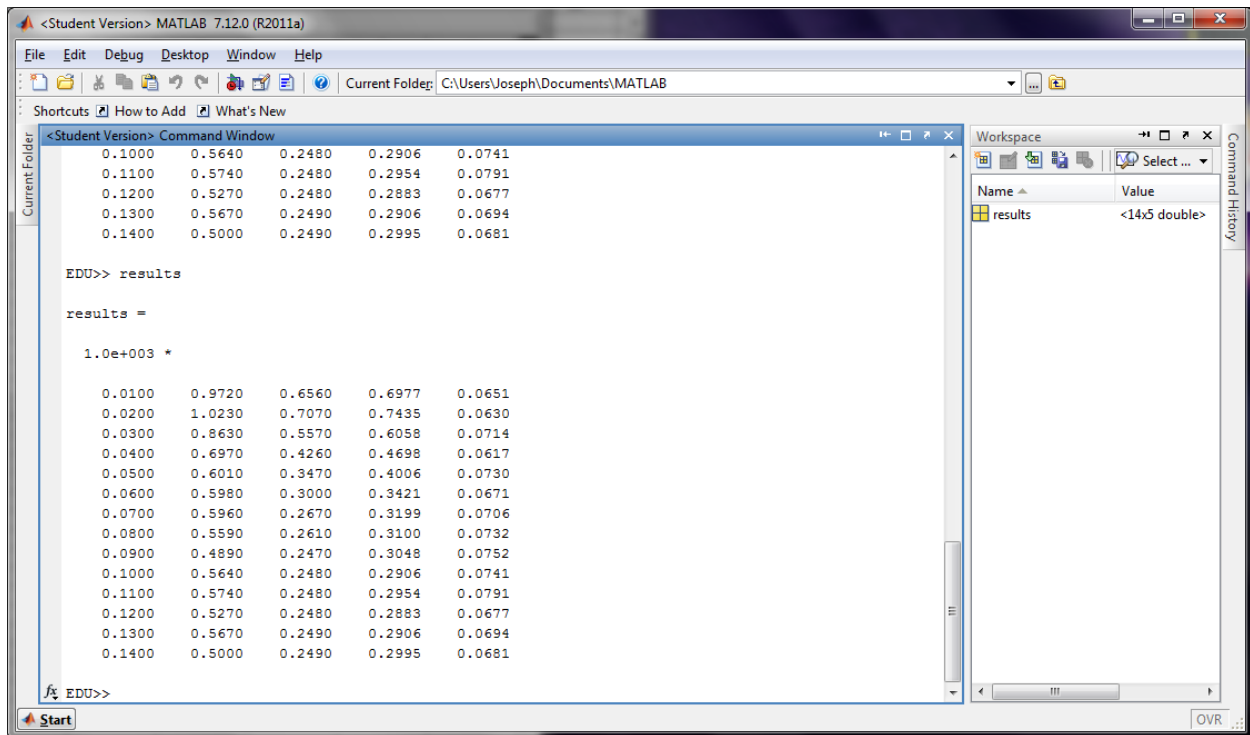
