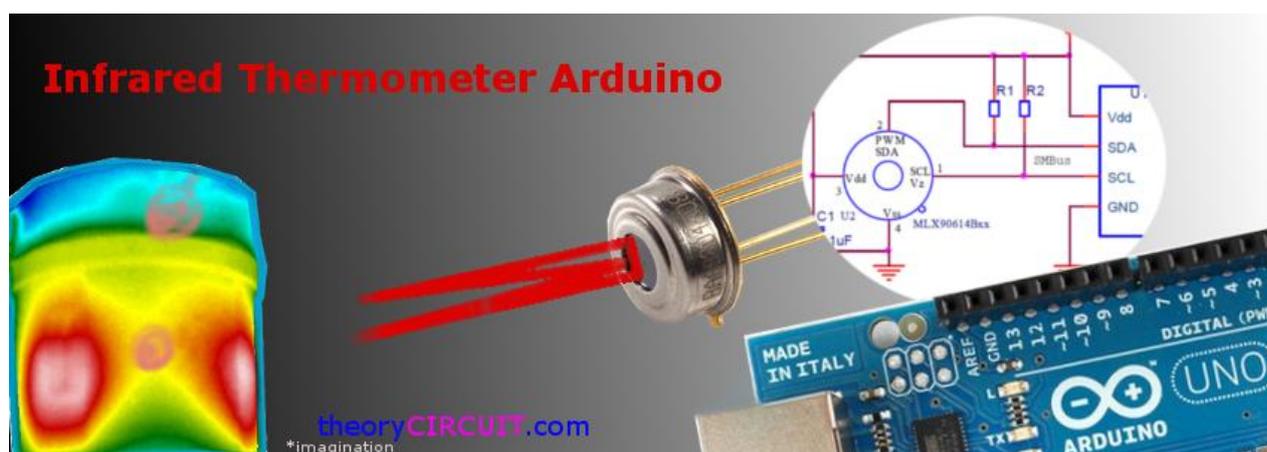


Unbelievable Arduino projects- (November 2016) from theoryCIRCUIT.com
Arduino brings lot of possibilities in electronics for Electronic designers, Hobbyist, Makers and students, the best way to learn arduino programming is just to try one more experiment. Hence we given interesting top five easy to make Arduino projects with code and library link. Happy learning Arduino ☺

1. [Infrared Thermometer Arduino](#)
2. [Gas Sensor Arduino Hookup & Code](#)
3. [LIDAR lite V3-High performance Optical long distance measuring sensor with Arduino](#)
4. [ISL 29125-RGB color Light Sensor with Arduino](#)
5. [Piezo Vibration Monitoring Sensor with Arduino](#)

Infrared Thermometer Arduino



To measure temperature different types of sensors are available, if you want to detect temperature in non-contact method, the Infrared thermometer sensor comes first. MLX90614 infrared thermometer from melexis is a non contact temperature sensing device.

[The LM35 temperature sensor](#) gives output depends on fallen heat over the sensor device, but you can't get into fire to detect accurate temperature value. This MLX90614 sensor gives non-contact temperature sensing.

MLX90614ESF-BAA Pinout



Pin Name,Function

VSS, Ground. The metal can is also connected to this pin.

SCL / Vz,Serial clock input for 2 wire communications protocol.

PWM / SDA,Digital input / output. pulse width modulation or Serial data for 2 wire communications protocol.

VDD, External supply voltage.

The sensor internally contains 17-bit ADC and a powerful DSP contributed to the high accuracy and resolution, and this sensor provides two methods of output, PWM and I²C but these output has a resolution variations like if you taken output as PWM then 10-bit PWM output provides a resolution of 0.14 °C, and the I²C method gives resolution of 0.02 °C.

The MLX90614 is factory calibrated in wide temperature ranges, -40 °C to 85 °C for the ambient temperature and -70 °C to 382.2 °C for the object temperature.

how does a infrared thermometer work?

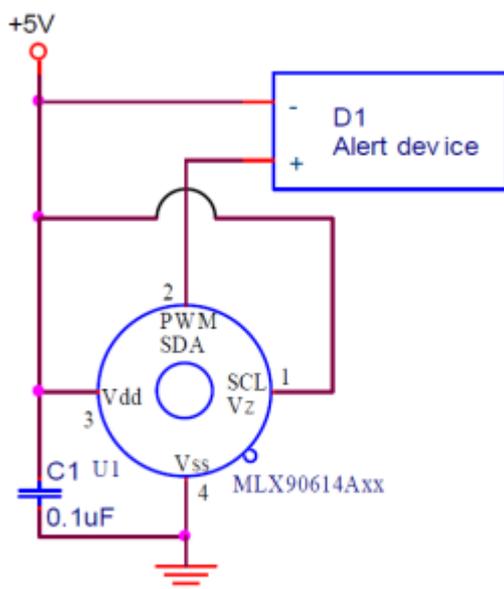
We know every object emits Infrared light rays, the concentration varies depends on temperature but those IR rays are not visible to the human eye. By detecting the IR rays we can quantize temperature range. By the way MLX 90614 thermometer sensor also works.

This sensor has two sections namely 1. Thermopile detector (this is responsible for to convert thermal energy into electrical energy), 2. Signal conditioning section (It process signal from thermopile detector and makes as readable signal by the external peripherals).

Signal Conditioning section has 17-bit ADC block to convert detected signal by the thermopile and Calibrated DSP (Digital signal processing) block quantize the entire signal after that output signal is travels through PWM and I²C/TWI terminals.

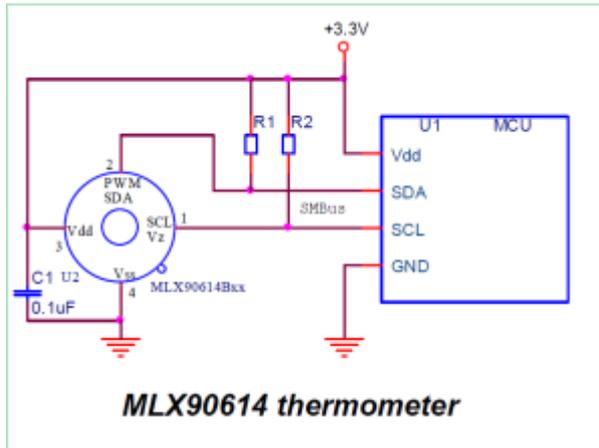
Application Circuit

The MLX 90614 thermometer sensor is plug & play device hence we can directly connect a alert device and easily make thermal alarm device.



