



# Anabat Swift Bat Detector

## User Manual

Titley Scientific

Version 1.5



**TITLEY**  
S C I E N T I F I C

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This manual was written by Julie Broken-Brow. We greatly appreciate the time, comments and assistance given by those people who were 'beta testers' for the Anabat Swift and this manual. The testing and troubleshooting have improved the new detector and increased the clarity of the manual.

## DOCUMENT HISTORY

Manual Version	Release Date	Firmware Version	Major Additions and Changes
1.0	5/06/2017	0.9	-
1.1	28/09/2017	0.15	Schedule mode, SD Card sizes, Constant recording
1.2	8/02/2018	0.16	Low Power Indicator, Extension cable recommendations
1.3	28/03/2018	1.0	Corrected recording mode description
1.4	12/7/18	1.1	Weatherproofing instructions for electrostatic build-up
1.5	24/08/2018	1.2	Microphone connection warning

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## **FEATURES OF THE ANABAT SWIFT**

The Anabat Swift is designed for low power and efficient operation in a compact, weatherproof and easily-concealed case. It can be used anywhere and is extremely fast to deploy and download. It uses a weatherproof microphone, which can be plugged directly into the case or via an extension cable. The Anabat Swift is designed for passive monitoring. Some of the key features of the Anabat Swift include:

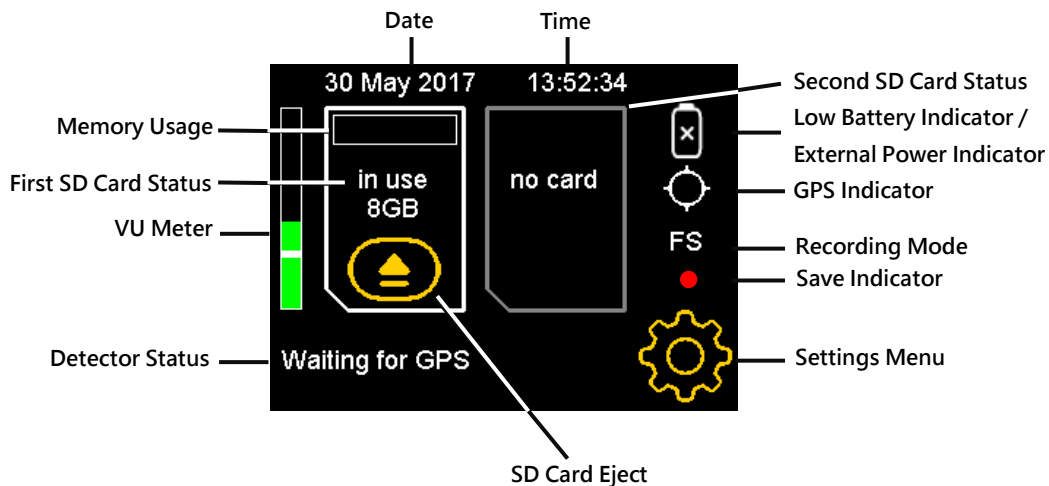
- Choose between Full Spectrum and Zero Crossing recording
- 500 and 320 ks/s sampling rates
- Built-in GPS
- Automatic Night Mode scheduling
- Two SD Card Slots
- Uses 4 or 8 AA batteries, or external power supply
- GPS Transect Mode
- 30 nights full spectrum recording using AA batteries
- Headphone audio output (frequency division)
- Colour touch screen display for easy & intuitive user experience
- Light weight, compact design

## GETTING STARTED

### USER INTERFACE

Inside the Anabat Swift camouflage case is the control panel and basic instructions on use.





If you are working in extremely cold environments, you can deploy the detector without using the touchscreen.


## SD CARDS

The Anabat Swift uses up to 2 SD cards for data storage. The detector can use SDHC and SDXC memory cards. Memory cards can be purchased from Titley Scientific, or most electronics/office stores. SD Card 1 is used until it becomes full, then the detector will automatically begin using SD Card 2. Titley Scientific recommends the Sandisk® brand of SD cards due to their performance and low power consumption.

To check the status of an SD card:

1. Insert the SD card/s into the slots until they click into place, as per the orientation shown on the control panel diagram.
2. The detector will state 'Checking' while reading the card, this may take a moment.
3. The total storage capacity of the card will be listed and the amount of memory already used will be displayed as a green bar graph.

To remove an SD card:

1. Press the "eject" button  on the screen corresponding to the SD card you want to remove, or power down the detector. **Do not remove the card without completing this step** or the data on the SD card could become corrupted.

2. To physically remove the card, gently press it further into the slot, you will hear a click and the card will be released.

## USB CABLE




The Anabat Swift comes with a USB cable for connection to your computer. You can use this cable to upgrade your firmware using Anabat Insight (see **Software**).

