

Song Meter SM2M Marine Recorder
User Manual

Wildlife Acoustics, Inc.

www.wildlifeacoustics.com

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Introduction

The Song Meter SM2M Marine Recorder is a submersible 16-bit digital recorder designed for short or long term deployments in fresh or salt water to depths of up to 150m. Like the terrestrial SM2+ package, the SM2M features flexible scheduling, extremely low power consumption, pristine digital recording quality and ease of use in a very cost effective package.

Use of this Document

This document is a supplement to the Song Meter SM2+ User Manual. It is not intended as a stand-alone document and describes only information specifically related to use of the Song Meter SM2M Marine Recorder. The SM2M is built upon the SM2 platform and that user manual should be read before this to fully understand the devices features and capabilities.

You will also want to download and install the latest Wac2Wav post-processing software and Song Meter Configuration Utility software from the “downloads” section of our website at www.wildlifeacoustics.com.

Overview of the Device

The SM2M housing is sealed for underwater use with a screw top containing two o-rings. The electronics simply slide into the housing and are held firmly in place when the top is tightened. The only connection point is a 3 pin connector to the external hydrophone. The hydrophone is protected with a stainless steel cage. The unit was designed to allow quick refurbishment of the device shipside for immediate redeployment. The batteries and SD flash cards can be easily swapped and the housing resealed. The device can be anchored and recovered via tether, diver or optional acoustic release. The attachment point for the anchor is a stainless steel eyebolt on the bottom of the housing. A high quality case is included for storage and transportation.

Setup

Switch Settings

High pass filter selection is dependent on the desired recording bandwidth. To capture low frequencies to the limit of the hydrophones sensitivity, 3Hz should be selected.

A good starting point for gain is 12dB, this will be optimal for recording distant marine mammals. If the unit is near anthropogenic noise sources, 0dB might be more suitable. Experimentation is advised! Since both Song Meter channels are connected to the hydrophone, it is also possible to record both channels with two different gain and filter settings.

The 2.5V Mic Bias switch should be set to “off”, this risks damage to the hydrophone.

The Power Source switch should be set to internal to power the device, external is not wired.

Audio Settings

The audio settings are covered in depth in the Song Meter SM2+ Users Guide. The SM2M does allow a sample rate of from 4kHz to 96kHz. This can theoretically record sounds up to 48kHz but the hydrophone has diminishing sensitivity above 30kHz. To choose an appropriate sample rate always at least double the highest frequency that you wish to record.

Compression is particularly important for the SM2M as, often, long deployments are desirable. WACO is a lossless compression and allows nearly doubling the recording length for a given card capacity.

For lower sample rates, it is likely better to record without triggers, both because card space is not as much of an issue and because there will likely be constant false triggers at lower frequencies. Triggers are an excellent way to extend storage space if the ambient conditions and recording bandwidth allow for their use. For high frequency recording it is possible that implementing a digital high pass filter in the audio settings might make triggers viable, again experimentation is encouraged.

Both channels are connected to the hydrophone, so it is arbitrary which channel you select for recording. This does present some opportunity for creative recording. Different gain, sample rate and trigger levels

could be used on the different channels. For example you might want to record at a high sample rate with a high pass filter to filter out lower sounds with more gain on the jumpers on one channel, and a lower sample rate with no filter and less gain on the other.

Recording Schedule

The SM2M can handle any complexity of schedule. It is even possible to program different sample rates for different recording sessions. Details in the SM2+ Users Guide. It is important to remember that when the SM2M is not recording it is in a very low power state such that low duty cycles can significantly extend the possible deployment longevity.

Batteries

The SM2M is powered with up to 32 D cells batteries. The device can accept 1.5V alkaline batteries, 1.2V NiMH batteries or 3V (or 3.3V) lithium batteries. The recommended lithium batteries are non-rechargeable lithium manganese batteries, model U10026 from Ultralife Batteries. Please contact Wildlife Acoustics support for more information. A board containing protection diodes in two configurations must be configured for the appropriate cell voltage. As shipped the SM2M is configured for 1.5 (or 1.2V) cells. In this configuration the batteries in parallel groups of 4 in series. To use 3V cells the board must be removed and rotated 180 degrees and reinstalled, this configures the battery cells in parallel groups of 2 in series. There is a small white arrow on the main battery board that aligns with the arrow on the diode board as shown in the 1.5V position in Figure 1.

