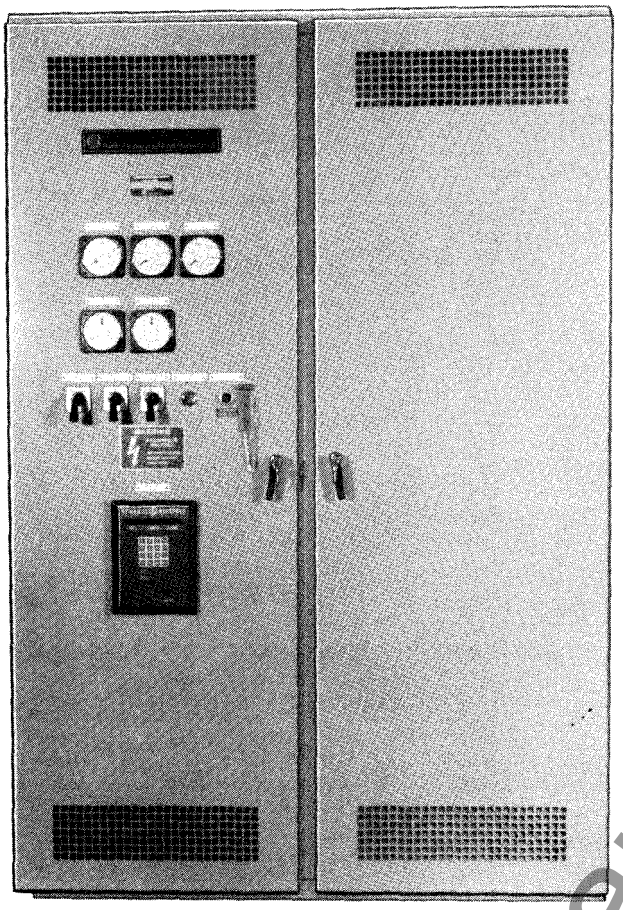
CUSTOMED DESIGNED STATIC EXCITATION SYSTEMS for SYNCHRONOUS BRUSH-TYPE MOTORS



FEATURES:

- Replaces rotating exciters and transformer rectifier bridges.
- Customed designed to specific motor site applications.
- Automatic VAR or power factor regulation.
- High initial response excitation system.
- Highly efficient static exciter design.
- Exciter power transformer matched to station bus voltages.
- All equipment mounted and interconnected in an all-metal, NEMA I enclosure (Other NEMA standards available.)
- Motor pole slip protection.
- All equipment 100% tested.

DESCRIPTION:

Chemical plants, refineries, paper mills, etc., can benefit from Basler Electric's Static Exciter-Regulator Systems used for brush type synchronous motors and synchronous condensers. Static Exciters offer an alternative replacement to repairing or maintaining the existing rotating exciter used to feed power into the main motor field. The Static Exciter System for motor control may be equipped with all the necessary equipment to automatically apply the static exciter across the motor field during motor starting.

Automatic VAR or power factor motor regulation is provided as standard equipment to achieve optimum unit performance. Other accessories are also available to provide more flexible system control. These include dc field contactors, solid-state field application relays with motor protection and updated controls with metering.

