Larson Davis

HVM200 Manual

DRAFT

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HVM200 Purchase Information

Record the serial number and date of purchase below.

Serial Number:________________________ Date of Purchase:_____________________

CHAPTER 1

Introduction

This chapter presents an overview of the HVM200 Human Vibration Meter.

Features

The Larson Davis HVM200 Human Vibration Meter is a Type 1 instrument designed for use in assessing vibration as perceived by human beings.

The HVM200 provides the following features for vibration measurement:

- Whole body, hand-arm, and general vibration applications
- Wireless mobile interface
- Compact design for easy wear and convenient placement
- Mobile G4 measurement application for configuring, measuring, and viewing vibration data on multiple meters
- Connection and control of multiple meters through Wi-Fi access (
- Support for optional 1/1 and 1/3 Octave Band Analysis
- Support for full SLM Utility G4 Software analysis

Standard Accessories

- USB 2.0 to Micro-USB power and communications cable
- Removable 64 GB SD memory

Optional Accessories

- 1/1 and 1/3 Octave Band Analysis firmware
- SLM Utility G4 for HVM Software
- Larson Davis PSA035 Power Supply

Optional Larson Davis CCS047 Hard Shell Case

- Larson Davis CCS048 Arm Band for wearing the HVM200
- Larson Davis SEN041F accelerometer for Hand-Arm vibration measurements
- Larson Davis SEN020 accelerometer for Hand-Arm and general vibration measurements
- Larson Davis SEN027 Seat Adapter, accelerometer, and adapter for whole-body vibration measurements
- Larson Davis ADP063, ADP080A, ADP081A, and ADP082A adapters for accelerometer placement
- Larson Davis CBL210-05, CBL216, and CBL217-01 cables for connection between accelerometers and HVM200 meter.
- Larson Davis 394C06 Hand-held Shaker for vibrational measurement verification
- Larson Davis CCS047 Hard Shell Case for transport and protection of HVM200 and accessories

Transducer Selection

The HVM200 requires a transducer to convert physical vibration quantities into measurable, electrical signals. In selecting a transducer for the HVM200, consider the following

ICP® or Charge Accelerometers

The HVM200 has built-in ICP® power supplies and charge amplifiers. This allows the HVM200 to interface directly with ICP or charge transducers, and eliminates the need for external signal conditioning.

- ICP accelerometers are also called “Voltage Mode” or “Low impedance” and may be known by various other vendor trade names. ICP is PCB’s registered trademark which stands for “Integrated Circuit Piezoelectric” and identifies PCB sensors which incorporate built-in, signal conditioning electronics. The built-in electronics serve to convert the high impedance charge signal that is generated by the piezoelectric sensing element to a usable low impedance voltage signal which can be readily transmitted over ordinary 2 wire or coaxial cables to any voltage readout or recording device. The low impedance signal can be transmitted over long cable distances and used in dirty field or factory environments with little signal degradation

The HVM200 could also be utilized through an alternative direct input. This would require, however, the use of some kind of external signal conditioning unit such as an external source of ICP power, or an external charge amplifier.

- Charge mode sensors output a high impedance, electrical charge signal that is generated by the piezoelectric sensing element. This signal is extremely sensitive to corruption from environmental influences. To conduct accurate measurements, it is necessary to condition this signal to a low impedance voltage before it can be input to a readout or recording device. A charge amplifier or in-line charge converter is generally used for this purpose.

Transducer Sensitivity

With accelerometers, the proper sensitivity depends on the application being performed. If the application is a high vibration level application, a low sensitivity should be selected. For low vibration level applications, a high sensitivity accelerometer should be used.

Transverse sensitivity may also affect measurements. It is defined as the unwanted output signal of a motion sensor when subjected to motion perpendicular to the sensitive axis. This is usually expressed as a percent of the normal axis sensitivity. For example if you are using a tri-axial accelerometer and place an input signal on the Z axis, your X axis could also be reading a level even though there is really no x-axis signal present.

Resonant Frequency

The resonant frequency is defined as the frequency at which the structure will readily vibrate. For accelerometers, there is one frequency at which the accelerometer vibrates much easier than at other frequencies. At this point, the reading will be very high, and could overload the input of the HVM200. However, for most of the recommended accelerometers, the resonant frequency is well above the upper limit of the HVM200, and will subsequently be masked out by the low pass filter on the HVM200. If the resonant frequency becomes an issue, it is recommended that an external mechanical filter be used.

Frequency Range

Most recommended accelerometers will have a frequency range sufficient for use with the HVM200. Refer to the frequency response tables and graphs in this manual for more information on the HVM200 frequency response.

Environmental Effects

Consider temperature, humidity, and other physical agents, such as mounting surface, mounting method, mass, and environment. The mass of the accelerometer should ideally be no more that 1/50 of the mass of the object being measured. A ratio of as little as 1/10 is acceptable in extreme circumstance

CHAPTER 2

Getting Started

This chapter provides instructions for setting up and configuring HVM200 meters for use with the G4App.

Unpacking the HVM200

The HVM200 package includes a USB to mirco-USB cable with the meter. After removing the HVM200 and cable from the packaging, record the serial number and date of purchase in a safe place where it can be retrieved, in case you require customer support.

Powering the HVM200

Before using your HVM200, you should charge the battery completely by following these steps:

Step 1 Slide and remove the back battery cover from the HVM200 meter.

FIGURE 2-1 Remove Battery Cover

Step 2 Insert the supplied battery into the HVM200 so that the battery contacts align with the power contacts in the device.

Step 3 Slide the back battery cover onto the HVM200.

Step 4 Connect one end of the supplied cable to the HVM200 micro-USB port and the other end to a powered USB port.

The Power LED displays a yellow color while charging. If the LED does not show any color, push the power button in for a few seconds.

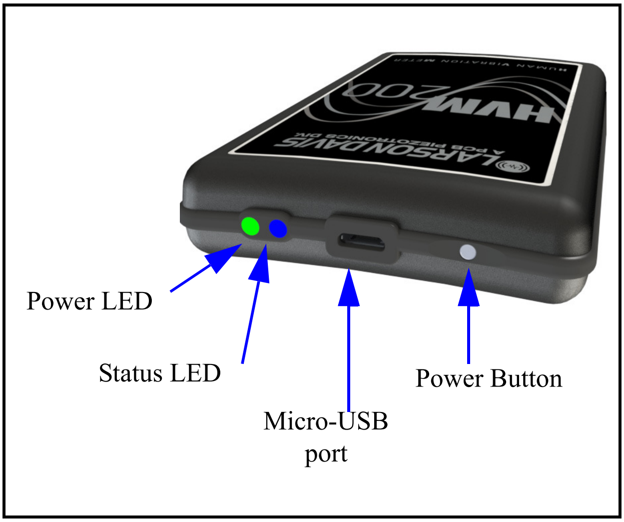


FIGURE 2-2 HVM200 Micro-USB Port

Refer to the back label of your HVM200 for a description of each LED indication.

Step 5 Make sure the HVM200 is fully charged before performing any operations. When fully charged, the Power LED displays a solid green (not blinking) color. This may take up to 6 hours, depending on the type of USB port used to charge the device.

Step 6 Once fully charged, allow the battery to completely drain with HVM200 usage in the first cycle before recharging. This allows the battery power display in the software to more accurately reflect battery life. After completing the first cycle, avoid leaving the battery drained for extended periods of time. This will maximize overall battery life.

Downloading the HVM200 App

Once your HVM200 is fully charged, use your mobile device to find and download the HVM200 app from Google Play or the Apple Store®.

Connecting to a Wi-Fi Network

To establish a Wi-Fi connection with the HVM200 meter, follow these steps:

Step 1 Launch the HVM App.

Step 2 Click the menu icon, as shown in Figure 2-3.

