# **Outline for Weather Station**

#### I. Assembly Instructions (Before and After configuration)

#### Materials Needed:

•

- Screwdriver with a hexagonal head (2.5 mm), you may also use an allen wrench.
  - An SD card reader. This may be a multi card reader or an SD card adapter.





## INSTRUCTIONS FOR ASSEMBLY BEFORE CONFIGURATION OF SD CARD

1. Open up the power box. (This requires your screwdriver)



2. Take the micro SD card out of its slot.



3. You now have all of the following parts.



4. Attach the cable to the bottom part of the power box. Make sure you line up the white circles and screw the blue cap on.



5. Next peel the white sticker off of the sensor on the other end of the cable. Now take the sensor end of the cable and slide it into the bottom circular part of your shield. Tighten each screw on either side equally to stabilize the sensor. Make sure you do NOT tighten these screws too much otherwise the 3D printed body will crack.





AT THIS POINT YOU WILL NEED TO CONFIGURE YOUR MICRO SD CARD! (See instructions for this)

#### INSTRUCTIONS FOR ASSEMBLY AFTER CONFIGURATION OF SD CARD

1. Insert your micro SD card back into it's correct slot. Make sure the print on the card faced toward the battery slot.



2. Place the battery into its correct position by placing the positive side matched up with the positive side. When you do this and the battery is working you will see a VERY QUICK green flash.



3. Place the lid back onto the power box in correct position according to the indentations on the lid. Then tighten screws. Make sure not to tighten the screws too tight. They should be flush with the top but not warping the top.





### NOW YOU ARE READY TO COLLECT DATA!!!

Don't forget when you decide to collect it, make sure you take the battery out BEFORE the SD card.

II. Configuration of data.

The SD card can be found under the (+) side of the battery, in the power box. It should be label side toward the battery.

\*\*Never remove the card when a battery is inserted.

\*\*Never plug anything into the USB port to the left of the MicroSD card slot.

- 1. Remove the card and place it in a micro SD card reader attached to your computer.
- 2. Open the card in file explorer and look for a file named Config.

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^		Name		^
*		Co	nfig	
*		da:	ta 5	
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- 3. Open this file in notepad or other word processing program.
- 4. You will see the following lines of code.
- {"StartDateTime": [2018, 6, 13, 3, 14, 22, 0, 0], "CurrentDateTime": [2018, 6, 19, 2, 9, 25, 30, 255], "Sleep": "15", "OutputType": "1"}

{"StartDateTime": [YYYY, MM, DD, W, HH, MM, SS, SubSS], "CurrentDateTime": [YYYY, MM, DD, W, HH, MM, SS, Sub Sec], "Sleep": "MM", "OutputType": "1"}

#### EXAMPLE:

Config - Notepad	<u> </u>		×
File Edit Format View Help			
File Edit Format View Help ["StartDateTime": [2018, 6, 13, 3, 14, 22, 0, 0], "CurrentDateTime": [2018, 6, 18, 1, 12, 7, 40, 255], "Sleep":	: "15"	, "Outp	₽ ^
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¢ la		3	>

- {"StartDateTime": [YYYY, MM, DD, W, HH, mm, SS, SubSS], in this section you will input start time you want the unit to begin taking data. It will begin once a battery is inserted so you want to move your minutes ahead of current time by approximately 5 min.
- 2. YYYY= 4 digit year i.e. 2018
- 3. MM= 2 digit month i.e. 06
- 4. DD= 2 digit day i.e. 23
- 5. W= day of the week Mon=1, Tue=2, Wed=3, Thur=4, Fri=5, Sat=6, Sun=7
- 6. HH= Hour in 24 clock time i.e. 14 would be 2PM
- 7. mm= minute i.e. 47
- 8. SS= seconds i.e. 35
- 9. Sub SS= Sub seconds (likely 00 due to nonuse.)
- 10. "CurrentDateTime": [YYYY, MM, DD, W, HH, MM, SS, Sub Sec], in this section you will delete code and replace with "". When complete it will read
- 11. "CurrentDateTime": "",
- 12. "Sleep": "MM", this section tells your device how long to sleep, in minutes, between each data point. Entering "01" would take a data point every 1 minute. Entering ".01" would take a data point every 6 seconds. Entering "15" would take a data point every 15 minutes. Using a longer sleep period increases battery life.
- 13. "OutputType": "1"} in this section you are telling the station where to save data points. Entering "1" tells the station to save to the MicroSD card.
- 14. **\*\***Always enter "1" here.
- 15. Save the configure file.
- 16. Properly eject the card by clicking the "safely remove hardware or eject media"

Safely Remove Hardware and Eject Media



button on the taskbar of your computer.