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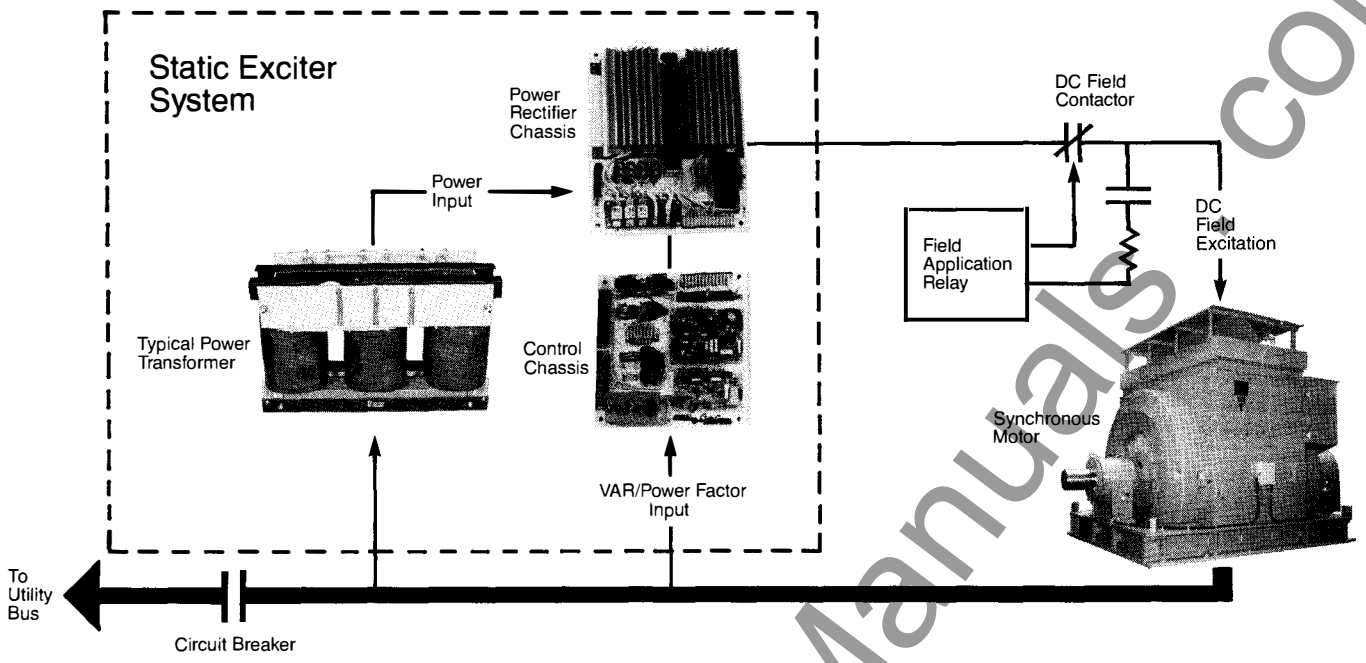


APPLICATION DIAGRAM

APPLICATION

Basler Electric's customized Static Excitation Systems are designed to meet specific site requirements for synchronous motor or synchronous condenser applications. They replace the rotating exciter or transformer rectifier bridge used to supply dc current into the main field of the synchronous motor.

The Static Exciter System can also replace the Amplidyne, Regulex, and Rototrol systems as well as MG exciter sets that have worn out or become obsolete. The burdensome maintenance of commutators and brushes and rheostats as well as the dc exciter rewinding is eliminated. It is replaced by solid-state devices offering high operating efficiency, improved performance, and zero maintenance.

In systems where transformer rectifier bridges are utilized, nuisance bridge failures due to motor pole slip can be avoided with a precision control SCR system.

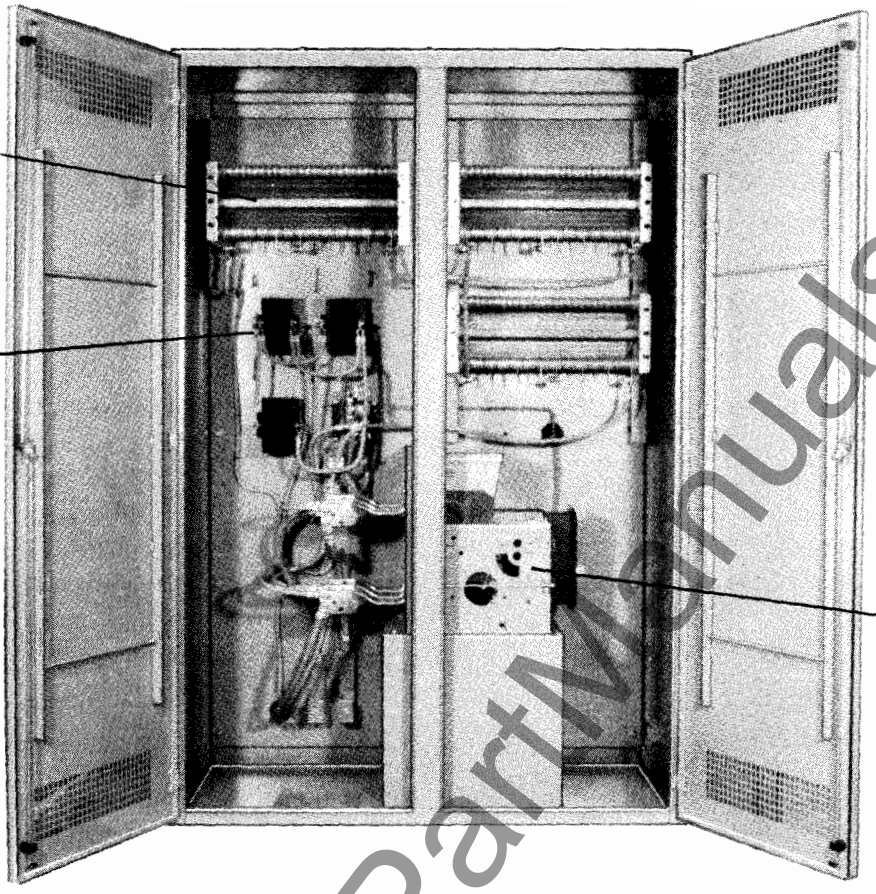
The solid-state exciter is sized to meet the full load excitation requirements of the main motor field. The Static Exciter is available with current ratings from 36 A to more than 2000 A. Filling out the Static Exciter Equipment Selection Guide in this brochure assures compatibility between the Static Exciter power rating and the synchronous motor field requirements.