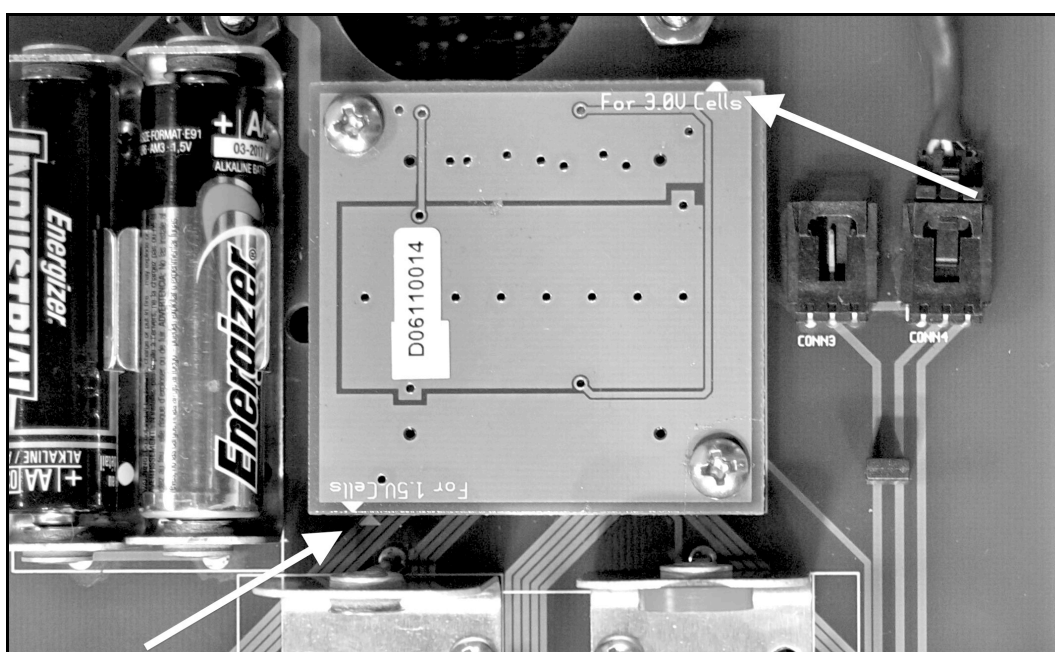


Figure 1

Batteries must be inserted in the proper groupings. Groupings are labeled on the battery board “A” through “H”. For 1.5V and 1.2V cells all four battery holders corresponding to a letter must be populated. Letters “F” and “C” have two on the back and two on the front. For 3V cells only two of each letter must be populated.

If not inserting all 32 batteries, it is best to populate the letters closest to the bottom as that will help the SM2M float vertically.

The following chart shows approximate recording longevity in days for a 100%, 50% and 25% duty cycle schedule. This assumes 0 degree Celsius water and compression, but battery life varies and this should be taken as a maximum figure. Sample rate selection will not affect battery longevity.

Number of Batteries	Lithium Manganese			Alkaline			LSD NiMH		
	100%	50%	25%	100%	50%	25%	100%	50%	25%
4	13	26	53	8	15	31	5	9	19
8	27	53	105	16	31	62	11	18	38
12	40	79	158	23	46	92	16	27	57
16	53	105	211	31	62	123	22	36	76
20	67	132	263	39	77	154	27	45	95
24	80	158	316	47	92	185	32	54	114
28	93	184	369	55	108	216	38	63	133
32	107	211	421	62	123	246	43	72	152

The two AA batteries run the SM2M clock. These should be alkaline batteries and, while they can last up to two years, it is recommended to change them every year, if not for every deployment. There are two holes to either side of the battery holder and the batteries should be zip tied to the board using these holes.

