CVK
Vibration & Noise

## Whole-body vibration measurement

# Manual

# HealthVib® WBV300 Measurement System

a CVK product

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# Manual – HealthVib® WBV300 measurement system

Version: 6.01

Revised: October 14, 2014

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## Short notice to the user

This manual describes how to use the HealthVib® WBV 300 vibration measurement system.

All products are patented and product names are registered trademarks.

## Limited Warranty

CV- Vibration & Noise AB guarantee their products free from material and function defects 2 years from date of purchase, if the product is used under normal circumstances. This warranty includes products bought within EU as well outside EU. The warranty is limited to repair or exchange of the product to what CVK finds necessary. To claim warranty CVK needs to be contacted and written report about problems that occurred and receipt where date and location report for purchase can be cleared from.

CVK supply free repair or exchange of product if the product has not been exposed to violence due to incorrect management or been taken apart by unauthorized personnel. CVK does not take responsibility to damage or misplacement that occurred during delivery, if the delivery is taken care of others than CVK. CVK do not take responsibility for any shipment costs regarding warranty matters.

## Terms and Conditions

HealthVib®WBV measurement system is designed for measurement of whole body vibrations (WBV) in three directions according to ISO2631, ISO 8041:2005 and requirements in 2002/44/EG.

Before start of measurement, please make sure that the units are unharmed, fully functional, are not used in unsuitable environment, are properly placed and battery level is sufficient.

## Recommendations

- The recommended mode of use of the equipment is the HealthVib WBV and analyse results with CVK VibNoiseView 3.0.
- Optional mode of use is the HealthVib WBV with Vibindicator WBV indicator.
- HealthVib WBV is IP-classed to IP40.
- Vibindicator WBV is IP-classed to IP40.
- Do not expose the product for harmful damage.
- In case of using Vibindicator:
  Do not exceed recommended 2 meter transmission range between HealthVib WBV and Vibindicator WBV.

# Available systems

## Equipment list

HealthVib WBV measurement system is developed to meet the requirement of 2002/44/EG in order to measure whole body vibrations.

*Table1: The two available packages with corresponding equipment*

| Available systems | HealthVib WBV | Vibindicator WBV | Seat plate | VibNoiseView 3.0 | USB-cable and chargers | Manual and certificates |
|---|---|---|---|---|---|---|
| HealthVib WBV300 system | ● | | ● | | 1 | ● |
| HealthVib WBV300 driver system | ● | ● | ● | ● | 2 | ● |

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HealthVib WBV300 measurement systems contains:

HealthVib® WBV300 with seat plate

*Measures and calculates whole body vibrations according to ISO 2631.Mounted on the seat of a machine or directly on floor.Data can be read out on display.*

Vibindicator ™ WBV

*The results are displayed simultaneously on an intuitive scale of LED's.*

USB-cable

*The USB- cable is used for recharging and exportation of data to a PC.*

Battery charger

*100-240V to 5 Volt*

*-Compact disc containing computer software and manuals*
*-CE-declaration and calibration certificate for HealthVib® WBV*
*-CE- declaration for Vibindicator™ WBV*

## Specifications

The HealthVib WBV measurement system is designed to measure whole body vibrations. The quantities measured are the frequency weighted 1 second root mean square (RMS), vibration dose value (VDV) and values of three axis (equation 1a,b). Filter used are band pass filter 0-160 Hz with weightings described in ISO 2631 (Wk, Wd). Value according to the daily dose value (A (8)) described by ISO 2631 and 2002/44/EC is calculated (equation 2) on the direction with highest vibration dose. On the Vibindicator WBV a ten second moving window is used to display the real time indication of the weighted RMS vibration levels.

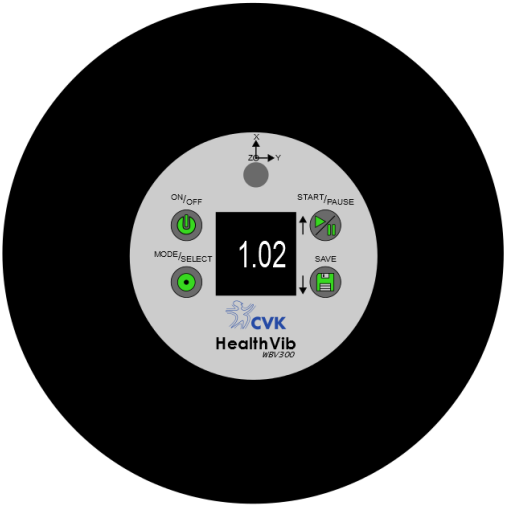
$$a_{w(x,y,z)} = \sqrt{\int_0^T a^2_{w(x,y,z)}(t)dt} \qquad (1a)$$

$$A\,(8) = a_w . \sqrt{\frac{T}{8}} \qquad (1b)$$

Where $T = \ time\ (h)$

Where $a^2_{w(x,y,z)}(t)$= instantaneous single-axis acceleration of the frequency-weighted whole body-transmitted acceleration at time t, in meters per second squared ($m/s^2$).

# CVK HealthVib® WBV 300




- Measures vibrations in three directions for sitting or standing posture.
- Measures and analysis vibrations according to approved regulations and ISO-standardizations.
- Displays instantaneous vibrations 1 second RMS, VDV, Peak, A (8) and VDV (8) - value for different measurement files.

## Functions – HealthVib ® WBV300

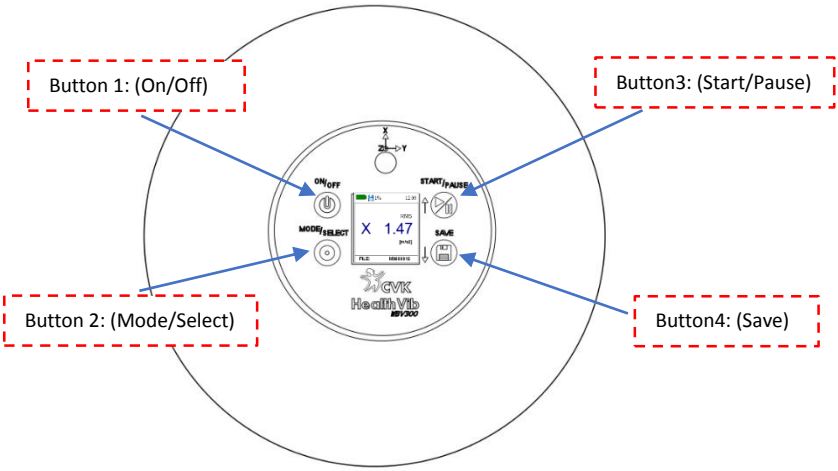



*Figure 1-a: HealthVib WBV 300 overview*

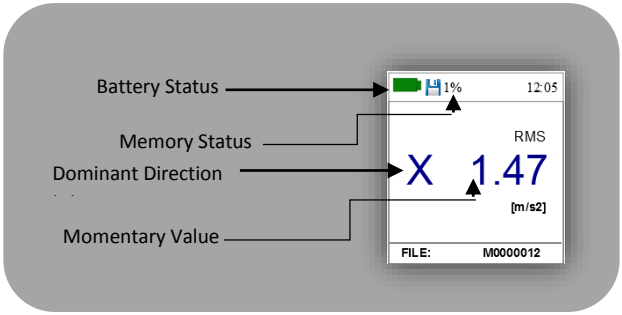



*Figure 1-b: HealthVib WBV 300 display*

1. Activate by pressing button 1.
2. Press “mode” button to choose new measurement or saved files.
   If you chose ‘new measurement’; *go to step 3*, if you chose ‘saved measurement’; go to step 7.

