



Bat Detector Information Pack

The basics

There are three types of bat detector:

1. Heterodyne

- Heterodyne detectors are **tuneable** – you select the frequency range to listen to. This makes them the best detectors for immediate identification of bats in the field.
- They work by filtering the inaudible bat sound with an ultrasonic signal from the detector, and producing the audible difference between the two sounds.
- Sounds can be recorded onto a recorder, but recordings **cannot** be used with sound analysis software to generate sonograms as frequency information is not retained.
- They are the **cheapest** of the detectors and are simple to use, making them ideal for beginners.

2. Frequency Division

- Frequency division detectors **detect all frequencies** so there is no need to tune into a specific frequency, and you don't miss any bats.
- They sample a set of incoming sound waves and take an average to divide the incoming frequency by a particular factor to give an audible output (e.g. 50kHz ÷ factor of 10 into 5kHz).
- Sounds can be recorded and used with sound analysis software but some information is lost.
- They are generally **low** to **mid-price** but cheaper versions tend not to retain amplitude information.

3. Time Expansion

- Like frequency division detectors, Time Expansion detectors **detect all frequencies**.
- They work by digitally recording a short snatch of sound (e.g. 1 second), then playing it back at a slower speed, resulting in the highest quality recording of all the detector types and retention of the most information. The disadvantage is that while the detector is playing back the slowed-down sounds, it becomes "deaf" to any bats flying past so continuous recording is not possible.
- Sounds can be recorded and used with sound analysis software. They enable a very detailed analysis of the sound and a clearer sonogram when compared to frequency division.
- They are the most **expensive** of the detectors.

Additional note

- Some detectors feature more than one type of sound conversion, for example some frequency division detectors have a heterodyne mode as well, and some feature all three models of sound conversion. These detectors are the most expensive.

There are a number of factors to consider when choosing a bat detector. These include:

- **Price**
- **Microphone and frequency range:** Microphones determine the sensitivity of the bat detector. Piezo – best at mid frequencies (~45kHz), Electret – lower frequencies (<30kHz), and Capacitance – higher frequencies (>80kHz). You will still be able to detect other frequencies, but the distance you can detect them from will vary. Detectors with more than one microphone are best because they will be sensitive at more than one frequency (e.g. Pettersson D100 overleaf). All European species are detectable within the range 20-120kHz.
- **Bandwidth:** How many kHz either side of your tuned frequency you can hear calls on (heterodyne). A wider bandwidth reduces the chances of missing species you are not tuned into, while a narrower bandwidth makes it easier to discern the difference between bats calling at similar frequencies.
- **Design:** size, display (LED/LCD), controls on side or top (side-controls easier for single-handed operation)

The following is a guide to some of the detectors that are available on the market at the present time, and their main features. It is not intended as a review, and prices should only be used as a guide.

Heterodyne Bat Detectors (Summary, in price order)

