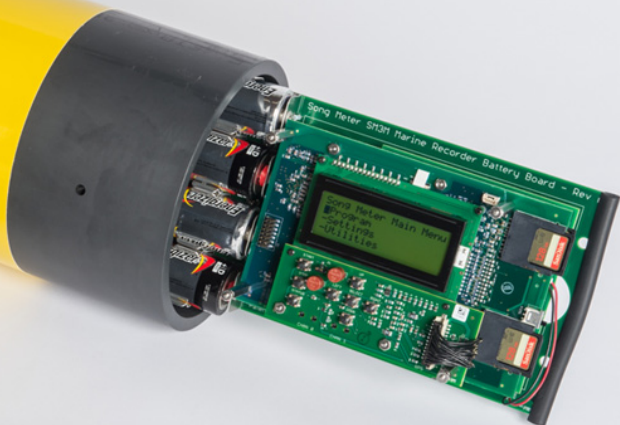


See Page 1 for  
Quick Start Guide.



# Song Meter SM3M Submersible and Deep Water

BIOACOUSTICS RECORDER

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Updated April 19, 2017

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# 1 Quick Start Recording Checklist

Complete the following checklist to start recording with the SM3 Marine.

- Remove the top cap and pull out the battery board with integrated LCD screen, keypad, and 4-slot memory card reader.
- Install up to thirty-two (32) new high-quality D size batteries in the *SM3M Submersible Edition* and up to sixty-four (64) batteries in the *SM3 Deep Water Edition* of the recorder. See 3.4 How to Install Batteries.

**NOTE:** The quantities above represent the maximum battery capacities for the longest deployment time. When testing the recorder, you can install fewer batteries.

- Insert at least one (1) and up to four (4) memory cards. See 3.5 How to Insert and Remove Memory Cards.
- Slide the power switch down to turn the recorder **ON**.
- The device powers on and reports its status. For example:

```
2016-Feb-19  19:02:39
SM3 12345    ULT R1.2.3
A:  0/64     B:  0/128
C:  0/128     D:  EMPTY
```

- After scanning the memory cards, the **Song Meter Main Menu** appears:

```
Song Meter Main Menu
-Program
-Settings
-Utilities
```

- Set the date and time. See 3.7 How to Set the Date and Time.
- Connect one (1) or two (2) hydrophones to the internal battery board in the ports marked Chan 0 or Chan 1. The recorder automatically detects the hydrophones and records on the appropriate channels (0, 1, or both). See 4.5 How to Deploy the Recorder.
- For programs based on sunrise or sunset, set the recorder location and time zone. See 3.8 How to Set the Location and Time Zone.
- Load a built-in program such as *30 min on/30 min off* or *24 Hours* for continuous recording. See 4.3 How to Load a Built-In Program.
- You may modify a built-in program on the recorder, but it is recommended to use the SM3 Configurator software on your computer. See Chapter 5.

- Press the **START** button to start the active program that you loaded. The SM3M knows when to enter sleep mode to save power and is also smart enough to wake itself up to record for the duration of your deployment.
- Replace and seal the top cap. See 4.5 How to Deploy the Recorder.
- Deploy the recorder at a suitable depth in any freshwater or saltwater environment appropriate for unattended recording. The device can be anchored and recovered via tether, diver, or optional acoustic release.

**NOTE:** As a simple hydrophone test out of the water, you can shout, make loud noises, or jingle keys (to simulate ultrasonic frequencies).

- Hours, days, or weeks later, the program ends, when the memory cards are full, or the batteries are depleted. You can also press and hold **STOP** for two seconds to finish any recording in progress.
- Remove the memory cards and review the recordings on your computer.



## 2 SM3 Marine Overview

### 2.1 Introduction

The Song Meter SM3 Marine (SM3M) is the most advanced, professional, cost-effective, and reliable next-generation solution for the periodic, seasonal, or long-term bioacoustic monitoring of dolphins, whales, and other marine wildlife in any underwater environment.

You can deploy the recorder where you want and program it to record when you want for as long as you want. The SM3M has the battery life and memory capacity to record for hundreds of hours and can be used in any marine environment including freshwater or saltwater for extended durations lasting days, weeks, or even months at a time. Take the rugged heavy-duty Submersible Edition with you anywhere. A special Deep Water Edition of the SM3M is also available for even more demanding deep water deployments.

The SM3M allows you to record at sample rates as high as 384 kHz on one channel and up to 256 kHz on two channels (192 kHz in WAC mode) simultaneously.

Use the available Kaleidoscope™ software, sold separately, to view spectrograms of your recordings or quantify the noise levels using several standard metrics.

### 2.2 What's New in the SM3M

The latest generation in the Song Meter series, the SM3M is designed to be the most reliable, easy-to-use, and most technologically advanced bioacoustics recorder on the market.

#### Unparalleled Reliability

- New heavy-duty hydrophone cage offers greater protection.
- The SM3M is protected by a 1-year limited warranty and is backed by our legendary Wildlife Acoustics support. If you experience an issue during the warranty period, we can help. We may even be able to assist you with an issue for a product that is no longer covered by the original warranty.

#### Improved Usability

- The SM3M alerts you about any warnings or errors when you load, edit, or run a program.
- The new programming language is powerful, flexible, and easy to use.

- No more complex audio hardware settings to manage. You can control all parameters in the program.
- Control gain and filters programmatically.
- Automatic setup allows you to begin recording right out of the box. Connect one or two hydrophones on channel 0, 1, or both, load a built-in program, and press **START**. You can capture the recordings and edit the program details later.
- Recognizes hydrophones to provide auto setup, warnings, and errors.
- Complete control over all internal parameters means much finer control of trigger and scrubber settings for advanced users.
- The **STATUS** button lets you see the current state of the unit. Check card usage, battery voltage, and more.
- Metadata is embedded in recordings and self-diagnostics to enhance customer support. The metadata contains all information about a recording including its source program, gain settings, and hydrophone type.

### Advanced Technology

- All new circuit design.
- Longer battery life:
  - New design is extremely efficient at all voltages.
- Choose from Standard, High-SPL, Low Noise, or Ultrasonic hydrophones.
- Built-in serial communication. Plug a GPS right in for time synchronization or location logging.
- A temperature-controlled crystal maintains clock accuracy at extreme temperatures and reduces clock drift.
- Native SDXC support – no reformatting needed.
- Better compatibility with all SDHC and SDXC cards. All class 4 or faster cards are supported at any sample rate.
- A *nap* mode allows for the recorder to enter a low-power state in between triggers to further conserve battery life during ultrasonic recordings of marine mammals. Nap mode can improve the already improved battery life by up to 50%.
- Record on two channels at sample rates up to 256 kHz or on one channel at up to 384 kHz.

## 2.3 Updates and Support

SM3M is field-upgradeable. New features, fixes, and improvements are available in firmware updates from our website. The *SM3 Configurator* software notifies you when new firmware is available. See 9.4 How to Update the Firmware on page 64.

### 2.3.1 How to Join Our Mailing List

Join our mailing list to receive important news and information about your Song Meter and related products, features, and events.

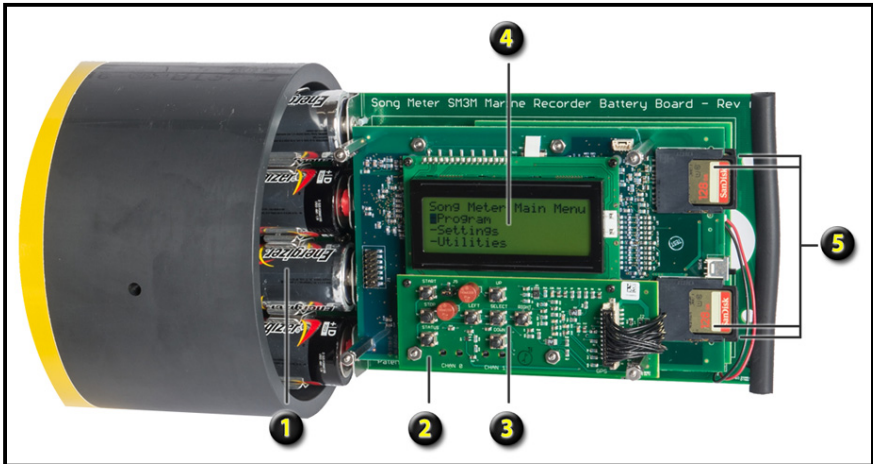
1. Open a web browser on your computer or mobile device.
2. Navigate to [www.wildlifeacoustics.com](http://www.wildlifeacoustics.com).
3. Click **Contact Us**.
4. Click **Join Our Mailing List**.
5. Complete the online form and click **Add to Mailing List**.

### 2.3.2 How to Contact Support

We have full-time support staff ready to assist you.

- Email: [support2017@wildlifeacoustics.com](mailto:support2017@wildlifeacoustics.com)
- In the United States (toll-free): 1-888-733-0200
- Outside the United States: +1 978-369-5225

## 2.4 SM3M Visual Tour



- 1 **Battery Bay:** Install up to 32 D-cell batteries for SM3M Submersible models and up to 64 batteries for SM3 Deep Water models.
- 2 **Start, Stop, and Status Buttons:** Press the **Start** button to initiate a program. The program instructs the recorder when to start and stop recording. Press the **Stop** button to manually stop a program and any recording in progress. Press the **Status** button to check the status of the device.
- 3 **Navigation Buttons and Select Button:** Use these keypad buttons to navigate through the menu options on the LCD screen and control the device.
- 4 **LCD Screen:** View the menu options and status information.
- 5 **Memory Slots:** Insert up to four (4) SDHC or SDXC memory cards. Supports up to 2 TB (currently 256 GB is the maximum capacity being manufactured). Remove the top cap to access the SD card slots and power switch.

All batteries, memory cards, LCD display, and keypad controls are mounted inside the water-tight enclosure to protect them from marine conditions.

**NOTE:** Do not disassemble the components inside your recorder. There are no user-serviceable parts and attempting to disassemble or repair the device will void your warranty. Follow the instructions in this guide.

The graphic below shows the actual arrangement of buttons on the keypad to help you understand the function of each button.

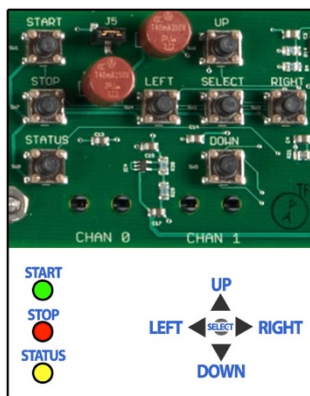
Press the directional arrow buttons while viewing the menu options on the LCD screen to configure settings and program the recorder.

Press ▲ **Up** or ▼ **Down** to navigate lists of options. Press ► **Right** to advance to the next submenu or next value to the right. In most cases, press ► **Right** to save your changes. Press ◀ **Left** to cancel or go back to the last menu item. Press **SELECT** to navigate menus, select options, and to confirm entries.

**Start:** Closes any open menus and starts your current program. Depending on the schedule, the device may begin recording immediately or go to sleep until a scheduled recording event. If a program is already running, pressing this button does nothing.

**Stop:** Stops the active program and returns to the main menu. You may need to hold the button for a couple seconds to register in some modes. In an open menu, pressing this button does nothing.

**Status:** Press this button to view status information about the current state of the recorder.



**WARNING:** Do not allow water, moisture, dirt, or debris of any kind to come in contact with the internal parts of your recorder. Failure to follow the procedures in this guide may void your warranty.



- |          |   |
|----------|---|
| <b>1</b> | <b>Storage Case:</b> Rugged portable storage case protects the equipment and offers convenient handles and wheels for reliable transport.                                 |
| <b>2</b> | <b>Desiccant:</b> Your unit ships with five (5) packs of desiccant. Apply a desiccant pack inside the unit before each deployment.  |
| <b>3</b> | <b>Silicon Lubricant:</b> Apply to the O-Rings and flat surface points inside the top cap.  |
| <b>4</b> | <b>O-Rings:</b> Flexible and durable O-Rings protect seals against water.   |
| <b>5</b> | <b>Spanner Wrenches (Set of 2):</b> Identical set of two wrenches offer superior form-fitting grip and balanced torque required to apply and remove the threaded top cap. |

**NOTE:** The firmware running on the SM3M underwater recorders is also used in our terrestrial products including the SM3 for birds and frogs as well as the SM3BAT for ultrasonic recording. In addition, the SM3 Configurator software and programming logic include extensible AUTO features designed to share some common conventions. Therefore, you may see references on the LCD display and throughout this guide to features or other types of recording modes that may not be completely applicable for marine deployments.

## 2.5 The LCD Main Menu

Refer to the following table when navigating the main menu using the LCD screen and directional arrow buttons.

**Recorder Main Menu on the LCD Screen**

Menu Item	Description
<b>Program</b>	
Load Program	Choose a ready-to-run (and customizable) built-in program.
Edit Program	Edit, add, or delete command lines in a program.
Import Program	Import a program and associated settings from an SD card.
Export Program	Export a program and associated settings to an SD card.
<b>Settings</b>	
(Optional) You can also use the SM3 Configurator software to override the settings on any SM3M device.	
Sunrise/Sunset Type	Specify one of four recognized methods for calculating the sunrise and sunset.
Location	Specify the location using a prefix, Lat/Long, and time zone.
Prefix	Specify a short code to identify recordings from a specific program, project, location, or SM3M device; useful to project teams with multiple recorders.
Latitude	Specify the latitude of the SM3M anywhere on the globe in degrees north (N) or south (S) of the equator. Latitude is used in sunrise and sunset time calculations.
Longitude	Specify the longitude of the SM3M anywhere on the globe in degrees west (W) or east (E) of Greenwich. Longitude is used in sunrise and sunset time calculations.
Timezone UTC	Set the global time zone for your device.
Time and Date	Set the local date and time for your device.
Power Volt Cutoff	Specify a minimum voltage from 0.0 to 12.0 volts in 0.1 volt increments. If voltage falls below this value in a 24-hour period, the program is suspended. Use to protect certain battery types from over-discharge. Recommended setting for alkaline and NiMH is 4.0 V.
Ch 0 Sensitivity	Specify channel 0 hydrophone sensitivity from 0.0 to -299.9 dB in 0.1 dB increments. This value is saved in the recording metadata and may be used in future features.
Ch 1 Sensitivity	Specify channel 1 hydrophone sensitivity from 0.0 to -299.9 dB in 0.1 dB increments. This value is saved in the recording metadata and may be used in future features.
<b>Utilities</b>	
Export Diagnostics	Display useful status and troubleshooting information.
Set Factory Default	Reset the original device settings.
Calibrate Mics	Test the sensitivity levels of built-in and connected mics. <b>NOTE:</b> Does not apply for SM3 Marine recorders.
Format All Cards	Erase and reformat all SD cards. The original file system such as exFAT or FAT32 is preserved. <b>CAUTION:</b> All data on all memory cards is permanently lost and cannot be recovered.
Firmware Update	Update the recorder with a new firmware file in memory slot A.

