

# Application Note

## DECS-2100 Provides Front End Retrofit for EX2000 Excitation System

**Digital Excitation Systems became increasingly popular in the early 1990s by various manufacturers whose popularity included applications for brushless excited generators and main field static exciter generator systems.**

The technology developed in the early 1990s has become obsolete and components are no longer supported. With aging equipment, there is an increased risk for equipment failure. The need for Power System Stabilizers, improved communications, and ease of testing are reasons to upgrade and modernize these vintage excitation systems.

As technology continued to evolve, the processing power of the microprocessor increased dramatically, providing more functionality and feature capabilities with operating software that was easier to use.

Today, an excitation system upgrade may include a number of different options ranging from:

- A complete replacement of the existing static exciter.
- Keeping the Power Potential Transformer and replacing the exciter cabinet, the rectifiers, controller, and power devices.
- Replacing only the portion of the excitation system that has issues, primarily the digital controls, which includes the firing circuit.

The reasons for selecting the option to replace only a portion of the excitation system may include:

- The new excitation system may not fit into the existing area.
- Obsolescence may involve only the control electronics and not the Power Thyristor Bridge, AC/DC Breaker, and/or Power Potential Transformer.
- Budget may not be available to replace the entire equipment package.

### The Problem

GE's EX2000 was one of the earliest digital static excitation systems containing large and/or small generators presented to the industrial and utility markets. The EX2000 consists of a single core with the voltage regulator, manual control, excitation limiters, Power System Stabilizer, and firing circuits embedded into its processor, requiring much less real estate compared to its analog predecessor.

Further, an additional cubicle contains the bridge configuration for the EX2000. (See Figures 1 and 2)

Today, this product is no longer being supported, although the large power components, such as the Thyristor Bridge, Power Potential Transformer, and AC/DC breaker remain viable as a working system with additional years of operating life. Keeping the larger expensive items and replacing only the control components with updated technology has become a common practice in the industry for larger static excitation systems.



Figure 1: EX2000 Single Channel Control Cubicle



Figure 2: EX2000 Bridge Cubicle

### Retrofit using Basler's DECS-2100 Controller

Basler Electric pioneered front end retrofits for analog systems including the GE Busfed, Basler SSE and SSE-N, Cutler Hammer MGR and Toshiba static excitation control system. Basler also offers a solution to retrofit the EX2000 static excitation system with the DECS-2100 Digital Excitation Control System as a front end retrofit solution. The DECS-2100 Front End Retrofit preserves the existing Thyristor Rectifier Bridge, field flashing resistor, AC/DC contactors/breakers, shaft suppression circuit, and power potential transformer. The existing digital core controller, interface boards, bulk power supplies, the field ground detector, DX (De-Excitation)

