Protection & Controls Fundamentals Seminar

Oakland East Bay Industry Applications Society

Date: Thursday, October 19, 2017

Time: 8:00AM- 4:00PM

Place: Hilton Pleasanton
7050 Johnson Drive
Pleasanton, CA 94588

IAS IEEE INDUSTRY APPLICATIONS SOCIETY

IEEE

Event Registration: ***http://ewh.ieee.org/r6/oeb/ias/Seminar_2017_.html***

EVENT PROGRAM

Session 1: *Review of Primary Service Interconnection Requirements*

This presentation will cover in detail Pacific Gas and Electric Company's (PG&E) Technical Requirements for Electric Service Interconnection at Primary Distribution Voltages technical Bulletin which is part of the PG&E Green book. This bulletin specifies the technical requirements for all customers requesting electric service at one PG&E's primary distribution voltages as defined in CPUC Rule 2. It is intended to give the customer a clear understanding of what their responsibilities are to receive Primary Service (PS) and those of PG&E. PG&E has developed these technical requirements in order to provide safe and reliable service to all of its customers. The PG&E Green book is widely referenced by architects, engineers, electrical contractors, city and county agencies and electrical equipment manufacturers.

Speaker: Michael Balmy – Industrial Power Engineer, PG&E

Michael Balmy is an Industrial Power Engineer (IPE) with PG&E's Service Planning Group in San Francisco. He has over 30 years of experience at PG&E. Throughout his PG&E career, Mike has worked at the Hunters Point Power Plant as Auxiliary Operator, as a Gas Service Representative; as Senior Gas Estimator, as Senior New Business Representative; and for the last 10 years as an IPE (including two years as a Service Planning Supervisor) in which he has worked directly with major commercial and industrial customers in helping them establish their electric and gas service installations. His recent projects include working with the San Francisco Port Authority and US Navy on the Pier 70 Electrical Improvements project and with the City and County of San Francisco (CCSF) on the Hunters Point Naval Base Redevelopment project.

Speaker: Robert Talbot – Industrial Power Engineer, PG&E

Robert Talbot is an Industrial Power Engineer (IPE) with PG&E's Service Planning Group in San Francisco. Rob has worked at PG&E for 38 years and as an IPE since 1998. He has worked in Marketing Dept., Gas dispatch, Environmental Dept. and Generation Interconnection. Born and raised in Bay Area and graduate of Fresno State.

Session 2: *Medium Voltage Circuit Breaker Design and Operation*

This presentation will focus on medium voltage circuit breaker design and operation basics:

- Types of MV breakers
- Main elements of MV breakers
- Vacuum interrupter technology
- Ratings and standards including Short Circuit and K-Ratings
- Commonly used accessories
- Breaker control circuit elements
- Contrast of MV breakers vs. LV Power Breakers
- Review of MV breaker selection criteria

Speaker: Bob Salter, P.E. – Power Distribution Specialist, Eaton Corporation.

Bob Salter has been working in and around the electrical Industry for over 40 years, including 11 years at Bussmann as a Sales and Applications Engineer, and over 9 years at Eaton as a Power Distribution Specialist. Bob received his BS-EE from Worcester Polytechnic Institute in 1976, and his MBA from SF State in 1981. Bob has been a Registered Professional Engineer (EE) in the state of California for 25 years.

Session 3: *Breaker Control Schematics Explained*

Breaker Control Schematics are often overlooked in electrical design packages and left for the contractor or manufacturer to “figure it out”. Some electrical designs will attempt to replace breaker control schematics with a control strategy of breaker operation. But simply put, the breaker control schematic is a complete picture of the breaker operation that cannot be misinterpreted like a written control strategy.

Breaker Control Schematics are an integral part of medium voltage and high voltage designs. Just as a motor control schematic is important to an industrial facility design, a breaker control schematic is equally important to a medium voltage design. The breaker control schematic depicts control power voltage (AC or DC), interlocks, permissives, manual operation, automatic operation, direct transfer trip, relay I/O, etc.

This presentation will focus on how to read and interpret breaker control schematics, and discuss why the schematics are an important part of electrical designs. Real-world examples of breaker control schematics will be reviewed.

Speaker: Michael Nakamura, P.E. – Sales Engineer, Matzinger-Keegan, Inc.

Michael Nakamura is a Sales Engineer with Matzinger-Keegan, Inc. (MKI), manufacturer’s representative for Schweitzer Engineering Labs, Southern States, Myers Power Products, and others. Prior to joining MKI, Mr. Nakamura was a Senior Electrical Engineer at the East Bay Municipal Utility District (EBMUD) where he supervised the Wastewater Electrical Engineering section. At EBMUD, Mr. Nakamura worked on the design, construction, testing, startup, commissioning, and troubleshooting of power distribution, control, and automation systems at water and wastewater facilities. Mr. Nakamura received the B.S.E.E. degree from California Polytechnic State University at San Luis Obispo. He is a Senior Member of IEEE and past-Chairman of the Oakland-East Bay Industry Applications Society. Mr. Nakamura holds a Certificate in Project Management from UC Berkeley Extension, and is a Registered Professional Engineer in the State of California.

