signature
- Identify which displays, Hi Frequency, Lo Frequency or Demod spectrum faults will used to identify all of the electrical and mechanical faults
- Understand how to set up ATPOL II™ for various electrical testing, such as transients & PQ studies
- Reprogram the ATPOL II™ using an SD card



- Discuss the types of DC motor controller faults that will be identified from the electrical spectrum
- Discuss the types of VFD faults that can be identified using the energized motor data captured by the ATPOL II™
- Demonstrate the ability to set up and perform predictive maintenance routes and upload the test data using the ATPOL II™
- Set-up and implement an energized motor testing program using the ATPOL II™

Cost: \$ 10,800.00 USD, Price includes course material for up to 10 attendees.

5 Day Motor Circuit Analysis & Electrical Signature Analysis Training Course – Level I

Course Number: 10062

This course is a combination of the (3) day MCA™ (deenergized Training) and the (2) day ESA (Energized Training) Level I. Course is virtual with a live instructor. See those course descriptions for details.

Course materials include Workbook, Motor Circuit Analysis manual, ESA 5.0 software & ESA exercise Disk. PC (Laptop) with administrative access (Must run Windows XP or later) provided by the student.

Cost: \$ 16,500.00 USD, Price includes course material for up to 10 attendees.

5 Day Motor Circuit Analysis & Electrical Signature Analysis Training Course – Level II

Course Number: 10060

This course is a combination of the (3) day MCA™ (deenergized Training) and the (2) day ESA (Energized Training) Level II. Course is virtual with a live instructor. See those course descriptions for details.

Course materials include Workbook, Motor Circuit Analysis manual, ESA 5.0 software & ESA exercise Disk. PC (Laptop) with administrative access (Must run Windows XP or later) provided by the student.

Cost: \$ 16,650.00 USD, Price includes course material for up to 10 attendees.



International Public & On-Site

For information on our International Public (Distributor Held) Motor Diagnostic Workshops and International On-Site Training Courses, please contact us at 860-399-4222 or email us at CE@alltestpro.com.

On-Line Course Information

Course Type: On-Line, Pre-recorded, computer based

Pre-Requisites: None

Assessment Style: Self assessed

Duration: 3 hours

AT33 IND™ On-Line Course

Course Number: 10032

This introductory course will present the theory and application behind the latest techniques in evaluating the condition of low voltage, 3 phase, and squirrel cage induction motors. This course goes beyond the standard measurements of insulation resistance to ground and winding insulation to enable the user to easily and automatically evaluate both of the motors insulation system. The class will also describe the measurement techniques in low voltage motor testing, the theories behind them and how to apply them. It will also discuss how to collect and interpret the data taken with the ALL-TEST PRO 33 IND™.

- Course will take approx. 3 hours, but will expire after 30 days
- Course is pre-recorded and taken at the students' pace
- Course is intended for all AT33 IND™ users
- Course is appropriate for interested purchasers of the AT33 IND™
- Downloadable AT33 IND™ user manual
- AT33 IND™ Instrument and test motor recommended but not required
- Have an understanding of "Improving Electrical Reliability"
- Implement a Deenergized Testing program
- Reduce the amount of catastrophic failures in your plant or facility
- Provide insight on how to improve the electrical reliability within your plant
- Identify the components in the winding system; factors that determine Resistance (R), Inductance (L), Capacitance (C) and Impedance (I/F)
- Describe how changes in R, L Z and I/F affect the winding system
- Use the basic MCA™ instruments to manually measure Static 33 DYN Test
- List the main types of failures associated with AC motors
- Explain the various measurements used in MCA™
- Evaluate a motor's winding condition based on MCA™ measurements
- Explain the purpose of the ALL-TEST PRO 33 IND™ and its features
- Obtain data from a 3 phase AC motor using the AT33 IND™ (on the AUTO and manual modes)
- Evaluate the condition of an AC Motor based on the measurements taken with the AT33 IND™

Cost: \$199.00 USD for 3-hour course