- 17. Remove MicroSD card.
- 18. Replace MicroSD card in weather station power box label side facing the battery.
- 19. At this point you need to begin logging observations of weather conditions and locations of weather station. Pictures are great for this step. Continue using 24 hr. time.

II. Downloading data (Chris)

2.

3.

1.

- A. Remove the SD card from the unit. MAKE SURE TO REMOVE THE BATTERY FIRST!!
- B. Place the SD into a Micro SD slot in a computer.
  - 1. If your computer does not have a Micro SD slot then you will need to get a Micro SD card reader.



3. Make sure that you then plug that into your computer using a USB slot.



- C. Open the SD card on your computer.
  - 1. Open file manager
    - a) This should open up automatically when you insert the Micro SD card into the Micro SD card reader.
  - 2. There will be a new USB Drive in your file manager. In the picture this one is labeled as F:

> 👝 USB Drive (F:)
> USB Drive (F:)
1 item

4. Double click that link and you will see a screen like this picture.



- 6. Double click the data file.
- D. A new window should open with the data file contained within, that file will look like this.

III weather data - Notepad
File Edit Format View Help
"2017-9-21 10:41:6,22.49,852.97,23.29885,39.26631""2017-9-21 10:42:8,22.89,852.83,23.29885,39.21748""2017-9
9.07099""2017-9-21 11:1:46,22.92,852.65,23.25856,38.86956""2017-9-21 11:2:48,22.96,852.63,23.30892,38.79632
281""2017-9-21 11:22:26,22.97,852.40,23.26863,41.83605""2017-9-21 11:23:28,22.98,852.38,23.26863,41.34163""
668,15.39401""2017-9-21 11:43:6,36.18,850.67,38.8189,15.97388""2017-9-21 11:44:8,36.56,850.61,39.1714,14.96
.88519,16.12647""2017-9-21 12:3:46,36.04,848.64,37.07655,16.02881""2017-9-21 12:4:48,36.1,848.66,37.20747,1

- E. Use Ctrl+A to select all then Ctrl+C to copy the information.
- F. Open a spreadsheet of your choice. I will be using Google Sheets for the images used in this manual. Then paste the information into A1 of Sheet 1.



G. You will notice that all of the information is in that first column.

1.

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fx	2017-9-21 10:4	1:6,22.49,852.97,	23.29885,39.2	6631
	А	В	С	
1	2017-9-21 10:41	6,22.49,852.97,2	3.29885,39.26	631
2	2017-9-21 10:42	:8,22.89,852.83,2	3.29885,39.21	748
3	2017-9-21 10:43	:10,22.94,852.86,	23.29885,38.9	9774
4	2017-9-21 10:44	:12,22.98,852.88,	23.30892,39.9	3164
5	2017-9-21 10:45	:14,22.98,852.82,	23.30892,38.8	2073
6	2017-9-21 10:46	:16,22.99,852.81,	23.32906,38.5	5216
7	2017-9-21 10:47	:18,22.99,852.80,	23.30892,38.2	5307
8	2017-9-21 10:48	:20,22.98,852.81,	23.30892,38.1	3099
9	2017-9-21 10:49	:22,22.99,852.81,	23.29885,38.3	5073
10	2017-9-21 10.50	.24 22 97 852 76	23 28878 38 7	719

#### III. Formatting Data in Excel

After downloading the data into Excel, the data will be all in one column separated by a comma.

