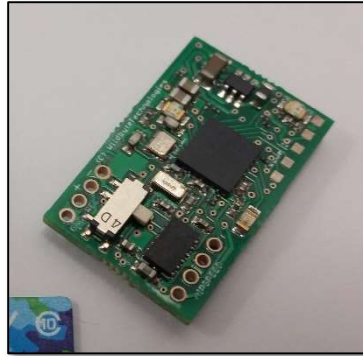


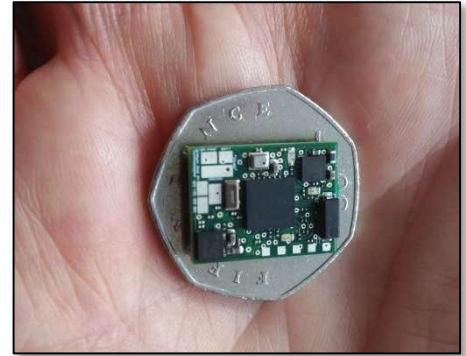
System overview



Standard / original Daily Diary with connectors for battery/external sensors. Additional light sensor



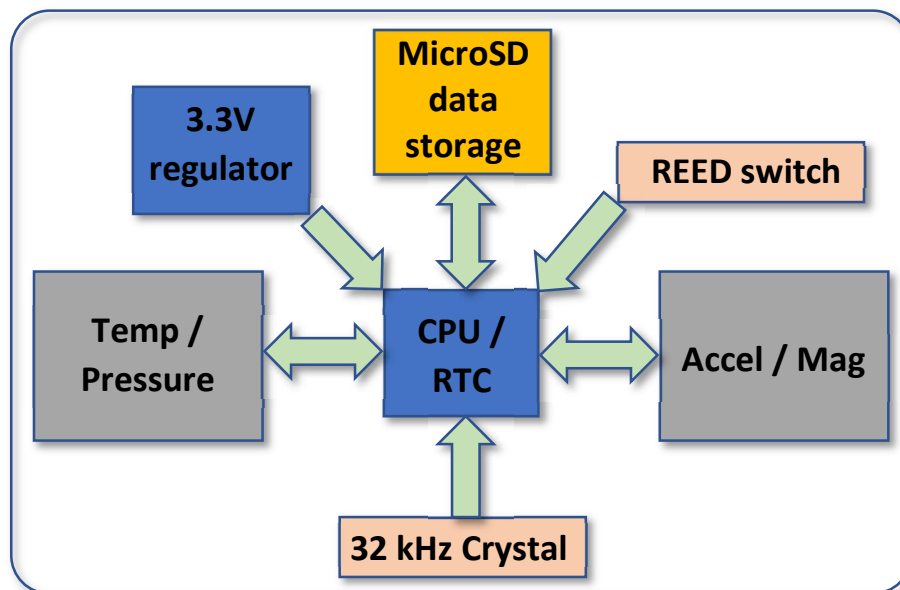
Elongated Daily Diary with no connectors, power switch on/off. No light sensor. Battery / external sensors soldered to board.



Thumb Daily Diary with no connectors, no power switch on/off. No light sensor. Battery soldered to the board.

The Daily Diary is typically powered by a lithium cell (rechargeable or non-rechargeable), 3.6 – 4.2V; the cell should be capable of supplying peak current up to ~ 100 mA for the MicroSD card. This supply is regulated to 3.3 V, powering the CPU, MicroSD data storage, and the sensors Temp/Pressure/Acc/Mag (+Light on some older 'Standard / original' variants). The Daily Diary monitors, and records, battery voltage, by using a potential divider to divide the incoming battery supply voltage by two, which is then read on one of the analogue inputs by the CPU and compared to the 3.3 V regulated supply.

The 32 kHz crystal is present to tick-over the Real Time Clock (RTC), and to regulate timing of sensor data collection.



Typically, the accelerometer is the primary sensor, and so, if the user selects 40 Hz as the sensor collection frequency, acceleration X, Y, and Z axes data will be collected at this frequency. Magnetometry, used more for direction information, doesn't need to be at such a high frequency, and so is normally collected every ~4th acceleration data point. Temperature / Pressure are less important still, and due to their inability to sense quick changes in their environment (due to housings dampening their response time), their data is collected every 8th acceleration data point. The frequency ratio of acceleration to magnetometry to temperature/pressure is therefore approximately 40:13:4:4.

Setting up the Daily Diary logger for use

There are two types of storage with the Daily Diaries from Wildbyte Technologies. One type with on-board flash memory where an app is used to configure the device for deployment and to extract the data post-retrieval, and the other that uses MicroSD flash cards for large storage capacity, up to 32 GB.

