
# ASUENG

## MCT232 – Electronics for Instrumentation

**Final Project**
**Digital Avometer using Arduino**

## Team Names :


| | |
|---|---|
| Eslam Sayed Rady Abbas | 1902236 |
| Mohamed Osman Ahmed | 18w5274 |

- **Introduction**

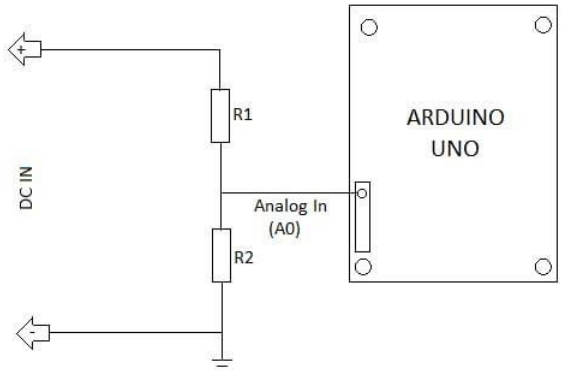
Digital multimeter, or DMM, has a component called an analog-todigital converter in it which turns a voltage into a number. That number, after some processing, is then displayed on the digital display.

To measure current, the the DMM has a low-value resistor with a known value. The current being measured flows through this resistor, and the DMM measures the voltage across it. From that voltage, the DMM calculates the current using Ohm's Law (I=E/R), and then displays the value on the digital display.

To measure resistance, the DMM has a current source of a known value. When connected to a resistance, that current flows through the resistor, generating a voltage. The DMM measures that voltage and using the Ohm's Law equation R = E/I, calculates the resistance and displays the value on the digital display.

- ***Voltmeter :-***

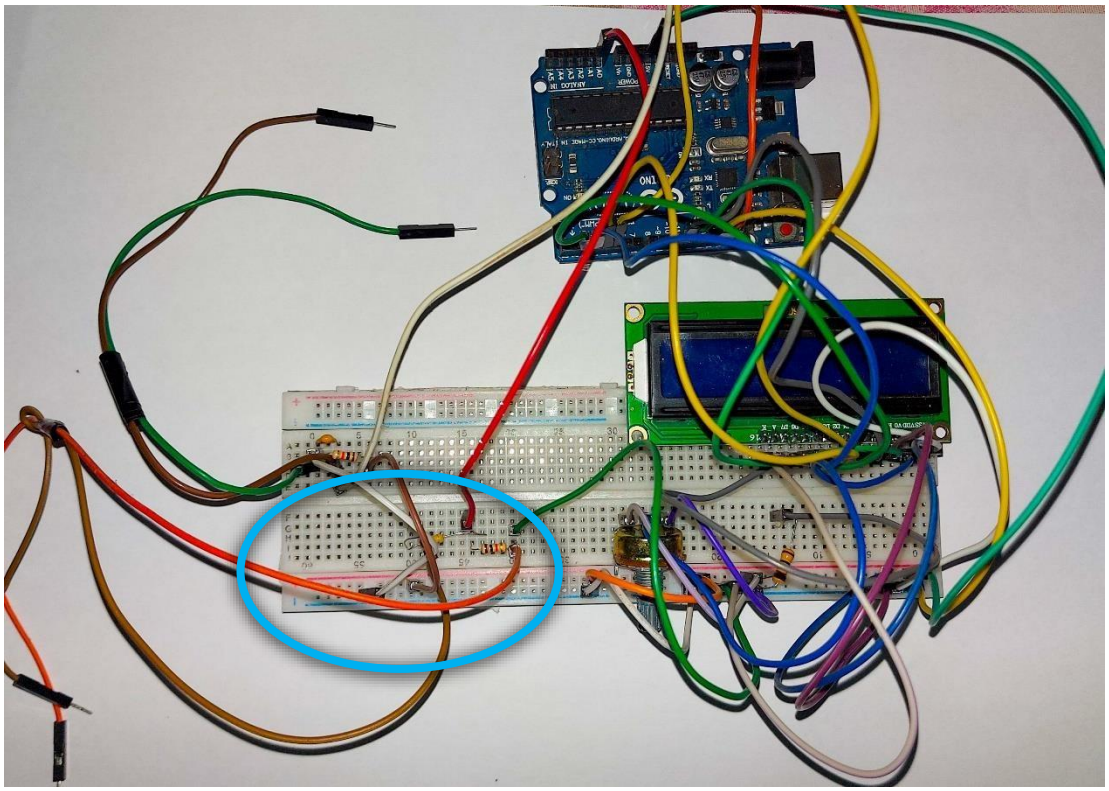
Digital voltmeter is the basic instrument used for measurement of voltage through the use of Analog to Digital converter. The basic principle behind digital multimeters is the Analog to digital converter because without this we are not able to convert the analog output into digital form.