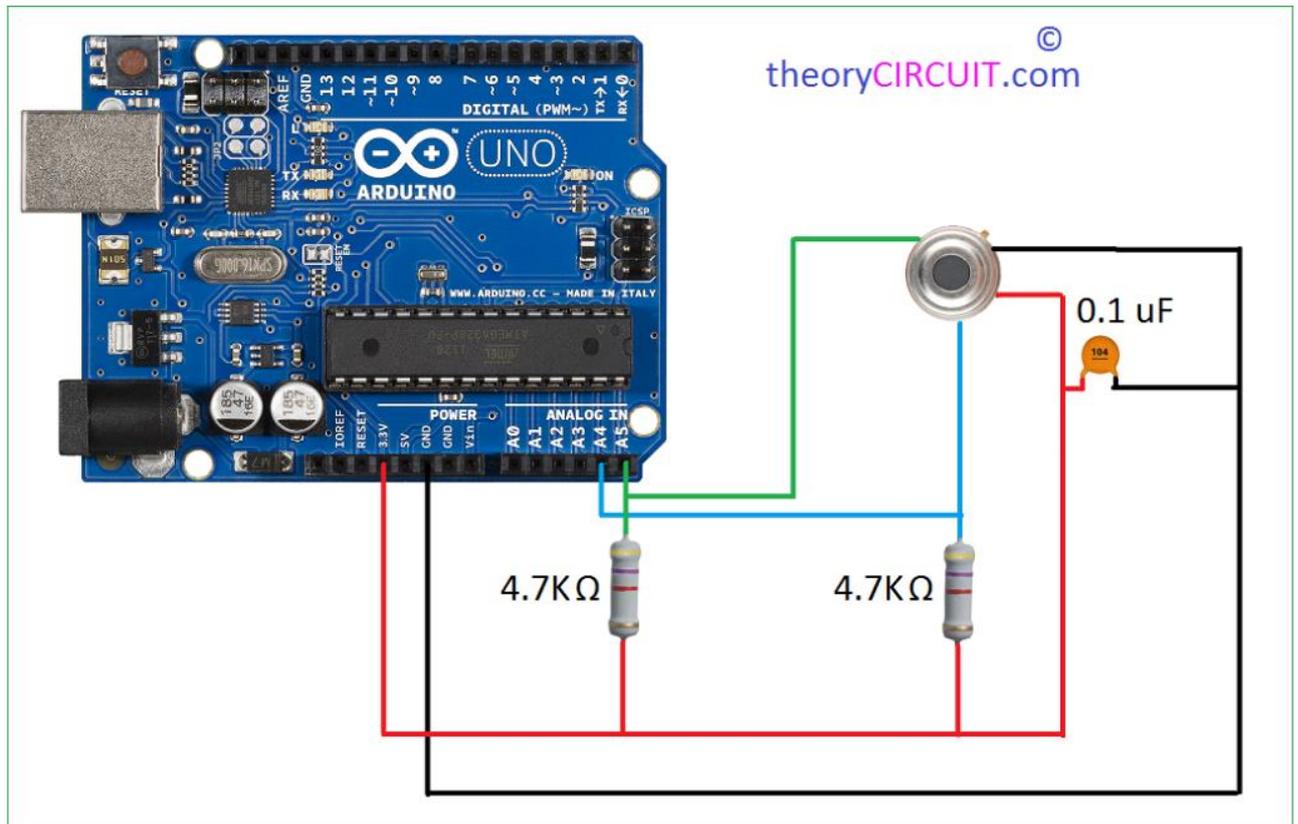
Interfacing MLX 90614

The micro controllers are have I2C communication way to get interfaced with external peripherals, The MLX 90614 thermometer also has I2C communication lines so that we can interface this sensor with microcontroller with out any additional circuits.



The sensor operates with 3.3V Dc supply, if the micro controller operates with 5V DC then we need pull up resistors between SDA and SCL lines to +3.3V DC line.

MLX 90614 Thermometer with Arduino



The Arduino Boards have I²C communication lines and it is easy to interface with I²C by wire header file. Here this Article uses Arduino uno board as example, if you are using different Arduino board and want to know I²C lines [checkout here](#).

Connect the sensor as illustrated and provide +3.3V DC power source from Arduino board to sensor. Here 4.7K Ω resistors are used to provide pullup over I²C lines.

Infrared Thermometer Arduino Code

```

/*****MLX90614 *****/
Arduino VDD ----- 3.3V VSS ----- GND SDA -----

```

```
----- SDA (A4 on older boards)  SCL ----- SCL (A5 on
older boards)*****/

#include <Wire.h> // I2C library, required for MLX90614

#include <SparkFunMLX90614.h> // SparkFunMLX90614 Arduino library

IRTherm therm; // Create an IRTherm object to interact with throughout

const byte LED_PIN = 8; // Optional LED attached to pin 8 (active low)

void setup()

{

  Serial.begin(9600); // Initialize Serial to log output

  therm.begin(); // Initialize thermal IR sensor

  therm.setUnit(TEMP_F); // Set the library's units to Farenheit

  // Alternatively, TEMP_F can be replaced with TEMP_C for Celsius or

  // TEMP_K for Kelvin.

  pinMode(LED_PIN, OUTPUT); // LED pin as output

  setLED(LOW); // LED OFF

}

void loop()

{

  setLED(HIGH); //LED on
```

```
// Call therm.read() to read object and ambient temperatures from the
sensor.

if (therm.read()) // On success, read() will return 1, on fail 0.

{

    // Use the object() and ambient() functions to grab the object and
ambient

    // temperatures.

    // They'll be floats, calculated out to the unit you set with
setUnit().

    Serial.print("Object: " + String(therm.object(), 2));

    Serial.write('°'); // Degree Symbol

    Serial.println("F");

    Serial.print("Ambient: " + String(therm.ambient(), 2));

    Serial.write('°'); // Degree Symbol

    Serial.println("F");

    Serial.println();

}

setLED(LOW);

delay(500);

}

void setLED(bool on)

{

    if (on)

        digitalWrite(LED_PIN, LOW);

    else

        digitalWrite(LED_PIN, HIGH);

}
```

Reference

[Arduino Library for IR thermometer](#)