It is recommended that a new MicroSD card at least be quick formatted before first use

2 GB MicroSD card logger

Start the 2GB application:

Select options (or just take the default – 40 Hz acceleration (13 Hz magnetometry, 4 Hz temperature and pressure), initial sleep (wake with a magnet)) and click **Generate string** to obtain the command string e.g.

AMTPXng,F40,R0144,Kh,s,ul,G060,s0000,Q030,I030,S300,b,t0000,P,S,g0000,gsd0000,grc0000,Dsd1985,T,I,S5,A30,t000,B20,T,p,p00,R16,p00,d0000,t000000000000

On the MicroSD card (formatted, no files present), in Windows, right click in the empty root directory, and select **New text document**, and name it text. Open this text document and copy/paste the above command string into the file and save/close it. Use the **Safely remove hardware** option in Windows to eject the MicroSD from the laptop/computer to ensure the text document was saved correctly to the card. Insert into the Daily Diary and apply power. The options in the app interface are discussed below:

(Note that some firmware versions may not have all these options present)

Basics

- Acc freq** This selects the logging frequency of the accelerometer (5, 10, 20, 30, 40, or 80 Hz). The accelerometer, magnetometer, temperature, and pressure sensors log with the ratio 40:13:4:4 (approximately), so if the accelerometer is set here to 10 Hz, then the magnetometer will sample at ~6 Hz, and the temperature/pressure sensors will log at ~ 2 Hz
- User key** All data on the MicroSD card is stored in sectors, with each sector holding information on timing, data, and also this key. When formatting in Windows, the default is to perform a Quick Format, that simply only erases the directory structure and not the actual data on the card. If one were to log for 2 hours, and then restart the logger and log for only one hour, then the data on the card would be read as a 2 hour log, with the first hour of data being the second logging session, and the second hour of data would be the partially overwritten first logging session. To get around this, one can either perform a Full Format, or simply change the **User key** to a character (any ASCII character on the keyboard i.e., a-z, A-Z, 0-9 etc. If the first logging session were with a key = 'h', and the second logging session with a key = 'g', then when the data is read into DDMT, it would see that there was a key change, and terminate reading the data at the end of the first hour with the key = 'g'
- Range, g** The accelerometer can be set to a range of +/- 2, 4, 7, or 16 g, with 2 g having the highest resolution, typically sub- milli' g, depending on the sensor on the board itself
- Duty (cycle)** With **Duty** the logger can be instructed to log for **X** days on and **Y** days off, switching at midnight

Low battery monitor / terminate logging

DD at ? V Daily Diaries are equipped with a simple voltage monitor circuit. When the voltage drops below the set point defined here, it will terminate logging, and stop writing data to the Micro SD card. This helps to prevent corruption of the SD card due to insufficient current as flash cards can require the order of “up to” 100 mA burst current to store data, but typically a lot less

Daily Diary time and sleep function

Sleep upon switch-on? (Immediate sleep)

When the logger is first powered up, it will read the command string that has been placed by the user on the SD card (discussed later). If the device is set to sleep, it will do nothing else, and immediately enter sleep. The user must either swipe a magnet by the device to wake it (yellow LED flash), or with the square logger (with connectors and a button), press the button to begin logging (if a “pre-sleep” is not also configured)

DD to sleep between hours

The Daily Diary can be configured to sleep between specific hours (24 hr clock). If set to 04 and 08, the logger would sleep at 04:00, and continue logging from 08:00

Set DD clock start time to

The Daily Diary can be configured to set its time to the data defined here (hrs:mins). This time will not be stored in the clock until woken from sleep (if configured). The idea is that the clock can be configured to 10:00, and the device powered up at 09:45. When the user see their watch switch to 10:00, they would swipe a magnet by the device to set the clock and begin logging

Pre-sleep hours

The Daily Diary can be configured to sleep for **X** hours before logging begins. This might be for a reason such as not logging until the animal has recovered from any stress related to its capture/release

Allow magnet to pause/continue DD

Allows a magnet to swipe past the device and toggle the logging process on/off. The on-board clock (RTC time/date) continues to “tick” even when logging is suspended

Protect data set on power reset

If this option is selected and previously recorded data is present on the card, it will alert the user with a short and long yellow (/amber) LED flash indicating old data present. The Daily Diary will not initiate the logging sequence until a magnet is brought to it's REED switch (magnetic switch) such that the yellow (/amber) LED illuminates continuously for 3 seconds and is then removed. For the square logger with a button present, this can instead be depressed for 3 seconds and released to acknowledge overwrite. Bear in mind that overwriting data on an SD card may result in “data overhang” from previous recording(s). It is ultimately better, for a true deployment, to either fully format the card, or to change the **User key** to a character that has not been used before with the SD card in question

