



Guide for Using iButtons in the Classroom

Created by: Jake Sanders, Kaitlin Campbell, Rita Hagevik, & Kathy Cabe Trundle
<https://www.usu.edu/smart-foodscapes/> USDA-NIFA-SAS Grant #2021-69012-35952

Thermochron iButton

Model: DS1921G-F5#



DS1921G iButtons

What is an iButton?

- Thermochron iButtons (Maxim Integrated), are a small piece of technology that can automatically take *in situ* temperature readings wherever they are placed. There are also models that can measure temperature and humidity and just humidity. iButtons are used in a variety of situations because they are small, enclosed in a stainless-steel case, are durable, and battery operated.

How can iButtons be used?

- iButtons can be programed to record temperature at designated intervals for months and with a simple adapter the data can be easily downloaded to a computer and interpreted quickly with basic programs like Microsofft Excel.
- A mobile temperature logger can be used for many things! Here are some examples for how they could be used:
 - To measure variation in the ambient temperature outside or in a green house
 - To determine if a freezer had a thaw period during a power outage
 - To measure temperature of food/produce or sensitive materials in transit
 - If placed in the pocket of a person, to track their body temperature throughout the day
 - We have even seen them used glued onto box turtle shells to determine what temperatures they experience and prefer to live in throughout an entire summer, to compare temperatures inside a bee hive to the outside of a bee hive, and to measure variation in temperature experienced by native bee houses.
- If you have a question about temperature, an iButton may help you answer it!

How Do I Get Them?

- We recommend the Thermochron iButton model [DS1921G-F5#](#) These range from \$25-60 each and adapter items are about \$50-70 combined. They can be shared resources for schools.
 - The purchased iButton should have the ability to measure temperatures within the typical range of the environment less than -10° C to +45° C
 - Make sure you also purchase the reader ([DS1402D-RP3+](#)) and USB adapter ([DS9490R#](#)). There are multiple models of readers and also kits that include all of the items across various websites. Just be sure you have verified that the reader can read the iButton you plan to purchase and work with the eTemperature software if you choose other models.
- Here are several websites that sell the items:
 - <https://www.ibuttonlink.com/collections/thermochron>
 - <https://qasupplies.com/ibutton-analog-devices/>
 - https://www.embeddeddatasystems.com/Maxim-Integrated_bymfg_3-0-1.html
 - You will also need to [download and install](#) the free software eTemperature to access the data your ibutton collects. <https://etemperature.com.au/download/> **The software only works for PCs.**
- Always make sure you have practiced using the iButtons (initiating the data collection, downloading the data, and reading the data) before you attempt to use them in the classroom.

How it Works

- iButtons record the surface temperature of the object they are in contact with. The iButtons collect info which can be retrieved through a probe and a master. The probe reads the information from the iButton. Once the probe has recorded the data, it will be transferred to the master which is plugged into a computer, information can then be retrieved. Using the iButtons gives more accurate temperature measurements than using alternative instruments.

How to Use

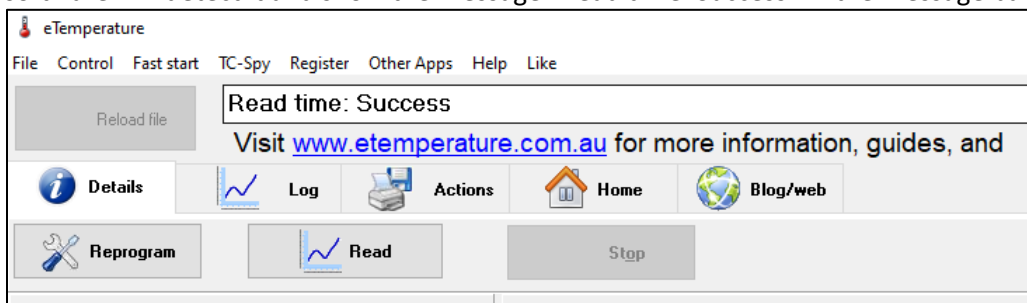
- Download the eTemperature software <https://etemperature.com.au/download/> to program and download the data from the iButton. You may also need to install drivers (same page).
 - Full help documents are located here: <https://etemperature.com.au/using-etemperature/>
- Plug the DS9490R# USB adapter into the PC. Windows should detect the “New Hardware” and install the USB drivers if it has not been completed previously. Then plug the Reader DS1402 cable’s RJ11 (phone) plug into the USB adapter.



