V9000
Seismograph

OPERATOR MANUAL

CONTENTS

INTRODUCTION

The V9000 Seismograph is an intelligent data logging Seismograph that can be configured to perform various monitoring operations. It is a lightweight, battery powered weather-proofed unit that is designed for use in rugged conditions, from demolition / construction sites, to quarries and underground locations. The V9000 Seismograph is also ideal for monitoring in Commercial and Industrial locations as well as Residential properties.

The V9000 Seismograph can store vibration data for all 3 axes at 1 millisecond intervals, and show frequency plots for the dominant frequencies of each axis.

There are many options available for the V9000 Seismograph, such as the air overpressure microphone, 2 stage audible / visual alarm, VDV (Vibration Dose Value) monitoring, a twin channel upgrade, the ability to upload data remotely via the internet, and various text alarm functions. The V9000 Seismograph can also be powered from an external power source such as 240 v mains adaptor or a 12 v battery.

The basic operation of the V9000 Seismograph is the same, no matter which options are fitted to the unit. For a full description of each function please refer to the relevant section depending on the configuration and options fitted to your V9000 Seismograph.

BASIC OPERATION

The V9000 Seismograph is powered by four 'D' Cell batteries, and has a 20 line x 40 character LCD together with 4 push-button switches. The display has a backlight, so can be used where light conditions are poor. The push-button switches correspond to the instructions shown on the LCD display. Users will be familiar with this method of operation as it is the same as a Bank a.t.m. machine (cash machine).

To switch on the Seismograph, press the green push-button.

The display will power up, showing Vibrocks' contact details (and the MAIN MENU option), and the Red light set in the Green push-button will flash. This Red light is to show there is sufficient power in the batteries.

Press the push-button for the MAIN MENU option and the unit will now go into its start up page, with the top line showing date, time, battery voltage, serial number, USB connection and modem status. The display will also show:-

	VIEW	PILING	BLASTING
SHIFT	MEMORY	MODE	MODE

SHIFT   - Pressing (and holding) this option allows the user to select other options such as custom set up.

VIEW MEMORY   - This option allows the user to view or delete ALL the contents of the Seismograph's memory.

PILING MODE   - This option puts the Seismograph in the continuous mode of operation where all vibration levels are logged at 5 second intervals.

BLASTING MODE - This option puts the Seismograph in the trigger mode of operation, where data is stored at 1 millisecond intervals for each axis. The default trigger level is 0.5 mm/s.

SHIFT FUNCTION

When the user presses and holds down the SHIFT push-button, the display will show a new set of options such as the examples shown below:

VIBROCK CONTACT   -   This option shows Vibrock Limited contact details.

CUSTOM MODE   - This option allows the user to set the date and time of the Seismograph and to set up the Seismograph using its custom mode settings.

MAIN MENU   - This option takes the user back to the main menu screen.

Other options are shown when the user is setting up the Seismograph for monitoring, etc.

STANDBY / SLEEP MODE

The V9000 Seismograph has a standby and sleep mode, which allows the four 'D' cell batteries to last for 4-5 weeks.

The standby mode is when the unit is on but not monitoring, it will power down after two and a half minutes if no push-buttons are pressed. This is to save battery power. Pressing any button will power the Seismograph back up to its on state.

When the unit is on and monitoring, the display backlight will turn off after twenty five seconds, and the display will turn off after another two and a half minutes, but the RED light on the green push-button will give a double flash to indicate it is still monitoring. **This is the sleep mode**. Pressing any push-button will wake up the unit and the monitoring screen will be displayed.

NOTE: When the Seismograph is connected to a PC, the internal batteries are switched off and the Seismograph is then powered by the USB socket. Sleep mode is disabled whilst the Seismograph is connected to the PC.

TRANSDUCER MOUNTING

One of the most critical aspects of vibration monitoring is the placement and coupling of the measurement transducer. The accuracy of any seismic reading is only as good as the quality of the connection between the transducer and the ground surface.

This connection, known as coupling, is vitally important in obtaining valid results. While it may seem that placing a sensor on firm ground, and even spiking it into the ground, should provide good coupling, often it does not. In order to be sure that the seismograph is faithfully recording the actual motion of the ground, the link between the ground and the sensor must be no less than perfect.

The potential for decoupling becomes greater with high particle velocities, associated with high-frequency vibration, i.e. high accelerations. Thus, the problem of decoupling is most often seen when recordings are made at short distances. This is when the highest frequencies are present, as well as the highest particle velocities.

At acceleration levels greater than 0.2g the transducer should be buried completely when the measurement surface consists of soil. When done in a careful manner, this is probably the ultimate way of assuring that perfect coupling with the ground is obtained. However, if not done properly, this method can also lead to erroneous readings.

A sandbag can also be effective if used properly, being loosely packed and large enough so that, when placed on the sensor, all sides of the bag are resting firmly on the ground surface. When measuring on a firm surface, attachment can also be by means of resin or bolting. When recording within a building, bolting or high modulus resin should be used on vertical surfaces.

Measurements on floors having compliant coverings should be avoided. British Standard guide 7385: 1990 discusses the mounting of transducers located within buildings in greater detail. The same document discusses monitoring being undertaken at different levels within a building to identify dissipation or magnification as well as simultaneous monitoring on the building foundation and ground outside to establish transfer functions.

PILING (CONTINUOUS) MODE

In normal operations with one PPV (red) transducer pack, default settings are pre programmed for this mode of monitoring.

The Transducer must be placed firmly in the measuring location and levelled by the use of the adjusting legs. Always tighten the locknuts to avoid any possibility of movement and hence erroneous readings. At particle velocity levels above 5 mm/s the use of fixing methods is recommended. Methods of fixing are gluing the levelling feet with rapid epoxy, bolting a clamp over the transducer or placing a sandbag over the transducer. Shallow burial can be used if no other method is possible. It is important to ensure that the transducer is firmly fixed down. If this is not done correctly, the transducer may bounce slightly during a transient vibration. This will always give a HIGH reading.

The default settings for PILING MODE are:-

Transducer A
PPV Peak
Continuous mode
5 second data storage interval
0 - 200 mms^{-1} auto scale
No timer, text or alarm function

When Piling mode is selected, the Seismograph carries out an internal set-up procedure and then displays the scanning screen. The Red light in the Green push-button will double flash. This double flash is to show the unit is in monitoring mode.

The Seismograph will display data for all 3 axes at the pre-set scanning interval (5 seconds). Data is also stored at this interval. The operator can view the bar graph of the data by pressing BAR GRAPH.

To stop the monitoring session, press and hold the SHIFT push-button and press the EXIT push-button. This procedure will take the operator back to the main menu screen.

BLASTING (TRIGGER) MODE

In normal operations with one PPV (red) transducer pack, default settings are pre programmed for this mode of monitoring.

The Transducer must be placed firmly in the measuring location and levelled by the use of the adjusting legs. Always tighten the locknuts to avoid any possibility of movement and hence erroneous readings. At particle velocity levels above 5 mm/s the use of fixing methods is recommended. Methods of fixing are gluing the levelling feet with rapid epoxy, bolting a clamp over the transducer or placing a sandbag over the transducer. Shallow burial can be used if no other method is possible. It is important to ensure that the transducer is firmly fixed down. If this is not done correctly, the transducer may bounce slightly during a transient vibration. This will always give a HIGH reading.

The default settings for BLASTING MODE are:-

Transducer A
PPV
Trigger mode
0.5 mmS^{-1} trigger level
No timer, text or alarm function

When Blasting mode is selected, the Seismograph displays the scanning screen and the Red light in the Green push-button will double flash. This double flash is to show the unit is in monitoring mode.

