Vexo H - (GA2006H)

Hand Arm Tri-Axial Vibration Meter

Operating Manual

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Vexo H
HARM Vibration Meter Operating Manual

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Thank you for buying a Castle product, I am sure you will find both the goods and the service to be of the highest quality but if not, then please feel free to write to me personally and I will ensure that your needs are dealt with immediately.

This manual is designed to show you the operation of the goods you have purchased and a very brief insight into vibration itself. If you would like to become a competent person in the eyes of the law, then you may like to know more about our Competent Persons training course for Human Vibration. You can visit **www.castletrainingacademy.com** to find out more.

Castle Group has become the leading supplier of solutions for health and safety, environmental compliance and plant maintenance and monitoring, with an ever expanding offer comprising equipment for sale or rent, residential or in-house training courses, consultancy services and equipment calibration. If you would like to know more about any of our other products and services then please visit **www.castlegroup.co.uk** or telephone us on **+44(0)1723 584250**.

Simon Bull
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. Take a note of the condition of the instrument and contact your authorised Castle service station.
- To ensure continued precision performance of your instrument have it checked and serviced at regular intervals.

Contacting Castle Group

This manual contains complete operating instructions for the Castle Vexo H 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 584250
Fax:	+44 (0)1723 583728
Website:	www.castlegroup.co.uk
Email:	techsupport@castlegroup.co.uk sales@castlegroup.co.uk

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Castle Group Ltd

If you want to keep up to date with the latest in health and safety, you should attend a Castle FREE seminar. These are run around the country and cover a wide range of topics. Packed with the latest information and delivered with the help of practical demonstrations, these seminars are a great way to really learn something at the same time as collecting cpd points! Go to the website below to find the lasts dates and venues and to see video clip samples.

www.need2know4free.com

Dedicated to professionals in Health and Safety, Environmental Compliance and Plant Maintenance Engineering, Castle set out to help you in a way that suits you best. We can provide or rent equipment, train you and your staff or we can carry out work on your behalf. We can even mix it up to suit your way of working.

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- Equipment Rental
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HEALTH AND SAFETY

Compliance with legislation and mitigation of claims is really what health and safety is about for most companies. That is how we are set up to help you; Our training courses are all geared to that end as is any equipment we might supply or rent to you. If you need us in person, we'll be there too! Call NOW on 01723 584250 and get your health and safety compliance on-track, the way you want to do it! There are many issues you might like us to have a look at

- Noise and Vibration at Work
- Audiometry
- HAVS Health Surveillance
- Health Screening
- Air Sampling and Gas Detection
- Indoor Air Quality
- Airflow
- EMF Testing and Monitoring
- Portable Appliance Testing (PAT)
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- Ground-Bourne & Building Vibration
- Stack-Emissions Monitoring
- Environmental Air Sampling
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Production plant needs maintenance and if this can be done only when needed, then cost savings can be huge. Condition monitoring offers the ability carry out predictive maintenance so shut-down is only when you plan it and only when it's needed. It is very simple to work out if this is the right approach for your business, so give us a call on 01723 584250 so we find out how much you could save!

- Vibration Monitoring Systems
- Vibration Meters
- Temperature Monitoring System
- Thermometers
- Thermal Imaging
- Diagnostic Vibration Analysis
- Tachometers
- Inspection Endoscopes

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- Health and Safety Compliance Courses
  - Noise, Vibration, COSHH, Asbestos
- Health Surveillance Courses
  - Audiometry, Lung Function, HAVS
- Environmental Monitoring Courses
  - Noise, Vibration, Air Quality
- Diagnostic Engineering Courses
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- Environmental Monitoring
- Expert Witness
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Castle Care

Maintaining calibrations on measuring equipment is absolutely essential to the integrity of your data. At Castle, we can calibrate virtually anything you have that can measure. We pride ourselves in fast-as-possible turnaround times and can normally give up-front prices for almost any equipment. Whether you have an anemometer, or a 'zero-g' accelerometer, then call us for a price on 01723 584250.

- If it Measures, and can be done - we'll Calibrate it
- UKAS Certificates Available
- Multiple levels of Calibration

Equipment Types Covered

- Air quality meters
- Air sampling pumps
- Air sampling calibrators
- Anemometers
- Audiometers
- Balances/Scales
- Barometers
- Dosemeters
- Electrical test equipment
- Force meters
- Gas Detectors
- Hygrometers
- Light meters
- Manometers
- Moisture meters
- Noise meters
- Pressure meters
- Sound level meters
- Sound analysers
- Strain gauges
- Tachometers
- Thermometers
- Thermo-hygrometers
- Thickness meters
- Timers
- Vibration meters
- Vibration analysers
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If peace of mind for equipment calibrations is important to you – and it should be, then check out our contract calibration deals. We will give you discounted, fixed-annual-pricing for selections of equipment and we will undertake to ensure calibration is maintained to your schedule. This is designed to take all the hassle out of equipment calibration.

- Maintain Instrument Calibrations
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- Easy on Cash-Flow
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Chapter 1

Introduction

Vexo H (GA2006H) – Tri Axial Hand Arm Vibration Meter (HARM)

Thank you for purchasing your product from Castle Group Ltd.

