

vb1

Instrument Reference Guide

Revision 081204

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Section 1: Introduction

This Instrument Reference Guide has been formatted to allow you to quickly and easily learn how to use your vb. Please keep this book for future reference and read it before operating your vb.

If you any have questions not answered by this manual or would like to make a suggestion, please contact us at our website, www.commtest.com.

Note: Although this document makes use of common vibration analysis concepts, it is not intended as a comprehensive guide or training manual. Please ensure you have the relevant knowledge and experience to carry out the procedures described. It is essential to follow all appropriate safety precautions when working near rotating machinery.

What's new in Firmware Version 4.30

The following new features are available:

Quick setup menus and automated menus - minimize setup time and take the guesswork out of setting appropriate measurement parameters. The new quick setup menus and automated menus set most of the parameters for you and allow you to record spectra and waveforms with just a few key presses. These menus are fully customizable so that you can apply your own settings for frequently repeated measurements.

Overall value display - the vb can now show the overall vibration level in \emptyset -peak and peak-peak as well as rms.

Fast settling algorithm - multiple measurements taken at a single location can be processed much faster with the new adaptive settling algorithm. If the sensor is not physically moved before the next measurement is taken the vb hardware does not have to re-settle so the measurements will be taken one after the other with little pause between them.

Sensor detection - the vb can detect broken or faulty sensors/cables and will display a message informing you that the sensor is short circuited or not connected.

Extended battery life - power consumption has been reduced by 100 mA to the lower level of approximately 50 mA. This results in 2 to 3 extra hours of battery life between re-charges.

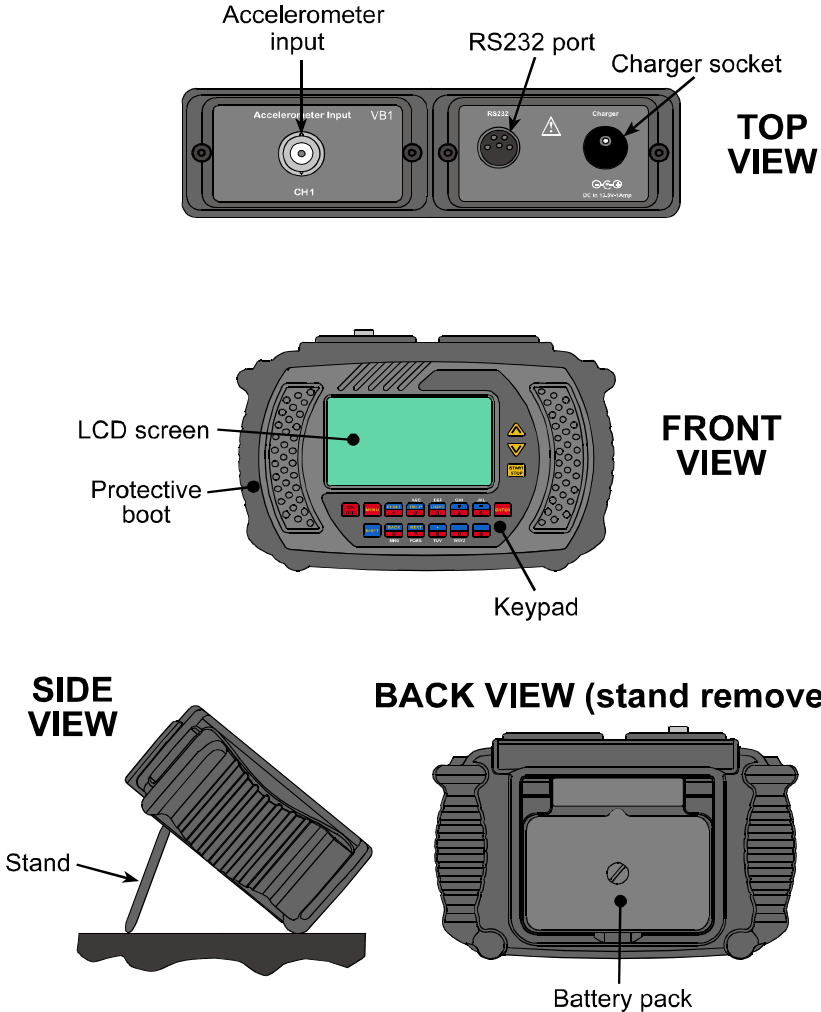
Standard Features

- DSP for fast, accurate calculations
- 16-bit A/D converter providing high-precision measurements
- Displacement, velocity, and acceleration measurements
- Frequency and time domain measurements
- 1 MB non-volatile memory capable of storing up to 1000 recordings at 400 line resolution
- Time and date stamped recordings
- *PROFLASH* upgradable vb firmware
- Temperature-compensated graphical LCD (Liquid Crystal Display) with 240 x 128 pixels and electroluminescent LCD backlight
- 1500 mAh Ni-Cad (Nickel-Cadmium) battery pack
- Battery charger and conditioner
- RS232 interface to communicate with your PC
- Ascent Vibration Analysis Software with exception reporting, data trending, alarm bands, orders display, fault frequency analysis, harmonic and sideband cursors, true peak approximation, notes, photographic image attachments and multiple chart modes

Standard Kit Items

- vb1 instrument
- Protective boot with strap
- Power transformer (13.5 ± 1.5) V DC, 1 A output
- Data-transfer cable
- 9-to-25-way serial adapter
- Accelerometer ICP[®] type
- Accelerometer coiled cable
- Accelerometer magnetic mounting base
- Ascent Vibration Analysis Software on CD-ROM
- Instrument Reference Guide
- Software Reference Guide
- Quick Start Guide
- Warranty card
- QA card
- Carry bag

Summary of Parts



Instrument Icons



The instrument is in spectra recording mode.



The instrument is in spectra review mode.



The instrument is waiting for the hardware to stabilize before taking a measurement.



There is a note attached to this item.



This item is tagged.



Only some items have been tagged on a machine, point or direction/axis.



One or more recordings have been taken within the machine, point, or direction/axis.



The machine structure has been defined (name, point, direction/axis and parameter set), but no recordings have been taken.



The instrument is communicating with a PC through Ascent.



A delta symbol used to show the frequency or time difference between two peaks of a spectrum.



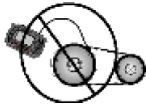
The battery is running low and needs charging.

Precautions

Please read and understand this section before operating your instrument. Heed all warnings and recommendations to prevent data loss, data inaccuracy, damage to the instrument, or injury to yourself.



Do not attach sensors to any object with a high potential voltage i.e. a voltage that exceeds 50 V DC or 32 V AC or the 'safety extra low voltage' (SELV) defined by your local power authority.



Ensure the cables and bootstrap cannot become entangled with any rotating or moving machinery.



Do not bring any objects sensitive to magnetic fields (e.g. cardiac pacemakers, credit cards, floppy disks, video tapes, audio cassette tapes, mechanical watches) near the magnetic mounting bases.

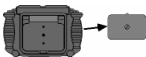


Do not operate the instrument in an explosive environment.



Charge the battery pack up to at least 30% capacity before taking a recording. If using the instrument for 4 hours or more, first ensure that the battery pack is fully charged.

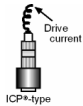
Constantly charging the battery when it is not fully drained will create a 'Memory' effect and eventually shorten the amount of charge that the battery can hold.



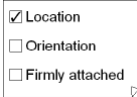
Do not detach the battery pack from the instrument for more than 2 hours as data and settings may be lost from the instrument.



Transfer data stored in the instrument to a PC before reprogramming the instrument. *PROFLASHING* the vb with new firmware may erase all data stored in the instrument.



When using an ICP[®]-type accelerometer, ensure that the drive current is turned on, otherwise the measurements will be incorrect.



Mount the sensor properly before taking measurements or recordings. Otherwise, the data will be incorrect and/or inconsistent.



To clean the instrument use a mild detergent diluted in warm water. Do not use abrasive or polishing substances, hydrocarbons, petrochemicals or solvents as they degrade the plastic.



Do not place the vb or the magnetic mounting base in a hot place where the temperature exceeds 140 °F (60 °C). Otherwise, the battery pack or magnet will degrade.



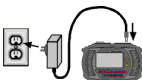
Although the instrument has a rugged construction, do not expose it to wet conditions or store it in a damp place where the relative humidity exceeds 95%.



If the instrument malfunctions, return it to an authorized dealer. Do not attempt to repair the instrument yourself, as this will invalidate the warranty.



Ensure that the battery pack is securely fastened (but not over-tightened) to the instrument before operating.



Use only an approved instrument power transformer (13.5 ± 1.5) V DC, 1 A output, center positive) and ensure its voltage and frequency rating matches that of your mains AC power.

Operating Overview

The instrument can be used to perform the following tasks:

- Taking live measurements for onsite analysis of vibration spectra and waveforms
- Recording of vibration data for transferral to a PC

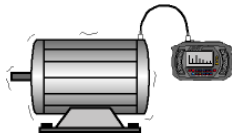
Onsite Analysis (Measure Mode)

Vibration spectra and waveforms are measured and analyzed onsite. This is suitable for one-off investigations and involves these steps:

- Measurement parameters are set on the vb.

Domain = frequency
Spectral lines = 1600
f max = 1000Hz
... etc.

- The spectrum or waveform is measured and analyzed onsite.



- The data is recorded to memory (optional).



- The data is transferred to a PC for further analysis (optional).



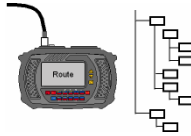
See Onsite Analysis - Measurement Menu (on page 42) for more information.

Recording

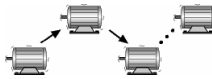
Vibration recordings are taken for all monitored machines and then transferred to a PC for analysis.

The following steps are involved:

- A recording list is created in the vb instrument.



- Data for each item on the recording list is collected by manually selecting items in the vb.



- The collected data is then transferred to a PC for analysis.



See [Creating a Recording List](#) (on page 56) and [Recording Data](#) (on page 72) for more information.

Section 2: Basic Operation


This section describes how to perform basic operations on your vb.

You will learn to:

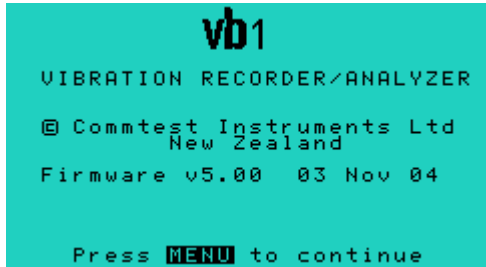
- Power up the vb
- Navigate through initial screens
- Select an option
- Display and use pop-up menus
- Enter and edit text and numbers
- Set up accelerometers

Caution: Read Precautions (on page 5) before operating your instrument.

Powering Up

- Press the  key to power up the instrument or turn it off.

The following screen is displayed at power up.



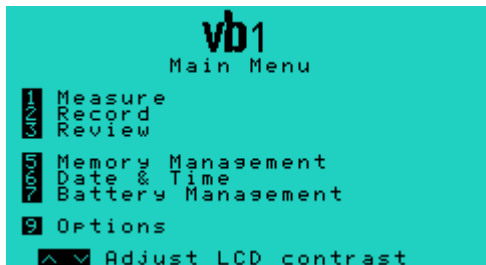
The displayed firmware version and creation date will reflect the currently installed firmware in your instrument. Updated firmware versions can be periodically downloaded from www.commtest.com.

- To continue to the Main Menu press .

Main Menu

The Main Menu provides access to the vb's main operational tasks.

