Anabat Scout Bat Detector

User Manual

Titley Scientific

Version 1.1

TITLEY SCIENTIFIC CONTACT DETAILS

AUTHORS AND ACKNOWLEDGMENTS

DOCUMENT HISTORY

Manual Version	Release Date	Firmware Version	Major Additions and Changes
1.0	25/05/2019	0.4	-
1.1	08/08/2019	1.0	Firmware update instructions; division ratio; reset settings

CONTENTS

FEATURES OF THE ANABAT SCOUT

The Anabat Scout is an affordable, full spectrum bat detector designed specifically for active bat monitoring.

Some of the key features of the Anabat Scout include:

- Easy to use and robust
- Record in either full spectrum or zero crossing
- Listen in heterodyne, auto-heterodyne & frequency division audio
- In & out bat counter, with automatic time stamping and geotagging
- Built-in GPS for transect mode and geotagging
- Glow in the dark buttons, easy to find and operate at night
- Record voice notes
- Includes a protective carry pouch and lanyard
- Comes with free version of Anabat Insight software

GETTING STARTED

USER INTERFACE

The Anabat Scout has an OLED display and a simple keypad interface.

GPS Indicator — Number of Satellites in View

Time — 05:58:16 ⊕7 13% — SD Card % Memory Available

Tuned / Peak Frequency — ♪ 40k Count

Last File Name & No. of Files Recorded — 05:55:20 #2 ⟶ 10 — Out Count

Status — Recording Now → 3 — In Count

Menu / Left Soft Key — Menu Memo — Right Soft Key

POWER REQUIREMENTS

The Anabat Scout is powered by two user replaceable AA batteries.

Insert the two batteries into the battery holder on the back of the detector. **Do not remove the batteries without turning off the detector first** to avoid potential SD card corruption.

The **Low Power Symbol** will appear ⊠ when the battery voltage is low. **The detector switches itself off** when the voltage drops below a usable level (1.9V). If the low battery symbol ⊠ appears should change the batteries as soon as possible to avoid the detector shutting down unexpectedly. 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.

AA batteries can be Alkaline, NiMh rechargeable, or Lithium (1.5V). Make sure all batteries are fresh and of the same type. Battery life will depend on the condition and type of batteries being used, as well as ambient temperature, audio volume setting, and amount of bat activity & ambient noise. Two alkaline AA batteries **typically** last for 10-20 hours of recording of full spectrum recording. However, in practice recording conditions can vary, so be conservative when using battery life estimates and carry spare batteries.

There is also an internal clock battery which should only need replacing about every 5-10 years, the detector will need to be sent to your local distributor for servicing to replace this battery. The detector will warn you when this battery is due for replacing.

SD CARDS

The Anabat Scout uses one SD card for data storage. Memory cards can be purchased from Titley Scientific, or most electronics/office stores. 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 into the slot at the base of the detector until it clicks into place, as per the orientation shown on the detector diagram.
2. Turn the detector on, the percentage of free space on the card will be displayed in the top right of the screen.

To remove an SD card:
1. Turn the detector off by holding down the ⏻K button for two seconds, then select Yes using the right soft key. **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.

MICROPHONE

The Anabat Scout has a built-in low-noise omnidirectional microphone in the top black face of the detector.

There is an additional microphone on the front of the detector above the display for recoding voice notes.

AUDIO OUTPUT

The detector has a built-in speaker to listen to the audio output, alternatively, you can connect headphones via the headphone jack on the base of the detector. If headphones are plugged in, the audio output will switch from the speaker to your headphones automatically.

GPS

As soon as the Anabat Scout is turned on, it will attempt to get a GPS lock. The GPS signal will be used to geotag the location in the metadata of the recordings, record a gpx track, and record locations in the bat count. The clock is also set accurately by the GPS.

When the detector is searching for satellites, the GPS icon ⬡ in the top of the screen will be flashing. The number next to this icon indicates the number of satellites the detector has in view. When a sufficient number of satellites have been obtained, the icon will change to ⬡. The more satellites, the more accurate the GPS signal.

