

Calibration

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Particulate Matter (PM) Sensor Calibration Guide

Fully Assembled Monitors

Starting October 2025 and onwards, every fully assembled AirGradient monitor is individually calibrated against a reference-grade instrument at the factory using our [Test Report V2](#) procedure. Based on this testing, a device-specific scaling factor and offset are calculated for the PM sensor.

These calibration parameters are tied to the sensor's serial number and are automatically applied when you register your device in the AirGradient dashboard. This is what you see as Factory Calibration in the dashboard.

In practical terms, this means:

- Each monitor is calibrated individually, not by batch.
- Calibration is based on comparison with a reference-grade instrument (PALAS)
- The correct calibration is automatically applied when the device is added to your dashboard

Viewing Your Factory Calibration Report

You can view the calibration details and test results for your specific device go to: **Dashboard > Locations > Admin > Retrieve Factory Test Report**

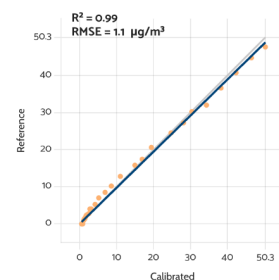
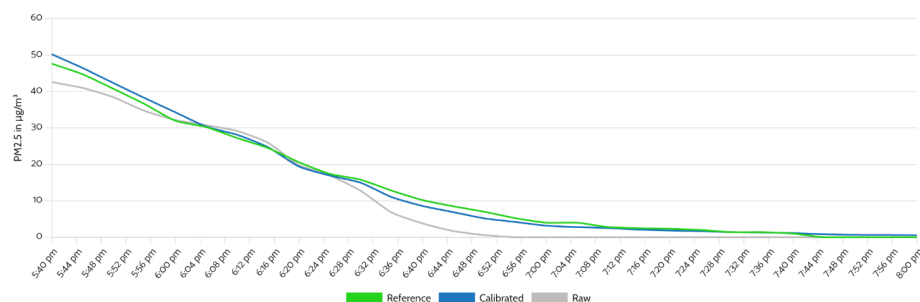
PM_{2.5}

Calibration Parameters via Count:

Scaling Factor: 0.018

Offset: 0

PM_{2.5} reference data is from our Palas Fidas 200 PM reference instrument placed in our test chamber. The Palas Fidas is an EN 16450 approved fine dust measurement device explicitly developed for environmental regulatory monitoring.



Historical Data Validity: 100%

Time Interval: 5 Minutes

Here you will find:

- The scaling factor and offset calculated for your PM sensor
- A test graph showing:
 - Raw sensor data
 - Calibrated data
 - Reference instrument data

This gives full transparency into how your device was calibrated. Detailed guide: [Where can I find the factory test report for my AirGradient monitor?](#)

Managing PM Calibration Settings for Fully Assembled Monitors

If you navigate to: **Locations > Admin > Edit Calibration > PM2.5**

Factory Calibration is selected by default.

You also have the option to remove or change it, but this is generally not recommended.

The screenshot shows the 'Advanced Settings | Home - Indoor - Tsaghkadzor' interface. At the top, there is a navigation bar with a close button (X). Below it, a horizontal menu contains four items: 'PM_{2.5}' (selected with a blue circle), 'Temperature/Relative Humidity', 'VOC, NOx', and 'CO₂'. The main content area contains several paragraphs of text explaining PM monitoring and calibration options. At the bottom, there is a dropdown menu for 'PM_{2.5} Calibration Formula' with 'EPA Formula' selected. The interface concludes with 'Cancel' and 'Next' buttons.

Advanced Settings | Home - Indoor - Tsaghkadzor

PM_{2.5} Temperature/Relative Humidity VOC, NOx CO₂

The PM monitor detects indoor particulate matter (PM₁₀, PM_{2.5} and PM₁₀) from sources like cooking, cleaning products, smoking and dust. These tiny particles can harm our health, especially PM_{2.5}, which is linked to respiratory and heart issues, asthma, and even premature death.

AirGradient monitors display raw data by default. To improve accuracy, the EPA developed a formula for Plantower PMS5003 sensor modules that adjusts the data, typically providing more reliable readings. Calibrated data will typically show lower PM levels than raw data, except at lower concentrations, where the calibrated data might be higher. You can learn more from our blog post about [EPA Calibration Algorithm](#). Keep in mind that the EPA calibration algorithm requires relative humidity readings. If these are not available and EPA Formula is selected, PM_{2.5} values will not be displayed.

