

Standard Operating Procedure #4: Automated Recording Systems

Version 1.2

In GLKN Amphibian Monitoring Protocol

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Revision History Log

The following table lists all edits and amendments to this document since the original publication date. Information entered in the log must be complete and concise. Users of this standard operating procedure will promptly notify the program manager and/or the Great Lakes Network (GLKN) data manager about recommended and required changes. The program manager must review and incorporate all changes, complete the revision history log, and change the date and version number on the title page and in the header of the document file. For complete instructions, please refer to Revising the Protocol, SOP #10.

Previous Version #	Revision Date	Author (with title and affiliation)	Location in Document and Concise Description of Revision	Reason for Change	New Version #
SOP #4 version 1.0	9/14/12	Bill Route, GLKN Program Manager	Made revisions after initial piloting of set-up procedures with SLBE and author G. Casper.	To clarify wording and move the song meter temperature probe testing to SOP #1; also renumbered this SOP #5 and added SOP #4 for selecting sites.	SOP #5 version 1.1
SOP #4 version 1.0	Continued from above 3/8/13	Bill Route, GLKN Program Manager	Revised for clarity throughout; information on backing up SD cards; updated data sheets to include additional information.	To clarify distinction between SOPs 4&5; to provide file naming standards, and methods for backing up and sending SD cards to ensure data are secure and linked to the correct park and site.	1.1
1.1	9/27/16	Gary Casper, GLES	Referenced Protocol 2.0, made water temperature logger optional and air temperature logger mandatory.	Equipment testing and revisions.	1.2
1.2	8/14/17				
Add rows as needed for each change or set of changes tied to an updated version number					

4.0 Introduction

The Great Lakes Inventory and Monitoring Network (GLKN) is implementing long-term monitoring of wetland-breeding amphibians in nine network parks. This monitoring will consist primarily of call surveys based on the North American Amphibian Monitoring Program (NAAMP) protocol (Weir and Mossman 2005) using Automated Recording Systems (ARS). This standard operating procedure provides a detailed outline of the steps to be taken and the methods to be followed when performing amphibian call surveys with ARS units. The amphibian monitoring protocol addresses the number of sites where units will be deployed in each park, site selection, and the sampling design. This standard operating procedure (SOP) explains the deployment, mid-season check, and retrieval of the ARS units and handling of the data that is obtained.

4.1 Equipment

Prior to the field season, an inventory should be conducted to make certain that all equipment is available and in good repair. All equipment should be cleaned, tested, and replaced as needed. See SOP #1, Preparing for the Field Season, for a step by step method of testing Song Meters and microphones. The Song Meter software (firmware) may also need to be up-dated. The Network office will send out a notice of software up-upgrades and may request that park staff download new versions from the Wildlife Acoustics website and/or up-load new versions to the Song Meters.

4.1.1 Equipment List

- SM2+ or newer Song Meters (Wildlife Acoustics, Inc.)
- 2 SMX-II (or newer) weather resistant acoustic microphones per Song Meter, with wind screens (Wildlife Acoustics, Inc.)
- HOBO Pendant (or newer) air temperature logger—one per Song Meter
- Flash memory cards (various sources)—two 32 GB cards for slots A and B of each unit; these should be SDHC Class 4 or better flash cards.
- D alkaline batteries (various sources)—4 per Song Meter, replaced annually
- AA alkaline batteries (various sources)—2 per Song Meter to power the clock, replaced annually
- Backboards, mounting screws, straps, screwdriver, posts, locks, etc.—mounting of Song Meters will normally be by strapping the housing to a shoreline tree, usually already mounted to a backboard with a shading roof, but specific mounts and accessories (signage, locks, etc.) will be determined for each site by park staff during Year 1, and recorded on the field data form.

- Meter stick or rule for measuring pond water depth
- 100 foot (30 m) tape for measuring distance to wetland
- Compass to determine orientation/direction of meter to wetland
- Cable ties, solar shield, and any other necessary supplies for mounting the HOBO air temperature logger on the Song Meter housing or backboard.
- Hip waders
- Air thermometer
- Camera for documenting location
- GPS unit loaded with site locations
- Field folders containing the following :
 1. Updated maps of sampling sites with coordinates
 2. Directions to and descriptions of sampling sites
 3. Instructions and forms for deploying Song Meters
 4. Emergency phone and radio numbers
 5. Copies of all applicable permits
 6. Blank data sheets on waterproof paper

4.1.2 Schedule for Field Work

See SOP #1: Preparing for the Field Season. Review the frog call quiz for species likely to be present in the sampling region before each season begins: <http://www.pwrc.usgs.gov/frogquiz/>.

