

# 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/>

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*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.](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 | V4 / V5  |
| 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 -40C)   |           |         |            |          |                       |           |                     |      |                        |           |        |        |
| 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> <table style="margin-left: 40px;"> <tr> <td>000[d,e]:</td> <td>Model B</td> </tr> <tr> <td>00[10,13]:</td> <td>Model B+</td> </tr> <tr> <td>a[01040,01041,21041]:</td> <td>2 Model B</td> </tr> <tr> <td>9000[92,93],920093:</td> <td>Zero</td> </tr> <tr> <td>a[02082,22082,a32082]:</td> <td>3 Model B</td> </tr> <tr> <td>9000c1</td> <td>Zero W</td> </tr> </table> | 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 |
| 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              | <p>8 Gb or + micro SD card</p> <p><u><i>Est. # days of disk space:</i></u><br/>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  |           |         |            |          |                       |           |                     |      |                        |           |        |        |
| Timing Quality              | NTP timing quality remains within 1 sample of accuracy versus startup accuracy: +/- 20 ms or better @ 50 sps  |           |         |            |          |                       |           |                     |      |                        |           |        |        |

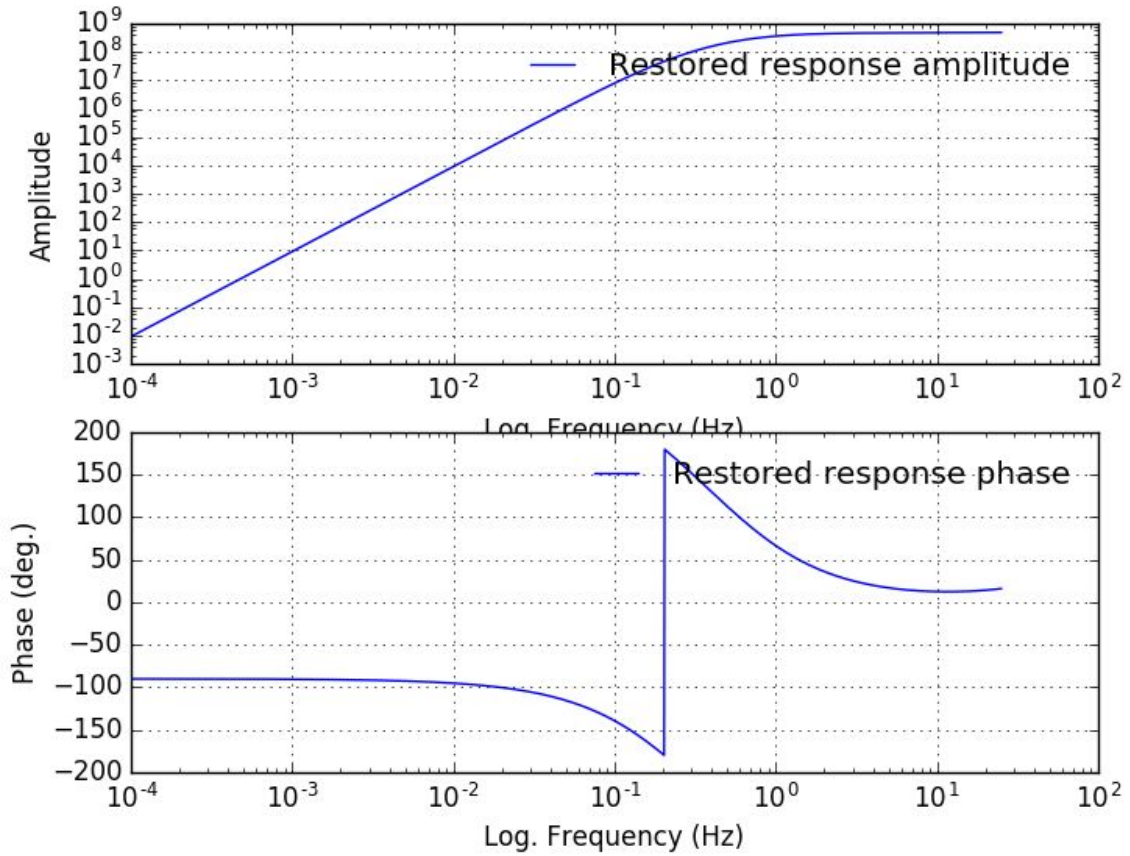
## Seismograph

| 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   |
| <p><i>Earthquake Early Warning (EEW) compatible*</i></p> <p><i>data packets shipped across serial port at a rate of 2 packets/ second (500 ms/ packet)</i></p> |  |
| 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)<br>V4/V5: 18 mm/s peak-to-peak from 0.1 to 10 Hz  |
| Minimum Detection Threshold (estimate)   | V4/V5: 0.14 $\mu$ m/ s RMS from 1 to 20 Hz @ 50 sps<br><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<br/>Dynamic range</p>    | <p>24-bit ADC Sigma-Delta <math>\Sigma\Delta</math><br/>144 dB (24 bits)</p>  |
| <p>Effective bits<br/>(estimated)</p> | <p>V4/V5: 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” or “RMS to RMS noise”.</p> |

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

# Velocity Channel Instrument Response:



# Software

| <b>Software installed on Raspberry Shake's RPi computer</b>                |
|--|
| 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><br>Outgoing rates TX: ~47.0 kbits/s<br><br>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).

## Questions?

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