

# Class 200 Equipment "ESS" EXCITATION SUPPORT SYSTEM for Shunt Static Exciter/Regulators

## APPLICATIONS:

The ESS (Excitation Support System) is used in power generation systems employing the Basler Electric model SSE (Shunt Static Exciter/Regulator) (see table 1 for matching the ESS with the correct SSE). The ESS provides the increased excitation necessary to maintain line current in the system during periods of large current demand, such as short circuits or motor starting. Also, the ESS will automatically shut down the power generation system if ESS activation exceeds a predetermined time limit. Power for the ESS is derived from current transformers installed in each generator armature line.

Advanced circuit design, based on Basler Electric's proven leadership in the power products industry, has resulted in both an economical and dependable support system. High output power and a wide range of available taps on the "interface transformers" provides the ESS with the range to meet the power requirements of most static exciter-equipped generators.

## FEATURES:

- Current regulated excitation boost.
- Available for exciters up to 50 kW.
- Generator fault current adjustable from 150% to 350%.
- Adaptable to wide range of generator sizes and voltages.
- Integrated circuitry for fast, precise response.
- Provides protective shutdown of power system if ESS operation exceeds predetermined time limit.
- Voltage sensing threshold limit automatically lowered during SSE frequency compensation operation.
- Limits phase-to-phase/phase-to-neutral fault current to same level as three-phase faults.
- Rugged construction.

