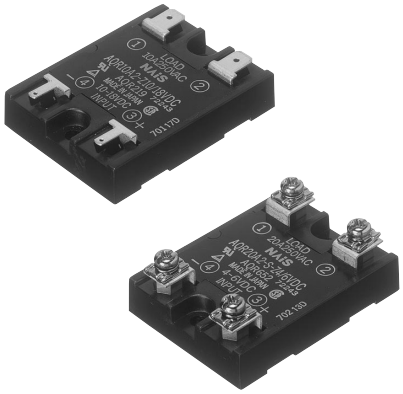
(10A, 15A, 20A type) (30A, 40A type) UL Pending C-UL Pending VDE Pending

AQ-R SOLID STATE RELAY

AQ-R RELAYS



FEATURES

1. Two types of terminal shape: Plug-in terminal and Screw terminal (30 A, 40 A is screw terminal types only)

2. Flat type of SSR possible by aluminium printed circuit board

3. High dielectric strength of 1,500 V between input and output. 4,000 V available for 10A, 15A, 20A devices.

4. Heat sink and DIN mounting rail and terminal cover are available as accessories

APPLICATIONS

1. Molding machine (heater control)
2. Temperature controlled bath (heater control)
3. Printing machine (heater control)
4. Machine tool (motor control)

TYPES

1. Plug-in terminal type

Type	Load voltage	Input voltage	Standard (1,500V AC) Part No.	Reinforced (4,000V AC) Part No.
Zero-cross 10 A	75 to 125V AC	4 to 6V DC	AQR10A1-Z4/6VDC	—
		10 to 18V DC	AQR10A1-Z10/18VDC	—
		18 to 28V DC	AQR10A1-Z18/28VDC	—
	75 to 250V AC	4 to 6V DC	AQR10A2-Z4/6VDC	AQR10A2-ZV4/6VDC
		10 to 18V DC	AQR10A2-Z10/18VDC	AQR10A2-ZV10/18VDC
		18 to 28V DC	AQR10A2-Z18/28VDC	AQR10A2-ZV18/28VDC
Zero-cross 15 A	75 to 125 V AC	4 to 6V DC	AQR15A1-Z4/6VDC	—
		10 to 18V DC	AQR15A1-Z10/18VDC	—
		18 to 28V DC	AQR15A1-Z18/28VDC	—
	75 to 250 V AC	4 to 6V DC	AQR15A2-Z4/6VDC	AQR15A2-ZV4/6VDC
		10 to 18V DC	AQR15A2-Z10/18VDC	AQR15A2-ZV10/18VDC
		18 to 28V DC	AQR15A2-Z18/28VDC	AQR15A2-ZV18/28VDC
Zero-cross 20 A	75 to 125 V AC	4 to 6V DC	AQR20A1-Z4/6VDC	—
		10 to 18V DC	AQR20A1-Z10/18VDC	—
		18 to 28V DC	AQR20A1-Z18/28VDC	—
	75 to 250 V AC	4 to 6V DC	AQR20A2-Z4/6VDC	AQR20A2-ZV4/6VDC
		10 to 18V DC	AQR20A2-Z10/18VDC	AQR20A2-ZV10/18VDC
		18 to 28V DC	AQR20A2-Z18/28VDC	AQR20A2-ZV18/28VDC

