



Anabat Express Bat Detector

User Manual

Titley Scientific

Version 1.9



TITLEY[™]
S C I E N T I F I C

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DOCUMENT HISTORY

Manual Version	Release Date	Firmware Version	Major Additions and Changes
1.0	08/04/2014	5504D	-
1.1	10/05/2014	V5504L	Manually changing timezone; fine-scale sensitivity change; setting a schedule update; download sequence files; visual instructions; FAQs
1.2	22/05/2014	5504Q	Schedule instruction change
1.3	22/10/2014	5505L	Battery life; extension cables; setting a schedule update; deleting files from SD card.
1.4	23/10/2014	5505L	Comments about using NiMh batteries
1.5	02/02/2015	5506G	Downloading files using Analook; how to use new GPS feature
1.6	18/05/2018	5507D	Downloading and converting ZCAs in Anabat Insight
1.7	12/07/2018	5507D	Weatherproofing instructions for electrostatic build-up; downloading with Anabat Insight
1.8	24/08/2018	5507D	Microphone connection warning; FAQ GPS lock failure
1.9	21/05/2020	5507J	Update to ZCA conversion in Insight

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INTRODUCTION

All bats belonging to the traditionally recognized suborder Microchiroptera (micro-bats) use echolocation to avoid obstacles and locate prey in conjunction with their eyesight. Evolutionary history and differing ecological requirements mean echolocation calls tend to differ between species, so they are often useful for identification. Echolocation calls vary greatly depending on what a bat is doing, especially in response to how close the bat is to clutter. Bat detectors detect the echolocation calls emitted by bats and produce audible and/or visible images which reveal the presence of bats, their activity and useful features of their calls. This gives us the opportunity to observe, identify and study bats without catching them.

The Anabat Express is equipped with a broad-band microphone and uses Frequency Division to produce data files which can be analysed using Zero-Crossings Analysis to make them visible as sonograms (time x frequency graphs). This manual contains the operating instructions for the Anabat Express, including advice for successful recording of bat calls. Furthermore, this manual includes testing and troubleshooting procedures.

FEATURES OF THE ANABAT EXPRESS

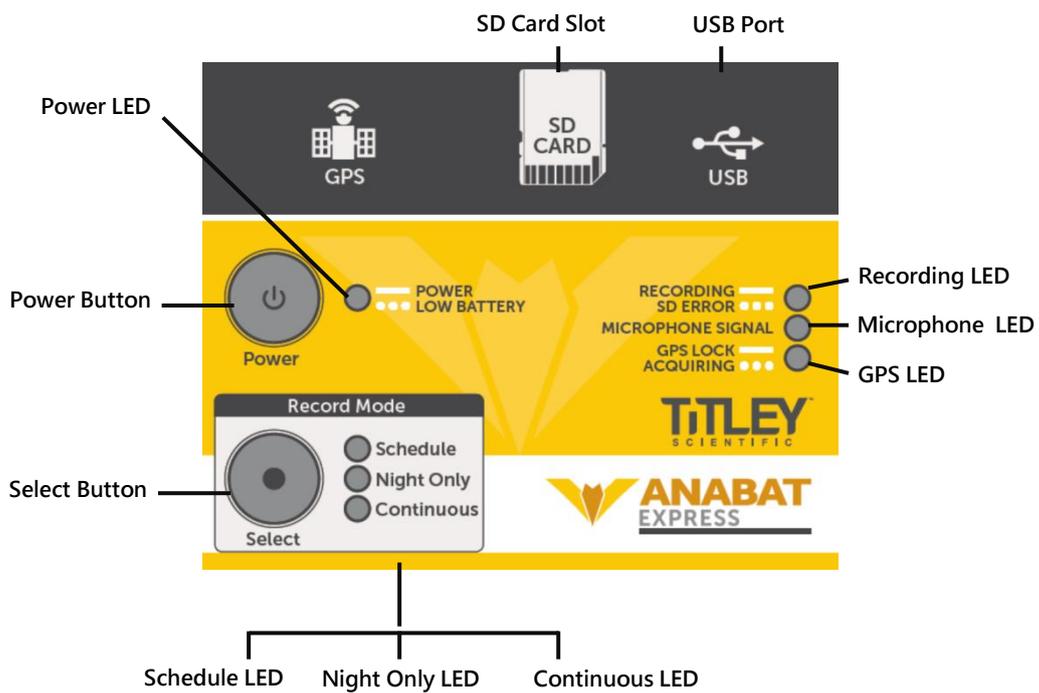
The Anabat Express is designed for low power and efficient operation in a compact, weatherproof and easily-concealed case. It can be used anywhere and is extremely fast to deploy and download. It uses a broadband, omni-directional, weatherproof microphone, which can be plugged directly into the case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

- New, easy-to-use interface for setup and download
- Weatherproof, camouflaged plastic case (IP Rating 67)
- Weatherproof, compact microphone (IP Rating 54)
- Built-in GPS for transect mode, location, setting the clock and calculating sunset/sunrise times
- Runs 14 nights on 4 alkaline AAs
- Records temperature and battery voltage
- One-touch recording mode selection for continuous, scheduled or night-only recording (with automatic sunset and sunrise calculation)
- Removable SD card for data storage and easy downloading

GETTING STARTED

USER INTERFACE

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



LED Indicators			
	— Solid Light Flashing Light	No Light
Power LED	Detector is on	. Low battery. Change batteries immediately.	Detector is off or asleep
Schedule LED	Recording on a predetermined schedule	No schedule set	-
Night Only LED	Will record from dusk until dawn	Satellite fix required	-
Continuous LED	Detector is continuously recording	-	-
Recording LED	Detector is recording	SD Card missing, full or faulty	-
GPS LED	GPS lock acquired	Slow flash: GPS has not yet acquired satellites Fast flash: GPS is entering transect mode	No GPS lock is needed
Microphone LED	-	Will flicker when receiving ultrasonic signal	-
Check LED (without magnet)	-	Detector not ready, open case to see what is required. In transect mode: Will flicker when receiving ultrasonic signal.	Detector is off or is working normally
Check LED (with magnet)	-	Will flash once to indicate the device is on. Will flicker when receiving ultrasonic signal	Detector is off

Functions	
Power Button	Press to turn detector on/off
Select Button	Press to select the desired recording mode, hold to enter transect mode
SD Card Slot	Insert SD memory card here
USB Port	Insert USB cable here
Battery Compartment	Insert four AA batteries here
Clock Battery	Battery to run the internal clock
Microphone Storage	For storing the microphone when not in use
Dust Cap Storage	For storing the microphone dust cap when not in use
Microphone Socket	Microphone attachment site

SD CARDS

The Anabat Express comes with an SD card for data storage. The detector can use SD and SDHC memory cards, up to 32GB. Memory cards can be purchased from Titley Scientific, or most electronics/office stores.

USB CABLE

The Anabat Express comes with a USB cable for connection to your computer. You can use this cable to configure your detector and upgrade your firmware using Anabat Toolbox (see [**ANABAT TOOLBOX**](#)). You can also use the USB cable to directly stream data from your detector to AnalookW, this can be used to view bat calls in real time. Simply connect the USB cable into the miniUSB slot on the detector and into your computer USB port.

