

# Power Switching Devices

Product	Maximum Output	Output Firing	Phase Configurations	Agency Approvals	Page
<b>EZ-ZONE® ST</b>	75A	Zero Cross, Phase Angle	1	UL®, CSA, CE, SCCR, RoHS, W.E.E.E.	<b>307</b>
<b>DIN-A-MITE® A</b>	25A	Zero Cross	1	UL®, C-UL®, CE, SCCR	<b>308</b>
<b>DIN-A-MITE B</b>	40A	Zero Cross	1	UL®, C-UL®, CE, SCCR	<b>311</b>
<b>DIN-A-MITE C</b>	80A	Zero Cross, Phase Angle	1 or 3	UL®, C-UL®, CE, SCCR	<b>314</b>
<b>DIN-A-MITE D</b>	100A	Zero Cross	1	UL®, C-UL®, CE, SCCR	<b>320</b>
<b>POWER SERIES™</b>	250A	Zero Cross, Phase Angle	1 or 3	UL®, C-UL®, CE, SCCR	<b>323</b>
<b>QPAC</b>	1000A	Zero Cross, Phase Angle	1 or 3	UL®, C-UL®, SCCR	<b>328</b>
<b>E-SAFE® II</b>	35A	Zero Cross	1, 2 or 3	UL®, C-UL®, CE, W.E.E.E.	<b>333</b>
<b>SERIES CZR</b>	42A	Zero Cross	1	UL®, CSA, CE	<b>336</b>
<b>Solid State Relays (SSR)</b>	75A	Zero Cross	1	UL®, CSA	<b>339</b>

**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

Initial Cost	3 Year Cost <sup>①</sup>	Control Life	Heater Life	EMI Generation	Control	Response Rate	Options	Comments
<b>Electromechanical Relay and Contactor</b>								
Low for low current	Highest	Limited electrical and mechanical	Shortest	Yes, coil and contacts	Poor	Slowest	None	To extend life the cycle time is normally extended to 30 seconds or more.
<b>Hybrid Power Switch</b>								
Low	Medium	High	Good	Minimal	Good	Fast	None	Such as Watlow E-SAFE II and NO ARC relays.
<b>Mercury Displacement Relay (MDR)</b>								
Low for low to medium current	Medium	High	Good	Yes, coil and contact	Fair to good	Medium to fast	None	Mercury is not desirable. Minimum cycle time is two seconds. Position sensitive.
<b>Solid State Relay (SSR) Fixed Time Base</b>								
Medium	Medium	Extended	Extended	Minimal	Good	Fast	None	Excellent control with one second cycle time. Requires heatsink.
<b>Silicon Controlled Rectifier (SCR) Fixed Time Base</b>								
Medium	Low	Extended	Extended	Minimal	Good	Fast	None	Excellent control with one second cycle time.
<b>SCR Burst Firing</b>								
High	Low	Extended	Longest	Minimal	Excellent	Fastest	None	Fastest variable time base unit.
<b>SCR Phase-Angle Firing</b>								
High	Low	Extended	Longest	High	Excellent	Fastest	Current limit	Required for tungsten elements, transformers, or for current limiting.
<b>Saturable Core Reactor</b>								
Highest	Low	Extended	Longest	Minimal	Very good	Fast	Current limit	Cannot be turned full on or off, inefficient.

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

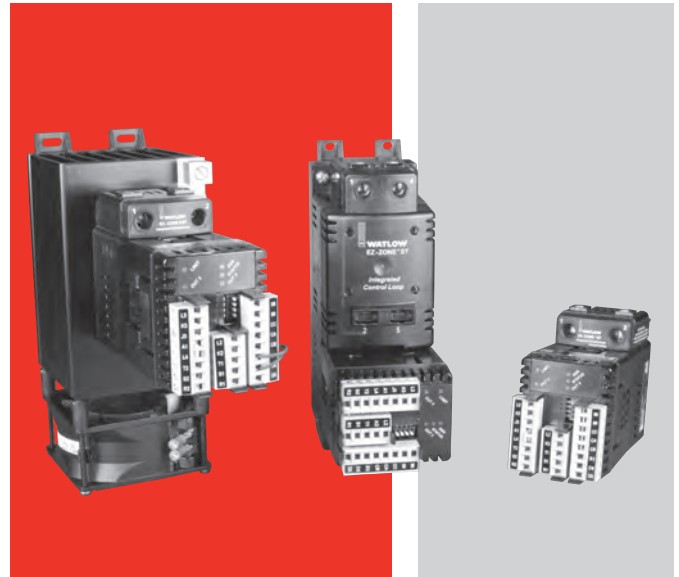
- Ensures Watlow's reliability and product support

#### 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 351 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 227 through 233.**

# Power Switching Devices

## DIN-A-MITE® A

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® and CE with filter

- Meets applications requiring agency approval

#### Back-to-back SCR design

- Ensures a rugged design

# Power Switching Devices

## 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<sup>2</sup>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 @ 4.5 VDC is 8mA
- Loop powered linear current 4 to 20mA DC: loop-powered, control option F0 only (requires current source with 6.2VDC available, no more than three 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<sup>®</sup> 508 listed and C-UL<sup>®</sup> File E73741

#### Control Input Terminals

- Compression: will accept 24 to 16 AWG (0.2 to 1.5 mm<sup>2</sup>) wire

#### Line and Load Terminals

- Compression: will accept 18 to 8 AWG (0.8 to 8.4 mm<sup>2</sup>) 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

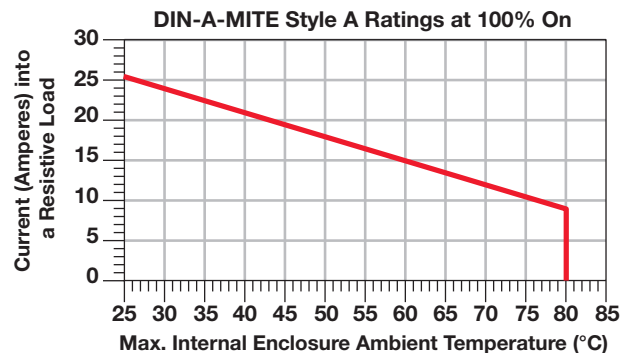
- Options include DIN-rail or standard back panel mounting
- DIN EN 50022, 35 mm by 7.5 mm
- Mount cooling fins vertically

#### 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 (0.32kg)

Specifications are subject to change without notice.

### Output Rating Curve



# Power Switching Devices

## DIN-A-MITE A

### Ordering Information

#### Part Number

①	②	③	④	⑤ ⑥	⑦ ⑧	⑨	⑩	⑪ ⑫	
D	A	Phase 1	Cooling & Current Rating 0	-	Line & Load Voltage	-	0	User Manual	Custom Options

③	Phase
1 =	1-phase, 1 controlled leg

④	Cooling and Current Rating (See rating curve)
0 =	Natural convection current rating 18A @ 50°C

⑤ ⑥	Line and Load Voltage
02 =	24 to 48VAC
24 =	120 to 240VAC
60 =	277 to 600VAC

⑦ ⑧	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

⑩	User Manual
0 =	English
1 =	German
2 =	Spanish
3 =	French

⑪ ⑫	Custom Options
00 =	Standard part
XX =	Any letter or number, custom options, labeling, etc.

