Pulsar vB
Hand Arm Tri-Axial Vibration Meter

Operating Manual

Pulsar Instruments Plc
The Evron Centre
John Street
Filey
North Yorkshire
YO14 9DW
UK

Copyright © Pulsar Instruments Plc 2018

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the copyright holder.

Rev B

HB/2006/060/EL

www.pulsarinstruments.com

Overview

Thank you for purchasing the Pulsar vB (vB001) Hand Arm Vibration Meter from Pulsar Instruments Plc. This manual is designed to show you the operation of the goods you have purchased and a very brief insight into vibration itself.

Should you need any further assistance in the operation of this instrument please contact us and we will be happy to help. We can also recommend suitable training courses in the UK should you wish to become a Competent Person for Human Vibration in the eyes of the law.

First Time Use

We pride ourselves on providing high quality measurement instruments to our customers, and I'm sure you will find this instrument meets those standards. We suggest however that before you switch the instrument on and use it for the first time that you inspect it for any signs of damage. You should also check that all the relevant accessories are present. Should you find any damage, please tell us immediately.

Phone: +44 1723 339715 or email: sales@pulsarinstruments.com

Pulsar vB Instrument Check List

The Pulsar vB is supplied with the following accessories as standard:

Pulsar vB Instrument
Tri-Axial Accelerometer with 1.4m Cable
Accelerometer Mounting Block and Screw
Rechargeable Battery Pack and Recharger
Pulsar vB Plus LITE software & USB Cable
Quick Start Guide
User Manual (USB drive)
Carry Case

For further details of your options and accessories for the Pulsar vB Vibration Meter, please contact your local representative or visit our website: www.pulsarinstruments.com

Simon Rehill
Managing Director

Note: for '**Getting Started**' section please turn to Chapter 4

Precautions

- Only operate the instrument as described in this manual.
- These are precision instruments, protect from shocks and physical extremes.
- Ambient conditions for the operation of the unit are as follows: -

  Temperature: -10°C to +50°C

  Relative Humidity: 25 to 90%
- Protect the unit from extremes of temperature and humidity, direct sunlight and air with a high salt or sulphur content.
- Always turn the unit off after use.
- Do not use any solvents or cleaning agents on the instrument. Use only a soft dry cloth or a soft cloth lightly moistened with water when necessary.
- Do not allow any conductive objects, such as wire or metal particles to enter the unit.
- Do not try to disassemble the instrument or attempt any repairs as this will invalidate your warranty.
- To ensure continued precision performance of your instrument have it checked and serviced at regular intervals.

Contacting Pulsar

This manual contains complete operating instructions for the Pulsar vB Vibration Meter, read it carefully and you will quickly become familiar with your instrument and its operation.

If you do encounter problems with the operation of your instrument please feel free to contact customer support with your enquiry on: -

Telephone:	+44 (0)1723 339715
Website:	www.pulsarinstruments.com
Email:	sales@pulsarinstruments.com

Contents

CHAPTER 1 1

Introduction 14
Pulsar vB – Tri Axial Hand Arm Vibration Meter (HARM) 14

CHAPTER 2 15

Accelerometer Type, Removal and Fitting 15
Accelerometer Type 15
Pulsar vB Hand Arm Tri-Axial Accelerometer (VB002) 15
Attaching & Removing the Accelerometer 16

CHAPTER 3 17

Measuring Vibration 17
Hand Arm Vibration 17
Hand Arm Vibration Transducer Mounting 17
Vibration Direction 18
Vibration Level 19
Frequency Weighting Filter 19
Under Range & Overload Conditions 20
Under Range Condition 20
Overload Condition 20

CHAPTER 4 21

Getting Started 21
Keypad Layout 23
Powering Your Pulsar vB Meter 24
Battery Indicator 25
Recharging the Battery Pack 26
Switching Your Pulsar vB Meter On/Off 27

CHAPTER 5 28

Menu Structure 28
Menu Options 30
Range 30
Files 31
Open All 31
Open Today's 32
Open 7 Days 33
Delete Single File 34
Delete All Files 35
Settings 36
Units 36
Brightness 37
Auto Dim 37
General 38
Time 38
Date 39
File Naming 39
Meter 40

Reset 40
Configuration 41
Exposure Points 41
Show Results 42
Information 42
Calibration 43
Measurement 43
Sensitivity 46

CHAPTER 6 47

Using the Pulsar vB 47
Stop State 47
Record State 48
Playback 49
Show Results - On 50
Exposure Points - On 51
Under Range Indicator 52
Overload Indicator 53
Parameters 54
Arms 54
Aeq 54
Amax 54
Peak 54
Vector 54
Exposure 54

CHAPTER 7 55

Downloading Saved Recordings to a PC 55

CHAPTER 8 56

Accessories 56

CHAPTER 9 57

Technical Specification 57
Applicable Standards 57
Noise Floors 57
Normal Operating Mode 57
Overload & Under Range Triggering Points 57
Level Ranges 58
Frequency Weightings 58
Accelerometer 59
Electrical Signal Input 60
Maximum Electrical Signal Input For No Damage 60
Environmental Stabilization Time 60
Warm up Time 60
Settling Time 60
Temperature Operating Range 60
Effect of Air Temperature 61
Effect of Surface Temperature 61
Real Time Clock 61
Digital Signal Processing 61
Analogue to Digital Converter & Microcontroller 61
Displayed Measurement Resolution 61

Display 61
Memory 62
Overload 62
Size and Weight 62
Connections 62
AC Output 62
Wiring Configuration – 4 Pole Jack Socket 3.5mm 62
Download 63
Wiring Configuration - Micro USB 'B' Socket 63
Input Signal 63
Wiring Configuration – (Lemo Socket EGG.0B.305.CLL) 63
Battery Recharge 63
Batteries 64
EC Declaration of Conformity 65

CHAPTER 10 66

Function Equations 66

CHAPTER 11 68

Customer Instrument Support 68
Warranty and After Sales Service 68
Disclaimer 70
Instrument Details 70

INDEX 117

`

Table of Figures

Figure 1 - Recommended Axes for Hand Arm Vibration 18
Figure 2 - Keypad Layout 23

Chapter 1

Introduction

Pulsar vB – Tri Axial Hand Arm Vibration Meter (HARM)

The Pulsar vB Tri Axial vibration meter brings simplicity, looks, value for money and power to the world of vibration monitoring.

The instrument is fully compliant with the standard ISO 8041:2005 and has been designed to make sure workers do not exceed the exposure to vibration levels as stated by the Control of Vibration at Work Regulations (2005).

It boasts a clear easy to read colour LCD and has full data logging capabilities with fast USB downloading to your laptop or PC. The Pulsar vB incorporates internal Flash memory to store all of your recordings and the data can then be transferred to the supplied software Pulsar vB Plus using the supplied USB cable or viewed onscreen.

Not only does the Pulsar vB vibration meter have all of these features in a small and ergonomic case but it is also supplied with a rechargeable battery pack featuring the latest NiMH technology which incorporates extremely low self-discharge.

Every part of the Pulsar vB has been thoughtfully designed. The case, accelerometer and cable are all rugged for industrial use and the meter is extremely easy to use with a simple three button operation, all you virtually need to do is press the power button and start recording.

With the Pulsar vB combating HAVS has become even easier.

Chapter 2

Accelerometer Type, Removal and Fitting

The accelerometer for use with the Pulsar vB produces a Voltage Output proportional to the signal being measured.

The table below shows the output voltage and specifications for the accelerometer where g is the acceleration due to gravity on the Earth's surface and is defined as 9.80665 ms^{-2}.

Acceleration is measured in metres per second per second (m/s/s) which can be written as either of the following: -

- ms^{-2}
- m/s^2

Accelerometer Type

Pulsar vB Hand Arm Tri-Axial Accelerometer (VB002)

Accelerometer Type	Output Voltage	Operating Range	Frequency Response
Hand Arm	10mV/g	±200g	2 to 5000Hz ±10%

Hand Arm Vibration Tri-Axial Accelerometer (VB002)

Attaching & Removing the Accelerometer

On the accelerometer cable connector locate the orientation key, and on the instrument locate the RED keying identification mark of the 5 pin Lemo socket. Position the accelerometer cable so that the orientation key is in line with the RED mark and then gently push the accelerometer cable into the instruments socket.

To unlatch and remove the accelerometer cable gently pull on the knurled part of the stem and pull the accelerometer from the instrument.

Do not twist the connector, doing so will likely damage internal wiring which would not be covered under warranty.

Removal of the accelerometer can be achieved with the instrument powered on or off.

Chapter 3

Measuring Vibration

Hand Arm Vibration

It is advisable to validate your instrument prior to, and after taking measurements using a known vibration source, such as a vibration calibrator.

To ensure measurements are as accurate and as repeatable as possible always ensure that your accelerometer is mounted as securely and as flush as possible to the vibration source. The trailing cable of the accelerometer should also be attached to the vibration source without creating a potential hazard for the operator or other people.

Where possible always mount the accelerometer as near to the centre of where the operator holds and grips the vibration source. In reality this is not always possible and the best compromise must be achieved.

Measurement durations are dependant on the vibration source, and a minimum period of 30 seconds for Hand Arm Vibration is recommended. Measurement periods of 3 to 15 minutes are often used for Hand Arm vibration. These increased durations will undoubtedly increase the accuracy and repeatability of your measured results.

