

Title: Standard Operating Procedure for Measurement of Barometric Pressure Using Vaisala PTB 220		
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1. INTRODUCTION AND SCOPE

This procedure describes the operation and maintenance of the Vaisala PTB 220 digital barometer. This sensor can be used for handheld measurements, and can be connected to a computer via RS232 connection to retrieve stored data if required. The PTB220 is a very accurate pressure sensor, which uses the BAROCAP® silicon capacitive sensor developed by Vaisala.

This method adheres to the requirements of the current Air Monitoring Directive (AMD) drafted by Alberta Environment in 1989. In some cases the limits and specifications exceed the requirements of the current AMD and subsequent amendments. It should be considered that the current and any future amendments or drafts of the AMD will be used as the benchmark for requirements and criteria for ambient air monitoring practices conducted in the Province of Alberta. Information used to write this procedure was also taken from sources identified in the reference section.

2. PRINCIPLE OF THE METHOD

The Vaisala PTB220 uses the BAROCAP® sensor developed by Vaisala for barometric pressure measurements. The BAROCAP sensor consists of two layers of single crystal silicon having a layer of glass between them. This creates a vacuum chamber and a diaphragm. A thin film of metal inside the vacuum chamber forms a capacitor electrode. The other electrode is the pressure sensitive silicon diaphragm. Pressure variations deflect the sensitive diaphragm and change the sensor's capacitance. The capacitance is measured by an integrated circuit designed for accurate and stable measurement of small capacitances. Atmospheric pressure is reported in hPa, but can be converted to mmHg, inches Hg, kilopascals or millibars.

3. MEASUREMENT RANGE AND SENSITIVITY

Table 1 Range and sensitivity for all three components.

Component	Range	Accuracy	Repeatability
Barometric Pressure	500 – 1100 hPa	± 0.10 hPa	± 0.03 hPa
Barometric Pressure	375 – 825 mmHg	± 0.08 mmHg	± 0.02 mmHg
Temperature	-60 to +60°C	N/A	N/A



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4. EQUIPMENT AND APPARATUS

The sensor suitable for use in this method which are currently used in the AENV network is the Vaisala PTB220

5. INTERFERENCES

The pressure sensor is inherently stable and unaffected by local variations in temperature or other variables.

The inlet port must be clean and free of obstructions; inaccurate measurement of pressure can result if the port is obstructed.

6. PRECISION AND ACCURACY

The measurement precision of the Vaisala PTB220 solid state Atmospheric Pressure sensor is established by the manufacturer.

The accuracy of the sensor is dependent on the accuracy of the calibration transfer standard utilized by the manufacturer at the time of manufacture. The standards used for verification of atmospheric pressure sensors in the AENV network are calibrated against National Institute of Standards and Technology (NIST) standard reference devices. See the table in section 3 for the manufacturers quoted accuracies.

7. SITE REQUIREMENTS

Site location of the Atmospheric Pressure monitoring station in an urban area should be determined according to the intended application of the monitoring data.

Atmospheric Pressure sensors are sited and operated in accordance with the guidelines outlined by the AES Guidelines for Co-operative Climatic Autostations Guide 89-1.

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8. INSTALLATION REQUIREMENTS

This sensor is used primarily as a lab or portable audit standard device. As such typical installation requirements for air quality analyzers are not applicable. If this sensor is installed at an air quality monitoring station for longer term measurements, all the installation requirements as specified by the manufacturer in the installation procedures as well as the general requirements below must be followed.

Spacing requirements for the atmospheric pressure sensor such as height above ground, distance from obstructions and distance from horizontal or vertical support are as follows:

- Height above ground - 2 to 15 metres

- Distance from support structure - > 1 metre

- Distance from any air flow obstacle, i.e. buildings - > 2×height of obstacle above the inlet

- Airflow obstructions - unobstructed airflow in all directions for more than 2 metres.

The sensor should be 1 metre away from any supporting structure. The sensor should also be at least 2 metres from any air flow obstruction.

A data acquisition system is required to record or download the signal output from the sensor if desired although this is not the standard configuration for AENV operations.

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9. OPERATIONAL REQUIREMENTS

The following table of activities must be performed when operating an Atmospheric Pressure sensor in the AENV network. Operational and maintenance manual(s) must be accessible to the operator on site.

**Table 2
Analyzer Operational Requirements**

Action	Time and Frequency	Procedure	Documentation	Action by
Set sensor and data system range	After installation	As per manufacturer's manual	Entry to log book	Station operator
Verification of operational parameters	Weekly	Visual check and verification of data values	Entry to log book	Station operator
Sensor Verification and Cleaning	Weekly	If required clean inlet port	Entry to logbook	Station Operator
Sensor maintenance	As recommended by manufacturer	As per manufacturer's manual	Entry to log book and Work Order	Instrument Technician
Calibration verification by observation or comparison	Maximum 4 month intervals	Station Audit SOP	Entry to log book; report to designated manager	Network auditor
Replace Sensor	As required	Replace with serviced and verified sensor	Entry to logbook and Work Order	Instrument Technician

10. CALIBRATION

No field calibration or calibration by Instrument Technicians is possible. Recertification, calibration and repair of the sensor are performed by the manufacturer. Barometric



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pressure sensors are factory calibrated and will not change unless damaged. If necessary, sensors are returned to the factory for repair and recertification.

Comparisons between co-located sensors can be performed.

11. APPLICABLE DOCUMENTS

EM-035a Vaisala PTB220 Operations Manual

12. LITERATURE REFERENCES

Environment Canada AES Guidelines for Co-operative Climatic Autostations Guide 89-1
June 30, 1989

13. REVISION HISTORY

Revision 0 (new document)

Revision 1 Grammatical changes Section 8 Installation requirements, note the typical use for this sensor in AENV operations

14. APPROVAL

Approved by: Harry Benders
Title: Air Monitoring Team Leader

Date: January 24, 2011



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