Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

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PurpleAir Sensor Installation Quick Guide
April 22, 2024

Overview

The Massachusetts Department of Environmental Protection (MassDEP) is providing PurpleAir sensors to organizations through a new grant program to measure levels of fine particulate matter (PM$_{2.5}$) in their communities' outdoor air for at least one year (grant program documents are posted on MassDEP's website at: https://www.mass.gov/how-to/apply-for-a-massdep-air-sensor-grant). PM$_{2.5}$ is a mixture of solid particles and liquid droplets found in the air and be made up of hundreds of different chemicals. PM$_{2.5}$ is so small that it can be inhaled deep into the lungs and may even enter a person's bloodstream.

Numerous scientific studies have linked breathing PM$_{2.5}$ to adverse health effects, including premature death in people with heart or lung disease, nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function, increased respiratory symptoms, such as irritation
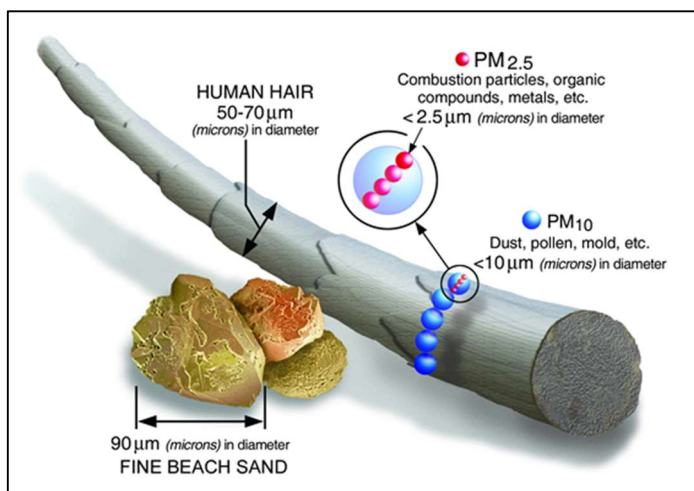
of the airways, coughing or difficulty breathing. People with heart or lung diseases, children, and older adults are the most likely to be affected by PM$_{2.5}$ pollution exposure.

This information is available in alternate format. Please contact Melixza Esenyie at 617-626-1282.
TTY# MassRelay Service 1-800-439-2370
MassDEP Website: www.mass.gov/dep

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PurpleAir sensors are used to measure $PM_{2.5}$ by a wide variety of governments, organizations, and citizens to monitor air quality. A detailed FAQ (https://community.purpleair.com/c/faq/27) and sensor startup guide (https://community.purpleair.com/t/sensor-wifi-and-registration/182) are available from the PurpleAir website. A few key questions are addressed below.

1. **How do PurpleAir sensors work?**

PurpleAir sensors use laser particle counters to count the number of particles by particle sizes 0.3, 0.5, 1, 2.5, 5, and 10 micrometers (μm), and use the count data to calculate mass concentrations of $PM_{1.0}$, $PM_{2.5}$, and PM_{10} in micrometers per cubic meter ($\mu g/m^3$). A laser counter uses a fan to draw a sample of air past a laser beam. Any particles in the air will reflect some light from the laser beam onto a detection plate, like dust shimmering in a sunbeam. The reflection is measured as a pulse by the detection plate, and the length of the pulse determines the size of the particle while the number of pulses determines the particle count. The $PM_{1.0}$, $PM_{2.5}$, and PM_{10} mass concentrations are calculated from these particle counts.

2. **Is any maintenance required for PurpleAir sensors?**

PurpleAir sensors generally do not require any maintenance. If needed, a vacuum cleaner can be used to clean out debris, insects, or spiders that may get into the bottom of the unit. More information on cleaning and troubleshooting can be found at: https://community.purpleair.com/t/sensor-maintenance/1531

3. **Where can I find real-time air quality data for the sensors and other MassDEP monitors?**

Once operating, real-time $PM_{2.5}$ air quality data for PurpleAir sensors is available from the PurpleAir website and EPA's Airnow Fire and Smoke Map. EPA's Airnow Fire and Smoke Map also shows data from regulatory $PM_{2.5}$ monitors that MassDEP operates. MassDEP's also displays data from all its monitors on its MassAir Online website. See the links below.

