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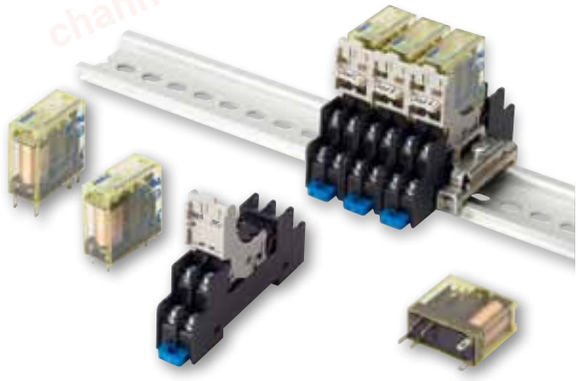
# RF2 2-pole Force Guided Relay / SJ Series Socket

## For simple and easy safety measures - reduce costs and installation space.

- 2-pole force guided relay to reduce cost and installation space.
- Force guided contact mechanism (EN50205 Type A TÜV approved).
- Reinforced insulation between coil and contact and contacts of different poles.
- Mechanical indicator shows contact status.
- Two terminal styles - socket mounting and PC board mounting.
- RTIII degree of protection, LED, diode models available.
- Can be used with SJ series relay socket.

| Applicable Standards | Mark | Certification Organization /File No. |
|---|---|---|
| UL60947-4-1A | | UL/Recognition File No. E55996 |
| CSA C22.2 No.14 | | CSA File No. LR35144 |
| EN50205<br>EN61810-1 | | TUV SUD |
| | | EU Low Voltage Directive |



## Force Guided Relays

| Contact Configuration | | Terminal Style | LED Indicator | w/Diode | Degree of Protection (Note) | | Rated Coil Voltage | Part No. |
|---|---|---|---|---|---|---|---|---|
| | | | | | Flux-tight (RTII) | Sealed (RTIII) | | |
| 2-pole | SPST-NO + SPST-NC | Plug-in | With | √ | √ | | 12V DC | **RF2S-1A1BLD1-D12** |
| | | | Without | — | √ | | 24V DC | **RF2S-1A1B-D24** |
| | | | | √ | √ | | | **RF2S-1A1BD1-D24** |
| | | | With | √ | √ | | | **RF2S-1A1BLD1-D24** |
| | | | | √ | | √ | | **RF2S-1A1BLD1K-D24** |
| | | | Without | — | √ | | 48V DC | **RF2S-1A1B-D48** |
| | | | With | √ | √ | | | **RF2S-1A1BLD1-D48** |
| | | | | √ | | √ | | **RF2S-1A1BLD1K-D48** |
| | | PC Board | Without | — | √ | | 12V DC | **RF2V-1A1B-D12** |
| | | | | — | √ | | 24V DC | **RF2V-1A1B-D24** |
| | | | | — | | √ | | **RF2V-1A1BK-D24** |
| | | | | √ | √ | | | **RF2V-1A1BD1-D24** |
| | | | | √ | | √ | | **RF2V-1A1BD1K-D24** |
| | | | With | √ | | √ | | **RF2V-1A1BLD1K-D24** |
| | | | Without | — | √ | | 48V DC | **RF2V-1A1B-D48** |
| | DPDT | | Without | — | √ | | 24V DC | **RF2V-2C-D24** |

• Other part numbers are available. See below (contact IDEC for details).

## Part No. Development

| RF | 2 | S | – | 1A1B | LD1 | K | – | D24 |
|---|---|---|---|---|---|---|---|---|
| Series | No. of Poles | Terminal Style | | Contact Configuration | Option | Degree of Protection | | Rated Coil Voltage |
| | 2 2-pole | S Plug-in | | 1A1B SPST-NO + SPST-NC | Blank Standard | Blank RTII | | D12 12V DC |
| | | V PC Board | | 2C DPDT | L With LED indicator | K RTIII | | D24 24V DC |
| | | | | | D With diode (Note 1) | | | D48 48V DC |
| | | | | | D1 With diode of reverse polarity coil (Note 2) | | | |
| | | | | | LD With LED indicator & diode (Note 1) | | | |
| | | | | | LD1 With LED indicator & diode of reverse polarity coil (Note 2) | | | |

Note 1: With diode: terminal 1 –, terminal 8 +
Note 2: With diode of reverse polarity coil: terminal 1 +, terminal 8 –
Note 3: Use this chart for interpreting part numbers. Not all possible variations can be realized.