### Recommended Fuses and Fuse Holders

#### Semiconductor Fuses and Holders

Part Number	Description
17-8025	25A fuse
17-5110	10-25A holder

#### DFJ Combination Fuses and Holders

Part Number	Description
0808-0325-0020	20A fuse
0808-0325-0030	30A fuse
0808-0326-1530	15-30A holder

# 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® and CE with filter

- Meets applications requiring agency approval

#### Back-to-back SCR design

- Ensures a rugged design

#### Shorted output alarm (optional)

- Simplifies troubleshooting and reduces downtime



# Power Switching Devices

## 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<sup>2</sup>s
- 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  $\pm$ 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
- Linear current: 4 to 20mA DC: loop-powered, control option F0 only (requires current source with 6.2VDC available, no more than three DIN-A-MITE inputs 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  $\mu$ A 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<sup>®</sup> 508 listed and C-UL<sup>®</sup> File E73741

### Control Input Terminals

- Compression: will accept 24 to 16 AWG (0.2. to 1.5 mm<sup>2</sup>) wire

### Line and Load Terminals

- Compression: will accept 18 to 8 AWG (0.8 to 8.4 mm<sup>2</sup>) 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

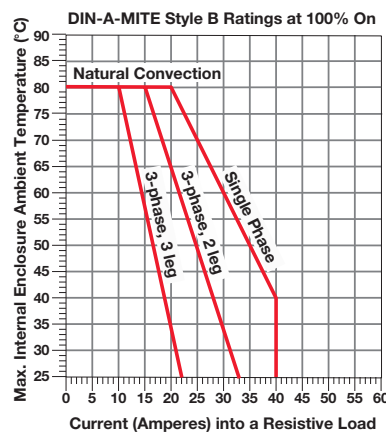
- Four mounting holes No. 6 to No. 8 (M3 to M4) fastener

### 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

Phase	Cooling	Current at 122°F (50°C)
1	0	35A
2, 8	0	25A
3, 9	0	17A



# Power Switching Devices

## DIN-A-MITE B

### Ordering Information

#### Part Number

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

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

④ Cooling and Current Rating (See rating curve)	
0 =	Natural convection

⑤ ⑥ Line and Load Voltage	
02 =	24 to 48VAC
24 =	120 to 240VAC
60 =	277 to 600VAC

⑦ ⑧ 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

⑨ Alarm	
0 =	No alarm
S =	Shorted SCR alarm

⑩ User Manual	
0 =	English
1 =	German
2 =	Spanish
3 =	French

⑪ ⑫ 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

Part Number	Description
17-8020	20A fuse
17-8025	25A fuse
17-8030	32A fuse
17-8040	40A fuse
17-8050	50A fuse
17-5110	10-25A holder
17-5114	32-50A holder

#### DFJ Combination Fuses and Holders

Part Number	Description
0808-0325-0020	20A fuse
0808-0325-0030	30A fuse
0808-0325-0040	40A fuse
0808-0325-0050	50A fuse
0808-0326-1530	15-30A holder
0808-0326-3560	35-60A holder

# Power Switching Devices

## DIN-A-MITE C

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® and CE with filter

- Meets applications requiring agency approval

#### System solution component

- Provides single source thermal loop

#### Back-to-back SCR design

- Ensures a rugged design

# Power Switching Devices

## DIN-A-MITE C

### 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. I<sup>2</sup>t for fusing is 9100A<sup>2</sup>s
- 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
-  UL® 508 listed and C-UL® File E73741
- Shock and vibration tested to IEC 60068-2-32
- Vibration tested to IEC 60068-2-6

### Control Input Terminals

- Compression: will accept 24 to 16 AWG (0.2 to 1.5 mm<sup>2</sup>) 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 mm<sup>2</sup>) 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 317 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

# Power Switching Devices

## DIN-A-MITE C

### Specifications (Continued)

#### Control Input

- AC contactor: 24VAC  $\pm 10\%$ , 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, no more than three inputs 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 250 $\Omega$  for 4mA to 20mA, 5k $\Omega$  for linear voltage input

#### Output Voltage

- 100 to 120VAC, 200 to 208VAC, 230 to 240VAC, 277VAC, 400VAC, 480VAC and 600VAC,  $\pm 10\%$

#### Linearity (Control Option S)

- $\pm 5\%$  input to output power over 0 to 100% of span between calibration points

#### Linearity (Control Options P and L)

- $\pm 5\%$  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:

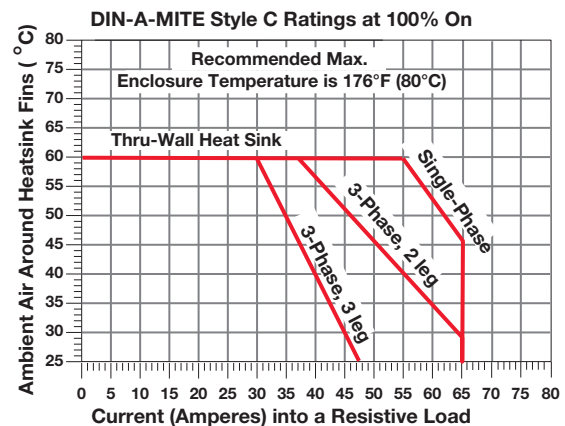
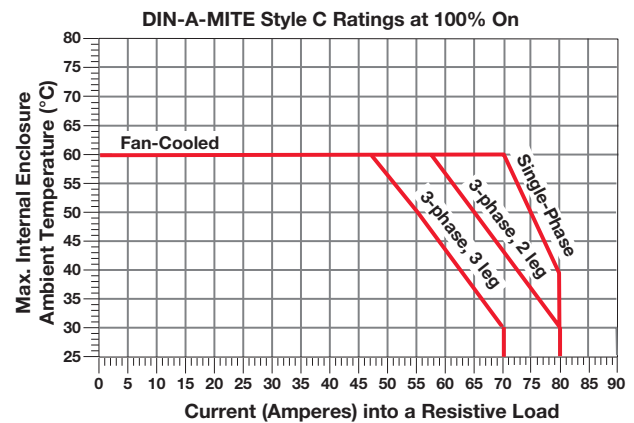
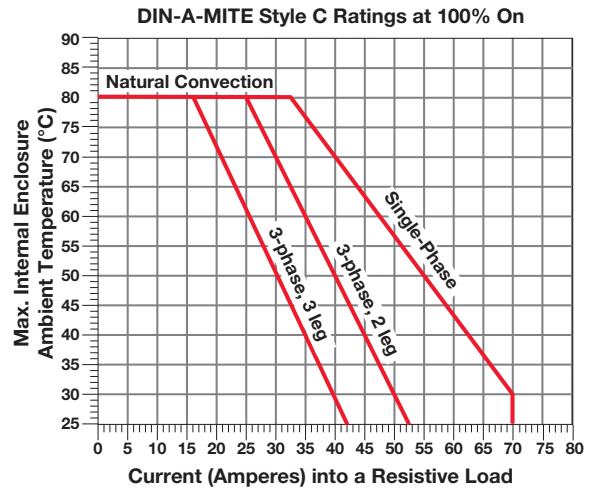
- 5 seconds soft start on power up
- Soft start on thermostat overtemperature
- Soft start on  $1/2$  cycle drop out detection
- 1 second soft start on set point change

#### Options

- Manual control kit (1k $\Omega$  potentiometer) 08-5362
- Alarm option is not available on control options P or L

Specifications are subject to change without notice.

