Measurement of vaginal temperatures in cows using the Thermochron™ iButton® and CIDR

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Introduction

Vaginal temperatures in cattle were first measured using a temperature data logger device attached to a blank CIDR device by Jousan et al. (2007), Dikmen et al. (2008) and Dikmen et al. (2009). In these early papers, the data logger was a relatively large HOBO device from Onset (Bourne, MA, USA). Subsequently, Dikmen et al (2014) improved on the system by replacing the HOBO with a Thermocron iButton (Maxim Integrated). The differences in size of the data loggers can be seen in Figure 1 [reproduced from Dikmen et al. (2014)].

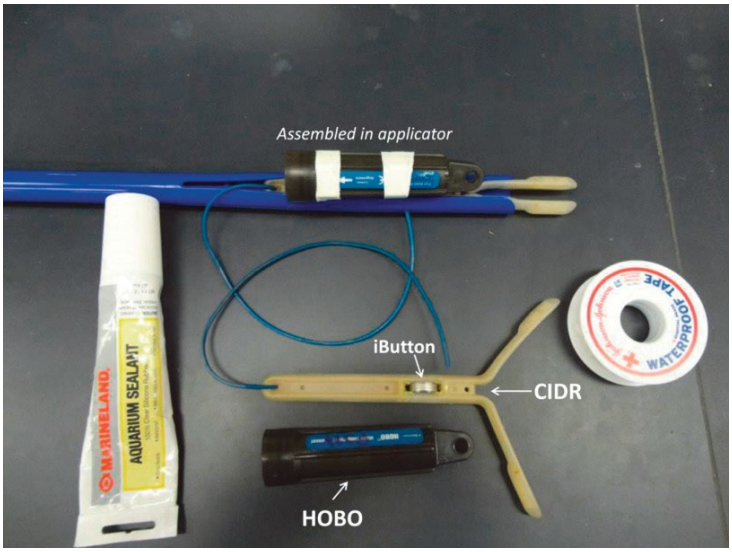

Figure 1. Comparison of size of HOBO and iButton data loggers for recording vaginal temperature. Reproduced from Dikmen et al. (2014).

As described by Maxim, the Thermocron "is a single-chip digital thermometer, thermostat, clock, calendar and data logging memory housed in the stainless steel iButton". **Note that there are many different kinds of Thermocrone iButtons. We usually purchase the DS1922L. It is important to set the resolution to 11 bit so as to achieve a resolution of 0.0625°C.**

Supplies (Figure 2)

i. OneWireViewer software (Maxim)
ii. iButton (Maxim) – we mark iButtons with a Sharpie for identification
iii. adapter to allow iButton to be accessed by personal computer (Maxim)
iv. parafilm (for wrapping iButton)
v. blank CIDR (these are donated to us by Zoetis; one could use progesterone-containing CIDRs sold commercially if treatment of animals with progesterone is not a concern.
vi. Waterproof adhesive tape (local pharmacy)

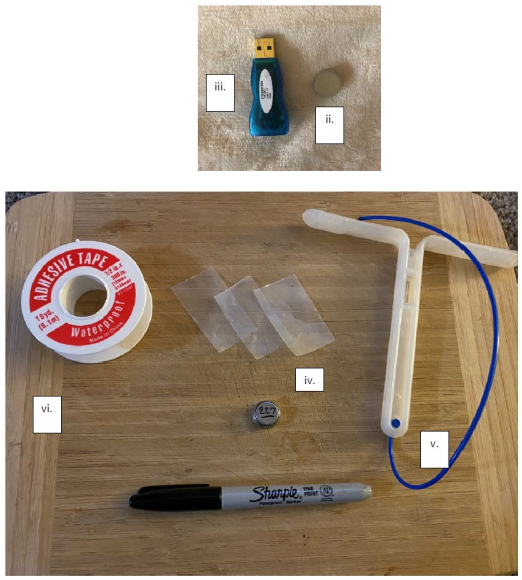

Figure 2. Some supplies needed to use iButtons to measure vaginal temperature.

Programming the iButton

1. Check Java version and update to newest if necessary
    a. for Windows computer, open Command Prompt
    b. use command: java -version
2. Download 1-wire drivers: https://www.maximintegrated.com/en/products/ibutton-one-wire/one-wire/software-tools/drivers/download-1-wire-ibutton-drivers-for-windows.html
3. Open **OneWireViewer.**
4. Insert adapter into USB port (Figure 3).
5. Insert iButton gently into the adapter (if you put it to far in, it will be stuck) – when inserted the device should appear in OneWireViewer.
6. Select the second choice in the device list to access the iButton (first device is the adapter) (Figure 4).
7. Adjust iButton time to the computer time.
8. Select the Mission tab, then select “New Mission” to program the iButton (Figure 5)
    a. Choose sampling rate (how often the button will record a temperature – 900 seconds = 15 minutes)
    b. Choose the time you want the buttons to turn on (i.e., 1 pm). Wait 5 sec until the adapter communicates and programs the iButton. If you take it out too quickly, the iButton will not be programmed successfully.
    c. Next, program the iButton based on minutes until start time (i.e., if you are programming at 8 pm and want them to turn on at 1 pm the next day, that would be 1020 minutes).

