Bat Recording with SM2BAT

1. Check the **preampilfier jumpers/switches** on SM2BAT board, for channels that are to be used.
   a. Bias should be ON for use with acoustic microphones. It can be ON or OFF with ultrasound microphones.
   b. Default analog high pass filter filter = 1 kHz (1000Hz).
   c. Gain (using SMX-US):
      > 60 = for ZC file format
      > 48 = most situations in Wac or Wav mode
      > 36 = in front of roost or where bats will pass close by, in Wac or Wav mode
   d. Gain (using SMX-UT):
      > 60 = for ZC file format
      > 36 = most situations in Wac or Wav mode (48 may cause too much clipping)
      > 24 = in front of roost or where bats will pass close by, in Wac or Wav mode
   e. Gain (using SMX-U1):
      > 24 = for ZC file format
      > 12 = most situations in Wac or Wav mode
      > 0 = in front of roost or where bats will pass close by, in Wac or Wav mode

2. **AA batteries** are okay? If voltage can be tested in situ: 1.6V is new battery, 1.2V is dead battery. Generally batteries need changed at least once per year depending on usage.

3. Switch the **power** on to the detector using switch/jumper for power. Choose internal/external as appropriate.
   a. Wiggle internal D batteries if display screen does not light up to signify power received.

4. **Check SD cards**:
   a. Check % displayed at start-up display – do the SD cards have sufficient space?
      - If not, they can be erased in the Utilities menu.
   b. Do you know if these cards are sufficient for recording high sampling rates?
      - If not, then do an SD card check of card in A slot (in Utilities Menu). All zeroes means you can use the card. If any numbers appear, replace the SD card with another one, preferably a different brand.

5. Check in Menu the following **settings** are correct:
   a. Date
   b. Time
   c. Time Zone
   d. Lat/Long
   e. Prefix
   f. HPF – is this appropriate for the species expected in the recording area?
   g. File Format – if this says ZC, make sure the gain on the Board was set to 60. If this says Wav make sure the Gain on the board was set to either 36 or 48.
      - If in Wav format, be sure File max length setting is at 15s or less.

6. If you suspect a **microphone** may be damaged, or its functionality is unknown, it may be a good idea to verify it is working:
    a. Formal test of microphone sensitivity:
        - following manual's instructions, and using the calibration function in Utilities menu. (Remember to adjust gain switches/jumpers on Board to match mic type)
    b. Quick test that system is working:
        - Force Record (Up + Down arrows, then Select) and view microphone output (registering as ***'s), or listening with earphones.
            - Snap fingers to initiate a trigger. ***'s should increase (and file may be recorded and end, depending on file format in settings).
    c. Check windscreen – if damaged, replace.
    d. Check all cables are properly twisted onto the detector and microphone, for a good waterproof seal and connection.

7. **Recording Schedule**. Take a look at this to ensure it is doing what it is supposed to be doing. (This should have been programmed in Config Utility and checked there.)
    a. If a recording schedule was not uploaded, then do so using Utilities Menu, Load Config from A: Songmeter.set from Slot A SD card.

8. **Wake/Exit**. If this is happening after the scheduled deployment time, it will go to sleep until tomorrow.
    a. If you wish for recording to begin that evening despite already being part way into the programmed recording session, then HOLD the Wake/Exit button until you see 'Backing Up…" on display. Release button and recording session will begin.
    b. Display will turn off if detector is not in a recording session, and will *sleep*.

9. Replace cover. **Check for flashing LED** light on cover:
    a. If it is sleeping, waiting for the time it is to turn on and record → flash rate once/minute
    b. If it is actively recording → flash rate once/second if triggered, once/2-seconds if waiting for trigger.
    c. See no light flashing even after waiting one minute?
        - If you gave the detector power to turn it on but did not push Wake/Exit, then it will take 5 minutes before it will automatically go to sleep. Wait 5 minutes if you really want to ensure the unit goes to sleep. (This scenario only happens if for some reason you can't open the cover of the detector. If you can open the cover it may be faster to just do so, and push Wake/Exit).
        - Power problems. If none of the above apply, then check battery and connections.
10. **Mic Placement**. Ensure the mic is not pointing upwards as it could get moisture in the windscreen, and this could be drawn into the mic and wreck it.
    a. Point mic on a slight downwards angle.
    b. If you have the mic sufficiently boosted up in the air on a tower/pole, you may point it straight down.
    c. Some sort of protection is recommended for long term deployment (e.g. board over top of mic to keep snow or rain from soaking/freezing the foam windscreen).

SongMeter 2 Bat – all models

Visual Manual
By Cori L Lausen

©Cori L Lausen

Hardware

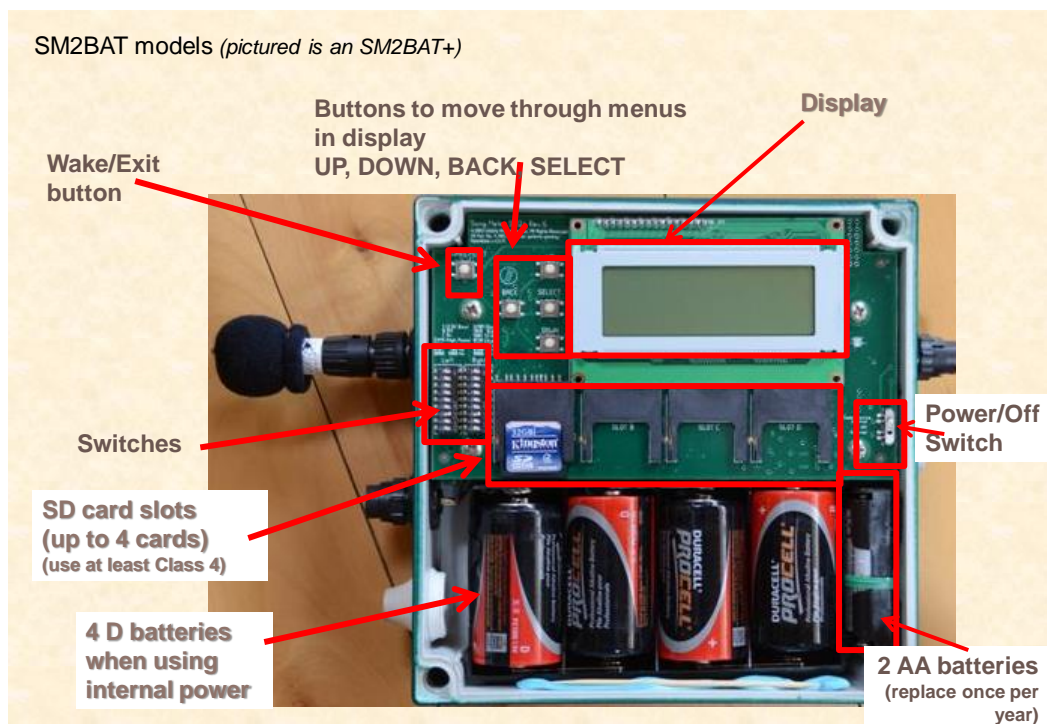SM2BAT -- This mamual covers all 3 models: 192, 384, Plus (+)
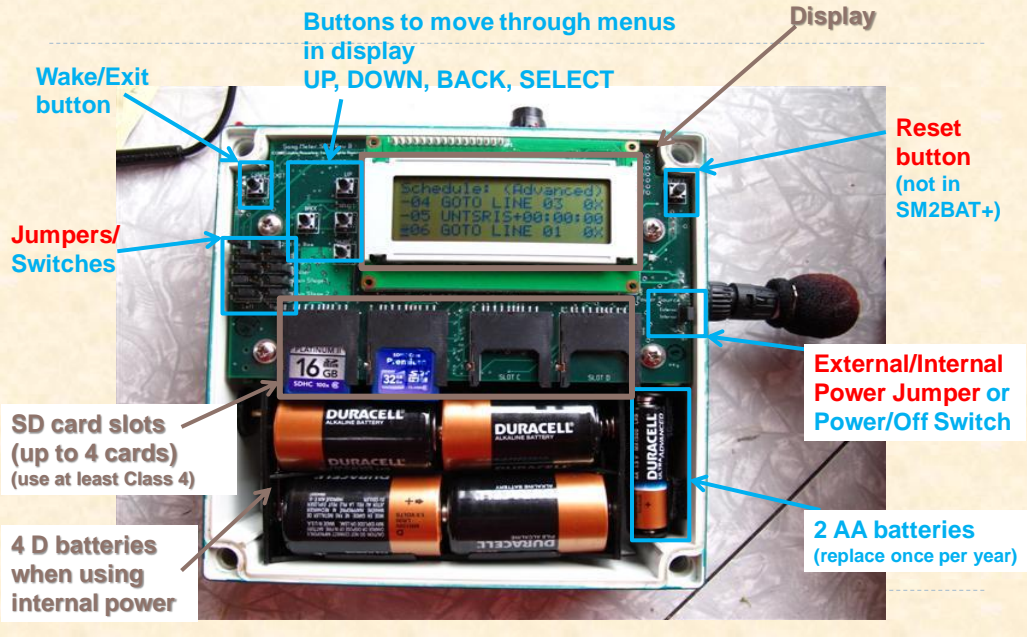
PART I

Specifics of SM2BAT+

▸ 2 mics available if recording on full spectrum 192 kHz sampling rate

▸ If recording to ZC only LEFT mic can be used

▸ Can record native zero-cross (ZC), or directly to .WAV format

▸ WAC format allows recording to a slightly compressed format for smaller file size

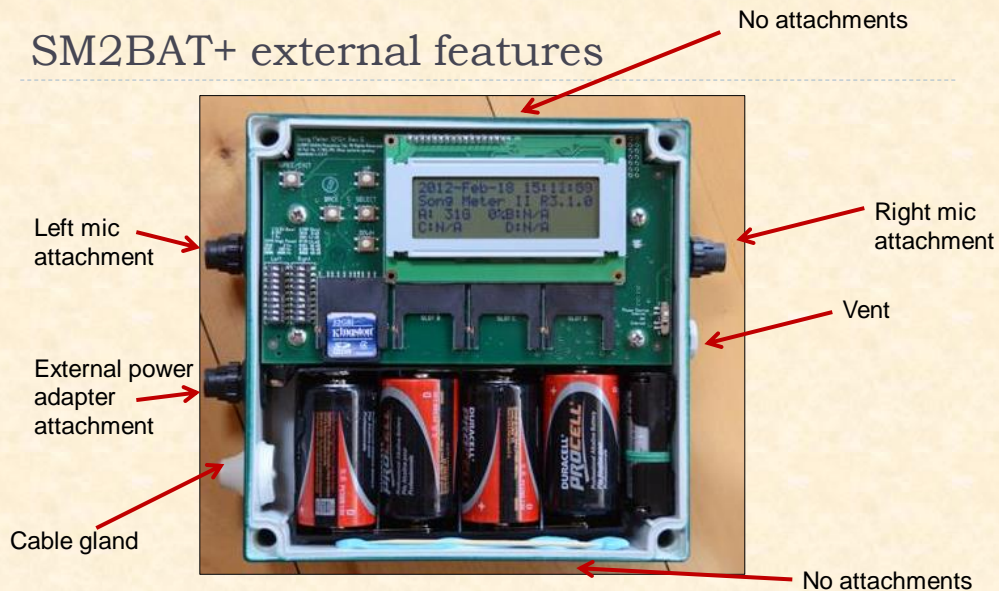 ▸ Can convert later to either ZC or WAV – or both!