- To access this menu, press  twice (from most screens).



Returning to a Previous Screen

- From most menus, press **SHIFT** + **BACK** to return to the previous screen.

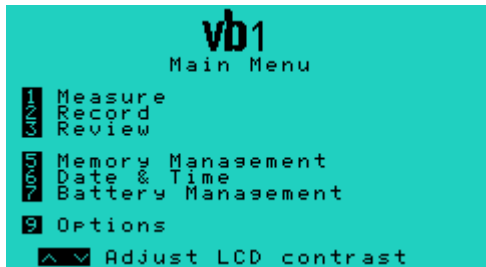
Pressing the **MENU** key will also normally return you to the previous screen (or the Main Menu depending on your current location).

Selecting an Option

- Press the number key that corresponds to the option you want.

Example:

- Press **RESET** **1** to select the Measure option from the Main Menu.

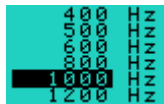


You may need to press **▲** or **▼** to highlight an option and then press **ENTER** to select the option.

Example:

To select a frequency maximum of 1000 Hz:

- Press **▼** to scroll down and highlight this option.



- Press **ENTER** to select this option.

Displaying Pop-up Menus

- Wherever **MENU ...** appears at the bottom of the screen, you can press **MENU** to display a pop-up list of all the available options for the current menu.

In the following example, pressing **MENU** in the Select Machine Menu displays these options:


- 1 Tag** (tag or untag this machine)
- 2 Edit** (change the name of the machine)
- 3 Notes** (add, view or erase notes)
- 5 Erase** (delete the machine and its recordings from memory)
- 6 Copy** (create a copy of the machine)



The number beside each menu item indicates the key that must be pressed to perform that function e.g. pressing **BACK 6** will copy the currently selected machine.

These functions can all be accessed *directly* e.g. with the Select Machine Menu displayed, pressing **BACK 6** will copy the currently selected machine without having to display the pop-up menu. The pop-up menus are used as a reminder of commonly used functions so that you do not have to memorize the number key for each function.

- The pop-up menu will disappear automatically within a few seconds or you can cancel it by pressing **ENTER**

- To keep the pop-up menu on screen, hold down 

Entering Text and Numbers

To enter text or numbers press the corresponding number/character key. As with a mobile phone, available character options for each key are displayed with subsequent key presses (e.g. first press of the '3' key displays '3', second press displays 'D', next press displays 'E' etc). The cursor will advance automatically after a short pause so that the next character can be entered.



Names can be up to 16 characters long in upper or lower case. To enter or edit names:

- Press the key that has the required characters displayed above it until the correct character appears above the flashing cursor.

Example:

To enter the word FAN


- Press  four times until the F displays.





The cursor advances automatically after a short pause.

- To enter the letter A press  twice until the A displays.



- Press  three times to display an N.




- Press  twice to enter a space between words if required.
- Press  to save when you have finished entering or editing your text.

Entering Numerical Values

To enter numerical values press the appropriate number key. It is not necessary to enter decimal points as they are placed automatically.


Example:



To enter the value 7.5



- Press  > 
- Press  > 
- Press  > 



To clear an incorrect entry press  until the value is reset to zero.

Other Name Editing Commands

 Cancels the current edit screen and retains the original name.



  Moves the cursor forward.


  Moves the cursor backward.


  Inserts a 0 at the current cursor position or deletes the character at the cursor position.


  Inserts a space at the current position.

  Deletes the character at the current position.

  Clears all the characters to the right of the cursor.

 Changes the currently selected letter to uppercase if it is currently lowercase.

 Changes the currently selected letter to lowercase if it is currently uppercase.

 Scrolls through the various symbols if the cursor is in a space.

Accelerometer Setup

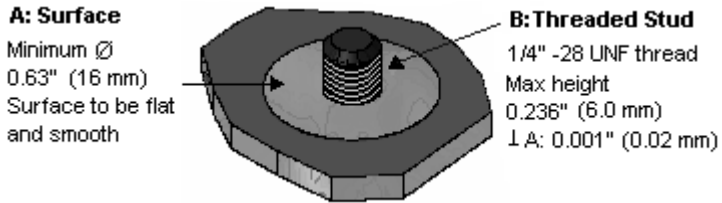
Plug the connector of the accelerometer into the vb accelerometer input. Now screw the accelerometer into the magnetic base and attach to the measurement point ensuring it is:

- Attached to a sturdy, rigidly mounted and non-flexible structure, where vibration from the rotating part of the machine will be accurately transmitted. Avoid attachment to sheet metal, guards, or any machine structure which is not closely coupled to the source of vibration in the spinning rotor as the vibration of such a structure will be different to the vibration source.
- Attached to a structure which is at least 10 times heavier than the sensor itself. Do not mount the accelerometer on lightweight motors or similar parts, as the weight of the accelerometer will distort the vibration signal. Use smaller accelerometers for small structures.
- Attached as closely as possible to, and in line with, the centerline of the bearings to avoid distorted signals.
- Securely attached to the mounting surface. The surface should be flat and smooth where the sensor makes contact. Attachment can be either using the supplied magnetic accelerometer base, or via a threaded stud on the machine surface. The accelerometer should not move independently of the machine part it is attached to.
- Oriented correctly, as vibration can differ greatly with respect to direction.
- Attached to exactly the same position as before if this is an ongoing study of a particular measurement point (mark the position if necessary).
- Clear from other cables and not twisted, kinked or tangled.

Permanent Mounting

To mount using the stud method, prepare a mounting spot on the machine following the specifications shown in the diagram.

- Unscrew the magnetic base from the accelerometer and screw onto the threaded stud. Use of thread locking compound is suggested.



Stud Mounting Spot

Caution: Do **not** use a wrench to tighten the accelerometer as this will damage the sensor.

Tips for Taking Measurements

- Measurements should always be taken using the machine operating mode that is typical for that machine (the typical load and running speed). This is to ensure that the loads on the components, such as bearings, are the same as those that define their wear. For multi-operating mode machines it is best to take measurements when the loads on the bearings are at a maximum and to take all future measurements in the same mode.
- When taking the measurement, try not to lean on the machine and do not put heavy objects (e.g. heavy tool boxes) on it since this will change the vibratory behavior of the machine.
- If there are machines operating nearby that might affect the vibration of the machine you are measuring, stop those surrounding machines if possible.
- In addition to the measurements that you will be taking, if possible, stop and listen to the sound of the machine; look for loose bolts and oil leaks; take note of any machine parts that are vibrating visibly; feel for hot bearings and manually 'feel' the vibration (e.g. with a screwdriver) to look for symptoms that might later aid vibration analysis. This should be done only if it is safe to do so.

Section 3: Onsite Analysis - Measurement Menu

This section describes the different parameters used to take measurements and how to apply them.




You will learn to:

- Take frequency domain measurements (spectra)
- Take time domain measurements (waveforms)
- Perform bump tests
- Take run-up and coast-down measurements
- Store measurements
- Analyze measurements
- Customize the default measurement menus
- Change the on-screen display options of your vb

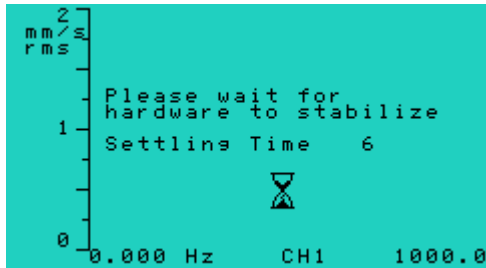
Walk-through: Taking Measurements in Measure Mode

Onsite analysis using Measure Mode involves watching a machine's vibration on-screen as it occurs and analyzing the measurement on the vb rather than transferring it to Ascent and analyzing it using the software. This method of measuring allows you to take a quick look at a machine's vibration patterns without having to save the recording or create a machine and points etc. You can still store the recording once the measurement is complete if you choose to do so.

Warning: Take care of personal safety when taking measurements in industrial environments. Follow all safety regulations at all times. Read also Precautions (on page 5), before attempting to take measurements.

- From the Main Menu press  Measure.
- Choose a quick setup menu or one of the automated menus.
- Press  and use the number keys to enter the machine running speed (RPM).
- Press  to continue.
- Attach the accelerometer.
- Start the machine and allow it to operate under its normal load and running speed.

- To start the measurement press **START STOP**



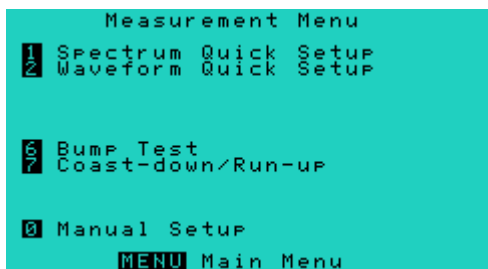
- Wait for the accelerometer and vb hardware to settle. When the settling time has elapsed or the hardware has settled measuring begins and the spectrum or waveform is displayed and continually updated. (You can press **START STOP** while the vb is settling to cancel the remaining settling time but this is **not** recommended as the measurement may not be accurate.)
 - To stop the measurement from updating press **START STOP**. To resume measuring and updating the display press **START STOP**. Some basic analysis can be carried out straight away including displaying the amplitude of a spectral peak and identifying any harmonics (see Analyzing Measurements on page 35).
 - To save the measurement press **MENU** to display a pop-up menu and select option **RESET 1** Record.
 - Select or create a machine, point and direction to save the recording to.
- OR
- To stop viewing the measurement and exit without saving press **MENU** twice to return to the Main Menu.

Using Quick Setup Menus

The vb's quick setup menus automate most of the measurement set up process for spectra and waveforms. These measurements are free run so you can record for as long or short a length of time as you wish.

Most parameters are set for you - you are only required to adjust a few settings. Any of the default parameters can be changed before or during measuring. The default parameters for each quick setup are listed in Default Parameters (on page 27).

- Access the Measurement Menu by pressing  from the Main Menu.



- To take a spectrum or waveform measurement press the number key that corresponds to that option.

Instructions for using each of these quick setup menus are described next.

1. Spectrum Quick Setup

- From the Main Menu press **RESET** **1** Measure, to open the Measurement Menu.
- From the Measurement Menu press **RESET** **1** Spectrum Quick Setup.



The only parameter you need to set is the Fmax value. This can be done in two ways:


- Press **RESET** **1** to display the Machine Running Speed Menu then use the number keys to enter an RPM value. The Fmax will be set to 40 x the RPM (or rounded up to the closest value).

OR

- Press **HELP** **2** to display the Set Fmax Menu and use **▲** or **▼** to manually select a value.
- Once the Fmax is set press **ENTER** to return to the quick setup menu then press **START STOP** to take the measurement.

When a measurement has been taken it can be analyzed immediately on the vb (see Analyzing Measurements on page 35) or stored for later analysis (see Storing Measurements on page 34).

Setting your own parameters

Option  Custom Setup allows you to customize this menu to use your own settings instead of the factory defaults. See Custom Setups (on page 37) for more information.

2. Waveform Quick Setup



- From the Main Menu press **RESET** 1 Measure, to open the Measurement Menu.
- From the Measurement Menu press **HELP** 2 Waveform Quick Setup.





The only parameter you need to set is the duration value. This can be done in three ways:

- Press **RESET** 1 to display the Machine Running Speed Menu then use the number keys to enter an RPM value. The duration will be set to the time it takes the machine to make 20 revolutions.

OR

- Press **HELP** 2 to display the Set Duration Menu and use  or  to manually select a value.


