Roost Logger Instruction Manual

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Notice for Customers in the U.S.A

Federal Communications Commission (FCC) Radio Frequency Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/television technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

CAUTION

Modifications

Changes or modifications not expressly approved by Titley Scientific could void the user's authority to operate the equipment.

Interface Cables

Use the interface cables sold or provided by Titley Scientific for your equipment. Using other interface cables may exceed the limits of Class B Part 15 of the FCC rules.

Notice for Customers in European Countries

Symbol for Separate Collection in European Countries

This symbol indicates that this product is to be collected separately.

The following apply only to users in European countries:

- This product is designated for separate collection at an appropriate collection point.
- Do not dispose of as household waste.

For more information, contact the retailer or the local authorities in charge of waste management.

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AUTHORS AND ACKNOWLEDGEMENTS

This manual was written by Kim Livengood, and Chris Corben, and Cori Lausen.

We appreciate the time, comments, and assistance provided by users and 'beta testers' for the Roost Logger and this manual. The testing and troubleshooting have improved the Roost Logger and increased the clarity of the manual.

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INTRODUCTION

The Roost Logger is a detector that passively monitors bat activity near roosts such as caves, mines, buildings and trees. Primarily, it should be used to monitor the chronological activity of bats in, or at the entrance to, roost locations. You can monitor a roost over as little as one night or for as long as a year. The Roost Logger is not intended for identifying bats to species, though the data are recorded in Anabat Frequency Division format and can be viewed using AnalookW. Acoustic identification at roost sites can be difficult because the bats are typically in very high clutter and not likely to give their most distinctive calls.

The Roost Logger is not intended for recording bat calls in open areas. Use an Anabat detector, fitted with a broadband microphone if the purpose is to identify bat calls to species. The broad-band Anabat microphone records all parts of the calls and has a much higher overall sensitivity. However, this device is not well suited to the task of monitoring a roost.

Sensitivity

The Roost Logger microphone has a peak sensitivity of about 40kHz with a decrease in sensitivity to frequencies as they get further from 40Hz. The peak is quite narrow, but appropriate for most species at roosts or in other high clutter situations, as part of their calls typically fall in the band of greatest sensitivity. It is also sensitive to a wide range of other frequencies, but as the frequency becomes further from 40 kHz, the sensitivity drops rapidly and the bat will have to be close for those frequencies to be detected. This sort of response is appropriate for monitoring roosts. Identification is not the objective, and the low overall sensitivity is good for reducing the impact of noise and echoes, and the likelihood of detecting bats outside the roost.

Weatherproofing

The Roost Logger microphone has the added advantage of being completely sealed against moisture. This makes it easy to sterilize in order to meet WNS decontamination protocols.

Deployment Duration

The Roost Logger is intended for long term deployments, where roosts are being monitored for long periods of time. We advise checking the detector periodically to ensure it is functional. We recommend you check frequently (e.g. every week) at first, and then you can reduce that once

you gain confidence in using the equipment. However, long term deployments always carry a risk of failure as so many factors can reduce effectiveness. For example, a build-up of ice could prevent the detector working for months at a time by blocking the microphone.

FEATURES OF THE ROOST LOGGER

Microphone

Locate the microphone on the outside of the logger. It is the round object on the front panel of your detector (Figure 1). The detector is in a rugged case, but the microphone should be handled with some care. We recommend you cover the microphone when the unit is not recording and especially when it is being transported (Figure 2).

Figure 1. Roost Logger microphone.

Figure 2. An example of how to cover a microphone to prevent damage.

Check LED indicator

The Check LED light is located on the front panel (Figure 3). When you first turn the power switch on, and you do not have an SD card inserted, the LED will flash to indicate that the Roost Logger is not functional (as there is no card to record data). When you have a card inserted, and the unit is powered up, the Check LED will not light. You will then need to use the magnet to check proper operation (more on that later in this manual).