2. Screw-terminal type

Type	Load voltage	Input voltage	Standard (1,500V AC) Part No.	Reinforced (4,000V AC) Part No.
Zero-cross 10 A	75 to 125 V AC	4 to 6V DC	AQR10A1-S-Z4/6VDC	—
		10 to 18V DC	AQR10A1-S-Z10/18VDC	—
		18 to 28V DC	AQR10A1-S-Z18/28VDC	—
	75 to 250 V AC	4 to 6V DC	AQR10A2-S-Z4/6VDC	AQR10A2-S-ZV4/6VDC
		10 to 18V DC	AQR10A2-S-Z10/18VDC	AQR10A2-S-ZV10/18VDC
		18 to 28V DC	AQR10A2-S-Z18/28VDC	AQR10A2-S-ZV18/28VDC
Zero-cross 15 A	75 to 125 V AC	4 to 6V DC	AQR15A1-S-Z4/6VDC	—
		10 to 18V DC	AQR15A1-S-Z10/18VDC	—
		18 to 28V DC	AQR15A1-S-Z18/28VDC	—
	75 to 250 V AC	4 to 6V DC	AQR15A2-S-Z4/6VDC	AQR15A2-S-ZV4/6VDC
		10 to 18V DC	AQR15A2-S-Z10/18VDC	AQR15A2-S-ZV10/18VDC
		18 to 28V DC	AQR15A2-S-Z18/28VDC	AQR15A2-S-ZV18/28VDC
Zero-cross 20 A	75 to 125 V AC	4 to 6V DC	AQR20A1-S-Z4/6VDC	—
		10 to 18V DC	AQR20A1-S-Z10/18VDC	—
		18 to 28V DC	AQR20A1-S-Z18/28VDC	—
	75 to 250 V AC	4 to 6V DC	AQR20A2-S-Z4/6VDC	AQR20A2-S-ZV4/6VDC
		10 to 18V DC	AQR20A2-S-Z10/18VDC	AQR20A2-S-ZV10/18VDC
		18 to 28V DC	AQR20A2-S-Z18/28VDC	AQR20A2-S-ZV18/28VDC
Zero-cross 30 A	75 to 250 V AC	4 to 6V DC	AQR30A2-S-Z4/6VDC	—
		10 to 18V DC	AQR30A2-S-Z10/18VDC	—
		18 to 28V DC	AQR30A2-S-Z18/28VDC	—
Zero-cross 40 A	75 to 250 V AC	4 to 6V DC	AQR40A2-S-Z4/6VDC	—
		10 to 18V DC	AQR40A2-S-Z10/18VDC	—
		18 to 28V DC	AQR40A2-S-Z18/28VDC	—

ORDERING INFORMATION

Ex. AQR [10A] [1] — [S] — [Z] [4/6VDC]

Load current	Load voltage	Terminal shape	Type	Input voltage
10 A, 15 A, 20 A, 30 A, 40 A	1: 75 to 125 V AC 2: 75 to 250 V AC	Nil: Plug-in terminal S: Screw terminal	Z: Zero-cross type (1,500 V) ZV: Zero-cross type (4,000 V)	4/6, 10/18, 18/28 V DC

Note: Standard packing: Carton 10 pcs., Case: 100 pcs.

SPECIFICATIONS

1. Ratings (at 20°C 68°F, Input ripple: 1% or less)

1) 10 A type

Items	Part No.	AQR10A1-Z4/ 6VDC	AQR10A1-Z10/ 18VDC	AQR10A1-Z18/ 28VDC	AQR10A2-Z4/ 6VDC AQR10A2-ZV4/ 6VDC	AQR10A2-Z10/ 18VDC AQR10A2-ZV10/ 18VDC	AQR10A2-Z18/ 28VDC AQR10A2-ZV18/ 28VDC	Remarks
		AQR10A1-S-Z4/ 6VDC	AQR10A1-S-Z10/ 18VDC	AQR10A1-S-Z18/ 28VDC	AQR10A2-S-Z4/ 6VDC AQR10A2-S-ZV4/ 6VDC	AQR10A2-S-Z10/ 18VDC AQR10A2-S-ZV10/18VDC	AQR10A2-S-Z18/ 28VDC AQR10A2-S-ZV18/28VDC	
Input side	Input voltage	4 to 6V DC	10 to 18V DC	18 to 28V DC	4 to 6V DC	10 to 18V DC	18 to 28V DC	
	Input impedance	Approx. 0.26 k Ω	Approx. 0.86 k Ω	Approx. 1.36 k Ω	Approx. 0.26 k Ω	Approx. 0.86 k Ω	Approx. 1.36 k Ω	
	Drop-out voltage, min.	1 V						
Load side	Max. load current	10 A						See “REFERENCE DATA 1”
	Load voltage	75 to 125 V AC			75 to 250 V AC			
	Frequency	45 to 65 Hz						
	Repetitive peak voltage	400 V			600 V			
	Non-repetitivesurge current	100 A						In one cycle at 60 Hz
	Max. “OFF-state” leakage current	2.5 mA (when 100 V AC applied)			5 mA (when 200 V AC applied)			at 60 Hz
	Max. “ON-state” voltage drop	1.6 V						at max. carrying current
	Min. load current	100 mA						
	OFF-state dV/dt	100 V/μs						

