

# Anabat Express FS

## Full Spectrum Upgrade

### User Manual

Version 1.2



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

## DOCUMENT HISTORY

| Manual Version | Release Date | Firmware Version | Major Additions and Changes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|--------------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.0            | 28/09/2023   | 2.4.11           | An update on the Express user manual                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 1.1            | 13/05/2024   | 3.0.8            | <u>SD card recommendations</u> ; <u>Toolbox uses</u> ; <u>sensor log files</u> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 1.2            | 21/10/2024   | 3.1.0            | <u>Lithium battery recommendations</u> ; <u>servicing recommendations</u> ; <u>time zone in log files</u> ; <u>sensor logs</u> ; <u>update download procedure</u> ; <u>microphone information update</u> ; additional settings include <u>sensor logging</u> , <u>noise filter</u> and <u>sample rate options</u> ; <u>file name prefix options</u> ; <u>reference to more options in Toolbox</u> ; <u>LED behaviour during update</u> ; USB data line references throughout; <u>update sample rate FAQ</u> ; <u>data rate information</u> ; <u>new FAQs</u> ; |

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# SUMMARY OF CHANGES TO YOUR EXPRESS DETECTOR

Your Express FS detector will operate in the same basic way as the previous Anabat Express with the following changes (click the links for more information):

- [You can now choose to record in full spectrum or zero crossing](#)
- [You can set the sample rate and sensitivity on-device](#)
- [ZC files will be recorded in .zc format \(individual sequence files\), not .zca \(an entire night\) like it previously did](#)
- [You can now use SD cards up to 512GB](#)
- [Extended battery life, up to 30 nights in full spectrum, longer in zero crossing](#)
- [Add a digital asset tag to your recorder](#)
- [No need to convert recordings, open files directly into your analysis software](#)
- [You can use an on-device noise filter](#)

# GETTING STARTED

## USER INTERFACE

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



| LED Indicators                         |                                                                                                      |                                                                                                                            |                                        |                                        |
|----------------------------------------|------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------|----------------------------------------|
|                                        | Red                                                                                                  | Green                                                                                                                      | Blue                                   | Yellow                                 |
| Sensitivity LED (new)                  | Low                                                                                                  | Normal                                                                                                                     | High                                   | Different sensitivity set by PC        |
| Sample Rate LED (new)                  | ZC recording (.zc)                                                                                   | 320ksps full spectrum recording (.wav)                                                                                     | 500ksps full spectrum recording (.wav) | Different sample rate set by PC        |
|                                        |                                                                                                      |                                                                                                                            |                                        |                                        |
| —— 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 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<br>Fast flash (very briefly): GPS is entering/leaving transect mode        |                                        | No GPS lock is needed                  |
| Microphone LED                         | -                                                                                                    | Should flicker when receiving ultrasonic signal<br>Constant flash: Microphone not detected/faulty                          |                                        | -                                      |
| Check LED<br>(without magnet)          | -                                                                                                    | Detector not ready, open case to see what is required.<br>In transect mode: Will flicker when receiving ultrasonic signal. |                                        | Detector is off or is working normally |
| Check LED<br>(with magnet in position) | -                                                                                                    | Will flash once to indicate the detector is on. Will flicker when receiving ultrasonic signal                              |                                        | Detector is off                        |
| Functions                              |                                                                                                      |                                                                                                                            |                                        |                                        |
| Power Button                           | Press to turn detector on/off                                                                        |                                                                                                                            |                                        |                                        |
| Settings Button (new)                  | Long-press to cycle through sensitivity options; double click button to change sample rate/file type |                                                                                                                            |                                        |                                        |
| Mode Button                            | Press to select the desired recording mode, hold down to enter/exit 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 recorder can use SDHC and SDXC memory cards. Titley Scientific highly recommends Sandisk® Extreme and Sandisk® Ultra SD cards, these cards have been tested with the Express FS and are recommended due to their reliable performance and low power consumption. Using other brands and models may result in reduced battery life or detector malfunction and are not recommended. **Titley Scientific does not support the use of microSD cards in adaptors**, using these may result in data loss/malfunctions. Memory cards can be purchased from [Titley Scientific](#), or most electronics/office stores.

