ELG2336
Laboratory Guidelines

Experiments: 15 marks

Mechatronics Project: 15 marks

Lab Duration: Weeks/Lab

- We will have a maximum of **two weeks** to complete one experiment. However, if all students complete an experiment in the first week, we will move to the next experiment in the following week.
- We will possibly take a break in the labs after we complete two experiments, that will be devoted to project discussion and preparation of the students' project proposal.

Lab. Group Formation

- Lab/Project Groups: 3 persons per group, group members to be chosen by the group itself
- Students are required to form a group of 3 students. They will do all the labs together as a group.
- Each group will be working under the supervision of a TA. He/she will be the group's corresponding TA.
- Form and submit your group members' names.
- The same group will be your project group.
- The same TA will supervise you in your project.

Lab. Score Distribution

- Lab score is on 15 (i.e. 15% of the course)
- We have 3 labs to do in this semester.
- Each lab is scored on a scale of 15.
- Average score of all labs on 15 will be forwarded to the professor at the end of the semester.
- The score 15 on each lab is distributed as per the following:
  - Prelab (3) + Participation (3) + Report (3) = 15

Prelab

- You have to do simulation works of the lab experiment before you actually do the experiment in actual circuits.
- Multisim software package is used for simulations.
  - Multisim is available in all computers at EECS laboratories.
  - You may have Multisim in your own computer, too.
  - It is your responsibility to do the pre-lab completely before you start the experiment. You have to learn Multisim if you have not done so yet.
- Multisim is a very useful simulation program. It helps you to find out what results you would be expecting in the actual experiment.

Prelab

- “No prelab, no participation policy.” So, you are NOT allowed to participate in the experiment part unless your prelab is submitted before the start of the lab.
- If your prelab is done completely and correctly you may expect a good score on the prelab (on a scale of 3).
- NOTE: Prelab needs to be submitted individually (i.e. per student) to your corresponding TA.
- Prelab score is given per student.

Participation

- We have a score of 3 on the lab. participation part. This means the completion of the experiment correctly and on time. It is a group score.
- Participation requires two things.
  - You have submitted the prelab.
  - You are present in the lab session.
- Participation score is given per group.

Lab Report

- We have a score of 4 on lab report.
- Lab report needs to be submitted per group, to your corresponding TA.
- A standard lab report has the following sections
  - Objectives
  - Introduction (some concepts as per needs)
  - Parts/components used
  - Experimental data
  - Critical analysis of the data
  - Summary and conclusions
- Procedure section is not required in the report.

Lab Report

- Lab report is due on or before you start the next lab. For example, your group can submit Lab Report-1 on or before you start Lab-2, and so on.
- Lab reports need to be submitted to your corresponding TA. So, know your TA's name and email address.
- Lab reports need to be submitted in hard copies unless there arises extra-ordinary circumstances where electronic version may be accepted.

Projects

- Each group is required to do a group project as part of the course.
- Score: 15 (15% of the course)
- Think about a mechatronic project and write a proposal (1-2 pages): idea and brief design.
  - Talk about your project ideas with your TA.
- **Very Important:** The project MUST contain a good balance of “mechanical” and “electrical/electronic” parts.
- Some examples of good projects from previous years can be found at **g9toengineering.com**.

Project Proposal

- In the project proposal you need to provide
  - The title of the project
  - Idea and motivation
  - Explanation of how you will implement the idea
  - Any circuit diagram, mechanical drawing etc.
  - Parts that you will probably need

Project Progress Reports

- Each week a project progress report needs to be submitted to “all” TAs.
- Start a new PowerPoint file and name it as follows
  - **ELG2336_Proj_Lastname1_Lastname2_Lastname3_Date.ppt**
- This will be your project progress report file. Each week you will add more materials in this same file and then you will send the updated file to **all** TAs who will keep track of your progress.

Project Progress Reports

- In the project progress report you will provide
  - Progress that you made last week
  - Tasks you are planning to do this week
  - Anything you think important to include
- Note that weekly project progress report contains a score. So, reporting your progress is very important. At the same time, good progress leads to successful completion of your project.

In the Lab

- 5-10 min tutorial
- Arrive prepared
- Return breadboard and other components at the end
- Power off the equipments
- Clean your desk
- Do not waste time
- **Make sure you get the TA sign on your "completed" lab works before leaving**

Lab reports format

- No copying from Lab Manual
- 5 steps
  - Problem identification/ experiment goal (abstract)
  - Gathering information
  - Experiment
    - Implementation
    - Measurement
  - Multisim (software testing) – MUST be before the experiment! (No lab will be allowed unless Multisim prelab is submitted before starting the experiment)
  - Conclusions – explain sources of errors, findings, etc.

Lab reports format

- Focus on measurements
- CALCULATE experiment errors
- Accurate graphs
  - Name and unit on all axis
  - Hand drawn graphs have to make sense in scale
- Answer all questions
- Concise yet Precise!
- No need to explain in the procedure in the report.

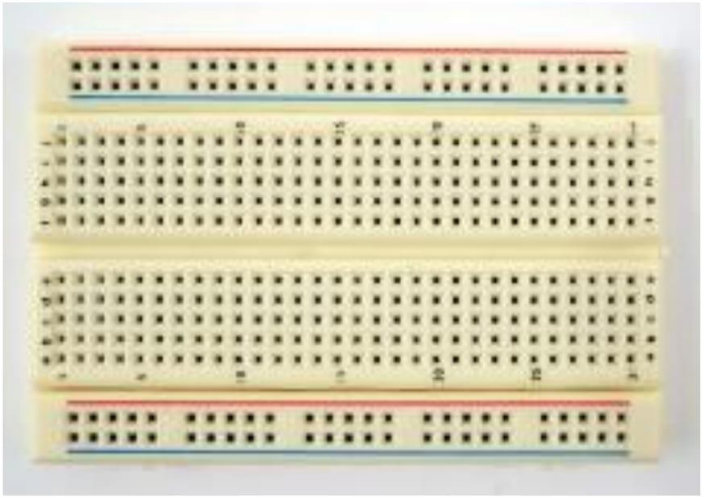
Lab reports

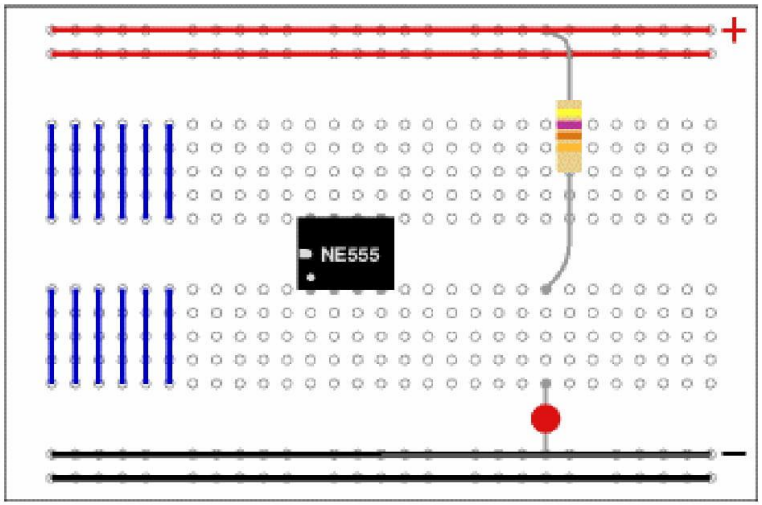
- Experiments + multisim
  - Attach signed multisim prelab with your report.
- Pictures from the screen
  - Save the graph
  - Or print screen, save in Paint then include in the lab report
- Graphs from oscilloscope
  - Camera phones (take a shot)
  - Resolution to read the axis
  - Include selections or settings on the scope
  - Be scientific!!!

