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UNIVERSITÉ DE TOULON

CARI'MAM

USER GUIDE

HIGH DEFINITION SUBSEA ACOUSTIC ACQUISITION SYSTEM JASON HIGHBLUE

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Le projet CARI'MAM est cofinancé par
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User guide for the installation of high definition subsea acoustic acquisition system Jason HighBlue in the Caribbean for the CARI'MAM project

SMIoT
Scientific Microsystems for Internet of Things

Système d'acquisition de signal

JASON HIGHBLUE

UNIVERSITÉ DE TOULON

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Introduction

The interregional cooperative CARI'MAM project (Caribbean Marine Mammals Preservation Network) is co-financed by the INTERREG Caribbean program for the European Regional Development Fund and led by the Agoa Sanctuary (France). It has for objective to reinforce the network of marine protected areas dedicated to the protection of marine mammals in the Caribbean.

One of the thematic of the project is to develop passive acoustic monitoring of marine mammals with the partners, through the development of a methodology user friendly and reusable by the local organization of the Caribbean..

In this framework, a mesh of hydrophones used to follow marine mammals trough passive acoustic monitoring will be deployed in several territories of the Caribbean. The network will be composed of 29 hydrophones and deployed for one year through 2 month periods.

The hydrophones financed by the CARIMAM project will be made available to the local partners, already involved in the monitoring and protection of marine mammals,. They will be in charge of their installation and maintenance during the whole survey.

The hydrophones used in this project are the Jason HighBlue model, developed by the University of Toulon/SMIOT laboratory, which is also in charge of the analysis of the data as they are received, thanks to deep learning software developed for this project.

The purpose of this guide is to help with the use of the hydrophones and ensure the respect of the precautionary measures.

Contenu du pack Jason HighBlue CARI'MAM

The HighBlue package comes with everything needed to use and includes the following:

- Watertight carrying case IP65, rolling
- Sealed tube until -100m, length 60cm with 3 plugs, one external switch, and a penetrator.
- Block batteries for the series connection of 21 type batteries D
- Grabber BlueEar 16bit Mono
- Map µSD 512GB + µSD- adapter> SD
- C75 hydrophone
- Rack hydrophone protection
- Flange for spare seals
- Joint replacement for tape
- Silicone grease
- Penetrator Wrench
- Allen wrench
- Screws and nuts in stainless steel additional A4.
- Cable micro USB for updating the embedded firmware.

The JASON HIGHBLUE system incorporates the latest technologies for signal acquisition, allowing a compromise between high sample rate and reduced energy consumption.

It can be used in "stand alone" mode, in which data acquisitions is connected directly to external USB media, or in “connected mode”. In the latter case, the JASON HIGHBLUE system is connected to a PC via the USB link.

Caractéristiques technique du matériel

Acquisition

- Acquisition Sample Rates: 512 Ksps / 256 Ksps / 128 Ksps / 64 Ksps / 32 Ksps / 8 Ksps
- Frequency range of the input signal: 5 Hz to 256 kHz.
- Acquisition in 8, 16 bits, adjustable via a configuration script.
- Differential acquisition with 3.3V maximum input level.
- Accurate timestamping
- Anti-aliasing filter configurable to input signal without change of input signal in the passband (see section characteristic filters).

Amplifier

- the signal from the hydrophone: X2
- Single ended input and differential output
- Input impedance: 10 ^ 13 ohm.

Storage

- Storage support on micro SD card (or SD via an adapter)

Energy consumption

- Max Power Consumption: 1.65W in lifelong learning (SD and hydrophone including C75)

Hydrophone C75

- Sensitivity of the transducer: -200dB, re. 1V / µPa
- Gain preamplifier: 20dB
- Effective sensitivity: -180 dB re. 1V / µPa
- Linear frequency: 10Hz to 170kHz (± 3dB)
- Usable bandwidth: 3 Hz to 250 kHz (+ 3 / -12dB)
- Power 5 to 32Vdc
- Acoustic Overload pressure: 184 to 201dB, re 1µPa
-

Characteristics of input files

Lowpass 1 (Wideband1): Cutoff frequency = 0.4 * Sampling Rate, constant gain in the passband, high attenuation beyond so as to avoid aliasing phenomena with an attenuation of 110 dB in the stopband.

Lowpass 2 (Wideband2): Cutoff frequency = 0.5 * SR. constant gain in the passband, high attenuation beyond so as to avoid aliasing phenomena.