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 if using triggered activation. All values in the table below are approximate per hour of recorded sound. SD card formatting options and trigger settings may change these estimates. You can estimate the amount of data to be collected in a survey using the **Battery/Data Estimator** in **Toolbox within Anabat Insight**.

| Sampling Rate         | Data (p/hr) |
|-----------------------|-------------|
| Full Spectrum 500Ksps | 3.4GB       |
| Full Spectrum 384Ksps | 2.6GB       |
| Full Spectrum 320Ksps | 2.2GB       |
| Full Spectrum 192Ksps | 1.3GB       |
| Zero Crossing         | 0.02GB      |

### **A note on triggered ultrasonic recording**

During a typical night of triggered ultrasonic 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 recorder could easily record several gigabytes of files in a single night. Keep this in mind when choosing SD card capacity, or if using the [Noise Filter](#).

## USB CABLE

Your original Anabat Express came with a USB cable for connection to your computer. You can use this cable, or any good quality USB cable with a data line (usually thicker than power-only cables) to configure your detector and upgrade your firmware using **Toolbox in Anabat Insight** (see the [Anabat Insight User Manual on our website](#) for further instructions).

## MICROPHONE

You can use an omnidirectional or directional microphone with your Anabat Express FS:

- The omnidirectional has a useable frequency response of 10 to 140kHz, whilst the directional has a frequency response from 10 – 250kHz.
- Both microphones are weather resistant, the capsule is protected by a waterproof membrane. Please refer to **WEATHERPROOF CONSIDERATIONS** for considerations for use in the rain.
- Microphone extension cables are available for purchase from [Titley Scientific](#). Cables can be daisy-chained if required.

**Please note:** Omnidirectional microphones not marked with "V2" or above will consume more power, considerably reducing battery life. We recommend purchasing a new US-O V3 omnidirectional microphone for best performance.

## POWER REQUIREMENTS

The Anabat Express FS 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.

AA batteries can be alkaline, rechargeable, or lithium (1.5V). 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 detector 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 "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 be 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 up to 30 nights in full spectrum (12 hours recording per night), ZC will be much longer. However, in practise 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. **Toolbox in Anabat Insight** allows you to estimate battery life for different conditions.

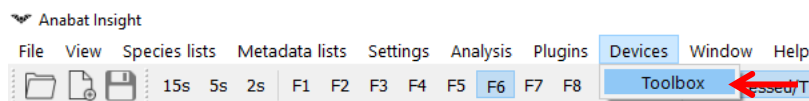
There is also an internal clock battery which should only need replacing about every 5 years. This is a CR2032 Coin Cell battery and can be purchased from [Titley Scientific](#), or from battery shops.

## UPDATING FIRMWARE

It is important to keep the firmware on your Express FS up to date to ensure trouble-free operation. The Express FS firmware can be updated through **Toolbox** by using an SD card, or via USB cable to your PC. It is highly recommended that you subscribe to receive email alerts of new Express FS firmware updates using this website <https://titley.m-pages.com/ryAAuj/expressfs-firmware-updates-subscription-form>

### To update firmware:

1. Download **Anabat Insight** from [Titley Scientific](#) (free download), or ensure your existing Insight is running the latest version. If an update is required it will be indicated by a green bar near the top of the program window.
2. Open Anabat Insight, under the **Devices** menu, select **Toolbox**.



3. Under **Selected Detector**, choose **Express FS**.
4. Click on the **Updates** tab  on the left of Toolbox.

### To update via USB cable:

1. Connect the Express FS to the computer via USB cable (with a data line, usually thicker than power-only cables), then turn on by pressing the **Power** button.
2. In the **Updates tab** Toolbox will state the current firmware version and the most recent online version. If the firmware needs to be updated, your current version will be displayed in red.



#### Updates

Current Version **2.4.6.23047**

Online Version 2.4.7.23058

**Update required**



#### Updates

Current Version **2.4.8.23137**

Online Version 2.4.7.23058

**Detector is up to date**

3. To update your recorder to the latest firmware, click **Apply to Recorder**. Update progress is shown with a progress bar in Toolbox, and by **Recording Mode LEDs** on the Express FS flashing sequentially. When all the LEDs are illuminated the update is complete and the unit will restart. The update should take around a minute to complete, once complete a message will appear in Toolbox stating "**Firmware update complete**". If the LEDs flash in a cycling/chasing pattern for more than a few moments, there has been an issue with the update – contact your local distributor for assistance.
4. When the update is finished, unplug the USB cable.

