
# Standard operating procedure

## Gas algorithm V5.0

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# Contents

# Introduction and scope

## 1.1 Introduction

AQMesh has been designed to offer a robust and easy-to-use air quality monitoring platform, including data processing algorithms that can deliver near real-time air quality readings in all environmental conditions anywhere, at any time.

Readings cannot be downloaded directly from the pod itself. The raw signals from the AQMesh sensors are transmitted to the secure AQMesh server for data processing, which includes carefully developed compensation for cross-gas effects and environmental factors.

This document aims to provide the necessary information for the user to achieve the best possible results with AQMesh.

# Principle of the method

## 2.1 Electrochemical sensors

AQMesh uses electrochemical sensors designed for measuring a range of gases at ppb levels.

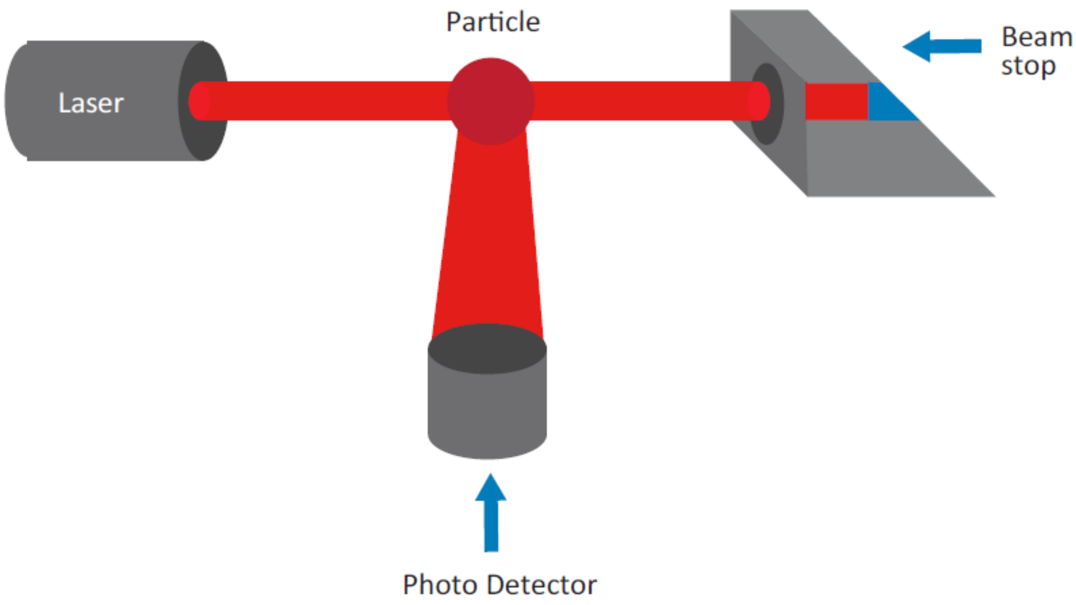
Electrochemical sensors work by reacting to the target gas, generating an electrical output which varies with the amount of target gas present.

The innovative difference in the new sensors used in AQMesh is their fourth electrode. This is embedded in the sensor electrolyte, allowing the reaction from environmental effects to be measured without the effects from the target gas. This means AQMesh is able to mitigate the effects of environmental factors such as temperature and humidity.


AQMesh, using these two outputs from the sensor, applies an algorithm to produce an accurate ppb value for the target gas. The algorithm for V5.0 uses sensor-specific characteristics, derived through a QA/QC process at factory, to improve the compensation of environmental and cross-gas effects.

## 2.2 Optical particle counter

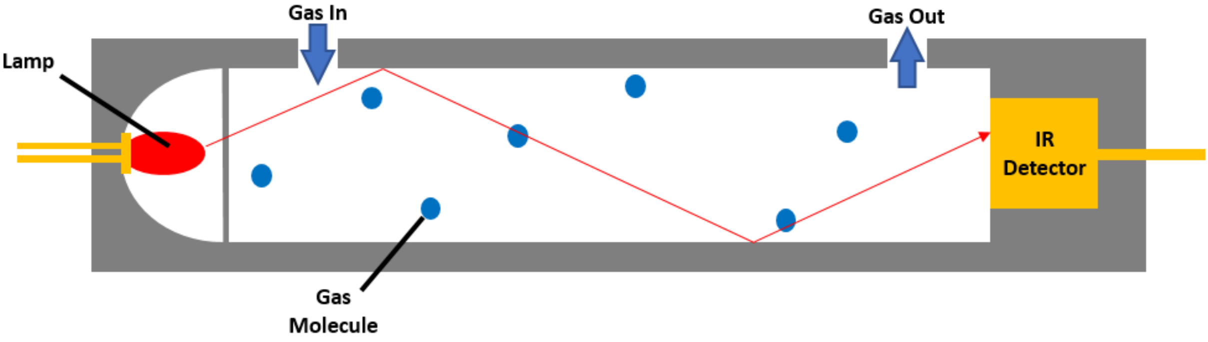
The AQMesh optical particle counter works by drawing a sample of air through the system via a pump. The gas sample, containing particulate matter, falls through the path of an internally mounted and optically focused laser. The path of this laser is deflected as an individual particle is hit by the laser. This deflection is detected by an optical sensor which counts the number of deflections as particles.