4	A	B	С	D
1	2017-9-21 10	:41:6,22.49,8	52.97,23.298	85,39.26631
2	2017-9-21 10	:42:8,22.89,8	52.83,23.298	85,39.21748
3	2017-9-21 10	:43:10,22.94	,852.86,23.29	885,38.99774
4	2017-9-21 10	:44:12,22.98	,852.88,23.30	892,39.93164
5	2017-9-21 10	:45:14,22.98	,852.82,23.30	892,38.82073
6	2017-9-21 10	:46:16,22.99	,852.81,23.32	906,38.55216
7	2017-9-21 10	:47:18,22.99	,852.80,23.30	892,38.25307
8	2017-9-21 10	:48:20,22.98	,852.81,23.30	892,38.13099
9	2017-9-21 10	:49:22,22.99	,852.81,23.29	885,38.35073
10	2017-9-21 10	:50:24,22.97	,852.7 <mark>6,23.28</mark>	878,38.7719
11	2017-9-21 10	:51:26,22.91	,852.77,23.19	813,39.80956
12	2017-9-21 10	:52:28,22.84	,852.79,23.10	749,39.73631
13	2017-9-21 10	:53:30,22.79	,852.76,23.03	699,39.8828
14	2017-9-21 10	:54:32,22.78	,852.74,23.02	692,39.68748
15	2017-9-21 10	:55:34,22.77	,852.76,23.03	699,39.54099
16	2017-9-21 10	:56:36,22.78	,852.76,23.04	706,39.51657

In order get the data into separate columns you will need to select column "A". Click on "Data" on the toolbar and select "text to columns"

	Excel	File	Edit	View	Insert	Forma	at To	ools	Data	Window	9	Help	
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		• B		C	D	-21 10.4 E	+1.0,22	49,0 F	Data	Table			
2	2017-9-21 10:	41:6,22.4	9,852.9	2 22 20005	20 21749				Text	to Column	s		-
2	2017-9-21 10.	42.8,22.8	94 852	86 23 2988	5 38 99774	1			Con	solidate			-
4	2017-9-21 10:	44:12,22.	.98,852.	.88,23.3089	2,39.93164				Grou	p and Outl	ine	•	
5	2017-9-21 10:	45:14,22.	.98,852.	82,23.3089	2,38.82073	8				•			-
6	2017-9-21 10:	46:16,22.	.99,852.	81,23.3290	6,38.55216	5 7			Pivo	tTable			
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10	2017-9-21 10:	50:24,22.	.97,852.	76,23.2887	8,38.7719				Get	External Da	ta		
11	2017-9-21 10:	51:26,22.	.91,852.	77,23.1981	3,39.80956	5			Refr	esh Data			
12	2017-9-21 10:	52:28,22.	.84,852.	79,23.1074	9,39.73631								
13	2017-9-21 10:	53:30.22.	79.852	76.23.0369	9.39.8828								

Choose "Delimited" and go to "Next". Then select "comma" and go to "Next". Finally select "General" and select "Finish"

Step	1
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Convert Text to Columns Wizard - Step 1 of 3	
The Text Wizard has determined that your data is Delimited.	
If this is correct, choose Next, or choose the Data Type that best describes your data.	
Original data type	
Choose the file type that best describes your data:	
<ul> <li>Delimited - Characters such as commas or tabs separate each field.</li> </ul>	
Fixed width	
Data preview	
Preview of selected data:	
1 2017-9-21 10:41:6,22.49,852.97,23.29885,39.26631 2 2017-9-21 10:42:8,22.89,852.83,233.29885,39.21748	
<u>5</u> [2017-9-21 10:45:12,22.98,852.88,23.30892,39.93164 <u>5</u> [2017-9-21 10:45:14,22.98,852.88,23.30892,39.93164	
<u>6</u> 2017-9-21 10:46:16,22.99,852.81,23.32906,38.55216	
Cancei < Back Next > Finish	

# Convert Text to Columns Wizard - Step 2 of 3 This screen lets you set the delimiters your data contains. You can see how your text is affected in the preview below. Delimiters Treat consecutive delimiters as one Tab Semicolon Comma Text qualifier: Space Other: Data preview 2017-9-21 10:41:6 22.49 852.87 23.29885 39.26631 2017-9-21 10:42:8 22.49 852.83 23.29885 39.21748 2017-9-21 10:42:8 22.98 852.83 23.29885 38.99774 2017-9-21 10:43:10 22.94 852.86 23.38929 39.93164 2017-9-21 10:45:14 22.98 852.82 23.38929 38.82073 2017-9-21 10:46:16 22.99 852.81 23.32996 38.55216 Cancel < Back Next > Finish

