

# Luftdaten Particulate Monitor - Aberdeen Build Version 3.1

Kevin (57North Hacklab)

10 June 2019

## Contents

<b>Introduction</b>	<b>1</b>
<b>Parts</b>	<b>1</b>
<b>Kit Preperation</b>	<b>3</b>
1. DHT22 . . . . .	3
Using Hot glue . . . . .	3
Replace the Dupont Housing . . . . .	3
2. SDS011 . . . . .	4
3. Mounting plate . . . . .	4
Making the baseplate . . . . .	4
4. Vent pipe . . . . .	4
To Bend the Vent Pipe . . . . .	4
5. Flash the NodeMCU . . . . .	5
<b>Assembly</b>	<b>6</b>
1. Mount the Base Plate . . . . .	6
2. Mount the Vent Pipe . . . . .	6
3. Cut the holes in the Vent Pipe . . . . .	7
4. Add the Humidity Sensor, <b>DHT22</b> . . . . .	7
5. Mount Particulate Monitor, <b>SDS011</b> . . . . .	8
6. Mount the Processor, <b>NodeMCU</b> . . . . .	8
7. Connect the Sensors . . . . .	9
8. USB Cable and Lid . . . . .	10
9. Flash the device . . . . .	10
10. Mount and Connect . . . . .	10
<b>Installation</b>	<b>11</b>
1. Mount the Sensor . . . . .	11
2. Connect to WiFi . . . . .	11
3. Register the sensor . . . . .	11
luftdaten.info . . . . .	11
opensensemap.org . . . . .	12

## Introduction

Here is an alternative build for the Luftdaten sensor air particulate monitor, but we have found it to be more robust for mounting, and still comes in about £30

## Parts

---

Quantity	Description
1	<b>NodeMCU</b> , v3 ESP8266, CH340, the microprocessor, Brain and WiFi.
1	<b>SDS011</b> , Laser based particulate monitor. <i>With cable.</i>
1	<b>DHT22</b> , Temperate Humidity Sensor. <i>With cable.</i>
1	<b>Box</b> , Junction Box, 105 x 80 x 150mm.

Quantity	Description
1	<b>Base plate</b> , 140mmx95mm mounting plate, ply or GRP.
60mm	<b>Intake tube</b> , 6mm Inside diameter, flexible pvc hose.
280mm	<b>Vent pipe</b> , 21.5mm pipe PVC.
1	<b>USB cable</b> , MicroUSB cable, <i>3m or 5m</i> .
1	Small cable-tie to hold vent tube in place
2	Self tapping screws 10mm Length
4	M3 Nylon Nuts
4	M3 Nylon Screws
4	M3 Nylon Standoffs 8mm rise
2	M3 Nylon Standoffs 25mm rise
2	2 way Dupont female header
1	3 way Dupont female header
1	6 way Dumont female header
4	Dupont female crimps

---

#### Tools

---

Drill & Bits; 4.5mm, 3.5mm, 10mm

Screw Drivers, flat and philips

Snips

Dupont Crimper

junior hacksaw

knife

Paint Pens, 3 colours

Computer (to load the software onto the sensor)

Heat Gun

Sand for pipe bending

Bending jig for pipe.