## Ratings

### Coil ratings

| Rated Voltage (V) | Rated Current (mA) ±15% (at 20°C) | | Coil Resistance ±10% (at 20°C) | | Operating Characteristics (against rated values at 20°C) | | | Power Consumption |
|---|---|---|---|---|---|---|---|---|
| | Without LED | With LED | Without LED | With LED | Minimum Pickup Voltage | Dropout Voltage | Maximum Continuous Applied Voltage | |
| 12V DC | 58 | 63 | 205 | 205 | 75% maximum | 10% minimum | 110% | Approx. 0.7W |
| 24V DC | 29 | 33 | 820 | 820 | | | | |
| 48V DC | 14.6 | 18 | 3300 | 3300 | | | | |

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

### Standard Ratings

| Voltage | UL Rating Resistive | | CSA Rating Resistive | |
|---|---|---|---|---|
| | NO | NC | NO | NC |
| 277V AC | 6A | 3A | 6A | 3A |
| 30V DC | 6A | 3A | 6A | 3A |

| Voltage | TÜV Rating Resistive | |
|---|---|---|
| | NO | NC |
| 240VAC | 6A | 3A |
| 24V DC | 6A | 3A |

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# RF2 2-pole Force Guided Relay / SJ Series Socket

## Specifications

| Model | | RF2S (Plug-in Terminal) | RF2V (PC board terminal) |
|---|---|---|---|
| No. of Poles | | 2-pole | |
| Contact Configuration | | SPST-NO + SPST-NC, DPDT | |
| Disconnecting Means | | Micro disconnection | |
| Contact Resistance (Note 1) | | 100mΩ maximum | |
| Contact Material | | AgNi+Au-Clad | |
| Degree of Protection | | RTII (flux-tight), RTIII (sealed) | |
| Rated Load (resistive load) | | NO contact: 240V AC, 6A/24V DC, 6A<br>NC contact: 240V AC, 3A/24V DC, 3A | |
| Contact | Maximum Allowable Power (resistive load) | NO contact: 1440VA/144W, NC contact: 720VA/72W | |
| | Maximum Allowable Voltage | 250V AC, 125V DC | |
| | Maximum Allowable Current | 6A | |
| Minimum Applicable Load (Note 2) | | 1V DC, 1mA | |
| Power Consumption | | Approx. 0.7W | |
| Rated Insulation Voltage | | 250V | |
| Insulation Resistance | | 1000MΩ minimum (500V megger) | |
| Impulse Withstand Voltage | | 6000V | |
| Pollution Degree | | 2 | |
| Dielectric Strength | Between contact and coil | 5000V AC, 1 minute | |
| | Between contacts of the same pole | 4000V AC, 1 minute | |
| | Between contacts of the different poles | 1500V AC, 1 minute | |
| Operating Time | | 15ms max. (at the rated coil voltage, excluding contact bounce time) | |
| Response Time (Note 3) | | 5ms max. (at the rated coil voltage, without diode)<br>20ms max. (at the rated coil voltage, with diode) | |
| Release Time | | 10ms max. (at the rated coil voltage, excluding contact bounce time, without diode)<br>25ms max. (at the rated coil voltage, excluding contact bounce time, with diode) | |
| Vibration Resistance | Operating Extremes | NO contact: 10 to 55Hz, amplitude 0.75mm<br>NC contact:10 to 55Hz, amplitude 0.2mm | |
| | Damage Limits | 10 to 55Hz, amplitude 0.75mm | |
| Shock Resistance | Operating Extremes | NO contact: 100m/s², NC contact: 50m/s² | |
| | Damage Limits | 1000m/s² | |
| Electrical Life | | NO contact:<br>100,000 operations minimum (operating frequency 1,800 per hour) at 240V 6A resistive load or 2A inductive load (power factor 0.4)<br>100,000 operations minimum (operating frequency 1,800 per hour) at 24V 6A resistive load or 1A inductive load (time constant 48ms)<br>NC contact:<br>100,000 operations minimum (operating frequency 1,800 per hour) at 240V AC, 3A resistive load or 2A inductive load (power factor 0.4)<br>100,000 operations minimum (operating frequency 1,800 per hour) at 24V DC, 3A resistive load or 1A inductive load (time constant 48ms) | |
| Mechanical Life | | 10 million operations minimum (operating frequency 18,000 operations per hour) | |
| Operating Temperature | | Single mounting: –40 to +70°C (no freezing)<br>Collective mounting: –40 to +55°C (no freezing) | –40 to +70°C (no freezing) |
| Operating Humidity | | 5 to 85%RH (no condensation) | |
| Storage Temperature | | –40 to +85°C (no freezing) | |
| Weight (approx.) | | 18g (without LED/diode), 20g (with LED/with diode/with LED & diode) | |

