BATLOGGER C

Manual

Firmware version V 2.6

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1 Safety information and notes

Before operating the device, please read this manual thoroughly and retain it for reference.

General safety information:
- Ignoring the associated information given under this symbol may result in serious injury or even death.
- Use the device only in its intended manner. Any other uses may lead to damage to the device or in the vicinity of the device.
- Do not place the device on or near a heat source (heating, fire, etc.). Protect. it against high temperatures and temperature fluctuations
- Place the device so that it can not become a danger due to dropping, falling etc.
- The device must be kept out of reach of children.
- Make sure no foreign objects (coins, pins etc.) or liquids can enter the unit.
- Only use the specified supply voltage for the device.
- When installing the device and the external cables (microphone, power supply, etc.) it must be ensured that it can not come into contact with other live objects. Also, make sure that no electric shock caused by lightning, high-voltage power lines etc. can occur. Faulty connections and damaged cables can cause electric shock or fire.
- Be sure the use of this device is allowed in the country and in the environment required. The use of this device may be dangerous and has to be avoided in the following areas:
  - Where it can interfere with other electronic devices in environments such as hospitals, airports, aircrafts, etc.
  - Where there is risk of explosion such as gasoline stations, oil refineries, etc.
- It is responsibility of the user to enforce the country regulation and the specific environment regulation.
- Do not use the unit while operating a vehicle (such as a bicycle, motorcycle or car).
- An alteration or modification of the device affects the product safety. Caution: Risk of injury!
- Do not perform any repairs.
- Handle the device with care. It can be damaged through impact, hits or dropping even from low height.
- Avoid operation in close proximity of strong magnetic or electromagnetic fields transmitting antennas, RF generators or near electronic devices such as mobile phones. This may affect proper operation.
- By handling error, unit malfunction, or during repair work the stored data may be destroyed or erased. It is therefore advisable to make a backup copy of important data, on the PC hard drive.

External power supply: Unplug from outlet when not in use and before conducting maintenance. The included power supply adaptor must be used indoors only (0..40°C). Do not use with a damaged cord or plug. Do not attempt to open the charger. Repairs should only be carried out by a qualified customer care centre. When disconnecting the power adapter from the wall outlet always grasp the adapter itself and not the cord.
If any other external power supply is used (e.g. photo-voltaic panel), make sure that it is properly connected and protected from moisture, rain and any other environmental influences.

Li-Ion battery: Do not attempt to open or repair the battery. Do not short circuit the battery. Do not expose the battery to high temperatures or allow moisture or humidity of any kind to come into contact with it. Only use original spare parts. When transporting and storing several BATLOGGER C together, the corresponding regulations have to be followed.
The battery should be charged at temperatures between 0°C and 40°C and discharged at a temperature between -10°C and +50°C. Using the battery at temperatures outside of this ranges may cause the battery to become hot or to break and may also harm the performance of the battery or reduce the battery's expectancy.

Environmental conditions: The BATLOGGER C is housed in a robust, weatherproof case. The case must be properly closed and secured to maintain weatherproofness.
All external connectors are protected against moisture and rain only if the corresponding cable is properly connected. If a connector is left unconnected, it must be protected with the dummy plug.

Microphone / Ultrasonic sensor: An active electret microphone is used as ultrasound sensor. Attention has to be payed to a proper fitting of the microphone in its plug. The microphone itself can be damaged by water. It must be protected from dirt, rain and extreme humidity, and it requires corresponding positioning. A defective microphone can lead to unusable or incorrect data.

Measurement device: The BATLOGGER C is a very sensitive measurement device and must be treated as such. To achieve useful and reproducible results you should consider some preparation measures and familiarize yourself with the device. Some basic knowledge about bats and ultrasound is required.

Maintenance and care: Only clean this device with a slightly damp, lint-free cloth and do not use aggressive cleaning agents. Ensure that no water intrudes the device.

Note on environmental protection: Electric and electronic devices as well as batteries must not de disposed of with household waste. Consumers are obliged by law to return electrical and electronic devices as well as batteries at the end of their service lives to the public collection points set up for this purpose or point of sale. Details to this are defined by national law of the respective country. This symbol on the product, the instruction manual or the package indicates that a product is subject to these regulations. By recycling, reusing the materials or other forms of utilising old devices/batteries, you are making an important contribution to protecting our environment.

2 Overview
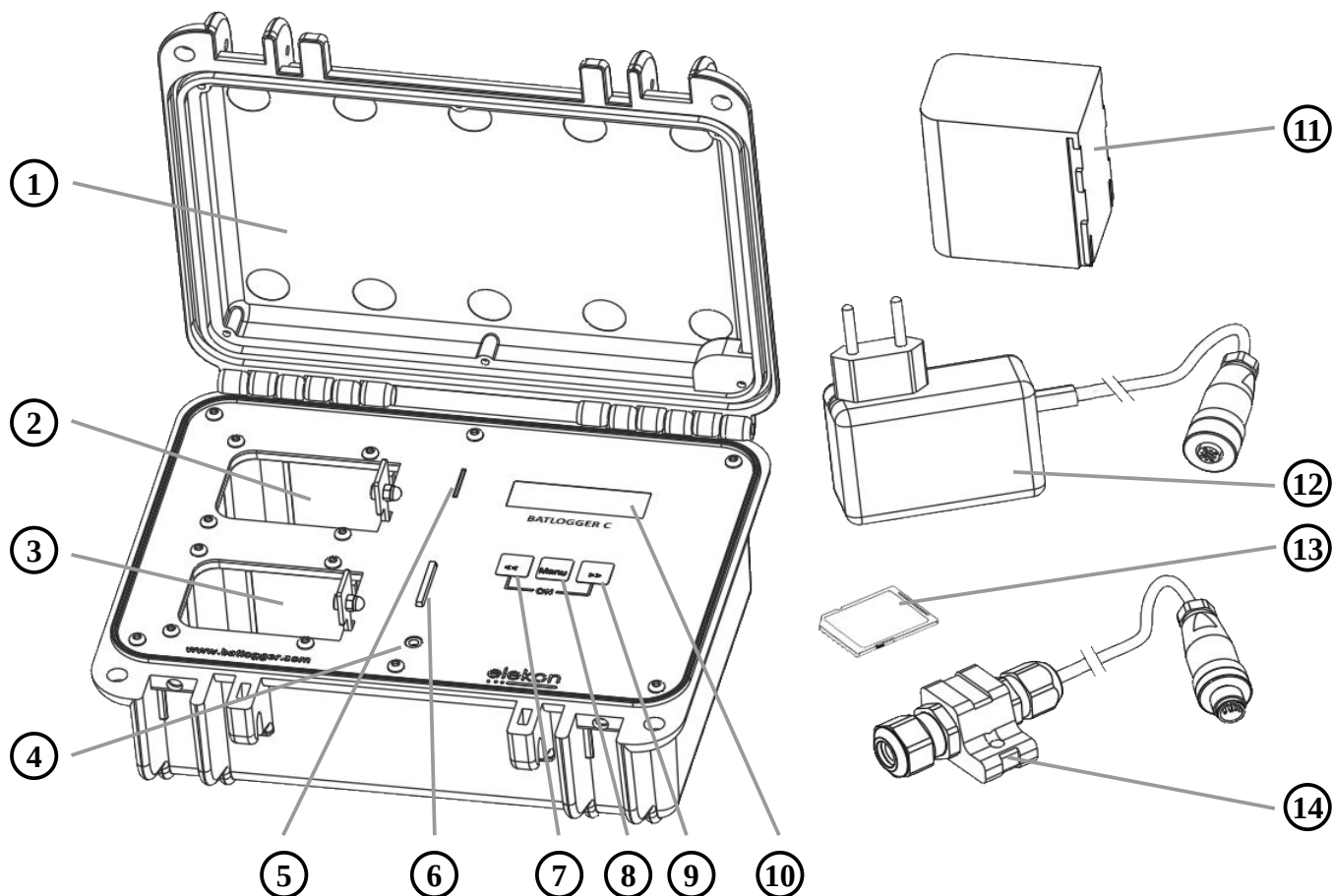
1	Case with cover	**10**	LC-Display with backlight
2	Battery slot 1 with battery status LEDs	**11**	Battery
3	Battery slot 2 with battery status LEDs	**12**	Power supply
4	Headphones 3.5mm jack	**13**	SD card
5	SIM card slot	**14**	Microphone with cable 2m
6	SD card slot	**15**	Power connector
7	Left Key (<<)	**16**	External SMA connector
8	Menu Key (MENU)	**17**	Microphone connector
9	Right Key (>>)		
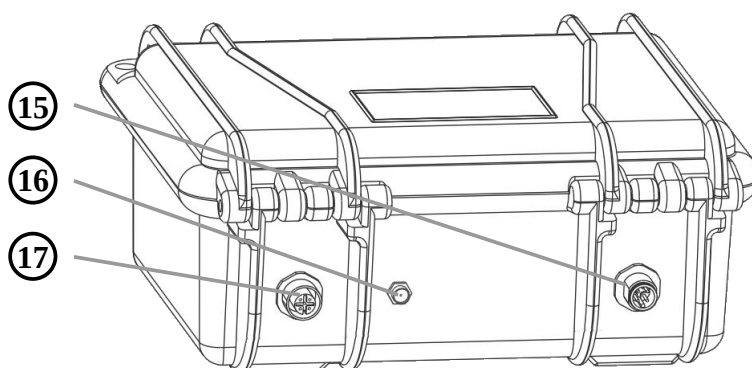
2.1 General

The BATLOGGER C is a data logger, which records ultrasound vocalisations of bats in real-time, and stores them for later processing on a SD / SDHC memory card (real-time recording system).
In a real-time recording system, the ultrasonic signal is digitized directly without change and with high sampling rate. Hereby the BATLOGGER C continuously analyses the signal and only stores it to the SD card when bat activity is detected. The Signal is recorded to internal RAM and subsequently, if certain criteria is fulfilled stored, as recording files (sequences of echolocation calls) onto SD card.
Apart from the bat calls, which are stored as standard audio WAVE files, additional information is written in text format into a ".xml" file, which stores all the settings of the BATLOGGER C at the time of recording, including time, date and location of the recording (GPS data), and the current temperature.
To allow a later overview over all deployments of the device, its operating state is being written to a "LOG" file on the SD card.
The BATLOGGER C is thus especially suitable for autonomous operation and long-term monitoring. The BATLOGGER C is primarily used stationary, which is often referred to as passive monitoring.

2.2 Device revisions

This device underlays continuous development efforts to maintain and improve its producibility and functionality.

Hardware revision history:

HW Revision B3:   Initial release

Mobile radio module: LTE support [A]

The revision number can be found in the BATREC.log file in the "power on" entry.

2.3   Data storage

The audio files are stored on the SD memory card as #****.wav files (where # = 4 digit serial number of the device), with consecutive numbering (****). For every #****.wav file, a #****.xml file is stored, which contains all parameter settings, date, time, geographic position and temperature at the time of recording of the corresponding WAVE file. Ultrasound data of the microphone are first written to the internal Random Access Memory (RAM) of the device. After termination of a single recording sequences (Recording...), the data is stored automatically from RAM to the SD card (Saving... #****.wav). During this storage time (duration depends on file size and card type), the device is blocked.

SD card: The device uses SD / SDHC /SDXC cards with FAT32 file system as storage media. When the term "SD card" is used, always an SD / SDHC / SDXC card is meant. Tests have shown, that cards of different vendors may vary in writing and erasing speed. We refrain from giving recommendations for specific products or vendors, as offered sizes and technologies change constantly, which may also influence card performance. SD cards may have a write protect switch that prevents writing to the cards when the switch is on LOCK. Please make sure to disable the write protect switch of the SD card before using it.
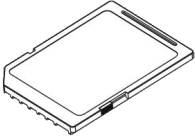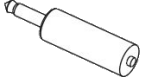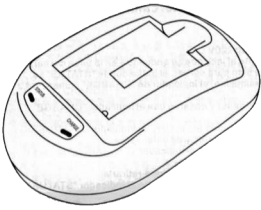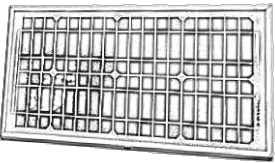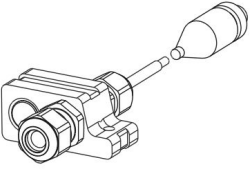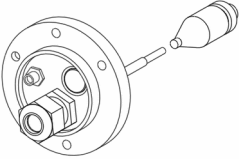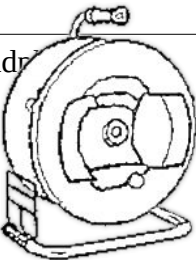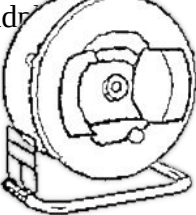
SDXC cards: SD cards larger than 32 GB (SDXC cards) may be formatted with exFAT upon delivery and must be formatted by with FAT32 before use. To do this insert the SD card into the SD card slot and turn on the device. You will be asked whether the card should be formatted. Press [>>] to format and confirm with [<<] [>>]. CAUTION: All data on the SD card will be deleted.

