Castle GROUP

Wellbeing and Productivity Solutions for Business

EXCIEO

human & environmental vibration meter

OPERATING MANUAL

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Castle Excieo
Vibration Meter

Operating Manual

Excieo GA2005H HARM Vibration Meter
Excieo GA2005S Single Axis Vibration Meter
Excieo GA2005M Multi Function Vibration Meter

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Castle Excieo
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 vibrations.
- 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. Remove the batteries from the instrument when not in 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 Excieo 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

Contents

Table of Figures

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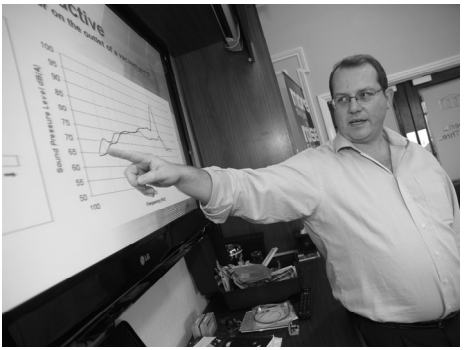
If you want to keep up to date with the latest in health and safety, you should attend a Castle FREE seminar. These are run around the country and cover a wide range of topics. Packed with the latest information and delivered with the help of practical demonstrations, these seminars are a great way to 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 view sample video clips.

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.



- Measuring and Monitoring Instruments
- Equipment Rental
- Database and Data-management Software
- Training Courses and In-house Provision
- Calibration and Repair of Monitoring Equipment
- Consultancy for Health, Safety, Environment and Engineering Solutions
- Online Knowledge

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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
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- HAVS Health Surveillance
- Health Screening
- Air Sampling and Gas Detection
- Indoor Air Quality
- Airflow
- EMF Testing and Monitoring
- Portable Appliance Testing (PAT)
- General Compliance and Risk Assessment

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In an increasingly sensitive atmosphere to environmental issues, businesses have to be careful. Neighbours are increasingly aware of theirs 'right' to complain and the environmental agencies are looking for industry to clean up its act. Simply call us on 01723 584250 if you have any environmental compliance issues and we will work with you to find the best way forward.

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- Ground-Bourne & Building Vibration
- Stack-Emissions Monitoring
- Environmental Air Sampling
- Water Quality Testing

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

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Competence and Compliance training is essentially all about obtaining the knowledge and skills required to get the job done. This is precisely how Castle courses are set out, with a high degree of practical 'hands-on' experience mixed with some background theory and a lot of job-specific information and discussion. If this doesn't whet the appetite, then there is also a fully inclusive dinner on the first nigh – perfect for getting to know some of your peers! You can see a full list of courses on our website.

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- Health Surveillance Courses
  - Audiometry, Lung Function, HAVS
- Environmental Monitoring Courses
  - Noise, Vibration, Air Quality
- Diagnostic Engineering Courses
- Maintenance and Monitoring Courses

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You can pick any of our standard courses, a shortened version as an awareness session or a toolbox talk, or you can design your own course covering a large range of topics. Visit our website for a list of ideas!

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Sometimes, the comfort of using an independent expert can be extremely valuable, whether that be for short-term help, Engineering project work, or an on-going support contract. Castle consultants are always at the top of their game and are waiting to hear from you. Have a look at our website or call on 01723 584250.

- Noise and Vibration, COSHH Assessments
- Light, Temperature, EMF Assessments
- Environmental Monitoring
- Expert Witness
- Diagnostic Engineering
- Engineering Control Solutions
- Risk Management
- Health Surveillance Services
- Health and Safety 'Department' Support Service

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
- Weighing equipment

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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.

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- Hassle-Free Administration
- Discounted Calibration Fees
- Single-Source Supplier

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Rental is a great way to have the use of measurement equipment without having to own it – especially is capital budgets are tight or it tax is an issue. If you need a short term solution, additional equipment to boost your capabilities or if contract-based tax deduction is important, then Rental could well be the way to go. Go to our website to find the huge range of equipment we have available.

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- Easy on Cash-Flow
- Short or Long Term Rentals
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- Try Before You Buy
- 4 weeks for the Price of 3!
- No On-going Maintenance

If it exists - we'll even source equipment for you!

www.castlegroup.co.uk

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Chapter 1

Introduction

Thank you for purchasing your product from Castle Group Ltd. The Excieo range of vibration meters bring to you unrivalled power and usability with parallel Tri-Axial measurement, multiple measurement parameters and all the frequency weighting curves you will need ... Vibration measurement for a plethora of applications has finally arrived.

A Tough Case For All Weathers...

The physical design and construction of the Castle Excieo casing is extremely tough and durable meaning that wherever you go and whatever you do, your Excieo can go with you without letting you down.

Talking To the Outside World...

The Excieo features USB connectivity to your laptop or PC and an RS232 interface for communication with the Castle GA505 Portable Printer.

Recorded data can be transmitted directly to the Castle GA505 Portable Printer providing ready formatted print-outs.

To gain the most out of your measured data, Castle VibdataPro software is the way to go. Post measurement analysis and presentation of data can be done using this package. VibdataPro allows seamless integration with word processing and spreadsheet packages enabling you to use your own standard report formats in programs that you are familiar with.

Simplicity and Power...

Using the meter couldn't be simpler. The intuitive Excieo operating system tells you where you are and what you want to do next. The massive power of the technology in the instrument is tamed by the user interface such that you are presented with information in a concise and unambiguous format. Menu choices are logical and straightforward and make maximum use of the clearly defined operation keys and the 'mobile phone' style 'soft' function keys.

Future Proof...

The built in software for these meters is designed to suit future upgrading for feature enhancements, legislative changes or instrument upgrades. Details are mailed to customers as soon as they become available. With Castle Excieo meters you will always be in step with the law and market requirements. Periodic enhancements or bug fixes to the software will be supplied free of charge for a period of one year from the purchase date.

About the Excieo

The Excieo has it all for either Health & Safety or Machine Monitoring with a rugged construction, large clear display, easy operation, long battery life, large data storage, over twenty simultaneous measured parameters and a large dynamic range.

Available in three variations to match your requirements: -

HARM (H)	SINGLE Axis (S)	Multi Function (M)
HARM	**SINGLE**	**HARM** **WBV** **SINGLE** **CUSTOM**

GA2005H – Hand Arm Vibration (HAVS)

Designed for the Health & Safety monitoring of Hand Arm Vibration.

Filter selection is fixed using the Wh filter for Hand Arm operation making the Excieo usability straightforward.

GA2005S – Single Axis Vibration

Provided for general vibration applications where only filters relevant to machine monitoring are selectable for added simplicity. Digital filtering is used to create the following selectable filters: -

- Fa, Fb, Fc, Fl and Ws

GA2005M – Multi Purpose Vibration

The Multi Purpose Excieo can be used in either HARM, Whole Body (WBV), SINGLE for simplicity, or in CUSTOM mode to allow the user total control of settings and filters providing an unprecedented amount of flexibility for advanced applications with ease. Digital filtering is used to create the following selectable filters: -

Mode	Filters Available
HARM	Wh (Fixed)
WBV	Wd (X and Y axis) , Wk (Z axis) (Fixed)
SINGLE	Fa, Fb, Fc, Fl, Fk, Ws
CUSTOM	Fa, Fb, Fc, Fl, Fk, Wb, Wc, Wd, We, Wh, Wj, Wk, Wm, Ws

Chapter 2

Accelerometer Types, Removal and Fitting

Accelerometer types for use with the Excieo produce a Voltage Output proportional to the signal being measured.

Below is a table which shows the output voltages and specifications of the Hand Arm Tri-Axial Accelerometer (KD1006), the Whole Body Tri-Axial Accelerometer (KD1007 & KD1009) and the Single Axis Accelerometer (KD1003): -

Accelerometer Type	Output Voltage	Operating Range	Frequency Response
Hand Arm	10mV/g	±500g	2 to 5000Hz ±10%
Whole Body (KD1007)	100mV/g	±50g	0.5 to 3000Hz ±5%
Whole Body (KD1009)	1000mV/g	±3.6g	0.1 to 125Hz ±5%
Single Axis	100mV/g	±80g	2 to 14000Hz ±5%

Where g is the acceleration due to gravity on the Earth's surface and is defined as 9.80665 ms^{-2}.

Acceleration is defined as the rate at which an object changes it velocity. Velocity is measured in metres per second (m/s) and therefore 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

Hand Arm Vibration Tri-Axial Accelerometer (KD1006) - Dytran	Hand Arm Vibration Tri-Axial Accelerometer (KD1006) - PCB	Single Axis Accelerometer (KD1003)
		

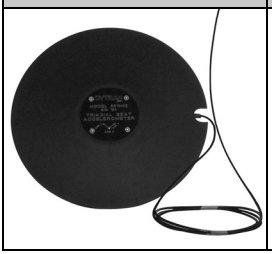
Whole Body Tri-Axial Accelerometer (KD1007)	Whole Body Tri-Axial Accelerometer (KD1009)
	

Figure 1 – Accelerometer Types

The Excieo vibration meter can be used with two seat pad transducers for Whole Body Vibration, both of which are available from Castle Group Ltd. See page 80 for details to ensure your instrument has been setup correctly.

Where the Tri-Axial accelerometers available for the Excieo have the axes labelled as 1, 2 or 3 the table below indicates the axis direction: -

Accelerometer Marking	Axis Direction
1	X
2	Y
3	Z

Otherwise the axis labelling and axis direction are as follows: -

Accelerometer Marking	Axis Direction
X	X
Y	Y
Z	Z

Attaching & Removing Accelerometers

On the accelerometer cable locate the orientation key, and on the instrument locate the RED keying identification mark. 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.

Figure 2 – Attaching Accelerometers to the Instrument

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

Chapter 3

Measuring 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 practicable it may be beneficial to permanently attach the accelerometer cable.

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 not governed but as a rule of thumb use an absolute minimum time period of 5 minutes for Whole Body and 30 seconds for Hand Arm Vibration.

It is recommended depending on the process that a minimum period of 15 minutes is used for Whole Body and between 3 to 15 minutes for Hand Arm vibration. These increased durations will undoubtedly increase the accuracy and repeatability of your measured results.

Single Axis Transducer Mounting

If your Excieo meter was purchased with a Single Axis Accelerometer then you will have been supplied with a large spike probe that can be used for the interface of the transducer to the vibration source.

Mounting of the single axis accelerometer to the vibration source can also be achieved by tapping a stud into the vibration source and attaching the accelerometer to the stud. Alternatively the stud may be adhered to the device with an adhesive that dries rigid. Castle Group Ltd can supply a glue and stud pack if required, (order code KD1215).

Hand Arm Vibration Transducer Mounting

If your Excieo meter was purchased with a Hand Arm Tri-Axial Accelerometer (abbreviated to HARM) then you will have been supplied with a HARM mounting block, retaining stud and Allen key. The mounting block can be attached to the HARM accelerometer using the supplied stud and tightened using the supplied 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. Castle Group Ltd can supply a glue and stud pack if required, (order code KD1215).

Whole Body Vibration Transducer Mounting

No definitive methods can be realized for mounting the seat pad as many permutations are possible; it is only possible to highlight suggestions.

The seat pad could be mounted on the seat of the vibration source with the user sat on the seat pad. The pad could also be taped to the seat to stop it moving if required.

The seat pad could be taped to the back of the seat or to the operator if required. If the latter option is employed it is imperative that all aspects of safety regarding the operator are considered and adhered to.

Position the seat pad on the floor of the vibration source ensuring that the pad is either fixed down possibly using tape or an object over it to keep it in position.

In all cases where the seat pad is used, ensure that the pad is kept in contact with the vibration source at all times and ideally taped in position to stop it moving.

Vibration Direction

Hand Arm Vibration

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.

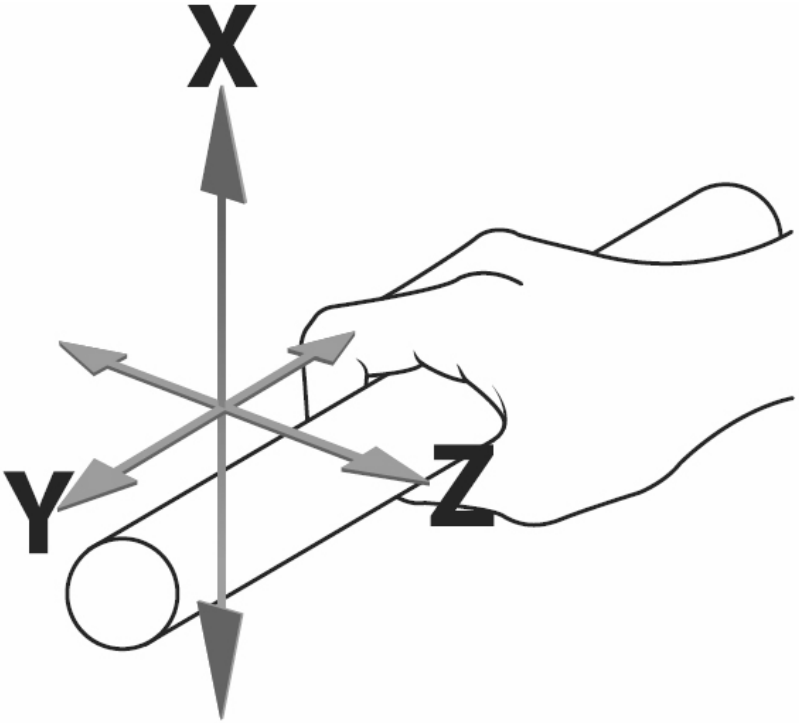


Figure 3 - Recommended Axes for Hand Arm Vibration

Whole Body Vibration

Axes orientation defined for Whole Body Vibration varies depending on the positioning of the person operating the vibration source. These are defined below: -

X – Direction
Vibration from the back to the chest of the operator.

Y – Direction
Vibration from the right side to left side of the operator.

Z – Direction
Vibration from the feet or buttocks, to the head of the operator.

The filtering and calculations used for Whole Body Vibration axes differ between each axis, and therefore choosing other axes orientations to those defined below will affect your measured data.

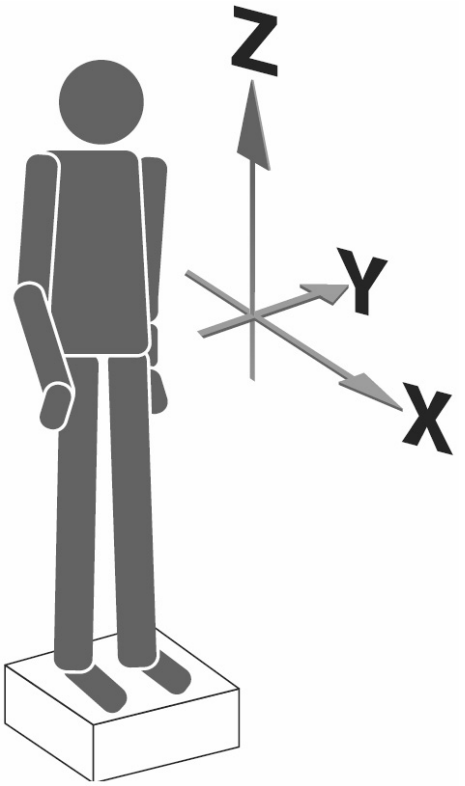


Figure 4 - Axis for Standing Operator

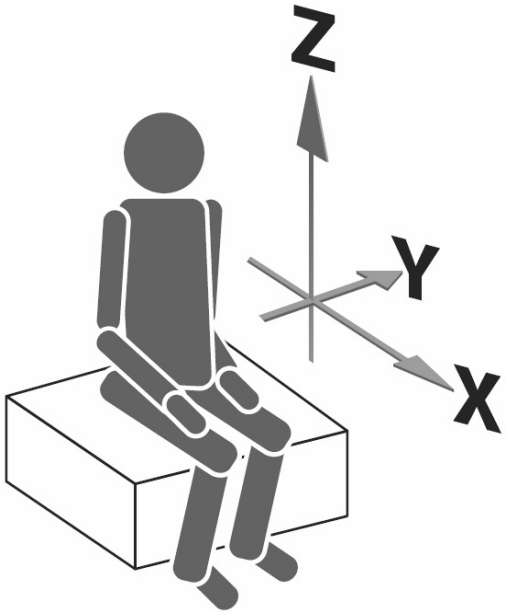


Figure 5 - Axis for Seated Operator

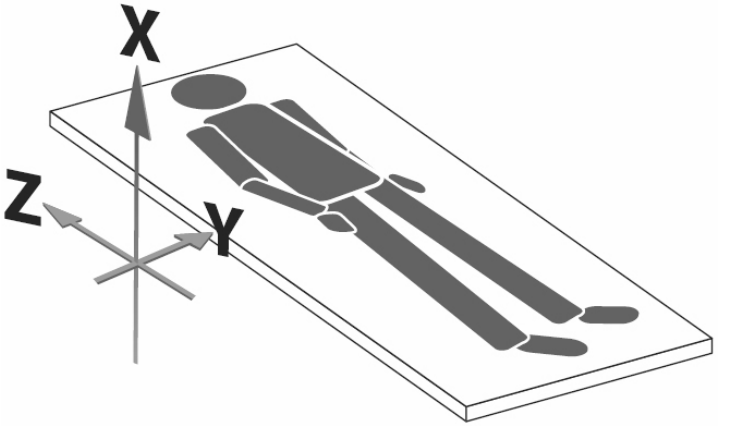


Figure 6 - Axis for Reclined Operator

Vibration Level

In some environments, high levels of vibration may occur. The Excieo meter has therefore been designed with 4 ranges for all of the following modes of operation: -

Hand Arm Vibration (HARM)
Whole Body Vibration (WBV)
Single Axis Vibration (SINGLE)
Custom Mode Vibration (CUSTOM)

Before you record measurements take the time to ensure you have selected the optimum range for the process being recorded and if using Single Axis or Custom Mode ensure that you have selected the correct parameters.

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 a higher range to accommodate the higher peak levels.

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 a lower range.

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

Frequency Weighting Filters

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 Excieo meter therefore has the following frequency weighting filters which are applied to the measured vibration signal using a fast, low powered digital signal processor for superior accuracy: -

Hand Arm Vibration

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

Whole Body Vibration

Filter	Description
Wb	Used for measurement of a seated or reclined person in a railway carriage for the vertical Z Axis.
Wc	For measuring at the seat back with a seated person present for the horizontal X Axis.
Wd	Used for measurement of a seated, standing or a reclined person for horizontal vibrations in the X and Y Axis.
We	Applied when measuring rotational vibration in all directions of seated people.
Wj	Used for measurement of a reclined persons vertical head vibration in the X Axis.
Wk	Used to measure the vertical Z Axis vibration of a seated, standing or reclined person.
Wm	Applied when measuring X, Y and Z Axis vibrations, in buildings.

Machine Monitoring

Filter	Description
Ws	Vibration monitoring between 10 and 1000 Hz
Fa	Vibration monitoring between 2 and 20 Hz
Fb	Vibration monitoring between 2 and 250 Hz
Fc	Vibration monitoring between 31.5 and 250 Hz
Fl	Suitable for monitoring at any frequency within the instruments or accelerometers tolerance and without applying high or low frequency roll off within the linear region specified.

The weightings specifically used for human vibration allow for the directional effects of vibration on people and compensate the vibration level to match the human discomfort throughout the frequency range of the weighting applied. As an example, study the gain response of the Wh filter and notice that it has a gain of -0.43dB at 10Hz whereas at 100Hz the gain is -15.91dB. This is because for HARM a human body is more susceptible to vibration levels at 10Hz than 100Hz and hence this is compensated for in the applied frequency weighting.

For ease of use, HARM and WBV display modes have set frequency weighting filters automatically applied to the measured vibration signal. CUSTOM mode allows any combination of frequency weighting filters within the axes whilst SINGLE Axis allows the selection of any filter suitable for vibration monitoring.

These frequency weighting filters allowable for each axis and each display mode is shown below: -

HARM	
Axis	**Filter**
X	Wh
Y	Wh
Z	Wh

WBV	
Axis	**Filter**
X	Wd
Y	Wd
Z	Wk

SINGLE
Filter
Fa, Fb, Fc, Fl, Fk, Ws

CUSTOM	
Axis	**Filter**
X	Fa, Fb, Fc, Fl, Fk, Wb, Wc, Wd, We, Wh, Wj, Wk, Wm, Ws
Y	Fa, Fb, Fc, Fl, Fk, Wb, Wc, Wd, We, Wh, Wj, Wk, Wm, Ws
Z	Fa, Fb, Fc, Fl, Fk, Wb, Wc, Wd, We, Wh, Wj, Wk, Wm, Ws

Filter responses can be viewed under **Technical Specification** in **Chapter 10**.

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 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 indicator is displayed as **UR** at the right hand side of the axis measurement that is causing the under range condition. Any axis where the measured value is below the Under Range point for that range will be blanked on the display and shown as a series of '-' characters.

For the display modes HARM, SINGLE and CUSTOM the under range indicator will remain on for a minimum of 2 seconds or while the under range condition remains.

For the WBV display mode the under range indicator will remain on for a minimum of 8 seconds or while the under range condition remains.

Due to the effects of integration when either Velocity or Displacement are selected in Single Axis mode, the dynamic range is approximately 10dB greater and therefore the under range indicator in these circumstances is approximately 10dB lower than other display modes.

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** indicator is displayed at the right hand side of the axis measurement that is causing the overload condition.

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.

For the display modes HARM, SINGLE and CUSTOM the overload indicator will remain on for a minimum of 2 seconds or while the overload condition remains.

For the WBV display mode, the over load indicator will remain on for a minimum of 8 seconds or while the over load 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.

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

Measuring Ranges

Each display mode on the Excieo meter has four ranges available (excluding KD1009 Seatpad option which has only one range when the sensitivity is set at 1000mV). Switching between ranges on any mode is achieved by pressing **Soft Key 2** labelled **RANGE.**

It is also possible to change the displayed working units for each display mode under **Global Settings** from the **Main Menu**.

See **Technical Specification** for a complete list of available ranges for each display mode and available units of measure.

Vibration Exposure Points

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

Partial exposure points can simply be added together manually to produce a total points exposure for a working day.

The vibration analysis software VibdataPro allows you to merge individual recordings and automatically calculate total exposure points. It even colour codes the results for instant recognition of compliance. VibdataPro is purchased separately.

The exposure points calculated are: -

- Partial Points
- Points (1hr)
- Points (15m)

Calculated exposure points are displayed on the calculation display screen after a recording has been made. It is possible to recalculate the Partial Points by changing the exposure time. Please see **Chapter 6** and **Chapter 7** for more details.

The exposure points are only available for individual HARM or WBV mode recordings using Metric units (see **Chapter 5, Real Time Operation** for more information on instrument modes).

Individual saved recordings of the same mode may be combined using the Exposure Point Calculator to calculate and display the Total Exposure Points. See **Exp Point Calc** under the heading **Logs** from **Main Menu** in **Chapter 7** for more details.

Chapter 4

Getting Started

At power on, a nominal delay of 20 seconds exists before valid measurements are being displayed. The meter highlights the selected range for 20 seconds, when this highlight is removed the measurements are valid.

Your Castle Excieo meter has two running states of operation:-

- **Real Time**
- **Recording**

Real Time operation does not record any measurements and the only parameters available are Arms, Aeq, Amax and Pmax (see **Real Time Operation** for more information and procedures).

The preceding 'A' in Arms, Aeq and Amax refers to Acceleration and in **Single Axis** mode it is possible to change the calculation integration method and therefore display the results as Velocity or Displacement. In such cases the preceding 'A' will be replaced with 'V' for Velocity or 'D' for Displacement.

To record data and obtain the extra parameters available the meter must be placed into Recording Operation (see **Recording Operation** for more information and procedures). When the meter is first switched on, the meter defaults to Real Time Operation.

Your meter is equipped with a simple to use navigation system using the four Yellow keys (**Soft Keys**) located at the top of the keypad.

Where appropriate, on the display directly above each Soft Key will be a description, pressing the Soft Key will bring up further menus or change the function as described.

The **Main Menu** is activated by pressing the **MENU** Key 

once.

Pressing the Menu Key again will put the instrument into Real Time measurement mode. The Main Menu and its functions are described in detail in **Chapter 7**.

The Main Menu and other sub menus use a numbered menu system. When displayed you are presented with a list of selectable options, to activate the required option press the corresponding number using the numeric keypad on your instrument.

Some options may also have further sub-menus or popup menus where further options are listed.