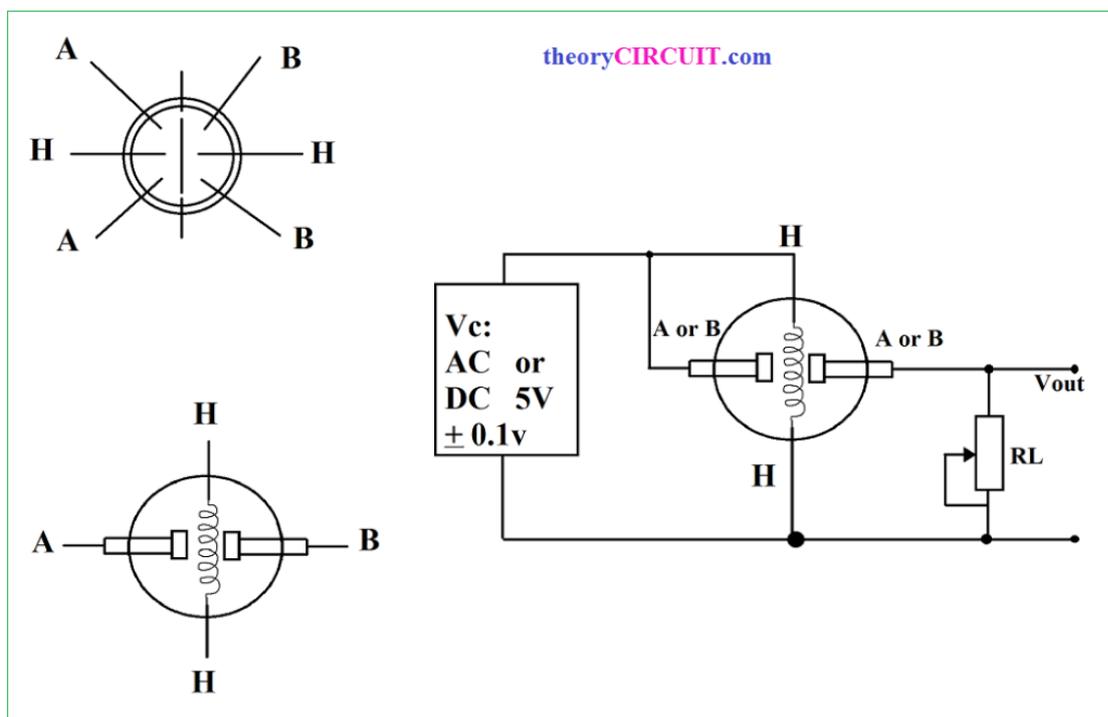
[MLX 90614 sensor Datasheet](#)

Gas Sensor Arduino Hookup&code



MQ-XX series Gas sensors are common and easy to use Gas detection sensors, in previous article i have discussed about [How to choose Gas Sensor?](#) Here we are going to know about how to interface Gas sensor with Arduino development board.

What is Gas Sensor?



Answer for this Question is simple that is a transducer converts particular Gas concentration in Air to equivalent electric signal. Every Gas sensor operates in a common way, it may contain a heater coil and a electro chemical sensor.

How Gas sensor Work?

When we apply bias to the sensor it takes some “burn-in time” that is for to sensor getting warm, after that the electro chemical sensor detects specific Gas and varies the current flow through sensor. Hence we get analog output ranges depends on Gas concentration.

Gas Sensor Pinout



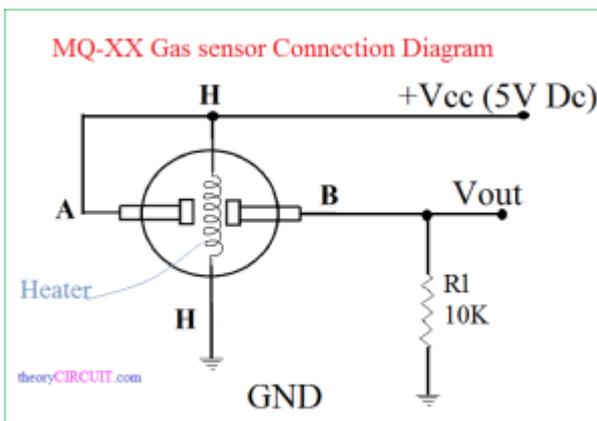
The MQ-xx have six pins, most of the Gas sensors in these series will have six pins.

The center two pins are called as H pins (Heater pins),

Remaining pins both up & down side called as A and B pins. Both pins are connected with separate electro-chemical sensor.

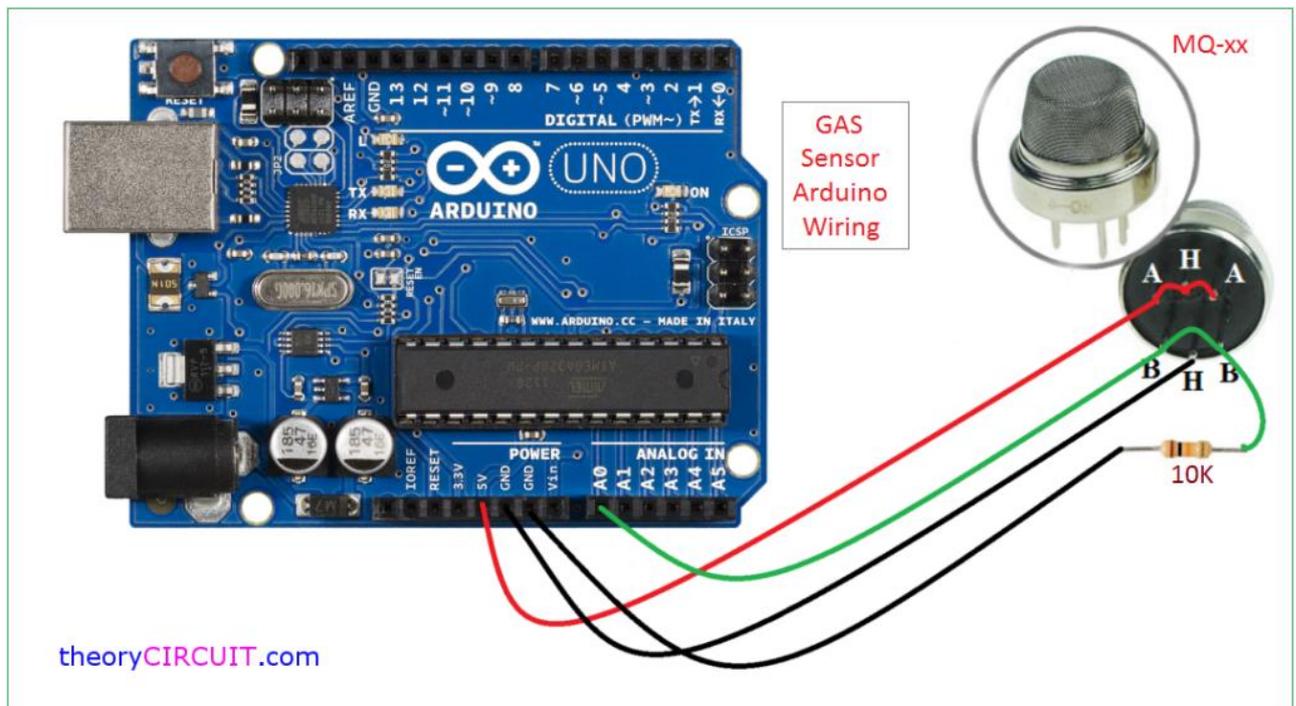
We can use both pins to bring output, only thing is No H pins are connected with micro controller or Arduino, because it draws much current.