### Output Rating Curves

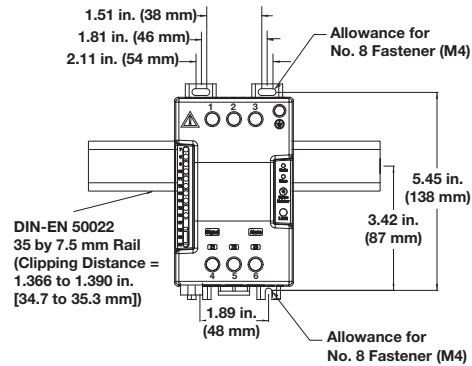


# Power Switching Devices

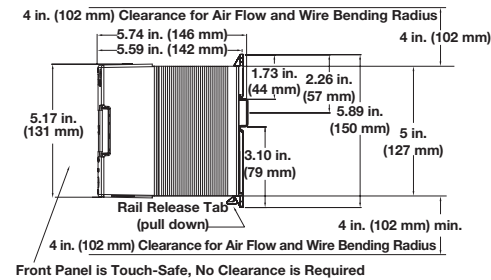
## DIN-A-MITE C

### Dimensions—Natural Convection, DIN-rail/Panel Mount

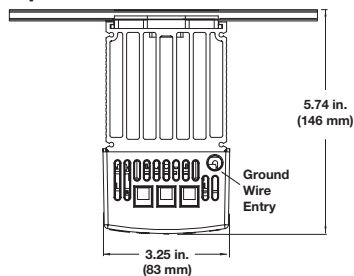
Front



Side

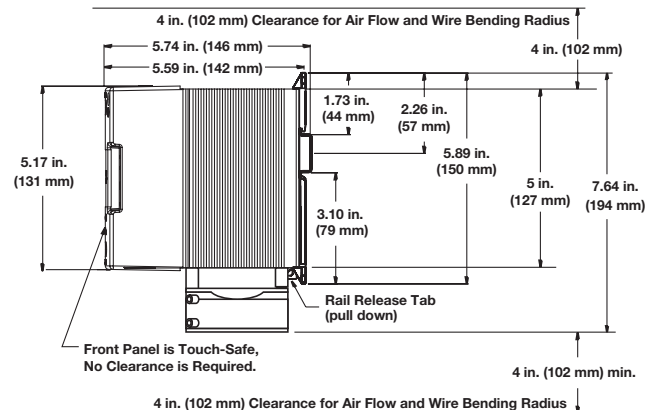


Top



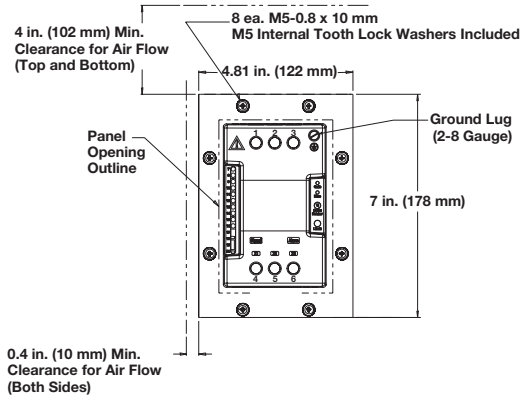
### Dimensions—Fan Cooled, DIN-rail/Panel Mount

Side

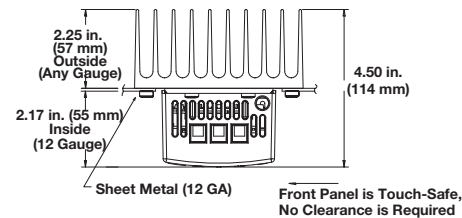


### Dimensions—Natural Convection, Through-Wall Mount<sup>①</sup>

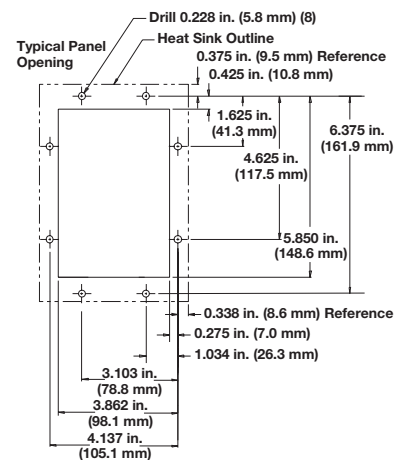
Front



Top



Panel Cutout



<sup>①</sup> With the potential for high through-wall heat sink temperatures, application may require a touch-safe shield.

# Power Switching Devices

## 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).

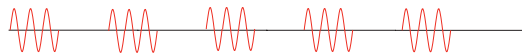
### Loop-Powered, Variable Time-Base Output

Models: DC\_\_ - \_\_F0 - \_\_\_\_\_

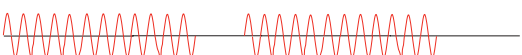
**20% Power Output: 3 AC cycles on, 12 cycles off**



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



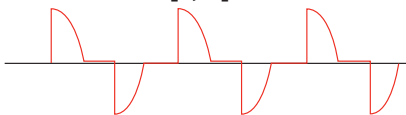
**80% Power Output: 12 AC cycles on, 3 cycles off**



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

### Phase Angle Output

Models: DC1\_ - \_\_ [L, P] - - 0\_ - \_ -

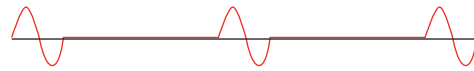


Phase angle control (control options L and P) is infinitely variable over the period of the AC sine wave. It provides a variable voltage and/or current output. The phase angle circuitry is transformer powered and accepts a linear voltage, current or potentiometer input.

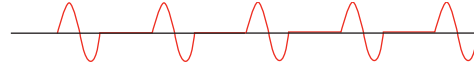
### Single-Cycle, Variable Time-Base Output

Models: DC\_\_ - \_\_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

Fuse Part Number		
Fuse Rating	Watlow	Cooper Bussman®
40A	17-8040	FWP-40A14F
50A	17-8050	FWP-50A14F
63A	17-8063	FWP-63A22F
80A	17-8080	FWP-80A22F
100A	17-8100	FWP-100A22F

Fuse Holder Part Number		
Fuse Rating	Watlow	Ferraz Shawmut
40A	17-5114	US1411
50A	17-5114	US1411
63A	17-5122	US2211
80A	17-5122	US2211
100A	17-5122	US2211

### Combined Branch Protection and Semiconductor Fuses for Applications through 480VAC

Fuse Part Number		
Fuse Rating 125% of Load	Watlow	Cooper Bussman®
20A	0808-0325-0020	DFJ-20
30A	0808-0325-0030	DFJ-30
40A	0808-0325-0040	DFJ-40
50A	0808-0325-0050	DFJ-50
63A	0808-0325-0060	DFJ-60
80A	0808-0325-0080	DFJ-80
100A	0808-0325-0100	DFJ-100

Fuse Holder Part Number		
Fuse Rating	Watlow	Cooper Bussman®
20 and 30A	0808-0326-1530	CH30J1i
40 to 63A	0808-0326-3560	CH60J1i
80 and 100A	0808-0326-7010	J601001CR



# Power Switching Devices

## DIN-A-MITE C

### Ordering Information

#### Part Number

①	②	③	④	⑤ ⑥	⑦ ⑧	⑨	⑩	⑪ ⑫
<b>D</b>	<b>C</b>	Phase	Cooling & Current Rating/Leg	Line & Load Voltage	Control	Alarm	User Manual	Custom Options
				-		-		

③ 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)

④ 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)

⑤ ⑥ Line and Load Voltage	
02 =	24 to 48VAC (control options C, F, K)
12 =	100 to 120VAC (control options L, P, S)
20 =	200 to 208VAC (control options L, P, S)
24 =	100 to 240VAC (control options C, F, K); 230 to 240VAC (control options L, P, S)
27 =	277VAC (control options L, P, S)
40 =	400VAC (control options L, P, S)
48 =	480VAC (control options L, P, S)
60 =	277 to 600VAC (control options C, F, K); 600VAC (control options L, P, S)

⑦ ⑧ 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
L (0 to 5) =	Phase angle with current limiting* (single-phase only)
P (0 to 5) =	Phase angle* (single-phase only)
S (0 to 5) =	Single-cycle variable time-base output
	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.

⑨ Alarm	
0 =	No alarm
S =	Shorted SCR alarm (not available with control options L or P)
H =	Open-heater and shorted-SCR alarm (control option S only)

⑩ User Manual	
0 =	English
1 =	German
2 =	Spanish
3 =	French

⑪ ⑫ Custom Options	
00 =	Standard part
1X =	1-second soft start (control options P, L)
XX =	Any letter or number, custom options, labeling, etc.