You can still record without a GPS signal, but the location data will be unavailable and a track will not be recorded. To improve the GPS performance, move to an area with a clearer view of the sky for better satellite reception.

ANABAT SCOUT BASIC OPERATION

The Anabat Scout is designed to be easy to use, and start recording immediately. Before you start a recording session with your detector you should set your current time zone (see Setting the time zone) otherwise the time stamps on the files will be incorrect. 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, ensure the SD card is correctly orientated as per the diagram.
2. Insert two fresh AA batteries in the back of the detector.

TURNING THE DETECTOR ON/OFF

Turn the detector on by pressing the ⏻K button. It will automatically start the live audio. If you have a SD card inserted, triggered recording will also begin. When a recording is

being triggered, the recording symbol ⦿ will appear in the bottom centre of the screen (for more information see TRIGGER SETTINGS).

To stop the detector recording briefly press the ⏻K button; it will ask Would you like to stop recording? Press the ⏻K button or the Yes right soft key to stop recording. Press the No left soft key to continue recording.

To turn the detector off, hold down the ⏻K button for two seconds; it will ask Would you like to shutdown? Select Yes using the right soft key. To continue recording, press the No left soft key.

UPDATE FIRMWARE

The Scout firmware is updated by using an SD card with the software update copied onto it. You can subscribe to receive email alerts of new Scout firmware updates using this website: http://eepurl.com/dNeMxc

1. Download the update file using this link and copy it to the root directly on an SD card. Make sure the file is named scout.adx. You can use the same SD card to update multiple Scouts.
2. Insert the SD card and fresh batteries into your Anabat Scout then power it on. After a short time a message will appear: **Firmware update 1.0 available. Would you like to update now?** Press the **Yes** key (right soft key) to start the update. Do not remove the batteries or power off the detector while the update is being installed. Two squares will scroll across the display while the update is being installed and then the detector will restart.

VOLUME CONTROL

To control the volume, use the left and right navigation buttons whilst in the main screen. Alternatively, you can change the volume in the settings.

BAT COUNTER

The bat counter will record every in and out button press into a .csv spreadsheet. Along with each button press, it will also record the date, time, and location. By default, each in/out button press will count as 1, however you can increase this increment up to 10 (see Bat count increment). To reset the bat counter, hold both the In and Out buttons simultaneously for 2 seconds. A new bat count file will be created for each night.

RECORDING A VOICE MEMO

By default, the right soft key will record a voice memo. You need to press and hold the memo whilst you record the memo, once the button is released the memo recording will end. You cannot record a voice memo and record bat files simultaneously. Speak into the voice microphone (located just above the screen) while taking the memo. It is best to hold the microphone around 15cm (6 inches) from your mouth while speaking.

If you have changed the function of right soft key (see Soft key options), then you can record a voice memo by pressing the left soft key, then the up ▲ arrow button, then pressing the ⏻K button to start recording. To stop recording, press the right soft key.

SETTINGS

To access the **Settings Menu**, press the left soft key.

TRIGGER SETTINGS

When turned on, the Anabat Scout will record continuously until the batteries run out, the SD card becomes full, recording is manually stopped, or the detector is turned off. This is the default recording mode designed for active detection of bats. Files will only be saved if they pass the trigger settings.

To access the **Trigger Settings** menu, press the left soft key, then use the ⏻K button to select **Trigger**. You will be able to change the sensitivity, minimum frequency, maximum frequency, recording mode, and minimum event time. Scroll through the menu using the

up/down navigation buttons and make a selection by pressing the ⏻K button, or right arrow ▶ button.

Setting the sensitivity

To change the sensitivity, select Sensitivity in the Trigger Settings, then use the left/right navigation buttons to increase/decrease the level. You can choose between Low, Medium and High sensitivity. High is selected by default.

