



# SPXR-DC20

## DC Voltage Regulator

The Power-Tronics SPXR-DC20 DC Voltage Regulator is the latest reliability and performance upgrade for all Power-Tronics DC and XR series DC voltage regulators. The SPXR-DC20 is also capable of replacing other manufacturers' voltage regulators or existing manually operated controls!

The SPXR-DC20 is a unique DC Voltage Regulator that is designed specifically for replacement of vintage or obsolete DC generator voltage regulation equipment, such as manually operated rheostats and/or resistor banks and offers precise voltage regulation regardless of the connected load and ambient temperature.

PLC and automated control is possible with the SPXR-DC20 by simply adding an optional, inexpensive digital interface module or motorized potentiometer. This capability makes the SPXR-DC20 suitable for automated or unattended installations.

The unitized encapsulated design of the SPXR-DC20 DC Voltage Regulator helps to increase reliability and tolerance to environmental conditions. The SPXR-DC20 contains an internal 25A rectifier section with integrated noise and transient suppression circuitry. Firing rate of the rectifier section is adjustable to meet the needs of a wide array of DC generators!

The SPXR-DC20 is compatible with all previous and current optional modules available for use with Power-Tronics voltage regulators making it extremely simple to upgrade an older voltage regulator installation with the modern features offered by the SPXR-DC20.

### Specifications

<b>Input Voltage:</b>	<b>SPXR-DC20/125:</b> 100-150VDC <b>SPXR-DC20/250:</b> 180-250VDC
<b>Frequency:</b>	DC
<b>Voltage Regulation:</b>	+/- 1% From NL to FL
<b>Output Voltage:</b>	0-125vdc @ 125vdc Input 0-250vdc @ 250vac input
<b>Maximum Continuous Output:</b>	20adc
<b>Minimum Field Resistance:</b>	6.25Ω @ 125vdc Input 12.5Ω @ 250vdc Input
<b>Min Residual Build up Voltage:</b>	5vdc
<b>Physical Size:</b>	12 x 6 x 3.25 in.
<b>Weight:</b>	2.75 lb.
<b>Fusing:</b>	Internal
<b>Fuse Type:</b>	0ADE, 500V 25A Fast-Blow
<b>External Voltage Adjustment:</b>	Yes
<b>Optional External Controls:</b>	Yes

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Electrical Power Controls™

# Table of Contents

Introduction and Functional Description:.....3

Determining Correct Application Sizing:.....4

Conversion From Shunt-Wound to Solid-State Voltage Regulation:.....6

Hookup Diagram:.....7

Initial Setup and Commissioning:.....8

Optional Power-Tronics Add-On Modules:.....9

Application Troubleshooting:.....10

Bench Check Procedures:.....10

Installation Warranty Form:.....11

Product Warranty Certificate:.....12



## 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 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 regulator receives ample airflow

**NEVER** hold the regulator in your hand when energized

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

**NEVER** mount the regulator over a screw, bolt, rivet, welding seam, or other fastener

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

**NEVER** install a switch in the DC field portion of the regulator's wiring

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## Functional Description

The SPXR-DC20 DC Voltage Regulator is the result of over 30 years of engineering efforts and offers an otherwise difficult to obtain product with a very short lead-time and competitive price. The SPXR-DC20 is a proven design and is engineered to greatly simplify setup while offering extreme durability and reliability. When properly installed, the SPXR-DC20 DC Voltage Regulator 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 and regulate the terminal voltage within its design specifications.

The SPXR-DC20 contains a time-proven, extremely reliable circuit for build-up functionality. Due to its simplicity, the SPXR-DC20 is able to build up generators with residual voltages from 5vdc without excessive overshoot or excessive delay. The SPXR-DC20 is also a precision voltage regulator and is capable of regulating the terminal voltage of the generator within +/-1% of its initial set point.

Due to its extreme simplicity and unitized design, the SPXR-DC20 DC Voltage Regulator is uncommonly reliable and offers features and regulation accuracy usually only offered by much more complicated and often much more expensive regulators.

**For Technical Support:**

Visit our website at: [www.power-tronics.com](http://www.power-tronics.com)

**Call Us at: (830) 895-4700**

## Determining Correct Application Sizing

The SPXR-DC20 DC Voltage Regulator is suitable for use on the vast majority of DC generators available on the market from past and present. It is necessary to verify the field amperage for your generator in order to provide the best regulation and greatest reliability possible.