## 2.6 Basic Operation

Typical operation of the recorder is represented in the following steps:

1. Configure the following key requirements of any deployment with your specific recording goals in mind:
  - a. **Power:** Insert batteries or connect another power source.
  - b. **Memory:** Insert and format memory cards.
  - c. **Location:** Identify an appropriate recording location and establish anchoring requirements for the duration of the deployment.

**TIP:** Use the *SM3 Configurator* software to estimate memory card requirements and power consumption for the program that you plan to run.

2. Load a program on the recorder. You can choose:
  - a built-in program already on the recorder
  - a program you edit on the recorder
  - a custom program that you design using the SM3 Configurator software and then import to the recorder on a memory card.
3. Press the **START** button.
4. Deploy, anchor, and secure the recorder.
5. The recorder *sleeps* until the next scheduled recording time.
6. The recorder *wakes* at the scheduled recording start time, records audio as programmed, and saves recordings on one or more memory cards.
7. After a period of time has elapsed (it might be several days, weeks, or even months), return and check on each recorder. To extend a deployment, bring the device to the surface and exchange the memory cards and install fresh batteries in a dry environment.
8. At the end of the deployment, remove the device from its underwater location, eject all memory cards in a dry environment, and examine the recorded output.
9. Clean, re-program, and prepare the recorder for its next assignment.



## 3 SM3 Marine Setup

### 3.1 Required Items

You need at least the following required items to operate the recorder:

- **Memory Card** for installing firmware updates and saving audio files. Insert at least one (1) and up to four (4).
- **Batteries** to power the recorder. Insert a maximum of 32 or 64 depending on model.
- **Program File** to determine when to record and other settings. Choose one of the built-in programs or your own custom program.
- **Integrated Hydrophone** to capture marine recordings. Choose from four types.

### 3.2 Hydrophones

SM3M Low Noise, Ultrasonic, Standard, and Hi-SPL Hydrophones (Left to Right)



The Standard Acoustic hydrophone is used to record whale songs, dolphin whistles, and/or ambient noise levels, from infrasonic into ultrasonic frequencies.

With the Ultrasonic upgrade, additional circuitry and the Ultrasonic hydrophone increases the recording bandwidth of the system to allow recordings not only from ultrasonic dolphin and porpoise echolocation calls, but also ultrasonic anthropogenic sounds as well.

The low-noise hydrophone is for recording ultra-quiet environments such as remote marine sanctuaries, deep-water locations or long-range, offshore sites. It has a lower noise floor than the standard hydrophone over its entire recording bandwidth.

**NOTE:** For low noise applications, a sample rate of 96,000 Hz or under should be selected. Higher sample rates use a separate signal path that has a higher noise floor. See the Specifications section for more information.

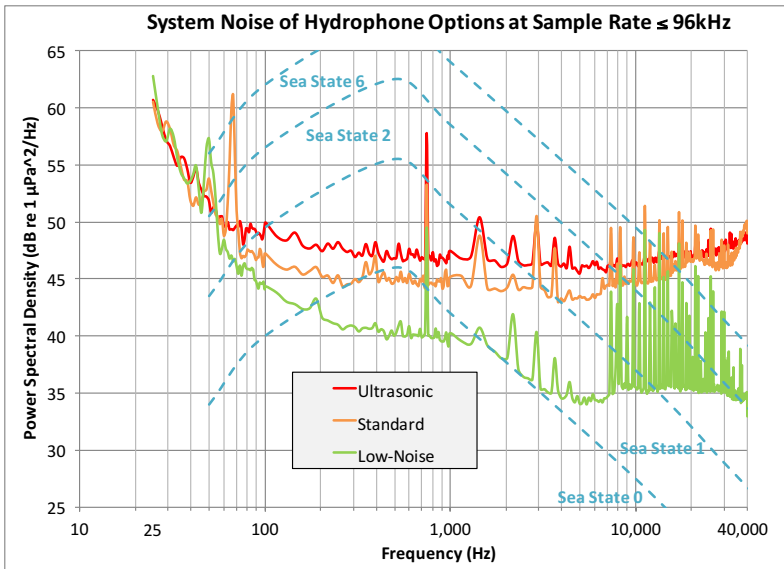
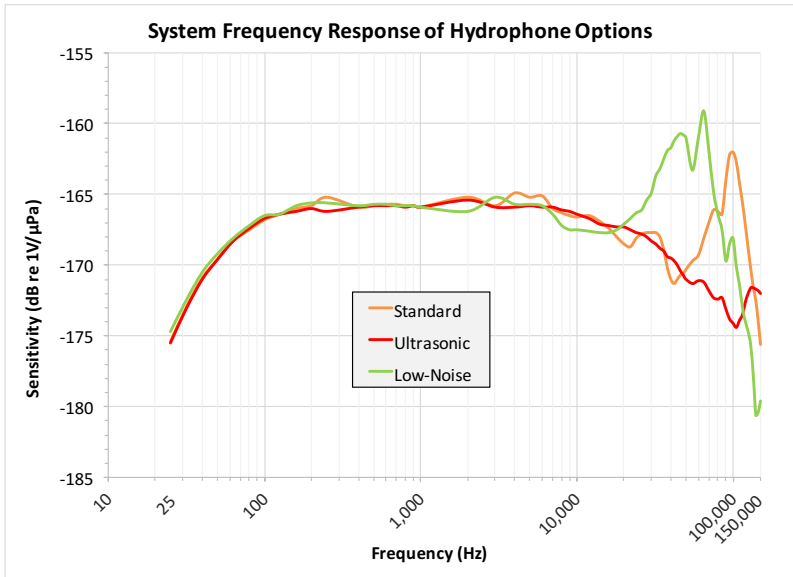
The High-SPL is specifically tailored to recording and quantifying high sound pressure levels such as those produced by pile drivers and air guns. When combined with any of the other hydrophones in a dual hydrophone configuration, the unit can record quiet or distant sounds from any source including marine life with one hydrophone, and at the same time accurately record and quantify very loud sounds from anthropogenic sources with the High-SPL.

The sensitivity of each hydrophone is calibrated to a 0.1 dB resolution by the hydrophone manufacturer. This value appears on a tag attached to the hydrophone cable and is reported as the average value over the band from 200 Hz to 1.6 kHz in increments of 100 Hz. From the recording bandwidths below you can extrapolate sensitivity across the rest of the frequency range with some degree of accuracy, as they are quite consistent in response.

#### Hydrophone Recording Bandwidth and Dynamic Range

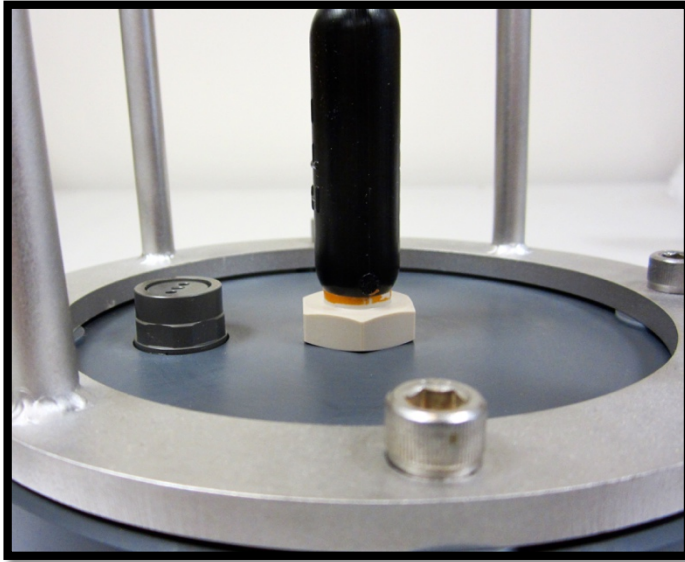
Hydrophones	± 5 dB Recording Bandwidth (Hz)	Dynamic Range (db SPL)
Standard Acoustic	2 – 48,000	78 – 165
Ultrasonic	2 – 192,000	81 – 165
Low-Noise	2 – 80,000	56 – 165
High-SPL (Dual Config with Standard)	2 – 48,000	78 – 240

Response and Noise Charts (testing done by the National Physical Laboratory in the UK)



### 3.3 Pressure Release Valve

A pressure release valve is installed on the top cap next to the hydrophone. The pressure release valve prevents dangerous pressure build up greater than 10 PSI within the enclosure by releasing air through the valve. No maintenance is required to the valve and it should not be removed. It should be verified that it is hand tight before deployment.



### 3.4 How to Install Batteries

You can use standard D sized alkaline or NiMH batteries. Use a minimum 8 batteries even for shorter deployment. Though the SM3M will power with only 4 batteries installed, it will not have a long life because the protection diodes will have a significant voltage drop with only one bank of batteries.

Prior to installation, we recommend that you test all batteries with a high-quality pulse load battery tester such as the ZTS MINI-MBT.

**NOTE:** Do not mix batteries of different types. Do not mix old and new batteries.

1. Remove the top cap.



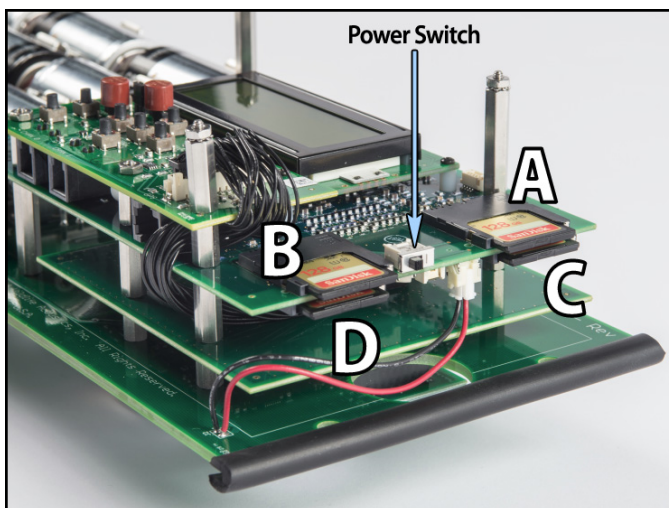
series. To use 3.0-3.3V cells, the board must be removed and rotated 180 degrees and reinstalled. This configures the battery cells in parallel groups of 2. There is a small white arrow on the main battery board that aligns with the arrow on the diode board as shown in the 1.5V position below.

Batteries must be inserted in the proper groupings which are labeled A through H on the battery board. For 1.2 and 1.5 volt cells, all four battery holders corresponding to a letter must be populated. Letters C and F have two on the back and two on the front. For 3V cells, only two of each letter must be populated. If not filling all available battery positions, it is best to populate the letters closest to the bottom as that will help the SM3M float vertically.

### 3.5 How to Insert and Remove Memory Cards

Insert a memory card in slot A when you want to update the firmware, import or export a program, or capture recordings from a program. Replace cards when all storage space is consumed by recordings. To capture program recordings, you can insert up to three (3) additional cards.

1. In a dry environment, remove the top cap.
2. Pull the battery board from the housing using the large finger hole at the top of the board.
3. Press **STOP** to stop the current program or command.
4. Refer to the memory slots using the letters A, B, C, and D as shown below. You must insert at least one card and it must be in slot A.



5. To remove a card, lightly push it forward and then feel it release from the slot and pull it out.

6. To insert a card, lightly push it forward until each card is secure. Insert at least one card and up to three additional cards.
7. Re-apply the top cap.

**TIP:** Insert multiple SD memory cards to take advantage of failover capabilities. If an error occurs on one card, the SM3M can continue writing data on another card.

If the recorder is unable to write to all available SD cards, one of the following errors appear:

```
2016-Jan-31 09:00:00
CARDS FULL, ERROR, or DIRTY
0: 24000 --- -----
1: 24000 --- -----
```

A card marked "DIRTY" indicates that a critical write operation affecting the file system (typically at the very beginning or ending of a recording) was interrupted due to an unrecoverable error or power failure. The Song Meter SM3 will avoid further use of a "DIRTY" card to avoid further card corruption that could lead to unrecoverable data loss. "ERROR" indicates some other flash card problems. The "DIRTY" condition can be cleared by accessing (writing) the card on your host computer or by reformatting the card using the SM3 on-board formatting utility.

**NOTE:** During a recording, do not remove memory cards. Replace cards only when the unit is in sleep mode or when power is **OFF**. In some cases, removing and/or inserting a memory card while the device is recording (often called *hot-swapping*) may cause the recorder to restart.

## 3.6 How to Turn Power ON and OFF

You can set the power selection switch to use internal power from thirty-two (32) D-size batteries (alkaline or NiMH) or sixty-four (64) with the Deep Water product configuration. The power selection switch is located on the top end of the battery board in between the memory slots.

Set the power switch down to turn the unit **ON** using internal battery power. When not in use, set the switch up to turn the unit **OFF** and conserve battery power.

**NOTE:** Do not turn the power **OFF** when a recording is in progress. To safely exit from recording, press **STOP PROGRAM**, allow the recorder to return to the main menu, and then power down the device.

**NOTE:** Avoid quickly switching power **OFF** and then **ON** again. The unit can interpret this sudden loss and restoration of power as an error and may start diagnostics.

When you turn the power **ON** the following LCD screen appears:

2016-Jan-31	09:00:00
SM3 99999	ULT R1.3.5
A: 2/128	B: 0/128
C: 0/128	D: 0/128

The same information appears when the unit wakes from sleep and starts itself as programmed. The startup screen shows the following information:

- The current date in YYYY-MMM-DD format.
- The current time in HH:MM:SS format.
- The model number and serial number for the recorder.
- ULT appears on SM3M models and indicates ultrasonic features.
- The firmware version. For example, R1.3.5.
- For each card slot (A, B, C, and D) the memory used as a fraction of the total capacity in GB.

