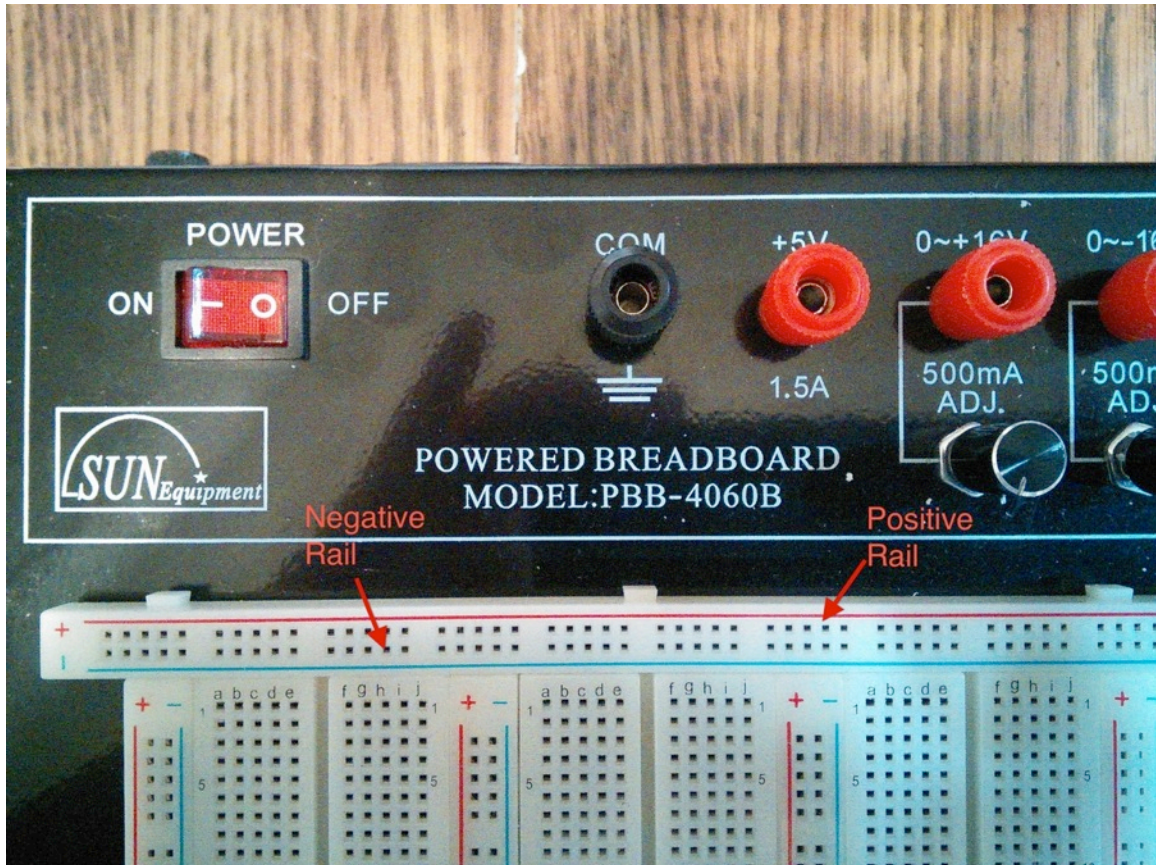
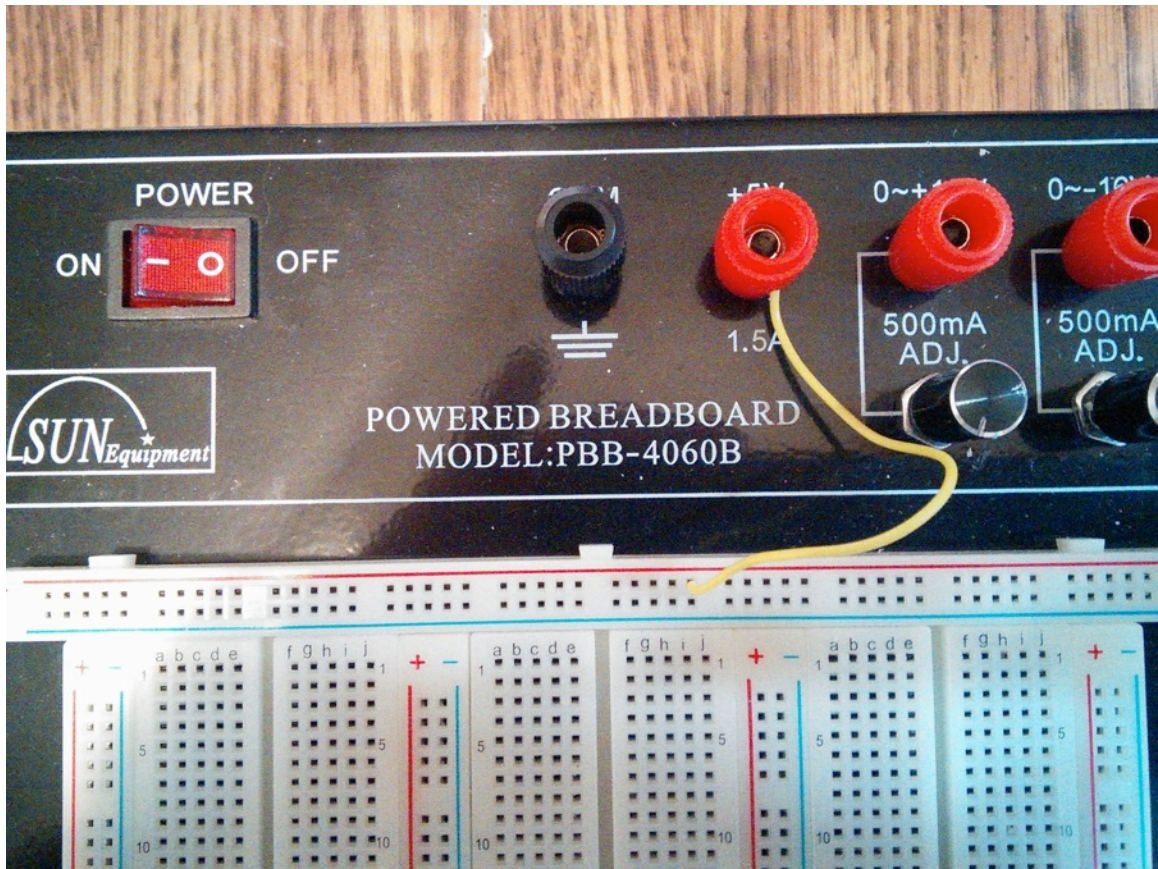


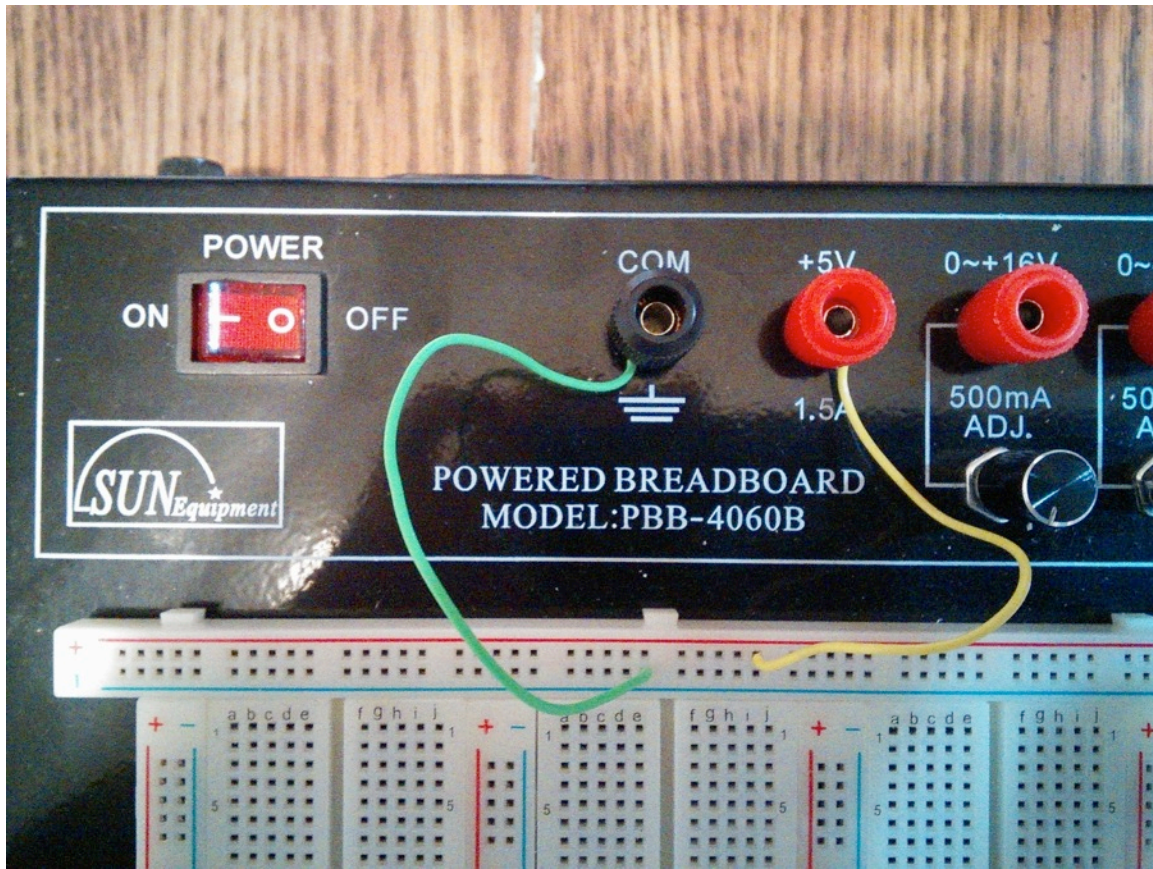
## Breadboard Tutorial



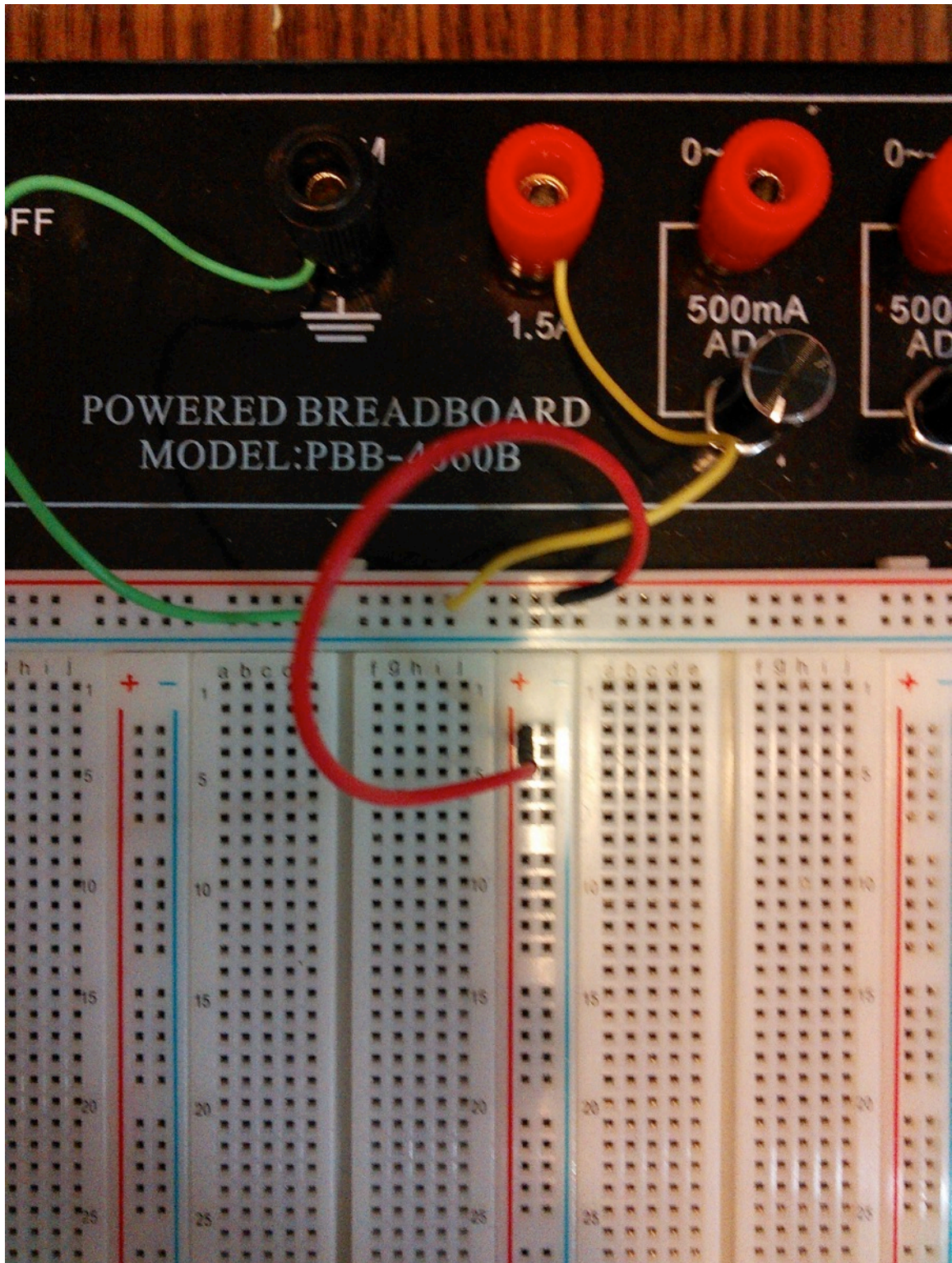
Notice that the breadboard has two horizontal rails, one positive and one negative. Additionally notice that there is a black thumbscrew labeled COM that represents ground lead (negative) and another red thumbscrew labeled +5V that represents the positive lead. Begin by partially unscrewing both the black and red thumbscrews.



