

GA2000 General Purpose

GA2001 HARM®

Vibration Meters



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 the Hand / Arm Vibration Regulations.

It is my intention for Castle Group Ltd to provide a complete range of Noise and Vibration products and Services of the highest standard. If you would like to know more about any of our other products and services then please complete the reply paid card in this manual and return it to us for prompt action or telephone on +44(0)1723 584250.

Simon Bull

A handwritten signature in black ink, consisting of several overlapping loops and a horizontal stroke at the end, representing the name Simon Bull.

Sales and Marketing Director

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## Introduction

This manual contains complete operating instructions for the GA2001. Read it carefully and you will quickly become familiar with your instrument. If you have problems with the operation of any model, please contact Castle Group Ltd by fax on 01723 583728 or phone 01723 584250.

## Vibration Overview

We have attempted to provide a basic starter to vibration. If you need any more detail on the subject of vibration, it is recommended that you attend a course on the subject (training courses are available from Castle Group Ltd, if you are interested please call the number in the front of the manual).

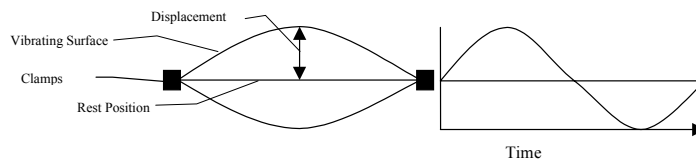


Figure 1.0V

The GA2000 series measures the vibration of a surface with the following parameters:

The **Displacement** of a vibrating surface is the distance the surface moves from a mean (or rest) position. Displacement is measured in  $\mu\text{m}$  (micrometers).

The **Velocity** of a vibrating surface is measured in  $\text{mms}^{-1}$  (millimetres per second).

The **Acceleration** of a vibrating surface is measured in  $\text{ms}^{-2}$  (meters per second per second).

The GA2000 series can measure each of these parameters. Acceleration, Velocity and Displacement correspond to the keys ACCEL, VEL and DISP respectively. Pressing the ACCEL key will initialise the Acceleration menu, similarly VEL the Velocity menu and DISP the Displacement menu.

Another consideration with vibration is its direction. In most cases the vibration will be different in different directions, but it would take quite a long time to measure the vibration in all possible directions. We can work out the overall vibration of the tool by measuring it in only three opposite directions, the X-, Y- and Z-axes and calculating the root-sum-of-squares. The GA2000 series is designed to provide the most cost-effective method of achieving tri-axial measurements.



Figure 1.1V

The number of times a surface vibrates per second is called its frequency. A person paddling a small boat on the sea will find that their boat will rock quite dramatically with small, frequent waves. The same person the next week is on a cruise ship, the person will notice that the small waves that rocked them in the smaller boat do not effect the cruise ship. If the person is very unfortunate they will find that large, infrequent waves, which rock the cruise ship, will not be felt so strongly in the smaller boat. Interestingly we may find that the small, frequent waves have the same energy total as the large, infrequent waves.

This example illustrates how different structures respond to different frequencies of vibration. Usually we are only interested in measuring the vibration which will affect a particular structure, so the GA2000 series has a set of filters which cut out irrelevant frequencies. The GA2000 series is also capable of Octave band analysis, which means that it can scan through different frequencies and show you what frequency band the most vibration occurs in.

Referring back to figure 1.0V, the vibration was graphed against time to achieve the signal shown in fig 1.2V. The peak of a signal is just what it's name implies, the peak. The RMS is the Root Mean Square of a signal, a full description is beyond the scope of this manual, what is important is that RMS is used regularly because the power of a signal can be calculated from it. The GA2000 series is capable of measuring both peak and RMS.

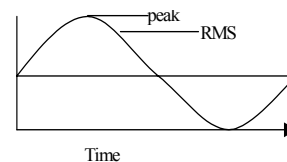


Figure 1.2V

## HARM<sup>®</sup> Overview

### Scope and Application of Use

The GA2001 is suitable for the assessment of hand-Arm Vibration as described in the above standards on hand held power tools. The vibration from percussive tools can contain very high level, high frequency vibration. Where percussive tools are used, the dynamic range of the GA2001 means that it is not suitable for measurement to ISO8041

HARM<sup>®</sup> (Hand Arm Risk Measurement) is of increasing concern to modern industry. It is very easy to reduce workers vibration exposure to zero, simply by stopping them from working. The GA2001 is a cost-effective way to get the most work done with the least discomfort to operators.

Different structures absorb different frequencies of vibration, the hand – arm structure has a frequency response that is simulated by the HARM<sup>®</sup> filter in the GA2001. The frequency weighting is primarily derived from studies of the subjective and biodynamic response of the hand and arm to vibration.

Vibration at these frequencies is likely to put the operator at risk. The GA2001 will calculate a workers daily exposure to HARM<sup>®</sup> weighted vibration.



Figure 1.0H

It is recommended that a copy of the appropriate National Standards be purchased, such as HSE guidance HS(G)88 and BS6842:1987.

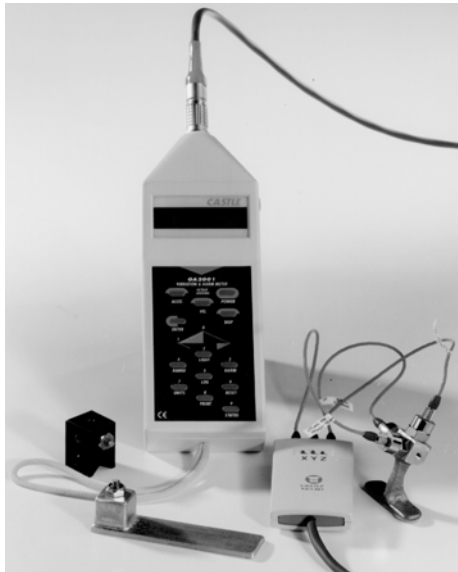
The GA2001 performs tri-axial HARM<sup>®</sup> measurements to avoid the ambiguities of dominant axis.

A HARM<sup>®</sup> record is stored to an employee (between 0 and 250), so it is possible for an employee to do different jobs through the day and as long as each job has been recorded, a complete daily exposure will be available.

To minimise the interference HARM<sup>®</sup> measurements cause in the workplace, a representative measurement is made of an operator's exposure to vibration. The operator's exposure time is also recorded. So it is not necessary to measure an entire shift to assess an operators daily exposure.

The vibration is measured in each axis separately. Each axis uses true integration, so the measurement should be left to integrate over a good representation of the vibration, then switched to the next axis. Once each axis has been recorded, you will have to assess how long the operator is exposed to the machine.