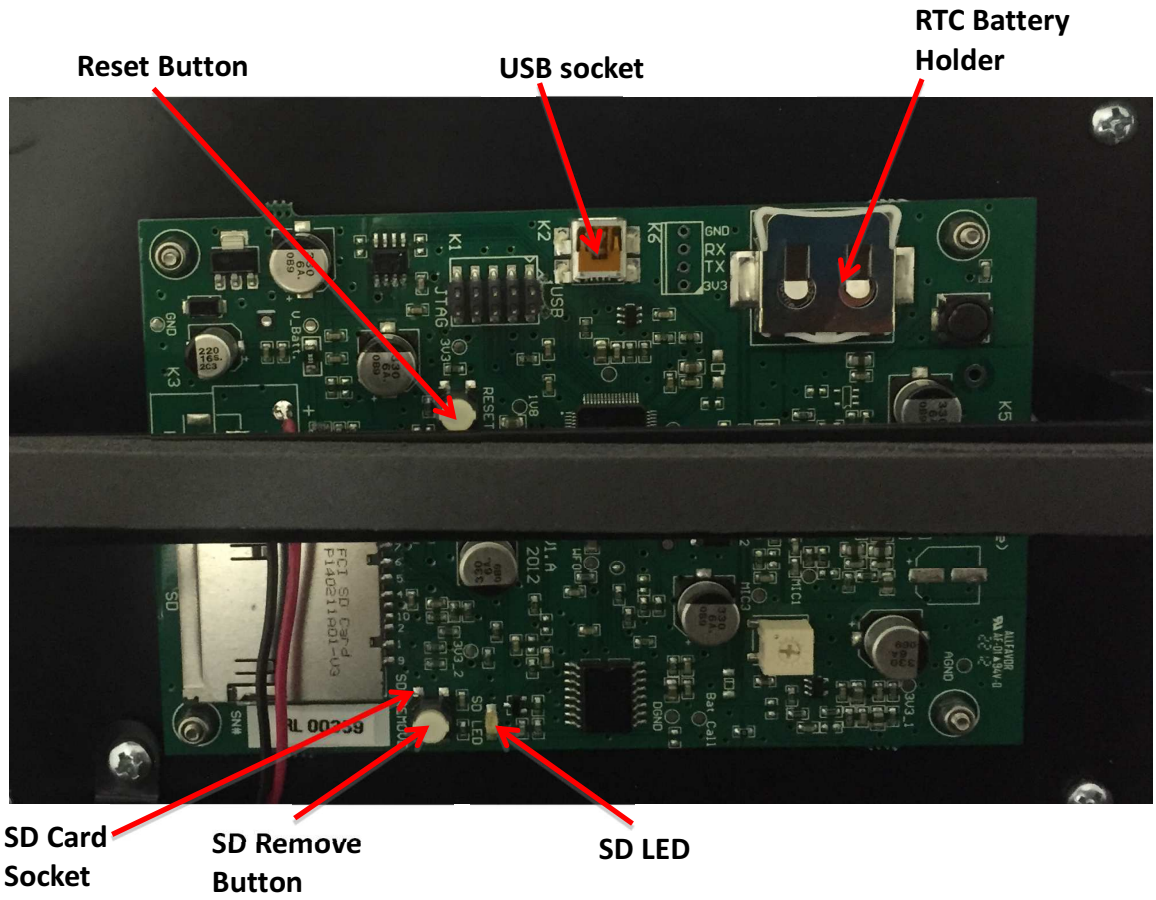
Figure 3. The check LED location is shown with a red arrow.

Internal Board of Roost Logger

There are several key parts of the internal board (Figure 4) you should be familiar with. These parts include:

- **SD LED** - Flashes fast when Roost Logger is correctly connected to PC
- **SD Remove Button** - Push for safe SD card removal, yellow light will flash then stay on to indicate removal of the card is safe.
- **SD Card Socket** - Holds SD card. The card is removed by gently pressing it further into the socket. However, ONLY remove the card if power has not yet been turned on, or if the SD LED is on after the SD remove button was pressed.
- **USB Socket-** The USB cable will plug in here to connect the Roost Logger to a computer
- **Reset Button** - To reset the Roost Logger. This should only be used if updating the Roost Logger firmware.
- **RTC Battery Holder** - Holds the battery for the real-time clock

Figure 4. The internal anatomy of the Roost Logger.



