SMART PRODUCTS FOR SMART PEOPLE

# VIBER X4™

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# Instrument Manual

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**Table of Contents**

**Instrument basics**

This section contains basic information about how to operate the instrument and the meanings of the different keys and symbols.

| | |
|---|---|
|  | ON/OFF Used to switch the instrument ON and OFF. |
|  | OK (Enter) Used to start a measurement, resume the measurement from Hold status, confirm an action or go forward in a menu. |
|  | ESC (Escape) Used to cancel an action or to return to the previous menu. |
|  | Arrows (up, down, left, right). Used to change the selected items or move the cursor depending on the context. |
|  | Menu Used to access the menu shortcut window. It is also used to save changes in edit controls or to select an item depending on the context. |
|   | AUX Used to stop a measurement. |
|   | Function keys (F1, F2, F3) Used to select an action in the shortcut bar displayed above the keys. These are also used together with the Ctrl key to select actions shown in the second (blue) row of the shortcut bar. |
|   | Ctrl Only used together with other keys (mainly function keys) to generate alternative key codes. |

**Connectors and sensors on front and rear sides.**


From the left in the picture:
Tacho connector (with yellow dot): Used to connect a tacho sensor to measure rotation speed and to perform balancing.

Temperature sensor (below) and laser module: Used to measure the temperature of an object by pointing the laser beam at the object.
Note that staring at the laser beam can damage your eyes.

Vib input (with red dot): Used to connect different types of sensors to measure vibration and perform balancing.

From the left in the picture:
USB-C connector: Used to connect the VIBER X4™ to a PC to transfer files or to connect to a battery charger.

Audio connector: Used to connect a headphones connector with a stereo 3.5mm plug.

**Main menu description**

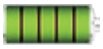
• Current date and time.

•  Audio. Only shown when the audio function is enabled.

•  Mute. Shown when mute is enabled while using audio.

•  Quick charger. Shown when charging with the original VMI quick charger.

•  Charger. Shown when using common chargers with a 5V output.

•  Battery. Each segment in the picture corresponds to 20% battery capacity.

•  Battery. The segments turn yellow when only 40% battery capacity remains.

•  Battery. The segment turns red when only 20% battery capacity remains.

• Menu description.

• Menus icons. Various menus included in the main menu.

• Model number.

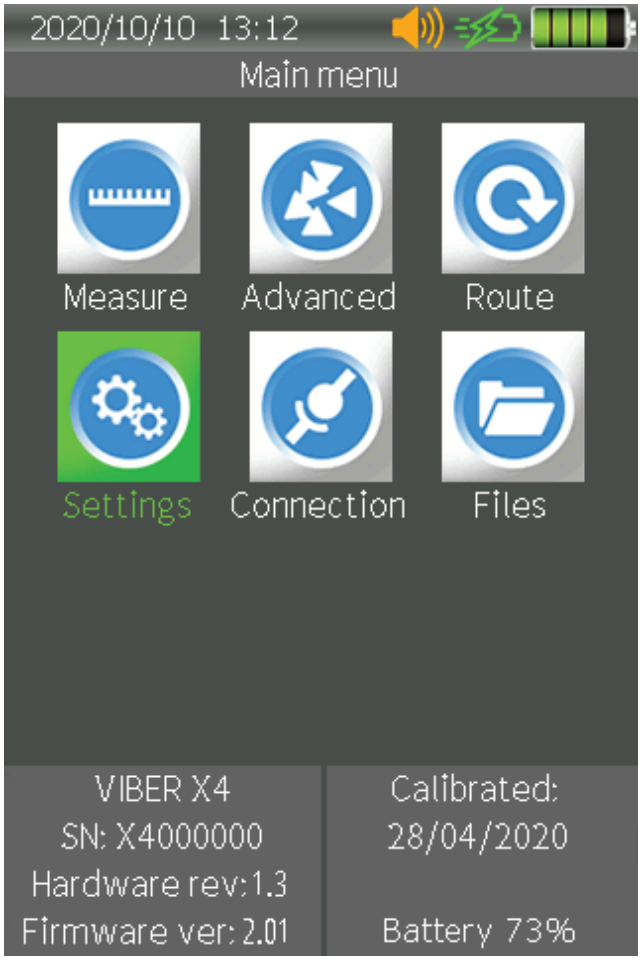
• Serial number.

• Hardware version number.

• Firmware version number.

• Calibration date.

• Percentage battery capacity remaining.



**Instrument settings**

• Tools. Check the instrument functions.

• General. Set the general instrument parameters.

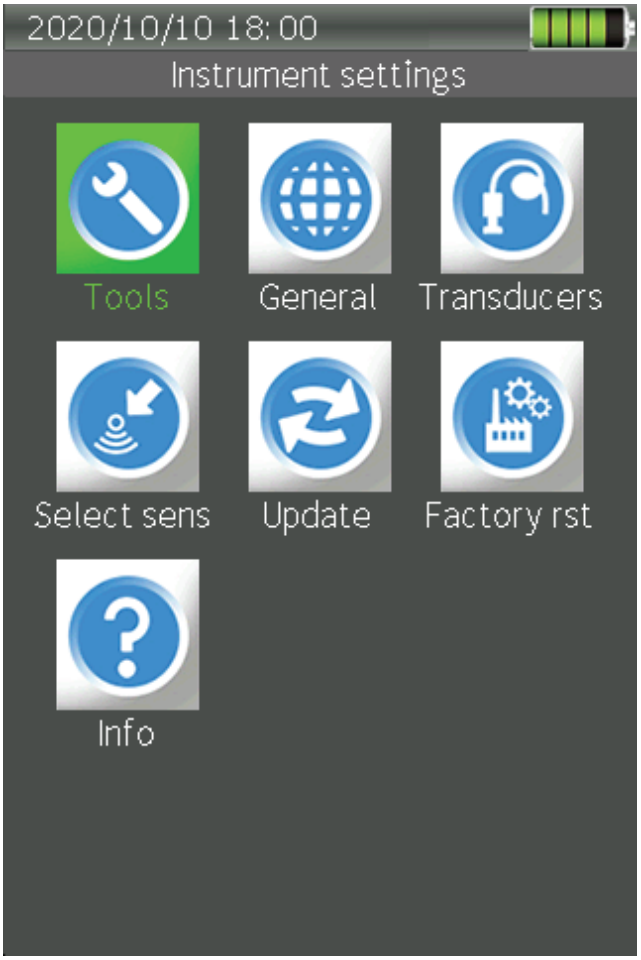
• Transducers. Edit the used transducer.

• Select Sensor. Choose which transducer is to be used.

• Update. Update the instrument firmware and applications.

• Factory Reset. Restore default settings.

• Info. Information regarding the running applications and resources.

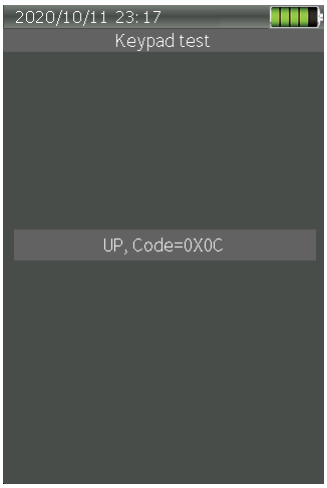


## Tools

This menu contains various tools for checking the functionality of the keypad, the display and Bias measurement.

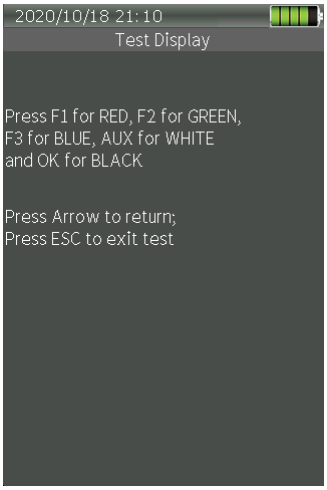
## Keypad

This tool performs a keypad test. Every time you press a key, the key name and the corresponding key code will be shown. Press ESC to exit the test.