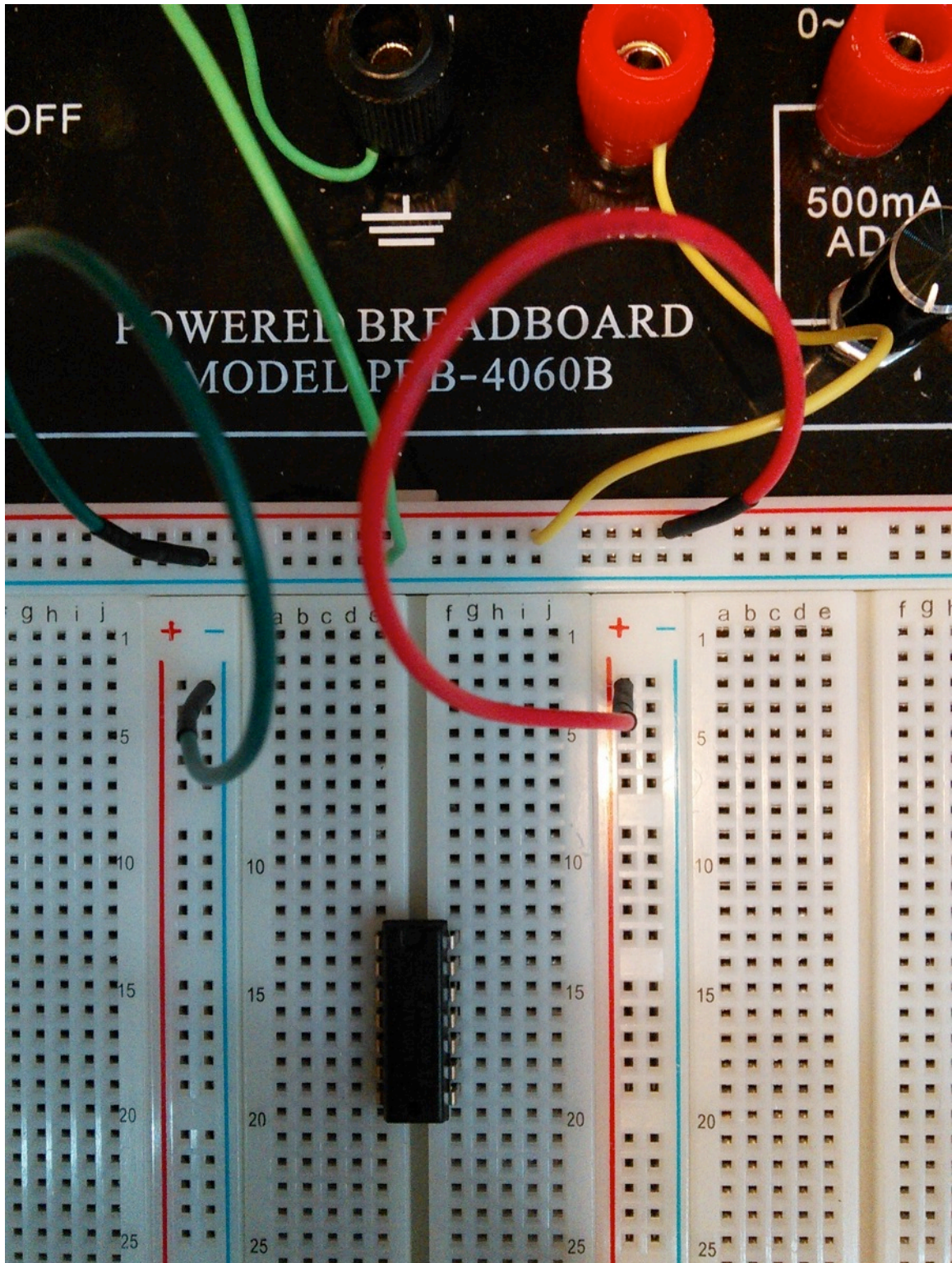
Attach a wire to the positive lead (red) and tighten the thumbscrew over the wire. Note that you will have to bend the wire so it will wrap around the screw. Put the positive wire in the positive rail. This is the top horizontal row of inputs. This will make every location along that row positive. You will notice that this row also has a plus (+) symbol on it.



