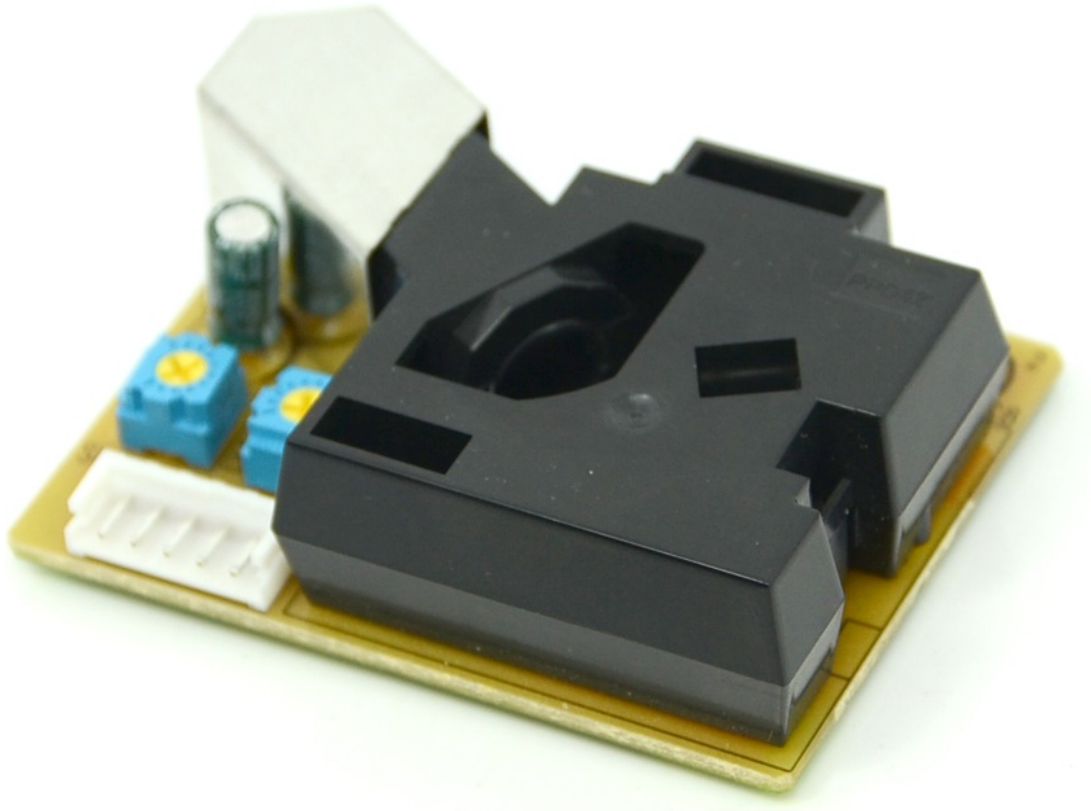# Grove - Dust Sensor

Introduction

This Dust Sensor gives a good indication of the air quality in an environment by measuring the dust concentration. The Particulate Matter level (PM level) in the air is measured by counting the Low Pulse Occupancy time (LPO time) in given time unit. LPO time is proportional to PM concentration. This sensor can provide reliable data for air purifier systems; it is responsive to PM of diameter 1μm.

Note

- This sensor uses counting method to measure dust concentration, not weighing method, and the unit is pcs/L or pcs/0.01cf.
- Please pay attention to the warnings listed here.

Specification

Item	Norm	Unit
VCC	4.75~5.75	V
Standby Current Supply	90	mA
Detectable range of concentration	0~28,000 / 0 ~ 8000	pcs/liter / pcs/0.01cf
Operating Temperature Range	0~45	°C
Output Method	Negative Logic, Digital output, High: over 4.0V(Rev.2), Low: under 0.7V	-
Detecting the particle diameter	>1	μm
Dimensions	59(W) × 45(H) × 22(D)	mm
Humidity Range	95% rh or less	-

