POWER-TRONICS, INC. Electrical Power Control Systems

P.O. Box 291509 Kerrville, Texas USA 78029 Phone: 830.895.4700 Email: pti@power-tronics.com Web: www.power-tronics.com



Specifications

Input Voltage: Frequency: Control Range: Output Voltage Range:

Maximum Output Voltage: Minimum Field Resistance:

Physical Size: Weight: Fully Encapsulated: Internal Protection: External Voltage Adjustment: System Operating Indicator: Optional External Controls 120 - 240vac 50 or 60 Hz 0-100% 0-105vdc @ 120vac input 210vdc @ 240vac input 210vdc @ 5adc @ 240vac 21Ω @ 105vdc output 42Ω @ 210vdc output 4.75 x 7.25 x 1.75 in. 1 lb. Yes Fuses, cartridge type Yes Yes Yes

PC5B Phase Control

The Power-Tronics PC5B Phase control is a self-contained complete Phase control designed for continuous operation at up to 210vdc at 5adc!

The PC5B is uniquely designed to sit in a compact footprint while being passively convection cooled for a long service life. Because of its unique encapsulated design, the PC5B minimizes downtime should a repair ever be necessary! The compact design allows a wide variety of installation methods, including installations where space is at a premium.

Over 25 years of field use and design refinement makes the PC5B a time-proven design utilizing high-reliability components. The PC5B is designed to provide a lifetime of service and is specifically built to minimize failures and potential downtime!

The PC5B includes an internal 0-10VDC or 4-20mA interface module to allow a wide variety of VAR, PF, or other PLC controls to remotely control the unit. An optional motorized potentiometer allows remote operation by dry contact switching or older pulsed-DC control schemes.

The PC5B Phase control is the latest upgrade to the XR500PC and PC500X series of phase controls and replaces all previous Power-Tronics phase control models!



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Introduction and Functional Description

Caution: Read This Installation Manual Carefully and Entirely!

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 the unit up ALWAYS ensure the phase control receives ample airflow ALWAYS use adequate fusing NEVER hold the phase control in your hand or lap when energized NEVER install the PC5B in a place it can be exposed to the elements or moisture NEVER mount the phase control 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 PC5B during operation NEVER install a switch in the DC portion of the phase control's wiring NEVER USE A DIGITAL FREQUENCY METER (*It can give a false reading*!)

Functional Description

The PC5B Phase Control is the result of over 25 years of engineering efforts and offers highdemand features at a competitive price point. The PC5B is a proven design and is engineered to greatly simplify setup while offering extreme reliability. When properly installed, the PC5B Phase Control is designed to provide a lifetime of service.

An automatic phase control has several automated tasks it must perform in order to provide reliable, clean, and regulated electricity. It must maintain a preset setpoint and protect both itself and the connected load should a fault situation arise.

The PC5B uses field-replaceable cartridge fuses to protect its internal circuitry should a fault occur and the load current exceeds what the phase control is capable of delivering. It also contains reliable circuitry that is designed to maintain a setpoint regardless of outside influences or ambient temperature.

Due to its extreme simplicity, the PC5B Phase Control is uncommonly reliable and offers features and accuracy usually only offered by much more complicated and often much more expensive phase controls.



Determining Correct Application Sizing

The PC5B Phase control is designed for use with 120-240VAC input. It contains internal suppression for use with brush-type loads such as synchronous motors. Before installation, it is necessary to verify that the PC5B is the correct product for your application.

To determine if the PC5B is the correct product for your load you need to know any two of the following 3 specifications from the rating plate of your load:

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

Using the specifications obtained from your connected load, verify that your load fits the specifications below:

• Connected load full load voltage is 125VDC or less, and the control field resistance is 25Ω or greater.