Lab reports submission

- Electronically via email by midnight the week after each lab
- .doc or .docx only
- Zero tolerance for copying results
- Please follow uOttawa plagiarism guideline while preparing your report. Be careful about plagiarism.

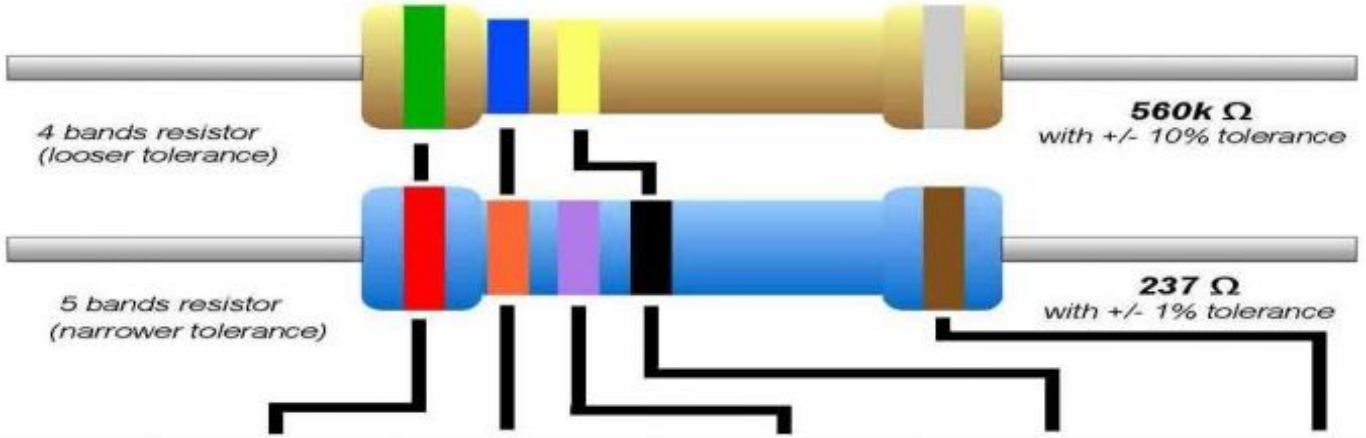
Breadboard





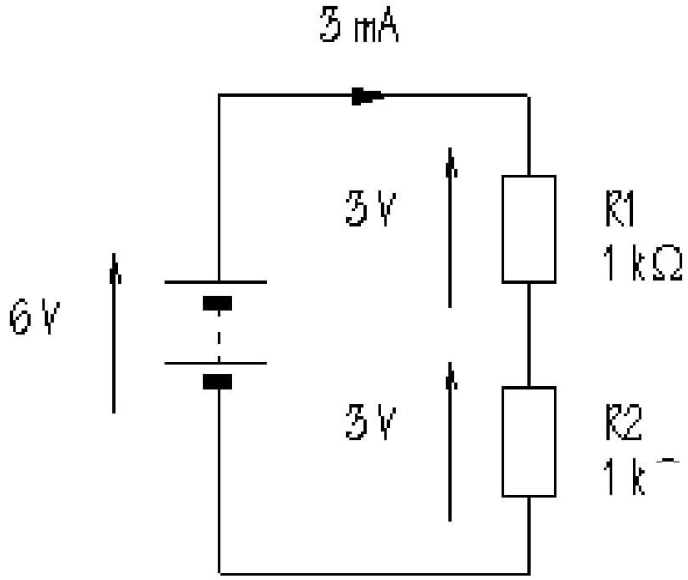
Resistor

- Resistance (ohm Ω)
- Two terminal electrical component
- R=V/I (volt/amp)

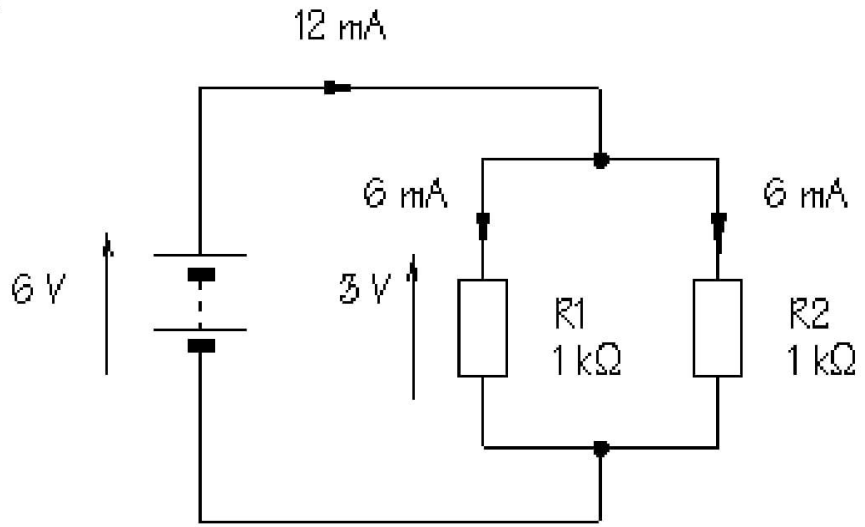


Color	1st Band	2nd Band	3rd Band	Multiplier	Tolerance
Black	0	0	0	x 1 Ω	
Brown	1	1	1	x 10 Ω	+/- 1%
Red	2	2	2	x 100 Ω	+/- 2%
Orange	3	3	3	x 1K Ω	
Yellow	4	4	4	x 10K Ω	
Green	5	5	5	x 100K Ω	+/- .5%
Blue	6	6	6	x 1M Ω	+/- .25%
Violet	7	7	7	x 10M Ω	+/- .1%
Grey	8	8	8		+/- .05%
White	9	9	9		
Gold				x .1 Ω	+/- 5%
Silver				x .01 Ω	+/- 10%

