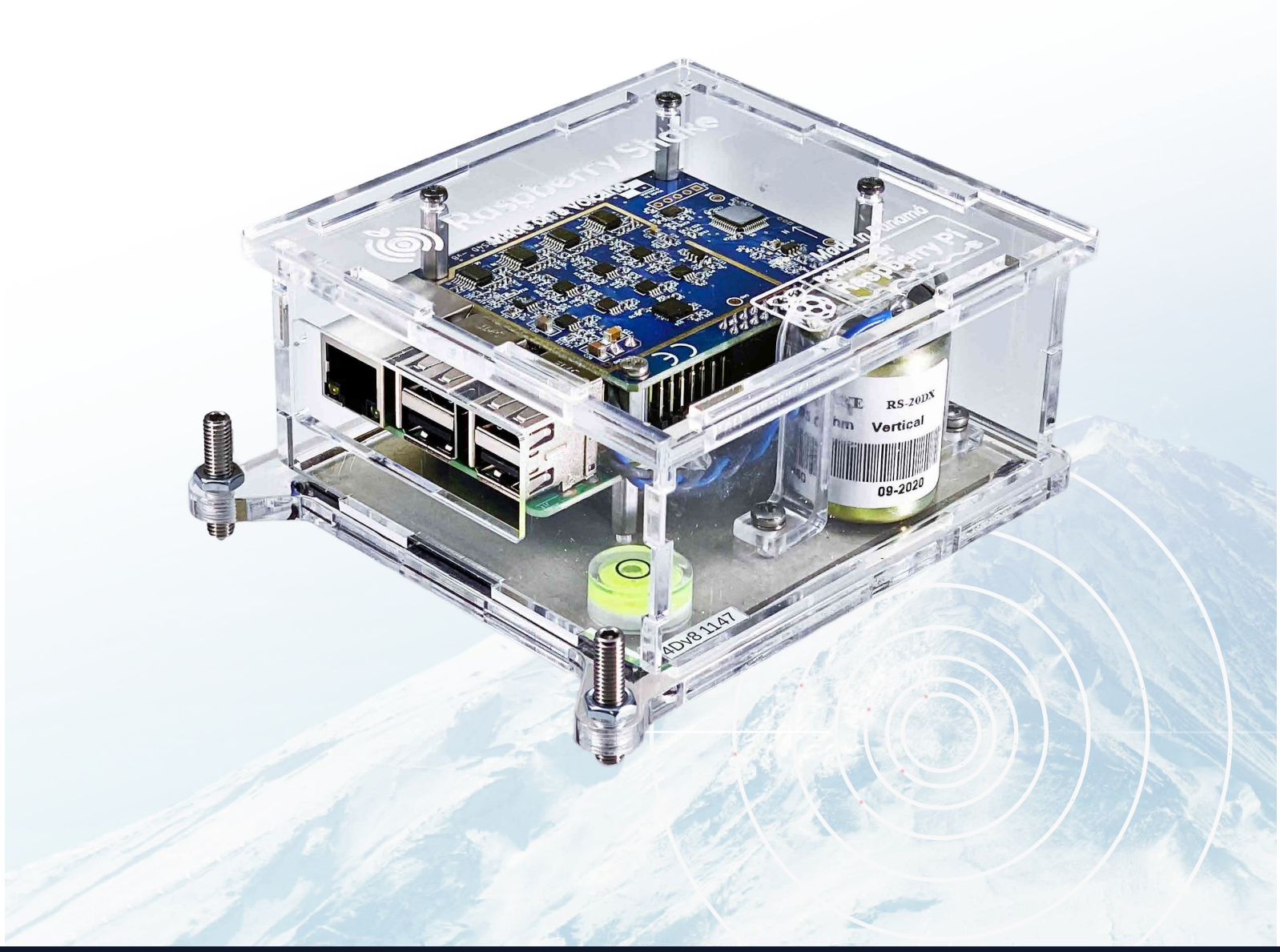
Raspberry Shake®
Watch the Earth Move

# Raspberry Shake Technical Specifications




**Website:** raspberryshake.org

**Contact us:** sales@raspberryshake.org

# Specifications for:

# The Original (1D) Raspberry Shake 1D

- Your Personal Seismograph -

*An IoT home automation device*

*Born on: October, 2016*

https://shop.raspberryshake.org/
sales@raspberryshake.org

*Last updated: 1/12/2025*

## 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 China 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) | *Standard enclosure*: 135x110x50 mm<br>*IP67 enclosure*: 160x90x90 mm |
| Weight (estimated) | 0.35 kg |
| Immersion rating | *Standard enclosure*: IP10<br>*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,<br>Composite video and audio output jack<br><br>*IP 67 enclosure: Ethernet (RJ45), Power. Note: the supported standard for the IP67 LAN connector is 100 Mbit/s (4-wired LAN cable).* |
| 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 | Raspberry Pi 3 Model B<br>*The Raspberry Shake board/ Software is also compatible with:*<br>00[10,13],900032: Model B+<br><br>a[01040,01041,21041,22042]: 2 Model B<br><br>9000[92,93],9200[92,93]: Zero<br><br>a[02082,22082,32082,52082]: 3 Model B<br><br>a020d3: 3 Model B+  4<br><br>Model B<br><br>9000c1: Zero W(H) |
| Storage Device | 8 Gb micro SD card<br><br>*Est. # days of disk space:*<br>OS/ software: ~4 Gb<br>Remaining space for data: ~3 Gb<br><br>V5/ V4 (50 sps):<br><br># days (7.5 Mb/ day/ channel [x1]):<br><br>~410<br><br>V6+ (100 sps): |

| | |
|---|---|
| | # days (15 Mb/ day/ channel): ~200 |
| Timing | Network Timing Protocol, NTP (default)<br>GPS timing supported |
| Timing Quality | NTP timing quality remains within 1 sample of accuracy versus startup accuracy:<br>V6+: +/- 10 ms or better @ 100 sps<br>V5 / V4: +/- 20 ms or better @ 50 sps |

# Seismograph

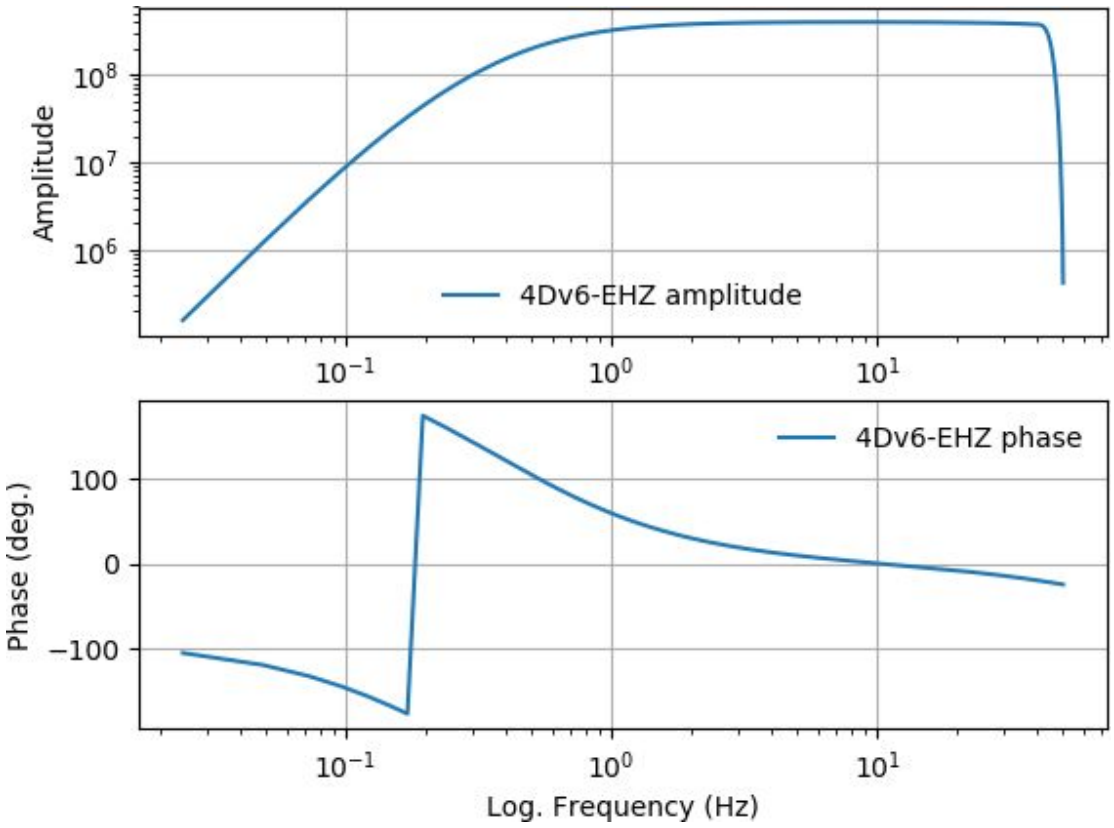
| Parameter | Value |
|---|---|
| Type | Single-component 4.5 Hz 395 Ohm vertical Racotech RGI-20DX geophone with electronic extension to lower frequencies (<1 Hz) |
| Samples per second | V6+: 100 sps<br>V5 / V4: 50 sps |
| *Earthquake Early Warning (EEW) compatible**<br>*V6: data packets shipped across serial port at a rate of 4 packets/ second (250 ms/ packet)*<br>*V5/ V4: data packets shipped across serial port at a rate of 1 packet/ second (1000 ms/ packet)* | |
| Bandwidth (estimated) | V7+: -3dB points at 0.7 and 44 Hz<br>V6: -3dB points at 0.8 and 29 Hz<br>V5/V4: -3dB points at 0.8 and 23 Hz |
| Poles (estimate, radians/ second) | V7+:<br>-1 (0.16 Hz, single pole high pass filter)<br>-3.03 x2 (0.48 Hz, double pole high pass filter)<br>-666.67 (106 Hz, single pole low pass filter)<br>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 (estimate, radians/ second) | V7+: 0; 0; 0<br>V6: -4.51+/-3.08E+02, 0, 0 |

| | |
|---|---|
| | V5/V4: -6.75, 0, 0, 0 |
| Sensitivity (estimated) | V7+: 3.996500E+08 counts/ meter/ second +/- 10% precision<br>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>V7+: 21 mm/s peak-to-peak from 0.1 to 10 Hz<br>V6: 22 mm/s peak-to-peak from 0.1 to 10 Hz<br>V5/V4: 18 mm/s peak-to-peak from 0.1 to 10 Hz |
| Minimum Detection Threshold (estimate) | V7+: 0.08 µm/ s RMS from 1 to 20 Hz @ 100 sps<br>V6: 0.03 µm/ s RMS from 1 to 20 Hz @ 100 sps<br>V5/V4: 0.14 µm/ s RMS from 1 to 20 Hz @ 50 sps<br>*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 $\Sigma\Delta$<br>144 dB (24 bits) |
| Effective bits (estimated) | V6+: 21 bits (126 dB) from 1 to 20 Hz @ 100 sps<br>V5/V4: 18.5 bits (110.5 dB) from 1 to 20 Hz @ 50 sps (for the entire analog to digital hardware chain).<br>*Note: Whereas most manufacturers report this for their digitizer only, we are reporting it for the entire sensor + ADC* |

