

# Using Power Point in Distance Learning Laboratories

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## **Abstract:**

The purpose of this paper is to discuss using power point presentations to enhance circuits laboratories for a distance learning course. Students in this course meet with the instructor for one day instead of two hours for eight weeks during the quarter. Laboratory experiments with directions portrayed with diagrams, photographs, and words were given to the students to do at home before they came to campus with power point presentations. This allowed the students to be more familiar with the material before they traveled to the campus for their full day sessions and alleviated the frustrations they had with earlier experiments performed at home.

## **Background:**

Distance Learning instruction in engineering education dates back to the late 1960's when Universities began offering graduate courses through this medium.<sup>1</sup> Distance Learning offered an easy and affordable way to instruct small classes, the maturity of the Graduate student enabled them to overcome the technical difficulties.<sup>2</sup> Distance Learning in undergraduate education is a relatively new development. Rochester Institute of Technology has been participating in distance learning teaching since 1989. RIT has used different formats in their distance-learning classes, which include flexible format, remote classroom, combination and video conferencing.<sup>3</sup> In the two years that I have been teaching at RIT, the most popular format has been the flexible format. The distance-learning course to be discussed is Electronic Principles for Design. Students in this class have the course materials delivered to their homes. Lab materials are included with the course material and include a multimeter, resistors, potentiometers, capacitors, power supply and hookup wire. Students in the electronic course I have taught are only required to attend one 8-hour lab session per quarter, where they use lab equipment not available in their kits. They demonstrate proficiency in use of an oscilloscope and function generator through several practical experiments.

When I started teaching the electronics course, the lab experiments that were being used were in the old format designed for weekly on campus lab experiments. These labs were well suited for the older format in distance learning where students would come to RIT or find a local community college to attend weekly or 3-4 times per quarter to complete their lab requirements. In spite of the movement toward the newer flexible format students in this class were merely instructed to do what they could at home and finish the labs during the single all day session on campus. The use of Power Point as shown in this paper allowed me to create new laboratory experiments students could perform at home. These labs contained tutorials that allowed students to acquire important lab skills and complete the labs at home. Parts of the lab tutorials that helped students build their laboratory skills are presented in this paper. The laboratory assignments provided building blocks that will be used in future labs.

**Introduction:**

This paper includes several samples of basic circuit theory labs for a distance-learning course. The goal of these labs is to teach current measurement and circuit construction.

The examples included in this paper were generated for students with little or no experience in electronics working toward degrees in Mechanical, Mechanical/Electrical and Manufacturing Technology. In general they have not built an electrical circuit and are making electrical measurements for the first time. This format can be used for Electrical students as well.

Distance Learning students taking our circuits course are expected to complete lab experiments both on campus and at home. To complete the experiments at home a student must rely heavily on written instructions and no demonstration. The experiments require the student to construct a circuit and make measurements using a multimeter, lab kit components and a power supply most of which students have little or no experience with. It is difficult for the student to describe the problems they are having using e-mail. They are often frustrated and feel as if nothing is working. This is all made worse by the time it takes for e-mail to be answered. The bottom line is that lab questions are difficult to answer with e-mail, a phone call or even chat. A good tutorial that shows common errors within the lab experiment can prevent frustration by allowing the student to see a similar circuit being built and measured. Being able to reference the tutorial during the experiment encourages the student to review the material, again minimizing errors and frustration.

**Analysis:**

Two areas students have a lot of problems within circuit labs are circuit construction and current measurement. Circuit construction errors prevent correct voltage and current measurements and leave the student frustrated and confused. Integrating step-by-step circuit construction that a student can “play” over and over at his or her own pace can help the student build the circuit correctly. If the circuit can be built correctly, voltage measurements are often accurate. However, current measurements still give students a lot of trouble. The concept of having the current you are measuring flow through the meter is not easily understood. Again, pictures integrated in the experiment can help reduce errors hear as well.