#### To update via SD card:

1. Insert a blank SD card into the computer. You can use the same SD card to update multiple Express FS detectors.
2. Click **Apply to SD** to save the most recent firmware to the SD card. Once completed, it will state 'Update copied'.
3. Safely eject the SD card from the computer.
4. Insert the SD card and fresh batteries into your Express FS then turn it on. The update will automatically occur if required. Do not remove the batteries or power off the recorder while the update is being installed. Update progress is shown by **Recording Mode LEDs** flashing sequentially, when all the LEDs are illuminated the update is complete and the Express FS will restart. The update should only take around a minute. If the LEDs flash in a cycling/chasing pattern for more than a few moments, there has been an issue with the update – try updating via USB cable method below.
5. You can now delete the update.adx file from the SD card with your computer or use the card again to update other recorders.

## ANABAT EXPRESS FS BASIC OPERATION

The Anabat Express FS is designed for fast and easy deployment. Before you start recording with your detector, we recommend you check for firmware updates. See the [Anabat Insight User Manual on our website](#) for instructions on updating firmware, setting the clock and time zone.

To begin:

1. Insert fresh **batteries** and an **SD card** with sufficient memory for your recording period. Ensure the SD card is correctly orientated per the diagram on the detector 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 case so it isn't lost.
3. 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 and void warranty.**
4. Turn the detector on by pressing the **Power button**.
5. By default your detector will record in full spectrum, with 320ksps sample rate on normal sensitivity. To change this, see **Recording Settings**.
6. Press the **Mode button** until your desired recording mode is chosen. There are three recording modes which you can choose from: schedule, night and continuous (see **Recording Modes**). For most surveys, the night recording mode is recommended.
7. 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.
8. 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. If the LED is steadily flashing consistently, the microphone is not detected by the ExpressFS and will not record.

9. 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 **DIGITAL ASSET TAG** (Computer Only))

You can add a digital asset tag to your detector which will save asset information in the metadata of all files recorded. This can include company name, device nickname, company contact, company address and asset ID. If you would like to add an asset tag, this can be done using **Toolbox** with your detector connected via USB.

**Please note:** The device nickname is limited to 10 characters.

## DEPLOYMENT

10. TESTING THE SYSTEM).
11. 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.

## RECORDING MODES

### SCHEDULE RECORDING MODE

Schedule recording mode allows you to customise to your preferred recording times and settings (including multiple tasks with different settings), however it must be saved onto an SD card with a computer prior to use (using **Toolbox in Anabat Insight**). See the [Anabat Insight User Manual on our website](#) for instructions on setting up a schedule. The schedule.json file must remain on the SD card for the deployment.

**Please note:** Any new schedules created will only be supported by recorders running firmware 3.1 or newer. Ensure your recorder is running the latest firmware before importing the schedule.

The detector does not require a GPS fix to record in Schedule mode if a deployment location was specified when creating the schedule in Toolbox or if the specified recording times aren't

relative to sunset or sunrise. The detector will still attempt to get a GPS to update its clock if possible.

## NIGHT RECORDING MODE

The night mode is designed for speedy & efficient deployment. This recording mode will turn the detector on 30 minutes before sunset and off 30 minutes after sunrise. This mode will continue to record nightly until the batteries run out, the SD card becomes full, or the detector is turned off. Night 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.

## 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. 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.

**Please note:** 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.

## SETTINGS

### TRANSECT MODE

Transect mode will record your GPS location every second. This will create a GPS file (.gpx), which will display the path traced by the detector. You can use the transect mode in conjunction with any of the three recording modes (Schedule, Night or Continuous).

To activate the transect mode:

1. Press and hold the **Mode button** until the GPS LED flashes quickly (should take about 5 seconds).

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

**Please note:** Transect mode will consume batteries more quickly than a standard mode.

## RECORDING SETTINGS (On Detector)

The Anabat Express FS is optimized for most detection situations with its default settings. If you would like to change the file type (FS or ZC), sample rate or sensitivity, you can do this on your detector by following the instructions below. Additional settings can be accessed using Toolbox within Anabat Insight on your computer.