- Open the eTemperature software. It may ask you for a code. Typically this is located on the USB adapter.

Programming your iButtons

- Take an iButton and press the rounded side to the circular part of the DS1402 reader. The eTemperature software will detect it and show the message “Read time: Success” in the message bar at the top.



- To Program your iButton:
 - Click the **Reprogram** button



6. Set up your Program. You can set up many options in the menu. They are described on the image below:

The screenshot shows the eTemperature software interface. At the top, there's a menu bar with 'File', 'Control', 'Fast start', 'TC-Spy', 'Register', 'Other Apps', 'Help', and 'Like'. Below the menu, a status bar shows 'Read time: Success' and a link to 'www.etemperature.com.au'. The main interface has tabs for 'Details', 'Settings', 'Log', 'Actions', 'Home', and 'Blog/web'. The 'Settings' tab is active, showing various configuration options. A green 'Start' button is at the top left of the settings area. Below it, there's a 'Description' field with the value '5'. To the right of the description is a 'Thermocron Memory Usage' section. The 'Sample rate' section shows a rate of '60' and 'Minute'. Below this, a calculation shows 'The 2048 log readings will contain 12:Weeks 1:Day 8:Hours 0:Minutes' and 'worth of readings and if started now would rollover at 4/22/2024 9:31:26 PM'. The 'Start delay' section has a 'Delay type' dropdown with 'Specify delay date and time' selected, and a 'Start at' date/time of '1/29/2024 5:00:00 PM'. The 'Fast start' section has a list of options like '1 Fridge 1 wk', '2 Fridge 1 mnth', etc. The 'Temperature alarm limits' section shows a range from '-30' to '0.0'. The 'Roll over' section has a checkbox for 'When the memory is full, allow rollovers' which is unchecked. At the bottom, a blue button says 'Press "Start" to download the settings to Thermocron.'.

Description- Name your iButtons here

Sampling Rate- Set to how frequently you want the iButton to collect data.

Based on the sampling rate, it will calculate how many data points you will have before it runs out of space and what the date will be at that point. If you need it to collect for a longer period, you can lengthen the sample rate.

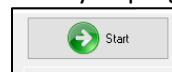
Roll over- it will overwrite earlier data points when it runs out of space if you have this box checked. We recommend leaving it unchecked.

Start Delay- You can select when you want the iButton to become active. This is useful if you want to set them all up and need time to deploy them before they start taking readings or if you are preparing for a future project.

Temperature Alarm Limits (°C)- These bars can be adjusted to create a "safe" zone temperature or to connect with the start delay. The colors also translate to the Log tab graph. It is not essential to edit this unless you are using the "On temperature alarm" setting for Start delay. This ibutton setting was used on a freezer, so anything above 0° C was considered "red".

Start- (Final) When you have all the settings completed, you must press start to turn on your iButton. If you have a start delay in place, it will be active but will not take readings until the delay is finished.

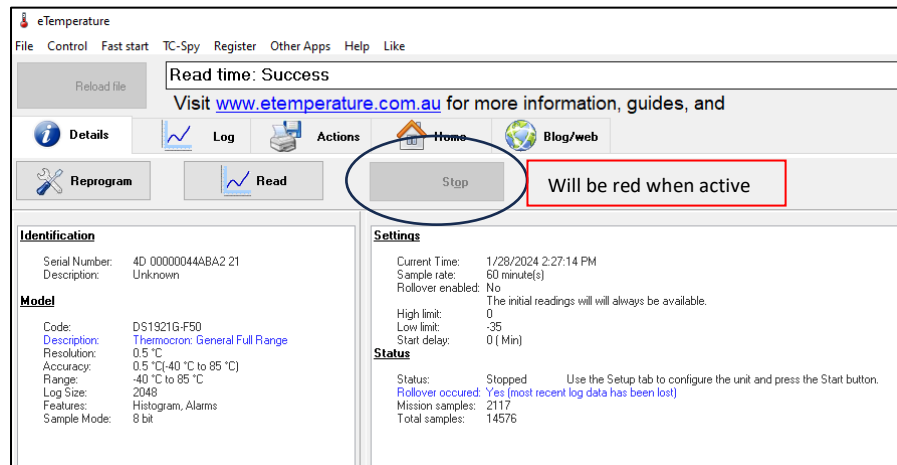
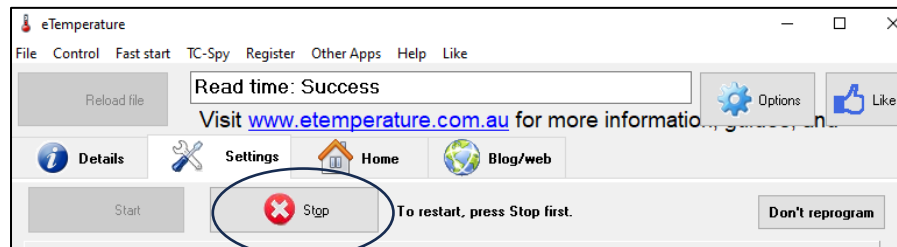
7. When you are satisfied with the settings press the green **Start** button. If you programmed a delay, it won't take readings until your delay has ended.