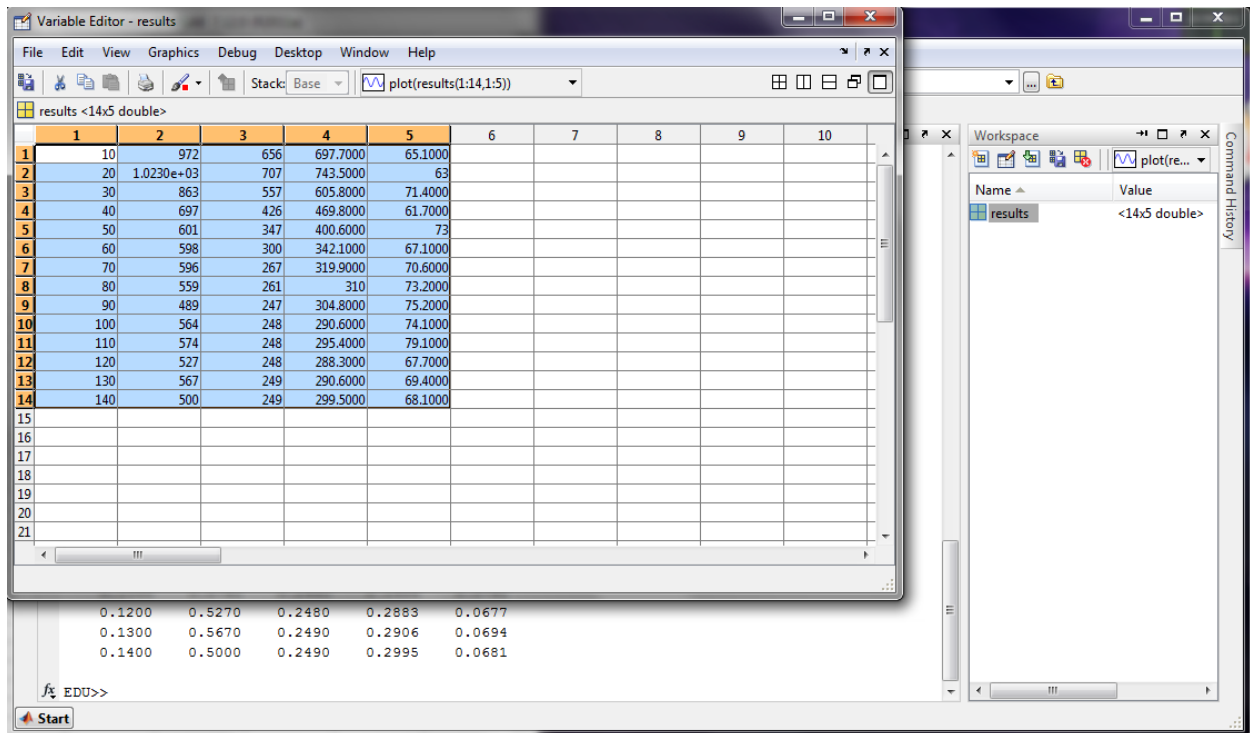


