

Specifications for: [OSOP Raspberry Shake 3D](#) V2/ V3

- Your 3D Personal Seismograph -

An IoT home-automation device

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Unit

The Raspberry Shake 3D Personal Seismograph is an all-in-one, IoT plug-and-go solution for personal seismology- [OSOP, S.A.](#) integrates a 3 orthogonal velocity sensors, the digitizers, the hyper dampers, and the computer into *a single box*. The Raspberry Shake 3D Personal Seismograph is manufactured in Volcán, Panamá using cutting-edge 3D printing and laser-cutting technology.

Warranty: 1 year from ship date

Specifications subject to change without notice.

Parameter	Value
Raspberry Shake 3D Version	V2/ V3
Dimensions (estimated)	140x130x60 mm
Weight (estimated)	0.6 kg
Immersion rating	<i>Standard enclosure: IP10</i> <i>IP66 enclosure available upon request at additional cost</i>
Connectors	<i>Standard enclosure: Ethernet (RJ45), Power Micro USB (5V, 2.5 Amps), USB 2 ports x4,</i>

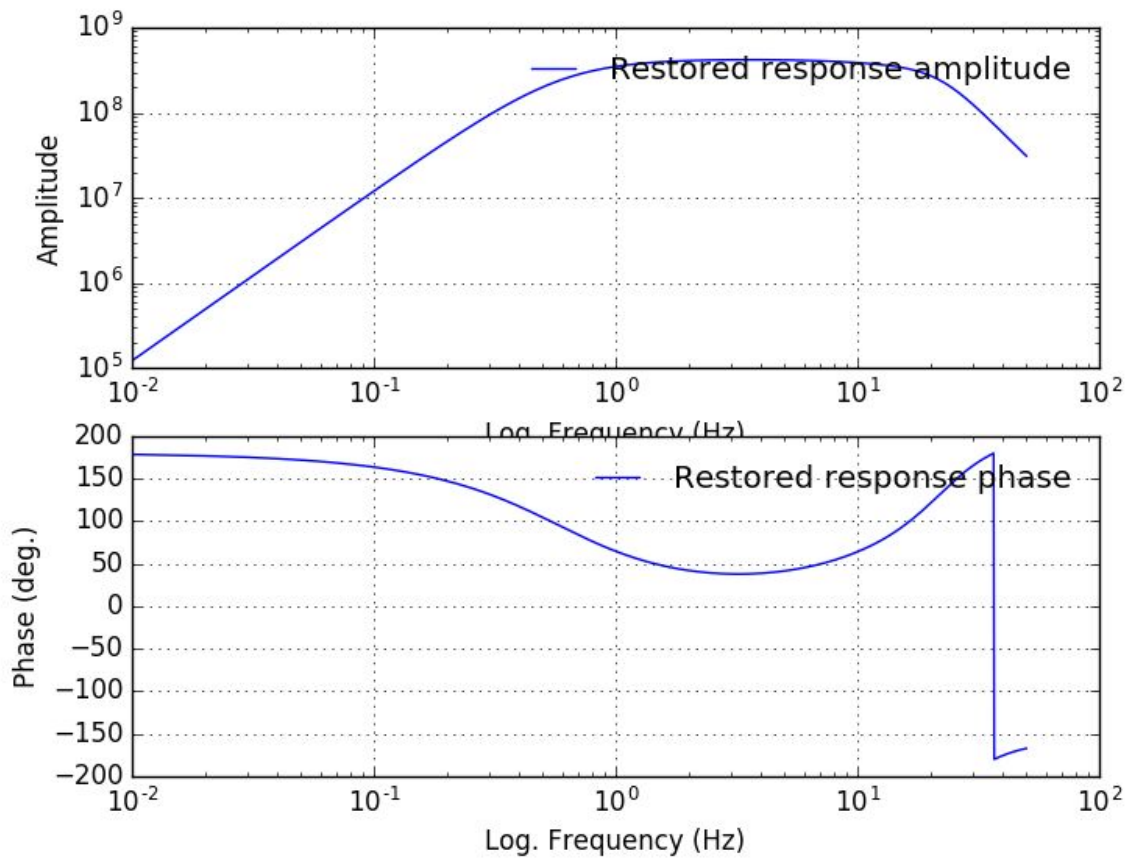
	<p>HDMI, Micro SD, CSI Camera port, Composite video and audio output jack</p> <p><i>IP66 enclosure: Ethernet (RJ45), Power</i></p>
Installation Considerations	Designed for plug-and-go installation
Operating Temperature	0 to 60 C (limited by RPi, the Raspberry Shake itself can go to -40C)
On Board Computer	Wifi-enabled Raspberry Pi 3 Model B
Storage Device	<p>8 Gb or + micro SD card</p> <p><u>Est. # days of disk space:</u> OS/ software: ~3 Gb</p> <p>Remaining space for data: ~5 Gb</p> <p># days (15 Mb/ day/ channel [x3]): ~110</p>
Timing	Network Timing Protocol, NTP
Timing Quality	NTP timing quality remains within 1 sample of accuracy versus startup accuracy: +/- 10 ms or better @ 100 sps