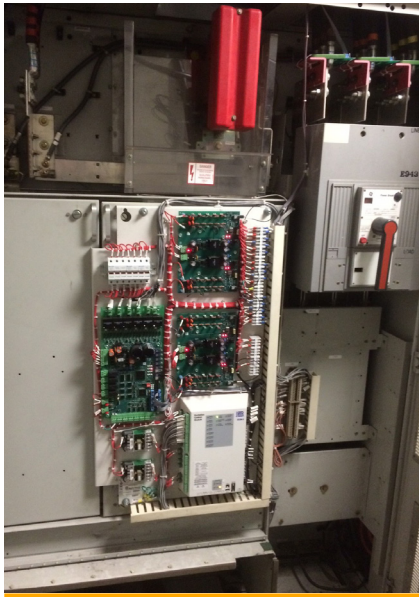


Figure 3: ECM-2 mounted in place of a single core

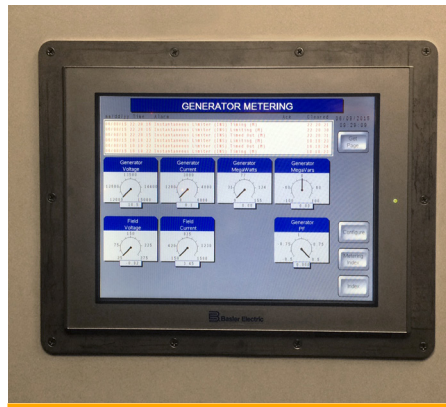


Figure 4: New IDP-1201

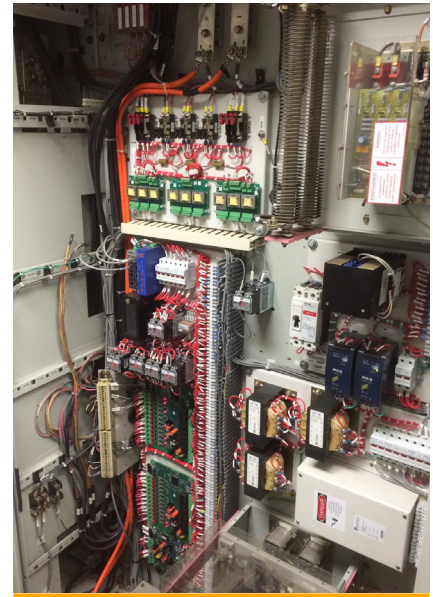


Figure 5: DX Cabinet Section

module, I/O boards, PT/CT sensing card, PT/CT test switches, and customer terminal blocks are removed. These components are replaced by easily mounted panels that are placed in the same general location as the components that were removed.

The new panels have all the components, including the controller, prewired with convenient interface terminal blocks necessary to accommodate the space available within the existing cubicle. Figures 3, 4, and 5 show an updated EX2000 with panels for the DECS-2100. The size and number of panels are subject to change with every application.

The controller inside the EX2000 is replaced with Basler's ECM-2 Excitation Control Module. The ECM-2 is a feature rich controller for the DECS-2100 which includes the features and functionality of the EX2000 and additional enhancements in a small enclosed package that is EMI (Electromagnetic Interference) protected.

The North American Electric Regulatory Council (NERC) requires model validation involving tedious testing of the generator and excitation systems. These include step responses for generator voltage recovery time, generator excitation limiters, and dynamic stability verification of the Power System Stabilizer (PSS). Basler's BESTCOMS™ Pro PC software interfaces directly with the ECM-2, providing a means to easily accomplish generator voltage step and frequency response with the benefit of reduced testing time. Additionally, Basler's BESTspace™ is used to develop specific testing routines or metering screens (See Figures 6 and 7) of interest that are easily saved for future use. A powerful tool in BESTCOMS™ Pro software is the Simulation

Program. The Simulation Program allows users to validate their system parameters by performing simulated responses. Figures 4 and 5 demonstrate the MW difference with the PSS enabled (Dampened MW swing) and disabled (undampened MW swing). The new Auto Synchronizing feature can be selected to control the speed of the governor to match the generator frequency and phase of the utility for the bus.

Unique to the DECS-2100 is the functionality of the Field Ground Detector. The Field Ground Detector continuously monitors the machine field circuit for ground faults. Ground faults are detected through the measurement of leakage current to ground. The leakage current to ground is determined by measuring the voltage drop across a shunt resistor within the ground detector source.

A new De-Excitation/Crowbar (DXCB) module is included with the DECS-2100. The DXCB module can be used in one of two modes: De-Excitation(DX) mode or Crowbar(CB) mode. The DXCB module protects the generator field and exciter circuits by providing a low impedance path for currents that may be damaging to the DECS-2100.

Retrofitting the EX2000 with Basler's DECS-2100 guarantees increased life of existing bridges, as well as increased control and operation of the overall system.

### For More Information

Visit [www.basler.com](http://www.basler.com) for more product information, bulletins, and application notes about this product and many more.