https://www2.purpleair.com/

https://fire.airnow.gov/

http://eeaonline.eea.state.ma.us/dep/massair/web/#/pollution/map/max

4. What is the process for installing a PurpleAir sensor?

PurpleAir Flex Installation and Setup

A PurpleAir sensor is easy to install and set-up and only needs access to an electrical outlet and a 2.4GHz WiFi connection. The PurpleAir sensor set-up involves four steps:
1) Register
2) Install
3) Plug in to electricity
4) Connect to WiFi

Each step is detailed below and once complete, real-time PM2.5 concentrations will display on the PurpleAir Map. The PurpleAir Map is available at https://www2.purpleair.com/. This website is also a great resource for information and any questions you may have. The data also will display on EPA's AirNow Fire and Smoke map at https://fire.airnow.gov/, where you can also see data from MassDEP's full-scale regulatory $PM_{2.5}$ monitors.

See also a step-by-step instructional video outlining registration, installation, and WiFi connection steps: https://www.youtube.com/watch?v=GnW63BvCn4U

Step 1 – Registration

The PurpleAir sensor must be registered so it will appear on the PurpleAir map. Registration can be completed before or after the sensor is deployed; however, it is easiest to register the sensor once a monitoring location is chosen but before it is deployed. You can complete the registration form at https://www.purpleair.com/register.

1. Enter the MAC ID # printed on the sensor label in the "Device-Id (MAC)" field.

Device-Id (MAC)*	Printed on the device label just above the bar code. Please include the colons (:)
🔒	XX:XX:XX:XX:XX:XX

2. Enter air.sensor@mass.gov in the "Associated Email" field. It is important to click "Outside" next to "Installed" and "Public (everyone)" next to "Visibility" to meet the conditions for MassDEP's grant program. Enter a descriptive location name exactly as you would like it to appear on the map.
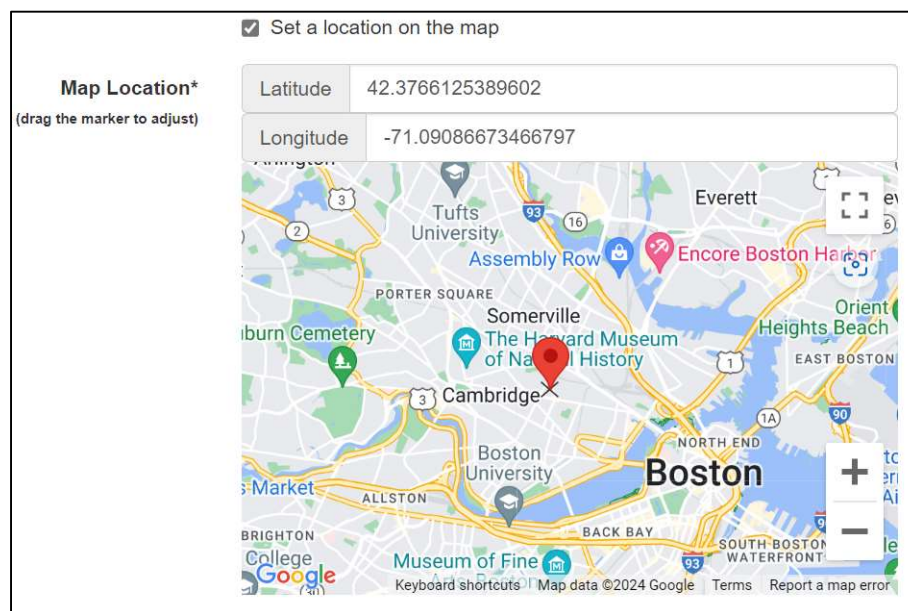
3. The sensor location (in latitude and longitude) can be populated by clicking "Allow" when asked to allow www.purpleair.com to access your location when you first go to the registration form. Drag the marker in the map to the actual location where the sensor will be deployed. **Ensure the red map marker is in the correct spot where the sensor will be deployed.**

4. Leave the "Onboard LED Options" as the default settings. The "Data Processor" fields are optional.

5. Under "Device Owner Information" enter the organization's contact email (as the grantee receiving the sensors from MassDEP) in the "Owner's Name" and "Owner's Email" fields. This contact person will receive a confirmation email once the sensor is registered. The "SMS Alert Phone Number" field is optional.