In summary, the schedule is:

- Deploy Equipment: If possible, initial deployment should be made within a week of ice-out, or up to a month prior to ice-out if a delayed start is programmed in.
- Check Equipment: Equipment should be checked to make sure it is undamaged and operating properly within 3 weeks following initial deployment, and additionally as convenience permits when personnel are nearby.
- Retrieve Equipment: Equipment should be retrieved, cleaned, tested, and repaired or replaced as needed, after 1 August. All data should be backed up and sent to the network office.

Because phenology will vary from year to year, flexibility is built into the schedule. However, park staff and the program manager should ensure that the equipment is deployed within one week of ice-out at the sampling sites.

4.1.3 Deploying the Song Meter

Site selection and documentation are covered under SOP #3. You will need the site documentation, including directions, GPS coordinates, and maps to each location (from SOP #3). There should also be instructions and reference photographs for mounting the Song Meter (e.g. what tree or post, how high, which direction, etc.) and for putting out optional water temperature sensors if used. If these items are not yet developed, see SOP #3 for instructions.

NOTE: These instructions are for Song Meter model SM2 and SM2+. New instructions will be developed for SM3 and SM4 units as these replace SM2s.

In the office:

1. Begin consulting with the Network program manager in February regarding phenology.
2. Decide if the deployment will require a delayed start or not. A delayed start is useful if you need to get the Song Meter in the field prior to it starting to collect data. For example if the unit will be deployed on an island, you may want to get it out before the ice thins so it can start collecting data during the period of dangerous ice conditions.
 - a. If a delayed start is planned, obtain and load the appropriate programming file from the program manager, and deploy the unit before ice-out.
 - b. If a delayed start is not planned, deploy the unit as soon after ice out as possible.
3. Prior to departure (can be a few days before), load fresh batteries and install the SD cards in the pre-tested unit(s), and ensure microphones are ready to be attached, and temperature logger(s) are programmed and launched. Power on the unit (refer to “Waking Song Meter” in section 4.2.6 below, and on p. 12 of the manual if needed) and re-set the date and time (section 4.2.5 below and pp. 17–18 in the manual). Use your local time (Daylight Savings).
4. After setting the date and time, load the appropriate program (*.SET for SM2 units) file provided by the Network - SELECT-UTILITIES-LOAD CONFIGURATION FROM A: (see section 4.1.5 below and Loading and Saving Configuration Files on p. 26 of the Song Meter manual).
5. After loading the program file, put the Song Meter to sleep - select Utilities, then “Go to sleep” (see manual p. 26). This puts the Song Meter to sleep immediately. In this mode, the Song Meter will not wake up again until the “WAKE/EXIT” or “RESET” buttons are pressed, unless the program file has a delayed start programmed. If the program file does have a delayed start, when deploying in the field verify that when the WAKE/EXIT button is pressed the wake time shown on the screen is the appropriate time and date (see Step 9 below). This is a convenient way of putting the Song Meter into a low power state for short-term transportation or storage and prevents it from automatically waking to make scheduled recordings.

6. Ensure all needed equipment is in hand, including tools and supplies needed for mounting the Song Meter and sensors (see site documentation and mounting instructions).

In the field:

1. Travel to the sampling site and navigate to the location specified per site instructions. Begin using the Song Meter Deployment Data Form (Appendix) to record all deployment information. It is important to document the Song Meter serial #, GLKN #, firmware version, file prefix (this is the station number, for example INDU_01-), SD card numbers (also the station number, for example INDU_01), and external logger serial #(s), in order to ensure that data are being correctly collected and assigned to sites. See steps 7-9 below to determine the firmware and file prefix numbers. Failure to note these numbers could result in data being lost or incorrectly assigned.
2. Attach microphones to the Song Meter as shown in Figure 1 (and on p. 2 of the manual).
3. Follow the site-specific documentation developed in SOP #3 to position and secure the Song Meter.
4. Mount the HOBO external data logger in a shaded location to record ambient air temperature (typically under the backboard roof, under another solar shield, or on north side of a tree, see examples in SOP #3).
5. Document the height of the Song Meter placement (cm) and orientation (compass degrees is best) on the form. This should be exactly the same as the original site documentation. Or, if you need to change the way the Song Meter is mounted due to altered circumstances (original tree down), get it close to the original position and document the new height and orientation on the form. Also note any vegetation or other obstructions that might deflect or alter sounds coming from the target wetland. This is especially important if conditions have changed. For example a tree may have fallen or a sapling is large enough to alter sound recordings.
6. Note the distance of the Song Meter to the wet (standing water) edge of the target wetland as instructed in the site documentation. Similarly, if used, note the distance of the optional temperature probe to the shoreline as instructed in the site documentation. These distances will change over years and even from day to day. Over time, these measurements will give us an idea of the constancy of the wetland.
7. Follow site-specific documentation to measure water depth(s) at the Meter and the sensor location(s) and record on the data sheet.
8. Document the set-up by taking digital photographs of the site with the Song Meter in the foreground and facing each of the cardinal directions; also one of the probe placement (if used). Note the photo numbers on the Deployment Form. Ensure that the HOBO air temperature logger is visible in at least one photo.

