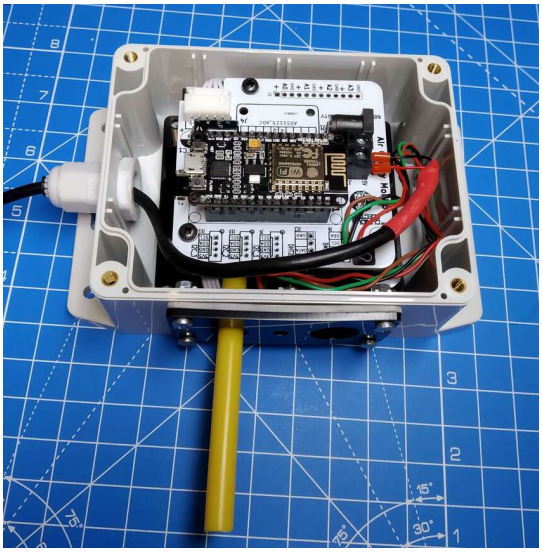
THE CURIOUS ELECTRIC CO.

Air Quality Unit Build Instructions

Date:	10/08/20	Version:	1.0	By:	Matt Little



Build your own air quality monitor and contribute to the https://sensor.community worldwide air quality monitoring project. Citizen science in action!

This kit contains all you need to set up your own online air quality monitoring unit. This records the PM2.5 and PM10 particulate data, along with temperature and humidity. This is sent (via your Wi-Fi connection) to the ***sensor.community*** platform.

In building and installing this equipment you are helping monitor local and global air quality and provide results to a growing network of citizen science sensor units!

The unit uses the SDS011 dust and particulate sensor, along with a BME280 temperature and humidity sensor. These are interfaced with an ESP8266 Wi-Fi enabled microcontroller.

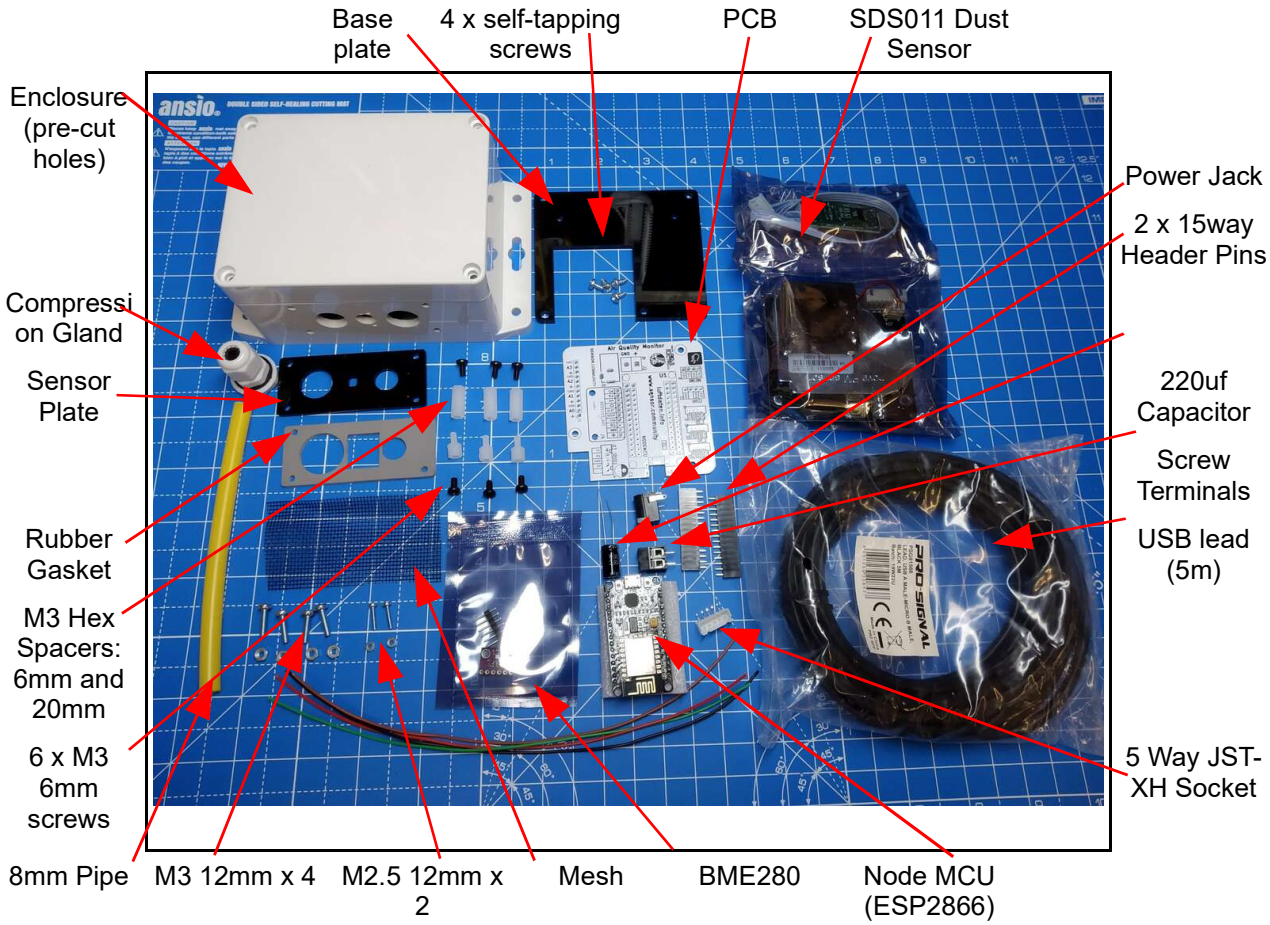
Additional PCB connections can be made to add more sensors in the future.

