

APPLICATION HINTS

The HEIMANN Sensor integrated module HTIA consists of a fast response thermopile sensor and an ASIC as specific integrated circuit for the signal processing and on chip calibration.

The thermopile sensor converts the temperature radiation of an object surface to an electrical signal (voltage) by thermocouples (Seebeck effect). The sensor output voltage is related to the object temperature and emissivity (radiation) as well as to the sensor chip temperature (housing temperature) and surrounding temperature (radiation) by the following equation :

$$V_S = K * \varepsilon * (T_O^n - T_S^n)_{T_A=T_S}$$

V_S -> sensor output voltage

K -> constant apparatus factor

ε -> object emissivity

T_O -> object temperature

T_A -> ambient (surrounding) temperature

T_S -> sensor (housing) temperature

n -> exponent to describe the temperature dependency of the signal voltage

The equation is simplified by the hypothesis of equal ambient and sensor temperatures. The exponent „n“ has the theoretical value of „4“ based on physical laws. But in the application practice it is an empirical determined, multi-polynomial regression function. The knowledge of the housing temperature is necessary to get the right object temperature from the sensor voltage. The integrated sensor module HTIA is designed to detect the housing temperature and to convert the temperature to a voltage. By the multi-functionality of the integrated sensor module HTIA it is possible to use that voltage for an on chip ambient temperature compensation which makes the output voltage of the sensor module widely independent from ambient temperature variations within a range of 40°C. For higher accuracy requirements the multi-functional sensor module can output the amplified and calibrated sensor voltage separated from the linear on-chip temperature reference voltage. With it the ambient temperature compensation can be simple done by an external microcontroller using a polynomial regression equation.

By the large number of physical affects influencing the non-contact temperature measurement, it is difficult to have the best initial adjustment for the different applications. In detail the measuring is influenced by the object emissivity and its variation, optical ratios (field of view, object size, measuring distances), the ambient and object temperature ranges, the adjustment of the ambient temperature compensation, unstable (dynamic) ambient temperature conditions.

For all applications an optimized solution can be found and fixed for a serial production. Don't hesitate to contact HEIMANN Sensor for support to use our long-time experience in infrared sensors and sensor modules.