### File Type / Sample Rate

1. Double click the Settings Button to toggle between 3 options:
  - Green Sample Rate LED - 320ksps full spectrum recording (.wav)
  - Blue Sample Rate LED - 500ksps full spectrum recording (.wav)
  - Red Sample Rate LED – Zero crossing recording (.zc)

You can also set the file type and choose from more sample rate options on your computer using Toolbox within Anabat Insight.

### Sensitivity

1. Hold down the Settings Button to cycle between 3 options:
  - Green Sensitivity LED – Normal sensitivity
  - Blue Sensitivity LED – High sensitivity
  - Red Sensitivity LED – Low sensitivity

You can set sensitivity to a finer scale on your computer using Toolbox within Anabat Insight.

## OTHER SETTINGS (Computer Only)

If you would like to change other settings, this can be done using **Toolbox within Anabat Insight** with your detector connected via USB. Under the **Device Settings** tab, you can change the following:

|                                  |                                                                                                                                                                                                                                                                                            |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Clock</b>                     | Set the date and time to match your computer clock.                                                                                                                                                                                                                                        |
| <b>Time zone</b>                 | Set the time zone for your detector in UTC.                                                                                                                                                                                                                                                |
| <b>Sensor Logging</b>            | Choose whether sensor logging (temperature and battery voltage) occurs only when recorder is active or all the time.                                                                                                                                                                       |
| <b>Sensor Logging Frequency</b>  | Set how often sensor logging (temperature and battery voltage) occurs when active: 10, 15, 20, 30 or 60 minutes.                                                                                                                                                                           |
| <b>WAV Sample Rate Precision</b> | This setting determines how the sample rate is specified in the metadata of WAV files. Choose 'Standard' for better compatibility with third-party analysis software, or 'Precise' for more accurate metrics in Insight. The default is Standard and is recommended for most applications. |

Under the **Recording Settings** tab you can change the following:

|                                   |                                                                                                                                                                                                                                                                                                                |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>File Type</b>                  | Choose between wav (full spectrum .wav) or ZC (zero crossing .zc)                                                                                                                                                                                                                                              |
| <b>Sample Rate</b>                | Available for wav recording only, choose between 192, 320 or 500kps. See the <a href="#">FAQs</a> for more information.                                                                                                                                                                                        |
| <b>Frequency Division Ratio</b>   | Available for ZC recording only, choose between 4, 8 and 16. We recommend 4.                                                                                                                                                                                                                                   |
| <b>Ultrasonic Activation</b>      | Choose between Trigger (recommended) and Constant (recording constantly). See <a href="#">FAQs</a> for more information.                                                                                                                                                                                       |
| <b>Microphone Sensitivity</b>     | This lets you control how loud the sound must be to trigger an ultrasonic recording. To trigger on quieter noises, increase the sensitivity setting (higher numbers are more sensitive). To trigger only on louder noises, reduce the sensitivity. Select sensitivity on a scale (1 – 20).                     |
| <b>Minimum Trigger Frequency</b>  | The minimum frequency that will trigger a recording.                                                                                                                                                                                                                                                           |
| <b>Maximum Trigger Frequency</b>  | The maximum frequency that will trigger a recording.                                                                                                                                                                                                                                                           |
| <b>Minimum Event</b>              | The minimum duration sound that will trigger a recording.                                                                                                                                                                                                                                                      |
| <b>Minimum Recording Duration</b> | The minimum amount of time recording will continue after a trigger event.                                                                                                                                                                                                                                      |
| <b>Maximum File Duration</b>      | The maximum length (time) of a file.                                                                                                                                                                                                                                                                           |
| <b>File Name Prefix</b>           | You are able to choose between serial number, recording type, device nickname, asset ID or no prefix.                                                                                                                                                                                                          |
| <b>Noise Filter</b>               | There is an on-recorder noise filter determines if a sound is 'structured' or 'unstructured' and will group recordings accordingly. You can additionally choose to delete noise files when memory capacity is low. Choose between Off, Keep or Overwrite. For more information on the noise filter, see below. |

|                                |                                                                                                                                   |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <b>Transect Mode</b>           | Transect mode will use the built-in GPS to save your track as a GPX file by logging GPS points once per second.                   |
| <b>Metadata Type and Value</b> | You can add a custom metadata key and value to be added to every file recorded (e.g. Key – Site, Value – Cat Tien National Park). |

For more information on changing these settings see [Using Toolbox](#).

