SPECSIFICATIONS

Contact

Arrangement 1 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A) 60 mΩ
Initial contact pressure Approx. 5 g .18 oz
Contact material Gold cobalt

Electrostatic capacitance

Contact type Sealed type 3 pF
Magnetically sealed type 4 pF
N.O. contact-coil type Sealed type 5 pF
Magnetically sealed type 6 pF
Nominal switching capacity 1A 20 VDC, 0.3A 110 VAC

Rating (resistive)

Max. switching power 33 VA, 100 W
Max. switching voltage 110 V AC, 30 V DC
Max. switching current AC 0.3 A, DC 1 A
Min. switching power Approx. 100 mV 10µA

UL/CSA rating Mechanical (at 500 cps.) 0.3 A 125 V AC, 1 A 30 V DC

Expected life (min. operations)

Mechanical (at 500 cps.) 1 A 20 VDC, 0.3 A 110 VAC 10⁷ (at 1 cps.)
Electrical (resistive) 0.3 A 20 VDC, 0.3 A 110 VAC 10⁷ (at 1 cps.)
0.25 A 20 VDC, 0.25 A 110 VAC 3 x 10⁹ (at 2 cps.)
0.2 A 24 VDC, 0.2 A 24 VAC 5 x 10⁹ (at 5 cps.)
0.1 A 12 VDC, 0.1 A 12 VAC 10¹⁰ (at 25 cps.)
0.1 A 9 V DC, 0.1 A 9 V AC 5 x 10¹⁰ (at 50 cps.)
0.1 A 6 V DC, 0.1 A 6 V AC 10¹³ (at 100 cps.)

Coil (polarized) (at 25°C 77°F)

Minimum operating power Single side stable 72 to 133 mW
1 coil latching 41 to 45 mW
2 coil latching 72 to 107 mW
Nominal operating power Single side stable 147 to 300 mW
1 coil latching 74 to 153 mW
2 coil latching 147 to 331 mW

Characteristics (at 25°C 77°F)

Max. operating speed 500 cps. (mechanical)
Initial insulation resistance Min. 1,000 MΩ at 500 V DC²
Between live parts and ground 1,000 Vrms
Between open contact 350 Vrms (500 V DC)
Between contact and coil 1,000 Vrms
Operate time*4 (at nominal voltage) Max. 3 ms (Approx. 1 ms)
Release time(without diode)*4 (at nominal voltage) Max. 2 ms (Approx. 0.5 ms)
Contact bounce time Single side stable Approx. 0.5 ms
1-coil /2-coil latching Approx. 0.3 ms

Temperature rise Max. 35°C at 0.5 W operating power
Max. 65°C at 1 W operating power

Shock resistance Functional*⁵ Min. 980 m/s² (100 G)
Destructive*⁶ Min. 980 m/s² (100 G)

Vibration resistance Functional*⁷ 98 m/s² (10 G), 10 to 55 Hz
at double amplitude of 1.6 mm*⁸
Destructive 117.6 m/s² (12 G), 10 to 55 Hz
at double amplitude of 2 mm

Conditions for operation, transport and storage*⁹
(Not freezing and condensing at low temperature) Ambient temp. −55°C to +65°C*¹⁰
−67°F to +149°F
Humidity 5 to 85% R.H.

Unit weight Approx. 7 g .25 oz

Remarks

*1 Measurement at same location as “Initial breakdown voltage” section
*2 Min. 500MΩ at 100 VDC between coils of 2 coil latching type
*3 Not meaningful for between coils of 2 coil latching type
*4 Excluding contact bounce time
*5 Half-wave pulse of sine wave: 6ms; detection time: 10µs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10µs
*8 Although R relays are rated at 10 G/55 cps. vibration resistance, they will withstand up to 60 G/2,000 cps., provided they receive additional support such as anchoring to the PC board with epoxy resin.
*9 Refer to Section 5. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (Page 49)

TYPICAL APPLICATIONS

Telecommunications equipment, alarm devices, machine tools, NC machines, automatic warehouse control, conveyors, air-conditioners, pressing machines, textile machinery, elevators, control panels, pin-board programmers, parking meters, industrial robots, detectors, annunciators, optical instruments, business machines, time recorders, cash registers, copiers, vending machines, medical equipment.
ORDERING INFORMATION

- Types of case
  - H: Sealed
  - S: Magnetically sealed

- Operating function
  - Nil: Single side stable
  - L: 1 coil latching
  - L2: 2 coil latching

