VPAC
User's Manual

Solid State Relay
Power Control

Watlow Controls
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Phone: 507/454-5300, Fax: 507/452-4507 http://www.watlow.com

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Supersedes:
WVPC-XUMN Rev A00

$5.00
Made in the U.S.A.
Printed on Recycled Paper
The VPAC Series Power Controls are a family of Solid State Relay (SSR) controls for electric heating applications. The VPAC provides output power proportional to the input command signal from a temperature control. The single phase VPAC-01 can be ordered in either ON/OFF (solid state contactor), burst fired or phase angle firing mode. The three phase, two leg VPAC-32 is for solid state contactor or burst fired (loop powered) operation only.

### Specifications (1822)

#### Solid State Relay Power Control with Heat Sink
- Solid state contactor, AC input (CA)
- Solid state contactor, DC input (CD)

#### Optional Loop-Powered Control Card
- Burst firing (zero cross) control, 4-20mA (BL)

#### Optional Transformer-Powered Control Card
- Burst firing (zero cross) control, Process Input, 10 only (BT)
- Phase angle control, Process input, 10 only (AT+)
- SDA Shorted SSR Alarm (for Zero cross only)

#### Line Voltage (50/60Hz)
- 120V~(ac) operation
- 208/240V~(ac) operation
- 277V~(ac) operation
- 380V~(ac) operation
- 415V~(ac) operation
- 480V~(ac) operation

#### Solid State Relay Control
- Single phase, single SSR
- Three phase, two leg control for three wire (non-grounded load), dual SSR.
- Resistive load only

#### Inputs
- Solid state contactor, AC input (CA)
  - ON, 90 to 240V~(ac); OFF, 0 to 10V~(ac)
- Solid state contactor, DC input (CD)
  - ON, 3 to 32VDC; OFF, 0VDC
- Burst firing (zero cross) control card (BL)
  - Input 4 to 20mA only
  - Bias and Gain adjustable
  - Input impedance 500 minimum
- Burst firing (zero cross) control card (BT), 10 only
  - Input factory adjusted for 4-20mA
  - Bias and Gain adjustable, 0 to 12VDC/0 to 25mA
  - Input impedance 300 (clip R-22 for 5KV, voltage input)
- Phase angle control card (AT+), 10 only
  - Input factory adjusted for 4-20mA
  - Bias and Gain adjustable, 0 to 12VDC/0 to 25mA
  - Input impedance 300 (clip R-2 for 5K, voltage input)
  - Soft start 10 seconds (approx.)
  - 120/240V~(ac) or 480V~(ac) to 24V~(ac) power transformer included, model dependent for AT+ and BT options.

#### Outputs
- 120V~(ac) through 480V~(ac)
- 10-75A

#### Operating Ambient
- Temperature - 0 to 50°C
- RH - 0 to 90%, non-condensing

Specification subject to change without notice.

### Returns

1. Call Customer Service, 507-454-5300, for a Return Material Authorization (RMA) number before returning any item for repair. We need:
   - Ship to address
   - Bill to address
   - Contact name
   - Phone number
   - Ship via
   - Symptoms and/or special instructions
   - Name & phone of person returning the material.
2. Prior approval and an RMA number, from the Customer Service Department, is needed when returning any unused product for credit. Make sure the RMA number is on the outside of the carton, and on all paperwork returned. Ship Freight Prepaid.
3. In cases of manufacturing defect, we will enter a repair order, replacement order, or issue credit for material. A 25% restocking charge is applied for all returned stock controls and accessories.
4. If the unit is unrepairable, it will be returned to you with a letter of explanation. Repair costs will not exceed 50% of the original cost.
### VPAC Dimensions and Mounting

**WARNING:**
VPAC mounting and spacing must conform to local, state and national safety codes. Failure to conform to codes could result in death or personal injury, or damage to equipment.

**CAUTION:**
Mount units with heat sink fins oriented vertically. Failure to do so could result in unit failure and damage to the process.