2) 15 A type

Items	Part No.	AQR15A1-Z4/ 6VDC	AQR15A1-Z10/ 18VDC	AQR15A1-Z18/ 28VDC	AQR15A2-Z4/ 6VDC AQR15A2-ZV4/ 6VDC	AQR15A2-Z10/ 18VDC AQR15A2-ZV10/ 18VDC	AQR15A2-Z18/ 28VDC AQR15A2-ZV18/ 28VDC	Remarks
		AQR15A1-S-Z4/ 6VDC	AQR15A1-S-Z10/ 18VDC	AQR15A1-S-Z18/ 28VDC	AQR15A2-S-Z4/ 6VDC AQR15A2-S-ZV4/ 6VDC	AQR15A2-S-Z10/ 18VDC AQR15A2-S-ZV10/18VDC	AQR15A2-S-Z18/ 28VDC AQR15A2-S-ZV18/28VDC	
Input side	Input voltage	4 to 6V DC	10 to 18V DC	18 to 28V DC	4 to 6V DC	10 to 18V DC	18 to 28V DC	
	Input impedance	Approx. 0.26 k Ω	Approx. 0.86 k Ω	Approx. 1.36 k Ω	Approx. 0.26 k Ω	Approx. 0.86 k Ω	Approx. 1.36 k Ω	
	Drop-out voltage, min.	1 V						
Load side	Max. load current	15 A						See “REFERENCE DATA 1”
	Load voltage	75 to 125 V AC			75 to 250 V AC			
	Frequency	45 to 65 Hz						
	Repetitive peak voltage	400 V			600 V			
	Non-repetitivesurge current	150 A						In one cycle at 60 Hz
	Max. “OFF-state” leakage current	2.5 mA (when 100 V AC applied)			5 mA (when 200 V AC applied)			at 60 Hz
	Max. “ON-state” voltage drop	1.6 V						at max. carrying current
	Min. load current	100 mA						
	OFF-state dV/dt	100 V/μs						

3) 20 A type

Items \ Part No.		AQR20A1-Z4/ 6VDC AQR20A1-S-Z4/ 6VDC	AQR20A1-Z10/ 18VDC AQR20A1-S-Z10/ 18VDC	AQR20A1-Z18/ 28VDC AQR20A1-S-Z18/ 28VDC	AQR20A2-Z4/ 6VDC AQR20A2-ZV4/ 6VDC AQR20A2-S-Z4/ 6VDC AQR20A2-S-ZV4/ 6VDC	AQR20A2-Z10/ 18VDC AQR20A2-ZV10/ 18VDC AQR20A2-S-Z10/ 18VDC AQR20A2-S-ZV10/18VDC	AQR20A2-Z18/ 28VDC AQR20A2-ZV18/ 28VDC AQR20A2-S-Z18/ 28VDC AQR20A2-S-ZV18/28VDC	Remarks
Input side	Input voltage	4 to 6V DC	10 to 18V DC	18 to 28V DC	4 to 6V DC	10 to 18V DC	18 to 28V DC	
	Input impedance	Approx. 0.26 k Ω	Approx. 0.86 k Ω	Approx. 1.36 k Ω	Approx. 0.26 k Ω	Approx. 0.86 k Ω	Approx. 1.36 k Ω	
	Drop-out voltage, min.	1 V						
Load side	Max. load current	20 A						See “REFERENCE DATA 1”
	Load voltage	75 to 125 V AC			75 to 250 V AC			
	Frequency	45 to 65 Hz						
	Repetitive peak voltage	400 V			600 V			
	Non-repetitivesurge current	200 A						In one cycle at 60 Hz
	Max. “OFF-state” leakage current	2.5 mA (when 100 V AC applied)			5 mA (when 200 V AC applied)			at 60 Hz
	Max. “ON-state” voltage drop	1.6 V						at max. carrying current
	Min. load current	100 mA						
	OFF-state dV/dt	100 V/µs						

