

Application Note

DECS-250E Synchronous Generator Applications

A synchronous generator (Figure 1) consists of a stationary component and a rotating component. The stationary component is the stator (or armature) and the rotating component is the rotor that contains the generator field windings. The stator winding is electrically connected to the ac (alternating current) output of the generator. A separate source of excitation power is supplied to the generator field (rotor). This dc (direct current) is fed into the rotating field through slip rings for a brush-type rotary exciter or static exciter (Figure 7) or, as is more common today, a directly-coupled, rotating brushless exciter.

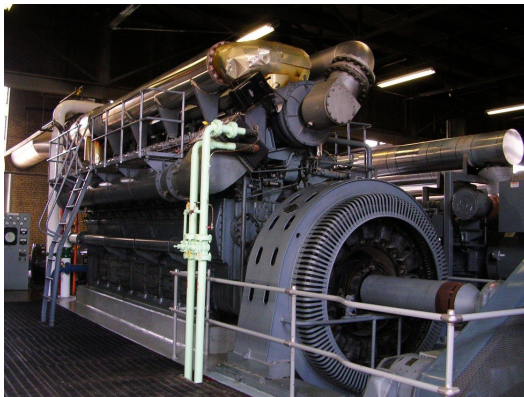


Figure 1. Synchronous Generator

Brush-type exciters have their ac output rectified to dc by commutators and fed to the generator field by brushes and slip rings. Brushless exciters are synchronous generators whose ac output is rectified by diodes. To maintain generator stability, the synchronous generator is equipped with a properly tuned voltage regulator. The voltage regulator is connected to the generator and exciter in a closed-loop system, receiving feedback from the generator output to maintain the proper amount of excitation for the generator to sustain a constant generator voltage. Voltage regulators are available in many different configurations with a variety of available electrical ratings.

In place of a rotating dc exciter, generators with slip rings can be equipped with a static excitation system.

Static exciters with voltage regulation feed directly into the generator main field as opposed to a voltage regulator that feeds into the exciter field. The question then becomes: why choose a static exciter over a rotating exciter? In short, a static exciter inherently responds faster to a system disturbance resulting in faster recovery and greater reactive support to a fault for relay coordination.

The DECS-250E

To meet that static excitation need for smaller generators with excitation fields up to 200 A, Basler Electric offers the DECS-250E Digital Excitation Control System (Figure 2). The DECS-250E provides accurate and reliable regulation, control, and field protection for synchronous generator applications. For slip-ring applications, the DECS-250E is available in three different models: 50 Adc, 100 Adc, and 200 Adc. It can be shipped loose or housed in a compact enclosure built by Basler Electric as a complete, ready-to-install packaged system (Figure 3). The DECS-250E offers enhanced control features including automatic voltage regulation (AVR), field current regulation (FCR), field voltage regulation (FVR), and power factor (PF) and var control.

For generator applications, AVR control mode is used most frequently. AVR control mode regulates the generator ac voltage by modulating the excitation level to maintain 0.25% regulation accuracy. The AVR setpoint can be



Figure 2. DECS-250E Digital Excitation Control System



Figure 3. DECS-250E in an enclosure

adjusted through various means using the DECS-250E BESTCOMSPlus® PC software, contact inputs, or through a serial or Ethernet communication network over Modbus®.

BESTCOMSPlus®

In addition to its advanced control modes, the DECS-250E has many features that can be used to make commissioning and operation of a generator easier and more efficient. All of these features are found in BESTCOMSPlus PC software (Figure 4). BESTCOMSPlus enables access to all DECS-250E settings and features such as auto tuning, auto sync, oscillography, real-time monitoring, and BESTLogic™Plus programmable logic.

Auto Tuning

During commissioning, the excitation system optimum PID (Proportional, Integral, Derivative) tuning gains may not be known. To determine these values manually, additional effort may be required to derive adequate gain settings which tends to slow down the commissioning process. The auto tuning function reduces commissioning time and cost by running a well-developed algorithm to determine the PID values and time constants of the main field on a static excitation system.

Auto Synchronizer

The auto sync function aligns the generator voltage, phase angle, and frequency of the generator with another generator or the utility bus. Once all three parameters are aligned within predefined parameters, the DECS-250E will send a generator breaker close signal via a programmed

contact output connecting the generator to another generator and/or the utility bus. The internal Auto Sync feature used in conjunction with a synch-check relay eliminates the need for an independent synchronizer and increases reliability.