Note: This kit contains all hardware required to set up your sensor unit. You will need a local wifi connection. You will need to install in a location which can connect to that network.

*This kit requires soldering, some hardware construction and setting up an online **sensor.community** account and sensor node. This should take in the region of 2-4 hours to build.*

*This kit relies upon the **sensor.community** platform. Curious Electric use their firmware and do not have any input to the software side of the project.*

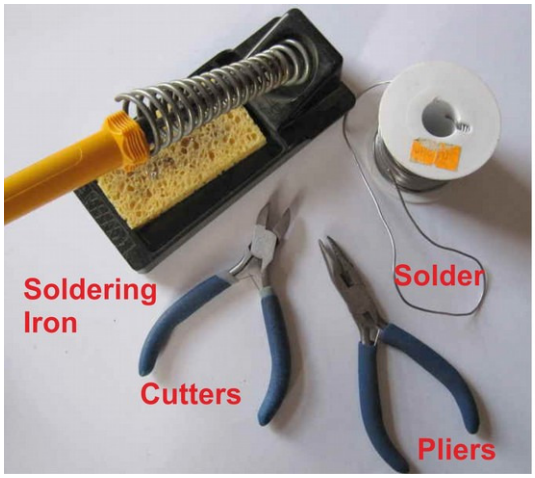
Parts included:



Parts list:

Item	Ref		Item	Ref
Power supply buffer capacitor. 220uf	C1		Dust and Particle sensor	SDS011
2.1mm barrel jack power connector	J1		5m USB cable.	USB Power Lead
2 way screw terminal	J2		Waterproof small enclosure. Pre-cut holes.	Enclosure
ADC input pins	J3		Laser Cut	Baseplate
ADS1115 ADC connector. **NOT supplied!**	J4		Laser Cut	Rubber Seal
BME280. Temperature and Humidity Sensor	J8		Laser Cut	Side Plate
4 way Connector - Grove Wiring. **NOT supplied!**	J9, J10, J11		Small piece	Insect Mesh
Temperature and Humidity Sensor. **NOT supplied!**	J12		For USB power lead	Compression Gland
5 Way JST-XH 90 Connector for SDS sensor.	J13		Small Pipe ID: 6mm OD 8mm - yellow	Pipe
15 way Header for NodeMCU	J14,J15		Hold SDS to PCB. M3 Hex.	Hex Spacers 3mm
SMD USB connector. **NOT supplied!**	P1		Hold SDS to baseplate. M3 Hex.	Spacers 20mm
4k7 ohm. For DHT22 sensor. **NOT supplied!**	R1		Hold PCB and Baseplate	M3 screws 6mm
NodeMCU ESP8266 Unit. Programmed with airRohr software.	U1		Hold baseplate to enclosure	Self Tapping screws
Printed Circuit Board.	PCB		Hold rubber seal and side plate	M3 screws 12mm
4 colour cable for connecting BME280 to PCB. 10Cm long.	Cable		Hold rubber seal and side plate	M3 Nuts
240V AC UK Plug USB PSU 1.2A	PSU		Hold BME280 in place	M2.5 screws 12mm
			Hold BME280 in place	M2.5 Nuts