Series/ Parallel Connection

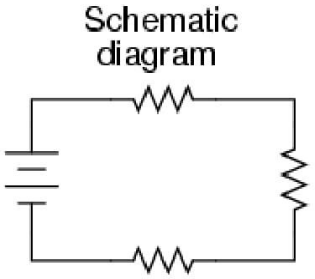


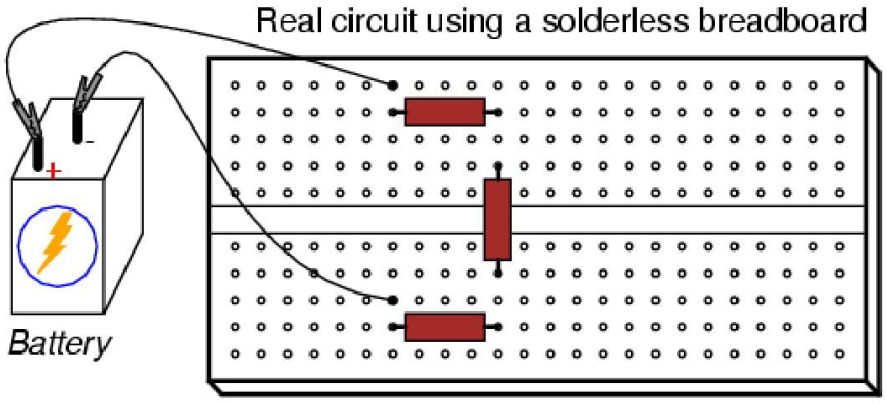
Series



Parallel

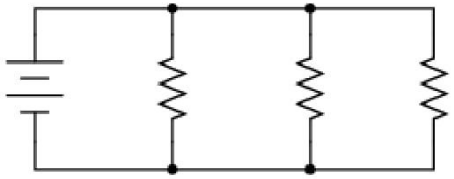
Series Connection on BB



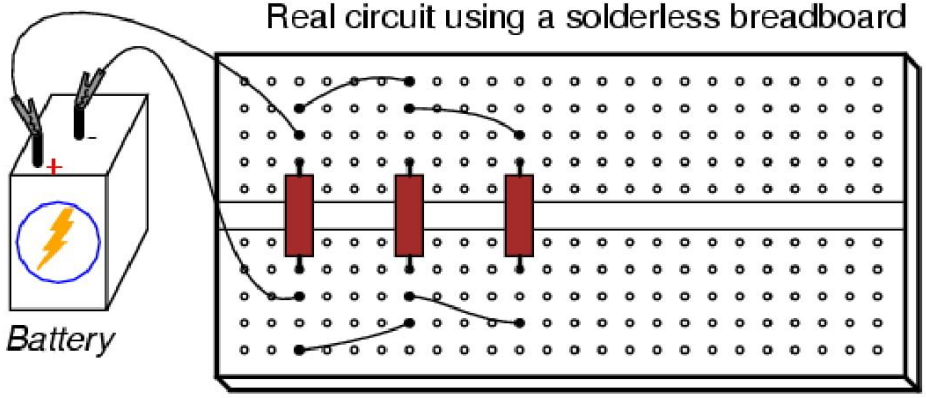


Parallel Connection on BB

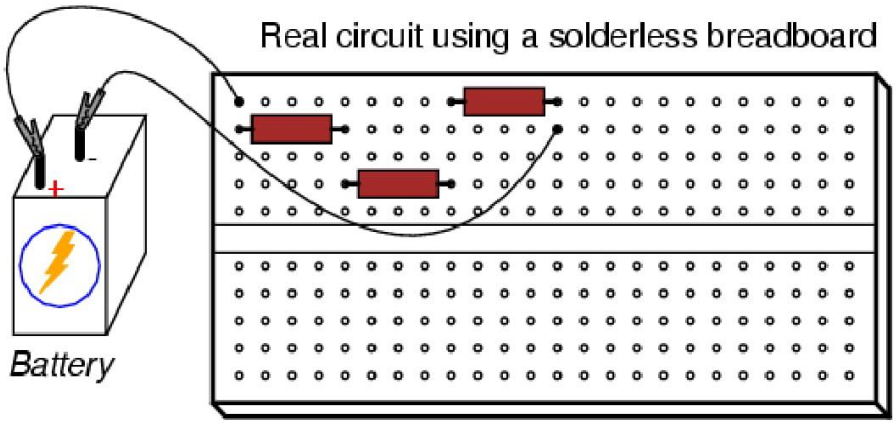
Schematic diagram

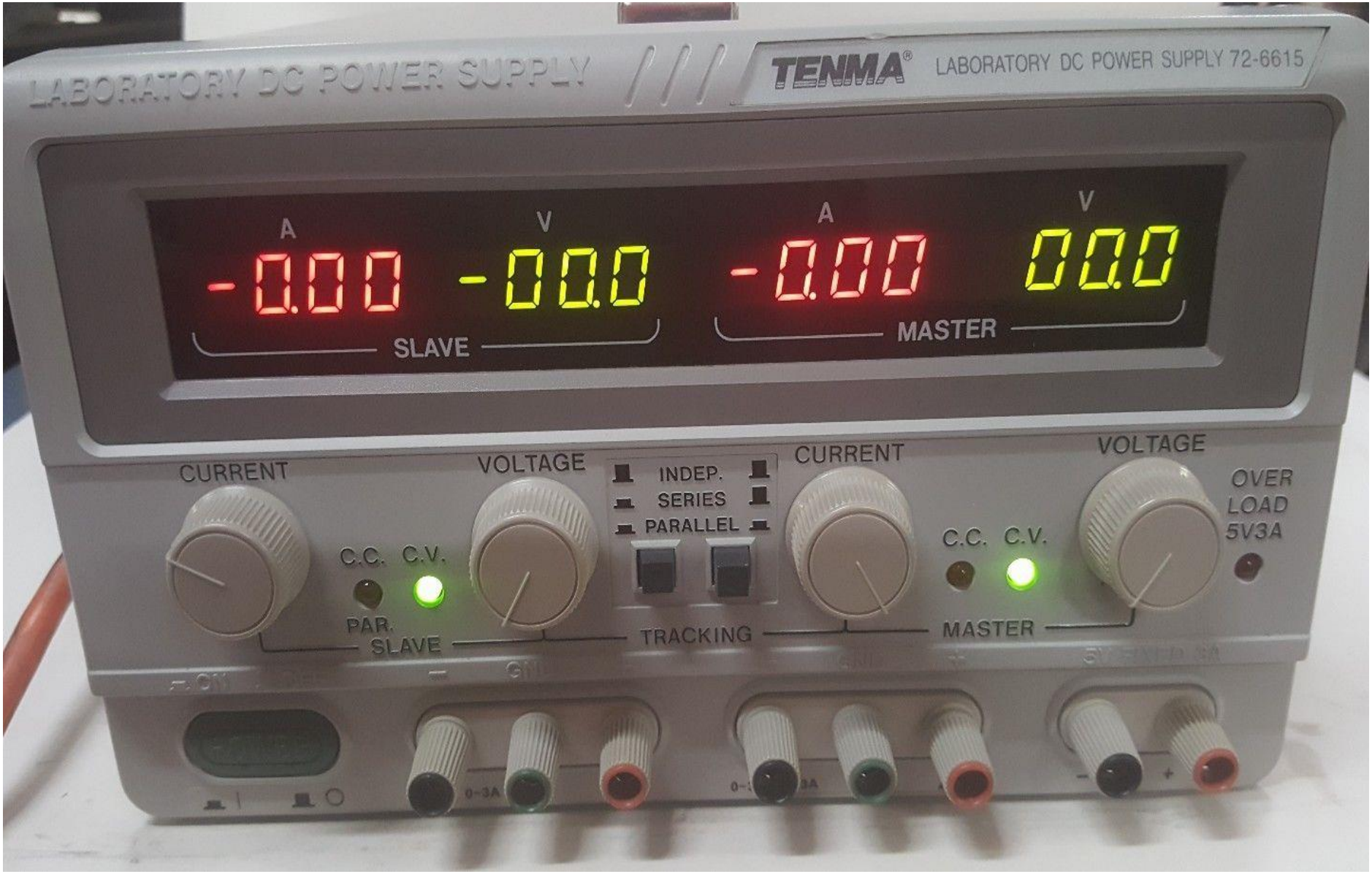


Real circuit using a solderless breadboard

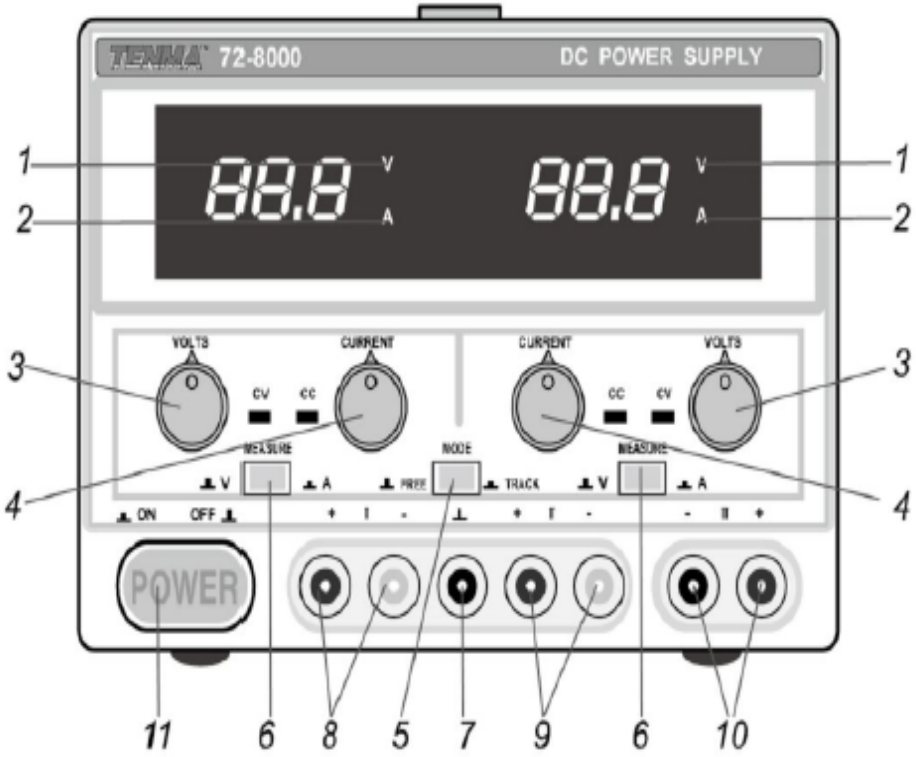


Series or Parallel?




LABORATORY DC POWER SUPPLY
TENMA
LABORATORY DC POWER SUPPLY 72-6615
A
V
-0.00
-00.0
SLAVE
A
V
-0.00
00.0
MASTER
CURRENT
VOLTAGE
INDEP.
SERIES
PARALLEL
CURRENT
VOLTAGE
OVER
LOAD
5V3A
C.C.
C.V.
C.C.
C.V.
PAR.
SLAVE
TRACKING
MASTER

Description of Panel



1)	Voltage meter
2)	Current meter
3)	VOLTS: Adjusts the output voltage at CV mode
4)	CURRENT: Adjusts the output current at CC mode
5)	MODE: Controls two main channels. Works in FREE mode or TRACK mode.
6)	MEASURE: Selects the digital meter's display, the output voltage or the output current
7)	Ground of instrument
8)	Output terminal of CH1
9)	Output terminal of CH2
10)	Output terminal of CH3
11)	POWER: Push in to turn on the power.