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, select Min Frequency in the Trigger Settings, then use the left/right navigation buttons to increase/decrease the frequency. 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, select Max Frequency in the Trigger Settings, then use the left/right navigation buttons to increase/decrease the frequency. The default value is 160 kHz.

Recording Mode

By default the Anabat Scout will record in triggered mode, where a sound needs to pass the trigger settings to be saved as a recording. You can also choose to record constantly. The constant recording mode will record all sound constantly (without triggers) until recording is manually stopped by pressing the ⏻K button, or the detector is turned off. To change the mode, select Rec Mode in the Trigger Settings, then use the left/right navigation buttons to change between **Triggered** and **Constant**, the selected mode will be highlighted in yellow, press the ⏻K button to confirm your selection. Once constant mode is selected, it will immediately begin recording.

If you wish to continue recording in triggered mode, and have the option of turning on constant recording quickly. Choose Rec Mode as your soft key option, then press the right soft key to start and stop constant recording.

If you would like to start and stop constant recording easily (for example when recording reference calls), choose Constant recording mode in the Trigger Settings, and Rec Mode as your soft key option. Then you can use the right soft key to start and stop recording.

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, select Min Event in the Trigger Settings, then use the left/right navigation buttons to increase/decrease the time.

Recording Window

A recording window, also known as a trigger window, is the minimum amount of time recording will continue after a trigger event. This will prevent a bat pass being broken up into multiple files. However, if file reaches the maximum length specified in the **File Length** it will be ended and a new file will begin. A recommended minimum event time is 2ms. To change this, select Rec Window in the Trigger Settings, then use the left/right navigation buttons to increase/decrease the time.

RECORDING SETTINGS

To access the **Recording Settings** menu, press the left soft key, then use the ⏻K button to select **Recording**. You will be able to change the file type, maximum file length, ZC division ratio, and add a filename prefix. Scroll through the menu using the up/down navigation buttons and make a selection by pressing the ⏻K button, or right arrow ▶ button.

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. By default, the Anabat Scout will record in FS. To change the mode, select Rec Type in the Recording Settings, then use the left/right navigation buttons to change between ZC and FS, the selected mode will be highlighted in yellow, press the ⏻K button to confirm your selection.

File Length

The file length 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 length, select File Length in the Recording Settings, then use the left/right navigation buttons to increase/decrease the time.

Filename Prefix

You are able to save the detector serial number as a filename prefix. To activate this feature select File Prefix in the Recording Settings, then use the right arrow to change to SN (Serial Number), then press the ⏻K button.

AUDIO SETTINGS

The Anabat Scout offers a number of audio outputs including heterodyne, auto-heterodyne and frequency division. To access the **Audio Settings** menu, press the left soft key, then use the ⏻K button to select **Audio**. You will be able to change the audio output, choose auto/manual tuning, and change the volume. Scroll through the menu using the up/down navigation buttons and make a selection by pressing the ⏻K button, or right arrow ▶ button.

Audio output

To change the mode, select Audio Output in the Audio Settings, then use the left/right navigation buttons to change between Het, FD or Both, press the ⏻K button to confirm your selection.

Heterodyne (Het) - Heterodyne shifts down a portion of the ultrasonic band into the human hearing range by mixing the signal with an internal reference frequency. This reference frequency is adjusted to suit the frequency of bat calls of interest. The bandwidth of the heterodyne mixing is about ±5 kHz, so bats calling at a significantly different frequency to the reference frequency will not be heard. In heterodyne mode, you can choose between auto-tuned heterodyne (default) and user-tuned heterodyne (see Heterodyne auto-tune).

Frequency Division (FD) - This audio mode divides down frequency of the incoming ultrasonic signal by a pre-set ratio (16) so as to allow ultrasonic sounds to be heard by the human ear. Please note that this mode is based on zero-crossing detector and thus only the loudest frequency component will be heard. No harmonics can be heard and the amplitude of bat calls is not retained, so all sounds will be of the same volume level.