At the same time the particle diameter is determined allowing the counts to be sorted into size defined bins. Using these size-specific bins, along with assumptions that all particles measured are spherical and have a standardised density, allow the accurate estimation of particle mass. This can then be broken down into PM1, PM2.5, PM10 and PM_Total fractions.

**2.3 NDIR sensors**

Non-dispersive infrared (NDIR) sensors can be used to measure a range of gases. By passing the emissions from an infrared light source, for which the wavelength has been tuned to a specific gas, through a sample of gas, an optical infrared sensor can then be used to determine the amount of the target gas present within the sample in ppm or percentage levels.



**2.4 Noise sensors**

Through use of a high-quality omnidirectional microphone, sampling at the same P1 interval as electrochemical and environmental sensors, AQMesh provides both average and peak noise over the user selected P2 interval through analysis of the samples taken in decibels (dB).

Due to the frequency range of the noise sensor used in AQMesh, it is not Class 1 or Class 2, but does provide a similar level of accuracy as Class 1 noise sensors within its limited frequency range. The frequency range has been targeted to identify potential pollution sources, for example, providing an indication of traffic volume close to the pod.

**2.5 Wind speed and direction sensor**

AQMesh also offers a wind speed and direction sensor, allowing a more understood meteorological view of how air pollution is generated as well as the information required for source apportionment, i.e. identifying where higher levels of pollution are coming from such as busy traffic junctions or industrial sites.

The wind speed and direction sensor works using a group of ultrasonic transducers. Working in two axis, the time taken for the ultrasound to travel to the opposite transducer is measured, with the sound travelling faster if in the direction of the wind or slower if travelling against the wind direction. Using the two axis a direction can be determined and the four results used to ascertain the speed of the wind in that direction.

# Interferences

### 3.1 Electrochemical sensors

Electrochemical sensors are susceptible to interference from multiple conditions found in the ambient environment, including temperature, humidity and cross-gas effects. The AQMesh algorithms are developed for individual sensor types. And are specifically designed to compensate for these environmental variables to provide the best possible precision and accuracy of measurement.

AQMesh algorithms are continually being improved to provide greater accuracy under increased ranges of environmental conditions.

### 3.2 Optical particle counter

The use of the heated Inlet option removes the effect of varying particle size due to deliquescence by maintaining the relative humidity of the sample being measured below the point of deliquescence, ~50%. Thus, providing a more consistent correlation with equivalence instruments which also dry or condition their sample.

AQMesh also provides an option of the particle counter with no heater to dry the air sample taken, all particles including water droplets will therefore be counted and sized from within the air sample at the ambient temperature and humidity.

As such, variation in particle type, i.e. hygroscopic or hygrophobic particles, or density variation, can also affect consistency of results in comparison to equivalence methods. The v3.0 PM processing does include an optional filter to remove samples which have a high potential for affects due to the effects of high humidity on hygroscopic particles, however this is not suitable for all applications.

### 3.3 NDIR sensors (CO2 sensor only)

NDIR sensors require an uninterrupted signal from the infrared light source. On very rare occasions, small amounts of condensation may form on the sensor and interfere with the signal, which may cause an anomalous reading.

# Precision and accuracy

## 4.1 Stabilisation and rebasing

Stabilisation is a period whereby a sensor provides “bad” data due to not being in a state of equilibrium. Once the sensor settles in its environment after being recently moved in a manner which may shock or destabilise the sensor or after its being first installed, it will provide usable data. This process takes 2 days to complete for electrochemical sensors, 12 hours for NDIR and is not required for the OPC.

The rebasing process standardises sensor output following the stabilisation of a sensor and is a vital stage before the start of a new project if there is any possibility that sensors have been destabilised. Sensors automatically rebase when first shipped by the manufacturer but after that, including if the pod is first switched on at a location other than the monitoring site, such as in an office, the process must be triggered manually. This will give the best possible pod-to-pod comparability and ‘out-of-the-box’ accuracy.

Please note:

1 Sensors must stabilise in the monitoring environment for two days before rebasing starts; rebasing will not be effective if carried out on a destabilised sensor

2 Re-basing must be carried out in the monitoring environment and not be interrupted by moving the pod during the process

## 4.2 Measurement procedure

The sampling interval for all measurement types is broken down into 3 levels. For environmental parameters and gas sensors this is split into: -

| | |
|---|---|
| P1 – Reading frequency | Frequency of sample taken, e.g. 10 seconds |
| P2 – Averaging frequency | Time period samples are averaged out to, e.g. 15 minutes |
| P3 – Transmission frequency | Frequency of raw signals being sent to the AQMesh server |