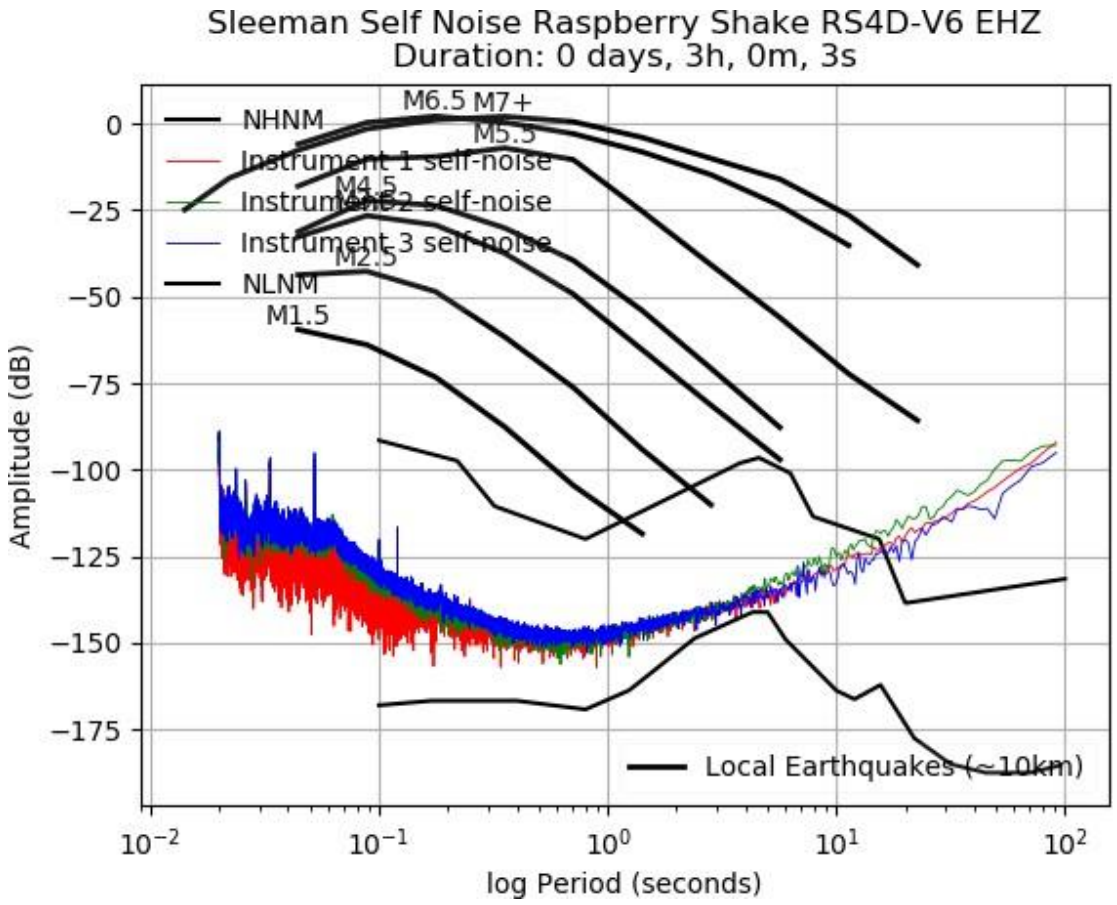
| | |
|---|---|
| | *hardware chain. The effective bits of the digitizer itself are necessarily better.*<br><br>This parameter is also commonly known as “Dynamic Range”; “RMS to RMS noise"; or "noise free bits". |

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

## Velocity Channel Instrument Response:



# Sleeman Self-Noise:



# Software

| Software installed on Raspberry Shake's RPi computer |
| --- |
| 100% SeisComP compatible<br>Also: AQMS, Antelope, 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 (Linux) |

## Communications

| Parameter | Value |
| --- | --- |
| Digital bandwidth consumption at 100 Hz, per channel | Average:<br>820 bytes/ second<br>71 megabytes/ day<br>Max:<br>1420 bytes/ second<br>123 megabytes/ day |
| TCP/IP compatible | |
| Compatible with Ethernet, Cell, GPRS, Satellite modems, StarLink. The supported standard for the IP67 LAN connector is 100 Mbit/s (4-wired LAN cable). | |

## Power

| Parameter | Value |
| --- | --- |
| Power Supply Voltage | 5.1 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).

# Specifications for: Raspberry Shake 3D

- Your 3D Personal Seismograph -

*An IoT home-automation device*

*Born on: February, 2017*

https://shop.raspberryshake.org/
sales@raspberryshake.org

*Last updated: 1/12/2025*

## Unit

The Raspberry Shake 3D Personal Seismograph is an all-in-one, IoT plug-and-go solution for personal seismology that 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 China 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 | All versions |
| Dimensions (estimated) | *Standard enclosure*: 140x135x60 mm<br>*IP67 enclosure*: 160x90x90 mm |
| Weight (estimated) | 0.6 kg |
| Immersion rating | *Standard enclosure*: IP10<br>*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 |

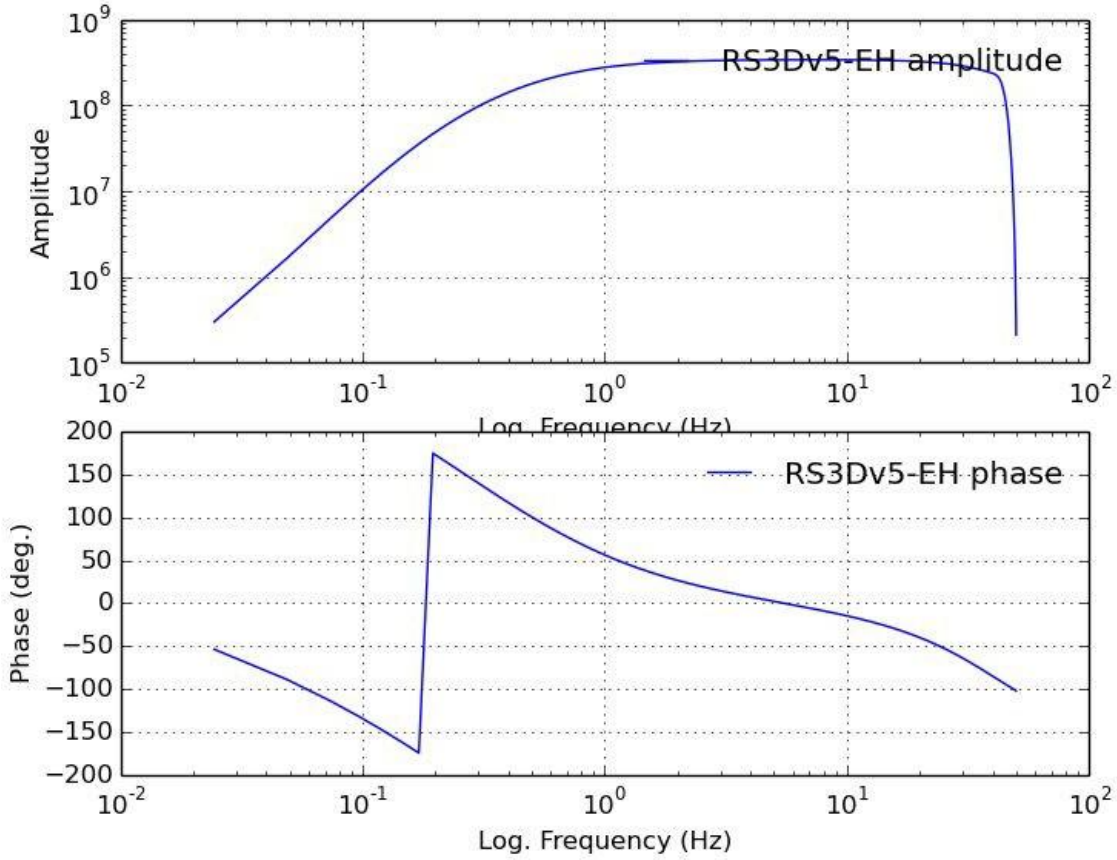
| | |
|---|---|
| | *IP 67 enclosure: Ethernet (RJ45), Power. Note: the supported standard for the IP67 LAN connector is 100 Mbit/s (4-wired LAN cable).* |
| Installation Considerations | Designed for plug-and-go installation |
| Operating Temperature | 0 to 60 C (limited by RPi, the Raspberry Shake itself can go to -20C) |
| On Board Computer | Raspberry Pi 3 Model B<br>*The Raspberry Shake board/ Software is also compatible with:*<br>00[10,13],900032: Model B+<br>a[01040,01041,21041,22042]: 2 Model B<br>a[02082,22082,32082,52082]: 3 Model B<br>a020d3: 3 Model B+<br>4 Model B |
| Storage Device | 8 Gb micro SD card<br>Est. # days of disk space:<br>OS/ software: ~4 Gb<br>Remaining space for data: ~3 Gb<br># days (15 Mb/ day/ channel [x3]): ~68 |
| Timing | Network Timing Protocol, NTP (default)<br>GPS timing supported |
| Timing Quality | NTP timing quality remains within 1 sample of accuracy versus startup accuracy: +/- 10 ms or better @ 100 sps |