Seismograph

Parameter	Value
Type	3-component, orthogonally placed 4.5 Hz (electronically extended down to 2 seconds) geophones, 380 Ohm
Samples per second	100
<p><i>Earthquake Early Warning (EEW) compatible</i></p> <p><i>data packets shipped across serial port at a rate of 4 packets/ second (250 ms/ packet)</i></p>	
Flat Frequency Range (rough estimate, -3dB points)	0.7 to 19 Hz <i>Note: We hope to extend this out to 40 Hz (or 80% of Nyquist) before shipping the first round of Raspberry Shakes</i>
Poles (rough estimate)	0, 0, 518
Zeros (rough estimate)	74.6, 74.6, 91.8, -3.33, -3.33
Sensitivity (rough estimate)	4.16E+08 counts/ meter/ second +/- 10% precision
Clip Level (rough estimate)	+/- 8,388,608 counts (24-bits) 20 mm/s peak-to-peak from 0.1 to 10 Hz
Minimum Detection Threshold (rough estimate)	0.14 $\mu\text{m/s}$ RMS from 1 to 20 Hz @ 100 sps <i>Note: The minimum detectable level is considered to be 10dB above the noise RMS. Dynamic range is the full scale sinusoid RMS over the noise RMS in dB.</i>

Digitizer Dynamic range	24-bit ADC Sigma-Delta $\Sigma\Delta$ 144 dB (24 bits)
Effective bits (rough estimate)	<p>18.5 bits (110.5 dB) from 1 to 20 Hz @ 100 sps (for the entire analog to digital hardware chain).</p> <p><i>Note: Whereas most manufacturers report this for their digitizer only, we are reporting it for the entire sensor + ADC hardware chain. The effective bits of the digitizer itself are necessarily better.</i></p> <p>This parameter is also commonly known as “Dynamic Range” or “RMS to RMS noise”.</p>

Instrument Response (rough estimate):



Software

Software installed on Raspberry Shake's RPi computer

Native SeedLink Server (source: GEOFON) with OSOP Data Flow Message Router

Tight and automatic integration with SeisComP

Web-interface (HTML) for easy configuration

Software to store continuous seismic data in miniSEED format

Web-based helicorder plot generator (source: USGS)

Swarm (source: USGS)

Software distributed with Docker

Automatic updates

Operating System: Debian 8 (Linux)

Communications

Parameter	Value
Digital bandwidth consumption at 100 Hz, 3 channels (estimated)	Incoming rates RX: ~72.0 kbits/s Outgoing rates TX: ~282.0 kbits/s TCP Flow rate: 25.2 kbits/s
TCP/IP compatible	
Compatible with Wifi, Ethernet, Cell modem, GPRS, Satellite	

Power

Parameter	Value
Power Supply Voltage	5 Volts DC (2.5 Amp supply)
Power Consumption (RPi + Raspberry Shake, estimated)	$5.14 \text{ Volts} \times 0.270 \text{ A} = 1.4 \text{ Watts}$

Calibration Mechanism: Calibration not required over time but can be verified using the [OSOP Calibration Table](#). All sensors are verified prior to shipping to ensure that their gain is within <10% of the nominal instrument response.

Questions?

Email us at sales@raspberrysshake.org