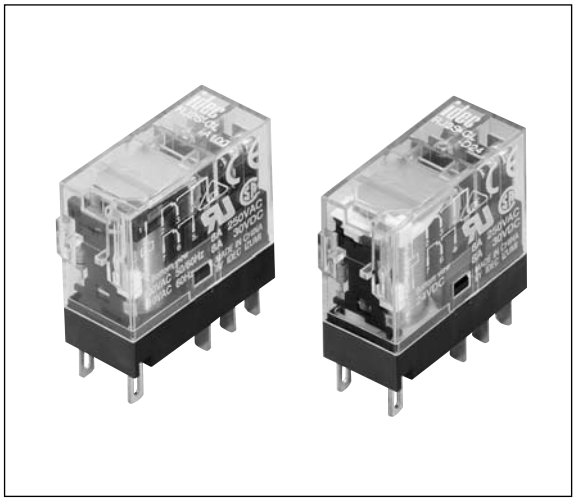
# RJ Series Slim Power Relays

## Compact and rugged power relays. Large switching capacity.

- Compact housing only 12.7-mm wide.
  Large contact rating
  RJ1S (1-pole): 12A
  RJ2S (2-pole): 8A
- Non-polarized LED indicator available. IDEC's unique light guide structure enables high visibility of coil status from any direction.
- Excellent electrical and mechanical life.
  Electrical life: 200,000 operations (AC load)
  Mechanical life: 30 million operations (AC coil)
- Environmentally friendly, RoHS directive compliant (EU directive 2002/95/EC). Contains no lead, cadmium, mercury, hexavalent chromium, PBB or PBDE).
- Diode type
  Diode reverse withstand voltage: 1000V
- UL recognized, CSA certified, EN compliant.



| Standard | Mark | Certification Organization / File No. |
|---|---|---|
| UL508 | | UL File No. E55996 |
| CSA C22.2 No. 14 | | 1608322 (LR35144) |
| EN61810-1 | VDE Reg.-Nr. B312 | VDE (REG.-Nr. B312) |
| | CE | EC Low Voltage Directive |

## Types

**• Plug-in Terminal Type**

| Type | 1-pole (SPDT) | | 2-pole (DPDT) | |
|---|---|---|---|---|
| | Type No. | Code | Type No. | Code |
| Standard (with LED Indicator) | RJ1S-CL-∗ | A24<br>A110<br>A120<br>A220<br>A230<br>A240<br>D12<br>D24<br>D48<br>D100 | RJ2S-CL-∗ | A24<br>A110<br>A120<br>A220<br>A230<br>A240<br>D12<br>D24<br>D48<br>D100 |
| Simple (without LED Indicator) | RJ1S-C-∗ | | RJ2S-C-∗ | |
| With diode (DC coil only) (with LED indicator)<br>A1: –, A2: + | RJ1S-CLD-∗ | D12<br>D24<br>D48<br>D100 | RJ2S-CLD-∗ | D12<br>D24<br>D48<br>D100 |
| With diode (DC coil only)<br>A1: –, A2: + | RJ1S-CD-∗ | | RJ2S-CD-∗ | |
| With diode (DC coil only) (with LED indicator)<br>A1: +, A2: – | RJ1S-CLD1-∗ | | RJ2S-CLD1-∗ | |
| With diode (DC coil only)<br>A1: +, A2: – | RJ1S-CD1-∗ | | RJ2S-CD1-∗ | |

**• Coil Voltage Code ∗**

| Code | Rated Coil Voltage |
|---|---|
| A24 | 24V AC |
| A110 | 110V AC |
| A120 | 120V AC |
| A220 | 220V AC |
| A230 | 230V AC |
| A240 | 240V AC |
| D12 | 12V DC |
| D24 | 24V DC |
| D48 | 48V DC |
| D100 | 100-110V DC |

Note: Specify a coil voltage code in place of ∗ in the Type No.