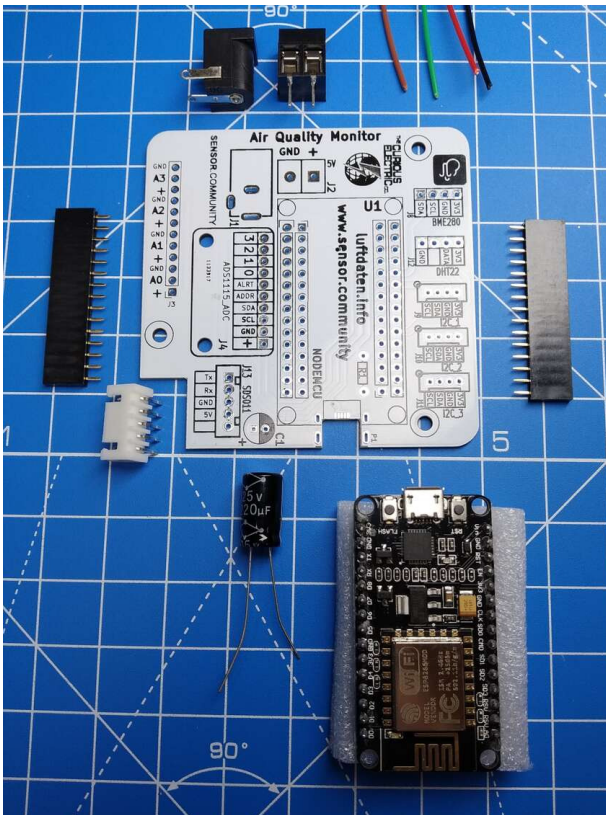
Tools required:



You may also need some scissors.

Hardware Instructions:

Step: 1	Solder PCB



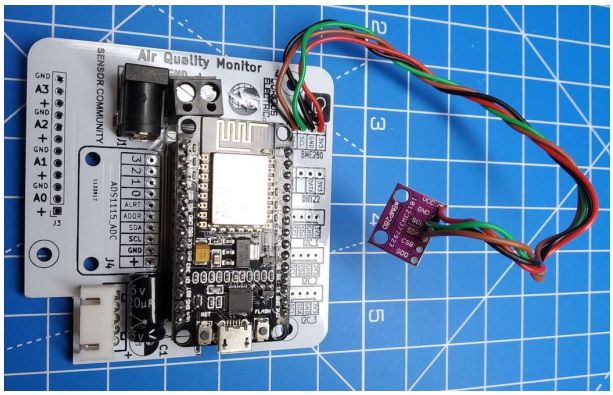
First we need to solder the components to the printed circuit board (PCB).
There are 6 components and 4 wires to solder.

Fit J1 (barrel jack socket) and solder.
Fit J2 (screw terminals) and solder.
Fit J13 (JST-XH 5 way right angle connector) and solder.

Fit the two rows of header pins onto the pins of the NodeMCU. This can then be put in the holes marked for U1. The header pins can then be soldered to the PCB. Using the NodeMCU during soldering keeps the pins in place.

Next solder the polarised capacitor. Ensure correct orientation of these components. The negative lead is marked with a white strip. The positive lead is slightly longer than the negative. Align the positive lead with the + sign and the negative lead with the white PCB marking.

Value	Ref	Marking
220uf Capacitor	C1	25V 220uf



This component is put into position then bent to lie flat on the PCB. Then solder it. This is required to ensure the lid fits on the enclosure.

Using the four wires we need to solder the main PCB and connect to the BME280 sensor. There are four connections to make:

PCB ***BME280***

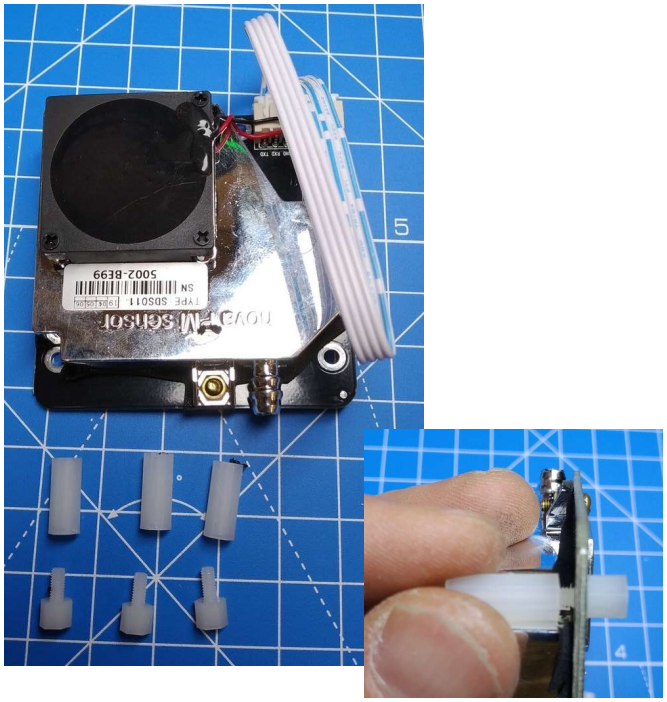
+3.3V – Use Red wire. - VCC
GND – Use Black wire. - GND
SDA – Use either colour. - SDA
SCL – Use either colour. - SCL

The BME280 PCB is labelled with the same connections. Solder the matching names to the BME280.