# Seismograph

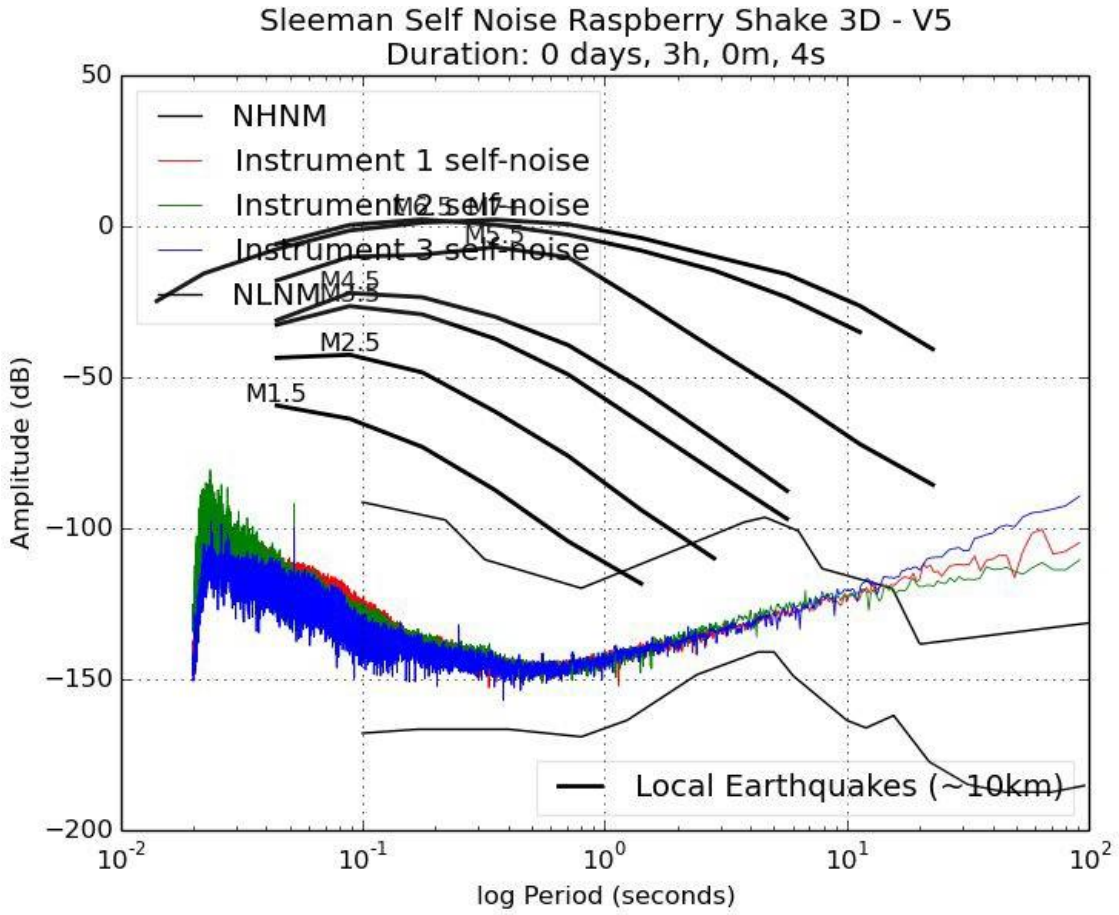
| Parameter | Value |
|---|---|
| Type | 3-component, orthogonally placed 4.5 Hz (electronically extended down to 2 seconds) Sunfull PS-4.5B geophones, 375 Ohm<br>*Note: These are not the same geophones used in the 1D and 4D versions of Raspberry Shake* |
| Samples per second | 100 |
| *Earthquake Early Warning (EEW) compatible*<br>*data packets shipped across serial port at a rate of 4 packets/ second (250 ms/ packet)* | |
| Bandwidth (estimate) | V5+: -3dB points at 0.7 to 39 Hz<br>V3: -3dB points at 0.6 to 34 Hz |
| Poles (estimate, radians/ second) | V5+:<br>-1 (0.16 Hz, single pole high pass filter)<br>-3.03 x2 (0.48 Hz, double pole high pass filter)<br>-666.67 (106 Hz, single pole low pass filter)<br>V3: 2.23E+02 +/- 2.95E+02; 3.76E-01; 0 |
| Zeros (estimate, radians/ second) | V5+: 0, 0, 0<br>V3: -1.96E+02 +/- 1.55E+02; 2.65 +/- 6.83E-01 |
| Sensitivity (estimate) | V5+: 3.60E+08 counts/ meter/ second +/- 10% precision<br>V3: 3.53E+08 counts/ meter/ second +/- 10% precision |

| | |
|---|---|
| Clip Level (estimate) | +/- 8,388,608 counts (24-bits)<br>V5+/ V3: 24 mm/s peak-to-peak from 0.1 to 10 Hz |
| Minimum Detection Threshold (estimate) | V5+: 0.03 µm/ s RMS from 1 to 20 Hz @ 100 sps<br>V3: 0.06 µm/ s RMS from 1 to 20 Hz @ 100 sps<br>*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<br>Dynamic range | 24-bit ADC Sigma-Delta $\Sigma\Delta$<br>144 dB (24 bits) |
| Effective bits (estimate) | V5+: 21 bits (124 dB) from 1 to 20 Hz @ 100 sps (for the entire analog to digital hardware chain).<br>V3: 20 bits (120 dB) from 1 to 20 Hz @ 100 sps (for the entire analog to digital hardware chain).<br>*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.*<br>This parameter is also commonly known as “Dynamic Range”; “RMS to RMS noise"; or "noise free bits". |

Velocity Channel Instrument Response:



Sleeman Self-noise:



# Software

| Software installed on Raspberry Shake's RPi computer |
| --- |
| 100% SeisComP compatible<br>Also: AQMS, Antelope, 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 (Linux) |

## Communications

| Parameter | Value |
| --- | --- |
| Digital bandwidth consumption at 100 Hz, per channel | Average:<br>820 bytes/ second<br>71 megabytes/ day<br>Max:<br>1420 bytes/ second<br>123 megabytes/ day |
| TCP/IP compatible | |
| Compatible with Ethernet, Cell, GPRS, Satellite modems, StarLink. The supported standard for the IP67 LAN connector is 100 Mbit/s (4-wired LAN cable). | |

## Power

| Parameter | Value |
| --- | --- |
| Power Supply Voltage | 5.1 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 0.320 A = 1.6 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).

# Specifications for: Raspberry Shake RS4D

- Your RS4D Personal Seismograph & Accelerograph -

*An IoT home-automation device*

*Born on: February, 2017*

https://shop.raspberryshake.org/

sales@raspberryshake.org

*Last updated: 1/12/2025*

## Unit

The “Raspberry Shake RS4D” Personal Seismograph & Accelerograph is an all-in-one, IoT plug-and-go solution for personal seismology that integrates a single vertical velocity sensors with a 2G orthogonal MEMS accelerometer, the digitizers, the hyper dampers, and the computer into *a single box*. The Raspberry Shake RS4D is manufactured in China 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 4D Version | All versions |
| Dimensions (estimated) | *Standard enclosure*: 135x110x50 mm<br>*IP67 enclosure*: 160x90x90 mm |
| Weight (estimated) | 0.35 kg |
| Immersion rating | *Standard enclosure*: IP10<br>*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,<br>Composite video and audio output jack<br><br>*IP 67 enclosure: Ethernet (RJ45), Power. Note: the supported standard for the IP67 LAN connector is 100 Mbit/s (4-wired LAN cable).* |
| Installation Considerations | Designed for plug-and-go installation<br><br>Mounting screw anchor slot provided<br><br>Alignment: with axis of building or magnetic.<br>North arrow provided. |
| Operating Temperature | 0 to 60 C (limited by RPi, the Raspberry Shake itself can go to -20C) |
| On Board Computer | Raspberry Pi 3 Model B<br>*The Raspberry Shake board/ Software is also compatible with:*<br>00[10,13],900032: Model B+<br><br>a[01040,01041,21041,22042]: 2 Model B<br><br>a[02082,22082,32082,52082]: 3 Model B<br><br>a020d3: 3 Model B+<br><br>4 Model B |
| Storage Device | 8 Gb micro SD card<br><br>Est. # days of disk space:<br><br>OS/ software: ~4 Gb<br><br>Remaining space for data: ~3 Gb<br><br># days (15 Mb/ day/ channel [x4]): ~51 |
| Timing | Network Timing Protocol, NTP (default) |

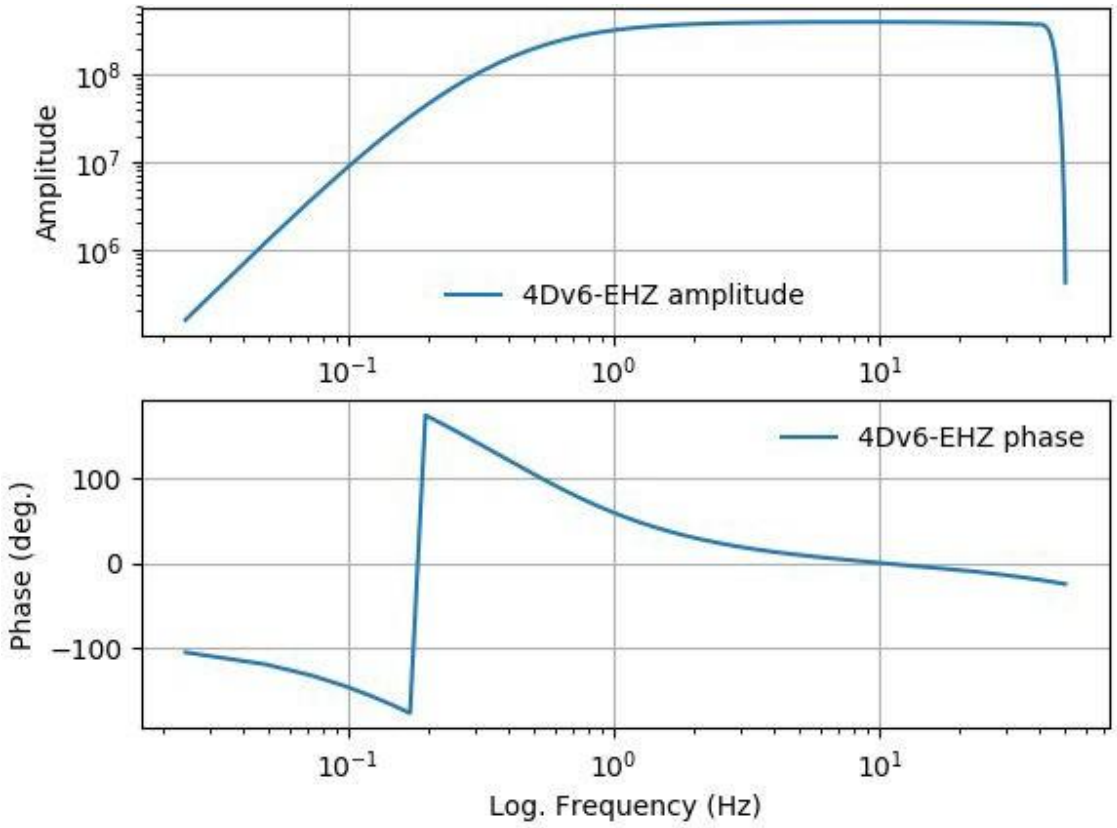
| | |
|---|---|
| | GPS timing supported |
| Timing Quality | NTP timing quality remains within 1 sample of accuracy versus startup accuracy: +/- 10 ms or better @ 100 sps |

