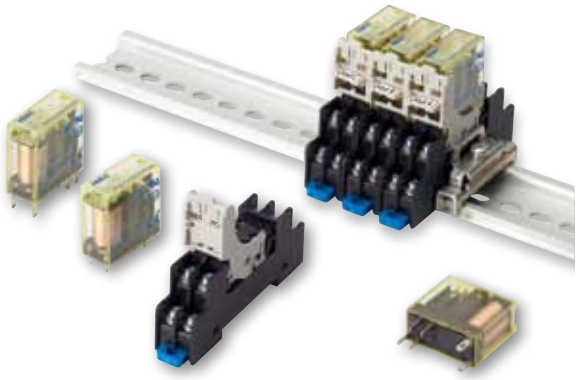
RF2 2-pole Force Guided Relay / SJ Series Socket

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 EN61810-1		TUV SUD
	CE	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

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 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) 20ms max. (at the rated coil voltage, with diode)	
Release Time		10ms max. (at the rated coil voltage, excluding contact bounce time, without diode) 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 NC contact:10 to 55Hz, amplitude 0.2mm	
	Damage Limits	10 to 55Hz, amplitude 0.75mm	
Shock Resistance	Operating Extremes	NO contact: 100m/s^2, NC contact: 50m/s^2	
	Damage Limits	1000m/s^2	
Electrical Life		NO contact: 100,000 operations minimum (operating frequency 1,800 per hour) at 240V 6A resistive load or 2A inductive load (power factor 0.4) 100,000 operations minimum (operating frequency 1,800 per hour) at 24V 6A resistive load or 1A inductive load (time constant 48ms) NC contact: 100,000 operations minimum (operating frequency 1,800 per hour) at 240V AC, 3A resistive load or 2A inductive load (power factor 0.4) 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) 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 File No. E62437
CSA C22.2 No.14		CSA File No. LR84913
EN60999-1 (Note 1) 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**

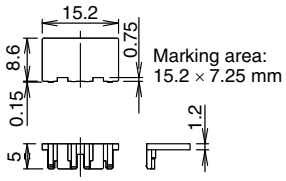
• Release lever is supplied with the socket.

Socket Specifications

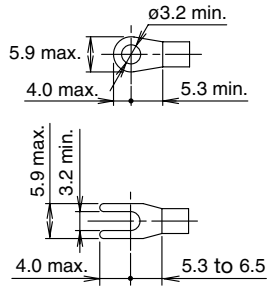
Model		SJ2S-05B/-07L	SJ2S-61
Mounting		DIN Rail	PC Board
Rated Current		8A	
Rated Insulation Voltage		250V AC/DC	
Applicable Wire		2mm²	–
Applicable Cripming Terminal		See dimensions below	–
Recommended Tightening Torque		0.6 to 1.0 N·m	–
Screw Terminal Style		M3 slotted Phillips screw (self-lifting)	–
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

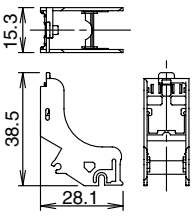
Description/Shape		Material	Part No.	Remarks
Removable Marking Plate		Plastic (white)	**SJ9Z-PW**	
Jumper	For 2 sockets	Nickel-coated brass with polypropylene coating	**SJ9Z-JF2**	Terminal centers: 15.5mm Rated current: 12A Ensure that the total current to the jumper does not exceed the maximum current.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

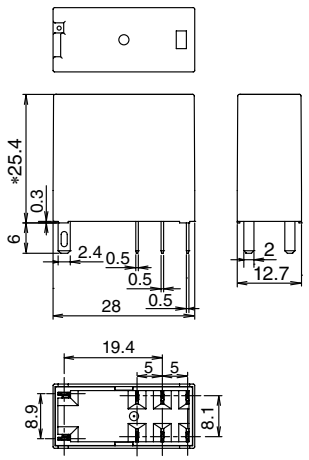
Replacement Parts

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

RF2 2-pole Force Guided Relay / SJ Series Socket

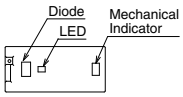
Relay Dimensions

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

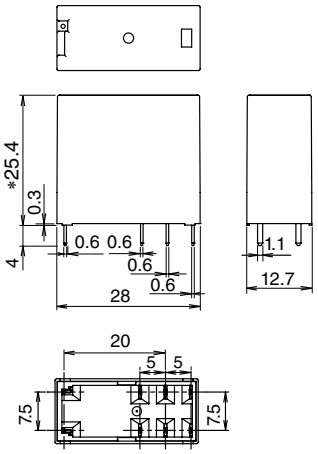


∗ With LED/diode: 28.4

With LED/diode

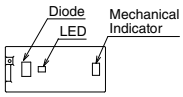


RF2V (PC board terminal)
Standard (without LED/diode)



