



# SE2000AF

## Static Exciter

The Power-Tronics SE2000AF Static Exciter is a self-contained complete Static Exciter. The SE2000AF Static Exciter is designed for continuous operation at up to 105vdc at 200adc!

The SE2000AF is uniquely designed to sit in a compact footprint while being passively convection cooled for a long service life. Because of its unique modular design, the SE2000AF minimizes downtime should a repair ever be necessary! The SE2000AF's compact design allows a wide variety of installation methods, including installations where space is at a premium.

The SE2000AF is a time-proven design, utilizing high-reliability components and a unique modular design to simplify repair. The SE2000AF is designed to provide a lifetime of service and is specifically built to minimize failures and potential downtime!

The SE2000AF is also capable of parallel operation with other generators or with a utility buss. Power-Tronics' wide variety of optional accessories also allows the SE2000AF to be remotely operated by dry contact switching or by a PLC controller!

The SE2000AF Static Exciter is the latest upgrade to the SE2000A series of static exciters and replaces all previous Power-Tronics SE2000A and SE2000AX Static Exciters!

### Specifications

Input Voltage:	208 - 240vac
Frequency:	50 or 60 Hz
Voltage Regulation:	+/- .25% From NL to FL
Parallel Operation:	Yes
Output Voltage:	0-105vdc @ 240vac input
Maximum Continuous Output:	200adc
Minimum Field Resistance:	.52Ω @ 105vdc output
Min Residual Build up Voltage:	3.5vac
Under Frequency Protection:	Yes, VPH reduction
Physical Size:	24 x 12 x 10 in.
Weight:	23 lb.
Voltage Regulator:	XR500D
Internal Build-Up Provisions:	Yes, AFM500X Auto-Flash
Repairable:	Yes
Internal Protection:	Fuses, cartridge type
External Voltage Adjustment:	Yes
System Operating Indicator:	Yes
Optional External Controls:	Yes



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## Introduction and Functional Description

# Caution: Read This Installation Manual Carefully and Entirely!

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**Warning:** Do not use digital equipment to read voltage, Hz, or amperage during this installation. Use only Analog sensing equipment! Failure to do so may result in damage to equipment or in personal injury!

**ALWAYS** perform all setup procedures off-line

**ALWAYS** wear eye protection

**ALWAYS** strip wire insulation properly or use insulated connectors

**ALWAYS** use analog metering equipment when setting up the regulator

**ALWAYS** ensure the static exciter receives ample airflow

**ALWAYS** use adequate fusing

**NEVER** hold the static exciter in your hand or lap when energized

**NEVER** install the static exciter in a place it can get wet or is exposed to the elements

**NEVER** mount the static exciter over a screw, bolt, rivet, seam, or other fastener

**NEVER** remove the regulator cover while the unit is in operation

**NEVER** insert a screwdriver or other object under the regulator cover

**NEVER** touch any exposed part of the SE2000AF during operation (**LIVE HEATSINKS**)

**NEVER** install a switch in the DC portion of the static exciter's wiring

**NEVER USE A DIGITAL FREQUENCY METER** (It can give a false reading!)

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## Functional Description

The SE2000AF Static Exciter is the result of over 20 years of engineering efforts and offers high-demand features at a competitive price point. The SE2000AF is a proven design and is engineered to greatly simplify setup while offering extreme reliability. When properly installed, the SE2000AF Static Exciter is designed to provide a lifetime of service.

A Generator voltage regulator has several automated tasks it must perform in order to provide reliable, clean, and regulated electricity. It must build-up the generator, regulate the terminal voltage within its design specifications, and protect both itself and the generator should a fault situation arise.

The SE2000AF Static Exciter is designed to replace older obsolete static exciters or rotating exciters with a minimum of connections and a minimum of required installation space. The SE2000AF Static Exciter contains an internal flashing circuit for guaranteed buildup, internal filter for voltage sensing, internal field-replaceable 200A fusing, and internal DC field noise suppression. The SE2000AF is also designed to be user-serviceable should a problem arise. Fuse or rectifier replacement in the field takes only minutes, thanks to the unique modular design of the SE2000AF.