Platform Supported

Arduino

Application Ideas
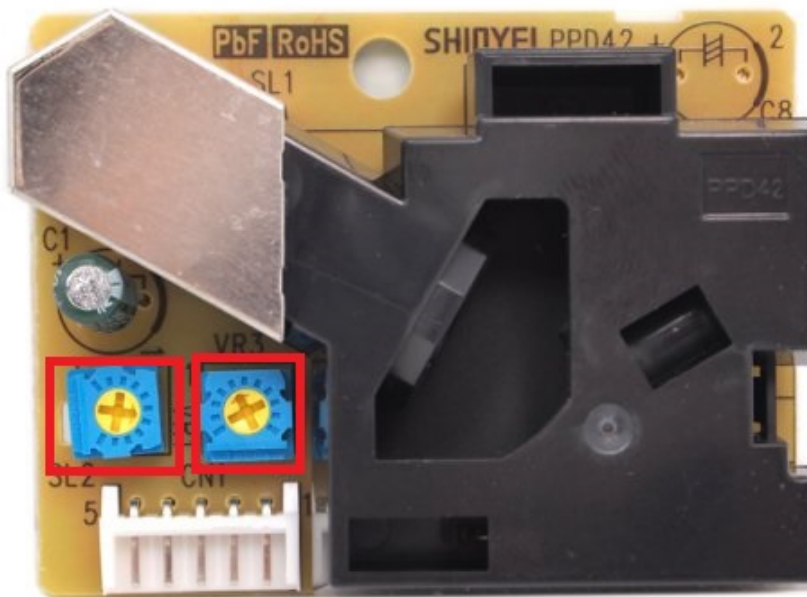
- Air Purifier
- [Air Quality Monitor](#)
- Air Conditioner
- Ventilator

Getting Started

Cautions

- Please keep it upright.
- 3 min preheat time is required while using for the first time.
- Arbitrary operation may cause unexpected damage.
- Following widgets (red rectangle marked) is used only for the factory setting. Please **DO NOT** change the default configuration.

Grove - Help

Following documents help user get started with Grove. - [Preface - Getting Started](#). - [Introduction to Grove.](#) - [Getting Started on Windows](#) - [Getting Started on Mac OS X](#)

Demos

Here is a demo to show how to obtain PM concentration data from this Grove - Dust Sensor.

1.Plug the dust sensor into digital port D8 on the Grove - [Base Shield](). It can only be D8 because the operation of this sensor involves sampling. This function only can be achieved by D8, the input capturing pin of ATmega328P, on Arduino/Seeeduino.

Also, you can connect Grove - Dust sensor to Arduino UNO without Base Shield: Arduino UNO |Dust Sensor –|– 5V| Red wire GND |Black wire D8| Yellow wire