---

# Kit Preperation

## 1. DHT22

### Using Hot glue

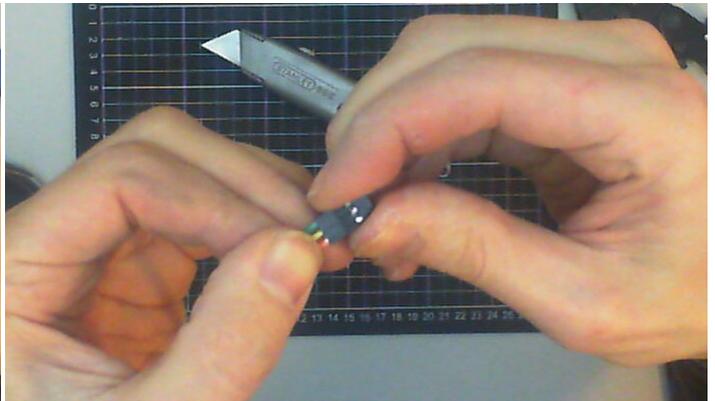
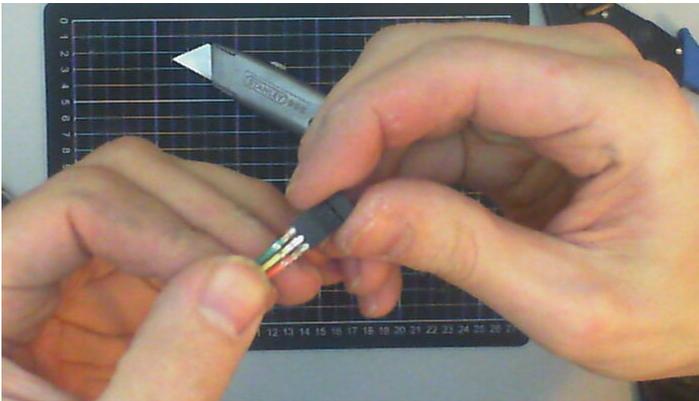
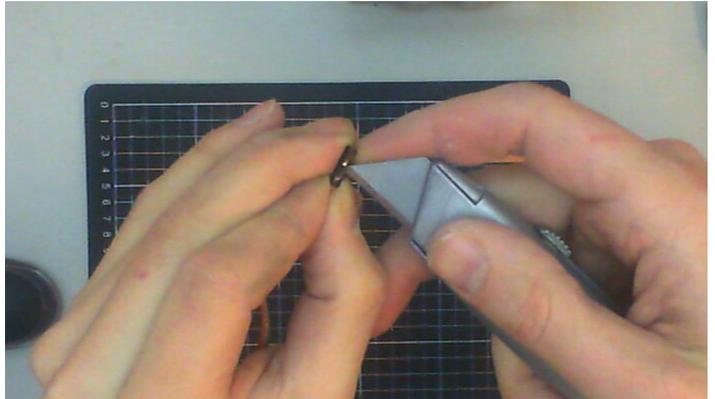
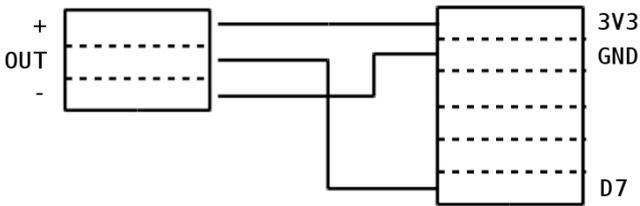
To do this use hot glue to glue them together as the drawings, use blank Dupont housings to space out the six way connector

### Replace the Dupont Housing

If you have replacement Dupont housings at in the parts lists

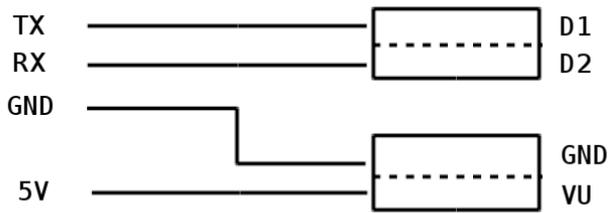
Use this diagram below to ensure the connections in the Dupont are correct:

- a. Use a small knife to lift the clip which is individual connector to release the crimp which can be pulled out of the individual plastic housings
- b. Ensuring that you match the order in the wiring diagram push the crimp into the housing connector.



## 2. SDS011

Here you will have to cut off the cable which connects to the usb-to-tty serial module, then crimp them with the Dupont female crimps, and push them into the housing matching the diagram below, to do this you need female crimps, the crimp tool and 2 two-way housings.