SPECIAL NOTE:
Some of the photos in this manual show the microphone attached directly to the box of the bat detector. Although this used to be done, it has since been determined that this can be associated with problems. As such, do *not* attach mics directly to the body of the detector when recording in the field. Always use some length of microphone cable to attach the mic to the bat detector. That microphone should be mounted away from the detector and other potentially reflective surfaces.

SM2BAT models *(pictured is an SM2BAT+)*

Wake/Exit button

Buttons to move through menus in display
UP, DOWN, BACK, SELECT

Display

Power/Off Switch

Switches

SD card slots (up to 4 cards) (use at least Class 4)

4 D batteries when using internal power

2 AA batteries (replace once per year)

2

SM2BAT models *(pictured is an SM2BAT-192)*

Buttons to move through menus in display
UP, DOWN, BACK, SELECT

Display

Wake/Exit button

Reset button
(not in SM2BAT+)

Jumpers/ Switches

Schedule: (Advanced)
-04 GOTO LINE 03 0X
-05 UNTSRIS+00:00:00
=06 GOTO LINE 01 0X

External/Internal Power Jumper or Power/Off Switch

SD card slots (up to 4 cards) **(use at least Class 4)**

4 D batteries when using internal power

2 AA batteries **(replace once per year)**

SM2BAT+ external features

No attachments

Left mic attachment

Right mic attachment

Vent

External power adapter attachment

Cable gland

No attachments

2012-Feb-18 15:11:50
Song Meter II R3.1.0
A: 31G 0%B:N/A
C:N/A   D:N/A

▶Temperature sensor (new style), headphones, or GPS go through cable gland to plug in to the inside.

Desiccant – a good idea

Newer units come with a desiccant pouch that does not need replacing. If your unit was prior to the inclusion of this type of pouch, you should routinely replace any desiccant pouch in your detector so that moisture does not build up inside.

NOTE: This desicant pack may be underneath the board inside the detector.

▶ Note that the SM2BAT+ units come with an additional coating over the internal components making them more resistant to moisture (e.g. when lid is open and moisture gets into box).

SD cards

▶ 128 GB by using four SDHC
▶ Possible: 256 GB using 4X64 GB SDXC cards*
  ▶ *while possible to reformat to FAT32, it is not recommended.
  ▶ When reformatting, best to not use Windows. Use Sdcard.org.
▶ Suggested capacity
  ▶ Typical night recording moderate level of bat activity without much other noise uses 0.5 GB in WAC0 stereo recording (with lots of wind/rain noise, allow up to 2GB/night)
    □ WAVE files get filtered to remove false triggers so your SD cards will last far longer
    □ ZC files are extremely small is size (a few kilobytes only, unlike a couple of megabytes for wave files!), so you can record for months if not years on a single 32 GB card!

SD cards

- Don't use too small of a card!
  - Because the detector looks for at least 2GB of empty space on a card before beginning a recording, if you use a small card it may be unable to record. It will go into sleep mode if there is deemed insufficient space.

- Lock – there is a tab on the side of the card. SM2BAT ignores this lock tab

▶

Stereo Mics
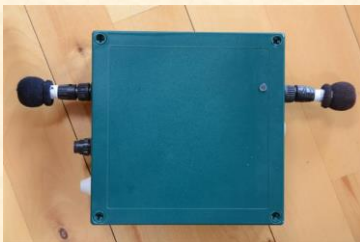
- Dual mics allows you to get creative!
- E.g. - determine direction of flight for bats on a linear path, or entering/exiting roosts.
- E.g. – meet the requirement for both ground and rotor swept area monitoring at MET towers or wind turbines – using just one detector!
- Files from dual mics are separated using 0 for Left Mic and 1 for Right Mic in filenames

Options for mixed acoustic and ultrasonic recording:

1. Ultrasound mic on one channel, and acoustic (conventional audio) mic on the other channel recording *simultaneously* AT THE SAME SAMPLING RATE.
   -e.g. record night-time migrating birds and bats (at 192 kHz fs) at the same time

2. Ultrasound on one channel and acoustic on the other channel each SAMPLING AT DIFFERENT RATES (not recording simultaneously).
   -e.g. record diurnal or crepuscular birds/frogs and at night record bats (at 192 or 384 kHz)
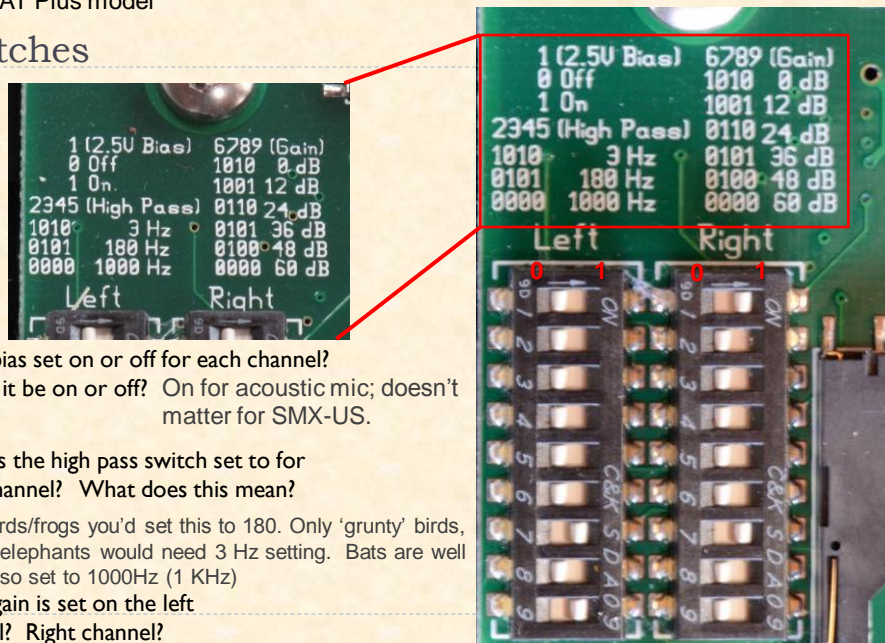
▶

SM2BAT Plus model

Switches on Board

1 (2.5V Bias)	6789 (Gain)
0 Off	1010 0 dB
1 On	1001 12 dB
2345 (High Pass)	0110 24 dB
1010 3 Hz	0101 36 dB
0101 180 Hz	0100 48 dB
0000 1000 Hz	0000 60 dB
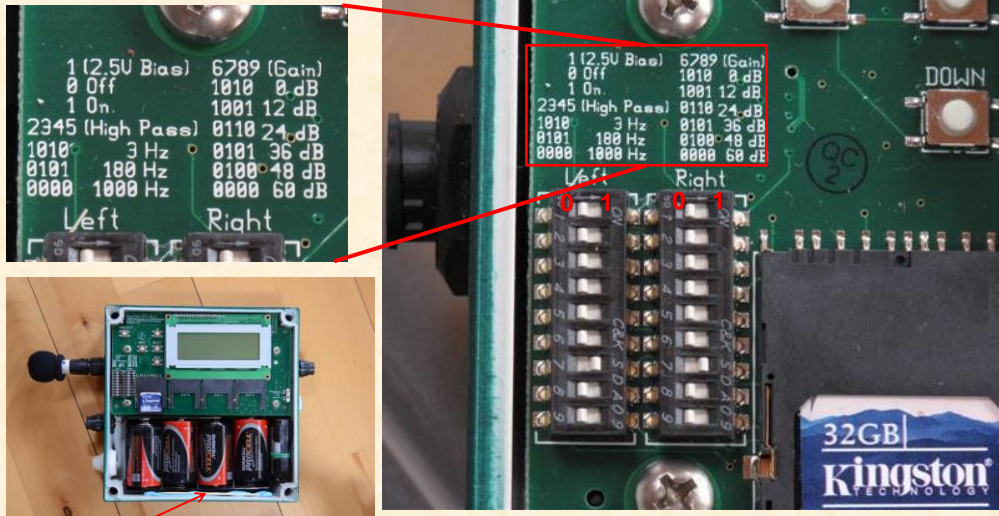
▶ A round toothpick works well for adjusting these switches, and fits easily inside the detector with funtak!

SM2BAT Plus model

Switches

Is the bias set on or off for each channel?
Should it be on or off? On for acoustic mic; doesn't matter for SMX-US.

What is the high pass switch set to for each channel? What does this mean?

Most birds/frogs you'd set this to 180. Only 'grunty' birds, whales/elephants would need 3 Hz setting. Bats are well above, so set to 1000Hz (1 KHz)

What gain is set on the left channel? Right channel?

6

High Pass filter set by jumpers/switches

Recall that the high pass filter switch/jumper is a '**soft**' filter –
-unlike the one that is in the menu settings [HPF] which is
digital and 'hard'

Thus consider the loudness and the frequency:
-e.g. on a cold day a bull frog can produce 80 Hz sounds,
so 3 Hz could be considered for these high pass switches,
but 180 is likely okay given how *loud* the frogs are.