Keypad Layout

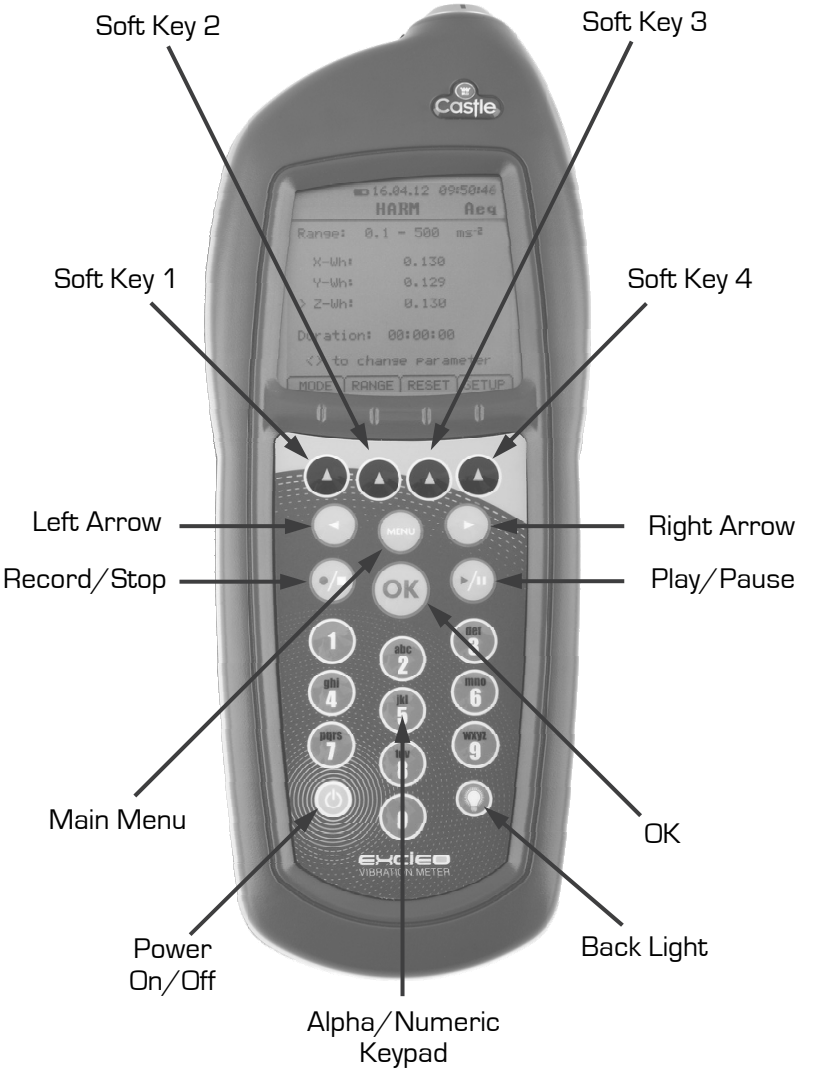


Figure 7 - Keypad Layout

Sample Screen Layouts

Hand Arm Vibration Mode (HARM)

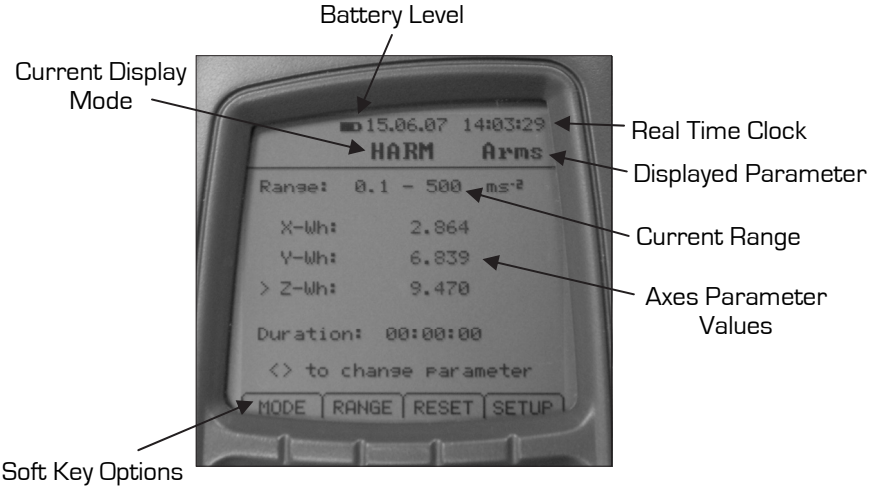


Figure 8 – HARM Mode Screen Layout

Custom Vibration Mode (CUSTOM)

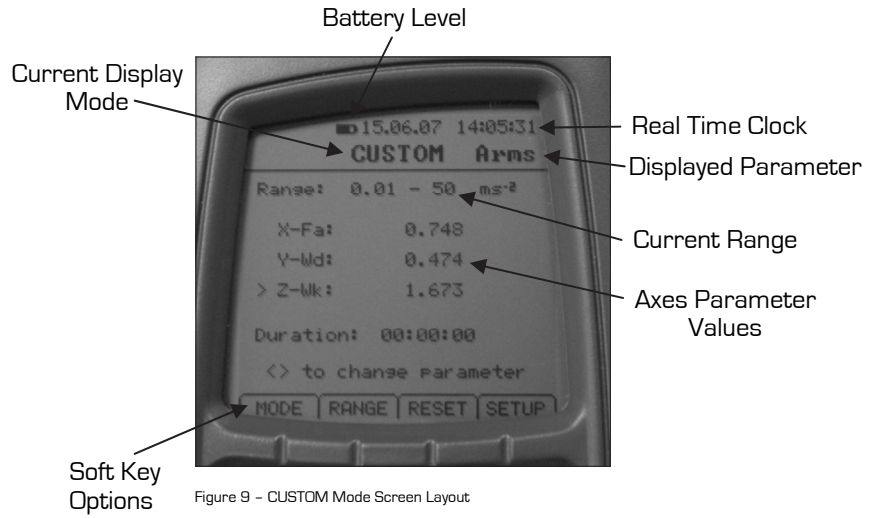


Figure 9 – CUSTOM Mode Screen Layout

Powering Your Excieo Meter

Your Excieo meter can be powered from either six AA batteries or an optional Castle 12V DC Power Supply which can be purchased separately if required (PSU3:PRO-DX).

The battery compartment is located on the rear of your instrument and its cover can easily be removed and fastened by the use of your thumb or a coin if required. Place each individual AA battery (6 required) with the positive terminal to the positive markings, which are moulded into the casing inside the battery compartment. To achieve a longer battery life with your instrument it is strongly recommended you use Alkaline type batteries, unplugging the transducer whilst not measuring may also prolong battery life.

To power the instrument via the optional Castle DC Power Supply simply plug the power supply connector into the DC socket located next to the USB socket at the base of your instrument. The circuit boards are protected from incorrect polarity of either the batteries or DC power supply.

Re-chargeable batteries may be used in this instrument but operating time will be reduced. Re-chargeable batteries must be removed from the Excieo to be charged.

Below is a typical graph which approximately indicates the Excieo battery level with respect to time using 2.7 Ampere Hour Alkaline type batteries.

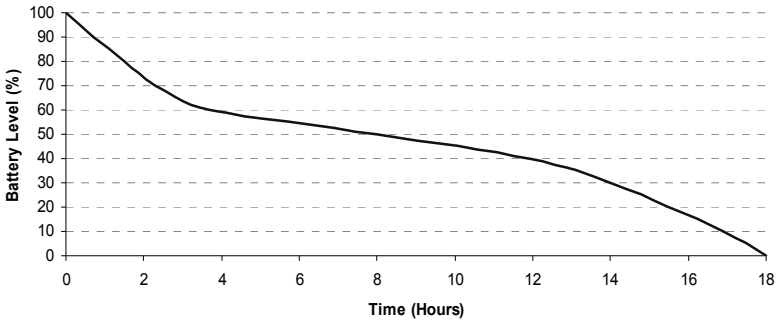


Figure 10 - Approximate Alkaline Battery Life

Switching Your Excieo Meter On/Off

To turn on your instrument press and hold the Power On/Off key for approximately one second. Your instrument will display the boot up screen with an initialisation progress bar at the bottom of the screen. When initialisation is complete, your meter will be ready for operation in Real Time mode with the previously used settings.

To turn your instrument off press the Power On/Off key at any time. Confirmation will then be required by pressing the **OK** key or using Soft Key 1 labelled **CANCEL** to cancel the shut down request. Please be aware that the Power On/Off key is disabled whilst the instrument is recording. To preserve your data always turn your instrument off using the Power Key.

Your Excieo meter is equipped with a battery indicator to easily identify the approximate remaining battery charge. When the batteries are low and need replacing, the **Time**, **Date** and **Battery Indicator** will start flashing. You should then turn off the instrument and replace the batteries as soon as possible.

The instrument is also fitted with an Auto Shut Down feature should the batteries run low and are not replaced. If recording and the Auto Shut Down feature activates, your data will be saved with an Employee Name **'Batt Low'**.

The battery indicator and its eight stages of graphical display are shown below: -

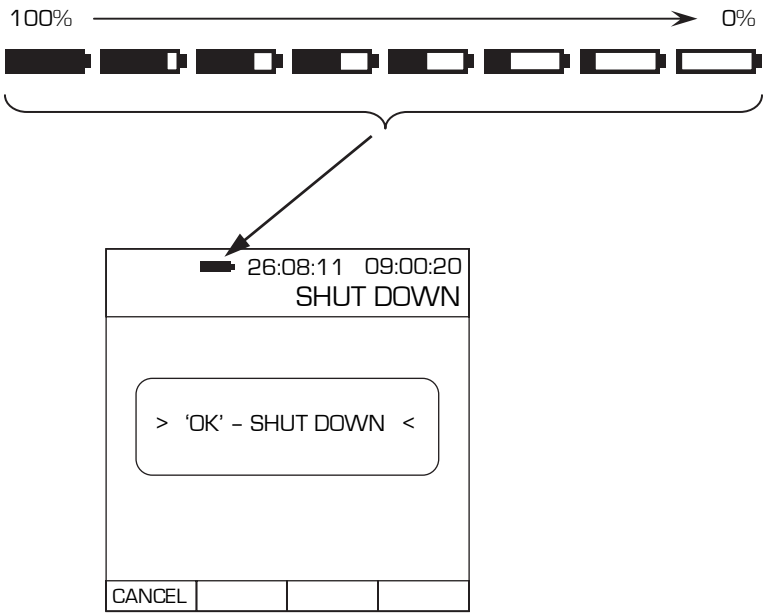


Figure 11 - Shut Down Screen

Chapter 5

Real Time Operation

Real Time operation is extremely useful for pre-check range Overload / Under range condiditons and can be identified by having a Duration value that does not flash and is set to the value 00:00:00.

Display Modes

Depending on the variation of meter purchased, the following display modes are available: -

HARM (H)	SINGLE Axis (S)	Multi Function (M)
HARM	**SINGLE**	**HARM** **WBV** **SINGLE** **CUSTOM**

To switch between the modes of operation for multi function meters press **Soft Key 1** labelled **MODE** and a popup menu will appear with a list of selectable display modes. Select which display mode you require by pressing the appropriate number on your keypad or press **Soft Key 1** labelled **CANCEL** to cancel the operation and return to the previous screen. Dedicated **HARM** and **SINGLE** axis meters do not have this facility.

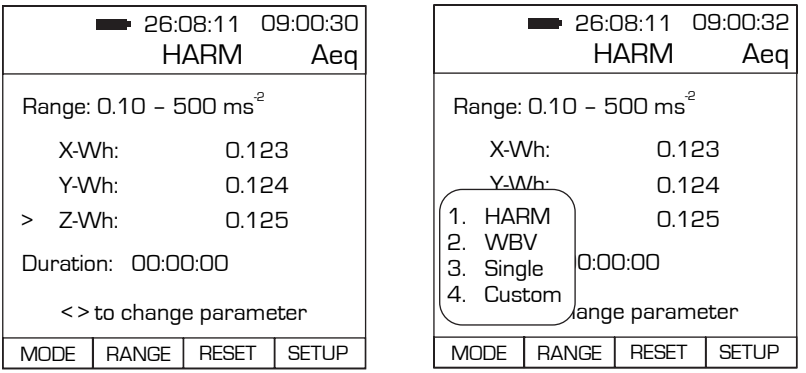


Figure 12 – Display Mode Selection

It is essential that whichever display mode is used for measuring vibration, that the correct transducer is attached to your meter. Mismatched display modes and transducers, or accelerometer sensitivities will give incorrect measurements.

Display Parameters

All display modes of operation have the following Acceleration display parameters which are identified as Acceleration with a preceding 'A': -

- **Aeq**
  The Aeq is time averaged and weighted with a frequency filter that is either set automatically or selected by the user depending on the mode of operation.

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

- **Amax**
  The Amax is the maximum Arms level reached.

- **Pmax**
  Pmax is the highest peak level of the weighted instantaneous acceleration.

Scrolling between these four parameter screens is achieved using the **Left** and **Right Arrow** Keys ◀▶.

The dominant axis is always identified by having the **>** character displayed next to it.

In Single Axis mode or Cusotm mode either a single integration change from Acceleration to Velocity or a double integration change from Acceleration to Displacement is possible. Depending on the integral method chosen, the selectable display parameters are shown below: -

Velocity			
Veq	Vmax	Vrms	Pmax

Displacement			
Deq	Dmax	Drms	Pmax

Scrolling between these four parameter screens is achieved using the **Left** and **Right Arrow** Keys ◀▶.

The dominant axis is always identified by having the **>** character displayed next to it.

To see how these parameters are calculated within the instrument, see **Function Equations** in **Chapter 11**.

Examples of the four parameter display screens for HARM are shown below: -

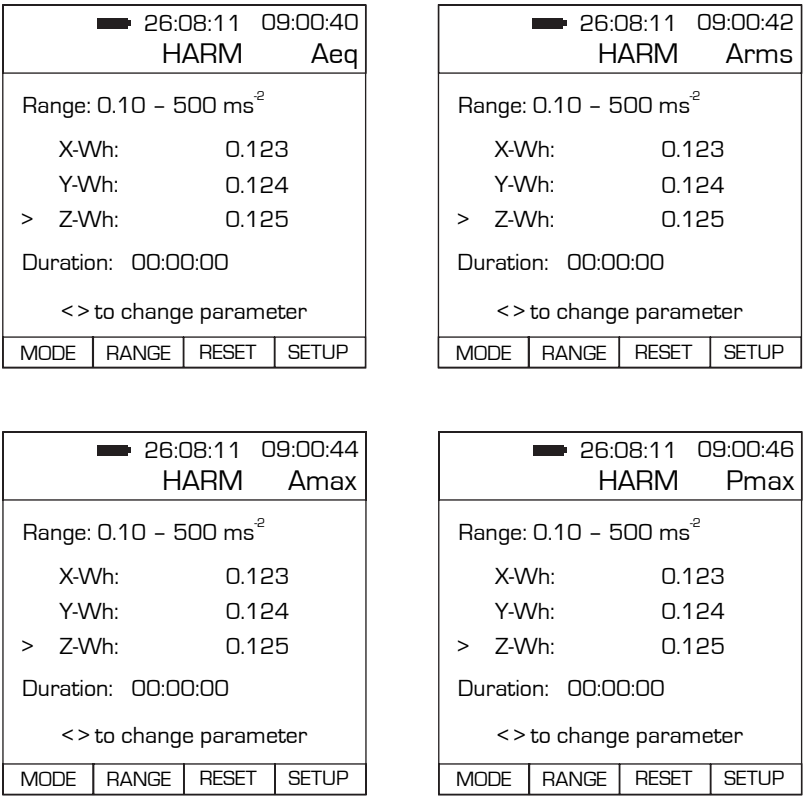


Figure 13 – Real Time HARM Parameter Display Screens

Resetting Parameters

Pressing **Soft Key 3** labelled **RESET** at any time whilst in Real Time Mode will reset each of the following parameters: -

- Aeq, Veq, Deq
- Arms, Vrms, Drms
- Amax, Vmax, Dmax
- Pmax

The nominal delay time between a reset operation and valid measurements being displayed is 3 seconds.

Changing the Measuring Range

Each display mode on the Excieo meter has four ranges available. Switching between the four ranges is achieved by pressing **Soft Key 2** labelled **RANGE.**

The nominal delay time between changing a range and valid measurements being displayed is 20 seconds, the displayed range is therefore highlighted for approximately 20 seconds when the range is changed.

A complete list of ranges can be viewed under the heading **Measuring Ranges** in **Chapter 3**.

Examples of the four parameter display screens for HARM are shown below: -

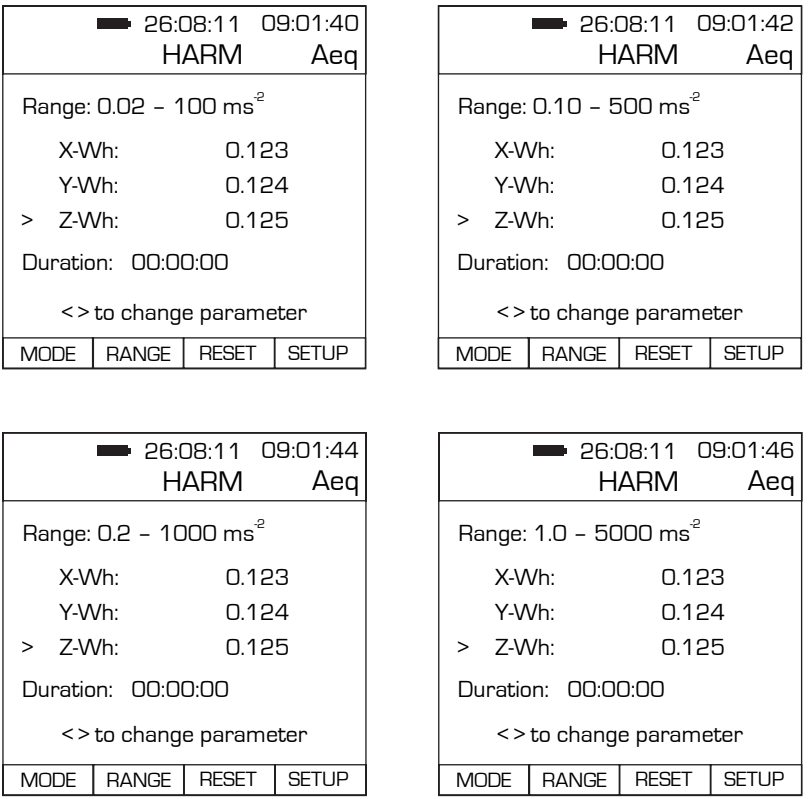


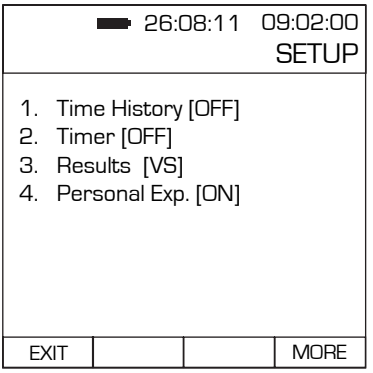
Figure 14 - HARM Range Selection Screens

Setup Options

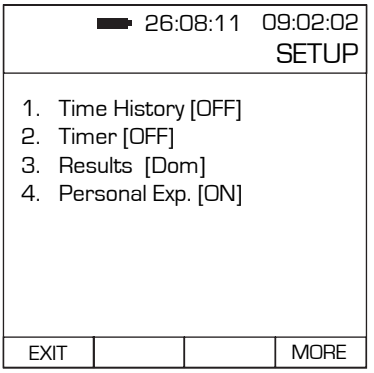
The options within Setup vary depending on which display mode is active. To display the list of currently available options press **Soft Key 4** labelled **SETUP**.

The defaults for each display mode are shown below: -

HARM



WBV



SINGLE

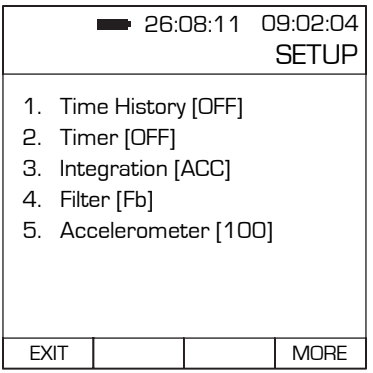
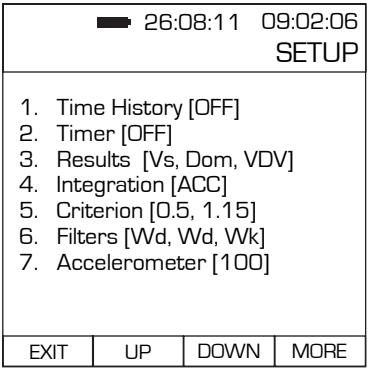


Figure 15 – Default Setup Option Screens (HARM, WBV, SINGLE)

CUSTOM



CUSTOM

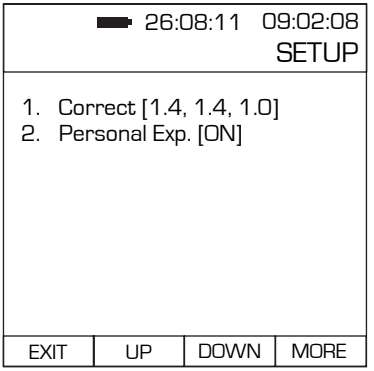


Figure 16 – Default Setup Option Screens (CUSTOM)

To change the settings of an option press its corresponding number on the keypad. A new screen will be displayed where the settings of the option selected can be changed. To return to Real Time Mode press **Soft Key 1** labelled **EXIT**.

In any display mode, press **Soft Key 4** labelled **MORE** to display a popup option screen with the following options: -

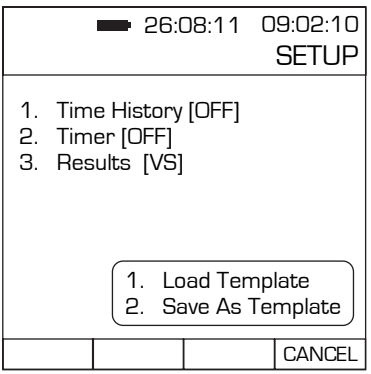


Figure 17 - SETUP, Popup Options

Press **1** on the keypad to Quick Load a Template for the display mode you are currently in. See under **Loading Templates Within Setup** for more details.

Press **2** to save the current settings for the current display mode as a Template for future use. See **Saving As Templates Within Setup** for more details.

Press **Soft Key 4** labelled **CANCEL** to close the popup and return to the **SETUP** screen.

Loading Templates Within Setup

Six template slots exist for each display mode. Slots that have no template are listed as '**Empty**'.

If a template has been saved in a slot then the template name will be shown. To open a template press its corresponding number using the numeric keypad.

In the example below, pressing 1 on the keypad would show the **TEMPLATE DETAILS** screen for the template named **TEST**. The template can then be loaded, edited or deleted.

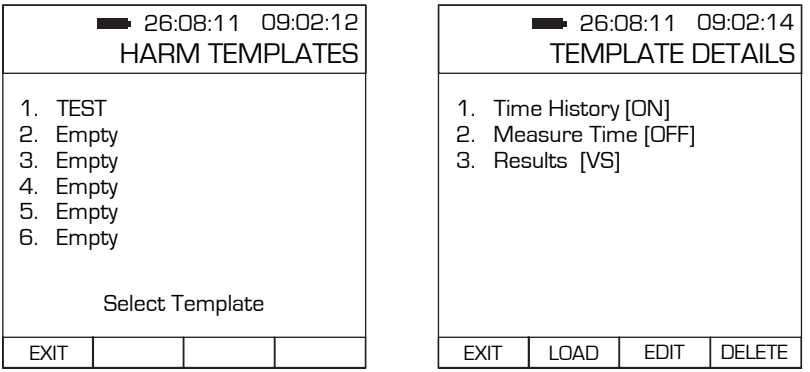


Figure 18 - Loading A Template From Within Setup

To Load the template press **Soft Key 2** labelled **LOAD**.

Pressing **Soft Key 3** labelled **EDIT** allows you to edit the settings of the template.

To delete the template press **Soft Key 4** labelled **DELETE**.

If the **TEMPLATE DETAILS** screen is displayed then pressing **Soft Key 1** labelled **EXIT** will return back to the previous screen which enables you to open a different template. If **Soft Key 1** labelled **EXIT** is pressed whilst displaying the selected modes **TEMPLATES** screen then you will return to the Real Time measuring screen.

See **Templates** under **Main Menu** for more information.

Saving As Templates Within Setup

Up to six templates maybe saved for each display mode. If no spaces are available to save the template then a popup window will display the message 'No free template slots' and return to the **SETUP** screen.

Use the keypad to type a name of up to 15 characters for the template to be saved. Use **Soft Key 2** labelled **NUMBER** or **LETTER** to toggle the input between numbers and letters.

Press **OK** to accept and Save the Template or press **Soft Key 1** labelled **CANCEL** to return to the **SETUP** screen without saving the Template.

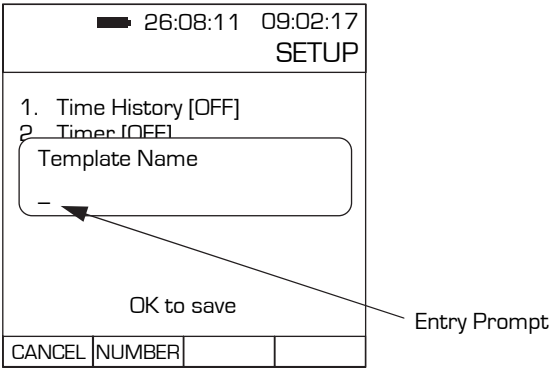


Figure 19 - SETUP, Popup Options

See **Templates** under **Main Menu** for more information.

Option 1 – Time History

Time History is setup whilst in real time mode but is used whilst recording. If the option is turned ON then interval data is recorded with the log at the interval time set.

Press **1** on the keypad to toggle Time History ON / OFF.

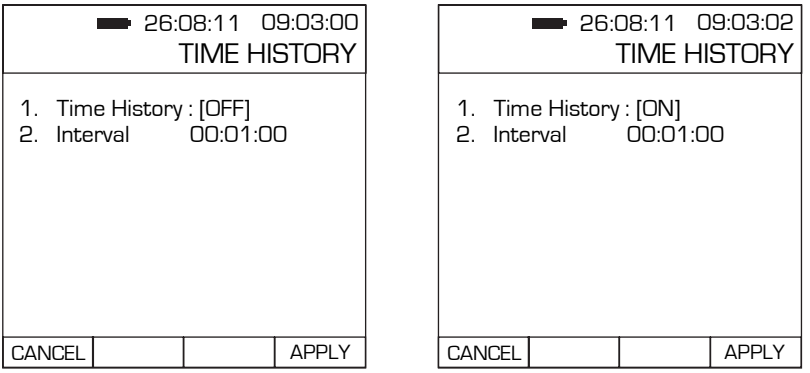


Figure 20 – Toggle Time History ON / OFF

Press **2** on the keypad to enter the Interval Time using the numeric keypad. The maximum interval time permitted is 23:59:59 (hh:mm:ss). Invalid entries will display an '**Out of range**' message and return the value to its previous state. To delete errors use the Left Arrow Key ◄.

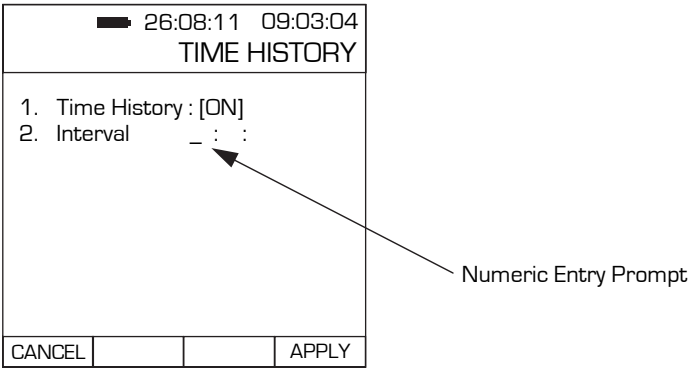


Figure 21 –Time Interval Entry

Press **Soft Key 1** labelled **CANCEL** to discard any changes or **Soft Key 4** labelled **APPLY** to make any changes made.

Option 2 –Timer

Measurement Time is setup whilst in real time mode but is used whilst recording. If the option is turned ON then if a recording is started, its time period is governed by the set measurement time period. The recording automatically stops once the measurement time has elapsed.

Press **1** on the keypad to toggle Measurement Time ON /OFF.

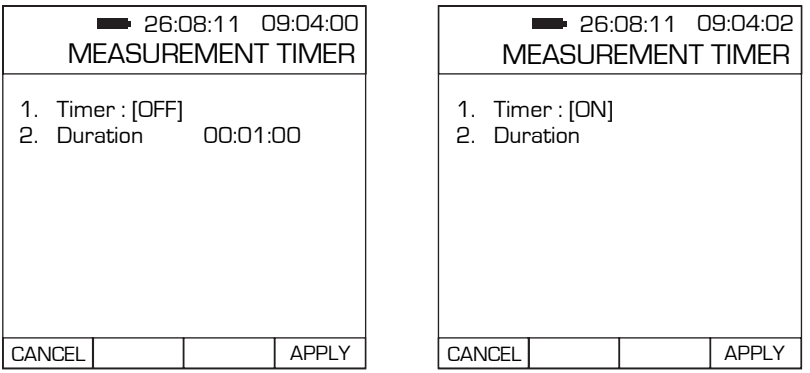


Figure 22 – Toggle Measurement Time ON / OFF

Press **2** on the keypad to enter the Interval Time using the numeric keypad. The maximum interval time permitted is 23:59:59 (hh:mm:ss). Invalid entries will display an '**Out of range**' message and return the value to its previous state. To delete errors use the Left Arrow Key ◄.