Hand Arm Vibration Transducer Mounting

The supplied mounting block can be attached to the HARM accelerometer using the supplied screw and Allen key. The mounting block can then be mounted to the vibration source using hose clamps or plastic ties. If plastic ties are used it is recommended that they are tightened using a tie tensioning tool. Attaching devices such as clamps and the accelerometer to hand held devices may alter the mass of the vibration source and will inevitably slightly alter the vibration emitted from the device, it is therefore recommended to keep the mass of hose clips or clamps to a minimum.

Other mounting possibilities to mount the accelerometer to the vibration source are tapping a stud into the vibration source and attaching the accelerometer to the stud. Alternatively, the stud may be adhered to the device rather than tapped with an adhesive that dries rigid. Pulsar Instruments Plc can supply a glue and stud pack if required, (order code KD1215). See **Accessories** for more options.

Vibration Direction

For Hand Arm vibration, the three axes being measured can be measured in any orientation. However, it is recommended that the suggested axes indicated in the figure below are used. If this is not possible, then choosing other axes orientation is permissible and will not affect your measured data.

In all cases it is strongly recommended to make notes on the axes used relative to the vibration source. This information will be required if vibration control is to be implemented on the vibration source.

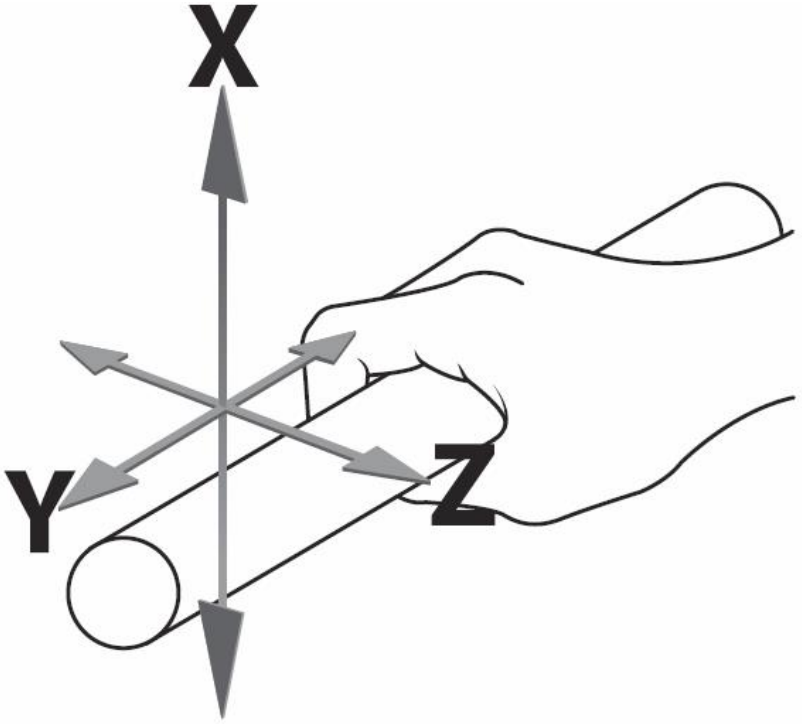


Figure 1 - Recommended Axes for Hand Arm Vibration

Vibration Level

In some environments, high levels of vibration may occur. Before you record measurements take the time to ensure you have selected the optimum range for the process being recorded.

The optimum range is generally the lowest range that can be selected that does not produce an overload condition for the process being monitored.

Where high levels of vibration are encountered the meter may register an overload and in these circumstances the meter will display that this has occurred. In such cases you will need to select the high range to accommodate the higher peak levels and if Overload conditions are still occurring on the high range it may be necessary to use an impact filter on the accelerometer.

If the vibration levels are too low for the range selected then the meter will display an under range condition. Under these circumstances you will need to select the low range if possible.

For more detailed information see **Under Range & Overload Conditions**.

Frequency Weighting Filter

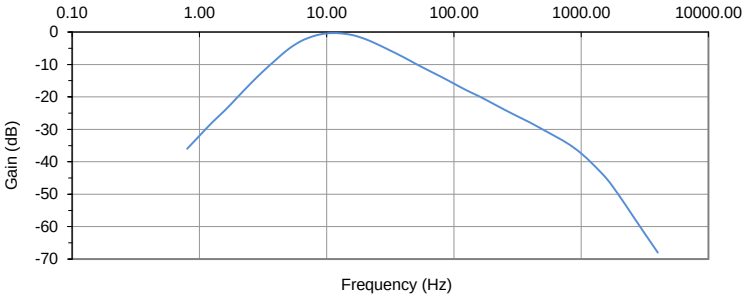
The human body's discomfort level to vibration alters depending on the vibration frequency and where the vibration is in contact with the body.

Your Pulsar vB meter therefore has the following frequency weighting filter which is applied to the measured vibration signal using a fast processor for superior accuracy: -

Hand Arm Vibration

Filter	Description
Wh	Always used for Hand Arm Vibration measurement in the X, Y and Z Axis.

Wh Filter Frequency Response:



Under Range & Overload Conditions

Under Range Condition

An under range condition occurs when the vibration level is equal to, or lower than the bottom of the current range the meter is set to. If this condition occurs then the UR (Under Range) indicator will be displayed on your instrument. In such circumstances it is highly recommended to change to a lower range with a higher sensitivity as your meter will be out of specification.

The under range indicator will remain on for a minimum of 2 seconds or while the under range condition remains.

Placement of the under range indicator can be found under **Under Range Indicator** in **Chapter 6**.

See **Technical Specification** for a complete list of Under Range triggering points.

Overload Condition

An overload condition occurs when either the peak signal starts to exceed the signal handling capability of the specialised amplifier circuitry or if the vibration level exceeds the top of the selected range by 5%. If the vibration source saturates the input circuitry or is 5% greater than top of the selected range an Overload condition occurs and an OL (Overload) indicator is displayed on your instrument.

If an overload condition occurs it is highly recommended to change to a higher range with a lower sensitivity as your meter will be out of specification.

The overload indicator will remain on for a minimum of 2 seconds or while the overload condition remains.

Please be aware that the selected frequency weighting may attenuate the displayed signal level below the overload triggering point but an overload can still occur. This is because the overload operates from the unweighted input signal.

Placement of the overload indicator can be found under **Overload Indictor** in **Chapter 6**.

See **Technical Specification** for a complete list of Overload triggering points.

Chapter 4

Getting Started

The Pulsar vB instrument has three states of basic operation: -

- Stop State
- Record State
- Playback

Whilst the instrument is in the Record State the vibration activity is analysed and all parameters available on your instrument are calculated.

The captured data is saved to the internal flash memory and can be viewed onscreen or downloaded to Pulsar's vibration analysis software **Pulsar vBPlus** or **Pulsar vBPlus LITE** as and when required.

To Start or Stop a recording press the following key

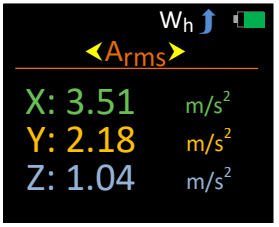
Whilst the instrument is in the Stop State, calculations are displayed on screen but are not stored in flash memory.

Exposure Points are only available at the end of a recording or when viewing a saved recording. The option to display Exposure Points must also be set to On.

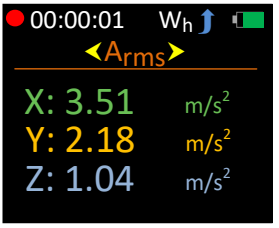
During Stop State it is possible to change the Settings and undertake Calibration of the instrument.

Stop State, Record State and playback can easily be distinguished: -

Stop State



Record State



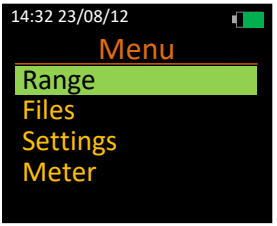
Record State shows Record Symbol and Time Recorded

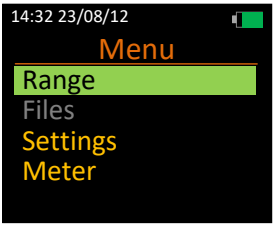
Playback

Playback shows Play Symbol and Total Time Recorded

Whilst in Stop State press to open the Main Menu. This key is also used to step back to the previous screen.

With the Main Menu screen open, use to scroll down the list of available options: -





If the instrument has no files saved then the Files option is not selectable

Press to select the required option. Note that a recording cannot be started from within the Main Menu.

Some options may also have further sub-menus where further options are available. Again use the key to scroll through the available options.

The menu structure is described in detail in **Chapter 5**.

Please be aware that your Pulsar vB instrument has a built in battery saving function that automatically dims the display. Any key can be pressed to exit this power saving function. See **Auto Dim** in **Chapter 5** for more details.

Keypad Layout

Please note that some keys have a dual function.

Figure 2 – Keypad Layout

Powering Your Pulsar vB Meter

Your Pulsar vB meter is powered using a rechargeable 2.4V NiMH battery pack. The battery pack employs the latest battery technology for maximum battery life between instrument uses.

The battery compartment is located on the underside of your instrument. Open the battery door by sliding the cover downwards towards the bottom of the instrument.

The cover can now be removed exposing the battery compartment and battery pack if fitted.

To fit a battery pack, plug the battery pack into the connector and insert the battery pack at an angle as shown below: -

Push the raised end of the battery pack downwards as indicated until the battery pack sits comfortably in place.