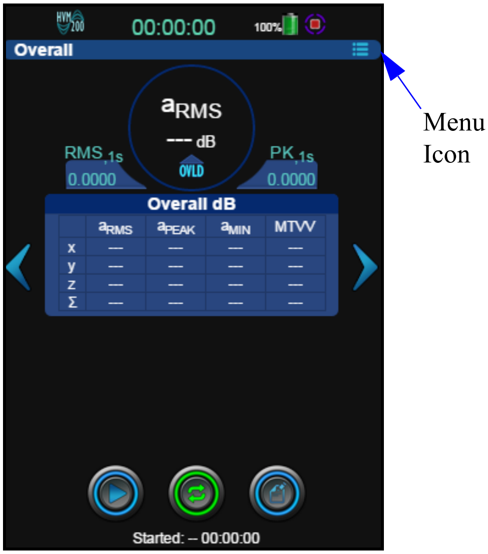


FIGURE 2-3 HVM200 App

Step 3 On the HVM200 Menu, select **Setup Wi-Fi**.

FIGURE 2-4 Wi-Fi Setup

Step 4 If no stored networks appear in the **Networks** dialog box, select an available network and click **Add Network**.

*If you have already entered a password and a stored network appears, select it and click **Connect Network**.*

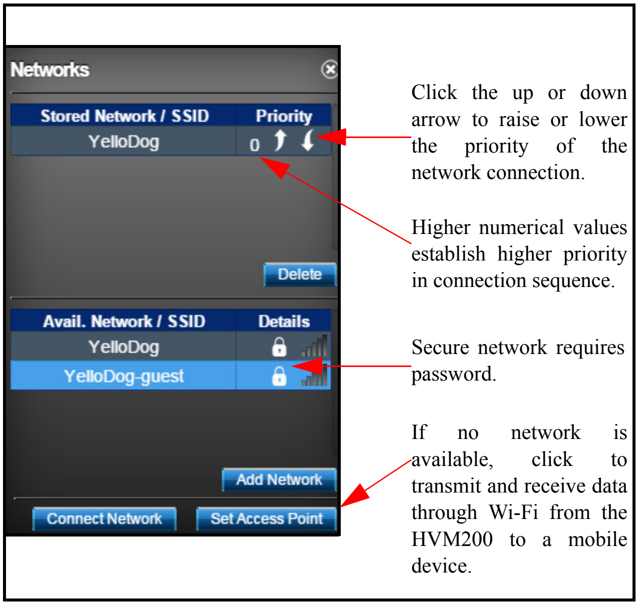


FIGURE 2-5 Networks Settings

Larson Davis recommends using secure Wi-Fi networks with your HVM200 meter.

Step 5 Enter the network password, if required, and click **Add**.

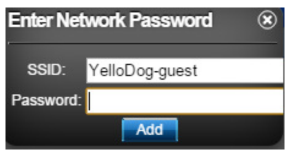


FIGURE 2-6 Enter Network Password

With multiple stored networks, you can establish a connection order by assigning a priority number to the network. An automatic connection is first made to the network with the highest priority. If multiple stored networks have the same priority number, an automatic connection is made with the network displayed higher on the list.

Step 6 Select the stored network and click **Connect**.

Step 7 Assign a connection priority value for the network, if needed.

Step 8 If no network is available, click **Set Access Point**. This enables the HVM200 to transmit and receive data through Wi-Fi to your mobile device.

Connecting the Accelerometer

Refer to the "Introduction" in this manual for information on selecting the proper accelerometer for the HVM200 meter.

To connect the accelerometer to your HVM200 meter, follow these steps:

Step 1 Insert the accelerometer cable into the 4-pin connector on the HVM200 and then screw it tight.

Step 2 Insert the other end of the accelerometer cable into the 4-pin connector on the accelerometer and then screw it tight.

Step 3 If the HVM200 is not already turned on, press the power button.

Step 4 Open the Setup Manager in the HVM200 App and click the **Sensor** tab.

If you are using an accelerometer with Transducer Electronid Data Sheet (TEDS) capabilities, the sensitivity values will already be displayed for the x, y, and z axes of the sensor.

FIGURE 2-7 Sensor Tab

Step 5 Click **Sensor List**.

Sensor information, including model, serial number, and sensitivity specifications are usually listed on the calibration certificate that comes with an accelerometer.

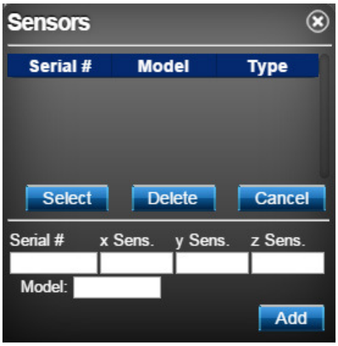


FIGURE 2-8 Sensor List Identification and Sensitivity

If you are using an accelerometer with TEDS capabilities, sensor information will appear automatically in this list.

In the **Sensor List**, type the model, serial number of your accelerometer, and the sensitivity for the x, y, and z axes and then click **Add**.

Select the accelerometer when it appears in the list and click **Select**. The sensitivity values will automatically appear on the Sensor tab. Click **Save**.

Use the Sensor List to quickly access and select stored sensors for future measurements.

CHAPTER

3

Making a Measurement

This chapter provides an example procedure for performing a vibration measurement with the HVM200 meter and the HVM200 App.

Overview

The following example demonstrates procedures for measuring vibration, including:

- **Setting Up the Measurement**
- **Making the Measurement**
- **Downloading the Measurement Data**

Setting Up the Measurement

To set up the measurement:

1. *Perform a calibration check.*
2. *Specify a setup file on your mobile device.*

The following sections describe these steps in more detail.

Perform a Calibration Check

Performing a calibration check tests the circuitry of the HVM200 to verify that all functions are working. To perform a calibration check:

Specify a Setup File on Your Mobile Device

The HVM200 App includes nine default setups on its **Settings** list. These default setups correspond to settings typically used for different methods of measurement.

Default Setup	Application
1secLog	

Table 3-1 HVM200 Default Setups

Default Setup	Application
60secLog	
ComfortBack	
ComfortFeet	
ComfortRot	
ComfortSeat	
Hand-Arm	
HealthSeat	
WmBuilding	

Table 3-1 HVM200 Default Setups

You can also create new setup files on the Settings list. To create a new setup file, follow these steps:

Name the Setup File

The easiest way to create a new setup file is to modify an existing default setup and save it with a different name.

Step 1 Right-click on a default setup file in the Settings list. Select **Save As** and specify the setup name.

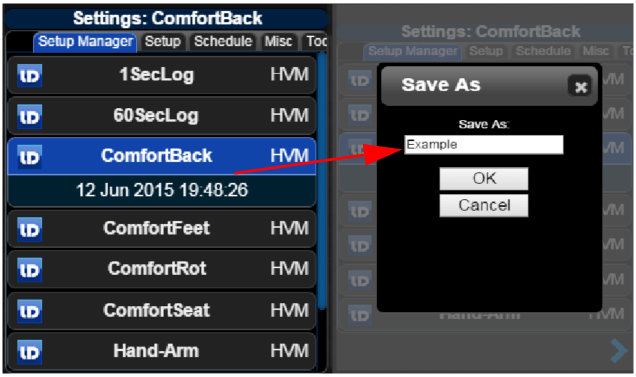


FIGURE 3-1 Name the Setup File

*If you return to the **Setup Manager** tab from a settings tab, you are prompted to save settings. Click **Yes** to apply the changes to the setup.*

Step 2 Find and click the setup file you just created. The list now displays a report icon next to your new setup file.

FIGURE 3-2 Select New Setup File

Set Operating Mode, Interval Time, and Weighting

*The interval time values represent the span that data is collected, averaged, and stored before starting a new sample. The **Slow** option is an exponential detector, meaning that each 1 second average computation includes all previous data in the measurement.*

*The supplied HVM200 memory card can store up to 24 hours of measurements with the **Store Raw Data** option enabled. When not enabled, the card can store approximately 8000 hours of measurements.*

*The **Wh** weighting is automatically specified for all axes with the Hand/Arm mode. For more information on operating mode options and weighting curves, see the "Technical Specifications" in this manual and ISO 8041:2005.*

Step 3 On the **Setup** tab, specify any changes to your settings and select the **Store Raw Data** option if you have the it installed and need it for your post-measurement analysis. The **Store Raw Data** option will greatly increase the amount of memory required to store the measurement. Click **Save**.