Model	Approx cost	Microphone (type & no.)	Freq. range	Bandwidth	Batteries	Size (mm)	Speaker	Design features/ other factors
Magenta MkII Kit	£36	Unknown	Unknown	16kHz (± 8kHz)	1 x 9V (PP3)	145x80x34	Y	Requires soldering & electronics skills & the ability to understand circuit diagrams.
Semafor UF-140	£45	Unknown	10-140kHz	Unknown	1 x 9V (PP3)	145x60x45	Y	
Semafor UF-220	£55	Unknown	10-220kHz	Unknown	1 x 9V (PP3)	145x60x45	Y	
Ciel CDB 105 R2 Mono	£60	Electret (1)	18-120kHz	10kHz (± 5kHz)	1 x 9V (PP3)	140x64x31	Y	Integrated LED torch. ('BATZ' model also available-same spec. aimed at children)
Magenta Bat4	£60	Electret (1)	15-130kHz	9kHz (± 4kHz)	4 x AAA	145x80x34	Y	LED torch. Large frequency dial with top illumination. Side controls for single-handed operation. Wrist strap.
Ciel CDB 103 R3 Stereo	£90	Electret (2)	15-130kHz	10kHz (± 5kHz)	1 x 9V (PP3)	170x75x40	Y	LED display.
Magenta Bat5	£90	Electret (1)	10-130kHz	9kHz (± 4kHz)	4 x AAA	135x72x27	Y	LCD display with backlighting. Inbuilt LED torch. Side controls for single-handed operation. Wrist strap.
Ciel CDB 101 R3 Stereo	£115	Electret (2)	15-130kHz	10kHz (± 5kHz)	1 x 9V (PP3)	170x75x40	N	LCD display. External speaker can be added.
Mini-3	£145	Electret (1)	15-160kHz	8kHz (± 4kHz)	2 x AA	147x65x40	Y	Large illuminated tuning dial. BBC Wildlife Magazine "Best buy".
Batbox IIID	£150	Electret (1)	19-125kHz	16kHz (± 8kHz)	1 x 9V (PP3)	125x69x32	Y	12.5mm digital LCD display with backlight. Side controls for single-handed operation.
Ciel CDP 102 R3 Professional Stereo	£150	Electret (2) - external	15-130kHz	13kHz (± 6.5kHz)	External 9-12V DC Source	125x75x40	N	Boxed (for mounting and long-term surveys). Stereo/dual option-can observe 2 frequencies at the same time. LCD display.
Pettersson D100	£185	Electret (1) & Piezo (2)	10-120kHz	8kHz (± 4kHz)	1 x 9V (PP3)	113x71x33	Y	Built in speaker. Backlit frequency control.
Pettersson D200	£225	Electret (1)	10-120kHz	8kHz (± 4kHz)	1 x 9V (PP3)	119x60x25	Y	Fully backlit LCD display. Side controls – easy to adjust.

Broadband Bat Detectors

Frequency Division Detectors (Summary, in price order)

Model	Approx cost	Division Factor	Microphone	Freq. range	Amplitude retaining	Batteries	Size (mm)	Design features/ other factors
FREQUENCY DIVISION ONLY								
Ciel CDB 205 Mono	£60	10	Electret (1)	18-120kHz	N	1 x 9V (PP3)	140x64x31	Built in speaker and LED torch.
Belfry Bat Detector	£65	Unknown	Unknown	25-100kHz	N	1 x 9V (PP3)	Unknown	Non-tuneable. Small internal speaker
Batbox Baton	£70	10	Electret (1)	20-120kHz	Y	1 x 9V (PP3)	165x46x34	Comes with BatScan sound analysis software. Very simple design & easy single-handed operation.
Anabat II & ZCAIM <i>(phasing out)</i>	£400	4,8,16,32	Electret (1)	10-200kHz	N/A	1 x 9V (PP3)	Unknown	Inbuilt speaker. Single-hand operation.
Anabat SD1	£1400	8,16,32	Electret (1)	10-200kHz	N/A	4 x AA (internal) or 12V (external)	159x90x45	LED indicator. Uses compact flash memory cards for data storage. GPS recorder can be connected. Real time clock. Programmable monitoring.
FREQUENCY DIVISION AND HETERODYNE								
Ciel CDB 305 R2 Dual	£100	10	Electret (1)	18-120kHz Bandwidth: 10kHz (± 5kHz)	N	1 x 9V (PP3)	140x65x40	Built in speaker
Ciel CDB 301 R3 Advanced	£200	10	Electret (2)	15-120kHz Bandwidth: 10kHz (± 5kHz)	Y	1 x 9V (PP3)	170x75x35	Backlit LCD display. Separate microphones for each function. Commentary button enabling note-taking.
Ciel CDP 302 <i>(Available from April 2009)</i>	Price to be advised	10	Unknown (2)	15-130kHz Bandwidth: 10kHz (± 5kHz)	Y	1 x 9V (PP3)	Unknown	Boxed (for mounting and long-term surveys).
Batbox Duet	£270	10	Electret (1)	17-125kHz <i>bandwidth:</i> <i>16kHz</i> (± 8kHz)	Y	1 x 9V (PP3)	125x69x32	Large LED display and control for single-handed operation. Wrist strap.
Pettersson D230	£425	10	Electret (1)	10-120kHz Bandwidth: 8kHz (± 4kHz)	Y	1 x 9V (PP3)	119x60x25	LCD Display. Comment switch.
U30	£525	10,20,40	Unknown	15-200kHz	Y	2 x AA	147x65x40	Miniature 'ultra-low-noise' microphone