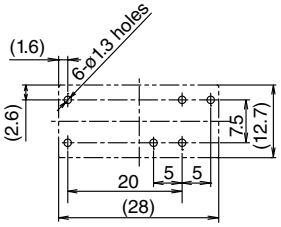
∗ With LED/diode: 28.4

With LED/diode

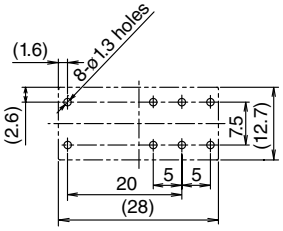


PC Board Terminal Mounting Hole Layout
(Bottom View)

RF2V (SPST-NO + SPST-NC)

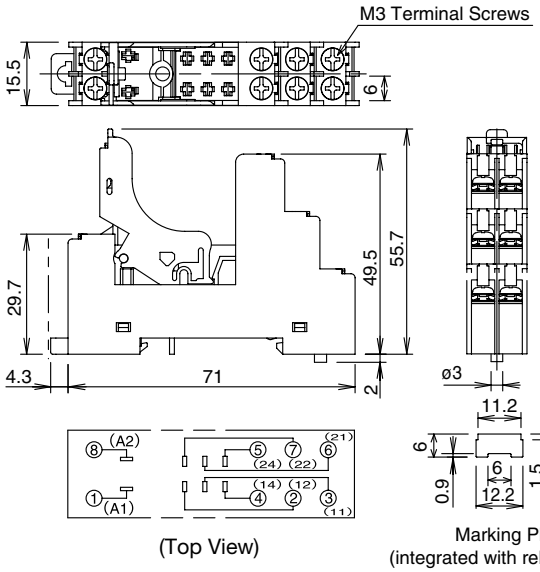


RF2V (DPDT)



Socket Dimensions

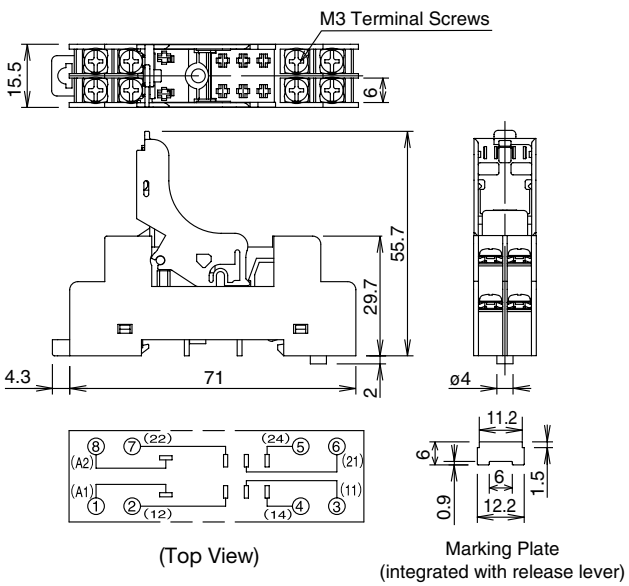
SJ2S-07L



(Top View)

Marking Plate
(integrated with release lever)

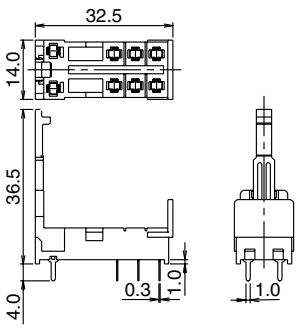
SJ2S-05B



(Top View)

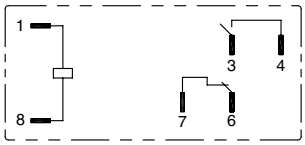
Marking Plate
(integrated with release lever)

SJ2S-61

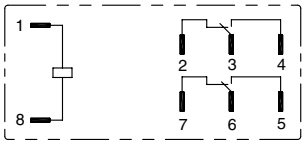


Internal Connection (Bottom View)