OR

- Press **LIGHT** 3 to display the Set Fmax Menu and use  or  to manually select a value. The value you select will determine the equivalent duration value. If the waveform is later transferred to Ascent and displayed as a spectrum, this Fmax value will be used on the chart.

- Once the duration is set press **ENTER** to return to the quick setup menu then press **START STOP** to take the measurement.

When a measurement has been taken it can be analyzed immediately on the vb (see Analyzing Measurements on page 35) or stored for later analysis (see Storing Measurements on page 34).

Setting your own parameters

Option  Custom Setup allows you to customize this menu to use your own settings instead of the factory defaults. See Custom Setups (on page 37) for more information.

Default Parameters


When using the quick setup menus the following parameters are automatically applied.

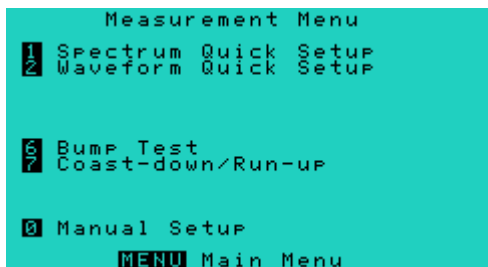
	Spectrum	Waveform
Domain	Frequency	Time
Window	Hanning	N/A
Quantity	User defined	User defined
Spectral Lines	400	1024 samples
Fmin	1 Hz (60 CPM)	N/A
Fmax	Automatic	Automatic
Average Type	4 x Linear 50% overlap	N/A
Amplitude Scale	Linear	N/A
Trigger	Free run	Free run
Harmonic Cursor	OFF	OFF
Overall Type	Rms	OFF

Any of the default parameters can be changed before and during measurement. See Setting Measurement Parameters (on page 42) for more information.

Using Automated Menus

Advanced operations can be carried out using the automated setups available from the Measurement Menu. You need only set one or two parameters yourself and the vb will automatically apply default parameters that are optimized for the settings you specify. As with the quick setup menus, any of the default parameters can be changed before or during measuring. The default parameters for each automated setup are listed in Default Parameters (on page 33).

- Access the Measurement Menu by pressing  from the Main Menu.



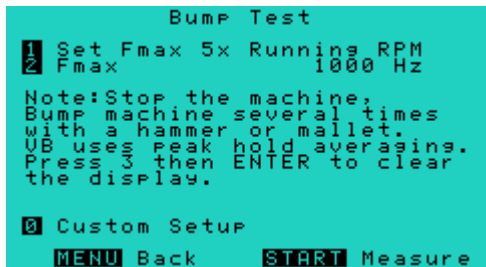
- To take a measurement, press the number key that corresponds to the option required.

Instructions for using each of these automated setup menus are described next.

6. Bump Test

The bump test is a useful vibration analysis technique to help identify resonance frequencies in a machine's structure. It requires 'bumping' (i.e. hitting) the machine structure when the machine is stopped, while taking a peak hold measurement. Careful selection of the mallet or hammer is required along with the strength and direction of the bump to ensure that suitable frequencies are injected into the structure without causing damage.

- From the Main Menu press **RESET** **1** to enter Measure mode then **BACK** **6** to display the Bump Test Menu.



The only parameter you need to set is the Fmax value. This can be done in two ways:



- Press **RESET** **1** to display the Machine Running Speed Menu then use the number keys to enter an RPM value. The Fmax will be set to 5 x the RPM (or rounded up to the closest value).

OR



- Press **HELP** **2** to display the Set Fmax Menu and use **▲** or **▼** to manually select a value.
- Once the Fmax is set press **START STOP** to begin sampling.
- 'Bump' the machine with the hammer.
- Repeat several times.

To store the measurement see Storing Measurements.

Note: In free run mode with peak hold averaging, the vb will continue sampling and displaying the peak values for each spectral line.

Tip: With the spectrum displayed press  or  to move the cursor and check the frequency of any resonance peaks found.

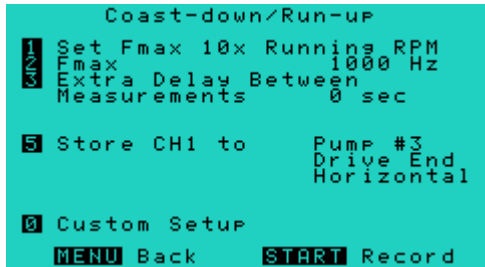
Setting your own parameters

Option   Custom Setup allows you to customize this menu to use your own settings instead of the factory defaults. See Custom Setups (on page 37) for more information.

7. Coast-down/Run-up Recordings

Coast-down and run-up recordings involve taking a series of recordings with a short delay between them. This technique can be used to study the resonance behavior of a machine as its speed gradually increases during power-up or decreases during coast-down.



- From the Main Menu press   to enter Measure mode then   to display the Coast-Down/Run-Up Menu.



The only parameter you need to set is the Fmax value. This can be done in two ways:

- Press **RESET** **1** to display the Machine Running Speed Menu then use the number keys to enter an RPM value. The Fmax will be set to 10 x the RPM (or rounded up to the closest value).

OR

- Press **HELP** **2** to display the Set Fmax Menu and use  or  to manually select a value.
- Once the Fmax is set, select the machine, point and direction in which the sequence of measurements will be stored.

Recommendations

A large number of recordings will be created so we recommended you create a new 'point' for each new coast-down or run-up measurement to clearly separate each set of recordings.

For machines with a slow coast down or run up, e.g. more than one minute, we recommend that you add a few seconds extra delay between recordings (press **LIGHT** **3** then enter the number of seconds required).


Taking a measurement

- Press **START STOP** to begin the recording sequence.
- After the first spectrum has been recorded, switch off the machine (or begin ramping its speed up or down).
- Once the machine has stopped rotating (or its speed has been fully adjusted) press **START STOP**

The measurement location should now contain a large number of measurements. These can now be transferred to the Ascent software for display as a waterfall chart.

To store the measurement see Storing Measurements (on page 35).

Setting your own parameters

Option  Custom Setup allows you to customize this menu to use your own settings instead of the factory defaults. See Custom Setups (on page 37) for more information.

Default Parameters

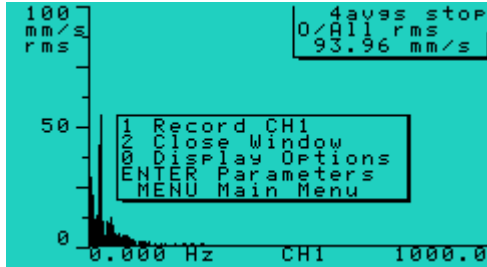
When using the automated menus, the following parameters are automatically applied.

	Bump Test	Coast-down/Run-up
Domain	Frequency	Frequency
Window	Hanning	Hanning
Spectral Lines	400	400
Fmin	1 Hz	1 Hz
Average Type	Peak hold	1 X Linear
Amplitude Scale	Linear	Linear
Trigger	Internal Free run	Internal Free run
Display Orders	OFF	OFF
Harmonic Cursor	OFF	OFF
Tach Display	OFF	OFF
Autorepeat	OFF	ON

As with any measurement, the parameters can be changed before and during measuring as described in Setting Measurement Parameters (on page 42).

Storing Measurements

- After taking a measurement, with the spectrum or waveform displayed press **MENU** to open a pop-up window containing the Record option.



- Press **RESET 1** to record the measurement. You will then need to either select a machine, point and direction to save the measurement to or create these now.

Selecting an existing machine, point and direction

- Press **▲** or **▼** to highlight a machine.
- Press **ENTER** to select it and display the next menu. Repeat this process for the point and direction.



Creating a machine, point and direction

- Highlight a '-new-' machine and press **HELP 2** to display the Edit Name Menu. See Entering Text and Numbers (on page 14), for details of how to enter names for your machines, points and directions.
- When you have entered a name, press **ENTER** twice to save the name and display the next menu. Repeat this process for the point and direction.





Analyzing Measurements

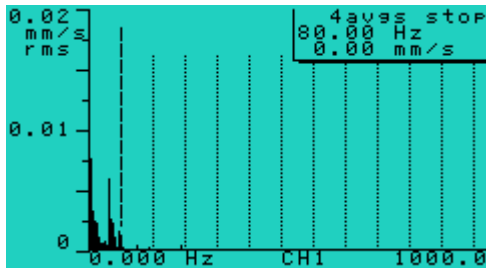
The spectrum/waveform chart is displayed on the vb screen once a measurement has been taken. Spectra and waveforms displayed on the vb can be analyzed in the following ways:

Displaying the amplitude/frequency of a peak

- To read the vibration amplitude or level corresponding to a particular frequency or time, press  or  to move the cursor to that frequency or time value. The values indicated by the cursor are displayed at the top-right of the screen.






Note: The overall vibration value is not displayed while cursors are activated.

- To move the cursor rapidly press  +  and  + 










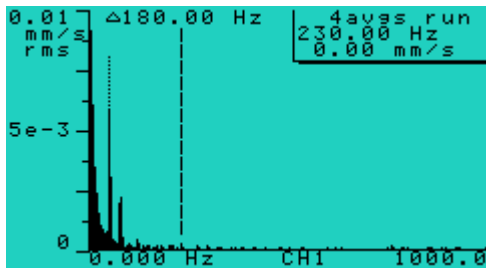
Using cursors to display frequency and amplitude levels





Displaying harmonics

- To identify the harmonics of a peak, move the cursor to the peak of interest. If the harmonic cursors option has been turned on (see below), additional cursors are displayed at frequency or time values that are whole-number multiples of the frequency or time value indicated by the main cursor.
- To turn on harmonic cursors, press   to access the Display Options Menu then press   to toggle the cursors on. Press  to return to the chart display.





Displaying frequency/time difference between peaks

- To display the frequency difference or time difference between two peaks, press  or  to position the main cursor at one of the peaks.
- Press  then  to anchor a datum cursor at the peak.
- Press  or  to position the main cursor at the other peak. The delta symbol  appears beside a value indicating the frequency or time difference between the two peaks.





- To clear the datum cursor, move the main cursor to where the datum cursor is and then press  then  again (or press  then  twice if not on the datum cursor).

Zooming

- To take a close-up view of a spectrum or waveform, move the cursor to the position of interest and press  then  to zoom in by a factor of 2.
- To zoom out (by a factor of 2), press  then .



The more spectral lines or the more waveform sample points used, the more times you can zoom. Moving the cursor to the edge of the screen within zoomed views pans the viewing area across the spectrum or waveform by up to 50% of the viewing area.

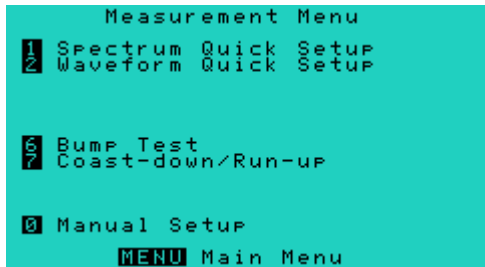
Changing display options

- To change the display options of a spectrum or waveform in order to view the spectrum or waveform more clearly, press   to access the Display Options Menu see Setting the Display Options (on page 39).


Custom Setups

Any of the vb's quick setup or automated menus can be customized to use your preferred settings. You simply choose your own measurement parameters, save the settings in a custom setup menu then choose that same custom setup whenever you want to measure or record that measurement type.

- To create a custom setup, from the Main Menu press   then select the Quick Setup or Automated menu you want to customize.



- Press   Custom Setup.



