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:

\[ T_{\text{sky}} = T_s - T_a \]

where \( T_{\text{sky}} \) = Corrected Sky Temperature (°C)
\( T_s \) = Infrared Sky Measured Temperature (°C)
\( T_a \) = Ambient temperature (°C)

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:

\[ T_d = \left( \frac{K_1}{100} \right) \times \left( T_a - \frac{K_2}{10} \right) + \left( \frac{K_3}{100} \right) \times \left( \exp \left( \frac{K_4}{1000 \times T_a} \right) \right) ^ {\left( \frac{K_5}{100} \right)} + T_{67} \]

where \( T_d \) = Correction value (°C)
\( T_a \) = Ambient temperature (°C)
\( K_1, K_2, K_3, K_4, K_5, K_6 \) and \( K_7 \) 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 \( (T_{\text{sky}}) \) is then given by:

\[ T_{\text{sky}} = T_s - T_d \]

where \( T_{\text{sky}} \) = Corrected Sky Temperature (°C)
\( T_s \) = Infrared Sky Measured Temperature (°C)
\( T_d \) = Correction value (°C)

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 $\text{Abs}((K2 / 10 - T_a)) < 1$ Then
$$T_{67} = \text{Sgn}(K6) \times \text{Sgn}(T_a - K2 / 10) \times \text{Abs}((K2 / 10 - T_a))$$
Else
$$T_{67} = K6 / 10 \times \text{Sgn}(T_a - K2 / 10) \times (\text{Log}(\text{Abs}((K2 / 10 - T_a))) / \text{Log}(10) + K7 / 100)$$
End If

where $\text{Sgn}(x)$ = function that returns the sign of $x$ (or 0 if $K6$ is 0)
$\text{Log}(x)$ = function that returns the natural logarithm of $x$
$\text{Abs}(x)$ = 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 $T_{sky} = T_s$