Coil voltage (DC)
- 5, 6, 12, 24, 42 V

(Notes) 1. Power types and 1 Form A types are available on request.
2. For UL/CSA recognized types, delete “N” at head portion of part No. and add suffix UL/CSA, when ordering. Ex. RSD-12V UL/CSA

TYPES AND COIL DATA at 25°C 77°F

Single side stable (R-SD)

<table>
<thead>
<tr>
<th>Nominal coil voltage, V DC</th>
<th>Pick-up voltage, V DC (max.)</th>
<th>Drop-out voltage V DC (min.)</th>
<th>Maximum allowable voltage, V DC (40°C)</th>
<th>Coil resistance, Ω (±10%)</th>
<th>Nominal operating power, mW</th>
<th>Inductance, Henrys</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>3.5</td>
<td>0.5</td>
<td>13</td>
<td>170</td>
<td>147</td>
<td>0.050</td>
</tr>
<tr>
<td>6</td>
<td>4.7</td>
<td>0.6</td>
<td>14</td>
<td>220</td>
<td>164</td>
<td>0.075</td>
</tr>
<tr>
<td>12</td>
<td>9.4</td>
<td>1.2</td>
<td>28</td>
<td>890</td>
<td>162</td>
<td>0.3</td>
</tr>
<tr>
<td>24</td>
<td>16</td>
<td>2.4</td>
<td>42</td>
<td>2,000</td>
<td>288</td>
<td>0.66</td>
</tr>
<tr>
<td>42</td>
<td>28</td>
<td>4.2</td>
<td>85</td>
<td>8,000</td>
<td>221</td>
<td>2.7</td>
</tr>
</tbody>
</table>

1 coil latching (R-SLD)

<table>
<thead>
<tr>
<th>Nominal coil voltage, V DC</th>
<th>Pick-up voltage, V DC (max.)</th>
<th>Maximum allowable voltage, V DC (40°C)</th>
<th>Coil resistance, Ω (±10%)</th>
<th>Nominal operating power, mW</th>
<th>Inductance, Henrys</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>3.5</td>
<td>18</td>
<td>340</td>
<td>74</td>
<td>0.12</td>
</tr>
<tr>
<td>6</td>
<td>4.3</td>
<td>20</td>
<td>450</td>
<td>80</td>
<td>0.16</td>
</tr>
<tr>
<td>12</td>
<td>8.0</td>
<td>30</td>
<td>1,500</td>
<td>96</td>
<td>0.66</td>
</tr>
<tr>
<td>24</td>
<td>17</td>
<td>75</td>
<td>6,000</td>
<td>96</td>
<td>2.4</td>
</tr>
<tr>
<td>42</td>
<td>23</td>
<td>110</td>
<td>12,000</td>
<td>147</td>
<td>3.9</td>
</tr>
</tbody>
</table>

2 coil latching (R-SL2D)

<table>
<thead>
<tr>
<th>Nominal coil voltage, V DC</th>
<th>Pick-up voltage, V DC (max.)</th>
<th>Maximum allowable voltage, V DC (40°C)</th>
<th>Coil resistance, Ω (±10%)</th>
<th>Nominal operating power, mW</th>
<th>Inductance, Henrys</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>3.5</td>
<td>13.0</td>
<td>170</td>
<td>170</td>
<td>147</td>
</tr>
<tr>
<td>6</td>
<td>4.3</td>
<td>14.0</td>
<td>225</td>
<td>225</td>
<td>160</td>
</tr>
<tr>
<td>12</td>
<td>8.0</td>
<td>26.0</td>
<td>650</td>
<td>650</td>
<td>230</td>
</tr>
<tr>
<td>24</td>
<td>17.0</td>
<td>50.0</td>
<td>2,700</td>
<td>2,700</td>
<td>213</td>
</tr>
<tr>
<td>42</td>
<td>23.0</td>
<td>75.0</td>
<td>5,500</td>
<td>5,500</td>
<td>321</td>
</tr>
</tbody>
</table>

(Notes) 1. Maximum allowable operating power: 1000 mW at 25°C 77°F.
2. Change rate of pick-up voltage vs. temperature is described in Data on page 157.

DIMENSIONS

Terminal dimensions (Except soldering)

<table>
<thead>
<tr>
<th>Terminal No.</th>
<th>Thickness</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 7</td>
<td>0.5</td>
<td>0.6</td>
</tr>
<tr>
<td>4</td>
<td>0.3</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Soldering: 0.3 .012 max.