## Contact Ratings

| No. of Poles | Contact | Allowable Contact Power | | Rated Load | | | Allowable Switching Current | Allowable Switching Voltage | Minimum Applicable Load (Note) |
|---|---|---|---|---|---|---|---|---|---|
| | | Resistive Load | Inductive Load | Voltage | Resistive Load | Inductive Load cos ø = 0.3 L/R = 7 ms | | | |
| 1 | NO | 3000VA AC<br>360W DC | 1875VA AC<br>180W DC | 250V AC | 12A | 7.5A | 12A | 250V AC<br>125V DC | 5V DC, 100 mA<br>(reference value) |
| | | | | 30V DC | 12A | 6A | | | |
| | NC | 3000VA AC<br>180W DC | 1875VA AC<br>90W DC | 250V AC | 12A | 7.5A | | | |
| | | | | 30V DC | 6A | 3A | | | |
| 2 | NO | 2000VA AC<br>240W DC | 1000VA AC<br>120W DC | 250V AC | 8A | 4A | 8A | 250V AC<br>125V DC | 5V DC, 10 mA<br>(reference value) |
| | | | | 30V DC | 8A | 4A | | | |
| | NC | 2000VA AC<br>120W DC | 1000VA AC<br>60W DC | 250V AC | 8A | 4A | | | |
| | | | | 30V DC | 4A | 2A | | | |

Note: Measured at operating frequency of 120 operations per minute (failure rate level P, reference value)

## Approved Ratings

| Voltage | UL | | | | CSA | | | | | | | | VDE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Resistive | | | | Resistive | | | | Inductive | | | | Resistive | | AC-15, DC-13 (Note) | |
| | RJ1 | | RJ2 | | RJ1 | | RJ2 | | RJ1 | | RJ2 | | RJ1 | RJ2 | RJ1 | RJ2 |
| | NO | NC | NO | NC | NO | NC | NO | NC | NO | NC | NO | NC | NO | NO | NO | NO |
| 250V AC | 12A | 12A | 8A | 8A | 12A | 12A | 8A | 8A | 7.5A | 7.5A | 4A | 4A | 12A | 8A | 6A | 3A |
| 30V DC | 12A | 6A | 8A | 4A | 12A | 6A | 8A | 4A | 6A | 3A | 4A | 2A | 12A | 8A | 2.5A | 2A |

Note: According to the utilization categories of IEC60947-5-1

## Coil Ratings

| Rated Voltage | | Coil Voltage Code | Without LED Indicator | | | With LED Indicator | | | Operating Characteristics (against rated values at 20°C) | | | Power Consumption |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Rated Current (mA) ±15% (at 20°C) | | Coil Resistance (Ω) ±10% (at 20°C) | Rated Current (mA) ±15% (at 20°C) | | Coil Resistance (Ω) ±10% (at 20°C) | Minimum Pickup Voltage | Dropout Voltage | Maximum Continuous Applied Voltage (Note) | |
| | | | 50 Hz | 60 Hz | | 50 Hz | 60 Hz | | | | | |
| AC 50/60 Hz | 24V AC | A24 | 43.9 | 37.5 | 243 | 47.5 | 41.1 | 243 | 80% maximum | 30% minimum | 140% | Approx. 0.9 VA (60Hz) |
| | 110V AC | A110 | 9.6 | 8.2 | 5270 | 9.5 | 8.1 | 5270 | | | | |
| | 120V AC | A120 | 8.8 | 7.5 | 6400 | 8.7 | 7.4 | 6400 | | | | |
| | 220V AC | A220 | 4.8 | 4.1 | 21530 | 4.8 | 4.1 | 21530 | | | | |
| | 230V AC | A230 | 4.6 | 3.9 | 24100 | 4.6 | 3.9 | 24100 | | | | |
| | 240V AC | A240 | 4.3 | 3.7 | 25570 | 4.3 | 3.7 | 25570 | | | | |
| DC | 12V | D12 | 44.2 | | 271 | 48.0 | | 271 | 70% maximum | 10% minimum | 170% | Approx. 0.53W |
| | 24V | D24 | 22.1 | | 1080 | 25.7 | | 1080 | | | | |
| | 48V | D48 | 11.0 | | 4340 | 10.7 | | 4340 | | | | |
| | 100-110V | D100 | 5.3-5.8 | | 18870 | 5.2-5.7 | | 18870 | | | 160% | |

Note: Maximum continuous applied voltage is the maximum voltage that can be applied on relay coils.

