VAQA'O Lite series sensors

Presentation

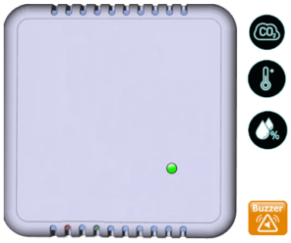
The VAQA'O Lt series devices are LoRaWAN Class A environmental sensors, powered by two 2600 mAh AA lithium batteries housed in internal slots.

The **VAQA'O Lt** can measure several environmental parameters, including temperature, humidity, carbon dioxide (CO2), and continuously monitor sensor movement.

The **VAQA'O+ Lt** expands on this by adding room illuminance measurement and human presence detection, capable of detecting movement up to 12 meters away through an passive infrared sensor.

The **VAQA'O Multi Lt** further enhances functionality with the addition of atmospheric pressure and volatile organic compound (VOC) measurement, utilizing an RMOX sensor.

Family code

	
50-70-223-xxx : **VAQA'O Lt**	50-70-251-xxx : **VAQA'O+Lt** 50-70-217-xxx : **VAQA'O Multi Lt**

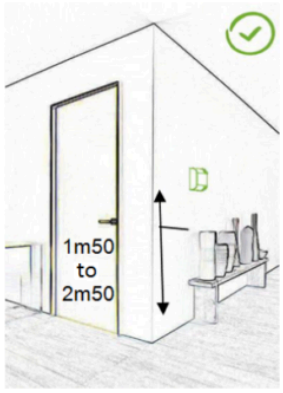
For previous release of **50-70-074-xxx** or **50-70-168-xxx** , see older revision documentation.

Installation and operation

Installation

Manual and QuickStart guide are available in our download center.

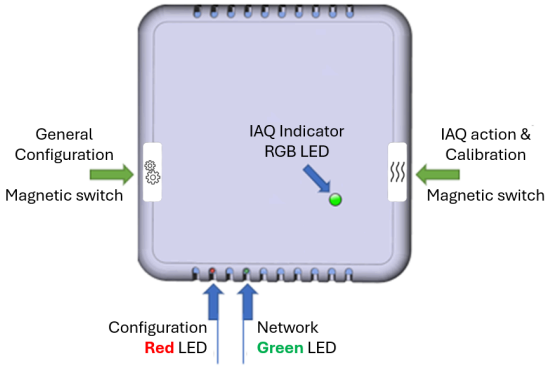
The housing should be installed inside a building, must be protected from any water spray and must be used in environnement with less than 80% relative humidity. The produ be installed in direct heat source (Heater, sunlight, ...) to avoid local heating effects that may alter a global estimation of environmental parameters in the measured room. The be installed in a representative position in regard of the required environemental parameters survey. Usualy, it should be installed between 1m50 and 2m50 from floor.



The product has 1 Green Led, 1 Red led, 1RGB led and two "magnetic switches" as human to machine interface. These elements should positioned as shown below when ins sensor.

To correctly install the sensor:

- Open the product from the two clips at the bottom using a small flat screwdriver.
- Use the base as a template and obtain horizontality using a level. Then hang the base on the wall using screws or double-sided tape. Thanks to the noticeably light wei product, you can use only two screws.
- Once done you can clip back the front, containing electronic parts, on the base.
- Please, **DO NOT USE** centered holes for the screws as their heads may interfere with the batteries!



Once installed, the two LEDs are visible through the bottom vertical windows and the magnetic switches can be actuated like simple buttons using a magnet.