The Vexo H 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 Vexo incorporates internal Flash memory to store all your recordings and the data can then be transferred to the supplied software Vibdata LITE using the supplied USB cable or viewed onscreen.

Not only does the Vexo H vibration meter have all 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 Vexo 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 do is press the power button and start recording.

With the Vexo H combating HAVS has become even easier.

Chapter 2

Accelerometer Type, Removal and Fitting

The accelerometer for use with the Vexo H 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

Vexo H - Hand Arm Tri-Axial Accelerometer (KD1010)

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

Hand Arm Vibration Tri-Axial Accelerometer (KD1010)

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 the 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 the Castle GA606 Vibration Calibrator.

To ensure measurements are as accurate and as repeatable as possible always ensure that your cable is tightened securely to your accelerometer and that the 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 tightened using a Phillips screw driver. 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. Castle Group Ltd 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.

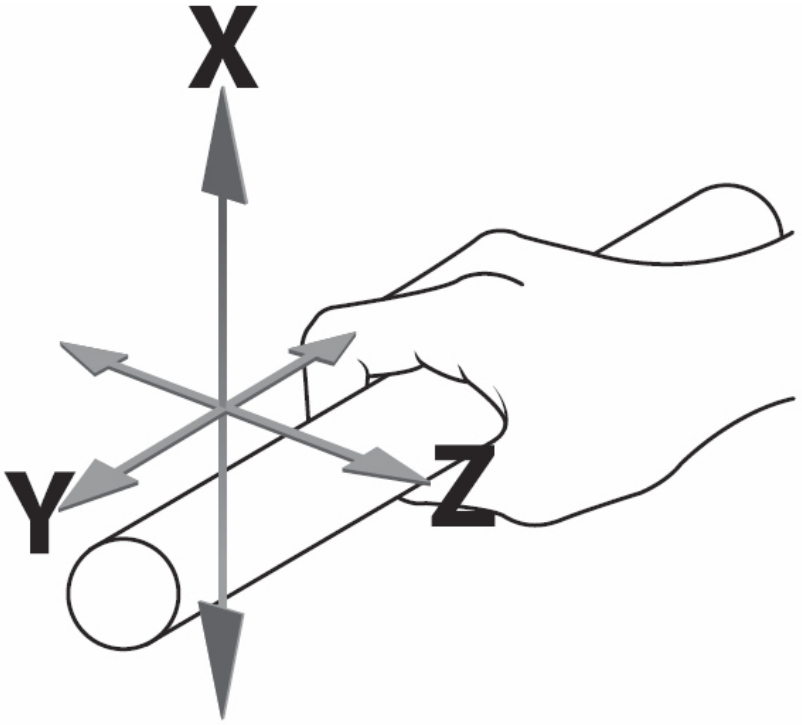


Figure 1 - Recommended Axes for Hand Arm Vibration

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

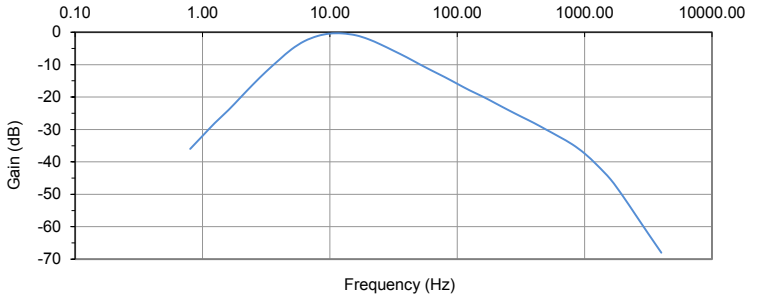
The human body's discomfort level to vibration alters depending on the vibration frequency and where the vibration is in contact with the body.

Your Vexo H 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 Vexo H 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 data captured is saved to the internal flash memory and can be viewed onscreen or downloaded to Castle's vibration analysis software **Vibdata LITE** or **VibdataPro** as and when required.

To Start or Stop a recording press the following key 

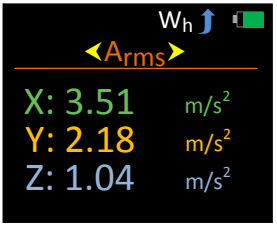
Whilst the instrument is in the Stop State, calculations are displayed on screen but are not stored in flash memory.

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.

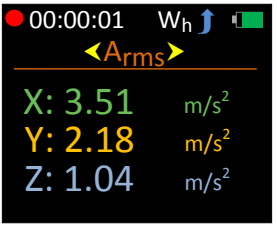
During Stop State it is possible to change the Settings and undertake Calibration of the instrument.

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

Stop State

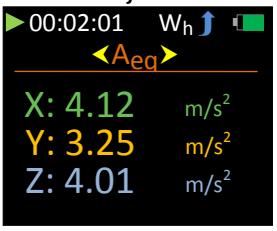


Record State



Record State shows Record Symbol and Time Recorded

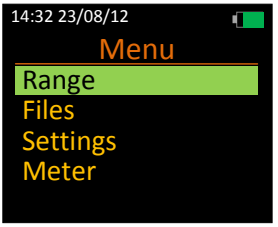
Playback

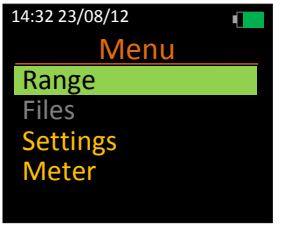


Playback shows Play Symbol and Total Time Recorded

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 Vexo H 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 Vexo Meter

Your Vexo meter is powered from a Castle 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 Vexo 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 Vexo 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 Castle.