You should notice two additional items:

The magnet

This is used to activate the Check LED when the unit is operational and the lid has been closed (Figure 5). As long as the Check LED flashes briefly as the magnet is passed close to it, you can be sure the unit is powered up and working properly. For ease of use when needed, attach onto the pelican case (i.e. with zip-tie, with rubber band, etc).

Figure 5. The Magnet is used to activate the Check LED light and verify that the unit is powered up and working properly.

USB Cable

This is used to connect the Roost Logger to a PC. The main use for this is to set the internal time in the Roost Logger.

BATTERY INFORMATION

There are two main battery options for your Roost Logger: lithium and alkaline. Regardless of which of these battery options you choose, keep the following two things in mind:

1. Internal batteries must provide roughly 5-7.5 Volts to operate
2. The higher the amp-hour rating, the longer your sampling period will last

Therefore, the battery you choose will depend on how many amp-hours (total energy) you want the batteries to provide your roost logger.

Option 1: Lithium batteries

If you use lithium batteries, you will only need TWO lithium D cell batteries. This is because each battery has 3.6V (3.6 x 2 = 7.2V). The two lithium batteries should be placed on the left side slots, below the power switch. The power switch should be switched to the left to power up the Roost Logger (Fig. 7). You can use AA lithium batteries with an adapter, but you will need four because they are 1.5V.

Lithium batteries are more expensive to purchase than alkaline batteries, but they are the best option for cold weather (They can be used down to -20° Celsius). They are also lighter weight. Do not use 4 of the 3.6 V cells. Although the extra voltage will not damage the Roost Logger, there is no possible benefit and the extra two cells will be wasted.

Examples of lithium batteries and their amp-hour ratings:

1. Standard lithium (Li-Thionyl Chloride) batteries – 17 AH
2. High capacity lithium D batteries=19 AH
3. Lithium AA batteries – 3 to 3.5 AH (each is 1.5V) so you would need four batteries with this set up (***low amp-hours if you do this)

Keep in mind:

- A battery rated at 17AH can deliver a 1 amp current for up to 17 hours.

- Expect about 40% decrease in AmpHour capacity of batteries at ~ -1oC
- Expect about 60% decrease in AmpHour capacity of batteries at ~ -7oC

Figure 6. Examples of lithium batteries that can be used with Roost Logger.

Figure 7. A Roost Logger set up with two lithium batteries, switch turned to the left.

Option 2: Alkaline batteries

If you use alkaline batteries, you will need four batteries because each has 1.5 V and you need 5-7.5 to power the Roost Logger. Alkaline batteries do not perform as well in cold temperatures, but they are lower in cost than lithium batteries. Place 4 alkaline batteries in the Roost Logger, and toggle the battery switch to the right to power up the Roost Logger (Figure 8). Make sure that you know the amp hours of the batteries that you are using. Some cheaper D cell batteries have a low amp hour capacity.

Examples of alkaline batteries and their amp-hour ratings:

1. Long-lasting alkaline D batteries (ex. Max, Ultra)= 19 Ah
2. Standard AA alkaline = 1-2.5 Ah each

Remember that when batteries are placed into the Roost Logger they are done so in SERIES, as such, the voltages sum (e.g. 1.5+1.5+1.5+1.5 = 6 V), but the amp hours remain the same. So, if an alkaline D battery is rated at 8000mAH (ie. 8 AH), then 4 of them in the RL will still have a capacity of 8AH, but will provide 6 volts.

Figure 8. Alkaline batteries with the switch turned to the right.

SAMPLING STRATEGIES

Sampling Strategies specify the times when the Roost Logger will try to record bats. There are many possible strategies for deploying your detector to suit the needs of your project. One option is to let the Roost Logger record constantly, 24 hours a day. If you want to monitor over the long term, you will have to replace the batteries every time they drain. However, if you wish to save battery life and therefore trips to replace batteries, there are various options to suit your needs. However, you choose to sample, you must set the options using the Sampling button in CFCread (see below).

Capacity Farming

This is a strategy that allows for recording over a long period of time by reducing the proportion of time actively sampling. The goal is to ensure there will still be battery power and card capacity at the end of the desired run time.

