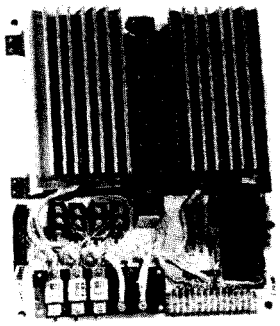
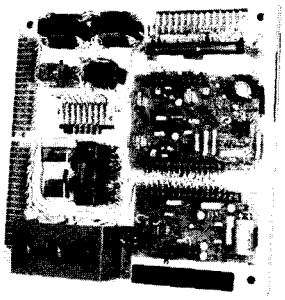


Rectifier Chassis
(Typical)



Control Chassis
(Typical)

"SSE" Shunt/Static Exciter/Regulators

The SSE Solid State Shunt Static Exciter/Regulator offers the performance and reliability demanded by industrial and utility users. Basler's SSE utilizes solid state analog design to provide high initial response for improved motor starting and fast voltage recovery. It may replace the rotary brush type exciter, eliminating most routine maintenance and repair. This static excitation system has a high operating efficiency and low operating cost.

On synchronous motor applications, the SSE may be used with a Basler VAR/Power Factor Controller to automatically maintain constant VARS or power factor on the motor during variations on motor loads.

FEATURES

- Automatic or manual voltage control operation
- Selectable single or three phase voltage sensing
- Paralleling provisions
- Voltage limited Volts/Hertz compensation
- High initial response per IEEE 421.2
- High efficiency
- Regulation better than ±½%
- Solid state circuitry
- Wide selection of accessories
- Modular design

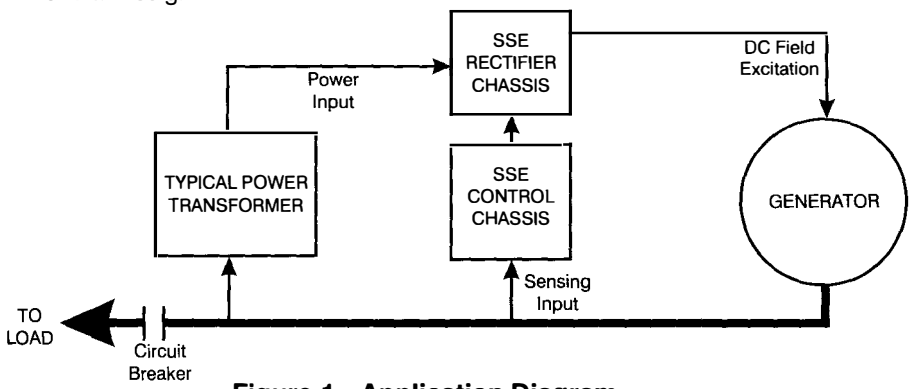


Figure 1 - Application Diagram

Basler Electric

P. O. BOX 269 HIGHLAND, ILLINOIS, U.S.A. 62249 PHONE 618-654-2341 FAX 618-654-2351

DESCRIPTION

The SSE consists of a control chassis, power rectifier chassis, and electrical power isolation transformer: all the elements required to maintain generator terminal voltage within ±½%. This is accomplished by monitoring the terminal voltage and comparing it to a voltage reference. Any difference developed from this comparison causes an immediate change in the dc output of the static exciter to the generator field to normalize the ac generator output voltage.

Standard features of the static exciter/regulator include selection of single or three phase voltage sensing.

A voltage limited Volts/Hertz circuit is standard. It is used to reduce generator voltage as a function of prime mover speed. A user-selectable 1 P.U. or 2 P.U. Volts/Hertz circuit is available to prevent generator field and stator heating caused by low prime mover speed. An LED is provided for indication during underfrequency operation. See Figures 2a and 2b.

When multiple generators are operated in parallel, a built-in reactive droop compensation circuit is used to balance VAR level sharing between generators to minimize the circulating current that may otherwise occur.

A built-in manual control offers easy troubleshooting and reliable backup as an alternate for the automatic voltage control.

Voltage shutdown is accomplished by electronically shutting off the rectifier bridge or by a contactor, depending on exciter rating, causing an immediate decay of generator output voltage. Voltage buildup is accomplished by rectifying the residual voltage from the generator output and applying it to the generator field. (A 5% minimum residual voltage is required.)