• Above values are initial values.
Note 1: Measured using 5V DC, 1A voltage drop method.
Note 2: Failure rate level P, reference value
Note 3: Response time is the time until NO contact opens, after the coil voltage is turned off.

## Socket Standards & Certification

| Applicable Standards | Mark | Certification Organization/File No. |
|---|---|---|
| UL508 | | UL Recognition<br>File No. E62437 |
| CSA C22.2 No.14 | | CSA File No. LR84913 |
| EN60999-1 (Note 1)<br>EN60664-1 (Note 2) | | EU Low Voltage Directive |

Note 1: Fingersafe screw terminal only.
Note 2: PC board terminal only.

Note: Sockets can be used on RF2S (Plug-in terminal) only.

## Sockets

### DIN-rail Socket

| Terminal Style | No. of Poles | Terminal No. Marking Color | Part No. |
|---|---|---|---|
| Standard Screw Terminal | 2 | White | **SJ2S-05BW** |
| Fingersafe Screw Terminal | | | **SJ2S-07LW** |

• Release lever is supplied with the socket.

### PC Board Socket

| No. of Poles | Part No. |
|---|---|
| 2 | **SJ2S-61** |

• Release lever is supplied with the socket.

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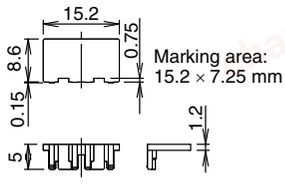
## Socket Specifications

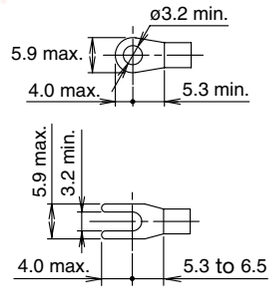
| Model | | SJ2S-05B/-07L | SJ2S-61 |
|---|---|---|---|
| Mounting | | DIN Rail | PC Board |
| Rated Current | | 8A | |
| Rated Insulation Voltage | | 250V AC/DC | |
| Applicable Wire | | 2mm² | – |
| Applicable Cripming Terminal | | See dimensions below | – |
| Recommended Tightening Torque | | 0.6 to 1.0 N·m | – |
| Screw Terminal Style | | M3 slotted Phillips screw (self-lifting) | – |
| Terminal Strength | | Wire tensile strength: 50N minimum | – |
| Dielectric Strength (Note) | Between contact and coil | 4000V AC, 1 minute | 5000V AC, 1 minute |
| | Between contacts of the same pole | 1000V AC, 1 minute | |
| | Between contacts of the different pole | 3000V AC, 1 minute | |
| Vibration Resistance | Damage limits | 90m/s² | |
| | Resonance | Frequency 10 to 55Hz, amplitude 0.75mm | |
| Shock Resistance (damage limits) | | 1000m/s² | |
| Operating Temperature | | –40 to +70°C (no freezing) | |
| Operating Humidity | | 5 to 85% RH (no condensation) | |
| Storate Temperature | | –55 to +85°C (no freezing) | |
| Storage Humidity | | 5 to 85% RH (no condensation) | |
| Degree of Protection (Screw Terminal) | | SJ2S-07L: IP20 (IEC 60529) | – |
| Weight | | 34g | 4.5g |

