

NEXT GENERATION

# POSTHOLE DIGITAL BROADBAND SEISMOMETER

## ALPHA $\alpha$ - TADP120 - LIGHT

**ALPHA  $\alpha$  - TADP120- LIGHT** is a three component low noise feedback, digital output velocity broadband seismometer designed to be installed in post-holes. This design is inspired by 40 years of experience by Dr. C.M. Guralp.

In 1970 and 1980 Dr. Guralp set out the standards for miniature surface and borehole broadband seismometers. First Posthole broadband seismometer was installed in 1987 By Dr. CM Guralp to monitor underground explosions.

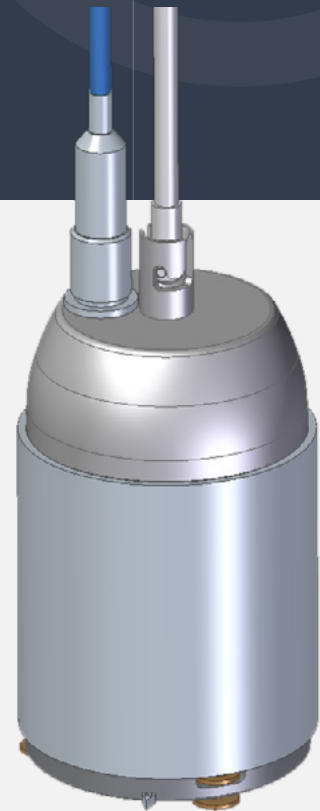
The Broadband Feedback seismometer is based on orthogonal three axis low noise sensor modules with double nested feedback loop topology.

The suspension system is based on the principles of "elastica". The mechanical sensor orientation is Non-Galperin with -75 dB cross axis rejection on all axis.

The sensor frequency response covers complete seismic spectrum with a flat frequency response (No peaks) from 0.008333 Hz (120 seconds) to 150 Hz.

A precision 24 bit 8 channel digitiser is housed inside waterproof enclosure.

9 extra State of Health (SOH) channels providing comprehensive state of health of the posthole sensor.



*The product specifications and the stated data are subject to change without prior notice.*

## SUITABLE FOR LOCAL, REGIONAL & TELE-SEISMIC RECORDING, INCLUDING:

- Single or large scale seismic networks
- Post hole seismology
- Micro-seismic monitoring
- After-shock monitoring
- Permanent reservoir monitoring
- Induced seismicity detection
- Explosion monitoring
- Volcanology
- Hydrocarbon exploration

## PHYSICAL

- Truly portable rugged seismometer with fine pitched adjustable feet manufactured from phosphor bronze.
- Sensor can be operated with  $\pm 5.0$  degrees of tilt, and microprocessor controlled remote centring is provided
- Remote electronic mass locking and unlocking facility, with serial interface for sensor control and parametric sensor data.
- Galvanically two stage isolated electronics. The sensor mechanical section and the feedback electronics sections have their own isolated and hermetically sealed enclosures
- All digital outputs and digital inputs are transient protected.
- Alpha Light sensor noise level crosses the New Low Noise Model (NLNM) (below) from 18 Hz to 50 Seconds period.
- The sensor installation and orientation tools are provided to install the sensor to depths of 5 to 10 meters. The T bar installation tool attachment on the top of the sensor housing is a backlash free bayonet interface.
- The diagram of the mechanical installation method is provided in Figure 3.

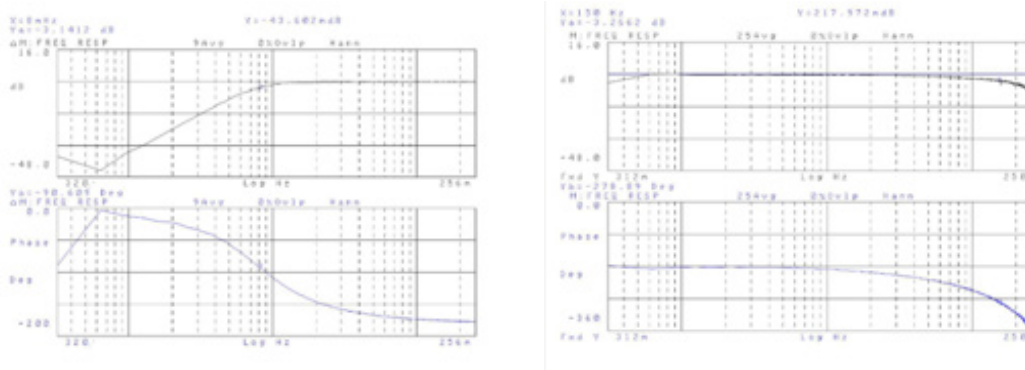
## SIGNIFICANT QUALITIES AND BENEFITS OF THE SYSTEM

- High data quality broadband data
- Suspension system with high cross axis rejection
- Broadband data with high frequency response extending to 150 Hz
- Automatic self-installation and zeroing for quick installation
- Tilt tolerance of  $\pm 5$  degrees
- Portable and easy to deploy
- Waterproof with connectors mated



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# MEASURED FREQUENCY RESPONSE OF THE DIGITAL SENSOR



Note: The measured frequency response is given as low and high frequency sections in order to identify accurately the corner frequency of the transfer function.