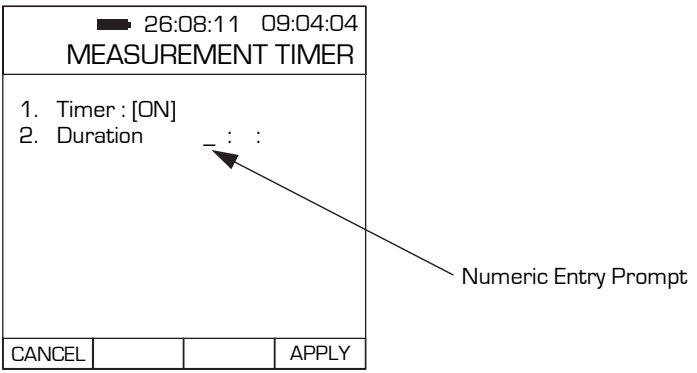


Figure 23 – Measurement Duration Time Entry

Press **Soft Key 1** labelled **CANCEL** to discard any changes or **Soft Key 4** labelled **APPLY** to make any changes made.

Option 3 – Results

Measurements for Hand Arm Vibration can be displayed as Vector Sum, Dominant Axis or both. Although the method to display the Results is selected in Real Time mode, the selection determines what is recorded when a recording is taken. The Vector Sum or Dominant Axis results are cumulative figures and therefore can only be viewed from a completed recording.

Press **1** on the keypad to toggle the display of Vector Sum ON /OFF or press **2** to toggle the display of Dominant Axis ON / OFF.

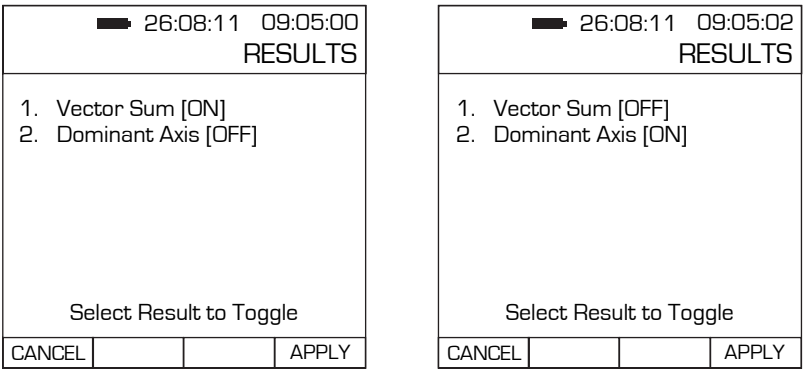


Figure 24 – HARM Results Selection

Press **Soft Key 1** labelled **CANCEL** to discard any changes or **Soft Key 4** labelled **APPLY** to make any changes made.

Option 4 – Personal Exposure

Set Personal Exposure to ON to show Personal Exposure information whilst viewing a saved log or viewing information directly after a recording has just been stopped.

Set Personal Exposure to OFF to hide the Personal Exposure information from display.

The Personal Exposure setting only alters the displayed information, it does not change which parameters are recorded.

Press **1** on the keypad to toggle the display of Personal Exp. ON / OFF.

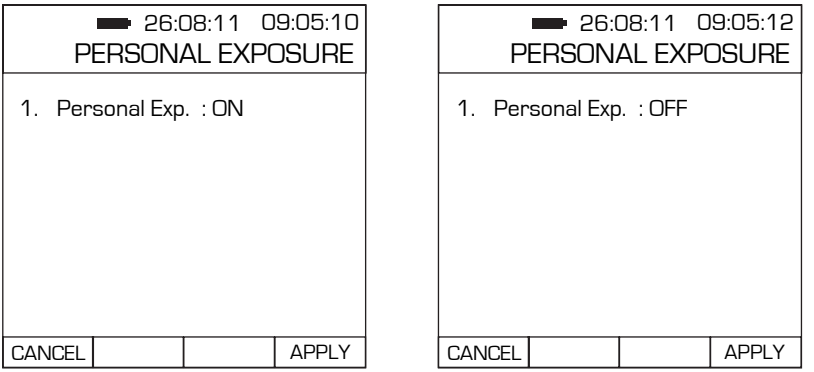


Figure 25 – HARM Personal Exposure Selection

Press **Soft Key 1** labelled **CANCEL** to discard any changes or **Soft Key 4** labelled **APPLY** to make any changes made.

The example screens below show how the display screens differ with setting Personal Exposure On or Off: -

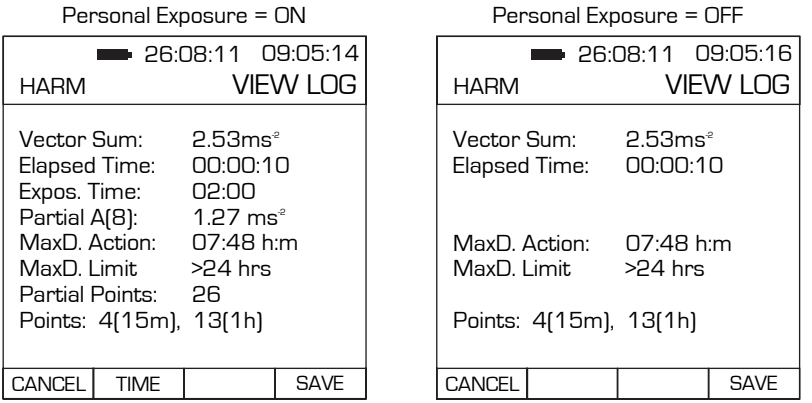


Figure 26 – HARM Display Screens with Personal Exposure On/Off

Option 1 – Time History

Time History is setup whilst in real time mode but is used whilst recording. If the option is turned ON then interval data is recorded with the log at the interval time set.

Press **1** on the keypad to toggle Time History ON / OFF.

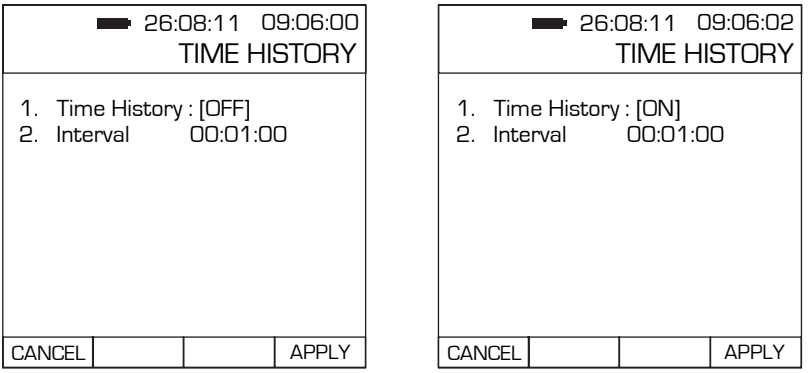


Figure 27 – Toggle Time History ON / OFF

Press **2** on the keypad to enter the Interval Time using the numeric keypad. The maximum interval time permitted is 23:59:59 (hh:mm:ss). Invalid entries will display an '**Out of range**' message and return the value to its previous state. To delete errors use the Left Arrow Key ⦿.

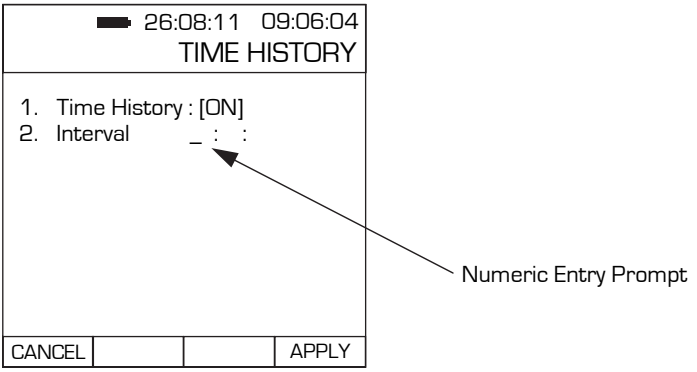


Figure 28 –Time Interval Entry

Press **Soft Key 1** labelled **CANCEL** to discard any changes or **Soft Key 4** labelled **APPLY** to make any changes made.

Option 2 –Timer

Measurement Time is setup whilst in real time mode but is used whilst recording. If the option is turned ON then when a recording is started, its time period is governed by the set measurement time period. The recording automatically stops once the measurement time has elapsed.

Press **1** on the keypad to toggle Measurement Time ON / OFF.

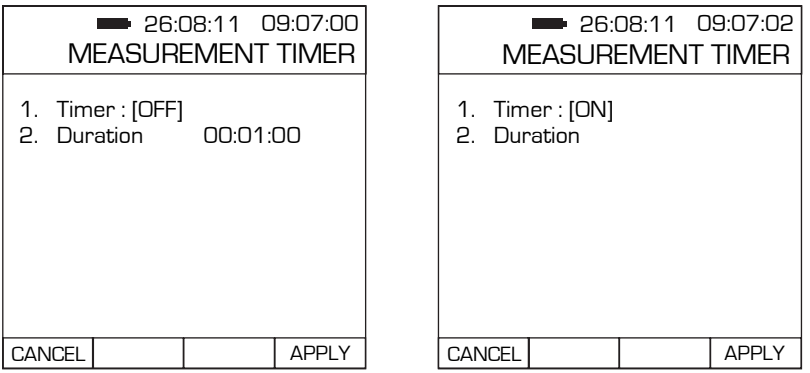


Figure 29 – Toggle Measurement Time ON / OFF

Press **2** on the keypad to enter the Interval Time using the numeric keypad. The maximum interval time permitted is 23:59:59 (hh:mm:ss). Invalid entries will display an '**Out of range**' message and return the value to its previous state. To delete errors use the Left Arrow Key ◄.

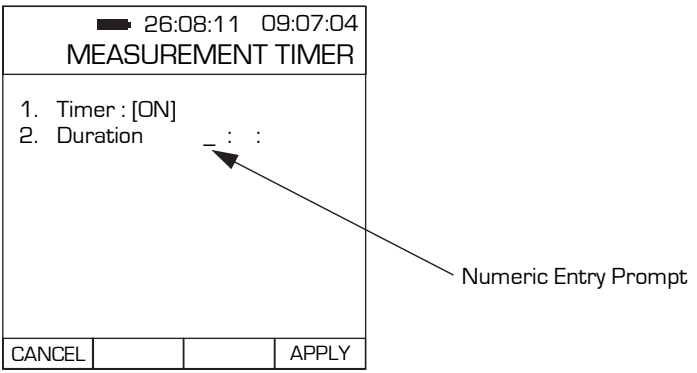


Figure 30 – Measurement Duration Time Entry

Press **Soft Key 1** labelled **CANCEL** to discard any changes or **Soft Key 4** labelled **APPLY** to make any changes made.

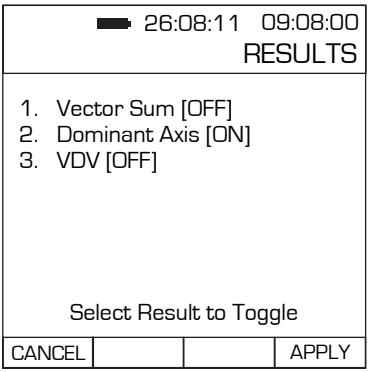
Option 3 – Results

Measurements for Whole Body Vibration can be displayed as any combination of the following: -

- Vector Sum
- Dominant Axis
- VDV

Although the method to display the Results is selected in Real Time mode, the selection determines what is recorded when a recording is taken. The Vector Sum, Dominant Axis and VDV results are all cumulative figures; therefore they can only be viewed from a completed recording.

Press **1** on the keypad to toggle the display of Vector Sum ON /OFF.
Press **2** to toggle the display of Dominant Axis ON / OFF.
Press **3** to toggle the display of VDV ON / OFF.



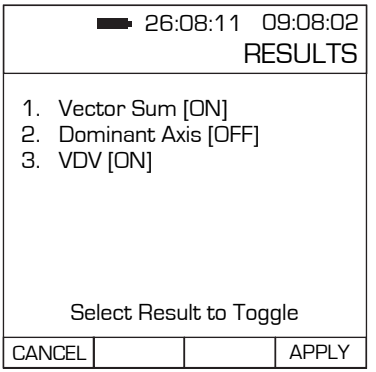


Figure 31 – WBV Results Selection

Press **Soft Key 1** labelled **CANCEL** to discard any changes or **Soft Key 4** labelled **APPLY** to make any changes made.

Option 4 – Personal Exposure

Set Personal Exposure to ON to show Personal Exposure information whilst viewing a saved log or viewing information directly after a recording has just been stopped.

Set Personal Exposure to OFF to hide the Personal Exposure information from display.

The Personal Exposure setting only alters the displayed information, it does not change which parameters are recorded.

Press **1** on the keypad to toggle the display of Personal Exp. ON /OFF.

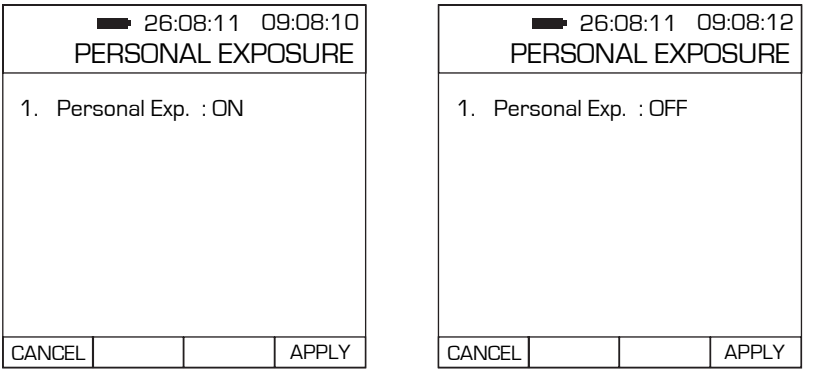


Figure 32 – WBV Personal Exposure Selection

Press **Soft Key 1** labelled **CANCEL** to discard any changes or **Soft Key 4** labelled **APPLY** to make any changes made.

The example screens below show how the display screens differ with setting Personal Exposure On or Off: -

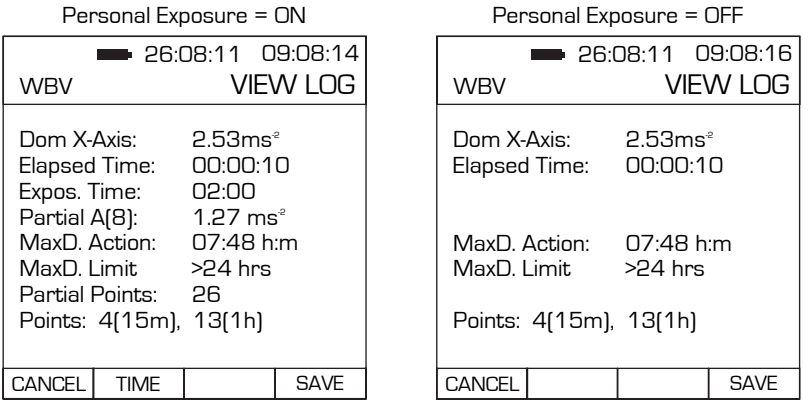


Figure 33 – WBV Display Screens with Personal Exposure On/Off

Option 1 – Time History

Time History is setup whilst in real time mode but is used whilst recording. If the option is turned ON then interval data is recorded with the log at the interval time set.

Press **1** on the keypad to toggle Time History ON / OFF.

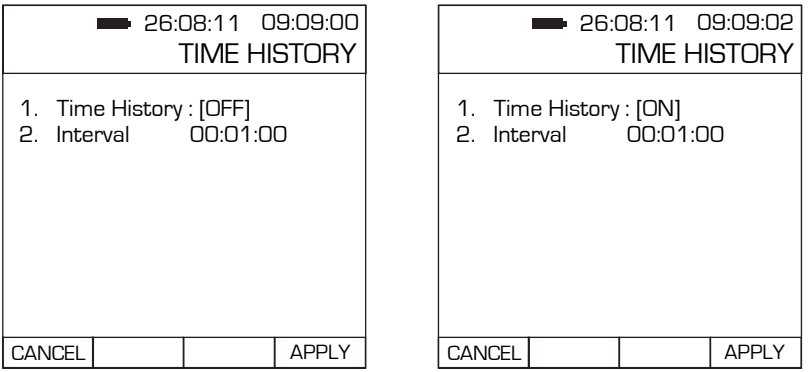


Figure 34 – Toggle Time History ON / OFF

Press **2** on the keypad to enter the Interval Time using the numeric keypad. The maximum interval time permitted is 23:59:59 (hh:mm:ss). Invalid entries will display an '**Out of range**' message and return the value to its previous state. To delete errors use the Left Arrow Key ◄.

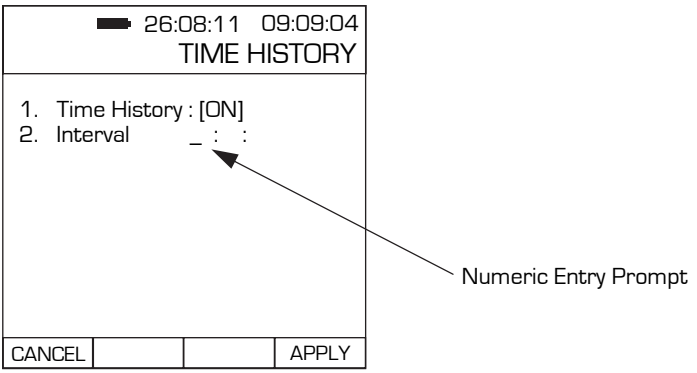


Figure 35 –Time Interval Entry

Press **Soft Key 1** labelled **CANCEL** to discard any changes or **Soft Key 4** labelled **APPLY** to make any changes made.

Option 2 –Timer

Measurement Time is setup whilst in real time mode but is used whilst recording. If the option is turned ON then when a recording is started, its time period is governed by the set measurement time period. The recording automatically stops once the measurement time has elapsed.

Press **1** on the keypad to toggle Measurement Time ON / OFF.

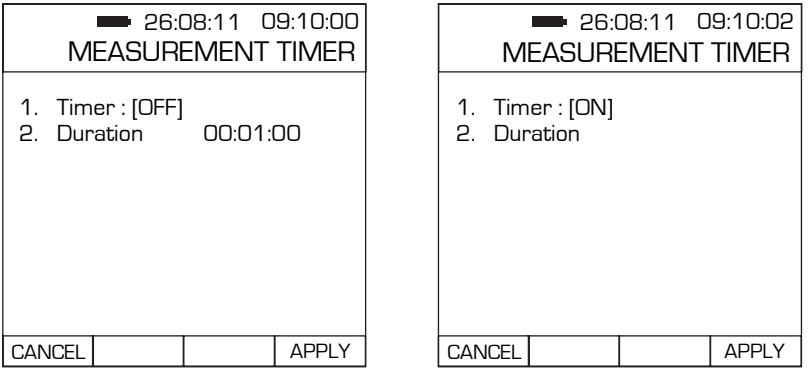


Figure 36 – Toggle Measurement Time ON / OFF

Press **2** on the keypad to enter the Interval Time using the numeric keypad. The maximum interval time permitted is 23:59:59 (hh:mm:ss). Invalid entries will display an '**Out of range**' message and return the value to its previous state. To delete errors use the Left Arrow Key ⦿.

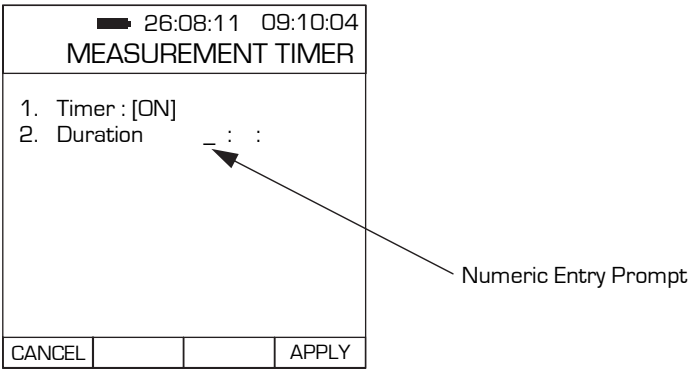


Figure 37 – Measurement Duration Time Entry

Press **Soft Key 1** labelled **CANCEL** to discard any changes or **Soft Key 4** labelled **APPLY** to make any changes made.

Option 3 – Integration

Performing a mathematical integration function on Acceleration gives Velocity whilst integrating Velocity gives Displacement.

- Acceleration is a vector quantity and is the rate of change of velocity with respect to time.
- Velocity is the speed at which an object travels in a particular direction.
- Displacement is a measure of the movement incurred on an object from a resting position.

In Single Axis display mode any of the above methods can be used and once selected the display parameters used for Real Time and Recording Operation are as follows: -

Acceleration			
Aeq	Amax	Arms	Pmax

Velocity			
Veq	Vmax	Vrms	Pmax

Displacement			
Deq	Dmax	Drms	Pmax

Press **1** on the keypad to display Acceleration measurements.
Press **2** to display Velocity measurements.
Press **3** to display Displacement measurements.

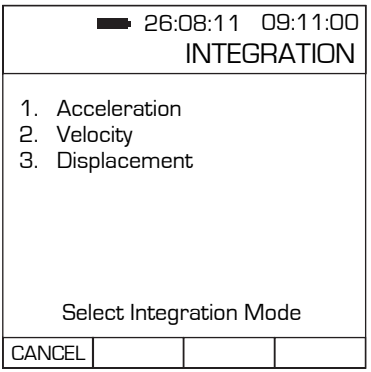


Figure 38 – Single Axis Integration Method

Press **Soft Key 1** labelled **CANCEL** to return to the previous screen without making any changes.

Option 4 – Filters

The following frequency weighted filters are available whilst in Single Axis mode: -

Filter	Description
Ws	Vibration monitoring between 10 and 1000 Hz
Fa	Vibration monitoring between 2 and 20 Hz
Fb	Vibration monitoring between 2 and 250 Hz
Fc	Vibration monitoring between 31.5 and 250 Hz
Fl	Suitable for monitoring at any frequency within the instruments or accelerometers tolerance and without applying high or low frequency roll off within the linear region specified.

Selection of the filter has immediate effect in Real Time Mode and is applied to any subsequent recordings.

Press **1** to activate Filter selection and then use the **Left** and **Right Arrow** Keys ◀▶ to scroll through the available filters.

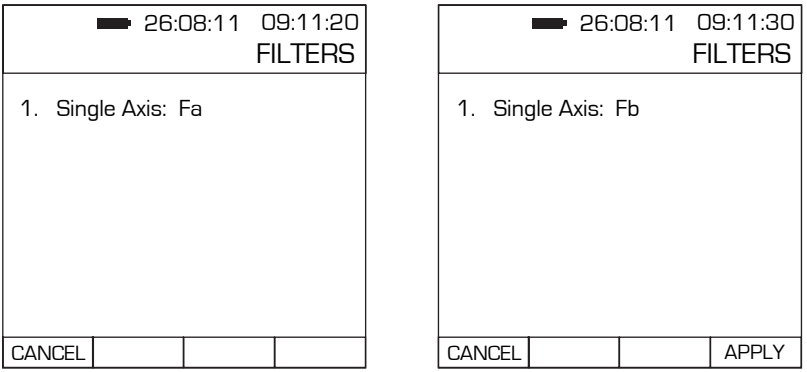


Figure 39 - Single Axis Filter Selection

Press **Soft Key 1** labelled **CANCEL** to discard any changes or **Soft Key 4** labelled **APPLY** to make any changes made.

Option 5 – Accelerometer

In Single Axis Mode it is possible to use accelerometers that produce either 10mv/g or 100mV/g. The single axis accelerometer (KD1003) available from Castle Group produces 100mV/g and is the default sensitivity setting.

To ensure meter readings are correct it is essential that the sensitivity selected matches the transducer being used with the instrument. A mismatched sensitivity setting and transducer will give incorrect measurement readings.

Press **1** for a sensitivity of 10mV/g.
Press **2** for a sensitivity of 100mV/g.

If the sensitivity is changed then a screen prompt informs you to re-calibrate your instrument to the new accelerometer being used. Confirmation of having accepted that the new accelerometer must be calibrated with the new settings of the instrument is achieved by pressing the **OK** button.

Selection of the change then has immediate effect in Real Time Mode and is applied to any subsequent recordings taken in this mode.

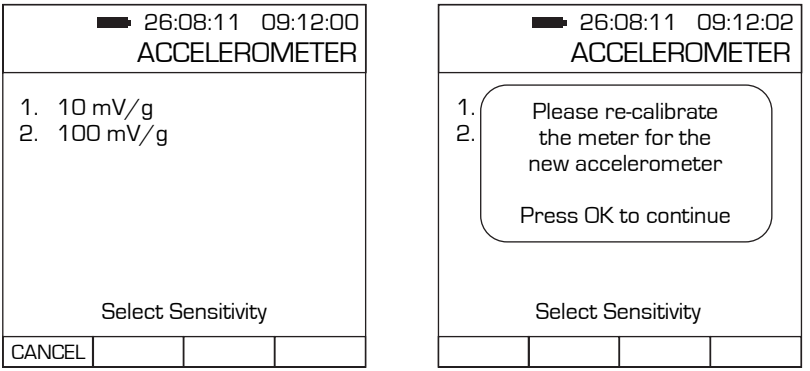


Figure 40 - Single Axis Accelerometer Sensitivity Selection

Press **Soft Key 1** labelled **CANCEL** to return to the previous screen without making any changes.

Option 1 – Time History

Time History is setup whilst in real time mode but is used whilst recording. If the option is turned ON then interval data is recorded with the log at the interval time set.

Press **1** on the keypad to toggle Time History ON / OFF.

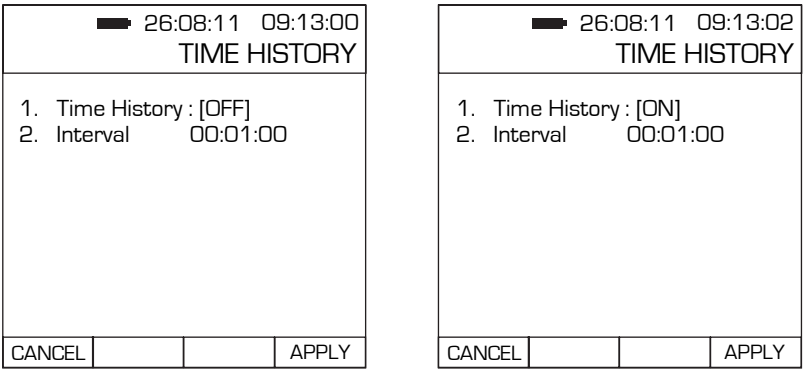


Figure 41 – Toggle Time History ON / OFF

Press **2** on the keypad to enter the Interval Time using the numeric keypad. The maximum interval time permitted is 23:59:59 (hh:mm:ss). Invalid entries will display an '**Out of range**' message and return the value to its previous state. To delete errors use the Left Arrow Key ◄.