- How it works

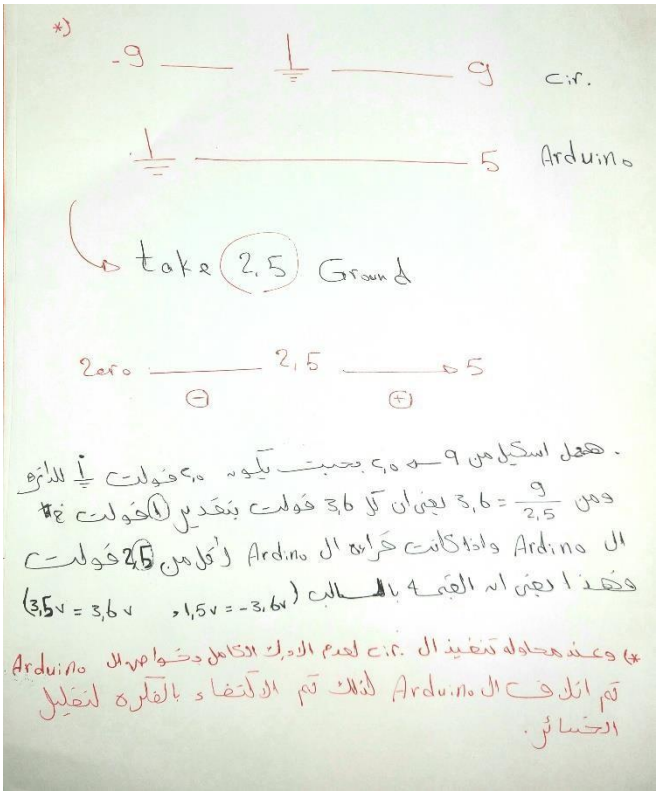
The analog sensor on the Arduino board senses the voltage on the analog pin and converts it into a digital format that can be processed by the microcontroller. Here, we are feeding the input voltage to the analog pin (A0) using a simple voltage divider circuit comprising resistors R1 (100K) and R2 (10K). With the values used in the voltage divider it is possible to feed voltage from 0V to 55V into the Arduino board. The junction on the voltage divider network connected to the the Arduino analog pin is equivalent to the input voltage divided by 11, so 55V ÷ 11 = 5V. In other words, when measuring 55V, the Arduino analog pin will be at its maximum voltage of 5V. So, in practice, it is better to label this voltmeter as “0-30V DVM” to add a safety margin!

## Our circuit



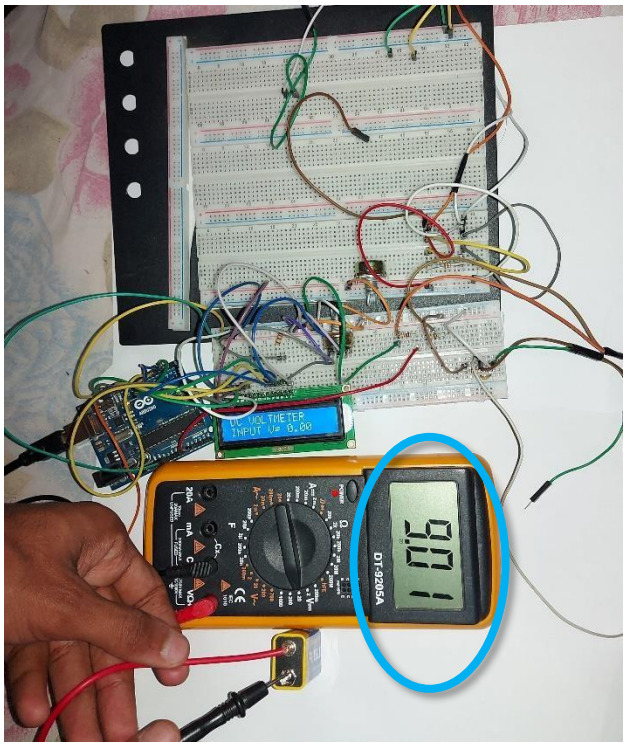
- **For range [ -9 V, 9 V ]**

**The idea is on the side, but when the connections were made, the Arduino was destroyed without knowing the reason, so the idea was satisfied**