Note: The above are same when used with a RF2 force guided relay.

## Accessories

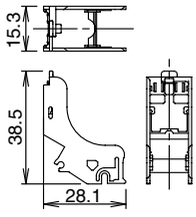
| Description/Shape | | Material | Part No. | Remarks |
|---|---|---|---|---|
| Removable Marking Plate  | | Plastic (white) | **SJ9Z-PW** |   |
| Jumper | For 2 sockets | Nickel-coated brass with polypropylene coating | **SJ9Z-JF2** | Terminal centers: 15.5mm<br>Rated current: 12A<br>Ensure that the total current to the jumper does not exceed the maximum current. |
| | For 5 sockets | | **SJ9Z-JF5** | |
| | For 8 sockets | | **SJ9Z-JF8** | |
| | For 10 sockets | | **SJ9Z-JF10** | |

## Applicable Crimping Terminal




Note: Ring terminal cannot be used on SJ2S-0L.

## Replacement Parts

| Description/Shape | Material | Part No. | Dimensions (mm) |
|---|---|---|---|
| Release Lever (with integrated marking plate)  | Plastic (gray) | **SJ9Z-CM** |   When not using marking plate |

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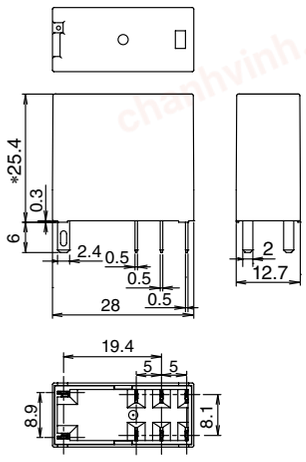
# RF2 2-pole Force Guided Relay / SJ Series Socket