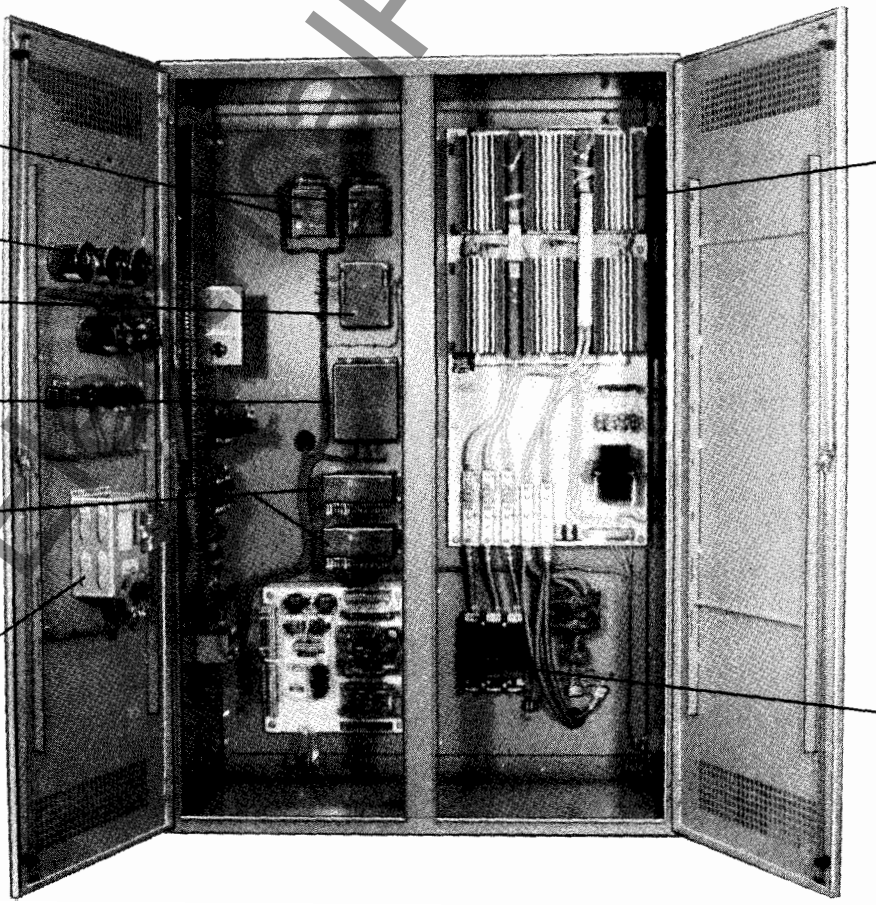
Besides eliminating maintenance, improved motor performance is also achieved with the Static Exciter System. Precise power factor or VAR regulation guarantees optimum motor efficiency by operating at a constant power factor regardless of motor load. Fast transient performance of the excitation system during motor over-load forces higher than normal field current into the field to prevent the synchronous motor from pulling out of step. With a voltage regulator added, the modified performance of the excitation system can help the synchronous motor to improve the voltage stability of the bus.