Gas sensor Wiring



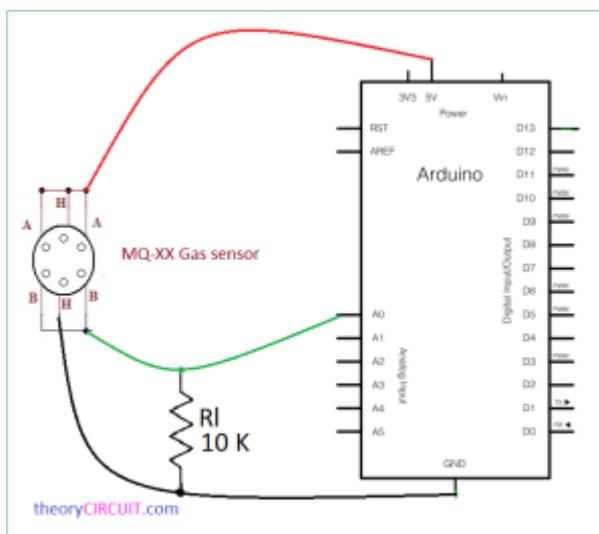
The both A pins can be connected together and applied to the +5V DC supply, By the way both B pins can be connected together and fed into the Output terminal. To vary the sensitivity we can connect the R1 resistor with B pin to Ground, it may valued from 2KΩ to 47KΩ, when you connecting lower value the less sensitivity, and the higher value gives good sensitivity but less accurate for higher concentration of Gas. The heater pins H & H should connected separately with +5V and Gnd.

Gas Sensor Arduino Hookup



As per the wiring diagram, the MQ-XX series sensor can be connected with Arduino board. The resistor (10K) connected with B pin to Gnd to maintain sensitivity level of Gas sensor at particular point, if you need variable sensitivity from your sensor you can use variable resistor instead for 10K.

A and H pins are connected together with +5V power source pin of Arduino board, and Separate H pin is connected with GND, Both B pins are connected together and linked to Arduino's Analog pin A0.



Just finished hookup, Don't Make mistakes in the wiring if any thing goes wrong the sensor could be damaged, otherwise you are advised to use breakout boards of Gas sensor.



These kind of breakout boards are easy to handle and it can directly connected with microcontroller or Arduino board,

It has four pins namely +Vcc, Gnd, Do, Ao.

The breakout board with three pins will only give Analog output(Ao), The four pin (With ADC) breakout board will give Ao and also Digital output (Do) in standard logic level.

Gas sensor Arduino Code

```
/* theorycircuit.com */

/* this code can be used for MQ2,MQ5,MQ-xx series Sensors*/

int mqxx_analogPin = A0; // connected to the output pin of MQ-xx

void setup() {

    Serial.begin(9600); // open serial at 9600 bps

}

void loop()

{

    // give ample warmup time for readings to stabilize

    int mqxx_value = analogRead(mqxx_analogPin);

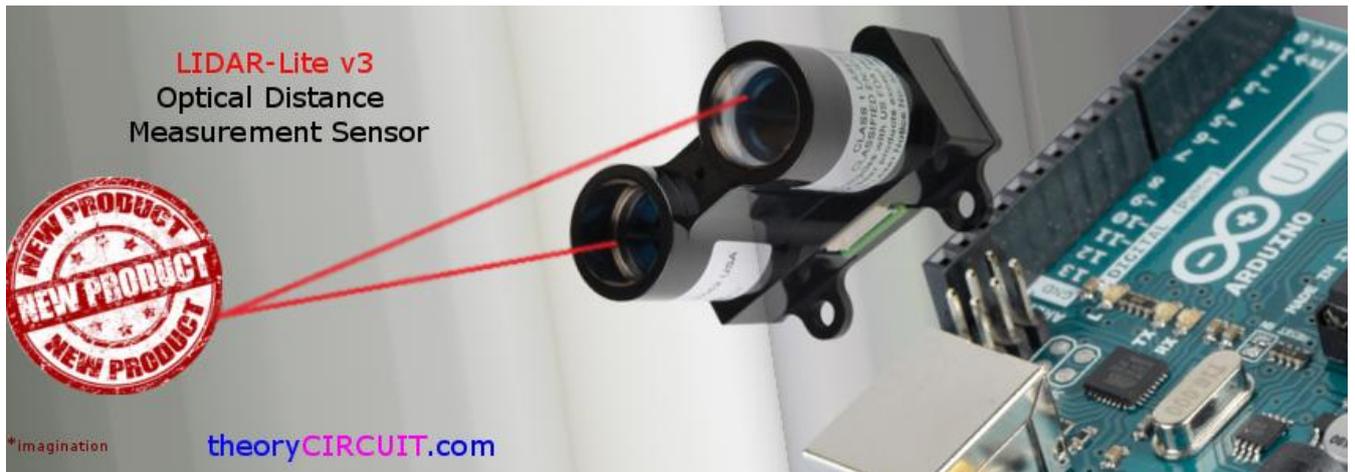
    Serial.println(mqxx_value);

}
```

```
delay(1000); //Just here to slow down the output.
```

```
}
```

LIDAR lite V3-High performance Optical long distance measuring sensor



Measuring distance using proximity sensors for few centimeters are past tense! This New Product page brings you a long distance measuring sensor with high accuracy. Now High performance optical distance measurement sensor from Garmin™ available to measure distance upto 40 meters yes 40-meters.

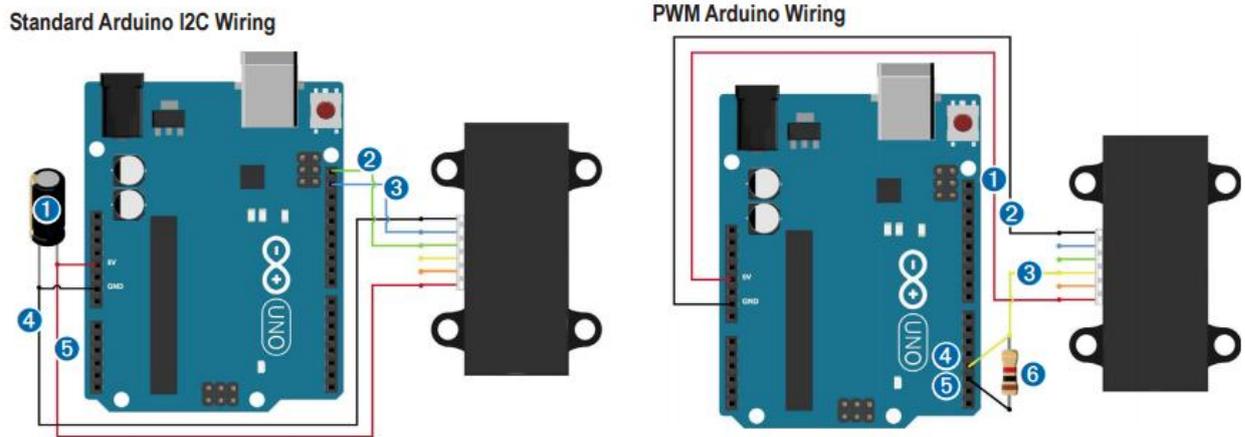
This sensor is very compact and light weight device hence this LIDAR-lite V3 is the ideal solution for drone, robot or unmanned vehicle application to measure distance.



