



AIR QUALITY EGG®



Air Quality Egg V2 2020 Model USER MANUAL

Monitors:

Temperature
Relative humidity
Barometric pressure

Your Egg may also monitor some of the following:

Carbon Monoxide (CO)
Carbon Dioxide (CO₂)
Hydrogen Sulfide (H₂S)
Nitrogen Dioxide (NO₂)
Ozone (O₃)
Particulate Pollution (PM1.0, PM2.5, PM10)

Sulfur Dioxide (SO₂)
Volatile Organic Compounds (VOCs)

Setup: Connecting and Positioning your Egg

The Air Quality Eggs needs to have an established Wi-Fi connection before it can post data online. This and claiming your data are the most important setup steps.

1. Take your Egg out of the box and clip the base tab to the bottom



2. Plug the Egg into your computer's USB port.
3. Download and install the Air Quality Egg configuration tool onto your Windows/Mac/Linux Computer.
<https://airqualityegg.com/setup>
4. In the configuration app, click the 'Step 1 - Select Task' dropdown, select 'set wifi'. Enter network name (SSID) and password. Click 'Apply'. Wait a couple of minutes for 'success'.
 - a. If you do not see 'success' refer to the troubleshooting section within this manual.
 - b. Note: The Egg cannot connect to eduroam Wi-Fi (this is a student Wi-Fi that does not support devices), your Egg does not need to be connected to the same Wi-Fi as your computer.
5. Your Egg must stay within range of a Wi-Fi network to automatically upload. To access offline data follow the directions below.
6. If you purchased the additional feature of offline data logging and do not want to connect to Wi-Fi follow the directions below.
 - a. Open the Egg Serial Configurator
 - b. From the 'Step 1' dropdown select 'set offline', click 'OK', then 'APPLY'
 - c. Data is saved to the SD card. For information on uploading data, see the Egg Serial Configurator section of this manual.
7. Positioning your Egg
 - a. Place the Egg in a sheltered location or (if inside) near the center of the space you wish to measure. Exposure to extended direct sunlight or excessive moisture may permanently damage the unit.
 - b. The Indoor Egg has two holes at the top which can be used to thread a string to hang the unit. The Outdoor can be hung on a wall or on the stand provided.
 - c. The Egg must be upright to function correctly.
 - d. The Egg's USB cable must be plugged into a power source at all times. Options include: computer, wall outlet, or external battery pack.
 - e. DO NOT cover the fan port or fan intakes while unit has power.
 - f. Note that the LCD backlight does not work while unit is resolving the internet connection, unless you touch it during the 12 second startup window.



8. Egg Screen Display



- a. The Egg can either be in operational mode or configuration (setup) mode. During operational mode, the display shows:
 - i. Temperature (TEMP) in either Fahrenheit or Celsius.
 - ii. Relative humidity percentage (RH)
 - iii. Additional results will be available on this screen depending on the customization of your sensor
 - iv. To activate the LED light place your hand over the left side of the Egg (may take up to 30 seconds)
- b. During configuration mode, the screen shows "CONFIG MODE".

Setup: Accessing and Analyzing Data

Your Egg will start publishing data after it connects to Wi-Fi (it takes approximately 30 minutes for the data to stabilize). In order to name the Egg and locate it on the map you will need to claim it as yours. This step requires your **Egg serial number** and **Claim code**, shipped with the Egg.

9. Go to the Egg Portal: <https://airqualityegg.com/portal/>
10. Click 'Login' in the top right. We recommend signing in with Google, or you can choose to create a new account with your email address. If you don't sign in with Google you'll need to validate your email to complete the registration. An email will be sent from egg@wickeddevice.com, click the validation link.
11. Add your Egg to your account
 - a. Select the menu icon in the top left
 - b. Select 'Eggs'
 - c. Go to 'My Eggs'
 - d. Click the plus symbol in the bottom right()
 - e. Enter your Egg's serial number and claim code (located on the card in your package)
12. Renaming your Egg
 - a. The default name for your Egg is the provided serial number
 - b. Click on your Egg icon within 'My Eggs'
 - c. Select the pencil icon in the top left  egg008022c2b2180141
 - d. Type the new name and click 'Save'
13. Download the mobile app to access data on the go



(<- app icon)

Login using your Egg Portal credentials

The Air Quality Egg **YouTube** channel has several how to videos, we recommend starting with “**1. Getting your Air Quality Egg Online**”.