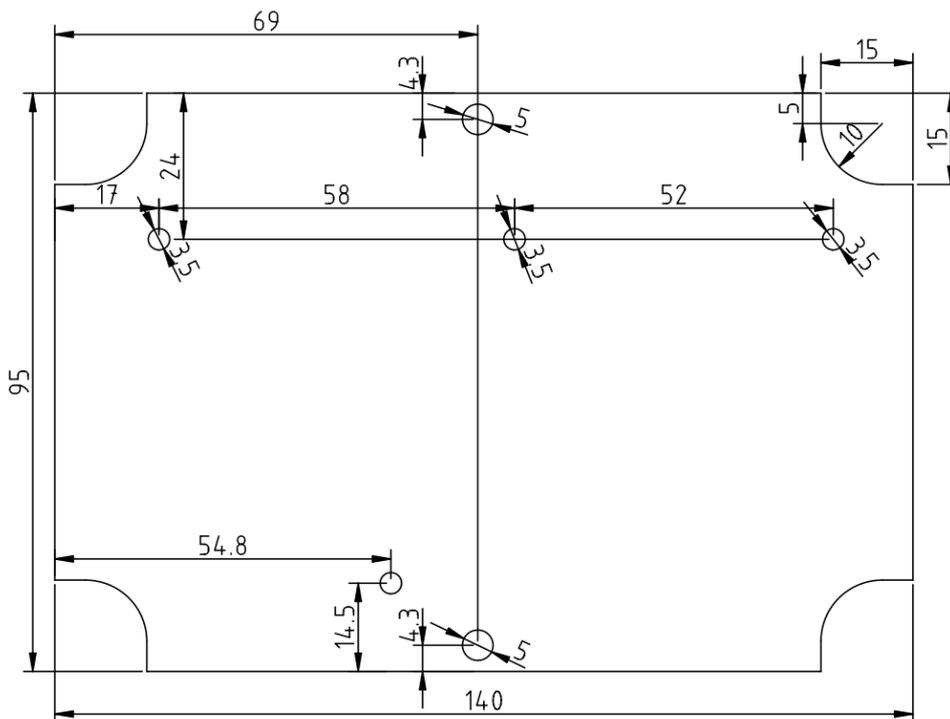


## 3. Mounting plate

You can use a GRP Epoxy fibre, I find this nice but it is a little more expensive than using ply, both can be laser cut or cut by hand, use the dimensions below, this is to fit the Schneider JB from the components list

### Making the baseplate

You can laser cut or use a hacksaw and drill to make the plates, the dimensions are below, this is for the Schneider JB. It is important to check these against your components when they arrive to ensure the dimensions are correct.



## 4. Vent pipe

Use 21.5mm diameter Overflow PVC Pipe, you can get it from most plumbing stores. I think you will need about 320mm in length.

### To Bend the Vent Pipe

- a. Fill with Sand and tape off the ends, this holds the shape while bending.
- b. **Use a Jig** this makes it easy to make multiple pipes see the picture below.
  - a. Create a jig with the required bend for the pipe to fit into, I used a 45mm diameter for the bend.

- b. Place the pipe in the jig and ensure you have enough length to get through your junction box.
- c. **Bend**
  - a. Heat the area you intend to bend
  - b. Slowly stretch and bend the area around the jig
  - c. Hold until cool
- d. Open the ends and remove all the sand from the pipe you can wash them out to get out the remaining,



## 5. Flash the NodeMCU

This will put the software onto the NodeMCU there are different instructions depending on your Computer you have available, We can do this step at the Hackerspace in Aberdeen, or you can find out how to do it at Luftdaten.info - <https://luftdaten.info/en/construction-manual/#firmware-einspielen>

# Assembly

## 1. Mount the Base Plate

The **base plate** is the plastic fibre sheet with no corners and holes in it, the **standoffs** are black or white plastic screws.

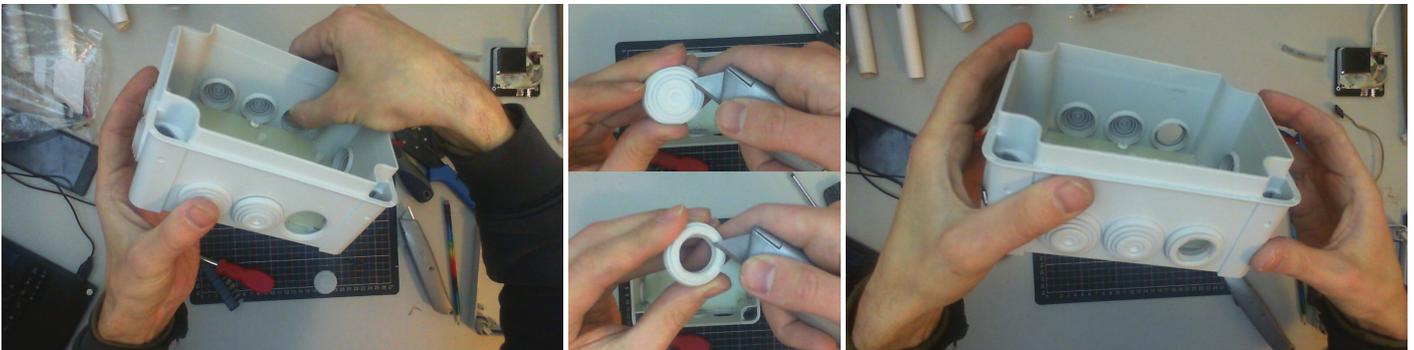
- Secure the **4 short standoffs** with 4 nuts. *In the middle picture below, there should be one standoff at the bottom of the baseplate, to the left of the larger hole.*
- Place the plate into the box with the standoffs facing upwards. *Make sure the standoff at the bottom is to the left of the screw*
- Secure with the two white headed screws.