The risk of setting these High Pass switches too low is that
the initial sound entering the detector could clip.

▶

Gain settings (preamp), on circuit board

2.5V Mic Bias	Bias	No Bias				
Switch Row 1	On	Off				
High Pass Filter	3 Hz	180Hz	1,000Hz			
Switch Row 2	On	Off	Off			
Switch Row 3	Off	On	Off			
Switch Row 4	On	Off	Off			
Switch Row 5	Off	On	Off			
Gain	0 dB	12 dB	24 dB	36 dB	48 dB	60 dB
Switch Row 6	On	On	Off	Off	Off	Off
Switch Row 7	Off	Off	On	On	On	Off
Switch Row 8	On	Off	On	Off	Off	Off
Switch Row 9	Off	On	Off	On	Off	Off

▶   This table is on your course CD in Manuals: SM2+-Changes-from-SM2.pdf

Deciding on a gain setting (jumpers) – when using an **SMX-US mic**:

48 dB gain – good for most situations of recording in a foraging/commuting area

36 dB -- good for detectors recording in front of roost entrances where bats will approach the detector closely (prevents clipping); also a good setting to choose if you want to produce clean looking calls, minimizing the amount of noise recorded.

60 dB – usually not recommended *except when recording in ZC mode --* if you are particularly interested in maximizing the amount of bat activity recorded by the detector at the expense of rather noisy looking files, then use this setting.

Deciding on a gain setting (jumpers) – when using an **SMX-UT mic**:

36 dB gain – good for most situations of recording in a foraging/commuting area

24 dB -- roost entrances where bats will approach the detector closely (prevents clipping)

60 dB –*ZC mode*

Deciding on a gain setting (jumpers/switches) for **BIRDS** using Acoustic Mic for SM2BAT

48 dB gain – good for most situations of recording

36 dB – eg. On shores where there is a lot of wind to avoid clipping

60 dB – usually not recommended; noisy recordings result.

▶ Further Gain refinement within Settings Menu…

Understanding Gain, SM2BAT

Two settings for gain exist:

1. Jumpers/switches – manually set by moving switches.

2. Audio settings in the menu (use Display to access) – digitally set on-board or using Config Utility software. This setting has no effect on the SM2BAT+ units at sample rates of 192000 and 384000.
   ▸ only useful for lower sampling rates, eg. recording birds

Set Jumpers
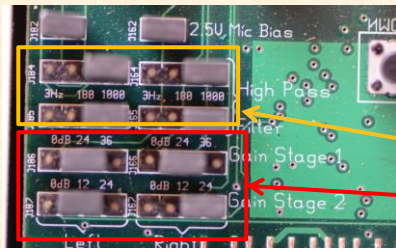
Set High Pass filter at what?   **1000 Hz**

Set Gain

Left Microphone settings – What is this used for (that the right mic is not?)
**-This is the only microphone that works on SM2BAT-384 model.
-This is the only microphone that will record in ZC mode on the SM2BAT+.**
Right Microphone settings

Set Jumpers (cont'd)

Pull black pins out and move to connect different pins.

Four rows of jumpers must be adjusted.

NOTE:
The **SM2BAT-384** can only accept input from the Left microphone. As such, the right microphone jumpers need not be adjusted.

The **SM2BAT-192** accepts audio input from both the left and right microphone. As such, both the left and right jumpers should be adjusted.
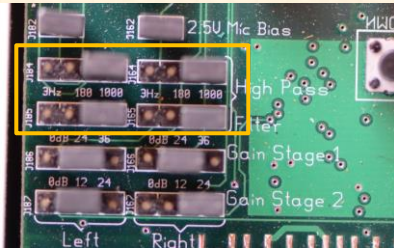
Set Jumpers (cont'd)

Top 2 rows (High Pass Filter) should each have their jumpers at the far right as shown in picture. 1000 Hz (1kHz)
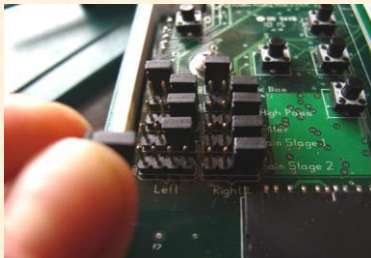
Set Jumpers (cont'd)

Move black pins in bottom two rows to adjust the Gain (Stage 1 and Stage 2, which sum together to give the total gain).

0   24   **36**

0   12   24

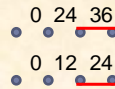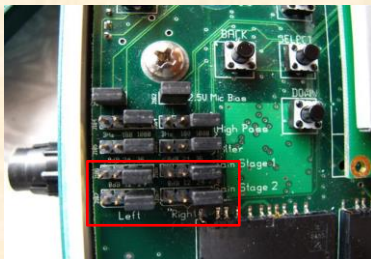Eg. A jumper over the last 2 pins or row 1 selects 36.
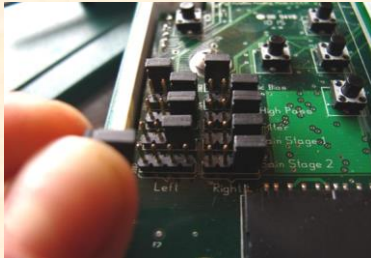
Set Jumpers (cont'd)

Move black pins in bottom two rows to adjust the Gain (Stage 1 and Stage 2, which sum together to give the total gain).

0 24 36
0 12 24

A jumper over the last 2 pins selects 36 on top and 24 on bottom.

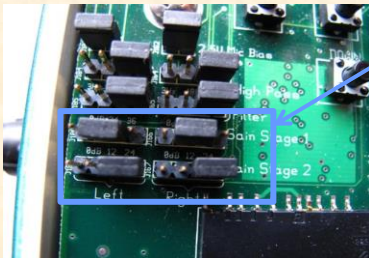This picture shows the maximum gain of 60 for each the left and right microphone:

36 + 24 = 60

In this picture both the left and right microphones are set at 60 dB gain.
To reduce noise files, 48dB setting is recommended, and to prevent clipping when recording at a roost, for example, 36 dB may be a better option.
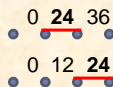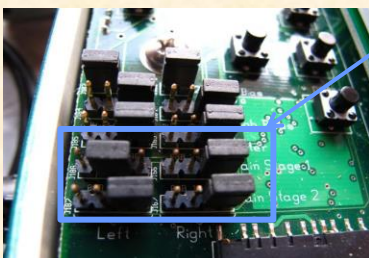
www.batsRus.ca

Set Jumpers (cont'd)

In this case, both the left and right microphones have been set to 48 dB gain instead of 60.

24 (stage 1 row TOP) + 24 (stage 2 row BOTTOM) = 48
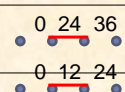
0 **24** 36
0 12 **24**

NB: If you used 36 and 12 instead, it *might* work the same way to provide 48db gain, but *not* recommended.

In this example, what gain is the left mic set at? Right mic?

What jumper arrangement would produce a 36 db gain?

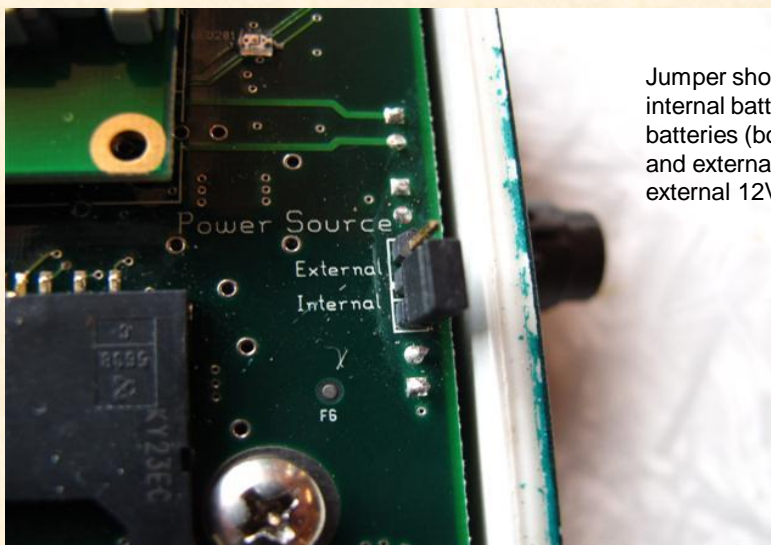0 24 36
0 12 24

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12

Powering Up!

SM2BAT 192/384 – move jumper to connect pins for Internal Power.

▶ TIP: When using internal batteries: wiggle D batteries if detector does not immediately turn on to make sure batteries are seated correctly.

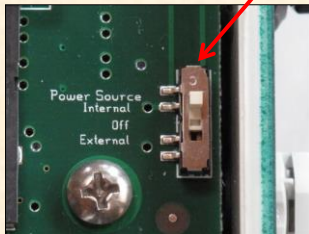# SM2BAT-192/384 models
Toggle to internal or external battery

Jumper should be on internal battery for D batteries (bottom 2 pins), and external battery for external 12V (top 2 pins).

Powering Up!

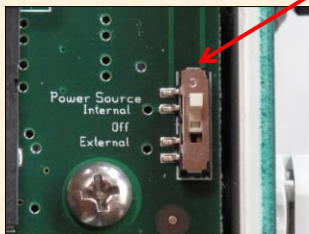SM2BAT 192/384 – move jumper
to connect pins for Internal Power.

SM2BAT+

On (internal batteries), Off, External batteries

Toggling this on/off is similar to old 'reset' button (do this
if unit ever 'freezes').

▶ TIP: When using internal batteries: wiggle D batteries if detector does not immediately turn on to
make sure batteries are seated correctly.

Powering Up!

SM2BAT+

On (internal batteries), Off, External batteries

Toggling this on/off is 'reset' or 'reboot' (do this if unit
ever 'freezes').

▶ TIP: When using internal batteries: wiggle D batteries if detector does not immediately turn on to
make sure batteries are seated correctly.

Powering Up!