The LIDAR-lite V3 works under Optical distance measurement technique and contains 950nm – 1.3 watts single strip laser transmitter, 4m Radian x 2m Radian beam divergence and an optical aperture of 12.5 mm, This sensor consumes 5V DC with less than 100 mA current during continuous operation and it has one special feature that is, the LIDAR-lite V3 is user configurable sensor, it allows adjustment between accuracy, Operating range and measurement time with I²C or PWM interfacing. There are different types of optical sensors available for distance measurements but this sensor gives reliable output.

LIDAR-lite V3 Arduino Hookup

LIDAR-Lite v3 High-performance Optical Distant Measurement Sensor



Arduino computing platform brings simple and easy way to connect lidar lite sensor with Arduino development board. There is two options provided (I²C and PWM) to interface sensor with Arduino board & micro-controllers.

While making hookup in the method of standard Arduino I²C wiring probably the **Green wire** (2) should connected with A5-SCA (for UNO) and **Blue wire** (3) should connected with A4-SDA (for UNO).

I²C pins of Arduino Boards

Board	I ² C / TWI pins
Uno&Ethernet	A4 (SDA) – A5 (SCL)
Mega2560	20 (SDA) – 21 (SCL)
Leonardo	2 (SDA) – 3 (SCL)
Due	20 (SDA) – 21 (SCL)/SDA1 – SCL1

And there is no changes in PWM Arduino hookup.

(Reference: [Datasheet of LIDAR-lite V3](#))

LIDAR lite V3-Optical distance sensor Arduino Code

Before jump into the code first get Arduino library for LIDAR lite V3 sensor from [here](#).

There is example for both I²C and PWM wiring choose as per your opinion, here for an example code given for PWM Arduino wiring.

```
unsigned long pulseWidth;

void setup()
{
  Serial.begin(115200); // Start serial communications

  pinMode(2, OUTPUT); // Set pin 2 as trigger pin

  digitalWrite(2, LOW); // Set trigger LOW for continuous read

  pinMode(3, INPUT); // Set pin 3 as monitor pin
}

void loop()
{
  pulseWidth = pulseIn(3, HIGH); // Count how long the pulse is high in
microseconds

  // If we get a reading that isn't zero, let's print it

  if(pulseWidth != 0)
  {
    pulseWidth = pulseWidth / 10; // 10usec = 1 cm of distance

    Serial.println(pulseWidth); // Print the distance
  }
}
```

Further

[Product Page](#)

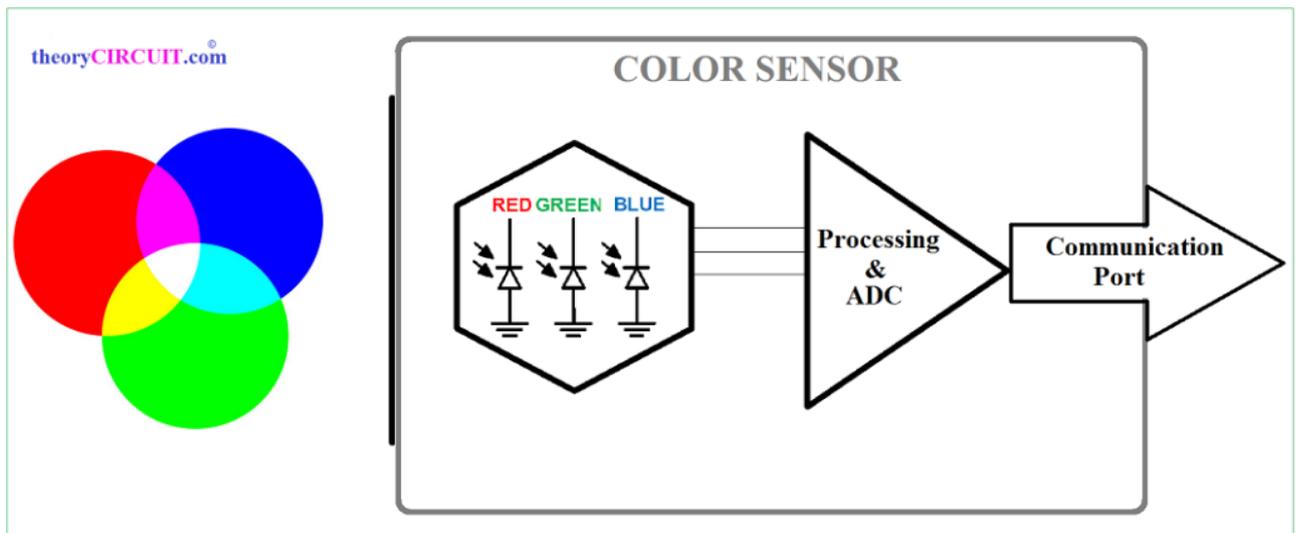
[Sparkfun](#)

ISL 29125-RGB color Light Sensor with Arduino



Is your Project design needs color light sensing? Here is the simple and robust sensor to satisfy your requirements. The ISL29125 RGB color light sensor with IR blocking filter helps to detect light spectrum color with high precision output, and it is suitable for any microcontroller or Embedded system hardware which has I2C communication line. This sensor comes with (ODFN) Optical Dual Flat package No lead, need magnifier to handle hence better to try in breakout board.

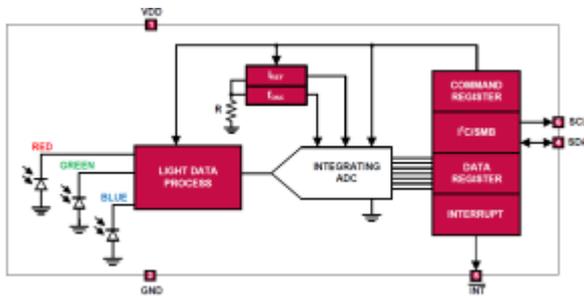
How RGB light Color Sensor Work?



Working principle of Color and RGB light sensor is just simple to understand, the color light have different wavelengths those are detected and converted into current levels by the photo detectors and then signal is processed. Finally current level signal is converted into digital values by the ADC (analog to digital converter). Output data can be handled by the Processor or Micro-controller to meet our applications.