The SSE may optionally be equipped with a contactor to interrupt ac power for generator voltage shutdown. For positive generator voltage buildup, optional field flashing relays may be selected to apply the station's battery power to the generator field. An overflash prevention circuit removes field excitation when the generator voltage has not built up within a predetermined time.

Note: AC Shutdown and Field Flashing Contactors are standard on SSE250 models rated up to 400 amps.

SPECIFICATIONS

Regulation
Better than ±½% for load application or rejection after all transients have decayed

Exciter/Regulator Response
Less than 50 milliseconds

Temperature Coefficient
Better than 1% for a 50°C ambient temperature change

Automatic Voltage Adjustment Range
±10% nominal voltage

Sensing Voltage
60Hz, 120-139, 208-240, 416-480, 520-600, ±10%
50Hz, 100-119, 220-240, 380-415, ±10%
Maximum burden per phase: 10VA

Parallel Compensation

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

Underfrequency Compensation Parameters
See Figures 2a and 2b

Ambient operating temperature
-40°C to +50°C (-40°F to +122°F)

Storage temperature
-65°C to +85°C (-85°F to +185°F)

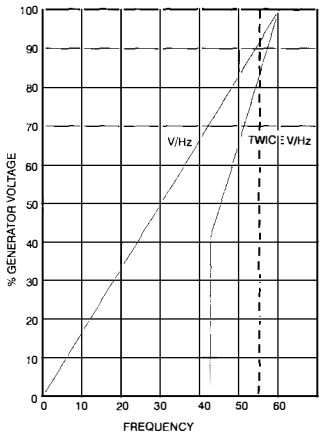


Figure 2a - Typical 60Hz Voltage/Frequency Characteristic Curve

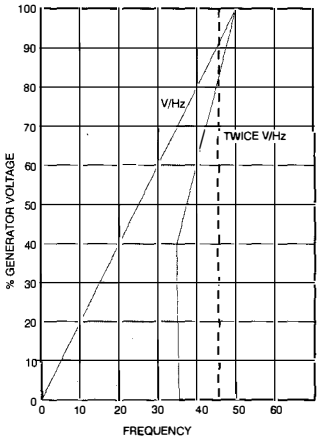


Figure 2b - Typical 50Hz Voltage/Frequency Characteristic Curve

SHUNT EXCITERS SELECTION TABLE

Model No.	AC Supply	Burden KVA	Generator Field Power: Max. Cont. VDC	Max. Cont. ADC	1 Minute Forcing VDC	1 Minute Forcing ADC	KW	Min. Field Resistance Ohms	Power Transformer Part Number	Power Transformer Dimensions (W x H x D) ⚠3	Rectifier Chassis Dimensions (W x H x D) ⚠3	Equipment Weight ⚠3
SSE 63-4.5	225/450	8	63	72	90	103	4.5	0.875	BE 15482	17x16x8 (432x406x203)	19x23x9 (483x584x229)	265 lb (120 Kg)
SSE 125-4.5	225/450	8	125	36	180	52	4.5	3.472				
SSE 63-6.5	225/450	12	63	103	90	147	6.5	0.612	BE 18222	18x13x10 (457x330x254)		340 lb (154 Kg)
SSE 125-6.5	225/450	12	125	52	180	75	6.5	2.404	BE 15201	19x17x7 (482x432x178)		350 lb (158 Kg)
	2400/4160								BE 15203	24x16x10 (609x406x254)		420 lb (190 Kg)
SSE 125-9	225/450	16	125	72	180	104	9	1.736	BE 15206	20x18x9 (508x457x229)		430 lb (195 Kg)
	2400/4160								BE 15208	25x18x12 (635x457x305)		380 lb (172 Kg)
SSE 125-13	225/450	24	125	104	180	150	13	1.202	BE 15211	20x19x19 (508x482x495)		430 lb (195 Kg)
	2400/4160								BE 15213	26x18x13 (660x457x330)		470 lb (213 Kg)
SSE 125-17	225/450	31	125	136	180	196	17	0.919	BE 15221	24x20x11 (609x508x279)	19x33x9 (483x838x229)	560 lb (254 Kg)
	2400/4160								BE 15223	27x18x13 (686x457x330)		540 lb (245 Kg)
SSE 250-17	225/450	31	250	68	360	98	17	3.676	BE 15221	24x20x11 (609x508x279)	26x48x11 (660x1219x279)	600 lb (272 Kg)
	2400/4160								BE 15223	27x18x13 (685x457x330)		580 lb (263 Kg)
