**INSTALLATION MANUAL**

# mBox Guardian

Indoor monitor

*MMG – 175 - Wellness*

meersens

https://meersens.com

Summary


| | | |
|---|---|---|
| 1 | Security | 3 |
| 2 | Positioning | 3 |
| 3 | Front facing opening | 5 |
| 4 | Embedding | 5 |
| 5 | Surface mounting (renovation) | 5 |
| 6 | Cabling | 5 |
| 7 | Installation | 6 |
| 8 | Feeding | 6 |
| 9 | Powering on | 6 |
| 10 | Commission | 7 |
| 11 | Output 0-10V | 8 |
| 12 | Disassembly of the front of an installed probe | 8 |
| 13 | Disconnection | 8 |
| 14 | Recommendations | 8 |
| 15 | Guarantee | 9 |
| 16 | ANNEX | 10 |
| 16.1 | VAV | 10 |
| 16.2 | PI command | 10 |
| 16.2.1 | Ventilation control control | 10 |
| 16.2.2 | Proportional regulation | 11 |
| 16.2.3 | Proportional – Integral Regulation (PI) | 12 |

# 1 Security

WARNING

Danger of death, risk of electrocution and fire!
The assembly must only be carried out by a specialized electrician!

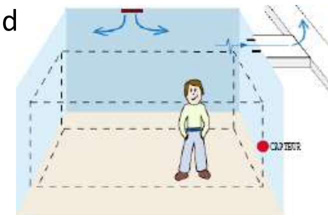
To properly install the power cables and to put the device into service, it is necessary to respect the state of the art and the standards in force.

Any intervention or modification made to the device entails the loss of any warranty claim.

• Do not use this probe in environments regularly exposed to silicone vapours (HMDS) as this gas gradually impairs the sensitivity of the VOC sensor.
• Do not use this probe for safety-related gas content measurements!
• Use the probe only with the very low voltages specified!

# 2 Positioning

The positioning of the IAQ (Indoor Air **Quality**) sensor is paramount with regard to the quality of measurements and the efficiency and energy savings related to ventilation and heating.

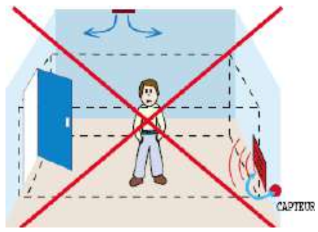


• The probe is intended to ensure air quality and comfort thermal, it must be placed in the area of occupation of the room served by ventilation, on a wall at eye level (human breathing, between 1.1 and 1.7m for WELL V2 compliance) and remote heating and cooling sources.

• Avoid drafts (proximity to openings, air blowing, doors, vents) and dead zones (niche, shelf, curtains). 1m doors, ventilation and areas where an occupant can exhale directly on the probe for WELL V2 compliance.

• Avoid orthogonal walls (angles of the room in particular)

