



See Page 1 for
Quick Start Guide

Song Meter SM4

BIOACOUSTICS RECORDER

User Guide

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1 Quick Start Recording Guide

- ❑ Release the side latch and open the security cover.
- ❑ Open the middle section to expose the battery bay and install four new alkaline or NiMH D batteries; close the middle section. Or see *Using External Power*.
- ❑ Insert one SD memory card in slot A and an optional card in slot B.
- ❑ Slide the power switch down to **INT** for internal battery power. Slide the switch up to **EXT** if using an external power source. The SM4 powers on and the main menu appears on the display.
- ❑ Press **CHECK STATUS** to verify the time, microphone, firmware, SD memory cards, battery voltage, and temperature.
- ❑ (Optional) Attach the GPS to auto-set date, time, and location. Leave the GPS attached. A # symbol will appear in between the date and time on the check status screen when the data have been set.
- ❑ Use the keypad to select **Quick Start** and choose a recording schedule.
- ❑ Press the **SCHEDULE START** button to start the schedule.
- ❑ For schedules defined to start or end at times that are based on sunrise or sunset (for example, *Record Sunset to Sunrise*), you are reminded to set the latitude and longitude. You should also set the date, time, and time zone. If you attached the available GPS accessory in an earlier step, the location, date, and time are set for you automatically. You must always set the time zone; it is not set by the GPS.
- ❑ The schedule begins:
 - The SM4 *sleeps* (goes blank) to conserve battery power if a recording is not scheduled in the next minute.
 - The SM4 *wakes* at the next scheduled recording start time and saves recordings to the SD memory card(s).
- ❑ Close the security cover and latch. To secure the recorder, attach an optional lock. Mount the recorder in a suitable location for recording. You can leave the recorder unattended after this step.
- ❑ When the deployment has ended, press and hold **SCHEDULE STOP** to finish recording. Eject the SD memory card(s) and review the recordings.

Contacting Support

For issues or questions that are not addressed in this guide, we have a full-time support team ready to assist you:

- Email: support2016@wildlifeacoustics.com
- North America (toll-free): 1-888-733-0200
- Outside North America: US+1 978-369-5225 (Toll charges may apply.)

2 Overview

2.1 Introduction

The latest generation in the Song Meter series, the SM4 is a weatherproof programmable audio recorder designed for the periodic, seasonal, and long-term monitoring of wildlife bioacoustics in almost any environmental conditions.


You can schedule daily recordings to meet a variety of needs including times that are relative to sunrise and sunset, specific duty cycles with on/off recording patterns, and continuous monitoring all day and all night. The SM4 optimizes battery life and memory capacity to record for extended periods of time. Using both memory slots and new alkaline batteries, a typical deployment can record for up to 500 hours spanning several months.

Features

- Lightweight, portable, and completely weatherproof.
- Includes two low noise built-in microphones for two-channel stereo sound.
- Built-in microphones are easily replaced if necessary.
- Supports one or two standard SDHC or SDXC SD memory cards.
- Control panel features a weatherproof keypad for easy entry and feedback with a dual-color LED status lamp and a backlit display.
- Integrated top and bottom mounting flanges are designed to work with cable locks, screws, radiator clamps, bungee cords, or other fasteners.
- Easy to set up and operate. Use the **Quick Start** menu to select a daily schedule and then press **START**. You can also make your own custom recording schedule.
- Use the SM4 Configurator software on a computer to create a custom schedule and estimate its impact on battery life and SD memory card usage.
- **CHECK STATUS** button for viewing the current health of the recorder without interrupting recording. Check SD memory card usage, battery voltage, and more.
- External power option using an SM3/SM4 power cable (sold separately).
- Self-generated diagnostics assist in basic troubleshooting.
- Internal temperature and battery voltage logging.
- Headphone port for real-time monitoring and system verification.
- Optional GPS accessory automatically sets the date, time, latitude, and longitude of the recorder and logs recording coordinates.

2.2 Visual Tour



ITEM:	DESCRIPTION:
Security Cover	Protects the recorder. The cover swings to open or close and can be secured with a standard lock (sold separately).
LED Status Indicator	Flashes  green every second when recording and every minute when sleeping.
Latch	Grip and pull to open the security cover. Push the security cover closed until the latch clicks to close.
Keypad	Press the buttons on this panel to navigate the display menus and options. Press ▲ Up or ▼ Down , ◀ Left or ▶ Right , or ENTER . Other buttons include SCHEDULE START , SCHEDULE STOP , and CHECK STATUS .
Mounting Flanges	Rugged and ready for almost any environment. Use the top and bottom cutouts to mount the recorder.
Power Switch	Slide down to turn power on using internal battery (INT). Slide up to use optional external power (EXT) or to turn off (if no external power).
Display	Displays all main menu items, values for settings, message prompts, and status information.
Built-in Microphone	On left and right, integrated replaceable low-noise stereo microphones.
Memory Slots A and B	Insert removable SD memory cards to store recordings.
Lock Ring	Insert the shackle of an optional key or combination lock to secure your recorder.
GPS Connection	Use the available GPS option to automatically set the date, time, and location settings.
Pressure Vent	Temperature, UV, and water-resistant vent protects the enclosure from condensation.
Headphone Jack	Connect headphones and press ENTER to listen to real-time audio as it is recorded

2.3 The Display Main Menu

Refer to the following table when navigating the display Menus using the directional buttons.

Menu Item	Description
Quick Start	
Record Always	Records continuously 24 hours a day.
Record 30on & 30off	Repeats an hourly duty cycle made up of 30 minutes of recording followed by 30 minutes of sleep.
Record 5on & 55off	Repeats an hourly duty cycle made up of 5 minutes of recording followed by 55 minutes of sleep.
Record Sunrise->Set	Based on your location, date, and sunrise/sunset settings, records continuously from sunrise until sunset.
Record Dawn & Dusk	Based on your location, date, and sunrise/sunset settings, records 2 hours centered at sunrise and 2 hours centered at sunset.
Settings	
Audio	Configure audio settings for recordings.
Date and Time	Set the local date and time for your recorder.
Location	Set the recorder prefix ID and the latitude, longitude, and time zone for your location.
Sunrise/Sunset Type	Set the method used to calculate the sunrise and sunset times. Choices include astronomical, civil, or nautical twilights or the actual sunrise/set times
Delay Start	Optionally delays the start of your daily schedule until a future date. At midnight on that date, the recorder starts its schedule.
Battery Cutoff	Set the cutoff voltage for external batteries. The recorder automatically shuts down if the voltage drops below this level to prevent battery damage.
Schedule	
Edit Schedule	Add, modify, or delete schedule blocks.
Import Sched+Setts	Import a schedule and settings from an SD card.
Export Sched+Setts	Export the current schedule and settings to an SD card.
Utilities	
Export Diagnostics	Save status and troubleshooting information to an SD card to send to the Wildlife Acoustics Support Team.
Set factory default	Reset the original recorder settings. Restore configurations to their factory-fresh, like-new state. CAUTION: Any custom schedules or settings are replaced.
Calibrate Mic	Test the sensitivity levels of built-in or connected microphones with a third-party external microphone calibrator.
Format all cards	Erase and reformat the SD cards. CAUTION: All data on the cards is permanently lost.
Firmware Update	Update the recorder with a new firmware file that you have downloaded and saved to an SD card.

3 Setup and Installation

3.1 Opening the Recorder

To install batteries, insert an SD memory card, or access the GPS and headphone jacks, open the security cover.



1. Locate the handle for the security cover on the front right side of the recorder as shown.
2. Grip the handle and lightly pull it to release the latch. The cover flips open and rotates along the hinged spine like a book, exposing the Display and keypad.
3. Press the small circular indentation between SD memory card slots A and B with your thumb to release the middle section. If it is difficult to release the section, press closer to the gasket seam. This section swings open exposing the battery bay

To close the cover, reverse the steps.