Due to its extreme simplicity, the SE2000AF Static Exciter is uncommonly reliable and offers features and regulation accuracy usually only offered by much more complicated and often much more expensive static exciters.



## Determining Correct Application Sizing

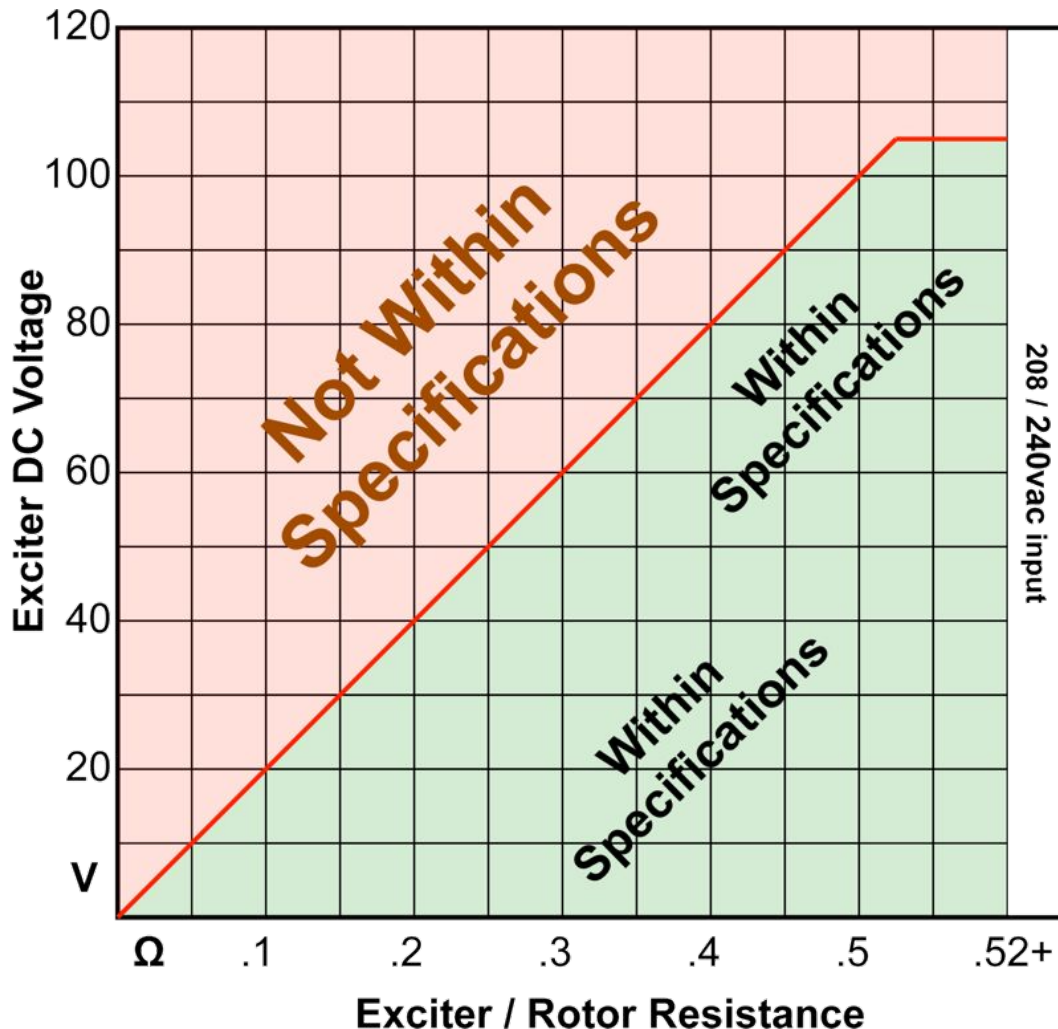
The SE2000AF Static Exciter is designed for use with 208-240VAC input. It contains internal suppression for use with brush-type generator sets. Before installation, it is necessary to verify that the SE2000AF is the correct product for your application.