PUSH POWER
BUTTON DOWN
for external power
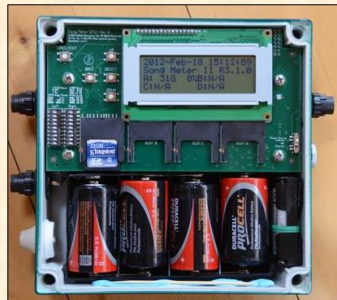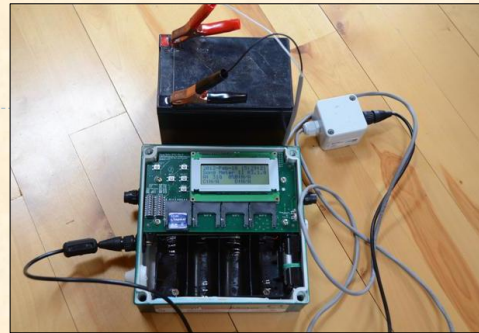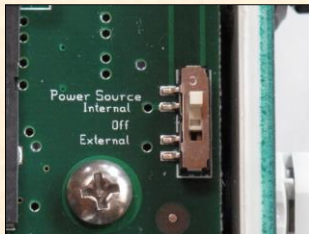
▶ Use 12V or 6V external power source.

Main Menu appears when detector first given power
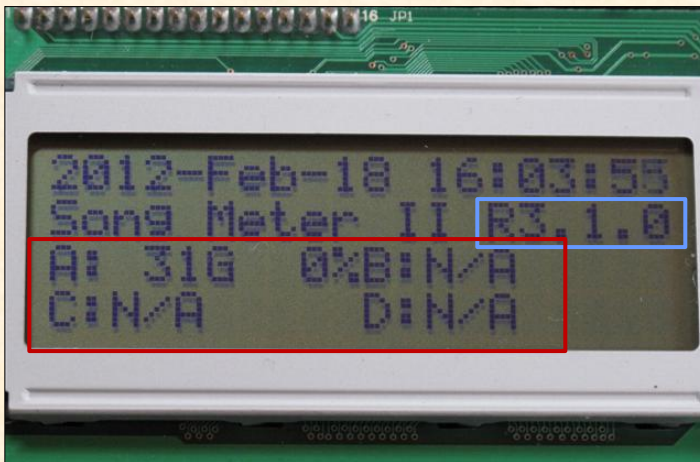
If your detector already had power and was in sleep mode, press the Wake/Exit button at top left of inside of box to see this display.

Version of Firmware: check *website for upgrades!*
*What is the current version?*

Status of SD cards in slots.

▶ Your SD cards can be loaded/removed at any point.

SD Cards

▸ What files might you want to have on your SD card before inserting it into the detector?

1. A firmware upgrade .SM2 file if a newer version of the firmware is posted to the website.
2. A configuration (programmed) file made in Song Meter Config Utility (to avoid having to manually program the detector).
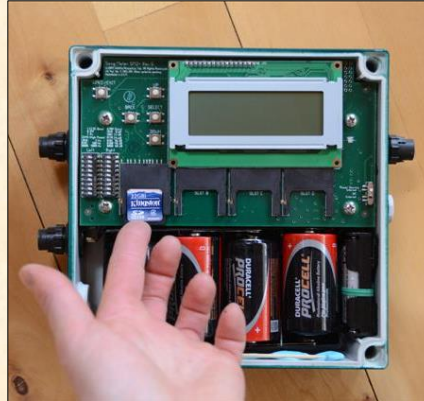
Buttons to Navigate the Menu
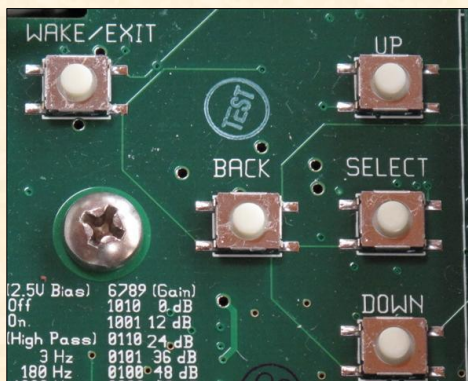
Select:
-moves forward through the line/menu
-"enter" at end of line
WITHIN A LINE OF CODE THIS IS EQUIVALENT TO 'ENTER'

Down:
-moves down in the menu list

Up:
-moves up in the menu list

Back:
-moves back up the menu hierarchy
-moves back a step in the menu
WITHIN A LINE OF CODE, THIS IS EQUIVALENT OF 'ESCAPE' – make sure you've made a change if you really wanted to edit something!

The hierarchy of the SM2BAT menu

Main Menu

3
SCHEDULE   **SETTINGS**   **2**   **UTILITIES**   **1**

Go to sleep
Load config
Save .set
Erase cards
Calibrate Mics
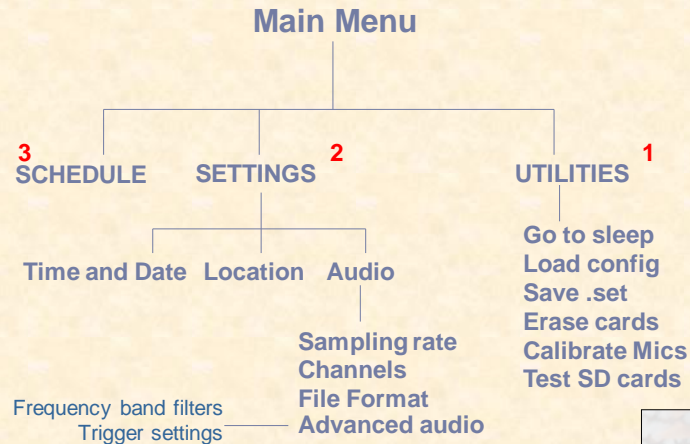**Test SD cards**

Time and Date   **Location**   **Audio**

Sampling rate
Channels
File Format
Frequency band filters   **Advanced audio**
Trigger settings

Utilities

| | | **POWER DOWN** |

Select →

POWER DOWN

This is a DEEP sleep. The detector will not wake up until the Wake/Exit button is pressed, or power is cycled by switching the detector to Off then On.

Low power consumption for transport or short term storage to make sure it doesn't wake up to do scheduled recordings.

SONGMETR.SET

-*LOAD* configuration from file which was programmed in Config Utility

-*SAVE* configuration to file for viewing in Config Utility

▶ Note: mic gain, sensor settings and prefix are **not** updated when loading a config files, unless you specified OVERRIDE in Config Utility

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Utilities

Select →

Up/Dwn ↓

Select to perform action

POWER DOWN

This is a DEEP sleep.

CALIBRATE MICS

Use the calibrator to test that mic is still performing within specs.

▶ Note: This mic calibration test can only be done on an SM2BAT+ model. You will need to manually configure the switches (48 dB for US mic, 36 dB for UT mic). A mic cable and callibrator are needed.

Utilities

Select →

Up/Dwn ↓

Select to perform action

Up/Dwn ↓

POWER DOWN

This is a DEEP sleep.

CALIBRATE MICS

Use the calibrator to test that mic is still performing within specs.

SPEED TEST SD CARD IN A SLOT

ERASE ALL CARDS

SET FACTORY DEFAULT

▶

Testing your microphones (using SM2Bat+)

- Takes one 9V battery
- Can act as a way to check your microphone, or your entire system (e.g. trigger levels)

CALIBRATOR/CHIRPER

Testing your microphones

- Check to make sure your microphones are working
- Determine if there has been some loss of sensitivity
- Confirm they are within 8 db of each other (typical max sensitivity difference between mics)

CALIBRATOR/CHIRPER

Testing your microphones

▸ How To:

  ▸ Set to Calibrate Mic mode in Utilities menu
  ▸ Adjust to appropriate gain using jumpers/switches:
    ▸ 48db for SMX-US
    ▸ 36db for SMX-UT
    ▸ 0 db for SMX-UI
  ▸ Plug mic into Calibrator
  ▸ Toggle to Calibrate
  ▸ Turn on Calibrator
  ▸ Rotate mic 360°

CALIBRATOR/CHIRPER

▸

Testing your microphones

▸ How To:

  ▸ Set to Calibrate Mic mode in Utilities menu
  ▸ Adjust to appropriate gain using jumpers/switches:
    ▸ 48db for SMX-US
    ▸ 36db for SMX-UT
  ▸ Plug mic into Calibrator
  ▸ Toggle to Calibrate
  ▸ Turn on Calibrator
  ▸ Rotate mic 360°
  ▸ Take note of largest (least negative value)
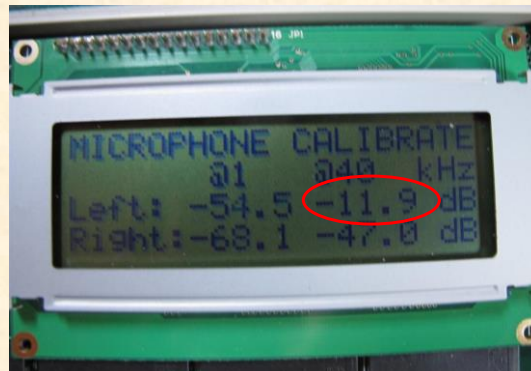
CALIBRATOR/CHIRPER

▸

Testing your microphones

▸ How To:

  ▸ Set to Calibrate Mic mode in Utilities menu

  ▸ Adjust to appropriate gain using jumpers/switches:

    ▸ 48db for SMX-US

    ▸ 36db for SMX-UT

    ▸ 0 db for SMX-U1

  ▸ Plug mic into Calibrator

  ▸ Toggle to Calibrate

  ▸ Turn on Calibrator

  ▸ Rotate mic 360°

  ▸ Take note of largest (least negative value)

  ▸ Check this value in the table….

CALIBRATOR/CHIRPER

Microphone	Must be this or larger (less neg) to be functioning appropriately
SMX-US	-17 dB
SMX-UT	-29 dB
SMX-U1	-38 dB

See Calibrator manual for further instructions

Testing your system

▸ Check to make sure you're unit is recording correctly and your settings are okay.

▸ Test in chirper mode, about 20 m from your mic. (remember that air movement can dramatically affect ultrasound)

▸ You can listen using the Forced Record mode (in RTE) to ensure triggered events are as expected.