4) 30 A type and 40 A type

Items \ Part No.		AQR30A2-S-Z4/ 6VDC	AQR30A2-S-Z10/ 18VDC	AQR30A2-S-Z18/ 28VDC	AQR40A2-S-Z4/ 6VDC	AQR40A2-S-Z10/ 18VDC	AQR40A2-S-Z18/ 28VDC	Remarks
Input side	Input voltage	4 to 6V DC	10 to 18V DC	18 to 28V DC	4 to 6V DC	10 to 18V DC	18 to 28V DC	
	Input impedance	Approx. 0.26 k Ω	Approx. 0.86 k Ω	Approx. 1.36 k Ω	Approx. 0.26 k Ω	Approx. 0.86 k Ω	Approx. 1.36 k Ω	
	Drop-out voltage, min.	1 V						
Load side	Max. load current	30 A			40 A			See “REFERENCE DATA 1”
	Load voltage	75 to 250 V AC						
	Frequency	45 to 65 Hz						
	Non-repetitivesurge current	300 A			400 A			In one cycle at 60 Hz
	Max. “OFF-state” leakage current	5 mA (when 200 V AC applied)						at 60 Hz
	Max. “ON-state” voltage drop	1.6 V						at max. carrying current
	Min. load current	120 mA						

2. Characteristics (at 20°C 68°F, Input ripple: 1% or less)

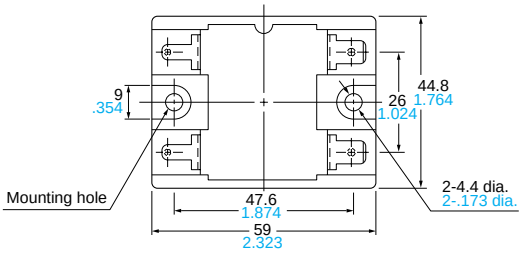
Item \ Type		Zero-cross type		Remarks
		Standard type	Reinforced type	
Operate time, max.		(1/2 cycle of voltage sine wave) + 1 ms		
Release time, max.		(1/2 cycle of voltage sine wave) + 1 ms		
Insulation resistance, min., Initial		100 M Ω between input, output and case		by 500V DC megger
Breakdown voltage		1,500 V AC between input, output and case	4,000 V AC between input, output and case	For 1 min.
Vibration resistance	Functional	10 to 55 Hz at double amplitude of 2 mm*		1 hour for X, Y, Z axes
	Destructive	10 to 55 Hz at double amplitude of 2 mm*		10 minutes for X, Y, Z axes
Shock resistance	Functional	Min. 980 m/s² {100 G}		5 time each for X, Y, Z axes
	Destructive	Min. 980 m/s² {100 G}		4 time each for X, Y, Z axes
Ambient temperature		–20°C to +80°C –4°F to +176°F		
Storage temperature		–25°C to +85°C –13°F to +185°F		
Operational method		Zero-cross (Turn-ON and Turn-OFF)		

Note: * 30 A and 40 A type is 10 to 55 Hz at double amplitude of 1.5 mm.