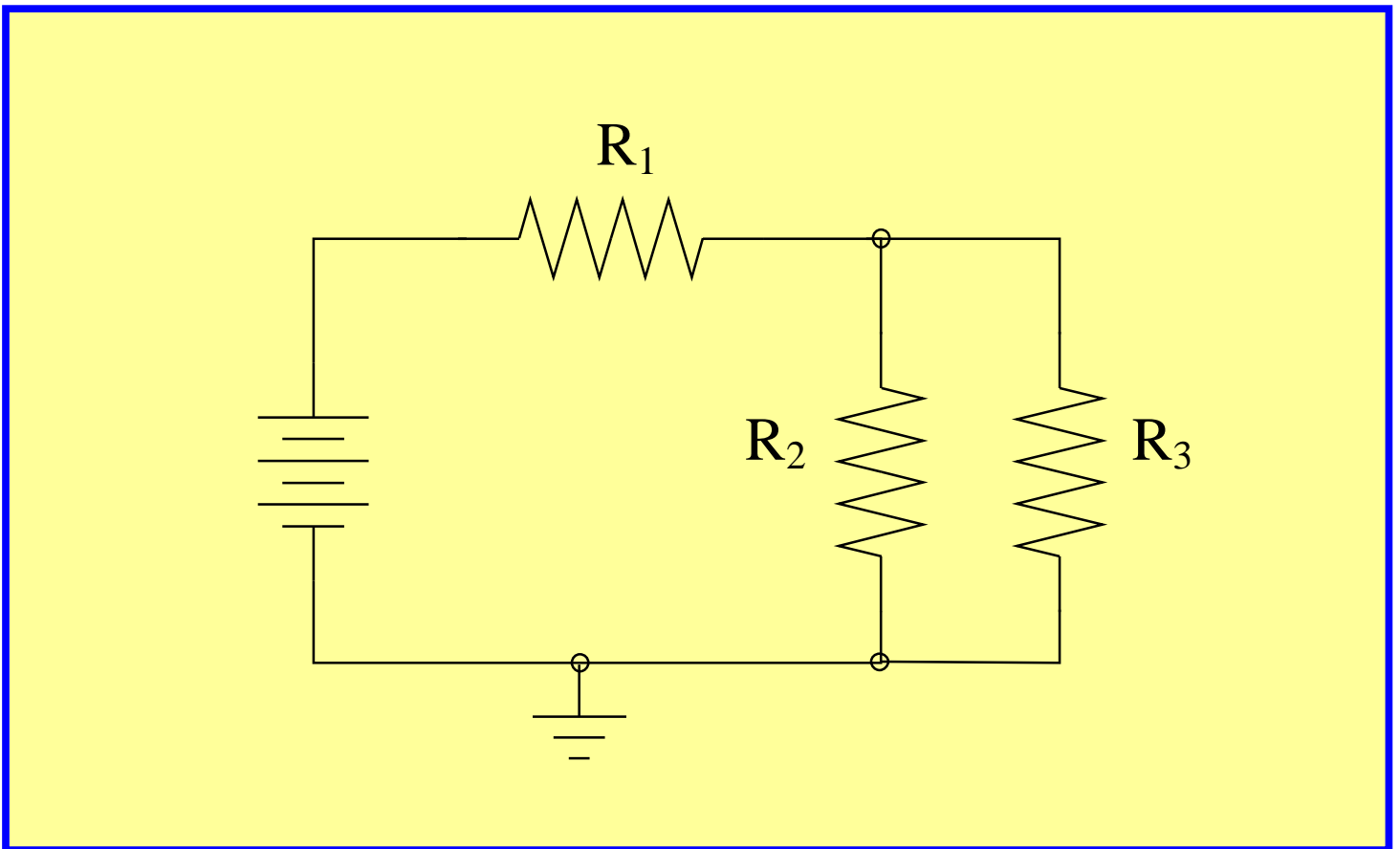
Although there is nothing new about using PowerPoint itself, PowerPoint lends itself to creating a tutorial that helps students in these difficult areas. It is easy to insert pictures in the lab of a well-built circuit that are easily taken by a digital camera. The fuse in the back of the multimeter can be shown for students to check if they are having trouble with current measurements. In addition, the drawing tools lend themselves to creation of animated circuit drawings. I have taken pictures of well build circuits, lab equipment and measurement equipment. Pictures and drawings can be integrated with text to show step-by-step real examples that the distance-learning students seem to relate to. Without the tutorial about 1 in 5 students had difficulty setting up the circuits and making current measurements. With the tutorials the number of students responding with questions was reduce to 1 in 40. Students told me that they would often rush into the experiment only to find it did not work. When they went back to see what else was in