9. If desirable, or if you could not take photographs, make a sketch of the site showing placement of the Song Meter and logger(s) on the back side of the form.
10. Remove the Song Meter cover (if needed) and wake the unit (press the “WAKE/EXIT” button, see manual p. 26). Check that the display indicates enough free space on each SD Card (it should display less than 1% space used). Note the SD card numbers (e.g. INDU_01) and the amount of space used on the Deployment Form. This is a critical step for ensuring there is adequate room and that the data are correctly assigned to the location. If there is more than 1% of the space used on an SD card it may contain data that could be overwritten. Contact the program manager before deploying.
11. Press the “WAKE/EXIT” button a second time and watch for the following message to be displayed:

2009-Sep-12 9:34:12 —should be today’s date/time
Going to sleep until
2009-Sep-12 15:00:00 —should be the next scheduled event

The first line should display today’s date and time, and the third line should show the next scheduled recording date and time. If the unit is turned on after first daily scheduled start time, the next scheduled event will be the next day. Note these dates and times on the Deployment Form. If you do not see this message, re-set the date and time, re-load the program file, and try again. If you still get the wrong message, do not deploy the unit and contact the program manager.

12. Use the toggle buttons to confirm the firmware version and file prefix, this is shown on the right side of the second line of the main menu screen. Note this on the Deployment Form. The firmware should be the latest version.
13. Check file prefix shown in SELECT-SETTINGS-LOCATION and note this on the Deployment Form. It should match your park and the assigned number for the site at your park (e.g. a file prefix of SLBE-01 means that all of the data will be assigned to Sleeping Bear Dunes National Lakeshore, collected at site #01). This file prefix is critically important. If it does not match the location do not deploy the unit.
14. Replace the cover, ensuring that the LED light is in the upper right hand corner (matched to marks on cover and body). Tighten screws snugly but do not over tighten, they are plastic.
15. Shield the Indicator LED and watch it until it blinks green. When sleeping but scheduled to wake up for a future recording, the LED will blink green for a second, once each minute. When actively recording, the LED will blink green for a fraction of a second each second. Otherwise, the LED remains off. Note in the place provided at the bottom of the form whether the unit passes or fails this test.

16. Make sure all blanks of the Deployment Data Form are filled in and legible.
17. Use the Notes section on the form to note any changes from the original site documentation or problems in setting up the Song Meter or sensor probes.

