bioacoustic unit

Autonomous Recording Unit Deployment Protocol SM2, SM3, and SM4 Models of Song Meters

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(Kolaczan, 2014)

discover nature's symphony

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Bioacoustic Unit

The Bioacoustic Unit is a collaboration between the Bayne Lab at the University of Alberta and the Alberta Biodiversity Monitoring Institute . The Bioacoustic Unit is the authority on best practices for using acoustic technology in the province and a leader in the application of wildlife acoustic data to environmental management and research needs. In addition, our team is actively engaged in research to enhance our methodologies and advance our tools to better understand our natural acoustic environment. Clients regularly partner with us to assist with their wildlife monitoring needs. Our involvement varies from client to client and spans the full range of services from simply providing information to conducting a full research project on their behalf.

Our services include:

Listening

We can collect the data you need, or help you do it yourself. We provide 'how to' protocols that will guide you through the process of deploying, programming, and retrieving your audio data. Or, let us do it for you!

Analyzing

We have a team of expert taxonomists that will translate your audio recordings into species identifications. In addition, our researchers have developed automatic recognizers that quickly process audio files to detect multiple species of conservation concern. We encourage all clients to contribute their data to our publicly available data set. However, we understand that some clients may be bound by confidentiality issues that preclude this. The Bioacoustic Unit is therefore flexible in how raw data is disseminated.

Reporting

Once the audio recordings have been translated into species identifications, we will prepare a report that fully describes the results. Each report will be accompanied by the full data set of species identifications.

Discovering

We are committed to providing leading edge bioacoustics services. As such, we're always striving for excellence and innovation. Check out our current bioacoustic research to learn more about where we're headed in the field!

For further information please visit: http://bioacoustic.abmi.ca/




Autonomous Recording Unit Deployment Protocol
SM2, SM3, and SM4 Models of Song Meters

OVERVIEW

Autonomous recording units (ARU's) are used to survey a variety of species such as birds, amphibians, and bats. The Bioacoustic Unit primarily uses Song Meter ARUs made by Wildlife Acoustics. The units are designed to record sound autonomously for long periods of time to conduct acoustic wildlife surveys. Because Wildlife Acoustics has updated the design of their bioacoustic recordings over the last few years, technicians need to be familiar with the different makes and models on units in circulation. The most common models we run are the SM2+ (variations are SM2+ bat enabled model and SM2+ GPS enabled model), SM3, and SM4. The basic operation of all SM2 models is the same but there are a few programming differences to be aware of. The SM3 Song Meters are substantially different from SM2 units in how they are programed and built. SM4 models are different from both SM2 and SM3 in some key aspects as well. This protocol will walk you through Song Meter deployment and data storage. Whereever the instructions are different between SM2, SM4 and SM4 units, this will be noted.

The field component of this protocol focuses on deployments in forest, grassland and wetland habitats. It does not cover project specific sampling design or site selections. Always check these details with your project supervisor so the deployment locations are correct for the project you are working on. Some adjustments in how the ARU is attached may be required. For example, wetland areas do not have trees and you may have to use a stake or another method to secure the ARU in place. In pastures, ARUs may need protection from curious livestock. Microphones on SM3 and SM4 models are more resistant to wildlife damage but still need to be protected.

The first step is to familiarize yourself with the Song Meter recording units and the software used to program them. Read the User manual for the Song Meter and practice using the Song Meter Configuration utility (SM2) and/or the SM3 Configurator (SM3). Talk to someone who has experience programming these units. The Wildlife Acoustics website (**http://www.wildlifeacoustics.com/**) is also a useful source of information. User manuals for all Wildlife Acoustics ARUs are available under the "documentation" section of their website: **http://www.wildlifeacoustics.com/support/documentation**. Be sure to read the SM2, SM3and SM4 user manuals. These would have been sent to you along with your order of Song Meters and contain valuable diagrams and information on the basic operation of Song Meter models. We require that all field staff review these manuals.

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1. ACTIVATION AND DEACTIVATION

This section covers what you need to know about starting an ARU to run in the field and how to stop it when you pick it up.

Activating the Autonomous Recording Unit SM2:

1. Attach microphones to each side.
2. Use Philips screwdriver to open lid (Use a large size screwdriver so that you do not strip the screws).
3. Press the "Wake/Exit" button (SM2).
4. Wait for the unit to initialize and display the start-up screen with the time, date, firmware and number of SD cards loaded. Make sure that none of the card slots show a row of question marks or say ERROR (this indicates that the card is not recognized).
5. **CHECK THAT THE TIME AND DATE ARE CORRECT**
6. Press "Select" button (SM2) the main menu. Use the "Up" and "Down" buttons (SM2) to navigate the menu.
7. Select the "Setting" section.
8. Scroll down to Location.
9. Select "File Prefix".
10. Change the file prefix to the station name using the correct format (project specific but will follow standard naming conventions).
11. Fill out the data sheet.
12. Press the "Wake/Exit" button (SM2). The unit will automatically do a 1-minute recording if programed to do so.
13. While this test recording is happening, read the data sheet information (date, time, observer, location info) so that it is recorded. Also check gain levels by pressing the "Select" button once (SM2) toggle to the recording screen showing dB levels.
14. Make sure that the unit correctly enters standby mode. It should show a message saying: "Going to sleep until <date and time> before it shuts off. Date and time should correspond to the start time programmed into the settings files. This will vary depending on the recording schedule that a specific species or project requires.