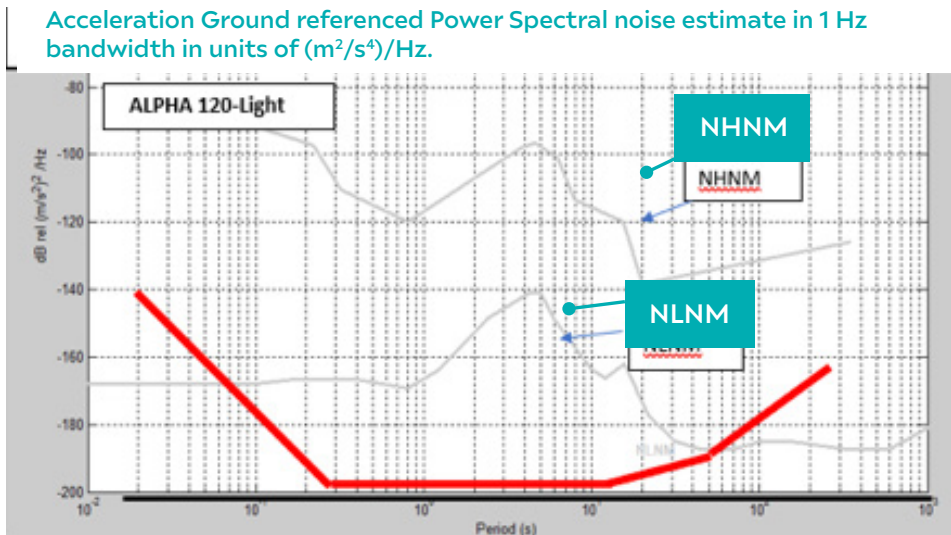


Figure 1: Red line is the sensor power spectral noise density estimate over the entire seismic spectrum. The black line is the Brownian motion of the mechanical suspension relating to each sensor component with a frame of reference mass of 0.320kg.

## TECHNICAL SPECIFICATIONS

**Standard Frequency Response:**  
Flat velocity 0.008333Hz (120s) to 150 Hz.

**Other optional responses:**  
0.01666 (60s) to 150 Hz.  
0.03333 (30s) to 200 Hz.

**VBB Optional Extended Broadband:**  
Flat velocity 0.002777 to 150 Hz.

**Analogue sensor sensitivity:**  
Differential: 2\*1500 V/m/s. Other responses are available: The sensor sensitivity can be set according to the customer's requirement.

The sensitivity, in V/m/s can be, given as examples: 1000 V/m/s. 5000 V/m/s. 10.000 V/m/s and others.

**Full scale Velocity outputs:**  
± 20 Vdc differential velocity. Other options are available according to the system power consumption requirements. Ask factory.

**Full Scale Mass Position outputs:**  
± 10 Vdc mass position (Applicable to all the sensor). Other options are available according to the system power consumption requirements. Ask factory.

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## SENSOR CONTROL LINES

**Mass Lock/Unlock:** Serial (RS 232) and Logic lines control.

**Centre the sensor mass Potions:** Serial (RS 232) and Logic lines control.

**Calibration On/Off:** Serial (RS 232) and Logic lines control. Calibration enable via serial port.

**Calibration signal:** Can be applied to each axis. The calibration signal can be any form of signal.

**Feedback Coil Constant:** Provided in the calibration document for all the sensor axis. Coil Constant presented in Amp/m/s<sup>2</sup>. See Ref 1.

**Mass Centring Operational Range:** ±5 Degrees. Microprocessor control available via serial RS232 Control.

**Cross axis Sensitivity:** -75 dB, In 6 degrees of freedom, all direction).

**Linearity:** Measured at 1 Hz: -110 dB, (Two-tone THD measurement).

**Lowest spurious Resonance:**  
340 Hz vertical and horizontal modules.  
(Horizontal Modules, cannot observe spurious modes of resonance)

## TIME SYNCHRONIZATION

**Time Source:** GPS, GNSS, NTP or internal source.  
GPS: Maximum 50 meters Cabling.

**NTP:** Option software selectable.

## USER INTERFACES:

**Available interfaces:** 10/100 Base-Ethernet, USB, Serial RS232

**RS232 Serial input:** Control and acquire digital data. Interface to e.g.: Weather stations, digital infrasound sensors, digital strain/stress gauges.