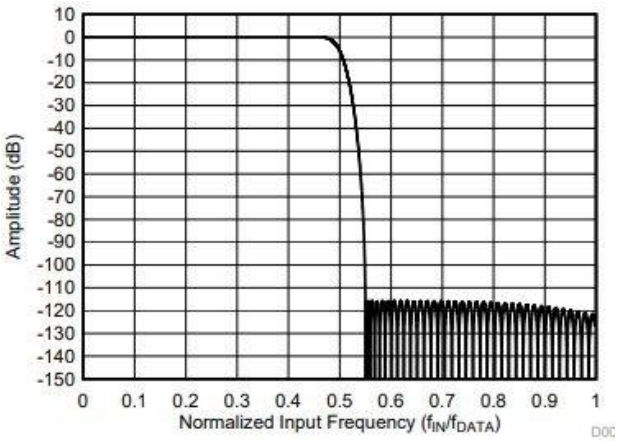


Figure 1 : Transfer function of the filter WB1

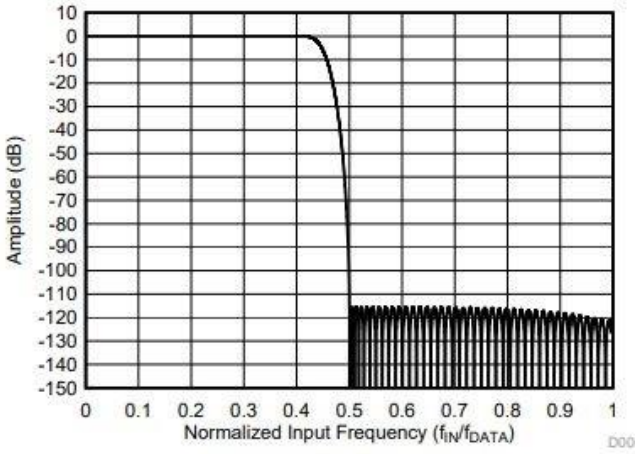


Figure 2 : Transfer function of the filter WB2

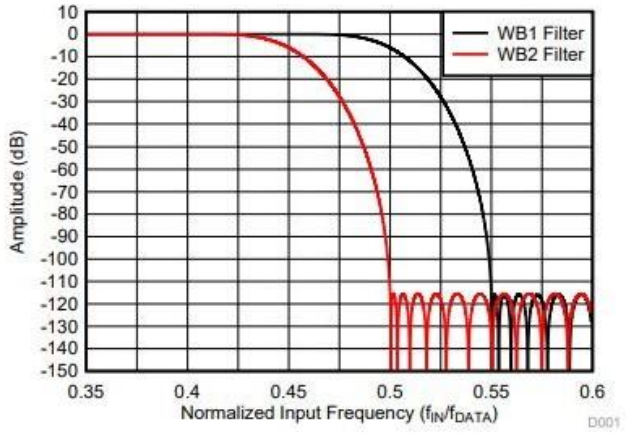


Figure 3 : Comparison of transfer functions of filters WB1 and WB2

Filter Low Latency (sinc / sin5c): Constant phase shift between the output and input signals irrespective of the frequency of the input signal. In return, the gain is not perfectly consistent in bandwidth. The noise level is lower than with an anti-aliasing filter.

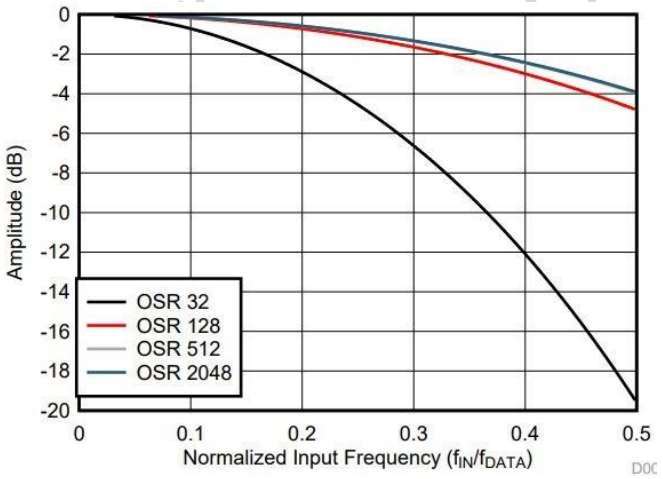


Figure 4 : Filter Transfer Function Low Latency for frequencies below the Shannon limit

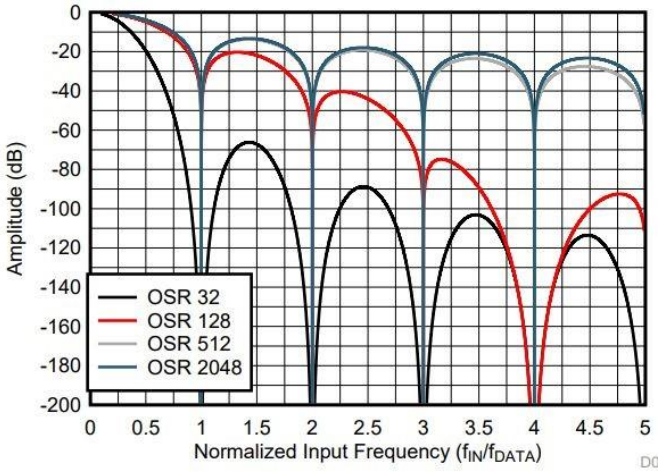


Figure 5 : Filter Transfer Function Low Latency for a range of fréquencies beyond the Shannon limit frequency

Features analog digital conversion stage

Table 1. Wideband Filters Performance Summary at AVDD = 3.0 V, DVDD = 1.8 V, and 2.5-V Reference

MODE	DATA RATE (SPS)	OSR	TRANSITION BAND	PASS BAND (kHz)	SNR (dB)	V_{RMS_noise} (μV_{RMS})	ENOB	I_{DVDD} (mA)
High-resolution (HR)	512,000	32	Wideband 1 filter	230.4	103.7	11.61	18.72	7.50
			Wideband 2 filter	204.8	104.1	10.64	18.84	
	256,000	64	Wideband 1 filter	115.2	107.3	7.61	19.33	4.35
			Wideband 2 filter	102.4	107.7	7.25	19.40	
	128,000	128	Wideband 1 filter	57.6	110.4	5.35	19.83	2.80
			Wideband 2 filter	51.2	110.9	5.06	19.91	
	64,000	256	Wideband 1 filter	28.8	113.4	3.79	20.33	2.00
			Wideband 2 filter	25.6	113.9	3.58	20.41	

Figure 6 : acquisition noise level depending on the configuration of wideband filters

Table 2. Low-Latency Filter Performance Summary at AVDD = 3.0 V, DVDD = 1.8 V, and 2.5-V Reference

MODE	DATA RATE (SPS)	OSR	-3-dB BANDWIDTH (kHz)	SNR (dB)	V_{RMS_noise} (μV_{RMS})	ENOB	V_{PP_noise} (μV_{PP})	I_{DVDD} (mA)
High-resolution (HR)	512,000	32	101.8	107.6	7.40	19.37	64.67	1.60
	128,000	128	50.6	110.8	5.12	19.90	44.11	1.39
	32,000	512	13.7	116.2	2.74	20.80	24.14	1.33
	8,000	2048	3.5	122.0	1.41	21.76	11.32	1.32

Figure 7 : Noise level of acquisition depending on the configuration of Low Latency filters

Recommandations and precautions of use

Security precaution

In this manual, the warning signs and caution should be read by users to avoid dangerous accidents and problems. The meaning of these symbols is as follows:

If users ignore this symbol and mishandle the device, it can result in personal injury and damage to equipment.
Please read the safety tips and the following precautions to ensure a safe use of the JASON system.

