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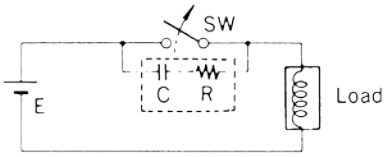
RC Networks

Engineering Guide

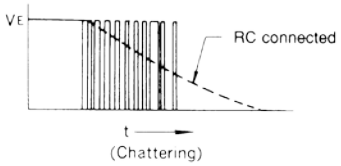
Effect of RC Networks

Arc suppression



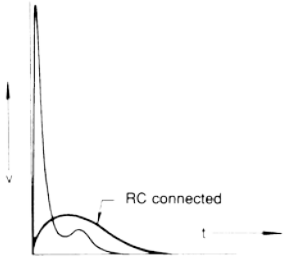
The moment the switch opens, the RC combination absorbs and suppresses the energy of the arc by allowing it to bypass the switch.

Damping oscillation



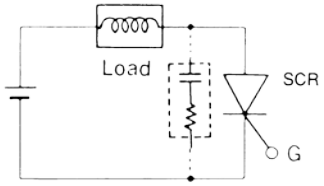
The RC combination absorbs the high frequency oscillations caused by mechanical vibrations such as relay contact chattering. Similarly, arcing creates oscillations that are averaged and suppressed by the RC combination regardless of their origin.

Back electromotive force suppression



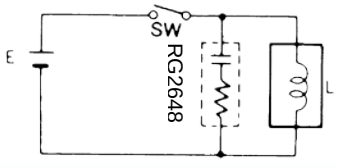
Back electromotive force due to inductance suppresses the surge voltage peak by conducting it through the RC circuit at low impedance. The capacitance of RC absorbs the peak. The time constant of the RC averages and smooths the waveform, thereby eliminating or substantially minimizing generated noise.

DV/DT suppression

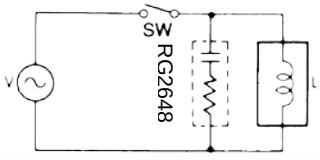


The RC combination allows the dv/dt of thyristors or similar devices' on and off operation to decrease. As a result, surge voltages are suppressed and semiconductor elements are protected. Even in the case of zero circuits, such as AC circuits, protection is necessary since harmonic noise occurs when there is a gap between current phases and load circuit voltage.

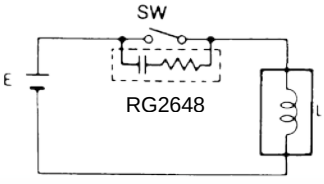
Application Examples



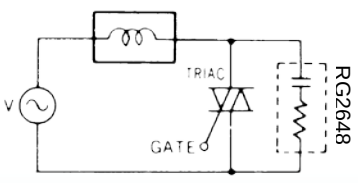
Standard example in DC circuits



Standard example in AC circuits



Standard example in DC circuits



Example for phrase control circuits employing SCR, TRIAC, etc.

Determining RC Value

In general, the calculated RC value is difficult to determine using the following formula. This is due to contributing factors such as equipment wiring and component locations which can vary from machine to machine.

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

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

C = Capacitance in MFD
I = Load Current in Amps
R = Resistance in Ohms
E = Source Voltage

The best way to determine the values needed is to obtain a storage oscilloscope and use the RG2648 Resistor-Capacitor Substitution Box (RCSB) placing the RCSB in circuit as shown in the Application Examples (found on the front page). The user matches combinations of resistors and capacitors, while viewing the amount of spike reduction on the oscilloscope, and should continue to change the combination of RC until the optimum spike reduction is achieved. Once the combination is determined, refer to Electrocube's RC Networks data sheet for the proper device. Note: The equipment should be powered down when switching combinations of the resistor and capacitors into the circuit. Please keep in mind, there is a shock hazard once the RCSB is removed from the circuit, since the capacitor may still retain a charge. The charge can be eliminated by shorting the terminals and turning the MFD switch through the values.

Electrocube has determined that the best overall combination is .47-.50 MFD @ 220Ω. This combination works for an estimated 90% of applications. The voltage should be selected for the normal DC or AC voltages. However, the designer must take into consideration the peak voltages involved.

The resistor wattage depends upon the number of times per minute the circuit is activated. As a general rule of thumb, the following chart should be considered.

The chart and formula are guidelines to give the user a starting point from which to work. The final selection must be evaluated in the application to determine its acceptability.

CIRCUIT ACTIVATION TIMES / MINUTE	RESISTOR WATTAGE
1-3	.5
4-5	1
6-9	2
10-15	5
>15	10

Resistor-Capacitor Network Substitution Box

For questions and/or a quote, contact Sales at 909-595-4037 or info@electrocube.com.

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Founded in 1961, Electrocube is one of the most respected design manufacturers of passive electrical components – film capacitors, RC Networks, EMI Filters and foil transformers – for a wide range of standard and custom applications in the aerospace, audio, elevator, heavy equipment industries and more. Electrocube's hallmark is its clear understanding of the challenges faced by design engineers and purchasing agents as well as design engineers, lab and repair technicians. www.electrocube.com