## Display

This tool performs a color display test. You can check if the screen colors are as expected and if any pixels are defective.
Press the F1, F2, F3, AUX and OK keys to change the fill color to red, green, blue, white or black. Press ESC to exit the test.

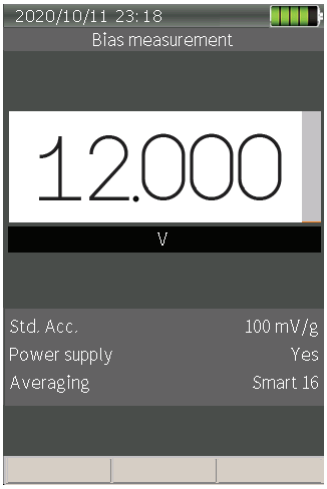



## Bias

This tool is used to check for transducer or cable faults.

When using the accelerometer, if the value is low and possibly close to zero, it means that there is a short circuit in the transducer or cable. If the value is high and close to the value of the power supply, it means that there is a break in the transducer or cable.

When using displacement transducers, this tool can be used to adjust the proper position, usually when the bias reaches half of the supply voltage.



**General settings**

Use the arrows and the OK key to change and save values.

**• Set date**

Set the date, which is also used whenever data is stored.

**• Set clock**

Set the clock, which is also used whenever data is stored.

**• Unit system**

Depending on this setting, the measuring units available in different menus will be restricted by the system selected.
For example: For vibration velocity measurements, the Metric setting uses mm/s as the measuring units while the Imperial System setting uses in/s.


**• Language**

The default language is English, but almost any language can be installed. To set a new language, first make sure you have placed the new language file in the SYSTEM folder, then go to the Update menu and Update language. You can then change the language.

**• Backlight off time (sec)**

The time (seconds) from the last key being pressed by the user until the LCD backlight turns off automatically to save power. You can select from Never, 10, 30, 60, 120 and 300 seconds.

**• Auto off time (min)**

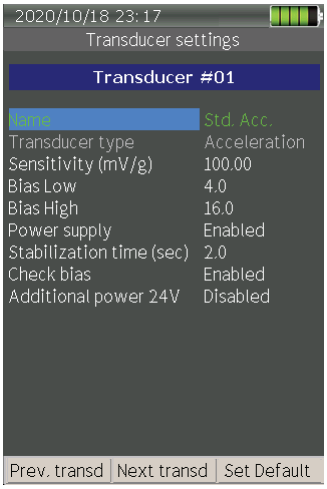
The time (minutes) from the last key being pressed by the user until the instrument shuts down to save power. You can select from Never, 1, 30, 60 and 120 minutes.

**• Backlight level**

This is used to set the backlight level in which the instrument starts.

## Transducers

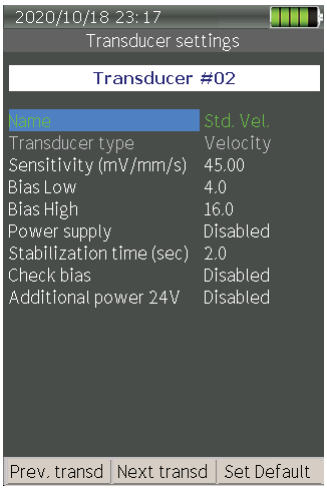
In this menu, you can edit a list of sixteen transducers which can be used for the measurements. The first three positions are prepared for accelerometer, velocity and displacement sensors.




**• Name**
Transducer description [max 15 characters]. This will appear whenever the program displays transducer characteristics or asks for transducer selection.

**• Transducer type**
Transducer type. This can be Accelerometer, Velocimeter, Displacement or Process AC.

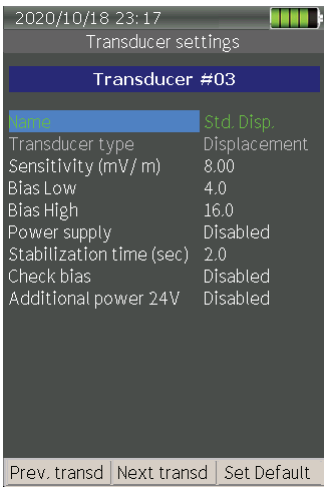
**• Sensitivity**
Transducer sensitivity, in mV/Unit. Notice that the unit may be different depending on the type of transducer. The value can be set from between 1 and 10000.




**• Bias Low**
The lowest bias voltage accepted. Used to determine if the transducer works prop- erly if the Check bias option is selected. The set value can be between -24V and 24V.

**• Bias High**
The highest bias voltage accepted. Used to determine if the transducer works prop- erly if the Check bias option is selected. The set value can be from -24V to 24V.

**• Power supply**
The instrument will supply a current of 4 mA (at max 24V) to the transducer, if this is enabled by the setting.

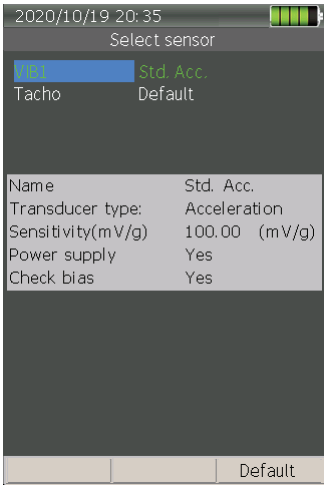



**• Stabilization time (sec)**
The minimum time to wait for a transducer to be stable after power is turned on. This can be between 0.5 and 10 seconds.

**• Check Bias**
The instrument will measure and compare the bias voltage with the Bias Low and Bias High values. If the measured bias is lower or higher than the set values, the instrument will indicate a transducer error.

**• Additional power 24V**
This enables a separate 24V supply to the transducer.

**• Function keys**
F1 previous transducers, F2 next transducer, F3 default settings.




**Select sensor**

This menu contains configuration settings for Vib1 and tachometer inputs. The settings will apply to all measurements. In most measurement settings, this menu is accessible by the Function key F1.

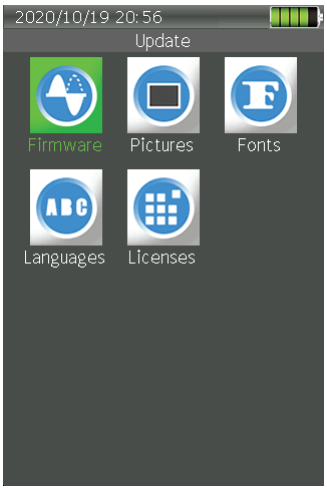
**Tacho Idle** This setting is to configure when the tachometer will trigger each rotation. When Low is selected, the leading edge of the reflective tape will initiate the count and when High is selected, the trailing edge will trigger the count.

**Update**

This feature allows you to update different applications to the latest versions. A list of all current versions of applications can be found in the Info menu.
The latest update file must be placed in the SYSTEM folder on the instrument's memory card before updating.

**NOTE 1** Connect the battery charger before starting an update to avoid any problems due to a sudden power failure (low battery level).

**NOTE 2** The instrument MUST be restarted after updating in order to run the new firmware or application.




**Firmware**

This updates the instrument's main firmware. Choose the latest version in the list if you have more than one file and press OK to start updating.
The file extension is: PRG Example: XV4_V201.PRG.

**Pictures**

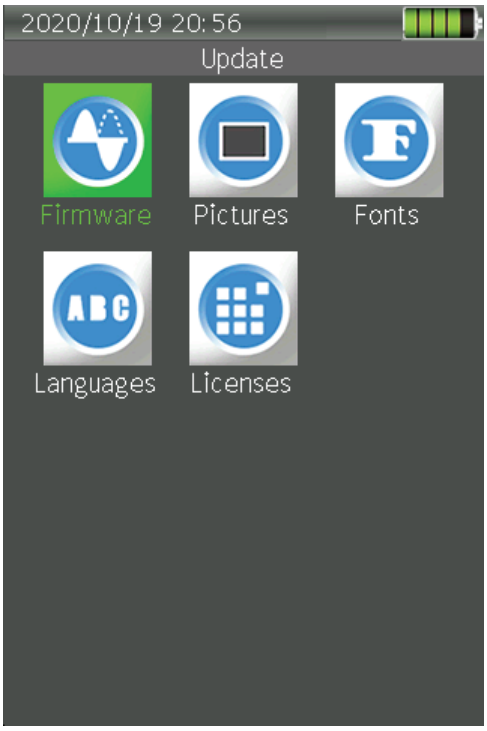
This updates the instrument's pictures and icons. Choose the latest version in the list if you have more than one file and press OK to start updating.
The file extension is: BIN Example: X4P_V105.BIN.

