

# Microprocessor Based Relay Testing - Generation

4.5 Days, 3.2 CEUs

This course will present the fundamentals of microprocessor-based generator protection, combined with hands-on testing of selected elements of the protective relays. This hands-on course is designed for test technicians and other persons involved in setting, testing, and diagnosing microprocessor-based relays that protect generators, generator buses, and transformers. NETA and NFPA 70B maintenance and testing standards recommend testing relays either every two years or at other regular intervals based on equipment condition and reliability requirements.

## Pre-Requisites

Student must bring a laptop and have full administration rights to install software, to complete the class labs. Laptop must have the most up to date version of Windows, 4+GB hard drive space, 1+GB RAM, and a CD-ROM drive. IPads and tablets without CD-ROM or USB ports are not acceptable.

Upon enrollment confirmation, an email containing instructions to install required software will be sent to the participant prior to attending the course. Please make sure you install the required software before attending the class.

## Lab and Classroom Attire

AVO Training Institute is committed to the personal safety of each participant and require long pants and ANSI rated "safety-toe" work shoes for lab activities. Lecture courses may involve a tour of a work or shop area and for this reason open-toe shoes and shorts are not considered appropriate attire for the classroom.

## Learning Objectives

To receive 3.2 CEUs, participants must attend 4.5 days of class (32 contact hours) and attain a minimum average grade of 80% (overall grade will consist of 50% lab practice and 50% final exam). Upon completion of this course and lab practice, the participants will demonstrate that they are able to:

- Determine relay baud rate and other communication parameters.
- Use manufacturer's software to communicate with the relay.
- Identify what equipment is necessary to communicate with the relay.
- List relay protective elements and how they work.
- Connect relay test equipment properly to the relay terminals by using connection diagrams and system schematics.
- Perform metering and test functions.
- Read, save, and evaluate relay settings and records.
- Perform the following relay element tests and interpret the results:
  - Backup Impedance (21)
  - Over Excitation (24)
  - Reverse Power (32)
  - Loss of Excitation (40)
  - Negative Sequence (46)
  - Voltage Controlled Overcurrent (51C)
  - Voltage Restrained Overcurrent (51V)
  - Under/Overvoltage (27/59)
  - Stator Ground (64)
  - Out-of-Step (78)
  - Frequency (81)
  - Generator Differential Elements (87)
- Send original settings to the relay after testing.

Note: Relays used in lab exercise will be: SEL-300G and Beckwith M-3425A.

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## SCOPE

### Day 1\* (7 contact hours)

#### I. Introduction (0.5 hour)

- A. Schedule
- B. Course Outline

#### II. Introduction to Generator Protection Fundamentals (3.5 hours)

- A. Causes of Faults
- B. Protection Requirements
- C. Generator Protection Application
- D. Generator Protection Components

#### AM BREAK

- E. Instrument Transformers
- F. Protective Relay Elements
- G. Protective Relay Testing

#### LUNCH

#### III. SEL 300G (3 hours)

- A. Relay Connections
- B. Establish Communications
- C. Event Record Data Management

#### PM BREAK

- D. Verify Operation of Front Panel LED's
- E. Verify Date and Time
- F. Conduct Meter Check

### Day 2 (7 contact hours)

#### III. SEL 300G (cont'd) (7 hours)

- G. Protective Element Testing

#### AM BREAK

- H. Clear Event Record

#### LUNCH

- I. Restore Relay Settings

#### PM BREAK

- I. Restore Relay Settings

### Day 3 (7 contact hours)

#### IV. Beckwith 3425A (7 hours)

- A. Relay Connections
- B. Establish Communications

#### AM BREAK

- C. Event Record Data Management
- D. Verify Operation of Front Panel LED's

#### LUNCH

- E. Verify Date and Time
- F. Conduct Meter Check
- G. Protective Element Testing

#### PM BREAK

- H. Clear Event Record
- I. Restore Relay Settings

### Day 4 (7 contact hours)

#### V. GE SR 489 (7 hours)

- A. Relay Connections
- B. Establish Communications
- C. Event Record Data Management

#### AM BREAK

- D. Verify Operation of Front Panel LED's
- E. Verify Date and Time

#### LUNCH

- F. Conduct Meter Check
- G. Protective Element Testing

#### PM BREAK

- H. Clear Event Record
- I. Restore Relay Settings

### Day 5 - 1/2 Day (4 contact hours)

#### VI. Conclusion (4 hours)

- A. Review

#### AM BREAK

- B. Final Exam

\*Class scheduling times may vary based on discussions and size of class

AVO Training Institute is accredited by the International Association for Continuing Education and Training (IACET) and is accredited to issue the IACET CEU

# COURSE EQUIPMENT LIST

## Microprocessor-Based Relay Testing - Generation (MBRT-G)

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**DEVELOPED:** AUGUST 2018

**BY:** DENNIS MOON/CH

**COURSE NUMBER:** 551, REV. 1

**COURSE LENGTH:** 4.5 DAYS

**TEACH DATE:**

**INSTRUCTOR:** DENNIS MOON

**TEXT**

1 / STUDENT

*MICROPROCESSOR-BASED RELAY TESTING -  
GENERATION  
COURSE # 511, REV 1*

**EQUIPMENT**

SCHWEITZER	BECKWITH