# Seismograph

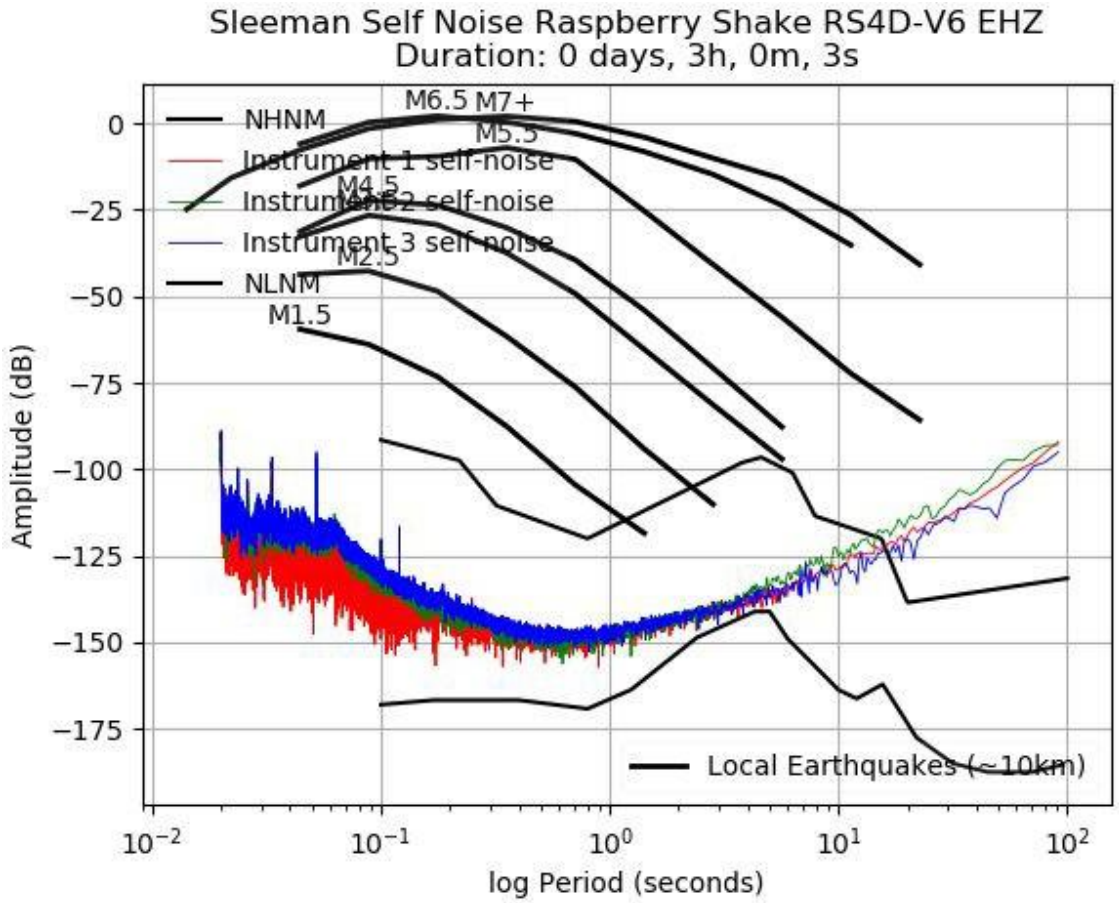
| Parameter | Value |
|---|---|
| Type | Single-component 4.5 Hz 395 Ohm vertical Racotech RGI-20DX geophone with electronic extension to lower frequencies (<1 Hz) |
| Samples per second | 100 |
| *Earthquake Early Warning (EEW) compatible*<br>*data packets shipped across serial port at a rate of 4 packets/ second (250 ms/ packet)* | |
| Bandwidth (estimate) | V6+: -3dB points at 0.7 and 44 Hz<br>V5: -3dB points at 0.7 and 26 Hz, possibly higher<br>V4: -3dB points at 0.7 and 40 Hz |
| Poles (estimate, radians/ second) | V6+:<br>-1 (0.16 Hz, single pole high pass filter)<br>-3.03 x2 (0.48 Hz, double pole high pass filter)<br>-666.67 (106 Hz, single pole low pass filter)<br>V5: -1.63E+02 +/- 1.02E+02; -3.61; -1.41 +/- 4.11E-01<br>V4: 1.82E+02 +/- 3.43E+02; 4.56E-01; 0 |
| Zeros (estimate, radians/ second) | V6+: 0; 0; 0<br>V5: -5.78E+03; 0; 0; 0<br>V4: -3.60E+02 +/- 8.29E+02; -3.04 +/- 8.48E-01 |

| | |
|---|---|
| Sensitivity (estimate) | V6+: 3.996500E+08 counts/ meter/ second +/- 10% precision<br>V5: 3.36E+08 counts/ meter/ second +/- 10% precision<br>V4: 4.05E+08 counts/ meter/ second +/- 10% precision |
| Clip Level (estimate) | +/- 8,388,608 counts (24-bits)<br>V4+: 21 mm/s peak-to-peak from 0.1 to 10 Hz |
| Minimum Detection Threshold (estimate) | V5+: 0.08 µm/ s RMS from 1 to 20 Hz @ 100 sps<br>V4: 0.16 µm/ s RMS from 1 to 20 Hz @ 100 sps<br>*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 $\Sigma\Delta$<br>144 dB (24 bits) |
| Effective bits (estimate) | V5+: 21 bits (126 dB) from 1 to 20 Hz @ 100 sps (for the entire analog to digital hardware chain).<br>V4: 18 bits (109 dB) from 1 to 20 Hz @ 100 sps (for the entire analog to digital hardware chain).<br>*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.*<br>This parameter is also commonly known as “Dynamic Range”; “RMS to RMS noise"; or "noise free bits". |

Velocity Channel Instrument Response:



Sleeman Self-Noise:



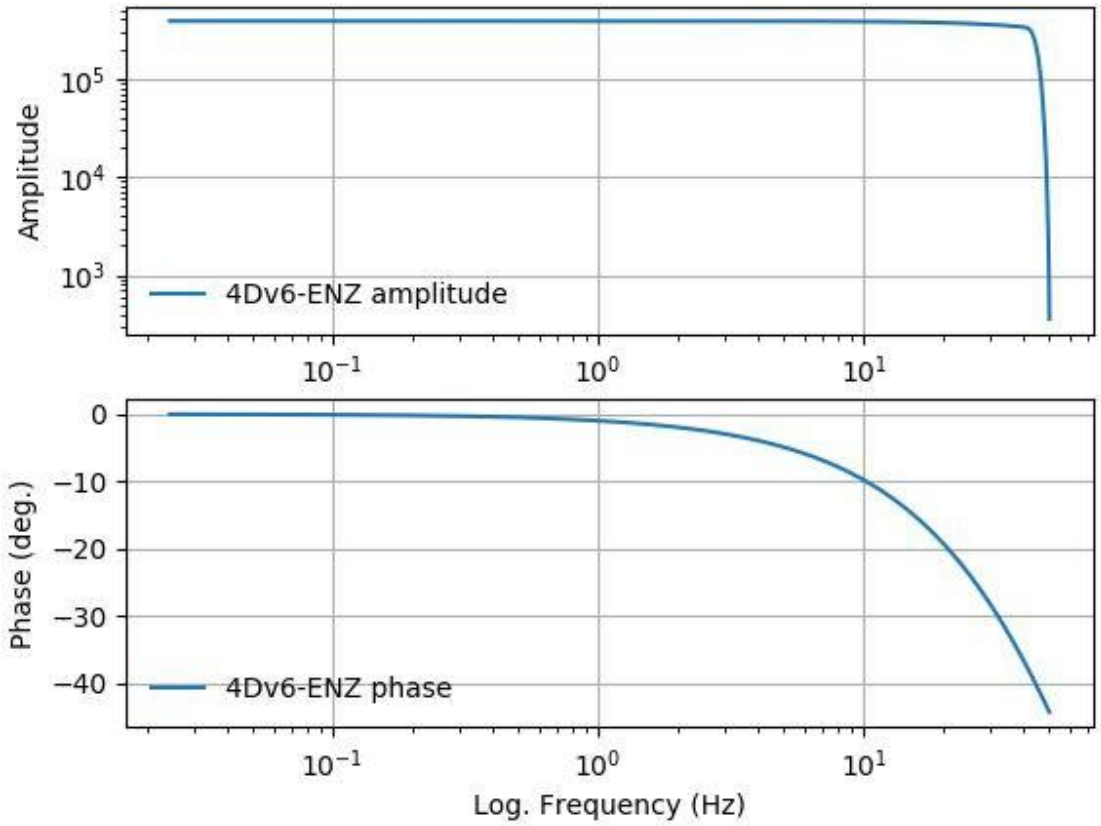
# Accelerograph: MEMs

*Think of the addition of the MEMs sensor as your insurance plan to guarantee that the Raspberry Shake remains on-scale for big earthquakes or smaller, local ones where the Raspberry Shake is located near the source, as often happens in settings like Oklahoma.*

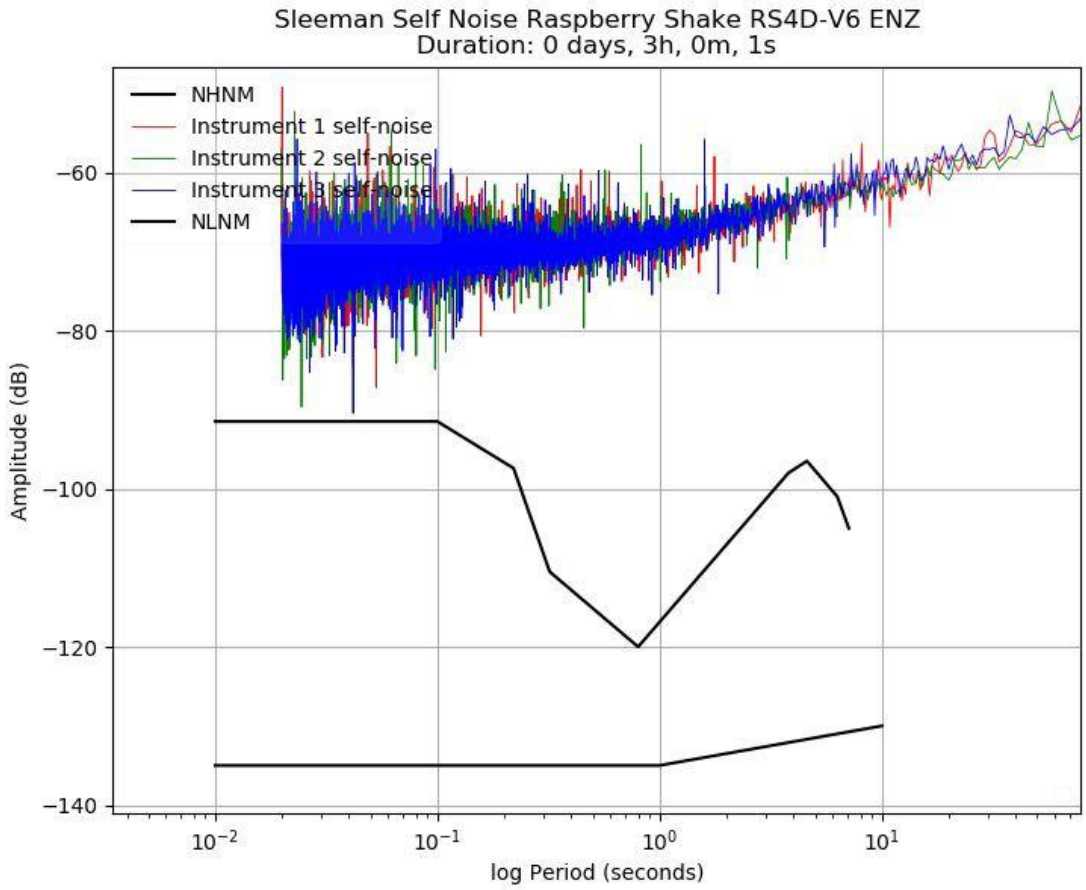
| Parameter | Value |
|---|---|
| Sensor | 3-component, orthogonally placed +/- 2g MEMs sensor (Class C) |
| Samples per second | 100 |
| *Earthquake Early Warning (EEW) compatible*<br>*data packets shipped across serial port at a rate of 5 packets/ second (200 ms/ packet)* | |
| Flat Frequency Range (estimate, -3dB points) | V6+: DC to 44 Hz<br>V5: DC to 23 Hz, possibly higher<br>V4: DC to 29 Hz, possibly higher |
| Poles (estimate) | V6+:<br>-459.56 (73 Hz, single pole low pass filter)<br>-1785.71 (284 Hz, single pole low pass filter)<br>V5: 6.57E+02 +/- 1.20E+03; 0<br>V4: 5.06E+01 +/- 2.86E+02; 0 |
| Zeros (estimate) | V6+: None<br>V5: -1.26E+02 +/- 1.02E+-02; -6.24E-05<br>V4: -4.33E+02; -1.45E+02 +/- 2.78E+02; 3.94E-02 |