the lab package they would view the tutorial and were able to successfully complete the lab. Students run their own slide show, at their own pace, in any order they choose. This freedom allows them to clear up questions and self correct the circuit problems changing a frustrating situation into one of satisfaction.

**Circuit Construction:**

The proto-type board can be described in the lab in various ways. Ripping one apart is often helpful as the students can see the inside of the board. Students still have trouble visualizing the connections they must make with the components. I have found the following presentation to be the most successful approach both in distance learning and on campus. A sample circuit, shown in figure 1, is shown being built one component at a time. Each of the figures copied here in this presentation would be a single slide within the lab experiment.

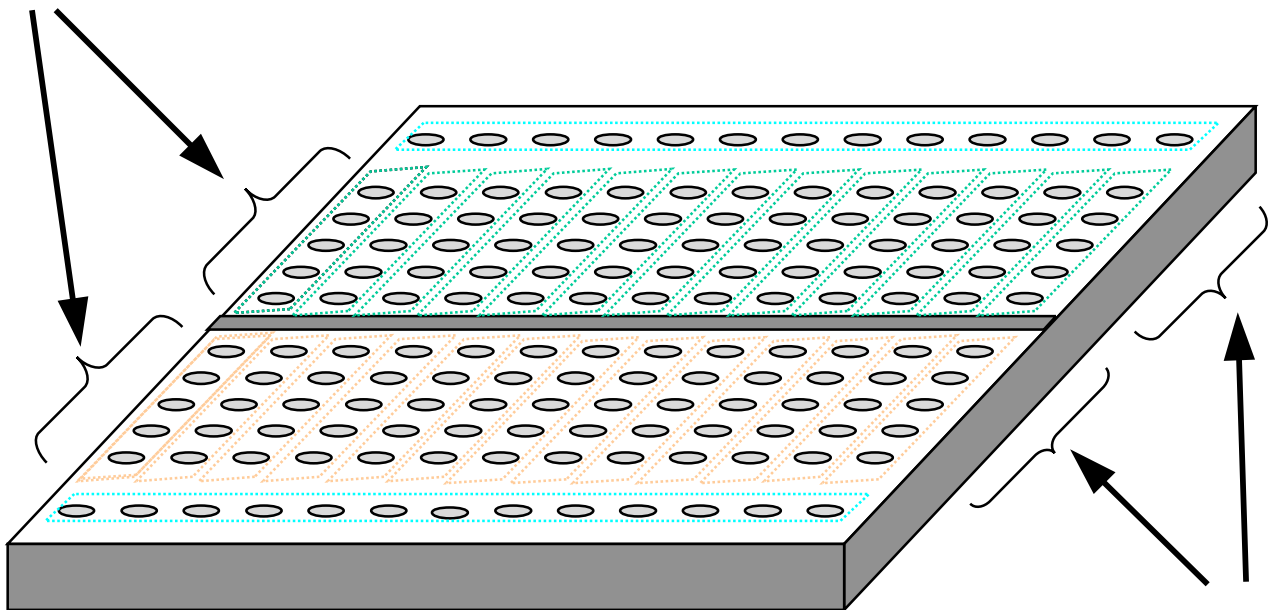
Figure 1  
Simple Circuit<sup>4</sup>



The proto-type board connections are shown. An advantage PowerPoint has over Word is the slide show. As each slide is advanced subtle changes can be shown like highlighting one of the 5 hole columns to emphasize that they are wired together. In future slides one component can be added at a time, making it more like a movie that students are willing to watch, not some long paper they shy away from. The slide below shows the column connections, the next slide would show the top and bottom row connections.

