Overview of conductivity measurement and Keithley's 6221-2182A interfacing with LabVIEW

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0) ***If you are using Computer 3.02, you don't have to perform steps 1-4, these have already been done.***

1) Download the Keithley 622x LV 8.zip from the following link,
   http://www.keithley.com/base_download?dassetid=53968

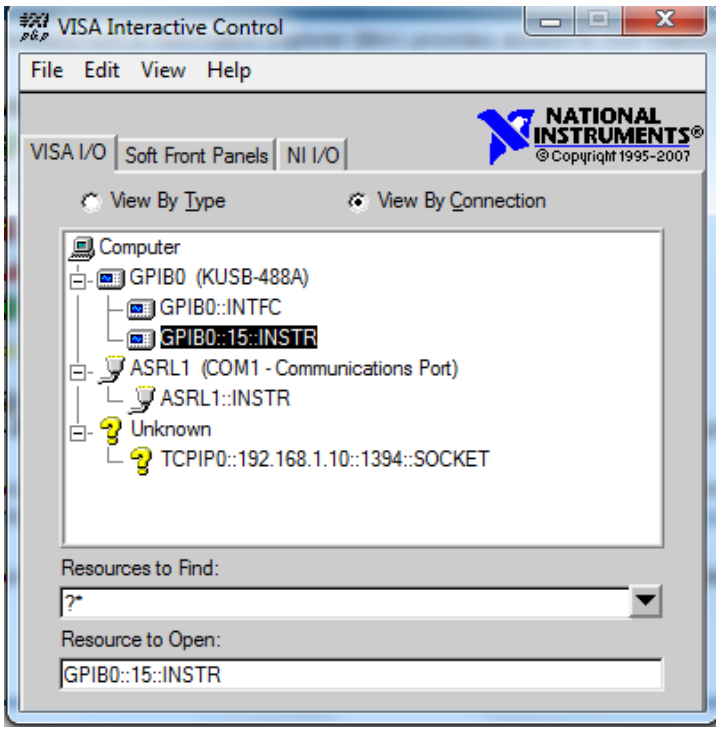
2) Unzip the file, and copy the folder at the following location,
   C:\Program Files\National Instruments\LabVIEW 8.6\instr.lib

3) Download Device Drivers software for KUSB-488A from the following link,
   http://www.keithley.com/base_download?dassetid=53029
   Unzip the file and install the software.

4) Download the **Delta Measurement file.vi** from the Facilities and Equipment page of,
   http://physlab.lums.edu.pk/

5) Change the communication settings form the front panel of 6221 as,
   Press COMM and select GPIB.
   Select address in between (0-30), e.g 15 and press enter.
   Select Language as SCPI, press enter.

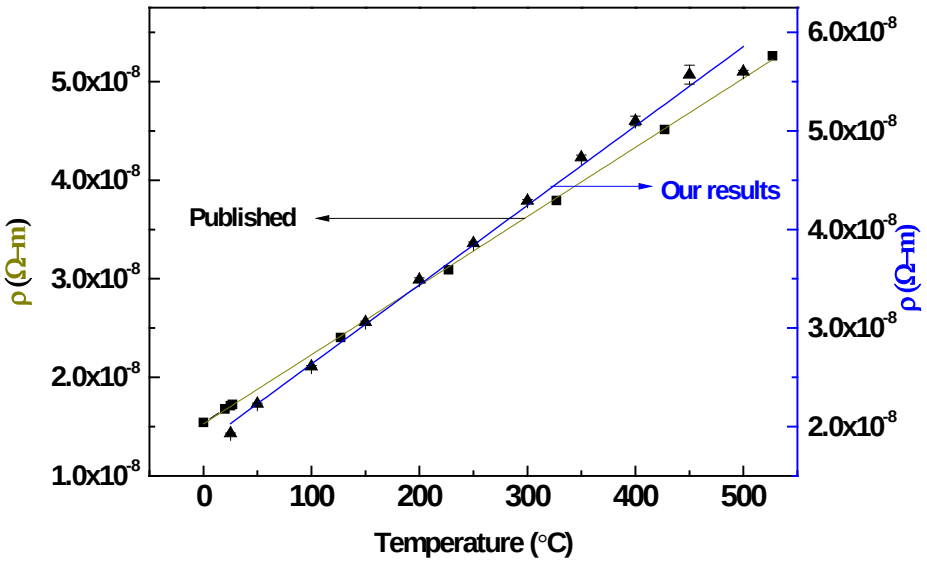
6) Open Measurement & Automation Explorer, Go to **Tools> NI-VISA> VISA Intercative Control**



This will show the resorce address **GPIB0::15::INSTR,** where 15 is the GPIB address selected from control panel of 6221.

7) Now, run the Delta Measurement.vi file. Enter the resource name **GPIB0::15::INSTR** and run the file.
   In 2182A Params in , select **NPLC's to 1.**
   Change the other values as desired.
   Enter the path where you want the file to be saved.

Sample results of four point conductivity of copper



Resistivity has been measured with the following formula [1,2]

$$\rho = R\frac{\pi}{\ln 2}\times t \times k$$

Here

ρ = resistivity of the sample
t = thickness of the sample
k = correction factor which depends on the thickness and probe spacing
R = Resistance of the sample

Temperature coefficient of resistivity has been found with the following formula [2]

$$\rho_T = \rho_0 (1+\alpha \Delta T)$$

Here

ρ_T = resistivity at "temperature *T*

ρ_0 = resistivity at initial temperature

α = temperature coefficient of resistivity

The measured and published values of resistivity and linear coefficient of resistivity are as follows.

Material	Room temperature Resistivity (Ω-m) ($\rho \pm \Delta\rho$)	Coefficient of resistivity ($\alpha \pm \Delta\alpha$) $(^{\circ}C)^{-1}$
Copper	$(1.92 \pm 0.01) \times 10^{-8}$	$(4.1 \pm 0.1) \times 10^{-3}$
Copper (published) [3]	1.70×10^{-8}	4.0×10^{-3}

References:

1. F.M. Smits, Measurement of Sheet Resistivities with the Four-Point Probe, The Bell System Technical Journal, May 1957.
2. Keithleys' "Low Level Measurements" Handbook.
3. Halliday, Resinick and Krane, Physics, 5th. Ed. 1997.
4. Lide, David R, CRC, Handbook of Chemistry and Physics, 75th. Ed. Boca Raton, CRC press 1994.