

AURAL-M2

USER GUIDE



Warranty policy

ONE (1) YEAR LIMITED WARRANTY (NEW PRODUCTS)

For a period of one year after the date of original shipment from our factory, products manufactured by Multi-Électronique (MTE) Inc. are warranted to function properly and be free of defects in materials and workmanship. Should a Multi-Électronique (MTE) Inc. instrument fail during the warranty period, return it freight pre-paid to our factory. We will repair it (or at our option, replace it) at no charge, and ship it back to you at your charge using the carrier of your choice.

LIMITED WARRANTY ON SERVICE & REPAIRS

Your warranty begins from the day (the "Purchase Date") you purchase the Product from Multi-Électronique (MTE) Inc. and is valid for a period of one year. This warranty is only available to the original purchaser of the Product and is not transferable.

For all equipments that are used on or under water, the warranty ends after one year or with the first deployment, whichever occurs first.

Equipments manufactured by other companies are warranted only to the limit of the warranties provided by their original manufacturers (typically 1 year).

Electrical cables and dummy plugs are warranted to function properly and be free of defects in materials and workmanship for 1 year.

This warranty is void if in our opinion the instrument has been damaged by accident, mishandled, altered, improperly serviced, or repaired by the customer where such treatment has affected its performance or reliability. In the event of such misuse/abuse by the customer, costs for repairs plus two-way freight costs will be borne by the customer. Instruments found defective should be returned to the factory carefully packed, as the customer will be responsible for freight damage.

Incidental or consequential damages or costs incurred as a result of product malfunction are not the responsibility of Multi-Électronique (MTE) Inc.

SERVICE / WARRANTY EXCLUSIONS – WHAT IS NOT COVERED BY THIS WARRANTY?

The following items are specifically excluded from, and not covered by, this limited warranty:

- Service, repairs or replacement made necessary by accident, misuse, abuse, moisture, liquids, dust, dirt, neglect, accident, damage, improper installation, improper operation, improper cleaning, improper maintenance, normal wear and tear, or any other event, act or omission outside the control of Multi-Électronique (MTE) Inc.
- Replacement of missing parts, the provision of retrofits, or preventive maintenance.
- Installation or removal of accessory retrofits, peripheral equipment or computer systems of which the Product may be a part.
- Service, repair or replacement made necessary by, or relating to, improper connection with any peripheral.
- Software, software faults, or software replacement or fixes.
- Repair or replacement of batteries, covers, plastics, or appearance parts such as interior or exterior finishes or trim.
- Batteries, zinc anodes or other consumable/expendable items are not covered under this warranty.
- Repair of damage that is cosmetic only or does not affect the Product functionality, such as wear and tear, scratches, dents, and scratched, faded or discolored keycaps.
- Service made necessary by any external cause, including fire, theft, acts of God, alteration, problems arising from software or hardware not supplied by Multi-Électronique (MTE) Inc., power failures, power surges or power shortages, lightning, other electrical faults, or repairs, modifications or replacements by persons other than those authorized by Multi-Électronique (MTE) Inc. to service the Product.
- On-site service and repair of the Product.
- Damage to Product caused by failure to follow the specifications, User manuals or Guides as to usage and/or storage.
- Modification to the Products not approved in writing by Multi-Électronique (MTE) Inc.

DISCLAIMER AND LIMITATION OF REMEDY

Multi-Électronique (MTE) Inc. can not be held responsible for any injury caused by the use of Multi-Électronique (MTE) Inc. Product.

Multi-Électronique (MTE) Inc. can not be held responsible for any monetary lost cause by a unit failure of any sort

Multi-Électronique (MTE) Inc. can not be held responsible for any damage to Multi-Électronique (MTE) Inc. product caused by misuse or water intrusion.

You must read and follow all set-up and usage instructions in the applicable user guides and/or manuals enclosed. If you fail to do so, this product may not function properly and you may lose data or suffer other damage.

This warranty will not cover any service that is required, in part or in whole, as a result of any failure to follow the set-up and usage instructions. This warranty does not apply and shall be void and unenforceable if the product is opened, serviced, or repaired by persons other than those authorized by Multi-Électronique (MTE) Inc. to service or repair the product.

If your product fails to work as warranted above, your sole and exclusive remedy shall be repair or replacement of the defective part. In no event will Multi-Électronique (MTE) Inc. be liable to you or any third party for any damages. This limitation applies to damages, costs or expenses of any kind whatsoever including damage to, or loss or corruption of, your records, programs, data or removable storage media, or any direct or indirect damages, lost profits, lost savings or other special, incidental, exemplary or consequential damages, or whether arising out of the use of or inability to use such product and/or the enclosed user guides and/or manuals.

PRE-INSTALLED SOFTWARE & OPTIONS

Multi-Électronique (MTE) Inc. offers no warranty or representation, either expressed or implied, with respect to software, its quality, performance, merchantability, fitness for a particular purpose or otherwise. Nor does Multi-Électronique (MTE) Inc. guarantee that the functions contained in this software will meet your requirements or that the operation of this software will be uninterrupted or error free. As a result, unless otherwise stated in writing, this software is provided "as is". Should this software prove defective, you, the purchaser, are assuming the entire risk as to its quality and performance as well as any costs associated with servicing, repair, or correction. In particular, Multi-Électronique (MTE) Inc. shall have no liability for any programs or data stored or used with Multi-Électronique (MTE) Inc. Products, including the costs of recovering such programs or data. Factory installed hardware items included or bundled with your Product are covered under this Limited Warranty. Multi-Électronique (MTE) Inc. accessory items purchased with the Product are covered by their own respective limited warranties.

WE ARE HERE FOR YOU

We believe in our customers and we are here for you. We understand that you may have questions regarding your Multi-Électronique (MTE) Inc. Products. Should you require any assistance, from technical questions to more general information, our Technical Support and Customer Service staff is available to you. You may reach any one of our Technical Support or Customer Service Representatives by contacting our Support line at 418-724-5835 or visit our website at www.multi-electronique.com. Please note that when you call the Multi-Électronique (MTE) Inc. Support Center you will be asked to provide your name, phone number, address, model number and serial number of your unit if applicable, in order to provide you quality support. All customer information will be used internally under strict confidential policies. If you unit is Out of Warranty and you call the Multi-Électronique (MTE) Inc. Support Center, please be advised that your call may be chargeable.

Packing List

- ☐ 1 x AURAL-M2 (Instrument)
- ☐ 1 x User Guide
- ☐ 1 x USB KEY
- ☐ 1 x HDD Enclosure
- ☐ 1 x AURAL-M2 Control Box
- ☐ 1 x Synchronization cable
- ☐ 1 x RS232 DB9F-DB9M cable
- ☐ 1 x USB STDI cable
- ☐ 1 x Small Cap O-Ring 025 (spare)
- ☐ 1 x Large Cap O-Ring 247 (spare)
- ☐ 3 x Hydrophone Elastic 125 (spare)
- ☐ 4 x Hydrophone Tie wrap (spare)
- ☐ 2 x Jumper
- ☐ 2 x Cap Screw #10 10-24 x 1 1/2 (spare)
- ☐ 2 x Cap Lock Washer #10 (spare)
- ☐ 1 x Cap Allen key
- ☐ 1 x Cup of O-Ring grease
- ☐ 2 x Desiccant Bag

S/N _____

Check by _____

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ABOUT AURAL-M2

(Autonomous Underwater Recorder for Acoustic Listening- Model 2)

Fields of application

- Mammal studies
- Hydrophone network
- Ice cracking
- Drilling and explosions
- Any sea noise...

Functions

- Underwater Sounds Recorder
- Pressure Sensor (0 to 1000 psi) (instrument's depth)
- Temperature Sensor (-10°C to 40°C)

Capabilities

- 16 Bits Digital recording
- Programmable recording mode : continuous with pause, delayed start, time spaced record
- Configurable sampling rate : 256 Hz to 32 678 Hz in 8 steps
- Usable frequency range : 10 Hz to 16 384 Hz
- Adjustable amplifier : 16, 18, 20 et 22 DB
- Combined Compact Flash and hard disk storage for optimal performance
- The hard drive can be mounted in a USB adapter and connected directly to a computer in order to hear the recordings.
- TCXO time base for stability
- Low power Logic and CPU
- Programming through RS232 (38,4Kbs, N, 8, 1)
- "FAT32" system support (hard disk)
- "WAV" format support (files)

Design Features

- Anti-aliasing filter
- Hydrophone HTI-96-MIN (other options are available on request)
- Delrin, Fibreglass/Epoxy and Stainless steel 316 case (salt water proof)
- Uses Standard D Size Alkaline batteries (other options are available on request)

This unit has been designed to minimize power consumption and can be deployed for several months in a row. The hard disk uses FAT32 format, and files are stored in WAV file format. The hard drive can be mounted in a USB adapter and connected directly to a computer in order to hear the recordings.

The AURAL-M2 comes with two programs which have been developed to help its use. [AURAL Setup](#) is used before immersion to configure the recording settings. [InfoWav](#) is used to collect technical information from the WAV files header.



The AURAL-M2 is available in three different sizes:

- 16 cells (length of 33 in)
- 64 cells (length of 47 in)
- 128 cells (length of 69 in)

The device can be safely used in salt water through the housing components: epoxy fiberglass and stainless steel 316. Devices have been tested to a depth of 300 meters (26 ppm) in salt water.

Conventions used in this guide

Please read the following manual carefully before using your AURAL-M2. This manual contains important information on how to properly operate the unit.



Tips or Tricks



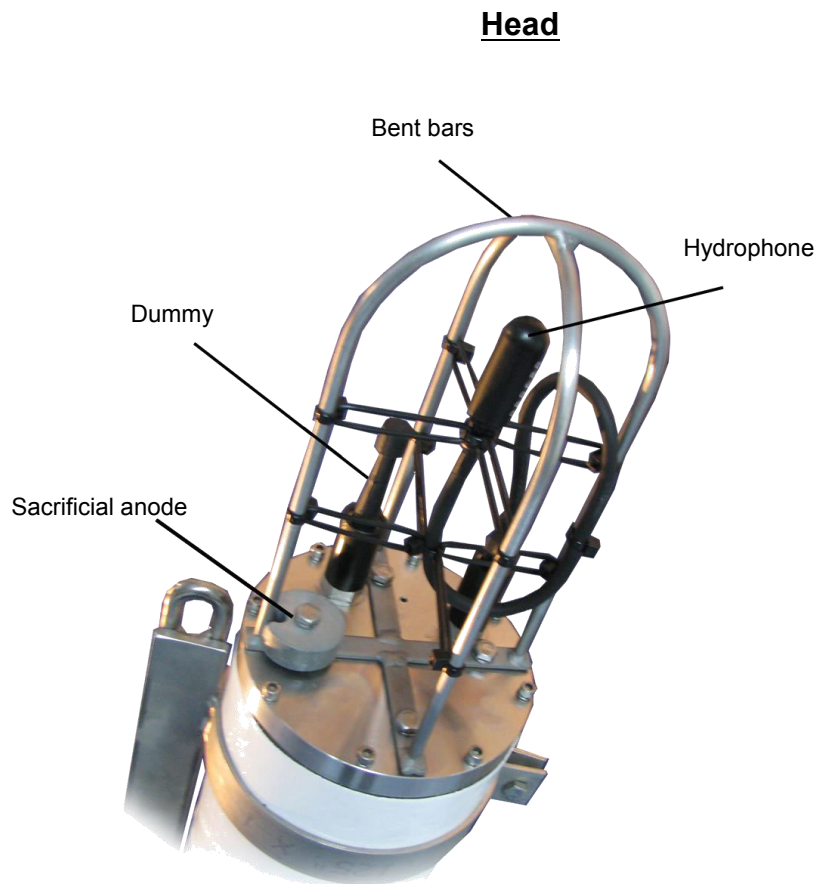
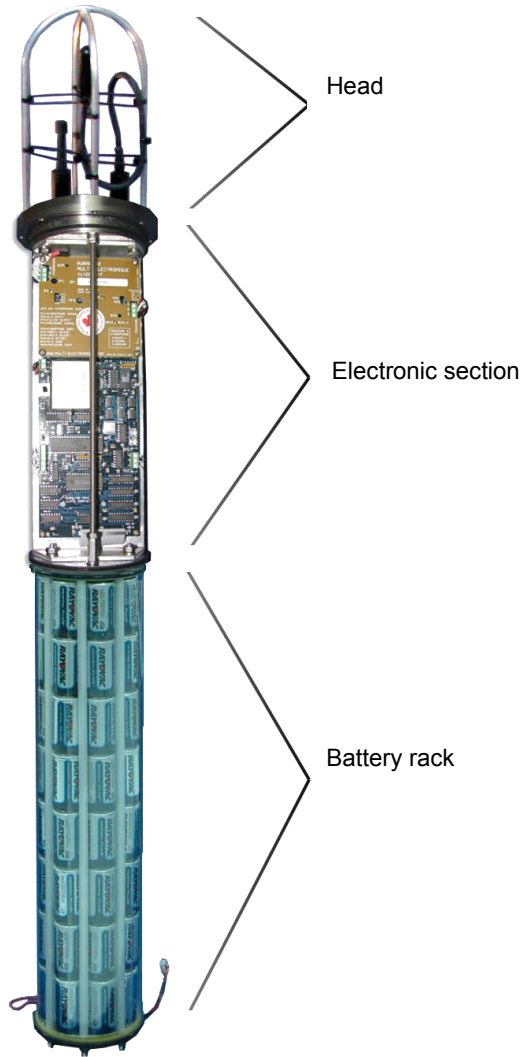
Essential information to know about the device