### DIN-A-MITE C Current Rating Table

Phase	Cooling	Current at 122°F (50°C)
1	0	55A
1	T	60A
1	1, 2, 3	75A
2, 8	0	40A
2, 8	T	46A
2, 8	1, 2, 3	65A
3, 9	0	30A
3, 9	T	35A
3, 9	1, 2, 3	55A



# Power Switching Devices

## DIN-A-MITE D

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® and CE with filter

- Meets applications requiring agency approval

#### 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  $\pm 5\%$

#### 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  $\pm 10\%$ , 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
- Linear current: 4 to 20mA DC, loop powered, input Type F0 option only, no more than three DIN-A-MITE inputs connected in series

#### 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


#### 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 1,000 $\Omega$  load

### 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<sup>®</sup> 508-listed and C-UL<sup>®</sup> File E73741

### Control Input Terminals

- Compression: will accept 26 to 12 AWG (0.13 to 3.3 mm<sup>2</sup>) wire

### Line and Load Terminals

- Compression: will accept 6 to 2 AWG (13.3 to 33.6 mm<sup>2</sup>) 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

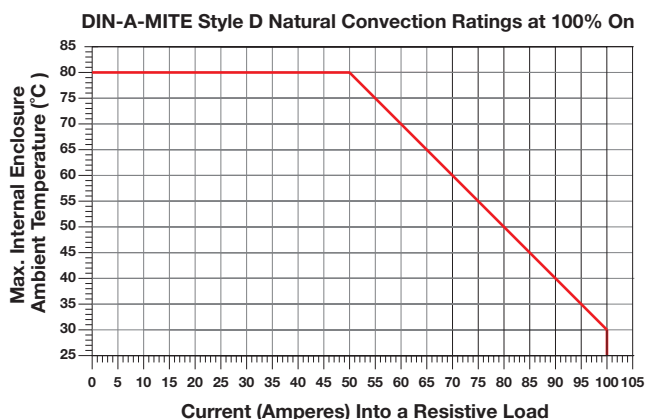
- Back panel mounting; fits the same mounting pattern as a 100A, single-phase mercury displacement relay
- On-board semiconductor fusing

### 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.

### Output Rating Curve



# Power Switching Devices

## DIN-A-MITE D

### Ordering Information

#### Part Number

①	②	③	④	⑤ ⑥	⑦ ⑧	⑨	⑩	⑪ ⑫
<b>D</b>	<b>D</b>	<b>Phase</b>	<b>Cooling &amp; Current Rating</b>	<b>Line &amp; Load Voltage</b>	<b>Control</b>	<b>Current Sensing or Alarm</b>	<b>User Manual</b>	<b>Custom Options</b>
		<b>1</b>	<b>0</b>					

③	Phase
1 =	1-phase, 1 controlled leg

④	Cooling and Current Rating (See rating curve)
0 =	Natural convection

⑤ ⑥	Line and Load Voltage
02 =	24 to 48VAC
24 =	120 to 240VAC
48 =	277 to 480VAC
60 =	277 to 600VAC

⑦ ⑧	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

⑨	Current Sensing or Alarm
0 =	No alarm
1 =	Load current transformer
S =	Shorted SCR alarm

⑩	User Manual
0 =	English
1 =	German
2 =	Spanish
3 =	French

⑪ ⑫	Custom Options
00 =	Standard part

### Replacement Semiconductor Fuse

Watlow Part Number	Cooper Bussmann® Part Number
<b>0808-0096-0000</b>	170N3437

# Power Switching Devices

## POWER SERIES™

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 with Ordering Information
- 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  $\geq 0.4$  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 11k $\Omega$  nominal
- Current input impedance 100 $\Omega$  nominal

##### Digital

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

#### Retransmit

- Field selectable and scalable, 0 to 20mA with 800 $\Omega$  max. load or 0 to 10VDC with 1k $\Omega$  min. load
- Default: 4 to 20mA
- Resolution:  
mA ranges =  $\pm 5\mu\text{A}$   
VDC ranges = 2.5mV nominal
- Calibration accuracy:  
mA ranges =  $\pm 20\mu\text{A}$   
VDC ranges = 10mV nominal
- Temperature stability: 100ppm/ $^{\circ}\text{C}$

#### 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<sup>®</sup> 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  $\pm 5\%$  line frequency independent
- Controller line voltage for electronic power supply can be run on separate line voltage

# Power Switching Devices

## POWER SERIES

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

#### Controller Terminals

- Touch safe
- $\frac{1}{8}$  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 EN50178, Pollution degree three

#### Storage Temperature

- -40 to 185°F (-40 to 85°C)

#### Shipping Weight

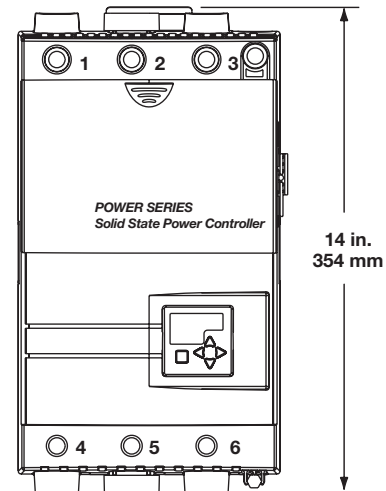
- Output Amperage Rating F35: 38 lbs (17.2 kg)
- Other Output Amperage Ratings: 23 lbs (10.3 kg)

#### Agency Approvals

- UL® 508 listed, File #E73741, Vol. 3, Sec. 2
- C-UL® listed to C22.2 NO. 14
- CE 2004/08/EC (EN61326-1), Class A with filter, CE 2006/95/EC (EN50178)

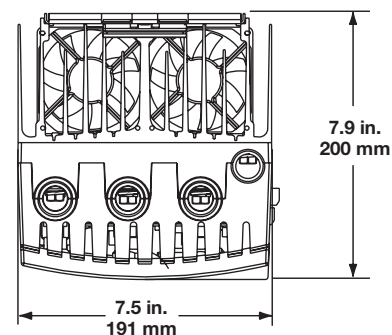
### Dimensions (Output Amperage Ratings: N20, N25, N30, F20, F25 or F30)