SSE 63-25	225/450	45	63	397	90	567	25	0.159	BE 15803	21x20x13 (533x508x330)	26x55x9 (660x1397x229)	800 lb (363 Kg)
SSE 125-25	225/450	45	125	200	180	288	25	0.625	BE 15226	25x20x13 (635x508x330)	26x50x9 (660x1270x229)	840 lb (380 Kg)
	2400/4160								BE 15228	25x21x14 (635x533x355)		720 lb (326 Kg)
SSE 250-25	225/450	45	250	100	360	144	25	2.500	BE 15226	25x20x13 (635x508x330)	26x48x11 (660x1219x279)	800 lb (362 Kg)
	2400/4160								BE 15228	25x21x14 (635x533x355)		720 lb (326 Kg)
SSE 125-33	225/450	59	125	264	180	380	33	0.473	BE 15236	25x21x14 (635x533x355)	26x50x9 (660x1270x279)	890 lb (404 Kg)
	2400/4160								BE 15238	26x22x15 (660x558x381)		770 lb (349 Kg)
SSE 250-33	225/450	59	250	132	360	190	33	1.894	BE 15236	25x21x14 (635x533x355)		890 lb (404 Kg)
	2400/4160								BE 15238	26x22x15 (660x558x381)		770 lb (349 Kg)
SSE 125-50	225/450	90	125	400	180	576	50	0.313	BE 15241	31x21x18 (787x533x457)	26x55x10 (660x1397x254)	1050 lb (476 Kg)
	2400/4160								BE 15243	30x27x15 (762x685x381)		1150 lb (522 Kg)
SSE 250-50	225/450	90	250	200	360	288	50	1.250	BE 15241	31x21x18 (787x533x457)	26x60x10 (660x1524x254)	1050 lb (476 Kg)
	2400/4160								BE 15243	30x27x15 (762x685x381)		1150 lb (522 Kg)
SSE 125-65	225/450	117	125	520	180	749	65	0.240	BE 18301	25x30x16 (635x762x406)	26x50x12 (660x1270x304)	1530 lb (694 Kg)
	2400/4160								BE 15248	30x28x16 (762x711x406)		1430 lb (949 Kg)
SSE 250-65	225/450	117	250	260	360	374	65	0.962	BE 18301	25x30x16 (635x762x406)	26x60x10 (660x1524x254)	1510 lb (985 Kg)
	2400/4160								BE 15248	30x28x16 (762x711x406)		1410 lb (640 Kg)
SSE 125-100	225/450	180	125	800	180	1152	100	0.156	BE 15231	31x23x19 (787x584x482)	26x55x18 (660x1397x457)	1940 lb (880 Kg)
	2400/4160								BE 15233	34x31x21 (864x787x533)		1840 lb (880 Kg)
SSE 250-100	225/450	180	250	400	360	576	100	0.625	BE 15231	31x23x19 (787x584x482)		1980 lb (844 Kg)
	2400/4160								BE 15233	34x31x21 (864x787x533)		1880 lb (853 Kg)
SSE 125-125	2400/4160	225	125	1000	180	1440	125	0.125	BE 20190	36x33x23 (914x838x584)		2190 lb (933 Kg)
	13,800								BE 20191	44x31x23 (1118x787x584)		
SSE 250-125	2400/4160	225	250	500	360	720	125	0.500	BE 20190	36x33x23 (914x838x584)		2210 lb (1003 Kg)
	13,800								BE 20191	44x31x23 (1118x787x584)		
SSE 250-150	2400/4160	270	250	600	360	864	150	0.417	BE 20192	38x35x24 (965x889x610)		
	13,800								BE 20193	46x33x24 (1168x838x610)		
SSE 250-200	2400/4160	360	250	800	360	1152	200	0.313	BE 20194	41x38x26 (1041x965x660)		2350 lb (1066 Kg)
	13,800								BE 20195	49x36x28 (1245x914x711)		

NOTES:
1. For voltages not shown, contact the factory.
2. For control chassis dimensions, see Figure 6.
⚠3. Dimensions and weights are approximate and subject to change without notice.
4. Dimensions in parentheses are in millimeters.
5. All 250Vdc SSEs rated up to 400 amps include Field Flashing and AC Shutdown contactors mounted on rectifier chassis.