MICROPHONE

An all-new microphone has been designed specifically for passive deployment applications with the following features:

- Omnidirectional - ideal for passive deployments.
- Integrated pre-amplifier with differential output to allow use on extension cables and provide good immunity to electrical interference.
- Sensitive from 10KHz to 150KHz
- Weather-proof - rain will not damage the microphone. 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 [**WEATHERPROOF CONSIDERATIONS**](#)
- 5m, 20m and 50m extension cables are available for purchase from Titley Scientific. Cables can be daisy-chained if required. For other sized cables, please consult Titley Scientific. We can provide custom cables for your application.

POWER REQUIREMENTS

The Anabat Express can be powered internally via 4 x AA batteries. The **Power LED** will begin to flash when the battery voltage is low. When it drops below a set voltage **the detector switches itself off**. If the **Power LED** is flashing you should change the batteries immediately. All AA batteries must be removed from the detector before they are stored for more than a few weeks; otherwise the batteries will slowly discharge and may leak, damaging the detector. The following table shows the standard power consumption of the Anabat Express.

Power consumption of the Anabat Express		
Recording (no bat activity)	Recording (bat activity)	Asleep
69mW	113mW	3.06mW

AA batteries can be alkaline, rechargeable, or lithium (1.5V or 3.6V). Make sure all 4 batteries are fresh and of the same type. Open the camouflage case, turn the detector off and insert the batteries into the battery compartment. **Do not remove the batteries while the device is on**, to avoid potential SD card corruption.

When using **rechargeable batteries**, we strongly recommend using NiMh batteries specifically advertised as "low self discharge", for example "Panasonic Eneloop Pro". These batteries are sometimes also advertised as "pre-charged" or "ready to use". The high self discharge rate of standard NiMh batteries will cause them to give shorter run times than expected.

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. Alkaline AA batteries **typically** last for 14 nights (12 hours recording per night). 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. The **Anabat Toolbox** software allows you to estimate battery life for different conditions. For further information about how long your batteries may last, see **Estimate the battery life** section of this manual.

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.

ANABAT EXPRESS BASIC OPERATION

The Anabat Express is designed for fast and easy deployment. Before you start recording with your detector we recommend you check for firmware updates. See the **ANABAT TOOLBOX** section for instructions on updating firmware and setting the clock and timezone.

To begin, insert fresh batteries and an SD card with sufficient memory for your recording period. Ensure the SD card is correctly orientated as per the diagram on the detector when inserting. 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 case so it isn't lost. Remove the microphone from inside the camouflage case and connect it to the microphone socket on the front of the case. 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.** Turn the detector on by pressing the **Power** button.

There are three recording modes which you can choose from: schedule, night only and continuous (see below). For most surveys, the night only recording mode is recommended. If you are using your Anabat Express on the move (walking/driving) we have created a GPS transect mode (see below) to track your detector's path and GPS tag bat calls.

SCHEDULE RECORDING MODE

The schedule recording mode can be customised to your preferred recording times, however it must be programmed onto the SD card with a computer prior to use (see [Setting a schedule](#) for programming instructions).

To select this recording mode:

1. Set a schedule using Anabat Toolbox. See the [Setting a schedule](#) section of this user manual for instructions on setting up a schedule.
2. Press the **Select** button until the **Schedule LED** is lit.
3. Wait for the **GPS LED** to turn on solid. The detector will automatically try to acquire satellites to obtain a GPS fix. Whilst acquiring satellites, the **GPS LED** will flash. Once a GPS fix is made the **GPS LED** will produce a solid light. 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 Schedule mode, however, without a GPS fix the position data could be wrong and the detector might record at the wrong time of day, and with incorrect time stamps.
4. While the case is still open, rub your fingers in front of the microphone; the **Microphone LED** will flicker to confirm that an ultrasonic audio signal is detected.
5. Once no LEDs are 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](#))

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 card becomes full. Night only mode will only work if a GPS fix can be acquired, 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 **Select** button until the **Night Only LED** is lit.
2. Wait for the GPS LED to turn on solid. The detector will automatically try to acquire satellites to obtain a GPS fix. While acquiring satellites, the **GPS LED** will flash. Once a GPS fix is made, the **GPS LED** will produce a solid light. 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, record the GPS location and determine the sunset/sunrise times.
3. While the case is still open, rub your fingers in front of the microphone; the **Microphone LED** will flicker to confirm that an ultrasonic audio signal is detected.
4. Once no LEDs are 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**).
5. 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. 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.

To select this recording mode:

1. Press the **Select** button until the **Continuous** LED is lit.
2. Wait for the GPS LED to turn on solid. The detector will automatically try to acquire satellites to obtain a GPS fix. While acquiring satellites, the **GPS LED** will flash. Once a GPS fix is made, the **GPS LED** will produce a solid light. 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 **Microphone LED** will flicker to confirm that an ultrasonic audio signal is detected.
4. Once no LEDs are 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**).

In standard Schedule, Night Only or Continuous mode, do not deploy if any LEDs are flashing, as this means there is an error or problem. See TROUBLESHOOTING for resolving flashing LEDs. In Transect mode, the Check LED will flicker when the detector is recording.

TRANSECT MODE

The transect mode will record your GPS location every second. This will create a GPS file, which can be used to display the sequence files recorded on a map at their closest GPS fix, as well as the path traced by the detector. You can use the transect mode in conjunction with any of the three standard modes (Schedule, Night Only or Continuous).

To activate the transect mode:

1. Select your desired mode by following the instructions above.
2. Press and hold the **Select** button until the **GPS LED** flashes quickly (should take about 5 seconds).
3. The detector is now in transect mode, when recording in transect mode the **Check LED** will flicker when receiving ultrasonic signal.
4. To exit transect mode, simply hold the **Select** button until the **GPS LED** flashes quickly again (should take about 5 seconds), **or** turn the detector off and on again.

Be aware that transect mode will consume batteries more quickly than a standard mode.

TESTING THE SYSTEM

To test the operation of the detector before deployment you can open the camouflage case and rub your fingers in front of the microphone; the **Microphone LED** (inside the case) will flicker to confirm that an ultrasonic audio signal is being detected. 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** (beside microphone, 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 inside to a clean, dry place out of the weather. Then dry it off as best as possible if it is wet. If there is a large temperature difference between inside and outside, 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 and press the **Power** button once. Remove the microphone from the microphone socket, **do not turn the body of the microphone (twisting the microphone housing can cause damage)**, and store inside the camouflage case for storage and transport. Replace the microphone dust cap onto the microphone socket whenever the microphone is not attached. Remove the SD card to download the data to your computer. Remove AA batteries for long storage periods. **Do not remove the SD card or batteries while the detector is on**, otherwise the SD card could be corrupted.

WEATHERPROOF CONSIDERATIONS

The Anabat Express 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 AA batteries you use will have temperature limits; these should be followed. 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.

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.

1. To begin, remove the SD card from the detector (**do not remove while the detector is 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 ZCA files.