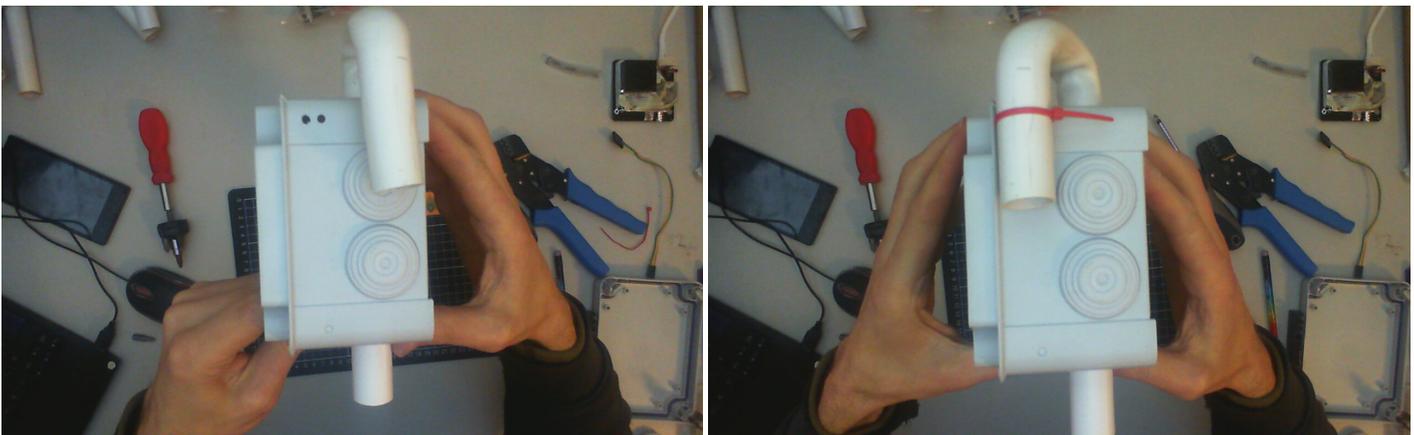
## 2. Mount the Vent Pipe

The **grommets** are the rubber stoppers around the side of the box and the **vent pipe** is the white plastic cube with the bend in it.

- Remove the two grommets from the right hand top and bottom by pushing the edge inwards from the inside.
- Use a knife to cut inward to the centre of the grommet and remove the two inner rings, once you have cut a little the ring should rip out.
- Replace the grommets and push in the vent pipe straight through from the top.



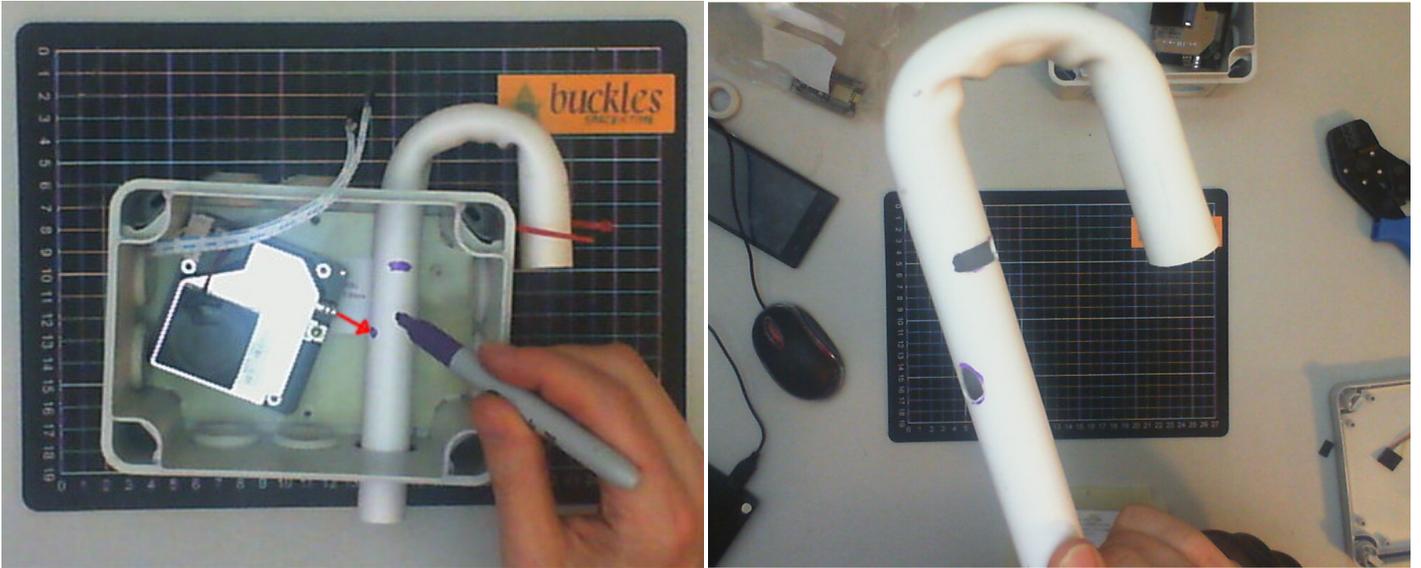
- Look at the side of the box where the pipe overhangs.
- Use a Dremmel to cut two small holes near the front of the box.
- Use the cable tie to hold the vent pipe. **Do not fully tighten the cable tie!**



### 3. Cut the holes in the Vent Pipe

The SDS011 is the larger board with the fan on it.