3. Activate body sensor or not by clicking “Yes” or “No”. The presentation of measured data starts.
4. If activate body sensor, the measurement will be saved when body is in contact with seat plate. If not activated; the measurement is saved without body contact.
5. The measurement can be paused by pressing button 3 or saved by pressing button 4. If paused mode, you need to resume the mode to be able to save. (Press ‘Start/Pause’ again.)
6. After saving, you are automatically back to main page.

**If you chose saved measurements**

7. Select the file of interest by scrolling with button 3 and 4. Press button 2 to select measurement file.
8. Data for selected measurement file; measurement time with A (8) value, RMS, VDV and Peak data for the three directions are shown.
9. To delete the file; once the file is selected; Press “mode/Select” button to delete the file or all files.

**body sensor- recognise when body is in contact with seat plate.*

## Step-by-step operations guide

### Step 1: Check the equipment

Make sure that the HealthVib is unharmed, is used in correct environment and handled according to this instruction.

### Step 2: Check battery status

Once you turn the unit on, the battery status is shown on display, see figure 2. The battery symbol shows the status. Maximum voltage is 4.2 V. The lowest limit is 3.5 V.

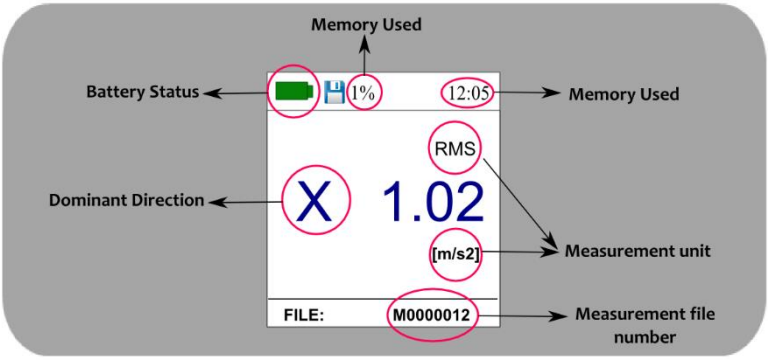



*Figure 2: HealthVib WBV 300 Display*

## Recharge HealthVib

1. Make sure the HealthVib is turned off by checking the display is empty. If not, press On/off (Button 1) once to turn it off.
   ***OBS!*** *It should remain turned off during the complete charging cycle.*
2. Connect the charger to wall socket and the USB-cable.
3. Connect USB-cable to HealthVib.
4. Recharge time: about 6 hours.

## Step3: Place the HealthVib

Place the HealthVib and seat plate on driver seat to measure on sitting operator or on floor beneath the feet on standing operator. The *X-mark* and arrow on the seat plate should be pointing the operator forward direction, see figure 3.

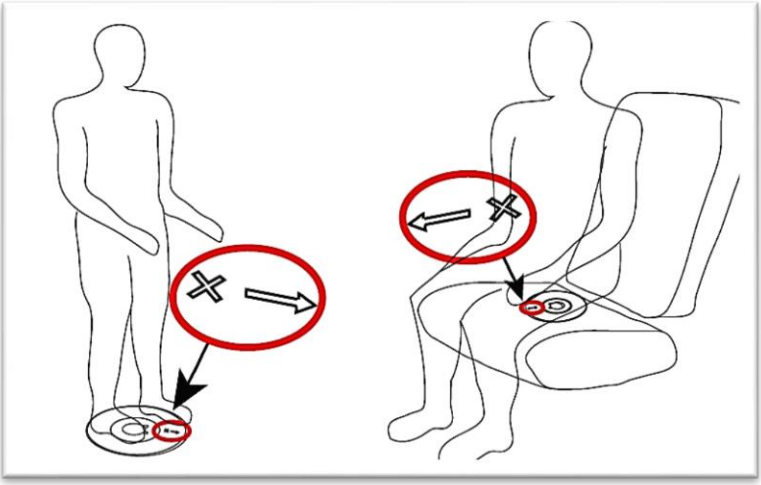


*Figure 3: HealthVib WBV 300 position*

## Step 4: Turn on the HealthVib

Press On/Off button (Button1) once to turn the instrument on. The starting page appears. See figure 4.


*Figure 4: HealthVib WBV 300 start-up page*

## Step 5: New Meas/manage saved files

Press ''MODE'' button (Button 2) to choose either starting a new ''measurement'' or managing the ''saved files'' from previous measurements. See figure 5.

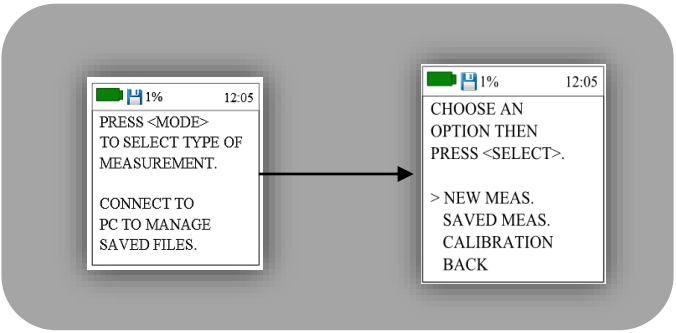



*Figure 5: Choose New Measurement or manage saved files.*

If you chose ''NEW MEAS.'' Go to step 6, if you chose '' SAVED MEAS.''; go to step 9.

## Step 6: Body sensor activation

If you want to activate body sensor; Choose ''Yes'' and if not choose ''No''. See figure 6.

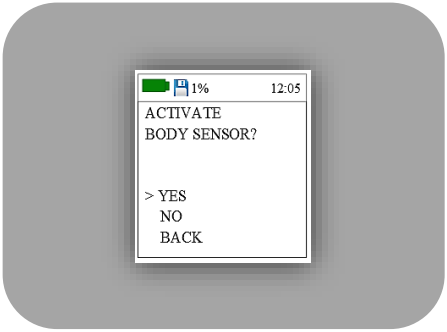



*Figure 6: Body sensor Activation*

It is recommended that you activate the body sensor when the operator will use the instrument in sitting position. The battery operation time is also extensively extended.

## Step 7: Start measurement

If the body sensor is activated; measurement is saved when body is in contact with seat plate. If the body sensor is not activated; measurement is directly performed after step 6. See figure 2.

During measurement HealthVib WBV displays RMS, VDV or Peak value once a second. The vibrations are based on acceleration ($m/s^2$) and direction with the highest level is momentary presented.

The x, y and z indicates the direction that dominates the last second of measure. X means forward, Y sideways and Z vertical direction.

## Step 8: Pause/Save measurement

To pause measurement, press Start/Pause button (button 3). The display indicate measurement is paused. To continue measurement again, press Start/pause button (button 1) again. See figure 7.

