



**Technical note series:  
An introduction to Filters – Article 1**

**What is an Electronic Filter?**

Electronic filters are an electronic circuit that is used within a signal processing system to remove unwanted frequency content from an applied signal, equally they can also enhance wanted content or sometimes both. Unlike digital filters they act on the pure analog continuous signal and do not suffer from errors inherent with digitising signals.

Electronic filters fall into two categories, passive and active.

- Passive – a passive electronic filter is the most basic option, it does not require an external power source and is generally composed of four basic linear elements – resistors (R), capacitors (C), and inductors (L). Although simple they are well suited to large signals (tens of amperes, hundreds of volts) and have guaranteed stability.
- Active – an active filter is an analog circuit design which creates an electronic filter using active components, typically an amplifier. By using an amplifier in a filter design it can improve the cost, performance and predictability of a filter. The most critical feature of an active circuit is the use of an amplifier which prevents the load impedance of the following stage from changing the filter characteristics.

**Basic electronic filter design concepts**

Inductors (L) block high-frequency signals and conduct low-frequency signals.

Capacitors (C) block low-frequency signals and conduct high-frequency signals.

Using these elements together in a filter in which a signal passes through an inductor, or in which a capacitor provides a path to ground, presents less attenuation to low-frequency signals than high-frequency signals and is therefore a low-pass filter (see article 2).

Similarly if the signal passes through a capacitor, or has a path to ground through an inductor, then the filter presents less attenuation to high-frequency signals than low-frequency signals and therefore is a high-pass filter (see article 2).

Resistors (R) in isolation have no frequency-selective properties but are added to inductors and capacitors to determine the time-constant of the circuit which provides control over the frequencies to which the filter responds.

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