Activating the Autonomous Recording Unit SM3:

1. Remove the small metal side panel.
2. Turn on the power switch.
3. Wait for the unit to initialize and display the start-up screen with the time, date, firmware and number of SD cards loaded. Make sure that none of the card slots show a row of question marks or say ERROR (this indicates that the card is not recognized).
4. **CHECK THAT THE TIME AND DATE ARE CORRECT**
5. Main menu: SM3 units will automatically go to this screen after showing the start-up screen for a few seconds. Use the arrows to navigate the menu.
6. Select the "Setting" section.
7. Scroll down to Location.
8. Select "File Prefix".
9. Change the file prefix to the station name using the correct format (project specific but will follow standard naming conventions).
10. Fill out the data sheet as you go through this process.
11. Press the "Program Start" button to put the unit in standby. The unit will automatically do a 1-minute recording.
12. While this test recording is happening, read the data sheet information (date, time, observer, location info) so that it is recorded.
13. Make sure that the unit correctly enters standby mode. It should show a message saying: "Going to sleep until <date and time> before it shuts off. Date and time should correspond to the start time programmed into the settings files. This will vary depending on the recording schedule that a specific species or project requires.

Activating the Autonomous Recording Unit SM4:

1. Open the front cover of the ARU.
2. Turn on the power switch
3. Wait for the unit to initialize and display the start-up screen with the time, date, firmware and number of SD cards loaded. Make sure that that none of the card slots show a row of question marks or say ERROR (this indicates that the card is not recognized).
4. **CHECK THAT THE TIME AND DATE ARE CORRECT**
5. Main menu: SM4 units will automatically go to this screen after showing the start-up screen for a few seconds. Use the arrows to navigate the menu.
6. Select the "Setting" section.
7. Scroll down to Location.
8. Select "File Prefix".
9. Change the file prefix to the station name using the correct format (project specific but will follow standard naming conventions).
10. Fill out the data sheet as you go through this process.
11. Press the up and down arrows simultaneously to do a 1-min voice note.
12. While this test recording is happening, read the data sheet information (date, time, observer, location info) so that it is recorded. Press program stop once you are done.
13. Make sure that the unit correctly enters standby mode. It should show a message saying: "Going to sleep until <date and time> before it shuts off. Date and time should correspond to the start time programmed into the settings files. This will vary depending on the recording schedule that a specific species or project requires.

Deactivating the Autonomous Recording Unit (at pickup):

1. Open the ARU.
2. Press the "Wake/Exit" button (SM2) or the "Program Stop" button (SM3 & SM4).
3. **CHECK THAT THE TIME AND DATE ARE CORRECT.** If not, note the ARU time on your data sheet.
4. Use the "Select" button to leave start-up screen (SM2) or wait for it to show the main menu (SM3 and SM4).
5. Go to "Settings" and "Location" and check the file prefix to make sure it corresponds to the station you are at. If not, make a very clear note of what the file prefix **IS** and what it **SHOULD BE** on the data sheet.
6. SM2 and SM4: Do a manual initiated test recording if the ARU still has room on the SD card and the batteries are not dead. Omit the recording if the cards are full.
7. For all models: turn the power switch to the off position. If SM3 and SM4 units do not have the power turned off, they will automatically resume their recording schedule in 2 minutes.
8. If the ARU is mid-recording when you arrive, you can either wait for the recording to finish or press the "Back" button or "Program Stop" button to stop the recording and then follow the steps above. Waiting for it to finish is preferred.
9. Follow other instructions as listed in Section 2: Field Deployment for data handling and storage.

2. FIELD DEPLOYMENT

This section will walk you through how to mount the ARU to a tree and other information for successful deployment. Always make sure that you are following project specific instructions to find the correct ARU location.

The following equipment is needed to complete the job (in addition to regular field equipment):

- ARU kit: ARU with mounting brackets, lock, cable, key, 2 microphones in hard-sided case (SM2), sufficient SD cards (consult program for size number), mounting screws
- SD card with SET (SM2) or PGM (SM3) or SM4 (SM4) files
- Spare microphones and SD cards
- Spare parts, especially wind screens
- Screw driver (electric drill for some applications)
- Grey electrical wire (for GPS enabled units)
- Philips screw-driver (or universal screwdriver with Philips bit)
- Datasheets
- Flagging tape
- Felt marker and pencil
- Wooden or metal stakes (or other appropriate support structure) if setting these up in bogs, fens or other open areas

Autonomous Recording Unit Placement

1. In forested areas, choose trees that are not wider than the ARU. A wider tree may interfere with sound reaching the microphones.
2. Locate units far enough away from the road so that they are not easily detected by humans (15 to 20 m is sufficient, especially once the trees and shrubs leaf out).
3. Put ARU on NORTH side of the tree to protect unit from direct sun as much as possible. Face ARUs north so that microphones point east and west so that people listening to the recordings know which way the unit was facing. In forested area, put ARU 1.5 m high on a tree (similar to head height). In open areas, put ARUs at 1 m height (more stable and will catch the wind less). Screw in both top and bottom brackets (SM2) or use the built in mounting holes (SM3 & SM4)

