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Application Note

MAVR Obsolescence Spurs Retrofit to a DECS-250N

Maintaining analog excitation equipment is becoming more difficult for industrial power producers, independent power producers, and utilities as existing components become obsolete. Replacement parts are scarce and support for the aging hardware is difficult to obtain. Specialized performance testing is required for older products to comply with NERC (North American Electric Reliability Corporation), which adds time and cost to the process. One example is the MAVR. It was installed on many combustion (Figure 1) and steam turbine generators throughout the 1980s and 1990s. For these systems, the MAVR can be retrofitted with a Basler Electric DECS-250N digital excitation control system that can eliminate several obsolete components at once.

Figure 1. Typical MAVR-controlled combustion engine generator set

Obsolete Components

A MAVR-controlled system can consist of redundant MAVR controllers, an analog auto-synchronizer, separate manual synchronizing hardware, and motor-operated potentiometers (MOPs) for voltage control. Figure 2 shows the redundant MAVRs and separate manual synchronizing hardware.

Figure 2. Redundant MAVR system with manual synchronization on the control panel

Figure 3 shows the analog auto-synchronizer (manufactured in the 1970s) and two MOPs: one for manual control and one for remote raise/lower control by the voltage regulator.

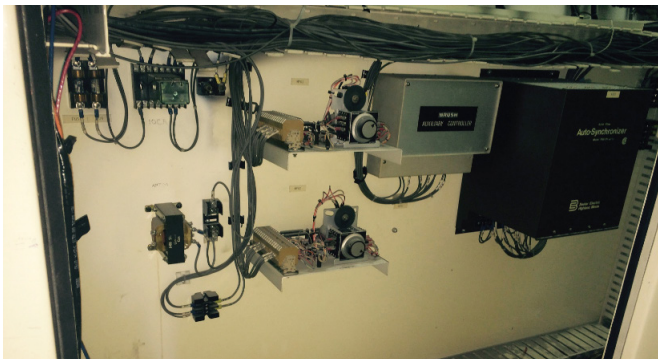

Figure 3. Analog auto-synchronizer (right; manufactured in the 1970s) and two MOPs (left): one for manual control and one for remote raise/lower control used for the voltage regulator.

Machine Data

In order to update an excitation system, machine data of the generator, exciter field, and Permanent Magnet Generator (PMG) (if present) is required. This data includes generator terminal voltage, MVA, PMG frequency, output voltage, and PMG phases. Pay close attention to PMG frequency as it may differ from most PMGs especially when used with a MAVR-controlled system. Figure 4 shows a nameplate for a brushless exciter and PMG set. Figure 5 shows a generator nameplate.

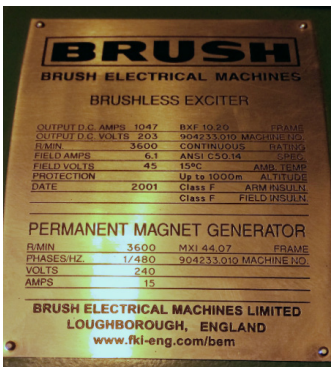

Figure 4. Brushless exciter and PMG nameplate

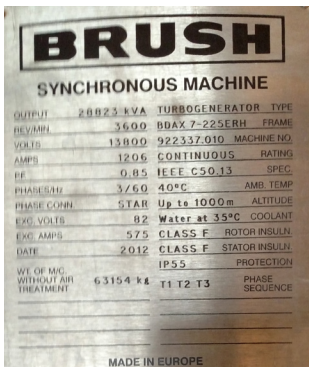

Figure 5. Generator nameplate

The Micro AVR and Prismic® A30

Another obsolete model with functions similar to the MAVR is the Micro AVR Voltage Regulator (Figure 6). This analog-based unit was designed to fit into the same location as the MAVR and has the following features: voltage regulation, manual control, excitation limiters, autotracking between the voltage regulator and manual control, and exciter diode monitoring. Depending on the application, a separate Power System Stabilizer (PSS) unit may be installed to interface with the Micro AVR.

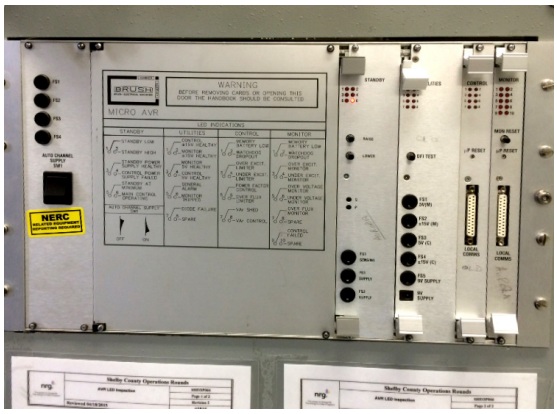

Figure 6. Micro AVR Voltage Regulator

A later version of the Micro AVR is the Prismic A30 excitation controller (Figure 7). Its functions are similar to that of the Micro AVR and it includes PC software for setup and maintenance.