SD card content: A recent version of BATPARS Editor software (Windows and Mac) is stored on the included SD card. The executable file is in directory Software/ BATPARS and can be started from there directly. Installation is not required. A recent version of BatExplorer PC software is stored on the included SD card. It must be installed on the computer before first use. It can be found in the directory Software/BatExplorer.

2.4 Accessories

Part	Description	Part#
SD card	SD / SDHC / SDXC cards up to 128 GB card size can be used (32 MB to 128 GB tested). The card must be formatted as FAT32. (1x SD card, 16GB included)	
Ultrasonic microphone FG black	Ultrasonic microphone FG black or FG green can be used. To replace the microphone, see chapter 11.2. (1x FG black included)	212.233
Battery BP-945	The battery operation endurance can be extended by installing a second battery. One battery lasts for approximately 5 nights a 10h (total 50h). See also chapter 3.2. (1x BP-945 included)	212.025
External battery charger	Charge a (additional) battery independent of the device, e.g. while the device is in use in the field. (optional)	212.026
Photo-voltaic panel	For power independent long-term monitoring, a photovoltaic panel can be used (10..26V, 20W). It can be connected directly to the power connector. The device has a built-in charger that is solar power ready and supports peak power tracking (MPPT). (optional)	212.027
12V adapter cable	If 12V power supply is available already, it can be connected directly to the power connector with the 12V adapter cable. (optional)	212.030
External mobile radio antenna with SMA cable	To improve signal reception, an external mobile radio antenna can be connected. See also chapter 11.5 (optional)	212.029
MC32	MC32, waterproof microphone cable 2m with integrated test signal	212.028

	generator. Compatible with microphones FG black and FG green. (optional)	
MC32W	MC32W, wind turbine microphone and mobile radio adapter with cable 5m and integrated test signal generator. Compatible with microphones FG black and FG green. (optional)	212.036
Microphone extension kit 100m green	Extend the operating freedom with the 100 meter extension cable and the FG green microphone. Place the microphone on top of a measurement mast or tree while having the device accessible on the floor. (optional)	212.031
Head...	Listen to recordings or live monitoring (heterodyne) with regular headphones with 3.5mm plug. Plug your headphones into the headphones jack and adjust the volume to a comfortable level (see also below). (optional)	

3   Preparation

3.1   Inserting/Removing Battery
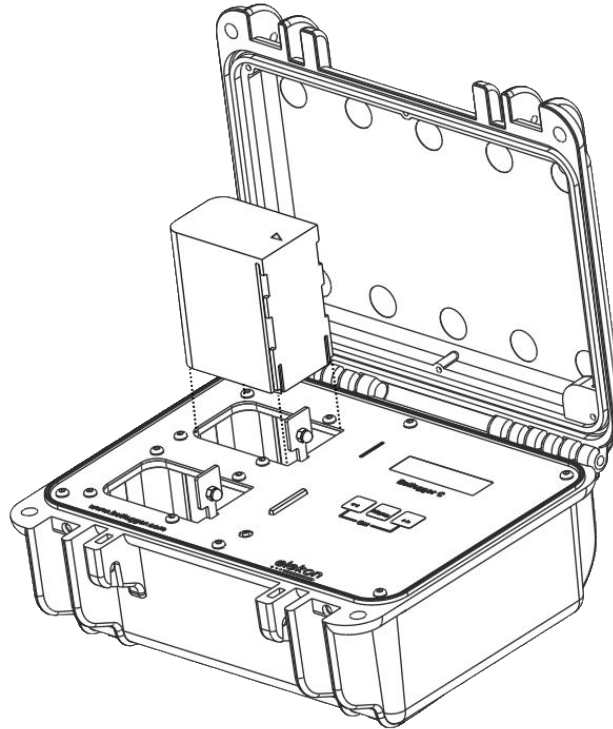
1. Open the case cover. Make sure that the device is turned off

2. Face the Δ mark on the battery towards the display and insert the battery into battery slot 1 or battery slot 2 until it locks into place.

3. To remove the battery, push the battery lock lever towards the display and pull the battery.

⚠️ **Battery may become hot:**   Be careful as the device or battery may become hot during charging or when used continuously for a long period of time.

ℹ️ **Remove battery:**   Turn off the device before removing the battery. Otherwise the data may become corrupted and/or the SD card may be damaged.

ℹ️ **Handle batteries with care:**   Wipe the electrodes of the battery with a soft dry cloth before inserting. Remove the battery when you will not use the device for a long time. The battery may leak and damage the device if left installed during prolonged periods of non-use. If the removed battery will not be used for six months or longer, charge the battery for about 30 minutes before storing it, and after that, recharge the battery every six to twelve months. Store the battery in a location where the temperature will remain at or below room temperature. Avoid locations with high temperatures.

3.2 Battery charging
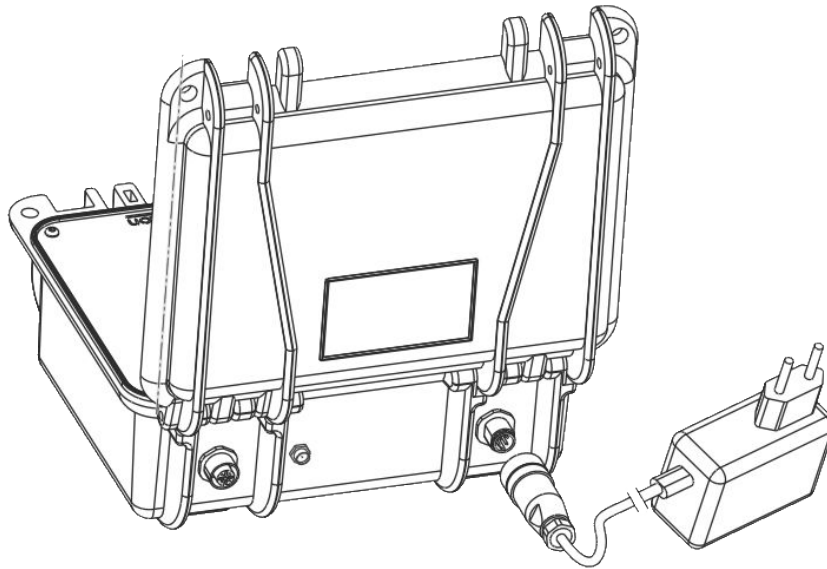
Upon delivery the battery of the device may not be fully charged. Please charge the battery before first use.

1. Insert one or two batteries (see above).

2. Plug in the provided power supply to the device power connector by arranging the notch of the plug to the clip of the socket.

3. Turn the screw locking ring clockwise to tighten the connector until it is fully inserted.

4. Plug the power supply into a power outlet.

5. Charging begins when the charging indicator lights red.

6. Charging is complete when the charging indicator turns green. The charging time can take several hours, depending on the state of charge.

Usage with power supply: The device can also be operated with the power supply connected to e.g. extend the operation time. It is even possible to use the device without a battery, but it is recommended to use at least one battery as backup power even if permanent external power supply is available.

Usage with multiple batteries: When using two batteries, an advanced discharge method is used to prolong battery life and minimize usage cycles. When exchanging with pre-charged batteries in the field, it may be needed to replace both batteries depending on the usage and operation method.

Alternative power supplies: The device can be used with alternative power supplies like photovoltaic panels, lead acid battery or similar. The power supply must meet the minimal power specification (10..26VDC, 20W). See also chapter 2.4.

Protect external connectors: When not in use, protect the external power connector from dirt and moisture with the supplied cover.

3.3 Adjusting parameters and settings

Basically the device can be used directly with factory settings. For some applications such as SMS/Email notifications, parameters must be adapted accordingly.

Ideally, adjusting parameters should take place before use, directly on a PC or Mac. See chapter 9.2 and 10.4 for detailed information about parameters and settings.

1. Insert the supplied SD card into the memory card reader of your computer and start the BATPARS editor software directly from the SD card.

2. Open the file "BATCPARS.xml" which is stored in the root directory of the SD card by clicking the "Open..." button.

3. Change parameters as needed.

   e.g. set capture time frames (schedule) for long-term monitoring and directly check programmed times in advance.

4. Save the parameter file by clicking *Save*. The parameters are now on the SD card.

5. Close the BATPARS editor software with "Close".

6. Insert the SD card now in the device. The parameters are now loaded at start-up.
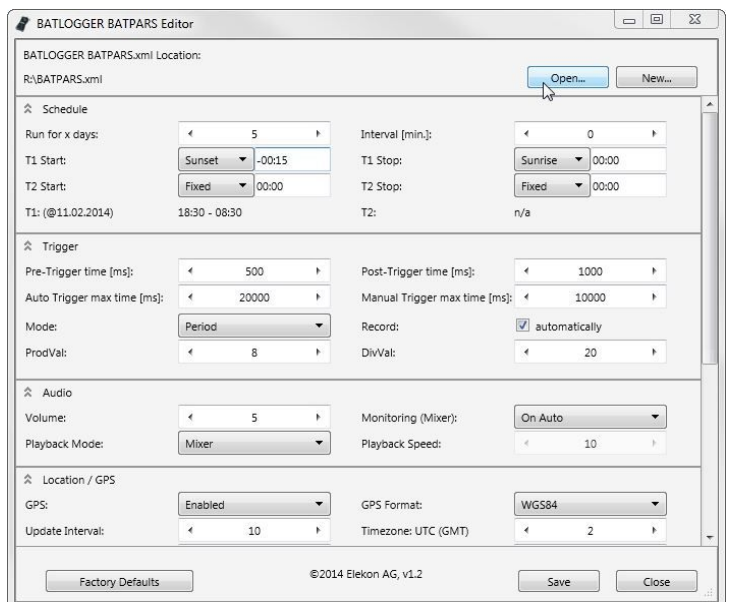
3.4 Connect and install the microphone
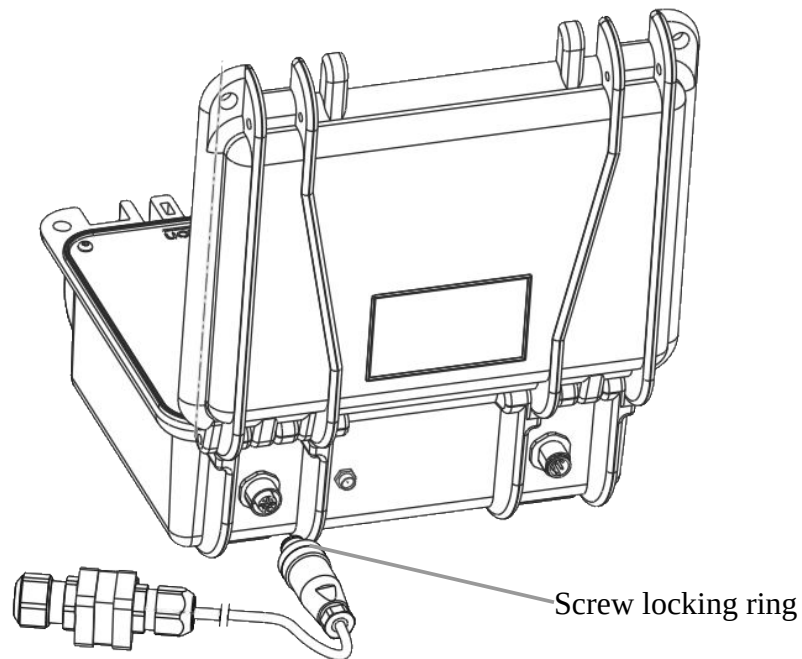
Screw locking ring

1. Plug in the connector by arranging the clip of the plug to the notch of the socket.

2. Turn the screw locking ring clockwise to tighten the connector until it is fully inserted.

The microphone can be placed independently from the device to ensure optimal acoustic reception, while allowing an inconspicuously placement.

To increase the life of your microphone, it should always be mounted with the opening facing ground up to a maximum horizontal position to prevent moisture accumulation inside. Use a tripod or similar to easily mount and direct the microphone as needed.

Also consider the surroundings of the microphone. Close objects or surfaces may reflect sound and distort recorded bat calls.