## Specifications

| Type | | RJ1S | RJ2S |
|---|---|---|---|
| Number of Poles | | 1-pole | 2-pole |
| Contact Configuration | | SPDT | DPDT |
| Contact Material | | Silver-nickel alloy | |
| Degree of Protection | | IP40 | |
| Contact Resistance (initial value) (∗1) | | 50 mΩ maximum | |
| Operate Time (∗2) | | 15 ms maximum | |
| Release Time (∗2) | | 10 ms maximum (with diode: 20 ms maximum) | |
| Dielectric Strength | Between contact and coil | 5000V AC, 1 minute | 5000V AC, 1 minute |
| | Between contacts of the same pole | 1000V AC, 1 minute | 1000V AC, 1 minute |
| | Between contacts of different poles | — | 3000V AC, 1 minute |
| Vibration Resistance | Operating extremes | 10 to 55 Hz, amplitude 0.75 mm | |
| | Damage limits | 10 to 55 Hz, amplitude 0.75 mm | |
| Shock Resistance | Operating extremes | NO contact: 200 $m/s^2$, NC contact: 100 $m/s^2$ | |
| | Damage limits | 1000 $m/s^2$ | |
| Electrical Life (rated load) | | AC load: 200,000 operations minimum (operation frequency 1800 operations per hour)<br>DC load: 100,000 operations minimum (operation frequency 1800 operations per hour) | |
| Mechanical Life (no load) | | AC coil: 30,000,000 operations minimum (operation frequency 18,000 operations per hour)<br>DC coil: 50,000,000 operations minimum (operation frequency 18,000 operations per hour) | |
| Operating Temperature (∗3) | | –40 to +70°C (no freezing) | |
| Operating Humidity | | 5 to 85% RH (no condensation) | |
| Weight (approx.) | | 19g | |

Note: Above values are initial values.

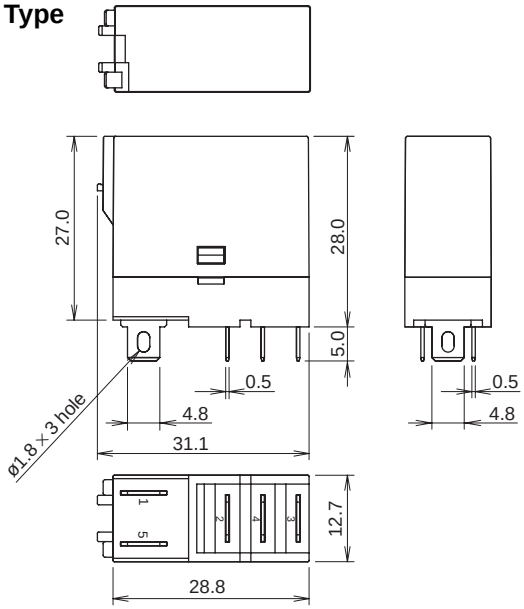
∗1: Measured using 5V DC, 1A voltage drop method.

∗2: Measured at the rated voltage (at 20°C), excluding contact bounce time.

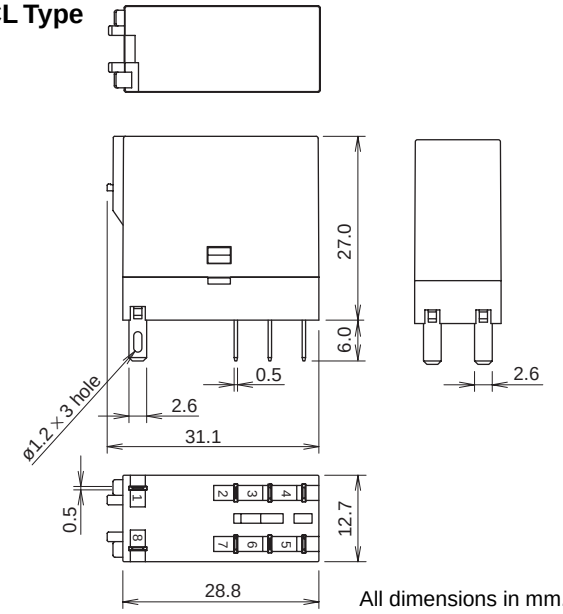
∗3: 100% rated voltage.

