



## SenseiAQ Software

### Using SenseiAQ to Analyze Air Quality

Application User Guide – Version 1.1 updated 6/29/2021

## Information on how to interpret data provided by SenseiAQ

SenseiAQ provides a lot of information. If you are knowledgeable on how Air Quality is measured, how the EPA reports Air Quality you might not need to read this section. If not, here are some helpful hints and some additional sources to help you interpret the data and take appropriate actions.

Figures 1, 2 show the values in micrograms/m<sup>3</sup> for PM<sub>2.5</sub> and 10 which are used to calculate the AQI values reported in SenseiAQ. Note that the values displayed update every minute (and can be adjusted) whereas the EPA index based on the [National Ambient Air Quality Standards](#) (NAAQS) is reported over a 24-hour period and is only outdoors. Nevertheless, the AQI index itself serves as a simple, easy to understand scale alongside mass concentration and particle count.

Air Quality Index Levels of Health Concern	Numerical Value	Meaning
Good	0-50	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	51-100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	101-150	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151-200	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	201-300	Health alert: everyone may experience more serious health effects.
Hazardous	> 300	Health warnings of emergency conditions. The entire population is more likely to be affected.



Figure 1 - PM 10 AQI Scale and Mass Concentration

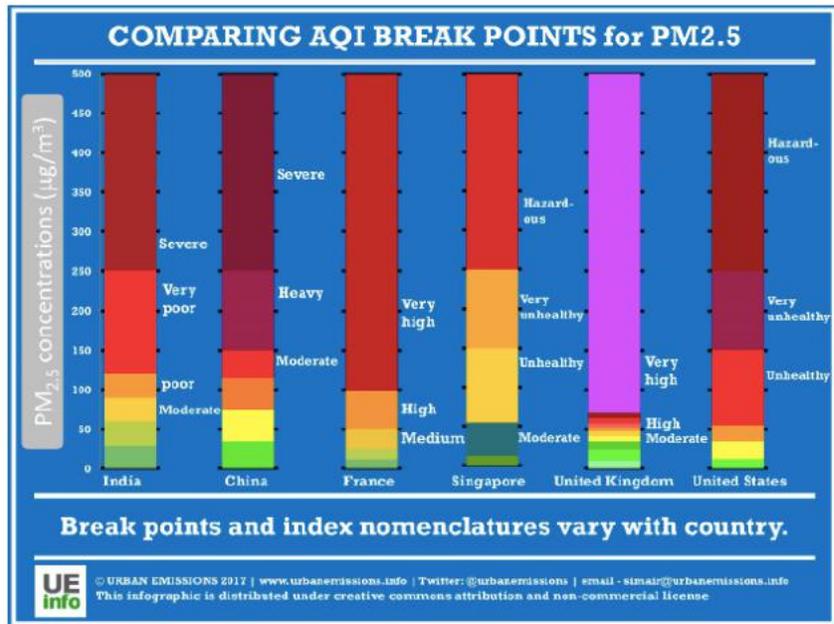


**Figure 2 - PM 2.5 AQI Scale and Mass Concentration**

SenseiAQ’s Dashboard has 3 PM ‘dials’, for PM10 (Coarse), PM2.5 (Fine), PM1.0 (Very or Ultra Fine) reporting mass concentration, the AQI and a minute-by-minute display for the last 60 minutes, See Fig. 3. Sample rate is controlled through software commands per [the data sheet](#) on our website. The factory defaults are measurements every second and the dashboard updates every minute. The IPS starts to send data automatically about 6 seconds after the device is plugged in to the USB port. On the SenseiAQ dashboard you’ll see serial data updating every second: a series of data strings containing particle counts (PC) and mass concentration (PM) data followed by device serial number and a network serial key. The PC data is in #/L, and the PM is in ug/m<sup>3</sup>. Allow at least 5 seconds to obtain stable data. The IPS will run a self-cleaning cycle for 10 seconds once a week by default.

PM10.0 includes ALL particles 10.0 microns and below so it includes the PM2.5 and PM1.0 data. Ideally all 3 will be green but because PM2.5 and 1.0 are more dangerous the Mass Concentration (and particle count) limits are lower for the smaller particles per Fig 2. Good for PM10 is < 55 ug/m<sup>3</sup>, for PM2.5 it’s < 12 ug/m<sup>3</sup>, **for PM <1.0 there is no recommended EPA MC standard, so we are using PM2.5.** In the future, the EPA and other regulatory bodies will likely establish PM 1.0 values that are lower than PM 2.5. It’s likely these will be based on particle count since the mass for these particles is negligible.