- Change the parameters as required then press  to save your custom settings. If you forget to save the settings the parameters will revert back to their previous settings after you take a measurement.

```

Spectrum Custom Setup
Mode                      Freq veloc
Spectral Lines            400
Max (display)            40 Ords
Min                       1 Hz
Averaging                 4x Lin
Trigger                   Free Run
CH1 Sensor                Undefined s
Display Options
Save Custom Settings
RESET Restore Factory Settings
MENU Back                 START Measure

```

You cannot save settings that conflict with the type of measurement you are trying to create e.g. if you are creating a Spectrum custom setup you cannot set the Mode to time domain. When you try to save the settings or take the measurement the vb will force the settings to whichever parameters are appropriate for that type of measurement (in this case the Mode would be forced to frequency).

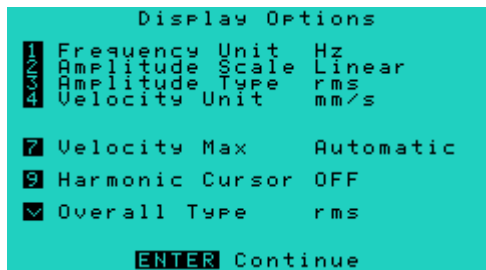
Note: When you create a custom setup your settings will overwrite the factory default parameters. If you wish to restore the factory defaults to any quick setup or automated menu, open the custom setup you want to restore then press  + .

Setting the Display Options

Display options control the way a measurement is displayed on the vb such as showing the frequency in Hz or CPM, or setting the amplitude type to rms, Ø-peak or peak-peak.

- To access the Display Options Menu, from the Main Menu press **RESET** **1** Measure, then press **>** **0**

Note: This screen shot shows the factory default settings (the measurement mode is set to frequency for spectra and the quantity to velocity). Your screen may differ depending on the settings you have chosen.



- To change any of the display options press the corresponding number key to cycle through the available options. When you have finished, press **ENTER** to return to the previous screen.

RESET
1

Frequency Unit

Available units are Hz and CPM/kCPM. The frequency unit Hz, is equivalent to 'cycles per second' and kCPM stands for 'kilocycles per minute'.

HELP
2

Amplitude Scale

Either linear or log scale can be chosen for the bottom axis. The linear amplitude scale can be used in most cases. The log scale (base 10) is more useful for displaying vibration with both very large and very small amplitudes. If the log scale is selected, the log range (the range of the amplitude axis) will appear as option 6 in this menu.

LIGHT
3

Amplitude Type

Applies to the chart scale for the left axis. For spectra this can be set to rms, Ø-peak or peak-peak. The Ø-peak and peak-peak values are 'derived' from the rms value. Ø-peak is calculated by multiplying the rms value by 1.414. Peak-peak is calculated by multiplying the rms value by 2.828. For time waveforms the amplitude type is always Ø-peak.

+
4

Velocity Unit

(Also acceleration unit and displacement unit) Available SI and imperial options are: velocity - mm/s, in/s; acceleration - g, m/s²; displacement - mm, mil. If the Amplitude Scale is set to Log, the options VdB and AdB are also available. The vibration velocity level (VdB) is defined as 20 times the logarithm of the ratio of the rms velocity level to a reference velocity value, the VdB reference. Acceleration expressed in AdB is defined as 20 times the logarithm of the ratio of the rms acceleration level to 1 µg rms.

-
5

VdB Reference

See above. The value 1e-6 mm/s is an abbreviation for 1x10⁻⁶ mm/s and is the SI reference level. The value 1e-5 mm/s is the reference level used by the US Navy and many American industries.



Log Range

Used to specify the left axis range when the amplitude scale is set to log.



Velocity Max

Velocity max, acceleration max or displacement max is the highest amplitude value that will be **displayed** on the amplitude axis. If the linear amplitude scale is selected this value can be set to automatic.



Harmonic Cursor



If the harmonic cursor option is turned on, additional cursors will be displayed at frequencies that are whole-number multiples of the frequency indicated by the main cursor. See Analyzing Measurements (on page 35), for information on using cursors.



Overall Type

The vibration overall level can be scaled as rms, Ø-peak or peak-peak. This setting can be different for each of acceleration, velocity and displacement if required. The overall scale can be set differently to the amplitude type (chart scale) e.g. you can set the amplitude type to Ø-peak and the overall scale to rms.

Changing display options once measuring has begun

- While the hardware is stabilizing or the vb is collecting data the hourglass icon will be displayed. During this time, press  to access the Display Options Menu directly. Note that only the options that are applicable to the type of measurement being performed will be displayed.
- Press  to resume measuring.

Section 4: Manual Setup Measurement Parameters

This section describes the different parameters used to take measurements and how to apply them.

You will learn to:

- Set spectrum parameters
- Set waveform parameters

Setting Measurement Parameters

To take a completely manual measurement (i.e. you set all parameters yourself) use the Manual Setup option.

- From the Main Menu press **RESET** **1** Measure then press **>** **0** to select Manual Setup. This opens the Set Parameters Menu.




- Change the parameter settings as required. Alternatively select a pre-existing parameter set by pressing **▲**. Use the arrow keys to highlight a parameter set then press **ENTER** to select it.
- To take a measurement press **START STOP**. See Walk-through: Taking Measurements in Measure Mode (on page 21) for full instructions for taking measurements. Ignore the first four steps as these refer to using the quick setup menus to take a measurement.

Some parameter values can be changed directly in this menu e.g. press **HELP** **2** to change the number of spectral lines or **NEXT** **7** to toggle the trigger between single and free run.

For other parameters, pressing a number key will open a sub-menu where you can change the parameters settings for that menu item e.g. pressing **LIGHT** **3** f max, opens the Set f max Menu.

Measurement parameters are normally chosen before taking a measurement but can also be changed once measuring is underway.

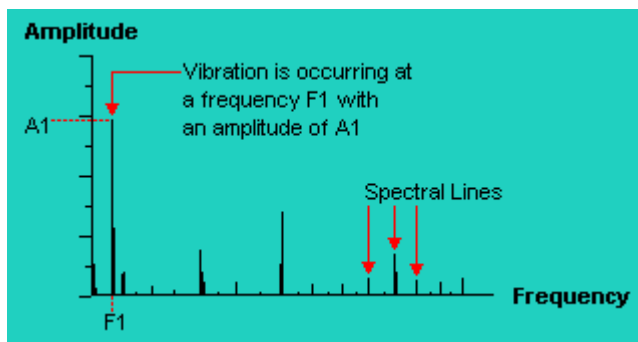
Changing parameters once measuring has begun

- While the hardware is stabilizing or the vb is collecting data the hourglass icon will be displayed. During this time, pressing keys 1, 3, 4, 5, 9 and 0 will access the associated Set Parameters Menu item directly.
- Make any required changes then press  to resume measuring.

Setting Spectrum Parameters


A vibration spectrum is a chart of vibration amplitude versus vibration frequency. The vibration spectrum of a machine component shows the frequencies at which the component is vibrating and the amplitude of vibration at each of these frequencies.

vb spectra consist of discrete spectral lines displayed at fixed frequency intervals. The height of each spectral line represents the amplitude of vibration at the frequency the spectral line is positioned. The more spectral lines in a spectrum, the higher the resolution of the spectrum (but more memory is used).



A simplified illustration of a discrete vibration spectrum

The vibration spectrum of a vibrating machine component is the basic tool for understanding the nature of the vibration. To ensure a spectrum is as informative as possible, the measurement parameters that are used to obtain the spectrum must be set appropriately.

- To begin setting measurement parameters, from the Main Menu press  to display the Set Parameters Menu.

Setting the Measurement Mode

- From the Set Parameters Menu press 



When in the Measurement Mode Menu:




Domain toggles the domain between Frequency (spectra) and Time (waveform).



Quantity toggles the amplitude quantity between Displacement, Velocity and Acceleration.



Window toggles the type of window between Hanning and Rectangular. This is not available when the Domain is set to Time.

- To change any of the options press the number key that corresponds to that menu item. When you have finished, press  to return to the Set Parameters Menu.

Domain

When the domain is set to frequency, the vb displays spectra rather than waveforms.


Quantity

Measuring velocity is applicable for most situations. However, displacement spectra are usually more informative for low vibration frequencies (below 1800 CPM), and acceleration spectra for high frequencies (above 60 kCPM).

Window

Measured data is usually not directly used to generate a spectrum but is first modified using a 'window' function. Windowing compensates for known limitations of the mathematical process (FFT) that transforms the data into a spectrum. Multiplying data by a window function prevents spectral lines from smearing or leaking into one another, thereby making the data block appear like a complete wave. The Hanning window is normally used for this purpose. If the Rectangular window is used, the data will not be modified.



Setting the Number of Spectral Lines

- From the Set Parameters Menu press  to toggle the number of spectral lines.

The number of spectral lines ranges from 400 to 3200.

The resolution of the spectrum increases with the number of spectral lines used i.e. the more spectral lines, the more information the spectrum contains. However, the more spectral lines used, the longer to take the measurement and the more memory is used to store the spectrum. Use 3200 lines only when required e.g. when you need to distinguish between two closely spaced vibration frequencies or when the Fmax is very large. For coast-down or run-up measurements a setting of 400 lines is recommended.

Setting the Average Type

- From the Set Parameters Menu press  then press  to cycle through the Average Types, Linear, Exponential and Peak hold.

When vibration is measured, several spectra are usually measured and then averaged to produce an average vibration chart. The averaging process minimizes the effect of random variations or noise spikes that are inherent in vibration signals. Averaging is applied to amplitude values, not to the frequency range.

Linear averaging is suitable for most cases. The amplitude value at each frequency of a spectrum is added to the same frequency of the next spectrum. The sum is then divided by the number of averages taken.

Exponential averaging is normally used only if vibration behavior varies significantly during measurement, such as during run-up and coast-down measurements. The most recent spectra have more influence on the final average than earlier measurements. Averaging is continuous until the measurement is stopped.

Peak hold is useful for measuring the maximum amplitude peak that occurs over a period of time and for measuring resonances during a bump test. Peak hold does not actually average the amplitude values but records and displays the maximum amplitude of each spectral line.

Setting the Number of Averages

- From the Set Parameters Menu press **5** then press **RESET 1** to display the No. of Averages Menu.



- Press **▲** or **▼** to highlight the number of averages and **ENTER** to select.

The larger the number of spectra used for averaging, the more any noise spikes in vibration signals are reduced and the more accurately true spectral peaks are represented. However, the larger the number of averages, the more data needs to be collected, and therefore the longer it takes to obtain the average spectrum. Four averages are sufficient for most cases. Set the number of averages to one if spectra averaging is not required, for example, with run-up and coast-down recordings.

Setting the Overlap Percentage

- From the Set Parameters Menu press **5** then press **LIGHT 3** to display the Overlap Menu.



- Press **▲** or **▼** to highlight the percentage to overlap and **ENTER** to select.

Overlapping is a means of collecting and displaying data more quickly. As vibration measurements are collected a percentage of the new data is combined (overlapped) with each subsequent measurement. The higher the overlap percentage the less newly acquired data is needed to generate a spectrum, and thus the faster the spectrum can be displayed. An overlap percentage of 50% is ideal for most cases.

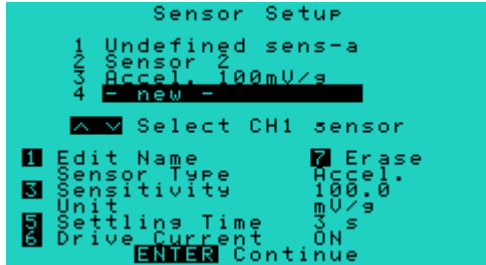
Setting the Trigger Mode



- From the Set Parameters Menu press **NEXT 7** to toggle the trigger mode.