**Fonts**

This updates the instrument's fonts that are used for different languages. Choose the latest version in the list if you have more than one file and press OK to start updating. The file extension is: BIN Example: X4F_V120.BIN.

**Language**

This updates the instrument's language. The instrument's default language is English but other languages can be easily installed using this feature and changes in the general settings menu.
Select the desired language file from the list if you have more than one file and press OK to start updating.
The file extension is: LNG. For example, the Swedish language file is SWEX4003.LNG.




**Licenses**

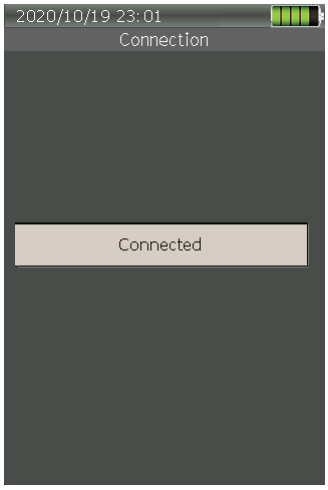
This updates the instrument's licenses. This file can be easily received via e-mail and installed afterwards to access several new functions. Choose the file and press OK to start updating. The file name is always the same as the instrument's serial number.
The file extension is: LIC. For example: X4000000.LIC

**Factory reset**

Restores default settings in all menus. Transducer sensitivities will also be restored.

**System information**

All system information is shown here such as serial number, firmware and hardware versions, bootloader, font and picture versions. All installed licenses are also shown.

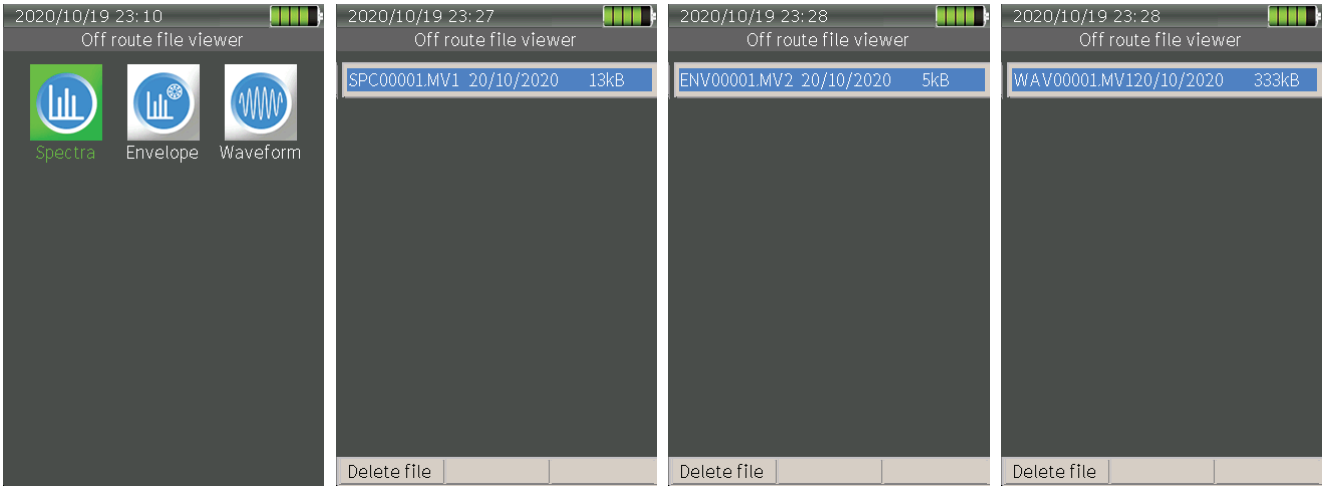



## Connection

This maintains communication between the instrument and the PC via a USB port. Connect the instrument to a PC with a USB-C cable, start the instrument and go to the connection menu. “Connected” appears on the display when communication is active.

## Files

All data is stored in files. The instrument uses a predefined set of folders, such as BALANCE, ENVELOPE, ROUTE, SPECTRA, SYSTEM and WAVEFORM, to store the files. This menu contains stored Off Route measurements of spectra, envelope and waveform signals. This makes it possible to select a measurement and view it later. It also makes it possible to export a file from one format to another and save it in the same folder with the same name but with a different extension.

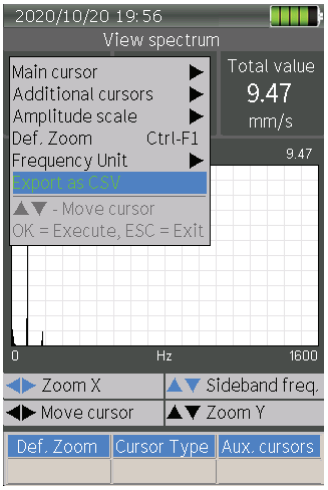


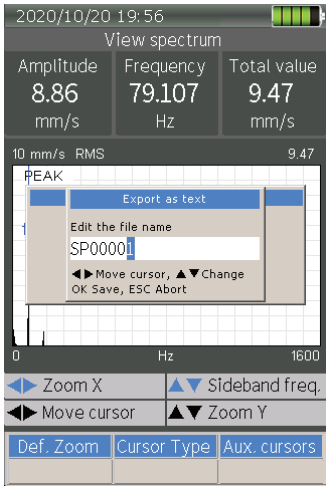
**Exporting data in file menu**

It is possible to export saved data in a different format. This allows you to use saved measurement results from Viber X4 in a third-party software. Spectrum and envelope files can be exported from MV1 format to CSV format and waveform files can be exported to WAV or TXT format.

**Export from Spectrum or Envelope file**

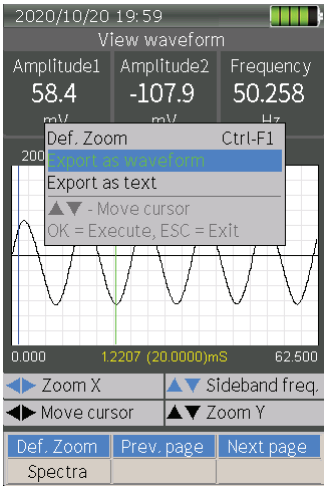
Go to file menu, open a saved spectrum or envelope file, press the MENU key, select Export as CSV, select a file name and save it in the instrument's memory card.

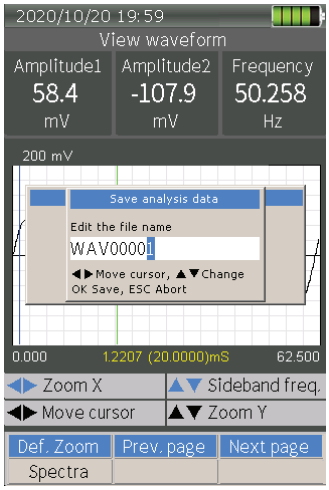



**Export from Waveform file**

Go to file menu, open a saved waveform file, press the MENU key, select Export as WAV or TXT, select a file name and save it in the instrument's memory card.



**Route**

Route measurement is used when machines are measured on a regular basis. The Route information is downloaded from the SpectraPro® PC software and the measurements, notes and other information are transferred back to the SpectraPro® software.
Route measurements and their settings are organized in the SpectraPro® software and downloaded to the instrument. It is not possible to change the Route settings in the instrument. Route measurement is easy; it measures the points on the different machines indicated on the VIBER X4™ display. The measurements are automatically stored under the same name as the measuring point. When the measurements have been made, you simply connect the instrument to the PC and all Route measurements are automatically transferred and stored in the SpectraPro® database (see section on transferring Route).

