Analog and LED options for
E4000-NG indoor air quality probe

| Ver	Date	Modification
V1		Initial Version
V2	Dec 2013	New CO2 graph + pictures
V3	Sept 2017	Timing changed for triggering Contact 1 & 2
V4	Oct. 2018	NG version; New thresholds and timings
V5	Oct 2018	VOC thresholds for BREEAM and regular buildings
V6	Oct 2018	Update 0-10V formula and LEDs thresholds

The optional analog board of the E4000 probe has two dry contacts and a 1 - 10V output.

The dry contacts are typically used to control a two speed (**L**ow **S**peed and **H**igh **S**peed) air extractor having two different coils.

The 1-10V output is used to control continuous ventilation having a 0 - 10V input speed control. The 1V minimum is used to unsure a minimum ventilation for the building heath.

Dry contacts

Contact 1   Contact 2
LS   HS

CO2 LS
CO2 HS
Logic
VOC
Reg/BREAM
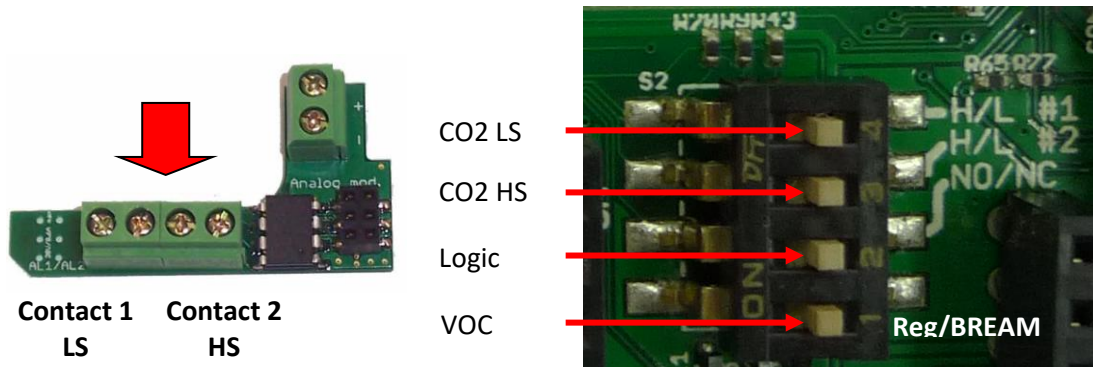
The two dry contacts are activated according to CO2, VOC or relative Humidity thresholds depending of the 4 deep switch configurations (see installation manual for details):

- **Contact 1 L**ow **S**peed: CO2= 700 or 1200 ppm (according to Switch #4 **H**igh or **L**ow position) / VOC = 300 or 1000 µg/m^3 (according to Switch #1) more than 10 minutes / RH threshold (default 75% RH) more than 2 minutes. Default threshold settable by LCD setting tool in analog EnOcean or Modbus mode.

- **Contact 2 H**igh **S**peed: CO2= 1500 or 2000ppm (according to Switch #3 **H**igh or **L**ow position) / VOC= 1000 or 3000µg/m^3 (according to Switch #1) more than 1 minute / RH threshold + 7%RH more than 20 seconds.

- **Contacts status**: Normally open (**NO**) or Closed (**NC**) logic selectable for the two dry contacts.

- **Hysteresis**: CO2 100ppm, RH: 5% of thresholds, VOC: 10% of threshold.

- Type of dry contacts: Isolation 3750 Vrms / 1 min, 30VDC / 0,6A max.

