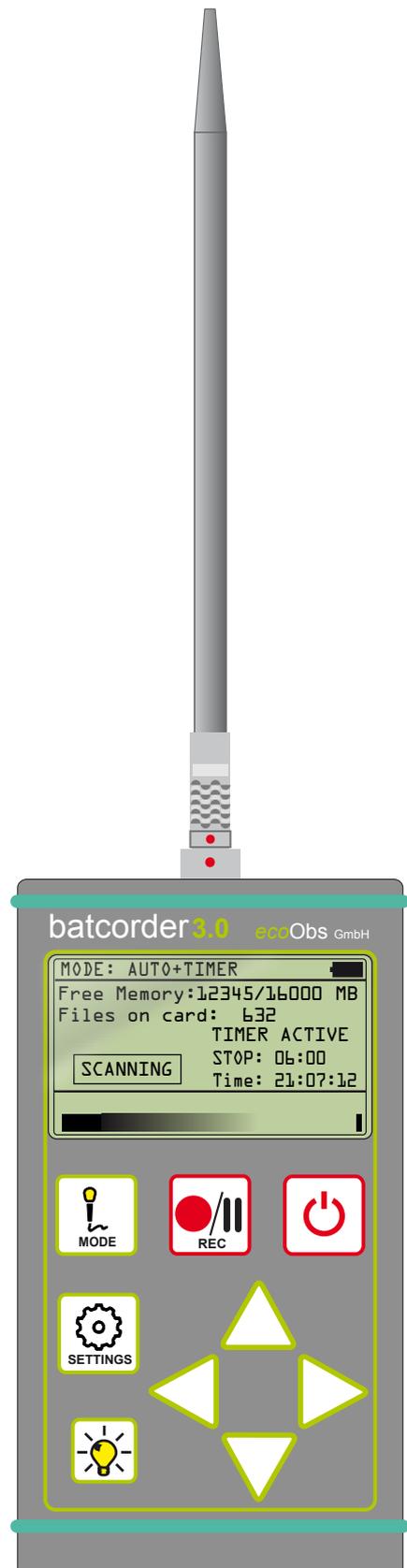


***batcorder* 3.0**

Manual

Manual Version 3.00 / en
March 2013



About this instruction manual

This instruction manual for the *batcorder* 3.0 contains important notes for the user. Please read this manual carefully, especially the safety suggestions, and pass this manual on to every user. Have this manual ready whenever you use the *batcorder*. **This version of the manual is in accordance with the software-version (SW) 300 or higher of the batcorder. Older SW-versions may lack some of the functions.**

Symbols

The following signs mark important notes for the user:



Attention!

This symbol marks instructions you have to comply with. Neglecting any of these instructions may harm user or material.



Important!

This symbol marks advices concerning correct usage of the instrument. Neglecting these notes may lead to partial or total malfunction of the *batcorder* device.

Waste disposal:

European Union:

According to the European WEEE Directive 2002/96/EC on Waste of Electronic and Electrical Equipment we take our devices back for recycling or proper disposal. Please send them to the address mentioned below; do not dispose devices at public or community supplied disposal systems! This is free of charge.

Other countries:

To reduce the environmental impact we take our devices back for recycling or proper disposal. We encourage you to send us back defective units or parts. This is free of charge.

If you have questions about the disposal process, please contact info@ecoobs.de

ecoObs GmbH, Tolstoistrasse 8, 90475 Nuernberg, Germany

Safety precautions



We are not legally liable for injury to persons or damages to property caused by improper use or by ignoring the safety instructions. For such occasions the warranty expires.

General instructions

- Don't use the *batcorder* while driving a car or another vehicle.
- Do not install the device at an unstable location, dropping can harm persons or property or damage the *batcorder*.
- Don't leave the *batcorder* unattended, since children can injure their eyes or health with the microphone extender.
- The device is designed to run on a special battery pack. **Don't** connect it to wall plugs or other power sources.
- Please mail our hotline at info@ecoobs.de or call **++49 911 3768053** if the *batcorder* shows any external damage or does not work. Please do not try to repair damage your self or through non-authorized personnel.
- Avoid excessive mechanic strain on the *batcorder*, especially on the plugs if cables are tightened to the case. Strong vibrations, shaking or dropping may damage the device.
- Only use accessories supplied or authorized by ecoObs GmbH to avoid damages to the device.

Battery pack

- The batteries are to be exchanged by qualified personnel only. Please contact us, if batteries have to be exchanged.

Application notes



- Try to avoid electromagnetic fields when using the *batcorder*! Although the *batcorder's* electromagnetic compatibility is standard practice (EMC-safe), microphones are sensitive to such fields. These can interfere with the audio signal.
- **The microphone is sensitive to mechanical strain.** Avoid impacts on the microphone tip and lateral mechanical strain on the microphone extender.
- Do not exchange the memory card while the device is in recording mode. This causes malfunctions or data loss.
- Please attach the power cable connector **carefully** without twisting. For fixation use the **knurled nut** at the connector. **Do not use tools** (nipper, wrench, ...) for fixation.
- Please avoid direct sun light on the *batcorder* as well as fast temperature variations or temperatures below 0°C and above 40°C.
- Dust or sticky substances can clog the microphone grid. Don't expose the *batcorder* to such conditions.
- The aluminum case is sealed up and the cordura bag keeps the *batcorder* dry. But the microphone has to be exposed to be sensitive to incoming sound waves. The fine mesh of the microphone grid is a comparatively good protection against raindrops. Nevertheless long lasting exposure to high humidity can lead to corrosion, thus to loss of sensitivity. Hence, avoid long-term outdoor exposure.
- If you have further questions, please contact info@ecoobs.de or **+49 911 3768053** .

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Introduction

You have purchased the *batcorder*, a state-of-the-art bio-acoustical measurement device. It enables you to systematically record bat echolocation calls in natural habitats. The *batcorder* makes scientific research or ecological consulting studies much easier. To gain optimal results, we recommend to use our custom developed software packages bcAdmin (recording database), bcAnalyze (manual sound analysis) and batIdent (developed to identify European bat species).

What is the *batcorder*

The *batcorder* was developed to automatically register bat activity (objective triggering and calibrated sensitivity). Hence, it is the choice solution for systematically recording bat activity in short or long-term monitoring studies. It has an intelligent and proven algorithm, triggering sound recordings when receiving bat calls. This way, only bat call sequences are recorded while other sound and ultrasound sources (like bushcrickets) are mostly ignored. Digital sound files are written in high quality (500 kHz, 16 bit) on an exchangeable SDHC card.

The *batcorder* is not a conventional bat detector. That means it does not transfer ultrasound to regular sound frequencies in the human hearing range. Thus, speaker or headphone jack are missing. Bats can not be heard directly in the field, but must be analyzed using signal analyzing tools.

What's new to the *batcorder* 3.0 ?

The *batcorder* version 3.0 (from march 2013) offers various innovations. Nevertheless, data acquisition will remain fully comparable to the data collected with preceding models. With its reduced size and the internal battery manual use of the *batcorder* for transects is much simpler now. The microphone is equipped with an improved type of connector, thus microphones of *batcorder* 2 and 3 can't be exchanged. Power consumption was reduced by 40% to allow even longer runtimes. A temperature sensor in the plug allows sampling of temperature when the *batcorder* is running. A built in voltage transformer allows running the *batcorder* with power supplies ranging from 6V to 16V, special cables are available through ecoObs.



It is not possible to run the new *batcorder* 3.0 with the old *batcorder* 1.0 battery pack. The battery differs from the old one by a green LED instead of a red one.

It is possible to switch microphones without conducting a new calibration of the *batcorder*. Only a correction factor (specific to each microphone) has to be set in the *batcorder* menu. Thus, it is not longer necessary to send in the recording device for calibration. Replacement microphones can be ordered on short notice.

