Song Meter II Firmware Release Notes

Version 3.3.9

SD Card Compatibility

Improve compatibility with certain SD cards

Version 3.3.8

Problem with schedules waking up just after midnight

The Song Meter usually wakes up 30 seconds before the next scheduled recording (or 150 seconds if a GPS is installed, or 210 seconds on SM2M marine units). There was a bug if the wake up time was exactly midnight (for example, if the next scheduled recording was 30 seconds past midnight) causing the Song Meter to incorrectly go back to sleep for 24 hours. This has been fixed.

Problem with GPS time synchronization

There was a bug in which it is possible for a recording to be marked with a '$' indicating time synchronization that started a multiple of exactly 1.000 seconds (to within a millisecond) late. For most time-of-arrival localization applications involving sub-second delays, the error is easily detected and corrected during analysis.In this version, the condition is less likely to occur, and if it does, the condition is detected and the '$' symbol will not be present.

Version 3.3.7

Adjust microphone calibration algorithm

Modified output of microphone calibration algorithm. The value displayed for 40kHz now reads 1.94dB higher than previous releases and reflects a more accurate estimate of dBVrms compared to earlier estimate of dB re full scale.

Note: For 1kHz measurements and recordings at non-ultrasonic sample rates, it remains true that the SM2 electronics need about 90 seconds to settle after recording starts before accurate measurements can be made.

Version 3.3.4

Fix potential problems with GPS time synchronization

Fixed a possible problem that could mark a recording as synchronized that in fact was out-of-synch.

Fixed a possible problem that could cause the SM2 to lose GPS synchronization even though the GPS remains synchronized.

Fixed a problem where the synchronized filename may be off by one or two seconds from the actual start time.

Version 3.3.3

Added beta support for 32-bit recording modes

Please contact customer service for details.

Version 3.3.2

Improvement to recovering from flash card glitching

For non-GPS synchronized recordings, if buffered samples are dropped due to flash card stalling, the SM2 no longer tries to insert extra samples (which would cause noise in the recordings) to keep time.

Version 3.3.1

Fix GPS time synchronization for triggered WAC recordings

A bug was introduced in 3.2.5 breaking GPS time synchronization of triggered WAC recordings. Time synchronization is not supported for triggered WAV recordings.

Version 3.3.0

Fix bug with WAC and 96kHz Stereo

A bug when using WAC file format with 96kHz sample rate and stereo recording did not set the correct sample rate.

Version 3.2.9

Fix Zero Crossing Hang Bug

If the SM2BAT+ is configured for zero crossing and no zero crossing triggers occur, it was possible that the firmware would lock up at the end of the recording period. This has been fixed.

Version 3.2.8

Fix GPS Time Synchronization Bug

A problem was introduced in 3.1.9 and fixed in 3.2.8 causing loss of synchronization.

Nap Mode

New release of nap mode with auto leveling.

Version 3.2.5

Improved recording quality with skipping SD Cards

Some flash cards cannot keep up with the high sample rates required for ultrasonic recording. This can result in occasional distorted areas in the recordings. This fix makes the effects of skipping flash cards much less obvious so that the skips will not interfere with analysis. For best results you should still check your flash cards with the SD card speed test in the Utilities Menu on the SM2, especially for high speed ultrasonic recordings, to make sure they will be compatible with the SM2.

Improve Zero Crossing scrubbing

Improved the zero crossing scrubbing algorithm to better ignore low frequency noise.

Version 3.2.4

Fixed bugs causing erratic scheduling behavior with GPS

When waiting for a GPS signal after wake-up, it was possible under some situations that the advanced schedule would incorrectly reset to the beginning. For sunrise/sunset schedules, this could cause the recorder to skip a full day of recording.

A second bug detected only with GPS enabled units but possibly affecting other units resulted in occasionally entering user input mode at the end of a recording as if the user pressed the “WAKE/EXIT” button. The recorder would wait for 5 minutes for a button to be pressed, and then resume the schedule in process. This could result in missing or truncated files that would otherwise have recorded during this 5 minute window.

Both bugs have been fixed in this release.