Microphone mounting: To properly place the microphone, use the tripod socket, the included strap or similar to mount it to sturdy object (tripod, post, branch, etc.).
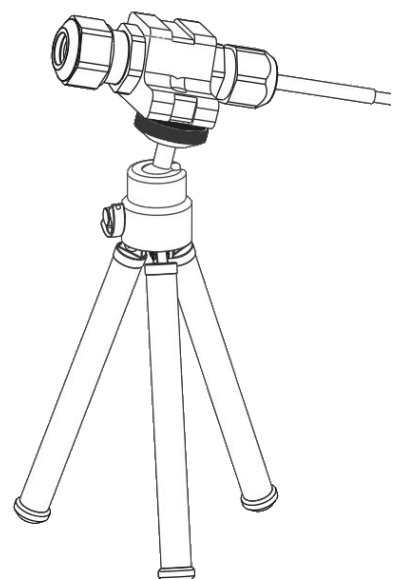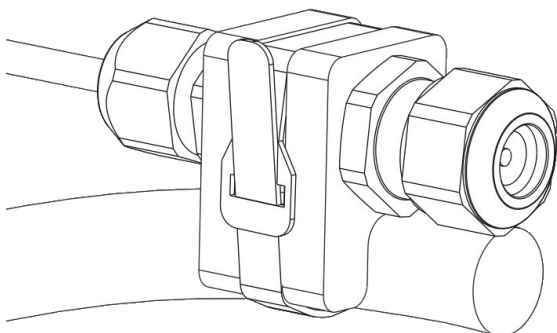
3.5 Close and secure the device

Closing latches   Lock
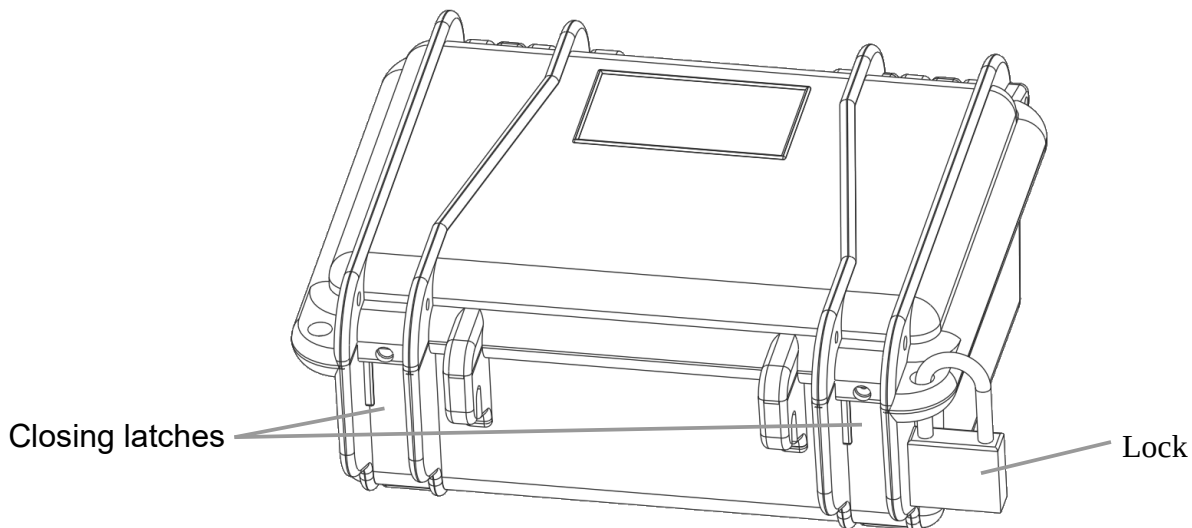
When using the device in the field, the cover must be closed tightly and the external connectors must be mounted correctly to protect the device from dust and water. Close the latches until you hear a "click".

Ensure tightness: Make sure that there is no dirt between the cover and housing that could affect tightness. If necessary, clean the sealing with a lint-free, slightly damped cloth.
The device should be placed so that the sockets are located rather down and the housing valve rather up so that water can not move into the connector on the cable. Internal moisture can lead to short circuits and damage the unit or even cause a fire.

Avoid temperature fluctuations: The device must be protected from direct sunlight and extreme cold in order to avoid extreme temperature fluctuations that could affect tightness. Place the device in a shady place. Optionally, a dehumidifying agent can be used to prevent condensation inside the unit.

The display backlight turns off when the cover is closed.

To prevent unauthorised manipulation use one or two locks, a cable lock, a chain or similar to protect the device.

Secure the device: The device must be properly installed and secured. In particular, it must be ensured that during operation it can not come loose or fall down and that no people or animals can be injured.

Motion detection: The device has a built-in motion detection sensor. Enable theft alarm notification to enable motion detection. See chapter 7.4.3 for further information.

4 General handling and operation

4.1 Inserting/Removing SD Card
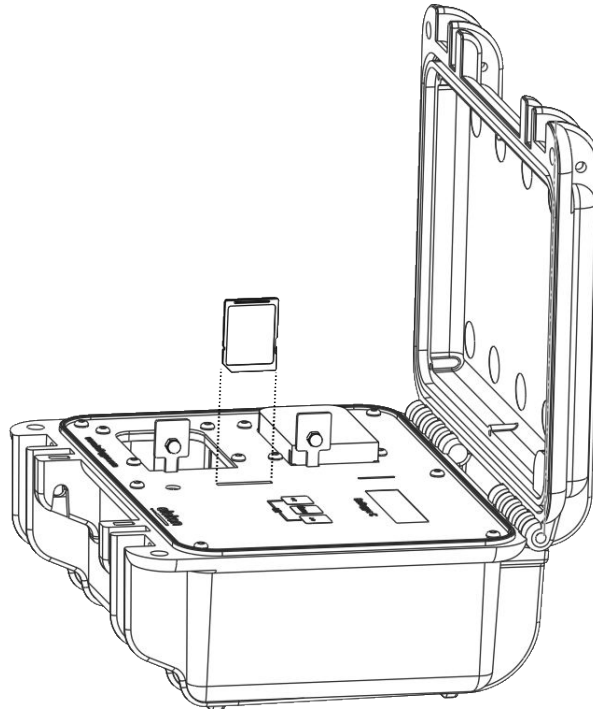
1. Open the case cover. Make sure that the device is turned off

2. Insert the SD card all the way into the SD card slot with the card label facing toward the display.

3. Push the SD card in once to remove.

Remove SD card: Turn off the device before removing the SD card. Otherwise the data may become corrupted and/or the SD card may be damaged.

4.2 Turn on the device
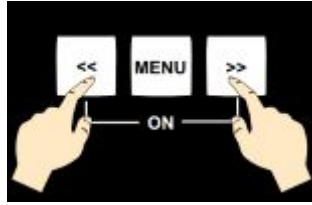
Press both keys `<<` and `>>` simultaneously to turn on the device.

| ```
BATLOGGER C
<<  Power-On  >>
``` | Device powers up, keep both keys `<<` and `>>` pressed. |
| ```
BATLOGGER C
#1234 FW2.5
Elekon AG    ^o^
``` | Serial number and software version are indicated on the display. Release the keys. |
| ```
Initializing
SD Card
``` | The SD/SDHC card is initialised. |
| ```
Using Parameters
from SD Card
``` | Parameters are loaded from "BATCPARS.XML" file. See also chapter 3.3. |
| ```
01.04.2015 18:59
15.2GB Free
Start Record   »
``` | Device is ready. The main menu is active. |

4.3   Main menu with info lines

Press the [MENU] key to change between the menu entries.

The top two lines of the display shows different information screens in cycle:

```
01.04.2015 19:00
15.2GB Free
Start Record?   »
```

Press [>>] key to enter "Recording mode". See chapter 5.
Press [MENU] key to proceed to the next menu item.

Date/Time, Free SD card memory

```
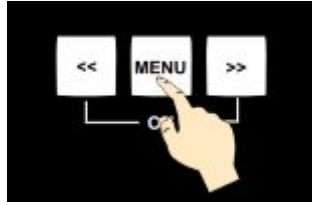#1234  19°C    ■
1. Freq  49kHz □
Test Record?   »
```

Press [>>] key to enter "Test Recording mode". See chapter 5.
Press [MENU] key to proceed to the next menu item.

Serial number, temperature, last detected frequency, battery status.

```
7 Sats 3D (2.5m)
+41.2535,+8.5455
Process File?  »
```

Press [>>] key to enter "Process File" menu. See chapter 6.
Press [MENU] key to proceed to the next menu item.

GPS/Location information, see chapter 8.1.

```
MOB (LTE): ####_
Provider
Setup?         »
```

Press [>>] key to enter "Setup" mode. See chapter 9.
Press [MENU] key to proceed to the next menu item.

Mobile radio information, see chapter 7.3.

```
01.04.2015 19:01
15.2GB Free
Shut Off?      »
```

Press [>>] key to shut-down the device.
Press [MENU] key to proceed to the first menu item.

Information screens cycle in 1s intervals.

Automatic shut-off:

If no keys are pressed for 4 minutes, and the device is not in recording or sleep mode, it will switch off automatically.

4.4 Set time

The device has an internal real-time clock that is used for the delayed recording and the time stamps of the recordings. There are three ways to adjust the device time: manually, via GPS receiver or via the mobile network.

To keep the clock current, it is necessary to update it regularly. In unattended operation, the time is automatically updated when the following conditions are met:

TIMEMODE = 1 (Auto GPS): GPS_MODE must be set to 1 (On) or 2 (On with GPX) and GPS reception must be ensured.

TIMEMODE = 2 (Auto MOB): Status notification must be enabled, GSM_SMSMODE or GSM_EMAILMODE >= 1 and mobile radio reception must be ensured (valid SIM card inserted).

See also chapter 9.2 for more information regarding settings.

4.5 Device lock (Theft protection)

The device lock can be used to prevent manipulations on a running unattended device or to leave the device unusable and thus unattractive for possible thieves. For this, a user definable PIN (Personal Identification Number) can be configured (see chapter 9.2.7).

If device lock is enabled, on device start-up or manual wakeup, the correct PIN must be entered before the device can be used.

`Enter device PIN` `«0»`	Use the keys `<<` or `>>` to change the digit between "<" ">". Press **MENU** key to switch to the next digit or to delete the digit on the left with <←>.
`Enter device PIN` `0000«↵»`	Press **MENU** key to enter the PIN with <↵>.

When the correct PIN was entered, the device will start up as usual.

When an incorrect PIN was entered, the device will turn off. After 5 incorrect attempts, the device is blocked and needs to be unblocked with the PUK (Personal unblock key). Contact Elekon AG to get the PUK.

5 Record bat calls

For long term passive monitoring, the device usually only operates during the night and "sleeps" during the day to save battery power and SD card space (Delayed recording).
It is also possible to immediately start record mode to test the installation or to use the device for active monitoring by executing the "Test record" function in the main menu.

5.1 Delayed recording *(Recording in time frames)*

One or two operation time frames can be configured.
During the operation time (record mode), the device detects and records bat calls depending on the recording and trigger settings (see below).
During the sleep time (sleep mode), the device goes into power saving mode and turns off any peripherals. It will only wakeup for SMS/Email notification, Theft alarms (see chapter 7.4.3) or if aborted by the user.

The time frames can be configured flexibly. The times can also be set dynamically by the position of the sun (sunrise and sunset). The device date/time and location must be configured correctly in order that the dynamic times are calculated accurately (see also chapter 9.2).

Example:
- Nr. Days = 2
- T1 Start = 20:30 (Sunset)   T1 Stop = 01:30
- T2 Start = 04:00   T2 Stop = 07:30 (Sunrise + 15min)

When starting delayed recording, the device checks its status depending on the configured features before changing to record or sleep mode:
- Microphone connection
- Date/Time
- GPS/Location
- Trigger
- Mobile radio settings/connection

`Mic possibly`
`damaged!`
`Continue?        »`
	If the microphone or its connection is not installed correctly or damaged:
	Press ⏩ key to start recording anyway.
	Press MENU key to abort.

`Check date/time`
`01.01.2000 00:00`
`Start w/o GPS? »`
	If internal clock not has been updated by GPS or mobile radio yet:
	Press ⏩ key to start recording anyway.
	Press MENU key to abort.

```
Loc. not set!
Start anyway?   »
```
If no GPS position fix and therefore manual location can not be updated:
Press `>>` key to start recording anyway.
Press `MENU` key to abort.

```
Manual mode set!
Start anyway?   »
```
If manual trigger mode is configured:
Press `>>` key to start recording anyway.
Press `MENU` key to abort.

```
Update to
curr. location?»
```
Current GPS position differs from manual location:
Press `>>` key to start update manual location with current coordinates.
Press `MENU` key to keep configured manual location.

```
Phone number
invalid!
Start anyway?   »
```
If SMS phone number is invalid and SMS notification is enabled:
Press `>>` key to start recording anyway.
Press `MENU` key to abort.

```
Email sett.
Invalid!
Start anyway?   »
```
If email settings are invalid and email notification is enabled:
Press `>>` key to start recording anyway.
Press `MENU` key to abort.

```
MOB not ready
or no signal!
Start anyway?   »
```
If mobile radio modem not connected yet and SMS/email notification is enabled:
Press `>>` key to start recording anyway.
Press `MENU` key to abort.

When time frame start time has not passed yet, the device displays the programmed schedule and then enters sleep mode:

```
Delayed rec:
T1 20:15-08:30
T2 00:00-00:00
```
Programmed time frames are displayed.