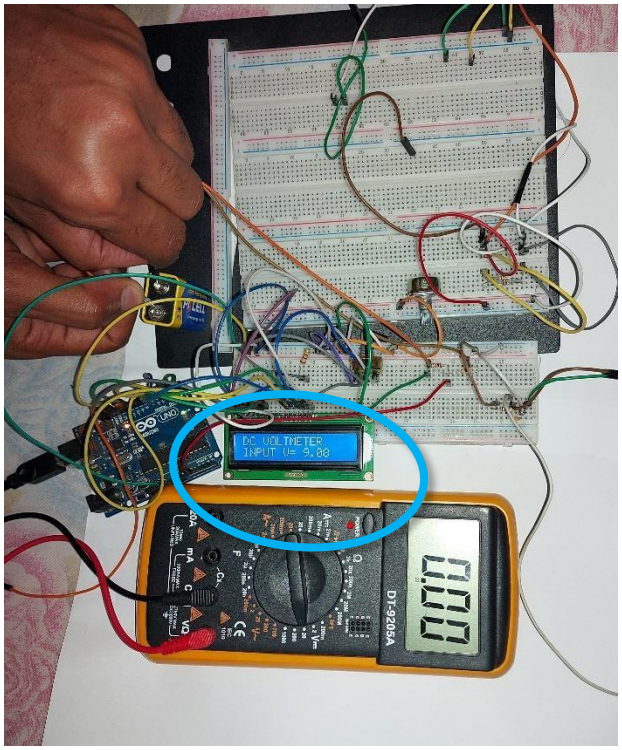


## Practical results

Test 1

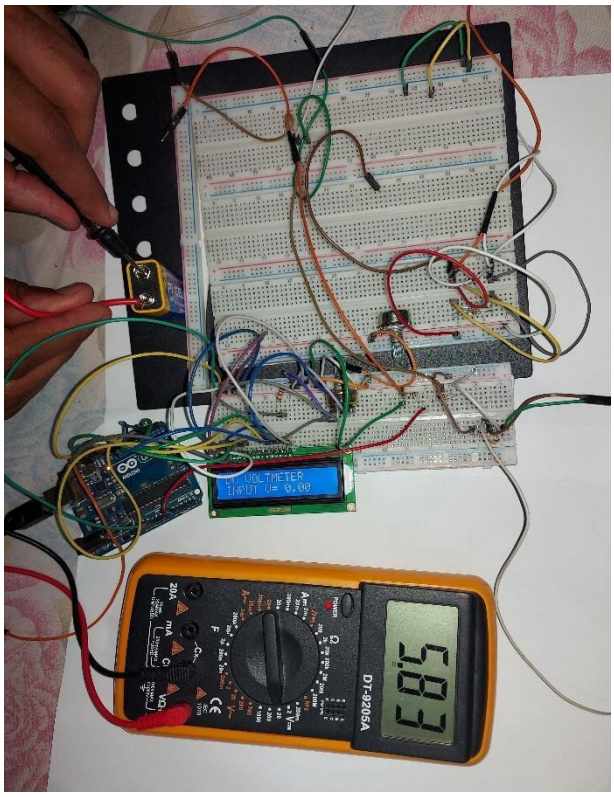


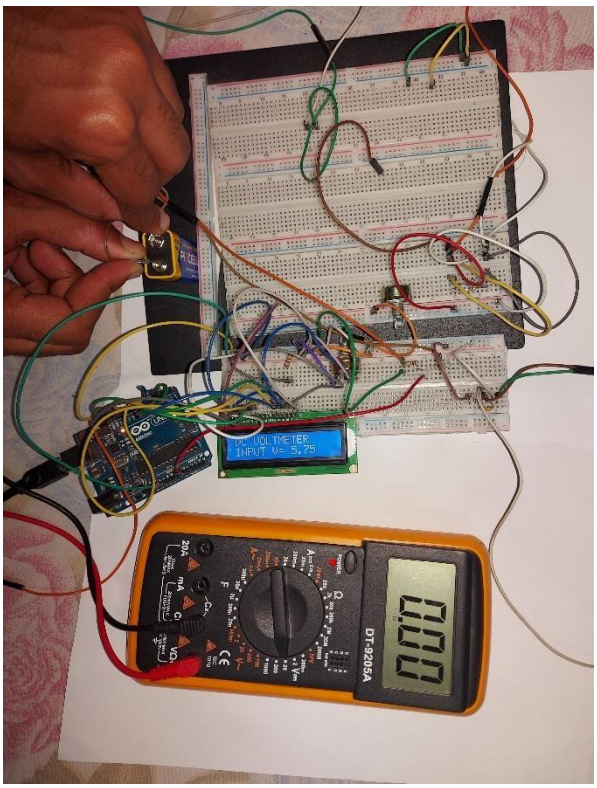

AVO




circuit

Test 2



AVO circuit

## Short sequence for the code

code

```
// Define the pins for voltage, current, and resistance measurement
const int voltagePin = A0;
const int currentPin = A1;
const int resistancePin = A2;

// Define the pins for continuity test
const int continuityPin = 7;

// Define the variables for storing measurement values
float voltageValue;
float currentValue;
float resistanceValue;

void setup() {
  // Set the pins as input or output
  pinMode(voltagePin, INPUT);
  pinMode(currentPin, INPUT);
  pinMode(resistancePin, INPUT);
  pinMode(continuityPin, INPUT);

  // Start serial communication
  Serial.begin(9600);
}
```

```
void loop() {
  // Measure the voltage and convert the value to volts
  voltageValue = (analogRead(voltagePin) * 5.0) / 1024.0;

  // Measure the current and convert the value to amperes
  currentValue = (analogRead(currentPin) * 5.0) / 1024.0;

  // Measure the resistance and convert the value to ohms
  resistanceValue = (analogRead(resistancePin) * 5.0) / 1024.0;