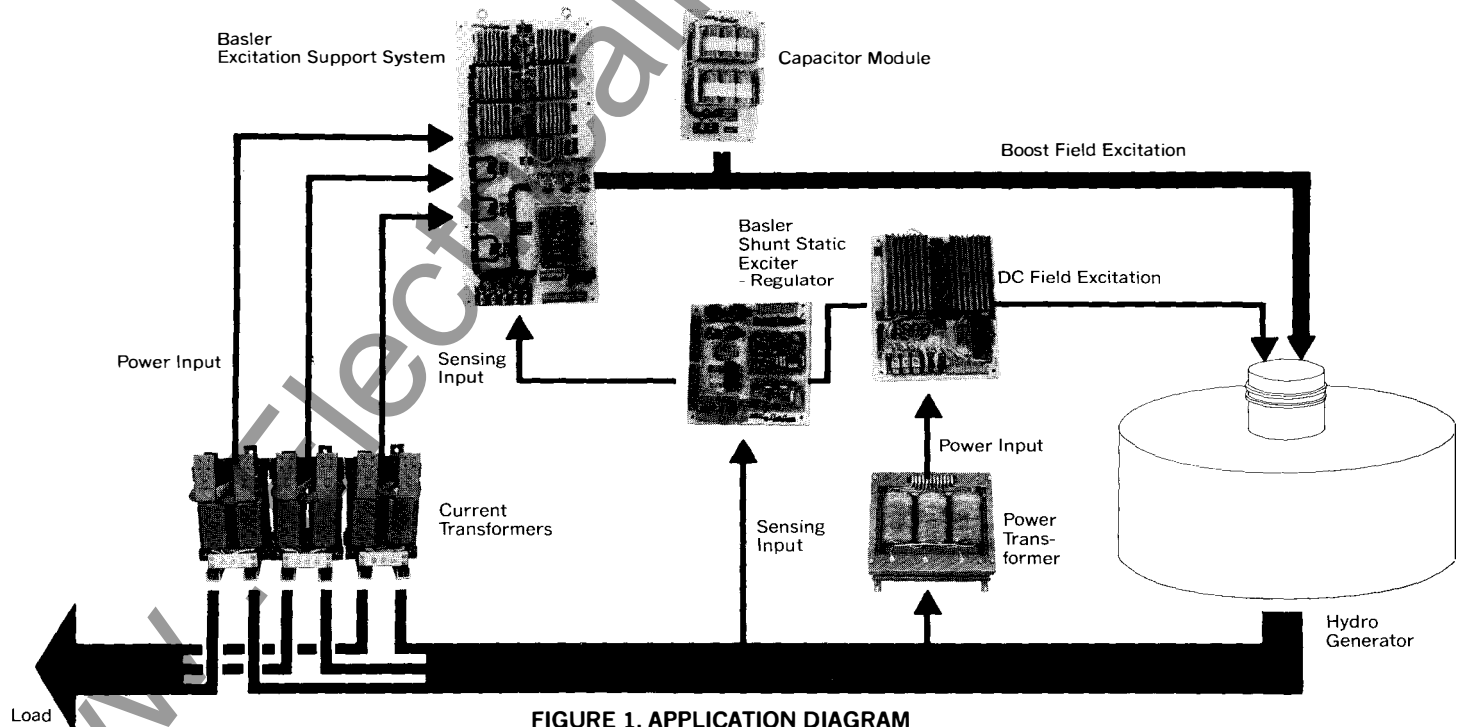


FIGURE 1. APPLICATION DIAGRAM

**B** Basler Electric

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

SNV-2  
6-92

## DESCRIPTION:

The ESS, designed for behind-the-panel mounting (see Figure 2), provides increased and fully regulated excitation during starting of extremely large motors and during phase-to-phase, phase-to-neutral and three-phase faults. A chassis mounted selector provides selection of fault current boost from 150% to 350% of nominal with LED indicator illumination during boost operation. A second selector provides selection of the ESS activating voltage in steps of 70%, 80% or 90% of the generator output voltage. The ESS employs a line current sensor to distinguish between the types of faults: during three-phase faults (and motor starting) the ESS and SSE operate simultaneously for maximum current output and faster voltage recovery; during phase-to-phase and phase-to-neutral faults the ESS disables the SSE so that line current will not exceed the level preselected for the ESS. During subsynchronous generator operation, the SSE frequency compensation circuit will cause the generator output voltage to be proportionally lowered; to prevent the ESS from becoming activated by this lowered voltage, the ESS employs a circuit that simultaneously lowers the voltage sensing threshold. A timer, selectable in increments of 15, 30, 45, 60 and 120 seconds, halts the operation of both the ESS and SSE if

the fault has not been cleared over the predetermined time.

The ESS consists of a power module, capacitor module(s), and three power CTs. The power module contains interface transformers, and electronic circuitry for sensing generator output voltage and for controlling output power SCRs. The SCRs are supplied with current, via the interface transformers, from CTs installed in the three generator lines. Taps on the interface transformers provide a wide range of turns-ratios so that the same percentage of fault current will be available for all SSE/generator systems.

Capacitor module(s) containing large capacitors are installed across the ESS excitation output terminals. The number of modules needed is determined at the factory upon receipt of generator size data (see "How to Order", page 8).

A power CT is installed in each of the three generator output phases to provide current for the output SCRs in the power module. The CT is tailored to the specific SSE/generator system - this is determined at the factory upon receipt of generator size data (see "How to Order", page 8).

## SPECIFICATIONS:

- **AC SENSING VOLTAGE:** Selectable in increments of 70%, 80% and 90% of generator nominal output voltage.
- **POWER DISSIPATION:** (See Table 1)
- **OPERATING TEMPERATURE RANGE:** -40°C to +60°C (-40°F to +140°F)
- **STORAGE TEMPERATURE RANGE:** -65°C to +85°C (-85°F to +185°F)
- **SHOCK:** Withstands up to 15 G's in each direction.

- **VIBRATION:** Withstand the following vibration spectrum:

Frequency	Acceleration
5 - 26 Hz	1.2 G
26 - 52 Hz	.036 in. displacement
52 - 260 Hz	5 G

