Clock oscillators

There are, basically, two categories of oscillators that are of interest to the electronics engineers: Harmonic and relaxation. The former produce sinusoidal waveforms and contains at least one active component that supplies power constantly to the passive components, whereas relaxation oscillators produce non-sinusoidal waveform, such as rectangular pulses.

An oscillator is generally an amplifier operating with positive feedback in a manner whereby an output is produced without any input signal. To achieve the desired frequency every oscillator contains a frequency-determining part, which may be an LC circuit, a phase-shifting RC network or a quartz crystal.

Requirements of a clock oscillator

Clock oscillators must be reliable, easily reproducible and simple. An example of such an oscillator is shown in figure 1.

![Figure 1](image1)

This series-mode circuit suitable for operation between 1 and 8 MHz. Fine adjustment of the frequency is provided by the trimmer $C_1$. If the required frequency accuracy is not important the trimmer may be omitted. Capacitor $C_p$ prevents operation on a harmonic frequency. The value of $R_1$ is 2kΩ for operation below 2 MHz. The value of $R_2$ is calculated from $R_2 = \frac{3000}{f_c}$ where $f_c$ is in MHz.

A better oscillator using inverter gates is given in figure 2.

![Figure 2](image2)

It operates in parallel mode. Resistor $R$ serves to limit the current through the crystal. If fine frequency adjustment is not required, $C_1$ may be omitted and $C_p$ increased to 56pF. This circuit is suitable for use between 1 and 30 MHz. The value of $R$ is calculated from $R = 10^4 / f_c - 300$ where $f_c$ is the crystal frequency in MHz.