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

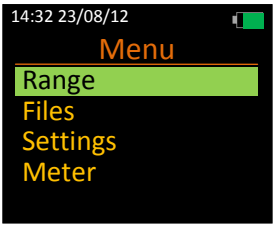
If any key is pressed after the instrument is turned on then the automatic shutdown will not occur.

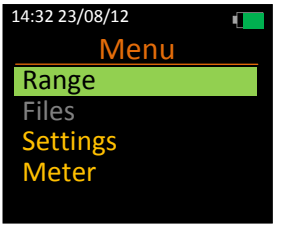
Chapter 5

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: -



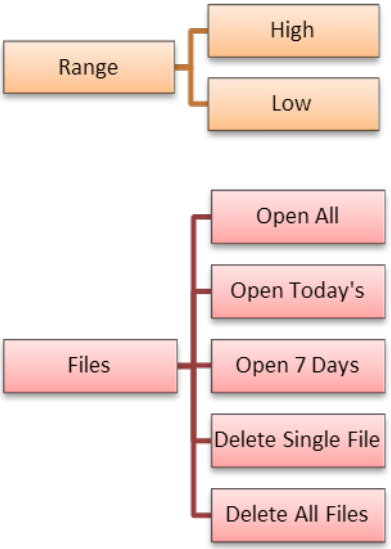


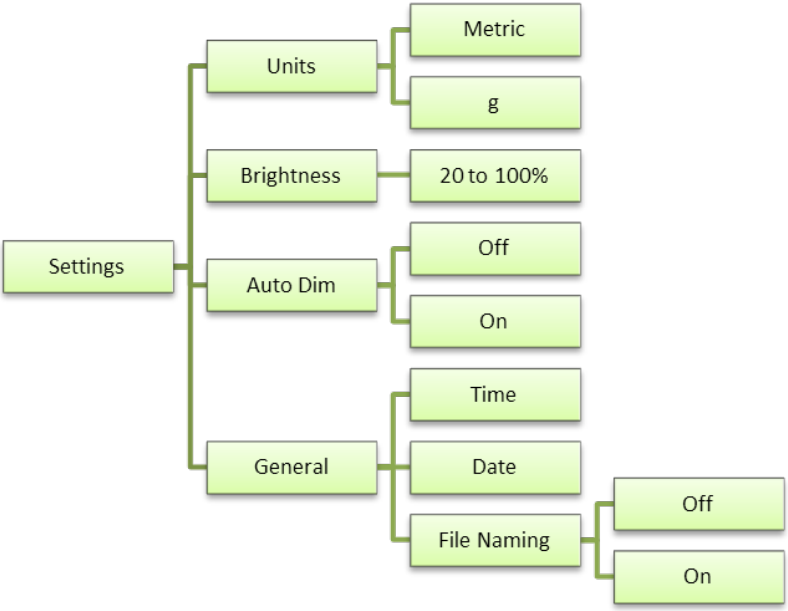
If the instrument has no files saved then the Files option is not selectable

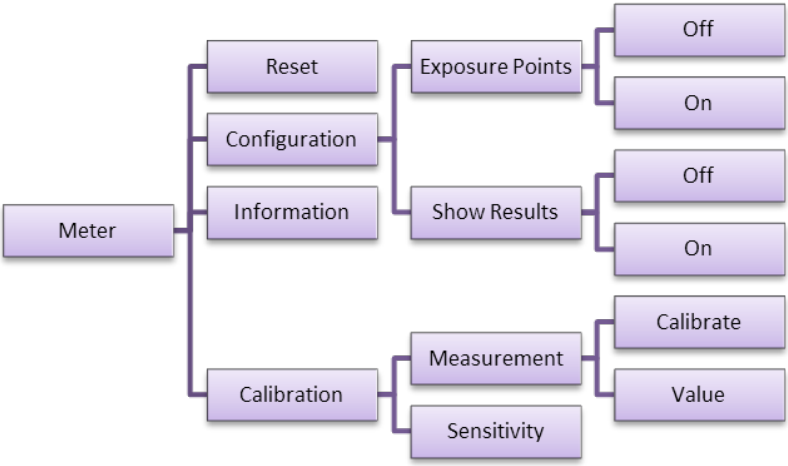
Press to select the required option. Note that a recording cannot be started from within the Main Menu.

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

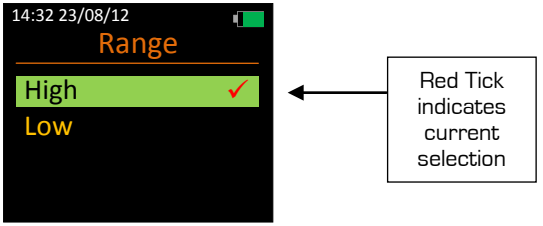

Meter
Reset
Configuration
Information
Calibration
Exposure Points
Off
On
Show Results
Off
On
Measurement
Calibrate
Value
Sensitivity

Menu Options

Each Menu option is described fully below: -

Range

Select this option to change the measuring range of your Vexo 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.

