CloudWatcher Sky Temperature Correction Model

The basic approach to determine sky temperature is simply subtracting the ambient temperature from the infrared measure temperature, as in:

$$T_{sky} = T_s - T_a$$

where T_{sky} = Corrected Sky Temperature (ºC)
T_s = Infrared Sky Measured Temperature (ºC)
T_a = Ambient temperature (ºC)

This simple approach, however, requires frequent changes to the limits - that is, the resulting cloud detection temperature is not the same as the weather changes along the year.

To improve on this, the CloudWatcher has a polynomial model to adjust the correction value depending on the ambient temperature, with different weights, given by:

$$T_d = (K1 / 100) * (T_a - K2 / 10) + (K3 / 100) * (Exp(K4 / 1000 * T_a))^\wedge (K5 / 100) + T_{67}$$

where T_d = Correction value (ºC)
T_a = Ambient temperature (ºC)
K1, K2, K3, K4, K5, K6 and **K7** are the coefficients defined in the ***Device*** section of the ***Setup*** TAB, or Solo configuration page
T_{67} (cold weather factor) calculation is shown below
Exp(**n**)= *e* (the base of natural logarithms) raised to the power of **n**.
A^b = **a** raised to the power of **b**

The corrected sky temperature (T_{sky}) is then given by:

$$T_{sky} = T_s - T_d$$

where T_{sky} = Corrected Sky Temperature (ºC)
T_s = Infrared Sky Measured Temperature (ºC)
T_d = Correction value (ºC)

Computing the sky temperature this way, and after proper calibration, makes it possible to have accurate detection along a wide temperature range.

Calculation of T_{67}(cold weather) term

If Abs((**K2** / 10 - T_a)) < 1 Then

T_{67} = *Sgn*(**K6**) * *Sgn*(T_a - **K2** / 10) * *Abs*((**K2** / 10 - T_a))

Else

T_{67} = **K6** / 10 * *Sgn*(T_a - **K2** / 10) * (*Log*(*Abs*((**K2** / 10 - T_a))) / *Log*(10) + **K7** / 100)

End If

where *Sgn*(*x*) = function that returns the sign of *x (or 0 if K6 is 0)*
Log(*x*) = function that returns the natural logarithm of *x*
Abs(*x*) = function that returns the absolute value of *x*

Important

In all calculations the values of the temperatures are in degrees Celsius.

Please note

Leaving K1=100, K2, K3… K7 = 0 results in the simplified $T_{sky} = T_s - T_a$

Leaving all K factors at 0, the result is the raw measured IR, that is $T_{sky} = T_s$