INTRODUCTION

The technical Information is divided into four basic parts:
(1) General application guidelines.
(2) Guidelines for relay handling.
(3) Guidelines for selecting contact protection circuits.
(4) Guidelines for selecting a temperature tolerant relay for your application.

In addition to the technical information, all data sheets in this catalog also include notes relevant to each specific relay. Please refer to these relay-specific notes, as they contain information vital to optimum relay performance.

GENERAL APPLICATION

1. Avoid Abuse
As with any electro-mechanical device, relays are sensitive to abuse. To assure optimum performance, avoid dropping, hitting, or other unnecessary shocks to the relay.

2. Never Remove the Case
The case of a relay is an integral part of that relay. SONG CHUAN relays are not designed to have the case detached. Never remove the case, as specifications or performance cannot be guaranteed.

3. Atmosphere Considerations
SONG CHUAN recommends that you use unsealed relays in an atmosphere with only a minimum of dust and other contaminants. If a relay must withstand a harsh atmosphere, SONG CHUAN recommends that you utilize a sealed relay.

4. Warning--Silicon Based Resins
Some silicon based resins can cause contact failure in a relay. The silicon based resin does not need to come in direct contact to cause damage—it just needs to be in close proximity. In cases where silicon based resins are used, it is recommended that a sealed relay be used.

5. Voltage
To assure meeting to electrical and performance characte ristics, only the correct rated voltage should be applied to the coil, i.e., voltage sine waves only for AC coils, rectangular for DC coils.

6. Over Voltage
Although typically a spike will not effect a relay's performance, the voltage on the coil should not continuously exceed the maximum allowable voltage.

7. Contact Current
Currents that exceed the designated values should be avoided.

8. Check Your Load and Conditions
The specifications provided in this catalog are "typical" specifications and are given only as guidelines. The performance of contacts vary depending on both the type of load and operating conditions encountered. Please consider your specific load and operating conditions in selecting the optimum relay for your application.

9. Warning--Ambient Temperature
The ambient temperature ranges, listed in the general specifications for each relay, must be adhered to, to assure proper operation. Note: Both the storage and operating range differs for the sensitive and standard version of the same model. Refer to the data sheet of the relay for specific information.

10. Ultrasonic Cleaning
Never use any type of ultrasonic cleaning. Ultrasonic cleaning is always traumatic and is not recommended.

11. Pickup & Dropout Voltages
Both pickup and dropout voltages should be considered when selecting a relay coil voltage. For specific information, contact us.

12. Relay Coil Transient Suppression
The use of a single diode in parallel with the coil for transient suppression causes longer contact release time. On power relays, longer release time may reduce relay life. For longer contact life, use a zener and diode, a capacitor and resistor, or only a resistor.

13. Storage
Avoid storing relays in excessively humid conditions where possible, as moisture can affect performance in some cases.

Technical Information

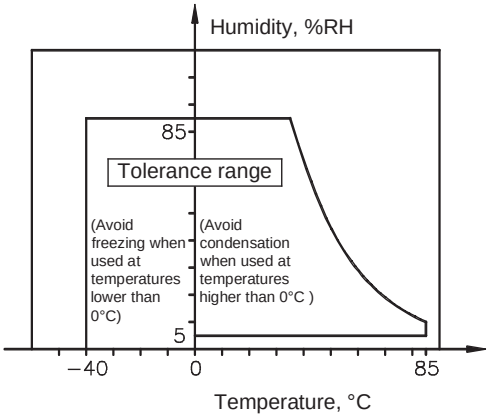
14. Usage Ambient Condition

(1) Temperature: The allowable temperature range differs with each relay.
Transporting and storing relays in a tube package, the temperature may differ from the allowable range of the relay. So, please contact us for individual specifications.

(2) Humidity: 5 to 85% R.H.

(3) Pressure: 86 to 106 kPa

Furthermore, the humidity range varies with the temperature. So, use relays within the range indicated in the graph below.



(The allowable temperature range differs for each relay.)

■ RELAY HANDLING

SONG CHUAN utilizes extensive quality control measures, and takes extreme care in packaging to assure that the relays you receive are in the best possible operating condition. Once they enter your facility, some common sense care can prevent damage during handling.

Some areas to closely monitor and supervise include:

1. Handling

◆ Avoid handling relay terminals.

Oils and contaminates common to the human hand can cause contamination of the surface finish--which in turn can lead to solder ability problems.

◆ Always store relays at recommended temperatures.

Observe maximum storage temperatures listed in the general specifications section of the data sheet for yourspecific relay.

◆ Avoid misalignment of the terminal layout and PC board hole pattern.