Oscillography

An integrated oscillography function records up to six parameters using the COMTRADE file format. The COMTRADE file shows the response of the six selected parameters over time during a specified duration in hours. Oscillography records are stored in nonvolatile memory and retained even when DECS-250E control power is lost.

The oscillography function is internal to the DECS-250E and does not require the use of an oscilloscope, which reduces the amount of setup time when commissioning or running various tests.

Real-Time Monitoring

The real-time monitor (Figure 5) records live system data without the need for external recording equipment. Simultaneous measurements of up to six variables within the DECS-250E can be performed with the ability to adjust the resolution as needed.

The real-time monitor is used to obtain accurate measurements over time so the system performance can be evaluated with little or no effort to set up. A real-time chart recorder is beneficial for commissioning and NERC testing.

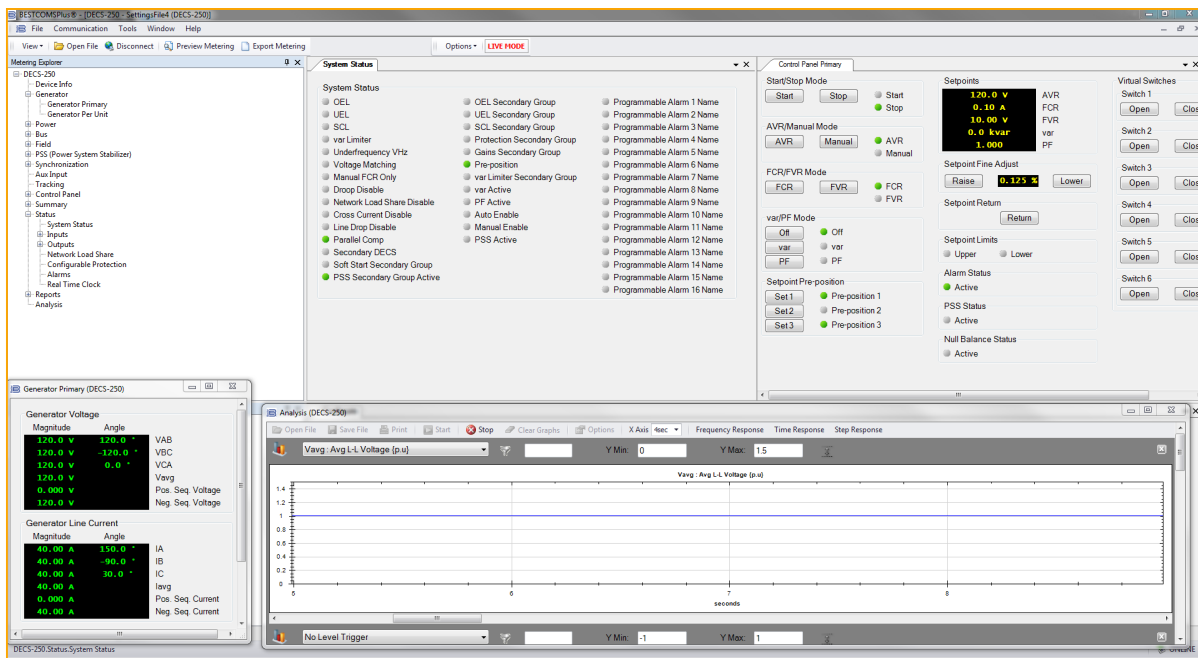


Figure 4. BESTCOMSPlus® Software

BESTlogic™Plus

BESTlogicPlus (Figure 6) is used to program all DECS-250E contact inputs and outputs. Intuitive logic schemes provide simple and flexible programming of DECS-250E functions. These functions include alarm configurations, control modes, auto sync, and configurable protection using analog inputs.

Communication

- RS-232 for external setpoint tracking
- CANbus
- RS-485 with Modbus® RTU
- Ethernet 100Base-T
- USB for BESTCOMSPPlus communication
- Optional PROFIBUS

Conclusion

The DECS-250E is the best solution for regulation and control in generator main field applications up to 200 Adc. It provides accurate and reliable regulation, control and protection. Its BESTCOMSPPlus software simplifies setup with real-time strip chart capabilities, an auto tuning function, and drag-and-drop BESTlogicPlus programmable logic. The DECS-250E's compact enclosure makes for simple and cost-effective installation in a wide variety of applications.