General tolerance: ±0.5 ±.020
Tolerance: ±0.2 ±.008
SCHEMATIC

1. Single side stable (2, 6: free terminals)
   Same operation as the conventional magnetic relays.
   (a) During deenergization, terminals No. 4 (COM) and No. 1 (N.C.) are on “make”.
   (b) During energization with the indicated polarity, terminals No. 4 and No. 7 (N.O.) are on “make”.

2. Latching type
   Once energized, the COM contact is kept under the same condition without further energizing continuously.
   To switch over the contact, energy with an opposite polarity should be applied to the coil.

   1 coil latching (2, 6: free terminals)
   (a) When terminals No. 5 (–) and No. 3 (+) are energized, terminals No. 4 and No. 7 are switched to “make”. (or stay on “make”). when the coil current is switched off, terminals No. 4 and No. 7 are held on “make.”
   (b) When energized with reverse polarity terminals No. 4 and No. 1 are switched to “make” and held on “make” until energized again with an opposite polarity.

   2 coil latching
   (a) When terminals No. 5 (+) and No. 6 (–) or terminals No. 3 (+) and No. 2 (–) are energized terminals No. 4 and No. 7 are switched to “make”. (or remain on “make”). When the coil current is switched off, these terminals are held on “make”.
   (b) When terminals No. 5 (–) and No. 6 (+) or terminals No. 3 (–) and No. 2 (+) are energized in the reverse of condition (a), terminals No. 4 and No. 1 are switched to “make” and held on “make” until energized in an opposite polarity once again.

   Special use of 2 coil latching
   2 coil latching can be used in the same manner as 1 coil latching by shorting No. 5 and No. 2 or No. 3 and No. 6

1. The latching type of R relay can be used as the memory element to be operated by a pulse supplied from one or two different sources.
2. With the 2 coil latching type, when simultaneously applying one polarity to one coil and the opposite polarity to the other, the previously energized coil will take priority of operation and will maintain the contact condition.
3. In practical use, switching either from a₁ to b₁ or from a₂ to b₂ is recommendable.

DIFFERENCES BETWEEN R RELAYS AND REED RELAYS

<table>
<thead>
<tr>
<th></th>
<th>R relays</th>
<th>Reed relays</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Getter&quot; hole</td>
<td>Stationary contact</td>
<td>Contact (magnetic substance)</td>
</tr>
<tr>
<td></td>
<td>&quot;Getter&quot; hole</td>
<td>Glass reed capsule</td>
</tr>
<tr>
<td></td>
<td>Permanent magnet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Movable contact</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stationary contact</td>
<td></td>
</tr>
<tr>
<td>Contact arrangement</td>
<td>1 Form C</td>
<td>1 Form A or 1 Form B</td>
</tr>
<tr>
<td>Contact capacity</td>
<td>20 W (high contact pressure)</td>
<td>5 to 15 W</td>
</tr>
<tr>
<td>Operating function</td>
<td>Single side stable, Latching</td>
<td>Single side stable</td>
</tr>
<tr>
<td>&quot;Getter&quot; hole</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

“Getter” holes are formed on both pole shoes to obtain uniform contact resistance throughout life. Film-forming phenomena on contacts is thus fully prevented.
**REFERENCE DATA**

1.-(1) Contact reliability

**Test sample:** R-SD-24V, 54 pcs.

**Circuits:**
- (A) Following figure with diode
- (B) Following figure without diode

**Item to be checked:** Detect with the circuit stopped

**Circuits:**
- (A) Diode provided: The circuit does not stop throughout 100 million times.
- (B) Diode not provided: $\lambda = 2.5 \times 10^{-6}$ times

---

2. **Coil temperature rise (under saturated condition)**

**Graph**
- Operating power, mW
- Coil temperature rise, °C
- Magnetically sealed type
- Plastics sealed type

---

3.-(1) Operate time including bounce time (Single side stable)

**Graph**
- Operate time, ms
- Voltage, %V

3.-(2) Operate time including bounce time (2 coil latching)

**Graph**
- Operate time, ms
- Voltage, %V

4. Release time including bounce time (Single side stable)

**Graph**
- Release time, ms
- Voltage, %V

---

5.-(1) Leaving at high temperature (Change of pick-up and drop-out voltages)