1. Snap the middle section (Display and keypad) back down into place.
2. Gently and firmly push the security cover back down and snap it into place.
3. Snap the security cover latch over the locking ring.

3.2 Turning Power On and Off

Follow these steps to switch the power on or off based on your choice of power source and the current switch position.

1. Open the cover to access the power switch on the side of the middle section above memory slot A.
2. Slide the switch down to **INT** to turn power on when using internal batteries; slide the switch up to **EXT** to turn power on when using external power.

Only one power source is used at a time so whichever position does not have a battery installed is functionally off.

1. To turn the recorder off to conserve battery power, slide the switch up to **EXT** when using internal batteries and **INT** when using external batteries.

NOTE: Do not turn the power off when a recording is in progress. To safely exit from recording, press **SCHEDULE STOP**, allow the recorder to return to the **Main Menu**, and then switch the power off. Avoid quickly switching power off and on again (avoid quick switches between **INT** and **EXT**). The recorder can interpret this sudden loss and restoration of power as an error and may start creating diagnostics.

3.3 Using Internal Batteries

The recorder uses four size D alkaline or NiMH batteries. The SM4 can record up to 400 hours using alkaline batteries and up to 250 hours using NiMH.

NOTE: More than half of the power consumption of the SM4 system can be due to the SD cards. Run times can vary by as much as 50% depending on the characteristics of specific brands and models of cards. We recommend using SanDisk SDHC/SDXC cards. Other factors like the kind and quality of batteries used, how rechargeable batteries are recharged, temperature, and configuration can also affect run times.

The SM4 enters a very low-power sleep state between scheduled recordings to conserve energy and maximize efficiency for long deployments.

TIP: Use the Song Meter SM4 Configurator software to estimate the recording requirements for your schedule including battery life and memory storage.

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

1. Open the recorder. See *Opening the Recorder* earlier in this chapter.
2. Insert batteries with their polarity (+/-) orientation as shown on the battery bay markings.

NOTE: Do not mix batteries of different types, and do not mix old and new batteries. Remove batteries before storing the recorder for an extended period.

3. Close the middle section and gently press down until it snaps into place.
4. Slide the power switch up to **INT**.
5. When not in use, set the power switch down to **EXT** to conserve internal battery power. With no external batteries installed, consider the **EXT** position to be off. Only one power source is active at a time.

3.4 Using External Power

With the optional external power cable, the power connector can accept voltages from 5-17 volts DC. It is intended for 6 or 12-volt external battery systems.

CAUTION: If you are unfamiliar with configuring external battery and power systems, consult a local installer for assistance.

1. Each power cable is shipped with a snap-on ferrite required to meet legal requirements for limiting electromagnetic emissions and for immunity from electrostatic discharge. The ferrite should be installed on the cable that attaches to the recorder and as close to the recorder as possible. The cable is looped through and the ferrite snapped shut. A zip tie is included for further securing the ferrite. The below picture shows the ferrite as shipped and as installed.



2. Align and seat the cable into the **EXT POWER** port on the side of the recorder.
3. Turn the grey locking ring (black on older SM3 cables) on cable ⤵ clockwise firmly until it stops and locks into place.



- Connect the cable to a 6 or 12-volt battery using one of the connectors provided. The cable includes F2 sized spade connectors as well as ring terminals. The SM4 provides protection against accidental reverse polarity connections.



- Open the security cover and locate the power switch on the side.
- Slide the power switch up to **EXT**.
- If necessary, set a minimum voltage to prevent damage to lead-acid batteries not designed for deep discharge. See *Setting a Minimum External Battery Voltage*.
- When not in use, set the power switch down to **INT** to conserve external battery power. With no internal batteries installed, consider the **INT** position to be off. Only one power source is active at a time.

3.5 SD Memory Cards

You must insert at least one SD memory card to save your recordings. The following table shows the actual stereo recording time in hours for each sampling rate and card capacity to help you choose the right SD memory card.

SD Card (GB)	8,000	12,000	16,000	22,050	24,000	32,000	44,100	48,000	96,000
16	139	93	69	50	46	35	25	23	12
32	278	185	139	101	93	69	50	46	23
64	556	370	278	202	185	139	101	93	46
128	1,111	741	556	403	370	278	202	185	93
256	2,222	1,481	1,111	806	741	556	403	370	185
512	4,444	2,963	2,222	1,612	1,481	1,111	806	741	370

NOTE: More than half of the power consumption of the SM4 system can be due to the SD cards. Run times can vary by as much as 50% depending on the characteristics of specific brands and models of cards. We recommend using SanDisk SDHC/SDXC cards.

1. Open the security cover and locate memory slots A and B on the side below the power switch.
2. Insert one required SD memory card in slot A or B. Push the card straight in until it clicks into place.
3. (Optional) To extend deployments, insert a second SD memory card in the remaining slot.



NOTE: Both slots A and B can be used for recording, but Slot A is required for schedule and settings import or export, or for firmware updates.

1. To remove a card, push it in and release it. The spring-loaded slot ejects your card so you can pull it away safely.

If the recorder is unable to access or write to a card, this error appears:

```
2017-Jan-31    09:00:00
CARD FULL OR ERROR
```

If no card is present, insert one. Make sure the card's read/write switch is set to allow write access to the card. You can also try copying the data to another card or hard disk and then using a new memory card.

NOTE: Do not remove SD memory cards when the SM4BAT FS is recording. This could corrupt the card.

3.6 Connecting External Microphones

Instead of using the built-in microphones, you can connect one or two external SMM-A2 microphones (sold separately). The two microphone connectors for channels 0 and 1 mate with our weatherproof acoustic microphones or an extension cable.

The cabled SMM-A2 acoustic microphone is completely weatherproof when deployed and handled correctly and can be deployed up to 100m away from the recorder. Cables are available in 3, 10, and 50-meter lengths and can be interconnected to form other lengths.

- Each extension cable is shipped with a snap-on ferrite required to meet legal requirements for limiting electromagnetic emissions and for immunity from electrostatic discharge. The ferrite should be installed on the cable that attaches to the recorder and as close to the recorder as possible. The cable is looped through and the ferrite snapped shut. A zip tie is included for further securing the ferrite. This picture shows the ferrite as shipped and as installed.



- Align and seat the cable into the keyed connector.
- Turn the grey locking ring (black on older SM3 cables) on the microphone or cable ⤴ clockwise firmly until it stops and locks into place.
- Replace the windscreen when the foam begins to break down and flake. With normal outdoor use over time, the foam windscreen fades to brown; however, color degradation does not indicate a loss of integrity.

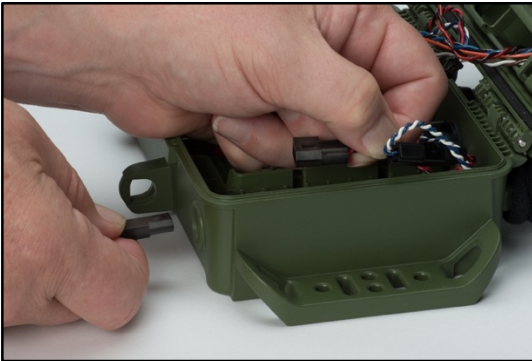


CAUTION: Do not mount cabled microphones pointing directly up at the sky, flat on the ground, or on ungrounded non-conductive masts, especially in dry or windy conditions. Unsafe mountings can result in damage to the microphones or recorder from electrostatic build-up or lightning. Such damage is not covered under warranty. Check with a professional licensed electrician or installer with experience in outdoor antennas or weather instruments for advice suitable to your specific situation.

3.7 Replacing a Built-in Microphone

The built-in microphones are easily replaceable should they become damaged. Replacement microphones are sold with a new windscreen and sealing O-ring.

