Barometer
(Order Code BAR-BTA)

The Barometer measures atmospheric pressure. As shipped, it measures actual, or *station pressure*, but it can be calibrated to measure the elevation-adjusted, or *sea level pressure*, if desired for weather studies (see Station Pressure *vs.* Sea Level Pressure on Page 3).

Collecting Data with the Barometer
This sensor can be used with the following interfaces to collect data.
- Vernier LabQuest® 2 or original LabQuest® as a standalone device or with a computer
- Vernier LabQuest Mini with a computer
- Vernier LabPro® with a computer or TI graphing calculator
- Vernier Go!®Link
- Vernier EasyLink®
- Vernier SensorDAQ®
- CBL 2™
- TI-Nspire™ Lab Cradle

Here is the general procedure to follow when using the Barometer.
1. Connect the Barometer to the interface.
2. Start the data-collection software
3. The software will identify the Barometer and load a default data-collection setup. You are now ready to collect data.

Data-Collection Software
This sensor can be used with an interface and the following data-collection software.
- **Logger *Pro* 3** This computer program is used with LabQuest 2, LabQuest, LabQuest Mini, LabPro, or Go!Link.
- **Logger Lite** This computer program is used with LabQuest 2, LabQuest, LabQuest Mini, LabPro, or Go!Link.
- **LabQuest App** This program is used when LabQuest 2 or LabQuest is used as a standalone device.
- **DataQuest™ Software for TI-Nspire™** This calculator application for the TI-Nspire can be used with the EasyLink or TI-Nspire Lab Cradle.
- **EasyData App** This calculator application for the TI-83 Plus and TI-84 Plus can be used with CBL 2, LabPro, and Vernier EasyLink. We recommend version 2.0 or newer, which can be downloaded from the Vernier web site, www.vernier.com/easy/easydata.html, and then transferred to the calculator. See the Vernier web site, www.vernier.com/calc/software/index.html, for more information on the App and Program Transfer Guidebook.

- **DataMate program** Use DataMate with LabPro or CBL 2 and TI-73, TI-83, TI-84, TI-86, TI-89, and Voyage 200 calculators. See the LabPro and CBL 2 Guidebooks for instructions on transferring DataMate to the calculator.
- **LabVIEW** National Instruments LabVIEW™ software is a graphical programming language sold by National Instruments. It is used with SensorDAQ and can be used with a number of other Vernier interfaces. See www.vernier.com/labview for more information.

NOTE: Vernier products are designed for educational use. Our products are not designed nor are they recommended for any industrial, medical, or commercial process such as life support, patient diagnosis, control of a manufacturing process, or industrial testing of any kind.

Specifications

Pressure range (as shipped)	77.98 kPa to 105.29 kPa
Maximum pressure that the sensor can tolerate without permanent damage	310 kPa
Resolution	
13-bit (SensorDAQ)	0.00416 kPa
12-bit (LabQuest 2, LabQuest, LabQuest Mini, LabPro, TI-Nspire™ Lab Cradle, Go! Link)	0.00830 kPa
10-bit, 5 volt A/D converter (CBL 2™)	0.0332 kPa
Combined linearity and hysteresis	±0.5% Full Scale
Response time	100 microseconds
Temperature range	−25°C to 85°C
Calibration values	
slope	6.825 kPa/V
intercept	76.29375 kPa

This sensor is equipped with circuitry that supports auto-ID. When used with LabQuest 2, LabQuest, LabQuest Mini, LabPro, Go! Link, SensorDAQ, TI-Nspire™ Lab Cradle, EasyLink, or CBL 2™, the data-collection software identifies the sensor and uses pre-defined parameters to configure an experiment appropriate to the recognized sensor.

How the Barometer Works
The heart of this circuit is a pressure sensor. It has a membrane that flexes as pressure changes. This sensor is set up for absolute pressure measurement, so one side of the membrane is a vacuum. The sensor produces an output voltage that varies in a linear way with absolute pressure. It includes special circuitry to minimize errors caused by changes in temperature.