Ensure battery cabling does not overlap or obstruct where the battery door is inserted.

Battery Indicator

Your Pulsar vB meter is equipped with a four stage battery level indicator and is visible in the top right hand corner of all screens.

With a fully charged battery pack the indicator with a full Green bar is displayed and as the battery pack discharges the relevant indicator is displayed.

The approximate values are 100%, 75%, 50% and 25%

When the battery pack is below 10% it will flash Red indicating that the battery pack is flat and requires a recharge.

When the battery pack is below 4% it will automatically power the unit down and save any data if the instrument is in **Record State**.

Recharging the Battery Pack

With a battery pack inserted and your instrument switched off plug your supplied charging unit into the DC socket indicated below: -

The Pulsar vB instrument will not operate while the battery pack is charging and will immediately switch off when the charger is plugged in to the DC socket, even if the charger is not switched on. This is normal.

If the unit switches off due to the charger plug being inserted then no settings or recordings will be saved.

A completely discharged battery pack may need several hours to become fully charged.

Observe the LED on the charging unit to determine the charging cycle.

LED Colour	Mode	Output
Yellow	No Battery	6.4V
Yellow	Initialisation	30mA
Orange	Fast Charge	1.3A
Green/Yellow	Top-off Charge	160mA
Green	Trickle Charge	30mA
Orange/Green	Error	30mA

When the charging unit displays a constant Green LED then charging is complete.

For safety only use the charging unit and battery pack supplied by Pulsar.

Switching Your Pulsar vB Meter On/Off

To turn on your instrument press and hold the Power On/Off key for approximately two seconds.

Your meter will display the start-up screen and initialise any saved settings.

The start-up screen is shown below: -

Once the start-up sequence is complete the instrument is placed in its **Stop State** displaying the parameter measuring screen.

To turn off your instrument press and hold the Power On/Off key for approximately three seconds and the following screen will be displayed: -

Release the Power On/Off key to shut down.

Your Pulsar vB meter is also equipped with an automatic shut down if no key is pressed for 3 minutes after power on.

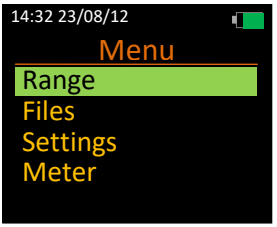
If any key is pressed after the instrument is turned on then the automatic shutdown will not occur.

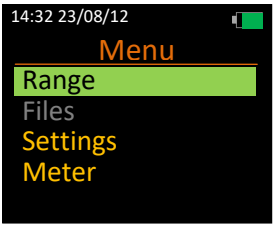
Chapter 5

Menu Structure

Whilst in Stop State press to open the Main Menu. This key is also used to step back to the previous screen.

With the Main Menu screen open, use to scroll down the list of available options: -



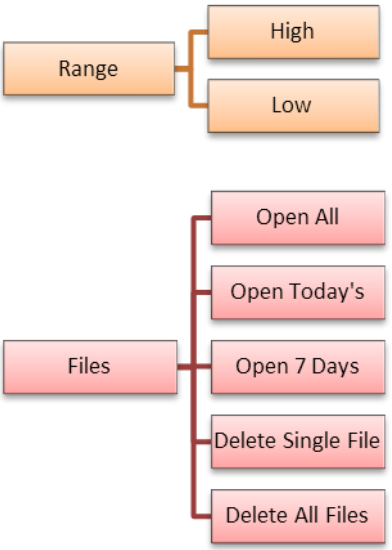


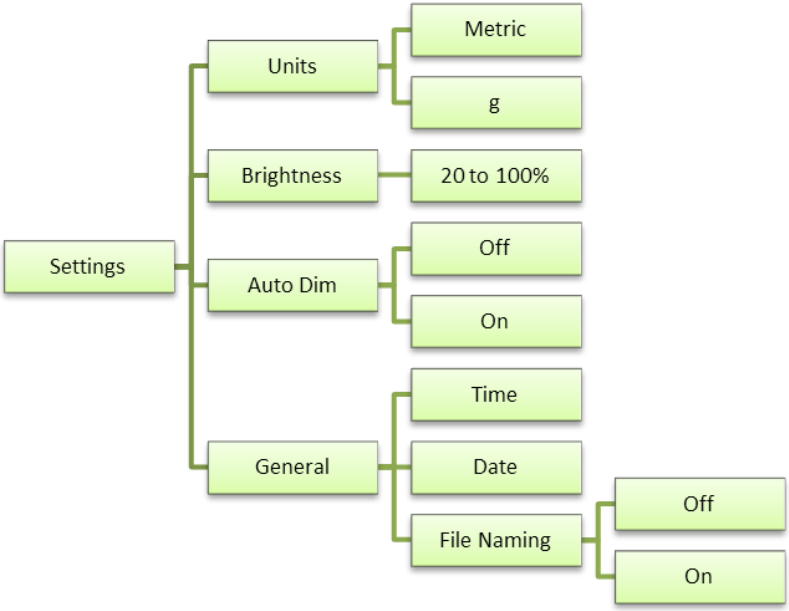
If the instrument has no files saved then the Files option is not selectable

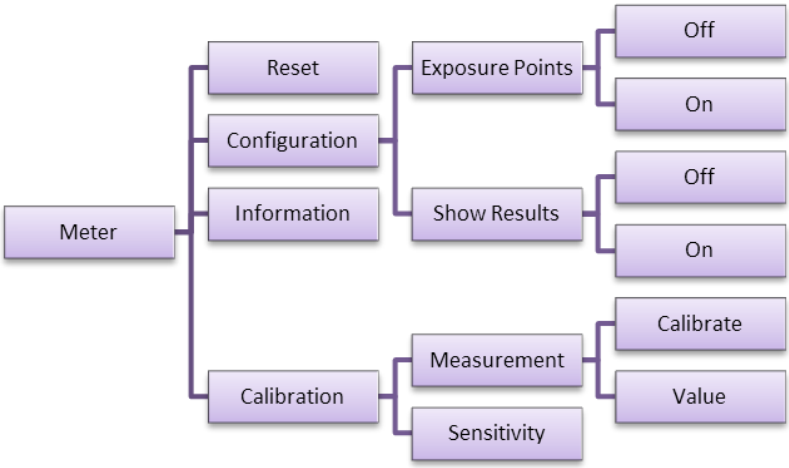
Press to select the required option. Note that a recording cannot be started from within the Main Menu.

Some options may also have further sub-menus where further options are available. Again use the key to scroll through the available options.

The complete menu structure is shown below: -




Settings
Units
Metric
g
Brightness
20 to 100%
Auto Dim
Off
On
General
Time
Date
File Naming
Off
On

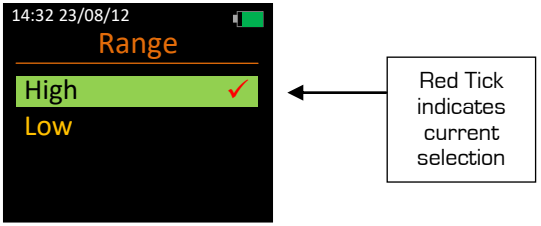

Meter
Reset
Configuration
Information
Calibration
Exposure Points
Off
On
Show Results
Off
On
Measurement
Calibrate
Value
Sensitivity

Menu Options

Each Menu option is described fully below: -

Range

Select this option to change the measuring range of your Pulsar vB instrument.



Use the key to highlight the required option and press to select. The range will be selected and the previous menu screen will be displayed.

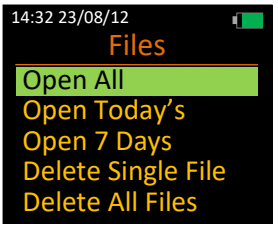
Range details are as follows: -

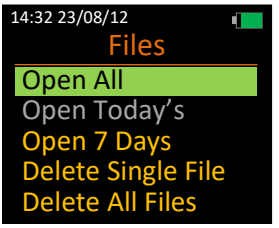
Range	(m/s²)	(g)
High	0.50 – 2000	0.051 – 204
Low	0.05 – 200	0.0051 – 20.4

Press to return to the previous screen without making a selection.

Files

Select this option to manage saved recordings on your Pulsar vB instrument.





If no files have been recorded today or in the last 7 days then these options will not be selectable

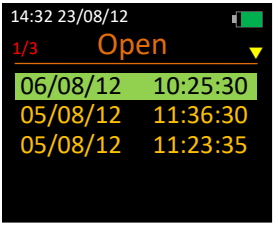
Use the key to highlight the required option and press to select.

Press to return to the previous screen without making a selection.

Open All

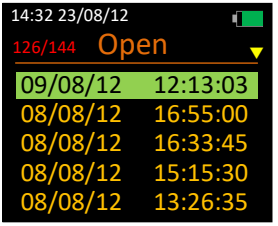
Select this option to show all saved recordings on the instrument. Recordings are listed by file name, date and time order showing the most recent first.

The file number and amount of recorded files are also shown in Red: -



Use the key to highlight the required file and press to open it.

If more than 5 files exist then use the key to scroll through the available recordings: -



Press to return to the previous screen without making a selection.

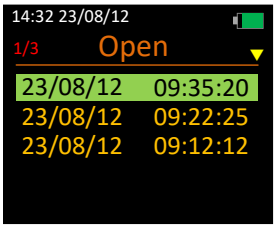
Open Today's

Select this option to show all saved recordings made today on the instrument.

