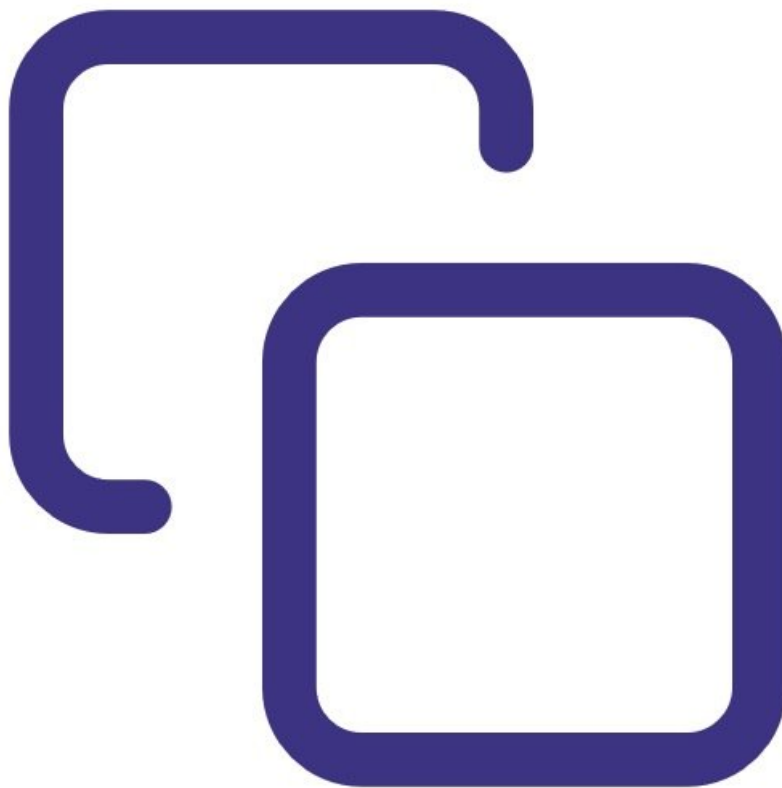




# Perform co-location calibration

Written By: Tanya Taylor



## INTRODUCTION

Field calibration of your particulate monitor is typically not required. However, it may be appropriate if you have very high data quality objectives, such as research studies that need to demonstrate traceability to another monitor.

A comparison with a reference instrument can also be undertaken when your Aeroqual monitor is first installed. This ensures readings from the Aeroqual monitor are adjusted for the local particle type, color and morphology.

The adjustment or correction taken after comparing the data from two monitors is commonly known as a 'K-factor'. The procedure for generating a K-factor involves co-locating the Aeroqual monitor next to a reference monitoring instrument.

Gravimetric instruments are considered the most accurate, but BAM or TEOM instruments deliver data faster and don't involve lab work.

## Step 1 — Enter service mode

The screenshot shows the 'Calibration and Service' interface for an AQY instrument. The left sidebar has 'Manual Entry' selected. The main area shows 'Manual service mode' with a 'Start' button. Below this are two tables: 'Calibration parameters' and 'Real time measurements'.

**Calibration parameters**

	NO2 ppb	Ox ppb	O3 ppb	O3 raw ppb	PM2.5 raw µg/m³	PM2.5 µg/m³	TEMP °C	RH %
Gain	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Offset	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.0
a	1.100		2.550					
b			1.870					

**Real time measurements**

Time	NO2 ppb	Ox ppb	O3 ppb	O3 raw ppb	PM2.5 raw µg/m³	PM2.5 µg/m³	TEMP °C	RH %
11:42 a.m.	2.9	29.6	24.2	23.7	1.7	1.1	15.74	86.1
11:41 a.m.	2.8	29.2	24.0	23.5	1.6	1.0	15.63	86.1
11:40 a.m.	3.1	29.7	24.2	23.8	1.9	1.2	15.60	86.1
11:39 a.m.	3.6	30.2	24.1	23.7	1.5	1.0	15.55	87.1
11:38 a.m.	4.7	30.4	23.4	23.0	1.3	0.8	15.48	87.1

- [Enter service mode](#) so any fluctuations in the data caused from this activity can be excluded from air quality reports.

