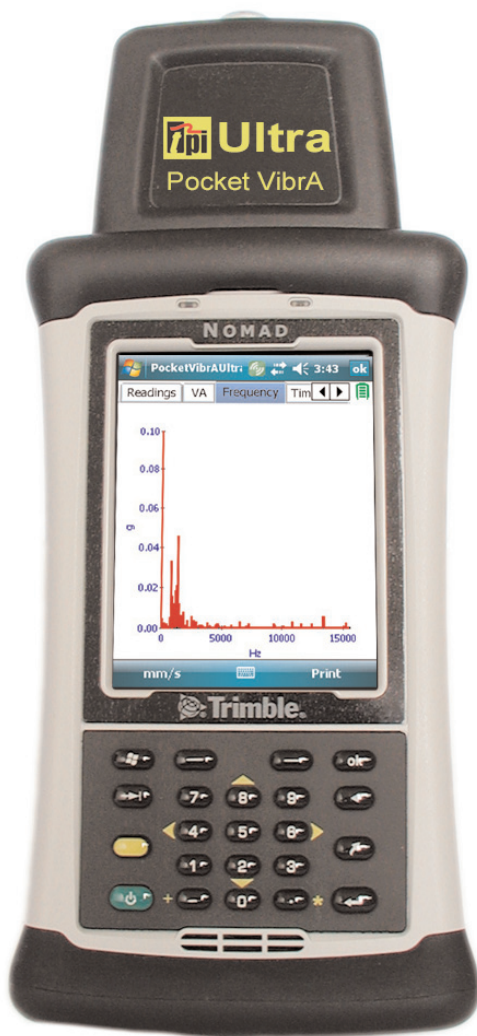




C-Trend Ultra + Pro



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9020 Pro & 9040 Ultra are high specification vibration monitoring and analysis tool based on an extremely rugged (IP67) Pocket PC.

The system allows easy user selectable display of vibration signals, and automatically performs vibration analysis functions to help diagnose faults such as unbalance, misalignment, looseness, bearing quality etc. Readings are stored in a database that automatically synchronises with a PC for display and trending of asset data (e.g. pumps, motors, fans and bearings) using the supplied **C-Trend™** software.

The system is designed to enable a user to take vibration measurements from assets using 9020 Pro & 9040 Ultra and trend these as a series of graph plots on C-Trend™. Additionally other asset data can be entered into the 9020 Pro & 9040 Ultra unit and subsequently trended (e.g. temperatures, acoustic emission values etc). Alarms can be set on any of the trended values and C-Trend™ has built in bearing diagnostic capabilities allowing bearing condition to be easily monitored

The system fully supports the management of asset monitoring and facilitates the downloading of measurement “routes” to the 9020 Pro & 9040 Ultra unit so that a user can easily take a series of readings from any group of assets. Whenever the 9020 Pro & 9040 Ultra unit is “docked” with a PC, these measurements can be automatically uploaded to C-Trend™ for display and report generation.

All asset data, including vibration readings and other user entered data, are held in a shared database and hence the functions for setting up asset measurement points and routes and displaying readings can be carried out using either C-Trend™ on the PC or on the 9020 Pro & 9040 Ultra unit.

C-Trend™ can also be used to automatically generate reports as user editable Microsoft Word™ documents with embedded Excel™ graphs that can be clicked on and edited within the report.

The basic **9020 Pro & 9040 Ultra** system comprises the following components:

- Rugged IP67 Pocket PC
 - o Including USB docking cradle, battery charger, software and accessories.
- Compact Flash Type 2 accelerometer interface card (fitted inside Pocket PC) and IP67 connector in extended end cap.
- TPI “smart” accelerometer and 1.5 metre connecting cable.
- Soft (IP67) Carrying Case.
- Installation software program on CD that installs:
 - o 9020 Pro & 9040 Ultra Pro for running on the Pocket PC.
 - o C-Trend™ for running on a PC.

As an alternative **Ultra** can be supplied, which in addition to the TPI “smart” accelerometer and 1.5 metre connecting cable also includes a constant current accelerometer interface head and a standard BNC connector adaptor for use with constant current accelerometers.

The 9040 Ultra interface head generates a +20V, 2mA constant current power supply for powering the accelerometers. This option is intended for use where a customer has existing preinstalled constant current accelerometers.

Multi-way switch boxes are also available for use with pre-installed accelerometers to facilitate the taking of readings from a group of sensors. The 9040 Ultra unit simply connects to the switch box via a short lead and each channel can then be read in turn.

1.1 Getting started

The 9020 Pro & 9040 Ultra unit comes with the PocketVibrA software preinstalled. C-Trend will need to be installed on your desktop or laptop PC using the CD supplied. This is done simply by inserting the CD into your computer and following the instructions.

Alternatively the installation program can be downloaded from the PocketVibrA website and run on your PC.

<http://www.pocketvibra.com/download/PocketVibrAPro>

<http://www.pocketvibra.com/download/PocketVibrAUltra>

If you are re-installing the software (to upgrade to a newer version for example) the previous version will need to be removed prior to the new version being installed. This happens automatically and you will be prompted with a message asking if you wish to completely remove the application. You should answer 'yes' to this question to install the new version (see Section 3.2).

After installing C-Trend, the first thing you should do is to make sure you have the latest version of **Microsoft ActiveSync™** installed on your PC or laptop computer. This program is used to allow the PC to connect to the 9020 Pro & 9040 Ultra unit over the supplied USB cable or via the docking cradle. This is in order to be able to upload and download data to and from the PocketVibrA unit.

If you do not already have ActiveSync™ on your PC it can be downloaded **free of charge** from Microsoft's website:

<http://www.microsoft.com/windowsmobile/en-us/help/synchronize/activesync-download.msp>

1.2 Power switch

Powering the 9020 Pro & 9040 Ultra unit on and off is done by briefly pressing the power (on/off) button **for less than one second**.

A one second press of the on/off button is used to turn the display backlight on or off.

A slightly longer than one second press of the on/off button will bring up the reset screen which also allows other modes to be selected such as screen cleaning or alignment, changing battery etc.

N.B. if it is ever necessary to reset the PocketVibrA Pocket PC (if it won't power on for example) this can be achieved simply by holding down the on/off button for approximately 5 seconds. After displaying a 5 second countdown the Pocket PC will give an audible double "bleep" and reset. No data or programs will have been lost.

Resetting the Pocket PC is not something that should need doing very often but may be required if, for example, the battery has been allowed to fully discharge whilst a program was still running.

1.3 Training

This user guide will explain in detail how to operate the equipment but the simplest way to get started is to visit the website at www.pocketvibra.com where you can view a selection of short training videos.

The following videos are all available on the website:

1. [Using C-Trend](#)

- Basic C-Trend usage video, creating sites and assets in Asset Manager, downloading data.

2. [Using C-Trend to interpret readings](#)

- Interpreting vibration data and alarms. ISO readings, bearing condition, vibration analysis, trend lines, harmonic cursors, waterfall diagrams, trending of other parameters (e.g. temperatures, comments etc).

3. [Taking readings with the PocketVibrA portable data collector](#)

- How to drive PocketVibrA, view data and save readings to the PC.

On-site training

9020 Pro & 9040 Ultra are so intuitive it really doesn't take long to work out how to use it, although we do offer training on system usage and vibration analysis.

Training typically consists of one day on how to use the equipment to take measurements and monitor machine condition. A further day's training can also be provided on how to interpret vibration data to diagnose specific faults. Training can be based at the customer's site or any location to suit.

BINDT VA Level 1 Courses

Additionally TPI can arrange for customers to receive certificated Vibration Analysis training to Levels 1, 2 or 3.

The level 1 course is typically of 3 days duration and is followed by an examination to obtain the certificate.

2.1 Setup

The hardware will come fully configured with the 9020 Pro & 9040 Ultra software already installed.

You will need to install C-Trend on your PC as described in the previous section.

2.2 Power Supply

The 9020 Pro & 9040 Ultra unit should always have a suitably charged battery prior to use.

N.B. It is recommended that the unit is charged fully prior to first use.

2.3 Sensor connection

The supplied TPI “smart” accelerometer is simply plugged into the rugged IP67 10 way connector on the top of the PocketVibrA unit.

If using a constant current accelerometer it can be plugged into the top of a **9020 Pro & 9040 Ultra** unit using the BNC connector adaptor cable (C307-207).

N.B. this will not work with PocketVibrA Pro units as they do not support the use of other accelerometers.

2.4 Sensor selection

9040 Ultra is suitable for use with the TPI range of ‘smart’ accelerometers, or for use with suitable constant current accelerometers if using the constant current supply in a 9040 Ultra via the BNC adaptor cable. The use of any other sensor combination may cause the unit to malfunction and invalidate the guarantee.

2.5 Service

The 9020 Pro & 9040 Ultra system contains no user serviceable parts. In the unlikely case of malfunction, please return the complete unit to your supplier for repair.

3.1 Installation

Simply run the PocketVibrA install program from the CD supplied on a laptop or desktop PC. C-Trend™ will then be installed on that PC and can subsequently be found on the PC's start menu under **Start, All Programs, TPI Ltd.**

The PocketVibrA program comes pre-installed on the PocketVibrA unit and can be found on the **Programs** menu of the PocketVibrA unit. PocketVibrA can be configured to auto-start whenever the PocketVibrA unit is turned on. This option can be turned on or off as explained later in the set up (configuration) menu section.

3.2 Software Updates

TPI operates a policy of continuous product improvement and releases free software updates for its products from time to time. If you are updating a system that has had a previously installed version of C-Trend and PocketVibrA, the installation program must uninstall the existing software before the new version can be installed. You will be prompted to check you wish to do this during the installation procedure.

N.B. When installing an update, it is important to update BOTH C-Trend and PocketVibrA, so that they are updated with the same version of the software. Failure to do this will lead to the two programs failing to communicate properly.

Updating the PocketVibrA software can only be done if the PocketVibrA unit is connected to the PC during the installation.

N.B. Software updates are designed to preserve the integrity of any pre-existing data but it is always good practice and a sensible precaution to Export, and hence make a back-up copy of, any pre-existing data prior to performing a software update.



4.0 Opening Menu

The opening display screen shows four icons that allow the user to select from the following operational modes:

- Asset Manager (“motor” icon)
- PocketVibrA Lite (“meter” icon)
- Set-up (Configuration) menu (“gear wheels” icon)
- Routeing (“Route 66” icon)

Asset Manager (see Section 4.1) displays a tree diagram of the sites and assets that have been downloaded onto this particular PocketVibrA unit. It allows assets and sites to be edited (password protected) and readings to be collected from those assets.

The **Set-up** menu (see Section 4.5) allows the PocketVibrA unit to be customised in how it displays and processes readings etc.

The **Route** menu (see Section 4.7) allows readings to be taken from assets in a predetermined order by following a “route” that has previously been downloaded from a PC.

PocketVibrA Lite is a simplified version of PocketVibrA that can be used for taking vibration readings without the need to set up an asset first. Its operation is explained in Section 4.8 of this user guide.

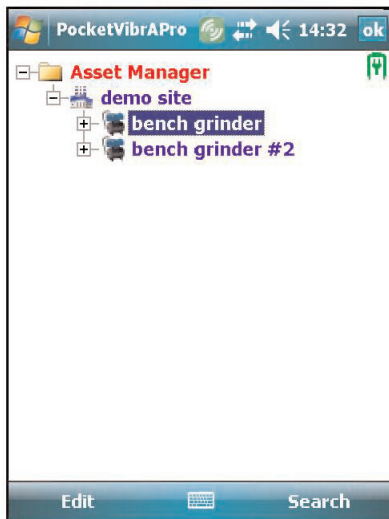
4.1 Asset Manager

The asset manager screen displays a tree diagram of the sites and assets that have been downloaded onto this particular PocketVibrA unit ready for data collection (i.e. taking readings).

Navigation around the tree structure can be achieved simply by touching the screen with a stylus on a site or asset name to open it.

Alternatively the cursor keys on the Pocket PC can be used to navigate around the tree diagram and the Enter key (↵) can be used to open sites and assets to give stylus-free operation.

This can be very useful when taking measurements as it allows onehanded use of the instrument leaving the other hand free for accelerometer attachment.



The bottom line of the display shows a menu bar with two options that can be selected either by touching them on the screen or by pressing the “soft” keys (-) that are located immediately below the PocketVibrA unit screen. These menu options are available from several of the displayed screens on the PocketVibrA unit and can be selected in the same way on each screen.

In this case selecting **Edit** enters edit mode (see next section), whilst **Search** initiates a search to see if the accelerometer that is currently connected to the PocketVibrA unit has been “**Assigned**” to a specific measurement point.

Assignment of accelerometers is explained fully in Section 4.3 of this user guide. Search is used as a means of automatically “jumping” to the correct measurement point in order to collect vibration data from, for example, a fixed installation accelerometer.

In this case the PocketVibrA unit will search for the serial number of the connected accelerometer, which is contained in a memory

chip inside the accelerometer, and check to see if that serial number has previously been assigned to a specific measurement point (MP). If so, then that MP will be “opened” ready to take readings.

This feature is particularly useful when using multi-way switch boxes to connect accelerometers to the PocketVibrA unit. The user simply switches to each channel in turn and selects “**Search**” to take the readings.

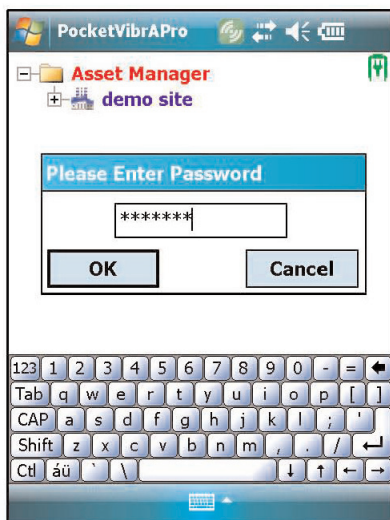
4.1.1 Edit mode

To employ PocketVibrA in the mode for which it was specifically intended involves setting up assets with measurement points from which readings can then be collected by an operator typically following a route around the measurement points. These “assets” are contained within “sites” on the asset manager and the setting up of this hierarchy is as described in this section.

In order to configure the assets it is necessary to first enter **Edit Mode** this is done by selecting **Edit** from the bottom left of the screen, either by touching the screen or by pressing the left hand soft key (-).

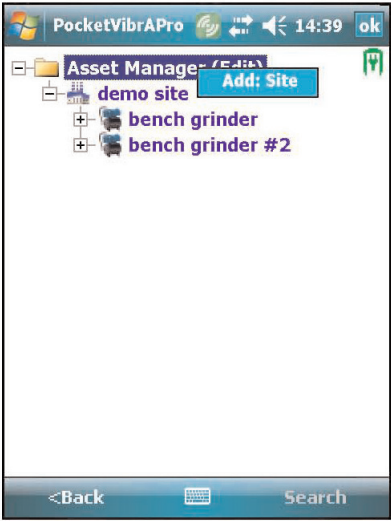
Edit mode is password protected and the screen shown opposite will appear when Edit mode is first selected to allow the password to be entered. The password will then be “remembered” until the PocketVibrA program is exited and will not need to be typed again until the program is next used.

The default password is the word **default** (in lower case) until this is changed to something else by the user (see Section 4.5).



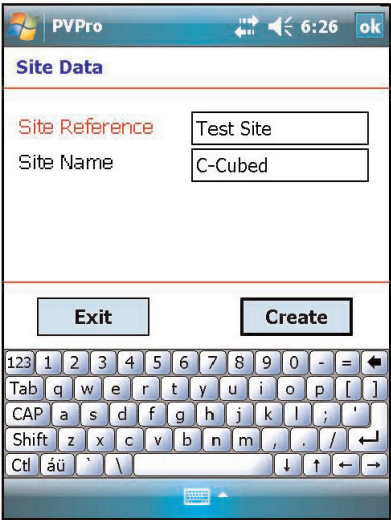
N.B. All the PocketVibrA Edit mode functions can also be carried out on a PC using C-Trend – as explained in later sections of this user guide.

4.1.1.1 Site Configuration



Adding a new site on the asset manager screen can be achieved by holding down the stylus on the words **Asset Manager** and then using the stylus to tap the Add Site box when it appears. This can also be done using the cursors and the Enter key (↵). This causes a dialogue box to open that requests the name and identity of the site (see screenshot below). This follows exactly the same procedure whether it is done on the PocketVibrA unit or in C-Trend running on a PC, as explained later in this manual.

The site reference must be entered and hence is shown in red (this also is how the site will be displayed on the Asset Manager screen). An optional additional site name can also be added. Once it has been created, by clicking on the **Create** button, the Site Reference will appear on the asset manager screen.

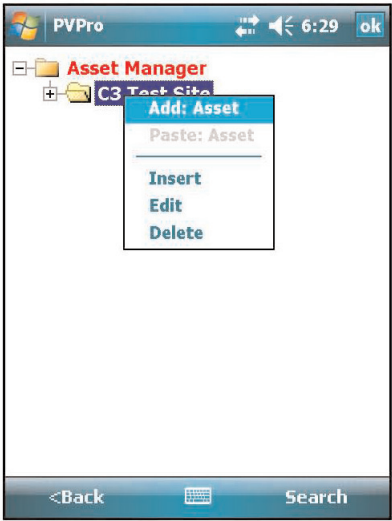


4.1.1.2 Adding an Asset

Adding an asset to a site is achieved in a similar manner but by holding the stylus on the Site name.

This causes a dialogue box to appear that also allows the user to edit or delete a site.

When an asset is added to a site it must first be configured as follows.



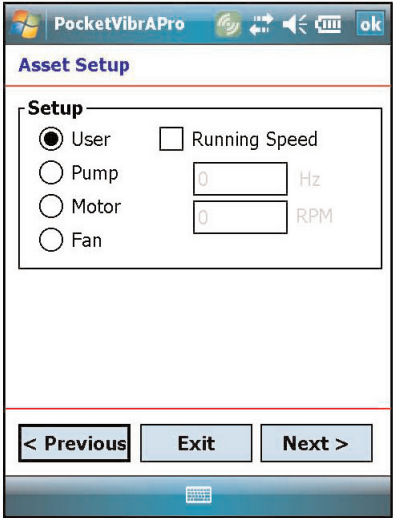
The **Asset ID** must be entered (and hence is shown in red). This is how the asset will be displayed on the asset manager screen. An optional **User Asset ID** can also be entered together with a description of the asset's **Location**.

The Asset configuration can now be continued in one of two ways. One method is to manually edit the asset as explained later in section 4.1.1.4. The other way is to utilise the **Asset Wizard** to automatically configure the Asset as follows:

Clicking on **Next >** will bring up the **Asset Wizard** screen.

4.1.1.3 Using the Asset Wizard

The **Asset Wizard** screen allows the user to automatically configure assets conforming to the pre-defined types of Pump, Motor or Fan.



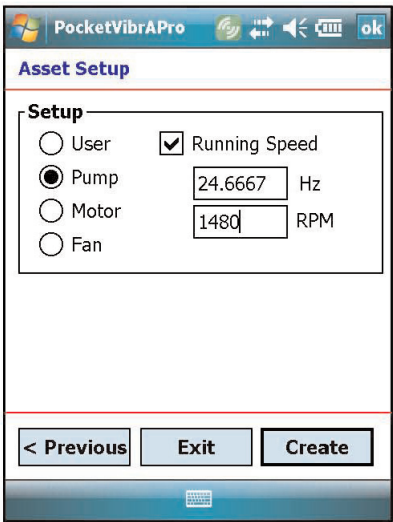
Selecting the **User** option at this screen will allow the asset to be user defined using the same procedures as described in section 4.1.1.4 below.

This screen also gives the user the option to input a running speed for the asset (by ticking the box). This can then be entered in either Hz or RPM and both values will update regardless of which one is entered. The asset running speed is used to determine the set-up of the VA band limits (for diagnosing unbalance, misalignment, looseness etc).

If one of the pre-defined asset set-ups is chosen (e.g. Pump, Motor or Fan) the ISO recommended measurement points (MPs) are then automatically allocated to the asset and their numbers and positions are pre-defined. Typically there are 5 MPs per asset (horizontal and vertical on each bearing and one axial). These can subsequently be edited and renamed or deleted if required (seeSection 4.1.1.4).

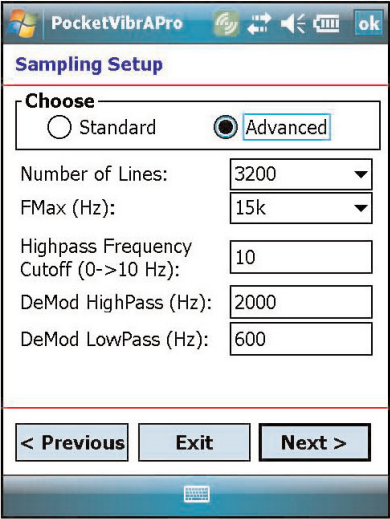
Once the asset type has been chosen the asset can be created by selecting **Create** from the bottom right of the Asset Setup menu screen.

If the **User** set-up is chosen, the MPs must be added later as next in section 4.1.1.5.



4.1.1.4 Editing an Asset

It is also possible to edit an Asset by selecting **Edit** from the drop down menu that appears on the Asset Manager screen when the stylus is held down on the Asset ID (asset name). This same procedure is also followed whenever an Asset is manually created by selecting User set up from the Asset Wizard screen.



The next screen following the Asset ID screen is the Sampling Setup screen (shown left). The example shown here is the **Standard** setup for **9020 Pro**.

By selecting **Advanced** the user has the option of changing the number of lines of resolution in the frequency spectrum, the maximum displayed frequency, the minimum displayed frequency (high pass frequency cut-off) and the cut-off frequencies for the envelope demodulation filter.

The cut-off frequencies for the envelope demodulation filter (described later in this user guide) do not generally need to be altered but more experienced users may have a preference for how these should be set.

