Solid State Relay



Solid State Relay Offers More For Less: Longer Heater Life at Lower Cost

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 ½ of a second heater life will be extended.

Both low and high voltage models are available from 24 up to 660V~(ac). 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.

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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 600V~(ac), File #LR700195 VDE 60950 License #40021401, File #1995500 up to 480V~(ac)

Meets applications requiring agency approval

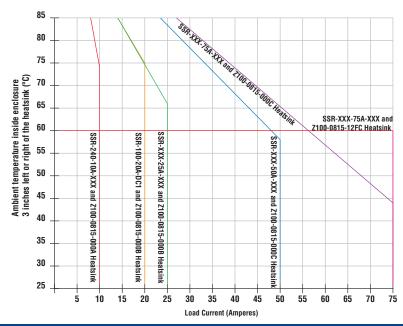




Specifications

Specifications Standard To All SSRs:								
Dielectric Strength (Volts)	4000 RMS							
Input, DC Control								
Voltage range	3-32V(dc)							
Input current	4mA (max.) @ 5V≕(dc)							
Turn on voltage (max.)	3V(dc)							
Turn off voltage (min.)	1V(dc)							
Input, AC Control								
Voltage range	90-280V~(ac)							
Input current	2mA (max.) @ 120V~(ac)							
Turn on voltage (max.)	90V~(ac)							
Turn off voltage (min.)	10V~(ac)							
AC Output (Max.)								
Forward voltage drop	1.5V~(ac) and 2.1V≕(dc)							
Min. holding current (mA)	50mA							
Turn on-off time (ms)	up to 10ms (max.)							
Frequency range	47 to 63Hz							

Temperature Operating Curve



120/240V∼(ac)						
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 Nominal voltage One cycle surge current Max. I²t for fusing Thermal resistance Base plate temperature	10A	25A	50A	10A	25A	50A
	120/240V~(ac)	120/240V~(ac)	120/240V~(ac)	120/240V~(ac)	120/240V~(ac)	120/240V~(ac)
	120A	250A	625A	120A	250A	625A
	60A² seconds	260A² seconds	1,620A² seconds	60A² seconds	260A² seconds	1,620A² seconds
	1.48° C/W	1.05° C/W	0.63° C/W	1.48° C/W	1.05° C/W	0.31° C/W
	-40 to 75°C	-40 to 75°C	-25 to 85°C	-40 to 75°C	-40 to 75°C	-13 to 85°C
	(-40 to 167°F)	(-40 to 167°F)	(-13 to 185°F)	(-40 to 167°F)	(-40 to 167°F)	(-13 to 185°F)
Output (Max.) Voltage range Over voltage rating Off state leakage	48-280V~(ac)	48-280V~(ac)	48-280V~(ac)	48-280V~(ac)	48-280V~(ac)	48-280V~(ac)
	600V (peak)					
	10mA	10mA	10mA	10mA	10mA	10mA

120/240V~(ac)			Random Fired I	100V≕(dc)		
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	120/240V~(ac)	120/240V~(ac)	480V~(ac)	480V~(ac)	120/240V~(ac)	100V≕(dc)
One cycle surge current	1000A	1000A	625A	1000A	120A	42A (10ms)
Max. I2t for fusing	6,000A ² seconds	6,000A2 seconds	1,620A2 seconds	6,000A ² seconds	60A ² 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
Base plate temperature	-25 to 85°C	-25 to 85°C	-25 to 85°C	-25 to 85°C	-40 to 75°C	-30 to 80°C
	(-13 to 185°F)	(-13 to 185°F)	(-13 to 185°F)	(-13 to 185°F)	(-40 to 167°F)	(-22 to 176°F)
Output (Max.)						
Voltage range	48-280V~(ac)	48-280V~(ac)	80-530V~(ac)	80-530V~(ac)	48-280V~(ac)	0-100V≕(dc)
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(dc)