| | |
|---|---|
| Sensitivity (estimate) | V6+: 3.845E+05 counts/ meter/ second squared +/- 10% precision<br><br>V5: 3.87E+05 counts/ meter/ second squared +/- 10% precision<br><br>V4: 3.96E+05 counts/ meter/ second squared +/- 10% precision |
| Clip Level (estimate) | V5+/ V4: +/-2G (21-22 m/s^2 peak-to-peak from 0.1 to 10 Hz) |
| Digitizer<br>Dynamic range | 24-bit ADC Sigma-Delta ΣΔ<br>144 dB (24 bits) |
| Effective bits (estimate) | V4+: 14 bits (84 dB) from 1 to 10 Hz @ 100 sps (for the entire analog to digital hardware chain).<br><br>*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.*<br><br>This parameter is also commonly known as “Dynamic Range”; “RMS to RMS noise"; or "noise free bits". |
| Noise Level | V4+: 3000 µm/ s (0.3 Gal, 0.0003 g) RMS from 1 to 10 Hz @ 100 sps |

Acceleration Channel Instrument Response:



Sleeman Self-Noise:



# Software

| Software installed on Raspberry Shake's RPi computer |
| --- |
| 100% SeisComP compatible<br>Also: AQMS, Antelope, 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 (Linux) |

## Communications

| Parameter | Value |
| --- | --- |
| Digital bandwidth consumption at 100 Hz, per channel | Average:<br>820 bytes/ second<br>71 megabytes/ day<br>Max:<br>1420 bytes/ second<br>123 megabytes/ day |
| TCP/IP compatible | |
| Compatible with Ethernet, Cell, GPRS, Satellite modems, StarLink. The supported standard for the IP67 LAN connector is 100 Mbit/s (4-wired LAN cable). | |

## Power

| Parameter | Value |
| --- | --- |
| Power Supply Voltage | 5.1 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 0.460 A = 2.3 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).

# Specifications for:
# Raspberry Boom (RBOOM) and 'Shake and Boom' (RS&BOOM)

- Your Personal Acoustic and Seismo-Acoustic Home Science Monitors -

*An IoT home-automation device*

*Born on: July, 2017*

https://shop.raspberryshake.org/

sales@raspberryshake.org

*Last updated: 03/June/2026*

## Unit

The “Raspberry Boom” (RBOOM) personal infrasound and "Raspberry Shake and Boom" (RS&BOOM) personal seismo-acoustic monitors are all-in-one, IoT plug-and-go solutions for personal infrasonics and seismology that integrates a single vertical velocity sensors with an acoustic pressure transducer, the digitizers, the hyper dampers, and the computer into *a single box*. These monitors are manufactured in China using cutting-edge 3D printing and laser-cutting technology.

Warranty: 1 year from ship date

*Specifications subject to change without notice.*

| Parameter | Value |
|---|---|
| Versioning | All versions |
| Dimensions (estimated) | *Standard enclosure*: 135x110x70 mm<br>*IP67 enclosure*: 160x90x90 mm |
| Weight (estimated) | 0.4 kg |
| Immersion rating | *Standard enclosure*: IP10 |
| Connectors | *Standard enclosure*: Ethernet (RJ45), Power Micro USB (5V, 2.5 Amps), USB 2 ports x4, |

| | |
|---|---|
| | HDMi, Micro SD, CSI Camera port,<br>Composite video and audio output jack<br><br>*IP 67 enclosure: Ethernet (RJ45), Power. Note: the supported standard for the IP67 LAN connector is 100 Mbit/s (4-wired LAN cable).* |
| Installation Considerations | Designed for plug-and-go installation<br>Mounting screw anchor slot provided (for RBOOM)<br>Alignment: no alignment required (the infrasound sensor is omnidirectional and the velocity sensor, vertical) |
| Operating Temperature | 0 to 60 C (limited by RPi, the Raspberry Boom itself can go to -20C) |
| On Board Computer | Raspberry Pi 3 Model B<br>*The Raspberry Shake board/ Software is also compatible with:*<br>00[10,13],900032: Model B+<br>a[01040,01041,21041,22042]: 2 Model B<br>9000[92,93],9200[92,93]: Zero<br>a[02082,22082,32082,52082]: 3 Model B<br>a020d3: 3 Model B+<br>4 Model B<br>9000c1: Zero W(H) |
| Storage Device | 8 Gb micro SD card<br><u>Est. # days of disk space:</u><br>OS/ software: ~4 Gb<br>Remaining space for data: ~3 Gb |

| | |
|---|---|
| | # days Raspberry Boom (15 Mb/ day/ channel): ~200<br># days Raspberry Shake and Boom (15 Mb/ day/ channel): ~100 |
| Timing | Network Timing Protocol, NTP (default)<br>GPS timing supported |
| Timing Quality | NTP timing quality remains within 1 sample of accuracy versus startup accuracy: +/- 10 ms or better @ 100 sps |

# Microbarograph (Infrasound)

*Applies to both Raspberry Boom & Raspberry Shake and Boom*

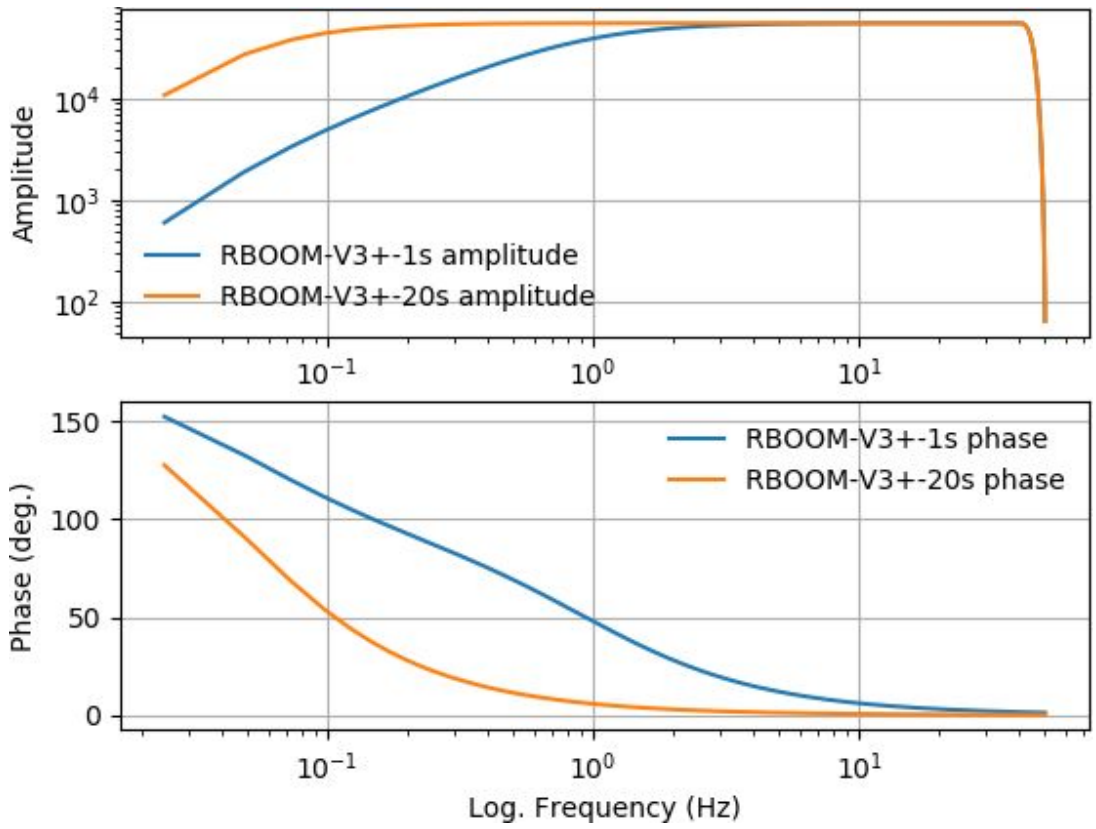
| Parameter | Value |
|---|---|
| Type | MEMS temperature compensated differential pressure transducer |
| Samples per second | 100 |
| Data packet transmission rate | Data packets shipped across serial port at a rate of 4 packets/ second (250 ms/ packet) |
| Bandwidth (estimate) | -3dB points at 1 Hertz (1 seconds) to 44 Hertz (for 1s mechanical filter, default).<br>-3dB points at 0.08 Hertz (13 seconds) to 44 Hertz (for 20s mechanical filter, not included by default with order, available upon special request only).<br>Rolloff past low frequency corners: 2 poles or 40dB/decade |
| Poles (estimate, radians/ second) | There is a hardware single-pole high-pass filter with a -3 dB point around 0.05 Hz.<br>With 1s mechanical filter attached (default):<br>-0.312 (20 seconds, single pole high pass filter, from hardware)<br>-6.289 (1 Hz, single pole high pass filter, from mechanical filter)<br>With 20s mechanical filter attached (not included by default with order, available upon special request only): |

| | |
|---|---|
| | -0.312 (20 seconds, single pole high-pass filter, from hardware)<br>-0.312 (20 seconds, single pole high pass filter, from mechanical filter) |
| Zeros (estimate, radians/ second) | 0,0 |
| Sensitivity (estimate) | 56,000 counts/ Pascal +/- 10% precision |
| Clip Level (estimate) | +/- 8,388,608 counts (24-bits)<br>0.5 inches of water, corresponding to +/- 125 Pa |
| Digitizer Dynamic range | 24-bit ADC Sigma-Delta $\Sigma\Delta$<br>144 dB (24 bits) |
| Effective bits (estimate) | 21 bits (126 dB) from 1 to 20 Hz @ 100 sps (for the entire analog to digital hardware chain).<br>*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.*<br>This parameter is also commonly known as “Dynamic Range”; “RMS to RMS noise"; or "noise free bits". |
| Error band | ~1% |
| Linearity of the pressure measurement (included in total error band measurement) | <0.5% |
| Gain Calibration | Automatic |