Flash Cards

Up to four SDHC or SDXC cards can be installed. SDHC cards are available up to 32GB and SDXC cards are currently available up to 128GB, with higher capacities coming. The following chart shows recording longevity in days for various total card capacities and sample rates using WAC 0 lossless compression. Using no compression (record straight to WAV) will approximately halve these values. Lossy compressions are available for even more compact storage. See the SM2 Platform User Manual for more information.

Total Card Capacity	32GB	64GB	128GB	256GB	512GB
96,000	3	6	13	26	51
48,000	6	13	26	51	103
44,100	7	14	28	56	112
32,000	10	19	39	77	154
24,000	13	26	51	103	206
22,050	14	28	56	112	224
16,000	19	39	77	154	309
8,000	39	77	154	309	617
4,000	77	154	309	617	1,235

Note: SDXC cards must be formatted to FAT32 file system to work with the SM2M. Please contact Wildlife Acoustics support for more information.

Sealing the Housing

Note: The SM2M ships with no o-rings installed, with no o-rings the unit will not seal and is unsuitable for deployment at any depth!

The housing is sealed using two o-rings on the top cap. This is a redundant system, only one o-ring is necessary to seal, but two are used to assure a seal if one should become compromised. The o-ring seal is designed for depths far greater than the rated depth of the housing, so with proper installation the unit is sure to seal at any depth.

Preparing the Top Cap

It is extremely important that the o-rings be clean, free of defects and properly lubricated. Take the o-rings and apply a small amount of the included lubricant. Apply around the entire o-ring, feeling for defects with your fingers as you apply. Insert the o-rings on the cap as shown in Figure 2.



Figure 2

Next apply a thin layer of lubricant all the way around the smooth inner diameter of the housing where the o-rings will mate as shown in the area between the two arrows in Figure 3. This area and the o-rings should be free of dust, hair and other debris.