**Tested sample:** R-SD-24V, 30 pcs.

**Condition:** Deenergized leaving at 90°C 194°F (constant temperature)

**Graph**
- Voltage, V
- Time, hr

5.-(2) Leaving at high temperature (Change of contact resistance)

**Tested sample:** R-SD-24V, 30 pcs.

**Condition:** Deenergized leaving at 90°C 194°F (constant temperature)

**Graph**
- Contact resistance, mΩ
- Time, hr

---

6. **High frequency characteristics**

**Tested sample:** R-SD-24V

**Condition:**

**Graph**
- Isolation, dB
- Frequency, MHz
7. Contact sticking resistance

**TEST CONDITION**

The purpose of this test was to confirm contact sticking resistance and contact stability against coil ripples.

Tested Sample: R-SD-24V, 10 pcs.
Test method: Following coil ripples were applied.
Test period: 500 hours

**TEST RESULT**

No occurrence of sticking was observed.

<table>
<thead>
<tr>
<th>Contact resistance (mΩ)</th>
<th>No. of operations, ×10⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0</td>
<td>1000</td>
</tr>
<tr>
<td>20.0</td>
<td>2000</td>
</tr>
<tr>
<td>30.0</td>
<td>3000</td>
</tr>
<tr>
<td>40.0</td>
<td>4000</td>
</tr>
<tr>
<td>50.0</td>
<td>5000</td>
</tr>
</tbody>
</table>

In actual application, above coil ripples should be avoided and use of a capacitor in the circuit is recommended to keep the ripple factor below 5%.

8. Distribution of contact resistance

Tested sample: R-SD-24V (WG type) 105 pcs.

<table>
<thead>
<tr>
<th>Contact resistance (mΩ)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0</td>
<td>100</td>
</tr>
<tr>
<td>20.0</td>
<td>200</td>
</tr>
<tr>
<td>30.0</td>
<td>300</td>
</tr>
<tr>
<td>40.0</td>
<td>400</td>
</tr>
<tr>
<td>50.0</td>
<td>500</td>
</tr>
</tbody>
</table>

9.- (1) Rate of change in pick-up and drop-out voltage (Single side stable)

<table>
<thead>
<tr>
<th>Ambient temperature, °C</th>
<th>Rate of change, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>90</td>
<td>90</td>
</tr>
</tbody>
</table>

9.- (2) Rate of change in pick-up voltage (2 coil latching)

<table>
<thead>
<tr>
<th>Ambient temperature, °C</th>
<th>Rate of change, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>90</td>
<td>90</td>
</tr>
</tbody>
</table>

10.- (2) Mechanical life

(Change of pick-up and drop-out voltage)

Tested Sample: R-SD-24V, 10 pcs.
Operation frequency: 500 cps

<table>
<thead>
<tr>
<th>Contact resistance (mΩ)</th>
<th>No. of operations, ×10⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0</td>
<td>1000</td>
</tr>
<tr>
<td>20.0</td>
<td>2000</td>
</tr>
<tr>
<td>30.0</td>
<td>3000</td>
</tr>
<tr>
<td>40.0</td>
<td>4000</td>
</tr>
<tr>
<td>50.0</td>
<td>5000</td>
</tr>
</tbody>
</table>

10.- (4) Electrical life

(Change of contact resistance)

Tested Sample: R-SD-24V, 10 pcs.
Operation frequency: 500 cps

<table>
<thead>
<tr>
<th>Contact resistance (mΩ)</th>
<th>No. of operations, ×10⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0</td>
<td>1000</td>
</tr>
<tr>
<td>20.0</td>
<td>2000</td>
</tr>
<tr>
<td>30.0</td>
<td>3000</td>
</tr>
<tr>
<td>40.0</td>
<td>4000</td>
</tr>
<tr>
<td>50.0</td>
<td>5000</td>
</tr>
</tbody>
</table>

11.- (1) Electrical life

(1 A 20 V DC resistive load)

Tested sample: R-SD-24V, 10 pcs.
Load: 60 mA 24 V DC resistive load
Frequency: 50(cps)

<table>
<thead>
<tr>
<th>Contact resistance (mΩ)</th>
<th>No. of operations, ×10⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0</td>
<td>1000</td>
</tr>
<tr>
<td>20.0</td>
<td>2000</td>
</tr>
<tr>
<td>30.0</td>
<td>3000</td>
</tr>
<tr>
<td>40.0</td>
<td>4000</td>
</tr>
<tr>
<td>50.0</td>
<td>5000</td>
</tr>
</tbody>
</table>