#### Front View

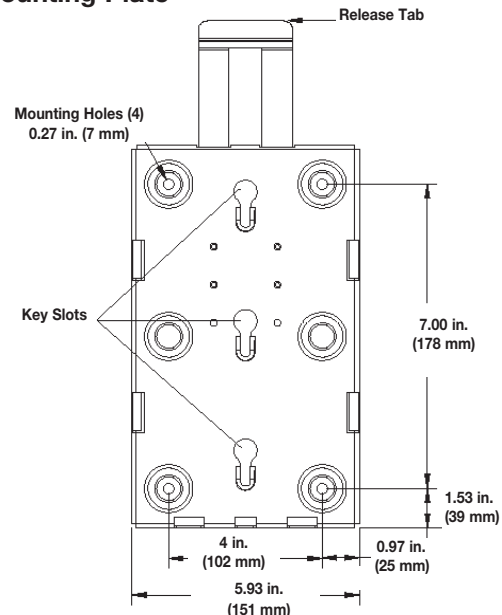


#### Top View

##### Power Series Top View



#### Mounting Plate

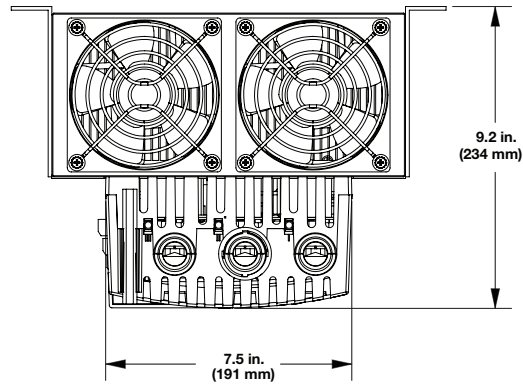




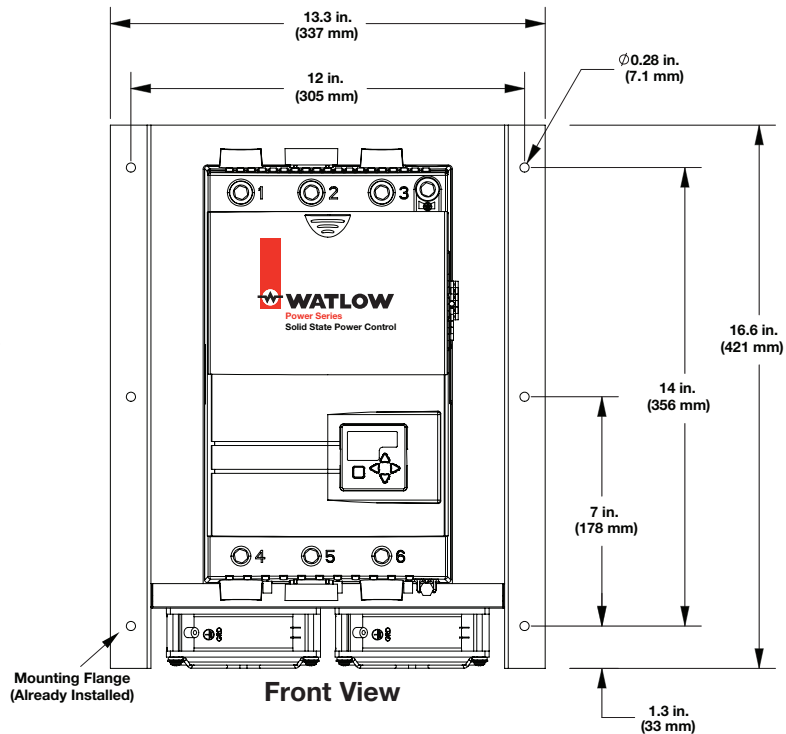
# Power Switching Devices

## POWER SERIES

### Dimensions (Output Amperage Rating: F35)



Bottom View



Front View

### 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

① ②	③	④	⑤ ⑥ ⑦	⑧	⑨	⑩	⑪ ⑫
<b>PC</b>	<b>Phase</b>	<b>Heater Diagnostics</b>	<b>Output Amperage Rating</b>	<b>Output Voltage Rating</b>	<b>Comm.</b>	<b>Feedback/Retransmit</b>	<b>Custom</b>

③ Phase	
1 =	1-phase
2 =	3-phase/2-leg control, (4 SCRs), zero cross only
3 =	3-phase/3-leg control, (6 SCRs)
4 =	3-phase/4-wire, wye connected load
8 =	2 single-phase zones
9 =	3 single-phase zones

④ Heater Diagnostics	
0 =	None
1 =	Heater diagnostics (required for any heater current monitoring or current limiting)

⑤ ⑥ ⑦ Output Amperage Rating	
See amperage chart below	

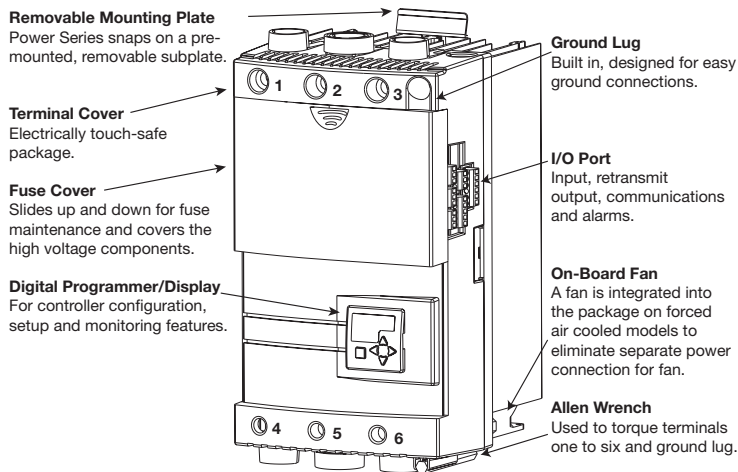
⑧ Output Voltage Rating	
A =	24 to 120V
B =	200 to 480V
C =	200 to 600V

⑨ Communications	
0 =	None
1 =	EIA/TIA-232/485 communications, opto-isolated, (field selectable)

⑩ Feedback/Retransmit	
0 =	None
1 =	Load current feedback (0-10V or 0-20mA scalable retransmit output) (Must have heater diagnostics selected)

⑪ ⑫ Custom	
00 =	None
AA =	No Watlow logo with agency approval marks
XX =	Custom, contact your Watlow representative for options

### POWER SERIES Features



### Amperage Chart – 122°F (50°C)

	Single-Phase		3-Phase, 2-Leg and 2 Single-Phase Zones		3-Phase, 3-Leg, 3 Single-Phase Zones and 4-Wire Model	
	Code	Amp	Code	Amp	Code	Amp
<b>Non Fan Cooled</b>	N20	100A	N20	80A	N20	65A
	N25	140A	N25	105A	N25	85A
	N30	165A	N30	120A	N30	105A
<b>Fan Cooled</b>	F20	125A	F20	120A	F20	90A
	F25	200A	F25	160A	F25	140A
	F30	250A	F30	185A	F30	155A
	N/A	N/A	F35	250A	F35	225A

**Note:** For current ratings at other temperatures see the rating curves in the POWER SERIES User's Manual available at [www.watlow.com](http://www.watlow.com).

### Replacement Fuses for Power Series

Watlow Part Number	Description	Bussmann Part Number
0808-0102-0100	100 amp @ 600VAC	170M1317
0808-0102-0125	125 amp @ 600VAC	170M1318
0808-0102-0160	160 amp @ 600VAC	170M1319
0808-0102-0200	200 amp @ 600VAC	170M1320
0808-0102-0250	250 amp @ 600VAC	170M1321
0808-0102-0315	315 amp @ 600VAC	170M1322

# 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% Δ in line, 2% Δ 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<sup>①</sup> 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

<sup>①</sup>MOV 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)

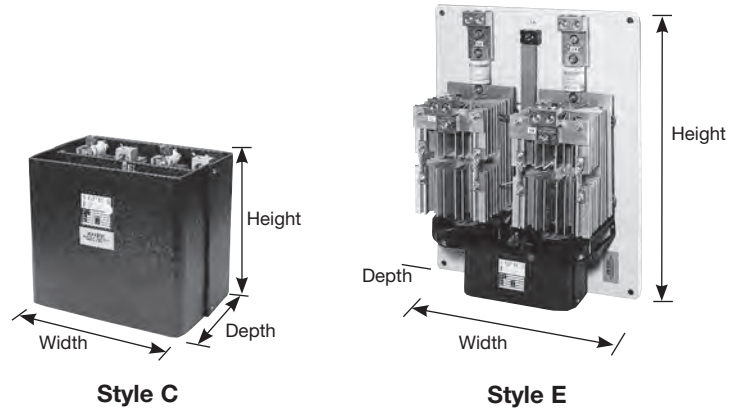
#### Options

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

### QPAC Weight Chart

Amps	Phase					
	1Ø/Q01		3Ø, 2-leg/Q32		3Ø, 3-wire/Q33	
	lb	(kg)	lb	(kg)	lb	(kg)
150	15	(6.8)	36	(16.3)	50	(22.7)
200	15	(6.8)	36	(16.3)	50	(22.7)
300	15	(6.8)	36	(16.3)	50	(22.7)
400-600	44	(20.0)	85	(38.5)	100	(45.4)
800-1000	49	(22.2)	120	(54.4)	135	(61.2)

### Case Styles



### QPAC Dimensions

Q01				
Style	Amps	Height (H) in. (mm)	Width (W) in. (mm)	Depth (D) in. (mm)
C	150	13 (330)	6.9 (175)	10.25 (260)
C	200	13 (330)	6.9 (175)	10.25 (260)
C	300	13 (330)	6.9 (175)	10.25 (260)
E	400-600	27 (685)	17 (430)	11.7 (300)
E	800-1K	27 (685)	17 (430)	13.3 (340)