When the Seismograph detects a ground vibration at or above the preset trigger level, the unit will trigger and the maximum vibration levels will be displayed. The Seismograph will still carry on scanning for ground vibrations until the operator stops the monitoring session.

To stop the monitoring session, press and hold the SHIFT push-button and press the EXIT push-button. This procedure will take the operator back to the main menu screen.

CUSTOM MODE

When custom mode is selected, the user can set the time and date of the Seismograph as well as select custom settings such as changing the trigger level, scan / storage interval, timer function, alarm function, entering a location name, and setting the modem text alarm and data upload times (if the modem option is fitted).

CUSTOM MODE - SET CLOCK

Selecting the SET CLOCK option, allows the user to set the date, time and day, by using the UP, DOWN and SELECT functions.

Once the correct information has been input, press the SHIFT and UPDATE CLOCK option, and the date, time and day are set.

CUSTOM MODE - SET LOGGER

Selecting the SET LOGGER option, allows the user to select different modes and units for vibration monitoring. The user can also select different trigger levels and scan intervals, alarm trigger levels and the option to input an SMS message which is transmitted when an alarm level is exceeded (modem option required).

The V9000 Seismograph also has a timer function which allows the user to set the monitoring times for each day of the week (this eliminates the storage of unnecessary data).

When the SELECT LOGGER option is selected, the user follows the on screen instructions to choose their settings. Once all settings have been input, the user presses and holds the SHIFT push-button and selects START LOGGER. The Seismograph now enters the monitoring mode.

CUSTOM MODE - SET MODEM (OPTION)

This option is visible if the modem is fitted, and allows the user to turn the modem on or off, view signal strength and connection status.

When the V9000 Seismograph is switched ON, the modem is also ON, and will remain ON, until the operator switches it OFF in the custom set up, or switches it OFF, when the V9000 Seismograph is switched OFF.

To turn OFF the modem, at the main menu screen, press SHIFT and SET LOGGER, MODEM. Select MODEM DISABLE. The screen will now show 'waiting for modem OFF', then after a few seconds the screen will show 'modem OFF'. Press EXIT and the main menu screen now appears.

The operator can now select the mode of monitoring required.

BATTERY POWER – IMPORTANT INFORMATION

If the V9000 Seismograph has the modem fitted, then please read the following:

When the V9000 Seismograph is switched ON, the modem is also ON, and will remain ON, until the operator switches it OFF as described above.

The modem is powered by a separate internal re-chargeable battery. When the modem battery goes flat, the four 'D' cell batteries take over the operation of the modem, but this reduces the 'D' cell battery life.

The V9000 Seismograph can be set to send a text message (see page 19 – status tab), warning the operator that the modem and 'D' cell batteries are flat, and therefore require charging / replacing.

Failure to re-charge the modem battery may cause the V9000 Seismograph to switch off when monitoring is started, therefore, no data will be stored in the memory of the Seismograph.

VIEW MEMORY CONTENTS

Selecting the VIEW MEMORY option (at the main menu screen), allows the user to view the vibration data, graphs and waveforms, or to delete all the data in the Seismograph's memory.

NOTE: Due to the amount of data the unit stores, memory deletion can take up to two minutes.

When the VIEW MEMORY option is selected, the user can then scroll through the memory contents to view any event. For each event, the screen will display only the maximum vibration levels, until the user selects an event they wish to view in more detail.

Once the user reaches the event they wish to **view in detail**, select the VIEW EVENT option.

The Seismograph now displays the detailed vibration information, as well as giving the user the option to view graphs, frequency plots and hourly data.

NOTE: A blasting / trigger event will be a maximum 15 seconds.
                A Piling / Continuous event will be a maximum 24 hours.

To exit the memory, press and hold the SHIFT option, press the EXIT option, and then select the MAIN MENU option.
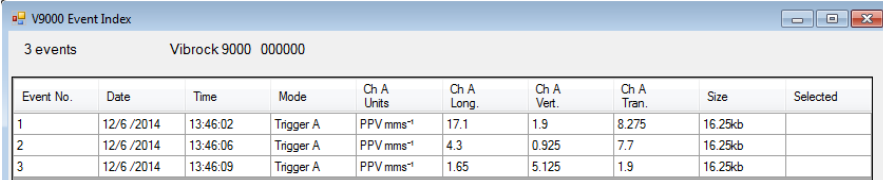
PC SOFTWARE (INSTALLATION & OPERATION)

To install the software, insert the CD ROM, open the disc contents and double click on the set up file. The Vibrock PC software will install and create a shortcut on your desktop. Connect the Seismograph to a USB port.

NOTE: The PC will power the V9000 Seismograph, even if the 'D' cell batteries are flat.

Open the Vibrock PC software, select LOGGER - CONNECT. When the connection is made, select LOGGER - INDEX. The index will download (the Index is the short hand version of the data contents of each event in the Seismographs memory).

V9000 INDEX

Event No.	Date	Time	Mode	Ch A Units	Ch A Long.	Ch A Vert.	Ch A Tran.	Size	Selected
1	12/6 /2014	13:46:02	Trigger A	PPV mms⁻¹	17.1	1.9	8.275	16.25kb	
2	12/6 /2014	13:46:06	Trigger A	PPV mms⁻¹	4.3	0.925	7.7	16.25kb	
3	12/6 /2014	13:46:09	Trigger A	PPV mms⁻¹	1.65	5.125	1.9	16.25kb	

V9000 Event Index — 3 events — Vibrock 9000 000000

The index is the simplified view of each vibration event. It shows the maximum vibration levels detected for each event.

The index can now be sorted, so that the user can sort the index data from the highest to the lowest vibration (and vice versa).
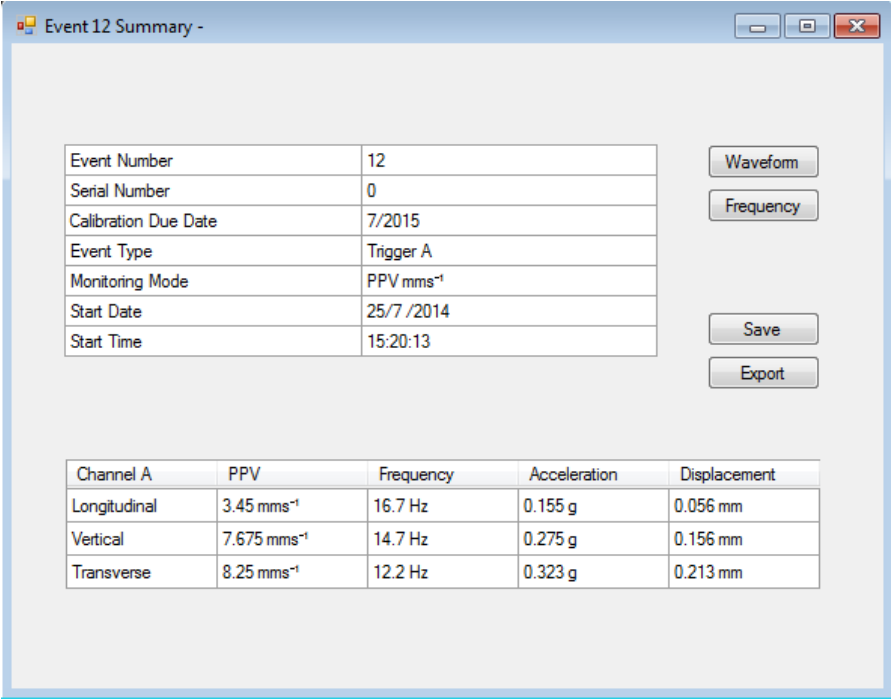
To sort the index, click on the relevant column heading and the index will sort from the lowest to the highest vibration level. Clicking on the column heading again, will sort from the highest to the lowest vibration level.