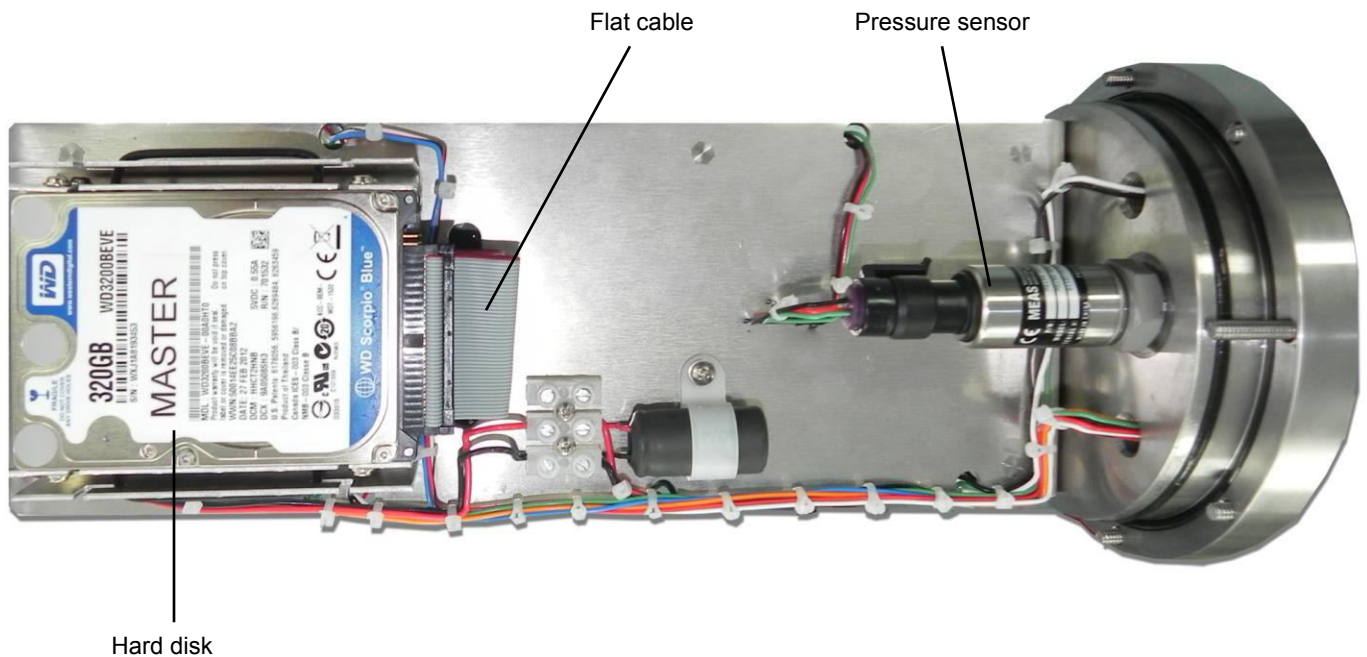
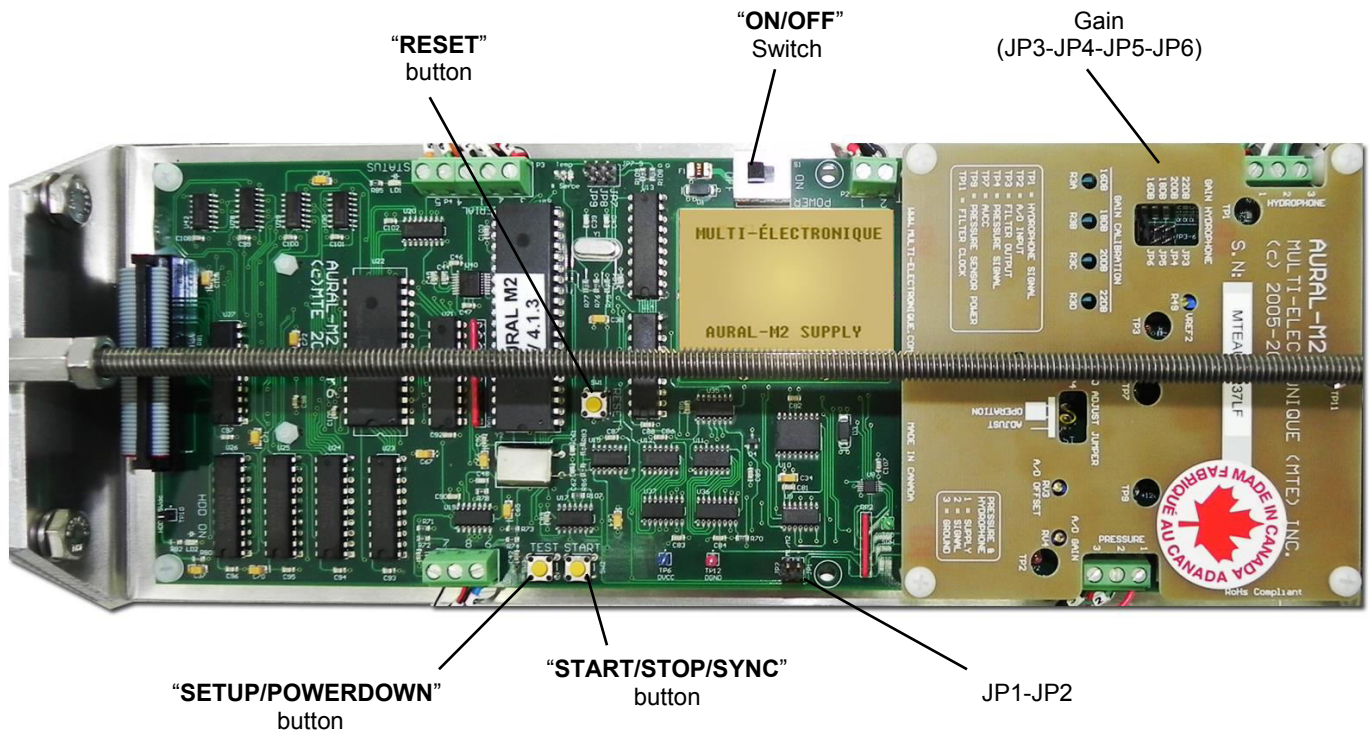
WARNING – To prevent possible injuries and equipment damage

Parts Identification

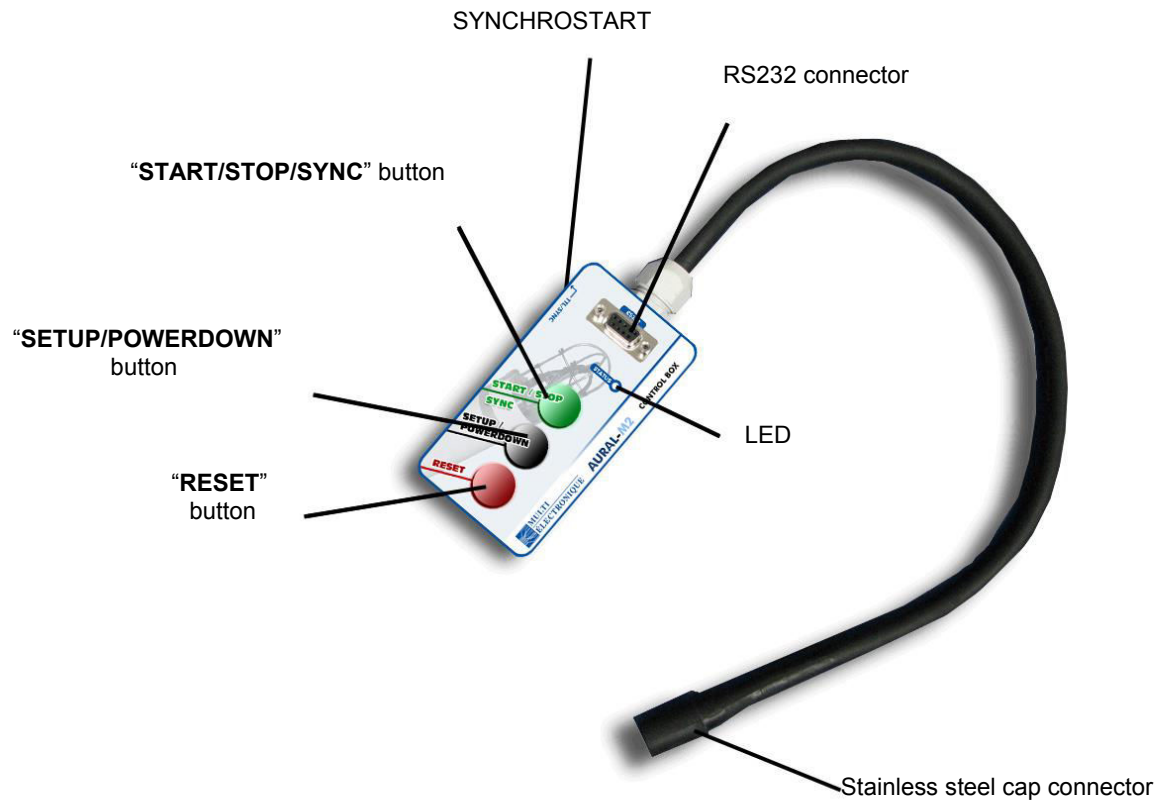
AURAL-M2



Electronic parts



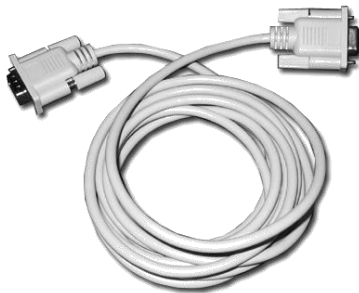
Control Box



Cables



Synchronization cable



RS232 cable



USB Serial adapter

Precautions

Thank you for purchasing the Autonomous Underwater Recorder for Acoustic Listening from Multi-Électronique (MTE) Inc. For optimum performance and safety, read this guide and retain it for future reference.

Important safety instructions

- Read this manual before using the apparatus for the first time.
- Keep these instructions for future reference.
- Heed all warnings.
- Follow all instructions.
- Contact Multi-Électronique (MTE) Inc. for any repair. Servicing is required when the device has been damaged in any way. Do not try to repair the AURAL by yourself.

Notes

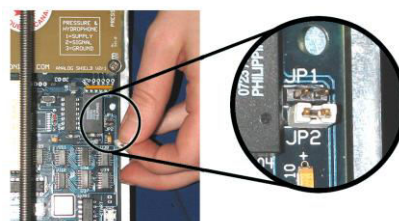
- Many wires are connected to the main PC board. No wires should ever be disconnected. In instances where a wire would break, it must be put back in place after having unscrewed the proper terminal screw. With the wire positioned properly, tighten the screw to keep it in place. **Great caution should be taken at any time, for the (red) positive battery wire not to be in contact with any other parts.** Remove all batteries from the AURAL if you have to manipulate any wire.
- The stainless cover has been subjected to a passivation treatment, which protects ferrous metals against rust.
- The device must be handled with care. Make sure not to hit or drop the instrument.
- Applying lubricant on the underwater connectors will help you insert them. **Never forget to put the dummy remote connector in place before the immersion.**
- Never remove the Delrin bottom cap.
- If you inadvertently press the “**RESET**” button of the Control box or the main circuit board, the AURAL reboots and returns in the operating mode it was previously (standby, setting up, recording or in hard disk data transfer). This is aimed to avoid repeating the setup procedure in case of any failure.
- Each unit has been tested in our workshop to ensure there is no leakage.



Although, before mooring the device for long periods of time, we recommend to remove the hard drive and immersing every unit at desired depths for at least 30 minutes and check if there is any water infiltration.

In the case of salt water intrusion, the unit must **IMMEDIATELY** be thoroughly cleaned with distilled water and dried with compressed air or with a hair dryer. The unit will have to be repair before any further utilization.

- **AURAL-M1 Mode.** Please note that to ensure compatibility with oldest generations of AURAL, you can enable the AURAL-M1 mode by installing a jumper on JP2 directly on the PCB. It allows a continuous recording without any programmable beginning time. This operating mode is no longer used today.





