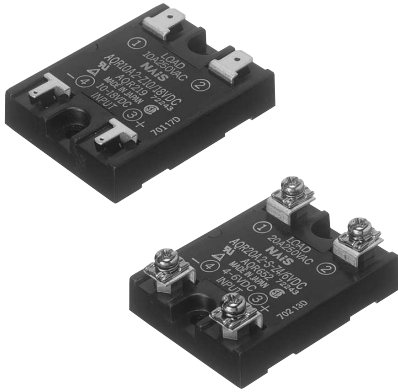


# NAIS

## 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) | Reinforced (4,000V AC) |
|-----------------|----------------|---------------|----------------------|------------------------|
|                 |                |               | Part No.             | 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) | Reinforced (4,000V AC) |
|-----------------|----------------|---------------|----------------------|------------------------|
|                 |                |               | Part No.             | 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<br>2: 75 to 250 V AC | Nil: Plug-in terminal<br>S: Screw terminal | Z: Zero-cross type (1,500 V)<br>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

| Part No.   |                                  | AQR10A1-Z4/<br>6VDC            | AQR10A1-Z10/<br>18VDC   | AQR10A1-Z18/<br>28VDC   | AQR10A2-Z4/<br>6VDC<br>AQR10A2-ZV4/<br>6VDC     | AQR10A2-Z10/<br>18VDC<br>AQR10A2-ZV10/<br>18VDC     | AQR10A2-Z18/<br>28VDC<br>AQR10A2-ZV18/<br>28VDC     | Remarks                  |
|------------|----------------------------------|--------------------------------|-------------------------|-------------------------|-------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|--------------------------|
|            |                                  | AQR10A1-S-Z4/<br>6VDC          | AQR10A1-S-Z10/<br>18VDC | AQR10A1-S-Z18/<br>28VDC | AQR10A2-S-Z4/<br>6VDC<br>AQR10A2-S-ZV4/<br>6VDC | AQR10A2-S-Z10/<br>18VDC<br>AQR10A2-S-<br>ZV10/18VDC | AQR10A2-S-Z18/<br>28VDC<br>AQR10A2-S-<br>ZV18/28VDC |                          |
| Items      |                                  |                                |                         |                         |                                                 |                                                     |                                                     |                          |
| 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

| Part No.   |                                  | AQR15A1-Z4/<br>6VDC            | AQR15A1-Z10/<br>18VDC   | AQR15A1-Z18/<br>28VDC   | AQR15A2-Z4/<br>6VDC<br>AQR15A2-ZV4/<br>6VDC     | AQR15A2-Z10/<br>18VDC<br>AQR15A2-ZV10/<br>18VDC     | AQR15A2-Z18/<br>28VDC<br>AQR15A2-ZV18/<br>28VDC     | Remarks                  |
|------------|----------------------------------|--------------------------------|-------------------------|-------------------------|-------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|--------------------------|
|            |                                  | AQR15A1-S-Z4/<br>6VDC          | AQR15A1-S-Z10/<br>18VDC | AQR15A1-S-Z18/<br>28VDC | AQR15A2-S-Z4/<br>6VDC<br>AQR15A2-S-ZV4/<br>6VDC | AQR15A2-S-Z10/<br>18VDC<br>AQR15A2-S-<br>ZV10/18VDC | AQR15A2-S-Z18/<br>28VDC<br>AQR15A2-S-<br>ZV18/28VDC |                          |
| Items      |                                  |                                |                         |                         |                                                 |                                                     |                                                     |                          |
| 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