ISL 29125-Color sensing sensor

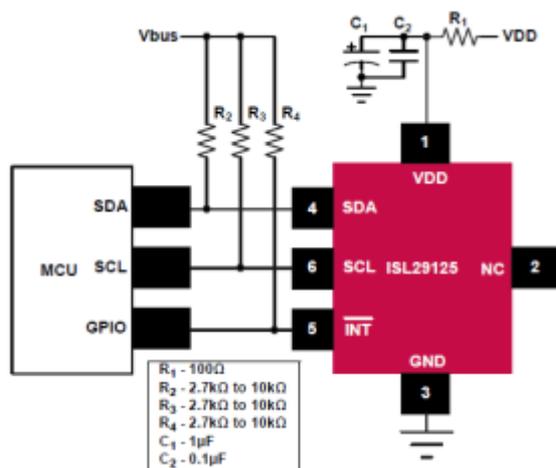
Block diagram-ISL29125



The ISL29125 is a low power, high sensitivity, RED, GREEN and BLUE color light sensor (RGB) with an I2C (SMBus compatible) interface. Its state-of-the-art photodiode array provides an accurate RGB spectral response and excellent light source to light source variation (LS2LS). The ISL29125 is designed to reject IR in light sources allowing the device to operate in environments from sunlight to dark rooms. The integrating ADC rejects 50Hz and 60Hz flicker caused by artificial light sources. A selectable range allows the user to optimize sensitivity suitable for the specific application. In normal operation mode the device consumes 56µA, which reduces to 0.5µA in power-down mode. The ISL29125 supports hardware and software user programmable interrupt thresholds. The Interrupt persistency feature reduces false trigger notification. The device operates on supplies (VDD) from 2.25V to 3.63V, I2C supply from 1.7V to 3.63V, and operating temperature across the -40°C to +85°C range.

source: <http://www.intersil.com/en/products/optoelectronics/ambient-light-sensors/light-to-digital-sensors/ISL29125.html>)

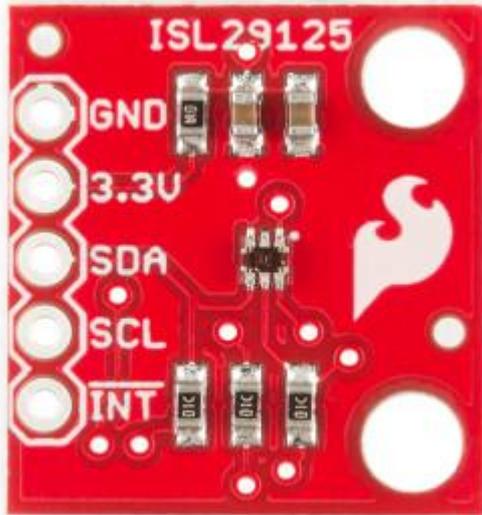
Interfacing



TYPICAL APPLICATION DIAGRAM source datasheet

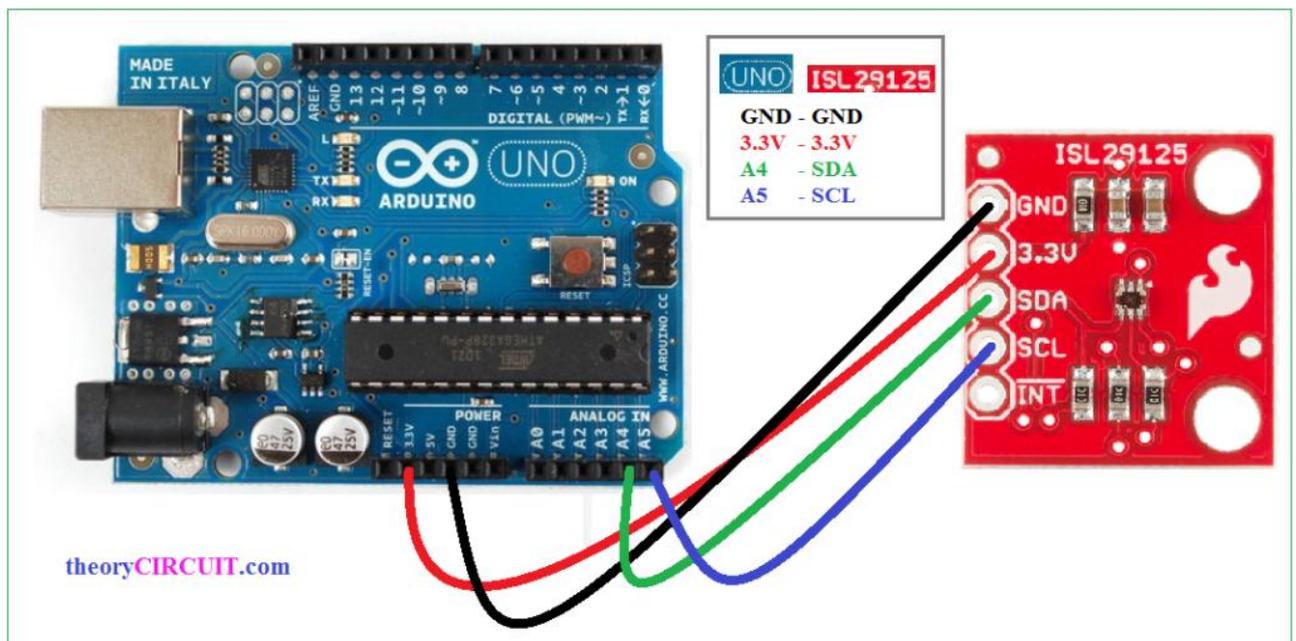
The sensor gives simple way to communicate with external world that is I2C communication pins, By using SDA (data line) and SCL (clock line) digital sensed data can be transferred to the micro-controllers with high baud rate. There is interrupt option also available to take control over the color sensing. If you are using 5 volt controller, you need to provide TTL logic converter 5V to 3.3V because the sensor operates with 3.3V. If bias increases than 3.3V it may hurt the sensor.

RGB light sensor ISL29125 Breakout board



ISL29125 sensor breakout board from [Sparkfun](#), It contains few pins for biasing and communication. It is most suited for Arduino open source development boards. Otherwise you can interface with any controllers having I2C lines.

ISL29125-Arduino Hookup



As stated it is very simple to connect RGB light sensor breakout board and Arduino, connect the bias pins GND,3.3 V on Arduino GND & 3.3 V pins. The well known Arduino uno has I2C communication lines SDA (in A4) and SCL (in A5) so connect sensors I2C lines as illustrated. The wiring between Arduino and sensor board is over before jump into the code first install Arduino Library for ISL29125 sensor from [github](#).

ISL 29125 Arduino Code

Here is simple code is provided to detect color light and it appears on serial port as hex values. (use 115200 as baud rate for serial port terminal).