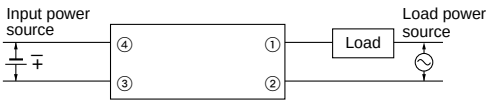
DIMENSIONS

mm inch

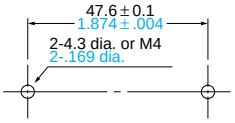
1. Plug-in terminal

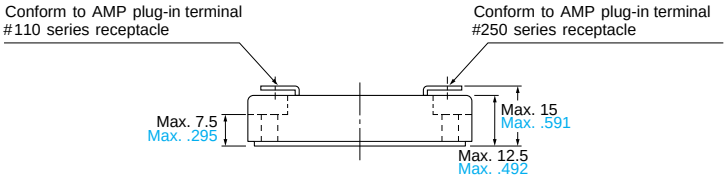


Schematic

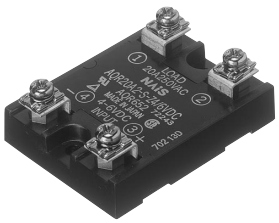


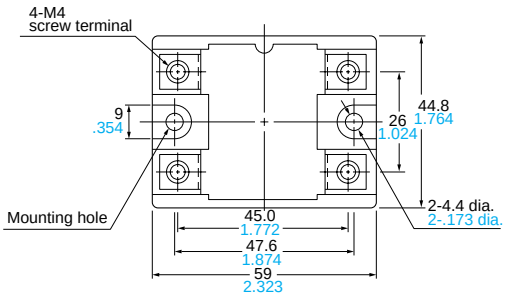
Mounting dimensions
(Bottom view)



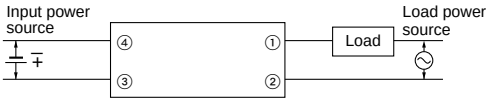


2. Screw terminal

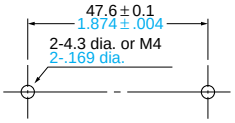


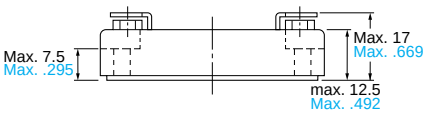


Schematic



Mounting dimensions
(Bottom view)

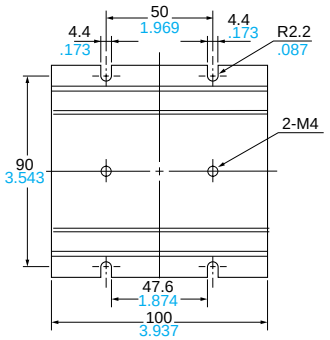


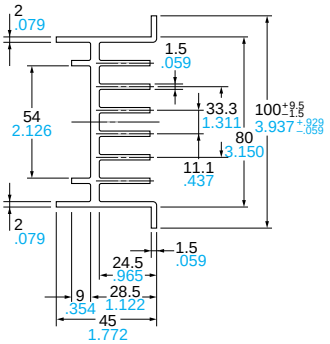


ACCESSORIES

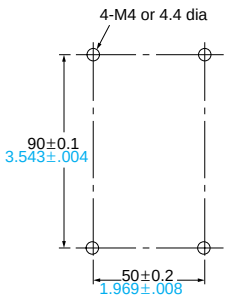
Heat sink (For 10 A, 15A and 20 A)

AQP-HS-20A





Mounting dimensions
(Bottom view)

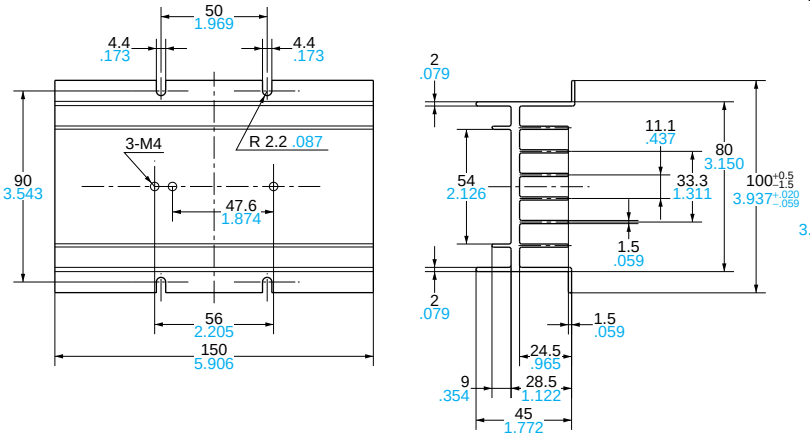


General tolerance: ±0.5 ±.020

Heat sink (For 30 A, 40 A)