To determine the proper amperage capacity 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)
- 3: Exciter Field Amperage (in DC Amps) [Generally given in full load Amps on nameplates]

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Using the specifications obtained from your generator exciter, verify that your measurements are within the operating specifications below:

- Field resistance is greater than  $6.25\Omega$  and field voltage is rated at 125vdc or less at full load.
  - Field resistance is greater than  $12.5\Omega$  and field voltage is rated at 250vdc or less at full load.
- 



**WARNING:** BRUSH AND COMMUTATOR CONNECTION PROBLEMS ARE A COMMON SOURCE OF VOLTAGE CONTROL PROBLEMS AND FAILURE OF VOLTAGE REGULATORS!!! DO NOT INSTALL THE SPXR-DC20 IF THE BRUSHES AND/OR COMMUTATOR ARE NOT IN EXCELLENT CONDITION!!!  
**STOP AND CORRECT BRUSH AND COMMUTATOR PROBLEMS IF ANY OF THE FOLLOWING CONDITIONS ARE PRESENT:**

- GROOVES IN COMMUTATOR
- ROUGH COMMUTATOR APPEARANCE OR GHOSTING (CHATTERING)
- OIL CONTAMINATION ON BRUSHES OR COMMUTATOR
- DULL, ROUGH, STRIPED, PITTED, OR METALLIC APPEARANCE OF BRUSH FACES
- EXCESSIVE BUILDUP OF CARBON OR DEBRIS ON COMMUTATOR

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## A Note About Brushes:

Arcing brushes, poor brush contact, burned commutator segments, high bars, or incorrect neutral plane alignment will cause severe damage to the SPXR-DC20 DC Voltage Regulator. Before installing the SPXR-DC20, inspect your commutator and brushes for signs of commutation problems and signs of arcing. **Failure to correct brush and/or commutation problems will result in severe damage to the voltage regulator as well as possible PERMANENT damage to the commutator segments themselves!** NEVER use emery cloth, carborundum stones, “comm sticks”, Brake Cleaner, or Tuner cleaner to dress or clean the commutator or brushes. 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!

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

- Measure your exciter field resistance using a multimeter on your field leads. Record this value.
- Next, start and run the generator and apply 12V from a battery through your field leads and record the DC voltage produced by the generator Armature at A1 and A2. To determine your full load 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.: 125 or 250vdc),  $E_{Gen.Output}$  is your recorded output voltage, and  $E_{Battery}$  is your battery voltage (12V usually).

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

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

Where  $I$  is your maximum 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 specifications on the previous page to determine whether the SPXR-DC20 DC Voltage Regulator will fit your application.**