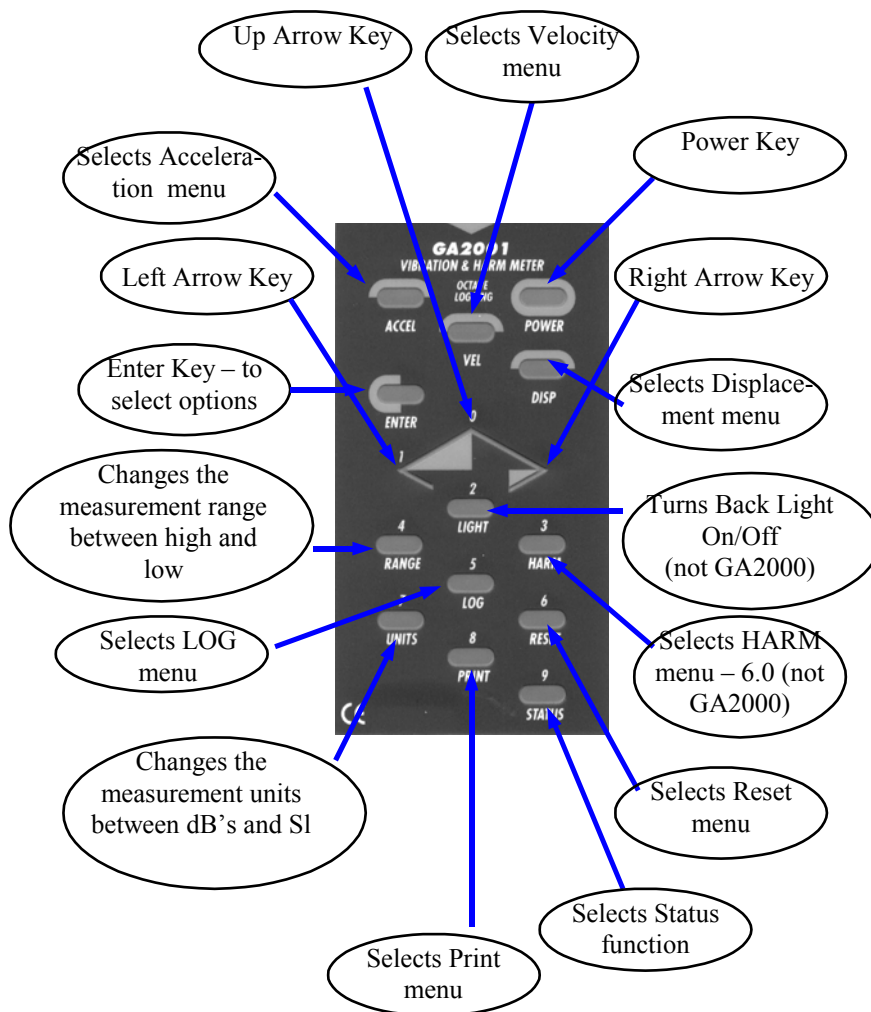
The GA2001 will calculate: the sum of squares of a record; the partial A(8) (daily exposure) of a record; the maximum exposure time for a given partial A(8) and A(8) for an employee.



The GA2001 offers a complete solution to HARM<sup>®</sup> measurements.

## Keypad Layout

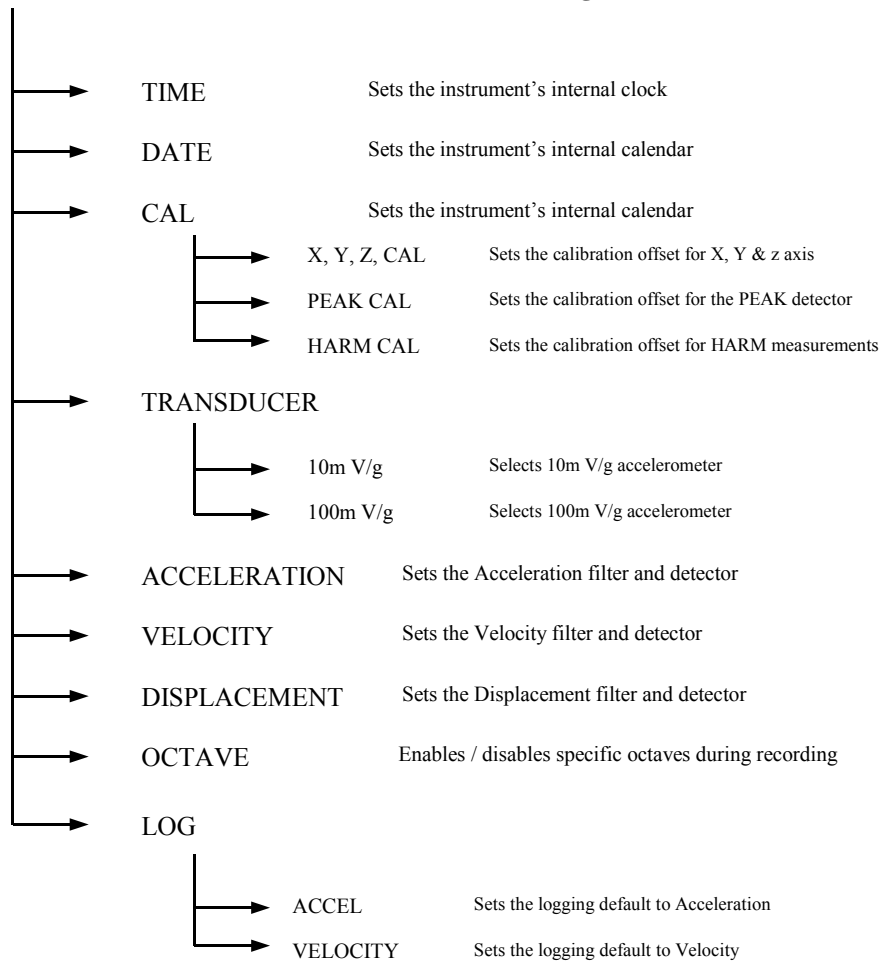
Below is a picture of the keypad for the GA2001 and the main functions of the keys.



