



Aquarian Audio Products

H3 Hydrophone User's Guide

Thank you for purchasing your *Aquarian Audio Products* H3 hydrophone. The H3 uses a unique high-sensitivity, dual-sensor, mechanically-balanced transducer assembly that offers exceptional signal-to-noise performance in the human auditory bandwidth. The fully-shielded design inherently rejects EMI and RFI noise, making it useful in the studio, lab or shop. It's low mass and full polyurethane rubber encapsulant makes it highly resistant to damage caused by impact. Its small size allows users to fish it inside of pipes and other tight spaces, making it excellent for leak monitoring. Though designed primarily for underwater listening, it is also useful as a waterproof microphone for tool room applications, such as monitoring cutting in waterjet and other CNC tooling.

Using the H3

The H3 is sold in two primary configurations and can be purchased with various options for output connectors:

H3 and H3b are passive devices. The standard configuration is terminated with a 1/4" TS plug, making it compatible with many high-impedance audio devices, such as guitar amplifiers or computer sound interfaces. The "b" configuration is terminated with a standard male BNC connector, useful for connecting to various test and measurement equipment. Each of these require a high-impedance amplifier to maximize bandwidth and minimize noise. 50 to 60 dB of adjustable gain is useful for common audio applications.

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 H3, 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 H3 with the following formula:

$$F_c = 1 / 0.000000094 * R$$

F_c is the frequency at which electrical output is 3dB below nominal and R is the input impedance of your preamp. Therefore, using a preamp with an input impedance of approximately 500 K Ω will give you a low-frequency cutoff of 20 hertz—the low end of what humans can hear. Many high-impedance audio preamps have input impedances of 1M Ω or more. Test equipment, such as oscilloscopes and spectrum analyzers have typical input impedances of 10M Ω or more.

H3m and H3x configurations include an impedance buffer amp that is built into the hydrophone, which make them compatible with standard consumer and professional microphone circuits. The "m" configuration is terminated with a 3.5mm "mini" stereo (TRS) plug that is wired with the tip and ring shorted. This is compatible with nearly all consumer microphone circuits, such as those used in hand-held recorders, computer sound interfaces, and many video devices. **Plug-in-power (PIP) is required** and may need to be switched on in your device.

The "x" configuration is terminated with a standard (full-sized) XLR male connector. These are typically used in professional-quality mic preamps, including those built into digital recorders and PA systems. **Phantom power is required** and may need to be switched on in your device. Any common phantom voltage will work.

Please note that the H3x is a single-ended output. The XLR connector is a 3-pin device that is typically used for balanced transmission lines. Pin 1 is typically ground, pin 2 carries the signal. Pin 3 most often carries an inverted signal, but in all balanced cables has an signal impedance that is equal to Pin 2. Receiving circuitry in the preamp then cancels signals that are common to both lines—primarily electrical noise induced into the cable. With the H3x, pin 3 is left unconnected. It is a simple output plug variation of the H3m that takes advantage of the very wide bias supply range of the included buffer amp. This single-ended configuration saves power and complexity and works well with nearly all microphone inputs. The hydrophone is very well shielded and common-mode noise is not really an issue in most hydrophone applications. If you have one of the few recorders or mic preamps that will not tolerate a single-ended load well, we recommend buying the H3b and using the Aquarian PA4 preamp.

The H3 hydrophone can be optionally assembled with our WT150g sliding stainless steel weight assembly for sinking the hydrophone. There are several advantages to placing the weight on the cable, rather than building it into the hydrophone. When the hydrophone is dropped, the cable flexes and deflects that impact away from the hydrophone. The weight can be moved if needed to allow insertion into a pipe. Both of these attributes are especially useful to the leak detection specialist. Moving the weight away from the hydrophone dampens acceleration noise that is transmitted down the cable from handling and it also minimizes response irregularities caused by material resonances and sound reflections. To move the WT150g weight, turn the black plastic thumbscrew counter-clockwise to loosen the the internal rubber compression sleeve and slide the weight where needed. Wet the cable if this is difficult. Secure again by turning the thumbscrew clockwise. **Be Advised:** Finger-tighten thumbscrew only and always leave a minimum spacing of 5cm (2 in.) between hydrophone and weight!

Hydrophone care

No special care is required for the H3. 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 H3 uses a custom-made cable with a very durable urethane jacket. However, it is also designed to be compact and flexible. 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 in long-term installations.

Specifications

Sensitivity:	-192dB re: 1V/ μ Pa	(+/- 5dB 20Hz-10KHz) H3m and H3x versions may have improved sensitivity, dependent on the bias voltage and input impedance of the preamp with which they are used.
Useful range:	<10 Hz to >100KHz	(not measured above 100KHz, approximate sensitivity @100KHz = -230dB re: 1V/ μ Pa)
Polar Response:	Omnidirectional	<10KHz
Operating depth:	<80 meters	
Operating temperature:	-10 to 65 Celcius	
Nominal Capacitance:	15nF	H3 and H3b configurations
Output impedance:	2.2 K Ω	depends on mic preamp
Power:	0.6 mA	depends on mic preamp

<u>Physical:</u>		(cable and output plug excluded)
Dimensions:	17mm x 32mm	
Mass:	10 grams	
Specific Gravity:	1.3	