



Course Information Letter ---- G535

(GE) EX2000 VOLTAGE REGULATOR
G535

Excitation System reliability and availability can be a matter of skilled routine maintenance activity and proficient troubleshooting capability. Proficient troubleshooting is greatly aided by a solid operational understanding of the excitation system and its voltage regulator. This course gives technicians and engineers the necessary knowledge to maintain, repair and calibrate an Excitation System with the EX2000 Voltage Regulator:

1. Using effective routine maintenance practices.
2. Knowing what checks may be performed on-line and how to perform these checks without causing an equipment shutdown.
3. Increasing the likelihood of accurate problem diagnosis by thoroughly understanding how the equipment operates.
4. Increasing the likelihood of accurate problem diagnosis by understanding any given circuit's impact upon operations; i.e., quickly linking the symptom(s) to the faulty circuit.
5. Verifying suspected faulty circuit by analyzing voltage levels and/or signal traces.
6. Understanding the necessary calibrations, after the faulty part has been replaced, including how the calibrations are performed.

HPC's EX2000 Excitation System course makes heavy use of prints, on which the participants are encouraged to take notes. This provides a valuable reference for future use. In addition, the student manuals contain a complete description of the excitation system operation.

Topics include: Excitation System Fundamentals, EX2000 Features, One-Line Diagram, Cabinet Layout, Board Interconnections and Descriptions, Control Core Software Functions, Protective Functions, Programmer, ST2000, IOS and Peripheral

OBJECTIVES: Upon completion of this course, participants will be able to:

1. Discuss how an excitation system accomplishes voltage and VAR control.
2. Discuss the primary and secondary roles of an excitation system.
3. Discuss the major excitation system components, including limit and protective features.
4. Demonstrate the ability to read the EX2000 documentation, including:
 - a. Elementary Diagrams
 - b. Interconnection Diagrams
 - c. Faults
 - d. Functional Blocks
 - e. Hardware Configurable Items
5. Demonstrate an understanding of the EX2000 board interconnections.
6. Demonstrate an understanding of the Control Core Software Functions.
7. Demonstrate an understanding of the Protection Module Software Functions.
8. Demonstrate an understanding of the Software Functions.
9. Demonstrate the knowledge necessary to use the Programmer.
10. Demonstrate familiarity and knowledge necessary to use the Intelligent Operator Station.
11. Demonstrate an understanding of the peripheral functions.
12. Demonstrate an ability to properly use "Toolbox" software functions.

COURSE DATES/LOCATION/FEE

For current dates / locations / prices, please see HPC's website, www.hpcnet.com.

WHAT YOU WILL RECEIVE:

1. 1 copy of HPC Technical Services' textbook, (GE) EX-2000
2. A "Certificate of Completion" with 2.9 CEUs, authorized for issue by the International Associate of Continuing Education/Training.

RECENTLY SATISFIED CLIENTS:

Doosan Heavy Industries, Florida Power Corporation, Korea East West Power, Korea Southern Power, Progress Energy, Western Resources

COURSE OUTLINE

- I. **Excitation System Fundamentals**
- II. **Features of the Digital EX2000 Voltage Regulator**
- III. **EX2000 One Line Diagram**
- IV. **Cabinet Layout**
- V. **Board Interconnections & Descriptions:** Drive Control Card, Microprocessor Application Board, DC Power & Feedback Board, Power Connect Card, SCR High Voltage Interface, PTCT Board, LAN Communications Card, ARCNET Terminal Board, LAN Terminal Board, I/O Termination Board, Relay Terminal Board
- VI. **Control Core Software Functions:** Automatic Voltage Regulator, AVR Reference Ramping, Manual Voltage Regulator (FVR), FVR Reference Ramping, Automatic Follow-Up, Reactive Current Compensator, Volts per Hertz Regulator, Over-Excitation Limiter, Generator Field Temperature Calculation, Under-Excitation Limit, Voltage Matching, Power System Stabilizer, PT Failure Detector
- VII. **Protection Module Software Functions:** Volts/Hertz Protection, On-Line Over Excitation Protection, Off-Line Excitation Protection, Under Excitation Protection, Exciter Phase Unbalance Protection, Generator Overvoltage Protection
- VIII. **Software Functions:** Power Factor Controller, VAR Controller
- IX. **Programmer:** Operate Mode, Parameter Mode, Diagnostic Mode
- X. **ST2000**
- XI. **Intelligent Operator Station:** Maintenance-Free Diagnostics, Configurator, Permissive Engines, Analog Display Values, Control Commands, Status Indications
- XII. **Peripheral Functions:** Power Supply Module, Shaft Voltage Suppression Module, Field Ground Detector, Field Flashing, De-excitation Module, Thyrite