Overview: The Egg Portal

All data and settings are controlled through the Air Quality Egg portal www.airqualityegg.com/portal

Data Refreshing

Data from the Egg is refreshed every minute on both the overall Egg map and the Egg details page.

Egg Color Key


Select your Egg in the portal to access a detailed view of the data (Menu -> Eggs -> My Eggs -> Click on your Egg icon). Monitor the safety level of each pollutant by reading the charts. The chart colors indicate the following:

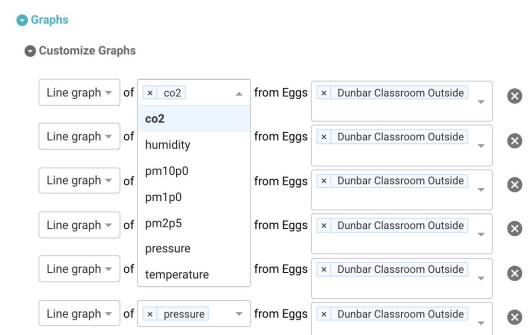
Air Quality Index (AQI) Values	Levels of Health Concern	Colors
<i>When the AQI is in this range:</i>	<i>..air quality conditions are:</i>	<i>...as symbolized by this color:</i>
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

*Note charts that do not include these colors report pollutants that are not included in the EPA Air Quality Index. They are reported as an Egg calculated Air Quality Index.

Creating Labs

Labs are used to save data for later, compare data and email results to yourself or others for additional analysis.

1. To create a lab, go to the the Egg Portal (<https://airqualityegg.com/portal/>)
2. From the menu icon in the top left select 'Labs'
3. Go to 'My Data'
4. Select the plus sign icon in the bottom right ()
5. Select 'Lab'
6. Give it a title which makes it easy to search
7. Add a description
8. Choose one or more Eggs to add to the lab. You can choose Eggs that are owned by other Air Quality Egg community members.
9. Select a timeframe.
10. Choose a type of pollutant to monitor. This is done in the graphs section. Select the icon next to 'Customize Graphs' to begin the configuration.




11. Choose a location. If the Eggs in the lab do not have a location set by the owners, you will have to choose one.

Labs are updated every **6 hours**. This means you will not see any data in the lab right away, even though it is running correctly.

You can create a lab using your data, or other Eggs, or both.

There are two ways to see the data:

- A lab collects new data, and displays it.
- A comparison allows you to compare existing labs to each other.



Leverage pre-existing labs by clicking 'Explore' or using the search tool  at the top of the page. We recommend starting with the following pre-existing labs:

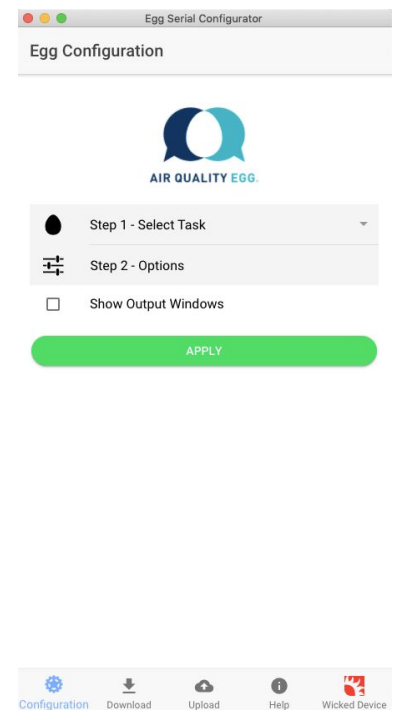
- Cold Front July 9th - July 11th
- Greenhouse data L-J over weekend

*Add the above labs by to your favorites by searching for them by name, checking the box next to the name and clicking 'DOWNLOAD'

Overview: Egg Serial Configurator

This software tool is used to setup your Egg, connect it to a Wi-Fi network, and customize your Egg, and more.