Measure each IR sensor using matlab code given in the lab.

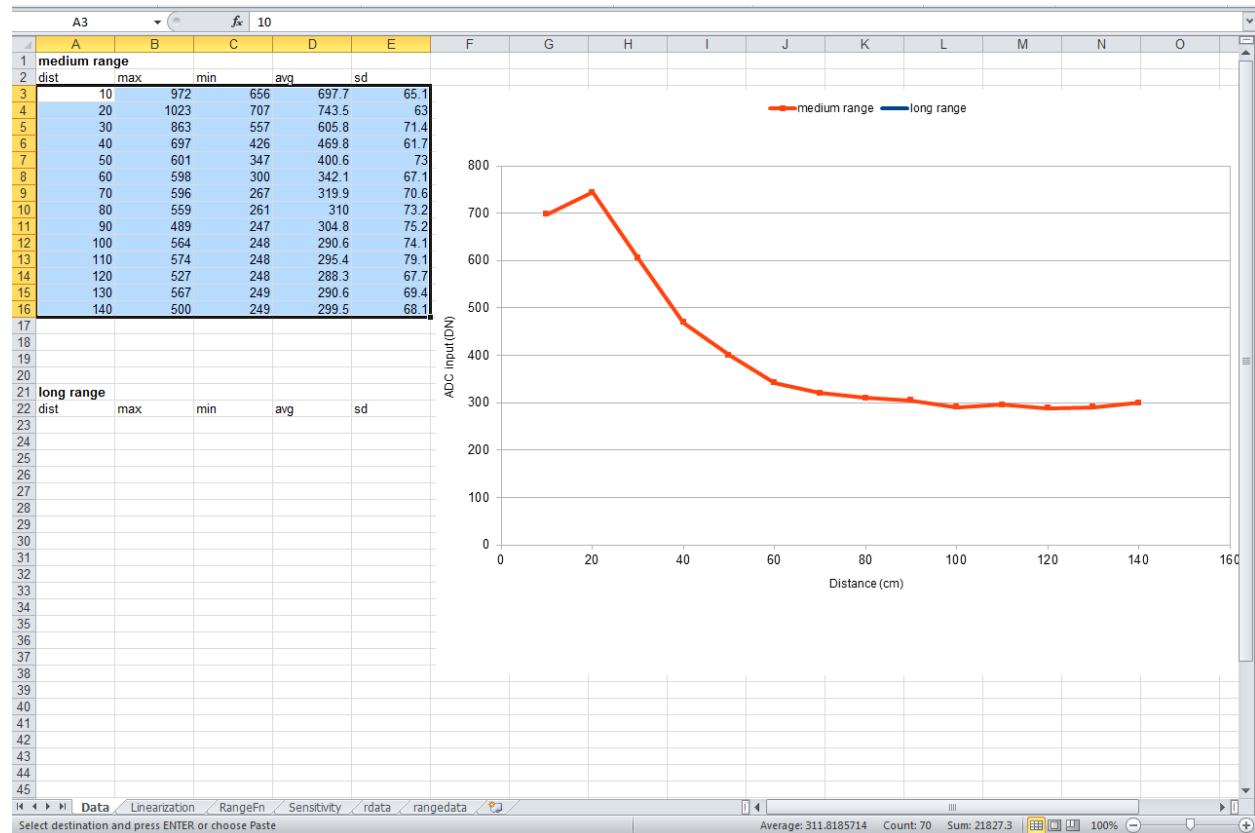


Open the results variable in the workspace and copy.

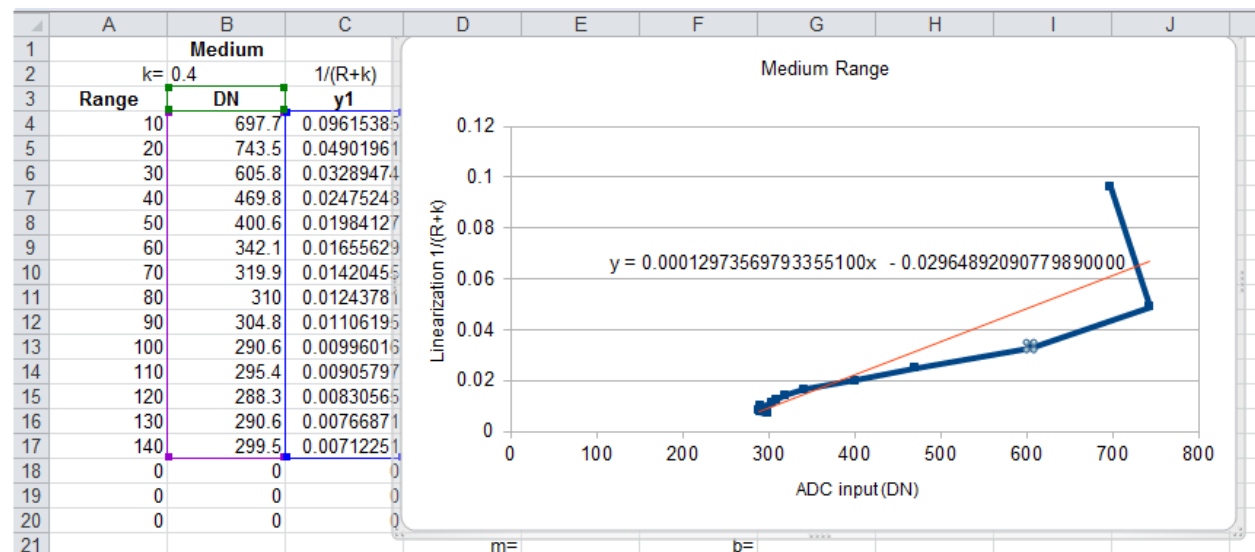


Paste into the excel sheet as shown. There is room for 20 measurements of the medium range sensor and 50 measurements of the long range sensor. The average DN vs. distance will be plotted.