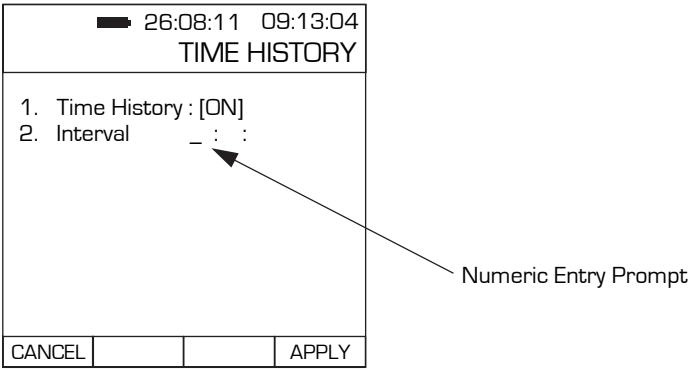


Figure 42 –Time Interval Entry

Press **Soft Key 1** labelled **CANCEL** to discard any changes or **Soft Key 4** labelled **APPLY** to make any changes made.

Option 2 –Timer

Measurement Time is setup whilst in real time mode but is used whilst recording. If the option is turned ON then when a recording is started, its time period is governed by the set measurement time period. The recording automatically stops once the measurement time has elapsed.

Press **1** on the keypad to toggle Measurement Time ON /OFF.

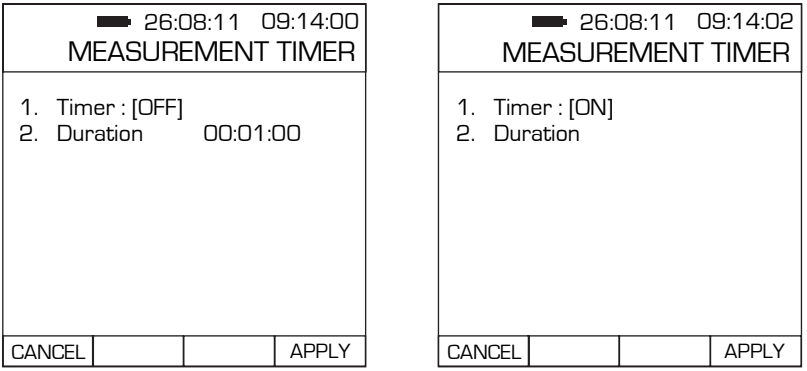


Figure 43 – Toggle Measurement Time ON / OFF

Press **2** on the keypad to enter the Interval Time using the numeric keypad. The maximum interval time permitted is 23:59:59 (hh:mm:ss). Invalid entries will display an '**Out of range**' message and return the value to its previous state. To delete errors use the Left Arrow Key ⦿.

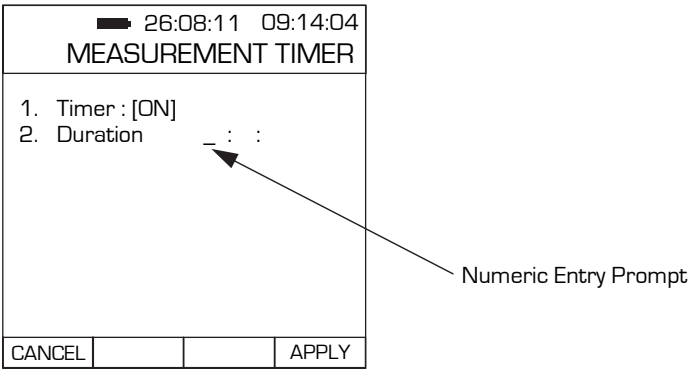


Figure 44 – Measurement Duration Time Entry

Press **Soft Key 1** labelled **CANCEL** to discard any changes or **Soft Key 4** labelled **APPLY** to make any changes made.

Option 3 – Results

Measurements for Custom Mode Vibration can be displayed as any combination of the following: -

- Vector Sum
- Dominant Axis
- VDV

Although the method to display the Results is selected in Real Time mode, the selection determines what is recorded when a recording is taken. The Vector Sum, Dominant Axis and VDV results are all cumulative figures; therefore they can only be viewed from a completed recording.

VDV results are only recorded for metric units.

Press **1** on the keypad to toggle the display of Vector Sum ON /OFF.
Press **2** to toggle the display of Dominant Axis ON / OFF.
Press **3** to toggle the display of VDV ON / OFF.

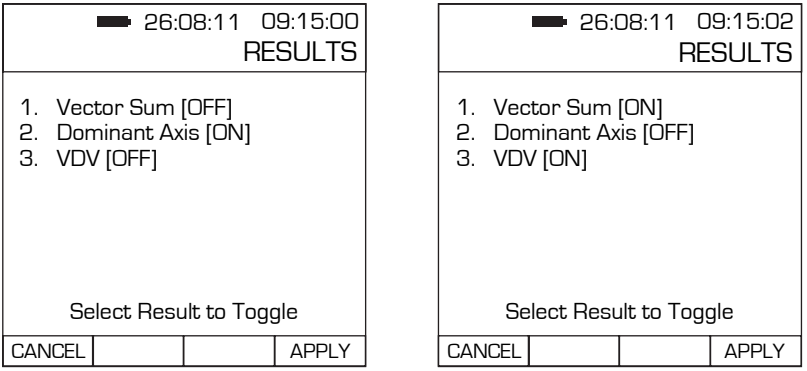


Figure 45 – Custom Mode Results Selection

Press **Soft Key 1** labelled **CANCEL** to discard any changes or **Soft Key 4** labelled **APPLY** to make any changes made.

Option 4 – Integration

Performing a mathematical integration function on Acceleration gives Velocity whilst integrating Velocity gives Displacement.

- Acceleration is a vector quantity and is the rate of change of velocity with respect to time.
- Velocity is the speed at which an object travels in a particular direction.
- Displacement is a measure of the movement incurred on an object from a resting position.

In Custom mode any of the above methods can be used and once selected the display parameters used for Real Time and Recording Operation are as follows: -

Acceleration			
Aeq	Amax	Arms	Pmax

Velocity			
Veq	Vmax	Vrms	Pmax

Displacement			
Deq	Dmax	Drms	Pmax

Press **1** on the keypad to display Acceleration measurements.
Press **2** to display Velocity measurements.
Press **3** to display Displacement measurements.

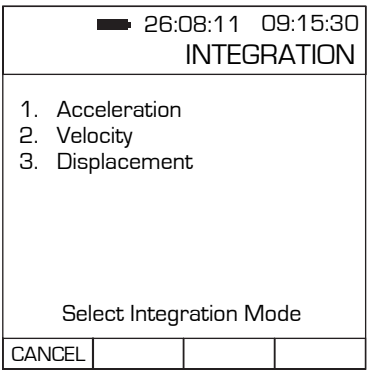


Figure 46 – Custom Mode Integration Method

Whilst displaying Velocity or Displacement, results for VDV, Vector Sum or Dominant Axis are not available.

Press **Soft Key 1** labelled **CANCEL** to return to the previous screen without making any changes.

Option 5 – Criterion

Whilst in Custom Mode it is possible to change all the legislative criterion levels as listed below: -

EAV	Exposure Action Value
ELV	Exposure Limit Value
VDV EAV	Vibration Dose Value Exposure Action Value
VDV ELV	Vibration Dose Value Exposure Limit Value

Action Values

The point at which vibration exposure levels requires controlling to reduce the risk to employees.

Limit Values

The maximum value that vibration exposure levels must not exceed.

Press **1** to toggle Criterion ON/OFF.
Press **2** to enter a new Exposure Action Value.
Press **3** to enter a new Exposure Limit Value.
Press **4** to enter a new VDV Exposure Action Value.
Press **5** to enter a new VDV Exposure Limit Value.

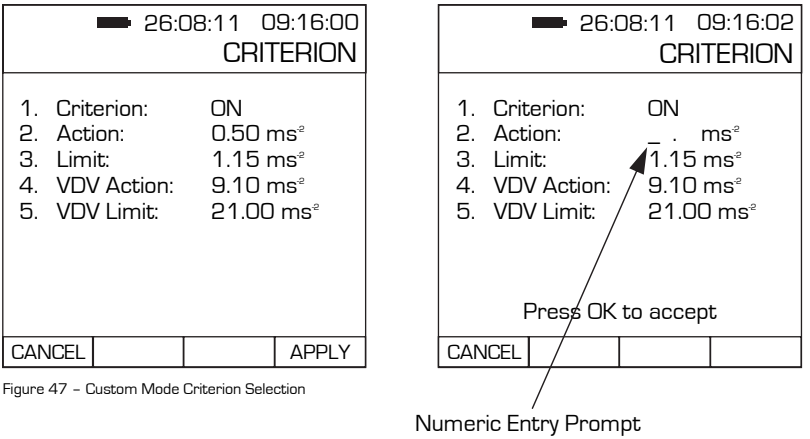


Figure 47 – Custom Mode Criterion Selection

Enter the new value using the numeric keypad, for example enter **0250** for a value of 2.50. The decimal point is applied automatically.

Use the **Left Arrow** key ◄ to delete unwanted input or press the **OK** key to accept the inputted value. An Invalid input will give an '**Out of Range**' error message.

Press **Soft Key 1** labelled **CANCEL** to discard any changes or **Soft Key 4** labelled **APPLY** to make any changes made.

Maximum inputs for each selectable display unit / dB reference are shown in the following tables: -

Metric	
Exposure Action Value	9.99 ms^2
Exposure Limit Value	9.99 ms^2
Vibration Dose Value Exposure Action Value	29.99 ms^2
Vibration Dose Value Exposure Limit Value	29.99 ms^2

dB (Reference : $1e^{-5}$)	
Exposure Action Value	139.99 dB
Exposure Limit Value	139.99 dB
Vibration Dose Value Exposure Action Value	149.54 dB
Vibration Dose Value Exposure Limit Value	149.54 dB

dB (Reference : $1e^{-6}$)	
Exposure Action Value	119.99 dB
Exposure Limit Value	119.99 dB
Vibration Dose Value Exposure Action Value	129.54 dB
Vibration Dose Value Exposure Limit Value	129.54 dB

Imperial	
Exposure Action Value	32.80 fts^2
Exposure Limit Value	32.80 fts^2
Vibration Dose Value Exposure Action Value	98.42 fts^2
Vibration Dose Value Exposure Limit Value	98.42 fts^2

Imperial	
Exposure Action Value	1.01 g
Exposure Limit Value	1.01 g
Vibration Dose Value Exposure Action Value	3.05 g
Vibration Dose Value Exposure Limit Value	3.05 g

Option 6 – Filters

Custom Mode allows the selection of any of the following frequency weighting filters independently for each axis: -

Wb, Wc, Wd, We, Wh, Wj, Wk, Wm, Ws, Fa, Fb, Fc, and Fl

See '**Frequency Weighting Filters**' under '**Measuring Vibration**' in **Chapter 3** for a full description of each weighting.

Selection of the filter has immediate effect in Real Time Mode and is applied to any subsequent recordings.

Press **1**, **2** or **3** to activate the Filter selection for the axis required and then use the **Left** and **Right Arrow** Keys ◄► to scroll through the available filters.

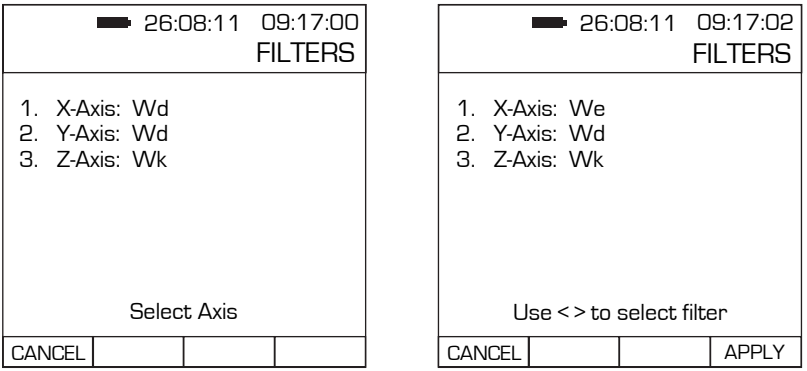


Figure 48 – Custom Mode Filter Selection

Press **Soft Key 1** labelled **CANCEL** to discard any changes or **Soft Key 4** labelled **APPLY** to make any changes made.

Option 7 – Accelerometer

In Custom Mode it is possible to use accelerometers that produce either 10mv/g , 100mV/g or 1000mV/g. By default in Custom Mode this selection is 100mV/g.

Either 100mV/g or 1000mV/g will be displayed depending on which seat pad has been selected for Whole Body Vibration. See page 80 for more information.

To ensure meter readings are correct it is essential that the sensitivity selected matches the transducer being used with the instrument. A mismatched sensitivity setting and transducer will give incorrect measurement readings.

Press **1** for a sensitivity of 10mV/g.
Press **2** for a sensitivity of 100mV/g.

or

Press **1** for a sensitivity of 10mV/g.
Press **2** for a sensitivity of 1000mV/g.

If the sensitivity is changed then a screen prompt informs you to re-calibrate your instrument to the new accelerometer being used. Confirmation of having accepted that the new accelerometer must be calibrated with the new settings of the instrument is achieved by pressing the **OK** button.

Selection of the change then has immediate effect in Real Time Mode and is applied to any subsequent recordings taken in this mode.

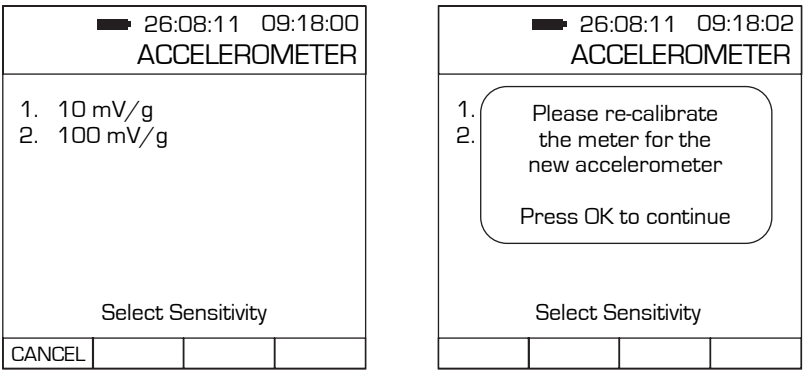


Figure 49 – Custom Mode Accelerometer Sensitivity Selection

Press **Soft Key 1** labelled **CANCEL** to return to the previous screen without making any changes.

Option 1 (Page 2) – Correction Factor

A correction factor is a multiplying factor that is applied to each axis individually. By default the X and Y axis have a correction factor of 1.4 whereas the Z axis has a correction factor of 1.0.

Press **1** on the keypad to enter the X Axis correction factor.
Press **2** to enter the Y Axis correction factor.
Press **3** to enter the Z Axis correction factor.

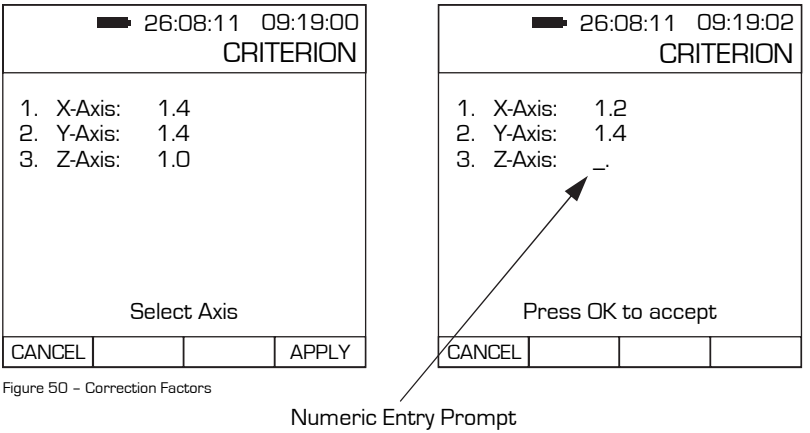


Figure 50 – Correction Factors

Enter the correction factor using the numeric keypad. The decimal point is applied automatically.

Use the **Left Arrow** key ◄ to delete unwanted input or press the **OK** key to accept the inputted value. An Invalid input will give an '**Out of Range**' error message; the valid range is 1.0 to 2.0.

Press **Soft Key 1** labelled **CANCEL** to discard any changes or **Soft Key 4** labelled **APPLY** to make any changes made.

The correction factor is automatically applied to all displayed figures and results where applicable.

Option 2 (page 2) – Personal Exposure

Set Personal Exposure to ON to show Personal Exposure information whilst viewing a saved log or viewing information directly after a recording has just been stopped.

Set Personal Exposure to OFF to hide the Personal Exposure information from display.

The Personal Exposure setting only alters the displayed information, it does not change which parameters are recorded.

Press **1** on the keypad to toggle the display of Personal Exp. ON /OFF.

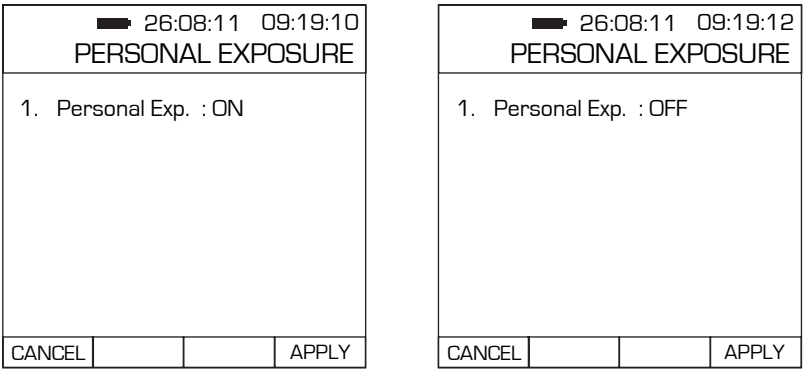


Figure 51 – Custom Mode Personal Exposure Selection

Press **Soft Key 1** labelled **CANCEL** to discard any changes or **Soft Key 4** labelled **APPLY** to make any changes made.

The example screens below show how the display screens differ with setting Personal Exposure On or Off: -

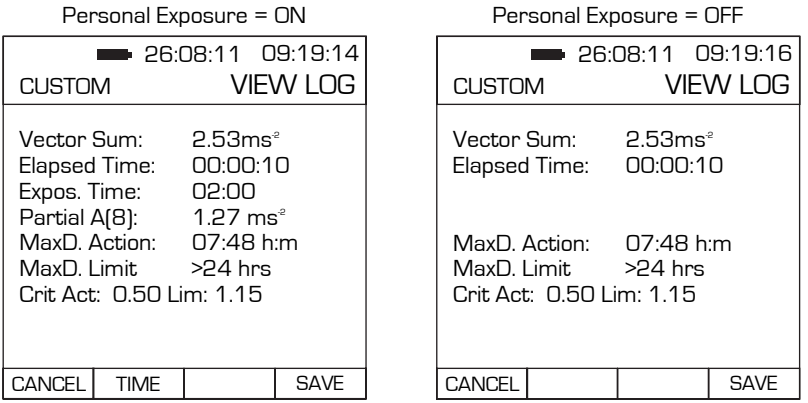


Figure 52 – Custom Mode Display Screens with Personal Exposure On/Off

Chapter 6

Recording Operation

Recording is achieved by pressing the **STOP** / **RECORD** Key  on your instruments keypad.

All settings/parameters from within SETUP in Real Time mode will be used or logged when a recording is started.

It is not possible to reset any parameter, change range or adjust any settings whilst recording.

Recording operation can be identified by having a duration value that flashes and shows the total duration that the recording has been running.

Scrolling between the four instantaneous display parameter screens **Arms**, **Aeq**, **Amax** or **Pmax** is achieved using the **Left** and **Right Arrow** Keys ◄►. The available parameters whilst recording are the same as in Real Time operation. See **Display Parameters** under **Real Time Operation** for more information on the display parameters.

By pressing the **PAUSE** Key  on the keypad it is possible to view a snapshot of the data values at that point in time. Use the **Left** and **Right Arrow** Keys ◄► to scroll between parameters. To revert back to instantaneous readings press the **PAUSE** Key once again. This function is a visual aid only and **does not** pause the duration time of the recording and all data values continue to be calculated and recorded as normal.

Cumulative parameters that have been selected in **SETUP** are only available when the recording has ended and as with Real Time mode the dominant axis is identified by having the **>** character displayed next to it.

The **Power On/Off** Key  is disabled whilst Recording to prevent the instrument from accidentally entering the Shut Down screen and possible data loss.

Ending a Recording

To stop recording at any time, press the **STOP** / **RECORD** Key  on your instruments keypad again and you will be taken to the Calculation Display Screen.

Calculation Display Screen

Please be aware that recordings are not saved on the Calculation Screen until **Soft Key 4** labelled **SAVE** is pressed.

The parameters displayed on the Calculation screen depend on whether the recording is HARM, WHOLE BODY, SINGLE or CUSTOM and also on the settings selected within SETUP for each display mode.

For any mode the **Left** and **Right Arrow** Keys ◀▶ can be used to scroll between the different calculation screens. *Time histories can only be viewed using the software VibdataPro or via a direct print using a Castle GA505 Portable Printer, both of which can be purchased separately if required.*

Whilst the Exposure Time is displayed it can be adjusted by pressing **Soft Key 2** labelled **TIME** and then entering a new exposure time using the numeric keypad, for example enter **0430** for a time of 4 hours and 30 minutes.

Use the **Left Arrow** key ◀ to delete unwanted input or press the **OK** key to accept the inputted value. The maximum allowable input is 11:59 (11 hours, 59 minutes). An Invalid input will give an '**Out of Range**' error message.

All relevant calculations are automatically re-made when the Exposure Time is altered.

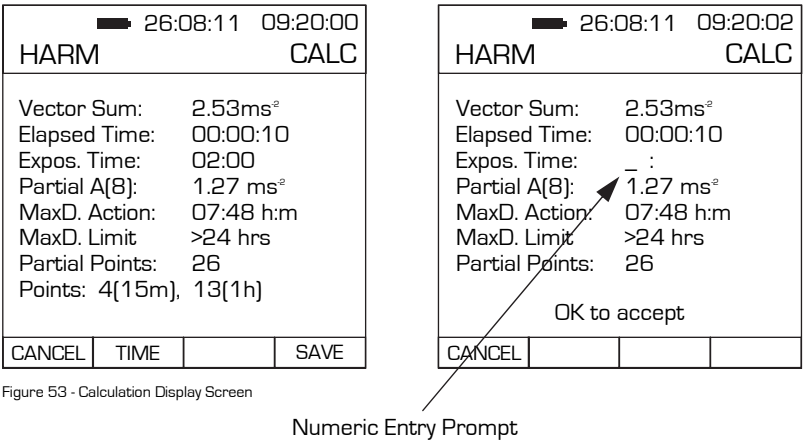


Figure 53 - Calculation Display Screen

To Exit back to Real Time Operation without saving the recording press **Soft Key 1** labelled **CANCEL** or to save the recording press **Soft Key 4** labelled **SAVE**.

In accordance with the European Union Physical Agents Directive 2002/44/EC, whole body calculations have a multiplication factor of 1.4 applied to the x and y axis. These values are also the default for **CUSTOM** but may be changed under **SETUP**.

Also in accordance with the European Union Physical Agents Directive, each mode has been allocated an **Action Level** and upper **Limit Level**, which are set as follows: -

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

Whole Body (Dominant Axis)	
Action Level	0.50 ms^{-2}
Limit Level	1.15 ms^{-2}

Whole Body (Vibration Dose Value)	
Action Level	9.10 ms^{-2}
Limit Level	21.00 ms^{-2}

CUSTOM vibration allows the user to change Action and Limit levels. See **Option 5 - Criterion** under **Custom Vibration Mode (CUSTOM)** for more information.

Saving The Recording

Pressing **Soft Key 4** labelled **SAVE** from the Calculation Display Screen will take you to the Save Recording display and entry screen.

This screen is identified with **SAVING LOG** displayed under the real time clock.

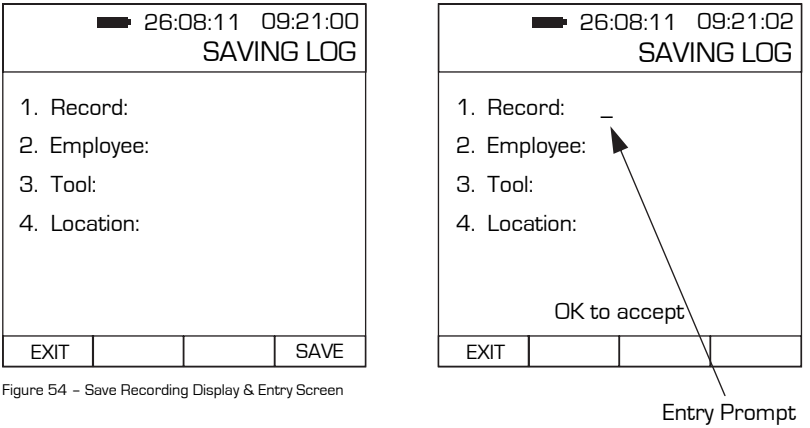


Figure 54 – Save Recording Display & Entry Screen

Press **1**, **2**, **3** or **4** to enter specific details to be saved with the recording. A prompt will appear at the right hand side of your selected field awaiting input from the keypad.

If the field accepts numbers and letters then you can switch between these using **Soft Key 2** which will be labelled **NUMBER** or **LETTER**.

If the field accepts letters then you can toggle between uppercase and lowercase using **Soft Key 3** labelled either **LOWER** or **UPPER**.

Where text entry is allowable you can enter a space using **Soft Key 4** labelled **SPACE**.

To delete errors use the Left Arrow Key ◄.

To accept any field entry press **OK**.

When you have entered all details press **Soft Key 4** labelled **SAVE** to save your recording and any details entered, to the internal flash memory. Over 3000 recordings without time histories can be saved.

Recordings saved on your instrument will not be lost when the batteries are removed.

Chapter 7

Main Menu

The Main Menu is activated by pressing the **MENU Key** (menu) and is identified by **MAIN MENU** under the real time clock.

In general, pressing the **MENU Key** once will display the Main Menu Screen. From certain display screens pressing the **MENU Key** will return operation to the Real Time Display Screen, press the **MENU Key** once more to activate the Main Menu.