4. For GPS enabled units, mount GPS receiver higher than ARU (as far as you are able to reach). Use grey electrical wire to secure the cable to the tree. It is important to use a soft material to secure the excess cable so it does not get creased or damaged.
5. Open the ARU. **DO NOT LOSE THE METAL COVER on the SM3**!
6. Follow the steps described in "Activating the ARU". Change the file name BEFORE you do the test recording
7. Press the wake/exit button (SM2) or the "Program Start" button (SM3 & SM4) to put the ARU into sleep mode.
8. Close the cover screws (SM2) or the metal side panel (SM3).
9. Finally, lock the unit to the tree. Run the cable over the lid and around the tree as required to take up slack. If possible, tighten the cable enough to lock the lid in place. Make sure that the cable does not touch the microphones.
10. Fill out all fields on the Deployment Datasheet every time, no exceptions.
11. Flag a tree or shrub 5 meters north of the ARU. Make sure that there are no loose flagging tape ends that can flap in the wind and make noise.
12. **BEFORE YOU LEAVE MAKE SURE THAT YOU ATTACHED THE MICROPHONES, NOTHING IS TOUCHING THE MICROPHONES, AND THE UNIT IS READY TO RECORD AT THE CORRECT TIME.**

Note: Not all units have locks. Always use locks near roads, pipelines, and compressor stations. Units without locks can be deployed when they are 100 m or more from an accessible forest edge.

Autonomous Recording Unit Pick-up

1. Make sure that you have the correct keys for the locks with you before you hike to the ARU.
2. Unlock the ARU.
3. Open the ARU.
4. Follow the instructions for "Deactivating an ARU".
5. Close the cover or metal panel.
6. Fill out all fields on the ARU Pick-up datasheet.
7. IMPORTANT: Mark the ARU with tape or flagging tape with the Station it was deployed.
8. Pack the unit and microphones securely in the carrying case.
9. Remove the SD cards and back up the data once you get back to camp.

Datasheets

Fill out all fields on the datasheets everytime that you deploy or pick-up the ARU. **Do not rely on your memory to fill information in later**. If for some reason you end up at a pick-up or deployment without your datasheets, use your field notebook to record the correct information and fill out the correct datasheets once you get to your truck or camp location. Never think that you are too busy or pressed for time to fill out datasheets. The datasheets are part of the job and need to be completed correctly.

Deployment Datasheets

Project ID: This is the abbreviation of the project name. E.g. "OG" is the abbreviation for the "Old Growth" project.
Cluster: Fill this in only if the study design has this grouping of points. Otherwise, put a line through the field.
Site: Site number or other official site descriptor (project dependent).
Station: Name of station that you are deploying the ARU (project dependent).
UTM zone: Enter the correct UTM zone if recording in UTMs. Leave blank if using Latitude Longitude.
Easting (Longitude) and Northing (Latitude): Write down the coordinates: if you are at the exact location designated by the GPS, use these coordinates and do not take a new point. If you have moved more than 10 m, take a new point. Please use only decimal degrees for latitude and longitude.
Location Moved: Yes/No. An ARU is considered moved if it is deployed more than 10 m from the designated location. In the case of the moved location, you need to take a new point and label with the same name as the original location (on your handheld GPS) but add *NEW* to the end. The Easting and Northing need be filled out with the new location.
Est. Dist. Moved (m): if moving a point, estimate the distance it needs to be moved.
Est. Direct. Moved: If moving a point, estimate the direction it got moved.
Reason for Move: Please briefly describe the reason why the ARU was moved.
Observer 1 & Observer 2: Name/initials of observer(s). Use three initials. E.g. HEL to reduce confusion.
Date from GPS: Date ARU is deployed (enter as dd/mmm/yy).
Time from GPS: The time of day the ARU is deployed. Use 24 hour time. *CHECK THAT THE ARU HAS THE CORRECT TIME BEFORE LEAVING THE UNIT.*
ARU time Matches GPS Time: Circle yes or no after checking. *If No, correct ARU time and confirm*: circle yes if you needed to correct the time. Time gets corrected to the nearest minute.
File Prefix: Use the file prefix designated for your project. Frequently this will be the same as the GPS point name. *BE SURE THAT YOU CHANGE THE FILE PREFIX EVERYTIME THAT YOU DEPLOY THE ARU AT*

A NEW LOCATION. CHANGE THE FILE PREFIX BEFORE YOU DO THE TEST RECORDING. Verify what the project specific file prefix is supposed to be.

ARU Height (m): estimate height of the *MICROPHONES* off the ground. This is the recording height of the unit.

How Deployed: indicate what the ARU was attached to. E.g. Tree versus stake, or stake with agronomy cages.

ARU ID: write out the *FULL* unit number (or the serial number if you have any doubt about the unit number). The serial number sticker is on the bottom of the Song Meter.

Left Mic. #: the number of the left microphone. The left mic is the one to your left as you face the ARU. Use the lower number on the left and the higher number on the right to reduce confusion. *WRITE OUT THE FULL MIC NUMBER*. SM3 units do not have mic numbers at this point. SM4 have the mic number on the inside of the unit cover.