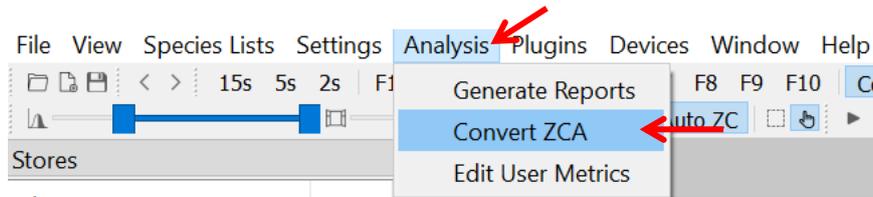
If you would like to convert the ZCA files to sequence files (see **UNDERSTANDING FILES AND FILE NAMES**) you can use Anabat Insight or AnaloookW to download the calls. Anabat Insight is free analysis software which can be downloaded from www.titley-scientific.com. **If you would like to open your sequence files in the free version of Anabat Insight, you need to convert the ZCA files to sequence files in Anabat Insight.** Files converted in Anabat Insight can still be opened in AnaloookW.

Convert to sequence files using Anabat Insight

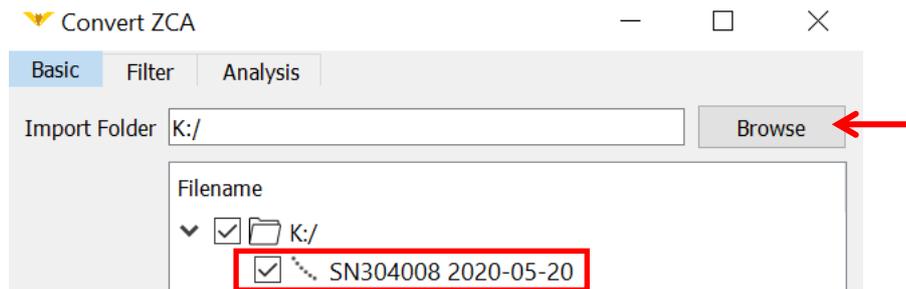
To convert ZCA files to sequence files in Anabat Insight:

1. If you wish to download directly from a SD card, 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)

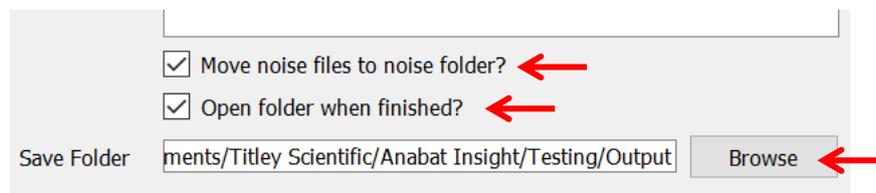
2. Open Anabat Insight
3. Click on Analysis from the **Menu** bar and then select **Convert ZCA**



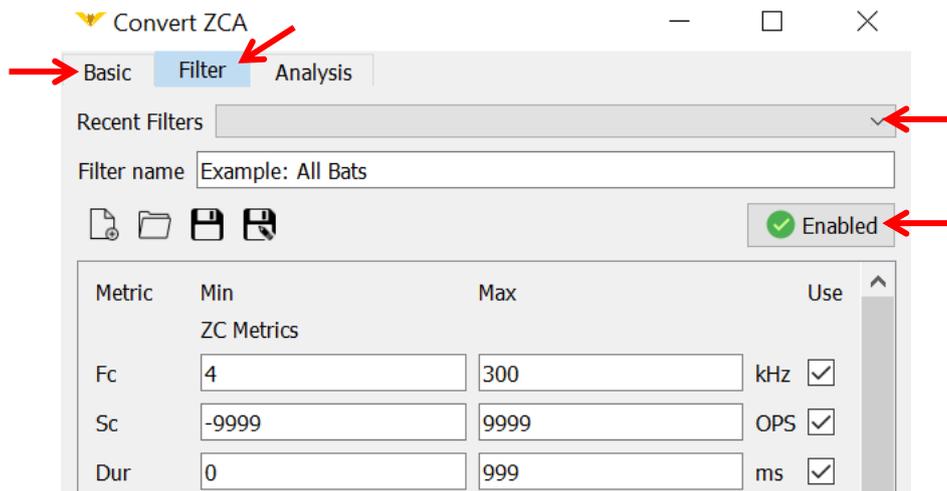
4. Click the **Browse** button to select the import folder where your ZCA files are stored on your computer, or choose the SD Card drive. The ZCA files will be listed.



5. The conversion will automatically run with an 'AllBats' filter. If you would like the files which do NOT pass the filter (noise files) to be moved to a separate noise folder, check the box **Move noise files to noise folder?**
6. If you would like to open the destination folder with the sequence files after conversion, click **Open folder when finished?**
7. Click **Browse** to select the destination folder for your converted files.



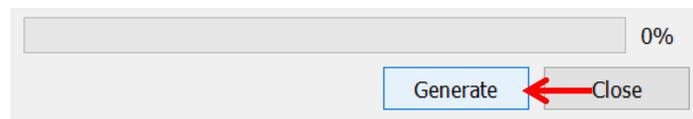
8. If you wish to edit the filter being used on the conversion, or select a different filter, click on the **Filter tab** at the top of the Convert ZCA window. From this window, you can select from a recently used filter list, edit the current filter, load or create a new filter. If you wish to disable the noise filter, click on the **Enabled** button so it shows **Disabled**. For more information on filters, see the Anabat Insight user manual.



9. You can also edit the analysis settings of the conversion process, changing the minimum and maximum trigger frequencies, and the smoothing. To change these settings, click on the **Analysis tab** and alter the settings.



10. Click on the **Basic tab** to return to the conversion window. Click **Generate**, it may take a few moments to process the files.



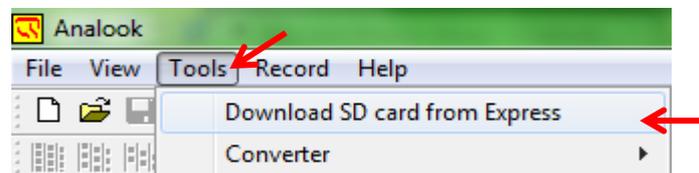
The sequence files will now be in your destination folder, and this folder will be automatically opened in the project panel, ready to view and analyse. For more information, see the Anabat Insight user manual.

