WORCESTER POLYTECHNIC INSTITUTE

MECHANICAL ENGINEERING DEPARTMENT

Engineering Experimentation
ME-3901, D'2012

Laboratory #1 (Part 2)

General information

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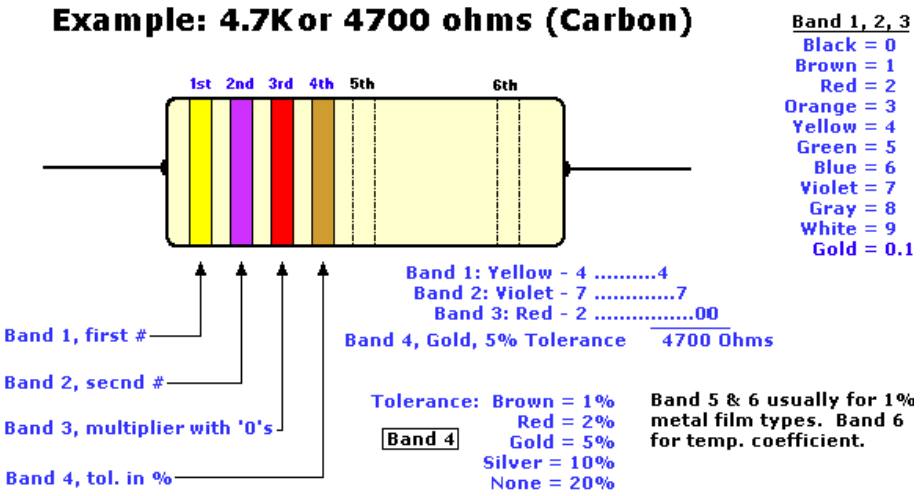
General information

Please refer to handout:
"Laboratory 1: Digital Ohm Meter"

Resistor color code



Example for a Precision Metal Film 19200 Ohms or 19.2 KiloOhms also known as 19K2 at 1% tolerance:

Band 1 = Brown, 1st digit
Band 2 = White, 2nd digit
Band 3 = Red, 3rd digit
Band 4 = Red, 4th digit, multiply with zeros, in this case 2 zero's
Band 5 = Brown, Tolerance, 1%
Band 6 = Blue, Temperature Coefficient, 6

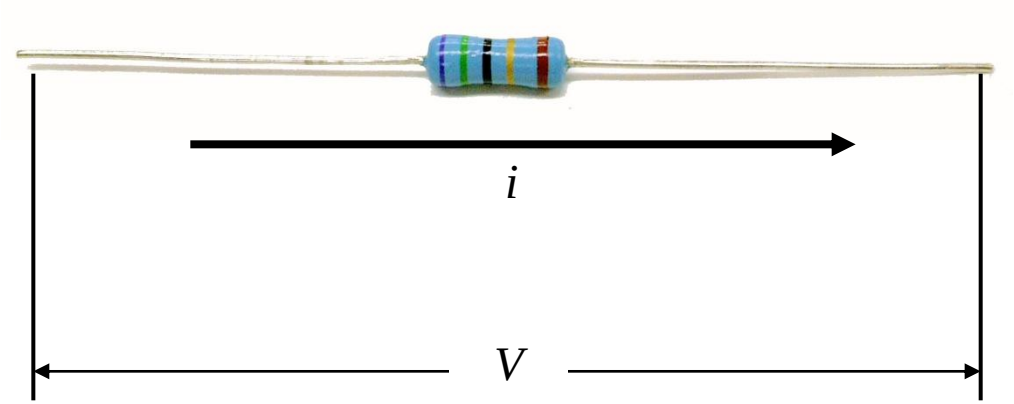
Temperature coefficient →

- R = physical property
- T = temperature
- T_0 = reference temperature
- α = temperature coefficient in the temperature interval $\Delta t = T - T_0$

$$R(T) = R(T_0)(1 + \alpha(T - T_0))$$

Here α has the dimensions of an inverse temperature (1/K or K^{-1}).

Measurement of resistance



Voltage induced by
provided current i

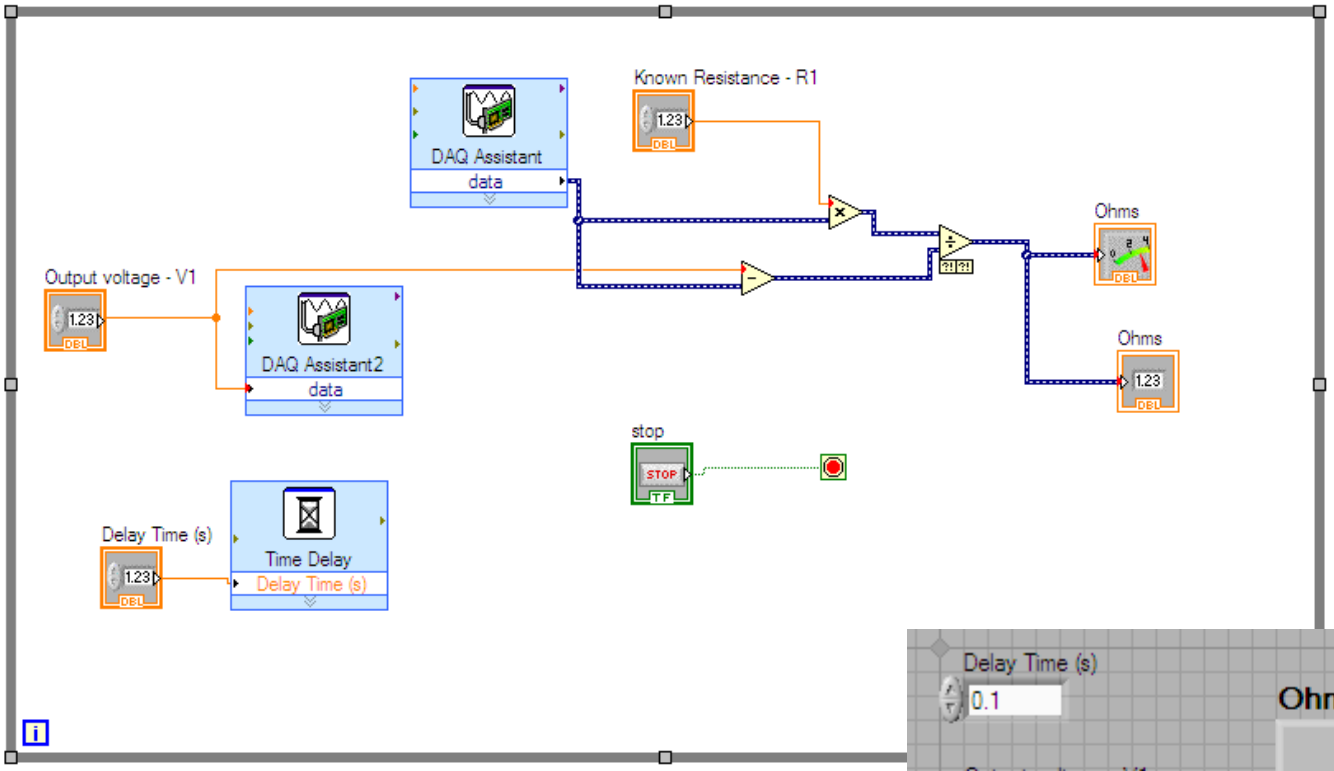
Objectives: Laboratory #1, Part 02. Digital Ohm meter