Power

The power consumption of this device is low. It should only be operated by being powered by 21 alkaline batteries of 1.5V connected in series, meaning a rated voltage of 31,5V.

- Alkaline batteries must not be recharged. Rechargeable batteries potentially emit gas that can be damageable to the system
- The JASON system cannot be used to recharge the batteries.
- In case of no use, remove the batteries from the system.
- If leakage battery leakage occurs, wipe the battery compartment, battery terminals and batteries to remove any remaining fluid. Common Baking Soda (NaHCO3) can be applied to neutralize battery acid contamination.

Modifications

Never attempt to modify in any way. It may cause damage and be dangerous for the user..

Environnement

To avoid problems and malfunctions, avoid using the system in an environment where it will be exposed to::

- Extreme temperatures (<-15 ° C;> 60 ° C)
- Heat sources such as radiators or stoves
- Excessive vibration or shock

Handling

- Do not place any objects filled with liquids, such as vases, on the open, as this may cause electric shock.
- Never place naked flame sources, such as lighted candles on the system as this may cause a fire.
- The JASON BLUE MONO system is a precision instrument. Be careful not to drop or subject it to shock or excessive pressure, as this could cause serious problems.
- Make sure that no foreign objects (coins or pins etc.) or liquid (water, soft drinks and fruit juices) to penetrate the unit.

Connecting cables and input/output

You should always turn off the system and all other equipment before connecting or disconnecting cables. Be sure to disconnect all connection cables and turn off the power before moving the system.

Electrical interferences

For security reasons, the system JASON HIGHBLUE was designed to provide maximum protection against the electromagnetic radiation from the device and to protect against external interference. However, any equipment that is very sensitive to electronic interference or that emits strong electromagnetic waves must not be placed near the system because the possibility of interference can not be completely eliminated. With any type of digital control device, including the JASON-HIGHBLUE, electromagnetic interference can cause malfunctioning and corrupt or destroy data. Care must be taken to minimize the risk of damage.

Cleaning

Use a dry, soft cloth to clean the system. If necessary, dampen the cloth slightly. Do not use abrasive cleaners, waxes or solvents (such as paint thinner or cleaning alcohol), since these materials may dull the finish, damage the surface or cause damage to the PCB.

Please keep this manual in a safe place for future reference.

Unpacking and installation

Unpacking

As with any electronic device, you should take care to handle this equipment carefully. Before removing the device from its packaging, discharge yourself of any static charge using a wrist strap or by simply touching the computer chassis or other grounded object to eliminate any stored static charge. Contact us immediately if any components are missing or damaged.

Installing the Hardware

The hardware of the system is delivered already assembled. No additional installation is required. Only the connection of the IO and power supply is required. However, a system disassembly guide is available below. (For data extraction, as well as for replacing or charging the battery.

System operation

System startup

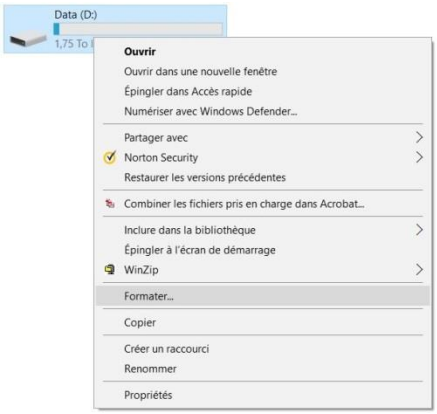
Formatting the storage medium

<u>Make sure to download all the available data on the card before formatting !</u>

Please preferably use fast storage media to benefit from a high transfer rate, and avoid packet loss (eg Western Digital Element 1TB).

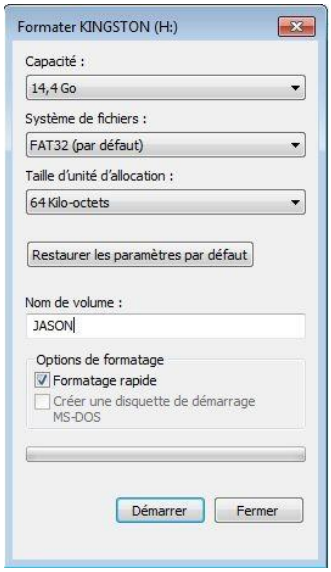
The JASON HIGHBLUE system takes into account that the FAT / FAT32 file systems. (The exFAT system is not compatible with the system).

It is therefore necessary to format the storage media µSD to use FAT32.



Formatting can be done via the Windows format utility (right click on the media to format):

Go to the desktop of your system, right-click the storage media format -> "Format".



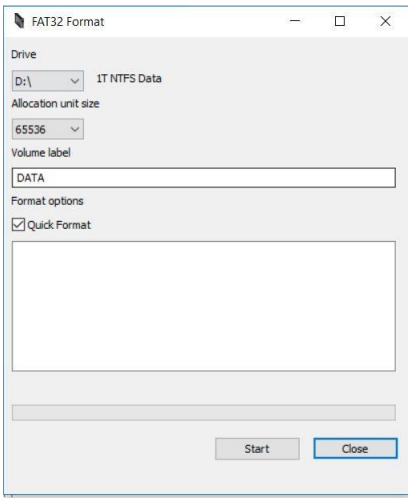
Select a unit of allocation of 65536 (64K).
Click "Start".

Wait for the media to be formatted.

This Windows formatting tool does not allow any time to format large capacity en FAT32. system FAT32. Windows often proposes that exFAT is incompatible with the system.

Specific formatting tools will solve this problem. The formatting can also be done via the formatting tool "guiformat.exe". Available for download from the web for free or ask SMIoT.

