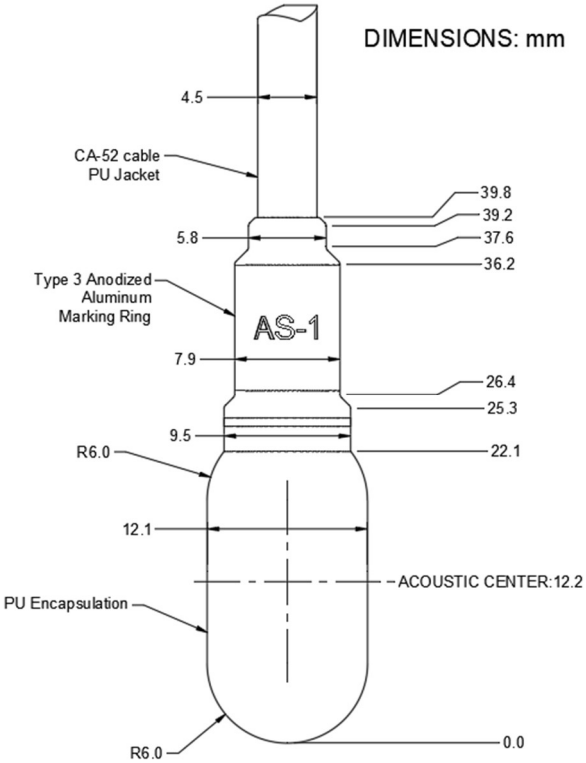
AQUARIAN AS1

Broadband measurement hydrophone



PRODUCT DATASHEET

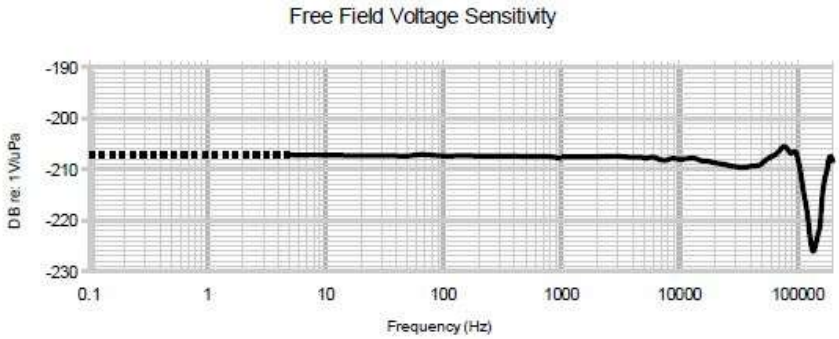
Aquarian AS1 Scientific Hydrophone

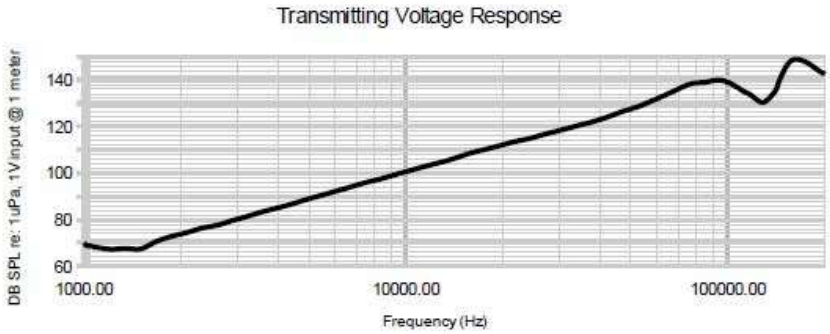
The AS-1 is designed to provide maximum sensitivity in a small size while also providing a linear response in the bandwidth of the highest-quality commercial digital sound recording interfaces. Response is omnidirectional in the human auditory bandwidth, as well as omnidirectional in the horizontal axis at all frequencies (theoretical). Given these qualities, the AS-1 is well-suited for absolute underwater sound measurements in marine and industrial environments. It can also be used as an omnidirectional reference projector.
Use directly with your scope or DAQ device or use with the PA6 preamp and any digital recorder or sound interface for high-quality, low-cost underwater sound analysis.
Fitted, breathable EVA case included with cable lengths of 20 meters or less (longer cable assemblies will not fit in case and will be bulk shipped in allowable packaging).