## MICROPHONES

The Anabat Swift supports a range of microphones, including omnidirectional and directional types. All microphones have the following features in common:

- Integrated pre-amplifier with differential output to allow use on long extension cables and provide good immunity to electrical interference.
- Weather-resistant - Please be aware that water collecting on the microphone will block sound until it dries out again. If recording is required during rain the microphone should be mounted in such a way so that water cannot land on the microphone element. For more information, please refer to **Weatherproofing Considerations**.
- The Swift is supplied with a 1.5m extension cable for mounting away from the detector. Longer extension cables are available for purchase from Titley Scientific. Cables can be daisy-chained if required.

## POWER REQUIREMENTS

The Anabat Swift can be powered internally via 4 or 8 x AA batteries, or with external power. The **Low Power Symbol** will appear  when the battery voltage is low. **The detector switches itself off** when it drops below a usable voltage (3.8V/7.6V). When connected to external power, the low voltage shutdown can be user defined. If the battery symbol is  you should change the batteries immediately. All AA batteries must be removed from the battery holder when they are not in use; otherwise the batteries will slowly discharge and may leak, damaging the detector. When the detector is powered by external power, the **Power Symbol** will appear as a plug 

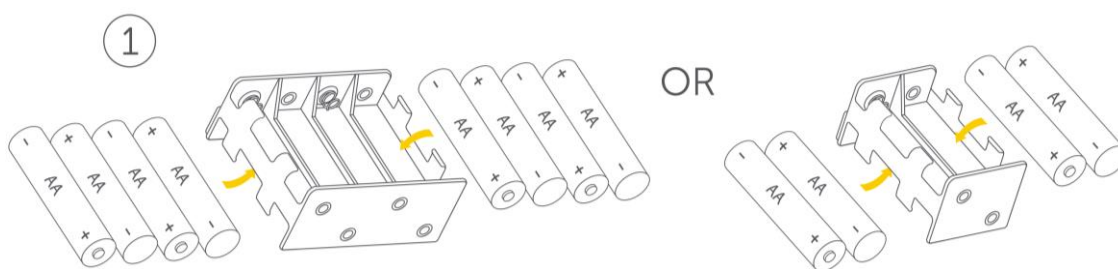
The following tables show the typical power consumption of the Anabat Swift. Power consumption when recording ZC files is lower.

Full Spectrum Power Consumption of the Anabat Swift		
Recording (no bat activity)	Recording (bat activity)	Asleep
20-60mW	160mW	1mW

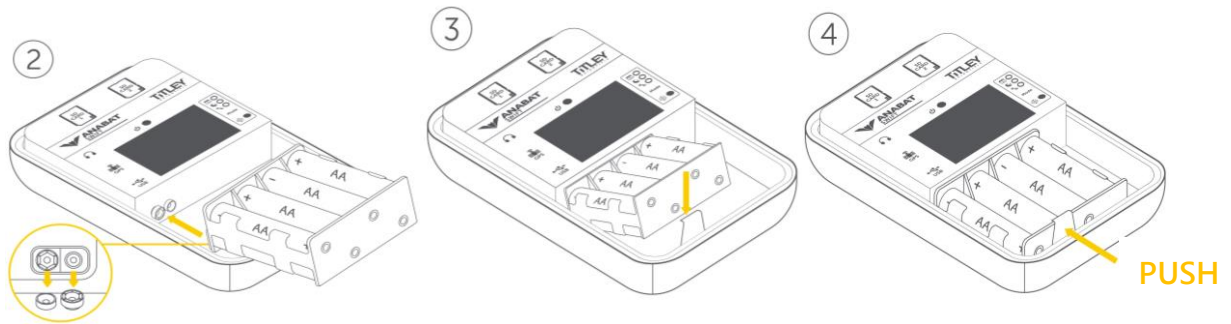
Zero Crossing Power Consumption of the Anabat Swift		
Recording (no bat activity)	Recording (bat activity)	Asleep
20-50mW	65mW	1mW

AA batteries can be Alkaline, NiMh rechargeable, or Lithium (1.5V). Make sure all batteries are fresh and of the same type. You can use either the 4 cell battery holder or the 8 cell, depending on your required deployment time. Battery life will depend on the condition and type of batteries being used, as well as ambient temperature, length of your recording session and amount of bat activity & ambient noise. Eight alkaline AA batteries **typically** last for 4 weeks of full spectrum recording (10 hours recording per night), four batteries typically last two weeks. However in practice recording conditions can vary, so be conservative when using battery life estimates to avoid the loss of sampling time should the batteries run out before you expect.

Insert the required number of batteries into the battery holder (4 or 8) and then tilt it into position (see diagram below). Ensure the terminals are properly connected and the battery is clicked into the clip. **Do not remove the batteries without turning off the detector first** to avoid potential SD card corruption.







The Anabat Swift can be powered from a 6V or 12V external power source. **Remove the AA batteries when using external power.**

There is also an internal clock battery which should only need replacing about every 5 years. This is a CR2032 Coin Cell battery and can be purchased from Titley Scientific, or from battery shops.

## STORAGE REQUIREMENTS

The amount of storage required for a given deployment time depends on the file type used, sample rate, and the amount of ultrasonic sound activity.

