The RC units are designed for use in DC and AC application:

- Contact protection
- Interference suppression of contacts
- Transient suppression for protection of low-power thyristors and triacs
- dU/dt suppression in thyristor and triac low-power snubber circuits.

Application of RC units

The use of a capacitor and resistor in series has long been known as a most effective means of increasing the life of contacts. At the same time electromagnetic interference suppression is achieved. RC units are also very suitable as dU/dt and transient suppressors on thyristors and triacs in low power applications, for example in dimmers and speed regulators.

RC units for contact protection and interference suppression:

Relay contacts that make and break a circuit are subjected to electrical erosion resulting from sparking and arcing. Spark suppressors used are RC units, nonlinear resistors; shunt resistors, diodes and gas discharge valves. Among these devices the RC network is in most cases the best spark suppressor for the reduction of contact erosion. The advantages are:

- RC networks are bipolar and therefore suitable for AC applications.
- The relay operating time will not be very much affected.
- No current consumption.
- Electromagnetic interference Suppression is achieved.

When the contact K (see figure 1) breaks, the voltage across the contact rapidly grows with the rate of I/C1 (C1 is the small capacitance of the wiring) resulting in a breakdown of K and a spark discharge of C1. The discharge stops when the voltage across K has decreased to about 15 V. C1 recharges and another breakdown occurs. This series of sparks stops when the contact clearance is wide enough to withstand the voltage without breakdowns (see figure 2).

Figure 1

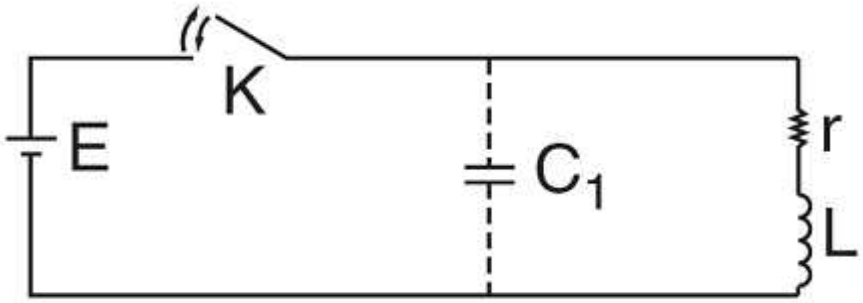
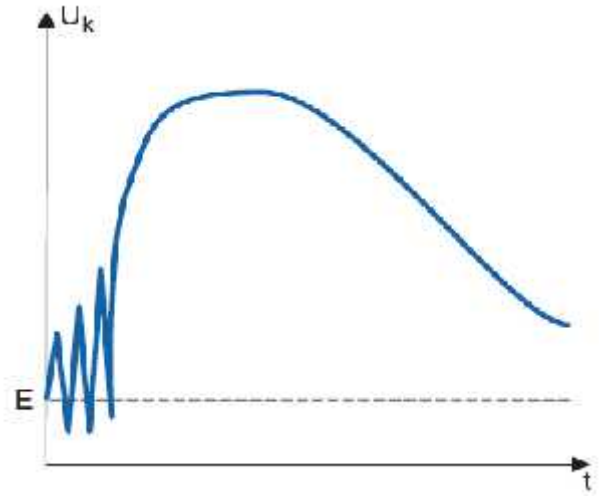
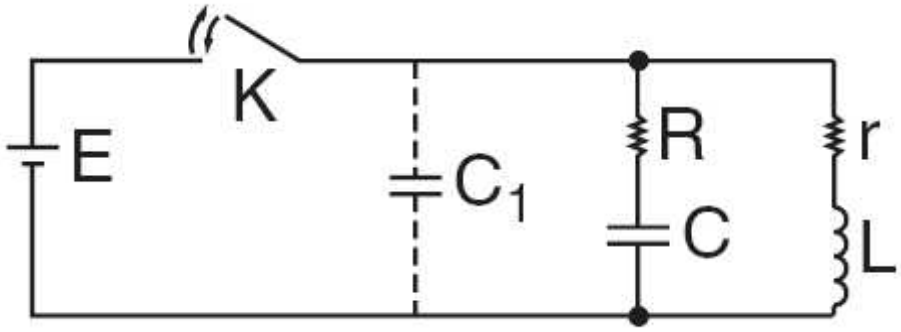


Figure 2



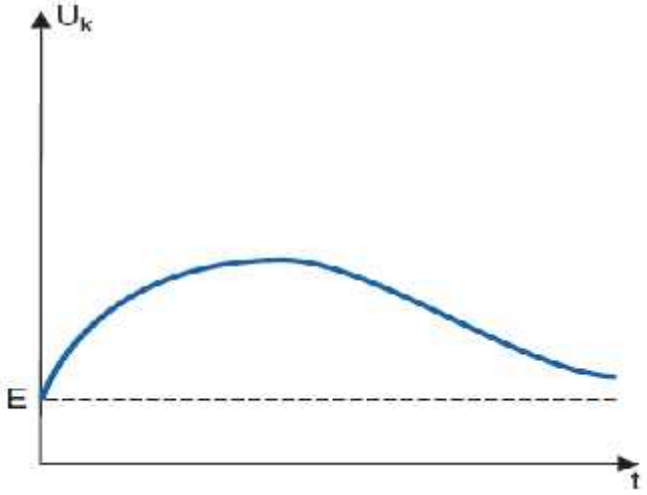
By coupling a capacitor C over the contact (see fi gure 3a) the voltage across the contact will be reduced and the voltage increase dU/dt will be limited to I/C instead of I/C1.

Figure 3a



As I/C is much less than I/C1 the voltage increase over the contact will be kept low enough to prevent breakdowns (see fi gure 3b).

Figure 3b



In order to limit the current through the contact when it closes, the resistor R must be connected in series with the capacitor. The values of the capacitor and the

resistor depend on the inductance and resistance in the load, the applied voltage and type of contact (i.e. exactly how the contact makes and breaks and its current rating). The protective capacitance must be large enough to prevent the contact voltage from rising to a value greater than the air breakdown value at any instant.

This value depends on the contact separation but is never less than 300 volts. With few exceptions, a 0.1 μF capacitor will be large enough to hold the peak voltage to less than 300 volts. Limiting the voltage rise across the contacts to less than 300 volts peak will not necessarily prevent all breakdowns of the gap. At the very first instant of contact breaking the contact operation is so minute that low-voltage breakdowns of the gap may occur. To minimize this risk the common procedure is to impose the additional requirement that the contact protection capacitor must limit the rate of voltage rise immediately after the contact breaks to 1 volt per microsecond. This requirement will be met if the ratio I/C is less than unity where I is given in amperes and C is in microfarads. For slow moving contacts even larger capacitors are used. With sufficient capacitance in the circuit for protection when the contact breaks, a resistor is needed for protection when the contact closes. The network capacitor is charged to the full voltage when the circuit is open. Closing the contacts effectively short-circuits this voltage, so a resistance is connected in series with the network capacitor to limit the current through the contact. The resistor thus reduces erosion as the contact closes, but also tends to increase it as it opens. The sudden diversion of the steady-state current into the protection network on contact breaking immediately produces a voltage across the contacts due to the current fl owing through the protection resistance. A compromise is there fore necessary, and it is general practice to have a resistance that gives the same current through the contact on closure as the steady-state current. The RC network can be connected across the contact or across the load. If there is long wiring between the contact and the load, connecting the RC network across the contact is to be preferred. At the same time as the contact is protected by the RC network, electromagnetic interference suppression is achieved as the sparks, which contain a high frequency spectrum are avoided.