Right Mic. #: the number of the right microphone. Use diagram on the bottom of the ARU to define left and right. *WRITE OUT THE FULL MIC NUMBER*.

SD Card Number: Fill in the SD card numbers for all used slots (e.g. SC 001 or EMCLA 157). *WRITE OUT THE FULL SD CARD NAME and NUMBER*.

Voice Note: Yes / No Confirm that you were able to read the data sheet information onto the test recording when you put out the ARU.

Photo: Yes / No. Indicate whether you took photos of the station. Do this at deployment. If photos are not taken at deployment, make sure that the person picking-up knows to do this. Always take photos in the same order (e.g Data Sheet-North-East-South-West-Canopy-ARU).

Battery Status: If batteries are new, write "*NEW*". Otherwise, use the ZTA Mini0mbt pulse load battery tester to check what amount of power (in percent) is left in the battery. If you don't have a battery tester, make a note on when the batteries were checked and/or replaced. This will depend on the recording schedule. More recordings per day equal less battery life. Check the settings file metadata for expected battery life for specific schedule.

Locked: circle *YES* if you locked the ARU to a tree or structure.

Set File: Put the name of the settings file loaded on the ARU. Refer to Appendix 2 for details.

Comments: Any comments related to the ARU location, e.g. distance from planned point, how to find them etc.

Retrieval Datasheet

Project ID: This is the abbreviation of the project name. E.g. "OG" is the abbreviation for the "Old Growth" project.
Cluster: Fill this in only if the study design has this grouping of points. Otherwise, put a line through the field.
Site: Site number or other official site descriptor (project dependent).
Station: Name of station that you are deploying the ARU (project dependent) .
File Prefix Correct: Yes / No. Check that the file prefix on the files is correct. The file prefix should match the Site and station you are at.
If NO, transcribe from ARU: write out the file prefix from the ARU to document the error.
Date from GPS: Date ARU is deployed (enter as dd/mmm/yy).
Time from GPS: The time of day the ARU is deployed. Use 24 hour time.
ARU time Matches GPS Time: Circle yes or no after checking.
If NO, transcribe ARU date and time: copy the date and time from the ARU as it appears at pickup if it is more than 15 min different from the GPS time.
Observer 1 & Observer 2: Name/initials of observer(s). Use three initials. E.g. HEL to reduce confusion.
ARU ID: write out the FULL unit number (or the serial number if you have any doubt about the unit number). The serial number sticker is on the bottom of the Song Meter
Left Mic. #: the number of the left microphone. The left mic is the one to your left as you face the ARU. Use the lower number mic of a set on the left and the higher number on the right to reduce confusion. *WRITE OUT THE FULL MIC NUMBER*. SM3 units do not have mic numbers at this point. SM4 have the mic number on the inside of the unit cover.
Right Mic. #: the number of the right microphone. Use diagram on the bottom of the ARU to define left and right. *WRITE OUT THE FULL MIC NUMBER*.
SD Card Number: Fill in the SD card numbers for all used slots (e.g. SC 001 or EMCLA 157). *WRITE OUT THE FULL SD CARD NAME and NUMBER*.
Voice Note: Yes / No. Confirm that you were able to read the data sheet information onto the test recording when you put out the ARU.
Photo: Yes / No. Indicate whether you took photos of the station. Do this at deployment. If photos are not taken at deployment, make sure that the person picking-up knows to do this. Always take photos in the same order (e.g Data Sheet-North-East-South-West-Canopy-ARU).
 # Cards w/Data: total number of cards that have data.
Settings File Save: confirm that you saved the setting file to the SD card. It is very small and will generally fit even on full cards.
Damage: Circle yes or no.
Describe: Give a brief description of the damage on the unit

Comments: Anything. For example, are the microphones working, or damaged etc. If there is a file name mistake, *PLEASE MAKE SURE TO MAKE A NOTE AND KEEP TRACK OF IT.*

Figure 1. ARU placement on tree. Microphones still are wider than the trunk, thus ensuring that sound is not blocked by the tree. Tree should not be any wider than this one, 4 to 7 inches in diameter is ideal.

Photos

Do a brief assessment of vegetation and keep a record of what every point looks like, we are taking photos at every ARU deployment location. Take 7 photos at each location. First take a picture of the completed data sheet. Then take 5 photos, one in each cardinal direction (North, East, South, West) and 1 of the canopy. Take the canopy photo by holding the camera at waist height and aiming the lens at the sky. For the 6th photo take a picture of the center of the site showing the ARU deployment. Take this photo from a short distance away so that you get the ARU and the tree it is mounted on all the way to the ground and a bit of the surroundings. Don't take photos with a bush immediately in front of them. Get as clear of a field of view as possible for all photos.

Take the photos at deployment if at all possible. Otherwise, make sure to tell the pick-up crew which locations still need photos taken. Also take extra photos of the center point so that we have a visual reference of what the oil and gas structure is. The only exception is if you are forbidden to take photos on active lease site.

At the end of each day download the photos of your camera to the field computer, put them in folders clearly labelled with the cluster, site and station ,and label the individual photos as DS, N, E, S, W, Can and ARU.

Important Note: Always take the photos in the same order: Data Sheet-N-E-S-W-Canopy-ARU.