**Full spectrum 500ksps** – 3.6GB per hour of recorded sound

**Full spectrum 320ksps** – 2.3GB per hour

**Zero Crossing** – 0.02GB per hour

During a typical night of full spectrum recording 1 - 3GB of files per night are recorded. However, if there is a high level of bat activity, wind, or rain the detector could easily record several gigabytes of files in a single night. Keep this in mind when choosing SD card capacity.

## ANABAT SWIFT BASIC OPERATION

The Anabat Swift is designed for fast and easy deployment. Before you start recording with your detector you must set your current timezone (see [Setting the Time Zone](#)). The clock

will be automatically set when the GPS obtains a signal. We also highly recommend you check for firmware updates (see [UPDATE FIRMWARE](#)).

To begin:

1. Insert an SD card with sufficient memory for your recording period and fresh batteries or plug in external power. Ensure the SD card is correctly orientated as per the diagram on the control panel when inserting.
2. Remove the microphone socket dust cap from the microphone socket on the front of the case. The microphone socket dust cap can be stored inside the carry case so it isn't lost.
3. Remove the microphone from inside the carry case and connect it to the microphone socket on the front of the detector. To connect it, gently insert the microphone into the microphone socket (there is a keyway to ensure correct alignment) and rotate the knurled ring clockwise to tighten the connection finger tight. **Do not turn the body of the microphone or over-tighten the connector. Over-tightening or twisting the microphone housing can cause damage.**

**For best results we recommend you mount the microphone on the supplied extension cable away from flat surfaces, especially if you plan to record in full spectrum. This is to minimise echoes and promote clearer recordings.**

## **TURNING THE DETECTOR ON/OFF & SLEEP**

Turn the detector on by pressing the **Sleep/Power** button. There are three recording modes which you can choose from: schedule, night only and continuous. For most surveys, the night only recording mode is recommended. These are selected by pressing the **Mode** button.

To send the detector to sleep, briefly press the **Sleep/Power** button; it will count down for 5 seconds before going to sleep. In sleep mode the screen will be off, but the detector will still record. To turn the screen back on, briefly press the **Sleep/Power** button again.

To turn the detector off, first wake the detector up by pressing the **Sleep/Power** button, then press and hold the **Sleep/Power** button for 5 seconds. The detector will shut down and no recording will occur. It is now safe to remove the batteries and SD cards.

## UPDATE FIRMWARE



To update the firmware, you will need the most current version of **Anabat Insight**, and if you are using a Windows PC you will also need to install the **Anabat Swift USB driver package** (both are available from the Titley Scientific website). You can subscribe to receive email alerts of new Swift firmware updates using this website: <http://eepurl.com/cSS6Mf>


1. Ensure the detector has fresh batteries installed and is turned on
2. Connect the detector to the computer via the USB cable.
3. Open **Anabat Insight**.
4. On the Anabat Insight menu bar, click **Devices**, then **Swift**.
5. Click **Download** to get the latest firmware version.
6. Once the update is downloaded, click **Start**. The detector will then be updated.
7. When the update is finished, unplug the USB cable and restart the detector by removing then reinserting the batteries.

## NIGHT ONLY RECORDING MODE

The night only mode is designed for efficient deployment. This recording mode will turn the detector on 30 minutes before sunset and off 30 minutes after sunrise. If the detector is left on, this mode will continue to record nightly until the batteries run out or the SD cards become full. Night only mode will only work if a GPS fix can be acquired on the deployment day, as the detector automatically calculates the sunset and sunrise times based on the longitude and latitude of the GPS location.

To select this recording mode:

1. Press the **Mode** button until the  **Night Only LED** is lit.
2. Place/hold the detector where there is a clear sky view, with the microphone facing skywards.
3. Wait for the **Check LED** to stop flashing. The detector will automatically try to acquire satellites to obtain a GPS fix. While acquiring satellites, the detector will state 'Waiting for GPS' at the bottom of the screen and the GPS Symbol will be .




Once a GPS fix is made, the **Check LED** will stop flashing, and the GPS Symbol will change to . The GPS fix will automatically set the clock, record the GPS location and determine the sunset/sunrise times. The recording start time will be displayed at the bottom of the screen.

4. While the case is still open, rub your fingers in front of the microphone; the **VU Meter** will move to confirm that an ultrasonic audio signal is detected.
5. Once the **Check LED** has stopped flashing, you can lock the lid closed and place the detector in its final deployment location and secure. Use the magnet to check the detector is functional after final deployment (see **TESTING THE SYSTEM** below).
6. The detector will automatically attempt to acquire a GPS fix daily. If a satellite fix cannot be found, the detector will refer to the last GPS fix made. In this case, the detector will state 'The location is ... days old'. If you are moving your detector to a new location, make sure you turn the detector off and on again at the new location to ensure a correct GPS fix.