2.Copy and paste the demo code below to a new Arduino sketch.

```
/*

Grove - Dust Sensor Demo v1.0

 Interface to Shinyei Model PPD42NS Particle Sensor

 Program by Christopher Nafis

 Written April 2012

 http://www.seeedstudio.com/depot/grove-dust-sensor-p-1050.html

 http://www.sca-shinyei.com/pdf/PPD42NS.pdf

 JST Pin 1 (Black Wire)  =&gt; //Arduino GND

 JST Pin 3 (Red wire)    =&gt; //Arduino 5VDC

 JST Pin 4 (Yellow wire) =&gt; //Arduino Digital Pin 8

 */

int pin = 8;

unsigned long duration;

unsigned long starttime;

unsigned long sampletime_ms = 2000;//sampe 30s ;

unsigned long lowpulseoccupancy = 0;

float ratio = 0;
```

```
float concentration = 0;

void setup() {
  Serial.begin(9600);
  pinMode(8,INPUT);
  starttime = millis();//get the current time;
}

void loop() {
  duration = pulseIn(pin, LOW);
  lowpulseoccupancy = lowpulseoccupancy+duration;

  if ((millis()-starttime) >= sampletime_ms)//if the sampel time = = 30s
  {
    ratio = lowpulseoccupancy/(sampletime_ms*10.0);  // Integer percentage 0=>100
    concentration = 1.1*pow(ratio,3)-3.8*pow(ratio,2)+520*ratio+0.62; // using spec sheet curve
    Serial.print("concentration = ");
    Serial.print(concentration);
    Serial.println(" pcs/0.01cf");
    Serial.println("\n");
    lowpulseoccupancy = 0;
    starttime = millis();
  }
}
```
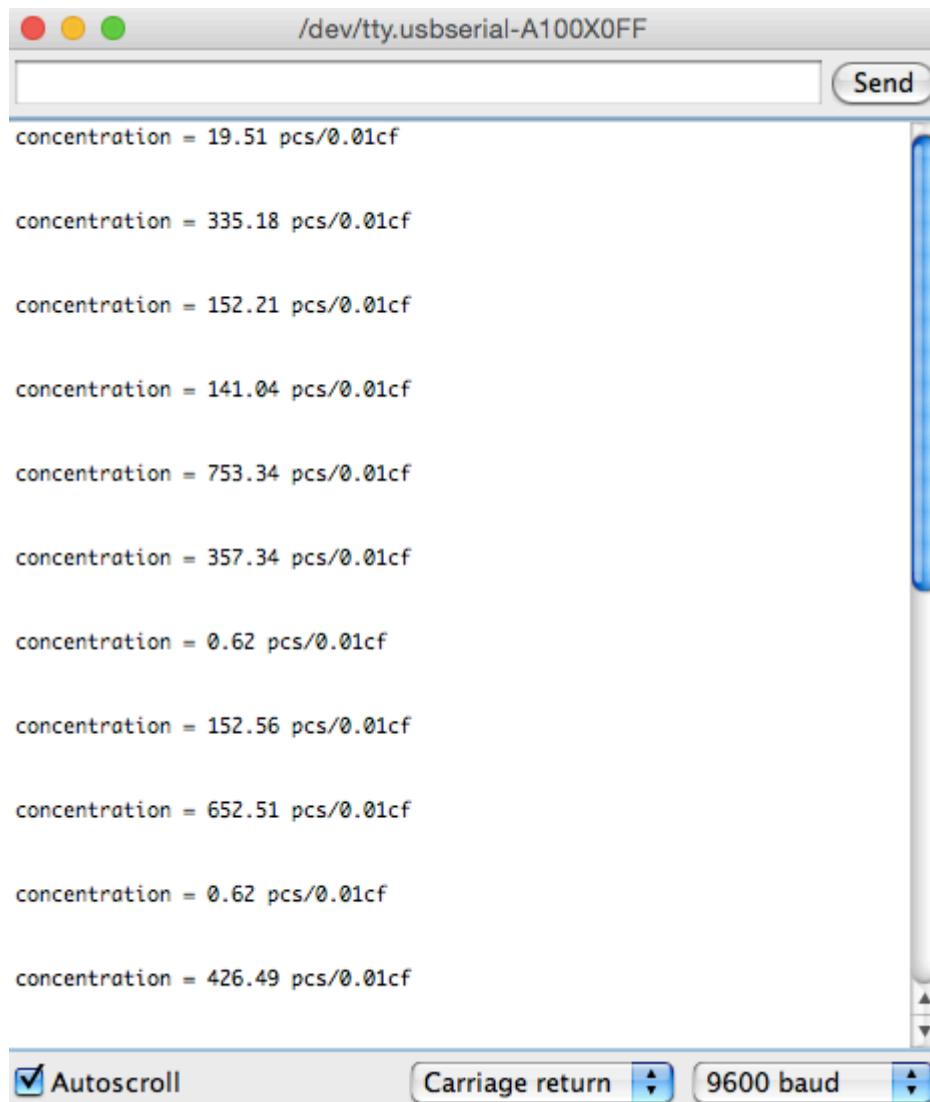
In this program, the Seeeduino samples the total duration of "logic low" in 30s, and this duration illustrates the dust density of environment. Open Serial Monitor, we can get air quality's value detected by sensor from PC's serial port.

```
●●●                /dev/tty.usbserial-A100X0FF
┌──────────────────────────────────────────┐ ┌──────┐
│                                            │ │ Send │
└──────────────────────────────────────────┘ └──────┘
concentration = 19.51 pcs/0.01cf

concentration = 335.18 pcs/0.01cf

concentration = 152.21 pcs/0.01cf

concentration = 141.04 pcs/0.01cf

concentration = 753.34 pcs/0.01cf

concentration = 357.34 pcs/0.01cf

concentration = 0.62 pcs/0.01cf

concentration = 152.56 pcs/0.01cf

concentration = 652.51 pcs/0.01cf

concentration = 0.62 pcs/0.01cf

concentration = 426.49 pcs/0.01cf

☑ Autoscroll          Carriage return ▲▼    9600 baud ▲▼
```

The result above consists of three parts: lowpulseoccupancy, ratio and concentration.

"lowpulseoccupancy" represents the Low Pulse Occupancy Time(LPO Time) detected in given 30s. Its unit is microseconds.

"ratio" reflects on which level LPO Time takes up the whole sample time.

"concentration" is a figure that has a physical meaning. It is calculated from the characteristic graph below by using the LPO time.

