



SM2+ GPS Time-Synch Option

Crystal oscillators used in electronic devices, including the SM2+, have frequencies that can vary by hundreds of parts per million over their operating temperature range. This can result in a clock drift of several milliseconds for every minute of elapsed time. The Song Meter SM2+ GPS option provides a mechanism to schedule and synchronize recordings to within one millisecond. An array of time-synchronized recorders can then be used to triangulate the location of a sound source by measuring the relative time-of-arrival of the sound wave as it travels across multiple microphones.

The SM2+ configured with the GPS option connects to the GPS antenna through a cable gland on the side of the SM2+. The GPS receiver comes with a 5 meter cable and should be located where a GPS signal can be reliably received. Note that it can be difficult to acquire a GPS signal in thick vegetation. The GPS option does not require any special configuration other than to properly set the time zone parameter on the GPS (Settings>Location>Timezone). The SM2+ automatically detects the presence of the GPS receiver and operates as follows:

1. When the SM2+ wakes up, the GPS receiver is powered up. The clock displayed on the LCD will show a blinking '?' character between the date and the time to indicate that the GPS receiver has been detected and is attempting to acquire the satellites.
2. When the GPS receiver has successfully acquired the satellites, the '?' will first turn to '!' for a second and then turn to a '\$' indicating that the clock is now synchronized. The SM2+ clock is automatically adjusted to GPS time. In addition, the location latitude and longitude parameters in the SM2+ will be updated (this may affect the calculated sunrise and sunset times when using advanced scheduling options). The Settings>Location menu will display the 5-digit precision latitude and longitude coordinates as read-only fields when the GPS is acquired.
3. For scheduled recordings, the SM2+ will wake up 150 seconds before the scheduled recording to give the GPS time to acquire satellites (without the GPS option, the SM2+ normally wakes up 30 seconds before the scheduled recording). The recording will then start to 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.
4. While making the recording, the SM2+ automatically makes small adjustments by inserting or removing samples as needed to maintain synchronization with the GPS clock to within one millisecond. Additionally, if recording to a .WAC file, the latitude and longitude coordinates are stored approximately every second. This data can then be viewed with SongScope or extracted by WAC2WAV software.

5. At the end of a recording, the ‘_’ character in the filename between the date and time is changed to a ‘\$’ if synchronization was acquired and maintained for the duration of the recording. 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 lost at any point during the recording, the ‘\$’ will not be present in the filename.

If the recordings are in WAC mode, location information can be viewed in Song Scope (version 3.4 or later) by dragging the cursor around the spectrogram. If the recordings are in WAC mode and converted to WAV in WAC2WAV, a gps.txt log file with the GPS coordinates from the end of each triggered event will be generated in the destination folder. If the recordings are converted to zero crossing (ZC), the GPS coordinates will be stored in the sequence file such that they can be viewed in compatible zero crossing software.

Additionally, a GPSdrift.txt file will be created on Slot A. This file logs the GPS date and time and the drift of the SM2+ real time clock (RTC). Negative numbers means the RTC is slow relative to GPS while positive numbers mean the RTC is fast relative to GPS. This file can be used for special cases, where drift of unsynchronized recordings between two synchronized recordings can be estimated and corrected.

The GPS receiver consumes about 90mA of additional current. This will result in a reduction of about 50% of the estimated battery life described in the SM2 User’s Manual for audio recordings and a reduction between 60-75% of the estimated battery life for ultrasonic recordings.