Repairs

Contact Multi-Électronique for any service, repairs, or part replacement. The unit might require repairs if:

- Water has infiltrated the unit.
- The unit was dropped or damaged.
- The unit's performance has changed.

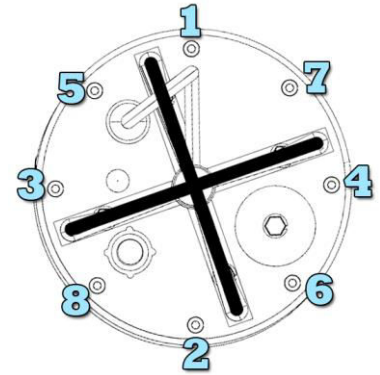
Do not try to repair this product by yourself.

Call Multi-Électronique (MTE) Inc. at (418) 724-5835 or by email at info@multi-electronique.com

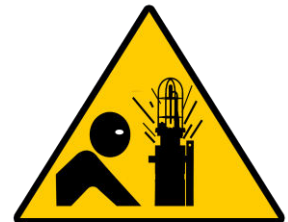
Handling of the AURAL

Cylinder opening

The AURAL-M2 unit must be opened **only** by the side of the stainless steel cover, where is located the hydrophone. Partially loosen the screws that hold the cap in sequence (follow the schematic on the right). This precaution is important because in the case of water infiltration, the internal pressure could violently blow the cap and cause possible injuries or instrument failures.



Water infiltration sign	Things to do
<ul style="list-style-type: none"> - Visible water or air leak. The air leak could cause a whistle. 	<ul style="list-style-type: none"> - Empty all water or air from the unit before opening the lid. Wait until the whistle sound stops before continue the process.
<ul style="list-style-type: none"> - As the lid is unscrewed, it tends to pop out. 	<ul style="list-style-type: none"> - If there is a water flow, wait for the unit to be empty before continuing to open it; - If there is no water flow, unscrew the lid gradually until the water flows out or until the internal air pressure comes down.
<ul style="list-style-type: none"> - When you unscrew the lid, there is a water flow. 	<ul style="list-style-type: none"> - Wait for the unit to empty before continuing to open it. - DO NOT continue to unscrew before the release of the internal pressure.



WARNING!
In all cases of infiltration, the cap can be violently pop out!

When all bolts are removed, pull and turn the lid in both directions by using the bent bars as handles. The device should firmly be held during this operation or it should be attached to a solid surface.

The lid can be quite difficult to open due to the internal pressure there is inside the cylinder. When all bolts have been removed and when there is no sign of water infiltration, we recommend exposing the equipment to direct sunlight or another weak heat source to increase the internal temperature and thereby facilitate the opening.

The use of any object to pry open the lid could result in damage of the tube or seal. Also, it is important not to mix lids and cylinders from a device to another. Every unit has been tested for leak when assembled, and the sealing depends on the combination of these. Changing a cylinder to another might counter the sealing of your AURAL.



Never use an object like a screwdriver to pry open the cap!



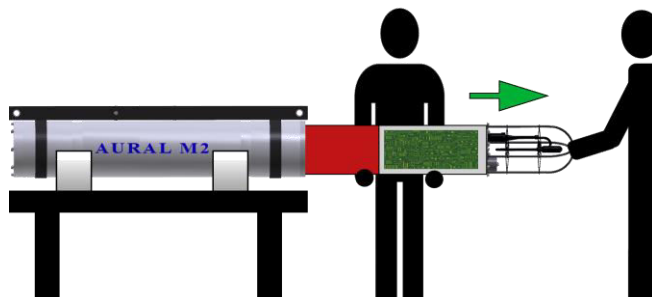
Method to insert and remove the electrical components

You must pay special attention to the battery section when handling the inner part of the device out of the cylinder. The battery section is very heavy. The device must be properly supported during this operation as its balance will be affected. Improper support could result in damage to the cylinder or the battery section.

Please follow the guidelines below in order to maximize the efficiency of your efforts while minimizing the risk of breakage.

How to remove the inner part?

The cylinder must be placed in horizontal position. A first person must pull on the inner part using the bent bars as handles, while the second person supports the battery section. Only the empty tube will remain on the table.



Be very careful, not to scratch the cylinder where the seals rests and make sure not to compress or jam any wires.

Cylinder inspection and closing

We recommend the use of two (2) desiccant bags fixed on the instrument for every long deployment as display on the picture. You need to use new bags at each deployment to optimize their effectiveness. Use the picture as a guide for the settling.

Make sure to inspect all seals, the cylinder's wall and the cap's surface for any dirt or cracks before closing the unit. All surfaces in contact with the seals must be perfectly clean. A single hair could cause water infiltration when submerged.



Never use the unit if the cylinder appears broken or damaged and make sure to replace any defective seals before use.



To close the device, you must apply a thin layer of lubricant to the seal and all the sealing surfaces, after making sure it is free of any dirt. Insert the cap up to the edge of the seal and firmly push taking care to align the cap with the cylinder. The seal should fit in the cylinder without much trouble. Thereafter, align the screws in their proper holes. Each screw must be easy to insert by hand until they reach the surface of the cap. Tighten them one by one, gradually until they are completely tight, following the same sequence as the opening. Make sure they are tightened enough to compress the seal perfectly without breaking the threads.

Sacrificial Anodes

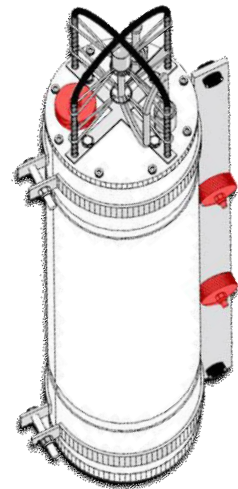
The AURAL-M2 comes with three sacrificial zinc anodes already installed on the unit. Their use is to help protect the unit from corrosion when immersed in salt water.

The three anodes are distributed along the length of the apparatus as follows to ensure the best possible protection:

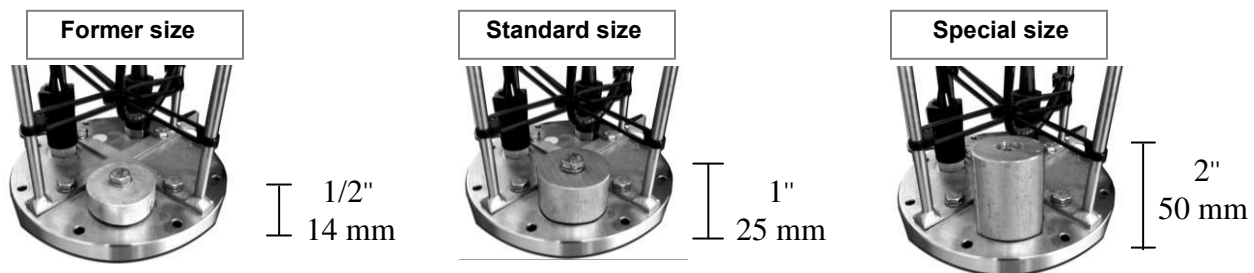
- One off-center hole main anode, fixed on the stainless steel cap
- Two centered hole anodes, fixed to the stainless steel support



Recent AURALS are now delivered with a larger main anode (on the stainless steel cap), allowing a better protection. Anodes on the lateral support remain unchanged.



Three (3) different sizes of sacrificial anodes:



The special size anode is conceived to be used in extreme mooring conditions; for instance:

- When the AURAL is deployed in strong currents;
- When the AURAL is deployed in a very low oxygen area;
- When the AURAL is deployed for more than one (1) year.

These hostile conditions accelerate the corrosion process. Replacement anodes can be obtained through Multi-Électronique. They are sold individually and require a 7/16" open-end wrench or a 3/16 hex key depending on the model.



We recommend doubling the sacrificial anodes on the lateral support for deployments more than six (6) months when immersed in salt water (to have at least 1 1/2" - 25 mm anodes). This will help protect stainless components.



Batteries

The device uses D-size industrial alkaline batteries. The quantity differs according to device model (16, 64 or 128 cells). To ensure good performance of the device, it is recommended to change all batteries before every immersion.



Even if they come directly from the manufacturer, it is possible to come across a dead battery. Batteries in the AURAL are connected in series. One defective battery can affect an entire string. You risk therefore losing weeks or months of recording due to a single defective cell. This recommendation is for conventional battery rack only. Battery packs made by Multi-Électronique have been tested and are ready to use.

What you will need:

- New cells
- 7/16" open-end wrench

How to replace cells:

1. Remove the inner section from the cylinder
2. Unbolt the bottom plate of the battery rack using the 7/16" open-end wrench
3. Remove old cells
4. Install the new batteries previously tested, making sure they are in the right direction.
5. Reinstall the bottom plate using the proper bolts.
6. Tighten the bolts in place until the springs are compressed at 2/3.

Because the rack is designed with springs at both ends, it is important to reply on the sticker that indicates the direction in which the batteries should be inserted.



DO NOT REVERSE THE BATTERIES.

Be careful because it is easy to reverse the polarity inadvertently.

For testing purposes, or for a very short immersion, you can use only a small amount of cells. The minimum amount must be 8 in a single row to allow the current to flow. The AURAL will function normally, but for a very short period of time.

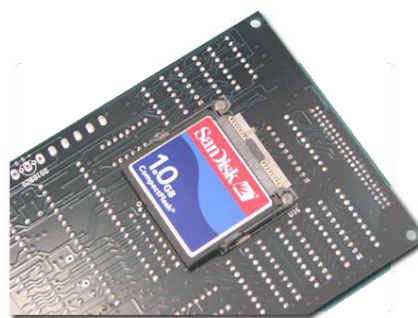
Total capacity of cells for your unit	Minimum quantity of cells for limited use
16	8
64	8
128	8

For an estimation of the duration of the recording duration, you can use AURAL Setup, where a section is provided for the purpose. You have to enter the amount of batteries in the **"Results"** field of the software in order to get the estimated total battery life expectancy.

Compact Flash

In order to save energy and allow the device to operate for a longer period of time, the Compact Flash is a temporary memory where data relating to the hydrophone is recorded first before being transferred to the hard disk. The energy demand would be too high to ensure an acceptable battery life expectancy if the data was directly saved on the hard disk after each recording.

The Compact Flash installed on the device can be of various sizes. The choice is made according to the customer needs, the trend and the market availability. The size of the Compact Flash mainly influences the possible size of files.



The Compact Flash is installed directly on the printed circuit board and is not easily accessible. In the event of undetected damage or malfunction, the entire unit should be returned to us for verification and necessary replacements.

Hard Drive

Different size of hard disk can be used in the unit depending on the customer needs, the trend and the market availability. The size of hard disk will influence the results obtained when configuring in [AURAL Setup](#).

The drive must be formatted into FAT32 for proper operation. It must be empty at the beginning of the recording period to allow a continuous sequence of files and samples in time.

How to format hard drive?

1. Make sure new batteries are in place to prevent power lost during the formatting process.
2. Connect the AURAL to a PC via the control box
3. Launch [AURAL Setup](#) software
4. Click the **"Format"** button and wait for the message **"Format done"** to appear in the messages box.

How to remove/install the hard drive?

1. Remove the inner part of the cylinder to get access to the electronic part.
2. Turn OFF the device, using the ON/OFF switch on the PCB.
3. Remove the rubber bands and withdraw the hard disk from the bracket.
4. Disconnect the flat cable, being careful not to bend the connector pins.
5. The hard disk is now free.
6. Use the reverse procedure to reinstall.

You will notice that two parts of the aluminum bracket are screwed directly on the hard disk. Leave them in place except if you intend to change the hard disk for a new one. Hard disks can be switched from one unit to another without having to change the support.



Keep the hard drive in an antistatic bag when not in use and make sure it is protected from any kind of shocks.



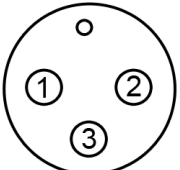
Be extremely careful when working with the hard disk. It is electrostatic discharges-sensitive and must be handled with care.

Hydrophone

The hydrophone is mounted on the stainless steel lid and is protected by the bent bars. It is connected to the device using a submarine connector.

The hydrophone is calibrated directly at the factory. At the purchase of an AURAL-M2, we provide you with a sheet showing the sensitivity of the hydrophone. This sheet comes from the factory and Multi-Électronique cannot be held responsible for any information presented on that sheet.

If necessary, additional hydrophones can be obtained individually from Multi-Électronique. Each hydrophone is accompanied by a specification sheet (the same that was provided at the purchase of your AURAL).

Pin Out	
1. 9V	
2. Signal Output	
3. 9DVC Return/Signal Gnd	



Before each immersion, it is very important to verify that the submarine connector is tightly in place and tight to prevent water infiltration.

Pressure Sensor

A pressure sensor is installed in the AURAL-M2. This sensor is very fragile and must be handled with care. It is used to measure the sampling's depth. That data is taken at the beginning of each recording and showed in each WAV file's header.