**NOTE:** *WP* will appear in place of the consumed memory for any card with a write-protection switch ON.

## 3.7 How to Set the Date and Time

You can set the current date and time for the recorder.

**NOTE:** The recorder does not automatically adjust for daylight savings time.

As you adjust the month and day, the unit calculates and displays the next sunrise and sunset times for your reference.

As you adjust the month and day, the unit calculates and displays the next sunrise and sunset times for your reference. The date and time set on the recorder are used to calculate when a program starts, how long it runs, and when it ends. The recorder date and time are stamped on the recorded output files.

1. At the **Song Meter Main Menu**, select **Settings**, and press **SELECT**.
2. Select **Time and Date** and press **SELECT**.

The date and time appear on one line in the following format:

YYYY-MMM-DD HH:MM:SS

For example:

2015-Oct-22	20:17:45
-------------	----------

3. Press **SELECT** or **▶ Right**.  
The cursor flashes on the last digit of the year.
4. To adjust the year, press **▲ Up** or **▼ Down**.



5. Press **SELECT** or **▶ Right** to set the month.
6. To adjust the month, press **▲ Up** or **▼ Down**.
7. Press **SELECT** or **▶ Right** to set the numeric day of the month.
8. To adjust the date, press **▲ Up** or **▼ Down**.
9. Press **SELECT** or **▶ Right** to set the hour.
10. To adjust the hour, press **▲ Up** or **▼ Down**.
11. Press **SELECT** or **▶ Right** to set the minute.
12. To adjust the minutes, press **▲ Up** or **▼ Down**.
13. Press **SELECT** or **▶ Right** to set the second.
14. To adjust the seconds, press **▲ Up** or **▼ Down**.  
At this point in the procedure, you have explored all of the options for changing date and time values.
15. (Optional) To go back and make any changes, press **◀ Left**.  
Press **▶ Right** to return to the seconds value.
16. Press **SELECT** or **▶ Right** to apply your changes. The cursor moves back to the first digit of the year and then applies your changes.
17. Press **◀ Left** two times to return to the main menu.

**NOTE:** To accelerate the pace when adjusting the date and time values, press and continue to hold down the **▲ Up** or **▼ Down** arrow buttons.

## 3.8 How to Set the Location and Time Zone

The selections you make for latitude, longitude, and time zone (in conjunction with the sunset/sunrise solar calculation type) enable the recorder to make adjustments and determine a specific sunrise and sunset time for each day.

**NOTE:** If you import a program with custom coordinates, a new prefix, UTC settings, and other check box items from the **Configuration Settings** section of the *SM3 Configurator* software, the new values from the program automatically override the original settings on the recorder.

You can specify the local time zone (as used to set the clock) in hours relative to UTC (Universal Time Coordinated). Half and quarter time zones (:00, :15, :30, :45) are also supported.

**NOTE:** The recorder does not automatically adjust for daylight savings time.

Use the following steps to set the latitude, longitude, and time zone.

1. At the **Song Meter Main Menu**, select **Settings**, and press **SELECT**.
2. Select **Location** and press **SELECT**.
3. On the **Location Settings** screen, press **▼ Down** to select **Latitude**.
  - a. Press **▶ Right**.

- b. To enter degrees of latitude north of the equator, press ▲ **Up**.
  - c. To enter degrees of latitude south of the equator, press ▼ **Down**.
  - d. Press ► **Right** to enter minutes.
  - e. Press **SELECT**.
4. On the **Location Settings** screen, press ▼ **Down** to select **Longitude**.
    - a. Press ► **Right**.
    - b. To enter degrees of longitude west of the prime meridian, press ▲ **Up**.
    - c. To enter degrees of longitude east of the prime meridian, press ▼ **Down**.
    - d. Press ► **Right** to enter minutes.
    - e. Press **SELECT**.
  5. On the **Location Settings** screen, press ▼ **Down** to select **Timezone**.
    - a. Press ► **Right**.
    - b. To specify one of the time zones ahead of 0:00 UTC, press ▲ **Up**.
    - c. To specify one of the time zones behind 0:00 UTC, press ▼ **Down**.
    - d. Press ► **Right** to specify additional 15-minute increments adopted by certain regions between two time zones.
    - e. Press **SELECT**.

## 3.9 How to Set the Solar Calculation Method

Song Meter can be used to schedule recordings relative to sunrise and sunset times, and adjusts these times as they change during the year. You can choose from four different recognized methods of calculating the sunrise and sunset.

1. At the **Song Meter Main Menu**, select **Settings**, and press **SELECT**.
2. Select **Sunrise/Sunset Type** and press **SELECT**.
3. At the **Sunrise/Sunset Type** menu, the **Solar** item is already selected.
4. Press ► **Right** to advance to the current solar calculation method.
5. Press ▲ **Up** or ▼ **Down** to advance through the following list of choices:
  - **Sunrise/set**: The sun is just below the horizon.
  - **Civil**: The sun is 6 degrees below the horizon.
  - **Nautical**: The sun is 12 degrees below the horizon.
  - **Astronomical**: The sun is 18 degrees below the horizon.
6. The calculated sunrise and sunset times for the method that you select appear as if they were occurring today. For example:

<b>Sunrise/Sunset Type</b>	
-Solar	Nautical
Rise 05:12	Set 18:57

7. Press **SELECT** to save your changes.
8. Press ◀ **Left** to return to the **Song Meter Settings** menu.

**NOTE:** Sunrise and sunset calculations require other settings including your location (latitude and longitude) and time zone.

## 3.10 How to Change the Prefix for Recorded Files

You can specify a filename prefix of up to 12 characters that appears in the recording file names to label every recording made by a specific program or recorder. For example, you can use one prefix (PROJECT-01) in a single program to tag all recordings from all devices linked to that single program or project. Or, you can use multiple unique prefixes on each recorder to tag recordings by location and device.

**NOTE:** The prefix can only contain capital letters, numbers, and hyphens.

The default prefix set by the hardware is the serial number of the recorder. You can edit this value on each device or override the prefix with a new one in the program file that you create using the *SM3 Configurator* software.

1. At the **Song Meter Main Menu**, select **Settings**, and press **SELECT**.
2. Select **Location** and press **SELECT**.
3. At the **Location Settings** menu, select **Prefix**, and press **▶ Right**.
4. Specify a 1 to 12 character prefix:
  - a. At the first position, press **▲ Up** to cycle through the alphabetic characters A to Z. Press **▼ Down** to cycle through the numbers 9 to 0. You can also select a hyphen.
  - b. Press **▶ Right** to advance to the next position in the prefix and repeat the previous step.

## 3.11 How to Verify the Device and Audio Settings

A quick way to test the device is to load the built-in 24-hour recording program. Complete the following steps to verify the recorder is working.

1. Press **STATUS** two times in sequence.
2. Verify that Mic0 and Mic1 show the attached hydrophones.
3. Insert an SD card into one of the memory slots.
4. Load the 24-hour recording program and press **START**.
5. Make audible sounds (talk or clap hands) and ultrasonic sounds (jingle keys).
6. After a few minutes of recording time, press **STOP**.
7. Remove the memory card and insert it in another computer, laptop, or mobile device.

- 8. View the recorded .wav or .wac file spectrogram. The filename should include the prefix set on the device or set by the SM3 Configurator if you loaded a custom program. For example:

ARIZONA-1234\_0+1\_20160104\_152209.wav

### 3.12 How to Check the Status of the Recorder

You can check the status of the recorder. Always perform this procedure to check the status of the recorder and memory cards before a deployment.

- 1. Press the **STATUS** button one time and quickly release the button.
- 2. If a program is loaded, the following screen appears:

```
2016-Jan-31  18:00:00
Going to sleep until
2016-Feb-01  13:00:00
```

To conserve power, the device enters sleep mode until the program starts.

- 3. Press and hold down the **STATUS** button for a full second.
- 4. The LCD screen backlight illuminates and an initial status screen appears.

```
2016-Jan-31  19:03:48
SM3 00123    ULT R1.2.3
A:  2/128   B:  0/128
C:  0/128   D:  EMPTY
```

See 3.6 How to Turn Power ON and OFF on page 17 for more details.

**NOTE:** *WP* will appear in place of the consumed memory for any card with a write-protection switch ON.

- 5. After a short delay, the screen resets and the backlight turns off to save power.
- 6. Press **STATUS** and then press **STATUS** a second time. A second status screen appears after the first one. This screen shows the current battery voltage and temperature. In both of the following examples, an integrated ultrasonic hydrophone is connected on channel 0.
  - a. In this example, the unit is not currently recording; however, it has been programmed to start recording at the date and time shown:

```
Bat  5.9V    Temp 11.70
Mic0: U1    Mic1: NA
Next recording at:
2016-Feb-01  05:30:00
```

- b. In this example, the unit is currently recording on hydrophone 1 at a sound level of 41.1 dB.

```
Bat 5.9V      Temp 16.70
Mic0: NA      Mic1: U1
0:  -----/--
1: *          -41.1dB/--
```

**NOTE:** New alkaline batteries should report 6 or more volts. The screen also shows the internal temperature of the recorder in degrees Celsius. This is intended for diagnostics and not to be an accurate measure of outside water temperature.

### 3.13 Temperature Sensor

The recorder includes an integrated temperature sensor to log temperatures inside the enclosure. This is intended for diagnostics only. Heat from the circuit can significantly increase the temperature reading above ambient water conditions.

### 3.14 The Backup Clock Battery

The CR2032 clock battery lasts up to eight (8) years with normal use. During normal operation, the D cell batteries supply power to the clock. The clock battery is only a backup to preserve the time settings when there is no main power or the SM3M is turned **OFF**. The unit operates properly without the backup clock battery; however, whenever the main D batteries are depleted or removed, you will need to reset the clock.

# 4 SM3 Marine Deployments

Recording time is determined by the demands of your program and the available power and memory resources required to carry out the recordings. The SM3M can only record while it has sufficient power available in the batteries and room to save recordings on SD memory cards. Download our free *SM3 Configurator* software application to see detailed visual forecasts for remaining battery life and memory card utilization given your specific recording schedule and configuration.

## 4.1 Storage and Transport

The SM3M ships in a high quality case suitable for storage and shipment. The case has wheels on one end for ease of travel and two latches which can accept locks for security. The spanner wrenches, O-rings, lubricant, desiccant, and other needed supplies can also be stored inside.

Install the hydrophone cage when transporting the SM3M in the case as shown. This provides a tight fit and protection from possible impacts during transit.



## 4.2 How to Estimate Battery Life

In sleep mode between scheduled recordings, the SM3M uses almost no power (around 0.5 mW) so it can remain idle (not recording) for months at a time. However, the batteries will discharge on their own over time. Depending on accessories, sample rates, compression, and other variables, the SM3M can use as little as 500 mW of power when recording. Use the *SM3 Configurator* to estimate a recording schedule based on your program requirements.

The following table shows approximate recording longevity in days for a 100% and 50% duty cycle schedule in WAV recording mode. Since the recorder uses very little power while sleeping, longevity for lower duty cycles can be deduced by multiplying the shown values (25% would be double 50% for example).

Estimated Maximum Battery Life in Days

Number of Batteries	4kHz - 96kHz Sample Rate				192kHz - 384kHz Sample Rate			
	Alkaline		NiMH		Alkaline		NiMH	
	100%	50%	100%	50%	100%	50%	100%	50%
4	11	23	6.8	14	4	8	2.3	5
16	46	92	27	54	15	31	9	18
32	92	184	54	108	31	61	18	36
64	184	367	108	216	61	122	36	72

This assumes 20 degree Celsius water. Battery life varies and this should be taken as a maximum figure.

## 4.3 How to Estimate Memory Requirements

The following table shows estimated recording longevity in days for various card capacities and sample rates using WAC 0 lossless compression. With no compression (recording to WAV), expect longevity to be reduced by as much as 50%. (For example, at 96 kHz, a 512 GB card may only last 26 days instead of 51.) Lossy compressions are also available for even more compact storage.

Estimated Recording Time in Days (WAC)

Sample Rate (kHz)	32GB	128GB	512GB	1 TB
384	0.8	3.2	13	26
192	1.6	6.4	26	51
96	3.2	13	51	103
48	6.4	26	103	206
16	19	77	309	617
4	77	309	1,235	2,469

### 4.3.1 Ultrasonic Recording

In a typical 10-hour period with echolocation activity (and no rain, wind, or waves), you need about 0.5 GB for a stereo recording. Even with gusty winds, waves, or currents causing false triggers, you only need about 2.0 GB per day or night. In WAV mode, since files are scrubbed for non-marine recordings, you need even less. A 32 GB card can last for 2-8 weeks.

### 4.3.2 Acoustic Recording

Acoustic recordings without triggers consume 2 bytes (16-bits) per sample, times the sample rate, times the number of channels per second. For example, a recording made at a sampling rate of 24,000 samples per second in stereo (2 channels) consumes  $2 \times 24,000 \times 2 = 96,000$  bytes per second. With 128 GB total capacity, an SD memory card of this size can record up to  $128,000,000,000$  divided by  $96,000 = 1,333,333$  seconds, or about 370 hours of recording time.

**NOTE:** The largest recording file size allowed is 2.0 GB. The recorder automatically breaks up large recordings into smaller segments to satisfy this requirement.

In most applications, there is no reason to use sampling rates faster (greater) than twice the frequencies of interest.