There are three parameters controlling capacity farming:

- **Run Time**: this is the total time period over which you want to sample (eg: 3 months)

- **Daily Sampling Time**: the total time the detector will be monitoring each day (eg: 2 hrs/day). Note that this can change due to variation in day length.
- **Duty Cycle:** the proportion of the daily sampling time which can actually be used in order to ensure the total desired run time can be achieved. This is worked out on a five-minute basis, and is the proportion of each five minute time slot which will be available.

For example, a battery providing 10 AH of capacity should run for 54 days of continuous recording. If the desired run time is greater than 54 days, then capacity farming will reduce the duty cycle accordingly. So, if desired run time is 108 days, the duty cycle would be 50% which is 150 seconds per 5 minutes. If the data rate is very high, that duty cycle could be reduced further. If 30 MegaBytes of data was recorded each day (an extremely high rate!), that would result in the loss of a further 3% in duty cycle, so 47% would be achieved.

Also note that the card capacity is farmed out in a similar way. A 2GigaByte card used over 6 months would allow a total of 11 MegaBytes per day, so if the data rate exceeded that, there would be a further reduction in the duty cycle to ensure that a minimum of 11 MB was kept available for every day of the 6 months run time. Please also note that although 8 GB cards or higher can be used, only up to 4 GB of data can be stored.

Capacity farming is calculated automatically by CFCread. You tell it your desired run time, the battery capacity and what times of the day and night you wish to record, and an appropriate sampling strategy will be worked out. You will be told the duty cycle which is attainable. You can vary that as desired by varying the run time or the amount of recording desired in each day. If appropriate, recording only at night will roughly double the run time available, though this depends on your latitude and the time of the year.

For studies on white-nose syndrome:
White-Nose syndrome often causes bats to fly during the day, which is very abnormal behavior. To monitor for such indications of infection, you would want to record all day, and probably all night as well to provide a baseline of more normal activity. So set the detector to sample continuously day and night and to run for as long as required. The duty cycle will be set accordingly; ensuring that there will be some sampling every five minutes and any pattern of diurnal emergence should become clear.

For studies to determine bat activity in mines:

If the objective is to determine if bats are using a mine, the best strategy would be to monitor all night. That way, any emergence of bats after sunset would be detected, as would any ingress of bats using the mine as a night roost or swarming site.

For studies on long term temporal patterns of bat activity at roost:

If you are interested in variance in bat activity across seasons and need your detector to last a long period of time. If it is known that most activity will be associated with bats leaving the roost, it would be best to set the Roost Logger to sample just for the first two hours after sunset. However, if patterns of use are unknown, it might be best to sample all night, and tolerate a reduced duty cycle. Patterns of use should still be made clear.

START UP INSTRUCTIONS

Power up: place batteries in the Roost Logger without an SD card. Turn the power switch above the batteries to select which batteries you are using (switch to the right for Alkaline, to left for Lithium). Outside LED light should be flashing slowly.

Connect the Roost Logger to the PC via a USB connection (Fig 9). The outside LED light should stop flashing, and the SD LED on the inside panel should be flashing yellow fast. The Roost Logger is now connected to the computer.

Figure 9. Location of USB port on Roost Logger.

STEPS FOR DRIVER INSTALLATION ON ROOST LOGGER

Before use, Anabat Suite must be loaded onto your computer so that the cable can communicate with Roost Logger. This only needs to be done once per computer. There is no CD. You can download all the necessary software and drivers online.

Go to www.titley-scientific.com/us/ click “DOWNLOADS”, click “SOFTWARE AND FIRMWARE” and install the Anabat Suite. This program allows USB connection to the Roost Logger Firmware Update USB driver. The driver is only needed for firmware updates. Please see document titled “Anabat Suite” for installation instructions. If you have previously downloaded and installed Anabat Suite, there is no need to re-download the program. Always check to ensure you are using the most up to date version.

You will also need to download CFCread and AnalookW. The CFC program is used to set the time on the Roost Logger. The AnalookW program is used to view and analyze the data.

