# Power Switching Devices

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<td>EZ-ZONE® ST</td>
<td>75A</td>
<td>Zero Cross, Phase Angle</td>
<td>1</td>
<td>UL®, CSA, CE, SCCR, RoHS, W.E.E.E.</td>
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<tr>
<td>DIN-A-MITE® A</td>
<td>25A</td>
<td>Zero Cross</td>
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<td>UL®, C-UL®, CE, SCCR, RoHS</td>
<td>328</td>
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<tr>
<td>DIN-A-MITE B</td>
<td>40A</td>
<td>Zero Cross</td>
<td>1</td>
<td>UL®, C-UL®, CE, SCCR, RoHS</td>
<td>331</td>
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<tr>
<td>DIN-A-MITE C</td>
<td>80A</td>
<td>Zero Cross, Phase Angle</td>
<td>1 or 3</td>
<td>UL®, C-UL®, CE, SCCR, RoHS</td>
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<td>DIN-A-MITE D</td>
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<td>1</td>
<td>UL®, C-UL®, CE, SCCR, RoHS</td>
<td>340</td>
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<tr>
<td>POWER SERIES™</td>
<td>250A</td>
<td>Zero Cross, Phase Angle</td>
<td>1 or 3</td>
<td>UL®, C-UL®, CE, SCCR</td>
<td>343</td>
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<tr>
<td>QPAC</td>
<td>1000A</td>
<td>Zero Cross, Phase Angle</td>
<td>1 or 3</td>
<td>UL®, C-UL®, SCCR</td>
<td>348</td>
</tr>
<tr>
<td>E-SAFE® II</td>
<td>35A</td>
<td>Zero Cross</td>
<td>1, 2 or 3</td>
<td>UL®, C-UL®, CE, RoHS, W.E.E.E.</td>
<td>353</td>
</tr>
<tr>
<td>SERIES CZR</td>
<td>42A</td>
<td>Zero Cross</td>
<td>1</td>
<td>UL®, CSA, CE, RoHS</td>
<td>356</td>
</tr>
<tr>
<td>Solid State Relays (SSR)</td>
<td>75A</td>
<td>Zero Cross</td>
<td>1</td>
<td>UL®, CSA, RoHS</td>
<td>359</td>
</tr>
</tbody>
</table>

**Note:** The specifications in the table above are best available values in each category. Not all combinations of these values are available in a single model number.
### Power Switching Devices

#### Comparison Guide

<table>
<thead>
<tr>
<th>Initial Cost</th>
<th>3 Year Cost</th>
<th>Control Life</th>
<th>Heater Life</th>
<th>EMI Generation</th>
<th>Control</th>
<th>Response Rate</th>
<th>Options</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electromechanical Relay and Contactor</td>
<td>Low for low current</td>
<td>Highest</td>
<td>Limited electrical and mechanical</td>
<td>Shortest</td>
<td>Yes, coil and contacts</td>
<td>Poor</td>
<td>Slowest</td>
<td>None</td>
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<tr>
<td>Hybrid Power Switch</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
<td>Good</td>
<td>Minimal</td>
<td>Good</td>
<td>Fast</td>
<td>None</td>
</tr>
<tr>
<td>Mercury Displacement Relay (MDR)</td>
<td>Low for low to medium current</td>
<td>Medium</td>
<td>High</td>
<td>Good</td>
<td>Yes, coil and contact</td>
<td>Fair to good</td>
<td>Medium to fast</td>
<td>None</td>
</tr>
<tr>
<td>Solid State Relay (SSR) Fixed Time Base</td>
<td>Medium</td>
<td>Medium</td>
<td>Extended</td>
<td>Extended</td>
<td>Minimal</td>
<td>Good</td>
<td>Fast</td>
<td>None</td>
</tr>
<tr>
<td>Silicon Controlled Rectifier (SCR) Fixed Time Base</td>
<td>Medium</td>
<td>Low</td>
<td>Extended</td>
<td>Extended</td>
<td>Minimal</td>
<td>Good</td>
<td>Fast</td>
<td>None</td>
</tr>
<tr>
<td>SCR Burst Firing</td>
<td>High</td>
<td>Low</td>
<td>Extended</td>
<td>Longest</td>
<td>Minimal</td>
<td>Excellent</td>
<td>Fastest</td>
<td>None</td>
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<tr>
<td>SCR Phase-Angle Firing</td>
<td>High</td>
<td>Low</td>
<td>Extended</td>
<td>Longest</td>
<td>High</td>
<td>Excellent</td>
<td>Fastest</td>
<td>Current limit</td>
</tr>
<tr>
<td>Saturable Core Reactor</td>
<td>Highest</td>
<td>Low</td>
<td>Extended</td>
<td>Longest</td>
<td>Minimal</td>
<td>Very good</td>
<td>Fast</td>
<td>Current limit</td>
</tr>
</tbody>
</table>

① Includes heater replacement and lost production.
Power Switching Devices

EZ-ZONE® ST

The EZ-ZONE® ST integrated solid state controller from Watlow®, offers a complete thermal system control solution in a single package. Features include a PID temperature controller connected to a high-amperage solid state relay with the option of adding a properly sized heat sink, an over- and under-temperature limit, a power shut-down contactor and digital communications in one complete and professionally engineered product.

Because the system is modular and scalable, a user only pays for what is needed. Stacking the EZ-ZONE ST integrated controller into multiple configurations enables flexibility to standardize the product platform to solve a wide range of application needs.

This integrated controller also includes 200KA short circuit current rating (SCCR) tested up to 480VAC to minimize damage in the event of a short circuit when used with required fusing.

Features and Benefits

Back panel or DIN-rail mount
- Provides several mounting options

Compact package
- Reduces panel size

Touch-safe package
- Complies with IP2X increasing user safety

±0.1 percent temperature accuracy
- Provides efficient and accurate temperature control

200KA SCCR with proper fusing
- Minimizes damage in the event of a short circuit

Agency approvals: UL®, CSA, CE, RoHS, W.E.E.E.
- Meets applications requiring agency approvals

Three-year warranty
- Ensures Watlow’s reliability and product support

Off-the-shelf designed system solution
- Improves system reliability and termination reduction
- Reduces installation cost
- Eliminates incompatibility headaches often encountered with using many different components and brands

Profile capability
- Includes ramp and soak with four files and 40 total steps

Ability to communicate with programmable logic controller (PLC), personal computer (PC) or operator interface terminal (OIT)
- Optional EIA-485 Modbus® RTU
- RUI/communications gateway with optional EIA-232/485 Modbus® RTU, EtherNet/IP™/TCP Modbus®, DeviceNet™ or PROFIBUS DP. Refer to page 371 for further information.

Solid state relay output
- Allows faster cycling, more precise control, increased heater life and improves energy efficiency
- Ability to handle up to 75 amperes
- Uses either zero-cross or phase angle control modes for flexibility to control resistive loads such as Nichrome®, tungsten or quartz lamps
- Utilizes phase angle control mode to prevent load failure or blowing fuses for tungsten or quartz loads

PID temperature control
- Allows single input/dual output
- Allows standard PID or adaptive TRU-TUNE+ tuning algorithms for demanding controllability requirements

Optional temperature limit
- Increases safety in over- and under-temperature condition

Optional definite purpose mechanical contactor
- Enables circuit safety shut down driven by limit control or PID alarm output signal

For detailed product and ordering information, see the full EZ-ZONE ST product section located on pages 242 through 248.
The DIN-A-MITE® A power controller provides a low-cost, highly compact and versatile solid state option for controlling electric heat. This controller is designed and manufactured with the quality features expected from Watlow. DIN-rail and panel mounting is standard on every controller. There is no need to worry about mercury, the DIN-A-MITE controller is mercury free.

Features include single-phase zero cross switching up to 25 amperes at 600VAC (see rating curve). A unique integrated design removes the guesswork associated with selecting a proper heat sink and adequate terminations for the application.

Variable time-base, 4-20mA process control and VAC/VDC input contactor versions are available. All options are model number dependent and factory configurable. This power controller also includes 200KA short circuit current rating (SCCR) tested up to 480VAC to minimize damage in the event of a short circuit when used with required fusing.

**Features and Benefits**

- **200KA SCCR with proper fusing**
  - Minimizes damage in the event of a short circuit

- **DIN-rail and panel mounting**
  - Provides versatility and quick, low-cost installation

- **Compact size**
  - Reduces panel space and cost

- **Touch-safe terminals**
  - Increases safety for installer and user

- **Mercury free**
  - Assures environmental safety

- **Faster switching with solid state**
  - Saves energy and extends heater life

- **UL® 508 listed, C-UL®, RoHS and CE with filter**
  - Meets applications requiring agency approval
  - Reduces end product documentation

- **Back-to-back SCR design**
  - Ensures a rugged design


**DIN-A-MITE A**

**Specifications**

**Operator Interface**
- Control input
- Input indication LED

**Amperage**
- Single-phase, see the output rating curve
- Max. I^2t for fusing: 4000A^2 sec
- Latching current: 200mA min.
- Holding current: 100mA min.
- Power dissipation is 1.2 watts per ampere switched
- 200KA SCCR, Type 1 and 2 approved with the recommended fusing; see user manual

**Line Voltage**
- 24 to 660VAC model number dependent; see ordering information
- Off-state leakage: 1mA at 77°F (25°C) max.
- 50/60Hz independent

**Control Mode, Zero Cross**
- Control option C: VDC input, contactor output
- Control option K: VAC input, contactor output
- To increase service life on contactor models, the cycle time should be less than three seconds
- Control option F: 4 to 20mA DC input, variable time-base control output (3 cycles on, 3 cycles off at 50% power)

**Control Input**
- AC contactor: 24VAC ±10%, 120VAC +10/-25%, 240VAC +10/-25% @ 25mA max.
- DC contactor: 4.5 to 32VDC: max. current @ 4.5VDC is 8mA
- Loop powered linear current 4 to 20mA DC: loop-powered, control option F0 only (requires current source with 8.0VDC available, no more than two DIN-A-MITE inputs can be connected in series)

**Agency Approvals**
- CE with proper filter:
  204/108/EC Electromagnetic Compatibility Directive
  EN 61326-1: Industrial Immunity Class A Emissions
  2006/95/EC Low Voltage Directive
  EN 50178 Safety Requirements
  Installation category III, pollution degree 2
- UL® 508 listed and C-UL® File E73741
- 2011/65/EU RoHS

**Control Input Terminals**
- Compression: will accept 24 to 16 AWG (0.2 to 1.5 mm^2) wire

**Line and Load Terminals**
- Compression: will accept 18 to 8 AWG (0.8 to 8.4 mm^2) wire

**Operating Environment**
- -4 to 176°F (-20 to 80°C); see the output rating curve chart for your application
- 0 to 90% RH (relative humidity), non-condensing
- Insulation tested to 3,000 meters
- Units are suitable for “Pollution degree 2”

**Mounting**
Options include DIN-rail or standard back panel mounting
- DIN EN 50022, 35 mm by 7.5 mm
- Mount cooling fins vertically

**Dimensions**
- 3.7 in. (94 mm) high x 2.0 in. (50 mm) wide x 3.9 in. (98 mm) deep
- Weight: 0.71 lb (0.32 kg)

Specifications are subject to change without notice.