WARNING: BRUSH AND SLIP RING CONNECTION PROBLEMS ARE THE #1 SOURCE OF VOLTAGE CONTROL PROBLEMS AND FAILURE OF PHASE CONTROLS!!! <u>DO NOT INSTALL THE PC5B IF THE BRUSHES AND/OR SLIP</u> RINGS ARE NOT IN EXCELLENT CONDITION!!! STOP AND CORRECT BRUSH AND SLIP RING CONNECTION PROBLEMS IF ANY OF THE FOLLOWING CONDITIONS ARE PRESENT:

- GROOVES IN SLIP RINGS
- ROUGH SLIP RING APPEARANCE OR GHOSTING (CHATTERING)
- OIL CONTAMINATION ON BRUSHES OR SLIP RINGS
- DULL, ROUGH, STRIPED, PITTED, OR METALLIC APPEARANCE OF BRUSH FACES
- FIELD RESISTANCE MEASURED BETWEEN SLIP RING BRASS AND FIELD RESISTANCE MEASURED BETWEEN FIELD LEADS EXCEEDS 1-2% DIFFERENCE



Note about Field Resistance

When measuring field resistance on a brush-type device, such as a synchronous motor, 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 device has brush and ring contact problems and will need cleaning or maintenance before installing the PC5B.

Failure to correct brush and ring contact problems will result in severe damage to the phase control 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!



Included Parts & Accessories

The PC5B Phase Control includes the following parts and accessories to ensure a quick and easy installation:



Included Parts List:

- 100K 2W Long-Life Potentiometer: Qty: 1 Qty: 1 Panel Knob for Potentiometer: Qty: 4 #22-18AWG .250 Female Terminals: Qty: 1 • Red Jumper Wire: Qty: 1 • Orange Jumper Wire: Qty: 1
- Purple Jumper Wire:

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Input Power & Field Connection Diagram

(See page 10 for control wiring information)

WARNING: The PC5B Phase Control is NOT Suitable for use on Electrical Generators Without a Suitable Voltage Control Source!!!

The PC5B is a Full-Wave rectified phase control, which allows a maximum of 210VDC at 5ADC continuous with an input voltage of 240VAC.

This product is typically used on slip-ring synchronous motors or on inductive loads with full load control field voltages of 125VDC or less and full load exciter field amperage up to 5ADC. Control fields with lower voltages can use the PC5B with a 120VAC input voltage for a maximum output of 105VDC @ 5ADC.

Note that the maximum input voltage to the PC5B Phase control is 240VAC! DO NOT input 277VAC into the PC5B! Severe damage to the unit will result! For use on 480V or higher systems, connect the PC5B to an appropriate step-down transformer to supply 240VAC to the PC5B.



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Terminal and Control Locations

The PC5B Phase Control is an integrated device designed to replace multiple discrete components in previous generations of Phase Controls. It incorporates a Phase Control Module, AC Input Filtering, and integrated 0-10VDC / 4-20mA Interface Module.

The unitary design simplifies installation in the field, and greatly simplifies replacement if a fault occurs with the control module. The unit has quick-connect terminals and can be quickly swapped out in less than 5 minutes should the unit ever need replacement.



Terminal Descriptions:

AC1 & AC2:

AC Voltage Input, 120-240VAC

- F+ & F-: Control Field Output, 0-210VDC
- G1 & G2:

Gate Enable Pins Short G1 & G2 To Operate Switch or Relay Recommended If No Switch, Install Red Jumper

R1 & R2:

Remote Adjustment Input

U- & U+:

Output From Internal Analog Input Module

CV- & CV+:

Input for 0-10V or 4-20mA Signal



Standard Control Wiring Diagram

This wiring diagram shows the default control wiring configuration for the PC5B and assumes manual control with a remote potentiometer. **Power wiring is shown on Page 7.**





Fully Automatic Remote Adjustment Wiring Diagram

This wiring diagram shows ONLY the control wiring configuration for fully-automatic Remote Control of the PC5B. **Control wiring is shown on Page 9.**



the Accessory Parts Kit



Automatic / Manual Selectable Remote Adjustment Wiring Diagram

This wiring diagram shows ONLY the control wiring configuration for selectable fully-automatic or manual Remote Control of the PC5B. **Control wiring is shown on Page 9.**



