

34<sup>TH</sup> ANNUAL

# HANDS-ON Relay School

MARCH 13–17, 2017



**WASHINGTON STATE UNIVERSITY  
PULLMAN, WASHINGTON**

**SPONSORED BY:**

**Western Energy Institute | Washington State University**

**ONE WEEK FOR ONLY \$650**

**Applications Accepted November 1, 2016 – January 25, 2017**



**Conference Management**

WASHINGTON STATE UNIVERSITY

34<sup>TH</sup> ANNUAL

# HANDS-ON Relay School

“This program is an incredible resource. All the instructors display great passion for the industry and the desire to pass on knowledge.”

“Nowhere else can you learn this much in one week.”

“The structure of taking senior and experienced technicians and letting them teach, walk through relays, and pass that experience on to upcoming technicians. What an outstanding concept.”

“The school provides excellent hands-on training with equipment that I am directly exposed to daily, along with the necessary theory to provide a strong understanding of protection.”

**WesternEnergy**  
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Conference Management

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# OBJECTIVES OF THE HANDS-ON RELAY SCHOOL

**The Hands-On Relay School is a professional development short course to train protective relay technicians, electrical/power plant technicians, engineers, and protective relay test specialists.**

Students are enrolled in one of seven tracks for the duration of the school.

- Basic
- Distribution
- Transmission
- Generation
- Electromechanical
- Automated Relay Testing
- Theory

Students participating in these tracks will:

- Become familiar with manual or automated test methods for a variety of protective relays and test equipment.
- Gain valuable knowledge relating to relay applications and operating characteristics.
- Exchange ideas and resolve problems in an open forum.
- Learn preventative and corrective maintenance methods.

## Application

School enrollment is limited, and priority is given to organizations providing Lab Facilitators, Lecturers, Steering Committee support, and Western Energy Institute member utilities. Refer to important application and enrollment procedures at the end of this brochure.

## Call for Lab Facilitators

If you are an experienced relay technician who is willing to share your knowledge with others, you can attend the Hands-On Relay School as a lab facilitator. Lab facilitators work with groups of three students in the hands-on labs testing relays and may attend all classroom lectures and school activities. Lab facilitators are not required to pay the application fee and their company receives priority points for students applying for the school. If you are interested, contact WSU Conference Management at **800-942-4978** or **509-335-3530** or sign up at **<http://cm.wsu.edu/hrs>**.

## BASIC TRACK

**This track is for those students who wish to focus on the calibration, maintenance, testing, and understanding of basic relays. The selection of relays may include overcurrent, differential, distance, reclosing, voltage, or frequency relays. This track is an excellent choice for beginning technicians. [ 48 students maximum ]**

### **Students in this track will:**

- Attend the Introduction to System Protection lecture series on Monday.
- Choose four Concurrent Open Lectures to attend on Tuesday.
- Attend the Friday Feature Lecture Presentations.
- Wire an overcurrent and a reclosing relay to a breaker simulator to test and troubleshoot an entire protection circuit.
- Perform hands-on testing in the lab on the following relays:
  - ABB: RC, IRD-9
  - Basler: BE1-79A, BE1-27/59
  - GE: IAC, BDD, CEY51A
  - SEL: 551

### **..... Introduction to System Protection Lecture Series**

This lecture series is for beginning relay technicians, newcomers to the relaying field, or anyone who needs the basics. We start with the very basics of relaying to provide a foundation of knowledge upon which to build. The closest thing to “Relaying for Dummies” that Hands-On Relay School has to offer! Taught by experienced system protection personnel, this lecture series will be presented on **Monday only** from **7:45AM – 3:00PM**.

### **Topics include:**

- Introduction to Protection Basics and Terminology  
*Brent Carper, Relay Application Innovation*
- Technicians Basic Math Review  
*Ron Alexander, Bonneville Power Administration*
- Mho Testing Techniques & Math  
*Rodger Allen, ACS Professional Staffing*
- Lessons Learned from the Field  
*Paul Luther, Puget Sound Energy*

# RELAY SCHOOL

## DISTRIBUTION TRACK

**This track is for those students who wish to focus on the testing and understanding of multifunction microprocessor relays and recloser controllers used for distribution protection. The selection of relays may include overcurrent, transformer differential, reclosing, synch-check, and frequency protection.**