The following tables estimate the recording time in hours for .wav file output and different combinations of memory capacity, sample rates, and channels:



Estimated Recording Time in Hours (1-channel Mono WAV)

	96,000	48,000	44,100	32,000	24,000	22,050	16,000	8,000	4,000
8 GB	12	23	25	35	46	50	69	139	278
16 GB	23	46	50	69	93	101	139	278	556
32 GB	46	93	101	139	185	202	278	556	1111
64 GB	93	185	202	278	370	403	556	1111	2222
128 GB	185	370	403	555	741	806	1111	2222	4444
256 GB	370	741	806	1110	1482	1613	2222	4445	8889
512 GB	741	1481	1613	2221	2963	3226	4444	8889	17778
1 TB	1481	2963	3225	4442	5926	6451	8889	17778	35555

Estimated Recording Time in Hours (2-channel Stereo WAV)

	96,000	48,000	44,100	32,000	24,000	22,050	16,000	8,000	4,000
8 GB	6	12	13	17	23	25	35	69	139
16 GB	12	23	25	35	46	50	69	139	278
32 GB	23	46	50	69	93	101	139	278	556
64 GB	46	93	101	139	185	202	278	556	1111
128 GB	93	185	202	278	370	403	556	1111	2222
256 GB	185	370	403	555	741	806	1111	2222	4444
512 GB	370	741	806	1110	1482	1613	2222	4445	8889
1 TB	741	1481	1613	2221	2963	3226	4444	8889	17778

If you enable compression, you can typically increase recording capacity by 40% (compression rates vary with sample rates and site-specific ambient sound levels).

**NOTE:** Compression (.wac file format) consumes more processing power and offers decreased value as memory card prices fall while capacities continue to grow. For most wildlife recording projects, we recommend the uncompressed .wav file format.

### 4.3.3 Mixed Acoustic and Ultrasonic Recording

Estimating mixed recording schedules can be very difficult. Use the *SM3 Configurator* to determine battery longevity. The software understands the power used in both recording modes and can easily generate a calendar showing you a good estimate.

## 4.4 Depth Rating

**Submersible:** The SM3M PVC housing is conservatively rated to 500 feet (150 meters). This figure assumes a ten-year deployment life. In pressure testing, failure did not start until the equivalent pressure of about 1000 feet (300 meters).

**Deep Water:** Rated at 2,625 feet (800 meters).

## 4.5 How to Deploy the Recorder

With normal operation and high quality alkaline batteries, the SM3M can store multiple days of triggered recordings. The device enters a very low power state when not recording and uses negligible power between scheduled recordings.

The SM3M can be anchored and recovered via tether, diver or optional acoustic release. A high quality case is included for storage and transportation. See also Chapter 10: Specifications before deployment.



### 4.5.1 Install the Battery Board

Before installing the top cap and sealing the unit, perform these steps to secure the battery board.

1. Slide the battery board down into the recorder cylinder.

2. Verify that the neoprene edging is in place on the top and bottom of the board to provide a small layer of insulation and cushioning. When the top cap is tightened this holds the board in place and prevents movement during deployment.
3. Loop the hydrophone cable through the large finger hole at the top of the board twice. Looping the cable provides strain relief so the wire twists above the hole and not at the connection point. Always inspect the connector prior to sealing to make sure the wires are intact.
4. Plug the cable into either channel connector, or both if using two hydrophones. The channel connectors are both electrically tied together.



#### 4.5.2 Perform a Pre-Deployment Test

At this point it is prudent to run a final system test.

1. Verify that you installed at least one memory card in slot A.
2. Power **ON** the unit.
3. Initiate an instant recording by pressing the **▲ Up** and **▼ Down** buttons simultaneously on the keypad below the LCD screen. Or you can load the built-in 24 Hour program and press **START**.
4. Make loud sounds or use your voice.
5. Press **STOP**.
6. Eject the memory card and insert it into a bioacoustics analysis workstation or another computer.

7. Verify the sounds or vocalizations that you just recorded in the audio files on the memory card.
8. Press the **START** button and watch for an announcement of scheduled recording time if in the future or *preparing to record* if the program starts in the next few minutes. The LED light on the Song Meter board blinks once a second during a recording and once per minute when awaiting a scheduled recording.
9. Drop a desiccant pack into the bottom of the housing before re-installing the top cap.
10. Store remaining desiccant packs in air-tight resealable storage bags to prevent them from absorbing moisture.

### 4.5.3 Prepare the Top Cap

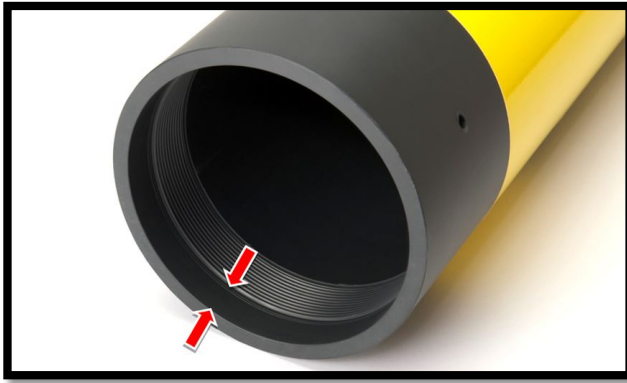
It is extremely important that the O-rings are clean, free of defects, and properly lubricated. The housing is sealed using two O-rings on the top cap. This is a redundant system. Only one O-ring is necessary to seal, but two are used to ensure a seal if one should become compromised.

**Note:** The SM3M ships with no O-rings installed. Follow the steps in this guide to install the O-rings. Without O-rings, the unit will not seal and is unsuitable for deployment at any depth.

1. Apply a small amount of the included lubricant to the entire O-ring, feeling for defects with your fingers as you apply.
2. Insert the two (2) O-rings on the cap as shown.



3. Apply a thin layer of lubricant all the way around the smooth inner circumference of the housing where the O-rings will mate as shown in the area between the two arrows below. This area and the O-rings should be free of dust, hair, and other debris.



**NOTE:** The SM3M package includes 4 O-rings, 5 packs of desiccant, and a tube of O-ring lubricant. Additional deployment supplies can be purchased from McMaster Carr ([www.mcmaster.com](http://www.mcmaster.com)). O-rings are part number 9557K334 and desiccant 5-pack is part number 2189K18. O-ring lubricant is part number 9463K33.

#### 4.5.4 Install the Top Cap

Follow these steps to install the top cap. Install the cap with the tube standing in an upright position.

1. Before inserting the cap, rotate the cap in the reverse direction of tightening four times. It takes eight turns to seal the cap. Loosen the cap with four turns to allow a maximum of four turns on the hydrophone cable.
2. Insert the cap. Gently place the cap into the tube opening. Verify that the cap is level.
3. In a single counterclockwise rotation, you should feel the cap fall into place with a click. At this point, the beginning of the threads are mated properly and the cap can then be installed by slowly rotating clockwise to tighten the cap onto the tube.
4. Rotate by hand to tighten the cap a couple turns to get it started. When the first O-ring engages, rotation becomes more difficult and requires the spanner wrenches.

**NOTE:** With the O-rings in place, the top cap can make one full rotation before the first O-ring is engaged by the tube. Further rotation requires more torque as the O-ring is compressed between the cap and the inside wall of the tube. With proper lubrication, it still does not require a tremendous amount of force even

after the O-rings are engaged. If rotation feels like it is too difficult or binding, stop and start over.

5. Insert the included spanner wrenches into the interfacing holes. One wrench interfaces with the two holes in the housing and the other interfaces with the 4 holes in the top cap. It is easiest to do the procedure while sitting atop the pipe (as though riding it). You can hold the housing wrench stationary and rotate the top cap, moving to a new hole as it is tightened.

**NOTE:** The wrenches are identical. They rotate in opposing directions to create a seal inside the threaded enclosure. Be careful to orient the wrenches as shown. Operating them backwards can easily break the small tabs.

6. Apply symmetric downward force as shown below to tighten.



7. Make six (6) more rotations. Turns are more difficult as the second O-ring engages.
8. Continue tightening until there is no gap between the top cap and the cylinder as shown below.

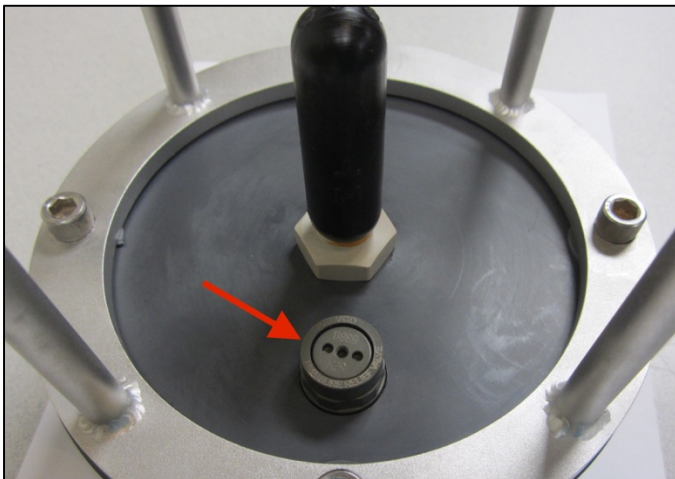


**NOTE:** It is critically important that the top caps be screwed on carefully to prevent cross threading and permanent damage to the watertight seal.

**TIP:** Without an O-ring installed on the top cap, the cap should screw all the way down until it is snugly mated to the tube effortlessly with no tools at all. Only a fingertip touch is required to spin the cap. It is recommended that you try this first to understand how easy it is to install the cap when properly threaded.



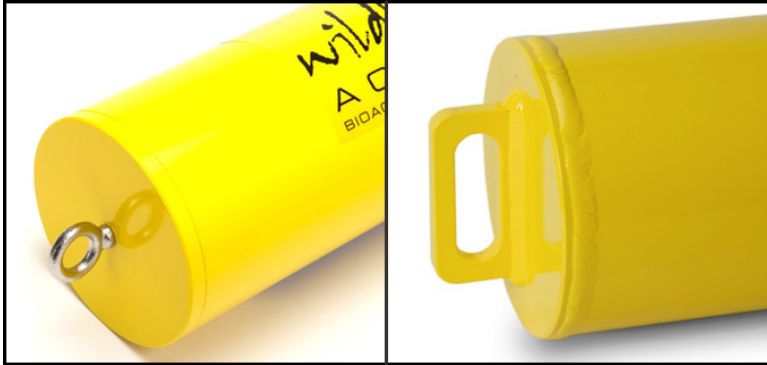
9. Make sure the Pressure release valve is hand tight.



10. Use the bottom flange to attach the recorder to an anchor system for underwater deployment.

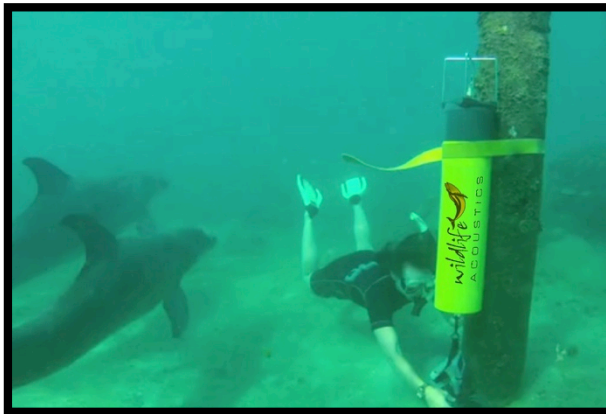
## 4.6 Anchoring Solutions

The SM3M Submersible model (shown at left below) can be anchored from the stainless steel eyebolt on the bottom of the housing. For the Deep Water Edition (shown at right below) there is a mounting bracket welded on the bottom.



The eyebolt was tested with a 150lb (68 kg) load. A heavier maximum load such as an anchor could be used underwater; however, do not exceed this limit as a best practice.

The unit can be tethered directly to an anchor for diver release, or tethered to a surface structure. Acoustic releases are commercially available which allow the unit to be released from the ocean floor by playing an acoustic signal from the surface. In this case, it is necessary to use a subsea float to increase the visibility of the housing when it surfaces.



The Deep Water unit is not positively buoyant with any batteries installed and will need additional flotation to return to the surface on its own.



**NOTE:** All metal hardware used on the SM3M is 316 stainless steel. If dissimilar metal is used for deployment that is near or contacting any of the hardware, a zinc or aluminum sacrificial anode should be used to prevent galvanic corrosion.

## 4.7 How to End a Deployment

Every deployment can be extended with proper maintenance. Deployments can also be temporarily suspended or end altogether. Follow the procedures in this section to end or extend a deployment.

### 4.7.1 How to Retrieve the Recorder

Regardless of method of retrieval, take care in getting the unit shipside not to damage the hydrophone. If planning on using hooks to snare the housing, it might be best to deploy with a ring of floating nylon line attached to the bottom eyebolt to give a hooking point. You can also attach rigging to the unit using large stainless steel band clamps around the length of the cylinder.

### 4.7.2 How to Remove the Top Cap

Follow these steps to remove the top cap and perform maintenance activities to extend or end a deployment:

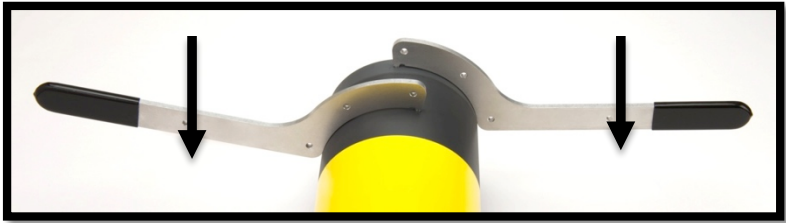
1. Clean the top of the cylinder to access the holes for the spanner wrenches. After a long underwater deployment, especially in shallow water, the unit may have accumulated significant biofouling.
2. On the SM3M Submersible, remove the cable tie around the hydrophone cage and pull the four cage legs from the top cap holes to fully remove the cage.

**NOTE:** Do not attempt to remove the cage on the Deep Water Edition. It is designed to remain attached to the top cap.

3. Insert the spanner wrenches in the top cap side holes.

**NOTE:** When sealing and removing the top cap, downward force is applied; however, the spanner wrenches are reversed. When unsealing the cap, the top wrench extends to the right and the lower wrench extends away from the cylinder to the left as shown. Be careful to orient the wrenches as shown. Operating them backwards can easily break the small tabs.

4. To remove the top cap, apply downward force to the spanner wrenches.



**DANGER:** Battery failures or water intrusion during deployment could cause the tube to become pressurized. Use extreme caution while unscrewing the cap. Orient the enclosure horizontally on a surface and aim in a safe direction before unscrewing the top cap. Wear safety goggles in case of the presence of corrosive chemicals from the batteries.

### 4.7.3 How to Maintain the Recorder

Whether you decide to redeploy the recorder or place it in dry storage, follow these maintenance steps.

