

Vernier Circuit Board



(Order Code VCB)

The Vernier Circuit Board is designed for use in the study of simple electric circuits. The circuit board itself contains resistors, a capacitor, an LED, switches, a battery holder for internal power, connections for external power, a resettable fuse, connections for the addition of other components, and turreted test points for easy connection of test leads and jumper wires.

Inventory of Items Included with the Vernier Circuit Board

Check to be sure that each of these items is included with your Vernier Circuit Board:

- One 10 in. \times 7 in. circuit board
- Ten 14-in. insulated jumper wires fitted with mini-alligator clips
- Five #48 lamps rated 0.06 A at 2.0 V (cylindrical body)
- Five #50 lamps rated 0.220 A at 7.5 V (round body)

Board Components and Layout

Providing Power

The upper left corner of the circuit board contains a battery holder for two D batteries. This combination of batteries provides access to 3 VDC. Binding posts J1 and J2 on the lower left part of the board allow you to connect external power, such as the Extech Digital DC Power Supply (Vernier order code EXPS, \$199). The Vernier Circuit Board is designed for low voltages only. Limit the external voltage to 10 volts.

Switch SW1 below the battery compartment, and to the right of J1 and J2, is a single-pole, double-throw (SPDT) switch. The switch is labeled for the 3 V power or external power. Set this switch to provide power to connection points 1 and 35.

A resettable fuse is located to the right of switch SW1. This fuse limits the current to 0.8 A. After being tripped, the fuse remains open until power has been removed.

Installed Components

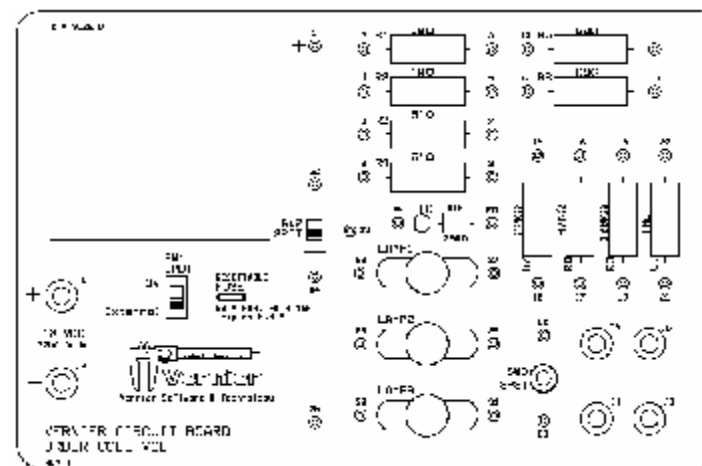
A variety of components have been installed on the circuit board, including nine resistors, one capacitor, one LED/resistor combination, and two switches. Here is a list of the components.

- R1 and R2–10 Ω resistors rated at 5 W
- R3 and R4–51 Ω resistors rated at 5 W
- R5 and R6–68 Ω resistors rated at 5 W
- R7–22 k Ω resistor rated at 5 W
- R8–47 k Ω resistor rated at 5 W
- R9–100 k Ω resistor rated at 5 W

- C1–10 μ F non-polarized capacitor
- LED and 220 Ω current limiting resistor
- SW2–Single-pole, double-throw (SPDT) switch
- SW3–Single-pole, single-throw (SPST) momentary switch

Attaching Other Components

Four 3-way binding posts labeled, J3, J4, J5 and J6, are located in the lower right corner of the circuit board. You can use these connections to add your own components, e.g. resistors, capacitors, diodes, etc. You can use lamp sockets Lamp1, Lamp2, and Lamp3 to install lamps such as the ones provided with the circuit board. The sockets are designed for common E-10 screw base lamps.



Replacement Parts

The #50 7.5 V bulbs (round body) are available at Radio Shack (part number 272-1133). Replacement jumper leads are also from Radio Shack (part number 278-1156). The # 48 2.0 V lamp (cylindrical body) is hard to find at retail. You can order a pack of 10 bulbs from Vernier Software & Technology (order code BULB, \$9)

Sample Uses of the Circuit Board

The Vernier Circuit Board is designed to help simplify the study of simple circuits. The versatility of the circuit board will let your students investigate a wide variety of circuits.

Circuits with the DC bulbs

Using the DC bulbs that are included, you can perform a variety of qualitative battery and bulb investigations, such as:

- Investigate the brightness of the #50 bulb and the #48 bulb when separately powered by the same voltage.
- Use the #48 2.0 V bulb with the internal 3 VDC power to investigate the lamp brightness when lamps are connected in series circuits. Please note that even though the #48 volt is rated at 2.0 V it will function properly with 3 VDC.
- Use the #48 2.0 V bulb with the internal 3 VDC power to investigate the lamp brightness when lamps are connected in parallel circuits.
- Quantify the above investigations by measuring current and voltage in these circuits.

Ohm's Law

You can use the 10 Ω and 51 Ω resistors on the circuit board to determine the mathematical relationship between current, potential difference, and resistance. This experiment is described in the Ohm's Law experiment in *Physics with Computers* and *Physics with Calculators*. During the activity, the student is instructed to use a light bulb instead of a resistor. The #50 7.5 V bulb included in this kit will work fine for that part of the lab.

Series and Parallel Circuits

Experiment 26—Series and Parallel Circuits in *Physics with Computers* and *Physics with Calculators* investigates current flow in series and parallel circuits. It also investigates the voltage throughout series and parallel circuits. You can use the 10 Ω , 51 Ω and 68 Ω resistors found on the Vernier Circuit Board to perform these investigations.

Charging and Discharging Capacitors

Experiment 27—Capacitors in *Physics with Computers* and *Physics with Calculators* investigates charging and discharging of capacitors. It uses the 10 μF non-polarized capacitor found on this circuit board. The capacitor is used in combination with a 22 k Ω resistor and a 47 k Ω resistor, and switch SW2, all found on the circuit board, to create two different RC circuits.

Analog Out

If you are using a LabPro interface, you can use the analog output of the channel CH4. The analog output is limited to 100 mA. With the appropriate computer or calculator software, you can drive a signal through the #48 2.0 V bulb (cylindrical body), which is rated at 60 mA. Please note that the analog output of LabPro can deliver 4 V. Running the #48 bulb at 4 V may reduce the bulb lifetime. If you want to explore these capabilities with a computer, use *Logger Pro* 3.2 or newer. Information about this software can be found on our web site. If you are interested in using the analog out with a TI graphing calculator, a calculator program called FunctGen is available and can be downloaded from our web site.

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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