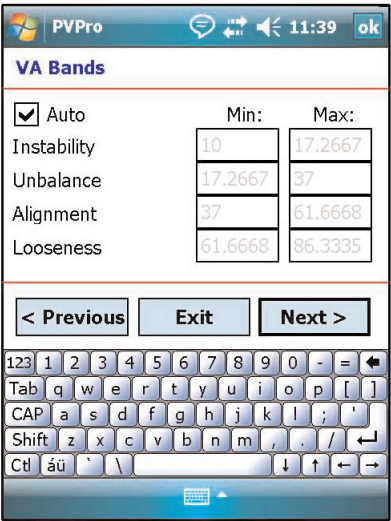
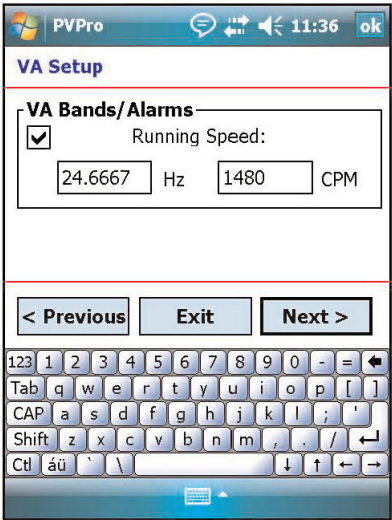
The standard setup for **9040 Ultra** looks much the same as that for PocketVibrA Pro with the exception that much higher frequency resolutions are selectable (up to 51,200 lines).

The default 9040 Ultra values of 12,800 lines and Fmax of 15 kHz (900,000 RPM) gives a default frequency resolution of approx 1.2 Hz (70 RPM). Selecting 51,200 lines gives a frequency resolution of approx 0.3 Hz (18 RPM).

It is also possible to set the minimum displayed frequency limit anywhere between 10 Hz (600 RPM) and zero. **However, in order to accurately read vibration signals at such low frequencies the accelerometer must be allowed a few minutes to settle after being placed on the measurement spot.**

The next stage in the asset configuration process is to turn on the vibration analysis (VA) bands, if they are desired.

This is first of all initiated by clicking on the check box as shown in the screen shot right.



The motor speed can then be entered in the user's preferred choice of units as previously described. The position of the VA bands (upper and lower frequency limits) can either be entered by the user or, by selecting **Auto**, they can be set to the default values shown below:

The band names shown opposite are the defaults (and the reasons for their choice are explained later in this guide) but these can be changed by the user if desired.

Band 1: 10Hz (600 RPM) up to 0.75 times running speed

Band 2: 0.75 to 1.5 times running speed

Band 3: 1.5 to 2.5 times running speed

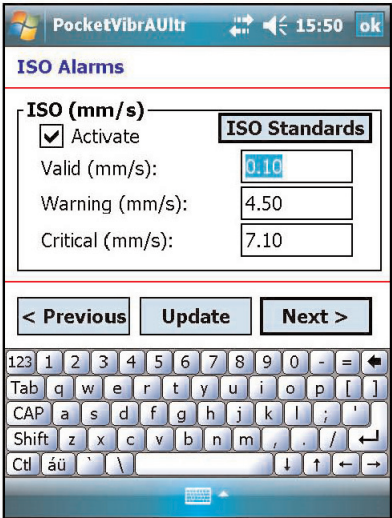
Band 4: 2.5 to 3.5 times running speed

Next the Overall Alarm levels can be configured and again, each must be **Activated** (by ticking the box) if required.

The VA band screens are then followed by the Alarm level screens for each of the following:

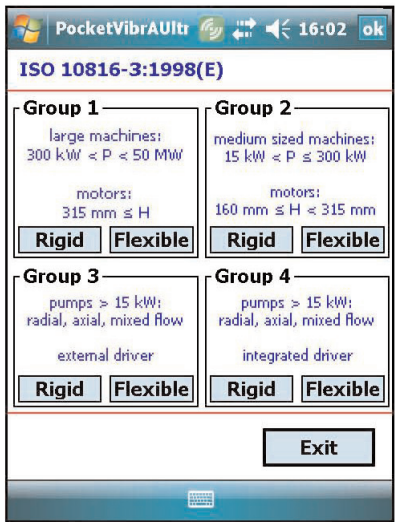
- ISO value (mm/s)
- Bearing Noise (g)
- Total RMS (mm/s and g)
- Peak Value (g)
- Crest Factor
- Demod

These can all be individually set to any suitable alarm values.



The ISO value is defined as the RMS (average value) of the vibration velocity between 10Hz and 1kHz.

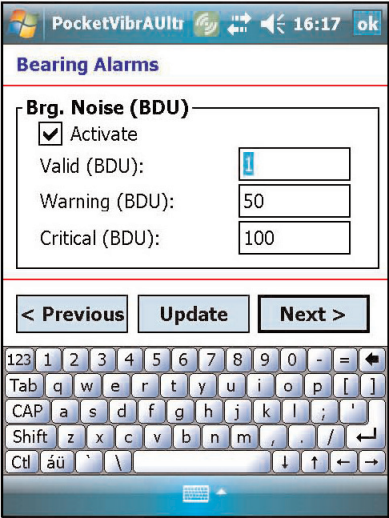
These alarms levels are preset with default values taken from ISO 10816-1:1995, Mechanical vibration -- Evaluation of machine vibration by measurements on non-rotating parts.



Selecting **ISO Standards** from the top right of the menu brings up the screen shot above left, showing the different machine types that can be selected to give the appropriate recommended ISO alarm values.

It is rare that truly rigid foundations are encountered in practice and, unless the machine is very firmly bolted down to concrete for example, it is usually best to choose flexible mounts when setting these alarms levels.

The bearing noise alarm values default to those shown in the screen shot below, where 100 BDU (bearing damage units) corresponds to 1g RMS of high frequency vibration (bearing noise).



Consequently a reading of 100 BDU is generally regarded as being indicative of a damaged bearing and as “a rule of thumb” it is sometimes helpful to think of the BDU value as a “percentage” of bearing wear.

This isn’t always the case however and it is often necessary to monitor asset bearing noise over a period of time using C-Trend before deciding on appropriate values for the alarm levels.

The alarm levels for the other measured values (Total RMS, Peak Value, Crest Factor and Demod) all have to be set up if they are to be used. Again the levels to use for any particular asset can only really be determined by monitoring over time

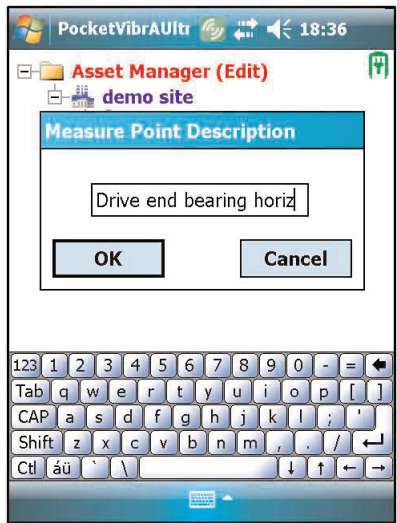
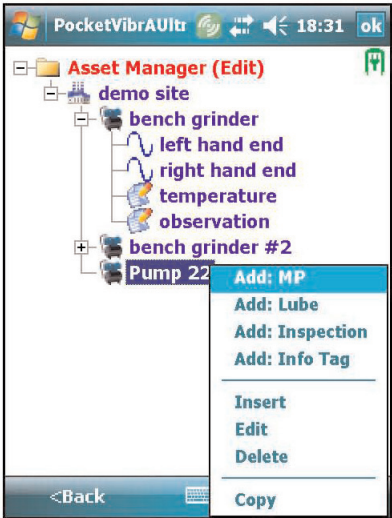
Finally, VA band alarm levels for each of the 4 VA bands can be entered in exactly the same way.

A more detailed discussion of diagnosing bearing condition using these measured values can be found in Appendix 2 (Bearing Fault Diagnosis).

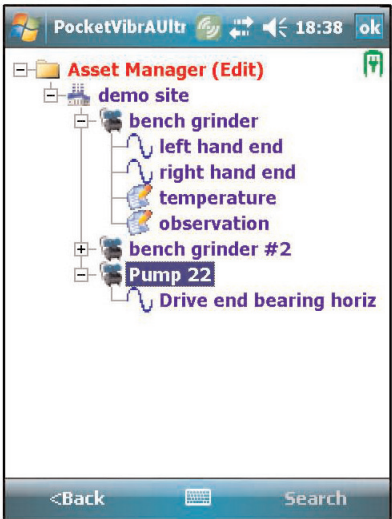
4.1.1.6 Adding Measurement Points

Once an asset has been created it is then possible to add **MPs** or measurement points (for taking vibration readings), **Info Tags** (that can give additional information about each of the measurements that are taken on an asset) and **Lube** and **Inspection** points.

Each of these will be explained in the following sections.



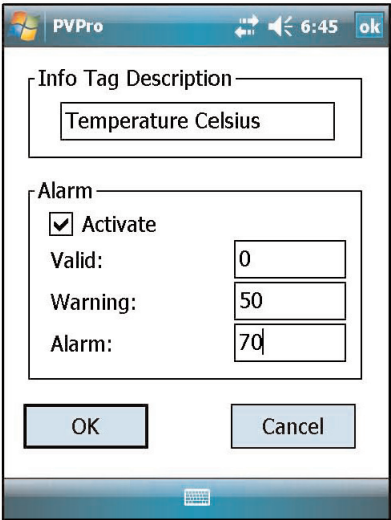
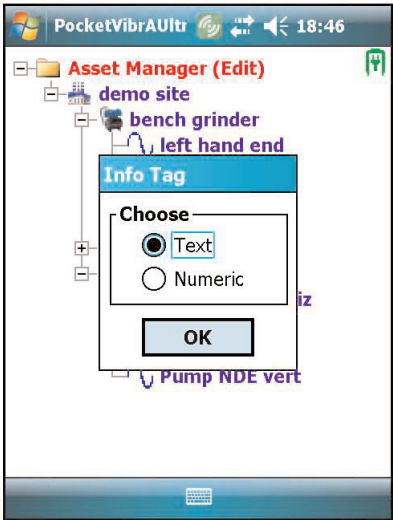
Entering the name of the MP will cause it to be displayed below the asset name on the Asset manager tree diagram, as in the example shown here.



This process can then be repeated until all the desired measurement points have been entered.

4.1.1.7 Adding Info Tags

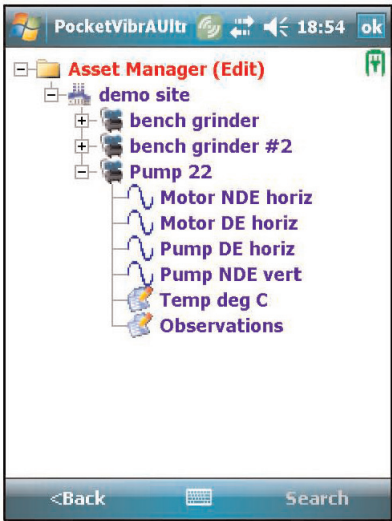
Info tags can be defined as being of either Text or Numeric type for recording measured process values or comments for example. The choice for each tag is made by clicking the appropriate radio button.



Numeric info tags can have alarm levels associated with them so that when they are displayed they will be colour coded. An example of how alarm levels are defined is shown in the screen shot to the left.

]The actual data will be entered when the asset is 'Run' (see later).

In the example shown here for Pump 22, two info tags have been added. One is a Numeric info tag 'Temp deg C' to record temperature for example and the other a Text info tag 'Observations' to allow text to be entered by the operator to record useful information, like the presence of an oil leak, for example.



4.1.1.8 Adding a Lube point

A lube point is a means of monitoring the addition of lubrication to an asset.

When a Lube point is “run” (see later) it records the bearing noise before, during and after lubrication and also the quantity of lubricant (in user defined units) that was added to the bearing. This information can then be uploaded to C-Trend and trended in the same way as Measurement Point readings and Info tag values.

PocketVibrAUltr 19:08 ok

Lube Point ID

Name: Lube Point 1

Type: castrol gtx

Units: squirts

< Previous Update Next >

123 1 2 3 4 5 6 7 8 9 0 - =

Tab q w e r t y u i o p []

CAP a s d f g h j k l ; ' /

Shift z x c v b n m , . /

Ctl áú ` \

PocketVibrAUltr 19:24 ok

Lube Point Alarms

Brg. Noise (BDU)

☒ Activate

Valid (BDU): 0

Warning (BDU): 100

Critical (BDU): 150

< Previous Update Next >

123 1 2 3 4 5 6 7 8 9 0 - =

Tab q w e r t y u i o p []

CAP a s d f g h j k l ; ' /

Shift z x c v b n m , . /

Ctl áú ` \

Lube points can also optionally be set up to have alarm levels based on the bearing noise (BDU) in the same way as MPs (see screen shot left) and any readings that are in alarm will be automatically flagged up by C-Trend.

It is also possible to add Info Tags (numeric or text) to Lube points in exactly the same way as described in section 4.1.1.7 above.

PocketVibrAUltr 19:25

Lube Point Info Tags

Info Tag Description

comments

OK Cancel

< Previous Update Next >

123 1 2 3 4 5 6 7 8 9 0 - =

Tab q w e r t y u i o p []

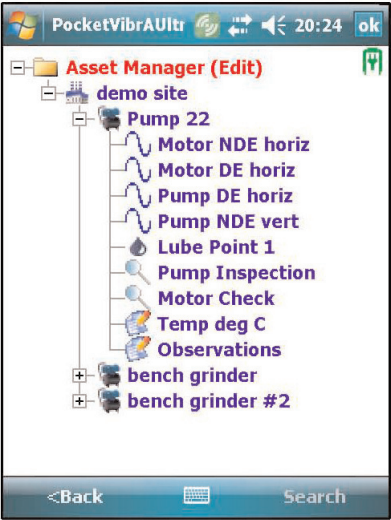
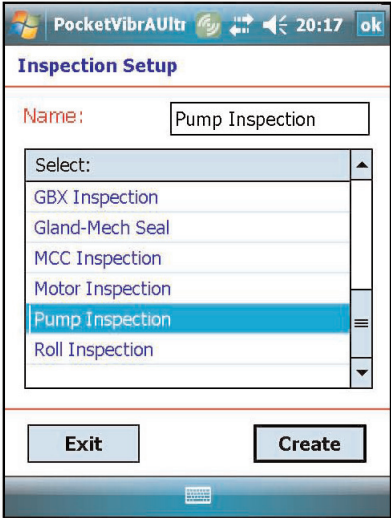
CAP a s d f g h j k l ; ' /

Shift z x c v b n m , . /

Ctl áú ` \

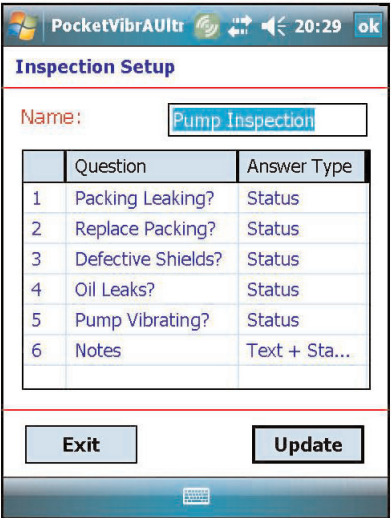
4.1.1.9 Adding an Inspection

An Inspection is basically a list of checks to be carried out when an asset is “run”. Inspections can be selected from a list of various predefined inspections. Alternatively a new inspection can be created by editing an existing one.



The example screen shot to the left shows an asset (Pump 22) that has four MPs, one Lube point, two inspections and two info tags.

Editing the “Pump Inspection” (as shown in the screen shot right) shows that it contains a list of questions and checks that have to be carried out when the inspection is “run”. This list can be amended or added to create new inspections that then become part of the “library” of inspections that the user can subsequently choose from.



In this example a new inspection is being created by editing the “Pump Inspection”.

Inspection Setup

Name:

	Question	Answer Type
1	Packing Leaking?	Status
2	Replace Packing?	Status
3	Defective Shields?	Status
4	Oil Leaks?	Status
5	Pump Vibrating?	Status
6	Notes	Text + Sta...

Context Menu: Insert, Edit, Delete

Buttons: Exit, Update, Keyboard Icon

Editing of inspections is achieved simply by holding a stylus on the question to be edited or by pressing the Enter key.

This brings up a dialogue box that asks for a question to be entered and the type of answer to be chosen.

PocketVibrAUltr 20:38 ok

Question

Answer Type

☐ Status
☒ Text + Status
☐ Numeric + Status

Buttons: Add, Cancel

Answers can contain text or numerical values and have a status assigned to them (OK, Warning or Critical), which causes them to be colour coded and flagged up by Ctrend when they are in alarm.

Inspections are described in more detail in section 4.2 of this user guide, under “running an asset”.

4.1.1.10 Copying and Pasting Assets

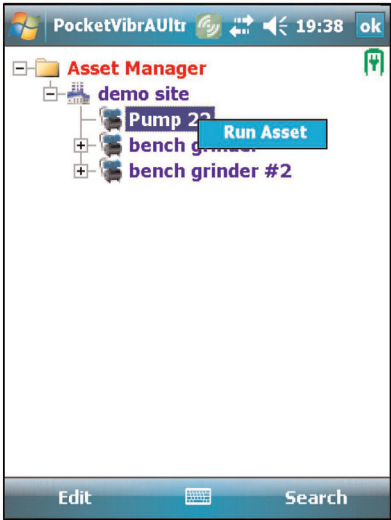
By simply holding the stylus on the appropriate site or asset under Asset Manager, a drop down menu will appear enabling the user to **Edit**, **Copy**, **Delete** or **Paste** a Site or Asset.

This works in exactly the same way as any other cut and paste operation and the user simply has to enter a new name for the asset or site being pasted.

This allows the user to create assets of similar construction very quickly and easily, simply by copying and then pasting them into sites with different Asset ID's.

When all desired editing functions have been completed, it is necessary to exit from Asset Manager's **Edit** mode by selecting **<Back** at the bottom left corner of the screen before any assets can be "run" to take readings (see next section).

4.1.2 Running an Asset



Running an asset (to take readings) can be achieved by holding the stylus on the asset name on the screen until the drop down dialogue box appears and then selecting **Run Asset**.

This can also be done by using the cursor arrows to scroll to the desired asset and selecting it via the Enter key (↵) on the PV unit.

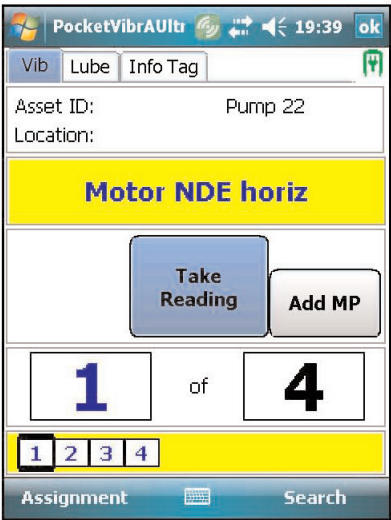
If RFID tags are being used, the PocketVibrA Unit head should be brought in close proximity to the RFID tag (see photo below), which will cause the unit to “beep” when it recognises the tag. This will then “open” any measurement point that has been assigned to the RFID tag.



4.1.2.1 Collecting vibration readings

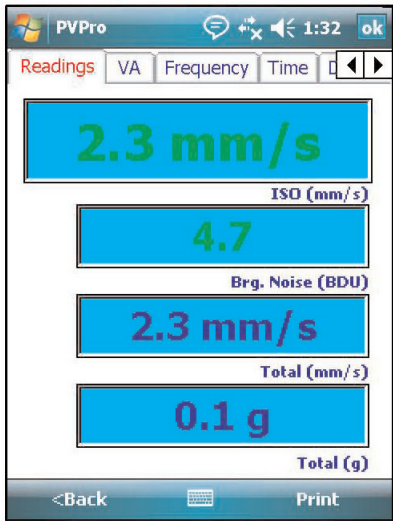
The first screen to appear after “running” an asset will show information about the asset such as its ID and location and also indicate the number of measurement points available for the asset.

The vibration measurement point numbers will appear in blue on the display until a reading has been taken, as shown left. After a reading has been taken the MP number will turn to inverse video (white on blue) to indicate that the reading has been taken.



Moving between measurement points is achieved by using the left or right cursor controls or by directly clicking on the MP number on the bar at the bottom left of the display.

Clicking on the Take Reading button will cause a message to appear to say that PocketVibrA is busy taking the reading and calculating data. When this process has finished the following screen will appear:



This screen shows the overall readings for acceleration that were measured for this measure point.

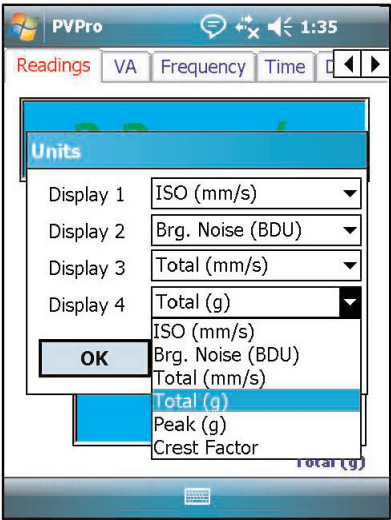
Readings are shown in different colours depending on their status. Red indicates an alarm, Amber a warning, Green that the reading is Valid and Blue indicates either that the alarm levels have not been configured or the reading is too low and below the level set for a valid measurement.

It is possible to display a range of different values obtained from the captured vibration data in the four windows on the Readings display.

These are user-selectable from a drop down menus under each of the four display windows. To access these menus, simply touch the largest of the four display windows until the display shown opposite appears.

The choice of parameters that can be displayed in each of the display windows is as follows:

- ISO (mm/s)
- Bearing Noise (g)
- Total (RMS) velocity (mm/s)
- Total (RMS) acceleration (g)
- Peak acceleration (g)
- Crest Factor

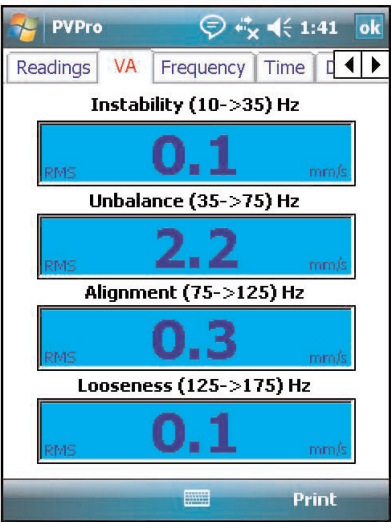


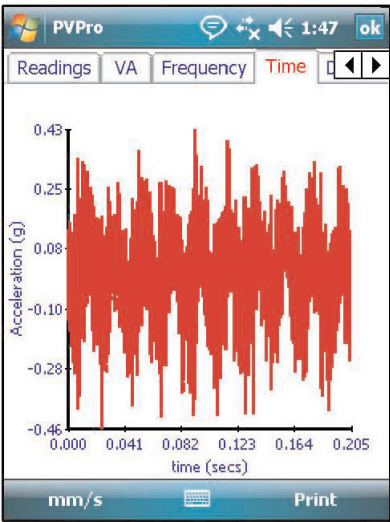
Clicking on any of the tabs along the top of the display will bring up the appropriate screen to view the data in different formats.