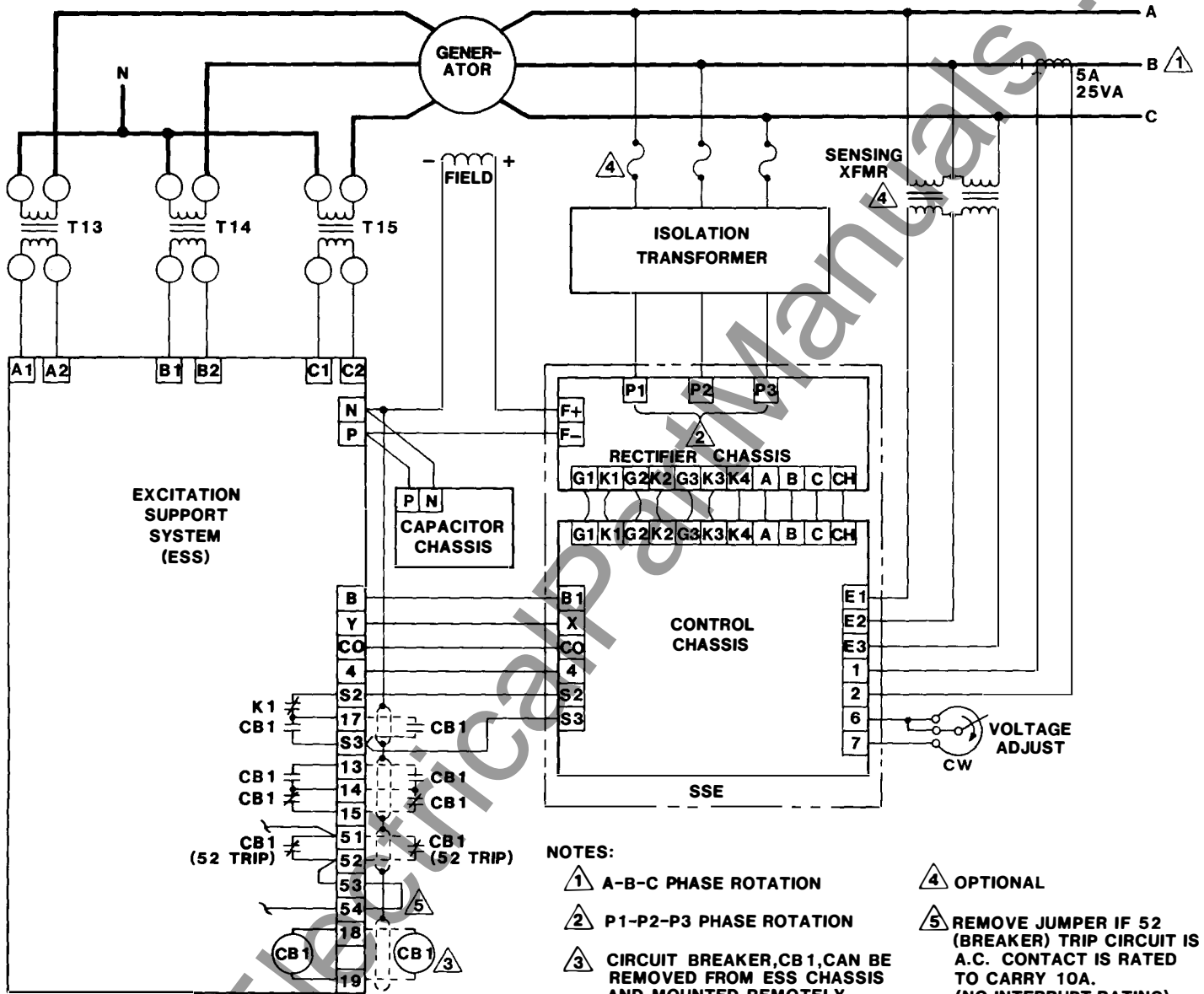
- **FINISH:** Gloss White
- **WEIGHT (POWER MODULE):** Approximately 320 lb. (145 kg)

**Table 1 – ESS SELECTION CHART**

If Applying SSE Model	Generator Field Power			Min. Field Resistance (ohms)	Then Select ESS Model	Power Module Power Dissip. (watts)
	1 Minute Forcing		KW			
	(Vdc)	(A dc)				
SSE 125-4.5	180	52	4.5	3.47	ESS 125-4.5	200
SSE 125-6.5	180	75	6.5	2.40	ESS 125-6.5	275
SSE 125-9	180	103	9	1.73	ESS 125-9	360
SSE 125-13	180	149	13	1.20	ESS 125-13	500
SSE 125-17	180	196	17	0.920	ESS 125-17	635
SSE 125-25	180	288	25	0.625	ESS 125-25	910
SSE 125-50	180	576	50	0.3125	ESS 125-50	1820
SSE 250-9	360	52	9	6.90	ESS 250-9	200
SSE 250-13	360	75	13	4.80	ESS 250-13	275
SSE 250-17	360	98	17	3.67	ESS 250-17	350
SSE 250-25	360	144	25	2.50	ESS 250-25	480
SSE 250-33	360	190	33	1.89	ESS 250-33	620
SSE 250-50	360	288	50	1.25	ESS 250-50	910