#### Maximum Overall Dimensions

<table>
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<tr>
<th>Amps</th>
<th>Height (H)</th>
<th>Width (W)</th>
<th>Depth (D)</th>
<th>Fan Cooled</th>
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#### V32 10-40A

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#### V32 50-75A

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<td>10.50&quot;</td>
<td>5.00&quot;</td>
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</tbody>
</table>

*NOTE:* *The 50Amp Single Phase width mounting dimension includes four mounting clips (#56-0308) instead of the 1/2 round cutouts.

*NOTE:* 3-Phase, 2-Leg 10-40A use 2 heat sinks for overall dimensions.

*NOTE:* Mounting dimensions show maximum possible height and depth with terminal-mounted control card attached. Unit height and depth varies with control card configuration.
Mount 120/240V Transformer AT+/BT Power

The AT+ or BT transformer powers the AT+ or BT control card. Mount the transformer within 12 in. (30.5cm) of the VPAC it connects to.

Mount 277 to 480V Transformers AT+/BT Power

The AT+ or BT transformer powers the AT+ or BT control card. Mount the transformer within 12 in. (30.5cm) of the VPAC it connects to.

Mount Optional Semiconductor Fuses near the VPAC. Mounting must conform to code requirements. Wiring diagrams show proper connections.

WARNING:

Fuse mounting and spacing must conform to local, state and national safety codes. Failure to conform to codes could result in damage to equipment and/or injury to personnel.
Single Phase Wiring

1Ø Wiring for AC & DC Input Contactor
10-40A, Models (CA or CD)

**WARNING:**

1. Wiring must conform to National Electric Code (NEC) safety standards, as well as locally applicable codes. Failure to do so could result in death or personal injury.

2. Wiring examples show L2 in 240V-(ac) or 480 V-(ac) configuration. In 120V-(ac) applications, L2 is neutral and must not be fused or switched. Failure to follow this guideline could result in death or personal injury.

### 1Ø Wiring, 4-20mA Burst, 10-40A (BL)

1. Limit Contactor Contacts (if required)

### 1Ø Wiring, 4-20mA Burst, 50 & 75A (BL)

1. Limit Contactor Contacts (if required)

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**WARNING:**

Wiring examples show L2 in 240V-(ac) or 480 V-(ac) configuration. In 120V-(ac) applications, L2 is neutral and must not be fused or switched. Failure to follow this guideline could result in death or personal injury.

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**WARNING:**

Electrical connections must be made by a qualified electrician. Improper installation can result in damage or malfunction of the device. Always follow the manufacturer's instructions and adhere to all safety guidelines.

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120V~(ac) Fan Power
20 Watts Max. - 75A Only
(Customer Supplied)
Separate Disconnect Required
Single Phase Wiring

1Ø Wiring, 4-20mA Burst (BT)
1Ø Wiring, 4-20mA Phase Angle (AT+)

NOTE: The control transformer must be on the same phase as the load. See wiring diagram above. All hot lines to the transformer should be fused at 1 Amp with the proper line voltage.

WARNING: 1
Wiring must conform to National Electric Code (NEC) safety standards, as well as locally applicable codes. Failure to do so could result in death or personal injury, or damage to equipment.

WARNING: 2
Wiring examples show L2 in 240V~(ac) or 480 V~(ac) configuration. In 120V~(ac) applications, L2 is neutral and must not be fused or switched. Failure to follow this guideline could result in death or personal injury.

NOTE: For manual control, a 1K potentiometer may be connected to the BT or AT+ card input terminals. Watlow offers a kit as Manual Control Kit, part number, 08-5362. Using this potentiometer requires removing the specified control card resistor for higher impedance.

