

Building circuits

Record all measurements made as part of the lab under the relevant section. Graphs of current or resistance versus voltage when relevant are encouraged.

Basic circuit:

1. Turn on the Raspberry pi (Rpi)
2. Connect one of the 5V pins on the Rpi to the + column on the breadboard
3. Connect one of the ground pins on the Rpi to the - column on the breadboard
4. Run a connector from the + column to one row on the main part of the breadboard
5. Run a connector from the - column to a different (but close) row on the main part of the breadboard
6. If we connected a 1Ω resistor between these two rows - so that it is in a closed loop with the 5V supply from the Rpi, how much current would this circuit attempt to draw across the resistor?
 - a. The Rpi adaptor provides 5V and up to 2 Amps, is this current sufficient?
No, the resistor would require 5 Amps of current and the raspberry pi only give 2 Amps
 - b. What do you think might happen? Please don't actually do this.
It'll either overheat and burns or short out the raspberry pi
7. Connect a resistor of more than at least 50Ω (Why might this be enough resistance?)
 - a. If you have a multimeter able to measure current evaluate the current across the resistor, is it what you expected?
100 Ω : Estimate 50 Milla Amps: Actual 50-40
1000 Ω : 5 mila amps: actual 5-4

LED in a circuit:

1. Add an LED to your circuit
 - a. Put it in series with the resistor and move the +/- connectors to the RPi 5V supply as needed
 - i. How does the diode need to be oriented? Which wire on the LED goes to the +5V side and which goes to the GND connector?
The longer one should be connected to the
 - b. What is the voltage drop across the resistor? Was this what you expected?
2.272V
 - c. What is the voltage drop across the LED?
2.854V
2. Try removing the resistor from the circuit, keeping the circuit closed - the LED is just in series with the 5V supply.
 - a. What do you think will happen to the LED brightness?
It'll get brighter 4.95V
3. Try including resistors of different values - how does LED brightness change vs resistor strength?
 - a. Do the voltage drops across the resistors and LED change?
560 Ω : 2.059 BULB:3.059
22k: 2.889 Bulb: 2.257
4. Using the configuration with the highest LED brightness now move the 5V connection on the RPi to one of the 3.3V pins.
 - a. What do you expect to happen to the LED brightness?
It should get dimmer because there's less
560 Ω : .661V Bulb 2.26V
5. Add a step-up circuit components to increase your RPi voltage from 5V to 10V but do not close your circuit yet
 - a. Using the dimmest configuration for the LED explored previously (meaning select the appropriate resistor from those you tried previously) now
 - b. How will the LED brightness change?
It got a little brighter
22k Ω 7.62 bulb: 2.378
6. How would you quantify the LED brightness changes?
You would use a light meter to quantify the change in led brightness.

Photo-diode:

1. Replace the LED with a photo-diode (remove the step-up component as well if you had one included previously)
 - a. NOTE: photo-diodes operate in reverse bias mode so you will need to orient the diode accordingly
2. What is the voltage across the resistor when you simply connect the 5V supply to close this circuit?
22k Ω 0.126 BULB: 5.015
3. What happens if you cover the photo-diode? What happens if you change the +connector to go to the 3.3V pin on the Rpi?
 - a. What is the dark current for this photo-diode?
5V = 0.0000001818 3.3V = 0.00000018
 - b. Is 5V enough supply voltage to see a signal from this diode? Is 3.3V?
Yes because we saw a signal from the reader. For 3.3V
 - c. What happens if you attach the step-up circuit component to increase the supply up to 10V?
0.008 v
4. What are the dark current and saturation current for the photo-diode?