Click "Start" and wait a few minutes. The support is ready.



Configure / update the system to a desired operation

The system parameter (and / or updates) via the text configuration file "JASONCONFIG.CFG" given below :

//System Configuration File

```
Sampling_Resolution=16;    // 16 = Resolution in bits (8 or 16)
Sampling_Freq=256000;      // 256000 = Sampling frequency (in sample
                           // per sec.) Possibles values are 512000,
                           //  256000, 128000, 64000 with wideband
                           // filters or 512000, 128000, 32000, 8000
                           // with low latency filter
Filter_Selection=1; // = 1 ; filter selection. Possible values are:
                    //  0-> wideband1 (0.45 to 0.55) xfDATA
                    //  1-> wideband2 (0.40 to 0.50) xfDATA
                    //  2-> LowLatency
AutoStart=true;     // = true = auto record at boot
FILE_Size_Limit=150000000;    // File size limitation (in bytes) =
                              //150 000 000 for 5 minutes
Record_Use_TimeInterval=true;    // set or unset the
                                  //discrete recording
Record_Time=60;                  // Time period of record (in seconds)
Record_Interval=300;          // Time period of wait time
                                  //between each record (in sec)
```

WARNING: This file is placed in the root of the storage medium. Its content is "Case sensitive".

If this file is not present, the recordings will not start.

This program (here above) was conceived thanks to the tests realized previously in the CARI'MAM project, and correspond to a recording of minute followed by a pause of 5 minutes. The same program need to be applied to all the hydrophones in the project and must not be modified individually.

Updating the date and time of the system

If needed, the system parameter (and / or updates) via a text configuration file "CLOCK.CFG" in the following form:

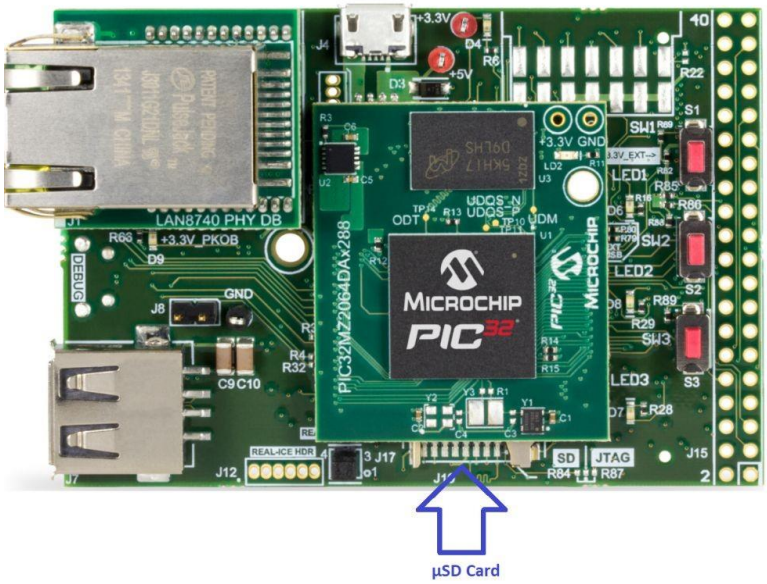
CLOCKTIME= 11/02/2018 10:02:00;

To insert the µSD support (and / or power on) the system CLOCK.CFG read the file, and updates the date and time of the system with the read settings and it removes the CLOCK.CFG file storage media. The date and time are kept current as the battery backup (CR2032) is present on the system. The file must be created only if the clock needs to be changed. It was not foreseen to change the clock in the project. If it is needed, you will be contacted directly.

The time need to stay the Coordinated Universal Time (UTC). You must not indicate the local time.

Connecting the external storage medium

To connect your storage media to the system, simply insert it into the connector µSD :

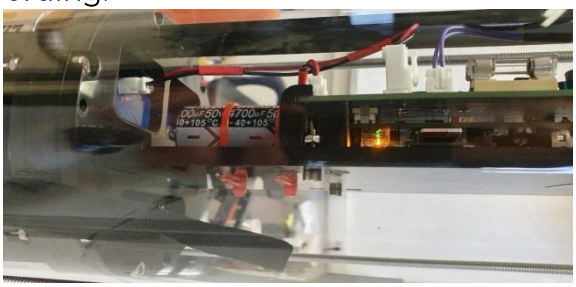


Insert card into the slot until "click" is heard. To retrieve the date, copy the available data on the µSD card onto a computer or hard drive, using a card reader or the adapter µSD/SD.

System startup

In this survey, the option “"Autostart" = true”, so the system will start the recordings with the parameters of the configuration file from its power. For powering the tube under water, it is sufficient to rotate the cap on the top of tube tape clockwise (red arrow).

Orange LED located on the capture card should light indicating that the system is recording.



Attention

Warning, don’t loosen the cap to much or you risk water infiltration. Try this outside the water to find the correct manipulation.

Stop system and recovery measures

For powering down the tube under water, it is sufficient to rotate the cap on the top of tube tape counterclockwise (white arrow).

All LEDs on the card must go out. The measured data is saved continuously on the µSD storage system. These are directly saved as a .WAV file.

Note: During the shutdown, it is possible that the last record is lost. This is why it is necessary to ensure enough wait time after the start of a record (greater than or equal to the parameter "Record_time"), or else to have a "FILE_SIZE_LIMIT" reduced (which the effect of cutting the recording file size).

To recover the data on the card µSD, refer to the next chapter "of the tube opening procedure".