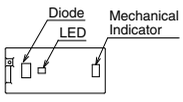
## Relay Dimensions

### RF2S (plug-in terminal)
### Standard (without LED/diode)

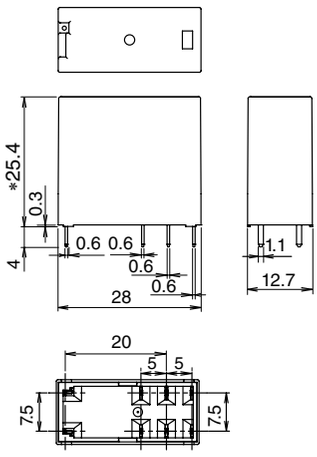



∗ With LED/diode: 28.4

### With LED/diode

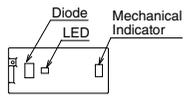



### RF2V (PC board terminal)
### Standard (without LED/diode)



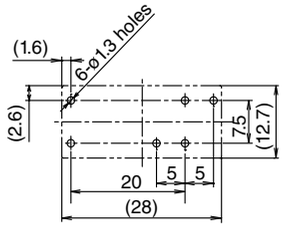

∗ With LED/diode: 28.4

### With LED/diode

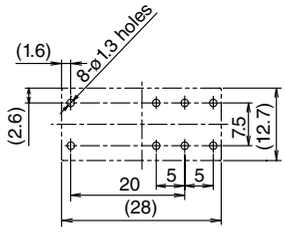



## PC Board Terminal Mounting Hole Layout
(Bottom View)

### RF2V (SPST-NO + SPST-NC)

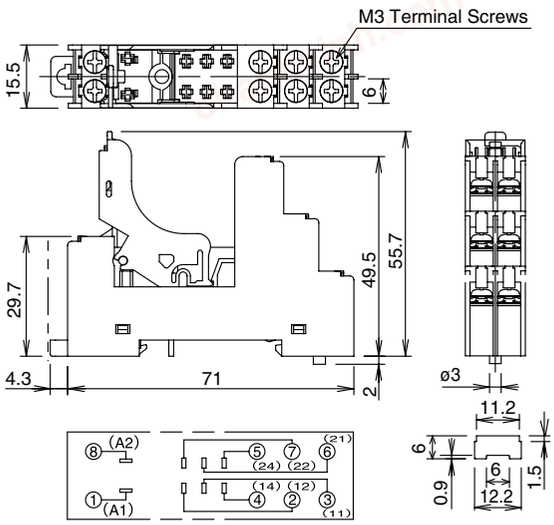



### RF2V (DPDT)




## Socket Dimensions

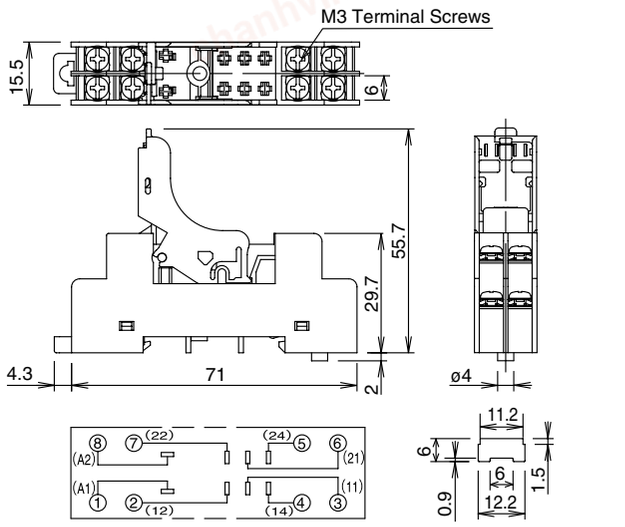
### SJ2S-07L




(Top View)

Marking Plate
(integrated with release lever)

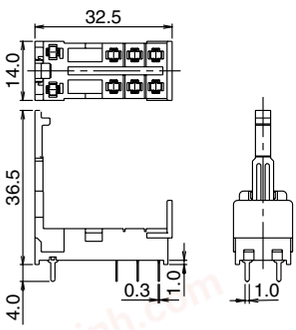
### SJ2S-05B




(Top View)

Marking Plate
(integrated with release lever)

### SJ2S-61



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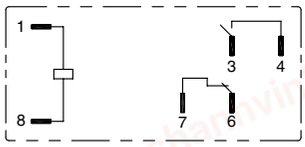
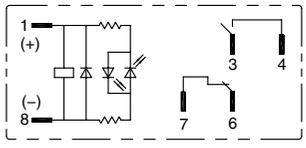
## Internal Connection (Bottom View)