3. DATA MANAGEMENT

Taking care of the data is one of the most important parts of ARU pick-up. Do not let data management pile up. If you are running behind in saving data from SD cards, take some time out of the field and copy the data. Keeping track of existing data is as important as collecting more. **Cards will not be cleared by field staff**. Please follow these steps carefully:

1. When you get back to camp or your office, turn on the ARU and recheck the file prefix against the data sheet.
2. Download the ARU settings to the SD cards.
    a. For SM2: Utilities>>Save A: SONGMETER.SET
    b. For SM3/SM4: Program>>Export Program
3. Copy the data from the SD cards onto the large hard drives you are provided with. Store all the data from one site in a folder labeled according to Cluster, Site, Station and Deployment Date (e.g. Cluster 01>Site 02>NE>Card A).
4. Put the SD cards in a small brown envelope (ONE station per envelope) labeled with the corresponding
    a. cluster, site, station
    b. pick-up date
    c. observer(s)
    d. ARU number
    e. SD card numbers by slot
5. Always check and double check file names so that we know where each set of recordings came from. If the files from one station have been mislabeled, make the data manager aware of the problem so that they can correct it before the files go into final storage. If anything else unusual happens, please let the data manager know so that they don't spend time searching for missing files or figuring out what you already know.
6. If possible, keep one copy of the data in camp and one in the truck to increase data security. If you leave the truck, take one copy of the data with you. The small hard drives are easy to

carry. Or leave one copy in the hotel room while you go out for the day. Some researchers have lost all their data when a truck is stolen.

7. Bring both the SD cards and the storage drive back to Edmonton or wherever the end destination is (main office etc.). Make sure to fill out the digital Data Shipping Form that is one each HDD before you hand over data. This form should list the data on the hard drive as well as the data sheets and photos brought back from each shift.
8. Make sure to get empty SD cards and hard drives for the next shift (if ARUs are being rotated from site to site). If your project does only a single deployment with each ARU in a year, you will have to go through the process only once at the end of the season.

Table 2. Downloading data. A. Check file prefix on ARU against the data sheet and cross reference using ARU number. B. Copy data from SD card onto back-up hard drive. C. Put SD card into labelled envelop. D. Store cards with data in a clearly labelled secure container and put all cards from each site into individual Ziploc bags.

4. TESTING AND PROGRAMMING

Testing a Song Meter in the Field

Song Meters should be tested before every deployment. The following steps allow you to test quickly if a Song Meter is recording correctly:

SM2:

- Put batteries in the unit and turn the power on.
- The LCD screen should show that the unit is waking up and display the date, time, software version and the status of the SD cards.
- Put a card in slot A.
- Connect microphones to each port on the outside.
- Do a test recording: manually initiate recording by pressing the up and down buttons at the same time.
- Once the unit is recording, press the select button to toggle to the screen showing the gain levels. The gain bars and numbers should be similar. Talking directly into the left or right microphone should cause them to peak on that side.
- Stop the test recording by pressing the back button.
- If there is a difference in the left and right gain levels, switch microphones and try again. If the relative difference between the sides remains the same, the unit itself is faulty. If the sides are reversed, one of the microphones is faulty and should be replaced.

SM3 and SM4:

- SM3 units: go to the calibration screen in the Utilities menu. Talk into the microphones or snap your fingers near them. Make sure the left (0) and right (1) channels respond at the 1 kHz level. Accurate comparison of microphone sensitivity can only be done with a calibrator.

Any substantial differences between channels indicate an issue with the microphone connection or the wiring or switches. See section on Troubleshooting for how to address some of these issues. **Any microphones or units that are not recording cleanly should not be deployed in the field until the issue is corrected**. See Appendix 1 for examples of good and bad recordings.

Other things to look at: Check that all external ports are tight and sealed so that water cannot get into the Song Meter case. The microphone ports are particularly important because a loose part will lead to a loose microphone connection and excess static in the recording. On SM2, check that the wiring to

the batteries are intact and that all button and switches are working. On newer models, check that the white switches on the switch board are in the correct configuration. The left and right switch rows need to be identical. See Appendix 1 for default settings. On older SM2 units, check that all small black connectors are in place.

Loading a Recording Schedule

Unless you are programming the unit yourself, you will be given a pre-made configuration file (SET file for SM2 or PGM file for SM3 or SM4S file for SM4 units) to upload from the SD card in slot A. **Always check that you are using the correct SET file or PGM file for the particular project that you are deploying the ARU for**.

1. Put the SD card with the .SET or .PGM or SM4S files in Slot A (will not load from another slot).
2. Wake up unit (see instructions above).
3. SM2: Navigate to "Utilities" page. Select "Load Songmeter Set from A". Select correct SET file from SD card in slot A. Press Select button again. The Song Meter set file will now load. This file will configure everything except for the time, date, and file prefix.
4. SM3 & SM4: Select the "Program" menu. Select "Import Program". Put the cursur next to the program you want to load. Press "Enter". The program is now loaded. **DO NOT USE THE "Load Program" option** because it will only load preset programs and not the project specific programs.

The SET or PGM file will load all the setting that you need *EXCEPT* the date and time and the file prefix. These *MUST* be checked and/or set manually.

