

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

- Your Personal Seismograph -

*An IoT home automation device*

*Born on: October, 2016*

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

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*Last updated: 5-aug-2021*

## Unit

The Raspberry Shake Personal Seismograph is an all-in-one, IoT plug-and-go solution for personal seismology that 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 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	All versions
Dimensions (estimated)	<i>Standard enclosure: 135x110x50 mm</i> <i>IP67 enclosure: 160x90x90 mm</i>
Weight (estimated)	0.35 kg
Immersion rating	<i>Standard enclosure: IP10</i> <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, 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>Raspberry Pi 3 Model B</p> <p><i>The Raspberry Shake board/ Software is also compatible with:</i></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>4 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>V5/ V4 (50 sps):</p> <p style="padding-left: 40px;"><i># days (7.5 Mb/ day/ channel [x1]):</i></p> <p style="padding-left: 40px;">~660, more if you use a bigger SD</p> <p>V6+ (100 sps):</p>

	<p># days (15 Mb/ day/ channel): ~320, more if you use a bigger SD</p>
Timing	<p>Network Timing Protocol, NTP (default)</p> <p>GPS timing supported</p>
Timing Quality	<p>NTP timing quality remains within 1 sample of accuracy versus startup accuracy:</p> <p>V6+: +/- 10 ms or better @ 100 sps</p> <p>V5 / V4: +/- 20 ms or better @ 50 sps</p>

# 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 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)	V7+: -3dB points at 0.7 and 44 Hz V6: -3dB points at 0.8 and 29 Hz V5/V4: -3dB points at 0.8 and 23 Hz
Poles (estimate, radians/ second)	V7+: -1 (0.16 Hz, single pole high pass filter) -3.03 x2 (0.48 Hz, double pole high pass filter) -666.67 (106 Hz, single pole low pass filter) V6: -4.88+/-3.06E+02, -2.22+/-1.18E+02, -3.33+/-1.98E+02 V5/V4: -4.21, -2.33, -1.30
Zeros (estimate, radians/ second)	V7+: 0; 0; 0 V6: -4.51+/-3.08E+02, 0, 0

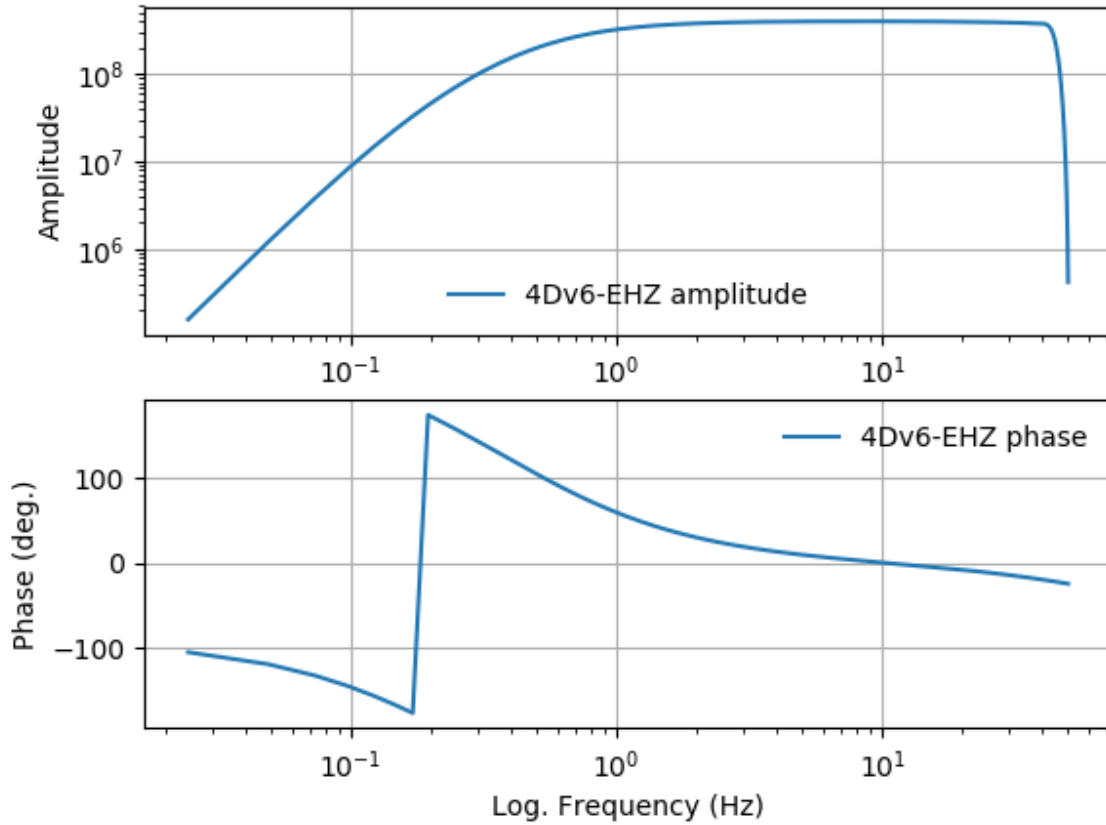
	V5/V4: -6.75, 0, 0, 0
Sensitivity (estimated)	<p>V7+: 3.996500E+08 counts/ meter/ second +/- 10% precision</p> <p>V6: 3.81E+08 counts/ meter/ second +/- 10% precision</p> <p>V5/V4: 4.69E+08 counts/ meter/ second +/- 10% precision</p>
Clip Level (estimated)	<p>+/- 8,388,608 counts (24-bits)</p> <p>V7+: 21 mm/s peak-to-peak from 0.1 to 10 Hz</p> <p>V6: 22 mm/s peak-to-peak from 0.1 to 10 Hz</p> <p>V5/V4: 18 mm/s peak-to-peak from 0.1 to 10 Hz</p>
Minimum Detection Threshold (estimate)	<p>V7+: 0.08 <math>\mu\text{m/ s}</math> RMS from 1 to 20 Hz @ 100 sps</p> <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</i></p>