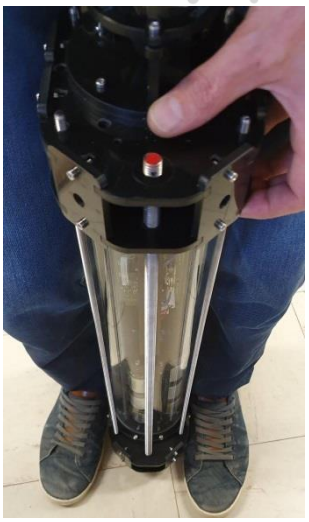
Opening, closing and maintenance of the system

Tube opening procedure

To open the tube to recover the data on the card or µSD to perform maintenance, it is necessary to observe the following procedure:

1. Make sure the tube is off (switch off mode).
2. To prevent water being introduced into the tube and the electric or electronic parts, ensure that the right parts close to the top step are kept dry or if necessary dry with a cloth.
3. Remove the switch cap to allow air into the tube. (Unscrew and pull it upwards)
4. Remove the quick release pin of the ring located on the top step of the tube, this ring then will unscrew ***(Note the rings of the various tubes are not interchangeable).***

5. Remove by unscrewing the four wing nuts of the upper portion of the tape.
6. Chock tape the bottom of the tube between feet and keep the transparent tube between knees:
7. Extracting the inner part of the tube by pulling the upper tape upward
8. Place both parts of the tube on a flat surface



Once the tube is removed the SD card can be removed and / or the batteries changed.

Tube closing procedure

Attention

To close the tube it is necessary to observe the following procedure **(WARNING, any mishandling or non-compliance with this procedure can cause irreparable damage to the system):**

1. To start, make sure that the tube is turned off, and the switch cap is removed:
2. Check that all the cables are plugged correctly (see: next part: "Electrical Installation").
3. If the tube is about to be used, ensure that the µSD card is present, and is consistent with the system conditions (formatting FAT32 configuration script and storage).
4. Ensure the good condition of the tube seal (2 present on the lower flange and 2 present on the upper flange of the tube). They must not have any cuts or unevenness of wear. If a seal is worn or

damaged, it is necessary to proceed to replace it before using the system. The joints must be clean and free of dust.

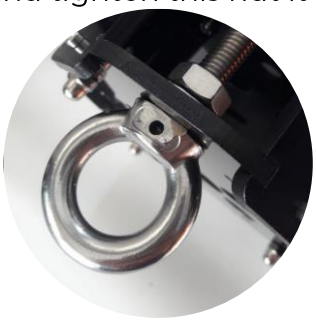
5. Check the condition of lubrication of the joints. See section "lubrication of joints." Warning: greasing the gasket ensures the tightness of the tube and facilitates sliding when closing. A poor state of lubrication of joints may lead to deterioration of these and leakage can then occur.
6. Place the tube vertically between legs, lower tape on the floor, and proceed with the insertion of the inner portion of the tube.

7. **Ensure no wires get jammed between the pipe and flange.**
8. Guiding the threaded rods in their corresponding holes on the top of tube tape:
9. Add the 4 wing nuts and the anchoring ring on their respective threaded rod and tighten.

10. Then add the locking pin on the anchoring ring.

11. Grease if necessary the connector of the hydrophone (see section "Lubrication connectors").
12. Lubricate the switch cap (see section "Lubrication plug and penetrators").
13. Then replace the cap of the switch in its location and rotate the screw one and a half turns.

14. Check tightening the nut: To prevent any rotation of the tube, a nut has been placed inside the lower tape to minimize any resonances transmitted by the tube structure to the hydrophone. Check the tightness and tighten this nut it if necessary :



15. The tube is ready for use.

Battery block assembly

The assembly of the batteries in the system is the more complex task to realize.

This block allows the assembly of 21 batteries connected in series delivering a voltage of 31.5V and a capacity of 530Wh. This procedure must be done carefully.

STEP 1 ON 3

Place the batteries on the floor. To do this, place the inside of the tube vertically as shown with tape at the upper top.

Insert the batteries according to the silkscreen printed on the battery pack per the image above. It is appropriate to place the stack to the left of the cross - bottom and top +. To facilitate inserting the batteries in the block, it is recommended to insert them at the middle of the stack on screen printing ties, to play on the elasticity of the material. Doing so for every stage 1.

Do not forget to place the battery in the central column, facing down + and - up

Then do the same for the second stage.

STEP 2 ON 3

This step consists in mounting the 3rd layer, making sure not to forget the central column, and by not filling it last (impossible to bring a stack in the middle if all the others are placed). This step is not difficult with a little practice by following these steps. For easy manipulation, bring one of the installed batteries to another column by inserting it between two others already in place.

STEP 3 ON 3

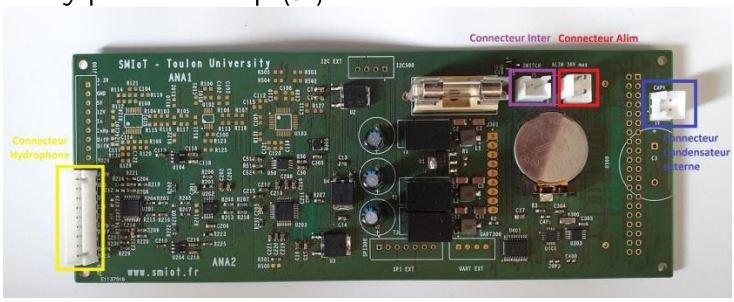
This last step is to place the last block of batteries before adding a small border fabric, which will allow the extraction of it at the next change of batteries:
Once the stack is positioned with the rim, insert it into the box by sliding the battery side spring to the bottom spring, and by forcing the cell to be inserted. Do not hesitate to go with the palm of the hand.

Connections

The hydrophone is provided complete and functional in this project. The points here below are only given for information. It is not recommanded to change the connection.

