Lab 1. Current, Voltage and Resistance

Introduction

1. The TA will show you how to use the multimeter for measuring current, voltage and resistance.

2. The TA will show you how to use a protoboard (also known as breadboard) and the DC power supply.

The Protoboard

The protoboard allows you to assemble circuits by placing components into the holes, which are connected internally in various patterns.

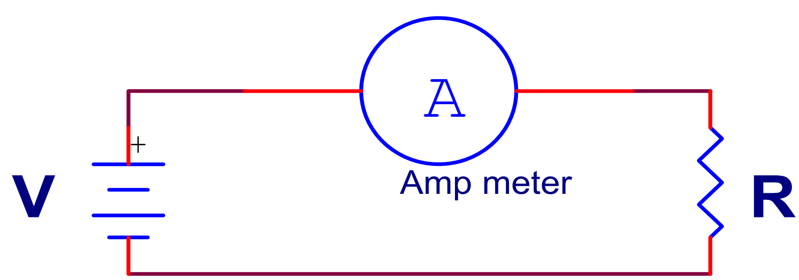
Measuring Resistance

1.1 Use the resistor color code scheme (as shown on the last page) to identify the resistance of the given resistor.

1.2 Use the multimeter to find the resistance of the above resistor.

Measuring Current and Voltage

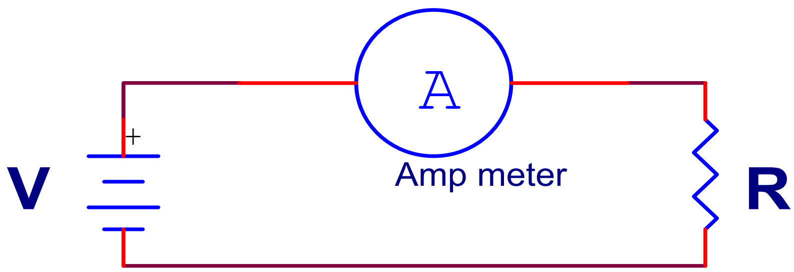
1.3 Connect the resistor in 1.1, the DC power supply (used as a constant voltage source) and the multimeter using the protoboard as shown below. **Switch the power supply ON only when the circuit is properly assembled and confirmed by the TA or instructor. Switch OFF the power supply while making changes to the circuit or when not in use.**



Current Measuring circuit for Ex. 1.3

1.4 Apply voltage across the resistor from 0 to 3 volts in increment of 0.5 volts using the power supply. Monitor the applied voltage by observing the analog meter on the front of the voltmeter. At every 0.5-volt increment, measure the current flowing through the resistor by using the multimeter. Plot the Voltage (V) versus Current (I) curve. From the slope of the curve, find the resistance (R) of the resistor.

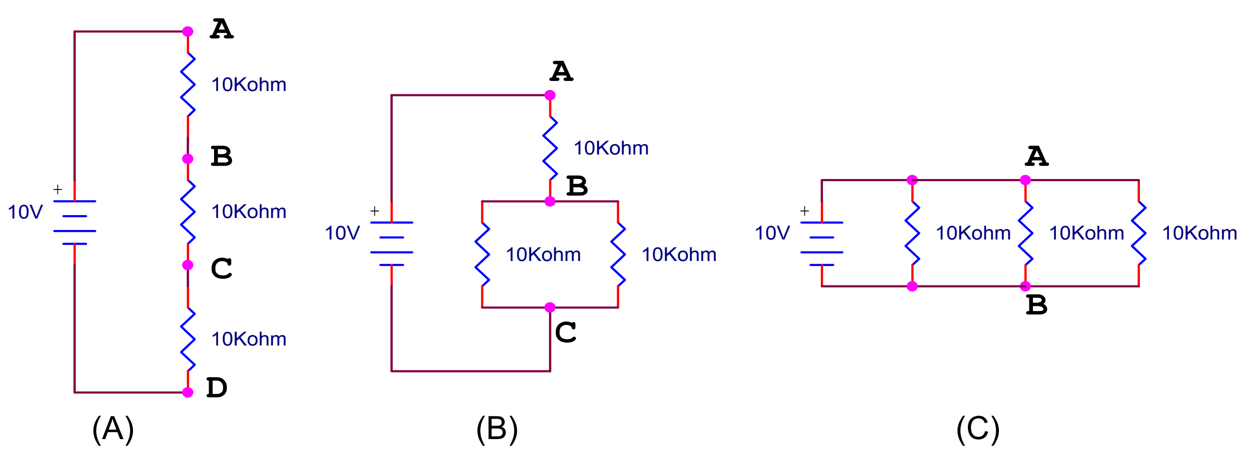
1.5 Compare the resistance of the resistor as measured using color code, the multimeter and the V-I curve.