## CONTINUOUS RECORDING MODE

The continuous recording mode will record continuously, starting as soon as this mode is selected. This mode will continue to record until the batteries run out, the SD card becomes full or the detector is turned off. This recording mode is designed to be used when the detector is deployed and collected in the same recording night; it can also be used to monitor acoustic activity in roosts during the day. Please note that files will only be saved if they pass the trigger settings.

To select this recording mode:

1. Press the **Mode** button until the  **Continuous LED** is lit.
2. Wait for the GPS to acquire a satellite fix. The detector will automatically try to acquire satellites to obtain a GPS fix. While acquiring satellites, the detector will state 'Waiting for GPS' at the bottom of the screen and the GPS Symbol will be . Once a GPS fix is made, the GPS Symbol will change to . To assist this process, place/hold the detector where there is a clear sky view, with the microphone facing skywards. The GPS fix will automatically set the clock and record the GPS location.


The detector does not require a GPS fix to record in Continuous mode, however the GPS and time stamps may not be correct if this is the case.

3. While the case is still open, rub your fingers in front of the microphone; the **VU Meter** will move to confirm that an ultrasonic audio signal is detected. You may wish to change the **Sensitivity** (see [Setting the sensitivity](#)).
4. Once the **Check LED** has stopped flashing, place the detector in its final deployment location and secure. Use the magnet to check the detector is functional after final deployment (see [TESTING THE SYSTEM](#) below).

## SCHEDULE RECORDING MODE

The schedule recording mode allows you to set a custom recording schedule on the detector. You can set a schedule based on sunset/sunrise times or on absolute times. The schedule is saved on the SD Card(s) that are installed in the detector, so keep this in mind when swapping out SD cards.




To set a schedule:

1. Ensure an SD card is inserted into the detector. Press the  **Settings** button, then the **Recording** button, then the **Next 1/2** button, then **Schedule**.
2. To check for any current schedule, press **Summary**, and it will display the saved schedule (if any).
3. To erase any current schedule, press **Clear**.
4. To create, or edit, a schedule press **Edit**. Select what time recording should begin (**From**) by pressing on the **Time of Day**, then using the arrows to select between **Time of Day**, **After Sunrise**, **Before Sunrise**, **Before Sunset** or **After Sunset**. Then select either the absolute time (for Time of Day, eg. 18:00), or the amount of time from the start reference (eg. 1h After Sunset). Then follow the same process to select what time the first recording period should end (**To**). Once these times are entered, you **do not** need to press Add, the schedule is already set. You can add *multiple* custom recording periods by using the **Add** button. To delete a recording period, use the **Delete** button.
5. Optionally, you can set specific dates for schedule recording, press **Dates**. Use the arrows to select your start and end dates. You may enter a start date without an

end date to continue recording until the batteries run out or the SD card/s become full.

6. Use the **Summary** button to check your full schedule once created.


To use this schedule for recording:

1. Press the **Mode** button until the  **Schedule LED** is lit.
2. If the schedule is based on sunset/sunrise times, wait for the GPS to acquire a satellite fix. The detector will automatically try to acquire satellites to obtain a GPS fix. While acquiring satellites, the detector will state 'Waiting for GPS' at the bottom of the screen and the GPS Symbol will be . Once a GPS fix is made, the GPS Symbol will change to . To assist this process, place/hold the detector where there is a clear sky view, with the microphone facing skywards. The GPS fix will automatically set the clock for your schedule and record the GPS location.
3. While the case is still open, rub your fingers in front of the microphone; the **VU Meter** will move to confirm that an ultrasonic audio signal is detected.
4. Once the **Check LED** has stopped flashing, you can lock the lid closed and place the detector in its final deployment location and secure. Use the magnet to check the detector is functional after final deployment (see TESTING THE SYSTEM below).
5. If your schedule is based on sunset/sunrise times, the detector will automatically attempt to acquire a GPS fix daily. If a satellite fix cannot be found, the detector will refer to the last GPS fix made. In this case, the detector will state 'The location is ... days old'. If you replace the batteries, or turn the detector off for any reason then you must make sure you allow the unit to get a GPS fix, or the sunset/sunrise recording won't work. If you are moving the detector to a new location you should turn the detector off, and on again at the new location to ensure a correct GPS fix.

## CONSTANT RECORDING MODE

The constant recording mode will record all noise constantly (without triggers) in whichever scheduled recording mode is selected (Night Only, Continuous, or Schedule). This experimental mode requires an SD card with fast writing speed, minimum of Class 10 80MB/s.

To select this recording mode:

1. Press the  **Settings** button, then press **Trigger**, then **Next 1/2**. Select **Constant Rec**, and then press **On** so it is highlighted in yellow.
2. To turn this mode off, press the **Off** button so it is highlighted in yellow.

**In any mode, do not deploy if the Check LED is flashing, as this means there is an error or problem & recoding will not occur. See TROUBLESHOOTING for resolving problems.**

## TESTING THE SYSTEM

There are a number of ways to test the system.