1. Open the recorder. See *Opening the Recorder* earlier in this chapter.
2. Firmly grasp both sides of the inline connector located above the battery tray and pull the connector from the socket. Do not pull on the wires, only the connector.
3. Remove the windscreen from the damaged microphone.
4. Loosen the microphone from the outside, turning it counter-clockwise. Use a standard 5/8" wrench if the microphone is too tight to loosen by hand.
5. Remove the microphone.



6. Push the connector for the new microphone through the hole.



7. Carefully engage the threads on the new microphone by hand and hand tighten clockwise a few rotations.
8. Use a standard 5/8" wrench to finish tightening until snug. The flat of the microphone should touch the housing. Do not over-tighten.
9. Plug the inline connector into the socket.
10. Install the windscreen.

11. Test the new microphone to ensure it is working correctly.

3.8 Using the GPS Accessory

The optional GPS accessory automatically sets the date, time, latitude, and longitude of the recorder. If you have several SM4 recorders to deploy in the field, you can use one GPS accessory to set up all recorders.

NOTE: The GPS cannot be used for precision time synchronization as it can on the SM3.



The available GPS accessory consumes about 90 mA of additional current—more than four times the current of the recorder itself. For passive recording, we recommend that you use the GPS to automatically set the clock and location at the beginning of the deployment but do not keep it attached for the duration of the deployment.

NOTE: The **Location Settings** coordinates are read-only when the GPS is attached. You cannot change them.

1. Open the security cover and locate the GPS port on the side.
2. Plug the GPS cable into the GPS port.
3. The recorder automatically detects the presence of the GPS. When the recorder wakes up, the GPS is powered up.
4. Press the **CHECK STATUS** button.
5. A question mark (?) appears between the date and time to indicate that the GPS accessory is attempting to acquire satellite data.

```

2017-Oct-14    ?    14:50:48
R:1.0.0      Mic0:A2    1:A2
SDA: 6/32    B: 0/32
Bat: 5.9V    Temp:16.70

```

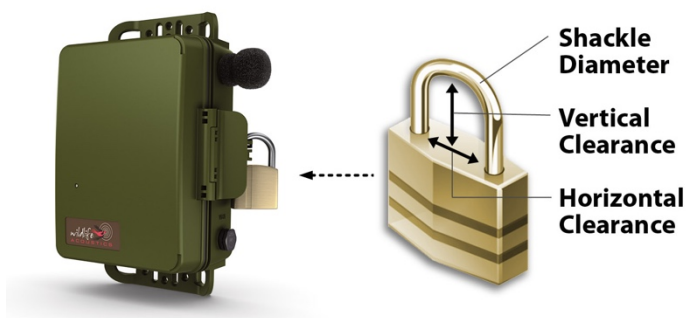
- When the GPS has successfully acquired satellite data, the question mark changes to a number sign (#) indicating that the location and clock have been set.

NOTE: If you connect a GPS accessory and are still prompted for latitude and longitude when starting a schedule, it most likely means the GPS accessory does not yet have a fix. Also be aware that it can be difficult to acquire a GPS signal in thick vegetation.

- Navigate to **Main Menu > Settings > Location > Timezone** and set the time zone. Even with the GPS accessory installed, you must still set the time zone. The observation of time zones varies by political region, country, or state.

3.9 Securing the Recorder

Close the cover to protect the recorder from environmental conditions. To secure the recorder with a standard key or combination lock, press the latch down and insert the lock shackle through the lock ring.



The following requirements apply to the size of the lock and assure that the security door cannot be opened or cracked:

	Minimum:	Maximum:
Shackle Diameter	1/8 inch (3 mm)	3/8 inch (9 mm)
Vertical Clearance	5/8 inch (16 mm)	1.0 inch (25 mm)
Horizontal Clearance	1/2 inch (13 mm)	1.0 inch (25 mm)

NOTE: The lock should be rated for outdoor use.

3.10 Mounting the Recorder

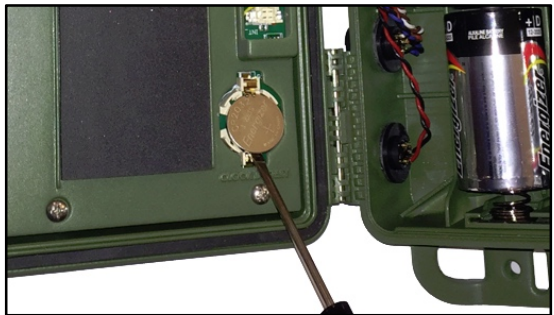
Use the holes in the top and bottom mounting bracket for mounting the recorder with cable locks, screws, radiator clamps, bungee cords, or other fasteners. The enclosure is fully weatherproof and does not require additional protection.



3.11 The Clock Battery

A separate button cell CR2032 lithium clock battery maintains real-time clock settings when the four main D batteries are being exchanged or are no longer operational. The included battery should last up to 3 years. Use the steps below to replace the internal clock battery.

1. Open the security cover and the middle section to access the battery bay.
2. Locate the circular **CLOCK BATTERY** bay behind the Display and keypad opposite the main battery bay.



3. Gently insert a flathead screwdriver to pry the old battery out and replace it with a new one. The side with the CR2032 lettering faces you.

3.12 The Temperature Sensor

The recorder includes an integrated temperature sensor to log temperatures inside the enclosure. This is intended for diagnostics only. Heat from the electronics and/or heat from sun on the enclosure can significantly increase the temperature reading above ambient air conditions.

4 Settings

4.1 Navigating the Menus

To navigate the main menu, select items, and configure the values for various settings, use the following basic steps. All procedures in this guide assume you are familiar with these basic steps.

1. Press **▲ Up** or **▼ Down** and **ENTER** to navigate any menu.
For example, navigate to **Main Menu > Settings > LED Indicator**.
2. Press **ENTER** or **▶ Right** to make your selections.

NOTE: Both **ENTER** and **▶ Right** are interchangeable everywhere in the menus with the exception of the line where schedule blocks are added and deleted, see note in that section.

3. Press **ENTER** or **▶ Right** to continue to the next editable item.
4. Press **▲ Up** or **▼ Down** to select values.

Tip: To accelerate the pace when selecting higher or lower values, press and continue to hold down the **▲ Up** or **▼ Down** arrow buttons.

5. Press **ENTER** or **▶ Right** to save your edits.
6. Repeat these steps as required. The exact buttons you press may vary by setting and parameter.
7. Press **◀ Left** to exit a line without saving or to go back to the previous menu.

TIP: For improved visibility in low-light environments, press any button on the keypad to illuminate the Display. The backlight remains lit while you continue operating the recorder and turns itself off after thirty seconds of inactivity.

4.2 Setting the Date and Time

If you are not using the available GPS accessory to automatically set the current date and time, you should manually set these parameters.

NOTE: The recorder does not automatically adjust for Daylight Saving Time.

As you adjust the month and day, the recorder calculates and displays the sunrise and sunset times (according to the Sunrise/Sunset Type setting) on that date for your reference.

1. Navigate to **Main Menu > Settings > Date and Time**.
The date and time appear on one line in the following format:
YYYY-MMM-DD HH:MM:SS
For example:

2017-Oct-22 20:17:45

2. Press ► **Right** to set the date (year, month, and calendar day).
3. Press ► **Right** to set the time (hours, minutes, and seconds).
4. To adjust any value, press ▲ **Up** or ▼ **Down**.
5. Press **ENTER** when finished.

4.3 Setting the Prefix for Recorded Files

You can specify a custom filename prefix of up to 12 characters to identify each recorder. The default prefix combines the model number with the serial number.

The prefix appears in every recording file name. This can be used to easily identify recordings made on a specific recorder or deployment.

Follow these steps to change the recorder-specific prefix:

1. Navigate to **Main Menu > Settings > Location > Prefix**.
2. Specify a 1 to 12 character prefix from left to right:
3. 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 (it is above the digit 9).
4. Press ► **Right** to advance to the next position in the prefix and repeat the previous step.
5. To erase characters, select the blank character. It is higher than the hyphen and lower than the letter A. All of the characters to the right of the blank character are erased.
6. When you are finished, press ► **Right** to advance to the last position and then press **ENTER**.