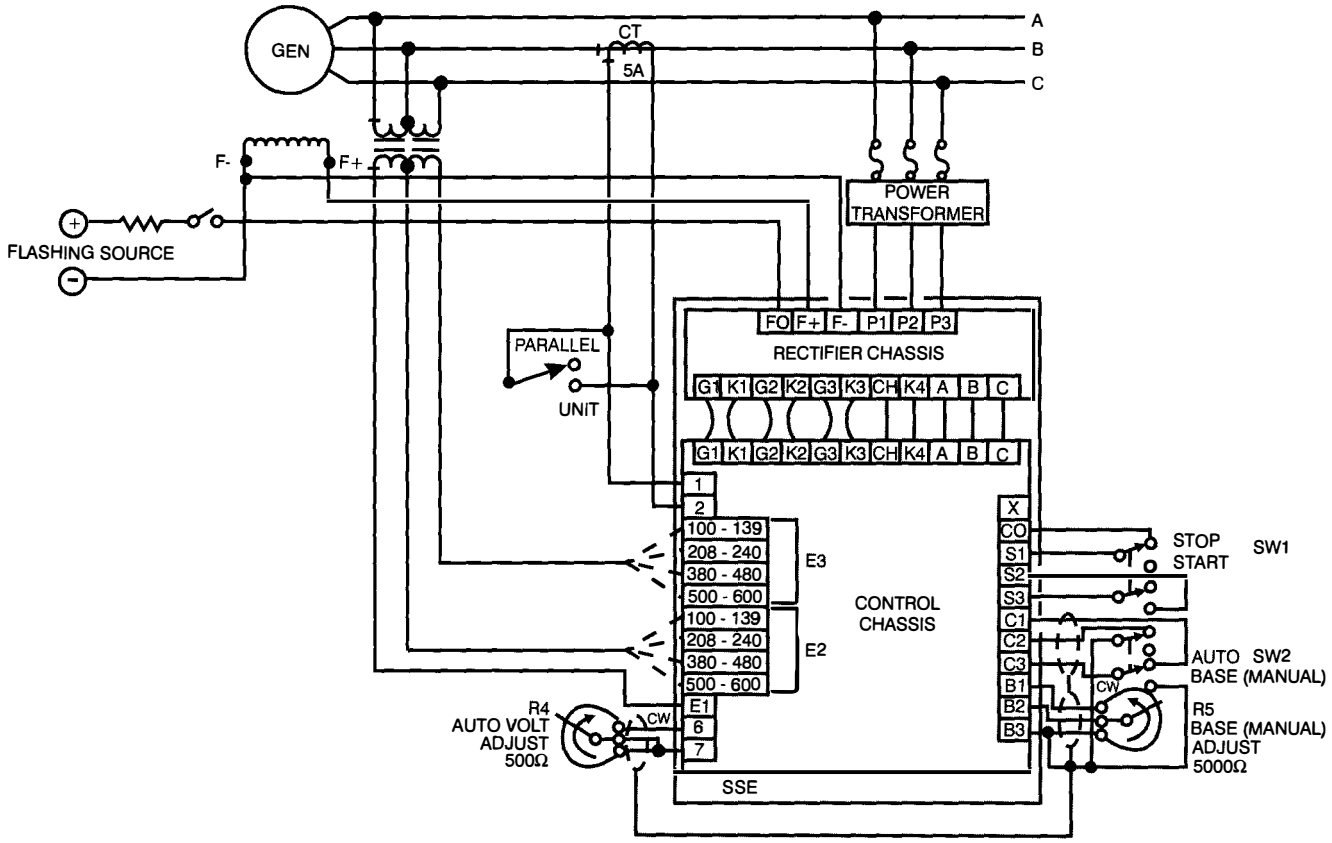


Figure 3 - Typical Interconnection Diagram for SSE with Generator

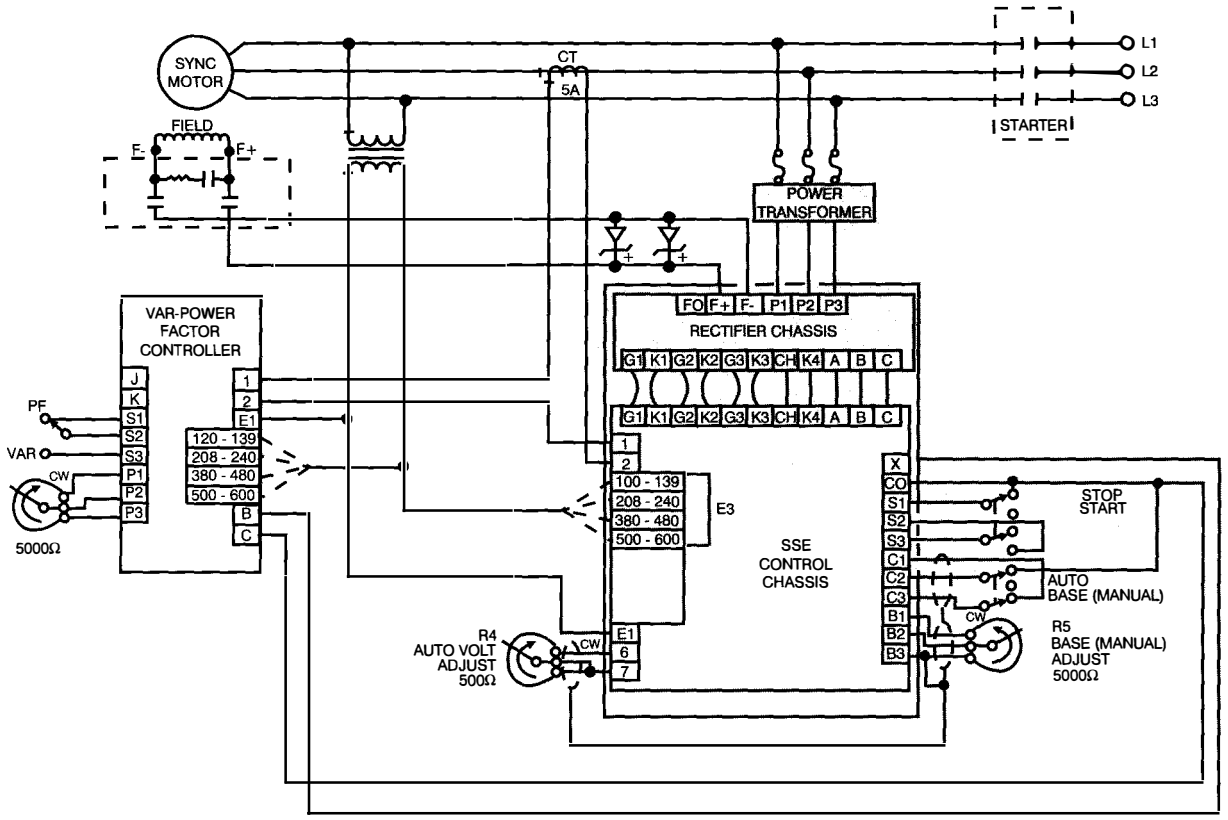


Figure 4 - Typical Interconnection Diagram with a Synchronous Motor

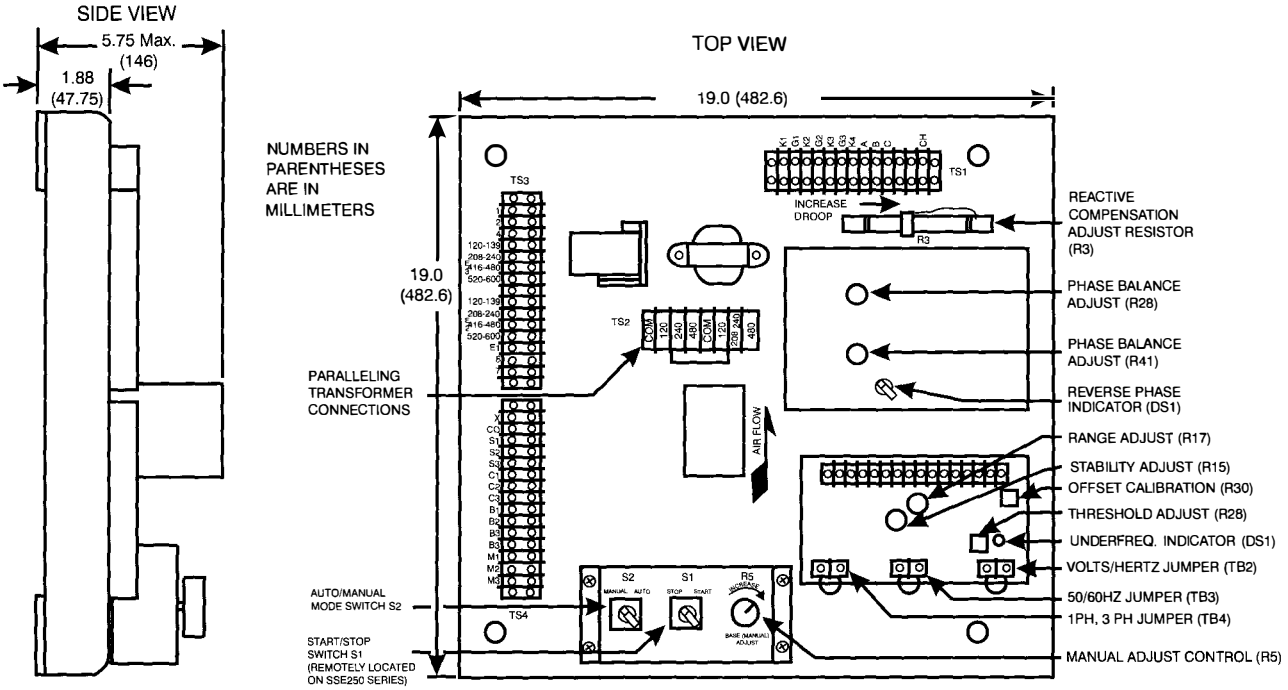


Figure 5 - Control Chassis

NOTES:
1. All items within grey shading are supplied with SSE static exciter.
2. These drawings are not intended for installation purposes. Refer to the applicable instruction manual for detailed information.

OPTIONAL SSE STATIC EXCITER ACCESSORIES for enhanced system performance

ENCLOSURE All elements of the excitation system can be mounted in a standard steel cubicle. The cubicle is rigid and self-supporting with full length doors in the low voltage compartment. Easy access is provided to all necessary controls and terminal points to make installation easy and trouble-free. The cabinet design is NEMA I, ventilated with gasketed doors. When requested, the cabinet may also include