SD Card Speed Test

Added an SD Card Speed test to the Utilities menu to qualify flash cards for making recordings at different sample rates. This test will test the SD card in slot A and takes 15-30 seconds to run. Results indicating 0/0 mean no problems were found. Otherwise, numbers indicate a first and possible second occurrence in seconds of a “glitch” where the flash card is unable to keep up resulting in losing up to one second of data. A 99 means the occurrence was greater than or equal to 99 seconds. Note that the test requires at least 64MB of free space on the card.

Calibrate Mode

Added calibrate mode on the Utilities menu to display dB (re full scale) of left and right channels centered at 1kHz for acoustic calibration and 40kHz for ultrasonic calibration.

Wake up earlier with Marine Personality

If the marine personality is configured, the SM2M will wake up 3.5 minutes before the scheduled recording period to give the hydrophone a chance to charge up for reduced noise.

Modify AT_DATE command to include year specification

The AT_DATE command now lets you specify the year. The previous version does not specify the year and would start on the next occurrence of the month and day, but that may not be desirable if the Song Meter reboots. By specifying the year, the Song Meter can handle a reboot more gracefully and resume the schedule in progress.

Add support for Song Stream

Added support for new Song Stream functionality.

Nap Mode

Experimental low power trigger mode. This functionality is under test and should not be used.

Version 3.1.9

Fix File Corruption Problems

Previous release introduced potential for corruption of flash cards fixed in this release.

Add Negative Values to Sunrise and Sunset Commands

Advanced scheduling commands AT_SRIS, AT_SSET, UNTSRIS and UNTSSET can now take both negative and positive time values for scheduling recordings to start and end either before or after sunrise or sunset.

Add AT_DATE command for Advanced Schedule

Added advanced scheduling command AT_DATE to schedule recordings to start up to one year in the future.

Add COMPRESS command for Advanced Schedule

Added COMPRESS command to advanced schedule for on-the-fly modification to compression modes. This enables switching between zero crossing, WAC compression and WAV.

Add frequency display to digital filtering menus

When adjusting the digital high-pass and low-pass filters, the display shows the actual frequency cut-off for ease-of-use rather than ratio of sample rate.

Improved noise filtering

Slight improvement to triggered WAV mode scrubbing.

Fix GPS Time Synchronization off-by-one problem

Worked around a problem in the GPS receiver that caused synchronized recordings to sometimes be off by exactly 1.000 seconds.

Version 3.1.8

Fix flash card problems introduced in 3.0.0

The performance improvements introduced in version 3.0.0 introduced potential problems. This mostly affects triggered WAV mode recordings in which the SM2 may hang at “Preparing to record” when the first flash card is almost full. Additionally, sometimes the SM2 will think there is no more room on a flash card when in fact there is. The problem may also occur when making back-to-back WAV file recordings, but won’t affect WAV files made if the unit goes to sleep between each recording, nor WAC files, nor Zero Crossing files. This has been corrected in 3.1.8.

Fix problem with sunrise/sunset and zero crossing

When using zero crossing with a sunrise/sunset schedule, it is possible for the sunrise/sunset calculations to become corrupted resulting in unpredictable scheduler behavior. This has been corrected in 3.1.8.

Version 3.1.7

Added maximum trigger length parameter for triggered WAV

Added “Trg Max Length” parameter for triggered WAV mode recordings that automatically end the trigger after the specified number of seconds. This is set to 0 by default indicating an infinite trigger length (e.g. trigger ends the usual way with no activity for the specified trigger window).

Version 3.1.6

Added SM2M Personality

The Song Meter board can now be configured with an “SM2M Personality” for marine recorders by upgrading the SM2 with the “SM2M.SM2” upgrade file, or restored to a regular SM2 personality by upgrading with the “SM2.SM2” upgrade file. With the SM2M personality, the start up display will show “Song Meter 2M” instead of “Song Meter II”.

With the SM2M personality, the factory default settings include mono-left recording and, in the case of the ultrasonic SM2M, disable triggers and digital filters. Additionally, the SM2M will wake up 2 minutes before scheduled recordings instead of 30 seconds before scheduled recordings in order to allow the hydrophone to “warm up” to steady state. Prior to this change, the first minute of recordings were noisier while the hydrophone was still charging a capacitor.