Download using Chris Corben's AnaloookW

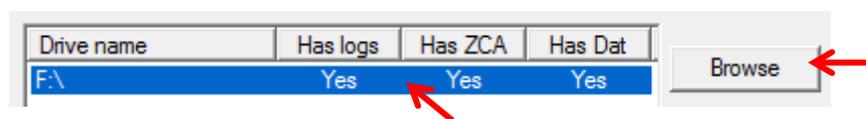
You can still use the **Download SD card from Express** tool in AnaloookW, however once the ZCA files have been converted to sequence files in AnaloookW, **you will not be able to open them in the free version of Anabat Insight for analysis**. You can get AnaloookW from Chris Corben's website: <http://users.lmi.net/corben/Beta/>

To download Express data using AnaloookW:

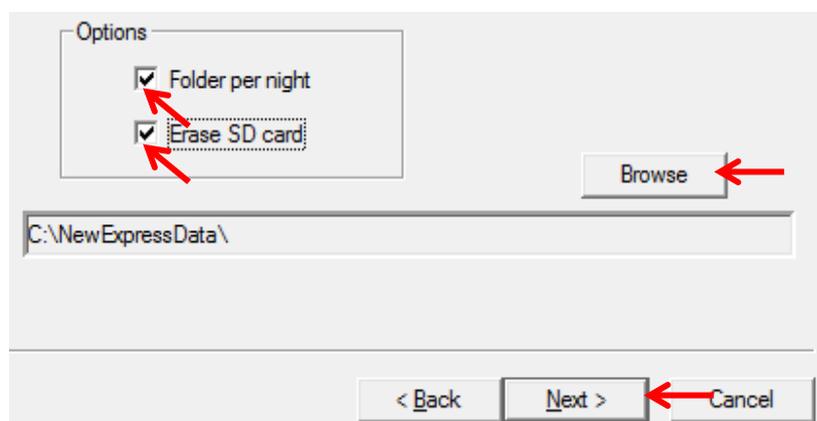
1. Remove the SD card from the detector (**do not remove while the detector is on**)
2. Insert the SD card into your computer (if it has a SD card slot) or into an external SD card reader (available from Titley Scientific)
3. Open AnlookW (Important: ensure you are using version 4.3v or later)
4. Click on **Tools**, then click **Download SD card from Express**



5. Select the drive which has your SD card (usually is located automatically). Or you can click the **Browse** button and select the SD card using Windows Explorer. Click **Next**



6. Click **Browse** to select the destination folder for your downloaded call files. If you do not select a folder, it will create a default folder C:\NewExpressData\. Check the **Folder per night** if you would like AnlookW to separate your data into nightly folders. Check **Erase SD Card** if you would like the files to be permanently deleted off the SD Card after downloading. Click **Next**.



7. Click **Next**. Your downloaded files will be located in the destination folder selected, ready to be viewed. This download will create both ZCA files and sequence files. Click **Finish** to close the window. If a message window appears stating “No data in file”, this means that there is a file that did not contain bat calls. This commonly occurs if you have turned the detector on and off one day without recording bats, then set the detector out another day. Your recorded data will still be converted correctly.

UNDERSTANDING FILES AND FILE NAMES

Log files are stored as CSV files, with extension of .csv. GPS data is stored as a GPS text file, when downloaded this is converted to a GPS.gpx file which can be opened in most mapping software, including Google Earth. Anabat data is recorded into ZCA files, with extension of .zca. A single ZCA file contains all the data for one 24 hour recording session. It can be opened/viewed directly in AnalookW, or it can be converted to Anabat sequence files, which will be more familiar to most users.

ZCA file names include the serial number of the detector and the date of the recording: SERIALNO YEAR-MM-DD.zca for example SN300632 2014-01-15.zca was recorded on detector SN300632 on 15th January 2014.

Anabat sequence files have a very specific filename structure, which encodes the date and time at which the file was recorded: YMDDhhmm.ss#

The first character encodes the year. "a" was used for the year 2000. "o" denotes 2014, "p" 2015 etc. The second character encodes the month. January is "1", September is "9" but October is "a", November is "b" and December is "c". The last four characters in the filename give the time in hours and minutes of 24 hour time, so 2035 is 35 minutes past 8 PM. Finally, the first two characters of the extension encode the seconds, from "01" to "59".

For example the file m10800239.31# was recorded in 2012, on 8th January at 2:39.31am; and lb272212.01# was recorded in 2011, on 27th November at 10:12.01pm.

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 Anabat Toolbox, which will interpret the data in the log file (see [DIAGNOSTIC LOG FILES](#)).

GPS FILES

A GPS file is created if you have used the detector in transect mode. On the SD Card, the GPS data is stored in a text file (.txt). Once downloaded using AnalookW (see **HOW TO DOWNLOAD FROM AN SD CARD**) this file is converted into a GPS.gpx file. This can be opened directly into most mapping software including Google Earth. It displays all of the sequence files recorded at their closest GPS fix, as well as the path traced by the detector.

SOFTWARE

ANABAT TOOLBOX

The Anabat Toolbox software is available for download at the Titley Scientific website (www.titley-scientific.com). This program can be used for the following:

- Check the serial number and firmware version of your Anabat Express
- Set the clock/time zone
- Change the sensitivity of the detector
- Choose your recording mode
- Set a schedule
- Change the data division ratio
- Estimate the battery life
- View the data and log files on the SD Card
- View graphs of the battery consumption and temperature over time
- View the GPS locations on Google maps

Connecting your detector to the PC

To connect the Anabat Express to a PC follow these steps. Do not connect the detector to you PC before installing the Anabat Toolbox software.

1. Download and install Anabat Toolbox from www.titley-scientific.com
2. Turn on your detector and connect the USB cable from the detector to the PC.

3. Your PC will automatically install the driver for the Anabat Express. Please wait until this is completed before running the Anabat Toolbox software.
4. Open Anabat Toolbox, your Anabat Express should automatically be detected.

Checking serial number and firmware version

The serial number for the detector can be found on the inside of the camouflage case on the right side of the battery compartment, also above the deployment instructions in the case. To check the serial number using Anabat Toolbox, turn your detector on and connect the detector to your computer via USB cable. Under the detector tab of Anabat Toolbox the first line shows the detector type (Express), the serial number and the hardware version (HW). The microphone is also issued with a separate serial number which can be found on the barrel of the microphone.

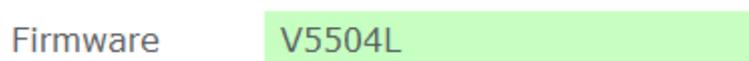
The firmware version is also displayed under the **Detector** tab in Anabat Toolbox.

How to upgrade firmware

Regular upgrades to the firmware will be supplied by Titley Scientific to improve the detector over time. It is important to upgrade the firmware on your detector as soon as an updated version is available. We highly recommend you subscribe to the Express Firmware mailing list to be notified immediately of any important firmware updates as soon as they become available: <http://eepurl.com/8Pyjr> Whenever your computer is connected to the internet, Anabat Toolbox will automatically search for updates. When you update the Anabat Toolbox software this will automatically contain new firmware upgrades. To update the firmware turn on the detector, connect your detector to the computer using the USB cable and open Anabat Toolbox. If a firmware upgrade is available, the firmware version will be highlighted in orange and there will be an option to **Upgrade Now**. Click this button and follow the prompts.



If there are no new upgrades, the firmware version will be highlighted in green.