NOTE: The prefix can only contain capital letters, numbers, and hyphens. When you change the default prefix, the serial number of the recorder no longer appears in the recording file names; however, it does still appear in the metadata inside the file.

4.4 Setting the Location and Time Zone

If you are not using the available GPS accessory to automatically set the latitude and longitude, you must manually set these parameters. The time zone cannot be set automatically by the GPS and must also be set manually.

The selections you make for latitude, longitude, and time zone enable the recorder to determine the specific sunrise and sunset times for each day.

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

NOTE: The recorder does not automatically adjust for Daylight Saving Time.

1. Navigate to **Main Menu > Settings > Location > Latitude.**
Enter the north or south latitude.
2. Navigate to **Main Menu > Settings > Location > Longitude.**
Enter the east or west longitude.
3. Navigate to **Main Menu > Settings > Location > Timezone.**
Enter the time zone relative to UTC.

4.5 Setting the Solar Calculation Method

The SM4 can schedule recordings relative to sunrise and sunset times, and adjusts these times as they change during the year. You can choose from four different methods of calculating the sunrise and sunset.

4. Navigate to **Main Menu > Settings > Sunrise/Sunset Type.**
5. Select one of the following solar calculation types:
 - **sunrise/set:** When the sun is just below the horizon.
 - **civil:** When the sun is 6 degrees below the horizon.
 - **nautical:** When the sun is 12 degrees below the horizon.
 - **astronomical:** When the sun is 18 degrees below the horizon.
6. The calculated sunrise and sunset times for the method that you select appear for today. For example:

Sunrise/Sunset Type	
-Solar	nautical
Rise 05:12	Set 18:57

7. Press **ENTER** to save your changes.

NOTE: Sunrise and sunset calculations also require other settings including the date and time, latitude, longitude, and time zone.

4.6 Setting a Minimum External Battery Voltage

You can set a minimum voltage cutoff to help prevent damage to external lead acid batteries from over-discharge. If the external battery's voltage falls below

this cutoff, the schedule is suspended. The SM4 then wakes every 24 hours to check the voltage and resumes the schedule if the voltage is restored.

1. Navigate to **Main Menu > Settings > Battery Cutoff**.
2. Press **▲ Up** or **▼ Down** to adjust the power cutoff in volts from 0.0 to 12.0 in 0.1-volt increments.
3. Press **ENTER** to save your changes.

NOTE: Leave the cutoff value at 0.0 if you are using internal alkaline batteries. Any non-zero setting decreases internal battery life as the recorder prematurely suspends operation. Also use a setting of 0.0 for external batteries that are designed for deep discharge.

4.7 The Audio Settings

When your schedule starts, it applies your current audio settings. When you import or export a schedule, the settings are included.

1. Navigate to **Main Menu > Settings > Audio**.
2. Select an audio setting to adjust its value.
3. Press **ENTER** to save your changes.

The following section describes each audio setting and indicates the range of acceptable values.

Channel

Select the audio channel or channels. The left microphone is on channel 0 and the right microphone is on channel 1.

Values: stereo, left, or right

Default: stereo

Left and Right Gain

You can adjust the left or right channel audio gain setting to boost the input level of the audio signal from the corresponding microphone.

The default 16dB gain is generally a good compromise between having fidelity of weaker signals while maximizing dynamic range to handle louder signals. A lower gain setting might be necessary in loud environments to avoid clipping. A higher gain setting might be necessary if you are trying to analyze very weak signals.

In addition to this programmable gain setting, there is a low-noise 24dB preamplifier gain stage that is always on.

The default setting of 16dB (and including the 24dB from the preamplifier) is equivalent to 48dB gain on a Song Meter SM2 and 24dB gain on a Song Meter SM3

Values: 0 to 59.5 dB in 0.5-dB increments

Default: 16 dB

Left and Right Filter

You can set a left or right channel high pass filter, which only allows signals higher than the specified frequency to be recorded. For recording very low frequency sounds such as elephants, set this to **off**. Otherwise it is useful for reducing wind and anthropogenic noise and should be set to at least 220 Hz.

The filter is a two pole filter, which attenuates sounds at 12dB per octave. For example, if the filter was set to 1.0 kHz, a 500 Hz sound would be attenuated by 12dB. Every 6dB represents a halving of sound level, so the 500 Hz sound would appear in the recording at one-fourth of its original amplitude.

Values: off, 220, or 1000 Hz

Default: off

Sample Rate

Your choice of rate determines the number of samples per second used to store any sounds detected during a recording period. Higher sample rates provide the ability to record higher frequencies. Choose a sample rate that is at least double the highest frequency to be recorded.

Values: 8000, 12000, 16000, 22050, 24000, 32000, 44100, 48000, or 96000 Hz

Default: 24000 Hz

Max Length

You can specify the maximum length (time duration) of recordings. There is also a maximum file size for any individual recording of 2.0 GB. When a recording reaches either maximum, that recording is ended and a new recording is started.

NOTE: Back-to-back recordings and recordings that are split when either maximum is reached may start a few seconds late to allow time to perform file operations on the SD card. This may result in file sizes slightly smaller than the *Max Length* setting. For example, a recording file might show a duration of 14:57 even though you set *Max Length* to 15:00.

Values: 1 minute up to 24 hours in 1-minute increments

Default: 01h: 00m

4.8 Setting a Delayed Start

The Delay Start setting waits until a future date to start your schedule. The recorder delays the start of the schedule until midnight of the specified day.

1. Navigate to **Main Menu > Settings > Delay Start**.
2. Set a future start date and set **Enable** to **yes**.

NOTE: You can use this feature to synchronize the start of one or more recorders.

When you start the schedule, a warning appears reminding you of the delayed start. If the date is in the past, no warning appears and the schedule starts without delay.

4.9 Setting the LED Indicator Mode

The LED Indicator in the keypad blinks to indicate the recorder status. It blinks green once per second during a recording and once per minute when the recorder is sleeping. This light is visible on the front of the recorder even when the security cover is closed.

1. Navigate to **Main Menu > Settings > LED Indicator**.
2. Choose **always** or **5 minutes only**.

When you choose **5 minutes only**, the LED only appears for approximately the first 5 recording minutes after you press **SCHEDULE START** or **CHECK STATUS** or until the first time the unit sleeps. This allows you to maintain some level of camouflage if security is a concern.

5 Making Scheduled Recordings

5.1 Recording Operation Overview

The current recording schedule determines the behavior of the recorder. The SM4 sleeps when no recordings are scheduled and wakes for each scheduled recording period. The screen is blank when the recorder is sleeping to save power.

5.2 Using a Quick Start Schedule

The Quick Start menu includes pre-configured schedules intended to satisfy most customers' scheduling requirements. They also serve as excellent starting points for editing if you need something a little different than one of these options. Creating custom schedules is covered in the next chapter.

1. Navigate to **Main Menu > Quick Start**
2. Choose one of the following Quick Start schedules and press **ENTER**.

Name	Definition of schedule
Record Always	Records continuously 24 hours a day.
Record 30on & 30off	Repeats an hourly duty cycle made up of 30 minutes of recording followed by 30 minutes of sleep.
Record 5on & 55off	Repeats an hourly duty cycle made up of 5 minutes of recording followed by 55 minutes of sleep.
Record Sunrise->Set	Based on your location, date, and sunrise/sunset settings, records continuously from sunrise until sunset.
Record Dawn & Dusk	Based on your location, date, and sunrise/sunset settings, records 2 hours centered at sunrise and 2 hours centered at sunset.