| Part No.   |                                  | AQR20A1-Z4/<br>6VDC            | AQR20A1-Z10/<br>18VDC   | AQR20A1-Z18/<br>28VDC   | AQR20A2-Z4/<br>6VDC<br>AQR20A2-ZV4/<br>6VDC     | AQR20A2-Z10/<br>18VDC<br>AQR20A2-ZV10/<br>18VDC     | AQR20A2-Z18/<br>28VDC<br>AQR20A2-ZV18/<br>28VDC     | Remarks                  |
|------------|----------------------------------|--------------------------------|-------------------------|-------------------------|-------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|--------------------------|
|            |                                  | AQR20A1-S-Z4/<br>6VDC          | AQR20A1-S-Z10/<br>18VDC | AQR20A1-S-Z18/<br>28VDC | AQR20A2-S-Z4/<br>6VDC<br>AQR20A2-S-ZV4/<br>6VDC | AQR20A2-S-Z10/<br>18VDC<br>AQR20A2-S-<br>ZV10/18VDC | AQR20A2-S-Z18/<br>28VDC<br>AQR20A2-S-<br>ZV18/28VDC |                          |
| Items      |                                  |                                |                         |                         |                                                 |                                                     |                                                     |                          |
| 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

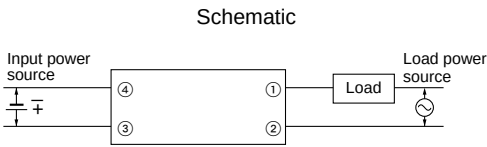
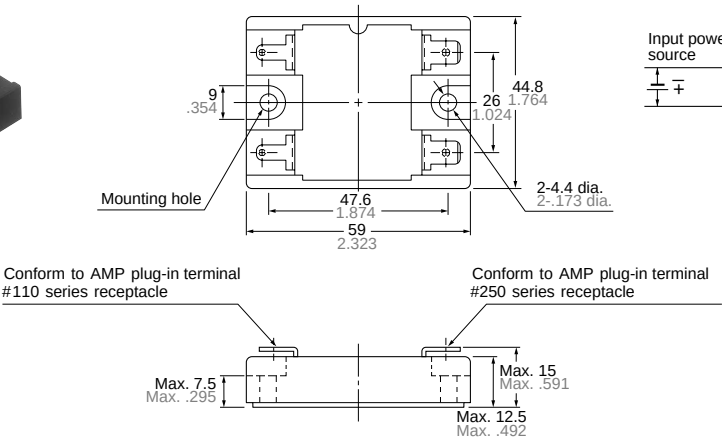
| Part No.   |                                  | AQR30A2-S-Z4/<br>6VDC        | AQR30A2-S-Z10/<br>18VDC | AQR30A2-S-Z18/<br>28VDC | AQR40A2-S-Z4/<br>6VDC | AQR40A2-S-Z10/<br>18VDC | AQR40A2-S-Z18/<br>28VDC | Remarks                  |
|------------|----------------------------------|------------------------------|-------------------------|-------------------------|-----------------------|-------------------------|-------------------------|--------------------------|
| 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)

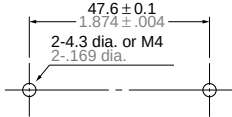
| Type                                 |             | Zero-cross type                               |                                           | Remarks                      |
|--------------------------------------|-------------|-----------------------------------------------|-------------------------------------------|------------------------------|
|                                      |             | 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 $\Omega$ 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/s <sup>2</sup> {100 G}             |                                           | 5 time each for X, Y, Z axes |
|                                      | Destructive | Min. 980 m/s <sup>2</sup> {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.

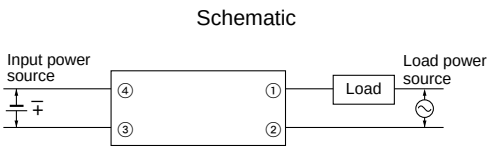
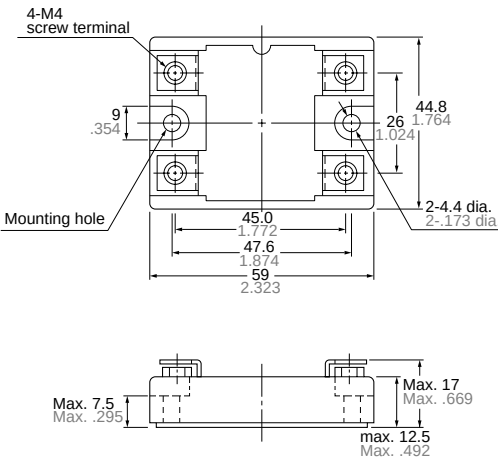
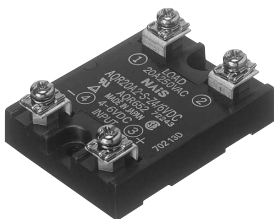
1. Plug-in terminal