[ 18 students maximum ] [ Laptop Computer Required ]

### **Students in this track will:**

- Attend the Distribution Overview lecture.
- Choose six Concurrent Open Lectures to attend.
- Attend the Friday Feature Lecture Presentations.
- Perform hands-on testing in the lab on the following relays:

ABB: REF615

Beckwith: M7651A

Cooper: Form 6

GE: F60

SEL: 351S, 787

## **Distribution Protection Overview Lecture**

*Kevin Damron, Avista, Spokane, WA*

This lecture will review fundamental principles of distribution system protection, including IEEE device designations, fault current calculations, coordination of overcurrent protection, and reclosing schemes.



## TRANSMISSION TRACK

**This track features both electromechanical and microprocessor-based multi-function relays used for protection of transmission equipment, including distance and line current differential protection.**

[ 24 students maximum ] [ Laptop Computer Required ]

**Students in this track will:**

- Attend the Transmission Overview lecture.
- Choose six Concurrent Open Lectures to attend.
- Attend the Friday Feature Lecture Presentations.
- Perform hands-on testing in the lab on the following relays:

ABB: KD10, RED670

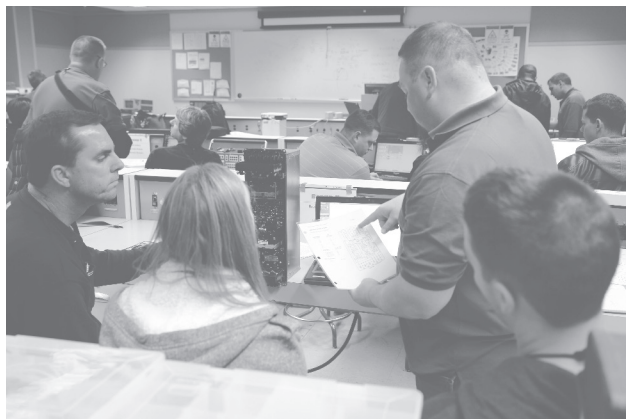
GE: L90, PVD

SEL: 411L

.....  
**Transmission Protection Overview Lecture**

*Roy Moxley, Siemens*

This lecture will review fundamental principles of transmission line protection. Concepts of distance protection, directional overcurrent, line differential, and communication assisted tripping will be discussed.



# RELAY SCHOOL

## GENERATION TRACK

**This track features electromechanical and multifunction microprocessor relays used for transformer and generator differential, over-excitation, stator ground, reverse power, synch-check, negative sequence, and loss of field protection of generators.**

[ 24 students maximum ] [ Laptop Computer Required ]

### **Students in this track will:**

- Attend the Generation Protection Overview lecture.
- Choose six Concurrent Open Lectures to attend.
- Attend the Friday Feature Lecture Presentations.
- Perform hands-on testing in the lab on the following relays:

Basler: BE1-11G

Beckwith: M3425A

GE: CEX57/GSY51

SEL: 700G

Siemens: 7UM621

### **..... Generation Protection Theory and Application Overview Lecture**

*Rogério Scharlach, Schweitzer Engineering Laboratories, Inc*

This lecture will review fundamental principles of generation protection theory and application with a focus on industry standards and best practices.



## ELECTROMECHANICAL TRACK

**This track focuses exclusively on electromechanical relays used for line, bus, transformer, or generator protection. More hands-on effort is spent on troubleshooting relay problems, calibrating relays, adjustment techniques, and verifying results. [ 12 students maximum ]**

**Prerequisite:** Basic track or related experience.

**Students in this track will:**

- Attend their choice of Distribution, Transmission, or Generation Protection Overview lecture.
- Choose six Concurrent Open Lectures to attend.
- Attend the Friday Feature Lecture Presentations.
- Perform hands-on testing in the lab on the following relays:  
ABB: KD11, KLF1, HU  
GE: PVD, INC77, GCX51, JBCG





# RELAY SCHOOL

## AUTOMATED TESTING TRACK

**This track is intended for technicians who already understand relay operating principals, have experience in manual testing, and are ready to learn automated testing methods.** [ student maximum varies ]

**Note:** This track is NOT recommended for those relay technicians who are just starting out. The emphasis of this track is on the test equipment and software, not on the relays. The hands-on labs are taught by the test equipment and software manufacturers, not by the relay manufacturers.