The VIBER X4™ Instrument can measure various parameters using a predefined list of measurements, named Route. The Route should be created in the SpectraPro® software. Each type of measurement can be configured in SpectraPro®. When the instrument measures the parameter, it will automatically configure the measurement parameters.

The following measurements are supported by VIBER X4™ Route measurements.

• Vibration, such as total level, BC, Envelope and spectra.

• Temperature, with built-in IR transducer.

• Speed, with external sensor or manual input.

Transfer a Route to or from the Instrument
Before transferring a Route to the instrument, the Route should be created in the SpectraPro® software (for more details, read the SpectraPro® User's Manual).

Transferring a Route from the PC to VIBER X4™ can be done in two ways:

1. Directly from the SpectraPro® software to the VIBER X4™ using the Connection menu.

2. Indirectly in SpectraPro® by transferring the Route to a file and then copying the file to the Route folder in the VIBER X4™ memory card. If you copy the Route file to another folder or to the memory card root directory, the instrument will not show the file in the existing Route list.

A large number of Route files can be stored in the memory card; however, when the Route list menu is shown in the Route manager, the instrument always checks the integrity of all Route files stored, depending on how many there are and the size of the Routes. This process takes time so we recommend only storing the Routes you require.

Enter the Route manager to select another Route or to see the details of a Route.
You can select a Route that is loaded in the instrument. Use the arrow keys and then press OK.

**Measuring in Route**

When entering the Route menu, you enter the location of the last point selected in the most recently used Route file. This means that when you stop the measurements in a Route, you can shut down the VIBER X4™ to save power or make additional Off Route measurements. You can then resume the Route measurement at any time from where you left off by simply selecting the Route application again.

The Route screen displays the following items:

• The Route, database, department, machine, point and direction to be measured.

• Record status (Collected or not).

• Transducer type (selected in SpectraPro® software).

• Alarm status (Warning or Danger).

• Date and time of last collection.

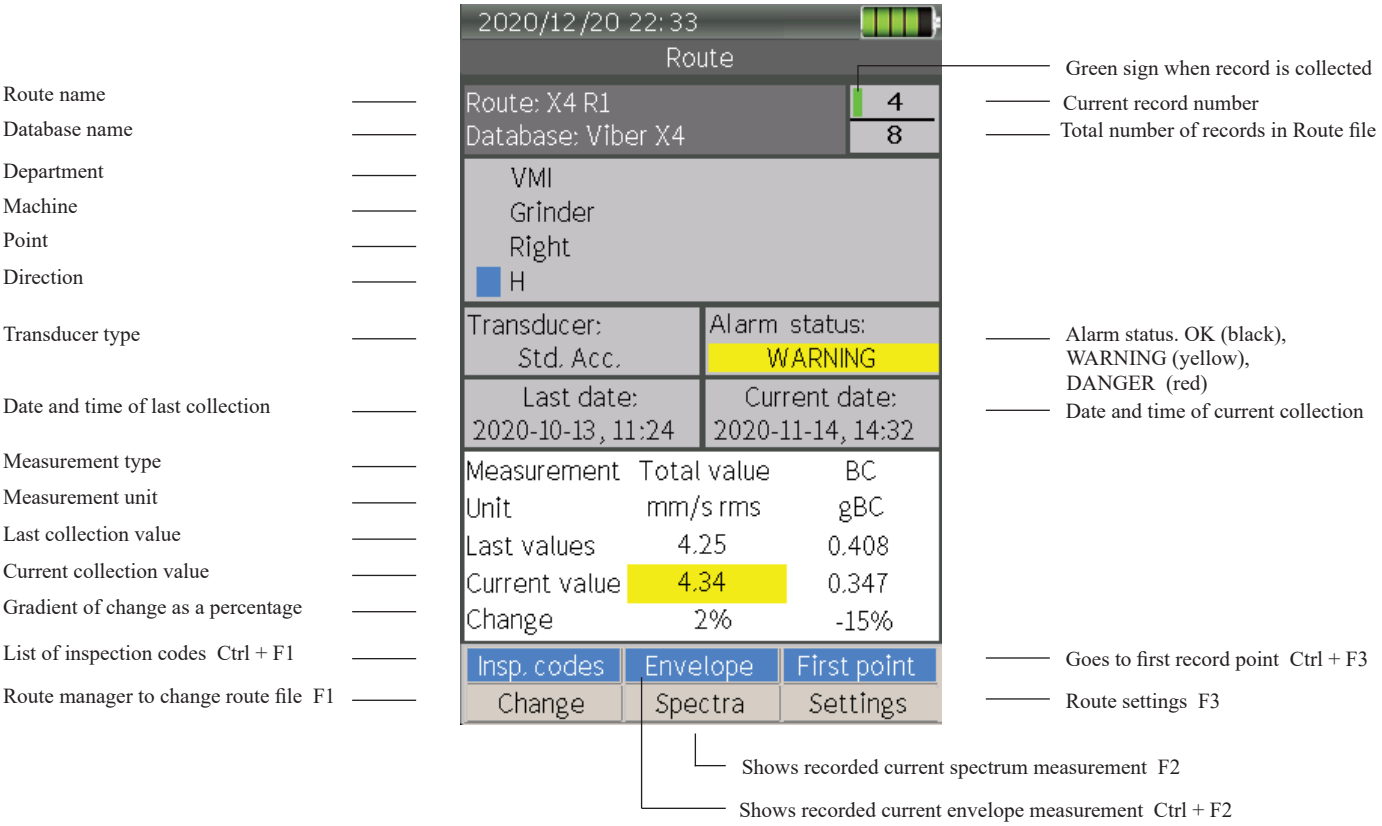
• Date and time of current collection.

• Type of measurements made at the point.

• Last values of the point saved in the machine database.

• Current values of the point.

• Gradient of change as a percentage.



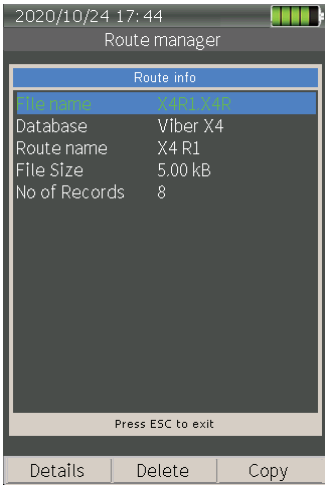
**Instrument Route Manager**
Enter the Route manager to select another Route or see the details of a Route.
You can select a Route loaded in the instrument. Use the arrow keys and press OK.

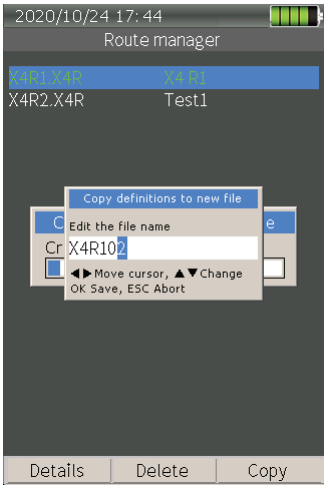
Using the function keys you can also:

• **Details F1** Show Route details such as file name, database, Route name, file size and number of records.

• **Delete F2** Delete a route file.

• **Copy F3** This function copies the contents of the Route file without measurement values and makes it possible to collect measurements twice on the same occasion.
For example, collect measurements on a fan, perform a balance, then collect new measurement values and save them in the copied file.

**Getting started with Measurements**
The general procedure for measurements using VIBER X4™ can be divided into 4 steps:

**1. Parameter check:** When pressing OK, the instrument will check if the transducers meet the required conditions and start the data acquisition for the measurement. In the meantime, the instrument will display a diagram related to the stability of the input signal and, for some measurements, auto ranging will ask you to confirm the stability of the signal.

**2. Data collection:** The instrument acquires the necessary data. Depending on the settings, this can take up to 30 seconds. It will also start to process and display the data. The measurement can be stopped either automatically or manually using the Aux key, depending on reference, setting and/or measurement.

**3. Settings:** Press the F3 key during measurement to enter the settings menu where you can set the parameters for the measurement. By pressing F3 the parameters will be set to default, which covers the majority of situations. The instrument always saves the last used settings for each type of measurement.

