



**LDR** ( Light Dependent Resistor ) is a **Variable Resistor**. **LDR Resistance Value will change according to the brightness** that it is exposed to.

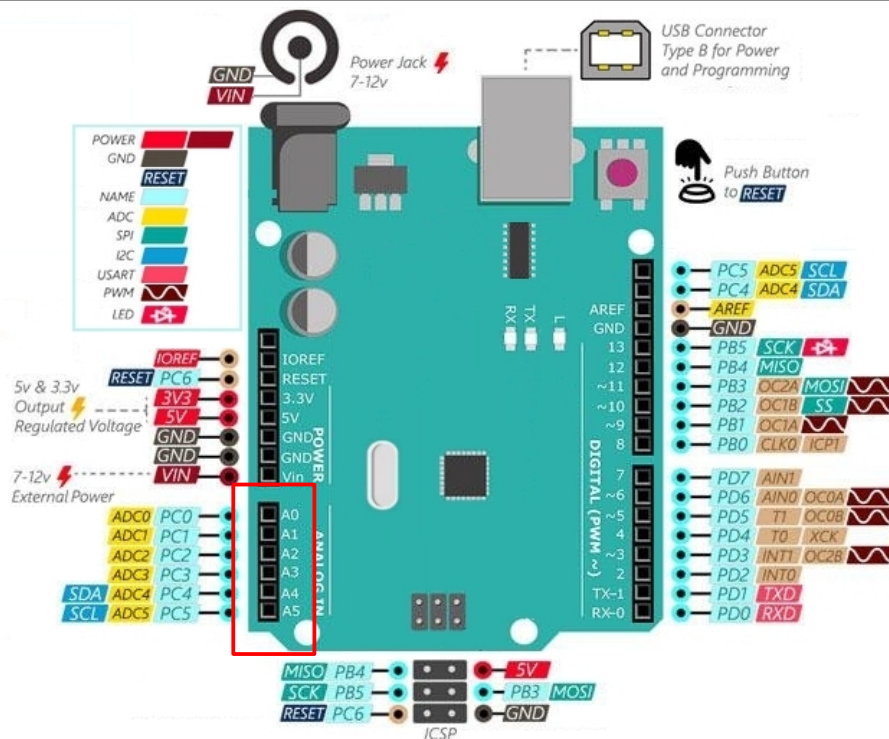
### **LDR Resistance Value Decrease as Brightness Increase**

In our previous lesson on Resistors (2021\_11\_23\_resistor), When a Resistor is combined with another Resistor, they can be used as a Voltage Divider

Since the **LDR Resistance Value change** when different brightness is exposed to it, we will also get a **"Variable Voltage"** when it is **used as a Voltage Divider with another Resistor**.

This **"Variable Voltage"** is our **Sensor Reading** which can **tell us brightness**.

### **Different Brightness, Different Voltage**



**Sensors** are just device that will **"Supply"** voltage to our **INPUT I/O Pins**

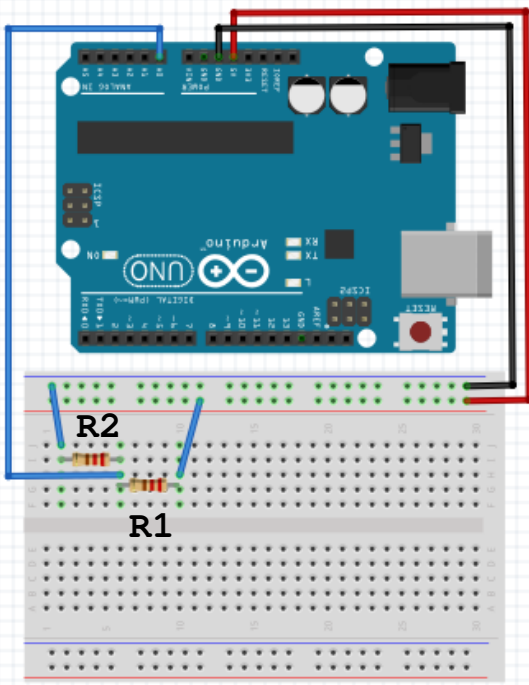
**Digital Sensors** can be connected to **any INPUT I/O Pin**, **digitalRead()**