▸

CALIBRATOR/**CHIRPER**

SD Card Speed Test

In *Utilities* menu

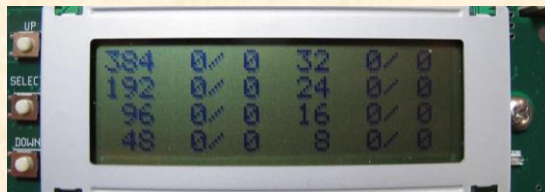▸ Checks flash card in A slot for ability to record at different sample rates.

▸ Takes 15-30 seconds to run.

▸

SD Card Speed Test

In *Utilities* menu

▸ Checks flash card in A slot for ability to record at different sample rates.

▸ Takes 15-30 seconds to run.

▸ Results
  ▸ 0/0 mean no problems were found.

▸ Note that the test requires at least 64MB of free space on the card.

SD Card Speed Test

In *Utilities* menu

‣ Checks flash card in A slot for ability to record at different sample rates.

‣ Takes 15-30 seconds to run.

‣ Results

   ‣ 0/0 mean no problems were found.

   ‣ numbers indicate a first and possible second occurrence in seconds of a "glitch" where the flash card is unable to keep up recording

      ‣ Eg. A 99 means the occurrence was greater than or equal to 99 seconds.

‣ What does a problem mean?

   ‣ SD card can't keep up resulting in loss of up to one second of data.

   ‣ Depending on needs and results, consider not using card.

‣

SD Card Speed Test

‣ Is your card worth keeping or not?

384 = this also refers to recording in stereo at 192. If there are glitches here, then you may not be able to record bats in stereo on this card.

First 'glitch' in seconds would appear here.

Unfortunately better classes of cards do not guarantee they will be good cards. Solution: try reformatting, the card may improve.

Firmware upgrades are making 'problem cards' less noticeable in the sonograms.
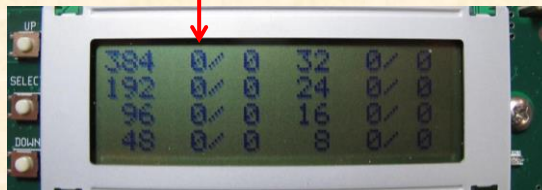
‣ Recall that ZC is a super low write rate, so even 'bad cards' are fine for ZC recording!

SD Card Speed Test

▸ Is your card worth keeping or not?

It depends on how many seconds until your glitches, and what data format you are using:

e.g., If you are recording to WAC, using large files such as 30 minute recordings, then if there is a glitch that just occurs at 5s (e.g. 5/0) then not much of a worry.
- 5 s into each WAC file you'd potentially have a 'skip' in data

VERSUS

e.g., If you are recording to WAV with short files, then you might repeatedly have this skipping issue with each file
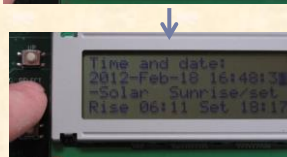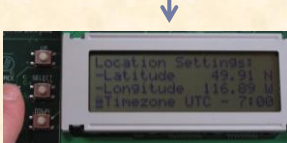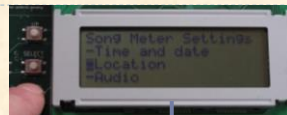
▸

Settings Menu

Time and Date

↓Select

↓Select

Location

↓

↓

↓

Return to Time/Date to verify Rise and Set times look correct

▸

Audio Settings

Sample Rate: 192000 or 384000 for bats
– lower for birds/frogs

Channels: right, left or stereo (automatically set for you if you use fs 384000 or ZC format, both of which can only use *left mic*)

File Format**: ….. See next page….**

Advanced Audio Settings

HPF = high pass filter
Sounds lower in frequency than this are filtered out (different process depending on file format setting)

Gain settings are for use with acoustic mics.

LPF = low pass filter
Sounds *higher* in frequency than this are filtered out
- ❑ useful for programming acoustic mics to record birds at the same time as bats

  e.g. If you set an LPF fs/24 on a SM2BAT-192 detector with an acoustic mic to record birds, what sounds would be filtered out?

▶ When you click into the Dig HPF settings, the frequency will appear, so no math is needed!
Eg. fs/12 = 16000 Hz filter

HPF/LPF

▸ These define the 'signal' of interest.

Frequency (kHz)

Signal of Interest lies between these lines.

LPF

Note, that with bats you'd rarely set an LPF.

HPF

A bit more on HPF/LPF

▸ These define the 'signal' of interest.

Frequency (kHz)

In SM2BAT, signal must also be detected above HPF following a trigger, in order for the Wav file recording to be kept.

Signal of Interest is above this line.

HPF

Signal below this freq threshold will not trigger a recording.

In SM2BAT, signal below the HPF will be filtered out in all Wac recordings.
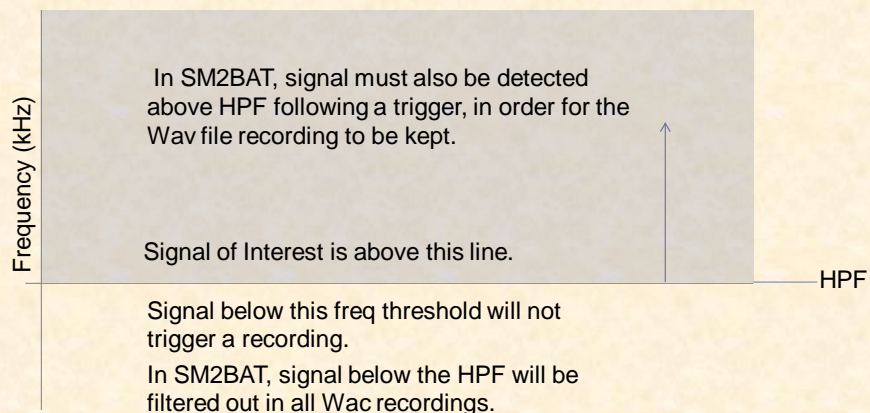
HPF/LPF

‣ When recording audible sounds with an acoustic mic, you may employ LPF's.

Frequency (kHz)

LPF

Signal of Interest lies below this line.

‣
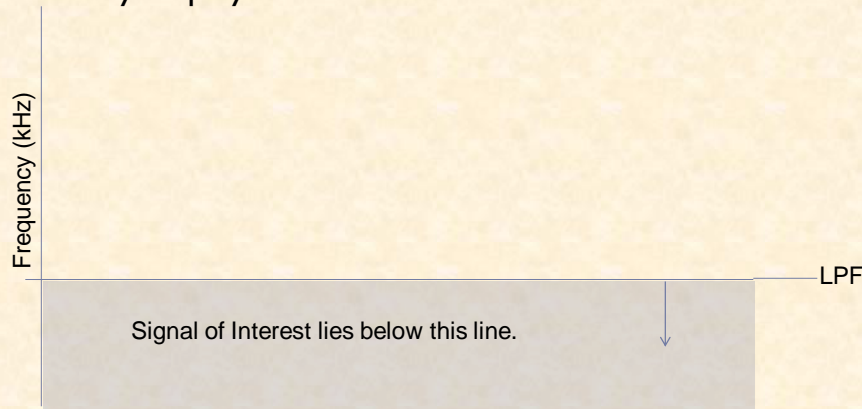
Summarizing High Pass Filter Use

‣ In WAC format, an HPF setting causes all frequencies below this value to not be recorded (ie. are filtered/scrubbed out). E.g. if HPF = 192kHz/12 then all components of the sound below 16kHz are removed from the recording.

‣ In WAV format, once triggered (ie. exceeds SNR threshold and is within freq band set by LPF/HPF) , all frequencies get recorded with no filtering, but the HPF defines the lowest minimum frequency of interest so that the built-in noise filter can then examine the file and if there is nothing of interest that could be bat, the file is not saved.

‣ Caution: HPF MUST BE *OFF* WHEN RECORDING BIRDS– All low frequencies bird sounds will be filtered out if HPF is set (in WAC mode), or the file not saved at all (in WAV mode)!

‣ Because ZC format uses a threshold above the noise floor, HPF does *not* apply.

‣ Remember that if you are monitoring in an area where there are very low frequency bats, you need to make sure your HPF setting is suitable.

Quiz: If you want to be sure to record audible bats (eg. spotted bats), what HPF setting would you have to use?

Advanced Audio Settings

Gain settings are for use with acoustic mics.

HPF = high pass filter
Sounds lower in frequency than this are filtered out (different process depending on file format setting)

LPF = low pass filter
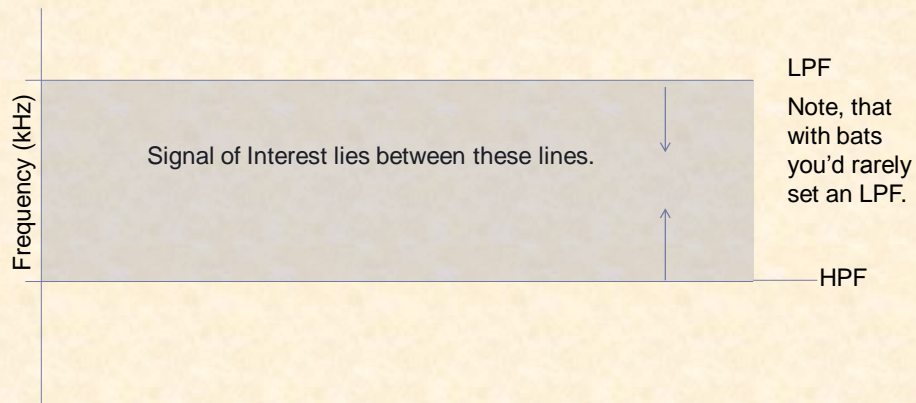Sounds *higher* in frequency than this are filtered out

Trg Lvl = dB above noise floor to trigger recorded event (SNR = signal to noise ratio) *applies to full spectrum recordings only

▶ Always make sure this SNR is a positive number (adaptive trigger relative to noise floor). Negative numbers are absolute threshold triggers and shouldn't be used.

Understanding Triggers

▶ Two Trigger settings

 ▸ 1. *Band pass filters* (HPF/LPF) define the frequencies for a trigger

  ▸ e.g. an HPF for fs/12 at 192kHz has means that a triggered event in WAC or WAV mode will only occur if a sound is 16kHz or higher.

