

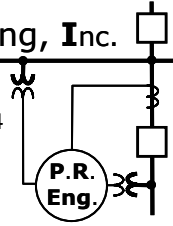
Protective Relay Engineering, Inc.

John Horak

johnhorak@p-r-eng.com 303-459-2284

6620 S. Broadway, Unit B

Centennial CO 80121



Protective Relay Engineering is the company that I (John) utilize for performing consultant and independent contract engineering work in the design, analysis, and protection of electric power systems and equipment. I am familiar with the electrical design practices found in utility transmission and distribution systems; large industrial end user systems at medium and low voltage, with and without generation; smaller standby electrical generation systems; and bulk power generation facilities. I have over 20 years experience in the industry. I am presently the sole employee of P.R.E., but via subcontracting some tasks to others, I could possibly take on tasks requiring more personnel. I am open to working as a subcontractor to other engineering firms.

Technical Skills Summary

Experienced in:

- Phase and ground overcurrent relaying practices in utility and industrial systems, using classic overcurrent relays, reclosers, fuses, and low voltage static trip and thermal magnetic circuit breakers.
- Transmission line protection using stepped distance impedance concepts, communication aided POTT/DCB/DCUB etc. schemes, line differential, and backup ground overcurrent schemes.
- Generator protection schemes, ranging from large base load units, to smaller peak shaving and Cogen units, to isolated emergency/standby units.
- Protection used at the interconnection between an IPP and the Utility.
- Protection of transformers, buses, motors, generators, and capacitor banks.
- The development of AC one-lines and three-lines.
- The development of DC control schematics and associated wiring designs.
- Arc flash analysis, appropriate system modeling using SKM PowerTools, and mitigation approaches.
- Configuration and setting of microprocessor based programmable logic relays from SEL, GE Multilin (UR and 7XX series), Siemens 7xx series, ABB DPU/TPU, and Basler Electric.
- Symmetrical component analysis (have taught in classes on this topic).

Software Capabilities

- Good knowledge of SKM PowerTools and ASPEN OneLiner.
- Moderate-good knowledge of CAPE, and light exposure to Neplan, ETAP, and EasyPower.
- P.R.E. owns SKM PowerTools (2000 bus option), with several optional modules (Arc Flash, Unbalanced Fault, Motor Start). Have used SKM PowerTools to analyze and model facilities with over 1200 buses.
- Have limited access to ASPEN and CAPE via client's copies. (Client copies cannot be used for billable work.)
- For general purpose calculations, I use MathCAD and MS Excel (I have prepared several complex spreadsheets found on the Basler Electric website).
- Moderate to light experience in AutoCAD, and light experience with MS Visio.
- Have used MS PowerPoint extensively, as well as MS Word.

Education and Licenses

- BSEE (Univ. of Houston) with electric power option classes.
- MSEE (Univ. of Colorado) with concentration on power system analysis.
- Have PE license in Colorado (License # 29838), California (License # E18133), and Texas (License # 99616; P.R. Eng. Tx State registration # is 773109). NCEES record is established.
- Have professional liability / errors and omissions insurance (\$1M), and business owners insurance. Higher coverage obtainable from current carrier if required.

Work History Highlights

- Projects via Protective Relay Engineering

This work was part time 2003-2006, and full time since 05/2006. Customers include:

- Xcel Energy; relay settings and control design on various HV transmission projects. Most relay work for Xcel is with SEL products. Major projects since 05/2006-Present include:
 - Spindle NUG Substation – Relay settings for 230kV sub feeding 2 new generators (early 2007)
 - Plains End NUG Substation – Relay settings for 3 new T-lines, GSU T-line, and GSU (early 2008)
 - Comanche 345kV Generation Substation – Relay settings for 2 feeds to 750MW generating plant, 2 T-lines, 2 large autoxfmrs, plus bus/ breaker failure/reclosing/sync relaying. (Late 2007-late 2008)