## Menu Structure

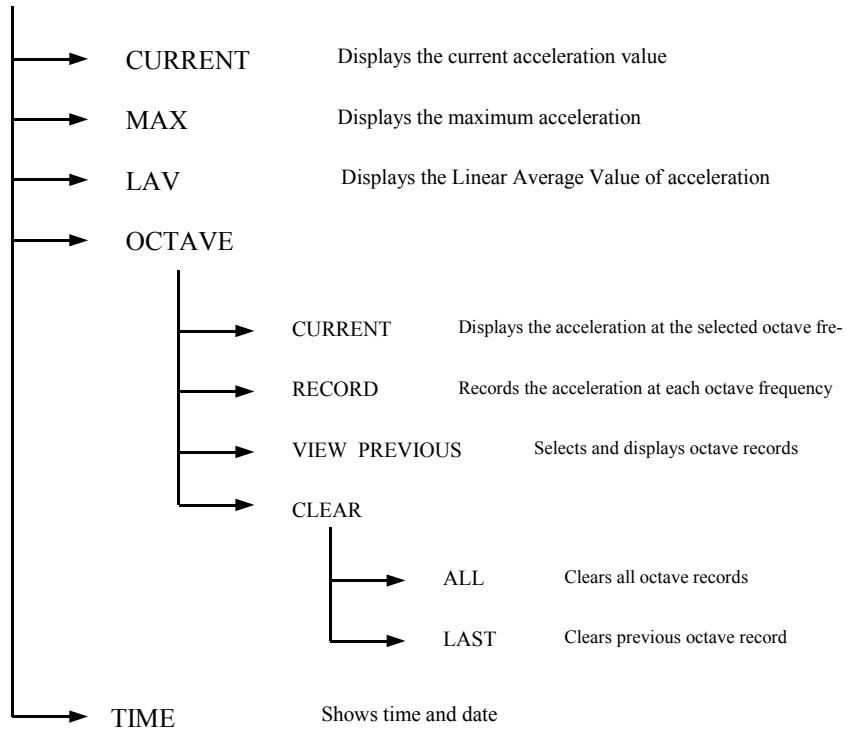
### SETUP

**All the instruments setup features are accessed through the SEUP menu.**



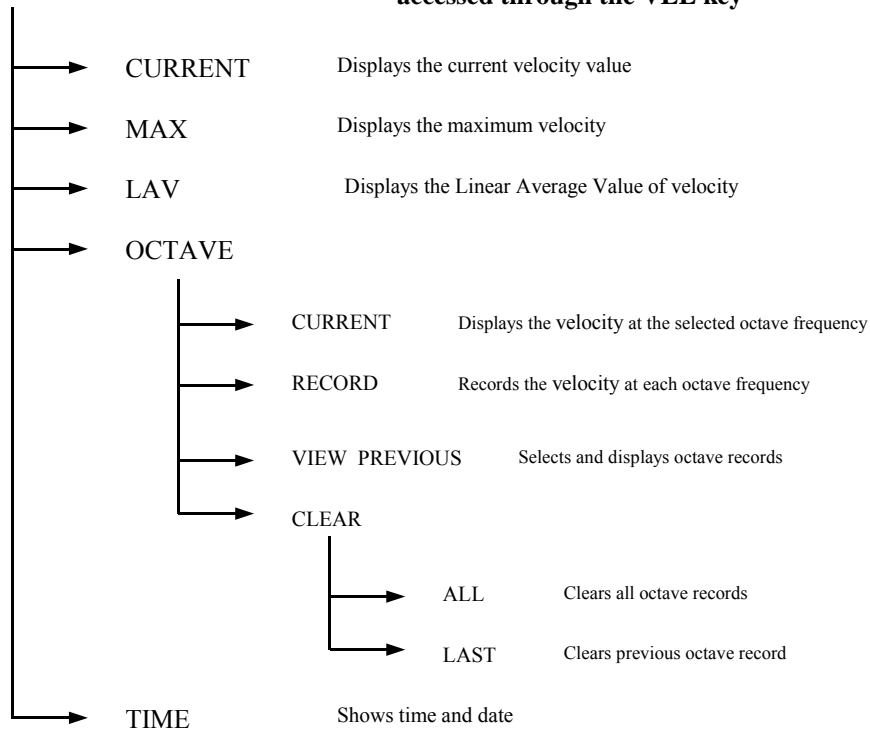
**ACCEL key**

**All the instrument's acceleration features are accessed through the ACCEL key**



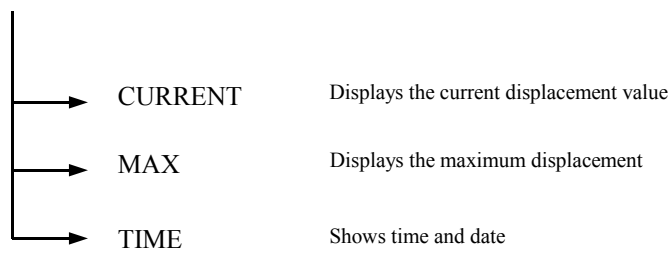
**VEL key**

**All the instrument's velocity features are accessed through the VEL key**



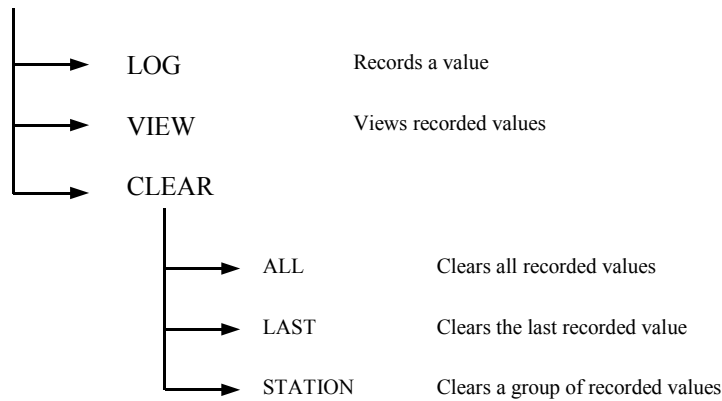
**DISP key**

**All of the instrument's displacement features are accessed through the DISP key**



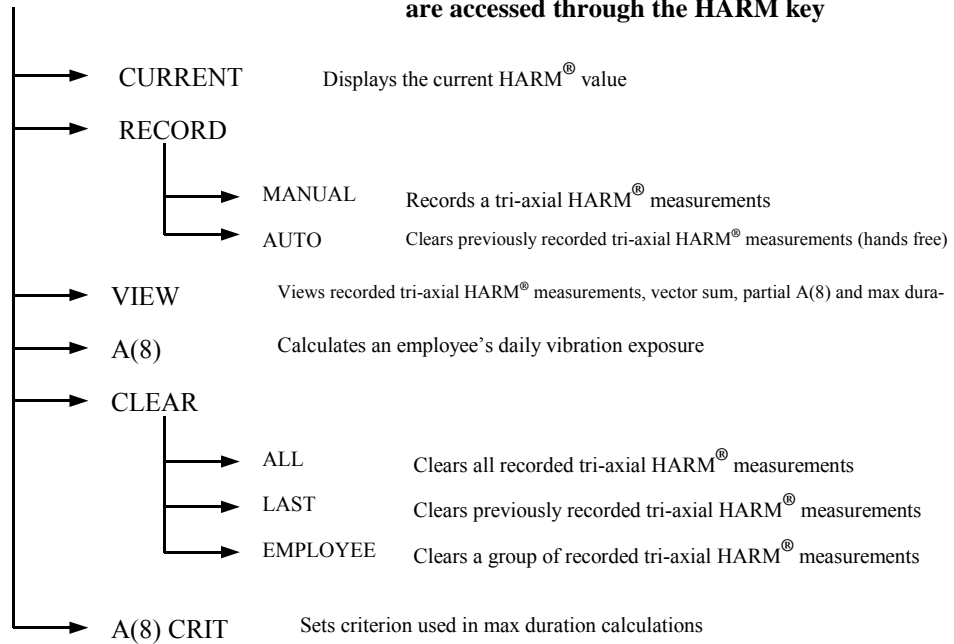
### LOG key

**Most of the instrument's log features are accessed through the LOG key**



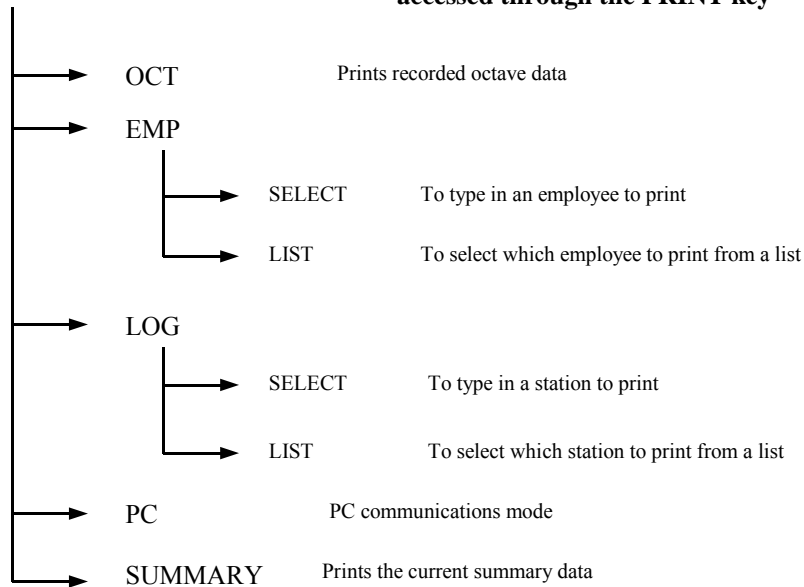
### HARM key

**All of the instrument's HARM<sup>®</sup> features are accessed through the HARM key**



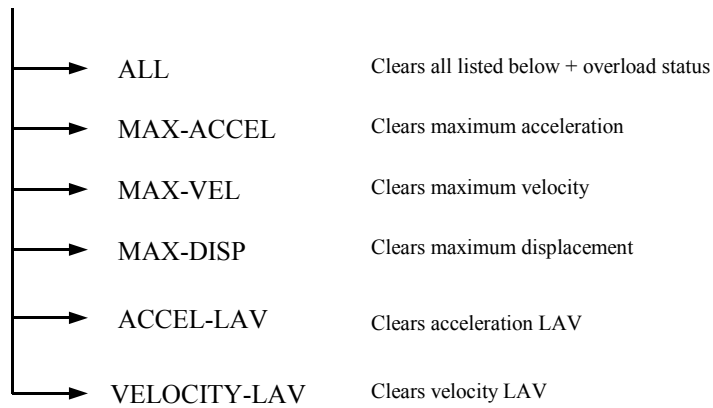
### PRINT key

**All the instrument's printout features are accessed through the PRINT key**



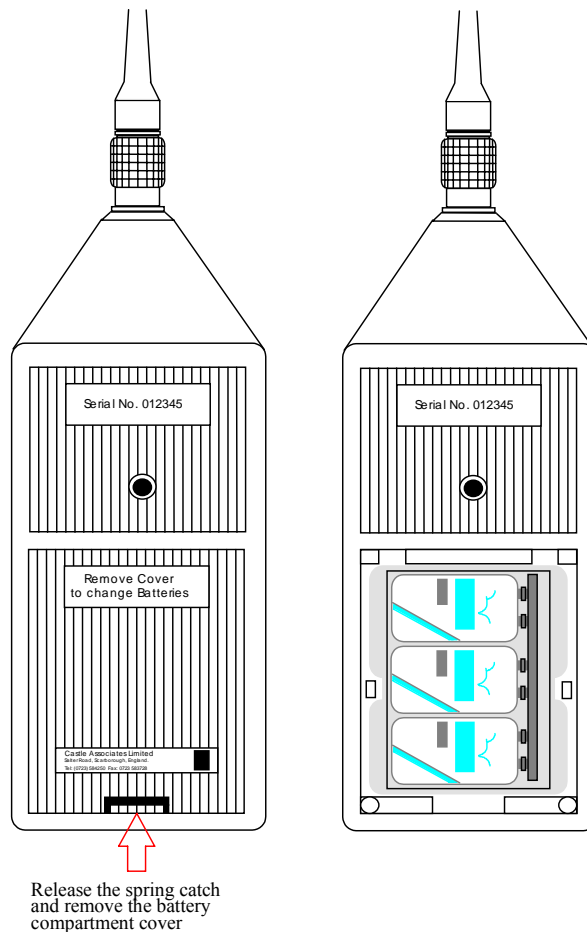
### RESET key

**Most of the instrument's reset features are accessed through the RESET key**



## Battery Installation

Use 3 high-capacity 9V batteries, Type 6LR61. The instrument will function with one or two batteries, but with a reduced running time. Do not use re-chargeable batteries.

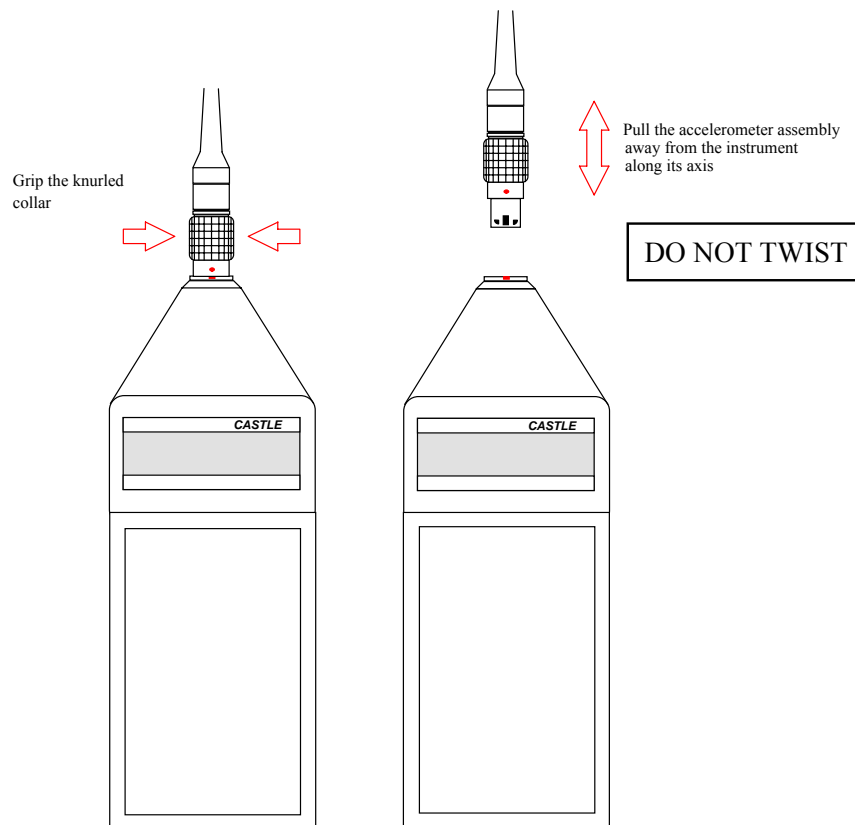


Press clip, remove cover, attach batteries to connector, replace cover firmly and close clip.

NOTE: A built-in lithium battery with a life of approximately 3 years provides back-up for the instrument's real-time clock, calendar and data storage. A new battery will be fitted when the instrument is returned for its annual re-calibration.

### Attaching / Removing the Accelerometer

Align the red dots on the accelerometer connector and instrument, grip the accelerometer connector and push firmly. To remove the accelerometer reverse this process. Do not twist the accelerometer connector.



### Switching On and Off

Hold the **POWER** button down until the screen displays the introduction

**GA2001  
VIBRATION METER**