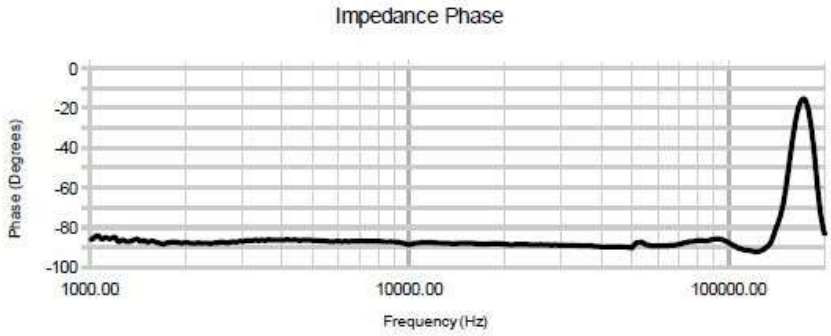
- Linear range: 1Hz to 100kHz ±2dB
- Receiving Sensitivity: -208dBV re 1µPa (40µV / Pascal)
- Transmitting Sensitivity: 140dB SPL re 1µPa, 1Vrms input at 1meter, 90kHz
- Maximum Input Voltage: 30V p-p (continuous); 150V p-p (<10% duty cycle, <100KHz)
- Horizontal Directivity(20kHz): ±0.2dB
- Horizontal Directivity (100kHz): ±1dB
- Vertical Directivity (20kHz): ±1dB
- Vertical Directivity (100kHz): +6dB -11dB
- Operating depth: 200m
- Survival depth: 350m
- Operating temperature range: -10°C to +80°C
- Nominal capacitance: 5nF +/- 15% (plus cable @ 118pF/m)
- Output connection: BNC (standard)
- Size: 12mm D x 40mm L
- Weight (in air): 8g (plus cable @ 28g/m)
- Cable length: 10 meters standard. Any length on request.
- Cable Jacket: Polyurethane, OD: 4.5mm
- Encapsulant: Polyurethane

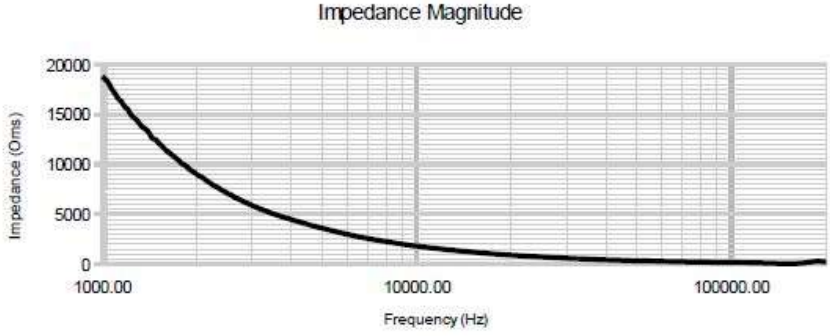
PRODUCT DATASHEET

Aquarian AS1 Scientific Hydrophone









FFVS: Nominal 5Hz – 100KHz, -207.6 (+2.1 / -2.0) dB re: 1V/uPa. Not tested (theoretical) below 5Hz.

PRODUCT DATASHEET

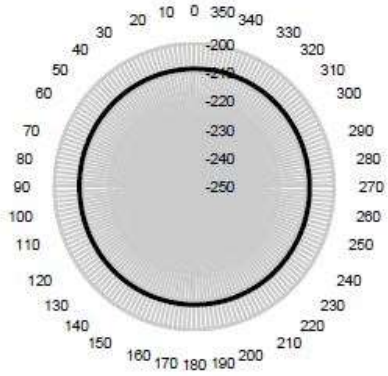
Aquarian AS1 Scientific Hydrophone

Aquarian Scientific
1004 Commercial Ave. #225
Anacortes, WA 98221 USA
www.aquarianscientific.com

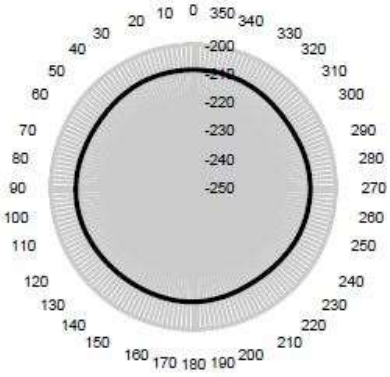
AS-1 hydrophone

SN#: (typical)