- To test the microphone before deployment, open the camouflage case, wake the detector and rub your fingers in front of the microphone; the **VU Meter** (on the control panel) will move to confirm that an ultrasonic audio signal is being detected.
- To listen to the microphone signal, open the camouflage case and plug in your headphones. Wake the detector and turn on the audio (see Turning on Frequency Division (FD) Audio), rub your fingers in front of the microphone; you should be able to hear the ultrasonic audio signal in frequency division.
- To test the operation of the detector while the camouflage case is closed, after deployment, place the magnet (at end of lanyard) next to the **Check LED** (on outside of case); a brief flash indicates unit is working. Hold the magnet next to **Check LED** and rub fingers near the microphone. The LED flickering faintly confirms that ultrasonic audio signals are being detected.


## COLLECTING THE DETECTOR

Best practice is to take the detector to a clean, dry place out of the weather. Then dry it off as best as possible if it is wet. If the unit is taken inside, there could be a large temperature difference, let it equilibrate to room temperature before opening the case. A cold detector




opened in a warmer place will often result in a film of water condensing over the electronics. Make sure the inside of the case is completely dry before closing the lid.

To turn the detector off, simply open the camouflage case, press the **Sleep/Power** button once to wake the detector, then press and hold the **Sleep/Power** button for 5 seconds. If the detector does not respond to the power button the batteries may have gone flat. Remove the microphone, **do not turn the body of the microphone (twisting the microphone housing can cause damage)**, and external power cable (if used) from their respective sockets and store inside the carry case for storage and transport. Replace the microphone and power dust caps onto the microphone and external power sockets. Remove the SD card to download the data to your computer. Remove AA batteries for long storage periods. **Do not remove the SD cards without first turning off the detector or pressing “eject” on the touchscreen**, otherwise the SD card data could be corrupted.

## SETTINGS

To access the **Settings Menu**, tap  on the control panel.

## TRIGGER

To access the **Trigger Settings** menu, tap on , and then press **Trigger**. You will be able to change the sensitivity, minimum event time, recording window, minimum frequency, and maximum frequency. To access the second page of trigger settings, tap **Next 1/2**. To return to Settings Menu tap , to return to the home page of the control panel, tap .

### Setting the sensitivity

To set the sensitivity, ensure the microphone is plugged in and tap on **Sensitivity**. The **VU Meter** will be displayed (see below), the **VU Meter** indicates the sound being detected by the microphone and can be used to set the sensitivity against ambient noise. The bar will move to indicate the intensity of noise input and will turn from red to green when the sensitivity would cause triggering to occur.



Not Triggering

16



Triggering



To change the sensitivity, tap on the **VU Meter** where the trigger point should be (left to increase, right to decrease sensitivity), or press the arrows on either side of the **Sensitivity** number. A higher number is more sensitive. A typical sensitivity value is 16. It should be noted that the noise level when deploying may be different to when you are recording and this should be kept in mind when setting the sensitivity.

### **Minimum Event Time**

This is the minimum duration sound that will trigger a recording. You can set this to the minimum duration bat pulse to be recorded. A recommended minimum event time is 2ms. To change this, tap on the **up** and **down arrows**.

### **Recording Window**

Also known as a Trigger Window. This is the minimum amount of time recording will continue after a trigger event. Set this to be longer than the shortest time between bat pulses you want to record. This will prevent a bat pass being broken up into multiple files. Note a file reaches the maximum length specified in the **Maximum File Time** it will be ended and a new file started. A recommended recording window is 2s. To change this, tap on the **up** and **down arrows**.




### **Minimum Frequency**

This is the minimum frequency that can create a triggering event. Any sound below this will not trigger a recording. A recommended minimum frequency is the lowest echolocation frequency you expect to record. To change this, tap on the **up** and **down arrows**. The default value is 10 kHz.


### **Maximum Frequency**

This is the maximum frequency that can create a triggering event. Any sound above this will not trigger a recording. A recommended maximum frequency is the highest echolocation frequency you expect to record. To change this, tap on the **up** and **down arrows**. The default value is 250 kHz.

## RECORDING SETTINGS

To access the **Recording Settings** menu, tap on , and then press **Recording**. You will be able to change the division ratio, file type, sample rate, analog filter and maximum file time. To access the second page of recording settings, tap **Next 1/2**. To return to Settings Menu tap , to return to the home page of the control panel, tap .

### Changing between Full Spectrum (FS) and Zero Crossing (ZC)

You can choose to record in either full spectrum (FS) or zero crossing (ZC). ZC requires very little memory compared to FS, however FS files contain more acoustic information. A FS file can be converted or viewed in ZC after recording. The selected mode will be shown on the home page of the control panel under . To change the mode, go to the recording settings menu, tap on **FS/ZC**. The selected mode will be in yellow, tap on your preferred mode.

### Division Ratio

The division ratio affects the amount of data which is saved in Zero Crossing recordings, the lower the division ratio, the greater the number of data points in the resulting sonogram. To change the division ratio, tap on the **up** or **down arrow** to select between 8 and 16. Typically, a division ratio of 8 is appropriate for most situations. A division ratio of 4 is only suitable for recording very low frequency calls. A division ratio of 16 will save SD card space at the expense of recording resolution.

