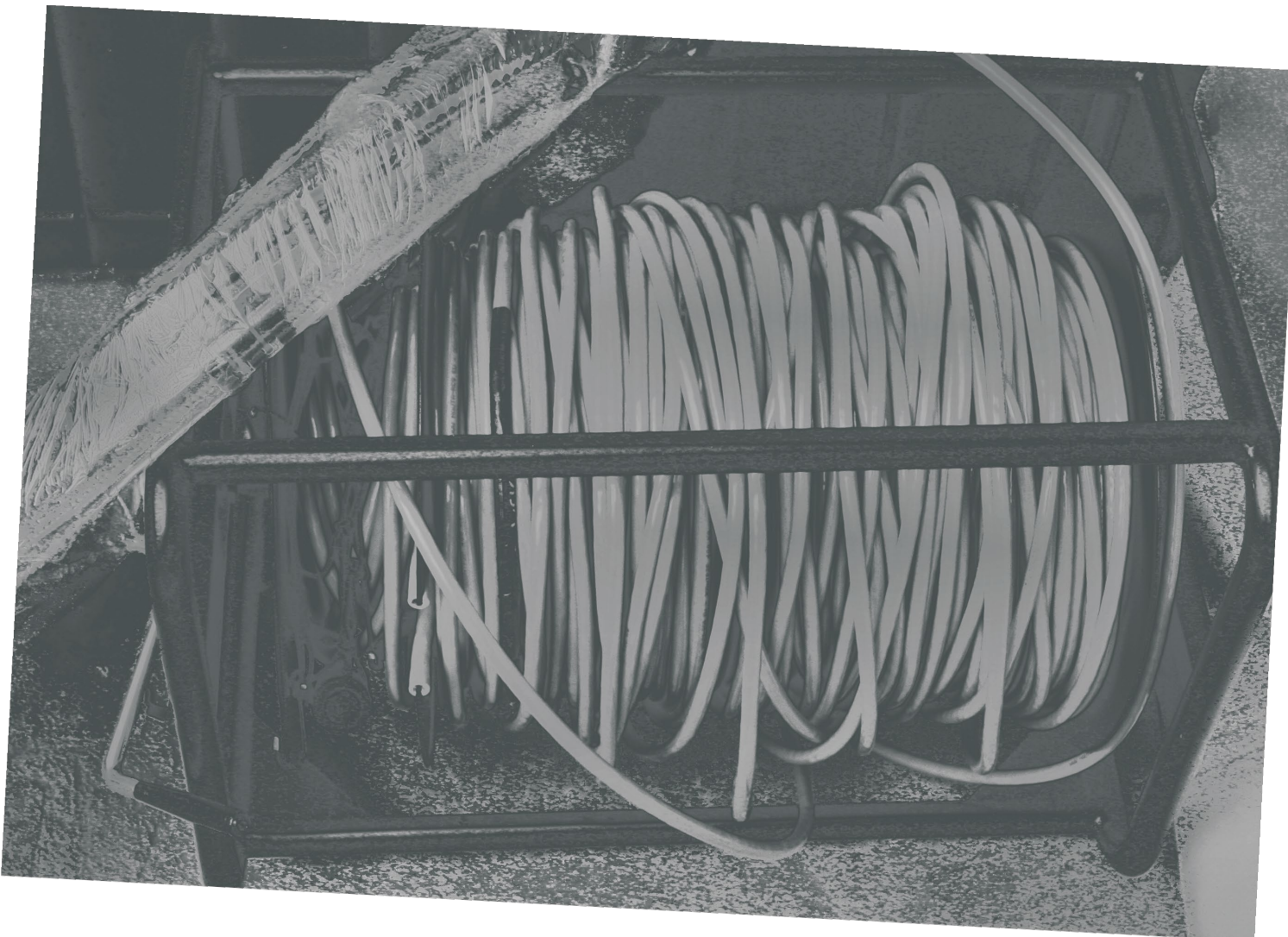


Towed Array of Hydrophones

version 2020 AS-1 - Operation guide



Safety first !

In our experience with small towable hydrophones we never had major nor minor injuries to people or damages to equipment.

Even if unlikely, please remember that the hydrophone pipe and / or the cable could get entangled while in the water.

The cause of entanglement (a net, a cable, a wreck, a plastic bag or whatever) could retain the hydrophone causing the towing cable to withstand **a very high strain**. This strain could lead to a breaking of the strength elements of the hydrophone or worse, to an unexpected movement/snapping of the cable on-board, up to the cable reel and the amplifier/interface.

The cable drum, if any, must be kept on deck, well protected from water and rain, and must always be clear so that it can fall in the water if the cable is, for any serious reason pulled away from the ship when operating it.

The standard operational configuration is therefore with all the cable, up to the cable grip, deployed into the water and the cable drum, if any, in a safe position.

The frame of the cable drum, if used, must be kept well tightened to the ship, so that it can not go into the water while operating on the cable.

Compliance

The product described complies with the European Community directions about electrical safety.

The product is assembled using commercially available items (CE compliant), and hydrophonic sensors produced in the U.S.A. by AFAB - Aquarian Audio & Aquarian Scientific (directly imported and CE compliant).

The system is powered up to the computer interface using standard phantom power provided by the interface itself.

