Specifications for:
The Original (1D) Raspberry Shake by OSOP

- Your Personal Seismograph -

An IoT home automation device

Born on: October, 2016

Last updated: 28-august-2017

Unit

The Raspberry Shake Personal Seismograph is an all-in-one, IoT plug-and-go solution for personal seismology- OSOP, S.A. integrates a vertical (1D) velocity sensor, the digitizer, the hyper damper, and the computer into *a single box*. The Raspberry Shake 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 Version	V4 / V5
Dimensions (estimated)	100x120x50 mm
Weight (estimated)	0.35 kg
Immersion rating	*Standard enclosure*: IP10 *IP67 enclosure available upon request at additional cost*
Connectors	*Standard enclosure*: Ethernet (RJ45), Power Micro USB (5V, 2.5 Amps), USB 2 ports x4,

	HDMi, Micro SD, CSI Camera port, Composite video and audio output jack *IP67 enclosure*: Ethernet (RJ45), Power
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 *The Raspberry Shake board/ Software is also compatible with:* 000[d,e]: Model B 00[10,13]: Model B+ a[01040,01041,21041]: 2 Model B 9000[92,93],920093: Zero a[02082,22082,a32082]: 3 Model B 9000c1 Zero W
Storage Device	8 Gb or + micro SD card *Est. # days of disk space:* OS/ software: ~3 Gb Remaining space for data: ~5 Gb # days (7.5 Mb/ day/ channel [x1]): ~660, more if you use a bigger SD
Timing	Network Timing Protocol, NTP
Timing Quality	NTP timing quality remains within 1 sample of accuracy versus startup accuracy: +/- 20 ms or better @ 50 sps

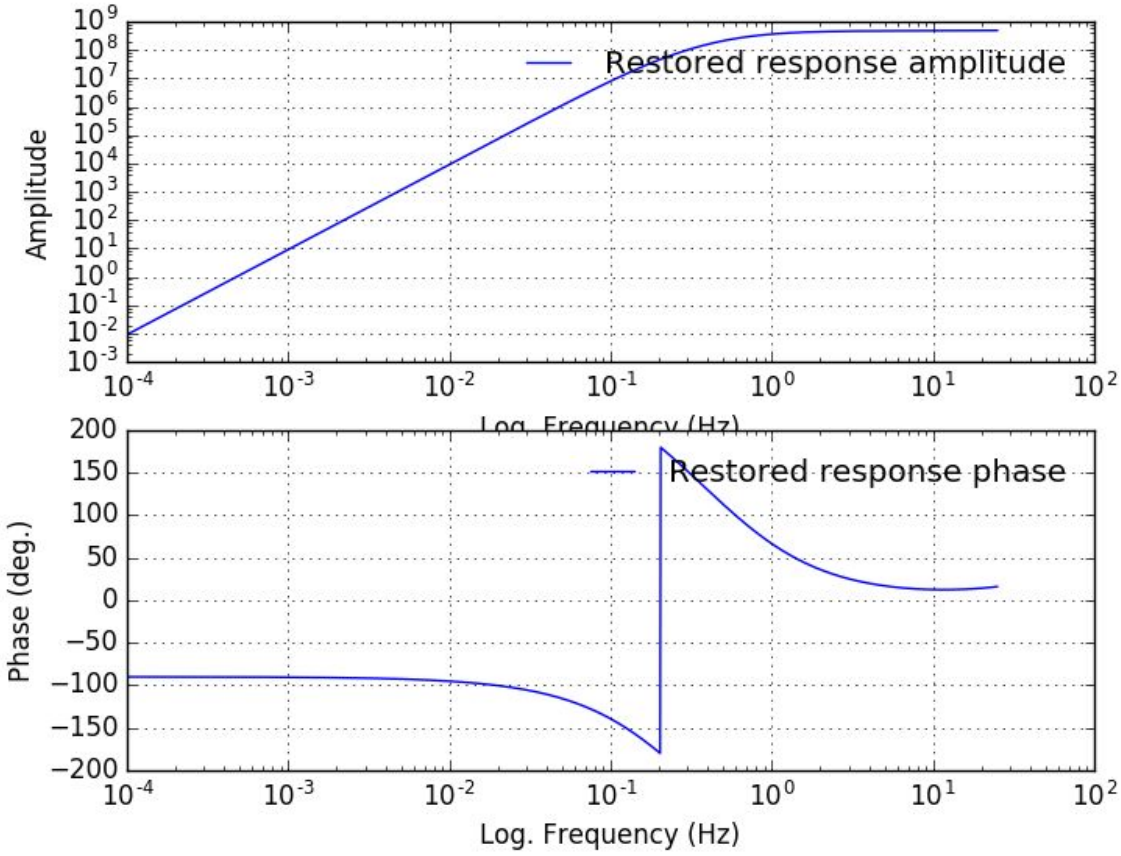
Seismograph

Parameter	Value
Type	Single-component 4.5 Hz 395 Ohm vertical Racotech RGI-20DX geophone with electronic extension to lower frequencies (<1 Hz)
Samples per second	50
*Earthquake Early Warning (EEW) compatible** *data packets shipped across serial port at a rate of 2 packets/ second (500 ms/ packet)*	
Bandwidth (estimated)	V4/V5: -3dB points at 0.8 to 23 Hz
Poles (estimated)	V4/V5: -6.75, 0, 0, 0
Zeros (estimated)	V4/V5: -4.21, -2.33, -1.30
Sensitivity (estimated)	V4/V5: 4.69E+08 counts/ meter/ second +/- 10% precision
Clip Level (estimated)	+/- 8,388,608 counts (24-bits) V4/V5: 18 mm/s peak-to-peak from 0.1 to 10 Hz
Minimum Detection Threshold (estimate)	V4/V5: 0.14 µm/ s RMS from 1 to 20 Hz @ 50 sps *Note: The minimum detectable level is considered to be 10 dB above the noise RMS. Dynamic range is the full scale sinusoid RMS over the noise RMS in dB.*

Digitizer Dynamic range	24-bit ADC Sigma-Delta **ΣΔ** 144 dB (24 bits)
Effective bits (estimated)	V4/V5: 18.5 bits (110.5 dB) from 1 to 20 Hz @ 50 sps (for the entire analog to digital hardware chain). *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.* This parameter is also commonly known as “Dynamic Range” or “RMS to RMS noise”.

**Applies to firmware versions 2.X.X and higher and units shipped purchased after July, 2017*

Velocity Channel Instrument Response:



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 50 Hz, 1 channel (estimated)	Incoming rates RX: ~12.0 kbits/s Outgoing rates TX: ~47.0 kbits/s TCP Flow rate: 4.20 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 Volts x 0.080 A = 0.4 Watts

Calibration Mechanism: Calibration not required over time but can be verified using the OSOP Calibration Table. All seismographs are verified prior to shipping to ensure that their gain is within 10% of the nominal instrument response (up to 10% variation attributable to geophones and capacitors).