For reference the WHO PM2.5 value is <10.0. Some countries like Canada use the EPA standards but several have their own AQI scales many of which are higher but a few lower than the EPA.



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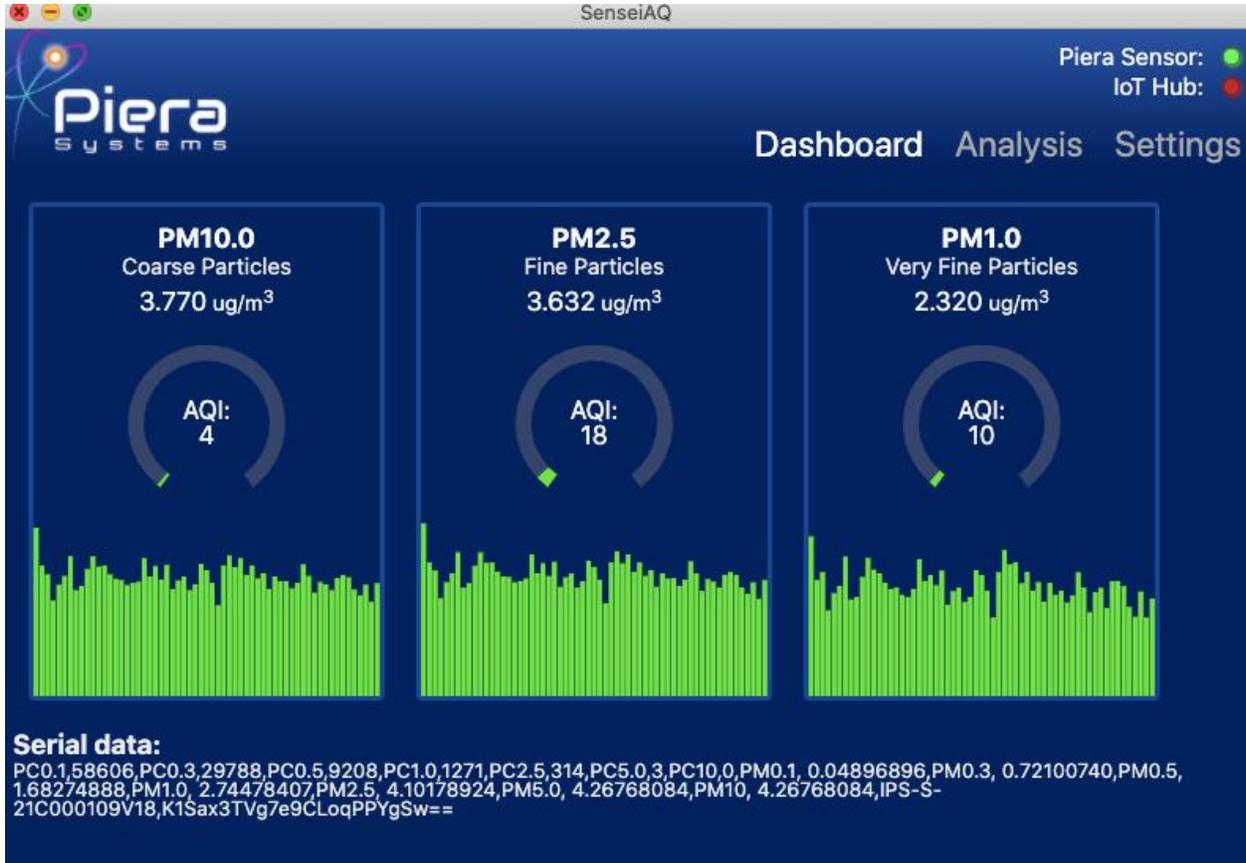