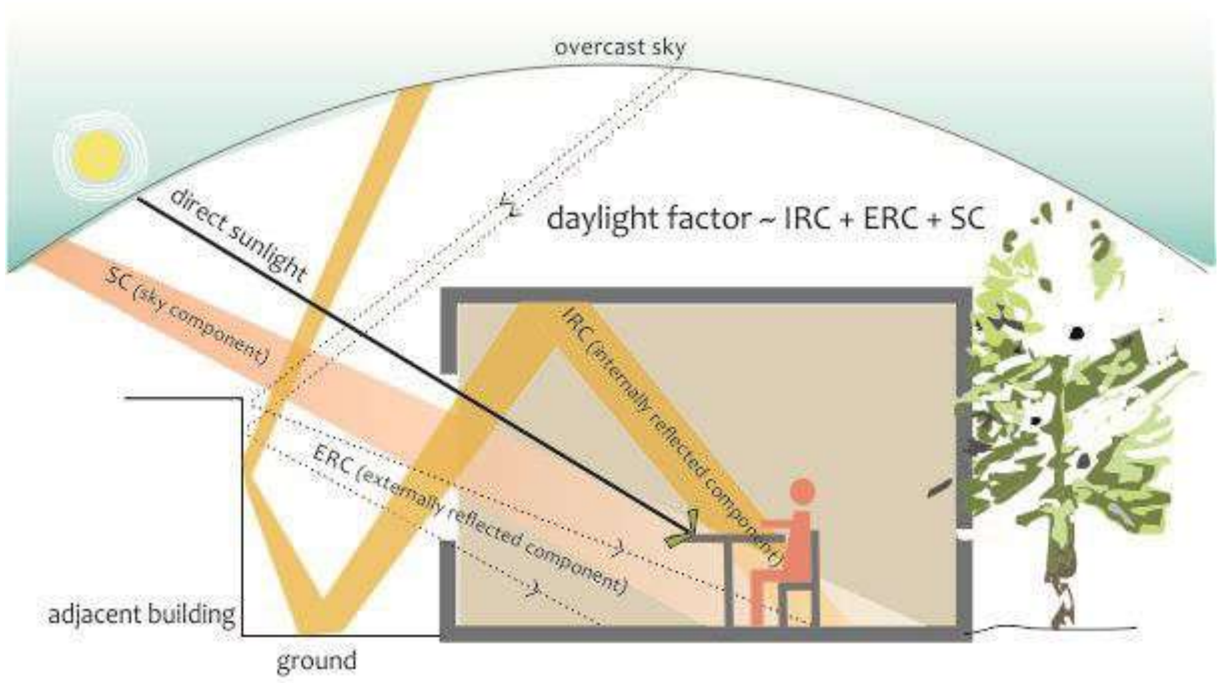
• Avoid heat sources and proximity to occupants (1 m radius of a workstation).




• Position the probe vertically in a wall or partition.
This device is not intended for duct or ceiling mounting.

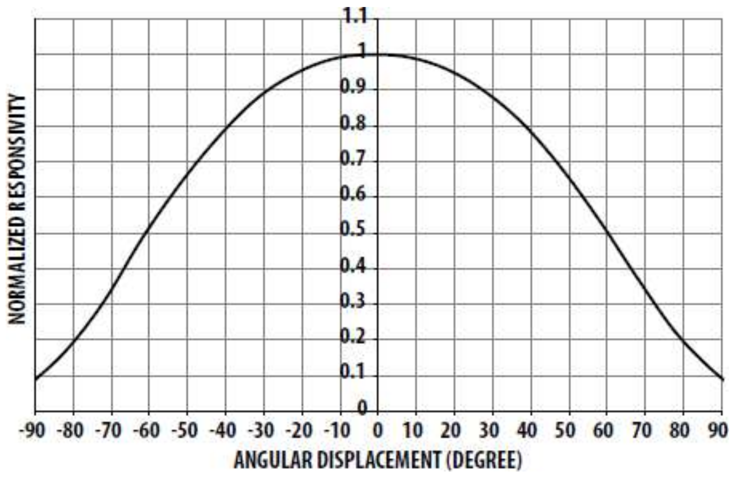
• Avoid direct exposure to sunlight

• The positioning must take into account the desired quality of the ambient light measurement

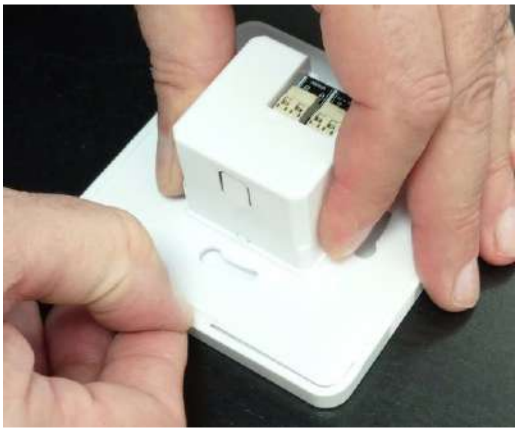



Any intervention not in accordance with this documentation or modification made to the device will result in the loss of any warranty rights.

We must also take into account the receptivity of the light sensor that is mounted vertically like our eyes:

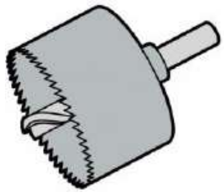


# 3 Front facing opening



The front is clipped onto the device.
Place the probe on a table, the glass facing the table (connectors up)
Using your nails or a finger, move a clip away from the contour of the front of the device and pull the device up.
Do not spread the contour too far and do not put pressure on the glass with your hand or other means as this may disassemble the front panel.