The firmware of the *batcorder* 3.0 reliably supports SDHC cards with up to 32 GB memory. A RS232 interface allows communication with extension like wind turbine kit or box extension from ecoObs. However, it is not possible to download recordings that way.

Optional accessories

There exist a variety of optional accessories to use the *batcorder* in special ways. For usage in a wind turbine nacelle a special windturbine extension is available. Long term monitoring can be done using the box extension.

Usage

Detecting bat calls reliably and in a quantitative manner poses high demands on setup and actual recording location. Automatic triggering, recording and computerized analyzing on species level highly depends on the proper detector setup. We therefore recommend to follow the pieces of advice. The user guidelines were compiled particularly regarding influences on the triggering mechanism, automated call analysis (with bcAdmin) and automated discrimination (batIdent).

Acoustic and electromagnetic influences

Noise in the audio signal can be induced by either acoustic or electromagnetic interferences. Such signals can influence bat call analysis dramatically. Even though the *batcorder* possesses a robust triggering-algorithm in most environmental setups, known sources of disturbance should be avoided. While the *batcorder* will cope with these situations, nevertheless it may record more parasite recordings or miss some bats. Also, the automated analysis of calls may suffer. The following list gives sources of perturbation, based on our knowledge:

- Strong electromagnetic fields (for example power lines, big coils, power switchboards, wind turbines, ...) may lead to additional recordings of noise and noise in recordings.
- AC sources (for example neon lamps, energy saving lamps, ...) may produce narrow bandwidth ultrasonic noise.
- Strong wind streaming alongside irregular shaped bodies (for example trains, cars, ...) create low frequency noise as well as broadband noise and can mask bat calls.
- Reflections from nearby objects can interfere with bat calls, since calls as well as echoes of the calls arrive with very small time differences at the microphone. This leads to interferences and thus to a decline of the trigger algorithms performance. Thus, the microphone should be placed at least at 2m distance (height & range) to any objects. Recording close to vegetation, walls, underneath bridges, underpasses as well as above sealed roads or water bodies is not recommended. Often the box extension will improve recordings at such

locations, since it shields for example echoes from behind the microphone.

- Many bushcrickets have calls in the ultrasonic spectrum. At a distance of 2 meters or more to vegetation, the signal strength of these calls is reduced, hence, generates only few to none trigger events.

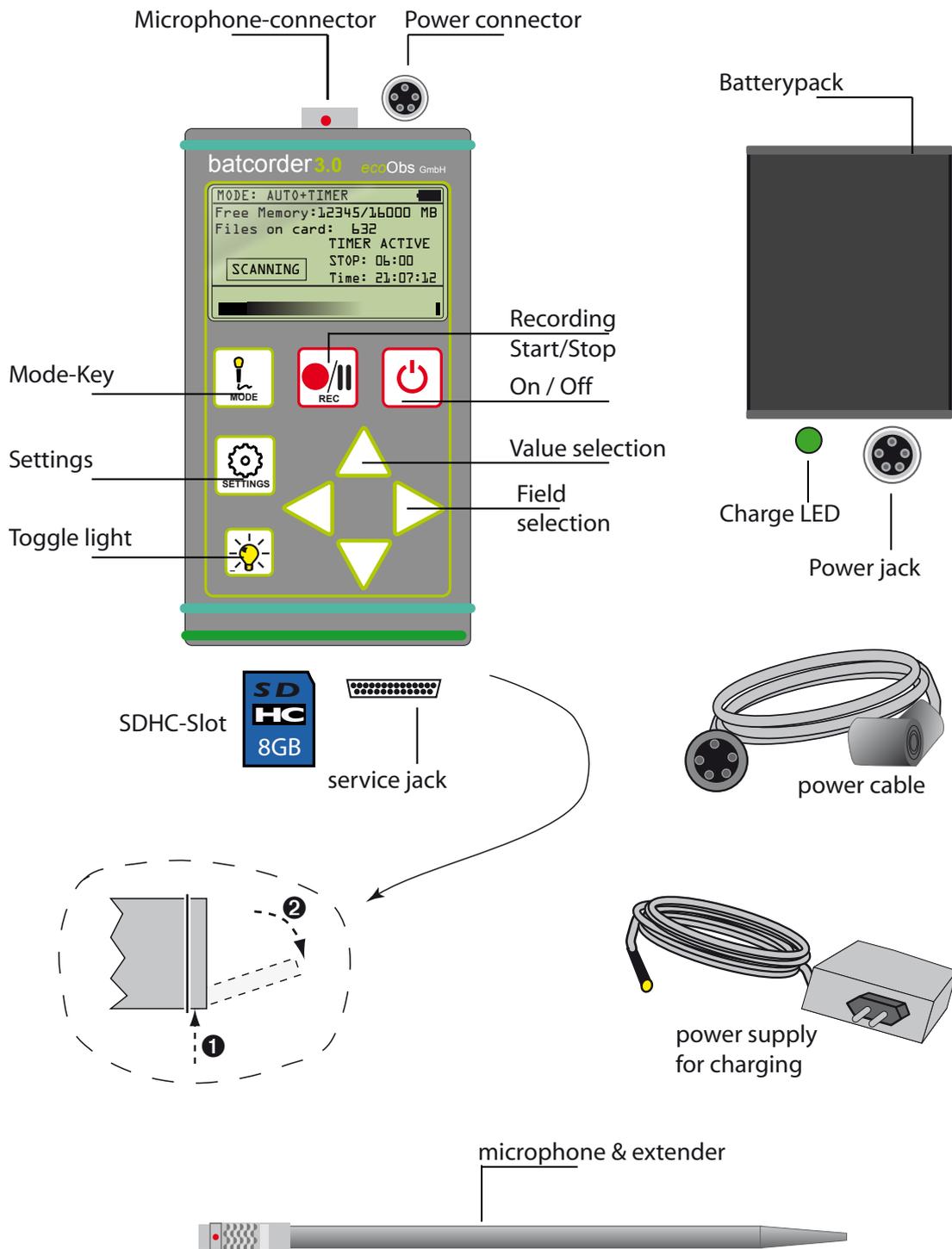
Site selection and recording modalities

Even if all tips mentioned before are taken into account, there are some disadvantageous locations for bat detection:

- **Hibernaculum or swarming site:** A bat detector set up inside or in front of a hibernaculum will lead to a huge number of recordings in autumn and spring. This makes data analysis more difficult. Social calls as well as unspecific echolocation calls near structures may lead to uninterpretable recordings. The more species and individuals are recorded at the same time, the less predictions can be made on bat density or quantification of activity. We recommend avoiding such sites, if studying general bat activity. Place the *batcorder* at distances of at least 50 to 100 meters of such sites to gain a more useful measure of activity.
- **Bodies of standing water:** many bat species are hunting at lakes and other water bodies. Thus, such sites lead to good results for accessing the overall species diversity of an area. But comparison of bat activity to recordings from other sites is difficult for similar reasons as mentioned before (swarming sites). In addition reflexions from the the water surface will degrade the quality of the recordings. We recommend to place the batcorder in a distance of at least 5 to 10 meters to the waterside.
- **Wind turbines:** Often bat detectors are installed on top of wind turbines (inside the hull or outside). Recording at such sites has to be planned very carefully. Depending on the turbine type and the actual setup, acoustic and electromagnetic disturbances, mechanic strain, acoustic shadowing, reflections as well as extreme climate conditions (wind, rain, ...) may lead to severe problems. For this location we have developed the wind turbine extension, which helps to improve the recording setup.
- **Car transects:** A method sometimes chosen for monitoring purposes are car transects. That means, bat activity is measured along a driven distance. We advise against using this method, since danger of acci-

dents rises, and recording while driving goes along with a lot of noise. In addition the mechanical strain on the device, echos from the car surface and the potential displacement of sensitive species have to be taken into account.

