APPLICATION NOTE #:	**AN_SS_GEN_003**
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ORIGINATOR:	**M. ZIRNHELD**
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SYNCHRONOUS MOTOR CONTROLLERS

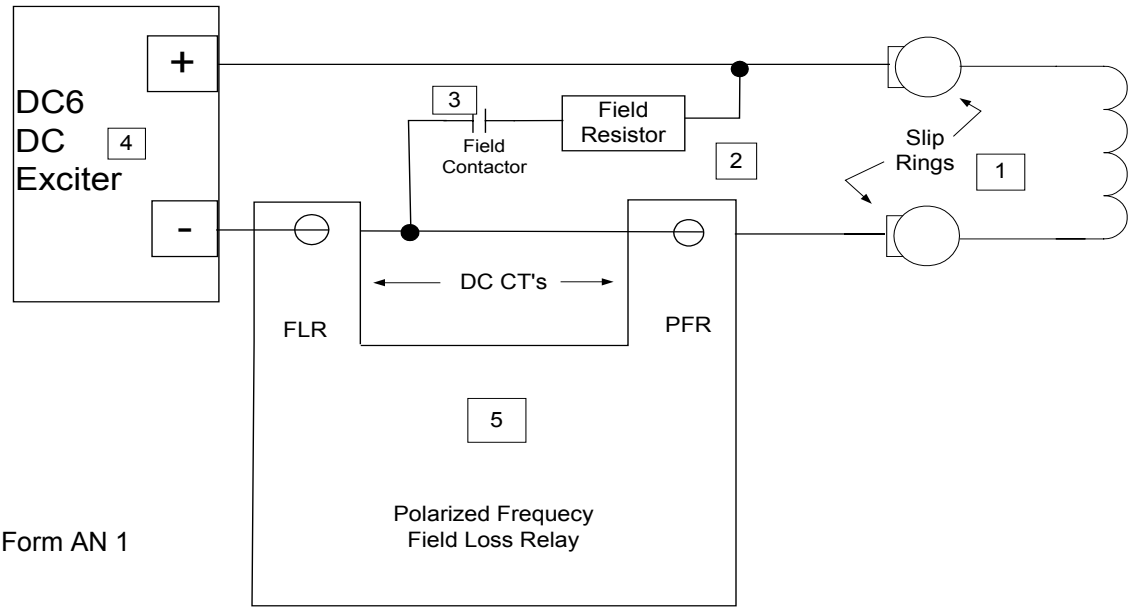
A tremendous opportunity for the EZ* starter (and DC6 Exciter) sales exists in the retrofit of old Electro-mechanical sync-motor control panels.

First, a bit about the idiosyncrasies of Synchronous Motors. The Sync-Motor functions as an induction motor during startup. Once the motor approaches full (synchronous) speed, a DC exciter charges a constant polarity field in the rotor, causing the motor to lock into "Sync". Because the rotor's field is constant and separately excited, there is no slip required to produce torque as with an induction motor, and the motor operates at its synchronous speed. As an interesting side benefit, by varying the field strength (current), we can adjust the power factor of the motor to unity, or even beyond unity to a leading power factor to help correct overall plant power factor.

The actual starter, or AC part of the controller is not unlike a standard induction motor starter. Since most sync-motors start unloaded, the EZ* is set up to operate in current limit and accelerate the motor as quickly as feasible to the sync-point where the DC field energizes and locks the motor in synchronous speed.

The logic and DC portion of the controller is more critical and complex. The field circuit consists of:

1) The actual field winding in the rotor that is connected to the controller via continuous slip rings in the motor's commutator.
2) The field discharge resistor which discharges the current generated in the field prior to synchronous operation.
3) The field contactor which removes the resistor from the circuit once the field is energized.
4) The DC exciter (usually a current regulated DC drive) which provides controllable DC current to excite the field.
5) The polarized frequency/field loss relay circuit which sequences the events leading to successful operation.



Start sequencing would proceed as follows:

1) The EZ* energizes the stator bringing the motor to the sync-point at 3Hz slip (about 95% speed).
2) The polarized frequency relay (PFR) monitors the frequency and the polarity of the current generated in the field and activates the field exciter on the positive going slope of the slip current once it is reduced to 3Hz.
3) The exciter charges the field pulling the motor into sync.
4) The field loss relay senses the continuous DC field current and opens the field contactor disconnecting the resistor.

Successful Start Sequence completed.

Standard Stop Sequence would proceed as follows;

1) EZ* de-energizes removing AC power from the stator.
2) Field contactor closes the field discharge resistor circuit.
3) Field exciter de-energizes.

Successful Stop Sequence completed.

Most existing systems will be complex Electro-Mechanical Control Panels with, mechanical control relays and timers for the sequencing, rotating DC generator and slide wire regulator for the exciter, and cumbersome high power contactors for controlling the application of stator and field current. Many of these systems are very old and are becoming constant maintenance headaches for the operator. In most cases, however, the motor itself is in fairly good condition, or can be reconditioned very reasonably. This is our invitation to sell!!!

By applying an updated Solid State Control System the customer benefits from better reliability, better protection and diagnostics, and their reassurance that if anything does go wrong help (and parts) will be only a phone call away. This should be an easy product to sell due to the fact that competition is scarce, and Saftronics has a proven track record. We will be happy to work with the customer regarding any special requirements.

HINT: When calling for a quote, the following information will be most helpful:

- Stator Volts and Amps
- Field Volts, Amps, and Ohms
- Discharge Resistor Ohms and Watts

Note: EZ* can be either the Saftronics EZ**6** Analog Series or the EZ**start** Digital Series.