**Logic Control Lines:** Calibration enable and centre via serial interface.

**IP Addressing:** Static, dynamic (DHCP) Protocols: UDP/IP unicast/multicast and sensor input power. All outputs are transient protected.

**Digital recorder Module:**  
Operational Performance: Independent 8--24 bit Delta Sigma Digitizer with simultaneous sampling

**Dynamic Range:** Sample rate: 1K Hz: -122.2dB, at:100 Hz:-136.3 dB, at: 10 Hz -138.4dB.

(Full scale P-P to RMS Shorted input Noise)

**Gain Accuracy:** ± <0.5%, Each channel calibrated.

**Configurable Preamplifier (PGA):** Gain settings \*1, \*2, \*4, \*8 \*12. Each channel independently controlled.

**Sample rates:** User selectable sample rates: 1 2,5,10,20,40,50,100,125,200,250,500,1000. Four separate same rates are available concurrently.

**Calibration signal:** 24 bit buffered output DAC with adjustable amplitude.

**Wave forms:** Square, Sine, Step, Pulse with duty cycle and frequency control and Pseudo random signals. Generated with an internal synthesizer.

**Decimation Filter Options:** Causal (minimum phase) and a-causal (linear phase) filters, Applicable to all the sample rates and concurrently available.

**Digital filters:** User selectable, high pass and band pass digital filters.

## DATA STORAGE

**Format:** MiniSEED and PCF (Proprietary data Format)

**Internal Memory:** 2 G byte

**Data Storage:** 32 G Byte SD card. Data down loadable via USB or Ethernet.

**Internal storage Memory:** 32 G Byte SD card.

## TRIGGERS:

**Threshold trigger** with high-pass filter. User selectable high pass filter.

**STA/LTA:** Band passed ratio-metric trigger. Concurrently available in addition to continuous data streams.

**Operating temperature:** -20 to 75 degrees centigrade.

**Power Supply:** +9 - +36 V DC, Galvanically Isolated Supply input.

**Power Consumption:** Less than 2.1 Watts

**Isolation and transient Protection:** Sensor casing is isolated as signal ground/sensor input power. All outputs are transient protected.

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## PHYSICAL

**Dual Chamber casing:** Sensor mechanics and electronics are isolated and sealed from the environment. Internal Pressure relief valve provided.

**Power/signal connector:** Hermetic Mil-spec connector on top cap. KPT 02E-16-26P.

**Case diameter:** 165 mm

**Case height:** 304 mm

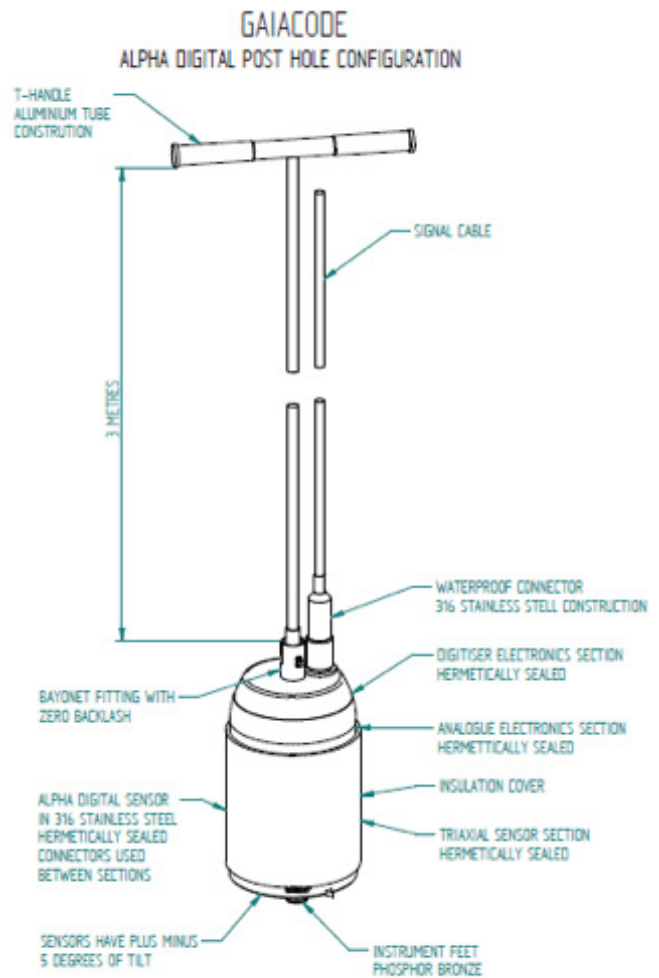
**North South Pointer:** Machined to the base.  
North - Black Pointer. South - White Pointer.

**Handle provided:** Flexible silicone handle.

**Base plate:** 316 Stainless steel.

**Casing and top cap:** Hard Anodised Aluminium.  
**Environmental:** IP-68

**Weight:** 10.5 Kg



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