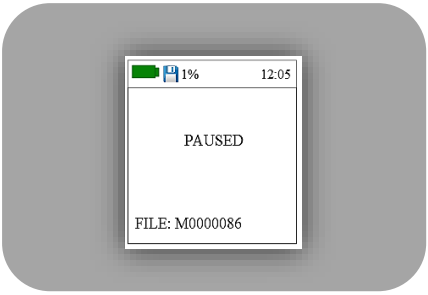



*Figure 7: Pause Mode*

***Note**! If paused mode, you need to resume the mode to be able to save the measurement.*

To stop and save measurement, press button 4. The display show that measurement is saved, see figure 8. Saved measurement can be analysed from the mode options. After saving, the main page is automatically shown.

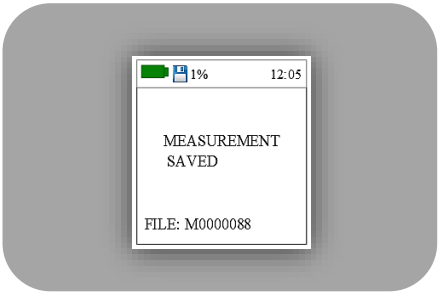



*Figure 8: Saving measurement*

## If you choose 'Saved measurement:

### Step 9: Measurement results

Select file of interest by scrolling with Button 3 (Up) & 4 (Down). Then press ‘’select’’ (button 2) to choose file.

Data from selected measurement file; measurement time; A(8) value, RMS, VDV and Peak values for three directions are shown, see figure 9.

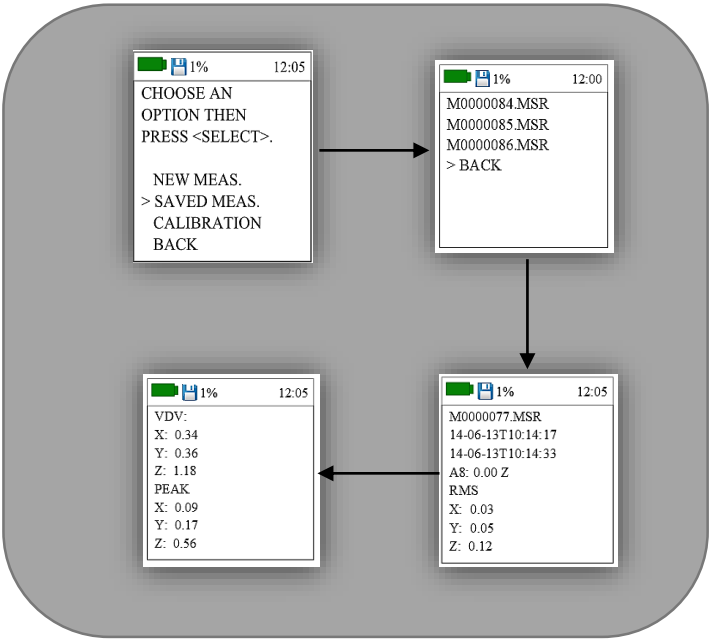



*Figure 9: Measurement results*

## Step 10: Erase Data

To delete a file or all files; once the file is selected;
Press ‘’mode/select’’ button to delete the file(s).

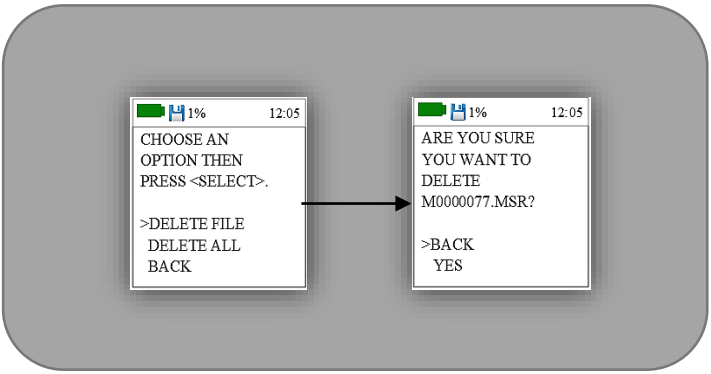



*Figure 10: Erase data*

## Step 11: Turn off Unit

Press On/Off (button 1) once to turn off HealthVib300, see figure 11.

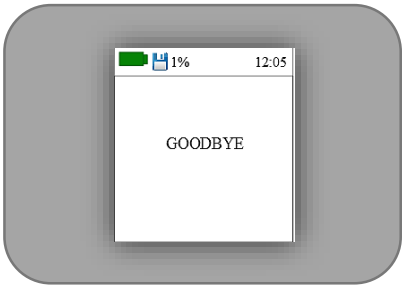
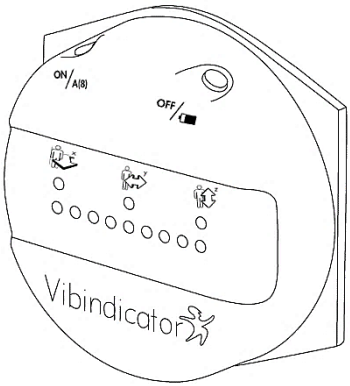



*Figure 11: Turn off HealthVib*

# Vibindicator ™ WBV




- Display current vibration level from HealthVib and accumulated dose.
- Wireless transmission from HealthVib.
- Store up to 17 hours of measurement.
- Saves three axis r.m.s- value every second from HealthVib.

## Functions – Vibindicator™ WBV

*The Vibindicator WBV operates only with a HealthVib WBV.*

- Place the Vibindicator in front of the driver where it is easy to perceive. Velcro patches can be used for mounting.
- Transmission of signals is done over 869, 8 MHz. Clear the path between the units to establish reliable transmission. Vibindicator and HealthVib is assured to work up to 2 meters with free path between them.
- Turn on Vibindicator by pressing left button once. All LEDs (light emitting diode) will be lit and wait for the user to verify by pressing one of the buttons. The three upper LEDs will flash when connected to a HealthVib.
- Current vibration dose, based on last 10 seconds, will be displayed by the number of LEDs on the lower row of LEDs. This is updated once every second. Dominating direction is showed in the upper row by constant light.
- Press left button to view the accumulated vibration dose. This is based on the daily dose and can be directly compared with the directives.
- Data for up to 17 hours can be logged in the internal flash memory. This data can be

transferred to a computer by using the software VibNoiseView.

- To erase the flash memory, press both buttons until all LEDs will go out.
- Press or hold right button to view battery status. The number of LEDs that lit indicates the current status. If all LEDs are lit the Vibindicator is fully charged (Note!after 5 seconds the unit turns off)
- Turn off the Vibindicator by pressing and holding the right button for 5 seconds.

