130 in One Electronics Lab Tutorial

This electronics experimentation board is a simple and well organized way to learn and experiment with basic electrical circuits, as well as to build a variety of projects which require more and more calculations and planning. This tutorial is designed to give you a basic introduction to setting up the board, using the various components, as well as giving you a basis to base your own experiments on.

The board operates by connecting the various components together with the wires provided in your supply box. The connections are made by gently bending the spring to one side and inserting one end of the wire in the spring and returning the spring to the unstretched position. It is important to put your first wire low in the spring and then other subsequent wires closer to the top in order to lessen the chance of knocking an earlier installed wire loose. You will find that the shorter the wire you can get away with using, the less confusing your board will appear and the easier it will be to check your circuits for completeness and troubleshooting.

Each spring terminal has a number associated with it. These numbers allow for simple directions for building circuits and for comparing your circuit design with others.

***Powering Up***

Your lab board requires power in the form of six AA batteries. Install them in the battery holder on the back of the board. Make sure you get the positive and negative terminals lined up. You will learn more about why this board won’t work if you put the batteries in incorrectly.

The batteries are accessed on the front of your board using the terminals in the upper right hand corner of the board.

***Simplest Circuit***

Circuits are shown using a schematic drawing. Basically, that is a plan showing how the different parts of the circuit are put together. You will be learning the different symbols which represent different components as you go along. The following circuit is the simplest of circuits: a power supply in the form of a battery, conductors in the form of wires and a lamp in the form of a LED (light emitting diode). The components are labeled. Each component is also numbered, which corresponds to a terminal on your lab board.

When you wire this circuit, the LED should be glowing constantly. If you disconnect any wire, the LED goes out because the power is interrupted. In effect, you are actually using the disconnect as a switch. There are two types of switches on your lab board – one is labeled switch, the other key. The key is a spring steel contact that only closes the switch when you press it down. The other switch is able to control up to four circuits at once, depending on how it is wired. Insert the key switch into your circuit as shown below. Before pushing the key, make a theory as to what will happen.

PRACTICAL (P3): Experiment with the switch (131-136). How many different ways can you wire it to control the LED? Demonstrate them to your instructor and have them initial the P3 box on your activity sheet.

This circuit provides full power to the LED when the switch/key is closed. Underneath the LED is a resistor. Look carefully at the resistor and you will see different bands of colors on it. These bands of color indicate the resistance of the resistor. By applying resistance to the circuit, you limit the power to the LED. Wire the circuit as shown, but don’t attach the 38/39 wire. Touch it to first 38, then 39. See if there is a difference between the brightness of the LED.

It only makes sense that the more resistance there is before electrons get to the LED, the less brighter it will be. There are twelve resistors on your board ranging from 100Ω to 470KΩ. Make a prediction which one will allow the LED to be the brightest and which will give the dimmest LED. This is done by wiring the the37 terminal to the 122, and the 124 and 38 connected to wires, but not together. By touching the 38 wire and 124 wires to either end of a resistor, you can see the difference in light created by the LED. There is a small, black cone shaped piece in your supplies. This cone limits the amount of light that can get to the LED and allows you to see how much light it is giving off. Place this cone over the LED while testing the effects of different resistors.

There are other resistors on your lab board, but they aren’t as obvious – or as simple – as the solid resistors. The control dial (26, 27, 28) is a variable resistor. The Cds cell is a light sensitive cell which affects resistance.

PRACTICAL (P4): Hook the Cds cell into a circuit with an LED and power source. Demonstrate to your instructor how it works and explain the relationship between light and resistance and how it works in this circuit. Draw the schematic for the circuit on your activity sheet and have the instructor initial it.

PRACTICAL (P5) Build a circuit which incorporates the control variable resistor, draw the circuit on your activity sheet and demonstrate it for your instructor. Have the instructor initial the activity sheet.

The digital display is essentially a collection of LED lamps. Experiment with the digital display, lighting more than one at a time with one power source and controlling the intensity (brightness) of the LEDs.

PRACTICAL (P6) Build a circuit which causes the digital display to display the letter S and allow you to control the brightness of the display. Demonstrate this to your instructor and have your activity sheet initialed.

Multimeter Tutorial

You have an INNOVA 3320 multimeter in your supplies. There is also a complete manual attached to this package in Appendix A. Take a few minutes to read over the operation of the multimeter. This particular meter is an “autoranging” meter, which means it automatically determines the range, or limits, of what you are measuring. Non-autoranging meters require you to set the meter to measure within a certain range where you are expecting the reading to be. If you underestimate the range, you risk damaging the meter, or having to reset it for another range.

Sections 8-1 through 8-7 in your textbook deal with the technical explanation of how your multimeter works. Read over these sections before using

The first use for the meter that we want to practice is measuring resistance. Set your meter to the ohm symbol (Ω), black probe in the common port and red probe in the right hand port. The meter reads “O.L” which stands for “Off Line”, or that no measurement is being taken. Touch and hold the probes against one of the resistors in your lab board. It is important to contact bare metal and hold the probes still. The top line of the meter where it reads “AUTO” and “Ω” will also read in kilo and mega ohms, so make sure when you are reading the measurements you include the prefix when applicable.

You will notice that the reading on the meter doesn’t always equal the rating on the resistance source. There are a couple reasons for this. One is the fact that the resistors are soldered into a board and there may be some residual or leftover conductivity or resistance from the terminals. If you are able to acquire resistors or an item which may have electrical resistance to it (such as heating coils), measure from the ends of the unit when it isn’t attached to the rest of the equipment and the results should be more accurate.

PRACTICAL (P7) Measure the resistance of the Control resistor at each of the 10 positions. Record your results on your activity sheet and have your instructor initial it.

To use your multimeter as a voltmeter for DC voltage, set the selector to DCV and test the voltage of lab board’s power source.

PRACTICAL (P8) Take the batteries out of the lab board and measure the voltage of each battery. Explain to your instructor why the batteries are not exactly the same in voltage. If they are exactly the same, you are very lucky. Get your instructor to initial your activity sheet.