```
Sleeping:
15:32 – 20:15
next: Rec T1
```
The device is now in sleep mode.
Press `<<` key to wakeup the device, abort delayed recording and exit to main menu.

When a time frame start time has passed, the device will wakeup and start recording mode. When a time frame stop time has passed, the device will go back to sleep mode.

5.2 Record mode

The device can be operated in different ways.

In **automatic recording** the signal from the microphone is constantly monitored and the recording started automatically, when a triggering event is registered (detected ultrasound signal, e.g. bat call). The duration of such recordings depends on the presence of the triggering criteria. The default setting allow for a recording duration which includes 0.5 seconds before the first and 1 second after the last trigger event (pre- and post-trigger). With the default settings, the shortest recording duration is therefore 1.5 seconds, which corresponds to roughly 1 MB of data on the SD card. To reduce recurring recordings of the same animal, a trigger ignore time can be configured.

If the device is set for **continuous recording**, the RAM is filled with data and thereafter data are written to the memory card. As the loggers RAM is limited to 32 MB, the length of a single recording sequence can not exceed approx. 53 seconds, but can be set to less. Subsequently this recording sequence will be written as #****.wav file to the SD card and a new recording will start, thereby overwriting data in RAM. The time required for data storage to the memory card is largely depending on the file size but also on the type of card. In general the writing of the file should require significantly less time than the recording itself.

In **manual recording** the triggering has to be performed through the key pad and may also be stopped this way. If a manual stop does not occur, the recording will stop automatically after a user selectable manual trigger time (default = 10 sec), and the #****.wav file be written to memory card.

In record mode, the device displays important information. The top two lines of the display shows different information, depending on the configured display mode (see chapter 5.2.1). The following functions can be executed:

Display	Functions

`01.04.2015 20:31`
`15.2GB Free #17`
`Sampling...   ^5^`
	Press ⟩⟩ key to manually start a recording. Press ⟩⟩ key again to stop it.
	Press ⟨⟨ key to reset mixer frequency (see chapter 5.4)
	Press MENU key to proceed to the next menu item.

`01.04.2015 20:31`
`15.2GB Free #17`
`Exit Record?    »`
	Press ⟩⟩ key to exit record mode.
	Press MENU key to proceed to the next menu item.

`01.04.2015 20:31`
`15.2GB Free #17`
`Volume = 3    «»`
	Press ⟨⟨ key to decrease volume.
	Press ⟩⟩ key to increase volume.
	Press MENU key to proceed to the next menu item.
	(Only available when live monitoring is enabled.)

`01.04.2015 20:31`
`15.2GB Free #17`
`MFreq = 48kHz «»`
	Press ⟨⟨ key to decrease mixer frequency.
	Press ⟩⟩ key to increase mixer frequency.
	Press MENU key to proceed to the next menu item.
	(Only available when live monitoring is enabled and mode is manual.)

`01.04.2015 20:31`
`15.2GB Free #17`
`LR:xxxxxxxx.wav»`
	The file name of the last recording is displayed.
	Press ⟩⟩ key to load the "Process File" menu with the last recording selected. it can then directly be processed, e.g. played, deleted, etc. See also chapter 6.
	After leaving "Process File" menu, record mode is continued.
	Press MENU key to proceed to the first menu item.

When an automatic trigger is configured (default), the device records bat calls automatically:

```
01.04.2015 20:31
15.2GB Free #17
Sampling...  ^5^
```
The device is listening for bat calls (triggers). The current crest factor is displayed (^5^) if a crest trigger is used.

```
Activity:
Freq 32 kHz
Recording...
```
If the trigger condition is met, a new recording is started automatically.
The recording stops, when the trigger condition is not met any more during at least the post trigger time.

```
Saving...
xxxxxxxx.wav
Freq = 32kHz
```
The recording is now saved to the SD card. The file name and detected peak frequency is displayed.
After that, listening continues.

5.2.1 Information displayed in record mode

The top two lines of the display shows different information, depending on the configured display mode.

DISPLAY_MODE = "Auto All"

The top two lines of the display shows different information screens in cycle:

```
01.04.2015 20:31
15.2GB Free #17
Sampling...  ^5^
```
Date/Time, Free SD card memory, Nbr. of recordings.

```
#1234  19°C    ■
l. Freq  49kHz □
Sampling...  ^5^
```
Serial number, temperature, last detected frequency, battery status.

```
7 Sats 3D (2.5m)
+41.2535,+8.5455
Sampling...  ^5^
```
GPS/Location information, see chapter 8.1.

```
MOB standby

Sampling...  ^5^
```
Mobile radio is inactive during record mode.

```
01.04.2015 20:32
15.2GB Free #17
Sampling...  ^5^
```
Information screens cycle in 1s intervals.

DISPLAY_MODE = "Auto Rec"

The top two lines of the display shows most important recording information permanently. Temperature, SD card and GPS information is displayed in cycle in 1s intervals:

```
20:31 23°C    1 ■
#20001234  64kHz
Sampling...  ^5^
```
Time, temperature, battery 1 status
Last recording, last trigger frequency

```
20:31 SD:12% 2 □
#20001234  64kHz
Sampling...  ^5^
```
Time, SD card storage % used, battery 2 status
Last recording, last trigger frequency

```
20:31 3D 7SU
#20001234  64kHz
Sampling...  ^5^
```
Time, GPS status information (see chapter 8.1)
Last recording, last trigger frequency

DISPLAY_MODE = "Auto GPS"

The top two lines of the display shows most important location information permanently. Temperature, recording and SD card information is displayed in cycle in 1s intervals:

```
20:31 23°C    1 ■
No GPS Fix
Sampling...  ^5^
```
Time, temperature, battery 1 status
No GPS location fix yet

```
20:31 #123    2 □
3 Sats in view
Sampling...  ^5^
```
Time, recording count, battery 2 status
GPS satellites in view but still no location fix yet

```
20:31  64kHz
7 Sats 3D (2.5m)
Sampling...  ^5^
```
Time, last trigger frequency
GPS satellites used for 3D location, location accuracy

```
20:31 SD:12%
+41.2535,+8.5455
Sampling...  ^5^
```
Time, SD card storage % used
current location coordinates

DISPLAY_MODE = "Custom"

The information displayed can be freely configured by the user. To change this configuration, the BATPARS-Editor software must be used (see chapter 3.3).

The format of the two top lines can be setup to fit your needs. Two string parameters (see chapter 9.2.7) are used to define the format of each line. For each information field, a two digit code is used as a placeholder. To separate the fields, any or no characters can be used.

The syntax is as follows (parameters in brackets {} are optional):

`{SEPARATOR}{FIELDCODE}{SEPARATOR}{FIELDCODE} ...`

`SEPARATOR`   none to multiple non-numerical ASCII characters, except '<', '>'

`FIELDCODE`   Two digit field code from the following table:

FieldCode	Description	Format	Length
01	Date	DD.MM.YYYY	10
02	Time	HH:MM	5
03	Temperature [°C]	123	3
05	Battery 1 status	CB	2
06	Battery 2 status	CB	2
07	Time with seconds	HH:MM:SS	8
10	Last trigger freq [kHz]	123	3
11	Rec count since start	1234	4
12	Last recording file	20001234	8
13	Last recording number	1234	4
14	SD card free space [GB]	12.3	4
15	SD card % used	12	2
16	Last recording time	HH:MM:SS	8
20	GPS status short	3D	2
21	GPS status long	NF 10SV	7
22	Location WGS84/CH1903	+12.123,+12.123	16
23	GPS speed/heading/altitude	NE 1.2km/h 123m	16

Examples:

```
20:31  23°C 1234
 64kHz #20001234
Sampling...  ^5^
```
DMCUSTOM_L1:   `02 03°C 11`
DMCUSTOM_L2:   `10kHz #12`

```
 64kHz SD:12%  ■
#20001234      □
Sampling...  ^5^
```
DMCUSTOM_L1:   `10kHz SD:15% 05`
DMCUSTOM_L2:   `#12    06`

```
NF 10SV  23C ■ □
+12.123,+12.123
Sampling...  ^5^
```
DMCUSTOM_L1:   `21 03C 0506`
DMCUSTOM_L2:   `22`

5.3   Trigger modes

There are different approaches to detect bat calls. As the nature is not predictable, none of them is perfect. The difficulty lies in the distinction between signal (bat calls) and unwanted noise. Different algorithms are implemented and can be selected to automatically trigger recordings. Depending on the recording location (e.g. noisy environment, insects, etc.) and operation purpose (e.g. passive or active monitoring, etc.), it may be good to use different trigger modes and/or trigger settings.

5.3.1   CrestAdvanced trigger

Responds to all loud, narrow noises like bat calls, sensitivity to disturbing noise minimized. Very sensitive, detects even very quiet respectively far away calls. Sensitivity and frequency bounds can be adjusted. Responds to any loud, narrow-band sound, e.g. to technical sounds and insects.

5.3.2   Crest trigger

Responds to all loud, narrow noises like bat calls, but also technical noise and insects. Very sensitive, detects even very quiet respectively far away calls. Sensitivity and lowest frequency can be adjusted. Responds to any loud, narrow-band sound, e.g. to technical sounds and insects.

5.3.3   Period trigger

The difference in sound production of bats (vocal cords) and insects (stridulation) affects the continuity period. The period trigger takes advantage of this. Insects (grasshoppers, crickets) do not trigger or only very rarely but low frequency bats may not be identified.

5.3.4   SD trigger

Similar to the period trigger, the SD trigger uses the periodicity of the signal to distinguish insects from bats and only triggers if sinusoid signals (bats) are present. To adapt to different recording environments, the sensitivity and frequency bounds can be adjusted.

5.4 Live monitoring

Is the device in record mode and live monitoring function is enabled (see page 39) the ultrasonic sounds are output live on the headphones. Here, the bat calls are transformed into audible range after the mixer-principle (heterodyne).
The volume can be adjusted during operation.

The are two methods to use the live monitoring:

- Automatic
  The mixer is adapted automatically and continuously to the currently detected frequency of the calling bat.
  Reset frequency: With the $\boxed{<<}$ key the mixer frequency can be reset to 48kHz at any time. This is handy to minimize noise or feedback loops that can occur at low frequencies.
  Squelch: To improve the hearing experience, an automatic muting/unmuting (squelch) can be configured (see chapter 9.2.3). The output is muted as long as no trigger event is happening.
- Manual
  The mixer frequency can be set manually. When the frequency is set to 0, the device switches to automatic mode and back to manual when changed again.

> ⚠️ **Volume:**   Too loud audio output, particularly with headphones, can cause hearing damage. Reduce the volume to an appropriate level.

5.5 Interval recording (Record in time intervals)

As with time delayed recording, time frames have to be defined and a number of days must be set. When also a recording interval is entered, then the device switches to record mode at the start time, but only for a single recording or max. for one minute.
Then further recordings are blocked for the programmed number of minutes ("RecIntvl" / default = 0 = off). This is followed by another record mode. This interval operation continues to the end of the time frame. For this interval operation the various trigger modes can be used.

Example:
- Rec Intervall = 3

---

6 Process recordings

For immediate control, stored audio files can be replayed through headphones in mixer or time expansion mode. Ultrasound signals are transformed to audible range, in time expansion slowed down by a user selectable factor x (default x = 10). A stored sequence therefore requires an x-fold playback time of the original recording to monitor. Only recorded files can be played back and listened to. Additionally recording details of a file such as date, time, length, peak frequency and more can be displayed.

Single recordings on the memory card can also be erased through this mode. Erasing the complete memory card must be achieved by formatting it (Settings menu).

> **Headphones:** To listen to a recording, headphones with 3.5mm connector are needed. They must be plugged into the headphones jack.

6.1 Select folder

Depending on the settings, the recordings are stored in folders on the SD card. Per default, every night a new folder will be used:

- BL20150401
    - 12340001.wav
    - 12340002.wav
- BL20150402
    - 12340001.wav
    - 12340002.wav
    - 12340003.wav
- BL20150403
    - 12340001.wav
- ...

To process a recording, first select the folder:

```
Process
Select folder:
BL20150403      «»
```
Press `<<` key to select the previous folder.
Press `>>` key to select the next folder.
Press `MENU` key to proceed to the next menu item.

```
Process
Fold: BL20150403
Open folder?    »
```
Press `>>` key to open the selected folder and proceed to select and process a recording file. See chapter 6.2.
Press `MENU` key to proceed to the next menu item.

```
Process
Fold: BL20150403
Delete folder? »
```
Press `>>` key to delete the selected folder and all its content. See chapter 6.1.1.
Press `MENU` key to proceed to the next menu item.

```
Process


Exit Process?  »
```
Press `>>` key to exit process menu.
Press `MENU` key to proceed to the first menu item.

When no folders are used or present, the select folder menu is skipped and the select file menu is displayed.

6.1.1 Delete folder

CAUTION: All data in the folder will be deleted.