- Hobbs/Higgs Project – Approximately 1/3 of the settings for new substation with 2 CTs, 1 ST, three 230kV and seven 115kV lines, and a large autotxfmr. (Late 2007-late 2008)
- Cox Substation – Settings for new relays for 4 transmission lines, 1 auto xfmr, 2 cap banks.
- Hartsel Sub Ground Overcurrent settings – used as a training session for another engineer. (Mid 2008)
- Hayden 230kV power plant – line protection replacement (late 2006)
- Valmont 230/115kV Auto #2 – Control design and relay settings for new parallel xfmr, 3 new breakers, redraft of non-standard drawing layouts, replacing substation DC equipment. (Mid 2008 to present)
- Central Contra Costa Sanitary District; 480V and 13kV systems analysis. Work included:
 - Reviewed causes of repeated loss of generation for utility transmission system faults. Provide a revision of 12kV relay line and generator settings to alleviate the problems. (Mid 2006-late 2006)
 - Extensive modeling of their system (SKM PowerTools) (1200 buses in model) involving walk down of plant. (mid 2007-early 2008)
 - Short circuit and overcurrent breaker settings for 12.47kV overcurrent, and 480V and major 208V breakers. Approximately 100 TCCs were generated. (mid 2007-mid 2008)
 - Arc flash analysis, and adjustment of relay and breaker settings to implement reduced arc flash levels. (mid 2007-mid 2008)
- WestPower Energy; assist in electrical design and relay settings in several IPP, utility, and industrial projects, performing short circuit, arc flash, and relay/breaker coordination studies. Projects include:
 - PEPCO: Relay settings and control design assistance for the interconnection of a standby/Cogen generation plant to the utility grid.
 - Settings and arc flash for various projects, such as Temple Inland, San Francisco Airport Generation, Tri-Hydro project, Wellhead-Mirimar, Wellhead-Margarita, Moreno Valley. (Each were small projects billed at less than 100hours, over the mid 2006- mid 2008 period.)
 - Yale University 12kV Coordination Study; Determine cause of generation loss during remote utility faults; analyze feeder coordination and review issues with ground fault coordination. (late 2006-early 2007)
 - Emery Station, CA; building coordination and equipment sizing analysis. (Late 2006)
- Other small relay setting projects/customers include:
 - Brookings Utilities, Creative Labs, RAI-Bremerton, Nooksack Hydro, Empire Caterpillar, Nova Group, American Energy Assets, Rolls Royce Generation
- Basler Electric, giving continued support in schools and literature development.
- **Past Employment**
 - Basler Electric; Applications Engineer; 9 years. 1997-2006
 - Advised customers on use of product, provided technical review of customer installations, taught at Basler schools; advised on product development, assisted sales reps on customer development.
 - Stone & Webster Engineering / Public Service of CO (now Xcel Energy) 8 years. 1989-1997. Stone and Webster was primary employer, but they subcontracted 60% of my time to PSCO/Xcel.
 - While at PSCO, duties included distribution and transmission line relay settings, set-up and maintenance of ASPEN software, and equipment troubleshooting.
 - While at S&W, performed fault analysis and circuit breaker/relay settings for power plants, industrial facility upgrades, and substation design work.
 - Chevron, QA inspector, electrical products; Houston Light and Power; Coop student 1985-87

Technical Papers

I have written and presented many technical conference papers, and Basler Electric internal documents, on topics related to electric power system design, analysis, and operation, with emphasis on protection practices.

- **Conference Papers**
 - Bus Protection Theory and Practice
 - Directional Relaying (67) Concepts
 - A Derivation of Symmetrical Components
 - A Review of Ferroresonance
 - Power Quality Measurements
 - Load Shedding Concepts
 - Three Phase Transformer Windings and Differential Relay Compensation
 - The NEC and Low Voltage System Protection Concepts for the High Voltage Utility Engineer.
 - Zero Sequence Impedance of Overhead Transmission Lines
 - Commissioning Numeric Relays, Pitfalls and Benefits
 - In progress: Generator Decrement Curves Beyond 3 Phase Terminal Faults.
- **Basler Electric technical classes, internal documents, or customer presentations:**
 - Generator Protection Guidelines (technical brochure, technical class)
 - Transformer Protection Guidelines (technical brochure, technical class)
 - Impedance relay theory of operation and settings (part of instruction manual)
 - IPP interconnect protection concepts (technical class)
 - Ground fault sensing concepts (internal documents, technical class, customer presentations)
 - Loss of excitation using Mho vs. VAR approaches (internal document)
 - Misc. reviews of Basler product designs vs. market opportunities.
- **Metropolitan State College, Denver: Teach class on a) Power System Analysis, and b) Electric Machines.**