LESSON 20 (p1 of 3) | **Multimeter Setup** | 20a1 ud

VERY IMPORTANT INFORMATION ABOUT USING THE MULTIMETER

To avoid damage to the DMM, this is the correct procedure to set up the meter:

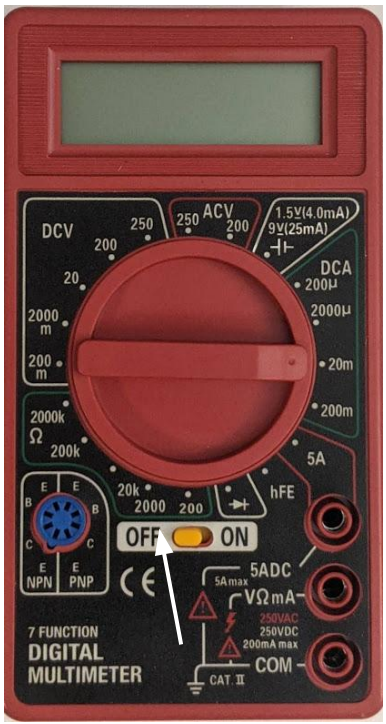
1. **If the meter has an ON/OFF switch, turn the meter OFF.**
2. **With the meter turned OFF, set the meter dial to the correct position.**
3. **If there is an on/off switch, turn it to ON.**
4. **Touch the tips of the meter probes to the circuit or device under test.**

a. **Measuring current requires much caution.** If you put the meter on the wrong Amps scale, you can blow the internal fuse. Always start with the highest Amps scale and then go down if it shows a very low reading.
b. The meter we show here has a 5 Amp DC jack. That is for 5 Amps or less.
c. The meter also has four other ranges for current. 200u which means 200 microAmps or less, 2000u which means 2000 microAmps or less, 20m which means 20 milliAmps or less, and 200m which means 200 milliAmps or less.
d. Every meter is different, so study carefully the current ranges before connecting the meter to read the current in a circuit.

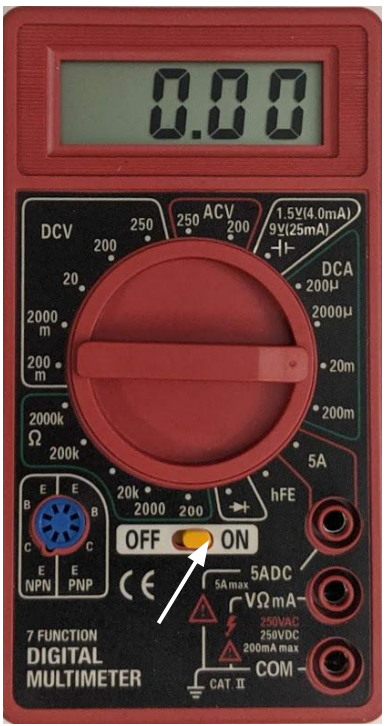
Measuring Voltages: If you want to measure a voltage and you are not sure what range to use, start at the highest voltage position on the dial which is the 250V position which is the highest on this meter. Touch the probes to see what you read. If it is too low, then move a lower range of voltage.

LESSON 20 (p2 of 3)	Here are the 3 steps to avoid damaging the meter.	Multimeter Setup	20b1

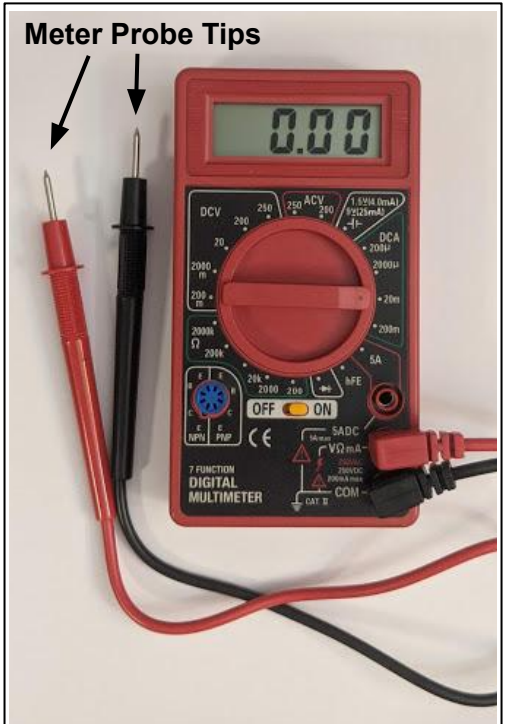
Step #1: With the meter switched **OFF**, rotate the dial to the correct measurement position you need.



Step #2: Then move the meter ON/OFF switch to the **ON** position.



Step #3: Plug in the meter leads to the correct sockets and then touch the meter probe tips to the circuit.



20a2 | **LESSON 20 (p3 of 3) Measuring Ohms**

Watch video Lesson 20

A digital multimeter (DMM) generally has 5 ranges of resistance values.

The meter shown here has these ranges: 200 Ω, 2000 Ω, 20k Ω, 200k Ω, and 2000k Ω.

Remember, to get 'ohms', if the meter dial position has a 'k' then move the decimal 3 places to the right.

Example: If the meter display shows **6.77** on any of positions with a k, then the resistor is **6770 ohms**

To start with, let's take a 100 ohm resistor (Brown, Black, Brown, Gold) and measure it on all 5 scales.

