

# Specifications for: The Original (1D) [Raspberry Shake](http://shop.raspberrysshake.org/) by [OSOP](http://shop.raspberrysshake.org/)

- Your Personal Seismograph -

*An IoT home automation device*

*Born on: October, 2016*

<http://shop.raspberrysshake.org/>

[sales@raspberrysshake.org](mailto:sales@raspberrysshake.org)

*Last updated: 10-september-2018*

## Unit

The Raspberry Shake Personal Seismograph is an all-in-one, IoT plug-and-go solution for personal seismology- [OSOP, S.A.](http://shop.raspberrysshake.org/) 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 | V6 / V5 / V4   |
| Dimensions (estimated)  | 100x120x50 mm  |
| Weight (estimated)      | 0.35 kg  |
| Immersion rating        | <i>Standard enclosure: IP10</i><br><i>IP67 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,<br/>Composite video and audio output jack</p> <p><i>IP67 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 -20C)  |
| On Board Computer           | <p>Wifi-enabled Raspberry Pi 3 Model B</p> <p><i>The Raspberry Shake board/ Software is also compatible with:</i></p> <p>000[d,e]: Model B</p> <p>00[10,13],900032: Model B+</p> <p>a[01040,01041,21041,22042]: 2 Model B</p> <p>9000[92,93],9200[92,93]: Zero</p> <p>a[02082,22082,32082,52082]: 3 Model B</p> <p>a020d3: 3 Model B+</p> <p>9000c1: Zero W(H)</p> |
| Storage Device              | <p>8 Gb or + micro SD card</p> <p><u><i>Est. # days of disk space:</i></u></p> <p>OS/ software: ~3 Gb</p> <p>Remaining space for data: ~5 Gb</p> <p># days (7.5 Mb/ day/ channel [x1]): ~660,<br/>more if you use a bigger SD</p>  |
| Timing                      | Network Timing Protocol, NTP (default)   |

|                |   |
|----------------|---|
|                | GPS timing supported  |
| Timing Quality | NTP timing quality remains within 1 sample of accuracy versus startup accuracy:<br><br>V6: +/- 10 ms or better @ 100 sps<br><br>V5 / V4: +/- 20 ms or better @ 50 sps |