To determine if the SE2000AF is the correct product for your generator you need to know any two of the following 3 specifications from the rating plate of your generator:

- 1: Exciter Field Voltage (in DC Volts) [Generally given in full load Voltage on nameplates]
- 2: Exciter Field Resistance (in Ohms) [**See Note Below**]
- 3: Exciter Field Amperage (in DC Amps) [Generally given in full load Amps on nameplates]

**Using the specifications obtained from your generator exciter, verify that your generator fits the specifications from the chart or graph below:**

- Exciter full load voltage is 63VDC or less, and your exciter field resistance is .52Ω or greater.





## Note about Field Resistance:

- When measuring field resistance on a brushless generator, simply measure the resistance of the exciter field through your field leads with a multimeter.
- When measuring field resistance on a brush-type generator, measure the resistance through both the field leads as well as directly on the slip rings themselves. **The readings you obtain should ideally be the same, but no more than 1% difference.** If you show more than 1% difference in reading your generator has brush and ring contact problems and will need cleaning or maintenance before installing the SE2000AF. **Failure to correct brush and ring contact problems will result in severe damage to the voltage regulator as well as possible PERMANENT damage to the slip rings themselves!** NEVER use emery cloth, carborundum stones, “comm sticks”, or Tuner cleaner to dress or clean slip rings. They will make a bad problem much, much worse! Only use Garnet or Flint sandpaper and clean with a clean rag soaked with Acetone for best results!

***If you do not have any of the specifications of your generator’s exciter, or if you don’t know where to start when trying to determine your exciter specs, please see the section below for instructions on measuring and calculating your exciter specifications.***

- Measure your exciter field resistance using a multimeter on your field leads. Record this value. If you have a brush-type generator, also take a resistance reading on your slip rings: the value you obtain on the slip rings should be no more than 1% difference from the value you obtained through the field leads.
- Next, start and run the generator and apply 12V from a battery through your field leads and record the AC voltage produced by the generator. To determine your full load exciter field voltage, use the following formula:

$$E_{Exc.} = \frac{E_{Gen.Conf.}}{\left( \frac{E_{Gen.Output}}{E_{Battery}} \right)} * 2$$

Where  $E_{Gen.Conf.}$  is your Generator’s configured voltage (e.g.: 120, 208, 240, 480V, etc.),  $E_{Gen.Output}$  is your recorded output voltage, and  $E_{Battery}$  is your battery voltage (12V usually).

- Next, calculate your maximum exciter field amperage using your measured field resistance and your calculated exciter voltage using the following formula:

$$I = \frac{E}{R}$$

Where  $I$  is your maximum exciter field current,  $E$  is your calculated field voltage from the above formula, and  $R$  is your measured field resistance.

**Using the values you just measured and calculated, see the chart on the previous page to determine whether the SE2000AF is the correct product for your application.**



## Connection Diagram

(See page 7 if the generator will be paralleled using this product)

The SE2000AF is a Half-Wave rectified static exciter, which allows a maximum of 105VDC at 200 ADC continuous with an input voltage of 240VAC.