At start-up, a solid-state Field Application Relay is utilized to assure that the excitation system is applied at the proper time. Here, the Field Application Relay senses the slip frequency across the discharge resistor to determine the optimum time to open the dc contactor and discharge resistor, and apply the Static Exciter across the motor field.

Many different accessories are available to enhance the operation of the excitation system. The Static Exciter Equipment Selection Guide allows a site specific system to be generated based on particular needs.

TYPICAL MOTOR EXCITATION SYSTEM IN CUBICLES





ECONOMICS

Economics play an important role in the evaluation and selection of an excitation system. The Static Excitation System not only provides the volts and ampere requirements of the motor field, but can accomplish it most efficiently. This is due to the Static Exciter having power semiconductors in the ac-to-dc power conversion bridge which have low heat rejection. Low heat rejection means fewer Watts and less operating cost.

Efficiency in measured by the power into the exciter versus the power out, and the higher the percent value, the greater the system efficiency. The formula for exciter efficiency is as follows:

$$Efficiency\ (\%) = \frac{Power\ Out}{Power\ In}$$

Basler Electric has a computer program which helps customers objectively evaluate the operating efficiencies and operating economies of different types of exciters. The program prints out the operating economics of your old exciter versus a modern maintenance-free Shunt Static Exciter.

For your site evaluation, answer the questions on the brief questionnaire located on the back page of this bulletin and fax the information to Basler Electric Company.

BASIC STATIC EXCITER DESCRIPTION: Model SSE

The Static Exciter consists of three fundamental elements: a control chassis, a power rectifier chassis, and a power isolation transformer.

Standard features of the Static Exciter-Regulator used for motor excitation includes automatic VAR/Power Factor regulation.

A manual field excitation control as well as excitation shutdown provisions which electronically shut off the power SCR bridge, are also included as standard features.

STATIC EXCITER SPECIFICATIONS

VOLTAGE SENSING:

60 Hz: 120/139, 208/240, 416/480, 520/600, ±10%
50 Hz: 100/119, 220/240, 380/415, ±10%

SENSING BURDEN: 10 VA per phase.

PARALLEL COMPENSATION:

Burden	Input Current	Droop	Power Factor
25 VA	3 - 5 A	0 - 5%	0.8

INPUT VOLTAGE LEVEL: Input voltages from 208 to 15,500 Vac are standard design levels. For other input voltage levels, contact Basler Electric.

OUTPUT VOLTAGE RANGE: 63 Vdc, 125 Vdc, and 250 Vdc are standard. For other output voltage levels, contact Basler Electric.

OUTPUT CURRENT RANGE: Output current ratings of 36 to 2000 A are available.

APPLICABLE SPECIFICATIONS:

ANSI C57.12.01 - General Requirements for Dry Type Distribution Power Transformer.

ANSI Z55.1 - Gray Finishes for Industrial Equipment.

NEMA - Part ICS6-110.10.02, Type 1, NEMA 1 ventilated.

IEEE 421A - IEEE Standard Criteria and Definitions for Excitation Systems for Synchronous Machines.

NEMA Transformer Specifications ST-20.

National Electrical Code - Enclosure for Electrical Installation.

IEEE 421B - High Potential Test Requirement for Excitation Systems on Synchronous Machines.

STATIC EXCITER EQUIPMENT SELECTION

To specify a Static Exciter System for any motor application, motor data information is necessary. The specification below is designed to assist in obtaining motor data as well as providing a means to identify equipment options that often may be considered for retrofit upgrades. Mark the **"Yes"** or **"No"** to select or decline the option.

