



## HIGH PERFORMANCE RUGGED BOREHOLE SEISMOMETERS

**BB603-BH; BB303-BH; MP403-BH**

PMD Scientific offers three extremely rugged pressurized high performance seismometer models for simplified installation and reliable operation in small diameter boreholes:

- A low noise very broad band 128 mm dia. **BB603-BH**
- An economical broad band 83 mm dia. **BB303-BH**
- A medium period 83 mm dia. **MP403-BH.**

Each instrument uses three identical proprietary electrochemical sensors<sup>1</sup> mounted orthogonally along the N, E, and Z-axes. These sensors have many advantages over traditional electromechanical devices. In particular, they are extremely rugged and have much larger ground motion-to-voltage conversion ratio that results in a uniquely shaped noise curve that starts bending up at much longer periods and then raises more shallow than the traditional 1/f curves. The efficient electrodynamic force-balancing feedback provides for an extended dynamic range, excellent stability and linearity across the entire passband.

All borehole seismometer models contain a microcontroller which maintains exceptionally accurate parameter stability over the full operating temperature range and over the life of the instrument. Optionally, the microcontroller can also generate internally calibrating sine or other waveform signals. The calibration can be initiated by applying a logic level to the Calibration Enable input or via an optional serial port. If the latter is provided, the user can also select and set the Generator Constant value in the 350-20,000 V/m/s range

These seismometers **do not** require a mass lock and mass centering and can stay fully operational at significant tilts. Therefore, they do not need expensive and cumbersome leveling and centering mechanisms resulting in lower cost, smaller size and weight, and increased reliability. All **BH** models can be optionally equipped with built-in 2-axis inclinometers so that the seismometer output data can be readily corrected for the installation tilt. The power consumption is low, which allows the use of lighter gage cables even in very deep boreholes. They operate over a wide temperature range, depending on the borehole can be made waterproof up to several hundred meters depths, and stay operational within a wide range of installation tilts. They provide low cost of ownership, **requiring no maintenance** over the life of the instrument. All models are also available as vertical-only uniaxial sensors (substitute **601**, **301**, **401** respectively in the models designations). Three and five-year extended warranties are available.



<sup>1</sup> US patent No.6,576,103

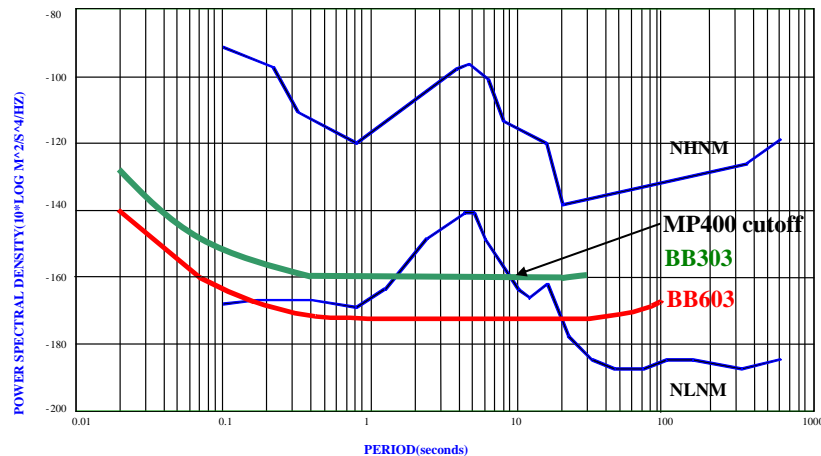
*Specifications subject to change without notice*

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PARAMETER	BB603-BH	BB303-BH	MP403-BH
Operating principle	Proprietary Electrochemical transducer with force-balancing feedback		
Output signals:	2 horizontal, 1 vertical; velocity flat response		
Output signal swing	±10V (±20 V p-p differential)		
Dynamic Range	150 dB @ 1Hz	142 dB @ 1Hz	142 dB @ 1Hz
Bandwidth:	Std.: 0.0167 – 50 Hz; Opt.: 0.0083 – 50 Hz	0.033 – 50 Hz	0.1 – 50 Hz
Self-noise (see noise curves plotted below)	Below USGS NLNM in 0.05 – 5Hz range;	See noise curves below	
Generator constant	Standard: 2000 V/m/s; Opt.: 350 – 20,000 V/m/s – factory preset or by the user via optional serial port		
Calibration input	1kΩ; 1V in – 1V out		
Mass Lock	<b>NONE REQUIRED</b>		
Mass Centering	<b>NONE REQUIRED</b>		
Max. installation tilt <sup>2</sup>	±10°		
Mechanical resonances	>150 Hz		
Built-in Bi-axial Tiltmeter	Applied Geomechanics, Model 900. Outputs: ±2.5Vdc; 10 degrees/V; Full Scale: ±25 degrees.		
Environmental	Pressurized; fully submersible: Std. 10m; Optional to 400m Special packages available for deeper boreholes.		
Temperature range	-12 to + 55C; Optional to +80C		
Case material	Stainless steel		
Case diameter	128 mm	83 mm	
Case height	1000 mm	900 mm	
Weight	~30 kg	~22 kg	
Power – Standard	10 – 15 Vdc; 12 Vdc nominal		
Supply current	Standard: 30 mA; LP version: ~12 mA		
Connector	Underwater circular; type depends on borehole depth		

## NOISE CURVES



<sup>2</sup> All three sensors stay fully operational; however they sensitivity axes will rotate in accordance with the tilt.

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