Mike Terbrueggen, CEO, O-T-S

Mike Terbrueggen is the CEO and Principal Engineer at Operations-Training-Solutions, which he founded in 1994. He designs, develops, and delivers advanced training seminars, develops training programs and materials, and provides consulting services for power operations and engineering personnel.

Mike received his undergraduate degree in Electronics Engineering from the University of Michigan (Go Blue!) and his graduate degree in Power Engineering from the University of Colorado.

Mike was born in Detroit, Michigan. After high school, he entered the U.S. Army and was stationed at Fort Carson, Colorado. He was in the 4th infantry with the 4th Combat Engineers. Mike has two daughters, one son, and four grandchildren. He lives in Longmont, Colorado, where he enjoys golf, music, and home improvement projects in his spare time.
Power System Protection is a class that describes and illustrates the fundamentals of power system protection and examines the types of protection used to protect transmission, generation, transformer, substation buses, and describes those protection systems used to maintain stability, voltage and frequency.

**Course Schedule**

**MONDAY, FEBRUARY 24, 2020**
Power System Protection
0800–1700
- Overview of the NERC PRC family of reliability standards
- Review of the IEEE relay definition
- What are the goals of protective relaying?
- Review of relay types
- Overview of the zones of protection
- Overview of the following:
  - Vectors and phasors
  - Per-unit systems
  - Transformer polarity
  - Symmetrical components
  - Polarizing quality
- Description of five functional types of relaying:
  - Protective
  - Regulating
  - Reclosing/Synchronism
  - Monitoring
  - Auxiliary

**TUESDAY, FEBRUARY 25, 2020**
Power System Protection
0800–1700
- Overview of the following:
  - Instrument transformers
  - Differential relays
  - Over-current and distance relays
  - Back-up protection
  - Electro-mechanical
  - Microprocessor relays
- Different types of generator protection:
  - Direct connected generators
  - Unit connected generators
- Introduction to power system grounding concept

**WEDNESDAY, FEBRUARY 26, 2020**
Power System Protection
0800–1700
- Issues facing power transformer protection
- Transformer protection
  - Power transformers
  - Phase shifting transformers
- Shunt capacitors and reactors
- Consideration in protecting radial versus looped transmission lines
- Detailed description of distance relaying and its application within our region for:
  - Transmission line protection
  - Transmission line back-up protection
- Overview and explanation of the most common types and the application of pilot protection schemes within and DAK region

**THURSDAY, FEBRUARY 27, 2020**
Power System Protection
0800–1700
- Explanation and illustration of out-of-step protection
- In-depth review of the advantages and disadvantages of automatic reclosing schemes
- Detailed explanation of the purpose and application of special protective systems within the Dakotas subregion (utility instructors)
- Overview of the design of substation bus configurations and how they are applied to the BES
- Description of the application of I and E differential protection schemes to the different bus configurations
- Description of the following systems in the DAK region (and how they are designed to avoid the associated collapse of the monitored element):
  - Under-voltage load shedding
  - Under-frequency load shedding

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**Registration**

- **NAME**
- **COMPANY**
- **BILLING ADDRESS**
- **PHONE**
- **EMAIL**
- **NERC CERT#**

**Fee:** $1,200.00 per attendee
(Includes hotel breakfast, breaks, and lunches)

**Method of payment:**
- [ ] Bill me
- [ ] Check

**Hotel accommodations:**
Country Inn and Suites (Bigwood Event Center)
218-739-2211 or 800-830-5222
cx_ffmn@country inn.com
925 Western Avenue, Fergus Falls, MN 56537

A block of 10 rooms has been held from Sunday–Thursday for the week. Rooms are blocked under *Otter Tail Power Company Training.*

**Room rate:**
$90.00 for Otter Tail Power Company. Government rate available upon request.

**To register, email this form or contact:**

Tammy Smith
Otter Tail Power Company
215 South Cascade Street
Fergus Falls, MN 56537
218-739-8264
tsmith@otpco.com