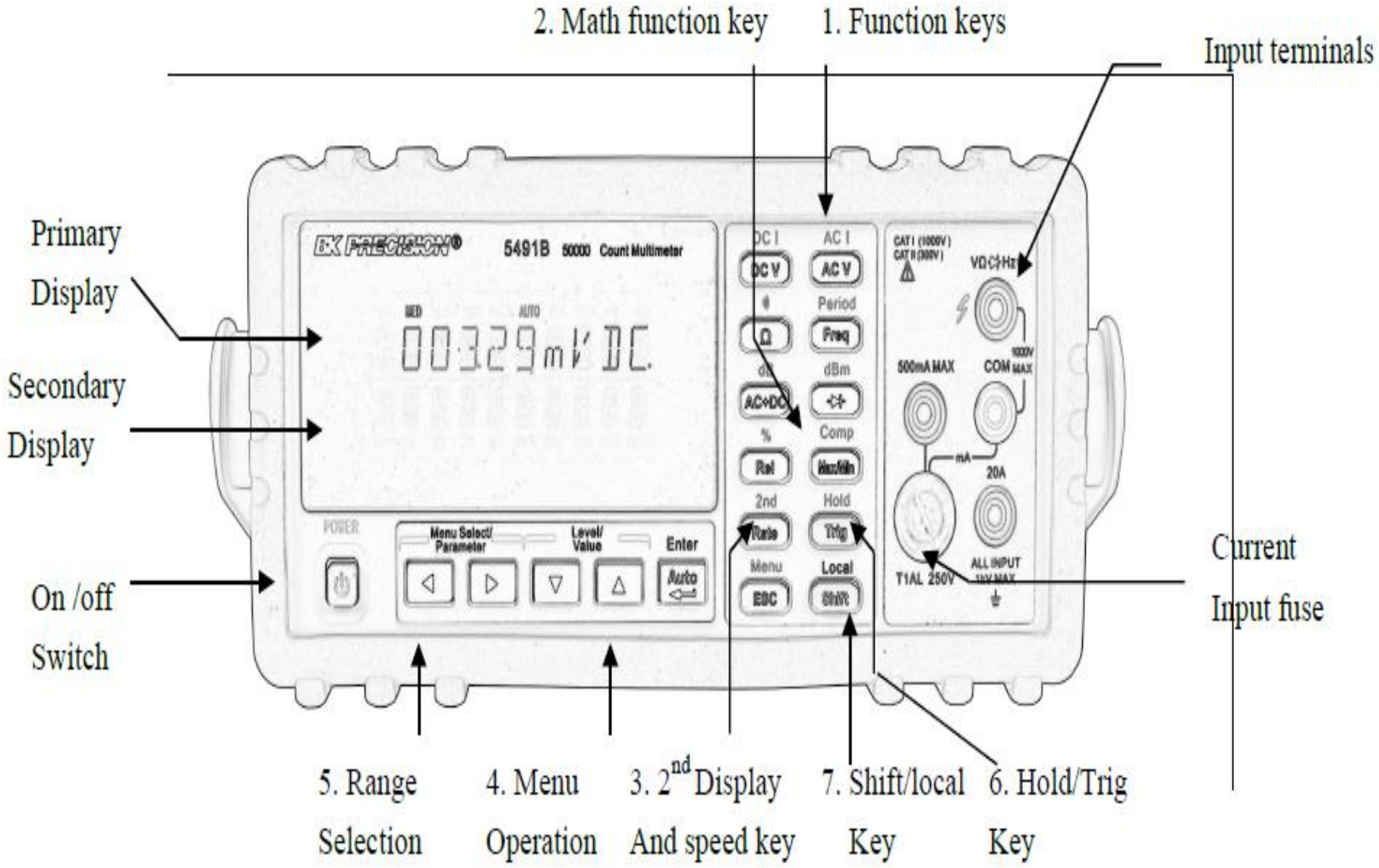
Function generator

To generate AC signals : Shape, Amplitude, and Frequency

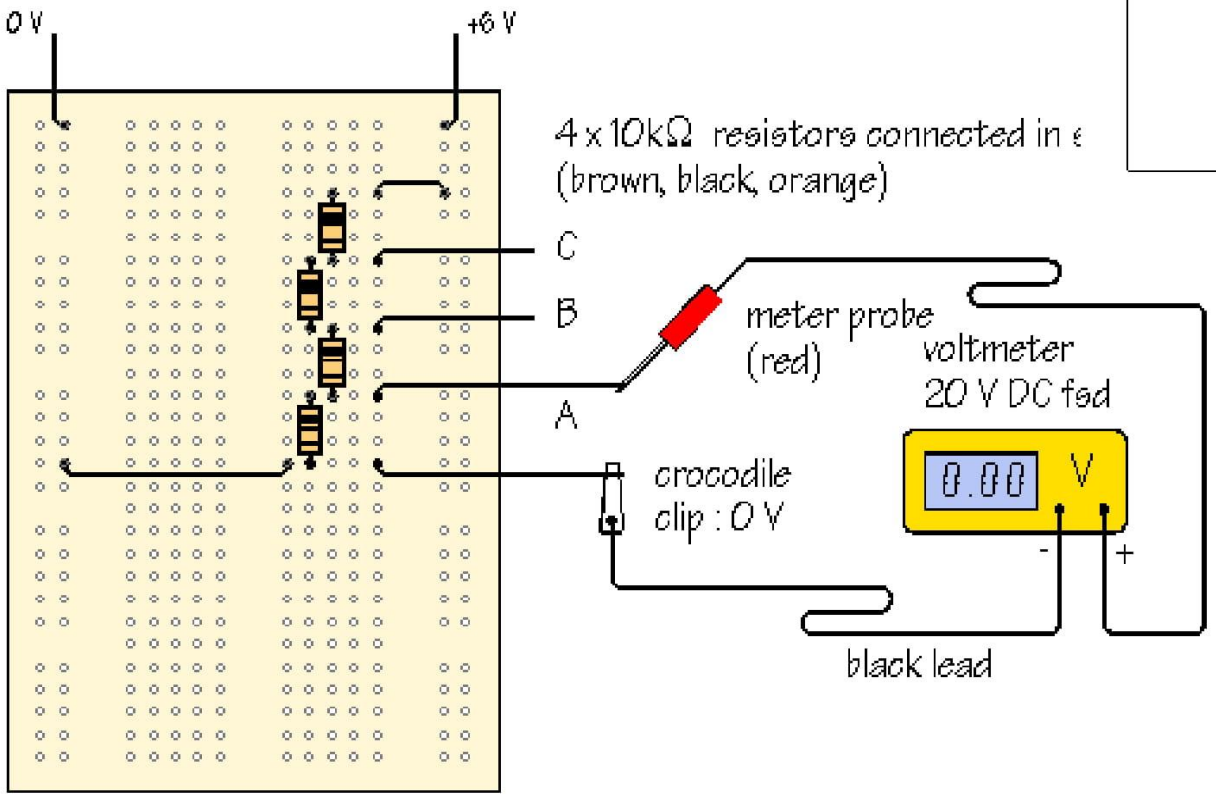
Measurement Devices

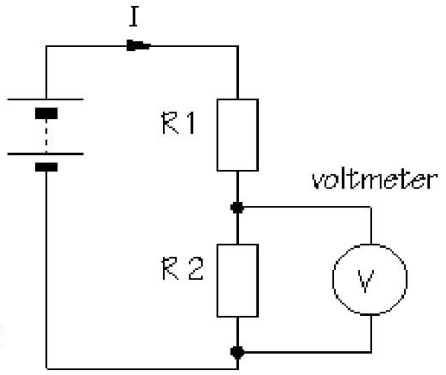
- Digital Millimetre
  - Only DC (or rms)
  - Voltmeter
  - Ammeter
  - Ohmmeter
  - Short circuit check
- Oscilloscope
  - Voltage AC, also DC
  - $R = V/I \rightarrow I = V/R$