The pressure sensor is installed at the workshop and filled with "silicone gel (for oldest AURAL)" or "mineral oil (for recent AURAL)" for protection.

No maintenance is required on the sensor himself, but you must make sure the pressure port cavity is filled up with "silicone gel (for oldest AURAL)" or "mineral oil (for recent AURAL)" before each deployment.

The pressure sensor must never be removed from the AURAL. The only reason why it should be manipulated or removed is if it should be defective and needs to be replaced. In that case, you should contact Multi-Électronique (MTE) Inc. We will provide you with a replacement kit and proper installation procedures.



We fixed an adhesive tape with the note "Remove tape before use" to seal the cavity of the white cap to prevent any loss of oil during the AURAL shipment. Remove the adhesive tape before deployment.

We recommend installing an adhesive tape when the AURAL need to be horizontal for a long stretch of time.

Setting up the AURAL

The AURAL-M2 offers the possibility to postpone the beginning of a recording sequence. It may be useful, for example, if you want to record whale song after the formation of ice.

As well as offering the opportunity to start recording at a future date and time, it allows the user to set the recording duration and time between the beginnings of each record sequence. It generates several files of the same size which varies regarding to the configurations. All these adjustments are made using the **AURAL Setup** program.

Furthermore, if you want a continuous recording, without starting the recording immediately, you can check the "Continuous" box in the **AURAL Setup** program to do so. This way, the recording will begin at the set date and time and will only stop when batteries are drained or the hard disk is full. Note that the recording is continuous for the time required to fill Compact Flash file (file of 61 MB). Then, you will get a brief period while the unit transfers from the Compact Flash on the hard disk. The transfer rate is around 1.5MB/second.

Sampling rates

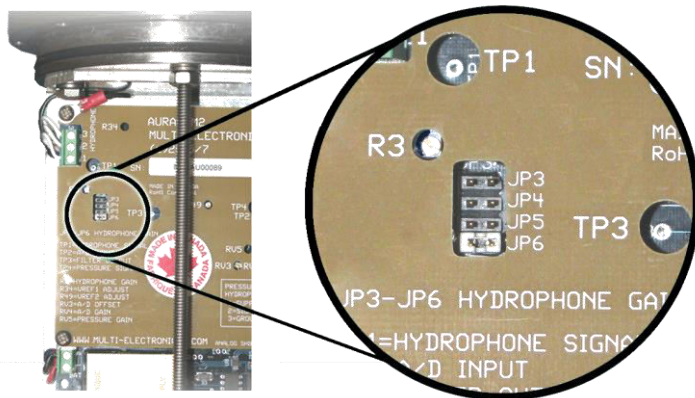
To select the sampling rate, you must use software **AURAL Setup**. To make an informed decision responding faithfully to your expectations, please refer to the following table.

Sampling Rate	Filter Corner Frequency (Hz)		Usable Frequency Range (Hz)
	$V \leq 3.2$	$V \geq 4.0$ or with patch	
32,768	20,000	15,000	10 - 16,384
16,384	10,000	7,500	10 - 8192
8192	5,000	3,750	10 - 4096
4096	2,500	1,875	10 - 2048
2048	1,250	937	10 - 1024
1024	625	469	10 - 512
512	312	234	10 - 256
256	156	117	10 - 128

Gain

You can adjust the amplifier gain according to the required amplification. Open the unit and remove the inner part from the cylinder to get access to the electronic section. Then install the jumper on the suitable pins (J3 to J6) as illustrated below:

The AURAL analog section offers four (4) gain setup: 16, 18, 20 & 22dB. The maximum signal to the A/D input is 3 dB or 4 Vpp. It is preferable to select your gain when the unit is turned OFF but it can be changed at any time.



Hydrophone amplification level

Jumper	Gain
J3	22 dB
J4	20 dB
J5	18 dB
J6	16 dB

Acoustic equation data

SONAR equation:

$\text{SPL(dB re 1}\mu\text{Pa)} = \text{Vdet} - \text{RS} - \text{G}$
--

SPL: Sound pressure level detected by the AURAL (μPa)

Vdet: Acoustic signal detected by the hydrophone in dB, therefore $20 \log$ (signal in volts);
The AURAL measures over a range of $\pm 2\text{V}$, converted to 16 bit.

RS: Receiving sensitivity ($\sim 165 \text{ dBV}/\mu\text{Pa}$, see specifications)

G: AURAL gain (16, 18, 20, or 22 dB)

AURAL-M2 operating range at various settings amplification

AURAL Gain (dB)	Saturation SPL Vdet = 2V (dB re 1μPa)	Minimum recorder SPL at [†] Vdet = 1 bit = $\pm 1/(2^{15})$ * 2V (dB re 1μPa)	SPL Difference (dB)
16	155	65	90
18	153	63	90
20	151	61	90
22	149	59	90

[†] In practice there is a self noise of a few bits that should be considered.

Note that the receiving sensitivity varies with frequency. The (RS vs. frequency) curve is obtained by users from their calibration according to ANSI calibration standards. Hydrophone RS nominal value is provided by HTI manufacturer. The (RS vs. frequency) curve measured by users is relatively flat ($\pm 1 \text{ dB}$), in the low frequency band below 5-10 kHz.

Software introduction



Your AURAL-M2 comes with two software programs: AURAL Setup and InfoWAV.

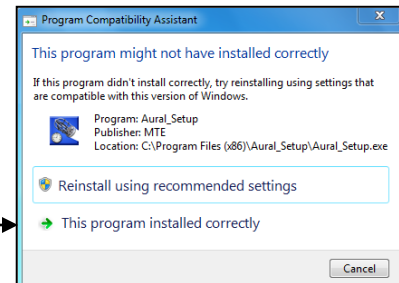
Both software programs are compatible with Microsoft Windows 2000, XP and 7. Less than 1 MB of the hard drive space is required to install the software. Prior to use the unit and after reading this manual, install the softwares on your computer. Insert the USB stick provided with the unit, click on the Setup.exe file in the appropriate folder and follow the instructions.

Software updates are available on our website: www.multi-electronique.com



It may happen that an error message appears when installing AURAL Setup and InfoWAV (especially in Windows 7). Proceed anyway and the software will work properly.

Click on "This program installed correctly"



AURAL Setup

This software is used before each immersion. It allows configuring the device by sending information for the desired recording settings. Also, parameters for deployment can be evaluated by the application future immersion like the batteries duration or the hard disk capacity.

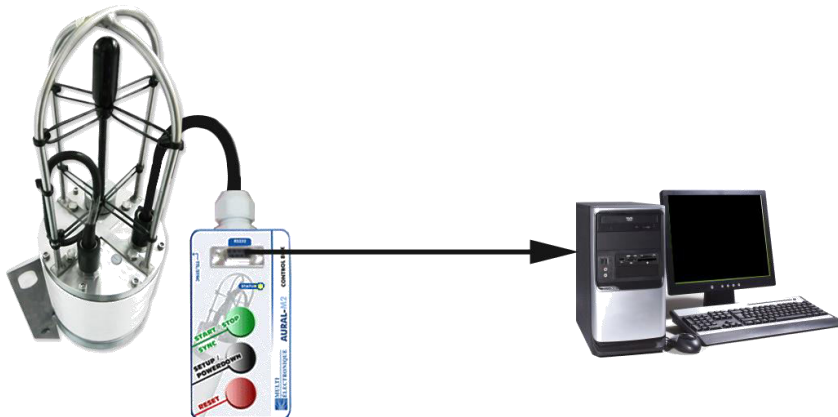


InfoWAV

This software is used subsequent to the device immersion. It allows extracting the information contained in the saved WAV files headers. This information can be displayed on screen or saved in a text file (.txt) format that can be accessed and analyzed later. All data coming from a group of WAV files can be displayed or can be extracted and save into a text file format.

Connect the AURAL to a PC

You can connect the AURAL to a PC with either the RS232 cable or the USB/serial adapter depending on your needs.



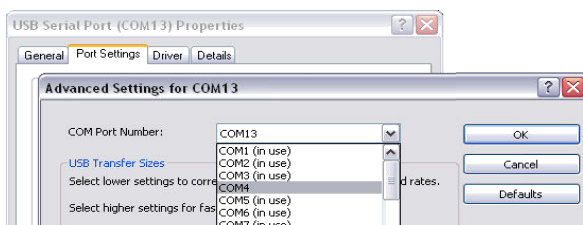
Via RS232 cable

If your PC has one available communication port between Com1 and Com4, use the RS232 cable provided in the package to connect the AURAL to your PC. You can now launch AURAL Setup and select the COM port.

Via USB/Serial adapter

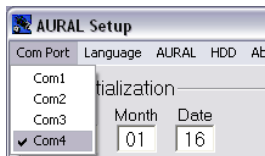
A USB/Serial adapter provides a simple way to add a serial port to your PC without the hassle of installing a serial card, turning off the PC or any configuring. You can use the serial/cable adapter we provided if your PC has no serial port.

1. Installation instructions and drivers can be found at <http://www.ftdichip.com/Products/Cables/USBRS232.htm>
2. When the installation is completed, you need to make sure which COM port the Windows operating system has assigned to the physical port. Since the AURAL is designed to communicate through a port located between COM1 and COM4, you may have to change it. For doing it:
3. Click Start > Setting > Control Panel
4. Click System > Hardware > Device Manager
5. Click on the plus sign (+) in front of "Ports (COM & LPT)", locate and double-click the port "USB Serial Port".
6. Click Port settings > Advanced > and select any port between 1 and 4 being careful not to select a COM port already in use. For this example we used COM4.



Note: If that same COM port is used for other devices, be sure to end those programs or configure them not to be using the same COM port that the USB Serial Port use, otherwise erratic behavior can result.

7. You can now launch AURAL Setup and select the COM port that you assigned at last step.





1. AURAL Setup Overview

1.1 Application configuration

Com Port

To communicate with the AURAL, the application requires one free RS232 communication port between Com1 and Com4. The available ports are displayed when selecting “**Com Port**”. Select the one that is connected to the AURAL. [AURAL Setup](#) will remember the port you have selected. If none are available, the application will shut down and show an error message.

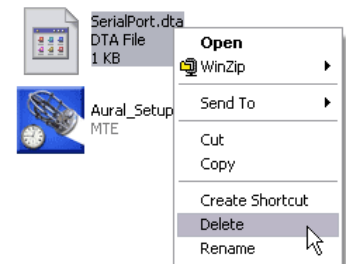
Occasionally, after Com Port reconfiguration on your PC, the application may no longer be able to open the previously selected port. It will result in an application crash with the error message:

ERROR! In SendCom1 (Operation valid only when the port is open).

You must “**Abort**” and manually delete the file that memorized the port selection by following these steps.

- Open Window Explorer
- Select C:\Program Files\Aural_Setup
- Delete the file SerialPort.dta
- Restart “[AURAL Setup](#)”

The application will recreate the file and the desired Com Port will be available for the selection.



1.2 Information bar



Com Port

Select the proper communication port.

Language

Select the user interface. (English or French)

AURAL

Select the AURAL board version.

HDD

Use for batteries life expectancy based on the hard drive installed on your AURAL.

About

Use to display the application version number in the Messages box.

1.3 General Information

- Some fields can be changed by user, while others are locked and updated by the application only. User-editable fields are validated by the application. If an illegal value is entered, the box becomes **yellow** and a beep sound occurs. For some parameters, you will not be able to leave the box until a valid value is entered.

The message box will display a comment in order to help the user to solve the problem.

- When entering new values, all the results fields will be erased and replaced by a question mark; some will be updated immediately and others are updated only when you press **“Compute”**.
- When a field turns red, it means the data new input invalidated another value. The situation must be corrected by changing back the fields or by correcting values in the red fields that will agree with his last input.

- To communicate with the device, turn on the AURAL directly on the PCB board. The following messages appear in AURAL Setup messages box:

Since the AURAL is designed for energy saving, it will get into standby mode after 5 minutes of inactivity in configuration mode. To wake it, hold the **SETUP** button of the control box and press the **RESET** button. Keep holding SETUP until “Entering in setup” appears in the message box.

At this step, it performs a disk check. The AURAL has a double flat cable ready to receive the double hard drive kit offer in option. When detecting the presence of hard drive, fields in the parameters sections become **blue**.

The real capacity of the Hard disk and the available space are indicated under the “HD” field.

Note: The message “Disk not detected” only means that a second hard drive is not installed. It does not affect your device operation.

