

Protection Circuit for Relay Contacts

Circuit		Application		Features/Others	Device Selection
		AC	DC		
CR Circuit		*	○	If the load is a timer, leakage current flows through the CR circuit causing faulty operation. *If used with AC voltage be sure the impedance of the load is sufficiently smaller than that of the CR circuit	As a guide in selecting r and c, r: 0.5 to 1Ω per 1V contact voltage c: 0.5 to 1μF per 1A contact current. Values vary depending on the properties of the load and variations in relay characteristics. Capacitor c acts to suppress the discharge the moment the contacts open. Resistor r acts to limit the current when the power is turned on the next time. Test to confirm. Use a capacitor with a breakdown voltage of 200 to 300V. Use AC type capacitors (non-polarized) for AC circuits.
		○	○	If the load is a relay or solenoid, the release time lengthen. Effective when connected to both contacts if the power supply voltage is 24 or 48V and the voltage across the load is 100 to 200V.	
Diode Circuit		X	○	The diode connected in a parallel causes the energy stored in the coil to flow to the coil in the form of current and dissipates it as joule heat at the resistance component of the inductive load. This circuit further delays the release time compared to the CR circuit. (2 to 5 times the release time listed in the catalog)	Use a diode with a reverse breakdown voltage at least 10 times the circuit voltage and a forward current at least as large as the load current. In electronic circuits where the circuit voltages are not so high, a diode can be used with a reverse breakdown voltage of about 2 to 3 times the power supply voltage.
Diode and Zener Diode Circuit		X	○	Effective when the release time in the diode circuit is too long.	Use a zener diode with a zener voltage about the same as the power supply voltage.
Varistor Circuit		○	○	Using the stable voltage characteristics of the varistor, this circuit prevents excessively high voltages from being applied across the contacts. This circuit also slightly delays the release time. Effective when connected to both contacts if the power supply voltage is 24 or 48V and the voltage across the load is 100 to 200V.	

- Avoid using the protection circuits shown in the figures on the right. Although DC inductive loads are usually more difficult to switch than resistive loads, use of the proper protection circuit will raise the characteristics to that for resistive loads. (Figure 1)

Figure 1	
No Good	No Good
Although extremely effective in arc suppression as the contacts open, the contacts are susceptible to welding since energy is stored in C when the contacts open and discharge current flows from C when the contacts close.	Although extremely effective in arc suppression as the contacts open, the contacts are susceptible to welding since charging current flows to C when the contacts close.

Relay Soldering Manual

This manual provides the precautions for soldering miniature relays

1. MOUNTING

- 1-1 Care should be taken not to bend the relay terminals when the relay is mounted on the P.C. board. Relay malfunction may be caused by damaged terminals.
- 1-2 The mounted P.C. board must be handled carefully. The enclosure of the relay should not be removed after the relay has been mounted to keep the relay performance in good condition
- 1-3 The performance of any relay dropped to the ground should be checked prior to mounting.

2. SOLDERING

- 2-1 The precautions for hand soldering are given below
 - (1) The capacity of the bit must be smaller than 30W.
 - (2) Any bit with a bigger capacity may cause damage to the copper of P.C. board or the relay mold.
 - (3) Avoid applying the bit for a long time, otherwise the copper of P.C. board or the relay mold may be damaged.
- 2-2 The precautions for the dip or automatic soldering are mentioned below:
 - (1) Only resin flux with non-corrosive residue should be used.
 - (2) The soldering flux must be applied equally with a foam-fluxing unit, etc. The foam should be fine enough to allow the precise level control in the fluxing unit.
 - (3) In case the soldering flux is applied with the impregnated sponge, take care not to pour the soldering flux on the surface of the P.C. board to prevent the flux from entering the relay. For the same reason, avoid putting the mounted P.C. board directly in the soldering tub.
 - (4) Heating is required after applying the soldering flux. The best condition is a heating temperature of 70°C to 90°C. Since the heating improves the solderability, the soldering flux dries quickly, and can be prevented from intruding into the relay.
 - (5) The best temperature for the soldering tub is 250°C ± 5°C.
 - (6) Material oxidized in the soldering tub should be periodically removed by hand or by an automatic device.
 - (7) The soldering dip time must be shorter than five (5) seconds. The traveling speed of the P.C. board must be adjusted to the above condition.
 - (8) The composition of the bar solder to be used is to be 60% tin/40% lead or 63% tin/37% lead.

3. CLEANING

The following precautions must be observed to maintain good relay performance (some solvents may cause erosion or breakage of the plastic parts):

- 3-1 Solvent
 - (1) Recommendable: Freon Family and Alcohol Family
 - (2) Unrecommendable: Chlorine Family
 - (3) Organic solvents such as trichloro-ethylene, Chlorothene, etc. may damage the polycarbonate parts such as the enclosure, etc.
- 3-2 Cleaning method
 - (1) Standard Type

Only the soldered side of the board should be cleaned. Take care not to pour the solvent on the surface of the board. The printed board must be laid with its soldered side downwards on a detergent-impregnated sponge to dissolve the flux. The board must lie for approximately 1 minute on the sponge. Subsequently, the remains of soldering flux can be removed by slight rubbing.
 - (2) Washable Type

The typical cleaning procedures are given below:

 - Vapor washing with recommendable solvent: 5 minute maximum
 - Shower with 70°C hot water for 5 to 10 minutes.
 - Drying approximately at 80°C 2 minutes.
 - (3) Ultrasonic cleaning should be avoided whenever possible, since certain components are apt to be damaged. If it is unavoidable, a series of tests should be carried out on odd components of the same type, using various cleaning times and solvents. In addition, cleaning time should be shorter than 60 seconds.

4. VARNISHING

If no cleaning has been performed, no varnishing is necessary. However, if special requirements are made, E.G. in case of bare copper conductors which need varnishing, only the soldered side of the board should be treated.