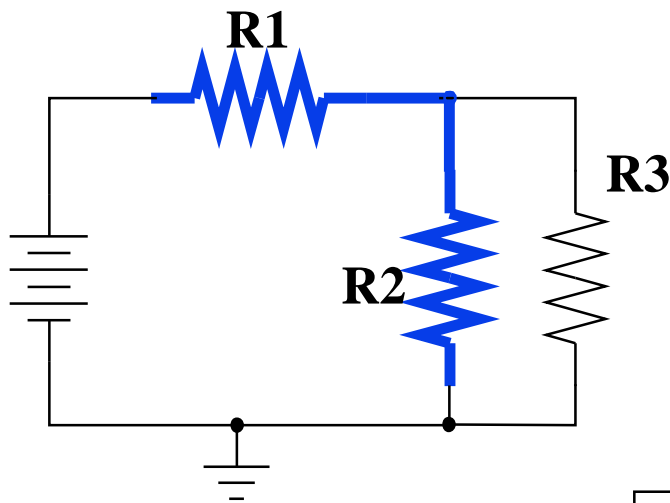
Figure 2  
Proto-Type Board

Each column made of 5 holes is wired together

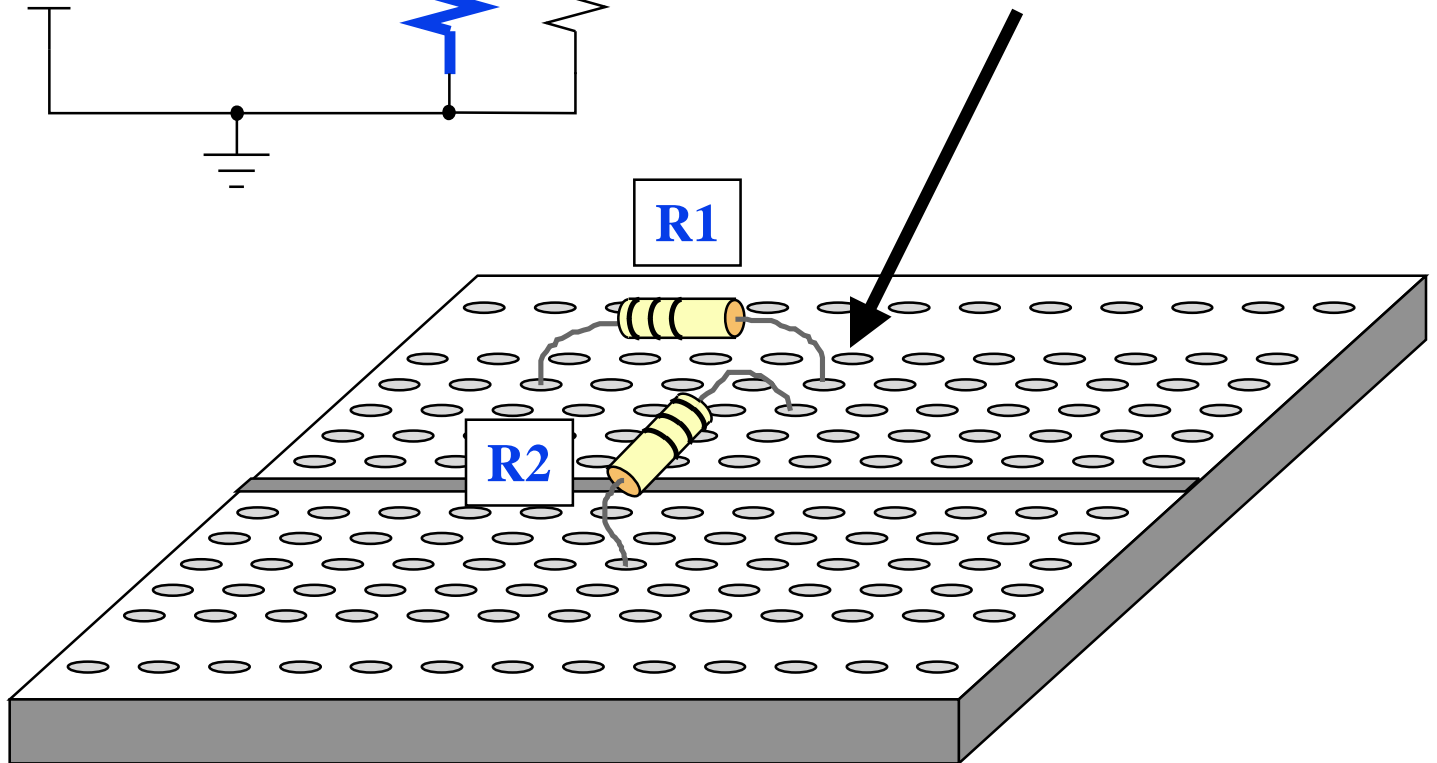


Two independent sets of columns are typical

The slide show continues with the simple circuit, figure 1, reduced in size and added to the top of the slide. Next a component is highlighted in the schematic and shown as a real resistor placed in the prototype board. A block of text appears next as the slide show is advanced mentioning that each of the leads of the resistor is placed in a separate column. Using