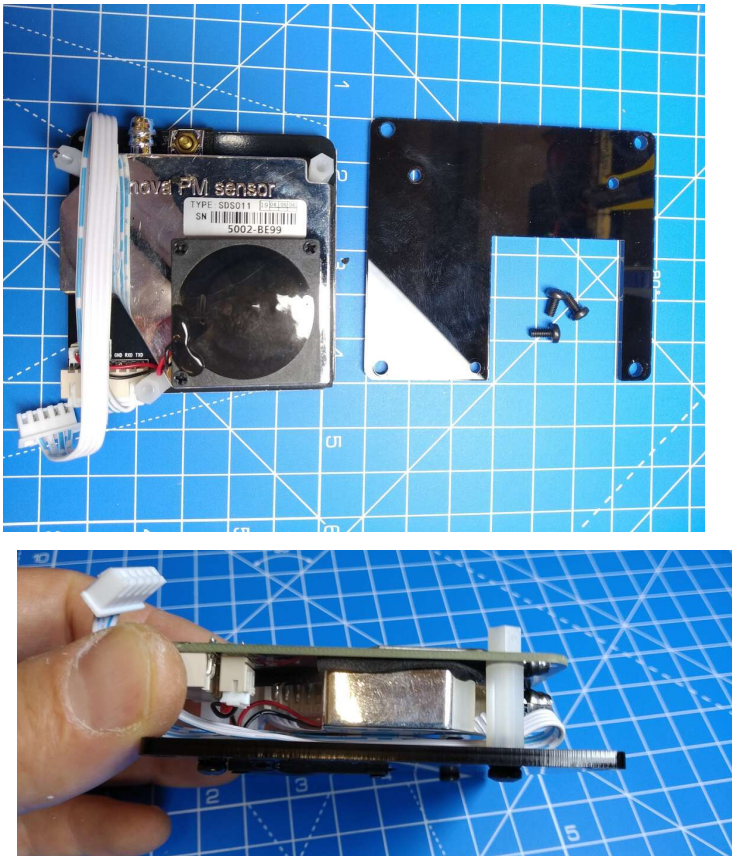
Step: 2	Add spacers to dust sensor

Take the SDS011 unit from its package. There is a USB to serial converter in the package, if you would like to directly connect to the sensor from a computer, but that is not needed for this project.

Use the 3 x 6mm M3 Hex spacers (with thread sticking out) and the 3 x 20mm M3 Hex spacers and connect through the three mouthing holes on the dust sensor. The longer (20mm) hex spacers should go on the side with the sensor (shiny box and fan), while the shorter spacers go on the PCB side of the sensor.



Step: 3	Mount sensor to baseplate.



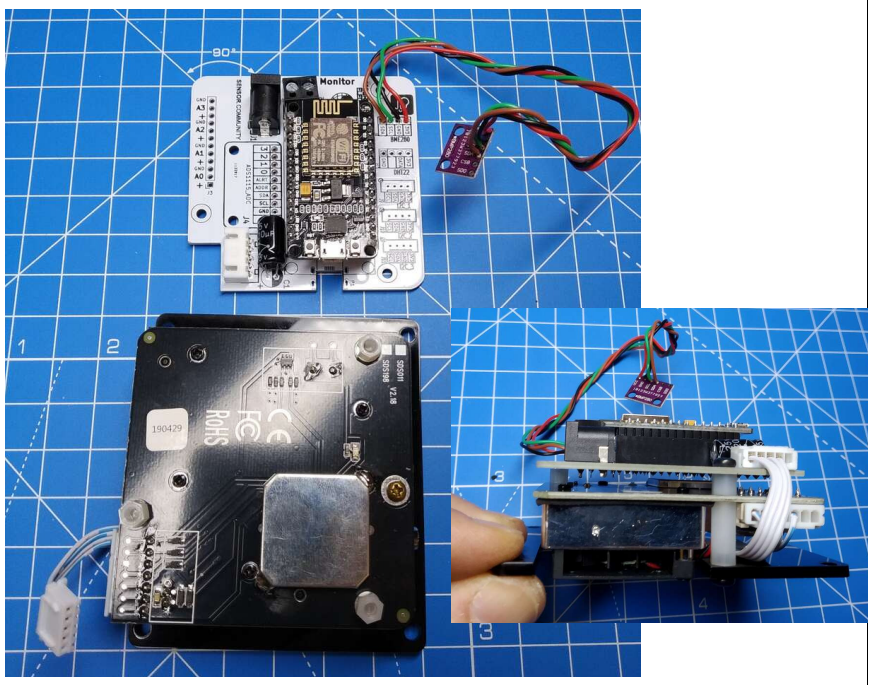
The SDS011 is mounted on the baseplate with the 20mm spacers towards the baseplate. The fan fits into the cut-out of the baseplate.

Use 3 x M3 6mm machine screws to hold the sensor to the baseplate.