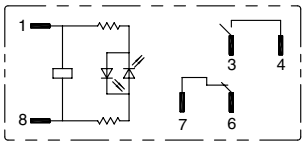
RF2∗-1A1B-☐
Standard



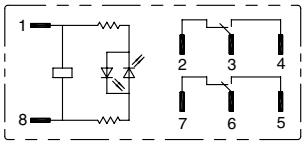
RF2∗-2C-☐
Standard



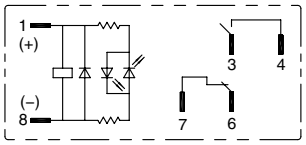
RF2∗-1A1BL-☐
With LED indicator



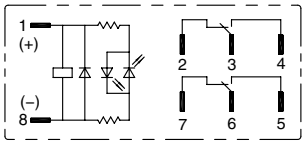
RF2∗-2CL-☐
With LED indicator



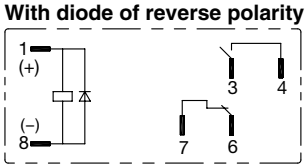
RF2∗-1A1BLD1-☐
With LED indicator + diode of reverse polarity coil



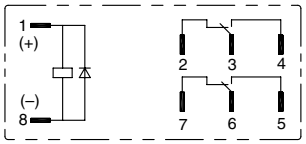
RF2∗-2CLD1-☐
With LED indicator + diode of reverse polarity coil



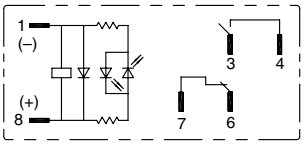
RF2∗-1A1BD1-☐
With diode of reverse polarity coil



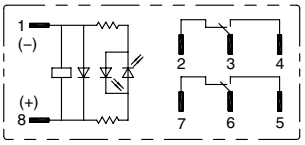
RF2∗-2CD1-☐
With diode of reverse polarity coil



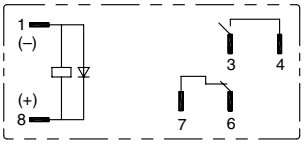
RF2∗-1A1BLD-☐
With LED indicator + diode



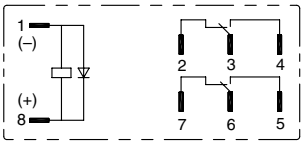
RF2∗-2CLD-☐
With LED indicator + diode



RF2∗-1A1BD-☐
With diode



RF2∗-2CD-☐
With diode



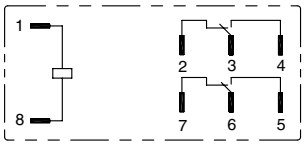
- Relays with diode have polarity. Take polarity into consideration when wiring.
- When using DPDT model as a force guided relay, use in SPST-NO + SPST-NC wiring (EN50205).

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



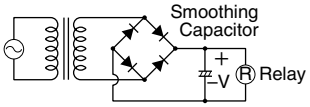
Example:
Use terminal 3-4 as NO contact and 6-7 as NC contact. Or terminal 2-3 as NC contact and terminal 5-6 as NO contact.

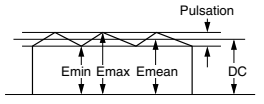
2. Driving Circuit for Relays

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.

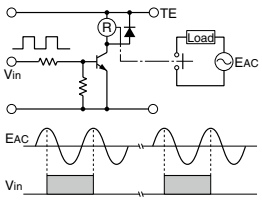




$$\text{Ripple Fctor (\%)} = \frac{E_{max} - E_{min}}{E_{mean}} \times 100\%$$

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

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



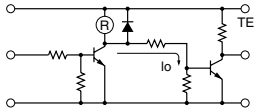
If the relay operates in sync with AC power voltage of the load, the relay life may be reduced. If this is the case, select a relay in consideration of the required reliability for the load. Or, make the relay turn on and off irrespective of the AC power phase or near the point where the AC phase crosses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

2-4. Leakage current while relay is OFF

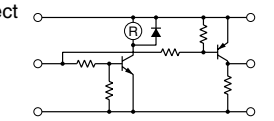
When driving an element at the same time as the relay operation, special consideration is needed for the circuit design. As shown in the incorrect circuit at right, leakage current (Io) flows through the relay coil while the relay is off.

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

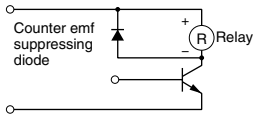
Correct



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

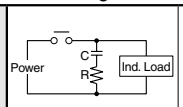
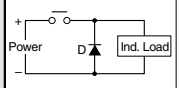
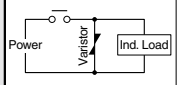
3-1. The contact ratings show maximum values. Make sure that these values are not exceeded. When an inrush current flows through the load, the contact may become welded. If this is the case, connect a contact protection circuit, such as a current limiting resistor.

RF2 2-pole Force Guided Relay / SJ Series Socket

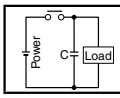
Operating Instructions

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. R: Resistor of approximately the same resistance value as the load. 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. Reverse withstand voltage: Power voltage of the load circuit × 10 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.

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