Function Based Temperature Calculation and Compensation

Base Function

$$V_{obj} = K * \varepsilon * \left(T_{obj}^{n} - T_{amb}^{n}\right)$$

Tamb=Tsensor

Vobj (V):	sensor object voltage
K :	constant apparatus factor -> test certificate
ε :	emissivity of the object
Tobj (K):	object temperature (Kelvin)
Tamb (K):	sensor (ambient) temperature (Kelvin); The equation is simplified by the hypothesis of equal ambient Tamb and sensor temperatures Ts.
n:	exponent, empirically determined, in sensor practice mostly in the range 3 to 4 -> test certificate

Object Temperature Calculation and Ambient Temperature Compensation Function

$$T_{obj} = \sqrt[n]{\frac{V_{obj}}{K * \varepsilon} + T_{s}^{n}}$$

Experimental Determined Factors

In a first approximation the constant factor "K" and exponent "n" based on the Heimann Sensor measuring data can be used. In most cases an exponent of 4 is sufficient for the required temperature tolerance, which simplifies the calculation.
The verification of the values is recommended by an application test.

$$K = \frac{V_{obj}}{\varepsilon * \left(T_{obj}^{n} - T_{s}^{n}\right)}$$

Application Hints for Sensor Modules HTIA

The uncompensated sensor output voltage *V(AOTu)*, measured at the output AOT, is containing the object signal value *Vobj* and the reference voltage *Vref* :
Vobj = V{AOTu} - Vref

Internal temperature gradients generate additional offset voltages *Voffs* depending on application influences :
Vobj = V{AOTu} - Vref + Voffs
The temperature generated offset can be determined by a output signal test at Tobj = Tamb.

Calculation of the ambient (sensor) temperature using the sensor output AOR :
$T_s = S_T$ * (V{AORt} – V{AORt@25}) + 298.15K

Ts:	sensor temperature
S_T (V/K):	temperature sensitivity of the internal temperature reference -> test certificate
V{AORt} (V):	measured temperature output voltage at output AOR
V{AORt@25}(V):	temperature output voltage at 25°C (298.15K) -> test certificate

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