The recordings are listed by file name, date and time order showing the most recent first.

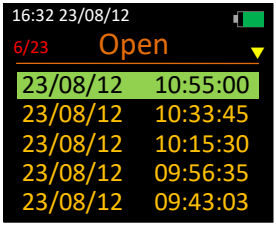
Note that this option is not selectable if no recordings have been made today.

The file number and amount of recorded files are also shown in Red: -



Use the key to highlight the required file and press to open it.

If more than 5 files exist then use the key to scroll through the available recordings: -



Press to return to the previous screen without making a selection.

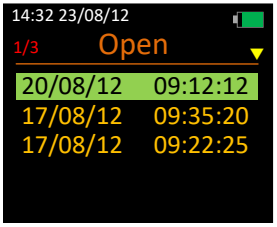
Open 7 Days

Select this option to show all saved recordings made in the last 7 days.

The recordings are listed by file name, date and time order showing the most recent first.

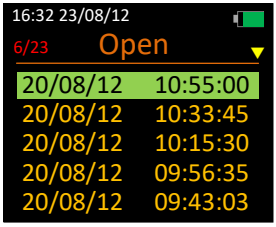
Note that this option is not selectable if no recordings have been made in the last 7 days.

The file number and amount of recorded files are also shown in Red: -



Use the key to highlight the required file and press to open it.

If more than 5 files exist then use the key to scroll through the available recordings: -



Press to return to the previous screen without making a selection.

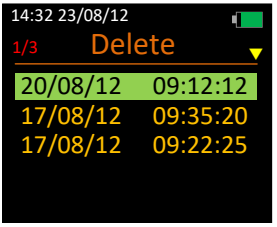
Delete Single File

Select this option to delete an individual file from the instruments flash memory.

Deleted files cannot be recovered.

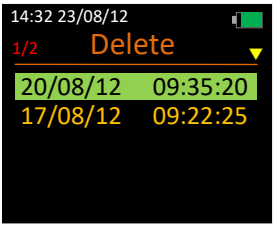
The recordings on the instrument are listed by file name, date and time order showing the most recent first.

All recordings will be available for selection and the file number and amount of recorded files are shown in Red: -

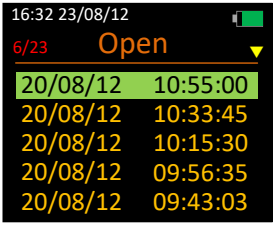


Use the key to highlight the required file and press to delete it.

The selected file will be immediately deleted: -



If more than 5 files exist then use the key to scroll through the available recordings: -

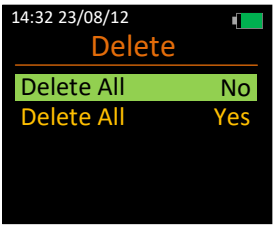


Press to return to the previous screen without making a selection.

Delete All Files

Select this option to delete all recordings from the instruments flash memory.

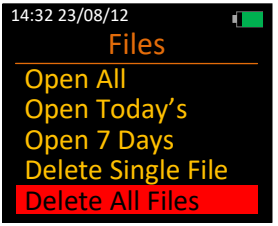
Proceed with caution as deleted files cannot be recovered: -



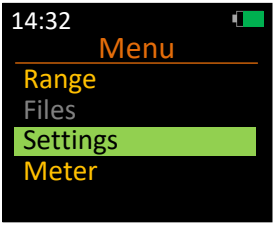
Use the key to highlight the required option and press to proceed.

Select No or press to return to the previous screen without deleting any files.

Select Yes to delete all saved files. Delete All Files will be highlighted red: -

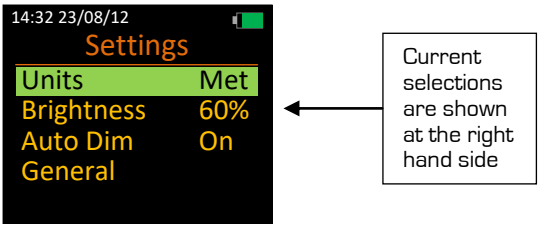


When all files are deleted the Main Menu is displayed: -



Settings

Select this option to manage settings on your Pulsar vB instrument.

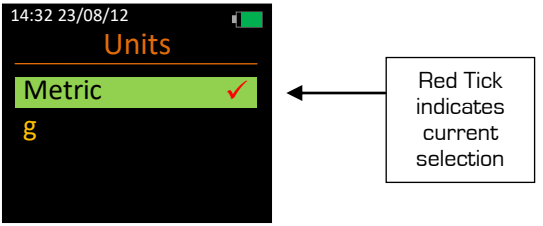


Use the key to highlight the required option and press to select.

Press to return to the previous screen without making a selection.

Units

Select this option to change the units of measure of your Pulsar vB instrument.

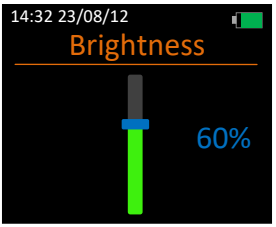


Use the key to highlight the required option and press to select. The unit will be selected and the previous menu screen will be displayed.

Press to return to the previous screen without making a selection.

Brightness

Select this option to change the display brightness of your Pulsar vB instrument.



Use the key to change the brightness level and the press OK to return to the previous screen with the selected brightness level.

The display brightness can be adjusted between 20% and 100% in 20% steps.

Press to return to the previous screen without altering the brightness level.

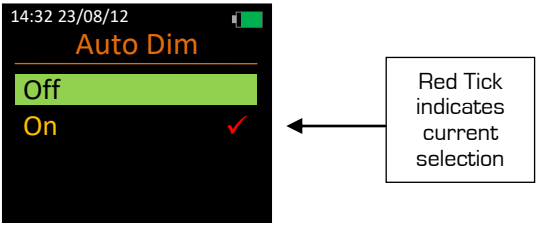
Note that the brightness may be affected by the Auto Dim function - see below.

Auto Dim

Select this option to determine if your Pulsar vB instrument should use the Auto Dim function or not.

The Auto Dim function is a battery saving feature that automatically reduces the display brightness of all screens to 10% if no key has been pressed for 30 seconds.

For optimum battery life, the Auto Dim should be switched **On**.



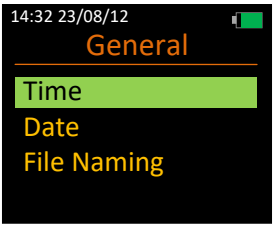
Use the key to highlight the required option and press OK to select. The option will be selected and the previous menu screen will be displayed.

Press to return to the previous screen without making a selection.

Whilst the Auto Dim feature is active press any key to deactivate it and return to the selected brightness level.

General

Select this option to open another menu level of General options.



Use the key to highlight the required option and press to select.

Press to return to the previous screen without making a selection.

Time

Select this option to change the time stored on your Pulsar vB instrument.

Use the key to change the value highlighted then press to move the highlight to the next position.

If an invalid time is selected the warning message **Invalid Time** will be displayed in red.

Press to return to the previous screen with any valid changes made.

Date

Select this option to change the date settings on your Pulsar vB instrument.

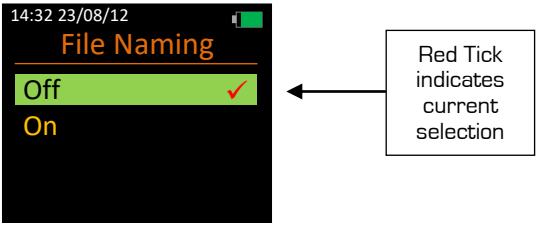
Use the key to change the value highlighted then press to move the highlight to the next position. If an invalid date is selected the warning message **Invalid Date** will be displayed in red.

Press to return to the previous screen with any valid changes made.

File Naming

Select this option to determine if your Pulsar vB instrument should store File Names with saved recordings or not.

A file name must be entered when ending a recording if this option is turned on.

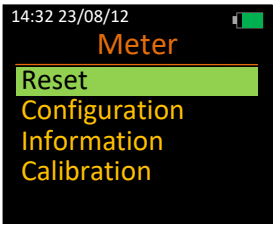


Use the key to highlight the required option and press to select. The option will be selected and the previous menu screen will be displayed.

Press to return to the previous screen without making a selection.

Meter

Select this option to change operational configuration settings, calibrate your instrument and view system information.

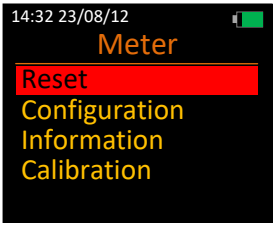


Use the key to highlight the required option and press to select.

Press to return to the previous screen without making a selection.

Reset

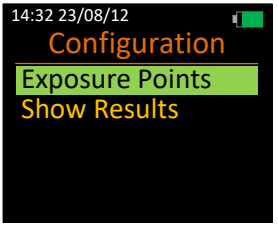
Select this option to reset all measurement parameter values.



The highlight turns red for 3 seconds to indicate that a reset has been performed.

Configuration

Select this option to change operational configuration settings.

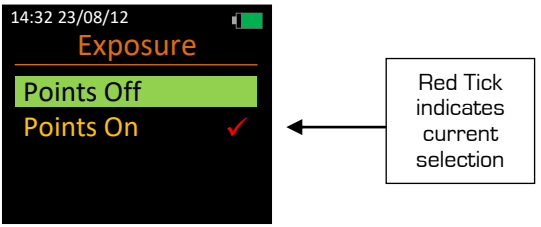


Use the key to highlight the required option and press to select.

