

LDR_Light_Switch1 -- Overview



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OBJECTIVES

After performing this lab exercise, learner will be able to:

- Understand the functionality of Light Dependent Resistor (LDR)
- Use LDR (Light Dependent Resistor) to measure the light intensity variation in terms of voltage at the LDR output
- Program Arduino board to digitize and capture voltage across LDR
- Relate the digitized value of voltage across LDR with value measured on oscilloscope
- Use digital oscilloscope to:
 - Measure the signal amplitude
 - Trigger on input channel

EQUIPMENT

To carry out this experiment, you will need:

- TBS1KB-Edu Digital Oscilloscope from Tektronix
- Arduino Duemilanove or Uno board
- Voltage probe (provided with oscilloscope) / BNC cables
- Breadboard and connecting wires
- Simple circuit components – LDR, Resistor 10k Ohms

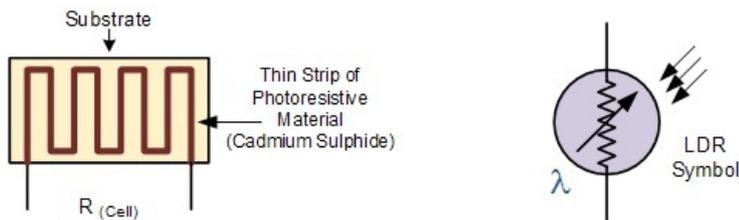


THEORY

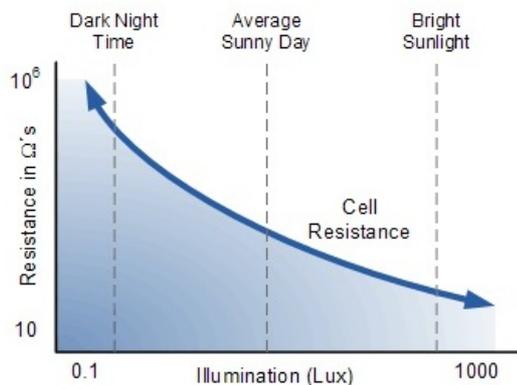
Key points:

- A photoresistor can be applied in light-sensitive detector circuits, and light- and dark-activated switching circuits.
- A photoresistor or light-dependent resistor (LDR) or photocell is a light-controlled variable resistor.
- A photoresistor is made of a high resistance semiconductor. In the dark, a photoresistor can have a resistance as high as a few megaohms ($M\Omega$), while in the light, a photoresistor can have a

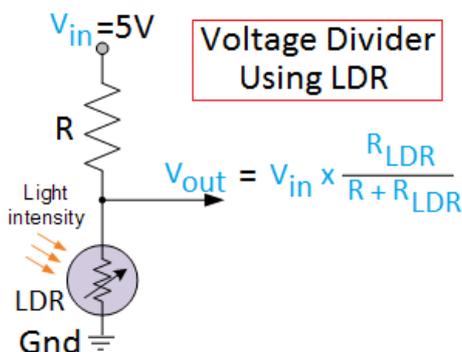
resistance as low as a few hundred ohms.



- If incident light on a photoresistor exceeds a certain frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons (and their hole partners) conduct electricity, thereby lowering resistance.



- Change in resistance can be converted in to voltage variation by voltage divider implemented using LDR and a fixed resistor.



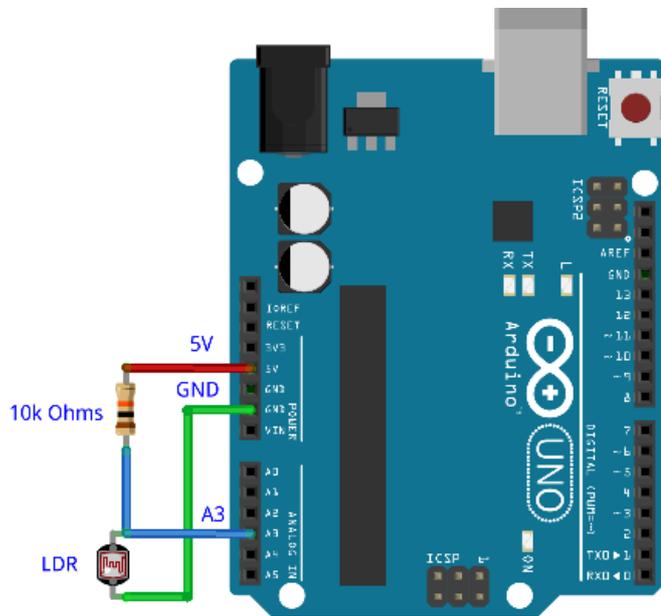
- The voltage across LDR can be measured using oscilloscope or digitized/recorded using Arduino - The voltage is proportional to darkness (%) -
 - ~5V = 100% darkness
 - ~0V = 0% darkness

LDR_Light_Switch1 -- Procedures

Step 1

DUT Setup: Arduino-LDR Circuit

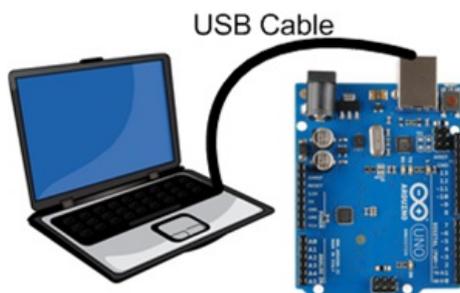
Prepare the circuit (using LDR, Resistor and Arduino) as shown below:



Step 2

DUT Setup: Connecting Arduino with Computer

- Connect the Arduino to computer using USB cable.



- Launch Arduino IDE and ensure correct USB port number and Board name for establishing the connection.

Step 3

DUT Setup: Programming Arduino

- Program the Arduino board with code - "Ligh_Switch_1.ino"
- Once the program is uploaded and running on Arduino, open serial monitor

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COM3
LDR Output: 701 | Volts = 3.27 | Darkness = 68 % | Brightness = 32 %
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Step 4

Scope and DUT Connection:

Connect channel 1 of the oscilloscope to LDR output. Probe at A3 pin of Arduino.

Step 5

Scope Settings: Horizontal / Vertical Scale & Trigger

Do autoset (or manually set) and ensure following settings:

- Horizontal scale 1ms/div
- Vertical scale 1V/div
- Vertical position at -3V (-3 divisions)

Step 6

Scope Settings: Measurements

Using 'measure' menu, add following measurements to CH1:

- RMS
- Mean
- Maximum

Step 7

Check the measurement value on the oscilloscope and compare it with "Volts" value on the serial monitor. The value in "Volts" should match the "Mean" value reported by oscilloscope.

Step 8

Change the light intensity around LDR - Cover the LDR to increase darkness. Again check the measurement value on the oscilloscope and compare it with "Volts" value on the serial monitor. The value in "Volts" should match the "Mean" value reported by oscilloscope.

Step 9

You can verify the output of LDR (readings on scope and Serial Monitor) matches for different light conditions around LDR.