For custom calibration via PM Count scaling factor and offset are applied to the PM Count readings from your monitor, not the PM_{2.5} values. If PM Count readings are not available, PM_{2.5} values will not be displayed. When selecting the custom option, ensure you understand the calibration logic.

Calibration changes saved here will be applied to incoming data going forward. For this reason, it may take several minutes for the updated values to display on the dashboard and the device screen .

PM_{2.5} Calibration Formula
EPA Formula

Cancel Next

The current calibration method will also be displayed there.

DIY Kits and Pre-Factory Calibration Assembled Devices

Since DIY kits are assembled by the user, they do not go through factory calibration. As a result, the PM data you see initially is raw sensor output, which can vary in accuracy.

To improve this, you should apply correction formulas.

EPA Correction (Recommended Default)

The most widely used correction is the U.S. EPA correction formula, designed specifically for Plantower PM sensors.

This formula adjusts raw readings to better match reference-grade instruments under typical environmental conditions. It compensates for known sensor biases and improves accuracy across a wide range of environments. This is the recommended baseline if you don't have your own reference instruments to calibrate with.

You can learn more here:

- [Does the EPA Correction Algorithm for Wildfire Smoke PM2.5 Developed for PurpleAir Work for AirGradient Monitors?](#)
- [Update: AirGradient and the PM2.5 correction algorithm from the EPA](#)

In most cases, applying the EPA formula is enough to get reliable data from a DIY unit.

Batch-Specific Correction (When Needed)

Some Plantower PM sensor batches show consistent deviations in their raw readings at low PM levels. See full explanation here: [Enhance the Accuracy of the PMS Sensors](#)

In these cases, an additional batch-specific correction may be required to enhance the accuracy of the PM sensor at low levels.

We have developed a range of batch-corrections for the PM sensors used in our monitors which help to improve accuracy and precision. To apply these batch corrections, you will need to know the first eight digits of the PM sensor's serial number.

How to find your PM sensor's batch number



To find the batch number, please look at the blue PM module. Each sensor has a sticker like the image above.

To avoid needing to open the monitor at a later date, please note down or take a photo of this number during assembly.

In the dashboard, you can then select the appropriate batch correction formula that matches your sensor's serial number. For example for the sensor in the image above, the correct batch



Applying corrections correctly

Batch-specific correction, described above, aligns your sensor with earlier, “classic” Plantower sensor behavior at lower PM levels. Batch specific corrections are essentially a calibration against an older Plantower sensor before the batch issue occurred. If you haven’t read the article linked above, please do so for more context: [Low Readings from Plantower PMS5003](#)

Once all sensors behave consistently, you can then improve accuracy.

This is where the EPA Formula comes in.

The EPA correction is based on comparisons with reference-grade instruments and is designed to improve real-world accuracy.

Therefore, for sensors that require batch correction, the correct approach is:

1. Apply the batch-specific correction
2. Then apply the EPA correction on top

PM _{2.5} Calibration Formula	Scaling Factor	Offset	<input checked="" type="checkbox"/> Apply EPA Formula
PMS5003T_20240518	0.03394	0	

Why this differs from factory-calibrated devices

For fully assembled monitors with factory (monitor-specific) calibration, the devices are individually calibrated against a reference instrument.

Because of this, EPA correction should not be applied on top of factory calibration, as it would effectively double-correct the data.

Managing PM Calibration Settings For DIY Kits

Navigate to: **Locations > Admin > Edit Calibration > PM2.5**

 PM_{2.5} Temperature/Relative Humidity VOC, NOx CO₂

The PM monitor detects indoor particulate matter (PM_{1.0}, PM_{2.5} and PM₁₀) from sources like cooking, cleaning products, smoking and dust. These tiny particles can harm our health, especially PM_{2.5}, which is linked to respiratory and heart issues, asthma, and even premature death.

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Calibration changes saved here will be applied to incoming data going forward. For this reason, it may take several minutes for the updated values to display on the dashboard and the device screen.

PM_{2.5} Calibration FormulaEPA Formula 

Cancel

Next

The current calibration method will also be displayed there.

Understanding Different PM Calibration Methods In The Dashboard

Understanding Different PM Calibration Methods

The dashboard supports several calibration modes. Each one fundamentally changes how your PM2.5 values are calculated.

1. Raw Data

- No calibration is applied.
- The monitor reports the unadjusted PM2.5 values.