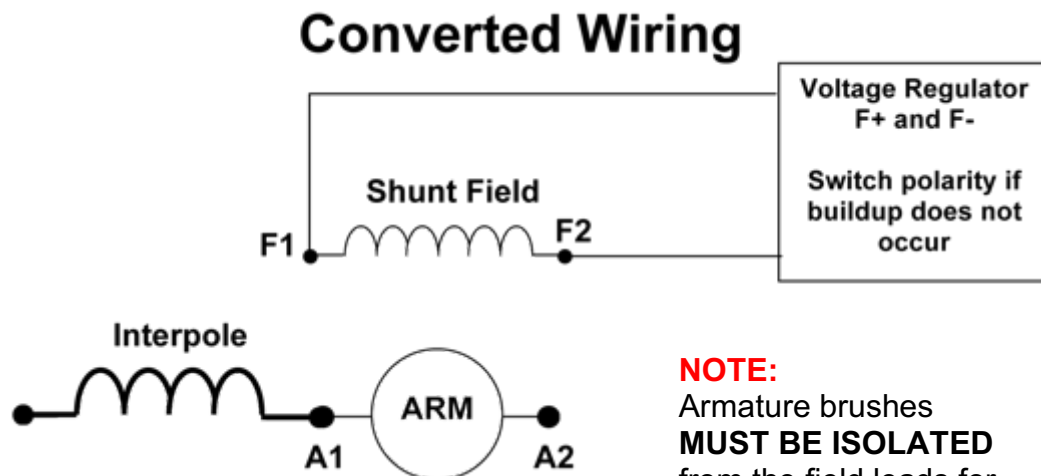
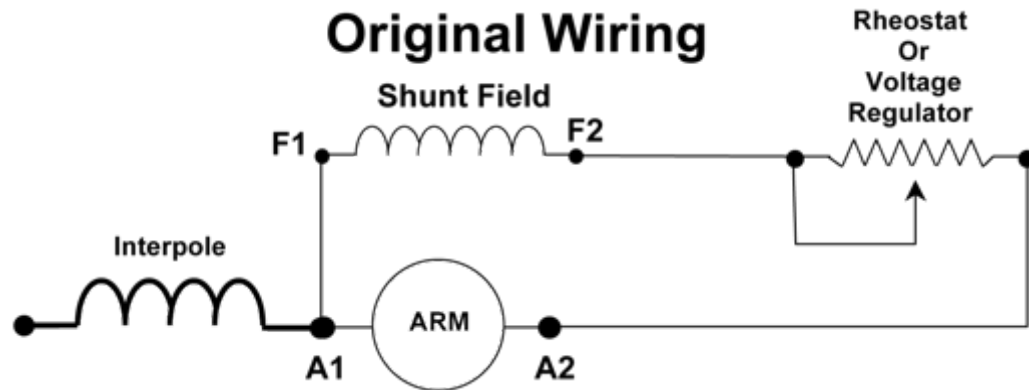
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# Conversion From Older Shunt-Wound Voltage Regulation to Modern Solid-State Voltage Regulation

It is possible to use the SPXR-DC20 DC Voltage Regulator with older Shunt-Wound generators that originally had manual or mechanical voltage regulators by converting the wiring as in the diagrams below. If the generator will not build up after conversion, try switching your F+ and F- leads at the regulator and try starting up again.



#### NOTE:

Armature brushes **MUST BE ISOLATED** from the field leads for proper operation!

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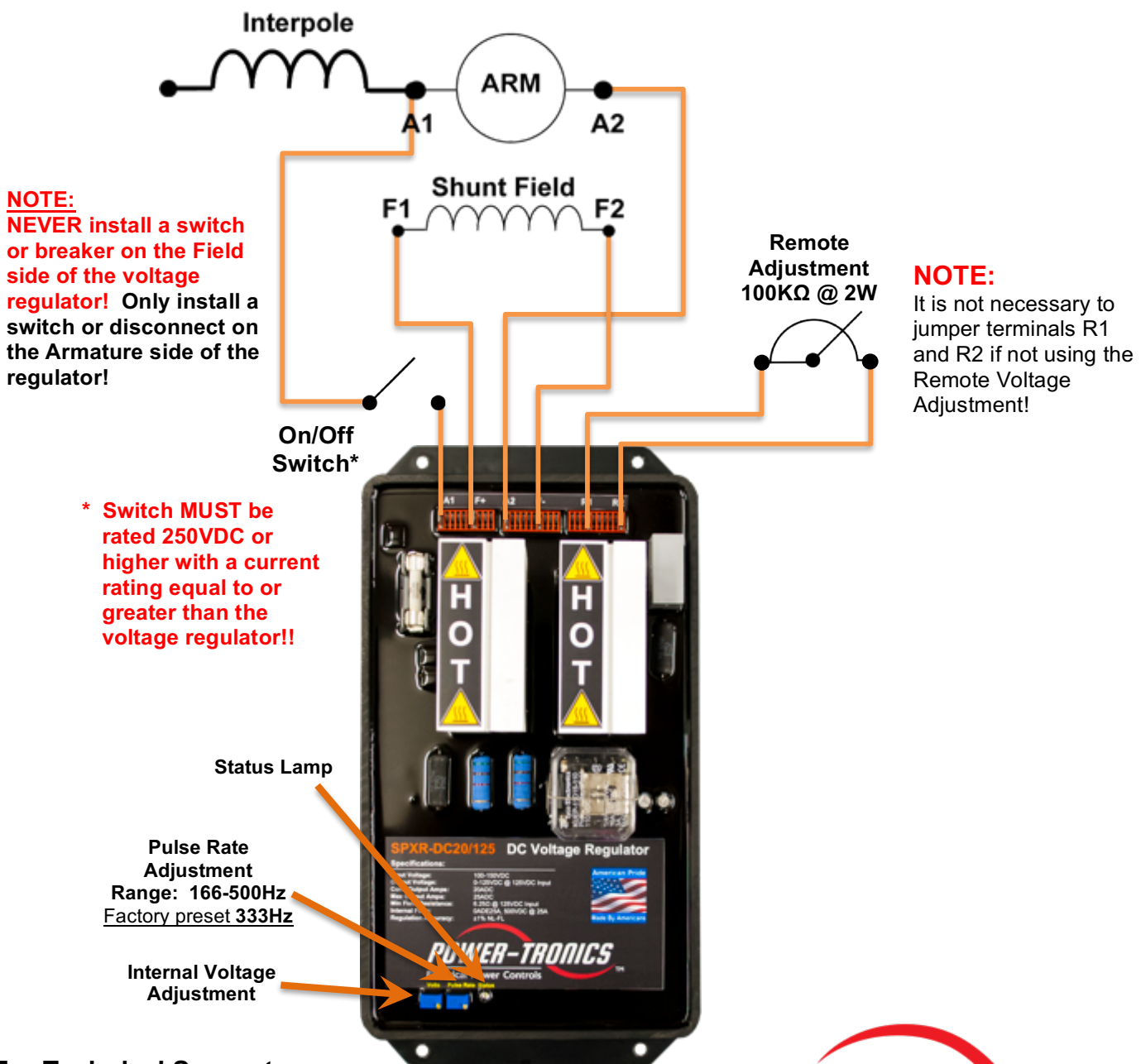