Step 2

#### Step 3

Convert Text to Columns	Wizard - Step 3 of 3
This screen lets you select each column and set the Data Format. 'General' converts numeric values to numbers, date values to dates, and all remaining values to text.	Column data format General Text Date: MDY C
Advanced	O Do not import column (Skip)
Data preview	Destination: \$A\$1
General         GeneralGeneralGeneral           2017-9-21         08:24:16         22.49         852.97         23.29885           2017-9-21         10:42:8         22.89         852.83         23.29885           2017-9-21         10:42:8         22.89         852.86         23.29885           2017-9-21         10:43:10         22.94         852.86         23.30892           2017-9-21         10:44:12         22.98         852.28         23.30892           2017-9-21         10:44:12         22.98         852.22         23.30892           2017-9-21         10:46:16         22.99         852.81         23.32906	General 39,26631 39,21748 38,99774 39,33164 38,82073 38,55216
Cancel	< Back Next > Finish

Now your data should be in columns and ready to be used. You may need to expand column "A" in order to read all of the dates and time if your data shows up as "#######".

_1	A	B	C	D	E	
1	9/21/17 10:41	22.49	852.97	23.29885	39.26631	-
2	9/21/17 10:42	22.89	852.83	23.29885	39.21748	-
3	9/21/17 10:43	22.94	852.86	23.29885	38.99774	C C
4	9/21/17 10:44	22.98	852.88	23.30892	39.93164	- C
5	9/21/17 10:45	22.98	852.82	23.30892	38.82073	
6	9/21/17 10:46	22.99	852.81	23.32906	38.55216	-
7	9/21/17 10:47	22.99	852.8	23.30892	38.25307	
8	9/21/17 10:48	22.98	852.81	23.30892	38.13099	-

Column Headers:

In order to label each column of data you will need to create a new row above the data sets. Select Row 1 and click "Insert" on the toolbar. Select "Row" and a new row will appear above the data.



4	A	B	C	D	E
1					
2	9/21/17 10:41	22.49	852.97	23.29885	39.26631
3	9/21/17 10:42	22.89	852.83	23.29885	39.21748
4	9/21/17 10:43	22.94	852.86	23.29885	38.99774
5	9/21/17 10:44	22.98	852.88	23.30892	39.93164
6	9/21/17 10:45	22.98	852.82	23.30892	38.82073

Label the columns as follows. Column "A" Date and Time, Column "B" Temp C<sub>0</sub>, Column "C" Pressure, Column "D" Temp C<sub>0</sub>, Column "E" Humidity.

4	A	B	С	D	E
1	Date and Time	Temp Deg C	Pressure	Temp Deg C	Humidity
2	9/21/17 10:41	22.49	852.97	23.29885	39.26631
3	9/21/17 10:42	22.89	852.83	23.29885	39.21748
4	9/21/17 10:43	22.94	852.86	23.29885	38.99774
5	9/21/17 10:44	22.98	852.88	23.30892	39.93164

- IV. Graphing and interpreting data (Kyle)
  - A. Using the excel graphing tools, create a X,Y Scatter Plot to represent the change in temperature (T), air pressure (P), and relative humidity (RH) over time.
  - B. Make sure the data used for the X axis is is in the first column (Date and time). The following data points will be in the columns to the left.