**4. Save:** When the measurement is stopped by pressing the Aux key, the collected data can be saved in files by selecting Save from the Menu key. You can review the files using the File Manager. For some measurements, such as Waveform, if the measurement has not been saved, a question will appear about saving before exiting the measurement.

**General Measurement Settings**
In this section, the general application settings that are most commonly used by different applications are described. The settings can vary from application to application but their function is the same.

**Measurement type**
Millivolt, Acceleration, Velocity or Displacement.

Depending on the choice, the instrument will integrate and display the units of measurement differently.

**Detection type**
RMS , Peak or Peak-Peak.

**RMS** The RMS value of a set of values, or of a continuous-time waveform, is the square root of the arithmetic mean (average) of the squares of the original values or the square of the function that defines the continuous waveform.

**Peak** The amplitude of a sine wave at the frequency of interest which is calculated from the RMS value. It can be used for detection of acceleration, velocity and high frequency energy.

**Peak-Peak** The amplitude of a sine wave at the frequency of interest which is calculated from the RMS value. This is used for detection of displacement and sometimes used for high frequency energy. In the case of the sine wave, the Peak-Peak value is exactly twice the Peak value because the waveform is symmetrical.

**HP Filter**
High pass filter frequency for the input signal. This sets the lowest level from which the frequency will be displayed and calculated. If disabled, the frequency starts from zero (0). The setting depends on the type of measurement.

**LP Filter**
Low pass filter frequency for the input signal. This sets the highest level from which the frequency will be displayed and calculated. This setting depends on the type of measurement.

**Max. frequency**
800, 1000, 1600, 3200, 6400 or 12800 Hz (depending on the type of measurement).
These are the adjustable frequencies. The unit Hz is 1 period/second, equivalent to 60 cycles per minute.
The resolution depends on the frequency range and the number of lines selected.

**Number of lines (800, 1600, 3200, 6400 or 12800)**
In this setting the number of lines is set and displayed in spectra. The resolution increases when the number of lines increases, as does the time needed for data acquisition.

From this it can be seen that a high resolution spectrum requires a long time to collect the data. This has nothing to do with the speed of the calculations in the instrument, it is simply a natural law of frequency analysis.

During measurement, the dynamic parameters of the machine (one example is speed) should not change. For this reason it can be better to choose a low number of lines in situations where the parameters of the machine are not steady or if you would like to study “real time” transients.

**Window (Hanning, Hamming, Blackman, Kaiser-Bessel, Rectangular)**
Windowing is used to shape the time portion of your measurement data in order to minimize edge effects that can result in spectral leakage in the FFT spectrum. The spectral resolution of your frequency result will increase if Window is used correctly.

Each window function has its own particular advantage and suitability for different situations. To choose a window function, you should estimate the frequency content of the signal.

• If the signal contains strong interfering frequency components distant from the frequency of interest, choose a smoothing window with a high side lobe roll-off rate.

• If the signal contains strong interfering signals near the frequency of interest, choose a window function with a low maximum side lobe level.

• If the frequency of interest contains two or more signals very close to each other, the spectral resolution is important. In this case, it is best to choose a smoothing window with a very narrow main lobe.

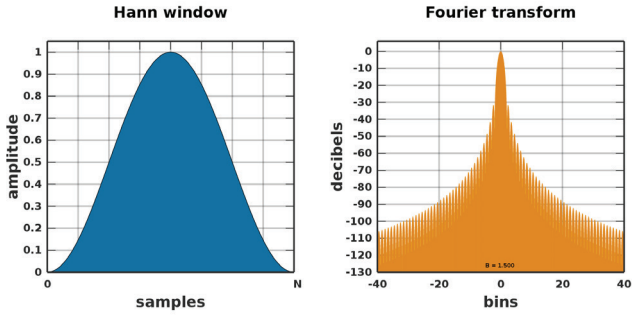
• If the amplitude accuracy of a single frequency component is more important than the exact location of the component in a given frequency bin, choose a window with a wide main lobe.

• If the signal spectrum is rather flat or broadband in frequency content, use the rectangular window.

**NOTE** In general, the Hanning window is satisfactory in 90% of all cases. It has a good frequency resolution and reduced spectral leakage.

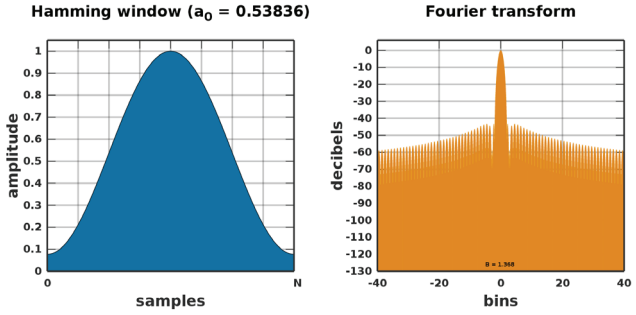
**Hanning**

This is useful for measurements where better frequency resolution than some of the other windows is desired but where moderate side lobes do not present a problem (resolution is more important than amplitude accuracy).



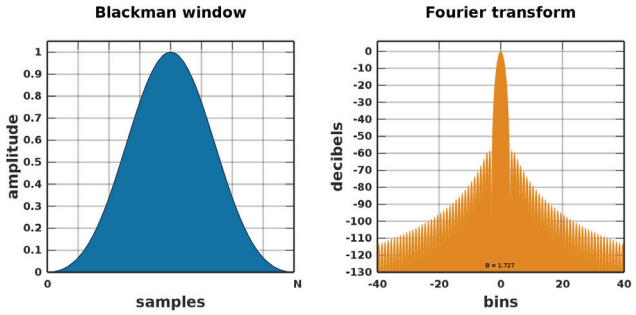

**Hamming**

This window is optimized to minimize the maximum (nearest) side lobe, giving it a height of about one fifth that of the Hanning window. Hamming has better frequency resolution but decreased amplitude accuracy than the Hanning window.
It may be used to separate frequency components that are close.



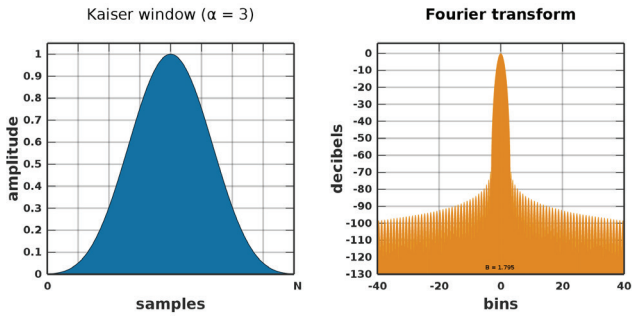

**Blackman**

The Blackman window holds back the side lobes by more than 92dB giving it approximately an 11% wider bandwidth than the Kaiser-Bessel window.



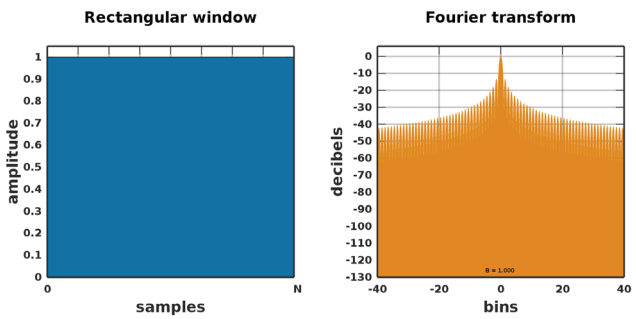

**Kaiser-Bessel**

This compares roughly to the Blackman; however, for the same main lobe width, the near side lobes tend to be higher, but the further-outside side lobes are lower.




**Rectangular**

This is the simplest window, taking a part of the signal without any other modification, unless the signal happens to be an exact fit for the window length, which then leads to discontinuities at the endpoints.
Using a rectangular window function (or no window function) is normally not recommended because of the high side lobes. This window can only be used when the signal is zero from the start and zero at the end of the measurement (explosion).



**Averaging** (Linear, Exponential, Smart, Peak Hold)
Averaging means that the different parts are averaged together and can then be used for reducing random errors, such as background vibration due to a source other than the machine being measured.