Digital Multimeter

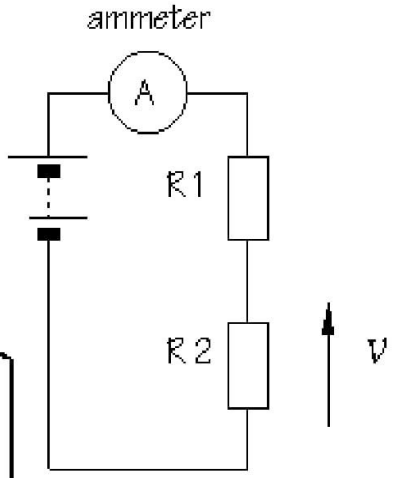

2. Math function key
1. Function keys
Input terminals
Primary
Display
Secondary
Display
On /off
Switch
Current
Input fuse
5. Range
Selection
4. Menu
Operation
3. 2nd Display
And speed key
7. Shift/local
Key
6. Hold/Trig
Key
B&K PRECISION
5491B 50000 Count Multimeter
00329mV DC
POWER
Menu Select/
Parameter
Level/
Value
Enter
Auto
DC I
AC I
DC V
AC V
Period
Freq
dBm
AC+DC
Comp
Rel
2nd
Rate
Hold
Trig
Menu
Local
ESC
Shift
500mA MAX
COM
mA
20A
T1AL 250V
ALL INPUT

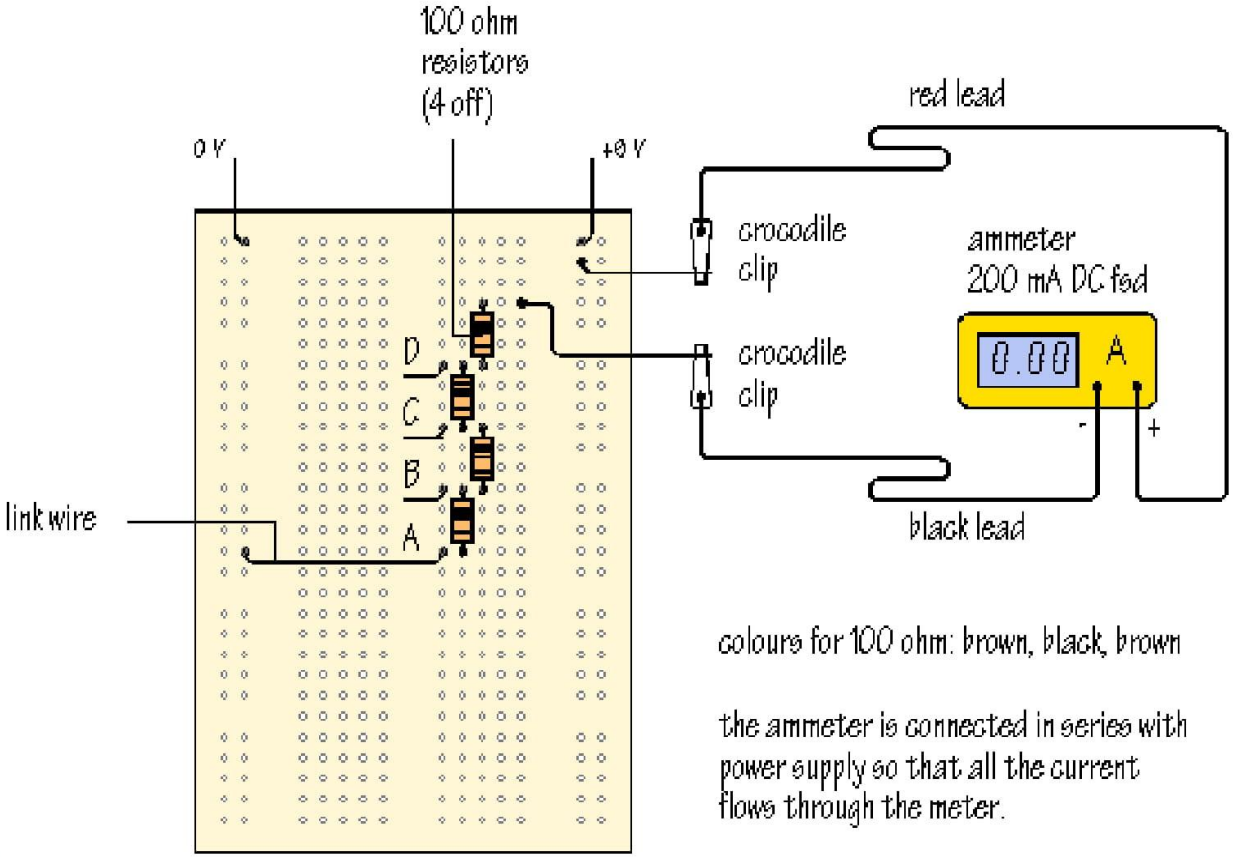
Measure Voltage





Measure Current

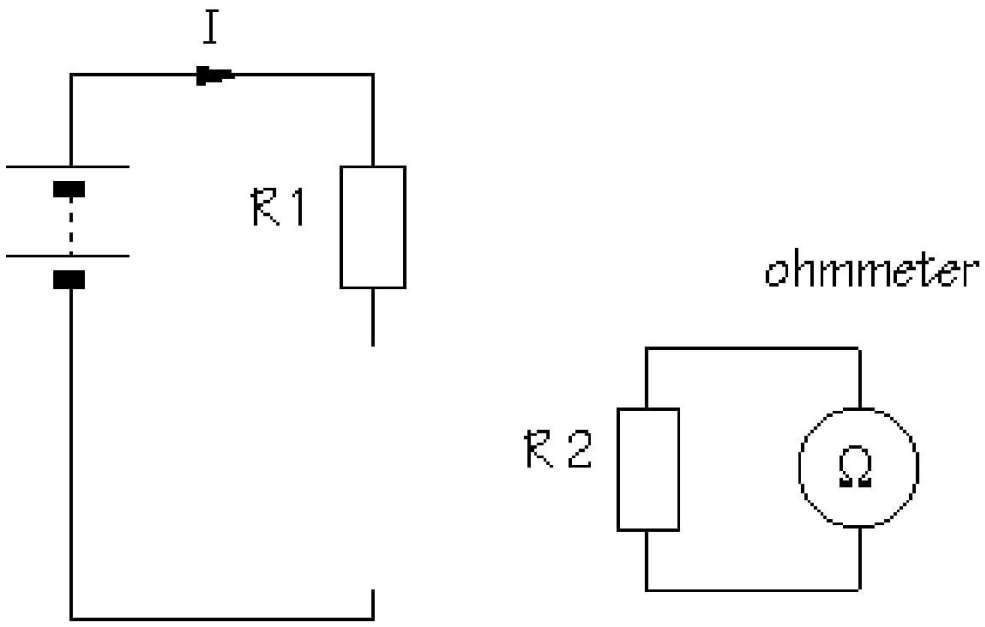




colours for 100 ohm: brown, black, brown

the ammeter is connected in series with power supply so that all the current flows through the meter.