11.- (2) Electrical life

Tested Sample: R-SD-24V, 10 pcs.
Load: 60 mA 24 V DC resistive load
Frequency: 50(cps)

<table>
<thead>
<tr>
<th>Contact resistance (mΩ)</th>
<th>No. of operations, ×10⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0</td>
<td>1000</td>
</tr>
<tr>
<td>20.0</td>
<td>2000</td>
</tr>
<tr>
<td>30.0</td>
<td>3000</td>
</tr>
<tr>
<td>40.0</td>
<td>4000</td>
</tr>
<tr>
<td>50.0</td>
<td>5000</td>
</tr>
</tbody>
</table>

11.- (3) Electrical life

Tested Sample: R-SD-12V, 10 pcs.
Load: 54 mA 12 V DC inductive load
with diode protection
(4 relay coils in parallel of NR-SD-12V)
Frequency: 50(cps)

<table>
<thead>
<tr>
<th>Contact resistance (mΩ)</th>
<th>No. of operations, ×10⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0</td>
<td>1000</td>
</tr>
<tr>
<td>20.0</td>
<td>2000</td>
</tr>
<tr>
<td>30.0</td>
<td>3000</td>
</tr>
<tr>
<td>40.0</td>
<td>4000</td>
</tr>
<tr>
<td>50.0</td>
<td>5000</td>
</tr>
</tbody>
</table>

11.- (4) Electrical life

(327 mA 24 V DC relay coil load)

Tested sample: R-SD-24V, 5 pcs.
Condition: HP2-DC24V×6 pcs. in parallel, diode protector provided

<table>
<thead>
<tr>
<th>Contact resistance (mΩ)</th>
<th>No. of operations, ×10⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0</td>
<td>1000</td>
</tr>
<tr>
<td>20.0</td>
<td>2000</td>
</tr>
<tr>
<td>30.0</td>
<td>3000</td>
</tr>
<tr>
<td>40.0</td>
<td>4000</td>
</tr>
<tr>
<td>50.0</td>
<td>5000</td>
</tr>
</tbody>
</table>
12. Thermal electromotive force
Tested Sample: R-SD-12V, 5 pcs.
Coil applied V: 12 V DC
Ambient atmosphere: 25°C, 60% RH

13. High temperature test
TEST CONDITION
Tested Sample: R-SD-24V, 30 pcs.
Ambient temperature: 80°C
Humidity: less than 50% R.H.
Exposure time: 2,000 hours with relays deenergized
TEST RESULT
Contact resistance: Fig. 1
All samples were measured less than 100 mΩ in contact resistance throughout this test.

APPLICATION HINTS
Contact protection circuit
When using R relays in inductive load circuits, a contact protection circuit is recommended.

Examples:

<table>
<thead>
<tr>
<th>CR</th>
<th>CR</th>
<th>Diode</th>
</tr>
</thead>
<tbody>
<tr>
<td>S Relay contact</td>
<td>S</td>
<td>L</td>
</tr>
<tr>
<td>L: Inductive load</td>
<td>r</td>
<td>c</td>
</tr>
</tbody>
</table>

1. r = more than 20 to 30 ohms
2. In an AC circuit
   Impedance of L is to be somewhat smaller than impedance of r and c.

Can be used for both AC and DC circuits. Use 500 to 1000 ohms for r and 0.1 µF to 0.2 µF 200 V for c in a general 12 to 24 V load circuit.

For DC circuits only.

The following is life data under our HP2 relay load.

<table>
<thead>
<tr>
<th>Contact voltage</th>
<th>Contact current</th>
<th>Contact protection circuit</th>
<th>Operating speed</th>
<th>Expected life, min. op.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 V DC</td>
<td>232 mA</td>
<td>0.2 µF + 1kΩ or diode</td>
<td>2 op./s</td>
<td>3×10⁷</td>
</tr>
<tr>
<td>12 V DC</td>
<td>106 mA</td>
<td>0.2 µF + 1kΩ or diode</td>
<td>2 op./s</td>
<td>3×10⁷</td>
</tr>
<tr>
<td>24 V DC</td>
<td>54 mA</td>
<td>0.1 µF + 1kΩ or diode</td>
<td>2 op./s</td>
<td>3×10⁷</td>
</tr>
<tr>
<td>100 V DC</td>
<td>15 mA</td>
<td>0.1 µF + 1kΩ or diode</td>
<td>2 op./s</td>
<td>2×10⁷</td>
</tr>
<tr>
<td>24 V DC</td>
<td>80 mA</td>
<td>0.2 µF + 1kΩ</td>
<td>2 op./s</td>
<td>3×10⁷</td>
</tr>
<tr>
<td>100 V DC</td>
<td>20 mA</td>
<td>0.1 µF + 1kΩ or varistor</td>
<td>2 op./s</td>
<td>2×10⁷</td>
</tr>
<tr>
<td>200 V DC</td>
<td>10 mA</td>
<td>0.1 µF + 1kΩ</td>
<td>2 op./s</td>
<td>2×10⁷</td>
</tr>
</tbody>
</table>