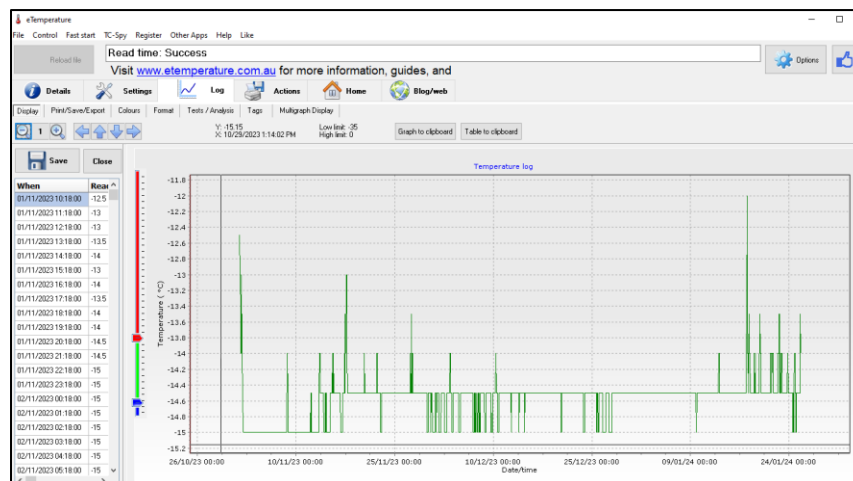
8. If you have multiple iButtons requiring the same settings, the settings will remain from the last set up. You can just put your next iButton on the reader, change the description (optional), and press the green start button.
9. Deploy your iButtons and pick them up when the time has elapsed for their readings.