1. Remove and clean the O-rings. If a tool is required, use only plastic tools to avoid damaging the smooth surface of the top cap where the O-ring sits.
2. Inspect the O-rings for signs of wear; replace worn or damaged O-rings.
3. Clean the top cap exterior, especially the O-ring area.
4. Clean the inside of the cylindrical housing especially where the O-rings make contact.
5. Discard the desiccant pack. It is not reusable and must be replaced before every deployment.
6. Inspect the entire unit for damage to the housing, attachment points, or hydrophone.
7. Verify that the hydrophone is still tightly secured to the top cap. The bottom of the hydrophone connector should make contact with the surface of the top cap.

**WARNING:** The hydrophone is a delicate instrument.

Do not attempt to remove the hydrophone from the top cap.

Do not drop, shake, or apply force or pressure to the hydrophone.

Never use it as a handle or pick up the recorder or top cap by the hydrophone.

Removing or mishandling the hydrophone will void your warranty.

# 5 Working with Programs

## 5.1 Introduction

The operating behavior of the SM3M is controlled by a program file. You can create and save multiple programs; however, you can only load one active program at a time on the recorder. You can load one of the built-in programs, import a program on an SD card, or create and edit your own program using the recorder or *SM3 Configurator* software. The program defines the recording schedule, commands, and all parameters.

This section describes how to work with programs on the recorder using the LCD screen main menu and keypad.

## 5.2 Recording Basics

The SM3M can record in mono using either channel 0 or channel 1, or in stereo using both channels. Recordings can be made using standard .wav file format or compressed .wac file format. By default, compression is turned off and the audio files are stored as uncompressed .wav files. If you enable compression to reduce file size, the SM3M stores the audio files in the proprietary Wildlife Acoustics Audio Compression (WAC) file format with a .wac filename extension. On average, .wac files are 40% smaller than uncompressed .wav files though the superior noise filtering in triggered .wav mode can still result in lower file size.

**NOTE:** As memory card capacities expand and prices fall, the value of the compressed .wac file format decreases. Compression consumes more processing power. For most wildlife recording projects, we recommend .wav format. For high-frequency ultrasonic marine recordings, we recommend .wac because memory is still the limiting factor.

In WAV mode, if either channel is recording, either because of a triggered recording or a continuous recording, the other channel will be forced to record as well. Therefore, it is not wise to record continuously (untriggered) on one channel and triggered on the other in WAV mode, as effectively the triggered side will also record continuously. If the desired behavior is to record continuously on one channel and only during a trigger on the other channel, then WAC mode will perform as desired.

## 5.3 How to Load a Built-In Program

You can load, edit, and run built-in programs directly on your recorder. The built-in programs are designed to implement the most popular recording schedules. You also have the flexibility to edit one or more lines in the built-in programs to satisfy your specific objectives.

1. At the **Song Meter Main Menu**, select **Program**, and press **SELECT**.
2. Select **Load Program** and press **SELECT**.
3. On the **Select Program** screen, press **▲ Up** or **▼ Down** to select one of the following built-in programs:

```
Sunrise to Sunset
Sunset to Sunrise
Dawn for 3 hours
Dusk for 3 hours
30min on/30min off
24 hours
```

**NOTE:** For *sunset to sunrise* or *sunrise to sunset* programs, set the recorder location and time zone. See 0

How to Set the Location and Time Zone.

4. Press **SELECT**. The following message appears:

```
Program loaded
```

5. The program that you selected is loaded onto the recorder.
6. Perform any of the following actions:
  - Edit the program.
  - Export the program to an SD card.
  - Start the program.

## 5.4 How to Edit a Program

Use this procedure to edit the currently active program directly on the recorder using the LCD screen and buttons. To learn more about each command and available settings, see 7.3 Program Commands.

1. At the **Song Meter Main Menu**, select **Program**, and press **SELECT**.
2. Load or import a program.
3. Select **Edit Program** and press **SELECT**.
4. Press **▼ Down** to select a line in the program.

5. To edit the line, press ► **Right** to advance to the command or value and then press ▲ **Up** or ▼ **Down** to make adjustments. When finished, press ◀ **Left** or **SELECT**.
6. To add or insert a line:
  - a. Press ▲ **Up** or ▼ **Down** to select the <Add/Insert> entry on the last line of the program and press **SELECT**. A new line appears at the bottom of the program.
  - b. Press ◀ **Left** and then press ▲ **Up** or ▼ **Down** to change the line number for the new line. Press **SELECT** to confirm the line number.
  - c. To edit the new line, press ► **Right** to advance to the command or value and press ▲ **Up** or ▼ **Down** to make adjustments. When finished editing, press ► **Right** or **SELECT**.
7. To delete a line:
  - a. Press ▲ **Up** or ▼ **Down** to select the line you want to delete.
  - b. Press ► **Right** to advance to the command for that line.
  - c. Press ▲ **Up** or ▼ **Down** until the <Delete> command appears.
  - d. Press **SELECT**. The line is removed and all higher lines cascade down in sequence by one line.
8. When finished editing all lines, press ◀ **Left**.
9. Any program errors appear. Repeat these steps to resolve the errors or press ◀ **Left** to ignore. Press ▼ **Down** to view the next problem. Press ▼ **Down** after the last problem to return to the **Program** menu. To return to the **Program** menu before reviewing all the problems, press ◀ **Left**.
10. When no errors exist, the following message appears:

```
Program edit OK
```

## 5.5 How to Create a Program On the Recorder

You can create a new program from scratch at line 1 using the recorder.

1. At the **Song Meter Main Menu**, select **Program**, and press **SELECT**.
2. Press ▼ **Down**, select **Edit Program**, and then press **SELECT**.
3. The following screen appears:

```
Edit Program
-01 <Add/Insert>
```

4. Press ► **Right** and then press ▲ **Up** or ▼ **Down** to cycle through the available program commands.
5. Select a command and press ► **Right**. Press ▲ **Up** or ▼ **Down** to adjust the associated parameters for the command.
6. Press ► **Right** to complete line 01 and repeat these steps for line 02 and each subsequent line.

7. When finished, press **◀ Left** to check the program. Any program errors or warnings appear. Press **▼ Down** to cycle through multiple errors or warnings.
8. Press **◀ Left** to exit.
9. Edit the program to resolve any errors.

## 5.6 How to Export a Program

You can export the current program to an SD card in slot A.

1. At the **Song Meter Main Menu**, select **Program**, and press **SELECT**.
2. Press **▼ Down** to select **Export Program** and press **SELECT**. The following message appears:

Program exported

3. Eject the SD card in slot A and examine the top-level folder contents on a computer or laptop. The exported file name is always the recorder prefix with the .PGM extension. For example:

SM3001234.PGM

The default prefix is the device serial number. You can specify a new prefix on the recorder or in a custom program.

**NOTE:** If a file with that name already exists on the SD card, it is overwritten.

## 5.7 How to Import a Program

Use this procedure after saving a custom program to the root or top-level directory of an SD card from another recorder or from the SM3 Configurator. You can import a program file (.PGM) from the SD card in slot A.

1. At the **Song Meter Main Menu**, select **Program**, and press **SELECT**.
2. Select **Import Program** and press **SELECT**.
3. At the **Select program file** prompt, press **▲ Up** or **▼ Down** to select a program file on the memory card in slot A.
4. Press **SELECT**.
5. If no warnings or errors exist, the following message appears:

Program imported

6. If a warning or error exists, the line number and a short notification appear as shown in the following example:

Program error

```
Line 14
No GAIN cmd
```

- a. Press ◀ **Left** to return to the list of available programs and choose a different one.
  - b. Press ◀ **Left** again to exit and go back to the **Program** menu. Edit the program using the recorder or *SM3 Configurator* software and try the import again. Select **Import Program** when the program is error-free.
7. The program that you select is imported onto the recorder and loaded as the active program. Press ◀ **Left** to return to the **Program** menu.
  8. You can perform any of the following actions on the imported active program:
    - Edit the program.
    - Export the program to an SD card.
    - Start the program.

## 5.8 How to Start a Program

Follow these steps to start the current program. The current program is the last one you loaded or imported.

1. Press **START**.
2. Errors or warnings may appear. For example:

```
Program warning
Line 12
No microphones
```

3. Press ▼ **Down** to advance to the next error or warning, if any.
4. If you do not press any buttons for 60 seconds, the Program Checker exits.
  - a. If there is at least one *error*, go back to the main menu. Edit the program and fix the errors.
  - b. If there are only *warnings*, the program starts running. Editing the program or attaching a missing item such as a hydrophone are optional steps that can often be used to resolve any *warnings*.
5. Press **START** again to run the revised program.
6. If the scheduled start time is more than four minutes into the future, the recorder enters sleep mode to conserve power. The SM3M wakes up 3.5 minutes before the scheduled recording start time.

**NOTE:** If you use an AT TIME, AT SRIS or AT SSET command that is within a daily repeating loop, and start the program after that time of day, the recorder will assume you wish to record starting at the previously occurring sunset, sunrise or time, and begin recording immediately.

For example, if you have a program that starts with AT TIME 16:00:00 and records for 3 hours, but you start the program at 17:00:00, the recorder will not wait until 16:00:00

the next day, but instead will start recording immediately and record the remaining two hours of the days' schedule.

If you start a program with an AT TIME command that is not contained in a daily loop or the program starts with an AT DATE command, then the recorder will wait until the next specified time or date.

## 5.9 How to Stop a Program

Press and hold the **STOP** button for two seconds while a program is running or scheduled to run to stop it from continuing. If you stop a running program, the recorded output up until recording was stopped is saved.



# 6 SM3 Configurator Software

## 6.1 Introduction

Use the *SM3 Configurator* software to create and edit recording programs for any SM3 series recorder. The software is available for Microsoft Windows, Apple Mac OSX, and Red Hat Linux.

You can also use this application to perform the following tasks:

- Estimate battery life and memory capacity for recording deployments.
- Open a recording to view the commands and settings used in the original program that captured it.
- Edit and save your own versions of a program and use them on future deployments to one or more SM3 acoustic or ultrasonic recorders.

## 6.2 How to Install the SM3 Configurator

Follow these steps to download and install the SM3 Configurator software.

1. Navigate to [www.wildlifeacoustics.com/support/download-software](http://www.wildlifeacoustics.com/support/download-software).
2. Find the setup file appropriate for your operating system.
3. Download the file and follow the installation instructions.

## 6.3 How to Open the SM3 Configurator

On Microsoft Windows computers, the program is located in the **Wildlife Acoustics** folder in **Program Files**. The installer creates shortcuts on your desktop and in the **Start** menu. On Apple Mac OSX computers, the program should be moved to the **Applications** folder.

# 6.4 SM3 Configurator User Interface



- 1 File and Help Menus:** Click the File menu to load a sample program, open one of your own programs, save a program, or exit. Click the Help menu and choose About to view the currently installed version number of the utility.
- 2 Configuration Settings:** Adjust the settings in this section to override the settings on the recorder that receives your imported program.
- 3 Program:** Enter your choice of commands and adjust their parameters to create, edit, and save your own custom programs.
- 4 Deployment Scenario:** Gauge the impact of your deployment settings on battery power, memory capacity, and the recording schedule. For SM3 Marine models, when you select SM3M, both microphone fields are set to the required SMX-H2 hydrophone and are disabled to prevent changes.
- 5 Scrollable Calendar View:** Use this section to explore the recording schedule, estimated battery life, and memory card requirements of your program. Black bars represent successful recordings; purple bars require more memory; and red bars represent insufficient power. Blue and yellow shading indicates night and day based on program settings.
- 6 Status Bar:** When you position your mouse pointer over an entry in the schedule, the status bar displays details about that point in the program. From left to right, it shows the recording date, time, duration, power consumption, memory card utilization, the running total number of sound files, recording type, channels, file format, and sample rate.

## 6.5 How to Create a Program (SM3 Configurator)

Although you can create a new program starting at line one, as a time-saving best practice use this procedure to create a new program from one of the sample programs provided as a template.

1. Open the **SM3 Configurator** software application.
2. Click the **File** menu and choose one of the sample programs:
  - Sunrise to Sunset
  - Sunset to Sunrise
  - Sunset - Sunrise ZC (SM3BAT models only)
  - Dawn for 3 hours
  - Dusk for 3 hours
  - 30min on/30min off
  - 24 hours
3. In the **Program** section, examine each line of the program. Use the drop-down value lists to edit fields. You can use the mouse or press the **Tab** key to advance to the next field. Press **Shift+Tab** to go back to the previous field. Press the arrow keys on your keyboard to cycle through value lists.
4. To change a command in any line, select another command from the list.
5. The last line in a program is empty and shows **<Choose>** in its command field ready for you to add a new line. To insert a new line, click a line number.
6. To remove a line, select **<Delete>** in the command field.
7. (Optional) Adjust the **Configuration Settings** section to override the settings in the recorder.
8. (Optional) Adjust the **Deployment Scenario** section to estimate a recording schedule.
9. Resolve any errors that appear below the **Program** section.
10. Click the **File** menu and choose **Save**.
  - a. Save the program to your computer to continue editing it or to use it as a template for future programs.
  - b. Save the program to an SD card to import it onto one or more recorders in the field.

## 6.6 How to Adjust Configuration Settings

Select any of the check boxes in the **Configuration Settings** section to override any values already set on an individual SM3M unit when you import your program. For example, select the **Prefix** check box and enter a new prefix for a location or project name.

All of the settings in this section are documented elsewhere in this guide.

## 6.7 How to Adjust Deployment Scenario Settings

Use the fields in the **Deployment Scenario** section to estimate the recording schedule for the currently open program in the calendar view.