In order not to stress the fan motor, the following timings are applied:
- From Low speed to High speed: 1s Off
- From High speed to Low speed: 10 seconds Off (to let the speed decrease naturally)
- From stop to High speed: Low speed activated during 10 seconds at start-up

The following graphs show the switching of the dry contacts for each criteria knowing that a switching On for one criteria prioritise on others. The switching off curves shows the influence of the hysteresis.
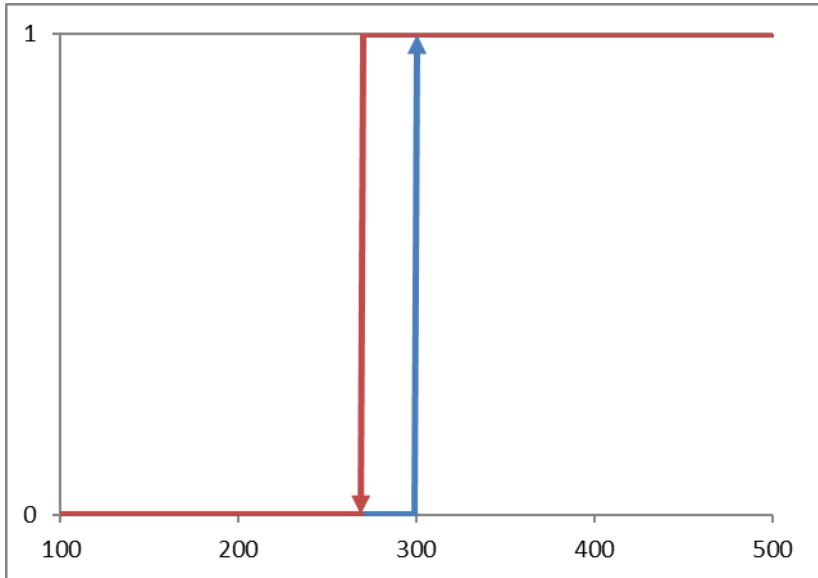
To ensure a minimum ventilation of 10% of the nominal ventilation to guaranty the health of the building and comply with the regulations that prohibit the complete shutdown of the ventilation, the high speed