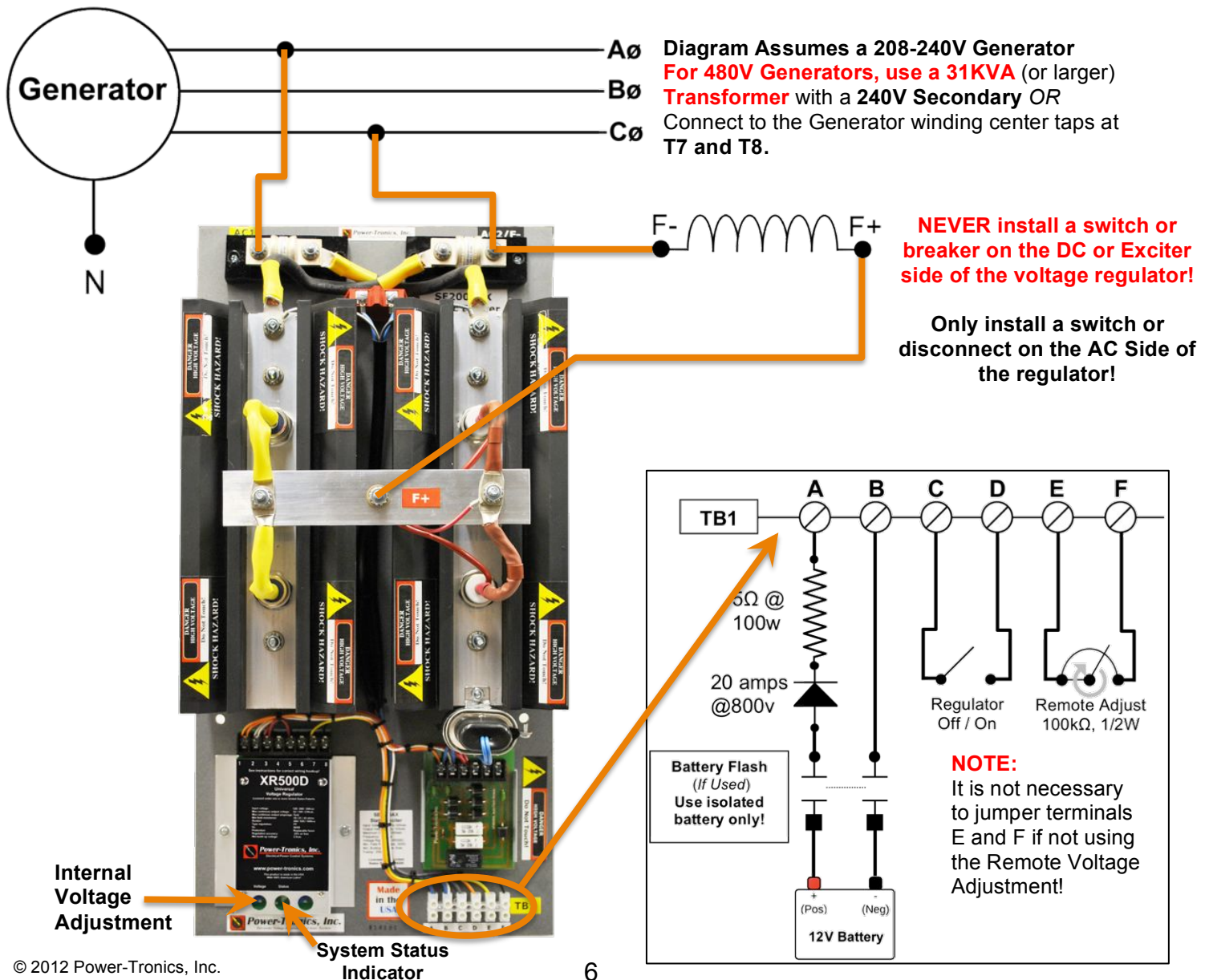
This product is typically used on slip-ring generators with full load field voltages of 63VDC or less and full load exciter field amperages between 90 and 190ADC.

**Note that the maximum input voltage to the SE2000AF Static Exciter is 240VAC!**

**DO NOT input 277VAC into the SE2000AF!** Severe damage to the unit will result!

For use on 480V systems, either connect the SE2000AF to the winding center taps T7 and T8 or use a 480-240V step-down transformer.

*Connecting the input of the SE2000AF to 2 different legs of the generator as shown in the diagram below will result in greater regulation accuracy than when connecting line-neutral.*

