

Current Draw

Lesson Setup

Overview

In this lesson, you will discover the relationship between work and current. However, before you can begin this lesson, you must build a robotic platform for the monitoring of current flow in the robot.

This document is the companion to “Lesson / Videos / Current Draw: Lesson Setup” video. If you have access to this video, it is recommended that you watch the video before attempting the Lesson Setup. In addition, it is recommended that you review “Background / Resources / Multimeter Guide” and “Background / Resources / Crimping Guide” before continuing.

You Will be Able to:

1. Wire the multimeter, battery and Vex microcontroller in series
2. Crimp a connector onto a wire
2. Measure motor current using a multimeter

Materials Needed:

- Digital multimeter
- Vex Squarebot
- Wire strippers
- Wire cutters
- Electrical tape
- Battery (fully charged)
- 2 connectors (alligator clips, female spade connectors, or similar connectors)
- Zip ties or other method of attaching the multimeter to Vex Squarebot



Figure 2



Figure 3



Figure 4

Procedure

1. If you are not familiar with the multimeter, refer to “Background / Resources / Multimeter Guide” for detailed instructions and videos on how to use a multimeter.
2. Plug the red wire of the multimeter into the highest current labeled, as shown in Figure 2. For this specific multimeter, it is 10 amps.
3. Plug the multimeter’s black wire into the port labeled “COM,” as in Figure 3.
4. Set the multimeter’s selector switch to the “A” that has two flat lines (one dotted and one solid) over it (Figure 4). You have now set the multimeter to measure Direct Current (DC).

Be careful: do not set the multimeter to the “A” that has a sine wave over it. This sets the multimeter to measure Alternating Current (AC). For more information about DC versus AC, refer to “Overview / Guides / Note to the Student.”

Current Draw *continued*

Lesson Setup



Figure 6



Figure 7



Figure 8

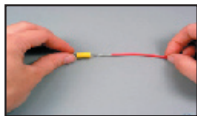


Figure 9



Figure 10

5. Now you will modify the battery so that you can put it in series with the multimeter and Vex microcontroller. For more information on series and parallel connections, refer to “Background / Resources / Series and Parallel Connections.”
6. Using wire strippers, cut the red wire of the battery as shown in Figure 6.
7. Attach connectors to both ends of the cut red wire, as shown in Figure 7. We recommend using alligator clips or female spade connectors (pictured), though many others will work. If you are not using female spade connectors, you may skip to Step 12.
8. Steps 8 through 11 are the companion to “Background / Resources / Crimping Guide.” If you do not have experience stripping wires or crimping, it is recommended that you review this material before continuing.
To attach a female spade connector, use a pair of wire strippers to strip 1 - 2 centimeters of the red wire, as in Figure 8.
9. Place the red wire inside the female spade connector, as shown in Figure 9.
10. Use a crimping tool or pliers to firmly lock the female spade connector to the wire, as shown in Figure 10.
11. Repeat steps 8 through 10 for the other red wire so that your battery looks like the battery in Figure 7.
12. Push the pin of the red wire of the multimeter into the connector on the red wire of the battery, as shown in Figure 12 below.

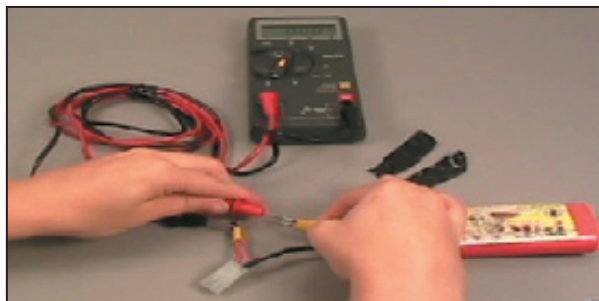


Figure 12

13. As in Figure 13, wrap electrical tape around any exposed metal to avoid shorting the circuit.



Figure 13

Current Draw *continued***Lesson Setup**

- 14.** Push the pin of the black wire of the multimeter into the connector of the other red wire. Wrap all exposed metal with electrical tape, as in Figure 14. Note that it doesn't matter if the pins of the multimeter are switched; your current readings will simply be negative.

