Personal Ozone Monitor™ (POM)™ and Application to GO3 Treks

John Birks
2B Technologies, Inc.
GO3 Foundation
Personal Ozone Monitor™ (POM™)

Size Comparison:
- 2B Tech POM Model 202
- Thermo Fisher Model 49i

- Introduced in 2012
- FEM: EQOA-0815-277
- > 140 sold
Ozone Monitors

Models 202 & 205

Model 211

Personal Ozone Monitor™
POM™

Models 106-L, -M, -MH, -H
for industrial ozone applications
Range: 1 ppb to 20 wt%
UV Absorbance Based on Beer-Lambert Law

\[ [O_3] = \frac{1}{\sigma l} \ln \left( \frac{I_o}{I} \right) \]
UV Absorbance Based on Beer-Lambert Law
## POM Specifications

<table>
<thead>
<tr>
<th><strong>Measurement Principle</strong></th>
<th><strong>UV Absorption</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Precision (1σ, rms noise)</td>
<td>1.5 ppb or 2% of reading</td>
</tr>
<tr>
<td>Accuracy</td>
<td>1.5 ppb or 2% of reading</td>
</tr>
<tr>
<td>Linear Dynamic Range</td>
<td>0-10,000 ppb (10 ppm)</td>
</tr>
<tr>
<td>Measurement Intervals</td>
<td>2 s, 10 s</td>
</tr>
<tr>
<td>Response Time</td>
<td>4 s or 20 s (to 100% of signal)</td>
</tr>
<tr>
<td>Flow Rate</td>
<td>~0.8 L/min (0.5 L/min required)</td>
</tr>
<tr>
<td>Averaging Time Choices</td>
<td>2 s, 10 s, 1 min, 5 min, 1 hr</td>
</tr>
<tr>
<td>Data Storage</td>
<td>8, 192 lines (~1 day for 10 s avg)</td>
</tr>
<tr>
<td>Power</td>
<td>7-24 V dc, 3.0 watt</td>
</tr>
<tr>
<td>Battery Life</td>
<td>12 hr</td>
</tr>
<tr>
<td>Size</td>
<td>4 x 3 x 1.5 inches</td>
</tr>
<tr>
<td>Weight</td>
<td>0.75 lb (0.34 kg)</td>
</tr>
</tbody>
</table>
POM vs. AQ-SPEC FEM

- Ozone measurements from the three PO₃Ms show an excellent correlation with the corresponding FRM data ($R^2 \approx 1.00$).
Ambient Air Applications

NFS/NPS

NOAA “Suitcase” Flights, Pieter Tans Group

Cloud Lab Dirigible

NASA Global Hawk RPV
O-Buoy: Network of Arctic Ocean Chemical Sensors

TRJ Environmental: Profiling Using a POM on a Quadcopter

NASA Ames Dassault/Dornier Alpha Jet
Jack Fishman: “Ozone Gardens”

EPA Village Green Project: Solar-Powered Air Pollution Monitors on a Park Bench

... and many more applications, especially in remote locations where there are size, weight and power limitations.
What is the GO3 Project?

A STEM project for middle and high schools where students measure air pollutants at their schools and share and discuss their data with other students around the world.
Participating Schools

More than 10 million ozone measurements made at ~100 locations over 6 years
Global Ozone Project Package

- UV Ozone Monitor
- Davis Weather Station
- Davis Data Logger
- Computer
- 12-h Battery
- 50 ft. Inlet Tubing
- Accessories
- Software
- Care Package
Measurement Levels vs. Time
Location: Pinedale High School of Pinedale, Wyoming, USA

Pinedale High School, WY
March 2011
Comparison of Pinedale GO3 Station with nearby State Monitoring Station

\[ y = 1.0409x - 3.5591 \]

\[ R^2 = 0.8671 \]
Loan ozone and BC personal monitors to schools for 3-4 weeks each
Students design and conduct their own monitoring experiments
Data are uploaded to the GO3 Database and displayed on Google Earth within a blog
Data are displayed on Google Earth within a blog where students, teachers and scientists discuss the results.

4 comments

**Jessica Hatz** likes this

Jessica Hatz Wow! It looks like the boat traffic really increased black carbon concentrations at certain points. This is only the third time anyone has measured black carbon concentrations near boat traffic—great job! ;)

Mon at 11:54 AM

**Will Enterline** This is interesting because when you think of BC pollution you don’t think of it coming from boats as well, COOL!

Mon at 4:22 PM

**beau sivy** Its amazing that the black carbon spiked to 24125 ng/m3. do you think its from the boats or was there an error?

1 hour ago

**Cristofer R. Badillo Olguin** I find it very interesting how the black carbon is very low by the river but when it gets by the basketball court and track is very high! Its really high! Especially the little part right beside the boat. At some points the ozone became higher than the black carbon and i wonder why.

1 hour ago
The Future of GO3 Treks
Personal Air Monitoring Module (PAMM)

- Multiple species monitored by multiple PAMMs: O₃, CO, CO₂, NO₂, PM₂.⁵, etc.
- Accomodate any sensor with V output
- Data transmitted by Blue Tooth to Nearby Smart Phones in real time
- Data transmitted to cloud for online discussions
Personal Air Monitoring Module (PAMM)  
Standard Sensors

Alphasense  
CO & NO₂

Plantower PMS1300  
Particle Count & PM2.5

ELT S-300  
CO₂
Thank You ☺️