Time Expansion Detectors (Summary, in price order)

Model	Approx cost	Expansion Factor	Microphone	Freq. range	Batteries	Size (mm)	Design features/ other factors
TIME EXPANSION ONLY							
Tranquility Transect	£470	N/A	Capacitive	10-160kHz	4 x AA	145x95x45	Hands-free (worn around neck). No speaker.
TIME EXPANSION AND HETERODYNE							
Tranquility III	£750	10,32,64	Capacitive	12-160kHz	4 x AA (& internal battery)	155x95x52	LED display. Internal digital recorder. 10.24sec memory.
Pettersson D240x	£1100	10	Advanced Electret (1)	10-120kHz 8kHz (± 4kHz)	1 x 9V (PP3)	119x60x25	LCD Display. Comment switch. Storage time 3.4, 1.7 or 0.1sec. Automatic or manual trigger.
ECO-Mega	£1550	10,32,64	Capacitor	12-160kHz	4 x AA	170x110x40	25.6sec memory. Voice commentary. Time tag-30min intervals. Back-to-back recording.

Time Expansion, Frequency Division and Heterodyne

Model	Approx cost	Frequency/ Expansion Factor	Microphone	Freq. range	Batteries	Size (mm)	Design features/ other factors
Batbox Griffin <i>(Launch date to be announced)</i>	Price to be advised.	Unknown	Unknown	Unknown	AA	Unknown	Built in recording. Date, time, temperature & light reading levels. Programmable menu-driven function set-up.
Pettersson D1000x	£3800 (built to order)	From 1 (original speed) to 30	Capacitance (1)	10-200kHz	Internal batteries or external power supply 6-10V	170x80x35	First bat detector with a built-in digital "tape recorder". 16-bit recording system using compact flashcard as storage. Manual or level-triggering modes. Comments recording mode.

Real-time Bat Recorders (for long-term, unattended monitoring)

Model	Approx cost	Microphone	Freq. range	Batteries	Size (mm)	Design features/ other factors
Pettersson D500x	£1699	Electret (1)	N/A Sampling rates: 44.1kHz, 300kHz and 500kHz (optimised for 500kHz)	4 x AA or external power supply	184x172x52	Detects and records ultrasound in real-time. Aimed for long-term unattended recording of bat calls. Four slots for CompactFlash memory cards with total capacity of 128GB. Triggering system allowing device to start recording as sound is detected.
Batcorder	€2400 (Email info@ecoobs.com for quote)	Electret (1)	16-150kHz	4 x AA	Unknown	Analyses microphone signal in real-time and discriminates between bat calls and other sound signals. Autonomous long-term monitoring. Independent recording device and software built to co-operate with the hardware.

Manufacturers and suppliers (details correct at time of going to print)

Alana Ecology Ltd: www.alanaecology.com The Old Primary School, Church Street, Bishop's Castle, Shropshire, SY9 5AE. Tel: +44 (0)1588 630173. Email: sales@alanaecology.com.

Anabat SD1
Batbox: III-D, Baton, Duet, Griffin
Magenta: MKII Kit, Bat4, Bat5
Mini-3
Petterson D100, D200, D230, D240x, D500x, D1000x

Batbox Ltd: www.batbox.com 2A Chanctonfold, Horsham Road, Steyning, West Sussex, BN44 3AA. Tel: 01903:816298. Email: info@batbox.com.

Batbox III-D, Baton, Duet

Bat Management: www.batmanagement.com **US-based** – email for a UK quote sales@batmanagement.com.