Programming a Song Meter

To program the Song Meter directly, follow the instructions in the Song Meter User Manual. You will get a manual with your new Song Meter or you can download this from the Wildlife Acoustics website. For both the configuration Utilities for SM2 and SM3 and manual programming, use the default settings in the Appendix, unless you are instructed otherwise.

IMPORTANT NOTE on GPS Enabled Units: GPS enabled units acquire the date, time and location from satellites. **Do not manually set the date and time on the GPS enabled units** unless they fail to sync with satellites. You can tell if the GPS unit has satellite signal by looking at the start up screen. A unit that does not have a signal will show a flashing question mark (?) in the top line with the date. Once it has a signal, it will show a steady dollar sign ($). Setting the time manually while the unit is trying to get satellite signal may cause problems with the time and date settings.

5. IMPORTANT CARE INSTRUCTIONS

Always handle the ARU units with care. They contain sensitive electronic components that will not withstand crushing or heavy impacts. Do not use excess force to remove the cover, tighten the cover screws, or take the mics on and off. Do all these operations gently. Use the correct size screwdriver on the cover screws so that the head do not get stripped.

ARU transport: Dropping the units or having them bounce around during transport can cause damage to the connections inside and destroy the outside as well. Always transport the ARUs in the padded bag provided (or in a similar padded bag with secure wrapping). Be especially careful with the GPS-enabled units and make sure that the cables do not get bent or damaged.

Transporting on quads and snowmobiles: make sure that the ARUs are not strapped directly onto the frame of the machine. Put a blanket, backpack or thickly folded tarp under the ARUs to protect them from getting jolted by the frame. While the padded bags are sufficient for most situations, extra packing is required for ATV transport.

The microphones are also sensitive to impact and pressure. Always transport them in hard sided cases that are waterproof and cannot be crushed. If microphones are wet when you pick up a recorder, make sure to dry them out before storing them.

Rain, Snow and other wet stuff: Extra care is required to handle ARUs in wet weather. When the Song Meters are closed, they are water tight and can withstand most weather conditions in the field. However, do not get water inside on the electronic components or into the external microphone sockets. Water will short out the electrical circuits and may cause permanent damage to the units. Take extra care on activation and deactivation on rainy days. Having wet hands, gloves and clothing will make it difficult to keep the inside of the ARU dry. The following steps may be used to minimize the amount of time an ARU is open if you need to deploy in heavy snow or rain.

Rainy day activation (mainly for SM2):

- Set up ARUs in your truck or room. Load SD cards, check batteries, test microphones.
- CLEARLY LABEL each recorder with the Site and Station that it is programed for.
- Take the recorder out, mount it to the tree (and securely attach the microphones if using SM2).
- Quickly open the unit and press the Wake/Exit button, do the voice note and close it again.

Rainy Day Take Down (mainly for SM2):

- Take the recorder off the tree.
- Open it and turn it off once you get to the truck or camp.
- Note the time when you take down the recorder so that blank tracks can be deleted. Mark this clearly on the datasheet.

6. TROUBLESHOOTING

If the ARU will not start, record, or is not recording equally on both channels, there are a number of things to check before taking it out of service.

Screen freezes: Just as with any other piece of electronic equipment, the unit will occasionally freeze and not respond to any of the buttons. If this happens, use the power switch to turn the unit off. Let it sit for a few minutes and then turn it back on. This will most likely get it started again. Reload the SET file and check all settings after a forced shutdown like this.

Song Meter won't turn on: This mostly happens due to an interruption in the power supply. Check that the power switch is moved to "internal power" (or the jumper is in the correct location for older models). Also check that the batteries are touching all the contacts. Sometimes a battery will not be positioned correctly and interrupt the circuit.
NOTE for SM3 units: If you turn the unit off and on too quickly, it will not initiate. If this happens, press the "Check Status" button.

Timer batteries: The timer batteries will also affect how the SM2 works. If you cannot set the time or the unit won't turn on, check the timer batteries. If the timer batteries are taken out and/or replaced, you will have to reset the time and the time zone information. SM4s will run without a time battery (but will not keep time if turned off).

Uneven gain: Check that both microphones are firmly connected. Check that the switch board is in the correct set up (or the jumpers are securely connected on the older units). Switch microphones to check if one of the mics is the problem. If none of these remedies work, there may be an internal wiring issue and the unit should be taken out of service and checked over more thoroughly.

Excess static: excess static in one of the channels may be caused by wiring issues or microphone connections. If a test recording shows excess static, try different microphones and make sure that the mics are properly connected to the external ports. If none of these remedies work, take the unit out of

service and have it checked over more thoroughly.

SD card is not recognized: turn off the ARU. Remove SD cards and insert into slots again. Turn on ARU.

SM3/4 will not start after the power is switched on: This can happen if you turn the power on and off too rapidly or for other unknown reasons. Press the "Check Status" button. This will most likely get the SM3 working. Pressing program stop also works. Taking out the batteries is another thing that may work.

Cable gland gets damaged: Use tape to make it waterproof and keep using the unit.

Microphone port is loose (SM2): Hold the mic connector with one hand and tighten the flat hex nut with the other. Take care not to rotate the mic connector.

Wind screen is damaged: Use snap ring pliers to take off what is left of the old windscreen. Replace with a new windscreen.

