MEASURING CURRENT USING DIGITAL MULTIMETERS

Introduction

Current is the rate at which charge passes a certain point in a circuit. Current not only has a value—it also has a *direction*. The link to the right provides more information about current.

The direction of the current must be accounted for when making a measurement; when you connect your DMM to a circuit, you will be *assuming* a particular current direction. The sign of the reading displayed on the DMM reflects this assumption—if the actual and assumed directions are the same, the displayed number will be positive. Conversely, if the number displayed is negative, the actual direction is opposite to your assumption.

Note

The way in which the probes are connected to your circuit defines the assumed direction of the measured current: The assumed current direction is such that *positive* current *enters* the **A** (or **µA mA**) port and *leaves* the **COM** port.

Current measurements tend to be viewed as being more difficult than either voltage or resistance measurements. This is typically because, when measuring current, you have to make sure that all of the current which you want to measure passes *through* the DMM. This invariably requires that you break your circuit apart at certain points and then insert the DMM at the two ends of those breaks. Of course, after measuring the current, you will also need to re-connect the circuit to its initial condition.

The other complication of measuring current is that most DMMs have multiple ports for current measurement—our DMM has two; they are labeled **A** and **µA mA**. The reason for the two ports is because the current through the DMM has to pass through a fuse. If too much current passes through the fuse, it will blow out. Unfortunately the construction of the DMM is such that, if you use a high capacity fuse in the measurement of a small current, you probably won't be able to read the current value accurately[1].

DMM Settings

There are two possible DMM configurations which we can use when measuring currents:

1. When measuring *large* currents, plug one of the DMM leads into the port with the **A** designation. The other DMM lead is plugged into the **COM** port. In this case, the DMM dial should be turned to the **A** setting. This configuration is shown in Fig. 1(a).
2. When measuring small currents, plug one of the DMM leads into the port with the **µA mA** designation. The other DMM lead is plugged into the **COM** port. In this case, the DMM dial should be turned to either the **mA** setting (if the current is in the milliamp, or thousandths of an amp range) *OR* the **µA** setting (if the current is in the microamp, or millionths of an amp range). This configuration is shown in Fig. 1(b).

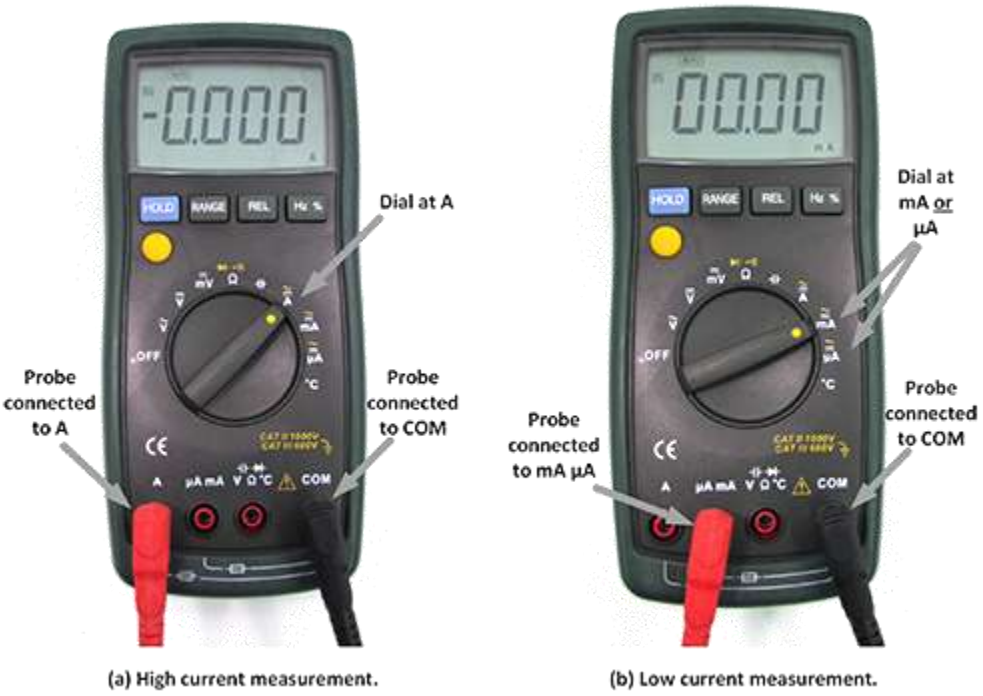

Figure 1. DMM configuration for current measurement.