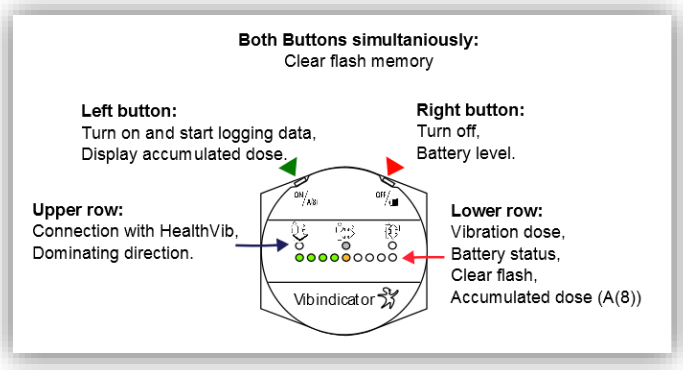



*Figure 12: Vibindicator function overview*

The three LEDs on the upper row display the dominating direction *(x-, y- or z- direction)* with a permanent light.

The other two will continue flashing to indicate that it is connected to the HealthVib.

The nine lower LEDs consists of four green, three yellow and two red LEDs. See table 2 for LEDs versus vibration levels. Current vibration dose calculated from *last 10 seconds* is updated every second.

Press and hold left button to see the accumulated daily dose (A (8) -value). This dose can be directly compared with the regulations.

*Table 2: Respective LEDs Vibration dose*

| **Vibration dose when LEDs are lit** | | |
|---|---|---|
| | LEDs | Vibration dose ($m/s^2$) |
| **1** | green | $\geq 0.1$ |
| **2** | green | $\geq 0.2$ |
| **3** | green | $\geq 0.3$ |
| **4** | green | $\geq 0.4$ |
| **5** | yellow | $\geq 0.5$ |
| **6** | yellow | $\geq 0.7$ |
| **7** | yellow | $\geq 0.9$ |
| **8** | red | $\geq 1.1$ |
| **9** | red | $\geq 1.4$ |

Table2: shows respective LEDs vibration dose. Green indicate the dose is below the limits for action and exposure limits. Yellow means that the action level is

exceeded. Red means that the exposure limit is exceeded.

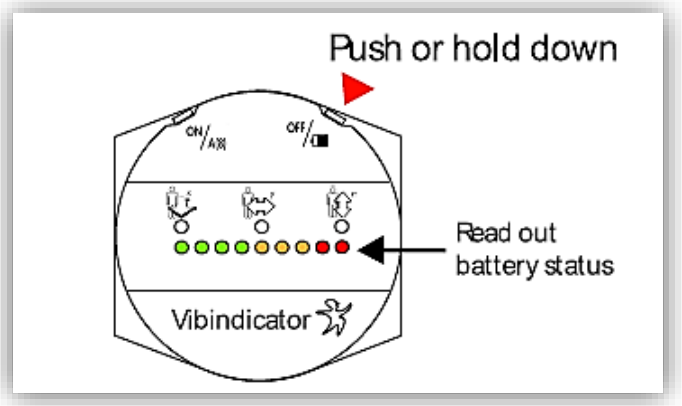



*Figure 13: Check battery status by pressing right button*

## Step-by-step operation guide

### Step1: Check the equipment

Make sure that the Vibindicator is unharmed, is used in correct environment and handled according to instruction.

### Step2: Check battery status

To check battery status the Vibindicator needs to be turned on (press left button once to turn it on). Press once or hold down right button to check battery status. Battery status is indicated by the number of LEDs that are lit, see figure 13.

Maximun battery voltage is 4.2 V. (all LEDs are lit)

### Recharge Vibindicator

1. Make sure that Vibindicator is turned off. If not, press and hold the right button for approx. 5 seconds.
2. Connect the charger to wall socket and the USB-cable.
3. Connect USB- cable to Vibindicator
4. Recharge time: about 6 hours.

## Step3: Place the Vibindicator

Place the Vibindicator visible, for example in center of the steering wheel. Attach it with provided velcro patches.

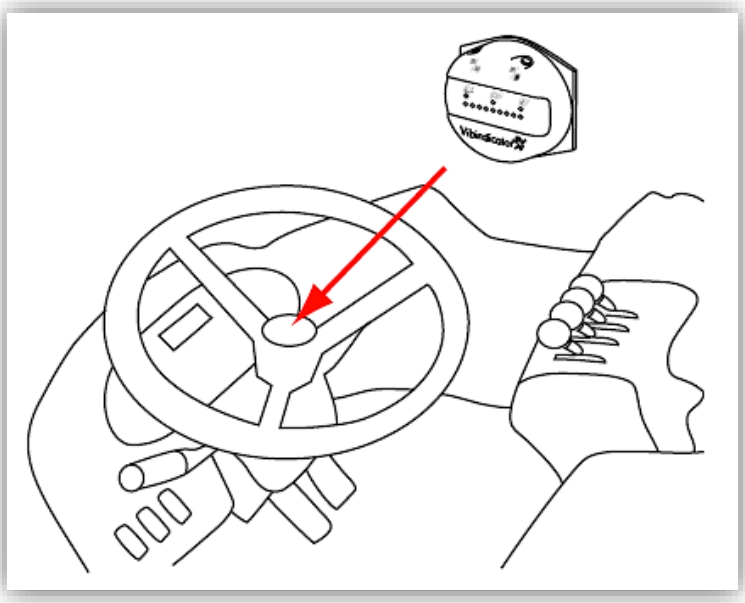


*Figure 14: Place Vibindicator visible*

## Step4: Turn on Vibindicator

Press left button once to turn on Vibindicator, see figure 15. Transmission and storage of data is possible when transmitter (HealthVib) and receiver (Vibindicator) are turned on and within the range for transmission. When HealthVib and Vibindicator is connected the upper row of LEDs flash.

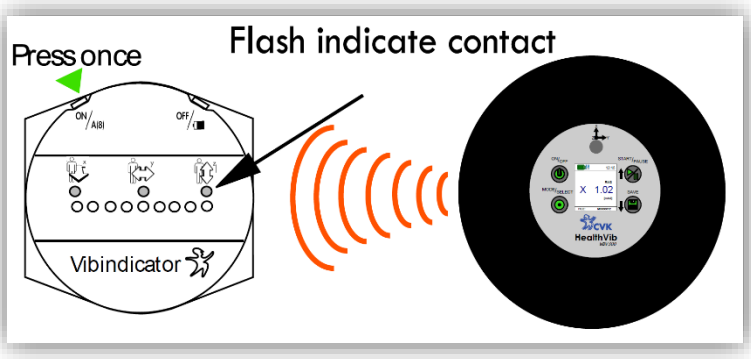



*Figure 15: Turn on Vibindicator and check transmission*

## Step5: Analyse with Vibindicator

### Current dose

The upper row of LEDs indicates the dominating direction of current vibrations (based on the last 10 seconds). One LED indicates the current dominating direction by fixed light and the other two indicates transmission by blinking once every second. See figure 16.

