Module 5 – Measure Voltage with ESP32

For this module you will need:

- ESP32
- Breadboard
- Male-to-Male jumper wires
- Two 10k Resistors

Be sure the ESP32 is unplugged.

We will now create a simple circuit that will help us measure the power voltage.

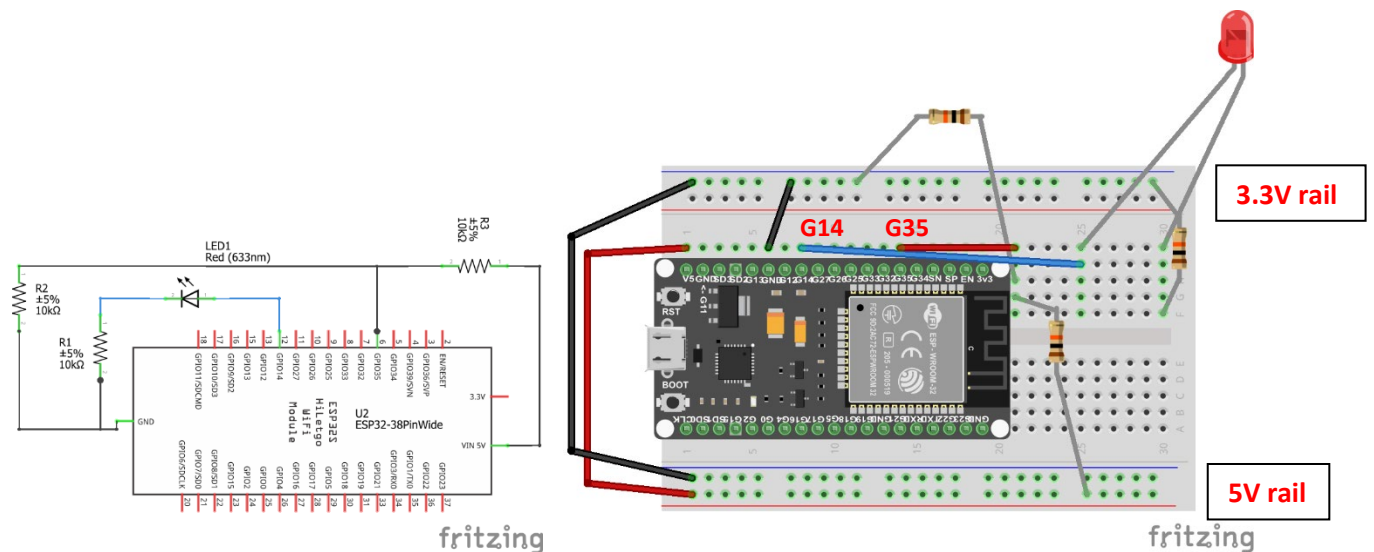The circuit we will create is called a **voltage divider circuit**.

Add onto the breadboard from Module 4.

Jumper V5 to **red rail on the BOOT button side. Jump the GND rails (on both sides) together.**

One 10kΩ resistor connecting red rail and row 21

One 10kΩ resistor connecting blue rail and row 21

Connect G35 to row 21

Adapted from:

In the Arduino IDE, add to the code:

Click the arrow and upload the code.

Click on **Tools->Serial Monitor**

In this code, pin G35 will read the voltage level, and display it on the screen.

The number displayed is only an index to the actual voltage.

What is a voltage divider?

A **voltage divider** is a simple circuit which turns a large voltage into a smaller one. Using just two series resistors and an input voltage, we can create an output voltage that is a fraction of the input. Voltage dividers are one of the most fundamental circuits in electronics. If learning Ohm's law was like being introduced to the ABC's, learning about voltage dividers would be like learning how to spell *cat*.

The Circuit

A voltage divider involves applying a voltage source across a series of two resistors. You may see it drawn a few different ways, but they should always essentially be the same circuit.

Adapted from:
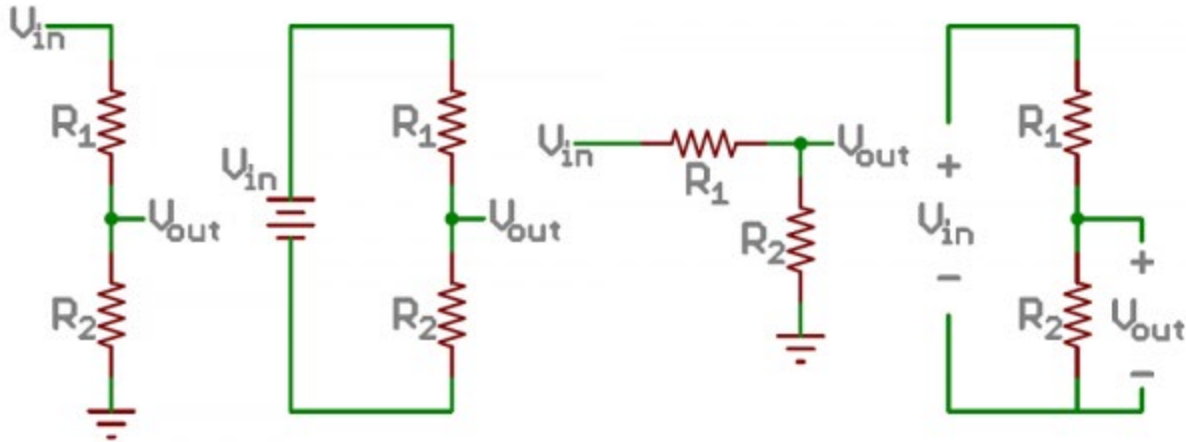
Examples of voltage divider schematics. Shorthand, longhand, resistors at same/different angles, etc.

We'll call the resistor closest to the input voltage (Vin) R1, and the resistor closest to ground R2. The voltage drop across R2 is called Vout, that's the divided voltage our circuit exists to make.

That's all there is to the circuit! Vout is our divided voltage. That's what'll end up being a fraction of the input voltage.

The Equation

The voltage divider equation assumes that you know three values of the above circuit: the input voltage (Vin), and both resistor values (R1 and R2). Given those values, we can use this equation to find the output voltage (Vout):

$$V_{out} = V_{in} \cdot \frac{R_2}{R_1 + R_2}$$

Memorize that equation!

This equation states that the output voltage is **directly proportional** to the **input voltage** and the **ratio of R1 and R2**.

Calculator

Have some fun experimenting with inputs and outputs to the voltage divider equation! Below, you can plug in numbers for V_{in} and both resistors and see what kind of output voltage they produce.

V_{in} = 5 V
R_1 = 10000 Ω
R_2 = 10000 Ω
V_{out} = 2.50 V

Or, if you adjust V_{out}, you'll see what resistance value at R_2 is required (given a V_{in} and R_1).

There is a voltage divider calculator here: https://learn.sparkfun.com/tutorials/voltage-dividers/all