#### **A note on the Noise Filter:**

There is an on-recorder noise filter available for triggered recording which determines the difference between structured and unstructured sounds. When enabled, it will direct recordings that contain structured sounds (i.e. bat calls) into the **Recordings** folder, and recordings without discernible structure will be directed to a **Noise** folder. The algorithm produces results similar to the 'All Bats' filter in [Anabat Insight](#); results will not match exactly.

**Please note:** No filtering option is ever perfect, there will always be cases where bat calls may be assigned as 'Noise' and noise will be deemed 'bat calls'. For this reason, we strongly recommend you test the function of the noise filter at the deployment site first to ensure it is separating bats from noise adequately in your target environment.

You can elect to **Keep** or **Overwrite** the noise files. If Keep is selected the Noise folder will be retained. When Overwrite is selected, if the SD card memory space falls below 5%, all of the files in the noise folder will be deleted. This process will be repeated until there is 'bat call' recordings filling 95% of the card, after which point any file deemed to be noise will be automatically deleted.

**Please note:** As the Overwrite option may result in data loss (if memory space drops below 5%) we do not recommend you select it unless you anticipate a noisy environment (eg. lots of rain, insects, wind etc.) and/or your storage space is limited; and you have tested the efficacy in your target environment or site. We do not recommend the use of Overwrite for zero crossing recordings as most memory cards should be sufficient for this recording format.

## **DIGITAL ASSET TAG (Computer Only)**

You can add a digital asset tag to your detector which will save asset information in the metadata of all files recorded. This can include company name, device nickname, company contact, company address and asset ID. If you would like to add an asset tag, this can be done using [Toolbox](#) with your detector connected via USB.

**Please note:** The device nickname is limited to 10 characters.

## DEPLOYMENT

### 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.

We also recommend you have any microphones serviced by your Titley Scientific distributor once yearly to ensure they are operating as expected.

### WEATHERPROOF CONSIDERATIONS

The Anabat Express FS 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 detector is deployed passively, 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. If recording is required during rain the microphone should be mounted in such a way so that water cannot land on the microphone element.
4. Dry off the camouflage case and microphone before opening the detector or removing the microphone. This prevents moisture from entering the detector.
5. The detector should not be partially or fully submerged in water.
6. Desiccant satchels can be added inside the case to help prevent condensation; these will need to be periodically replaced or dried in an oven.

**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 FR6 1.5V Lithium non-rechargeable LiFeS<sub>2</sub> batteries (eg. Energizer™ Ultimate Lithium) 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.

## 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.

## DOWNLOADING DATA

### HOW TO DOWNLOAD DATA FROM AN SD CARD

Once you have recorded 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 with **Anabat Insight** or other sound analysis software packages.

1. To begin, turn off the detector, then remove the SD. **Failure to turn off the detector before SD card removal could result in data loss or corruption.**
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 using your file 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. Files will be arranged on the card in folders as follows:
  - **Recordings:** This folder contains recordings grouped into subfolders based on the recording profile or schedule.

- **Noise:** This folder will only be created if the Noise Filter is turned on. It will contain files deemed to be 'noise'.
- **Log:** This folder contains the log files for the deployment. This should be kept in case future troubleshooting is required.
- **GPS:** This folder contains the transect GPX files (if created).

## FILE NAMES

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

File names include the date and time of the recording beginning: YEAR-MM-DD\_HH-MM-SS.filetype for example 2021-03-15\_19-42-07.wav was a full spectrum file recorded on 15<sup>th</sup> March 2021 at 7:42:07pm. You can also elect to add a file prefix to your file names.

## DIAGNOSTIC LOG & SENSOR FILES

The diagnostic log files contain all the information about the recording sessions on the SD card. Information such as detector settings, time zone, GPS locations, files recorded, and user interactions can be viewed in these files. Each log file is a .csv which can be opened in Excel.

The recorder will also create sensor files that contain the temperature and battery voltage. Each sensor file is a .csv which can be opened in Excel. For more information see **Sensor Logging in Other Settings**.

## 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 .gpx file. This can be opened directly into most mapping software including Google Earth, and displays the path traced by the detector. It can also be converted into a .kml file using **Anabat Insight**.