AURAL Setup

Com Port Language AURAL HDD About

RTC Initialization

Year: 2013 Month: 01 Date: 14 Hour: 09 Min: 12 Sec: 05

☐ Sunday
 ☒ Monday
 ☐ Tuesday
☐ Wednesday
 ☐ Thursday
 ☐ Friday
☐ Saturday

☐ Sync RTC/PC

System Operation

Wake Up: Month: 01 Date: 14 Hour: 09 Min: 12 ☐ Continuous Sampling Rate: 32768

Cycle Time: 60 Time/Record: 0000:17:03 File Size: 64 MB
 0001:00:00 HHHH:MM:SS Min = 1 Max = 0000:17:03 Max = 128

Messages

2013/01/14 09:15:44

Parameters

CF Capacity: 128 MB HD: 60 GB
 134,217,728 Bytes 64,424,509,440 Bytes

Current S.R.: —

Bat: 64 Capacity/Cell: 15000

Results

Recording Time	273 / 11	Battery Life	5965 / 249	Sample/Record	33521664	Rec./File	1	Samples/File	33521664
Operation Period	960 / 40	Battery End Date	2013/09/19	File Size Total	67043832	Number of Files/HD	960		
Operation End Date	2013/02/23	Limit Operation Date	2013/02/23						

1. By clicking the “**ShutDown**” button, the AURAL can be put into sleep mode without configuring it.
2. The current time is permanently displayed here.
3. Messages box can be cleared by pressing “**Clear Messages**”.
4. At any time, you can use this button to format the AURAL hard drive. **FORMAT WILL ERASE ALL DATA OF THE DRIVE**. It will be formatted in FAT32 file system, supported by basically all operating systems.

A progress bar displays the status of the operation. It disappears when formatting completed. The operation could take several minutes.



Make sure you have backed up any existing file before you format. This action is irreversible.

Messages

Detecting presence of drive
 ...
 Formatting hard drive ...
 ...
 Format done.

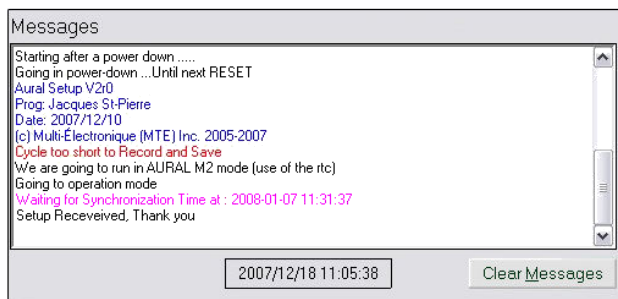
AURAL-M2

1.4 Messages Box

This is a text box where messages from both AURAL and application are displayed. When the box fills up, the text will scroll up, always displaying the last entry at the bottom of the box. The box has a limit of 16,000 characters. When the limit is reached, it automatically deletes the oldest text, keeping the most recent entries.

The text is displayed in different colors:

Color	Meaning
Black	AURAL messages
Red	Application's error messages
Magenta	Application's recommendation messages
Blue	Application about information



1.5 RTC Initialization Frame

The AURAL-M2 firmware uses an integrated **RTC (Real Time Clock)** to access current Date & Time. That RTC stops working and reset when the unit is turned **OFF**. You must reload it each time you turn the unit **ON**.

There is two different ways to proceed:

- Sync RTC/PC, or
- Manual synchronization.



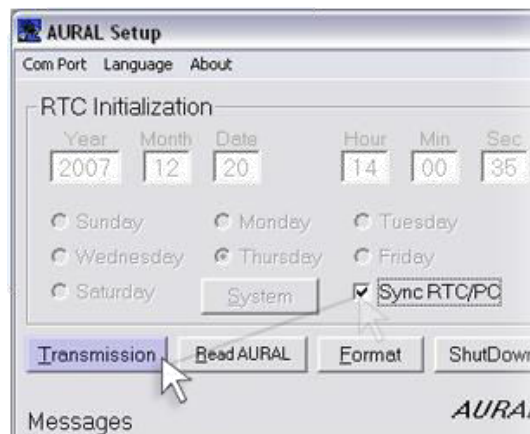
RTC/PC Synchronization

This method is the easiest. The AURAL RTC will synchronize with the PC clock when you press "**Transmission**". It will perform the setup and synchronize the procedure immediately.

Simply check the "**Sync RTC/PC**" option. The information field boxes will display the current Date & Time and the "**System**" button will be disabled.

After you have entered all requested parameters, press the "**Transmission**" button, the Date & Time information will be sent (with all other setup information) and an automatic synchronization will be performed to synchronize the RCT with the PC clock.

Afterwards, the unit turns into sleeping mode until the scheduled wake up time. Don't plug off the unit before you receive a message of confirmation.



Manual Synchronisation

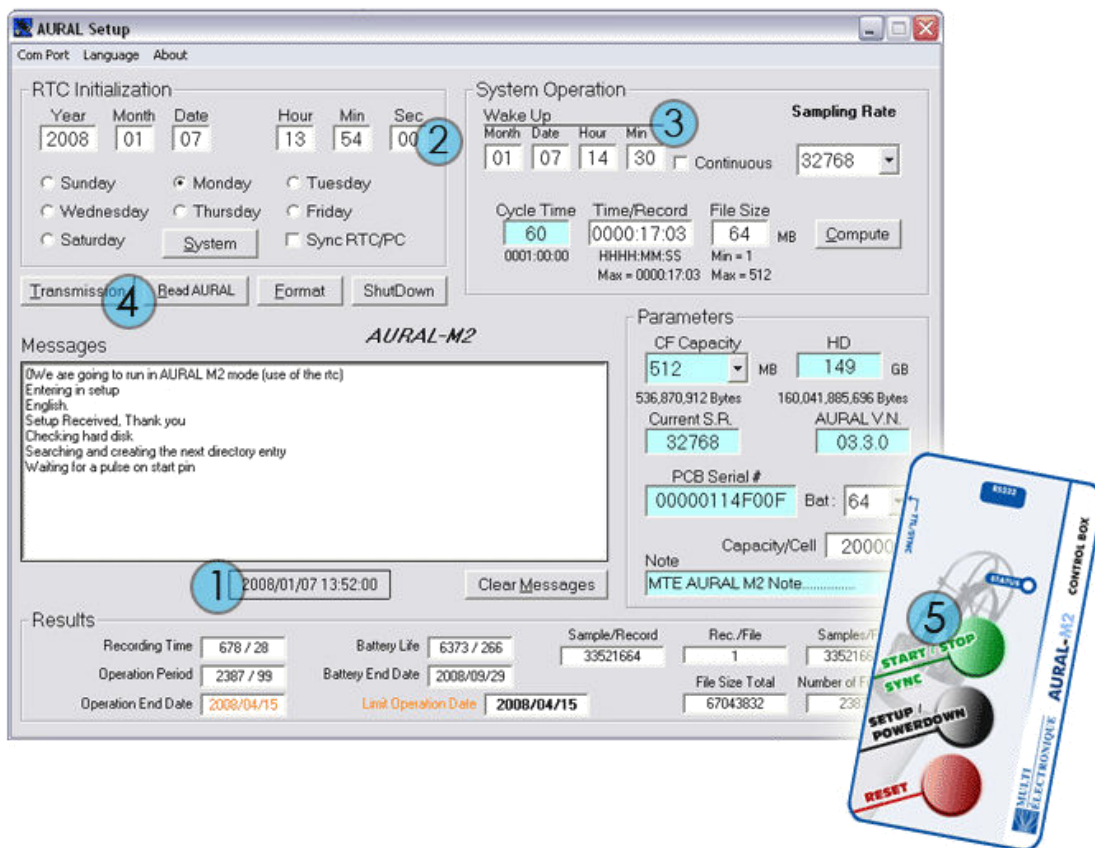
The selected Date & Time information will be sent to the AURAL (including all setup information) when you press **“Transmission”**, but the unit waits for a manual synchronization from the **“SYNC”** button of the Control box. You must set the current Date & Time information using each information fields. At any time, you can click the **“System”** button to reload the information with the current PC Date & Time information.

That method is less precise, since it depends on the user reflex to press the **“SYNC”** switch at the exact time to synchronize the RTC. Many AURAL can be synchronized simultaneously, by connecting them in parallel using the supplied Synchronization Cable. Refer to the section 5 (Recording) to learn how to connect many devices together.

A later time must be entered (a few minutes ahead) in order to get ready to press the **“SYNC”** switch on the control box after clicking **“Transmission”**. After loading the current time, set the “Hour”, “Min” and “Sec” with a value a few minutes ahead of the current time. When everything is set, click the **“Transmission”** button and wait for the real time to reach the programmed value to press the **“SYNC”** switch on the **“Control box”** to synchronize the RTC at the correct time. The AURAL will fall into sleep mode.

Example :

1. The current time is 13:52:00
2. Set the desired time for manual synchronization (*We chose 13:54:00*)
3. Set the Wake up time (*We want the AURAL to wake up at 14 :30 :00*)
4. When everything is set, click on **“Transmission”** button (a message will appear in the Messages box).
5. When 13:54:00 is reached in the current time (1), press the **“SYNC”** button of the “Control Box”. The unit will then turn into sleep mode until its wake up time.

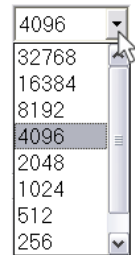


1.6 System Operation Frame

In this section, you set all the desired operation parameters for your deployment.

Sampling Rate

Sampling rate can be modified using a drop down list. **Do not forget that the sampling frequency represents twice the maximum frequency that you will record**, so if 8192 Hertz is chosen, you will end up with an audio range of 5 to 4096 hertz. Changing the sampling rate will affect the “Time/Record” field. Sampling rate field will become **yellow** if you select a sampling rate that can not be used with other parameters. You will need to change it.



Wake Up

Here, the required wake up time must be entered. This precise time represent the moment when the unit will begin to record the first data.

You must enter the “Month”, “Date”, “Hour” and “Minute” for the unit to start recording. This value must be greater than the current time you use to set the RTC, otherwise an error message will appear requesting to enter a wake up Date & Time further in time.

In such case, those fields become **red** and you will need to change it.

Continuous option

Check this box to enable continuous mode. You will no longer be able to select and modify the “Time/Record” or “Cycle Time”.

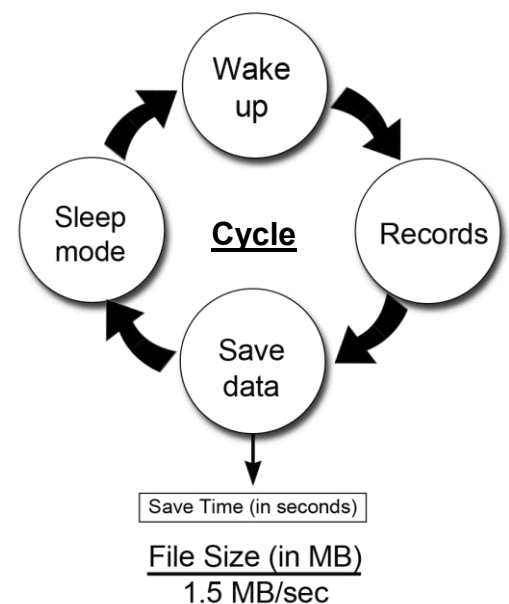
At the wake up time, the AURAL will begin to record continuously until the “File Size” is filled up and will pause recording to save on hard disk as described previously. When done, it will immediately restart the process until the hard disk reaches its full capacity or until the batteries are exhausted.

Cycle Time

When continuous mode is disabled, the AURAL-M2 works in Cycle mode. It means the unit will wake up at scheduled time, record for the programmed time, save the data and return to standby until next cycle. Here you entered the cycle duration.

Cycle time must be entered in minutes as multiples of 5 (5, 10, 15...) up to 1275. It must be greater than the time needed to record and save the desired amount of samples at selected sampling rate.

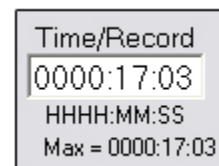
Save Time is the data transfer time from the CompactFlash Memory to the hard disk.



Time/Record

In the "**Time/Record**" field, you must enter the required recording time. This will compute the number of samples that will be collected for this period of time (shown in the "**Results**" frame at the bottom of the screen) in function of the selected sampling rate.

The value must not be greater than the maximum shown under the field. Also, the Cycle Time must be considered to determine the expected value (see the "**Cycle Time**" section). That field is not editable when switched in Continuous mode, but the "**Time/Record**" will stay to display the time in relation with selected sampling rate. You should be aware that this value is validated according to the maximum number of records by file available for the AURAL.



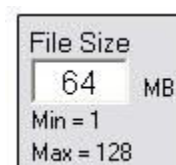
Time/Record
0000:17:03
HHHH:MM:SS
Max = 0000:17:03

If you end up with more than possible, you will get an error message and the field will turn yellow. You need to make the proper correction.

File Size

The requested file size must be entered in megabytes (MB). Range (min/max) depends on the Compact Flash capacity and is indicated under the box. This value affects the maximum "**Time/Record**" that can be entered (shown under the "**Time/Record**" field).

You are not able to change the file size in AURAL-M1. The value is fixed to 61 MB.