## Dimensions

- **RJ1S Type**



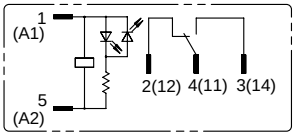

- **RJ2S-CL Type**



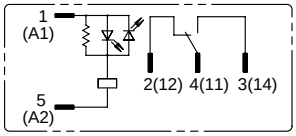

All dimensions in mm.

## Internal Connection Diagrams

- **RJ1S-CL-∗ Standard Type (w/LED Indicator)**

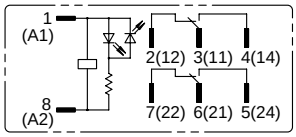



Coil voltage 24V AC/DC and below

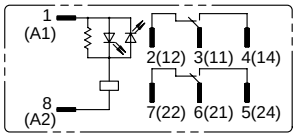



Coil voltage greater than 24V AC/DC

- **RJ2S-CL-∗ Standard Type (w/LED Indicator)**

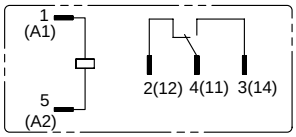



Coil voltage 24V AC/DC and below

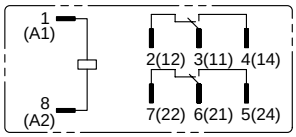



Coil voltage greater than 24V AC/DC

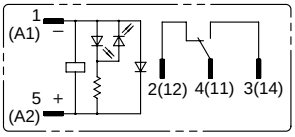
- **RJ1S-C-∗ Simple Type**



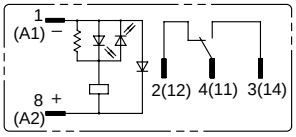

- **RJ2S-C-∗ Simple Type**




- **RJ1S-CLD-∗ With Diode (w/LED Indicator)**

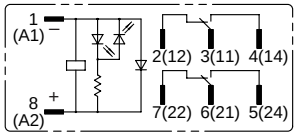



Coil voltage 24V DC and below

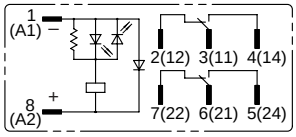



Coil voltage greater than 24V DC

- **RJ2S-CLD-∗ With Diode (w/LED Indicator)**

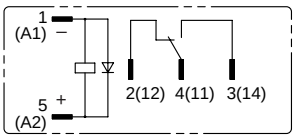



Coil voltage 24V DC and below

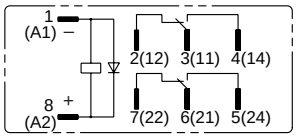



Coil voltage greater than 24V DC

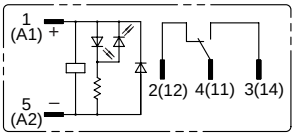
- **RJ1S-CD-∗ With Diode**



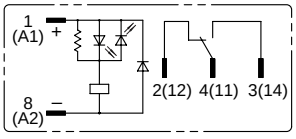

- **RJ2S-CD-∗ With Diode**




- **RJ1S-CLD1-∗ With Diode (w/LED Indicator)**

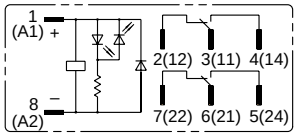



Coil voltage 24V DC and below

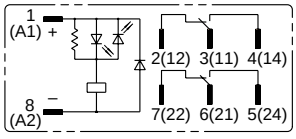



Coil Voltage greater than 24V DC