1. Change temperature units
 - a. From the 'Step 1 - Select Task' dropdown choose 'set temperature,' choose between celsius and fahrenheit
2. Upload offline data to cloud
 - a. From the 'Step 1' dropdown select 'set offline', click 'OK', then 'APPLY'
 - b. Data is saved to the SD card. This option is only available if you purchased the additional feature of offline data logging.
 - c. Connect your Egg to your computer's USB port.
 - d. Click the Upload icon  at the bottom of the Egg Serial Configurator
 - e. Select a start and end date/time
 - f. Login using your Egg Portal credentials
 - g. Click 'UPLOAD DATA TO CLOUD'
 - h. You should now see your data on the Egg Portal
3. Download data to your laptop
 - a. Click the Upload icon  at the bottom of the Egg Serial Configurator
 - b. Select a start and end date/time
 - c. Click 'SELECT DESTINATION' and choose where on your computer you wish to save the data
 - d. Click 'DOWNLOAD DATA TO FILE'



Overview: Digital Gas Sensors

As of July 2020, for NO₂, CO, O₃ (Ozone), and SO₂, Air Quality Eggs use Digital Gas Sensors (aka DGS). These sensors offer users the ability to re-zero the units more easily and as often as they deem appropriate for their use case.

1. Re-zero an Air Quality Egg DGS sensor
 - a. Open the Egg Serial Configurator application.
 - b. Connect your Air Quality Egg to your computer and keep it connected throughout the whole process. It should be connected to your computer's USB for at least 20 minutes, or preferably an hour. This gives the gas sensors time to warm up and stabilize. If the sensors haven't been powered up for a long time (e.g. a week), they may take longer to stabilize. Interruption of power can cause them to require more time to stabilize, so keep them plugged into your computer for this whole process.
 - c. It's vital that this process takes place in an environment that is presumed to be relatively free of the target species gas. For example, things like laser printers can produce ozone levels that you might not be aware of, but that the Egg can definitely measure. Do not re-zero an Egg with O₃ sensors near a laser printer.
 - d. Electrochemical gas sensors are quite sensitive to temperature. For best results, the following procedure should be conducted in a stable room temperature environment (i.e. around 20 Celsius / 68 Fahrenheit).
 - e. Within the Egg Serial Configurator application, click the dropdown menu "Step 1 - Select Task"
 - f. Scroll down to the bottom of the list of available tasks, select the option "console window", and click "OK"
 - g. Click the green "OPEN CONSOLE WINDOWS" button and a new window with a black background will open.
 - h. After a short period of time, text will start to appear as the Egg reports its configuration data to the screen, and eventually will end with an "AQE>:" prompt where you can type commands into the Egg. It will look something like this:

```
03 Report Negative values as zero: yes
03 Baseline Voltage Characterization:
   idx temp [degC] slope [V/degC] intercept [V]
-----
No valid entries found.
Temperature Reporting Offset [degC]: 0.00
Humidity Reporting Offset [%]: 0.00
Temperature Reporting Offline Offset [degC]: nan
Humidity Reporting Offline Offset [%]: nan
-----+
| note: '*' next to label means the setting is not backed up. |
|   run 'backup all' when you are satisfied                    |
|-----+
AQE>:
@=====
# GETTING STARTED                                           #
#-----#
# First type 'ssid your_ssid_here' and & press             #
# Then type 'pwd your_network_password' & press            #
# Then type 'get settings' & press to review config        #
# Finally, type 'exit' to go into OPERATIONAL mode,       #
# and verify that the Egg connects to your network!       #
@=====
AQE>: |
```

- i. For each sensor you want to re-zero (there can be at most two per Egg currently):
 - i. First select the DGS channel (1 or 2) by typing `dgsch 1` or `dgsch 2` and press Enter.
 - ii. Type `dgscmd trans` to begin a session communicating with the selected DGS channel.
 - iii. Type `e` and press Enter (note this is a lowercase letter e).
 - iv. Make sure the output reflects the sensor you want to re-zero on the Gas line of output text.