This process is similar for the particle counter, however slightly different: -

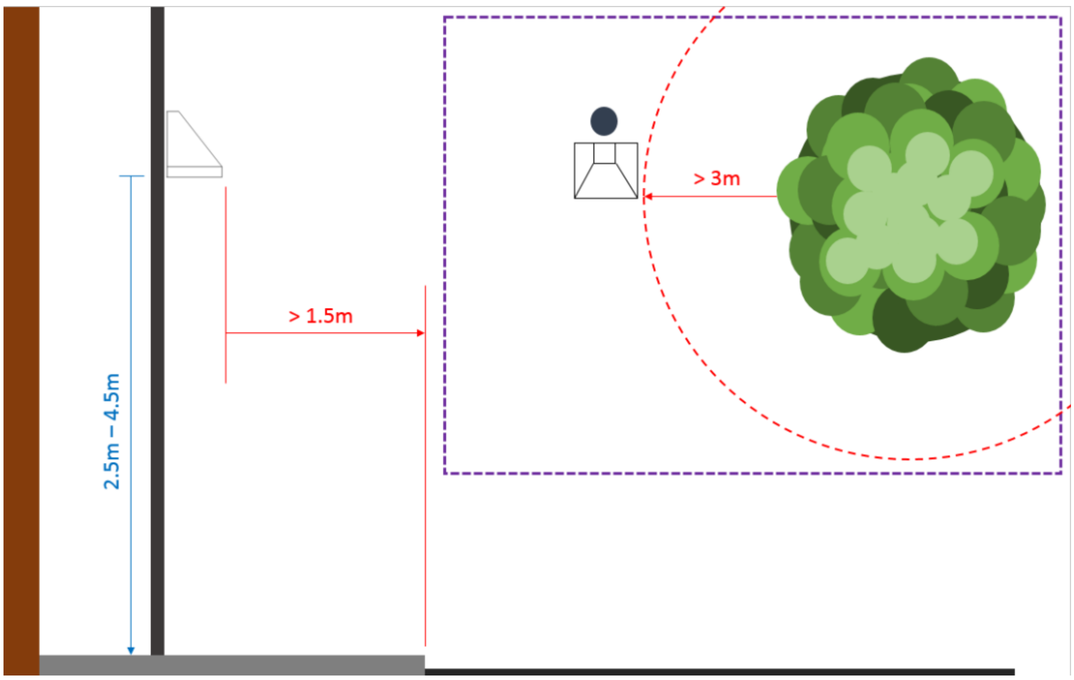
| | |
|---|---|
| T1 – Sample duration | Pump run time for the sample, e.g. ≤60s. sampling at 1-minute intervals |
| T2 – Averaging frequency | Time period samples are averaged out to, e.g. 15 minutes |
| T3 – Transmission frequency | Frequency of raw signals being sent to the AQMesh server |

**4.3 Optimal positioning**

While AQMesh is very versatile and can be positioned almost anywhere, it is still important to realise that some locations are unsuitable. These can be for a number of reasons, such as: -

- Vicinity to oxidising surfaces – causing a change in the measured pollutants at the specific location in comparison to ambient
- Incorrect direction/vicinity to reflective surfaces – the AQMesh sunshield is designed to protect the instrument and its sensors, from increases in temperature. However, the back and base of the pod are not protected, so direct sunlight and reflected/radiated heat onto these surfaces can cause erroneous results.

As such, we suggest the following parameters with regards to pod positioning when installing a pod. These are not hard and fast, but should provide a good degree of “margin for error” without data being affected.



### 4.4 Summary of scaling and validation options

| VALIDATION LEVEL | DESCRIPTION | Suitable for single pod deployment | Suitable for multiple pod networks |
|---|---|---|---|
| Basic | Correct Stabilisation and Rebasing completed | ✓ | ✓ |
| Tier 1 | Analysis of each sensor's variation to the group average over the network. Is the variation as expected? Or anomalous? Can any variation be explained by local changes in the pollution source? | ✗ | ✓ |
| Tier 2 | Gold pod Scaling. Co-location of one or more AQMesh pods with reference to scale and validate each sensor, before being moved alongside other pods in the network as a transfer standard or used to monitor a chosen point away from the reference station. | ✓ | ✓ |
| Tier 3 | Frequent validation of individual pods through comparison to reference or gold pod at a set interval, with analysis looking at variation over time for the network. | ✓ | ✓ |

The above are just examples of some of the measures which can be used to help validate AQMesh results when in the field, both individually or as part of a larger network. The specifics on how best to achieve an acceptable level of validation and the means to achieve it, will vary for each project, based on expectations.

### 4.5 With access to reference or diffusion tubes

When users have access to reference instrumentation it is possible to correct AQMesh slope and offset values to improve the accuracy of results moving forward by completing a co-location study and comparison of data over a period of days or weeks. If multiple locations with reference equipment are available, we advise that the site with the highest pollution levels is used. However, if no reference is available, diffusion tubes (indicative, interpolated standard of measurement for some pollutants can be used as per the method listed at the end of this document) can be used instead.

Once a pod has been successfully scaled against multi-point reference, equivalence or indicative measurements it can be used as a transfer standard or "Gold Pod" to scale other AQMesh pods in the local network, thus allowing only 1 pod being required to be moved for QAQC rather than the full network.