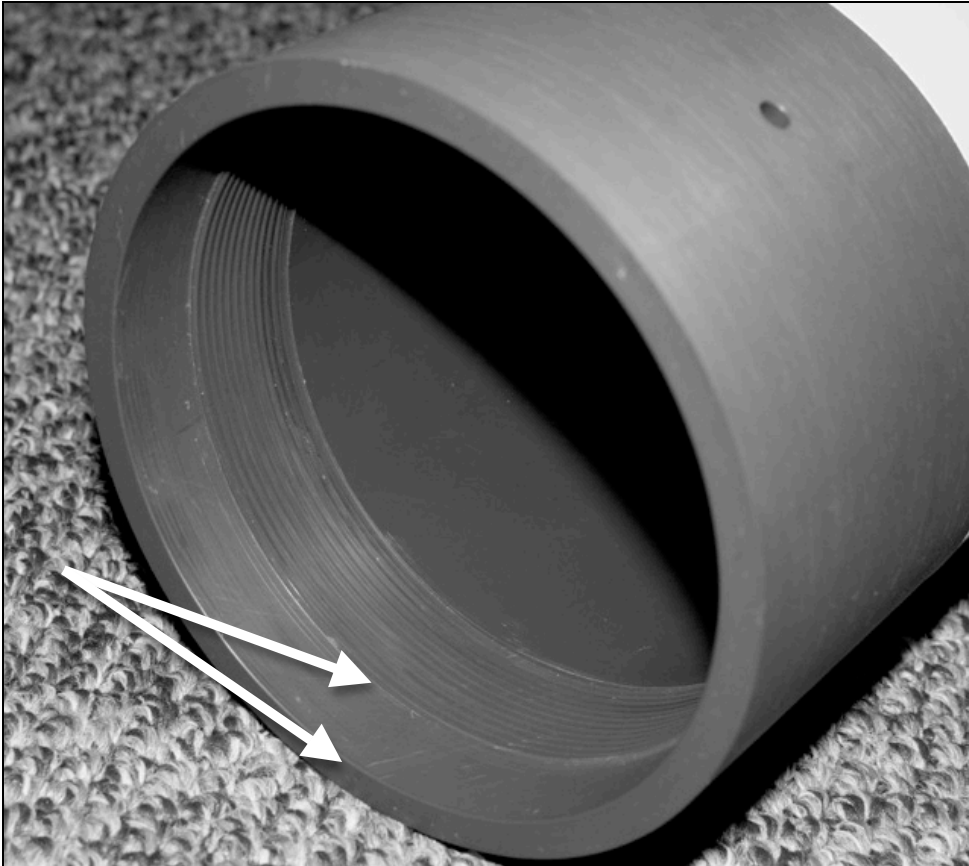


Figure 3

Installing Battery Board and Connecting

The battery board simply slides into the housing. The neoprene edging should be in place on the top and bottom of the board, when the top cap is tightened this hold the board in place and prevents movement during deployment. The hydrophone cable should be lopped twice through the large finger hole at the top of the board and then plugged into either connector; they are both electrically tied together.

Looping the cable provides strain relief so the wire twists above the hole and not at the connection point. Always inspect the connector prior to sealing to make sure the wires are intact. Proper connection is shown in Figure 4 below (though again either connector can be used).

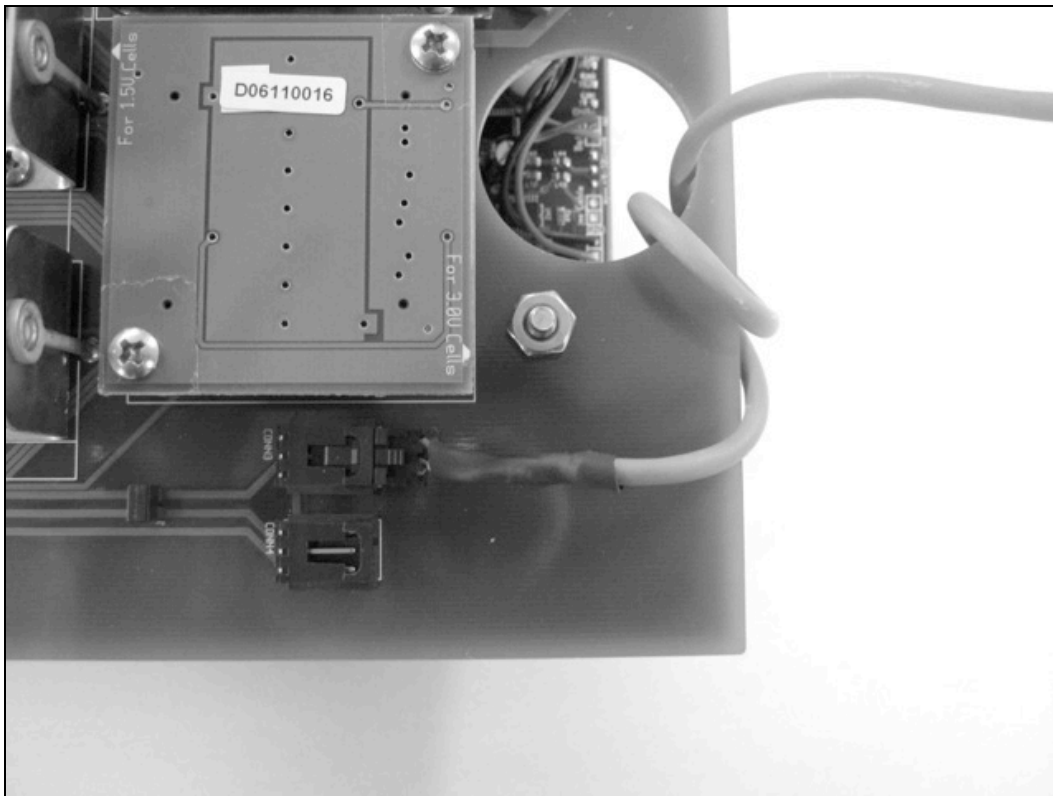


Figure 4

At this point it is prudent to run a final system test. An instant recording can be initiated by pressing the “up” and “down” buttons on the Song Meter board simultaneously and then stopped by pressing the “back” button. Recorded sounds or vocalizations can then be immediately verified on a computer. Once satisfied, make sure the internal/external jumper is set to internal and the unit is powered. Press the “wake/exit” button and watch for with an announcement of scheduled recording time if in the future or “preparing to record” if the schedule starts with record. The LED light on the Song Meter board will also blink once a second during a recording and once per minute when awaiting a scheduled recording.