Selecting the VA screen for example, shows the readings of vibration velocity for each of the 4 bands.

These bands are set up with userdefined names and frequency ranges in the configuration screen.

The display opposite shows the default names and frequency ranges based on multiples of run speed (50Hz in this example).

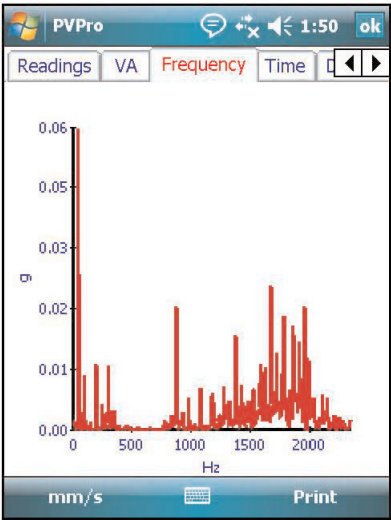
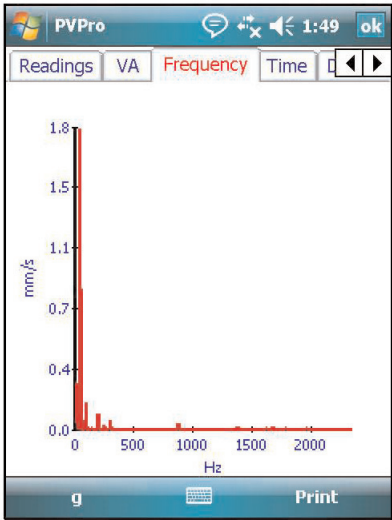




Selecting Time for example will show the time waveform of the data that was collected (as shown in the screen shot on the right).

It is also possible to switch between displaying the reading as acceleration (g) or velocity (mm/s) in any of the reading screens simply by selecting the appropriate units from the menu bar at the bottom of the display. This can be done either by tapping the screen or by using the “soft” keys (-) located immediately below the PocketVibrA unit screen.

This point is further illustrated below with an example of the Frequency display.

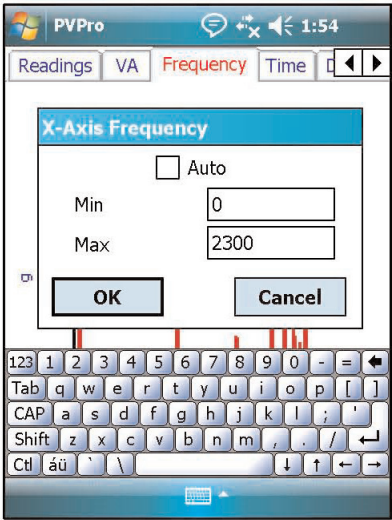


It is also possible to change the ranges of the displayed axes in any of the graphs.

These are normally set up automatically but this can be changed by the user to values that enable areas of interest to be ‘zoomed’.

Another way to “zoom” the display is to touch the screen and drag an expandable window over the area of the display to be zoomed. This must be done from the top left of the window to be zoomed.

This will then zoom the screen to the size of the window.

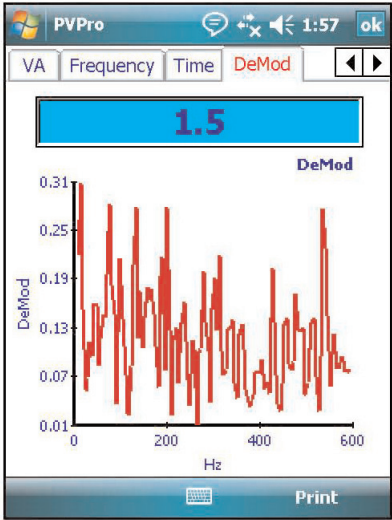


“Double tapping” the display (two taps in quick succession) will return the display to its default scale.

The final window on the readings screen shows Demod (envelope demodulated) signals after they have been high pass filtered above 2kHz, demodulated and then low pass filtered below 600Hz.

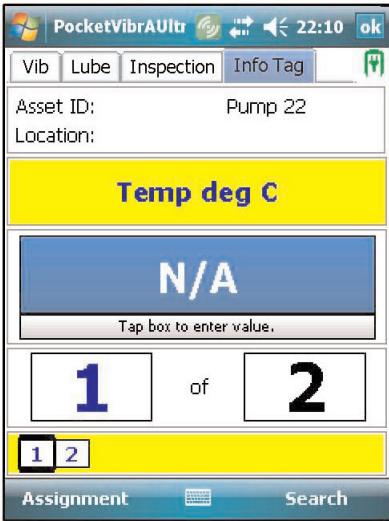
This spectrum is a good indication of bearing wear as it shows any low frequency signals (e.g. bearing clicks that have been modulated onto higher frequencies such as bearing shell resonances).

More detailed information on how to interpret Demod data is contained in Appendix 2.



4.1.2.2 Entering Info Tag values

Whilst taking vibration readings it is also possible to enter additional information in the form of **Info Tags**. These were described previously in the asset set up section of this user guide.

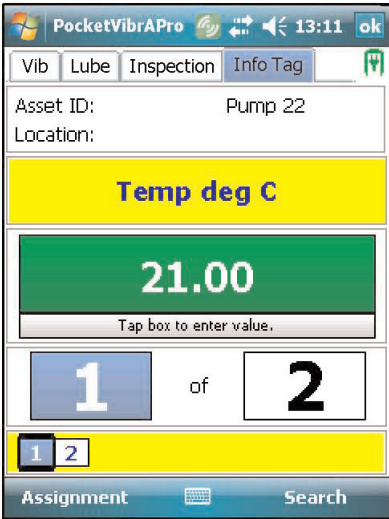


Pressing the up and down cursor keys will toggle between vibration measurement points and the Info Tag screen (see left)

Tapping the box in the centre of the screen allows information to be entered for each info tag.

Navigating between info tags is achieved by using the left and right cursor keys or by tapping the corresponding number on the menu bar at the bottom left of the display.

Inputting of data will be different depending on the type of Info Tag (text or numeric). For a Text input tag a screen similar to that shown opposite right will appear where the user is invited to input the text and a status level which will then be flagged up later in C-Trend if it is set to Warning or Critical.



Entering Numerical info tags will bring up a screen like that shown left, where the numerical value entered will determine the colour coding (green, amber or red) depending on the alarm levels that have been previously set up for the info tag.

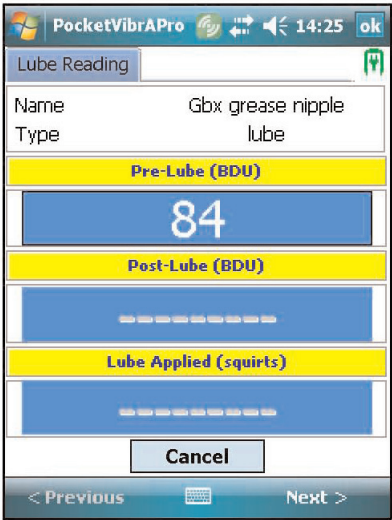
4.1.2.3 Entering Lube Point readings

Selecting the **Lube** tab (either by touching the tab on screen or using the up and down cursor arrows) will bring up a screen like that shown right.

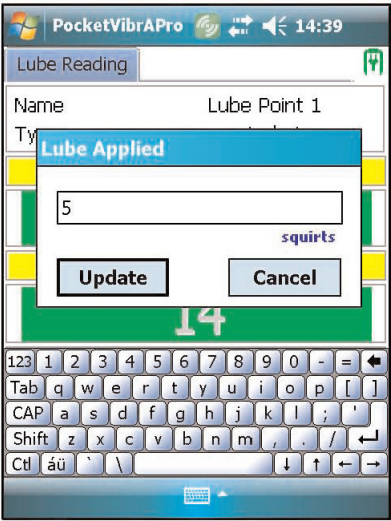
Selecting **Take Reading** will bring up a screen showing the Pre-Lube bearing noise (BDU) at the Lube point prior to lubrication.



Selecting **Next** (either by touching the screen, pressing the right hand soft key (-) or Enter) will “freeze” the Pre-Lube (BDU) reading and advance to display the Post-Lube value. Selecting **Next** once more will allow the user to enter the quantity of lubricant added.



The amount of lubricant added is specified in the user defined units that were selected when the Lube point was originally set up.



PocketVibrAPro 14:38 ok

Lube Reading

Name Lube Point 1

Type castrol gtx

Pre-Lube (BDU)

93

Post-Lube (BDU)

14

Lube Applied (squirts)

5

Cancel

< Previous Save

After the Lube information has been entered and **saved** (either by touching Save on screen or by pressing the Enter key) any info tags associated with the Lube point can then be entered.

PocketVibrAPro 14:46

Lube Reading Lube Info Tags

Reading

grease nipple cap missing

Alarms

☐ Off ☐ OK

☒ WARNING ☐ CRITICAL

Update Cancel

123 1 2 3 4 5 6 7 8 9 0 - =

Tab q w e r t y u i o p []

CAP a s d f g h j k l ; ' "

Shift z x c v b n m , . / <

Ctl áü ` \ _ { } ~ = >

In the example shown here on the right, a Lube info tag is being entered as text plus a status code that will be flagged up by C-Trend if it is a Warning or critical.

After all the Lube info has been entered the Lube Point can be closed by selecting OK. This can be done either by touching the screen where it says “OK” or by pressing the **OK** key.

4.1.2.4 Running an Inspection

Running an inspection is achieved simply by touching the blue box in the centre of the screen (or by pressing the Enter key).

Individual Inspections are selected in the same way as different vibration MPs or Lube Points. In the example shown here there are three inspections. The first one is called “Motor Check”.

PocketVibrAUltr 22:25 ok

Vib Lube **Inspection** Info Tag

Asset ID: Pump 22
Location:

Motor Check

Run Inspection

1 of **3**

1 **2** **3**

Assignment Search

Running the inspection brings up an initial screen that gives the user the option to indicate whether the Motor is “OK” in which case the inspection will terminate, or “NOT OK”, which will bring up a list of checks to be made.

PocketVibrAUltr 22:26 ok

Question:

Motor Check

Select:

OK

NOT OK

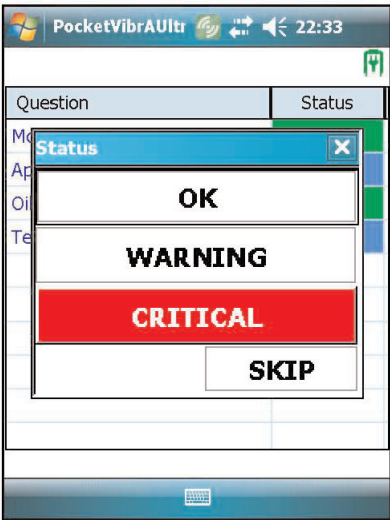
<Back Save

Each question can be answered by touching it on the screen (or by scrolling and pressing the Enter key). This will cause a different dialogue to open depending on what type of question is being answered.

PocketVibrAUltr 22:30 ok

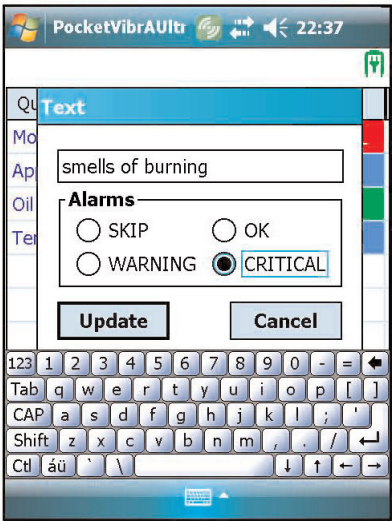
Question	Status
Motor OK?	OK
Appearance?	-----
Oil Leaks?	OK
Temperature?	-----

<Back Save

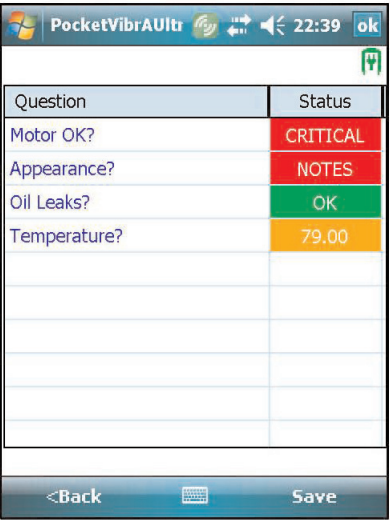


A simple Status type question brings up a dialogue like that shown opposite left, where the user is asked to specify which of four possible statuses should be assigned to the answer.

Selecting Skip causes no particular status to be assigned to the answer.



Inputting text to a Text + Status question causes the word “NOTES” on a background colour of the selected status level. This text will be visible in C-Trend after the data has been uploaded and any alarms will be flagged up. In the example shown here the text has been set to critical (red).

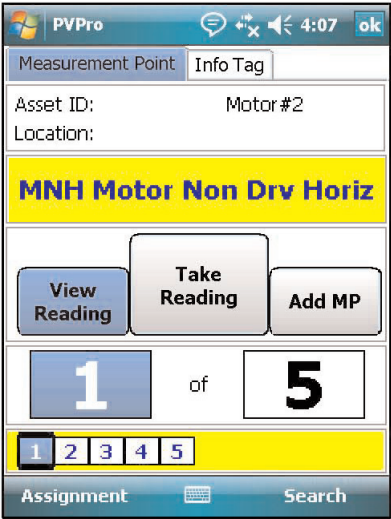


In a similar manner, questions that are Numeric + Status will display the numerical value that is entered against a background colour determined by the chosen status value. In the example shown left, a temperature value of 79 has been entered and set as a warning (amber).

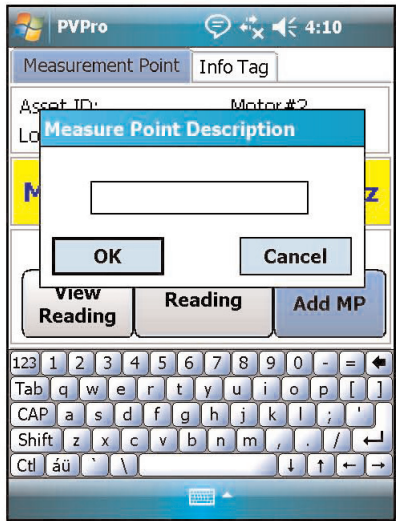
4.1.2.5 Viewing previously taken readings

Once taken, readings can be viewed again simply by selecting **View Reading** which re-opens the readings screens for the selected measurement point as described above.

The **View Reading** button is only available for measurement points that have already been read and hence have their MP number displayed in inverse (white on blue) as shown in the example screen shot to the right.



4.1.2.6 Adding a measurement point



It is also possible to add a measurement point to an asset whilst taking readings.

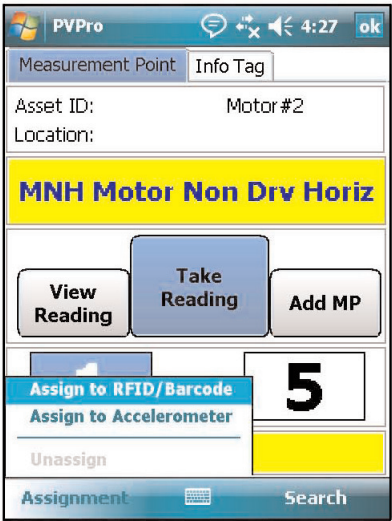
This is achieved by selecting the **Add MP** button on the display which pops-up a screen that asks for the description (name) of the new measurement point to be entered.

This new measurement point will be added to the asset on C-Trend at the next synchronisation.

4.1.2.7 Assigning an I.D. to a measurement point

By selecting **Assignment** from the bottom menu bar (either by tapping the screen or pressing the soft key) it is possible to give measurement points (MPs) unique identities.

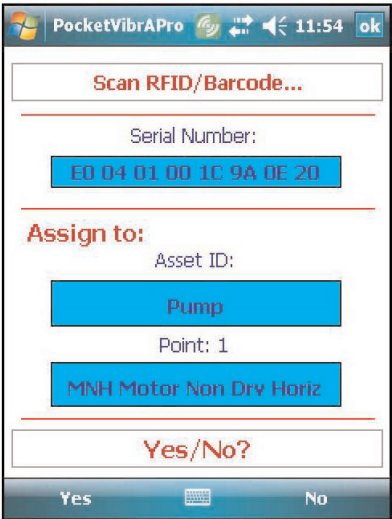
This allows MPs to be subsequently recognised automatically, either by RFID, scanning a barcode (using the optional barcode scanner) or by plugging in an accelerometer with a previously assigned serial number.



Assigning a barcode or RFID tag to a MP is achieved by first of all selecting **Assign to RFID/Barcode** from the pop-up assignment menu (as shown above), and then scanning the appropriate RFID tag or barcode.

The serial number of the scanned RFID tag or barcode will then be displayed and the user will be given the option to assign this code to the current MP (see example on right).

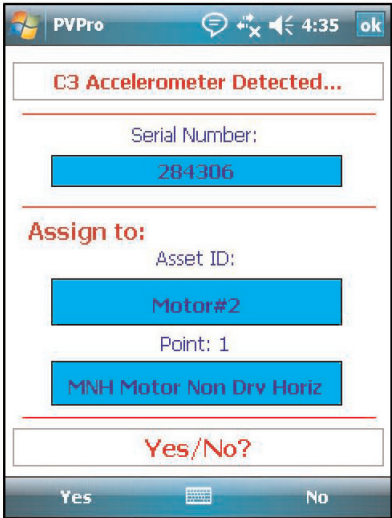
N.B. In the case of an RFID tag being assigned, the user is prompted to scan the tag a **second** time to allow the software to overwrite any data that has been previously stored in the tag.



Once an assignment has been made, it is possible to go straight to the assigned measurement point from any point in the PocketVibrA software by simply scanning the RFID tag or barcode. This will cause the point to be opened for reading. A second scan of the RFID tag or barcode will cause the reading to be taken automatically without further operator intervention (i.e. no need to select “take reading”).

Assigning a Measurement Point to an accelerometer is done in a similar manner to RFID/Barcodes, only this time the software searches for a connected C-Cubed ‘smart’ accelerometer and reads its serial number, (Serial Number: 284306 is shown in the example on the right).

Once assigned to an accelerometer serial number, MPs can be “opened” for data collection by selecting **Search** from any of the menus where it is displayed at the bottom right of the menu bar.



This is achieved simply by tapping **Search** on the menu at the bottom of the screen or by selecting it with the soft key (-). This will cause PocketVibrA to open up the measurement point previously assigned to the connected accelerometer ready to take a reading.

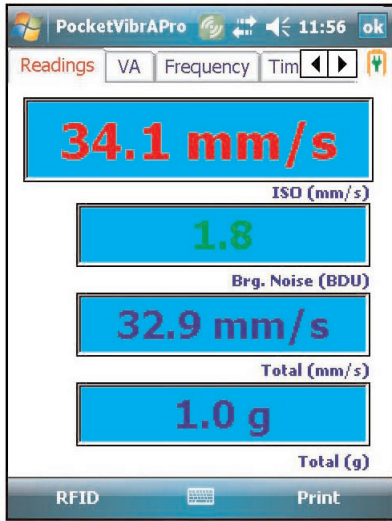
Un-assigning an RFID tag/barcode or accelerometer serial number is achieved simply by opening the appropriate MP and then selecting **Unassign** from the assignment pop-up menu.

4.1.3 RFID

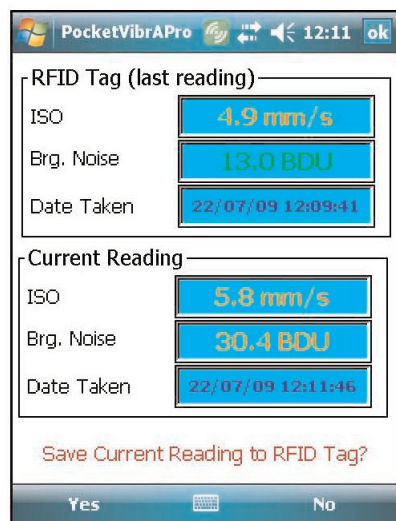
The RFID option on 9020 Pro & 9040 Ultra is a powerful means of automatically identifying measurement points.

Simply by holding the 9020 Pro & 9040 Ultra unit next to the RFID tag the measurement point will be recognised and “run”.

In addition it is possible to save data to an RFID tag and this can later be viewed and compared against subsequent readings.



If the RFID option has been enabled on the PocketVibrA unit a green disc will be visible in the centre of the top menu bar of the PocketVibrA unit. The **RFID** button will then be displayed at the bottom left of the screen when a reading is taken.



This button can be used to view any previous (last) reading stored on the RFID tag and compare it to the current reading (see screen shot left).

The option to overwrite the stored last reading with the current reading is also available. Selecting “**Yes**” will cause the PocketVibrA unit to prompt the user to scan the RFID tag to allow the new data to be written to the tag.

N.B. For a reading to be written back to the RFID tag it is of course necessary to hold the PocketVibrA unit head in close proximity to the tag to allow the RFID data to be written into the tag.

4.1.4 Printing a screen

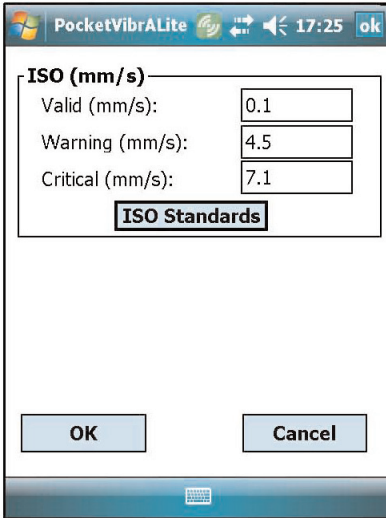
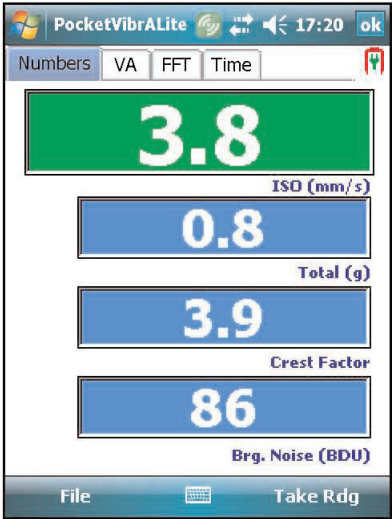
Several of the results screens (e.g. readings, time waveform, frequency plot and VA values) give the user the option to print the screen to an optional Bluetooth connected printer. If a screen is printable, the word **Print** will be displayed at the bottom right of the screen on the menu bar. Printing of the displayed screen is achieved simply by tapping **Print** on the menu at the bottom of the screen or by selecting it with the appropriate soft key (-).