## How to use the GA2000 Series Menu System

During this manual the terms ‘function’ and ‘menu’ are used. A function is something that the vibration meter does e.g. measure acceleration, take an octave, store a value etc. A menu is a list of functions, each menu groups functions together into a logical set to make the instrument easy to use. For example in the octave menu, the functions are:

- current** gives an overview of the octave bands
- record** records an octave
- Replay** replays recorded octaves
- clear** which selects a further menu - the clear menu - in which there is a choice of clearing all the octaves or the previous octave.

It is recommended that you turn on your vibration meter and follow the following section to familiarise yourself with the menu system and the keypad layout.

Turn the instrument on

READY:V1.0	←→
>SETUP<	

Press the **ACCEL** key

ACCEL:	←→
>CURRENT<MAX	

Press **ENTER**, the CURRENT reading is shown. This is the current **function**

ACCEL:	0.10ms <sup>-2</sup>
MECH	RMS

Pressing the **ENTER** key selects the highlighted option (using ‘>option<’ brackets), this will lead either to a function or a further menu. To move back to previous menu levels press the **UP** arrow.

Press the **UP** arrow to go back to the previous menu

ACCEL:	←→
>CURRENT<MAX	

Press the **RIGHT** arrow until >OCTAVE< is selected. This demonstrates that more options can exist off screen when indicated by ←→ in the top right of the screen

ACCEL:	←→
LAV>OCTAVE<	

Press ENTER. This is the OCTAVE menu

```
OCTAVE:      ←→
>CURRENT<RECORD
```

Press the LEFT arrow until >RECORD< Is selected. This demonstrated the cyclic nature of the menu system

```
OCTAVE:      ←→
>CURRENT<RECORD
```

Press the UP arrow to go back to the previous menu

```
ACCEL:       ←→
>CURRENT<MAX
```

Press the UP arrow to go back to the previous menu

```
READY:V1.0  ←→
>SETUP<
```

There are further keys which allow you to access certain functions with one touch. Their use, and the use of the numeric keys, will be discussed in the relevant parts of this manual.