Overview



Included in standard delivery

- (a) *batcorder* + Cordura® bag
- (b) NiMH battery pack incl. charging electronics (6V / 2.4 Ah)
- (c) Power supply for the battery charger (110-240 V)

- (d) cables to connect *batcorder* and battery pack (5 pins)
- (e) microphone extender + microphone
- (f) cables for charging
- (g) hard-case for secure transport

Microphone

The microphone is attached to the tip of a 16 cm aluminum pole. This extender accounts for good recording quality from all sides (omnidirectional). Its connector fits to the middle jack (**five pins**) on the *batcorder* front plane. It locks itself when plugged-in and can be untucked by pulling the plug. Plug and connector feature a red dot, these have to be aligned, then the connector can be plugged in correctly. Even though pole and connector are rather robust, shearing forces should be avoided. Please note also the paragraphs on calibration at the end of the manual.

Power supply

Next to the microphone jack there is a **five pole jack**. Use this for connecting the battery pack. It allows a runtime of up to 100 hours of scanning and recording with the standard battery pack.



The jack should be secured with the knurled-nut to avoid a slack joint. Take care to not twist the cable when attaching the pack and do only use the **knurled-nut** for tightening the cables. Please mind the right orientation of tongue and groove of the connectors. The tongue has to point to the microphone (*batcorder*) respectively to the LED (battery pack).



The *batcorder* is built to run with a voltage of 6V to 16V. You may need a special cable to connect other batteries than the standard battery pack. Please note, that other voltages or mixing up the polarity may damage the *batcorder* if no precautions are taken.

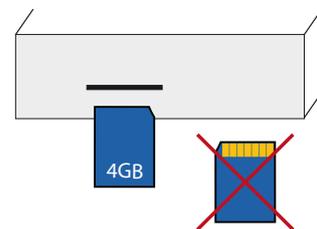
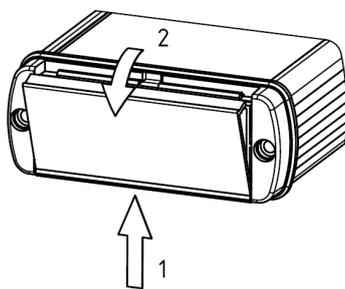
Internal battery

The *batcorder* has a built in battery for runtimes of around 10 hours. This internal battery is charged automatically if the external battery pack is used. If the external battery pack is empty, the internal battery pack takes over. Charging is also possible by connecting the charger directly to the *batcorder* using the charging cable. If the *batcorder* is turned on while charging, it dis-

plays the current charge status. Within approx. two hours the internal battery reaches 95%, after another two hours it is fully charged.

SDHC-card

The slot to insert the SDHC card is located at the bottom end of the casing (opposite to the microphone/power connector) of the *batcorder*. It is secured by a lid. Open the lid to access the slot. Press slightly on the back lid of the *batcorder* top while simultaneously lifting and flapping back the lid (see drawing). The lid features seal up of the SDHC slot. Thus, correct closing is important.



With some practice the lid can easily be opened. Always remember that you don't have to use force, otherwise you may damage the *batcorder*.

The SDHC card has to be pushed slowly into the central slot of the *batcorder*'s backplane until it snaps in. The contacts of the SDHC card have to point downward and to the *batcorder* (see drawing). For removal the card has to be pushed gently inside the *batcorder* and will be thrown out (push-in-push-out). The *batcorder* supports SDHC cards of up to 32 GB (software 201 and higher).



Please note that the *batcorder* can **only** be run with **SDHC cards**. Cheap cards, that do not strictly follow all SDHC regulation, may not be compatible with the *batcorder*. The card doesn't need a special speed rating.

The *batcorder* will ask you to rewrite the FAT table whenever you insert a new or computer manipulated (formatted or otherwise changed directory structure) SDHC card. Accept that step, but be advised that all existing files

will be erased when continuing! This step is necessary to lay out the FAT table and sector size such that the *batcorder* can use it with optimal speed.

If you want to erase data from the card, the *batcorder* offers an Erase function. This function is accessed via the settings page SDHC-CARD+CLOCK. To erase the card press the keys REC + Δ . After confirming the erase action all data is removed without recovery.



Service jack: A service jack is located next to the SDHC slot. We use it for applying software updates or doing internal tests. Connecting non-compatible devices can damage or destroy the *batcorder*.

Display illumination

The display illumination has an extremely low power consumption and therefore isn't affecting the runtime of the battery pack much. It is no problem to use the illumination in Manual- or Auto-Mode (e.g. at transects) permanently. Display brightness can be varied when in Settings-Mode by pressing the light button and using the up/down arrow keys for adjusting the illumination.

Setting up the *batcorder*

For setting up the *batcorder* you need additional accessory not packed with the standard delivery: SDHC card with a capacity of up to 32 GB.

Preparing the power supply

The *batcorder* includes a sealed up battery pack (rechargeable, 6V / 2.4 Ah, NiMH). This pack includes internal charging electronics. It has to be recharged within the aluminum casing. It can not be exchanged by yourself. Before first use we recommend a full charge cycle.

Assembling the *batcorder*

1. Insert SDHC card
2. Attach battery pack to the *batcorder*
3. Connect the battery pack (angular connector at the *batcorder*)
4. Connect the microphone (don't forget to remove the protector for recording)

Switching the *batcorder* on

Press the On/Off button for approximately 3 seconds to start the *batcorder*. The *batcorder* will search for attached equipment (approx. 7 seconds). The settings screen is displayed after this step.



You can start the *batcorder* without a SDHC card to check settings. The recording modes require an inserted SDHC card.

Settings

On the setting pages you can navigate between fields using the left/right arrow keys (◀ , ▶). The up/down arrow keys (Δ , ▽) change the selected value.

Settings SDHC-CARD + CLOCK

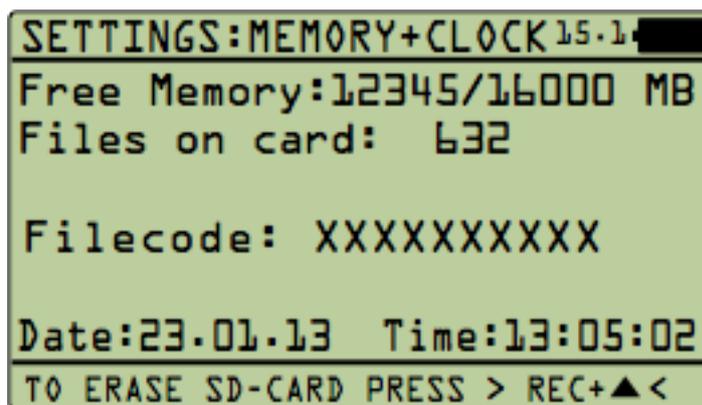
At this screen you can change the following settings:

- 1) Erase SDHC card
- 2) Filecode (part of the filename)
- 3) Date and Time

1) Using the **Erase** function you can format a SDHC card. Press REC+Δ key to start the process. After a confirmation screen, all files get erased from the card.

2) The **Filecode** consists of ten alphanumeric characters (including underscore) and is used as identification of a recording.

3) **Date and Time** should be set as accurately as possible, since they are used to mark recordings and to control automatic activation.

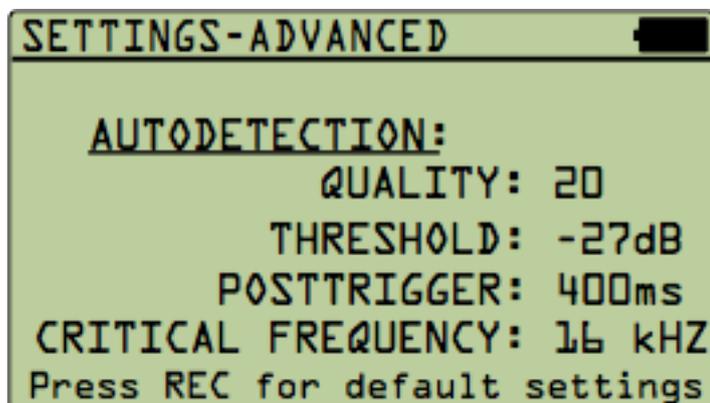


Settings ADVANCED

The advanced setting screen contains parameters of the signal recognition algorithm (*Quality, Threshold, Critical Frequency*) as well as the post-trigger time in milliseconds. You can reach the page by pressing the SET key on the SDHC-CARD+CLOCK screen.