If the free run trigger mode is selected the vb will take measurements continuously. If the single trigger mode is selected only one measurement will be taken.







Specifying Sensor Settings

- From the Set Parameters Menu press 



- Press  or  to select the sensor to edit.

Once the desired sensor has been selected:



- Press  to edit the Name of the sensor.
- Press  to change the Sensitivity of the sensor. The allowed range of sensitivities are (8.5 to 2300) mV/g.
- Press  to change the Settling Time for the sensor. The settling times can be anything from 0 seconds to 99 seconds inclusive.
- Press  to toggle the Drive Current for the sensor ON or OFF. This is the 4 mA supply to power ICP[®] type accelerometers.
- Press  to erase all details about the sensor.
- Make any changes then press  to continue.

Setting Waveform Parameters

A vibration waveform is a chart of how vibration level changes with time. A vibration waveform shows the vibration level at any particular time during the measurement period.

vb waveforms are discrete charts represented by a series of equally spaced discrete sample points connected by straight lines. The more sample points in a spectrum the higher the resolution of the waveform (but the more memory used).

To ensure a waveform is as informative as possible the measurement parameters used to obtain the waveform must be set appropriately.

- To begin setting measurement parameters, from the Main Menu press  then press  to display the Set Parameters Menu.

Setting the Measurement Mode

- From the Set Parameters Menu press **RESET 1**



- Press **RESET 1** to change the Domain to Time.
- Press **HELP 2** to toggle the quantity to be measured between Acceleration, Displacement and Velocity
- When finished, press **ENTER** to return to the Set Parameters Menu.

Note: Option 3: Window, is not available with waveforms.

Setting the Number of Samples

- From the Set Parameters Menu when Time mode is selected, press **HELP 2** to cycle the number of samples between 1024, 2048, 4096 or 8192.






The resolution of the waveform increases with the number of samples used i.e. the more samples, the more information the waveform contains. However, the more samples in a waveform, the more memory is used up to store the waveform.

Tip: An easy way to select the number of samples and duration is to let the vb set them for you. In Frequency mode (option 1 in the Set Parameters Menu), select the Fmax and number of lines, then switch to Time mode and the vb will select the corresponding values.

Setting the Duration

- From the Set Parameters Menu press 



- Press  or  to select the required duration and  to select. You can also press  or  to move horizontally across the columns.

The duration of a waveform is the total time period over which information may be obtained from the waveform. The unit ms is short for 'millisecond' (i.e. a thousandth of a second). The duration values that you can select are dependent on the number of samples you selected earlier (see previous topic). The larger the number of samples the larger the duration values.

Setting Other Parameters

To change the settings for other measurement parameters, please refer to the appropriately titled topics following Setting Spectrum Parameters (on page 45).

Section 4: Creating a Recording List

This section describes the procedures for creating machines within the vb.

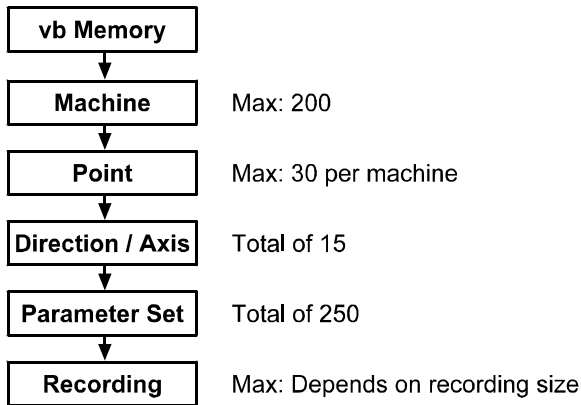
You will learn to:

- Create machines, points and directions
- Create parameter sets
- Copy a machine
- Erase machines, points and directions
- Rename machines, points and directions
- Select and attach notes to items
- Remove and erase notes
- Tag items in a recording list

vb Data Structure

Instead of analyzing data onsite, you can also record the data on your vb and analyze the data later. If many machines need to be analyzed we recommend that recordings be taken of all machines before any analysis is done. Analysis is best carried out away from machines in safe, quiet environments.

The vb uses the following hierarchical data storage structure:



Starting at the bottom of the diagram, a **recording** is the vibration data collected at a particular location on a machine.

A **parameter set** defines a set of measurement parameter values that can be used to take a recording. These are useful when you are taking a large number of recordings, each using the same parameter values.

The **direction** refers to the orientation of the sensor - horizontal, vertical etc. Directions are grouped under points as each point can have recordings taken in several axes.

A **point** represents a place on a machine that a measurement will be taken. Points are grouped under the machine that they are located on.


Machines, points, and directions are identified by the names you give them. Parameter sets are identified by their parameter value summaries e.g. accel 400 ms or veloc 1000 Hz. Recordings are identified by their date and time stamps.

Creating a Recording List

If recordings are to be taken for a large number of machines on a regular basis, we recommend you create the machine structures in the vb before taking any recordings. You can create a recording list of all machines to be monitored, including their respective points, directions, and measurement parameters.





Machines and measurement parameter sets created in the vb are automatically added to the Ascent database when you use Ascent's receive function to transfer data from the vb to your PC.

Creating a Machine

- From the Main Menu press . The Select Machine Menu displays a list of numbered memory locations.

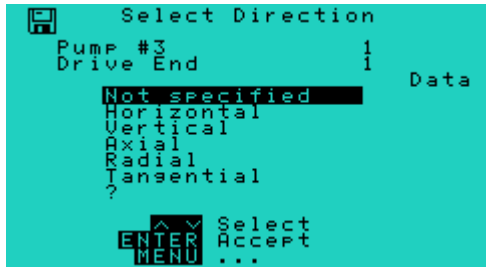


If you have not yet created any machines, the screen will contain numbered slots labeled - new -.

- Press  or  to scroll to one of the slots labeled - new - then press  to display the Edit Name Menu.
- Enter a name for the machine by choosing characters from the keyboard (see Entering Text and Numbers on page 14, for details of how to do this).
- Press  to save the name.

Creating a Direction/Axis

- Create a point as described in the previous topic: Creating a Point (on page 60).
- From the Select Point Menu press **ENTER**



- Press **▲** or **▼** to highlight a direction/axis.
- Press **ENTER** to select the highlighted direction/axis.

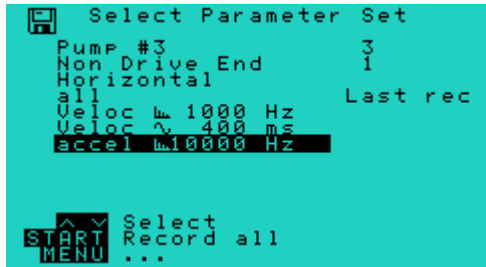
All points share the same direction names. The first six default direction names **cannot** be edited.

To create a new direction

- Press **▲** or **▼** to highlight a question mark in the Select Direction Menu and press **HELP** **2** to display the Edit Name Menu.
- Enter a name for the direction by choosing characters from the keyboard (see Entering Text and Numbers on page 14, for details of how to do this).
- Press **ENTER** to save the name.

Creating a Parameter Set

A parameter set is a user-defined group of measurement parameters that are used to take a measurement. Once a parameter set has been created in the vb it will be added to the list in the Select Parameter Set Menu.



Any parameter set in the list can be selected and used to take measurements. A point can also have more than one parameter set applied to any given axes, giving you the flexibility to take multiple measurements at one location using different parameters.

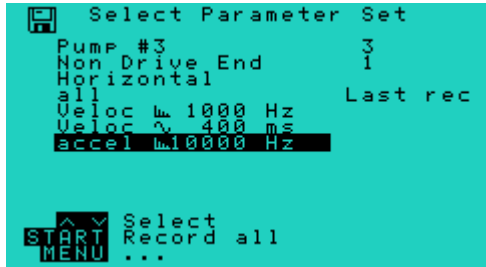
- Select a direction/axis as described in the previous topic: Creating a Direction/Axis (on page 61).
- From the Select Direction Menu press **ENTER** to select the highlighted direction/axis.

If the direction/axis does not have any parameter sets defined, the Set Parameters Menu will be displayed.



Refer to Setting Spectrum Parameters (on page 45) for information on setting the different parameters.

If the direction/axis already has a parameter set defined the Select Parameter Set Menu will be displayed.






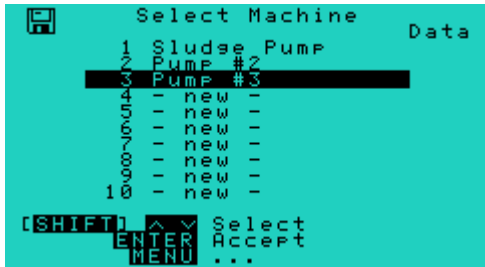
- To review a parameter set, highlight it in the Select Parameter Set Menu and press **HELP 2** to review its parameter values.
- To review the parameter set's most recent recording press **ENTER**


Note: When taking recordings, only the single trigger type can be selected because you are limited by the number of lines specified in your parameter set.

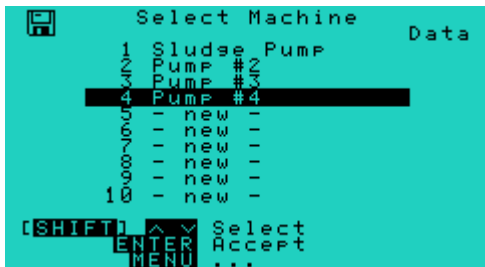
Copying a Machine

If you have many identical machines you can save a lot of set up time by using the vb's copy function. Copying a machine creates a new machine with the same named points, directions and parameter sets. Any recordings taken on the original machine are **not** copied to the new machine.

- From the Main Menu press  to display the Select Machine Menu.
- Press  or  to highlight the machine you wish to copy.



- Press  to copy the machine. The copied machine appears in the first unused slot in the list.

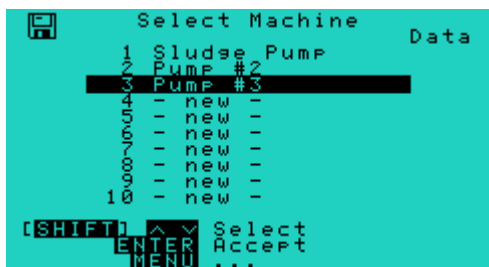


The name is the same as that of the original machine except for the last character, which is automatically incremented.

Erasing an Item

Erase machines, points and other items in a recording list as follow:


- From the Main Menu press **HELP** **2** to display the Select Machine Menu.







- Press **▲** or **▼** to highlight the machine containing the item to be erased.
- Press **ENTER** repeatedly in combination with **▲** or **▼** to navigate to the menu containing the item to erase.
- Once you have the correct menu displayed, highlight the item and press **MENU** to display a pop-up menu containing the erase option.



- Press **5** to select the erase option. You will be prompted to confirm.

- Press  +  to erase the item.
- Press  +  to erase the item.

Renaming a Machine, Point or Direction/Axis

- Select the machine, point or direction/axis.
- Press  to enter the Edit Name Menu.
- Press  +  to clear the current name then type in a new name.
- Press  to save the name and return to the previous screen.