Press to return to the previous screen without making a selection.

Exposure Points

Select this option to determine if your Pulsar vB instrument should display exposure points after ending a recording.



Use the key to highlight the required option and press to select.

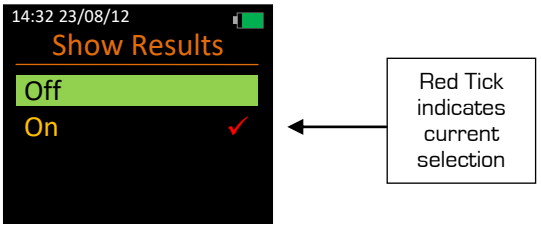
Press to return to the previous screen without making a selection.

Exposure points were developed in the UK by the Health and Safety Executive such that combinations of vibration magnitude and exposure time are given in Exposure Points rather than in values in m/s^2.

Exposure points may be easier to work with as they can simply be added together.

Show Results

Select this option to determine if your Pulsar vB instrument should display calculated results after ending a recording.

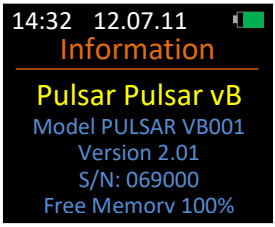


Use the key to highlight the required option and press to select.

Press to return to the previous screen without making a selection.

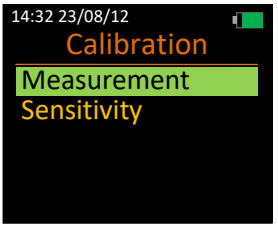
Information

Select this option for instrument details.



Calibration

Select this option to calibrate your Pulsar vB instrument using accelerometer sensitivity figures or using a calibrator.

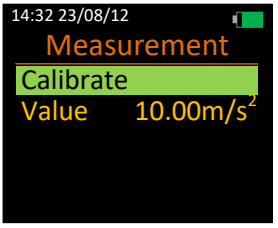


Use the key to highlight the required option and press to select.

Press to return to the previous screen without making a selection.

Measurement

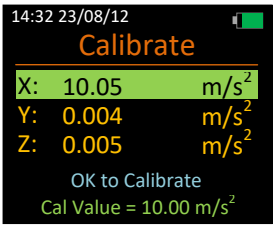
Select this option to calibrate your Pulsar vB instrument and to select the output level of the calibrator.



Use the key to highlight the required option and press to select.

Press to return to the previous screen without making a selection.

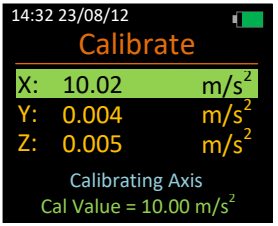
Select this option to calibrate your Pulsar vB instrument using a calibrator.



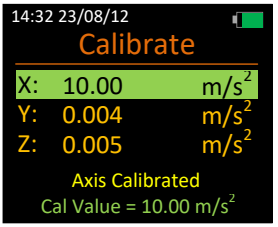
Attach the accelerometer to the calibrator such that the vibration travels through your chosen Axis.

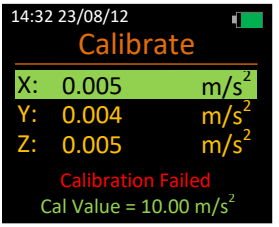
Use the key to highlight the relevant axis and press to select ensuring your calibrator is also switched on.

Calibration of each axis takes 15 seconds to complete.



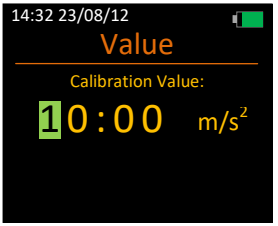
If calibration is successful Axis Calibrated will be shown in Yellow for 5 seconds or if the calibration fails Calibration Failed will be displayed in Red for 5 seconds.





Press to return to the previous screen.

Select this option to change the value that your vibration calibrator outputs in m/s^2.



Use the key to change the value highlighted then press to move the highlight to the next position.

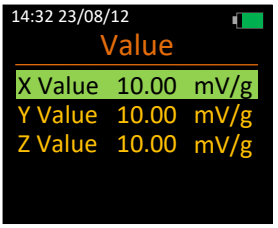
Valid levels are between 9.00 and 11.00 m/s^2.

If an invalid value is selected the warning message **Value Not Valid** will be displayed in red.

Press to return to the previous screen with any valid changes made.

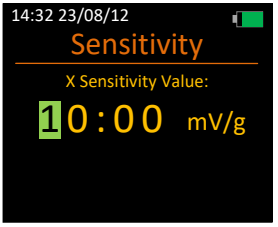
Select this option to set the sensitivity value for each axis that has been supplied with your accelerometer.

No vibration calibrator is required for this option.



Press to return to the previous screen with any valid changes made.

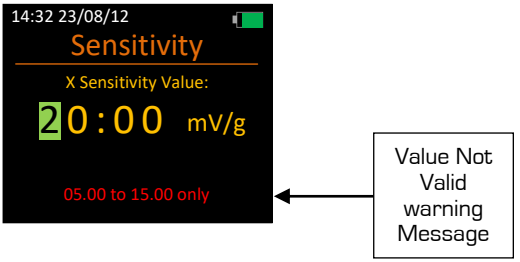
Use the key to highlight the relevant axis and press to select and change its value.



Use the key to change the value highlighted then press to move the highlight to the next position.

Valid levels are between 5.00 and 15.00 mV/g.

If an invalid value is selected the warning message **05.00 to 15.00 only** will be displayed in red.



Press to return to the previous screen cancelling any changes made.

Repeat for all axes as required.

Chapter 6

Using the Pulsar vB

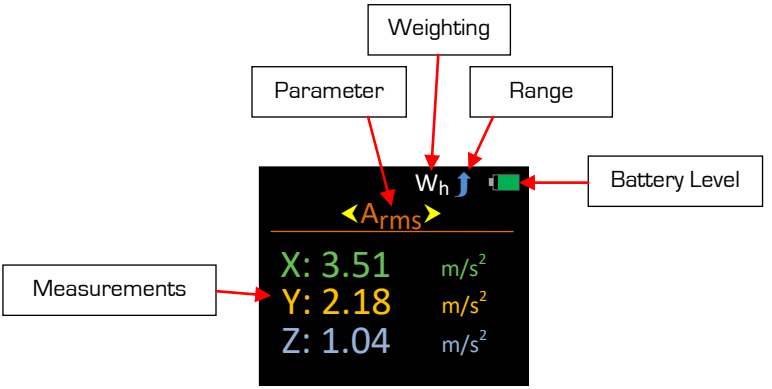
The Pulsar vB instrument has three states of basic operation: -

- Stop State
- Record State
- Playback

Stop State

This is the default state of the Pulsar vB instrument and whilst in this state limited calculations are displayed on the instruments screen but no values are recorded in the internal flash memory.

It is only possible to change Settings and undertake Calibration of the instrument whilst in Stop State. Exposure Points are not available when in Stop State.



Scroll through the available parameters using the key.

The parameters available in Stop State are: -

- Arms
- Aeq
- Peak
- Vector

Weighting is fixed to Wh (Hand Arm) on the Pulsar vB instrument, the range can be changed through the Main Menu.

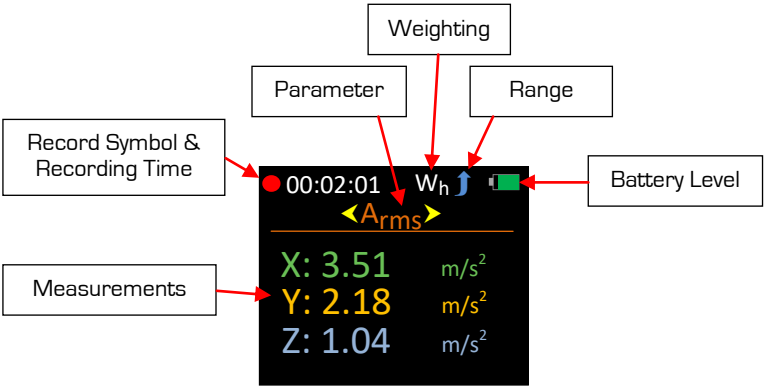
To start a recording (Record State) press the key at any time.

Record State

Whilst the instrument is in the Record State the vibration activity is analysed and all parameters available on your instrument are calculated.

Record State is easily identified by the Record Symbol and the Recording Time in the top left hand corner of the screen.

It is not possible to enter the Menu system or turn the instrument off whilst in Record State.



Scroll through the available parameters using the key.

The parameters available in Record State are: -

- Arms
- Aeq
- Peak
- Vector

To end a recording press the key.

If File Naming is turned on then you will be prompted to enter a file name. See page 39 for more information.

The data is saved to the internal flash memory. If Show Results or Exposure Points are turned on, then the instrument will automatically display the relevant parameters.