- v. Type 'Z' and press Enter (note this is a capital letter Z).
 - vi. Type '!' and press Enter (that's an exclamation point) to end the session communicating with the selected DGS channel.
- j. Here is an example command sequence and responses for an O3 DGS unit on channel 1:

```
AQE>:
AQE>: dgsch 1
AQE>: dgscmd trans
Starting DGS Transparent Mode.
AQE>: e
EEPROM Values
nA_per_PPM_x100= -4877
ADC_OC= 32711
ADC_Zero= 32619
ADC_Span= 65535
Temperature_Offset_x1000= -1
T_Zero= 24728
RH_Zero= 34022
T_Span= 65535
RH_Span= 65535
LMP91000 Register 0x10= 3
LMP91000 Register 0x11= 161
LMP91000 Register 0x12= 3
Average_Total= 1
Barcode= 060718011516 110406 O3 1807 -48.77
Serial_Number= 060718011516
Part_Number= 110406
Gas= O3
Date_Code= 1807
Sensitivity_Code= -48.77
AQE>: Z
Setting zero...done
AQE>: !
Exiting DGS Transparent Mode.
AQE>: |
```

- k. You can repeat that command sequence for the second DGS channel as appropriate by starting with a different dgsch command.

That's it! Your sensors should now be appropriately re-zeroed. You can unplug them from your computer and they should report measurements close to zero! You can repeat this process as often as desired for application.

Overview: Education, Curriculum and Training

We provide a variety of educational tools, training and curriculum aimed at middle and high schools, as well as teacher training. Access the curriculum on the homepage of the Egg Portal (<https://airqualityegg.com/portal/>). Please contact support@airqualityegg.com for details.

My Classes

You can manage your classes and assignments within the Egg Portal.

1. Select 'My Classes' from the menu dropdown.
2. Choose to create classes directly in the tool or integrate with Google Classroom
3. Assignments
 - a. Leverage labs or create new assignments
 - b. Students will need to create an Egg Portal account to access assignments

*Note you will only have access to these resources if you purchased an organization subscription

Overview: Air Pollutants

The Clean Air Act requires the EPA to set National Ambient Air Quality Standards (NAAQS) for six common air pollutants (also known as "criteria air pollutants"). These pollutants are found all over the U.S. and can harm your health and the environment, and cause property damage. The criteria pollutants include: Carbon Monoxide, Nitrogen Dioxide, Ozone, Particulate pollution, Sulfur Dioxide, and Lead. While there are only 6 criteria pollutants, there are additional elements that contribute to air pollution.

For more information about the EPA's National Ambient Air Quality Standards, visit <https://www.epa.gov/criteria-air-pollutants/naaqs-table>

What is particulate pollution?

The air contains small particles, less than 10 μm in size, which can be harmful to human health. These are regulated by the US Environmental Protection Agency (EPA). **The best source for particle pollution information is the EPA website, www.epa.gov.**

The Egg can detect particles from 0.5 μm to 10 μm (particles larger than 10 μm are not regulated by the EPA) and provides an aggregate measure of both PM10 and PM2.5, reported in micrograms per cubic meter.

Evidence indicates a clear relationship between exposure to particulate matter and effects on health, particularly smaller particles that can reach the deep regions of the lungs.

PM10 and PM2.5 are defined in ISO 7708:1995 as:

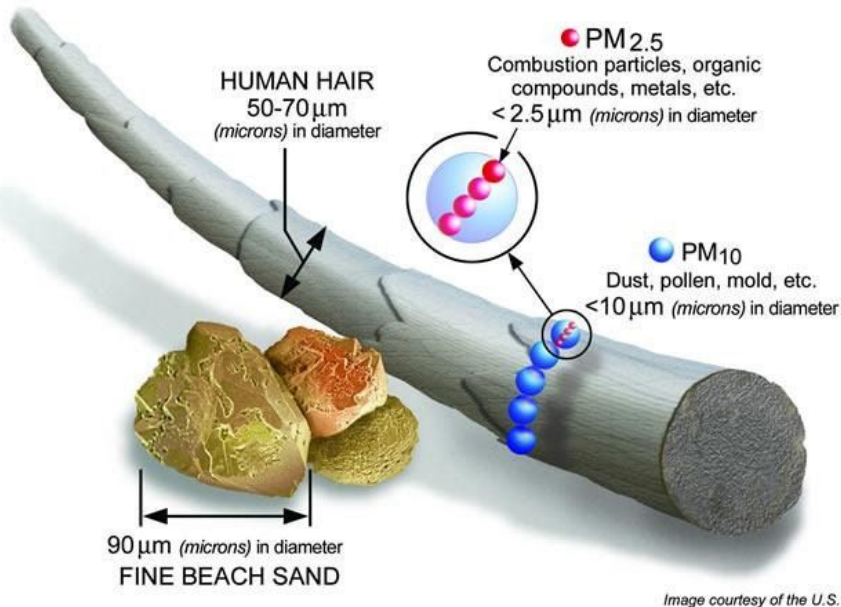
PM10 – particles which pass through a size-selective inlet with a 50% efficiency cut-off at 10 μm aerodynamic diameter.

PM2.5 – particles which pass through a size-selective inlet with a 50% efficiency cut-off at 2.5 μm aerodynamic diameter.

This means for PM10 the median diameter is 10 μm . Half the particles are larger, and half are smaller. Similarly, for PM2.5, the median diameter is 2.5 μm .

PM2.5 is also called the "High risk respirable condition," because smaller particles can get lodged deep into your lungs, causing a variety of adverse effects.

Figure 1: Particle Size Comparison:



Additional Air Pollution Resources

- Carbon Monoxide Pollution: https://19january2017snapshot.epa.gov/co-pollution_.html
- Carbon Dioxide: <https://toxtown.nlm.nih.gov/chemicals-and-contaminants/carbon-dioxide>
- Hydrogen Sulfide: <https://www.atsdr.cdc.gov/phs/phs.asp?id=387&tid=67>
- Nitrogen Dioxide Pollution: https://19january2017snapshot.epa.gov/no2-pollution_.html
- Ozone Pollution: https://19january2017snapshot.epa.gov/ozone-pollution_.html
- Sulfur Dioxide Pollution: https://19january2017snapshot.epa.gov/so2-pollution_.html
- Volatile Organic Compounds: <https://www.epa.gov/indoor-air-quality-iaq/volatile-organic-compounds-impact-indoor-air-quality>

About the Egg

Visit our website, www.airqualityegg.com, to learn more.

FCC Statement

The Texas Instruments CC3000 Wi-Fi module complies with Part 15c of the FCC rules. Operation is subject to the following conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

WARNING: Changes or modifications not expressly approved by the party responsible for compliance will void the user's authority to operate the equipment.

THE UNIT IS DISTRIBUTED IN THE HOPE THAT IT WILL BE USEFUL, BUT WITHOUT ANY WARRANTY. IT IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE UNIT IS WITH YOU.

NOTE: THE EGG IS NOT A SAFETY-OF-LIFE DEVICE. THE EGG IS NOT A MEDICAL DEVICE. DO NOT USE IT AS A SUBSTITUTE FOR CORRECT WARNING AND MONITORING SYSTEMS.

Specifications

TYPE	SYMBOL	VALUE
Width x Height x Thickness-indoor	Millimeters	140x140x85
Width x Height x Thickness-outdoor	Millimeters	50x147x147
Weight (indoor)	oz	7.2
Weight (indoor)	grams (approx.)	250
Weight (outdoor)	oz	26
Weight (outdoor)	grams (approx.)	740
Unit operating range	degrees Celsius	0 to 40
USB power supply operating range	degrees Celsius	0 to 40
Temperature accuracy	degrees Celsius	0.2 ¹
Humidity accuracy	% relative hum.	1.8 ²
Humidity range	% relative hum.	0 – 99
Minimum detectable particle size	micrometers	0.3
Maximum detectable particle size	micrometers	10
Particle detection range	particles	0 – >1000
Typical max sensor response time	seconds	30
Data transfer frequency	seconds	5
Transmission Range	meters	70 ³
Sensor life expectancy	years	3