# Hookup Diagram

The SPXR-DC20 DC Voltage Regulator controls the strength of the DC shunt-field of a DC generator to regulate the terminal voltage produced at A1 and A2 of the armature. The SPXR-DC20 is capable of outputting 0-250vdc with an input of 250vdc (0-125vdc with an input of 125vdc).

Use the diagram shown below for proper hookup to the typical DC generator. **Note that the shunt field is isolated from the rest of the generator and connected ONLY to the SPXR-DC20 DC Voltage Regulator!!** See Page 6 for details on how to convert the wiring on a typical Shunt-Field DC Generator for use with the SPXR-DC20 DC Voltage Regulator! Before proceeding, verify that the Armature brushes are **ISOLATED FROM THE FIELD!** **Verify that the Shunt Field is ISOLATED and connected ONLY to the SPXR-DC20 Voltage Regulator!**

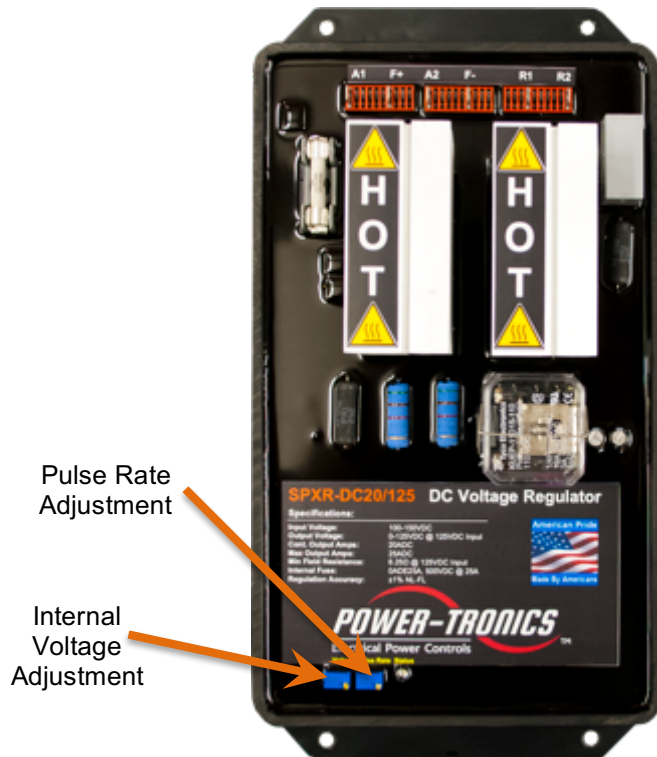
Note that the maximum input voltage to the SPXR-DC20 DC Voltage Regulator is 250VDC (125VDC for 125V Models)! **DO NOT input higher voltages into the SPXR-DC20!** Severe damage to the unit will result!