To return the index to its original state, click on the Event heading. Clicking on the Event heading again, sorts the index from the latest to the first vibration event monitored.

To **print** the index, select '**File**' and '**Print**'. (**NOTE:** if the index has been sorted, then the sorted view is printed).

OPEN AN EVENT

To open a vibration event, double click on the required line in the index. The event will download and show the event summary screen.


From here, the user can view the maximum data values, open the waveform graph and frequency / peak maximum graphs, as well as save and export the data.

NOTE: If a twin channel event is selected, both waveform / frequency / peak maximum graphs are opened.
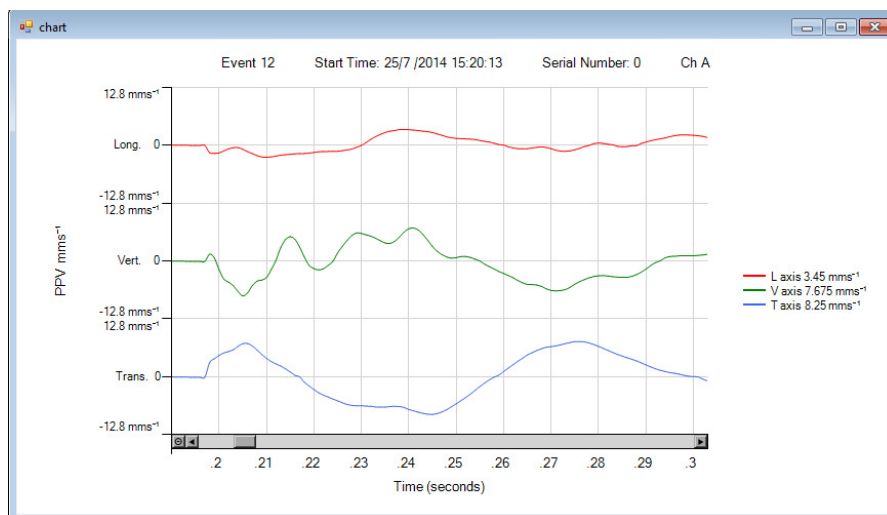
When viewing a waveform graph (example below):
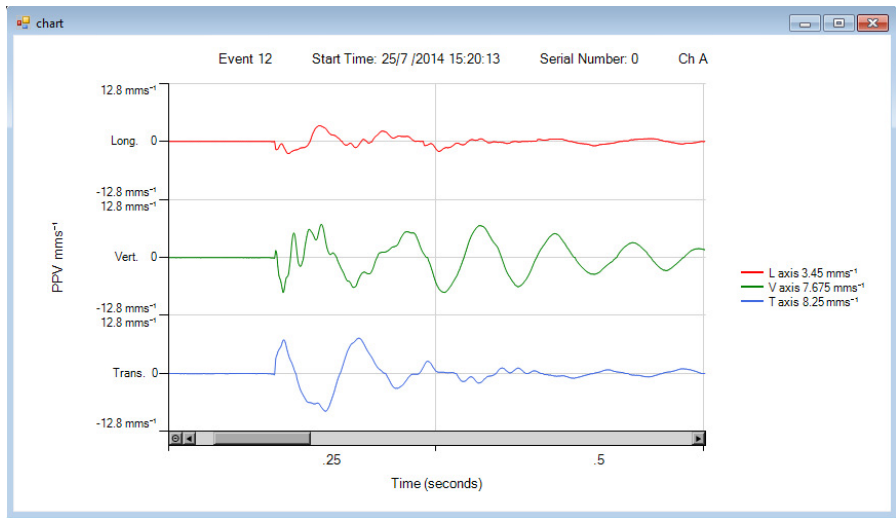
The user can ZOOM in on an area of interest. To do this, click and drag the mouse (L–R or R–L) over the required section of the graph. This section of the graph turns grey in colour.
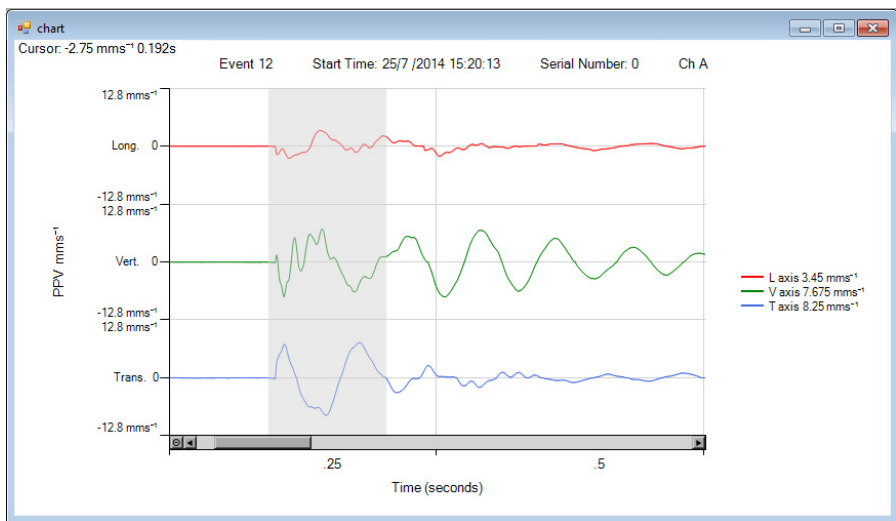
Let go of the mouse button, and the zoomed area will then be displayed (the zoom function can be used a number of times on the required section).

The user can print this zoomed view by selecting the FILE option at the top of the screen, and clicking on PRINT.

To return to the original waveform graph, click the ZOOM OUT button at the bottom left corner of the graph.
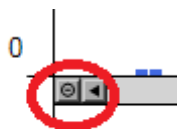
NOTE: The user can zoom in several times on the same section of the graph if necessary. The zoom function works with Piling (Continuous) and VDV graphs.

An example of a frequency plot from a Trigger (or Blasting event) is shown below:
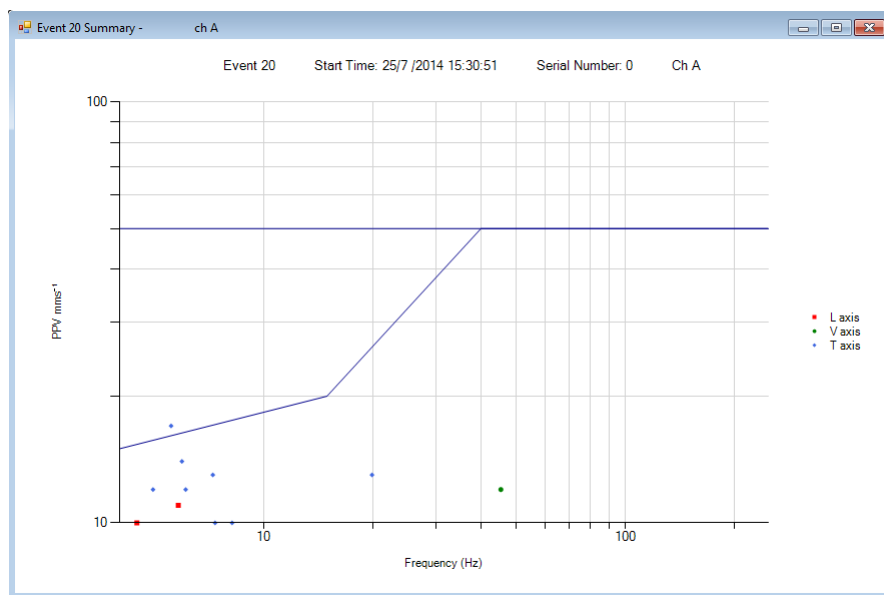
The user can print the frequency plot chart by selecting the FILE option at the top of the screen, and clicking on PRINT.