*hardware chain. The effective bits of the digitizer itself are necessarily better.*

This parameter is also commonly known as “Dynamic Range”; “RMS to RMS noise”; or "noise free bits".

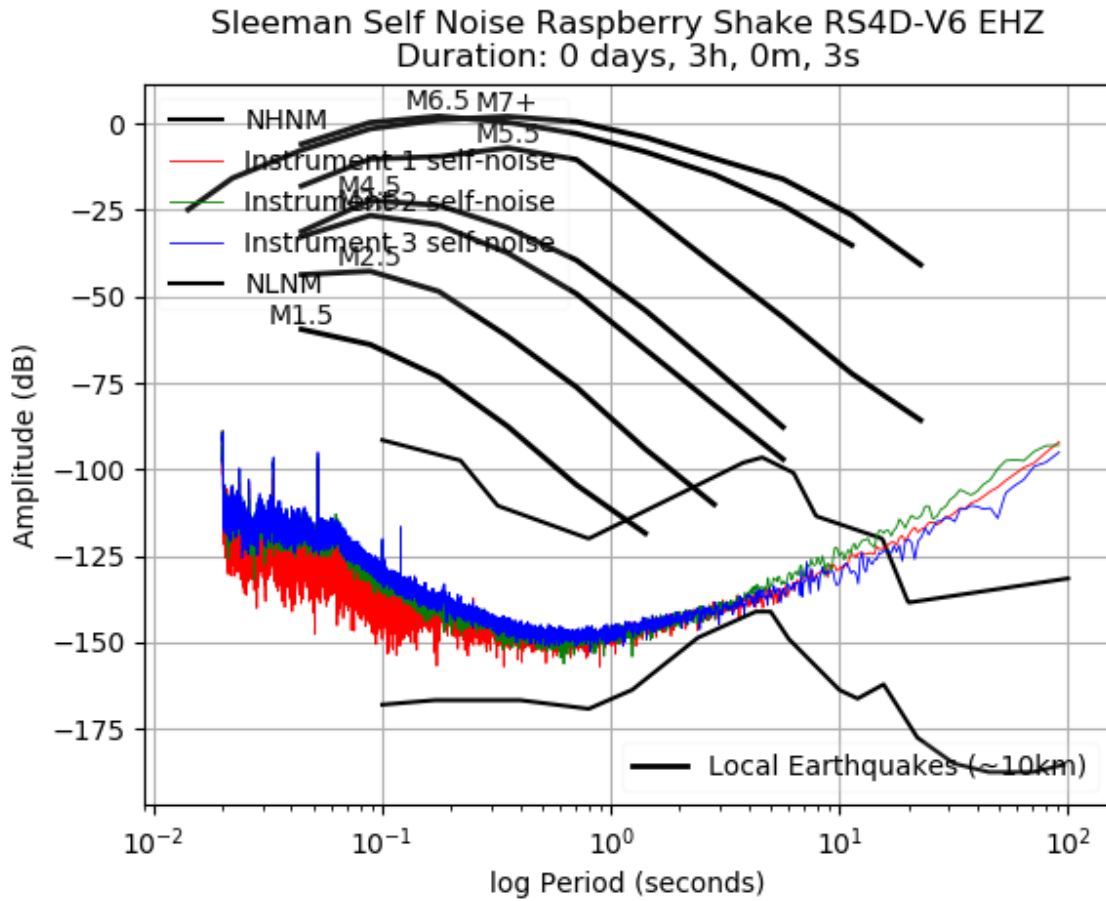
\*Applies to firmware versions 2.X.X and higher and units shipped purchased after July, 2017

Velocity Channel Instrument Response:



(same as 4Dv6)

# Sleeman Self-Noise:



(same as 4Dv6)



# Software

Software installed on Raspberry Shake's RPi computer
100% SeisComP3 compatible Also: AQMS, Antelope, Earlybird, Earthworm, Hydra, ObsPy, SEISAN, ...
Native SeedLink Server (source: GEOFON) with Raspberry Shake's 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, per channel	Average:  820 bytes/ second  71 megabytes/ day  Max:  1420 bytes/ second  123 megabytes/ day
TCP/IP compatible	
Compatible with Ethernet, Cell, GPRS, Satellite modems	

## 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 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)