### 4.6 No access to reference/diffusion tubes – single pod

Without scaling locally, the AQMesh V5.0 algorithm provides a degree of accuracy using factory slope and offset values. Average variance without local calibration is typically as listed in the table below.

| Sensor Type | Typical accuracy versus reference/equivalence of uncalibrated results at hourly sample intervals | |
|---|---|---|
| NO | +/- 5ppb | |
| $NO_2$ | +/- 10ppb | |
| $NO_x$ | +/- 10ppb | |
| $O_3$ | +/- 10ppb | |
| CO | +/- 0.05ppm | |
| $SO_2$ | +/- 5ppb | |
| $CO_2$ | +/- 30ppm | |
| PM 10 | +/- 30ug/$m^3$ | +/- 5 ug/$m^3$ * |
| PM 2.5 | +/- 20ug/$m^3$ | +/- 5 ug/$m^3$ * |
| PM 1 | +/- 15ug/$m^3$ | +/- 5 ug/$m^3$ * |
| Average Noise | +/- 1dB | |
| Peak Noise | +/- 3dB | |

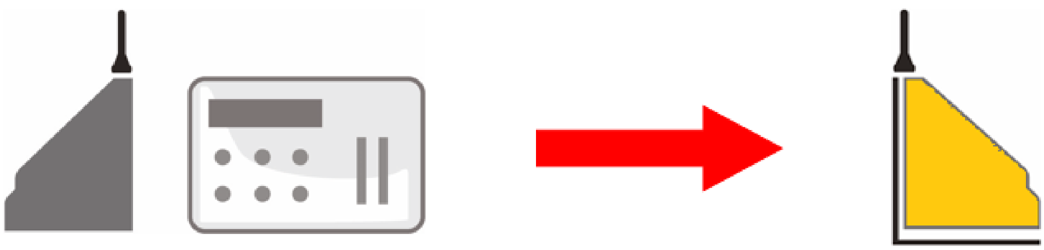
* When using heated inlet and v3.0 PM processing.

### 4.7 No access to reference/diffusion tubes – multiple pods

If the user does not have access to reference and has multiple pods they can be used comparatively. By scaling one or more pods against a single pod so that all pods provide the exact same output using the same methodology as when comparing versus reference, they can then be deployed around an area to show pollution “hot spots” with the same validity as when moving the same pod however concurrently. Allowing users to mitigate for pollution levels by through comparison of the different areas being measured, e.g. one pod could be in a park and show low pollution levels, while a roadside pod shows comparatively high results. While these values may not be proven to be 100% accurate, they do show when air quality is poor, when it is good and can indicate when mitigation from the user improves air quality within the area being measured.

**4.8 QA/QC of an AQMesh network**

An important factor in the QA/QC of AQMesh is the traceability back to a known (preferably reference) standard and having confidence in consistency throughout the network. This can be done with correct co-location (described later in this document) and calibration/scaling (again described in detail later in this document). By calibrating AQMesh pod(s) against this using this method it is possible to determine both the uncertainty of measurement between AQMesh and the reference standard and, based on the uncertainty of the reference used, the uncertainty of AQMesh measurements when moved away from the reference instrument.
We refer to this process as creating a “Gold standard” pod, the scaled results from which can then be used as a transfer standard.

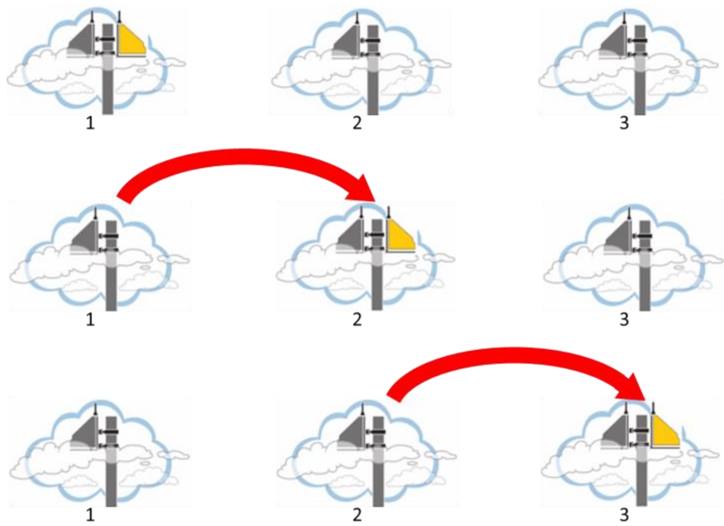


Once a network of AQMesh pods has been positioned in the areas of interest for your project, the Gold standard pod(s) can be moved around the network to scale or validate the results from each pod within the network in turn, this typically takes 7-10 days of co-location at each position, returning to the reference as frequently as required by the user’s QA/QC and confidence levels.

Period 1: Gold pod co-located with pod at position 1 for QA/QC and scaling.

Period 2: Gold pod moved to be co-located with pod at position 2 for QA/QC and scaling.

Period 3: Gold pod moved again to be co-located with pod at position 3.




This same process can be used to locally scale any replacement sensors without the need to move pods from their measurement location. This allows continuous measurement from sensors which have not failed until maintenance of the affected pod has been completed.

**4.9 Pre-ratification process**

The ultimate goal of AQMesh is to provide precise and accurate data so that users have confidence in their results. To do this the AQMesh team have provided coded diagnostics for users so that they understand which data points are good and to be trusted, but also the reasoning behind why some data points should be ignored so that both experienced and less experienced users of AQMesh can use the data gathered by AQMesh in the simplest of ways, without requiring detailed analysis and high level quality assurance of each data point gathered.

While the Pre-Ratification process is efficient at removing obvious outliers, and identifying the cause of those outliers, it is still advised that “good” data provided by AQMesh which is used is calibrated locally to provide quality assurance.

The following table explains the codes used and under what circumstances the post-algorithm value may be returned to the downloadable dataset.