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## Initial Setup and Commissioning

1. Install the regulator and wire according to the hookup diagram.
2. Verify that the brushes and brush riggings are isolated, ungrounded, and connected ONLY to the SPXR-DC20.
3. The SPXR-DC20/125 is preset for 125VDC (with external adjustment potentiometer set to mid-position) [SPXR-DC20/250 for 250VDC] from the factory. **DO NOT TURN THE VOLTAGE ADJUSTMENT CCW FOR FIRST STARTUP TO PREVENT EXCESSIVE CYCLING OF THE BUILDUP RELAY!**



4. If you are using a remote voltage adjustment, set it at 50% of adjustment.
5. Start up the prime mover and bring up to operating speed and turn on the regulator switch (if used).
6. Set the internal voltage adjustment 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!**
7. Place the generator on line and observe the voltage.
8. 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.
9. If necessary, adjust the Pulse Rate using the adjustment provided. Pulse rate is 166-500Hz. **The rate is preset at mid-range of 333Hz from the factory and should be adequate for most generators.** Turning the adjustment clockwise increases the firing rate of the rectifier section and speeds up the response time of the regulator accordingly. A lower pulse rate will prolong the life of the regulator and extend the life of the rectifier module.

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## Optional Power-Tronics Add-On Modules

Power-Tronics offers optional add-on modules for the SPXR and DC series DC voltage regulators such as motor-operated potentiometers and 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)



### MOP1224HD

#### Motorized Potentiometer

Allows the SPXR-DC20 to be externally controlled by older automated controllers using pulsed signals or dry contacts for control!



### EIM1020VM

#### External Interface Module

Allows the SPXR-DC20 to be controlled externally by virtually any digital or analog signal from a PLC or genset controller!

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## Application Troubleshooting

Installation of the SPXR-DC20 DC Voltage Regulator is normally a very simple process; however occasionally conditions arise that require troubleshooting assistance. Because of the nature of DC voltage regulation, **please contact Power-Tronics for any troubleshooting assistance!**

## Bench Check Procedures

**Because of the nature of DC voltage regulation, the SPXR-DC20 DC Voltage Regulator has no bench-test procedure. If you suspect a problem with your SPXR-DC20, please contact Power-Tronics for assistance or service!**

# 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!**

Submit Online at: [www.power-tronics.com/warranty](http://www.power-tronics.com/warranty)

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Product Model:		Additional Module(s) or Options:	
Serial #:			
Date of Installation:			
<b><u>This Section for Brushless Generators Only</u></b>			
Exciter Field Voltage:		Exciter Field Resistance:	
<b><u>This Section for Brush-Type Generators Only</u></b>			
Shunt-Field Voltage:		Shunt-Field Resistance:	
Rotor Resistance @ Brush Leads:		Rotor Resistance on Slip-Rings:	
Rotor Excitation Voltage:			
<b><u>Generator Wiring/Usage Information</u></b>			
Generator Leads (Check One:) <input type="checkbox"/> 12 <input type="checkbox"/> 10 <input type="checkbox"/> 6 <input type="checkbox"/> 4 (3ø) <input type="checkbox"/> 4 (1ø) <input type="checkbox"/> 3			
Generator Wiring Mode (Check One:) <input type="checkbox"/> High-Wye <input type="checkbox"/> Low-Wye <input type="checkbox"/> Series Delta			
<input type="checkbox"/> Zig-Zag <input type="checkbox"/> Double-Delta <input type="checkbox"/> Single-Phase <input type="checkbox"/> Other			
Terminal Voltage:		Residual AC Voltage:	
Rated KW:		Rated KVA:	
Primary Load (Please Explain):			
<b><u>Repair/Warranty Request Information</u></b>			
Company Name:			
Contact Person:			
Telephone Number:			
Email Address:			
Ship-To Address (City, State, Zip, Country):			
Problem Description/History (Please be detailed!!!):			

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# 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.**, warranties **only parts and workmanship** of this product for a **period of 3 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(s) on the printed circuit card.
- ❖ Overheating of the IGBT Module 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.**

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