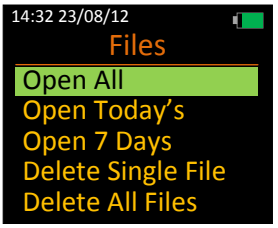
Range details are as follows: -

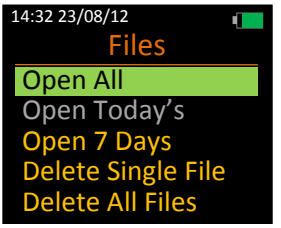
Range	(m/s²)	(g)
High	0.50 – 2000	0.051 – 204
Low	0.05 – 200	0.0051 – 20.4

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

Files

Select this option to manage saved recordings on your Vexo instrument.





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

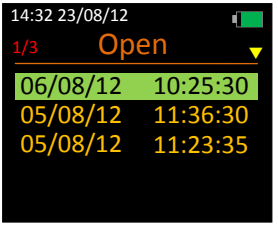
Use the key to highlight the required option and press to select.

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

Open All

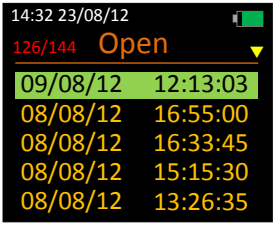
Select this option to show all saved recordings on the instrument. Recordings are listed by file name, date and time order showing the most recent first.

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.

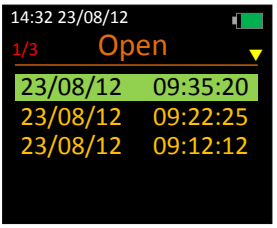
Open Today's

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.

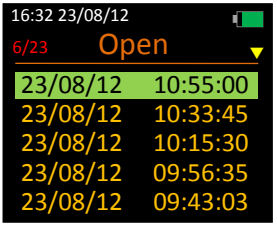
Note that this option is not selectable if no recordings have been made today.

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.

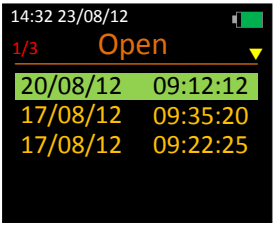
Open 7 Days

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.

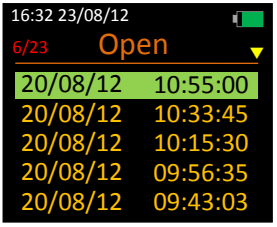
Note that this option is not selectable if no recordings have been made in the last 7 days.

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.

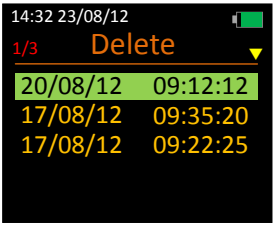
Delete Single File

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

Deleted files cannot be recovered.

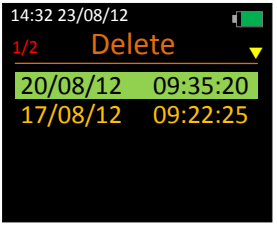
The recordings on the instrument are listed by file name, date and time order showing the most recent first.

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

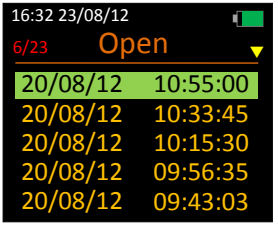


Use the key to highlight the required file and press to delete it.

The selected file will be immediately deleted: -



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

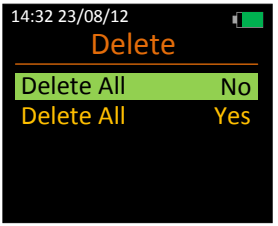


Press to return to the previous screen without making a selection.

Delete All Files

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

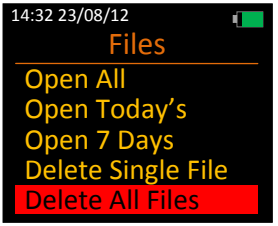
Proceed with caution as deleted files cannot be recovered: -



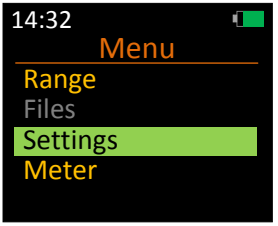
Use the key to highlight the required option and press to proceed.

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: -

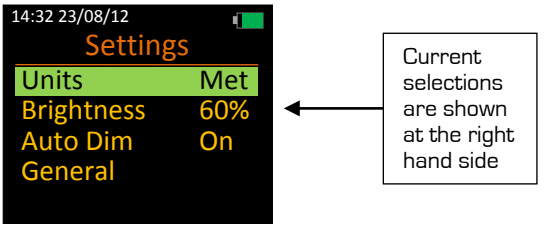


When all files are deleted the Main Menu is displayed: -



Settings

Select this option to manage settings on your Vexo instrument.

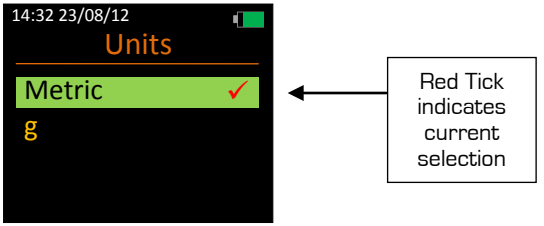


Use the key to highlight the required option and press to select.