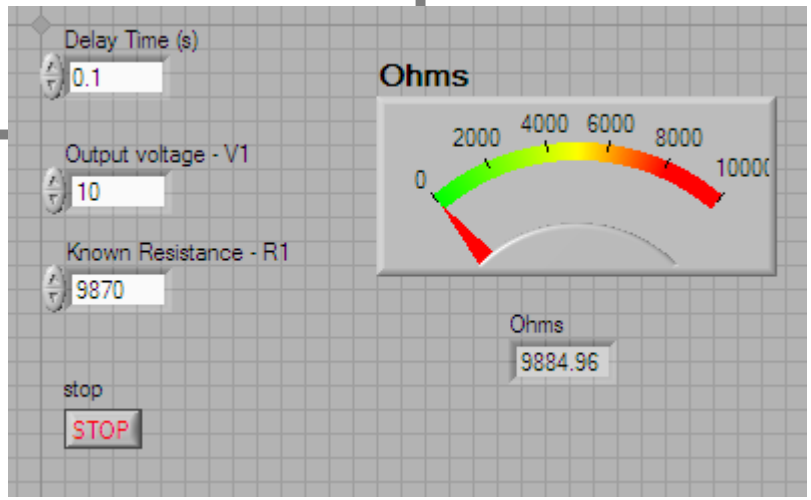
The objectives of this laboratory are:

- Modify previously developed VI to add capability of "writing" data, in "text" format, to a file;
- The digital readings will be transferred to a spreadsheet for statistical analysis;
- Measure single resistor multiple times; determine statistics; what is the significance of these data?;
- Measure batch of same resistors; determine statistics; what is the significance of these data?
- Measure batch of different resistors determine statistics; what is the significance of these data?
- You will also observe the temperature versus resistance characteristics of a batch of resistors;

Update VI program to write data to a "File"

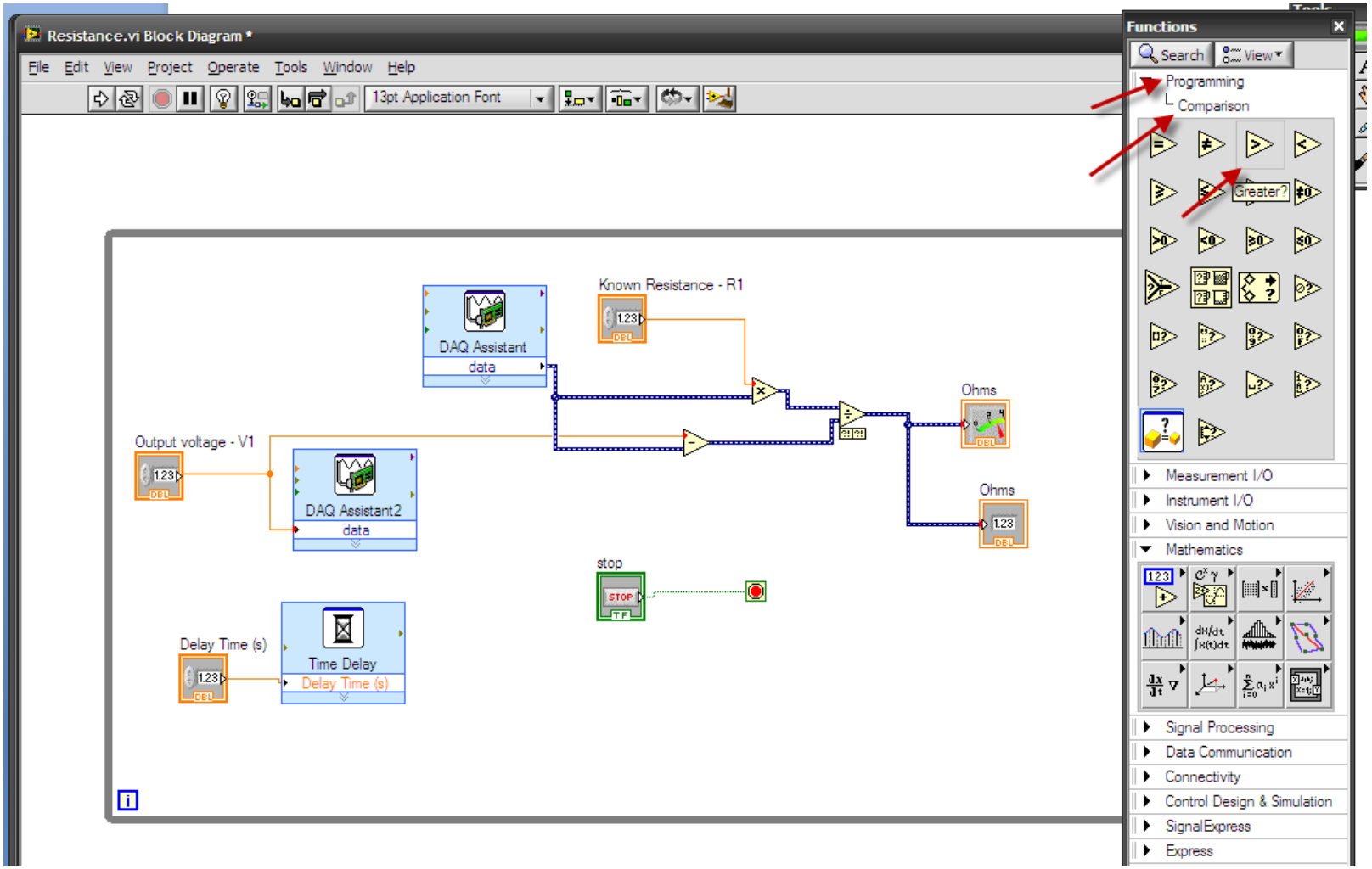
Recall previously developed VI





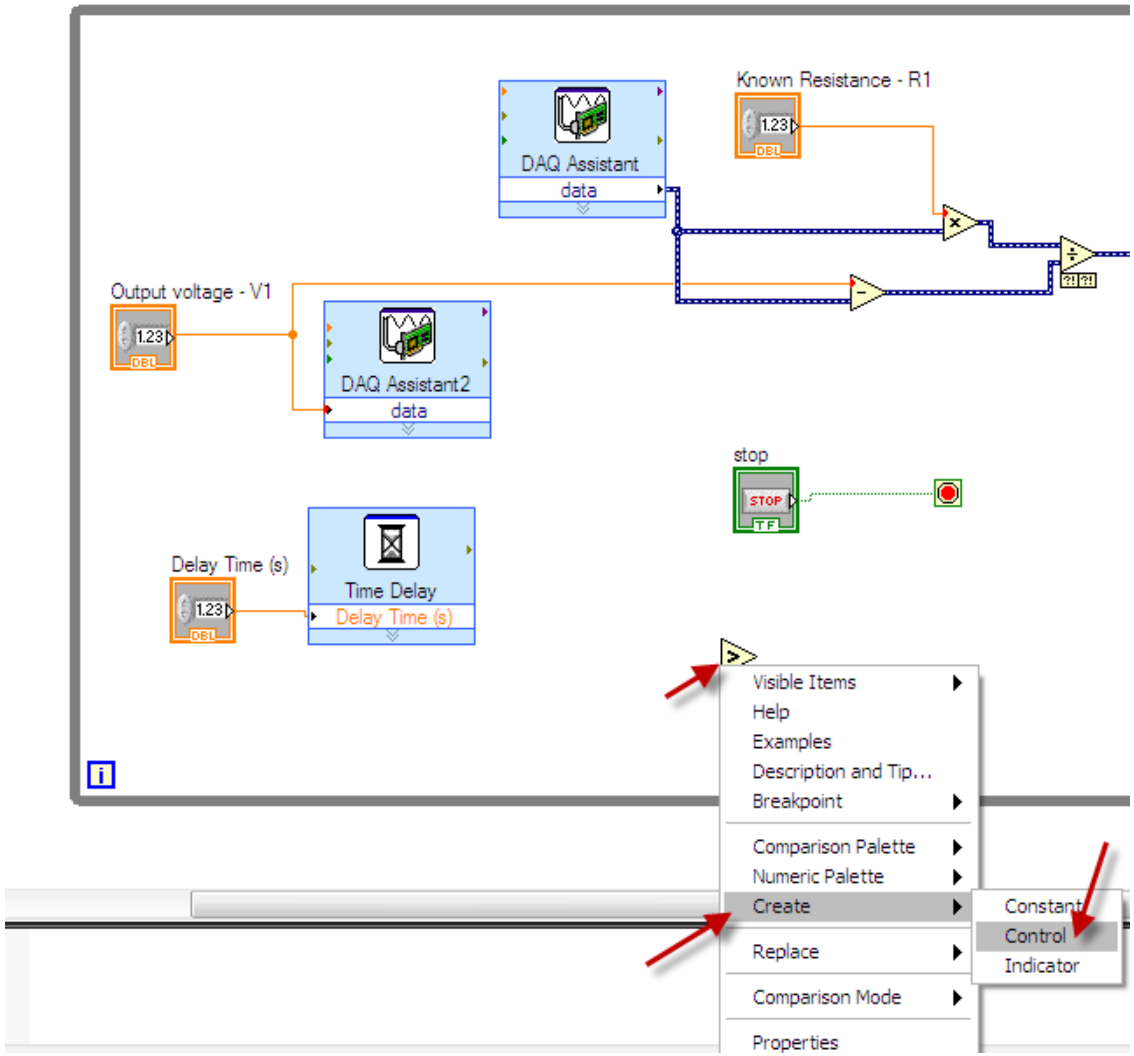
Limit the number of iterations: add conditional ">"