# 4 Embedding



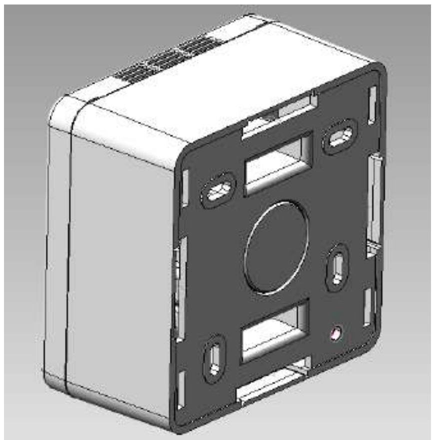
Ø 67/68

Use the supplied multi-material waterproof housing.

If using another flush-mounting box, choose an airtight housing with waterproofing membrane through which the sheath passes. If the housing crosses the sealing plane (plasterboard), seal between the housing and the panel with a special silicone- and VOC-free sealant. The depth of the case must be at least 50mm.
Attach the probe to the flush-mounting box.

# 5 Surface mounting (renovation)

Use the specific wall box (To be ordered separately).



This box has 4 pre-cut cable passages (one on each side) for cabling under chute.
In case of recessed cable the bottom of the case has a pre-cut central pad.

Fix the case to the wall with four screws by checking the direction (arrow inside the case indicating the top "UP")

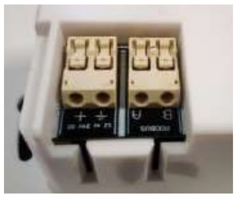
Attach the probe in the housing


# 6 Cabling

Attention the wiring must be waterproof. Even minimal air intake through the sleeve would seriously disrupt temperature, humidity and air quality measurements.

When the electrical panel is located in the heated volume: caulk the inlets to the panel between ducts and cables.

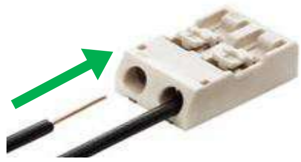
When the electrical panel is out of heated volume, caulk between sleeve and cable before indoor distribution. A leak-proof cap must also be placed between cable and sleeve arriving at the probe to prevent air intake.



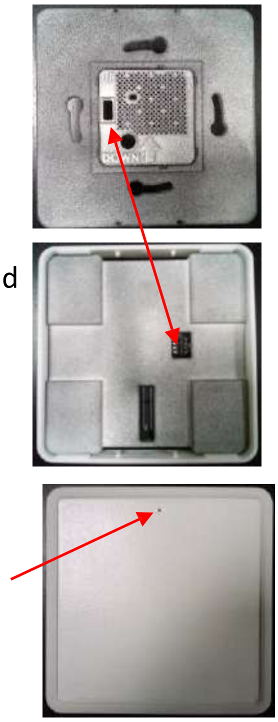
When sealing the sleeve is not possible, use a specific sealant without silicone and VOCs (acrylic is recommended).

The connectors are specified for rigid cable 18 to 24 AWG (1 to 0.5mm diameter) or twisted 20 to 22 AWG (0.8 to 0.65mm diameter)

The connectors accept two 0.8mm cables on the same terminal to chain several sensors. Beware of online losses, a 0.8mm cable has a resistance of 21Ω per Km.



# 7 Installation



It is recommended to install the probe at the end of the site (after painting work and use of silicone-based products).

Take the 0.10V and 24V DC power cables and connect both pairs on the terminal block on the back of the product. Pay attention to markings and polarities.
Simply push the bare ends (flexible or rigid) into the connector. In case of multi-strand cable be sure to twist them well before inserting them. In case of difficulty pushing the release pin. Respect the polarity (non-destructive).

Make sure to respect the high meanings indicated on the product otherwise the

Temperature and humidity measurements will be distorted and the particle sensor will become clogged.
Screw the probe plate onto the flush-mounting box.
Clip the front panel, making sure to position the connector.
If the housing is properly mounted, the window for the light sensor is at the top.

# 8 Feeding

The power supply must be continuous (DC) and between 12 and 32V (24V nominal).

# 9 Powering on

A few seconds after powering up, all LEDs are activated individually for a visual test. At the end of the cycle, a failure message made of flashing between the orange and red LEDs may appear for a few seconds, the time to query all the
Sensors.