Fixed bug to clean up noise at end of WAC files

There was a bug in which the last bytes of a WAC file may not have been properly flushed to the flash cards resulting in data corruption at the very end of the file.

Fixed 96kHz Mono Recordings

There was a bug in which some 96kHz mono recordings may not have functioned properly.

Fixed start time for non-synchronized recordings

There was a bug in which the start time of a recording that was delayed due to cleanup from a previous recording would not have an adjusted filename timestamp representing the actual recording start time. (This was not the case for GPS time synchronized recordings).

Fixed SPL logging for start of recording

There was a bug in which the start of a recording would have SPL logging that was left over from a previous recording. Now the start of a recording would have no SPL logging entry until subsequent logs.

Version 3.1.5

Fixed non-ultrasonic recordings broken in 3.1.3

The fix in 3.1.3 to make zero crossing mode work inadvertently broke non-ultrasonic recordings resulting in the SM2 locking up at “preparing to record” after waking up to make a recording at <=96K sample rates. This has been corrected.

Version 3.1.3

Fixed Native Zero Crossing mode for Rev C SM2BAT+

A hardware change between revision B2 and revision C of the SM2BAT+ daughter card requires a change in firmware to operate correctly. Prior to this release, the zero crossing function would not work on the newer boards.

Version 3.1.2

New Sensor Log Fields

In previous versions, the sensor log was formatted as follows:

```
YYYY-MMM-DD hh:mm:ss AAAAAA BBBBBB
```


Where AAAAAA and BBBBBB were the formatted readings from the two sensor ports e.g. the internal temperature sensor and the optional external sensor.

With release 3.1.1, we have added the following fields after the sensor readings:

```
      aaa.aaaaaA bbb.bbbbbB -cc.cc -dd.dd -ee.ee -
ff.ff -gg.gg -hh.hh
```

Where aaa.aaaaaA and bbb.bbbbbB are GPS coordinates which are displayed if a GPS hardware option is present and the GPS is synchronized with the satellites, otherwise these fields are blank.

The cc.cc, dd.dd and ee.ee are the minimum, mean and maximum dBVrms signal levels on the left channel as observed since the previous log entry.

The ff.ff, gg.gg and hh.hh are the minimum, mean and maximum dBVrms signal levels on the right channel as observed since the previous log entry.

Note that measurements at the beginning of the recording may only be for a very short interval (fractional seconds).

The dBVrms values are measured over 1/10th of a second intervals, and the minimum, mean, and maximum values calculated based on these 1/10th second measurements.

Version 3.1.0

Triggered WAV mode improvements

In triggered WAV mode, instead of using digital filters, a more sophisticated FFT-based set of algorithms are used for better triggering of ultrasonic events, less susceptible to non-ultrasonic events, followed by automatic “scrubbing” causing triggers that contain no useful information to be deleted automatically from the flash card so the space can be immediately reused by subsequent triggers.

ZCA mode improvements

Improvements to the handling of zero crossing files to simulate behavior of legacy systems. Also improved auto leveling performance.

New default settings for SM2BAT

Default settings in SM2BAT now prefer triggered WAV mode. For SM2BAT+ and SM2BAT384, default is 384kHz on left channel; for SM2BAT192x2, default is 192kHz stereo. In both cases, digital high-pass filter setting sets band of interest above 16kHz.

Improve flash card performance

Additional improvements in flash card compatibility and performance.

Fix potential scheduling bug

A potential bug was discovered relating to a recording ending at the same time as a surrounding DO/UNTIL loop is scheduled to end that could result in a scheduler hang.

Minor user interface improvements

Fixed a few minor bugs and other improvements to user interface.

Version 3.0.4

Add support for Zero Crossing mode in SM2BAT+ hardware

Fixes to Zero Crossing support for SM2BAT+

Delete empty files

If a WAC, WAV or zero crossing file is created without any samples, it is automatically deleted from the flash card. Note that empty files may still exist in the event of power loss during recording.