2. EPA Formula

- The correction formula developed by the U.S. Environmental Protection Agency (EPA) is applied.
- Find the formula here: [AirGradient Documentation - Calibration Algorithms](#)

3. Custom Calibration(via Raw PM2.5)

PM_{2.5} Calibration Formula
Custom via PM_{2.5} Raw Scaling Factor Offset Apply EPA Formula

- A custom calibration directly adjusts the raw PM2.5 concentration values:
$$PM_{2.5}(\text{calib}) = PM_{2.5\text{ raw}} \times \text{scaling factor} + \text{offset}$$
- If the scaling factor and offset were determined with a local reference instrument, the EPA formula does not apply.

4. Custom Calibration (via PM Count)

- A custom calibration uses the raw particle count (PM count) rather than the raw PM_{2.5} concentration.

$$PM_{2.5}(\text{calib}) = PM \text{ Count}_{\text{raw}} \times \text{scaling factor} + \text{offset}$$

At very low concentrations, PM count data often provides better resolution (since raw PM_{2.5} may already read 0; see [Low Readings from PMS5003](#)).

Note: If the scaling factor and offset were determined with a local reference instrument, the EPA formula does not apply.

5. Factory Calibration

- Calibration factors calculated at the factory via co-location with a reference instrument.

6. Special Formulas by Specific Batch

- Some Plantower sensor batches show systematic differences in raw readings at lower PM levels. In these cases, special correction formulas are applied to compensate.
- It is recommended to also apply the EPA formula on top, unless you have a reliable local reference for a custom calibration.

Carbon Dioxide (CO2) Sensor Calibration

CO2 sensors rely on an internal algorithm called Automatic Baseline Correction (ABC) to maintain calibration.

How ABC Works

CO2 sensors naturally drift over time. ABC compensates for this by making a key assumption:

At some point during each cycle, the sensor will be exposed to fresh outdoor air (~400 ppm).

- The sensor records readings over a defined period (e.g. over an 8 day period by default, this period can be changed in the dashboard, Dashboard > Locations > Admin > Edit Calibration > CO2 > Set ABC Duration)
- It identifies the lowest reading during that period
- That value is assumed to represent fresh air
- The sensor adjusts its baseline so that value equals ~400 ppm

When This Works Well

ABC performs well when the sensor regularly encounters fresh air: outdoor installations, indoor environments with regular ventilation.

Example: Your AirGradient ONE is in your living room. You regularly open windows or doors during the day. Fresh air regularly enters the space and CO2 drops close to outdoor levels of ~400-420 ppm.

Result: ABC keeps the sensor calibrated automatically

When This Does Not Work Well

Problems arise when the sensor never sees outdoor air. For example:

Your AirGradient ONE is in your bedroom. You sleep there every night with the door and windows closed, and your pet also stays in the room. During the night, CO2 levels rise from breathing. During the day, even when you're not in the room, your pet continues to produce CO2, and because the space isn't ventilated, levels never drop to true outdoor air.

Instead of falling to ~400 ppm, the lowest level might only reach around 500–600 ppm. The sensor assumes this is fresh air and adjusts its baseline to it. Over time, this shifts all readings downward, so the CO2 levels shown are consistently lower than the actual values. The result is systematic underestimation over time.

Manual Calibration

Manual calibration is possible, but it must be done carefully. You can calibrate the CO2 sensor in two ways:

The first way is to place the device in fresh air (ideally outdoors or near a fully open window) and leave it there for several hours. This allows the ABC algorithm to naturally reset the baseline when it detects the lowest CO2 level.

The second way is to use the Request CO2 Calibration button in the dashboard. This tells the sensor to treat the current air as ~400 ppm, so it's important that the device is in fresh air when you do this.

To use this option, go to:

Dashboard > Locations > Admin > Edit Calibration > CO2 > Request CO2 Calibration

The screenshot shows a web interface for 'Advanced Settings | Balcony'. At the top, there are four sensor categories: PM_{2.5}, Temperature/Relative Humidity, VOC, NOx, and CO₂. The CO₂ category is highlighted with a red box. Below this, there is a section for 'CO₂ Automatic Baseline Calibration Duration' with a dropdown menu set to '8 days (Factory Default)'. A section titled 'Requesting CO₂ Calibration' contains instructions and a 'Request CO₂ Calibration' button, which is also highlighted with a red box. At the bottom of the interface, there are 'Cancel' and 'Finish' buttons.

Before pressing the button, place the device in fresh air for a few minutes and keep people or pets away, as breathing can affect CO2 levels. After calibration, the reading should settle around 400–420 ppm.