PowerPoint allows the distance-learning student to watch the same presentation the campus student does. By putting the presentation and the lab procedure in the same PowerPoint document, the needed information is all in one place and the student will look at the whole lab when the procedure is not working out. Figure 3 shows two resistors in the proto-board with a brief block of text emphasizing the connections being made.

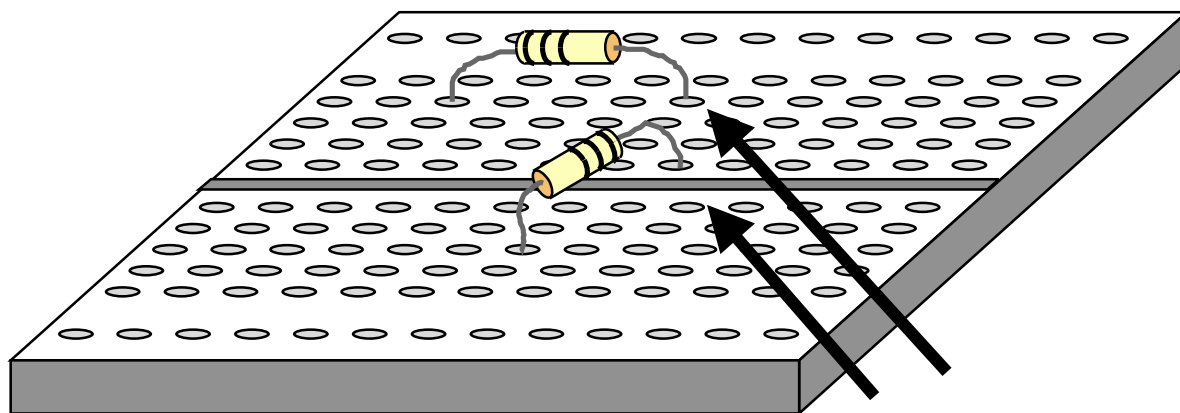


Components placed in the same column are connected. The right side of R1 and top of R2 are connected here.



