HIGH BLUE MONO RECORDER

HIGH FREQUENCY AND LOW POWER ACOUSTIC ACQUISITION

MONO Version - CARIMAM AGOA AFB March 2019

http://smiot.univ-tln.fr/downloads/highblue.pdf

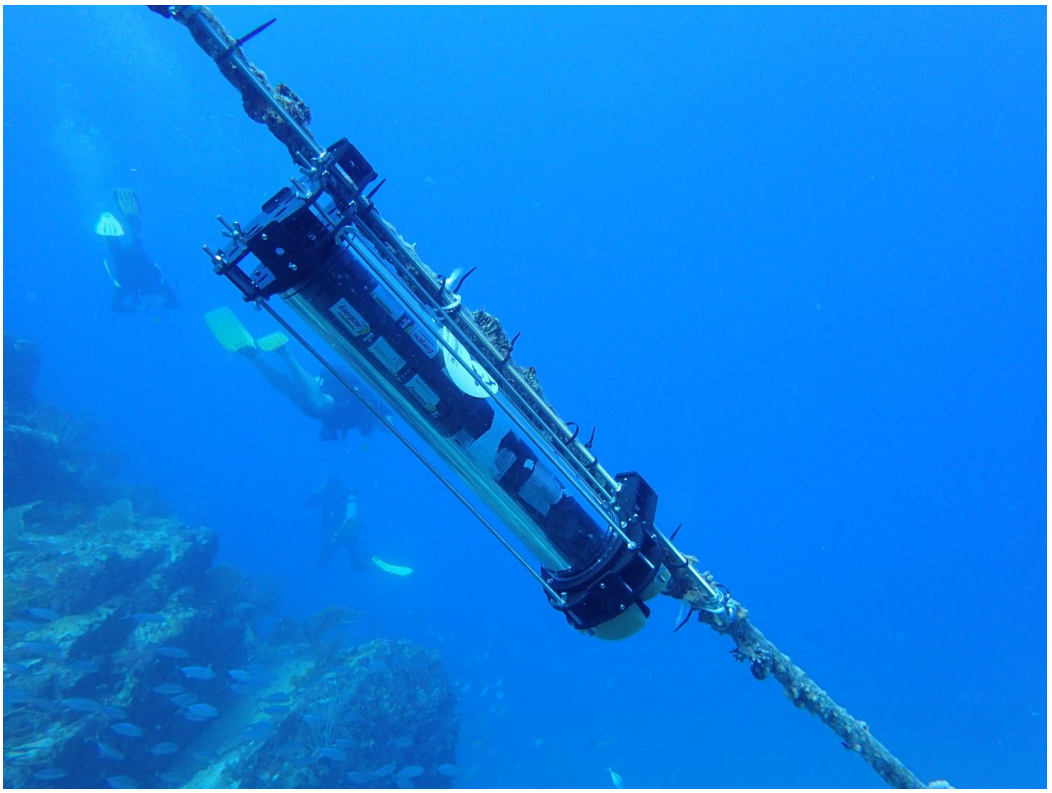


Photo : Jeffrey Bernus

Specifications of the HIGHBLUE MONO Acquisition System

The HIGH BLUE MONO system incorporates the latest signal acquisition technologies, allowing for a compromise between high sample rate and reduced power consumption. It can be used in "stand alone" mode, in which the data acquisition is done directly on an external USB support, or in a mode connected to a PC (USB cable) to which the data are directly sent.