Current Measuring circuit for Ex. 1.3

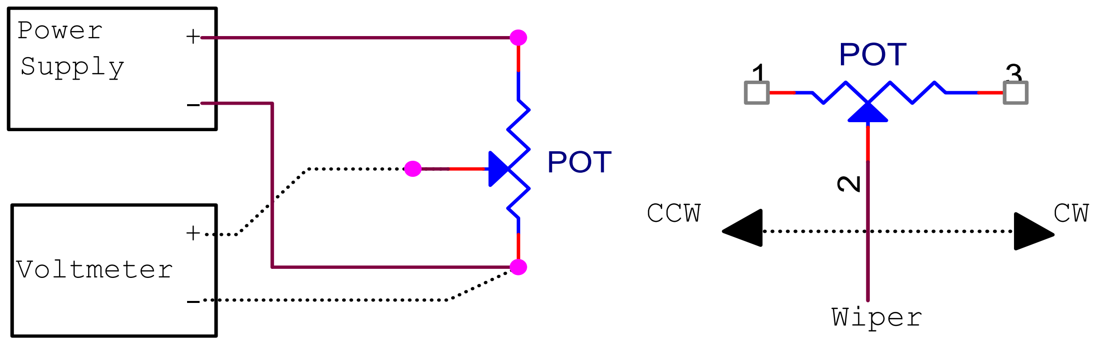
Distributing Current and Voltage

1.6 Connect the circuits shown below (Resistors in Series and Parallel). Calculate the voltage between each of the nodes, A to B, B to C, C to D, in each of the circuits below. Confirm your calculations with voltage measurements using the voltmeter.



Variable Resistor (Potentiometer)

1.7 Apply 10 volts across a 5 kΩ potentiometer as shown below. Rotate the potentiometer clockwise or counterclockwise from end to end and measure the voltage between one of the end terminals and the central terminal (wiper). Write down the range of voltage you observed?