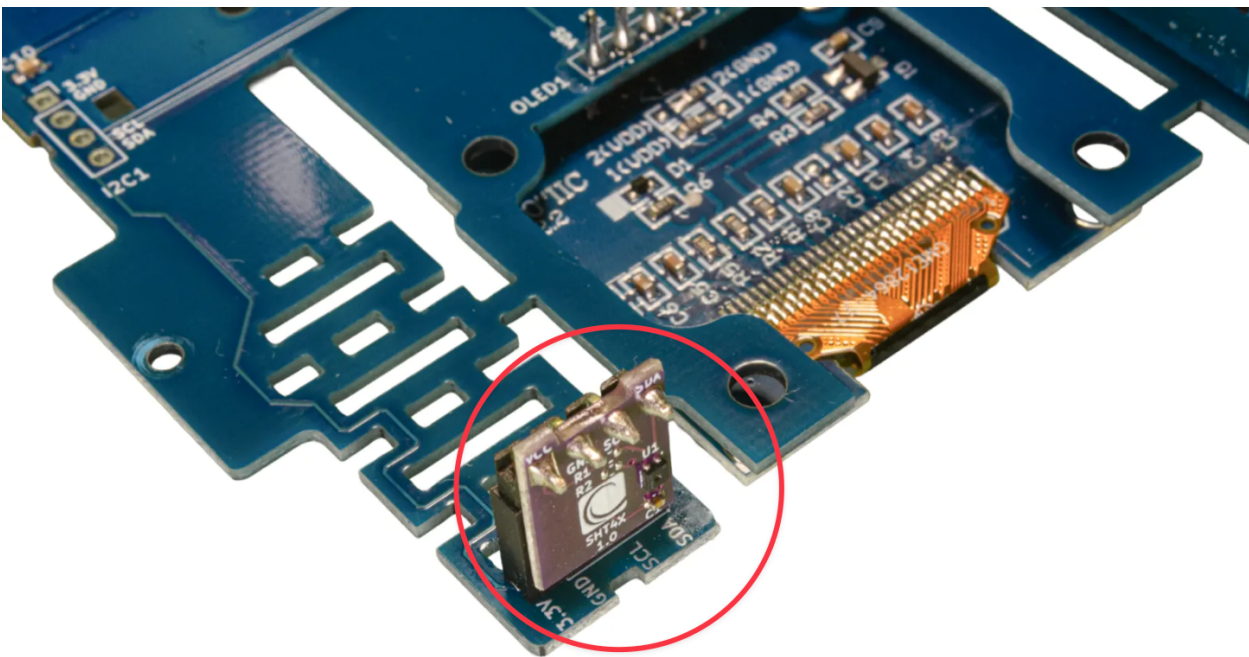
Once calibration is done, you can move the device back to its normal location. The CO2 baseline is stored and will remain even if the device is powered on/off.

If done incorrectly, manual calibration can make readings worse, not better.

Temperature & Humidity Sensor Calibration

Indoor Monitors

Indoor AirGradient monitors generally do not require calibration as the sensors are directly exposed to ambient air so the readings are accurate by default.



But if needed, you can apply an offset by going to **Dashboard > Locations > Admin > Edit Calibration > Temperature/Relative Humidity**

Here you can apply a custom scaling factor and offset:

Temperature Calibration Formula	Scaling Factor	Offset
Custom	1	0 °C
Relative Humidity Calibration Formula	Scaling Factor	Offset
Custom	1	0 %

Outdoor Monitors

For the Open Air, the temperature and humidity sensor is located inside the enclosure so heat buildup and airflow limitations can affect readings.

To compensate for this, we provide an Open Air Standard Calibration formula

This can be enabled in the dashboard: Dashboard > Locations > Admin > Edit Calibration > Temperature/Relative Humidity

Temperature Calibration Formula

Standard AirGradient Open Air Calibration ▼

Relative Humidity Calibration Formula

Standard AirGradient Open Air Calibration ▼

Without this correction, outdoor temperature and humidity readings from the Open Air may be incorrect, especially if the monitor is placed in direct sunlight.

TVOC / NOx Sensor Calibration

TVOC and NOx sensors do not follow traditional calibration approaches. Instead, they rely on internal algorithms and a continuous learning period which the sensor uses to build a baseline and adjust its readings accordingly.

In practice this means that readings may fluctuate more in the beginning and be unstable until a baseline is established. Values stabilize after a learning period (which is 12 hours by default).

For a deeper explanation:

[Explaining VOCs, TVOC and the VOC Index](#)