NOTE: The zoom function cannot be used on the frequency plot chart.

An example of a Piling (or Continuous) graph is shown below:
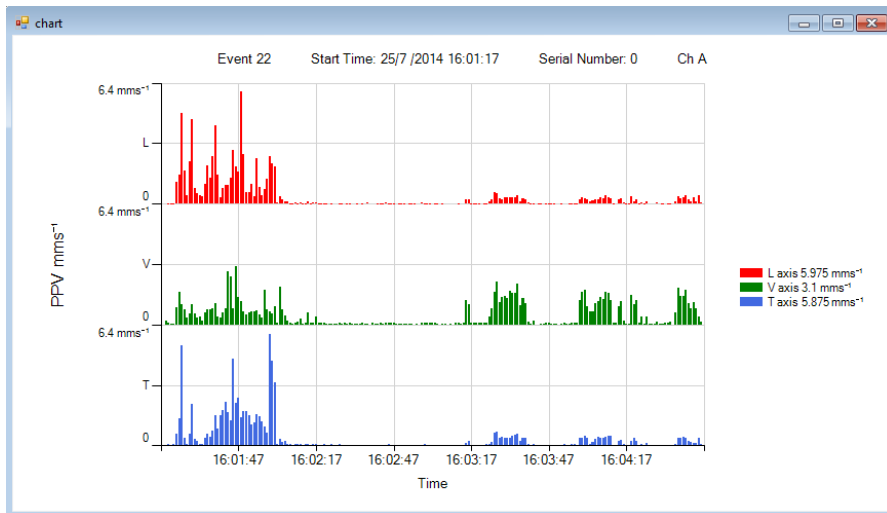
The peak maximum graph is shown below. This graph can help the user decide if the peak vibration value was vibration activity or "a one off event".
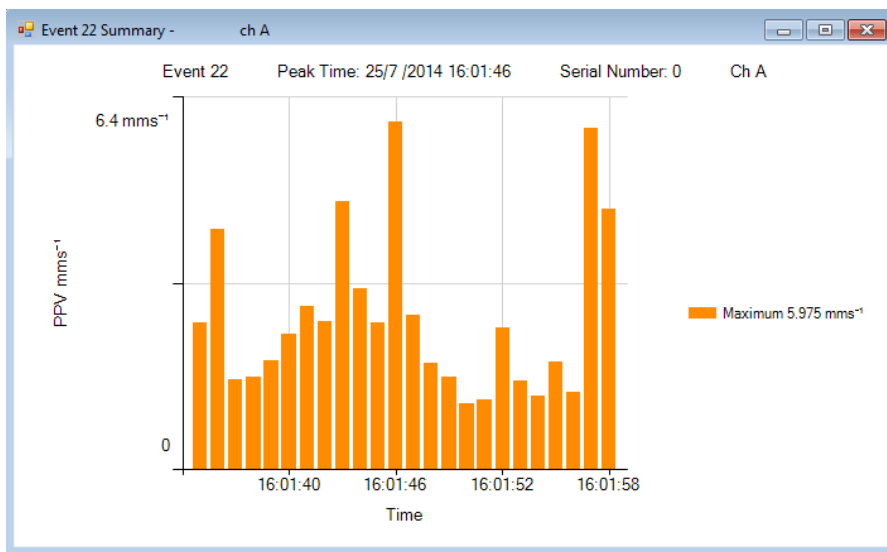
SAVE AN EVENT

To save a vibration event, click on the Save option (on the event summary screen), and follow the on screen instructions.

EXPORT AN EVENT

To export a vibration event (export data into excel format), click on the export option (on the event summary screen), and follow the on screen instructions.

PRINT AN EVENT
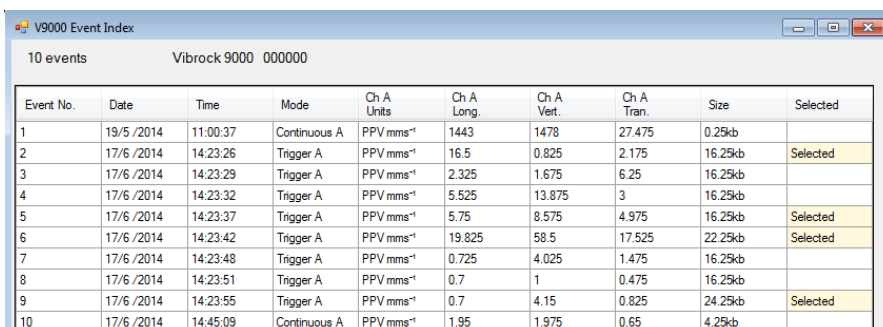
To print a vibration event, select the FILE option at the top of the screen, and click on PRINT. The graph and summary data will be printed.

NOTE: If the ZOOM function has been used, then the zoomed view is printed.

PRINT / SAVE / EXPORT MULTIPLE EVENTS

The user can print, save, or export multiple events by using the following procedure:

On the index, click down the selected column to select each event required.

Event No.	Date	Time	Mode	Ch A Units	Ch A Long.	Ch A Vert.	Ch A Tran.	Size	Selected
1	19/5 /2014	11:00:37	Continuous A	PPV mms⁻¹	1443	1478	27.475	0.25kb	
2	17/6 /2014	14:23:26	Trigger A	PPV mms⁻¹	16.5	0.825	2.175	16.25kb	Selected
3	17/6 /2014	14:23:29	Trigger A	PPV mms⁻¹	2.325	1.675	6.25	16.25kb	
4	17/6 /2014	14:23:32	Trigger A	PPV mms⁻¹	5.525	13.875	3	16.25kb	
5	17/6 /2014	14:23:37	Trigger A	PPV mms⁻¹	5.75	8.575	4.975	16.25kb	Selected
6	17/6 /2014	14:23:42	Trigger A	PPV mms⁻¹	19.825	58.5	17.525	22.25kb	Selected
7	17/6 /2014	14:23:48	Trigger A	PPV mms⁻¹	0.725	4.025	1.475	16.25kb	
8	17/6 /2014	14:23:51	Trigger A	PPV mms⁻¹	0.7	1	0.475	16.25kb	
9	17/6 /2014	14:23:55	Trigger A	PPV mms⁻¹	0.7	4.15	0.825	24.25kb	Selected
10	17/6 /2014	14:45:09	Continuous A	PPV mms⁻¹	1.95	1.975	0.65	4.25kb	