Attach another wire to the ground lead (black) and tighten the thumbscrew over the wire. Note that you will have to bend the wire so it will wrap around the screw. Put the ground wire in the ground (negative) rail. This is the second horizontal row of inputs. This will make every location along that row positive. You will notice that this row also has a ground symbol on it and the word COM.

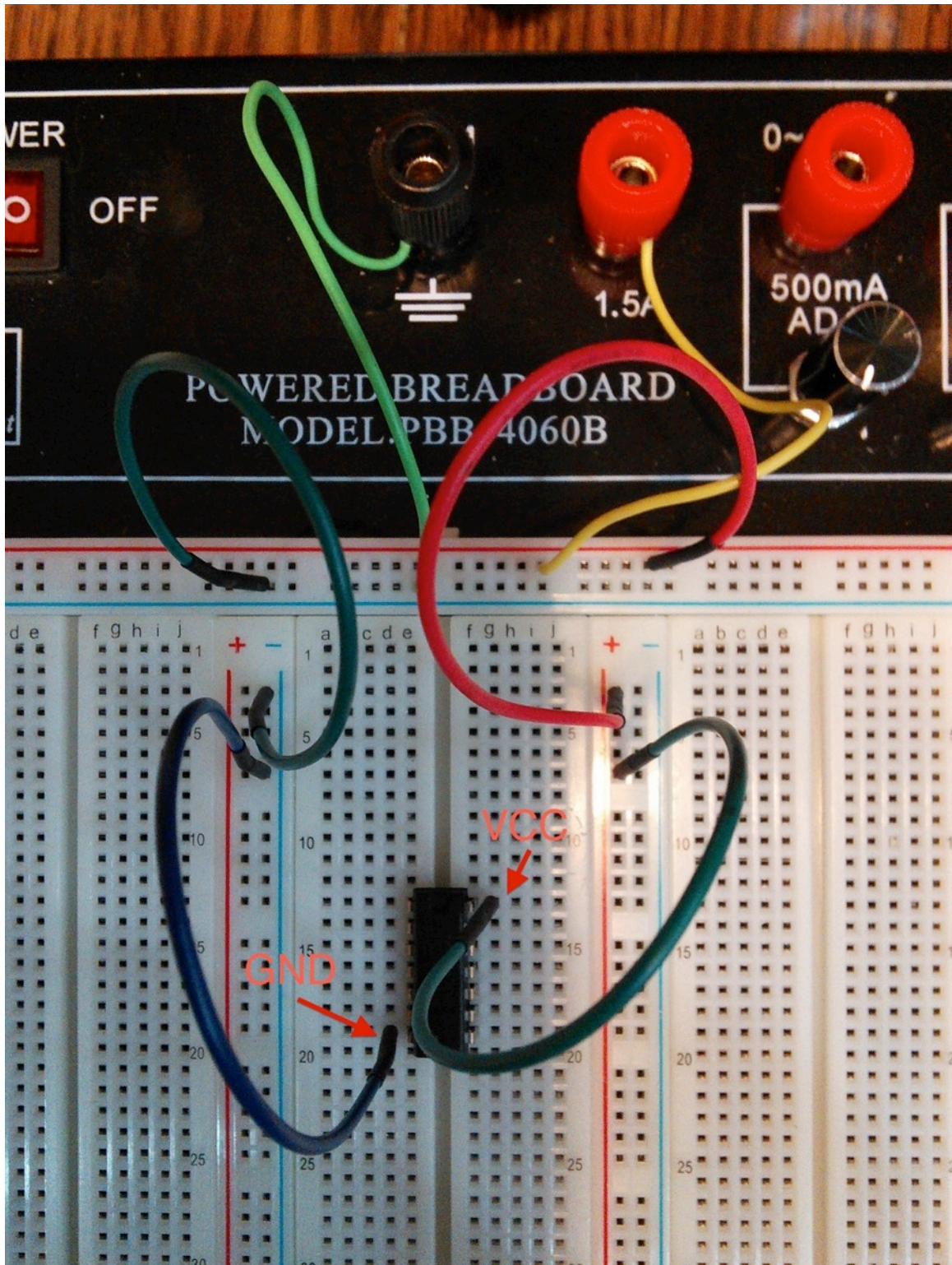


Near the vertical rails, there are three vertical ridges that provide a small separation between input locations. These ridges are wide enough to allow a chip to be plugged in. Plug a wire into the positive horizontal rail. Connect this wire to one of the vertical positive rails on the left of a ridge. This will make every location along that column positive.