Then the blue LED must "breathe" if the air quality is good enough.

Start-up cycle includes built-in tests and visual checks of the LEDs The cycle lasts **one minute** in total.

The LEDs indicate failures as follows:

LEDs indicate defects as follows:

| LED code on the front panel | # of identification * | URS in default * |
|---|---|---|
| No active LED | NA | Suspected power or power card failure of the probe. |
| Red LED lit for 5 Seconds | | |
| Followed by orange flashing | 1 | Front panel. |
| Followed by 2 orange flashes | 2 | Single-band CO2 sensor module. |
| Followed by 3 orange flashes | 3 | Dual-band CO2 sensor module. |
| Followed by 4 orange flashes | 4 | VOC sensor module. |
| Followed by 5 orange flashes | 5 | Motherboard. |
| Followed by 6 orange flashes | 6 | Interconnect card. |
| Followed by 7 orange flashes | 7 | Particle sensor board. |
| Followed by 8 orange flashes | 8 | Power card. |
| Flashing red LED | 9 | Multiple failures. |
| Alternation Red Blue | 10 | Perishable sensors at the end of life. |
| All LEDs flash simultaneously | NA | No communication with the face before (after 30 seconds) |

# 10 Commission

NFC is used for commissioning and parameterization (thresholds). See commission manual and smartphone application.

# 11 Output 0-10V

The 0-10V output is a voltage generator with a low current capacity (limited by a resistance of 1KΩ).
Make sure that the input impedance of the register or BDV (Variable Flow Box or VAV) does not affect the signal.
Note that, to comply with the regulations in force, which stipulates a ventilation of 10% of the nominal in order to preserve the health of the building, the sotie 0-10V never goes below 1V.

For installations with dual flow CTAs, it is imperative to ensure that BDV motors for blowing and recovery are set for the same flow rate (MR for simple registers). The blowing and recovery registers must be connected in parallel to the 0-10V control.

# 12 Disassembly of the front of an installed probe

There are 4 side recesses.

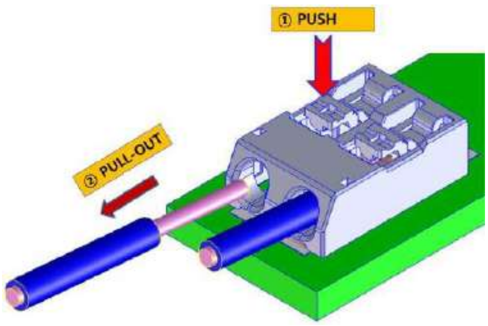
Horizontally insert a small 1mm screwdriver head into one of the recesses to avoid damaging the wall.

Pull the front panel 2mm from the wall and push the screwdriver deeper. (Between 2 plastic pieces).

Move the screwdriver to the middle of the side until the front panel unclips from the unit.

Be careful not to drop the panel as tempered glass may break.

# 13 Disconnection




## Recommendations

The EP50000 probe guarantees you accurate measurements for years provided you give it some attention...

- Do not install your sensor near sources of alcohol, gasoline, fuel oil, lubricants, paint or chemicals. The VOC sensor would be contaminated.
- Do not spread aerosol products such as deodorants, perfumes, paints, lubricants... in the vicinity of the probe.
- Avoid contact or proximity to silicone-based materials.
- Do not use detergent or solvent to clean the probe, chemicals can cause sensor failures by contaminating or damaging it temporarily or permanently.
- Do not immerse or spray any liquid in the openings, this could permanently damage probe.
- Not expecting to have an accurate VOC measurement immediately after exposure to a high concentration, the sensor requires time to recover and give its full potential.

# 15 Guarantee

This probe has been manufactured to high quality standards. However, it may happen that it has a defect or failure despite the many tests to which it has been subjected.
This device is guaranteed against any defect in manufacture or materials within the limits of the following provisions:

- The warranty is strictly limited to the exchange or repair at the factory of parts recognized as defective, after examination and control, to the exclusion of any other compensation.
- The duration of the warranty, offered by the manufacturer, is one year and begins to run from the date of purchase.
- It is only effective if the device has been used in accordance with installation instructions, recommendations and good practice.
- The following are excluded from the warranty:
  - Damage resulting from abnormal conditions of use.
  - Damage caused by shocks or excessive mechanical strain,
  - Damage or accidents resulting from negligence or resulting from a transformation or - attempted transformation of the device.
  - Deterioration due to disassembly and improper reassembly of the probe.
- The warranty is only valid for devices that are returned to the manufacturer's address.
- Interventions under the guarantee may not have the effect of extending the duration of the guarantee.
- The provisions of this warranty are not exclusive of the benefit, for the benefit of the buyer, of the legal guarantee for defects and hidden defects that applies in any case.

