Intro to Calibrating CO2 sensors

Premise:
To calibrate the CO2 sensors and check their accuracy using a LiCor Sensor.

Materials:

- CO2 Sensor
- Extra Pins
- Strands of tin
- Heated iron tool
- Placeholder for Sensor (If provided)
- Jumper Wire for the Pins

Activity:
<u>Goal 1: Solder the two pins for calibration</u>
Steps:

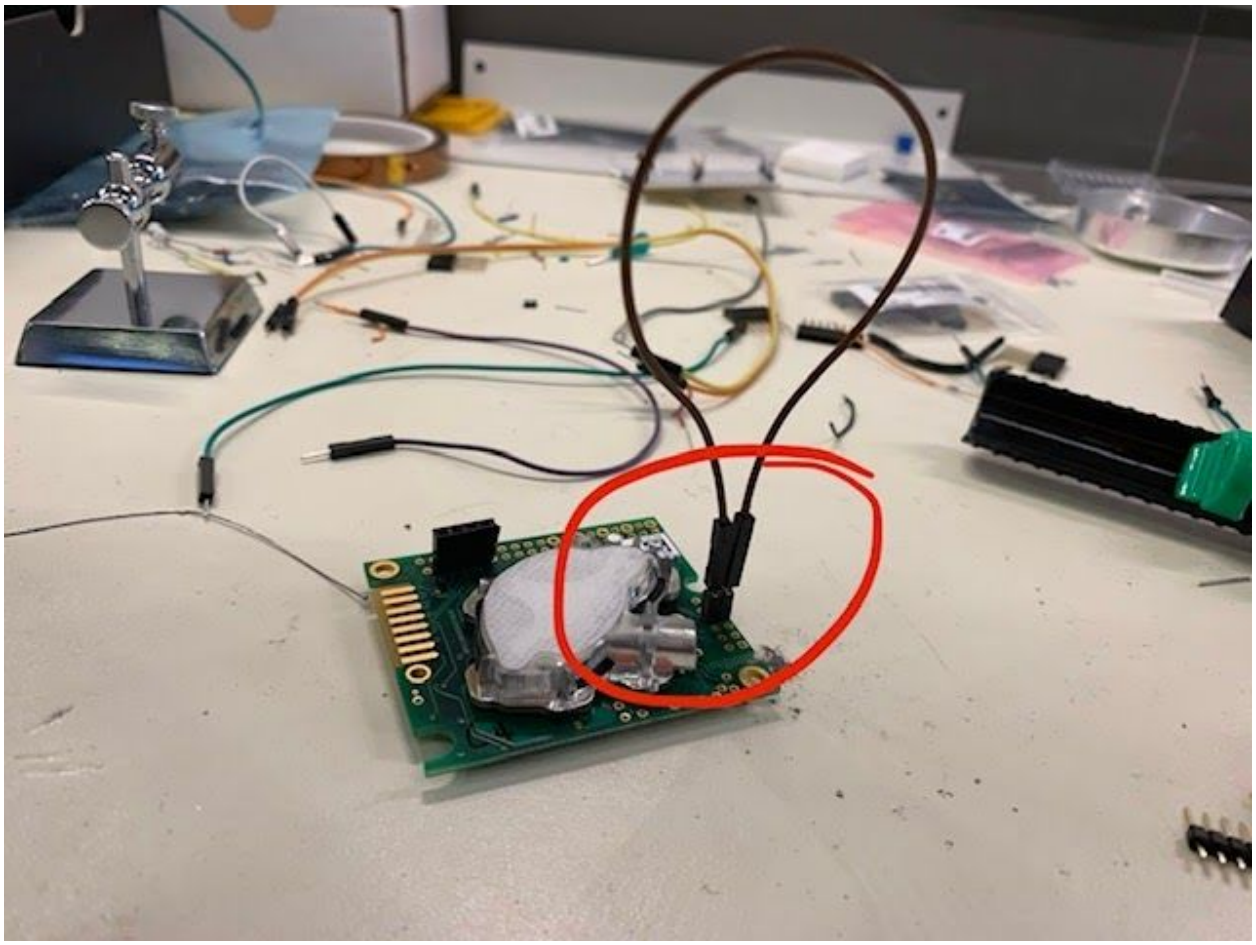
1. Take one sensor
2. Gather two pins that you will be adding to the sensor
3. Refer to the image below and locate where you will insert the pins.
4. Set up the sensor in a way that you can maneuver around when you solder without hurting yourself or anyone around you.