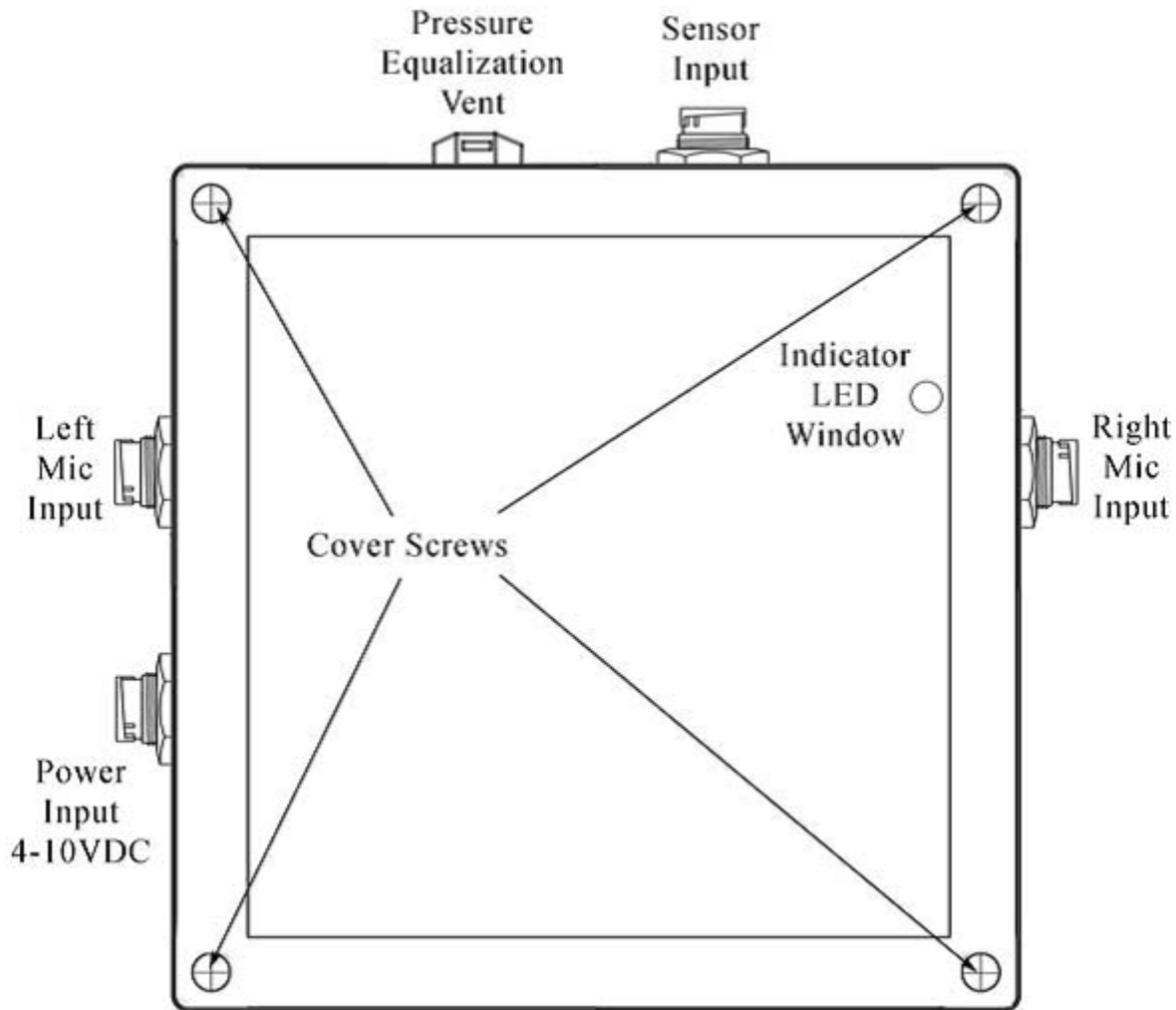


Figure 1. Microphone and sensor placement.

4.1.4 Loading Program (*.SET) files

Program files are provided by the program manager and contain the programming necessary for the unit to turn on and off at the correct times. These are small files that can easily be distributed by email and loaded on to an SD card. A program file will be created and named to match each site at every park and it is important that the program file matches the site and park exactly. If these are not correct we will get erroneous data. To load a program file follow these steps:

1. Ensure batteries are properly installed.

2. Wake the Song Meter: press the WAKE/EXIT button.
3. Re-set the date/time to your local time if necessary (always after fresh clock batteries are installed). See below.
4. Enter the utilities menu: SELECT, scroll down to Utilities and SELECT. The DOWN and UP buttons are used to scroll.
5. Scroll down to “Load config from A:” and SELECT. If you installed the SD Card in a slot other than A:, power off and move the card to Slot A, then begin again.
6. Choose the correct program file in the list and SELECT.
7. The program file is now loaded and a CONFIGURATION LOADED message will display.
8. Push the BACK button.
9. Scroll up to “Go to sleep” and SELECT.
10. The unit is now asleep and will not wake to record without user intervention (see manual p. 26).

4.1.5 Re-setting Date and Time

Re-setting the date and time to your local time is required whenever the clock batteries are removed or replaced, and should be done prior to loading program files.

1. Ensure batteries are properly installed.
2. Wake the Song Meter: press the WAKE/EXIT button.
3. Enter the utilities menu: SELECT, scroll down to Utilities and SELECT. The DOWN and UP buttons are used to scroll.
4. Select Settings.
5. Select Time and Date
6. Select again with the cursor on the second line (year)
7. Scroll to correct the year, press SELECT, scroll to change the month, press SELECT, and continue this process to set day, hour, minutes, and seconds.
8. Press the BACK button to navigate back to the Utilities menu, enter Utilities and select Go to Sleep.
9. The date and time are now set, and is shown at the top of the main menu screen.