```
Delete folder?
« » to confirm
```

Press both keys [<<] and [>>] simultaneously to confirm deletion.
Press [MENU] key to cancel.

6.2   *Select recording file*

To process a recording, select the recording file (wav):

```
Process
Sel File (54):
12340001.wav  «»
```

Press [<<] key to select the previous recording file.
Press [>>] key to select the next recording file.
Press [MENU] key to proceed to the next menu item.

```
Process
File: #12340001
Play Mixer?    »
```

Press [>>] key to play back the selected recording file in mixer mode. See chapter 6.2.1.
Press [MENU] key to proceed to the next menu item.

```
Process
File: #12340001
Play Pitch?    »
```

Press [>>] key to play back the selected recording file in pitch mode. See chapter 6.2.2.
Press [MENU] key to proceed to the next menu item.

```
Process
File: #12340001
Play All?      »
```

Press [>>] key to play all recordings of the selected folder in sequence. See chapter 6.2.3.
Press [MENU] key to proceed to the next menu item.

```
Process
File: #12340001
Analyse?       »
```

Press [>>] key to analyse the selected recording file. See chapter 6.2.4.
Press [MENU] key to proceed to the next menu item.

```
Process
File: #12340001
Delete?        »
```

Press [>>] key to deleted the selected recording file. See chapter 6.2.5.
Press [MENU] key to proceed to the next menu item.

```
Process

Exit Process?  »
```

Press [>>] key to exit process menu.
Press [MENU] key to proceed to the first menu item.

6.2.1 Play recording in mixer mode

```
Loading...
#12340001
```

The selected recording file is loaded from the SD card into RAM.

```
Playing...
#12340001
PB Volume=2    «»
```

Press `<<` key to decrease volume.
Press `>>` key to increase volume.
Press `MENU` key to stop playback.

After playback stops, a new recording file can be selected. See chapter 6.2.

6.2.2 Play recording in pitch mode

Play back real ultrasonic sound: When the pitch factor is set to one, the recordings are played in real-time, full spectrum. This means that the recorded bat calls are reproduced close to the original bat calls from the animal. With this mode an artificial bat can be simulated.

```
Loading...
#12340001
```

The selected recording file is loaded from the SD card into RAM.

```
Playing...
#12340001
PB Volume=2    «»
```

Press `<<` key to decrease volume.
Press `>>` key to increase volume.
Press `MENU` key to stop playback.
After playback stops, the first menu item is loaded.

After playback stops, a new recording file can be selected. See chapter 6.2.

6.2.3 Play all recordings in the folder

```
Loading...
#12340001
```

The first recording file of the folder is loaded from the SD card into RAM.

```
Playing...
#12340001
PB Volume=2    «»
```

Press `<<` key to decrease volume.
Press `>>` key to increase volume.
Press `MENU` key to stop playback.

After playback of a recording, the next recording is loaded and played.
After the last recording, the first is played (endless loop).
After playback was manually stopped, a new recording file can be selected. See chapter 6.2.

6.2.4 Analyse recording

The metadata of the selected recording file is loaded and displayed:

```
File: #12340001
03.04.2015
20:34:46        «»
```
Press `<<` key to show previous data screen.
Press `>>` key to show next data screen.
Press `MENU` key to go to the last menu item.

```
File: #12340001
Dur =    4 s
Peak = 40 kHz «»
```
Press `<<` key to show previous data screen.
Press `>>` key to show next data screen.
Press `MENU` key to go to the last menu item.

```
File: #12340001
Temp =   10 °C
               «»
```
Press `<<` key to show previous data screen.
Press `>>` key to show next data.
Press `MENU` key to go to the last menu item.

```
Process
File: #12340001
Exit Analyse?  »
```
Press `>>` key to exit analyse menu.
Press `MENU` key to show first data screen.

6.2.5 Delete recording

CAUTION: The recording (wav) and its metadata (xml) will be deleted.

```
Delete file?
« » to confirm
```
Press both keys `<<` and `>>` simultaneously to confirm deletion.
Press `MENU` key to cancel.

After deletion, a new recording file can be selected. See chapter 6.2.

7   SMS/Email notification

To used SMS/Email notification via the inbuilt mobile radio module (cellular radio), a valid mobile phone contract and a SIM card (standard size) is needed.

> **ℹ** **Mobile phone costs:**   Depending on your mobile phone contract, additional costs may occur when sending SMS or email notifications. For sending emails, a data contract may be needed.

> **ℹ** **Email account:**   It is recommended to use an individual email account for sending emails from the device. The login data is saved on the device itself and in an event of loss or theft, the login data may be abused.

7.1   Inserting/Removing SIM card

1. Open the case cover. Make sure that the device is turned off

2. Insert the SIM card all the way into the SIM card slot with the card label facing toward the display.

3. Push the SIM card in once to remove.

> **ℹ** **Remove SIM card:**   Turn off the device before removing the SIM card. Otherwise the data may become corrupted and/or the SIM card may be damaged.

7.2   Configuration

To monitor the unsupervised operation, a notification via SMS (Short Message Service) and/or email can be set up as follows:

1. Start BATPARS Editor Software on your PC/MAC (see chapter 3.3)

2. Enter the Mobile radio/SMS/Email parameters

    ○   Transmission mode and time (See also chapter 7.4)

    SMS:

    ○   Phone number of the recipient in international format e.g. +411234567 (see also chapter 9.2.5)

    Email:

    Sending emails needs an internet connection via LTE^A (4G) or GPRS (2G) mobile phone data communication and SMTP (Simple Mail Transfer Protocol) server access. The internet connection is provided by your mobile phone provider. As SMTP server most email providers or an own email server can used.

    ○   APN server/login data (ask your phone provider for the correct data)

        Some examples:

        •   Swisscom: APN: gprs.swisscom.ch, no usename/password needed

        •   T-Mobile: APN: internet.t-mobile, Username: tm, Password: tm

        •   Vodafone: APN: web.vodafone.de, no usename/password needed

        •   A1:   APN: a1.net, Username: ppp@a1plus.at, Password: ppp

    ○   SMTP server data (ask your email provider for the correct data)

        Some examples:

        •   Bluewin: Server: smtpauths.bluewin.ch, Mode: SSL, Port: 465

        •   GMX: Server: mail.gmx.net, Mode: SSL, Port: 465

        •   T-Online: Server: securesmtp.t-online.de, Mode: SSL, Port: 465

        •   Gmail: Server: smtp.gmail.com, Mode: SSL, Port: 465

    ○   SMTP login data, the username and password of email account

        For example:

        Username: batlogger1234@myprovider.com

        Password: *******

    ○   Email address of the sender and recipient

        For example:

        "From" Address: batlogger1234@yourprovider.com

        "To Address":   yourname@yourprovider.com

3. Insert the SIM card into the SIM card slot, and turn on the device (see above)

4. Enter PIN code of the SIM card when prompted

```
MOB:
Enter SIM PIN
«0»
```

Use the keys [<<] or [>>] to change the digit between "«" "»".
Press [MENU] key to switch to the next digit or to delete the digit on the left with "←".

```
MOB:
Enter SIM PIN
0000«↵»
```

Press [MENU] key to enter the PIN with "↵".

Test settings: It is recommended to test the Mobile/SMS/email settings before deploying the device in the field. To do this, turn on the device, enter the "Setup" menu "Mobile/SMS/Email" section and execute the SMS or Email test functions.

See chapter 9.2 for detailed description of the Mobile/SMS/Email settings.

7.3 Mobile radio information

```
MOB initializing
No Signal
Start Record?  »
```

After turning on the device, the mobile radio module needs to initialize and to register to the mobile network.

```
MOB (LTE): ###__
Provider
Start Record?  »
```

Once the mobile radio module is connected to the network, the signal level (e.g. ###__) and the provider name is displayed.

7.4 Notification modes

Any of the following modes can be configured to be either sent by SMS and/or email.

7.4.1 Status message

A status message is sent once a day to ensure normal operation and to get get an overview of the current status of the device.

`BATLOGGER C #2123`	Device
`08.04.2015 10:00:27`	Date/Time of the device
`456 new recs`	Nbr of recordings of last night
`25:14`	14 recordings triggered on 25kHz ±5kHz (20..29)
`35:86`	86 recordings triggered on 35kHz ±5kHz (30..39)
`45:157`	157 recordings triggered on 45kHz ±5kHz (40..49)
`55:73`	73 recordings triggered on 55kHz ±5kHz (50..59)
`75:7`	7 recordings triggered on 75kHz ±5kHz (70..79)
`7.3V 7.9V 23C 14.5GB Free`	Battery voltages, temperature, SD card space
`Loc man: +47.2000,+7.4000`	GPS information
`Mic S/N=19.4 dB`	Microphone information

Send-time: The status message can only be sent during the sleep time (sleep mode) of the device. The first status message will be sent after the end of the first recording time frame.

Send error: If the status message can not be sent on the configured time or a transmission error occurs, the device tries to send the message again every hour during the sleep mode.

7.4.2 Alerts

If an unexpected event occurs, like low battery, microphone defects etc. an alert message is sent with information regarding the event.

7.4.3 Motion alarm

When the motion alarm (theft alarm) is enabled, device movements will be detected.

```
Motion alarm
armed in
    25.3 s
```
After starting record mode, one has 30s until the motion detection is active.
Close the case and complete installation in this time.

If motion is detected in record mode (and sleep mode):

```
Device moved!
Alarm in
    12.9 s
```
One has 30s until the alarm is triggered.
Press any key to disarm the alarm.

If the device lock feature is enabled (see chapter 9.2.7), the correct PIN must be entered to disarm the alarm.

```
Enter device PIN
«0»
```
Use the keys ⟨<<⟩ or ⟨>>⟩ to change the digit between "«" "»".
Press ⟨MENU⟩ key to switch to the next digit or to delete the digit on the left with "←". Press ⟨MENU⟩ key to enter the PIN with "⏎". See also chapter 4.5.

```
Disarmed
```
The motion alarm is now inactive, the record mode is aborted and the device can be used as usual.

If the alarm is not disarmed within 30s, an alarm message is sent. After an alarm message was sent, the motion alarm is disabled for one hour.

If device lock is set to "on alarm only" (see chapter 9.2.7) the device is protected with the device PIN after a motion alarm event.

8   GPS / Location

The device is equipped with a GNSS (Global Navigation Satellite System) receiver, commonly known as "GPS".

It is used to set the device date and time and to set/update location coordinates stored together with each recording. Additionally it can be used to record the travelled track to a GPX file if used for active monitoring.

Each recording is geotagged with the coordinates of the recording location.

For passive monitoring, the recording location is set once upon start of the record mode. In the record mode, the GPS receiver is then turned off to save battery power.

If no GPS reception is possible (e.g. in a cave), a manual position can be configured (see chapter 9.2). It is also possible to navigate to this position by using the GPS status display ("Show Status"). There the distance and heading from the current position to the manual position is displayed continuously (find starting point again, Geocaching, ...).

GPS receiver: GPS requires a direct line of sight between the receiver and the satellites. If an object is within direct path, the accuracy suffers due to reflections and attenuation of the signals. This is particularly problematic in urban areas, in valleys and on mountain slopes. Even smaller objects (tree cover, roof, human body) can lead to reflections and attenuation. For accurate positioning it is therefore essential to have unobstructed view to the sky.

8.1   GPS information

```
No GPS fix
3 Sats in view
Start Record?   »
```

After turning on the device, the GPS receiver searches for currently visible satellites.

```
7 Sats 3D (5.3m)
NW 5.3km/h 524m
Start Record?   »
```

Once a position fix has been achieved, the number of satellites (e.g. 7) used to calculate the position and the approximate position accuracy (e.g. circle with radius 5.3m) is displayed.

When in motion, heading (e.g. NW), velocity (e.g. 5.3km/h) and height above see level (e.g. 524m) is displayed.

When in stand, current positions coordinates (e.g. +41.2535, +8.5455) are displayed.

9 Setup (Settings)

The device can be configured to fit different needs. Parameters of functions like recording time frames (delays), triggers, GPS, backlight, time zone, audio, SD card and more can be changed in the setup menu.

Most settings can be changed both directly on the device as well as with the BATPARS Editor software on your computer (see also section 3.3). Some settings can only be carried out on the device itself (e.g. set time). Others can only be made with the BATPARS Editor software (e.g. email settings), because it would be very time-consuming to enter long values with three keys.

9.1 Operation

The setup menu is structured in various submenus. The structure is described in chapter 9.2. The general operation and navigation is as follows:

```
Setup X/Z


Submenu X        »
```
Press `<<` key to go to the last menu item.
Press `>>` key to enter the submenu X.
Press `MENU` key to go to the next menu item.

```
Setup Y/Z


Submenu Y        »
```
Press `<<` key to go to the last menu item.
Press `>>` key to enter the submenu Y.
Press `MENU` key to go to the next menu item.

```
Submenu Y
Parameter A
ON             «»
```
Use the keys `<<` or `>>` to change the value.
Press `MENU` key to go to the next parameter.