480 and 600V~(ac)								
Model Number 480V~(ac)	SSR-480-25A-DC1	SSR-480-50A-DC1	SSR-480-75A-DC1	SSR-480-25A-AC1	SSR-480-50A-AC1	SSR-480-75A-AC1		
Model Number 600V~(ac)	*SSR-600-25A-DC1	*SSR-600-50A-DC1	*SSR-600-75A-DC1	*SSR-600-25A-AC1	*SSR-600-50A-AC1	*SSR-600-75A-AC1		
Current output	25A	50A	75A	25A	50A	75A		
Nominal voltage	480V~(ac)	480V~(ac)	480V~(ac)	480V~(ac)	480V~(ac)	480V~(ac)		
One cycle surge current	250A	625A	1000A	250A	625A	1000A		
Max. I2t for fusing	260A ² seconds	1,620A2 seconds	6,000A ² seconds	260A ² seconds	1,620A2 seconds	6,000A ² 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		
Base plate temperature	-13 to 185°F	-13 to 185°F	-13 to 185°F	-13 to 185°F	-13 to 185°F	-13 to 185°F		
	(-25 to 85°C)	(-25 to 85°C)	(-25 to 85°C)	(-25 to 85°C)	(-25 to 85°C)	(-25 to 85°C)		
Output (Max.)								
Voltage range (480V model)	48-530V~(ac)	48-530V~(ac)	48-530V~(ac)	48-530V~(ac)	48-530V~(ac)	48-530V~(ac)		
*Voltage range (600V model)	48-660V~(ac)	48-660V~(ac)	48-660V~(ac)	48-660V~(ac)	48-660V~(ac)	48-660V~(ac)		
Over voltage rating	1200V (peak)	1200V (peak)	1200V (peak)	1200V (peak)	1200V (peak)	1200V (peak)		
Off state leakage	10mA	10mA	10mA	10mA	10mA	10mA		

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 (4V~ cycles on and 4V~(ac) 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 16 mm (0.625 in.) inch 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

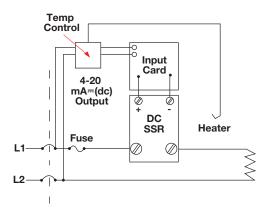
Solid state devices require a small voltage to turn on, which is consumed as heat (approx. 1.5 volts x amps = watts). This heat must be removed from the device and is usually accomplished by mounting the relay on heat sinks.

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

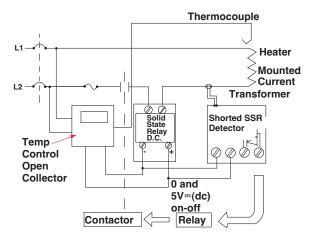


Shorted SSR Alarm

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.

Single-Phase Shorted SSR Detector

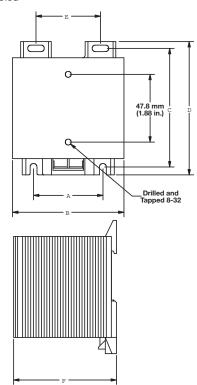


Note: Semiconductor power switching devices are not legal for over temperature limit or safety devices. For limit and safety devices you must have a positive mechanical break of all electrically hot legs simultaneously.

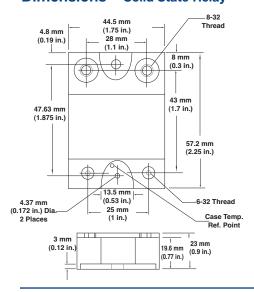
Dimensions

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

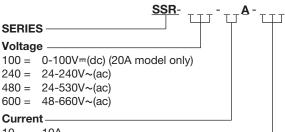
Fan cooled



Dimensions - Solid State Relay



Ordering Information



10 = 10A

20 = 20A (100V - (dc) model only)

25 = 25A40 = 40A50 = 50A75 = 75A

Control Voltage

DC1 = 3-32V=(dc) (see specifications)

 $AC1 = 90-280V \sim (ac)$

RND = 3-32V=(dc) 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)

 $Z100-0815-000A = 18A \text{ or } 2.2^{\circ}\text{C/watt}$

Z100-0815-000B = 35A or 1.1°C/watt

 $Z100-0815-000C = 55A \text{ or } 0.6^{\circ}C/\text{watt}$

 $Z100-0815-12FC = 75A \text{ or } 0.16^{\circ}C/\text{watt } (120V\sim(\text{ac}) \text{ fan})$ $Z100-0815-24FC = 75A \text{ or } 0.16^{\circ}C/\text{watt } (240V\sim(\text{ac}) \text{ fan})$

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, 4-20mA input RPC-5386-0000 = Shorted SSR alarm card

Sub Cycle Fuses-I2t (sold separately)

Recommended and available with holders

Your Authorized Watlow Distributor is:

To be automatically connected to the nearest North American Technical Sales Office:

1-800-WATLOW2 • www.watlow.com • info@watlow.com

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