4.1.6 After Deployment—Checking Song Meter Operation

Song Meters should be checked once shortly after deployment to ensure proper operation, and periodically throughout the season when convenient, to ensure batteries are powered and data are being recorded correctly. A low-power LED is visible through a window on the enclosure cover and provides a visual clue as to the status and health of the Song Meter. When sleeping but scheduled to wake up for a scheduled recording, the LED will blink green for one second, once each minute. When actively recording, the LED will blink green for a fraction of a second each second. Otherwise, the LED remains off. The LED is intended to provide some status, but not at the cost of high power consumption. Therefore, it may not be easily seen in bright sunlight or from off angle.

Steps for collecting data and checking Song Meter operational status (mid-season checks):

1. Upon arrival at each site, record the water depth at the same location as determined in the site documentation. If an external temperature sensor is being used at the site, check that it is not damaged, and identify a suitable site (shaded with air movement), near the Song Meter location. Try to use the same location for the temperature recorders every year.
2. Shield the Indicator LED and watch it until it blinks green. Cupping the light in a palm/finger curl suffices to darken it enough in bright sunlight to see the green light.
3. If the indicator light blinks as described above, circle the “pass” choice on the data form to indicate a successful check.
4. If the indicator light does not blink as described circle “fail” to indicate an unsuccessful check. Then open the unit and perform the following troubleshooting:
 - a. Press the WAKE/EXIT button and see if a display comes up. If not, batteries are probably exhausted. Check off “unit will not wake” on the Song Meter Check data form and remove the unit for re-setting as described in 4.1.3 with fresh batteries. If possible, before re-setting, download and backup any data on the card that might have been recorded before batteries failed (see retrieving Song Meter and Data below). If not possible, such as when re-setting in the field without a laptop for backup, re-set without backing up data but be sure not to erase the card, or swap in a new card. Once re-set, re-deploy as soon as possible.
 - b. If pressing the WAKE/EXIT button does result in a display coming up, the unit probably failed to start (was not awakened properly when deployed). Start by checking the date and time, re-set if necessary, and then follow steps 3–10 under 4.1.4 to re-load the program file and re-set the unit. This can be done in the field and if successful will re-start the unit but not wipe any existing data on the card.
5. If the check test fails and the unit cannot be re-set in the field, remove the unit and notify the program manager.

4.1.7 Removing the Song Meter and Data Retrieval

At the end of the recording season (August 1) the program manager will remind park staff/contractors to begin recovering the units and data. The following steps describe the recovery process.

1. Travel to the site with needed equipment (map, data form, GPS, screwdriver, storage bins, sensor plug caps, etc.). Plan ahead to ensure that there will be no precipitation when you arrive (units should not be opened in the rain).
2. Upon arrival, perform a Song Meter check as described above, but do not re-set units if the check fails. This is important to document that the unit was recording up until the retrieval.
3. Remove the cover from the Song Meter and press WAKE/EXIT.
4. Press SELECT, choose Utilities, choose Go to Sleep. With the cursor on Go to Sleep pressing SELECT will turn the unit off and the screen will go blank.
5. Remove the unit from its mount, and replace the cover.
6. Detach the microphones and any sensors, attach plug caps if available, and safely store all equipment.
7. If the HOBO air temperature logger is mounted separate from the Song Meter housing or backboard, remove it.
8. Fill out the Song Meter Recovery Form.
9. Upon return to the office, open the cover and remove the SD Cards. Make sure the cards are correctly labeled then back up cards to an office computer or network. There should be a large amount of data (up to 30Gb per Song Meter). If you choose not to archive the data on your computer or park server you can delete these files after confirming that they have arrived at the Network office in good condition. But please do not send SD cards without first backing them up. Whether you keep the files or not, you should organize a folder structure on your computer to separate data by year and site. We recommend folders for each site within each year. Simply copy/paste all the data in to the correct site folder being careful not to delete the original data.
10. After backing up each SD card, package them appropriately and send them to the Network data manager. It is best to send by FedEx, early in the week, using second-day service so that the shipment will not get delayed. Alert the data manager that the shipment was sent and when it should arrive.
11. Remove the batteries and properly dispose of them.

12. Determine if the Song Meter units will be serviced at the park, or at the Network office (see SOP #1).
 - a. If serviced at the park, follow SOP #1 procedure for cleaning, repairing, checking and storing the equipment.
 - b. If to be serviced at the network office, ship units with SD cards to the network office.

Literature Cited

Weir, L. A., and M. J. Mossman. 2005. North American Amphibian Monitoring Program (NAAMP). Pages 307–313 *in* M. J. Lannoo, editor. *Amphibian Declines: The Conservation of United States Species*. University of California Press, Berkeley, California.