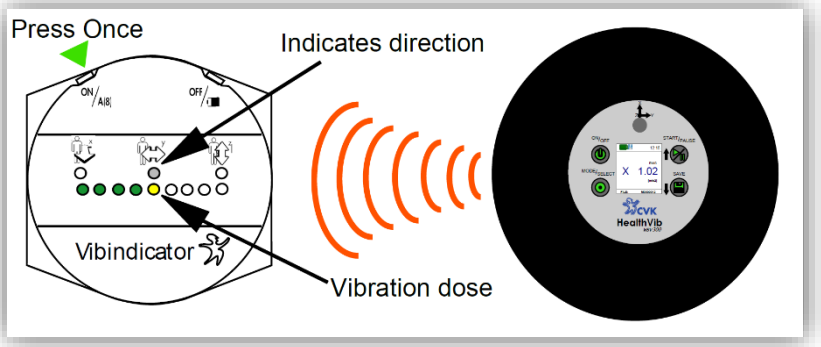



*Figure 16: How to interpret Vibindicator*

The nine lower LEDs (four green, three yellow and two red) indicates the vibration dose ($m/s^2$) for the last 10 seconds and are updated every second, see figure 15. Green light indicates vibration values below action limit, yellow indicates that the *action limit* is exceeded but the exposure is within the *exposure limit* value. Red indicates that the exposure limit is exceeded.

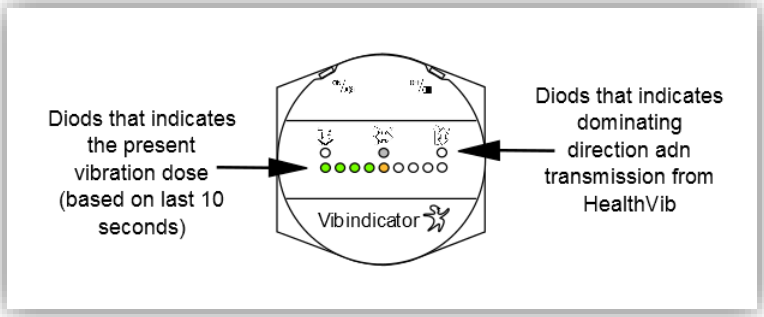



*Figure 17: How to interpret Vibindicator*

## Accumulated dose

Press left button to display the accumulated vibration dose. This status can be compared with the regulations for vibrations exposure. Green light indicates vibration values below action limit, yellow indicates that the action limit is exceeded but the exposure is within the exposure limit value. Red indicates that the exposure limit is exceeded. See figure 18.

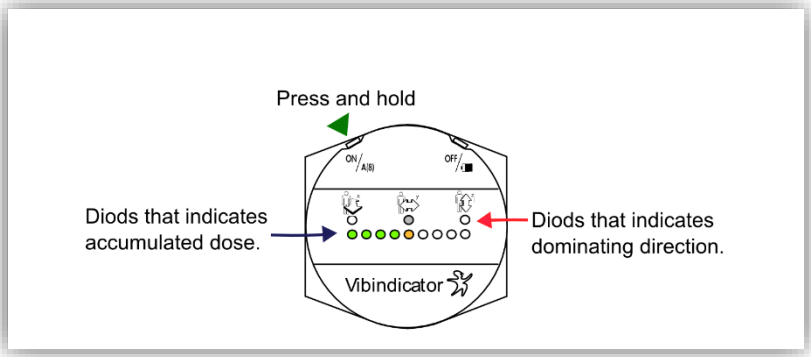



*Figure 18: How to interpret Vibindicator*

## Step 6: Turn off Vibindicator

Press and hold right button for 5 seconds to turn Vibindicator off, see figure 19. Before it turns off, battery status is shown.

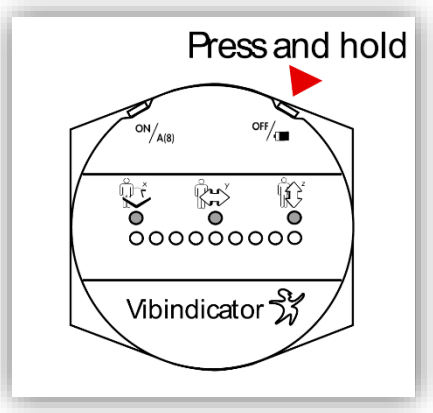



*Figure 19: Turn off Vibindicator*

## Step 7: Transfer data to PC

Transfer stored data from a Vibindicator by connecting to PC with USB-cable and use the computer software CVK VibNoiseVIew 3.0.

*Further information in CVK VibNoiseView 3.0 chapter.*

## Step 8: Erase data in Vibindicator

Press and hold buttons both simultaneously. The lower row of LEDs will be lit and then go out one by one. When all LEDs have gone out the flash will be erased. See figure 20.

***Note!*** *If any button is released before all LEDs have gone out the flash, memory will remain.*

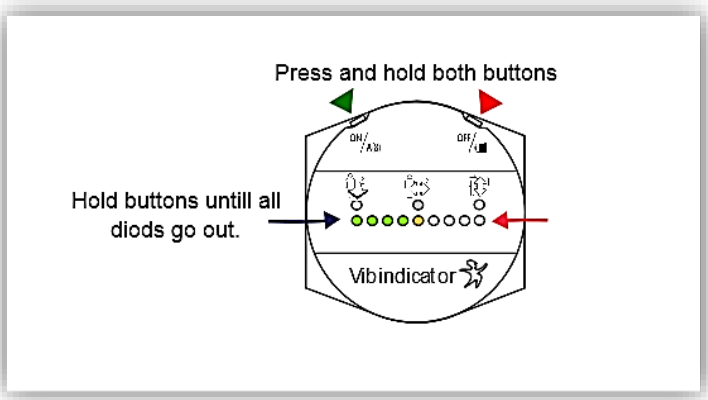
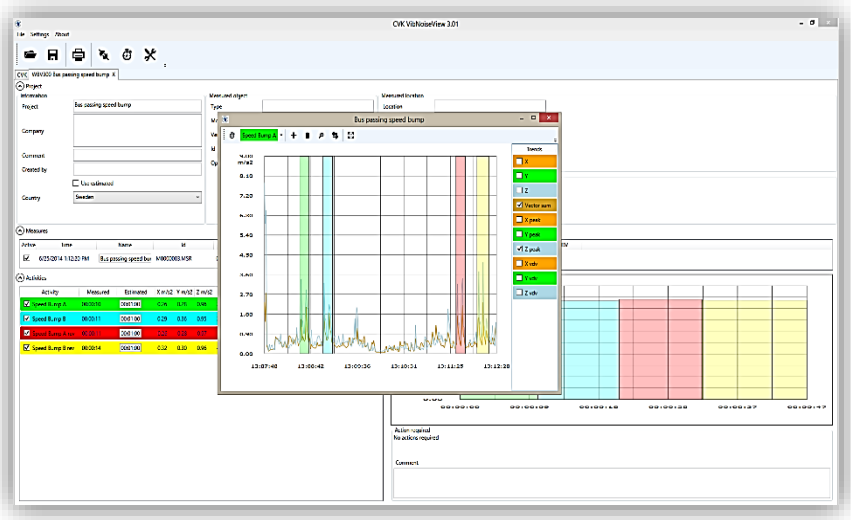



*Figure 20: Press and hold both buttons to erase data.*

# CVK VibNoiseView 3.0




- Import and manage measurements from CVK products. Data export to text format is possible.
- Perform different analysis as RMS, 1sec RMS, VDV and Peak.
- Cut and trim measured data.
- Synchronize data from CVK products.
- Create exposure reports.
- Store measured data and create projects.