  resistanceValue = (5.0 - resistanceValue) / resistanceValue;

  // Check for continuity
  int continuityValue = digitalRead(continuityPin);

  // Print the measurement values and continuity result to the serial monitor
  Serial.print("Voltage: ");
  Serial.print(voltageValue, 2);
  Serial.println("V");

  Serial.print("Current: ");
  Serial.print(currentValue, 2);
  Serial.println("A");

  Serial.print("Resistance: ");
  Serial.print(resistanceValue, 2);
  Serial.println("Ω");

  if (continuityValue == HIGH) {
    Serial.println("Continuity: Yes");
  } else {
    Serial.println("Continuity: No");
  }

  // Wait for a brief moment before taking measurements again
  delay(500);
}
```

Done Saving.

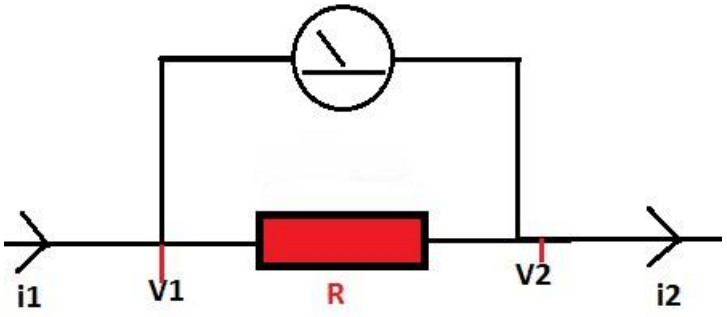
Note :

We have error = (- + )0.03

- Ammeter

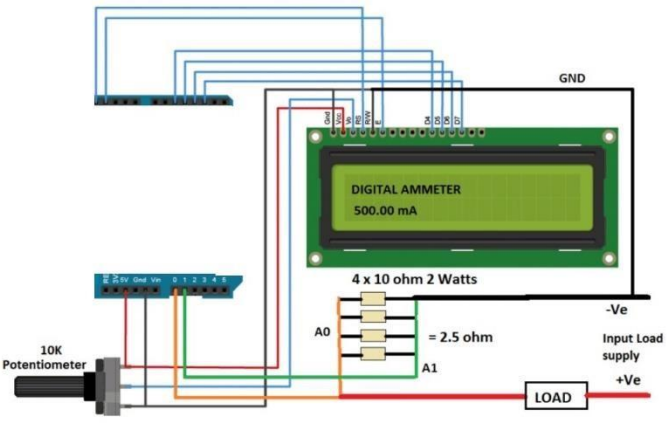
Its a device or instrument that is used to measure the current is called the ammeter. The unit of the current is ampere. So this device measures the current flow in ampere is named as an ammeter or ampere meter. The internal resistance of this device is ‘0’ however in practical; it has some amount of internal resistance. The measuring range of this device mainly depends on the resistance value.