# 16 ANNEX

## 16.1 VAV

VAV (Variable Air Volume) dampers

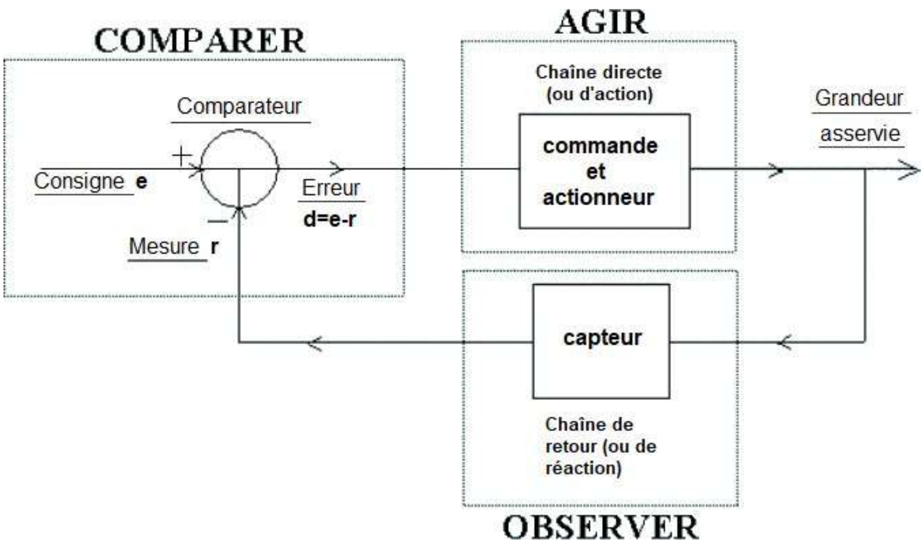
A VAV (in French BDV or Variable Flow Box) is to the air flow what a thermostatic valve is to the flow of water.
A VAV controls the flow rate thanks to a local control loop: the regulator compares the measured flow to the set flow (0-100%), in case of deviation it controls the motor which modifies the position of the register so that the actual flow corresponds to the set flow. Thus the air flow is regulated continuously according to the setpoint. Each BDV is set for a throughput and the order is a percentage of that maximum throughput. If for example a BDV is set to 500m3 / h maximum, an order of 50% will correspond to a flow of 250m3 / h.

Thus, not only will the air flow correspond to the control but also, in the event of closure, the flow rate of the registers of the neighboring parts, if they are equipped with VAV, will remain constant.
We therefore have a real servo in flow according to a measurement. It is much more stable and precise than a simple register controlled at an opening angle. This solution is not recommended with 0-10V signal control based on measurements but quite appropriate with a PI control signal (see next chapter).