Figure 7. Prismic A30 excitation controller

DECS-250N Retrofit

The fully digital DECS-250N excitation control system directly replaces the MAVR, Micro AVR, and A30 controllers. It can be mounted in the original controller's location with a new mounting plate, it accepts all existing connections that were wired to the original controller, and it provides many modern features to improve excitation system performance and reduce setup and commissioning time. These features are described in the following paragraphs.

Retrofit Kit

The DECS-250N retrofit kit for this system included the DECS-250N voltage regulator, an escutcheon plate, power fuses for the PMG, and an interconnection diagram.

Mounting

An escutcheon plate is provided for easy mounting into the existing panel cutout. See Figure 8.

Connections

A system interconnection diagram details connections for the existing PMG, generator PTs, CTs, exciter field, and controls for Start/Stop, Raise/Lower, and Auto/Manual transfer.

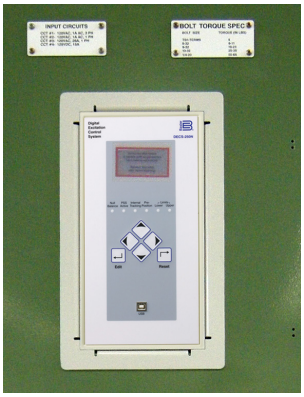

Figure 8. DECS-250N with escutcheon plate mounted in panel.

Negative Field Forcing

The DECS-250N provides negative field forcing. This feature improves generator voltage response time during system disturbances with the ability to drive the exciter field voltage positive or negative. For systems equipped with a PSS, negative field forcing provides linear control of the exciter field to enhance its ability to quickly dampen the MW oscillations in a voltage-weak system.

BESTCOMS*Plus*® Software

Configuring the DECS-250N to fit the application is easy with Basler Electric's complimentary BESTCOMS*Plus* PC software. It features simple drag-and-drop programmable logic, strip chart capabilities, and automatic PID tuning. BESTCOMS*Plus* communicates with many other Basler Electric products to minimize retraining.

Commissioning Tools

Commissioning tests on old analog systems are time-consuming because external test equipment must be delivered to the site. The DECS-250N reduces commissioning time with BESTCOMS*Plus* software's built-in commissioning tools such as a real-time chart recorder, a dynamic system analyzer, a step test function, a frequency response function, and an AVR auto tuning feature. The real-time chart recorder and step test function enable the commissioning engineer to record data for performance and modeling evaluation. An AVR auto tuning feature automatically determines the PID values for optimum voltage response. See Figure 9.