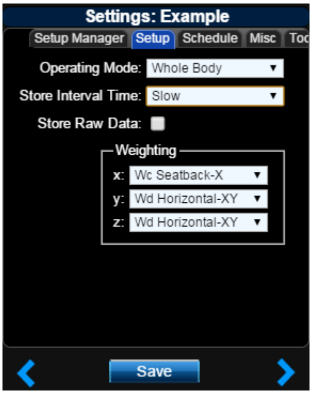


FIGURE 3-3 Operation Settings

Set Measurement Schedule

Step 4 If needed, schedule the HVM200 to take a measurement automatically by selecting the **Enable Schedule** option on the **Schedule** tab. Specify the **Start Date** and **Start Time**, as well as the **End Date** and **Duration**. Specify a **Delay Start**, if needed. Click **Save**.

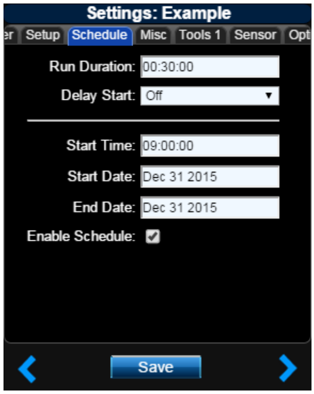


FIGURE 3-4 Schedule Settings

Set OBA Time History, Decibel Reference, and Exposure Settings

*The **dB Reference** options are applicable only if you have selected to display acceleration, velocity, or displacement in decibels on the **Tools** tab; otherwise, the **dB Reference** selection is ignored.*

Step 5 On the **Misc** tab, select **1/1 Octave** or **1/3 Octave** to include octave band analysis in your measurement data, if you have the options installed. Select **10e-5** or **10e-6** as the **dB Reference**, and specify the exposure settings. Click **Save**.

The exposure settings show default values according to the EU Physical Agents Directive (2002/44/EC) but can be modified according to differing standards or needs.

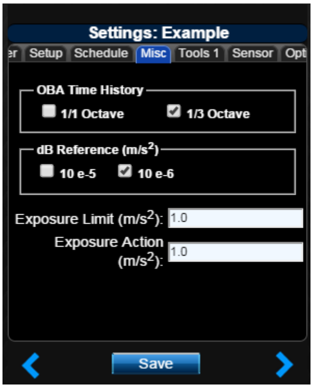


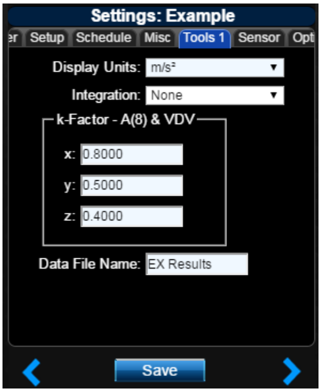
FIGURE 3-5 Misc. Settings

Choose Tools Settings

*If you are connected to multiple meters, the HVM200 App displays a **Tools** tab for each meter, according to their numbered order.*

*Single integration calculations convert acceleration values into velocity values; double integration converts acceleration values into displacement values. Display units may be converted to match integration results if not specified correctly. Integration is applicable only to the **Vibration** mode.*

Step 6 On the **Tools** tab, choose the **Display Units** and **Integration** method. Specify the **k-Factor** for each axis and type a **Data File Name**. Click **Save**.



*The HVM200 multiplies the specified **k-Factor** by the instantaneous acceleration for each axis to produce the summation (Σ) value on the HVM200 App.*

FIGURE 3-6 Tools Settings

Verify Sensor Settings

If you are using an accelerometer with TEDS capability, the **Sensor** tab settings are automatically specified. If your accelerometer does not have TEDS capability and you have not already specified the settings, refer to the section "Transducer Selection".

Verify Installed Options

If you have purchased Octave Band Analysis or Raw Data options, click the **Options** tab and verify that they are displayed and selected in the list.

Making the Measurement

To make the vibration measurement:

When using the HVM200 for vibration measurements, ensure that the ambient temperature during operation does not exceed 50 °C (122° F).

1. *Position the HVM200 meter and accelerometer.*
2. *Start the measurement.*
3. *Observe data.*
4. *Stop and annotate the measurement.*

The following sections describe these steps in more detail.

Position for Hand/Arm Vibration

For Hand/Arm vibration measurement, follow these steps:

Step 1 Attach the Larson Davis CCS048 Arm Band on the person being monitored. The end with the transparent cover should be the farthest from the hand.

Step 2 Insert the HVM200 into the arm band so that the accelerometer connector is nearest the hand.

Refer to the seciton "Transducer Selection" for more information.

Step 3 Connect the accelerometer to the HVM200.

Step 4 Attach the accelerometer to an appropriate adapter.

Position for Whole Body Vibration with Seat Adapter

For whole body vibration measurements using the Larson Davis SEN027 Seat Adapter, follow these steps:

The Seat Adapter is sold with the SEN027 accelerometer already housed within the adapter and with the cable already connected to the accelerometer.

Step 1 Place the seat adapter in the location where the person being monitored will sit.

Step 2 Connect the accelerometer cable to the HVM200.

Step 3 Set the HVM200 meter in a secure location, where it will not fall from its position.

Start the Measurement

Click the **Start** button that appears on all HVM200 App displays.

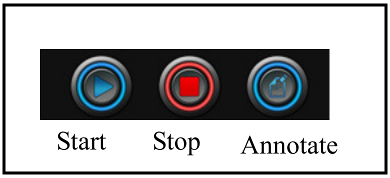


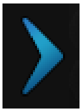
FIGURE 3-7 Start, Stop, or Annotate the Measurement

Observe Data

The HVM200 App provides the following data displays:

*Alternatively, you can also schedule measurements automatically on the **Schedule** tab if you do not need to observe them.*

- **Overall**
- **Summation**
- **X-axis**



Next Arrow

Zoom Button

- **Y-axis**
- **Z-axis**

To advance from one data display to the next, click the **Next Arrow**. To enlarge a data display, click the **Zoom** button.

The **Overall** display shows cumulative data for all three axes and their summation for the measurement.

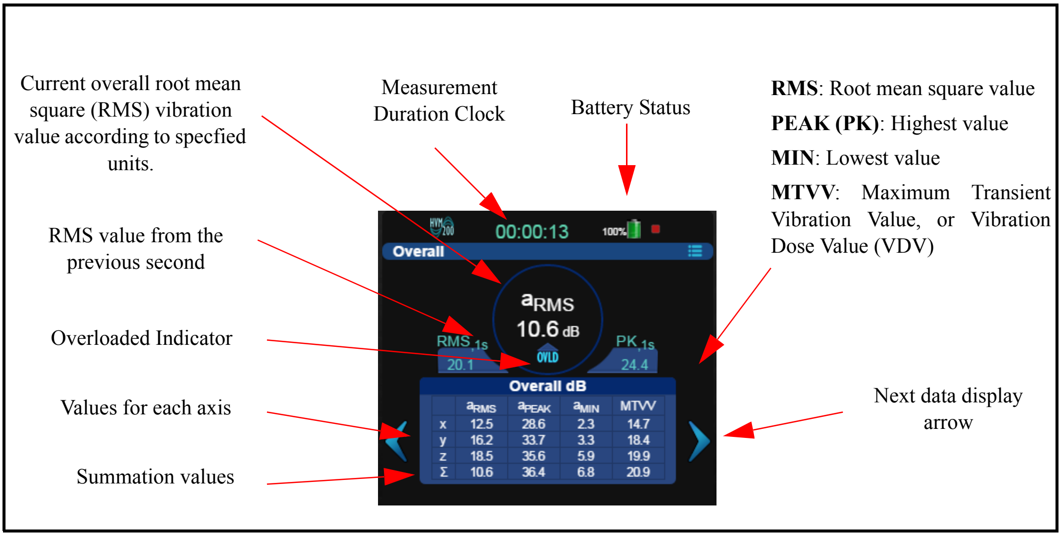


FIGURE 3-8 Overall Data Display

Σ represents the summation of vibration values taken from the X, Y, and Z axes.

The **Summation** display provides a real-time graphical representation of the current summed values from all three axes.