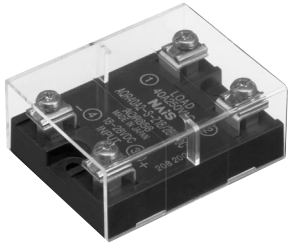
mm inch

AQP-HS-30/40A

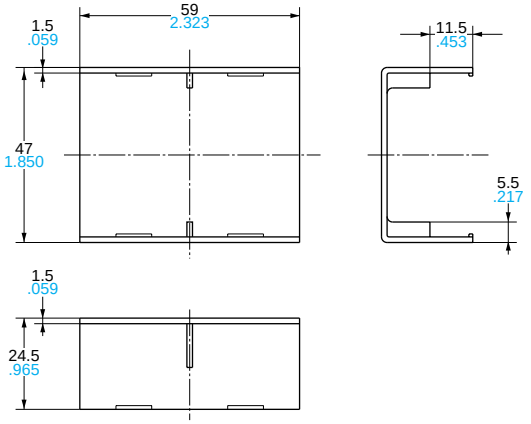


General tolerance: ±0.5 ±.020

With terminal cover



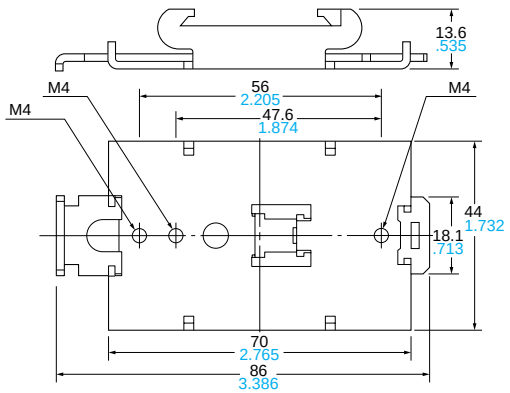
AQP-PC



General tolerance: ±0.5 ±.020

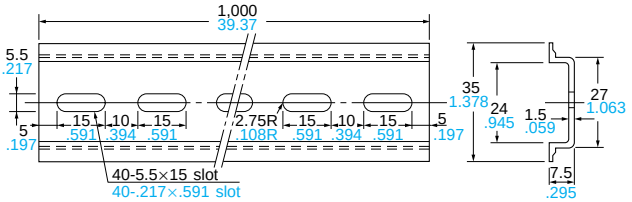
DIN rail mounting plate

AQP-DP



Mounting rail

AT8-DLA1

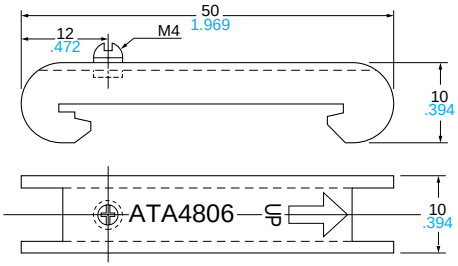


General tolerance: ±0.5 ±.020

Fastening plate

mm inch

ATA4806



REFERENCE DATA

1. Load current vs. ambient temperature

Use load current within range specified in the figure below.

Tested condition:

(1) With external heat sink

1) (a) 10 A, 15A, 20 A type

• A heat sink; optional heat sink (AQP801) or a 150×150×3.2 mm aluminum sheet (painted black)

(b) 30 A, 40 A type

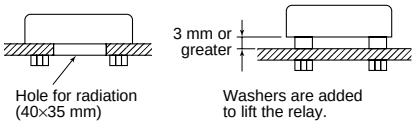
Shown with standard heat sink (AQP804)

2) If attached to a heat sink, use a heat-conductive compound or similar coating to improve cooling.

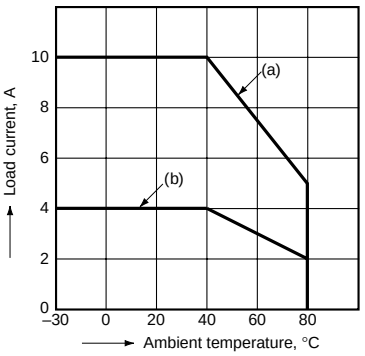
(2) Without external heat sink

If the mounting surface is not metallic and a heat sink is not used, expose the bottom surface and plate surface to improve heat dissipation.