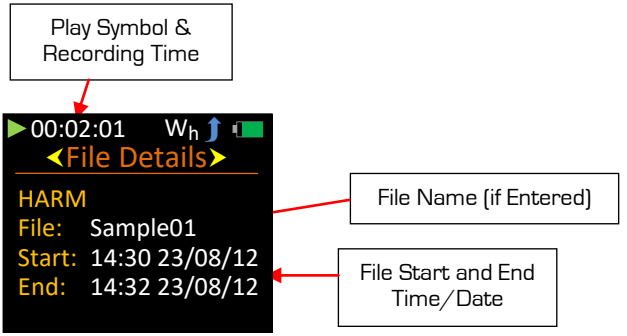
If neither of the above are turned on then the instrument is placed back into Stop State.

Recordings saved on your instrument will not be lost if the battery pack is removed.

Playback

Playback is identified by having a green play symbol in the top left hand corner and is where a recorded file is opened to be viewed on screen.

When Playback is started manually, all parameters are available to view including Exposure Points, even if Exposure Points are turned off.



Scroll through the available parameters using the key.

The parameters / screens available whilst in Playback Mode are: -

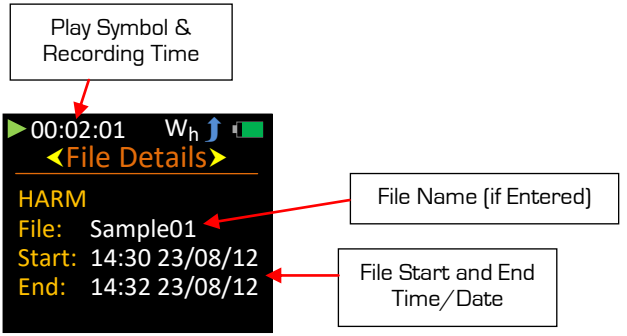
- File Details
- Arms
- Aeq
- Peak
- Vector
- Exposure

Exit Playback by pressing either or and the instrument is placed into Stop State.

Show Results - On

When a recording is stopped and the option Show Results is turned on then the instrument will automatically enter Playback and display the recorded parameters.

Playback is identified by having a green play symbol in the top left hand corner.



Scroll through the available parameters using the key.

The parameters / screens available whilst in Playback Mode are: -

- File Details
- Arms
- Aeq
- Peak
- Vector
- Exposure ← Only Available if Exposure Points are On

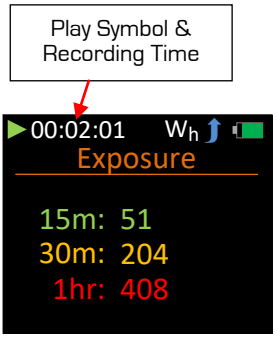
Exit Playback by pressing either or and the instrument is placed into Stop State.

Exposure Points - On

When a recording is stopped and the option Exposure Points is turned on then the instrument will automatically enter Playback and display the Exposure Point values.

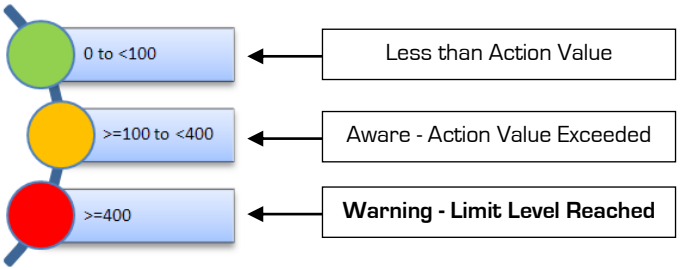
See **Show Results – On** if Show Results are also turned on.

Playback is identified by having a green play symbol in the top left hand corner.



Exposure Points are shown for periods of 15 minutes, 30 minutes and 1 hour.

The values are also colour coded to give instant visual indication and are based on the following criteria in the UK specified by the HSE: -



Exit Playback by pressing either or and the instrument is placed into Stop State.

In accordance with the European Union Physical Agents Directive, the **Action Level** and upper **Limit Level** are set as follows: -

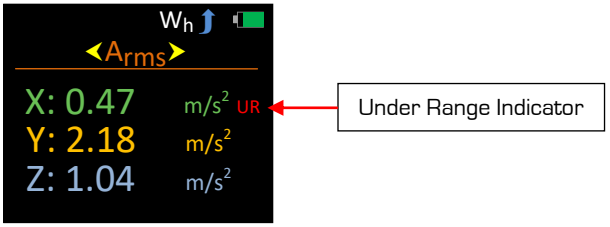
Hand Arm		
Action Level	2.50 ms^{-2}	100 Points
Limit Level	5.00 ms^{-2}	400 Points

Under Range Indicator

Each axis on the Pulsar vB has independent Under Range indicators which are visible in Stop State or Record State.

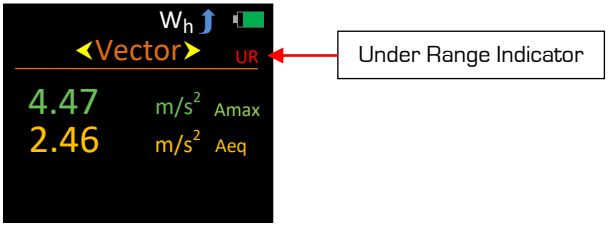
Unlike overload, the under range condition is not saved with the recording and is therefore not available in Playback.

The under range indicator '**UR**' is placed in red at the far right of each axis where the condition occurs: -



The under range indicator remains on for a minimum of 2 seconds or whilst the under range condition remains.

For Vector Sum where cumulative figures are used the location of the under range indicator is as below. The indicator on this screen identifies that at least one axis has at some stage gone under range.

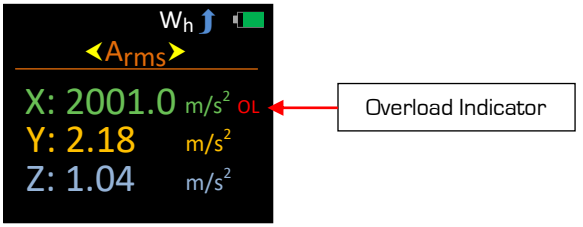


Overload Indicator

Each axis on the Pulsar vB has independent Overload indicators which are visible in Stop State, Record State and Playback.

Unlike under range, the overload condition is saved with the recording and is therefore also available in Playback.

The overload indicator '**OL**' is placed in red at the far right of each axis where the condition occurs: -



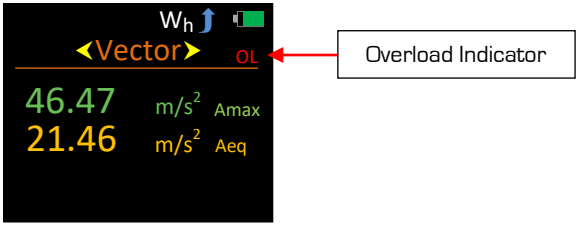
The overload indicator remains on for a minimum of 2 seconds or whilst the overload condition remains. However, during Stop State or Record State the overload indicator is latched on the following screens: -

- Aeq
- Vector

It is possible to remove the latched overload indicator during Stop State by selecting Reset under Meter from the Main Menu.

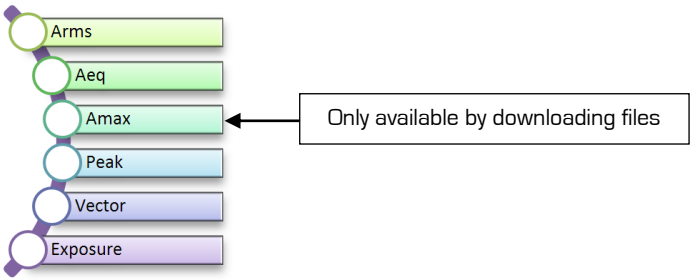
The overload indicator cannot be reset during Record State or Playback.

For Vector Sum where cumulative figures are used and where Exposure Points are being displayed the location of the overload indicator is as below. The indicator on this screen identifies that at least one axis has at some stage overloaded.



Parameters

The parameters that are recorded and displayed on your Pulsar vB instrument are as follows: -



Parameters measured as Acceleration are identified as Acceleration with a preceding 'A'.

Brief descriptions of each parameter are given below and for full mathematical descriptions see **Chapter 10**, **Function Equations**.

Arms

The Arms is the Wh weighted, running RMS (Root Mean Square) acceleration value.

Aeq

The Aeq is time averaged and Wh weighted acceleration value.

Amax

The Amax is the maximum Arms level reached.

Peak

Peak is the highest peak level of the Wh weighted instantaneous acceleration.

Vector

This is the Vector Sum calculation from the Aeq and Amax.

Exposure

The vibration exposure point system is based on the UK's Health & Safety Executive's system where vibration magnitude and exposure time are given in exposure points rather than m/s^2.

Chapter 7

Downloading Saved Recordings to a PC

Using the supplied software Pulsar vBPlus or Pulsar vBPlus LITE it is possible to download the stored recordings on your meter to your PC allowing the data to be viewed and printed in professional reports.

Communication between a PC and your Pulsar vB meter is made via the USB connector at the top of your instrument. The correct Pulsar vB USB driver will need to be installed on your PC, and is automatically installed whilst installing Pulsar vBPlus.

To ensure data does not become corrupt please ensure that Stop State is selected on the instrument before downloading saved recordings.

1. Ensure the Pulsar vB instrument is **OFF**
2. Connect the Pulsar vB instrument to the PC via the USB lead
3. Switch the Pulsar vB instrument **ON**

Your Pulsar vB instrument is now ready to download data to Pulsar vBPlus.

For comprehensive instructions please refer to the Pulsar vBPlus user manual.