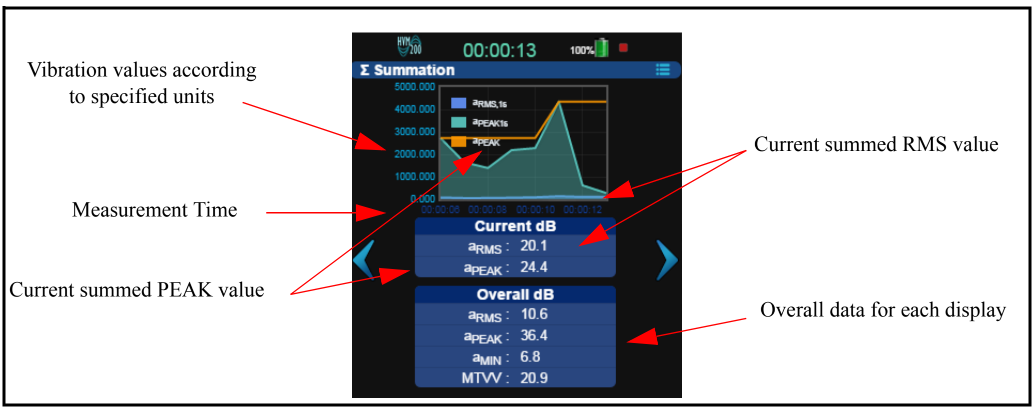


FIGURE 3-9 Summation Data Display

The Axis displays provide real-time graphical representations of current values for each axis.

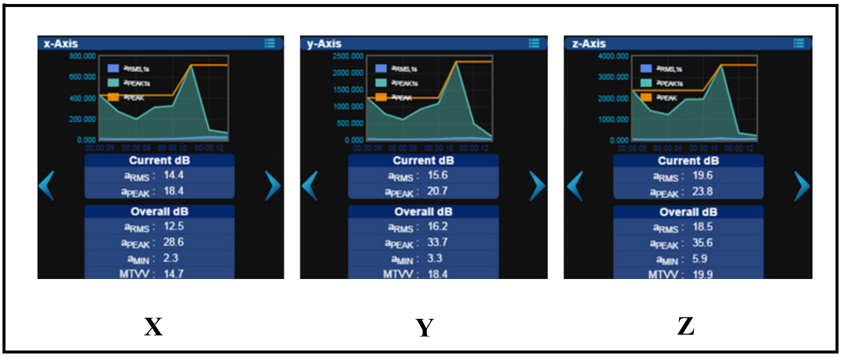


FIGURE 3-10 X, Y, and Z Axis Data Displays

Stop and Annotate the Measurement

Click the **Stop** button and, if needed, click the **Annotate** button to provide a note to include with the measurement.

Downloading the Data

Once the measurement is completed, you can download data as raw data or with a third-party tool.

APPENDIX

A Technical Specifications

Specifications are subject to change without notice. Numerical values given are typical. Refer to specific calibration or test results for accurate data on a specific unit.

Functions Measured

Mode	Data Buffer Measurements	Time History Buffer Measurements
Vibration	Arms, Amin, Amax, Amp, Peak, Aeq, PE	Arms with optional Peak
Hand Arm	Arms, Amin, Amax, Amp, Peak, Aeq, A(1), A(2), A(4), A(8), A(8) Exposure, PE	Arms with optional Peak
Whole Body	Arms, Amin, Amax, Amp, Peak, Aeq, CFmp, CF, VDV,PE	Arms with optional Peak

General Characteristics

Real-time Clock/Calendar

- Accuracy: 0.02% (-10° C to 50° C)
- 24 hour clock: hh:mm:ss

Run-time Clock

- One second resolution
- Format: hh:mm:ss
- Maximum run time: 99:59:59

Effects of Temperature

The RMS level varies ±0.5 dB when the complete instrument is tested over the - 10° C to 50° C temperature range. The reference reading, for this test, is taken at 20° C and 36% relative humidity (RH); the input signal is at 79.6 Hz.

Effects of Humidity

The RMS level varies ±0.5 dB when the complete instrument is tested over the 0% to 90% RH, noncondensing range. This test is performed at 40° C, with an input signal of 79.6 Hz.

Limits of Temperature and Humidity

Permanent damage can occur when stored or operated above 60° C or below -20° C.

Effects of Magnetic Fields

The RMS level varies ±0.5 dB when the complete instrument is tested in an 80 A/m, 60 Hz magnetic field (worst case orientation).

Effects of Mechanical Vibrations

The instrument meets the specifications for susceptibility to vibration in accordance with ISO 8041:2005(E) section 7.1.

Stabilization Time

At power-on, allow the instrument to stabilize, approximately 20 seconds, prior to performing any measurements. When changing sensors, allow 10 seconds of stabilization time prior to performing a new measurement.

Physical Characteristics

Dimensions/Weight

- Length: 4.6 inches (11.8 cm)
- Width: 2.6 inches (6.7 cm)
- Depth: 0.7 inches (1.8 cm)
- Weight: 4.6 ounces (130 grams) - including battery

Data Storage

- Removable micro SD memory card up to 64 GB.

- 2 GB file size limit. No limit to number of files or setups.
- No limit to number of files or setups
- 5 minute (typical) data retention for clock during battery change
- Data and settings are stored in non-volatile memory

Data Rate

- USB 2.0 hi-speed
- Data rate > 1 MBps
- Wi-Fi 802.11 b/g

Connections

- Input: 1/4-28 4-pin male
- Charging and communicaiton: Micro USB

Data Communication Characteristics

Need specs.

SSID Connection:

Bandwidth Consumption:

USB effects:

FCC Wi-Fi Characteristics:

Maximum Data Rate:

Electrical Characteristics

Power Consumption

Need specs

Power Supply

- User replaceable 2100 mAh rechargeable Lithium-ion battery
- Operation time > 12 hours
- Battery life is maintained at 80% after 2 weeks without operation
- External Power: Micro USB cable or Larson Davis Power Supply PSA035

Power Usage/Storage

Need specs.

Swapping Limitations

Device must be off while replacing Micro SD card or battery.

Adaptor Resonances and Frequency Responses

Need specs

Reference Values

Reference Acceleration

The reference acceleration (for displaying data in dB) is 10^{-6} m/s^2. the user can also select a reference of 10^{-5} m/s^2 (see section 4-3 of the manual for an explanation of how to select the reference acceleration.)

Reference Calibration Frequency

Operating Mode	Frequency Weighting	Reference Calibration Frequency
Vibration	Fa (0.4 Hz to 100 Hz) Wf (Severity) Fb (0.4 Hz to 1250 Hz) Fc (6.3 Hz to 1250 Hz)	7.96 Hz 79.6 Hz
Hand Arm	Wh	79.6 Hz
Whole Body	Wm Wb Wc Wd We Wg Wj Wk	7.96 Hz

Reference Calibration Vibration

The reference calibration vibration is 1 m/s^2

Typical Measurement Ranges

Need specs for all filters. In both mv/g and dB?