**Prerequisite:** Experience in manual relay testing and computer use. A laptop computer will be used to communicate with the relays and/or the test set. All students must have administrative rights to their laptop, with the appropriate software pre-loaded.

### **Students in this track will:**

- Attend an Overview Lecture provided by the test equipment or software manufacturer.
- Choose six Concurrent Open Lectures to attend.
- Attend the Friday Feature Lecture Presentations.
- Perform hands-on testing in the lab using one of the following testing software programs:

Doble

Enoserv RTS

Manta

Megger AVTS

Omicron

Noram SMC

Some test software vendors will offer both a Beginning and an Advanced section, depending on enrollment and skill level of the students. Beginning automated testing still requires a prerequisite understanding of manual testing.

## THEORY TRACK

**This track provides more in-depth training on application and theory of operation of protection systems utilized in the power system. This track does not normally include any hands-on training with relays, but will include some hands-on use of your laptop. [ Laptop computer required ]**

Emphasis this year will be on Communication concepts and applications.

**Note:** The theory track is for the journeyman relay technician and relay engineers. It is NOT recommended for those relay technicians who are just starting out. Instructors and lecturers for the theory track are considered to be experts in their field. Students are expected to bring their own laptop PC with administrative privileges over the operating system sufficient to load vendor software.

### **Students in this track will:**

- Attend the Theory Communication Overview lecture.
- Choose six Concurrent Open Lectures to attend.
- Attend the Monday and Tuesday PM and all day Wednesday and Thursday Lectures.
- Attend the Friday Feature Lecture Presentations.
- Attend the advanced topic lectures throughout the week, as follows.

### **Theory Track Overview**

*David Belcher & John Stohel,  
Bonneville Power Administration*

This lecture will review the three fundamental methods of transmitting data that are primarily used in protection schemes. Discussion will include some of the advantages and disadvantages of radio, fiber and Power Line Carrier.

### **IP Based Data Communication Networks**

*Joe Andres, Bonneville Power Administration*

Topics covered are the OSI model, hubs, switches, and routers. The students will trace a packet's journey across a local and wide area network.

### **RS-232 Standard, Modems, and PSTN Connectivity**

*Karin Butler & Chris Martin,  
Bonneville Power Administration*

This class will cover both the RS-232 standard used in relay communications and modems used on Public Switched Telephone Networks. In the RS-232 section, students will learn about the standard, handshaking, and basic troubleshooting

# RELAY SCHOOL

## THEORY TRACK

techniques. Students are encouraged to bring their own RS-232 breakout box if they have one available. In the modems section, students will learn about the Hayes command set, initialization strings, and flow control modem troubleshooting. There will be a demonstration of telephone connectivity via a line sharing switch and polling controller.

**Please note:** Includes hands-on exercises requiring students to bring their own laptop PC.

### Communications History and Basic Principles

*Tim Walker, Omicron*

This lecture will review the history and basic principles of communications applied for protection automation and control. It discusses the fundamentals, applications, and benefits of IEC 61850, the standard for communication networks and systems for power utility automation, in a combination of theoretical and demonstration sessions. Commissioning and testing of digital substations using IEC 61850 is discussed with a review of the testing tool's requirements.

### Power Line Carrier

*Mike O'Neal, RFL Electronics, Inc*

The course will cover the basics of the power line carrier. Applications and theory will be introduced. Typical channel elements will be discussed, including transmitters/receivers, hybrids, line tuners, line traps, instrumentation, and transmission line characteristics at RF frequencies. A basic channel performance exercise will bring all the information together in a practical, real-world example.

### IRIG Timecode and Relays

*Larry Gross & Rick Turner, Relay Application Innovation*

Learn the basics of how IRIG timecodes are used with relays. Discussion will include why it is important, applications, functional testing, and troubleshooting.

### Relay Communication Schemes

*Larry Gross & Rick Turner, Relay Application Innovation*

Learn how a POTT, DCB, current differential, and some variations on these work in general and relative to their communication media. Discussion will include functional testing and troubleshooting using event reports.

## THEORY TRACK cont.

### Cyber Attacks

*Dr. Murty Yalla, Beckwith Electric*

Cyber attacks on an electric power system can have a devastating impact and cause widespread power outages as evident from the December 2015 cyber attack on a Ukrainian electric power distribution system. Securing the electric power system from cyber attacks is of national importance, and in North America, NERC is spearheading the effort in developing and enforcing Critical Infrastructure Protection (CIP) standards for the Bulk Electric System (BES).