Configuration magnetic switch label on the left	**IAQ actions** magnetic swith label on the right

It is important to start the device once fixed to the wall. *The tilt box's pull-out alert function is based on the angle with the vertical. This initial angle is taken at startup, ar check of the angle is performed. If the angle varies by more than 4 degrees from the initial position, then the alert is triggered. It is necessary to return to the initial angle ±2 the alert to be deactivated.*

About CO2 and VOC/Indoor Air Quality index:

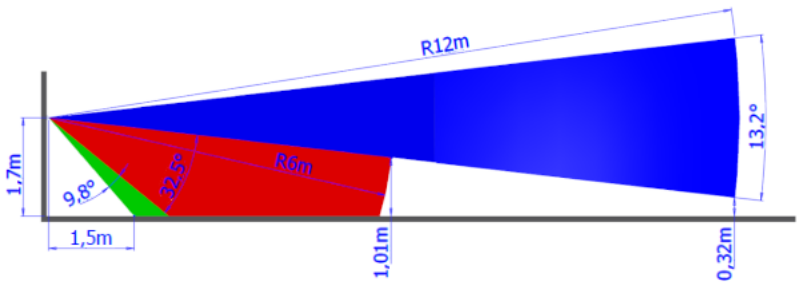
CO2 concentration is measured with a dedicated CO2 gaz sensor using NDIR technology. This measurement can be normative.
A separated MOX sensor embeded in VAQAO, is used to estimate an Indoor Air Quality Index. This AQI (or IAQ) is deduced from the measurement of the concentration of vola compounds in the air. The compounds taken into account are numerous, such as formaldehydes, ethanol, acetone or others, coming from paints, cleaning products, solvents, etc and even CO2 itself. The concentration attribute for IAQ gives an estimator of air polution with the following scale:

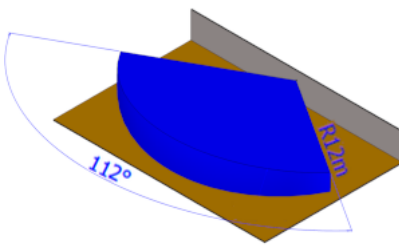
Note about the "Indoor Air Quality" index: The device uses a "Static IAQ" index of the MOX sensor". This index is suitable for "non-mobile" use. The VOC sensor gradually ada environment, and the value read is "normally" between 0 and 500. However, it can make excursions, greater than 500, in the event of "significant/sudden" variations in the env an indication, the "IAQ" value (rather for mobile use) is really constrained between 0 and 500, by specific filtering. This value is available on Concentration cluster Endpoint 2, l part of the default reporting configuration.

Following table summarize Classifications, default values and HMI display for CO2 and/or VOC.

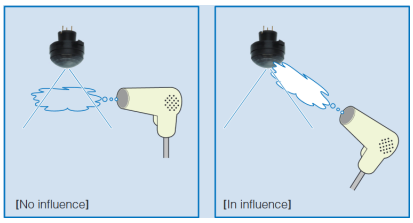
Level Value	level name	CO2	VOC	IAQ Led blink
0	EXCELLENT	< 500	50	**GREEN** (Default blinks each 30s)
1	GOOD	[500, 700]	[50, 100]	**GREEN** (Default blinks each 30s)
2	AVERAGE	[700, 1100]	[100, 150]	**ORANGE** (Default blinks each 15s)
3	BAD	[1100, 1300]	[150, 200]	**ORANGE** (Default blinks each 15s)
4	VERY BAD	[1300, 1700]	[200, 300]	**RED** (Default blinks each 7s)
5	UNHEALTHY	> 1700	> 300	**RED** (Default blinks each 7s)

VAQAO+Lt / Multi Lt : PIR sensor detection area:





Warning: *The PIR sensor should not be exposed directly to hot air flow (such as from a split air conditioning unit) as it may cause false detections.*



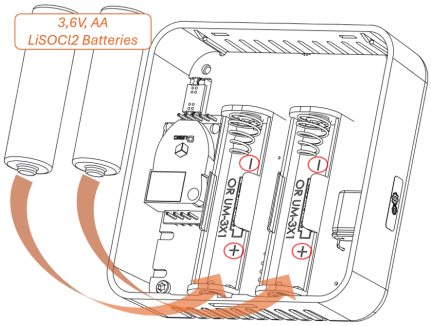
Replacing batteries

Batteries should be replaced with lithium-thionyl-chloride (Li-SOCl2) LR6/AA of 2600mAh each (example: SAFT LS14500). The batteries can be replaced on the fly, one after e each battery slot is protected against side overvoltage.