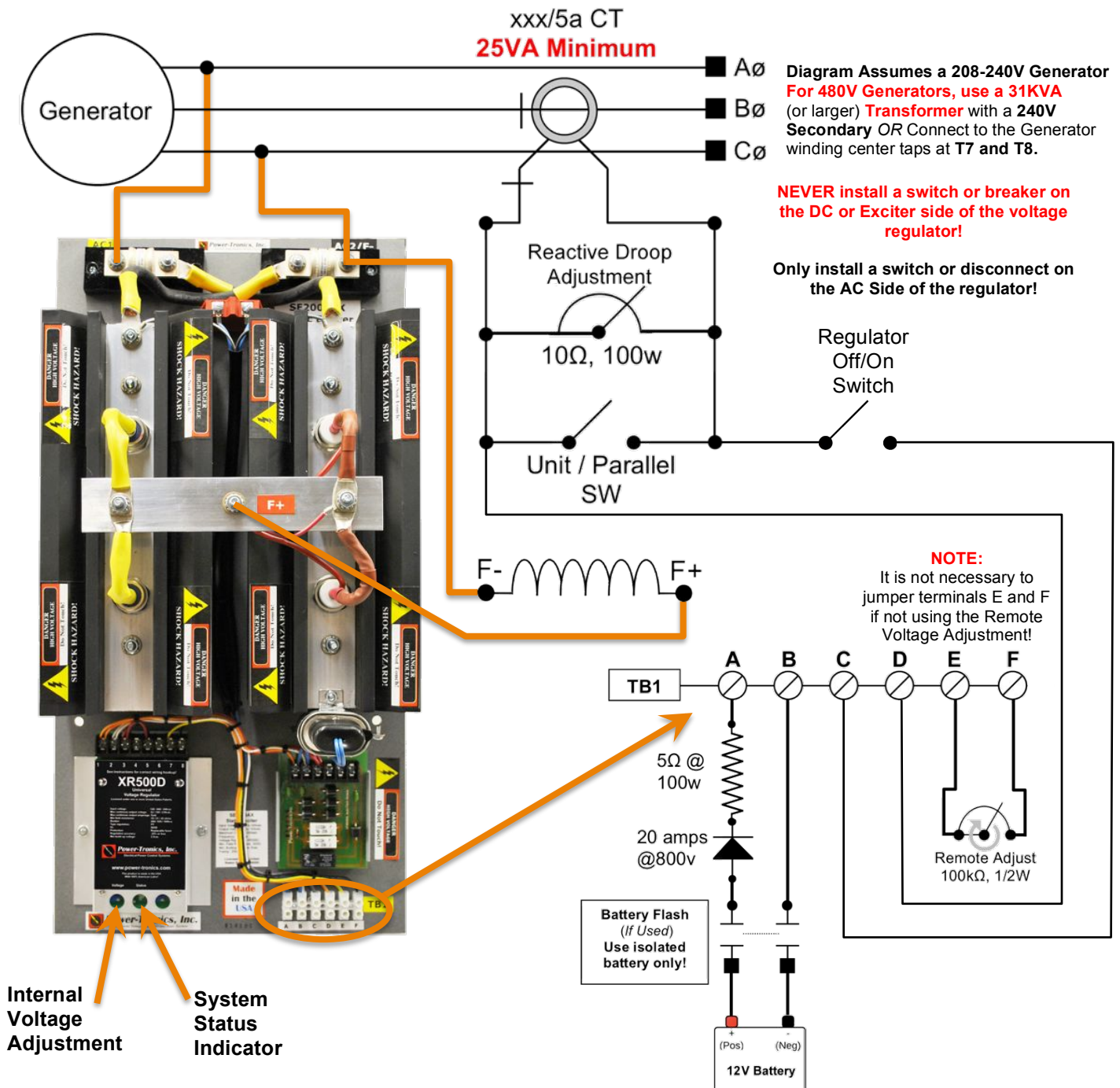




## Parallel Connection Diagram

To use the SE2000AF Static Exciter in a parallel configuration either with another generator or with a buss such as a utility, use the diagram below for proper hookup with the SE2000AF.

**NOTE:** Power-Tronics products parallel using the Reactive Droop compensation method. This allows our products to parallel with existing systems easily while also allowing islanded operation with the flip of a switch. **When initially installing the droop resistor, set it for approximately 7Ω before final adjustment later.** If the droop is excessive when load testing, reduce the resistance a bit at a time until satisfactory droop is achieved. **CT should be sized at 25VA or larger capacity!**





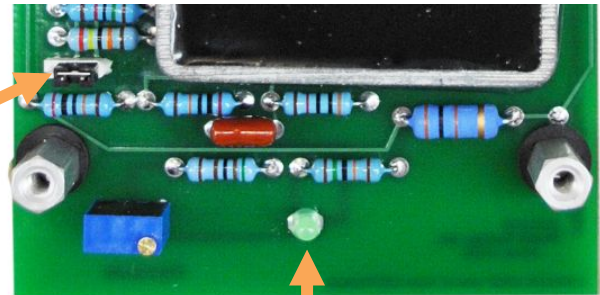
## Initial Setup and Commissioning

1. Install the SE2000AF and wire up to the correct wiring diagram (Stand Alone or Parallel Operation).
2. If installing the SE2000AF on a brush-type generator, verify that the brushes and brush riggings are isolated, ungrounded, and connected ONLY to the SE2000AF.
3. Turn the internal voltage control on the XR500D voltage regulator 15 or more turns counter clockwise (left) or until you hear the screw click. This procedure is necessary in case the original factory settings have been altered.