The presentation discusses cybersecurity basics including passwords, access management, authentication, and encryption. The tutorial also covers latest NERC CIP requirements. A brief overview of IEEE standards related to cybersecurity is presented. A cybersecurity implementation example for IEDs used in electric power distribution protection and control is presented.

## CONCURRENT OPEN LECTURES

The Hands-On Relay School offers twelve lectures on a wide range of topics relevant to the trade. Each lecture is one hour long and given a total of three times. Students can attend up to six lectures of their choosing.

### Basic Math Review for Relay Techs

*Bill Unbehaun, Tacoma Power*

Forgot some of that high school math but embarrassed to ask? This is a no-guilt refresher on some important bits of math and geometry that should be at our fingertips. We'll cover geometry, arithmetic, Cartesian planes, trigonometry, and algebra as they're used in electrical theory and relay work at the "hands-on" level.

### Bus Protection

*Robert Smallwood, Portland General Electric*

This lecture will cover various types of bus protection relaying, including low/high impedance, summation, and partial bus differential schemes. Less common blocking and optical detection schemes are covered. The requirements for setting relays in a bus differential scheme will be described.

# RELAY SCHOOL

## CONCURRENT OPEN LECTURES

### ..... **Communication Aided Tripping**

*Jared Mraz & Matt Horvath, POWER Engineers*

When speed is a necessity for transmission line protection, communication between line terminals can provide high speed clearing of faults. Topics include communication aided protection schemes and the equipment that makes it possible.

### ..... **CT Testing**

*Steve Laslo, Bonneville Power Administration*

Opening an energized current transformer (CT) secondary can result in very hazardous voltages and possible damage to the CT. This is a discussion of how a CT can generate high voltages, some video demonstrations of an open CT secondary, and suggested work practices to safely work on current transformer secondaries.

### ..... **Fault Analysis for Relay Technicians**

*Ken Workman, Schweitzer Engineering Laboratories*

Event reports continue to be an invaluable feature in microprocessor-based relays. Some events are relatively straightforward to analyze, and others require experience and considerable knowledge of the power system and protective relay system in order to find the root cause. This session provides an outline of the event analysis process, several real-world event examples, time to evaluate them, and solutions.

### ..... **Phasor Diagrams**

*Ron Alexander, Bonneville Power Administration*

Phasors are the universal language of system protection technicians and engineers. This lecture emphasizes the need for a basic knowledge of phasor diagrams and their use in understanding the power system. Topics include load flow phasor analysis, fault phasor analysis, and using phasors to determine the phase angle across delta-wye transformer banks

### ..... **Series Capacitors**

*Michael Hulse, Bonneville Power Administration*

What are series capacitors and why do we use them in electrical transmission systems? This lecture covers the theory of how these devices work, the benefits, and the systems/schemes employed to protect them.

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## **Substation Commissioning**

**Paul Luther, Puget Sound Energy**

*A discussion on substation commissioning, from small device repair to full green field substation projects. The focus will be on developing a plan to completely commission equipment with a check and balance system that gives the technician confidence that the job was done correctly. Example checklists and worksheets will be handed out to students.*

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## **Symmetrical Components 1**

**Stephen Marx, Bonneville Power Administration**

*Basic principles of symmetrical components with explanation of phasors, per unit system, and symmetrical component equations using sequence networks. Suggested prerequisite for Symmetrical Component 2 class.*

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## **Symmetrical Components 2**

**Stephen Marx, Bonneville Power Administration**

*Analysis of power system elements with symmetrical components sequence networks and network connections for each power system fault type. Samples of protective relay applications using symmetrical component method. Suggest attending Symmetrical Components 1 lecture as a prerequisite.*

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## **The X, Y, and Z of Circuit Breaker Control**

**Brent Carper, Relay Application Innovation, Inc**

*Circuit breakers are required by IEEE Standard C37.11 to have internal factory wiring and auxiliary relays to perform functions such as anti-pumping, close seal-in, trip-free, and permissive control. The schematic and internal wiring within the circuit breaker to accomplish these functions can be confusing. This lecture will explain the X/Y/LC/69 schemes and other aspects of breaker control using actual breaker schematic examples and animated logic, and a breaker simulator will be used to demonstrate seal-in and anti-pumping.*