Even if there is just a slight misalignment, forcing a relay into the board can cause relay damage compromising such important factors as seal integrity, relay performance, and relay reliability.

◆ Store handle relays in a clean environment.

Your relays are state-of-the-art, electromechanical components, and should be stored and handled as such. Even environmentally sealed relays have exposed contacts that are subject to contamination, and therefore are minimally sensitive to their storage and production environment.

2. Mounting

◆ Suggested PC board layout.

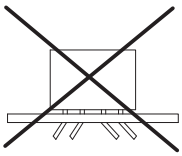
Refer to the PC board layout located on the data sheet for your specific relay.

◆ For automatic insertion.

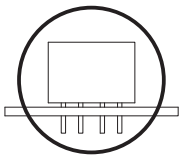
SONG CHUAN relays are available packaged for a variety of automatic insertion machines. Please consult with our Technical Services Department.

◆ Never bend terminals.

Once relay terminals are bent, performance can no longer be guaranteed. Never bend terminals to make them self-clinching, and avoid bending them to fit misaligned holes.



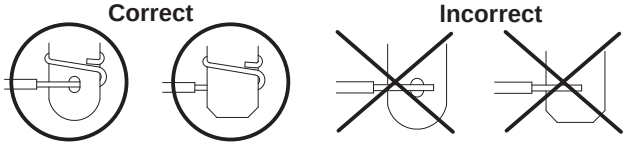
Incorrect
Bending the relay leads, for any reason, can cause failure.



Correct
Relay terminals remain straight and penetrate completely through the PC board.

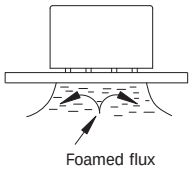
◆ Connection and mounting.

To connect a lead wire to the terminal or to mount the relay on a PC board, securely wind the lead wire around the terminal as shown.



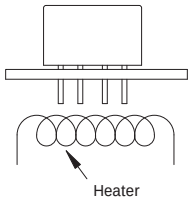
3. Soldering and washing guidelines

◆ Flux coating



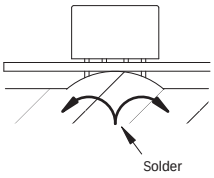
- ●Adjust the position of the PC board so that flux does not overflow onto the top of it.
- ●Use rosin-based flux, which is non-corrosive and requires no washing.
- ●Do not use Automatic Flux Coating Method to dust-cover type relays.
- ●Do not overflow onto the top of PC board, in such a case, the flux may even penetrate a flux-resistant type relay.

◆ Preheating



- ●Be sure to preheat before soldering.
- ●Preheating acts to improve solder ability.
- ●Preheat according to the following conditions:
  Temperature--100℃/212℉ or less
  Time within--approx. 1 minute

◆ Soldering



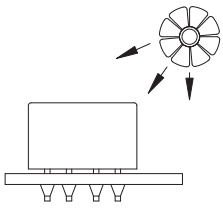
Automatic Soldering

- ●Flow solder is the optimum method for soldering.
- ●Adjust the level of solder so that it does not overflow onto the top of the PC board.
- ●Unless otherwise specified, solder under the following conditions depending on the type of relay.
- ●Solder Temperature---approx. 250℃/482℉ for SnPb soldering, 260℃/500℉ for Lead-free oldering.
- ●Soldering Time---within approx. 5 seconds
- ●Solder Ratio--- Sn/Pb = 60/40 or 63/37

Hand Soldering

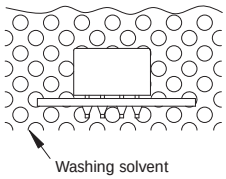
- ●Keep the tip of the soldering iron clean.
- ●Solder Iron---30W to 60W.
- ●Iron Tip Temperature--approx. 300℃/572℉
- ●Solder Time---within approx. 3 seconds

◆ Cooling



- ●Immediate air cooling is recommended to prevent deterioration of the relay and surrounding parts due to soldering heat.
- ●Although the sealed type relay can be cleaned, avoid immersing the relay into cold liquid (such as washing solvent) immediately after soldering. Doing so may eteriorate the sealing performance.

◆ Washing

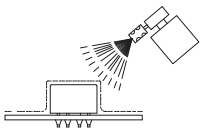


- ●Do not wash flux-resistant type relays and dust cover type relays by immersion.
- ●Careless washing may cause washing solvent to penetrate the relay.
- ●Plastic sealed type relays can be washed by immersion. Use washing solvents shown in Table 1.
- ●Use of other washing solvents may damage the relay case and cover, and also cause washing solvent to penetrate the relay.
- ●Washing with the boiling methods is recommended. Avoid ultrasonic washing on relays. Use of ultra-sonic cleaning may cause breaks in the coil or slight sticking of contacts due to the ultrasonic energy.