File Size
64 MB
Min = 1
Max = 128

Compute

Click this button to validate the "**System Operation**" fields and compute all results. It can be used at any point to check your inputs.

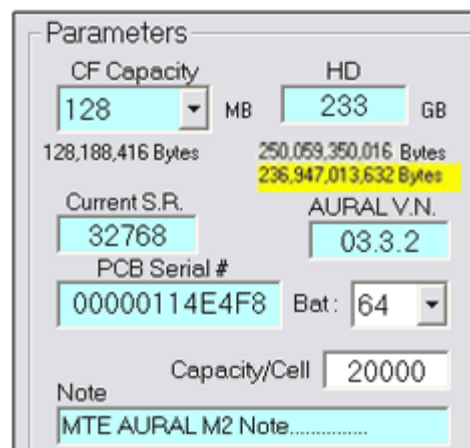
1.7 Parameters Frame

This frame is used to enter and display AURAL's hardware information.

Compact Flash Capacity and Hard Disk

When the application is used to evaluate deployment parameters, you can input the target CompactFlash and Hard Disk capacity used by the AURAL. "**File Size**" maximum and the "**Results**" frame are directly linked to these values. When you click on "**Read AURAL**", the AURAL sends its hardware current CompactFlash and Hard Drive size information. These fields will become **blue** and will get locked.

In this application, we consider Megabyte and Gigabyte as power of 2 values (as Windows do). So **1 Megabyte = 1,048,576 bytes while 1 Gigabyte is 1024 Megabyte**. Many CompactFlash and Hard Disk manufacturers use decimal values instead of power 2 values, which give them greater numbers to advertise. To make thing more understandable for all users, the real usable "Bytes" count under each field is displayed. Power 2 numbers are commonly used in computer technology, using that base return values that will correspond to the information displayed by Windows.



Parameters

CF Capacity	HD
128 MB	233 GB
128,188,416 Bytes	250,053,350,016 Bytes
	236,947,013,632 Bytes
Current S.R.	AURAL V.N.
32768	03.3.2
PCB Serial #	Bat:
00000114E4F8	64
Capacity/Cell: 20000	
Note: MTE AURAL M2 Note.....	

Current Sampling Rate and Jumper

When the sampling rate set command is received by the AURAL-M2, the action will be confirmed by sending the resulting sampling rate; that value is displayed in "**Current F.**" and should match the user's selections. Those fields are always locked.

PCB Serial Number

Display the serial number of the PCB.

Batteries and Capacity by cell

A drop down list is used to select the number of cells to be used in the AURAL and the "**Capacity/Cell**" field is used to enter one cell's capacity. The cell current must be input in milliamp. These values are used to compute approximate "**Battery Life**" in the "**Results**" frame.

Note

You can add text up to 32 characters that will be entered in each WAV file's header saved by the AURAL. It can be useful to indicate the hydrophone's serial number or the deployment's site location of that specific instrument or any other purposes. The **InfoWav** application will extract that information from the header.

1.8 Results Frame

Results from computed user inputs are displayed in that frame. These are useful to evaluate mission operation parameters. These fields are all locked and cannot be edited by the user.

Results						
Recording Time	273 / 11	Battery Life	6372 / 266	Sample/Record	Rec./File	Samples/File
Operation Period	960 / 40	Battery End Date	2008/09/14	33521664	1	33521664
Operation End Date	2008/02/02	Limit Operation Date	2008/02/02	File Size Total	Number of Files/HD	
				67043832	960	

Recording Time, Operation Period and Operation End Date

- « **Recording Time** » is the total time the unit will record audio sampling. It represents the total time of each recording cycle, excluding the sleeping mode time. For more convenience, the information is indicated in hours and days (H/D)
- « **Operation Period** » is the total time that the unit can operate, without regards to recording time and battery's life expectancy. It is related to the Hard Disk size, number of records by file and cycle time. For more convenience, the information is indicated in hours and days (H/D).
- « **Operation End Date** » is the date when the Hard Disk will be filled up.

These two last are approximate values. They do not take in consideration the space used by the FAT and Directory entries on the Hard Disk. The real value should be a bit a smaller than what is calculated. It is not possible for the application to compute in advance the exact size requirements for these locations on the hard disk. It does not represent much on the final result it is why the application does not take it into account.

Batteries life expectancy and Batteries End Date

These values are computed based on the number of cells and capacity by cell in relation with the AURAL consumption in its different operation condition (record, save & sleep). These are approximate values, current consumption can vary from one AURAL unit to another, cells will not perform all the same and their efficiency is also affected by water temperature. These variables cannot be calculated by the program but must be taken into consideration so values should be used as references only.

Limit Operation Date

This field indicates the approximated date when the unit will stop working. It is the first date to happen between the "Operation End Date" and the "Battery End Date". Limit operation date will become **orange**.

Sample by Record

This is the number of samples by record. It is computed from the required "Time/Record" and the current sampling rate.

Record by File

This represents the number of records you will get in each file. That value cannot be greater than the maximum space allowed reserved in the WAV file's header. That value is computed from the requested "File Size" and "Samples/Record", taking into consideration the header's size.

Samples by File

Represent the result of the "Samples/Record" number multiplied by the number of "Rec./File".

File Size Total

This is the exact resulting file size in bytes. It can be under the requested file size, since it depends on the resulting "Samples/File" added to the header's size. You should remember that two bytes (one word) are required per sample.

Number of Files by Hard Disk

This is the approximate total amount of files that will be computed on the hard disk. Again, the application did not take into consideration the space used by the Fat and Directory entries, so the total number of files may be a bit lower than displayed. In most case, the result should be one or two files under the real final value. Always take into consideration battery life expectancy as they might run out before the hard disk is filled. This field has a limit of **10 000**, that is generally enough for common use. It is possible to avoid this limit by grouping together many recordings in a same file. To do so, modify "Size File".

System Operation

Wake Up: Month [05] Date [27] Hour [11] Min [50] ☐ Continuous

Sampling Rate: [32768]

Cycle Time: [5] Time/Record: [0000:02:00] File Size: [32] MB

0000:05:00 HHHH:MM:SS Min = 1 Max = 0000:08:31 Max = 1024

[Compute]

Sample/Record	Rec./File	Samples/File	File Size Total	Number of Files/HD
3932160	4	15728640	31457784	5085

Example: With a sample rate of 32,768 and a limit file size of 32 MB (**A**), the AURAL has a recording capacity of 8 minutes and 31 seconds (**B**). The cycle here is 2 minutes of recording every 5 minutes.

With these settings, you will get 4 recordings (**C**) of 2 minutes (**D**) in a file of 31457784 bytes (**E**), (that is a bit fewer than 32 Mb).

$$(8.5 \text{ minutes} / 2 \text{ minutes}) = 4.25 \text{ recordings}$$

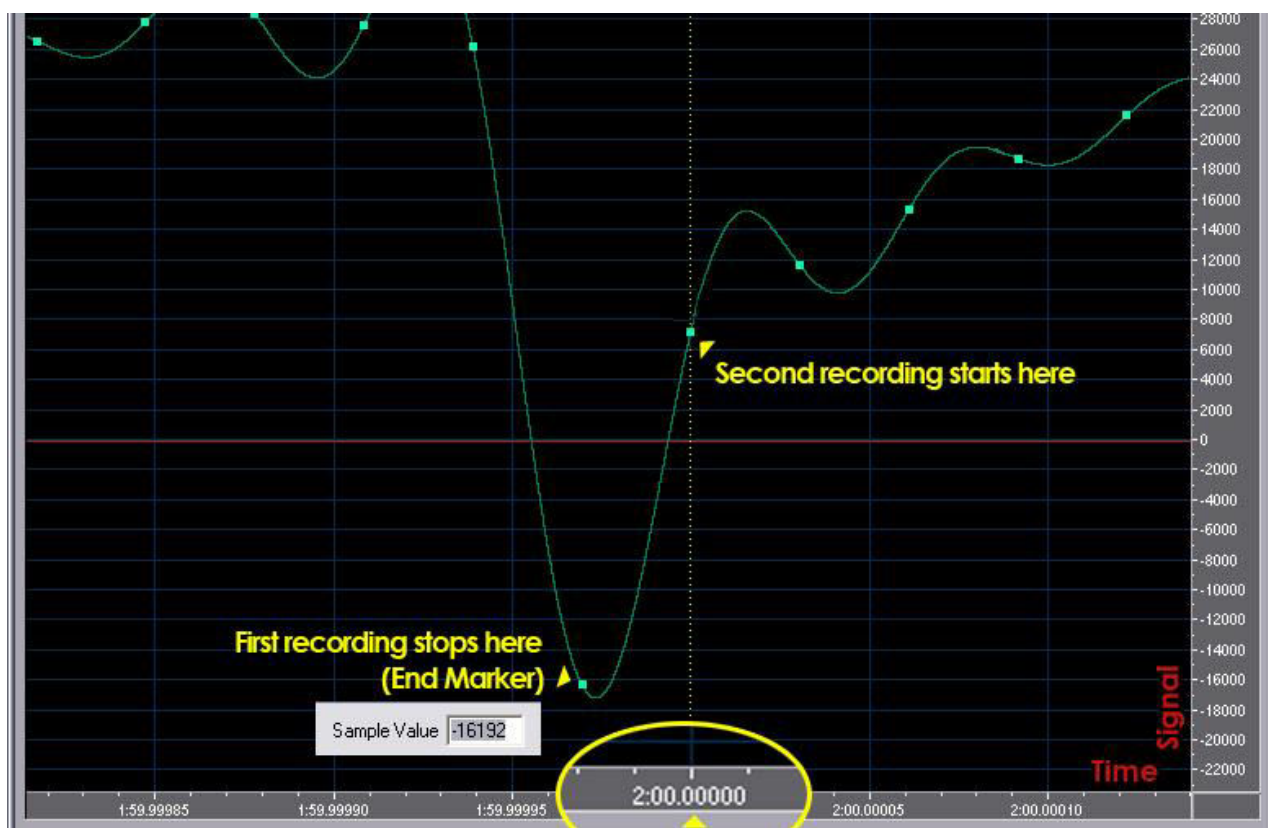
AURAL Setup rounds the number of recording to the lower unit. Therefore, an audio WAV file of four (4) recordings will be created.

Picture 8.1: Configuration in AURAL Setup

How to locate the recordings in time?

The AURAL automatically replace the last sample of each recording by an **End Marker** to help you locating the beginning and the end of your recordings. This marker default value is -16192 (*picture 8.2*). Use this information and the WAV file's header (*picture 8.3*) contents to determine the exact date of your recordings. Note that all 4 recordings will appear continuous, without any gap.

Example (following):



Picture 8.2: WAV file zoomed in to the maximum in a sound editor software

Wav file header coming from the 4 recordings

1 st	→ C:\InfoWav_Data\CA580002.WAV;32768;000001B7CA58;25.6;665.3;NA;NA;00:05:00;3932160; <u>2010/05/25:16:58:00</u> ;000;2010/05/25;17:00:00;000;AURAL-M2;04.0.1;Note...;12.8;13.0
2 nd	→ C:\InfoWav_Data\CA580002.WAV;32768;000001B7CA58;25.4;665.3;NA;NA;00:05:00;3932160; <u>2010/05/25:17:03:00</u> ;000;2010/05/25;17:05:00;000;AURAL-M2;04.0.1;Note...;12.8;13.0
3 rd	→ C:\InfoWav_Data\CA580002.WAV;32768;000001B7CA58;25.6;665.4;NA;NA;00:05:00;3932160; <u>2010/05/25:17:08:00</u> ;000;2010/05/25;17:10:00;000;AURAL-M2;04.0.1;Note...;12.8;13.0
4 th	→ C:\InfoWav_Data\CA580002.WAV;32768;000001B7CA58;25.7;665.3;NA;NA;00:05:00;3932160; <u>2010/05/25:17:13:00</u> ;000;2010/05/25;17:15:00;000;AURAL-M2;04.0.1;Note...;12.8;13.0

Picture 8.3 : WAV file header contents

According to the information in your sound editor software and the WAV file header, you can know the exact time when the recording has started. Date and Hour information are underlined in the picture above. You will gain knowledge of file data structure later in this manual.

First recording started on **May 25th 2010, 16h58**; Second recording started on **May 25th 2010, 17h03**; Third recording started on **May 25th 2010, 17h08** and Fourth recording started on **May 25th 2010, 17h13**.

1.9 Error message list and troubleshooting

Below is a list of possible error message that can arise in AURAL Setup.

Error message:

Some values are incorrect, rectify and try again.

Please Check: Frequency, Record/File or Sample/File

Possible resolution: If this message appears after clicking “**Transmission**”, it means an error occurred during parameters validation. Please check the following points:

- Does the “Sampling Rate” and the “Current S.R.” are the same?