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

Units

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

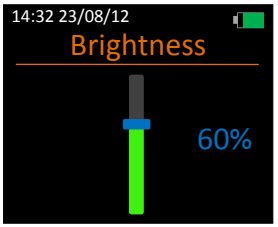


Use the key to highlight the required option and press to select. The unit will be selected and the previous menu screen will be displayed.

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

Brightness

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



Use the key to change the brightness level and the press 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.

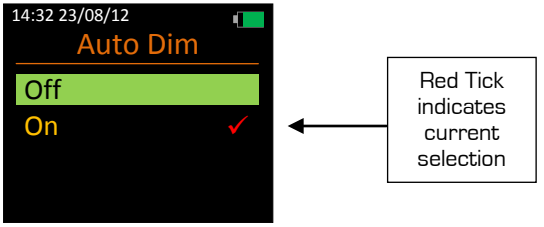
Note that the brightness may be affected by the Auto Dim function - see below.

Auto Dim

Select this option to determine if your Vexo 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**.



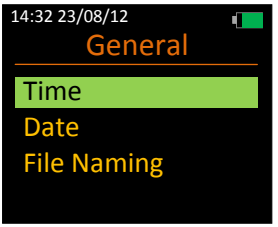
Use the key to highlight the required option and press to select. The option will be selected and the previous menu screen will be displayed.

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.

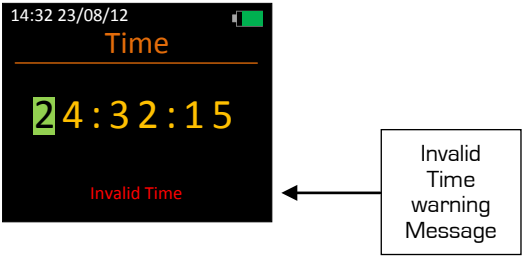
Press to return to the previous screen without making a selection.

Time

Select this option to change the time stored on your Vexo 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.

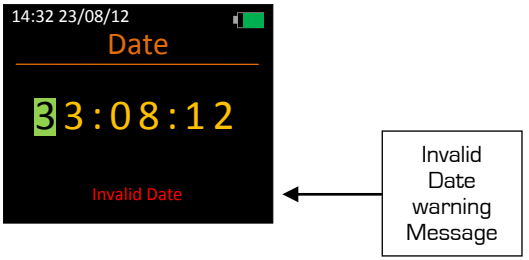


Press to return to the previous screen with any valid changes made.

Date

Select this option to change the date stored on your Vexo 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 Vexo instrument should store File Names with saved recordings or not.

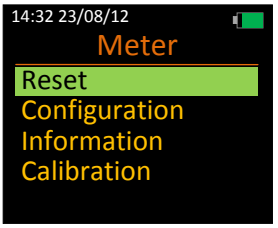
A file name must be entered when ending a recording if this option is turned on.

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.

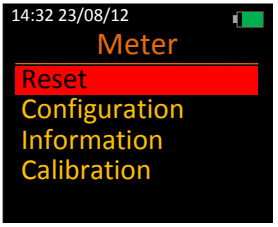


Use the key to highlight the required option and press to select.

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

Reset

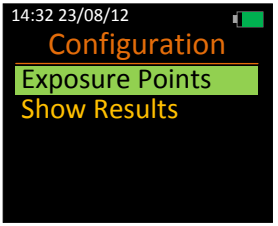
Select this option to reset all measurement parameter values.



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

Configuration

Select this option to change operational configuration settings.

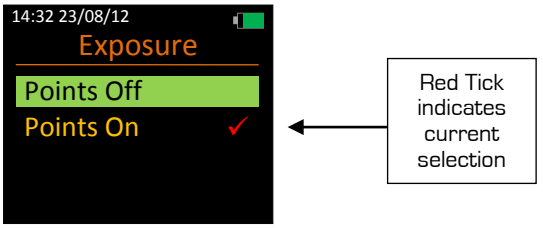


Use the key to highlight the required option and press to select.

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

Exposure Points

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



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

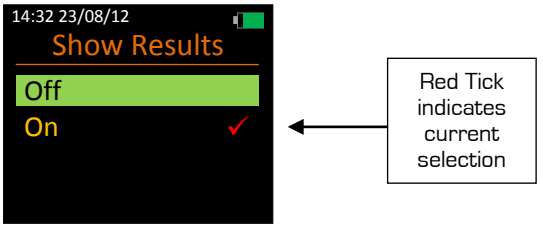
Press to return to the previous screen without making a selection.

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 Vexo instrument should display calculated results after ending a recording.



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

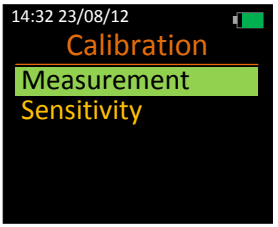
Press to return to the previous screen without making a selection.

Information

Select this option for instrument details.

Calibration

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

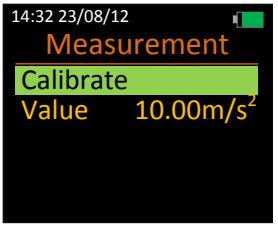


Use the key to highlight the required option and press to select.