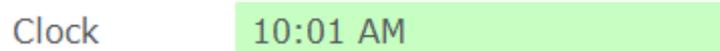


Setting the clock/timezone

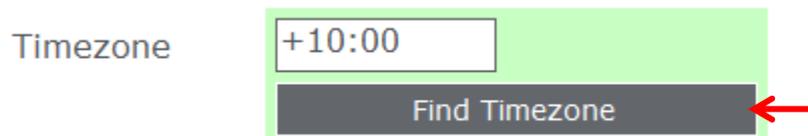
Whenever the detector acquires a GPS fix, this will automatically set the clock/timezone. However if you are unable to acquire satellites for a GPS fix or would like to set the clock manually, this can be done in the Anabat Toolbox software. Turn the detector on, then connect it to your computer with the USB cable and open Anabat Toolbox. The time/timezone on the detector will be displayed under the Detector tab. If the time is highlighted in orange, the time is not set. To set the clock, simply click the Set the Clock button and it will synchronize with your computer clock.



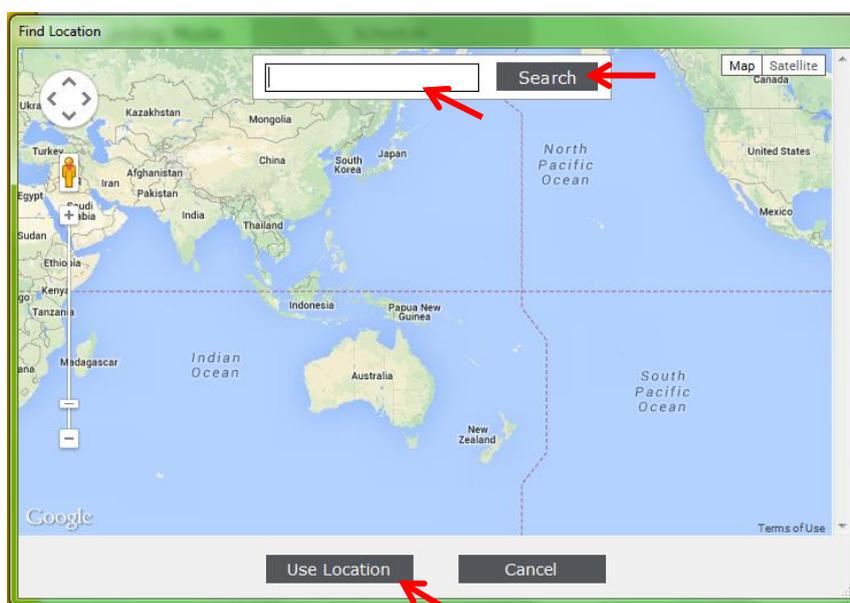
This should only need to be performed once. After the clock is set, the time will be highlighted in green.



To set the timezone, click on the **Find Timezone** button.

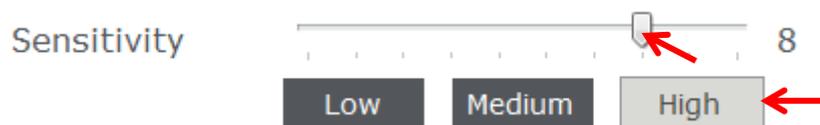


Type your location into the search bar and click **Search**. If the placemark is correct, click **Use Location**. If you do not have internet you can manually type in your timezone.

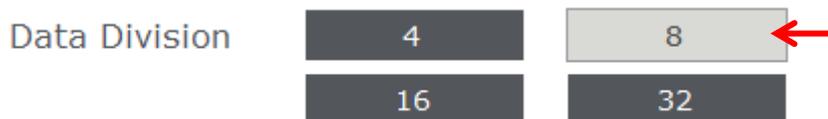


Adjusting sensitivity and data division

The Anabat Express is optimized for most detection situations with its default settings. However if you would like to change the sensitivity or data division, this can be done using the Anabat Toolbox. Turn on the detector, connect to your computer using the USB cable and open Anabat Toolbox. Under the **Detector** tab, the default sensitivity setting will be highlighted (**High**, **Medium** or **Low**), we suggest that **8 (High)** is the appropriate setting in most situations. However if you are in a high-noise area you may prefer to use **Low**, alternatively if you are trying to record a particularly quiet bat species, you may prefer to use a higher level of **High**. To change the sensitivity simply click the sensitivity level you want, or move the scale bar for fine-scale changes.



The default data division ratio on the Anabat Express is **8**. However if you would like to change the data division ratio, click on the data division ratio (under the **Detector** tab) you want: **4**, **8**, **16** or **32**.



Choose a recording mode

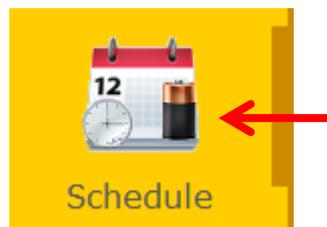
You can select the recording mode directly on the detector or through Anabat Toolbox. To choose a recording mode in Anabat Toolbox, connect the detector to your computer using the USB cable, turn the detector on and open Anabat Toolbox. Under the **Detector** tab click on your desired recording mode: **Schedule**, **Night** or **Continuous**.



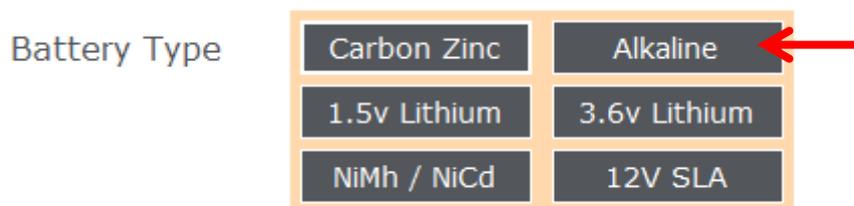
Setting a schedule

To use the schedule recording mode, you will need to set a schedule on the SD card prior to recording using a computer with Anabat Toolbox. To set a schedule:

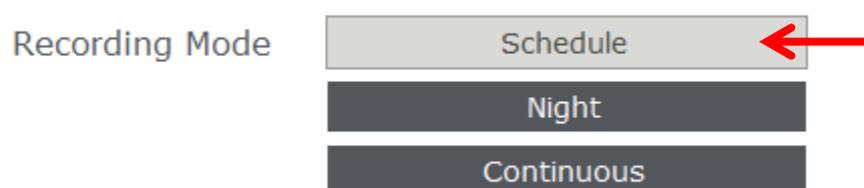
1. Remove the SD card from the detector (**make sure the detector is switched off first**)
2. Insert the SD card into your computer (if it has a SD card slot) or into an external SD card reader (available from Titley Scientific)
3. Open Anabat Toolbox and click on the **Schedule** tab