SETTINGS

Changes to these values influence call detection dramatically. Wrong values may lead to improper or incomplete call recognition. These settings should not be changed within one sample period. Otherwise comparisons between different locations or nights are not possible anymore.



Quality

The standard value for *Quality* is 20, which is optimal for most bats in common recording situations. At higher values (>20), less call like signals will be recognized, while lowering the *Quality* value (<20) tightens up the trigger algorithm.

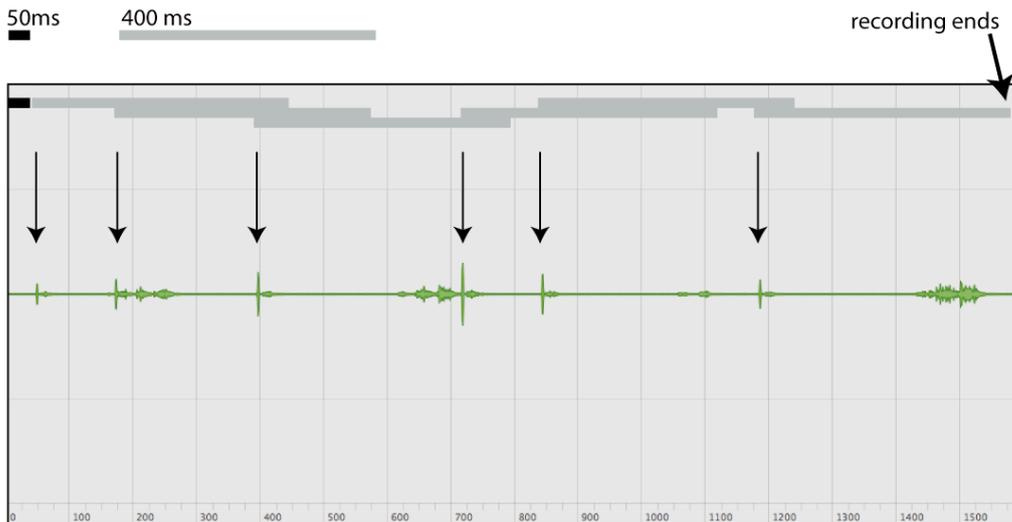
Threshold

The *Threshold* influences the recording range of the *batcorder*. The device is set to a fixed sensitivity. This is chosen by means of a 40 kHz signal at full gain if played with 96 dB SPL at the microphone. The threshold value is dependent on this calibration. The standard value of -27 dB is approximate to an amplitude of 4.5% of the maximal amplitude. This resembles a recording distance (radius) of at least 10 meters for most European bat species. If you want to increase the recording range, *Threshold* has to be lowered to a value of -30 dB or -36 dB. A change of the threshold value does not change the *batcorders* gain! Only signals with amplitudes above the threshold will be analyzed. Possible values are -18, -24, -27, -30 and -36 dB (12.5% to 1.6% of maximal amplitude). If you use a value different from -27 dB you have to adjust the appropriate setting in bcAdmin. In newer versions of bcAdmin the threshold is set in the same steps as in the batcorder menu. In older versions the analysis threshold for -36 dB should be set to 1.6%, for -18 dB set to 12.5%.

Posttrigger

The post trigger is defined by the interval between two successive detected calls that are still written into the same sound file. After this interval, a new recording is started if a call is recognized. We recommend a value of 400 ms or 600 ms. Possible values are 0 ms, 200 ms, 400 ms, 600 ms and 800 ms.

Pretrigger/Posttrigger



The graph explains pre- and posttrigger times of the *batcorder*. Arrows indicate positive trigger events (= bat calls). The pretrigger of 50 ms is not adjustable.

Critical Frequency

The third setting, is important for bat call recognition. Calls below this frequency are ignored in the analysis, thus, the signal is neither filtered analogously nor digitally. It is set independently of the existing, unchangeable analogous high pass filter. By choosing a higher *Critical Frequency*, bush-crickets can be more effectively eliminated. Be reminded that you may also miss low frequency bats, like the noctule bat if the CF is chosen too high. Possible are all values from 14 to 110 kHz in steps of 2 kHz.

Default Settings

Reset the *batcorder* to default settings with *Quality* = 20, *Threshold* = -27 dB, *Posttrigger* = 400ms and *Critical Frequency* = 16 by pressing the REC key. These values are optimal for the analysis with bcAdmin and bcDiscriminator.

Specific Settings

Further menu screens may be selectable, if components like the the windturbine extension are used with the *batcorder*.

Recording

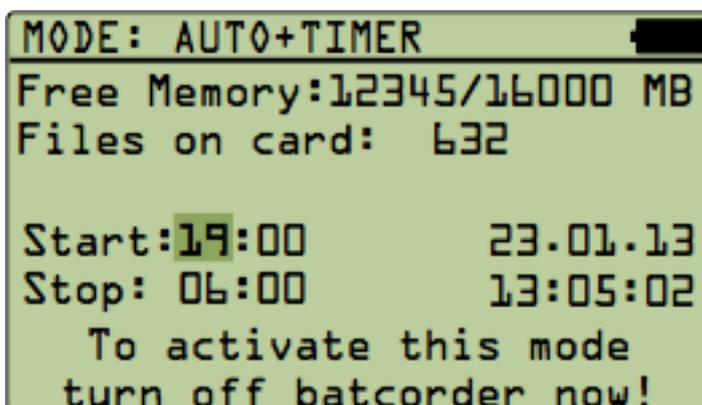
The *batcorder* has three different recording modes:

- automatic, timer started recording: **Auto+Timer Mode**
- automatic, manual started recording: **Auto-Mode**
- manual recording: **Manual-Mode**

Auto+Timer Mode

The *batcorder* is designed for field recording and to start sampling automatically. After successfully recording, it will stop sampling and shut down again. The **Auto+Timer Mode** is specifically designed for scheduled sampling.

When reaching the start time, the *batcorder* starts automatically (if Auto+Timer mode was activated before and a battery pack is connected). When reaching the chosen stop time, it powers off. While running, the *batcorder* scans for bat calls and records whenever it recognizes one.



```

MODE: AUTO+TIMER
Free Memory:12345/16000 MB
Files on card: 632

Start:19:00      23.01.13
Stop: 06:00     13:05:02

To activate this mode
turn off batcorder now!

```

To activate this mode, switch to the display shown above via the **MODE** key (MODE: AUTO+TIMER)

Start/Stop controls the automatic start and stop time of the *batcorder*. Adjust these entries as you like. Now turn off the *batcorder*, without switching to another screen and the **Auto+Timer mode** is activated. A successful activation is additionally displayed by a message.



Avoid changing the SDHC card after you have activated the **Auto+Timer** mode. If the newly inserted card is not properly formatted, the *batcorder* will stop on the SDHC format step after powering itself up. It will not start sampling activity.



If the *batcorder* was not properly connected to the power supply or the internal battery is empty at start time it will power up. If connected afterwards it won't start as well.



If you manually interrupt the scanning process in **Auto+Timer mode**, this will end these mode. The *batcorder* will not stop at the chosen time automatically.

The timer can be set for run times of up to 23:59 hours. It will automatically start again 24 hours after the first auto start. The auto start cycle continues as long as the *batcorder* was not powered up manually or runs out of power. If the battery power is low while active and scanning, the *batcorder* stops the scanning process and terminates sampling before powering off. This is documented in the log file with a power low message.