## Setting up your Vibration Meter

### The Ready menu

When the meter is turned on, it performs a start-up routine, then displays the READY menu. Only one menu option is present, the >SETUP< menu (when an option is surrounded by >arrows< it is selected, this means pressing **ENTER** will go into the function/menu). If you press the **ENTER** key now the instrument will go into the SETUP menu.

### The Setup menu

The SETUP menu is where various settings can be changed. In the SETUP menu there are a number of functions.

<b>TIME</b>	sets the time
<b>DATE</b>	sets the date
<b>CAL</b>	sets the calibration offset for the X, Y and Z transducers used during HARM measurements
<b>TRANSDUCER</b>	sets the instrument's transducer sensitivity
<b>ACCELERATION</b>	sets the instrument's acceleration filter and detector
<b>VELOCITY</b>	sets the instrument's velocity filter and detector

***DISPLACEMENT*** sets the instrument's displacement filter and detector  
***OCTAVE*** enables / disables octaves during recording  
***LOG*** sets the logging default

### **The Time function**

To select the TIME function move the selection arrows (using the **LEFT** or **RIGHT ARROW** keys) to >TIME< in the SETUP menu, then press the **ENTER** key. The TIME function enables you to set the instrument's internal clock. The function first prompts you to enter the current hour (24hr clock), do this using the numeric values on the keypad (the time is a two digit value so 1am is entered as 01, 2pm as 14 and so on). When satisfied that the hour is correct, press the **ENTER** key. Do the same for the minute and the second (when the second has been entered the time will be displayed to the screen). If at any time you want to quit the TIME set-up just press the **RIGHT** arrow to go back to the SETUP menu, also, by pressing **ACCEL**, **VEL**, or **DISP**, the relevant menu will be initiated and the clock will revert to the previous time. Press the **UP** arrow to exit the function.

### **The Date function**

To select the DATE function move the arrows (using the **LEFT** or **RIGHT ARROW** keys) to >DATE< in the SETUP menu, then press the **ENTER** key. The date function enables you to set the instrument's internal calendar. The function first prompts you to enter the current day, do this using the numeric values on the keypad (the date is a two digit value so 1 is entered 01, 2 as 02 and so on). When satisfied that the day is correct, press the **ENTER** key. Do the same for the month and the year (when the year has been entered the date will be displayed to the screen). If at any time you want to quit the DATE set-up just press the **RIGHT** arrow to go back to the SETUP menu, also, by pressing **ACCEL**, **VEL** or **DISP**, the relevant menu will be initialised and the date will revert to the previous date. If the date has been entered correctly press the **UP** arrow to exit the function.

### **The Cal function**

The CAL menu is where various calibration offsets can be changed. In the CAL menu there are a number of functions.

The calibration settings are set correctly at the factory, however, calibration of the instrument should be verified on a regular basis using a vibration exciter such as the Castle GA606 or the Rion VE-10. Adjustments to the calibration of the instrument can only be made when using a traceable calibration source. If a nominal 10 mV/g is used, calibration is performed on the low range. If a nominal 100 mV/g is used, calibration is performed on the high range.

***X,Y,Z CAL*** sets the calibration multiplier for each axis  
***PEAK CAL*** sets the calibration multiplier for the peak detector  
***HARM CAL*** sets the calibration multiplier for the HARM filter

#### **The X,Y,Z Cal function**

To select the X, Y, Z CAL function move the arrows (using the **LEFT** or **RIGHT ARROW** keys) to >X, Y, Z CAL< in the CAL menu, then press the **ENTER** key. The X, Y, Z CAL function enables you to set the calibration multiplier for each axis. To achieve good resolution on the cal multiplier, the vibration value is divided by 256 then multiplied by the cal multiplier. To increase the cal multiplier in single steps press the **RIGHT ARROW** key and to decrease the cal multiplier in single steps press the **LEFT ARROW** key. To increase the cal multiplier in steps of 10 press the **HARM** key and to decrease the cal multiplier in steps of 10 press the **RANGE** key. Press the **ENTER** key to change axes. Press the **UP ARROW** key to exit the function.

#### **The Peak Cal function**

To select the PEAK CAL function move the arrows (using the **LEFT** or **RIGHT ARROW** keys) to >PEAK CAL< in the CAL menu, then press the **ENTER** key. The PEAK CAL function enables you to set the calibration multiplier for the peak indicator. To achieve good resolution on the cal multiplier, the vibration value is divided by 256 then multiplied by the cal multiplier. To increase the cal multiplier in single steps press the **RIGHT ARROW** key and to decrease the cal multiplier in single steps press the **LEFT ARROW** key. To increase the cal multiplier in steps of 10 press the **HARM** key and to decrease the cal multiplier in steps of 10 press the **RANGE** key. Press the **UP ARROW** key to exit the function.

### **The HARM Cal function**

To select the HARM CAL function move the arrows (using the **LEFT** or **RIGHT ARROW** keys) to >HARM CAL< in the CAL menu, then press the **ENTER** key. The HARM CAL function enables you to set the calibration multiplier for the peak detector. To achieve good resolution on the cal multiplier, the vibration value is divided by 256 then multiplied by the cal multiplier. To increase the cal multiplier in single steps press the **RIGHT ARROW** key and to decrease the cal multiplier in single steps press the **LEFT ARROW** key. To increase the cal multiplier in steps of 10 press the **HARM** key and to decrease the cal multiplier in steps of 10 press the **RANGE** key. Press the **UP ARROW** key to exit the function.

### **The Transducer function**

To select the TRANSDUCER function move the arrows (using the **LEFT** or **RIGHT ARROW** keys) to >TRANSDUCER< in the SETUP menu, then press the **ENTER** key. The TRANSDUCER function enables you to select the transducer's sensitivity. To select 10mV/g sensitivity select >10mV/g< from the ACCELEROMETER menu, to select 100mV/g sensitivity select >100mV/g < from the ACCELEROMETER menu. A message will appear showing which sensitivity has been selected, to calibrate each axis to the new sensitivity press the **ENTER** key and follow the instructions in 'The X, Y, Z CAL function'. Press the **UP ARROW** key to exit the function.

### **The Acceleration function**

To select the ACCELERATION function move the arrows (using the **LEFT** or **RIGHT ARROW** keys) to >ACCELERATION<, then press the **ENTER** key. This function enables the operator to change the filter and detector used on the Acceleration measurements. On the second line of the display the current filter (left hand side) and detector (right hand side) are shown. To change the filter press the **LEFT ARROW** key, subsequent presses of the **LEFT ARROW** key will cycle through all the filters. To change the detector press the **RIGHT ARROW** key, subsequent presses of the **RIGHT ARROW** key will cycle through all the detectors. Press the **UP** arrow to exit the function, exiting will set the filter and detector to the selected settings.



In the OCTAVE function the operator can specify which octaves will be recorded during an automatic octave record. In this function, the second line displays 16 Hz with a tick (√) next to it. The tick next to each octave means that it will be included in the automatic octave. Pressing the ENTER key will remove or reinstate the tick.

### **The Log function**

To select the LOG function move the arrows (using the **LEFT** or **RIGHT ARROW** keys) to >LOG<, then press the **ENTER** key. This function selects the default logging parameter. Default is used because logs are stored in groups called stations. Each station uses the same parameters, so if you log into a station that already exists the station's parameters are selected. If a you log to a new station the default parameter is used.