```
Submenu Y
Parameter B
Value = 1«2».3
```
For larger number values (e.g. coordinates, date/time, ...) single digits can be increased/decreased
Use the keys `<<` or `>>` to change the digit between "«" "»".
Press `MENU` key to switch to the next digit, to delete the digit on the left with "←" or to enter the value with "↵".

```
Setup Y/Z


Function         »
```
Press `>>` key to execute the function.
Press `MENU` key to go to the next menu item.

```
Setup Z/Z


Exit Setup?      »
```
Press `>>` key to exit (sub-)menu.
Press `MENU` key to show first menu item.

9.2   Setup-Menu

9.2.1   Setup 1/8: Delay Record

See also chapter 5.1.

Menu / Parameter		Description	Default
Setup 1/8 Delay Record		**Timing** (delay) of the recordings (Program 1 or 2 time slots per day for a programmed number of days)	
	Nr. Days	Enter the number of days (0..999) on which the time frames (one or both) are performed. 0 = time control (delay) disabled Example: 30 For a maximum of 30 days, recording is performed during the configured time slot (see below)	365

	T1 Start Mode	Mode 1. start time
		0 = Fixed: Fixed time
		1 = Sunset: Time of sunset
		                at location of LOC_LAT/LOC_LON of the respective day
		2 = Sunrise: Time of sunrise
		                at location of LOC_LAT/LOC_LON of the respective day
			1

	T1 Start	1. start time Depending on the mode: time or difference (in 15 minute steps) Example: Fixed 20:30 Start 1. time frame at 20:30	00:00

	T1 Stop Mode	Mode 1. stop time
		0 = Fixed: Fixed time
		1 = Sunset: Time of sunset
		                at location of LOC_LAT/LOC_LON of the respective day
		2 = Sunrise: Time of sunrise
		                at location of LOC_LAT/LOC_LON of the respective day
			2

	T1 Stop	1. stop time Depending on the mode: time or difference (in 15 minute steps) Example: Fixed 01:00	00:00

		Stop 1. time frame at 01:00	

	T2 Start Mode	Mode 2. start time
		0 = Fixed: Fixed time
		1 = Sunset: Time of sunset
		                 at location of LOC_LAT/LOC_LON of the respective day
		2 = Sunrise: Time of sunrise
		                 at location of LOC_LAT/LOC_LON of the respective day
			0

	T2 Start	2. start time Depending on the mode: time or difference (in 15 minute steps) Fixed 00:00 = 2. time slot disabled Example: Sunrise -02:30 Start 2. time frame 2:30h before sunrise	00:00

	T2 Stop Mode	Mode 2. stop time
		0 = Fixed: Fixed time
		1 = Sunset: Time of sunset
		                 at location of LOC_LAT/LOC_LON of the respective day
		2 = Sunrise: Time of sunrise
		                 at location of LOC_LAT/LOC_LON of the respective day
			0

	T2 Stop	2. stop time Depending on the mode: time or difference (in 15 minute steps) Fixed 00:00 = 2. time slot disabled Example: Sunrise +00:30 Stop 2. time frame 30min after sunrise	00:00
	Rec Intervall	Interval time between single recordings (in one minute steps) Example: 3 After a recording at least 3 minutes no new recording is started (triggered)	0

9.2.2   Setup 2/8: Trigger

See also chapter 5.3.

Menu / Parameter			Description	Default
Setup 2/8 Trigger			**Trigger settings** Set the trigger mode, that is how a recording is started	
	TRIG_MODE		*Choose trigger mode:* 0 = Manual: start and stop recording need manual key input (autom. stop after "MANTRIG MAXTIME") 1 = Continuous: continuous recording of blocks of default 53 seconds duration (interrupt for storage). 2 = Crest Adv: automatic triggering with Crest factor, enhanced call detection and reduce noise sensitivity (manual triggering possible to override automatism) 3 = Crest: automatic triggering with Crest factor (manual triggering possible to override automatism) 4 = Period: automatic triggering with Period algorithm (manual triggering possible to override automatism) 5 = SD: automatic triggering on periodic signals (manual triggering possible to override automatism)	2
	TRIG_AUTOREC		0 = Manual: A trigger event does not start recording. The recording must be started and stopped manually, but the trigger frequency is displayed. 1 = Auto: A trigger event automatically starts the recording and recording automatically stops when trigger conditions are no longer met.	1
	POSTTRIG_IGNORE_S		Ignore same frequency for n seconds after last recording 0..3600 (0 = off) Example: 60 After a recording was made, for the next 60s trigger events with the same frequency (+/- 5 kHz) are ignored and no new recording is started. Other frequencies trigger as usual.	0
	TRIG_MODE: Crest Adv	Min. Crest	Minimal Crest factor as trigger condition Lower values trigger easier	7
		Min. F	Minimal frequency for trigger condition in kHz	15
		Max. F	Maximal frequency for trigger condition in kHz	155
	TRIG_MODE:	Min. Crest	Minimal Crest factor as trigger condition	6

	Crest		Lower values trigger easier	
		Min. RMS	Factor for minimal effective value as trigger condition Lower values trigger easier	2
		Min. Peak	Factor for minimal amplitude as trigger condition Lower values trigger easier	2
		HP	Factor for the lowest frequency, that still may elicit a trigger event (Factor times 1,22 kHz)	6
	TRIG_MODE: Period	ProdVal	Period-Trigger: ProdVal Higher values improve triggering at low frequencies, but also insects, and vice versa.	8
		DivVal	Period-Trigger: DivVal Higher values improve triggering at low frequencies, but also insects, and vice versa.	20
	PRETRIG_TIME_MS (only changeable via BATPARS.XML)		Pre-trigger length in ms 0..5000 Length ahead of the trigger event that is saved from the buffer to the recording file.	500
	POSTTRIG_TIME_MS (only changeable via BATPARS.XML)		Post-trigger length for automatically triggered recordings in ms 0..10000 If no trigger event is detected during this time, the recording will be stopped.	1000
	AUTOTRIG_MAXTIME_MS (only changeable via BATPARS.XML)		Maximal length for automatically triggered recordings in ms 0..535000 The recording is stopped when reaching maximal length even if trigger events are still detected.	20000
	MANTRIG_MAXTIME_MS (only changeable via BATPARS.XML)		Maximal length for manually triggered recordings in ms 0..535000 The recording is stopped when reaching maximal length even if the stop key (>>) is not pressed.	10000
	TRIG_NRBLOCKS (only changeable via BATPARS.XML)		Number of blocks that must meet trigger criteria in order to trigger 1..10	2

9.2.3 Setup 3/8: Audio

Menu / Parameter		Description	Default
Setup 3/8 Audio		**Audio settings**	
	Volume	Headphones/Speaker -Volume 0 = mute 9 = very loud ATTENTION: Too high volume can cause hearing loss.	2
	Monitoring	Live monitoring (mixer output) 0 = Off:　　　　Live monitoring disabled 1 = On Auto:　　Live monitoring enabled, frequency is set automatically 2 = On Manual:　Live monitoring enabled, frequency must be set manually	0
	Squelch	Automatic muting of live monitoring after n seconds 0..60 (0 = Off) Example: 3 If no trigger event happens for 3 seconds, the audio output is muted. On the next trigger event it is unmuted automatically.	0
	PB Mode	Playback mode 0 = Pitch:　　　playback slowed down with PB Speed factor 1 = Mixer:　　　playback mixed with peak frequency of the recording	1
	PB Speed	Playback speed 1: real-time 2: half speed etc. Example: 10 The recordings are played slowed down 10 times (time expansion and frequency division). Thus the ultrasonic sounds are audible (e.g. 45 kHz -> 4.5 kHz) The real-time playback enables the output of the original ultrasonic sounds. This can be useful for demonstration purpose for example. Pay attention to connect a speaker with appropriate ultrasound capability.	10
	Microphone-test mode	Mode used when "Test Microphone" function is executed.	0

| | | 0 = Manual: Record the current (silent) spectrum and write it to the log file
1 = Automatic (tbd) | |
| | Test Microphone | Execute microphone test with selected mode (see above) | |

9.2.4 Setup 4/8: Location / GPS

See also chapter 8.

Menu / Parameter		Description	Default
Setup 4/8 Location / GPS		**Position and GPS settings**	
	Show Status	Displays the current status of GPS reception and information about the current location and the received satellites. Switch the displayed information with the [<<] or [>>] key or exit with the [MENU] key. • Fix status, approx. accuracy in meters (radius), actual position • Hight above sea level, speed and heading • HDOP and VDOP • Sunset and sunrise at actual location at today's date • Satellites in view, SNR (S) and PRN (#) of the five strongest satellites (PRN Prefixes: G=GPS, L=GLONASS) • Distance and direction to position of LOC_LAT/LOC_LON	
	GPS Mode	Set position determination mode 0 = Off: position determination disabled 1 = On: position determination enabled 2 = On w/GPX track: position determination and track recording (GPX) enabled 3 = Off w/ManLoc: position determination disabled, position of LOC_LAT/LOC_LON is stored as recording position into the XML file 4 = Off w/StartLoc: position determination disabled, position of LOC_LAT/LOC_LON is updated when start recording mode and stored as recording position into the XML file Example: 0 GPS off for the lowest possible power consumption or because reception is not possible, such as in caves.	4
	Coord.Fmt	Coordinates display format to display current location 0 = WGS84: (e.g.. 47.052804 / 8.257801) 1 = CH1903: (e.g.. 662240 / 211632)	0
	TZ	Set time zone Deviation to UTC in hours Example: +2	+2

			Daylight savings time in Zurich (CH)	
	GPS_INTERVAL		Interval of position determination in seconds Lower values = more frequent position determination, higher power consumption Higher values = less frequent position determination, lower power consumption Note: While recording, the position determination is paused for performance reasons.	1

	Set manual location		Enter manual location (coordinates)
			This location is used:
			  • To calculate sunset and sunrise
			  • As recording position in GPS mode 3 and 4 (Off w/Loc, **Off w/StartLoc**)
			  • To calculate distance and direction in the GPS status view	

		LOC_LAT	Latitude, in WGS84 or CH1903 (dep. Coord. Fmt)	47.2
		LOC_LON	Longitude, in WGS84 or CH1903 (dep. Coord. Fmt)	7.4
		Set current location	The coordinates of the current position are stored as manual location	
	Reset module		Reset the GPS module to factory defaults. A reset may help if no position fix can be achieved even after a long time trying.	

9.2.5 Setup 5/8: Mobile / SMS / Email

See also chapter 7.

Menu / Parameter			Description	Default
Setup 5/8 Mobile / SMS / Email			**Mobile / SMS / Email notification setup**	
	Show Status		Displays the current status of mobile radio modem and information about the current connection. Switch the displayed information with the <<or >> key or exit with the MENU key. • IMEI • Modem revision • Signal strength • Provider	
	SMS		Enter SMS (Short Message Service) submenu	
		GSM_SMSMODE	SMS notification mode. Send a message to the configured telephone number when: Off: SMS notification is disabled Status: Everyday at the configured time (see below) a message is sent with status information like battery voltage, nbr. of recordings, SD card space Alerts: Send a message if a critical state is detected like battery low, Theft Alarm: Enable motion detection (see also 7.4.3) and send a message if the device was moved but not disarmed. Any combination of the above modes can be configured.	Off
		GSM_NUMBER Code	Telephone number prefix (International format) without the leading +. Examples: +4179 Switzerland +43664 Austria +447701 GB +491511 Germany	41
		GSM_NUMBER	Telephone number without prefix. Example: 791234567 The prefix (above) and this number is combined to the complete telephone number in the format +YYYYYYYYYXXXXXXXXX. For numbers longer than 9 digits split the number and extend the code above with the first additional digits. Example with long numbers: GSM_NUMBER Code=491520, GSM_NUMBER=123456789	0

		Send Test SMS	Send a test SMS to the configured telephone number	
		Read SMS	Read SMS. Displays the numbers of SMS received. Choose the SMS number to display with the [<<] or [>>] key and display the message with the [MENU] key. Scroll the message text with the [<<] or [>>] key. Exit with the [MENU] key.	
	Email		Enter Email submenu Most email and GPRS parameters must be configured with the BATPARS Editor Software. See chapter 3.3.	
		GSM_EMAILMODE	Email notification mode. Send a message to the configured email address when: Off: Email notification is disabled Status: Everyday at the configured time (see below) a message is sent with status information like battery voltage, nbr. of recordings, SD card space Alerts: Send a message if a critical state is detected like battery low, Theft Alarm: Enable motion detection (see also 7.4.3) and send a message if the device was moved but not disarmed. Any combination of the above modes can be configured.	0ff

		Show Email parameters	Displays the configured email and APN parameters
			Switch the displayed information with the [<<] or [>>] key or exit with the [MENU] key.
			   • APN server and user name
			   • SMTP server, mode, port, user name
			   • Senders email address
			   • Receivers email address	

		Send Test Email	Send a test email to the configured email address	

	Status notification send time mode		Notification send time mode
			0 = Fixed: Fixed time
			1 = Sunset: Time of sunset
			                 at location of LOC_LAT/LOC_LON of the respective day
			2 = Sunrise: Time of sunrise
			                 at location of LOC_LAT/LOC_LON of the respective day
				0

	Status notification send time		Notification send time Depending on the mode: time or difference (in 15 minute steps) Example: Fixed 10:00 Send a status notification every day at 10:00	10:00

	Get date/time	Update device date/time with mobile radio date/time. Depending on the network operator (provider) this feature might not be supported.	
	Dial number	Enter a telephone number and dial to test if the mobile radio module is functional or to send supplementary service codes like *130# to configure telephone functions like redirections, check credits etc.	
	Reset module	Reset the mobile radio module to factory defaults. A reset may help if no connection can be achieved or SMS/Email notification does not work correctly.	