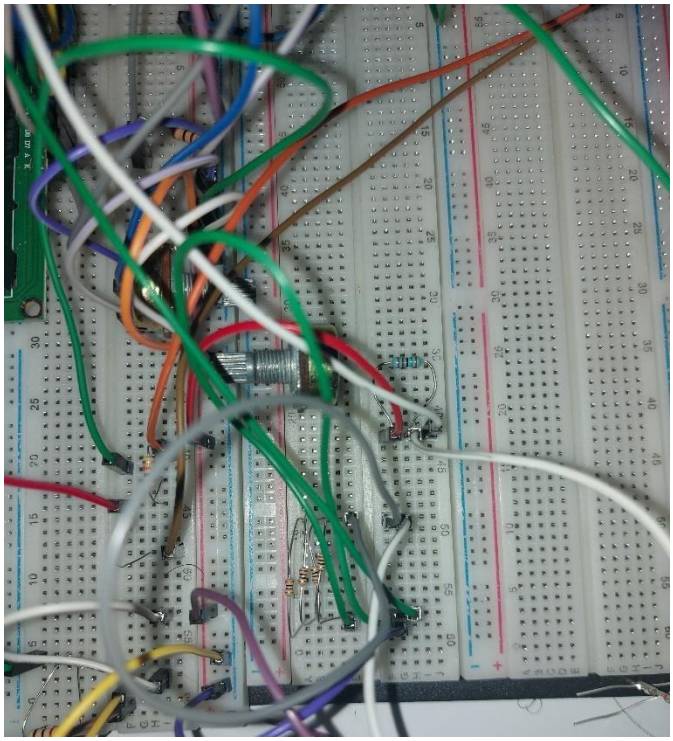
## How it works




The working principle of an ammeter mainly depends on resistance as well as

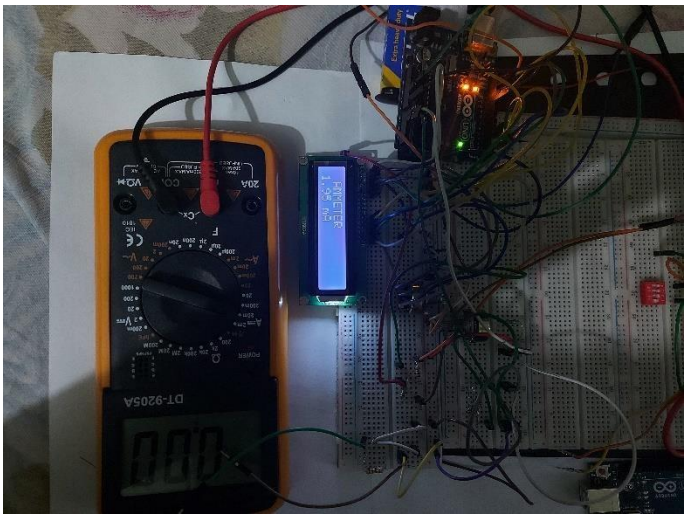
## The idea of measure

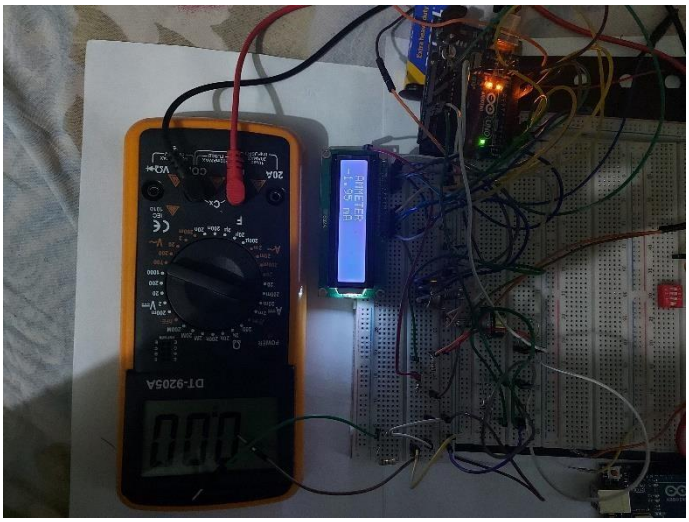


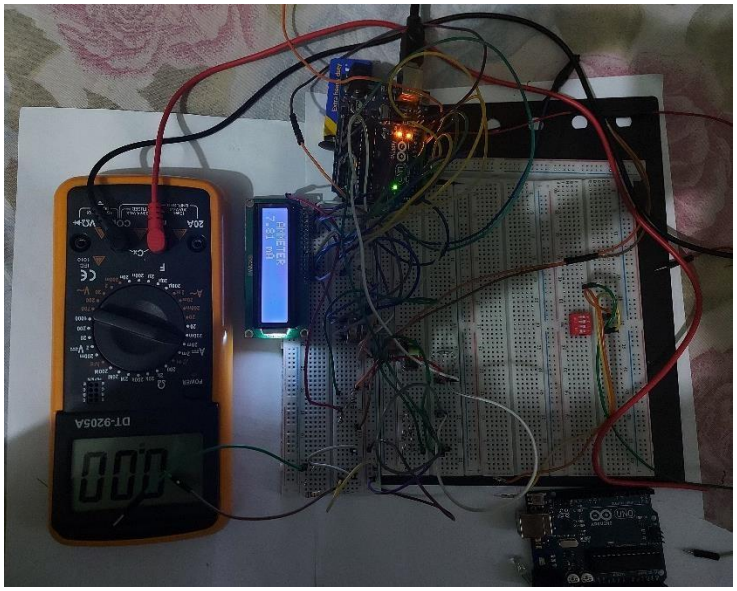
inductive reactance. This device includes extremely less impedance because it must include less amount