is activated in High Speed 10% of the time on a cycle of 10 minutes through the low speed timing indicated above.
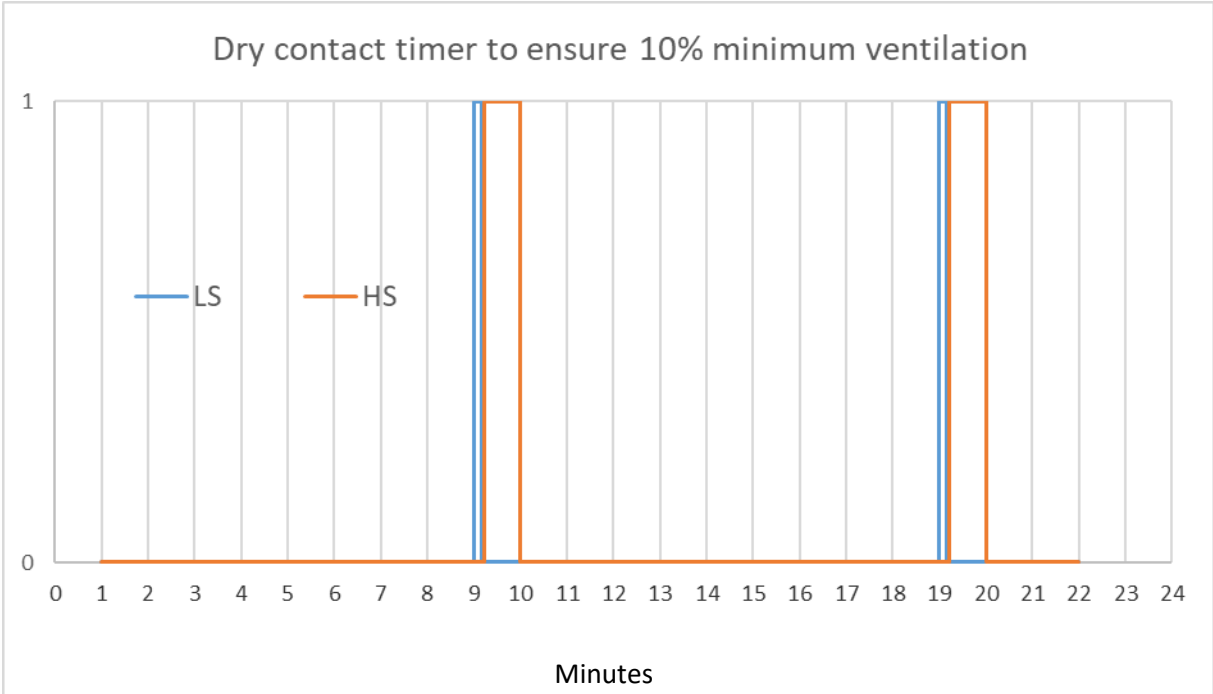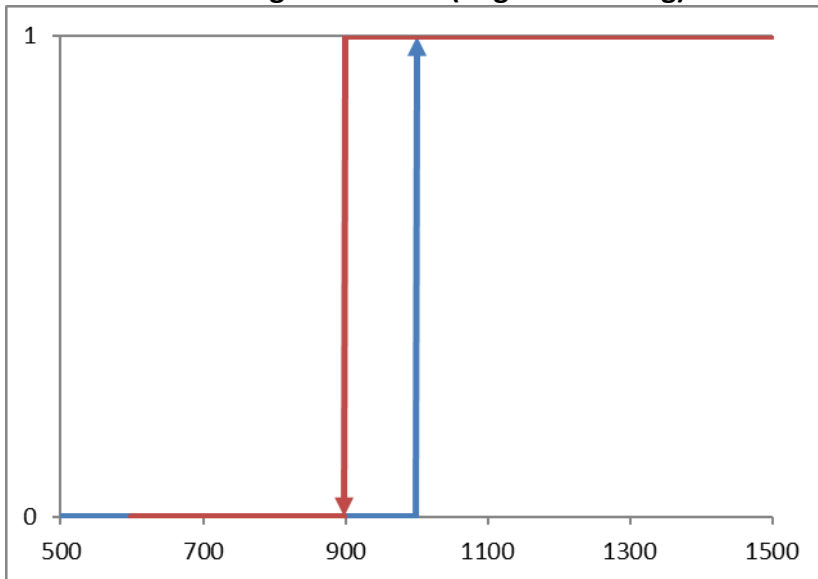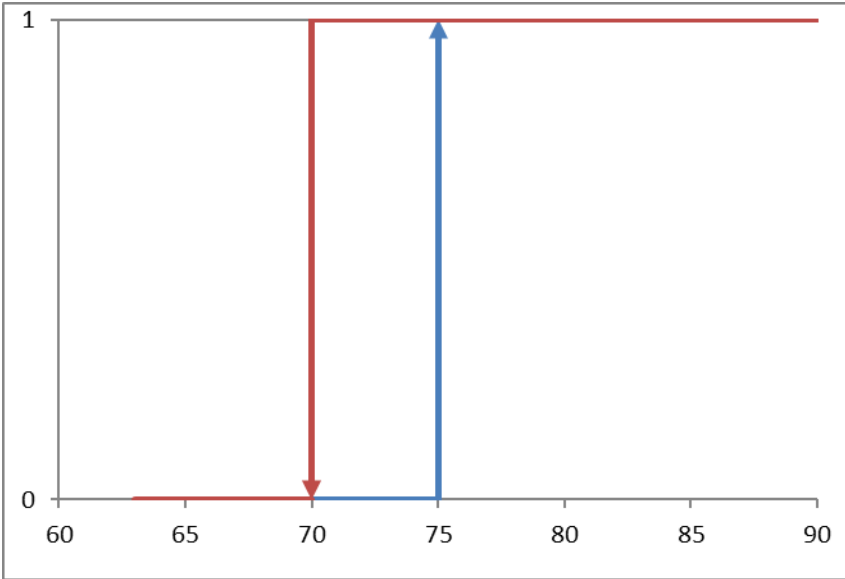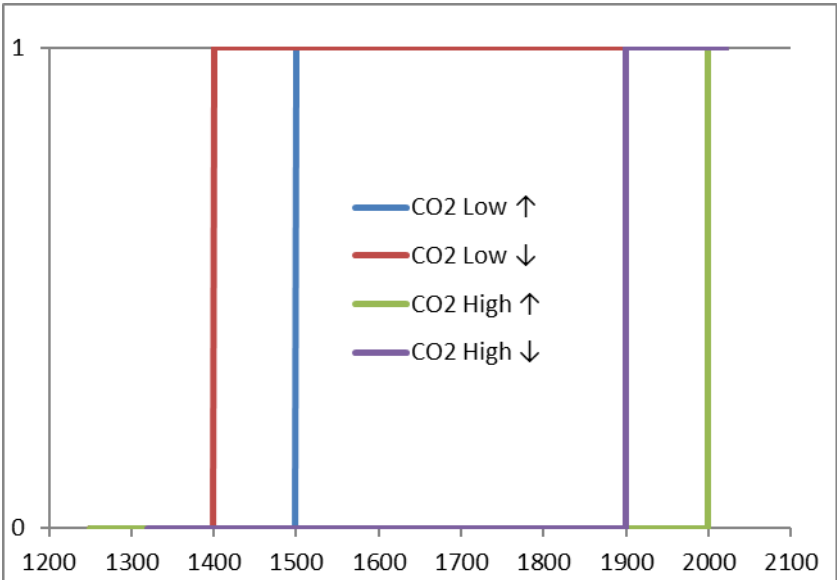
Contact 1 CO2
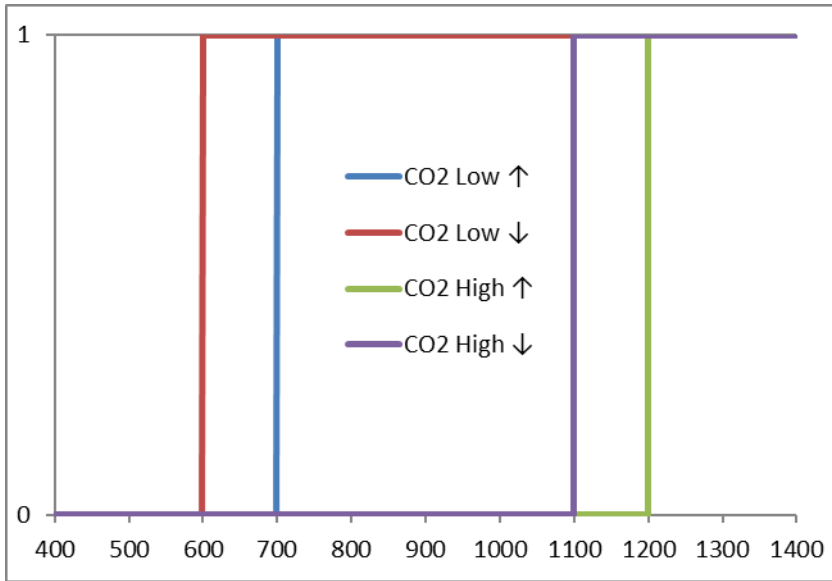
Contact 1 VOC in BREEAM version