## 16.2 PI command

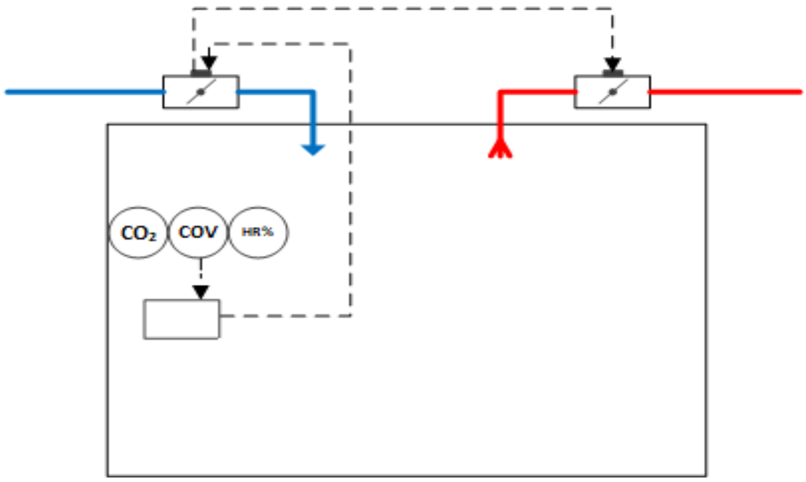
### 16.2.1 Ventilation control control

Ideally, ventilation motors or VAVs should be controlled by a real servo loop.
A servo loop requires a setpoint and a regular comparison between the setpoint and the value achieved by a sensor. The greater the gap between the setpoint and the death, the larger the order will be (so-called proportional control). The control loop also includes an integral component (PI) for better accuracy.




The QAI EP5000 probe allows the control of VAVs with a PI setpoint.
The IAQ instructions are adjustable thanks to the smartphone application but can also go through the communication system.
If the setpoint is exceeded, the control sign will ensure that the ventilation keeps the value below the setpoint.
The control signal will act directly on the air flow if it controls a servo ventilation motor

in flow or VAV.




### 16.2.2 Proportional regulation

Imagine a ventilation system with a VAV type damper that would modulate the flow rate so that the room receives the volume of air just necessary, such that fresh air just compensates for the CO2 generated by the breathing of the occupants of the room. In this case the ambient CO2 level would be stable.
Either a set point of 1000ppm. Initially assume a CO2 level higher than the setpoint, so it is necessary to ventilate.
Suppose the VAV is at 100% of the maximum flow rate for 1200ppm (deviation of 200ppm from the deposit). Fresh air arrives, the CO2 level drops and arrives at 1100ppm. The difference is then 100ppm and the VAV is only 50% of the maximum flow.
Unfortunately, arrived at 1100ppm, nothing moves: the CO2 level of the room is stabilized and the opening of the VAV too: it remains open at 50% of the maximum flow.

What for?

With a flow rate of 50%, it provides a quantity of fresh air such as to exactly compensate for the CO2 generated by the occupants of the room. The CO2 remains at 1100ppm, the deviation remains 100ppm from the setpoint, and this deviation leads to 50% of the maximum flow! Everything is stable and will remain so.
It is therefore impossible to reach the desired 1000ppm! If this were the case, the gap would be zero, the VAV would be closed, the CO2 level would rise since the occupants continue to breathe, so the gap would not remain zero!
This is the problem of proportional regulation: since fresh air is needed, the VAV must be interopened, so there must be a gap. The CO2 level will stabilize at 1100ppm, instead of the requested 1000ppm.
New idea: could we not reduce the range of CO2 that generates the opening of the register? Repeating the previous situation, if the register were at 100% of the maximum flow above 1100ppm, it would stabilize at 50% of its value for an ambient CO2 level of 1050ppm. This is indeed a possibility: it is said that the **proportional band is reduced** from 200 to 100ppm.
But this solution has its limits: with a proportional band that is too narrow, the system will start to oscillate, going from too open to too closed, sometimes without being able to stabilize. It is said that the system "pump", unable to stabilize.

### 16.2.3 Proportional – Integral Regulation (PI)

By acting with a force proportional to the difference between the ambient CO2 level and the setpoint, a gap remains permanently. It is therefore decided that the intervention force will have two components. The first is proportional force, as above. But a second force completes it: a force linked to
the integration of the gap over time, i.e. a function of the sum of all continuously measured deviations.
If CO2 stabilizes at 1100, due to the proportional component, a difference of 100ppm remains. Every "time step", the regulator will measure this deviation and add it to the value of a "memory" box. The opening of the register will be given by the sum of the 2 components. As long as the setpoint is not reached, the integral component will increase, the VAV will open a little more, until this time reaching the setpoint.
Once this is reached, the gap becomes zero and the integral component is no longer modified (since it adds a value "0"). If the setpoint is exceeded, the deviation will be negative and the integral component will decrease.
But couldn't this integral component work alone? No, it is too slow to react effectively to changes in CO2. It would be necessary to reduce its time step (decrease the "time
integration") but then the system becomes unstable. It is the marriage of the 2 actions (P and I) that is the most appropriate to meet demand: component P does the bulk of the work, then component I refines over time to converge on the set value.

meersens

www.meersens.com
sales@meersens.com