3. When you change schedules, a confirmation screen appears.
 - Select **Yes** to continue with your new schedule. Your audio settings are saved but any custom edits you made to the last schedule are not. Export that schedule if you want to save any custom edits or blocks you already made.
 - Select **No** to retain the current schedule.
4. Press **SCHEDULE START** to start the schedule or **◀ Left** to return to the Quick Start menu. The new Quick Start schedule is loaded even if you return to the menu. See the next chapter for details on running and stopping the schedule.

Tip: The recorder automatically attempts to start the current schedule after three (3) minutes of inactivity.

5. When you press **SCHEDULE START**, warning messages may alert you about needed settings, missing SD memory cards, or incompatible or missing microphones.
6. Each warning is displayed for several seconds. You can proceed immediately to the next warning by pressing **▼ Down**. After the last warning, the recorder will attempt to run the schedule.
7. While any warning is being displayed, you can press **SCHEDULE STOP** or **◀ Left** to avoid running the schedule and return immediately to the main menu. Adjust any settings or hardware configurations to resolve the warnings. Press **SCHEDULE START** again when you are ready.
8. One of the following screen appears:

If your schedule records always:

```
2017-Dec-05      10:58:37
Preparing to record
A CONTINUOUS      #00001
```

If your schedule calls for specific start and end times that define a contiguous recording period, recording within the next 45 seconds, then the first recording period's beginning and ending times are shown::

```
2017-Dec-05      10:58:37
Preparing to record
A 11:00-17:00     #00002
```

If you defined a duty cycle that calls for an even smaller segment of recording time, that time range appears:

```
2017-Dec-05      10:58:37
Preparing to record
A 11:00-11:30     #00003
```

If the first recording period's beginning time is more than 45 seconds into the future, then the recorder goes to sleep to conserve power:

```
2017-Feb-10      11:05:00
Going to sleep until
2017-Feb-10      19:15:00
```

The recorder wakes up 30 seconds before the next scheduled recording period so that it is ready to record on time.

```
2017-Feb-10 08:59:30
Preparing to record
A 09:00-09:30#000000
```

5.3 The Recording Screens

While recording, the recording screen is shown on the display. Below are two examples.

```

2017-Apr-25          23:50:48
Currently recording:
B CONTINUOUS          #00088
STEREO                @SR=48000

```

```

2017-Apr-25          09:02:48
Currently recording:
B 09:00-09:30        #00088
STEREO                @SR=24000

```

- Line 1: The current date and time.
- Line 3: Which card the recorder is writing to (**A** or **B**). Also shown are the beginning and ending times of the current recording period or CONTINUOUS if the recorder is recording always. On the right is the running count of recording files created since the recorder was last powered on.
- Line 4: Which channels are being recorded and at which sample rate.

5.4 Checking the Status of the Recorder

Use the following procedure anytime to check the status of the recorder.

NOTE: Always perform this procedure to check the status of the recorder and SD memory card before a deployment.

9. Press the **CHECK STATUS** button. If the recorder is sleeping, press and hold down **CHECK STATUS**.

The following status information appears:

```

2017-10-23          9:14:48
R:1.2.1             Mic0:A2 1:A2
SD A: 7/64          B: EMPTY
Bat: 5.2V           Temp:17.00

```

- Line 1: The current date and time.
- Line 2: The installed firmware version and the currently connected microphones on channels 0 and 1 (**IN** for a built-in microphone, **A1** or **A2** for an external acoustic microphone).
- Line 3: The memory usage as a fraction of the total capacity in GB for SD cards in slots A and B.
- Line 4: The internal battery or external power supply voltage, and the internal temperature in degrees Celsius.

NOTE: The internal temperature of the recorder is intended for diagnostics and not as an accurate measurement of outside air temperature.

10. (Optional) You can press the **CHECK STATUS** button again to return to the previous screen. The status screen automatically stops appearing after ten (10) seconds.

NOTE: When the recorder is sleeping, the Going to sleep until screen is shown first and another press of the Check Status button is required to see the Check Status screen.

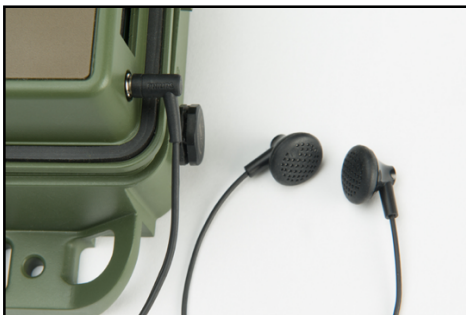
5.5 Monitoring Live Audio with Headphones

You can connect headphones to the headphone jack to listen to real-time audio as it is recorded. Headphone audio can be heard only during a live recording.

1. Open the security cover and insert the headphone cable into the headphone jack on the side below the GPS port.
2. You can start a schedule, start instant recording mode, or allow a currently running schedule to continue.
3. Press **ENTER** during a recording to enable monitoring on headphones.

CAUTION: Initial headphone volume may be loud.

4. Press **▲ Up** or **▼ Down** to adjust the volume.
5. Press **ENTER** again to toggle the headphone output on and off. Headphone sound automatically resets to off when the current recording period ends.



5.6 Stopping a Recording Schedule

When you stop a running schedule, the current recording is terminated and saved to the SD memory card.

1. Press and hold the **SCHEDULE STOP** button for several seconds while a schedule is running or scheduled to run to stop it.

The recorder automatically resumes the recording schedule after three minutes of no activity. When not recording for an extended period of time, power the recorder off.

5.7 Making an Instant Recording

In addition to running a schedule, you can start an Instant Recording anytime.

1. Verify the recorder is turned on and displaying the main menu. If the recorder is sleeping, press and hold **SCHEDULE STOP** to wake it.
2. Press and hold both the **▲ Up** and **▼ Down** keys at the same time.
3. The recorder immediately starts continuous instant recording.

2017-Oct-14	14:50:48
Instant recording:	
A CONTINUOUS	
STEREO	@SR24000

4. Press **SCHEDULE STOP** to stop instant recording. After 24 hours, instant recording will automatically stop and the current schedule will begin.

NOTE: The length of recordings made during instant recording is dictated by the **Max Length** setting in **Audio Settings**.

5.8 Recording Filenames

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

PREFIX_YYYYMMDD_HHMMSS.wav

PREFIX: The current prefix as set in the location settings.

YYYYMMDD_HHMMSS: The date-time stamp including the year, month, day, hour, minute, and second when the recording started.

.wav: The audio file name extension for Waveform Audio File Format (WAVE)

5.9 Recording Metadata

Values for the attributes listed below are stored as metadata in your recordings. The Wildlife Acoustics Support Team can use these metadata when troubleshooting issues.

NOTE: You can open a recording in the SM4 Configurator to view the schedule and settings used to make the recording.

Device Model: The device model name. For example, *SM4*.

Device Serial Number: The unique serial number of your recorder.

Firmware Version: The firmware version installed on the recorder.

Prefix: The prefix assigned to the recorder in the location settings.

Timestamp: The date and time when the recording started.

GPS Coordinates: The location of the SM4 when the recording first started. The file metadata stores the location coordinates that you manually entered on the recorder as well as the coordinates from the GPS accessory if attached.

Schedule and Settings: The schedule and all settings in use when the recording was made.

5.10 Recording Summary Text File

Approximately once per minute during a recording, the SM4 appends a line of text to the summary text (.txt) file. This file is in comma-separated values (.csv) format. You can open it in Microsoft Excel, in database software, or in a text editor.

The file begins with a header line which identifies the fields that appear in each line of summary data:

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

Two lines from a sample summary file appear below:

```
2017-Jan-22, 17:15:24, 42.00000, N, 71.00000, W, 5.9, 12.00, 0, IN, IN
2017-Jan-22, 17:16:38, 42.20000, N, 71.10000, W, 5.9, 11.75, 1, IN, IN
```

DATE & TIME: The date and time for each entry. This is the time taking into account the time zone set in the location settings.

LAT & LON: If the GPS accessory is installed, the latitude and longitude are given with identifiers for north (N), south (S), east (E), and west (W). Without GPS, the latitude and longitude values are 0.