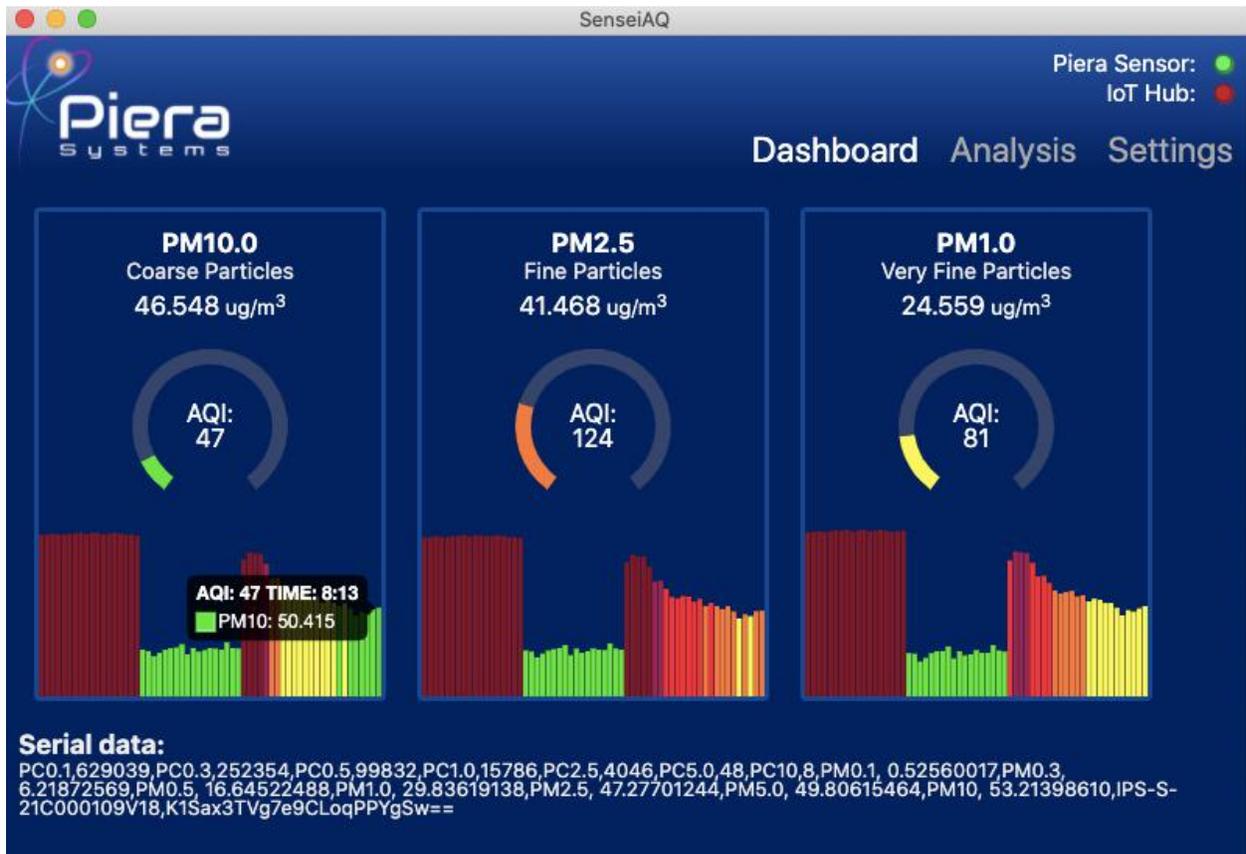
Figure 3: Good Air Quality for all PM values

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Figure 4 was taken in a home that had Hazardous Air due to Air Filters that were very dirty. The purple shows the Hazardous readings with MC ~500 ug, then the sensor was taken outdoors (the green period) while the filters were replaced and the AC unit turned on then it was brought back indoors, and you can see the gradual clearing of the air. Since the filters were MERV-6 quality they don't filter out the Fine and UFP particles as well, so they decrease but don't come down completely. You can see that while the PM10 is good (green bars on the right), the PM2.5 is still unhealthy. Note that of the 41.468 ug/m<sup>3</sup> reported as PM2.5, 24.559 of that is PM1.0 It is only yellow because we are using the same scale as PM 2.5. The point is that the sources of most bad air indoors is PM1.0 and below which is more dangerous and requires much higher MERV rating filters. ASHRAE, the CDC and EPA recommend using MERV-13 filters and fresh outside air which can reduce the spread of Covid-19 and other viruses by ~50 %.

**Figure 4: Poor Air Quality air due to poor HVAC filtration example**



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## Appendix D: Additional Reference Information on measuring Air Quality

[This White Paper](#), "Testing, Testing, 1.2.3.." discusses the EPA's test method for PM sensors and the IPS Test Report.

[California's South Coast Air Quality Monitoring District](#) which covers southern CA and Los Angeles has an excellent website and a program for testing and reporting on sensors and Air Quality monitors.

The EPA's [Airnow.gov](#) website and application shows real-time AQI data and a Fire and smoke map and several other useful tools and educational material.

[LocalHaze](#) is a free application that displays outdoor Air Quality from several sensor networks including the EPA, Purple Air, etc.

The [EPA's Air Sensor Toolbox](#) provides insight into the EPA's initiatives to help educate on low-cost sensors.

The [Encyclopedia of the Environment](#) is a wealth of information regarding Particulate Matter and its health effects.