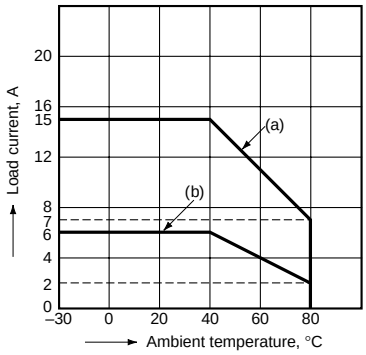
The graphs show the characteristics when the relay is mounted as shown in the right figure.



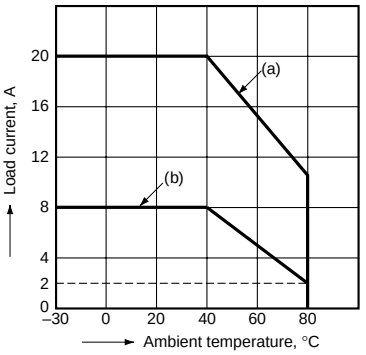
(1) 10 A type



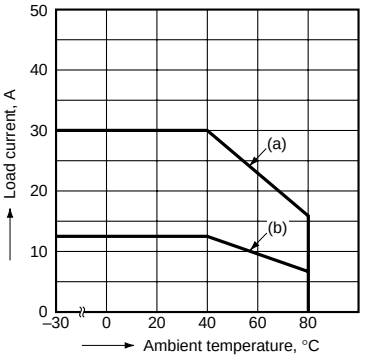
(2) 15 A type



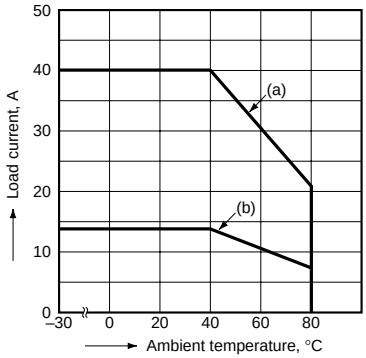
(3) 20 A type



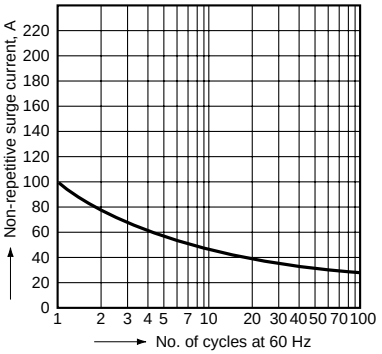
(4) 30 A type



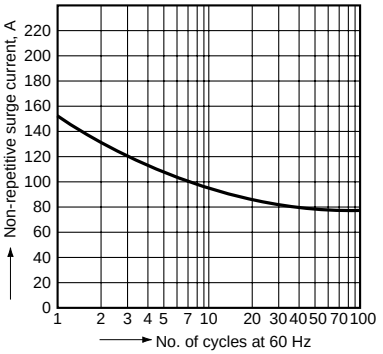
(5) 40 A type



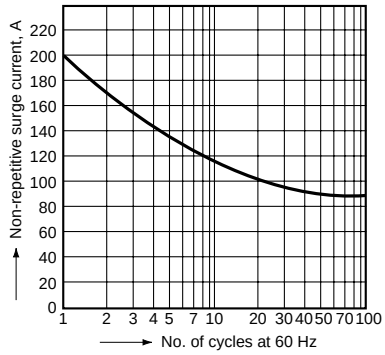
2-1. Non-repetitive surge current vs. carrying time (10 A type)



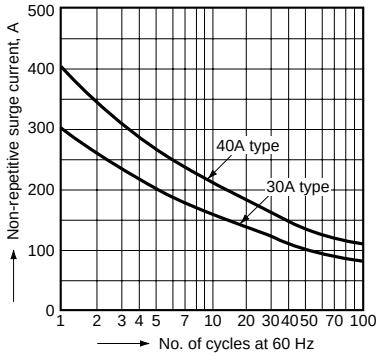
2-2. Non-repetitive surge current vs. carrying time (15 A type)



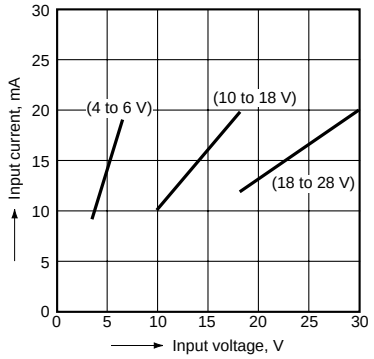
2-3. Non-repetitive surge current vs. carrying time (20 A type)