▹

Understanding Triggers

▸ Two Trigger settings

  ▸ 1. *Band pass filters* (HPF/LPF) define the frequencies for a trigger

    ▸ e.g. an HPF for fs/12 at 192kHz has means that a triggered event in WAC or WAV mode will only occur if a sound is 16kHz or higher.

  ▸ 2. *Trigger Levels* (Trg Lvl) determine how loud a signal has to be above the noise floor (SNR = signal to noise ratio) to trigger a recording.

    ▸ This is a 'relative' trigger, varying with the noise floor.

▸

dB

Threshold (for trigger)

Noise Floor

▸

A triggered event.
'good SNR'

Signal

Threshold (for trigger)

Noise Floor

A diminishing signal

A triggered event.
'good SNR'

What happens at
this point? Does
the recording end?

Recording triggered

Threshold (for trigger)

Noise Floor

Weakening Signal

Once the signal is too
weak to trigger an
event, the amount of
time specified in the
'**trigger window**' is
waited, and then the
triggered event is
ended.
NB: in **WAC** = the end
of the triggered event is
marked in the file

dB

No triggered event.
SNR set too high

Signal

Threshold (for trigger)

Noise Floor

▶ The higher you set the SNR, the stronger the signal needs to be above the noise floor to trigger a recording.

Advanced Audio Settings

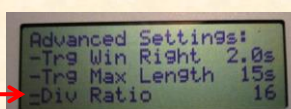Gain settings are for use with acoustic mics.

Audio output ➜ (headphones)

HPF = high pass filter
Sounds lower in frequency than this are filtered out (different process depending on file format setting)

LPF = low pass filter
Sounds *higher* in frequency than this are filtered out

Trg Lvl = dB above noise floor to trigger recorded event (SNR = signal to noise ratio)

Trg Win = amount of 'silence' before the triggered event is considered over and file ends.

Set Max Trigger Length
- To keep .wav files short enough for Sonobat (<8s or <16s)

▶ Advanced Users – trigger window length also determines amount of time during which the rolling average noise is calculated.

File Formats

WAV

No compression

Can be listened to in media players.

Analysis can take place in programs such as SongScope, Sonobat, BatSoundPro, etc.

Triggered wave files result in separate .wav files on SD card. Length of file controlled by "Max Trigger Length"

WAC

Wildlife Acoustic's file compression format (0 or 1 recommended only).

Compression results in an increase in energy consumption.

Can be analyzed directly in SongScope.

Must be converted to be analyzed in other software (wav, or ZC).

A continuous recording. Highly compressed zero-value frames are stored in recording, preserving elapsed time between triggered events.

Max file size for any individual recording is 2GB. So if your settings cause this to be exceeded, then the recording may be split into more than one file.

You must have at least 2GB remaining on your card for the detector to even start one of these files!

ZC

Zero-crossing analysis files

To be analyzed in AnalookW.

Triggered ZC files result in separate .00# files on SD card. Max file length is controlled by whatever comes first:

15 s
32 kB
16384 data points

Small files!

File Formats – cont'd

WAVE

The high/low pass filter settings do not actually filter out information from the recordings.

Instead the HPF/LPF define the frequency band of interest for the SM2BAT+ to determine whether the file is of interest or not. If not, the file is not saved.

e.g. if a **LPF** is set to fs/24 in 192kHz mode, birds and voice note files will be kept; e.g. if an **HPF** filter is set to this same setting (fs/24) for recording bats, only files containing high frequency data will be kept.

WAC

Components of sound that do not meet High/Low Pass filter settings are *filtered out* in this mode.

e.g. if an HPF filter is set to fs/24 at 192kHz sampling rate for recording bats, all triggered files will undergo a scrubbing process to remove sounds lower than 8 kHz.

ZC

HPF/LPF settings have no effect on this format of recording; instead the noise floor is established at the beginning of a recording session and anything exceeding that threshold triggers a recording.

Last new Feature in Sm2BAT Firmware

▸ NAP MODE
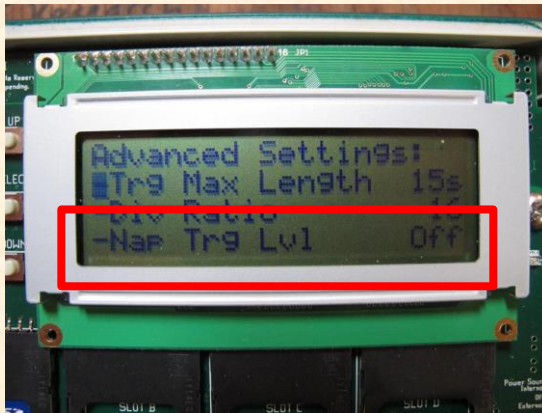
▸ Found in advanced audio menu

▸ This mode, when enabled, will put the detector into a low power state (*not* as low as 'sleep') between triggers to conserve energy. It wakes upon trigger but will usually miss about 200ms of bat activity recording.

▸ Choose ANY number in this menu to enable nap mode. The numbers in this case do not correspond to any setting. (this feature was never fullly developed in this detector)

Scheduled Recordings
Advanced
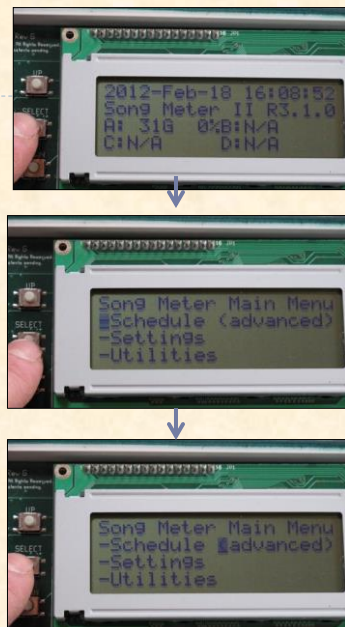
If it says *Daily*, use the Up/Down buttons to access *Advanced*, then push *Select*

AT TIME
AT SRIS
AT SSET
AT DATE 01 Jan YY
COMPRESS *format*
RECORD
PAUSE
GOTO LINE
SET 16000XSTEREO
DO
UNTTIME
UNTSRIS
UNTSSET

▸ Daily schedules are very straightforward, refer to the user manual.

Example: Simple Daily Schedule

- @ 19:00 for 01:00
- @ 00:00 for 01:00
- @ 04:00 for 00:30

Turns on and records for 1 hour at 7 pm and again at midnight for 1 hour. It turns on again at 4 am for another half hour recording.

▶

Example: Simple Advanced Schedule

1 AT TIME 19:00:00
2 DO
3 RECORD 00:30:00
4 GOTO LINE 03 00X
5 UNTSRIS+00:00:00
6 GOTO LINE 01 00X

▶ How long to make each recording?
  ▸ Each file can only be a max of 2GB
  ▸ If power is taken away mid-recording, the whole file becomes corrupted.
  ▸ So you might even prefer 10 minute recordings.
  ▸ You have to put some value of time in here! Safest to not make this too short in case file type gets changed to WAC.

▶ If you use an "until" statement, then you need to use DO. (ie. Do…. Until)

Example: More Advanced Schedule

Summarize what the following schedule does:

1. AT SSET-00:00:00
2. PAUSE 00:30:00
3. RECORD 00:30:00
4. GOTO LINE 03 05X
5. AT SRIS-01:30:00
6. RECORD 00:30:00
7. GOTO LINE 06 02X
8. GOTO LINE 01 00X

▶ Records for 3 hrs starting a half hour after dusk. Then records for 1.5 hr before dawn.

Example: More Advanced Schedule

Summarize what the following schedule does:

1	AT SSET-00:00:00
2	PAUSE 00:30:00

Can you think of another way to do this same thing in one step of code?

3. RECORD 00:30:00
4. GOTO LINE 03 05X
5. AT SRIS-01:30:00
6. RECORD 00:30:00
7. GOTO LINE 06 02X
8. GOTO LINE 01 00X

▶

Advanced Schedule Programming Options

AT TIME – specify a time 00:00:00

AT SRIS – at sunrise (this refers to actual sunrise, or civil twilight, astronomical, nautical solar settings depending on what you've programmed in Time/Date menu**)

AT SSET – at sunset **

AT DATE 01Jan YY

COMPRESS *format =* wac0, ZC, wav etc.

RECORD 00:00:00 *must have **some** time value*

PAUSE

GOTO LINE – note that 0Xor 00X means 'infinitely'

SET 16000XSTEREO – specifies sampling
frequency and channel

DO – is the start of a loop: Do.....Until.

UNTTIME – until a specified time

UNTSRIS – until sunrise **

UNTSSET – until sunset **

<DELETE> - select to remove a line

<ADD/INSERT>

- when you SELECT this, you can then BACK up to the line number, change it, and then proceed to specify the code for that line.
- when you are done, that row will be inserted into the appropriate place based on the line number.
- Note: if you specify code before you specify line number, the option to change line number will be lost.

▶ **or other specified solar setting as determined in Time/Date menu; note that these also allow you to specify -00:00:00 or +00:00:00 for after/before sunrise/sunset

Configuration for birds and bats in SM2BAT

One of two ways:

I. You can record at 192 kHz at a scheduled time with an SMX-US/T ultrasonic microphone and then record at a lower acoustic sample rate at a different scheduled time with the SMX-II acoustic microphone.

View an example of this in Config Utility
included in sample folder:

▶ SM2BAT-192-MIXED–SCHED.SET

SM2BAT-192-MIXED–SCHED.SET

01 SET 192000XMONO-L

02 COMPRESS ZC

03 AT SSET-00:00:00

04 DO

05 RECORD 12:00:00

06 UNTSRIS+0:00:00

07 SET 24000XMONO-R

08 COMPRESS WAC4

09 RECORD 01:00:00*

10 GOTO LINE 01 00X

▸ LINES 1 – 6 record bats at night.

▸ LINES 7 – 9 record birds/amphibians by day.

▸ *You may wish to break this into smaller files in case the unit loses power; a wac file is corrupted it if loses power before finishing. Would need to insert a Do…Until Loop.