### 4.9.1 Gas sensor pre-ratification codes

| Code | Label | Description | Effect on Data |
|---|---|---|---|
| -999 | Stabilisation | Period of 2 days from installation of a new sensor which needs to settle in its new environment | Data classified as stabilising will remain as non-viewable |
| -998 | Rebasing | Typically, this is a 2-day period where local variables are calculated for use in the AQMesh algorithm are found | During the flagged period the coded flag will remain, however upon completion of this process, valid data will write over the code |
| -996 | Sensor Failure | In the event of a sensor failure, all post-failure results will be removed from view as the data is classed as erroneous | Data from a failed sensor will remain as non-viewable |
| -995 | Cross Gas Error | If a sensor fails which is relied upon for the removal of interferences on another sensor, data from the reliant sensor becomes invalid | Data will remain as non-viewable until compensating sensor is replaced and producing good results, data gathered while compensating sensor was failed will remain as non-viewable |
| -994 | No Data | If a sensor has been removed or data cannot be processed by the server due to a fault the “No Data” flag will alert the user to that further investigation can take place | If sensor is working, then data will be processed as soon as any fault has been fixed. Causing no data loss |
| -993 | Destabilisation | Rapid changes in environment can cause the sensors to provide erroneous data until they settle into their new environment, this can take either 1 or 6 hours depending on the severity of the rapid change in temperature or humidity | Data classified as destabilising will remain as non-viewable |
| -992 | Extreme Environment | Following intensive testing of all electrochemical sensors we have determined the combination of extremes in climate in which the electrochemical sensors do not provide consistent outputs. As such precise and accurate measurement is not possible | Data classified as within the extreme ranges of environment will remain as non-viewable |
| -991 | Condensation | NDIR sensor affected by condensation on the detector | Data classified as being affected by condensation will remain as non-viewable |

### 4.9.2 Particle counter pre-ratification codes

| Code | Label | Description | Long term effects |
|---|---|---|---|
| | Deliquescence | When not using the heated inlet option, outlying data points caused by hydroscopic particle size growth will be removed following analysis of the particle count distribution | Data classified as being affected by will only be viewable by request on the server. i.e. this "flag" can be turned on or off by the user depending on their needs |
| -892 | Other fault zero | There is a chance that the particle counter is unable to provide a particle reading following a power-cycle and/or a change in the pod settings. | Occasional loss of data. |
| -893 | Misread | Particle counter misread | N/A |

# Additional features

## 5.1 Fast transmission

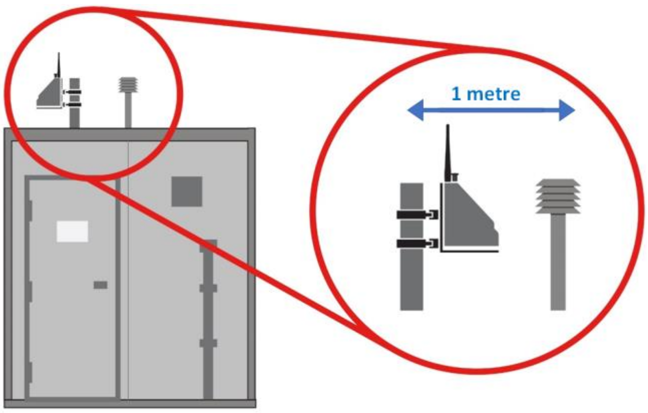
Transmission of data from pods to the server via the 3G/GPRS modem was previously limited to 30 or 60 minute intervals. Now, using the MK4 hardware and v3.2 firmware and onwards 1 minute interval data can be transmitted as frequently as every 5 minutes. Earlier versions of hardware will still be limited to transmitting data every 30 or 60 minutes.

# Co-location requirements

## 6.1 Set up an effective comparison trial

To set up an effective trial to compare AQMesh performance and complete the scaling exercise against a reference station or gold standard pod, the following conditions must be adhered to in order to complete a valid comparison of AQMesh and reference/equivalence instruments. Not complying with these conditions will likely cause poor correlation which may lead to poor scaling of results:

- A reliable reference station (maintained and ideally certified) should be chosen as the trial location, in an environment where there is some pollution, e.g.: ideally at least several weekly peaks above 10ppb for gas parameters and 10 $\mu g/m^3$ for particle fractions.
- All pods being co-located for scaling or validation should be placed next to the reference station inlet (or gold pod), ideally immediately adjacent or no further than 1m apart.
- Pods should be mounted away from any reflective or known oxidising surfaces or air conditioning exhausts which cause the pod's local environment to be different from ambient, i.e. 0.5m or greater from the floor.
- Pod should be placed in a position with free movement of air, i.e. not affected by turbulence from local barriers.




**IF NOT CARRIED OUT AS SPECIFIED, COMPARISONS ARE LIKELY TO BE INVALID.**

# Pod relocation

When relocating a pod to a new location, to limit failures of electrochemical sensors, it is advised that they remain in ambient conditions. Exposure to rapid changes in temperature following exposure to high RH can commonly cause sensor failures.

If pods are required to move from an outdoor to indoor location, pods should be transitioned slowly between environments. For example, if moving from a hot climate to a cool indoor area it is advised that the pod be moved at the coolest point of the day, when the temperature change is preferably not more than 10 Celsius cooler than ambient. This advice is reversed for areas with cold climate, where pods are moving to warm indoor conditions, by moving the pod at the hottest point of the day, and to an area which is no greater than 10 Celsius hotter than ambient, sensor failure rates can be limited.

