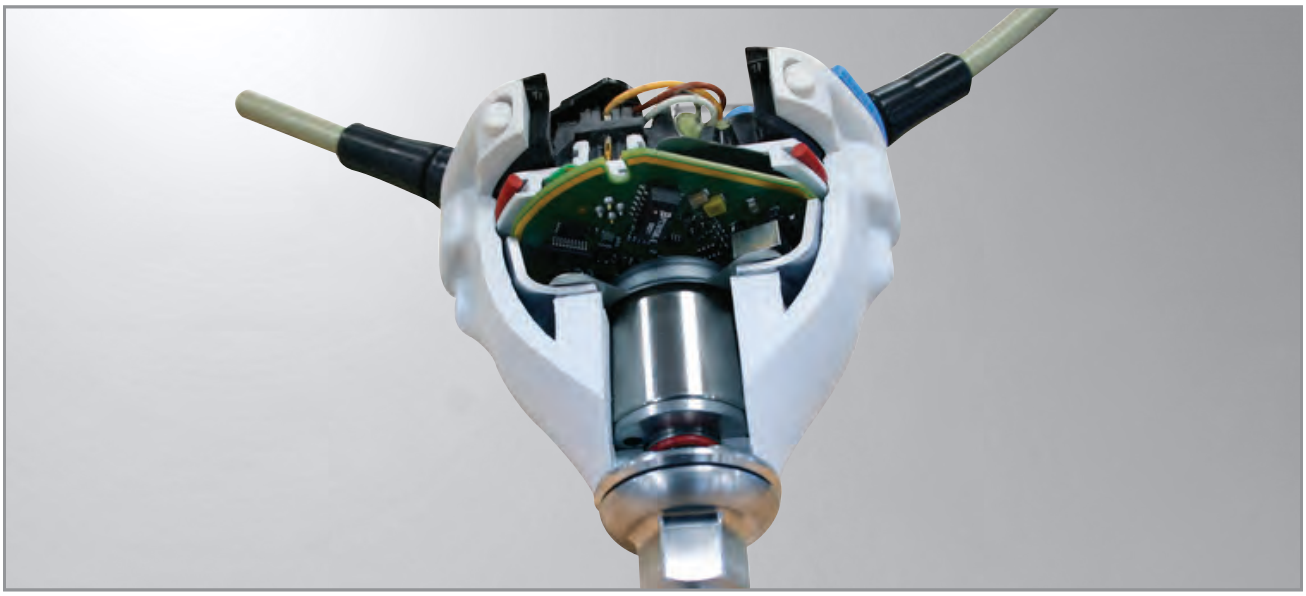
UniQ

WesternGeco

# UniQ INTEGRATED POINT-RECEIVER LAND SEISMIC SYSTEM

## Geophone Accelerometer (GAC)



The Schlumberger UniQ* integrated point-receiver land seismic system geophone accelerometer (GAC) is a motion sensor with significantly reduced signal distortion and increased bandwidth. This is achieved by combining our proprietary 18-Hz geophone with additional electronic circuitry.

### HOW THE GAC WORKS

- A geophone element is connected across the input of an operational amplifier (OpAmp) circuit. A feedback resistor connects the OpAmp circuit output to the geophone element (Fig. 1).
- If the GAC coil moves within its magnetic field, the voltage it generates is detected by the OpAmp circuit, which responds by sending a current back through the feedback resistor, heavily damping the coil movement.
- Because the force necessary to hold the coil stationary is proportional to the coil acceleration, the output voltage of the GAC device represents the earth motion expressed as acceleration.
- As the coil movement is reduced by more than an order of magnitude, the associated signal distortion is also reduced by more than an order of magnitude.
- The GAC negative feedback loop widens the pass-band of the signal it controls. An 18-Hz tilt-indifferent geophone becomes an accelerometer with the -3-dB point below 2 Hz.
- An 18-Hz geophone was chosen because of the stiffness of the springs and the reduced coil displacement. This will allow it to work in any orientation and to still optimize the characteristics of the pass-band.

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## THE GAC ADVANTAGE

**Reduced Distortion**: By reducing coil movement, the GAC avoids the major sources of signal distortion that affect conventional geophones.

- When a conventional geophone coil moves, the springs supporting it are stretched from their static position; all springs have non-linearities that result in distortion in the output signal. Additionally, the coil shifts away from its resting position in the magnetic field created by the permanent magnets. Because the field is not completely uniform, the further the coil moves from its center point, the greater the signal distortion.

**Wide Frequency Pass-Band:** The GAC can collect greater spectral content from earth motion. The GAC uses a feedback loop to flatten out the pass-band characteristic of the 18-Hz geophone, extending the pass-band down to below 2 Hz.

- Conventional geophones impose a low-cut filtering effect on the acquired data for frequencies below the natural frequency of the geophone element, typically 10 Hz (Fig. 2a). The GAC allows extension of the low-frequency signal pass-band down to 2 Hz; i.e., the sensor is not limiting the low-frequency content of the data (Fig. 2b). A 2-Hz conventional geophone would be operationally unrealistic because the large coil displacements would make the device physically large and heavy.

The UniQ system offers continuous acquisition from up to 200,000 live GAC channels.

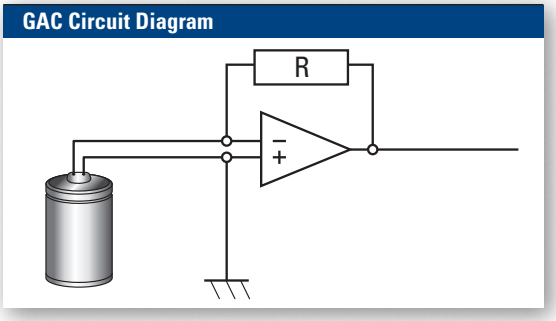


*Figure 1. Circuit diagram of a geophone accelerometer (GAC).*

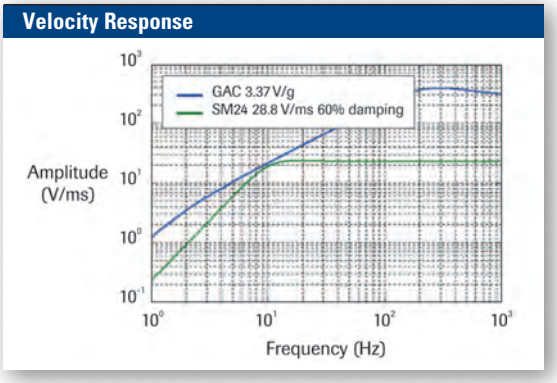


*Figure 2a. Velocity response graph showing conventional geophone low-cut filtering effect.*

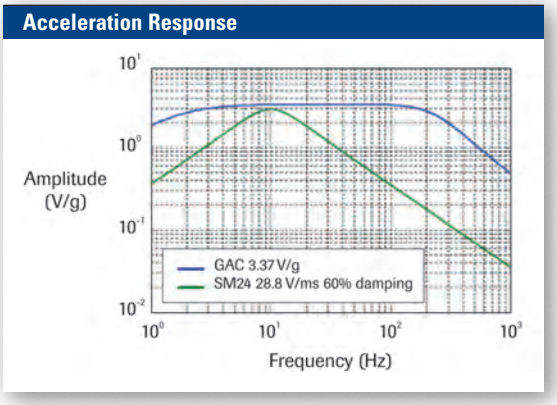


*Figure 2b. Acceleration response graph showing extension of the GAC low-frequency signal passband.*