Code

```
#include <Wire.h>

#include "SparkFunISL29125.h"

// Declare sensor object

SFE_ISL29125 RGB_sensor;

void setup()

{

    // Initialize serial communication

    Serial.begin(115200);

    // Initialize the ISL29125 with simple configuration so it starts
    sampling

    if (RGB_sensor.init())

    {

        Serial.println("Sensor Initialization Successful\n\r");

    }

}

// Read sensor values for each color and print them to serial monitor

void loop()

{

    // Read sensor values (16 bit integers)

    unsigned int red = RGB_sensor.readRed();

    unsigned int green = RGB_sensor.readGreen();

    unsigned int blue = RGB_sensor.readBlue();
```

```
// Print out readings, change HEX to DEC if you prefer decimal output

Serial.print("Red: "); Serial.println(red, HEX);

Serial.print("Green: "); Serial.println(green, HEX);

Serial.print("Blue: "); Serial.println(blue, HEX);

Serial.println();

delay(2000);

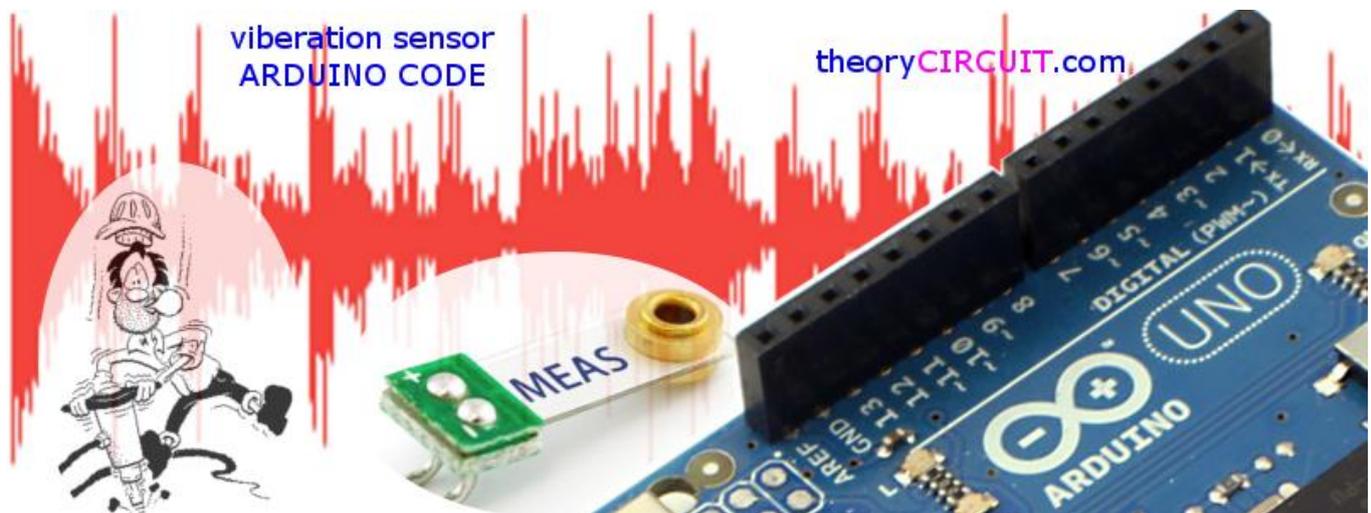
}
```

Datasheet



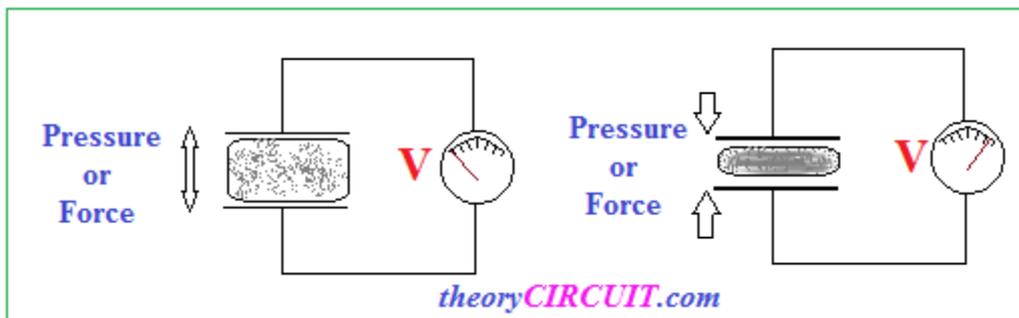
[isl29125](#)

Piezo Vibration Monitoring Sensor with Arduino



Detecting and measuring vibration can be used for several applications, Decision making circuits or alarm circuits. The best method to detect vibration is Piezo electric method. The vibration sensor or Piezo electric vibration detector is affordable sensing device that can be easily reachable by electronic designers, Engineers and hobbyist. If you are looking for Vibration Monitoring system or vibration alarm this article gives considerable idea about the design and implementation.

Piezoelectric pressure transducer working principle



Pizo sensor or Vibration sensor is made by the piezo element, this is uses the piezo electric effect. The Piezo Electric sensor element is a transducer which converts Pressure, Force, Strain some times Temperature into Electrical Charge.

You may heard about Buzzer (Piezo alarm device) that is also uses the piezo element, when we apply electric charge this element gets vibration at different frequency range (depends on the size of piezo material) so that it gives buzzer beep sound. For the both transducer and buzzer, piezo element is placed between two metal plates. the illustration represents working principle of piezo element when the pressure applied electric charge induced in piezo elements and that is measured through the voltmeter.

Piezo Vibration Monitoring Sensor

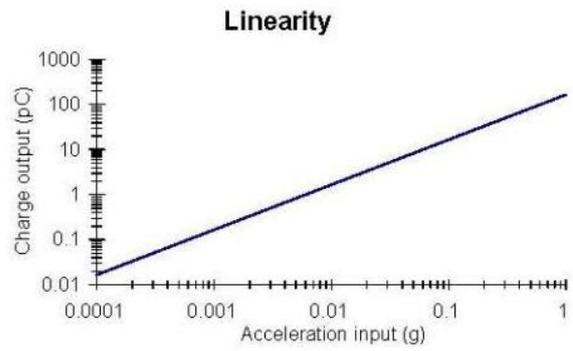
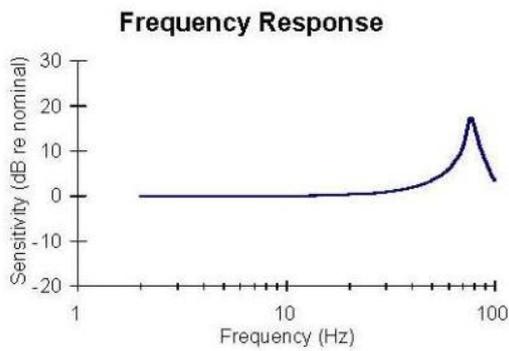


MiniSense 100 Vibration Sensor from Measurement Specialties is a low-cost cantilever-type vibration sensor loaded by a mass to offer high sensitivity at low frequencies. The pins are designed for easy installation and are solderable.