**Output Rating Curve**

- [Output Rating Curve Graph]

<table>
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<tr>
<th>Current (Amperes) into a Resistive Load</th>
<th>Max. Internal Enclosure Ambient Temperature (°C)</th>
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<tr>
<td>30</td>
<td>25</td>
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<tr>
<td>25</td>
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<tr>
<td>5</td>
<td>80</td>
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<tr>
<td>0</td>
<td>85</td>
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</tbody>
</table>

DIN-A-MITE Style A Ratings at 100% On
Power Switching Devices

DIN-A-MITE A

Ordering Information

Part Number

<table>
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<tr>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
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<tbody>
<tr>
<td>D</td>
<td>A</td>
<td>1</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Phase**

1 = 1-phase, 1 controlled leg

**Cooling and Current Rating (See rating curve)**

0 = Natural convection current rating 18A @ 50°C

**Line and Load Voltage**

02 = 24 to 48VAC
24 = 120 to 240VAC
60 = 277 to 600VAC

**Control**

C0 = 4.5 to 32VDC input, contactor output
F0 = 4 to 20mA DC input, variable time-base output
K1 = 22 to 26VAC input, contactor output
K2 = 100 to 120VAC input, contactor output
K3 = 200 to 240VAC input, contactor output

**User Manual**

0 = English
1 = German
2 = Spanish
3 = French

**Custom Options**

00 = Standard part
XX = Any letter or number, custom options, labeling, etc.

Recommended Fuses and Fuse Holders

**Semiconductor Fuses and Holders**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>17-8025</td>
<td>25A fuse</td>
</tr>
<tr>
<td>17-5110</td>
<td>10-25A holder</td>
</tr>
</tbody>
</table>

**DFJ Combination Fuses and Holders**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0808-0325-0020</td>
<td>20A fuse</td>
</tr>
<tr>
<td>0808-0325-0030</td>
<td>30A fuse</td>
</tr>
<tr>
<td>0808-0326-1530</td>
<td>15-30A holder</td>
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</tbody>
</table>
Power Switching Devices

DIN-A-MITE B

The DIN-A-MITE B power controller provides a low-cost, highly compact and versatile solid state option for controlling electric heat. This controller is designed and manufactured with the quality features expected from Watlow. DIN-rail and panel mounting are standard on every control. There is no need to worry about mercury, the DIN-A-MITE controller is mercury free.

Features include single-phase and three-phase zero cross switching up to 40 and 22 amperes, respectively, at 600VAC (see rating curve). A unique, integrated design removes the guesswork associated with selecting a proper heat sink and adequate terminations for the application.

Variable time-base, 4-20mA process control and VAC/VDC input contactor versions are available. A shorted output alarm option is also available. All options are model number dependent and factory configurable. This power controller includes 200KA short circuit current rating (SCCR) tested up to 480VAC to minimize damage in the event of a short circuit when used with required fusing.

Features and Benefits

200KA SCCR with proper fusing
- Minimizes damage in the event of a short circuit

DIN-rail and panel mounting
- Provides versatility and quick, low-cost installation

Compact size
- Reduces panel space and cost

Touch-safe terminals
- Increases safety for installer and user

Single- and three-phase power
- Permits use in a variety of applications

Mercury free
- Assures environmental safety

Faster switching with solid state
- Saves energy and extends heater life

UL® 508 listed, C-UL®, RoHS and CE with filter
- Meets applications requiring agency approval
- Reduces end product documentation

Back-to-back SCR design
- Ensures a rugged design

Shorted output alarm (optional)
- Simplifies troubleshooting and reduces downtime
DIN-A-MITE B

Specifications

Operator Interface
- Control input and indication light
- Alarm output and indication light

Amperage Rating
- See the output rating curve
- Max. surge current for 16.6ms, 380A peak
- Max. I^2t for fusing is 4,000A^2s
- Latching current: 200mA min.
- Holding current: 100mA min.
- Off-state leakage 1mA at 77°F (25°C) max.
- Power dissipation = 1.2 watts per ampere per leg switched
- 200KA SCCR, Type 1 and 2 approved with the recommended fusing; see user manual

Line Voltage
- 24 to 660VAC model number dependent; see ordering information

Control Mode, Zero Cross
- Control option C: VDC input, contactor output
- Control option K: VAC input, contactor output
- To increase service life on contactor models, the cycle time should be less than three seconds
- Control option F: 4 to 20mA DC input, variable time-base control output

Control Input
- AC contactor: 24VAC ±10%, 120VAC +10/-25%, 240VAC +10/-25% @ 25mA max. per controlled leg
- DC contactor: 4.5 to 32VDC: max. current @ 4.5VDC is 6mA per leg. Add 2mA per LED used to the total current
- Loop powered linear current 4 to 20mA DC: loop-powered, control option F0 only (requires current source with 8.0VDC available, no more than two DIN-A-MITE inputs can be connected in series)

Alarm

Shorted SCR Alarm Option
- Alarm state when the input command signal off and a 10A or more load current is detected by the current transformer (two turns required for 5A and three turns for 2.5A)

Alarm Output
- Energizes on alarm, non-latching
- Triac 24 to 240VAC, external supply with a current rating of 300mA @ 77°F (25°C), 200mA @ 122°F (50°C), 100mA @ 176°F (80°C) and a holding current of 200 µA with a latching current of 5mA typical

Agency Approvals
- CE with proper filter:
  - 204/108/EC Electromagnetic Compatibility Directive
  - EN 61326-1: Industrial Immunity Class A Emissions
  - 2006/95/EC Low Voltage Directive
  - EN 50178 Safety Requirements
  - Installation category III, pollution degree 2
- UL® UL 508 listed and C-UL® File E73741
- 2011/65/EU RoHS

Control Input Terminals
- Compression: will accept 24 to 16 AWG (0.2 to 1.5 mm²) wire

Line and Load Terminals
- Compression: will accept 18 to 8 AWG (0.8 to 8.4 mm²) wire

Operating Environment
- See the output rating curve
- 0 to 90% RH (relative humidity), non-condensing
- Storage temperature: -40 to 185°F (-40 to 85°C)
- Operating temperature: -4 to 176°F (-20 to 80°C)
- Insulation tested to 3,000 meters

DIN-rail Mount
- DIN EN 50022, 35 mm by 7.5 mm

Back-Panel Mount
- Four mounting holes No. 6 to No. 8 (M3 to M4) fastener

Dimensions
- 3.7 in. (94 mm) high x 3.3 in. (83 mm) wide x 4.9 in. (124 mm) deep
- Weight: 1.5 lb (0.68kg)

Specifications are subject to change without notice.

Output Rating Curve

Current Rating Table
Power Switching Devices

DIN-A-MITE B

Ordering Information

Part Number

1 2 3 4 5 6 7 8 9 10 11 12
D B Phase Cooling & Current Rating Line & Load Voltage Control Alarm User Manual Custom Options

Phase

0 = 1-phase, 1 controlled leg
1 = 2-phase, 2 controlled legs
2 = 3-phase, 3 controlled legs
3 = 3-independent zones (control options C or K)
8 = 2-independent zones (control options C or K)
9 = 3-independent zones (control options C or K)

Cooling and Current Rating (See rating curve)

0 = Natural convection

Line and Load Voltage

02 = 24 to 48VAC
24 = 120 to 240VAC
60 = 277 to 600VAC

Control

0 = 4.5 to 32VDC input, contactor output
1 = 4 to 20mA DC input, variable time-base output
2 = 22 to 26VAC input, contactor output
3 = 100 to 120VAC input, contactor output
4 = 200 to 240VAC input, contactor output

Alarm

0 = No alarm
S = Shorted SCR alarm

User Manual

0 = English
1 = German
2 = Spanish
3 = French

Custom Options

00 = Standard part
XX = Any letter or number, custom options, labeling, etc.

Recommended DIN-rail Mount Fuses and Fuse Holders

Semiconductor Fuses and Holders

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>17-8020</td>
<td>20A fuse</td>
</tr>
<tr>
<td>17-8025</td>
<td>25A fuse</td>
</tr>
<tr>
<td>17-8030</td>
<td>32A fuse</td>
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<td>17-8040</td>
<td>40A fuse</td>
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<tr>
<td>17-8050</td>
<td>50A fuse</td>
</tr>
<tr>
<td>17-5110</td>
<td>10-25A holder</td>
</tr>
<tr>
<td>17-5114</td>
<td>32-50A holder</td>
</tr>
</tbody>
</table>

DFJ Combination Fuses and Holders

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0808-0325-0020</td>
<td>20A fuse</td>
</tr>
<tr>
<td>0808-0325-0030</td>
<td>30A fuse</td>
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<td>40A fuse</td>
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<td>0808-0325-0050</td>
<td>50A fuse</td>
</tr>
<tr>
<td>0808-0326-1530</td>
<td>15-30A holder</td>
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<tr>
<td>0808-0326-3560</td>
<td>35-60A holder</td>
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</table>
The DIN-A-MITE C silicon controlled rectifier (SCR) power controller provides a low cost, compact and versatile solid state option for controlling electric heat. This controller is designed and manufactured with the quality features expected from Watlow. DIN-rail/panel mount and through-wall mount versions are available. Features include single-phase, three-phase/two leg, and three-phase/three leg, 24-600VAC operation. Current switching capabilities range from 30 to 80A depending on the model ordered. Variable time-base, linear voltage and current process control or VAC/VDC input contactor versions are available. Single-phase, phase angle firing and current limiting are also available. All options are model number dependent and factory configurable. This power controller includes 200KA short circuit current rating (SCCR) tested up to 480VAC to minimize damage in the event of a short circuit when used with required fusing.

Features and Benefits

- **200KA SCCR with proper fusing**
  - Minimizes damage in the event of a short circuit

- **DIN-rail, panel and thru-wall mounting**
  - Provides versatility and quick, low-cost installation

- **Compact size**
  - Reduces panel space and cost

- **Touch-safe terminals**
  - Increases safety for installer and user

- **One- and three-phase power**
  - Can be used in a variety of applications

- **Open heater/shorted output alarm**
  - Notifies the user in case of an open heater or shorted output

- **Mercury free**
  - Assures environmental safety

- **Faster switching with solid state**
  - Saves energy and extends heater life

- **UL® 508 listed, C-UL®, RoHS and CE with filter**
  - Meets applications requiring agency approval
  - Reduces end product documentation

- **System solution component**
  - Provides single source thermal loop

- **Back-to-back SCR design**
  - Ensures a rugged design
**Specifications**

**Operator Interface**
- Control input and indication light
- Alarm output and indication light
- Current limit indication LED

**Amperage Rating**
- See output rating curves on the next page
- Max. surge current for 16.6ms, 1,350A peak
- Max. I²t for fusing is 9100A²s
- Latching current: 200mA min.
- Holding current: 100mA min.
- Fan current: 0.14A for 24VDC; 0.12A for 120VAC; 0.06A for 240VAC
- Off-state leakage 1mA at 77°F (25°C) max.
- Power dissipation: 1 watt per ampere per leg switched
- 200KA SCCR, Type 1 and 2 approved with the recommended fusing; see user manual

**Line Voltage**
- 24 to 48VAC units: 20.4VAC min. to 53VAC max.
- 100 to 240VAC units: 48VAC min. to 265VAC max.
- 277 to 600VAC units: 85VAC min. to 660VAC max.
- 100 to 120VAC, 200 to 208VAC, 230 to 240VAC, 277VAC, 400VAC, 480VAC, 600VAC, +10/-15%, 50 to 60Hz independent ±5% (control options L, P and S)

**Alarms (Zero Cross Models Only)**

**Shorted SCR Alarm Option**
- Alarm state when the input command signal is off and a 10A or more load current is detected by the current transformer (two turns required for 5A and three turns for 2.5A)

**Open Heater Alarm Option (Control Option S Only)**
- Alarm state when the input command signal is on and the load current detected by the current transformer is 20% less than customer adjusted set point