interior lighting with switch convenience outlet, thermostatically controlled space heaters, current limiting fuses for primary of power potential transformer and instrument potential transformers.

ESS — EXCITATION SUPPORT SYSTEM When selective tripping of circuit breakers requires the generator to provide current under fault conditions, an excitation support system can provide three phase current support and aid the starting of large motors.

NEGATIVE FIELD FORCING Refer to Basler product bulletin TBY for a description of our SSE-N, Negative Field Forcing Shunt Exciter/Regulator System.

METERING — AC and DC All meters are switchboard type with 1% accuracy and 270° dial scale. Metering may include ac voltmeter, dc field voltmeter, dc field ammeter, and Auto/Manual nullmeter for bumpless transfer from automatic to manual voltage control.

DIODE FAILURE DETECTOR When power semiconductor functional status is required, a monitor can be provided with the static excitation system to annunciate when rectifier failure has occurred.

VAR/POWER FACTOR CONTROLLER This device is used for parallel operation with the utility to regulate generator power factor or reactive power at a desired level without operator action. It is also used to maintain constant VARs or power factor on synchronous motor applications.

AUTO TRACKING MICROPROCESSOR-BASED REFERENCE ADJUSTER Used to adjust the manual voltage control for tracking the output of the automatic voltage regulator. This option allows for bumpless transfer when switching from automatic control to manual control.

MICROPROCESSOR-BASED REFERENCE ADJUSTER Used to remotely control the regulation setpoint from one or more locations.

PROTECTIVE RELAYS A wide variety of protective relays can be included with the static excitation system, including Field Ground Detection Relay, Voltage Phase Balance Relay, Underexcitation Relay with time delay, Overexcitation Relay with time delay, and Overvoltage Relay.