APPENDIX 1: SETTING AND SCHEDULES

Information that is the same for SM2 and SM3

Location (specified in SET or PGM file):

- Latitude: area dependent
- Longitude: area dependent

Solar Mode: Sunrise/Sunset (specified in SET or PGM file).

Timezone: UTC -06 for Alberta between March and November (this is 6 from Prime Meridian = Mountain Standard Daylight Savings Time, specified in SET or PGM file). *IMPORTANT: CHECK and MANUALLY SET TIME ON EACH INDIVIDUAL UNIT TO MOUNTIAN STANDARD DAYLIGHT SAVINGS TIME.*

Memory: Use as many SD cards that makes sense to store the amount of data you want to collect. Use the configuration utilities to figure this out.

Batteries: 4 D-Cell batteries (Internal, Alkaline). Note: both SM2 and SM3 programs can be scheduled to do a 1-minute Test recording when they are put into standby. When you press the Wake/Exit button on SM2, it will record for 1 min and then say: Going to Sleep Until 01 March 2015 (or whenever the next scheduled recording time is). When you press "Start Program" on the SM3, it will record for 1 min and then say: Going to Sleep Until 01 March 2015 (or whenever the next scheduled recording time is).

Settings Specific to SM2

Switch Configuration (set on unit, shouldn't have to adjust)

- Row 1: On
- Row 2: On
- Row 3: Off
- Row 4: On
- Row 5: Off
- Row 6: Off
- Row 7: On
- Row 8: Off
- Row 9: Off

Audio Settings (specified in SET file):

- *Sample rate*: 44100
- *Channels*: stereo
- *Compression*: WAC0 (for loss less 60% compression of files)
- Gain left +0.0dB
- Gain right +0.0dB

Advanced Settings (specified in SET file):

- Dig HPF Left: Off
- Dig HPF Right: Off
- Dig LPF Left: Off
- Dig LPF Right: Off
- Trg Lvl Left: Off
- Trg Lvl Right: Off
- Trg Win Left: 2.0s
- Trg Win Right: 2.0s
- Div Ratio: 16

Audio and Advanced settings are both updated from the SET file. These settings are the same for the GPS enabled units and for BAT enabled units if they are used for recording birds. If you are using a BAT enabled unit to record birds, make sure that any default BAT settings are turned off before you start.

Settings Specific to SM3

Note 1: SM3 does not use left and right to identify channels. The left channel is designated as CH 0 and the right channel is designated as CH 1.

Note 2: All information for audio setting, file type, gain and schedule are specified in the SM3 program file. There are no longer any manual switches for any of these. Similar to the SM2, this info is entered line by line into the program using the SM3 configuration utility.

Program (part 1 to determine settings):

- 1 HPF CH 0: Off Ch 1: OFF
- 2 GAIN CH 0: 19.5 dB CH 1: 19.5 dB (NOTE: THIS IS NOT THE DEFAULT GAIN)
- 3 FS WAC Format CH 0+1 48000 Hz
- 4 ZC Off DIV 8

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- 5 TRGLVL CH 0: Off CH1: Off
- 6 RECORD 00:01:00 (this initiates the 1-minute test recording)

Setting Specific to SM4:

Location (specified in SET or PGM file):

- Latitude: area dependent
- Longitude: area dependent

Solar Mode: Sunrise/Sunset (specified in SET or PGM file).

Timezone: UTC -06 for Alberta between March and November (this is 6 from Prime Meridian = Mountain Standard Daylight Savings Time, specified in SET or PGM file). *IMPORTANT: CHECK and MANUALLY SET TIME ON EACH INDIVIDUAL UNIT TO MOUNTIAN STANDARD DAYLIGHT SAVINGS TIME.*

Memory: Use as many SD cards that makes sense to store the amount of data you want to collect. Use the configuration utilities to figure this out.

Batteries: 4 D-Cell batteries (Internal, Alkaline).

Channel: Stereo.

Gain: Left and right at 12.5 dB (BU specific settings file).

High-pass filter: left and right are to be off.

Sample Rate: 44100 kH

APPENDIX 2: DEPLOYMENT ZONES

Instructions for Identifying ARU Deployment Zones

The ARU settings files are designed to track sunrise and sunset. To do this correctly the ARU needs to "know where it is" in the province. This means setting the location to the latitude and longitude where the ARU is deployed. For now we have decided to divide the province into 10 zones (Figure A2.1.) and use the centers of the zones for the ARU locations. The zones are set up so that the difference between the center and the NE and SW corners is less than 20 minutes. This means that the ARU will do sunrise and sunset tracking recordings within 20 minutes of true sunrise.

The challenge for deployment is to make sure that the correct location is entered on the ARU. To make this easy, we have made one settings file for each zone. To identify which zone you are in, simply look at the latitude and longitude of where you are and compare it to the chart below. The settings files are identified by their zone number.

Table 1. Zone reference chart in Latitude and Longitude .

	Center Coords		NE Corner		SW Corner	
ZONE	Lat	Long	Lat	Long	Lat	Long
1A	59	-117.5	60	115	58	120
1B	57	-117.5	58	115	56	120
1C	55	-117.5	56	115	54	120
1D	53	-117.5	54	115	52	120
1E	50.5	-117.5	52	115	49	120
2A	59	-112.5	60	110	58	115
2B	57	-112.5	58	110	56	115
2C	55	-112.5	56	110	54	115
2D	53	-112.5	54	110	52	115
2E	50.5	-112.5	52	110	49	115

Table 2. Zone reference chart in UTMs. UTM 11 coordinates are italicized. UTM 2 coordinates are bolded.