To select acceleration (includes current acceleration filters and detectors) as the default select >ACCEL< and press the ENTER key, to confirm the selection. Similarly to select velocity as the default select >VEL< and press the ENTER key, to confirm the selection.

### **Taking Measurements**

In the measurement menus (Acceleration, Velocity and Displacement) there are a number of functions

**CURRENT**

**MAX**

**LAV**                      Linear Average Value - Not available in Displacement menu

**TIME**

**OCTAVE**                Not available in Displacement menu

### **The Current function**

To select the CURRENT function move the arrows (using the **LEFT** or **RIGHT ARROW** keys) to >CURRENT< in either the ACCEL, VEL or DISP menu then press the **ENTER** key. The CURRENT function displays the current measurement value. The second line of the display indicates the detector and filter weighting in use.

To exit the CURRENT function press the **UP** arrow key, alternatively you can move straight to the next function (MAX) by pressing the **RIGHT ARROW** key or the previous function (TIME) pressing the **LEFT ARROW** key. Pressing the **LOG** key will store the value at the instant the key was pressed to STATION 000 – see the logging section for an explanation of stations. Pressing the parameter key again i.e. ACCEL, VEL or DISP will change the axis (automatically using the KD1301 Tri-axial pre-amp interface).

### **The Max function**

To select the MAX function move the arrows (using the **LEFT** or **RIGHT ARROW** keys) to >MAX< in either the ACCEL, VEL or DISP menu then press the **ENTER** key. The MAX function displays the maximum value that has occurred. The second line of the display shows the time the maximum occurred. To exit the MAX function press the **UP** arrow key, alternatively you can move straight to the next function (LAV) by pressing the **RIGHT ARROW** key or the previous function (CURRENT) by pressing the **LEFT ARROW** key. Pressing the **LOG** key will store the max value and event time at the instant the key was pressed to STATION 000 – see the logging section for an explanation of stations. Pressing the parameter key again i.e. ACCEL, VEL or DISP will change the axis (automatically using the KD1301 Tri-axial pre-amp interface).

### **The LAV function (not available in Displacement menu)**

To select the LAV function move the arrows (using the **LEFT** or **RIGHT ARROW** keys) to >LAV< in either the ACCEL or VEL menu then press the **ENTER** key. The LAV function displays the equivalent level of vibration over the elapsed time. The second line displays the elapsed time. This function only works with the RMS detector. To exit the LAV function press the **UP** arrow key, alternatively you can move straight to the next function (TIME) by pressing the **RIGHT ARROW** key or the previous function by pressing the **LEFT ARROW** key. Pressing the **LOG** key will store the LAV value and elapsed time at the instant the key was pressed to STATION 000 – see the logging section for an explanation of stations. Pressing the parameter key again i.e. ACCEL, VEL or DISP will change the axis (automatically using the KD1301 Tri-axial pre-amp interface). Pressing the **ENTER** key will pause / play the LAV.

### **The Time function**

To select the TIME function move the arrows (using the **ARROW** keys) to >TIME< in either the ACCEL, VEL or DISP menu then press the **ENTER** key. The time function displays the elapsed time, the second line displays the real time and date. As displacement has no LAV, there is no elapsed time. To exit the TIME function press the **UP** arrow key, alternatively you can move straight to the next function (CURRENT) by pressing the **RIGHT ARROW** key or the previous function (LAV) by pressing the **LEFT ARROW** key.

### **The Octave menu (not available in Displacement menu)**

To select the OCTAVE menu move the arrows (using the **LEFT** or **RIGHT ARROW** keys) to >OCTAVE< then press the **ENTER** key. Selecting OCTAVE will bring up the OCTAVE menu. In the OCTAVE menu there are a number of functions

**CURRENT**

**RECORD**

**VIEW PREVIOUS**

**CLEAR**

To exit the OCTAVE menu press the **UP** arrow. All octaves are taken using the LINEAR filter and RMS detector.

### **The (Octave) Current function**

To select the CURRENT function move the arrows (using the **LEFT** or **RIGHT ARROW** keys) to >CURRENT< in the OCTAVE menu then press the **ENTER** key. The CURRENT function displays the current measurement value filtered through the 16 Hz filter. Pressing the **RIGHT** arrow/**LEFT** arrow will select the next/previous octave filter. To exit the CURRENT function, press the **UP** arrow.

Pressing the parameter key again i.e. ACCEL, VEL or DISP will change the axis (automatically using the KD1301 Tri-axial pre-amp interface).

### **The Record function**

To select the RECORD function move the arrows (using the **LEFT** or **RIGHT ARROW** keys) to >RECORD< in the OCTAVE menu then press the **ENTER** key. The RECORD function automatically scans through each (or as is explained in 'The (USER) OCTAVE function', selected) octave.

When an octave is scanned, the instrument takes an average value and records it (each band takes 12 seconds, 2 seconds to select and warm up the filters and then 10 seconds to average the vibration level in the particular band). Once the octave is recorded press the **UP** arrow to exit the function.

#### **The View Previous function**

To select the VIEW PREVIOUS function move the arrows (using the **LEFT** or **RIGHT ARROW** keys) to >VIEW PREVIOUS< in the OCTAVE menu then press the **ENTER** key. The VIEW PREVIOUS function allows review of previously recorded octaves, which are identified either by number or by the date and time they were recorded. To select an octave press the **ENTER** key. Once selected the individual bands can be reviewed by pressing the **RIGHT** and **LEFT ARROW** keys. To exit the VIEW PREVIOUS function, press the **UP** arrow.

#### **The Clear menu**

To select the CLEAR menu move the arrows (using the **LEFT** or **RIGHT ARROW** keys) to >CLEAR< in the OCTAVE menu then press the **ENTER** key. The CLEAR menu enables the operator to clear octaves and hence free memory for more recent octaves. In the CLEAR menu there are two functions  
**ALL**  
**LAST**

To exit the CLEAR menu press the **UP** arrow.

#### **The (Clear) All function**

To select the ALL function move the arrows (using the **LEFT** or **RIGHT ARROW** keys) to >ALL< in the CLEAR menu then press the **ENTER** key. This clears **ALL** the octaves in memory (this includes octaves taken in both ACCEL and VEL measurement modes). To exit the ALL function press the **UP** arrow.

#### **The (Clear) Last function**

To select the LAST function move the arrows (using the **LEFT** or **RIGHT ARROW** keys) to >LAST< in the CLEAR menu then press the **ENTER** key. This function clears the **LAST** octave recorded (once again, this includes octaves taken in both ACCEL and VEL measurement modes). To exit the LAST menu press the **UP** arrow.

### **Printing an Octave**

To print an OCTAVE press the **PRINT** key then select >OCT< with the **RIGHT** or **LEFT ARROW** keys then press the **ENTER** key. The PRINT function allows you to print previously recorded octaves, which are identified either by number or by the date and time they were recorded. To select an octave press the **ENTER** key.

### **Function Keys**

There are a number of keys that call functions just by pressing them. These are:

#### **The Range key**

The **RANGE** key changes the range of the instrument (the ranges for each measurement are detailed in the section 'TECHNICAL SPECIFICATIONS'). When you first press **RANGE** the current range is displayed. Subsequent presses of the range key change the range. There is a delay after each range where the electronics are settling.

#### **The Reset key**

The **RESET** key has two functions. Firstly, if you are in either MAX or LAV and you press the **RESET** key you will be asked if you want to clear that particular value. If you do, press **ENTER**, otherwise press any other key, you will now be asked if you want to clear the other value (i.e. LAV or MAX), once again press **ENTER** to clear the value or any other key not to clear it. Secondly if you are in a menu and you hit the **RESET** key the full RESET menu will come up. This is like any other menu, select the value you wish to clear and press **ENTER**, a message will appear to the effect of 'value cleared', press any key and you will return to the menu.

