

# AQ-SPEC

## Air Quality Sensor Performance Evaluation Center

### Sensor Description

Manufacturer/Model:  
Igienair Zaack AQI

Pollutant: NO<sub>2</sub>

Measurement Range:  
0 - 20 ppm

Type: Electrochemical

Time Resolution: 30-sec



### Additional Information

#### Field evaluation report:

<http://www.aqmd.gov/aq-spec/evaluations/field>

#### Lab evaluation report:

<http://www.aqmd.gov/aq-spec/evaluations/laboratory>

#### AQ-SPEC website:

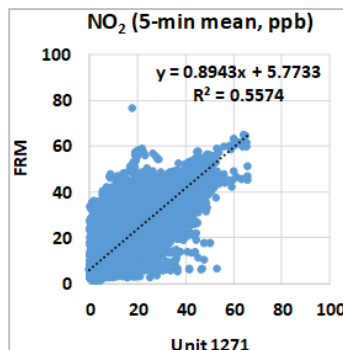
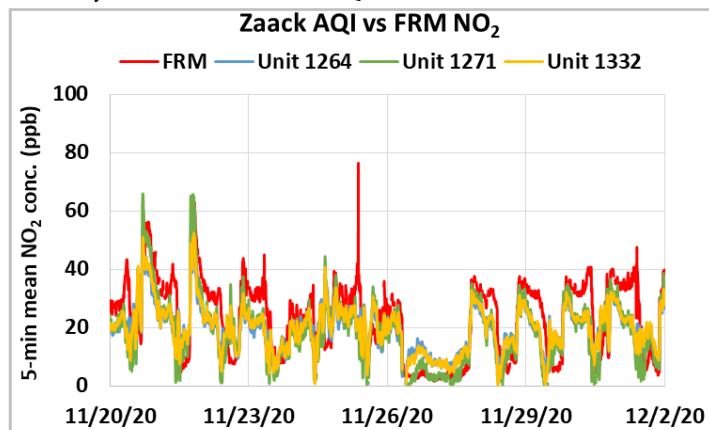
<http://www.aqmd.gov/aq-spec>

### Evaluation Summary

- Low to moderate intra-model variability was observed among the three Zaack AQI units at different NO<sub>2</sub> concentrations.
- The three Zaack AQI units showed moderate accuracy compared to the FRM NO<sub>2</sub> monitor, for a concentration range between 15 to 300 ppb.
- Units demonstrated high precision in all of the tested environmental conditions (NO<sub>2</sub> conc., T and RH). However, the Zaack AQI units were susceptible to weather conditions (e.g. high temperature & RH).
- NO<sub>2</sub> data recovery from the three Zaack AQI units was 94-99% in the field.
- Zaack AQI units showed moderate correlations with the FRM NO<sub>2</sub> in the field ( $R^2$ : 0.53-0.58) and very strong correlations in the lab ( $R^2 > 0.99$ ).

### Field Evaluation Highlights

- Deployment period 11/13/2020 - 01/08/2021: the three Zaack AQI units had a strong correlation with the FRM instrument.
- Data recovery from the Zaack AQI units was 94-99%.



Coefficient of Determination ( $R^2$ ) quantifies how the three sensors followed the NO<sub>2</sub> concentration change by FRM.

An  $R^2$  approaching the value of 1 reflects a near perfect agreement, whereas a value of 0 indicates a complete lack of correlation.

# Laboratory Evaluation Highlights

**Accuracy**  $A (%) = 100 - \frac{|\bar{X} - \bar{R}|}{R} * 100$

Steady State (#)	Sensor mean (ppb)	FRM T200 (ppb)	Accuracy (%)
1	10.55	13.86	76.1%
2	35.18	50.06	70.3%
3	66.27	102.51	64.7%
4	128.59	200.19	64.2%
5	195.56	297.23	65.8%