b	a										/IVVS_RawData_03 - I	
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Н7	-	X V I	s									
		B	C	D	F			G	1	e		1
1	Date Time	Temp (C.) A	bs Air Press (hPa)	Humid Air Temp (C.)	Rel. Humid %		2	0				
2	6/15/2018 13:58	32.2	850.05	33,58176	19,22114							
3	6/15/2018 14:13	31.71	849.85	33.00769	20.89361							
4	6/15/2018 14:28	31.8	849.72	33,12855	20.25881							
5	6/15/2018 14:43	31.84	849.41	33,14869	19.24556							
6	6/15/2018 14:58	32.11	849.17	33.35012	22,27919							
7	6/15/2018 15:13	32.88	850.48	34,10548	16.81621							
8	6/15/2018 15:28	23.88	851.04	23.82256	28,66386							
9	6/15/2018 15:43	21.64	851.08	21.75792	32.16139							
0	6/15/2018 15:58	20.49	851.15	20.69035	33,70567							
1	6/15/2018 16:13	20.06	852.96	20.28749	36,2693							
2	6/15/2018 16:28	20.42	851.99	20.73064	34.00476							
3	6/15/2018 16:43	20.89	849.87	21.16371	33.11359							
4	6/15/2018 16:58	21.33	845.73	21.59678	32.63749							
5	6/15/2018 17:13	21.75	844.94	22.01977	32.38723							
6	6/15/2018 17:28	22.17	845.32	22.43271	32.1858							
7	6/15/2018 17:43	22.53	842.82	22.83556	32.01489							
8	6/15/2018 17:58	22.82	842.33	23.14777	31.94165							
9	6/15/2018 18:13	23.05	841.34	23.44992	31.91113							
0	6/15/2018 18:28	23.28	835.12	23.67149	31.91113							
1	6/15/2018 18:43	23.52	833.58	23.96356	31.88671							
2	6/15/2018 18:58	23.74	833.72	24.18513	31.83788							
3	6/15/2018 19:14	23.92	833.8	24.38656	31.83788							
4	6/15/2018 19:29	24.03	834.05	24.52756	49.14851							
5	6/15/2018 19:44	22.13	834.02	22.51328	56.69291							
6	6/15/2018 19:59	24.05	833.72	24.59806	49.44149							
7	6/15/2018 20:14	24.37	833.71	24.79949	48.46487							
8	6/15/2018 20:29	24.5	833.45	24.98077	47.31734							
19	6/15/2018 20:44	24.66	833.43	26.0282	44.96124							
0	6/15/2018 20:59	25.92	833.37	26.6627	43.02021							
1	6/15/2018 21:14	26.4	833.33	27.16627	39.85839							
2	6/15/2018 21:29	26.64	833.54	27.38784	38.60099							
3	6/15/2018 21:44	26.73	833.52	27.49863	37.97839							
14	6/15/2018 21:59	26.77	833.52	27.52884	37.63047							
15	6/15/2018 22:14	26.07	833.61	27.42812	37.53281							
6	6/15/2018 22:29	26.78	833.48	27.53891	36.83697							
7	6/15/2018 22:44	26.8	833.64	27,55905	36.31814							

- C. There are two measurements for temperature, one associated with the pressure sensor and one associated with the humidity sensor. You are welcome to keep both, delete one, or find the average between the two; whichever you decide.
- D. Left click on the first cell in the first column and select the data you would like to graph.

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	A	В	C	D	F	F		6	
1	Date Time	Temp (C)	Abs Air Press (hPa)	Humid Air Temp (C	Rel. Humid %				
135	6/16/2018 23:02	17.58	836.28	17.5984	3 96.62456				
136	6/16/2018 23:17	17.81	836.33	17.8401	4 93.88391				
137	6/16/2018 23:32	17.59	836.36	17.5883	5 96.78325				
138	6/16/2018 23:47	17.71	836.42	17.7092	1 89.44027				
139	6/17/2018 0:02	17.74	836.65	17.7092	90.66715				
140	6/17/2018 0:17	17.81	836.65	17.8	2 94.11586				
141	6/17/2018 0:32	17.82	836.62	17.8502	1 92.10768				
142	6/17/2018 0:47	17.77	836.73	17.7797	1 89.64781				
143	6/17/2018 1:02	17.71	836.76	17.67	9 89.11677				
144	6/17/2018 1:18	17.75	836.74	17.7696	4 85.79015				
145	6/17/2018 1:33	17.66	836.83	17.6991	4 87.48703				
146	6/17/2018 1:48	17.61	836.84	17.6387	1 89.09236				
147	6/17/2018 2:03	17.32	836.81	17,2660	7 90,60001				
148	6/17/2018 2:18	16.95	836.91	16.8531	4 91.71092				
149	6/17/2018 2:33	17.22	836.93	17.25	6 88.34768				
150	6/17/2018 2:48	17.47	837.05	17,4775	7 82.30483				
151	6/17/2018 3:03	17.36	837.12	17.326	5 89,50742				
152	6/17/2018 3:18	17.18	837.19	17.0747	1 90.99677				
153	6/17/2018 3:33	16.94	837.23	16.8732	8 91.87572				
154	6/17/2018 3:48	16.65	837.21	16,5308	5 93.28572				
155	6/17/2018 4:03	16.87	837.22	16.9135	7 85,57651				
156	6/17/2018 4:18	17.13	837.28	17.1351	4 84.87456				
157	6/17/2018 4:33	17.33	837.31	17.326	5 83.31197				
158	6/17/2018 4:48	17.17	837.34	17.1452	1 84.85625				
159	6/17/2018 5:03	16.86	837.36	16.8430	7 89.23274				
160	6/17/2018 5:18	16.81	837,49	16,7725	7 89.83703				
161	6/17/2018 5:33	16.91	837.64	16.8732	8 87.53586				
162	6/17/2018 5:48	17.22	837.7	17.25	6 84,1299				
163	6/17/2018 6:03	17.65	837.75	17,7092	1 82,28042				
164	6/17/2018 6:18	18.05	837.94	18,1221	4 79.36886				
165	6/17/2018 6:33	18.1	838 13	18 1674	3 77 67198				
166	.,,	1011	000120	1011024					
167									
168									
169									