#### **The (Reset) All function**

clears all max values, LAV's and the overload status

#### **The (Reset) Max-Accel function**

clears the max accel value and the time it occurred

#### **The (Reset) Max-Vel function**

similar to reset max accel but for velocity

#### **The (Reset) Max-Disp function**

similar to reset max accel but for displacement

***The (Reset) Accel\_LAV function***      clears the acceleration LAV value and elapsed time

***The (Reset) Vel-LAV function***      similar to reset accel-lav but for velocity

**The Status key**

The **STATUS** key will display the battery status which tells you the power left in the batteries in your unit (three bars = full power, one bar = nearly dead, two bars is in between the two). The Overload status is also displayed, if the accelerometer has been overloaded the time of this overload will be displayed, otherwise the display will read 'OVERLOAD NOT SET'. To get out of the STATUS function just press the **STATUS** key again.

**The Print key**

The **PRINT** key will bring up the PRINT menu. This will give you the option to print summary information about any measurement (ACCEL, VEL or DISP) you have made, to print octaves and logs you have recorded and to connect the unit to the PC.

***The (Print) Oct function***      prints a selected octave to the printer

***The (Print) Emp function***      prints an employee to the printer. There are two options: SELECT or LIST

**SELECT:** allows you to type the employee you want to print

**LIST:** allows you to select, with the arrow keys, the employee you want to print

***The (Print) Log function***      prints a range of stations to the printer. There are two options SELECT or LIST

**SELECT:** allows you to type the station you want to print

**LIST:** allows you to select, with the arrow keys, the station you want to print.

***The (Print) Summary function***      prints information from whichever parameter is selected

***The PC function***      switches the meter to computer mode, in this mode communications software on the PC can upload information from the meter to the PC

**The Units key**

The **UNITS** key switches the displayed value (and printed values) between relative notation (dB's) and absolute notation ( $\text{ms}^{-2}$  and  $\text{mms}^{-1}$ )

## Logging

### The Log key

The logging method is orientated towards industrial use, where there are a number of machines to be monitored over a period of time. Each monitoring point on a machine should be given a station number, if you take regular measurements at the same station the readings can be used to indicate trends in the particular station. When a log is taken you are prompted to enter a station number (more about this in section 5.02 Taking a log). This log will then be stored along with all the other logs taken at that station, this eases reviewing data and removes ambiguity from storing data.

### Important

Once you have started logging to a particular station, successive logs use the same filter and detector as the first log. This ensures that a station is consistent and contains values which are of use for statistical/graphical analysis.

### The (User) Log function

To select the (USER) LOG function move the arrows (using the LEFT and RIGHT ARROWS) to LOG in the USER menu then press the **ENTER** key. This function enables the operator to specify whether to log Acceleration values or Velocity values. If you select Acceleration the current acceleration filter and detector will be used during the log, similarly if Velocity is selected the velocity setup will be used during the log.

### Taking a Log

The **LOG** key works in a similar way to any of the other function keys i.e. if you are in any menu and you press the **LOG** key it will bring up the LOGGING menu. To record a log select >LOG< from the LOGGING menu and press the **ENTER** key. The meter prompts for a station number. If you start a new station (enter a station which doesn't already exist) the settings will be loaded from the logging setup. If you use a station which already contains data the settings used during the recording of previous data will be used.

ENTER STATION NO STAT (= < 250):
-------------------------------------

STAT prompts for a station number, this must be less than or equal to 250 .

### Viewing a Log

To view a log select >VIEW< from the LOGGING menu and press the **ENTER** key. The meter prompts you for the station number you wish to view. Type the station number and hit the **ENTER** key (to exit the routine press the **RIGHT** arrow key). Pressing the **RIGHT** and **LEFT** arrow keys will select other logs which have been recorded under the same station number. Press the **UP ARROW** to return to the station prompt.

### Clearing a Log

To clear a log select >CLEAR< from the LOGGING menu and press the **ENTER** key. This will bring up the CLEAR menu. There are three options ALL, LAST and STATN.

**ALL** will clear **ALL** logs from memory.

**LAST** will clear the last log from memory.

**STATN** will prompt for a station number, entering a station number will clear that station number.

**Important** - it takes approximately 12 seconds to clear a location in a station so a station with 10 locations will take 2 minutes to clear and a station with 100 locations will take 20 minutes to clear.

### **HARM (The HARM key)**

HARM is a tri - axial measurement i.e. you measure the vibration on the top, front and side of the tool. Each HARM log measures three values corresponding to each axis. Taking a HARM log is similar to taking a normal log except that the filter and detector are already set (HARM and RMS respectively, the measurement parameter is Acceleration).

### **WARNING!**

**If an overload occurs during a HARM<sup>®</sup> measurement it is recommended that you go to the next range up and perform the measurement again.**

**If the instrument displays UNDERRANGE this indicates that the measurements are below that of the present indicator range and it may be necessary to change to a lower operating range to obtain more accurate measurements.**

### **Viewing HARM levels**

To view the current acceleration through the HARM filter network select >CURRENT< from the HARM menu and press the **ENTER** key. This is provided merely for spot-checking and is not recorded in the unit's memory. The current axis is displayed on the bottom right of the screen. Pressing **ENTER** will cycle through each axis. Pressing the parameter key again i.e. ACCEL will change the axis (automatically using the KD1301 Tri-axial pre-amp interface).

### **Recording HARM levels**

To record HARM values select >RECORD< from the HARM menu and press the **ENTER** key. You are now prompted for either a manual or automatic record.

### **Manual HARM levels**

Select >MANUAL< from the HARM record menu. You will now be prompted for an employee number (= <250). It's important to record under the correct employee because vibration dose is calculated by employee. Once the employee has been entered, the current value of acceleration on the X-axis is displayed. This value is not being recorded, it is merely displayed to show the operator the vibration level. Pressing the **ENTER** key will start an LAV calculation on the X-axis vibration level, the elapsed time of this LAV is shown but the displayed level is the current vibration level and not the LAV (note:- at least one second must elapse before going to the next measurement). Pressing the **ENTER** key again will store the LAV value to memory and begin again with the Y-axis (if at this point you wish to exit the routine having measured only one axis press the **UP ARROW**) and then the Z-axis. Once all three axes are stored you are prompted for an exposure time, this is the duration of exposure to the vibration. The HARM log is now complete.

### **Automatic HARM records**

Select >AUTO< from the HARM record menu. You will be prompted to enter minutes and then seconds. This interval is the time spent averaging in each axis e.g. if you select 10 seconds the X axis is selected, averaged for 10 seconds (LAV) and the average stored as the vibration for the axis, then the Y axis is selected and averaged for 10 seconds etc. Once the interval has been selected you will be prompted for an employee number.

It is important to record under the correct employee because vibration dose is calculated by employee. Entering the employee number begins the automatic HARM record. Each axis is given approx. 8 seconds to settle then the averaging period starts. After the interval has elapsed the next axis is automatically selected and is given 8 seconds to settle before it is averaged over the programmed interval. At the end of the automatic record the operator is prompted for the exposure period this is the duration of exposure to the vibration. The HARM log is now complete.

#### **Viewing HARM records**

To view HARM records select >VIEW< from the HARM menu and press the **ENTER** key. You will now be prompted for an employee number (= <250). Once the employee number has been entered the date and time of the first log taken under that employee is displayed, pressing the **ARROW** keys will bring up any more logs under the employee. To view a selected log press the **ENTER** key. Pressing the **ARROW** keys will enable you to look at the value recorded for each axis, the root-sum-of-squares values and the exposure period, the partial exposure value for the record and the maximum recommended exposure for an A(8) value specified by user. The partial exposure is the exposure calculated from the root-sum-of-squares acceleration value using the input exposure period and based on 8 hours exposure. A(8) is the accumulation of partial exposures for any one employee.