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## **Transformer Protection**

**Scott Cooper, OMICRON Energy**

*An overview of power transformer protection practices. Emphasis is placed on solutions to the challenges of effective protection, including transformation ratio, transformer connection, current transformer connections, zero sequence current elimination, inrush, and over excitation. Analysis of differential relay operation for various types of faults and fault locations is discussed.*

# RELAY SCHOOL

## FRIDAY FEATURE PRESENTATIONS

### Switching Incident Lessons Learned

*Ty Ehrman & Bob Lemon, Grant County PUD*

On October 8, 2015, a generator circuit breaker at Priest Rapids dam experienced a failure due to mis-operation, causing arcing and a release of heated insulating gas, injuring 6 employees with severe burns. The protection system was not designed with this failure mode in mind. The event, its causes and protection system effects will be covered during this presentation.

### Ukrainian Power System Cyber Attack

*Roger Alexander, Schweitzer Engineering Laboratories, Inc*

Covers the coordinated cyber attack on the Ukrainian power grid as well as lessons learned. The first publicly documented cyber attack on power system assets put 225,000 customers in the dark for several hours. Is this the way it's going to be from now on? What can we do to protect our assets?



## 2017 SCHEDULE AT A GLANCE

The Hands-On Relay School is held on the Washington State University campus in Pullman, Washington. Evening events and Sunday check-in registration are held at the University Inn Best Western in Moscow, Idaho, or as noted.

**Sunday, March 12**

3:00-6:00 PM	<b>Facilitator Lab Set Up</b> (EE/ME 44)
5:30-7:30 PM	<b>Registration &amp; Reception</b> (University Inn)
7:00-8:00 PM	<b>Lab Facilitator Meeting</b> (University Inn)

**Monday, March 13**

6:45-7:30 AM	<b>Registration</b>
7:30 AM-Noon	<b>Opening Announcements</b> <b>Overview Lectures</b> <b>Concurrent Open Lectures</b> <b>Introduction to</b> <b>System Protection Lecture Series</b>
1:00-3:00 PM	<b>Intro to System Protection Series</b> <b>continued</b>
1:00-5:00 PM	<b>Hands-on Lab Instruction</b>
5:00 PM	<b>Optional Social Get Together at</b> <b>Birch &amp; Barley Restaurant</b>

**Tuesday, March 14**

7:30 AM-Noon	<b>Concurrent Open Lectures</b>
1:00-5:00 PM	<b>Hands-on Lab Instruction</b>
6:30-9:00 PM	<b>Suppliers Showcase</b> (University Inn)

**Wednesday, March 15**

7:30 AM-Noon	<b>Hands-on Lab Instruction</b>
1:00-5:00 PM	<b>Hands-on Lab Instruction</b>
6:30-9:00 PM	<b>Banquet &amp; Entertainment</b> (University Inn)

**Thursday, March 16**

7:30 AM-Noon	<b>Hands-on Lab Instruction</b>
1:00-5:00 PM	<b>Hands-on Lab Instruction</b>

**Friday, March 17**

7:30-8:00 AM	<b>Closing Remarks</b>
8:00-11:30 AM	<b>Friday Feature Presentations</b>



# RELAY SCHOOL

## SPONSORS



## Conference Management

WASHINGTON STATE UNIVERSITY

## WesternEnergy INSTITUTE

## STEERING COMMITTEE

Cliff Harris	<i>Committee Chair, Idaho Power Company</i>
Rick Asche	<i>Portland General Electric</i>
Karl Cabrera	<i>Salt River Project</i>
David Downing	<i>San Diego Gas &amp; Electric</i>
Bryan Focht	<i>Portland General Electric</i>
Chris Gallacher	<i>Avista Utilities</i>
Scott Hanson	<i>Washington State University</i>
Tamara Kirk	<i>Washington State University</i>
Stephen Marx	<i>Bonneville Power Administration</i>
Pat Phillips	<i>Seattle City Light</i>
Travis Rider	<i>Pacific Gas &amp; Electric Company</i>
Greg Sharpes	<i>Avista Utilities</i>
Tanyl Tinhof	<i>PacifiCorp</i>
Randy Turnley	<i>Puget Sound Energy</i>
Bill Unbehaun	<i>Tacoma Power</i>
Darryl Walker	<i>Puget Sound Energy</i>
Beverly Jones Woolf	<i>Western Energy Institute</i>
Louis Wright	<i>Bonneville Power Administration</i>
Diana Zoren	<i>Western Energy Institute</i>