- E. Left click on "Insert" > "Charts" > "X,Y Scatter Plot"
  - 1. Choose a plot with connected points on a curve, there are usually a few options to choose from.

	All Charts
Keent     Templates     Complate     Complate     Complate     Complate     Complate     Complate     Disc     Complate     Complate	Cater with smooth Lines Conter with smooth
	OK Cancel

Add Chart Quick Element * Layout * Chart Layouts	ange lors +		Char	t Styles	Ĩ			Switch Row/ Sele Column Dat Data	ct Change a Chart Type Type	Move Chart Location					
Chart 5 * :	× ✓ J	-SERIES(data)	ext_061718_0720_fig!\$C\$1	,dataext_06171	3_0720_fig!\$A	\$2:\$A\$165,data	ext_061718_0720	_fig!\$C\$2:\$C\$165,2)							
A	в	с	D	E	F	G	н	1	J	К		L	м	N	<b>_</b>
1 Date Time	Temp (C)	lbs Air Press (hPa)	Humid Air Temp (C) Re	el. Humid %											Format Data Series
2 6/15/2018 13:58	32.2	850.05	33.58176	19.22114	0						-0				Series Options 🔻
3 6/15/2018 14:13	31.71	849.85	33.00769	20.89361						Ch	art litle				A O di
4 6/15/2018 14:28	31.8	849.72	33.12855	20.25881	900										→ <b>…</b>
5 6/15/2018 14:43	31.84	849.41	33.14869	19.24556			30								Series Ontions
6 6/15/2018 14:58	32.11	849.17	33.35012	22.27919	800	C									Plot Series On
7 6/15/2018 15:13	32.88	850.48	34.10548	16.81621											The series of
8 6/15/2018 15:28	23.88	851.04	23.82256	28.66386	700	( <u> </u>									Primary Axis
9 6/15/2018 15:43	21.04	851.08	21.75792	32.10159											<ul> <li>Secondary Axis</li> </ul>
10 0/15/2018 15:58	20.49	851.15	20.09035	35.70567	600	0									
11 6/15/2018 16:15	20.08	052.90	20.26749	30.2095											
12 6/15/2018 10:28	20.42	031.33	20.73004	22 11250	500	c									
14 6/15/2018 16:59	20.85	945.72	21.10371	33.62749											
15 6/15/2018 17:13	21.55	844.94	22.03078	32.03743	1 40										
16 6/15/2018 17:28	22.17	845.32	22.01377	32 1858											
17 6/15/2018 17:43	22.53	842.82	22.43271	32 01489											
18 6/15/2018 17:58	22.82	842 33	23 14777	31 94165	- 30										
19 6/15/2018 18:13	23.05	841.34	23.44992	31,91113	1000										
20 6/15/2018 18:28	23.28	835.12	23.67149	31,91113	200										
21 6/15/2018 18:43	23.52	833.58	23,96356	31,88671											
22 6/15/2018 18:58	23.74	833.72	24,18513	31,83788	100					-	-				
23 6/15/2018 19:14	23.92	833.8	24,38656	31.83788			anness of the second								
24 6/15/2018 19:29	24.03	834.05	24.52756	49.14851											
25 6/15/2018 19:44	22.13	834.02	22.51328	56.69291	6/15	2018 9:55 6/1	15/2018 14:24 6/1	15/2018 19:12 5/16/3	018 0:00 6/16	/2018 4:48 6/1	/2018 9:36 6/10	5/2018 14:24 6/16	2018 19:12 6	/17/2018 0:00 6	6/17
26 6/15/2018 19:59	24.05	833.72	24.59806	49.44149	~ .				• Temp (C)	<ul> <li>Abs Air Press (hPa)</li> </ul>	e Humid Air Tem	p(C) • Rel. Humid	%		
27 6/15/2018 20:14	24.37	833.71	24.79949	48.46487	0						0				
28 6/15/2018 20:29	24.5	833.45	24.98077	47.31734											
29 6/15/2018 20:44	24.66	833.43	26.0282	44.96124											
30 6/15/2018 20:59	25.92	833.37	26.6627	43.02021											
31 6/15/2018 21:14	26.4	833.33	27.16627	39.85839											
32 6/15/2018 21:29	26.64	833.54	27.38784	38.60099											
33 6/15/2018 21:44	26.73	833.52	27.49863	37.97839											
34 6/15/2018 21:59	26.77	833.52	27.52884	37.63047											
35 6/15/2018 22:14	26.07	833.61	27.42812	37.53281											
36 6/15/2018 22:29	26.78	833.48	27.53891	36.83697											
37 6/15/2018 22:44	26.8	833.64	27.55905	36.31814		m Later -			Pr. Laboration	Lature 1	0.100				
· · datad	ext_001718_07.	dataext_06	51/18_0/20_calc   Sheet3	dataext_061	/18_0/20_calc	(2)   dataext_	061818_0630	dataext_001818_0630	_rig   sheet 2	Sneet1   (		Inerane: 0012 70	2069 Count 93	5 Sum 7351081	206 FFF (E) (T) - 100