Power connection

To function properly, the system must be powered with a 12V minimum voltage of up to 35V. To do so, is necessary to connect the JST connector from the battery pack to map (J1):

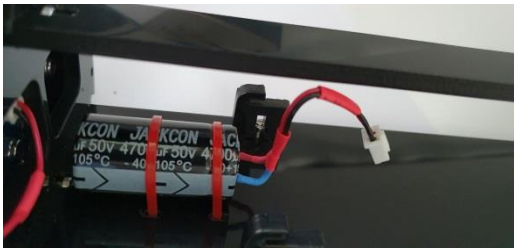


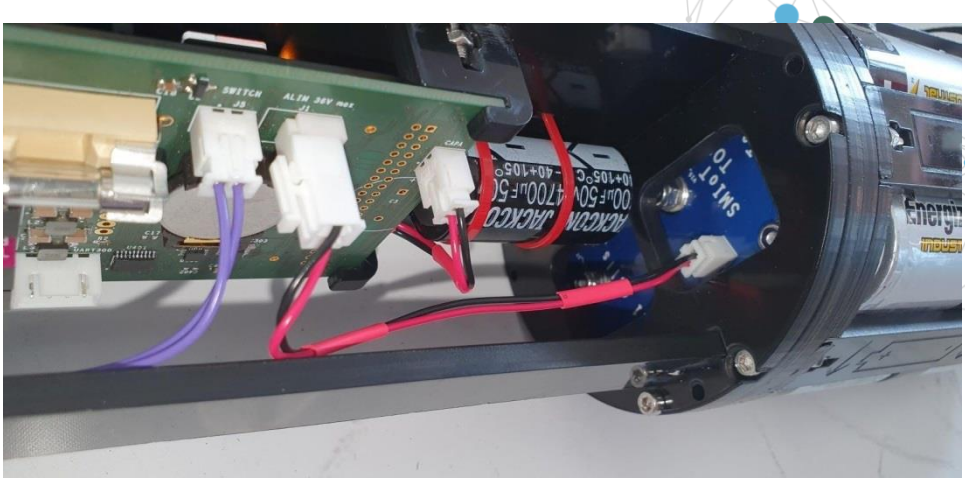
Connecting the remote switch

In order to start the system without having to re-open the sealed tube, a switch has been moved outside of the tube (upper Tape, connected by means of two purple plugs and a JST) and must be connected to the board via connector J5.

Connecting the decoupling capacitor

To avoid power loss at light impacts or movements, a decoupling capacitor has been added to the system. This must be connected to the capture card to ensure proper operation thereof.



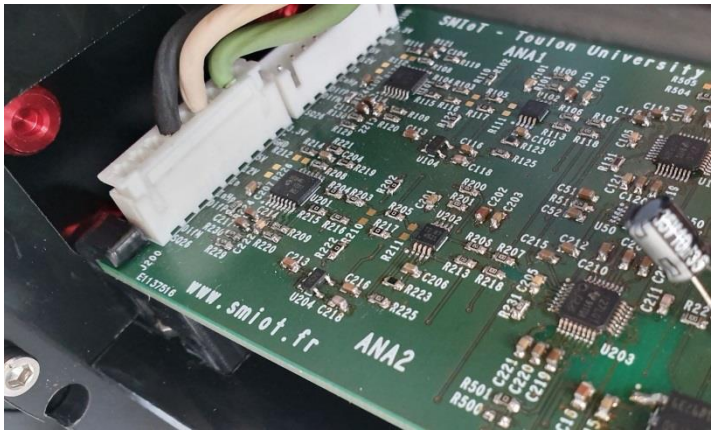


Installing the CR2032

HIGHBLUE the system has a holder for a CR2032 for saving and maintenance of the internal clock for a period of 10 to 15 years in the case of cutoff of the power supply. This battery will be necessary to maintain the time of day system (Main Switch Off) or in the case of too low power (low battery ...).

Connecting hydrophones

The hydrophone connects to the circuit board via a 9-pin connector. In the case of a system in MONO configuration, the hydrophone is connected to the path "ANA2". In the case of a system configuration Stereo, the hydrophones are connected on both channels.



When wiring hydrophones ensure work is accomplished in an anti-static environment, and be discharged of static load. (Avoid wool clothing and touch a point of grounding i.e.: PC casing ...)

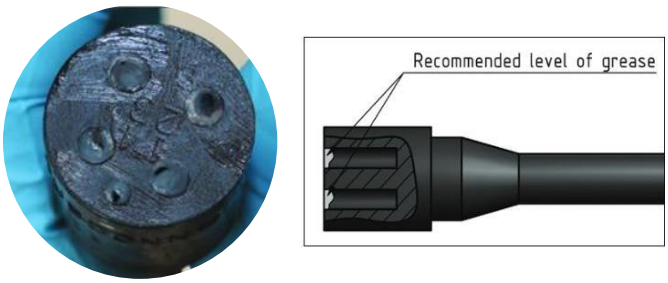
Lubrication of the connectors

If the connectors SubConn® happened to be unmated due to a wrong manipulation or for a specific maintenance, follow closely the instruction to lubricate them and use them correctly. In the framework of this project, the connectors should not be unmated.

- The hydrophones connectors must be greased before each mating.
- Disconnect the hydrophone pulling the plug without any twisting using the solid surfaces not the cable.
- Do not pull on the cable and avoid the pronounced corners near the connector / penetrator.
- The SubConn® connectors should not be exposed to long periods of heat or direct sunlight. If a connector becomes very dry, it should be soaked in fresh water before use

Recommended lubircation products

Dry coupling



- The connectors must be greased with Molykote 44 Medium, or supplied lubricant (silicone grease) before each assembly
- A grease layer corresponding to at least 1/10 of the depth of the socket to be applied to the female connector.
- The inner edge of all holes must be completely covered and a thin transparent layer of grease must be visible on the face of the connector.

After greasing completely, fit the male and female connectors to ensure optimum distribution of the grease on all pins and sockets.

Recommended cleaning products

See below *

Liquid soap and hot water

Acetone or similar products

Gasoline or similar products

Cap lubrication

When using the HIGHBLUE system, it is necessary to regularly check the condition of lubricating seals the tube and those penetrators if they were dismantled (which is not foreseen in this project).

Remove any excess grease with a woven cloth, and some Isopropyl alcohol. Let dry a few seconds. Then apply a silicone grease dab on your finger, and then spread it around the cap (at both small joints).