4. Click on the **battery type** you plan to use



5. If not already selected, click the **Schedule** recording mode

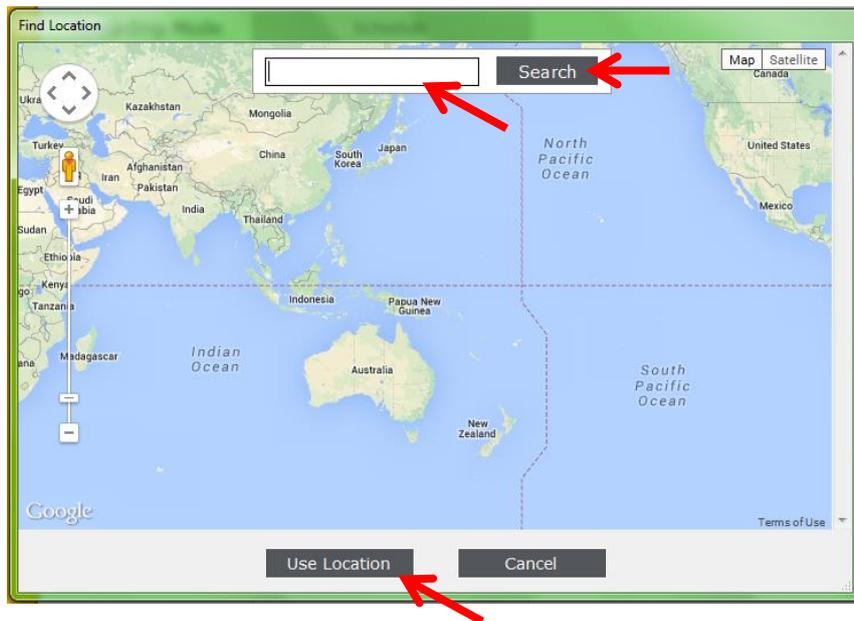


6. Click on **Find** for deployment location, and google maps will appear*.

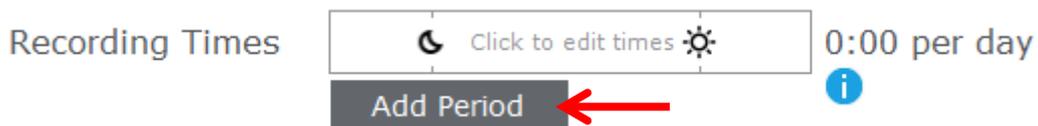


- a. Type your location into the search bar and click **Search**. If the placemark is correct, click **Use Location**.

*If you do not have internet you can type in your longitude and latitude, then manually type in your timezone.



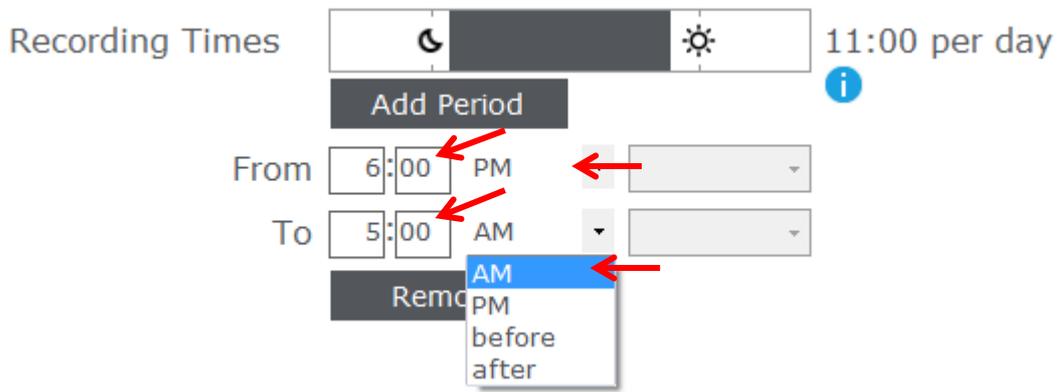
7. Click on **Add Period** to create a set recording period. You can either enter a fixed start and stop time, or you can enter times relative to sunset and sunrise (or a combination of both).



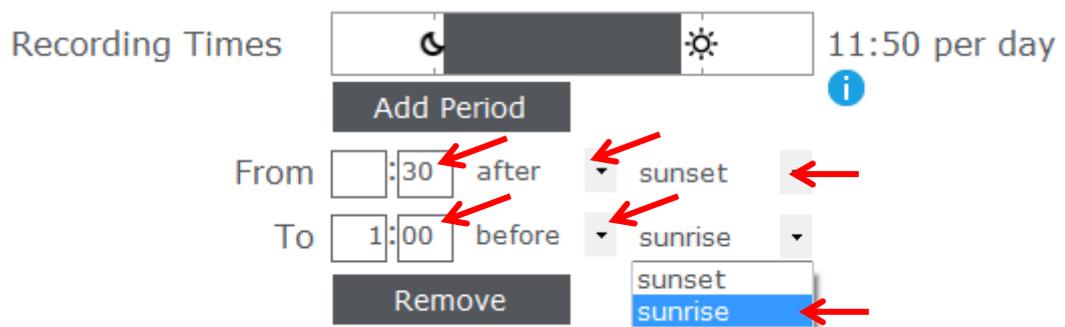
- a) To determine the sunset or sunrise times based on your specified location, simply hover your mouse over the moon or sun symbols and the time will be displayed.



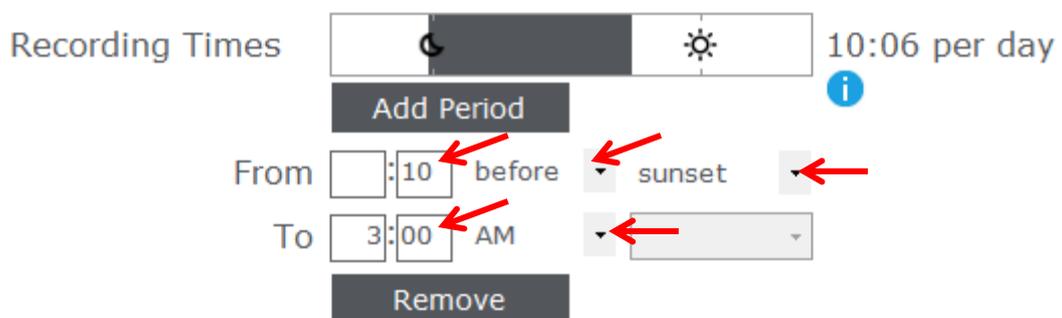
- b) To record from 6pm (18:00) to 5am (05:00), for example, you will need to enter a **From** time of 6:00 and select **PM** from the drop down menu, then enter a **To** time of 5:00 and select **AM** from the drop down menu.



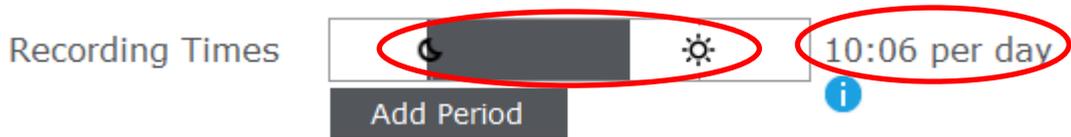
To record from 30 minutes after sunset to 1 hour before sunrise, enter a **From** time of 0:30 and select **after** from the first drop down menu, then sunset from the second drop down menu. Then enter a **To** time of 1:00 and select **before** from the first dropdown menu, then select **sunrise** from the second dropdown menu.



To record from 10 minutes before sunset to 3am, enter a **From** time of 0:10 and select **before** from the first drop down menu, then sunset from the second drop down menu. Then enter a **To** time of 3:00 and select **AM** from the drop down menu.



