DC Nanovolt Amplifier model A10 Technical Description

The A10 is a very low level DC Nanovolt Amplifier, which is designed for sensitive detection of DC signals down to a level of 100 pico-volts. The applications are largely research into superconductivity, precision calibration and standards and ultra low level thermodynamic research into pharmaceuticals using micro calorimeters. A10s have also been used in other fields, such as audio and seismic research.

The A10 uses a modulating technique to convert the input DC to an AC signal for initial amplification. This technique gives an advantage for the immunity to noise and thermal drift, which are so prevalent in low level DC amplifiers. It is these causes of interference which limit the level of sensitivity in DC amplifiers. All semiconducting devices display a noise characteristic which is above the physical thermal noise associated with resistive elements and is the fundamental limit of resolution.

Semiconductors display another disturbing characteristic and that is known as 1/f noise. The noise characteristic of a semiconductor amplifying device shows an increasing level of unwanted signal at decreasing frequency. This is caused by a fundamental property of semiconducting devices and limits the level at which they can amplify very low frequency signals. This is shown by sudden jumps in level and can make measurement very difficult and is sometimes called ‘flicker noise’.

Another fundamental limit of low level DC measurement is the changing offset voltage associated with the thermal emf generated at the junction of dissimilar materials. This problem often swamps the input signal being resolved and can make measurements at low level very difficult or even impossible.

Modulating the input signal to a detecting amplifier can reduce the effects of thermal emf and unwanted very low frequency signals as the amplifier sees only an AC signal which is then amplified by an AC coupled amplifier and demodulated to provide an amplified version of the input DC signal.

Care needs to be taken with the design of the input modulator as this can add unwanted signal to the input and adulterate the required signal to be measured.