Department of Electrical and Computer Engineering
Howard University 2008

NET1LAB Hybrid Class (202&208) **Dr. Charles Kim**

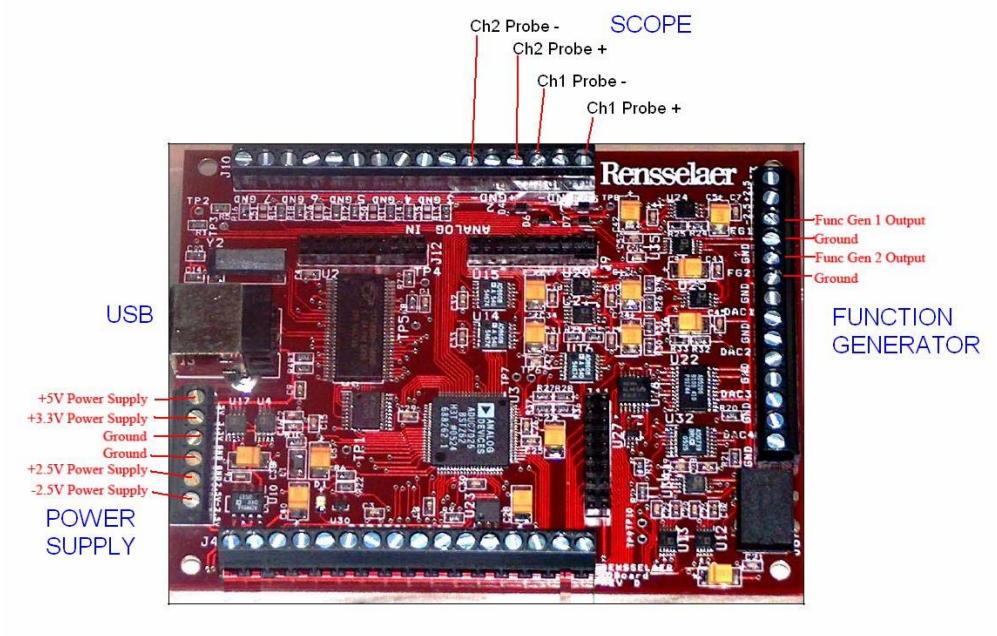
Mobile Studio (MS) 1 - Series/Parallel Resistors and Voltage Division

1. Mobile Studio and Instrumentation Board

MS is a technology-based new learning tool comprising a tablet PC (or any PC) and an instrumentation board, which replaces most of the lab equipment. Therefore, MS allows a small foot print, mobile laboratory experiments any place any time. The measurement by MS is possible by a Windows-based software, Mobile Studio Desktop, which is already installed in the tablet PCs. The icon for the Mobile Studio Desktop is illustrated below.

The opening window when you double click the icon above would be like this:

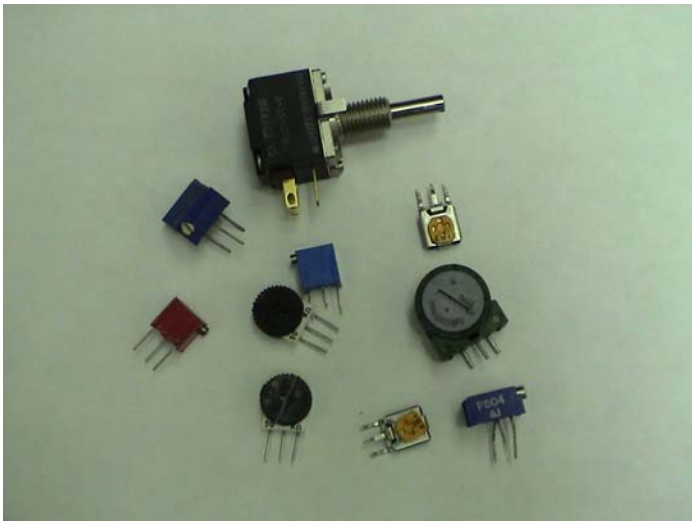
As you see in the above picture, the instrumentation board is USB connected to the tablet PC. The instrumentation board (shown below is the first version called "red board", and a new "blue board" is under construction.) can function as (a) scope, (b)DMM, (c) Power supply, and (d) Function generator.



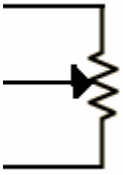
There are, however, important limitations in using the Red board:
(1) No direct measurement of current -- You get current indirectly (by measuring voltage across a resistor, etc)
(2) No direct measurement of resistance -- You get it indirectly (You may still need a DMM for resistance measurement)
(3) There is no variable voltage unless you use a variable resistor. There are fixed voltages generated from the power supply sources.

2. Variable Resistor

Since a variable resistor (or "potentiometer") is an important part of successful Mobile Studio, we will discuss about it here. A variable resistor is a resistor, with 3 legs or pins, whose value can be changed by turning a wiper (knob) attached to it. Some variable resistors, called digi-pot ("Digital Potentiometer") are digitally controlled. The variable resistor varieties are shown below.



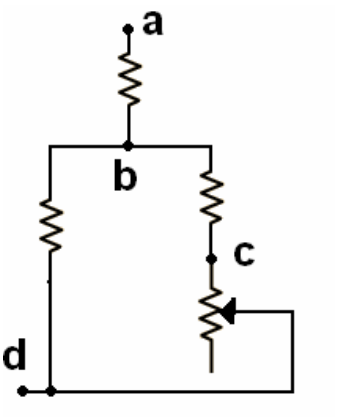
The symbol for a variable resistor is shown below.