V9000 Event Index

10 events   Vibrock 9000 000000

When all events have been selected, at the top of the screen click FILE and DOWNLOAD EVENTS. The Download logger events screen will open and the user can now print/save/ export the selected events, by placing a 'tick' in the relevant box.
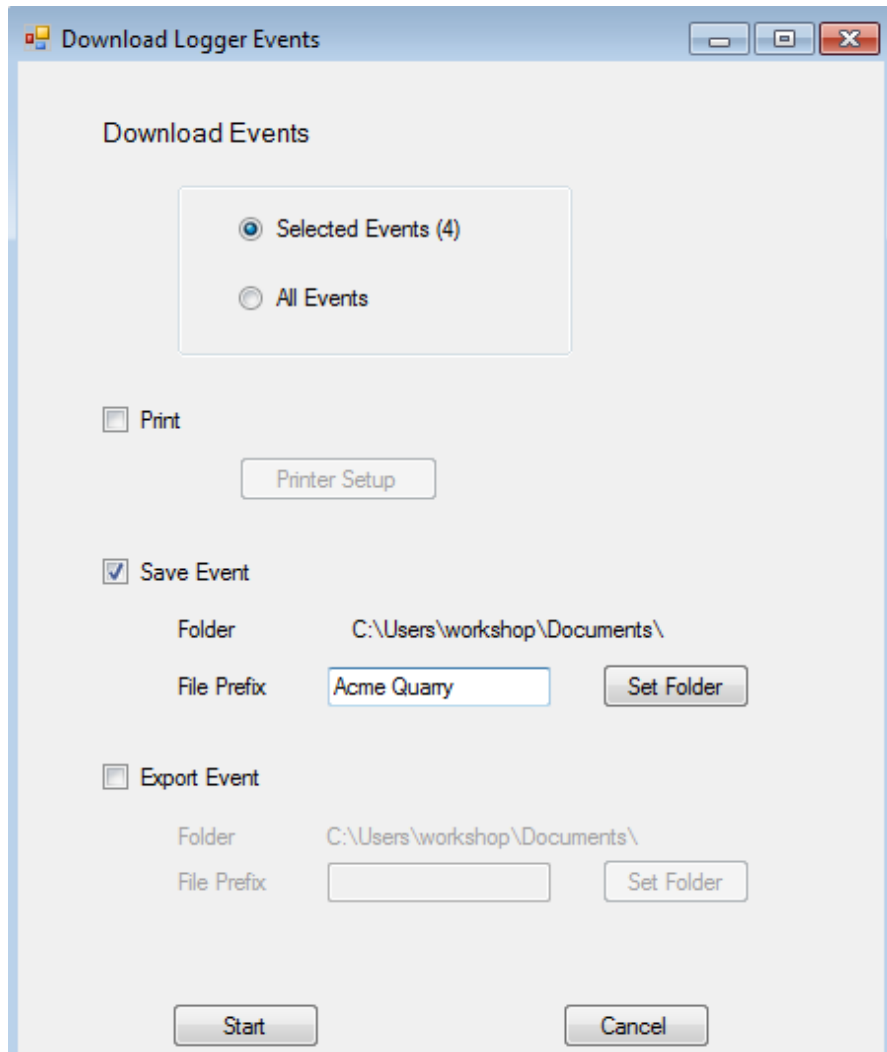
PC SOFTWARE CUSTOM SETTINGS

The user can set up many options using the PC software, then save and store them to the V9000 Seismograph. These options include mode of operation, seven day timer function, alarm trigger levels, SMS alert details, and SMS status alerts.

Click on LOGGER, OPERATE and then click the CUSTOM button. The following screen should appear:
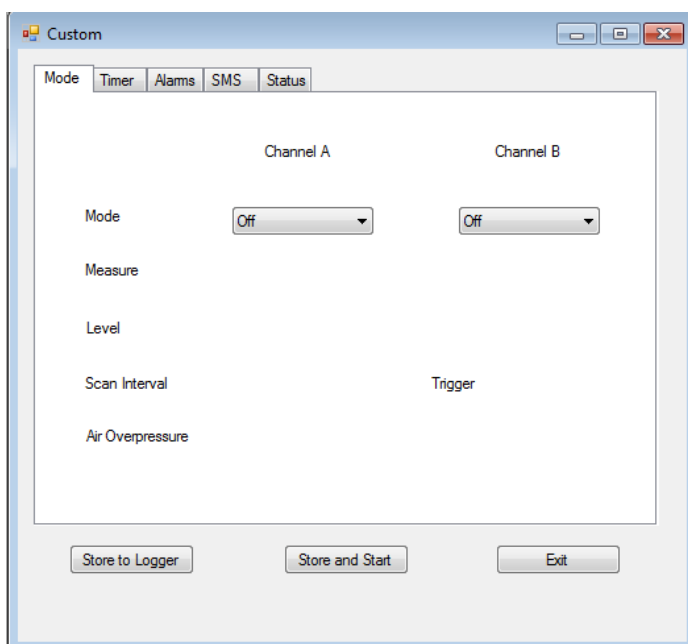
By clicking on the relevant 'tabs', the user can set up the various options and parameters. Once all settings have been input, they can be saved to the Seismograph by clicking on 'Store to Logger', or click on 'store and start' to send / save the data and start the logger monitoring.

SMS ALERT FUNCTIONS (OPTION)

The V9000 Seismograph has several SMS alert functions, some of which can be set by the user. The SMS alert functions are:

Low battery
Low modem battery
Low memory (memory full)
External power supply removed
Data logging ended
Low and high vibration level alerts
Programmable timed status update

These can be set using the custom option (see page 19).
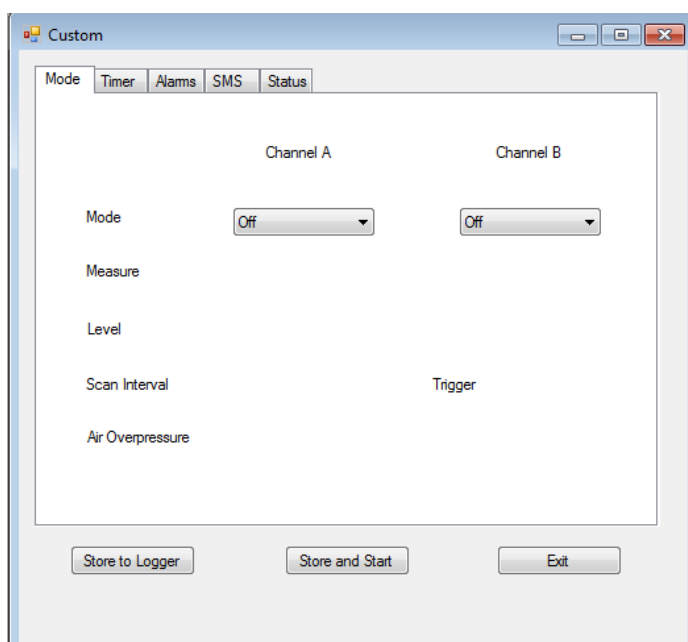
NOTE: The text alert functions are only available on V9000 Seismographs with the built in modem option.

REMOTE MODEM SETUP (OPTION)
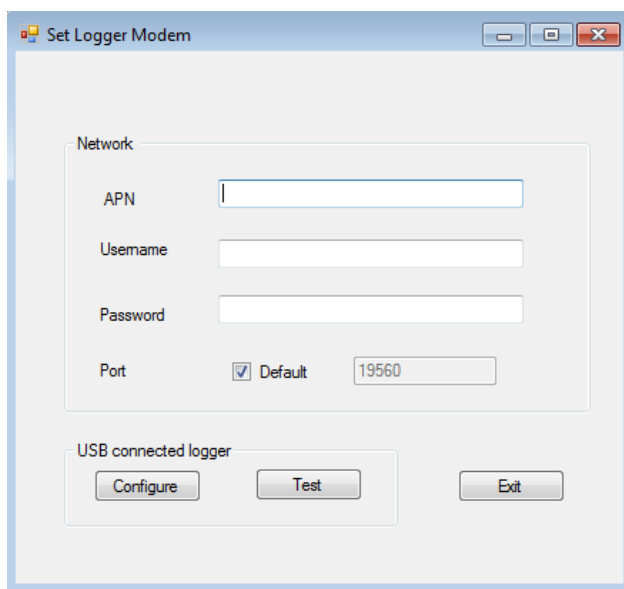
The V9000 Seismograph can remotely connect to a PC, via the internet, using the built-in optional modem (which can be retro-fitted to non modem Seismographs).