### Sample Rate

The recommended sample rate will depend on the highest frequency bat you want to record. The sample rate should be at least double the highest frequency bat of interest. You can choose between 500k and 320k. The selected rate will be in yellow, to change to your preferred rate tap on it. Note that higher sample rates require more storage space on the SD card, refer to the **Power and Data Storage** section.

### Analog Filter




The Analog Filter is a high pass filter that attenuates signals below 10 kHz. In typical bat recording situations, enabling this filter will reduce the number of noise files recorded and

extend battery life. It is recommended to have the analog filter **On** unless are intending to record sounds under 10KHz. The selected option (**On** or **Off**) will be in yellow.

### Maximum File Time

The maximum file time represents the maximum length of any recording and can be up to 20 seconds. When a recording is triggered, the detector will record files up to the specified number of seconds in length before starting a new file. To change the maximum file time press the “**up**” or “**down**” arrow.

## SYSTEM SETTINGS

To access the **System Settings** menu, tap on , then press **System**. You will be able to change the time zone, check the detector status and select the external power cut-off. To return to Settings Menu tap , to return to the home page of the control panel, tap .

### Setting the Time Zone

It is important to set your time zone **before** recording with the detector, otherwise the date/timestamps of your files will be incorrect. To set the time zone, tap on **Time Zone** then press the **up** or **down arrow** to reach your correct time zone. Remember to account for any daylight saving time that might be in effect.




### Status

The status will display the battery voltage, external voltage, software version, bootloader version, hardware version, serial number, temperature and when the last GPS fix was made. To access this, tap on **Status** in the System Settings menu.

### Select External Power Cut-out

To protect an external power source, you can select the battery voltage at which the detector will turn off. To set the external powers cut-out, tap on **External Power** then press the **up** or **down arrow** to select the battery voltage that the detector will turn off. For a 12V lead acid battery this is typically 10.8V. For a 6V lead acid battery this is typically 5.4V.

## OTHER SETTINGS

To access the **Other Settings** menu, tap on , then press **Next 1/2**, then press **Other**. You will be able to turn on the transect mode and the frequency division audio. To return to Settings Menu tap , to return to the home page of the control panel, tap .




### Turning on Transect Mode

Transect mode will use the built-in GPS to save your track as a .gpx file by logging GPS points once per second. To turn on transect mode, tap **Transect**, then **On**, the selected option (**On** or **Off**) will be in yellow. Note that using transect mode will approximately halve the battery life.

### Turning on Frequency Division (FD) Audio

Frequency division audio can be played using the headphones. To turn on the audio, connect your headphones, tap **FD Audio**, then **On**, the selected option (**On** or **Off**) will be in yellow.

## MAINTENANCE


To access the **Maintenance** menu, tap on , then press **Next 1/2**, then press **Other**. You will be able to format the SD cards, reset the GPS location and calibrate the screen. To access the second page of the Maintenance menu, tap **Next 1/2**. To return to Settings Menu tap , to return to the home page of the control panel, tap .

### Format SD1 and SD2

You can erase the SD cards using the Format SD Card function. To do this, make sure the cards are inserted into the slots, and then tap on **Format SD1** or **Format SD2** for the corresponding card slot. **Ensure all data is saved elsewhere before formatting the card, this will erase all the data on the card.**

### Reset Location

You can manually reset the detector's saved location by taking a new GPS fix. You may wish to do this if you have moved the detector while it is on. To reset the location, tap **Reset Location**. The GPS will automatically attempt a new satellite fix, so ensure you are in

an area with a clear view of the sky. When the GPS symbol on the home page of the control panel changes to , then a new location has been set.

## Calibrate Screen

If the touchscreen becomes erratic or inaccurate, it can be recalibrated by selecting this menu option. Calibration can also be forced by removing the battery pack, external power, and the clock battery for 60 seconds. Next time the detector is powered on, it will prompt for screen calibration. Note that all settings will be reset to default if the clock battery is removed.

## WEATHERPROOFING CONSIDERATIONS

The Anabat Swift is designed as a weatherproof detector, which means the detector can be left in the field during rain, sunshine and snow without any additional weatherproofing. However if the device is left in the rain, please consider the following advice:

1. The detector is only weatherproof when the camouflage case is closed; do not open the case in the rain. Be careful not to get dirt or other contamination in the rubber seal around case, as this can allow the ingress of water into the detector.
2. Mount the microphone pointing horizontally to prevent water droplets hitting the microphone element. Such water droplets generate large amounts of noise and can block ultrasound signals from reaching the microphone until they dry out. This needs to be considered when you are analysing your data. Sensitivity can be reduced by inclement weather. **Do not let heavy rain land directly onto the microphone element.** The impact force of the raindrops can permanently damage the sensitive element, reducing its sensitivity.
3. Dry off the camouflage case and microphone before opening the detector or removing the microphone. This prevents moisture from entering the detector.
4. The detector should not be partially or fully submerged in water.
5. Desiccant satchels can be added inside the case to prevent condensation, these will need to be periodically replaced or dried.