#### **Altering the Exposure period**

While the root-sum-of-squares is displayed on the top line and the exposure time on the bottom line pressing the **ENTER** key will call a prompt to change the exposure period.

#### **Calculating Vibration DOSE A(8)**

To calculate Vibration dose select A(8) from the HARM menu. You will now be prompted for an employee number (= <250). Once the employee number has been entered the A(8) for the employee is calculated and displayed. Press the **UP ARROW** to exit the routine. Note - each record under an employee is within +/- 1 %.

### Clearing records

To clear a log select >CLEAR< from the menu and press the **ENTER** key.

This will bring up the CLEAR menu.

There are three options ALL, LAST and EMPLY.

**ALL** will clear ALL logs from memory.

**LAST** will clear the last log from memory.

**EMPLY** will prompt for the employee number that you want to delete then delete that employee.

### A(8) Criterion

In the section on viewing HARM<sup>0</sup> records we mentioned the maximum exposure time for an A(8) specified by the user. To set the A(8) criterion select >A(8)CRIT< from the menu and press the **ENTER** key.

The bottom line of the screen shows the A(8) criterion, to increase the value in steps of .01 press the **RIGHT ARROW** key, to decrease the value in steps of .01 press the **LEFT ARROW** key. To increase the value in steps of 0.1 press the **HARM** key, to decrease the value in steps of 0.1 press the **RANGE** key. Pressing the **UP ARROW** key will exit the routine.

## Technical Specification

### Standards

*Designed to* ISO 8041 : 1990 Type 2

### Filters

*Mechanical* 10Hz to 1kHz +/- 1dB +12% and  
-11% (as specified in BS 4675:Part 2:1978  
and ISO 2954:1987)

Linear 10Hz to 10kHz (not applicable with KD1301  
which contains a 2.6kHz 3<sup>rd</sup> order low pass filter)

*Hi Pass* 5kHz to 50kHz (not applicable with KD1301  
which contains a 2.6kHz 3<sup>rd</sup> order low pass filter)

### Reference Calibration

*Frequency* 160Hz

*Vibration* 10ms<sup>-2</sup>

### Temperature

*Operating range* -10°C to +50°C

*Storage without batteries* -20°C to +70°C

*Effect* < 0.5 dB from -10°C to +50°C

### Time

*Detector indicator constant* 1 second – Linear integrated mean square value  
evaluated from exponentially averaged signal

*Warm up* 2 minutes

*LAV maximum integration* 72 hours

**Output connector impedance** should not be less than 2k2Ω

To test the instrument electrically an input of 1000pF impedance is required

### Instrument meets the requirements of

ISO 8041 section 7.1 effect of mechanical vibration

ISO 8041 section 7.2 effect of magnetic fields (test results pending)

ISO 8041 section 7.4 effect of humidity

In compliance with ISO 8041: 1990 – ENV 28041: 1993. The GA2000 series expresses weighted vibration in metres per second squared (3.1), optionally the instrument may express results as a level in decibels by means of the “UNITS” key. Ref  $10^{-6}\text{ms}^{-2}$  (120dB =  $1\text{ms}^{-2}$ ).

The linearity range of the instrument is 40dB as specified in section 6.7 of ISO 804, the primary indicator range is 0-30dB (a minimum of 10dB is required to comply with the standard).

To power the unit via an external power source you must use a 9V 40mA device.

Calibration should be performed on a GA2001 using VE-10 vibration calibrator  $10\text{ms}^{-2}$  Linear, according to section 2.05.

**KD1005 Accelerometer specification.**

To obtain the correct performance one of the following two mounting methods must be chosen:

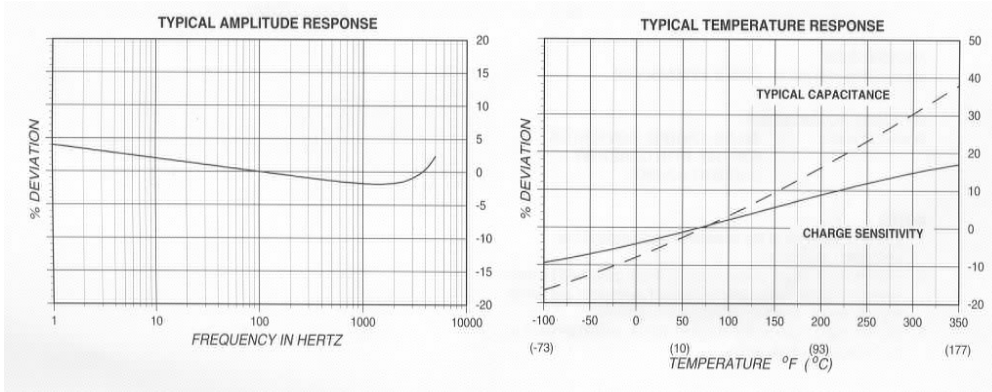


KD1207 General-purpose transducer block



KD1209 HARM<sup>R</sup> Handblok

DYNAMIC CHARACTERISTICS	Units	
CHARGE SENSITIVITY		
TYPICAL	pC/g	2.8
MINIMUM	pC/g	2.2
FREQUENCY RESPONSE		See Typical Amplitude Response
RESONANCE FREQUENCY	kHz	21
AMPLITUDE RESPONSE [1]	Hz	1 to 5000
±5%		
TEMPERATURE RESPONSE		See Typical Curve
TRANSVERSE SENSITIVITY	%	≤ 5
AMPLITUDE LINEARITY [2]	%	1
Per 500 g, 0 to 2000 g		



<b>Parameter</b> <i>Acceleration</i>	<b>Range</b> 0.1 – 10 ms <sup>-2</sup>	100mV/g	Low Range
	1 – 100 ms <sup>-2</sup>	100mV/g	High range
	1 – 100 ms <sup>-2</sup>	10mV/g	Low Range
	10 – 1000 ms <sup>-2</sup>	10mV/g	High Range
<b>Velocity</b>	0.1 – 10 mms <sup>-1</sup>	100mV/g	Low Range
	1 – 100 mms <sup>-1</sup>	100mV/g	High range
	1 – 100 mms <sup>-1</sup>	10mV/g	Low Range
	10 – 1000 mms <sup>-1</sup>	10mV/g	High Range
<b>Displacement</b>	0.1 – 10 mm	100mV/g	Low Range
	1 – 100 mm	100mV/g	High range
	1 – 100 mm	10mV/g	Low Range
	10 – 1000 mm	10mV/g	High Range

## **Warranty and After Sales Service**

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

In the event of a fault occurring, during the warranty period, the instrument should be returned to Castle Group Ltd, in its original packaging, or to an authorised agent. Please enclose a clear description of the fault or symptom.

Details of the warranty cover are available from Castle Group Ltd or an authorised agent.

All instruments are designed to meet rigid British and International Standards. An annual calibration is recommended to ensure that these high standards are maintained. This is particularly important for cases in which instrument readings are to be used in litigation or compliance work.

For warranty and service return to:

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

Telephone	UK:	(01723) 584250
	INT:	44 1723 584250
Fax	UK:	(01723) 583728
	INT:	44 1723 583728

Any misuse or unauthorised repairs will invalidate the warranty.

Damage caused by faulty or

H:\Research & Development\Manuals\ Vibration meter manual