**Alarm Output**
- Energizes on alarm, non-latching
- Triac 24 to 240VAC, external supply with a current rating of 300mA @ 77°F (25°C), 200mA @ 122°F (50°C), 100mA @ 176°F (80°C) and a holding current of 200μA with a latching current of 5mA typical

**Agency Approvals**
- CE with proper filter:
  - 204/108/EC electromagnetic compatibility directive EN 61326-1: industrial immunity Class A emissions not suitable for Class B environments
  - Phase angle and phase angle with current limit (control options P and L) are not CE approved for conducted or radiated emissions
  - 2006/95/EC low voltage directive EN 50178 safety requirements installation category III, pollution degree 2
- UL® 50 Type 4X enclosure, Class 1, Div. 2 per ANSI/ISA 12.12.01. Through-wall heat sink models T4 File 184390
- IP65
- UL® 508 listed and C-UL® File E73741
- Shock and vibration tested to IEC 60068-2-32
- Vibration tested to IEC 60068-2-6
- 2011/65/EU RoHS

**Control Input Terminals**
- Compression: will accept 24 to 16 AWG (0.2 to 1.5 mm²) wire
- Torque to 4.4 in. lb (0.5 Nm) max. with a 1/8 in. (3.5 mm) blade screwdriver

**Line and Load Terminals**
- Compression: will accept 14 to 4 AWG (2 to 21 mm²) wire
- Torque to 24 in. lb (2.7 Nm) max. with a 1/4 in. (6.4 mm) blade screwdriver, or a type 1A, #2 Pozi driver

**Operating Environment**
- See the output rating curve chart on next page
- 0 to 90% RH (relative humidity), non-condensing
- Storage temperature: -40 to 185°F (-40 to 85°C)
- Operating temperature: -29 to 176°F (-34 to 80°C)
- Insulation tested to 3,000 meters

**DIN-Rail Mount**
- DIN EN 50022, 35 mm by 7.5 mm

**Back-Panel Mount**
- Four mounting holes No. 6 to No. 8 (M3 to M4) fastener

**Through-Wall Mount**
- See page 337 for through-wall panel cutout
  - (Note: Mount cooling fins vertically.)

**Additional Specifications for Contactors and Proportional Controllers**

**Control Mode, Zero-Cross**
- Control option C: VDC input, contactor output
- Control option K: VAC input, contactor output
- To increase service life on contactor models, the cycle time should be less than three seconds
- Control option F: 4 to 20mA DC input, variable time-base control output
DIN-A-MITE C Specifications (Continued)

Control Input
• AC contactor: 24VAC ±10%, 120VAC +10/-25%, 240VAC +10/-25% @ 25mA max. per controlled leg
• DC contactor: 4.5 to 32VDC: max. current @ 4.5VDC is 6mA per leg, add 2mA per LED used to the total current
• Loop powered linear current 4 to 20mA DC: loop-powered, control option F0 only (requires current source with 8.0VDC available, no more than two DIN-A-MITE inputs can be connected in series)

Additional Specifications for Phase Angle, Phase Angle Current Limit and Single-Cycle Variable Time-Base

Operation
• With control option S (single-cycle, variable time-base) the output is not on for more than one consecutive AC cycle below 50% power and not off for more than one consecutive AC cycle above 50% power
• Phase angle control, single-phase only

Control Input
• 0 to 20mA, 4 to 20mA, 0 to 5VDC, 1 to 5VDC and 0 to 10VDC
• Input impedance 250Ω for 4mA to 20mA, 5kΩ for linear voltage input

Output Voltage
• 100 to 120VAC, 200 to 208VAC, 230 to 240VAC, 277VAC, 400VAC, 480VAC and 600VAC, ±10%

Linearity (Control Option S)
• ±5% input to output power over 0 to 100% of span between calibration points

Linearity (Control Options P and L)
• ±5% input to output power, as referenced to a sinusoidal power curve, between calibration points

Resolution
• Better than 0.1% of input span with respect to output change

Soft Start (Control Options P and L)
Typically:
• 5 seconds soft start on power up
• Soft start on thermostat overtemperature
• Soft start on 1/2 cycle drop out detection
• 1 second soft start on set point change

Options
• Manual control kit (1kΩ potentiometer) 08-5362
• Alarm option is not available on control options P or L

Specifications are subject to change without notice.
**Power Switching Devices**

**DIN-A-MITE C**

Dimensions—Natural Convection, DIN-rail/Panel Mount

**Front**

- 1.51 in. (38 mm)
- 1.81 in. (46 mm)
- 2.11 in. (54 mm)
- 1.89 in. (48 mm)

Allowance for No. 8 Fastener (M4)

**Side**

- 4 in. (102 mm) Clearance for Air Flow and Wire Bending Radius
- 3.10 in. (79 mm)
- 1.73 in. (44 mm)
- 2.26 in. (57 mm)

Allowance for No. 8 Fastener (M4)

**Top**

- 5.74 in. (146 mm)
- 5.17 in. (131 mm)
- 3.25 in. (83 mm)
- 4.50 in. (114 mm)

Front Panel is Touch-Safe, No Clearance is Required

Dimensions—Fan Cooled, DIN-rail/Panel Mount

**Side**

- 4 in. (102 mm) Clearance for Air Flow and Wire Bending Radius
- 5.74 in. (146 mm)
- 5.59 in. (142 mm)
- 1.73 in. (44 mm)

Front Panel is Touch-Safe, No Clearance is Required.

**Top**

- 5.74 in. (146 mm)
- 5.17 in. (131 mm)
- 3.25 in. (83 mm)

**Panel Cutout**

- Drill 0.228 in. (5.8 mm) (8)
- Heat Sink Outline 0.375 in. (9.5 mm) Reference 0.425 in. (10.8 mm)
- Typical Panel Opening 1.625 in. (41.3 mm) 4.625 in. (117.5 mm) 6.375 in. (161.9 mm)
- 0.338 in. (8.6 mm) Reference 0.275 in. (7.0 mm) 1.034 in. (26.3 mm)

**With the potential for high through-wall heat sink temperatures, application may require a touch-safe shield.**
DIN-A-MITE C

Extended Heater and Power Controller Life with Variable Time-Base
With variable time-base control, the power controller automatically adjusts the time-base and output power with respect to the command signal. Accelerated life testing shows that variable time-base control significantly reduces expansion and contraction of the heater element. This extends heater and power controller life while improving process temperature control. This saves money on heaters, downtime and maintenance.

Loop-Powered or Transformer Powered

Loop-Powered
By using a temperature controller’s 4-20mA process output signal as the power supply for the DIN-A-MITE input, the cost of the power controller can be reduced. With control option F0 the 4-20mA control signal simultaneously powers the DIN-A-MITE’s internal electronics and provides the input command signal.

Transformer-Powered
DIN-A-MITE controllers with single-cycle, variable time-base or phase angle outputs (control options L, P and S) detect the power line zero cross with a transformer that also powers their internal electronics. These units can be controlled manually with a potentiometer or automatically with a temperature controller using any of the control options: 4-20mA, linear voltage (0-5,1-5 and 0-10VDC).

Loop-Powered, Variable Time-Base Output
Models: DC, L, P, S, F0

20% Power Output: 3 AC cycles on, 12 cycles off

50% Power Output: 3 AC cycles on, 3 cycles off

80% Power Output: 12 AC cycles on, 3 cycles off

With loop-powered, variable time-base control, the minimum on or off time is three cycles.

Phase Angle Output
Models: DC1, [L, P] 0

Phase angle control (control options L and P) is infinitely variable over the period of the AC sine wave. It provides a variable voltage and/or current output. The phase angle circuitry is transformer powered and accepts a linear voltage, current or potentiometer input.

Single-Cycle, Variable Time-Base Output
Models: DC, L, P, S

25% Power Output: 1 AC cycle on, 3 cycles off

50% Power Output: 1 AC cycle on, 1 cycle off

With single-cycle, variable time-base control, at 50 percent power, the output is on for one cycle and off for one cycle. At 25 percent, it is on for one cycle and off for three cycles. Under 50 percent, the output is not on for more than one consecutive cycle; over 50 percent the output is not off for more than one consecutive cycle.

Semiconductor Fuses for Applications through 600VAC

<table>
<thead>
<tr>
<th>Fuse Part Number</th>
<th>Fuse Rating</th>
<th>Watlow</th>
<th>Cooper Bussman®</th>
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</thead>
<tbody>
<tr>
<td>40A</td>
<td>17-8040</td>
<td></td>
<td>FWP-40AT14F</td>
</tr>
<tr>
<td>50A</td>
<td>17-8050</td>
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<td>FWP-50AT14F</td>
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<td>65A</td>
<td>17-8063</td>
<td></td>
<td>FWP-65AT22F</td>
</tr>
<tr>
<td>80A</td>
<td>17-8080</td>
<td></td>
<td>FWP-80AT22F</td>
</tr>
<tr>
<td>100A</td>
<td>17-8100</td>
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<td>FWP-100AT22F</td>
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Fuse Holder Part Number

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<tr>
<td></td>
<td>17-5122</td>
</tr>
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<td>17-5122</td>
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Combined Branch Protection and Semiconductor Fuses for Applications through 480VAC

<table>
<thead>
<tr>
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<th>Fuse Rating 125% of Load</th>
<th>Watlow</th>
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<tbody>
<tr>
<td>20A</td>
<td>0808-0325-0000</td>
<td>DFJ-20</td>
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<tr>
<td>30A</td>
<td>0808-0325-0030</td>
<td>DFJ-30</td>
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<td>0808-0325-0040</td>
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Fuse Holder Part Number

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<td>0808-0326-3560</td>
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<td>0808-0326-7010</td>
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<table>
<thead>
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<tr>
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</tr>
<tr>
<td></td>
<td>CH60J11</td>
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<tr>
<td></td>
<td>J601001CR</td>
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# DIN-A-MITE C

## Ordering Information

<table>
<thead>
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<th>Part Number</th>
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<th>3</th>
<th>4</th>
<th>5/6</th>
<th>7/8</th>
<th>9</th>
<th>10</th>
<th>11/12</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>C</td>
<td>Phase</td>
<td>Cooling &amp; Current Rating/Leg</td>
<td>Line &amp; Load Voltage</td>
<td>Control</td>
<td>Alarm</td>
<td>User Manual</td>
<td>Custom Options</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1 = 1-phase, 1 controlled leg</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2 = 3-phase, 2 controlled legs</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3 = 3-phase, 3 controlled legs (use with four wire wye)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>8 = 2 independent zones (control options C, K)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>9 = 3 independent zones (control options C, K)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

### Phase

1 = 1-phase, 1 controlled leg
2 = 3-phase, 2 controlled legs
3 = 3-phase, 3 controlled legs (use with four wire wye)
8 = 2 independent zones (control options C, K)
9 = 3 independent zones (control options C, K)

### Cooling and Current Rating Per Leg (See chart below)

0 = Natural convection standard DIN-rail or panel heat sink
1 = Fan cooled 120VAC standard DIN-rail or panel heat sink
2 = Fan cooled 240VAC standard DIN-rail or panel heat sink
3 = Fan cooled 24VDC standard DIN-rail or panel heat sink
T = Natural convection through-wall or cabinet heat sink (NEMA 4X)

### Line and Load Voltage

<table>
<thead>
<tr>
<th>02</th>
<th>12</th>
<th>20</th>
<th>24</th>
<th>27</th>
<th>40</th>
<th>48</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>= 24 to 48VAC (control options C, F, K)</td>
<td>= 100 to 120VAC (control options L, P, S)</td>
<td>= 200 to 208VAC (control options L, P, S)</td>
<td>= 100 to 240VAC (control options C, F, K); 230 to 240VAC (control options L, P, S)</td>
<td>= 277VAC (control options L, P, S)</td>
<td>= 400VAC (control options L, P, S)</td>
<td>= 480VAC (control options L, P, S)</td>
<td>= 277 to 600VAC (control options C, F, K); 600VAC (control options L, P, S)</td>
</tr>
</tbody>
</table>

### Control

<table>
<thead>
<tr>
<th>C0</th>
<th>F0</th>
<th>K1</th>
<th>K2</th>
<th>K3</th>
<th>L</th>
<th>P</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>= 4.5 to 32VDC input, contactor output</td>
<td>= 4 to 20mA DC input, variable time-base output</td>
<td>= 22 to 26VAC input, contactor output</td>
<td>= 100 to 120VAC input, contactor output</td>
<td>= 200 to 240VAC input, contactor output</td>
<td>= Phase angle with current limiting* (single-phase only)</td>
<td>= Phase angle* (single-phase only)</td>
<td>= Single-cycle variable time-base output</td>
</tr>
</tbody>
</table>

| 0 = 4 to 20mA input | 1 = 12 to 20mA input (option S only) | 2 = 0 to 20mA input | 3 = 0 to 5VDC input | 4 = 1 to 5VDC input | 5 = 0 to 10VDC input |

*Not CE approved for conducted or radiated emissions.