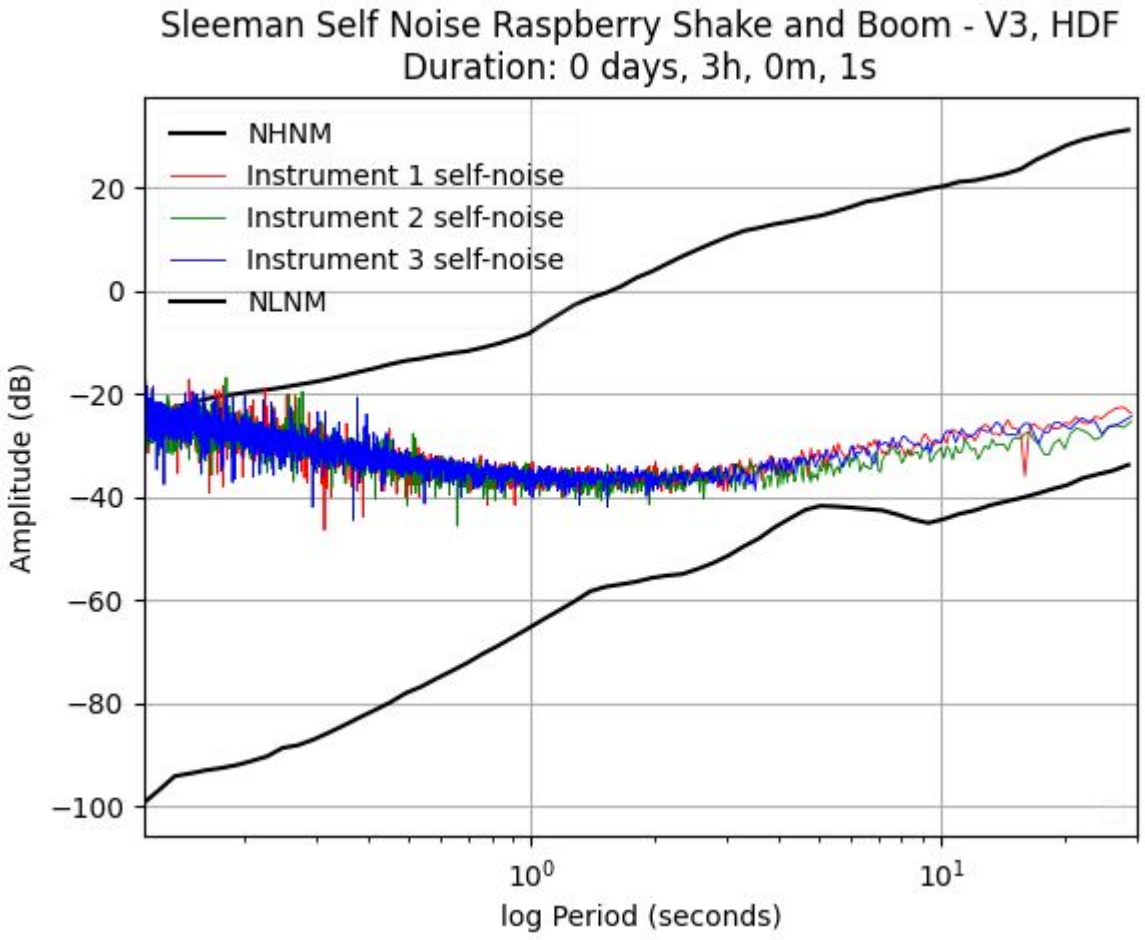
| | |
|---|---|
| Mechanical filter High Pass filter options | 1s (default, included with order), 20s (available upon special request only) |
| Operating Temperature of sensor | Compensated operating range: 0 to 50 C<br>Max. operating range: -25 to 85 C (though the rest of the electronics are limited to 0-60C) |

The Raspberry Boom infrasound sensor was based on Jeffrey Johnson's InfraBSU sensor and the work published in (1) Marcillo, O., Johnson, J.B., and Hart, D. (2012) Implementation, Characterization, and Evaluation of an Inexpensive Low-Power, Low-Noise Infrasound Sensor Based on a Micromachined Differential Pressure Transducer and a Mechanical Filter, Journal of Atmospheric and Oceanic Technology 29:1275-1284; and (2) Johnson, J.B. and Ripepe, M. (2011) Volcano Infrasound: A review, Journal of Volcanology and Geothermal Research 206:61-69.

# Microbarograph: Acoustic Channel Instrument Response



Microbarograph: Sleeman Self-Noise



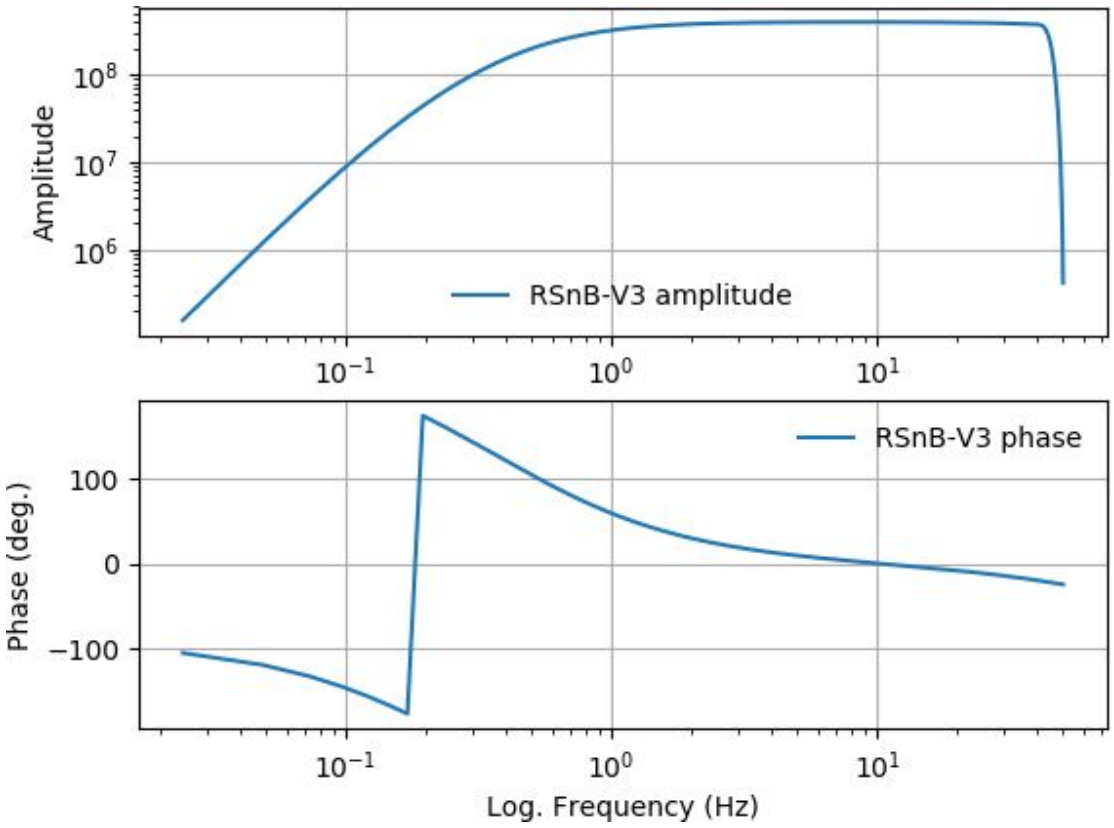
# Seismograph

*Raspberry "Shake and Boom" only*

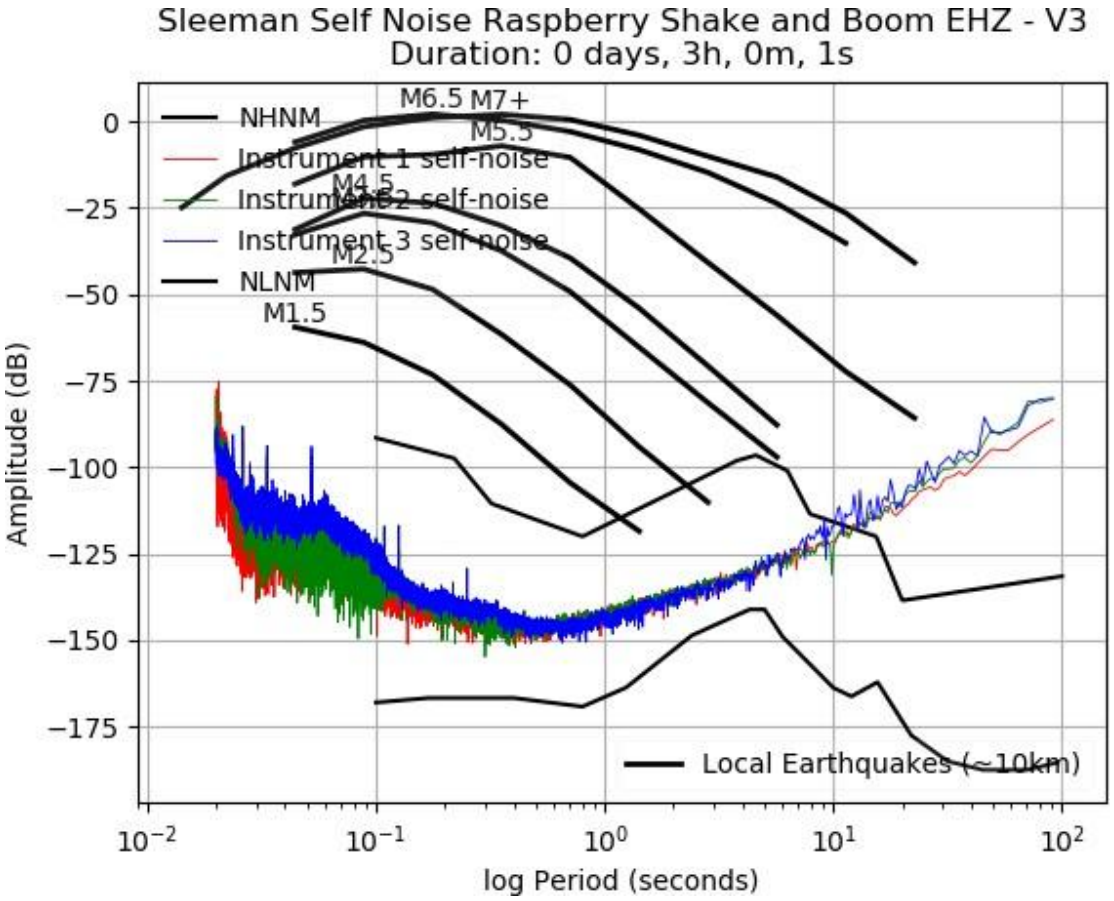
| Parameter | Value |
|---|---|
| Type | Single-component 4.5 Hz 395 Ohm vertical Racotech RGI-20DX geophone with electronic extension to lower frequencies (<1 Hz) |
| Samples per second | 100 |
| *Earthquake Early Warning (EEW) compatible*<br>*data packets shipped across serial port at a rate of 4 packets/ second (250 ms/ packet)* | |
| Bandwidth (estimate) | -3dB points at 0.7 to 44 Hz |
| Poles (estimate, radians/ second) | -1 (0.16 Hz, single pole high pass filter)<br>-3.03 x2 (0.48 Hz, double pole high pass filter)<br>-666.67 (106 Hz, single pole low pass filter) |
| Zeros (estimate, radians/ second) | 0; 0; 0 |
| Sensitivity (estimate) | 3.996500E+08 counts/ meter/ second +/- 10% precision |
| Clip Level (estimate) | +/- 8,388,608 counts (24-bits)<br>21 mm/s peak-to-peak from 0.1 to 10 Hz |
| Minimum Detection Threshold (estimate) | 0.08 µm/ s RMS from 1 to 20 Hz @ 100 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<br>Dynamic range | 24-bit ADC Sigma-Delta $\Sigma\Delta$<br>144 dB (24 bits) |
| Effective bits (estimate) | 21 bits (126 dB) from 1 to 20 Hz @ 100 sps (for the entire analog to digital hardware chain).<br><br>*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.*<br><br>This parameter is also commonly known as “Dynamic Range”; “RMS to RMS noise"; or "noise free bits". |