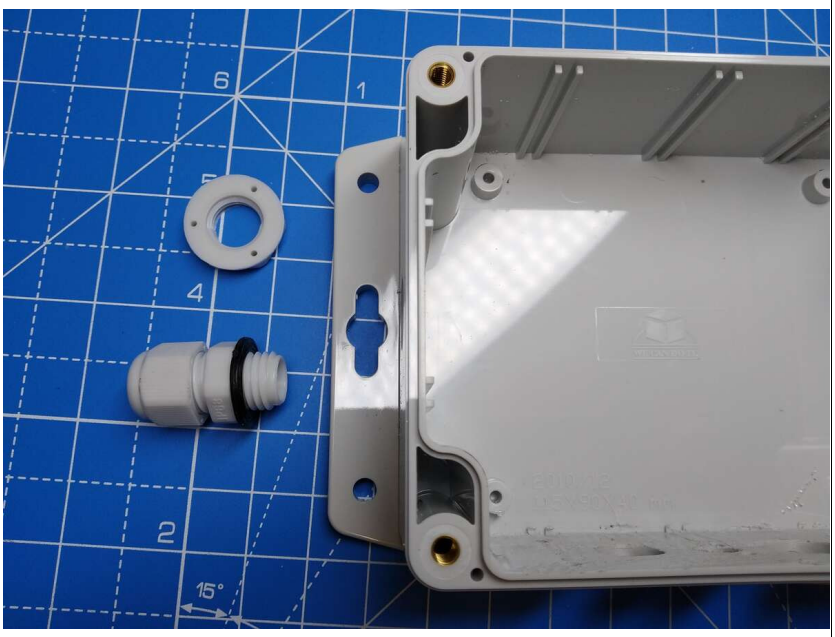
Step: 4	Mount PCB to Sensor

Mount the PCB to the top of the sensor. Use the 3 x M3 6mm machine screws to hold the PCB to the shorter hex spacers on the sensor.

Use the white cable that comes with the SDS011 dust sensor to the PCB. The cable might need to be folded under to keep it out of the way.



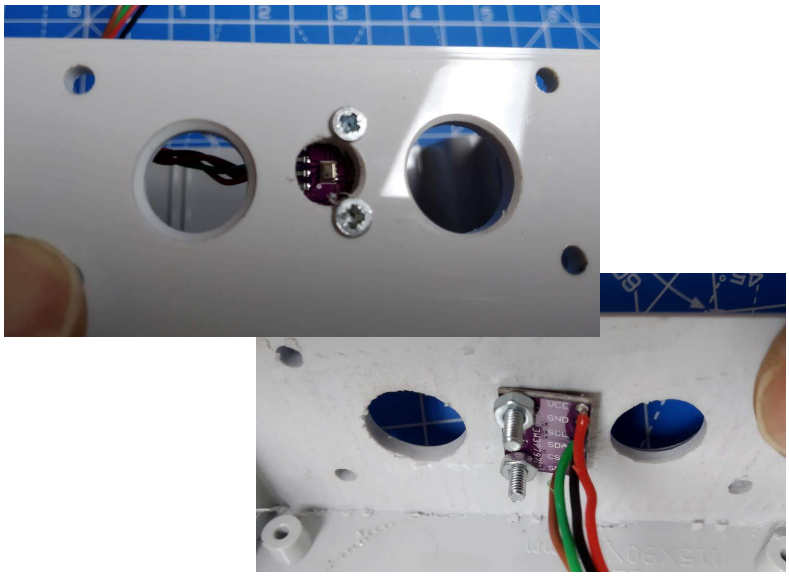
Step: 5	Add compression gland

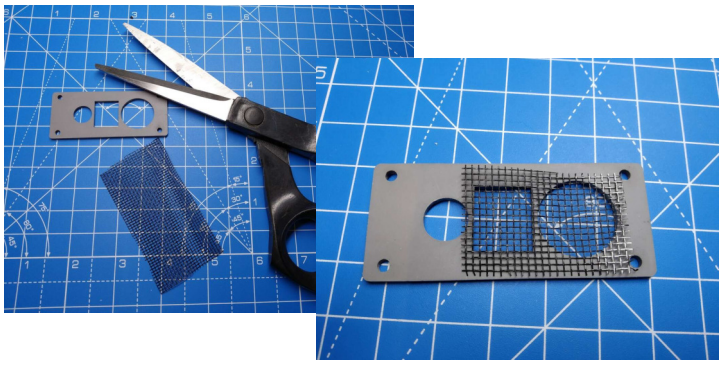


Mount the compression gland through the hold on the side of the enclosure.

The enclosure is slightly thick for the gland, but if the nut is turned around, so the wide lip faces away from the gland, then it should grip the screw thread.

Or the black rubber ring can be removed, although it will have slightly less waterproofing.

Step: 6	Mount BME280 temperature and humidity sensor
Use the 2 x M2.5 screws and nuts to mount the BME280 sensor PCB into the middle hole (hole with two smaller holes next to it) so that the small metal sensor unit shows through the larger hole in the middle.	