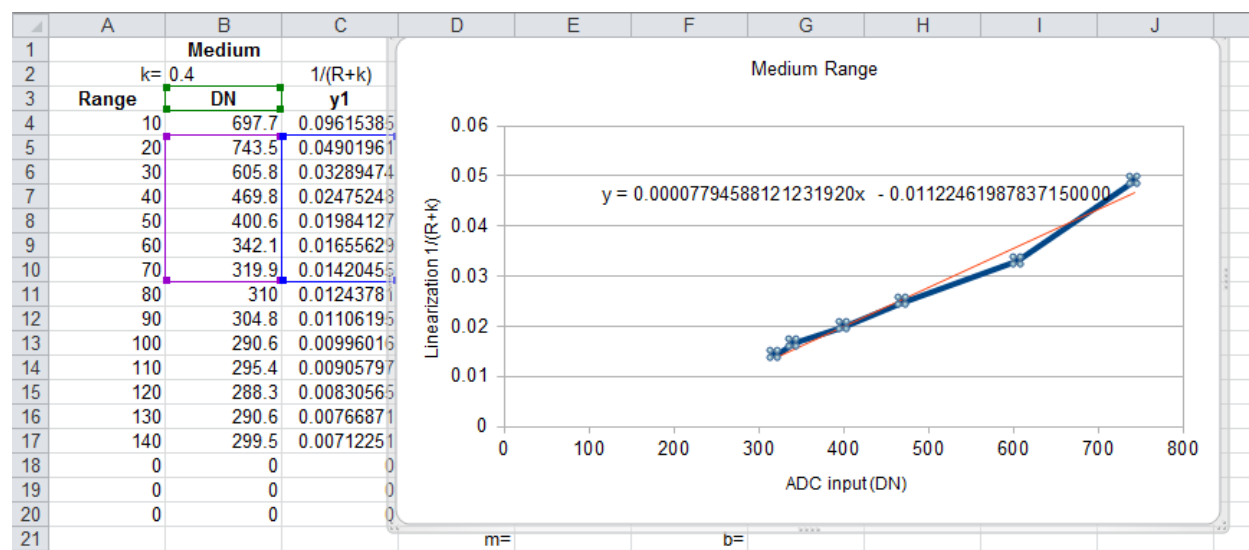
Note: The images only show the process for the medium range sensor. The process is similar for the long range sensor.



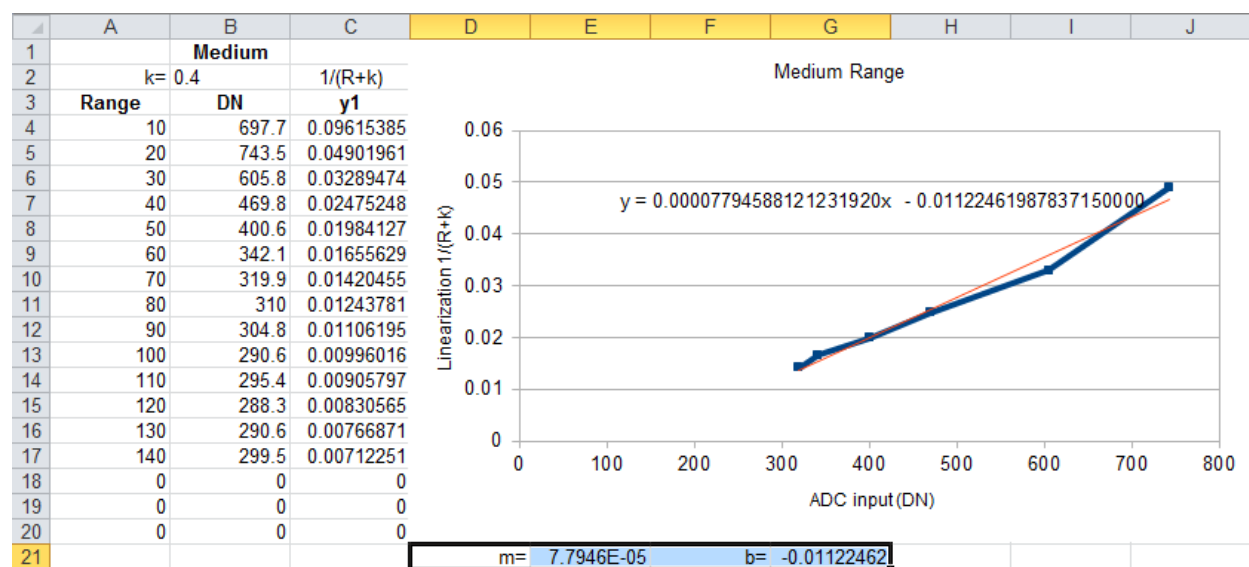
Switch to the linearization sheet.



Edit the plot to display only the linear range. Change k to improve the linearization if desired.