Seismograph: Velocity Channel Instrument Response



# Seismograph: Sleeman Self-Noise



# Software

| Software installed on Raspberry Shake's RPi computer |
| --- |
| 100% SeisComP compatible<br>Also: AQMS, Antelope, 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 (Linux) |

## Communications

| Parameter | Value |
| --- | --- |
| Digital bandwidth consumption at 100 Hz, per channel | Average:<br>820 bytes/ second<br>71 megabytes/ day<br>Max:<br>1420 bytes/ second<br>123 megabytes/ day |
| TCP/IP compatible | |
| Compatible with Ethernet, Cell, GPRS, Satellite modems, StarLink. The supported standard for the IP67 LAN connector is 100 Mbit/s (4-wired LAN cable). | |

## Power

| Parameter | Value |
| --- | --- |
| Power Supply Voltage | 5.1 Volts DC (2.5+ Amp Supply) |
| Power Consumption (RPi + Raspberry Shake, estimated) | Raspberry Boom:<br>Startup: 5 Volts x 0.550 A = 3.0 Watts<br>Run-time: 5 Volts x 0.290 A = 1.8 Watts |

| | |
|---|---|
| | Raspberry Shake and Boom:<br>Startup: 5 Volts x 0.550 A = 3.1 Watts<br>Run-time: 5 Volts x 0.290 A = 1.9 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).

# Specifications for: Raspberry Shake 6D

https://shop.raspberryshake.org/
sales@raspberryshake.org

*Last updated: 1/12/2025*

## Unit

The Raspberry Shake 6D (RS6D) Seismograph & Accelerograph is an all-in-one, IoT plug-and-go solution for professional seismology that integrates a 3 orthogonal velocity sensors with a 2G orthogonal MEMS accelerometer, the digitizers, the hyper dampers, and the computer into *a single box*. The RS6D is manufactured in China 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 6D Version | All versions |
| Dimensions (estimated) | *Standard enclosure*: 140x135x60 mm<br>*IP67 enclosure*: 160x90x90 mm |
| Weight (estimated) | 0.6 kg |
| Immersion rating | *Standard enclosure*: IP67 |
| Connectors | Ethernet (RJ45), Power. Note: the supported standard for the IP67 LAN connector is 100 Mbit/s (4-wired LAN cable). |

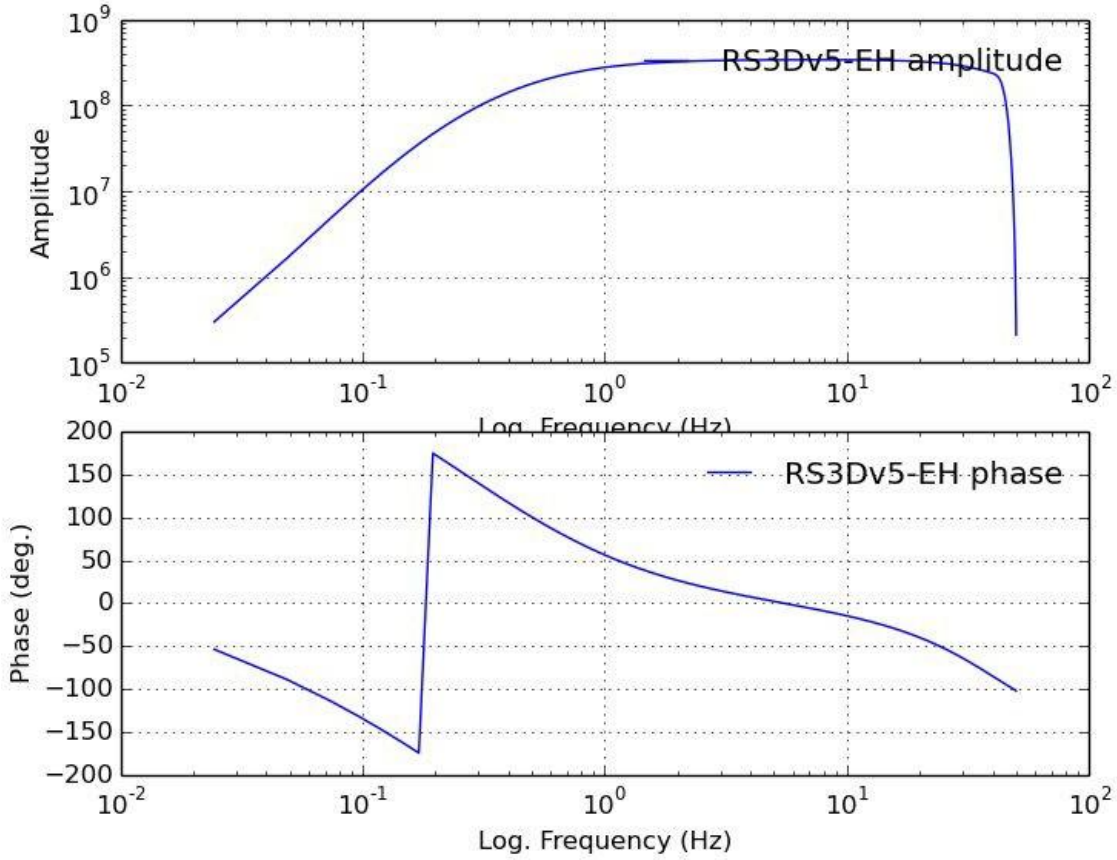
| | |
|---|---|
| Installation Considerations | Designed for plug-and-go installation |
| Operating Temperature | 0 to 60 C (limited by RPi, the Raspberry Shake itself can go to -20C) |
| On Board Computer | Raspberry Pi 3 Model B<br>*The Raspberry Shake board/ Software is also compatible with:*<br>00[10,13],900032: Model B+<br>a[01040,01041,21041,22042]: 2 Model B<br>a[02082,22082,32082,52082]: 3 Model B<br>a020d3: 3 Model B+<br>4 Model B |
| Storage Device | 8 Gb micro SD card<br>Est. # days of disk space:<br>OS/ software: ~4 Gb<br>Remaining space for data: ~3 Gb<br># days (15 Mb/ day/ channel [x6]): ~1 month |
| Timing | Network Timing Protocol, NTP (default)<br>GPS timing supported |
| Timing Quality | NTP timing quality remains within 1 sample of accuracy versus startup accuracy: +/- 10 ms or better @ 100 sps |

# Seismograph

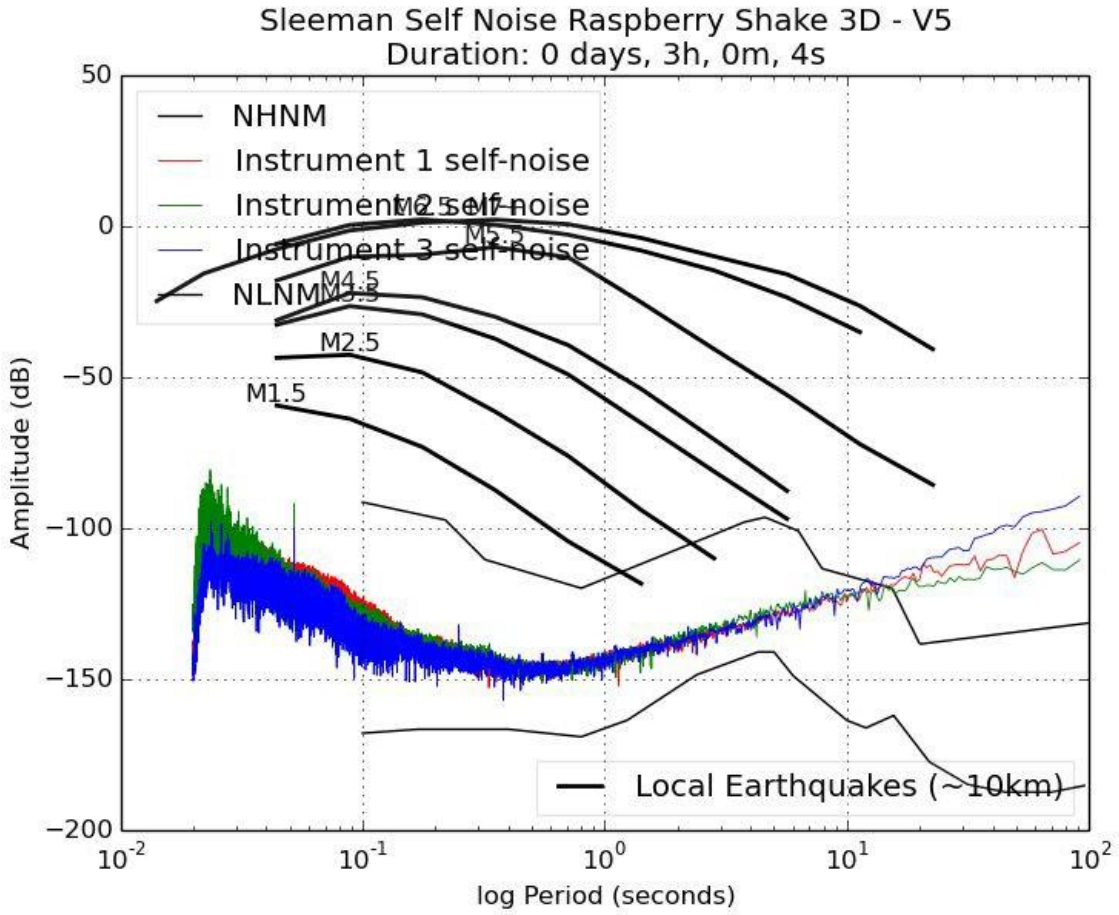
| Parameter | Value |
|---|---|
| Type | 3-component, orthogonally placed 4.5 Hz (electronically extended down to 2 seconds) Sunfull PS-4.5B geophones, 375 Ohm<br>*Note: These are not the same geophones used in the 1D and 4D versions of Raspberry Shake. They are the same geophones used in the 3D.* |
| Samples per second | 100 |
| *Earthquake Early Warning (EEW) compatible*<br>*data packets shipped across serial port at a rate of 4 packets/ second (250 ms/ packet)* | |
| Bandwidth (estimate) | V4+: -3dB points at 0.7 to 39 Hz |
| Poles (estimate, radians/ second) | V4+:<br>-1 (0.16 Hz, single pole high pass filter)<br>-3.03 x2 (0.48 Hz, double pole high pass filter)<br>-666.67 (106 Hz, single pole low pass filter) |
| Zeros (estimate, radians/ second) | V4+: 0, 0, 0 |
| Sensitivity (estimate) | V4+: 3.60E+08 counts/ meter/ second +/- 10% precision |