## CONTRIBUTING ORGANIZATIONS

**The Hands-On Relay School Steering Committee gratefully acknowledges the following organizations for their generous contributions of equipment and support personnel.**

ABB Power T&D Company Inc.	OMICRON
ACS Professional Staffing	PacifiCorp
Avista Utilities	Pacific Gas & Electric
Basler Electric Company	Peak Measure
Beckwith Electric Company	Pegasus-Global
Benton County PUD	Portland General Electric
Bonneville Power Administration	POWER Engineers
BSC Engineered Systems	Power Testing and Energization Inc.
Central Electric Cooperative Inc.	PPL Montana
Central Lincoln PUD	Puget Sound Energy
Chelan County PUD	Relay Application Innovation
City of Richland	RFL Electronics Inc.
Clark Public Utilities	RuggedCom
Cooper Power Systems	Sacramento Municipal Utility District
Doble Engineering Company	Salt River Project
Douglas County PUD	San Diego Gas & Electric
Emerson	Schneider Electric
Energy Northwest	Schweitzer Engineering Laboratories
ENOSERV	Seattle City Light
Eugene Water & Electric	Siemens
Franklin County PUD	SMC Inc.
GE Digital Energy – Multilin	Snohomish County PUD
Grant County PUD	Tacoma Power
Idaho Power Company	Tri-State G&T
Manta Test Systems	U.S. Army Corps of Engineers
Matanuska Electric Association	U.S. Bureau of Reclamation
Megger	Washington State University
MWH	Western Area Power Administration
NorthWestern Energy	Western Energy Institute
NV Energy	

# RELAY SCHOOL

## SCHOOL INFORMATION

### ..... Application Process and Fees

- Application is online at **<http://cm.wsu.edu/hrs>**.
- School fee of \$650 includes electronic copies of lecture notes, Sunday night reception, Tuesday night Vendor Showcase, Wednesday night banquet meal, break refreshments, and parking fees.
- Priority is given to utilities providing lab facilitators, lecturers, steering committee support, and Western Energy Institute member utilities, if the application is received by January 25, 2017. Remaining slots will be filled on a first-come, first-served basis.
- Applicants select which track they wish to attend in order of preference. Every effort will be made to place students into their preferred track, but track placement is by availability and subject to the priorities as described above. Many tracks will fill up and students may not be able to get their preferred track. If we are unable to place you in a track you have selected, or in an acceptable substitute track, your full application fee will be refunded.
- Students will be notified in writing no later than February 5, 2017, of their acceptance into the school and track placement. **You are not accepted to attend unless you receive the confirmation of acceptance from WSU.**
- Questions? Call **800-942-4978** or **509-335-3530** or email us at **tlkirk@wsu.edu**. Visit our website at **conferences.wsu.edu**.

## SCHOOL INFORMATION

### ..... **Accommodations and Travel**

Please make your own travel and hotel reservations once you have received registration confirmation. The Pullman/Moscow Airport is served by Alaska/Horizon Airlines. Spokane International Airport is 80 miles north of Pullman. Holiday Inn Express (509-334-4437) in Pullman, and the University Inn (208-882-0550) in Moscow, Idaho, have rooms blocked for this event and all will provide local transportation upon request.

### ..... **Cancellation Policy**

Your complete application fee will be refunded if WSU receives your written cancellation notice by **February 22, 2017**. Cancellations made after February 22 are subject to a processing fee of \$325. Students who do not attend and have not cancelled by March 11th are responsible for the full application fee. Substitutions may be made at any time.

### ..... **Program Changes and Cancellations**

WSU reserves the right to make changes in programs or speakers or to cancel programs if enrollment criteria are not met. In the unlikely event that this school is cancelled, Washington State University's liability is limited to refund of registration fees. If we are unable to place you in a track you have selected or an acceptable substitute track, your full registration will be refunded.