This function allows the user to download data, watch the Seismograph monitoring in real time, change the set up of the Seismograph, and change any of the SMS alert parameters.

The user can fit the SIM card (provided by Vibrock Ltd, or their supplier) to the modem, and then follow the set up procedure below:

Connect the V9000 to your PC. Open the V9000 PC software and select TOOLS, SET MODEM. The following screen appears. Enter your APN, Username and Password, (as provided with the SIM card), click CONFIGURE, and then click EXIT.

Entering this information, only needs to be done once.

REMOTE MODEM SETUP-CONTINUED (OPTION)

When the instructions on the previous page have been completed, click on TOOLS, SET REMOTE CONNECTION, and the screen below appears:
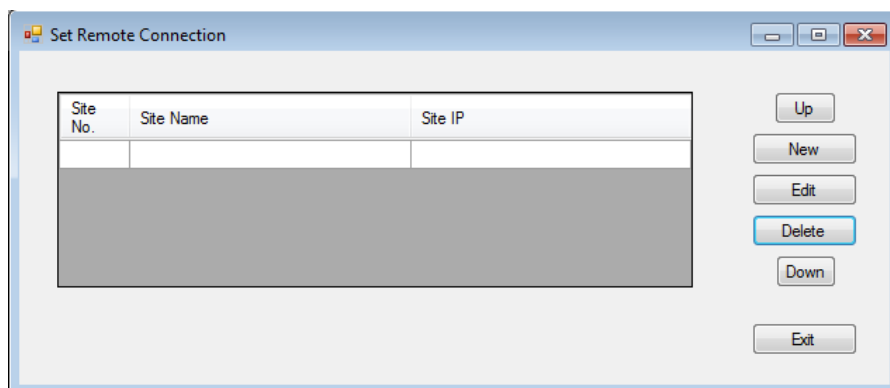

Click on NEW, and the following screen appears:
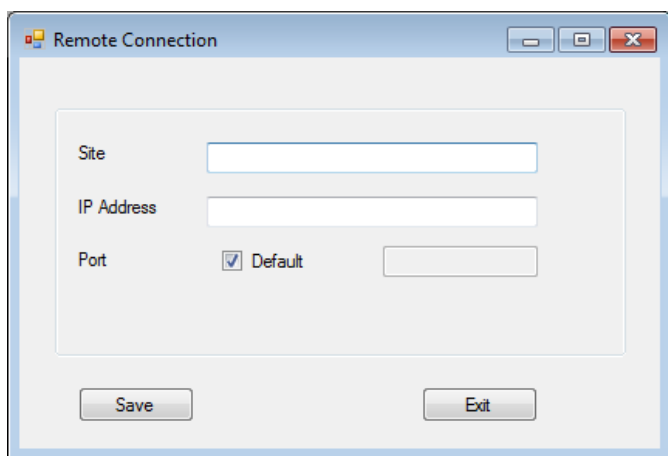
Enter your site location and the IP address as provided. Click SAVE, then EXIT. The modem set up procedure is now complete. You can now disconnect the V9000 Seismograph from your PC if required.

REMOTE MODEM OPERATION (OPTION)

To connect to the V9000 Seismograph, run the Sonicwall software and click CONNECT (enter your LOGIN details if required). Open the V9000 PC software, click on TOOLS, REMOTE CONNECT. The following screen appears with your site location visible.
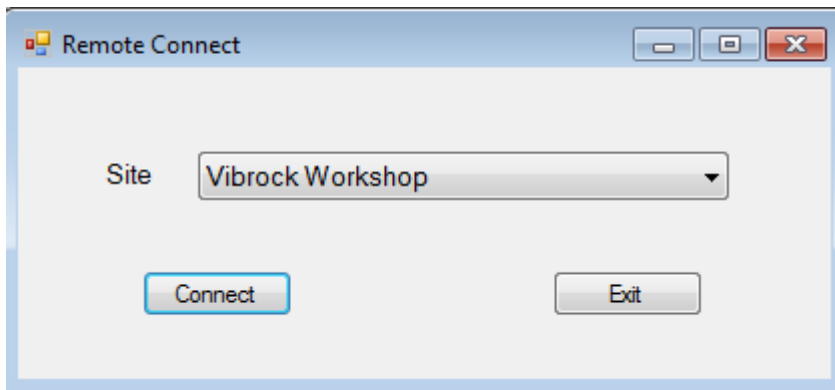
Click on CONNECT. The screen below appears and the connection is made. This is the **connection status screen**.
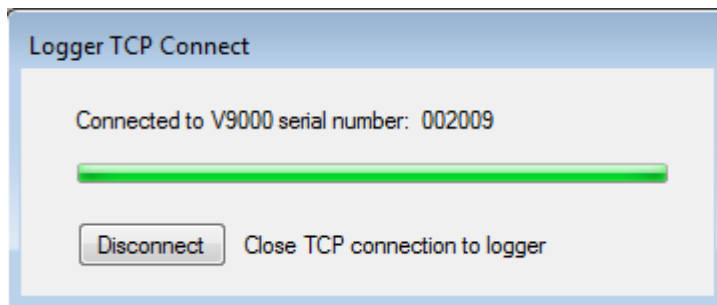

The operator can now download data, watch the Seismograph monitoring, check the status or change the set up of the Seismograph.

REMOTE MODEM OPERATION-CONTINUED (OPTION)

To download the vibration data, click on LOGGER, INDEX. The index will download, and the data can be saved by following the same procedure outlined on pages 17 and 18.
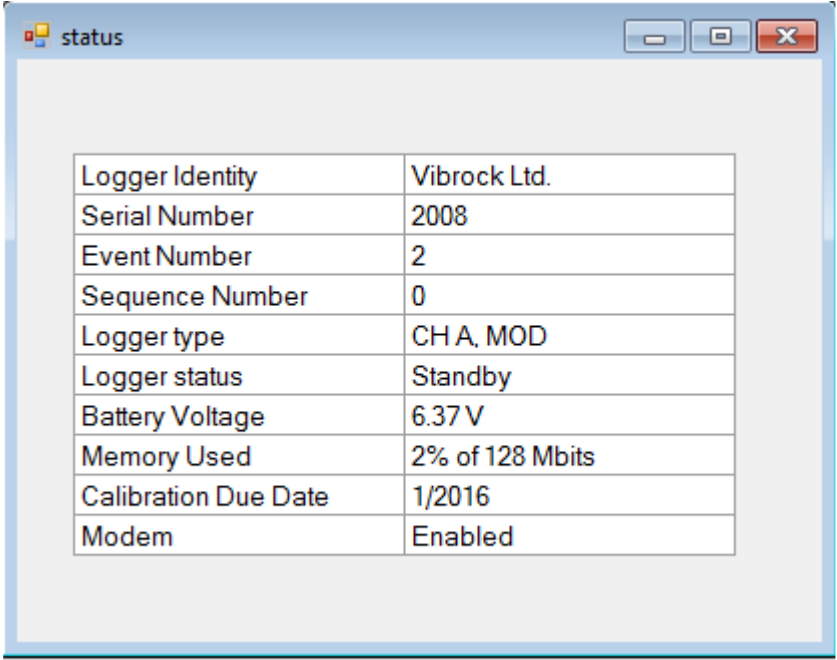
To watch the Seismograph monitoring, click on LOGGER, REAL TIME DATA. The following screen will appear (screen may vary depending on mode of operation).
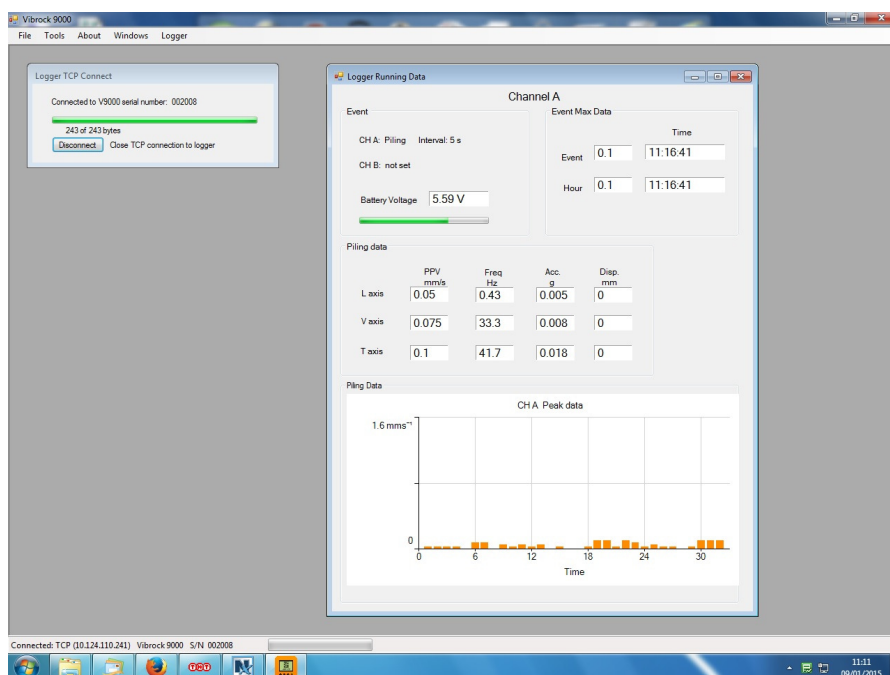
To change the mode of operation of the Seismograph, refer to the instructions on pages 19 and 20.