- When the Digital Sensor **"Supply"** Less than 3V, we get a **LOW** reading
- When the Digital Sensor **"Supply"** 3V or More, we get a **HIGH** reading

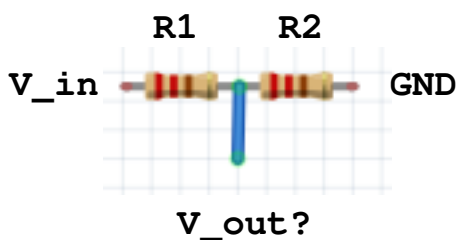
**Analog Sensors** can be connected to **Analog INPUT I/O Pin Only**, **analogRead()**

- We want the actual Voltage (ranged from 0V to 5V), where each different Voltage value has a different meaning. On the Arduino Uno Board, the Analog INPUT I/O Pins are labelled as **A0,A1,A2,A3,A4** and **A5**

**In this tutorial we are using the LDR as an Analog Sensor, most the other Sensors works about the same. You know this, you know almost all of them**



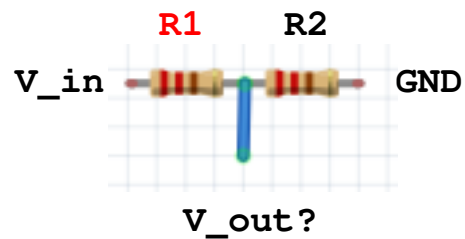
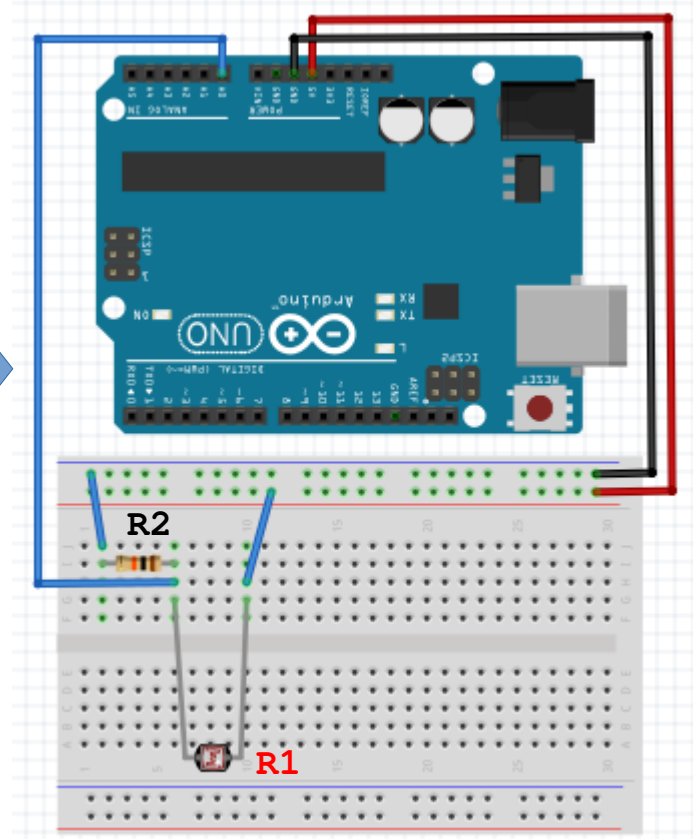
INPUT I/O Pin A0 will receive about half of 5V ( Voltage Divider with 2 same value Resistor on the 5V from Arduino 5V Pin )