Check-list before immersion

- Check the uSD is correctly set and the batteries are fully charged and properly placed.
- Check the foam guard around the hydrophone is correctly installed.
- Check the screws are tight.
- Check by looking on 360° that both end of the tube are well closed without strand, hair, etc... stuck in the gaskets.
- Check that the switch cap is in place, tighten it to the test run of the system, enabling operation, the batteries and the uSD card has been verified. Unscrew the cap a bit just to get off the system.

System update

The firmware can evolve, and can be downloaded via the back of the card. A connector is provided for this purpose with a simple USB cable. If, during the project, the firmware needs to be updated, you will be directly informed. In the contrary, the installed version should not be modified during this survey.

Downloading and installing the software

To update the embedded firmware, simply download the specific tool: MPLAB X IDE. It is available at the following address: https://www.microchip.com/mplab/mplab-x-ide

It contains two components: the IDE, and PEI. In our case, only the IPE is required. It is therefore not necessary to install the IDE (large).

An installation tutorial is available at: https://microchipdeveloper.com/ipe:installation

Download the embedded firmware

To download the firmware embedded in the BlueEar map, simply connect via the micro-USB cable supplied the card to the PC. Once done, open MPLAB PEI, and select the next target: PIC32MZ2064DAA288 (or PIC32MZ2064DAB288 following version of this component on the board), and follow the step described at the following address: https://microchipdeveloper.com/ipe:importing-hex-file

When importing, next select the hex file provided by SMIoT corresponding to the correction. Then follow the following procedure: https://microchipdeveloper.com/ipe:programming-device

Errors, FAQ and notes

Warranty

SMIoT is not responsible for leakage or immersion inside the tube. If damaged, spare O-rings are provided or available on request to SMIoT within in 15 days if necessary.
It is impossible that leakage can occur unless above instructions are not followed..

Information on LEDs

We advise you to check the status of the LEDs to detect any false manipulation

The LED GREEN indicates that the system has recognized the SD card, and is ready at start acquisitions.
The LED ORANGE indicates that the system is being recorded.
Finally, the LED RED indicates a potential problem: permanently lit: critical error (fatal error).

Notes

The storage medium is mandatory in the case of stand-alone operation. If a system error in this case, restart the system.

Installation of the mooring

Mooring

The mooring itself is composed of weight plates of 20kg, easy to manipulate. For the hydrophone Jason Highblue it is recommended to have minimum 4 plates with enough space between them to correctly anchor the mooring. Alternatively, a existing mooring can be used if it doesn't produce any sound. Opt for ecological friendly mooring.
The mooring need to be installed on minimum 110ft (35m) seabed, to avoir acoustic pollution for the benthos, and maximum 390ft (120m).

Mooring line

It is recommended to use a resistant rope, with a low drag coefficient. Dyneema ropes are good but have a relatively high price and their very low drag coefficient can make knots slip (a splicing is also possible and more secure). A 3 strands line type mooring rope of 16 mm can also work.
Add two buckles on the line at approximately 20m to help fix the hydrophone.