<u>Tips for soldering</u>

-once you identified the holes and have entered the pins, choose one of the pins you want to solder.
-place the iron next to the hole you want to solder.
-Let the iron heat for around 3 to 4 seconds.
- Take the strand of tin and place it next to the tip of a heated iron.
-It will begin to melt and fumes will rise from the melted tin.
-The hole should be enveloped in the liquid from the melted metal.
- if it's not straight after you've soldered the pin. Take the iron and place it on the soldered hole. it should straighten after melting and reheating the pin.
- You also want to be careful and make sure the melted tin does not flood over into other pins and sever connections, or not to fill the pin too much.
- Soldering one of the pins should be enough to straighten the rest of them.

-Check connectivity of pins with multimeter

5. Insert the one wire in a way that it connects the two pins together to apply a short circuit as seen below.



Goal 2: Get it to Blink to check if your arduinos work

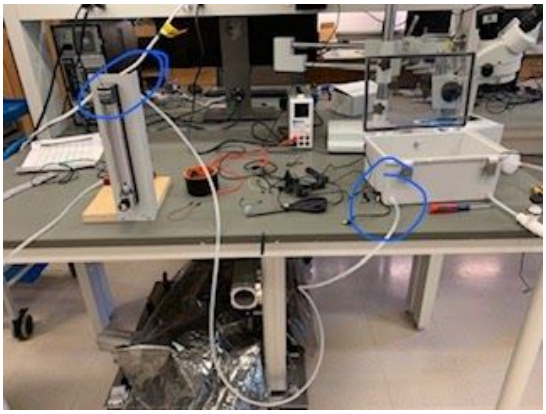
Steps:

1. Run the Arduino program.
2. Select the Blink test by going to File -> Examples-> Basics then select the Blink code.
3. Connect the Arduino boards with the attached LCD shield and sensors to the computer using a USB cable.
4. Make sure you're using the right board with the program.
    a. To do this, go to tools and under boards you should find the name of the Arduino board you're using. Set it to that if it has not already been detected by the program.
5. Press the plus key to upload and compile the code.

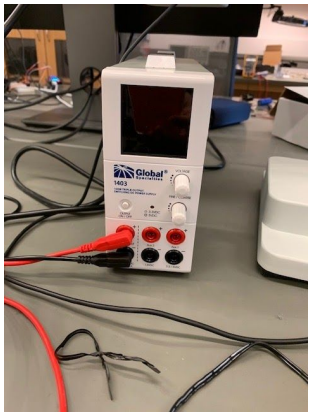
Goal 3: Calibrate CO2 sensors with 3 or 4 at a time

Steps:

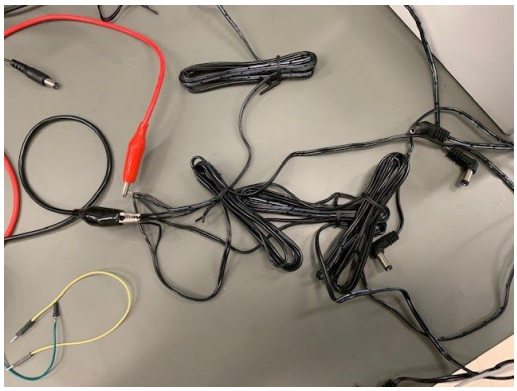
1. Connect the Brooks flowmeter to the nitrogen tank at the bottom and connect another tube from the top of the flowmeter to the enclosed box that will have sensors in them as shown below.



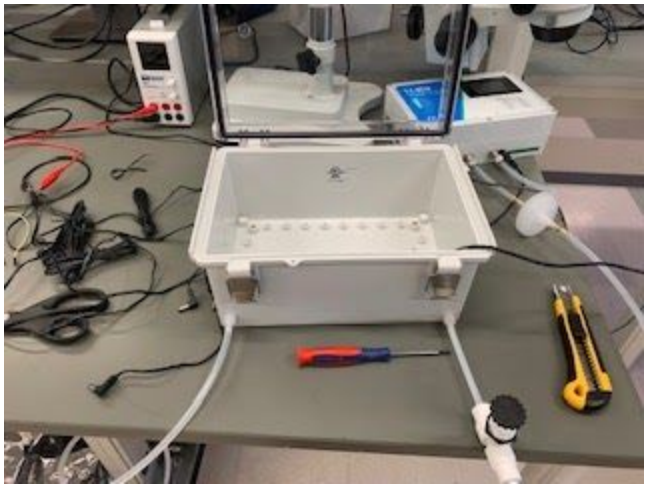
2. Set up the multimeter to 9V and 5A.