REMOTE MODEM OPERATION-CONTINUED (OPTION)

To check the status of the Seismograph, click LOGGER, STATUS. The following screen will appear. This status screen is a simplified version of the running data screen and can be used to confirm the Seismograph is monitoring, checking the battery and memory status, etc.

Logger Identity	Vibrock Ltd.
Serial Number	2008
Event Number	2
Sequence Number	0
Logger type	CH A, MOD
Logger status	Standby
Battery Voltage	6.37 V
Memory Used	2% of 128 Mbits
Calibration Due Date	1/2016
Modem	Enabled

Whichever of the four functions are used by the operator, the **connection status screen** is always visible. When the remote connection is finished with, click on DISCONNECT. The link is shut down, but you can keep the Sonicwall software running as it does not use any of your SIM card data allowance.

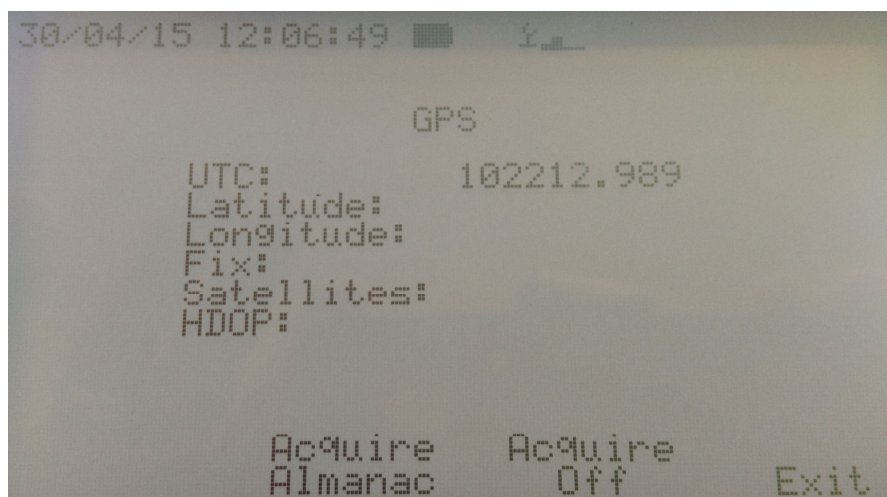## V9000 SEISMOGRAPH OPTION – GPS LOCATION

The GPS Location option is ideal for showing the position of the Seismograph when monitoring, on a map software package such as Google maps.

The GPS option powers up when the V9000 Seismograph is switched on.

The first time the GPS option is used, the user must carry out the 'acquire almanac' function. This locates the number of satellites it can lock on to for its co-ordinate position (we recommend this function is done every six months).
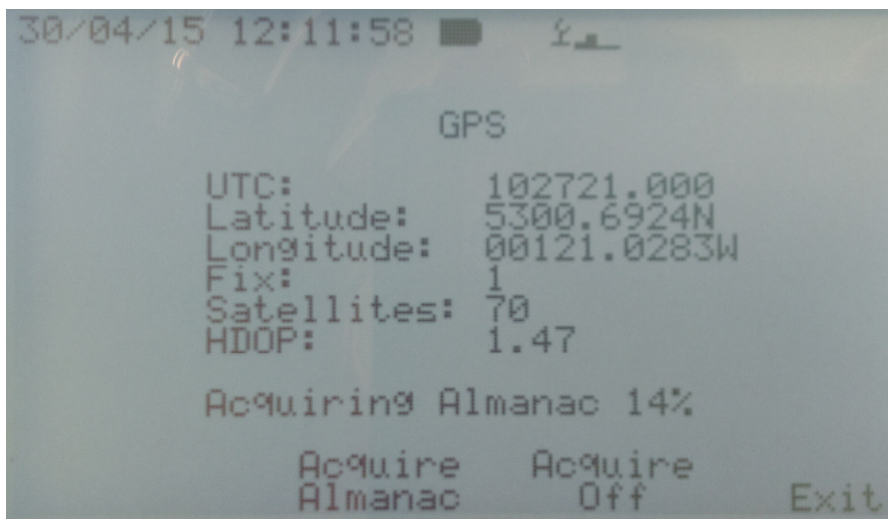
To 'acquire almanac', at the main menu screen, press SHIFT and SET LOGGER. Hold the SHIFT KEY down and press GPS.

The following screen appears – Press ACQUIRE ALMANAC.

V9000 SEISMOGRAPH OPTION – GPS LOCATION (CONTINUED)

When the GPS has located all available satellites, the screen then updates as shown below:

Press EXIT. The operator can now select PILING or BLASTING mode to monitor or SHIFT and SET LOGGER, then release the SHIFT button and select CUSTOM MODE.