of voltage drop across it. It is connected in series because the flow of current within the series circuit is the same.

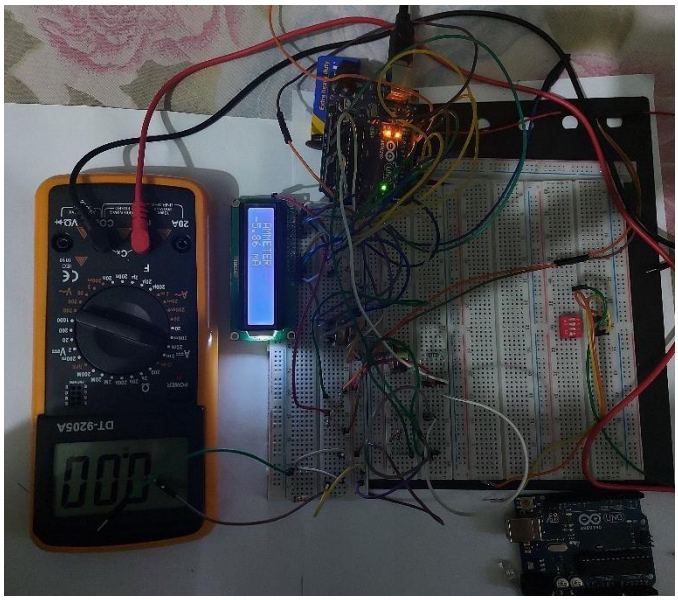
Test 1





Test 2



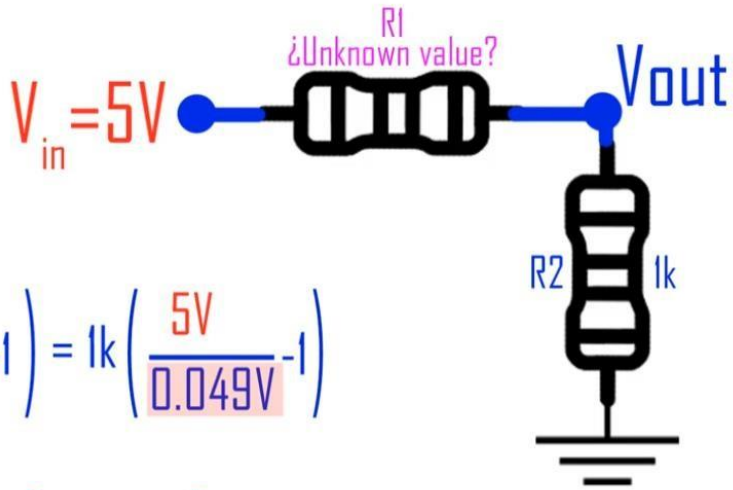


- Ohmmeter

ohmmeter is an electrical instrument that measures electrical resistance (the opposition offered by a substance to the flow of electric current) .