Sensor Accuracy

1. Temperature accuracy below 0°C no worse than 0.5°C
2. Relative humidity accuracy below 10% and above 90% no worse than 4% RH
 - a. If relative humidity (RH) varies by more than 20% in 15 seconds, or is <15% RH for 30 days or more, unit may require factory recalibration. Contact support@airqualityegg.com for more information.
3. Transmission range under ideal conditions. Reduced by walls and objects.
4. Temp and humidity sensor datasheet: <https://cdn.sos.sk/productdata/bf/f4/e1c6ad4c/sht-25.pdf>
5. If unit is exposed to excessive smoke, for example holding a cigarette at the air intake to 'test' it, unit will require cleaning and recalibration.
6. Particulate sensor: Dual Plantower PMS5003 sensors. See datasheet: https://www.aqmd.gov/docs/default-source/aq-spec/resources-page/plantower-pms5003-manual_v2-3.pdf.

Precautions

- Do not subject the unit to excessive force, shock, dust, temperature or humidity. Doing so may cause permanent damage.
- Do not attempt to 'test' the unit by exposing it to excessive smoke, eg: by placing a cigarette at the air intake. This will over expose the sensor and compromise accuracy, requiring recalibration.
- To clean, disconnect power and dust with a slightly damp cloth. Do not use solvents.
- Do not cover the ventilation holes of the fan. This will give inaccurate results. Covering the fan could result in an electrical short, shock and fire.
- Do not tamper with the unit's internal components, it is dangerous to do so and could impact the function of the unit.
- Keep out of reach of children.
- Only use the 5v power supply that was provided with the unit.
- This unit is intended for indoor operation, or outdoor operation in a protected location. Do not expose to precipitation, direct sunlight or heat.
- Images shown in this manual may differ from the actual product.
- This product contains leaded PCBs and components.
- When disposing of this product, please do so responsibly.

NOTE: The technical specifications of this product and the contents of this user manual are subject to change without notice.

All readings are temperature dependent. That means placing the unit in direct sunlight, above a heater or radiator or otherwise exposed to unusual heat or cold will result in inaccurate readings and may permanently damage it.

Troubleshooting

Issue	Solution
Computer does not show a USB / serial port when plugging the Egg in.	This should be automatic, but is not on all machines. Install the FTDI drivers from here: http://www.ftdichip.com/Drivers/VCP.htm
Egg displays "Config integrity check failed".	1. Your device has tried to connect with the information you provided, and is unable to do so. It will keep trying, and if the information is correct, it will connect. 2. If you still can't connect, you may need to explicitly set the security mode. Contact support@airqualityegg.com for assistance.
Does not display gas concentrations.	There is a warm up period as the Egg collects enough data to start displaying results. If it still does not display results after 20 minutes, post to the Educator Chat Room or email support@airqualityegg.com for help.
Cannot connect to Wi-Fi, even though Wi-Fi credentials are added.	1. Check Wi-Fi credentials are correct. 2. Move Egg closer to Wi-Fi router. RSSI should be at least 80 during setup. 3. If you still cannot connect, make sure that your wireless security policy allows connections. If not, consult with your IT department to add the Egg's MAC address to the allowed devices list.
LCD screen is dark.	The Egg contains a touch sensor switch. Cover the left hand side of the egg with your hand for several seconds to turn on the LCD panel.

Buy an Egg: www.airqualityegg.com/shop

Revision History:

April 20, 2015	Initial version
May 5, 2015	Specs
May 12, 2015	Claiming
May 20, 2015	Setup
June 22, 2015	Troubleshooting
June 25, 2015	Fix PPM/PPB typo
July 14, 2015	Troubleshooting
September 10, 2015	O3, SO2 changes
September 15, 2015	Particulate pollution
February 5, 2016	Opensensors, download
Jun 16, 2017	Major revision
July 30, 2018	Major revision
October 24, 2019	Major revision
August 25, 2020	New internal sensors