Station Pressure *vs.* Sea Level Pressure

Station pressure is the true atmospheric pressure at your location, or station. This is the pressure your Vernier Barometer is calibrated to read and is useful for tasks such as gas law calculations or as an altimeter. *Sea level pressure* is the pressure after the station pressure has been adjusted to its equivalent pressure at sea level. This is commonly done to normalize pressures at various altitudes for weather forecasts. If this was not done, there would always appear to be areas of low pressure over high-elevation cities such as Denver. If weather studies are of interest, the next section will explain how to recalibrate your Barometer.

Using the Barometer for Weather Studies

As discussed above, the Vernier Barometer has been calibrated to read station pressure. If you prefer it to read sea level pressure for conducting weather studies, you can perform a one-point calibration to correct for elevation. You may also want to change units to something more appropriate for weather studies such as in Hg or mbar. To do this, connect the Barometer to an interface and launch the software. Change the units first, if desired. Initiate the calibration procedure and choose the one-point calibration option. Enter the sea-level corrected pressure value for your location obtained from a reputable source (NOAA, Weather Underground, etc.). Save this calibration onto the sensor (this option is found on the Storage tab in LabQuest App and the Calibration Storage tab in Logger *Pro*).

Suggested Experiments

Weather Studies

This sensor can be an accurate, reliable barometer as part of a weather station. It is temperature compensated, so changes in room temperature will not interfere with the data. It is especially interesting to watch pressure changes as a storm moves in. You could connect temperature, relative humidity, or light sensors to the same computer. We used a Barometer to produce the graph in Figure 1 during the biggest storm in a decade in Portland, Oregon (December 1995).
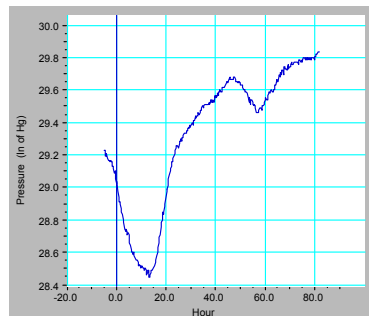

Figure 1

Altimeter

If you have a portable interface such as a LabQuest, you can do some interesting studies using this sensor as you drive in a mountainous area. Simply leave the Barometer in the car and take data as you drive. The pressure reading gives you a measure of the altitude. Figure 2 is a graph collected while driving over a pass in the Cascades mountain range.
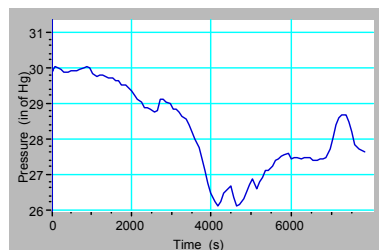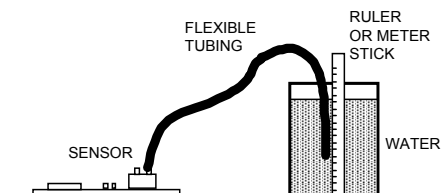

Figure 2

Pressure in Liquids

The pressure in a liquid can be investigated using a setup similar to this one.


Connect the tubing to the input port of the Barometer before you put the end of the tube under water. Collect pressure data as a function of depth. Model this data with a linear function.

Barometer Models

This sensor booklet is valid for Vernier Barometers sold beginning in November 2014, Model BAR4314R2. For earlier models, see the legacy section at www.vernier.com/legacy-manuals

Warranty

Vernier warrants this product to be free from defects in materials and workmanship for a period of five years from the date of shipment to the customer. This warranty does not cover damage to the product caused by abuse.
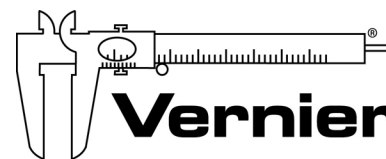
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