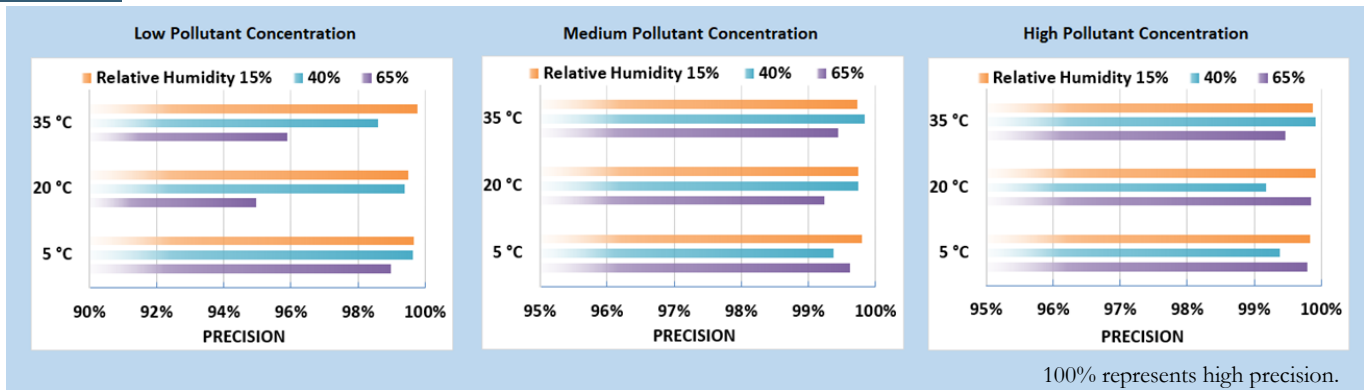
Accuracy was evaluated by a concentration ramping experiment at 20 °C and 40%.

The sensor's readings at each ramping steady state are compared to the reference instrument.

Negative % means sensors' overestimation by more than two fold. The higher the positive value (close to 100%), the higher the sensor's accuracy.

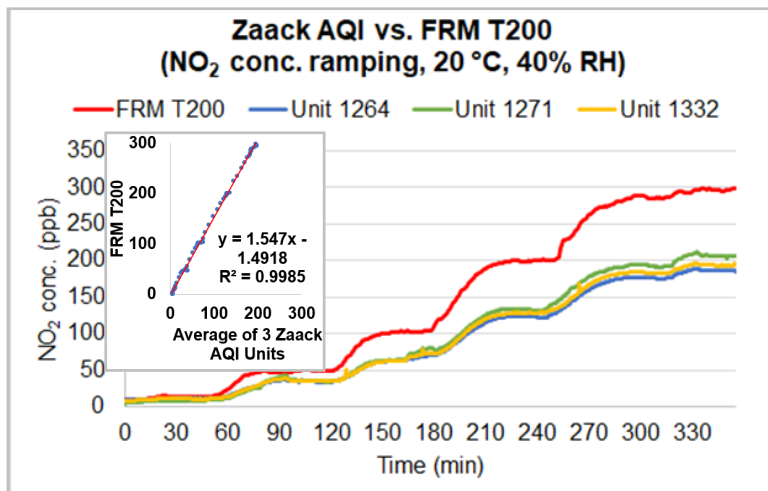


## Precision



Sensor's ability of generating precise measurements of NO<sub>2</sub> concentration at low, medium, and high pollutant levels were evaluated under 9 combinations of T and RH, including extreme weather conditions like cold and humid (5 °C and 65%), hot and humid (35 °C and 65%), cold and dry (5 °C and 15%), and hot and dry (35 °C and 15%).

## Coefficient of Determination



The Zaack AQI units showed very strong correlations with the corresponding FRM data ( $R^2 > 0.99$ ) at 20 °C and 40% RH.

## Climate Susceptibility (linear correlation R<sup>2</sup>)

R <sup>2</sup>	5 °C	20 °C	35 °C
15%	1.00	1.00	1.00
40%	0.99	1.00	1.00
65%	1.00	1.00	1.00

From the laboratory studies, temperature and humidity had negligible effect on the Zaack AQI's linear correlation with the FRM NO<sub>2</sub>.

## Observed Interferents

Low and high temperature and humidity, O<sub>3</sub>.



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