| | |
|---|---|
| Clip Level (estimate) | +/- 8,388,608 counts (24-bits)<br><br>V4+: 24 mm/s peak-to-peak from 0.1 to 10 Hz |
| Minimum Detection Threshold (estimate) | V4+: 0.03 µm/ s RMS from 1 to 20 Hz @ 100 sps<br><br>*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<br>Dynamic range | 24-bit ADC Sigma-Delta $\Sigma\Delta$<br>144 dB (24 bits) |
| Effective bits (estimate) | V4+: 21 bits (124 dB) from 1 to 20 Hz @ 100 sps (for the entire analog to digital hardware chain).<br><br>*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.*<br><br>This parameter is also commonly known as “Dynamic Range”; “RMS to RMS noise"; or "noise free bits". |

Velocity Channel Instrument Response
(same as RS3D):



Sleeman Self-noise
(same as RS3D):



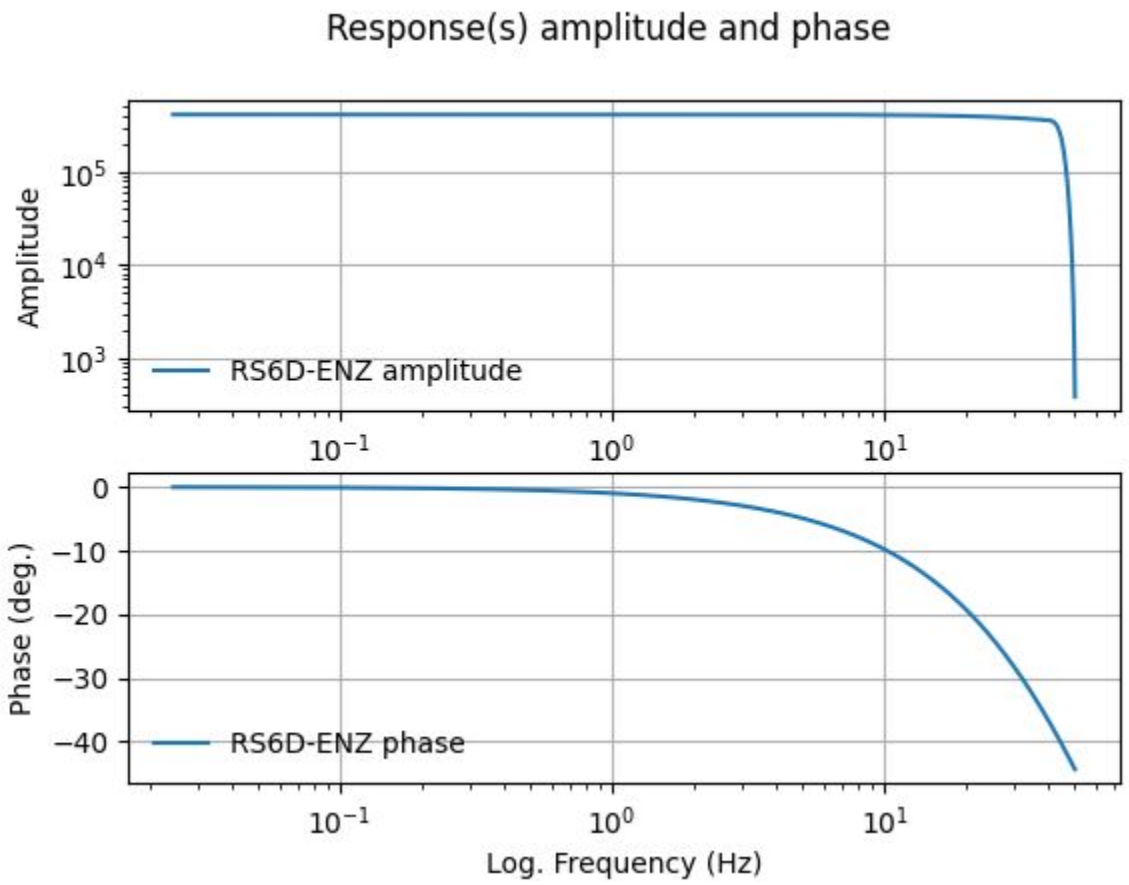
# Accelerograph: MEMs

*Think of the addition of the MEMs sensor as your insurance plan to guarantee that the Raspberry Shake remains on-scale for big earthquakes or smaller, local ones where the Raspberry Shake is located near the source, as often happens in settings like Oklahoma.*

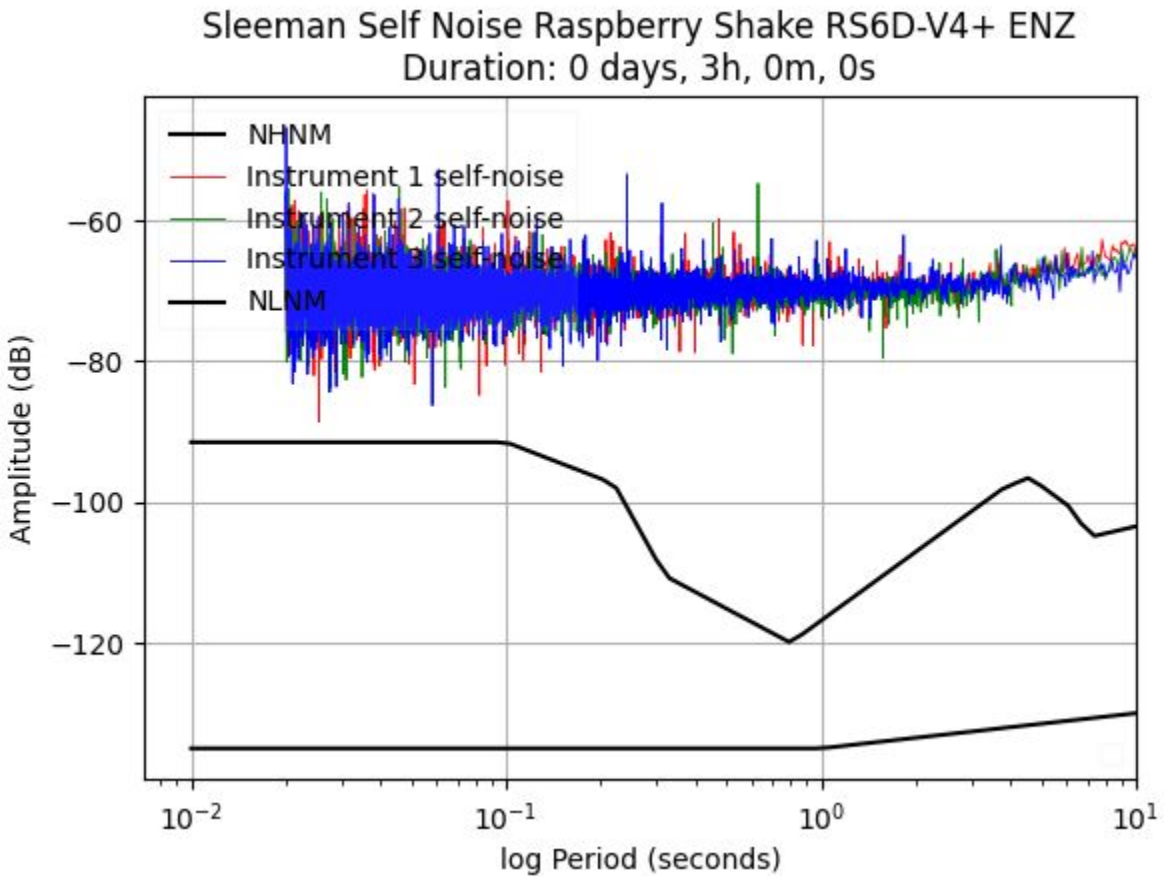
| Parameter | Value |
|---|---|
| Sensor | 3-component, orthogonally placed +/- 2g MEMs sensor (Class C) |
| Samples per second | 100 |
| *Earthquake Early Warning (EEW) compatible*<br>*data packets shipped across serial port at a rate of 5 packets/ second (200 ms/ packet)* | |
| Flat Frequency Range (estimate, -3dB points) | V4+: DC to 44 Hz |
| Poles (estimate) | V4+:<br>-459.56 (73 Hz, single pole low pass filter)<br>-1785.71 (284 Hz, single pole low pass filter) |
| Zeros (estimate) | V4+: None |

| | |
|---|---|
| Sensitivity (estimate) | V4+: 4.095E+05 counts/ meter/ second squared +/- 10% precision |
| Clip Level (estimate) | V4+: +/-2G (20-21 m/s^2 peak-to-peak from 0.1 to 10Hz) |
| Digitizer<br>Dynamic range | 24-bit ADC Sigma-Delta ΣΔ<br>144 dB (24 bits) |
| Effective bits (estimate) | V4+: 14 bits (84 dB) from 1 to 10 Hz @ 100 sps (for the entire analog to digital hardware chain).<br>*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.*<br>This parameter is also commonly known as “Dynamic Range”; “RMS to RMS noise"; or "noise free bits". |
| Noise Level | V4+: 3000 µm/ s (0.3 Gal, 0.0003 g) RMS from 1 to 10 Hz @ 100 sps |

Acceleration Channel Instrument Response:



Sleeman Self-Noise:



# Software

| Software installed on Raspberry Shake's RPi computer |
| --- |
| 100% SeisComP compatible<br>Also: AQMS, Antelope, 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 (Linux) |

## Communications

| Parameter | Value |
| --- | --- |
| Digital bandwidth consumption at 100 Hz, per channel | Average:<br>820 bytes/ second<br>71 megabytes/ day<br>Max:<br>1420 bytes/ second<br>123 megabytes/ day |
| TCP/IP compatible | |
| Compatible with Ethernet, Cell, GPRS, Satellite modems, StarLink. The supported standard for the IP67 LAN connector is 100 Mbit/s (4-wired LAN cable). | |

## Power

| Parameter | Value |
| --- | --- |
| Power Supply Voltage | 5.1 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 0.460 A = 2.3 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).