4.2 9020 Pro & 9040 Ultra Lite

The Meter Icon on the Main menu of PocketVibrA opens up **9020 Pro & 9040 Ultra Lite**, which functions as explained in the PocketVibrA Lite user guide contained in Appendix 2 of this guide.

When 9020 Pro & 9040 Ultra Lite is run from within Pro or Ultra however, it contains a couple of extra features.

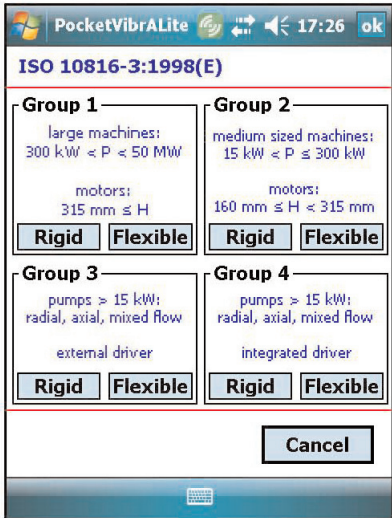
The main one to note is that the ISO value is now colour coded depending on the ISO alarm settings chosen.

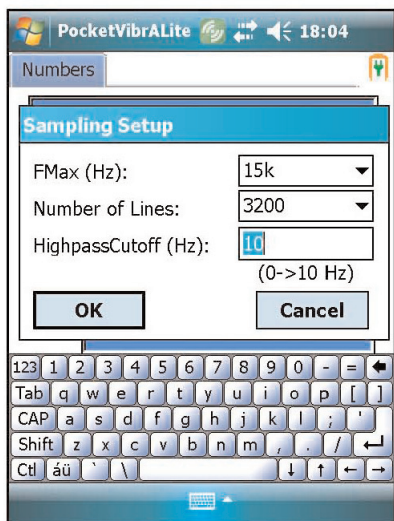


The ISO alarm levels can be viewed and set using the PocketVibrA Lite File Menu as shown opposite left.

Selecting ISO Standards opens the menu shown below where the user can select the alarm levels depending on the type, size and mounting arrangement of the particular machine being assessed.

Tip: Most machines will come into the category of flexibly mounted, unless bolted directly to a concrete floor for example (in which case they can be considered as rigid).





Selecting **Sampling Setup** from the file menu will open up the screen shot left, where the number of lines of resolution used to display FFT plots can be chosen from 800, 1600 or 3200 (default) lines.

It is also possible to change Fmax from 15kHz (default value) to 1kHz if higher resolution low frequency measurements are to be made.

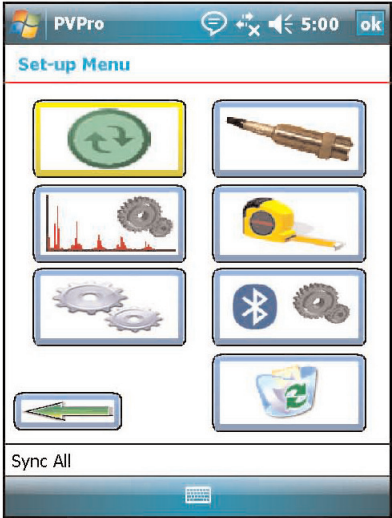
Also the high pass cut-off frequency can be set anywhere in the range from 0 to 10 Hz to allow very low frequency measurements.

N.B. it is usually necessary to allow the accelerometer several minutes to “settle” after it has been moved if making measurements below about 2 Hz.

4.3 Set-up Menu (Configuration menu)

The set-up icon (shown as a spanner and a gear wheel on the main menu) switches to a screen that contains a series of icons that allows the selection and set up of various configuration parameters.

These are as follows:



- Sync All (green circle icon)
- FFT set-up menu
- Config Menu (gears icon)
- Accelerometer set-up
- Units (tape measure icon)
- Bluetooth Menu
- Delete data (recycle bin)

There is also a back arrow icon (bottom left) to return to the main menu screen.

4.3.1 Sync All

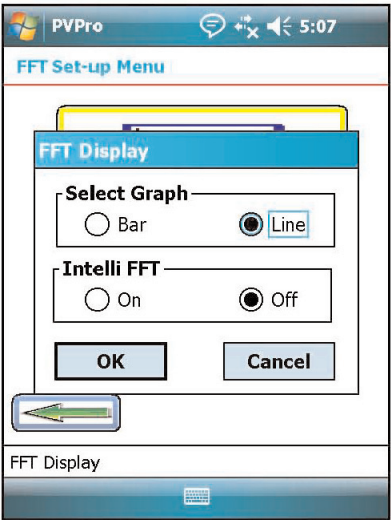
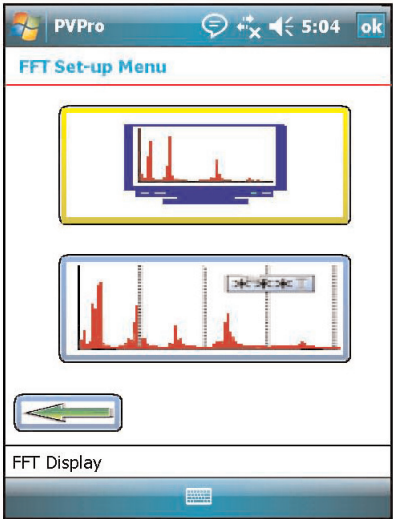
By selecting the Synchronisation icon (green circle) it is possible to force re-synchronisation of all the data held on a PocketVibrA unit back to the C-Trend database on a PC by forcing a '**Sync All**'. Effectively, on the next synchronisation with C-Trend, **Sync All** uploads any data that is contained in the PocketVibrA unit, including any that has already been synchronised with a PC on a previous occasion.

4.3.2 FFT Display

Clicking on the **FFT Set-up** icon brings up the display shown opposite and allows the user to select from the following options:

- **FFT display**
- **VA band descriptions**

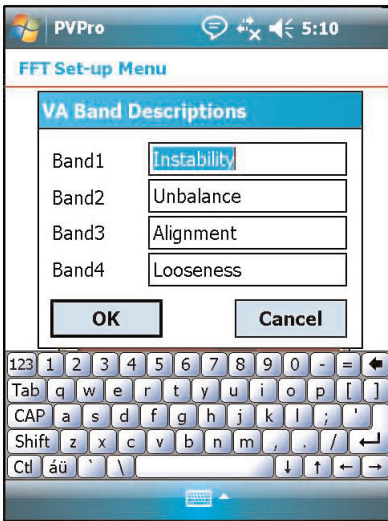
FFT Display allows the user to specify the type of FFT graph to be displayed and to turn the intelli-FFT feature on or off.



Select Graph: This feature allows the frequency plots to be displayed using either a **Bar** graph (where individual frequencies are plotted as vertical lines) or a **Line** graph (where the peaks of each frequency component are joined together with a line).

The user should select whichever they wish according to personal preference. The display defaults to Bar graph.

Intelli FFT: defaults to OFF and can be used to sharpen the display of the individual frequency peaks in the frequency plots by employing an algorithm that avoids 'leakage' between the displayed frequency bins that make up the FFT. It should be turned OFF if the user wishes to view low level signals that are very closely spaced on the frequency axis.



VA band descriptions: these are the names given to the 4 vibration analysis frequency bands that are displayed on 9020 Pro & 9040 Ultra. The names can be user defined with terms such as instability, unbalance, misalignment and looseness, (which are the default descriptors).

4.3.3 Config Menu



Selecting the **Config Menu** (gear wheels icon) allows the user to choose from a menu screen with the following functions:

Language (world icon): users can choose the unit's operating language from a drop down menu that shows the available choices.

The list of available languages is continuously being updated and users should contact TPI if a desired language is not shown on the list.

Password edit (keys icon): allows the user to set a new password.

The default password is **default** (all passwords are case sensitive).

Auto Start (chequered banner icon): this feature enables the automatic start up of 9020 Pro & 9040 Ultra when the Pocket PC is turned on. It defaults to ON but can be set to OFF (signified by a red diagonal cross through the icon) by the user if preferred.

Auto Next Point: This feature enables the automatic incrementing to the next measurement point whenever a reading is taken in 9020 Pro & 9040 Ultra . The default is that auto next point is turned on but it can be set to OFF by the user if preferred (signified a red diagonal cross).

Inspections (magnifying glass icon): allows the user to select between the questions in Inspections being displayed all together as a list (allowing skipping of questions) or displayed individually one by one.

4.3.4 Accelerometer Set-up

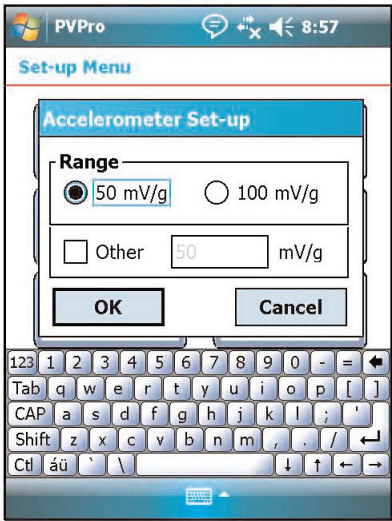


The **Accelerometer Set-up** icon is used to configure the sensitivity setting (mV/g) for accelerometers.

If a TPI accelerometer is connected, the display shows the settings that are read directly from the accelerometer. The sensitivity and serial number are pre-programmed into all TPI accelerometers. The current temperature of the accelerometer is also displayed (this is read out of a temperatures sensor inside the accelerometer).

However if a constant current accelerometer is used, then the user must pre-set the accelerometer sensitivity. Pre-set sensitivities of 50mV/g or 100mV/g can be selected by clicking the radio buttons.

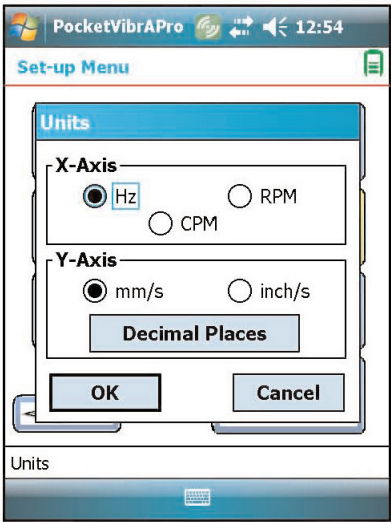
Alternatively other user-specified values can be typed in by checking the box marked **Other** and using the keyboard feature of the Pocket PC to enter the value.



4.3.5 Units

Tapping on the **Units** (tape measure) icon allows the x-axis units for frequency plots to be changed. These can be set to display in either **Hertz (Hz)**, **Cycles per Minute (CPM)** or **Revolutions per Minute (RPM)**.

Similarly the y-axis units for velocity can be selected to be in mm/s or inch/s and the number of displayed decimal points for on-screen readings can be selected (up to a maximum of 5 d.p.s).

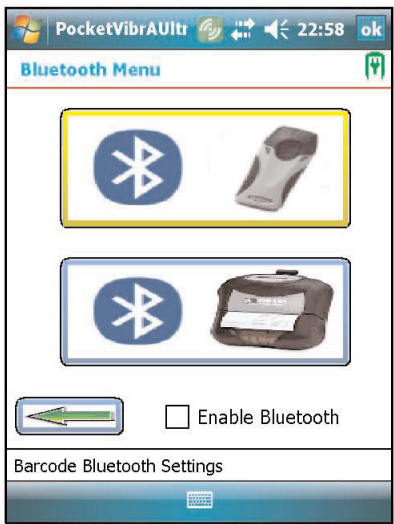


4.3.6 Clean Up



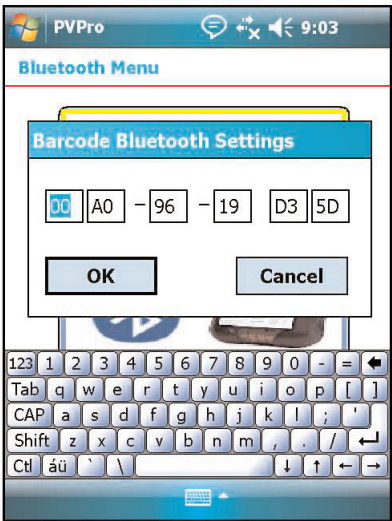
Clean Up - the clean up icon on the Set-up menu is the recycle bin symbol towards the bottom right of the screen. This button can be used to delete all data that has previously been synchronised and hence transferred to C-Trend. This is done to free up memory on the PocketVibrA unit.

4.3.7 Bluetooth Settings



The **Bluetooth** menu is used to enter the Bluetooth addresses of the optional bar-code scanner and printer. It is also where the Bluetooth can be enabled or disabled (by ticking the box).

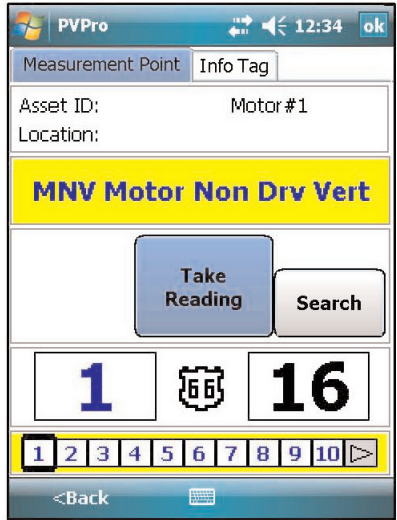
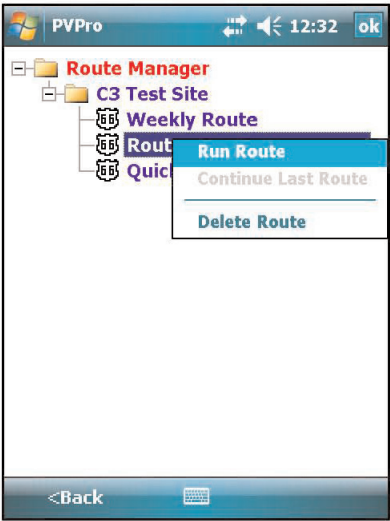
The Bluetooth addresses can be found printed on the devices to be connected and are entered as 12 digit numbers, as shown in the screen shot to the right.



4.4 Routeing

Selecting the “Route 66” icon from the main menu opens up the Route Manager, which allows the user to run pre-determined routes that have been set up using C-Trend.

Selecting a route (either by touching the screen or navigating to it via cursor and Enter key) opens up a drop down menu that allows it to be run, continued or deleted. This is shown in the screen shot opposite.



When a route is run, the screen is slightly different to when an asset is run. The difference being that there is no distinction between MPs and Info Tags and they all appear on the menu bar at the bottom of the screen.

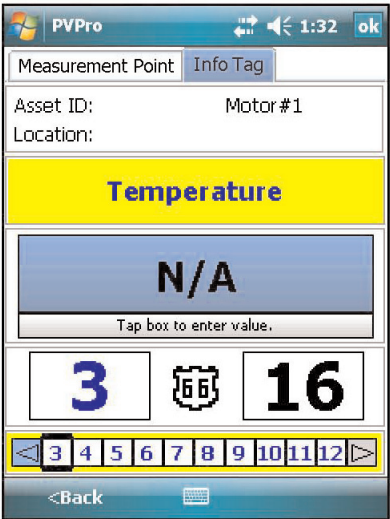
In all other aspects the mode of operation for a route is the same as when running an asset.

The screen shot on the right shows how the entering of an info tag would appear during a route.

The measurement point bar at the bottom of the screen indicates that all MPs prior to MP #3 have been taken as the left arrow on the bar is shown in blue.

The right arrow on the MP bar indicates that there are still MPs above MP #12 that have not yet been taken. This is indicated by the arrow being grey in colour.

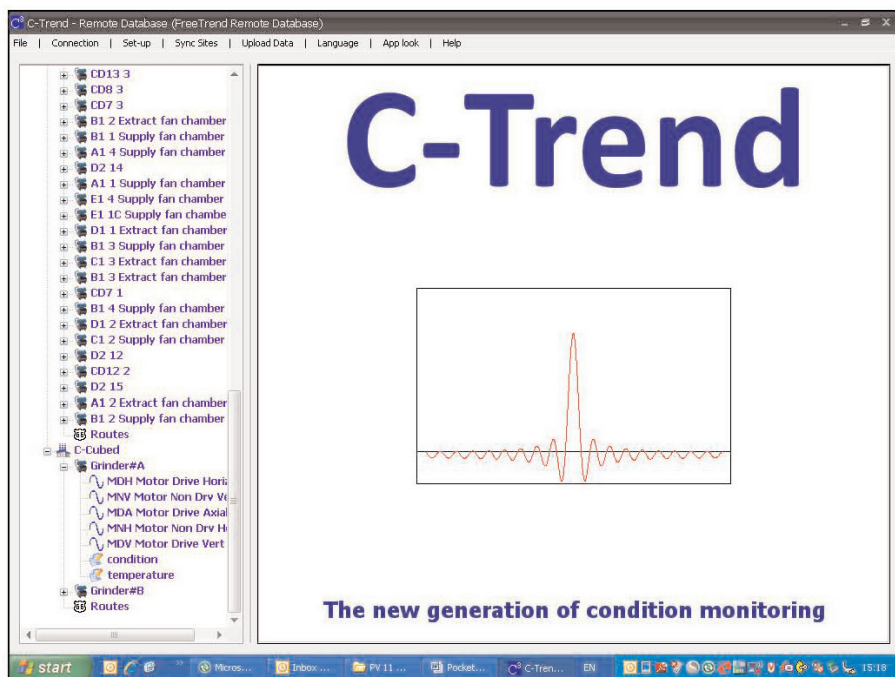
The data files generated whilst running a route will be automatically added to the Asset Manager screen in exactly the same way as if they were produced by “running” an asset from the Asset Manager screen. The data files will be automatically named with the date and time when they were created.



The following sections of this user guide describe the operation of C-Trend™, the PC based trending software that comes with PocketVibra®. Whilst the user guide describes the detailed operation of C-Trend, it is best read after viewing the previously described short training videos accessible via the www.pocketvibra.com website.

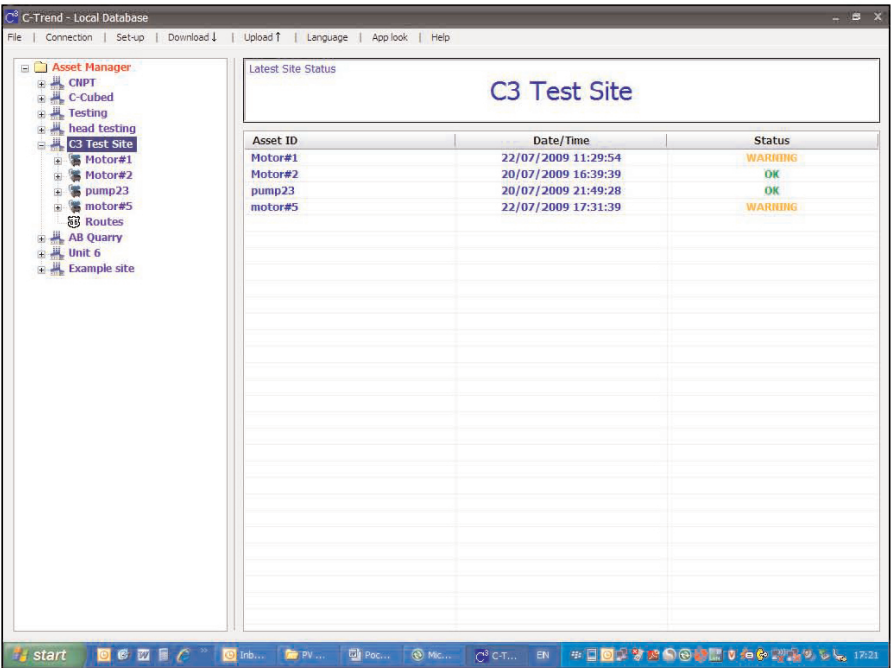
5.1 Screen layout and data display

The opening screen of C-Trend is shown below. The asset manager window, showing the currently installed sites, is visible on the left hand side. In the example below there is a site with the name “TPI”, containing assets Grinder #A and Grinder #B.



5.1.1 Site Status

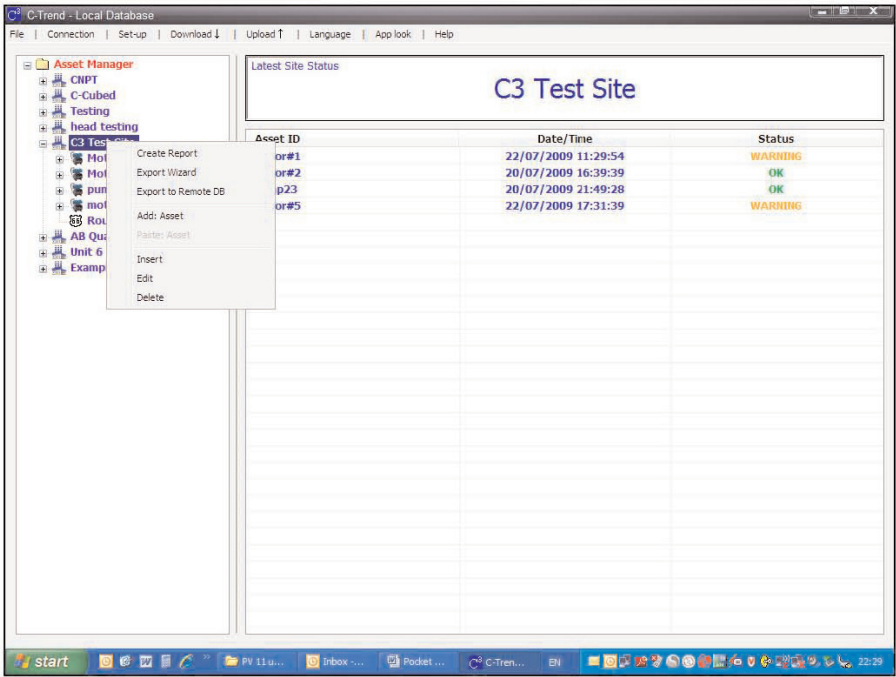
Left clicking on the name of a site (single click of left hand mouse button), opens up a status window to the right of the asset manager window which shows a list of the assets for that site and their **current** alarm status. The alarm status is displayed in the appropriate colours for OK (green), warning (amber) or alarm (red).