From the Main Menu it is possible to: -

- Create or Load saved recording searches
- View, Delete and Print recordings
- Create, Edit and Load templates
- Calibrate the meter to match the transducer/s used
- Adjust the Time, Date, Contrast and Backlight settings
- View Instrument Specific Information

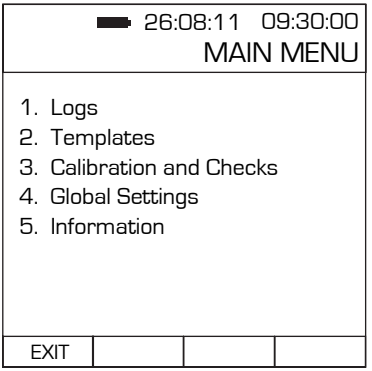


Figure 55 – Main Menu Screen

- Select option 1 '**Logs**' to search, view, delete or print recordings.
- Select option 2 '**Templates**' to create, edit or load a template.
- Select option 3 '**Calibration**' to calibrate or check your instrument.
- Select option 4 '**Global Settings**' to adjust the calendar or display settings.
- Select option 5 '**Information**' to view information about the Excieo meter.

Press **Soft Key 1** labelled **EXIT** or the **MENU Key** (menu) to return to Real Time operation.

Logs

Selecting option 1 from the **Main Menu** will display the following screen.

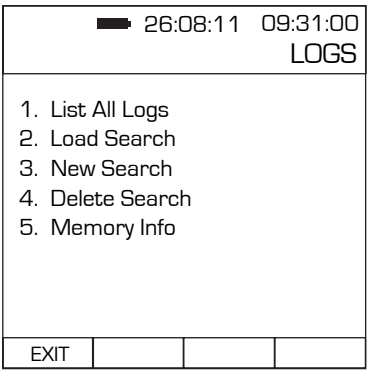


Figure 56 – Logs Option Screen

List All Logs

To display a list of all recordings (logs) saved in the internal memory, select option 1 '**List All Logs**'. If more than 6 recordings exist then **Soft Keys 2** and **3** labelled **UP** and **DOWN** respectively can be used to scroll between the pages of available recordings. The current Page Number is displayed at the top left of the screen as shown below. To scroll between the log detail screens use the **Left** and **Right Arrow** Keys ◄►. Press the list number of the log to display the recorded parameters or press **Soft Key 1** labelled **EXIT** to return to the previous screen.

The recording list is displayed and sorted by the parameter having the sort mark next to it. In the example below the list is sorted by **REC**.

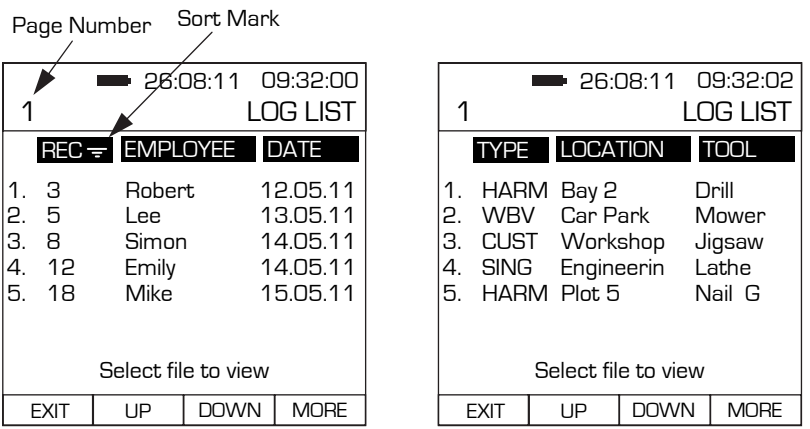


Figure 57 – Log List Screens

Press **Soft Key 4** labelled **MORE** to display a popup that enables sorting of the log list or to mark recordings.

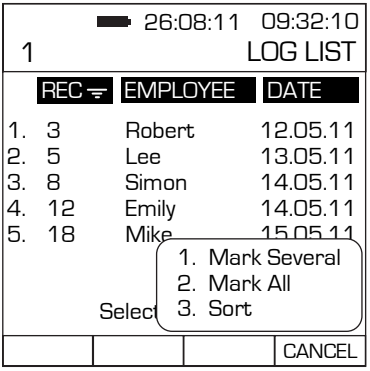


Figure 58 - Mark Recordings or Sort List Popup Menu

- Select option 1 '**Mark Several**' to mark individual or multiple recordings.
- Select option 2 '**Mark All**' to mark all saved recordings.
- Select option 3 '**Sort**' to sort the way the log list is displayed.

Marked Recordings

To mark an individual recording press the number on the keypad that corresponds with the recording. If more than 6 recordings exist then **Soft Keys 2** and **3** labelled **UP** and **DOWN** respectively can be used to scroll between the pages of available recordings. The current Page Number is displayed at the top left of the screen and marked recordings have the list number highlighted. To unmark any marked recordings press the number corresponding with the recording or press **Soft Key 1** labelled **CLEAR** to clear all marked recordings and return to the Log List.

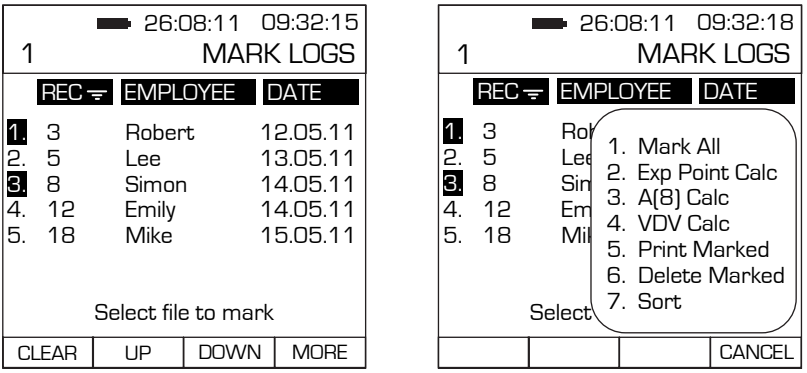


Figure 59 - Mark Recordings

Press **Soft Key 4** labelled **MORE** to display a further popup menu with options relevant to marked recordings.

Note that Option 2 '**Exp Point Calc**' is not shown if Custom mode recordings are marked.

Mark All

Use this option to mark all the saved recordings.

Exp Point Calc

Select to calculate the Exposure Point Total of the combined marked recordings.

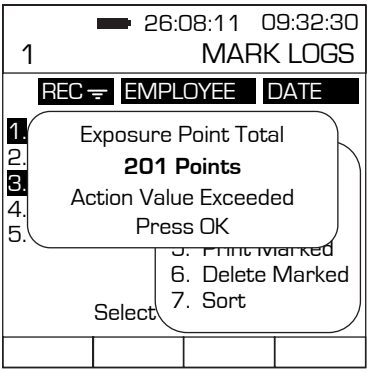
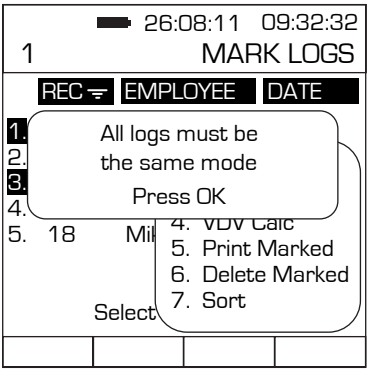


Figure 60 – Exposure Point Total Calculator

All logs must be of the same mode for this function excluding single axis and custom mode recordings which cannot be combined and therefore will not work under the Exposure Point calculator. The examples below show mismatched modes and single axis error messages: -



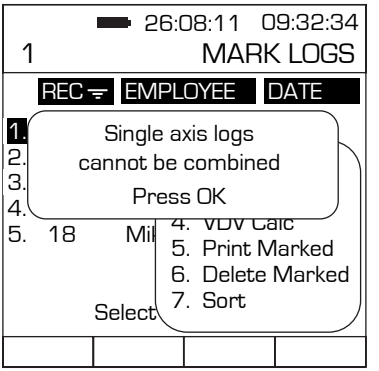


Figure 61 – Exposure Point Calculator Error Messages

Press the **OK** key to return to the previous screen.

Select to calculate the daily exposure A(8) of the combined marked recordings.

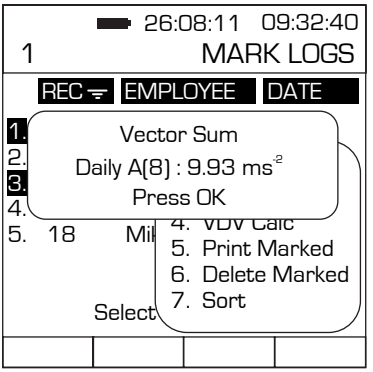
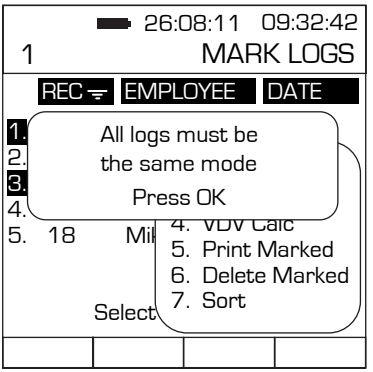


Figure 62 - A(8) Calculator

All logs must be of the same mode for this function excluding single axis mode recordings which cannot be combined and therefore will not work under the A(8) calculator. The examples below show mismatched modes and single axis error messages: -



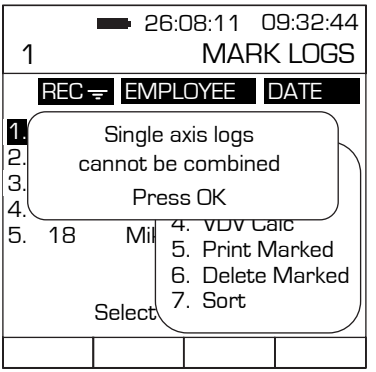


Figure 63 - A(8) Calculator Error Messages

Press the **OK** key to return to the previous screen.

Select to calculate the daily exposure VDV on the combined marked recordings.

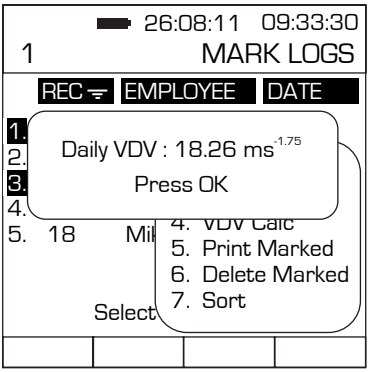


Figure 64 - VDV Calculator

All logs must be of the same mode for this function and must also have been recorded with VDV values. The example below shows the reported error message if other selections are attempted: -

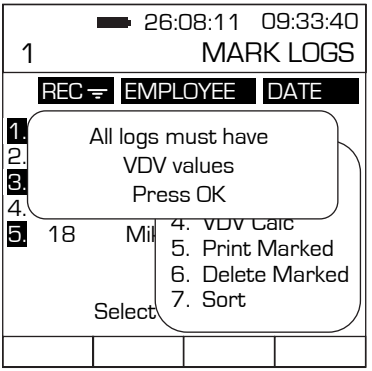


Figure 65 - VDV Calculator Error Messages

Press the **OK** key to return to the previous screen.

Selecting this option allows the marked recordings to be printed to the Castle GA505 portable thermal printer (purchased separately).

To ensure trouble free printing, ensure that the printer is turned on and in online mode, connected to the 9 pin socket at the right hand side of the Excieo and sufficient paper inserted in the printer.

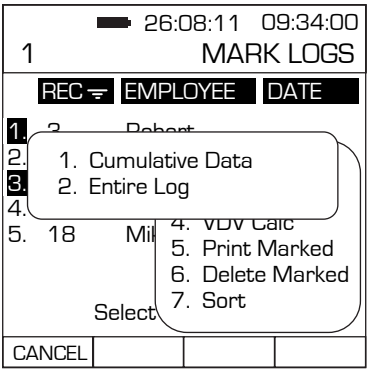


Figure 66 – Print Marked Recordings

- Select option 1 '**Cumulative Data**' to print cumulative data only.
- Select option 2 '**Entire Log**' to print all cumulative and interval data.

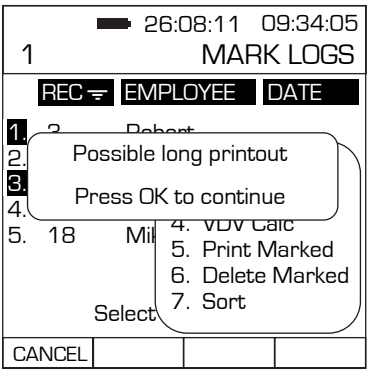


Figure 67 – Print Marked Recordings Warning

Printing multiple recordings may produce a long printout especially if interval data is printed.

Press **Soft Key 1** labelled **CANCEL** to return to the previous screen or cancel the print whilst printing. Please be aware that the printer buffer is emptied before the printing ceases.

Delete Marked

Selecting this option allows the marked recordings to be permanently deleted from memory.

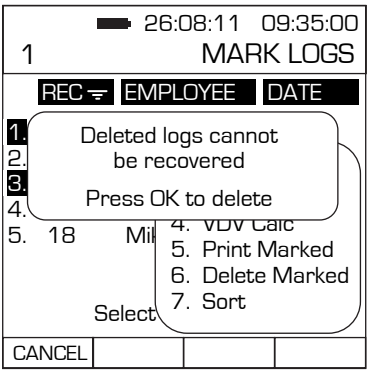


Figure 68 – Delete Marked Recordings

Press **OK** to delete all the marked recordings or press **Soft Key 1** labelled **CANCEL** to return to the previous screen without deleting. Once recordings are deleted they are not recoverable. Caution is advised if deleting multiple recordings.

Sort

Selecting this option allows the recording list to be sorted by columns for any of the criteria selectable. As an example to sort the recording list by Date, select option 3 labelled **Date** or press **Soft Key 1** labelled **EXIT** to return to the previous page.

This option is also available directly through the **LOG LIST** popup menu **option 3**. Both perform exactly the same function.

Figure 69 – Sort Options

Load Search

Searches can be loaded to search the entire list of saved recordings quickly and efficiently to aid in finding the specific recording you wish to load.

To display a list of all saved searches select option 2 '**Load Search**'.

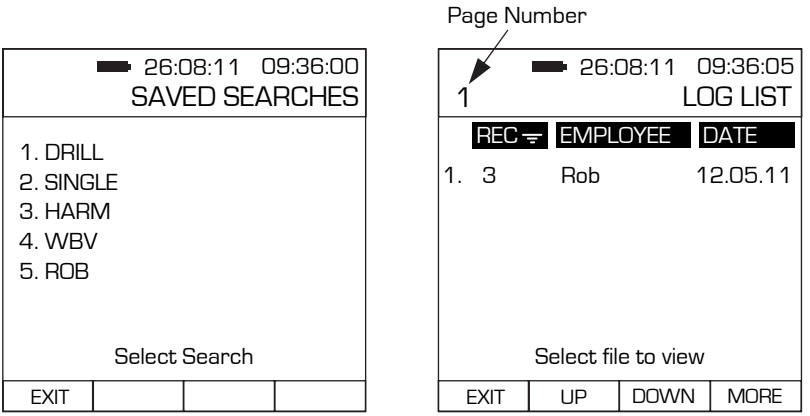


Figure 70 - Load Saved Search Screens

In the example shown above the saved search '**DRILL**' was selected by pressing 1 on the keypad. The search created called '**DRILL**' is to search all recordings that have used a tool named '**Drill**'. The **LOG LIST** screen will be displayed listing all recordings that meet this criterion and these recordings can be loaded directly from this screen.

If more than 6 recordings from the search exist then **Soft Keys 2** and **3** labelled **UP** and **DOWN** respectively can be used to scroll between the pages of available recordings that meet the search criterion. The current Page Number is displayed at the top left of the screen.

Press **Soft Key 1** labelled **EXIT** to return to the previous screen without loading a recording.

New Search

To create a new search select option 3 '**New Search**'.

Searches can be created to aid in searching for saved recordings. The criteria that can be saved with the search are shown below: -

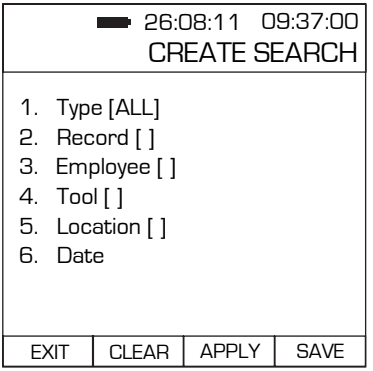
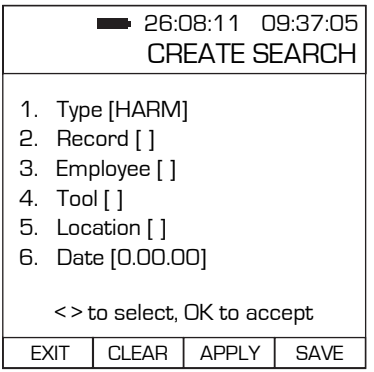


Figure 71 – Create Search

Select which criteria you wish to create in the search by selecting 1 to 6 from the options listed. Depending on which option is selected the criteria is either entered using the alpha / numeric keypad or using the **Left** and **Right Arrow** Keys ◀ ▶ to scroll through the available criteria.

Use the **Left Arrow** key ◀ to delete unwanted input or press the **OK** key to accept the inputted value. An Invalid date input will give an '**Out of Range**' error message.



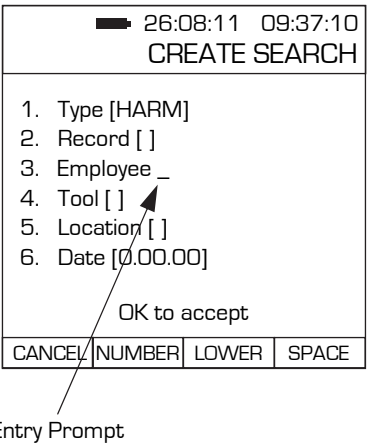


Figure 72 – Create Search Entry Prompts

Search criteria entered is not case sensitive but the spelling of both items must match exactly.

Depending on the option selected, press **Soft Key 1** labelled **EXIT** or **CANCEL** to return to the previous screen without creating a search.

Press **Soft Key 2** labelled **CLEAR** to reset all the criteria.

Use **Soft Key 3** labelled **APPLY** to instantly make the search and display the found recording list. Using this option will not save the search.

To save the criteria as a search press **Soft Key 4** labelled **SAVE**. Use **Soft Key 1** labelled **CANCEL** to return to the previous screen without saving. Use **Soft Key 2** to toggle between **NUMBER** and **LETTER** entry, use **Soft Key 3** to toggle between **UPPER** and **LOWER** case when **LETTER** is selected. Use **Soft Key 4** to enter a **SPACE**.

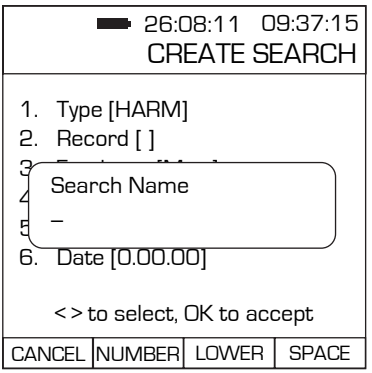


Figure 73 – Save Search

A total of 5 searches can be created and saved. If none of the 5 slots are free and a save is attempted you will be presented with the following: -

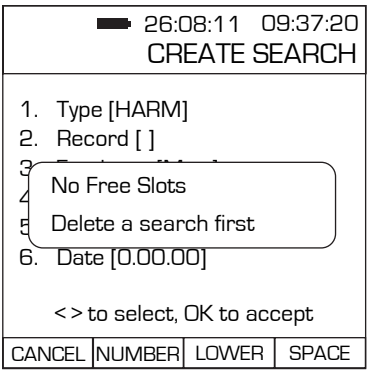


Figure 74 – Save Search Error Message

If this message appears then a search must be deleted before a new search can be saved.

Delete Search

To delete a search select option 4 '**Delete Search**'.

The list of saved searches will be displayed up to a maximum of 5. Press the number on the keypad corresponding to the search that you wish to delete.

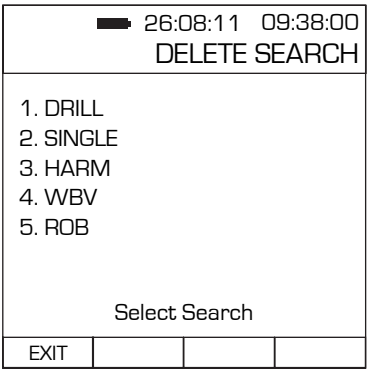


Figure 75 – Delete Search

Press **Soft Key 1** labelled **EXIT** to return to the previous screen.

Memory Info

To view on screen how much memory has been used with saved recordings select option 4 '**Memory Info**'. Over 3000 recordings without time histories can be saved.

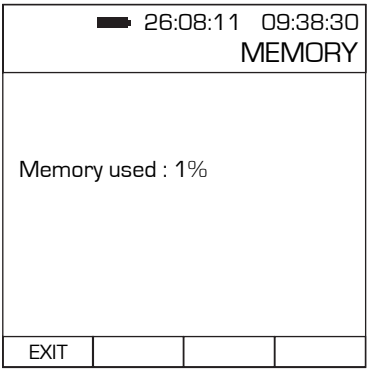


Figure 76 – Memory Info

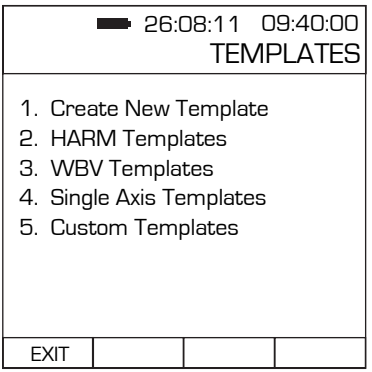
Press **Soft Key 1** labelled **EXIT** to return to the previous screen.

Templates

Templates can be used to hold settings for specific or generic tasks that can quickly be loaded to ensure that the meter is in the correct mode with the correct settings applied automatically.

Select option 2 from the **Main Menu** to display the following screen.

MULTI PURPOSE



HARM or SINGLE

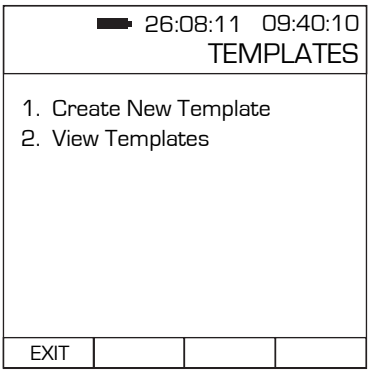


Figure 77 – Templates

To create and save a new template select option 1 '**Create New Template**'.

To display a list of templates to **Load**, **Edit** or **Delete** using a Multi-Purpose instrument select either: -

- Option 2 for HARM templates
- Option 3 for WBV templates
- Option 4 for Single Axis Templates
- Option 5 for Custom Mode templates

To display a list of templates to **Load**, **Edit** or **Delete** using SINGLE or HARM variations of the Excieo use option 2 '**View Templates**'.

To return to the previous screen press **Soft Key 1** labelled **EXIT**.

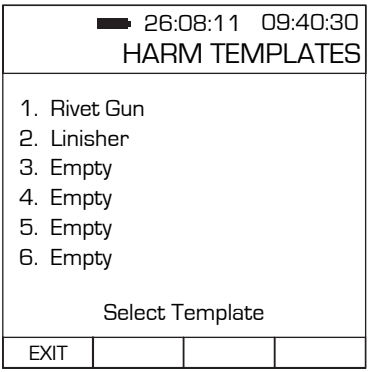


Figure 78 - Template Selection

From the list of available templates select a template by pressing the corresponding number on the keypad.

Press **Soft Key 1** labelled **EXIT** to return to the previous screen without selecting a template.

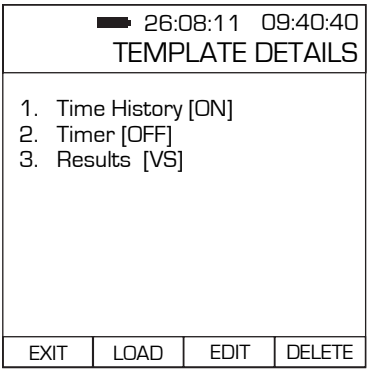


Figure 79 - Template Details

Press **Soft Key 1** labelled **EXIT** to return to the previous screen.

Press **Soft Key 2** labelled **LOAD** to load the options within the template and return to the Real Time Measurement Screen.

To edit the settings within the template press **Soft Key 3** labelled **EDIT**. Default settings are shown under **Create New Template**.

To delete the selected template press **Soft Key 4** labelled **DELETE**.

Create New Template

For the Multi Purpose Excieo model select which type of template you wish to create by selecting one of the listed options or to return to the previous screen without creating a template press **Soft Key 1** labelled **EXIT**.

SINGLE or HARM Excieo variations do not allow the creation of other types of templates and hence as no selection is required you are taken directly to the selectable options for the model variation type.

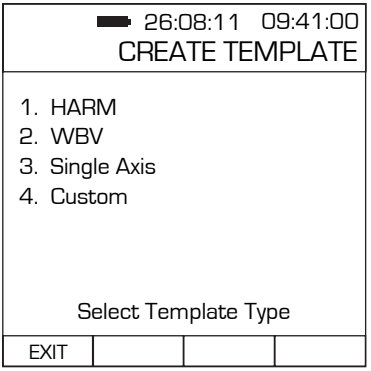
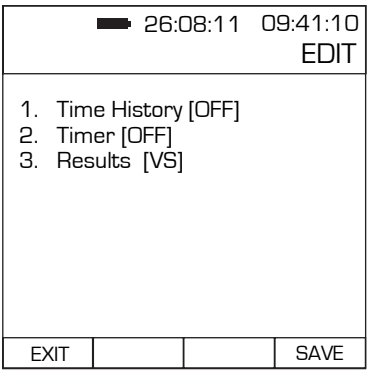


Figure 80 – Create Template

A maximum of 6 templates can be created and saved for each mode, if no space is available to create a template the message '**No free slots**' will be displayed. Existing templates would need deleting before new templates can be created.