Both - This audio mode allows you to listen to heterodyne and frequency division audio in each side of your ear/headphones simultaneously. This feature is generally only useful if you are listening to audio using ear/headphones. If you are using the built-in speaker, both audio outputs will be combined and play though the speaker together.

Heterodyne auto-tune

Auto-tuned heterodyne will automatically determine the peak frequency being recorded, and tune in to this frequency. This means that you will not have to manually scroll the heterodyne tuning to listen to bats at different frequencies. In auto-tune mode the peak frequency and the tuned frequency are the same, and will be displayed on the main screen next to the ♪ symbol. If you are in auto-tune mode, you can still use the up/down navigation buttons to manually tune, but once the peak frequency changes again the tuned frequency will snap back to the peak frequency.

Turning off auto-tuned heterodyne will mean that you have to manually tune the heterodyne to the frequency of interest using the up/down navigation buttons. In manual tuning mode, the manual tuned frequency is displayed next to the ♪ symbol, and the peak frequency being detected is displayed next to the ⋔ symbol.

Auto-tune heterodyne will be on by default, to change this, select Auto Tune in the Audio Settings, then use the left/right navigation buttons to change between On and Off, the selected mode will be highlighted in yellow, press the ⏻K button to confirm your selection.

Volume

You can change the volume using the left/right navigation buttons, or in the Audio Settings menu, by selecting Volume, then using the left/right navigation buttons to increase/decrease the volume (0 – 28).

OTHER MENU

To access the **Other** menu, press the left soft key, then use the ⏻K button to select **Other**. You will be able to change the soft key functionality, format the SD card, turn off transect mode, check sunset/sunrise times, and change the bat count increment. Scroll through the menu using the up/down navigation buttons and make a selection by pressing the ⏻K button, or right arrow ▶ button.

Soft key options

The soft key options decide the functionality of the right soft key on the main screen. You can choose between voice memo, auto/manual tuning, audio mode, recording mode, and none. By default, the soft key will record a voice memo. To change this, select Soft key options in the Other menu, then use the left/right navigation buttons to change between options, then press the ⏻K button to confirm your selection.

Format SD card

You can erase the SD card using the Format SD Card function. To do this, make sure the card is inserted into the slot, and select **Format SD** by pressing the ⏻K button. **Ensure all data is saved elsewhere before formatting the card, this will erase all the data on the card.**

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. The transect mode will be on by default. To turn off transect mode, navigate to **Transect** using the up/down navigation buttons, then use the left/right navigation buttons to change between On and Off, the selected mode will be highlighted in yellow, press the ⏻K button to confirm your selection.

Sunset/Sunrise times

This will display the exact sunset and sunrise times, as well as the time zone. This requires a GPS lock.

Bat count increment

When you press the In/Out counter buttons, they will record 1 in/1 out by default. You can increase this increment up to 10 by selecting Bat Incr. in the Other menu, then use the

left/right navigation buttons to increase/decrease the increment, then press the ⏻K button to confirm your selection.

Reset count

To reset the bat counter, you can hold both the In and Out button simultaneously. Alternatively you can select Reset Count in the Other Settings menu by pressing the ⏻K button, it will ask Would you like to reset the bat counter? Press the right soft key to select Yes. Resetting the count will not erase the count data from the .csv file. It will just reset the count in/out to 0.

SYSTEM MENU

To access the **System** menu, press the left soft key, then use the ⏻K button to select **System**. You will be able to set the time zone, reset to factory default settings, check the detector status, check for updates on the SD card, and access the diagnostics menu. Scroll through the menu using the up/down navigation buttons and make a selection by pressing the ⏻K button, or right arrow ▶ button.

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, select Time Zone in the System menu, then use the left/right navigation buttons to choose the correct time zone, then press the ⏻K button. Remember to account for any daylight-saving time that might be in effect.

Reset settings

To reset the detector to factory default settings, select **Reset Settings** in the System Settings menu by pressing the ⏻K button. This will override any previous settings changes you have made.