Clicking on an alarm will open up the measurement point display for that asset and show the status all its measurement points. This allows a user to “drill down” to find out the actual cause(s) of the alarm status.

5.1.1.1 Editing a Site

Right clicking the mouse on a site name opens a drop down window that allows the user to edit sites exactly as described in the previous section on the PocketVibrA software.

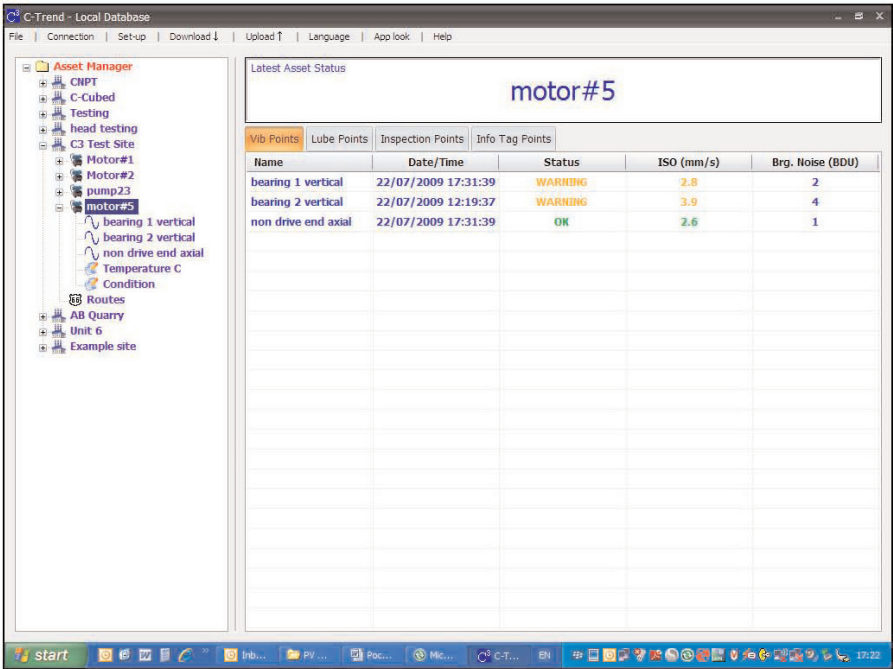


Other options displayed on the drop down window (e.g. create report, export wizard etc) will be described in more detail in later sections.

5.1.2 Asset Status

Clicking on the name of an asset will bring up a display in the right hand window that shows all the measurement points for that asset. This window will also display the latest alarm status for each of the vibration measurement points.

Again, clicking on an alarm status will allow “drilling down” to see the source of the alarm, by causing the appropriate graph or alarm table to be displayed.



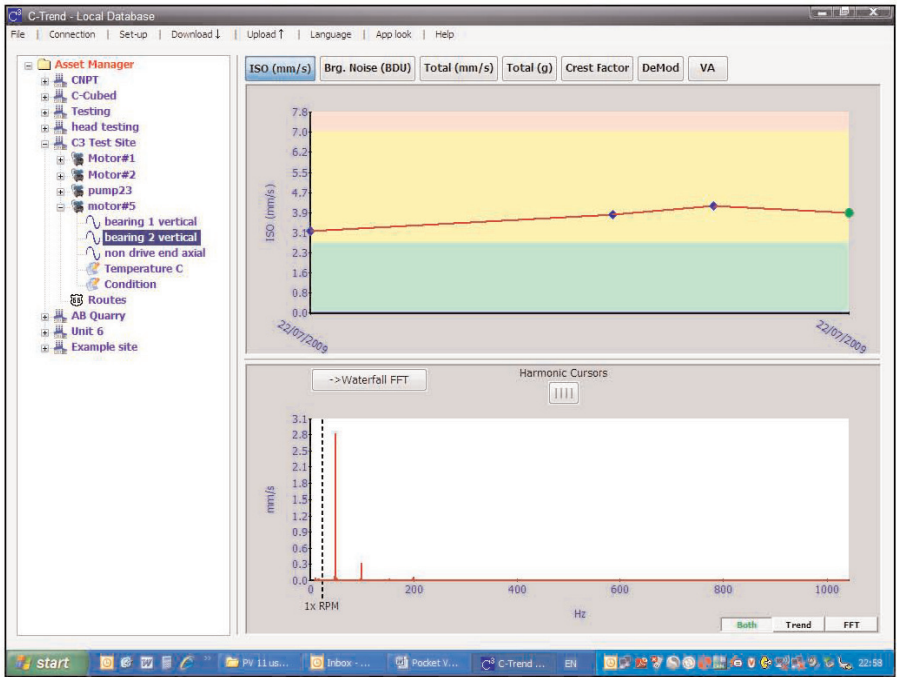
The alarm status table for each measurement point can be user-configured to display up to 3 different parameters in columns to the right of the Status column. The parameters to be displayed in the table are chosen from a dropdown menu that is accessed via the **Set-up** menu (explained in section 5.4 below).

Tip: the most useful set of parameters to show to describe the health of an asset would typically be the ISO reading and Bearing Noise.

The **ISO** value tells you the overall vibration levels of the asset due to running speed related faults such as unbalance, misalignment, looseness etc.

The **bearing noise** value (and its trend) indicates the degree of bearing wear. This figure can be used as a means of estimating bearing lifetime using Trend Lines (see later)

5.1.2.1 Measurement point data display



Clicking on an individual measurement point will bring up a trend plot for that measurement point. If the measurement point is a vibration measurement, the top half of the screen will show the trend of the average (or RMS) value for each reading (depending on which plot has been selected from the menu tab at the top of the screen). The bottom half of the screen will show the frequency plot for the currently selected reading (identified by the green marker in the trend plot).

Readings taken on other dates/times can be displayed as frequency (FFT) plots in the lower window simply by clicking on the markers in the trend plot with the mouse. This will cause the trend plot marker for that measurement to change from a blue diamond to a green circle and the appropriate FFT plot will appear in the bottom half of the screen.

Positioning the cursor over a reading on the trend plots will cause a box to appear that contains the exact value of the measurement, the date and time the reading was taken, and the serial number of the accelerometer that was used (the serial number only applies if using a TPI smart accelerometer).

N.B. the values that are purely calculated from the vibration waveform data (Bearing Noise and Crest Factor) do not have an associated FFT plot.

Other information on the plots includes the running speed of the asset, (shown as a vertical black dashed line) if it was entered during set up, and any alarm levels that have been set. The alarm levels (if activated) are shown as a colour coded background to the graph in red, yellow and green, corresponding to Critical, Warning and OK.

Zooming on any of the graph plots can also be achieved simply by drawing a rectangle from top left to bottom right of the area to be zoomed. This is achieved simply by holding the left mouse button down as the zoom window is dragged.

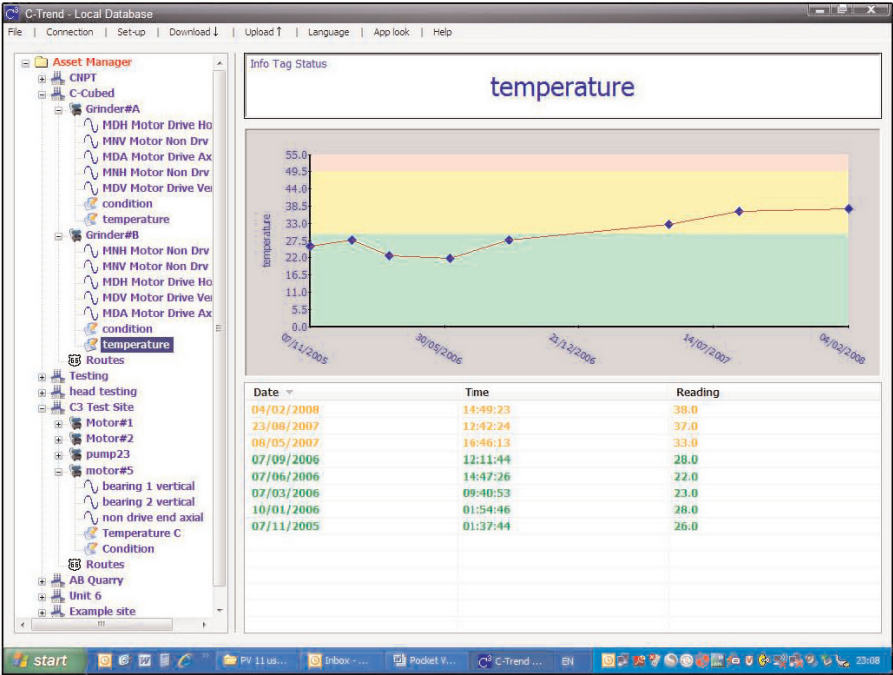
Double clicking the mouse on the graph will **reset the zoom** level to the original default value.

The user can elect to display only the trend plot or the frequency plot or both by selecting the desired view from the 3 buttons at the bottom left of the display.

5.1.2.2 Info Tag data display

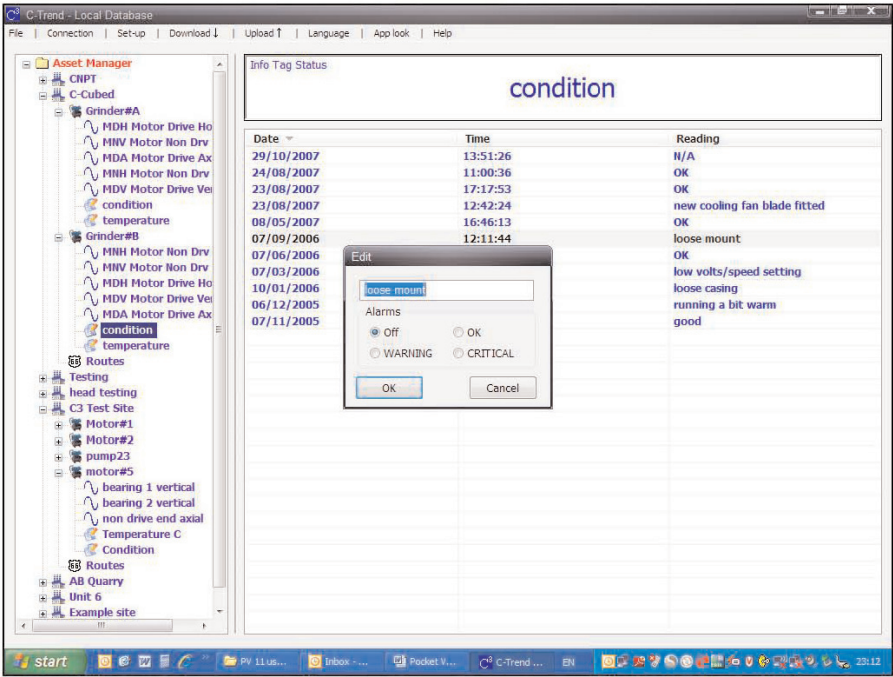
Clicking on the name of an info tag in the asset manager window will cause the info tag to be displayed in the right hand window.

Numeric info tags can be displayed as trend plots in a similar way to vibration data measurement points.



Alarm levels (if set) are shown on the graphs as red, yellow and green backgrounds.

In the case of info tags that are text input only, clicking on the name of the info tag brings up a table of text strings that have been entered together with the dates and times on which they were entered (as shown below).

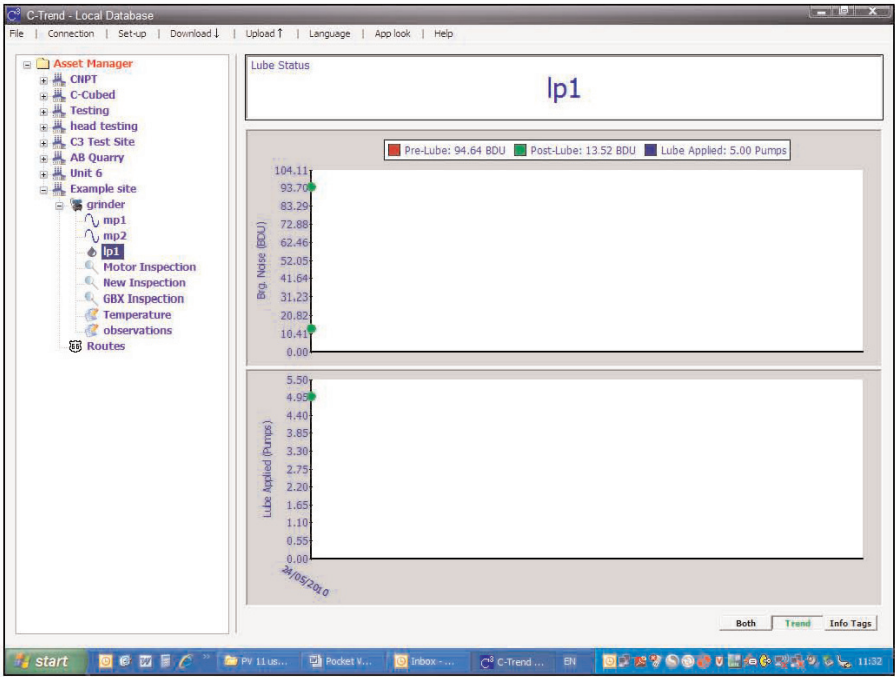


In the case of both numeric and text info tags, it is possible to edit the entries. This is done simply by right clicking on the table entry (text or numeric) and choosing to either edit or delete the entry.

This is a very useful feature for adding further detail to brief text entries that were made on the 9020 Pro & 9040 Ultra unit whilst being used to collect readings.

5.1.2.3 Lube point display

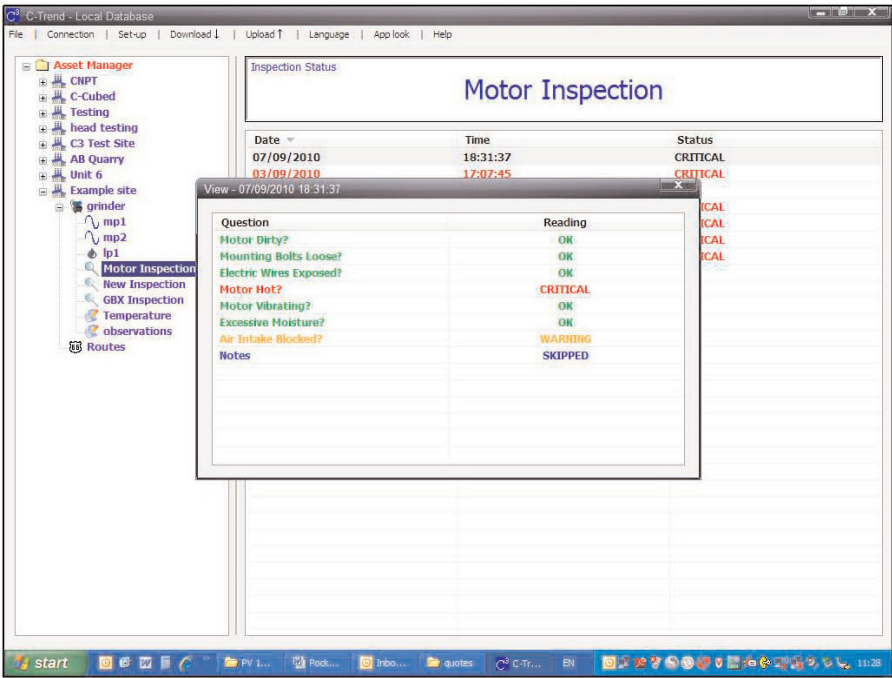
Clicking on (selecting) a Lube Point will open up its history and display



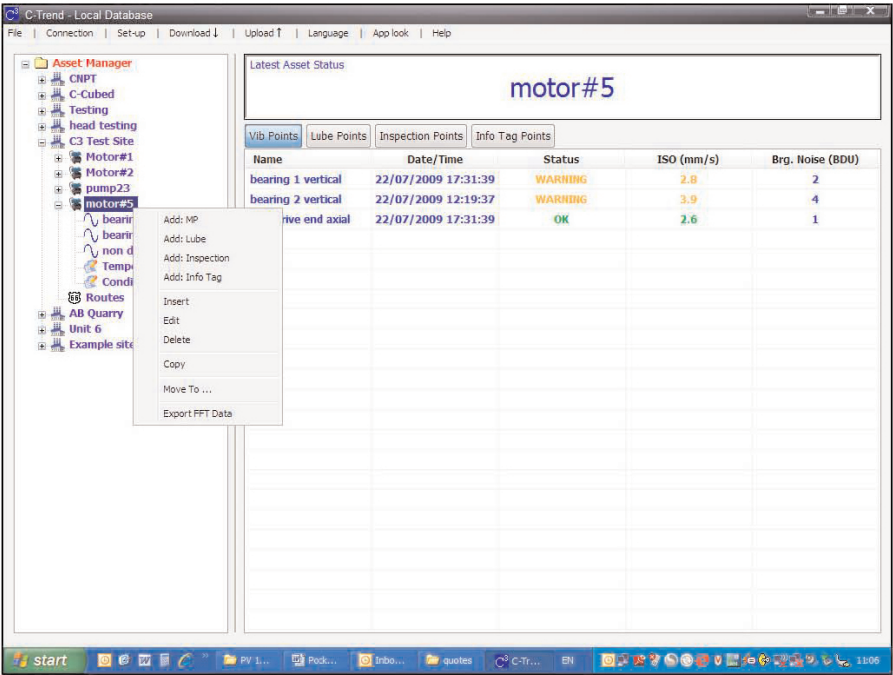
5.1.2.4 Inspection display

Clicking on an inspection point opens up a window that shows the history of, inspections carried out and their status.

Double clicking on an individual inspection will open a window that shows the status of that individual inspection and the answers (and status) given to each of the questions in the inspection (see below).



5.1.3 Editing an asset



Right clicking on the name of an asset opens up a drop down menu (see above) that allows editing of the asset in exactly the same way as described in the section on PocketVibrA.

Assets can be copied and then pasted into sites (by using the Edit Site menu) allowing easy set up of groups of similar assets.

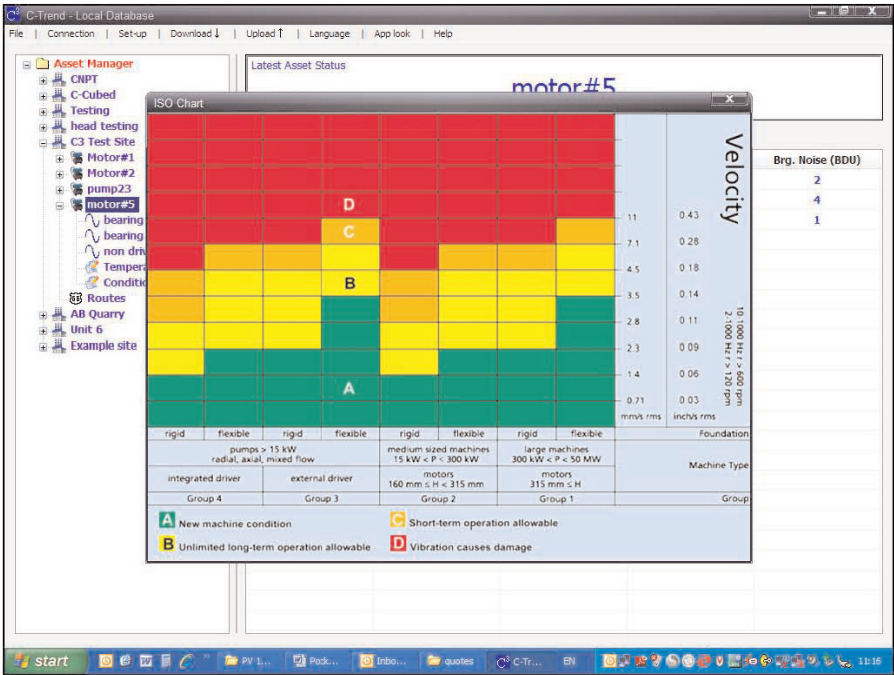
Tip: It is always best to concentrate on setting up one asset, take some readings, look at the results etc, BEFORE copying and pasting lots of them!

5.1.4 Alarm levels

Clicking on the C-Trend Help menu allows the user to view a chart based on the ISO alarm levels for different sizes of machine. This is helpful when deciding what alarm levels to select when setting up an asset.

As a “rule of thumb” it is always best to assume that unless something is bolted down to concrete, in which case it may be considered as rigid, it will fall into the category of flexible foundations.

The rest of the table is fairly self explanatory but further guidance can be obtained from the pocketvibra.com website “application notes” section.



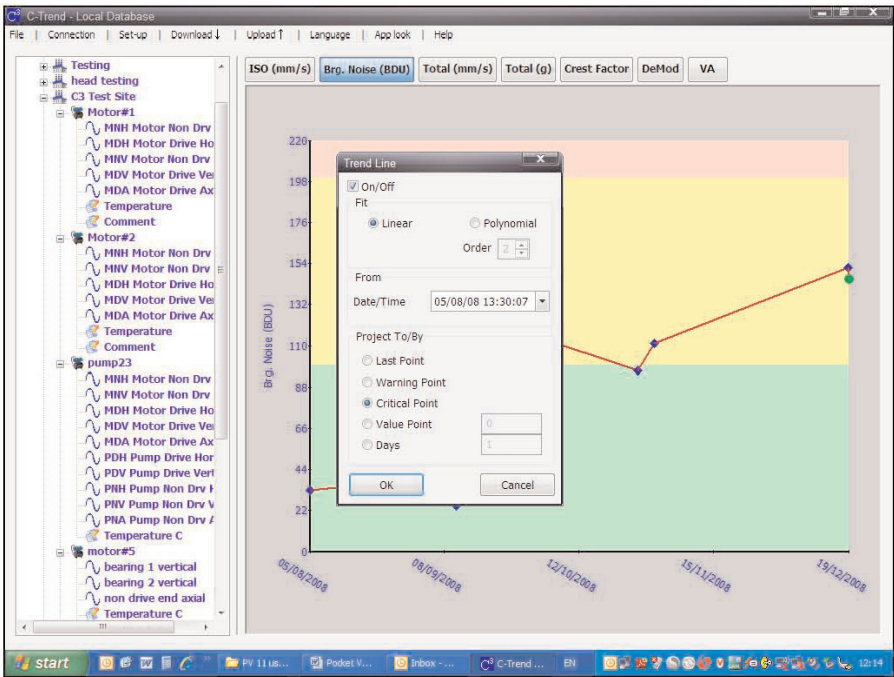
Unfortunately there are no hard and fast standards for bearing noise alarm levels as they do depend on the size of the machine and its running speed, as well as the type of bearing. But again, a good rule of thumb is to use the default settings in C-Trend/PocketVibrA of 50 BDU for a Warning and 100 BDU for a Critical level. It may help to think of the bearing noise in BDU (bearing damage units) as a very rough percentage figure for bearing wear.