**Linear** means that each part spectra/value has the same weight in the final spectra/value. If, for example, you select 8 as the Number of Averages, every line level in the spectra will be divided by 8. When all the parts of the spectra are summed the level of each line is an average of the 8 measurements. This type of average will enhance continuous signals and reduce noise and stochastic signals. Linear averaging is well suited for trend analysis and for most other frequency analysis. The measurement stops automatically when all the part spectra have been measured.

**Exponential** means that the last part spectra/value has the same weight in the final spectrum/value as the sum of all the previously measured parts. A sudden change in the vibration level is more visible than with the other averages. Exponential is used when you want to see the variations in the vibration signal. The measurement stops automatically when all the parts have been measured.

**Smart** averaging is similar to linear averaging with one difference: if the value changes more than 5%, the averaging resets.
The advantage is that when you move the transducer from one location to another, the movement of the transducer will generate a high value. On linear averaging, if the Number of Averages is high, this will cause the value to slowly change to the actual value over a long time. This is also the case when the measurement condition (such as speed) changes.

**Peak Hold** means that the largest value of each spectrum line is stored in the final spectra.
If the level at the 50 Hz line is largest in part spectrum 2, and the 200Hz line is largest in part spectrum 7, both will be saved in the final spectrum.
Peak hold is used for coast up or coast down, or when you want to measure an unexpected event.

**Number of Averages (1, 2, 4, 8, 16, 32)**
To get a representative measurement of the vibrations in a machine, the vibrations must be measured over a certain length of time. You cannot decide to stop a machine or a whole plant based on a measurement taken over less than a few seconds.
One way to extend the measuring time is to measure several spectra over a longer time and calculate an average spectrum. Each of these single spectra is called a measurement.

If you collect more averages, you will have fewer random errors. However, collecting more averages requires more time. If, for example, you select the Number of Averages as 8, the instrument will measure 8 different spectra and continuously calculate an average spectrum. Usually 6 to 8 measurements are enough.

**Frequency unit (Hz or CPM)**
With this setting you select which frequency unit is displayed, either Hertz (Hz) or Counts per Minute (CPM).

**Save Waveform with spectra**
If enabled, the analysis file will also contain waveform data.

**Speed Measurement**
Measures speed along with the measurement.

**Measure BC**
The instrument will measure the Bearing Condition value (see the Bearing Condition section under Measurement for further information about this measurement).

**Recommended Vibration Levels**
This chapter describes the ISO standard 10816-3 and the recommended vibration levels. It also describes resonance and where to place the transducers for best result.

The lists and tables in this chapter can be used as a first consideration when you approach a machine that is newly commissioned, or after some time in operation. Investigate the reason for any machine vibrating above 3 mm/s RMS. Do not leave levels above 7 mm/s without analyzing the cause and consequences.

**0 -3 mm/s (0 - 0, 12 in/s)**
Small vibrations: None or very small amount of bearing wear. Rather low noise level.

**3-7 mm/s (0, 12-0, 28 in/s)**
Noticeable vibration levels. These are often concentrated to some specific part and direction of the machine. Noticeable bearing wear. Seal problems occuring in pumps etc. With an increase in noise level, try to investigate the reason. Plan to take action during the next regular stop. Keep the machine under observation and measure at shorter time intervals than before to detect if there is any deterioration trend. Compare vibrations to other operating variables.

**7-11 mm/s (0, 28-0, 43 in/s)**
Large vibration levels. Bearings are running hot. Bearings wear out frequently and need replacing. Seals wear out, leakage of all kinds is evident. Cracks in welding and concrete foundations. Screws and bolts are loosening. High noise level. Plan to take action as soon as possible. Do your best to find the cause. You are rapidly wearing down your investments.

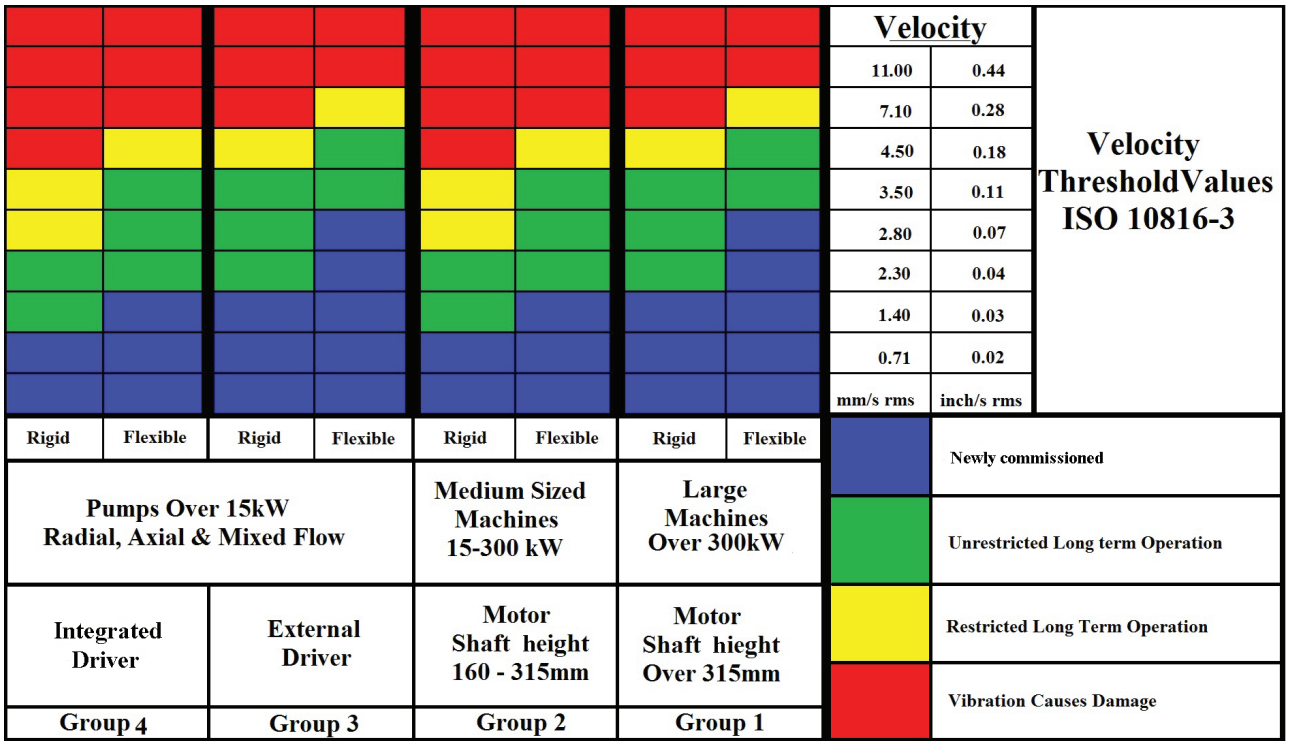
**11- mm/s (0,43 − in/s)**
Very large vibrations and high noise levels. This is detrimental to the safe operation of the machine. Stop operating if technically or economically possible considering the plant stop cost. No known machine will withstand this level without internal or external damage.
Reduce any further running time to an absolute minimum.

**ISO standard 10816-3**

The ISO standard 10816-3 classifies machines differently according to whether the machines are considered to be flexibly or rigidly mounted. This reflects the location of the machines stiff body resonances related to the basic running speed of the machine.

For instance, a machine supported by rubber or spring has resonances at low running speeds. The machine starts to vibrate at certain low revolutions. When the speed is increased above these resonance frequencies, the vibration is reduced. This machine is considered flexible.

Modern machines that have high RPM's and flexible bearing supports and foundations can be treated as flexible, even when they are not mounted on rubber or springs.



**Measure (Off Route)**

This section describes the applications in the Measurements menu. In this menu the programs are used to make an analysis on site or when you need to make additional measurements during Route.

The following measurement applications are included in the instrument when delivered.
See the specified application section for a detailed description.

**Total value**

This application is used for analyzing the effect of mechanical actions and is an easy way to quickly gain an overview of the vibration status of a machine.