Configuration for birds and bats in SM2BAT (cont'd)

OR

2. Record simultaneously with both microphones at 192 kHz. In this case you configure the digital filters on the SM2BAT to filter out acoustic sounds on the SMX-US with a *high* pass filter and filter out ultrasonic sounds on the SMX-acoustic mic with a *low* pass filter.

The downside is that the 192 kHz will use up more card space than a lower sample rate and the SM2BAT has lower battery longevity then the SM2 acoustic recorder.

▸

CAUTIONS! Re: MIXED recordings

Recording Birds/Frogs on:

Separate schedule from bats:

Once you use **SET** or **COMPRESS**, the SM2BAT will remember those settings and they will override what is in the onboard menu. So be sure to specify in your code what Sampling Rate and File Format once you make any changes!

Same schedule as bats:

You must specify STEREO WAC as your file type and channels because you can't have independent triggers with frogs/birds. Left mic (for bats) will be triggered; right mic (for birds/frogs) will have no trigger settings, thus recording all of the time. 0/1 in filename after Kaleidoscope conversion will separate your frog/bird recordings from your bat recordings.

SET AND COMPRESS

Another example:

BATS	
	01 AT SSET-00:00:00
	02 **COMPRESS** ZC
	03 **SET** 192000XMONO-L
	04 DO
	05 RECORD 00:30:00
	06 PAUSE 00:01:00
	07 GOTO LINE 05 00X
	08 UNTSRIS-01:00:00
BIRDS/ FROGS	09 DO
	10 **SET** 24000XMONO-R
	11 **COMPRESS** WAV
	12 RECORD 00:30:00
	13 GOTO LINE 12 00X
	14 UNTSRIS+01:00:00
	15 GOTO LINE 01 00X

Exercise 1: Practice Making Schedules

Exercise 1-A   Lat/Long you will need for this exercise __.__ N/__.__W

▸ 1. Program a schedule that will have the unit start up at sunset, and record ZC files, until sunrise. Have this schedule repeat daily.

▸ 2. Now, using <ADD/INSERT> found at the end of the program, into the program where appropriate, a PAUSE for 1 minute that will cause the detector to re-check the noise floor every 30 minutes.

   ☐ When you are done, save the configuration to the SD card, and load this onto your laptop, renaming it SongmeterA.set.

Exercise 1-B

▸ 1. Program a schedule that will have the unit start up 15 minutes before civil twilight, and record in stereo, 30 minute wac0 files for 8 hours, each day.

   ☐ When you are done, save the configuration to the SD card, and load this onto your laptop, renaming it SongmeterB.set.

Exercise 1-C

▸ 1. Program a daily schedule that will have the unit record wave files using the right microphone for 1 hour at 7 pm and another hour at 7 am. (*hint: set your file length in the Audio menu*)

   ☐ When you are done, save the configuration to the SD card, and load this onto your laptop, renaming it SongmeterC.set.

WHEN YOU ARE DONE ONE OR MORE OF THESE, VIEW .set FILES IN CONFIG UTILITY.
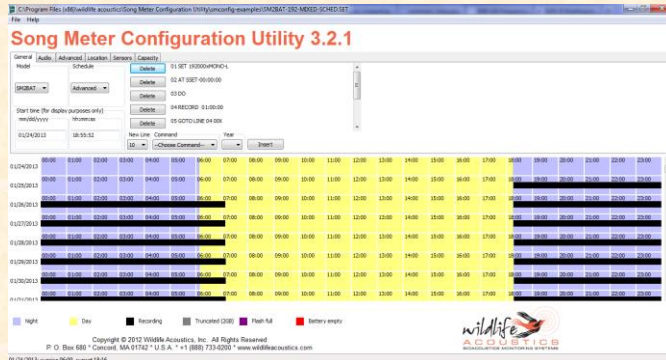
▸ ***Tip****: make sure all of your other settings, including audio, are set appropriately.*
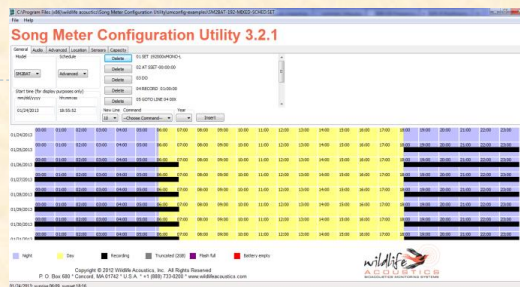
Software

## SM Configuration Utility (for SM2BAT)

▸

Why Use SM **Config Utility**? (pre-field software)

All of the programming of settings and recording schedule for SM2BAT units can be done in this software (free download from www.wildlife acoustics.com). The resulting SONGMETR.SET file can then be uploaded to detector via SD card.

SONGMETR.SET files saved from the detector can also be loaded into Config Utility for viewing/editing.

▶ Until you feel comfortable with programming the SM2BAT+, this software is recommended to 'check' your programming using the CALENDAR feature.
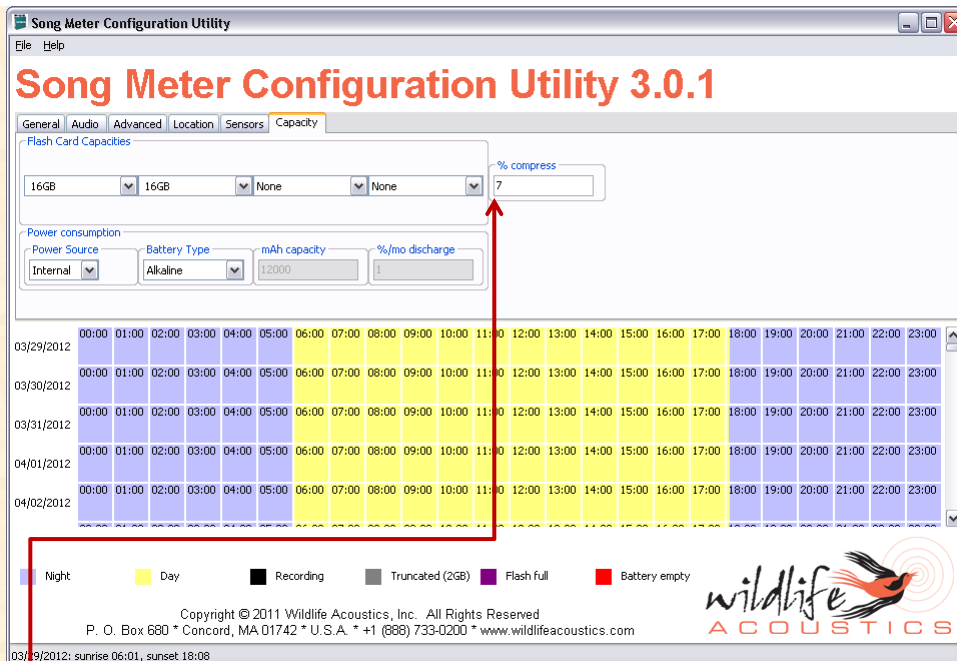
▶ the percent taken up on the card relative to a WAV file. *Eg*. wac0 with triggers will take up 7% of the room that would have been taken up using WAV with no triggers

SM Config Utility Software

▸ A few slight quirks to be aware of:

1. If you Save As, then *reload* that file to ensure you know which file you are actually changing.

2. When inserting a new line, always enter the line number *last*.

3. Enter – or + times by typing in front of the numbers. And remember that -(-) is +.
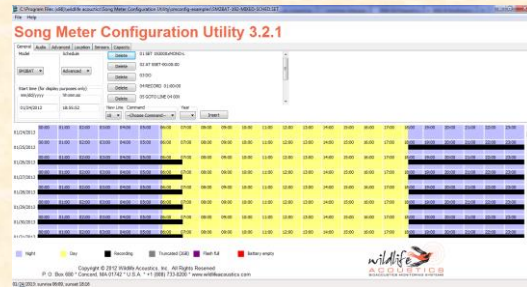
▸   e.g. ATSSET- -01:00:00 => ATSSET + 01:00:00


Uploading Configuration in to SM2BAT

Tip:

The date and time do NOT upload from a configuration file, so even though it may appear in Config Utility, it will not reset the detector.

ALWAYS double check your detector to be sure it has the correct date/time in the field.

You can check your sampling rate in Config Utility

HOLD CURSOR OVER CALENDAR 'BLOCKS' TO SEE SAMPLING RATE AT THAT TIME
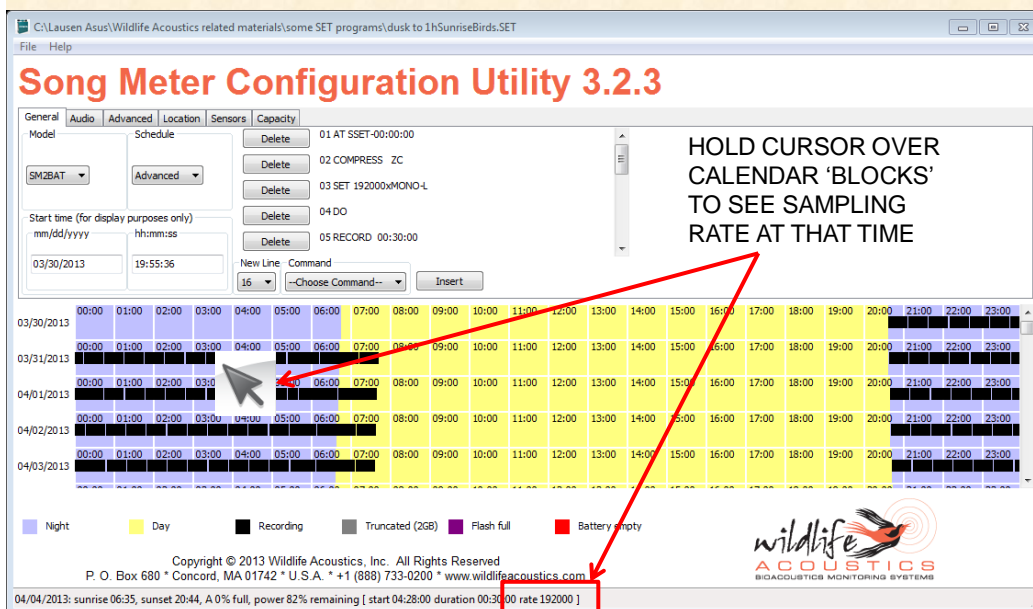
SET AND COMPRESS

For example:

Quiz!:

1. What HPF and LPF should your Left and Right mics be set to?

2. What type of mic would you have attached to each channel on the box?

3. When you download the data, how will you know which recordings are of birds and which are of bats?

4. If you wanted to change line 01 of the code to have the detector start 30 minutes AFTER sunset, how would you rewrite this line? How would you enter this into SM Config Utility?