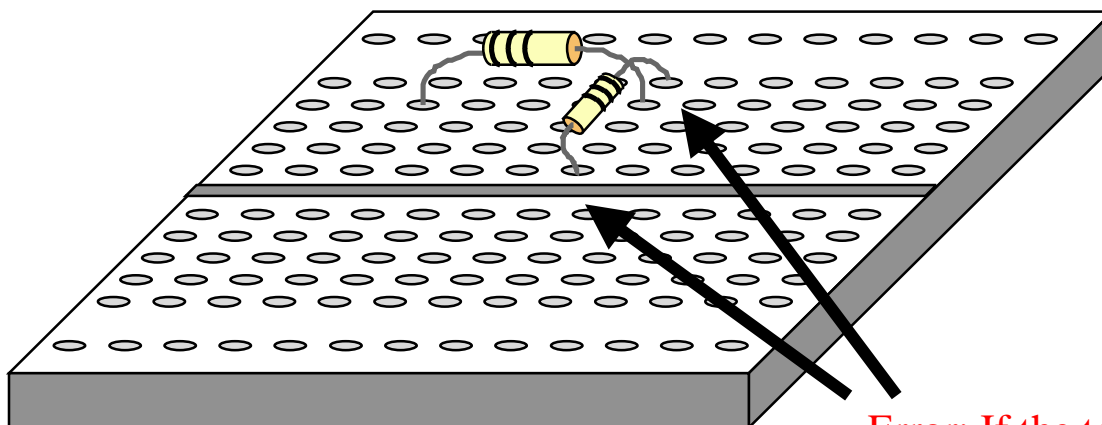
**Figure 3**  
**Circuit Construction**

Various errors can be pointed out. The slide show can allow the student to guess what is wrong before going to the next slide. Figure 4 shows components in different rows while Figure 5 shows components that are shorted out.



**Figure 4**  
**Components not Connected in**  
**Circuit Construction**

**Error: If the top of R2 is accidentally placed in different columns than the right side of R1, they will not be connected.**



**Figure 5**  
**Shorted Components in**  
**Circuit Construction**

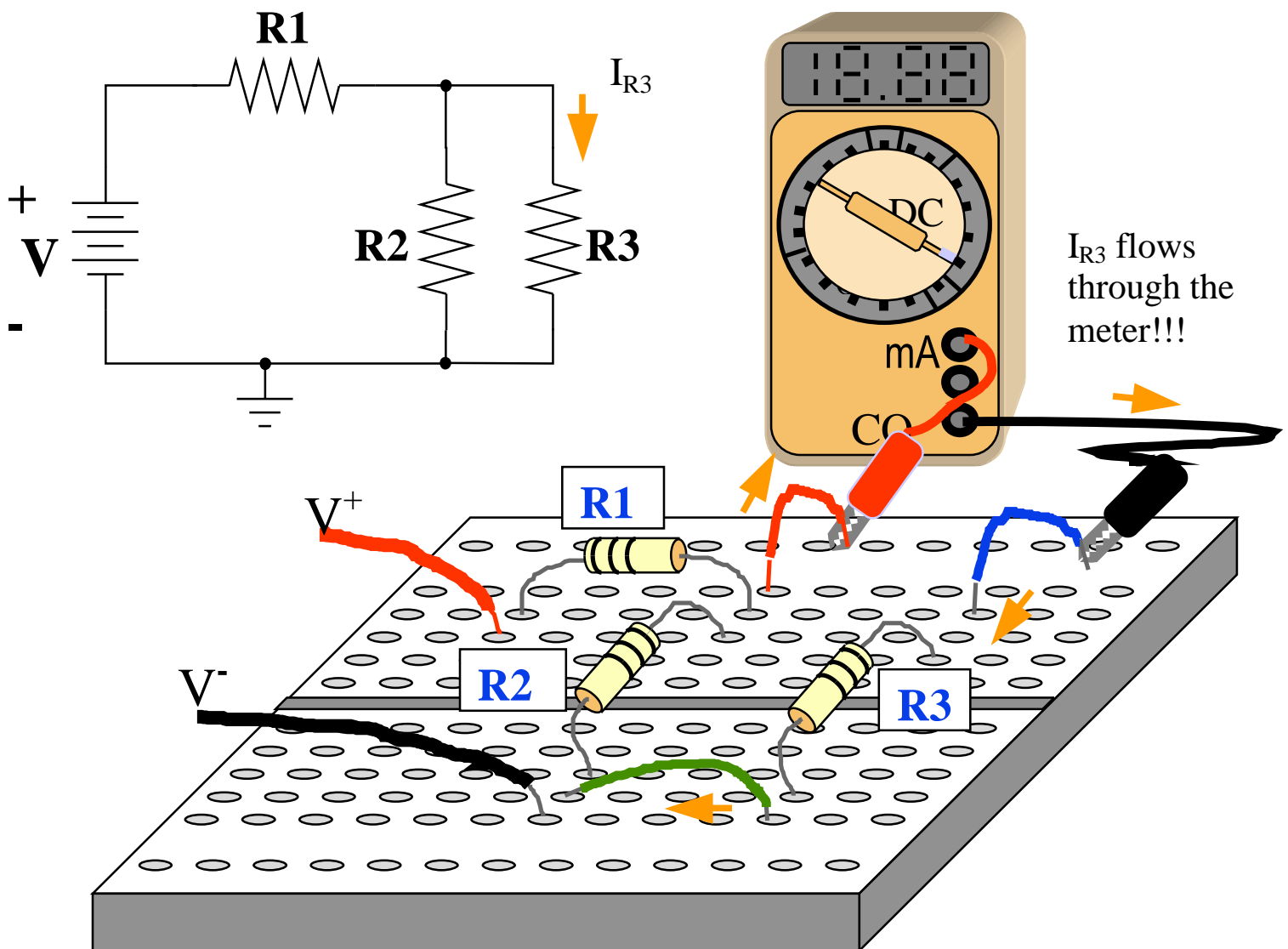
**Error: If the top and bottom of R2 is accidentally placed in just the top (or bottom) column, it will be shorted out by the proto board.**