1. Load a sample program or a custom program.
2. In the **Deployment Scenario** section, choose the target Song Meter device for this program.
  - **SM3**: This model has two built-in internal acoustic microphones.
  - **SM3BAT**: This model supports ultrasonic sample rates.
  - **SM3M**: This model includes the SM3 Marine Submersible Edition and SM3 Marine Deep Water Edition.
3. In the **Start** fields enter the date and time in the following format:  
DD/MM/YYYY HH:MM:SS
4. In the series of four (4) fields labeled **A**, **B**, **C**, and **D**, select the estimated capacity of the memory card you plan to insert in each slot.
5. In the **Mic 0** field, select the type of microphone you plan to use on channel 0 (left). This field remains fixed at *SMX-H2* for the SM3M.
6. In the **Mic 1** field, select the hydrophone you plan to use on channel 0 (right). This field remains fixed at *SMX-H2* for the SM3M.
7. In the **Trig Ratio (%)** field, indicate the percentage of time during recording periods that a given hydrophone will be triggered. This only applies to triggered recordings. The default value of 10% is a good estimate for underwater recordings. Adjust as needed based on past experience with your specific recording conditions.
8. In the **Power (Wh)** field, enter the anticipated battery energy to be used for recordings made from this program in watt-hours. Wh can be calculated by multiplying the battery capacity in amp hours (divide by 1000 if given in milliamp hours) by the total voltage of the batteries. Total voltage is the sum of all the battery cells. For example, 32 internal alkaline D size batteries at 1.5 V each with a capacity of 12,000 milliamp hours would be 12,000 divided by 1,000 = 12 amp hours. And 1.5 V times 32 batteries = 48 V. Multiplying 48 V times 12 amp hours gives us 576 Wh.
9. Examine the recording calendar and make any adjustments.
10. Click the **File** menu and choose **Save**. Save the resulting .PGM file to a memory card and insert in slot A of the SM3M recorder.
11. Import the program onto the recorder. See 5.7 How to Import a Program on page 40.

## 6.8 How to Use the Scrollable Calendar View

The scrollable view on the lower portion of the application window shows the recording schedule for over a year from the **Start** date and time in the **Deployment Scenario** section. Recording periods are shown with black bars. Blue shaded areas represent nighttime and yellow shaded areas represent daytime based on sunrise/sunset calculations determined by the time zone (hours relative to UTC), latitude, and longitude specified in the **Configuration Settings** section. The recorder breaks up long recordings so they do not exceed the 2.0 GB limit.

The scrollable view also illustrates when Song Meter is likely to stop recording after running out of memory storage or battery power. Running out of memory storage is shown with recordings in purple, and running out of power is shown with recordings in red. These are estimates based on the memory card and battery capacity specified in the **Deployment Scenario** section. Actual performance is subject to variations in memory card and battery manufacturers and numerous other factors such as temperature or battery charging method.

To estimate memory requirements for triggered recordings, set the **Trig Ratio (%)** field in the **Deployment Scenario** section. The application estimates memory consumption based on how often the unit is likely to be triggered as opposed to merely waiting in **nap** mode to record. The default value of 10% is good for underwater recording. You can adjust based on personal experience with your specific recording conditions.

# 7 Developing Custom Programs

**TIP:** Start by loading one of the sample programs and then make adjustments to create your own custom programs.

## 7.1 Loops

An essential logical structure in any computer program, a *loop* repeats a task, state, or condition until a necessary event occurs. For example, you need a program that waits, and continues to wait until sunrise; and then you want it to record, and repeat that action, recording over and over (we call that a *loop*) until 15 minutes before sunset.

Loops are programmed by using pairs of **REPEAT** and **UNT** commands, nested to any depth. Loops have an explicit ending condition, such as a date for an **UNTDAT** command or a count for an **UNTCOUNT** command. In addition, loops have an implicit ending time, inherited from any enclosing loops. The implicit ending time is the earliest of all the enclosing loop ending times. In other words, the ending condition of a loop is either its own ending condition or the implicit ending time, whichever occurs first.

The **RECORD** command likewise inherits an implicit ending time from any enclosing loops, perhaps causing a **RECORD** command to finish earlier than indicated by its own duration.

**UNTCOUNT** loops do not have an ending time of their own, although they do pass along any implicit ending time that they inherit. If a program contains just one loop, a **REPEAT/UNTCOUNT** loop, with a **RECORD** command inside that loop, then the **RECORD** command will always run for its full duration, and the loop will end after the specified count of passes.

## 7.2 AUTO Values

Instead of an explicit value, some commands allow a value of **AUTO** for one or more of their parameters. Examples include the channel 0 and 1 parameters of the **GAIN** command and the **FS** command channels and rates. When **AUTO** values are set, the recorder automatically chooses appropriate values based on its current configuration. For example, **AUTO** settings tell the recorder to use the currently installed hydrophone.

All the built-in sample programs use **AUTO** values to help you get started.

## 7.3 Program Commands

Use the following commands to create programs for your specific recording needs. A program can contain up to 99 command lines.

**NOTE:** Some commands listed in this section refer to *sunrise* or *sunset* in a general sense and depend on them in program calculations. The recorder recognizes different methods for calculating precise sunrise and sunset times. To specify a method and view the next available sunrise and sunset times, select **Sunrise/Sunset Type** in the **Settings** menu.

### HPF {OFF,220HZ,1KHZ,16KHZ} {OFF,200HZ,1KHZ,16KHZ}

This sets the channel 0 and 1 analog high pass filter. A high pass filter only allows signals higher than the specified frequency to be recorded. For recording very low frequency sounds, set this to **OFF**. Otherwise it is useful to cut down on anthropogenic noise and should be set to at least 220 Hz. If your signals of interest are higher, it is better to go even higher.

The two-pole filter attenuates sounds at 12dB per octave. When set to 1.0 kHz for example, a 500 Hz sound is attenuated by 12dB. Every 6dB represents a halving of sound level, so the 500 Hz sound would appear in the recording at one-fourth ( $\frac{1}{4}$  or 0.25) its original amplitude.

Do not use 16 kHz for acoustic recording; it is only useful to filter out all non-ultrasonic frequencies for recording only echolocations.

### GAIN <gain-channel-0> <gain-channel-1>

This sets the audio gain. The range is 0 dB to 59.5 dB in 0.5 dB steps for acoustic sample rates (96 kHz or below) or 0 dB or 12 dB for ultrasonic recordings. Gain **AUTO** setting behavior is 0 dB.

For the Standard, Low-Noise and Ultrasonic Hydrophones, a good starting point for gain is 12 dB, this will be optimal for recording distant marine mammals or quantifying ambient conditions. If the unit is near louder anthropogenic noise sources, 0dB might be more suitable to avoid clipping.

For the High SPL hydrophone Option when combined with the standard hydrophone, 0dB gain on both channels will assure that sounds can be recorded from about 78dB SPL all the way up to 240dB SPL. There is no reason to use additional gain as both hydrophones are fully covering the available dynamic range. Further gain will not allow recording quieter sounds due to the self-noise of the standard hydrophone.

Test recordings are encouraged to select the optimal gain.

**FS <WAV,WAC> {OFF,0,1,0+1} <sample rate>**

Specifies the file type produced, the source channels used, and the sample rate for full-spectrum recordings. Channel and sample rate both have **AUTO** selections available but it is best to explicitly state channels and sample rate. **AUTO** simply selects Channel 0 and 96 kHz sample rate.

Choose the standard WAV mode for uncompressed .wav recording files. They consume less power and you can open them in any audio software. The .wac file format offers about a 40% reduction in storage, but at the expense of 40% more power consumption. Choose WAC for acoustic recordings when storage is more important than power.

The following sample rates are available on two channels simultaneously unless otherwise specified:

- 1000
- 2000
- 4000
- 8000
- 9600
- 12000
- 16000
- 19200
- 24000
- 32000
- 48000
- 96000
- 192000
- 256000 (1 channel in WAC mode, up to 2 channels in WAV mode)
- 384000 (one channel)

Choose a sample rate that is at least double the highest frequency to be recorded.

The **AUTO** setting behavior is stereo channels at 48 kHz sample rate.

**ZC {OFF,0,1,0+1} {4,8,16}**

This is not applicable to SM3M recorders and should be set to OFF.



## TRGLVL <level-channel-0> <level-channel-1>

This specifies the digital trigger level. Thresholds are either absolute (negative values) or relative to the measured noise floor (positive values). The range is -88 dB – +88 dB in 1-dB steps or **OFF** or **AUTO** selection is available.

Triggered recording can minimize card usage for ultrasonic recording. Triggers do not work well for lower sample rates because there will likely be constant false triggers from ambient noise. For ultrasonic recording where there is much less noise sources triggers can be an excellent way to reduce data and only record when there is an event of interest. If triggers are set in WAV mode, the recorder will save a WAV file for each triggered event and will delete recordings that do not appear to contain biological activity. To discuss optimal settings for your particular deployment, please contact Wildlife Acoustics' support team at support2015@wildlifeacoustics.com

If either channel value is not **OFF**, then the **FRQMIN**, **FRQMAX**, **DMIN**, **DMAX**, **TRGWIN**, and **TRGMAX** commands are required before the next **RECORD** command.

The trigger is satisfied if a signal exceeds the specified level within the frequency range defined by **FRQMIN** and **FRQMAX**.

Turning on triggers will also activate file scrubbing. For information on setting the scrubber function and how to turn off the feature, see **DMIN**.

Relative triggers (positive level values) are recommended for ultrasonic marine recordings as the trigger will intelligently adapt to the environment.

If WAV format is specified in the FS command, an individual time-stamped .wav file is created for each triggered event during the scheduled recording period. If you specify the WAC compressed file format, one .wac file is created for the recording duration containing all the triggered events.

Trigger **AUTO** setting behavior is 12dB.

## TRGWIN <window-channel-0> <window-channel-1>

Specifies the maximum recording duration in the absence of a triggering signal. 0.1 sec – 9.9 sec in 0.1-sec steps.

This should be set sufficiently long to avoid a recording that ends after one echolocation. If a marine mammal echolocates every 0.5 seconds and this is set to 0.1 seconds, you get a new trigger with every single echolocation. Two (2.0) seconds works well for species in most parts of the world.

## TRGMAX <len-channel-0> <len-channel-1>

Specifies the maximum duration for a triggered recording. 0.1 sec – 99.9 sec in 0.1-sec steps, or **OFF**.

Some software programs only accept files under certain durations. Use this command to set a maximum file duration.

### DMIN <dur-channel-0> <dur-channel-1>

set this command and **DMAX** to **OFF**. Specifies the minimum duration for a signal in the specified frequency range to be a valid signal to satisfy the scrubber 0.1 – 800.0 msec in 0.1-msec steps, or **OFF**.

It is recommended that this be set to **OFF** to prevent deletion of marine mammal echolocations.

The scrubber automatically deletes files where no suitable signal is detected. The scrubber looks for at least two narrow band signals of at least this **DMIN** duration and shorter than **DMAX** and within the frequency range specified by **FRQMIN** and **FRQMAX**. If two such signals exist, the file is saved, if they are not, the file is not saved.

To turn off the scrubber, set this command and **DMAX** to **OFF**.

### DMAX <dur-channel-0> <dur-channel-1>

Specifies the maximum duration for a signal in the specified frequency range to be a valid signal to satisfy the scrubber. 0.1 msec – 800.0 msec in 0.1-msec steps, or **OFF**.

The shortest **DMAX** chosen between channel 0 and 1 will also truncate the total length of a WAV while recording on stereo channels. This means that if one channel is in mid trigger and has not yet reached its **DMAX** and the other channel does reach **DMAX**, the first channel will be truncated shorter than its programmed **DMAX**.

See **DMIN** for more information on how the scrubber uses this value.

### FRQMIN <freq-channel-0> <freq-channel-1>

Specifies the lower bound for the frequencies of interest to the scrubber and the triggering mechanism. 1 kHz – 192 kHz in 1-kHz steps, or **OFF**.

Echolocations or other signals occurring below this frequency will not cause a trigger and will be consider noise to the scrubber mechanism.

See **DMIN** for more information on how the scrubber uses this value.

See **TRGLVL** for more information on how the trigger uses this value.

### FRQMAX <freq-channel-0> <freq-channel-1>

Specifies the upper bound for the frequencies of interest to the scrubber and the triggering mechanism. 1 kHz – 192 kHz in 1-kHz steps, or **OFF**.

Echolocations or other signals occurring above this frequency do not cause a trigger and are considered noise to the scrubber mechanism.

See **DMIN** for more information on how the scrubber uses this value.

See **TRGLVL** for more information on how the trigger uses this value.

### NAP <delay>

Specifies how long to wait in the absence of a trigger before going into power-saving nap mode. Set a value from 1 to 99 minutes in 1 minute steps, or set to **OFF**.

It takes approximately 200 ms to wake from a nap to start recording. Once out of a nap, the SM3M remains ready and waits for a trigger for the amount of time specified here. Shorter times yield greater battery savings with the compromise that you often lose the first 200 ms of a recording.

### RECORD hh:mm:ss

Starts a new recording of the specified duration. If the **RECORD** command is inside a repeat/until loop, the recording may end early to match the outer loop ending time.

Before a **RECORD** command, your program must include one of each of the following commands: **HPF, GAIN, FS, ZC, and TRGLVL**. It is not necessary to repeat those commands before each **RECORD** command, but you may if you wish to have different values in effect at each **RECORD** command.

In addition, the **FS** command must have its **channels** parameter set to a value other than **OFF**.

Recording files larger than 2.0 GB are divided into smaller segments.

**Note:** References to ZC or zero-crossing do not apply for SM3 Marine recorders.

### PAUSE hh:mm:ss

Pauses the program for the specified amount of time. If you set the duration of the **PAUSE** command to greater than 4 minutes the SM3M enters low-power sleep mode and wakes up at the next scheduled recording.

### AT DATE DDMMYY

Causes the program to wait until the specified date. YY are the last two digits of the year in the current century beginning with the year 2000.

**NOTE:** If you start the program after the specified **AT DATE**, the command is ignored and the program continues.

**AT TIME hh:mm:ss**

Causes the program to wait until the specified date time.

**NOTE:** If you use an AT TIME, AT SRIS or AT SSET command that is within a daily repeating loop, and start the program after that time of day, the recorder will assume you wish to record starting at the previously occurring sunset, sunrise or time, and begin recording immediately.

For example, if you have a program that starts with AT TIME 16:00:00 and records for 3 hours, but you start the program at 17:00:00, the recorder will not wait until 16:00:00 the next day, but instead will start recording immediately and record the remaining two hours of the days' schedule.

If you start a program with an AT TIME command that is not contained in a daily loop or the program starts with an AT DATE command, then the recorder will wait until the next specified time or date.

**AT SRIS±hh:mm:ss**

Causes the program to wait until sunrise, plus or minus the specified time.