### Alarm

<table>
<thead>
<tr>
<th>0 = No alarm</th>
<th>S = Shorted SCR alarm (not available with control options L or P)</th>
<th>H = Open-heater and shorted-SCR alarm (control option S only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>= English</td>
<td>= German</td>
<td>= Spanish</td>
</tr>
<tr>
<td>= French</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### User Manual

<table>
<thead>
<tr>
<th>0 = English</th>
<th>1 = German</th>
<th>2 = Spanish</th>
<th>3 = French</th>
</tr>
</thead>
<tbody>
<tr>
<td>= English</td>
<td>= German</td>
<td>= Spanish</td>
<td>= French</td>
</tr>
</tbody>
</table>

### Custom Options

<table>
<thead>
<tr>
<th>00 = Standard part</th>
<th>1X = 1-second soft start (control options P, L)</th>
<th>XX = Any letter or number, custom options, labeling, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>= Standard part</td>
<td>= 1-second soft start (control options P, L)</td>
<td>= Any letter or number, custom options, labeling, etc.</td>
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</tbody>
</table>

## DIN-A-MITE C Current Rating Table

<table>
<thead>
<tr>
<th>Phase</th>
<th>Cooling</th>
<th>Current at 122˚F (50˚C)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>55A</td>
</tr>
<tr>
<td>1</td>
<td>T</td>
<td>60A</td>
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<td>1, 2, 3</td>
<td>75A</td>
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<td>2, 8</td>
<td>0</td>
<td>40A</td>
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<tr>
<td>2, 8</td>
<td>T</td>
<td>46A</td>
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<td>1, 2, 3</td>
<td>65A</td>
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<tr>
<td>3, 9</td>
<td>0</td>
<td>30A</td>
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<tr>
<td>3, 9</td>
<td>T</td>
<td>35A</td>
</tr>
<tr>
<td>3, 9</td>
<td>1, 2, 3</td>
<td>55A</td>
</tr>
</tbody>
</table>
The DIN-A-MITE D silicon controlled rectifier (SCR) power controller provides an inexpensive, versatile product for controlling heat in an efficient package. This controller is designed and manufactured with the quality features expected from Watlow. The mounting footprint matches that of the industry standard mercury displacement relay (MDR), but there is no need to worry about mercury, the DIN-A-MITE controller is mercury free.

The DIN-A-MITE Style D is capable of zero cross switching up to 100 amperes single-phase, at 600VAC at 86°F (30°C), depending on the model selected. Combining the input of two or three controllers allows control of three-phase loads. The controller is completely touch-safe and includes on-board, front-accessible, semiconductor fuses. Options include a current transformer for load current monitoring and a shorted output alarm. The controller is UL® 508, C-UL®, and CE approved making it ideal for panels and cabinets that require agency approvals.

Variable time-base, 4-20mA process control and VAC/VDC input contactor options are available. All options are model number dependent and factory configurable. This power controller also includes 200KA short circuit current rating (SCCR) tested up to 480VAC to minimize damage in the event of a short circuit when used with required fusing.

Features and Benefits

200KA SCCR with proper fusing
- Minimizes damage in the event of a short circuit

Standard panel mount
- Provides same mount as industry standard 100A MDR

Compact size
- Reduces panel space and cost

Touch-safe terminals
- Increases safety for installer and user

Mercury free
- Assures environmental safety

Faster switching with solid state
- Saves energy and extends heater life

UL® 508 listed, C-UL®, RoHS and CE with filter
- Meets applications requiring agency approval
- Reduces end product documentation

Back-to-back SCR design
- Ensures a rugged design

On-board semiconductor fusing
- Provides quick access with no extra mounting necessary
Power Switching Devices

DIN-A-MITE D

Specifications

Amperage
• See the Output Rating Curve below
• Max. surge current for 16.6ms, 1,800A peak
• Latching current: 500mA min.
• Holding current: 200mA min.
• Power dissipation is 1.4 watts per ampere switched including on-board fusing
• 200KA SCCR, Type 1 and 2 approved with the recommended fusing; see user manual

Line Voltage
• 24 to 48VAC units: 20VAC min. to 53VAC max.
• 100 to 240VAC units: 48VAC min. to 265VAC max.
• 277 to 480VAC units: 85VAC min. to 528VAC max.
• 277 to 600VAC units: 85VAC min. to 660VAC max.
• 50/60Hz independent ±5%

Control Mode, Zero Cross
• Control option C: VDC input, contactor output
• Control option K: VAC input, contactor output
• To increase service life, the cycle time should be less than three seconds
• Control option F: 4 to 20mA DC input, variable time-base control output

Control Input
• AC contactor: 24VAC ±10%, 120VAC +10/-25%, 240VAC +10/-25% @ 25 mA max. per controlled leg
• DC Contactor: 4.5 to 32VDC: max. current @ 4.5VDC is 8mA per leg
• Loop powered linear current 4 to 20mA DC: loop-powered, control option F0 only (requires current source with 8.0VDC available, no more than two DIN-A-MITE inputs can be connected in series)

Control Input Terminals
• Compression: will accept 26 to 12 AWG (0.13 to 3.3 mm²) wire

Line and Load Terminals
• Compression: will accept 6 to 2 AWG (13.3 to 33.6 mm²) wire

Operating Environment
• Operating temperature range: -4 to 176°F (-20 to 80°C)
• 0 to 90% RH (relative humidity), non-condensing
• Vibration: 2 g, 10Hz to 150Hz, applied in any one of three axes
• Storage temperature: -40 to 185°F (-40 to 85°C)
• Insulation tested to 3,000 meters
• Installation Category III, pollution degree 2

Mounting
• Back-panel mounting; fits the same mounting pattern as a 100A, single-phase mercury displacement relay
• On-board semiconductor fusing

Dimensions
• 7.3 in. (185 mm) high x 2.6 in. (66 mm) wide x 9.4 in. (239 mm) deep
• Weight: 6.5 lb (2.95kg)

Specifications are subject to change without notice.

Agency Approvals
• CE with proper filter:
  204/108/EC Electromagnetic Compatibility Directive
  EN 61326-1: Industrial Immunity Class A Emissions
  Not suitable for Class B emissions environment
  2006/95/EC Low Voltage Directive
  EN 50178 Safety Requirements
• UL® 508-listed and C-UL® File E73741
• 2011/65/EU RoHS

Alarm Output
• Energizes on alarm, non-latching
• Triac 24 to 240VAC external supply with a current rating of 300mA @ 77°F (25°C)

Current Sensing
• On-board current transformer (CT), typically 0.2VAC output signal per ampere sensed into 1,000Ω load

Shorted SCR Alarm Option
• Alarm state when the input command signal off and a 15A or more load current is detected by the current transformer

Output Rating Curve
Power Switching Devices

DIN-A-MITE D

Ordering Information

Part Number

<table>
<thead>
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<td>-</td>
<td>0</td>
<td>0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
</tbody>
</table>

- **Phase**: 1 = 1-phase, 1 controlled leg
- **Cooling and Current Rating (See rating curve)**: 0 = Natural convection
- **Line and Load Voltage**: 02 = 24 to 48VAC, 24 = 120 to 240VAC, 48 = 277 to 480VAC, 60 = 277 to 600VAC
- **Control**: C0 = 4.5 to 32VDC input, contactor output, F0 = 4 to 20mA DC input, variable time-base output, K1 = 22 to 26VAC input, contactor output, K2 = 100 to 120VAC input, contactor output, K3 = 200 to 240VAC input, contactor output
- **Current Sensing or Alarm**: 0 = No alarm, 1 = Load current transformer, S = Shorted SCR alarm
- **User Manual**: 0 = English, 1 = German, 2 = Spanish, 3 = French
- **Custom Options**: 00 = Standard part

Replacement Semiconductor Fuse

<table>
<thead>
<tr>
<th>Watlow Part Number</th>
<th>Cooper Bussmann® Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>0808-0096-0000</td>
<td>170N3437</td>
</tr>
</tbody>
</table>
Watlow has manufactured solid state power controllers for over forty years. Watlow’s POWER SERIES™ is a microprocessor-based product that features application flexibility unmatched by any other silicon controlled rectifier (SCR) power controller on the market today. Watlow’s POWER SERIES controllers include single and three-phase models from 65 to 250 amperes. Field configurable phase-angle or zero-cross firing improves application flexibility on site where needed.

50/60Hz independent operation allows utilization almost everywhere in the world without special calibration considerations. Serial communication via Modbus® RTU allows setup and monitoring of load status from a computer station or control room.

On-board semiconductor fusing improves reliability by protecting the SCRs from heater short circuits. Plus, on-board heater bakeout and control diagnostics can help eliminate initial start up problems. All these benefits are in a touch-safe package that can be quickly and easily mounted in a control cabinet.

Watlow’s POWER SERIES controllers are UL® and C-UL® listed, ensuring that they meet world safety and operational standards.