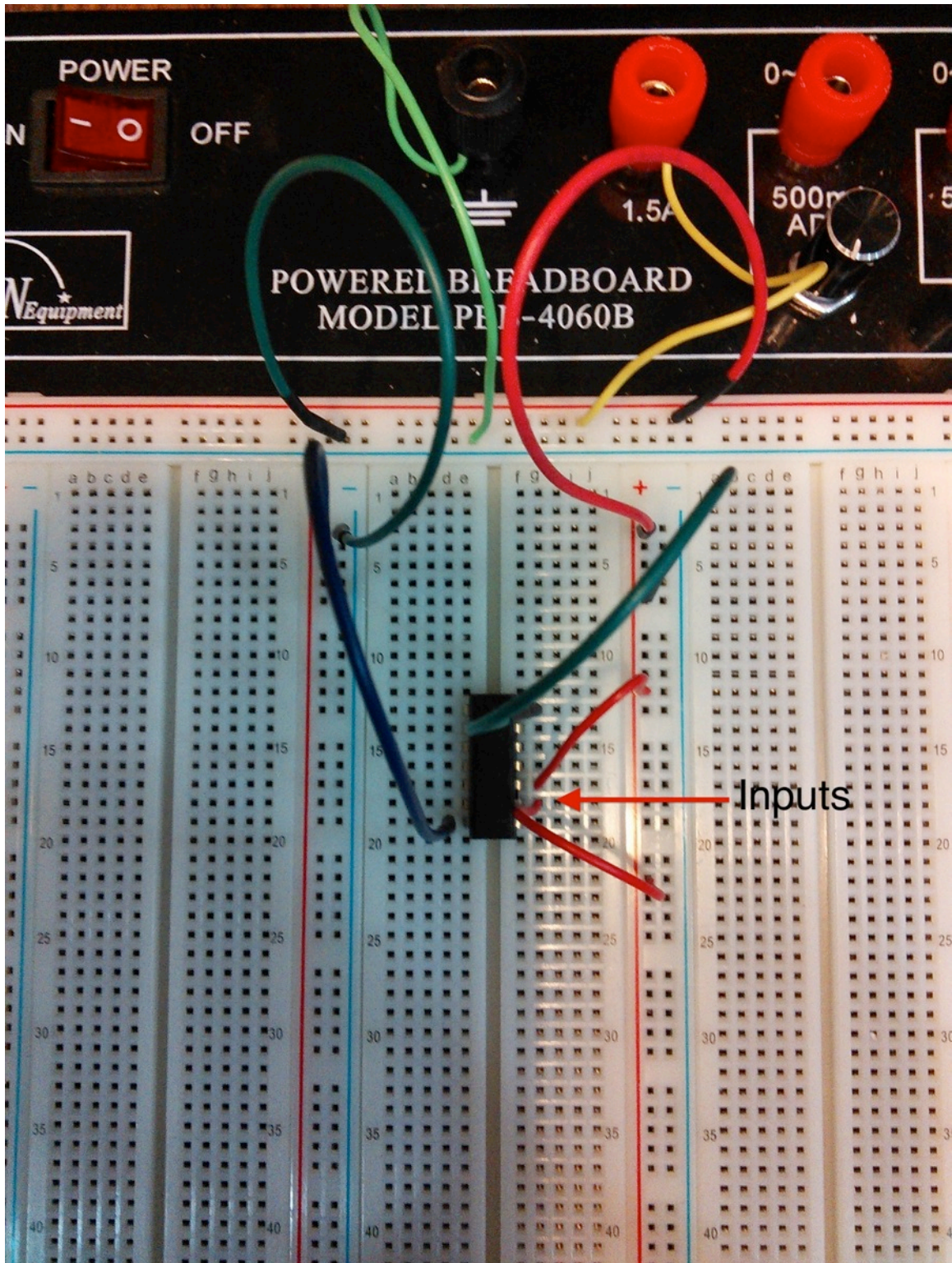


Next, plug a wire into the negative horizontal rail. Connect this to one of the vertical rails on the right of a ridge. This will make every location along that column negative.