**Spectra**

This measurement displays a spectrum (chart) of the frequencies at which the machine component is vibrating and the amplitude of the vibration at each of these frequencies.

**Bearing Condition**

This application is used for analyzing the effect of lubrication or other actions on journal bearings. The bearing condition value is a sum average value, the RMS value, of all high frequency vibrations in the set frequency interval.

**Envelope**

Envelope is a spectra measurement that enhances the energy in the high frequency signals and is used to find early signs of bearing faults. Envelope can also be used to detect cavitation in pumps.

**Phase**

In the Phase application you can measure the Amplitude and Phase of the vibration using 1 or 2 vibration sensors and a speed sensor. This tool will help you to confirm a specific machine fault or prevent false conclusions.

**Speed**

The speed can be measured using an external speed sensor. The application can also calculate a gear speed, if you know the gear ratio.

**Temperature**

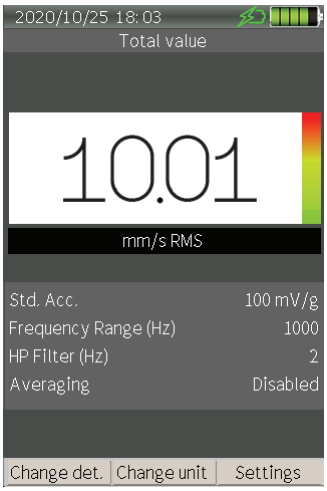
In the temperature application, the bearing house temperature or any other surface temperature can be measured using the built-in infrared temperature sensor.

**Audio**

This application is used for listening to ball bearing noise, or to other parts of the machine.

## Measure Total Value

The Total Value screen for vibration measurement is shown at the top. A bar on the right of the value indicates the measurement stability. The lower the bar, the more stable.




On the lower part of the screen there are details regarding:

• Transducer used

• Frequency range

• HP filter

• Averaging type

During live measurements you can press:

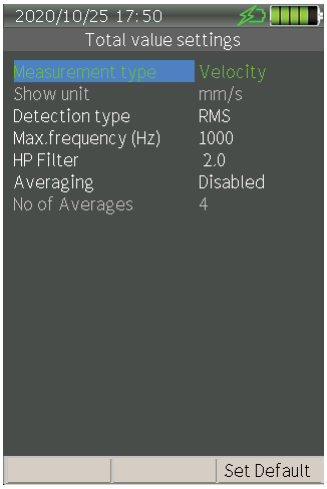
• **Change detection F1** Changes detection type, RMS, Peak or Peak-Peak.

• **Change unit F2** Changes the measuring unit between mm/s, m/s, µm, mm, mV, g or m/s².

• **Settings F3** Enters the settings menu.

## Total Value Settings

The following parameters can be set on total value settings




• **Measurement type** Millivolt, Acceleration, Velocity or Displacement

• **Show Unit** Depending on the measurement type selected above

• **Detection** RMS, Peak or Peak-Peak

• **Max. frequency** 800, 1000, 1600, 3200 or 6400 Hz

• **HP Filter** Disabled, 1.0, 2.0, 3.0, 5.0, 10.0 Hz

• **Averaging** Disabled, Linear or smart

• **Number of Averages** 1, 2, 4, 8, 16, 32

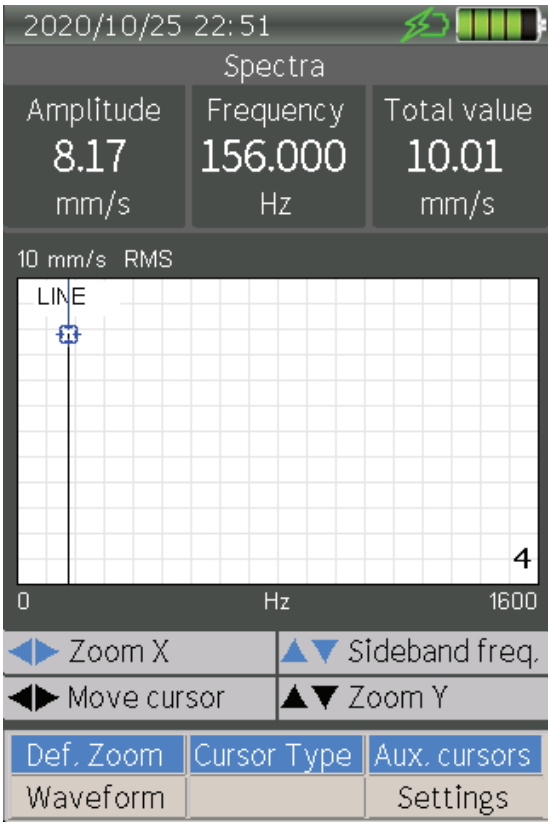
• **Set Default F3** Resets settings to default

## Spectra

This measurement displays a spectrum (chart) of the frequencies at which the machine component is vibrating and the amplitude of the vibration at each of these frequencies.

### Measure Spectra

There are three windows at the top of the screen. The left window shows the amplitude of the cursor, the middle window shows the frequency of cursor and the right window shows the total value.
The scale for the value is displayed above the spectrum chart and the frequency range is displayed below the spectrum chart.




The following actions can be performed during measurement:

• **Waveform F1** Instead of spectra, the waveforms are shown.

• **Default zoom Ctrl + F1** Set the zoom back to default mode.

• **Cursor type Ctrl + F2** Change cursor type between LINE, PEAK and FREE.

• **Settings F3** Enter the settings menu.

• **Aux cursors Ctrl + F3** Add different types of cursors such as Harmonic or Sideband.

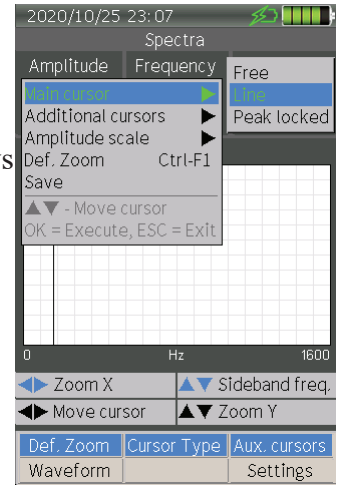
• Move the cursor using the Left and Right arrow keys. When pressing the key once, the cursor will move one line at a time, when keeping the key pressed, the cursor will move 10 lines at a time.

• Zoom in or out of the X Scale using the Ctrl + Right arrow keys or the Ctrl + Left arrow keys. The cursor remains visible on the spectra during zooming.

• Zoom in or out of the Y Scale using the Up or Down arrow keys. Notice that once the zoom occurs on the X or Y Axis, the plot will not be auto scaled. Instead, the manual settings are used. Press Ctrl + F1 (Default Zoom) to re-enable the auto scaling mode.

**Aux** It is possible to freeze (HOLD) the measurements by pressing the Aux key.

**Menu** In HOLD mode, the (MENU) key menu can be accessed where it is possible to:

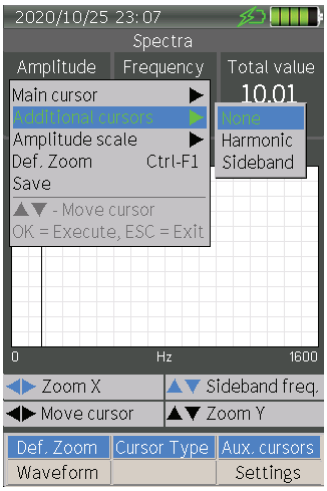



• **Change the Main cursor**

• **Free** The cursor is positioned over a line of the screen. If the screen area is less than the number of lines, the cursor moves pixel by pixel on the screen and displays the values for the highest line represented on the pixel. When you have zoomed enough, the cursor will move to the next line.

• **Line** This cursor is mainly used to see line values. The cursor will move to the position of the next spectrum line. This does not necessary involve a change of X position on the screen, although the Y position will change. This is the default cursor.