Frequency Weighting Curves

Fa (Flat 0.4 Hz to 100 Hz)

Freq (Hz) Nominal	Freq (Hz) True	Fa dB	Tolerance dB
0.100	0.1000	-24.10	+2/-∞
0.125	0.1259	-20.12	+2/ -∞
0.160	0.1585	-16.19	+2/ -∞
0.200	0.1995	-12.34	+2/ -∞
0.250	0.2512	-8.71	+2/-2
0.315	0.3162	-5.51	+2/-2
0.400	0.3981	-3.05	+1/-1
0.500	0.5012	-1.48	+1/-1
0.630	0.6310	-0.65	+1/-1
0.800	0.7943	-0.27	+1/-1
1.00	1.000	-0.11	+1/-1
1.25	1.259	-0.04	+1/-1
1.60	1.585	-0.02	+1/-1
2.00	1.995	-0.01	+1/-1
2.50	2.512	0.00	+1/-1
3.15	3.162	0.00	+1/-1
4.00	3.981	0.00	+1/-1

Freq (Hz) Nominal	Freq (Hz) True	Fa dB	Tolerance dB
5.00	5.012	0.00	+1/-1
6.30	6.310	0.00	+1/-1
8.00	7.943	0.00	0
10.0	10.00	0.00	+1/-1
12.5	12.59	0.00	+1/-1
16.0	15.85	0.00	+1/-1
20.0	19.95	-0.01	+1/-1
25.0	25.12	-0.02	+1/-1
31.5	31.62	-0.04	+1/-1
40.0	39.81	-0.11	+1/-1
50.0	50.12	-0.27	+1/-1
63.0	63.10	-0.64	+1/-1
80.0	79.43	-1.46	+1/-1
100	100.0	-3.01	+1/-1
125	125.9	-5.46	+2/-2
160	158.5	-8.64	+2/-2
200	199.5	-12.27	+2/ -∞
250	251.2	-16.11	+2/ -∞
315	316.2	-20.04	+2/ -∞
400	398.1	-24.02	+2/ -∞

Fb (Flat 0.4 Hz to 1260 Hz) Frequency Weighting

Freq (Hz) Nominal	Freq (Hz) True	Fb dB	Tolerance dB
0.100	0.1000	-24.10	+2 / -∞
0.125	0.1259	-20.12	+2 / -∞
0.160	0.1585	-16.19	+2 / -∞
0.200	0.1995	-12.34	+2 / -∞
0.250	0.2512	-8.71	+2 / -2
0.315	0.3162	-5.51	+1 / -1
0.400	0.3981	-3.05	+1 / -1
0.500	0.5012	-1.48	+1 / -1
0.630	0.6310	-0.65	+1 / -1
0.800	0.7943	-0.27	+1 / -1
1.00	1.000	-0.11	+1 / -1
1.25	1.259	-0.04	+1 / -1
1.60	1.585	-0.02	+1 / -1
2.00	1.995	-0.01	+1 / -1
2.50	2.512	0.00	+1 / -1
3.15	3.162	0.00	+1 / -1
4.00	3.981	0.00	+1 / -1
5.00	5.012	0.00	+1 / -1
6.30	6.310	0.00	+1 / -1
8.00	7.943	0.00	+1 / -1
10.0	10.00	0.00	+1 / -1
12.5	12.59	0.00	+1 / -1
16.0	15.85	0.00	+1 / -1
20.0	19.95	0.00	+1 / -1
25.0	25.12	0.00	+1 / -1

Freq (Hz) Nominal	Freq (Hz) True	Fb dB	Tolerance dB
31.5	31.62	0.00	+1 / -1
40.0	39.81	0.00	+1 / -1
50.0	50.12	0.00	+1 / -1
63.0	63.10	0.00	+1 / -1
80.0	79.43	0.00	0
100	100.0	0.00	+1 / -1
125	125.9	0.00	+1 / -1
160	158.5	0.00	+1 / -1
200	199.5	0.00	+1 / -1
250	251.2	-0.01	+1 / -1
315	316.2	-0.02	+1 / -1
400	398.1	-0.04	+1 / -1
500	501.2	-0.11	+1 / -1
630	631.0	-0.27	+1 / -1
800	794.3	-0.64	+1 / -1
1000	1000	-1.46	+2 / -2
1250	1259	-3.01	+2 / -2
1600	1585	-5.46	+2 / -2
2000	1995	-8.64	+2 / -2
2500	2512	-12.27	+2 / -∞
3150	3162	-16.11	+2 / -∞
4000	3981	-20.04	+2 / -∞
5000	5012	-24.02	+2 / -∞
6300	6310	-28.01	+2 / -∞
8000	7943	-32.00	+2 / -∞
10000	10000	-36.00	+2 / -∞

Fc (Flat 6.3 Hz to 1260 Hz), Wh, and Wf Frequency Weighting.

Freq (Hz) Nominal	Freq (Hz) True	Fc dB	Wh dB	Tolerance dB	Wf dB	Tolerance dB
0.800	0.7943	-36.00	-36.00	+2 / -∞	-76.00	+4 / -∞
1.00	1.000	-32.00	-31.99	+2 / -∞	-68.00	+4 / -∞
1.25	1.259	-28.01	-27.99	+2 / -∞	-60.00	+4 / -∞
1.60	1.585	-24.02	-23.99	+2 / -∞	-52.00	+4 / -∞
2.00	1.995	-20.04	-20.01	+2 / -∞	-44.00	+4 / -∞
2.50	2.512	-16.11	-16.05	+2 / -∞	-36.00	+4 / -4
3.15	3.162	-12.27	-12.18	+2 / -∞	-28.00	+4 / -4
4.00	3.981	-8.64	-8.51	+2 / -2	-19.90	+4 / -4
5.00	5.012	-5.46	-5.27	+2 / -2	-12.20	+4 / -4
6.30	6.310	-3.01	-2.77	+2 / -2	-5.30	+4 / -4
8.00	7.943	-1.46	-1.18	+2 / -2	-1.50	+4 / -4
10.0	10.00	-0.64	-0.43	+1 / -1	0.00	+1 / -2
12.5	12.59	-.027	-0.38	+1 / -1	0.00	+1 / -2
16.0	15.85	-0.11	-0.96	+1 / -1	0.00	+1 / -2
20.0	19.95	-0.04	-2.14	+1 / -1	0.00	+1 / -1
25.0	25.12	-0.02	-3.78	+1 / -1	0.00	+1 / -1
31.5	31.62	-0.01	-5.69	+1 / -1	0.00	+1 / -1
40.0	39.81	0.00	-7.72	+1 / -1	0.00	+1 / -1
50.0	50.12	0.00	-9.78	+1 / -1	0.00	+1 / -1
63.0	63.10	0.00	-11.83	+1 / -1	0.00	+1 / -1
80.0	79.43	0.00	-13.88	0	0.00	0
100	100.0	0.00	-15.91	+1 / -1	0.00	+1 / -1
125	125.9	0.00	-17.93	+1 / -1	0.00	+1 / -1
160	158.5	0.00	-19.94	+1 / -1	0.00	+1 / -1
200	199.5	0.00	-21.95	+1 / -1	0.00	+1 / -1

Freq (Hz) Nominal	Freq (Hz) True	Fc dB	Wh dB	Tolerance dB	Wf dB	Tolerance dB
250	251.2	-0.01	-23.96	+1 / -1	0.00	+1 / -1
315	316.2	-0.02	-25.98	+1 / -1	0.00	+1 / -1
400	398.1	-0.04	-28.00	+1 / -1	0.00	+1 / -1
500	501.2	-0.11	-30.07	+1 / -1	0.00	+1 / -1
630	631.0	-0.27	-32.23	+1 / -1	0.00	+1 / -2
800	794.3	-0.64	-34.60	+1 / -1	0.00	+1 / -2
1000	1000	-1.46	-37.42	+2 / -2	0.00	+1 / -2
1250	1259	-3.01	-40.97	+2 / -2	-1.70	+4 / -4
1600	1585	-5.46	-45.42	+2 / -2	-4.30	+4 / -4
2000	1995	-8.64	-50.60	+2 / -2	-9.80	+4 / -4
2500	2512	-12.27	-56.23	+2 / -∞	-16.30	+4 / -4
3150	3162	-16.11	-62.07	+2 / -∞	-25.80	+4 / -4
4000	3981	-20.04	-68.01	+2 / -∞	-36.00	+4 / -4
5000	5012	-24.02	-73.98	+2 / -∞	-44.00	+4 / -∞
6300	6310	-28.01	-79.97	+2 / -∞	-52.00	+4 / -∞
8000	7943	-32.00	-85.97	+2 / -∞	-60.00	+4 / -∞
10000	10000	-36.00	-91.97	+2 / -∞	-68.00	+4 / -∞