If it is past the set start time, you still can switch on the **Auto+Timer mode** instantly with a shortcut. Press the **REC** and the **POWER** key at the same time and hold down the **REC** key until the **TIMER** screen appears. This is only possible, if the SDHC card was formatted previously with the *batcorder*.

Auto-Mode

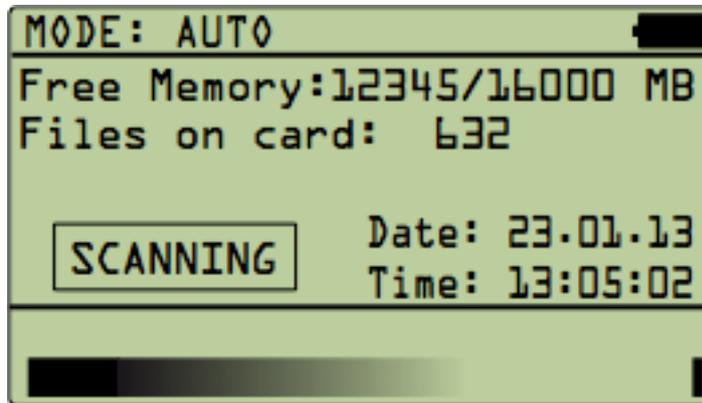
Switching to the **Auto mode**, the device initially is in pause mode until the scanning process for call detection is started with the **REC** key. It can be switched to the pause state again by pressing the **REC** key a second time. This mode proves useful if you walk transects and you want to automatically record bat calls with the same detection algorithm the autonomous *batcorder* mode uses.



As long as the scanning is in progress, the *batcorder* can not be turned off or switched to a different screen. Only after deactivation of the scanning progress by pressing the **REC** key, the other keys are unlocked.

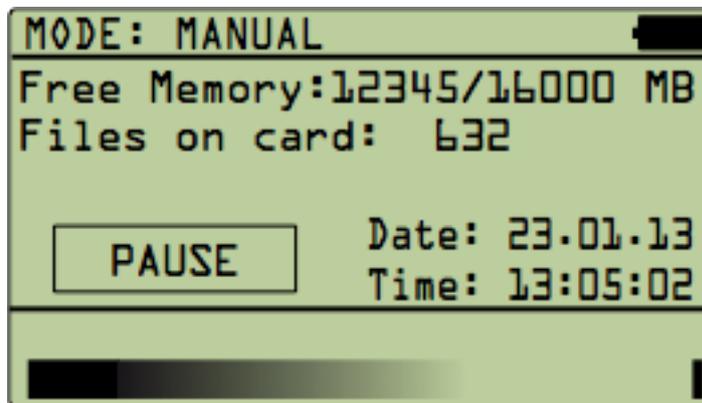


24h continuous recording: We recommend to not use AUTO-Mode, but set a timer to for example 12:10 start and 12:00 end. This will make data import to bcAdmin much easier.



Manual-Mode

Using the manual mode, recordings are started or stopped only by pressing the **REC** key. This mode is useful if signals have to be recorded that are not triggered by the automatic modes or if the recording time has to be controlled manually.



Display elements in the recording modes

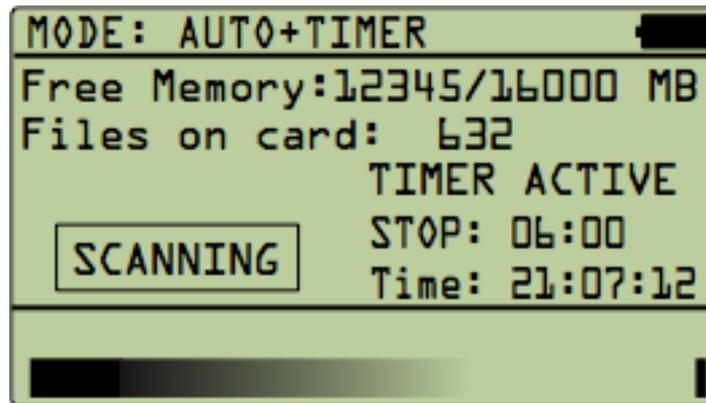
In recording mode the *batcorder* displays different status information. In the upper right corner a battery indicator shows an approximated battery status. Actual battery run time depends on temperature and age.

First and second line show the used memory versus total memory of the SDHC card, as well as the number of recordings stored on the card. Below, a rectangular info field indicates **pause**, **scanning** or **recording** operations of

RECORDING

the selected mode. At the lower screen edge, a bar shows the sound input level. A small open rectangle on the right side of the bar indicates overdrive of the input signal.

If the batcorder was activated by the timer, the display is showing this accordingly. AUTO-TIMER mode can be stopped by pressing REC. If an extension with GSM module is connected, it will also send a SMS.



Miscellaneous

Sound format

Recordings with the *batcorder* are written as raw audio files without header information. The data is organized as PCM values with an amplitude resolution of 16 bit, LittleEndian byte order (Intel) and a sample rate of 500 kHz. The files can be read with any sound software that is capable of opening raw audio files with the necessary sampling parameters. This should work in SASLab Pro (Avisoft; user defined import format), Pettersson Batsound (chose .dat file, samplerate of 50 kHz!), Audacity (use 50 kHz samplerate!) and Amadeus Pro (Hairer; import raw audio file).

Filenames

Each recording gets a unique filename using a fixed scheme. The names are chosen to support easy archiving and quick recognition of recordings. The filename begins with the date: DDMMYY (for example 100707 for July, 10th 2007). This is followed by the ten characters long filecode (see Settings SDHC-CARD+CLOCK) and a consecutively numbered count. A valid filename, is for example

100707-LOCATIONAX-00095.RAW

By choosing descriptive **filecodes** and including the date, filenames are easily recognizable. Thus, recordings can easily be assigned to an event.

Log file

The *batcorder* creates a log file on the SDHC card to control its proper function (LOGFILE.TXT). This file holds entries to all important events. Activation and deactivation of each mode are stored, as well as each recording. Furthermore, the advanced settings are printed for each start event (auto on, timer on) as simple list of *quality*, *threshold*, *posttrigger* and *critical frequency* separated by colons (e.g. "20;27;400;16").

MISCELLANEOUS

A valid **log entry** for an event (not a recording) consists of five fields separated by tabulators: Mode (**Auto on/off** or **Timer on/off**), date (DD.MM.YY), time (HH:MM:SS), filecode and settings:

```
Auto on      30.03.08      19:00:44 FILECODE  SETTINGS
```

A recording entry consists of five elements. The kind of recording (A automatic, T timer, M manual), date, time, filename and recording duration (milliseconds):

```
M  30.03.08 19:08:30 300308-UNIXXXXXXX-0003.raw      979ms
```

A complete log file looks for example like:

```
Batcorder sw2.00 / logfile 2.0  
created on 05.04.2013 21:22:16
```

```
Auto on 05.04.13 21:22:32 XXXXXXXXXXXX "20;27;400;16;"  
A 05.04.13 21:22:34 050408-XXXXXXXXXX-00001.raw 1112ms  
A 05.04.13 21:22:36 050408-XXXXXXXXXX-00002.raw 935ms  
A 05.04.13 21:22:37 050408-XXXXXXXXXX-00003.raw 871ms  
A 05.04.13 21:22:38 050408-XXXXXXXXXX-00004.raw 835ms  
A 05.04.13 21:22:39 050408-XXXXXXXXXX-00005.raw 710ms  
A 05.04.13 21:22:40 050408-XXXXXXXXXX-00006.raw 606ms  
A 05.04.13 21:22:41 050408-XXXXXXXXXX-00007.raw 602ms  
A 05.04.13 21:22:42 050408-XXXXXXXXXX-00008.raw 598ms  
Auto off 05.04.13 21:22:45
```

```
M 05.04.13 21:22:50 050408-XXXXXXXXXX-00009.raw 1357ms  
M 05.04.13 21:22:52 050408-XXXXXXXXXX-00010.raw 1148ms  
M 05.04.13 21:22:53 050408-XXXXXXXXXX-00011.raw 975ms
```

```
Auto on 05.04.13 21:28:20 XXXXXXXXXXXX "20;27;400;16"  
A 05.04.13 21:28:23 050408-XXXXXXXXXX-00012.raw 1032ms  
A 05.04.13 21:28:24 050408-XXXXXXXXXX-00013.raw 831ms  
A 05.04.13 21:28:25 050408-XXXXXXXXXX-00014.raw 1116ms  
Auto off 05.04.13 21:28:26
```