1.0 MOTOR RATING DATA

_____ HP, ___ Vac, 60 Hz
_____ PF, ___ RPM
Rated field current at full load: _____
Rated field voltage: _____
Motor field resistance at 25°C: _____

1.1 MOTOR FIELD APPLICATION RELAY (OPTIONAL EQUIPMENT)

During start-up, ac power is applied to the motor stator through the main ac breaker (Device 72). Across the motor field is a discharge resistor used to absorb the induced energy and to help develop the motor starting torque. A field application sensor monitors the slip frequency of the motor at start-up. When the slip frequency is less than the control setting, the power factor regulator/static exciter will be enabled and field excitation will be applied to the motor field while simultaneously opening the field discharge resistor circuit.

Select features desired:

a. Loss of Motor Field Excitation Protection Relay	Y ___ N ___
b. Incomplete Sequence Protection	Y ___ N ___
c. Overexcitation Protection Relay	Y ___ N ___
d. Synchronous Motor Pullout Protection	Y ___ N ___

Data required for Motor Field Application Relay.
_____ Stator full-load current.
_____ Stator locked-rotor current.
_____ Discharge resistance (in ohms).
Induced field current at full ac input voltage:
_____ 0% Speed.
_____ 75% Speed.
_____ 90% Speed.
_____ Allowable stall time, full-voltage.
_____ Allowable running time at 50% or 75% voltage.
Type of starter: full voltage _____
reduced voltage _____
Control Voltage:
_____ Vdc,
_____ Vac

2.0 STATIC EXCITER SYSTEM

2.1 VAR/POWER FACTOR REGULATION (STANDARD EQUIPMENT)

During transient loading conditions, the power factor controller shall control the motor field to maintain the precise power factor regulation from no-load to full-load on the motor. In VAR control, the reactive component of the motor line current will be regulated.

2.2 MANUAL VOLTAGE CONTROL (STANDARD EQUIPMENT)

Standby manual voltage control shall be provided to adjust the motor field excitation. Control range shall be from 25% to 115% of nominal motor field voltage.

2.3 IMPROVED BUS VOLTAGE STABILITY (OPTIONAL EQUIPMENT)

For improved system bus voltage stability, a voltage regulator can be furnished in place of the standard manual control with the Static Exciter System. The Static Exciter Regulator provides ±1/2% voltage regulation. The control range of the automatic voltage regulator will be from -10% to +10% of the nominal motor field voltage.

Y ___ N ___

2.4 POWER STEPDOWN TRANSFORMER (STANDARD EQUIPMENT)

A three-phase, dry-type, power isolation transformer shall be supplied to stepdown the station terminal voltage to the proper level for the power semiconductor bridge. The transformer shall be designed in accordance with transformer NEMA standard ST.20.

2.5 POWER TRANSFORMER PRIMARY FUSING (OPTIONAL EQUIPMENT)

Primary phase fusing will be placed at the input of the power potential transformer. Y ___ N ___

2.6 POWER CONVERSION BRIDGE (STANDARD EQUIPMENT)

A three-phase, semiconverter rectifier bridge will be provided. It will consist of three power SCR's and three power diodes to phase control the dc power to the main field of the motor. A permanent diode will be connected at the output of the rectifier bridge to provide a commutating path for the power SCR's during switching.

Three fast-acting, current limiting fuses will be provided at the ac input to the three-phase rectifier bridge.

The Static Exciter Regulator is capable of providing a minimum of 145% field forcing for one minute from the nominal full-load voltage rating. Additionally, it has a response ratio of not less than 1.76 for 145% maximum exciter ceiling voltage.

3.0 AC MOLDED CASE CIRCUIT BREAKER (OPTIONAL EQUIPMENT)

A shunt trip ac molded case breaker may be provided to interrupt the ac input power to the three-phase rectifier bridge. The ac breaker includes thermal element for overload. Y ___ N ___

4.0 DC FIELD BREAKER (OPTIONAL EQUIPMENT)

A field breaker (or contactor) will apply dc power to the synchronous motor main field. A separate pole will be provided for the discharge resistor. Y ___ N ___

4.1 MOTOR FIELD DISCHARGE RESISTOR (REQUIRED WITH DC FIELD BREAKER)

A field discharge resistor for application across the main field is provided for motor starting. The resistance value will be based upon the vendor motor data. Y ___ N ___

5.0 RECOMMENDED/PERFORMANCE FEATURES

The application of various accessories will be used to modify the operating characteristics of the automatic power factor regulator.