Probe Connections

Now we have to connect the DMM leads to our circuit. As indicated above, this usually involves disconnecting parts of our circuit so that we can connect the DMM appropriately. For example, suppose we want to measure the current *I* between components 1 and 2 in the circuit from Fig. 2. In order to measure this current, we will need to break the circuit apart between the two components, as shown in Fig. 3(a)[2].

Now we place our DMM between the two components, as shown in Fig. 3(b); current will flow through component 1, through the DMM, and then through component 2. At this point, we also need to make sure that our measurement matches the sign of the current we want to measure. Since the assumed direction of the current *I* is from component 1 to component 2, we need to set up our DMM so that the current enters the **A** (or **µA mA**) port and leaves the **COM** port[3].

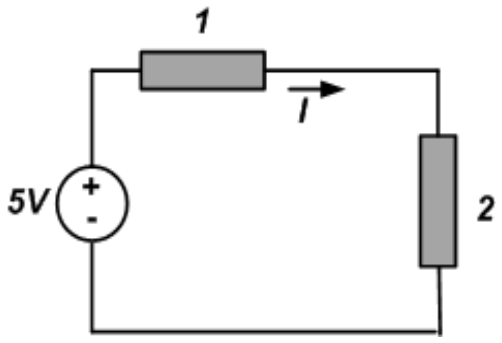

Figure 2. Current *I* to be measured.

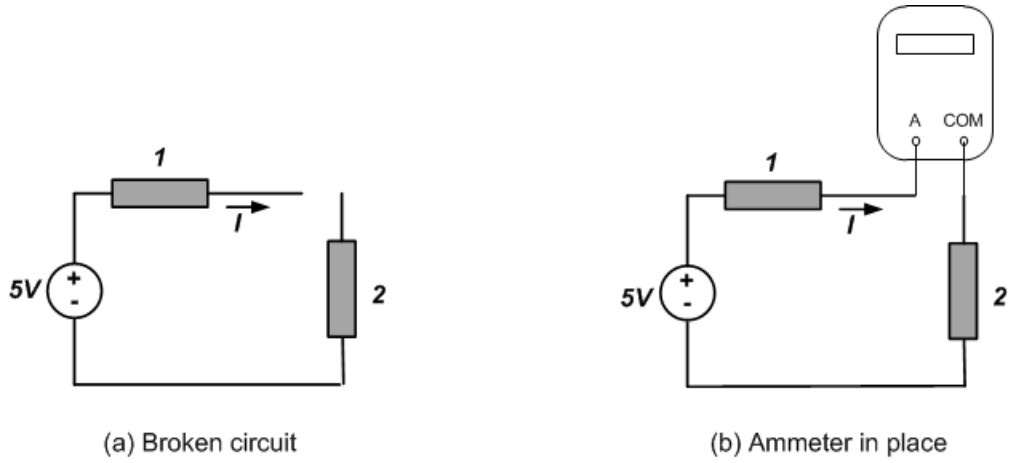

Figure 3. Placement of an ammeter for current measurement.

One final comment on current measurement: as we pointed out above, we have two different ports on the DMM with which we can make current measurements. If we try to measure a high current with the low-current port, we can burn out the fuse. It is always possible to replace a burnt fuse; however, it is inconvenient and an easily avoidable situation. The question is, how do we know what the current is before we measure it[4]? The answer is, we don't. Therefore, to play it safe, *always* make sure your current measurement is using the high-current port first. If that measurement indicates a low current, then switch to the lower-current port.

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