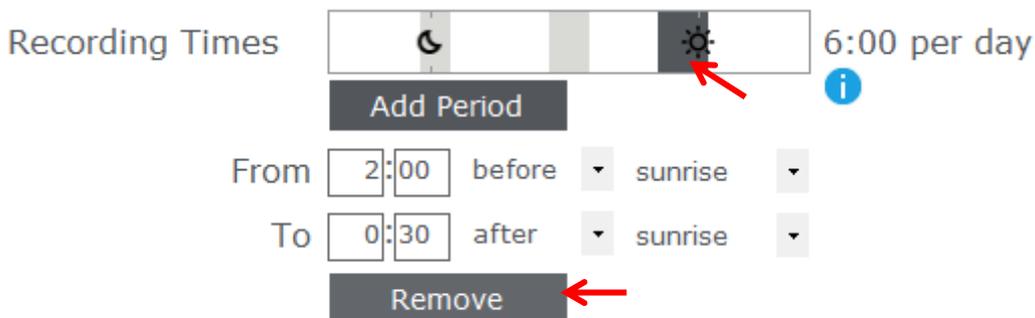
- c) The shaded area on the time bar and the number of hours per day will be displayed depending on the specified recording period.



8. To record over two or more periods in a night, set your first recording period (following steps 7a-c), then repeat for each new recording period. Each recording period will be shaded on the time bar.

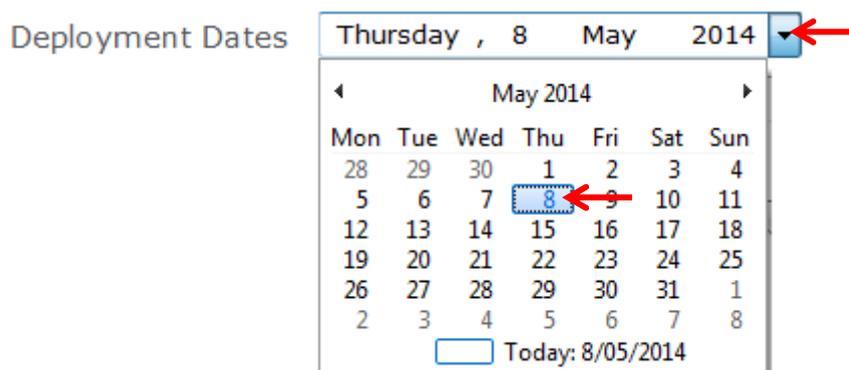


9. To change or remove a time period, simply click on the shaded area and either edit the times or click **Remove**.



10. To deploy your detector for a set period you can choose your deployment dates, and use our recording rate function to maximise detector nights. If you do not select a deployment period, the default deployment period is from the date the schedule is set until the estimated battery life end date.

- a. To choose your deployment period dates, select your dates by clicking on the dropdown calendar.



Deployment Dates

Thursday , 8 May 2014

Sunday , 11 May 2014

May 2014						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
28	29	30	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1
2	3	4	5	6	7	8

Today: 8/05/2014

- b. To continue the recording schedule until batteries are depleted, choose your start date, then choose an end date that matches the estimated battery life.

Deployment Dates

Friday , 24 October 2014 15 days

Friday , 7 November 2014

Recording Rate

100 %

Battery Estimate 14.8 days

Estimates are based on new/full-charged batteries

- c. If you plan to replace the detector batteries regularly or run the detector with a solar panel and you would like the schedule to continue running past the estimated battery life, simply select an end date that is well beyond your estimated survey end date (for example 1 year).

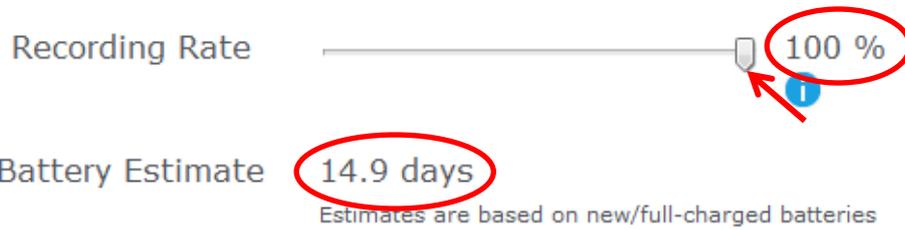
Deployment Dates

Friday , 24 October 2014 366 days

Saturday , 24 October 2015

- d. To use our recording rate function and maximise your recording period, use the scroll bar to choose your **Recording Rate**. As you change the recording rate, the number of battery estimate days will change correspondingly. For example, a 50% recording rate will record for 50% of the deployment time (out of 5 minute blocks), in other words, it will turn the detector on for 2.5

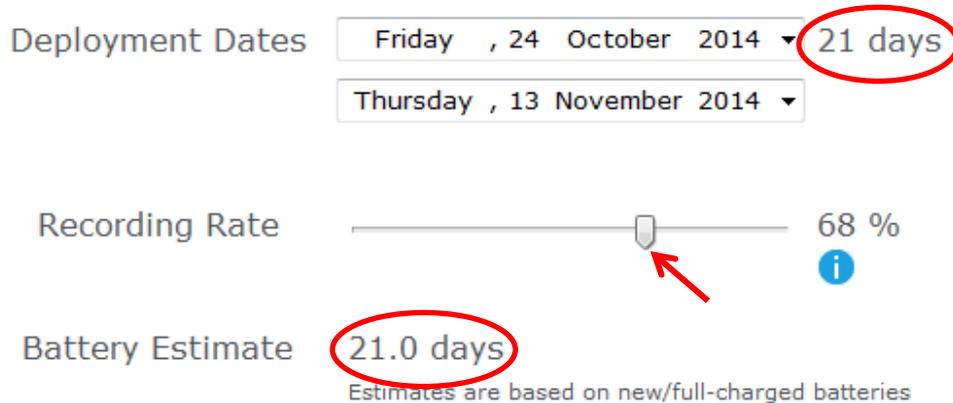
minutes, then off for 2.5 minutes. A 20% recording rate will turn on for 1 minute, then off for 4 minutes. A 100% recording rate will record all the time.



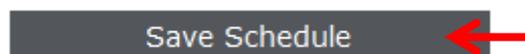
OR



- e. If you require your detector to be out for a certain period (eg. 3 weeks), choose a recording rate that will match the battery estimate to that period.



- 11. Click on the **Save Schedule** button



Estimate the battery life

Anabat Toolbox is also equipped with a useful feature to estimate the battery life based on the settings and data volume. This feature is an **estimate only** and actual battery life may vary. To estimate the battery life:

1. Open Anabat Toolbox on your computer
2. Click on the **Schedule** tab
3. Click on the type of battery you plan to use, the standard battery capacity will automatically update below. However you can change the battery capacity if your chosen batteries vary, simply type in the milliamp hours (mAh)
4. Select the recording mode you will use (if schedule, enter your schedule details)
5. Move the gauge to select your predicted data volume; this is the amount of bat activity **and** noise you expect to be recording. You can choose between **Low**, **Medium** and **High**.
6. Move the gauge to select the number of **Night Hours** you are recording for. For example if sunset is at 7:30pm and sunrise at 5am, the number of night hours will be 9.5 hours. The detector starts recording 30 minutes before sunset and finishes 30 minutes after sunrise. This extra hour is automatically accounted for in the calculation, there is no need to add it to the number of night hours.
7. Your estimated battery life will be displayed below.