## Terms and Conditions

CVK VibNoiseView 3.0 ™ is a measurement analysis software for hand and arm vibration (HAV), Whole body vibration (WBV) and Noise in accordance to ISO 5349, ISO 2631-1, requirements of 2002/44/EG, ISO 60491, requirements of 2003/10/EG. The software is compatible with windows 7 and 8.

Before installation, please make sure that you have approvement from computer administration and right to install this software onto the computer. User license is included in instrument package.

To be able to have software updates and support, the support license purchase is needed.

## Recommendations

- Do backup of important data before installation.
- Close all programs before installation.

## Installation guide

Run the CVK VibNoiseView 3.0 setup-file provided. This will install the necessary files to the computer and create a start menu icon.

When the CVK VibNoiseView setup is launched:

1. The serial number will show up in License window.
2. In order to receive the License key, please provide your supplier with the serial number.

**OBS!** *Without License key, the software can be used for 10 days.*

3. Once entered the license key; the software is activated.

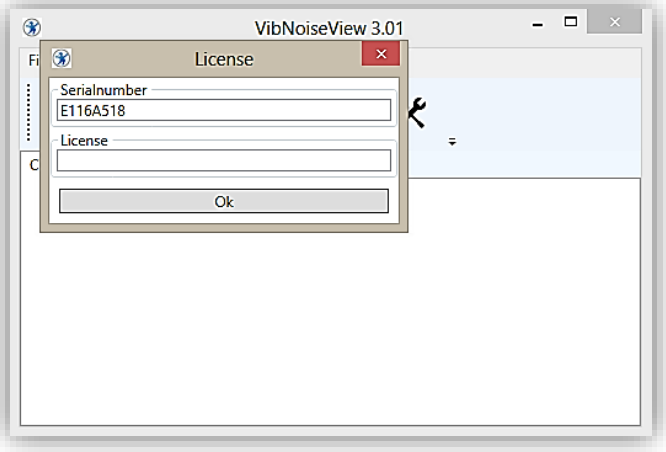



*Figure 21: VibNoiseView Start- up*

## Acquire Data from HealthVib WBV

First, run the software; VibNoiseView and connect unit to computer using USB cable:

1. Open a New HAV/WBV/Noise measure from ‘File’ menu.
2. Click on ‘Connect’ button on top of the main window or Select ‘Read from hardware’ from ‘File’ menu to import the measurements.

## Functions – CVK VibNoiseView 3.0

CVK VibNoiseView 3.0 main functions:

1. Manage and store measurement files in the file management window. Export data as .txt-file or .xls-file.
2. Cut, trim and organize measurements in the graph window.
3. Create, activities in the Activity list and calculate exposure using measured or estimated exposure time.
4. Print or save report by using report button.

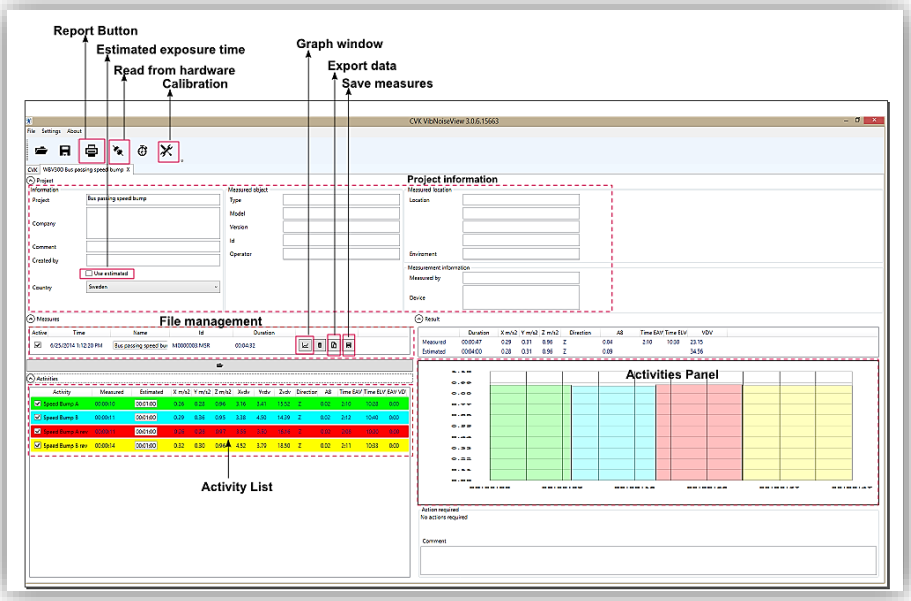



*Figure 22: VibNoiseView OverView*

## File management

In *file management window* all measurement files are shown. Date, time, name, duration and ID file numbers are found and names can be altered in *Name* panel.

There are three options for each measurement file:

### Graph window, Delete file, export file.

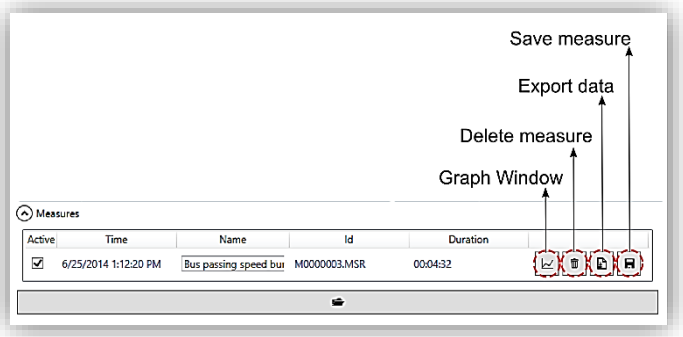



*Figure 23: VibNoiseView File management*

In graph window; activities are found and can be created.

It is possible to delete each measurement file by using 'Delete' button and export data to other file formats such as excel or text file.

## Activity List

In activity list, different activities are presented. Different activities are created in the graph window, popping up when pressing the graph window button.

Marked activities in created activity list will be included in report and calculations.

Measured exposure time is the default but estimated exposure time can be used by selecting ''use estimated'' box in ''project information'' window.

## Estimate time

Different activities can also be time estimated by choosing "*use estimated*". By this it is possible to calculate vibration exposure i.e. when using different machines during different exposure times. It is also possible to recalculate allowed exposure time.

## Graph window

In graph window; chosen file is displayed. There are tools for zoom in/out, pan and creating activities, cut and trim measurements. And activity is created in activity list.

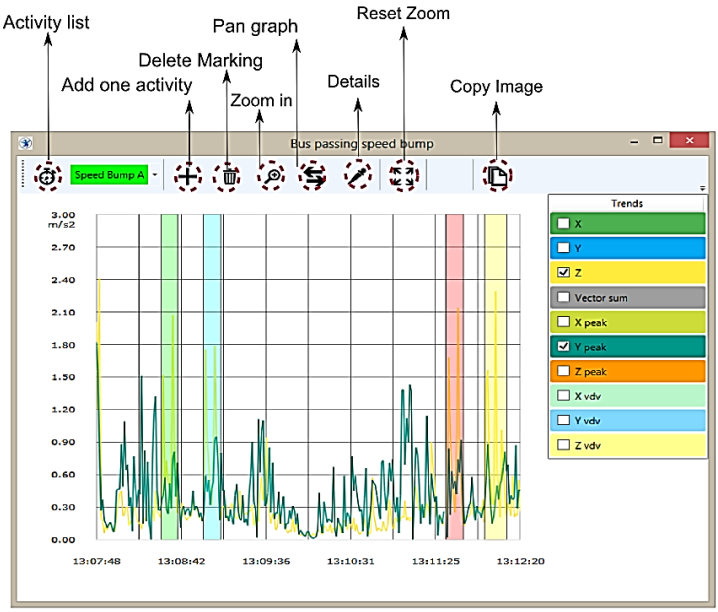



*Figure 24: Graph window*

## Graph- Zoom, and manage data

a) It is possible to choose to display R.M.S (X, Y, Z, and Vector sum), Peak (X, Y, Z) and VDV (X, Y, Z) values by checking them on the left side of the graph window.

b) To define activity(s) in each measurement graph

1. Choose activity panel by clicking on  .
2. It is possible to rename, add, and choose different colors for activities (please see figure 25&26).