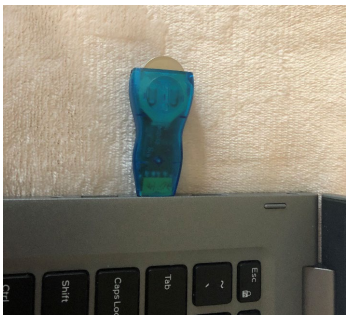

Figure 3. Adapter containing iButton plugged into USB port of a PC.

You will need to progressively change the start delay minutes as you program each button.

d. Create an Excel file with the programming time and the number of minutes until start time.
e. Change the resolution to 0.0625C.

9. Choose OK to set up the mission. The iButton will turn on at the appointed time and begin recording at the set interval and resolution.

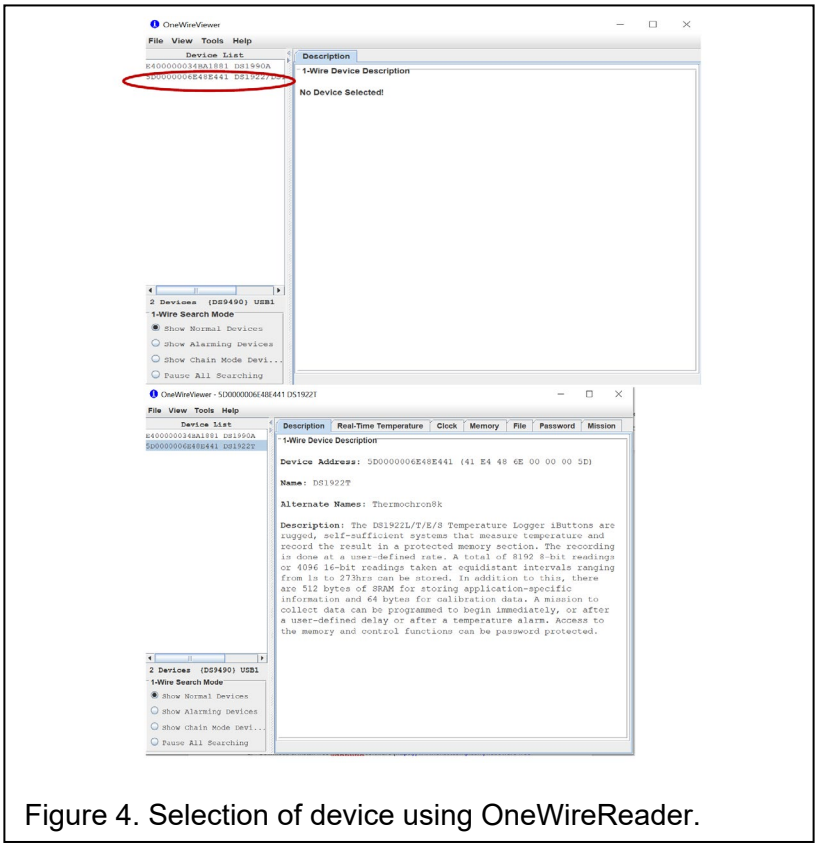

Figure 4. Selection of device using OneWireReader.