NOTE: When monitoring is started, the GPS system will locate and lock on to a satellite – the satellite symbol is shown during this period as shown below:
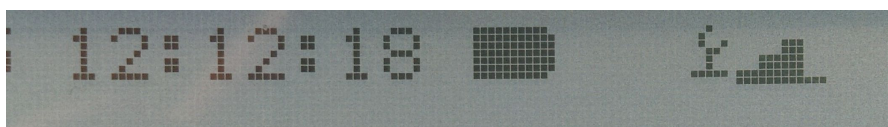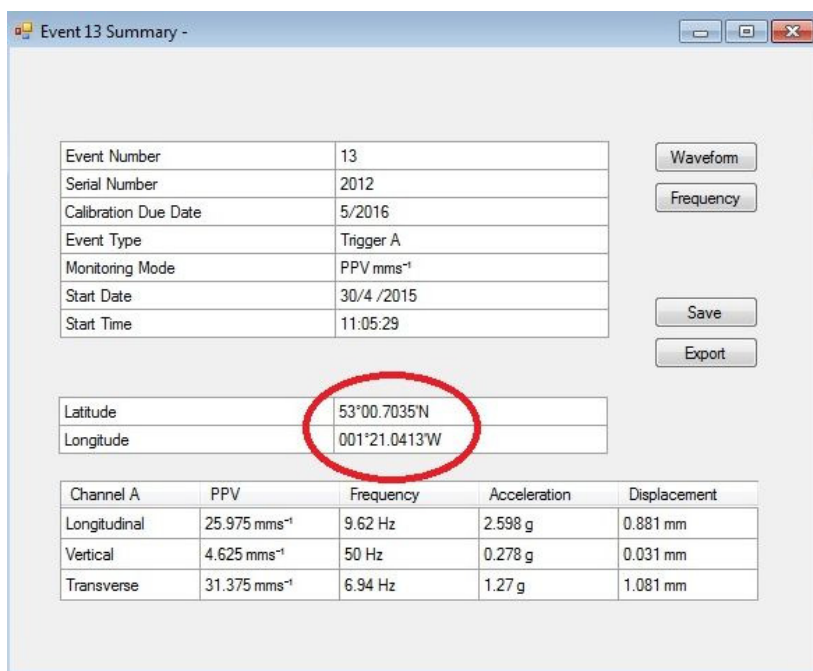
V9000 SEISMOGRAPH OPTION – GPS LOCATION (CONTINUED)

When the GPS has locked on to a satellite, the symbol then disappears, as shown below:

The GPS co-ordinates are now stored with the monitoring event.

To use the GPS co-ordinates in Google maps, download the index, and open the relevant event. The GPS co-ordinates are on the summary screen as shown below.

V9000 SEISMOGRAPH OPTION – GPS LOCATION (CONTINUED)

Click on either the Latitude or Longitude number, and the co-ordinates are then copied onto the PC clipboard, and the following screen appears:
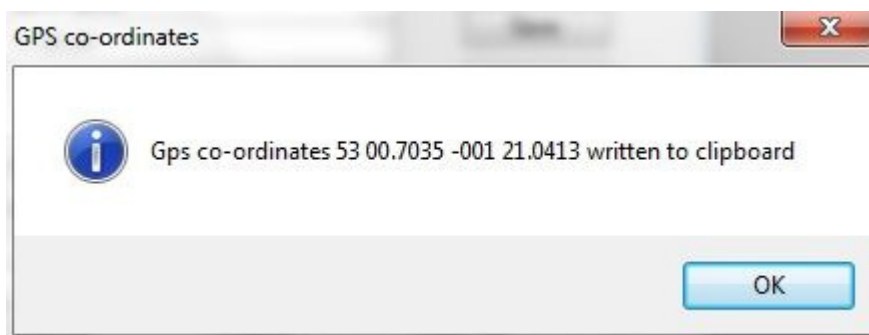
Click OK, close or minimize the V9000 Software, and open your internet browser. Open Google maps and right click (paste) in the search box and press ENTER. The map should then locate the position of the co-ordinates and show where the V9000 Seismograph was monitoring for that particular event. An example is shown below:
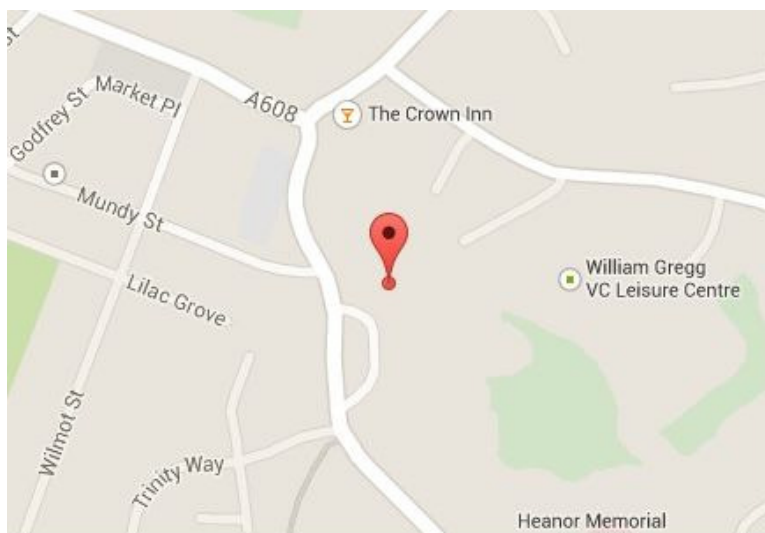
V9000 SEISMOGRAPH OPTIONS – TWIN CHANNEL PPV

The V9000 Seismograph can be fitted with a 2nd channel, which allows the user to monitor two locations, independently.

NOTE: NEW MODE OF MONITORING: The V9000 Seismograph can now monitor in continuous mode on one channel and in trigger mode on the 2nd channel.

The extension cable is 50 metres in length, and comes on a retractable drum. Other cable lengths are available on request.

V9000 SEISMOGRAPH OPTIONS - VIBRATION DOSE MODE PPV & VDV

The V9000 Seismograph has the option to measure Vibration Dose in accordance with BS6472 PART1: 2008.

The user connects the Gold coloured VDV Transducer into the 'VDV (GOLD) Transducer' socket and then goes through the CUSTOM MODE set up to select VDV monitoring. The user can also measure PPV whilst monitoring VDV, if required.

V9000 SEISMOGRAPH OPTIONS - AIR OVERPRESSURE MICROPHONE

The V9000 Seismograph can be fitted with an air overpressure microphone which can measure the air blast from such sources as a demolition or quarry blast. The range of the microphone is 100 – 152 db (linear).

V9000 SEISMOGRAPH OPTIONS -TWO STAGE AUDIBLE / VISUAL ALARM

The two stage alarm can easily be connected to the V9000 Seismograph, and set up. It comes with a standard 10 metre cable length, and battery charger. The alarm only uses power when it is activated, so the internal battery will last for between 3 – 4 months before requiring a re-charge. When activated, the alarm will operate for 15 seconds before re-setting.

The two stage alarm can work in conjunction with the text alarm function, on Seismographs which have the modem fitted.

FUTURE DEVELOPMENTS

Vibrock Limited is also developing Ethernet, WI-FI and Bluetooth connectivity, as well an App for mobile phones, for the V9000 Seismograph. Please contact Vibrock Limited for latest details.

BATTERIES

The V9000 uses four 'D' cell batteries for monitoring. It is strongly recommended that the V9000 Seismograph is fitted with alkaline batteries such as Duracell™, for maximum operating efficiency. Good quality batteries will give up to 40 days of monitoring (depending on temperature).

NOTE: The Seismograph does not lose any data when the batteries are flat. Any vibration event being monitored when the batteries reach their flat state, is saved, to prevent data loss.

CARE AND MAINTENANCE

The V9000 Seismograph is a rugged piece of monitoring equipment designed to be weatherproof. It has a toughened Perspex screen which protects the LCD, and the PELI case can withstand severe handling.

It is designed and built to be used indoors as well as outdoors, but should be protected from the worst of wet conditions. Placing the instrument in a plastic bag during use in heavy rain or muddy conditions will prolong the life of the unit.

Be aware that when the lid is open, the V9000 Seismograph is no longer weatherproof. **Vibrock Limited recommends that if the batteries need changing during wet conditions seek shelter or cover first.**

Vibrock Limited recommends an annual calibration and service to ensure the accuracy of the vibration results.