
Current & Voltage Probe System

(Order Code CV-BTA or CV-DIN)

The Current & Voltage Probe System is designed for exploring the basic principles of electricity. By using the probes in simple circuits, you can explore Ohm's Law, series and parallel circuits, phase relationships in reactive components, and much more. With a range of $\pm 6\text{ V}$ / $\pm 0.6\text{ A}$, this system is ideal for use in most "battery and bulb" circuits. It also can be used with low-voltage AC circuit experiments.

NOTE: This product is to be used for educational purposes only. It is not appropriate for industrial, medical, research, or commercial applications.

Using the Current & Voltage Probe System with a Computer

This sensor can be used with a Macintosh[®] or PC computer and any of the following lab interfaces: Vernier LabPro[™], Universal Lab Interface, or Serial Box Interface. Here is the general procedure to follow when using the Current & Voltage Probe System with a computer:

1. Connect the Current & Voltage Probe System to the appropriate ports on the interface.
2. Start the data-collection software on the computer. If you are using a Power Macintosh or Windows[®] computer, run the *Logger Pro*[™] software. If you are using older Macintosh, MS-DOS[®], or Windows 3.1 computers, run the Electricity program.
3. Open an experiment file in the *Logger Pro* or Electricity folder, and you are ready to collect data.

Using This Sensor with Graphing Calculators

This sensor can be used with a TI Graphing Calculator and any of the following lab interfaces: LabPro, CBL 2[™], or CBL[™]. Here is the general procedure to follow when using the Current & Voltage Probe System with a graphing calculator:

1. Load a data-collection program onto your calculator:
 - LabPro or CBL 2 - Use the DataMate program. This program can be transferred directly from LabPro or CBL to the TI Graphing Calculator. Use the calculator-to-calculator link cable to connect the two devices. Put the calculator into the Receive mode, and then press the Transfer button on the interface.
 - Original CBL - Use the PHYSICS program. This program is available free on our web site at www.vernier.com. Our programs can also be obtained on disk. (Contact us for more information.) Load the program into a calculator using TI-GRAPH LINK[™].
2. Use the calculator-to-calculator link cable to connect the interface to the TI Graphing Calculator using the I/O ports located on each unit. Be sure to push both plugs in firmly.
3. Connect the Current & Voltage Probe System to any of the analog ports on the interface. In most cases, CH 1 and CH 2 are used. Note that both cables on the dual-channel amplifier must be connected to the interface, even if you are only using one sensor.
4. Start the data-collection program, and you are ready to collect data.

Specifications

Voltage probe range: +/- 6.0 V

Current probe range: +/- 0.6 A

Linearity: 0.01%

Resolution (using LabPro, ULI II, SBI): 3.1 mV
0.31 mA

Resolution (using ULI, CBL, CBL 2): 12.5 mV
1.25 mA

Supply voltage: 5 VDC

Supply current (typical): 9 mA

Input Impedance: 10 k Ω

Max. voltage on any input: ± 10 V

Output voltage range: 0 - 5 V

Transfer function (Voltage Probe): $V_O = -0.4 (V_+ - V_-) + 2.5$

Transfer function (Current Probe): $V_O = -4 (I) + 2.5$

This sensor is equipped with circuitry that supports auto-ID. When used with LabPro or CBL 2, the data collection software identifies the sensor and uses pre-defined parameters to configure an experiment appropriate to the recognized sensor. This greatly simplifies the setup procedures for many experiments. Auto-ID is required for the Quick Setup feature of LabPro and CBL 2 when the unit operates remotely from the computer or calculator.

How the Current & Voltage Probe System Works

The Current & Voltage Probe System consists of two voltage probes, two current probes, and a dual channel amplifier. The amplifier expands the data collection abilities of your interface by providing two differential inputs with selectable gain. Circuitry inside the amplifier automatically adjusts the gain of each channel as you switch from voltage to current probes and vice versa. The two channels of the amplifier operate independently; any combination of current and voltage probes may be used.

The voltage probes are meant to be treated like voltmeter leads. They should be placed across a circuit element. They measure the potential difference between the V_+ clip (red) and the V_- clip (black). The range is -6 volts to +6 volts and overvoltage protection is provided, so that slightly higher voltages will not damage anything. Of course, you should never use high voltages or household AC with these probes. The voltage probes have differential inputs. This means that you can 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 small current probe boxes each contain a 0.1- Ω resistor. The current probes were designed to look like they should be wired in series with the circuit. Currents in either direction can be measured. The current will be indicated as positive if current flows in the direction of the arrow on the small box (from the red terminal to the black terminal). The range is ± 0.6 amps (± 600 ma). When a current probe is connected to

the amplifier, the gain of the amplifier is automatically increased. The final result is that a voltage is produced from the amplifier that can be measured by the lab interface. It varies in a linear way with the current through the current probe.

Do I Need to Calibrate the Current & Voltage Probe System? “No”

We feel that you should not have to perform a new calibration when using the Current & Voltage Probe System 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 in any of these ways:

1. If you ordered the CV-BTA version of the sensor, and you are using it with a LabPro or CBL 2 interface, then a calibration is automatically loaded when the Current & Voltage Probe System is connected.
2. If you are using Logger *Pro* software (version 2.0 or newer) on a Power Macintosh or Windows computer, open an experiment file for the Current & Voltage Probe System, and its stored calibration will be loaded at the same time.
Note: If you have an earlier version of Logger *Pro*, a free upgrade is available from our web site.
3. If you are using Electricity software on an older PC or Macintosh computer, open an experiment file for the Current & Voltage Probe System, and its stored calibration will be loaded at the same time.
4. Any version of the DataMate program (with LabPro or CBL 2) has stored calibrations for this sensor.
5. Any version of the PHYSICS program (for CBL), version 4/1/00 or newer, has stored calibrations for this sensor. Go to our web site, www.vernier.com, to download a current version.

When used with either voltage or current probes, 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 or currents 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 voltage or current, use either the calibration supplied with your program, or calibrate the unit using known voltages or currents. A standard, two-point calibration is done, as with any Vernier sensor. Another option to consider instead of calibrating is “zeroing” either or both sensors. 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.

The default calibration slopes and intercepts for these sensors are:

Current in amperes:

Slope: -0.25 Intercept: 0.625

Potential in volts:

Slope: -2.5 Intercept: 6.25



Vernier Software & Technology
13979 S.W. Millikan Way
Beaverton, Oregon 97005-2886
(503) 277-2299 • FAX (503) 277-2440
info@vernier.com • www.vernier.com

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