5.2. Analysis of asset readings

5.2.1 Trend lines

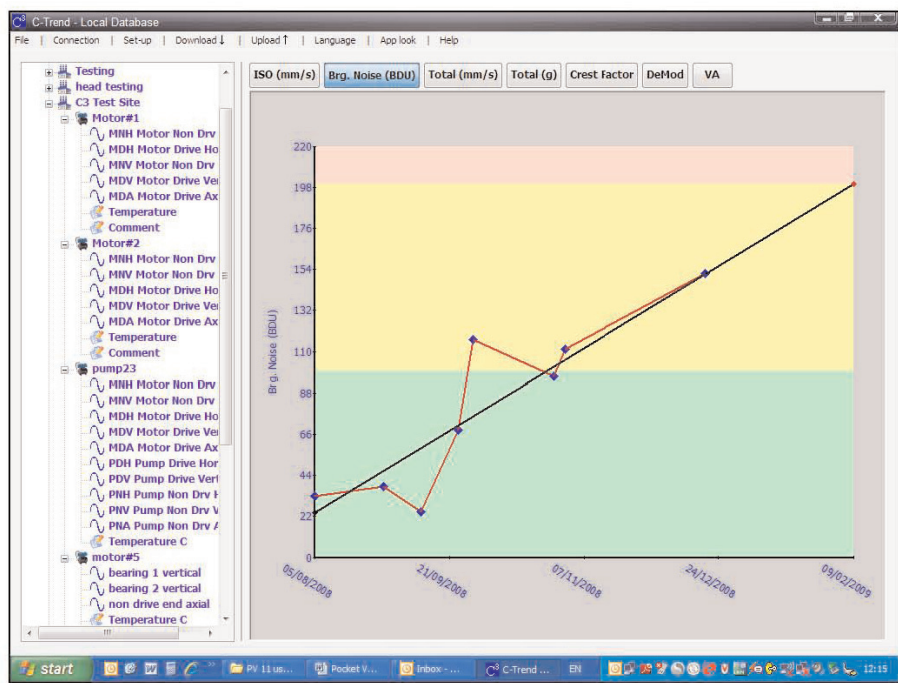
As a means of predicting breakdowns, the use of trend lines can be a very powerful tool. Right clicking the mouse on the graph brings up a dialogue box that allows the user to choose from adding a trendline to the plot, zooming on the x and y axes, or adding the plot to the clipboard (this last option is explained further in the later section on reporting).

If a trendline is selected, a window opens that allows the user to specify the type of trendline to be displayed (as shown in the example screen shot below).



In the example shown here a linear trendline has been selected to commence at the first data point on the plot and continue until the alarm level (as indicated by the red zone on the graph).

This results in the display shown below:

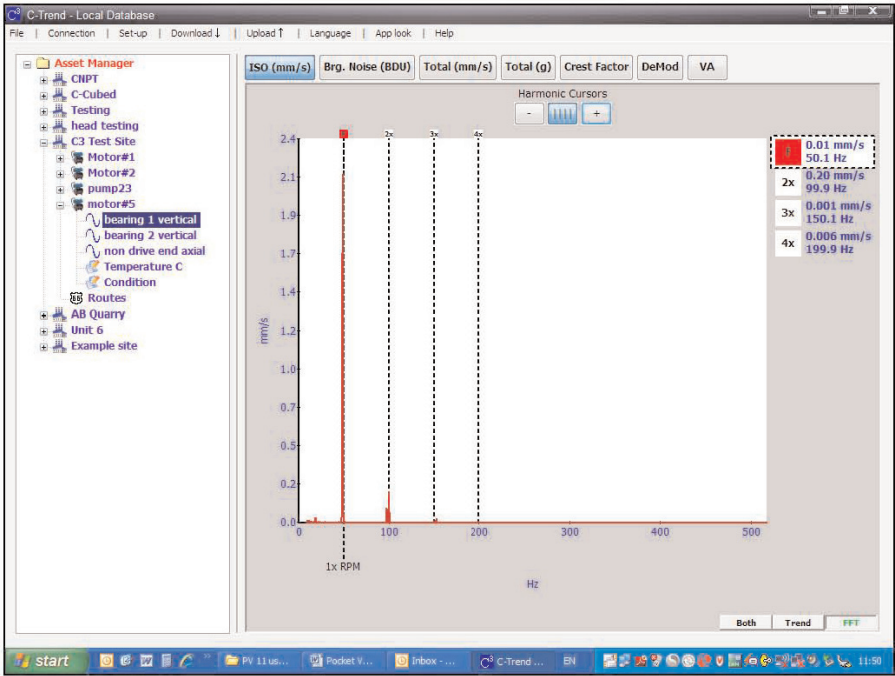


In this example the trendline is predicting that, if it continues at its present underlying rate of trend, the measured value would reach the alarm level after a further two months from the date of the last reading.

It is entirely up to the user's experience and interpretation of the shape of the trend to determine exactly which type of trendline should be selected (linear, polynomial etc). Clearly the exact choice could significantly affect the predicted time to any particular point. For this reason trendlines should be used only for rough guidance and it should never be assumed that the data will in fact follow the predicted pattern.

5.2.2 Harmonic cursors

Another very powerful technique for fault finding is to use harmonic cursors to show up frequency components that are multiples of other frequencies (running speed for example).



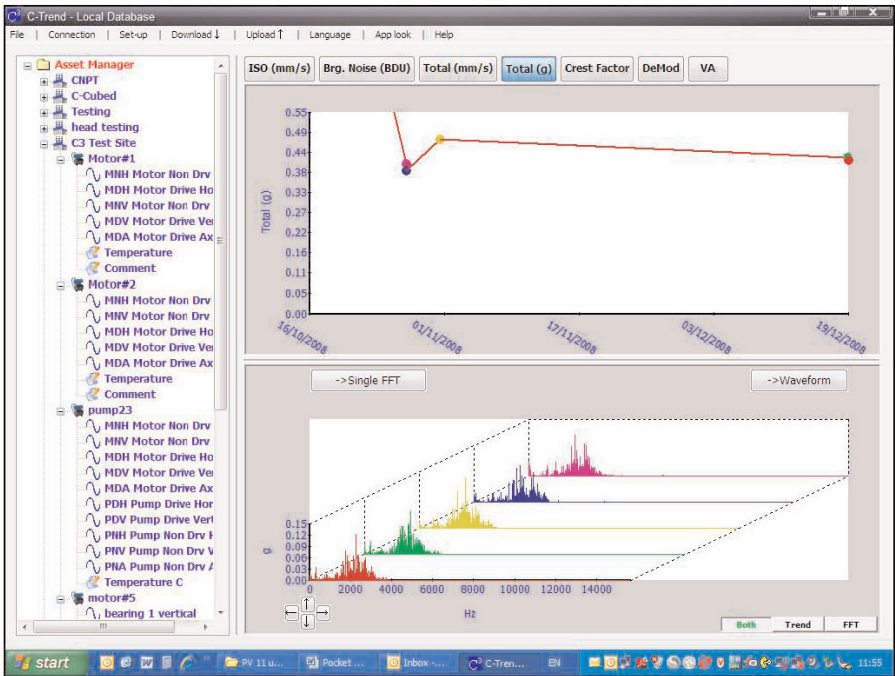
In the example screen shown here the first 3 harmonic cursors have been turned on, by clicking on the + symbol just to the right of the harmonic cursor symbol (|||||).

Adjustments to the position of any of the cursors can be made by clicking on a cursor and dragging it with the mouse, or by clicking on it (so that the top of the cursor turns red) and then positioning it with the PC keyboards arrow keys. Whenever a cursor is moved, the other cursors will move with it to maintain the harmonic ratio (x1, x2, x3, etc) of the cursors.

5.2.3 Waterfall diagrams

A useful means of determining exactly how a measurement point reading is changing is by viewing it on a pseudo 3-D diagram called a waterfall plot.

This technique enables the trend of the individual frequency components in a frequency spectrum to be seen at a glance. The example shown in the screen shot below illustrates increasing levels of vibration on a measurement point starting from the oldest reading (at the back) to the newest reading (at the front).



Plots can be added or removed from the waterfall diagram by holding down the control key and drawing a box on the trend plot around the points to be added/removed. Consequently this feature toggles the display of points on and off. Trend points displayed on the waterfall diagram are shown as coloured dots on the trend plot (with the colours of the dots corresponding to the colours on the waterfall plot) and trend points not currently displayed are shown as blue diamond shapes.

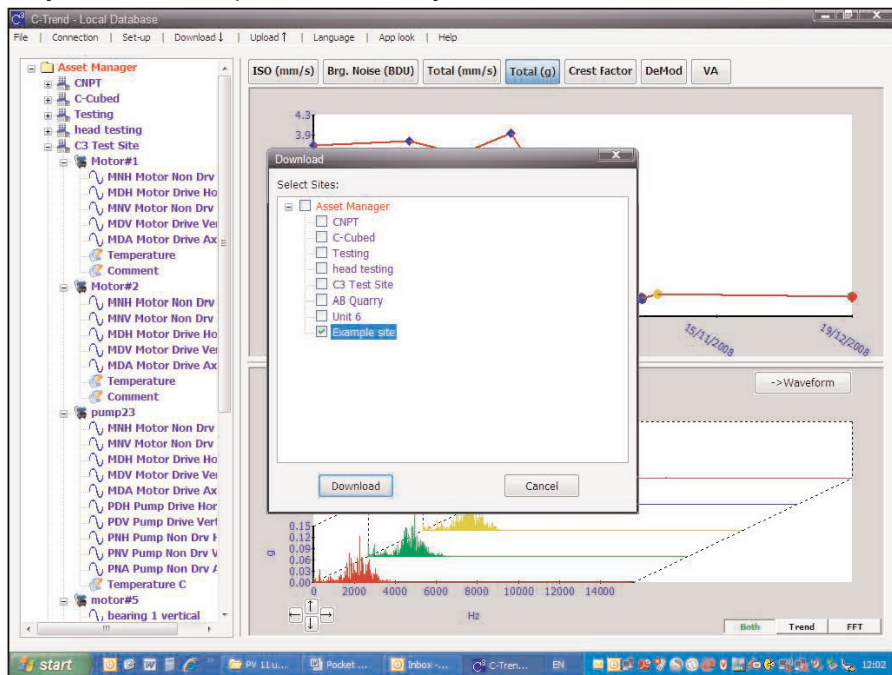
N.B. The waterfall diagram itself can be zoomed using a mouse drawn window as previously described. It can also be rotated in 3 dimensions using the PC keyboard arrow keys while the “control” key is being pressed.

5.3 Uploading and Downloading of data

Transfer of data between PocketVibrA and C-Trend is controlled from within C-Trend. This is so that only those sites that are required to be on the PocketVibrA unit are downloaded. The user selects which sites to download to form a “route” (list of assets to be monitored) when synchronisation occurs.

Choosing the sites to download is done by first of all selecting **Download** from the menu (top left of screen), which opens up a window as shown below. Checking (ticking) the boxes next to the site names will then cause those sites to be downloaded to the PocketVibrA unit.

The synchronisation process can only occur if the PocketVibrA unit is



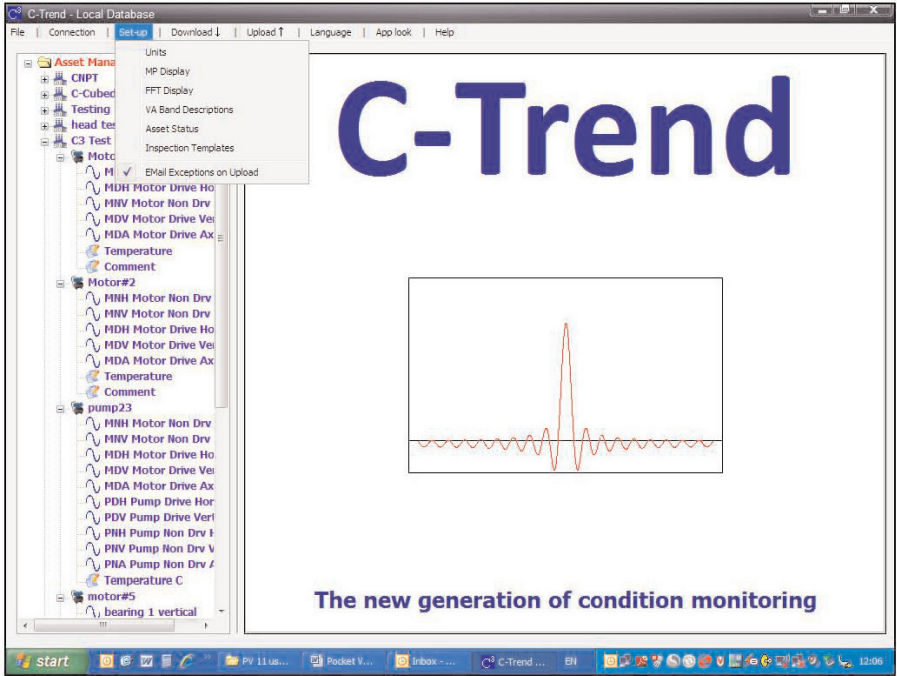
“**connected**” with the C-Trend PC (e.g. via ActiveSync using the USB docking cable). During synchronisation a drop down window is displayed that shows the current status of the synch process.

Uploading the readings from a connected PocketVibrA unit is done by selecting **Upload** from the C-Trend menu bar at the top of the screen. This works in a similar way to Download but simply fetches all new readings from the PocketVibrA unit without asking for the user to select which sites are to be synchronised.

N.B. After plugging in the PocketVibrA unit to the USB socket please allow time for ActiveSync to establish a connection (up to a minute or two) before attempting to synchronise or upload data.

5.4 System Set-up

The Set-up facility is accessed by clicking on the menu at the top right of the C-Trend™ screen.

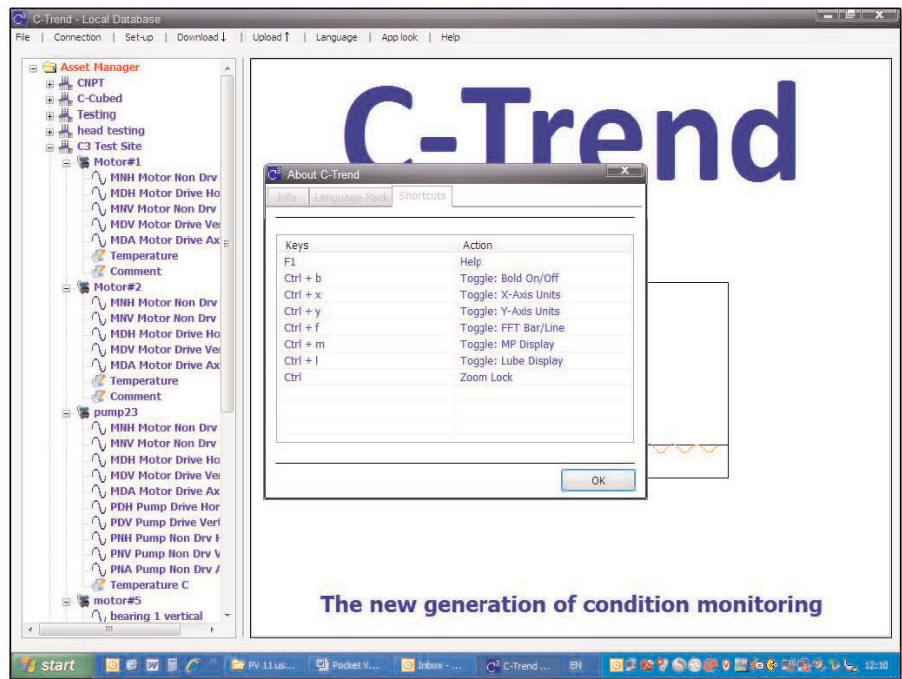


This drop down menu enables the user to do any of the following:

- Change units (Hz, RPM or CPM, mm/s or inch/s)
- Choose whether to display trend or frequency plots (or both) for measurement points
- Choose line or bar graphs for the frequency (FFT) plots and turn Intelli-FFT on or off
- Give user defined names to any of the four VA frequency bands
- Choose which parameters will be displayed in the asset status (alarm) tables
- Edit the list of predefined Inspection templates
- Turn on (or off) the emailing of alarm information after an upload of PocketVibrA readings

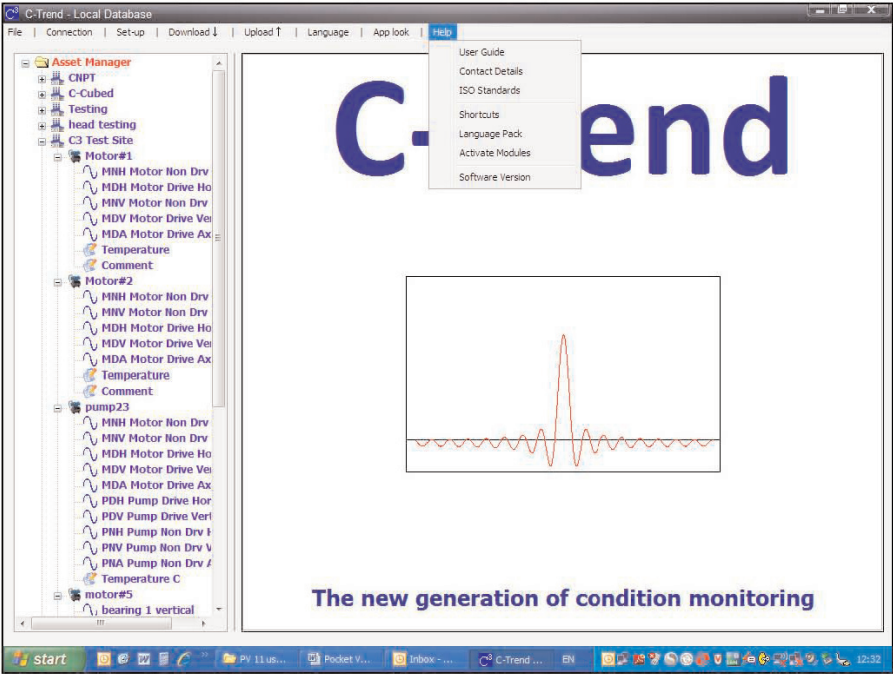
5.4.1 Short cut keys

In addition to being able to turn features on and off using the Set up menu as described above, some of the features can be switched using the PC keyboard as shown in the example screen shot above. This screen is accessed from the “Help” menu at the top of the C-Trend screen.



5.5 Help menu

The help menu (see screen shot below) gives access to information about the current version number of C-Trend, contact information for TPI Limited, short cut keys, installed language packs, activation of additional software modules (as explained later) and allows a copy of this user guide to be opened on screen.

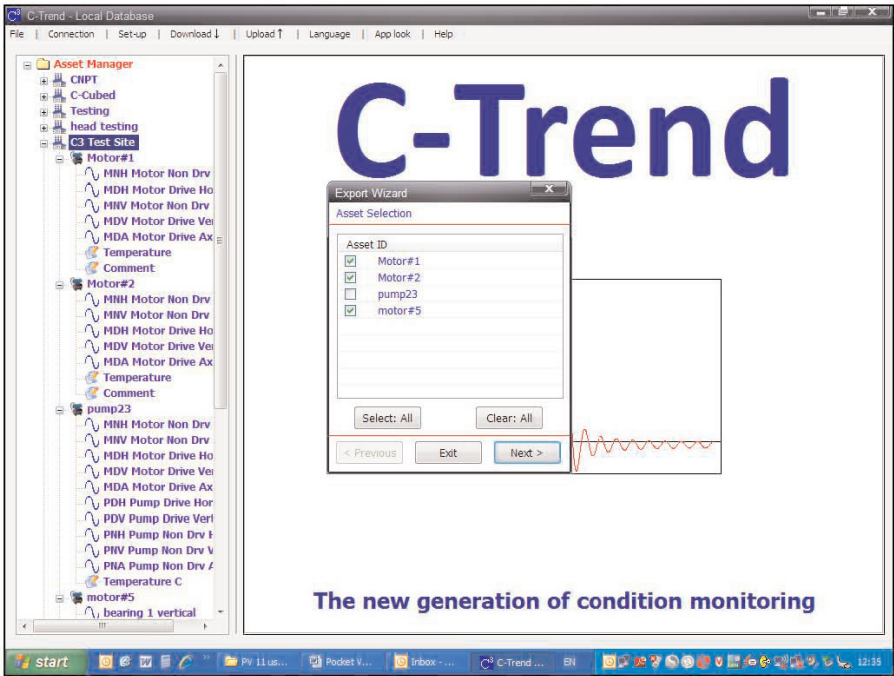


5.6 Import and Export of data

Clicking on the **File** menu (top left of C-Trend screen) allows all the data currently contained within C-Trend to be **Exported** (saved to file). This is a useful feature for making back up copies of the entire database and should be done on a routine basis to guard against data loss, due to computer failure for example.

Additionally data can be **Imported** from a file and added to the existing data within C-Trend. However it should be noted that any **conflicting data will be over-written** by the Import function and hence this feature should be used carefully.