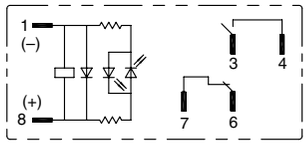
**RF2∗-1A1B-☐**
**Standard**



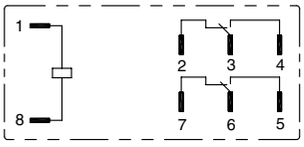

**RF2∗-1A1BLD1-☐**
**With LED indicator + diode of reverse polarity coil**



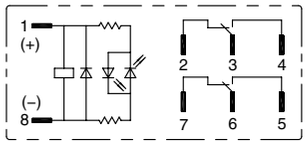

**RF2∗-1A1BLD-☐**
**With LED indicator + diode**



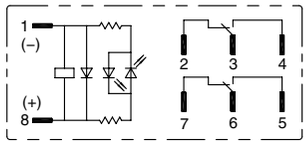

**RF2∗-2C-☐**
**Standard**



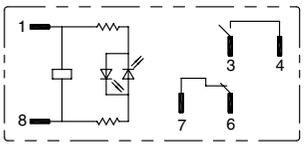

**RF2∗-2CLD1-☐**
**With LED indicator + diode of reverse polarity coil**



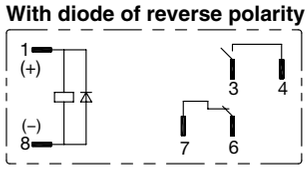

**RF2∗-2CLD-☐**
**With LED indicator + diode**



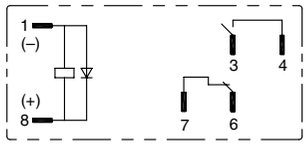

**RF2∗-1A1BL-☐**
**With LED indicator**



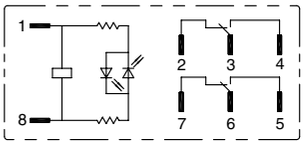

**RF2∗-1A1BD1-☐**
**With diode of reverse polarity coil**



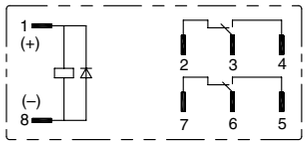

**RF2∗-1A1BD-☐**
**With diode**



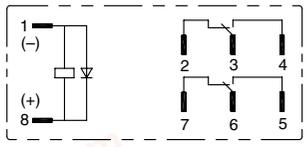

**RF2∗-2CL-☐**
**With LED indicator**




**RF2∗-2CD1-☐**
**With diode of reverse polarity coil**




**RF2∗-2CD-☐**
**With diode**



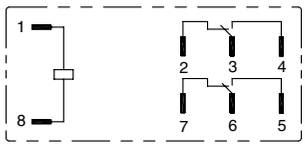

- Relays with diode have polarity. Take polarity into consideration when wiring.
- When using DPDT model as a force guided relay, use in SPST-NO + SPST-NC wiring (EN50205).

## Operating Instructions

**1. When using DPDT model as a force guided relay**

Use in SPST-NO + SPST-NC wiring according to EN50205 (2002)

RF2∗-2C-☐
Standard



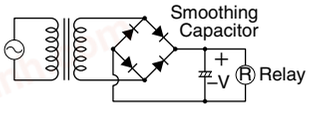

Example:
Use terminal 3-4 as NO contact and 6-7 as NC contact. Or terminal 2-3 as NC contact and terminal 5-6 as NO contact.

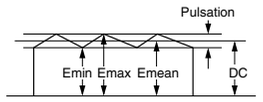
**2. Driving Circuit for Relays**

2-1. To make sure of correct relay operation, apply rated voltage to the relay coil. Pickup and dropout voltages may differ according to operating temperature and conditions.

2-2. Input voltage for DC coil:

A complete DC voltage is best for the coil power to make sure of stable 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.

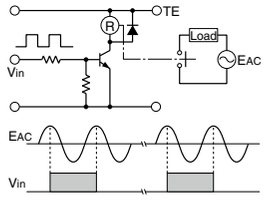



$$\text{Ripple Fctor (\%)} = \frac{E_{max} - E_{min}}{E_{mean}} \times 100\%$$

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

2-3. Operating the relay in sync with an AC load:



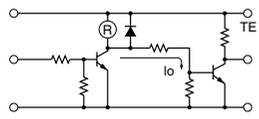

If the relay operates in sync with AC power voltage of the load, the relay life may be reduced. If this is the case, select a relay in consideration of the required reliability for the load. Or, make the relay turn on and off irrespective of the AC power phase or near the point where the AC phase crosses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

2-4. Leakage current while relay is OFF

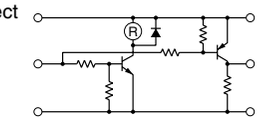
When driving an element at the same time as the relay operation, special consideration is needed for the circuit design. As shown in the incorrect circuit at right, leakage current (Io) flows through the relay coil while the relay is off.