The available options when creating a template differ depending on the template mode that is being created. Default options are shown below: -

HARM



WBV

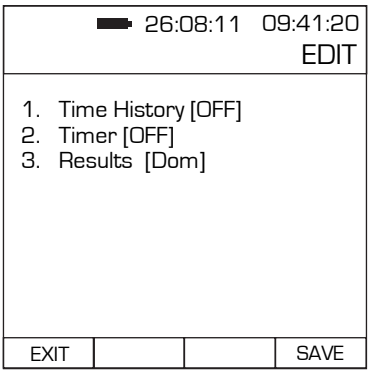
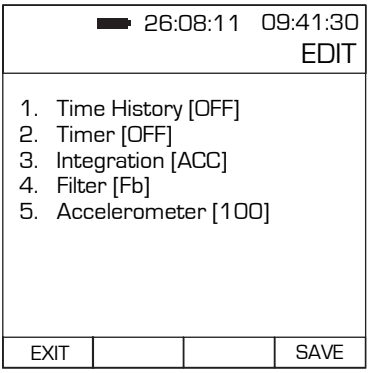
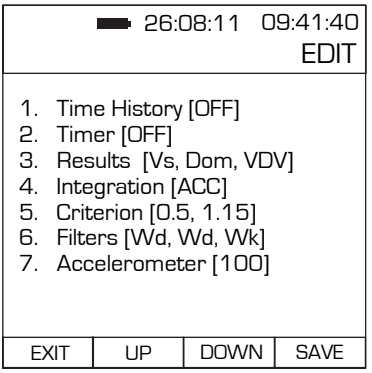


Figure 81 - Default Template Options (HARM, WBV)

SINGLE



CUSTOM



CUSTOM

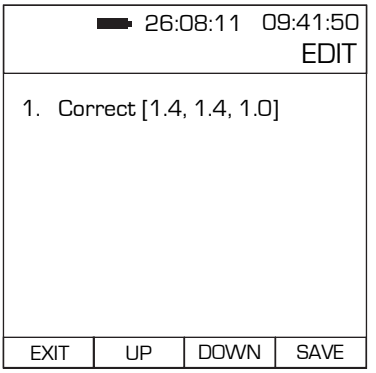


Figure 82 – Default Template Options (SINGLE, CUSTOM)

To change the settings of an option press its corresponding number on the keypad. A new screen will be displayed where the settings of the option selected can be changed. See **Setup Options** under **Chapter 5** for details on the available options and how to change them.

To return to Real Time Mode press **Soft Key 1** labelled **EXIT**.

To save the template press **Soft Key 4** labelled **SAVE**.

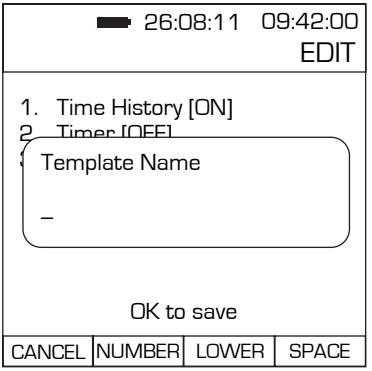


Figure 83 – Saving Templates

Use **Soft Key 1** labelled **CANCEL** to return to the previous screen without saving.

Use **Soft Key 2** to toggle between **NUMBER** and **LETTER** entry and **Soft Key 3** to toggle between **UPPER** and **LOWER** case when **LETTER** is selected.

To enter a space in the template name use **Soft Key 4** labelled **SPACE**. A maximum of 15 characters may be used in the template name.

Use the **Left Arrow** key ◄ to delete unwanted input and press the **OK** key to accept and save the template.

Selecting option 3 from the **Main Menu** will show the Calibration Selection Screen below.

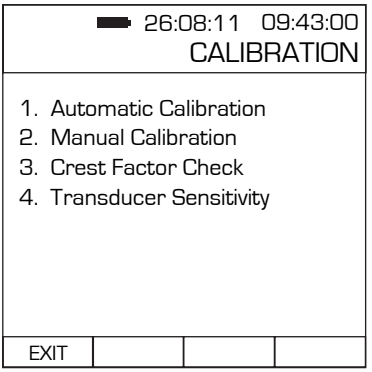


Figure 84 – Calibration Selection

To exit to the previous screen press **Soft Key 1** labelled **EXIT**.

Automatic Calibration

Automatic Calibration is selected when you wish the instrument to determine the individual axis coefficients for the specific transducer you are using; hence a vibration calibrator is required.

The Multi-purpose type Excieo instrument (GA2005M) allows the calibration of the following transducers: -

Hand Arm (10mV/g) – HARM mode
Whole Body (100mV/g) or (1000mV/g) – WBV mode
Single Axis (100mV/g) or (10mV/g)– SINGLE mode
Custom (10mV/g) or (100mV/g) or (1000mV/g) – Custom Mode

Where different transducer sensitivities are available it is only possible to store calibration information for one transducer. You will be asked to re-calibrate if the Accelerometer sensitivity is changed.

The GA2005H HARM Excieo meter only allows for calibration of a 10mV/g tri-axial transducer.

The GA2005S Single Axis Excieo meter only allows for the calibration of an individual axis specifically for single axis transducers. 10mV/g or 100mV/g transducer sensitivities can be selected however it is only possible to store calibration information for either 10mV/g or 100mV/g and not both. You will be asked to re-calibrate if the Accelerometer sensitivity is changed.

It is recommended that automatic calibration is performed using the Castle Vibration Calibrator GA606 in conjunction with its supplied Petro wax mounting compound for transducers other than KD1009. Calibration of transducer

KD1009 requires specialised equipment and should be returned to Castle's calibration laboratory for correct calibration.

Once calibrated, the axis coefficients will be saved until the next calibration.

For automatic calibration of WBV the transducer (KD1007) must be removed from the seat pad. This is achieved by removing the top cover plate of the seat pad by unscrewing the four visible screws. The top cover plate has the description and serial number etched on it.

The centre screw on the underside now needs removing to allow the transducer to be freed from the seat pad. Carefully slide the cable and transducer through the seat pad until an adequate length is free to allow calibration. The illustration below shows the front plate and transducer removed from the seat pad.

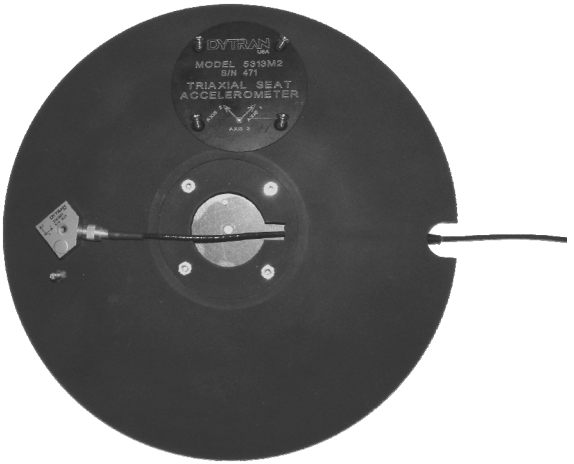


Figure 85 - WBV Transducer Removal

NEVER attach or remove a transducer to / from a mounting plate whilst the mounting plate is attached to the calibrator. Always remove the mounting plate first, attach or remove the transducer and then screw the mounting plate to the calibrator. Failure to do so may result in permanent damage to your vibration calibrator and invalidate its warranty.

NEVER use the cable clamp as leverage when fastening or removing your transducer, doing so may result in damage to your cable which may lead to incorrect measurement results being obtained.

Once calibration of the WBV seat pad is completed, re-assembly is required. Ensure that the transducer is fitted with the etching towards the top plate. When fitting the top plate ensure that the axis orientation on the cover plate etching matches the orientation of those on the transducer.

Incorrect seat pad assembly whereby axis orientation of cover plate and transducer are not aligned may result in incorrect axis readings whilst measuring or recording.

Choosing option 1 from the Calibration Selection Screen will display the **AUTO CAL** screen shown below. The displayed mode may vary depending on the instrument version and/or previous selections and also for GA2005H and GA2005S Excieo models, MODE selection using **Soft Key 4** is not possible.

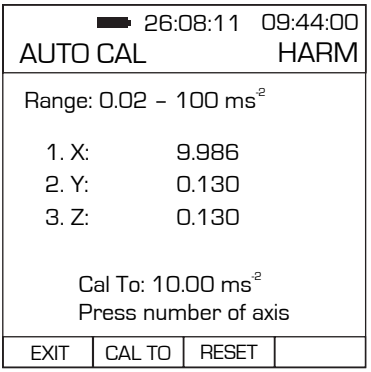


Figure 87 – Automatic Calibration (Type H)

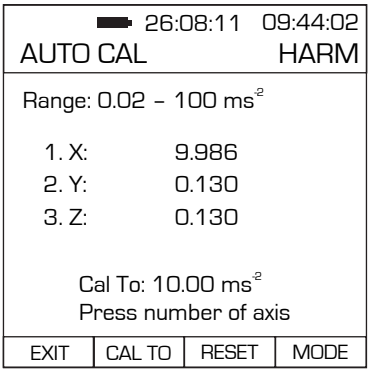


Figure 86 – Automatic Calibration (Type M)

For the multi-purpose Excieo variation, use **Soft Key 4** labelled **MODE** to display a popup which allows the selection of the available modes. Press **Soft Key 4** labelled **CANCEL** to return to the previous screen without changing the calibration mode otherwise press **1**, **2**, **3** or **4** depending on which mode / transducer you wish to calibrate.

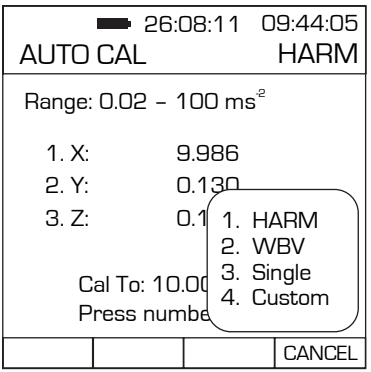


Figure 88 – Automatic Calibration Mode Selection

To reset all displayed axes measurements press **Soft Key 3** labelled **RESET**.

The '**Cal To**' figure displayed can be changed by selecting **Soft Key 2** labelled **CAL TO**. If selected then the '**Cal To**' figure will be blanked and you will be required to enter a new value using the numeric keypad. The '**Cal To**' figure is the value outputted from your calibrator in m/s^2. This figure can be found on the calibration certificate of your calibrator.

To enter '**Cal To**' values lower than 10 enter a preceding 0, for example if you wish to enter 9.98 then enter this as **0998** noting that the decimal point is inserted automatically.

Use the **Left Arrow** key ◄ to delete unwanted input or press the **OK** key to accept the inputted value. An Invalid input will give an '**Out of Range**' error message; the valid range is 0.50 to 15.00.

Before calibration takes place, ensure the calibrator mounting plate is removed from the calibrator. Securely fasten the transducer being calibrated to the mounting plate using a thin layer of petro wax between the transducer and mounting plate, ensuring that the axis orientation is noted.

Carefully screw the mounting plate to the calibrator and switch the calibrator on. Press either **1**, **2** or **3** (depending on the mounting orientation of the transducer to the calibrator) to calibrate either the X, Y or Z axis respectively.

Press the **OK** key to start the selected axis calibration.

The calibration is calculated over a 15 second period which is displayed on the screen. If the calibration is successful this counter will revert back to '**Press number of axis**' or if the calibration fails it will display '**Calibration Failed**'.

Carefully unscrew the mounting plate from the transducer before re-orientating the transducer to a different axis.

Repeat the procedure above for each axis and each mode of operation if required.

Once completed or at any stage press **Soft Key 1** labelled **EXIT** to return to the Calibration Selection Screen.

Manual Calibration

Manual Calibration is selected when you wish to manually enter individual axis coefficients using the numeric keypad on your instrument. These figures are located on your instruments calibration certificate. No vibration calibrator is required for Manual Calibration.

Choosing option 2 from the Calibration Selection Screen will display the **MANUAL CAL** screen shown below. The displayed mode may vary depending on the instrument version and/or previous selections and also for GA2005H and GA2005S Excieo models, MODE selection using **Soft Key 4** is not possible.

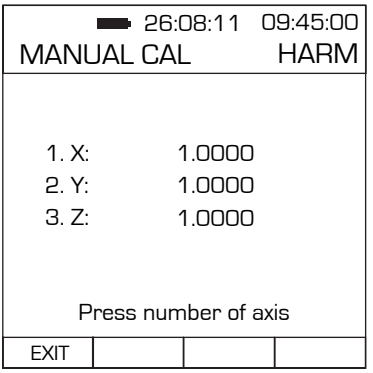


Figure 89 – Manual Calibration (Type H)

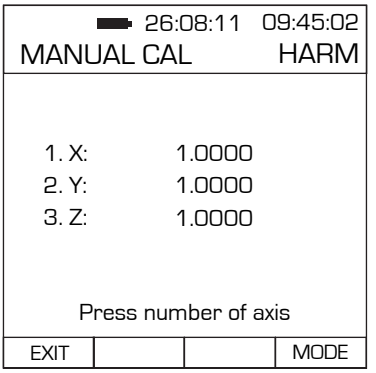


Figure 90 – Manual Calibration (Type M)

For the multi-purpose Excieo variation use **Soft Key 4** labelled **MODE** to display a popup which allows the selection of the available modes. Press **Soft Key 4** labelled **CANCEL** to return to the previous screen without changing the calibration mode otherwise press **1**, **2**, **3** or **4** depending on which mode / transducer you wish to manually calibrate.

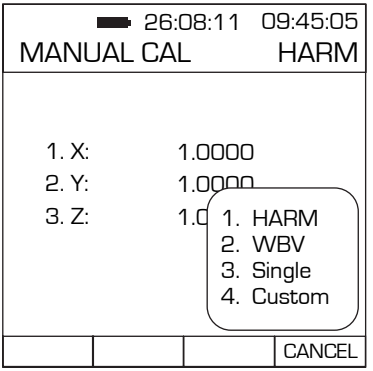


Figure 91 – Manual Calibration Mode Selection

Press either **1**, **2** or **3** to enter the axis coefficients for the X, Y or Z axis respectively or just **1** for SINGLE axis mode. The axis coefficients are multiplying factors applied to the instrument to compensate the output of the specific transducer being used. The axis coefficients can be found on the instrument calibration certificate.

Enter the coefficient figure for the chosen axis using the numeric keypad. Use the **Left Arrow** key ⦿ to delete unwanted input or press the **OK** key to accept the inputted value. Repeat for all axes and modes as required. The valid coefficient range is 0.8000 to 2.0000, any other inputted value will return an '**Out of range**' error message.

Undertaking automatic calibrations will overwrite the existing coefficients with new ones calculated from the automatic calibration. To return to factory settings then use the coefficients supplied on your calibration certificate

Once completed or at any stage press **Soft Key 1** labelled **EXIT** to return to the Calibration Selection Screen.

Crest Factor Check

The crest factor check is a whole body vibration pre-check that can be carried out to verify if Vibration Dose Values are required with the recording. To ensure accuracy always ensure that the operation being monitored is currently being undertaken before the crest factor check is started.

Various application standards such as ISO 2631 require that VDV be recorded if the crest factor exceeds 9.00ms^{-2}. See **Setup Options** under **Chapter 5** for the procedure to turn on VDV for whole body vibration.

Please be aware that other application standards may require that VDV is recorded at different crest factors, please refer to the specific standard for exact requirements.

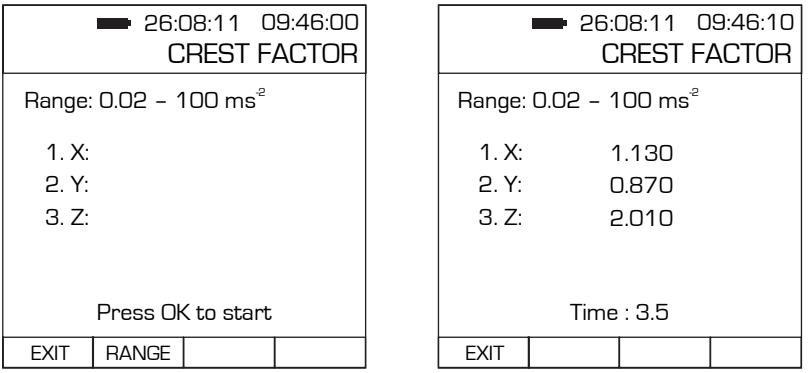


Figure 92 – Crest Factor Check

With the operation in progress, press the **OK** key to start the check which takes a total of 15 seconds. While the check is active pressing **Soft Key 1** labelled **EXIT** will cancel the check and return to the previous screen.

When the check is not active, use **Soft Key 1** labelled **EXIT** to return to the previous screen or **Soft Key 2** labelled **RANGE** to change the range if an Under Range or Over Load condition occurs.

Transducer Sensitivity

The Excieo vibration meter can be used with two seat pad transducers for Whole Body Vibration, both of which are available from Castle Group Ltd.

Use this option to select the sensitivity of the seat pad being used. Below are the sensitivities of the available seat pads:-

Whole Body Vibration Transducer Sensitivity Values	
KD1009	1000mV/g
KD1007	100mV/g

To ensure meter readings are correct it is essential that the sensitivity selected matches the transducer being used with the instrument. A mismatched sensitivity setting and transducer will give incorrect measurement readings.

Press **1** for a sensitivity of 100mV/g.
Press **2** for a sensitivity of 1000mV/g.

If the sensitivity is changed then a screen prompt informs you to re-calibrate your instrument to the new accelerometer being used. Confirmation of having accepted that the new accelerometer must be calibrated with the new settings of the instrument is achieved by pressing the **OK** button.

Selection of the change then has immediate effect in Real Time Mode and is applied to any subsequent recordings taken in this mode.

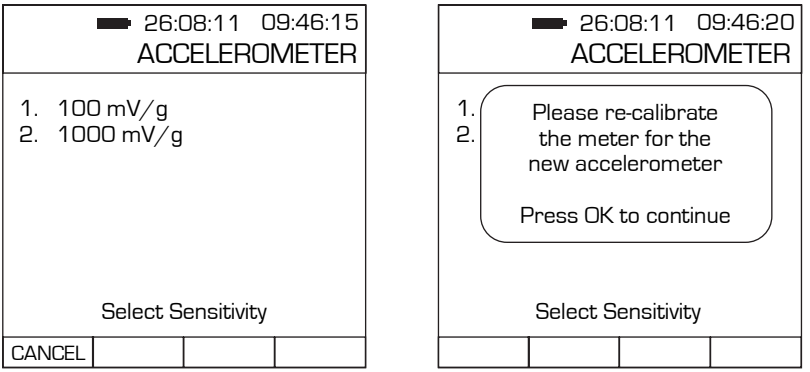


Figure 93 – WBV Transducer Sensitivity Selection

Press **Soft Key 1** labelled **CANCEL** to return to the previous screen without making any changes.

Global Settings

Select option 4 to adjust the system Date, Time, Units of operation, display contrast or the display backlight timeout.

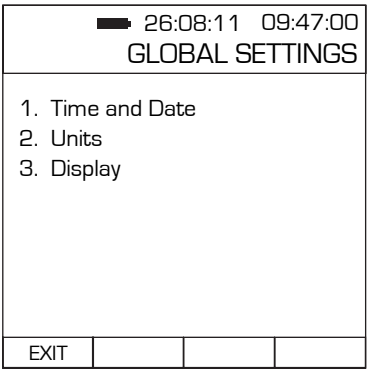


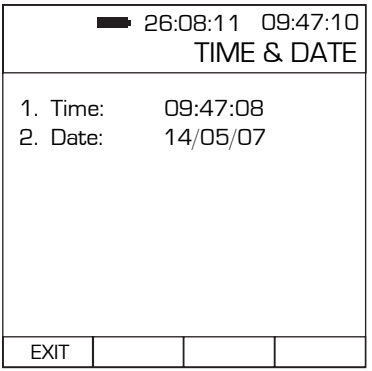
Figure 94 – Global Settings Selection

To exit to the previous screen press **Soft Key 1** labelled **EXIT** or select one of the displayed options.

Time and Date

To adjust the Time and Date, select option 1 from the **GLOBAL SETTINGS** menu and then select option 1 to change the current time, or option 2 to change the current date. Press **Soft Key 1** labelled **EXIT** to return to the previous screen.

Enter the required fields using the keypad pressing **OK** to confirm each field or press **Soft Key 1** labelled **CANCEL** to return to the previous screen without amending the value.



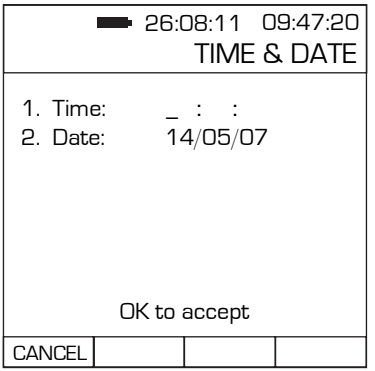


Figure 95 – Time & Date

Units

To adjust the working units and reference levels of the instrument select option 2 from the **GLOBAL SETTINGS** menu, the default settings are shown below: -

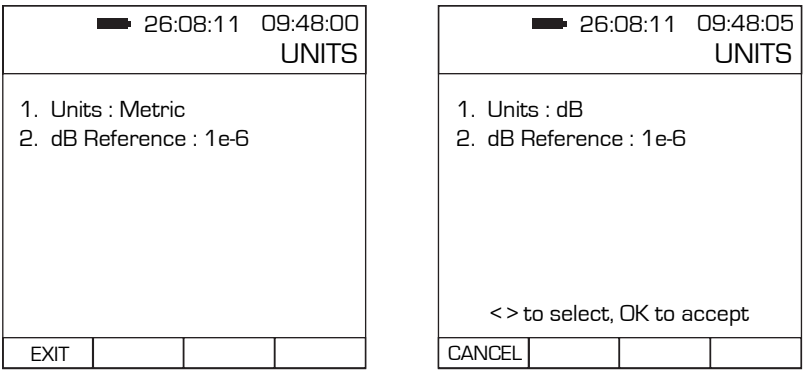


Figure 96 – Units

From the displayed list select option 1 to change the working units or option 2 to change the dB reference level. Press **Soft Key 1** labelled **EXIT** to return to the previous screen.

For either selection, use the **Left** and **Right Arrow** Keys ◀▶ to scroll through the list of available settings, press **OK** to confirm the required selection or press **Soft Key 1** labelled **CANCEL** to cancel and return to the previous screen.

See **Measuring Ranges** and also **Overload & Under Range Triggering Points** under **Chapter 3** for the effects of changing units and/or the dB reference level. The available settings are as follows: -

Units
g
Metric (default)
dB
Imperial

dB Reference Level
$1e^{-5}$
$1e^{-6}$ (default)

To adjust the contrast and the backlight timeout setting select option 3 from the **GLOBAL SETTINGS** menu, the default settings are shown below: -

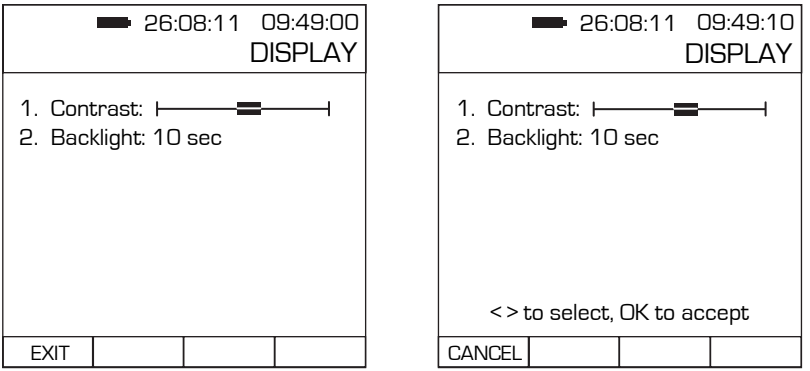


Figure 97 – Display Settings

From the displayed list select option 1 to change the display contrast or option 2 to change the backlight timeout setting. Press **Soft Key 1** labelled **EXIT** to return to the previous screen.

For either selection, use the **Left** and **Right Arrow** Keys ◄► to adjust or scroll through the list of available settings and press **OK** to confirm the required selection. Press **Soft Key 1** labelled **CANCEL** to cancel and return to the previous screen.

The available backlight timeout settings are as follows: -

Backlight Timeout
On
5 seconds
10 seconds (default)
30 seconds
1 minute

The backlight timeout occurs when the backlight is switched on using the backlight key of the keypad. The backlight switches off automatically after the timeout period selected. If the timeout period is set to On then the backlight will remain on permanently unless switched off via the keypad. Use of the backlight reduces the operational time of the batteries.

Information Screen

Select option 5 from the Main Menu to view instrument information. Press **Soft Key 1** labelled **EXIT** to return to the previous screen.

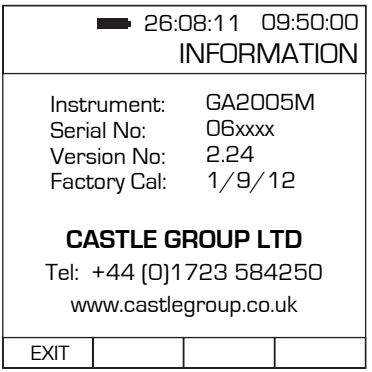


Figure 98 – Instrument Information

Chapter 8

Downloading Saved Recordings To a PC

Using the software 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 Excieo meter is made via the USB connector at the base of your instrument. The correct Castle Excieo USB driver will need to be installed on your PC, the installation procedure of which can be found in detail in the VibdataPro user manual.

To allow your instrument to be found by your Windows operating system on your PC, you will need to ensure your instrument is in any non-recording screen. For comprehensive instructions please refer to the VibdataPro user manual.