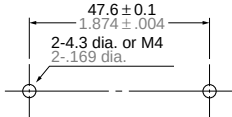
Mounting dimensions (Bottom view)



2. Screw terminal



Mounting dimensions (Bottom view)

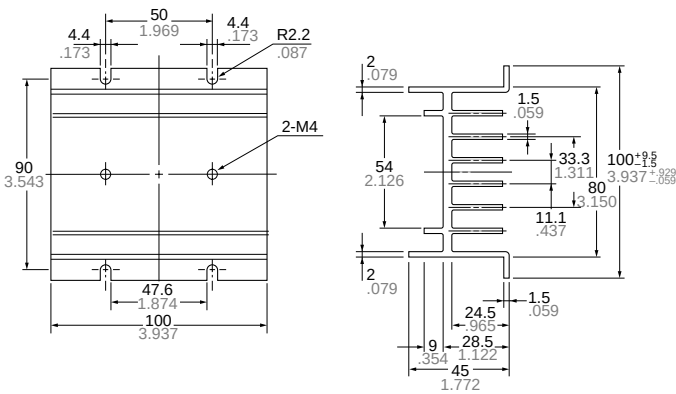


ACCESSORIES

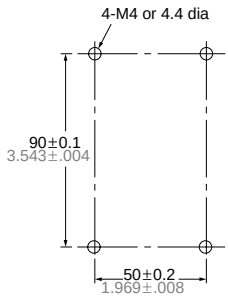
Heat sink (For 10 A, 15A and 20 A)



AQP-HS-20A



Mounting dimensions (Bottom view)

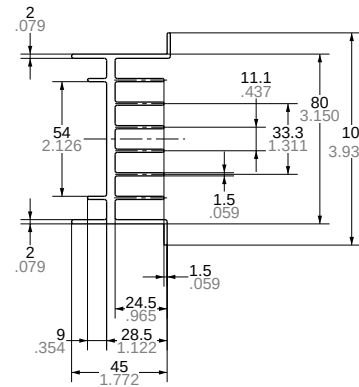
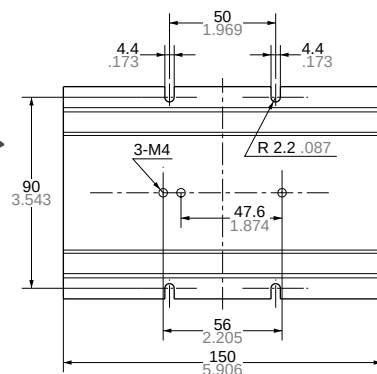


General tolerance: ±0.5 ±.020

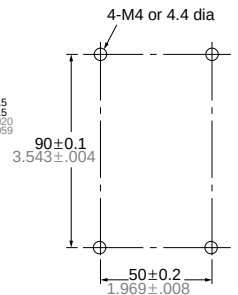
Heat sink (For 30 A, 40 A)



AQP-HS-30/40A

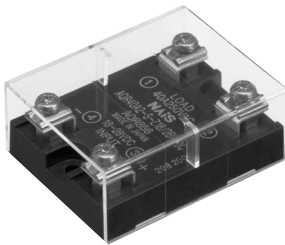


Mounting dimensions  
(Bottom view)