Petterson D200, D500x (only available here), D1000x

Bat Planet: www.batplanet.co.uk C/o Yarwood Ltd, Treefield Industrial Estate, Gelderd Road, Leeds LS27 7JU. Email sales@batplanet.co.uk

Full range of Ciel detectors (not including CDP 302)
Belfry bat detector

Bioquip: www.bioquip.net

Batbox III-D and Duet
Full range of Ciel detectors (not including CDP 302)

Courtpan: <http://courtpan.gnxt.net> 3 Suffolk Street, Cheltenham, GL50 2DH. Tel: 01242 570123. Email courtpan@gxn.co.uk.

Tranquillity Transect, Tranquillity III, ECO-Mega

EcoObs: www.ecoobs.com. Contact via online contact form <http://www.ecoobs.com/cnt-contact.html>
Batcorder

Green witch: www.green-witch.com (search for bat detectors) Tel: 01954 211 288

Batbox: III-D, Baton, Duet, Griffin (available to pre-order)

Magenta Electronics Ltd: www.magenta2000.co.uk 135 Hunter Street, Burton on Trent, Staffs, DE14 2ST. Tel: 01283 565435. Email: sales@magenta2000.co.uk.

Magenta: MKII Kit, Bat4, Bat5

Petterson Elektronik AB: www.batsound.com **Sweden-based** – email for a UK quote info@batsound.com

Full range of Petterson detectors (except D500x)

Semafor: <http://www.semafor.co.uk/bat-detector.html> Email: enquiries@semafor.co.uk (for a catalogue)

Semafor UF-140, UF-220 (Please note that both models are currently marked as 'unavailable' on their website.)

Titley Electronics: www.titley.com.au **Australia-based** – can be shipped to UK. Email: info@titley.com.au.
Anabat II is being phased out, and Anabat SD1 is also available from UK suppliers Alana Ecology (details above).

Anabat II, Anabat SD1

Ultra Sound Advice: <http://www.ultrasoundadvice.co.uk> 27 Merton Hall Road, Wimbledon, London SW19 3PR. Tel: 020 8287 4614. Email: sales@soundadvice.co.uk.

Mini3 Detector, U30 Detector

Sound Analysis Software

A selection of software packages for analysing bat echolocation calls recorded using a broadband bat detector (time expansion or frequency division).

- **Adobe Audition v 3.0.** Is a substantial package that calculates all the start/end/peak frequencies of a pulse for you and you can do great manipulations with the sound. It can also convert batches of mp3 or other formats to WAV format really quickly. You can also listen to heterodyne separate from the FD channel on Duet recordings which is a good training tool. Audition is available as a **30 day try-out** and the full package is \$350. Web site <http://www.adobe.com/uk/products/audition/>
- **Avisoft** at www.avisoft.com offers **free download** of a minimal program called SAS lab Light (5.7 MB) for very basic editing and generation of spectrograms. The full Avisoft has a whole range of functions although it takes time to learn how to use them all.
- **Bat Scan** available from www.batbox.com comes with a selection of sample files so that you can compare your own recordings. It costs £17 (plus VAT and delivery) and is a simplified version of Spectrogram. In general it is faster and easier to use than BatSound, but does not have all of the functions, although the sonogram is nice and clear and there are memory saving devices. Follow up service and advice is always outstanding. It is also available from Alana ecology www.alanaecology.com at £30 (including VAT).
- **BatSound** the original software developed especially for use with ultrasonic bat calls. It is available from Alana Ecology www.alanaecology.com and costs around £275 and more for multiple licenses. BatSound has a nice big window for sonograms and an easy to use toolbar with shortcut buttons that operate on a mouse click for common functions. It has lot of extra tools but also some annoying little quirks like re-setting your parameters as you are working. The help files are generally well structured and easy to use. You can download an **evaluation version for free** from the BatSound website at <http://www.batsound.com/psnan.html> (1210kb).
- **Bat Wave Analyzer** can be found by going to the Arboriculture Information Exchange site at <http://www.aie.org.uk/> and look in the A-Z index for Bats. It has been developed by Chris Skillern and is available as a free download at the moment (you will need 364k). There is also a help manual to go with the program. It allows all the usual recording and analysis and notes can be inserted onto the sound wave and saved with the file. Totally **free** so well worth snapping it up while you can.
- **bcAnalyze 1.0** is a programme designed to work with real-time recordings of bat calls. To be used with recordings from the batcorder system <http://www.ecoobs.com/cnt-bcAnalyze.html>. A call finding algorithm quickly finds calls within the recording. A license costs €140 (+VAT) and runs for 30 days in trial mode. System requirement is a Mac running Mac OS X 10.5.
- **Cool Edit Pro 2.1** an old favourite taken over by Audition is now available as a **free download** from <http://www.softpedia.com/progDownload/Cool-Edit-Pro-Download-2076.html> (18.20 MB). It is not the full version but is still useful and recommended for people that want to have a try with a simple program. The spectrogram and oscillogram cannot be viewed simultaneously.
- The Bioacoustics Research Programme at **Cornell Laboratory of Ornithology** developed a well respected sound program called **Canary** some time ago. It is **free** to download, but unfortunately only runs on Mackintosh <http://www.birds.cornell.edu/brp/software/canary-information>. The user manual has some really useful background information about how spectrograms are created and analysed. If you are willing to delve into some physics it can help you to use other sound analysis programs more effectively. Relevant sections (available from <http://www.birds.cornell.edu/brp/software>) are Appendix A: Digital Representation of Sound, and Appendix B: A Biologists Introduction to Spectrum Analysis:
- The new sound analysis software from **Cornell University**, called '**Raven**' is available from <http://www.birds.cornell.edu/brp/raven/Raven.html>. There are two options – Raven v 1.4, and Raven Lite which is **free**. Full version is able to display any number of sound files simultaneously, with each