If this is your first time installing the program, remember where you saved it!

STEPS TO PROGRAM/INTIALIZE THE SD CARD

Choose an SD Card (up to 4 GB of space can be used on an SD card no matter what its actual size, use ones that say “slow” or class 4 or lower.

Figure 12. Example of SD Card that can be used with Roost Logger

How to initialize an SD card

1. Insert the SD card into the computer using the built in SD card reader or a SD card reader adapter.

2. In “My Computer” select the card and right click to FORMAT. Select Fat32 and Quick format. Click OK/START. You can do a full format but it might take a very long time.
3. Open CFCread program.
4. Choose Input File and locate/select the SD card you just formatted.
5. Click ‘INTIALIZE CF’ then click YES – (this may take some time)
6. To program the SD card, Open CFCread and Choose input file. Then Click “Erase”, if SD card was previously used, then click sampling
7. Decide what sampling regime you want, and set up run/sampling time.
8. In CFCread, click “SAMPLING” in Roost Logger Only Box
9. Select RUN TIME (how long you want to sample for)
10. Select SAMPLING TIME (see 'Sampling Time Options' section for details on how to choose an option best suited for your project needs).
11. Programmed Sampling Table will adjust to meet this goal by subsampling
12. The RL will record longer than this period if there is still battery life and card capacity.
13. If needed, enter your latitude and longitude (in decimal degrees), which you can get online from websites such as mygeoposition.com. In the US, latitude should be a positive number and longitude should have a (-) sign before the number.
14. Select the amp Hour rating (see battery information of manual).

Note on estimating Amp Hours:

You are FAR BETTER OFF underestimating Amp Hours if it is important that the Roost Logger lasts for the duration of the desired recording (run) time (e.g. 6 months).

The Roost Logger will strive to have the batteries last as long as the desired sampling timeframe (e.g. 6 months). To do this, CFCread will program the Roost Logger to ‘subsample’, if necessary, in each 5-minute period to extend battery life through the desired time period. You will know if you have exceeded the system’s power capacity (or potential card space) and must therefore subsample by taking note of the % Net Sampling Ratio.

How to interpret the net sampling ratio:

Example: You want to have the Roost Logger sampling for 1 month, for the first 2 hours of the night. You select this from the menu in CFCread, and also a battery capacity of 13 Amp Hours.

Net sampling ratio says 100%. This means:

The two hours per night for which Roost Logger is running will be broken down into 5-minute intervals, and the data logger will record data for 100% of those 5 minutes. If net sampling ratio said 50%, that means the Roost Logger would record for 2.5 minutes of each 5-minute interval.

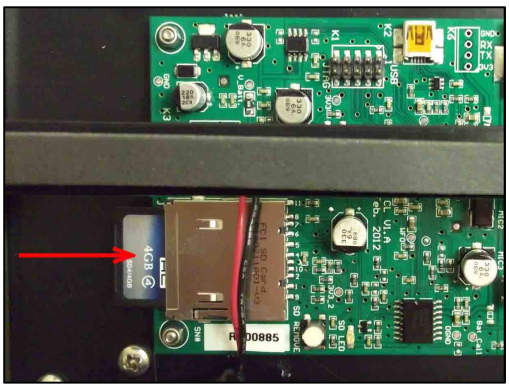
Choose folder for where to save CFC log files. Select a location for the log (sampling table info) to be stored as a text file.

Optional: In CFCread main screen, check to make sure the card has a sampling table programmed on it. Click CHECK CARD. Look for "Card has Sampling Table" (Fig 13). Your CF Card is not programmed.

Figure 13. An example of programmed CF SD card with a sampling table.

Make sure the red LED light is flashing (on front), shows batteries are all in place. Insert an SD card in the Board (Figure 14). Yellow LED light will flash twice briefly to indicate SD card sampling table has been read. Red Light on front will stop flashing.

Figure 14. Location of where SD card should be placed.



Close lid of case, red light should NOT be flashing. To confirm that the Roost Logger is active, hold magnet close to LED. The light will flash red briefly if there is power. If you are checking during a recording period, red light will flicker if data not being recorded. Red light will stay on continuously if data is recording at that moment. If no light, there is an issue.