- **RJ2S-CLD1-∗ With Diode (w/LED Indicator)**

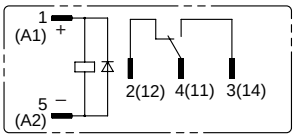



Coil voltage 24V DC and below

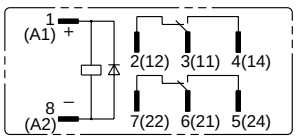



Coil voltage greater than 24V DC

- **RJ1S-CD1-∗ With Diode**

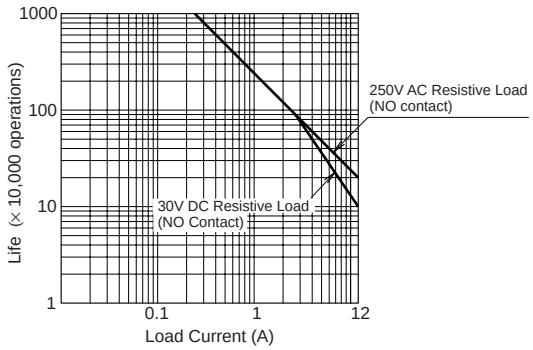



- **RJ2S-CD1-∗ With Diode**

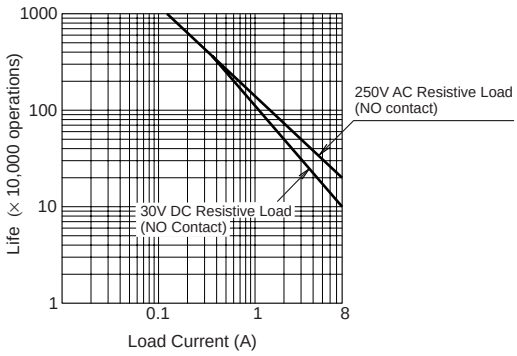


## Electrical Life Curve

**• RJ1 (resistive load)**

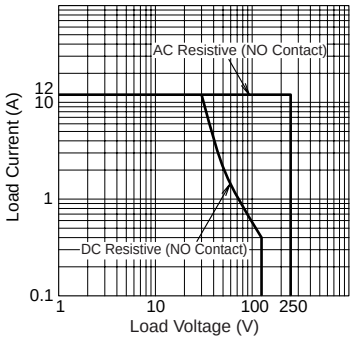



**• RJ2 (resistive load)**

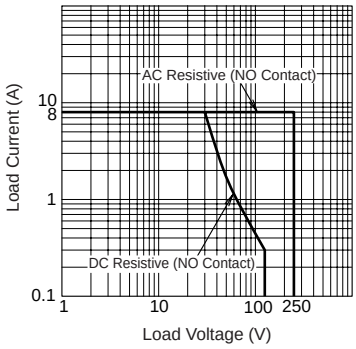



## Maximum Switching Capacity

**• RJ1 (resistive load)**

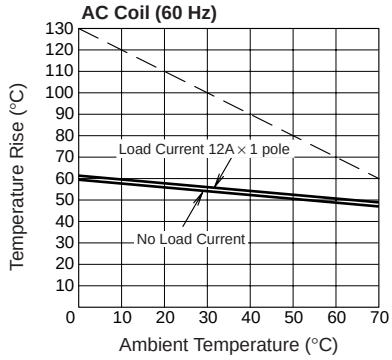


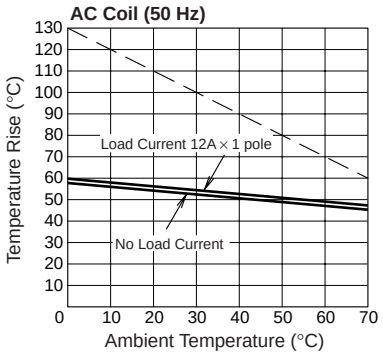

**• RJ2 (resistive load)**

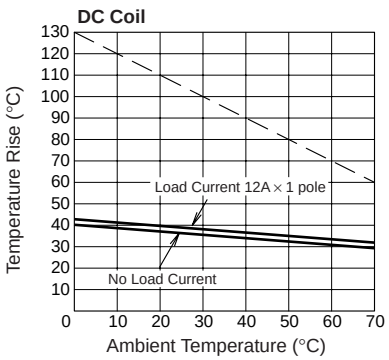



## Operating Temperature and Coil Temperature Rise

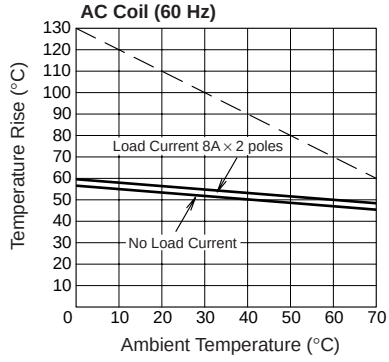
**• RJ1**

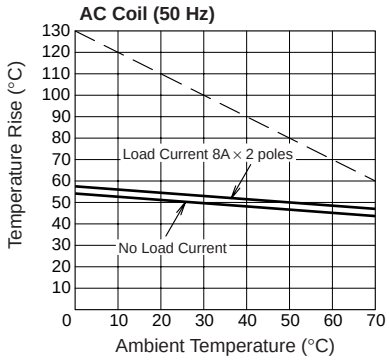


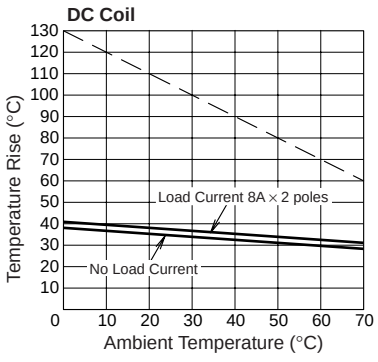




**• RJ2**



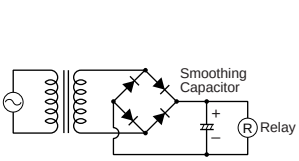

The above temperature rise curves show characteristics when 100% the rated coil voltage is applied.
The slanted dashed line indicates allowable temperature rise for the coil at different ambient temperatures.

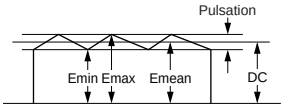
# Instructions

## Driving Circuit for Relays

1. To make sure of correct relay operation, apply rated voltage to the relay coil.
2. Input voltage for the DC coil:

   A complete DC voltage is best for the coil power to make sure of stable relay operation. When using a power supply containing a ripple voltage, suppress the ripple factor within 5%. When power is supplied through a rectification circuit, the relay operating characteristics, such as pickup voltage and dropout voltage, depend on the ripple factor. Connect a smoothing capacitor for better operating characteristics as shown below.



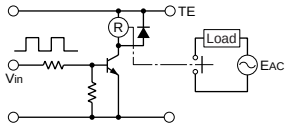



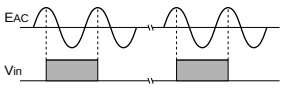

$$\text{Ripple Factor (\%)} \quad \frac{\text{Emax} - \text{Emin}}{\text{Emean}} \times 100\%$$

Emax = Maximum of pulsating current
Emin = Minimum of pulsating current
Emean = DC mean value

3. Operating the relay in synchronism with AC load:

   If the relay operates in synchronism with the AC power voltage of the load, the relay life may be reduced. If this is the case, select a relay in consideration of the required reliability for the load. Or, make the relay turn on and off irrespective of the AC power phase or near the point where the AC phase crosses zero voltage.

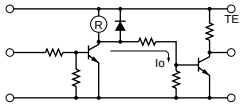


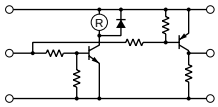

4. Leakage current while relay is off:

   When driving an element at the same time as the relay operation, a special consideration is needed for the circuit design. As shown in the incorrect circuit below, leakage current (Io) flows through the relay coil while the relay is off. Leakage current causes the coil release failure or adversely affects the vibration resistance and shock resistance. Design a circuit as shown in the correct example.