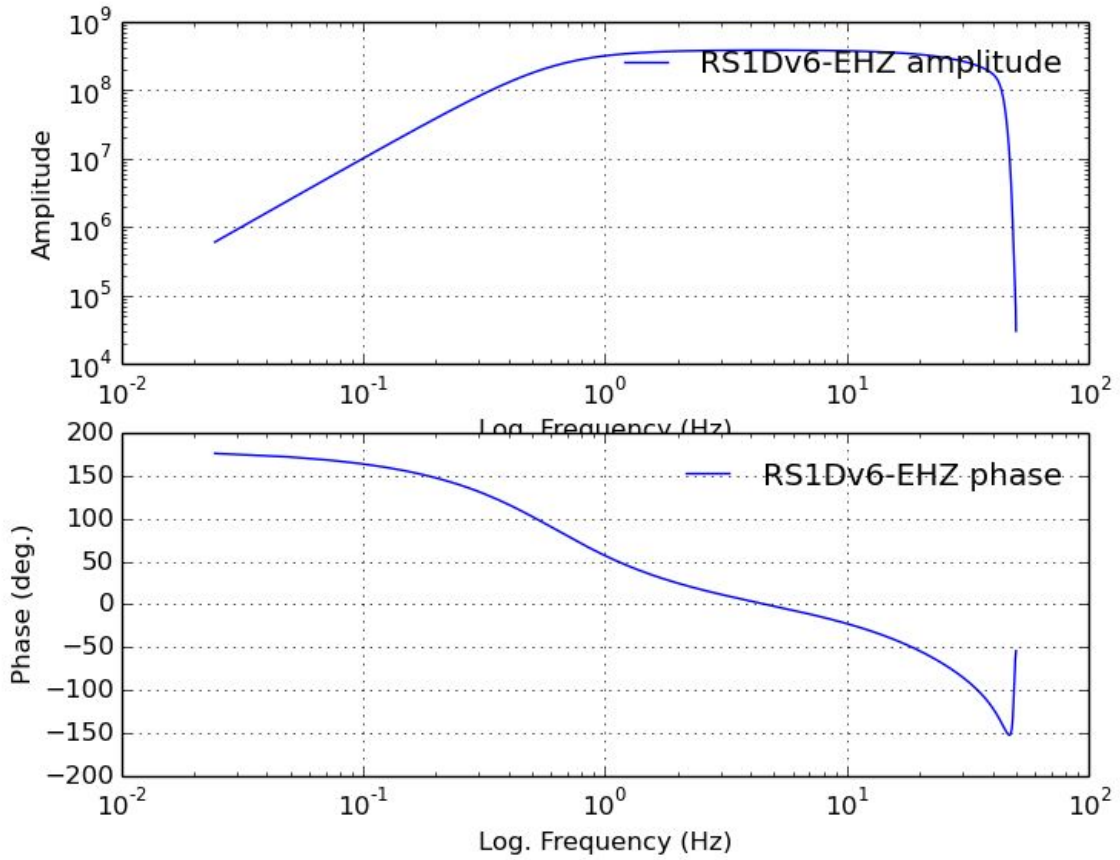
# Seismograph

| 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   | V6: 100 sps<br>V5 / V4: 50 sps   |
| <p><i>Earthquake Early Warning (EEW) compatible*</i></p> <p><i>V6: data packets shipped across serial port at a rate of 4 packets/ second (250 ms/ packet)</i></p> <p><i>V5/ V4: data packets shipped across serial port at a rate of 1 packet/ second (1000 ms/ packet)</i></p> |  |
| Bandwidth (estimated)  | V6: -3dB points at 0.8 to 29 Hz<br>V5/V4: -3dB points at 0.8 to 23 Hz  |
| Poles (estimated)  | V6: -4.88+/-3.06E+02, -2.22+/-1.18E+02, -3.33+/-1.98E+02<br>V5/V4: -4.21, -2.33, -1.30                                     |
| Zeros (estimated)  | V6: -4.51+/-3.08E+02, 0, 0<br>V5/V4: -6.75, 0, 0, 0  |
| Sensitivity (estimated)  | V6: 3.81E+08 counts/ meter/ second +/- 10% precision<br>V5/V4: 4.69E+08 counts/ meter/ second +/- 10% precision            |
| Clip Level (estimated)   | +/- 8,388,608 counts (24-bits)<br>V6: 22 mm/s peak-to-peak from 0.1 to 10 Hz   |