The current system includes a 4-channel interface that must be powered using an external power supply connected to 220VAC, or a custom made supply delivering the same voltage.

All components are approved to follow the ROHS directive.

General use rules to be followed

While the system is produced for scientific use only, and does not have any other application, please consider that local rules regarding the use of towed cables in the water may apply in the seas or the areas in which you plan to use this equipment.

Navigation code and local rules must be strictly followed when using this equipment.

The hydrophone

Your system is assembled using a 250m cable PolyUrethan jacketed and kevlar reinforced (400kg breaking strain).

The towed hydrophone body is made using two short PU pipes containing one sensor each. The sensors are set at a distance of 5m one from the other.

A 10m stabilizing rope attached to the end ring stabilized the arrays when towed.

Each pipe contains two wideband hydrophones, with separate preamps. The preamps have a 400Hz single-pole, high-pass filter. Being a single-pole filter, the frequencies will be attenuated by half at every octave. This smooth filter is set in order to lower the flow noise. The two sensors are 5m from each other.

The pipe is filled with IsoParaffine oil.

Tow speed should be around 3 knots, and the depth of the sensors will depend on the deployed cable, speed, water current, length of the stabilizing rope, height of the deck of the ship.

The hydrophone pipe contains a pressure gauge that delivers the pressure of the sensors to a display kept on-board. The display is powered using AA batteries and ranges from 0 to -400m (which is the range of the pressure gauge). I go without saying that the max reading will be in the range of 230m, which is the length of the cable.

The pressure gauge display has to be connected using the plastic black-and-blue plug at the dry end of the cable.

The dry end of the cable is also terminated with two standard XLR connectors.

Each of them has a clear marking stating the corresponding hydrophone.

Geometry

We call HEAD the end of the hose that faces the ship, and TAIL the free end in the water.

The hydrophone is a two-element array, with a fixed 5 meters distance between hydrophone elements.

The hydrophones are firmly kept in position by means of kevlar lines running along the hose.

The hydrophones and preamps are well visible in the hose, while other spacers help to keep the shape of the hose and compensate the movements.

The hose is a thin wall PU pipe.

The oil contained in the hose is a IsoParaffine with high flash-point.

The cable is made of a polyurethan coated cable with 2 shielded twisted pairs for signal, one pair for 4..20mA loop, two cables for extra powering. A short sample of the cable is included for reference.

An additional kevlar fibre (breaking strength approx. 400kg) keeps the cable as inextensible.

Please mind:

When you connect a computer to the USB port and to the MIC outputs of this hydrophone, noise could derive from the computer's power supply.

This kind of equipment is sensitive to interferences deriving from sources like VHF, radar, ground loops and engines.

Experience a little with grounding this equipment before using on operation.

Two cable grips (called "Chinese fingers") are installed on the cable and allow safe towing. The grips are the only points at which the link from the boat to the cable must be applied. The cable grips are installed at different distance from the hydrophone body, to facilitate the towing with two different configurations. Grips can be moved along the cable first removing the shrinking sleeve and then re-applying some tape when in the new position.

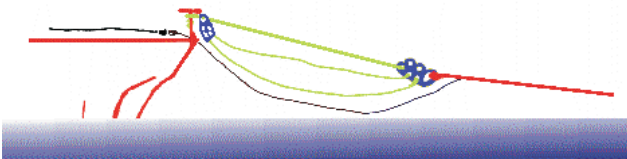
Operations

The hydrophone must be deployed while the boat is slowly moving (2knots).

The rope tail must first go into the water, followed by the sensors and the cable needed.

The deployment must be done with the cable disconnected from the amplifier.

Once that the cable is in the water and that a cable length is set (the recommended option is with all the cable deployed), the cable must be tied as described later, and the connectors can be plugged into the interface.



Towing

When towing please use some elastics [yellow in the drawing] in order to smooth the ship's movements propagating along the cable.

The elastics can be in different lengths in order to obtain a progressive retainment of towing. Firmly attach the elastics and a loose extra rope to the ship.

The electrical connector must be kept on-board well protected from water.

Use the installed cable-grip to link the elastic to the boat.

For safety reasons, in case of emergency, you should always be prepared to release the towing. To be prepared to release the towing you should tight the towing to the boat via a safety release.

Should the connectors go in the water they must be immediately washed shortly in freshwater and then opened and carefully dried at best. A replacement of the connectors should also be considered.

Periodical greasing of the connector will limit oxidation.

To obtain a temporary grip at the desired length you will have to use a spiral knot as this in the pictures. This will help distributing the towing load over several centimetres of the cable.



On operation

The two hydrophones contained in the hose will allow you to determine the direction from where an underwater sound is arriving, by ear, using the headphones, or using a software like Ishmael or PAMguard (to obtain separately).

Sounds in the water will be heard arriving from different directions.

Listener's perception of the sound source direction (according to the delay in the sound received at the two ears) will give the course to the source.

There will always be a left/right ambiguity, that will be solved manoeuvring the boat while approaching the animals.

With experience the user will be able to direct the boat to the vocalizing animals.

It is not possible to determine which will be the best operational depth in your conditions, but you will easily find, with time, the best depth for your detection aims and target species.

Due to physical reasons the best depth for acoustic propagation changes according to seasons.