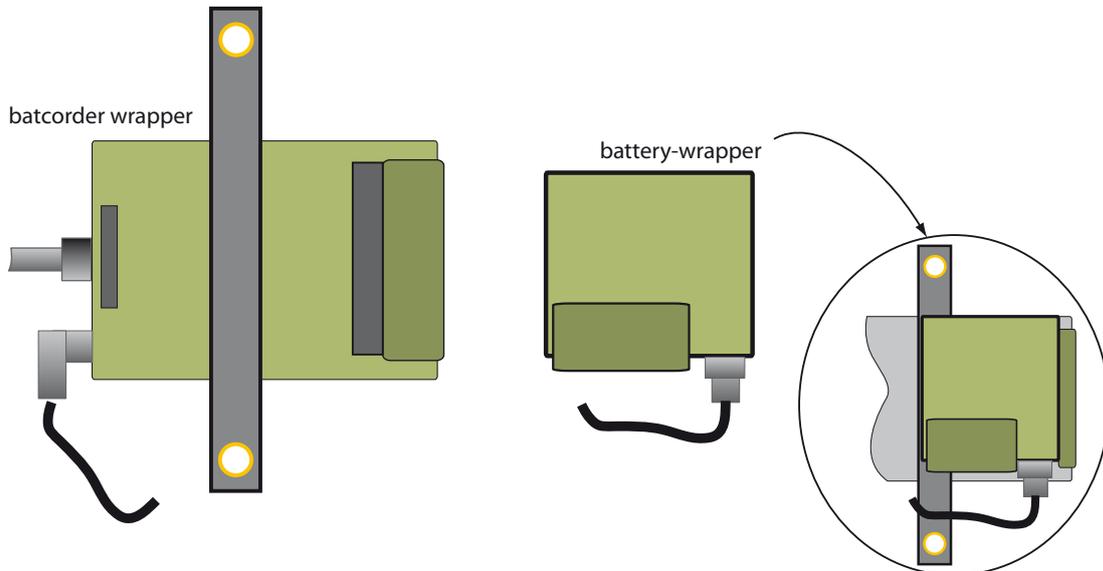
```
Auto on 05.04.13 21:28:27 XXXXXXXXXXXX "20;27;400;16"  
Auto off 05.04.13 21:28:28
```

```
Timer on 05.04.13 16:54:02 XXXXXXXXXXXX "20;27;400;16;"  
T 05.04.13 16:54:08 050408-XXXXXXXXXX-00015.raw 963ms  
T 05.04.13 16:54:09 050408-XXXXXXXXXX-00016.raw 783ms  
T 05.04.13 16:54:10 050408-XXXXXXXXXX-00017.raw 1160ms  
Timer off 05.04.13 16:55
```

Field setup

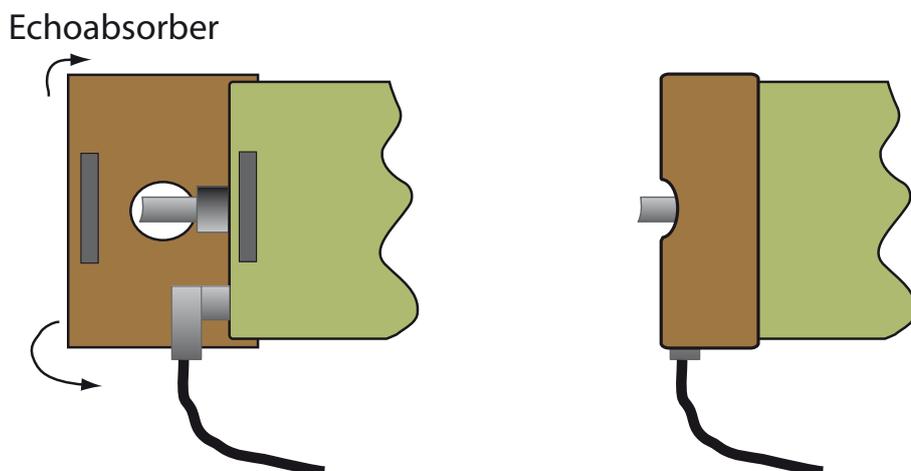
Attaching the battery pack

The *batcorder's* cordura® bag is designed to easily attach the battery pack. Battery pack and *batcorder* cases have Velcro® fasteners for solid fixation (see drawing).



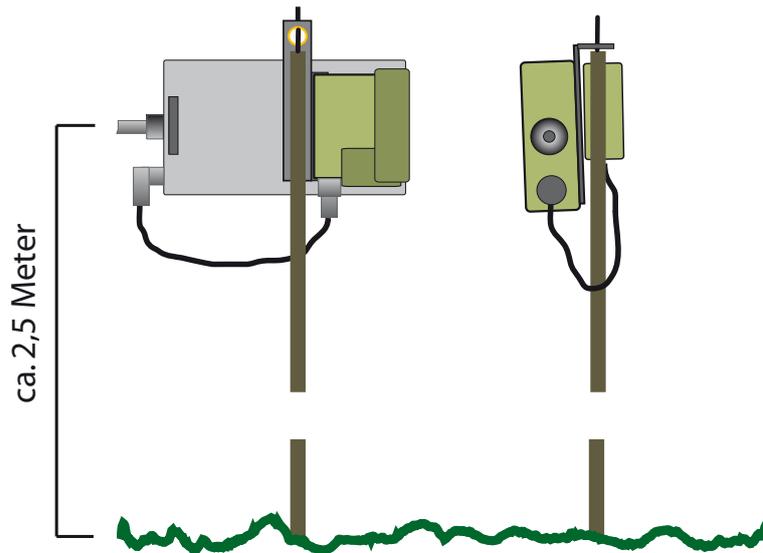
Echoabsorber

The *batcorder* is delivered with a special echo absorbing velvet cloth. This minimizes echos reflected directly from the *batcorder*. We recommend installing it whenever you record bat calls. Otherwise, interferences will occur. These disturb call analysis.



General echo avoidance

A carefully chosen set up is necessary to get well and echo-reduced recordings. Place the *batcorder* on top of a 2.5 meters high pole and place it in approximately 2 to 4 meters distance to vegetation structures or other sound reflecting surfaces (including stems of trees). This minimizes interferences of direct sound and echos at the microphone. Such interference can lead to the extinction of sound waves.



Attachment at a tarp pole

The cordura® bag has a strip with a two metallic eyes that can be stripped over the bolt at the top of a tarp pole respectively attached to the tarp pole via a small strip (lower eye).

General tips

Many of the commonly used bat detectors are placed inside plastic boxes or other casings (safety against theft or rain) when used as simple automatic bat detection systems. Usually, these are either placed on the ground or attached to trees. Furthermore, a couple of solutions exist to place the microphone facing downwards onto a reflecting surface (indirect sound paths).



All these solutions are counterproductive to good recordings. Such setups lead to multiple paths sound waves, that can lead to interferences at the microphone. Additionally the microphone loses it's omni-directionality.

FIELD SETUP

To avoid echoes and improve recording quality when structures are behind the microphone, you may want to investigate the box extension. its setup reduces echoes and allows running the batcorder for months in the field.