## How it works

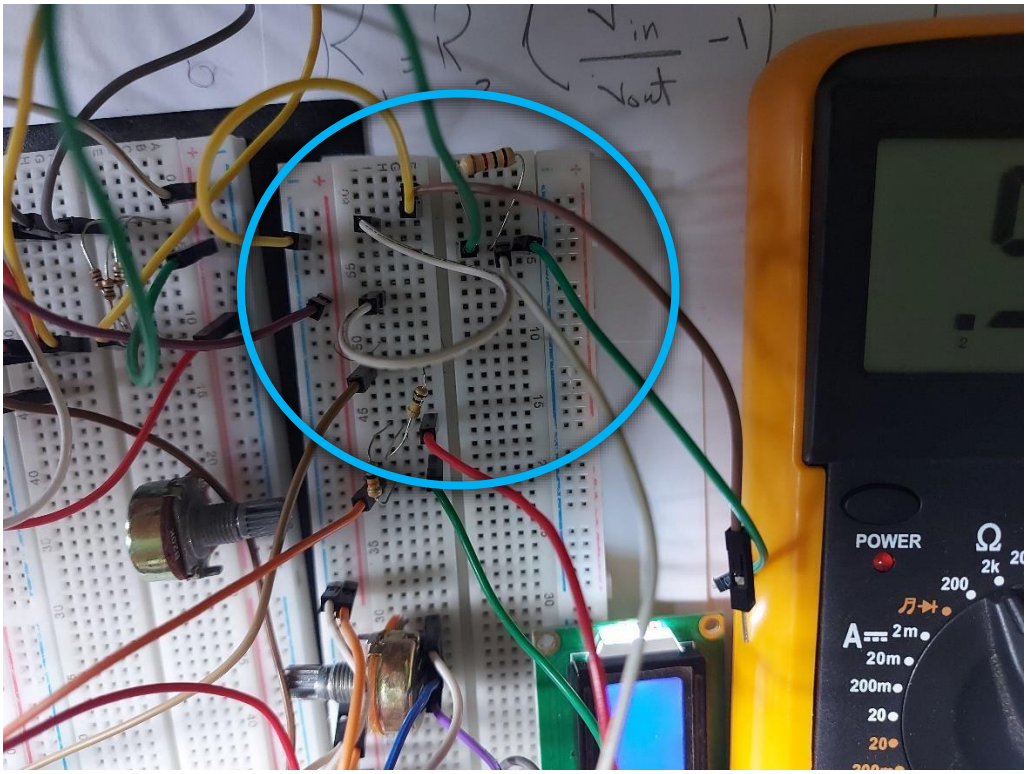
Use a basic voltage divider to calculate the resistence. As we know, a voltage divider is made of two resistences (R1 and R2) in series. The output voltage in the middle point is [R2/(R1+R2)]Vin. Using this formula and knowing the value of one of the two resistors and measuring the Vout we can calculate the resistence of the seacond resistor.



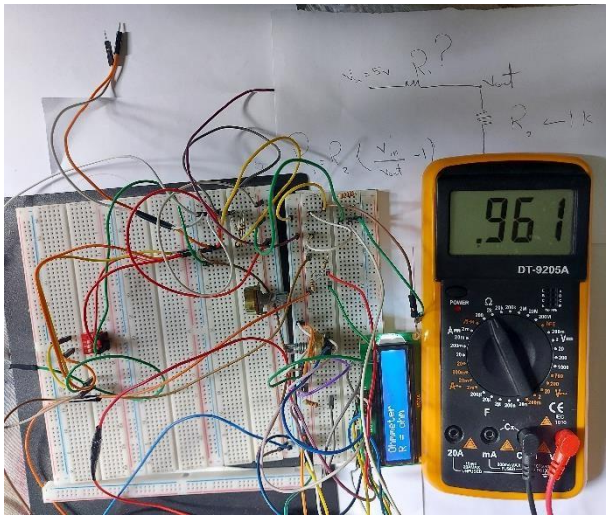

$$R_1 = R_2\left(\frac{V_{in}}{V_{out}} - 1\right) = 1k\left(\frac{5V}{0.049V} - 1\right)$$