- Place the SDS011 on the standoffs left of the vent pipe, see the orientation in the picture below, the holes should align with the standoffs.
- Use a pen to mark the vent pipe just below where the nozzle on the SDS011 points to. *See the red arrow on the image below.*
- Mark the pipe again, half way between your first mark and the top edge of the box.
- Take the vent pipe out of the Box and use a drill to cut a hole on your first mark. *Enough for the intake tube.*
- Use a junior hacksaw and a knife to cut a letterbox style hole on the second mark. *see image below.*



- Push the vent pipe back into to the box.

### 4. Add the Humidity Sensor, DHT22

The DHT22 is the small white sensor with three connecting wires.

- Put the smaller end of the cable into the letter box shaped hole at the top of the vent pipe, feed it until it reaches the bottom.



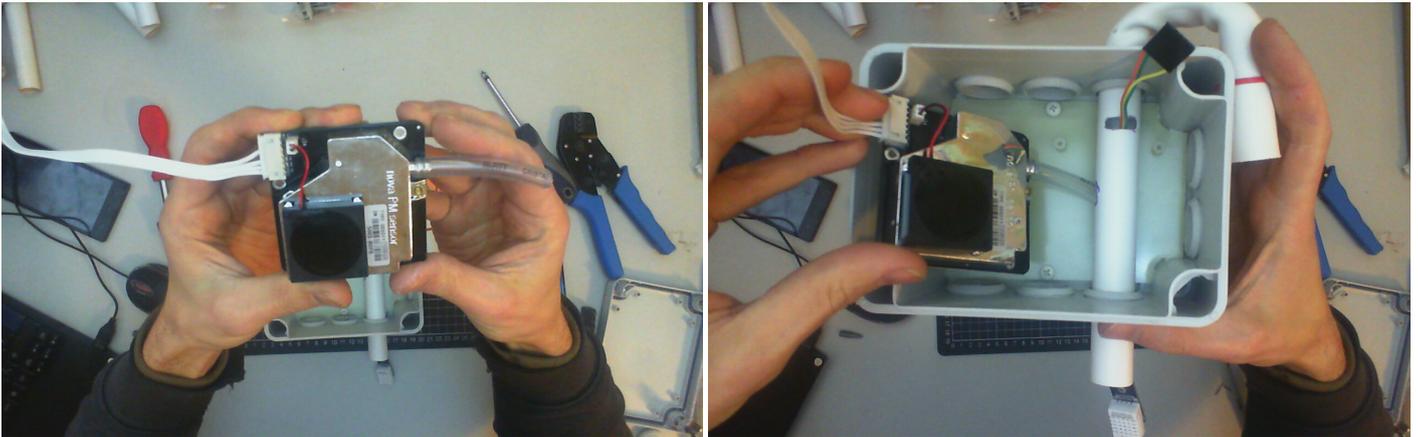
- Plug in the sensor and pull so it is just outside vent pipe.



## 5. Mount Particulate Monitor, SDS011

The SDS011 is the board you used above, and the intake tube if the small clear plastic tube.

- Ensure the cable is connected to the SDS011 and push the intake tube onto the nozzle.
- Feed the intake tube into the hole you made on the vent pipe until you can set it flat onto the standoffs.



- Line the holes on the SDS011 over the standoff.
- Secure the **top right** hole with a **long standoff**.
- Secure the other two holes with the screws provided.



## 6. Mount the Processor, NodeMCU

The nodeMCU is the last board you have left, it should have a smaller board on a larger board.