Features and Benefits

200KA short circuit current rating (SCCR)
- Minimizes damage in the event of a short circuit

Microprocessor-based technology
- Extremely versatile and field configurable

Snap-fit on a pre-mounted plate
- Simplifies installation

Models 65 through 250 amperes rating
- Handles a wide range of loads

UL® 508 listed, C-UL® and CE with filter
- Meets applications requiring agency approval

Adjustable soft start
- Provides application flexibility

Heater and control diagnostics capability
- Monitors actual heater and controller performance

Electrically touch-safe package
- Enhances safety for installer and users

Serial communications with Modbus® RTU protocol
- Provides computer control and/or monitoring

Multizone capability
- Increases application flexibility and reduces panel space
Power Switching Devices

POWER SERIES

Specifications

Power Bases
- Single-phase, (2 SCRs)
- 3-phase, 2-leg control, (4 SCRs)
  Resistive load only, zero-cross firing only
- 3-phase, 3-leg control, (6 SCRs)
- 3-phase, 3-leg control, (6 SCRs) for 4-wire wye loads
- Multizone, two and three single-phase zones

Output Control Options
- Zero-cross control, fixed time base
  - Time base one or four seconds with digital programmer
- Zero-cross control, variable time base
- Phase-angle control and phase-angle control with current limit (not for 3-phase, 2-leg models)
  - Soft start factory default four seconds upon power-up, and adjustable from 0.0 to 120 seconds
  - Soft start upon input signal change, output rate of change adjustable to limit max. rate of change from 0.1 to 100% per 0.1 second. Factory default 10%
- Current transformer included when required
- Line voltage compensated (variable time base and phase angle controllers only)
- Standby or non-operational mode

Output Voltage and Current Rating
- 24 to 120VAC (+10%, -15%)
- 200 to 480VAC (+10%, -15%)
- 200 to 600VAC (+10%, -15%)
- 65 through 250A per pole, model dependent; see amperage chart in the POWER SERIES spec sheet on the Watlow web site
- Min. load 1A rms ac
- Max. leakage current 5mA
- 200KA SCCR, Type 2 approved with the recommended fusing; see user manual

Alarms
- Single alarm relay
- Latching or non-latching
- Separate high and low values
- Alarm silencing (inhibit) on power up for alarm
- Alarm indication LEDs, shorted SCR, open heater, fuse
- Electromechanical relay, Form C contact, software configurable
  - Min. load current 10mA @ 5VDC
  - Rated resistive loads: 3A @ 250VAC or 30VDC max., inductive load rating 1.5A with a power factor ≥ 0.4 without contact suppression

Heater Bakeout
- For single-phase (phase to neutral) and 3-phase 6 SCR models only (not for 3-phase, 2-leg models)
  - Soft start with over current trip, runs until programmed bakeout time expires, then goes burst or phase-angle firing. Factory default of 24 hours
  - Adjustable 0 - 9999 minutes with over-current trip
  - Internal current transformer included

Command Signal Input

Analog
- Input signal: field selectable and scalable, 0 to 20mA or 0 to 10VDC
- Default input signal: 4 to 20mA
- Manual control input via digital programmer/display
- Voltage input impedance 11kΩ nominal
- Current input impedance 100Ω nominal

Digital
- On-board digital programmer/display and optional serial communications

Retransmit
- Field selectable and scalable, 0 to 20mA with 800Ω max. load or 0 to10VDC with 1KΩ min. load
- Default: 4 to 20mA
- Resolution:
  - mA ranges = ±20µA
  - VDC ranges = 10mV nominal
- Calibration accuracy:
  - mA ranges = ±20µA
  - VDC ranges = 10mV nominal
- Temperature stability: 100ppm/°C

Digital Programmer/Display and Communications Capabilities

- Programming functions
  - Adjust input and output control type, alarms and soft start, heater bakeout and current limit prompts
- Monitoring functions
  - Display input and output values along with actual output current
- Data retention of digital programmer/display upon power failure via nonvolatile memory

Serial Communications
- RS-232 for single drop control
- EIA-485 for single or multidrop control
  - 32 units maximum can be connected. With additional 485 repeater hardware, up to 247 units may be connected
- Isolated
- Modbus® RTU protocol
- 1200, 2400, 4800, 9600, 19200 baud rates

Controller Power Supply
- Universal line voltage input range 100 to 240VAC (+10%, -15%) at 55VA max.
- 50/60Hz ± 5% line frequency independent
- Controller line voltage for electronic power supply can be run on separate line voltage
Specifications (Continued)
Natural Convection and Fan Cooled Models
- Cabinet venting may be required
- See Amperage Chart with Ordering Information for available configurations

Power Dissipation (Watts)
- Approximately 1.25 watts/ampere per controlled leg

Isolation
- Command signal to load and line/load to ground 2200VAC min.
- On-board semiconductor fuses provide SCR protection

Mounting
- Output Amperage Rating F35: back panel
- Other Output Amperage Ratings: removable mounting plate

High Current Terminals
- Touch safe
- 3/8 in. (10 mm) Allen head compression terminals will accept 6 AWG to 350 MCM wire. Allen wrench adapter (included) for 3/8 in. (10 mm) socket, 6 point only
- Torque to 180 in.-lbs (20.3 Nm)
- Wire strip to 1 1/8 in. (30 mm)
- Requires 194°F (90°C) wire insulation rating on line and load terminals

Controller Terminals
- Touch safe
- 1/8 in. (2.5 mm) blade screwdriver, accepts 12-22 AWG or 2 ea. 22-18 AWG wires
- Torque to 8 in.-lbs (0.9 Nm)
- Wire strip to 0.24 in. (6 mm)

Operating Environment
- 122°F (50°C) base rating
  - 32 to 140°F (0 to 60°C) fan cooled
  - 32 to 149°F (0 to 65°C) natural convection cooled
- 0 to 90% RH, non-condensing
- Meets EN 50178, Pollution degree three

Storage Temperature
- -40 to 185°F (-40 to 85°C)

Shipping Weight
- Output Amperage Rating F35: 38 lbs (17.2 kg)
- Other Output Amperage Ratings: 23 lbs (10.3 kg)

Agency Approvals
- UL® 508 listed, File #E73741, Vol. 3, Sec. 2
- C-UL® listed to C22.2 NO. 14
- CE 2004/08/EC (EN 61326-1), Class A with filter, CE 2006/95/EC (EN 50178)
Single-Phase Configuration
This configuration can be purchased with any or all the features available on the POWER SERIES, based on customer preference. It is intended for resistive heaters, but can also be used on transformer connected loads in the phase angle firing mode.

Three-Phase, Two Leg Configuration
This configuration is intended for zero cross firing only into a stable resistive heater. Typically, a three-phase delta or ungrounded wye connected heater is used and only two of the three VAC line phases are switched. The third phase is a direct connection through a bussbar on board the POWER SERIES. Heater current monitoring and kVA options are available via the heater diagnostics option.

Three-Phase, Three-Leg Configuration
All POWER SERIES options are available with this configuration. It works well with phase angle firing into a three-phase, three-wire wye or delta connected heater. In this configuration, the more common applications are transformer connected loads with heaters requiring a soft start and/or current limiting.

The three-phase, four-wire configuration is intended for zero cross firing into a three-phase grounded wye/star heater. (This is a separate hardware option, model number dependent.)

Single-Phase, Multizone Configuration
This configuration is available in two and three single-phase zones and all the features of a single-phase unit are available. (Note that there is only one alarm relay and all zones in the controller must use the same control method.)

Heater Diagnostics
Heater diagnostics may include some or all of the features that require heater current monitoring, depending on the model selected. Heater current monitoring is only available with heater diagnostics installed on the controller. The features dependent on heater current monitoring are heater bakeout, current limiting, heater kVA monitoring, retransmit and heater monitoring alarms such as open heater, heater out of tolerance, load balance and shorted SCR detection/error. Heater diagnostics must also be installed if you need phase angle control with current limit.
Power Switching Devices

POWER SERIES

Ordering Information

Part Number

<table>
<thead>
<tr>
<th>Phase</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phase</th>
<th>1 = 1-phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3-phase/2-leg control, (4 SCRs), zero cross only</td>
</tr>
<tr>
<td>3</td>
<td>3-phase/3-leg control, (6 SCRs)</td>
</tr>
<tr>
<td>4</td>
<td>3-phase/4-wire, wye connected load</td>
</tr>
<tr>
<td>8</td>
<td>2 single-phase zones</td>
</tr>
<tr>
<td>9</td>
<td>3 single-phase zones</td>
</tr>
</tbody>
</table>

| Heater Diagnostics | 0 = None |
|                   | 1 = Heater diagnostics (required for any heater current monitoring or current limiting) |

| Output Amperage Rating | See amperage chart below |
|                       |                          |
| Output Voltage Rating  |                          |
| A                    | 24 to 120V |
| B                    | 200 to 480V |
| C                    | 200 to 600V |

POWER SERIES Features

- **Ground Lug**: Built in, designed for easy ground connections.
- **I/O Port**: Input, retransmit output, communications and alarms.
- **On-Board Fan**: A fan is integrated into the package on forced air cooled models to eliminate separate power connection for fan.
- **Allen Wrench**: Used to torque terminals one to six and ground lug.

Amperage Chart—122°F (50°C)

<table>
<thead>
<tr>
<th>Single-Phase</th>
<th>3-Phase, 2-Leg and 2 Single-Phase Zones</th>
<th>3-Phase, 3-Leg, 3 Single-Phase Zones and 4-Wire Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>Amp</td>
<td>Code</td>
</tr>
<tr>
<td>Non Fan Cooled</td>
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<td>Fan Cooled</td>
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<tr>
<td>N20</td>
<td>100A</td>
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<td>N/A</td>
<td>N/A</td>
<td>F35</td>
</tr>
</tbody>
</table>

**Note**: For current ratings at other temperatures see the rating curves in the POWER SERIES User’s Manual available at www.watlow.com.

Replacement Fuses for Power Series

<table>
<thead>
<tr>
<th>Watlow Part Number</th>
<th>Description</th>
<th>Bussmann Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>0808-0102-0100</td>
<td>100 amp @ 600VAC</td>
<td>170M1317</td>
</tr>
<tr>
<td>0808-0102-0125</td>
<td>125 amp @ 600VAC</td>
<td>170M1318</td>
</tr>
<tr>
<td>0808-0102-0160</td>
<td>160 amp @ 600VAC</td>
<td>170M1319</td>
</tr>
<tr>
<td>0808-0102-0200</td>
<td>200 amp @ 600VAC</td>
<td>170M1320</td>
</tr>
<tr>
<td>0808-0102-0250</td>
<td>250 amp @ 600VAC</td>
<td>170M1321</td>
</tr>
<tr>
<td>0808-0102-0315</td>
<td>315 amp @ 600VAC</td>
<td>170M1322</td>
</tr>
</tbody>
</table>
Power Switching Devices

QPAC

The QPAC SERIES from Watlow is a modular Silicon Controlled Rectifier (SCR) power controller with plug-in features for flexibility. Bases are rated from 150 to 1000 amperes in one-phase, three-phase, two leg and three-phase, three leg.

A variety of transformers from 120 to 575VAC along with 50/60Hz operation enable the QPAC to operate in applications anywhere. Plug-in control cards set the QPAC’s SCR firing modes; solid state contactor, burst firing (zero cross) or phase-angle models are available with a wide variety of options. This power controller includes 200KA short circuit current rating (SCCR) and high speed fuses to minimize damage in the event of a short circuit.