Drop a desiccant pack into the bottom of the housing before installing top cap. Remaining desiccant should be kept in zip-lock bags to prevent them from absorbing moisture.

Installing Top Cap

Before inserting the cap, rotate the cap in the reverse direction of tightening four times. It takes eight turns to seal the cap, so this will keep a maximum of four turns on the hydrophone cable.

Insert the cap and rotate by hand a couple turns to get it started. When the first o-ring engages it will become more difficult. Insert the included spanner wrenches into the interfacing holes. One wrench interfaces with the two holes in the housing and the other interfaces

with the 4 holes in the top cap. It is easiest to do the procedure while sitting atop the pipe (as though riding it). You can hold the housing wrench stationary and rotate the top cap, moving to a new hole as it is tightened. The wrenches are identical. Apply force as shown in Figure 5 to tighten.



Figure 5

After six more turns it will get more difficult as the second o-ring engages. Continue tightening until there is no gap between the top cap and the cylinder as shown in Figure 6.

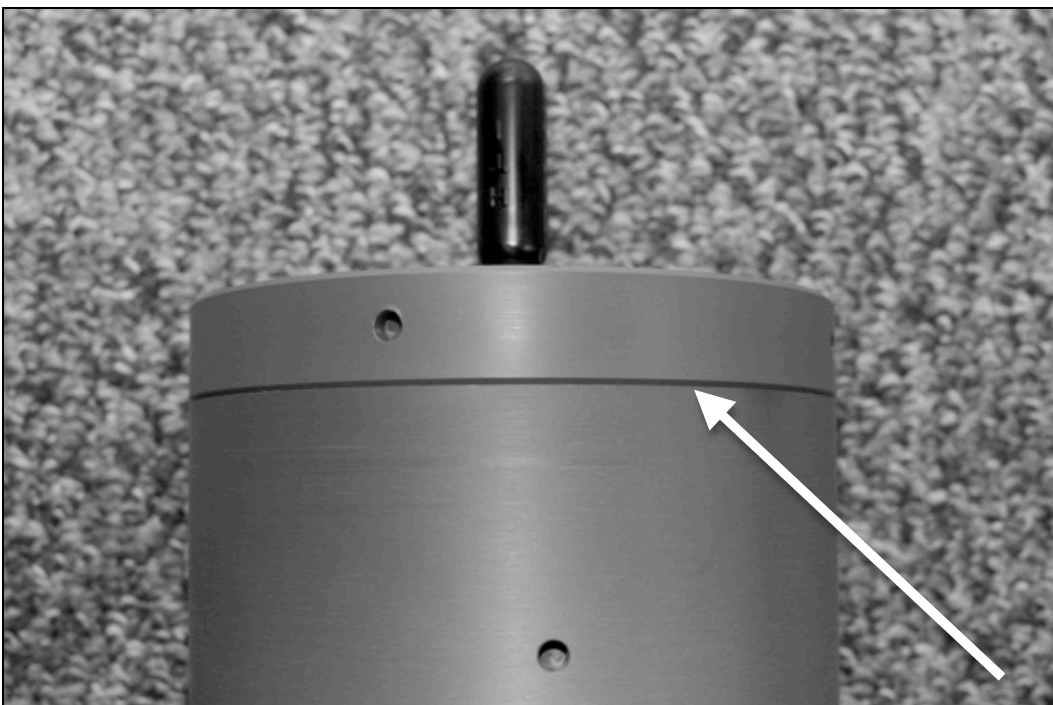


Figure 6

Now insert each of the four legs of the hydrophone cage into the four top cap holes. Cinch a cable tie around the entire assembly as shown in Figure 7.