Block diagram

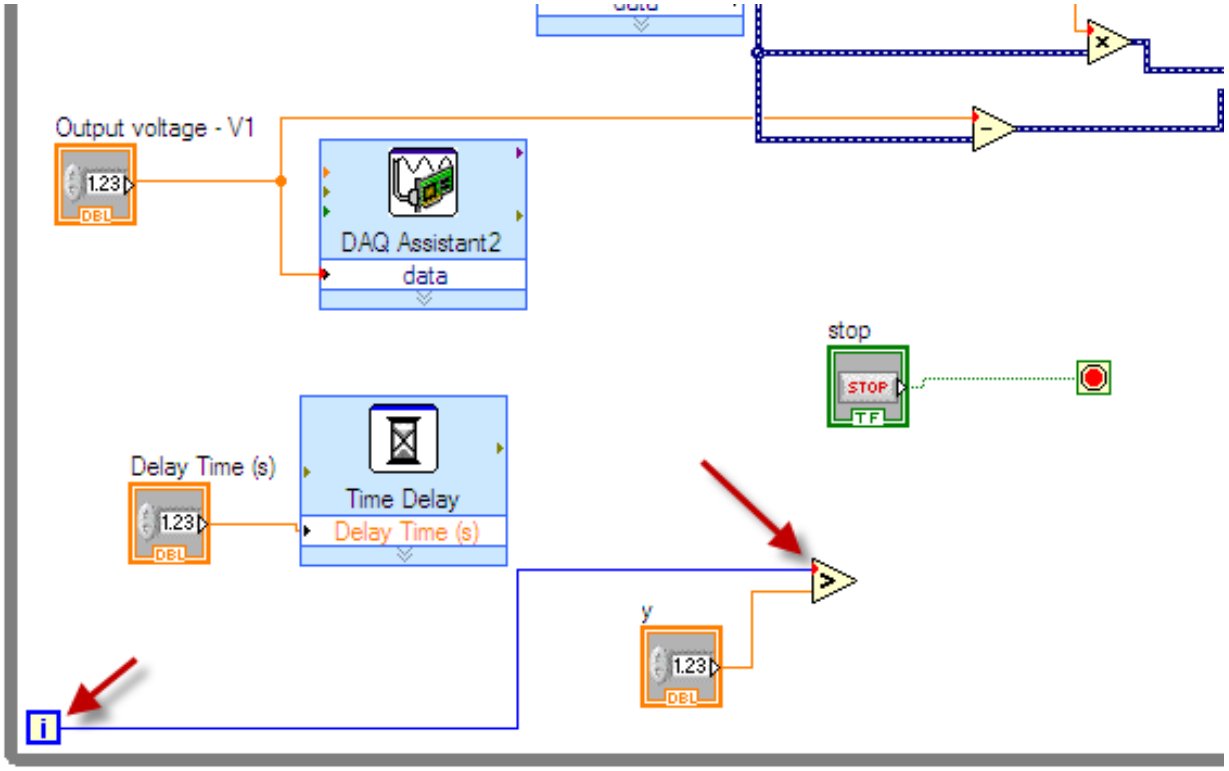


Limit the number of iterations: add conditional ">"

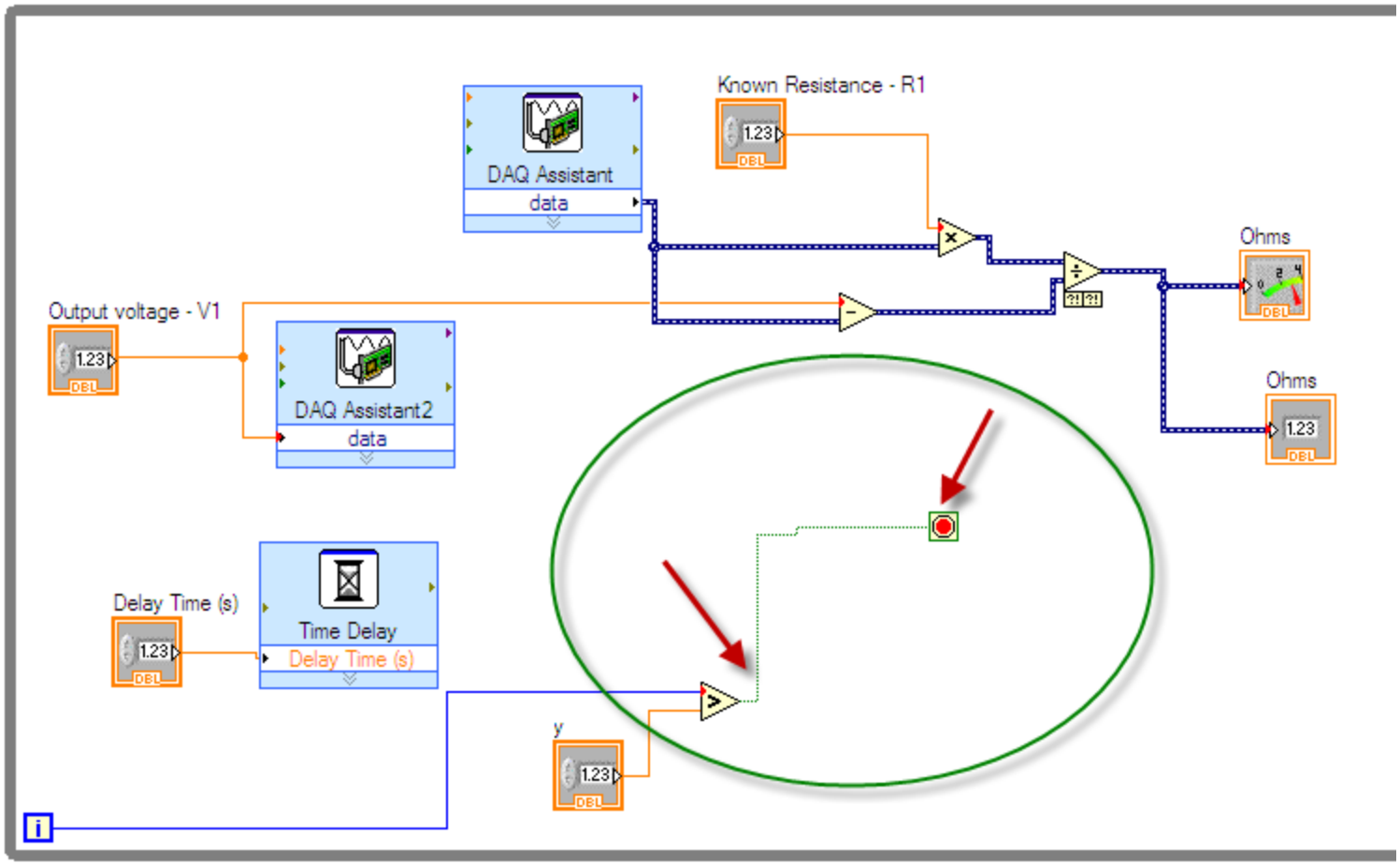
Block diagram



Add control to conditional ">"



