



VALENCE
ELECTRICAL TRAINING SERVICES

How to Test Protective Relays Online Seminar



About Valence Electrical Training Services

About Our Relay Training Center

Most protective relay training falls into three categories:

- Engineering books written for design engineers, not relay testers.
- Courses hosted by relay manufacturers specific to their relays.
- Test-set manufacturer, or automated test software, training focused on how to get their solution to test the relay with minimum user input.

We believe that:

- The power system is universal, and you can apply the same principles to any relay model or manufacturer
- All modern test-sets can test any modern relay.
- A skilled relay tester will always test a relay more effectively and efficiently than a button pusher, while fixing problems the alternatives will never discover.

All of our relay training material:

- Is written specifically for relay testers in plain language.
- Is designed to be universal and can be applied to any relay or any test-set.
- Includes the theory necessary to understand what is happening inside the relay, and why.
- Has universal, step-by-step procedures so the relay tester knows how to apply the theory.
- Uses the most efficient and effective relay testing techniques used today.

The Relay Testing Handbook Series

Valence Electrical Training Services started with a paper presented at a major electrical testing conference that turned into *The Relay Testing Handbook* series, a comprehensive series of nine books, each of which covers a specific relay testing topic. Any technician who has ever been faced with a confusing or challenging situation in the field will appreciate that a relay tester, not an engineer, wrote these books. This practical resource gives you the tools you need to test almost any type of protective relay, no matter who the manufacturer is.

Some of the topics included in *The Relay Testing Handbook* series include:

- Basic electrical fundamentals
- Basic relay testing fundamentals
- Relay testing equipment options and how to use them
- Information about the most common protective elements (50/51/67/59/27/81/87/21 protection) including:
 - Theory behind the element
 - How and when the element is applied
 - Step-by-step test procedures
 - Tips and tricks to overcome common problems
- Relay testing approaches and how to select the best ones
- Test plans with real-world applications
- Examples from multiple manufacturers and test-set models

Online Training

Online Protective Relay Training

Today's relay testers have to perform more work in less time, and typically have very little support to help them test modern digital relays that become more complex every year. We created *The Relay Testing Handbook* series as a practical reference guide for the modern relay tester, but studies have shown that most people must apply multiple learning styles before they fully understand a topic.

Each course in this online protective relay training series is based on a topic in *The Relay Testing Handbook*, and hits three key learning styles to ensure you retain the information and can start using it immediately in your day-to-day activities.

- You can read about the topic with excerpts from *The Relay Testing Handbook*.
- You will listen to a narrator while watching videos that discuss the topic in greater detail. You can learn at your own pace with controls that can pause, rewind, fast-forward, etc.
- You will use our interactive exercises that simulate the topic using the most realistic situations possible to help you learn by doing.



Our online protective relay training courses are designed to:

- Allow you to choose the topics most important to you.
- Complete the courses at a location and time convenient for you and your schedule.
- Focus on the skills you need to become a better relay tester.
- Be universally applied to any relay or test-set.

Each of our online relay training courses has the following structure:

- An introduction to the course topic with excerpts from *The Relay Testing Handbook* series
- A video series describing the topic with animations and examples
- A series of exercises to help you master the topic through real-world examples
- A quiz with real-world questions to see how much you've learned taking the course
- A certificate of achievement that can be used for continuing education credits.

Online Training Seminars

How to Test Protective Relays, 16 CEUs

This online protective relay testing seminar follows Chris Werstiuk (author of *The Relay Testing Handbook*) as he tests a relay from start to finish. You'll learn the basic skills needed to test any digital relay with any modern test-set, how to perform each testing step, and why each step is important.

You'll see how to make smarter test plans that are quicker and more effective than traditional methods (including tips and tricks you won't find in any manual or YouTube video).

Watch this series of videos on any device with speakers or headphones, and a high-speed internet connection. The videos are broken down into logical chunks that you can watch at any time, and in any order, to fit this series into your busy schedule.

What do I get when I enroll in the "How to Test Protective Relays Online Seminar" today?

- Download a simple flowchart to follow while testing digital protective relays with any test-set.
- Unlimited access to 17+ hours of videos where Chris Werstiuk tests various relays using different test-sets, and explains how he performs the test, and why.
- Content to download and follow along.
- Comment sections to ask Chris questions, and interact with other students.
- Ask for more content if you don't see your relay or test-set represented in the course.



"This is a fantastic course in how to test relays and covers aspects that are not found anywhere else - set up, print and documentation review, testing philosophy, the testing process and reporting results. The quality of the material in these videos and Chris's engaging delivery have led me to be infinitely more prepared to take on the task of relay testing than ever before."