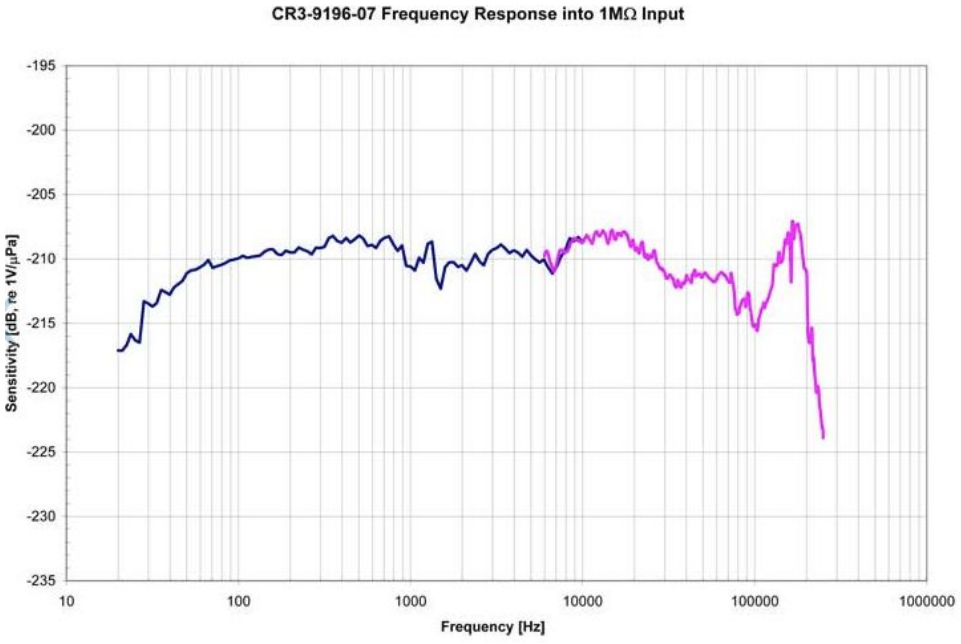
Acquisition

- Acquisition frequency: 512 Ksps / 256 Ksps / 128 Ksps / 64 Ksps / 32 Ksps / 8 Ksps
- Input signal frequency: 5 Hz to 256 kHz
- Acquisition in 8, 16 or 24 bits, adjustable via a configuration script
- Differential acquisition with maximum input level 3.3V
- Precise timing
- Possible manual start
- Anti-aliasing filtering of the input signal configurable without modification of the input signal in the bandwidth (see filters' characteristics section)

- Programming of recording ranges possible (see v1.2 for Carimam session 2).

- Omnidirectional CR3 Hydrophone:

CR3 Hydrophone specifications	
Linear Frequency Range (±3dB) [kHz]	0.0004† to 180
Usable Frequency Range (+3/-12dB) [kHz]	0.0001† to 240
Transducer Sensitivity [dB, re 1V/µPa]	-207‡
Preamplifier Gain [dB]	N/A
SPL Equiv. Self Noise at 1kHz [dB, re 1µPa/√Hz]	54
Power Requirement [Vdc]	N/A
RMS Overload Acoustic Pressure [dB, re 1µPa]	N/A
Maximum Operating Depth [m]	250
Operating Temperature Range [°C]	-40 to 90‡
Capacitance [nF]	4.7
Dimensions [mm]	50 L x 18 dia
Coaxial Cable Length [m]	15 Cable terminated with male BNC c (longer cable optional)
Directionality	omnidirectional
Battery / Connector box	power not required



Plot of CETACEAN RESEARCH™ CR3 hydrophone frequency response - log scale.

Amplificateur

- Signal amplification of hydrophone: gain times 20
- Single ended input and differential output

- Input mpedance: 10 ^ 13 ohm.

Storage

- Storage on micro SD card (or SD via adapter) in WAV format
- Transmission to a PC in online mode.

Power consumption : Maximum consumption: 1.65W for continuous acquisition (SD and Hydrophone CR3 included)

Input filters' characteristics

Low-pass 1 (Wideband1): Cut-off frequency = 0.4*Fech. Constant gain in bandwidth, strong attenuation beyond to avoid aliasing phenomena with a loss of 110 dB in the cutoff band.

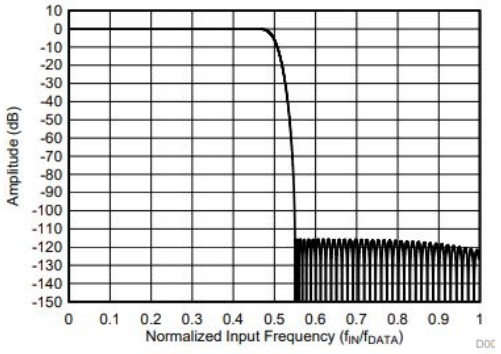


Figure 1: Transfer function of the WB1 filter

Low-pass 2 (Wideband2): Cutoff frequency = 0.5*Fech. Constant gain in bandwidth, strong attenuation beyond that to avoid aliasing phenomena.