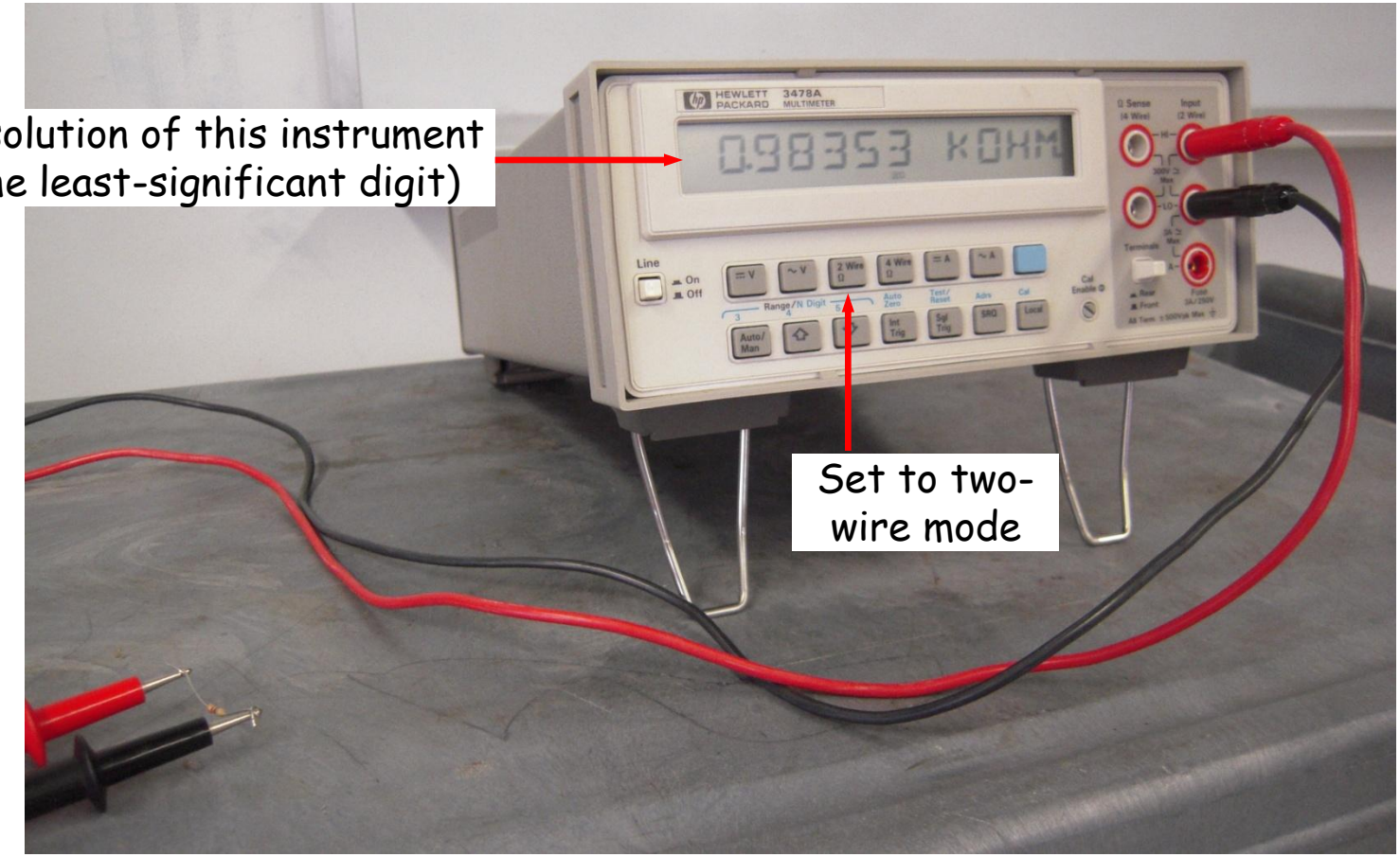
Remove "stop" button and wire up



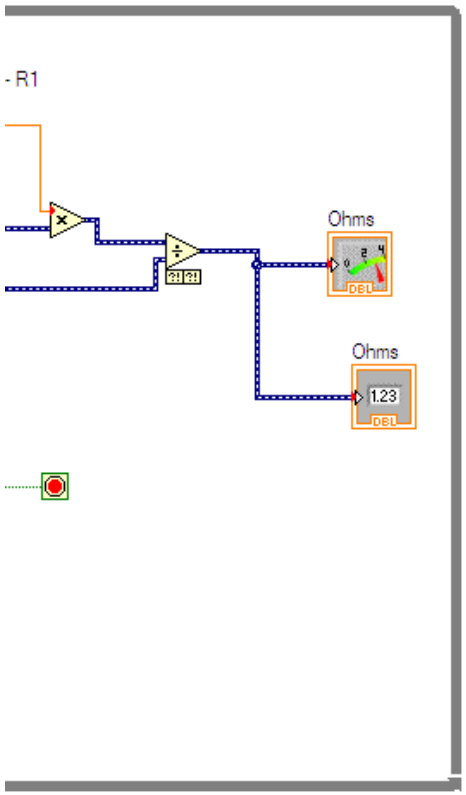
Next: write a series of readings to a spreadsheet file (try 10 readings)

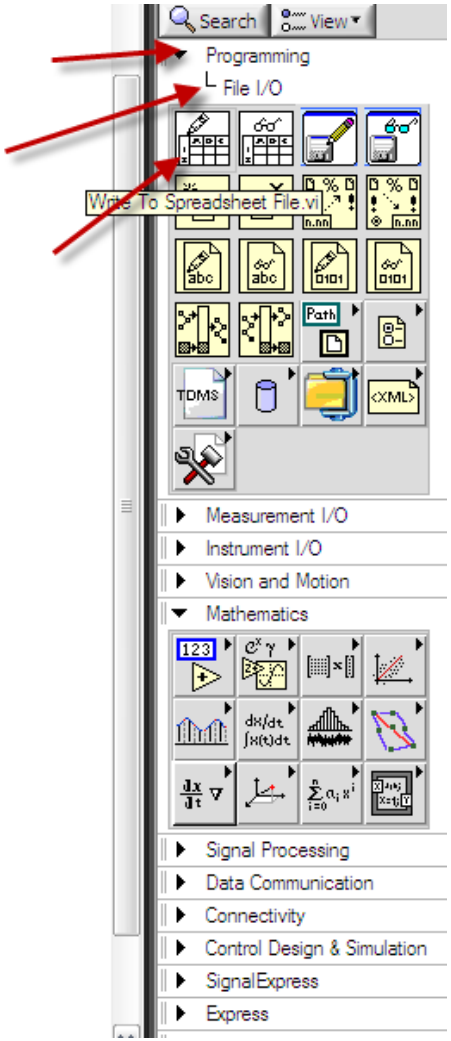
To do calibration of your measurements use a "calibrated" and "high-resolution" instrument (our Standard)

