Lab Manual

This lab manual functions as a guide through the labs.

Don't lose it, you will need the help

Lab 1

The goal of this lab is to design and build a circuit that turns an led on from a constant voltage source.

The second part of this lab will be creating an I-V plot of the LED in the circuit.

If any questions arise during the lab, there are TA's walking around who are more than happy to help.

Lab 1

An LED has a few characteristics that need to be taken into account in order to calculate the right values of passive components used to power the LED.

These characteristics are the forward voltage and the forward current denoted by Vf and If

The values for these is given by the datasheet which can be found on your desk

Lab 1

After finding Vf and If, we can design a circuit that will make sure these voltages and currents are actually provided to the LED. Since we are working with a constant voltage supply of 5V, The circuit to provide the right voltage and current to the LED can simply be a series resistor. Draw a schematic of the circuit and let the TA's check it for errors

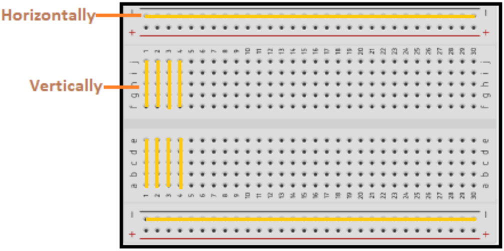
Lab 1

Congratulations!! You made the correct circuit. Now it's time to calculate values for the components used. For this, a few laws are noted below of which some might prove useful.

Capacitance	Ohm's law	Maxwell eq.
$C = \frac{Q}{V}$	$V = IR$	$\nabla \cdot E = \frac{\rho}{\epsilon_0}$
$V = \frac{Q}{C}$	$I = \frac{V}{R}$	$\nabla \cdot B = 0$
$Q = CV$	$R = \frac{V}{I}$	$\nabla \times E = -\frac{\partial B}{\partial t}$
		$\nabla \times H = J + \frac{\partial D}{\partial t}$

Lab 1

After finding the right values, the circuit can be built. The TA's will provide you with components and a breadboard. follow the diagram below to find out where to put which component.



Notice that there are horizontally and vertically connected holes

Lab 1

Now that the circuit is built, ask a TA to check the circuit for errors. After approval, the power supply can be connected and turned on to provide constant 5 volts.
If everything went well, the LED should light up and stay lit without turning black, burning, exploding or commencing radioactive decay.

Lab 1

The last part of this lab will be the creation of an I-V plot. Here we change the voltage of the power supply and note down the voltage across the LED and the current through it. For this measurement we shall use the multimeters in the upper cabinets.

After finding sufficient values for current and voltage we can make a graph in which all the points are connected by a smooth line.

Lab 1

Congratulations!

The I-V plot is done and all it took was blood sweat and tears.

You may check the I-V plot with the TA's to see if it's correct.

You won't need this manual until later when you're back for lab 2

See you then :)

Lab 2

Ah! you have returned for lab 2. Welcome back :)
As stated before, don't lose this manual, you will need the help.

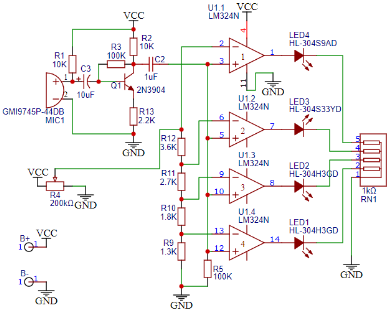
Similarly, TA's will be walking around who will assist in any way needed when questions arise.

For this lab a soldering iron will be used, these get extremely hot so stay alert and use common sense whenever the soldering iron is on

Lab 2

The goal of lab 2 is to solder a full VU meter. All components for this will be supplied beforehand.

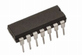
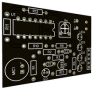
There is a small appendix at the back of this lab's section with troubleshooting in case necessary.



Lab 2

First of all, check if everything is present in the bag provided.

Bag contents:

- 9 resistors 
- 2 capacitors 
- 1 transistor 
- 1 resistor network 
- 4 led's 
- 1 chip and socket  
- 1 microphone 
- 1 potentiometer 
- 1 battery connector 
- PCB 

Lab 2

Before soldering anything in place, it's important to get comfortable with the soldering iron.

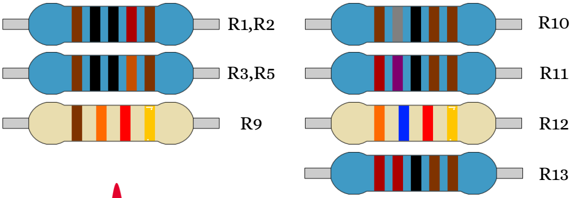
Start by turning the soldering iron on and setting the temperature to between 370°C and 450°C

Get a bit of solder wire and try touching the tip of the soldering iron with said solder.

The solder should have melted and stuck to the tip of the soldering iron. The solder can be removed using brass wire or a sponge.

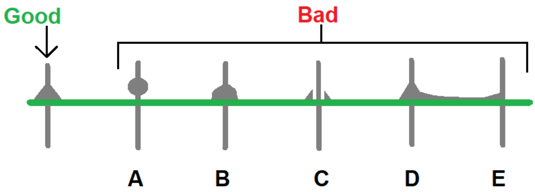
Lab 2

Now that the soldering iron is nice and hot and the nose is filled with vaporized flux, let's start by soldering in all the resistors. We start with resistors as they are the lowest components. The resistance of a resistor is denoted by the colored stripes on the resistor itself. The following color codes should be in the bag:



Lab 2

A good solder joint is made when the soldering iron heats up the PCB and the component at the same time before applying the solder. This way the solder will flow and create a triangle of solder connecting the component to the PCB.



Lab 2

After the resistors, the next lowest component will be the transistor. The transistor is denoted on the PCB as Q1. It's leads are very close making it hard to solder. If you aren't sure you will be able to properly solder this in place, let a TA help you and proceed.

The next component will be the ceramic capacitor. Denoted by C2 The capacitor's leads need to be spread apart before soldering to make it fit

Lab 2

Now seems like a good time to solder in the microphone denoted with MIC1. Make sure it's oriented correctly

After this, the LED's can be soldered. Start with two green LED's in position 1 and 2, followed by yellow for 3 and red for 4. Also make sure to put the longer lead through the hole with a small +. To solder the LED's straight, push from behind while soldering

Lab 2

Next is the electrolytic cap at C3. This component, like the LED's, has the longer lead poke through the hole with a little +.

After this, the resistor network can be soldered into place. Make sure the white dot on the black package is above the square pad. This white dot indicates pin 1.

The penultimate component will be the potentiometer in place R4.

Lab 2

Feed the battery connector wires through the holes, red going to B+ and black going to B-.
As the final component, orient the socket to align with the white outline and solder all 14 pins.
After all is done, insert the chip.
Note while inserting, you might have to persuade the pins of the chip inwards to fit into the socket.
Now you're ready to connect a 9V battery to the connector and watch as the LED's react to sound!