### 7.1 Manual stabilisation and rebasing

If moving a pod to a new location the conditions which the pod is moving to, how it was moved and whether you are wanting to use previous scaling of the sensors in it are very important. For example, if you have scaled a pod at site A and want to move it to site B which is 20 miles away, if it is transported in a manner which will **not** shock the sensors the scaling of that pod should still be accurate. However, if the pod is moved between an air-conditioned space and outdoors in the process, causing thermal shock, the scaling will be invalidated and likely require the stabilisation and rebasing periods to be restarted. This will require the user to manually restart this process via the user interface and begin the scaling process again.

Manual stabilisation and rebasing may also be required following first receipt of the pod from factory or distributor. Whether this is required can be confirmed by looking downloading data over the first two days of installation to confirm that automatic stabilisation has occurred.

# Maintenance

## 8.1 Electrochemical sensors

Should an electrochemical sensor fail, the user will be alerted to the failure via the AQMesh server or via email. Should the failure occur within the warranty period of the sensor a free of charge replacement will be issued. The user must then replace the sensor as per the operating manual supplied with the pod both physically in the AQMesh pod, and on the AQMesh server.

## 8.2 Optical particle counter

Regular maintenance and cleaning of the particle counter is advised, with frequency dependent on the environment in which the pod is located. Specific instructions on completing this process are available via the manufacturer or local distributor. Lasers and pumps should typically be changed annually for best practice; however, this is dependent on the measurement strategy chosen, with particle counters working well beyond 2 years with no interruption dependent upon the measurement strategy.

## Calibration & improving accuracy

It is advised that AQMesh sensors are locally calibrated (scaled) as frequently as the reference or equivalence instrument being used for the process. Reference instruments are typically calibrated on at least a 6-monthly basis however this varies between instrument manufacturers, regions, etc.

### 9.1 Scaling

Scaling is a common tool for air quality instrumentation. It is used across most instruments designed for ambient air quality measurement, including reference equipment, and provides an increased level of accuracy based on the local environmental conditions and how the sensors used react to that environment during stabilisation and rebasing.

For AQMesh to provide the greatest degree of accuracy it is advised to co-locate the pod with a local serviced and calibrated reference station. This will provide the information necessary for calculating scaling variables; offset and slope for all sensors where comparison is available.

AQMesh pods which are not locally scaled will still be able to provide dependable and repeatable performance, as scaling does not affect correlation ($R^2$) values. However, without reference the accuracy of results will have a greater level of uncertainty.

Scaling values are calculated over a specific time period and as such are based on the environmental conditions on site over this period. By applying these values for offset and slope we are able to determine the best possible performance for this pod over the same period and improve the accuracy of the pod moving forward.

For optimum results from AQMesh, the scaling of sensors is recommended every 6 months, or in line with service and calibration of the reference instrument being used to validate the AQMesh results, but also in the following circumstances, i.e.

- Following a sensor change, the new sensor will need scaling to its new environment

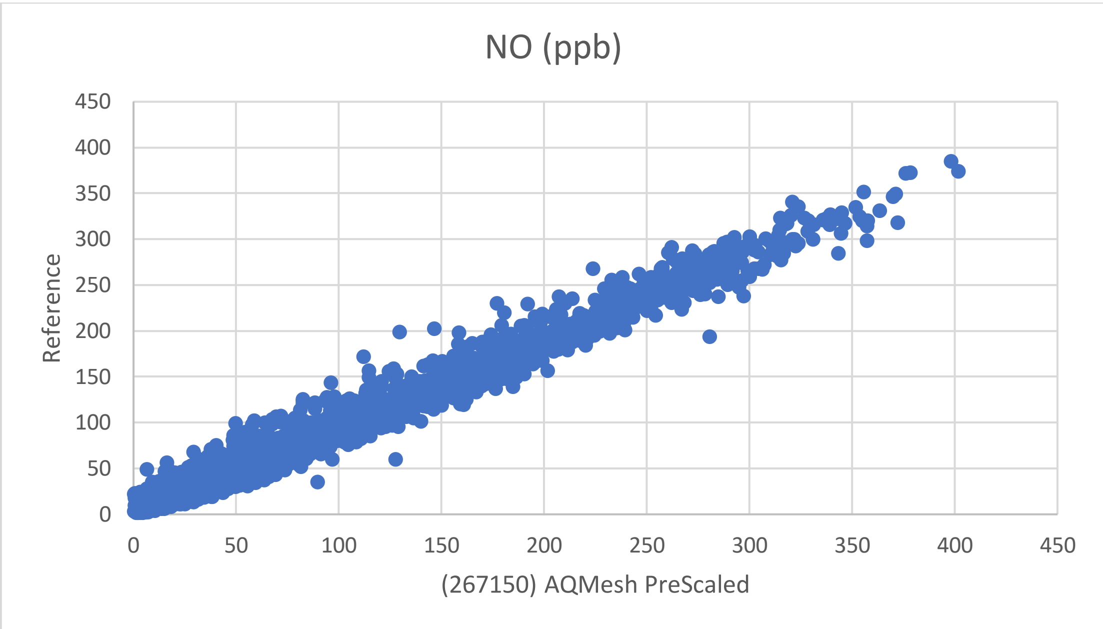
- Following a large step change in environmental conditions at the site, e.g. a change in average temperature of 10 degrees Celsius or more, compared to when it was scaled.