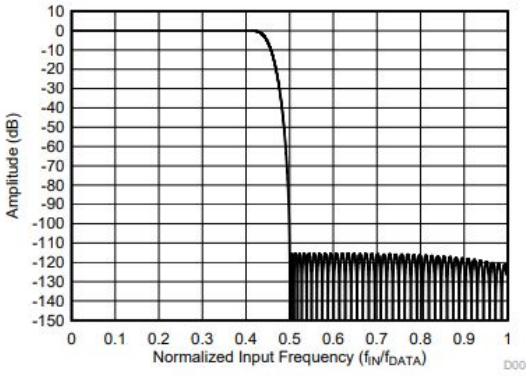


Figure 2: Transfer function of the WB2 filter

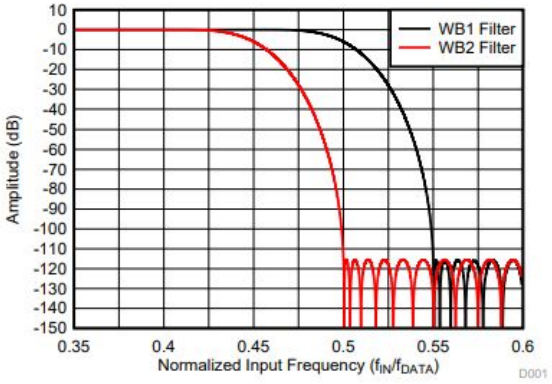


Figure 3: Comparison of the transfer functions of the WB1 and WB2 filters

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

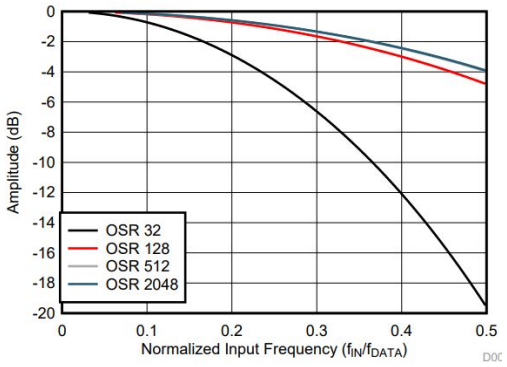


Figure 4: Low Latency filter transfer function for frequencies below the Shannon limit

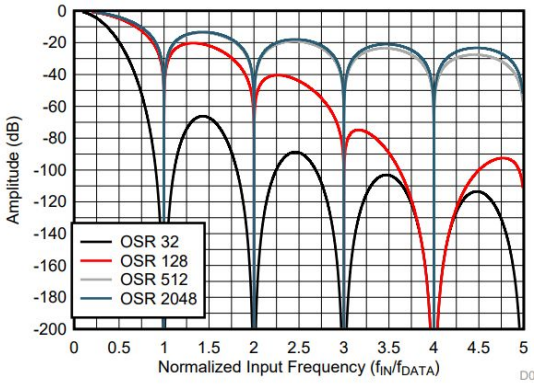


Figure 5: Low Latency filter transfer function for a frequency range beyond the Shannon limit frequency

Characteristics of the analog to 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 according to the configuration of the 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: Acquisition noise level depending on the configuration of the Low Latency filters

User Manual

Recommendations for user

In this manual warning and caution symbols 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, injuries may result, and or damage to the equipment. Please read the safety tips completely.

About the power supply : The power consumption of this unit is quite low. It must operate exclusively by being powered by a continuous type of power supply between 9 and 32V (LiPo / Batteries).

- When disconnecting the battery for charging, grasp the connector on the circuit board and never pull on the cable.
- The HIGHBLUE system can not be used to recharge batteries.
- In case of prolonged non-use, remove the batteries from the system.
- In case of battery leakage, carefully wipe the battery compartment and the battery terminals to remove any remaining fluid.

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

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

- Excessive vibrations or shocks

Handling : Do not place any objects filled with liquid on the open system, as this may cause an electric shock.

- Never place a naked flame source, such as lighted candles, on the system as this could result in a fire.
- The HIGH BLUE MONO system is a precision instrument. Be careful not to drop it, hit it, or subject it to shock or excessive pressure, as this could cause serious problems.
- Make sure that no foreign object (coin or pin etc.) or liquid (water, alcoholic beverages and fruit juice) enters the unit.

Connecting cables and input / output jacks: You must always turn off the system and all other equipment before connecting or disconnecting cables. Be sure to disconnect all connecting cables and turn off the power before moving the system.

Modifications: Do not attempt to modify the system as this may damage it and be dangerous for the user.

WARNINGS

For safety reasons, the HIGHBLUE system has been designed to provide maximum protection against electromagnetic radiation emissions from the device, and protection against external interference. However, equipment that is very sensitive to interference or that emits strong electromagnetic waves should not be placed near the system, as the risk of interference can not be completely eliminated. With any type of digital control device, including HIGHBLUE, electromagnetic interference can cause malfunction and alter or destroy data. Care must be taken to minimize the risk of damage.