### Current Measurement:

Current measurement is difficult enough to teach on campus to Electrical Engineering students; teaching current measurement in distance learning to non-electrical majors was even more challenging. The PowerPoint Slide Show that showed circuit construction continues in figure 6 where the current in R3 is measured. Although not shown here, PowerPoint has the capability of adding animation to the slide that would show  $I_3$  flowing through the meter and the resistor. The comment in the figure emphasizes the fact that the circuit must be broken and current must flow through the meter.

In the first course using this PowerPoint presentation, the entire class of about 20 students performed several similar exercises without a single problem or question.

Figure 6  
Measuring Currents:  $I_{R3}$



## Conclusion:

This paper has shown several samples of basic circuit theory labs for a distance-learning course. Its goal has been to demonstrate the use of PowerPoint to create a current measurement and circuit construction tutorial for distance learning students. Although there is nothing new in the use of PowerPoint itself, the paper demonstrates proven and effective ways of teaching circuit construction and current measurement to a distance-learning student. This format can be used for Electrical students and on campus students as well distance learning.

Labs created with the integral tutorials shown in this paper allow distance-learning students to complete lab experiments at home. Our distance-learning students are required to come on campus as well in most classes. When the distance-learning students come for the on campus lab they are able to demonstrate the skills they have acquired at home. The students relate well to the tutorials as evident in there course evaluations.

The use of PowerPoint made putting these tutorials straightforward. Having the tutorial integral to the lab experiment allows students to go back and review it when things are not going well in the experiment. The slide show and animation features bring the tutorial to life and make it less intimidating, increasing the students' confidence and performance.

## Reference:

<sup>1</sup> Sanoff, P.A., "Long Distance Relationship," *ASEE Prism*, Vol. 9, no. 2, 1999, pp. 22-26.

<sup>2</sup> Thiagarajan, Ganesh and Jabobs, Caroline, "Teaching undergraduate mechanics via Distance Learning: A new experience," *Journal of Engineering Education*," Jan. 2001, pp. 151 – 156.

<sup>3</sup> Richardson, Carol, "Distance Learning Course in Engineering Technology at Rochester Institute of Technology," *ASEE Session* 1149

<sup>4</sup> Dingman, Tom, DC Circuit and Simulation on campus lab lecture.