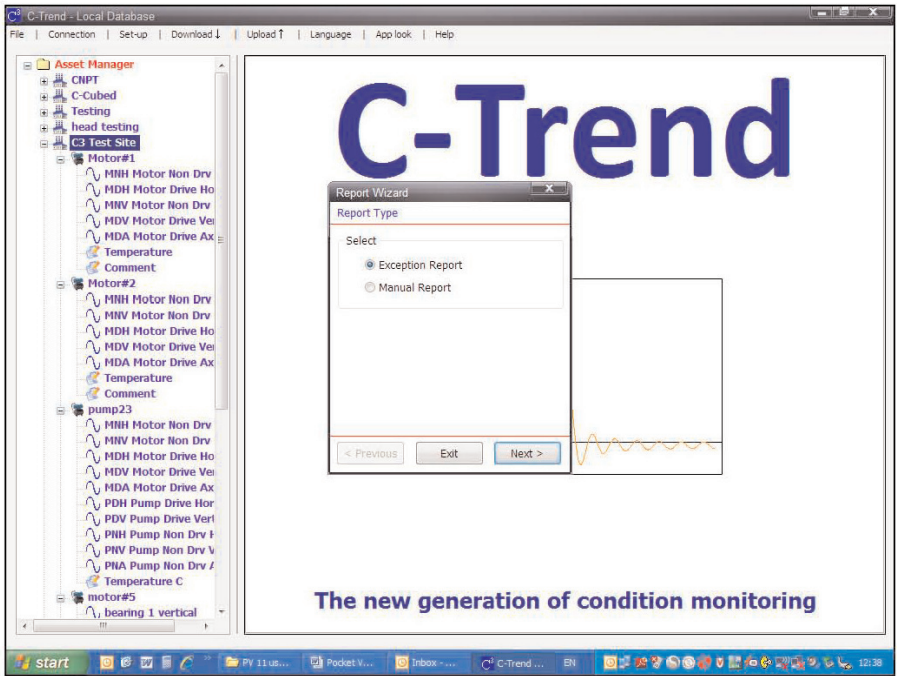
A further way to save data is to use the Export Wizard, which is accessed by right clicking on the site name (as in the screen shot shown below). This opens up a window that allows individual assets, or groups of assets, to be selectively Exported to a file. This feature is particularly useful for saving data for emailing to a vibration expert for example.



5.7 Automatic report generation

C-Trend also has the ability to automatically generate reports on a site by site basis. This is achieved by clicking on the site and selecting the **Create Report** function from the drop down menu.

The report is produced as a WORD™ document that can be edited with comments if desired and then printed or saved as a DOC file. The report is generated by the **Report Wizard** that allows the user to specify which assets are to be reported on and what status tables, trends and FFT plots are required for the chosen assets.



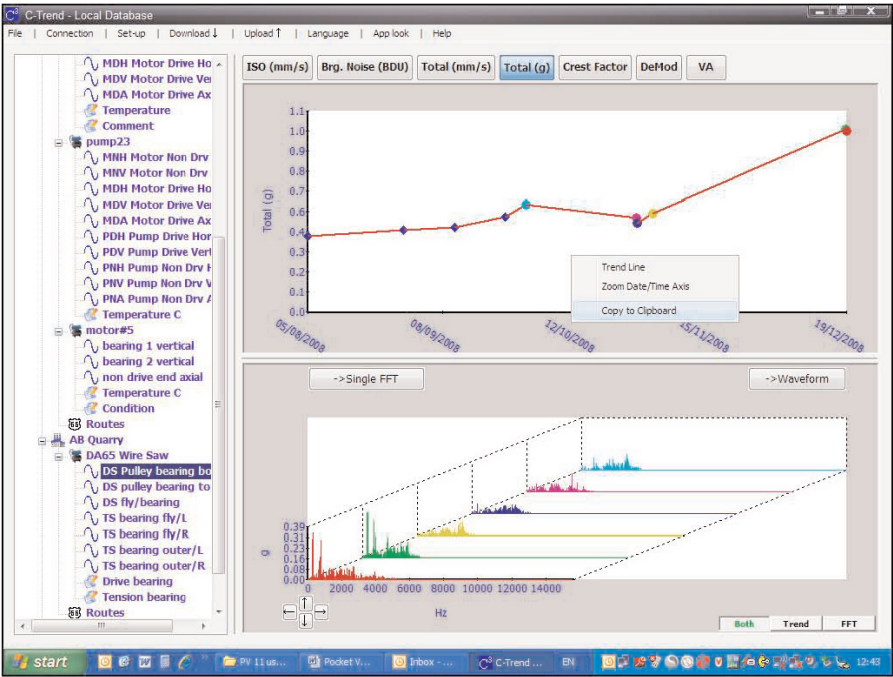
The first screen of the report wizard allows the user to specify whether the report will contain only items that are in alarm (Warnings or Critical) by selecting an **Exception Report**, or to manually specify what the report content will be. Other screens will allow the selection of what is to be reported on and the final screen of the report wizard allows the user to specify what period of time the report should cover.

N.B. The asset status tables included in the report will contain the same information as the status tables displayed in C-Trend and as selected by the user in the asset status set-up.

Tip: The Report Wizard should be used thoughtfully if reasonable length reports are to be produced. The temptation to simply tick everything should be resisted as this will generate reports of excessive length when large numbers of assets are included.

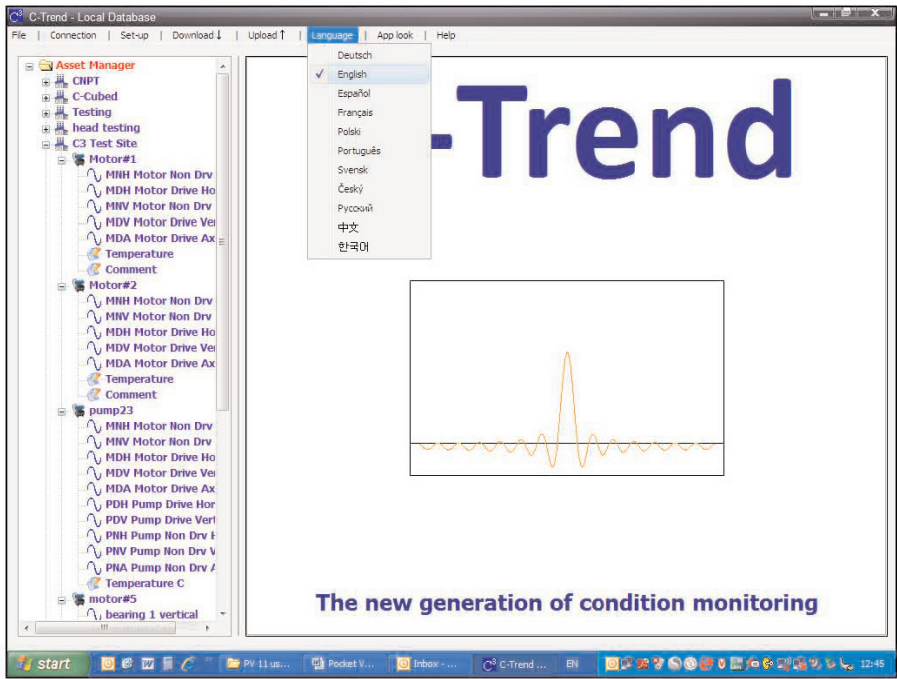
A useful tip is to start off with the minimum of information and gradually expand the size of the report by including graphs only where they are necessary. For example, by only including FFT plots when a trend plot indicates there might be a problem with a particular measurement point.

Another way to do this is to generate a report that simply consists of the asset status tables and paste in graphs that have particular relevance (e.g. where there is an alarm condition) using the **Copy to Clipboard** feature illustrated below.



5.8 Language selection

Clicking on Language on the top menu bar causes a drop down menu to appear that allows a choice of different languages to be made.



The list of available languages is continuously being expanded.

Please contact TPI to arrange to receive a language file if a particular desired language is not displayed in the drop down menu.

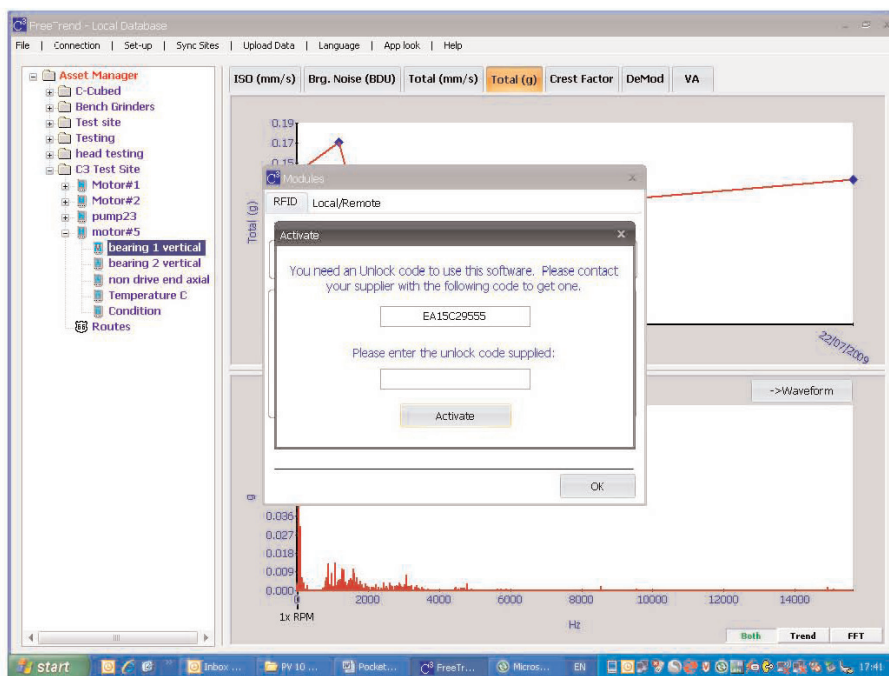
6 Software module activation

Some additional features of PocketVibrA and C-Trend are available as optional extras for a small incremental cost. These currently include **RFID** on the PocketVibrA unit, **Local/Remote Database** capability on C-Trend, **Inspections** and **Lube**.

In order to activate these features the user needs to send a code to their local distributor (or direct to TPI) that is used to generate an “unlock” code that is sent back to the customer.

To obtain the reference code that must be sent to the distributor, the user selects **Activate Modules** from the C-Trend **Help** screen and selects. After selecting the required module, the screen displays the code that has to be sent to the distributor (see screen example below).

The unlock code is then emailed back to the customer and used to activate the desired feature by typing it in on this screen.



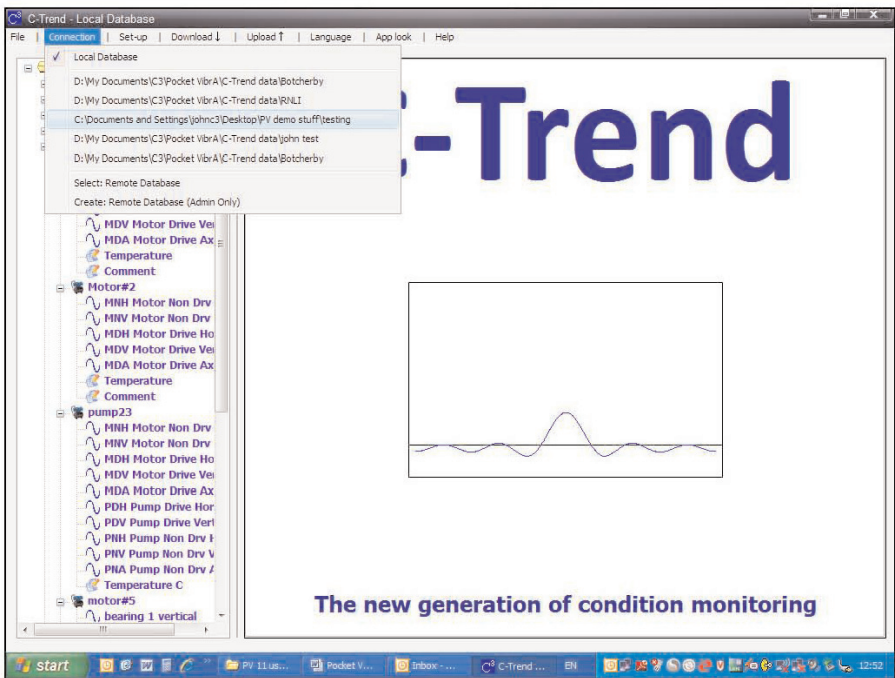
6.1 Local/Remote databases

The C-Trend local/remote database feature (if activated) is a very powerful means of organising asset data. It allows the database used by C-Trend to be switched between a local version (e.g. located on a laptop PC) and a remote database (e.g. located on a file server PC).

Data (assets and readings) can very easily be moved (imported and exported) between the two databases allowing a high degree of operational flexibility.

Examples include the use of a company wide network for storing the asset data, offering the ability for different users to access assets for data collecting and analysis purposes.

This access can be from anywhere including over the internet. Once activated, the drop down Connection menu allows the creation of remote databases and switching between them (as shown below).



7 Specifications

- o Input voltage range:
 - ICP Accelerometer +/- 2.5V
 - 3 wire accelerometer (bias =1.25VDC) +/- 1.25V
- o Absolute max input voltage: 10V DC
- o Usable frequency range: 0Hz to 15kHz
- o Dynamic range: 108dB
- o Working temperature range: 0 - 60°C

8 Revision History

ISSUE	PAGES	DATE	NOTES
1.0	25	March 15th 2005	First Issue
2.0	37	Nov 1st 2006	Version 5
2.1	38	14.12.2006	Added Active Sync details
2.2	39	12.01.2007	PDA Reset info plus general edits
3.0	49	26.11.2007	Updated to Version 7.06
4.0	69	23.07.2009	Updated to Version 10.04
5.0	100	21.10.2010	Updated to version 12.01

Appendix One – Example Site Report

The following example report has been generated using the report wizard and by selecting two assets (Grinder#1 and Grinder#2). The report wizard has been asked to include Status tables, Total vibration (g) and user defined tags for the two assets.

User Guide: Version 2

PocketVibrA Lite

Vibration Monitoring & Analysis



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A2.1 OVERVIEW

PocketVibrA Lite is a simple to use single channel vibration monitoring and analysis tool based around an extremely rugged (IP67) Pocket PC.

The system allows easy display of vibration signals, and automatically performs vibration analysis functions to help diagnose faults such as unbalance, misalignment, looseness etc.

The system is designed to enable a user to take vibration measurements from assets (e.g. pumps, motors, fans and bearings). The unit displays vibration frequency plots and time waveforms allowing vibration severity and bearing condition to be monitored.

The basic PocketVibrA Lite system comprises the following components:

- Rugged IP67 Pocket PC (TDS Nomad)
- Battery charger (mains power supply unit)
- Compact Flash accelerometer interface card (fitted inside Pocket PC) and IP67 connector in extended end cap.
- C-Cubed "smart" accelerometer and 1.5 metre connecting cable.
- PELI (IP67) Carrying Case.
- Installation software program on CD that installs PocketVibrA Lite for running on the Pocket PC.

A2.1.1 Getting started

Turning the PocketVibrA Lite unit on is achieved simply by giving the power on/off button a short (less than 1 second) press.

A slightly longer (e.g. greater than 1 second) press of the power button will turn the backlight on or off.

N.B. if it is necessary to reset the PocketVibrA Lite this can be achieved simply by holding down the on/off button for approximately 5 seconds. The PocketVibrA Lite will give an audible “bleep” as it performs a power on reset and no data will have been lost.

Resetting the Pocket PC is not something that should need doing very often but may be required if, for example, the battery has been allowed to fully discharge whilst a program was still running.

A2.1.2 Setup

The unit comes fully configured with an appropriate end cap connector to take a C-Cubed ‘smart’ accelerometer. This should be plugged in prior to operating the unit.

A2.1.3 Power Supply

The system takes its power from a rechargeable battery that is contained within the unit, which should always be suitably charged prior to use.

N.B. It is recommended that the unit is charged fully prior to first use.

A2.1.4 Sensor selection

PocketVibrA Lite is suitable for use with the C-Cubed range of ‘smart’ accelerometers only. The use of any other sensor combination may cause the unit to malfunction and invalidate the guarantee.

A2.1.5 Service

The PocketVibrA Lite system contains no user serviceable parts. In the unlikely case of malfunction, please return the complete unit to your supplier for repair.

A2.2.1 Installation

PocketVibrA Lite comes with its software pre-installed on the unit. However, if it is ever necessary to re-install the software (during a software upgrade for example) the following procedure should be followed.

First make sure you have the latest version of the program “**Active Sync**” available on your desktop or laptop PC. Active Sync can be downloaded free of charge from the Microsoft

website: <http://www.microsoft.com/windowsmobile/en-us/help/synchronize/activesync-download.msp>

Connect the PocketVibrA Lite unit to the laptop or desktop PC with a USB cable. This will cause Active Sync to automatically run and “connect” the PocketVibrA Lite with the PC.

Now you can run the PocketVibrA Lite install program (e.g. from the CD supplied) on the laptop or desktop PC.

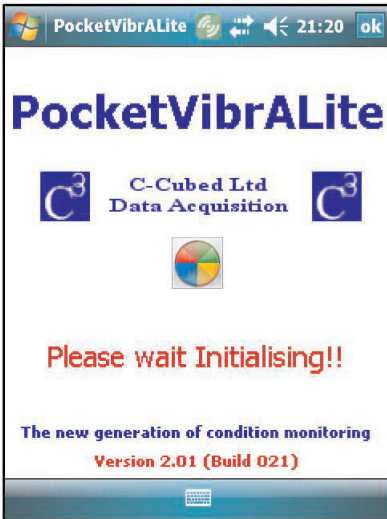
The PocketVibrA Lite program will then be installed to the PocketVibrA Lite unit from the PC and can then be found on the Programs menu of the PocketVibrA Lite.

N.B. PocketVibrA Lite can be configured to auto-start whenever the Pocket PC is turned on. Auto-start can be turned on or off by holding down the UP arrow cursor, key and simultaneously pressing the Enter key ().

A2.2.2 Software Updates

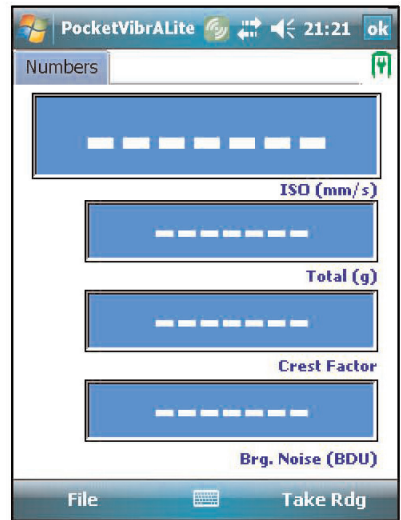
C-Cubed operates a policy of continuous product improvement and releases free software updates for its products from time to time. If you are updating a system that has had a previously installed version of PocketVibrA Lite, the installation program must first of all uninstall the existing software before the new version can be installed. You will be prompted whether you wish to do this when installing updates and you should answer “yes”.

A2.3.0 Opening Menu

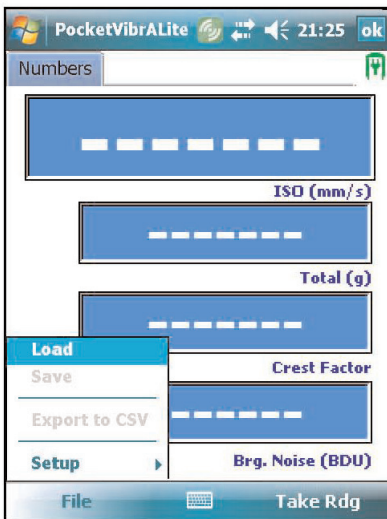


The opening display screen (left) is shown briefly while PocketVibrA Lite initialises. This screen also shows the version number of the software at the bottom of the screen.

This screen is followed closely by the readings screen, which will look like the screenshot below until a reading is taken.



The bottom line of the display shows a menu bar with two options that can be selected either by tapping the screen or by pressing the “soft” keys (-) that are located immediately below the screen.



The two menu options available are **Take Rdg** (take reading), and **File** which activates the menu shown in the screen shot left.

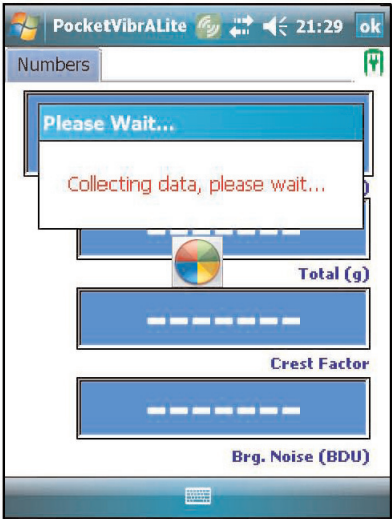
Until a reading is taken the only two menu options that are active are **Load** and **Setup**. These functions are explained in a later section of this guide.

A2.3.1 Taking a reading

Taking a reading can be achieved either by touching **Take Rdg** on the menu bar on the screen, pressing the right hand softkey (-) or by pressing the Enter key ().

As long as an accelerometer is connected a reading will then be taken, a process that lasts a few seconds.

N.B. during this time it is important not to move the accelerometer to ensure a valid reading is obtained.



If the accelerometer is not connected an error message will be displayed.

It is important to ensure that the measurement is taken with the accelerometer mounted on a flat surface on the equipment being monitored. The magnet must not be loose and should be tightly screwed to the accelerometer (the use of some thread lock should help ensure the magnet does not come loose from the accelerometer while it is in use).

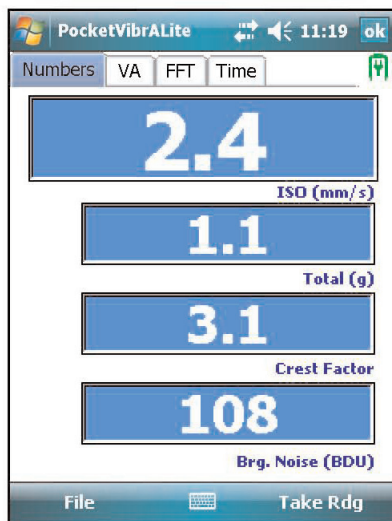
A2.3.2 Vibration readings

A2.3.2.1 Numbers screen

Once a vibration reading has been taken, the display will initially show four values, as shown in the screenshot on the right.

- ISO value
- Total g (acceleration)
- Crest factor
- Brg. Noise

These readings are explained in detail below with some examples of what they actually mean:



The **ISO value** (in mm/s) is the large number at the top of the screen, which is the RMS (average) of the vibration velocity in the frequency band 10Hz (600 RPM) to 1kHz (60,000 RPM), as specified by the ISO standard¹.