Chapter 9

Accessories

GA505	Portable, Battery Operated Thermal Printer
GA606	Vibration Calibrator
KA016V	Kit Case for Excieo and Accessories
KD1003	Single Axis Accelerometer
KD1006	HARM Tri-axial Accelerometer
KD1007	Tri-axial Seat Pad WBV Accelerometer
KD1009	Tri-axial Seat Pad WBV Accelerometer
KD1203	High Strength Mag Mount (Single Axis)
KD1204	Standard Strength Mag Mount (Single Axis)
KD1205	Large Spike Probe (Single Axis)
KD1211	Cable Ties Metal Barbed (Pk 100)
KD1213	Environmental Ground Spike (Single Axis)
KD1215	Transducer Mounting Glue and Stud Pack
KD1216	Transducer Mounting Block (HARM)
KD1217	Transducer Petro wax Mounting Compound
PC009	VibdataPro Windows Vibration Analysis Software
PSU3:PRO-DX	12V DC External Power Supply
TT4KIT	Cable Ties Metal Barbed (100) with Tensioning Tool
ZL1064-01	AC Output Cable (1 metre)
ZL1084-01	Printer Cable for use with GA505 (1 metre)
ZL1096-03	HARM Tri-axial Accelerometer Cable (3 metres)
ZL1097-FLEX	Industrial Coiled Cable (Single Axis)
ZL1105-02	USB A to B Download Cable

Chapter 10

Technical Specification

Applicable Standards

ISO 8041:2005 Human Response to Vibration – Measuring Instrumentation

Noise Floors

Axis	Range			
	100 m/s²	500 m/s²	1000 m/s²	5000 m/s²
X	< -80 dB	< -90 dB	< -90 dB	< -90 dB
Y	< -80 dB	< -90 dB	< -90 dB	< -90 dB
Z	< -80 dB	< -90 dB	< -90 dB	< -90 dB

Normal Operating Mode

Type H:
Fitted with HARM accelerometer (KD1006), dB reference = $1e^{-6}$

Type S:
Fitted with Single Axis accelerometer (KD1003), dB reference = $1e^{-6}$

Type M:

Meter Mode	Condition
HARM	Fitted with HARM accelerometer (KD1006) dB reference = $1e^{-6}$
WBV	Fitted with WBV accelerometer (KD1007) or (KD1009) dB reference = $1e^{-6}$
SINGLE	Fitted with Single Axis accelerometer (KD1003) dB reference = $1e^{-6}$, Sensitivity = 100mV
CUSTOM	Fitted with either: - HARM accelerometer (KD1006) WBV accelerometer (KD1007) or (KD1009) Single Axis accelerometer (KD1003) dB reference = $1e^{-6}$

Overload & Under Range Triggering Points

Hand Arm Vibration Mode (HARM)

Acceleration : Metric		
RANGE	**UR**	**OL**
0.02 – 100	0.020	105.0
0.1 – 500	0.100	525.0
0.2 – 1000	0.200	1050.0
1 – 5000	1.000	5250.0

Acceleration : dB (ref $1e^{-6}$)		
RANGE	**UR**	**OL**
86 – 160	86.0	160.5
100 – 174	100.0	174.5
106 – 180	106.0	180.5
120 – 194	120.0	194.5

Acceleration : dB (ref $1e^{-5}$)		
RANGE	**UR**	**OL**
66 – 140	66.0	140.5
80 – 154	80.0	154.5
86 – 160	86.0	160.5
100 – 174	100.0	174.5

Acceleration : Imperial		
RANGE	**UR**	**OL**
0.06 – 328	0.06	345.0
0.3 – 1640	0.30	1725.0
0.6 – 3280	0.60	3450.0
3 – 16400	3.00	17250.0

Acceleration : g		
RANGE	**UR**	**OL**
0.002 – 10	0.002	10.8
0.01 – 50	0.01	53.8
0.02 – 100	0.02	108.0
0.10 – 500	0.10	538.0

Transducer = 100mV

Acceleration : Metric		
RANGE	**UR**	**OL**
0.002 - 10	0.0020	10.50
0.010 - 50	0.0100	52.50
0.02 - 100	0.0200	105.00
0.1 - 500	0.1000	525.00

Acceleration : dB (ref $1e^{-6}$)		
RANGE	**UR**	**OL**
66 – 140	66.0	140.5
80 – 154	80.0	154.5
86 – 160	86.0	160.5
1000 – 174	100.0	174.5

Acceleration : dB (ref $1e^{-5}$)		
RANGE	**UR**	**OL**
46 – 120	46.0	120.5
60 – 134	60.0	134.5
66 – 140	66.0	140.5
80 – 154	80.0	154.5

Acceleration : Imperial		
RANGE	**UR**	**OL**
0.006 – 33	0.006	34.5
0.03 – 164	0.03	172.5
0.06 – 328	0.06	345.0
0.3 – 1640	0.30	1725.0

Acceleration : g		
RANGE	**UR**	**OL**
0.0002 – 1	0.002	1.08
0.001 – 5	0.001	5.38
0.002 – 10	0.002	10.80
0.01 – 50	0.010	53.80

Acceleration : Metric		
RANGE	**UR**	**OL**
0.010 – 35.0	0.010	35.0

Acceleration : dB (ref $1e^{-6}$)		
RANGE	**UR**	**OL**
80 - 151	80.0	151.0

Acceleration : dB (ref $1e^{-5}$)		
RANGE	**UR**	**OL**
60 - 131	60.0	131.0

Acceleration : Imperial		
RANGE	**UR**	**OL**
0.03 – 115.0	0.03	115.0

Acceleration : g		
RANGE	**UR**	**OL**
0.001 – 3.5	0.001	3.5

Transducer = 10mV

Acceleration : Metric		
RANGE	**UR**	**OL**
0.02 – 100	0.020	105.00
0.1 – 500	0.100	525.00
0.2 – 1000	0.200	1050.00
1 – 5000	1.000	5250.00

Acceleration: dB (ref $1e^{-6}$)		
RANGE	**UR**	**OL**
86 – 160	86.0	160.5
100 – 174	100.0	174.5
106 – 180	106.0	180.5
120 – 194	120.0	194.5

Acceleration: dB (ref $1e^{-5}$)		
RANGE	**UR**	**OL**
66 – 140	66.0	140.5
80 – 154	80.0	154.5
86 – 160	86.0	160.5
100 – 174	100.0	174.5

Acceleration : Imperial		
RANGE	**UR**	**OL**
0.06 – 328	0.06	345.0
0.3 – 1640	0.30	1725.0
0.6 – 3280	0.60	3450.0
3 – 16400	3.00	17250.0

Acceleration : g		
RANGE	**UR**	**OL**
0.002 – 10	0.002	10.8
0.01 – 50	0.01	53.8
0.02 – 100	0.02	108.0
0.10 – 500	0.10	538.0

Velocity : Metric		
RANGE	**UR**	**OL(1.592Hz)**
Low	1mm/s	10.0m/s
Med Low	5mm/s	50.0m/s
Med High	10mm/s	100.0m/s
High	50mm/s	500.0m/s

Velocity : dB		
RANGE	**UR**	**OL(1.592Hz)**
Low	120.0	200.0
Med Low	134.0	214.0
Med High	140.0	220.0
High	154.0	234.0

Displacement : Metric		
RANGE	**UR**	**OL(1.592Hz)**
Low	100µm	1.0m
Med Low	500µm	5.0m
Med High	1mm	10.0m
High	5mm	50.0m

Displacement : dB		
RANGE	**UR**	**OL(1.592Hz)**
Low	160.0	240.0
Med Low	174.0	254.0
Med High	180.0	260.0
High	194.0	274.0

Acceleration : Metric		
RANGE	**UR**	**OL**
0.002 - 10	0.0020	10.50
0.010 - 50	0.0100	52.50
0.02 - 100	0.0200	105.00
0.1 - 500	0.1000	525.00

Acceleration: dB (ref $1e^{-6}$)		
RANGE	UR	OL
66 – 140	66.0	140.5
80 – 154	80.0	154.5
86 – 160	86.0	160.5
100 – 174	100.0	174.5

Acceleration : dB (ref $1e^{-5}$)		
RANGE	UR	OL
46 – 120	46.0	120.5
60 – 134	60.0	134.5
66 – 140	66.0	140.5
80 – 154	80.0	154.5

Acceleration : Imperial		
RANGE	**UR**	**OL**
0.006 – 33	0.006	34.5
0.03 – 164	0.03	172.5
0.06 – 328	0.06	345.0
0.3 – 1640	0.30	1725.0

Acceleration : g		
RANGE	**UR**	**OL**
0.0002 – 1	0.002	1.08
0.001 – 5	0.001	5.38
0.002 – 10	0.002	10.80
0.01 – 50	0.010	53.80

Velocity : Metric		
RANGE	**UR**	**OL(1.592Hz)**
Low	100µm/s	1m/s
Med Low	500µm/s	5m/s
Med High	1mm/s	10m/s
High	5mm/s	50m/s

Velocity : dB		
RANGE	**UR**	**OL(1.592Hz)**
Low	100.0	180.0
Med Low	114.0	194.0
Med High	120.0	200.0
High	134.0	214.0

Displacement : Metric		
RANGE	**UR**	**OL(1.592Hz)**
Low	10µm	0.1m
Med Low	50µm	0.5m
Med High	100µm	1.0m
High	500µm	5.0m

Displacement : dB		
RANGE	**UR**	**OL(1.592Hz)**
Low	140.0	220.0
Med Low	154.0	234.0
Med High	160.0	240.0
High	174.0	254.0

Transducer = 10mV

Acceleration : Metric		
RANGE	**UR**	**OL**
0.02 – 100	0.020	105.00
0.1 – 500	0.100	525.00
0.2 – 1000	0.200	1050.00
1 – 5000	1.000	5250.00

Acceleration: dB (ref $1e^{-6}$)		
RANGE	**UR**	**OL**
86 – 160	86.0	160.5
100 – 174	100.0	174.5
106 – 180	106.0	180.5
120 – 194	120.0	194.5

Acceleration: dB (ref $1e^{-5}$)		
RANGE	**UR**	**OL**
66 – 140	66.0	140.5
80 – 154	80.0	154.5
86 – 160	86.0	160.5
100 – 174	100.0	174.5

Acceleration : Imperial		
RANGE	**UR**	**OL**
0.06 – 328	0.06	345.0
0.3 – 1640	0.30	1725.0
0.6 – 3280	0.60	3450.0
3 – 16400	3.00	17250.0

Acceleration : g		
RANGE	**UR**	**OL**
0.002 – 10	0.002	10.8
0.01 – 50	0.01	53.8
0.02 – 100	0.02	108.0
0.10 – 500	0.10	538.0

Velocity : Metric		
RANGE	**UR**	**OL(1.592Hz)**
Low	1mm/s	10.0m/s
Med Low	5mm/s	50.0m/s
Med High	10mm/s	100.0m/s
High	50mm/s	500.0m/s

Velocity : dB		
RANGE	**UR**	**OL(1.592Hz)**
Low	120.0	200.0
Med Low	134.0	214.0
Med High	140.0	220.0
High	154.0	234.0

Displacement : Metric		
RANGE	**UR**	**OL(1.592Hz)**
Low	100µm	1.0m
Med Low	500µm	5.0m
Med High	1mm	10.0m
High	5mm	50.0m

Displacement : dB		
RANGE	**UR**	**OL(1.592Hz)**
Low	160.0	240.0
Med Low	174.0	254.0
Med High	180.0	260.0
High	194.0	274.0

Acceleration : Metric		
RANGE	**UR**	**OL**
0.002 - 10	0.0020	10.50
0.010 - 50	0.0100	52.50
0.02 - 100	0.0200	105.00
0.1 - 500	0.1000	525.00

Acceleration: dB (ref $1e^{-6}$)		
RANGE	**UR**	**OL**
66 – 140	66.0	140.5
80 – 154	80.0	154.5
86 – 160	86.0	160.5
100 – 174	100.0	174.5

Acceleration : dB (ref $1e^{-5}$)		
RANGE	**UR**	**OL**
46 – 120	46.0	120.5
60 – 134	60.0	134.5
66 – 140	66.0	140.5
80 – 154	80.0	154.5

Acceleration : Imperial		
RANGE	**UR**	**OL**
0.006 – 33	0.006	34.5
0.03 – 164	0.03	172.5
0.06 – 328	0.06	345.0
0.3 – 1640	0.30	1725.0

Acceleration : g		
RANGE	**UR**	**OL**
0.0002 – 1	0.002	1.08
0.001 – 5	0.001	5.38
0.002 – 10	0.002	10.80
0.01 – 50	0.010	53.80

Velocity : Metric		
RANGE	**UR**	**OL(1.592Hz)**
Low	100µm/s	1m/s
Med Low	500µm/s	5m/s
Med High	1mm/s	10m/s
High	5mm/s	50m/s

Velocity : dB		
RANGE	**UR**	**OL(1.592Hz)**
Low	100.0	180.0
Med Low	114.0	194.0
Med High	120.0	200.0
High	134.0	214.0

Displacement : Metric		
RANGE	**UR**	**OL(1.592Hz)**
Low	10µm	0.1m
Med Low	50µm	0.5m
Med High	100µm	1.0m
High	500µm	5.0m

Displacement : dB		
RANGE	**UR**	**OL(1.592Hz)**
Low	140.0	220.0
Med Low	154.0	234.0
Med High	160.0	240.0
High	174.0	254.0

Acceleration : Metric		
RANGE	**UR**	**OL**
0.010 – 35.0	0.010	36.5

Acceleration : dB (ref $1e^{-6}$)		
RANGE	**UR**	**OL**
80 - 151	80.0	151.5

Acceleration : dB (ref $1e^{-5}$)		
RANGE	**UR**	**OL**
60 - 131	60.0	131.5

Acceleration : Imperial		
RANGE	**UR**	**OL**
0.03 – 115.0	0.03	121.0

Acceleration : g		
RANGE	**UR**	**OL**
0.001 – 3.5	0.001	3.75

Velocity : Metric		
RANGE	**UR**	**OL(1.592Hz)**
High	500µm/s	3.65m/s

Velocity : dB		
RANGE	**UR**	**OL(1.592Hz)**
High	114.0	185

Displacement : Metric		
RANGE	**UR**	**OL(1.592Hz)**
High	50µm	0.365m

Displacement : dB		
RANGE	**UR**	**OL(1.592Hz)**
High	154	225

Level Ranges

On instruments and display modes capable of displaying velocity or displacement then note that as the highest velocity or displacement reading on each range is a function of frequency, no precise figures can be assigned to individual ranges.

Whole Body Vibration Mode (WBV)

Transducer = 100mV

Acceleration : Metric	
Range 1	0.002 – 10.0 ms^{-2}
Range 2	0.010 – 50.0 ms^{-2}
Range 3	0.020 – 100.0 ms^{-2}
Range 4	0.100 – 500.0 ms^{-2}

Acceleration : dB (ref $1e^{-6}$) *	
Range 1	66.0 – 140.0 dB
Range 2	80.0 – 154.0 dB
Range 3	86.0 – 160.0 dB
Range 4	100.0 – 174.0 dB

* for a dB reference level of $1e^{-5}$ subtract 20 from both the lower and upper dB levels

Acceleration : Imperial	
Range 1	0.006 – 33.0 fts^{-2}
Range 2	0.03 – 164.0 fts^{-2}
Range 3	0.06 – 328.0 fts^{-2}
Range 4	0.30 – 1640.0 fts^{-2}

Acceleration : g	
Range 1	0.0002 – 1.0g
Range 2	0.001 – 5.0g
Range 3	0.002 – 10.0g
Range 4	0.010 – 50.0g

Transducer = 1000mV

Acceleration : Metric	
Range 1	0.010 – 35.0 ms^{-2}

Acceleration : dB (ref $1e^{-6}$) *	
Range 1	80.0 – 151.0 dB

* for a dB reference level of $1e^{-5}$ subtract 20 from both the lower and upper dB levels

Acceleration : Imperial	
Range 1	0.03 – 115.0 fts^{-2}

Acceleration : g	
Range 1	0.001 – 3.5g

Acceleration, Transducer = 10mV

Acceleration : Metric	
Range 1	0.02 – 100.0 ms^{-2}
Range 2	0.10 – 500.0 ms^{-2}
Range 3	0.20 – 1000.0 ms^{-2}
Range 4	1.00 – 5000.0 ms^{-2}

Acceleration : dB (ref $1e^{-6}$) *	
Range 1	86.0 – 160.0 dB
Range 2	100.0 – 174.0 dB
Range 3	106.0 – 180.0 dB
Range 4	120.0 – 194.0 dB

* for a dB reference level of $1e^{-5}$ subtract 20 from both the lower and upper dB levels

Acceleration : Imperial	
Range 1	0.06 – 328.0 fts^{-2}
Range 2	0.30 – 1640.0 fts^{-2}
Range 3	0.60 – 3280.0 fts^{-2}
Range 4	3.00 – 16400.0 fts^{-2}

Acceleration : g	
Range 1	0.002 – 10.0g
Range 2	0.01 – 50.0g
Range 3	0.02 – 100.0g
Range 4	0.10 – 500.0g

Acceleration, Transducer = 100mV

Acceleration : Metric	
Range 1	0.002 – 10.0 ms^{-2}
Range 2	0.010 – 50.0 ms^{-2}
Range 3	0.020 – 100.0 ms^{-2}
Range 4	0.100 – 500.0 ms^{-2}

Acceleration : dB (ref $1e^{-6}$) *	
Range 1	66.0 – 140.0 dB
Range 2	80.0 – 154.0 dB
Range 3	86.0 – 160.0 dB
Range 4	100.0 – 174.0 dB

* for a dB reference level of $1e^{-5}$ subtract 20 from both the lower and upper dB levels

Acceleration : Imperial	
Range 1	0.006 – 33.0 fts^{-2}
Range 2	0.03 – 164.0 fts^{-2}
Range 3	0.06 – 328.0 fts^{-2}
Range 4	0.30 – 1640.0 fts^{-2}

Acceleration : g	
Range 1	0.0002 – 1.0g
Range 2	0.001 – 5.0g
Range 3	0.002 – 10.0g
Range 4	0.010 – 50.0g

Acceleration, Transducer = 1000mV

Acceleration : Metric	
Range 1	0.010 – 35.0 ms^{-2}

Acceleration : dB (ref $1e^{-6}$) *	
Range 1	80.0 – 151.0 dB

* for a dB reference level of $1e^{-5}$ subtract 20 from both the lower and upper dB levels

Acceleration : Imperial	
Range 1	0.03 – 115.0 fts^{-2}

Acceleration : g	
Range 1	0.001 – 3.5g

Velocity, Transducer = 10mV or 100mV

Velocity : Metric
Low
Med Low
Med High
High

Velocity : dB
Low
Med Low
Med High
High

Velocity, Transducer = 1000mV

Velocity : Metric
High

Velocity : dB
High

Displacement, Transducer = 10mV or 100mV

Displacement : Metric
Low
Med Low
Med High
High

Displacement : dB
Low
Med Low
Med High
High

Displacement, Transducer = 1000mV

Displacement : Metric
High

Displacement : dB
High

Single Axis Vibration (SINGLE)

Acceleration, Transducer = 10mV

Acceleration : Metric	
Range 1	0.02 – 100.0 ms^{-2}
Range 2	0.10 – 500.0 ms^{-2}
Range 3	0.20 – 1000.0 ms^{-2}
Range 4	1.00 – 5000.0 ms^{-2}

Acceleration : dB (ref $1e^{-6}$) *	
Range 1	86.0 – 160.0 dB
Range 2	100.0 – 174.0 dB
Range 3	106.0 – 180.0 dB
Range 4	120.0 – 194.0 dB

* for a dB reference level of $1e^{-5}$ subtract 20 from both the lower and upper dB levels

Acceleration : Imperial	
Range 1	0.06 – 328.0 fts^{-2}
Range 2	0.30 – 1640.0 fts^{-2}
Range 3	0.60 – 3280.0 fts^{-2}
Range 4	3.00 – 16400.0 fts^{-2}

Acceleration : g	
Range 1	0.002 – 10.0g
Range 2	0.01 – 50.0g
Range 3	0.02 – 100.0g
Range 4	0.10 – 500.0g

Acceleration, Transducer = 100mV

Acceleration : Metric	
Range 1	0.002 – 10.0 ms^{-2}
Range 2	0.010 – 50.0 ms^{-2}
Range 3	0.020 – 100.0 ms^{-2}
Range 4	0.100 – 500.0 ms^{-2}

Acceleration : dB (ref $1e^{-6}$) *	
Range 1	66.0 – 140.0 dB
Range 2	80.0 – 154.0 dB
Range 3	86.0 – 160.0 dB
Range 4	100.0 – 174.0 dB

* for a dB reference level of $1e^{-5}$ subtract 20 from both the lower and upper dB levels

Acceleration : Imperial	
Range 1	0.006 – 33.0 fts^{-2}
Range 2	0.03 – 164.0 fts^{-2}
Range 3	0.06 – 328.0 fts^{-2}
Range 4	0.30 – 1640.0 fts^{-2}

Acceleration : g	
Range 1	0.0002 – 1.0g
Range 2	0.001 – 5.0g
Range 3	0.002 – 10.0g
Range 4	0.010 – 50.0g

Velocity, Transducer = 10mV or 100mV

Velocity : Metric
Low
Med Low
Med High
High

Velocity : dB
Low
Med Low
Med High
High

Displacement, Transducer = 10mV or 100mV

Displacement : Metric
Low
Med Low
Med High
High

Displacement : dB
Low
Med Low
Med High
High

Hand Arm Vibration Mode (HARM)

Acceleration : Metric	
Range 1	0.02 – 100.0 ms^{-2}
Range 2	0.10 – 500.0 ms^{-2}
Range 3	0.20 – 1000.0 ms^{-2}
Range 4	1.00 – 5000.0 ms^{-2}

Acceleration : dB (ref $1e^{-6}$) *	
Range 1	86.0 – 160.0 dB
Range 2	100.0 – 174.0 dB
Range 3	106.0 – 180.0 dB
Range 4	120.0 – 194.0 dB

* for a dB reference level of $1e^{-5}$ subtract 20 from both the lower and upper dB levels

Acceleration : Imperial	
Range 1	0.06 – 328.0 fts^{-2}
Range 2	0.30 – 1640.0 fts^{-2}
Range 3	0.60 – 3280.0 fts^{-2}
Range 4	3.00 – 16400.0 fts^{-2}

Acceleration : g	
Range 1	0.002 – 10.0g
Range 2	0.01 – 50.0g
Range 3	0.02 – 100.0g
Range 4	0.10 – 500.0g

Frequency Weightings

All measurements shown are relative to the expected result at this individual frequency for this particular frequency weighting, allowing for easier recognition that tolerances are met.

Mode	Available Filters
HARM	Wh
WBV	Wd, Wk
SINGLE	Fa, Fb, Fc, Fl, Ws
CUSTOM	Fa, Fb, Fc, Fl, Wb, Wc, Wd, We, Wh, Wj, Wk, Wm, Ws

Measured electrically on the 1000 m/s^2 range of the X-axis with a reference frequency of 16 Hz at an approximate level of 900 m/s with Fl (LIN) weighting applied. All errors and measurements are in dB.

Frequency (Hz)	Wb	Wc	Wd	We	Wj	Wk	Wm	Tolerance
0.1	-3.5	-3.2	-3.4	-3.4	-2.9	-3.4	-3.4	+2, -∞
0.2	-1.0	-0.9	-1.0	-0.9	-1.0	-0.9	-0.9	+2, -∞
0.4	-0.5	-0.2	-0.3	-0.3	-0.4	-0.5	-0.4	+2, -∞
1.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	0.0	±2
2.0	0.0	0.0	-0.1	0.0	-0.1	0.1	0.0	±1
4.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	±1
8.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	±1
10	0.0	0.0	0.1	0.1	0.0	0.0	0.0	±1
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	±1
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	±1
80	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	±2
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	±2
200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	+2, -∞
400	-0.1	-0.1	-0.2	-0.2	0.0	-0.1	-0.1	+2, -∞

Measured electrically on the 1000 m/s² range of the X-axis with a reference frequency of 80 Hz at an approximate level of 900 m/s with Fl (LIN) weighting applied. All errors and measurements are in dB.

Frequency (Hz)	Wh	Fc	Tolerance
1	-0.3	0.0	+2, -∞
2	0.1	0.1	+2, -∞
4	0.1	0.2	+2, -∞
8	0.1	0.1	±2
10	0.1	0.1	±1
20	0.0	0.0	±1
40	0.0	0.1	±1
80	-0.1	0.0	±1
100	0.0	0.0	±1
200	0.1	0.1	±1
400	0.0	0.1	±2
1000	0.0	0.1	±2
2000	-1.2	-0.7	+2, -∞
4000	-6.0	-4.0	+2, -∞

Ws	Tolerance
2.0	+4, -∞
0.3	+4, -∞
0.1	+4, -∞
-1.0	+1 / -2
-0.6	±1
0.3	±1
0.1	±1
0.0	±1
0.0	±1
0.1	±1
0.3	±1
0.2	+1 / -2
1.3	±4
-1.2	±4

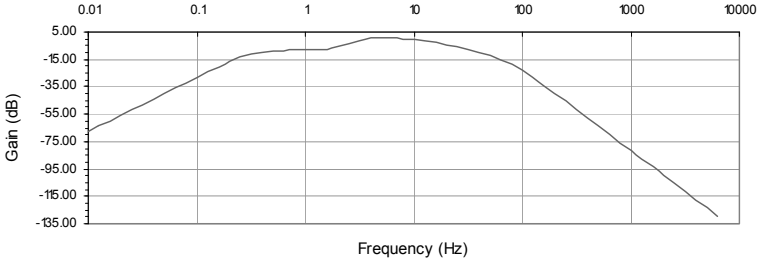
Measured electrically on the 1000 m/s² range of the X-axis with a reference frequency of 80 Hz on Fl (LIN) for Fl, Fb filters and 8 Hz on Fl (LIN) for Fa, Fk filters, all with an approximate level of 900 m/s. All errors and measurements are in dB. No tolerance requirements exist for Fl or Fk.