9.2.6   Setup 6/8: SD card

See also chapter 2.3.

Menu / Parameter		Description	Default
Setup 6/8 SD Card		**SD card setup**	
	Folder_MODE	Store recording in folders 0 = None: No folders used, all data is stored in the root folder of the SD card 1 = Daily: Use a new folder daily (12:00 – 12:00): BLyyyymmdd 2 = Weekly: Use a new folder weekly (Mo 12:00 – Mo 12:00): BLyyyWww 3 = Monthly: Use a new folder monthly (1. 12:00 – 1. 12:00): Blyyyymm ==4 = Every Start: New folder every time a recording session is started: BLyyyymmddhhmmss== Example: 1 Recordings (WAV, XML, GPX, KMZ) are stored into a separate folder each night Folder "BL20130802" contains data of the night from 2. to the 3. August 2013 Folder "BL20130803" contains data of the night from 3. to the 4. August 2013 etc. The folder is changed each day at noon (12:00)	1
	STATUS_MODE	BLWiFi status 0 = Off: Disabled 1 = On: Enabled, BLWiFi can display the actual state if a connection is established	0
	Write BATPARS	Write the current settings to the BATPARS.XML file	
	Delete BATPARS	Delete the BATPARS.XML file from the SD card	
	Format SD Card	Format the SD card Delete all recordings, meta-data and files from the SD card. Only BATPARS.XML and BATREC.LOG files will not be deleted. CAUTION: All data on the SD card will be deleted. Make sure that you have made a backup.	
	Test SD Card		

9.2.7 Setup 7/8: Miscellaneous

Menu / Parameter			Description	Default
Setup 7/8 Miscellaneous			**Various settings**	
	Set Date/Time		Set date and time	
		TIMEMODE	0 = Manual: Date and time can be set manually 1 = Auto GPS: Date and time is set automatically on GPS reception 2 = Auto MOB: Date and time is set automatically on mobile radio reception	1
	Backlight mode		Set the display backlight brightness 0 = Off: 1 = Dimmed: 2 = Bright: Backlight is turned off when the case cover is closed.	1

	Display mode		Set the display mode during recording mode
			0 = Auto All: Cycle all information fields
			1 = Auto Rec: Show: recording information, time, battery; cycle: temp., GPS, SD card
			2 = Auto GPS: Show: location information time, battery; cycle: temp., #recs, SD card
			3 = Custom: Setup displayed fields yourself (see chapter 5.2.1)
				0

	Charger mode		Off: Charge always if external power supply is available On: Disconnect external power supply (charging) during recording to minimize electrical noise	0
	12V		Off (Auto): 24V power supply or photo-voltaic panel is used to charge On: 12V power supply is used	Off
	Device Lock (Theft protection)		Change device lock mode and PIN	
		Device Lock Mode	Off: Device is always operable On: Device is operable only after entering correct PIN (see also chapter 4.5) On alarm only: Device is locked if a motion alarm was triggered only (see also chapter 7.4.3)	Off
		Device PIN	PIN (Personal Identification Number) can be freely selected by the user and must be 4..6 digits. PIN must be confirmed by entering it again. ATTENTION: Write the PIN down and keep it in a secret and secure place. If the PIN is lost, the device must be unblocked with the PUK. Contact Elekon AG to get the PUK.	

	Load Defaults	Set settings back to factory defaults	
	SETUP_DISABLED (only changeable via BATPARS.XML)	Disable setup menu 0 = Setup menu is accessible 1 = Setup menu is locked, no configuration changes can be done on the device	0

9.2.8   Setup 8/8: Exit setup

Menu / Parameter		Description	Default
Setup 8/8 Exit Setup		**Exit Setup menu** and save changes	
	Save to BATCPARS	Write settings to BATCPARS.XML file and exit Setup menu	
	Save to int.Mem	Write settings to internal memory and exit Setup menu If the BATCPARS.XML file exists on the SD card, those settings will be loaded on the next start of the device.	
	Discard changes	Discard changes and exit Setup menu	

10   Recordings and Files

10.1   The audio data file "xxxxxxxx.wav"

After completion of recording into internal RAM, the stored data is written as standard audio WAVE file onto the inserted SD card with the file name "xxxxxxxx.wav". (e.g. 10160435.wav)
The first four digits identify the serial number of the device and the following four digits exhibit the consecutive number of the recorded files on the inserted SD card.
The above example therefore identifies the 435th recording on this SD card of the device with the serial number 1016.

The *.wav file contains all the uncompressed raw measurement values of the analogue to digital converter and a "header", which is specific to the wave format. This "header" contains, amongst other information, the sampling rate of the digitiser. Additionally, the file contains a further sub-chunk for GUANO metadata (see below).

Concurrent with these recorded wave data, a file containing meta information about the recording (see below) is saved to SD card with the name *.xml (in our example 10160435.xml).

The recordings can optionally be stored into sub-folders (daily, weekly, monthly, every start). See also chapter 9.2.6.

The standard *.wav files can be read and opened with general audio software or bat specific sound analysis programs. It may be displayed as time signal or spectrogram. The latter offers best possibilities to identify species.

Elekon AG offers a specific analysis software for Windows PCs: **BatExplorer**. It can be found on the included SD card or can be downloaded from www.batlogger.com.

WSL offers **BatScope**, a Mac or Windows software tool for management and review of recorded data and automatic species classification: www.batscope.ch.

10.1.1   GUANO metadata

GUANO is a device independent standard for storing bat detector metadata directly in the *.wav file. See https://guano-md.org for further information.
The guano sub-chunk is placed at the end of the file. BATLOGGER specific data is stored under the "BATLOGGER" namespace.

Example:
```
GUANO|Version:                  1.0
Make:                           BATLOGGER
Model:                          C
Firmware Version: 2.6.0
Serial:                         1103
Original Filename: 11030003.wav
Timestamp:                      2019-01-21T22:14:29
Length:                         7.02
Samplerate:       312500
Temperature Ext:  23
BATLOGGER|Trigger|Frequency:        52
```

10.2   Meta data file "xxxxxxxx.xml"

With every saved recording "xxxxxxxx.wav" audio file, an additional information file "xxxxxxxx.xml" (e.g. 10160435.xml) is saved, following the same numbering convention, and containing various meta information on recording time, date, location, temperature and device parameter settings.

Example of the content of an *.xml meta information file:

\<BatRecord\>	**The .xml info file contains the following information:**
\<Firmware\>2.4\</Firmware\>	*The firmware of the device was version 2.4*
\<SN\>1016\</SN\>	*The device number was 1016 (**S**erial **N**umber)*
\<Filename\>10160435.wav\</Filename\>	*The accompanying WAVE file is "10160435.wav"*
\<DateTime\>28.04.2015 21:31:29\</DateTime\>	*The recording happened on April, 28. 2015 at 21:31:29*
\<Duration\>2 Sec\</Duration\>	*The recording duration is 2 seconds*
\<Samplerate\>312500 Hz\</Samplerate\>	*The sampling rate was 312500 samples per second*
\<Temperature\>26 C\</Temperature\>	*The temperature when recording was 26° C*
\<BattVoltage\>3.92 V\</BattVoltage\>	*The battery voltage amounted to 3.92 V*
\<GPS\>	
\<Valid\>yes\</Valid\>	*The GPS information was valid*
\<Position\>47.056358 8.251432\</Position\>	*Lat.- & longitude of the rec. position in degrees **(WGS84)***
\<Altitude\>475.299988 m\</Altitude\>	*Elevation above sea level was 475.3 m*
\<CH1903\>661752/212022\</CH1903\>	*The Swiss coordinates are 661752 / 212022 m **(CH1903)***
\<HDOP\>1.140000\</HDOP\>	*The horizontal precision amounts to 1.14 (lower=better)*
GPSTimestamp\>19:31:20+2h\</GPSTimestamp\>	*GPS time was 19:31:20 UTC + 2 h. for local time*
\<GPSAge\>9 Sec\</GPSAge\>	*The GPS "age" was 9 seconds (last positional reading)*
\</GPS\>	

(In case of invalid or missing GPS information, the above section will just contain: **\<Valid\>never\</Valid\>**)

\<Trigger\>	
\<TRIG_MODE\>Crest\</TRIG_MODE\>	*The trigger mode was set to "Crest"*
\<Version\>V1.0\</Version\>	*The version of the triggering algorithm was V1.0*
\<Event\>AutoTriggerd\</Event\>	*The triggering was automatic, thus with the Crest routine*
\<PRETRIG_TIME_MS\>500\</PRETRIG_TIME_MS\>	*Before the first trigger occurred, 0.5 s were recorded*
\<POSTTRIG_TIME_MS\>1000\</POSTTRIG_TIME_MS\>	*After the last trigger event, 1 s was additionally recorded*
\<TRIG_PAR0\>6\</TRIG_PAR0\>	*The parameter "min.Crest" was set to 6*
\<TRIG_PAR1\>2\</TRIG_PAR1\>	*The parameter "min.RMS" was set to 2*
\<TRIG_PAR2\>2\</TRIG_PAR2\>	*The parameter "min.Peak" was set to 2*
\<TRIG_PAR3\>12\</TRIG_PAR3\>	*Trigger cutoff freq. was set to > than 12x1.22kHz=15 kHz*
\<TrigValue0\>6\</TrigValue0\>	*Triggering Value of parameter TRIG_PAR0*
\<TrigValue1\>40\</TrigValue1\>	*Triggering Value of parameter TRIG_PAR1*
\<TrigValue2\>263\</TrigValue2\>	*Triggering Value of parameter TRIG_PAR2*
\<TrigValue3\>44\</TrigValue3\>	*Triggering Value of parameter TRIG_PAR3*
\</Trigger\>	
\</BatRecord\>	

10.3 Log file "BATREC.log"

When in use, the device automatically writes a log file "BATREC.log" in text format to the SD card.
Every text line is preceded by the serial number (SN) of the device writing the log.
In the file "BATREC.log", all activities of the device are listed chronologically.
Events like starting up or shutting down are logged accurate to the minute, while logging of the normal recording activity only happens every hour.

Example BATREC.log:

Log line	Description
SN2123 07.04.2015 19:25:10? - power on (SWRev=2.4, HWRev=B3)	Device #1021 was switched on
SN2123 07.04.2015 19:25:16 - Schedule: T1 20:15 - 07:00, MSG 08:15	Delayed record schedule
SN2123 07.04.2015 19:25:18 - record mode started	Record mode was started by the user
SN2123 07.04.2015 19:25:20 - sleeping until 20:15 ...	Device is in sleep mode
SN2123 07.04.2015 20:15:01 - Idle: #R=0, T[°C]=24, B1[V]=n/a, B1[A]=7.37, B2[V]=0.115, B2[A]=n/a, C[V]=n/a, C[A]= n/a	Device status after wakeup
SN2123 07.04.2015 20:15:01 - sampling T1 until 07:00 ...	Device is in record mode
SN2123 07.04.2015 21:00:00 - Listening: #R=27, T[°C]=23, B1[V]=7.36, B1[A]=0.112, B2[V]=n/a, B2[A]=n/a, Ext[V]=n/a, Ext[A]= n/a	Device status during record mode (listening for trigger event)
SN2123 07.04.2015 22:00:00 - Listening: #R=32, T[°C]=22, B1[V]=7.34, B1[A]=0.111, B2[V]=n/a, B2[A]=n/a, Ext[V]=n/a, Ext[A]= n/a	Number of recordings, actual temperature,
SN2123 07.04.2015 23:00:00 - Listening: #R=54, T[°C]=22, B1[V]=7.31, B1[A]=0.113, B2[V]=n/a, B2[A]=n/a, Ext[V]=n/a, Ext[A]= n/a	battery and external power voltage and current is logged
SN2123 08.04.2015 00:00:00 - Listening: #R=7, T[°C]=21, B1[V]=7.28, B1[A]=0.109, B2[V]=n/a, B2[A]=n/a, Ext[V]=n/a, Ext[A]= n/a	(only battery 1 is present in this ex.)
SN2123 08.04.2015 01:00:00 - Listening: #R=10, T[°C]=21, B1[V]=7.27, B1[A]=0.110, B2[V]=n/a, B2[A]=n/a, Ext[V]=n/a, Ext[A]= n/a	
...	End of time frame T1 is reached
SN2123 08.04.2015 07:00:02 - sleeping until 08:15 ...	Device is in sleep mode
SN2123 08.04.2015 08:15:01 - Idle: #R=0, T[°C]=19, B1[V]=7.27, B1[A]=0.114, B2[V]=n/a, B2[A]=n/a, C[V]=n/a, C[A]= n/a	Device status after wakeup
SN2123 08.04.2015 08:15:25 - SMS sent to: +41XXXXXXX	Notification message was sent
SN2123 08.04.2015 08:17:09 - sleeping until 20:15 ...	Device is in sleep mode
SN2123 08.04.2015 11:57:08 - record mode stopped (wakeup by user)	Record mode was aborted by the user
SN2123 08.04.2015 11:57:13 - shutdown	Device was shut-down

10.4 Parameter file "BATCPARS.xml"

The device settings are stored in the BATCPARS.xml file on the SD cards root directory. The parameter file is loaded upon device start-up. The file can be modified with any computer as it complies to the XML standard. Preferably it is edited with the BATPARS Editor Software, see chapter 3.3.
Settings, that are changed interactively on the device are also saved to the file.

When formatting an SD card, the parameter file will be preserved.
Without the "BATCPARS.xml" file on the SD card, the device starts with its internal "CMOS" parameters, which correspond to the values last set.

10.5 Google-Earth file "route.kml"

When GPS is in use, the device automatically stores a Google-Earth file with the name "route.kml" onto the SD card, which will be extended with every additional recording. If the SD card is used repeatedly (eject, reinsert) the "route.kml" will not be erased, but also extended.
Deleting recording files does not affect the "route.kml" file. However, formatting the SD card will also erase the "route.kml file.
In the file "route.kml", all recording positions with "valid" GPS data are listed chronologically.
A new file is created if no "route.kml file is available one a recording is stored.

10.6   Track file "xxxxxxxx.gpx"

Optionally, the track travelled can be recorded. This requires that the GPS mode is set to 2.
In this mode a GPX file is with the current record number created (e.g. 10160435.gpx) and then the current GPS position is recorded continuously. The sampling rage can be set using the „GPS_INTERVAL" parameter.
The track recording is stopped when the recording mode is exited. When recording mode is restarted a new GPX file is created, or, if no audio recording was made since last start, the existing GPX file is continued.
The GPX file contains the route taken as so-called track. It is based on the XML standard and can be opened with Google Earth for example or most major GIS software.

10.7   Activity statistics file "BATSTAT.csv"

When in recording mode, the BATLOGGER automatically stores a statistics CSV file (Comma separated values) with the name "BATSTAT.csv" onto the root folder of the sd card. The file is extended with new data if already available.

Each hour, a new line is added to the file, containing the number of recordings made in the last hour. Additionally, temperature and battery data is stored.

To use this data, load the file in a spreadsheet application (Excel).