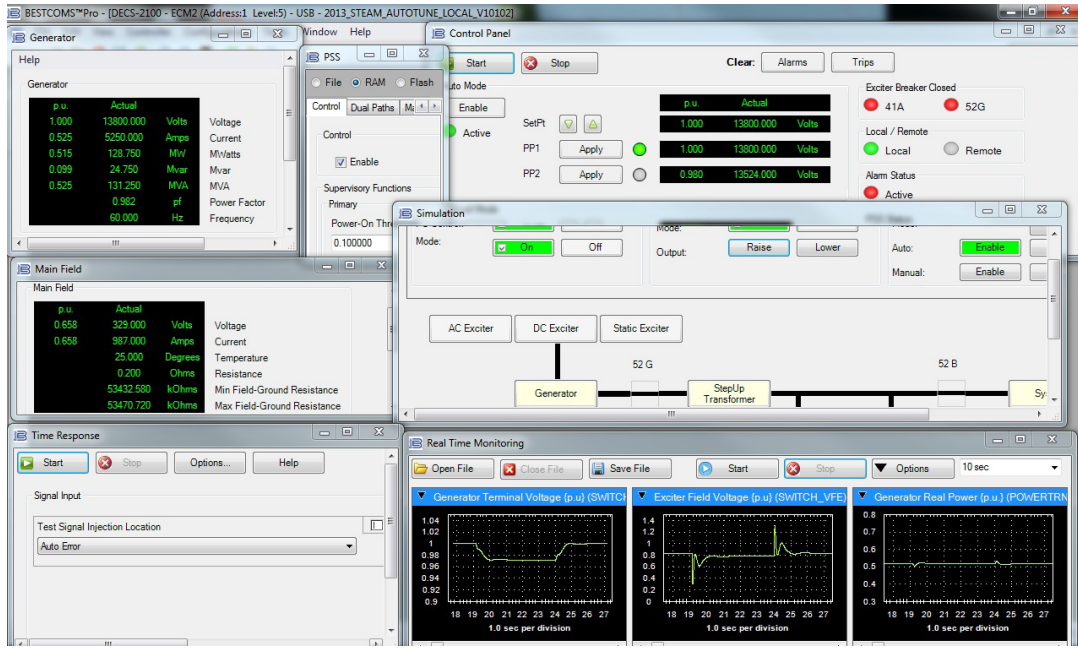


Figure 6: BESTspace™ showing a step response with the PSS enabled



Figure 7: BESTspace™ showing a step response with the PSS disabled

## Equipment Features of the DECS-2100

- $\pm 0.1\%$  Voltage Regulation Accuracy
- Control Modes with Auto tracking
  - Automatic Voltage Regulation (AVR)
  - Manual (Field Current and Voltage)
  - Var
  - PF
- High Side Voltage Regulation Mode
- Dual and Supervisory channel options
- Integrated PSS Type 2A/2B
- Interactive Display Panel (IDP-1201) for local and/or remote monitoring and control
- Real-Time Monitoring with up to six (6) parameters
- Sequence of Events Recording
- Oscillography
- System Simulation Mode
  - Time Responses
  - Frequency Responses
- Automatic Synchronizing
- Auto tuning
- Programmable input/output terminations
- IRIG-B Time Synchronization
- Communication:
  - Multiport Ethernet
  - USB
  - Fiber Optics for bridge firing
  - RS-485
- Protection
  - Field Overvoltage
  - Generator Overvoltage/Undervoltage
  - Bridge Overtemperature
  - Field Flashing
  - Field Overtemperature
  - Loss of Excitation
  - Loss of Voltage Sensing
  - Overcurrent
  - Overexcitation
  - PPT Fuse Failure
  - Thyristor Conduction Monitor
  - Volts/Hertz
  - Watchdog
  - Exciter/Main Field Ground Protection
- Limiters
  - Max Field Current
  - Min Field Current
  - Overexcitation
  - Underexcitation
  - Stator Current
  - Temperature Compensation
  - Volts/Hertz
- Dual PID Settings Group