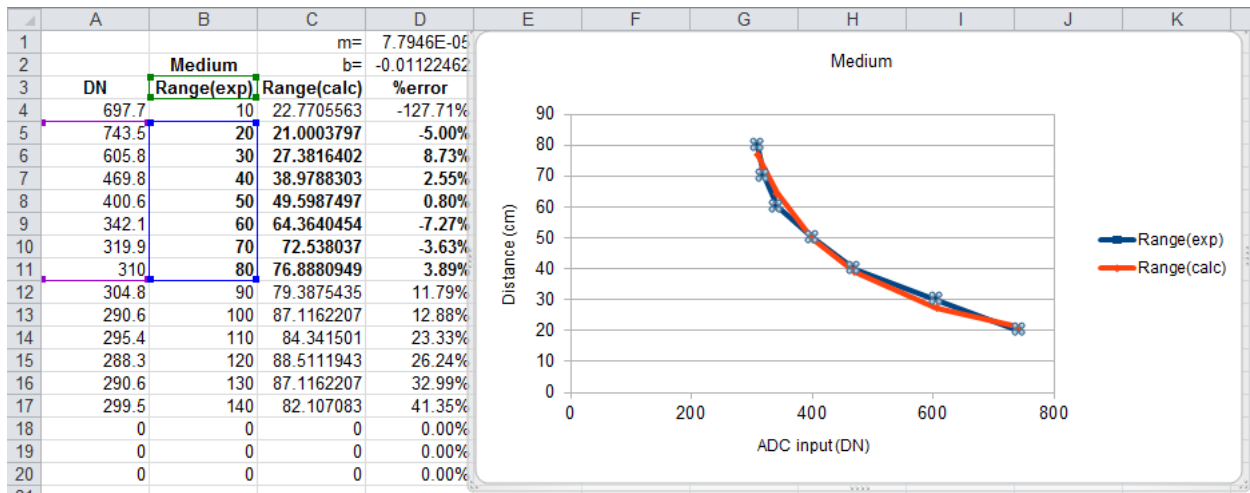


Copy the slope from the line equation and paste it into the column next to “m=”. Copy the y intercept from the line equation and paste it into the column next to “b=”.

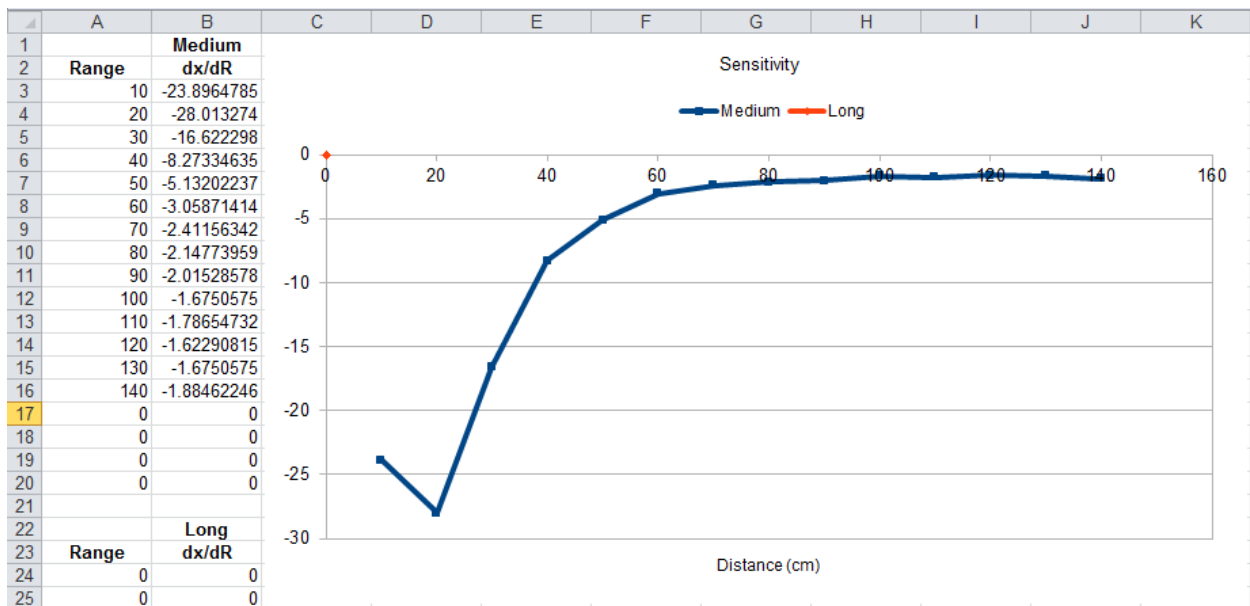


Switch to the RangeFn sheet.