FREQUENTLY ASKED QUESTIONS

- Will HPC Technical Services bring this course to our location for our personnel only? YES, call or email Stephen Parker, stparker@hpcnet.com for a price quotation.
- Will HPC Technical Services customize the presentation at our site to suit our particular needs? Yes.
- Is HPC Technical Services' textbook available for purchase as a reference document? No, this book is not for sale.
- What is the cost for HPC Technical Service to deliver this course at our location? Well, of course that can vary, but generally speaking, if you're planning on having 6+ attend, when considering your T&L, it is to your advantage to perform the course at your plant (office). You gain from the customization and price.
- Can HPC Technical Services provide "Technical Assistance" in the maintenance troubleshooting of your excitation system? Yes we can. Call or contact Harold Parker, hparker@hpcnet.com for our rate sheets and any further information required.

(GE) EX-2000 Voltage Regulator – G535

www.hpcnet.com

GENERATOR I&C CERTIFICATION:

Those who attend this course are automatically qualified to take HPC Technical Services' Certification Examination. This examination is offered at no additional expense to the participant. An 80% passing grade is required. The examination length will not exceed 2-hours. Those who complete this examination will receive a revised "certificate of completion" that recognizes this accomplishment along with two-copies of a "To Whom It May Concern" letter that states their accomplishment. (Two copies are provided, one for the participants' employer and one for the participants' personal file.)

Consult HPC's website, www.hpcnet.com, for detail on this certification program.

HPC INSTRUCTOR / CONSULTANT (S):

Stuart Fasser. Mr. Fasser earned his BSEE from Union College, Schenectady, NY, in 1967. He retired in 2002 after 37 years of service with GE, including an early career in factory and field testing of power generation equipment and concluded with 10 years of field engineering in the installation and service of excitation systems. As a field engineer assigned to GE International he installed new GE excitation systems on generators as well as trouble shooting and maintaining existing installations. His most recent installations included 21 EX2000 exciters on units in Egypt, Thailand, Korea and the United States. In these assignments he was responsible for installation of the exciters as well as their checkout and start-up. These activities included component checks, initial calibration, pre-roll simulation of operation and both off-line and on-line alignment and checkout. Stuart is associated with HPC Technical Services in the areas of generator maintenance, testing, excitation systems and instruction.



John Marshall. Mr. Marshall, worked for GE 35 years in the power system service and installation business. 25 years of this time was in the international service business. During his career, Mr. Marshall's positions included Field Engineer, Service Supervisor, Technical Training Instructor and Senior Application Engineer. Mr. Marshall's work covered electrical power distribution and control of power generation equipment. His expertise is GE manufactured excitation systems for large and medium size generators used on gas and steam powered turbines. As a Technical Training Instructor for over 20 years, Mr. Marshall developed and presented training programs for GE manufactured excitation systems. As a Senior Application Engineer, Mr. Marshall's work included the upgrading/replacement of older excitation systems with GE's digital excitation system. His Field Service work was worldwide. BSEE degree from Virginia Polytechnic Institute and State University in Blacksburg, Virginia.

HPC TECHNICAL SERVICES
500 Tallevast Road, Suite 101, Sarasota, FL 34243
Telephone: 941-747-7733 FAX: 941-746-5374
Website: www.hpcnet.com

REGISTRATION FORM

Company: _____

Plant: _____

Address: _____

City/State/Zip: _____

Telephone: _____ FAX: _____

Course Number/Title: _____

Course Dates: ____/____/____ Thru ____/____/____

Course Location: _____ Course Fee: _____

Please enroll the following individual(s) listed below:

Student #1: _____

Student #2: _____

Taking advantage of HPC's 3-4-2 Policy: Send 3, Pay for 2 when paying in advance.

Student #3: _____

Enrolled by: _____ **Date:** _____

METHOD OF PAYMENT

Check to Follow: _____

Check Enclosed #: _____

MC/Visa/AMEX #: _____

Expiration Date: _____ CV Code: _____

Purchase Order #: _____

HOW DID YOU LEARN OF THIS COURSE?

Attended HPC courses before

Received a fax

Received an email

Received a mailing update

Internet search

Other: _____