Session 4: *Symmetrical Components: Demystification and Applications*

Power system calculations involve analysis of a balanced three-phase system, for which only one phase needs to be analyzed. The symmetry of the problem allows the behavior of the other two phases to be determined based on the calculated response using the first phase. This single-phase equivalent approach highly simplifies the calculation process. But when the system entails an unbalanced system of voltage and current phasors, as encountered during faults, the single-phase analysis approach cannot be directly applied. The option of analyzing the unbalanced system as a three-phase problem is no longer appealing, since the resulting mathematics becomes cumbersome and very difficult to solve. Use of a single-phase approach would still be possible if the unbalanced phasors could be resolved into balanced components. To simplify fault analysis by converting a three-phase unbalanced system into sets of balanced phasors, symmetrical components are used. They allow for the simplified analysis of power systems under faulted or other unbalanced conditions. Once the system is solved in the symmetrical component domain, the results can be transformed back to the phase domain.

The topic of symmetrical components is very broad and can be quite comprehensive to cover in depth. A summary of important points is included in this introductory yet informative presentation. While the concept of symmetrical components is demystified from fundamentals, using the phasor diagrams covering unique power system scenarios, usage of these components in realizing specific protective applications is thoroughly covered. Functionalities based on symmetrical components, including directional and sequence filtering in relays, are illustrated through pictorial representations. Onset and penetration of distributed generation in utility systems has made a recognizable impact on protective relaying applications. Perspectives arising from such interconnections and their understanding through the powerful tool of symmetrical components are also briefly covered. Specific tips to enhance evaluation of diverse system configurations are presented as important takeaways.

Speaker: Harjeet Singh Gill, Ph.D., P.E., M.B.A., PMP – Senior Protection Engineer, PG&E

Harjeet S. Gill received his B.Sc. and B.E. Honors (Electrical Engg.) degrees from Panjab University, India, M.Sc. and Ph.D. degrees from University of Saskatchewan, Canada, and M.B.A. degree from Cameron University, USA. He has comprehensive professional experience of working in research, industry and academics. This includes association as teaching and research assistant in university, Applications Engineer at ABB Inc. in Santa Clara, CA and Allentown, PA, and as Protection Engineer at Pennsylvania Power Light Utility, Allentown, PA. He has been associated in diverse areas of power systems including load-flow and stability studies for system interconnections, energy management systems, defining and implementing relay algorithms and their testing within relay manufacturing environment, field tests for high-impedance fault detection, process development and support systems (version control and testing software), and reviewing/updating/implementing utility protection practices and principles. Technical publications contributed by him have been recognized with Best IEEE Paper and IEE's premium paper awards. In current position, he is engaged in distribution system protection and provides support to diverse engineering groups - distributed generation, operations and planning. He is a registered Professional Engineer in California and a licensed Project Management Professional with PMI.

Session 5: *Selecting Current Transformers for Protection Applications: Practical Issues and Remedial Solutions*

The foremost interface device between the power system and the protective relaying is the ubiquitous current transformer. Per ANSI/NEMA/IEEE standards, a standard current transformer (CT) secondary winding is rated at 5A. Typically, IEC standards call for 1A CT secondary ratings and they exist elsewhere. The primary purpose of a current transformer is to translate the current from a high voltage power system to a signal level that can be handled by delicate electromechanical or electronic devices. These secondary connected devices could be indicating or energy integrating instruments, protective relays, transducers etc. Since the applications are so diversified, the CT needs to be properly specified, depending on the application. The engineering task of optimal selection of current transformers and associating them with certain protection and/or control devices, has always been between the art and science for electrical engineers (oversizing vs. undersizing the CTs and consequences, as well as considering extremes like high cost vs. low cost analysis in the worst case scenarios). Parameters such as CT Ratio, frequency, Polarity, Accuracy Class, Saturation Voltage, Knee point voltage, Excitation characteristics, Voltage rating, current rating, thermal ratings etc. are of prime consideration while selecting CTs to suit primary power system. With CT specifications known, it is necessary to match these against the requirements of the protection schemes. This presentation delves into identifying the requirements of protective and sometimes even control application in driving CT selection. While specific examples are utilized in underlining the selection procedures, atypical applications requiring special considerations are included in this presentation for purpose of users' awareness. Selecting CTs for schemes such as high-impedance, sensitive earth fault, and differential protection are outlined highlighting the associated issues and practical resolutions. Typical examples drawn from utility and industrial applications are included to reinforce the understanding. Selecting too big or too small CTs can have unexpected consequences. This presentation provides users with few simple rules to optimize the selection of current transformers. It offers practical assistance in CT selection. A case study to protect a small transformer in the strong system, which is always a problem, is analyzed.

Speaker: Miroslav Ristic, P.E. – Senior Consulting Engineer (System Protection), PG&E

Miroslav Ristic has been with System Protection of Pacific Gas and Electric Company for more than fifteen years. Currently, he is the technical lead in Distribution System Protection with emphasis on San Francisco-East Bay area, supporting numerous venues of utility business, namely: Distribution Switching Centers and Distribution Operations Department on clearances and event analysis, Distribution Planning Department on relevant protection issues, Design, Substation Engineering and Construction Departments on protection aspects of the new and ongoing projects. He has been awarded by PG&E for innovation and contribution in design standards, special protection schemes, and unique scheme for audio noise reduction in transformers. Prior to this, he was an Application Consultant with GE Multilin in Toronto, Canada, where he provided field support and protection expertize to the utilities and industrial companies worldwide. He gained his practical experience working in protection on the Electric Power System of Yugoslavia. He has received a Master in Electrical and Computer Engineering degree from University of Novi Sad, Yugoslavia, and has more than 35 years of experience in relay protection. He is a Registered Professional Engineer in California, and recently put on hold his P.Eng. license in Ontario, Canada.

Lunch and the following book is included in the Registration Cost!

Modern Solutions for Protection, Control, and Monitoring of Electric Power Systems