- F. A plot should appear in your workbook. Right click on the air pressure data. Select "Format Data Series" > Axis > <u>Secondary Axis</u>.
  - 1. Using the same steps, make sure the temperature and humidity are on the "Primary Axis."



G. Change the design of the Chart Elements and add a Chart Title, Axis Labels, and a Legend.



- H. This is the Combined Data figure for your mobile weather station. You can repeat the procedure and create figures for individual measurements i.e. Air Pressure (hPa) vs Time (min).
- I. Calculating air density using the Ideal Gas Law (P=  $\rho$ RT)
  - 1. Ideal gas constant is 287.058 J/Kg\*K. Therefore we need to convert the air pressure to Pa and the Temperature to K.

Google	ideal gas constant in J/k		<b>୍</b>							
	All Images Shopping	lore Settir	ngs Tools							
	About 11,300,000 results (0.51	seconds)								
	Specific gas constant									
	R <sub>specific</sub> for dry air	Units								
	287.058	J kg <sup>−1</sup> K <sup>−1</sup>								
	53.3533	ft lbf lb⁻	<sup>-1</sup> °R <sup>-1</sup>							
	1,716.49	ft lbf slu	ıg <sup>−1</sup> °R <sup>−1</sup>							
	Based on a mean molar <b>mass</b> for dry air of 28.9645 <b>g</b> /mol.									
	Gas constant - Wikipedia https://en.wikipedia.org/wiki/Gas_constant									
			About this result	Feedback						

- 2. Insert and title new columns next to temperature column (B) and the Air Pressure column (D)..
  - a) Insert the formula "=273.15+(B2)"

Date Time	Temp	(C)	Temp (K)	
6/15/2018 13:58		32.2	=273.15+(B2)	

b) Insert the formula "=100\*(D2)"



- c) Copy and paste these formulas for the rest of the columns.
- 3. Using the Ideal Gas Law, calculate the air density as shown below.

1	A	В	С	D	E	F	G	Н
1	Date Time	Temp (C)	Temp (K)	Abs Air Press (hPa)	Abs Air Press (Pa)	Humid Air Temp (C)	Rel. Humid %	Air Density (p)
2	6/15/2018 13:58	32.2	305.35	850.05	85005	33.58176	19.22114	=E2/(287.058*C2)

\*Make sure to use the Pascal and Kelvin measurements. Copy and paste this formula for the rest of the Air Density column.