Wm, Wc, and Wd Frequency Weightings

Freq (Hz) Nominal	Freq (Hz) True	Wm dB	Wc dB	Wd dB	Tolerance dB
0.100	0.100	-32.04	-24.10	-24.09	+2 / -∞
0.125	0.1259	-28.20	-20.12	-20.12	+2 / -∞
0.160	0.1585	-23.98	-16.19	-16.18	+2 / -∞
0.200	0.1995	-20.23	-12.34	-12.32	+2 / -∞
0.250	0.2512	-16.71	-8.71	-8.68	+2 / -2
0.315	0.3162	-13.51	-5.51	-5.47	+2 / -2
0.400	0.3981	-10.98	-3.05	-2.98	+1 / -1
0.500	0.5012	-9.53	-1.47	-1.37	+1 / -1
0.630	0.6310	-8.71	-0.64	-0.50	+1 / -1
0.800	0.7943	-8.38	-0.25	-0.08	+1 / -1
1.00	1.00	-8.29	-0.08	+0.10	+1 / -1
1.25	1.259	-8.27	+0.00	+0.06	+1 / -1
1.60	1.585	-8.07	+0.06	-0.26	+1 / -1
2.00	1.995	-7.60	+0.10	-1.00	+1 / -1
2.50	2.512	-6.13	+0.15	-2.23	+1 / -1
3.15	3.162	-3.58	+0.19	-3.88	+1 / -1
4.00	3.981	-1.02	+0.21	-5.78	+1 / -1
5.00	5.012	0.21	+0.11	-7.78	+1 / -1
6.30	6.310	0.46	-0.23	-9.83	+1 / -1
8.00	7.943	0.21	-0.97	-11.87	0
10.0	10.0	-0.23	-2.20	-13.91	+1 / -1
12.5	12.59	-0.85	-3.84	-15.93	+1 / -1
16.0	15.85	-1.83	-5.74	-17.95	+1 / -1
20.0	19.95	-3.00	-7.75	-19.97	+1 / -1
25.0	25.12	-4.44	-9.80	-21.98	+1 / -1

Freq (Hz) Nominal	Freq (Hz) True	Wm dB	Wc dB	Wd dB	Tolerance dB
31.5	31.62	-6.16	-11.87	-24.01	+1 / -1
40.0	39.81	-8.11	-13.97	-26.08	+1 / -1
50.0	50.12	-10.09	-16.15	-28.24	+1 / -1
63.0	63.10	-12.43	-18.55	-30.62	+1 / -1
80.0	79.43	-15.34	-21.37	-33.43	+1 / -1
100	100.0	-18.72	-24.94	-36.99	+1 / -1
125	125.9	-23.00	-29.39	-41.43	+2 / -2
160	158.5	-28.56	-34.57	-46.62	+2 / -2
200	199.5	-34.03	-40.20	-52.24	+2 / -∞
250	251.2	-39.69	-46.04	-58.09	+2 / -∞
315	316.2	-45.65	-51.98	-64.02	+2 / -∞
400	398.1	-51.84	-57.95	-70.00	+2 / -∞

We, Wj, and Wk Frequency Weighting

Freq (Hz) Nominal	Freq (Hz) True	We dB	Wj dB	Wk dB	Tolerance dB
0.100	0.100	-24.08	-30.18	-30.11	+2 / -∞
0.125	0.1259	-20.09	-26.20	-26.14	+2 / -∞
0.160	0.1585	-16.14	-22.27	-22.21	+2 / -∞
0.200	0.1995	-12.27	-18.42	-18.37	+2 / -∞
0.250	0.2512	-8.60	-14.79	-14.74	+2 / -2
0.315	0.3162	-5.36	-11.60	-11.55	+2 / -2
0.400	0.3981	-2.86	-9.15	-9.11	+1 / -1
0.500	0.5012	-1.27	-7.58	-7.56	+1 / -1
0.630	0.6310	-0.55	-6.77	-6.77	+1 / -1
0.800	0.7943	-0.52	-6.42	-6.44	+1 / -1
1.00	1.00	-1.11	-6.30	-6.33	+1 / -1
1.25	1.259	-2.29	-6.28	-6.29	+1 / -1
1.60	1.585	-3.91	-6.32	-6.13	+1 / -1
2.00	1.995	-5.80	-6.34	-5.50	+1 / -1
2.50	2.512	-7.81	-6.22	-3.97	+1 / -1
3.15	3.162	-9.85	-5.60	-1.86	+1 / -1
4.00	3.981	-11.89	-4.08	-0.31	+1 / -1
5.00	5.012	-13.93	-1.99	+0.33	+1 / -1
6.30	6.310	-15.95	-0.47	+0.46	+1 / -1
8.00	7.943	-17.97	+0.14	+0.32	0
10.0	10.0	-19.98	+0.26	-0.10	+1 / -1
12.5	12.59	-21.99	+0.22	-0.93	+1 / -1
16.0	15.85	-23.99	+0.16	-2.22	+1 / -1
20.0	19.95	-26.00	+0.10	-3.91	+1 / -1

Freq (Hz) Nominal	Freq (Hz) True	We dB	Wj dB	Wk dB	Tolerance dB
25.0	25.12	-28.01	+0.06	-5.84	+1 / -1
31.5	31.62	-30.04	+0.00	-7.89	+1 / -1
40.0	39.81	-32.11	-0.08	-10.01	+1 / -1
50.0	50.12	-34.26	-0.25	-12.21	+1 / -1
63.0	63.10	-36.64	-0.63	-14.62	+1 / -1
80.0	79.43	-39.46	-1.45	-17.47	+1 / -1
100	100.0	-43.01	-3.01	-21.04	+1 / -1
125	125.9	-47.46	-5.45	-25.50	+2 / -2
160	158.5	-52.64	-8.64	-30.69	+2 / -2
200	199.5	-58.27	-12.26	-36.32	+2 / -∞
250	251.2	-64.11	-16.11	-42.16	+2 / -∞
315	316.2	-70.04	-20.04	-48.10	+2 / -∞
400	398.1	-76.02	-24.02	-54.08	+2 / -∞

Wg Frequency Weighting (Defined in BS6841:1987)

Freq (Hz) Nominal	Freq (Hz) True	Wg dB	Tolerance dB
1.00	1.00	-7.5	+1 / -1
1.25	1.26	-6.0	+1 / -1
1.60	1.59	-4.6	+1 / -1
2.00	2.00	-3.4	+1 / -1
2.50	2.51	-2.2	+1 / -1
3.15	3.16	-0.9	+1 / -1
4.00	3.98	-0.0	+1 / -1
5.00	5.01	+0.4	+1 / -1

Freq (Hz) Nominal	Freq (Hz) True	Wg dB	Tolerance dB
6.30	6.31	+0.1	+1 / -1
8.00	7.94	-1.0	0
10.0	10.00	-2.5	+1 / -1
12.5	12.59	-4.2	+1 / -1
16.0	15.85	-6.3	+1 / -1
20.0	19.95	-8.2	+1 / -1
25.0	25.12	-10.1	+1 / -1
31.5	31.62	-12.1	+1 / -1
40.0	39.81	-14.2	+1 / -1
50.0	50.12	-16.3	+1 / -1
63.0	63.10	-18.7	+1 / -1
80.0	79.43	-21.6	+1 / -1

Wm (Whole Body) Frequency Weighting

Freq (Hz) Nominal	Freq (Hz) True	WM dB	Tolerance dB
0.100	0.100	-36.00	+2 / -∞
0.125	0.1259	-32.00	+2 / -∞
0.160	0.1585	-28.01	+2 / -∞
0.200	0.1995	-24.02	+2 / -∞
0.250	0.2512	-20.05	+2 / -∞
0.315	0.3162	-16.12	+2 / -∞
0.400	0.3981	-12.29	+2 / -∞
0.500	0.5012	-8.67	+2 / -2
0.630	0.6310	-5.51	+2 / -2
0.800	0.7943	-3.09	+2 / -2
1.00	1.00	-1.59	+2 / -2
1.25	1.259	-0.85	+1 / -1
1.60	1.585	-0.59	+1 / -1
2.00	1.995	-0.61	+1 / -1
2.50	2.512	-0.82	+1 / -1
3.15	3.162	-1.19	+1 / -1
4.00	3.981	-1.74	+1 / -1
5.00	5.012	-2.50	+1 / -1
6.30	6.310	-3.49	+1 / -1
8.00	7.943	-4.70	0
10.0	10.0	-6.12	+1 / -1
12.5	12.59	-7.71	+1 / -1
16.0	15.85	-9.44	+1 / -1
20.0	19.95	-11.25	+1 / -1
25.0	25.12	-13.14	+1 / -1