BATS

01 AT SSET-00:00:00
02 **COMPRESS** ZC
03 **SET** 192000XMONO-L
04 DO
05 RECORD 00:30:00
06 PAUSE 00:01:00
07 GOTO LINE 05 00X
08 UNTSRIS-01:00:00

BIRDS/ FROGS

09 DO
10 **SET** 24000XMONO-R
11 **COMPRESS** WAV
12 RECORD 00:30:00
13 GOTO LINE 12 00X
14 UNTSRIS+01:00:00
15 GOTO LINE 01 00X

▸ There is a trick to entering a + in SSET when programming code in Config Utility: type a negative sign in front of the numbers, so that – x -- = positive!

OPTIONAL: SM Config Utility Practice

Exercise 1-D

You may want to work with a partner to:

Make a **SONGMETR.set** file that programs the detector to make a 'mixed' recording for recording birds and bats.

Your scheduled program should record birds for one hour before sunset, then record bats starting a half hour after sunset, all night until sunrise, and then record birds for another hour after sunrise. Have it repeat daily.

Refer to your manual for an example.

Exercise 1-E

In Config Utility, make a program to record birds and bats from dusk to dawn.

Hint: you will need to record in stereo and use a low pass filter on ONE channel. Refer to manual for assistance. And see the example .set files in SM Config Utility.

Hardware

SM2BAT family of detectors: 192, 384, Plus

PART II

Making Practice Schedules

▸ Exercise 1-F

Use one of the files you made in Config Utility.

Load a SONGMETR.set file onto the SM2BAT+ (name it whatever you'd like).

If you'd like, you may wish to practice doing an override on the PREFIX name.

▸ Note that you can name your .set files anything you'd like (e.g. Dusk2Dawn.set)

Deploying the detector

▸ When you have finished changing all of the settings on the detector and are ready to leave it in the field, simply push WAKE/EXIT.

▸ The detector will go into a LIGHT sleep, using low power, and start up at the specified time in the schedule.

Green LED light

2012-Mar-24 12:11:15
Going to sleep until
2012-Mar-24 20:00:00

Flashes **once per minute** when in light sleep mode awaiting to start a scheduled recording. Does not flash in DEEP sleep mode (in Utilities Menu).
Flashes **once every 2 seconds** while in record mode.
Flashes **once/second** while recording a triggered event.

Troubleshooting: if it is not flashing as expected, check that the SD cards are not full, are seated correctly, and that batteries are not dead.

Deploying the detector

NOTE: After the SM2BAT receives power, the menu display will automatically light up. If nothing is done for 5 minutes, it will then automatically go to sleep.

You will then see the LED once/minute to know it is waiting for its scheduled start time.

If you give it power mid-way through its programmed schedule it won't just start recording on its own, it will go to sleep and wait until the next recording session (ie. the next day) to start.

However, you can *force* the detector to start recording part-way into a schedule….

Green LED light

▸

Deploying the detector

▸ If the scheduled recording start time has already passed for the current day, it will go to sleep until the next day. You can force it to start into the current schedule by pushing (and holding) WAKE/EXIT.

Green LED light

2012-Mar-24 12:09:39

Backing up..........
012-Mar-25 10:00:00

▸

Deployment in ZC mode

▸ When the detector starts its recording session, it will Auto-Level to determine what sensitivity threshold to use (based on back ground noise in the environment).

▸ So it is important that when the recording session starts in ZC mode that you **have the mic on** and you are on site..

▸ The only way to have the SM2BAT auto-level again during the night is to program into it a PAUSE line to force it to sleep and then wake up again. E.g. have it pause for >1 minute at some point mid-night for another auto-level.

Deployment – Stopping a Recording

▸ Don't remove power while a recording is taking place; the file that is being recorded could be corrupted this way.

▸ To end a recording safely, push the Back Arrow.

▸ Also, do not remove an SD card while recording is taking place.

SM2BAT Accessories

- GPS – to schedule and synchronize recordings to within one millisecond.
  - Records location at start of recording and every 5 min (wav and ZC). In wac after conversion, there are GPS locations for every minute location. Kaleidoscope has a tab specifically to handle GPS data.

SM2BAT Accessories, cont'd

- Up to 2 mics can be used, and can use a combo of:
  - ultrasound (SMX-US) obsolete
  - ultrasound (SMX-UT) obsolete   New! **SMX-U1**
  - acoustic (SMX-II)

- Horn
  - Turn your SMX microphones into a uni-directional mic
  - This was invented for the Indiana myotis protocol.
  - Using the horn, the mic is only recording bats in front of the microphone, rather than all directions; and detects bats slightly further away than without the horn.

SM2BAT Accessories, cont'd

- Cables for the mics
  - Standard lengths up to 50 m, starting as short as 1 m.
  - Custom- made up to 100m.
    - □ Note that long cables do not result in signal loss in the range of bats (loss is at frequencies above 120kHz)
  - You can join shorter cables together.
- SMX-UT has its own unique style of mic cable

obsolete

SMX-U1 mic for SM2BAT

- Interim – there was an adapter allowing for the U1 mic, but that was phased out, and now all cables work with the U1 mic.

- Mic Gain settings for this new U1 mic:

  0 for at roosts

  12 for normal foraging type recording situations

  24 - 36 dB for recording directly to ZC   [I use 36 dB]

  This replaces the current recommendations of 36, 48 and 60 dB when using the –US or –UT mics.
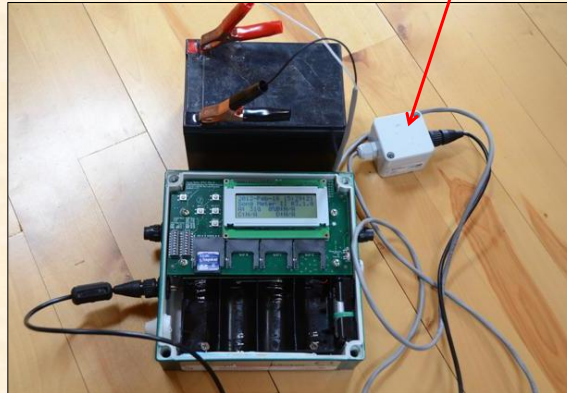
  NOTE: all microphones should be deployed with a *windscreen* to protect it from driving rain.

- Note: SM2 cables – especially the long ones -- are not as resistant to EMI as SM3 mic cables which are thicker

SM2BAT Accessories, cont'd

▸ External power adapter
  ▸ For 6 – 12 V power supply

Other Tidbits: Forced Record and Listening

▸ You can have the detector record manually (ie. without a schedule) by pushing UP and DOWN buttons at the same time. It will use whatever audio settings are currently in place for file format and sampling rates, etc.

▸ Push SELECT to listen via headphones (will see sound metre *** in display). **Up and Down buttons are headphone volume.**

  ▸ In WAC mode, default file length is 46 or 60 min (192kHz or 384 kHz)

PLUG
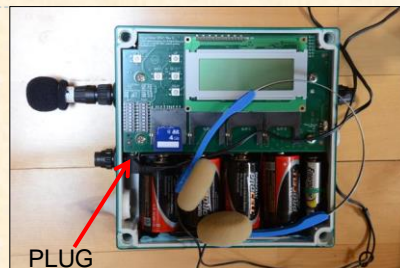
Forced Record in WAV and ZC formats only make ONE file of the length of the trigger window (intended to 'test' only). Use WAC mode to do active monitoring, but know that voice recordings will be scrubbed.

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Exercise 2 – Forced Record

1. Ensure your SM2BAT detector is on the following settings:
   - 192,000
   - Mono-L
   - HPF = fs/12
   - WAC0
   - Trigger window 2.0 s

2. Once the ultrasound generator is running in the room, force record (Up+Dwn), and point the detector mic at the generator. If you have earphones or earbuds, you can use these to listen to the 'bats'.

3. Record for a few minutes.

4. Push BACK to end the .wac file.

5. Push record (Up+Dwn) again.

6. Repeat steps 3 – 5 until you have generated at least 5 .wac files.

7. Load the .wac files onto your laptop.

▶ If you'd like to simultaneously *see* the bat calls, you can power up an EM3 or EM-Touch.

Exercise 2b – Forced Record Dual Mics

1. Ensure your SM2BAT detector is on the following settings:
   - 192,000
   - **STEREO**
   - HPF = fs/12
   - WAC0
   - Trigger window 2.0 s

2. Once there is an ultrasound generator running at each end of the room, force record (Up+Dwn), and point the detector mic at the generator.

3. Record for a few minutes.

4. Push BACK to end the .wac file.

7. Load the .wac file onto your laptop.

SM2BAT Upgrading Firmware Procedure

SM2BAT

1. Download the firmware file (eg. SYS3-1-5.SM2)
2. Copy this file to the top level directory of an SD card.
3. Insert the SD card into Slot A of the SM2BAT.
4. Press and release the "Reset" button (for SM2BAT) or turn on power (for SM2BAT+) while pressing the "Up" button. Continue holding the "Up" button until you see the message "Song Meter II Boot".
5. A list of available .SM2 files will be displayed. Use the "Up" and "Down" buttons to scroll to the desired firmware file and press "Select". You should see the following messages: Upgrading... Upgrading Complete! Press Reset to Boot
6. Press the "Reset" (for SM2BAT) or turn power off and on (for SM2+BAT) to reboot the SM2 with the new firmware.
7. Repeat steps 3 through 6 for any other SM2BATs you wish to upgrade.

You can see what version you are running by powering up your Song Meter SM2+ or SM2BAT+. The version number will be displayed on the LCD.

▶ *These instructions are on the website where you download the firmware.*