



Aquarian Audio

H3n Hydrophone User's Guide

H3 product family overview

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. Its low mass and full polyurethane rubber encapsulant make 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 finding. Though designed primarily for underwater listening and leak finding, it is also useful as a waterproof microphone for tool room applications, such as monitoring cutting in waterjet and other CNC tooling¹.

The **H3nP** and **H3nB** are sold as passive hydrophones, terminated with 1/4" TS and BNC output plugs respectively. These can be useful with DAQ and test equipment or high-impedance audio preamps. **H3dM** and **H3dX** configurations include signal conditioning that is built into the hydrophone, which make them compatible with standard consumer and professional microphone circuits. They are identical, other than the output connector. The "n" in the part number designates the signal conditioning board used—in this case, none. The piezo sensor array is connected directly to the cable. Please reference correct manual for each version.

The H3 hydrophone can be optionally assembled with our WT150g sliding stainless steel weight assembly for maintaining negative buoyancy. 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 absorbs any stress from impact, making the hydrophone more durable. The weight can be moved if needed to allow insertion into a pipe. Both of these attributes are especially useful to the leak finding 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. It can also be used for mounting a shroud tube to minimize flow noise over the hydrophone. To move the WT150g weight, turn the black plastic thumbscrew counter-clockwise to loosen 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!

Using the H3n

When using a passive piezo sensor, input impedance of the hydrophone preamp should be considered. Impedance is the 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 result in extended low-frequency response. Very low frequency response can be troublesome because it is most often noise from acceleration or thermal change, or sound that is dominated by machinery, so it is often desirable to filter low frequency using the input impedance of your amplifier. If your hydrophone response is unstable (seems to be cutting out) it is very possible that you are saturating the input of your preamp with infrasound.

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, measured in ohms (Ω). 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.

¹ Aquarian does not guarantee compatibility of rubber and plastic materials used in its hydrophones for anything other than natural aquatic environments. Prospective users should test compatibility with machine coolants and lubricants in production environments.

Hydrophone care

No special care is required for the H3dM. 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 corrode the output plug. Making an extra effort to coil the cable neatly when retrieving the hydrophone will help avoid problems with tangles as the cable ages. Most importantly, protect the cable from cuts and abrasions! The H3d 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 conduit, such as plastic tubing, can help protect the hydrophone in long-term installations.

Specifications

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| Sensitivity: | -192dB re: 1V/ μ Pa | (+/- 5dB 20Hz-10KHz) |
| 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 | |
| Physical: | | (cable and output plug excluded) |
| Dimensions: | 17mm x 32mm | |
| Mass: | 10 grams | |
| Specific Gravity: | 1.3 | |