Add support for SM2BAT+ hardware

Now supports SM2BAT+ hardware in 192kHz mono and stereo, 384kHz mono and zero crossing modes.

Add support for triggered WAV recording

When triggers are enabled and compression is disabled (native WAV format), individual WAV files are now created for each trigger. Previous

releases would create a single WAV file for the entire duration storing trigger samples without any inter-trigger samples.

Add GPS Drift File

When using the GPS time synchronization option, a line is appended to a GPSDrift.txt file on the A card each time the GPS establishes a fix. The line indicates the difference between the on-board real-time clock and the GPS time. (If the time differs by more than one second, the real-time clock is adjusted to within one second, but fractional second error is not adjusted).

Version 3.0.0

Improved flash card performance and compatibility

Several improvements in flash card performance, compatibility and reliability.

Various system performance improvements

Several improvements to system performance including upgrading of operating system and tool chain.

Version 2.4.0

Add support for 96kHz sample rate

SM2 can now be configured to sample at 96kHz.

Version 2.3.9

Add schedule back-up for starting advanced schedule

If an advanced schedule is programmed to wait for a specific time or time relative to sunset or sunrise using AT_TIME, AT_SSET or AT_SRIS commands, pressing the “WAKE/EXIT” button after the specified time has occurred will cause Song Meter to go to sleep until the next time e.g. tomorrow. If the intention is to start relative to today’s occurrence of the event, you can now press and hold the “WAKE/EXIT” button for one second while the “Going to sleep untill...” message is displayed. The

display will then indicate “Backing up....”. At this point, release the WAKE/EXIT button, and the Song Meter will back up 24 hours and start again resulting in a schedule starting earlier today instead of tomorrow.

Change factory defaults for ultrasonic recording

We now recommend WAC0 (lossless) compression for ultrasonic recording, and this is the new factory default setting for SM2BAT units. Additionally, recommended trigger levels are now +18dB and recommended trigger windows are 2.0 seconds.

Fix Real Time Expansion

The Real Time Expansion (RTE) feature stopped working with release 2.3.0 and is now fixed.

Increase GPS acquisition time

Increased the time Song Meter will wait for GPS synchronization from one to two minutes. The Song Meter will now wake up 2.5 minutes early and wait up to two minutes after scanning flash cards to acquire a GPS signal when a GPS unit has been installed and detected. This increases the likelihood of synchronizing before the recording start time in areas with weaker GPS reception.

Version 2.3.7

Add default parameters for SM2BAT configurations

Factory default parameters are now automatically set to recommended values for the SM2BAT192x2 and SM2BAT384 configurations if the corresponding daughter cards are installed. With prior releases, the defaults were for non-ultrasonic recordings only.

Version 2.3.6

Manufacturing diagnostics update

Revisions to manufacturing diagnostics

Version 2.3.5

Fix bug introduced in 2.3.4

The fix in 2.3.4 broke support for uncompressed ultrasonic recordings, now corrected.

Verison 2.3.4

Fix bug writing to uncompressed ultrasonic rates

There was a bug that under some circumstances would cause dropped sectors in .wav output files resulting in lost time and phase discontinuities. This generally only happened at ultrasonic sampling rates without compression and has been fixed.

Version 2.3.3

Add support for GPS way points in WAC files

New WAC format with GPS way points each second is used if a GPS signal is acquired. Wac2Wav 3.0 and Song Scope 3.4 support this format and make it possible to extract location information from the recordings.

Version 2.3.1

Add support for GPS time synch

Added UART driver and time synchronization capability for optional GPS option when installed.

Version 2.2.6

Fix bug writing to uncompressed ultrasonic rates

There was a bug that under some circumstances would cause dropped sectors in .wav output files resulting in lost time and phase discontinuities.

This generally only happened at ultrasonic sampling rates without compression and has been fixed.

Version 2.2.5

Bug Fix - Correct cold weather problems

Previous fixes to correct known cold weather problems were incomplete. This release now appears to resolve the issue once and for all after more extensive testing. The problem could affect flash card detection and push button responsiveness in cool weather.

Version 2.2.4

Add support for SM2BAT384

This version works with the 384kHz SM2BAT daughtercard.