| Range | 0-2k | 2k-20k | 20k-200k |
|---|---|---|---|
| R2 | 2k | 20k | 200k |

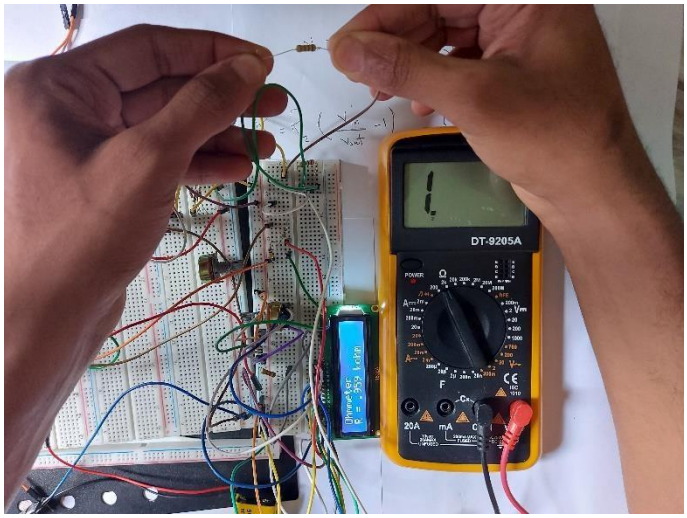
## Our circuit



Test 1

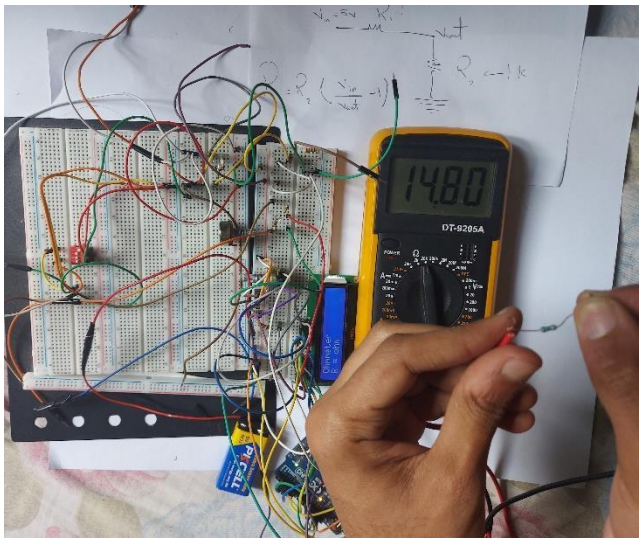



AVO

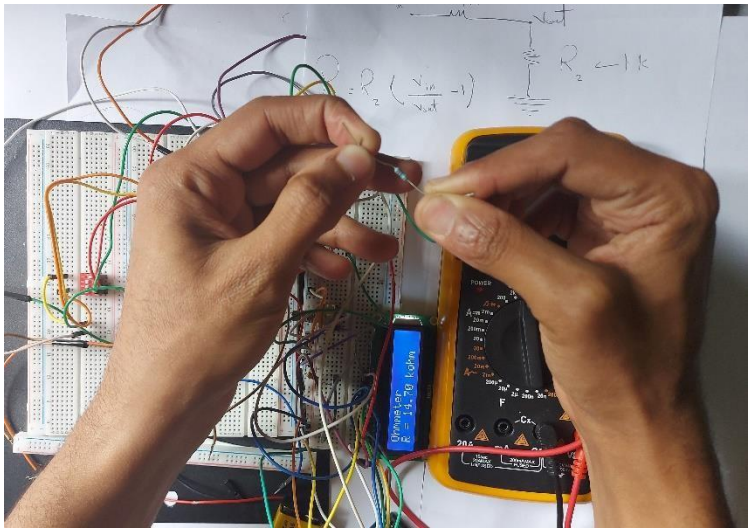



circuit

Test 2




AVO

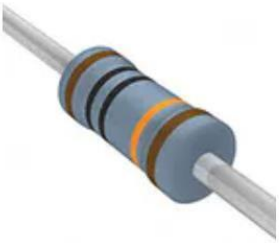


circuit

Note : we have an error = 0.1

# Components we used

Arduino UNO



Resistor 100k ohm