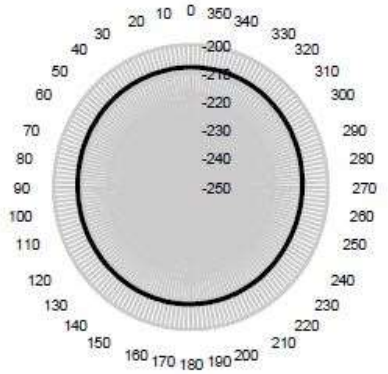
Directional Response, 20KHz XY (Horizontal)



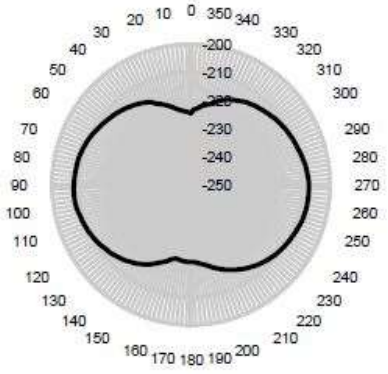
Directional Response, 20KHz XZ (Vertical)



Directional Response, 100KHz XY (Horizontal)



Directional Response, 100KHz XZ (Vertical)



NOTES:
Data obtained from US Navy, Underwater Sound Reference Division, Newport. Average of three samples measured, June 2013.

Measurements taken at end of 9-meter cable

FFVS Low frequency response is limited by amplifier input impedance. Fc= 1/4.71e-8(amplifier input impedance) – Approximately 1Mohm for 20Hz cutoff; 22Mohm for 1Hz; 220Mohm for 0.1Hz.

Directional Response: Hydrophone rotated on same axis as the cable for XY measurements. XZ measurements are made with rotation perpendicular to the cable and with origin (0 degrees) facing end opposite the cable.

The preceding specifications were obtained from the average of a limited sample group and were measured at the end of 9-meter cable lengths. The AS-1 is not individually calibrated. Standard quality control allows for a +/- 3dB deviation of nominal sensitivity plus measurement error with compensation for cable attenuation. Thus, any given AS-1--especially those with longer cable lengths--can deviate from the published specifications. Aquarian Scientific attempts to represent its products fairly, but no guarantee of compliance is offered.

Options Detail:

WEIGHT:

No Weight: Hydrophone is close to neutral buoyancy.
Weight installed: 150-gram adjustable cable weight. Secured to cable with compression thumbscrew. Permanently installed but can be moved up and down the length of cable and locked into desired position. Assists in sinking the hydrophone and dampens vibrations in cable. Low-drag shape. Placing mass on the cable (rather than on the hydrophone) minimizes acoustic reflections and minimizes the likelihood of damage to hydrophone when dropped. Weight can also serve as a point to clamp flooded rubber tube for control of flow noise around hydrophone while towing. Stainless Steel with rubber collet and plastic thumbscrew. OD = 25mm.

CABLE LENGTH:

Cable length is easily modified. 10-meters is the base length. For longer cables, please ask your seller. Please note that, with very long cables, output will be attenuated due to loading from cable capacitance. Keep cable length between AS-1 and preamp, such as PA6, to a minimum for best performance. Cable lengths of more than 30 meters are not recommended.

CALIBRATION:

Standard QC includes**:** Nominal Sensitivity (+/- 2dB accuracy), capacitance, leak test and listening test.
Calibration services can be provided by the US Navy Underwater Sound Reference Division. Typical calibrations are done in their open tank facility and include 1-200KHz free-field voltage sensitivity and transmit voltage response (1/12th octave resolution), and

directional response at 50KHz (horizontal and vertical, 10 degree resolution). Cost for this service must be quoted at the time of your order.

User Manual

AS-1
Aquarian Scientific Broadband Measurement Hydrophone

Thank you for choosing the Aquarian Scientific AS-1 hydrophone. The AS-1 is designed to provide maximum sensitivity in a small size while also providing a linear response in the bandwidth of the highest-quality commercial digital sound recording interfaces. Response is omnidirectional in the human auditory bandwidth, as well as omnidirectional on the horizontal axis at all frequencies (theoretical). Given these qualities, the AS-1 is well-suited for absolute underwater sound measurements in marine and industrial environments. It can also be used as an omnidirectional reference projector.