Bias and gain adjustment is required when changing from 4-20mA input to a manual control input or a voltage input.
3Ø Wiring for AC & DC Input Contactor
10-40A, Models (CA or CD)

VDC

Semiconductor Fuses

L1
L2
L3

Limit Contactor
(if required)

T1
T2
T3

3Ø Wiring, DC Contactor, 50 & 75 A (BL) (CD)

Semiconductor Fuses

L1
L2
L3

Limit Contactor
(if required)

T1
T2
T3

3Ø Wiring, Burst Fired, 4-20mA, 10-40 A (BL)

Semiconductor Fuses

L1
L2
L3

Limit Contactor
(if required)

T1
T2
T3

3-Phase, 2-Leg Wiring

WARNING:
Wiring must conform to National Electric Code (NEC) safety standards, as well as locally applicable codes. Failure to do so could result in death or personal injury, or damage to equipment.

90-240V~(ac) -
AC Input +

4-20mA + Input -

120/240V~(ac) Fan Power
(model # dependent)
20 Watts Max.
(Customer Supplied)
Separate Disconnect Required

4-20mA

Fan

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Troubleshooting

To isolate a system problem involving the VPAC, answer these questions:

- Are inputs to the VPAC present?
- Are outputs from the VPAC present?
- Are all connections good?
- Is the load good?
- Is line voltage within specification?
- Are temperature control signals present? If so, then the VPAC power control itself may be the problem. The problem may be with the VPAC's control card, transformer or solid state relay. Use the table below to assist with troubleshooting.

### Bias And Gain Adjustments

The VPAC bias and gain can be adjusted for the output of most standard, proportional output temperature controls. Bias and gain is factory set for an input control signal (0-5VDC or 4-20mA), but may require minor adjustments to match the output of a specific temperature control.

We recommend that bias and gain adjustment be performed using a dummy load. In some applications, a dummy load may be required if the controlled load can not be turned full ON. A dummy load can be easily made by connecting 150 watt lamps in series to match the operating voltage of the VPAC. Use the following steps to make adjustments.

1. Connect an AC voltmeter across the load or dummy load of the VPAC. Connect a DC voltmeter across, or milliampmeter in series with, the input signal from the temperature controller.
2. Apply power to the system.
3. Set the output signal of the temperature controller to zero or its minimum output. Adjust the bias potentiometer slowly until the VPAC output just comes ON. Then turn it in the opposite direction until the output is just full OFF as observed on the output voltmeter.
4. Adjust the output of the temperature controller to full ON (5VDC, 20mA, etc.). Adjust the gain potentiometer until the VPAC output is just full ON.
5. Repeat Steps 3 and 4 until the VPAC turns full ON with a full ON signal from the temperature control, and full OFF with the minimum input signal from the temperature control. Steps 3 and 4 may need to be repeated a few times (an adjustment made on one of the potentiometers affects the adjustment of the other potentiometer).

### Replace SSR

Screw, 2 ea., #8-32
See Note 4.

Solid State Relay
See Note 3.

Thermal pad or a thin coat of thermal joint compound (Dow DC-340)

1. Surface must be clean and flat.
2. Use a thermal pad or a thin coat of thermal joint compound (Dow DC-340 or equivalent).
3. Mount the SSR to the heat sink.
4. Use Belleville (spring) washers and tighten screws alternately until the spring is deflected slightly.

CAUTION:
Heat sink must be mounted so that the fins are vertically aligned.

CAUTION:
Heat sensitive component; ambient temperature must not exceed 122°F (50°C). If overheated, unit could fail.

CAUTION:
Heat sensitive component; do not mount SSRs on panels that are painted, plastic, steel or stainless steel. These materials will not remove heat generated by the SSR. If overheated, unit could fail.

Feedback

Your comments and suggestions on this manual are welcome. Please send them to: Technical Writer, Watlow Controls, P.O. Box 5580, Winona, MN 55987-5580, or call (507) 454-5300 or fax (507) 45204507. The VPAC Users Manual is copyrighted by Watlow Winona, Inc., © December 1999, with all rights reserved. (1820)