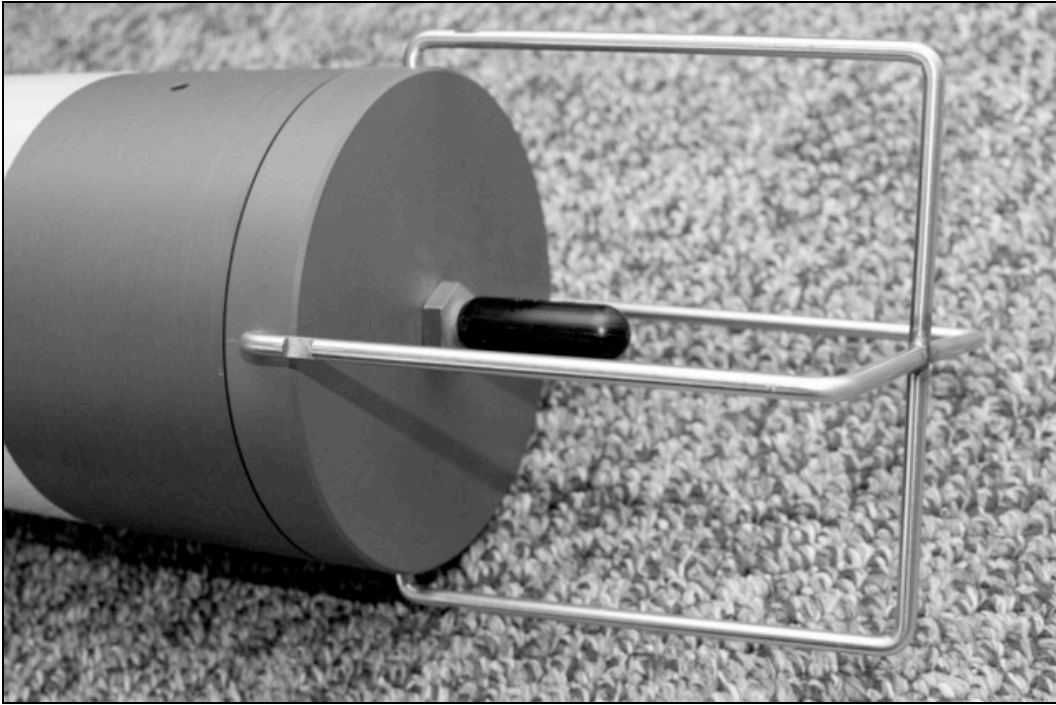


Figure 7

There are grooves in the side of each leg to hold the cable tie in place.

The unit is now ready to be attached to an anchor system and deployed!

Note: The SM2M package includes 4 o-rings, 5 packs of desiccant and a tube of o-ring lubricant. Additional deployment supplies can be purchased from McMaster Carr (<http://www.mcmaster.com/>). O-rings are part number 9557K333, 5 pack of desiccant is part number 2189K18 and o-ring lubricant is part number 9463K33 .

Deployment

Depth Rating

The SM2M's PVC housing is conservatively rated to 500ft (150m). This figure assumes a ten year deployment life. In pressure testing, failure did not start until the equivalent pressure of about 100ft (300m). Deployments below 150m are possible but not covered under warranty and will decrease the housing effective deployment lifespan.

Anchoring Solutions

The SM2M can be anchored from the 316 stainless steel eyebolt on the bottom of the housing as shown in Figure 8 below.



Figure 8

The eyebolt was tested for a 150lb load. Certainly a larger anchor could be used, but it is recommended that no more than 150lb be placed on the eyebolt in air.

The unit can be tethered directly to an anchor for diver release, or tethered to a surface structure. Acoustic releases are commercially available which allow the unit to be released from the ocean floor by playing an acoustic signal from the surface. In this case, it is necessary to use a subsea float to increase the visibility of the housing when it surfaces. Wildlife Acoustics has developed a subsea float with an integrated 4' tall flag, which is perfect for this application. Please contact Wildlife Acoustics support for more information.