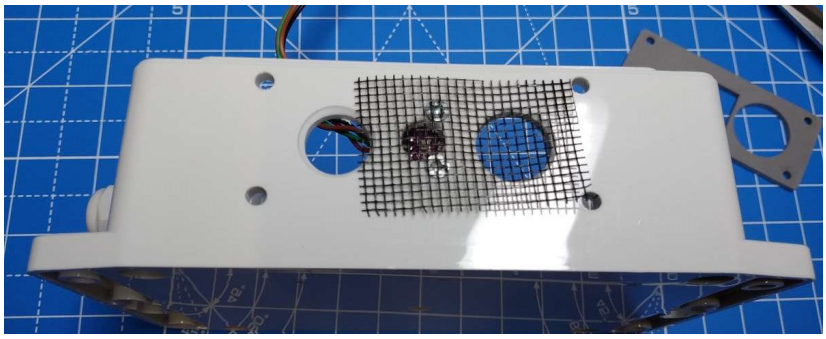
Step: 7	Cut mesh
	Cut the piece of mesh to a size that covers the larger round and the middle rectangular hole.

Step: 8	Add mesh, gasket and sensor plate

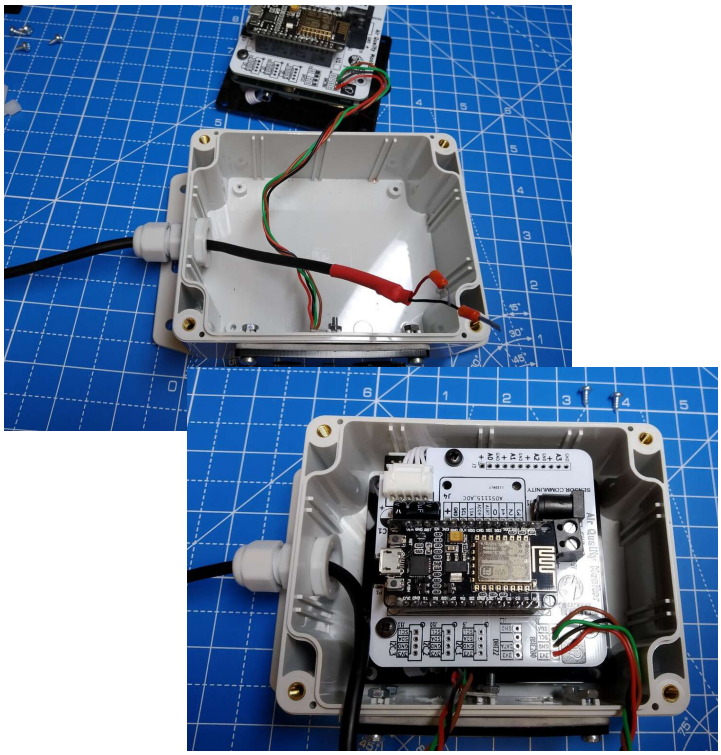
The mesh is held in place with the rubber gasket and the plastic outer plate.

Fit the mesh first, then the rubber gasket, then the 3mm acrylic output plate.

Use the 4 x M3 12mm screws and nuts to hold these in place onto the enclosure.



Step: 9	Mount baseplate into enclosure.



Put the USB power cable through the compression gland, with the power terminals through into the enclosure. It's easiest to add the USB lead now, or else it's more difficult with the sensor/baseplate in place.
Fold the USB cable out of the way.

Fit the baseplate (with sensor and PCB) into the enclosure.
Use the 4 x self-tapping screws to hold the baseplate to the base of the enclosure.