POWER(V): The internal battery or external power supply voltage. In the example, the voltage is 5.9 volts.

TEMP(C): The temperature in degrees Celsius inside the recorder. In the example, the internal temperature has fallen from 12.00 to 11.75 degrees.

#FILES: The number of recording files written since the previous summary file line. Since a new summary line is written one per minute, if your recording length is longer than 1 minute a zero will appear on all lines until the recording is concluded. In the example, a recording was completed and written during the second line's period.

MIC0TYPE & MIC1TYPE: The microphone types currently attached to channels 0 and 1. When an internal mic is used, **IN** appears. External mic values include **A1** or **A2**.

6 Configuring Recording Schedules

The recording schedule determines when recordings occur. You can choose one of the Quick Start schedules, create your own schedule using the built-in editor, or import a schedule from an SD card. You can export the current schedule to an SD card. You can use the Song Meter SM4 Configurator software on your computer to create and edit schedules.

SM4 schedules are flexible and portable. Schedules exported from recorders or created by the Song Meter SM4 Configurator software include all configurable settings. The settings are applied when a schedule is imported. This coupling of schedules and settings enables you to share entire configurations from one recorder to another.

6.1 Schedule Blocks

Schedule blocks are the components which make up a schedule. Each schedule comprises at least one block. Every block has the following three lines:

```
START:  time hh:mm or  
        rise +/-hh:mm or  
        set  +/-hh:mm  
  
DUTY:   always or  
        ON hh:mm OFF hh:mm  
  
END:    time hh:mm or  
        rise +/-hh:mm or  
        set  +/-hh:mm
```

The SM4 assumes that you want to record at the same times every day, although the times are adjusted for varying sunrise and sunset if applicable. Each block defines a single recording period between its **START** and **END** times (if **DUTY** is **always**) or a series of recording periods between its **START** and **END** times according to a duty cycle (if **DUTY** is **ON & OFF**). The overall schedule is the combination of all of the recording periods generated by all the blocks (see examples below).

The **START** line specifies the start time for the block and can be a specific time or relative to sunset or sunrise. Time is specified in 24-hour time. When relative to sunset or sunrise, a positive or negative offset can be specified with + and -. For example, to begin recording 2 hours prior to sunrise, specify: sunrise - 2:00.

In the same way, the **END** line specifies the end time for the block.

The **DUTY** line specifies the duty cycle, which is how often the recorder should be recording during the schedule block. If set to **always**, the recorder will record continuously between the block's start and end times. If set to **ON & OFF**, the recorder will record for the number of hours and minutes specified for ON, then pause for the number of hours and minutes specified for OFF. This cycle will repeat as many times as possible before the **END** time is reached.

The duty cycle begins at the **START** time, not when you actually begin running the schedule. For example, in the following schedule:

```
START: time 07:00
DUTY: ON: 00:10 OFF: 00:50
END: time 19:00
```

If you begin the schedule by pressing **SCHEDULE START** at 10:50, the recorder sleeps until the next duty cycle ON occurring period at 11:00.

A typical schedule might only need one block; however, you can have up to ten (10) blocks in a single schedule and can even overlap them. The SM4 scans all blocks and combines all their recording periods. For example, you can create a schedule to record continuously from sunset to sunrise in one block and to record 5 minutes on the hour throughout the whole day (24 hours) in another block. The recorder combines these, resulting in 5-minute recordings during the days and continuous recordings during the nights. For another example, if one block generates a recording period from 08:00 to 10:00, and another block generates a recording period from 09:00 to 11:00, the end result will be a single recording period from 08:00 to 11:00.

6.2 SM4 Configurator Software

In addition to configuring schedules on the recorder, as described in this chapter, you can use the Song Meter SM4 Configurator software to confirm schedule behavior on a graphical calendar and to estimate power consumption and SD card usage of schedules that you plan to run.



We recommend using the software to configure the recorder's settings and schedule when possible as the additional visualization and information it provides allows you to be sure that your schedule and settings will perform as intended. The software is free and available for Mac, Windows and Linux from www.wildlifeacoustics.com.

6.3 Editing a Schedule

Use this procedure to edit a schedule directly on the recorder using the Display and buttons. We recommend that you edit schedules using the Song Meter SM4 Configurator software whenever possible; however, if you are in the field and need to edit a schedule, this method is convenient. The recorder comes from the factory with the Quick Start schedule "Record Always" loaded. You can load any other Quick Start schedule if that provides a better starting point for your custom schedule. See the previous chapter for how to load a Quick Start schedule.

1. Navigate to **Main Menu > Schedule > Edit Schedule**.
2. Edit any of the three lines of a schedule block:
3. **START**: Press **▲ Up** or **▼ Down** to select rise, set, or a specific time. Press **▲ Up** or **▼ Down** to adjust the + plus or – minus sign for times that are relative to sunrise or sunset. For example, enter **rise -01:15** to start recording one hour and fifteen minutes before the calculated sunrise time.
4. **DUTY**: Schedules can record continuously between a block's **START** and **END** times (**always**) or for a specific repeating duty cycle within those times (**ON & OFF**). To learn more, see the schedule examples in this chapter.
5. **END**: Press **▲ Up** or **▼ Down** to select rise, set, or a specific time. Press **▲ Up** or **▼ Down** to adjust the + plus or – minus sign for times that are relative to sunrise or sunset. For example, enter **rise -01:15** to start recording one hour and fifteen minutes before the calculated sunrise time.

Press **ENTER** to save your changes.

TIP: To undo your changes in any line, you can press **◀ Left** to return to the start of the line and revert to its original values.

6.4 Adding or Deleting Schedule Blocks

When you edit a schedule, you can add or delete schedule blocks.

To add a new block:

1. Press **▼ Down** repeatedly to navigate to the bottom line of the last block in the schedule.

- Press **▶ Right** to advance to the **[ADD]** label and press **ENTER** to add another block. The bottom line below the block shows the number of the block you are viewing and the total number of blocks.

NOTE: On this line **ENTER** and **▶ Right** behave differently than in all other menus. Here the **▶ Right** does not act as **ENTER** in order to prevent selection of **ADD** while trying to get to **DEL**.

A newly added block has these initial values (the numbers on the bottom line may be different):

```
START:   time 00:00
DUTY:    always
END:     time00:00
02/02    [ADD]
```

TIP: Press **▲ Up** when on the **START** line to move to the previous schedule block and press **▼ Down** when on the bottom line below a block to move to the next schedule block.

To delete a block:

- Press **▲ Up** or **▼ Down** to navigate to the bottom line below the block you want to remove.
- Press **▶ Right** to advance to the **[DEL]** label and press **ENTER** to delete the block.

The following example stretches the Display to demonstrate the concept of stacking code blocks in a series:

```
START:    set -00:05
DUTY:     always
END:      rise
01/03    [DEL]
```

```
START:    time 09:15
DUTY:     always
END:      time 11:15
02/03    [DEL]
```

```
START:    set +02:15
DUTY:     always
END:      rise +01:30
03/03    [ADD] [DEL]
```

6.5 Schedule Block Examples

In this section you can see several examples of recording schedules to understand how the blocks work.

Record Continuously All Hours of Every Day

The following schedule records continuously all day and night, 24 hours per day.

```
START: time 00:00
DUTY: always
END: time 00:00
```

NOTE: This schedule appears under the **Quick Start** menu as **Record Always**. It runs continuously until you press STOP or it runs out of power or memory space.

Whenever the start and end times are identical and **DUTY** is set to **always**, your schedule is essentially the same as the **Record Always** schedule.

Record Continuously for a Portion of Each Day

The following schedule records continuously for the same six (6) hour window every day:

```
START: time 04:00
DUTY: always
END: time 10:00
```

The **Max Length** audio setting determines the maximum recording file duration in hours and minutes. To capture output from this schedule in hourly segments (6 recording files per day) for example, set the **Max Length** audio setting to 01h:00m.