Benjamin

How to Test Protective Relays Seminar

"Chris is extremely knowledgeable and experienced. He has seen almost every mistake that can be made in the protection and control game. This course will provide you with a great step-by-step guide to testing. Not only will you have a good guide, but you will understand WHY you are doing that step."

Student

How to Test Protective Relays Seminar

Online Training Seminars

How to Test Protective Relays, 16 CEUs (Continued)

This seminar explains how to test protective relays using Chris' decades of relay testing experience and nearly a decade of relay testing training to make smarter test plans that are more effective and more efficient than traditional test plans.

What do you cover in this online protective relay testing seminar?

We cover the following information using a variety of relays and test-sets for every topic:

Introduction Videos

- Electromechanical relays
- Review Documentation
- Create a Checklist
- Isolate and Connect to the Relay
- Upload the Relay Settings
- Decide What Kind of Test to Perform
- Perform an Acceptance Test
- Introduction to Common Test Procedures
- Old Test Procedures
- Understand the Element
- Choose the Fault Type for Your Test
- How to Perform a Pickup Test
- How to Perform a Timing Test
- How to Evaluate Your Test Results
- How to Perform Simple Logic Tests
- How to Perform Complex Logic Tests
- How to Test the Non-Tripping Logic
- Final Tasks and Conclusion
- How to Test All Remaining Logic
- Final Tasks and Conclusion

Obtain and Review the Relay Settings, Drawings, and Application

- Obtain and Review the Relay AC Single-Line Drawings
- Obtain and Review the Relay AC Three-Line Drawings
- Obtain and Review the Relay DC Drawings
- Obtain and Review the Relay Main Settings
- Obtain and Review the Relay Logic Settings
- Obtain and Review the Relay Global and Port Settings
- How to Understand and Determine Phase Rotation in a Power System- TechTalk Post
- How to Measure Phase Angles with a Phase Angle Meter – TechTalk Post

Create a Checklist of all Elements, Outputs, and Signals to be Tested

- Create a Checklist of All Elements to be Tested
- Create a Test Checklist of all Logic, Outputs, and Signals

Isolate the Relay From the System

- Understanding FT Style Test Switches
- Isolate the Relay From the System

Connect the Test Set to the relay

- Connect the Test-Set to the Relay
- Connect the Test-Set to the Relay - Alternate DC Connections
- Connect the Test-Set to the Relay - Alternate AC Connections
- Connecting Omicron Test-Sets to the Relay

Upload the Relay Settings

- Serial Connections
- Ethernet Communication
- Upload SEL Relay Settings
- Upload GE Relay Settings
- Upload Siemens Relay Settings
- Upload ABB Relay Settings

Online Training Courses

How to Test Protective Relays, 16 CEUs (Continued)

Perform an Acceptance Test

- Record the Relay Self-Test Results
- Check all Digital Inputs and Outputs on SEL Relays
- Check all Digital Inputs and Outputs on GE UR Relays
- Check all Digital Inputs and Outputs on GE SR Relays
- Check all Digital Inputs and Outputs Beckwith Electric Relays
- Check all Digital Inputs and Outputs - Siemens Relays
- Check all Digital Inputs and Outputs on ABB Relays
- Understanding Phase Angles
- Perform a Meter Test - Option 1 - Balanced Three-Phase
- Perform a Meter Test - Option 2 - Unbalanced Three-Phase
- Perform a Meter Test - Option 3 - Combined Meter Test
- Perform a Meter Test With Different Test Sets
- Perform a Meter Test - Open-Delta PTs and GE SR Relays
- Perform a Meter Test - GE UR Relays
- Perform a Meter Test - Beckwith Electric Relays
- Perform a Meter Test - Siemens Relays
- Perform a Meter Test on ABB Relays
- Why Does My Open-Delta Connected Phasor Diagram Look Weird?