HP-3478A Multimeter

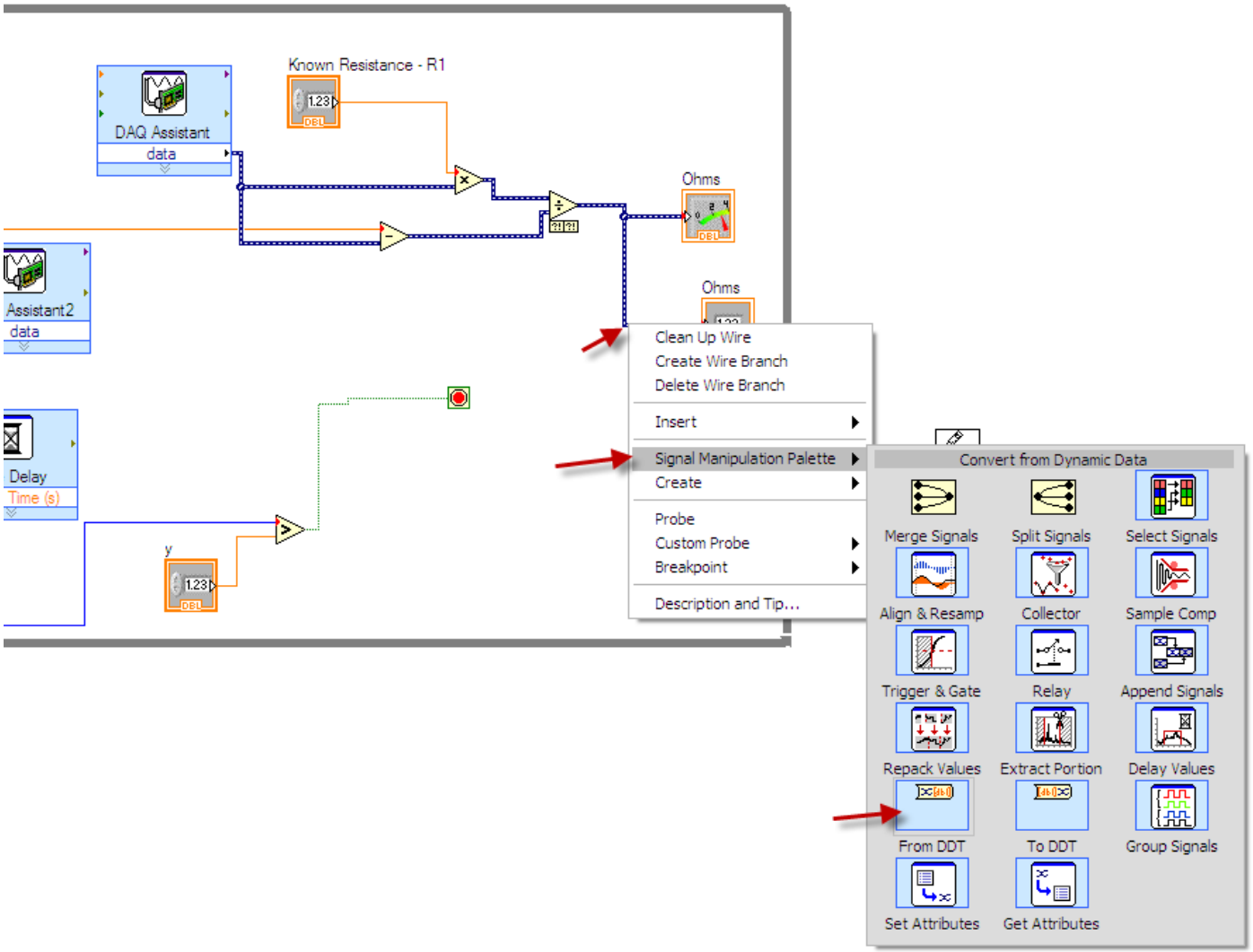


Add 'write to spreadsheet file' capability

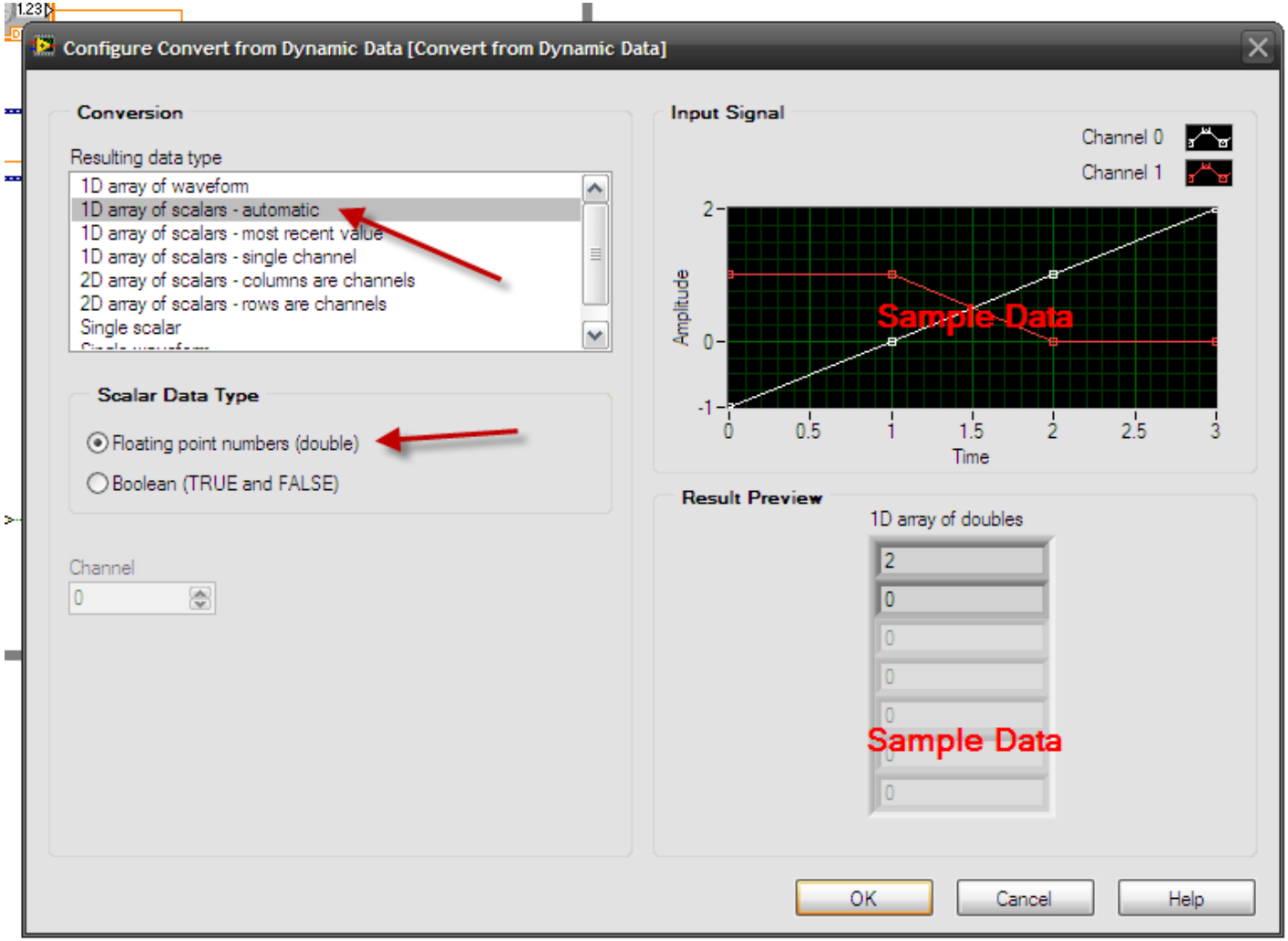




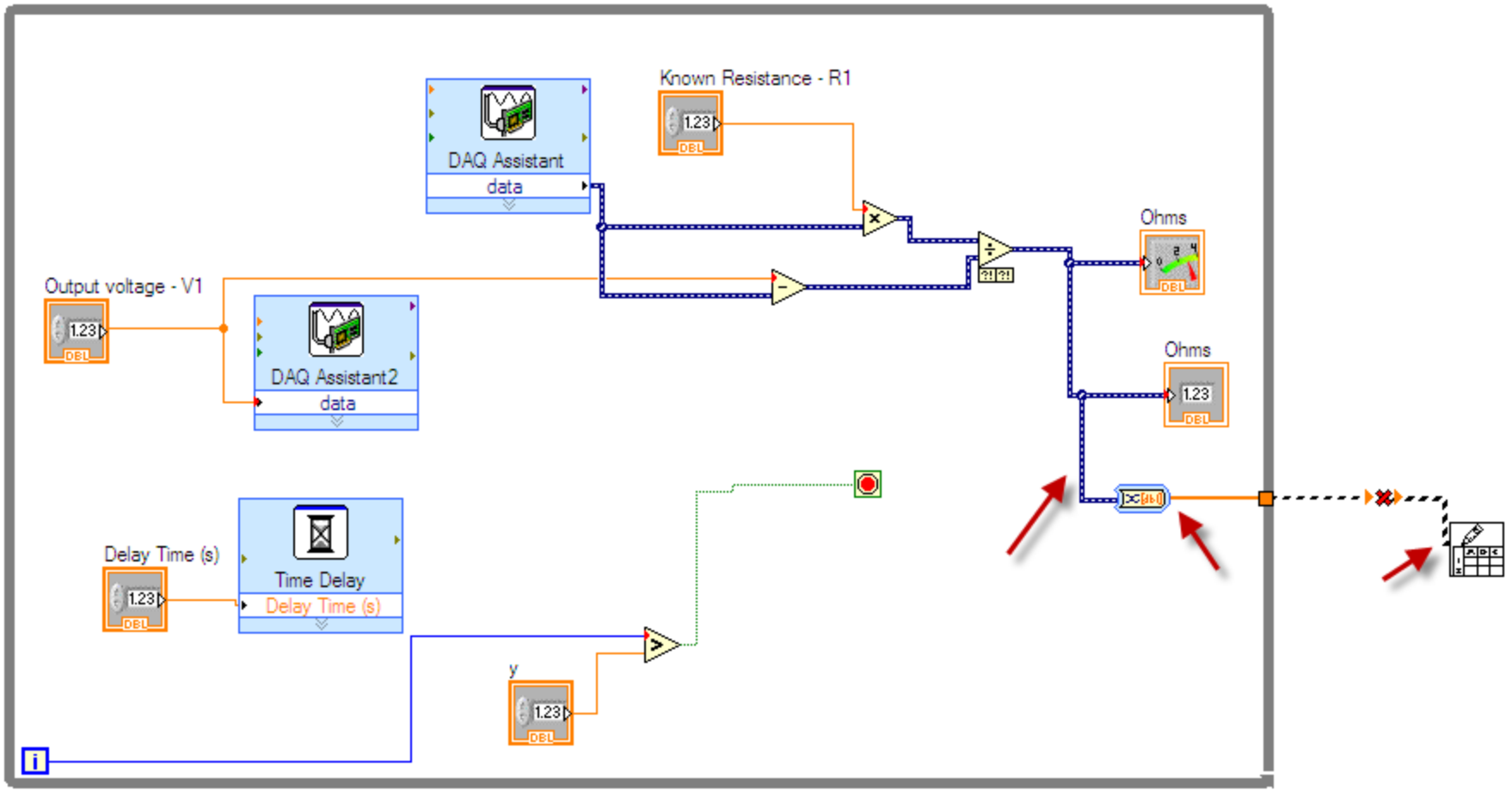
Add From Dynamic Data converter



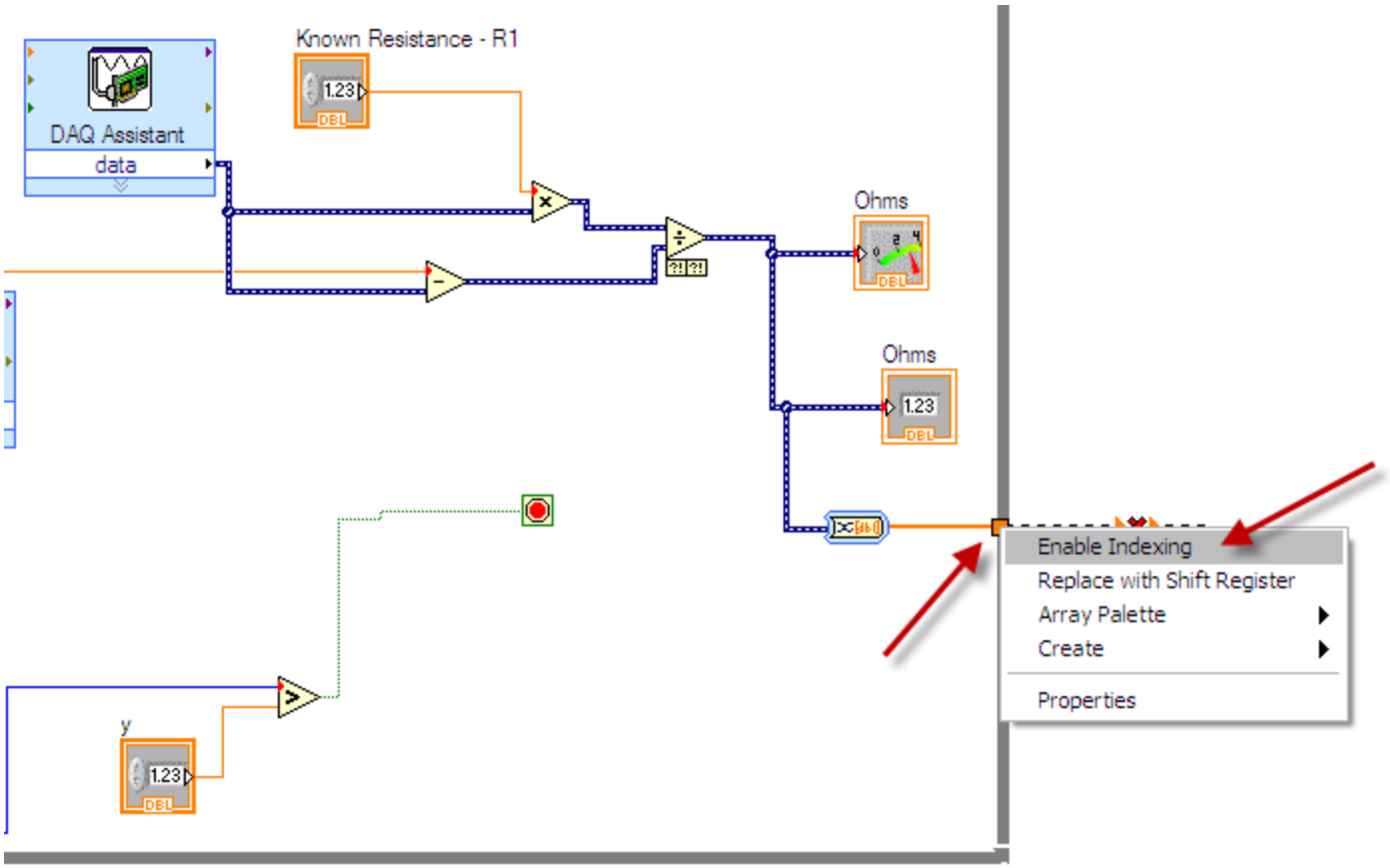