Chapter 8

Accessories

GA606	Vibration Calibrator
KA010V*	Carry Case for Pulsar vB and Accessories
VB002*	HARM Tri-axial Accelerometer
KD1202	Mounting Studs (Pk 5)
KD1211	Cable Ties Metal Barbed (Pk 100)
KD1215	Transducer Mounting Glue and Stud Pack
KD1217	Transducer Petro wax Mounting Compound
PC009**	Pulsar vBPlus Vibration Analysis Software
TT4KIT	Tensioning Tool and 100 Cable Ties Metal Barbed
01KD1218*	Transducer Mounting Block and Screw
01VIBBATT*	2.4V 2100mAh NiMH Battery Pack
01PSU5*	NiMH Battery Pack Recharger
01ZL1065-01	AC Output Cable (1 metre)
01ZL1108-01*	USB Download Cable (1 metre)

* supplied with the Pulsar vB
** upgrade from supplied Pulsar vBPlus LITE

Chapter 9

Technical Specification

Applicable Standards

ISO 8041:2005 Human Response to Vibration – Measuring Instrumentation

Noise Floors

Axis	Range m/s² rms	
	Low	High
X	0.002	0.02
Y	0.002	0.02
Z	0.002	0.02

Normal Operating Mode

Fitted with Hand Arm accelerometer VB002

Overload & Under Range Triggering Points

Points when calibrated with an accelerometer of sensitivity 10.0mV/g

Acceleration : Metric m/s²		
RANGE	UR	OL
LOW	0.050	200.0
HIGH	0.500	2000.0

Acceleration : g		
RANGE	UR	OL
LOW	0.0051	20.40
HIGH	0.0510	204.0

Level Ranges

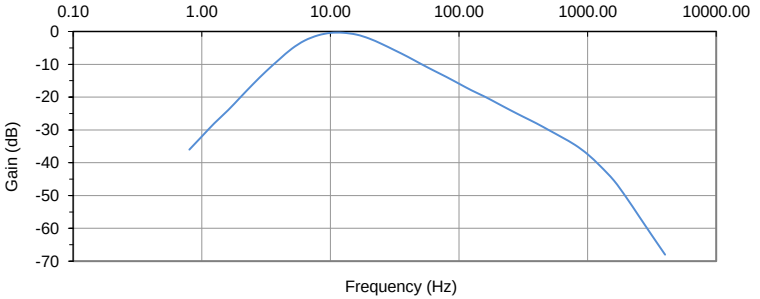
Acceleration : Metric	
LOW	0.05 – 200 m/s^2
HIGH	0.50 – 2000 m/s^2

Acceleration : g	
LOW	0.0051 – 20.4g
HIGH	0.051 – 204g

Frequency Weightings

Wh weighting as defined in ISO 8041:2005.

Wh Filter Frequency Response: -



Deviations are 80Hz in dB and tolerances required for a typical Pulsar vB instrument: -

Frequency (Hz)	Wh	Tolerance
1	0.2	+2, -∞
2	0.2	+2, -∞
4	0.2	+2, -∞
8	0.1	±2
12.5	0.0	±1
20	0.0	±1
40	0.0	±1
80	REF	±1
160	0.0	±1
315	0.0	±1
630	-0.1	±1
1000	-0.2	±2
2000	-1.3	+2, -∞
4000	-6.1	+2, -∞

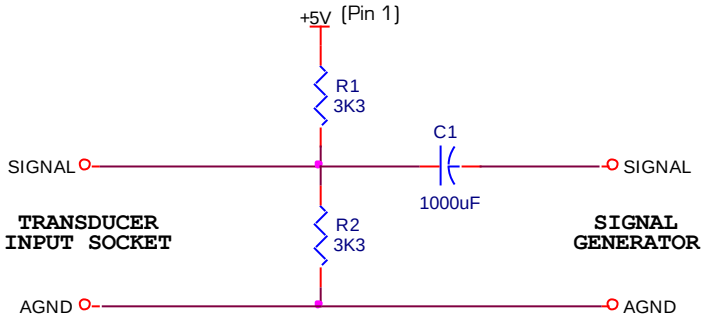
Accelerometer

Specification	VB002
Output Voltage	10mV/g ±20%
Operating Range	±200g
Frequency Response	0.3 to 10000 Hz ±3dB
Resonant Frequency	>30kHz
Weight	30 Grams
Operating Temperature Range	-54°C to 85°C -65°F to 185°F
Thermal Sensitivity Coefficient	0.18% / °C 0.10% / °F
Linearity	±1%
Electrical Noise Floor	0.003g pk
Transverse Sensitivity	5%
Maximum Shock	7000g pk

Electrical Signal Input

Electrical signals at frequencies >2Hz can be applied to the Pulsar vB instruments by interfacing a suitable signal generator with an output impedance of 600Ω to the 5 pin Input Lemo Socket, type (EGG.0B.305.CLL).

Each individual axis shall be subject to the following circuitry, (see Signal Wiring).



Maximum Electrical Signal Input For No Damage

5 Volts (Peak to Peak)

Environmental Stabilization Time

30 minutes

Warm up Time

≤ 2 minutes

Settling Time

It is recommended that a calculation settling period of ≥30 seconds is allowed for in any recording.

Temperature Operating Range

-10°C to +50°C

Effect of Air Temperature

Accuracy better than ±5% over the range -10°C to +50°C

Effect of Surface Temperature

Accuracy better than ±4% over the range -10°C to +50°C

Real Time Clock

Day, Month, Year, Hour, Minute and Seconds at ±2ppm accuracy per day

Digital Signal Processing

Direct processing using digital recursive filters (infinite impulse response)

Analogue to Digital Converter & Microcontroller

ADC: Word Length: 24 bits, Sampling Rate: 16kHz

Processor Operating Frequency: 25MHz (max.)

Displayed Measurement Resolution

High range – 0.01 m/s^2 up to 99.99, 0.1 m/s^2 100.0 – 2000.0 m/s^2

Low range – 0.001 m/s^2 up to 9.999, 0.01 m/s^2 10.00 – 200.00 m/s^2

Display

OLED Module (160x128 pixels) with 262,144 colours

Refresh Rate ≤ 500mS

Displayed parameter at each update interval is the value at the time of the update interval.

Memory

2Mb On-board FLASH allowing up to 992 recordings to be saved.

Overload

Positive overload warning when the input circuit saturates. See **Overload & Under Range Triggering Points** for overload triggering points.

Size and Weight

Dimensions: (H):117mm (without Cable) x (W) :78mm x (D): 24mm

Weight: 182g approximately (including batteries)

Connections

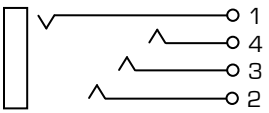
AC Output

Unweighted
Short circuit Protected
Load Impedance >10k recommended

AC Output Voltages	
Range	Output Voltage rms at full scale ±1.5dB
LOW	1000mV
HIGH	1000mV

Wiring Configuration – 4 Pole Jack Socket 3.5mm

AC Output	
Pin Number	Description
1	Analogue Ground
2	X Axis Output
3	Y Axis Output
4	Z Axis Output



Download

USB 1.0 or 2.0 compatible.

Wiring Configuration - Micro USB 'B' Socket

Download	
Pin Number	Description
1	Vcc
2	D-
3	D+
4	Not Connected
5	Ground

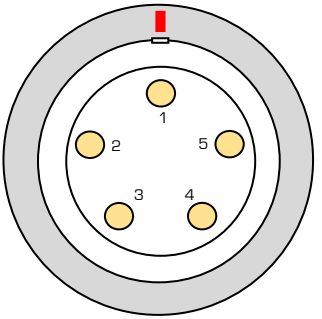
Input Signal

Voltage Mode, 3-Channel Input

Wiring Configuration – (Lemo Socket EGG.0B.305.CLL)

Mating Lemo Plug FGG.0B.305.CLAD52Z

External View



Transducer Input Socket	
Pin Number	Description
1	+5V
2	Analogue Ground
3	X Axis Input
4	Y Axis Input
5	Z Axis Input

Battery Recharge

Powered from a nominal AC supply using Mascot 2116, 2 cell battery charger

Centre Terminal: 0V

Outer Terminal: +V

Batteries

Real Time Clock:	CR1220 Lithium Battery (Factory Fitted)
Life Expectancy:	Approximately 2 years
Main:	2100mAh NiMH Battery Pack
Life Expectancy:	10 hours continuous use (approx.)
Min Battery Level:	1.8V DC

EC Declaration of Conformity

The CE marking of the Pulsar vB Vibration Meter indicates compliance with the EMC and Low Voltage Directive.

The C-Tick marking of the Pulsar vB Vibration Meter indicates compliance with EMC requirements for Australia and New Zealand.

We, Plusar Instruments Plc declare that the: -

- *Pulsar vB Vibration Meter*

have in accordance with the following Electromagnetic Compatibility Directives: -

- *SI 2005/281*
- *2004/108/EC*

been designed and manufactured to meet the following tests: -

- *EMC Emissions:* *EC 61000-6-3:2007+A1:2011*
  EN61326-1:2006
  CISPR 22:2008
  EN55022:2006+A1:2007
  FCC Rules, Part 15 2003 Class B
- *EMC Immunity:* *IEC 61000-6-2:2005*
  EN61326-1:2006
  Levels: ±4kV(Contact), ±8kV(Air)
- *RF EM Amplitude Mod:* *IEC 61000-6-2:2005*
  Level 10 V/m

No performance or function degradation is noticeable whilst subject to electrostatic discharge or a.c power frequency and radio frequency fields under any operating condition with the meter and no differences in radio frequency emissions are apparent between operating modes where appropriate.