Features and Benefits

200KA short circuit current rating (SCCR)
• Minimizes damage in the event of a short circuit

Modular power controller
• Unit base can be fitted with a variety of plug-in transformers and control cards

Available in 150 to 1000 ampere ratings
• Handles large or small loads

Available in solid state contactor, burst firing (zero cross) or phase-angle fired mode
• Meets most application requirements

Rugged design for 122°F (50°C) ambient operation
• Full rating of the power controller can be used in industrial applications

Semiconductor fuses and snubber protection included
• Protects the SCR from voltage or current surges or spikes

Open heater or shorted SCR detector option
• Diagnostic capabilities

UL® 508 listed and C-UL® up to 1000 amperes
• For applications requiring agency approvals

Typical Applications

• Furnaces and ovens
• Petrochemical
• Heat treating
• Duct heating
• Environmental chambers
• Kilns
Power Switching Devices

QPAC

Specifications

Operation
Modular Controller Base with Plug-In Card and Transformer
- Plug-in control cards
  - Solid state contactor, dc input
  - Burst fire control, fixed or variable time base
  - Phase-angle fire control
- Phase-angle control with soft start and current limiting
- Plug-in transformers (50/60Hz)
- 120, 208, 240, 380, 415, 480, 575VAC operation

Power Bases
- 1-phase (Q01), 1 pair of SCRs
- 3-phase (Q32), 2 leg control, 2 pair SCRs
- Resistive load only, burst firing only
- 3-phase (Q33), 3 pair hybrid SCRs/diodes
  - Recommended for phase-angle only with balanced load

Agency Approvals
- UL® 508 and C-UL® listed, 150 to 300A all configurations, File #E73741
- UL® 508 and C-UL® listed, 400 to 1,000A on Q01 and Q32, up to 480VAC

Control Card Inputs
(CD) Solid state contactor, dc input
- On, 4-32VDC; off, 0.5VDC
- Built-in noise reduction network
(BF) Burst firing control fixed time base
- Process input factory set @ 4-20mA DC
- Input impedance 250Ω (clip resistor for 5kΩ impedance voltage input), or manual control input
- Time base 4 seconds (clip resistor for 1 sec)
(BV) Burst firing control, variable time base
- Process input factory set @ 4-20mA DC
- Input impedance 250Ω (clip resistor for 5kΩ impedance voltage input), or manual control input.
- Requires an accessory bias and gain card to calibrate for 0-5VDC input.
(AF) Phase-angle control
- Process input factory set @ 4-20mA DC
- Input impedance 250Ω (clip resistor for 5kΩ impedance voltage input), or manual control input.
- Soft start approximately 6 seconds upon power-up, 1 second upon set point change

(Al) Phase-angle control with current limit
- Process input factory set @ 4-20mA DC
- Input impedance 250Ω (clip resistor for 5kΩ impedance voltage input), or manual control input
- Soft start approximately 10 seconds upon power-up, 1 to 2 seconds upon set point change
- Current transformer included

Open Heater/Shorted SCR Detector
- Zero cross/burst fire models only
- Triac output
- 24 to 240VAC, 300mA @ 77°F (25°C), 125mA @ 176°F (80°C)
- Energizes on alarm
- Holding current 200µA min.
- Latching current 5mA typical

Outputs
- 120 through 575VAC
- 1, 2 or 3 pole
- 150 to 1000A per pole
- SCCR, 200KA with original equipment specified semiconductor fusing

Line Voltage / Power
- 50/60Hz ac line frequency, Q32 and Q33 models are 50/60Hz calibration dependent
- Voltage: ±10%, 120, 208, 240, 277, 380, 415, 480, 575VAC

Line Voltage Compensation
- 10% ∆ in line, 2% ∆ in load in the 30 to 70% power region (AF, AL and BV)

Power Dissipation (Watts)
- 1.5 W/A per controlled leg

Isolation
- Command signal to load 1250VAC min.

Linearity
- 2%, 30 to 70% power region (All units except CD)

Off-State Leakage Current
- 20mA @ 480VAC

SCR Protection
- Semiconductor fuses provided dv/dt 200V/µsec min.
- MOV® and RC snubber network standard
- (Q32) 3rd leg fuse kit may be used, but not required, with 3-phase, 2 leg models

Mounting
- Heat sink fins must be mounted in vertical orientation

3MOV comes only on Q33 (3-phase, 3 leg).
Power Switching Devices

QPAC

Specifications (Continued)

Operating Environment
- 32 to 122°F (0 to 50°C)
- 0 to 90% RH, non-condensing
- 2,000 meters altitude

Storage Temperature
- -40 to 185°F (-40 to 85°C)

Options
- Manual Control Kit for process input cards (1kΩ potentiometer) #08-5362
- 240VAC and 120VAC cooling fans

Case Styles

QPAC Weight Chart

<table>
<thead>
<tr>
<th>Amps</th>
<th>1Ø/Q01 (lb)</th>
<th>3Ø, 2-leg/Q32 (lb)</th>
<th>3Ø, 3-wire/Q33 (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>15 (6.8)</td>
<td>36 (16.3)</td>
<td>50 (22.7)</td>
</tr>
<tr>
<td>200</td>
<td>15 (6.8)</td>
<td>36 (16.3)</td>
<td>50 (22.7)</td>
</tr>
<tr>
<td>300</td>
<td>15 (6.8)</td>
<td>36 (16.3)</td>
<td>50 (22.7)</td>
</tr>
<tr>
<td>400-600</td>
<td>44 (20.0)</td>
<td>85 (38.5)</td>
<td>100 (45.4)</td>
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<tr>
<td>800-1000</td>
<td>49 (22.2)</td>
<td>120 (54.4)</td>
<td>135 (61.2)</td>
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QPAC Dimensions

<table>
<thead>
<tr>
<th>Style</th>
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<th>Height (H) (in. / mm)</th>
<th>Width (W) (in. / mm)</th>
<th>Depth (D) (in. / mm)</th>
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</thead>
<tbody>
<tr>
<td>Q01</td>
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<td></td>
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</tr>
<tr>
<td>C</td>
<td>150</td>
<td>13 (330)</td>
<td>6.9 (175)</td>
<td>10.25 (260)</td>
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<td>C</td>
<td>200</td>
<td>13 (330)</td>
<td>6.9 (175)</td>
<td>10.25 (260)</td>
</tr>
<tr>
<td>C</td>
<td>300</td>
<td>13 (330)</td>
<td>6.9 (175)</td>
<td>10.25 (260)</td>
</tr>
<tr>
<td>E</td>
<td>400-600</td>
<td>27 (685)</td>
<td>17 (430)</td>
<td>11.7 (300)</td>
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<tr>
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<td>800-1K</td>
<td>27 (685)</td>
<td>17 (430)</td>
<td>13.3 (340)</td>
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<td>Q32</td>
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<td>13.7 (350)</td>
<td>10.25 (260)</td>
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<td>13.3 (340)</td>
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<td>13 (330)</td>
<td>20.7 (525)</td>
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<td>13 (330)</td>
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<td>400-600</td>
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<td>11.7 (300)</td>
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<tr>
<td>E</td>
<td>800-1K</td>
<td>33 (840)</td>
<td>27 (685)</td>
<td>13.3 (340)</td>
</tr>
</tbody>
</table>
In heat treating applications, the QPAC offers modular flexibility. Different heater elements require different control firing modes, for example, tungsten elements need phase-angle firing, while Nichrome® elements use burst (zero cross) firing.

Shipping the furnace to different countries could require different voltage sources (and thus transformers): i.e., U.S. 240 or 480 volt, Australia 415 volt; Europe 380 or 400 volt. By simply changing plug-in transformers, the OEM can ship anywhere in the world.

### Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual Control Kit</td>
<td>08-5362</td>
</tr>
<tr>
<td>150A : 5A Current Transformer</td>
<td>16-0008</td>
</tr>
<tr>
<td>200A : 5A Current Transformer</td>
<td>16-0045</td>
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<tr>
<td>300A : 5A Current Transformer</td>
<td>16-0073</td>
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<tr>
<td>600A : 5A Current Transformer</td>
<td>0004-0286-0600</td>
</tr>
<tr>
<td>800A : 5A Current Transformer</td>
<td>0004-0286-0800</td>
</tr>
<tr>
<td>1,000A : 5A Current Transformer</td>
<td>0004-0286-1000</td>
</tr>
<tr>
<td>5A : 20mA Interstage Transformer</td>
<td>16-0176</td>
</tr>
</tbody>
</table>

**Wiring Example**

![Wiring Example Diagram]
## QPAC

### Ordering Information

QPAC - Modular power controller; phase, burst or solid state contactor, fuse(s) and holder(s) included.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Phase

- 01 = 1-phase
- 32 = 3-phase, 2-leg (Optional 3rd leg fuse kit extra)
- 33 = 3-phase, 3-leg

#### Operating and Output Voltage

<table>
<thead>
<tr>
<th></th>
<th>12</th>
<th>20</th>
<th>24</th>
<th>27</th>
<th>38</th>
<th>41</th>
<th>48</th>
<th>57</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>120VAC</td>
<td>208VAC</td>
<td>240VAC</td>
<td>277VAC</td>
<td>380VAC</td>
<td>415VAC</td>
<td>480VAC</td>
<td>575VAC</td>
</tr>
</tbody>
</table>

#### Cooling Fan Voltage

- 1 = 120VAC; required on all 3-phase models
- 2 = 240VAC; required on all 3-phase models

**Notes:**
- Customer to supply wiring and hook-up.
- All cooling fans rated at 20 W each, must be wired by customer.

#### Output Control (Amps)

<table>
<thead>
<tr>
<th></th>
<th>150</th>
<th>200</th>
<th>300</th>
<th>400</th>
<th>500</th>
<th>600</th>
<th>800</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>150A</td>
<td>200A</td>
<td>300A</td>
<td>400A</td>
<td>500A</td>
<td>600A</td>
<td>800A</td>
<td>1000A</td>
</tr>
</tbody>
</table>

**Input Control Card**

- **CD** = Solid state dc input (08-5286) contactor 4-32VDC
- **BF** = Burst fired, fixed time base (08-5289) 4-20mA dc
- **BV** = Burst fired, variable time base (08-5342) 4-20mA dc
- **AF** = Phase-angle fired, not available on Q32 (08-5288) 4-20mA dc
- **AL** = Phase-angle fired w/current limit (08-5411) 4-20mA, not available on Q32. AL option includes one current transformer. Add second CT for 3-phase, 3-leg

**Open Heater/Shorted SCR Detector**

- 0 = None
- 1 = 1-phase operation
- 2 = 3-phase operation

**Notes:**
- The open heater/shorted SCR detector is for burst fire operation only.
- Includes one current transformer for 1-phase and two current transformers for 3-phase.
Power Switching Devices

**E-SAFE® II**

The E-SAFE® II hybrid power switch provides reliable and accurate power switching up to 35 amperes at 158°F (70°C). This mercury-free product is specifically designed to operate in the higher ambient temperatures of foodservice applications.

Utilization of mercury relays is being eliminated due to many regulations affecting its use in the United States and around the world. The E-SAFE II is the best performing product at the most economical price. Because of the product’s unique design, there is no need to purchase costly heat sinks used with traditional solid state relays (SSRs). In addition, since this is a three-phase device, there is no need to wire multiple command signals. With a switching life of millions of cycles and an ambient rating of 158°F (70°C), with no heat sink required, this product is superior to typical SSRs.

The E-SAFE II hybrid power switch provides foodservice operators with longer contact life and higher performance than typical mechanical contactors used in equipment. By using Watlow’s patent NO-ARC technology, the E-SAFE II can switch millions of cycles to increase the life of the product with reduced noise and increased temperature accuracy. E-SAFE II’s inherent ability to operate at fast cycle times makes it an ideal complementary product for a time, proportional, integral derivative (PID) controller.

E-SAFE II is mercury free, RoHS compliant by design, CE approved and C-UL®/UL® recognized. The reliability of the product is protected by a two-year warranty.

### Features and Benefits

**Mercury free**
- Improves safety by eliminating risk of toxic metals in proximity to food
- Adheres to federal and state regulations to phase out and ban mercury

**High ambient temperature rating of 158°F (70°C)**
- Specifically designed to operate in the higher ambient temperatures of foodservice applications

**NO-ARC hybrid power switch technology**
- Combines the current carrying capacity of mechanical contacts with the longevity of solid state technology
- Allows faster cycling times than mechanical contactors
- Delivers more precise temperature control, saves energy, extends heater life and decreases total cost of ownership

**Compact and touch-safe package**
- Fits in shallow foodservice cabinets
- Allows for horizontal or vertical mounting installations
- Increases safety for installer/operator
- Uses Ultem® enclosure material with a horizontal burn rating (HB) rating of 338°F (170°C) and a UL® flame retardant rating of 94 5VA

**RoHS compliant by design**
- Specifically designed to meet Asian and European requirements

**LED indicator light**
- Indicates command signal presence from controller
- Assists in troubleshooting

**Agency approvals**
- UL® recognition, C-UL® and CE
- W.E.E.E. compliant
Power Switching Devices

E-SAFE II

Specifications

Output voltage
- 200/240VAC +10/-15%, 50/60Hz, 100/120VAC +10/-15%, 50/60Hz

Output amperage
- Up to 35A single, dual and three-phase

Operating environment
- 32 to 158°F (0 to 70°C) operating temperature
- 0 to 90% RH (relative humidity), non-condensing
- Operational life: four million switching cycles
- Installation category III, pollution degree 2

Control mode
- NO-ARC hybrid contactor

Input command signal
- 3 to 32VDC, 24VAC +20/-20%, off state ≤2.7VDC
- 100 to 240VAC +10/-15%, (85 to 264VAC)

Note: On the 100 to 240VAC input models, do not use a RC snubber on the E-SAFE II relay input or the temperature control command signal output

LED indicator light
- Built in LED assists in troubleshooting; LED “off” indicates relay(s) are open, LED “on” indicates relay(s) are closed.