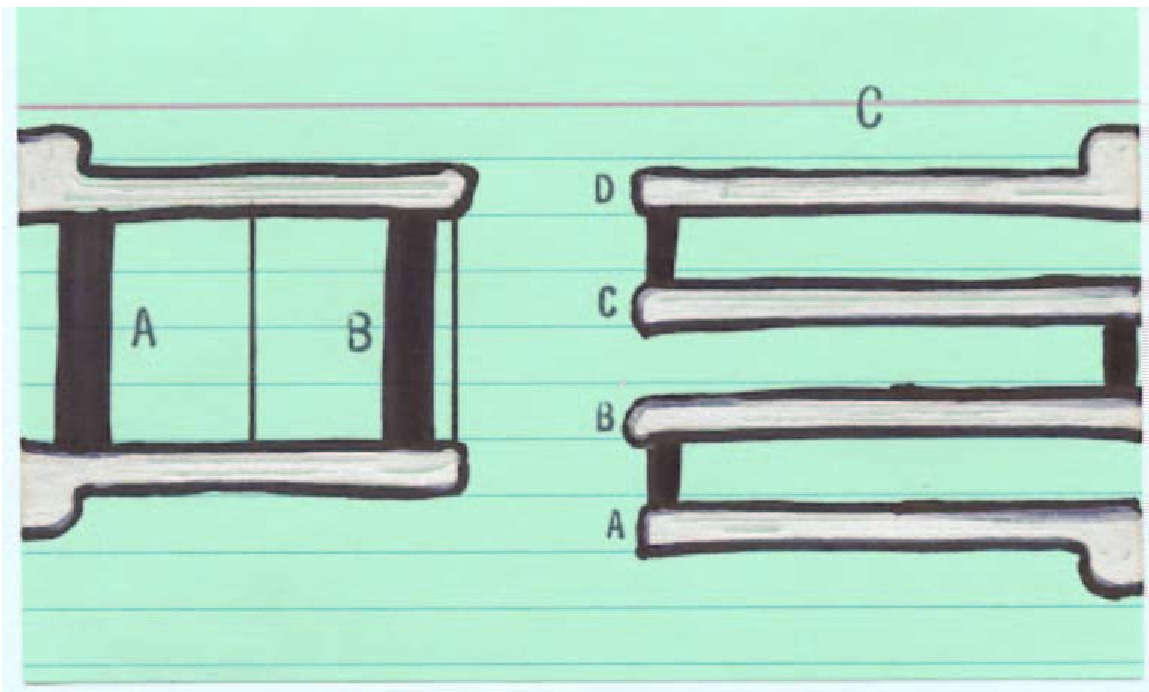


Fabricating a thin film resistor, Series Connection

1.8 Use the cards given to you for fabricating a thin film resistor. The card has four silver painted lines, A, B, C, and D on the right side of the card. These lines are electrically conducting. Use the pencil given to you to shade a stripe, shown below, between the silver lines as follows:

> Connect A to B on the left side
> Connect B to C on the right side
> Connect C to D on the left side

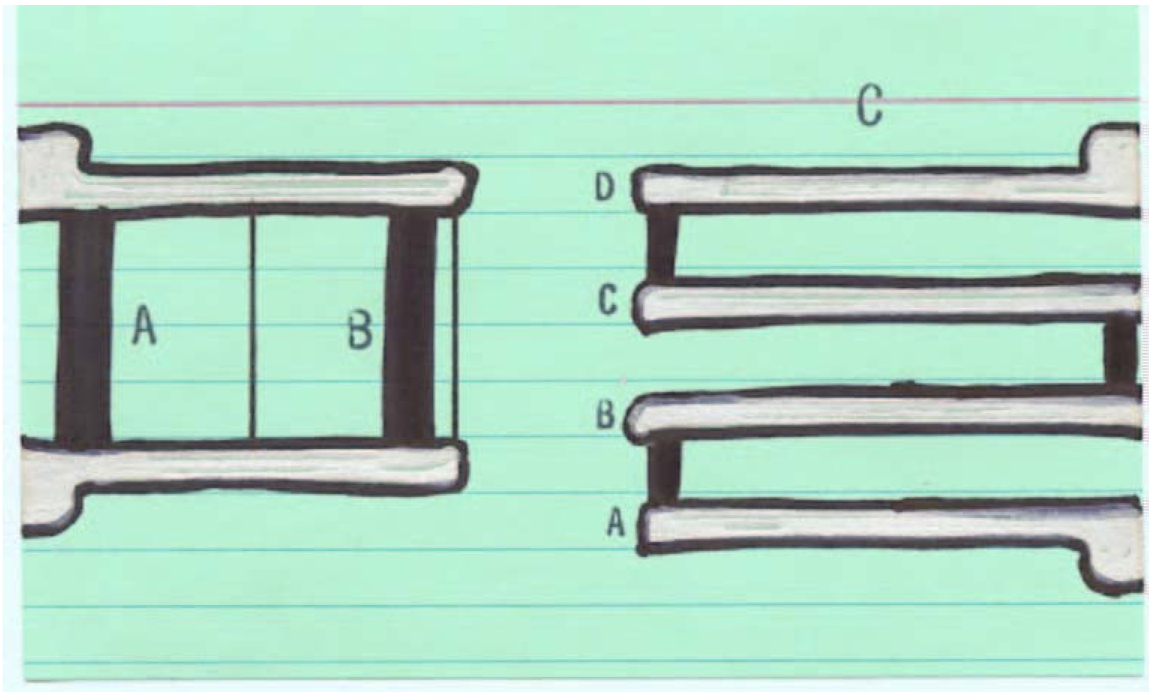
The graphite in the pencil provides a conducting path for current between A to B to C to D. Hence shade it uniformly to allow proper path for current flow.