Record in 15-Minute Segments

The following schedule starts at 18:00 in the evening and records for the first 15 minutes of every hour until 6:00 in the morning.

```
START: time 18:00
DUTY: ON: 00:15 OFF: 00:45
END: time 06:00
```

NOTE: When you enter an end time that's earlier than the start time, the recorder interprets the end time as being in the next day (i.e. the schedule crosses over midnight).

Record in 5-Minute Segments Every Hour

The following schedule records in 5-minute intervals each hour for an entire day and continues indefinitely every day thereafter. This schedule produces 24 recording files per day.

```
START:   time 00:00
DUTY:   ON: 00:05 OFF: 00:55
END:    time 00:00
```

NOTE: The **ON** and **OFF** periods need not add up to an hour, but if they do not add up to a factor of 24 hours, the duty cycle truncates and restarts at the start time. For example, a duty cycle with **ON** 00:04 and **OFF** 00:03 divides 24 hours by 205 7-minute cycles plus one 5-minute partial cycle. In 206th cycle, the recorder records for 4 minutes of the 5 minutes and pauses for only 1 minute (instead of 3). This pattern repeats daily.

This schedule appears in the **Quick Start** menu as **Record 5on & 55off**.

Record Continuously Before Sunset until Sunrise

The following schedule records continuously every day from 30 minutes before sunset until the next day's sunrise.

```
START:   set -00:30
DUTY:   always
END:    rise +00:00
```

Record in Multiple Blocks Relative to Sunset and Sunrise

The following schedule uses two continuous blocks. The first block defines a duty cycle relative to sunrise and the second block is relative to sunset. The combined blocks in this schedule record for two hours centered at sunrise and two hours centered at sunset.

```
START:   rise -01:00
DUTY:   always
END:    rise +01:00
01/02
```

```
START:   set -01:00
DUTY:   always
END:    set +01:00
02/02
```

This schedule appears in the **Quick Start** menu as **Record Dawn & Dusk**.

6.6 Importing a Schedule

You can import a schedule file (for example, mySchedule.SM4S) from an SD card. The imported schedule includes settings too.

1. Save a custom schedule to the top-level directory (not in a folder) of an SD card from the Song Meter SM4 Configurator software, or export a schedule to an SD card from another recorder.
2. Insert the SD memory card in slot A of the recorder.

3. Navigate to **Main Menu > Schedule > Import Sched+Setts**.
4. At the **Select Schedule File** prompt, press **▲ Up** or **▼ Down** to select a schedule file on your SD memory card. Press **ENTER**.

NOTE: The file name can only be 28 characters or less. The SM4 will not recognize or display file names of longer length on the import screen.

5. If no warnings or errors are found, the following message appears:

```
Schedule imported
```

6. The imported schedule is now the current schedule.
7. Press **◀ Left** to return to the **Schedule** menu.
8. You can perform any of the following actions on the imported schedule:
 - Edit the schedule.
 - Export the schedule to an SD memory card.
 - Start the schedule.

NOTE: Schedules exported from a recorder and imported on another will not override the second recorder's **Prefix**, **Latitude**, **Longitude**, **Time zone**, or **Battery Cutoff** settings. Schedules created or edited by the Song Meter SM4 Configurator software can selectively override any setting upon import.

6.7 Exporting a Schedule

You can export the current schedule including settings to an SD card. When you import a schedule, its settings are applied.

1. Insert an SD card in slot A.
2. Navigate to **Main Menu > Schedule > Export Sched+Setts**.

The following message appears:

```
Schedule exported
```

3. You may now eject the SD card if you wish.

The exported file is named with the recorder prefix and the **.SM4S** extension. For example: **SM400155.SM4S**

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

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

After exporting the schedule, you can share it with others, load it on another recorder, or edit it using the SM4 Configurator software.

7 Utilities

7.1 Exporting Diagnostics

This procedure exports a diagnostic file that can be used to assess the audio performance, settings, schedule, and status of the recorder. The Wildlife Acoustics Support Team can use this information to help diagnose problems.

1. Insert an SD card into slot A.
2. Navigate to **Main Menu > Utilities > Export Diagnostics**.
3. The recorder performs internal diagnostic tests and then exports the test results, the current schedule, and the settings to a file.
4. Remove the SD memory card and insert it into a computer in order to send the file to Wildlife Acoustics.

The file is named with the recorder's prefix, the date and time, and the .sm4dump extension:

```
PREFIX_YYYYMMDD_hhmmss.sm4dump
```

7.2 Resetting to Factory Default Settings

This procedure restores all recorder settings to their original default values as they were configured when your recorder was first assembled and tested.

1. Navigate to **Main Menu > Utilities > Set factory default**.
2. Select **Yes** on the confirmation screen.

CAUTION: When you select **Yes** and reset defaults, your custom settings and any edited schedules are erased.

7.3 Testing Microphones with the Calibrate Utility

You can view and verify the sensitivity of built-in or external acoustic microphones. This utility displays dB (re full scale) at 1kHz.

NOTE: This procedure is only for use with a third-party microphone calibrator that emits a calibrated 1.0 kHz signal.

1. Navigate to **Main Menu > Utilities > Calibrate Mics**.

```
MICROPHONE CALIBRATE
@1kHz :
Ch 0 : -4.8 dBV
Ch 1 : -73.6 dBV
```

2. Test the microphone by generating a 1 kHz signal with the professional microphone calibrator and sliding it over the microphone.
3. The values represent amplitude levels at 1 kHz.
4. Press any button to end the calibration.

7.4 Formatting and Erasing SD Cards

This procedure formats and erases the inserted SD cards. Use this procedure prior to all deployments for optimal performance.

WARNING! This procedure erases all data files on the SD memory card. Verify that you have saved any important schedules or recordings before running this utility.

1. Insert an SD card in slot A and an optional second card in slot B.
2. Navigate to **Main Menu > Utilities > Format All Cards**
3. At the **Confirm: Format All?** prompt, choose one of the options:
 - Select **No** to cancel this procedure. Any existing data files remain on the SD card(s).
 - Select **Yes** to format the SD cards in both slots.
4. If you select **Yes**, progress messages appear, and then the screen returns to the **Utilities** menu.

7.5 Updating the Firmware

The SM4 is field-upgradeable and firmware updates are occasionally available with fixes or improvements.

1. Download new firmware from www.wildlifeacoustics.com. While visiting our website, you can join our mailing list to receive important notices about your SM4 and related products.
2. Save or copy the firmware file to the top-level directory (not in a folder) of an SD card and insert it into the recorder in slot A.
3. Navigate to **Main Menu > Utilities > Firmware Update**.
4. The recorder scans the SD memory card for .SM4 firmware files.

TIP: If you need to exit for any reason, press **◀ Left** to exit without updating.

5. At the **Select upgrade file** prompt, select the correct firmware update file and press **ENTER**. The recorder applies the new firmware and restarts.

8 Specifications

8.1 Physical

Length: 8.6 inches (218 mm)
Width: 7.3 inches (185 mm)
Depth: 2.8 inches (71 mm)
Weight: 1.6 pounds (0.73 kg)
Weight with 4 D Batteries: 2.9 pounds (1.3 kg)
Operating Temperature: -4°F to 122°F (-20°C to 50°C)
Enclosure: Weatherproof durable polycarbonate. A pressure vent and a self-regenerating desiccant packet control humidity and prevent condensation.

8.2 Power

Battery Specifications: The recorder uses four standard D size disposable alkaline batteries or rechargeable NiMH batteries.

Recording times:

Alkaline batteries (14,000 milliamp-hours at 1.5V each): up to 400 hours

NiMH LSD batteries (9,500 milliamp-hours at 1.2V each): up to 250 hours

NOTE: More than half of the power consumption of the SM4 system can be due to the SD cards. Run times can vary by as much as 50% depending on the characteristics of specific brands and models of cards. We recommend using SanDisk SDHC/SDXC cards. Other factors like the kind and quality of batteries used, how rechargeable batteries are recharged, temperature, and configuration can also affect run times.