Input command signal terminals
- 1/4 in. fast on appliance

Line and load terminals
- No. 10 screw will accept ring or spade, 1/4 in. (6.35 mm) x 10-32

Mounting
- Back panel mount, horizontal or vertical mounting options

Dimensional Drawings

![Dimensional Drawings Image]
Power Switching Devices

**E-SAFE II**

**Product Rating Curve**

These ratings apply to 3-phase units with cycle times of 30 seconds or more. Consult the factory for 1- and 2-phase unit ratings.

**UL® Conditions of Acceptability**
Applications must be tested as described below for specific wire insulation or specific wire gauge sizes. Tests shall be performed in the end application under worst case operating conditions.

**Test Procedure**
A. Monitor temperatures of terminals, using thermocouples between the ring terminal and connectors L1, L2 or L3. The temperature must not exceed 203°F (95°C).
B. Monitor temperatures of wire insulation, using a thermocouple located three inches from the connector. The temperature must not exceed the insulation rating of the wire.

*30A is maximum rating when operating above 240VAC.

**Warning:** Thermocouples attached to terminals will be at load voltage potential, measurements need to be taken with isolated equipment or isolate the sensor from terminal with suitable insulation.

**Ordering Information**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Number of Poles</th>
<th>Load Voltage</th>
<th>Command Signal Voltage</th>
<th>Future Option</th>
<th>Future Option</th>
<th>Custom Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES2</td>
<td>1 = 1 pole</td>
<td>1 = 100 to 120VAC</td>
<td>LV = Low voltage 3 to 24VDC or 24VAC</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2 = 2 poles controlled</td>
<td>2 = 200 to 240VAC</td>
<td>HV = High voltage 100 to 240VAC +10/-15% (85 to 264VAC)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 = 3 poles controlled</td>
<td>3 = 230/277VAC (400/480VAC with wye/star, neutral connected to center required)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Any three letters or numbers = cosmetic options
SERIES CZR

The SERIES CZR solid state relay provides a low-cost, highly-compact and versatile solid state option for controlling electric heat. With DIN-rail and back panel mounting standard on every controller, the CZR allows for simple and quick installation.

The extensive capabilities of the SERIES CZR include single-phase, 18 to 42 ampere zero-cross switching up to 600VAC (see output rating curve). Its unique integrated design removes the guesswork associated with selecting a proper heat sink and precise terminations for the application.

This controller holds many agency certifications and is ideal for applications that require UL®, CSA and CE approvals. The SERIES CZR is available in VAC/VDC input contactor versions and all configurations are model number dependent and factory selectable.

The SERIES CZR is protected by a two-year warranty.

Features and Benefits

DIN-rail or standard panel mount
- Versatile, quick and low-cost installation

Compact size
- Reduces panel space and cost

Touch-safe terminals
- Increases installer and operator safety

Mercury free
- Environmentally safe

Faster switching with solid state
- Saves energy and extends heater life

UL® 508 recognized, CSA LR700195 certified, CE 60950 and RoHS
- Applications requiring agency approval

Back-to-back SCR design
- Offers rugged design for different application environments
SERIES CZR

Specifications

Control Mode
- Zero-cross fired contactor output

Operator Interface
- Command signal input
- Input signal indication LED

Input Command Signal
- Input Type DC1
  - Turn on voltage 4VDC max., turn off voltage 1VDC min.
  - Input current: dc typically 10mA @ 4VDC, 13mA @ 32VDC
- Input Type AC1
  - 90 to 140Vrms, must turn on at 90VAC, must turn off at 10VAC
  - Input current: 15mA typical @ 120VAC

Output Voltage
- 24V; 24VAC min. to 280VAC max.
- 48V; 48VAC min. to 530VAC max.
- Off state leakage: 10mA at 77°F (25°C) max. for 24 through 480VAC models
- Holding current: 250mA max.

Output Amperage
- See output rating curve. Ratings are into a resistive heater load.

Output Amperage Rating

<table>
<thead>
<tr>
<th>Model</th>
<th>Max. Surge Current 16.6 mSec</th>
<th>Max. I’t Fusing</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>625</td>
<td>1620</td>
</tr>
<tr>
<td>24</td>
<td>250</td>
<td>260</td>
</tr>
<tr>
<td>34</td>
<td>625</td>
<td>1620</td>
</tr>
<tr>
<td>42</td>
<td>1000</td>
<td>4150</td>
</tr>
</tbody>
</table>

Agency Approvals
- Class II construction
- UL® 508 recognition, File #E73741 and CSA File LR 700195
- CE per 2006/95/EC Low Voltage Directive
- 2011/65/EU RoHS

Output Terminals
- Compression type
- For 18A models:
  - Max. wire size 3.0 mm (10 AWG), torque to 0.6Nm (5.3 in. lbs)
- For 24 to 42A models:
  - Max. wire size 16.0 mm (6 AWG stranded) torque to 1.5-1.7Nm (13-15 in. lbs)

Operating Environment
- Up to 176°F (80°C). See output rating curves for applications
- 0 to 90% RH (relative humidity), non-condensing
- Insulation tested to 3,000 meters
- Units are suitable for “pollution degree 2”
- Cycle time should be less than 3 seconds

Mounting
Options include DIN-rail or standard back panel mounting.
- The DIN-rail specification: DIN EN 50022, 1.38 in. x 0.30 in. (35 mm x 7.5 mm)
- Min. clipping distance: 1.37 in. (34.8 mm)
- Max. clipping distance: 1.39 in. (35.3 mm)
- Mount cooling fins vertical

Weight/Dimensions
- 9.2 oz (260g)
- 24 to 42A models: 3.95 in. (100 mm) high x 1.75 in. (45 mm) wide x 4.3 in. (109 mm) deep
- 18A models: 3.95 in. (100 mm) high x 0.89 in. (22.6 mm) wide x 3.9 in. (99 mm) deep
Power Switching Devices

SERIES CZR

Ordering Information

Part Number

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Z</td>
<td>18</td>
<td>24</td>
<td>34</td>
<td>42</td>
<td>A</td>
<td>V</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
</tr>
</tbody>
</table>

Control Mode

Z = Zero cross

Output Amperage

<table>
<thead>
<tr>
<th>18</th>
<th>24</th>
<th>34</th>
<th>42</th>
</tr>
</thead>
<tbody>
<tr>
<td>18A</td>
<td>24A</td>
<td>34A</td>
<td>42A</td>
</tr>
</tbody>
</table>

Output Voltage

<table>
<thead>
<tr>
<th>24</th>
<th>48</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 to 280VAC</td>
<td>48 to 530VAC</td>
</tr>
</tbody>
</table>

Input Type (Contactor)

DC1 = 4 to 32VDC
AC1 = 90 to 140VAC

Note: Do not use the AC1 input type with temperature controller outputs that include an AC snubber filter. This could cause the SERIES CZR to stay full on.

Output Rating Curve

The output rating curve shows the relationship between maximum ambient temperature and current (amps) for different models of the SERIES CZR. The graph includes lines for CZ18, CZ24, CZ34, and CZ42, indicating how the current rating changes with temperature.

Current (amps) is plotted on the y-axis, with values from 0 to 70 in increments of 10. Maximum Ambient Temperature °C is plotted on the x-axis, with values from 0 to 80 in increments of 10.

Maximum Ambient Temperature °F is also plotted on the x-axis, with values from 50 to 176 in increments of 50.
Solid State Relays (SSR)

Watlow solid state relays (SSR) offer many of the advantages of solid state power controllers, yet at a lower cost. Watlow’s extensive knowledge in power controller design has led to the development of a special fast cycle input card that enables a SSR to operate from a standard 4-20mA instrumentation command signal. Test results have shown that a zero cross SSR in combination with the fast cycle card promotes better temperature control and longer heater life than slow cycle relays. Through a time proportional cycle rate of one tenth of a second heater life will be extended. Both low and high voltage models are available from 24 up to 530VAC. All ac output models include back-to-back Silicon Controlled Rectifiers (SCRs) for a more rugged design than the traditional triac based SSR. The internal design allows it to handle high currents and the harsh electrical environments of heavy industry. Watlow also offers a switched VDC model for dc heating applications.

Watlow can provide all the components necessary for trouble-free operation. This includes two standard convenience items: a thermal foil to ensure proper thermal transfer from the relay to the heat sink and belville washers that ensure the relay is mounted with sufficient pressure for good heat transfer. Matched semiconductor fuses and heat sinks are available to complete the power switching package.

Features and Benefits

Fast cycle card
- Increases heater life
- Optimizes temperature control
- Allows for higher watt density heaters

Zero cross firing
- Results in minimal electrical noise

Back-to-back SCR design
- Withstands harsh or hostile industrial environments

UL® recognized File #E151484 and #E73741
CSA certified up to 600VAC, File #LR700195
VDE 60950 License #40021401, File #1995500
up to 480VAC, CE - EN 60950 and RoHS
- Meets applications requiring agency approval
## Power Switching Devices

### Solid State Relays

#### Specifications

<table>
<thead>
<tr>
<th>Specifications Standard To All SSRs:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dielectric Strength (Volts)</td>
<td>4000 RMS</td>
</tr>
</tbody>
</table>

#### Input, DC Control

<table>
<thead>
<tr>
<th>Voltage range</th>
<th>3-32VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical input current</td>
<td>3.4 to 20mA</td>
</tr>
<tr>
<td>Turn on voltage (max.)</td>
<td>3VDC</td>
</tr>
<tr>
<td>Turn off voltage (min.)</td>
<td>1VDC</td>
</tr>
</tbody>
</table>

#### Input, AC Control

<table>
<thead>
<tr>
<th>Voltage range</th>
<th>90-280VAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical input current</td>
<td>2mA (typical) @ 120VAC</td>
</tr>
<tr>
<td>4mA (typical) @ 240VAC</td>
<td></td>
</tr>
<tr>
<td>Turn on voltage (max.)</td>
<td>90VAC</td>
</tr>
<tr>
<td>Turn off voltage (min.)</td>
<td>10VAC</td>
</tr>
</tbody>
</table>

#### AC Output (Max.)

| Forward voltage drop | 1.5VAC and 2.1VDC |
| Min. holding current (mA) | 50mA |
| Turn on-off time (ms) | up to 10ms (max.) |
| Frequency range | 47 to 63Hz |