**Windy, dry conditions can result in electrostatic build-up which may damage the microphone.** The movement of wind over an un-grounded object can build-up an

electrical charge. Ultimately, the charge will discharge along a metal conductor, such as the metal in the microphone cable. This will result in a spark which could damage the microphone or detector. **Also be aware that mounting your microphone or detector on a tall mast may attract lightning.**

To minimise the chance of electrostatic damage:

1. Isolate the detector from ground, i.e. operate it from internal batteries or make sure the external power supply doesn't have a path to ground.
2. In dry conditions avoid mounting microphones on tall non-conductive masts (inc. fibreglass and nylon), wood or metal masts are preferable.
3. Ground the microphone, either by making sure it is clamped to a properly grounded metal surface directly (metal to metal contact), or by attaching an earth wire to the body of the microphone (e.g. with a hose clamp) and then connect that wire to a grounded surface (e.g. metal mast or ground stake).

Mounting the detector and microphone this way will give electricity from static build-up or lightning an alternative path to ground.

The detector operates in a wide range of temperatures, however the batteries you use will have temperature limits; these should be considered. Most Alkaline and Lithium batteries are recommended for use between -18°C to 55°C; and -20°C to 60°C respectively. Please note that in cold temperatures battery capacity (and therefore detector run time) will be reduced. The capacity of alkaline batteries is significantly reduced in cold conditions and in these circumstances it is recommended to use 1.5V lithium batteries instead. Also be aware that if your detector is left in direct sunlight, especially inside a vehicle, the temperature inside the case may be much higher than ambient temperature and can potentially damage batteries, causing them to leak.

## DOWNLOADING DATA

### HOW TO DOWNLOAD FROM AN SD CARD

Once you have recorded the bat calls onto the SD card, you can simply transfer the files from the SD card onto your computer or an external memory source. These files can be opened directly from the SD card with Anabat Insight.

1. To begin, remove the SD card from the detector (**don't remove while detector on**)
2. Insert the SD card into your computer (if it has a SD card slot) or into an external SD card reader (available from Titley Scientific)
3. Open the SD card folder in Windows Explorer
4. Copy/cut the files from the SD card folder into the desired folder/storage device. Make sure to include the log file with the recording files.

### FILE NAMES

Log files are stored as CSV files, with extension of .csv. Files are recorded as either zero crossing, with extension of **.zc**, or full spectrum, with the extension of **.wav**. Both of these file types can be opened/viewed directly in Anabat Insight. Zero Crossings files can also be opened with AnalookW. The full spectrum files and Zero Crossings files can be opened in any software that accepts .wav or .zc files.

File names include the date and time of the recording: YEAR-MM-DD HH-MM-SS.filetype for example 2017-03-15 19-42-07.zc was a zero crossing file recorded on 15<sup>th</sup> March 2017 at 7:42:07pm.

### DIAGNOSTIC LOG FILES

The diagnostic log files contain all the information about the recording sessions on the SD card. Information such as temperature, battery voltage, GPS locations, settings and user interactions can be extracted from this file. Each log file can be opened as a text file or in a spreadsheet viewer such as Microsoft Excel.

## **SOFTWARE**

The Anabat Swift comes with a free version of **Anabat Insight**, available for download from [www.titley-scientific.com](http://www.titley-scientific.com)

Anabat Insight has the following features:

- View your files in full spectrum & zero crossing
- Use filters and scans to optimize your analysis
- Display metrics for passes and individual pulses
- View & customize metadata
- Use a project management system to keep track of your files
- Generate reports to present your analysis results
- Use built-in mapping to view your tracks & waypoints
- Export mapping data to GIS programs

## **TIPS FOR PASSIVE MONITORING**

### **POWER AND DATA STORAGE**

For short term monitoring sessions the Anabat Swift can simply be powered by AA batteries. We recommend Alkaline or low self-discharge type Nickel Metal Hydride rechargeable batteries with a capacity of at least 2000mAh. These add very little weight and may last for 30 nights depending on the length of your recording sessions, battery type and condition etc. Be conservative in your battery run time estimate because battery capacity is also affected by other factors such as temperature, and they may not last as long as expected in the field.

There is no maximum SD card memory size that can be used in the Anabat Swift. Currently SD cards can store up to 512GB of data, with two of these cards, the Anabat Swift can record over a terabyte of data.

### **EQUALIZATION**

In some situations where multiple detectors are deployed, it may be a requirement to ensure all the bat detectors being used are equalized to the same sensitivity. This is



important whenever quantitative comparisons of bat activity will be made. Levels of sensitivity will vary among detectors due to differences in age, wear and so on. Bat detectors can be equalized using a 'Chirper' or 'Chirp Board' which emits an ultrasonic signal at a constant frequency.