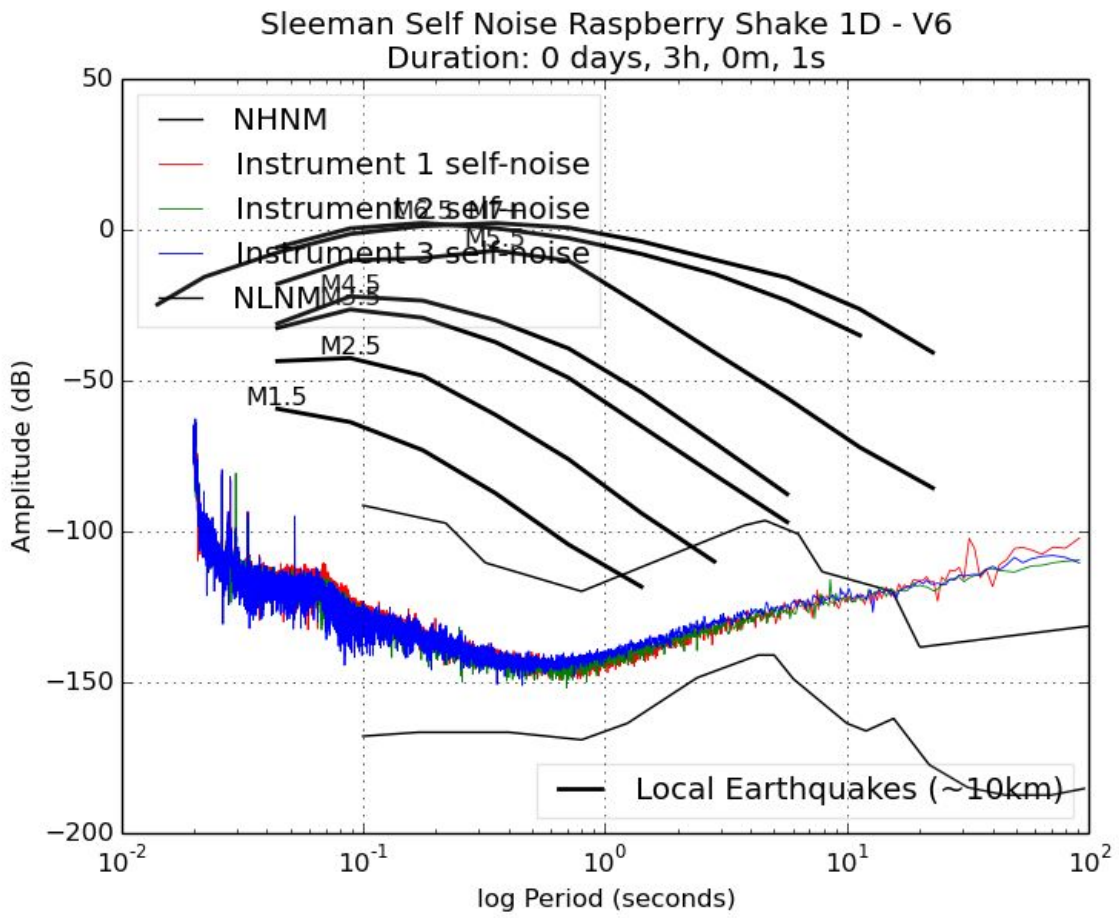
|  |   |
|--|---|
|  | V5/V4: 18 mm/s peak-to-peak from 0.1 to 10 Hz   |
| Minimum Detection Threshold (estimate) | <p>V6: 0.03 <math>\mu\text{m/s}</math> RMS from 1 to 20 Hz @ 100 sps</p> <p>V5/V4: 0.14 <math>\mu\text{m/s}</math> RMS from 1 to 20 Hz @ 50 sps</p> <p><i>Note: The minimum detectable level is considered to be 10 dB above the noise RMS. Dynamic range is the full scale sinusoid RMS over the noise RMS in dB.</i></p>  |
| Digitizer Dynamic range                | <p>24-bit ADC Sigma-Delta <math>\Sigma\Delta</math></p> <p>144 dB (24 bits)</p>   |
| Effective bits (estimated)             | <p>V6: 21 bits (126 dB) from 1 to 20 Hz @ 100 sps</p> <p>V5/V4: 18.5 bits (110.5 dB) from 1 to 20 Hz @ 50 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”; “RMS to RMS noise”; or "noise free bits".</p> |

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

# Velocity Channel Instrument Response:



# Sleeman Self-Noise:



# Software

| Software installed on Raspberry Shake's RPi computer   |
|--|
| 100% SeisComP3 compatible<br>Also: AQMS, Antelope, Earlybird, Earthworm, Hydra, ObsPy, SEISAN, ... |
| 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<br>Outgoing rates TX: ~47.0 kbits/s<br>TCP Flow rate: 4.20 kbits/s |
| Digital bandwidth consumption at 100 Hz, 1 channel (estimated) | Incoming rates RX: ~24.0 kbits/s<br>Outgoing rates TX: ~94.0 kbits/s<br>TCP Flow rate: 8.40 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) | Startup: 5 Volts x 0.550 A = 2.8 Watts<br>Run-time: 5 Volts x 0.290 A = 1.5 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).

## Questions?

Email us at [sales@raspberrypi.org](mailto:sales@raspberrypi.org)