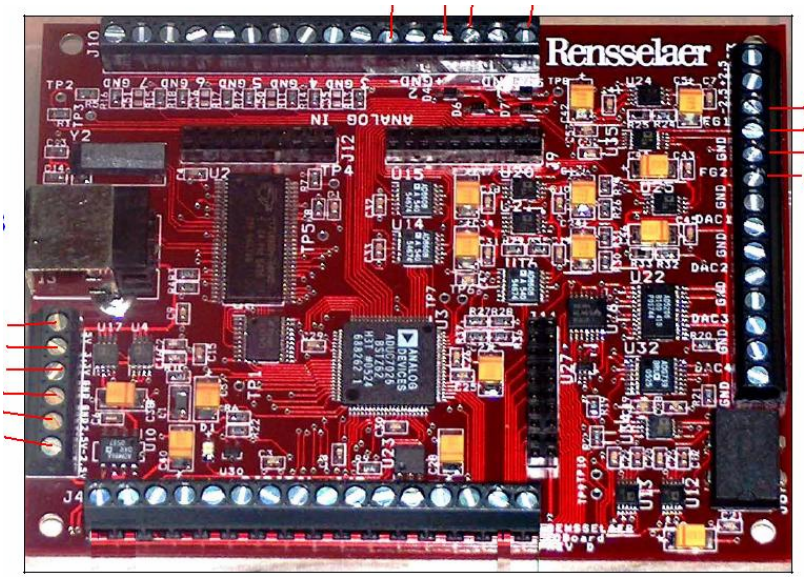


MS-01 Pre-Lab **NAME:**_____

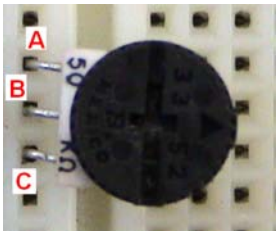
1. Read the tutorial of the Mobile Studio Lab from
Web page: http://www.hirstbrook.com/MSD/Tutorial.pdf
Before answering the question below:

Question: Draw connections from the terminals of the instrumentation board to the circuit if (a) you want to supply +5V between **a** and **d** and (b) you want to measure the voltages between **a** and **b** as well as **c** and **d** at the same time. Draw wiring diagram on this page.





2. Pick a variable resistor from the supply box (or ask the lab technician), preferably the one shown below. Measure the resistance between two terminals of the all combination while turning the knob (wiper) left or right.



Terminals	Wiper Position		
	Left Most	In the Middle	Right Most
A - B			
B - C			
C - A			

Which two terminals do you have to use as a variable resistor in the circuit formation?

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REPORT

Name:_____ ID#:_____ Group#:_____

1. Tablets and Instrumentation Board: we had our first mobile studio lab session with 8 groups formed. The circuit we tested was the one shown in Figure 1, with R1=910 ohm and R2=1.4Kohm. The supply voltages at the terminals **a** and **d** is either 5V DC or 0.75V peak-to-peak sinusoid. Let's indicate the resistance determined by the VR (the resistance between A and B) as Rx.

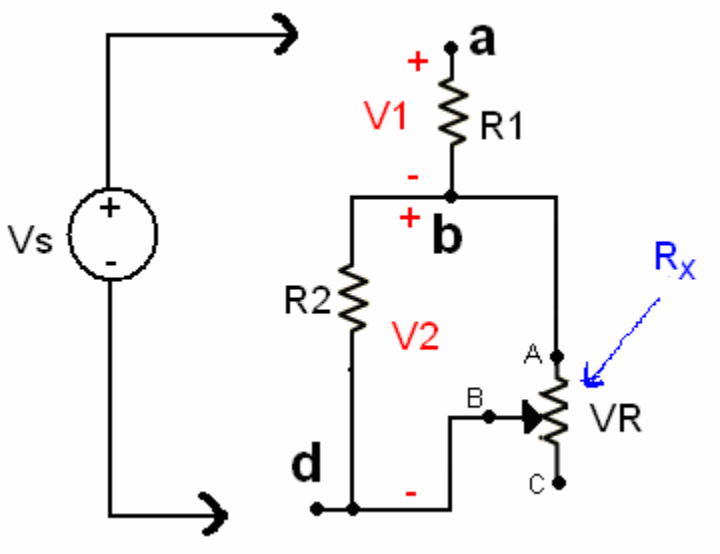

FIG.1

(a) Could you successfully implement the circuit on your breadboard?

(b) Could you see the V1 and V2 on the Tablet PC when 5V DC was applied?

(c) Could you see the V1 and V2 on the Tablet PC when a sinusoid was applied?

(d) Could you see the V1 and V2 change when you turn your variable resistor knob?

2. Let's now analyze FIG.1 in circuit theory point of view. R1=910 ohm and R2=1.4Kohm. The supply voltages at the terminals **a** and **d** is Vs with either 5V DC or 0.75V peak-to-peak sinusoid. The resistance determined by the VR (the resistance between A and B) is Rx.

(a) Express the resistance between **b** and **d** in terms of Rx, R_{bd}.

(b) Express V1 in terms of Vs and Rx.

(c) Express V2 in terms of Vs and Rx.

(d) What is the maximum possible value of V2 from (c).

(e) What must be the value Rx when V2 equals 0.

(f) What must be the value Rx when V2 equals V1.

(g) What is the minimum (or maximum) value of Rx which pushes V2 to its maximum?

3. Logistics (* This section is not graded, but your honest answers would be appreciated.)

(a) What was most frustrating in the class?

(b) What was most interesting in the class?

(c) How much do you understand the function of a variable resistor?

(d) How confident are you in connecting a variable resistor in breadboard?

(e) How much are you comfortable with measuring voltage using the instrumentation board and tablet PC?

(f) Was mobile studio a helper (with your understanding and practice of circuit theory) or a distracter/nuisance ?

(g) Did you get your needed help from the discussion with your team member?

(h) Did you get your needed help from the instructor/TA? Satisfied?