# Microphone

**(Order Code MCA-BTA)**

The Microphone can be used for a variety of activities with sound waves.

- Demonstrate how the wave pattern changes when frequency and amplitude are changed
- Compare the waveforms from various musical instruments
- Have students capture the waveform of the sound of a tuning fork and model the sine wave using a function
- Measure the speed of sound by using reflected sound waves in a tube
- Demonstrate beat patterns
- Determine the period and then the frequency of a sound by measuring the time between peaks on the waveform
- Display the fast Fourier transform (FFT) of a sound

## Collecting Data with the Microphone

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 SensorDAQ®
- CBL 2™
- TI-Nspire™ Lab Cradle

Here is the general procedure to follow when using the Microphone:

1. Connect the Microphone Probe to the interface.
2. Start the data-collection software.
3. The software will identify the Microphone 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*** This computer program is used with LabQuest 2, LabQuest, LabQuest Mini, or LabPro
- **Logger Lite** This computer program is used with LabQuest 2, LabQuest, LabQuest Mini, or LabPro.
- **LabQuest App** This program is used when LabQuest 2 or LabQuest is used as a standalone device.
- **EasyData App** This calculator application for the TI-83 Plus and TI-84 Plus can be used with CBL 2™ or LabPro. 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.
- **DataQuest™ Software for TI-Nspire™** This calculator application for the TI-Nspire™ can be used with the TI-Nspire™ Lab Cradle.
- **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 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

| | |
|---|---|
| Frequency range: | approximately 100 Hz to 15 kHz |
| Power: | 1.45 mA @ 5 VDC |
| Stored calibration | |
| slope: | 1 |
| intercept: | 0 (arbitrary units) |

**Note**: The maximum data-collection rate of the interface affects the maximum frequency you can effectively sample.

This sensor is equipped with circuitry that supports auto-ID. When used with LabQuest 2, LabQuest, LabQuest Mini, LabPro, 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 Microphone Works

The Microphone uses an electret microphone that has a frequency response covering essentially the range of the human ear. An op-amp circuit amplifies the signal and sends it to the British Telecom connector. The signal is sent to the interface on two different lines. A signal centered at 2.5 volts is on the Vin-low line and a signal centered at 0 volts is on Vin. More information about the input lines on LabPro, LabQuest 2, LabQuest, and LabQuest Mini, is available in their respective manuals.

The LabQuest 2 and original LabQuest include an app called Audio Function Generator. You can use this app to generate various waveforms, tones, and beats. The internal speaker can distort at higher volumes, so we suggest connecting a pair

of powered computer speakers to the LabQuest 2 or LabQuest.

The best sound source to use with the microphone is an electronic keyboard set to a flute sound, but you may want to investigate a human voice or a whistle, tuning forks, or other musical instruments. Try comparing the wave pattern for different sound sources. Try playing two sounds of nearly the same frequency to produce beat patterns.

Make sure the sound level is in the correct range to produce good wave patterns. If the sound is too loud, the wave pattern will be clipped off at the top or bottom. Move the microphone further from the sound source, or turn down the volume of the sound.

## 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 or improper use.



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