Maintaining Data Integrity

Caution: Ascent identifies machines, points, axes and sensors by their names. If you rename such an item in the vb and then transfer data from the vb to Ascent, Ascent will treat it as a new item. Furthermore, avoid having duplicate names in the vb. They will be differentiated solely on the order that they appear in the vb and Ascent.

Attaching Notes to an Item

A 16-character note can be attached to each item on the recording list: machines, points, directions/axes, and recordings. To view or edit the note for an item:

- From the Main Menu press **HELP** 2 then press **ENTER** till you have the correct menu displayed.
- Press **▲** or **▼** to highlight the item in the list.
- Press **LIGHT** 3 to enter the Notes Menu. This menu lists all the notes that are attached to the currently selected item.

```

Notes
Pump #4          5
Non Drive End   1
Horizontal
hot bearing     5 AUG 04

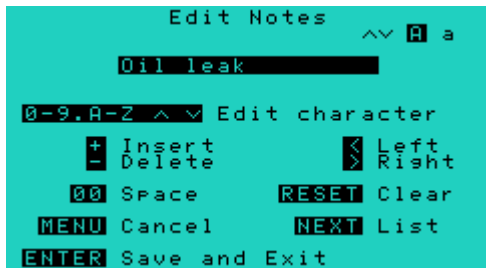
▲▼ Select  SHIFT+RESET Erase
ENTER Continue  1 Edit
  
```

- Press **RESET** 1 to add a note. See Entering Text and Numbers (on page 14), for details on how to add text.
- Press **MENU** to save the note and return to the previous screen. The **G** icon will appear beside the item to indicate that a note has been attached.

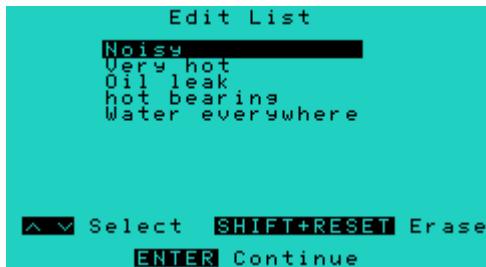
Selecting a Note from a List

When in the Notes Menu, pre-defined notes can be added to a machine, point, direction/axis or recording.

- From the Notes Menu (see previous topic: Attaching Notes to an Item on page 67) press **RESET** **1** to display the Edit Notes Menu.








- Press **SHIFT** + **NEXT** **7** to display the Edit List Menu.










- Press **▲** or **▼** to highlight the note to be used.
- Press **ENTER** to select the note and return to the Edit Notes Menu. The note can then be edited if required or press **MENU** then **ENTER** again to add this note to your item.

Removing a Note from an Item

- Highlight the item with the note attached then press  to enter the Notes Menu.
- If there is more than one note attached to the item press  or  to highlight the note you wish to remove.
- Press  +  to remove the note.

Note: This procedure only removes the note from the selected item. The note remains in the Edit List Menu where it can be selected and attached to other items. To permanently erase a note see the next topic.

Erasing a Note Permanently

- Access the Edit List Menu (see Selecting a Note from a List on page 68).
- Press  or  to highlight the note to be erased.
- Press  +  to erase the note.
- Press  then  then  again to return to whichever menu you started from.

Tagging Items

Not all machines or points need to have recordings taken during every recording session. In such cases, you can create a sub-list by tagging only the items for which recordings need to be taken. Tags are also helpful in that they remind the person taking recordings which items have not yet been measured.

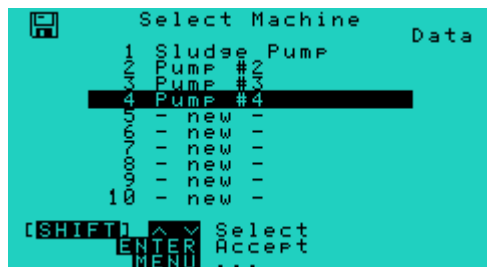
Tagging an item automatically tags all of its sub-elements e.g. tagging a point automatically tags all of its axes and parameter sets. Such an item is marked with a **T**. If you selectively tag only some of the elements of an item the item is marked with a **t**. When a recording is taken the tag will disappear.

- To tag an item, from the Main Menu press **HELP** **2** then press **ENTER** till you have the correct menu displayed.
- Press **▲** or **▼** to highlight the item in the list and press **RESET** **1** to tag it.

Example:

To tag a machine:

- From the Main Menu press **HELP** **2** to display the Select Machine Menu.



- Press  and  to select the machine and press 


```

Select Machine      Data
1 Sludge Pump
T 2 Pump #2
  3 Pump #3
  4 Pump #4
  - new -
  - new -
  - new -
  - new -
  - new -
  - new -
  - new -
  - new -
[SHIFT] ^ v Select
[ENTER] Accept  [MENU] ...

```

Note: Only items with at least one parameter set can be tagged.

To untag an item

- Highlight the item in the list and press 

If you wish to tag most elements of an item it might be faster to first tag the item and then untag the elements within it that are not required.

Section 5: Recording Data

This section describes the procedures for recording vibration data on the vb and transferring it to Ascent on a PC.









You will learn to:

- Take recordings
- Review recordings
- Erase recordings
- Use autorepeat to add a time delay between recordings
- Transfer recorded data to the PC



Walk-through: Taking Recordings

The following instructions assume that you have already created the machines you intend to take recordings of.

Warning: Take care of personal safety when taking recordings in industrial environments. Follow all safety regulations at all times. Also read Precautions (on page 5) before attempting to take recordings.

- Check the battery capacity of the vb and if it is less than 30%, charge the battery pack. See Battery Management (on page 81) for more information.
- From the Main Menu press  to access the Select Machine Menu.
- Press  or  to highlight the machine for which recordings are to be taken then press  to select the machine.
- In the Select Point Menu select the point for which recordings are to be taken then press .
- In the Select Direction Menu select the direction for which recordings are to be taken then press .
- In the Select Parameter Set Menu highlight the parameter set for which recordings are to be taken. If **all** is selected a recording will be sequentially taken for each **tagged** parameter set. If none of the parameter sets are tagged and **all** is selected a recording will be taken for all parameter sets.
- To view or edit the parameter values of the highlighted parameter set press  then press  to return to the Select Parameter Set Menu.

Note: If you change any of the parameter values, apart from display options in the Set Parameters Menu, a new parameter set will be created.













- Connect the accelerometer to the measurement location.
- When you are ready to take the recording(s) press .
- Wait for the accelerometer and vb hardware to settle and for the vb to collect data (if you press  at this stage, the recording(s) will be aborted).

When the vb has finished collecting the data for a particular spectrum or waveform, the spectrum or waveform will be displayed momentarily along with a message confirming that the recording has been completed. You can use the 'Halt after recording' option to keep the chart displayed until you choose to continue (see Halt After Recording on page 92). The recording is stored to your selected location and the Select Parameter Set Menu is then re-displayed. You can then select another parameter set for another recording. Recording tags are automatically cleared as each recording is completed.

- When you have finished taking recordings for a measurement location you can then take recordings at other measurement locations by repeating the above process.

When you have finished taking recordings at all measurement locations, you can review the recordings on the vb (see next topic, Reviewing Recordings) or transfer them to a PC for detailed analysis using Ascent.

Reviewing Recordings

- From the Main Menu press  Review, to access the Select Machine Menu.
- Highlight the machine to be reviewed by pressing  or  then press  to select the machine. The  symbol indicates that you are in review mode.
- In the Select Point Menu select the point to be reviewed then press 
- In the Select Direction Menu select the direction to be reviewed then press 
- In the Select Parameter Set Menu select the parameter set with the recordings to be reviewed then press 
- In the Select Recording Menu highlight the recording to be reviewed then press  to display it. Cursors and zooming may be used to better display the data (see Analyzing Measurements on page 35).
- When you have finished reviewing the data in the recording press  to return to the Select Recording Menu from where you may select another recording to be reviewed.
- To select recordings under other parameter sets, directions, points, or machines, press  then  to navigate back through the menus.

Erasing Recordings

- From the Select Recording Menu press   to erase the highlighted item then  +  to confirm.

Autorepeat

Autorepeat is used to take the same recording repeatedly with a short, user-specified delay between recordings. This option is ideal for taking coast-down/run-up recordings. The vb will take recordings continuously until you choose to stop.

- From the Main Menu press **HELP** **2** Record then choose a machine, point and direction.
- In the Select Parameter Set Menu press **▲** or **▼** to highlight the parameter set you wish to record then press **MENU** to open a pop-up menu containing the autorepeat option.



- Press **BACK** **6** Autorepeat then enter the number of seconds the vb should pause before repeating the recording.



- Press **ENTER** to return to the Select Parameter Set Menu then press **START STOP** to begin recording.

Transferring Recordings from the vb to Ascent

- Plug your vb into the PC using the communications cable (RS232).
- If this is the first time data is being transferred from the vb you will need to create and open a new folder in Ascent to receive this data (see the *Ascent Software Reference Guide*, Creating a Folder, for instructions on how to do this).
- Turn on the vb and click the **Receive** button in Ascent to transfer data from the vb to your PC.



- Follow the on-screen instructions to transfer the data.

The next time you transfer data the receive process will proceed automatically (you will not need to create or open a new folder).

Analyzing Data in Ascent

Once your data has been transferred to the PC you can use Ascent to view spectra, waveforms and trends; to create envelope and band alarms; and to generate reports, such as a detailed exception report, to summarize information in your database. Full instructions for carrying out these tasks can be found in the *Ascent Software Reference Guide*.

Section 6: Utilities



This section describes how to use the utility functions of your vb.

You will learn to:

- Adjust the LCD display
- Set the date and time
- Manage the vb battery pack
- Erase all recordings and machines
- Upgrade the instrument firmware using *PROFLASH*
- Set other vb options

Adjusting the LCD Screen

Adjusting the Contrast

- From the Main Menu press and hold  to darken the LCD.
- Press and hold  to lighten the LCD.

If the screen flickers when the cursors or highlight bar are moved rapidly, make the LCD darker.

Restoring the Default Contrast

- From the Main Menu press  +  to restore the default contrast.


Turning the Backlight On/Off

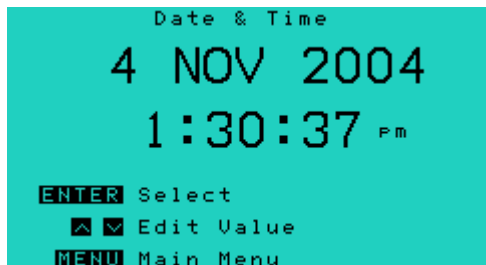
The backlight provides better LCD visibility in dark environments.





- In any screen, press  +  to turn the backlight on/off.

Note: The backlight consumes a relatively high level of power and will automatically turn off if the battery voltage falls below 6.1 V.

Setting the Date and Time

- From the Main Menu press  Date & Time.




- To cycle to a particular item press . The item will flash to show that it is selected.
- Use  and  to change the value of the currently selected item.
- Press  to save changes and exit.

All recordings are date and time stamped according to the clock shown in the Date & Time Menu.

Battery Management

The instrument is powered by a rechargeable Nickel-Cadmium (Ni-Cad) battery pack. The normal operating range is (6.0 to 8.5) V. The Battery Management Menu displays the current percentage of full battery charge available.

Some automatic features have been built into the instrument to help ensure that the battery pack is always sufficiently charged.

Below 6.6 Volts, the instrument displays a flashing  icon at the top left corner of the screen and beeps once every minute as a reminder that the battery pack needs to be charged. In the Battery Management Menu, a flashing 'Low Battery' message is also displayed.