Otherwise, select a new frequency that will determinate the number of Records and Samples recorded by file (click on Compute, if needed).

- Does the “Rec./File” and the “Sample/File” equal zero?

If these two last fields equals to zero, the AURAL won’t record any data. Be sure the “Sampling Rate” and “Current S.R.” correspond to one another (click on Compute, if needed).

The screenshot shows the AURAL Setup software interface. A red box labeled "Must be equal" points to the "Sampling Rate" (8192) and "Current S.R." (8192) fields. Other fields include "Rec./File" (0) and "Samples/File" (0), which are also circled in red. The interface includes sections for Time/Record, File Size, Parameters, and Hardware information.

Error message:

The AURAL is Power Down.

Please Reset and ReEnter Setup.

Possible resolution: The AURAL is turned into standby mode. The AURAL is designed for energy saving, it will get into standby mode after five minutes of inactivity during the configuration mode. To awake it, hold the **SETUP** button of the Control Box and momentarily press **RESET**. Keep hold the **SETUP** button until the message “**Entering in setup**” appears in the message box. You will be able to continue the configuration.

Error message:

Too much file, Maximum is 99999. Please rectified and try again.

Please check: File Size, Record/File or Sample/File

Possible resolution: The AURAL has a limit of 9999 files. Why? The AURAL files counter has a limit of 4 digits, therefore a maximum of 10 000 files (0000 to 9999). To avoid this limit, it is recommend to put multiple recording in a same file. To do so, modify “**Files Size**”. By modifying the file size limit, you can have multiple recordings in a same file. Please refer to section **Number of Files by Hard Disk** on page 31.

Error message:

ERROR: Setup_Info.ini not found,
Closing application

Possible resolution: Setup_Info.ini file is missing. AURAL Setup software does not find the **Setup_Info.ini** file in its root directory (C:\Program Files\Aural_Setup\Setup_Info.ini), which is required to run the application.

Reinstall AURAL Setup to recreate this file.



2. InfoWav

2.1 Purpose

That application is used to extract the embedded information saved by the AURAL in the WAV file header. The information can be either displayed or be saved in a text file for further analysis. You can choose to display the information of a particular file, but you can also extract and save to a file the information from a group of WAV files. At startup, InfoWav will create a directory to save default information (C:\InfoWav_Data).

2.2 Main window

At the top you will find two menus:

- File
- Language

The window is composed of **three major sections**:

- Source
- Destination
- Information

InfoWav Version 7.0.0

File Language

Source

Refresh

Record List

W\Kingsserveur\jobs

AURAL

InfoWav_V6

Package

4E8F0003.WAV

2007/11/08 16:50:00

Destination

C:\InfoWav_Data

Browse

File Name

Ext.

Information

AURAL Mode	Cycle Time	Sampling	T (°C)	Cor.	Validate	D (m)	Cor.	Validate
AURAL-M2	01:00:00	32768	23.8	0	Validate	0.8	0	Validate
Serial Number	Sample / Cycle	Start Time			VBat. HD ON			
00000114E4F8	400000	2007/11/08 16:50:00.000			12.0			
AURAL V.N.	Sample	End Time			VBat. HD OFF			
03.3.2	400000	2007/11/08 16:50:12.207			12.0			

Note

Test de la note perso...

File Menu

Click **"About"** button to see application information. Click the **"Exit"** to close the application.

Language

Use to select your language.

2.3 Source Section

1. Driver Selection

Use to select the files source drive.

2. Directory Selection

Use to select the files source directory.

3. File Selection

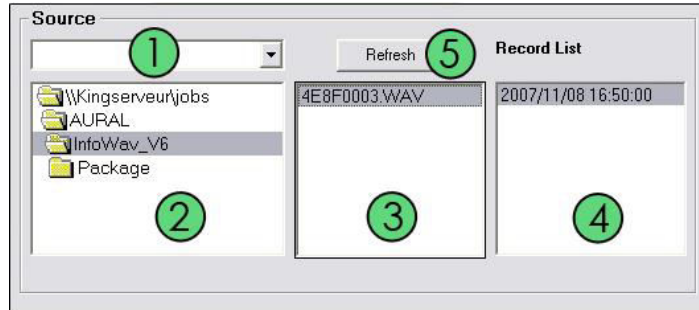
Use to select the file you wish to display the information for.

4. Record List

Appear to display the record list of the selected file. You can have one or more records for each file. Select the record you wish to display the information for.

5. Refresh

Click to reload drive or directory information after connecting a USB drive or similar device.



2.4 Destination Section

1. Browse Button

Use to select the files destination drive

2. Directory Selection

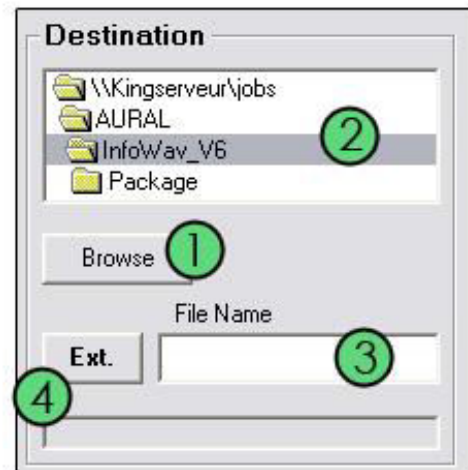
Use to select the file destination directory.

3. File Name

Will display the application extract procedure generated file name.

4. Extraction

Click the button to read the entire WAV file group in the source directory and create a file that contains all the information.



2.5 Information Section

Use to display the embedded information. Take note that some information fields will be displayed only if they are available or particular to a certain model of instrument.

Only the “**Cor.**” (Correction) fields are user editable in this section. The information entered there will be saving according to the particular unit’s serial number and will be recovered each time that particular unit will be selected. **VBat. HD ON** represents battery voltage when the Hard disk is ON, **VBat. HD OFF** represents battery voltage when the Hard disk is OFF.

Information							
AURAL Mode	Cycle Time	Sampling	T (°C)	Cor.	D (m)	Cor.	
AURAL-M2	01:00:00	32768	23.8	0	0.8	0	
				Validate		Validate	
Serial Number	Sample / Cycle	Start Time			VBat. HD ON		
00000114E4F8	400000	2007/11/08 16:50:00.000			12.0		
AURAL V.N.	Sample	End Time			VBat. HD OFF		
03.3.2	400000	2007/11/08 16:50:12.207			12.0		
Note							
Test de la note perso...							

AURAL Mode

Display the AURAL Mode used to record the selected file (AURAL-M1 or AURAL-M2).

Serial Number

Display the AURAL PCB (Printed Circuit Board) serial number. This is a 12 characters hexadecimal value link to the temperature sensor. Note that if the sensor is replaced, the serial number will change.

AURAL V.N. (Version Number)

Display the AURAL MCU (Micro Controller Unit) firmware version number. That information is available in AURAL-M2 mode with firmware version 3.3 and up.

Note

Display the user note registered using **AURAL Setup**. It can be used to record unit location or any information user can need. That information is available with firmware version 3.3 and up.

Cycle Time

Display the record Cycle Time as **Hours : Minutes : Seconds**.

Sample / Cycle

Display the number of samples per record.

Sample

Display the total number of samples for that file.

Sampling Rate

Display the record sampling rate (number of samples by second).

Start Time & End Time

Display the Start and End (of a record) time for each record as Year/Month/Date Hours:Minutes:Seconds:Thousandths. *Note that in AURAL-M1 mode, "Years" and "Month" information will be zero while the Date information represents the number of days since the beginning of the first record.*

T (°C), Cor. & Validate

Display recorded temperature at the beginning of the sampling. This value can be manually corrected using the associated "Cor." value. Enter the required correction and click "Validate". The correction value will be saved and associated with the unit's serial number so it can be recovered as needed.

P (m), Cor. & Validate

Display recorded Depth at the beginning of that sampling. That value can manually be corrected using the associated "Cor." value. Enter the required correction and click "Validate". The correction value will be saved and associated with the unit serial number so it can be recovered as needed.



Some device comes without a pressure sensor. In this case, the depth will read approximately 249m (78,74 ft).

Start & End Sample Nbr

Those values are displayed only in AURAL-M1 mode. They indicate the sample number for Start and End as a counter.

2.6 Generated File

When clicking the "Ext." (Extract) button, the application generates a file containing all the information for the selected files group. The file will be saved in the selected destination and will have a generated file name as follow:

Example: Bilan_4E8F_20071217142810.txt

Bilan	Always the same, this is the default file name
4E8F	Last four digits of the PCB serial number of the first file in the source path
2007	Year of creation
12	Month of creation
17	Day of creation
14	Hour of creation
28	Minute of creation
10	Second of creation
.txt	This is a text file

2.7 File Data Structure

All data are separated by semicolons (;), each line represents a record.

Example:

E:\4E8F0003.WAV;32768;00000114E4F8;23.8;0.8;NA;NA;01:00:00;400000;2007/11/08;16:50:00;000;2007/11/08;16:50:12;207;AURAL-M2;V.N.03.3.0;Test...

File Path & File Name	E :\4E8F0003.WAV
Sampling Rate	32768
Serial Number	00000114E4F8
Corrected Temperature	23.8
Corrected Depth	0.8
Sample Counter at Beginning	NA
Sample Counter at Ending	NA
Cycle Time (Hours : Minutes : Seconds)	01:00:00
Number of Samples by Record or «Continuous»	400000
Start (first sample) Year/Month/Day	2007/11/08
Start (first sample) Hours/Minutes/Seconds	16:50:00
Start (first sample) Thousandths of second	000
End (last sample) Year/Month/Day	2007/11/08
End (last sample) Hour/Minute/Second	16 :50 :12
End (last sample) Thousandths of second	207
Operating Mode	AURAL-M2
Firmware Version Number (AURAL-M2 version 3.3 and up)	V.N.03.3.0
User note (AURAL-M2 version 3.3 and up)	Test...

Recording

To start the recording



Since the unit is designed for energy saving, it will get into standby mode after five minutes of inactivity during the configuration mode. To awake it, hold the **SETUP** button and press the **RESET** button. You must hold the **SETUP** button until the message "Entering in setup" appears in the message box of the program. You will be able to continue the configurations using program **AURAL Setup**.

This action is valid in configuration mode until you press the button "Transmission". From that moment, the device will not enter into standby mode as long as you do not synchronized its internal clock with the "SYNC" button of the control box. This option has been added to allow the simultaneous synchronization of multiple devices to synchronize simultaneously without being pressed by time.



To power up the AURAL and proceed to setup, you will need:

- The device you want to configure
- All you need to open the AURAL
- Control box
- Communication cable (RS232 or USB/serial adapter)
- A computer (Windows base)

Procedure :

1. Open the AURAL. (Refer to section **Cylinder opening** at page 13)
2. Connect the AURAL to the PC using the control box and the communication cable provided.
3. Launch AURAL Setup program.
4. Turn ON the AURAL using the switch located directly on the PCB.
5. Hold the "**SETUP**" button on the control box and turn ON the switch on the PCB. You must hold the "**SETUP**" button until the message "**Entering in setup**" appears in the message box of the program. The device sends information concerning its hard disk and compact flash to the PC.
6. The configuration of all units must be done individually. With AURAL Setup, specify the parameters you wish to obtain. Refer to section **AURAL Setup overview** on page 23 for more details. When all configurations are completed, press the "**TRANSMISSION**" button in the software. The PC will transmit the parameters to your unit. If you want to configure many units with the same parameters, you can do so by moving the RS232 cable from the control box to another control box and pressing the "**TRANSMISSION**" button again. You can configure as many units as you want.
7. When the real time reaches the time chosen in the "**RTC Initialization**" section of the program, press the "**SYNC**" button on the control box. At this precise time, the AURAL starts its clock, and send a confirmation to the AURAL Setup program indicating that the instrument started correctly with the desired parameters. Then it turns to standby mode until the first recording time.

If the synchronisation signal is done for several devices simultaneously, the confirmation received by the AURAL Setup software is valid only for the device directly connected to the computer. The only way to ensure that all internal clocks have received this signal at the same time is by checking the condition of the LED of each control boxes. When the process is complete, the LED of the control box turns off.

The AURAL will wake up five seconds before the next planned recording time for the stabilization of the circuits before beginning the recording, which will be done precisely at the required time. Please note, if the first

recording is to be delayed more than one month, the device will wake up for few seconds each month until the start time is reached. The temperature and the pressure are taken at the beginning of each recording.

How to connect multiple AURAL together

To start/stop the recording of many devices in a single step and to have them working precisely at the same time, it is possible to connect them together.

