

# LDR\_Light\_Switch5 -- Overview



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## OBJECTIVES

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

- Interface LDR and pushbutton with Arduino to make light controlled switch
- Program Arduino board to:
  - Measure LDR output as light intensity variation
  - Detect switch (push button) press and measure duration
  - Calibrate switching threshold with current LDR output using button press
- Use digital oscilloscope to measure the pulse width (duration) and burst width

## EQUIPMENT

To carry out this experiment, you will need:

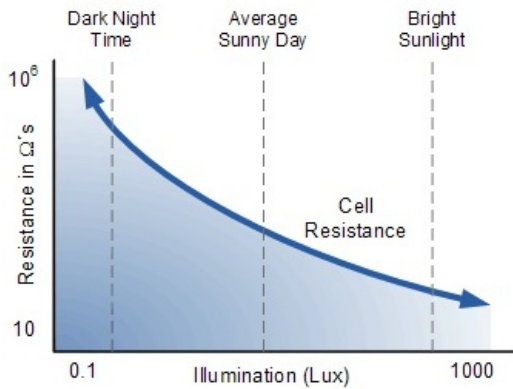
- TBS1KB-Edu Digital Oscilloscope from Tektronix
- Arduino Duemilanove or Uno board
- Voltage probe (provided with oscilloscope) / BNC cables
- Breadboard and connecting wires
- Simple circuit components – LDR, Resistor 10k & 470 Ohms, LEDs and Push button (switch)



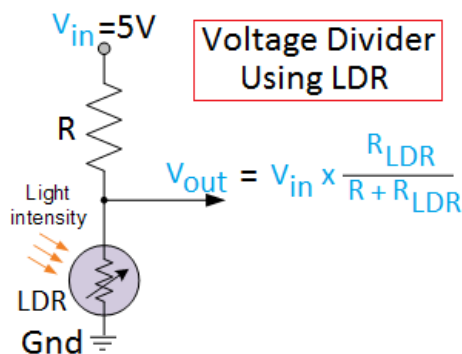
## THEORY

Key points:

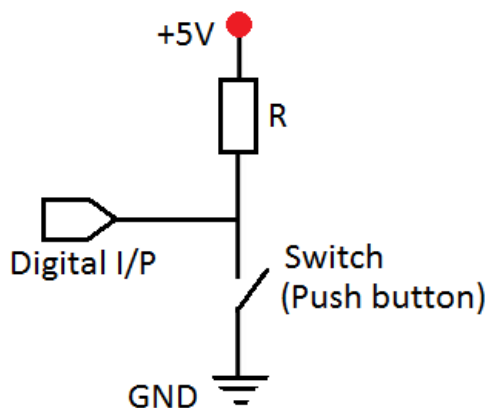
- LDR (photo-resistor) changes its resistance with intensity of light falling on it. More the light, lesser is the resistance.



- The light variation can be 'measured' by using LDR with another resistor as voltage divider circuit. ADC of Arduino can be used to measure the voltage change (due to variation in intensity of light on LDR).



- A push button can be interfaced with Arduino's digital input pin using a pull-up resistor. Arduino can be programmed to detect the switch press which will be used for calibration of threshold.



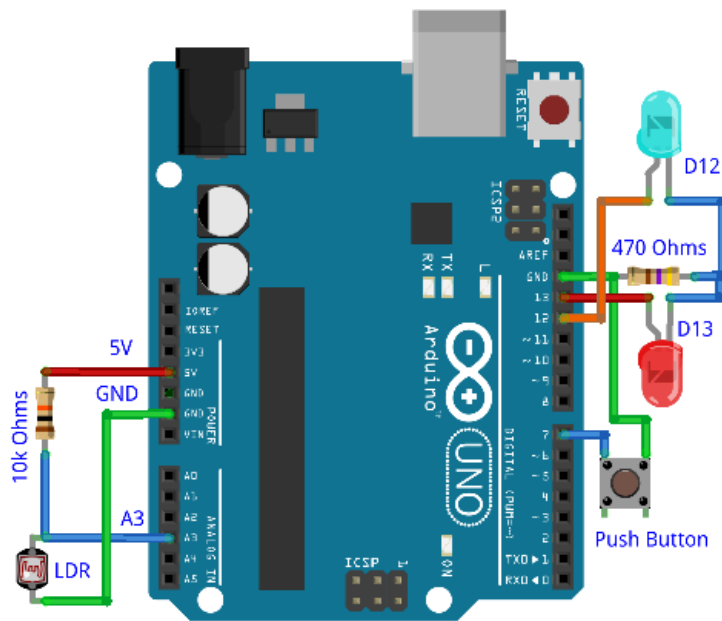
- When "calibrate" switch is pressed for over 2 seconds, the current value of LDR output can be assigned as Threshold.
- When switch is released, instantaneous LDR output is compared against the Threshold and switching is performed.

## LDR\_Light\_Switch5 -- Procedures

### Step 1

## DUT Setup: Arduino-LDR Circuit

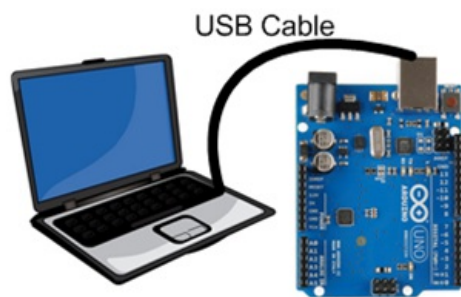
Prepare the circuit (using LDR, Resistor and Arduino) as shown below:



## 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

- Open the code - "Ligh\_Switch\_5.ino" - in Arduino IDE.
- Compile and upload the program on Arduino board for execution

## Step 4

### Scope and DUT Connection:

- Channel 1 probing at Push Button (pin D7 of Arduino)
- Channel 2 probing at 'calibrate' LED (pin D12 of Arduino)

## Step 5

### Scope Settings: Horizontal / Vertical Scale & Trigger

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

- Horizontal scale = 250 ms/div
- Channel 1 :
  - Vertical scale = 2V/div
  - Vertical position = +2V (+1 divisions)
- Channel 2 :
  - Vertical scale = 2V/div
  - Vertical position = - 6V (-3 divisions)
- Trigger on CH1, Falling Edge
- Horizontal Position (Pre-trigger) = 10% (1st div from left side)
- Take Single Acquisition (no free run)

## Step 6

### Scope Settings: Measurements

Using 'measure' menu, add POS WIDTH and BURST WIDTH measurements to CH2

## Step 7

- Ensure that Serial Monitor is turned on, press SINGLE (on the scope front panel)

## Step 8

- Create darkness that you want to have switching at (threshold definition).
- Press the 'push button' - Calibrate LED will glow.
- Keep the button pressed till LED is on. Release it once the LED turns off.

## Step 9

- You can verify the burst width measurement to be close to 2s.
- How's the CH2 (Calibrate LED output) - Smooth pulse of 2s or burst of square wave / pulses with burst width of 2s?
- We expected a smooth pulse of 2s as LED output. Without scope we could not figure it out that we have so many switchings till push button is pressed (2s).
- Can you debug the code and correct it?

## Step 10

- The corrected code is "Light\_Switch\_5a.ino". Upload this code and run Arduino.
- Repeat step 8 & 9 to verify you get a smooth 2s pulse now.

## **Step 11**

Now your Light switch is ready -

- You can define light intensity for switching by creating that exact darkness and pressing the Calibrate switch for 2s (till calibrate LED glows)
- Once the threshold is defined through calibration, main output LED (pin 13) will glow when the darkness is more than defined threshold.