Cleaning and handling: Use a dry, soft cloth to clean the system. If necessary, moisten the cloth slightly. Do not use abrasive cleaners, waxes, or solvents (such as paint thinner or cleaning alcohol) as they may dull the finish or damage the surface, or damage the PCB. As with any electronic device, you must take care to handle it with care. Before removing the device from its packaging, discharge any static charge with a wrist strap or by simply touching the chassis of a computer or other grounded object to eliminate any stored static charge. Contact us immediately if any components are missing or damaged.

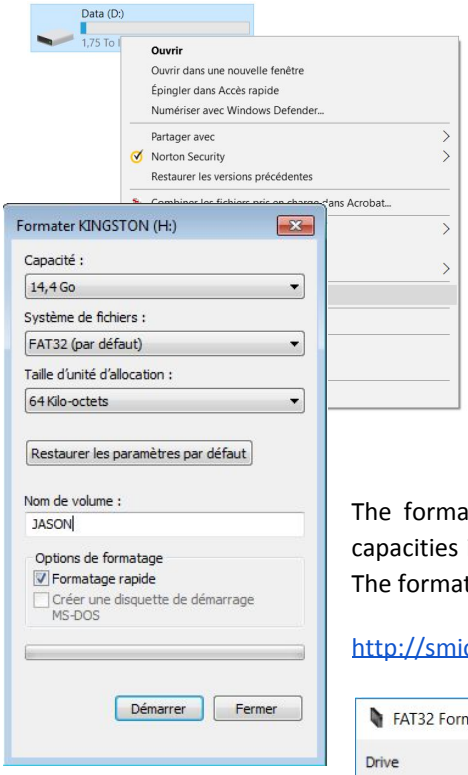
INSTALLATION

Installing the Hardware: The system is delivered mounted out of the tube to simply nest and screw. Only the connections of the inputs, outputs, and power supply are necessary. However, a guide to dismantling the system is available below. (For data extraction, as well as battery recharging, as appropriate).

Formating the storage : The system only considers FAT / FAT32 file systems. (The exFAT system is not compatible with the system). It is therefore necessary to format the storage medium to be used in FAT32.

Please preferably use fast storage media, in order to benefit from a high transfer rate, and thus avoid the loss of any packets. (eg Western Digital Element 1TB).

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



From the workstation of your system, right-click on the storage medium to format -> "Format". Select an allocation unit of 65536 (64K).

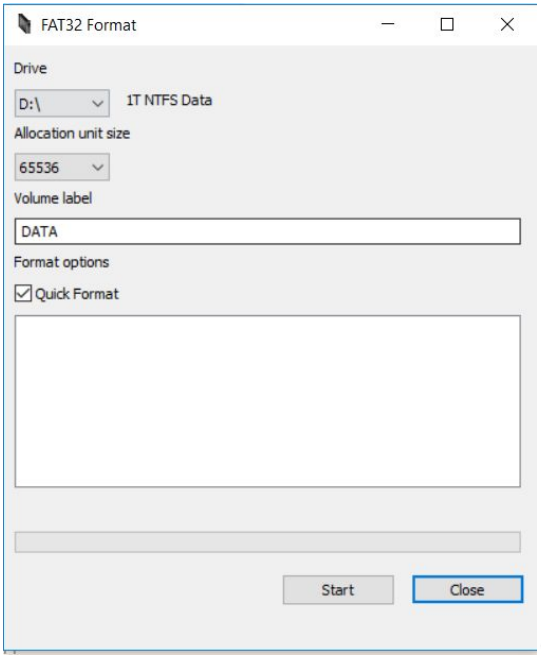
Click on "Start".

Wait a few seconds (minutes depending on the capacity of the media to be formatted).

Formatting can also be done Via the formatting tool "guiformat.exe"

The formatting tool of Windows does not allow all the time the system formatting of large capacities in Fat32. Windows often only offers the exFAT that is incompatible with the system. The formatting tool is here:

http://smiot.univ-tln.fr/downloads/HighBlue/Tools/guiformat.exe



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

Configuration The system is parameterized via this type of textual configuration file "JASONCONFIG.CFG":

```
//System Configuration File

Sampling_Resolution=16;     //Resolution in bits (8,16,24)
Sampling_Freq=256000;       //Sampling frequency(in sample
                            //per sec). Possibles values are:
                            //512000,256000, 128000,64000 With
                            //WidBand Filters, or 512000,
                            //128000,32000,8000 With Low
                            //Latency filter
Filter_Selection=1;         //Filter selection. Possibles
                            //values are:
                            //0->Wideband1 (0.45 to0.55)×fDATA
                            //1->Wideband2 (0.40 to0.50)×fDATA
                            //2->LowLatency
AutoStart=true;             //Auto record at boot
FILE_Size_Limit=1000000000;//File Size limitation (in bytes)
```

ATTENTION: This file is to be placed at the root of the storage medium.

