A temperature compensated power measurement system based on a Hall effect sensor

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Abstract:
This paper introduces the use of a Hall effect sensor as the main part of a microcontroller-based power measurement system. The system is designed around 8 bit microcontroller PIC16F84 that performs the acquisition, processing and display of sensor's data. In order to reduce the undesired influence of the temperature on system's accuracy, an additional temperature sensor (ON-400 thermistor) and a temperature correction software component are introduced. Referring to the analog to digital conversion of the sensor data, a two-channel pulse-width modulated scheme is implemented based on microcontroller's digital input-output lines. The instantaneous power is displayed using a LCD display controlled by a Hitachi 44780 controller.

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Contents

In many electrical and electronic systems, the rate at which energy is transferred is an important parameter. Referring to the true power or active power, it can be defined as the quantity taken from the source and converted to heat in a nonreversible process. As it is well known, the defining equation for determining the active power in an electrical circuit is:

$$P = \frac{1}{T}\int_0^T p(t)dt \quad (1)$$

where P is the active power, $p(t) = i(t)u(t)$ the instantaneous power and T the period of the electrical signals. One possible way to evaluate P is to acquire the i(t)u(t) product and to post-process the time average. The Hall effect sensor represents a solution for this purpose [1].