How to Test Protective Relay Elements

- Percent Error and Metering Specifications
- Relay and Element Specifications
- Understand the Basic Operation of the Element - SEL 50
- Understand the Basic Operation of the Element - SEL 51
- Understand the Basic Operation of the Element - GE & Siemens
- Understand the Basic Operation of the Element on ABB Relays
- Understanding The Power System
- Choose the Appropriate Fault Type for the Test - Three Phase Faults
- Choose the Appropriate Fault Type for the Test - Phase-Ground Faults
- Choose the Appropriate Fault Type for the Test - Phase-Phase Faults
- Perform a Ramping Pickup Test via Relay Setting Changes
- Perform a Ramping Pickup Test via the SEL TAR Command
- Perform a Ramping Pickup Test via Software and Front Panel - SEL
- Perform a Ramping Pickup Test via Software and Front Panel - GE SR
- Perform a Ramping Pickup Test via Software and Front Panel -GE UR
- Perform a Ramping Pickup Test via Human Machine Interface (HMI) -Beckwith
- Perform a Ramping Pickup Test via Human Machine Interface (HMI) - Siemens
- Perform a Ramping Pickup Test via Human Machine Interface (HMI) - ABB
- Perform a Manual Ramping Pickup Test with Different Test Sets -Omicron
- Perform a Ramping Pickup Test via Automatic Ramp - Manta
- Perform an Automatic Ramping Pickup Test with Omicron
- Perform a Ramping Pickup Test via Hybrid Ramp - Manta
- Perform a Ramping Pickup Test via Hybrid Ramp - Omicron
- Perform a Manual Pulsing Pickup Test with Omicron
- Perform Manual Pulsing Pickup Tests with Manta
- Perform an Automatic Phase to Phase Pulsing Pickup Test with Omicron
- Perform an Automatic Phase to Ground Pulsing Pickup Test with Omicron
- Perform Automatic Pulsing Pickup Tests with Manta
- Troubleshooting Pulsing Pick Up Tests
- Perform a Generic Inverse Timing Test with Omicron
- Perform Generic Inverse Timing Tests with Manta
- Perform Generic Inst/Def Timing Tests with Omicron
- Perform Generic Inst/Def Timing Tests with Manta
- Perform Dynamic Pickup/Timing Tests with Omicron
- Perform Dynamic Pickup/Timing Tests with Manta - Part 1
- Perform Dynamic Pickup/Timing Tests with Manta - Part 2
- How to Perform Dynamic Relay Testing on Digital Relays

Online Training Courses

How to Test Protective Relays, 16 CEUs (Continued)

Perform a Commissioning Test

- Putting it all Together with Standard Tests and Omicron
- Putting it all Together with Standard Tests and Manta
- Putting it all Together with Universal Tests
- Testing Multiple Physical Outputs with Omicron
- Testing Multiple Physical Outputs with Manta Test Systems
- Understanding Digital logic - Part 1
- Understanding Digital logic - Part 2
- Understanding Digital logic - Part 3
- Testing Digital Logic
- Testing Digital Logic with Manta Test Systems
- Testing Digital Logic with Omicron
- Testing Non-Contact Outputs
- Testing Non-Contact Outputs with Checklists
- Testing Non-Contact Outputs with Omicron
- Putting It all Together with Dynamic Tests and other Elements
- Putting it all Together with Dynamic Tests and Manta
- Can Dynamic Tests Replace Traditional Tests?
- Testing Directional Elements with Dynamic Tests
- Putting it all Together with Dynamic Tests and Omicron - Overcurrent-1
- Putting it all Together with Dynamic Tests and Omicron - Overcurrent-2
- Putting it all Together with Dynamic Tests and Omicron - Overcurrent-3
- Putting it all Together with Dynamic Tests and Other Elements - Omicron
- Putting it all Together with Dynamic Tests and Other Elements - Manta
- Reviewing Sequence of Event Reports

Perform Maintenance Tests

- Download All Settings, Events, and Meter Logs
- Download All Settings, Events, and Meter Logs - SEL
- Download All Settings, Events, and Meter Logs - Beckwith Electric
- Download All Settings, Events, and Meter Logs - GE SR Relays
- Download All Settings, Events, and Meter Logs - GE UR Relays
- Download All Settings, Events, and Meter Logs - Siemens Relays
- Download All Settings, Events, and Meter Logs on ABB Relays
- Perform the Relay's Self-Test and Record Results
- Perform a Meter Test and Record Results
- Verify All External Inputs and Watch them Change State in the Relay
- Verify All Outputs

Post Testing Tasks

- Clear Metering, Sequence of Events, and Oscillography Records - SEL
- Clear Metering, Sequence of Events, and Oscillography Records - GE SR
- Clear Metering, Sequence of Events, and Oscillography Records - GE UR
- Clear Metering, Sequence of Events, and Oscillography Records - Beckwith Electric
- Clear Metering, Sequence of Events, and Oscillography Records - Siemens Relays
- Metering, Sequence of Events, and Oscillography Records on ABB Relays
- Return The Relay to Service
- How to Perform an In-Service Protective Relay Meter Test
- Submit Your Report

Final Thoughts on Relay Testing

- Description of Operation
- Conclusion



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