For more information

For further assistance with product orders or questions, contact Basler Electric Technical Support at 618.654.2341.

For additional information, including more application notes, product bulletins and instruction manuals, visit www.basler.com, contact your Application Engineer, or contact Technical Support at 618.654.2341.

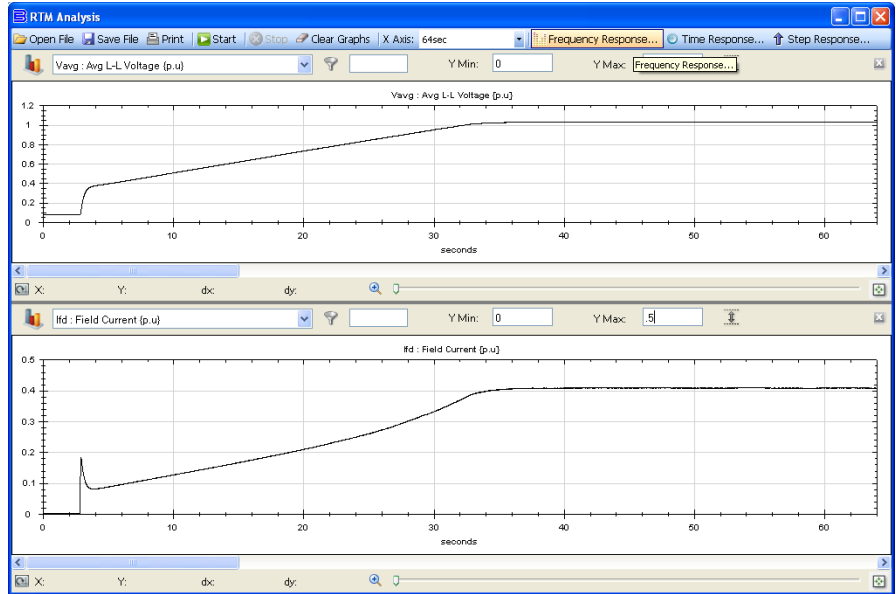


Figure 5. BESTCOMSPPlus® Software Real-Time Monitor

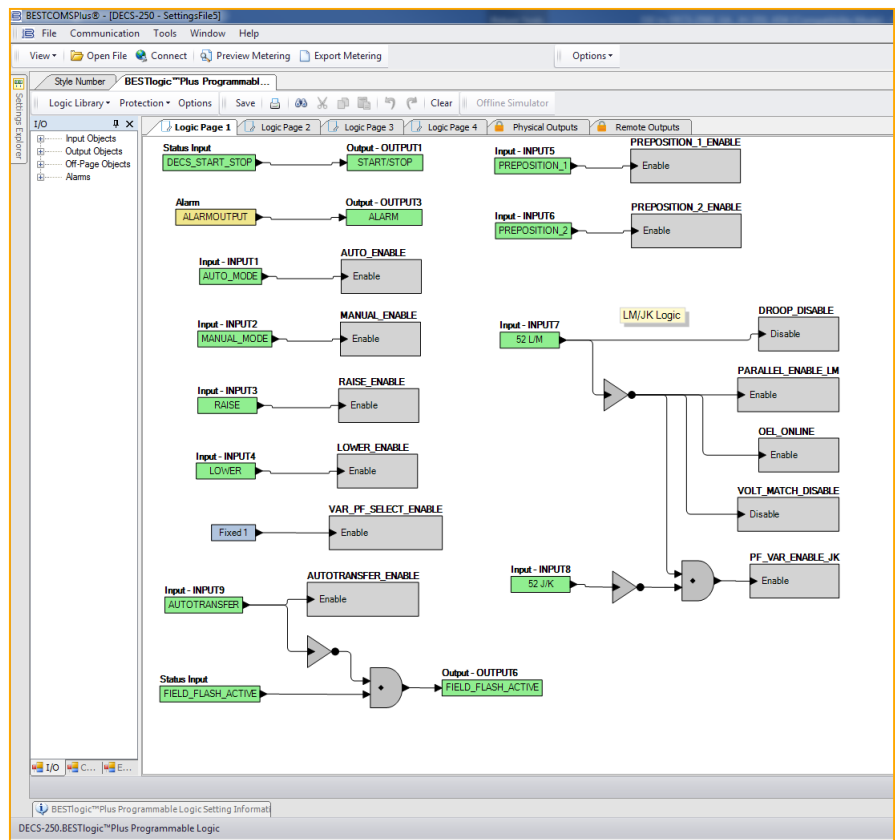


Figure 6. BESTlogic™Plus Programmable Logic

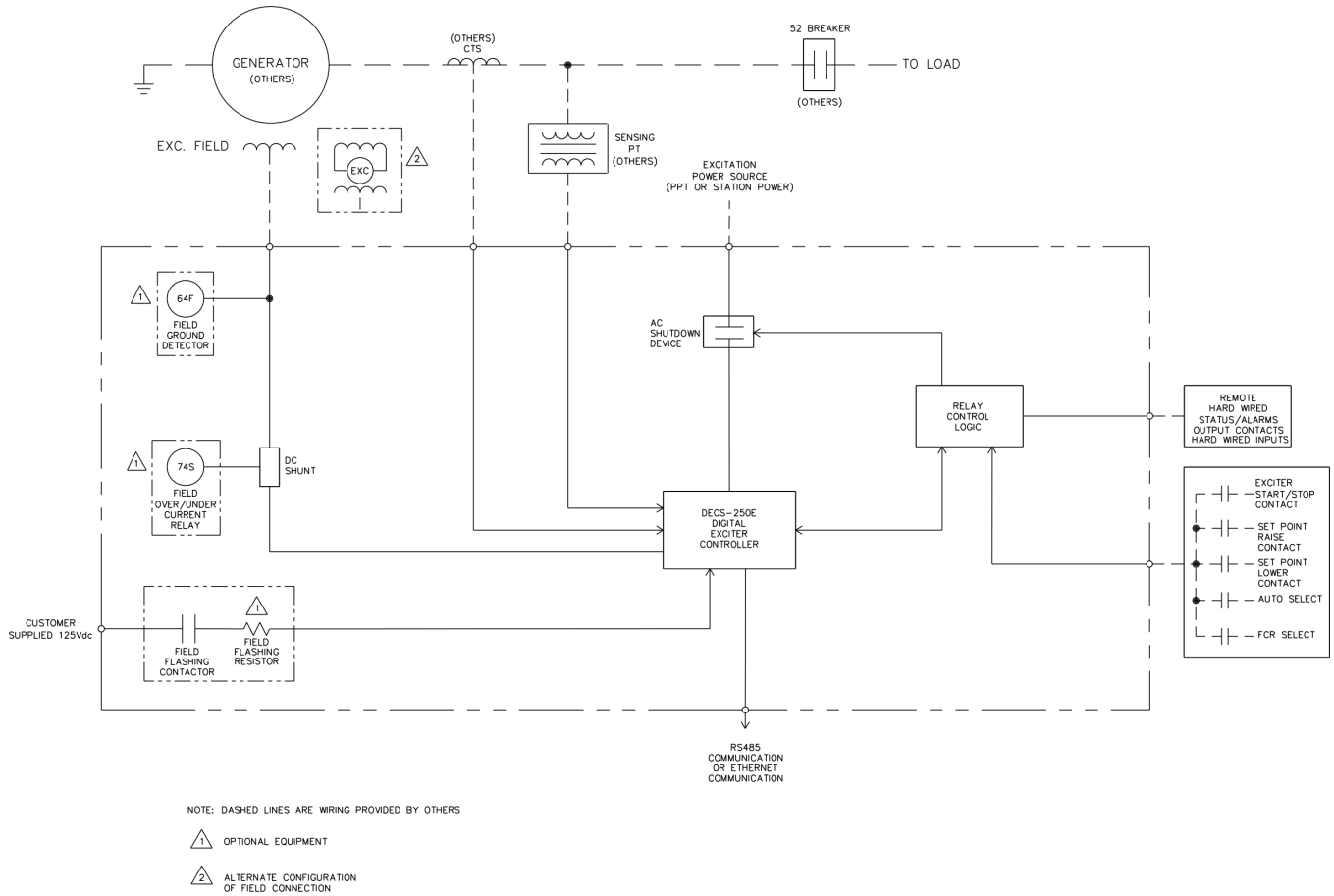


Figure 7. DECS-250E Typical One-Line Drawing