Hydrophones
Characterized, Calibrated, Plus Ongoing Traceability

Seamap’s state of the art design enables customers to re-calibrate hydrophones onboard. This significant development in technology contrasts with hydrophones that boast inbuilt memory capability but actually only ever provide derived data stored at time of manufacture.

Seamap’s groundbreaking design utilizes an in-built EEPROM memory device and thermometer to enable ongoing verification of data at chosen future intervals. This up-to-date data, collected by the customer at a time of their choosing, will be stored in the hydrophone memory and can be accessed at a later date to provide traceability. This extra functionality will negate unnecessary hydrophone wastage and assist with preventative maintenance of equipment.

A hand held ‘Verification and Re-Calibration Unit’ is available to customers for ongoing verification and re-calibration of hydrophones onboard the vessel. This unit contains a reference calibrated sound source and hydrophone to facilitate the calibration of the test subject. The hand held unit can be periodically sent off to Seamap for re-calibration, but this would only be necessary once a year at most.

GunLink software enhancement has already been planned by Seamap. Future developments will enable the software to access the EEPROM and thermometer in real-time, offline or online, display the calibration information within the GunLink GUI, and make compensation adjustments for temperature variations. This streamlined approach between GunLink and Seamap’s hydrophone range will improve reliability.

Each hydrophone, specifically designed for near field monitoring of air guns in the marine seismic environment, is characterized against a reference. The PCB memory stores this data. Characterization is performed as part of the design proving. The characterization will detail the full and exact performance of the product over a wide frequency range, temperature range, and will simulate a series of stressful shock and vibration scenarios.

Calibration will be performed at manufacture on each individual production run unit. Each Seamap hydrophone will be calibrated at a frequency over 10Hz – 500Hz. The data from this calibration is stored in the EEPROM memory on the PCB.

• EEPROM memory device and thermometer inside the hydrophone enable automated GunLink Software adjustments in real-time.
• User can check hydrophone calibration over the frequency band of 10Hz-500Hz with immediate pass or fail results.
• Calibration data can be uploaded to PC via USB.
• Ongoing traceability feature on 4 pin hydrophones allows updated calibration data to be written to the EEPROM memory device inside the hydrophone for future reference.
• Acoustic sensitivity of 10V/bar @ 20°C (200dB +1.5dB re 1 uPa)
• Capacitance nominal 10nF @20°C.
• Peak pressure pulse 20 bar-m max.
• Static pressure rating 50 bar max (500m water depth).
• Flat response from 1Hz up to 5KHz.
The units are robust and designed to remain stable in response both over time and over a wide range of acoustic exposure. Ongoing verification and re-calibration, performed by the customer, will trace any drift in capacitor induced by excessive use in the field. This live data can be verified on a project by project basis improving reliability and reducing downtime through the identification of faulty units.

Seamap Hydrophones have been independently verified by our partner and in extensive field trials.

Seamap hydrophones are fully functional with the GunLink 4000 or 2500 digital source controller, but can be purchased as a stand-alone product offering a clean signal and precision auto fire detection, even with small air leaks.

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### GPM XT Specifications:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>10V/bar @ 20°C (200dB+-1.5dB re 1 uPa)</td>
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<tr>
<td>Capacitance</td>
<td>Nominal 10nF @20°C</td>
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<tr>
<td>Peak Pressure Pulse</td>
<td>20bar-m</td>
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<tr>
<td>Static Pressure Rating</td>
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<tr>
<td>Flat Response</td>
<td>From 1Hz up to 5KHz</td>
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<tr>
<td>Phase Shift/Distortion</td>
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<tr>
<td>Operating Temperature</td>
<td>10°C to +50°C</td>
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<tr>
<td>Storage Temperature</td>
<td>-30°C to +70°C</td>
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<td>Nominal Operating Depth</td>
<td>6-15m</td>
</tr>
<tr>
<td>Maximum Depth</td>
<td>Survives up to 500m</td>
</tr>
<tr>
<td>Mount</td>
<td>Integrated or Non-integrated</td>
</tr>
<tr>
<td></td>
<td>Omni-directional</td>
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</tbody>
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**NON INTEGRATED (CABLE TYPE):**

- 2 Pin connector. With 3m cable. (part # 02-94-2395)

This 2 pin Hydrophone can be used retrospectively with any GunLink 2000 or 4000 system. Seamap can supply any connector combination to suit customer array cabling.

- 4 Pin connector. With 2m cable with traceability features. (part # 02-94-2390)

**INTEGRATED (BULKHEAD TYPE) - FOR DIRECT MOUNT TO A GFSM:**

- 4 Pin connector with traceability features. (part # 02-94-2389)
**Verification and Re-Calibration Unit: Part #02-94-2418**

- Allows operation remotely in a hand held configuration.
- Tolerant to salt spray and rain, and general operation at sea, outdoors.
- -10°C to 35°C Operating Temperature.
- Checks the calibration of Seamap hydrophones over the frequency band of 10Hz – 500Hz.
- Logs the calibration data and has the ability to upload this data to PC via USB interface.
- Provides immediate pass or fail information to the user.
- Built-in calibrated reference hydrophone, accurate to +/-0.1 dB.
- Acoustic measurement accuracy of, at least, +/-0.5dB from 10-200Hz and +/-1dB up to 500Hz.
- 4 Pin Type has the same acoustic interface, but also interfaces to the hydrophone PCB, which is a single line EEPROM. This allows; reading from, and writing to, the EEPROM memory inside the hydrophone.

The Hydrophone Verification and Re-Calibration Unit can be used for all Seamap hydrophone variants. A short jumper cable is provided in order to adapt between 4 pin and 2 pin hydrophone types. The unit has the capability of reading from and writing to the EEPROM inside the 4 pin hydrophones. The USB-A connector with standard pin out allows programming of the processor and uploading and downloading of data.

The unit is simple to operate. The user plugs in the test hydrophone and sets the mode to automatic or manual. In automatic mode the calibrator automatically calibrates the hydrophone with a preset program and stores the data in the memory and also in the hydrophone EEPROM. The automatic mode can be programmed via the USB interface. In manual mode the user selects a frequency and pushes the power switch to get a readout response. The user controls include a potentiometer knob to control frequency for the manual mode, and a push button switch (on only while being pushed), for running the manual signal, or starting the automatic calibration.

The Hydrophone Verification and Re-Calibration Unit has a display for frequency shown in Hertz, and a display for voltage given in dBV. The latter will typically be given in dBV referenced to the internal reference and will therefore be a measure of the hydrophone's sensitivity. In the manual mode, when the unit is not connected to another device, the display will show sound pressure level in the calibrator, such that the user can determine if the system is giving the correct output.

Power is supplied via battery which can be recharged via the USB port. The hand-held unit is supplied in a carry case.
Seamap Hydrophone fitted to the Gun Firing and Sensor Module (GFSM).