6. Check the box next to "I agree with the terms and conditions" and click the "Register" button. Detailed instructions are also available at: https://www2.purpleair.com/pages/install#registration.

Step 2 – Installation

- Choose an outdoor location that is convenient to reach, and accessible to both a power outlet and WiFi.

- The ideal locations are 7 to 30 feet above ground level, have at least 180° of unrestricted airflow, and are free of obstructions that may block the sensor inlet on the bottom of the unit.

- As much as possible, mount away from vents, BBQs, smoking areas, and foliage.

- The unit can be in direct sunlight; however, partially shaded areas are preferred.

- The sensor has an attached mounting plate and comes with a screw and three zip ties; either

can be used to secure the mounting plate to a surface or object (i.e., post, etc.). Install the sensor in the vertical position with the open end facing toward the ground. The housing is designed to protect the device from rain and snow while allowing free flow of air.


- The sensor should be securely attached with cable ties (zip-ties), screws, or other means, to prevent wind from knocking it over. A "drip loop" on the power cord will prevent water from running down the wires and into the electronics. Check that the sensor bottom can be viewed and reached.


Step 3 – Plug in

- Plug the power cord into a wall outlet or extension cord before attaching it to the PurpleAir.

- Attach the Micro USB Port to the unit (make this connection carefully, it is a little tight). Once it is powered, you should notice some flashing lights before a very dim red glow inside the sensor housing. If it is sunny, the lights can be difficult to see so you may have to cup your hands around the sensor as you peer inside. You may also notice a slight vibration once it is running.
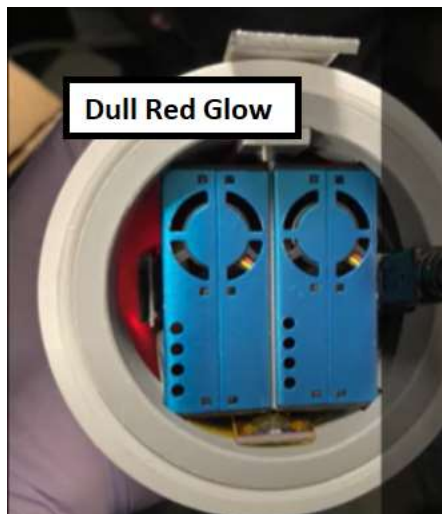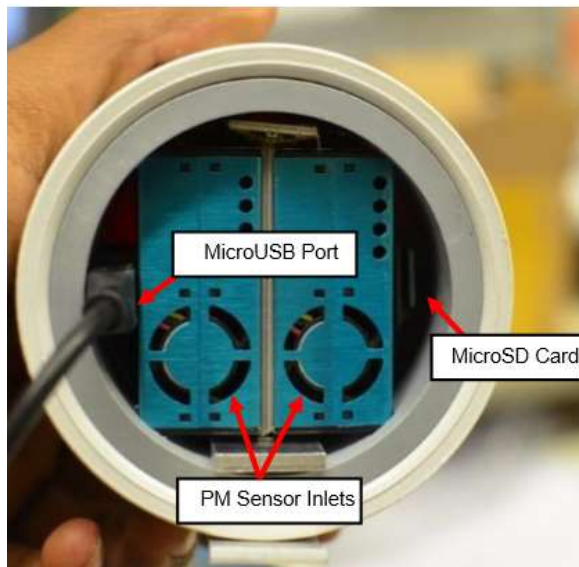
Step 4 - Connecting the PurpleAir to a WiFi Network

- Using a WiFi-enabled device (cell phone, tablet, or laptop), open the WiFi settings menu to connect to the sensor's network, **PurpleAir-XXXX**. The "XXXX" is the last 4 digits of the MAC ID # mentioned above that is written on the unit. It may take up to up to 10 minutes after the sensor is plugged in for this network to appear. Your device may display an error such as "Internet may not be available." This is normal and you can proceed to the next step.

- Depending on your operating system or device, you may get a pop-up window or a message to sign into the network. If you receive a message to sign into the network, then press it to allow the pop-up window to appear. The pop-up window will list all available WiFi networks.