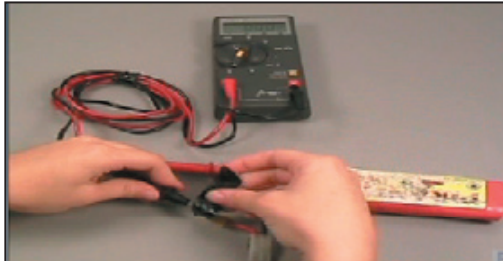


Figure 14

- 15.** Check that the finished setup of your multimeter and battery looks like Figure 15 below.

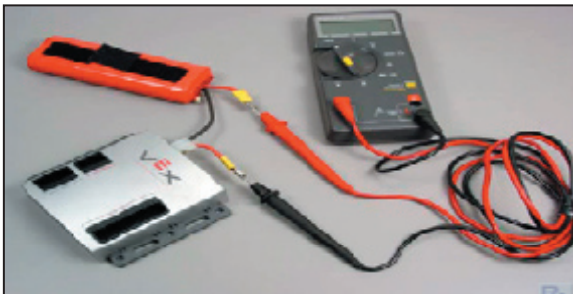


Figure 15

- 16.** While you may attach the battery and multimeter any way that produces a stable multimeter reading, we recommend steps 16 through 18. Attach the battery connector to the Vex microcontroller, as in Figure 16.

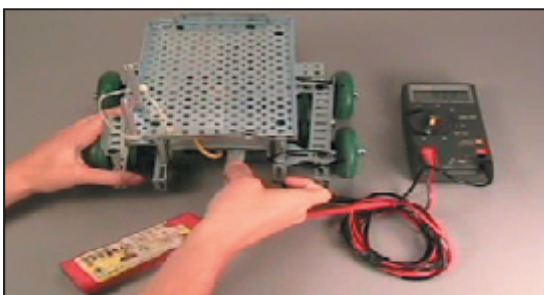


Figure 16

Current Draw *continued***Lesson Setup**

- 17.** Place the battery in a secure holder to the side of the robot. We have fashioned a battery holder out of Vex parts in Figure 17.

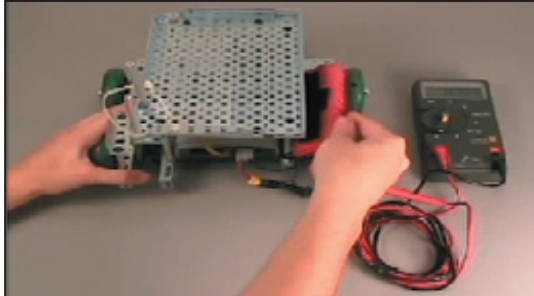


Figure 17

- 18.** Place the multimeter securely on the side of the robot. Make sure to place the multimeter upright and to the side of the robot so that it is easy to read the multimeter during the experiment. We have attached our multimeter with zip ties, as shown in Figure 18.

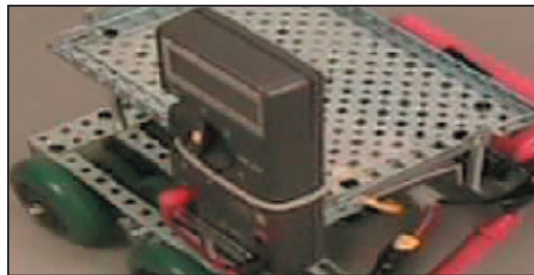


Figure 18

- 19.** Your robot and multimeter should now be ready to begin the current draw experiment. Make sure to test your multimeter connection by turning on the Vex microcontroller. As shown in Figure 19, the multimeter display should show idle current.

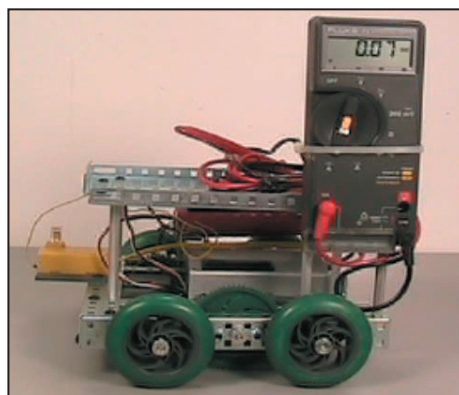


Figure 19