If Roost Logger LED is not lighting up:

Eject the SD card by pressing the SD remove button. Disconnect power by turning the switch to off. Remove SD card. Reposition batteries and make sure all are engaged. Red light will flash if it is has power again. Reinsert SD card, yellow light on inside panel will flash if SD card is recognized as already programmed. If no flashes, check card in CFCread to see if it has a sampling table. Retest with magnet on LED light on front panel.

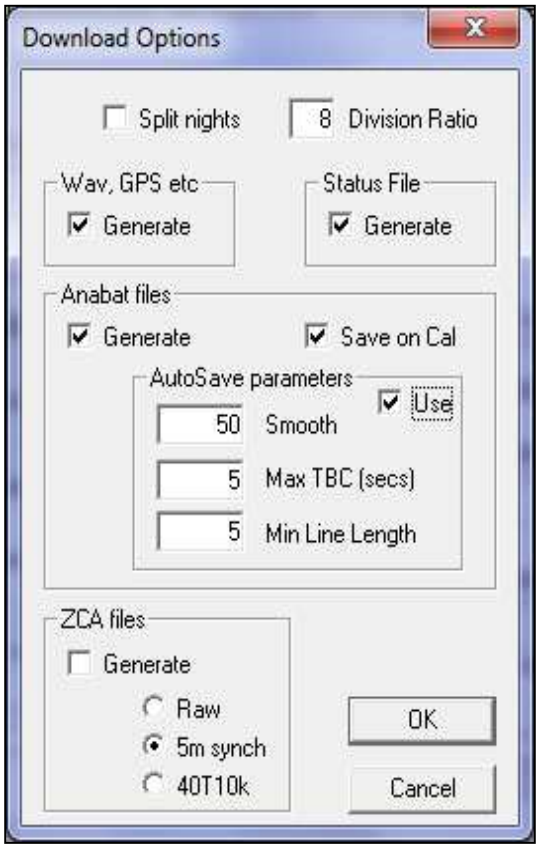
NOTE: Never remove SD card while RL has power. Push the SD eject button, and disconnect power by turning the switch to off.

DOWNLOADING DATA

1. To eject SD Card, push SD eject button and see yellow light flash showing you can eject the SD card.
2. Put SD card into computer.
3. Open CFCRead program.
4. Choose input file.
5. Select the SD card.
6. Select Download
7. Indicate folder to which you want to save data (can make new one).
8. Keep all defaults as seen in Figure 15. “OK” it.

Choose Split Nights if want subfolders of each night of recordings. To store new data, you can create new folder from CFCRead.

Figure 15. The CFCRead program interface used to download data from the Roost Logger.



After download complete, files can be viewed in AnalookW, a program downloadable on our site.

ROOST LOGGER PLACEMENT

The bats you would like to record must be close to the detector. Specifically, if the bats are flying in and out of a roost, they are most likely to be detected if they are between 1 and 5 meters from the detector. At closer range, they might be echolocating so quietly that they are hard to detect anyway. At greater range, they might be hard to detect because they are too far away. However, all this depends on a number of factors.

The Roost Logger microphone is rather directional. This means it needs to be pointing roughly towards where the bats are flying. The axis of greatest sensitivity is straight out from the face of the microphone. The closer a bat is to some structure, the quieter its calls will be. Therefore, ideally you want to be monitoring a place where the bats are not flying right up against a wall or the ground. For example, if the bats are flying along a tube 1 m in diameter, it will make a difference whether they are flying through the middle of the tube or along one edge of it. If the

tube is small, you may well be best off trying to monitor the bats as they emerge from the tube into a more open situation. However, bats emerging into the outside before it is dark often keep very close to edges and vegetation and that could make them hard to detect.
It follows that bats flying through a constriction (a bottleneck) in a cave or mine may be hard to detect even though you can be sure to get close to them. It may be more effective to try to detect them as they emerge from the restriction or approach it from a more open place.
If the bats fly close to structures which are far from the detector, that will make them very difficult to detect. If bats tend to hug the wall of a cave, for example, the best chance of detecting them will be to get close to where the bats are actually flying.
It is generally easier to detect a bat coming towards the detector than when it is going away from the Roost Logger. It is generally easier to detect a bat from below than from above if it is flying horizontally.