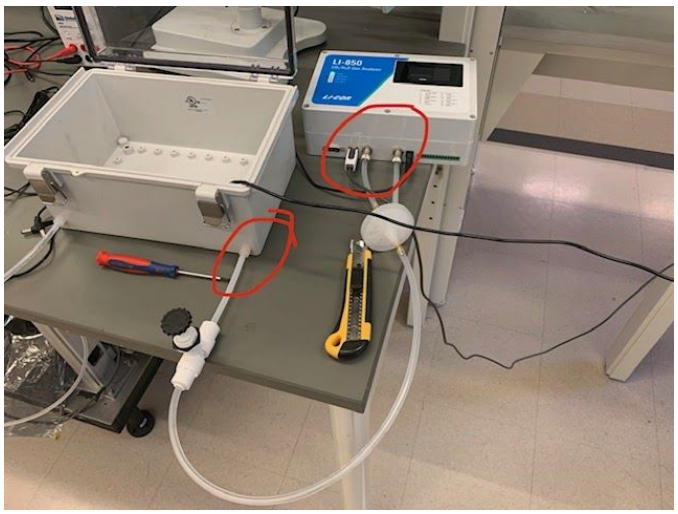
3. Connect each sensor to the multimeter using wires that will be provided.



4. Place the sensors in the sealed chamber.

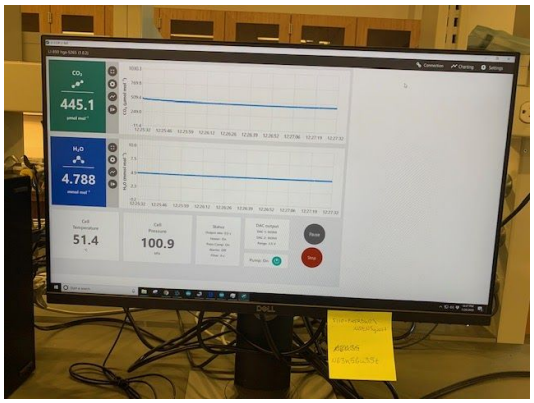


5. Connect the other side of the sealed chamber with another tube to the LI-850 CO2/H20 Analyzer (LiCor Sensor).



6. Turn the knob for the nitrogen tank and allow gas to enter the chamber with the sensors and flow out to the LI-850 Analyzer for about and hour until the LI-850 Analyzer reads 0ppm of CO2.

7. Once that happens, connect the sensors to a power source for 10 minutes and then disconnect them after the 10 minutes without removing them from the chamber.
8. Open the chamber and remove the jumper wires connecting the two pins that you soldered earlier for each sensor inside the chamber.
9. Close the chamber back and power back the sensors to measure the drop from the ambient ppm of its surroundings to 0ppm which will take about 30 mins reported by the LI-850.

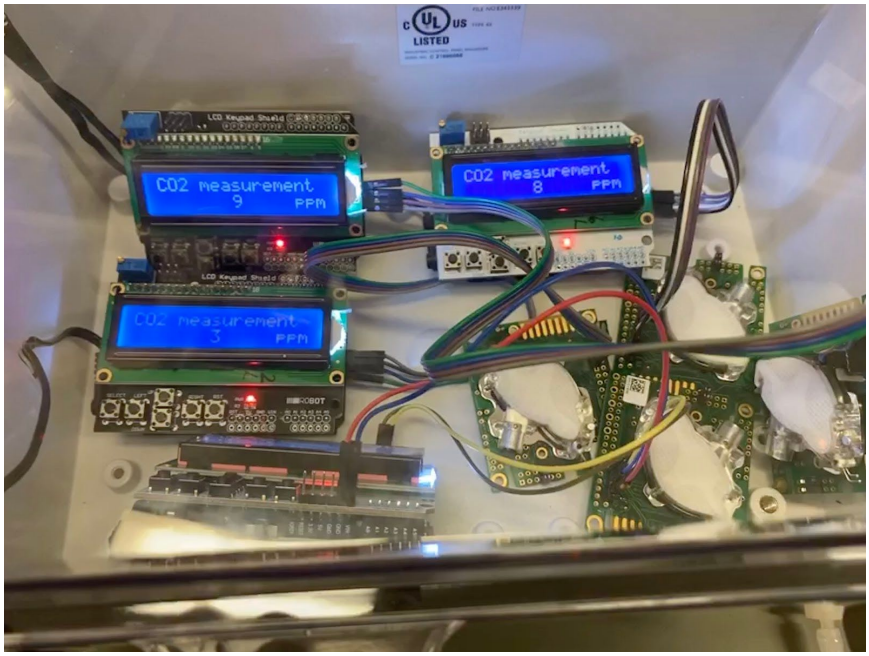


10. Then open the chamber backup to watch the sensors shoot back to ambient ppm.

Goal 4: Check Sensors for Accuracy

Steps:

1. Place the sensors in the chamber (if not in the sensor already).
2. Run the nitrogen gas again until the LiCor Sensor ready 0 ppm for CO2 gas.
3. Check the sensors to see if they show measurements between 0-9 ppm as shown below. If they do that means they are accurate with a +/- 9 mom error.



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