Version 2.2.2

Bug Fix - Recording hang after upgrading to 2.2.1

There was a bug in which upgrading from 2.1.5 to 2.2.1 caused recordings to fail unless power is disconnected from the SM2 after an upgrade, not just a reset. There is a remote possibility of other issues arrising from the root cause of the problem that is now corrected.

Bug Fix - Advanced Schedule now reset after time change

The advanced schedule state is now reset if you change the time.

Version 2.2.1

Bug Fix - Buttons Not Responding in Cold Weather

When making back-to-back recordings (e.g. not going to sleep and then waking up again), there was a possible firmware problem that, in colder weather, could cause the pushbuttons to become unresponsive. This has been corrected.

Version 2.2.0

New Feature - Real-Time-Expansion Detector for Bats

Now with ultrasonic recording (with 192khz or 384khz boards installed), our new patent pending Real-Time-Expansion produces a frequency divided output at the headphones so you can listen to bats in real-time. Unlike other detectors, however, the detailed spectral characteristics of the original ultrasonic echolocation calls are preserved so you hear nice short whistled sounds, not the scratchy sounds common in legacy frequency division bat detectors.

New Feature - Support for Steinhart-Hart Sensors

Now SM2 can calculate Steinhart-Hart equations for more accurate temperature readings from external thermistor sensors.

New Feature - Support for Half and Quarter Timezones

Now SM2 supports half and quarter timezones for our customers in locations where this is required.

Version 2.1.7

Bug Fix - Running Schedule after Load Configuration

There was a bug that caused Song Meter to hang on the next recording if a configuration file is loaded and the “Wake/Exit” button is pressed without first resetting the Song Meter or removing and reinstalling the batteries.

Bug Fix - Intermittent Hang with some Flash Cards

There was a bug that caused Song Meter to hang with some flash cards with slow response times.

Bug Fix - Corrupted Directories after Reset during Recording

There was a bug that caused Song Meter to corrupt directories under some conditions if a recording terminated unexpectedly by loss of power or the reset button.

Version 2.1.4

Bug Fix - Solar Tracking with SM2BAT

There was a bug that caused solar calculations for sunrise and sunset times in the advanced schedule to fail after making ultrasonic recordings resulting in unpredictable scheduling. This has been corrected.

Version 2.1.3

Bug Fix - Compatibility with old SD1.0 Cards

There was a bug that caused old SD1.0 cards (not SDHC/SD2.0 cards) to report that they were more full. This has been corrected.

Version 2.1.1

Support for SM2BAT 192kHz Stereo Daughtercard

Add support for the SM2BAT daughter card. If this card is installed, then a 192kHz sample rate choice becomes available in the audio settings menu and the advanced scheduling SET command.

If the 192kHz sample rate is selected, the daughter card is used to sample audio from the preamplifier stage (the audio settings for left and right gain will have no effect as these are only used for sample rates <= 48000kHz).

Support for lossless compression formats

The lossless WAAC compression format is now known as WAC0. Additional lossy compression formats are now available from the audio settings menu. These include WAC1 through WAC8 and represent the number of least significant bits dropped from the original 16-bit sample.

Each bit represents a dynamic range of approximately -6dB full scale, so 16 bits can represent -6x16 =-96dBV full scale.

However, the typical configuration of microphones and gain settings used with Song Meter result in a noise floor well above -96dBV such that some number of the least significant bits contain only random noise and no useful

information. By ignoring these bits, better compression ratios can be achieved.

For example, SMX-II microphones have a signal-to-noise ratio of 62dB and a sensitivity of no worse than -40dBV/pa. If amplified +48dB, then the noise floor would be -40 - 62 + 48 = -54dBV. This can be represented in 9 bits (54/6). So using only the 9 most significant bits will result in no appreciable loss in audio quality and the WAC7 format can be used. (Since this is on the edge and some individual SMX-II may have better SNR, WAC6 may be a better choice).

The SMX-US ultrasonic microphones have a signal-to-noise ratio of 59dB and a sensitivity no worse than -50dBV/pa. If amplified +48dB, then the noise floor would be -50 - 59 + 48 = -57dBV. This can be represented in 9.5 bits (57/6). So using only the 10 most significant bits will result in no appreciable loss in audio quality, and theWAC6 format can be used.