Besides, we always recommend to consider the tips mentioned in this manual. These are based upon years of experience in making ultrasound recordings with and without automated recording systems and call analysis.

Battery pack

Charging batteries

The aluminum casing holds charging electronic, designed to work with the power supply. A fitting power supply as well as a cable to connect the battery pack and the power supply is included. The green diode on the battery pack indicates the fast charging process by blinking. The LED stops blinking and is continuously on, if trickle charge mode is entered after approximately four hours of fast charging. Fully charged batteries are hold in a state of trickle charge when connected.



Charging should take place in aired rooms.



After a deep discharge we recommend to repeat the charging process. Disconnect battery pack and power supply after the first charging cycle. A new charging cycle is started after connecting the battery pack to the power supply again.



The batteries within the battery pack are sealed up and can only be exchanged by the batcorder manufacturer. Do not try to change the batteries yourself!



Battery packs delivered with the batcorder 3.0 can be used with older batcorder models. But the batcorder 3.0 can not run on old batcorder 1.0 battery packs. Old battery packs have a red LED while new battery packs have a green LED.

The internal battery can be charged using the charging cable and charger connected to the batcorder. It also will be charged when the external battery pack is connected.

batcorder software update

The batcorder firmware is continuously developed and improved. Your batcorder's firmware (shown as SW at startup) can be updated from a SDHC card to participate of these improvements. The few necessary steps of this process are illustrated on the following pages. It is highly important to follow exactly each of these steps. A failure of the update process will render your batcorder unusable and you have to send it to us for reprogramming.

Update using a Windows computer

To patch the batcorder you will need a 4 or 8 GB SDHC card. This card has to be prepared as described in the following steps. You also need a Windows PC running at least Windows 2000. Please read the instructions thoroughly before starting the update! Please also deactivate all kind of software that interacts with the SDHC card unasked (virus scanners, ...). So, let's head to the update:

1. Format card with the computer

Insert a SDHC card, that was used with the batcorder already, into your card reader and connect it to your computer. Open an Explorer window, navigate to My Computer and right click on the symbol of the SDHC card drive. In the menu click on Format. A dialog is displayed. Choose FAT32 as filesystem, BATCORDER as volume descriptor and check that Quickformat is deselected. Do not activate any other of the options. Next click Format or Start and the formatting process is started.

2. Copying the update file

Reinsert the SDHC card into your computer's card reader. Copy the update file onto the card. Do not change anything else on the card, copy, move or delete no other files! Make sure that no other applications are accessing or changing the SDHC card! Eject the card after the copy process finished.

3. Patching the batcorder

Insert the card again into the batcorder. Turn on the batcorder and follow the on screen instructions. That's it - if you succeeded the SW version displayed at startup has changed.

The SDHC card can be used to update further batcorders without repeating the first two steps.

Update using an Apple Mac

1. Format card with the computer

Insert a SDHC card, that was used with the batcorder already, into your card reader and connect it to your Mac. Open the Disk Utility application located inside Applications/Utilities. From the list on the left choose the entry of your card reader. Check that in the lower right half of the main window **Master Boot Record** is displayed.

Check that volume format is set to **MS-DOS (FAT)** and enter **BATCORDER** as name. Press **Erase...** to format the card.

a) Master Boot Record is not displayed

If the partition map scheme is not set to **Master Boot Record** you have to repartition the SDHC card. Choose the tab **Partition** in that case. The following screen allows you to choose the partition scheme via the **Options** button. If it is grayed out, choose a single partition scheme first from the pop up above. Then select **Options** and in the new dialog **Master Boot Record**. Make sure to set the name to **BATCORDER** and the volume format to **MS-DOS (FAT)** before starting the process with **Apply**.

2. Copying the update file

Reinsert the SDHC card into your computer's card reader. Copy the update file onto the card. Do not change anything else on the card, copy, move or delete no other files! Make sure that no other applications are accessing or changing the SDHC card! Eject the card after the copy process finished.

3. Patching the batcorder

Insert the card again into the batcorder. Turn on the batcorder and follow the on screen instructions. That's it - if you succeeded the SW version displayed at startup has changed.

The SDHC card can be used to update further batcorders without repeating the first two steps.

Tips & Tricks

Formatting SDHC cards

The *batcorder* writes on SDHC cards in a PC/Mac compatible format (FAT32). If necessary, the *batcorder* will ask you to format the SDHC card. This happens, for example, after manipulating the card or its contents with the computer.



We recommend to copy files from card to computer shortly after *batcorder* use. This way, you ensure that recordings are backed up. After this please format the SDHC card or delete the files (the *batcorder* will reformat the card after this).



Attention: Even after you have formatted the card with the computer, the *batcorder* will reformat the card. Always manually format the card with the *batcorder* prior to its use in **Auto+Timer** mode. Otherwise, the *batcorder* may not be able to start in **Auto+Timer** mode.

SDHC card and Windows Vista / Windows 7

Windows Vista / Windows 7 may ask to repair the SDHC card. Please skip this step to avoid data loss.

Switching SDHC cards

Do not switch between SDHC cards while recording or the device may crash and loose all data.

No remaining space on the SDHC card

If the card is full with recordings while sampling, the *batcorder* will shut down and add an entry to the log file.

Low battery voltage

If the battery is on low power while sampling, the *batcorder* will shut down and add an entry to the log file.

Problems / Support

***batcorder* serial number**

Each device has a unique serial number on a durable sticker located at the *batcorders* bottom side. This number allows to recognize each of your *batcorders*. Please send us this number with every bug or problem report.

Software updates and versioning

The *batcorder* software is improved regularly. You can easily install the updates yourself in most cases. Update files (free of charge) are available on our homepage (<http://www.ecoobs.com/cnt-bcupdate.html>). Copy an update on an empty SDHC card according to the instructions. If the *batcorder* is started with this card inserted, it automatically updates its software. The current software and hardware versions are displayed when starting the *batcorder* (H999 S999).

Error descriptions and contact

As any other device, the *batcorder* can encounter errors. These can often be fixed very easily, thus we recommend to contact us with a detailed error description prior to sending the *batcorder*. Please always include the *batcorders* serial number, as well as its hardware and software versions (Hxxx Sxxx) in your report. Furthermore, tell us how to reproduce the error.

We offer the possibility to either report errors online with our bug reporting tool (<http://bugreporter.ecoobs.de>) or per EMail at info@ecoobs.de or per regular mail at **ecoObs GmbH, Tolstoistrasse 8, 90475 Nuremberg, Germany**. Telephone is **+49 911 3768053**

Typical problems

Defective SDHC card

If a defective SDHC card is inserted, an error message appears. Use a different card to avoid the error. If the error does not disappear, we ask you to contact us.

SDHC cards do have a limited lifetime and are also erasable by magnetic emissions. We recommend to have sufficient new cards available and to sort out cards after one season.

None or only few bat recordings

If you achieve only a few recordings after one night of sampling at a location with high bat activity, this might be due to the following reasons:

- a) **Disadvantageous setup:** Setting up the microphone close to reflecting surfaces (vegetation, walls, water bodies, ground) leads to strong echoes and therefore interferences of echo and signal. This will affect the call detection of the *batcorder*. A different setup is highly recommended.
- b) **Changed settings (Settings Advanced):** If you have changed any of the advanced settings, you may have changed vital parameters for bat call detection. Please make sure that *Quality* is set to 20, *Threshold* to -27 dB and *Critical Frequency* to 16 kHz. Especially low values for *quality* (0 to 10) influence the triggering and bias it towards high quality calls.
- c) **Connectors not tightened:** Check if all connectors are not only connected but tightened via the screw-nut.
- d) **Microphone protective cap:** The microphone is protected against mechanical damage by a short plastic tube during transport. Check if you removed this cap.
- e) Use the log files to check if the *batcorder* terminated on account of **low batteries** or a **full SDHC card**.