Configure From Dynamic Data converter



Wire output of the channel to the "2D data" port of the spreadsheet file

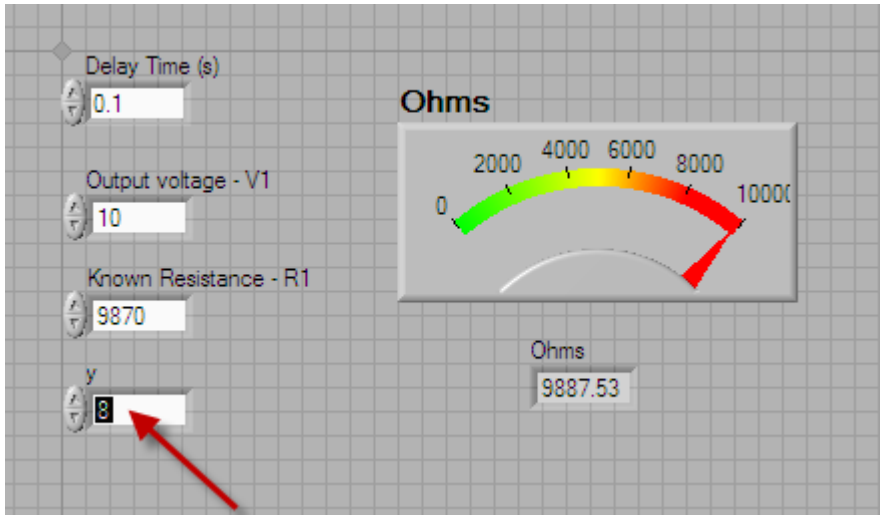


Enable Indexing



Run your VI. Enter filename when the filename window pops up (specify Excel file