file in its own window. It has other features that allow you to easily measure, compare and edit parts of different sequences and sounds. The Raven Lite version has ability to view only a single spectrogram at one time. Both versions are available for Mac OSX or PC. The full version is US \$400 (\$100/year for students).

- **Sonobat v 2.5.5** is a program developed in the USA. It includes an auto-trigger recording function developed especially for the D240x set up to trigger automatically & allowing remote recording to a digital recorder. It allows you to look at reference calls in the same window next to a call that you are trying to identify. Reference calls are automatically adjusted to match time and frequency scale of the one you are looking at. Analysis functions are plentiful including definition of low/high frequencies, bandwidth, duration, heel, slope, characteristic frequencies, harmonics and automatic calculation of the inter-pulse interval. The program costs US\$320. There is a **free downloadable demo** of v2.4 for Mac and PC. www.sonobat.com.
- **Sony Sound Forge** available at <http://www.sonycreativesoftware.com/products/soundforgefamily.asp>. These are audio editing and production software. Sound Forge Audio studio costs £33.29 and there is a **free trial** available. Also available is Sound Forge 9 – Professional audio production suite, costing £230.
- **Spectrogram v 16** processes both ultrasonic and audible sound. You have to select the ultrasound controls and it has a lot of functions that are not relevant for bat analysis. It can take a while to set up the parameters to your personal requirements although once done it is easy enough to use. The help file is huge but otherwise it is similar to BatScan. Most operations use function keys. It is free to download at <http://www.visualizationsoftware.com/gram.html>. Richard Horne who developed it is very helpful and any queries receive a quick response.
- **Syrinx** is another program designed by Dr John Burt for bird calls. It shows a spectrographic rolling display and allows analysis and editing. It can be obtained for **free** after filling in a short application form at <http://syrinxpc.com>.
- **TF32** is a **free** programme which is very simple to use. There is a user manual available on the website <http://www.medsch.wisc.edu/~milenkvc/tools.html>.
- **Wavesurfer** – another completely **free** program available from <http://www.speech.kth.se/wavesurfer>. This was developed for speech analysis and you need to establish your own spectrogram parameters and save them so you need to know a little about the terminology (FFTs etc.) or you can look at the ibats website for instructions written by Dr Jon Russ <http://www.ibats.org.uk/page.aspx?tabid=256>

Web addresses frequently change. If the link no longer works enter the programme name in a search engine such as Yahoo or Google.