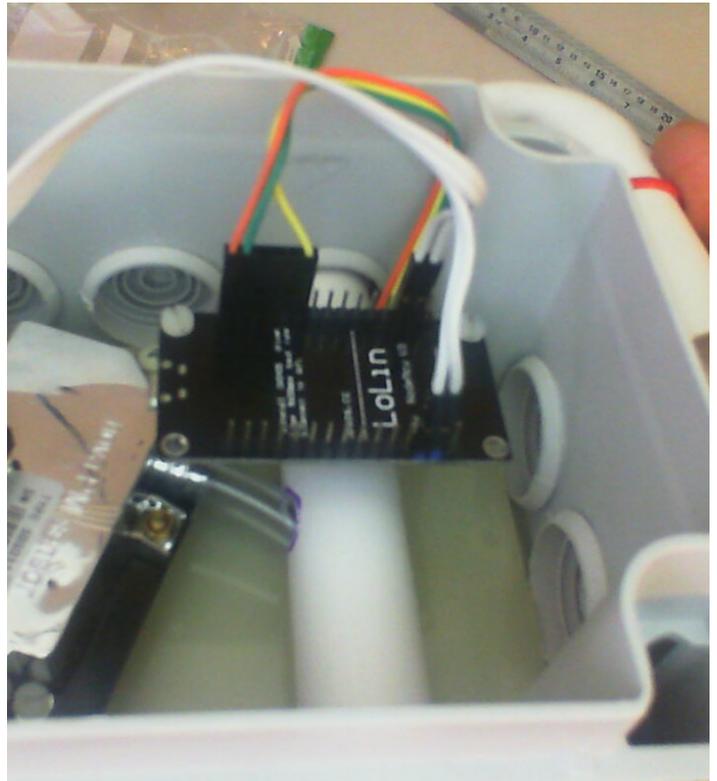
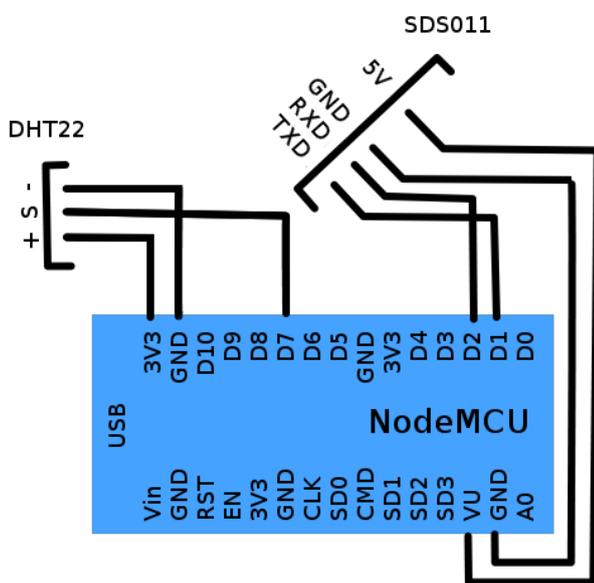
- Screw in the last **long standoff** into the standoff on the right of the vent tube.
- Place the **NudeMCU** with the pins upwards and the USB plug pointing to the middle of the box.
- Align the top mounting holes on the NodeMCU with the standoffs.
- Secure with the two remaining screws.



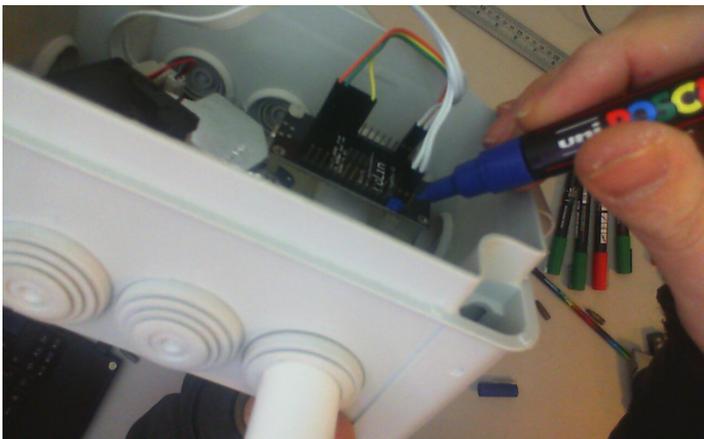
## 7. Connect the Sensors

Now to Connect it all together, use the diagram below as an aid.

- Plug in the 6way connection to the NodeMCU as the diagram, identify the colour of the cable which connects to the positive 3V3.
- At the other end of that cable, the DHT22 at the bottom of the vent tube, ensure the cable identified as 3V3 is connected to the pin marked +.
- The SDS011 cables should be identifiable by the pattern printed on them. Look at the SDS011 and identify the wire by itself on the connector this is the 5v.
- Find the other end with that pattern and connect it the NodeMCU, the bottom row, 3<sup>rd</sup> pin in from the right, and have the other pin on this connector to the right of it VU & GND.
- Back to the SDS011 same as above, Identify the wire leftmost on the connector, then connect that to the NodeMCU, top row, 2<sup>nd</sup> from the right, and have the other pin to the left of it, D1 & D2.