Leakage current causes coil release failure or adversely affects the vibration resistance and shock resistance. Design a circuit as shown in the correct example.

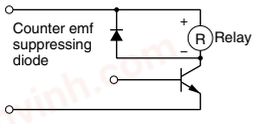
Correct




Incorrect




2-5. Surge suppression for transistor driving circuits:
When the relay coil is turned off, a high-voltage pulse is generated. 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 controlling transistor. Select a Zener diode with a Zener voltage slightly higher than the power voltage.




2-6. The coil terminal of the relay has polarity.

Connect terminals according to the internal connection diagram. Incorrect wiring may cause malfunction.

**3. Protection for Relay Contacts**

3-1. 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.

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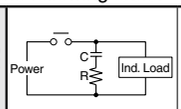
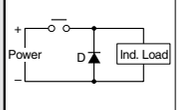
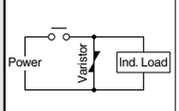
# RF2 2-pole Force Guided Relay / SJ Series Socket

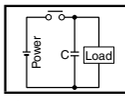
## Operating Instructions

3-2. 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 an 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 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: Power voltage of the load circuit × 10<br>Forward current: More than the load current |
| Varistor |  | This protection circuit can be used for both AC and DC load powercircuits. For the 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. |

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

| | |
|---|---|
|  | This protection circuit is very effective in arc suppression when opening the contacts. But, 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 will improve the switching characteristics of a DC inductive load.

### 4. Usage, transport, and storage conditions

4-1. Condensation

Condensation occurs when there is a sudden change in temperature under high temperature and high humidity conditions. The relay insulation may deteriorate due to condensation.

4-2. Freezing

Condensation or other moisture may freeze on the relay when the temperatures is lower than 0ºC. This causes problems such as sticking of movable parts or delay in operation.

4-3. Low temperature, low humidity environments

Plastic parts may become brittle when used in low temperature and low humidity environments.

### 5. Other Notices

5-1. General notice:

① To maintain the initial characteristics, do not drop or shock the relay.

② The relay cover cannot be removed from the base during normal operation. To maintain the initial characteristics, do not remove the relay cover.

③ Use the relay in environments free from condensation, dust, sulfur dioxide (SO2), and hydrogen sulfide (H2S).

④ RTII model cannot be washed as it is not a sealed type. Also make sure that flux does not leak to the PC board and enter the relay.

⑤ Make sure that the voltage applied to the coil cotinuously does not exceed the maximum allowable voltage.

5-2. 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.

① Connect an integration circuit.

② Suppress the pulse voltage due to bouncing within the noise margin of the load.

5-3. Do not use relays in the vicinity of strong magnetic fields, as this may affect relay operation.

5-4. UL and CSA ratings may differ from product rated values determined by IDEC.

5-5. Others

• Shock Resistance

For the best shock resistance, it is ideal to install the RF2 relay so that the armature movent is perpendicular to the direction of vibration/shock.

• Life

Large loads that causes arcs may result in the contact material scattered off, accumulating around the contact. This will degrade insulation resistance between the circuits. Make sure that the relay is mounted in the correct direction.

• Counter-electromotive force model (diode)

Counter-electromotive force diode model has polarity. The diode absorbs counter-electromotive force of relay coil. When excessive external surge voltage is anticipated, take additional counter-electromotive force measures. Otherwise the diode may be damaged.

• When using general purpose relays and force guided relays closely, use of a marking plate (optional) on the release lever or socket is recommended, so that force guided relay can be recognized easily.

### 6. Notes on PC Board Mounting

• When mounting two or more relays on a PC board, keep a minimum spacing of 5 mm in each direction. If used without spacing of 10 mm, rated current and operating temperature differs. Consult IDEC.