#### Specifications

<table>
<thead>
<tr>
<th>Voltage range</th>
<th>120/240VAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical input current</td>
<td>3-32VDC</td>
</tr>
<tr>
<td>Turn on voltage (max.)</td>
<td>90VAC</td>
</tr>
<tr>
<td>Turn off voltage (min.)</td>
<td>10VAC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current output</th>
<th>10A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage</td>
<td>120/240VAC</td>
</tr>
<tr>
<td>One cycle surge current</td>
<td>120A</td>
</tr>
<tr>
<td>Max. I^2t for fusing</td>
<td>60A^2 seconds</td>
</tr>
<tr>
<td>Thermal resistance</td>
<td>1.48°C/W</td>
</tr>
<tr>
<td>Ambient operating temperature</td>
<td>-40 to 176°F (-40 to 80°C)</td>
</tr>
<tr>
<td>Output (Max.)</td>
<td>48-280VAC</td>
</tr>
<tr>
<td>Over voltage rating</td>
<td>600V (peak)</td>
</tr>
<tr>
<td>Off state leakage</td>
<td>10mA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current output</th>
<th>25A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage</td>
<td>120/240VAC</td>
</tr>
<tr>
<td>One cycle surge current</td>
<td>250A</td>
</tr>
<tr>
<td>Max. I^2t for fusing</td>
<td>260A^2 seconds</td>
</tr>
<tr>
<td>Thermal resistance</td>
<td>1.05°C/W</td>
</tr>
<tr>
<td>Ambient operating temperature</td>
<td>-40 to 176°F (-40 to 80°C)</td>
</tr>
<tr>
<td>Output (Max.)</td>
<td>48-280VAC</td>
</tr>
<tr>
<td>Over voltage rating</td>
<td>600V (peak)</td>
</tr>
<tr>
<td>Off state leakage</td>
<td>10mA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current output</th>
<th>50A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage</td>
<td>120/240VAC</td>
</tr>
<tr>
<td>One cycle surge current</td>
<td>625A</td>
</tr>
<tr>
<td>Max. I^2t for fusing</td>
<td>1,620A^2 seconds</td>
</tr>
<tr>
<td>Thermal resistance</td>
<td>0.63°C/W</td>
</tr>
<tr>
<td>Ambient operating temperature</td>
<td>-40 to 176°F (-40 to 80°C)</td>
</tr>
<tr>
<td>Output (Max.)</td>
<td>48-280VAC</td>
</tr>
<tr>
<td>Over voltage rating</td>
<td>600V (peak)</td>
</tr>
<tr>
<td>Off state leakage</td>
<td>10mA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current output</th>
<th>10A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage</td>
<td>120/240VAC</td>
</tr>
<tr>
<td>One cycle surge current</td>
<td>100A</td>
</tr>
<tr>
<td>Max. I^2t for fusing</td>
<td>600A^2 seconds</td>
</tr>
<tr>
<td>Thermal resistance</td>
<td>0.31°C/W</td>
</tr>
<tr>
<td>Ambient operating temperature</td>
<td>-40 to 176°F (-40 to 80°C)</td>
</tr>
<tr>
<td>Output (Max.)</td>
<td>100VDC</td>
</tr>
<tr>
<td>Over voltage rating</td>
<td>1200V (peak)</td>
</tr>
<tr>
<td>Off state leakage</td>
<td>10mA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current output</th>
<th>25A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage</td>
<td>480VAC</td>
</tr>
<tr>
<td>One cycle surge current</td>
<td>625A</td>
</tr>
<tr>
<td>Max. I^2t for fusing</td>
<td>1,620A^2 seconds</td>
</tr>
<tr>
<td>Thermal resistance</td>
<td>1.02°C/W</td>
</tr>
<tr>
<td>Ambient operating temperature</td>
<td>-40 to 176°F (-40 to 80°C)</td>
</tr>
<tr>
<td>Output (Max.)</td>
<td>480VAC</td>
</tr>
<tr>
<td>Over voltage rating</td>
<td>1200V (peak)</td>
</tr>
<tr>
<td>Off state leakage</td>
<td>10mA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current output</th>
<th>50A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage</td>
<td>480VAC</td>
</tr>
<tr>
<td>One cycle surge current</td>
<td>1000A</td>
</tr>
<tr>
<td>Max. I^2t for fusing</td>
<td>6000A^2 seconds</td>
</tr>
<tr>
<td>Thermal resistance</td>
<td>0.31°C/W</td>
</tr>
<tr>
<td>Ambient operating temperature</td>
<td>-40 to 176°F (-40 to 80°C)</td>
</tr>
<tr>
<td>Output (Max.)</td>
<td>1200V (peak)</td>
</tr>
<tr>
<td>Over voltage rating</td>
<td>1200V (peak)</td>
</tr>
<tr>
<td>Off state leakage</td>
<td>10mA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current output</th>
<th>75A</th>
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<tbody>
<tr>
<td>Nominal voltage</td>
<td>480VAC</td>
</tr>
<tr>
<td>One cycle surge current</td>
<td>250A</td>
</tr>
<tr>
<td>Max. I^2t for fusing</td>
<td>260A^2 seconds</td>
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<tr>
<td>Thermal resistance</td>
<td>0.63°C/W</td>
</tr>
<tr>
<td>Ambient operating temperature</td>
<td>-40 to 176°F (-40 to 80°C)</td>
</tr>
<tr>
<td>Output (Max.)</td>
<td>480VAC</td>
</tr>
<tr>
<td>Over voltage rating</td>
<td>1200V (peak)</td>
</tr>
<tr>
<td>Off state leakage</td>
<td>10mA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current output</th>
<th>25A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage</td>
<td>480VAC</td>
</tr>
<tr>
<td>One cycle surge current</td>
<td>625A</td>
</tr>
<tr>
<td>Max. I^2t for fusing</td>
<td>1,620A^2 seconds</td>
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<tr>
<td>Thermal resistance</td>
<td>1.02°C/W</td>
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<tr>
<td>Ambient operating temperature</td>
<td>-40 to 176°F (-40 to 80°C)</td>
</tr>
<tr>
<td>Output (Max.)</td>
<td>480VAC</td>
</tr>
<tr>
<td>Over voltage rating</td>
<td>1200V (peak)</td>
</tr>
<tr>
<td>Off state leakage</td>
<td>10mA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current output</th>
<th>50A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage</td>
<td>480VAC</td>
</tr>
<tr>
<td>One cycle surge current</td>
<td>1000A</td>
</tr>
<tr>
<td>Max. I^2t for fusing</td>
<td>6000A^2 seconds</td>
</tr>
<tr>
<td>Thermal resistance</td>
<td>0.31°C/W</td>
</tr>
<tr>
<td>Ambient operating temperature</td>
<td>-40 to 176°F (-40 to 80°C)</td>
</tr>
<tr>
<td>Output (Max.)</td>
<td>1200V (peak)</td>
</tr>
<tr>
<td>Over voltage rating</td>
<td>1200V (peak)</td>
</tr>
<tr>
<td>Off state leakage</td>
<td>10mA</td>
</tr>
</tbody>
</table>
**Solid State Relays**

**Heater Life**
Watlow has extensively tested electric heating elements with a variety of power switching devices. Results prove that the life of an electric element dramatically increases when the on-off cycle time that is used to time-proportion the heater is kept at less than one second. This reduces the thermal expansion and contraction of the element and improves heater life as much as 20 times. This very fast cycle time controls temperature much more accurately and allows the use of higher watt density heating elements.

**Fast Cycle Card**
In order to obtain the very rapid cycling time required for longer heater life, accurate temperature control and higher watt densities, Watlow has developed a loop-powered firing card for SSRs. This card operates from a standard instrumentation signal of 4 to 20mA and controls solid state relays with a time proportional cycle rate of less than one second (4VAC cycles on and 4VAC cycles off at 50 percent power).

**Thermal Transfer**
A thermal foil is provided with each solid state relay for mounting on the base of the relay to improve heat transfer. In addition, two belville washers are supplied to provide the proper pressure for this transfer of heat. Use two #8-32 screws 0.625 in. (16 mm) long to secure the relay to the heat sink.

**Replacing Contactors or Mercury Displacement Relays (MDRs)**
Improvements in heater life and control accuracy can be achieved with SSRs operated with rapid cycle times as compared to slower operating electromechanical relays or even MDRs. When replacing these types of relays with the SSR, it is important to consider two aspects:

1. **Heat**
   - Solid state devices require a small voltage to turn on, which is consumed as heat (approx. 1.5 volts x amps = watts). This heat must be removed from the device and is usually accomplished by mounting the relay on a heat sink.

2. **Failure Mode**
   - Solid state devices should last for many years when properly protected with voltage snubbers, mounted on appropriate heat sinks and when fused with semiconductor fuses against the high currents caused by electrical shorts. Watlow’s SSRs include an internal voltage snubber. However, if the unit fails, the most probable condition will be a short. Mechanical relays also have a good probability of failing short. In all cases where uncontrolled full power can cause damage, it is recommended that a high limit temperature controller and contactor be used for protection.

**Wiring Diagrams**

**Single-Phase Fast Cycle Input Card**

**Shorted SSR Alarm**
The most prevalent concern when using solid state relays is the possibility of a relay failing in a shorted condition. With this in mind, Watlow has designed a cost effective “Shorted SSR Alarm.”

The device monitors the output (current through the heater) and activates a triac (alarm) if there is no command signal from the temperature controller. The triac can be wired to a bell, or to a normally closed latching relay to remove power to the heater.

The shorted SSR alarm is not a substitute for an agency-approved high-temperature limit device.

**Single-Phase Shorted SSR Detector**

**Note:** Semiconductor power switching devices are not legal for over temperature limit or safety devices. For limit and safety devices you must have a positive mechanical break of all electrically hot legs simultaneously.
**Power Switching Devices**

**Solid State Relays**

### Dimensions - Heat Sink

![Diagram of Heat Sink Dimensions]

**Heat Sink Dimensions by Part Number**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Descriptor</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z100-0815-000A</td>
<td>18A</td>
<td>A: 1.8 in. (46)</td>
</tr>
<tr>
<td>Z100-0815-000B</td>
<td>35A</td>
<td>A: 1.91 in. (48.5)</td>
</tr>
<tr>
<td>Z100-0815-000C</td>
<td>55A</td>
<td>A: 1.89 in. (48)</td>
</tr>
<tr>
<td>Z100-0815-XXFC*</td>
<td>75A</td>
<td>A: 1.89 in. (48)</td>
</tr>
</tbody>
</table>

*Fan cooled

### Dimensions - Solid State Relay

![Diagram of Solid State Relay Dimensions]

### Ordering Information

**Part Number**

- **SSR**
- **Voltage**
- **Current**
- **Control Voltage**

#### Voltage

- 100 = 0 to 100VDC (20A model only)
- 240 = 24 to 240VAC
- 480 = 24 to 530VAC

#### Current

- 10 = 10A
- 20 = 20A (100VDC model only)
- 25 = 25A
- 40 = 40A
- 50 = 50A
- 75 = 75A

#### Control Voltage

- DC1 = 3 to 32VDC (see specifications)
- AC1 = 90 to 280VAC
- RND = 3 to 32VDC (10, 50 and 75A models only)

**Note:** Relay will also include thermal foil, two belville washers and #8-32 screws for mounting to a heat sink.

### Heat Sinks (sold separately)

- Z100-0815-000A = 18A or 2.2°C/watt
- Z100-0815-000B = 35A or 1.1°C/watt
- Z100-0815-000C = 55A or 0.6°C/watt
- Z100-0815-12FC = 75A or 0.16°C/watt (120VAC fan)
- Z100-0815-24FC = 75A or 0.16°C/watt (240VAC fan)

### Fast Cycle Input Card and Shorted SSR Alarm Card

For direct mounting on zero cross dc input solid state relay.

- RPC-5399-42-000 = Fast cycle input card, 4 to 20mA input
- RPC-5386-0000 = Shorted SSR alarm card

### Sub Cycle Fuses - I²T (sold separately)

Recommended and available with holders.