If bats emerge from a small opening, such as a crevice or a small hole, they may not echolocate much initially as they launch straight out into the open. However, they are likely to echolocate more conspicuously as they approach the opening from the outside when returning to the roost. In such a case, it would likely be best to place the Roost Logger close to the opening but facing a point just outside the opening. Most likely, bats in such a situation will produce quite different call types when they are close to the roost entrance, and these calls would help distinguish a bat in that situation from one free-flying in the vicinity of the roost but not necessarily associated with the roost. Dripping or flowing water can generate a lot of ultrasonic noise. If water seeps or flows smoothly, without any turbulence, this will not be a problem. If the surface of the water is broken and causes any splashing, the result will be a lot of noise. so, if there is any splashing, that will make a lot of noise.
Be aware that a Roost Logger exposed to the weather in winter may collect ice, which could block sound from the microphone.

Every situation is different, and different species will behave differently. Therefore, familiarity with a given roost, or a species of interest, would greatly help understand how to place the Roost Logger. Ideally, the researcher should test different deployments at a roost to see what works best prior to the survey.

Some general points to be aware of when placing a Roost Logger:

- Avoid the risk of things falling on the Roost Logger

- Avoid the risk of the unit being flooded. Even tiny streams can grow dramatically as a result of heavy rain.
- Always place the Roost Logger in a dry place and avoid sites where contamination is likely from animal dung or bird droppings. These can cover the microphone and greatly reduce its sensitivity.
- It is usually best to elevate the detector off the ground if possible. Be aware that animals taking refuge in a cave or mine might interfere with it. Check your surroundings for objects that may produce extraneous noise, such as dripping water, and move the detector into a location that is less likely to pick up unwanted noise.
- If in an area with pack rats, we advise you to minimize their potential damage by suspending the detector with a wire or enclosing in a security box. They can eat through the cases.

The roost logger has a built-in temperature logging capability, so if you intend to use temperature data, consider what temperature is being measured. Microclimates can vary greatly along the length of a cave or mine, especially near the entrance.

SAFETY/ANTI-THEFT

A padlock may be used to lock lid and chain detector to something to prevent animals or human tampering. You may want to put 'notes' on the roost logger to let people know that it has no value to them, or add a contact name, address and phone number. Additionally, you can use a Titley Roost Logger Security Box to secure your Roost Logger to prevent damage caused by rodents. The Security Box may be padlocked and chained to objects. Please see our website for additional details.

CARE/CLEANING/DECONTAMINATION OF ROOST LOGGER

Can be fully exposed to the weather, BUT be careful with the microphone and ice buildup. Rain may mask bat calls and create unwanted noise in the sample on the SD card. The detector may experience some condensation due to vent that equalizes air pressure of outside the roost logger to inside.

There are several ways to decontaminate your detector. The easiest way is to wipe it down in accordance with white-nose syndrome protocols. Please refer to online resources such as the https://www.whitenosesyndrome.org/topics/decontamination for current protocols. You can also

decontaminate your detector by immersing the roost logger in water at 50 degrees C (122 degrees F) for 15 minutes. You should see bubbles leaving the roost logger vent to ensure the pressure in the Roost Logger is sufficient and no water is being sucked back inside logger (so water must be hot!)

DON'T FORGET

- Check to make sure the Roost Logger time is set correctly
- As firmware is upgraded, you will need to upgrade yours!
    - If your firmware is out of date, you will need to copy the “Roost Logger Firmware Upgrade Pack” to your PC hard drive and extract.
    - Power up Roost Logger without SD card. The front LED will flash. Plug the USB cable from the PC into the Roost Logger. The front LED will go off, and the SD LED will flash fast.
    - To place the Roost Logger in update mode: Hold down the SD remove button and then press the reset button. The SD LED will turn off. Release the SD remove button.
    - Now run “Program RL1.cmd” from the Firmware Upgrade Pack, and follow the on-screen prompts.