**Voltage Divider Formula**

$$V_{out} = V_{in} \times ( R2 / R1+R2 )$$

$$\begin{aligned} \text{Voltage Supplied to A0( } V_{out} \text{ )} &= \\ 5 \times ( 220 / (220 + 220) ) &= \\ = 2.5V \end{aligned}$$



**Voltage Divider Formula**

$$V_{out} = V_{in} \times ( R2 / R1+R2 )$$

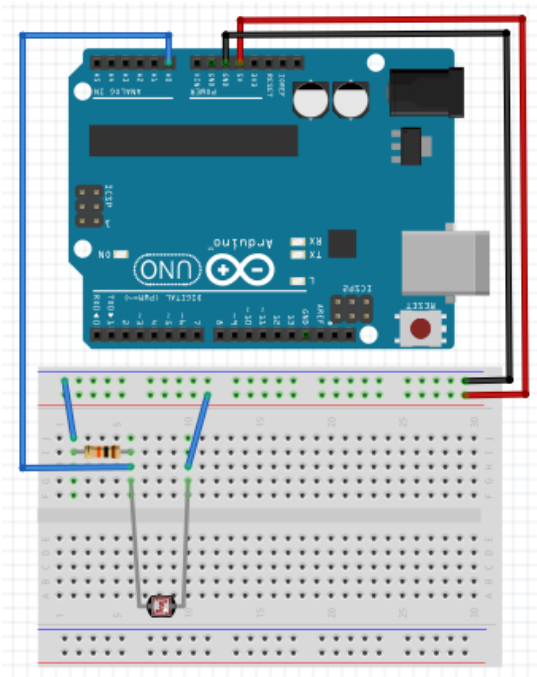
**R1 is now replaced by LDR**

$$\begin{aligned} \text{Voltage Supplied to A0( } V_{out} \text{ )} &= \\ 5 \times ( 10,000 / (\text{LDR?} + 10000) ) &= \\ = ? \text{ VOLTAGE is variable depending} & \\ \text{on the LDR Resistance Value which} & \\ \text{depends on brightness} \end{aligned}$$

**VOLTAGE on A0 now Represents Brightness - Coming from "Brightness Sensor" made from an LDR and a Resistor**

## ATMEGA328/Arduino Uno - I/O Pins - INPUT SENSOR LDR

<https://github.com/teaksoon/lmaewapm>



1x Computer with Arduino IDE Software  
1x USB 2.0 Type A/B Data Cable  
1x Arduino Uno Board  
1x Solderless Breadboard  
Jumper wires

1x LDR  
1x 10K Ohm Resistor

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Arduino Uno 5V connect to LDR  
10K Resistor Connect to GND  
In-Between 10K Resistor and LDR, make  
connection to Pin A0 ( a Voltage divider  
circuit to Pin A0 )

Program: io\_pin\_input\_sensor\_ldr )

```
void setup() {  
  pinMode(A0, INPUT);  
  Serial.begin(9600);  
}  
  
void loop() {  
  int pinDigital = digitalRead(A0);  
  int pinAnalog = analogRead(A0);  
  
  Serial.print("\nINPUT I/O Pin A0: ");  
  Serial.print("Digital Value=");Serial.print(pinDigital);  
  Serial.print(", Analog Value=");Serial.print(pinAnalog);  
  Serial.print(", Voltage=");Serial.print( (float) (pinAnalog*5)/1023,2 );  
  delay(500);  
}
```

Open the Serial Monitor from the Arduino IDE Software and watch the Output on the serial monitor screen. Observe the Voltage Reading. While still watching the Serial Monitor Screen do the following,

Try cover the LDR with your hands so that it is exposed to different brightness.

The different numbers that you get from Analog Value and Voltage is the different brightness detected by our homemade "Analog Brightness Sensor" ( made from a LDR and a 10K Resistor )

Our ATMEGA328 micro controller now have a little bit of intelligence, it can tell the brightness