Practice Quiz

1	2	3	4	5
				
200 ohm Dial position up to 199 ohms	**2000 ohm Dial position** up to 1999 ohms	**20k ohm Dial position** up to 19,999 ohms	**200k ohm Dial position** up to 199,999 ohms	**2000k ohm Dial postion** up to 1,999,999 ohms

Meter #1 shows 98.7 ohms (most accurate)
Meter #2 shows **098** ohms
Meter #3 shows **0.10k** ohms = 100 ohms
Meter #4 shows **00.1k** ohms = 100 ohms
Meter #5 shows **000k** ohms = 0 ohms

Resistance Scales

100 ohm resistor

Note: Since resistors do not have polarity, it does not matter which way you connect the meter leads to the resistor.

Reading OHMs	Activity Page	Measuring Ohms on a Digital Multimeter (DMM)	20b2

Let's practice reading OHMs on the DMM. Use your actual meter to verify clearly what the dial setting is.

Be careful with the 'k' as explained in the lesson on page 20a2.

Write the ohms value under each meter shown. (Don't use 'k' in your answer.)

Ω

#1 - 200Ω position

Ω

#2 - 20k Ω position

Ω

#3 - 200k Ω position

Ω

#4 - 200k Ω position

Ω

#5 - 200 Ω position

Ans:
(1) 1.2 Ω,
(2) 12,280 Ω
(3) 18,200 Ω
(4) 74,400 Ω
(5) 3 Ω
(6) 148.5 Ω
(7) 24,100 Ω
(8) 1568 Ω
(9) 64,000 Ω
(10) 1,007,000 Ω

Ω

#6 - 200 Ω position

Ω

#7 - 200k Ω position

Ω

#8 - 2000 Ω position

Ω

#9 - 200k Ω position

Ω

#10 - 2000k Ω position

Resistance Scales

20a3	Resistance Tolerance Chart	Activity Page	± 5 % Resistors

The resistors in this lab have a fourth band which is Gold and that means that these resistors are rated at a ± 5% Tolerance. To be within tolerance, a ± 5% resistor has to be between 5% less to 5% more than the **nominal** resistance. (By **nominal**, we mean the named or labeled value of a component.) Our resistors have color bands to tell you the nominal resistance value of each resistor.

Instructions: Take each resistor's nominal value and multiply it by 0.95 (which equals the nominal value less 5%) and then multiply the nominal value by 1.05 (which equals the nominal value plus 5%) Fill in the Tolerance Chart below by writing in the ohms values you calculate. Follow the example below.

Example: Nominal value = 100 ohms (Brown, Black, Brown, Gold)

100 X 0.95 = **95 ohms** Min.	100 X 1.05 = **105 ohms** Max.

Nominal value = 220 ohms (Red, Red, Brown, Gold)

220 X 0.95 = Min.	220 X 1.05 = Max.

Nominal value = 330 ohms (Orange, Orange, Brown, Gold)

330 X 0.95 = Min.	330 X 1.05 = Max.

Lab #1201

OHM'S LAW and more!

FILL IN THE CHART

Resistance Tolerance Chart (Page 2)	Activity Page	± 5 % Resistors	20b3

Nominal value = 10,000 ohms (10k) (Brown, Black, Orange, Gold)

10,000 X 0.95 = Min.	10,000 X 1.05 = Max.

Nominal value = 39,000 ohms (390k) (Orange, White, Orange, Gold)

39,000 X 0.95 = Min.	39,000 X 1.05 = Max.

Nominal value = 330, 000 ohms (330k) (Orange, Orange, Yellow, Gold)

330,000 X 0.95 = Min.	330,000 X 1.05 = Max.

Nominal value = 470,000 ohms (470k) (Yellow, Violet, Yellow, Gold)

470,000 X 0.95 = Min.	470,000 X 1.05 = Max.

Nominal value = 1,000,000 ohms (1Meg) (Brown, Black, Green, Gold)

1,000,000 X 0.95 = Min.	1,000,000 X 1.05 = Max.

FILL IN THE CHART

20a4	Compare to Tolerance LESSON	Activity Page	± 5 % Resistors ud

Now we are going to measure the resistance of each of the listed resistors below with the meter set to all the different ranges. Fill in the rectangle with what you see in the display for each resistor and each range. **Circle** the most accurate reading for each resistor. Then, we will compare this reading to the Tolerance Chart on 20a2 to check if each resistor is within tolerance. (Remember, that to be within tolerance, a ± 5% resistor has to be between 5% less to 5% more than its **nominal** resistance value.) We will again use the 100 Ω resistor as an example. Notice that it says 98.7 ohms. To be within tolerance, this ± 5% resistor with a nominal value of 100 Ω has to be between 95 Ω and 105 Ω. It is and therefore it is within tolerance. Now let's check all the rest of the resistors on this page and on page 20b3..

Within Tolerance Circle Answer	Resistor	Resistance Ranges on Meter				
		200 Ω	2000 Ω	20k Ω	200k Ω	2000k Ω
Yes / No	100 Ω	98.7	098	0.10	00.1	000
Yes / No	220 Ω					
Yes / No	330 Ω					

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OHM'S LAW and more!

FILL IN THE CHART

Resistance Tolerance Chart (Page 2)	Tolerance Chart	± 5 % Resistors	20b4

Within Tolerance Circle Answer	Resistor	Resistance Ranges on Meter: 200 Ω	2000 Ω	20k Ω	200k Ω	2000k Ω
Yes / No	10,000 Ω					
Yes / No	39,000 Ω					
Yes / No	330,000Ω					
Yes / No	470,000Ω					
Yes / No	1,000,000Ω					

Lab #1201

OHM'S LAW and more!

FILL IN THE CHART