Internal  
voltage  
adjustment

**Frequency Selection  
(Under XR500D Cover)**  
Remove jumper for 50Hz  
operation. This product's  
default setting is 60Hz.  
(Pull up to remove)



System  
indicator light

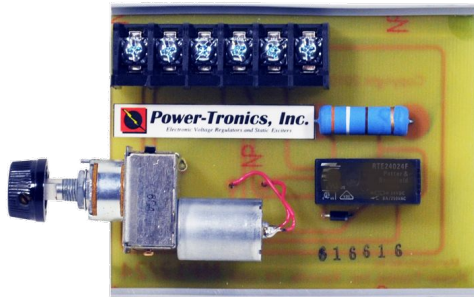
4. If you are using a remote voltage adjustment, set it at 50% of adjustment.
5. If the generator is to be paralleled, set the droop resistor between 6Ω and 10Ω.
6. Start up the prime mover and bring up to operating speed and turn on the regulator switch (if used).
7. Set the internal voltage adjustment on the voltage regulator to the desired voltage setting for the generator output by turning the adjustment screw clockwise (right).  
**Note that the voltage adjustment is a 25-turn pot!**
8. Place the generator on line and observe the frequency and voltage.
9. If the generator is being paralleled, measure the droop during loading and adjust the droop resistor as necessary. Reducing droop resistor resistance will reduce droop.  
**NOTE: Loading the generator with a purely resistive load-bank may cause undesirable droop characteristics such as no droop, very slight droop, or even rising terminal voltage. Measure droop with a mixed load for best results.**
10. If paralleling and the terminal voltage rises or excessive amperage exportation occurs during loading with a mixed load connected, reverse the CT leads and try again.
11. Observe voltage regulation during no-load and full-load conditions. Once the voltage is set and regulating characteristics are satisfactory the installation procedure is complete.



## Optional Power-Tronics Add-On Modules

Power-Tronics offers a wide array of optional add-on modules for the SE2000AF Static Exciter from automatic flashing modules to digital interface cards. For more information on any of the modules below, visit our online catalog at:

[www.power-tronics.com](http://www.power-tronics.com)



### MP12/MP24

#### Motorized Potentiometer

Allows the SE2000AF to be externally controlled by older automated controllers using pulsed signals or dry contacts for control!



### AFM500X

#### Automatic Flash Module

Adds Automatic Flash or Battery Flash to installations with low residual or requiring guaranteed buildup!



### UIC200

#### Optical Interface

Allows the SE2000AF to be controlled externally by virtually any digital load-sharing controller, VAR controller, genset controller, or digital governor controller!



### HVD1

#### High Voltage Disconnect

Saves your generator and connected equipment from runaway voltage conditions! Disconnects power to the voltage regulator instantly in the event of high voltage!



## Application Troubleshooting

### Problem:

### Possible Cause

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No Voltage	1 3 5 7 9 11 13 15 20 21
Pulsating Voltage	4 5 6 12 16
Flickering Voltage	4 6 7 14 21 22
High Voltage	6 7 8 9 12 13 17 18 20 21 22
Voltage Drop on Load	5 8 10 12 16 23 24
Low Voltage	5 8 12 13
Poor Voltage Regulation	2 4 10 12 13 16 23 24
No Voltage Control	13 19 20 21 22 23 24