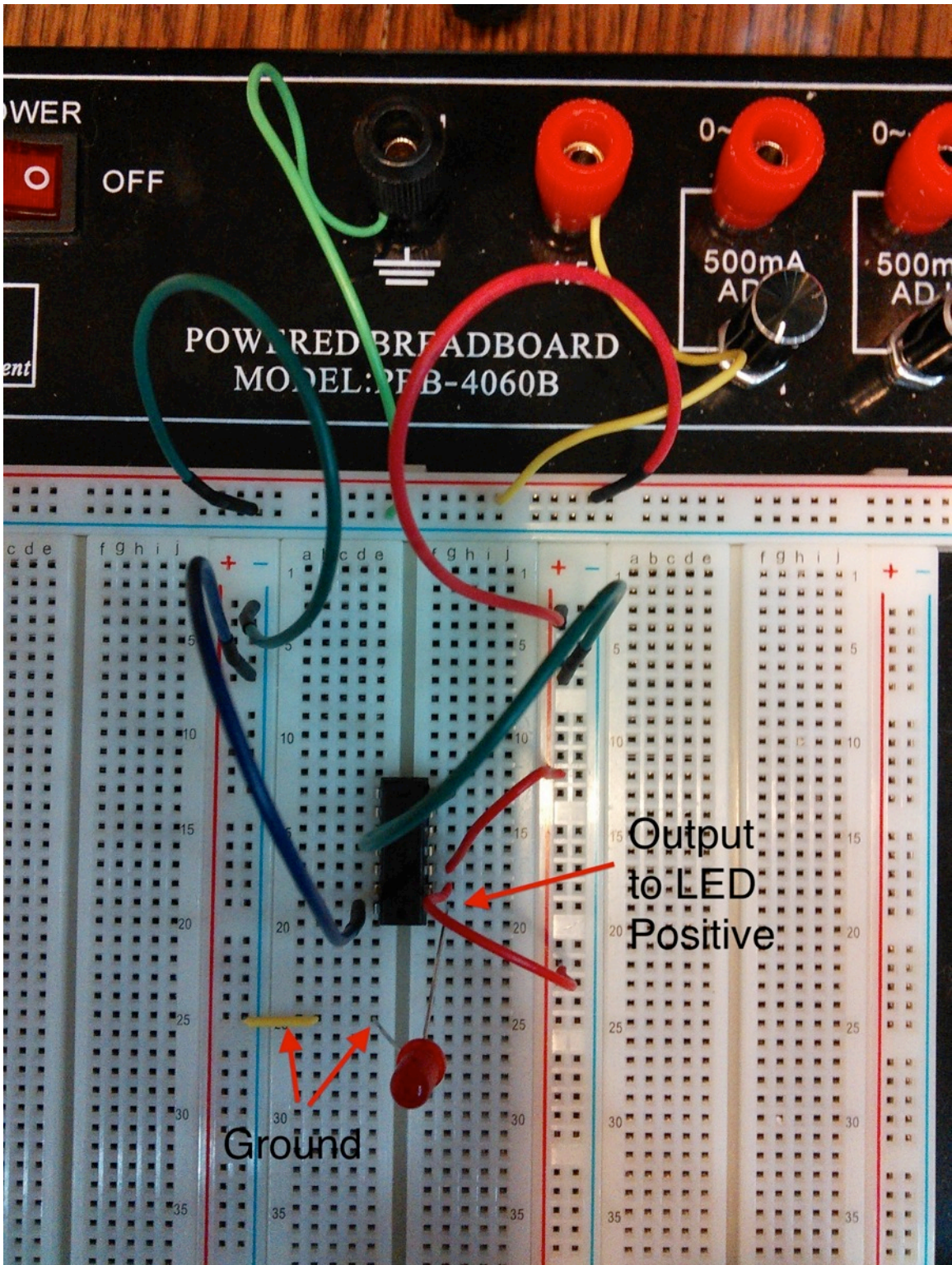
You can now plug in a chip such that its pins lie along either side of the ridge.



Be sure to consult the reference sheet to see where the VCC (positive input) and Ground (negative input) inputs lie. Make sure the chip is aligned properly. Plug in a wire to the positive vertical rail and into the VCC input. Plug in a wire to the negative vertical rail and the ground input. This will power the chip.