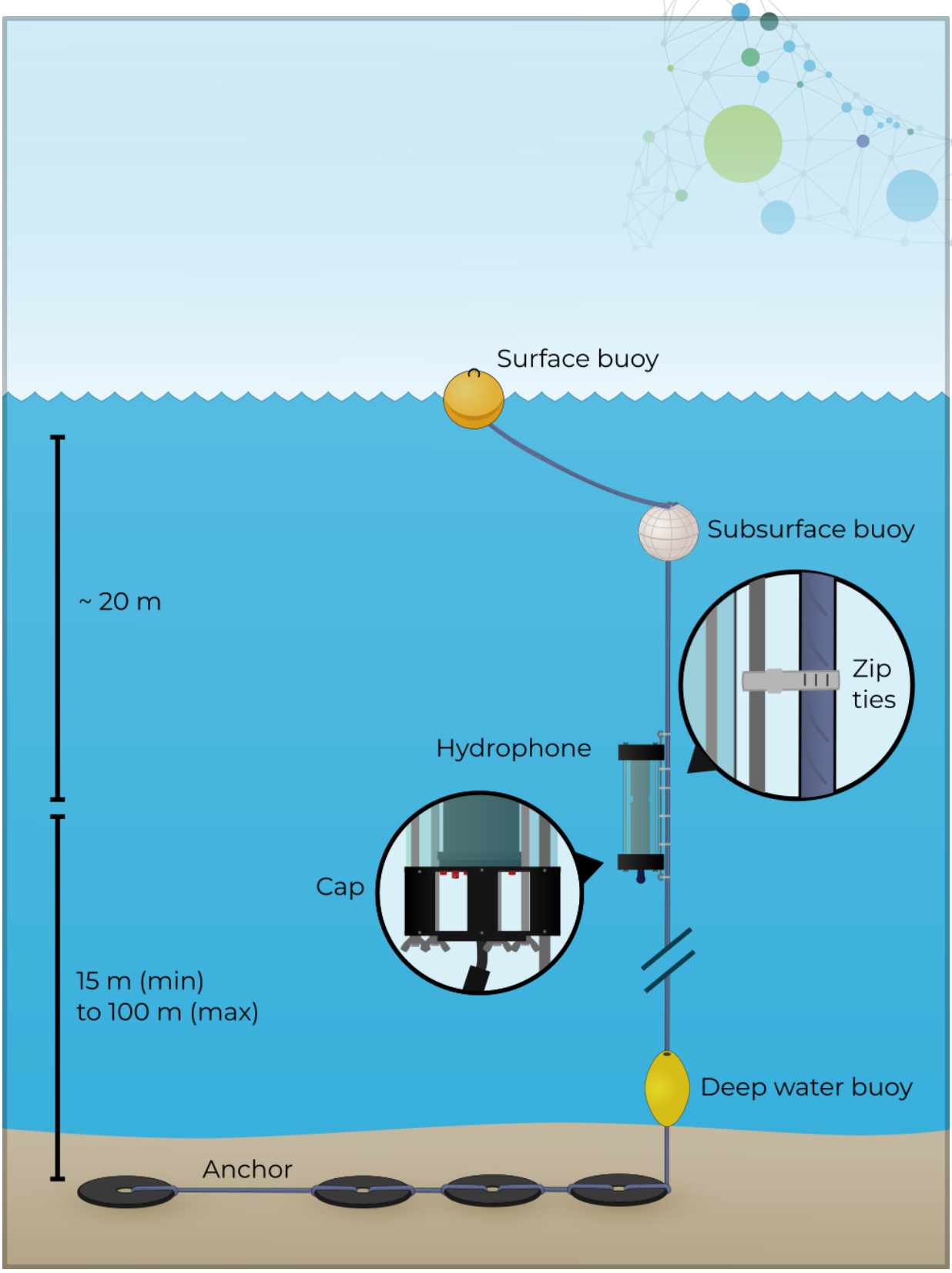
Buoys

Three type of buoys are recommended for this mooring :

- A bottom buoy, of low volume, installed just above the mooring. It is optional but helps the line to not entangle with the seabed habitats. If the whole mooring is correct, the traction of the subsurface buoy should be sufficient to avoid any issue with at the bottom.
- A subsurface buoy, on which is written the information about the project, contact, etc. It is the minimum to find the hydrophone and ensure the floatability of the mooring line. It is installed approximately 30ft (10m) of the surface.
- A surface buoy to identified the mooring easily. It also makes the whole installation more visible and increase the risk of degradation or theft. An artisanal buoy made of bottle can also be used but ensure that is not taken by the sea and create new waste.

Fixation of the hydrophone

The hydrophone is fixed on the line, at approximately 60ft (20m) of depth. It is fixed using plastic hose clamp. TO fix the hydrophone, follow the instruction here below. To retrieve the hydrophone, simply use cutting pliers to cut the ties. Take care of the wastes after their retrieval.


Surface buoy
Subsurface buoy
~ 20 m
Zip ties
Hydrophone
Cap
15 m (min)
to 100 m (max)
Deep water buoy
Anchor

Fixation of the hydrophone

Put the tube in the water, with the hydrophone looking upward, to avoid that eventual infiltration the electronic equipment is not the first affected.

Keep the hydrophone end far from the boat to avoid any choc. It is the most fragile area of the system.

In case of infiltration or in the presence of bubbles, keep the tube vertical (so that no water gets in contact with the electronic card) and immediately bring the tube out of the water. Check that it's completely dry before putting it again in the water. If salt water enters the tube, rinse affected sections with fresh water before drying.

Le tube est installé sur le bout, hydrophone pointant vers le bas, à l'aide de colliers de serrage en plastique.

Fix the first collar on the upper ring, then a second on the bottom ring. Tighten it at the maximum while ensuring it is on the right side. Warning, do not fix the collars on the quick release pins.

Fix some more collars on the line, along the main threaded rod (the one with the ring at the end) to avoid any movement of the hydrophone on the line than can cause parasite noises.

Put the hydrophone online by turning the cap until the red LED lights.

Calendar

The installation of the mooring needs to be done preferably before the 15th November 2020. The latest, it can be done at the same time of the first installation.

	Installation hydrophone*	Retrievalof l'hydrophone**
❯ 1st session	18 November +/- 2 days	28 December au 11 January
❯ 2nd session	20 January +/- 2 days	1 March au 15 March
❯ 3rd session	17 March +/2 days	26 April au 10 May
❯ 4th session	19 May +/- 2 days	28 June au 12 July
❯ 5th session	21 July +/- 2 days	30 August au 13 September
❯ 6th session	22 September +/- 2 days	1 November au 15 November

Uninstalling the mooring can be done as soon as the last session is done. Après the recuperation of the data, the hydrophone cleaned and dried will be given back.

* the reference date mentioned dis the one shared by all. Ideally, it is preferable that the hydrophones are installed the same day throughout the whole network.
** the period mentioned is an indication. The hydrophone must not be retrieved earlier (except in case of technical issue, hurricane risk, etc.) but can potentially be retrieved until the same day of the next installation. Keep in mind to have enough time between the retrieval and the next installation to rinse and dry the tube, download the data and change the batteries.

Summary of the CARI'MAM **survey**

Recording

The recording is set to 1 minute followed by a 5 minutes break. It is done by periods of 2 months. After a recording period of 40 days, the batteries need to be changed and the data downloaded. The partners then have a 15 days window to put the hydrophone back in place (see calendar above).

First installation

Before the first installation, think about formatting the µSD card (see page 13) and upload the configuration file on the card (see page 15).
To open and close the tubes, following closely the instruction (page 19).

Launching

Make a last verification before putting the tube in the water (see page 30)
Fix the hydrophone on the line following the installation guidelines.
Once installed, turn on the hydrophone (see page 17).

Recovery of the hydrophone and data

After the retrieval of the hydrophone underwater at the defined dates (or earlier in case of hurricane alert), you can recover the data and change the batteries in a dry environment. To do this, open the tube by respecting the instruction (see page 19). The data are downloaded from the µSD card (see page 16) before updating it (see page 15). Change the batteries (see page 23) and import the configuration file on the card (see page 15).
After closing the tube following the instruction (see page 20), it is ready for a new installation at sea.

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- « Caribbean Marine Mammal's Passive Acoustic Observatory Technical note », J.Bernus, *Sanctuaire Agoa/Office français de la biodiversité*

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Interreg Caraïbes
Fonds européen de développement régional

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CARI'MAM

USER GUIDE

HIGH DEFINITION SUBSEA ACOUSTIC ACQUISITION SYSTEM JASON HIGHBLUE

SMIoT
Scientific Microsystems for Internet of Things

Système d'acquisition de signal

JASON HIGHBLUE

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