1.9 Measure the resistances between A and B, B and C, C and D, and A and D. Is the resistance between A and D larger or smaller than the individual resistances measured? Why?

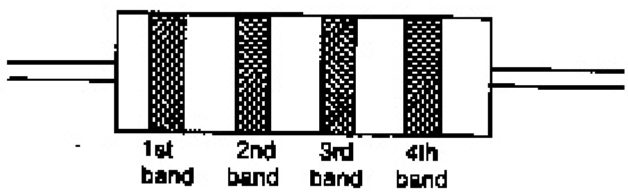
Fabricating a thin film resistor, Parallel Connection

1.10 Shade one line between A and B on the left side of the card, shown below, and measure its resistance between A and B. Next shade a second line between A and B and measure the resistance between A and B. Is the final resistance larger or smaller? Why?



Color code scheme to identify the resistance of a fixed resistor

Color	Nominal (1st & 2nd band)	Multiplier (3rd band)	Tolerance (4th band)	Reliability (5th band)
Black	0	1	N/A	N/A
Brown	1	10	N/A	1.0%
Red	2	100	N/A	0.1%
Orange	3	1,000	N/A	0.01%
Yellow	4	10,000	N/A	0.001%
Green	5	100,000	N/A	N/A
Blue	6	1,000,000	N/A	N/A
Violet	7	10,000,000	N/A	N/A
Gray	8	100,000,000	N/A	N/A
White	9	1,000,000,000	N/A	N/A
Gold	N/A	0.1	5%	N/A
Silver	N/A	0.01	10%	N/A
No Band	N/A	N/A	20%	N/A



The first and second bands represent digits, while the third band indicates the power of 10 by which to multiply. The fourth band indicates the tolerance of the indicated value. ~~A silver~~ band ~~represents a~~ tolerance of 5%, ~~and a gold band~~ indicates 10%. --

Example:

Red, Black, Orange, Gold

2 0 3 —> $20 \times 10^3 = 20k\Omega$ 5% tolerance

Yellow, Violet, Black, Silver

4 7 0 —> $47 \times 10^0 = 47\Omega$ 10% tolerance

ANSWER SHEET

Lab 1. Current, Voltage and Resistance

Name:____________________________ Section Number:________________
TA init:_______________ Date__________________________

1.1 Find Resistance from chart.

1.2 What is the resistance as determined by the multimeter?

1.4 Plot of Current vs. Voltage (I vs. V). What is the Resistance (slope of curve from V=IR)

1.5 What are the differences in the above three results? Why?

1.6

Voltage between	Figure A	Figure B	Figure C
A and B			
B and C			
C and D			

Voltage Calculations

ANSWER SHEET

Lab 1. Current, Voltage and Resistance

Name:_____________________________ Section Number:________________
TA init:_______________ Date___________________________

1.7 Voltage range of potentiometer:

1.9 Film Resistor Series Connection

Resistance between	Resistance
A and B	
C and C	
C and D	
A and D	

1.10 Film Resistor Parallel Connection

Resistance between	Resistance
A and B 1 line	
A and B 2 lines	