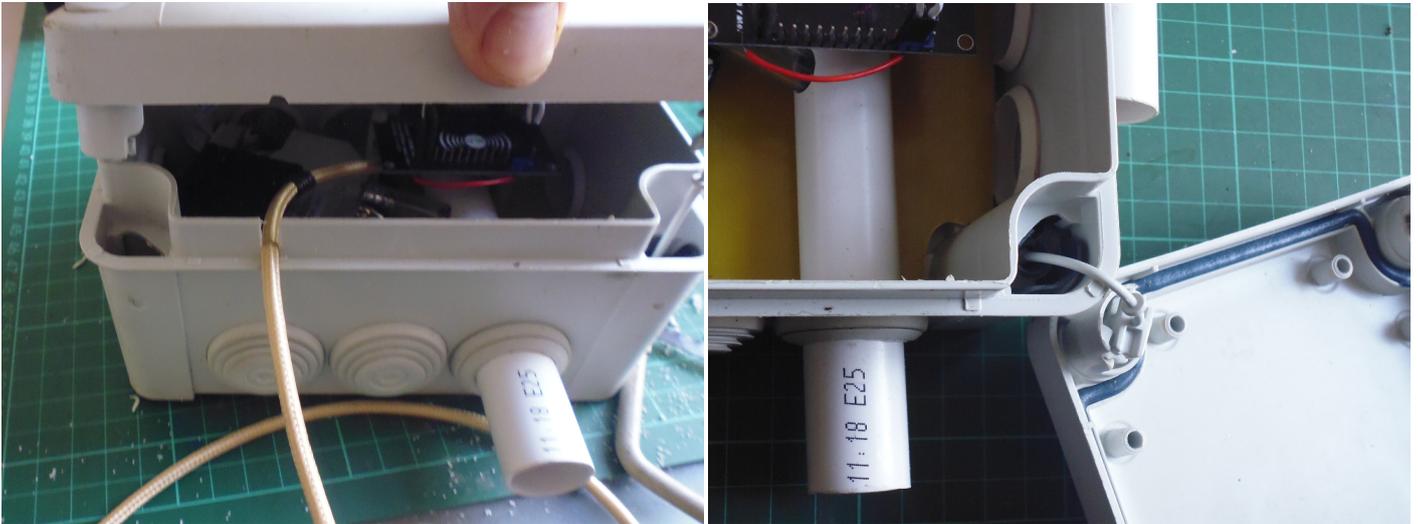
- Use the different colour paint pens and paint the connector and board next to the connection each with a different colour, this will help if it ever gets disconnected.



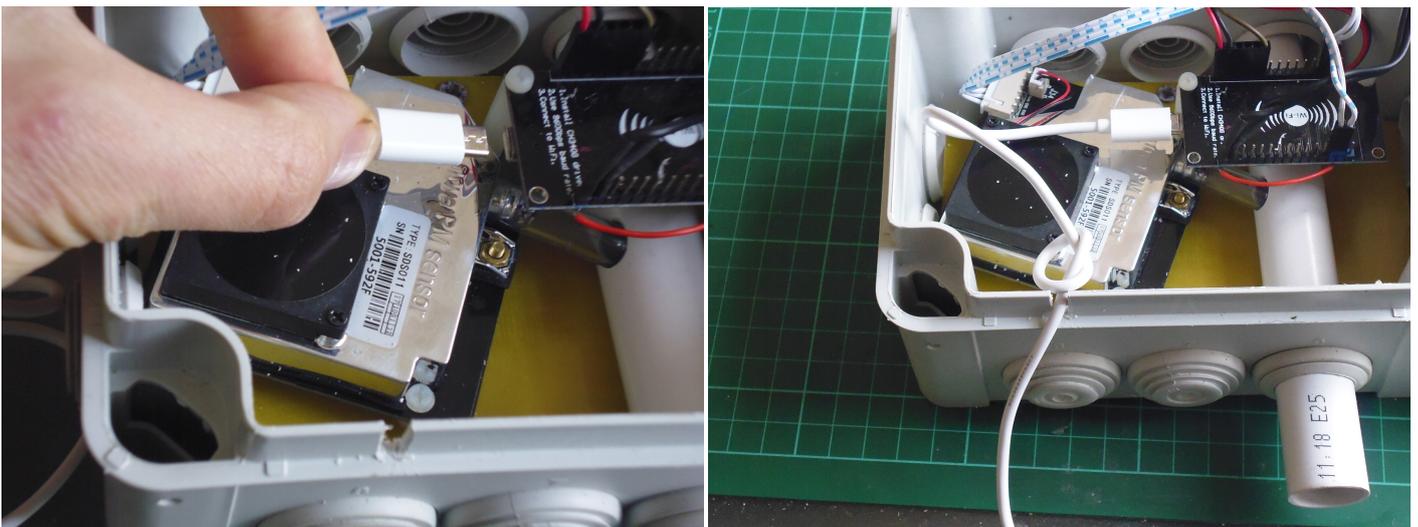
## 8. USB Cable and Lid

The USB cable will have to connect to the NodeMCU inside the Box.