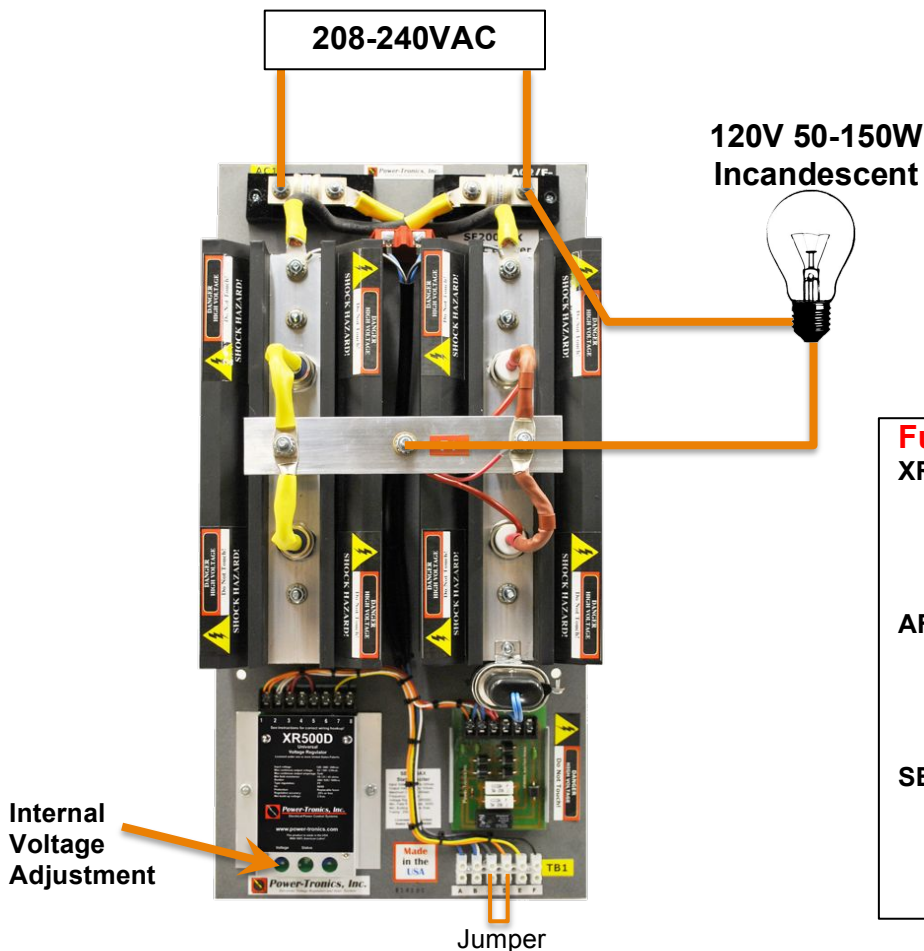
### Possible Causes:

- 
1. Residual input voltage to the voltage regulator is below 3.5vac or fuses are open in the regulator.
  2. Unbalanced generator load.
  3. Open exciter field or defective generator.
  4. Non linear load or defective connection in exciter field.
  5. Open diode in exciter or shorted rotor in generator.
  6. Loose component in voltage regulator.
  7. Loose wiring connections.
  8. Input voltage to regulator is too low.
  9. Exciter field is grounded.
  10. Non linear load or wrong selection for regulator hookup.
  11. Exciter fields are reversed.
  12. Wrong selection of regulator wiring configuration.
  13. Defective voltage regulator.
  14. SCR or Inverter drive effecting generator waveform.
  15. Regulator needs external flashing circuit.
  16. Isolation transformer is too small.
  17. Isolation transformer is needed.
  18. Exciter fields are not isolated from other circuits.
  19. Input and field circuit are being fed by a common cable or conduit.
  20. Incorrect hookup or wiring.
  21. Poor brush contact to commutator or sliprings.
  22. Damaged, pitted, or grooved slip ring surface.
  23. Current transformer has reversed polarity or is not shorted during non parallel operation.
  24. Input to regulator is from an auxiliary winding and not the generator main stator.