The standard AS-1 is a passive piezo device and thus will require an amplifier with high input impedance to achieve the best low-frequency response and noise performance. The low frequency cutoff (Fc-HP) is determined by the total capacitance of the hydrophone and cable and the input impedance of your amplifier. A typical 1MΩ audio interface will result in a Fc-H P of approximately 30Hz. To find the input impedance (Z) required for your low-frequency bandwidth of interest, use this formula: Z=1/(0.000000038*Fc-HP). Note that this equation is approximate and based on the use of a 9-meter cable but should be adequate for all typical configurations and use with common voltage-mode amplifiers. Using very high input impedance amplifiers will allow the AS-1 to monitor sounds of well under 1Hz. Keep in mind though that most audio equipment is designed to filter infrasound and you can not hear it.

Using an amplifier with excessively high input impedance may only increase susceptibility to noise.

Your amplifier may also need 60dB of gain or more for effective monitoring of bioacoustic sound sources. You can use it directly with the high-impedance input of common USB sound interfaces for monitoring loud sounds, such as pile-driving operations. Receiving sensitivity of hydrophones is not an intuitive specification to most users and the details of calculating the AS-1's output for any given source level are beyond the scope of this document. A few things to keep in mind though is that underwater sound is commonly referenced to a pressure of 1uPa, rather than the typical 20uPa for which terrestrial sound is referenced.

Sound intensity is also different underwater. The result is that dB measurements in water are typically much higher than those in air. Very loud sounds in water can be 200dB or more. A receiving sensitivity of -208 dB, ref: 1V/uPa also equals 208 dB SPL for a 1V RMS output. Or, to convert to specifications familiar to microphone users, it has a sensitivity of -88dBV or 40uV/Pa. There are convenient calculators on the Internet to help with calculating the output of the hydrophone at a given sound pressure level. Search terms such as “dB conversion”.

Also feel free to contact us for tech support with your specific questions.

Use and Care:
Be very careful to avoid rough service with this instrument. As compared to measurement tools of this kind, the AS-1 is a rugged device. The sensor is encased within a solid brass fixture to relieve much of the stress from impact of dropping it. But by its nature, it can not be sensitive to minute pressure variations in the water and still be structurally resilient against crushing or cracking the sensor element if it were to be stepped on. Similarly, we use a topquality polyurethane cable jacket material to minimize damage from cuts and abrasions to the cable. But it is also designed to be lightweight and flexible even in the coldest conditions. If deploying this hydrophone in long-term installations, take all precautions practical to protect it from storm stresses and biological damage. Route the cable through a hard conduit and put a cage around the hydrophone if possible. Also try to avoid prolonged UV exposure and try to keep the connector dry and clean to minimize corrosion.

Options:
The AS-1 can be made to order with any cable length. We recommend keeping the cable length less than 30 meters if possible for the best bandwidth and sensitivity. Adding a balanced preamp in-line will improve performance with remote installations and often save money by allowing the use of a cheaper transmission cable.

Factory quality control includes a pressure test of a minimum two hours at 30 meters equivalent water depth, a capacitance tolerance measurement, an in-air sensitivity comparison to a calibrated reference (passed if within +/- 3dB of mean; <+/-2dB typical), and a listening test. The AS-1 can also be sold with a precision calibration from the US Navy Underwater Sound Reference Division.

The AS-1 is close to neutral buoyancy. Only the modest cable weight will sink the hydrophone. This hydrophone can also be assembled with our WT150g sliding weight. Attaching the weight to the cable, rather than to the hydrophone itself has two primary benefits: It can be moved out of the way when the hydrophone needs to be installed through a small cavity or when minimizing all acoustic reflections and resonances is critical. It also protects the hydrophone by minimizing the mass attached to the sensor when dropped. This weight can be moved by loosening (CCW) the black plastic thumb screw. Tighten again to secure in your desired location.

Specifications:

- Linear range: 1Hz to 100kHz ±2dB
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- Nominal Transmitting Sensitivity: 140dB re 1µPa, 1Vrms input at 1m, 90kHz
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- Output connection: BNC (standard)
- Size: 12mm D x 40mm L
- Weight (in air): 8g (plus cable @ 28g/m)
- Cable length: 9 meters standard. Any length on request.
- Cable Jacket: Polyurethane, OD: 4.5mm
- Encapsulant: Polyurethane