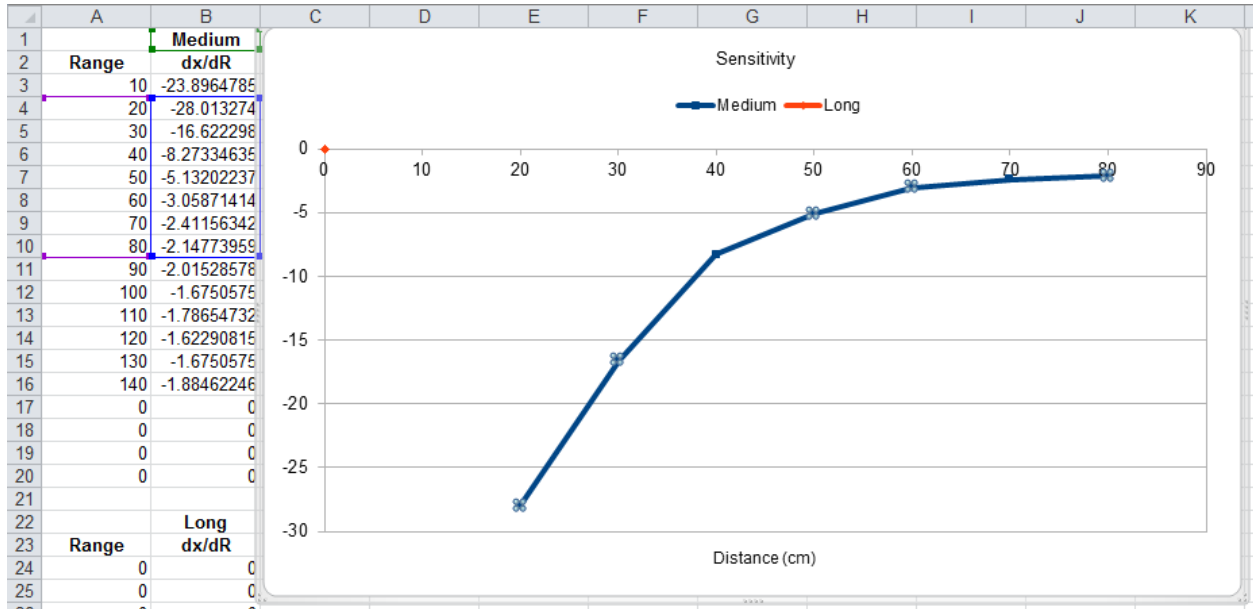
Choose the range over which you will use each sensor based on the **%error**. This is the error between the real and calculated distance. In this example the acceptable range is 20-80cm. Change the plotted data to this acceptable range to check. The two graphs should be very close.



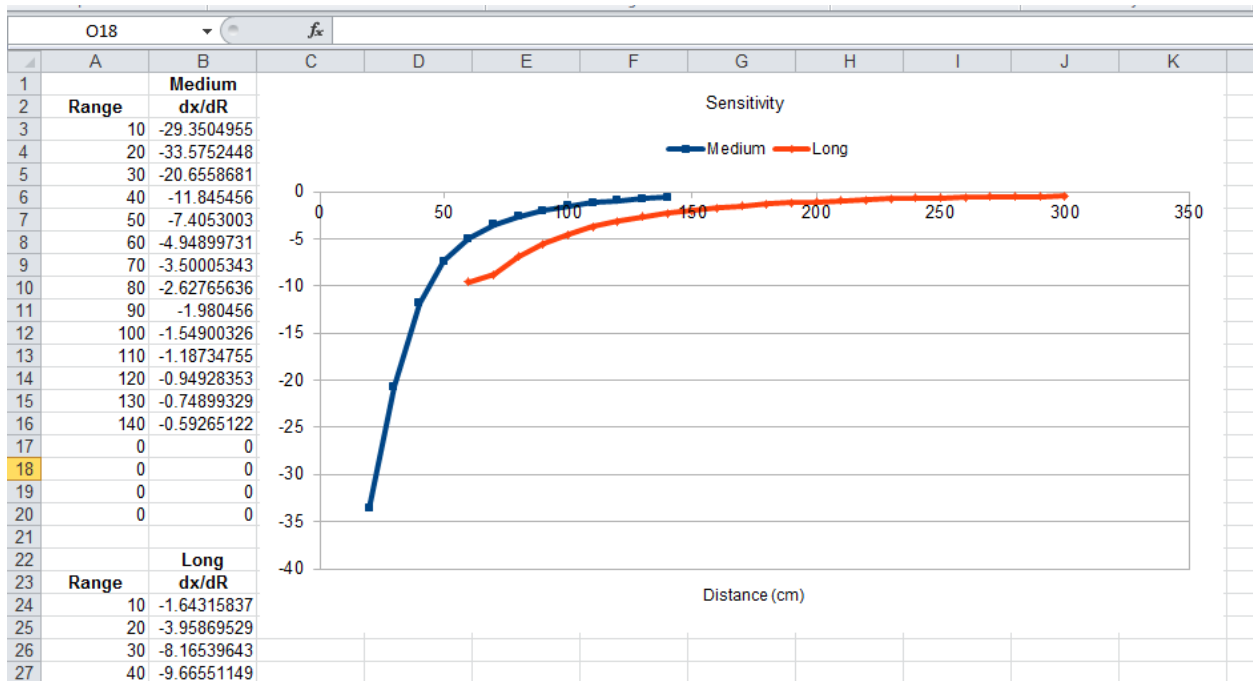
If desired switch to the Sensitivity sheet. This section is not necessary, but may be useful.