# SOFTWARE

## ANABAT INSIGHT

Anabat Insight is the free software you can use to view and analyse zero crossing and full spectrum recordings from your Titley Scientific detectors. You can open/view .zca, .zc and .wav files in Anabat Insight. The program offers the following features:

- Ability to view recordings in full spectrum and zero crossing
- Metadata 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

Anabat Insight is available to download for free at the Titley Scientific website ([www.titley-scientific.com](http://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**.

## TOOLBOX within ANABAT INSIGHT

Toolbox is available within Anabat Insight and can be used for the following:

- Check the serial number and firmware version of your Anabat Express FS
- Add a digital asset tag to be saved in file metadata
- Set the clock/time zone
- Change the recording settings
- Choose your recording mode
- Set a schedule
- Estimate the battery life

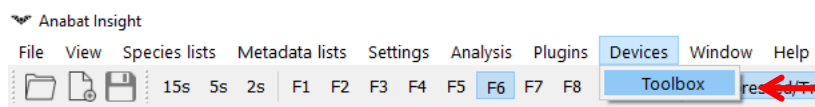
For instructions on how to use Toolbox with your detector, see the [Anabat Insight User Manual on our website](#).

## Using Toolbox

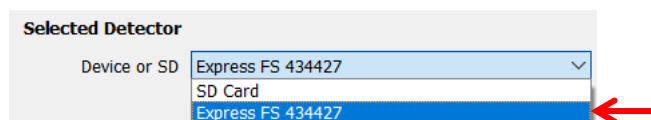
To use Toolbox with your Anabat Express FS, you will either need an **SD card**, or to **connect the detector via USB** to your computer, ensuring you are using a USB cable with a data line (usually thicker than power-only cables). For certain functions (changing some settings, adding asset tag, checking the detector info), you need to connect to the PC.

### To connect the Anabat Express FS to a PC:

1. Download and install **Anabat Insight** from [www.titley-scientific.com](http://www.titley-scientific.com)
2. Turn on your detector and **connect the USB cable** (with a data line) from the detector to the PC.
3. Open Anabat Insight, under the **Devices menu**, select **Toolbox**.

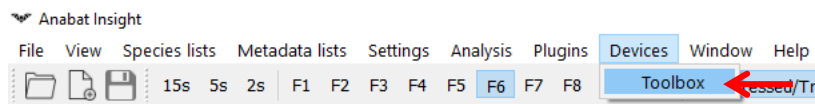


4. Your Anabat Express FS should automatically be detected, it may take several moments to load when you first connect your Anabat Express FS while the drivers are setup.

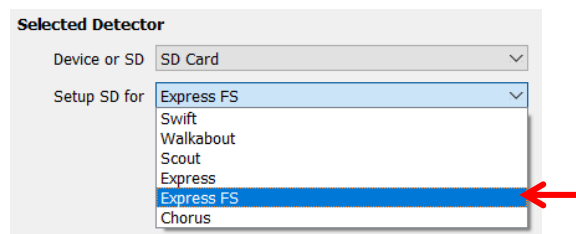


### To set up an SD card for Anabat Express FS:

1. Download and install **Anabat Insight** from [www.titley-scientific.com](http://www.titley-scientific.com)
2. Insert a **blank SD card** into your computer.
3. Open Anabat Insight, under the **Devices menu**, select **Toolbox**.

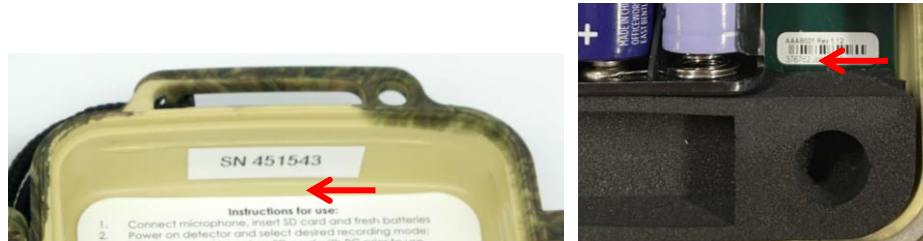


4. Under **Device or SD**, select **SD card** from the dropdown menu.
5. Under **Setup SD for**, select **Express FS** from the dropdown menu.