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

Measurement

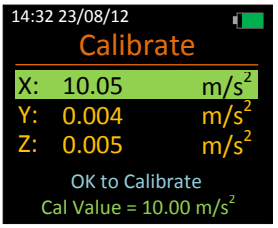
Select this option to choose between calibrating your Vexo instrument using a calibrator and selecting the output level of the calibrator.



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

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

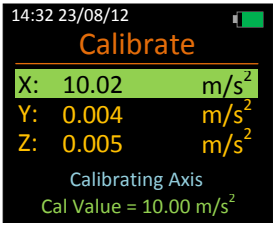
Select this option to calibrate your Vexo instrument using a calibrator.



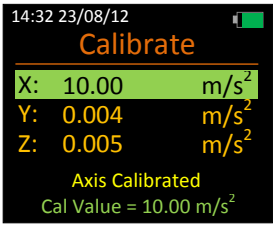
Attach the accelerometer to the calibrator such that the vibration travels through your chosen Axis.

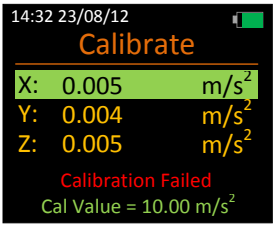
Use the key to highlight the relevant axis and press to select ensuring your calibrator is also switched on.

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.





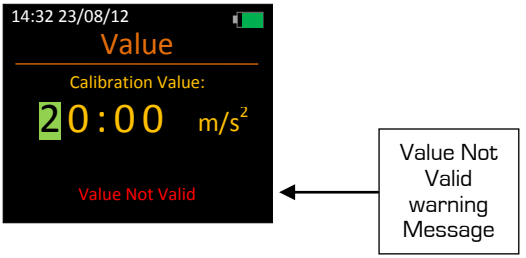
Press to return to the previous screen.

Select this option to change the value that your vibration calibrator outputs in m/s².

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/s².

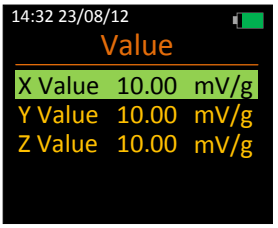
If an invalid value is selected the warning message **Value Not Valid** will be displayed in red.



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

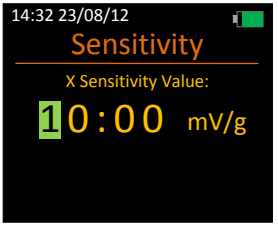
Select this option to set the sensitivity value for each axis that has been supplied with your accelerometer.

No vibration calibrator is required for this option.



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

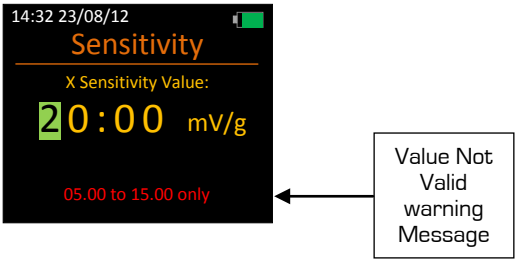
Use the key to highlight the relevant axis and press to select and change its value.



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 Vexo H

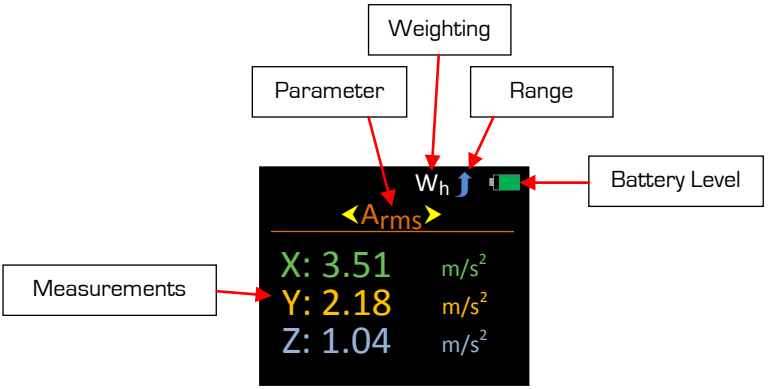
The Vexo H instrument has three states of basic operation: -

- Stop State
- Record State
- Playback

Stop State

This is the default state of the Vexo H 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 Vexo H instrument, the range can be changed through the Main Menu.

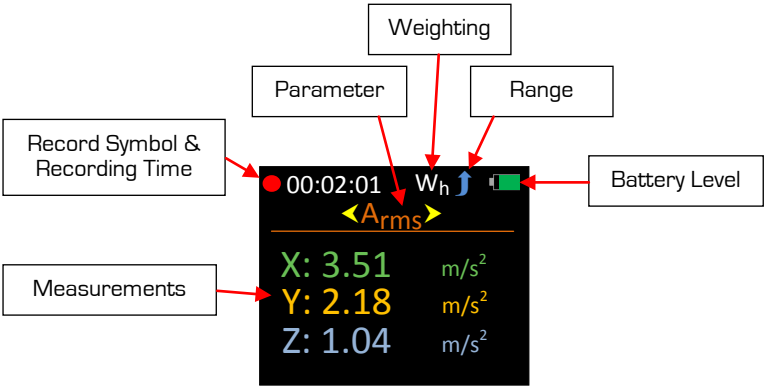
To start a recording (Record State) press the key at any time.