Too many recordings, many bushcricket recordings

Too many recordings can be created due to some settings as well as a disadvantageous set up.

- a) **Microphone too close to vegetation:** Placing the microphone close to vegetation may lead to a higher sound pressure level of bushcrickets, singing in the vegetation. This can lead to bushcricket calls triggering re-

ording events. Move the microphone further away from vegetation.

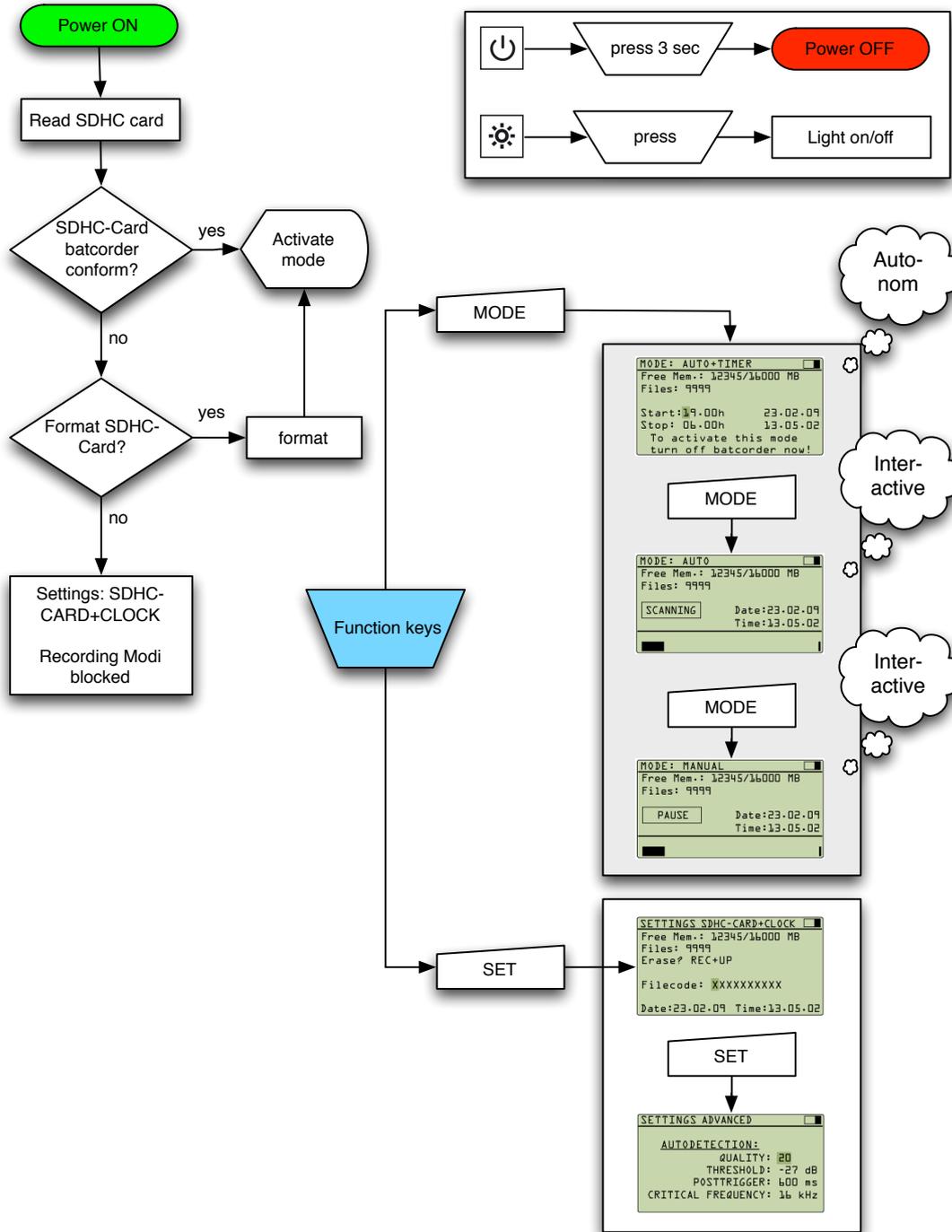
- b) **Wrong advanced settings -> Quality**: Check if Quality is set to 20 in the advanced settings screen. Higher values may lead to more recordings of non-bat calls.

Reduced battery run time

The *batcorder* runs less than two nights on a single battery charge. A couple of reasons can be responsible for this. Rechargeable batteries have only a limited lifetime, expressed in numbers of charging cycles. The older the batteries, the less capacity they can hold. If your batteries are old or have already been used a high number of charge cycles, they should be exchanged. Furthermore, batteries prefer temperatures above 10° C. If reduced run time occurs in cold nights, the low temperatures are probably the reason. The newer the battery, the better it copes with such situations. Please note that the *batcorder* is not built to be used at temperatures below 0°C.

The number of recordings taken in a single night strongly influence battery consumption. When writing to SDHC card, the current drain nearly doubles in comparison to scanning operation. Thus, more recordings lead to higher battery consumption.

Menu Overview



Technical Details

Product	<i>batcorder</i>
Description	Call triggered, automatic bat recorder

File- / Sound Properties

Type-of-recording	real-time
Samplingrate	500 kHz
Amplitude-resolution	16 bit
Sensitivity	16 - 150 kHz (ca. 32 dB loss at 150 kHz)
Sound-samples	LittleEndian, PCM, w/o header
Memory-type	SDHC-card (FAT32), 4/8/16/32 GB capacity

Recording properties

type of microphone	Electret, power-supply 1,3 V
signal-to-noise ratio (SNR)	ca. 70 dB
Directionality	0 to -9 dB loss at 0 - 180° incidence

Analoge-circuitry

Highpassfilter	16 kHz, Butterworth, 10th order
Lowpassfilter	150 kHz, Butterworth, 10th order
Overall-gain	calibrated: 40 kHz @ 96 dB SPL = full gain

Power Supply and Usage

Power supply	NiMH 6V 2400mA + internal Lilon battery
Charger (AC/DC converter)	Input 100V- 240V 0.3A max, output 12V 0.5A
Power consumption (Scanning)	78 mW
Power consumption (Writing)	ca. 148 mW (depending on the SDHC card)
Runtime	ca. 7-12 nights with timer, up to 110 hours

Temperature range for operation	0°C - 40°C
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Technical details are subject to change.

Microphone calibration

Both *batcorder* and microphone are calibrated before delivery to ensure comparability of recorded data when used either simultaneously or sequentially [40 kHz @ 96 dB SPL equals full gain]. The calibrated sensitivity is only guaranteed for the microphone delivered with this *batcorder* unit. Please use only the supplied microphone and do not exchange microphones of different *batcorders*!

The correction-factor (CF) is listed for each microphone as MCF. Following is the MCF of the originally included microphone:

MCF : _____

***batcorder* bc3 -** _____

We also recommend the regular, annual test of the correction factor. To update the correction factor, you have to send the microphone (not the *batcorder*!) to ecoObs GmbH. We will test the microphone, determine an updated correction factor and send you details on how to set the new factor in the *batcorder*. Please consult our online pricelist for the current price..

Send to:

ecoObs GmbH
Tolstoistrasse 8
90475 Nuernberg
Germany

Adjustment of the Microphone Calibration Factor

If a *batcorder* 3.0 microphone is recalibrated, replaced or exchanged by a disc microphone, the microphone correction factor (MCF) needs to be adjusted for the batcorder.

4. **Main** menu.
5. Place the cursor on the first character of the **FILECODE** field.
6. Press **REC** together with the **right arrow** button (▷).
7. The menu for the adjustment of the **Microphone Correction Factor (MCF)** will show up.
8. The second line on the screen displays the **CF** („correction factor“). It can be changed, using the **arrow buttons** △, ▽
9. The new CF is set to the MCF of the according microphone
10. Press **REC** to save the new value and leave the menu or press **SET** to leave without saving.