

To: OPEnS Lab
From: Andrew Walker
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Subject: Power Budget

Objective:

Power is a challenge with any battery-operated project and knowing how long your device will last in the field depends on the current it consumes in operation and while asleep. The purpose of this memo is to outline an instructional document for creating your own power budget at home without a variable power source. It will detail the general procedure using a multimeter and a power source. It will also detail a special case for devices using USB power, including the Feather M0. These procedures will provide the current use for each sensor and device within your system. Using these recordings for when the system is both awake and asleep will allow you to calculate total power use by the system and the longevity of your power source in the field.

General Procedure:

For the general procedure you will need the following devices: a power source (ideally the battery you will be using to power your devices in the field), the device(s) and sensor(s) you wish to power, and a multimeter. Your power source will need to have the positive and negative wires available for this procedure. If your power source does not have these readily available, simple adapters should be purchased to make them so. Alligator clip leads for the multimeter are recommended for this procedure for easier measurement recording; however, probe leads can be used.

Instructions:

A. Device Preparations

1. Ensure power is OFF until you are ready to test for current.
2. Ensure your sensor or Feather M0 is wired for power and your sensors are properly connected to ground.
3. Remove the power wire to your device from the source keeping the ground wire connected in its normal configuration.

B. Multimeter Preparations

1. Place the negative lead into the COM junction and the positive lead into the amperage junction.
2. Connect the positive lead to the device's usual power source and the negative lead to the wire normally connecting power to the device.

Note: This is made easier by using a jumper cable if the power source contact is not easily reachable. Connect the jumper to the female power input and use the exposed end as your power source.

3. Turn your multimeter to the amperage setting that is reasonable for your devices. This can be found on your respective device's specification sheets.

C. Measurement Recording

1. Once everything is set up as described above, turn on the power source.
2. Check your multimeter for the measurement reading and record the voltage supplied by the source and the amperage reading.

Note: If the multimeter is not reporting any current, you may need to lower the setting on the multimeter to detect the lower current supply.

Note: If you are on the lowest amperage setting, ensure your device is powered correctly and the configuration is correct.

Note: The fuse in your multimeter may also be broken. Ensure that it is working or replace it if needed.

Note: If the current being reported is close to the maximum of the setting, you should increase the amperage setting to ensure a good read.

3. Turn off the power supply and repeat until all sensors and devices are recorded.
4. Repeat B. while your unit is asleep to ensure a complete power budget.

Special Case, USB Power:

Many devices used in the lab are powered via USB, the most common of which is the Feather M0 boards we use for most projects. Though you can cut a USB micro connector precisely enough to conduct the instructions above, it is tedious, difficult, and wasteful and therefore not recommended. Instead we will use two Feather M0's (one normally used for the system and another to supply power) to detect how much total current is supplied to the devices using the Feather as their power source. Two jumper wires will be used in addition to the previous devices for this procedure.

Instructions:

A. Setup

1. Ensure power is OFF until you are ready to test for current.
2. Connect the GND pins of the two Feathers via a jumper.
3. Place a jumper wire in each Feather's USB pin.

Note: This step is not necessary if you are using probe leads.

4. Connect the positive multimeter lead to the USB pin on the Feather supplied via USB cable and the negative multimeter lead to the USB pin on the system Feather.
5. Ensure all sensors and devices are properly connected to your systems Feather.

B. Measurement Recording

1. Once everything is set up as described above, turn on the power source.
2. Check your multimeter for the measurement reading and record the voltage supplied by the source and the amperage reading.

Note: If the multimeter is not reporting any current, you may need to lower the setting on the multimeter to detect the lower current supply.

Note: If you are on the lowest amperage setting, ensure your device is powered correctly and the configuration is correct.

3. Repeat B. while your unit is asleep to ensure a complete power budget.

Summary & Considerations:

These instructions were created to help those who did not have extensive equipment on hand. There may be other, more complete ways to create a power budget, but these instructions can be used by most individuals with little equipment on hand. Finding the current used by each of your devices and your system as a whole can be supplemented with post processing to find how long your power supply will last in the field. One such supplement has been provided by our own Bao Nguyen and can be found below in the attachments.

Attachments:

<https://baonguyen.me/tool/index.html>