**AT SSET±hh:mm:ss**

Causes the program to wait until sunset, plus or minus the specified time.

**REPEAT**

Indicates the beginning of a loop. Must be ended by an **UNT** command.

**UNTDAT DDMMYY**

Ends a loop when the specified termination date is reached. Any **RECORD** commands in progress in this loop are forced to stop recording.

**UNTTIME hh:mm:ss**

Ends a loop when the specified termination time is reached. Any **RECORD** commands in progress in this loop are forced to stop recording.

**UNTSRIS±hh:mm:ss**

Ends a loop at sunrise, plus or minus the specified time. Any **RECORD** commands in progress in this loop are forced to stop recording.

**NOTE:** Some commands listed in this section refer to *sunrise* or *sunset* in a general sense and depend on them in program calculations. The recorder recognizes different methods for calculating precise sunrise and sunset times. To specify a method and view the next available sunrise and sunset times, select **Sunrise/Sunset Type** in the **Settings** menu.

**UNTSSET±hh:mm:ss**

Ends a loop at sunset, plus or minus the specified time. Any **RECORD** commands in progress in this loop are forced to stop recording.

**UNTCOUNT {<count>, INF}**

Ends a loop after <count> passes. **INF** specifies an infinite count.

**FEATURE <feature number> {OFF,ON}**

This is for advanced use only and is not a required command by the program checker. The first parameter is a number from 1 to 16 and the second parameter is OFF or ON. By default, all features are OFF.

- **FEATURE #01:** If ON, disables the LED blinking during recording. Insert into the top of a program "01 FEATURE 01 ON" to disable the LEDs. This command is for our terrestrial SM3 recorders only and does nothing on an SM3M.
- **FEATURE #02:** If ON, enables 32-bit recording mode. This feature is specific to certain marine recording applications and is not intended for general use. The following conditions must also be met or the SM3 will warn with "Can't record 32 bit" and record in 16-bit mode:
  - FS chan must be 0.
  - FS rate must not be AUTO and must be explicitly set to ≤ 96 kHz (i.e. no higher than 96 kHz).
  - FS file type must be WAV.
  - TRGLVL for chan 0 must be OFF.

This command may be used to add additional features in the future.

**PLAY {0-9}**

Not applicable to SM3M recorders.

## 7.4 How to Work With the Program Checker

The Program Checker runs automatically to verify the configuration of the hardware and software, and to check your program for errors or warning conditions. If it detects contradictory commands, the Program Checker reports the latter of the two as the error source. Use the Program Checker output to correct your program, save it, and then attempt to import or run it again.

1. The Program Checker runs at all of the following times:
  - After you finish loading or importing a program.
  - After you finish editing a program and press the main buttons on the device to exit the editor as viewed through the LCD screen.

- Before you run a program by pressing the **START** button.
- 2. The Program Checker performs several tests on the current program. For example, it checks for the following items:
  - Balanced **REPEAT/UNTX** loops
  - At least one **RECORD** or **PLAY** command that is reachable; in other words at least one **RECORD** or **PLAY** precedes, or is inside of, an infinite loop.
  - All required parameters set prior to a **RECORD** command.
  - Parameters that are consistent with the present hardware.
- 3. It shows *errors* (if any), followed by *warnings* (if any). It shows the matching line number in your program for the error or warning.
- 4. To view the next error or warning, press the ▼ **Down** button.
- 5. To exit the Program Checker, press the ◀ **Left** button. You can also exit by pressing ▼ **Down** after the last error or warning.
- 6. If no buttons are pressed for 60 seconds while a problem is displayed, the Program Checker times out and exits.
- 7. When the Program Checker exits:
  - If you were loading or editing a program, you return to the main menu.
  - If you were running a program and there are no errors (only warnings or no problems at all), your program starts.

## 7.5 How to Resolve Program Checker Errors

When a program contains *warnings*, you can address them or ignore them and continue, the program will run with *warnings*. However, when a program contains one or more *errors*, it will not run. To resolve an error, edit the program and adjust a parameter or add, move, or delete a command line. Refer to the following list of the most common possible program warnings and errors.

Program Errors and Warnings

Message	Warning/Error	Explanation
Unmatched REPEAT:	error	a REPEAT command for which no corresponding subsequent UNT_X command can be found.
Unmatched UNTX:	error	an UNT_X command for which no corresponding preceding REPEAT command can be found.
Inf lp bfr REC/PLAY:	error	the program has an infinite loop before reaching any RECORD or PLAY command.
Unreachable command:	warning	the program has commands following an infinite loop.
No RECORD or PLAY:	error	the program contains neither a RECORD nor a PLAY command.

Message	Warning/Error	Explanation
No HPF cmd:	error	a RECORD command has been reached with no preceding HPF command.
No GAIN cmd:	error	a RECORD command has been reached with no preceding GAIN command.
No FS cmd:	error	a RECORD command has been reached with no preceding FS command.
No ZC cmd:	error	a RECORD command has been reached with no preceding ZC command.
No DTRGLVL cmd:	error	a RECORD command has been reached with no preceding DTRGLVL command.
No FREQMIN cmd:	error	a RECORD command has been reached, with triggered recording enabled, with no preceding FREQMIN command.
No FREQMAX cmd:	error	a RECORD command has been reached, with triggered recording enabled, with no preceding FREQMAX command
No DMIN cmd:	error	a RECORD command has been reached, with triggered recording enabled, with no preceding DMIN command
No DMAX cmd:	error	a RECORD command has been reached, with triggered recording enabled, with no preceding DMAX command
No DTRGWINDOW cmd:	error	a RECORD command has been reached, with triggered recording enabled, with no preceding DTRGWINDOW command
No DTRGMAXLEN cmd:	error	a RECORD command has been reached, with triggered recording enabled, with no preceding DTRGMAXLEN command
FREQMAX <= FREQMIN:	error	a RECORD command has been reached, and a channel's preceding FREQMAX value is less than or equal to its preceding FREQMIN value.
DMAX <= DMIN:	error	a RECORD command has been reached, and a channel's preceding DMAX value is less than or equal to its preceding DMIN value.
Nap not triggered:	warning	a NAP command has been reached with triggered recording disabled.
Bad FS sample rate:	error	a RECORD command has been reached and the preceding FS command rate parameter does not have one of the allowed values: OFF, AUTO, 1000, 2000, 4000, 8000, 9600, 12000, 16000, 19200, 24000, 32000, 48000, 96000, 192K, 256K, 384K
No record channels:	error	a RECORD command has been reached and the preceding FS and ZC command channel parameters are both OFF.
ZC not triggered:	error	a RECORD command has been reached, the preceding ZC command channel parameter is not OFF, and triggered recording is not enabled.
Ult rate, no ult hw:	error	a RECORD command has been reached, the preceding FS command's channel parameter is not OFF, and its rate parameter is greater than or equal to 192K.
Using only channel 0:	run-time warning	a RECORD command has been reached, an ultrasonic board is present, the preceding FS command channel parameter

Message	Warning/Error	Explanation
		is AUTO, there are two external microphones, and the preceding FS command rate parameter is set too high for stereo for the file type (WAV, WAC): the recorder will choose one channel to use rather than stereo, choosing whichever channel has an ultrasonic microphone or channel 0 if they both have ultrasonic microphones.
Using only channel 1:	run-time warning	a RECORD command has been reached, an ultrasonic board is present, the preceding FS command channel parameter is AUTO, there are two external microphones, and the preceding FS command rate parameter is set too high for stereo for the file type (WAV, WAC): the recorder will choose one channel to use rather than stereo, choosing whichever channel has an ultrasonic microphone or channel 1 if they both have ultrasonic microphones.
Bad rate for stereo:	error	a RECORD command has been reached and the preceding FS command's channel parameter is 0+1 (stereo) and its rate parameter is set too high for its file type (WAV, WAC).
HPF 16K, no ult hw:	error	a RECORD command has been reached, an ultrasonic board is not present, and the preceding HPF command has one or both channels set to 16K.
HPF 16K, acoust rate:	error	a RECORD command has been reached, the preceding FS command's rate parameter is less than 192k, and the preceding HPF command has one or both channels set to 16K.
Bad FS ultra gain:	error	a RECORD command has been reached, an ultrasonic board is present, the preceding FS command has a channel enabled (either explicitly at any time or via AUTO selection at run time) and a rate greater than 96000, and the preceding GAIN command value for that channel is neither 0 nor 12 dB.
Ultra mic no ultr hw:	run-time warning	a RECORD command has been reached, an ultrasonic device is not present, the preceding FS command Channel parameter is not OFF and its rate parameter is AUTO, and at least one external ultrasonic microphone is connected.
Ext acst & ultr mics:	run-time warning	a RECORD command has been reached, the preceding FS command Channel parameter is not OFF and its rate parameter is AUTO, and an external ultrasonic microphone is connected to one channel and an external acoustic microphone is connected to the other channel.
Can't open play file:	run-time error	a PLAY command has been reached and there is a failure accessing the SD card in slot A or a failure opening the desired file on the card.



# 8 Audio Recordings

## 8.1 Filenames for Recordings

Audio recording files are saved in a **Data** folder on each memory card and use the following naming conventions:

PREFIX\_XXX\_YYYYMMDD\_HHMMSS.wav

### PREFIX

The prefix set by the program file or the SM3M hardware.

### XXX

The channel indicator for each recording. Possible values include:

- `_0_` Mono on channel 0.
- `_1_` Mono on channel 1.
- `0+1` Stereo (both channel 0 and 1).

Triggered .wav recordings use both channels regardless of which channel caused the trigger. This part of the file name indicates which channel caused the trigger.

**NOTE:** Triggered .wac recordings are made on the channel that caused the trigger. This part of the file name indicates the channels that are armed for triggered recording.

### YYYYMMDD\_HHMMSS

The full timestamp including the year, month, day, hour, minute, and second when the recording started.

### .wav

The filename suffix.

- .wav for uncompressed files
- .wac for the proprietary lossless compression WAAC audio format

## 8.2 Recording Behavior

Three and a half minutes before the device starts a recording, it wakes up from sleep mode to allow the hydrophone noise to settle before recording. When processing consecutive recordings in a series, the first recording finishes on time; however, the system needs several seconds before it will be able to start the next recording. This results in the next recording starting a few seconds late. To

compensate, the SM3M automatically extends the duration of the recording so it will finish on time to keep to the schedule. In this scenario, it is normal to see a delayed start time and a shorter recording.

## 8.3 Recording Metadata

Values for the attributes listed below are stored as metadata in your recording files when recording in .wav format. These metadata tags are helpful in compiling metrics or troubleshooting issues, especially in multi-unit deployments. For example, recordings from a specific device, identified by serial number, can be traced to determine what settings and programs were used during the recording.

Some of the metadata information is visible in the available Kaleidoscope software. Kaleidoscope software has the ability to add further metadata relating to analysis of the recording.

**NOTE:** Some of the metadata tags described below are only used by Wildlife Acoustics for diagnostics, while others may be used to provide future capabilities and are not currently available.

### Device Model

The device model. For example, SM3 or SM3M.

### Device Serial Number

The unique serial number for your recorder.

### Firmware Version

The firmware version installed on the source recorder.

### Device Name

The prefix assigned on the recorder under the **Settings** menu.

### Timestamp

The date and time when the recording started.

### GPS Coordinates

The location of the recorder when recording first started.

### Program and Settings

A block of metadata containing the entire program and settings.

**TIP:** Open the recording in the SM3 Configurator to view the program and settings used to make the recording.

## 8.4 Summary Text Files

Once per minute during a recording, and when each recording file ends, the SM3M appends a line of text to the summary text (.txt) file. It is in comma-separated format (CSV) and you can open it in Excel or in a text editor. The file begins with a header line which identifies the fields that appear in each line of summary data in the rest of the file:

```
DATE, TIME, LAT, , LON, , STEP, POWER(V), TEMP(C), #FILES, #SCRUBBED, MIC0
TYPE, MIC0 TRIGGERS, MIC0 ZCFILES, MIC1 TYPE, MIC1 TRIGGERS, MIC1 ZCFILES
```

As examples, three lines from a sample summary file appear below:

```
2016-Jan-22,17:15:24,42.00000,N,71.00000,W,0.000000,5.9,12.00,2,1,H2,29,0,H2,19,0
2016-Jan-22,17:16:38,42.20000,N,71.10000,W,0.000000,5.9,11.75,3,4,H2,34,0,H2,21,0
2016-Jan-22,17:17:47,42.35000,N,71.18200,W,0.300000,5.5,11.75,1,2,H2,21,0,H2,11,0
```

### Date

The date for these entries was January 22, 2016.

### Time

The current local time for each entry appears about one minute from the last entry.

**NOTE:** The date, time, and time zone are set on the recorder.

### Latitude and Longitude

If the GPS receiver is installed, the coordinates are given.

### Step

The step represents the drift between the GPS time base and internal real time clock. It is only useful for advanced time synchronization calculations.

### Power

The power supply voltage for the internal batteries.

### Temperature

In our example, the internal temperature has fallen from 12.0 to 11.75 degrees Celsius.

### Number of Files and Scrubbed Files

The values 2, 3, and 1 represent the number of recording files written since the previous summary line.

The values 1, 4, and 2 represent the number of files scrubbed since the previous summary line.

### Channel 0 Microphone Type, Triggers, and ZC Files

The channel 0 microphone type: A1, U1, H1, or NA if no microphone is connected on that channel or if channel 0 has been set to an internal mic (not available on SM3M units). For SM3M units, this value is always H2.

The number of channel 0 triggers detected in triggered mode. A zero (0) appears for continuous mode.

The number of zero-crossing files written on channel 0. A zero (0) appears when you are not recording in ZC mode.

### Channel 1 Microphone Type, Triggers, and ZC Files

The channel 1 microphone type: A1, U1, H1, or NA if no microphone is connected on that channel or if channel 1 has been set to an internal mic (not available on SM3M units). For SM3M units, this value is always H2.

The number of channel 1 triggers detected in triggered mode. A zero (0) appears for continuous mode.

The number of zero-crossing files written on channel 1. A zero (0) appears when you are not recording in ZC mode.