However, operator must carefully avoid any **short circuit** or **electrostatic discharge** during battery replacement.

Steps to replace batteries are:

- Open the product from the large center clip at the bottom using a small flat screwdriver.
- **Use a plastic spludger** to extract batteries from their slots and replace them with new ones.
  BEWARE that batteries must all be placed in the same direction. Notice the **"+"** sign on the PCB.
  Renew this operation for the 2 other batteries.
- Once done you can clip back the front containing electronic parts, on the base starting from upper side.



Autonomy

The information in the table below represents how long the batteries can last. It is based on the default configuration at ambient temperature (+25°C) within the optimal operati the sensor via a LoRaWAN network (one uplink frame), when the spreading factor used is SF12.

Following estimations are given with default reporting configuration and using two 2.6Ah capacity 3,6v AA Li-Ion batteries installed, of which 85% is used.
With the default configuration the sensor will record all significative measurements up to once each 10 minutes and at least once per hour. Then batch reports will be regularly containing all these last measurements. It may contain several sample for any of the measured parameters (T, H, CO2). Some specific reports/alarms may also be sent becau configuration (case opening, threshold crossing for Temperature, Humidity, CO2, ...). Due to all these possibly reported information, consumption estimation is based on a pe transmission in range from 20 minutes to one hour.

Battery life expectancy :

Transmission periodicity	Spreading factor	VAQAO Lt VAQAO+Lt : 1 or 2 months less
1 Frame / Hour	SF12	5 years
3 Frames / Hour	SF12	3,5 Years
1 Frame / Hour	SF9	7 Years
3 Frames / Hour	SF9	6 Years

Note: Activating Buzzer and TAP HMI can reduce the battery life expectancy by up to 1 year.

Human Machine Interface

3 LEDs are available on VAQA'O Lt. 2 LEDs Green and Red are visible through the down ears of the sensor. These are the usual leds of Watteco sensors giving indication abo "Network status and running modes". One more led (RGB) is available in the front of the sensor mainly used as a "CO2 level visual indicator" and can also be used during "Op calibration actions" when "Calibration and IAQ button" on the right side of the sensor is used.

Common configuration actions:

Network status and running modes HMI *(Watteco sensors common behaviour)*

IAQ actions:

Automatic CO2 Level indicator HMI

User triggered CO2 Level indicator HMI

CO2 Calibration HMI and fresh air calibration selection

CO2 Calibration HMI : Example of calibration running

About CO2 calibration capabilities:

- On VAQA'O Lt and VAQA'O+Lt, calibration requests are limited to target contexts of **400 to 1500 ppm**. Please do not attempt to set a calibration that takes the current meas outside of this range.
- Instead of using HMI, calibrations can be initiated trhough downlink specific commands. See Concentration cluster specfic commands.

Applicative layer

CoDecs are available to decode frames: *Downloads*
All downlink frames have to be sent on port 125
Please, try and see also Watteco *Online codecs*

The VAQA'O Lt device implements many applicative clusters associated to different sensors entries. The associations between measurement functionalities and EndPoints/Clu shown below:

Cluster	Cluster name	EndPoint: Rôle	Product	Managed attributes
0x0402	Temperature	EP0 (0x11): Accuracy +/-0,5°C [1/100 °C]	All	All
		EP1 (**0x31**): Accuracy +/-0,2°C [1/100 °C]	All	All
0x0405	Relative humidity	EP0 (0x11): Accuracy +/-3% [1/100 %RH]	All	All
		EP1 (**0x31**): Accuracy +/-2% [1/100 %RH]	All	All
0x800C	Concentration	EP0 (**0x11**): VOC [IAQ]	Multi Lt	All, Except calibration attributes and comman
		EP1 (**0x31**): CO2 [ppm]	All	All
0x0400	Illuminance	EP0 (0x11): Illuminance [Lux]	+ Lt Multi Lt	All
0x0406	Occupancy	EP0 (0x11): Occupancy [1: Occupied, 0: Unoccupied]	+ Lt Multi Lt	All
0x000F	Binary input	EP0 (0x11): Effraction status [1: Yes, 0: No]	All	All
0x0403	Pressure (Ambiant atmospheric)	EP0 (0x11): Ambiant atmospheric pressure [1/10 mBar or hPa]	Multi Lt	All
0x0000	Basic	EP0 (0x11): Sensor firmware and hardware informations	All	All
0x0050	Configuration	EP0 (0x11): Sensor global configuration parameters and commands	All	All
0x8004	LoRaWAN	EP0 (0x11): Sensor LoRaWAN parameters management	All	All

Default "Main" configuration

VAQA'OLt sensors implements a default Batch and Standard configuration that manages all embedded measurements through a periodic reporting of up to 2 frames per hour. configuration can be summarized as follow:

The "Batch" part

It records environmental parameters with a 10 minutes max time sampling and sends them once or twice per hour:

*On **VAQA'O Lt :***

- Temperature with a resolution of 0.1°C
- Humidity with a resolution of 1%

- CO2 in a range of 0 to 5000 ppm, with a resolution of 10 pmm

*In addition on **VAQA'O+Lt :***

- Illuminance with a resolution of 10 Lux
- Occupancy status

In addition on **VAQA'O Multi Lt**:

- Atmosphéric pressure
- Indoor Air Quality indicator (COV)

The "Standard" part

It monitors critical events on environnemental parameters

- a report on case moving (violation)
- an alarm/report on power supply lowering down to 2,9v and once each 5 days
- an alarm on concentration of CO2 if 1500 ppm is crossed
- In Addition **VAQA'O+Lt** produces an occupancy report each time a presence is detected
- In Addition **VAQA'O Multi Lt** produces an alarm on IAQ if Indicd 300 is crossed

Any of these configurations can be removed or modified, and some different ones can be set. However, **every change made to the default configuration must comply witl duty cycle. For example, the most restrictive in the EU is 0.1%, corresponds to approximately 2 frames per hour with the most constrained Spreading Factor : SF1**

Typical/Usual/Basic DL configurations

See also Detailed defaul configuration below or "Concentration cluster"

Remenber that VAQAO is a ClassA sensor, so all downlinks will be delayed until the next Uplink delay.

ABC calibration (Default 'Off')

Set ABC calibration period (Default 5)

Start an immediate fresh air calibration

Calibrate based on actual and expected value

Buzzer alarms (Default 'Off')

TAP HMI (Default 'Off'. Beware, 'On' may reduce life expectancy of about 1 year)

Detailed default configurations

Note that each frame is preceded by a one-byte size prefix. When used for downlink on port 125 within most LoRaWAN infrastructures, this size prefix should be removed.

Main configuration

VAQA'O Lt / VAQA'O+Lt / VAQA'O Multi Lt

Alternate 'No Batch' configuration

VAQA'O Lt sensors has got an alternate default configuration that can be activated instead of default one. In this alternate configuration Batch is not used. Beware that this cor more verbose on radio and will drain battery faster.

Following configuration commands can be used to swap between default configuration and alternate one:

- Set 'No Batch' default configuration: **11500050F101**
- Set Back default configuration : **11500050F100**

VAQA'O Lt / VAQA'O+Lt / VAQAO

Received frame examples

***Codecs are available to decode frames:** Downloads*

*Please, try and see also Watteco **Online codecs***

Batch report

Typical VAQA'O Lt batch report

Standard report

Report on violation (sensor moved from its original position)

Alarm on Humidity level getting lower than specified threshold

Alarm on CO2 level getting lower than Thresold