Smoke(Cigarette)·Output P1 Characteristics
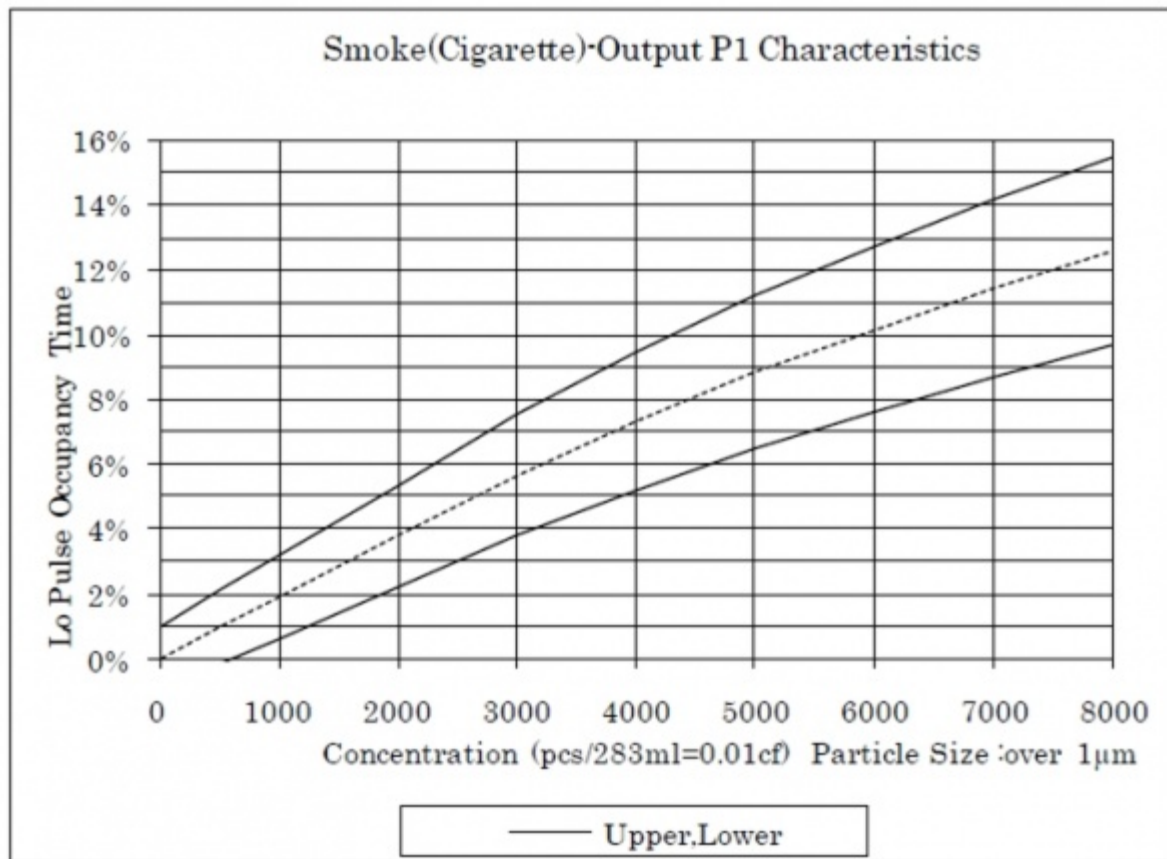
Here is a graph of the dust concentration measured in office :
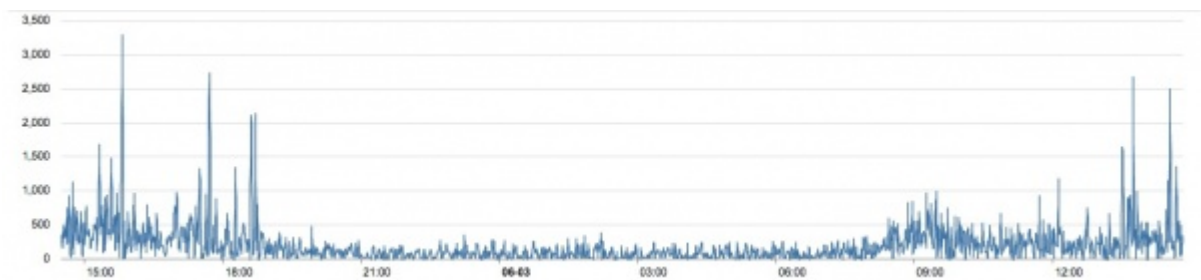
We can see the concentration of dust is very low in the evening, but it is higher in the afternoon. A threshold can be set when the concentration is above a value. Also, if you want to set the sensor more sensitive you can add a fan on the sensor, and add a 10kΩ resistor between the Pin5 and Ground. More information please visit the blog of A.J.

Reference

- [Building a low-cost networked PM2.5 monitor](#) – Made by A.J.
- [Measuring the Pickle Jr. – a modified PPD42 with an attached fan.](#) – Made by A.J.
- [Testing the Shinyei PPD42NS](#) – Made by darell tan
- [Air Quality Monitoring](#) – Made by Chris Nafis

Related Projects

If you want to make some awesome projects by Grove - Dust Sensor, here is a project for reference.

Air Quality Box

This section an IoT demo make by Seeeduino and [Grove](#).

More attention is being paid to the environmental air quality nowadays because the tiny particles in the air around can badly endanger people's health. We always get the information of environment from our government department. But it's the average value of the whole city/section. It can not reflect the environment around you accurately.