

## FED2 operating instructions

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This document is designed to describe the main functions and use of FED2.

### 1. Flashing the FED

Install and familiarize yourself with the Arduino IDE (<https://arduino.cc>), and read up on the Adafruit Feather Adalogger board (<https://learn.adafruit.com/adafruit-feather-m0-adalogger/>). To use FED you should be comfortable with flashing code onto the FED with the Arduino IDE.

To flash the newest code onto FED, download the latest .zip file from the Hackaday.io page, and extract to a single directory. Open the file named FED030818.ino in the Arduino IDE. You should see the main experimental file, with FED's functions as individual tabs.



```
FED030818 | Arduino 1.6.11
// Change FED value to change the mouse number at the beginning of the filename. This must remain an integer, no strings!
int FED = 1;
.....
FED 2.00
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```

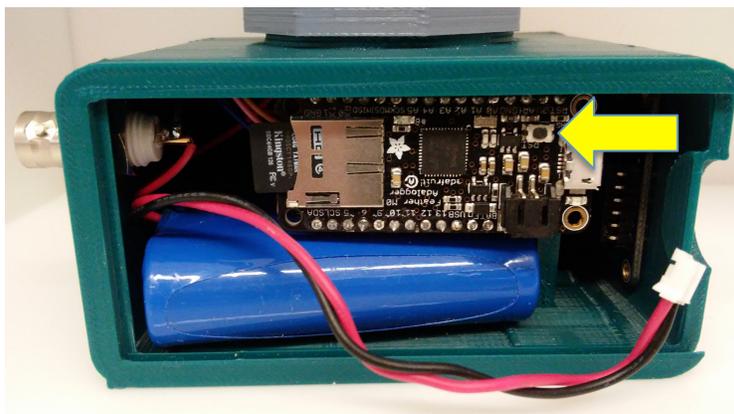
You can ignore all of the tabs, and simply edit the FED name (the “int FED” variable in the 2<sup>nd</sup> line). **This name must be an integer of no more than 3 digits.** Flash the FED as described in the Adalogger documentation above.

### 2. Turning FED on and off

FED2 does not have a power switch. To turn it on and off, open the back and plug/unplug the battery. A power switch can be added, but we opted not to do so to simplify the construction. FED uses the sleep functionality of the M0 chip and battery should last >2 weeks with normal use.

### 3. Resetting FED

To reset FED, open the back and push the small button on the Adalogger board (yellow arrow below)



#### 4. Basic operation

When you start up FED it will attempt to dispense a pellet and once successful it will display the “home screen”, which shows the name of the FED, battery life, number of pellets dispensed, and current date/time. Once the pellet is removed, the date/timestamp will be logged to the internal SD card, and FED will wait for a 15 second timeout (this timeout length can be edited in the Arduino code) before it dispenses another pellet. We used a 15 second timeout to reduce “hoarding” behavior where mice take a pellet, drop it, and grab a new one from FED.



#### 5. Reading the data

Every time FED starts up it initializes a new .CSV file on the SD card. The filename is named according to the following convention:

FEDXXX\_MMDDYY\_NN where XXX is the “name” of the FED (this actually has to be a 3 digit number at the moment), MMDDYY is the date-stamp the file was initialized, and NN is an incrementing number of the number of files initiated each day (starts at 00, then 01, etc).

After an experiment ends, pull the SD card out and read the .CSV file. It will have 5 columns, which should be self-explanatory:

	A	B	C	D	E
1	MM:DD:YYYY hh:mr	Mouse	PelletCount	MotorTurns	BatteryVoltage
2	3/8/2018 19:15:34	6	1	4	3.78
3	3/8/2018 19:15:59	6	2	2	3.78
4	3/8/2018 19:16:41	6	3	4	3.78
5	3/8/2018 19:17:37	6	4	2	3.78
6	3/8/2018 19:35:46	6	5	3	3.78

We are working on new scripts for analyzing the data (meals, bouts, light/dark cycle etc). Our FED1.0 scripts are here (these may need some tweaks to use with FED2.0 data):

<https://github.com/KravitzLab/FED/tree/master/FED-Python-scripts>

#### 6. Changing the mouse name (#) and updating the time on the clock

**FED2 must be re-flashed (step 1) to change the mouse # and to reset the clock.** We may include some type of input device in the future (touchscreen?) but for the moment this is the only way to update these. To change the FED name, edit the variable named “FED” in the first line before flashing.

FED2 also uses the real-time-clock capability of the ARM M0 chip. Unfortunately, FED2 does not have a battery backup, and the clock will “reset” to the last saved date and time whenever the power is disconnected, or the FED is reset (as in step 2). A dedicated RTC chip can be added but we did not to simplify the build.

## 7. Error states.

### Check SD Card:

When you start up FED, it checks for a valid SD card, and if it can't find one it will display "Check SD Card" on the screen. If this happens, try popping the card in and out once and reset the FED.

### Clearing Jam...

If the FED fails to dispense after 10 attempts it will display "Clearing Jam..." on the screen and attempt to clear a jam. It will make a full 360 degree rotation of the pellet disk in the forward and then backwards directions. The pellet well is monitored during these rotations, and if a pellet is released the rotations will abort.

## 8. BNC output

The BNC output connector sends a 200msec TTL pulse whenever the pellet is removed. To avoid false positives, this pulse is sent 500msec after the removal of a pellet (the FED monitors for 500msec to ensure the pellet is removed and not simply bounced around by the mouse). These delays should be taken into account if this pulse is used to sync pellet removal events with other equipment.