To complete the following scaling methodology, the user must first download "PreScaled" values for each sensor, these are available via the user interface or API.

### 9.2 Scaling process for calibration & verification

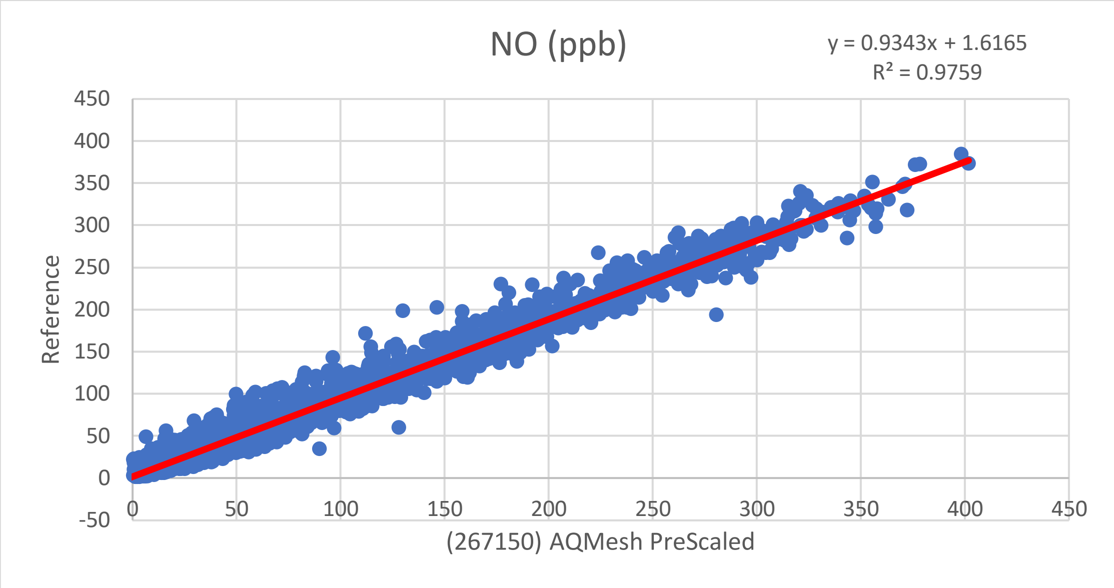
- **STEP 1**

Regression comparison of AQMesh PreScaled data versus reference or Gold Pod Scaled data, using the candidate pod on the x axis and the reference on the y axis. Switching axis from the standard method is done as it simplifies the calculation of slope and offset results significantly later in this process. Regression analysis can be completed using Microsoft Excel, Mathcad or similar mathematical programs.




- **STEP 2**

Removal of potential erroneous data points, such as -99# codes and other obvious outlying data points, and find the linear trend line with associated Cartesian equation.




- **STEP 3**

Apply Offset and slope to full PreScaled data set (including erroneous data points)

**Reference ≈ (PreScaled data *x* Gradient) + Y-Intercept**
**Gradient = Slope**
**Y-Intercept = Offset**
**AQMesh Scaled data = (PreScaled data *x* Slope) + Offset**

For the example shown in step 2: -

**Y = (0.9343. X) + 1.6165**
**Slope = 0.9343**
**Offset = 1.6165**

- **STEP 4**

Upload slope and offset values to the online application for each gas sensor and particle fraction.

- **STEP 5**

Validate pod accuracy by following the scaling process by either a second co-location with reference or co-location with Gold pod at the target location, at an interval determined by the users own QAQC process.
For long projects, it is advised that data is validated every six months to account for any changes in calibration at the reference station.
For shorter projects, good practice for validation of data would be to run a scaling exercise both pre and post the trial period, providing full confidence in the data received from the trial.

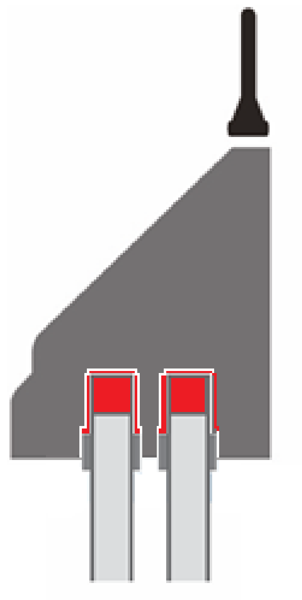
### 9.3 Method adjustment for use with diffusion tubes

As not all users have access to reference equipment to perform standard scaling of pods, but still require the improved accuracy and validation of results which scaling provides, comparison versus diffusion tubes can provide a good alternative.

**Set up**

1. Set pod to sample (P2 setting) at the desired minimum required interval, e.g. 1 minute intervals.

2. Position pod in desired location for monitoring following criteria set out in section 6. “Co-location requirements” of the AQMesh S.O.P



- **Method**

1. Once equipment positioned correctly, turn on the AQMesh pod.

2. Following completion of the AQMesh 2 days Stabilisation period, open diffusion tubes in line with manufacturer’s specification – It is typically advised to open 2 tubes for each measurement point in case of failure/contamination and leave 1 closed.