2-4. Non-repetitive surge current vs. carrying time (30 A, 40 A type)



3. Input voltage vs. input current (10 A, 15 A, 20 A, 30 A, 40 A common)

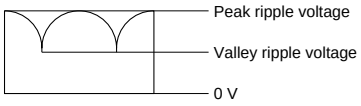


CAUTIONS FOR USE

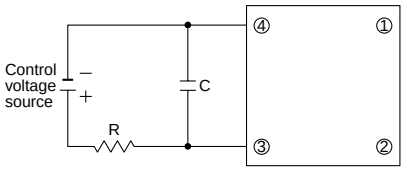
1. Input side

1) If the SSR control voltage contains ripple, the peak of the ripple should not exceed the maximum rated control voltage, and the bottom of the ripple should exceed the minimum rated control voltage.

Input voltage	Valley ripple voltage	Peak ripple voltage
4 to 6V DC	Min. 4 V	Max. 6 V
10 to 18V DC	Min. 10 V	Max. 18 V
18 to 28V DC	Min. 18 V	Max. 28 V

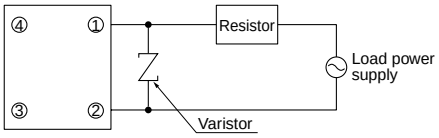


2) A high noise surge voltage applied to the SSR input circuit can cause malfunction or permanent damage to the device. If such a high surge is anticipated, use C or R noise absorber in the input circuit.

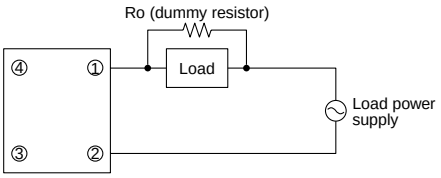


2. Output side

1) A high noise surge voltage applied to the SSR load circuit can cause malfunction or permanent damage to the device. If such a high surge is anticipated, use a varistor across the SSR output.



2) An SSR may malfunction if it is used below the specified load. In such an event, use a dummy resistor in parallel with the load.



Load specification: Load current min. 120 mA

3. When the input terminals are connected with reverse polarity

Reversing the polarity may cause permanent damage to the device. Take special care to avoid polarity reversal or use a protection diode in the input circuit.

4. Cleaning solvents compatibility

Dip cleaning with an organic solvent is recommended for removal of solder flux, dust, etc. Select a cleaning solvent from the following table. If ultrasonic cleaning must be used, the severity of factors such as frequency, output power and cleaning solvent selected may cause loose wires and other defects. Make sure these conditions are correct before use. For details, please consult us.

Cleaning solvent		Compatibility (❍: Yes ×: No)
Chlorine-base	• Trichlene • Chloroethlene	❍
Adueous	• Indusco • Hollis • Lonco Terg	❍
Alcohol-base	• IPA • Ethanol	❍
Others	• Thinner • Gasoline	×

5. Others

1) We recommend using a standard heat sink (AQP801/AQP804).
2) Make sure that the terminals are wired properly.
3) Be sure to take SSR layout and ventilation into account. Installing a heat source near another solid-state relay could raise the ambient temperature.
4) If attached to a heat sink, use a heat-conductive compound or similar coating to improve cooling.
5) Handle the exterior and interior boxes with care. Excessive vibration during transport could warp the terminals or damage the unit.
6) Storing the unit under extremely adverse conditions could damage the product's appearance or impact performance.
We recommend that the unit be stored in a location meeting the following requirements:
Temperature: 5 to 30°C 41 to 86°F
Humidity: Max. 60% RH
Atmosphere: Should be free of sulfurous acid and other toxic gasses, and relatively free from dust.

Thermal Design

SSRs used in high-reliability equipment require careful thermal design. In particular, junction temperature control has a significant effect on device function and life time. The rated load current for board-mounting SSRs is defined as the maximum current allowable at an ambient temperature of 40°C 104°F (30°C 86°F) and under natural cooling.