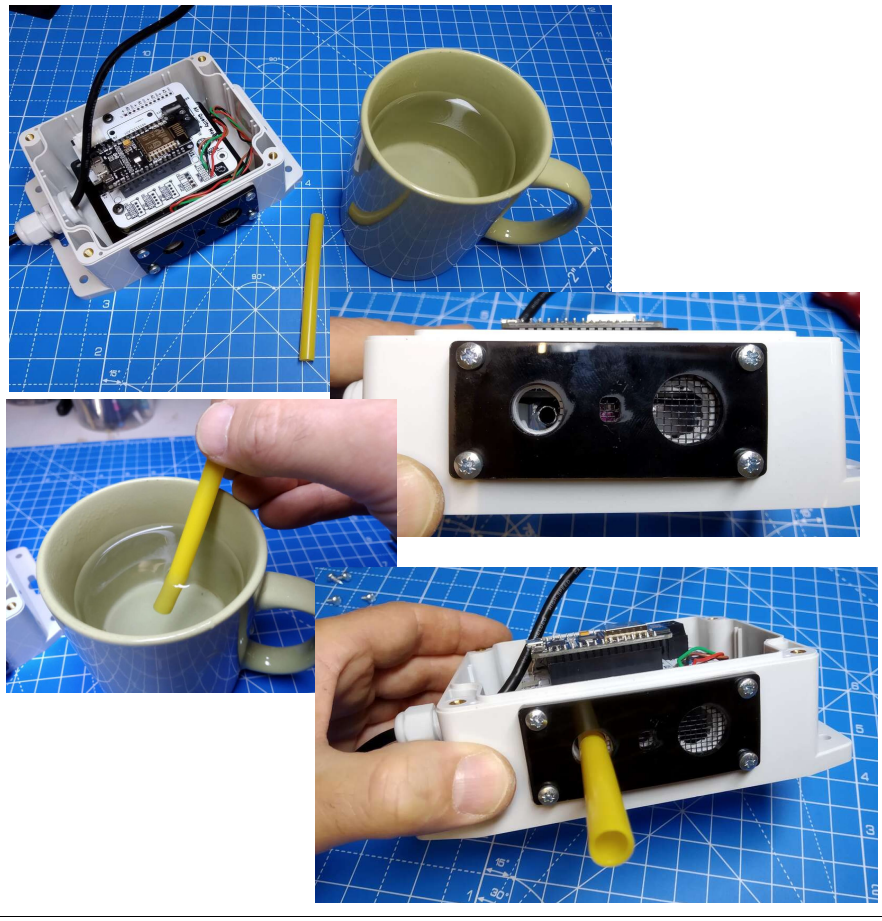
I only use two of the self-tapping screws, as that is enough to hold the baseplate.
Ensure no cables are pinched or trapped.

Step: 10	Add the sensor tube

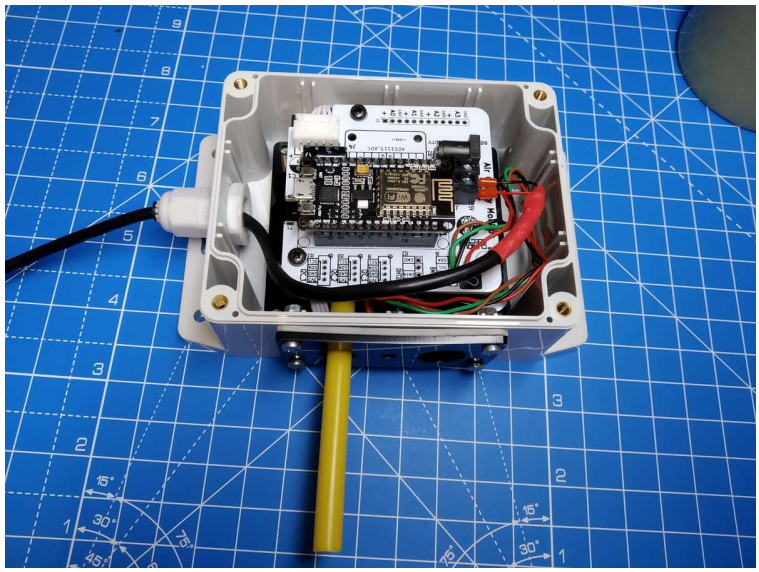
The yellow plastic tube is used as the intake for the sensor. The tube is mounted through the smaller round hole on the outer sensor plate through and onto the round intake for the SDS011.

To make this a bit easier, warm the yellow tube in some boiling water for a few minutes.
Warning: Take care! This can be very hot!

Push the intake tube through the smaller hole and onto the intake for the SDS011 sensor. You may need to rotate slightly as you push. This will be quite a tight fit.



Step: 11	Wire up power supply



Ensure the cables fit into the enclosure.

Wire up the USB power supply cable into the unit, with the red wire into the “+5V” screw terminal and the black wire into the “GND” terminal.

If you plug the other end into the USB power supply unit then the blue light on the NodeMCU should briefly flash.

Step: 12	Fit lid to enclosure

The lid needs the sealing strip mounted around the lid.

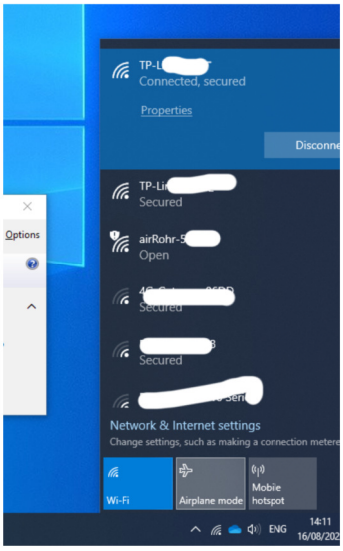
Then fit the 4 x enclosure screws through the lid holes and close the unit up.