What you will need:

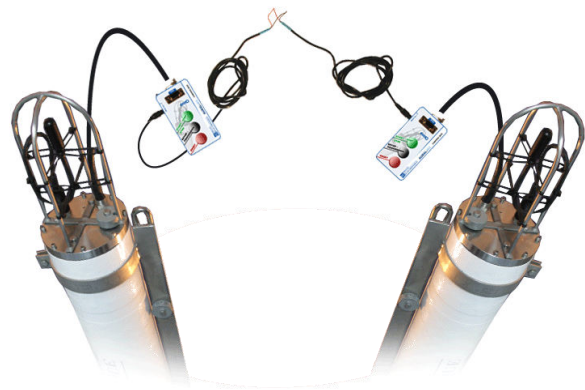
- Your devices
- Synchronisation cable for each apparatus
- Control box for each apparatus
- One RS232 cable to connect all that stuff to your computer (if necessary)



As soon as a synchronisation cable is connected to any control box, you must pay attention that the black wires do not touch the coloured wires. If by misfortune they come in contact, the synchronisation signal would be initiated and may cause improper operation.

Procedure:

1. Remove the dummy located on the stainless steel cap of each instrument.
2. Connect the control box on each instrument.
3. Connect the stripped part of all synchronisation cable together (the black ones with the black ones, the coloured ones with the coloured ones)
4. Connect a synchronisation cable on each control box using the “TTL/SYNC” connector.
5. The computer can be connected to any control box using the RS232 cable if necessary.



You will be able to control all the devices connected in parallel using any control box or a GPS connected to the wire.

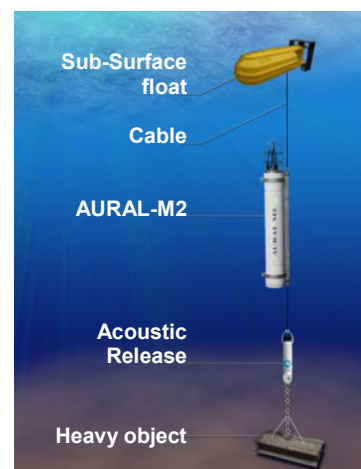


The configuration of all units must be done individually with the AURAL Setup program but it is possible, when the set time on the real time clock is reached, to start the internal clock of all units at the same time using any of the control boxes.

Mooring example

Different methods can be used to immerse a unit. In all cases, the primary thing that you should think is the noise. You must ensure that the neighbourhood where the instrument will be based is exempt of any harmful noise. Furthermore, the equipment used to anchor your device must be silent. You must prevent any chain noise or possible friction.

Here is an example of mooring that has already been done.



Recovery

Recovery of the instrument and terminating the recording

At the recovery, rinse the instrument thoroughly with fresh water.

Next, check the device status by connecting the control box and observing the LED located on the box.



LED's action	Description
1 short pulse every 10 seconds	Sampling in progress
OFF	Standby or batteries empty
Other	See appendix 1 for significance

It may be important, depending on the use of the instrument, to be able to calculate the drift of the clock throughout recording, especially to synchronize the recordings of several devices. If it is your case, it could be advisable to record some sounds at a precise time before stopping the recording, for example clapping the hands near the hydrophone and noting the time.

Press **“STOP”** of the control box to end the recording, if the device sampling is in progress,

If the LED is OFF, hold the **“STOP”** button and press the **“RESET”** button. If the instrument was in standby, this action will awaken it, and if the **“STOP”** button is continuously pressed, the recording will end. Then, the LED illuminates continuously the **“STOP”** button may be released. During this time, the last file is completed with zero values and is transferred to the hard disk. This step may take a few minutes.

When the transfer is completed, the LED will flash in intervals of 3 short pulses. You can turn OFF the unit using the ON/OFF switch. It is important to make sure that the cylinder is quite clean and dry before opening the device. This is especially important close to the opening where the hydrophone is located.



It is necessary to wait until the transfer is completed and the LED flashes in intervals of 3 short pulses before powering off the instrument otherwise the last file will be lost.

The finalization of the recording could be made with the instrument connected to a computer in order to follow, on the screen, the steps in the message section of the **AURAL Setup** program but this step is not necessary. To end the recording of several AURAL simultaneously, connect them together as indicated in section **How to connect multiple AURAL together** on page 40.

Recovery of the files

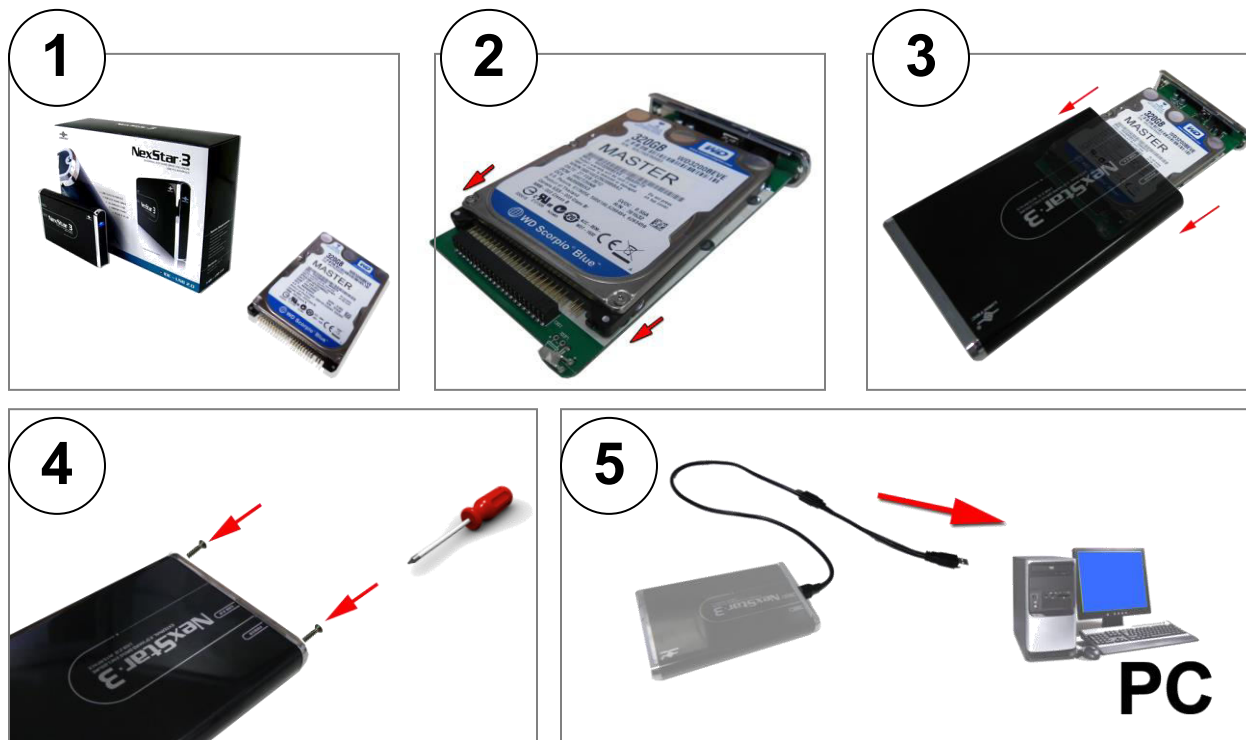
Turn OFF the instrument using the ON/OFF switch and remove the hard disk. Next, you have to install the hard disk in the USB interface provided and connect it to the PC.



If you are using the double hard drive kit, please remove the jumper located on the slave drive prior to download the data. Do not forget to put it back for further use.

How to install the hard drive to the USB adapter?

- Refer to section **How to remove/install the hard disk** on page 17 to remove Hard Drive.
- When the hard drive is removed, use a Philips head screwdriver to loosen the screws on each side to separate the bracket gently.
- Unpack the external hard drive enclosure kit provided and perform the followings steps:



You can access the information directly on the disk or files can be transferred to the desired storage medium (hard disk, DVD, USB drive, etc.). You will notice that the name of the sequential files has as root, the serial number of the instrument temperature sensor.

At this step, the use of the software **InfoWAV** will help you creating a report file that contains all technical information displayed on each recording.

Getting Started

AURAL Unboxing

- ☐ Open the box and check if you have received everything
- ☐ From the provided USB key, recover the manual and install softwares (visit our website for further update)
 - ☐ User Guide
 - ☐ AURAL Setup
 - ☐ InfoWAV

Configuration

- ☐ Open the AURAL
- ☐ Verify and install the batteries
- ☐ Connect Control box
- ☐ Run AURAL Setup
- ☐ Turn ON the AURAL (switch on PCB)
- ☐ Hold the Setup button from Control box and wait for message “*AURAL ready to receive setup*”
- ☐ Format Hard disk
- ☐ In AURAL Setup, select desired parameters to transmit to AURAL
- ☐ Check for confirmation message (Setup received, thank you)
- ☐ Inspect all terminals of the printed circuit board and condenser terminals. Make sure all screws are snug.
- ☐ Close the AURAL
- ☐ Disconnect Control Box

Mooring

- ☐ Check anodes
- ☐ Make sure that the pressure sensor cavity is filled with heavy mineral oil
- ☐ Make sure that the AURAL is properly closed
- ☐ Make sure the dummy connector is in place before immersion
- ☐ Make sure all mooring parts are securely installed

Recovery

- ☐ Retrieve AURAL
- ☐ Thoroughly rinse AURAL external parts with fresh water
- ☐ Visually inspect the AURAL
- ☐ Connect Control Box and stop the recording
- ☐ Open the AURAL to retrieve hard disk and data

Basic maintenance

- ☐ Thoroughly rinse AURAL external parts with fresh water
- ☐ Visually inspect the AURAL and change damaged parts
- ☐ Remove and discard old batteries
- ☐ Install new batteries (or battery pack), sacrificial anodes and desiccant bags
- ☐ Install and format the new hard disk

APPENDIX 1- LED'S ERROR CODE

LED's action	Error code in AURAL Setup	Significance
Always lit		Transfer of the last file from the compact flash to the hard disk (when stopping the recording) During the process of setup's configuration, from the power ON until the pulsation of starting.
Always OFF		The instrument is in standby
1 short pulse every 10 seconds		Function normally, sampling in progress
1 long pulse every second		Waiting for the recording start signal
3 short pulses	(0) Normal Termination	Stopped manually
2 short pulses, 1 long pulse	(1) Unable to copy on hard drive	The transfer from the compact flash to the hard disk doesn't succeed
1 short pulse, 1 long pulse, 1 short pulse	(2) Compact flash error	Error on the compact flash
1 short pulse, 2 long pulses	(3) Hard drive error	Error on the hard disk
1 long pulse, 2 short pulses	(4) Hard drive not formatted	Hard disk not or badly formatted
2 long pulses , 1 short pulse	(6) Sys info report hard drive full	Hard disk is full according to sys info
3 long pulses	(7) No more space for directory	Cannot create additional files because the hard disk is full

APPENDIX 2 – GLOSSARY

	DEFINITION
A/D Chip	Analog to Digital converter integrated circuit
AURAL	Autonomous Underwater Recorder for Acoustic Listening
Boot Entry	Space reserved on a HD to inform the PC how to boot the operating system
Byte	One 8 bits element of data
Cell	One unit of battery, in AURAL case, 1 « D » size 1.5 VDC battery
CF	CompactFlash Memory
Com Port	Communication Port (Refer to PC) Rs232 Input/Output Port
ComX	Refer to Communication Port Number
DC	Direct current
Decimal Number	Unit based on power of 10, ex: $10^0=1$, $10^1=10$, $10^2=100...$
Directory Entry	Space reserved on a HD to locate the saved date
FAT32	File system for HD
Format	(In reference to HD) Action of erasing all information on the HD while writing basic structural information.
Gain	Hydrophone amplification level
Gigabyte	1024 Megabytes
GPS	Global Positioning System
HD	Hard Disk
Hertz	Cycle by second
Jumper	Small device used to electrically connect two pins together on a PCB
M1	Model 1 (in reference to AURAL)
M2	Model 2 (in reference to AURAL)
Megabyte	1 048 576 bytes
PC	Personal Computer
PCB	Printed Circuit Board (in reference to the AURAL electronic circuit)
Power 2 Number	Unit based on power 2, ex: $2^0=1$, $2^1=2$, $2^2=4...2^{10}=1024$
RS232	Hardware serial communication standard
RTC	Real Time Clock (in reference to an integrated circuit on the PCB)
Sample	Refer to one recording information, a WAV file is build from a serie of samples taken at regular interval (Sampling Rate). Each sample represents that instant sound level.
VDC	Volt DC
Wave File Header	Structural information Header on a audio WAV file
Word	Two Bytes (16 bits element of date)

MTEAU_____

AURAL S/N

Model

Battery number

Battery rack

Standard _____

Custom _____

Battery pack (option)

D -1.5V _____

Custom _____

About PCB:

Version

S/N

Firmware

About Hard Drive:

Simple _____ Double _____

Brand

1. _____

2. _____

Model

1. _____

2. _____

S/N

1. _____

2. _____

Size

1. _____

2. _____

About Compact Flash

Brand: _____

Size : _____

Hydrophone S/N

Pressure sensor