Table 1. Washing solvent compatibility chart for sealed type relays.

	Flourinated	Aqueous	Chlorinated	Alcoholic
Solvent trade name	Freon TF	Aqua flux	Perclean B-5	IPA
	Freon TE	#WL 1000	Perclean D	Ethanol
	Freon TES	Indusco 624	Cholorothene VG	
	Freon TMC	Indusco1000	Cholorothene N	
	Alpha 1001	Lonco terge 530	Cholorosolve	
	Alpha 1003	Hollis 310	Alpha 564	
		Lonco Terg	Trichcloroethan	

◆ Coating



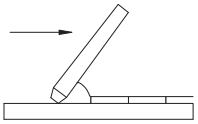
- ●If the PC board is to be coated to prevent the insulation of the PC board from deteriorating due to corrosive gases and high temperature, note the following.

Technical Information

●Do not coat dust-cover type relays and flux-resistant type relays.
●Depending on the type, some coating materials may have an adverse affect on relays, select coating materials carefully.
●Not to use silicon based resins.

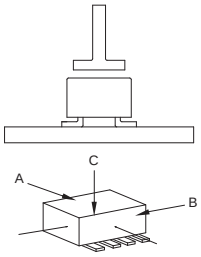
4.Surface Mounting

◆ Cream solder printing



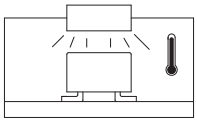
●Please use the cream solder that contains a flux without a large of chlorine, to avoid the terminal being corroded.

◆ Mounting



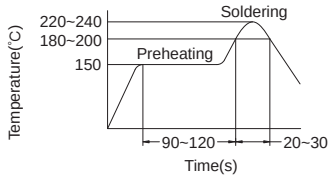
●The holding pressure on relay must be equal or less than the following reference. Or we can't guarantee the relay performance.
Direction A: 1.96N max.
Direction B: 4.9N max.
Direction C: 1.96N max

◆ Reflow soldering

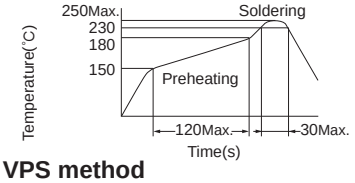


●Recommended conditions of soldering for example, as following. (The temperature profile shows the temperature on the PC board side.)
●Don't make the relay in a cold washing solvent instantly after soldering, to avoid the seal ability of relay being damaged.

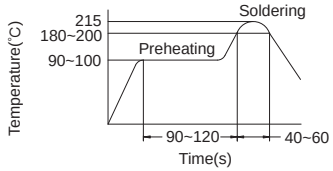
(1) IRS method (for SnPb solder)



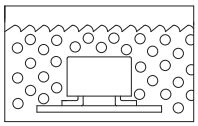
(2) IRS method (for Pb-Free solder)



(3) VPS method



◆ Washing



●Washing by boiling method and immersion is recommended.
●Use of ultra-sonic cleaning may cause break in the coil or slight sticking of contacts.
●Recommended washing solvent are aqueous solvent & alcoholic solvent. Furthermore, the solvent temperature must be within 40˚C.

Washing solvent

	Chlorinated	Aqueous	Alcoholic
Solvent	Perochlene	Indusco	IPA
	Chlorosolder	Holys	Ethanol

■ CONTACT PROTECTION CIRCUIT

A contact protection circuit, designed to prolong the life expectancy of the relay is recommended. This protection will have the additional advantage of suppressing noise, as well as preventing the generation of carbon at the contact surface when the relay contact is opened. However, unless designed correctly, the protection circuit may produce adverse effects, such as prolonging the release time of the load. The following table lists examples of contact protection circuits:

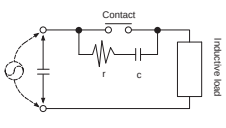
DIODE AND ZENER DIODE CIRCUIT

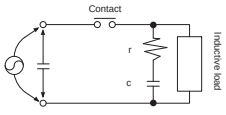
●DC applications only.
●Utilize when diode circuit causes longer turn off time on the load.
●Use zener diode with zener voltage about equal to power supply voltage.

DIODE CIRCUIT

●DC applications only.
●Compared to RC type, circuit delays longer turn off time on the load.
●For larger voltages, use diode with reverse breakdown 10 times circuit voltage and forward load circuit.
●For smaller voltages, use reverse breakdown v or 2 to 3 X power supply voltage.

RC CIRCUITS



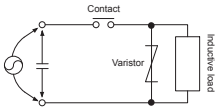


●This circuit is suitable for AC or DC Contact applications, but if used with AC voltage, impedance of the load should be smaller than the RC circuit's. Do not utilize for timer loads, as leakage current can cause faulty operation.
●This circuit is suitable for AC or DC. If Circuit the load is a relay or solenoid, release times lengthen.