## 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.



You can also check your serial number and firmware version using **Toolbox**. To check the serial number or firmware version using Toolbox, you'll connect the detector to your computer via USB cable. For further instructions see the [Anabat Insight User Manual on our website](#).

## TIPS FOR PASSIVE MONITORING

### POWER AND DATA STORAGE SPACE

For short term monitoring sessions, the Anabat Express FS 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 up to 30 nights in full spectrum, 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 **Toolbox** for a more accurate idea of how long your batteries will last.

### EQUALISATION

In some situations where multiple detectors are deployed, it may be a requirement to ensure all the bat detectors being used are equalised 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 equalised 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.

You can choose between a weatherproof, omnidirectional or directional microphone. An omnidirectional microphone means that it can record ultrasonic sounds from all directions, however sensitivity is limited behind the detector. One advantage of an omnidirectional microphone 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 FS is mounted vertically (refer to the section on weatherproofing) so that any rainwater 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 FS camouflage case is designed so that the detector 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                                                                                                                                                                                                                                      |
|-------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Power</b>      | Batteries are too low           | Replace AA batteries                                                                                                                                                                                                                          |
| <b>Schedule</b>   | No schedule set                 | Need to set the schedule on the SD card with a computer, or select a different recording mode                                                                                                                                                 |
| <b>Continuous</b> | Error                           | Turn the detector off then on again                                                                                                                                                                                                           |
| <b>Recording</b>  | 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.                    |
| <b>Microphone</b> | Microphone missing or faulty    | Should flicker when receiving ultrasonic signal<br>Constant flash: Microphone not detected/faulty                                                                                                                                             |
| <b>Night</b>      | 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 |
| <b>GPS</b>        | Satellite fix is required       |                                                                                                                                                                                                                                               |

|                                                                                                                                                    |                                                                                                                                                   |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>Check<br/>(front of case)</b>                                                                                                                   | If flashing without a magnet,<br>satellite fix is required<br>If flickering when receiving ultrasonic<br>signal, the detector is in Transect 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 |                                                                                                                                                   |  |

## FAQS

### **How far away can a bat be detected using the Anabat Express FS?**

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 third-party software [AnaVolumes](#).

### **Can I use the Anabat Express FS as an active detector?**

While the Anabat Express FS is designed as a passive detector, it can be used as an active detector for transects using the transect mode.

### **What does microphone frequency response mean?**

Microphones exhibit a 'frequency response', which basically means they have differing sensitivities at different frequencies. A microphone may be very sensitive at 40kHz, then lower sensitivity at 60kHz, then be very sensitive again around 80kHz. Microphone sensitivity doesn't just flat-line at a specific frequency but has a tendency to 'roll-off' around a certain frequency. When we refer to the 'maximum frequency', this is the point where the frequency response has begun to taper off. However, the microphone can still detect higher frequency sounds (they just need to be louder or closer to the microphone).

### **The Express FS is recording huge quantities of ultrasonic files, how can I address this?**

It is always best to have a memory card that exceeds your expected capture requirements. If you think you'll capture 32GB we suggest at a minimum, use a 64GB card. You can use the data estimator tool in **Toolbox within Anabat Insight** to help guide this, ensure your activity level in Toolbox is set to High.

There are several options to reduce the number of files your record. Firstly, check your trigger settings to ensure they are optimized for your deployment, specifically ensure your **minimum trigger frequency** is set as high as possible without missing your lowest frequency bat, and your **minimum event** duration is not set too short. Secondly, lowering the **sensitivity** can help reduce number of files, however this will result in a trade-off in the ability to record quiet sounds. You can also turn on the **noise filter** to separate noise from

bat calls and choose the overwrite setting to delete noise files when memory storage runs low.

You can also reduce the size of the files recorded. Higher **sample rates** equate to larger files, so reduce your sample rate to the lowest possible setting without missing your highest frequency bat (see FAQ below for more information).

Finally, you can always apply noise filters to your data during your post-recording analysis in **Anabat Insight** (free to use). There is a built-in 'AllBats' filter, and you can utilise other filtering features (such as smoothness, synthetic filters and metric parameters) to help sort files into more useful batches and eliminate unwanted noise post deployment.