Below 6.1 Volts, the instrument automatically turns off the backlight to prevent further power draining.

Below 80% battery capacity, the instrument automatically begins to charge the battery pack if external power is supplied.

At 5.5 Volts, the instrument automatically powers down. The power saver is another feature that helps conserve power.

The instrument is equipped with an internal backup component that protects data and settings in the event the battery pack is momentarily removed from the instrument. The backup component is kept charged by the battery pack if the battery pack is functioning normally.

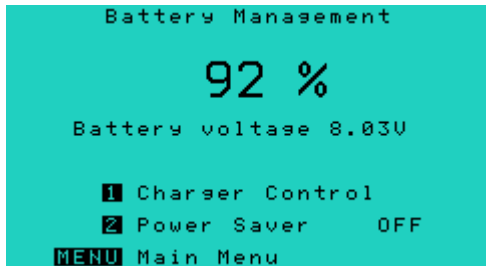
Warning: Do not detach the battery pack from the instrument for more than 2 hours as this will drain the backup component, thereby causing data and setting to be lost.

Warning: Before charging the battery pack, ensure that the power transformer used is an approved instrument power transformer (13.5 ± 1.5) V DC, 1 A output, center positive, and that the voltage and frequency of your mains AC power matches that of the power transformer.

The battery pack can be charged by supplying (13.5 ± 1.5) V DC, 1 A power to the instrument charger socket. The power transformer supplied in the kit provides this DC voltage. The optional car adapter charging lead may also be used to charge the battery pack in a vehicle with a 12 V negative-chassis power system.

Checking the Battery Charge and Voltage

- From the Main Menu press  to display the Battery Management Menu.



The remaining battery charge and voltage are displayed.

Charger Control

This menu allows manual control of the battery charge function. The current battery voltage and charging state are displayed.

```
Charger Control
[UP] Charge Battery
[DOWN] Recondition Battery
Fresh Battery Inserted

Battery voltage 8.02V

[ENTER] Continue
```

RESET
1

Charge Battery

Manually begins battery charging cycle.

HELP
2

Recondition Battery

Fully discharges and then automatically recharges the battery.

LIGHT
3

Fresh Battery Inserted

Resets the battery capacity scale percentage to 100% at the current battery voltage.

These options are explained in detail in the following pages.



Recharging the vb

Warning: Read the warnings in Battery Management (on page 81) before charging the battery.


- Plug the power transformer into a standard power outlet and the connector to the instrument's charger socket.

If the battery charge level is less than 80% the battery will begin charging automatically. You can continue to use the vb while the battery pack is being charged.

If the battery does not begin charging automatically, access the Battery Management Menu and follow the instructions below to begin charging.

- Press  to display the Charger Control Menu.
- Press  to begin charging. A flashing 'CHARGING' message will be displayed.

If there is no power coming from the power transformer, a flashing 'NO CHARGER' message will be displayed. If this happens, check that the mains power is turned on and the battery adapter is connected properly.



Charging stops automatically when complete or you can press  in the Charger Control Menu to stop the charging. A full charging cycle takes approximately two and a half hours.

Reconditioning the Battery Pack

Warning: Read the warnings in Battery Management (on page 81) before performing this operation.

Battery reconditioning is the process of first discharging and then recharging batteries. It reduces the undesirable memory effect in the Ni-Cad battery. The battery pack should be reconditioned the first time it is used and at least once a month thereafter to prevent battery degradation. The recondition process will take up to two hours, depending on initial battery charge.

Caution: If the battery pack is not reconditioned the first time it is used, the battery charge displayed may be incorrect.

- Plug the instrument power transformer to a standard power outlet and its connector to the instrument charger socket.
- Access the Battery Management Menu.
- Press  to access the Charger Control Menu.
- Press  to recondition the battery. Discharging is indicated by the flashing 'DISCHARGING' message on the screen.

The instrument automatically proceeds to charge the battery once the battery pack is fully discharged.

Fresh Battery Inserted

Resets the battery capacity scale percentage to 100% at the current battery voltage. This option should be used when a new, fully recharged battery is exchanged for a discharged battery.



Caution: If this selection is made when the attached battery is not fully charged, then the battery capacity scale will no longer be set accurately. Performing a Recondition Battery will recharge the battery and reset the scale.

Power Saver

Power saver is a feature that helps conserve power in the vb. Power saver will turn the LCD display off after 8 minutes of inactivity (no key presses). The instrument will continue to function and any key press will turn the LCD on to the previously displayed screen. After 15 minutes of inactivity, power saver will power down the vb. If the battery is being recharged, only the LCD screen will be turned off and the instrument will remain on until charging is complete.

The power saver is automatically turned on every time the instrument is powered up. You may turn it off temporarily by toggling power saver OFF from the Battery Management Menu.

To turn off Power saver:

- From the Main Menu press  to access the Battery Management Menu.
- Press  to toggle Power saver ON and OFF.

Replacing the Battery Pack

- Lift the boot stand.
- Unscrew the battery pack using a suitable screwdriver and screw in the new one.

Warning: Ensure that the battery pack is securely fastened but not over-tightened.


Memory Management

vb Memory

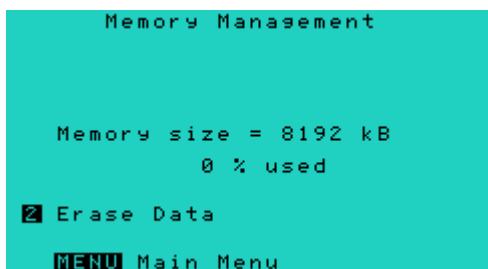
The vb has a standard memory size of 1 MB that can store up to 1000 spectra at 400 line resolution or 512 waveforms with 1024 samples each. For high-resolution recordings a total of 128 spectra at 3200 line resolution can be stored (or 64 waveforms with 8192 samples each).

We recommend you transfer recordings to a PC (see the *Ascent Software Reference Guide*) and erase recordings not required on the vb at the earliest convenience. This frees up memory on the vb for later use.

Checking the Memory Used

- From the Main Menu, press  to access the Memory Management Menu.

The percentage of memory used is displayed in the middle of the screen.






Note: If more than 98% of the memory is used, you will need to erase some recordings before further recordings can be taken.

Erasing all Recordings






Warning: This procedure permanently erases all the recordings in all folders. This cannot be undone.

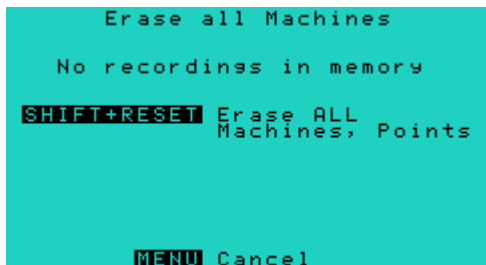
To erase individual recordings see Erasing Recordings (on page 76).

Erasing all recordings removes each machine's recordings permanently from memory but retain the machines, points, directions and parameter sets.

- From the Main Menu press  to access the Memory Management Menu.
- Press   Erase Data.



- Press  +  to erase all data (recordings). You will be prompted to confirm the erasure.
- Press  +  again to confirm or  to cancel. The Erase all Machines Menu displays with a message confirming there are no recordings in memory.

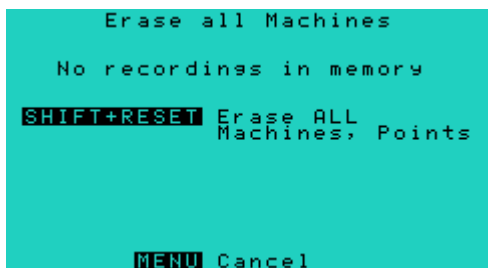






Erasing all Machines

Warning: The following procedure erases **all** machines (including all the points, directions, and parameter sets in the machines). The procedures for erasing individual machines, points, directions or parameter sets are covered in section 4.

Erasing all machines is a two-stage process. Before erasing all machines, all recordings must first be erased. See the previous topic, Erasing all Recordings, for instructions on how to do this.

After erasing all recordings you will be prompted to erase all machines.

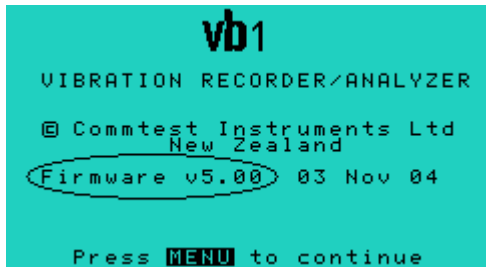


- Press  +  to erase all machines. You will be prompted to confirm.
- Press  +  again to confirm the erasure. The displayed menu will now show 0% memory usage.

Upgrading Firmware Using Proflash

To upgrade the vb to the latest version of firmware you *PROFLASH* the instrument with a new firmware file. When an upgraded firmware version is available it will be posted on the Commtest Instruments Ltd website and can be downloaded free of charge from www.commtest.com under downloads>vb series download.

- To view your vb's firmware version, turn the vb off then on again. The current firmware version is displayed at power up.



Warnings

PROFLASHING to any version will erase **all** recordings in the instrument memory.


PROFLASHING the instrument takes approximately one minute and the vb will re-start several times during the process. Do **not** interrupt the process as this will damage the instrument. The vb's LCD screen will advise when the *PROFLASH* is complete.

- With the instrument turned on, connect and turn on the battery charger *OR* ensure the battery voltage is 7.5 or higher.
- Connect the vb via the communication cable to a PC with the Ascent software.
- From the main menu in Ascent, select **File>Proflash VB** and follow the on-screen instructions.

Most of the tasks involved with *PROFLASHING* are carried out from within the Ascent software. Refer to the Ascent on-line help for detailed instructions on how to *PROFLASH* your vb. (From the Ascent menu, select **Help>Index**, then type 'Proflash' to display the help file).

Other Options

The Options Menu provides you with a number of choices to customize the way your instrument works. To access the Options Menu:

- From the Main Menu press 

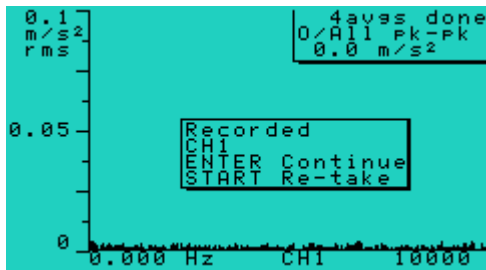
```
Options
1 Halt After Recording ON
2 DSP Power Off Delay 20s
3 VB Data Lock OFF






MENU Main Menu
```



Halt After Recording

If Halt After Recording is OFF, after each recording is completed, the corresponding spectrum or waveform is displayed for two seconds before the instrument returns automatically to the Select Parameter Set Menu.

If this option is turned ON then the spectrum or waveform remains on the display after recording, along with the following message:





- From the Main Menu, press   to access the Options Menu.
- Press   to toggle this option ON / OFF.
- Halt After Recording can be enabled temporarily for just the current reading by pressing  at any time during the recording.

With the display halted it is possible to use the cursor and zooming features to review the chart before deciding to accept (record) it by pressing  or reject it and restart the recording by pressing .

DSP Power Off Delay




DSP Power Off Delay is the delay after a recording finishes before the Digital Signal Processor (and other circuitry) is powered down to reduce power consumption. By leaving the DSP powered up, another recording may be started within the delay period, resulting in a reduced settling time.

- From the Main Menu, press  to access the Options Menu.
- Press  and enter a number between 0 seconds and 99 seconds for the delay time. The default is 20 seconds.




vb Data Lock

This feature prevents machine names, point names, routes or folders being deleted accidentally or by unauthorized persons. Notes, machine, points and directions can still be added, but cannot be deleted when the instrument has the Data Lock turned ON.