Retrieval and Shiptside Refurbishment

Retrieval

Regardless of method of retrieval, take care in getting the unit shiptside not to damage the hydrophone. If planning on using hooks to snare the housing, it might be best to deploy with a ring of floating nylon line attached to the bottom eyebolt to give a hooking point. It would also be possible to attach rigging to the unit use large stainless steel band clamps around the diameter of the housing.

Opening Recorder

After a long deployment in shallow water, the unit is likely to have accumulated significant biofouling. It may be necessary to clean the top of the cylinder to access the holes for the spanner wrenches. The hydrophone cage must be removed to allow the spanner wrench to interface with the top cap side holes. Remove the cable tie around the hydrophone cage and pull the four cage legs from the top cap holes to fully remove the cage. To get the top cap started, give a good impulse of force to the spanner wrench, then proceed opposite sealing as shown in Figure 9.



Figure 9

Flash Card and Battery Replacement

To remove the board, first disconnect and remove the hydrophone cable and then simply pull the board from the housing using the large finger hole at the top of the battery board. The D cell batteries can simply be removed and replaced, the AA batteries will assure that the clock setting is maintained.

Flash cards can either be swapped for new empty cards or, if time allows, inserted into a laptop, transferred and then erased.

Resealing

The o-rings should be removed and the top cap thoroughly cleaned, paying special attention to the o-ring area. The inner diameter of the housing should also be well cleaned, again particularly where the o-rings will contact the housing. The o-rings themselves should be cleaned and then inspected for any damage, best to be on the safe side and replace when in question. The desiccant pack is not reusable and should be replaced for every deployment. Give the entire housing an inspection to make sure there is no damage to the housing, the eyebolt or the hydrophone. Check to make sure the hydrophone is still tight to the top cap, the metal of the hydrophone connector should make contact with the plastic of the top cap. Next the o-rings should be lubricated and the unit sealed as per previous instructions.

Storage and Transport

The SM2M ships in a high quality case suitable for storage and shipment. The case has wheels on one end for ease of travel and two latches which can accept locks for security. An accessory compartment allows storage of the spanner wrenches, o-rings, lubricant desiccant and other needed supplies.

The SM2M should have the hydrophone cage installed when transported in the case as shown in Figure 10. This assures a tight fit and protection from impact.



Figure 10

Specifications

Physical Specifications

Height: 31.25 in. (79.4 cm) including eyebolt and hydrophone.

Diameter: 6.5 in.(16.5 cm)

Eyebolt Anchor: 1.7 in (4.3 cm) outer diameter

1.0 in (2.5 cm) inner diameter

2.0 in (5.1 cm) height off housing

Hydrophone: 2.5 in (6.4 cm) length

0.75 in (1.9 cm) diameter

Weight in air: 21 lbs (9.5 kg) with no batteries

31 lbs (13.5 kg) fully populated with batteries

Buoyancy in salt water: 12 lbs (5.5kg) with no batteries

3 lbs (1.5 kg) fully populated with batteries

Rated Depth: 500ft (150 m)

Electrical Specifications

Audio Sample Rate: 4kHz to 96kHz

Hydrophone Sensitivity: -165dB re: 1V/ μ Pa

Hydrophone Frequency Response: 2Hz to 30kHz (+/- 2dB of rated sensitivity)

30kHz to 48kHz (+/- 5dB of rated sensitivity)

Hydrophone Directional Response: Omnidirectional (+/- 1dB up to 30kHz)

Hydrophone Equivalent Input Self Noise: 78dB re 1 μ Pa

Maximum SPL at hydrophone with no damage: 240dB SPL

Storage Media: up to four 32GB SDHC or up to four 128GB SDCX

Battery: Up to 32 alkaline, LSD NiMH or lithium manganese D cells

Note: Full specifications for the SM2+ Platform can be found in the SM2+ Platform User Manual.