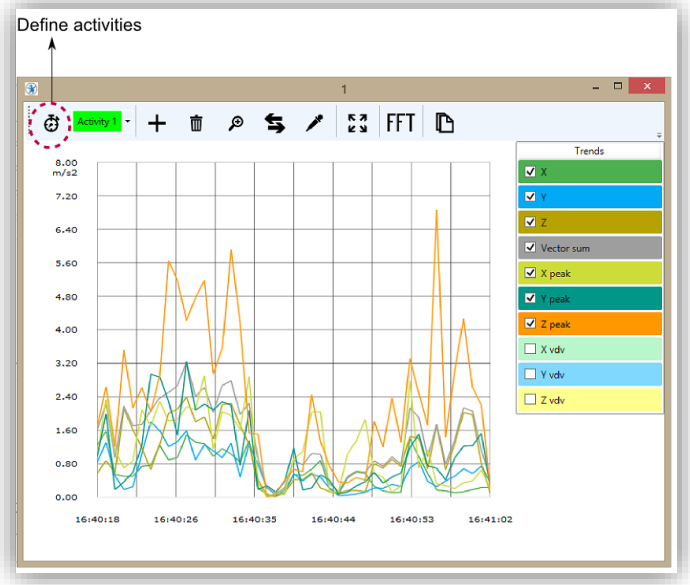



*Figure 25: Graph window- Define activities*

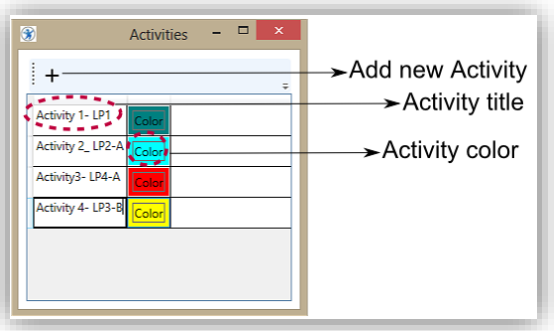



*Figure 26: Define and/or add new Activities*

c) To select area of each activity in the graph;

1. Select the activity you are interested from top of the graph window.
2. In graph window; select "add activity" by clicking on  .
3. Drag and mark the area. (See figure 24)

***Note!*** *It is possible to select the whole measurement as only one activity.*

d) To delete area(s) of each activity in the graph;

1. In graph window; select “delete activity” by clicking on  .
2. Select the marked area to delete it.

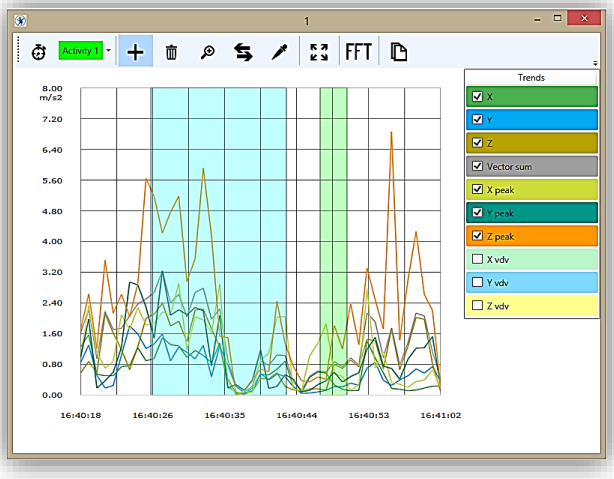


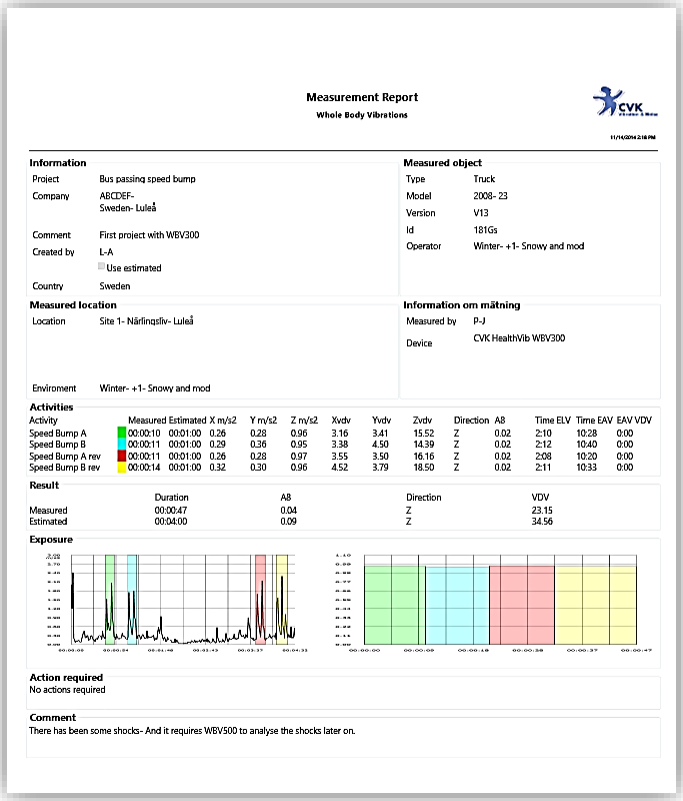

*Figure 27: Graph window- With 2 activities defined.*

## Analysis methods

Different analysis methods can be chosen depending on the vibration characteristics- *RMS, VDV, and Peak.* By this, it is possible to calculate vibration exposure in accordance to ISO 2631.

## Report

Report can be printed or saved as pdf.