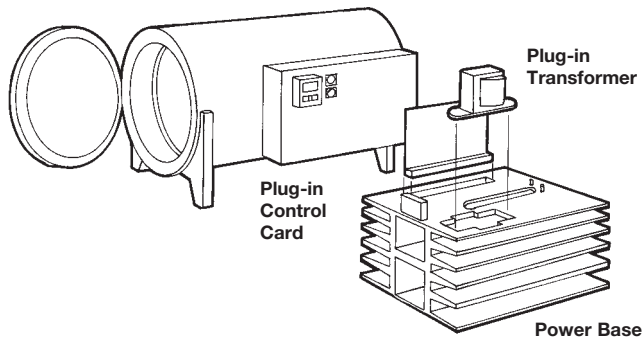
Q32				
Style	Amps	Height (H) in. (mm)	Width (W) in. (mm)	Depth (D) in. (mm)
C	150	13 (330)	13.7 (350)	10.25 (260)
C	200	13 (330)	13.7 (350)	10.25 (260)
C	300	13 (330)	13.7 (350)	10.25 (260)
E	400-600	27 (685)	21 (535)	11.7 (300)
E	800-1K	33 (840)	21 (535)	13.3 (340)

Q33				
Style	Amps	Height (H) in. (mm)	Width (W) in. (mm)	Depth (D) in. (mm)
C	150	13 (330)	20.7 (525)	10.25 (260)
C	200	13 (330)	20.7 (525)	10.25 (260)
C	300	13 (330)	20.7 (525)	10.25 (260)
E	400-600	33 (840)	27 (685)	11.7 (300)
E	800-1K	33 (840)	27 (685)	13.3 (340)

# Power Switching Devices

## QPAC

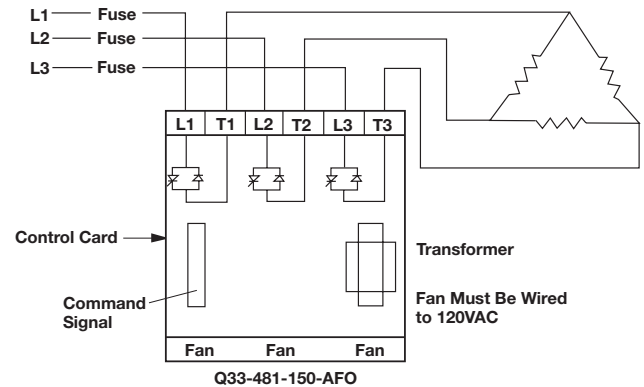
### Applications Sketch



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.

### Wiring Example



### Accessories

Manual Control Kit		08-5362
150A : 5A	Current Transformer	16-0008
200A : 5A	Current Transformer	16-0045
300A : 5A	Current Transformer	16-0073
400A : 5A	Current Transformer	0004-0286-0400
500A : 5A	Current Transformer	0004-0286-0500
600A : 5A	Current Transformer	0004-0286-0600
800A : 5A	Current Transformer	0004-0286-0800
1,000A : 5A	Current Transformer	0004-0288-1000
5A : 20mA	Interstage Transformer	16-0176

# Power Switching Devices

## QPAC

### Ordering Information

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

#### Part Number

①	② ③	④ ⑤	⑥	⑦ ⑧ ⑨	⑩ ⑪	⑫
Q	Phase	Operating & Output Voltage	Cooling Fan Voltage	Output Control (Amps)	Input Control Card	Open Heater/Shorted SCR Detector
Q		-		-		

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

④ ⑤ Operating and Output Voltage	
12=	120VAC
20=	208VAC
24=	240VAC
27=	277VAC
38=	380VAC
41=	415VAC
48=	480VAC
57=	575VAC

⑥ 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.

⑦ ⑧ ⑨ Output Control (Amps)	
150 =	150A
200 =	200A
300 =	300A
400 =	400A
500 =	500A
600 =	600A
800 =	800A
01k =	1000A

⑩ ⑪ Input Control Card	
CD =	Solid state dc input (08-5286) contactor
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

⑫ 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 phasing out and banning 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
- WEEE 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  $\leq 2.7$ VDC
- 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

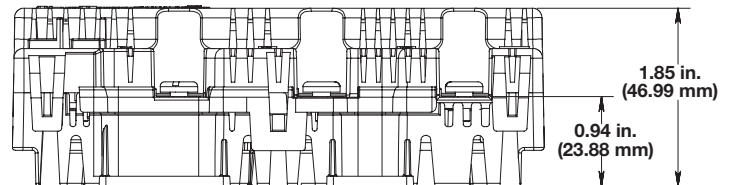
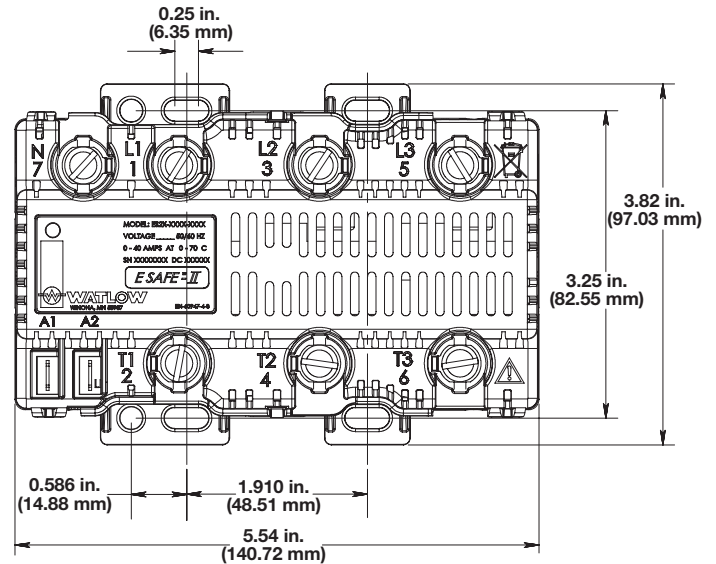
#### Line and load terminals

- 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

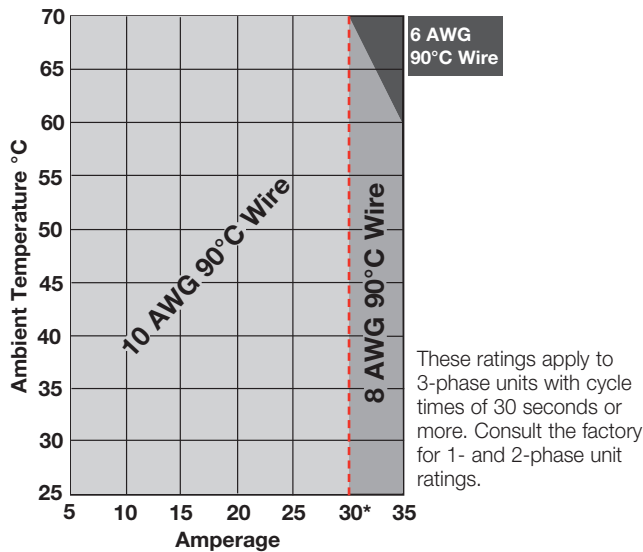
### Dimensional Drawings



# Power Switching Devices

## E-SAFE II

### Product Rating Curve



#### 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

- 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).
- 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

#### Part Number

① ② ③	④	⑤	⑥ ⑦	⑧	⑨	⑩ ⑪ ⑫
	Number of Poles	Load Voltage	Command Signal Voltage	Future Option	Future Option	Custom Options
ES2		-		0	- 0	

④ Number of Poles	
1 =	1 pole
2 =	2 poles controlled
3 =	3 poles controlled

⑤ Load Voltage	
1 =	100 to 120VAC
2 =	200 to 240VAC
3 =	230/277VAC (400/480VAC with wye/star, neutral connected to center required)

⑥ ⑦ Command Signal Voltage	
LV =	Low voltage 3 to 24VDC or 24VAC
HV =	High voltage 100 to 240VAC +10/-15% (85 to 264VAC)

⑩ ⑪ ⑫ Custom Options	
000 =	Standard product
Any three letters or numbers = cosmetic options	

# Power Switching Devices

## 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<sup>®</sup>, 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<sup>®</sup> 508 recognized, CSA LR700195 certified and CE 60950