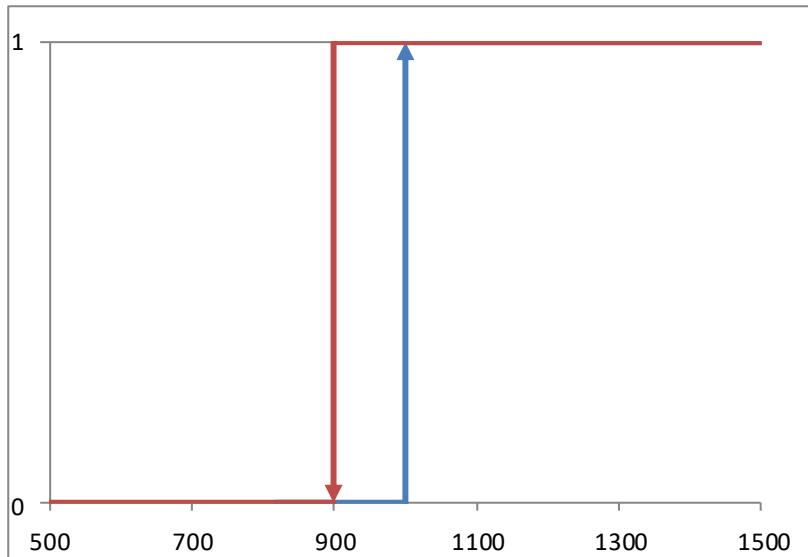## Contact 1 VOC in Regular version (Regular Building)
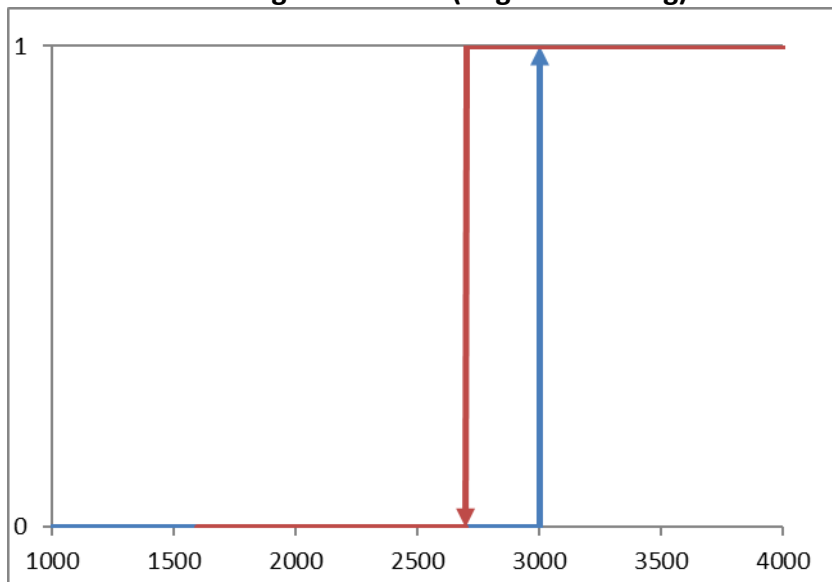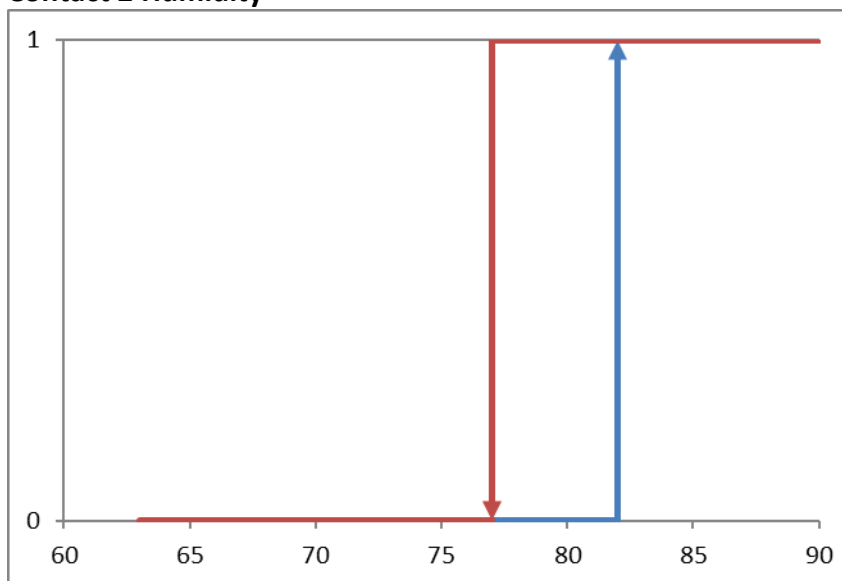
Below