AC SHUTDOWN and FIELD FLASH CONTACTOR ASSEMBLY A contactor assembly can be supplied for all models. The ac contactor removes ac input power to the exciter to shut down excitation. The contactor is controlled from remote contacts. A field flashing contactor provides fast, positive voltage buildup from a dc battery remote from the exciter. The field flashing circuit also includes an overflash protection circuit to automatically interrupt the dc source from the field when the generator terminal voltage has not built up within 20 seconds. All 250Vdc SSEs rated up to 400 amps include Field Flashing and AC Shutdown contactors mounted on rectifier chassis. (Designed for 125Vdc battery. For operating voltages other than 125Vdc, consult the factory.)

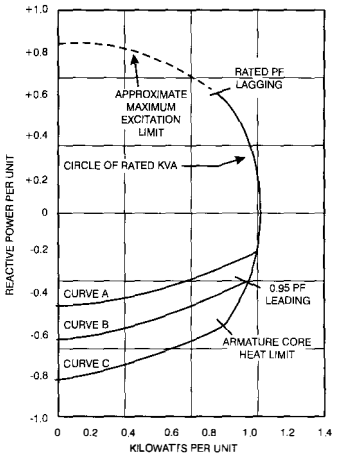


Figure 6 - Minimum/Maximum Excitation Limiting

MINIMUM/MAXIMUM EXCITATION LIMITER The excitation limiter performs two functions when used with the SSE. As a maximum excitation limiter, it senses the field current output of the SSE and limits the field current to prevent overheating of the field. As a minimum excitation limiter, it senses the leading VARs into the generator and limits the excitation to prevent loss of synchronization and end-iron overheating during parallel operation. The limiter is adjustable to the machine's specific requirements. See Figure 6.

OVER AND UNDER EXCITATION PROTECTIVE RELAYS When positive generation system shutdown is required due to exciter malfunction, the Basler Over/Under Excitation relays provide preprogrammed excitation limits to cause tripping of the shunt static exciter.

POWER SYSTEM STABILIZER When the power plant is subject to local or interarea mode oscillations, a Power System Stabilizer (PSS) can be provided. The PSS works through the summing point of the excitation system to eliminate the low frequency power oscillations typically in the range of .2-3 Hertz. The PSS is a two input stabilizer (compensated frequency and power) that provides a conditioned signal into the excitation system to modulate a braking torque on the rotor via the excitation system to resolve the power oscillation.

ACCESSORIES

The list below reflects some of the commonly requested accessories. The SSE system is a highly adaptable system, able to accommodate virtually any custom-designed control scheme. Send in your specifications for a design customized to your needs.

Description	Standard Feature		Optional Accessories		Customer Required (Generator)	Customer Required (Motor)
	Gen.	Motor	Gen.	Motor		
1) Underfrequency Compensation	X	X				
2) Parallel Compensation	X	X				
3) Manual Control	X	X				
4) Automatic Regulation ±½%	X					
5) Three Phase Sensing	X					
6) Single Phase Sensing	X					
7) Min/Max Excitation Limiting			X	X		
8) Power Transformer Primary Fusing			X	X		
9) Failed Power Rectifier Detector			X	X		
10) Autotracking Microprocessor-Based Reference Adjuster			X			
11) Nulling Meter			X			
12) AC Voltmeter			X	X		
13) DC Volt/Ammeter			X	X		
14) Sensing Potential Transformer			X	X		
15) Var/PF Controller			X	X		
16) Field Ground Detection Relay			X	X		
17) Voltage Phase Balance Relay			X	X		
18) Overvoltage Relay			X	X		
19) Overexcitation Relay w/Time Delay			X	X		
20) Underexcitation Relay w/Time Delay			X	X		
21) AC Shutdown and Field Flash Contactor Assembly			X	X		
22) a) Enclosure NEMA I			X	X		
b) Space heater with Thermostat			X	X		
c) Incand. Light/Convenience Outlet			X	X		
d) Cabinet mounted Control Switches			X	X		
23) ESS Excitation Support			X			
24) Microprocessor-Based Ref. Adjuster			X	X		
25) Motor Surge Suppression		X				
26) Negative Forcing			X			
27) Power System Stabilizer			X			