## 8.5 How to Install the Kaleidoscope Software

The free version of the Kaleidoscope post-processing software from Wildlife Acoustics can convert .wac format into .wav. Upgrade to Kaleidoscope Viewer to view spectrograms of your recordings. Upgrade to Kaleidoscope Noise Analysis Module to scan recordings to analyze the noise spectrum.

1. Navigate to [www.wildlifeacoustics.com/support/download-software](http://www.wildlifeacoustics.com/support/download-software).
2. Find the file appropriate for your operating system.
3. On Windows, open file and follow installation instructions. On Mac copy the file to the **Applications** folder.

# 9 Utilities

## 9.1 How to Erase and Format SD Memory Cards

This procedure erases and formats all installed memory cards. Use this procedure prior to all deployments for optimal performance.

**WARNING:** This procedure erases all data files on all memory cards in all slots. Verify that you have imported, saved, or copied any important programs, backed up any important recordings, and updated any firmware files before running this utility.

1. At the **Song Meter Main Menu**, select **Utilities**, and press **SELECT**.
2. Select **Format all cards** and press **SELECT**.
3. At the **Confirm: Format All?** prompt, choose one of the following options:
  - Press **▶ Right** to select **No** and cancel this entire procedure. Any existing data files remain on the memory cards.
  - Press **▼ Down** to select **Yes** and press **SELECT** to format all current memory cards in slots A, B, C, and D.
4. If you select **Yes**, the progress of each card in each slot appears and then the screen resets to the last selected submenu.
5. With up to four clean formatted memory cards, you now have the maximum available space on all cards and are ready to start a program and save recordings.

## 9.2 How to Reset Factory Default Settings

This short procedure restores the original device settings set as default values in the factory when your recorder was first assembled and tested.

1. At the **Song Meter Main Menu**, select **Utilities**, and press **SELECT**.
2. Select **Set factory default** and then press **SELECT**.
3. The original settings are restored.

**CAUTION:** Any custom settings, including solar calculation method, location, and prefix, are erased.

## 9.3 How to Measure HYDROPHONE Sensitivity

**NOTE:** We include this section because all SM3 models support this functionality; however, this procedure is not intended for use with hydrophones, though it could be utilized with a pistonphone to check sensitivity.

You can view and verify the sensitivity of acoustic and ultrasonic hydrophones. This utility displays dB (re full scale) of both types of microphone.

1. At the **Song Meter Main Menu**, select **Utilities**, and press **SELECT**.
2. Select **Calibrate Mics** and then press **SELECT**.

MICROPHONE CALIBRATE	
	@1 @40 kHz
Ch 0 :	-62.4 -73.8 dB
Ch 1 :	-62.5 -73.6 dB

- a. The values under @1 represent levels at 1 kHz, a good measure of acoustic sensitivity.
  - b. The values under @40 are for testing the SM3-U1 with the available Ultrasonic Calibrator.
3. Press **SELECT** when finished.

## 9.4 How to Update the Firmware

When a new firmware update is available, download and install it to update your recorder components. You must register online to access the downloads.

1. On your computer or mobile device, open a web browser.
2. Navigate to [www.wildlifeacoustics.com](http://www.wildlifeacoustics.com).
3. Click **Support** and then click **Downloads**.
4. Complete the online form and click **Request Downloads**.
5. Select the latest SM3M firmware update file to download it.
6. (Optional) As a registered user, you can also access the following downloads:
  - Free SM3 Configurator
  - Free Kaleidoscope software for sound file conversions
  - Kaleidoscope Noise Analysis trial for quantification of noise levels in recordings.
7. Save or copy the .SM3 firmware file to the top level of an SD card.
8. Turn each of the four thumb-screws ⤴ counterclockwise and remove the cover to the memory bay.
9. Insert the SD card into slot A of the recorder.

**NOTE:** Perform all firmware updates on an SD card in memory slot A. The **Firmware Update** menu option waits for a card to be inserted in slot A.

10. At the **Song Meter Main Menu**, press **▼ Down** to select **Utilities** and then press **SELECT**.
11. Press **▼ Down** to select **Firmware Update** and then press **SELECT**.

**NOTE:** You can also press and hold **▲ Up** while powering the unit **ON** to activate the firmware update menu.

12. The recorder scans your SD card in slot A for valid .SM3 files.
13. At the **Select upgrade file** prompt, select the firmware update file that you want to apply and press **SELECT**. The following message appears:

```
Upgrading.....
UPGRADE COMPLETE
Rebooting
```

The system applies the new firmware and restarts.

## 9.5 How to Generate Diagnostics

Use this procedure to generate diagnostic information about the current state of the recorder. Use the diagnostic information to troubleshoot any problems you may be experiencing. When contacting customer support, a representative may ask you to provide this information to diagnose the problem.

1. Insert at least one SD card into the recorder.
2. At the **Song Meter Main Menu**, select **Utilities**, and press **SELECT**.
3. Select **Export Diagnostics** and then press **SELECT**.
4. The unit performs audio path tests and then exports the following information in a log file to the first available SD card:
  - current settings
  - current configurations
  - current program
  - other diagnostic information

**Note:** You can also press and hold **▼ Down** while powering the unit **ON** to activate the diagnostics utility.

The diagnostic file name ends in an .sm3dump extension and includes the location prefix, date, and time. For example:

```
ARIZONA-1234_20160106_215045.sm3dump
```

# 10 Specifications

## 10.1 Physical Specifications

### 10.1.1 SM3M Submersible and Deep Water Dimensions

#### SM3M Submersible Physical Specifications

Length/Height: 35.8 +/-0.3 inches (90.9 +/- 0.8cm) includes eyebolt and hydrophone cage
Diameter: 6.6 inches (16.8 cm)
Eyebolt Anchor: 1.0 in (2.5 cm) inner diameter 1.7 in (4.3 cm) outer diameter 2.0 in (5.1 cm) height off housing
Standard Hydrophone: 2.50 in (6.4 cm) length 0.75 in (1.9 cm) diameter
Weight (Dry): 21.0 lb (9.5 kg) without batteries 31.0 lb (13.5 kg) with 32 batteries
Buoyancy (salt water): 12.0 lb (5.5kg) without batteries 3.0 lb (1.5 kg) with 32 batteries
Rated Depth: 500ft (150 m)
Operating Temperature: -4°F to 122°F (-20°C to 50°C)

#### SM3M Deep Water Physical Specifications

Length/Height: 58.3 in (148 cm) includes bottom bracket and hydrophone cage
Diameter: 6.5 in (16.5 cm)
Mounting Bracket Slots: 1.5 in (3.8 cm) high 3.0 in (7.6 cm) wide
Standard Hydrophone: 2.50 in (6.4 cm) length 0.75 in (1.9 cm) diameter
Weight (air): 53.8 lb (24.4 kg) without batteries 71 lb (32.2 kg) with 64 batteries
Buoyancy (salt water): 2.2 lb (1 kg) without batteries -21.6 lb (-9.8 kg) with 64 batteries (note negative buoyancy with batteries)
Rated Depth: 3,280 ft (800 m)



## 10.2 Power Specifications

**Main Power:** 4.5 - 17V DC (32 internal D-size batteries; Deep Water option is capable of utilizing 32 additional batteries for a total of 64 D batteries)

**Clock Backup Battery Type:** CR2032 (approximate lifespan is up to 8 years)

**Power Consumption:** 0.5 mW (sleeping); 250 – 800 mW (recording)

**Batteries:** The recorder uses standard D size disposable alkaline batteries or rechargeable NiMH batteries. Battery life can vary widely depending on the battery type, brand, charger, temperature, and other factors.

The recorder can accept 1.5V alkaline batteries or 1.2V NiMH batteries.

## 10.3 Memory Card Specifications

Up to four SDHC or SDXC cards can be installed in the recorder. SDHC cards are available up to 32GB and SDXC cards are currently available up to 128GB, with higher capacities coming.

The four (4) memory card slots can be populated with at least one (1) and up to four (4) memory cards of assorted capacities. The device supports all class 4 or faster SDHC or SDXC cards.

**Memory Sizes:** Up to four 32GB SDHC or up to four 128GB SDXC

Up to 1.0 terabyte (1024 gigabytes) supported total capacity using 256 GB SDXC memory cards for all four (4) memory slots. This is the maximum currently available; higher capacities may be available in the future.

**Formats:** FAT32 for SDHC or exFAT for SDXC

Compression typically increases effective capacity by 40%.

## 10.4 Audio Specifications

### 10.4.1 Acoustic Audio

**Channels:** 2

**Recording format:** 16-bit or PCM .wav or optional .wac proprietary lossless compressed format. (Capable of 32-bit recording format with 24-bit resolution.)

**Analog to Digital Converter:** 0.707 V RMS (2v p-p) full-scale

**Amplifier Gain:** 0 dB – 59.5 dB in 0.5-dB steps

**Noise Floor with Standard Hydrophone:** -119 dBfs/sqrt(Hz) @48 kHz rate, 1 K input impedance, 0 dB gain

**Noise Floor with Low Noise Hydrophone:** -129 dBfs/sqrt(Hz) @48 kHz rate, 1 K input impedance, 0 dB gain

**High Pass Filter:** Optional 2-pole at 220 Hz or 1 kHz

**Sample Rates:** 4 kHz – 96 kHz (4 kHz – 384 kHz with ultrasonic capabilities)

The recorder supports the following sample rates in samples per second on one or two channels:

- 1000
- 2000
- 4000
- 8000
- 9600
- 12000
- 16000
- 19200
- 24000
- 32000
- 48000
- 96000

**Anti-alias filter gain:**

- From 0 to 0.39 sample rate:  $\pm 0.1$  dB
- At 0.4125 sample rate: -0.25 dB
- At 0.45 sample rate: -3 dB
- At 0.5 sample rate: -17.5 dB
- From 0.55 to 64 sample rate: -75 dB

## 10.4.2 Ultrasonic Audio

**Channels:** 2

**Recording format:** 16-bit PCM .wav or optional .wac proprietary lossless compressed format

**Analog to Digital Converter:** 0.884V RMS (2.5v p-p) full-scale

**Amplifier Gain:** 0 dB or 12 dB (+/- 0.2dB accuracy)

**Noise Floor with Ultrasonic Hydrophone:** -112 dBfs/sqrt(Hz) @48 kHz rate, 1 K input impedance, 0 dB gain

**Peak Noise with Ultrasonic Hydrophone:** -95 dBfs/sqrt(Hz) @48 kHz rate, 1 K input impedance, 0 dB gain

**High Pass Filter:**

- One pole at 3 Hz at 0dB gain and 2 Hz at 12dB gain
- Optional 4-pole at 16 kHz

**Sample Rates:** The recorder supports the following rates in samples per second:

- WAC recording
  - 192000 (one or two channels)
  - 384000 (one channel)
- WAV recording
  - 192000 (one or two channels)
  - 256000 (one or two channels)
  - 384000 (one channel)

**Anti-alias filter:**

- 2-pole at 128 kHz for 192 kHz and 256 kHz sample rates
- 2-pole at 192 kHz for 384 kHz sample rate

# 11 Warranty and Disclosures

Except as specifically provided herein, Wildlife Acoustics makes no warranty of any kind, express or implied, with respect to this product.

## 11.1 Wildlife Acoustics, Inc. Limited Warranty

**Hardware:** Wildlife Acoustics, Inc. (“WAI”) warrants to the original end user (“Customer”) that new WAI branded products will be free from defects in workmanship and materials, under normal use. Refer to the following table for the applicable warranty period from the original date of purchase.

**Hardware Limited Warranty**

Product	Components	Hardware Warranty Period
SM3M Recorders	all components (excluding hydrophones, batteries and accessories)	1 Year
SM3 and SM3M Recorders	microphones, hydrophones, batteries, and accessories	1 Year
Other WAI products	all components	1 Year

WAI warrants refurbished WAI products, marked and sold as such, for ninety (90) days from the original purchase date.

**Software:** WAI warrants to Customer that any WAI branded software will perform in substantial conformance to their program specifications for a period of ninety (90) days from the date of original purchase. WAI warrants the media containing software against failure during the warranty period. WAI makes no warranty or representation that the operation of the software products will be uninterrupted or error free, or that all defects in the software products will be corrected.

**Exclusions:** This warranty excludes (1) physical damage to the surface of the product, including cracks or scratches on the outside casing; (2) damage caused by misuse, neglect, improper installation or testing, unauthorized attempts to open, repair, or modify the product, or any other cause beyond the range of the intended use; (3) damage caused by accident, fire, power changes, other hazards, or acts of God; or (4) use of the product with any non-WAI device or service if such device or service causes the problem.

Any third party products, including software, included with WAI products are not covered by this WAI warranty and WAI makes no representations or warranties on behalf of such third parties. Any warranty on such products is from the supplier or licensor of the product.

No warranty is provided by WAI unless the product was purchased from an authorized distributor or authorized reseller.

**Exclusive Remedies:** Should a covered defect occur during the warranty period and you notify WAI, your sole and exclusive remedy shall be, at WAI’s sole option and expense, to repair or replace the product or software. If WAI cannot reasonably repair nor replace then WAI may, in its sole discretion, refund the purchase price paid for the product. Replacement products or parts may be new or reconditioned or comparable versions of the defective item. WAI warrants any replaced or repaired product, part, or software for a period of ninety (90) days from shipment, or through the end of the original warranty, whichever is longer.

**Obtaining Warranty Service:** Customer should refer to the WAI website at [www.wildlifeacoustics.com/support/contact-support](http://www.wildlifeacoustics.com/support/contact-support) for information on obtaining warranty service authorization. Methods for obtaining warranty service may vary depending on whether purchases were made from an authorized provider of WAI products or from WAI directly. All requests for warranty service authorization must be made within the applicable warranty period. Dated proof of original purchase will be required. Products or parts shipped by Customer to WAI must be sent postage-paid and packaged appropriately for safe shipment. WAI is not responsible for Customer products received without a warranty service authorization and may be rejected. Repaired or replacement products will be shipped to Customer at WAI expense. All products or parts that are replaced become the property of WAI. WAI shall not be responsible for Customer software, firmware, information, or memory data contained in, stored on, or integrated with any products returned to WAI for repair, whether under warranty or not. The repair and replacement process for products or parts in locations outside of the United States will vary depending on Customer's location.

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# Song Meter SM3 Marine

BIOACOUSTICS RECORDER

## User Guide



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