Approved cables for use with Pulsar vB meters to comply with these specifications: -

Cable	Order Code	Length
Pulsar vB to PC (USB)	01ZL1108-01	1m

The technical file for the above is maintained at Pulsar Headquarters.

I hereby declare that the instruments named above have been designed to comply with the relevant sections of the above referenced specifications, and that the above named instruments comply with all essential requirements of the specified Directives.

Simon Rehill
Managing Director
Pulsar Instruments Plc, The Evron Centre, John Street, Filey, North Yorkshire, YO14 9DW
March 2018

Chapter 10

Function Equations

The following table describes mathematically how the functions available on the Pulsar vB Vibration Meter are calculated. All calculations displayed are subject to rounding and/or truncation.

Function	Equation
Acceleration (Metric)	$Aeq := \sqrt{\frac{1}{T}\cdot\int_0^T (a_w)^2\cdot(ta)\,d(ta)} \quad (ms^{-2})$ T = total integration time (seconds) $a_w(ta)$ = instantaneous acceleration value (ta) = time (seconds)
Acceleration (g)	$Aeq := \frac{1}{9.807}\cdot\sqrt{\frac{1}{T}\cdot\int_0^T (a_w)^2\cdot(ta)\,d(ta)} \quad (g)$ T = total integration time (seconds) $a_w(ta)$ = instantaneous acceleration value (ta) = time (seconds)
Running rms Acceleration (Metric)	$Arms := \sqrt{\frac{1}{\theta}\cdot\int_{t-\theta}^{t} (a_w)^2(ta)\,d(ta)} \quad (ms^{-2})$ t = instantaneous time (seconds) θ = integration time of the measurement (1 second) $a_w(ta)$ = instantaneous acceleration value (ta) = time (seconds)
Running rms Acceleration (g)	$Arms := \frac{1}{9.807}\cdot\sqrt{\frac{1}{\theta}\cdot\int_{t-\theta}^{t} (a_w)^2(ta)\,d(ta)} \quad (g)$ t = instantaneous time (seconds) θ = integration time of the measurement (1 second) $a_w(ta)$ = instantaneous acceleration value (ta) = time (seconds)

Function	Equation
Vector Sum (HARM)	$VSum := \sqrt{(X)^2 + (Y)^2 + Z^2}$ X = X Axis Aeq Y = Y Axis Aeq Z = Z Axis Aeq
Peak	Peak = The peak level of the weighted instantaneous acceleration over the measurement period
Maximum rms Level (Acceleration)	Amax = The maximum Arms level reached over the measurement period
Points (15m)	$Points(15m) := \left[\left(\frac{Aeq}{EAV}\right)^2 \cdot \left(\frac{0.25}{8}\right)\right] \cdot 100$ Aeq = Acceleration (Metric) EAV = Exposure Action Value (2.5 m/s^2)
Points (30m)	$Points(30m) := \left[\left(\frac{Aeq}{EAV}\right)^2 \cdot \left(\frac{0.5}{8}\right)\right] \cdot 100$ Aeq = Acceleration (Metric) EAV = Exposure Action Value (2.5 m/s^2)
Points (1h)	$Points(1h) := \left[\left(\frac{Aeq}{EAV}\right)^2 \cdot \left(\frac{1}{8}\right)\right] \cdot 100$ Aeq = Acceleration (Metric) EAV = Exposure Action Value (2.5 m/s^2)

Chapter 11

Customer Instrument Support

Warranty and After Sales Service

Pulsar Instruments Plc design and manufacture precision instruments, which if treated with reasonable care and attention should provide many years of trouble free service.

In the unlikely event of a fault occurring with your product during the warranty period, the instrument should be returned in its original packaging to Pulsar Instruments Plc or to an authorised agent. Please enclose a clear description of the fault to ensure your instrument is dealt with as quickly as possible.

Any misuse or unauthorised repairs will invalidate your warranty.

Damage to your product caused by faulty or leaking batteries is not covered by the warranty.

Details of the warranty cover are available upon request from Pulsar Instruments Plc or your authorised agent.

All instruments designed and manufactured by Pulsar Instruments Plc adhere to strict British and International standards. To ensure your instrument remains compliant with these standards it is highly recommended that your instrument is returned annually for calibration.

Annual calibration is particularly important for cases in which instrument readings are to be used in litigation or compliance work.

For warranty or service please return your instrument to: -

Pulsar Instruments Plc
The Evron Centre
John Street
Filey
North Yorkshire
YO14 9DW
UK

Question	Answer
The instrument will not power on.	Recharge or replace the battery pack.
The Instrument is not responding on all or individual axis to inputted vibration levels.	Turn the instrument Off, wait 10 seconds to allow the instrument to reset and then turn back On.
	Check the cable for possible damage or incorrect attachment to the instrument.
The instrument is displaying unexpected readings in one or more modes of operation.	Are the sensitivity values entered correctly?
	Ensure the transducer is fitted securely to the source of vibration.
	Ensure cable is securely fastened.
The overload indicator is permanently on.	Change to a higher range.
The overload indicator comes on before the top of the range is reached.	The overload indicator will also be shown if the input amplifier is saturated. This is possible even if the displayed vibration reading on your instrument is below the top of the selected range because of the applied frequency weighting filter.

Disclaimer

Whilst every effort is made to ensure the accuracy and reliability of both the instrument described and the associated documentation, Pulsar Instruments Plc makes no representation or warranties as to the completeness or accuracy of this information.

Pulsar Instruments Plc assumes no responsibility or liability for any injury, loss or damage incurred as a result of misinterpreted or inaccurate information.

Any documentation supplied with your product is subject to change without notice.

Instrument Details

For your records and for future correspondence with Pulsar Instruments Plc regarding your instrument, please complete the following details: -

Instrument

Instrument Serial Number

Transducer Serial Number

Software Version Number

Purchase Date

Index

A

Acceleration 2
Accelerometer
  Fitting 3
  Removing 3
  Sensitivity 33
  Specifications 2, 46
  Type 2
Accessories 43
Action Level 38
Action Levels
  Hand Arm 38
Auto Dim 24

B

Battery
  Indicator 12
  Pack 51
  Recharging 13
Battery Indicator 12
Battery Pack 51
Brightness 24

C

Calibration 30
  Calibrate 31
  Measurement 30
  Value 32
Configuration 28
Connections 49
Customer Support 55

D

Date 26
Delete
  All Files 22
  Single File 21
Disclaimer 57
Download Recordings 42

E

EC Declaration 52
Electrical Noise 44
Exposure
  Action Level 38
  Limit Level 38
  Points 28, 38

F

File Naming 26
Files 18
  Playback 36
Frequency Weighted Filters 45
  Hand Arm 6
    Table Data 45
Frequency Weightings 45
Function Equations 53

G

General 25
Getting Started 8
  Keypad Layout 10

I

Indicator
  Overload 40
  Under Range 39
Information 29
Input
  Electrical Signal 47
  Maximum Electrical Input Level 47
  Wiring Configuration 50
Instrument Details 57
Introduction 1

K

Keypad Layout 10

L

Level Ranges 45
Limit Level 38
Limit Levels
  Hand Arm 38

M

Measuring Ranges 45
Measuring Vibration 4
Memory 49
Menu
  Options 17
    Files 18
      Delete All Files 22
      Delete Single File 21
      Open 7 Days 20
      Open All 18
      Open Today's 19
    Meter 27
    Range 17
    Settings 23
      Brightness 24
      General 25
        Date 26
        File Naming 26
        Time 25
      Meter
        Calibration 30
          Calibrate 31
          Measurement 30
        Configuration 28
          Exposure Points 28
          Show Results 29
        Information 29
        Reset 27
      Units 23
  Structure 15
Menu Options 17
  Brightness 24
  Calibrate 31
  Calibration 30
  Configuration 28
  Date 26
  Exposure Points 28
  File Naming 26
  Files 18
  General 25
  Information 29

Measurement 30
Meter 27
Range 17
Reset 27
Settings 23
Show Results 29
Time 25
Units 23
Menu Structure 15
Meter 27

N

Noise Floor 44

O

On / Off Key
Location 10
Using 14, 17
Open
7 Days 20
All 18
Playback 36
Today's 19
Output
Voltage Levels 49
Wiring Configuration 49
Overload 7, 40, 44, 49

P

Parameters 41
Playback 36
Power
Battery Pack 51
Powering Your Vexo Meter 11

R

Range 17
Ranges 45
Recharging the Battery Pack 13
Record State 35
Reset 27

S

Sensitivity 33
Settings 23
Settling Time 47
Show Results 29, 37
Stabilization Time 47
Standards 44
Stop State 34
Switching Your Vexo Meter Off 14
Switching Your Vexo Meter On 14

T

Technical Specification 44
Temperature Operating Range 47
Time 25
  Settling 47
  Stabilization 47
  Warm Up 47
Transducer Mounting
  Hand Arm 4
Turn Off 14
Turn On 14

U

Under Range 7, 39, 44
Units 23
Using the Vexo H 34

V

Velocity 2
Vexo USB Drivers 42
VibdataLITE 42
Vibration
  Direction 5
  Level 6
  Measuring 4

W

Warm Up Time 47
Warranty 55