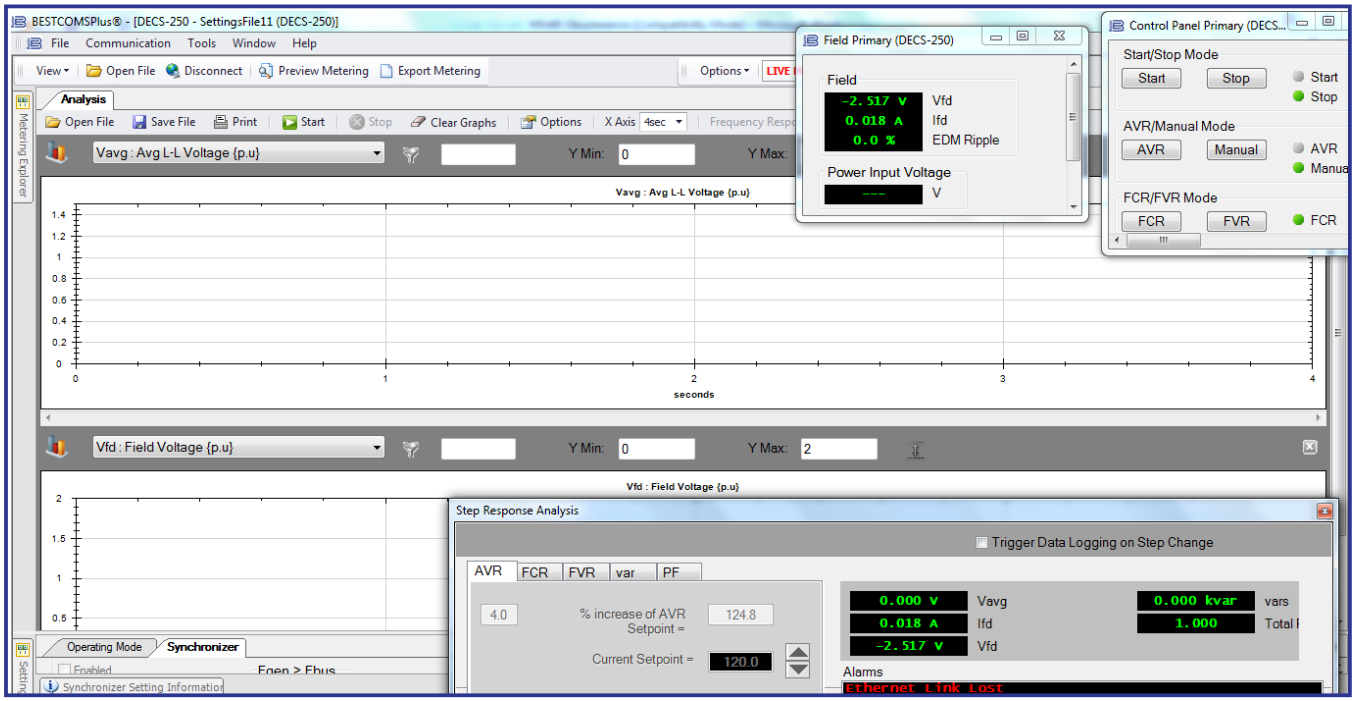

Figure 9. BESTCOMSPlus Real-Time Chart Recorder, Step Test Tool, Control and Field Monitoring screens

Communication

The DECS-250N has extensive communication options to allow for easy integration into a wide variety of control systems. These include USB for locally configuring settings, RS-485 for Modbus® RTU protocol, Ethernet for Modbus TCP protocol, and CAN bus for ECU and expansion modules.

Exciter Diode Monitoring

An exciter diode monitor detects shorted and open diodes in the bridge of a brushless exciter. Should diode failure occur on the brushless exciter, an alarm is annunciated by output contact closure, Modbus, or both.

Optional Features

Power System Stabilizer

The DECS-250N offers an optional integrated PSS. It is an IEEE type PSS2A, dual-input, "integral of accelerating power" stabilizer that provides supplementary damping for low-frequency, local-mode oscillations and power system oscillations.

Automatic Synchronizer

Many vintage generator control systems used a separate automatic synchronizer for closing the generator breaker whereas an optional automatic synchronizer is built into the DECS-250N. The DECS-250N automatic synchronizer can be programmed with all essential generator breaker parameters to ensure a smooth breaker closure upon achieving synchronization. These parameters include voltage matching, slip frequency, and breaker compensation.

DECS-250N Features

The list below highlights many features included in the DECS-250N package.

- Negative forcing
- 20-ampere, six-thyristor rectifier bridge
- Single and dual redundant DECS-250N option
- Dual control power provisions
- BESTCOMS*Plus* PC software
- Preprogrammed logic
- Autotracking between modes of operation
- Autotracking between dual DECS-250N controllers
- Real-time monitoring
- Sequence of events recording
- Automatic tuning
- Extensive communication options
  - USB
  - CAN bus
  - RS-485 Modbus RTU
  - Ethernet Modbus TCP
- Profibus
- Reactive load sharing over communication
- Field flashing provisions
- Provisions for sync check
- Optional automatic synchronizer
- Optional integrated PSS

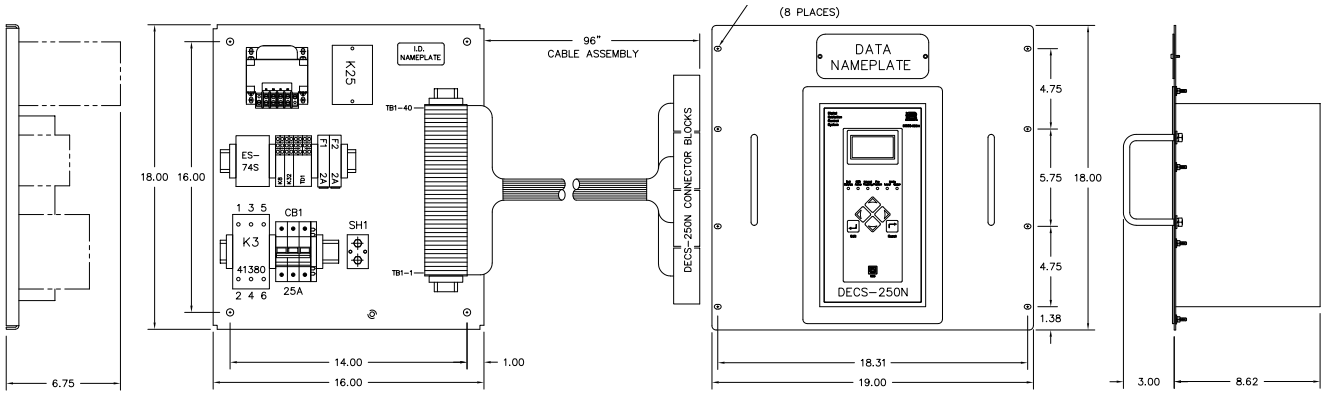

Figure 10. Typical Connection Diagram of a DECS-250N Replacement of an Obsolete Micro AVR, A30, or A32 System

Conclusion

The DECS-250N offers an easy retrofit solution to the MAVR, Micro AVR, and A30 controllers. The single-package excitation system controller is manufactured in the United States and technical product support is available 24 hours a day, 7 days a week. Basler Electric has manufactured excitation systems since 1958 and offers retrofit solutions for a wide variety of excitation systems.

For More Information

For further assistance with product orders or questions, contact Basler Electric Technical Support at +1 618.654.2341. 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 +1 618.654.2341.

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