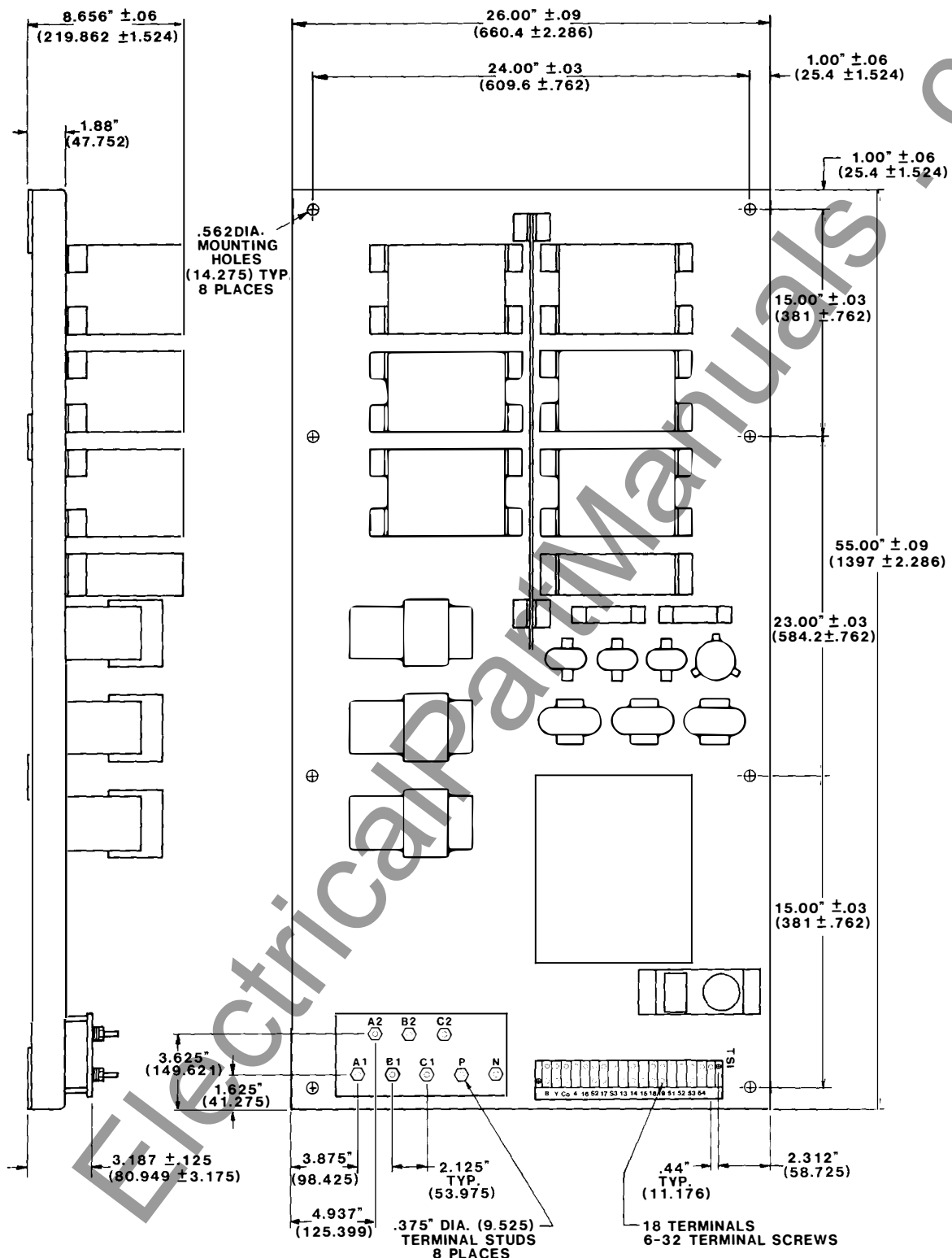
**FIGURE 2 – ESS IN CUBICLE**



**NOTES:**

- ① A-B-C PHASE ROTATION
- ② P1-P2-P3 PHASE ROTATION
- ③ CIRCUIT BREAKER, CB1, CAN BE REMOVED FROM ESS CHASSIS AND MOUNTED REMOTELY. WIRE WITH SHIELDED LEADS AND CONNECT SHIELD TO ESS TERMINAL "N".
- ④ OPTIONAL
- ⑤ REMOVE JUMPER IF 52 (BREAKER) TRIP CIRCUIT IS A.C. CONTACT IS RATED TO CARRY 10A. (NO INTERRUPT RATING)

FIGURE 3 – INTERCONNECT DIAGRAM



NUMBERS IN PARENTHESES INDICATE METRIC DIMENSIONS.