extension as well). Is the result what you expected? Why?

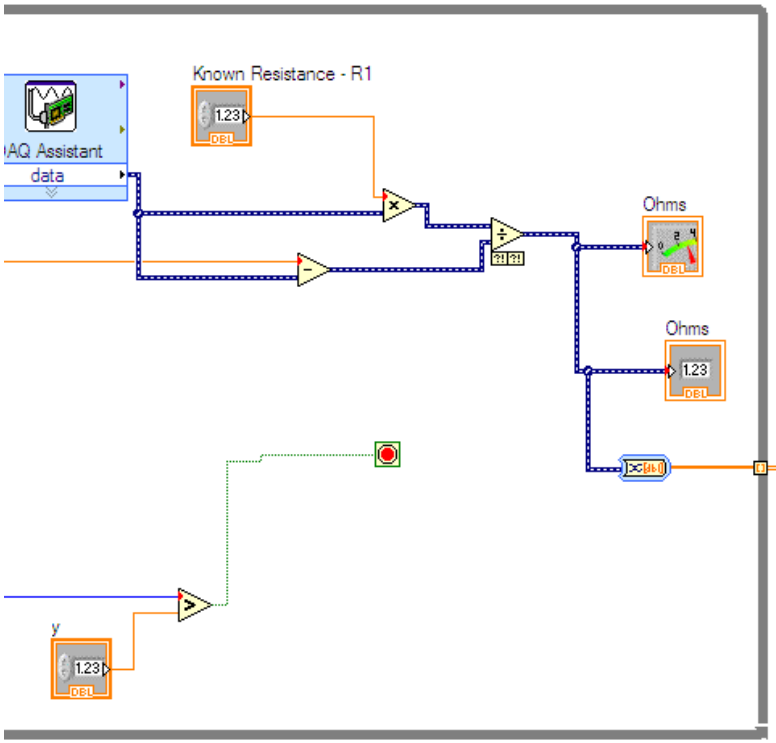
Change number of measurements to "8" – "y" shown

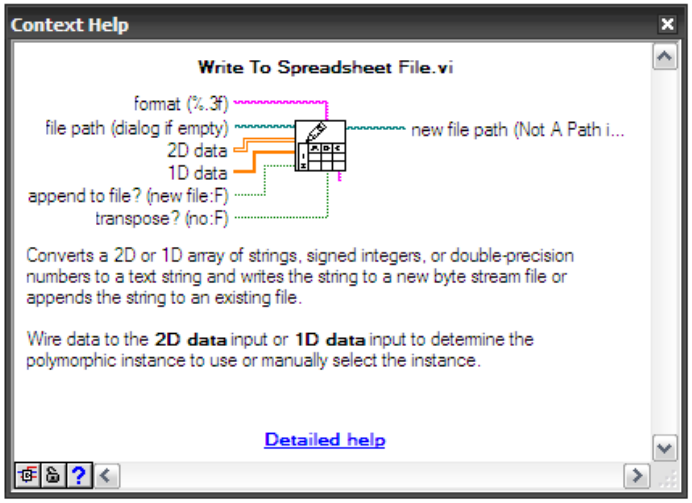


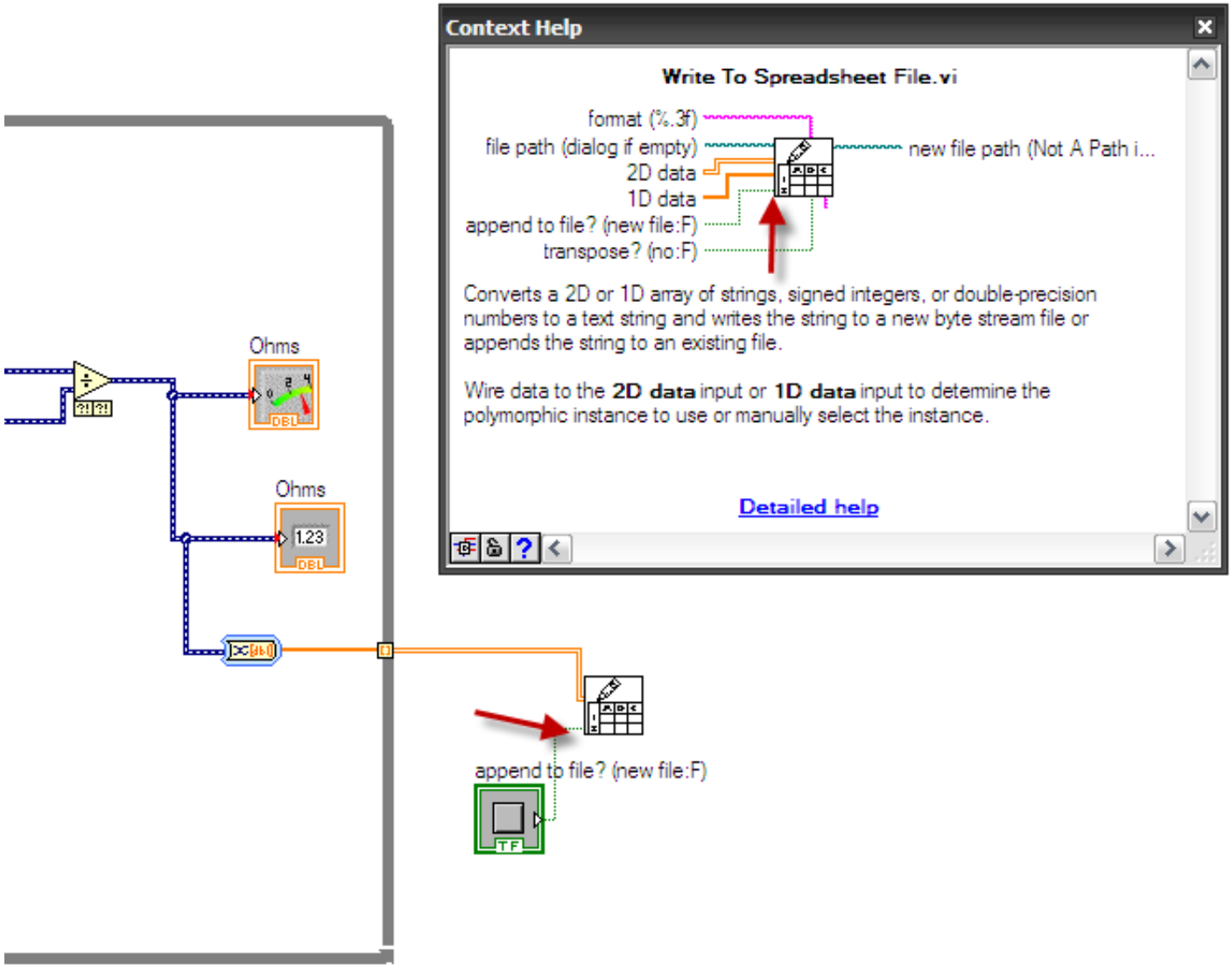
Run your VI. Check the output file.