(Notes)
1. When inrush current occurs in the capacitor load circuit or incandescent lamp load circuit, reduce it to less than 5 A. Electrical life of “AuCo” contact types is 10,000 operations in a 5 A inrush current circuit.
2. When 5 A to 10 A inrush current occurs in the capacitor load circuit or incandescent lamp load circuit, the use of power types is recommended.

2 coil latching types
A) The circuit at right is recommended when using one coil for latching and the other coil for reset.
R relays are sensitive enough to be operated by the discharge of energy accumulated in the inner-coil capacitance. The use of a diode of over 200 V breakdown will prevent misoperation from this source.

In order to maintain the insulation between the two coils, connection of the terminal No. 3 and No. 6 or the terminal No. 2 and No. 5 is recommended, as shown in the right figure.
Rectifiers should be inserted in this circuit when the nominal coil voltage of the R relay is more than 24 V DC.
B) No damage will occur to the coil of either the one or two coil bistable types even if the operating voltage is as much as 2 or 3 times the nominal coil voltage.

C) If separate pulses are applied to each coil of the 2 coil bistable types, the first pulse will operate when the pulses are of equal voltage. When voltages differ the higher voltage will cause operation provided the voltage difference is greater than the measured pick-up voltage. Voltage difference on the coils will reduce contact pressure proportionately.

Continuous bias voltage after an operating pulse lowers contact pressure and vibration resistance.

Ripple factor

Coils should be operated on pure DC. Rectified AC may cause changes in the pick-up/drop-out characteristics because of the ripple factor. Use of a capacitor in the circuit is recommended to keep the ripple factor below 5%.

![Ripple factor diagram]

To calculate the ripple factor

Ripple factor (%) =\[ \frac{E_{\text{max}} - E_{\text{min}}}{E_{\text{mean}}} \times 100\% \]

Where:
- \( E_{\text{max}} \) = max. value of pulsating component
- \( E_{\text{min}} \) = min. value of pulsating component
- \( E_{\text{mean}} \) = average value DC component

When designing R relay circuits

Care should be taken when designing relay circuits since the response of the relay is so fast that bouncing or chattering from conventional relays in the circuit may cause false operation.

When using long lead wires

When long wires (as long as 100 m or more) are to be used, the use of resistance (10 to 50 Ω) in series with the contact is required in order to eliminate the effect of the possible inrush current due to the stray capacitance existing between the two wires or between the wire and ground.

AC operation of latching relays

When using circuits such as those at the right, avoid continued or extended latching or resetting power input.

Capacitor discharge operation of latching types

When operating bistable (latching) types by discharge of a capacitor, more reliable operation can be expected if the time to reach pick-up voltage is greater than 2 ms at 5 to 10 μF: (24 V type).
Automatic coil circuit interruption
Misoperation may occur in self-operated cutoff circuits such as shown at right. This can be avoided by adding a resistor and capacitor and increasing the pick-up voltage to above that specified.

In a timer circuit, step-pulse voltage from PUT (Programmable Unijunction Transistor) or SBS (Silicon Bilateral Switch) is recommended.

Residual voltage
When single side stable types or latching types are driven by transistor or UJT, residual voltage is sometimes applied to the coils and decreases contact pressure at N.O. side even if the transistor or UJT are in OFF condition. As a result, characteristics of relays may be harmed. Design your circuits in principle to make such residual voltage zero.

Short circuit prevention between N.C. and N.O.
The separation of loads or insertion of a resistor for circuit protection are recommended for the circuits where large current flows due to arcing. (See Fig. 1).

ACCESSORIES
PC board terminal sockets (with hold-down clip)

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For Cautions for Use, see Relay Technical Information.