GPS Time-Synch for the SM4

Overview

The Song Meter SM4 recorder is available with a GPS time-synch option. This model is called the SM4TS.

The SM4TS ships with additional electronics hidden inside the SM4 housing, a weatherproof GPS connector on the side of the recorder, and a cabled weatherproof GPS receiver. Crystal oscillators used in clocks and electronics, including the SM4 are not perfect. One crystal might be faster or slower than another, and oscillations might speed up or slow down by different amounts as temperature changes.

When the GPS receiver is connected to the SM4, the GPS receiver synchronizes the SM4 clock to the GPS time base for extremely accurate time stamping on all your recordings to facilitate localization calculations of wildlife signals

The SM4TS GPS receiver can synchronize your recordings across multiple recorders to within one millisecond. The start times are synchronized to start on the second as indicated in the filename, and the sample rate is fine-tuned over the duration of the recording to keep the recordings synchronized typically to less than one millisecond error.

NOTE: The GPS Time Synch Option provides synchronized recordings, but additional tools are needed to determine the time of arrival of a particular signal to each microphone and calculating the position of the source.

Installation and Use

1. The GPS Time-Synch option requires the external GPS receiver to be connected to the SM4TS during recording. The second external microphone connector of the SM4 has been replaced by an external GPS receiver connector. This does not prevent the second internal microphone from being used.

2. On the front panel of the SM4TS navigate to Main Menu > Settings > Location > Time zone and set the time zone.

NOTE: The time zone must be set prior to using the GPS receiver accessory to automatically set the correct time. The SM4TS adjusts the time from the GPS based on the time zone setting and sets the recorder's clock after this calculation. If you change the time zone after the clock has been set, this automatic adjustment does not take place and the clock will not be set correctly.

3. Unpack the GPS time-synch receiver and the included 5-meter cable.
4. Remove the cap over the external GPS receiver connector, the second connector from the top in the series of three ports on the side of the SM4TS (labeled GPS Port)
5. Attach, rotate, and secure the cable to the GPS receiver connector to make a weatherproof seal
6. Position the receiver where a reliable GPS signal can be received.
7. The recorder automatically detects the presence of the GPS. When the recorder wakes up, the GPS is powered up.
8. Wait for the GPS to communicate with the satellite.

NOTE: It can be difficult to acquire a GPS signal in thick vegetation or canopy.

9. A few seconds after connecting the GPS Accessory, the GPS status is shown on the top right of all menu screens. When the GPS has successfully communicated with the satellite, the status changes from asterisks to FIX.
10. Or, on the CHECK STATUS screen, a question mark (?) appears between the date and time to indicate that the GPS accessory is attempting to acquire satellite data.
11. When the GPS has successfully acquired satellite data, the question mark (?) changes to a dollar sign ($), indicating that the clock is now synchronized.

NOTE: If the question mark (?) changes to a number sign (#) but does not change to a dollar sign ($), that indicates the GPS receiver has detected a satellite and has found GPS location coordinates, but has not yet locked to the GPS time.

12. The location, date, and time are automatically set. Coordinates are given in decimal degrees and use the WGS-84 coordinate system.

NOTE**:** Although the navigation steps are the same, the Location Settings coordinates are now read-only. You cannot change them. This change in location may affect the calculated sunrise and sunset times when using advanced scheduling commands.

Details of Operation

The recording starts within a fraction of a millisecond of GPS time. If the GPS has been used recently in the area, the position fix will take under a minute. If a significant amount of time has elapsed or the GPS has been shipped some distance, the GPS must download new tables. In this case the first position fix can take up to 40 minutes, but subsequent fixes should still occur in under a minute.

While making the recording, the SM4TS automatically makes small adjustments to the sample rate as needed to maintain synchronization with the GPS clock to within one millisecond.

If synchronization was acquired and maintained for the duration of the recording, the underscore character in the filename between the date and time changes to a dollar sign as shown in the following filename examples:

```
ARIZONA-1234_20160104_152209.wav
ARIZONA-1234_20160104$152209.wav
```

This is how you can tell if the entire recording was successfully synchronized. If the GPS signal was not successfully acquired before the recording started or was lost at any point during the recording for more than a few seconds, the **$** does not appear in the filename.

Power Considerations

The GPS receiver consumes about 500 mW of additional power. This can result in a significant reduction in battery life for audio recordings. Therefore, it may be desirable to use an external power source for the SM4TS when doing time-synchronized recordings.