## Step 2 — Co-locate monitors



- Install and commission your Aeroqual monitor alongside your reference instrument.
- Preferably position their inlets within 10m of each other and at the same height. At reference sites using a monitoring shed, the roof top of the shed is usually the best location.
- Operate both monitors together for 1-2 weeks (no shorter than 48 hrs).
- ① BAM / TEOM are continuous methods, meaning more data can be collected in a shorter period. Gravimetric instruments need to be run for a longer period as they operate on 24-hr averages (1 data point per 24 hrs).
- ① As a general rule, the longer you co-locate the monitors the better, as this gives you more data points and more confidence in your field calibration.

### Step 3 — Collect data

$$\text{Concentration} = \frac{\text{Filter weight at end} - \text{filter weight at start}}{\text{Total volume of air sampled}}$$

- Collect the data from both monitors.
- Using Microsoft Excel, remove any odd spikes, maintenance, errors and automated zero calibration data.
- If your reference instrument is gravimetric:
  - Send your filter/s to the lab for weighing.
  - When the lab results return, calculate your concentrations using the equation shown.
- ① You don't need to do this for BAM / TEOM instruments.

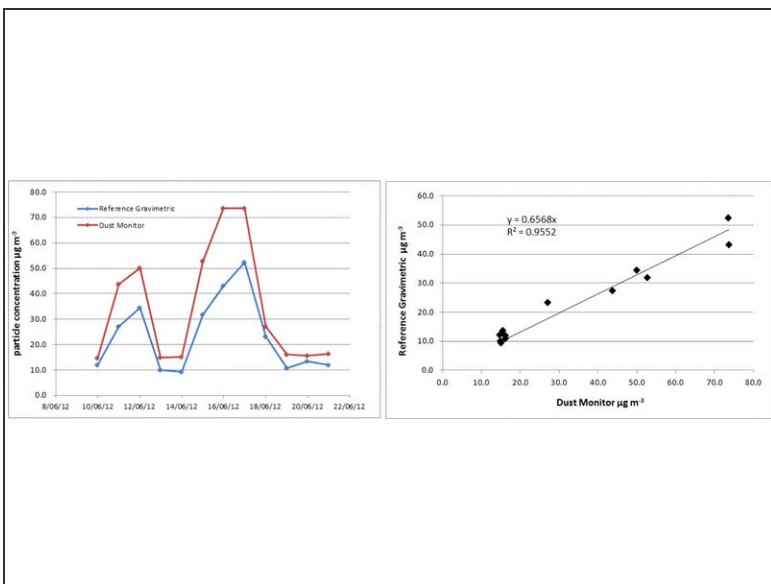
## Step 4 — Calculate average

$$\text{Average} = \frac{\text{Sum of readings}}{\text{Number of readings}}$$

10 June to 21 June Monitoring site 1		
Date	Reference Gravimetric, daily mass ug m-3	Aeroqual Monitor daily average ug m-3
10/06/12	12.0	14.8
11/06/12	27.2	43.9
12/06/12	34.5	50.1
13/06/12	10.0	14.9
14/06/12	9.3	15.1
15/06/12	31.7	52.8
16/06/12	43.1	73.7
17/06/12	52.3	73.6
18/06/12	23.2	27.2
19/06/12	10.7	16.2
20/06/12	13.5	15.6
21/06/12	11.9	16.3

- Select an averaging period, eg. 1 hr or 24 hrs, for the period of your co-location (24 hrs is usually appropriate).
- ① BAM and TEOM monitors run continuously and data is available at as low as 10-minute averages. This data can be noisy, so we recommend 24 hr averages if PM levels are low.
- Calculate averages for your Aeroqual monitor and the reference instrument using the equation shown.
- The goal is to create a spreadsheet with 1 column of reference data and 1 column of Aeroqual data, in the averaging period you selected. Zero check data should be included as a point.