Battery Type

Carbon Zinc	Alkaline
1.5v Lithium	3.6v Lithium
NiMh / NiCd	12V SLA

Battery Capacity mAh i

Recording Mode

Schedule
Night
Continuous

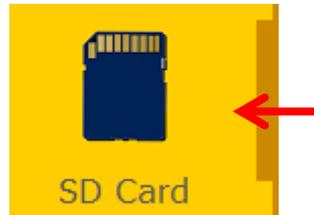
Data Volume High i

Night Hours 9.5 hours

Battery Estimate 19.9 days

Viewing data and log files

While your SD card is inserted into computer (or into a card reader), you can view the data and log files using Anabat Toolbox. Simply open Anabat Toolbox and click on the **SD Card** tab.

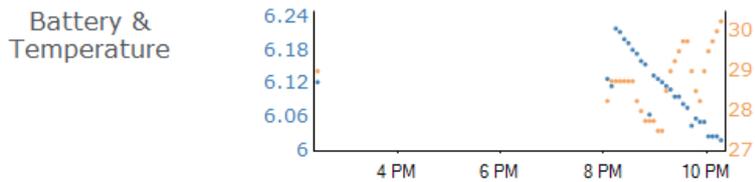


The SD card will automatically be selected, if not then click on the (F:\) drive to select the correct SD card.



The data files will be listed as .zca files which each represent a single night of recording. The log files will also be listed as .csv files which each represent a single night of recording. To view the battery and temperature variations and GPS location of each log file, simply click on the desired log file. Any errors or warning associated with that night of data will be displayed. A graph will display the battery voltage (left axis, in blue) and temperature variation (right axis, in orange) for the selected recording night. The GPS location will also be displayed using Google Maps, you can switch between map/satellite image and zoom in/out of this map, or click the “view on google maps” link to view in an separate, larger browser window.

Data Files	SN300623 2014-03-20.zca SN300623 2014-03-07.zca SN300623 2014-03-04.zca
Log Files	log SN300623 2014-03-04.csv log SN300623 2014-03-07.csv ← log SN300623 2014-03-20.csv
Errors	No errors
Warnings	No warnings



ANABAT INSIGHT

Anabat Insight is the free software you can use to view and analyse zero crossing and full spectrum recordings from your detectors. You can open/view both ZCA files and Anabat sequence files in Anabat Insight. Anabat Insight is a viewing and reporting software package for sound files which perfectly complements bat call analysis. The program offers the following features:

- Ability to view recordings in full spectrum and zero crossing
- Project management to keep all your calls organised
- Metrics calculations for passes and individual pulses
- GUANO metadata support
- Customizable filters and scans

- Choose between multiple audio modes to listen to calls
- Inbuilt mapping to view tracks and file locations
- Supports open source Auto ID plugins (currently Bat Classify UK)
- Can be used on Windows or Mac

To view sequence files recorded on an Anabat Express in the free version of Anabat Insight, you need to convert the ZCA files to sequence files in Anabat Insight. Anabat Insight can be downloaded for free from www.titley-scientific.com

We are regularly updating Anabat Insight software to improve its functionality and capabilities, so please ensure that you are using the latest version.

TIPS FOR PASSIVE MONITORING

POWER AND DATA STORAGE SPACE

For short term monitoring sessions the Anabat Express 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 2500mAh. These add very little weight and may last 14 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. Try the battery life estimator in Anabat Toolbox (see **Estimate the battery life**) for a more accurate idea of how long your batteries will last.

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 most bats cannot fly.

The Anabat Express comes with a weatherproof, omnidirectional microphone. An omnidirectional microphone means that it is able to record ultrasonic sounds from all directions, however sensitivity is limited behind the detector. One advantage of an omnidirectional detector is that mounting direction is not crucial; however it is more susceptible to any noise from sources all around the microphone. Avoid having vegetation or other objects between the detector and the bat's expected flight path, or close beside the detector, as echoes can degrade the signal. 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 do recommend that the Anabat Express 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. 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 Express camouflage case is designed so that the device can be padlocked closed.

TROUBLESHOOTING

FLASHING INDICATORS

Any LED indicator persistently flashing means there is an error or problem. Do not deploy the detector if there are LEDs flashing. Please see the table below to resolve a flashing LED indicator.

LED Indicator	Problem	Solution
Power	Batteries are too low	Replace AA batteries
Schedule	No schedule set	Need to set the schedule on the SD card with a computer, or select a different recording mode
Continuous	Error	Turn the detector off then on again
Recording	SD Card missing, full or faulty	Make sure a card is inserted. Make sure the card is properly seated in its socket. Try removing it and replacing it. If that does not work, use a different card. The faulty card may be fixed if formatted on a computer.
Night Only	Satellite fix is required	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
GPS	Satellite fix is required	
Check (front of case)	If flashing without a magnet, satellite fix is required If flickering when receiving ultrasonic signal, the detector is in Transect Mode	
<p>* 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</p>		

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.

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

A. While the Anabat Express is designed as a passive detector, it can be used as an active detector by connecting the detector via USB to a computer or some tablets. While the detector is connected to the computer and recording, simply open Anabook and click on the red record button from the menu and it will begin to stream the calls in real time.

Q. When I open a ZCA file in Analoow it looks like its empty?

A. The ZCA file recorded on the SD card actually represents an entire night of data, so initially you will need to play around with Analoow to see what your preferred method of viewing the file is. Many people prefer to compress empty space between call pulses, and view in F7 zoom. Also remember that to see all the calls from a ZCA file, you will need to scroll the file across the screen. If you do not like viewing/analysing ZCA files, you can change them to sequence files. See **Downloading Data** for more information. Alternatively, when you open a ZCA file in Anabat Insight, it automatically displays as sequence files for you to view.

Q. What happens if my detector can't get a GPS fix (eg. in a cave)?

A. If your detector secured a GPS fix when first turned on, then cannot secure a subsequent fix the next day, it will default to the previous GPS location and remain in Night Only mode. However, if you deploy your detector and it does not get an initial GPS fix, it will record in Constant Recording mode (with the Check LED flashing). The detector requires a GPS fix whenever it is first turned on in order to work in Night Only mode.

This may be an issue if you change the batteries, or restart the detector, inside a cave (for example). To avoid this issue, you can create a schedule with Anabat Toolbox that will run from sunset to sunrise (or your preferred times), and then manually specify the latitude and longitude, there is a map to make this easier. Set the end date to after you expect the batteries will run out. **Make sure the recording rate is set to 100%** otherwise if you don't have a large enough SD card specified, it will take breaks from recording to save memory. Save the schedule on the SD card and then use the Express in schedule mode.

Q. Can I buy a directional microphone for the Anabat Express?

A. Yes, the directional microphone is now available for the Anabat Express, speak to your local distributor or check the website for pricing.

FURTHER INFORMATION

For further information please visit the Titley Scientific website: www.titley-scientific.com