Measurement Report

Whole Body Vibrations

11/14/2014 2:18 PM

**Information**

| | |
|---|---|
| Project | Bus passing speed bump |
| Company | ABCDEF-<br>Sweden- Luleå |
| Comment | First project with WBV300 |
| Created by | L-A<br>Use estimated |
| Country | Sweden |

**Measured object**

| | |
|---|---|
| Type | Truck |
| Model | 2008- 23 |
| Version | V13 |
| Id | 181Gs |
| Operator | Winter- +1- Snowy and mod |

**Measured location**

| | |
|---|---|
| Location | Site 1- Närlingsliv- Luleå |
| Enviroment | Winter- +1- Snowy and mod |

**Information om mätning**

| | |
|---|---|
| Measured by | P-J |
| Device | CVK HealthVib WBV300 |

**Activities**

| Activity | Measured | Estimated | X m/s2 | Y m/s2 | Z m/s2 | Xvdv | Yvdv | Zvdv | Direction | A8 | Time ELV | Time EAV | EAV VDV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Speed Bump A | 00:00:10 | 00:01:00 | 0.26 | 0.28 | 0.96 | 3.16 | 3.41 | 15.52 | Z | 0.02 | 2:10 | 10:28 | 0:00 |
| Speed Bump B | 00:00:11 | 00:01:00 | 0.29 | 0.36 | 0.95 | 3.38 | 4.50 | 14.39 | Z | 0.02 | 2:12 | 10:40 | 0:00 |
| Speed Bump A rev | 00:00:11 | 00:01:00 | 0.26 | 0.28 | 0.97 | 3.55 | 3.50 | 16.16 | Z | 0.02 | 2:08 | 10:20 | 0:00 |
| Speed Bump B rev | 00:00:14 | 00:01:00 | 0.32 | 0.30 | 0.96 | 4.52 | 3.79 | 18.50 | Z | 0.02 | 2:11 | 10:33 | 0:00 |

**Result**

| | Duration | A8 | Direction | VDV |
|---|---|---|---|---|
| Measured | 00:00:47 | 0.04 | Z | 23.15 |
| Estimated | 00:04:00 | 0.09 | Z | 34.56 |

**Exposure**

**Action required**

No actions required

**Comment**

There has been some shocks- And it requires WBV500 to analyse the shocks later on.

*Figure 28: VibNoiseView Report preview*

## Open previous saves measurement files

1. Open a New HAV/WBV/Noise project tab from ‘File’ menu.
2. Click on ‘Open button’ in “Measures” section to open your saved measurement files. (see figure 29)

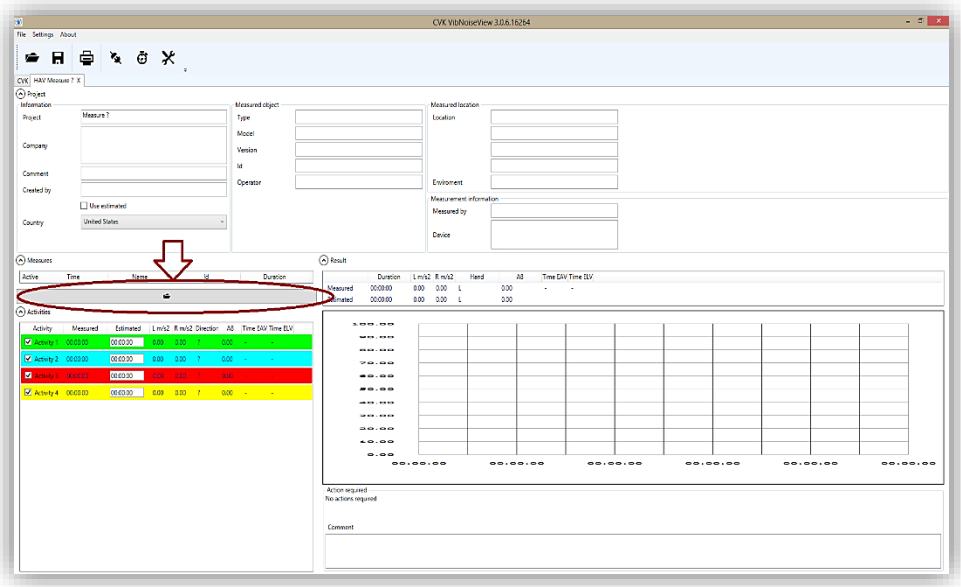



*Figure 29: Open a saved measurement file*

## Adjust time

To change date and time in your unit:

1. Choose ‘’Calibration mode’’ on unit

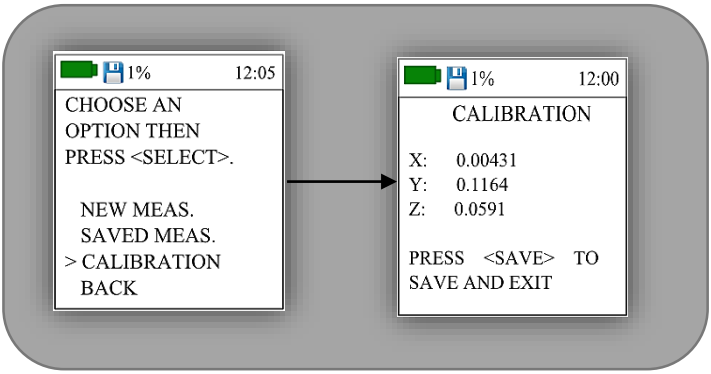



*Figure 30: Choose Calibration mode on unit*

2. Choose ‘’Calibration mode’’ on unit
3. Connect the unit to the computer and run VibNoiseView
4. Start Calibration software by click on icon  And the ‘’Calibrate’’ window will show up.
5. Press ‘’Set Clock’’ to synchronise your unit time and date with your computer.

6. Press ‘’Save’’ button on unit and close the Calibrate window. (See figure 31)

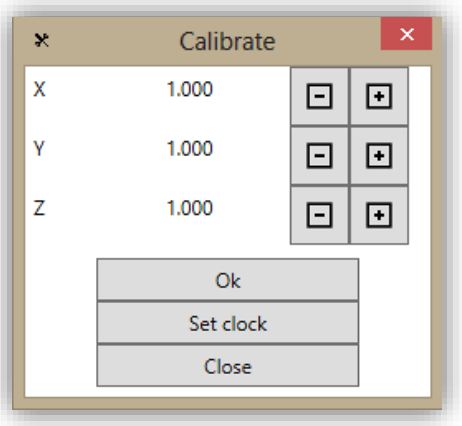



*Figure 31: Adjust date and time on unit*

# Calibration control

In order to control the measurement accuracy of measurement, shaker or Calibrator are needed. A steady state sine wave of 8, 15.92 or 159.2 Hz and an efficiency level of 2 – 10 m/s$^2$ root mean square (RMS) are recommended. Contact your supplier for further information about CVK calibrator adaptor and recommended calibrator/shaker.

## Equipment

Equipment recommended to use for calibration:

- Shaker or calibrator with 8, 15.92 or 159.2 Hz and vibration level 2 – 10 m/s$^2$ (RMS).
- CVK adaptor to fasten HealthVib in three directions.
- Computer reading CVK VibNoiseView 3.0 to display R.M.S value and data for calibration.

***Note**! For WBV300/500; the sensor part has to be removed from seat plate by losing the screws under the seat plate. Firmly remove the sensor part and mount it on the CVK WBV calibrator adaptor.*

## Procedure

Connect unit with USB-cable to PC, mount unit firmly on calibrator.

Start calibration software by click on icon 

Run a sine wave at 8, 15.92 or 159.2 Hz at 2-10 $m/s^2$. Each directions are controlled by remounting the unit for different directions.

Read out value directly in HealthVib's display or in CVK software. If measured value differs from the nominal value, the sensitivity can be adjusted by +/- in calibration software.


*Figure 32: mounting HealthVib sensor unit on calibrator/shaker*