Contact 1 Humidity

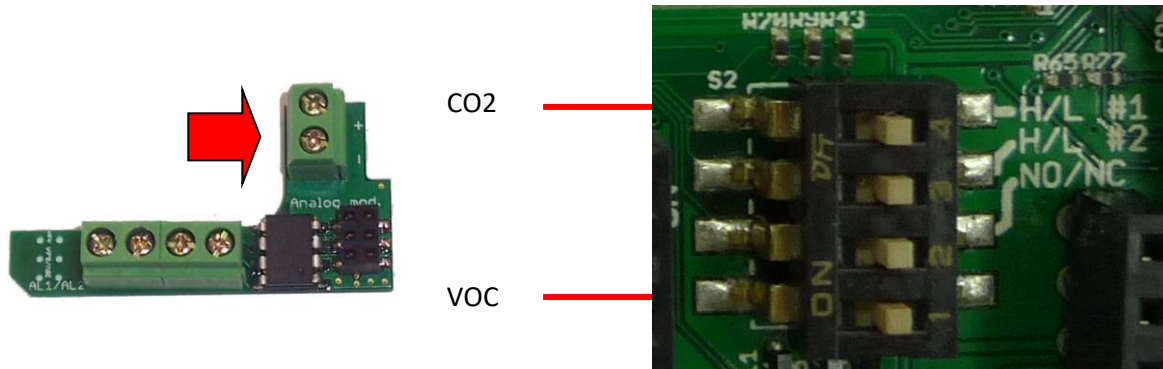**Contact 2 CO2**

Contact 2 VOC in BREEAM version

Contact 2 VOC in Regular version (Regular Building)

Contact 2 Humidity

Details on the 0-10V output algorithm

Only the #4 deep switch used for the dry contacts allows a setting of High or Low threshold of C02 for the 1-10V output.

The #1 deep switch (without marking) of dry contacts allows a setting of High or Low threshold of VOC for the 1-10V output. The low threshold complies with sustainable building standards like BREEAM or LEED if equipped with a good ventilation system and very low level of VOC. The Higher threshold is dedicated to regular buildings with higher VOC level. Be careful that there is no marking for this switch.