To Lock the instrument

- From the Main Menu press  to access the Options Menu.
- Press  and enter a code (remember this code or write it in this manual).
- Press  and the instrument will then be locked.

To Unlock the instrument

- From the Main Menu, press  to access the Options Menu.
- Press  and enter the code that was used to lock the instrument.
- Press  and the instrument will then be unlocked.

Section 7: Troubleshooting

Contacting Technical Support

If you have any problems please contact Commtest support staff directly for assistance. Our e-mail address is help@commtest.com.

We also provide a searchable knowledge base of frequently asked questions (FAQ) on our website.

- The knowledge base can be found at www.commtest.com. Click the FAQ link to access the knowledge base.

Resetting the vb

Warning: If the vb does not respond to any key press while it is operating it will continuously draw power until it is reset and turned off. It is therefore important to reset a non-responding vb as soon as possible.

- In any screen, hold down  and press  then release to reset the instrument.

Resetting the vb does not erase data or stored settings.

Power Problems

Symptom	Cause	Remedy
Instrument cannot power up	Low battery level Electrostatic discharge (ESD exceeding 8 kV)	Charge battery pack Reset instrument
Instrument powers down when backlight is turned on	Low battery level	Charge battery pack
Instrument powers down shortly after powering up	Low battery level	Charge battery pack

Data Transfer Problems

Symptom	Cause	Remedy
vb unable to transfer data and 'Transfer failed' or Ascent Error dialog is displayed on the computer	Data transfer cable not properly connected Data transfer cable connected to wrong computer COM port	Check cable connections Test COM port availability with instrument and use an available COM port

Data Problems

Symptom	Cause	Remedy
'Insufficient Memory' is displayed	No memory space left for new recordings	Erase obsolete recordings (transfer data to a computer first if necessary)
Spectrum/waveform displayed seems incorrect	Displayed units (amplitude scale, log range, velocity max) set incorrectly Accelerometer mounted to wrong location Accelerometer not mounted properly Accelerometer damaged	Adjust display units, especially increase log range and/or reduce velocity max Mount accelerometer on substantial structures near bearings and in the appropriate location and orientation Ensure accelerometer is mounted firmly Replace accelerometer
Measured data is inconsistent	Accelerometer not mounted correctly	Ensure accelerometer is consistently and firmly mounted in the same location and orientation
A machine, point or direction cannot be tagged for taking recordings	No parameter sets in the machine, point or direction	Create parameter sets for the machine, point or direction

Other Problems

Symptom	Cause	Remedy
Instrument does not respond to any key press	Electrostatic discharge exceeds 8 kV	Reset the instrument
'DSP cmd' 'DSP no ack' 'DSP not rdy' 'Dsp no cmd' or 'Stack overflow' displayed	Memory conflict	Turn the instrument off and on again. If the problem persists, send the instrument to an authorized dealer for servicing
'Switch off then connect module' is displayed	Module has worked itself loose (n.b. the module is where sensors are plugged in). Module is damaged	Switch off the instrument and press firmly on the module or use an allen key to tighten it Reset instrument Test for module damage - switch off the instrument and plug in the battery charger. From the battery management menu press the 'menu' key. The main menu should appear without the model number (instrumentvb3000/2000/1000/vb1). This will confirm that the main instrument is OK and that the module is faulty. Send instrument to an authorized dealer for servicing.
Instrument does not seem to measure	Accelerometer drive current not turned on for ICP-type accelerometer Sensor sensitivity set too low or high Sensor not connected Sensor damaged Sensor cable damaged	Toggle ON the drive current in the Sensor Setup Menu Match sensor sensitivity to sensor specifications (usually 100 mV/g) in the Sensor Setup Menu Connect Sensor Replace Sensor Replace Sensor cable

Appendix 1: List of Abbreviations

AC	Alternating Current
A/D	Analog-to-Digital
CH	Channel
COM port	Computer Serial Port (1 to 4)
CPM	Cycles per minute
DC	Direct Current
DSP	Digital Signal Processor
ESD	Electro-Static Discharge
FFT	Fast Fourier Transform
Fmax	Maximum Frequency
Fmin	Minimum Frequency
Hz	Hertz
In or "	Inches
ISO	International Organization for Standardization
KB	Kilobytes
kCPM	Kilocycles per minute
kV	Kilovolts
LCD	Liquid Crystal Display
MB	Megabyte
MHz	Megahertz
MIMOSA	Machinery Information Management Open Systems Alliance
µm	Micrometer
mm	Millimeter
ms	Millisecond
Ni-Cad	Nickel-Cadmium
PC	Personal Computer
QA	Quality Assurance
RAM	Random Access Memory
rms	Root-mean-squared
ROM	Read-Only Memory
V	Volts
V DC, 1 A	Volts DC, 1 Amp

Appendix 2: Specifications

Specifications	Model vb1	Remarks																														
Accelerometer Input Number of channels Type Sensitivity Connector Input impedance Voltage swing Sensor excitation current Sensor excitation voltage Sensor detection	1 2-wire, low impedance piezoelectric 100 mV/g nominal BNC >100 k Ω 16 V peak-to-peak 0 mA or 2.2 mA (configurable) 24 V maximum Warns if short circuit or not connected	Commonly termed 'ICP® type' Calibration adjustable 8.5 mV/g to 2300 mV/g Safety feature: break-free inline connector AC coupled input, allows for ± 8 V sensor output swing (± 80 g) 2.2 mA required for ICP® type accelerometer At sensor terminals with sensor attached																														
Parameter Indication Displays Maximum levels Dynamic signal range Harmonic distortion Display ranges Units Graph types Magnitude display Cursors Accuracy Frequency response	Acceleration, velocity, displacement ± 80 g (800 m/s ²), ± 4 in/sec (100 mm/s) ± 400 mil (10 mm) ≥ 95 dB (typical at 400 line resolution) Less than -70 dB typical 60 dB or 120 dB visible range with manual shift g or m/s ² , in/s or mm/s, mil or mm AdB, VdB Spectrum (freq domain), waveform (time domain) Overall rms value, cursor-position value Standard cursor Dual cursors Harmonic cursor $\pm 1\%$ (0.1 dB) ± 0.1 dB from 10 Hz to 5 kHz; ± 0.5 dB from 3 Hz to 20 kHz	User selectable (all rms) Zero-to-peak. Approximate, dependent on individual calibration Acceleration and velocity. Greater with higher resolution and averaging Dependent on input level and type. Other distortions and noise are lower Zero-to-peak, peak-to-peak or rms AdB ref. 1 μ g rms, VdB ref. configurable 1.0e-5 mm/s rms or 1.0e-6 mm/s rms Solid histogram for spectrum, line graph for waveform Digital readout on graph Vary x position to display x and y values Lock standard cursor as reference and display difference Up to 32 whole-number multiples of standard-cursor frequency Measured at 100 Hz, 23 ± 5 °C, 400 lines, 400 Hz range From value measured at 100 Hz																														
Spectrum Display Fmax possible ranges Fmin possible range Resolution Frequency scale Amplitude scale Window shapes Overlap Number of averages Averaging types	0 to (100, 125, 150, 200, 300, 400, 500, 600, 800) Hz 0 to (1, 1.2, 1.6, 2, 2.5, 3, 4, 5, 6, 8, 10, 15, 20) kHz 0 to Fmax 400, 800, 1600, 3200 lines (configurable) Hz, CPM Acceleration, velocity or displacement Hanning, rectangular 0, 12.5, 25, 37.5, 50, 62.5, 75, 87.5% 1, 2, 4, 8, 16, 32, 64, 128 Linear, exponential, peak hold	Or equivalent CPM values Or orders-based from 1 times to 30 000 times vb zeroes all spectral lines below Fmin 1600 lines maximum if more than 50% overlap used Linear scale. Can zoom in to display individual spectral lines Linear or log scales Dependent on frequency range Increases sampling time proportionally																														
Time Intervals Sampling time in seconds (example ranges) Typical measure and record	<table border="1"> <thead> <tr> <th></th> <th colspan="4">Lines</th> </tr> <tr> <th>Range</th> <th>400</th> <th>800</th> <th>1600</th> <th>3200</th> </tr> </thead> <tbody> <tr> <td>(0 to 100) Hz</td> <td>4</td> <td>8</td> <td>16</td> <td>32</td> </tr> <tr> <td>(0 to 800) Hz</td> <td>0.5</td> <td>1</td> <td>2</td> <td>4</td> </tr> <tr> <td>(0 to 4) kHz</td> <td>0.1</td> <td>0.2</td> <td>0.4</td> <td>0.8</td> </tr> <tr> <td>(0 to 20) kHz</td> <td>0.02</td> <td>0.04</td> <td>0.08</td> <td>0.16</td> </tr> </tbody> </table> 5 s for 1600 lines, 1600 Hz, 8 averages, 50% overlap		Lines				Range	400	800	1600	3200	(0 to 100) Hz	4	8	16	32	(0 to 800) Hz	0.5	1	2	4	(0 to 4) kHz	0.1	0.2	0.4	0.8	(0 to 20) kHz	0.02	0.04	0.08	0.16	Dependent on number of lines and number of averages (values shown in table for no overlap, no averaging, maximum display update rate of 4 per second) Not including initial startup and settling time
	Lines																															
Range	400	800	1600	3200																												
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(0 to 4) kHz	0.1	0.2	0.4	0.8																												
(0 to 20) kHz	0.02	0.04	0.08	0.16																												
Trigger Modes	Single (key press), free run	Trigger status displayed (busy, done, run, stop)																														
Logging Features Output formats Data storage Data storage format	vb screen, transfer to Ascent PC-based software 1 MB non-volatile Up to 200 named machines Up to 30 multi-axial points per machine	Total of 1000 spectra at 400 line resolution User-specified machine, point, and axis names (16 characters) entered from PC or keypad. Each recording has a unique time/date stamp																														
Display Resolution Viewing area Backlight	Graphic LCD 240 x 128 pixels 4.3" x 2.3" (110 x 60) mm Electro-luminescent																															
REFLASH	Allows vb firmware to be upgraded via built-in serial port	Download firmware service packs via the Internet																														
Communications Baud rate	RS232 57 600 bits per second	15 kV ESD protected. Cable with DB9 connector																														

Specifications	Model vb1	Remarks
Battery Type Voltage Capacity Operating time (typical)	Custom Nickel-Cadmium pack 7.2 V nominal 1500 mAh nominal 12 hours with backlight off, 7 hours with backlight on	Depends on mode and setup
Charger and Conditioner Charge rate Discharge rate	Integral charger – automatic and manual control 0.7 A nominal 0.5 A nominal	Power transformer with (13.5 ± 1.5) V DC, 1 A output included in kit. 2.5 hours for complete charge nominal Combats NiCad battery memory effect
Mechanical Size Weight	9.7" W x 6.1" L x 3.0" H (247 x 154 x 75) mm 4.4 lb (2 kg)	Including protective boot Including protective boot and strap
Environmental Temperature/Humidity Operating Storage EMC	32 °F to 122 °F (0 to 50) °C 80% RH 32 °F to 86 °F 70% RH 86 °F to 122 °F 14 °F to 140 °F (-10 to 60) °C 95% RH EN55022, CISPR22 EN55024, CISPR24	Non-condensing Non-condensing Radiated and conducted emissions RF field, ESD and fast transient immunity

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