Continuous green LED flash

If this is selected then, instead of the green LED intermittent flashing (indicates logging is ongoing) switching to dim flashing after a few minutes, it will continue to flash brightly the whole time. This will of course impact on battery life, but might be more useful when testing and not likely to influence animal behaviour in the wild (at night)

No indicator once logging

This will switch off the green LED from flashing at all when logging

8-32 GB MicroSD card logger

Start the 32GB application:

The screenshot shows the configuration interface of the 32GB application. At the top, a title bar displays the command string: `AMTPXng,F40,R8640,Kh,s,ul,s0000,b,T000001012017,R000027120000,P,S,Dsd1861,T,I,B20,t,p,p00,R16,p000000,d0000`. The interface is divided into several sections:

- Basics:** Includes fields for Frequency (40 Hz), User key (h), Range (+/- 16g), Daily Diary start time (01 January 2017), Logging hrs (8640), and a 'Calculate' button. There are also checkboxes for 'Daily duty' and 'Set release time / date to:'. Below these are fields for 'Days on (1-21)' (7) and 'Days off (1-21)' (14).
- Daily Diary sleep function and additional sensors:** Includes checkboxes for 'Sleep upon switch-on? (immediate sleep)', 'DD to sleep between hours: 00 to 00', 'Depth sensor enabled?', and 'Pre-sleep until: 00 hours, on the 01 January'.
- Other:** Includes checkboxes for 'Allow magnet to pause/continue DD', 'Protect data set on power reset?', 'Continuous green LED flash?', and 'No indicator once logging'.
- Low battery monitor/system shutdown:** Includes a checkbox for 'DD sleep at (wake and release):' and a '3.0 Volts' field.

A large green button labeled 'Generate string' is located at the bottom right of the interface.

Select options (or just take the default – 40 Hz acceleration (13 Hz magnetometry, 4 Hz temperature and pressure), initial sleep (wake with a magnet)) and click **Generate string** to obtain the command string e.g.

```
AMTPXng,F40,R8640,Kh,s,ul,s0000,b,T000001012017,R000027120000,P,S,Dsd1861,T,I,B20,t,p,p00,R16,p000000,d0000
```

On the MicroSD card (formatted, no files present), in Windows, right click in the empty root directory, and select **New text document**, and name it “text”. Open this “text.txt” document and copy/paste the above command string into the file and save/close it. Use the **Safely remove hardware** option in Windows to eject the MicroSD from the laptop/computer to ensure the text document was actually saved correctly to the card. Insert into the Daily Diary and apply power. The options in the app interface are discussed below:

(Note that some firmware versions may not have all of these options present)

Basics

Frequency This selects the logging frequency of the accelerometer (5, 10, 20, 30, 40, or 80 Hz). The accelerometer, magnetometer, temperature, and pressure sensors log with the ratio 40:13:4:4 (approximately), so if the accelerometer is set here to 10 Hz, then the magnetometer will sample at ~6 Hz, and the temperature/pressure sensors will log at ~ 2 Hz

User key All data on the MicroSD card is stored in sectors, with each sector holding information on timing, data, and also this key. When formatting in Windows, the default is to perform a Quick Format, that simply only erases the directory structure and not the actual data on the card. If one were to log for 2 hours, and then restart the logger and log for only one hour, then the data on the card would be read as a 2 hour log, with the first hour of data being the second logging session, and the second hour of data would be the partially overwritten first logging session. To get around this, one can either perform a Full Format, or simply change the **User key** to a character (any ASCII character on the keyboard i.e. a-z, A-Z, 0-9 etc. If the first logging session were with a key = ‘h’, and the second logging session with a key = ‘g’, then when the data is read into DDMT, it would see that there was a key change, and terminate reading the data at the end of the first hour with the key = ‘g’

Range, g The accelerometer can be set to a range of +/- 2, 4, 7, or 16 g, with 2 g having the highest resolution, typically sub- milli’ g, depending on the sensor on the board itself

Daily Diary start time

The Daily Diary can be configured to set its time to the data defined here (hrs:mins). This time will not be stored in the clock until woken from sleep (if configured). The idea is that the clock can be configured to 10:00, and the device powered up at 09:45. When the user see their watch switch to 10:00, they would swipe a magnet by the device to set the clock and begin logging. As this is the larger capacity device, the user can also set the date here. This is not absolutely necessary as this can be set later in DDMT, but using this option fixes the date within the datafile itself

Logging hrs If the logger is only required to log for **X** hours, then enter the hours here, and click calculate, and the app will determine the stop time. This might be for testing where battery capacity is limited and required for multiple tests

Set release date/time to

Or enter manually the date/time here for it to terminate the logging

Daily duty

With **Duty** the logger can be instructed to log for **X** days on and **Y** days off, switching at midnight