Lossless compression can achieve compression ratios better than 5:1. Actual compression ratios will vary depending on the actual audio samples present. The new lossless formats are supported by SMConfig 2.1.0, WAC2WAV 2.0.0, and SongScope 3.0.0. WAC0 is compatible with older versions.

Advanced Audio Settings

A set of advanced parameter settings have been added to the audio settings menu.

Digital Band-Pass Filtering

Each channel (left and right) can have a low-pass and/or a high-pass digital filter applied. The low-pass filter allows frequencies below a certain threshold to pass while filtering higher frequencies while a high-pass filter allows frequencies above a certain threshold to pass while filtering lower frequencies.

The corner frequency of these filters is a ratio of the selected sample rate with the following ratios available: 1/3, 1/4, 1/6, 1/8, 1/12, 1/16, 1/24, 1/32, 1/48, 1/64, and 1/96.

For example, if using 192kHz sampling rate, setting a high-pass filter of 1/8 and a low-pass filter of 1/3 will allow frequencies between

24kHz and 64kHz to pass through while filtering out frequencies below 24khz and above 64kHz.

Filtering out unwanted frequencies can improve compression ratios by removing portions of the signal that are not of interest.

The band-pass filter is also used for the new triggering feature described below.

Band-Pass Triggering

Band-pass triggering can be used to reduce flash card storage requirements by saving only those portions of audio containing energy in a selected frequency band.

A digital high-pass filter, and optionally, a digital low-pass filter, can be configured as described above to define a band of frequencies of interest.

When a signal is detected exceeding a specified threshold, Song Meter begins recording until no such signal is detected for a specified period of time.

When using WAC0-WAC8 compression, Song Meter can trigger independently on either the left or right channel, and highly compressed zero-frames are inserted into the data stream to maintain an accurate time stamp of triggered events. The new trigger-aware WAC formats are supported by SMConfig 2.1.0, WAC2WAV 2.0.0, and SongScope 3.0.0.

When using uncompressed WAV format, Song Meter will skip samples that are not triggered by either the left or right channel. The file will be shortened, and there will be no information about the timing of triggered events within the recording file.

The left and right channels can be triggered independently.

There are two kinds of triggers supported. Relative triggers indicate a threshold above the background noise levels (+1dB to +88dB SNR). When a relative trigger is specified, Song Meter measures the rolling average energy in the band and looks for an event that exceeds this background level by the value specified. A value of +6dB works fairly well in many situations. Increasing the value will make the trigger less

sensitive. The other kind of trigger is an absolute trigger measured in dBV from -88dBV to -1dBV RMS.

The trigger window can be specified in 0.1 second increments from 0.1 to 9.9 seconds. When no trigger is detected for the specified period of time, the recording is turned off until the next trigger is detected. This is also the length of the window used to calculate the rolling average background levels used for the relative trigger described above.

Bug Fix - Problems in Cold Temperatures

There was an issue in 2.0.8 in which flash card detection and push buttons may not respond correctly at low temperatures.

Bug Fix - Loading Old Configuration Files

There was a bug in 2.0.8 in which loading a configuration file created with an old version of the Song Meter Configuration Utility could cause the sensor settings to become corrupted.

Bug Fix - Auto Exit Timeout and Wake Up

There was a bug in 2.0.8 as follows: If the Song Meter goes to sleep after 5 minutes of inactivity, and then is manually awoken by pressing the “Wake/Exit” button, the Song Meter would wake up. But instead of letting the operator enter the main menu, would immediately resume the recording schedule which may put the Song Meter back to sleep again. Reset clears the problem. Now Song Meter will wake up and enter the start-up display without resuming the schedule unless another 5 minute inactivity period elapses.

Bug Fix - Support for UTC+13

The Song Meter configuration utility did not allow UTC+12, and the Song Meter itself did not allow UTC+13 needed in some locations for daylight savings time near 180 degrees longitude such as New Zealand.

Version 2.0.8

Initial release

This was the first production firmware release for the SM2 platform.