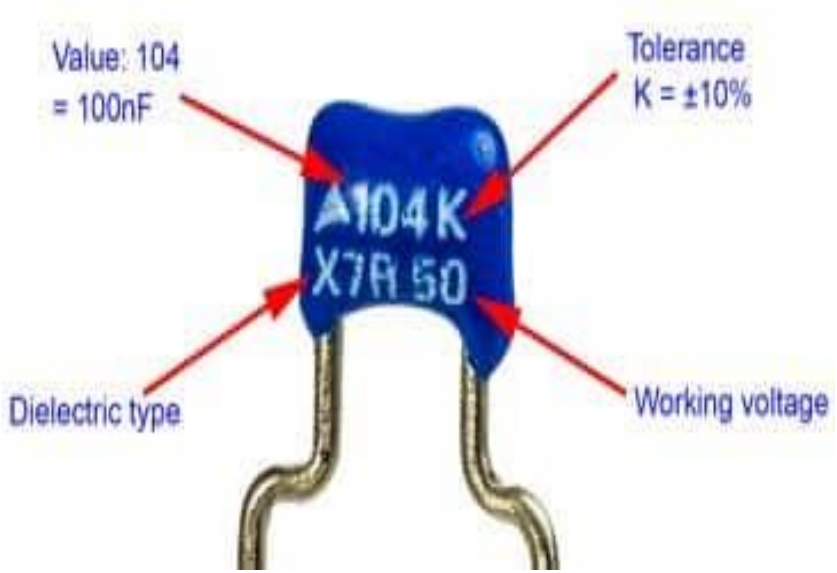
Measure Ohm



Capacitor

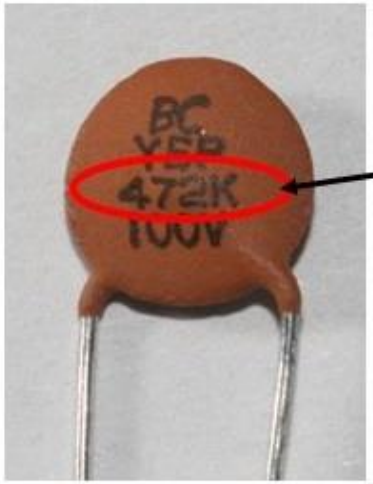
A Capacitor is an electronic component which stores the charge.
$C=\epsilon A/d$

For example, a capacitor can be labelled as, n47 = 0.47nF, 4n7 = 4.7nF or 47n = 47nF and so on. Also, sometimes capacitors are marked with the capital letter K to signify a value of one thousand pico-Farads, so for example, a capacitor with the markings of 100K would be 100 x 1000pF or 100nF.



How To Read A Capacitor's Value

Disc Capacitors



4 7 2 K

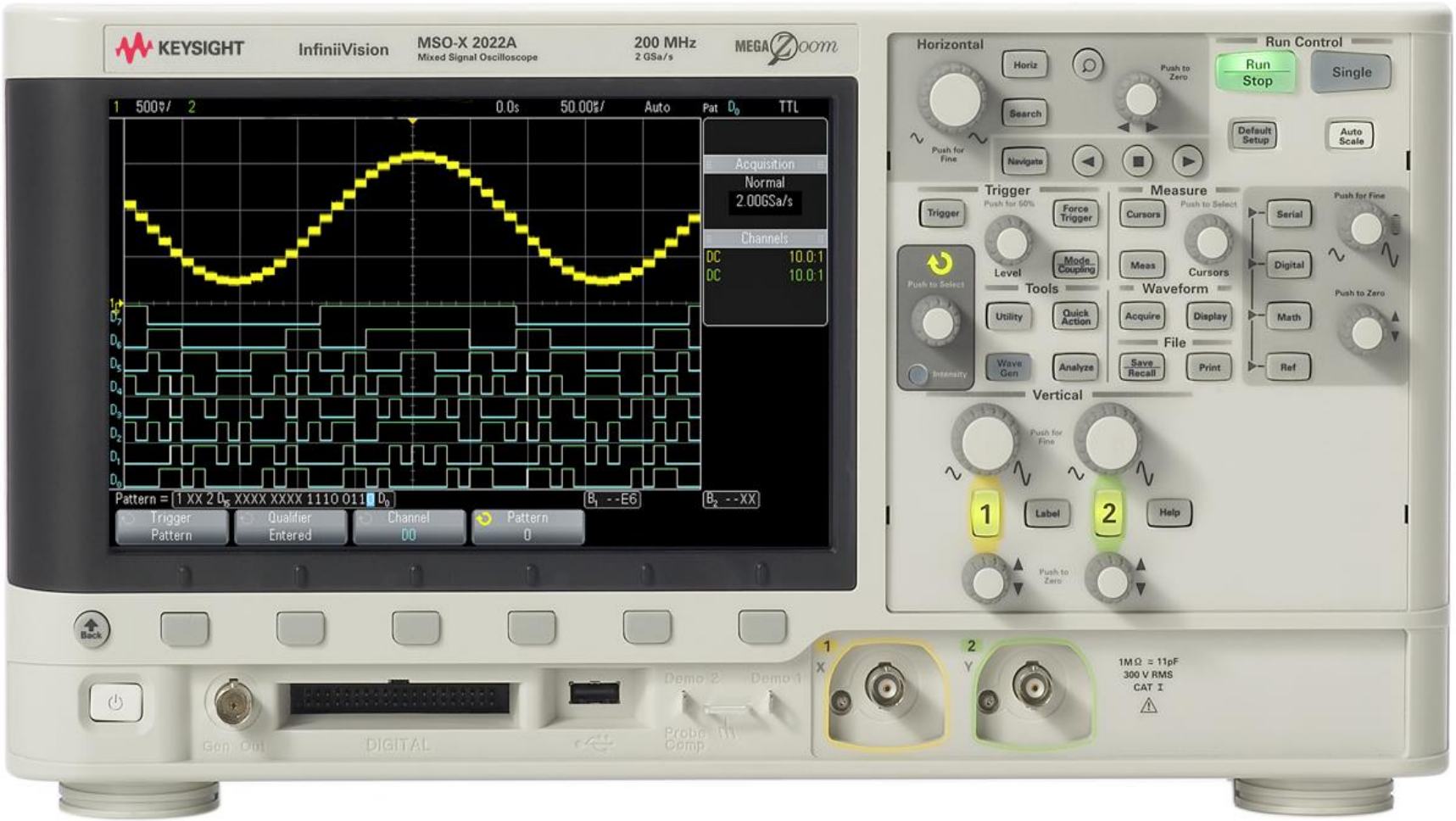
First Digit	Second Digit	Third Digit	Fourth Digit
First Figure	Second Figure	# of Zeros	Tolerance
4	**7**	**00**	**K**