The 0-10V output is dedicated to continuous ventilation command.
This is representative of the C02, VOC and humidity combined concentrations.
<u>According to the concentration, a value between 0 and 10V is computed for each criteria and the highest value of the 3 is applied</u>. In addition, a minimum value of 1V is applied to unsure a minimum ventilation at 10% of the nominal to take care of the building health and comply with current regulation that forbid shutting down ventilation entirely.
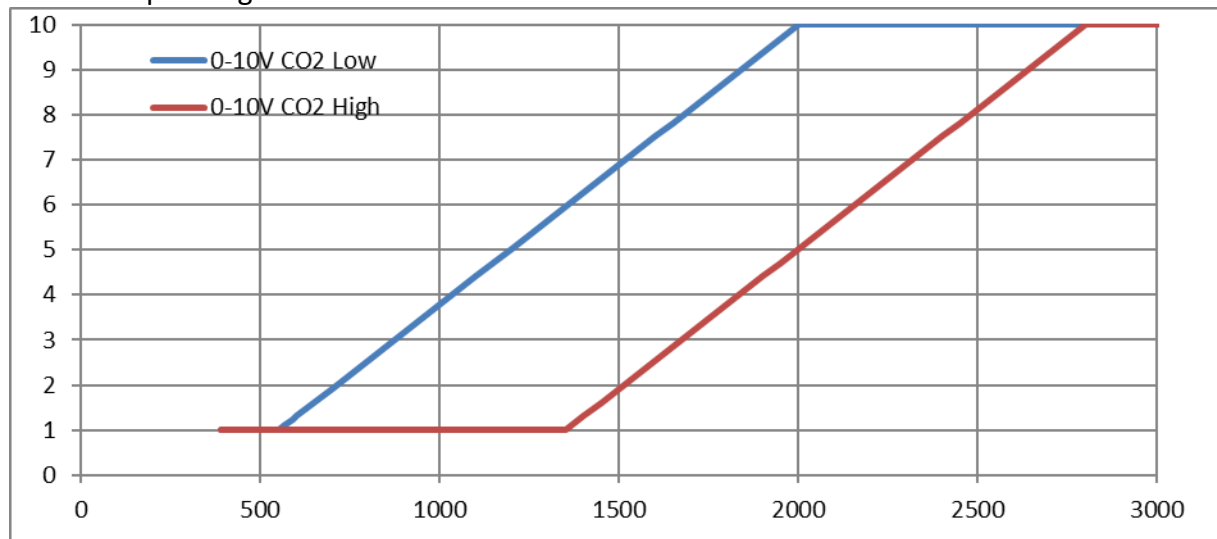
The formula for C02 is the following:
Low threshold: (VCO2 - 390) / 161
High threshold: VCO2 - 1190) x 0.82 / 161
With
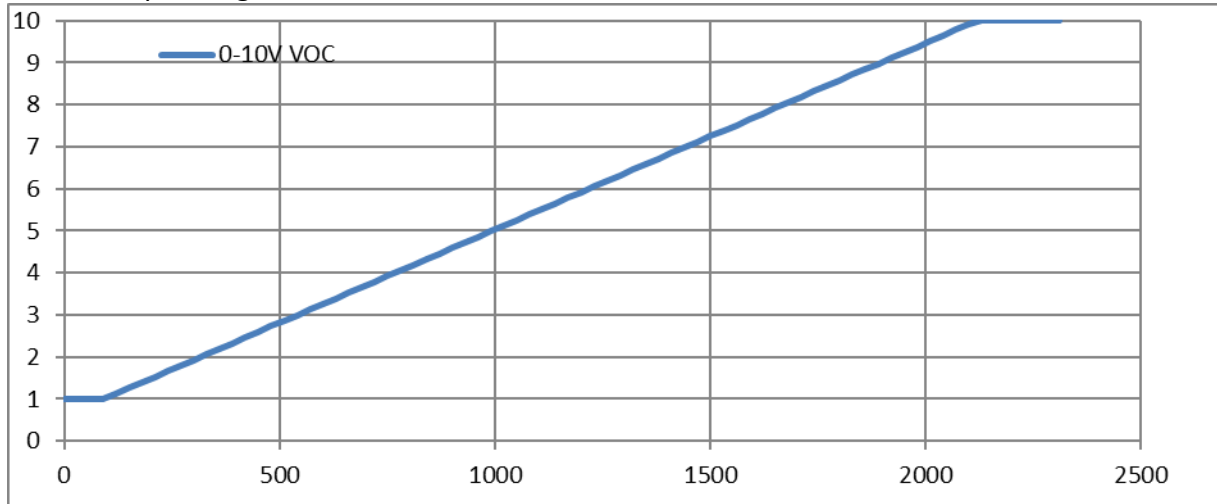*Value CO2 =VCO2*

The corresponding curve is as follow:

The formula for VOC in BREEAM building is the following:
Vout = (VCOV – 134) x 0.71 / 161

With
Value VOC = VVOC

The corresponding curve is as follow:

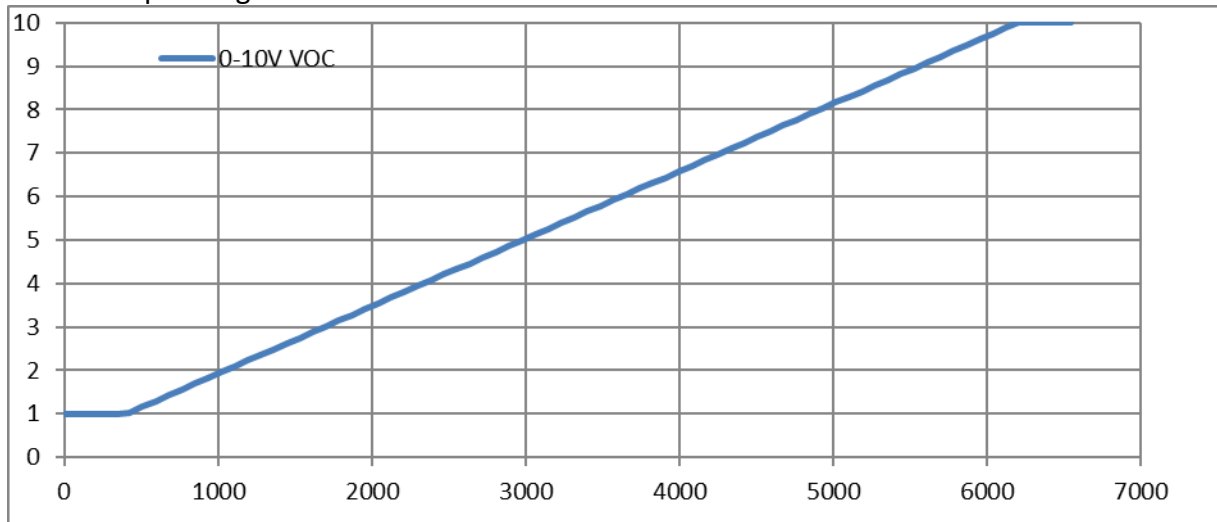The formula for VOC in Regular mode is the following:
Vout = (VCOV – 240) x 0.25 / 161
Avec
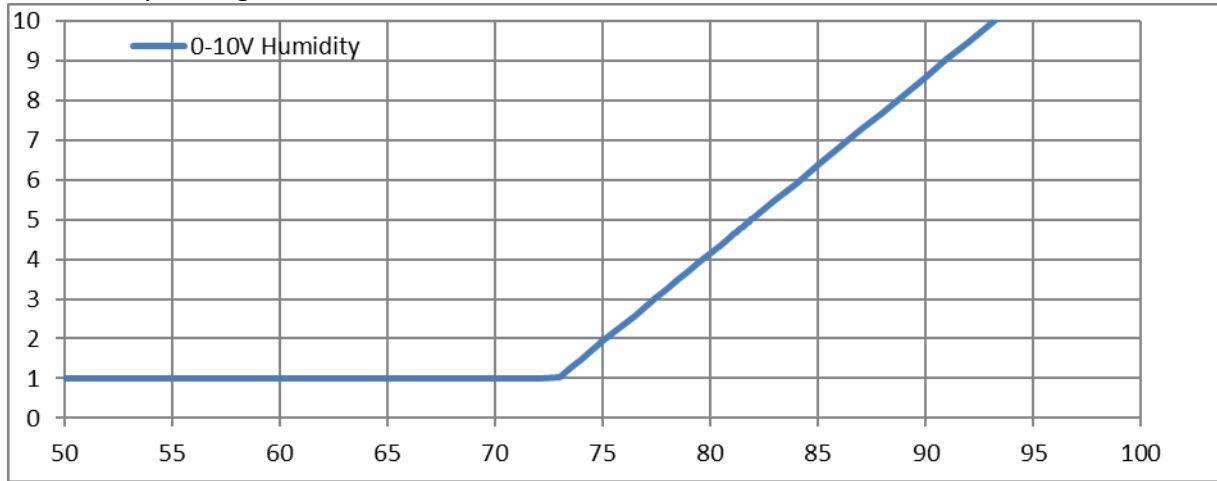*Valeur COV = VCOV en µg/m³*

The corresponding curve is as follow:

The formula for humidity is the following for threshold at 75% RH:

Vout = (VRH – 70.66) x 71.43 / 161

With

Value Relative Humidity = VRH

The corresponding curve is as follow:

In a generic manner if the threshold is set at SPRH (RH Set Point), the formula is the following:

Vout = (VRH – (SRH-(310/MRH)) x MRH /161

With MRH = (SRH-310) / (SRH +7 -810)

Tricolours LEDs

Coloured LEDs are activated based on the 1-10V output.
Thresholds are as follow:

Green: < 3.33V
Orange: between 3.33V and 6.66V
Red: between 6.66 and 10V

Le here under spread sheet recaps the thresholds:

	CO2 L	CO2 H	COV HQE/BREEAM	COV Regular	Humidity
Green	< 920ppm	< 1720ppm	< 870 µg/m^3	< 2380 µg/m^3	< 78.5%
Orange	920 < < 1450ppm	1720 < < 2250ppm	870 < < 1650µg/m^3	2380 < < 4550µg/m^3	78.5 < < 85.5%
Red	> 1450ppm	> 2250ppm	> 1650 µg/m^3	> 4550 µg/m^3	> 85.5%