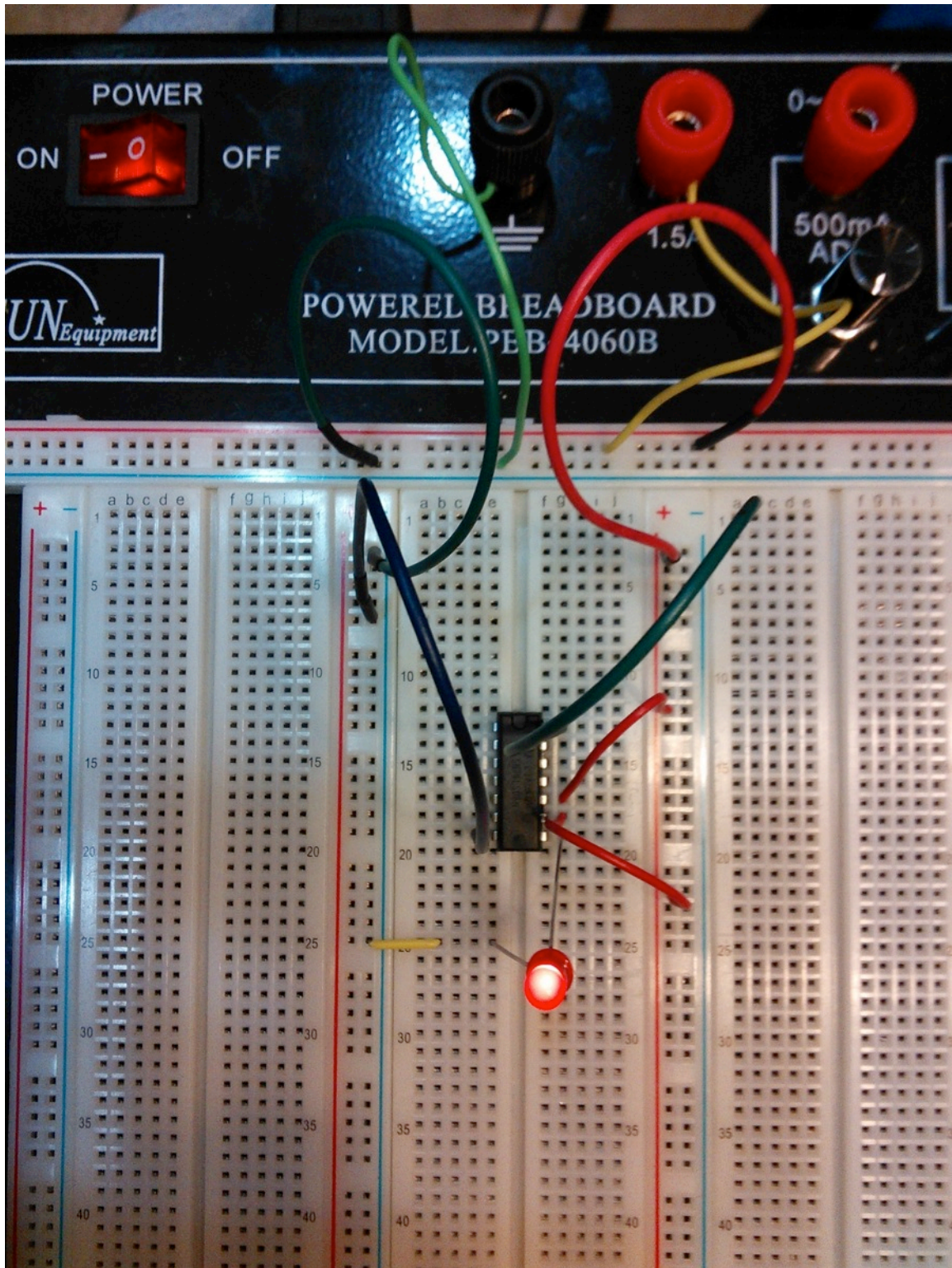


Finally, plug in wires to the gate inputs of your choice for the chip. Use positive for true and negative for false. The chip above contains four AND gates, and two positive inputs are provided to one of these gates.



Plug in an LED to the output of the gate from the chip. One wire from the LED should go into the output and the other wire from the LED needs to be plugged into a ground rail. Notice that a horizontal section of the breadboard bus can be made either positive or ground by connecting a rail to it. As indicated by the arrows showing where ground is available.





Now, you can power the breadboard. The LED should light up. If this doesn't work, try checking the connections. Power must flow through the LED in the proper direction. If it does not light up, first check your connections, then try reversing the LED.