Power Blocks

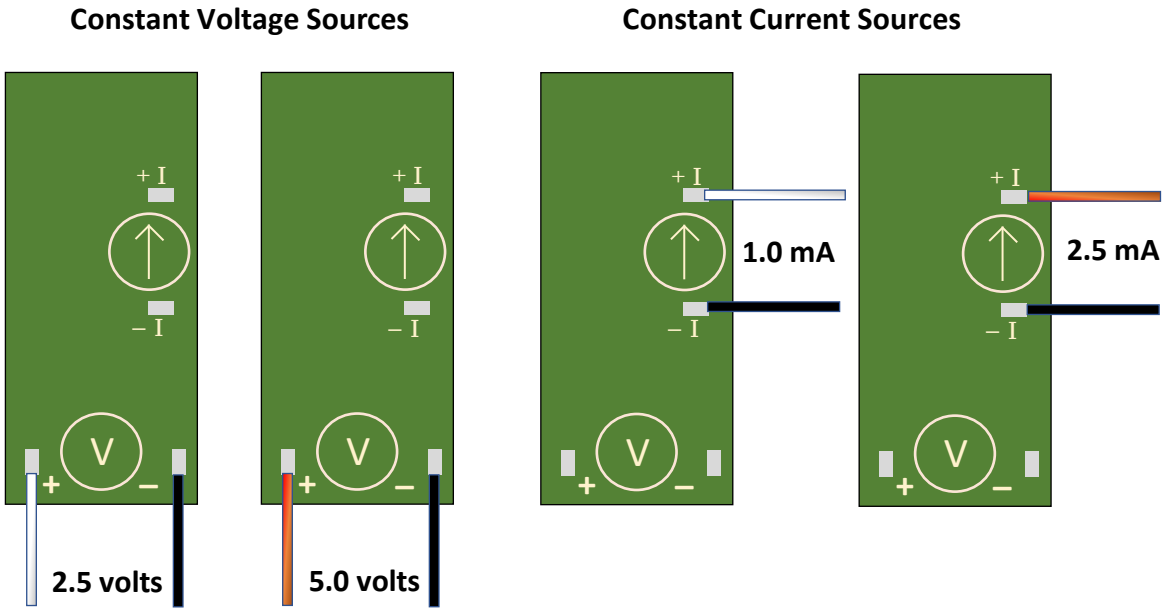
Rev: 01/23/2021

Description

Power Blocks (P-Blocks) are precision sources of stable DC current and voltage that together with a few electronics components and a digital multimeter enable low-cost, table-top exploration of of math, physics and electronics principles. P-Blocks come in four versions constituting a set. Two provide constant voltage; 2.5V and 5.0V, and two are constant current sources at 1.0 mA and 2.5 mA. Each is powered by its own 9-volt battery and therefore self-contained and independent. They can individually power circuits or, because there are no shared common connections, multiple units can be distributed as independent sources within multi-loop networks. For higher output levels, two or more voltage sources can be combined in series and multiple current sources can be combined in parallel. Outputs from each come on wires with solid AWG 22 conductors that connect well with solderless prototype circuit boards.

As shown below, output type – voltage or current, is indicated by where the wires attach and how they depart from the circuit board. Voltage sources have wires attached near the encircled "V" at the short side of the board and aligned with the board's long axis. Current source wires are attached near the flow arrow on the long edge and depart perpendicular to that edge.

Output level is indicated by insulation color for the positive (+) wire. Red indicates the higher level, 5.0 volts or 2.5 mA. White insulation indicates 2.5 volts or 1.0 mA. All negative wires are black.



Useful knowledge

* Dimensions with battery connected (mm): 57L x 25W x 20 H. (2.25 x 1.0 x 0.8 inches)
* 5.0V sources require higher battery voltage than the other sources. For stable output, battery voltage needs to be greater than about 7.5 volts. Batteries provide many hours of use before decaying to this level and they can then be used on the 2.5V source or the current sources.
* Voltage sources suffer life-ending damage when subjected to short-circuit loads.
* Load resistances presented to 5.0V sources should be 500 ohms (I = 10 mA) or greater for reasonable 9V battery life. Similarly, 250 ohms minimum with 2.5V is a good lower limit. Occasional, short duration use at lower resistances is fine but batteries do not survive for long at 50 mA and above.
* Current sources work fine at low load resistances all the way down to short-circuits at 0.0 ohms. Trouble comes at high values of resistance that require more voltage than is available. Your voltmeter and Ohm's Law will help you understand if there is a problem.

Things to do & not do

* Do not allow voltage source leads to touch. Voltage sources do not have over-current protection and current delivered into a short-circuit will blow out transistor Q2 and end the source's useful life.
* Do confirm that each of your P-Blocks provides the expected output. Voltage sources are easy, just measure it directly with the voltmeter. A simple way to confirm I-source current level is to measure the voltage produced with load resistance = 1.0 k-ohm. The current in milliamps is equal to the voltage across that resistance.
* Do construct your circuit(s) before connecting the 9V battery.
* Do connect the 9V battery only when you are actively using a source. Batteries last longer and the likelihood of a voltage source short-circuit problem is reduced.
* Do disconnect battery when P-Block is not in use.