- a. Use the junior hacksaw and knife to cut a slot into the rim of the bottom of the box and a little notch into the lid for the USB cable to sit in.
- b. There is a bag with a black plastic clip, which will fit into the bottom right corner of the box, push it in, then push the tail from the lid into the clip. This will stop the lid from falling if you have to open the box in the future.



- c. Plug the USB plug and plug it into the NodeMCU.
- d. Tie a knot in the USB cable further along the cable then it takes to get to the slot you cut in the box. This is to stop the cable pulling on the NodeMCU board.



## 9. Flash the device

Call over the instructor, and they will flash the firmware onto the NodeMCU. If you are curious and do not know what that means, ask them, they will happily explain it.

## 10. Mount and Connect

Take the air monitor home and mount it on an outside wall and connect it to your WiFi, then register the device, More information will follow on this.

# Installation

## 1. Mount the Sensor

- **Location** To mount the sensor find a location outside where you can reach power to the monitor this can be near a vent or window, to get the power cable out, do Not place it too close to an extractor vent as that will affect the readings. For the location think head height somewhere that is relatively open, to get a representative reading of the area.
- **Configure and Register** Once you have the sensor mounted and powered Use the Luftdaten documentation in the link below to setup of the device and connect it to your local WiFi network you can ignore the build section of the Manual.  
<https://luftdaten.info/en/construction-manual/>

To power the device you need a standard micro USB cable with a 5v supply. There are a number of options available for bower from battery backs, to a direct link to some external power supply. Cutting another hole in one of the other Grommets to get the USB Supply into the box.

## 2. Connect to WiFi

To Connect the sensor it needs to know the WiFi Network and the password:

- a. Power up the device and use your computer or mobile to search for WIFI networks.
- b. You will see a station called: (the will be a decimal number you should note this down, it will Identify your device)

Feinstaubsensor-\_\_\_\_\_

- c. Connect this Network: (this may take a few tries, I don't know why but the network seemed to drop out when we were testing it.)
- d. Use a web browser and go to the address <http://192.168.4.1/>
- e. You should automatically see the configuration page to the right, (if you do see the home page below click on the configuration button)
- f. Enter your WiFi Network Name (BSSID) and the password, it should be on the back of your router or on a card.
- g. When you click **Save and restart** the network should disappear any you will be disconnected. Keep looking at the networks available, if it appears again there is a problem with the WiFi name or password entered.
- h. To test the device connect to your WiFi to get an internet connection, go to the below address <http://www.madavi.de/sensor/gr> and search for your sensor ID. Here look at the graphs for the SDS011 and the Temp Humidity sensor you have.

**Particulate matter sensor**  
ID: [REDACTED]  
MAC: [REDACTED]  
Firmware version: NRZ-2018-123B

Home » Configuration

**WiFi Settings**  
Found Networks: 6

Network Name	Signal Strength
57North	100%
[REDACTED]	80%
[REDACTED]	38%
[REDACTED]	36%
[REDACTED]	30%
[REDACTED]	18%

Name:

Password:

**Advanced settings (only if you know what you are doing)**

**More settings**

- Auto update firmware
- Load beta firmware
- OLED SSD1306
- OLED SH1106
- LCD 1602 (I2C: 0x27)
- LCD 1602 (I2C: 0x3F)
- LCD 2004 (I2C: 0x27)

© Open Knowledge Lab Stuttgart a.o. (Code for Germany)

## 3. Register the sensor

[luftdaten.info](https://luftdaten.info)

If you have the the sensor reading to Medavi. you can add it to Luftdaten's map at:

<https://meine.luftdaten.info/>

Register an account and follow the instructions to register the device to your location.

### **opensensemap.org**

Here you can register an account:

<https://opensensemap.org/register>

you will have to add a configuration option to your Sensor you can find out how to do that at Register a Luftdaten.info Particulate Matter Sensor on the openSenseMap at [https://osem.books.sensebox.de/en/luftdaten\\_feinstaub.html](https://osem.books.sensebox.de/en/luftdaten_feinstaub.html)