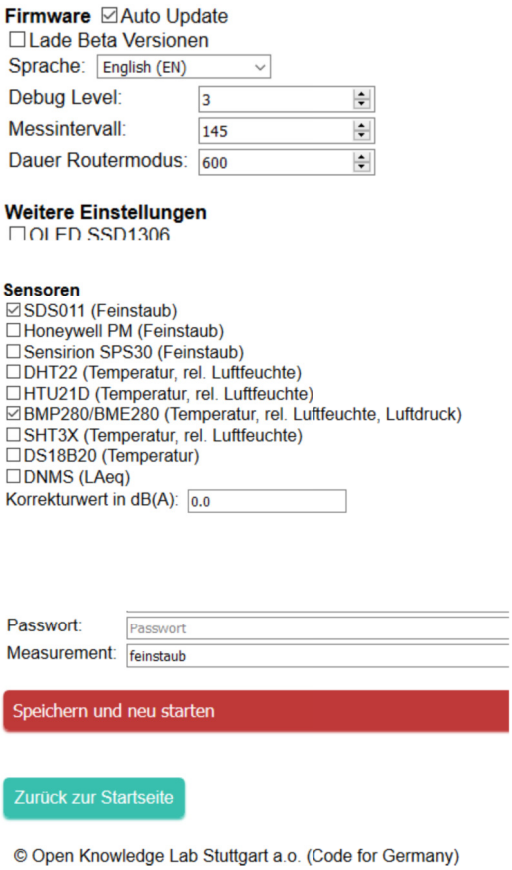
Step: 13	Build is finished!

Have a nice cup of tea.

Set-Up Instructions:

Step: 1	Register and set-up your sensor node





Note: These instructions follow the information given by the air-rohr/sensor.coummunity information given here:
https://sensor.community/en/sensors/airrohr/

Power up the sensor node using the USB lead.

Wait a few moments and refresh your Wi-Fi channel list (Note: this might take a while and require a few refreshes of the list)

There should be a Wi-Fi connection called “airRohr-123456”, where 123456 is an ID number.
Write down the ID number for future reference.

Connect to the airRohr Wi-Fi connection.

It should open automatically, but if not: Using your browser, go to http://192.168.4.1/

There will be a lot of options on that page. Some is written in German (as this was originally a German project).

Click on your network and enter in the network password.

Click on the “English” language option (or others for different language options).

Un-click the DHT22 sensor.
Click on the BME280 sensor.

Click on the “Zurück zur Startseite” button at the bottom of the page. This will save the data and restart the node.

Re-connect to your normal Wi-Fi connection.

Step: 2	Register the sensor with sensor.community

Go to: https://devices.sensor.community/

You will need to register an account with this site.

Then click on: “My Sensors”
The click on “Register a new Sensor”

Follow the sensor registration page – you will need the device ID you wrote down in the previous step.

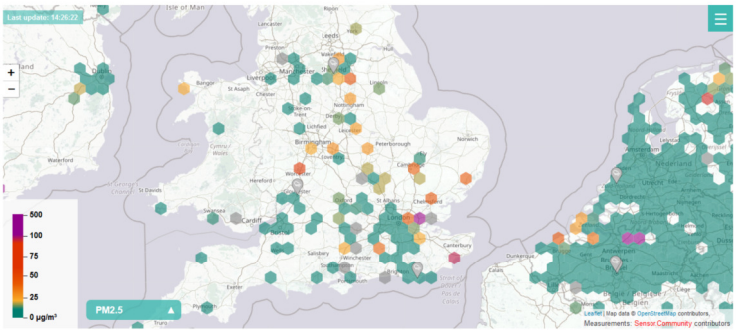
Change the hardware configuration so that the first sensor is the SDS011 (on pin 1) and the BME280 (on pin 11). The pin number change automatically when you click on the correct sensor.

Enter the location and any other details required and then “Save settings”

You can then check under your “My Sensors” list to check it is there.
Wait at least 30mins (or more!) and then re-check the “My Sensors” list.

Click on ‘Data’ and you should be able to see the latest data that has been uploaded.

Step: 3	



Congratulations! You are now sending data to the sensor.community site and you should be able to see you sensor data on the world map!

This project full build, PCB and instructions can be found here:

https://github.com/curiouselectric/airQualitySensor_airrohr

Contact details:

We would like you to be happy with this kit. If you are not happy for any reason then please contact us and we will help to sort it out.

Please email **hello@curiouselectric.co.uk** with any questions or comments.
Please tweet us at **@curiouselectric**

If any parts are missing from your kit then please email **hello@curiouselectric.co.uk** with details and, if possible, when and where the kit was purchased.

More technical information can be found via **www.curiouselectric.co.uk**

This kit has been designed and produced by:

The Curious Electric Company
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www.curiouselectric.co.uk
Unit 23, Block D, Hartley Business Centre, Haydn Rd, Nottingham, NG5 1DG, UK

History

This kit is based upon lots of work by others especially:

- https://luftdaten.info/
- https://sensor.community/en/
- https://github.com/CivicLabsBelgium/influencair-pcb
- https://github.com/Naesstrom/Airrohr-kit

Circuit Schematic