Retrieving the iButton Data

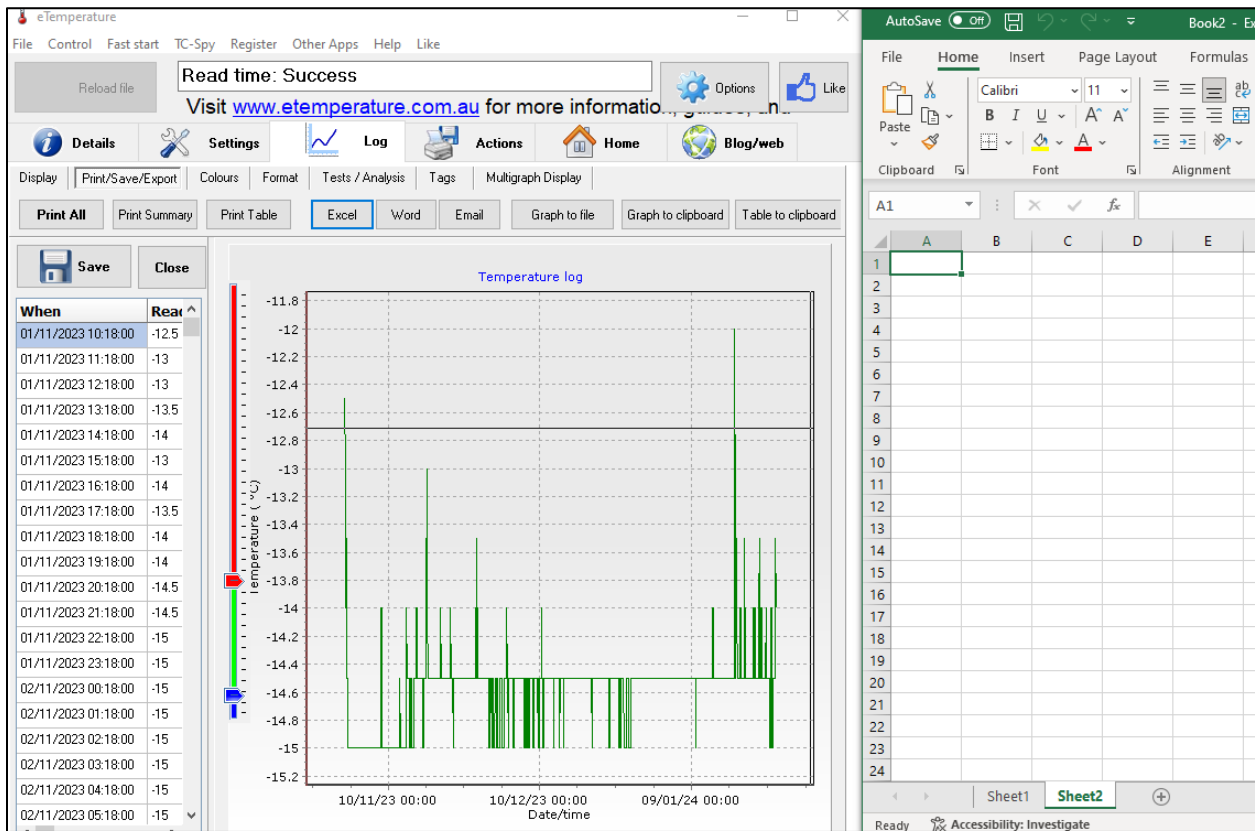
10. Press the iButton to the reader. Click the red **Stop** button on the main screen, or on the reprogram menu.



11. Click the **Read** button. It will open the Log tab. Where you will see a colored graph based on the settings you used.



- Open a new **Microsoft Excel** book and click in the first cell (A1). Place this window next to your eTemperature window on the Log Screen.



- Tap the **Excel** button on the eTemperature **Log** Screen. It will automatically import the data starting at A1. For each iButton, make a new sheet and follow the same procedure to import each one's data into its own sheet. If you want them all on the same sheet, you can shift over a few columns, click in D1 and have it put the next one's data in that spot. Image on right shows example of data output in excel.
- You can now manipulate and analyze the data in Excel.

C1	A	B	C
1	Identification		
2	Serial Number:	4D 00000044ABA2 21	
3	Description:	Unknown	
4	Model		
5	Code:	DS1921G-F50	
6	Description:	Thermocron: Genera	
7	Resolution:	0.5 °C	
8	Accuracy:	0.5 °C(-40 °C to 85 °C	
9	Range:	-40 °C to 85 °C	
10	Log Size:	2048	
11	Features:	Histogram, Alarms	
12	Sample Mode:	8 bit	
13	Log Values		
14	Reading	Values	
15			
16	1/11/2023 10:18	-12.5	
17	1/11/2023 11:18	-13	
18	1/11/2023 12:18	-13	
19	1/11/2023 13:18	-13.5	
20	1/11/2023 14:18	-14	
21	1/11/2023 15:18	-13	
22	1/11/2023 16:18	-14	
23	1/11/2023 17:18	-13.5	
24	1/11/2023 18:18	-14	
25	1/11/2023 19:18	-14	
26	1/11/2023 20:18	-14.5	
27	1/11/2023 21:18	-14.5	
28	1/11/2023 22:18	-15	
29	1/11/2023 23:18	-15	
30	2/11/2023 0:18	-15	
31	2/11/2023 1:18	-15	
32	2/11/2023 2:18	-15	

Additional Advice:

- iButtons are water resistant, but not waterproof. Don't put them directly in water, underground, or very moist environments without any protection. You can put them in ziplocks or other sealed containers and deploy them in wet environments, but you may still run the risk of damaging your item if your seal fails.
- iButtons can easily get lost- be sure you know exactly where you put it and affix it with tape or other material to an item you are measuring. Try not to cover up the rounded part of the iButton so readings can be taken. You can remove tape residue with acetone.