	Center Coords		NE Corner		SW Corner	
ZONE	Lat	Long	Lat	Long	Lat	Long
1A	*471274*	*6540159*	*611544*	*6653097*	*322707*	*6432647*
1B	*469626*	*6317497*	*618207*	*6430460*	*312928*	*6210141*
1C	*468016*	*6094906*	*624726*	*6207884*	*303379*	*5987687*
1D	*466445*	*5872387*	*631090*	*5985372*	*294071*	*5765288*
1E	*464539*	*5594344*	*637294*	*5762926*	*280586*	*5431792*
2A	**413826**	**6541019**	**555776**	**6651832**	*618207*	*6430460*
2B	**408882**	**6318386**	**559107**	**6429147**	*624726*	*6207884*
2C	**404051**	**6095820**	**562366**	**6206530**	*631090*	*5985372*
2D	**399337**	**5873322**	**565548**	**5983984**	*637294*	*5762926*
2E	**393621**	**5595300**	**568649**	**5761510**	*646280*	*5429382*

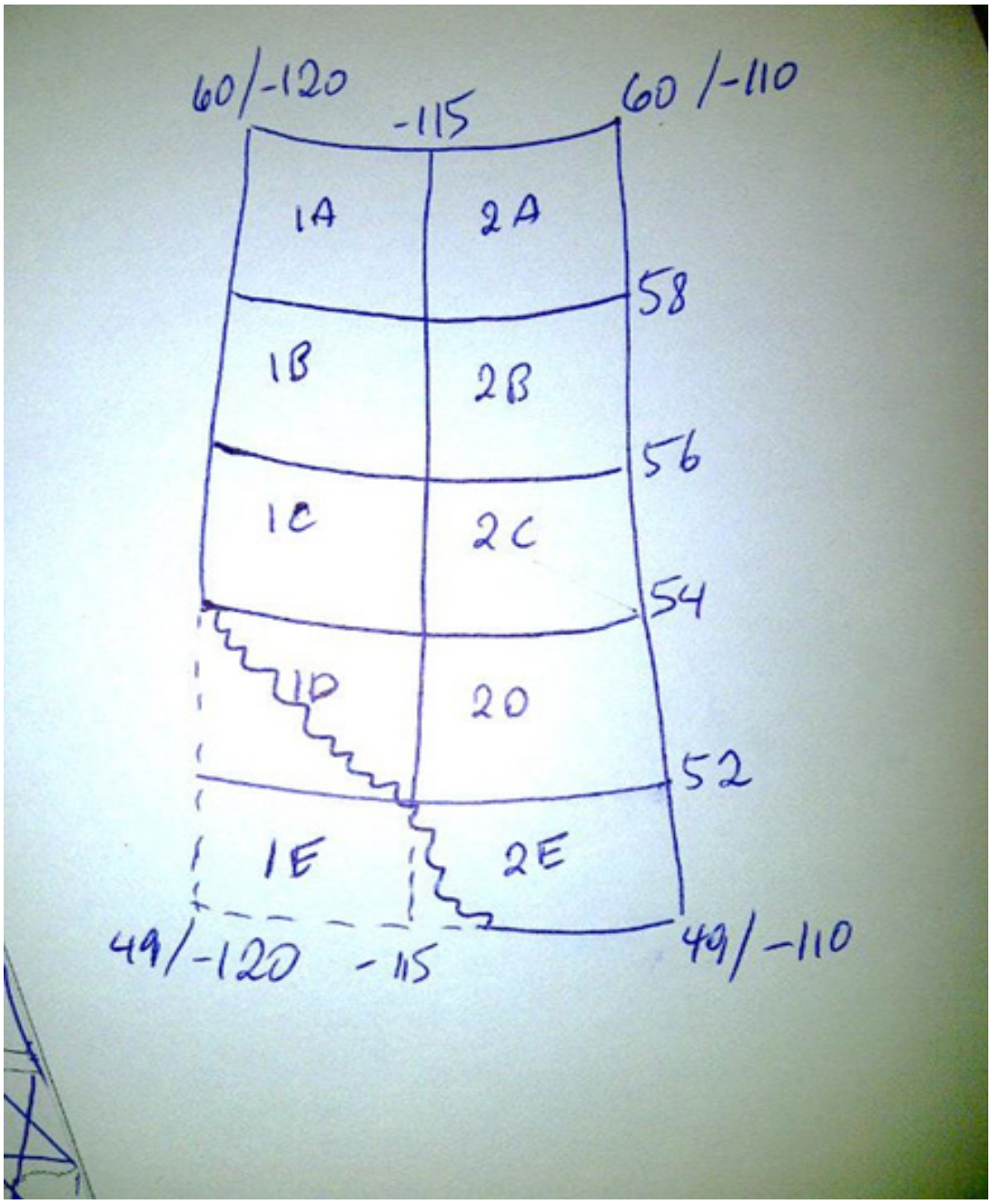

Figure A2.1. Ten designated zones within Alberta, centre of zones are for ARU placement.