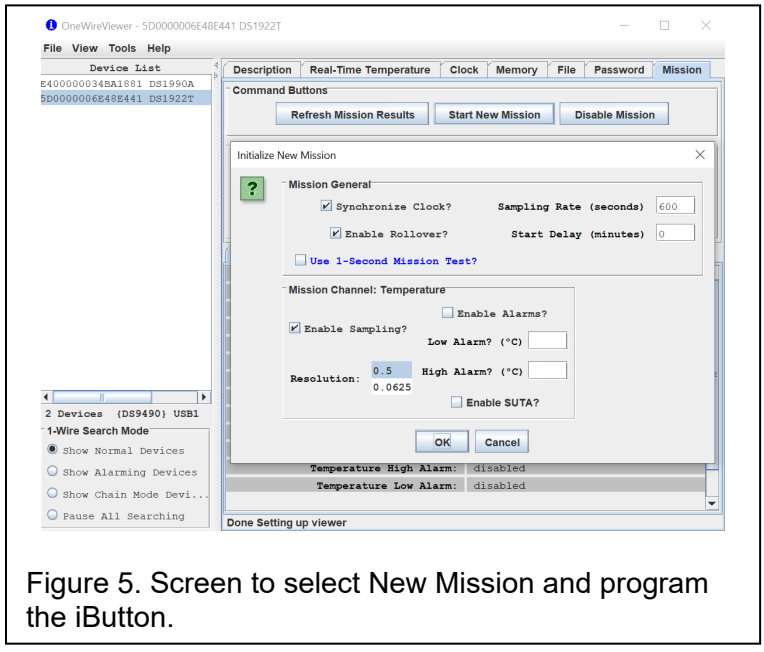

Figure 5. Screen to select New Mission and program the iButton.

Assembly of the programmed iButton/CIDR (Figure 6)

1. Wrap iButton in small piece of parafilm (iButtons are water resistant, but this will help keep moisture from damaging the iButtons) (Figure 6a).
2. Insert iButton into the spine of the CIDR spine (use scissors to split the thin piece of silicone in the middle of the spin on new CIDRs). Push gently the iButton inside so that it is easily felt on the back part of the CIDR (Figure 6bc).
3. Wrap parafilm around CIDR spine containing iButton (figure 6b). **If this is not done so that the parafilm is tight, the iButton will fall out while in the animal!**
4. Wrap tape around the center of the CIDR (Figure 6d) and write the number of the CIDR on the tape (figure 6e).

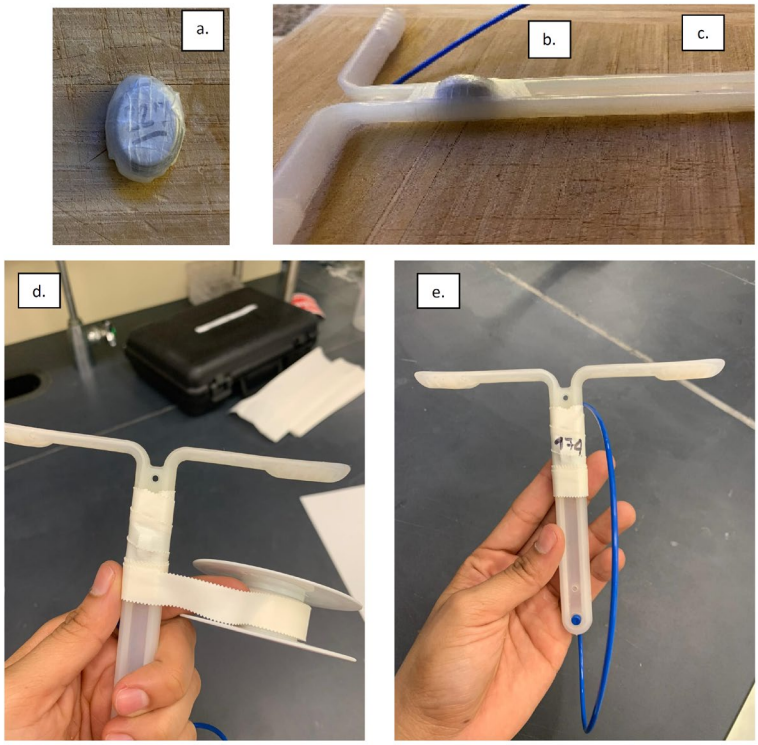

Figure 6. Insertion of CIDR containing iButton.

Insertion and removal of the programmed iButton/CIDR in the cow or heifer

1. Insert CIDR in cow and record iButton number using the normal procedure for CIDR insertion. Make sure that A.I. lube is used. **Be careful as the tape and extra bulk from the iButton can cause the CIDRs to stick in the applicator.**
2. We routinely leave CIDRs in for 5 to 7 days. After CIDR removal, gently clean iButtons with paper towel and a little bit of ethanol if necessary (again, the iButtons are water resistant, not waterproof).
3. Retrieve data to save as a .csv file under the Mission tab. Switch the view from “Status” to “Temperature Data Log” (You should see a graph of the temperatures recorded). Right click on the graph and “choose save as .csv file”.
4. Don’t forget to turn off the iButton by clicking on the clock tab and turning off iButton. Doing so will ensure that the battery is not used up while the iButton is not in use.

Recording capacity and lifetime of iButtons (model: 1922L/1922T) at 11 bit resolution (recording between 30-40°C)

Recording Interval	Recording Capacity (Days)	Lifetime
1 min	5.7	6 month
5 min	28.4	8 month
15 min	85.3	2 years
30 min	170.7	3.5 years
60 min	341.3	5 years

References

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