Aquarian Audio
H1a Hydrophone User's Guide

Thank you for purchasing your *Aquarian Audio* H1a hydrophone. This hydrophone is designed to provide high-quality audio performance in a low-cost device. It is very durable and will interface directly with high-impedance microphone or guitar preamps. It offers very good sensitivity and low noise in the human auditory range. The H1a's streamlined shape and high specific gravity will help to maintain a low working depth in a moving water column. Its compact size and the easy hand of its cable make it very portable and simple to use.

Using the H1a

The H1a utilizes a passive piezo sound pickup. There is no preamp or impedance buffer circuit within the hydrophone. The advantages are that the hydrophone remains as simple and low cost as possible, it does not require any power, and it offers a very wide dynamic range. System gain and input impedance must be considered while choosing a preamp.

System gain is the amount of signal amplification required and will depend on the amplitude of the sounds that you are attempting to monitor, as well as what you are doing with the output. Generally speaking, if you are driving headphones or a line audio circuit, or working with a computer sound device, you may require 20 dB of gain for industrial monitoring, 40 ~ 50 dB for listening to cetaceans and large aquatic wildlife, and 60 dB or more for very distant or faint sounds.

Input Impedance is the amount of load that your preamp puts on the hydrophone. The low-frequency response of a piezo transducer, such as that used in the H1a, will be limited by the input impedance of the preamp. Higher input impedance will give you an extended low-frequency response. This relationship can be calculated for the H1a with the following formula:

$$Fc = 1 / 0.000000157 * R$$

Fc is the frequency at which electrical output is 3dB down from nominal and *R* is the input impedance of your preamp. Therefore, using a preamp with an input impedance of 300 Kohms will give you a low-frequency cutoff of 20 hertz—the low end of what humans can hear. A preamp with an input impedance of 100 Kohms might work well for the PA system on a whale-watching vessel, giving a *Fc* of 64 Hz, which is compatible with the capabilities of most speaker systems. The higher *Fc* might also help filter the extreme low frequency noise of the hydrophone rising and falling in the water as the boat moves on a swell.

¼" TS output (standard): If the numbers above are not obvious to you, just try to take note of whether any audio input is labeled "Hi-Z" or similar. Audio components that are built for electric guitars, such as combo amps, DI boxes and many USB audio interfaces are likely to work. Do note that not all will offer adequate gain for use recording very low-amplitude or distant sounds in quiet water, as guitars typically emit a stronger signal than hydrophones. The same ¼" jack is often used for line-level balanced and unbalanced signals. These types of inputs often found in mixing consoles and many digital recorders will not offer adequate sensitivity for the hydrophone and will likely filter low frequencies due to impedance mismatch. It is very unlikely that you will damage either the hydrophone or preamp by trying it.

BNC output (optional): BNC connectors are typically used on high-impedance amplifiers, such as specifically built for hydrophones. It is also the most commonly used connector in test and measurement devices, such as oscilloscopes, spectrum analyzers, and more generalized data acquisition devices (DAQs). Nearly all of these devices will offer very high input impedance. In fact devices like these with input impedance exceeding 1Mohm and DC input coupling could experience problems with pickup of high levels if infrasound noise from acceleration and temperature change. If the signal from your hydrophone

seems to cut out when the hydrophone is moved, this is probably a result if infrasound distortion and input impedance may need to be lowered.

Hydrophone care

No special care is required for the H1a. It is designed to withstand corrosion and the impact of accidental drops, but making an attempt to keep the output plug clean and dry and avoiding unnecessarily rough handling will help to ensure the long-term stability of the product. It is best not to store the hydrophone in a waterproof enclosure. Doing so will trap moisture, salts and minerals that are left on the hydrophone and cable after deployment and increase corrosion problems with the output plug. Making an extra effort to coil the cable nicely when retrieving the hydrophone will help avoid problems with tangles as the cable ages. Most importantly, protect the cable from cuts and abrasions! The cable chosen for this application was designed to be compact and easy to use. This unfortunately comes at the expense of ultimate durability. Kinking the cable, walking on it, or dragging it over a sharp or abrasive surface may damage the cable sheath and eventually cause the hydrophone to fail. Both aquatic and terrestrial animals may attack the cable in an unattended application. Using some kind of cable shroud, such as plastic tubing, can help protect the hydrophone with long-term installations.

Specifications

The H1a is intended to be a lower-cost alternative to military and lab-grade hydrophones. Deriving high sensitivity and low noise from lower-cost components were made a priority over maintaining strict tolerances. These specifications are typical of a limited sample group and are not guaranteed. They are for basic comparison information only.

Sensitivity:	-185dB re: 1V/μPa	(+/- 4dB 20Hz-4KHz)
Useful range:	<1 Hz to >100KHz	(not measured above 100KHz, approximate sensitivity @100KHz = -220dB re: 1V/μPa)
Capacitance:	20nF	
Polar Response:	Omnidirectional (horizontal)	
Operating depth:	<80 meters	

Physical:		(cable and output plug excluded)
Dimensions:	25mm x 46mm	
Mass:	105 grams	
Specific Gravity:	5.3	