## Bench Check Procedures

1. Wire up the SE2000AF as shown in the figure below.
2. Connect a 120 volt 50 to 150 watt light bulb to the F+ and F- Terminals.
3. Install a temporary jumper wire between terminals C and D on TB1 Terminal Board.
4. Turn the internal voltage adjustment on the XR500D Voltage Regulator fully Counter-Clockwise (Left) before beginning the testing procedures below.
5. Input 208-240VAC fused at no more than 5A into the SE2000AF. **The test light should be OFF.**
6. Slowly turn the internal voltage adjustment on the XR500D Voltage Regulator Clockwise (Right) until the lights glow. **The test light should light to HALF Brightness. NOTE: It may take several turns of the adjustment screw before the lights illuminate!**
7. Slowly turn the internal voltage adjustment of the XR500D Voltage Regulator Counter-Clockwise (Left) until the light goes dark. **The test light should be OFF. NOTE: It may take several turns of the adjustment screw before the light goes dark!**
8. Turn off power and disconnect the SE2000AF from your power source. Inspect all electronic components on the SE2000AF to ensure they are isolated from touching any part of the SE2000AF housing.
9. **If you were able to successfully perform all of these tests, the SE2000AF is good.**



### Fuse Replacement Information:

#### XR500D:

Rating: 5A @ 250VAC

Qty: 2

PTI Part # 5R3-403

Cooper-Bussman Part # BK/GDB-5A

#### AFM500X:

Rating: 5A @ 250VAC

Qty: 3

PTI Part # 5R3-27

Littelfuse Part # 0263005.MXL

#### SE2000AF:

Rating: 200A @ 250VAC

Qty: 2

PTI Part # 5R3-231

Cooper-Bussman Part # JJN-200



## Installation Warranty Form

It is very important that you fill out this form completely when installing a voltage regulator. This form serves as a history record on the application. This form also contains the information needed by Power-Tronics, Inc., for repair and troubleshooting of any product you may be having problems with.

**Failure to fill out this form during installation will result in a cancellation of your warranty coverage! Filling out this form takes only minutes but will save hours or days later on if your product should require service!**

Product		Other options		
Serial Number				
Date of Installation				
Type of Generator			Model #	
	Brush type	<input type="checkbox"/>		
	Brushless	<input type="checkbox"/>		
AC Stator Information				
Wired for	Volts	Phase	Hz	
Generator Configuration: Lead				
Exciter/Rotor Information				
Exciter field resistance		$\Omega$	@ F+ / F-	$\Omega$
Exciter field volts		vdc	@ Slip Rings	$\Omega$
Description of problem with product or generator				
Your phone number		Name:		
Your fax number		Ship to Address:		
Your email address		Ship to City, State, Zip:		



## PRODUCT WARRANTY

**Power-Tronics, Inc.**, assumes no liability for damages due to incorrect voltage or other voltage related damages resulting from either output of the generator or input to the generator exciter system. These problems should be protected with external devices provided by the customer such as **fuses, surge suppressors, over/under voltage and frequency controls.**

**Power-Tronics, Inc.**, warrants **only parts and workmanship** of this product for a **period of 2 years from the original date of purchase from Power-Tronics, Inc.** Under warranty, Power-Tronics, Inc. will replace, exchange or repair the defective product **without labor or parts cost to the customer.** Remaining warranty of the original product will be transferred to the replaced or repaired product. To obtain warranty, a copy of the original Installation Warranty Form must be sent in with the defective product, which clearly shows the purchase date and serial number of the defective part. A repair request form must be sent in with the product before repairs will begin. You can obtain this form by contacting Power-Tronics, Inc.

**Send repairs to: Power-Tronics, Inc., 2802 Cobbler Ln., Kerrville Texas USA 78028.**

***Send in repairs only by UPS or FedEx.* USPS will NOT deliver to our facility!**

**Any one of the following conditions will void the warranty:**

- ❖ Overheating of the power supply resistor on the printed circuit card.
- ❖ Overheating of the SCR or freewheeling diode.
- ❖ Physical damage to the printed circuit card, housing or components.
- ❖ Unauthorized repair or alteration of printed circuit card.
- ❖ Installation by anyone other than a qualified professional generator service technician.
- ❖ Conductive or corrosive contamination of the circuit card.
- ❖ Removal of our company identification from the product.
- ❖ Removal of any conformal coating of the printed circuit card or components.
- ❖ Overheating of foil on the printed circuit card.
- ❖ Inappropriate or infeasible application.
- ❖ Use with any external device other than manufactured by Power-Tronics, Inc.
- ❖ Failure to fill out the attached warranty card during installation

**No other warranty is expressed or implied.**