Status

This will display the date, software version, bootloader version, hardware revision, battery voltage, SD card memory, and serial number. To access this, select **Status** in the System Settings menu.

About

This will display the make, model and brand of the detector, as well as our website.

Update

You can use this to install a firmware update from the SD card. Usually, if a firmware update is available on the SD card, upon placing the card in the detector you will be prompted to perform the update. However, if you are not prompted, you can manually search by pressing the ⏻K button on Update in the System menu. If no update is available, it will state Update file not found on SD card. Please check SD card is inserted and scout.adx is present. The firmware update file must be named scout.adx and copied onto the root folder of the SD card. Anabat Insight can automatically download and copy the latest update to the card for you; see Update Firmware.

Diagnostic Menu

The diagnostics menu can be found in the System Menu. For more information, see Diagnostic Menu.

SCREEN BRIGHTNESS

The Anabat Scout provides two screen brightness options, low and high. By default, high screen brightness is used. To change this, press the left soft key (Menu), then the up ▲ arrow button twice, then pressing the ⏻K button. Use the left/right navigation buttons to change between Low and High, the selected mode will be highlighted in yellow, press the ⏻K button to confirm your selection.

DIAGNOSTICS MENU

The diagnostics menu is used by Titley Scientific representatives to diagnose potential issues with the detector. You will only need to use this menu if instructed by Titley Scientific. To access the menu, select System menu, navigate to Diagnostics and press the ⏻K button.

Test hardware

This feature will perform a hardware test, displaying the hardware metrics and in some cases pass/fail. This is usually only performed by a Titley Scientific representative in a service.

Test screen

This feature can be used to perform a visual inspection of the screen, to ensure there are no missing pixels. This is usually only performed by a Titley Scientific representative in a service.

Test buttons

This feature will allow you to test the functionality of each button on the detector. This is usually only performed by a Titley Scientific representative in a service. To exit this test, hold both soft keys down simultaneously.

Debug Log

This feature only needs to be activated when instructed by Titley Scientific, it allows for additional information to be logged, which may assist with debugging. Leave this feature **Off**, unless otherwise instructed.

MICROPHONE AND DETECTOR CARE

The Anabat Scout is not weather-proof, take care to protect it from rain, dew and snow. The ultrasonic microphone is located on the black top of the detector, ensure that dirt and dust does not enter the microphone hole. Do not insert anything into the microphone hole, this will cause damage to the microphone and void your warranty.

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 also 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 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 or Finder (Mac)
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 2019-03-15 19-42-07.zc was a zero crossing file recorded on 15th March 2019 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 battery voltage, GPS locations, settings and user interactions can be extracted from this file. Each log file can be opened can be opened as a text file or in a spreadsheet viewer such as Microsoft Excel.

SOFTWARE

The Anabat Scout comes with a free version of **Anabat Insight**, available for download from 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
- Generate reports to present your analysis results
- Use built-in mapping to view your tracks & waypoints
- Export mapping data to GIS programs

METADATA

All metadata recorded on the Anabat Scout is saved to files in the GUANO (Grand Unified Acoustic Notation Ontology) format. This format is now the standard across bat acoustic fields. For recordings from an Anabat Scout, it includes the following:

- Timestamp
- Detector make and model
- Detector ID (serial number)
- GPS location
- Detector firmware version
- Trigger settings

TROUBLESHOOTING & 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).

Q. What is the division ratio for zero crossing recording on an Anabat Scout?

A. The division ratio is set at 8. 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. The division ratio for the FD audio output is 16.

Q. What is the sample rate of an Anabat Scout?

A. The sample rate of the Anabat Scout is 320ksps.

Q. I can't get a GPS lock or my GPS data is inaccurate

A. To improve the GPS lock, move to an area with a clearer view of the sky for better satellite reception. You can still record without a GPS lock, but the timestamp and location data may not be accurate. Initially, your GPS data may be less accurate, but this will improve within a few minutes as more satellites are locked.

FURTHER INFORMATION

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