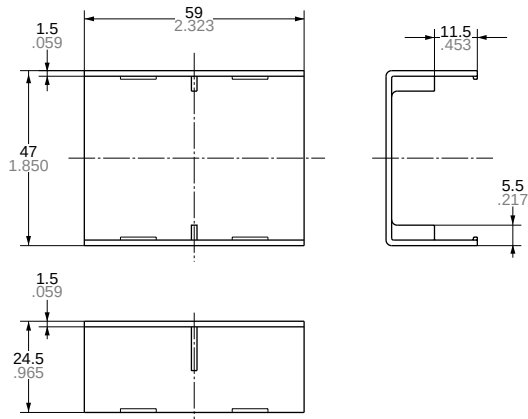


General tolerance:  $\pm 0.5 \pm .020$

With terminal cover



AQP-PC



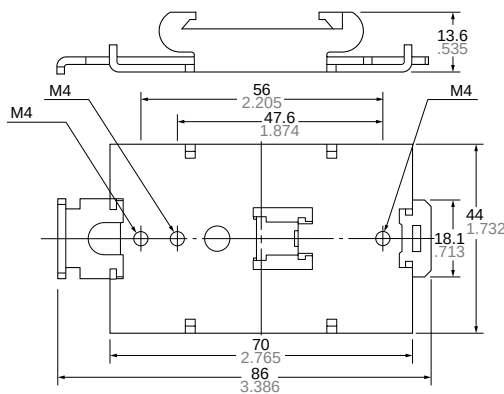
General tolerance:  $\pm 0.5 \pm .020$

DIN rail mounting plate

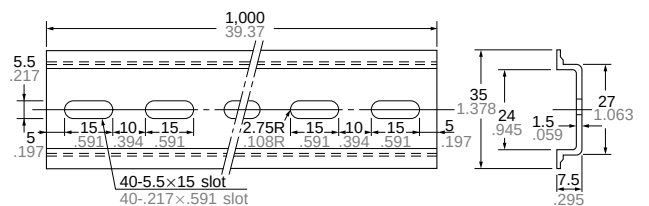
Mounting rail



AQP-DP



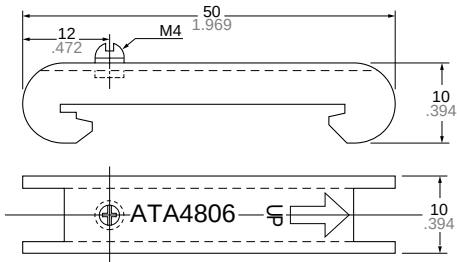
AT8-DLA1



General tolerance:  $\pm 0.5 \pm .020$



ATA4806



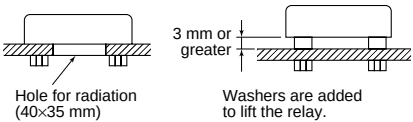
REFERENCE DATA

1. Load current vs. ambient temperature  
Use load current within range specified in the figure below.

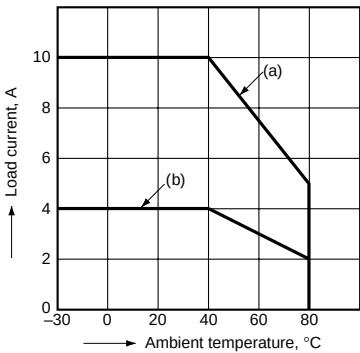
Tested condition:

- (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.

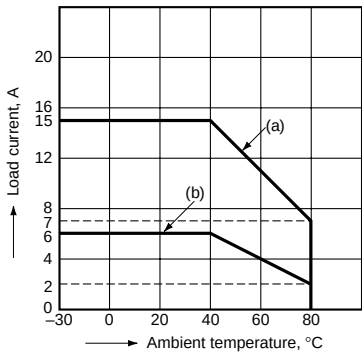
The graphs show the characteristics when the relay is mounted as shown in the right figure.