- **Note:** If the pop-up window does not appear, then make sure you've selected the "PurpleAir-XXXX" network and wait a few minutes. If the pop-up still does not appear, then try opening a web browser and loading a webpage. If you are connected to the PurpleAir network, this will load the sensor interface with the WiFi settings for the sensor. Another option is to open a webpage and in the address bar, enter the default IP address for the sensor: http://192.168.4.1/config. If using an iPhone, a screen should automatically pop-up that allows you to connect the sensor to the desired WiFi network.

- The pop-up window will list available WiFi networks. Choose the WiFi network you would like the sensor to use, enter the password, and click save. Ensure the password is the correct password for the 2.4Ghz WiFi and is spelled correctly; entering an incorrect password will block connection. A hidden WiFi network can be entered by selecting the option at the bottom of the list.
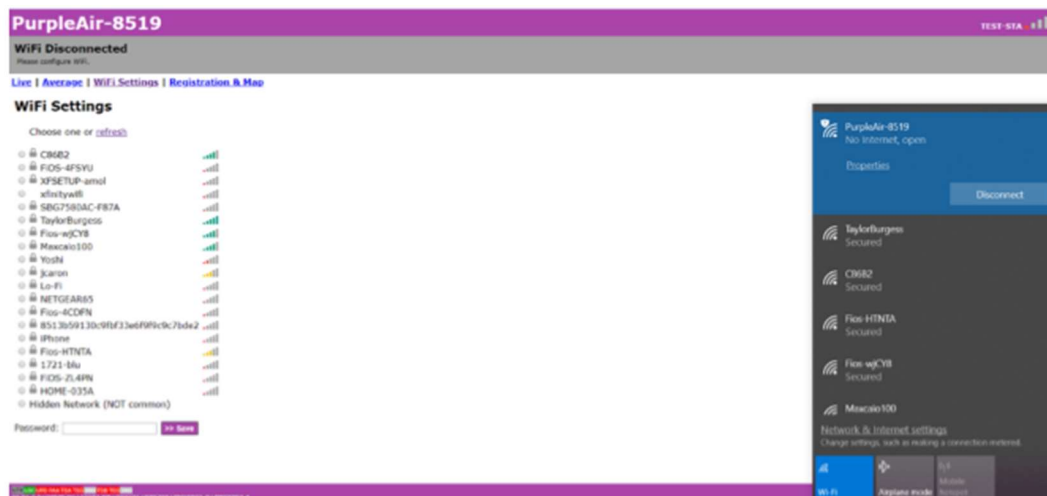

- A "disconnected" message may appear first but within a minute or so, the connection should be a success and the status bar will turn green and indicate "WiFi Connected."

- Once your device is configured to your local WiFi network, it will no longer appear in the list of available networks - the fact that it has disappeared

means that the sensor is successfully configured to WiFi. The sensor data should become visible in the PurpleAir map. If the PurpleAir network continues to show on the WiFi menu, double-check the password for your 2.4GHz WiFi network. This can be a different password than other bands or SSIDs if it is set up that way. You can check the password by logging in to the router.

- Go to http://map.purpleair.com to confirm successful registration and WiFi connection. The search icon is on the top right, and you can look by sensor name or city, state.
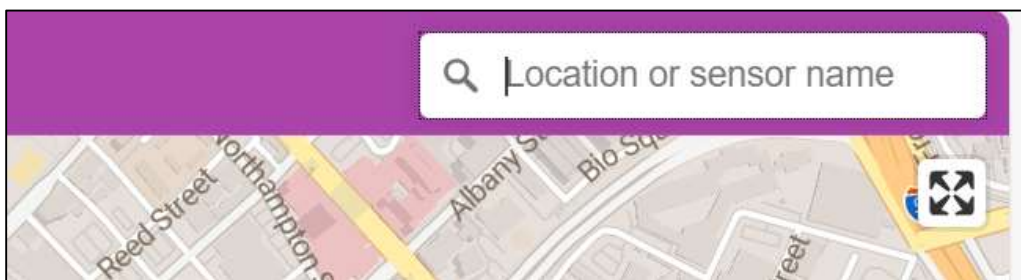
- For WiFi troubleshooting and information on network requirements, network encryption, and using a captive portal WiFi network, please see the below resources:

  https://community.purpleair.com/t/sensor-won-t-connect-to-your-wifi-network/133

  https://community.purpleair.com/t/using-captive-portal-networks/132