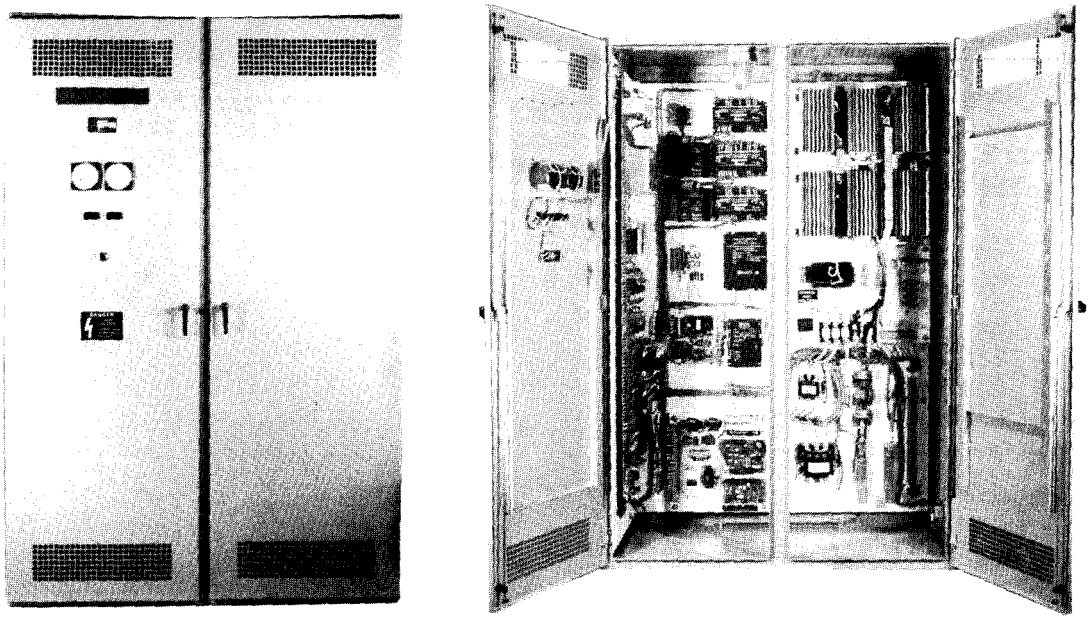


Figure 7 - SSE in cubicle

HOW TO ORDER

Determine the following information:

GENERATOR DATA

1) VOLTAGE (L-L) KW FREQUENCY POWER FACTOR

_____ ___ _____ _____

PRIME MOVER RPM

_____ ___

2) Generator Field Data at Rated Load and Power Factor

Generator Field Voltage = _____Vdc

Generator Field Resistance = _____Ohms

3) Determine SSE voltage and kilowatt size:

a) Select the SSE voltage (63, 125 or 250) that equals or is greater than the field voltage at full load.

= _____

b) Calculate the kilowatt size by squaring the SSE voltage divided by the generator field resistance.

SSE Voltage		Generator Field Resistance	
_____	² /	_____	= Kilowatts

c) From Table on page 3, select the SSE where the kilowatt size matches or exceeds the kilowatts required by step b.

Insure that the static exciter minimum resistance is equal to or less than the resistance of the generator field.

d) Specify the nominal voltage rating for the excitation power transformer.

EXAMPLE

GENERATOR DATA

1) VOLTAGE (L-L) KW FREQUENCY POWER FACTOR

4160 5250 60 0.8

PRIME MOVER RPM

Hydro-Turbine 120

2) Generator Field Data at Rated Load and Power Factor

Generator Field Voltage = 200 Vdc

Generator Field Resistance = .659 Ohms

3) Determine SSE voltage and kilowatt size:

a) Select the SSE voltage (63, 125 or 250) that equals or is greater than the field voltage at full load.

= 250

b) Calculate the kilowatt size by squaring the SSE voltage divided by the generator field resistance.

SSE Voltage		Generator Field Resistance		
250	² /	.659	= 95	Kilowatts

c) From Table on page 3, select SSE250-100

Insure that the static exciter minimum resistance is equal to or less than the resistance of the generator field.

d) Specify the nominal voltage rating for the excitation power transformer.

_____ Volts

(Usually the same as the generator voltage rating)

Detailed sample specifications are available upon request. Contact the Basler Power Systems Group at the factory and ask for Basler Publication #3222.

Basler Electric

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