3. Log the date and precise time that diffusion tubes were opened, along with the tube serial number.

4. Once the period required for a suitably accurate sample has finished (typically 1 month) close the diffusion tube lids

5. Log the date and precise time that diffusion tubes were closed, along with the tube serial number.

6. Repeat a minimum of 3 further times over different time periods, as each sample only creates one point of comparison and multiple sample points are required for accurate scaling.

NB: To reduce the time required for this process, comparison periods can overlap, i.e. Open sets of diffusion tubes on consecutive days, rather than on consecutive months.

7. Return all diffusion tubes for analysis

8. Continue to use AQMesh at the desired location to gather data

- **Analysis**

It is important to remember that the diffusion tubes provide the mean levels of the target gas over the period of deployment, therefore any comparison with real-time monitoring devices, such as AQMesh should be with results averaged over the same period.

Once results from diffusion tubes have been returned to you: -

1. Gather your diffusion tube results into a format where you can include the start and end dates

2. Download AQMesh data for the whole period of comparison

3. Find the mean AQMesh PreScaled result between each diffusion tube start and end date/time

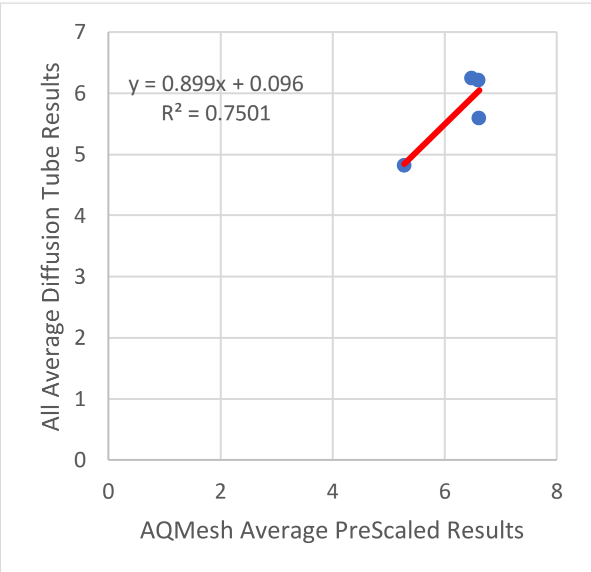
4. List these averaged pod results alongside the diffusion tube in chronological order

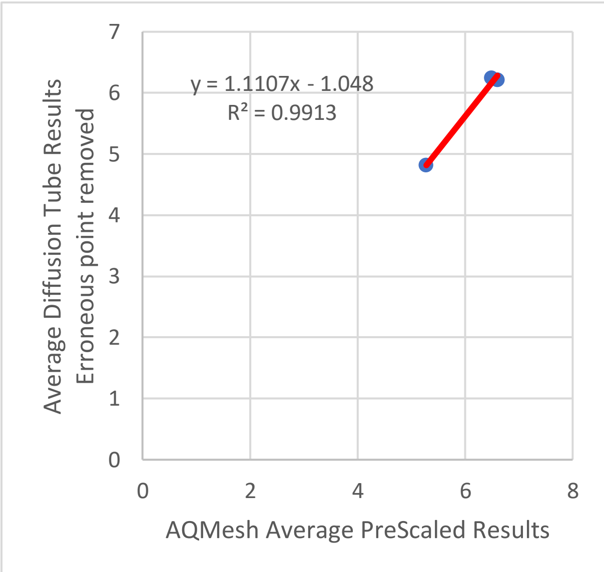
Regression comparison of AQMesh PreScaled data versus diffusion tube data, using the candidate pod on the x axis and the tube data on the y axis. Regression analysis can be completed using Microsoft Excel, MathCad or similar mathematical programs in the same manner as the standard methodology.

- **Example results**

| Sample Start Time | Sample End Time | Diffusion Tube 1 Result | Diffusion Tube 2 Result | Diffusion Tube Average | AQMesh PreScaled Average Over Same Period |
|---|---|---|---|---|---|
| **5th Sept 09:00** | **6th Oct 09:00** | **5.57*** | **5.61*** | **5.59*** | **6.62*** |
| **10th Sept 09:00** | **11th Oct 09:00** | **4.84** | **4.78** | **4.81** | **5.28** |
| **15th Sept 09:00** | **16th Oct 09:00** | **6.19** | **6.29** | **6.24** | **6.49** |
| **20th Sept 09:00** | **22nd Oct 09:00** | **6.29** | **6.13** | **6.21** | **6.60** |

***Erroneous data point removed from analysis**



# Document history and version control

| AQMesh Standard Operating Procedure | |
|---|---|
| **AQMesh Algorithm version** | **V5.0** |
| **Document issue number** | **3.0** |
| **Issue Date** | **TBA** |

**Prepared by:……….Tom Townend, Product Manager** **Signed:………**

**Authorised by:…….Steve Earp, Technical Director** **Signed:………………….**

| Version number | Changes made | Date Issued |
|---|---|---|
| **1.0** | **Original document** | **18/01/2016** |
| **2.0** | **Update for v4.2.3** | **19/12/2016** |
| **2.1** | **Addition of section 4.4** | **18/01/2017** |
| **3.0** | **Complete update for v5.0 algorithm** | **11/04/2019** |