Change the plotted data to the usable range chosen earlier.



This graph will display the sensitivity of both sensors. The plots of two sensors from a different rover are shown below.



Switch to the rdata sheet. Enter the acceptable range chosen earlier. In this example only 20-80cm is acceptable. At 80cm the sensor measured a digital number of 310, and at 20cm the sensor measured about 740.

Clipboard		Font		Alignment		Number		Style		
N4		fx								
	A	B	C	D	E	F	G	H	I	J
1	0	80	300		Acceptable range	min	DN at min	max	DN at max	
2	1	80	300				(approximate)		(approximate)	
3	2	80	300		Medium	20	740	80	310	
4	3	80	300		Long	70	1000	300	480	
5	4	80	300		Create rangedata.h					
6	5	80	300							
7	6	80	300							
8	7	80	300							
9	8	80	300							
10	9	80	300							
11	10	80	300							
12	11	80	300							
13	12	80	300							
14	13	80	300							
15	14	80	300							
16	15	80	300							
17	16	80	300							

Click "Create rangedata.h".

rangedata.h should be in the same folder as the excel file.

Double check the results. The original measurements are shown on the left for reference. Rdata is shown on the right.

Column B corresponds to the distance measured by the medium range sensor. Column A corresponds to the digital number measured. As shown, at the maximum DN of 740, the approximated range is 21.126cm. This is close to the measured DN of 743 at 20cm.

Similarly, at a DN of 310, the approximated range is 76.9cm. This is close to the measured DN of 310 at 80cm.

A4		fx		20	
	A	B	C	D	E
1	medium range				
2	dist	max	min	avg	sd
3	10	972	656	697.7	65.1
4	20	1023	707	743.5	63
5	30	863	557	605.8	71.4
6	40	697	426	469.8	61.7
7	50	601	347	400.6	73
8	60	598	300	342.1	67.1
9	70	596	267	319.9	70.6
10	80	559	261	310	73.2
11	90	489	247	304.8	75.2
12	100	564	248	290.6	74.1
13	110	574	248	295.4	79.1
14	120	527	248	288.3	67.7
15	130	567	249	290.6	69.4
16	140	500	249	299.5	68.1

731	730	21.4933963
732	731	21.4560989
733	732	21.4189283
734	733	21.381884
735	734	21.3449652
736	735	21.3081714
737	736	21.2715018
738	737	21.234956
739	738	21.1985332
740	739	21.1622328
741	740	21.1260542
742	741	20
743	742	20
744	743	20

	A	B	C	D	E
1	medium range				
2	dist	max	min	avg	sd
3	10	972	656	697.7	65.1
4	20	1023	707	743.5	63
5	30	863	557	605.8	71.4
6	40	697	426	469.8	61.7
7	50	601	347	400.6	73
8	60	598	300	342.1	67.1
9	70	596	267	319.9	70.6
10	80	559	261	310	73.2
11	90	489	247	304.8	75.2
12	100	564	248	290.6	74.1
13	110	574	248	295.4	79.1
14	120	527	248	288.3	67.7
15	130	567	249	290.6	69.4
16	140	500	249	299.5	68.1

305	304	80
306	305	80
307	306	80
308	307	80
309	308	80
310	309	80
311	310	76.8880949
312	311	76.4252773
313	312	75.9679695
314	313	75.5160739
315	314	75.0694948
316	315	74.6281391
317	316	74.1919155
318	317	73.7607352
319	318	73.3345111
320	319	72.9131583
321	320	72.4965937
322	321	72.0847362

The contents of rangedata.h are shown below. Note that the name of the medium range data must be different than that of the long range data.

[illegible][illegible]