## Step 5 — Calculate K-factor

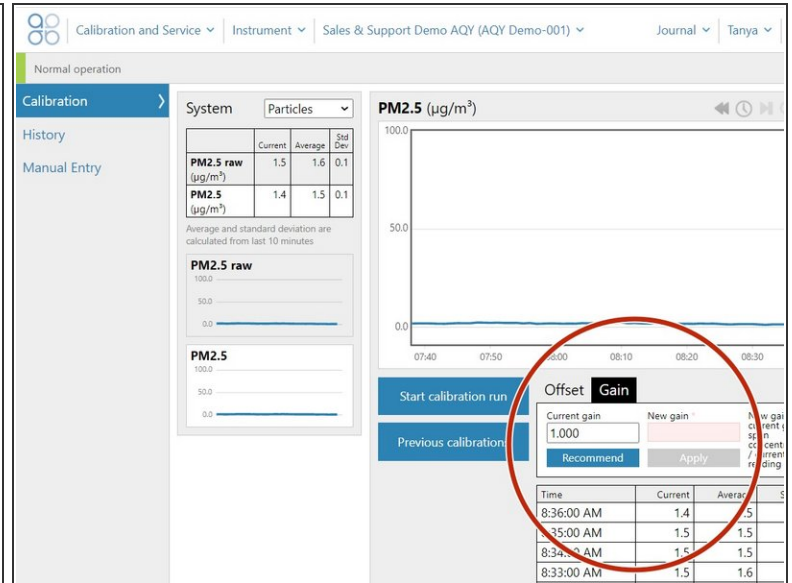


$$K \text{ Factor} = \frac{\text{Average PM (Reference)}}{\text{Average PM (Aeroqual)}}$$

- Plot your 2 data sets in an x-y scatter plot. Add a trend line and equation.
- Calculate the K-factor (calibration curve) using the equation shown.
- ❗ In this example the Aeroqual monitor is reading higher than the reference instrument. The slope of the calibration curve is 0.6568.

## Step 6 — Calculate and apply gain

$$\text{New Gain} = \text{Old Gain} \times K \text{ Factor}$$



Calibration and Service | Instrument | Sales & Support Demo AQY (AQY Demo-001) | Journal | Tanya

Normal operation

Calibration | History | Manual Entry

System: Particles

	Current	Average	Std Dev
PM2.5 raw (µg/m³)	1.5	1.6	0.1
PM2.5 (µg/m³)	1.4	1.5	0.1

Average and standard deviation are calculated from last 10 minutes

PM2.5 raw

PM2.5

Start calibration run

Previous calibration

PM2.5 (µg/m³)

Offset | **Gain**

Current gain: 1.000

New gain:

Recommend | Apply

Time	Current	Average	Std Dev
8:36:00 AM	1.4	1.5	0.1
8:35:00 AM	1.5	1.5	0.1
8:34:00 AM	1.5	1.5	0.1
8:33:00 AM	1.5	1.6	0.1

- Calculate the new gain using the equation shown.
- Go to the **Calibration and Service** app and select **Calibration** from the side menu.
- Select your PM channel from the **System** panel and enter the new gain in the details panel.
- ❗ When you start typing in the **New gain** field, the **Apply** button is enabled.



## Step 7 — Record in journal

Instrument ▾ Air Quality Monitor (AQM65 04082015-437) ▾

All journal types ▾

User entry | Cloud user - John Wagner

1. Site Inspection:	No new local emission sources Instrument in good condition No obstructions to monitoring equipment	2. Instrument inspection: Cooling fan operational PM and gas inlet secure Instrument has been running at stable
3. Equipment:	Aeroqual Gas dilution calibrator: Aircal 1000 Aeroqual Ozone calibrator: AQM O3Cal Aeroqual Flow meter: AQM R7	4 Gas cylinders: CO 1000 ppm in Air (expiry March) SO2 20 ppm in Air (expiry December) NO2 20 ppm in Air (expiry November)
4. Flow rate check:	Expected flow rate = 0.450 ml per min, Measured flow rate = 0.452 ml per min Main inlet flow rate OK, individual module flow rates were not measured.	5. Open door and change gas inlet filter
6. Zero calibration	All modules passed zero calibration, all modules were stable and all offsets were within acceptable limits.	
7. Span Calibration	CO @ 10.00 ppm Module response was 8.95 ppm gain adjustment to 1.15 pass SO2 @ 0.2 ppm Module response was 0.210 ppm gain adjustment to 0.92 pass NO2 @ 0.2 ppm Module response was 0.090 ppm gain adjustment to 2.10 pass (module may need replacing soon contact Aeroqual)	
8 Pack up. Next scheduled calibration 3 months from now. June 2017.		

- [Record the results of this service activity in the monitor's journal.](#)
- [Exit service mode.](#)

For further support, contact [Technical Support](#).