# RELAY SCHOOL

## SCHOOL INFORMATION

### Americans with Disabilities Act

Accommodations for individuals who qualify under the Americans with Disabilities Act are available upon request. Please contact us at least ten days before the school at **800-942-4978** or **509-335-3530**, email **wsuconf@wsu.edu**

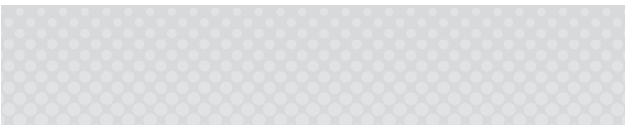
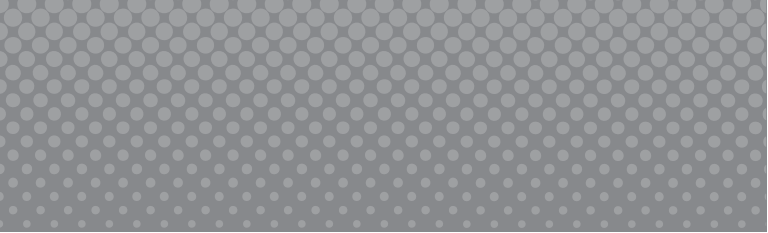
### Continuing Education Units (CEUs)

CEUs are available to participants who complete a CEU enrollment form prior to the start of the school and satisfactorily complete the requirements for the class. CEUs are nationally recognized units of achievement that may be used as evidence of professional development and for job advancement. One CEU is awarded for every 10 hours of instruction, totaling 3.6 for this school. A fee of \$10 must accompany the registration fee to receive the CEU credits.

### Promotional Video

Need help convincing your organization about the benefits of attending the Hands-On Relay School? Contact us today to request your copy of our promotional video that demonstrates the invaluable training experience of attending this school or view the video at **[www.youtube.com/watch?v=Tu5GmeJg7r0](http://www.youtube.com/watch?v=Tu5GmeJg7r0)**.

Call **800-942-4978** or **509-335-3530** or email us at **wsuconf@wsu.edu** for more information.



# HANDS-ON Relay School

## MARCH 13-17, 2017

#2087

**BY MAIL:**

Washington State University  
Conference Management  
PO Box 645222  
Pullman, WA 99164-5222

**BY FAX:** 509-335-7781**ONLINE:** [cm.wsu.edu/hrs](http://cm.wsu.edu/hrs)

Please print or type. For additional applicants, please duplicate this form. To significantly increase your chances of being accepted, send a facilitator.

**Name:** \_\_\_\_\_**Organization:** \_\_\_\_\_**Title:** \_\_\_\_\_**Address:** \_\_\_\_\_**City:** \_\_\_\_\_**State/Province:** \_\_\_\_\_**Zip/Postal Code:** \_\_\_\_\_**Country:** \_\_\_\_\_**Phone:** \_\_\_\_\_**Fax:** \_\_\_\_\_**Attendee email (required):** \_\_\_\_\_**TRACK SELECTION**

NUMBER only the tracks you will accept in order of preference (1 being your first choice). A letter of confirmed registration and track assignment will be emailed on February 5, 2017. Students will not be allowed to switch tracks once the school has begun.

**Manual Relay Testing**

- ☐ Basic
- ☐ Distribution M/P
- ☐ Transmission
- ☐ Generation
- ☐ Electromechanical
- ☐ Theory

**Automated Relay Testing**

- ☐ Doble (Beginning)
- ☐ Doble (Advanced)
- ☐ Enoserv (Beginning)
- ☐ Enoserv (Advanced)
- ☐ Manta AVTS
- ☐ Megger AVTS
- ☐ Noram SMC
- ☐ Omicron (Beginning)
- ☐ Omicron (Advanced)

**SCHOOL FEE**

- ☐ \$650 Please register me for the school (Checks payable to Washington State University, payment in U.S. funds drawn on a U.S. bank.)
- ☐ \$10 I would like Continuing Education Units (CEUs).

**PAYMENT METHOD**

- ☐ Check enclosed
- ☐ Please call 509-335-3530/800-942-4978 to pay by **Visa** or **MasterCard** after submitting the form
- ☐ Bill my company, purchase order no. \_\_\_\_\_
- Bill to email \_\_\_\_\_





Conference Management  
PO Box 645222  
Pullman, WA 99164-5222

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