Now you want to append multiple rows of readings to the file for each of the resistance test

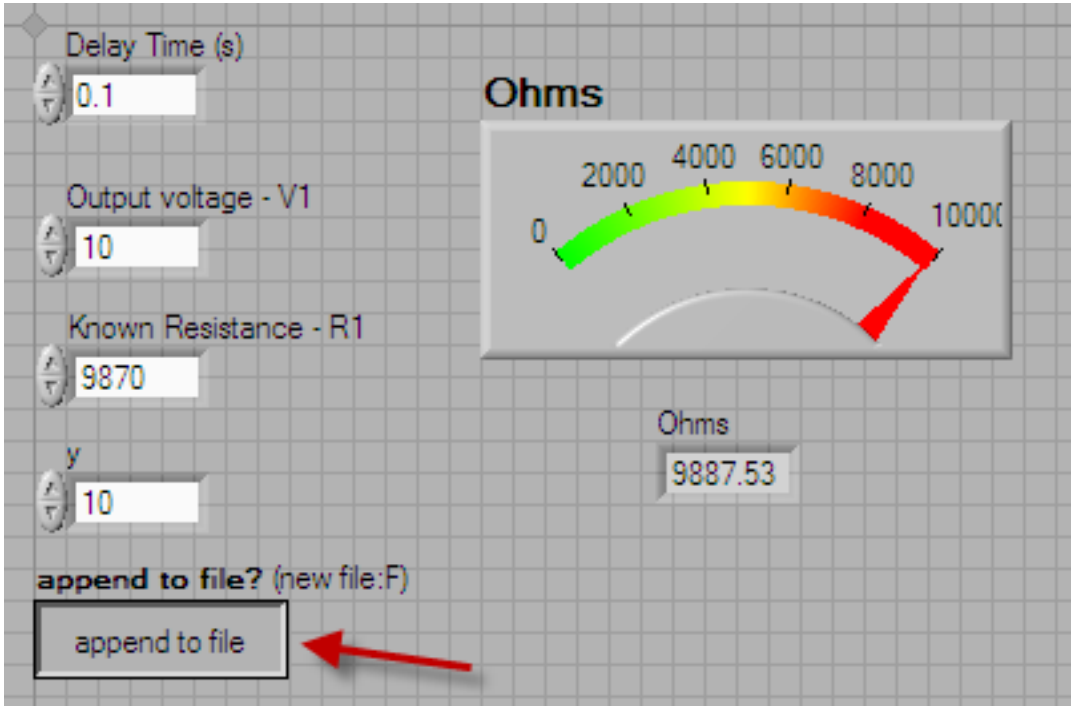
Consider adding control to 'append to file'. Use Ctrl+H to open the help window for detailed information for any block






Context Help
Write To Spreadsheet File.vi
format (%.3f)
file path (dialog if empty)
2D data
1D data
append to file? (new file:F)
transpose? (no:F)
new file path (Not A Path i...
Converts a 2D or 1D array of strings, signed integers, or double-precision numbers to a text string and writes the string to a new byte stream file or appends the string to an existing file.
Wire data to the 2D data input or 1D data input to determine the polymorphic instance to use or manually select the instance.
Detailed help
Ohms
Ohms
1.23
DBL
append to file? (new file:F)
TF

On the front panel, make 'append to file' to be "true"



Run your VI again. Check the output file.

Is it exactly 10 ('y') readings per run? Explain
(Modify your VI accordingly)

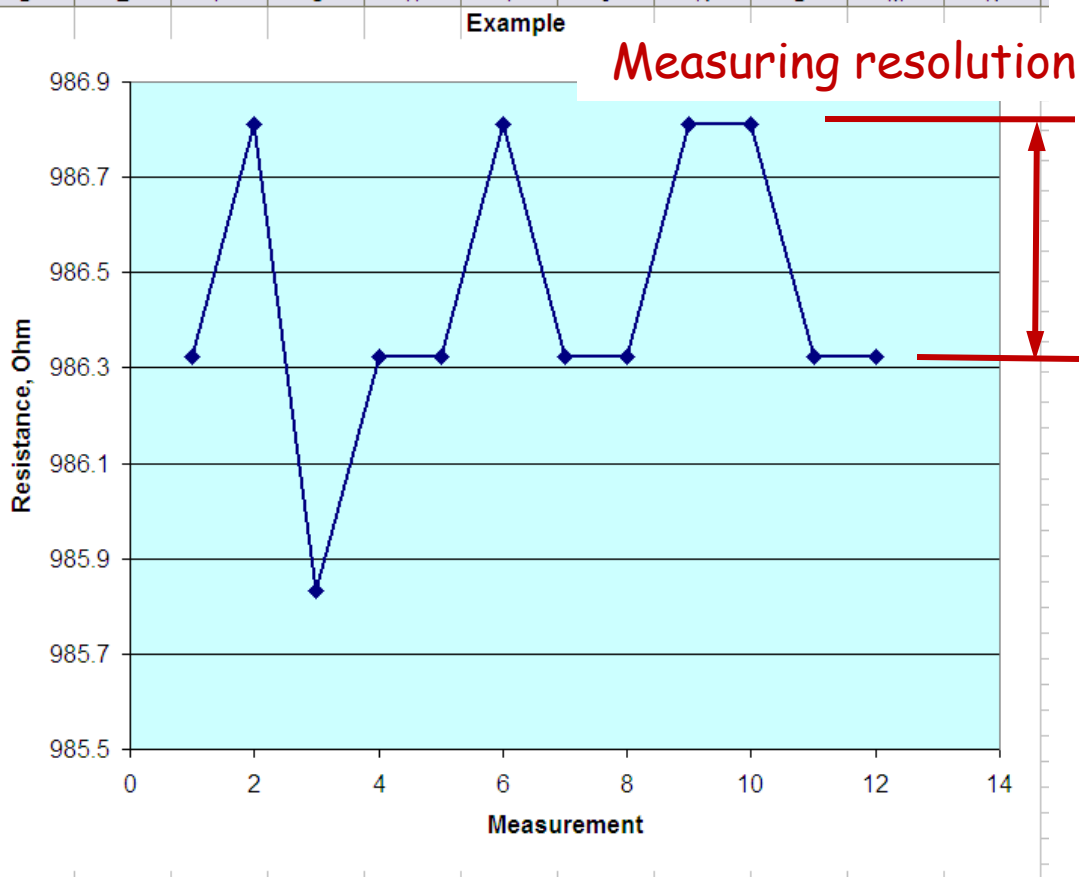
Sample measurements in Excel. Data analysis.

Microsoft Excel - 1kOhm_v01.xls

File Edit View Insert Format Tools Data Window Help

B26

	A	B	C
1	Measurement	Resistance	Difference (resolution)
2	1	986.322	
3	2	986.810	0.488
4	3	985.834	-0.976
5	4	986.322	0.488
6	5	986.322	0.000
7	6	986.810	0.488
8	7	986.322	-0.488
9	8	986.322	0.000
10	9	986.810	0.488
11	10	986.810	0.000
12	11	986.322	-0.488
13	12	986.322	0.000



Do error and statistical analyses

Chauvenet's criterion can be used for "data rejection"

Make sure to have met objectives of this lab!
(See Lab #1 description)

Write-up of the report: due next Wednesday

Use laboratory report template – available in the website of our course