### **What is the sample rate and how to choose it?**

A sample rate is the number of samples per second taken in a recording. You can only record to a frequency approximately half the sample rate (Nyquist frequency). For example, at a sample rate of 500ksps you can record sounds up to 250kHz. So ensure your sample rate is at least double your highest frequency bat of interest. Remember though, the higher the sample rate, the larger the file.

### **What is the difference between constant activation recording and continuous recording mode?**

The recording mode, set by the Mode button on the detector interface (eg. Night or Continuous) refers to when the detector is "active" or "listening". In continuous recording mode, the detector is "listening" all the time (24 hours a day). It won't necessarily record files when it's "listening", that will depend on the activation. The activation refers to when files should actually be saved to memory. A constant activation mode means that files are constantly be recorded (without gaps) regardless of what sound, if any, is present. If it's in triggered activation mode, it will only save files to memory if the sounds pass certain trigger settings.

To be clear here is a synopsis of what will be recorded:

**Continuous + Constant:** It will save all sounds, without gaps, 24 hours a day for as long as the battery or memory cards last.

**Continuous + Trigger:** It will save only files when a 'triggering' sound occurs, 24 hours a day.

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

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 mode. However, if you deploy your detector and it does not get an initial GPS fix, it will record from 7pm to 7am. The detector requires a GPS fix whenever it is first turned on in order to work correctly in Night 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 Toolbox that will run from sunset to sunrise (or your preferred times), and then manually specify the latitude and longitude using the "Location override". There is a map to make this easier. Set the end date to after you expect the batteries will run out. Save the schedule on the SD card and then use the Express FS in Schedule Mode.

### **Can the Anabat Express FS record acoustic/audible data?**

No, the Express FS and its microphone is only capable of ultrasonic recording (bats and other high frequency sounds). If you wish to record acoustic/audible data (birds, frogs, vocalising animals) you will need to purchase a Chorus or Ranger.

### **Can I buy a directional microphone for the Anabat Express FS?**

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

### **There are a lot of echoes in the spectrogram, how can I reduce this?**

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 mount the microphone away from any flat surfaces (such as boxes or walls). This will produce much clearer recordings.

We recommend using the microphone extension cable originally supplied with your Anabat Express, which allows you to position the ultrasonic microphone away from the detector/mounting surface.

### **The files recorded on my Express FS aren't being recognised/processed in a third-party app?**

In some cases (e.g. BTO Pipeline or Kaleidoscope) the sample rate prevents the file from being opened/processed. This is due to the precise sample rate being reported in the WAV file metadata. For pre-existing recordings with this issue you can use a third-party application such as Audacity to resample your existing data to the required sample rate. For future recordings, make sure the WAV sample rate setting is configured to **Standard**. Please refer to the section regarding the **WAV Sample Rate setting**.

## FIRMWARE RELEASE NOTES

The following release notes apply to firmware version 3.1.0:

### New Features:

- Noise filter for triggered ultrasonic recording (both FS and ZC) to categorise files as either 'noise' or 'recording', with optional removal of 'noise' files when SD cards become greater than 95% full. For more information, see the updated user manual.
- Time zone information in log files (always at the start of every log file, in the header next to the file date) and in recording metadata.
- Power and temperature logging now has a setting that allows logging even when recording isn't active.

### Changes:

- Added a new system global setting to control whether WAV files report the precise sample rate used by the hardware (e.g. 44.101ksps) or the standard sample rate as specified in the Profile (e.g. 44.1ksps) to improve third party application compatibility. Defaults to "Standard".
- Additional logging to assist troubleshooting.
- Added protection against physical buttons being held down 'forever' (which previously would have prevented power saving modes from occurring).
- Removed support for importing schedule.csv files - all schedule import/export is now in JSON format.
- Schedule import/export user interface changes.

### Fixes:

- Fixed an issue with schedule JSON files that sometimes resulted in incorrect recording start dates being used.

- GPS coordinates now appear in log files.
- Toggling of Transect is now more robust and predictable; by changing the press-and-hold behaviour of the Mode button so that it toggles once, rather than continuously toggling on and off while the button is held down.
- Pressing the Sample Rate/Settings button while in Schedule mode no longer changes the main settings.
- Miscellaneous fixes for quality of life and stability.

## FURTHER INFORMATION

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