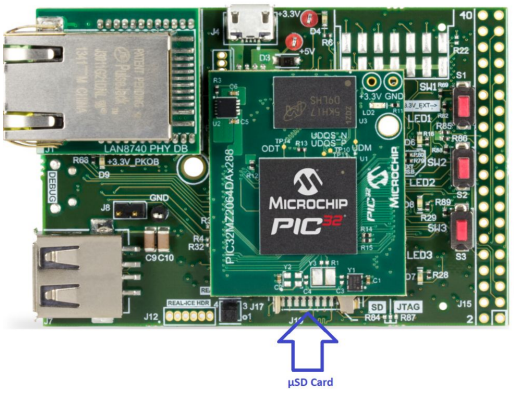
If this file is not present, it is still possible to start an acquisition manually (and with the default settings) by pressing the button 2 once.

Updating Date and Time: The system is parameterized (and/or updates) via a textual configuration file "CLOCK.CFG" of the form:

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

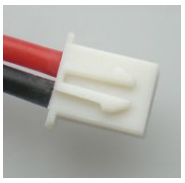
When the µSD support is inserted, the system reads the CLOCK.CFG file, and updates the date and time of the system with the parameters read, then removes the CLOCK.CFG file from the storage medium. The date and time are maintained until the next power down.

Connecting of the external storage media: To connect your storage medium to the system, simply insert it into the µSD connector provided for this purpose:

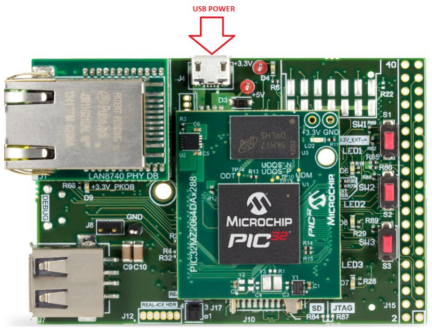


Connecting the power supply: To function properly, the system must be powered with a minimum voltage of 6V up to 35V. To do this, it is possible to wire the system in two different ways:

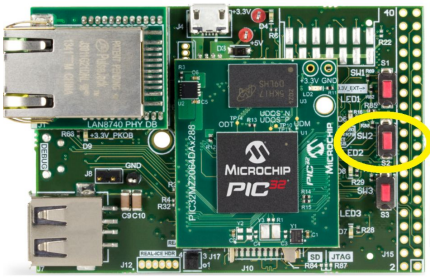
- Via the dedicated JST connector



- Via the µUSB connector



System startup : It is necessary before starting an acquisition to power the system. If the option "Autostart" = true, the system will start the records with the parameters read. Otherwise you have to start the recordings manually. To do so, simply press the SW2 button on the card once. The Orange LED should light up indicating that the system is in the recording process.



LED CODE AND NOTES

We advise you to check the LEDs' state to detect possible mishandling

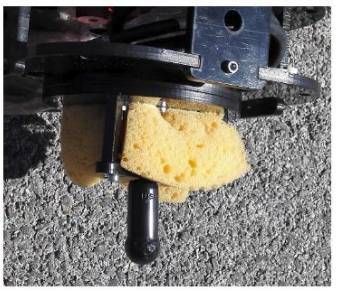
The GREEN LED indicates that the system has recognized the SD card, and is ready to start the acquisitions.
The LED ORANGE indicates that the system is recording.
Finally, the RED LED indicates a possible problem: permanently lit = critical error (blocking error).

NOTE : The storage medium is mandatory for autonomous functioning. Any error concerning it can lead the system in error. In this case, reboot the system.

MOUNTING HYDROPHONE, TUBE AND BATTERIES

The tube is mounted by screwing the 3 stainless steel rods plus the bar on the anchor, hydrophone down. Unscrew the switch to let the air out of the tube when closing it, gently, taking care not to pinch any cable or slip on the seals. Screw the switch before launching, this triggers the recording. Put the pin on the ring to block it, otherwise risk of loss of the material.



The hydrophone must be mounted through a simple kitchen sponge, as figured. Be careful not to let the cable make noise behind the tape: attach it with a rope or flex clamp to the edges of the tape, this will block the cable. Handle the hydrophone with care, do not squeeze or twist it, it may damage it. Transport it protected behind the small tripod and covered with foam.

CONTACT US

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