Freq (Hz) Nominal	Freq (Hz) True	WM dB	Tolerance dB
31.5	31.62	-15.09	+1 / -1
40.0	39.81	-17.10	+1 / -1
50.0	50.12	-19.23	+1 / -1
63.0	63.10	-21.58	+1 / -1
80.0	79.43	-24.38	+2 / -2
100	100.0	-27.93	+2 / -2
125	125.9	-32.37	+2 / -2
160	158.5	-37.55	+2 / -2
200	199.5	-43.18	+2 / -∞
250	251.2	-49.02	+2 / -∞
315	316.2	-54.95	+2 / -∞
400	398.1	-60.92	+2 / -∞
500	501.2	-66.91	+2 / -∞
630	631.0	-72.91	+2 / -∞
800	794.3	-78.91	+2 / -∞

Typical Measurements Ranges

Vibration - Fa

Gain	Direct			Charge (1000pF)			ICP®		
	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV
0 dB	See Note 1	60 dB 74-134	38 dB 99-137	See Note 1	60 dB 74-134	38 dB 99-137	See Note 1	60 dB 74-134	38 dB 99-137
20 dB	See Note 1	60 dB 54-114	38 dB 79-117	See Note 1	60 dB 54-114	38 dB 79-117	See Note 1	60 dB 54-114	38 dB 79-17
40 dB	26	58 dB 36-94	36 dB 61-97	26	58 dB 36-94	36 dB 61-97	26	58 dB 36-94	36 dB 61-97
60 dB	17	47 dB 27-74	25 dB 52-77	17	47 dB 27-74	25 dB 52-77	23	41 dB 33-74	19 dB 58-77

Notes:

1. Under-Range (?) - The noise floor is below the measurement range of the analog to digital converter.

2. The data in the above table was obtained by electrically testing the HVM200.

Vibration - Fb, Fc, and Wf

Gain	Direct			Charge (1000pF)			ICP®		
	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV
0 dB	64	60 dB 74-134	38 dB 99-137	64	60 dB 74-134	38 dB 99-137	64	60 dB 74-134	38 dB 99-137
20 dB	44	60 dB 54-114	38 dB 79-117	44	60 dB 54-114	38 dB 79-117	44	60 dB 54-114	38 dB 79-117
40 dB	30	54 dB 40-94	32 dB 65-97	30	54 dB 40-94	32 dB 65-97	30	54 dB 40-94	32 dB 65-97
60 dB	23	41 dB 33-74	19 dB 58-77	23	41 dB 33-74	19 dB 58-77	23	41 dB 33-74	19 dB 58-77

Notes

1. The data in the above table was obtained by electrically testing the HVM200.

Hand Arm - Wh

Gain	Direct			Charge (1000pF)			ICP®		
	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV
0 dB	See Note 1	60 dB 74-134	38 dB 99-137	See Note 1	60 dB 74-134	38 dB 99-137	See Note 1	60 dB 74-134	38 dB 99-137
20 dB	See Note 1	60 dB 54-114	38 dB 79-117	See Note 1	60 dB 54-114	38 dB 79-117	See Note 1	60 dB 54-114	38 dB 79-117
40 dB	See Note 1	60 dB 34-94	38 dB 59-97	See Note 1	60 dB 34-94	38 dB 59-97	See Note 1	60 dB 34-94	38 dB 59-97
60 dB	10	54 dB 20-74	32 dB 45-77	10	54 dB 20-74	32 dB 45-77	10	54 dB 20-74	32 dB 45-77

Notes:

1. Under-Range (?) - The noise floor is below the measurement range of the analog to digital converter.

2. The data in the above table was obtained by electrically testing the HVM200.

Whole Body - Wm

Gain	Direct			Charge (1000pF)			ICP®		
	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV
0 dB	See Note 1	60 dB 74-134	38 dB 99-137	See Note 1	60 dB 74-134	38 dB 99-137	See Note 1	60 dB 74-134	38 dB 99-137
20 dB	See Note 1	60 dB 54-114	38 dB 79-117	See Note 1	60 dB 54-114	38 dB 79-117	See Note 1	60 dB 54-114	38 dB 79-117

Gain	Direct			Charge (1000pF)			ICP®		
	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV
40 dB	See Note 1	60 dB 34-94	38 dB 59-97	See Note 1	60 dB 34-94	38 dB 59-97	See Note 1	60 dB 34-94	38 dB 59-97
60 dB	14	50 dB 24-74	28 dB 49-77	14	50 dB 24-74	28 dB 49-77	14	50 dB 24-74	28 dB 49-77

Notes:

1. Under-Range (?) - The noise floor is below the measurement range of the analog to digital converter.

2. The data in the above table was obtained by electrically testing the HVM200.

Whole Body - Wc

Gain	Direct			Charge (1000pF)			ICP®		
	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV
0 dB	See Note 1	60 dB 74-134	38 dB 99-137	See Note 1	60 dB 74-134	38 dB 99-137	See Note 1	60 dB 74-134	38 dB 99-137
20 dB	See Note 1	60 dB 54-114	38 dB 79-117	See Note 1	60 dB 54-114	38 dB 79-117	See Note 1	60 dB 54-114	38 dB 79-117
40 dB	See Note 1	60 dB 34-94	38 dB 59-97	See Note 1	60 dB 34-94	38 dB 59-97	See Note 1	60 dB 34-94	38 dB 59-97
60 dB	13	51 dB 23-74	29 dB 48-77	13	51 dB 23-74	29 dB 48-77	23	41 dB 33-74	19 dB 58-77

Notes:

1. Under-Range (?) - The noise floor is below the measurement range of the analog to digital converter.

2. The data in the above table was obtained by electrically testing the HVM200.

Whole Body - Wd, We

Gain	Direct			Charge (1000pF)			ICP®		
	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV
0 dB	See Note 1	60 dB 74-134	38 dB 99-137	See Note 1	60 dB 74-134	38 dB 99-137	See Note 1	60 dB 74-134	38 dB 99-137
20 dB	See Note 1	60 dB 54-114	38 dB 79-117	See Note 1	60 dB 54-114	38 dB 79-117	See Note 1	60 dB 54-114	38 dB 79-117
40 dB	See Note 1	60 dB 34-94	38 dB 59-97	See Note 1	60 dB 34-94	38 dB 59-97	See Note 1	60 dB 34-94	38 dB 59-97
60 dB	11	53 dB 21-74	31 dB 46-77	11	53 dB 21-74	31 dB 46-77	23	41 dB 33-74	19 dB 58-77

Notes:

1. Under-Range (?) - The noise floor is below the measurement range of the analog to digital converter.

2. The data in the above table was obtained by electrically testing the HVM200.

Whole Body - Wg

Gain	Direct			Charge (1000pF)			ICP®		
	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV
0 dB	See Note 1	60 dB 74-134	38 dB 99-137	See Note 1	60 dB 74-134	38 dB 99-137	See Note 1	60 dB 74-134	38 dB 99-137
20 dB	See Note 1	60 dB 54-114	38 dB 79-117	See Note 1	60 dB 54-114	38 dB 79-117	See Note 1	60 dB 54-114	38 dB 79-117
40 dB	24	60 dB 34-94	38 dB 59-97	24	60 dB 34-94	38 dB 59-97	24	60 dB 34-94	38 dB 59-97
60 dB	14	50 dB 24-74	28 dB 49-77	14	50 dB 24-74	28 dB 49-77	14	50 dB 24-74	28 dB 49-77

Notes:

1. Under-Range (?) - The noise floor is below the measurement range of the analog to digital converter.

2. The data in the above table was obtained by electrically testing the HVM200.

Whole Body - Wm, Wj, Wk

Gain	Direct			Charge (1000pF)			ICP®		
	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV	Noise Floor dBµV	RMS Range dBµV	Peak Range dBµV
0 dB	See Note 1	60 dB 74-134	38 dB 99-137	See Note 1	60 dB 74-134	38 dB 99-137	See Note 1	60 dB 74-134	38 dB 99-137
20 dB	See Note 1	60 dB 54-114	38 dB 79-117	See Note 1	60 dB 54-114	38 dB 79-117	See Note 1	60 dB 54-114	38 dB 79-117
40 dB	24	60 dB 34-94	38 dB 59-97	24	60 dB 34-94	38 dB 59-97	24	60 dB 34-94	38 dB 59-97
60 dB	13	51 dB 23-74	29 dB 48-77	13	51 dB 23-74	29 dB 48-77	18	46 dB 28-74	24 dB 53-77

Notes:

1. Under-Range (?) - The noise floor is below the measurement range of the analog to digital converter.

2. The data in the above table was obtained by electrically testing the HVM200.

Standards Met

Type Precision

The Larson Davis HVM200 Human Vibration Meter is a Type 1 instrument designed for use in assessing vibration as perceived by human beings. The instrument meets the requirements of ISO 8041:2005(E).HVM200

Additionally, the current ISO 8041:2005 standard, and therefore the HVM200 is compatible with the standards listed below. These standards define methods for the measurement of whole-body and hand-arm vibration.