```
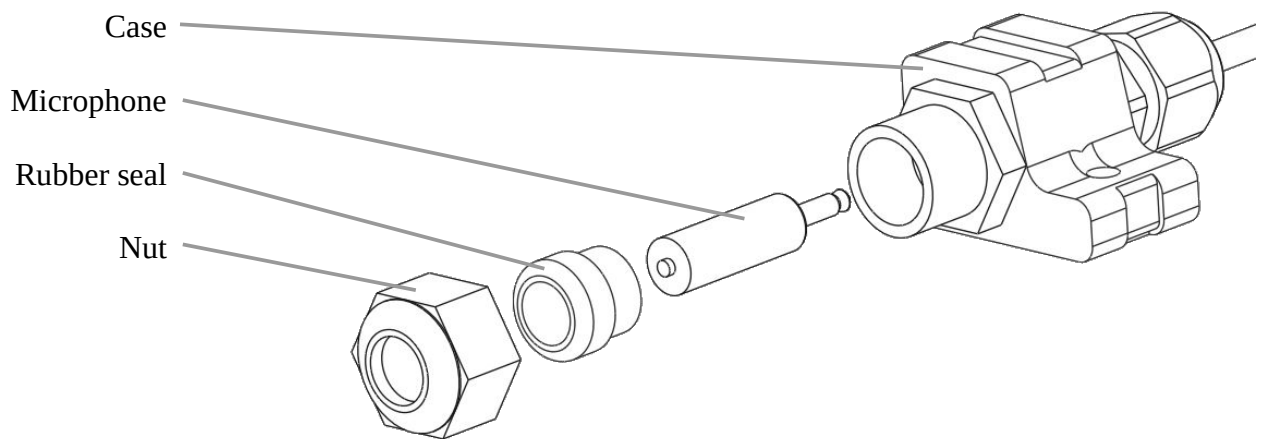Timestamp,Status,#Recordings,Temperature [°C],Battery 1 [V],Battery 1 [A],Battery 2 [V],Battery 2 [A],Charge [V],Charge [A]
03.06.2018 21:00:00,Listening,22,26,8.24,0.10,0.00,0.00,0.00,0.00
03.06.2018 22:00:02,Listening,154,27,8.24,0.10,0.00,0.00,0.00,0.00
03.06.2018 23:00:00,Recording,131,26,8.23,0.10,0.00,0.00,0.00,0.00
04.06.2018 00:00:00,Listening,15,25,8.23,0.10,0.00,0.00,0.00,0.00
04.06.2018 01:00:00,Listening,24,24,8.22,0.10,0.00,0.00,0.00,0.00
04.06.2018 02:00:00,Listening,6,23,8.21,0.10,0.00,0.00,0.00,0.00
04.06.2018 03:00:00,Listening,7,21,8.20,0.09,0.00,0.00,0.00,0.00
04.06.2018 04:00:00,Listening,5,21,8.19,0.09,0.00,0.00,0.00,0.00
04.06.2018 05:00:00,Listening,13,21,8.18,0.09,0.00,0.00,0.00,0.00
```

11 Troubleshooting

11.1 Checklist

Problem	Cause	Remedy
Device does not turn on.	Battery/power supply is not installed properly.	Check battery and/or power supply.
	Battery power is low.	Charge battery.
A lot of noise is recorded.	Trigger settings not optimal.	Check and/or adapt trigger settings.
	Electromagnetic interferences.	Check installation and power supply. Connect microphone shield to ground.
	Noisy environment.	Change location and/or placement/orientation of microphone.
No recordings triggered.	Microphone is defective.	Check and/or replace microphone. See chapter 11.2.
	Trigger settings wrong.	Check and/or adapt trigger settings. See chapter 9.2.2.
"SD card error" is displayed.	SD card is full.	Delete files or format SD card.
	SD card is write protected.	Disable "Lock" switch on SD card.
	SD card is defective.	Check and/or replace SD card.
	SD card type is not supported.	Replace SD card with a valid type.
SMS/Email notification does not work	SIM card, mobile provider registration issue.	Check SIM card and mobile contract. Check the log file for error messages.
	Invalid mobile radio settings.	Check and/or adapt mobile radio settings. See chapter 9.2.5.
	Insufficient mobile radio signal strength.	Install an external mobile radio antenna. See chapter 11.5.
GPS position does not get a „fix"	Insufficient GPS signal strength.	Ensure the a clear view of the sky. Avoid any obstacles (trees, buildings, mountains, etc.) in the field of view to improve signal reception.
	GPS module disturbed.	Reset GPS module to factory settings. See chapter 9.2.4.
Device lost date/time information.	CR2032 battery is dead.	Replace CR2032 battery. 1. Disconnect power supply 2. Remove batteries 3. Remove 6x screws 4. Lift and tilt the inset core carefully 5. Replace CR2032 battery 6. Place back inset core 7. Restore 6x screws

11.2 Replace microphone

Case

Microphone

Rubber seal

Nut

1. Remove the microphone case nut by unscrewing it counter-clockwise

2. Pull out the rubber seal

3. Pull out the microphone

4. Insert the new microphone carefully. Avoid touching the microphones top (capsule). Make sure it is fully inserted until you hear a "click".

5. Insert the rubber seal

6. Mount the microphone case nut by screwing it clockwise by hand (max. torque 3 Nm)

11.3 Test microphone

Microphone testing: The ultrasonic microphone should be tested on a regular basis as it may become less sensitive over time, especially if it was exposed to moisture and weather. Keep it clean and dry to get best results.

11.3.1 Record silent spectrum

1. Place the white protective cover over the microphone in order to block any noise from reaching the microphone. Go in a silent environment.

2. Use the "manual test microphone" function (see chapter 9.2.3) or start a manual recording.

3. Compare the silent spectrum to the microphones specification.

11.3.2 Record a test tone

If you have access to an ultrasonic tone generator that produces reproducible output, you can record that tone and measure the frequency peak of the tone in the recording with appropriate audio software (e.g. Audacity).

11.4 Update device firmware

⚠️ **Power loss during update:** If the device loses power during firmware update, it may get damaged and left unusable. Make sure that batteries are fully loaded and/or plug in power supply before updating.

Download possible new firmware version from www.batlogger.com and copy it to the SD card.

Power up the device as in chapter 4.2.

`New FWxxx.BLC` `Flash Firmware »`	Device starts up and detects new firmware file Press `>>` key to install the new firmware. Press `MENU` key to skip firmware installation.
`Programming` `xxxxxx Bytes...`	The new firmware is flashed to the device. After flashing, the device needs to be restarted. Press both keys `<<` and `>>` simultaneously to turn on the device again if it does not reboot by itself.
`FW Verify Ok !` `Del. FW on SD? »`	The installed firmware is then verified against the version stored on the SD card. Press `>>` key to delete the firmware file from the SD card. Press `MENU` key to keep the firmware file e.g. to update another device.

Also see notes attached to the firmware file for further information.

11.5   Install external mobile radio antenna

6x screws

mobile radio antenna

SMA cable

Inset

1. Disconnect power supply

2. Remove batteries

3. Remove 6x screws with a Torx® T10 screwdriver

4. Lift and tilt the inset carefully

5. Remove the mobile radio antenna by unscrewing it counter-clockwise carefully

6. Plugin the SMA cable into the internal SMA connector where the antenna was and screw it on clockwise carefully

7. Place back inset

8. Mount 6x screws

9. Plugin the cable of the external mobile radio antenna into the external SMA connector and screw it on clockwise carefully by hand (max. torque 0.5 Nm)

Protect external connectors: When not in use, protect the external SMA connector from dirt and moisture with the supplied cover.

12   Technical specifications

Case, dimensions	
Size (B x H x T)	224×191×99 mm
Weight	1.55 kg (with 1 battery), 1.8kg (with 2 batteries)
Weather protection (case closed)	IP67 (except microphone, ext. power supply)
Operating conditions	-10..+50°C, 10..90%RH (non condensing) Charging: 0..+40°C Ext. power supply: 0..+40°C
Storage conditions	-20..+60°C, 5..95%RH (non condensing)
Power	
Battery	One or two 7.2V, >6600 mAh Li-Ion batteries BP-945, Operating time approx. 5 nights a 10h per battery
Power supply	10..26 VDC, min. 20W, Wall power supply 24 VDC 24W (100-240 VAC), Photovoltaic-panel support
Audio	
Sampling	312.5 kHz, 16 bits
Microphone	Ultrasonic microphone FG black, Waterproof cable 2m
Sensitivity range	10 – 150 kHz
Recording duration	0 – 53.5 sec per file; pre- and post-trigger, ignore-time configurable
Trigger modes	Manual, Continuous, Crest Adv, Crest, Period, SD
Scheduled recording	Two time frames programmable per day for recordings (time of the day)
Interval recording	Recording in intervals with preset pause times (number of minutes)
Output/Playback	3.5 mm headphones jack, Heterodyne, Time expansion (1 – 20)
Data storage	
File formats	*.wav, *.xml, *.kml, *.gpx, *.log, *.csv
Storage media	SD/SDHC/SDXC card (SD 2.0), max. 128GB, FAT32 formatted
Software	
Settings and configuration	BATPARS Editor (WIN, MAC)
Analysis and species identification	BatExplorer (WIN) BatScope (MAC, WIN)
Various	
Mobile radio (cellular)	Integrated GSM/GPRS/LTE[A] module EU+APAC+LATAM: 2G (850/900/1800/1900 MHz), 4G (B3/B5/B8/B20/B28) [A] North America: 4G (B2/B4/B12/B13) [A] Standard SIM card slot internal or external antenna SMS and/or email notification
GNS/Location	Integrated GPS/GLONASS receiver coordinates / elevation / time manual location

13 Exclusion of Warranty

Elekon AG assumes no liability and provides no warranty for damage resulting from improper installation, mounting and improper use of the product or from failure to observe the operating instructions and/or safety notes.

14 Service and Support

Please contact Elekon AG if you have any questions about this product:
+41 41 2504040 or mail@elekon.ch
Further support information can be found on: www.batlogger.com

A   Only certain models, see also 2.2 Device revisions

elekon

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