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.

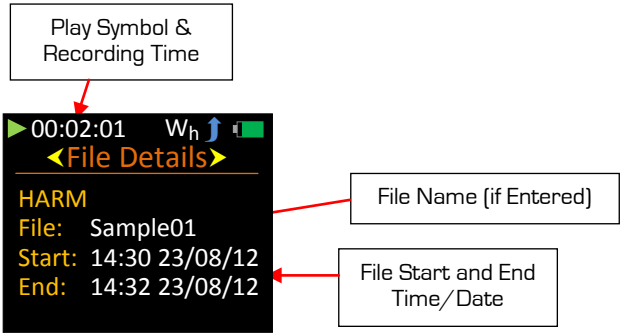
If neither of the above are turned on then the instrument is placed back into Stop State.

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: -

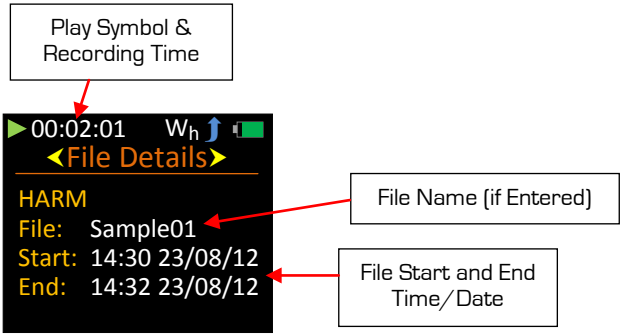
- File Details
- Arms
- Aeq
- Peak
- Vector
- Exposure

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

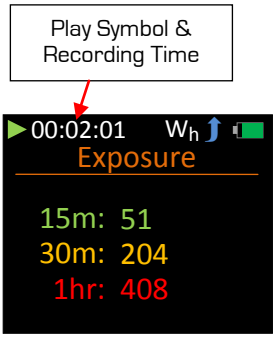
Exit Playback by pressing either or and the instrument is placed into Stop State.

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.

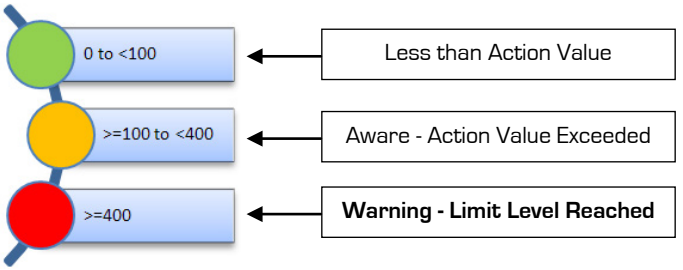
See **Show Results – On** if Show Results are also turned on.

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: -

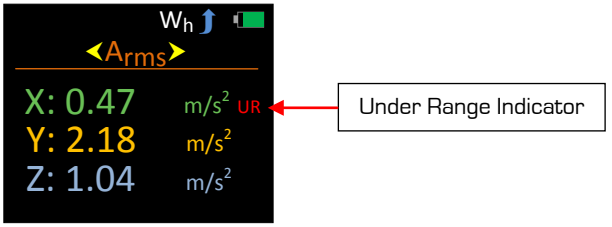
Hand Arm		
Action Level	2.50 ms^{-2}	100 Points
Limit Level	5.00 ms^{-2}	400 Points

Under Range Indicator

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

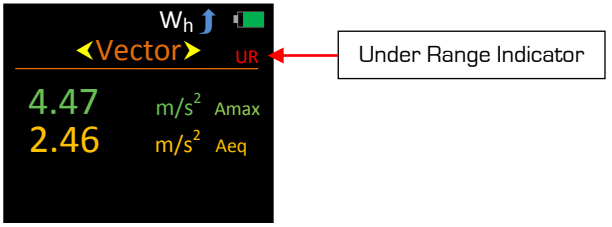
Unlike overload, the under range condition is not saved with the recording and is therefore not available in Playback.

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.

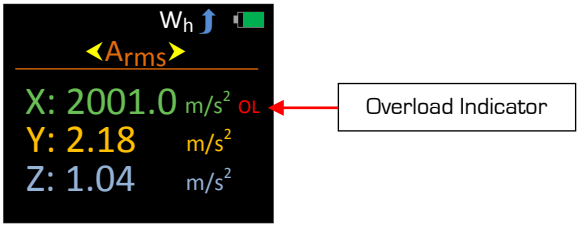


Overload Indicator

Each axis on the Vexo H 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: -



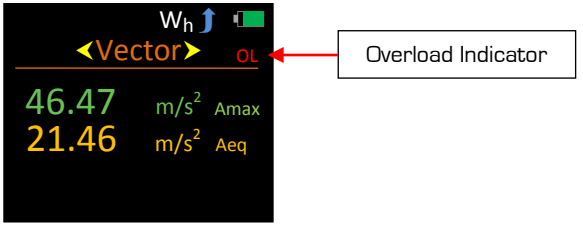
The overload indicator remains on for a minimum of 2 seconds or whilst the overload condition remains however during Stop State or Record State the overload indicator is latched on the following screens: -

- Aeq
- Vector

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

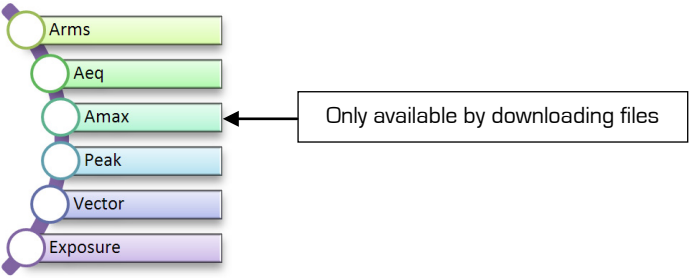
The overload indicator cannot be reset during Record State or Playback.