Horizontal and vertical mounting options are offered as well as a reduced height version. The active sensor area is shielded for improved RFI/EMI rejection. Rugged, flexible PVDF sensing element withstands high shock overload. Sensor has excellent linearity and dynamic range, and may be used for detecting either continuous vibration or impacts.

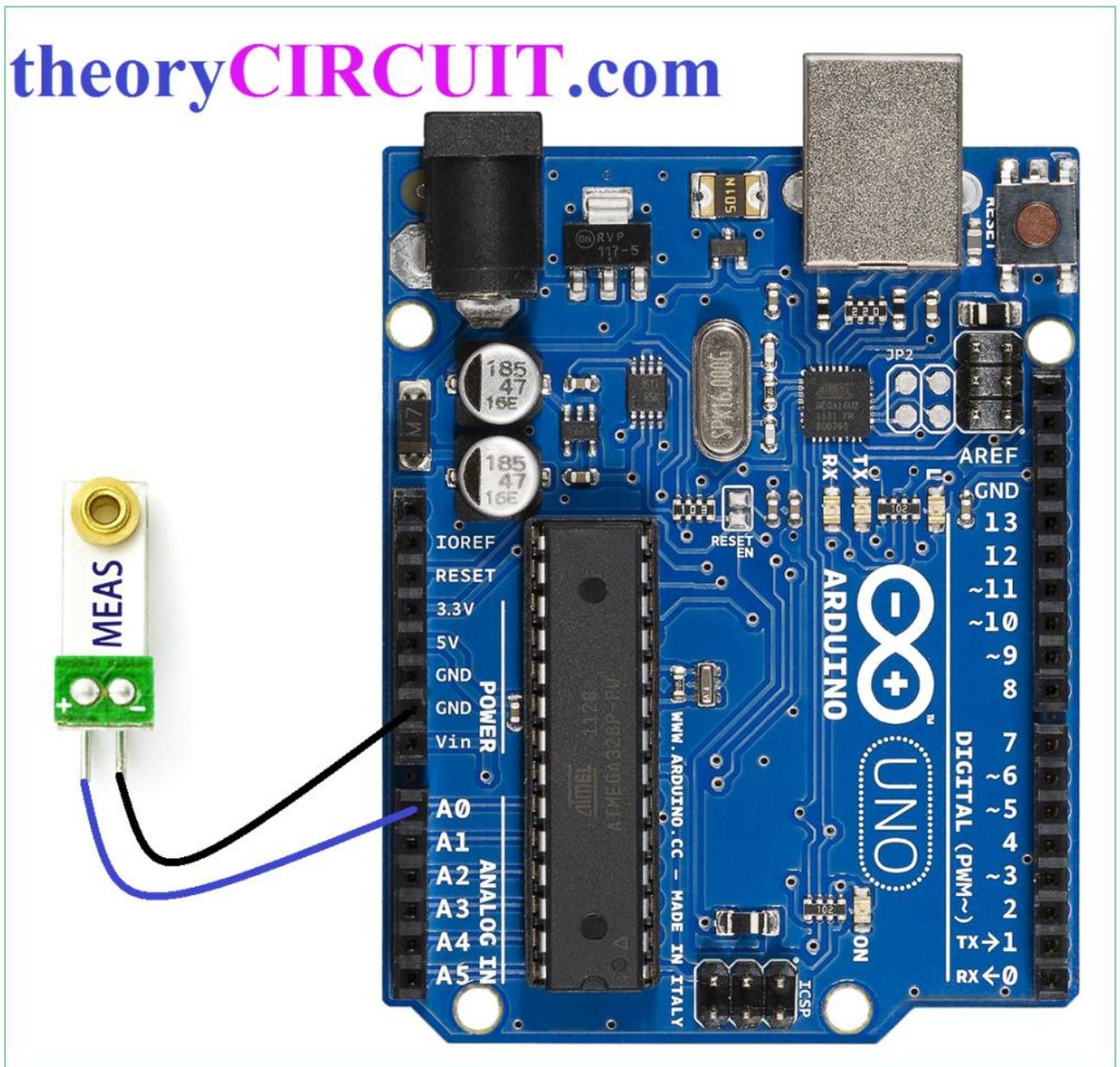
FEATURES

- High Voltage Sensitivity (1 V/g)
- Over 5 V/g at Resonance
- Horizontal or Vertical Mounting
- Shielded Construction
- Solderable Pins, PCB Mounting
- Low Cost
- < 1% Linearity
- Up to 40 Hz (2,400 rpm) Operation Below Resonance (Source [Datasheet minisense_100](#)).



This sensor has only two terminals as +Ve and -Ve, hence it is easy to interface with most micro-controllers, embedded systems and Arduino development board.

Piezo Vibration Sensor Arduino Hookup



By simply connecting Ground terminal to GND and +ve (signal out) terminal of vibration sensor to Arduino Analog input pin A0, we can create high sensitivity vibration monitoring

equipment. By interfacing [RF wireless Transceiver](#) modules we can make wireless vibration monitoring device.

In this article simple sensor interface only done, after the hookup is over upload the following Arduino code of piezo vibration sensor.

Arduino Code for Piezo vibration monitor

```
int piezo_Pin= 0;

int LED_Pin= 13;

//Set the threshold levels

int threshold= 500;

//Wakeup the Serial Monitor

void setup()

{

  Serial.begin(9600);

  pinMode(LED_Pin, OUTPUT);

}

//if the reading is higher than the threshold value, then the LED is turned
ON for a Second You can edit to your sepecification

void loop()

{

  int reading= analogRead(piezo_Pin);

  Serial.println(reading);

  if (reading > threshold)

  {

    digitalWrite(LED_Pin, HIGH);

    delay(1000);
```

```
digitalWrite(LED_Pin, LOW);  
  
}  
  
}
```

This code sense the vibrations or impacts and gives visible alert through LED connected at pin D13 of arduino, you can connect buzzer device instead of LED for sound alert. Vary the threshold level depends on you need here i have taken threshold level as 500 for an example.

Arduino Code for Piezo vibration Sensor (Read ADC)

```
const int PIEZO_PIN = A0; // Piezo output  
  
void setup()  
{  
  Serial.begin(9600);  
}  
  
void loop()  
{  
  // Read Piezo ADC value in, and convert it to a voltage  
  
  int piezoADC = analogRead(PIEZO_PIN);  
  
  float piezoV = piezoADC / 1023.0 * 5.0;  
  
  Serial.println(piezoV); // Print the voltage.  
}
```

This code helps you to serial print the piezo sensor output voltage level.

NOTE: If you need graph for serial data output from the vibration sensor use higher version [Arduino IDE](#) (opensource software).

-----end [of top five arduino projects from theoryCIRCUIT.com](#)-----