• Manual soldering: Solder the terminals at 350°C within 3 sec.

• Auto-soldering: Preliminary heating at 120°C within 60 sec. Solder at 250°C within 4 to 5 sec.

• Because the terminal part is filled with epoxy resin, do not excessively solder or bend the terminal. Otherwise, air tightness will degrade.

• Avoid the soldering iron from touching the relay cover or the epoxy filled terminal part. Use a non-corrosive resin flux.

• Do not install the relay on the PC board in the way the PC board is bent, otherwise copper foil may be cut or solder may be displaced after operating for a long time or due to vibration, degrading the relay's performance.

• When multiple PC boards with relays are mounted to a rack, the temperature may rise excessively. When mounting relays, leave enough space so that heat will not build up, and so that the relays' ambient temperature remains within the specified operating temperature range.

## RF1V Force Guided Relay / SF1V Relay Socket (4-pole/6-pole)

- Compact and EN compliant RF1V force guided relays.
- Force guided contact mechanism (EN50205 Type A TÜV approved)
- Contact configuration
  4-pole (2NO-2NC, 3NO-1NC), 6-pole (4NO-2NC, 5NO-1NC, 3NO-3NC)
- Built-in LED indicator available.
- Fast response time (8 ms maximum).
- High shock resistance (200 m/s2 minimum)
- Finger-safe DIN rail mount socket and PC board mount socket.



Specifications and other descriptions in this brochure are subject to change without notice.

IDEC CORPORATION
6-64, Nishi-Miyahara 2-Chome, Yodogawa-ku, Osaka 532-0004, Japan
Tel: +81-6-6398-2571, Fax: +81-6-6392-9731, E-mail: marketing@idec.co.jp

IDEC CORPORATION (USA)
Tel: +1-408-747-0550 / (800) 262-IDEC (4332)
Fax: +1-408-744-9055 / (800) 635-6246
E-mail: opencontact@idec.com

IDEC CANADA LIMITED
Tel: +1-905-890-8561, Toll Free: (800) 262-IDEC (4332)
Fax: +1-905-890-8562
E-mail: sales@ca.idec.com

IDEC AUSTRALIA PTY. LTD.
Tel: +61-3-8523-5900, Toll Free: 1800-68-4332
Fax: +61-3-8523-5999
E-mail: sales@au.idec.com

IDEC ELECTRONICS LIMITED
Tel: +44-1256-321000, Fax: +44-1256-327755
E-mail: sales@uk.idec.com

IDEC ELEKTROTECHNIK GmbH
Tel: +49-40-25 30 54 - 0, Fax: +49-40-25 30 54 - 24
E-mail: service@idec.de

IDEC (SHANGHAI) CORPORATION
Tel: +86-21-6135-1515
Fax: +86-21-6135-6225 / +86-21-6135-6226
E-mail: idec@cn.idec.com

IDEC (BEIJING) CORPORATION
Tel: +86-10-6581-6131, Fax: +86-10-6581-5119

IDEC (SHENZHEN) CORPORATION
Tel: +86-755-8356-2977, Fax: +86-755-8356-2944

IDEC IZUMI (H.K.) CO., LTD.
Tel: +852-2803-8989, Fax: +852-2565-0171
E-mail: info@hk.idec.com

IDEC TAIWAN CORPORATION
Tel: +886-2-2698-3929, Fax: +886-2-2698-3931
E-mail: service@tw.idec.com

IDEC IZUMI ASIA PTE. LTD.
Tel: +65-6746-1155, Fax: +65-6844-5995
E-mail: info@sg.idec.com

IDEC ASIA (THAILAND) CO.,LTD.
Tel: +662-392-9765, Fax: +662-392-9768
E-mail: sales@th.idec.com

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Cat. No. EP1471-0 NOVEMBER 2013 PDF Updated 3/14 USA