- Applications requiring agency approval

#### Back-to-back SCR design

- Offers rugged design for different application environments



# Power Switching Devices

## 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.
- 480V; 48VAC min. to 530VAC max.
- 600V; 48VAC min. to 660VAC max.
- Off state leakage  
1mA at 77°F (25°C) max. for 600VAC models; 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

Model	18	24	34	42
Max. Surge Current 16.6 mSec	625	250	625	1000
Max. I <sup>2</sup> t Fusing	1620	260	1620	4150

#### Agency Approvals

- Class II construction
- UL® 508 recognition, File #E73741 and CSA File LR 700195
- 2006/95/EC Low Voltage Directive

#### 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

①	②	③ ④	⑤	⑥ ⑦	⑧	⑨ ⑩ ⑪	⑫
	Control Mode	Output Amperage	-	Output Voltage		Input Type (Contactor)	
C	Z		-	A	V	-	0

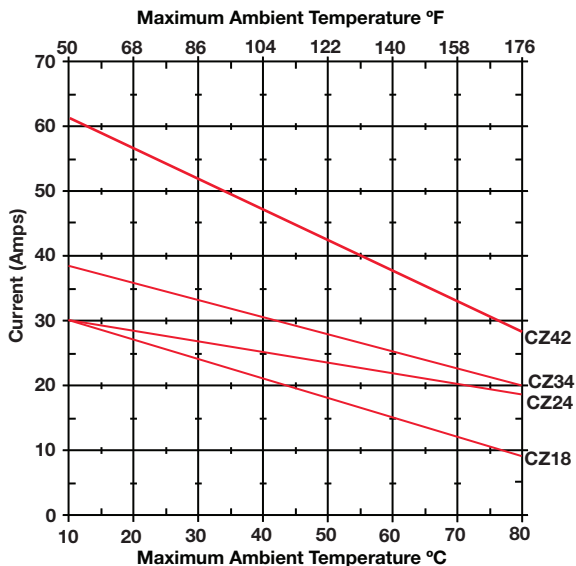
②	Control Mode
Z =	Zero cross

③ ④	Output Amperage
18 =	18A
24 =	24A
34 =	34A
42 =	42A

⑥ ⑦	Output Voltage
24 =	24 to 280VAC
48 =	48 to 530VAC
60 =	60 to 660VAC

⑨ ⑩ ⑪	Input Type (Contactor)
DC1 =	4 to 32VDC
AC1 =	90 to 140VAC
<b>Note:</b> 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



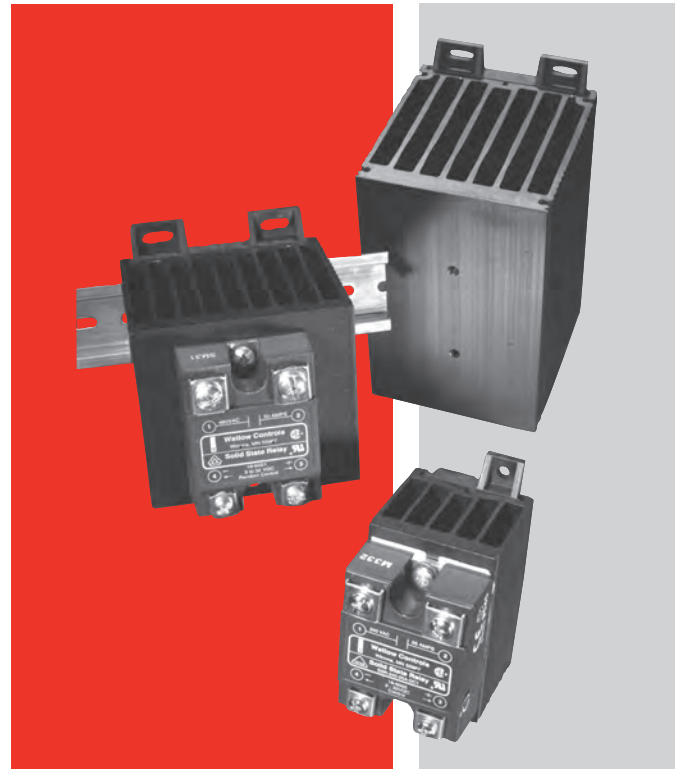
# Power Switching Devices

## 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 Belleville 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 - EN60950**

- Meets applications requiring agency approval

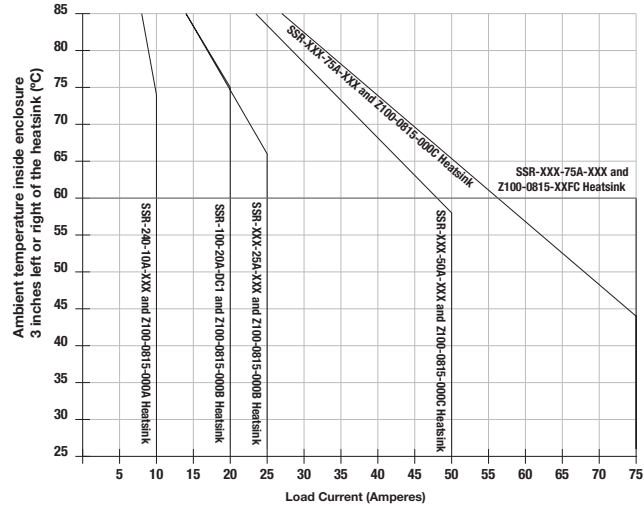
# Power Switching Devices

## Solid State Relays

### Specifications

Specifications Standard To All SSRs:	
Dielectric Strength (Volts)	4000 RMS
<b>Input, DC Control</b>	
Voltage range	3-32VDC
Typical input current	3.4 to 20mA
Turn on voltage (max.)	3VDC
Turn off voltage (min.)	1VDC
<b>Input, AC Control</b>	
Voltage range	90-280VAC
Typical input current	2mA (typical) @ 120VAC 4mA (typical) @ 240VAC
Turn on voltage (max.)	90VAC
Turn off voltage (min.)	10VAC
<b>AC Output (Max.)</b>	
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

### Ambient Temperature Operating Curve



120/240VAC						
Model Number	SSR-240-10A-DC1	SSR-240-25A-DC1	SSR-240-50A-DC1	SSR-240-10A-AC1	SSR-240-25A-AC1	SSR-240-50A-AC1
Current output	10A	25A	50A	10A	25A	50A
Nominal voltage	120/240VAC	120/240VAC	120/240VAC	120/240VAC	120/240VAC	120/240VAC
One cycle surge current	120A	250A	625A	120A	250A	625A
Max. I <sup>2</sup> t for fusing	60A <sup>2</sup> seconds	260A <sup>2</sup> seconds	1,620A <sup>2</sup> seconds	60A <sup>2</sup> seconds	260A <sup>2</sup> seconds	1,620A <sup>2</sup> seconds
Thermal resistance	1.48° C/W	1.05° C/W	0.63° C/W	1.48° C/W	1.05° C/W	0.31° C/W
Ambient operating temperature	-40 to 176°F (-40 to 80°C)	-40 to 176°F (-40 to 80°C)	-40 to 176°F (-40 to 80°C)	-40 to 176°F (-40 to 80°C)	-40 to 176°F (-40 to 80°C)	-40 to 176°F (-40 to 80°C)
<b>Output (Max.)</b>						
Voltage range	48-280VAC	48-280VAC	48-280VAC	48-280VAC	48-280VAC	48-280VAC
Over voltage rating	600V (peak)	600V (peak)	600V (peak)	600V (peak)	600V (peak)	600V (peak)
Off state leakage	10mA	10mA	10mA	10mA	10mA	10mA