Total acceleration – this is the RMS (average) value of the total vibration in the frequency range 10Hz to 15kHz (the upper limit of the PocketVibrA Lite frequency response). This reading is shown in units of g (Earth's gravitational constant, where $g = 9.81 \text{ m/s}^2$).

Crest Factor – this is a measure of the shape of the vibration waveform and is defined as the peak of the waveform divided by its RMS (average) value. Crest Factor is sometimes used as a measure of the quality of a machine's bearings. This is based on the fact that high Crest Factor is often associated with high frequency bearing noise as illustrated in the following diagrams.

The following diagram (Figure 1) shows a vibration waveform with a crest factor of 1.47, which is very close to that of a pure sine wave. Crest factor can never have a value lower than 1.414, which is the value for a pure sine wave.

¹ISO 10816-1:1995. Mechanical vibration -- Evaluation of machine vibration by measurements on non-rotating parts

This particular vibration waveform was taken from a brand new bench grinder with good bearings and shows a waveform with a period of 0.02 seconds, which is due to run speed vibration at 50Hz (3,000 RPM). There is very little high frequency bearing noise visible on the waveform.

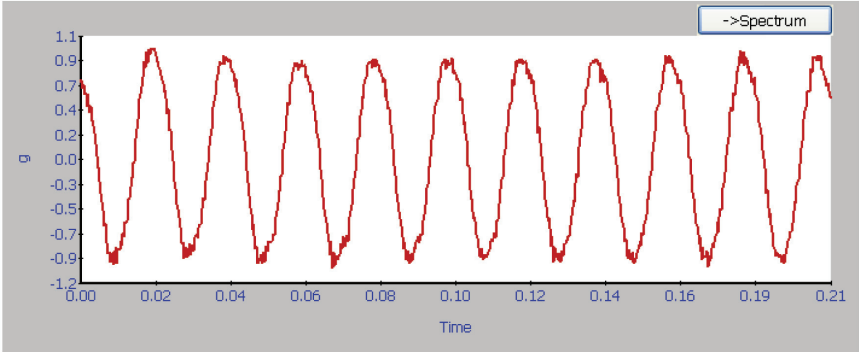


Figure 1 – vibration waveform from a “good” bearing

By comparison the waveform shown below (Figure 2) has a crest factor of 8.83 and shows noisy “spikes” typical of worn bearings. This waveform was in fact taken from a deliberately damaged bearing on an identical bench grinder to the one producing the waveform in Figure 1.

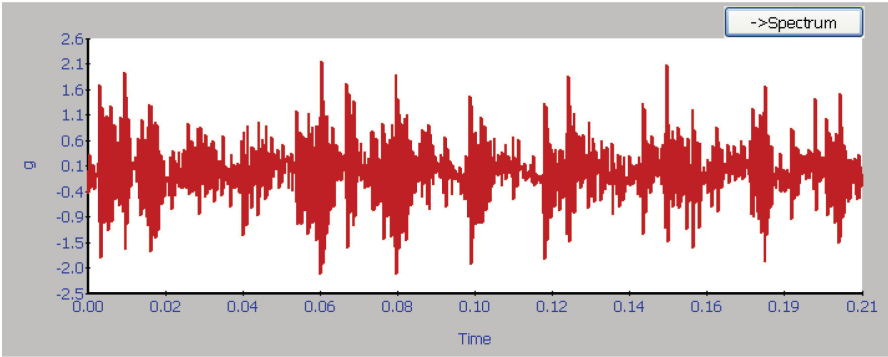


Figure 2 – vibration waveform from a damaged bearing

You can just about see the run speed vibration waveform (still with a 0.02 second period) but it is “buried” underneath all the high frequency bearing noise.

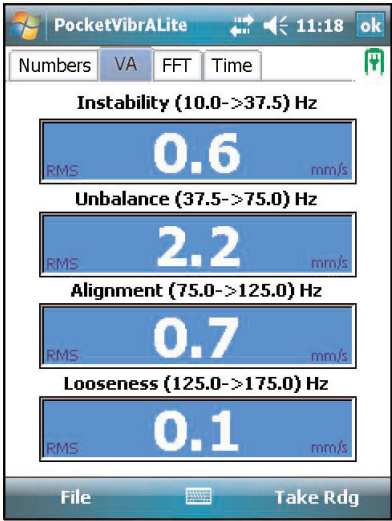
Brg Noise - the final reading shown is the value of high frequency noise in Bearing Damage Units (BDU), where 100 BDU corresponds to 1g RMS vibration. This is a measure of the wear on the bearings in the equipment being monitored. The higher the number the more worn is the bearing.

1g of vibration (100 BDU) generally corresponds to a high level of bearing noise and so can be considered indicative of a damaged bearing. In other words it may be helpful to think of the Bearing Noise figure as being very roughly equivalent to “**percentage**” of bearing wear.

For example the bearing waveform shown in Figure 1 above for a good bearing gave a Bearing Noise figure of 1.66 BDU.

However the Bearing Noise figure for the damaged bearing waveform in Figure 2 above was 101.2 BDU.

A2.3.2.2 Vibration Analysis



Moving across the tabs at the top of the screen from **Numbers** to **VA** (vibration analysis) brings up a display similar to that shown on the left, which shows the readings of vibration velocity broken down into each of 4 bands.

Moving between the display tabs can be achieved by using the cursor arrows or simply by touching the desired tab.

The display shown above shows the names and frequency ranges of the bands that are all based on multiples of the specified **Running Speed** (50Hz in this case).

N.B. in order to perform a vibration analysis it is important that the running speed of the machine is entered correctly. This is done in “Setup” as described in Section 3.3 of this guide.

The frequency ranges of the bands are based on the following multiples of running speed²:

Instability: 10Hz (600 RPM) up to 0.75 times running speed

Unbalance: 0.75 to 1.5 times running speed

Alignment: 1.5 to 2.5 times running speed

Looseness: 2.5 to 3.5 times running speed

The following descriptions of these frequency bands show why they are based on these particular frequencies.

² Multiples of running speed are often referred to as “orders”

Instability:

Vibration in the frequency band 10Hz (600 RPM) up to 0.75 times running speed means the vibration is occurring at less than the running speed of the machine. This not usual for a normal machine and may be an indication of an electrical fault, looseness, rubbing or some such problem that is causing uneven running. Because of the difficult of classifying them separately, these types of fault are often grouped together into the category of Instability.

Unbalance:

The level of vibration in the frequency band 0.75 to 1.5 times running speed is usually indicative of how well balanced the machine is. A large vibration at the running speed indicates that the machine is out of balance. However even a very well balanced machine will usually show some vibration at the running speed but this figure should ideally be quite low (e.g. typically less than 2 mm/sec for a medium sized machine).

Alignment:

Vibration in the frequency band 1.5 to 2.5 times running speed is a possible indication of misalignment. This is based on the fact that shaft misalignment can result in a double peak in the waveform due to there being two different centres of gravity (one from each shaft). In other words the accelerometer picks up a peak as each centre of gravity passes by and hence there will be two positive and two negative peaks each revolution of the shaft. This will typically give rise to a vibration signal at double the running speed of the machine.

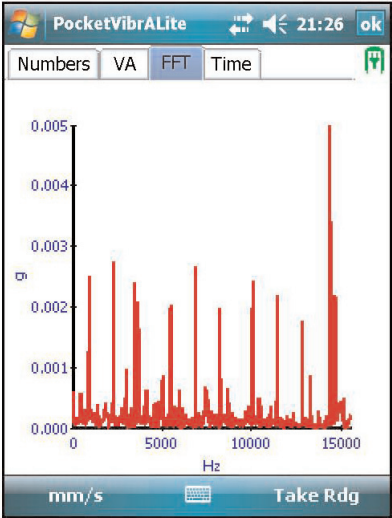
Looseness:

Vibration in the frequency band 2.5 to 3.5 times running speed is a possible indication that something may be loose (e.g. loose mounting bolts, weak foundations etc) as it is not usual to see third order vibration in a machine unless there is some structural looseness that is being “excited” by the vibration of the machine.

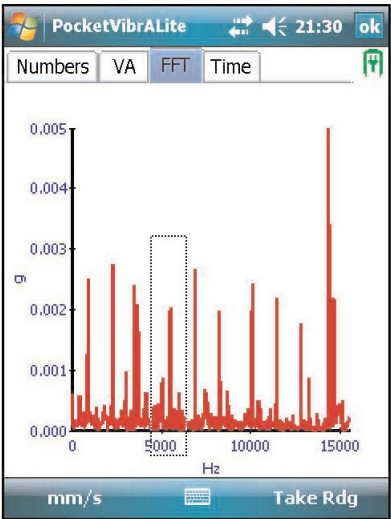
A2.3.2.3 FFT (frequency plot) screen

Moving across to the **FFT**³ screen tab brings up a frequency plot of the vibration reading. Both vibration velocity (in mm/s) and acceleration (in g) can be displayed.

Switching between the two is chieved by touching the appropriate units displayed on the menu at the bottom left of the display, or by pressing the left hand soft key (-).

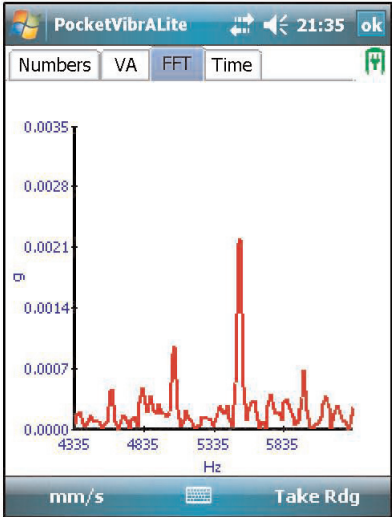


It is also possible to **zoom** into the FFT display. This is done by touching the screen and dragging a zoom box from the top left to the bottom right hand corner as shown in the example display on the left.



The screen shot right shows the effect of zooming into the zoom box drawn in the example shown above.

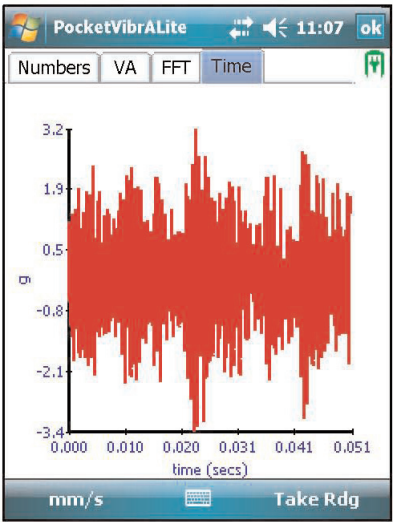
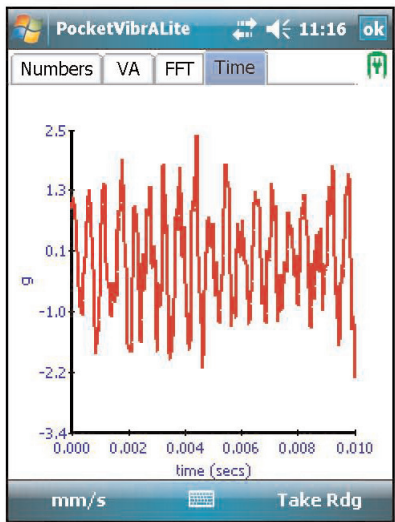
Tapping the screen twice in quick succession (double tap) returns the screen to the normal display.



³ FFT stands for Fast Fourier Transform and is a mathematical technique for calculating the frequency spectrum of a vibration waveform. FFT is often used as an abbreviation for a frequency spectrum plot.

A2.3.2.4 Time (waveform) screen

Moving across to the Time screen tab brings up a display of the time waveform of the vibration reading. Again, both vibration velocity (in mm/s) and acceleration (in g) and the display can be switched between them in exactly the same way the FFT display.



It is also possible to zoom into the time waveform display in exactly the same way as for the FFT zoom feature just described. Un-zooming is also achieved with a double screen tap.

A2.3.3 File (Set up) Menu

The File (or Setup) menu is entered from the main menu screen either by touching **File** on the menu bar on the screen, pressing the right hand softkey (-) as previously explained in Section 3.0

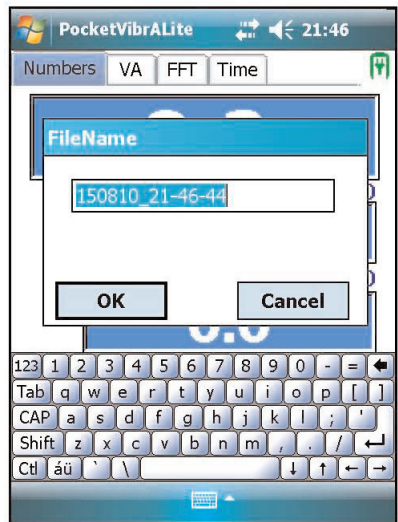
The options available under this menu include:

- Load – loads in the values from a previously saved reading
- Save – save a reading into the PocketVibrA Lite memory
- Export to CSV – save a reading as an Excel compatible (comma separated variable) data file
- Setup – customisation and configuration menus

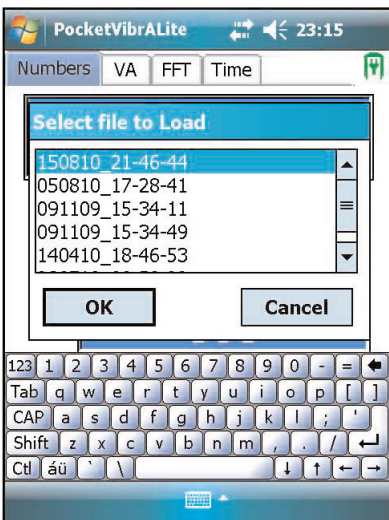
A2.3.3.1 Save

Selecting this menu option causes a dialogue box to open that allows the user to save the current reading into a file with the displayed filename.

The default filename is the date and time the reading was saved. The filename can be edited however to anything else the user prefers.



A2.3.3.2 Load

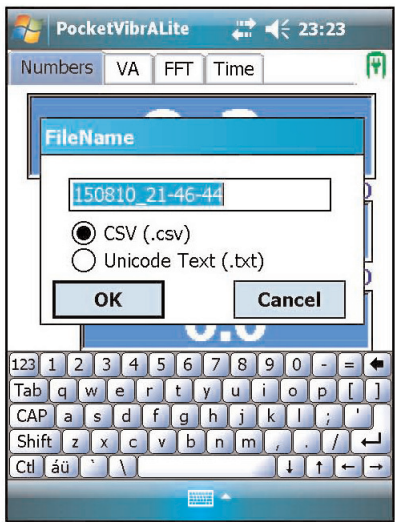


Loading a previously saved readings file is achieved by selecting **Load** from the File menu. This opens a dialogue box like that shown in the example screen shot left, from which the user can select the previously saved readings file.

The reading can then be examined in the same way as when it was first taken via the Numbers, VA, FFT and Time display tabs.

A2.3.3.3 Export to CSV

It is also possible to save readings in an Excel spreadsheet compatible form as a comma separated variable (CSV) file.



Selecting **Export** to CSV from the File menu brings up the dialogue box shown left, where the user can input the file-name for the saved CSV file. The default filename is the date and time the reading was taken but this can be edited by the user.

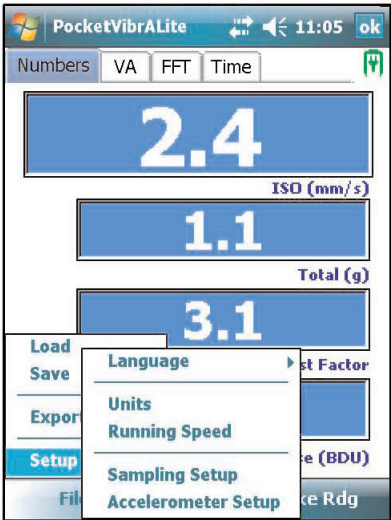
The filename extension will be either .csv or .txt depending on the option chosen in the dialogue box. Unicode Text is available for saving files that contain non-standard language codes that will not load into CSV files for example.

A2.3.3.4 Setup

Selecting **Setup>** from the File menu causes a further menu to pop up as shown in the screen shot right.

This menu contains the following sub menu options:

- Language
- Units
- Running Speed
- Sampling Setup
- Accelerometer Setup

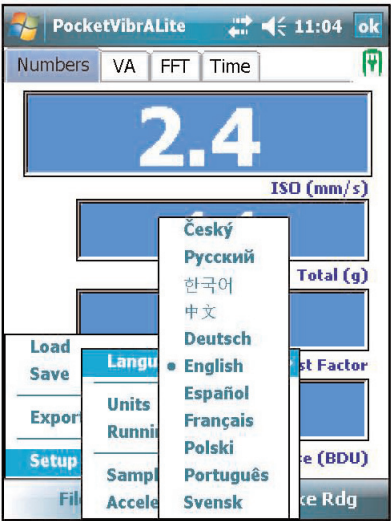


Each of these menu options will be explained in detail in the following sections.

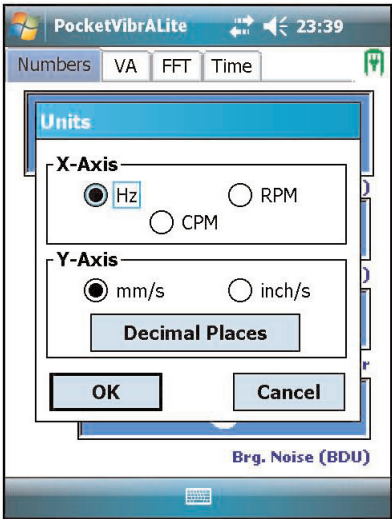
A2.3.3.4.1 Language

PocketVibrA Lite can be run in a variety of different languages that are selected from the pop-up language menu shown in the example screen shot right.

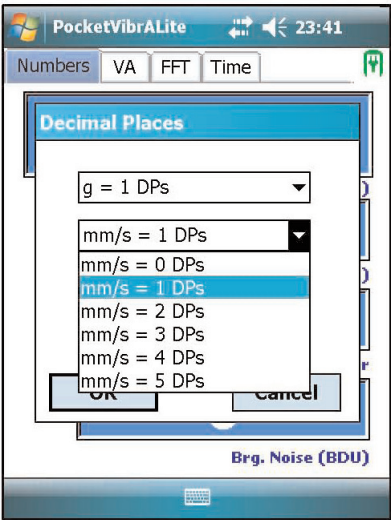
If you require a particular language that is not shown please get in touch with C-Cubed, as it may be that we can arrange for you to receive an update containing that particular language.



A2.3.3.4.2 Units

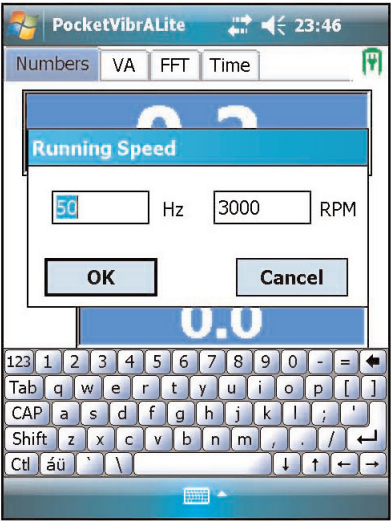


The **Units** menu (shown left) can be used to change the displayed x and y axis values.



The units menu can also be used to set the number of decimal places that are displayed on the Numbers screen up to a maximum of 5 decimal places.

A2.3.3.4.3 Running Speed



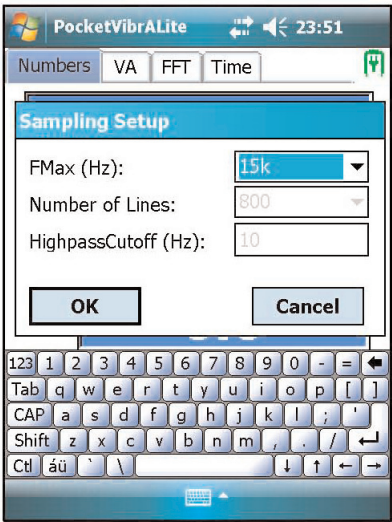
In order to perform a vibration analysis (VA) it is important that the running speed of the machine is entered correctly.

The running speed can be entered and displayed in units of Hertz⁴ (Hz) or RPM⁵. Entering the value as Hz causes the RPM value to be filled in automatically and vice versa. The conversion factor is 1 Hz equals 60 RPM.

A2.3.3.4.4 Sampling Setup

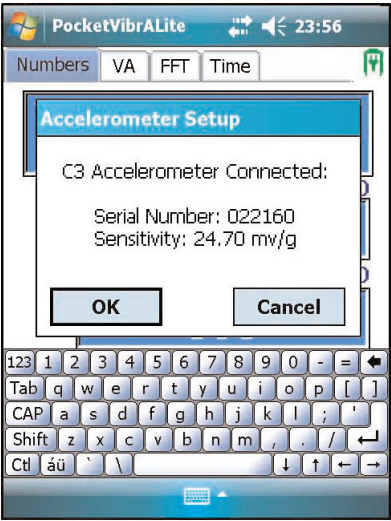
Choosing **Sampling Setup** from the File menu opens the dialogue box shown right. The user has the ability to set Fmax to either 15kHz (default value) or 1kHz if higher frequency resolution is required.

The number of lines displayed in the frequency spectrum is fixed at 800 and the high pass cut off frequency (Fmin) is fixed at 10Hz (600 RPM). 4 Hertz are also sometimes referred to as cycles per second.



⁴ Hertz are also sometimes referred to as cycles per second.
⁵ Revolutions per minute (RPM) are sometimes also referred to as cycles per minute (CPM)

A2.3.3.4.5 Accelerometer Setup



Selecting **Accelerometer Setup** from the setup menu causes the PocketVibrA Lite to read out the contents of the memory chip in attached accelerometer.

This is then used to display the serial number and sensitivity (in mV/g) of the connected C-Cubed accelerometer.

A2.4 Specifications

- o Input voltage range:
 - 5 wire accelerometer (bias =1.25VDC) +/- 1.25V
- o Absolute max input voltage: 10V DC
- o Usable frequency range: 10Hz to 15kHz
- o Dynamic range: 108dB
- o Working temperature range: -20°C to +60°C

A2.5 Revision History

ISSUE	PAGES	DATE	NOTES
1.0	16	1st September 2008	First Issue
2.0	23	16th August 2010	Updated to version 2