FIGURE 4 – OUTLINE DRAWING, POWER MODULE

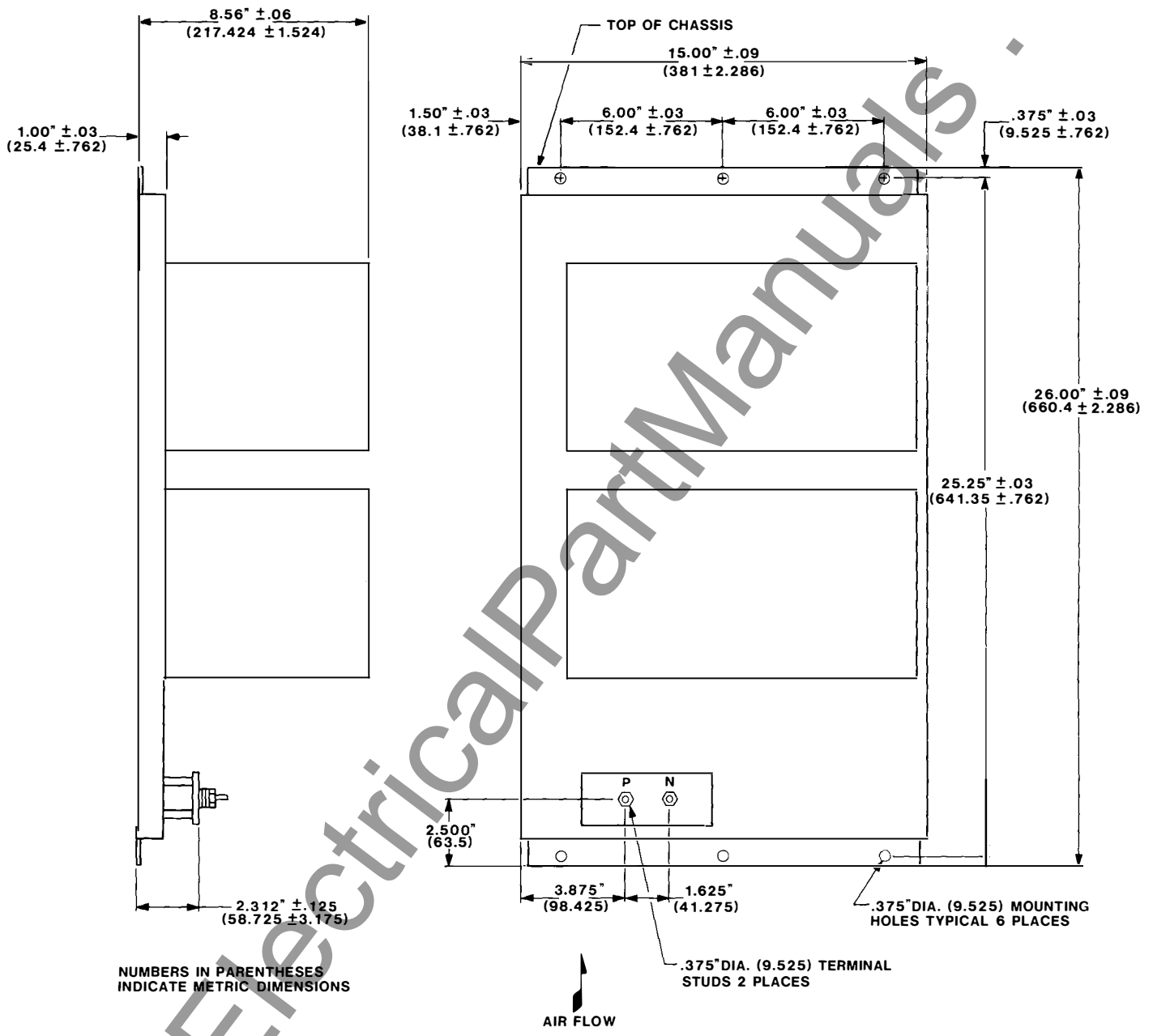


FIGURE 5 – OUTLINE DRAWING, CAPACITOR MODULE

**Table 2 – SHUNT STATIC EXCITER (SSE) ACCESSORIES SELECTION CHART**

Description	Standard Feature		Optional Accessories		Customer Required (Generator)		Customer Required (Motor)	
	Gen.	Motor	Gen.	Motor	Yes	No	Yes	No
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) Field Current Regulation			X	X				
9) Power Transformer Primary Fusing			X	X				
10) Failed Power Rectifier Detector			X	X				
11) Autotracking Manual Motor Operated Potentiometer			X					
12) Nulling Meter			X					
13) AC Voltmeter			X	X				
14) DC Volt/Ammeter			X	X				
15) Sensing Potential Transformer			X	X				
16) VAR/PF Controller			X	X				
17) Field Ground Detection Relay			X	X				
18) Voltage Phase Balance Relay			X	X				
19) Overvoltage Relay			X	X				
20) Overexcitation Relay with Time Delay			X	X				
21) Underexcitation Relay with Time Delay			X	X				
22) AC Shutdown and Field Flash Contactor Assembly			X	X				
23) a) Enclosure NEMA 1			X	X				
b) Space Heater/with Thermostat			X	X				
c) Incandescent Light/Convenience Outlet			X	X				
d) Cabinet Mounted Control Switches			X	X				
24) ESS Excitation Support			X					
25) Motor Operated Control Potentiometer			X	X				
26) Motor Surge Suppression		X						
27) Negative Forcing			X					

**SAMPLE SPECIFICATION:**

A static excitation system, consisting of an ESS, together with a Shunt Static Exciter/Regulator (SSE) is required to provide a generator with one horsepower per kilowatt motor starting and single or three phase short circuit current support. The system shall be able to discriminate between single phase/three phase short circuits and phase to neutral short circuits, limiting generator output current to 300% maximum. Short circuit support current transformers shall be connected to the generator neutral lines for minimum dielectric stress. All elements of the static excitation system power stage shall be solid state, and phase controlled by silicon controlled rectifiers.

The ESS shall have a chassis mounted selector for selection of short circuit current over the range of 150% - 350% of the rated line current. Another chassis mounted selector shall

