electrocube

Electrocube offers many years of experience in the design and manufacture of standard precision RC Networks, as well as special units to meet customer requirements. The company has developed encapsulated networks for such industrial and commercial applications as machine tools, switchgear, motor controls, electro plating, computers, telephone and automated equipment.

The following pages describe more than 200 standard RC Network units, in a range of configurations. These are available off-the-shelf for a wide variety of applications.

RC Networks manufactured to specific customer requirements cover the range from 1 to as many as 40 networks in a container, for single or 3-phase operation. Many of these feature unusual case configurations (metal can or epoxy cases), solid wire or machine tool wire leads, varying lead length and/or lead configuration. Networks are also supplied mounted on printed circuit boards.

If you do not find a standard unit on the following pages to fit your particular application, contact Electrocube to design and supply the right RC Network to meet your exacting requirements.

RC NETWORK APPLICATIONS

The generation of inductive or switching transients is a well-known phenomenon to design engineers. The suppression of such transients is required for two general purposes. For contact protection and/or to prevent the generation of electromagnetic interference (EMI). When arc suppression only is required, the suppression device is normally placed across the switching device. When EMI is to be suppressed, optimum results are obtained when the suppression device is placed across the load, particularly if long leads are required between the switching device and the load. Many techniques have been devised to eliminate or suppress the transients. When features such as cost, size, and effect on the circuit are considered, the most effective application is a series capacitor-resistor network.

The selection of the optimum value of capacitor and resistor combination depends on the ratio of inductance to resistance of the switched load, the distributed capacitance of the circuit, the speed of the contact opening, and the voltage at the time of contact opening is: $e l = L \frac{di}{dt}$. Depending on the circuit resistance and the rate of switch opening, thousands of volts can be developed in very low voltage circuits.

The capacitor should be capable of absorbing the stored energy of the inductive load which is ½ LI^2 joules but the resistance and distributed capacitance of the load and line effect this selection. It should also be noted that the value of the capacitor selected can cause ringing in the circuit unless properly damped. It is obvious that the calculation can be complex and most times impossible, because in commercial applications, the inductive value of the load is not known or may not be constant. However, practical values can be obtained from the following formulas for contact protection:

$$C = \frac{I^2}{10} \text{ Mfd.}$$

$$R = \frac{E}{10\,[3.16\sqrt{C}]\,(1 + 50/E)}$$

where I is the load current and E is the open circuit voltage.

Starting with these values, either or both components can be varied to obtain the optimum result. A general rule is to increase the value of the capacitor to decrease the transient voltage. (Note that contact arcing begins around 320V in air.) However, care should be taken so that the values of the RC across contacts will limit the open circuit current to the load AC applications.

The correct wattage of the resistors is dependent on the frequency of contact closure/opening in DC circuits. Most often a ½ to 1 watt resistor will suffice. In AC circuits the actual currents can be calculated and the I^2R value used.

RC networks placed across the load are more difficult to calculate. A rule of thumb again is to select a capacitor whose value in Mfd. is between ½ and 1 times the load current in amps. The series resistor should initially be chosen to equal the load DC resistance.

In summary, RC networks provide simple, economical means of suppressing inductive transients. The optimization of the component values can be quite complex. However, it has been found that most contact protection can be achieved with capacitor values between .22 Mfd. and .47 Mfd. with series resistance values from 10 Ohm to 400 Ohm.