Effective when connected to both contacts, power supply voltage across the load is 100 to 200V.

●As a guide in selecting c and r,
c: 0.5 to 1μF per 1A contact current,
r: 0.5 to 1Ω per 1V contact voltage.

VARISTOR CIRCUIT



●Effective for AC & DC applications.
●Circuit slightly delays release time. Effective when connected to both contacts, power supply voltage across the load is 100 to 200V.

Inrush Current

The type of load combined with it's inrush current characteristics, together with switching frequency can cause contact welding. For loads with inrush current, measure the steady state current and inrush current to determine the proper relay. Typical types of loads and the inrush current they create are shown in Table 2. Note that the effect of wiring resistance can reduce the inrush currents to less than the levels shown.

Table 2

Type of load	Inrush current
Resistive	Steady state current.
Solenoid	10~20 times the steady state current.
Motor	5~10 times the steady state current.
Incandescent lamp	10~15 times the steady state current.
Mercury lamp	3 times the steady state current.
Sodium vapor lamp	1~3 times the steady state current.
Capacitive	20~40 times the steady state current.
Transformer	5~10 times the steady state current.

■ TEMPERATURE TOLERANT RELAY

More and more applications require relays that operate at higher temperatures. Relays run "hot" due to high ambient temperatures and/or high contact switching. These "hotter" environments can destroy a relay's insulation system and lead to product failure in the field.

To help prevent this type of failure, SONG CHUAN has, for several years, offered UL Class A, Class B, Class F insulating systems on its miniature power relays. Class F relays have significant "heat" advantage over Class A or Class B relays that, by contrast, only offer a rating of 105℃ (Class A) or 130 ℃ (Class B) .
This Class F insulating system is designated by UL and it is rated at a full 155℃. This section is a discussion of why and when an engineer needs to select a high temperature rated for the application.

First, let's define an insulation system, as it pertains to this application note. An insulation system may be defined as simply any combination of insulating materials used in electrical equipment. In a relay it is the combination of a coil form, the magnet wire coating, and the outer wrapping of the relay coil.

A proper insulating system is essential because it separates the control side of a relay (the coil) from the switch side of the relay (the contacts). The switch side of the relay may be used to switch high voltages that are potentially lethal to humans as well as to the circuitry that is connected to the coil side of the relay.

Consequently, when a relay is evaluated for a particular project, it should be evaluated at the maximum ambient temperature it will see in that product. If the insulating system breaks down, it allows electrical current to flow from the switch side of the relay to the control side of the relay. This in turn causes failure--and in some cases can present a safety hazard.

UL understands that time and temperature are the enemies of an insulating system. Just as paint on a house begins to peel with age and exposure to heat, aninsulation system begins to break down with age and exposure to heat. Consequently, UL designed and administers a series of tests that assure that this breakdown does not occur even after aging and heating.

UL Document 1446 is concerned with systems of insulating materials. Insulating systems are classified by their ability to withstand elevated temperatures. It is from this document that we derive Class A, Class B, and Class F.

Table 3
Max. Hot-Spot Temperature of Insulating Systems

System Class	℃	℉
B	130	266
F	155	311
H	180	356
N	200	392
R	220	428
S	240	464

Table 3 is printed directly from the UL document. As it indicates, a Class B relay is rated for a maximum hot spot temperature of 130℃, and Class F relay is rated for a maximum hot spot temperature of 155℃. For a relay, the hot spot temperature is basically the coil temperature. The coil temperature is a result of the self-heating of the coil due to the power dissipation of the coil (coil voltage and current), heating due to the load being carried by the contacts (they get hot too and that leaks over to the coil), and by the ambient temperature of the environment.

Technical Information

At room temperature, most relay coils will not exceed a temperature of 130˚C even with full contact load and continuous operation. However, if a particular circuit design calls for the relay to work in a high ambient temperature, or at a coil voltage higher than nominal (or both)--it is possible that the coil temperature might exceed 130˚C. Sometimes the designer does not realize this until the product gets to UL--and at that point it is determined that a higher class of insulating system is required. If the Class B (rated up to 130˚C) is not sufficient, Class F (rated up to 155˚C) would be the next logical choice. Class F relays are proving to be ideal for applications such as:

- Appliance Controls
- Automotive Controls
- Spas and Pool Controls
- Industrial Controls

Plus, as power relays are used more and more in control application, and boards get smaller and smaller allowing less room for heat dissipation--Class B and Class F relays become increasingly attractive.

WARRANTY

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