provide selection of short circuit support pickup points of 70%, 80%, and 90% of the rated generator voltage. The duration of short circuit current shall be limited by a timer preselectable in increments of 15, 30, 45, 60 and 120 seconds.

The Shunt Static Exciter/Regulator shall provide better than ±½% voltage regulation, include controls for maintaining generator terminal voltage at the rated load rated power factor, and include single or three phase voltage sensing, frequency compensation, manual voltage control and paralleling provision.

Specify Basler Model "SSE" Shunt Static Exciter/Regulator and Model "ESS" Excitation Support System. See SSE Bulletin number SNE-2 for further information and for "SSE" accessories.

## HOW TO ORDER

Determine the following information:

### EXAMPLE

#### GENERATOR DATA

I) VOLTAGE (L-L)      KW      FREQUENCY  
 \_\_\_\_\_  
 POWER FACTOR      PRIME MOVER      RPM  
 \_\_\_\_\_

II) Generator Field Data at Rated Load and Power Factor

Generator Full Load Field Voltage = \_\_\_\_\_ Vdc

Generator Full Load Field Current = \_\_\_\_\_ Idc

Generator Field Resistance = \_\_\_\_\_ ohms

Generator Field Current = \_\_\_\_\_ Amps

at \_\_\_\_\_ % short circuit generator current

Starting inrush load @ \_\_\_\_\_ kVA ( \_\_\_\_\_ P.F.)  
 requires generator field excitation of

\_\_\_\_\_ Amps \_\_\_\_\_ Volts

III) Specify the SSE model \_\_\_\_\_  
 (Reference SSE Shunt Static Exciter/Regulator Bulletin  
 SNE-2 for proper selection)

IV) Determine the ESS model \_\_\_\_\_  
 (Reference Table 1 and select the ESS that corresponds  
 with the appropriate SSE model)

#### GENERATOR DATA

I) VOLTAGE (L-L)      KW      FREQUENCY  
4160      2800      60  
 POWER FACTOR      PRIME MOVER      RPM  
0.8      DIESEL      1800

II) Generator Field Data at Rated Load and Power Factor

Generator Full Load Field Voltage = 122 Vdc

Generator Full Load Field Current = 123 Idc

Generator Field Resistance = 0.97 ohms

Generator Field Current = 72 Amps

at 300 % short circuit generator current

Starting inrush load @ 4725 kVA (0.0 P.F.)  
 requires generator field excitation of

168 Amps 170 Volts

III) Specify the SSE model SSE 125-17

IV) Determine the ESS model ESS 125-17

# B Basler Electric