**Incorrect**

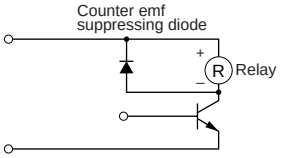



**Correct**




5. Surge suppression for transistor driving circuits:

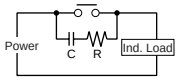
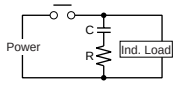
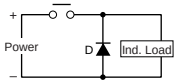
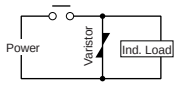
   When the relay coil is turned off, a high-voltage pulse is generated, causing the transistor to deteriorate and sometimes to break. Be sure to connect a diode to suppress the counter electromotive force. Then, the coil release time becomes slightly longer. To shorten the coil release time, connect a Zener diode between the collector and emitter of the transistor. Select a Zener diode with a Zener voltage slightly higher than the power voltage.



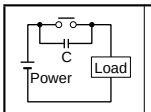
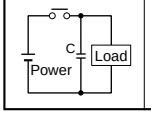

## Protection for Relay Contacts

1. The contact ratings show maximum values. Make sure that these values are not exceeded. When an inrush current flows through the load, the contact may become welded. If this is the case, connect a contact protection circuit, such as a current limiting resistor.
2. Contact protection circuit:

   When switching an inductive load, arcing causes carbides to form on the contacts, resulting in an increased contact resistance. In consideration of contact reliability, contact life, and noise suppression, use of a surge absorbing circuit is recommended. Note that the release time of the load becomes slightly longer. Check the operation using the actual load. Incorrect use of a contact protection circuit will adversely affect switching characteristics. Four typical examples of contact protection circuits are shown in the following table:

| | | |
|---|---|---|
| RC |  | This protection circuit can be used when the load impedance is smaller than the RC impedance in an AC load power circuit.<br>R: Resistor of approximately the same resistance value as the load<br>C: 0.1 to 1 µF |
| RC |  | This protection circuit can be used for both AC and DC load power circuits.<br>R: Resistor of approximately the same resistance value as the load<br>C: 0.1 to 1 µF |
| Diode |  | This protection circuit can be used for DC load power circuits. Use a diode with the following ratings.<br>Reverse withstand voltage:<br>Power voltage of the load circuit × 10<br>Forward current:<br>More than the load current |
| Varistor |  | This protection circuit can be used for both AC and DC load power circuits.<br>For a best result, when using on a power voltage of 24 to 48V AC/DC, connect a varistor across the load. When using on a power voltage of 100 to 240V AC/DC, connect a varistor across the contacts. |

3. Do not use a contact protection circuit as shown below:

| | |
|---|---|
|  | This protection circuit is very effective in arc suppression when opening the contacts. But, the capacitor is charged while the contacts are opened. When the contacts are closed, the capacitor is discharged through the contacts, increasing the possibility of contact welding. |
|  | This protection circuit is very effective in arc suppression when opening the contacts. But, when the contacts are closed, a current flows to charge the capacitor, causing contact welding. |

Generally, switching a DC inductive load is more difficult than switching a DC resistive load. Using an appropriate arc suppressor, however, will improve the switching characteristics of a DC inductive load.

## Other Precautions

1. General notice:

   To maintain the initial characteristics, do not drop the relay or shock the relay.

   The relay cover cannot be removed from the base during normal operation. To maintain the initial characteristics, do not remove the relay cover.

   Use the relay in environments free from condensation, dust, sulfur dioxide ($SO_2$), and hydrogen sulfide ($H_2S$).

   Make sure that the coil voltage does not exceed the applicable coil voltage range.

2. Connecting outputs to electronic circuits:

   When the output is connected to a load which responds very quickly, such as an electronic circuit, contact bouncing causes incorrect operation of the load. Take the following measures into consideration.

   - Connect an integral circuit.
   - Suppress the pulse voltage due to bouncing within the noise margin of the load.

3. UL- and CSA-approved ratings may differ from product rated values determined by IDEC.
4. Do not use relays in the vicinity of strong magnetic field, as this may affect relay operation.