5.1 EXCITATION LIMITER (OPTIONAL EQUIPMENT)

MAXIMUM EXCITATION LIMITER. To prevent rotor field heating due to excessive current in the motor field, time delay will be inverse or definite time, field selectable. Y ___ N ___

MINIMUM EXCITATION LIMITER. To prevent too little field current being applied to the motor field. The minimum excitation limiter will provide a correction signal into the Static Exciter. This is to prevent too little field current that can otherwise cause loss of motor synchronization. Y ___ N ___

5.2 FIELD TEMPERATURE MONITOR/RELAY (OPTIONAL EQUIPMENT)

The Field Temperature Monitor/Relay measures the exciter voltage and current from the field, calculates the resistance, and then provides a 4 to 20 ma dc signal scaled to read the motor field temperature. This signal varies as the field winding resistance changes due to temperature changes. The setpoint for overtemperature is adjustable on the face of the meter. A red line indicates the operating point of the Relay. Y ___ N ___

5.3 LOCAL CONTROL WITH ALL FEATURES MOUNTED INSIDE CABINET (STANDARD EQUIPMENT) REMOTE CONTROL WITH ALL FEATURES MOUNTED REMOTELY (OPTIONAL EQUIPMENT)

Provisions for remote control of the excitation at a remote switchboard or other supervisory station may be provided. Note: switches provided by others:

a. Power Factor/Manual Transfer Y ___ N ___
b. Motor Shutdown Y ___ N ___
c. Voltage Raise/Lower for Manual Voltage Control Y ___ N ___
d. VAR/Power Factor Raise/Lower Y ___ N ___

5.4 MOTOR THERMAL PROTECTION MODULE (OPTIONAL EQUIPMENT)

A multi-parameter protective and multi-function monitor motor protection relay is available to provide dynamic and active protection for the motor within its design limitations.

Y ___ N ___

6.0 EXCITATION CUBICLE

All elements of the field application excitation system are mounted into a metal enclosed, NEMA I cubicle. The cubicle is rigid, self-supporting. A full length door in the low voltage compartment provides easy access to all equipment.

The power isolation transformer is shipped in a separate, metal-enclosed, NEMA I cabinet.

6.1 METERS (OPTIONAL EQUIPMENT)

All meters are Switchboard Type, 1% accuracy, with a 270 dial range.

a. Dc Voltmeter Y ___ N ___
b. Dc Ammeter Y ___ N ___
c. Power Factor Meter Y ___ N ___
d. Field Temperature Meter Y ___ N ___

6.2 STATUS INDICATION (OPTIONAL EQUIPMENT)

a. Maximum Excitation Limit Y ___ N ___
b. Minimum Excitation Limit Y ___ N ___
c. Raise/Lower Limits of Motorized Potentiometer for:
(1) Auto Regulator Y ___ N ___
(2) Manual Control Y ___ N ___
(3) Power Factor Controller Y ___ N ___
d. In Power Factor or Manual Mode Y ___ N ___
e. Ac Field Breaker
(1) Open/Closed Y ___ N ___
f. Dc Field Breaker
(1) Open/Closed Y ___ N ___

6.3 CONTACTS WIRED REMOTE FOR PROTECTIVE RELAYS AND THEIR INCLUDED FEATURES (STANDARD EQUIPMENT)

For any included features of your custom excitation system, the contacts for remote monitoring or control are wired to terminal boards at no additional cost.

6.4 OTHER CUBICLE ACCESSORIES (OPTIONAL EQUIPMENT)

a. Space Heater with Thermostat Y ___ N ___
b. Incandescent Light with Convenience Outlet Y ___ N ___

6.5 OTHER PROTECTIVE RELAYS (OPTIONAL EQUIPMENT)

a. Device 47N, Voltage Balance Relay for Fuse Failure of Power Rectifier Bridge Y ___ N ___
b. Device 47N/27 for Loss of Voltage Sensing Y ___ N ___
c. Device BE -16A Motor Protection Unit Y ___ N ___

After selecting the equipment package of interest, return the information to your regional sales representative or directly to Basler Electric.