Frequency (Hz)	Fb	Tolerance
0.1	-3.4	+2, -∞
0.2	-0.9	+2, -∞
0.4	-0.2	±1
1.0	0.0	±1
2.0	0.1	±1
4.0	0.1	±1
8.0	0.1	±1
10	0.1	±1
20	0.0	±1
40	0.1	±1
80	0.0	±1
100	0.0	±1
200	0.1	±1
400	0.1	±1
1000	0.1	±2
2000	-0.7	±2
4000	-4.0	+2, -∞

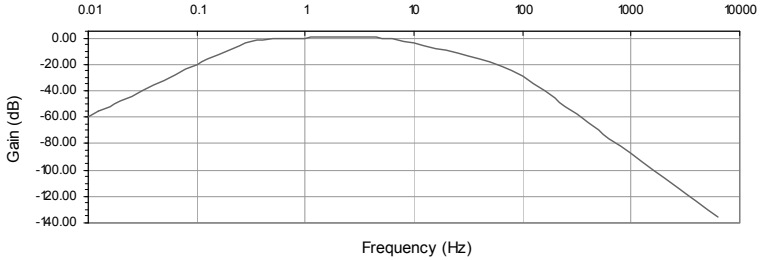
Fa	Tolerance
-3.5	+2, -∞
-1.0	+2, -∞
-0.3	±1
-0.1	±1
0.0	±1
0.0	±1
0.0	±1
0.0	±1
0.0	±1
0.0	±1
-0.1	±1
-0.1	±1
0.0	+2, -∞
-0.1	+2, -∞

Fl	Fk
-2.9	-3.0
-0.9	-0.9
-0.2	-0.3
0.0	-0.1
0.1	0.0
0.1	-0.1
0.1	-1.4
0.1	-2.9
0.0	-17.6
0.1	-38.8
REF	-43.6
0.0	-43.6
0.0	-43.6
0.1	-43.6
0.1	
0.2	
0.2	

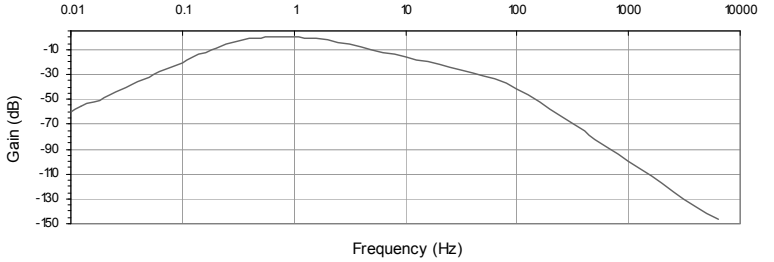
Wb Filter Frequency Response



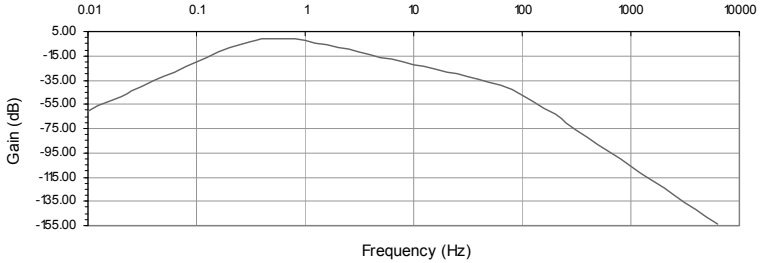
Wc Filter Frequency Response



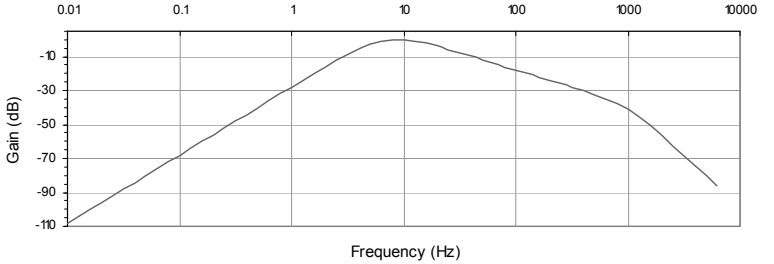
Wd Filter Frequency Response



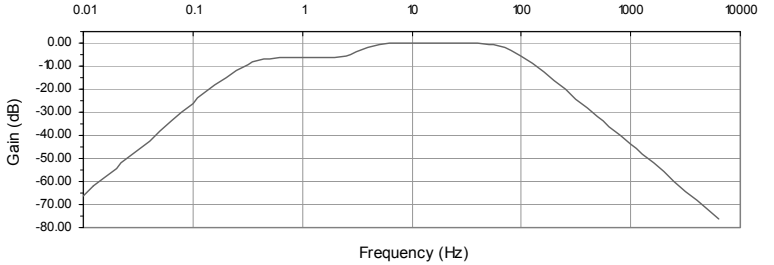
We Filter Frequency Response



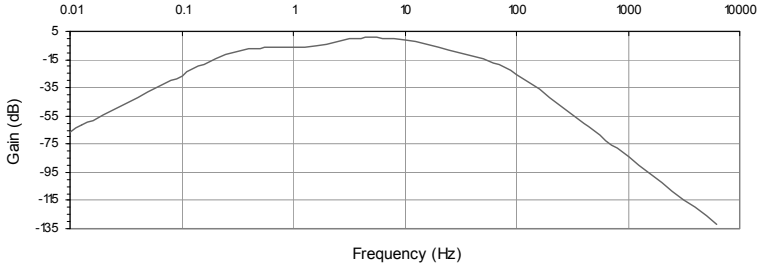
Wh Filter Frequency Response



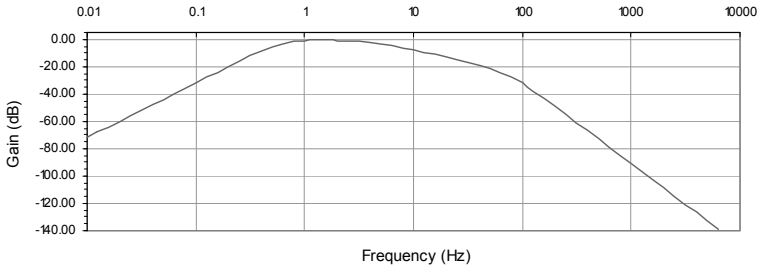
Wj Filter Frequency Response



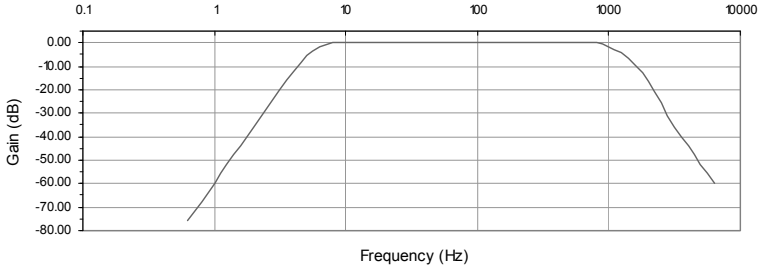
Wk Filter Frequency Response



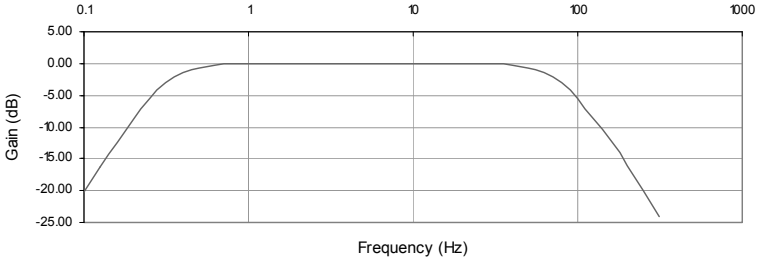
Wm Filter Frequency Response



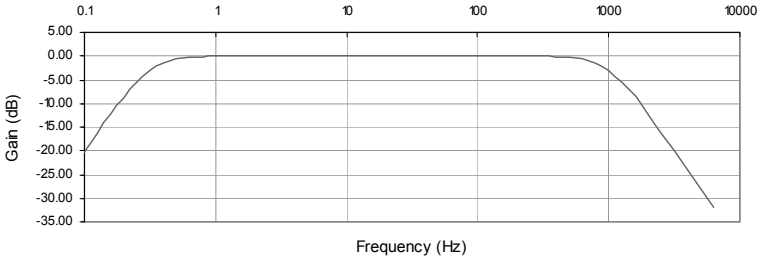
Ws Filter Frequency Response



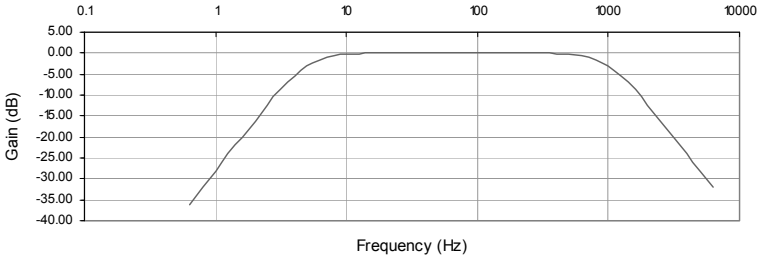
Fa Filter Frequency Response



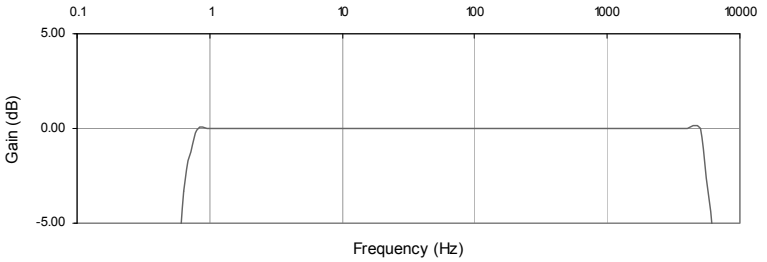
Fb Filter Frequency Response



Fc Filter Frequency Response



FI Filter Frequency Response



Accelerometers

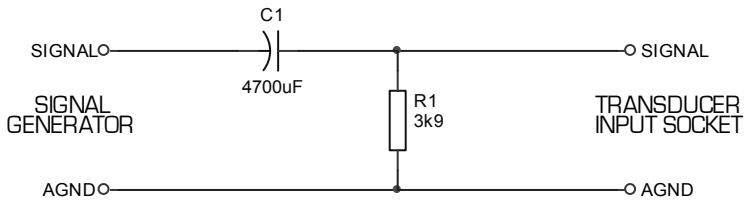
Specification	Hand Arm (KD1006)		Single Axis (KD1003)
	Dytran	PCB	
Output Voltage	10mV/g -10%, +15%	10mV/g ±10%	100mV/g ±10%
Operating Range	±500g	±500g pk	±80g
Frequency Response	2 to 5000 Hz ±10%	1 to 5000 Hz ±5%	2 to 14000 Hz ±5%
Resonant Frequency	30000Hz	≥25000Hz	22000Hz
Weight	7.5 Grams	10.5 Grams	50 Grams
Operating Temperature Range	-50°C to 120°C -60°F to 250°F	-54°C to 120°C -65°F to 250°F	-55°C to 140°C -67°F to 284°F
Thermal Sensitivity Coefficient	0.06% / °C 0.03% / °F	0.036% / °C 0.022% / °F	0.08% / °C 0.04% / °F
Linearity	±1%	to 400g ≤1% to 500g ≤2%	±1%
Electrical Noise Floor	0.007g	0.0005g	0.0001g
Transverse Sensitivity	5%	≤5%	5%
Maximum Shock	5000g	7000g pk	5000g
Seal	Hermetic	Hermetic	IP65

Specification	Whole Body (KD1007)	Whole Body (KD1009)
Output Voltage	100mV/g ±5%	1000mV/g ±5%
Operating Range	±50g	±3.6g
Frequency Response	0.5 to 3000 Hz ±5%	0.1 to 125 Hz ±5%
Resonant Frequency	25000Hz	5000Hz
Weight	227 Grams	550 Grams
Operating Temperature Range	-50°C to 70°C -60°F to 160°F	-10°C to 50°C 14°F to 122°F
Thermal Sensitivity Coefficient	0.06% / °C 0.03% / °F	0.012dB / °C
Linearity	±1%	±1%
Electrical Noise Floor	0.0007g	< 316µV rms
Transverse Sensitivity	5%	5%
Maximum Shock	1500g	100g
Seal	Hermetic	Hermetic

Electrical Signal Input

Electrical signals at frequencies >1Hz can be applied to the Pro-DX Excieo range of Vibration Meters by interfacing a suitable signal generator with an output impedance of 600Ω to the 5 pin Input Lemo Socket, type (EGG.1K.304.CLL).

Each individual axis shall be subject to the following circuitry to create the required d.c offset voltage and current (for type 'S' mode Excieo meters connect only to the 'X' Axis). See **Transducer Input** in the **Technical Specification, Chapter 10** for socket wiring information.



Maximum Electrical Signal Input For No Damage

18 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 or 1 minute if using the seat pad KD1009.

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 < 0.06% accuracy per day

Digital Signal Processing

Direct processing using digital recursive filters (infinite impulse response)

Memory

4Mb On-board FLASH

3.5Mb is available for data-storage allowing more than 3000 recordings (with no time history) to be saved.

Analogue to Digital Converter & Microcontroller

ADC: Word Length: 20 bits, Sampling Rate: 16kHz

Micro: Word Length: 16 bits, Operating Frequency: 16MHz

Displayed Measurement Resolution

0.1dB or <1%

Display

Electro-Luminescent, Back-lit LCD panel (160x160 pixels)

Refresh Rate ≤ 250mS

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

Overload

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

Size and Weight

Dimensions: (H):255mm (without Cable) x (W) :100mm x (D): 49mm

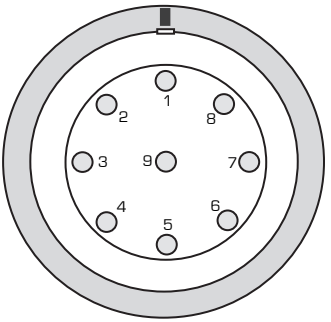
Weight: 780g approximately (including batteries)

Output

Wiring Configuration – Signal / Printer (9 Pin Lemo)

AC Out & Printer Socket	
Pin Number	Description
1	X Axis Output
2	Y Axis Output
3	Z Axis Output
4	Analogue Ground
5	Digital Ground
6	Receive
7	Transmit
8	Not Used
9	Not Used

External View



AC Output

Unweighted
Short circuit Protected
Load Impedance >10k recommended
Input Impedance = 520Ω

AC Output Voltages	
Range	Output Voltage rms at full scale ±1.5dB
1	65mV
2	325mV
3	650mV
4	650mV

Printer

2400 Baud, 8 bit, no parity, bi-directional

USB 'B' Socket

USB 1.0 or 2.0 compatible

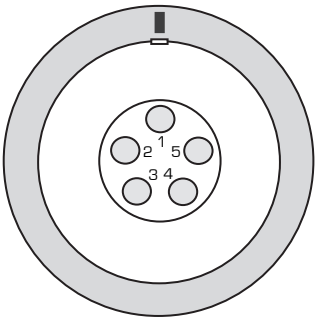
Wiring Configuration – (5 Pin Lemo)

Voltage Mode, 3-Channel Input

Transducer Input Socket	
Pin Number	Description
1	X Axis Input
2	Y Axis Input
3	Z Axis Input
4	Analogue Ground
5	Not Used

** Pins 2, 3 and 5 are not used for Single Axis Transducers*

External View



Batteries

Real Time Clock: CR2032 Lithium Battery (Factory Fitted)

Life Expectancy: Approximately 2 years

Main: Six size AA Alkaline cells (MN1500)

Life Expectancy: 18 hours continuous use (approx.) without backlight

Min Battery Level: 6.0V DC

External Power Supply

Mains Power (option) [order code PSU3:PRO-DX]:

Powered from a nominal AC supply of 230V ± 10% at 50 / 60Hz

12V DC mains adapter 1.25A

Centre Terminal: +12V

Outer Terminal: 0V

Min Voltage Level: 11V DC

Max Voltage Level: 18V DC

EC Declaration of Conformity

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

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

Castle Group Ltd declares that the: -

- *Excieo GA2005H, GA2005M and GA2005S 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 61000-6-3:2005*, *EN61326-1:2006*, *CISPR 22:1997*, *EN55022:1998*, *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 mode with the meter and no differences in radio frequency emissions are apparent between operating modes of multipurpose instruments.

Approved cables for use with Castle Excieo meters to comply with these specifications: -

Cable	Order Code	Length
Printer	ZL1084-01	1m
Excieo to PC (USB)	ZL1105-02	2m

Approved 12V DC (240V UK PSU) to comply with these specifications: -

Order Code
PSU3:PRO-DX

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

Chapter 11

Function Equations

The following table describes mathematically how the functions available on the Excieo 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 (dB)	$Aeq := 20\cdot\log\left[\frac{\sqrt{\frac{1}{T}\cdot\int_0^T (a_w)^2\cdot(ta)\,d(ta)}}{dBref}\right] \quad (dB)$ T = total integration time (seconds) $a_w(ta)$ = instantaneous acceleration value dBref = reference acceleration (ta) = time (seconds)
Acceleration (Imperial)	$Aeq := 3.28084\cdot\sqrt{\frac{1}{T}\cdot\int_0^T (a_w)^2\cdot(ta)\,d(ta)} \quad (fts^{-2})$ 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)

Function	Equation
Velocity (Metric) If 'Imperial' or 'g' is selected then the default result is displayed in Metric	$Veq := \int \left[\sqrt{\frac{1}{T} \cdot \int_0^T (a_w)^2 \cdot (ta)\, d(ta)} \right] d(tv) \quad (mm^{-1})$ T = total integration time (seconds) $a_w(ta)$ = instantaneous acceleration value (ta), (tv) = time (seconds)
Velocity (dB)	$Veq := \int 20 \cdot \log \left[\frac{\sqrt{\frac{1}{T} \cdot \int_0^T (a_w)^2 \cdot (ta)\, d(ta)}}{dBref} \right] dtv \quad (dB)$ T = total integration time (seconds) $a_w(ta)$ = instantaneous acceleration value dBref = reference acceleration (ta), (tv) = time (seconds)
Displacement (Metric) If 'Imperial' or 'g' is selected then the default result is displayed in Metric	$Deq := \int \int \left[\sqrt{\frac{1}{T} \cdot \int_0^T (a_w)^2 \cdot (ta)\, d(ta)} \right] d(tv)\, d(td) \quad (mm)$ T = total integration time (seconds) $a_w(ta)$ = instantaneous acceleration value (ta), (tv), (td) = time (seconds)
Displacement (dB)	$Deq := \int \int 20 \cdot \log \left[\frac{\sqrt{\frac{1}{T} \cdot \int_0^T (a_w)^2 \cdot (ta)\, d(ta)}}{dBref} \right] dtv\, d(td) \quad (dB)$ T = total integration time (seconds) $a_w(ta)$ = instantaneous acceleration value dBref = reference acceleration (ta), (tv), (td) = time (seconds)

Function	Equation
Running rms Acceleration (Metric)	$Arms := \sqrt{\frac{1}{\theta}\cdot\int_{t-\theta}^{t}(a_w)^2(ta)\,d(ta)} \quad \left(ms^{-2}\right)$ t = instantaneous time (seconds) θ = integration time of the measurement (seconds) $a_w(ta)$ = instantaneous acceleration value (ta) = time (seconds)
Running rms Acceleration (dB)	$Arms := 20\cdot\log\left[\frac{\sqrt{\frac{1}{\theta}\cdot\int_{t-\theta}^{t}(a_w)^2(ta)\,d(ta)}}{dBref}\right] \quad (dB)$ t = instantaneous time (seconds) θ = integration time of the measurement (seconds) $a_w(ta)$ = instantaneous acceleration value dBref = reference acceleration (ta) = time (seconds)
Running rms Acceleration (Imperial)	$Arms := 3.28084\cdot\sqrt{\frac{1}{\theta}\cdot\int_{t-\theta}^{t}(a_w)^2(ta)\,d(ta)} \quad \left(fts^{-2}\right)$ t = instantaneous time (seconds) θ = integration time of the measurement (seconds) $a_w(ta)$ = instantaneous acceleration value (ta) = time (seconds)
Running rms Displacement (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 (seconds) $a_w(ta)$ = instantaneous acceleration value (ta) = time (seconds)

Function	Equation
Running rms Velocity (Metric) If 'Imperial' or 'g' is selected then the default result is displayed in Metric	$Vrms := \int \left[\sqrt{\frac{1}{\theta} \cdot \int_{t-\theta}^{t} (a_w)^2 [ta]\, d[ta]} \right] d[tv] \quad (mms^{-1})$ t = instantaneous time (seconds) θ = integration time of the measurement (seconds) a_w[ta] = instantaneous acceleration value [ta], [tv] = time (seconds)
Running rms Velocity (dB)	$Vrms := 20 \cdot \log \left[\frac{\int \sqrt{\frac{1}{\theta} \cdot \int_{t-\theta}^{t} (a_w)^2 [ta]\, d[ta]}\, dtv}{dBref} \right]$ (dB) T = total integration time (seconds) a_w[ta] = instantaneous acceleration value a_{ref} = reference acceleration [ta], [tv] = time (seconds)
Running rms Displacement (Metric) If 'Imperial' or 'g' is selected then the default result is displayed in Metric	$Drms := \int \int \left[\sqrt{\frac{1}{\theta} \cdot \int_{t-\theta}^{t} (a_w)^2 [ta]\, d[ta]} \right] d[tv]\, d[td]$ (mm) t = instantaneous time (seconds) θ = integration time of the measurement (seconds) a_w[ta] = instantaneous acceleration value [ta], [tv], [td] = time (seconds)
Running rms Displacement (dB)	$Drms := 20 \cdot \log \left[\frac{\int \int \left[\sqrt{\frac{1}{\theta} \cdot \int_{t-\theta}^{t} (a_w)^2 [ta]\, d[ta]} \right] d[tv]\, d[td]}{dBref} \right]$ (dB) T = total integration time (seconds) a_w[ta] = instantaneous acceleration value [ta], [tv], [td]= time (seconds)

Function	Equation
Vibration Dose Value (VDV)	$VDV := \left[\int_0^T (a_w)^4 \cdot (ta)\, d(ta) \right]^{\frac{1}{4}} \quad (ms^{-1.75})$ T = total measured integration time (seconds) $a_w(ta)$ = instantaneous acceleration value (ta) = time (seconds)
VDV_{shift}	$VDV_{shift} := VDV \cdot \left(\frac{Exp}{t} \right)^{0.25} \quad (ms^{-1.75})$ VDV = Vibration Dose Value Exp = Exposure Time (Seconds) t = Measurement Log Duration (Seconds)
Vector Sum (HARM)	$VSum := \sqrt{(X)^2 + (Y)^2 + Z^2}$ X = X Axis Aeq Y = Y Axis Aeq Z = Z Axis Aeq
Vector Sum (WBV)	$VSum := \sqrt{(1.4X)^2 + (1.4Y)^2 + Z^2}$ X = X Axis Aeq Y = Y Axis Aeq Z = Z Axis Aeq
Dominant Axis (HARM)	Largest Aeq value from the X, Y and Z axis readings
Dominant Axis (WBV)	Largest Aeq value from the X, Y and Z axis readings Where the X and Y axis are subject to a multiplication factor of 1.4
Partial Ai(8) (Vector Sum)	$Ai(8) := Vsum \cdot \sqrt{\frac{Exp}{28800}}$ Vsum = Vector Sum (HARM or WBV) Exp = Exposure Time (Seconds)
Partial Ai(8) (Dominant Axis)	$Ai(8) := dom \cdot \sqrt{\frac{Exp}{28800}}$ dom = Dominant Axis (HARM or WBV) Exp = Exposure Time (Seconds)
Daily Exposure	$A(8) := \sqrt{(Ai(8)_1)^2 + (Ai(8)_2)^2 + (Ai(8)_n)^2}$ Ai(8) = Partial Exposures (Vector Sum or Dominant Axis)

Function	Equation
Exposure Time Allowed before Action Level Reached (Vector Sum) HARM or WBV	$t := \left(\frac{EAV}{Vsum}\right)^2 \cdot 8$ EAV = Exposure Action Value Vsum = Vector Sum (HARM or WBV)
Exposure Time Allowed before Limit Level Reached (Vector Sum) HARM or WBV	$t := \left(\frac{ELV}{Vsum}\right)^2 \cdot 8$ ELV = Exposure Limit Value Vsum = Vector Sum (HARM or WBV)
Exposure Time Allowed before Action Level Reached (Dominant Axis) HARM or WBV	$t := \left(\frac{EAV}{dom}\right)^2 \cdot 8$ EAV = Exposure Action Value dom = Dominant Axis (HARM or WBV)
Exposure Time Allowed before Limit Level Reached (Dominant Axis) HARM or WBV	$t := \left(\frac{ELV}{dom}\right)^2 \cdot 8$ ELV = Exposure Limit Value dom = Dominant Axis (HARM or WBV)
Exposure Time Allowed before Action Level Reached (VDV)	$t := \frac{\left[\left(EAV_{vdv}\right)^4 \cdot logtime\right]}{VDV^4}$ logtime = total measurement duration in seconds, minutes or hours EAV = Exposure Action Value VDV = Vibration Dose Value
Exposure Time Allowed before Limit Level Reached (VDV)	$t := \frac{\left[\left(ELV_{vdv}\right)^4 \cdot logtime\right]}{VDV^4}$ logtime = total measurement duration in seconds, minutes or hours ELV = Exposure Limit Value VDV = Vibration Dose Value
Peak	Pmax = The peak level of the weighted instantaneous acceleration, velocity or displacement over the measurement period

Function	Equation
Crest Factor	$CF := \frac{Peak}{rms}$ Peak = The highest peak level of the weighted instantaneous acceleration achieved over a measurement duration of 15 seconds rms = The running rms acceleration value over a measurement period of 15 seconds
Maximum rms Level (Acceleration)	Amax = The maximum Arms level reached over the measurement period
Maximum rms Level (Velocity)	Vmax = The maximum Vrms level reached over the measurement period
Maximum rms Level (Displacement)	Dmax = The maximum Drms level reached over the measurement period
Partial Points (Dominant Axis or Vector Sum) HARM or WBV	$Points\_Points := \left[\left(\frac{Aeq}{EAV}\right)^2 \cdot \left(\frac{Exp}{8}\right)\right] \cdot 100$ Aeq = Acceleration (Metric) EAV = Exposure Action Value (2.5 HARM, 0.5 WBV) Exp = Exposure Time (hours)
Points (15m) (Dominant Axis or Vector Sum) HARM or WBV	$Points(15m) := \left[\left(\frac{Aeq}{EAV}\right)^2 \cdot \left(\frac{0.25}{8}\right)\right] \cdot 100$ Aeq = Acceleration (Metric) EAV = Exposure Action Value (2.5 HARM, 0.5 WBV)
Points (1h) (Dominant Axis or Vector Sum) HARM or WBV	$Points(1h) := \left[\left(\frac{Aeq}{EAV}\right)^2 \cdot \left(\frac{1}{8}\right)\right] \cdot 100$ Aeq = Acceleration (Metric) EAV = Exposure Action Value (2.5 HARM, 0.5 WBV)

Chapter 12

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.	Check condition of batteries and replace if required.
	If batteries are inserted and are of adequate charge, remove one battery for approximately 10 seconds and replace.
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.	Ensure correct Axis coefficients are entered in the Manual Calibration screen for the mode of operation.
	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 5% over 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.

Instrument Disposal

The symbol shown to the left can be found on your instrument and means that the product is classed as electrical or electronic equipment and should be disposed of at the end of its life separately to your commercial or household waste.

The Waste of Electrical and Electronic Equipment Directive (2002/96/EC) has been established to help reduce the influx on landfill sites and effectively treat hazardous substances by using best practices for the recovery and recycling of products.

Over 75% of waste electrical goods end up in landfill, where lead and other toxins contained in the electrical goods can cause soil and water contamination.

This can have a very harmful effect on natural habitat, wildlife and also human health. When situated near populated areas these toxins can cause problems to communities as their water and soil is polluted.

Many of the electrical items that we throw away can be repaired or recycled. Recycling items helps to save natural finite resources and also reduces the environmental and health risks associated with sending waste electrical goods to landfill.

To minimise our impact on this earth and to protect the environment for future generations it is important that we are all aware of the consequences of our actions and how we can make a difference.

There are various collection systems in place within the EU for the disposal of your product. To find the nearest UK waste recycling point in your area, enter your postcode in the website **www.recycle-more.co.uk**

For more information please contact your local authority, the dealer where you purchased your product or Castle Group Ltd.

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 Model		
GA2005H ☐	GA2005M ☐	GA2005S ☐

Instrument Serial Number

Supplied Transducer Serial Number			
HARM (KD1006)	SINGLE (KD1003)	WBV	
		(KD1007)	(KD1009)

Purchase Date

Index

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Castle GROUP

Wellbeing and Productivity Solutions for Business




LEGISLATION AND LITIGATION

The introduction of 'The Control of Vibration at Work Regulations 2005' in the UK and similar throughout Europe is an important signal that employers should be protecting employees from this debilitating exposure. Government enforcement is fairly rigorous but this may not be enough to protect companies from civil claims! It is important to seek advice to avoid a potentially very expensive problem!

WHAT IS HUMAN VIBRATION EXPOSURE?...

Long term exposure to vibration can lead to permanent disability for employees and to huge civil claims and massive insurance premiums for companies. Any hand contact with a vibrating surface will result in Hand Arm Vibration Exposure. The most commonly known Hand Arm Vibration problem is Vibration White Finger. Whole Body Vibration Exposure results from seated or standing people being in contact with vibrating surfaces. For Companies to protect themselves and their employees properly, it is imperative to measure the levels of exposure. The Castle Excieo Vibration meter can provide these measurements with the simplest of instruction and the greatest of ease. The final results are presented in Castle's VibdataPro software, which instantly gives daily exposures and maximum operating times.

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