- ISO 2631-1:1997 Mechanical vibration and shock -- Evaluation of human exposure to whole-body vibration -- Part 1: General requirements

- ISO 2631-2:2003 Evaluation of human exposure to whole-body vibration -- Part 2: Continuous and shock-induced vibrations in buildings (1 to 80 Hz)

- ISO 2631-4:2001 Mechanical vibration and shock -- Evaluation of human exposure to whole-body vibration -- Part 4: Guidelines for the evaluation of the effects of vibration and rotational motion on passenger and crew comfort in fixed-guideway transport systems

- ISO 5349-1:2001 Mechanical vibration -- Measurement and evaluation of human exposure to hand-transmitted vibration -- Part 1: General requirements

- ISO 5349-2:2001 Mechanical vibration -- Measurement and evaluation of human exposure to hand-transmitted vibration -- Part 2: Practical guidance for measurement at the workplace

Declaration of Conformity

PCB Piezotroncs Inc. declares that:

- Product Name: Human Vibration Meter
- Model: HVM200

The Model HVM200 Human Vibration Meter complies with the European Community EMC Directive (2004/108/EC) and also with the Low Voltage Safety Directive (2006/95/EC) by meeting the following standards:

- IEC 61326-1:2005-Electrical equipment for measurement, control and laboratory use-EMC requirements-Part 1: General requirements.

  •IEC 61000-4-2:2008-Electrostatic discharge immunity test ±4kV contact ESD and ±8kV air ESD). Performance Criteria B.

  •IEC61000-4-3:2006 with am1 2007-Radiated, radio-frequency electromagnetic field immunity test. 26 to 1,000 MHz at 10 V/m, 1.4 to 2.0 GHz at 3 V/M, and 2.0 to 2.7 GHz at 1 V/M, all with AM 80%, 1 kHz. $\Delta<\pm 6\%$ from 1 g. Performance Criteria A.

  •IEC61000-4-8:2009: Power frequency magnetic field immunity test. 80 A/m, 50/60 Hz. $\Delta<3\%$ from 1 g. Performance Criteria A.

  •CISPR 11:2009-Industrial, scientific and medical equipment-Radio-frequency disturbance characteristics-Limits and methods of measurement. Class B, Group 1.

- IEC 61010-1:2001- Safety requirements for electrical equipment for measurement, control, and laboratory use-Part 1:General requirements.

B Glossary

The following table contains definitions and calculations for terminology used in the HVM200 manual.

Term	Equation Description
RMS Acceleration	$$Aeq = \sqrt{\frac{1}{T}\int_0^T a_w^2(t)dt}$$ T= Integration time in seconds. $a_w(t)$ = instantaneous acceleration. t = Time, in seconds. The Aeq integration time is from Run to Reset; the display is updated once per second.
RMS Acceleration in Decibels	$$Aeq = 20Log\sqrt{\frac{1}{T}\int_0^T \frac{a_w^2(t)}{a_o^2}(dt)} \quad dB$$ a_o = reference acceleration, 10^{-6} m/s^2 or 10^{-5} m/s^2 (user selectable)
Allowed Exposure Time	$$[(2.8m/s^2)/(Aeq)]^2 \times 8hours$$

Term	Equation Description
Energy Equivalent RMS Acceleration	The HVM100 measures the following quantities: $$A(8) = \sqrt{\frac{1}{8Hours}\int_0^T a_w^2(t)dt}$$ $$A(4) = \sqrt{\frac{1}{4Hours}\int_0^T a_w^2(t)dt}$$ $$A(2) = \sqrt{\frac{1}{2Hours}\int_0^T a_w^2(t)dt}$$ $$A(1) = \sqrt{\frac{1}{1Hours}\int_0^T a_w^2(t)dt}$$
Running RMS Acceleration LINEAR	$$Arms = \sqrt{\frac{1}{\tau}\int_{t_0-\tau}^{t_0} a_w^2(t)dt}$$ τ = Integration time, in seconds. t_o = Observation time The linear Arms integration time is controlled by the Averaging time setting; a new linear Arms value is calculated and displayed at the end of each integration period.
Running RMS Acceleration EXPONENTIAL	$$Arms = \sqrt{\frac{1}{\tau}\int_{-\infty}^{t_0} a_w^2(t)\exp\left(\frac{t-t_0}{\tau}\right)dt}$$ τ = Time constant of the measurement. An averaging time of SLOW is equivalent to a time constant of 1 second.

Term	Equation Description
Vibration Dose Value	$$VDV = \left(\int_0^T a_w^4(t)dt\right)^{\frac{1}{4}}$$ The *VDV* integration time is from Run to Reset; the display is updated once per second. The *VDV* is not calculated for units of dB or g.
Maximum Transient Vibration Value	Amax = maximum reading of all Arms readings from Run to Reset. The display is updated at the end of each Averaging time period.
Minimum Transient Vibration Value	Amin = minimum reading of all Arms readings from Run to Reset. The display is updated at the end of each Averaging time period.
Long Term Maximum Peak	Amp = peak level of the instantaneous weighted acceleration, $a_w(t)$; measured over the entire measurement period, from Run to Reset. The displayed Amp value is updated once per second.
Short Term Maximum Peak	Peak = peak level of the instantaneous weighted acceleration, $a_w(t)$; measured during one Averaging time period. The peak measurement period is controlled by the Averaging time setting; a new Peak value is calculated and displayed at the end of each Averaging time period.
Long Term Crest Factor	$$CFmp = \frac{Amp}{Aeq}$$ The *CFmp* measurement period is from Run to Reset; the display is updated once per second.

Term	Equation Description
Short Term Crest Factor	$$CF = \frac{Peak}{Arms}$$ The *CF* measurement period is controlled by the Averaging time setting; a new *CF* value is calculated and displayed at the end of each Averaging time period. *CF* is not calculated if the Averaging time setting is **SLOW**.
Summed Instantaneous Acceleration	$$\sqrt{[K_x a_{wx}(t)]^2 + [K_y a_{wy}(t)]^2 + [K_z a_{wz}(t)]^2}$$ $a_{w\Sigma}(t)$ = instantaneous, summed acceleration $a_{wx}(t), a_{wy}(t), a_{wz}(t)$ = X, Y, and Z axis instantaneous acceleration K_x, K_y, K_z = X, Y, and Z axis Sum Factors The HVM200 uses the formula above to calculate the instantaneous, summed acceleration, $a_{w\Sigma}(t)$. This value is then used to calculate a sum quantity for the A_{rms},A_{min}, A_{max}, A_{mp}, A_{eq}, Peak, VDV, and PE. K factors affect only sum value and not individual axis data.

APPENDIX

A Regulatory Compliance Statement

FCC

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Any changes or modifications not expressly approved by manufacturer could void the user's authority to operate the equipment.

IMPORTANT! Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Industry Canada

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

This Class [*] digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe [*] est conforme à la norme NMB-003 du Canada

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, meme si le brouillage est susceptible d'en compromettre le fonctionnement.

IMPORTANT! Tous les changements ou modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actioner cet équipment.

47 CFR 15.505- FCC

Class B

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver
- is connected.
- Consult the dealer or an experienced radio/ TV technician for help.

Class A- FCC

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.