Daily Diary sleep function and additional sensor**Sleep upon switch-on?**

When the logger is first powered up, it will read the command string that has been placed by the user on the SD card (discussed later). The device will first set the start time and date and if the device is set to sleep, it will do nothing else, and immediately enter sleep. The user must either swipe a magnet by the device to wake it (yellow LED flash), or with the square logger (with connectors and a button), press the button to begin logging

DD to sleep between hour

The Daily Diary can be configured to sleep between specific hours (24 hr clock). If set to 04 and 08, the logger would sleep at 04:00, and continue logging from 08:00

Depth sensor enabled

If a depth sensor (Keller) is connected to the logger, this needs to be enabled for the logger to include it in its sensor data log

Pre-sleep until

The Daily Diary can be configured to wait until a specific hour, on a specific date, before it starts the logging process

Other

Allow magnet to pause/continue DD

Allows a magnet to swipe past the device and toggle the logging process on/off. The on-board clock (RTC time/date) continues to “tick” even when logging is suspended

Protect data set on power reset

If this option is selected and previously recorded data is present on the card, it will alert the user with a short and long yellow (/amber) LED flash indicating old data present. The Daily Diary will not initiate the logging sequence until a magnet is brought to it's REED switch (magnetic switch) such that the yellow (/amber) LED illuminates continuously for 3 seconds and is then removed. For the square logger with a button present, this can instead be depressed for 3 seconds and released to acknowledge overwrite. Bear in mind that overwriting data on an SD card may result in “data overhang” from previous recording(s). It is ultimately better, for a true deployment, to either fully format the card, or to change the **User key** to a character that has not been used before with the SD card in question

Continuous green LED flash

If this is selected then, instead of the green LED intermittent flashing (indicates logging is ongoing) switching to dim flashing after a few minutes, it will continue to flash brightly the whole time. This will of course impact on battery life, but might be more useful when testing and not likely to influence animal behaviour in the wild (at night)

No indicator once logging

This will switch off the green LED from flashing at all when logging

Low battery monitor / terminate logging

DD at X Volts

Daily Diaries are equipped with a simple voltage monitor circuit. When the voltage drops below the set point defined here, it will terminate logging, and stop writing data to the Micro SD card. This helps to prevent corruption of the SD card due to insufficient current as flash cards can require the order of “up to” 100 mA burst current to store data, but typically a lot less

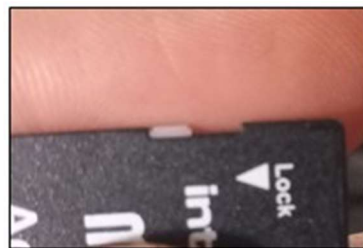
Powering up the Daily Diary device

When power is applied to the Daily Diary, it will quickly read the command string within the text.txt file on the SD card and configures itself. If no initial sleep is enabled, then it will flash a few times, and if all is well, it will initiate logging. When it's logging data to the SD card, it will flash the green LED once per ~40 data points, so if logging acceleration at 40 Hz, this will flash at approximately 1 Hz. Some firmware will cause a bright green flash for the first 8-10 minutes and then switch to a very dim flash. A darkened room may be required to see this dim flash. If an error occurs on bootup such as no SD card, or the incorrect type (2 GB instead of 8-32 GB or vice versa), or it finds an error in the command string to stop its proper interpretation, it will flash the red LED. The number of flashes (repeated with pause) is indicative of the actual error

Sleep mode	A brief yellow(/amber) flash every 2-3 seconds	
Logging mode	Brief green flash every 1-3 seconds, depending on the sampling frequency	
Error	2 red flashes	Can't find the SD card
	3 red flashes	No text.txt file found on the SD card. If present on the card, then perform a quick format and recreate the text file on the card. A full format of any SD card prior to a proper deployment is recommended, rather than a quick format
	5 red flashes	Command string sequence error
	6 red flashes	Low battery – this is shown only once (non-repeated), so connecting a low battery, it beginning logging, and then flashing the red LED 6 times and going to sleep (intermittent yellow (/amber) LED tells you low battery i.e. below the DD sleep at X Volts setting

To stop the device logging, either pop out the SD card (Thumb DD, just pull the card, other devices click in to eject), switch off power (Elongated 'long' DD), or just pull the battery connector (square logger).

It is **HIGHLY** recommended that when taking the SD card out of the logger and putting it into a PC/laptop to extract the data, that the SD card be inserted into an SD card adapter with a "Lock" set to lock. This prevents Microsoft Windows from overwriting any data on the SD card as the Daily Diary writes the data into "free space" on the card.



Please see chapter 1 on extracting data from the SD card using DDMT.