

# Differential Voltage Probe

(Order Code DVP-BTA)



The Differential Voltage Probe is designed for exploring the basic principles of electricity. Use this probe to measure voltages in low voltage AC and DC circuits. With a range  $\pm 6.0$  V, this system is ideal for use in “battery and bulb” circuits. Use it with the Current Probe (order code DCP-BTA) to explore Ohm's law, phase relationships in reactive components and much more. This differs from the Voltage Probe in that neither clip is connected to ground. Use multiple sensors to explore series and parallel circuits.

## Collecting Data with the Differential Voltage Probe

This sensor can be used with the following interfaces to collect data:

- Vernier LabQuest<sup>®</sup> 2 or original LabQuest<sup>®</sup> as a standalone device or with a computer
- Vernier LabQuest<sup>®</sup> Mini with a computer
- Vernier LabPro<sup>®</sup> with a computer or TI graphing calculator
- Vernier Go!<sup>®</sup>Link
- Vernier EasyLink<sup>®</sup>
- Vernier SensorDAQ<sup>®</sup>
- CBL 2<sup>™</sup>
- TI-Nspire<sup>™</sup> Lab Cradle

Here is the general procedure to follow when using the Differential Voltage Probe:

1. Connect the Differential Voltage Probe to the interface.
2. Start the data-collection software.
3. The software will identify the Differential Voltage Probe 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<sup>™</sup> Software for TI-Nspire<sup>™</sup>** This calculator application for the TI-Nspire<sup>™</sup> can be used with the EasyLink or TI-Nspire<sup>™</sup> 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](http://www.vernier.com/easy/easydata.html), and then transferred to the calculator. See the Vernier web site, [www.vernier.com/calc/software/index.html](http://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<sup>™</sup> 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](http://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

Differential Voltage Probe input voltage range	$\pm 6.0$ V
Max. voltage on any input	$\pm 10$ V
Input impedance (to ground)	10 M $\Omega$
Linearity	0.01%
13-bit resolution (using SensorDAQ)	1.6 mV
12-bit resolution (using LabPro, LabQuest 2, LabQuest, LabQuest Mini, Go!Link, TI-Nspire Lab Cradle or EasyLink)	3.1 mV
10-bit resolution (using CBL 2)	12.5 mV
Supply voltage	5 VDC
Supply current (typical)	9 mA
Output voltage range	0–5 V
Transfer function	$V_o = -0.4 (V_+ - V_-) + 2.5$
Stored calibration	
slope	-2.5 V/V
intercept	6.25 V

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

## How the Differential Voltage Probe Works

The Differential Voltage Probe measures the potential difference between the  $V_+$  clip (red) and the  $V_-$  clip (black). The voltage probes have differential inputs. The voltage measured is with respect to the black clip and not circuit ground. This allows you to measure directly across circuit elements without the constraints of common grounding. The voltage probes can be used to measure negative potentials, as well as positive potentials. This is a nice improvement for people using one of our 0 to 5 volt interfaces.

The Voltage Probes are designed to be used like voltmeter leads. They should be placed across a circuit element. The differential input range is  $-6$  volts to  $+6$  volts. Over-voltage protection is provided so that slightly higher voltages will not damage the sensor. You should NEVER use high voltages or household AC with these probes.

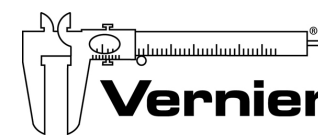
## Optional Calibration Procedure

You should not have to perform a new calibration when using the Differential Voltage Probe in the classroom. We have set the sensor to match our stored calibration before shipping it. You can simply use the appropriate calibration file that is stored in your data-collection program from Vernier.

The output of this system is linear with respect to the measurement it is making. As mentioned before, the amplifier allows you to measure positive and negative voltages on any of our interfaces. Since many lab interfaces can read voltages only in the range of 0 to 5 volts, the amplifier offsets and amplifies the incoming signal so that the output is always in the range of 0 to 5 volts. If an input is zero volts, for example, the amplifier will produce an output of 2.5 volts. The output varies from this 2.5 volt level, depending on the input. To collect data as differential voltage, use either the calibration supplied with your program, or calibrate the unit using known voltages. A standard, two-point calibration is done, as with any Vernier sensor. Another option to consider instead of calibrating is “zeroing” the sensor. This is done by shorting out the leads of the sensor, then choosing the Zero option in the data-collection software. This option adjusts the calibration offset but does not adjust the calibration gain.

## 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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13979 S. W. Millikan Way • Beaverton, OR 97005-2886  
Toll Free (888) 837-6437 • (503) 277-2299 • FAX (503) 277-2440  
info@vernier.com • www.vernier.com

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