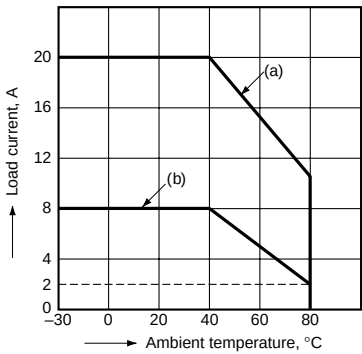
(1) 10 A type



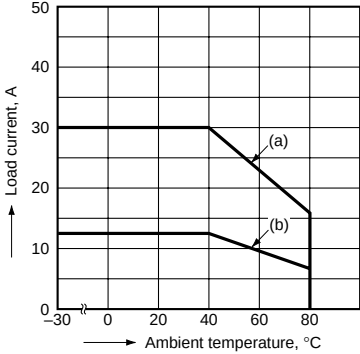
(2) 15 A type



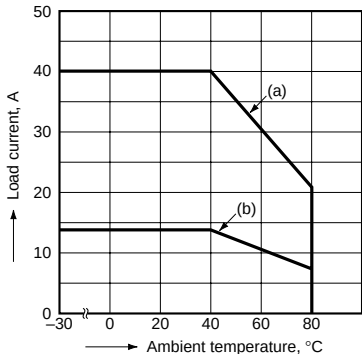
(3) 20 A type



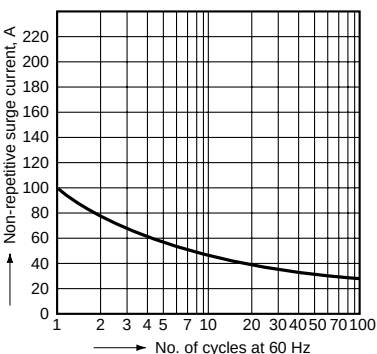
(4) 30 A type



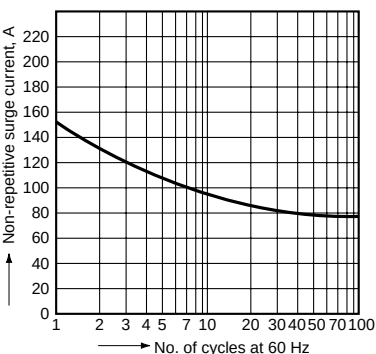
(5) 40 A type



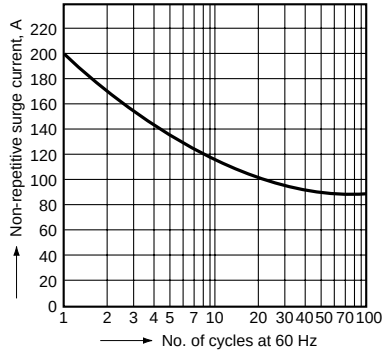
2-1. Non-repetitive surge current vs. carrying time (10 A type)



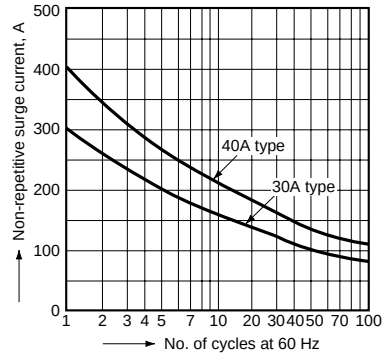
2-2. Non-repetitive surge current vs. carrying time (15 A type)



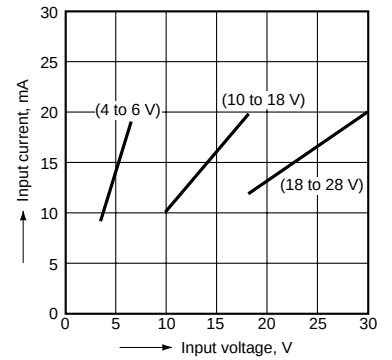
2-3. Non-repetitive surge current vs. carrying time (20 A type)



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



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



**For Cautions for Use, see Page 24 to 27.**