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 Vexo H 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 VibdataLITE or VibdataPro (available separately) 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 Vexo meter is made via the USB connector at the top of your instrument. The correct Castle Vexo USB driver will need to be installed on your PC, and is automatically installed whilst installing VibdataLITE.

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

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

Your Vexo instrument is now ready to download data into VibdataPro.

For comprehensive instructions please refer to the VibdataPro user manual.

Chapter 8

Accessories

GA606	Vibration Calibrator
KA010V*	Carry Case for Vexo and Accessories
KD1010*	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**	VibdataPro 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 Vexo H
** upgrade from supplied Vibdata LITE

Chapter 9

Technical Specification

Applicable Standards

ISO 8041:2005 Human Response to Vibration – Measuring Instrumentation

Noise Floors

Axis	Range m/s^2 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 KD1010

Overload & Under Range Triggering Points

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

Acceleration : Metric m/s^2		
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

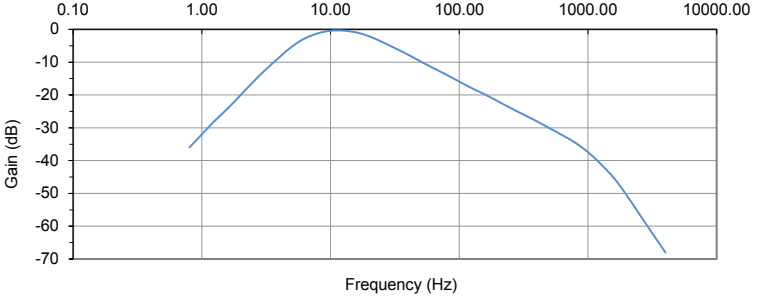
Acceleration : Metric	
LOW	0.05 – 200 m/s^2
HIGH	0.50 – 2000 m/s^2

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 re 80Hz in dB and tolerances required for a typical Vexo H 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, -∞

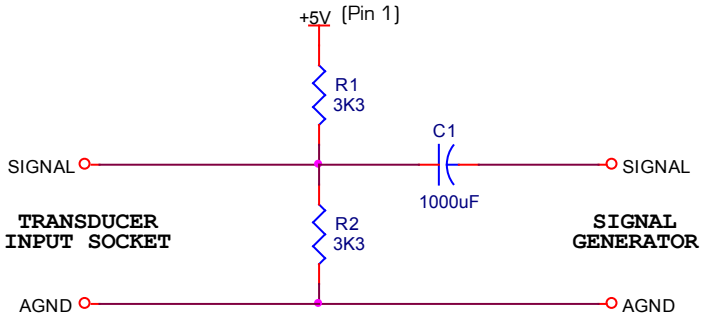
Accelerometer

Specification	KD1010
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 Vexo H 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

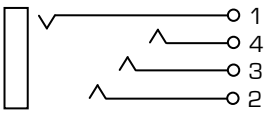
AC Output

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

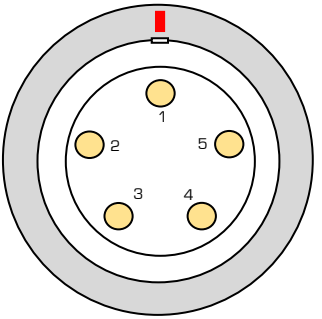
Input Signal

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 Castle Vexo Vibration Meter indicates compliance with the EMC and Low Voltage Directive.

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

We, Castle Group Ltd declare that the: -

- *Vexo H and Vexo S range of Vibration Meters*

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 Castle Vexo meters to comply with these specifications: -

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

The technical file for the above is maintained at Castle 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 Bull
Managing Director
Castle Group Ltd, Salter Road, Scarborough, North Yorkshire, YO11 3UZ
August 2012

Chapter 10

Function Equations

The following table describes mathematically how the functions available on the Vexo 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

Castle Group Ltd 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 Castle Group Ltd 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 Castle Group Ltd or your authorised agent.

All instruments designed and manufactured by Castle Group Ltd 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: -

The Service Department
Castle Group Ltd
Salter Road
Cayton Low Road Industrial Estate
Scarborough
North Yorkshire
England
YO11 3UZ

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 transducer or 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, Castle Group Ltd makes no representation or warranties as to the completeness or accuracy of this information.

Castle Group Ltd 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 Castle Group Ltd regarding your instrument, please complete the following details: -

Instrument

Instrument Serial Number

Transducer Serial Number

Software Version Number

Purchase Date

Index

M

N

O

P

R

S

T

U

V

W