## **MOUNTING AND PLACEMENT**

The placement of any detector can have a significant effect on the results of a survey. It is important to consider the location and height of the detector. Detectors are typically placed in or beside a 'flyway', a corridor where bats will fly through or beside vegetation. You can place your detector anywhere bats will fly, depending on your survey goals or target species. Avoid placing the detector inside dense vegetation where bats cannot fly.

Avoid having vegetation or other objects between the detector and the bat's expected flight path, or close beside the detector, as echoes will also be recorded. The best signals will be obtained when the microphone is in the open away from other objects and pointing in the direction of the bat's expected flight path.

We recommend that the Anabat Swift is mounted vertically (refer to the section on weatherproofing) so that any rain water runs off the microphone and doesn't settle on the element. We recommend that you mount the microphone on the extension cable supplied, away from any flat surfaces (such as boxes or walls) to reduce echoes in the recordings. Also make sure that the magnetic lanyard is not being blown around in the wind as this may create unwanted noise on your recordings. It is also important to avoid surface noise, such as vegetation brushing against the detector case or microphone.

The Anabat Swift camouflage case is designed so that the device can be padlocked closed. A lockable metal security box is also available for purchase from Titley Scientific.

## **TROUBLESHOOTING**

### **Flashing Check LED**

If the Check LED is flashing without the magnet applied, it means there is one of the following issues:

- **No satellite fix:** If this persists for several minutes, move to an area with a clearer view of the sky for better satellite reception and restart the detector by turning it off, then on again. If no GPS fix can be acquired, use a different recording mode. You only need to move the detector until a GPS fix is obtained. Once a fix is obtained, you can move the detector to its intended deployment site.
- **SD card issue:** You have not inserted an SD card, the cards are full, or a card is corrupted. Insert an empty, formatted SD card.

### **Detector not turning on**

The most common reason the detector won't turn on is when the battery pack is not installed correctly, ensure you have placed 4 or 8 batteries into the battery pack (both sides should be full) and follow the instructions on the diagram in **POWER REQUIREMENTS**.

### **Echoes in the spectrogram**

When recording in full spectrum, if you find that your spectrogram has excessive echoes ("messy"), it is likely due to echoes from where the microphone was mounted. We recommend that you use the supplied extension cable to mount the microphone away from the detector itself, or any other flat surfaces (such as boxes or walls). This will produce much clearer recordings.

### **The GPS doesn't seem to be taking a daily fix**

You may notice this error if the detector has been out for a period of time, but it states on the control panel that your last GPS fix was more than one day ago. To resolve this issue simply reset the location where you have a clear view of the sky (see **MAINTENANCE**).

## FAQS

### **Q. How far away can a bat be detected using the Anabat?**

**A.** Detection distances will vary with frequency and loudness (amplitude) of the bat calls, atmospheric attenuation, and the directional characteristics and sensitivity of the bat detector. It will also be affected by the amount of structural clutter (obstacles such as vegetation) which can block the path of the signal.

The frequency and amplitude of the bat call have a major influence on how far away the call can be detected, and makes some species easier to detect from afar than others.

Quiet (low amplitude) and high frequency bat calls are more difficult to detect than loud (high amplitude) or low frequency calls. Call amplitude can vary within an individual, as many bats will reduce the amplitude of their calls as they approach prey or depending on the context in which they are flying. Call amplitude can also vary between species. Species which always produce low amplitude calls ('whispering bats') will be more difficult to detect from a distance than other species. In addition, bat calls of higher frequencies cannot usually be detected from as far as those of lower frequencies, as higher frequencies suffer greater absorption by the atmosphere than lower frequencies.

Atmospheric absorption depends upon weather conditions such as temperature, humidity and air pressure. This relationship is complex, but in general, cool dry conditions will allow the detection of bat calls over greater distances.

The sensitivity of the detector also has a major influence on detection distance, and while there is always some variability in sensitivity among units, the biggest influence is the sensitivity setting.

Given all the above, it is obvious that detection distances will vary enormously. Many bats are easily detected over 30m under typical conditions, while some species which call at low frequencies may be detectable from as far as 100m. However, some species will be hard to detect from even 1m away. This is why activity levels measured acoustically cannot easily be compared between different species. However, acoustic indices of activity are generally much less biased than indices based on capture data

Further information on detection distances and the calculation of detection fields and distances can be obtained from the software AnaVolumes (you can download at [www.titley-scientific.com](http://www.titley-scientific.com)).

**Q. Can I use the Anabat Swift as an active detector?**

**A.** While the Anabat Swift is designed as a passive detector, it can be used as an active detector by connecting your headphones and turning on the frequency division audio. It may be easiest to use the detector actively with the microphone on the extension cable. You can also use the built-in GPS to log your track using the **Turning on Transect Mode** function.

**Q. Can I power the detector using solar panels?**

**A.** Yes, using an appropriate solar panel, battery, and regulator system. Contact your Titley distributor for more information.

**FURTHER INFORMATION**

For further information please visit the Titley Scientific website: [www.titley-scientific.com](http://www.titley-scientific.com)