120/240VAC			Random Fired Models			100VDC
Model Number	SSR-240-75A-DC1	SSR-240-75A-AC1	SSR-480-50A-RND	SSR-480-75A-RND	SSR-240-10A-RND	SSR-100-20A-DC1
Current output	75A	75A	50A	75A	10A	20A
Nominal voltage	120/240VAC	120/240VAC	480VAC	480VAC	120/240VAC	100VDC
One cycle surge current	1000A	1000A	625A	1000A	120A	42A (10ms)
Max. I <sup>2</sup> t for fusing	6000A <sup>2</sup> seconds	6000A <sup>2</sup> seconds	1,620A <sup>2</sup> seconds	6000A <sup>2</sup> seconds	60A <sup>2</sup> seconds	N/A
Thermal resistance	0.31° C/W	0.31° C/W	0.63° C/W	0.31° C/W	1.48° C/W	1.06° C/W
Ambient operating temperature	-40 to 176°F (-40 to 80°C)	-40 to 176°F (-40 to 80°C)	-40 to 176°F (-40 to 80°C)	-40 to 176°F (-40 to 80°C)	-40 to 176°F (-40 to 80°C)	-4 to 176°F (-20 to 80°C)
<b>Output (Max.)</b>						
Voltage range	48-280VAC	48-280VAC	80-530VAC	80-530VAC	48-280VAC	0-100VDC
Over voltage rating	600V (peak)	600V (peak)	1200V (peak)	1200V (peak)	600V (peak)	N/A
Off state leakage	10mA	10mA	10mA	10mA	10mA	0.3mA VDC

480 VAC						
Model Number	SSR-480-25A-DC1	SSR-480-50A-DC1	SSR-480-75A-DC1	SSR-480-25A-AC1	SSR-480-50A-AC1	SSR-480-75A-AC1
Current output	25A	50A	75A	25A	50A	75A
Nominal voltage	480VAC	480VAC	480VAC	480VAC	480VAC	480VAC
One cycle surge current	250A	625A	1000A	250A	625A	1000A
Max. I <sup>2</sup> t for fusing	260A <sup>2</sup> seconds	1,620A <sup>2</sup> seconds	6,000A <sup>2</sup> seconds	260A <sup>2</sup> seconds	1,620A <sup>2</sup> seconds	6,000A <sup>2</sup> seconds
Thermal resistance	1.02° C/W	0.63° C/W	0.31° C/W	1.02° C/W	0.63° C/W	0.31° C/W
Ambient operating temperature	-40 to 176°F (-40 to 80°C)	-40 to 176°F (-40 to 80°C)	-40 to 176°F (-40 to 80°C)	-40 to 176°F (-40 to 80°C)	-40 to 176°F (-40 to 80°C)	-40 to 176°F (-40 to 80°C)
<b>Output (Max.)</b>						
Voltage range	48-530VAC	48-530VAC	48-530VAC	48-530VAC	48-530VAC	48-530VAC
Over voltage rating	1200V (peak)	1200V (peak)	1200V (peak)	1200V (peak)	1200V (peak)	1200V (peak)
Off state leakage	10mA	10mA	10mA	10mA	10mA	10mA



# Power Switching Devices

## 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.

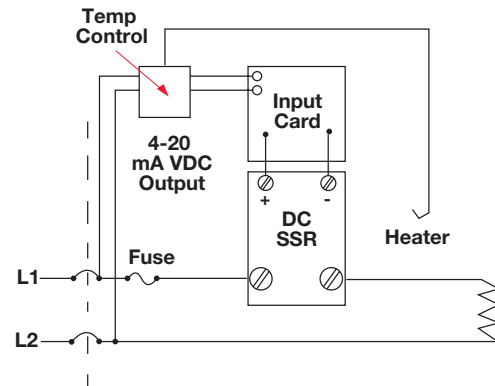
#### 2. Failure Mode

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



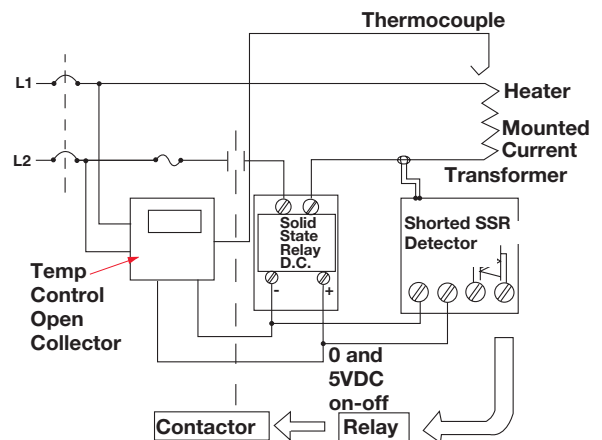
#### Shorted SSR Alarm

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

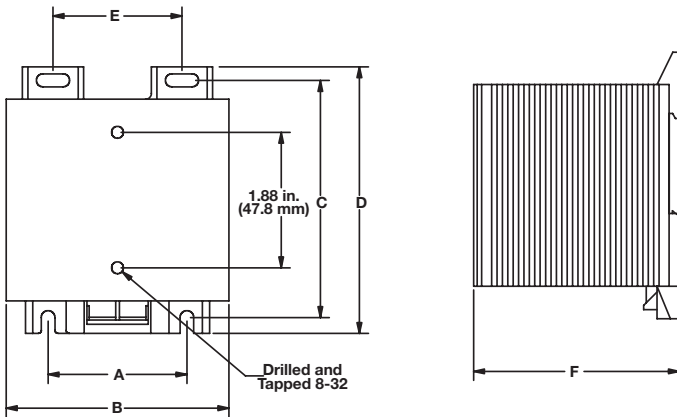


**Note:** Semiconductor power switching devices are not legal for over temperature limit or safety devices. For limit and safety devices you must have a positive mechanical break of all electrically hot legs simultaneously.

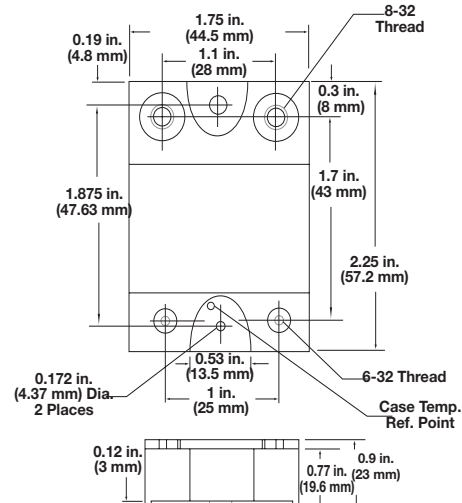
# Power Switching Devices

## Solid State Relays

### Dimensions - Heat Sink



### Dimensions - Solid State Relay



### Heat Sink Dimensions by Part Number

Part Number	Descriptor	Dimensions					
		A in. (mm)	B in. (mm)	C in. (mm)	D in. (mm)	E in. (mm)	F in. (mm)
Z100-0815-000A	18A	N/A	1.8 (46)	3.25 (82.6)	3.7 (94)	N/A	1.9 (48)
Z100-0815-000B	35A	1.91 (48.5)	3.2 (81)	3.25 (82.6)	3.7 (94)	1.81 (46)	2.9 (74)
Z100-0815-000C	55A	1.89 (48)	3.2 (81)	5.45 (138.4)	5.89 (149.6)	1.81 (46)	3.6 (91)
Z100-0815-XXFC*	75A	1.89 (48)	3.2 (81)	5.45 (138.4)	7.16 (181.9)	1.81 (46)	3.6 (91)

\*Fan cooled

### Ordering Information

#### Part Number

① ② ③	④ ⑤ ⑥	⑦ ⑧	⑨	⑩ ⑪ ⑫
SSR	Voltage	Current	A	Control Voltage

④ ⑤ ⑥	Voltage
100 =	0 to 100VDC (20A model only)
240 =	24 to 240VAC
480 =	24 to 530VAC

⑦ ⑧	Current
10 =	10A
20 =	20A (100VDC model only)
25 =	25A
40 =	40A
50 =	50A
75 =	75A

⑩ ⑪ ⑫	Control Voltage
DC1 =	3 to 32VDC (see specifications)
AC1 =	90 to 280VAC
RND =	3 to 32VDC (10, 50 and 75A models only)
<b>Note:</b> 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 - I <sup>2</sup> T (sold separately)	
Recommended and available with holders.	