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Initial Setup and Commissioning

- 1. Install the PC5B and wire according to the correct wiring diagram and control wiring diagram (**Pages 7-11**).
- 2. If installing the PC5B on a load containing slip rings and brushes, verify that the brushes and brush riggings are isolated, ungrounded, and connected ONLY to the PC5B.
- 3. Base Voltage and Manual Internal Voltage adjustments are preset from the factory for use with a remote adjustment potentiometer or the internal 0-10V interface module.
- 4. If you are using a remote voltage adjustment, set it at 0% of adjustment.
- 5. If you are using the PC5B on a synchronous motor, bring the motor up to operating speed and turn on the phase control switch (if used).
- 6. If you are using an external voltage adjustment potentiometer or the internal 0-10V interface module, adjust the remote control until reaching the desired voltage setting for the connected load.
- 7. If you are using the PC5B as a fixed voltage source (non-adjustable), turn the Manual Internal Voltage control potentiometer (**MANUAL**) clockwise until the desired voltage setting for the connected load is reached. **Note that the control potentiometer is a 25-turn Pot!**
- 8. Observe operation during no-load and full-load conditions. Once the voltage is set and adjustment characteristics are satisfactory the installation procedure is complete.
- **NOTE:** Tolerances in remote potentiometers and control arrangements can cause the base voltage to rise preventing the PC5B from reaching 0VDC output. If this occurs, the base voltage can be adjusted using the **BASE** adjustment potentiometer. Turn the external control to 0%. If the PC5B is still outputting DC voltage, slowly turn the **BASE** adjustment CCW until 0VDC output is achieved.

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Bench Check Procedures

- 1. Wire up the PC5B as shown in the figure below.
- Connect up two 120 volt 50 to 150 watt incandescent light bulbs in series to the F+ and F-Terminals.
- 3. Install a temporary jumper wire between terminals G1 and G2.
- 4. Turn the internal voltage adjustment (MANUAL) fully Counter-Clockwise (Left) before beginning the testing procedures below.
- 5. Input 120-240VAC fused at no more than 5A into the PC5B. The test light should be OFF.
- 6. Slowly turn the Manual internal voltage (MANUAL) adjustment Clockwise (Right) until the lights glow. The test light should light to *FULL* Brightness. *NOTE: It may take several turns of the adjustment screw before the lights illuminate!*
- 7. Slowly turn the Manual internal voltage (MANUAL) adjustment Counter-Clockwise (Left) until the lights go dark. The test light should be OFF. *NOTE: It may take several turns of the adjustment screw before the lights go dark!*
- 8. Turn off power and disconnect the PC5B from your power source. Inspect all electronic components on the PC5B to ensure they are isolated from touching any part of the PC5B housing.
- 9. Steps 4-8 may be repeated using an external 100KΩ potentiometer attached to R1 and R2 to test the external input ability of the PC5B. Instead of turning the internal voltage adjustment potentiometer, turn the external 100KΩ potentiometer when performing steps 5 and 6.
- 10. If you were able to successfully perform all of these tests, the PC5B is good.





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 Model:	Additional Module(s) or Options:	
Serial #:		
Date of Installation:		
This Section for Brushless Generators Only		
Exciter Field Voltage:	Exciter Field Resistance:	
This Section for Brush-Type Generators Only		
Shunt-Field Voltage:	Shunt-Field Resistance:	
Rotor Resistance @ Brush Leads:	Rotor Resistance on Slip-Rings:	
Rotor Excitation Voltage:		
	-	
Generator Wiring/Usage Information		
Generator Leads (Check One:) 12	10 □6 □4 (3ø) □4 (1ø) □3	
Generator Wiring Mode (Check One:) High-Wye Low-Wye Series Delta		
□Zig-Zag □Double-Delta □Single-Phase □Other		
Terminal Voltage:	Residual AC Voltage:	
Rated KW:	Rated KVA:	
Primary Load (Please Explain):		
Repair/Warranty Request Information		
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 <u>one</u> 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.