External Power Voltage: 5 – 17 volts DC

Clock Backup Battery Type: 3.0 volt lithium CR2032 (approximate 3-year life)

Internal Clock Accuracy: 3.5ppm from -40°C to 0°C, 2.0ppm from 0°C to 40°C (Temperature-Compensated Crystal)“

8.3 SD Memory Cards

Type: Supports up to 32 GB (SDHC) or up to 512 GB (SDXC) per slot. Using two 512 GB SDXC cards, supports up to 1.0 terabyte total capacity.

Formats: FAT32 for SDHC or exFAT for SDXC

8.4 Audio

Channels: 2

Recording format: 16-bit PCM .wav

Analog to Digital Converter Full-scale: 0.707V rms (2v p-p)

Preamplifier Gain: 24dB used for internal microphones

Amplifier Gain: 0.0 – 59.5 dB in 0.5-dB steps

Noise Floor: -93dBV, A-Weighted (@0dB gain, HPF disabled)

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

Supported Sample Rates (Hz):

8000, 12000, 16000, 22050, 24000, 32000, 44100, 48000, or 96000 Hz

Anti-Alias Filter Performance:

Fraction of Sample Rate:	Anti-Alias Filter Gain (dB):
0 to 0.39	±0.1
0.4125	-0.25
0.45	-3.0
0.5	-17.5
0.55	-75.0

8.5 Microphones

Built-in microphones or SMM-A2 acoustic external microphone

Enclosure: Weather resistant

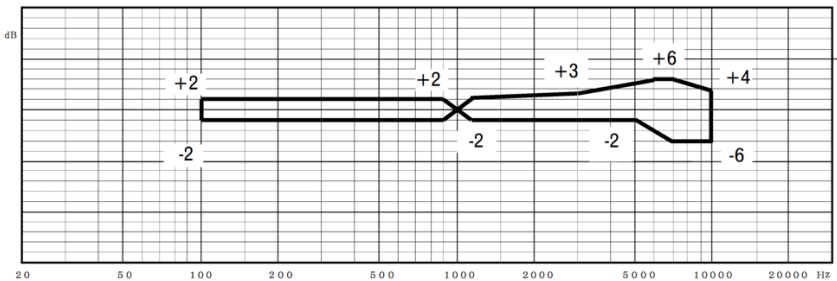
Sensitivity: $-4 \pm 3\text{dB}$ ($0\text{dB} = 1\text{V/pa}@1\text{kHz}$)

Signal-to-Noise Ratio: 80dB typical at 1kHz (1 Pa, A weighted network)

Dynamic Range: 14dB - 94dB SPL at 0dB gain

Directionality: Omnidirectional

Frequency response: Typical as shown in chart below.



SMM-A1 acoustic external microphone

Enclosure: Weatherproof

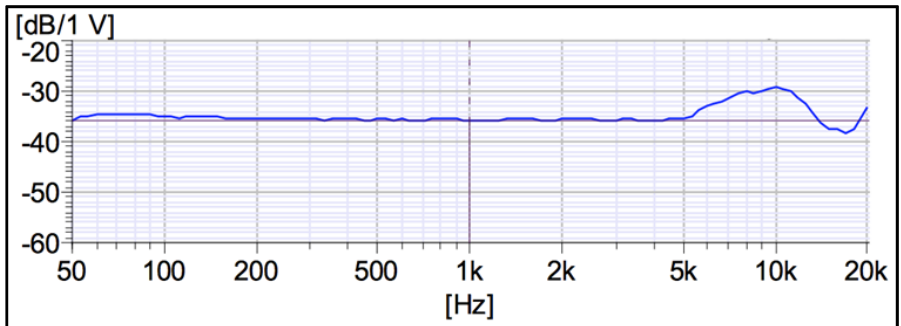
Sensitivity: $-11 \pm 4\text{dB}$ ($0\text{dB} = 1\text{V/pa}@1\text{kHz}$)

Signal-to-Noise Ratio: $> 68\text{dB}$

Dynamic Range: 26dB - 102dB SPL at 0dB gain

Directionality: Omnidirectional

Frequency response: Typical as shown in chart below.



9 Warranty and Disclosures

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

Hardware Limited Warranty

Product	Components	Hardware Warranty Period
Song Meter SM4	All components (excluding built-in and external microphones and accessories)	3 Years
Song Meter SM4	Built-in and external microphones and accessories	1 Year

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 Hardware Limited Warranty table at the top of this page for the applicable warranty period from the original date of purchase.

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 schedule 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 or 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 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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DISCLAIMER: Some countries, states, or provinces do not allow the exclusion or limitation of implied warranties or the limitation of incidental or consequential damages so the above limitations and exclusions may be limited in their application to you. When implied warranties may not be excluded in their entirety, they will be limited to the duration of the applicable written warranty. This warranty gives you specific legal rights; you may have other rights that may vary depending on local law. Your statutory rights are not affected.

GOVERNING LAW: This Limited Warranty shall be governed by the laws of the Commonwealth of Massachusetts, and by the laws of the United States, excluding their conflicts of laws principles. The United Nations Convention on Contracts for the International Sale of Goods is hereby excluded in its entirety from application to this Limited Warranty.

DECLARATION OF CONFORMITY (EN 45014)

Manufacturer:
Wildlife Acoustics, Inc.
3 Clock Tower Place, Suite 210
Maynard, MA 01754
United States of America



Declares that the following product:

Product Name: Song Meter
Product Model Number: SM4
Product Type: Bioacoustics Recorder

Conforms to the appropriate country standards and governing regulations listed below and/or on the following page. As the manufacturer, we are fully responsible for the design and production of the above-mentioned equipment.

Federal Communications Commission Rules Part 15, Class A

AS/NZS CISPR 11, 2011, Industrial, scientific and medical (ISM) radio-frequency equipment – electromagnetic disturbance characteristics – limits and methods of measurement, Class A

EN 55011, 2009/A1, 2010, Industrial, scientific and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics – Limits and methods of measurement, Class A

ICES-003, 2012, Industry Canada, Interference-Causing Equipment Standard, Digital Apparatus, Class A

EN61326, 2006 Electrical Equipment for Measurement, Control and Laboratory use EMC Requirements (EMC Directive 2004/108/EC)

EN61000-4-2 Electrostatic Discharge

EN61000-4-3 Radiated Electromagnetic Fields

This product was tested in a typical configuration.

Ian Agranat, President
Wildlife Acoustics, Inc.
January 6, 2016

ELECTROMAGNETIC INTERFERENCE

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications not expressly approved by Wildlife Acoustics, Inc. could void the user's authority to operate the equipment.

Note: Use of ferrite clamped cables are required to comply with the Class B limits in part 15 of the FCC rules. A Fair-Rite 0431164181 ferrite clamp (or equivalent) must be placed on each cable near the recorder with the ferrite residing within one loop of the cable. This clamp is provided with all cables sold by Wildlife Acoustics.

PROHIBITION AGAINST EAVESDROPPING

United States law (Federal Communications Commission Part 15 Section 15.9) states "Except for the operations of law enforcement officers conducted under lawful authority, no person shall use, either directly or indirectly, a device operated pursuant to the provisions of this Part for the purpose of overhearing or recording the private conversations of others unless such use is authorized by all of the parties engaging in the conversation."

You are responsible for complying with all applicable laws within your jurisdiction

PRODUCT DOCUMENTATION

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Song Meter SM4

BIOACOUSTICS RECORDER

User Guide

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Updated on January 6, 2016

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SM4 is a trademark of Wildlife Acoustics, Inc.

All other trademarks are the property of their respective owners.

The Song Meter is patented (U.S. Pat. No. 7,782,195).

Additional U.S. and international patents and trademarks are pending.

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