4700 pF ±10%

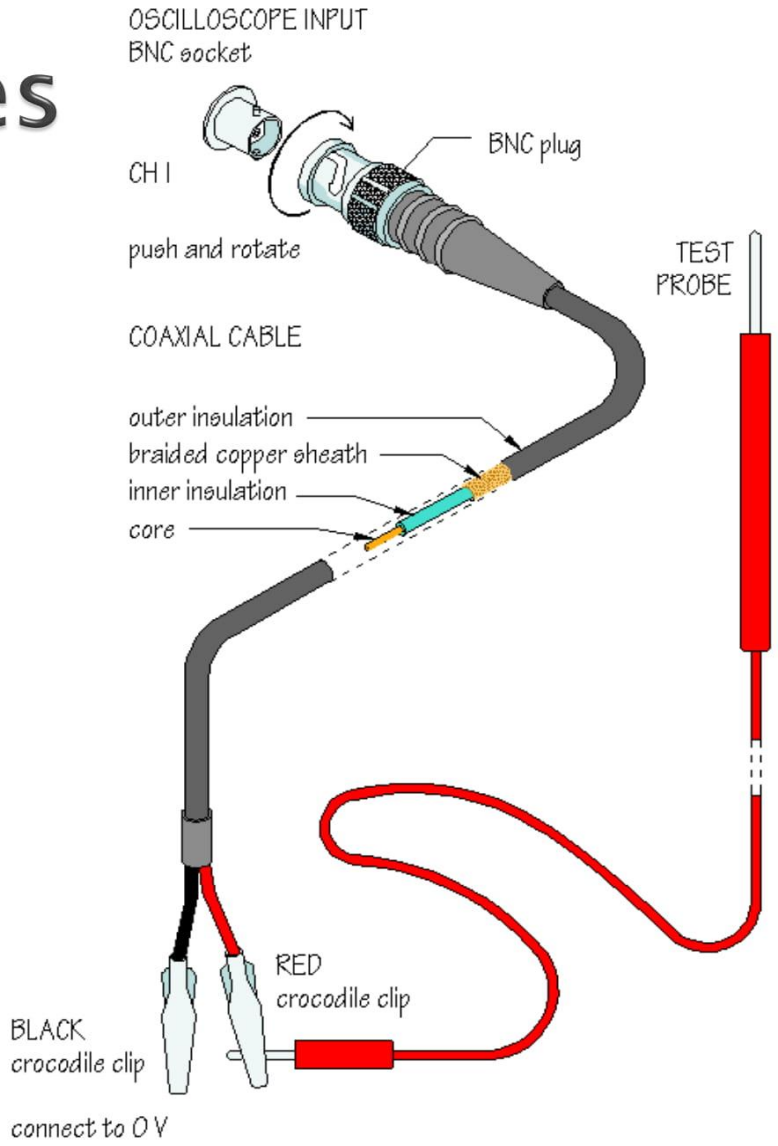
Code	Tolerance
A	±0.05%
B	±0.1%
C	±0.25%
D	±0.5%
F	±1%
G	±2%
J	±5%
K	±10%
M or NONE	±20%
N	±30%
Q	−10%, +30%
S	−20%, +50%
T	−10%, +50%
Z	−20%, +80%

Note: Disc Capacitors are always in pico-farads

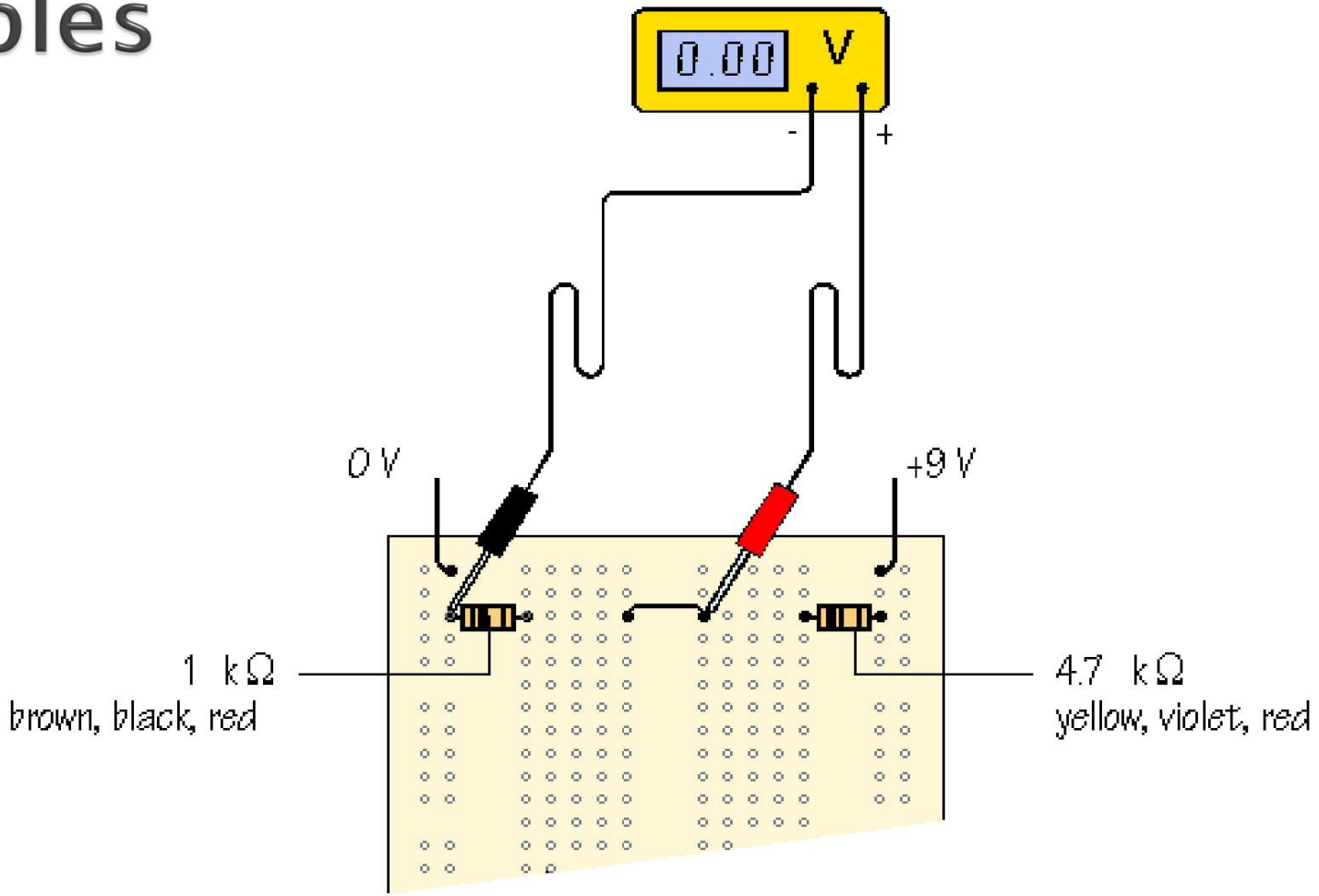
Oscilloscope



Cables vs. Probes



Cables



Coaxial Cable