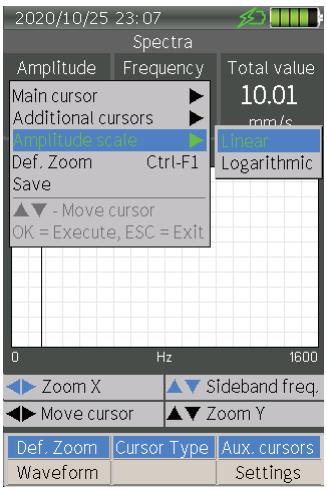
• **Peak locked** If the screen area is less than the number of lines, the cursor moves pixel by pixel on the screen and selects the highest line represented on a new pixel. It determines if that line is a peak and if it is, calculates and displays the peak values as cursor values. If it is not a peak, it will display the line value. When a peak is found, the cursor shape changes. The X position of the cursor is still the line position.




• **Additional cursors** This setting is the same as Ctrl + F3 during measurement.

• **Harmonic** Shows four harmonics of the cursor frequency.

• **Sideband** Shows four bands on each side of the cursor's frequency. You can change the frequency between each band by pressing the Ctrl + Up or Down arrows.




• **Amplitude scale** Two basic amplitude scaling types are linear and logarithmic.

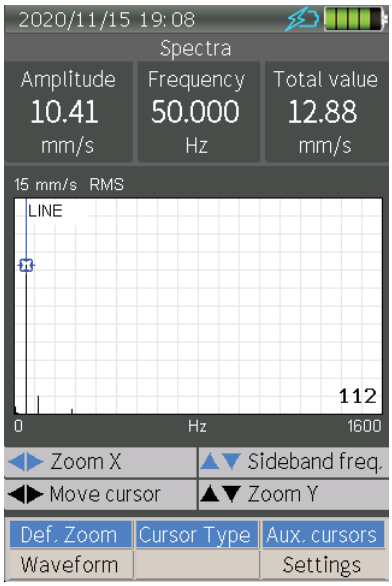
• **Linear** Linear amplitude scaling makes the largest components in a spectrum very easy to see and to evaluate, but very small components may be overlooked completely. Linear scaling may be adequate in cases where the components are all about the same size.

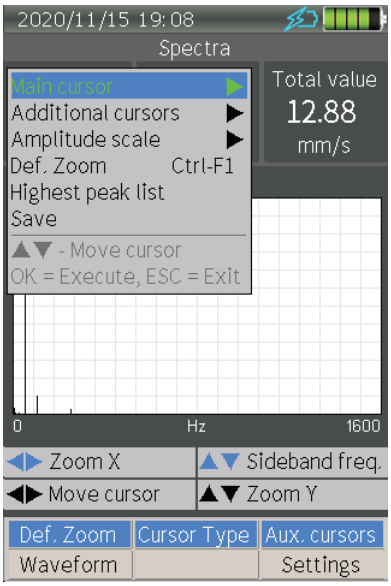
• **Logaritmic** Logarithmic amplitude scaling clearly shows the low level signals in the presence of stronger signals.

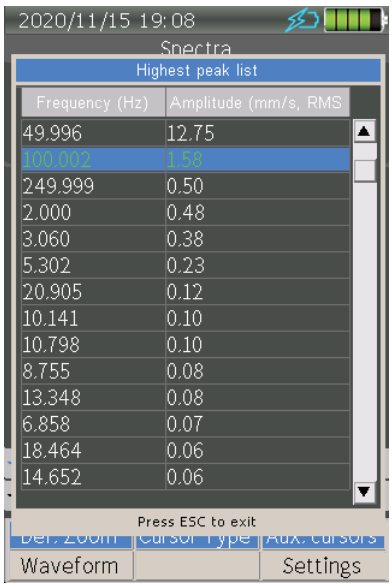
• **Highest peak list** Shows a list containing the 20 highest peaks in spectrum measurement.

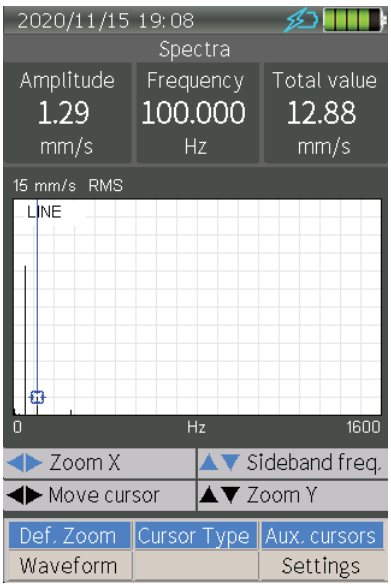
The list is sorted with the highest peak first and allows a quick overview of the 20 highest peaks and the possibility to move the cursor directly to the selected peak in spectrum menu.

By selecting one of the peaks in the list and pressing OK, you return to the spectrum menu with the cursor over the peak you have selected in the list.

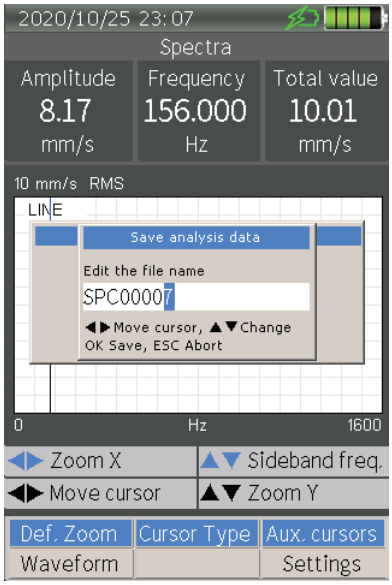


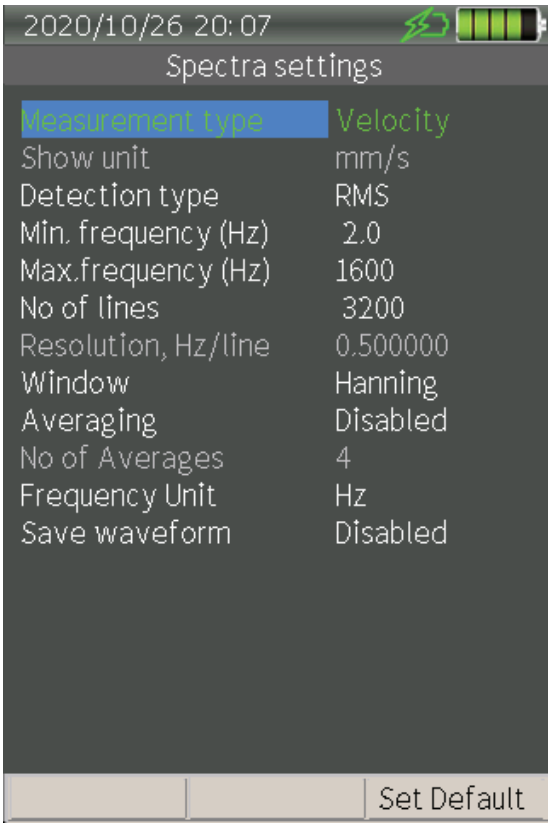
• **Save** Saves a measured spectrum file in the SD memory card. It can be opened later in file menu or transferred to PC software to be analyzed.




**Spectra Measurement Settings**
When measuring a spectrum, you can enter the settings menu by clicking F3. The instrument will display the setting menu where the following parameters can be set:

• **Measurement type** Millivolt, Acceleration, Velocity or Displacement

• **Show Unit** Depending on the measurement type selected above




• **Detection type** RMS, Peak or Peak-Peak

• **Minimum frequency Hz** Disabled, 0.5, 1.0, 2.0, 3.0, 5.0, 10.0 Hz

• **Maximum frequency Hz** 1600, 3200, 6400 or 12800 Hz

• **Number of lines** 800, 1600, 3200, 6400 or 12800

• **Resolution Hz/line** Depending on chosen maximum frequency vs number of lines above

• **Window** Hanning, Hamming, Blackman, Kaiser Bessel or Rectangular

• **Averaging** Disabled, Linear, Exponential or Peak Hold

• **Number of averages** 1, 2, 4, 8, 16 or 32

• **Frequency unit** Hz or CPM

• **Save waveform** Enables a short waveform file to be saved while measuring spectrum

• **Set Default F3** Resets settings to default

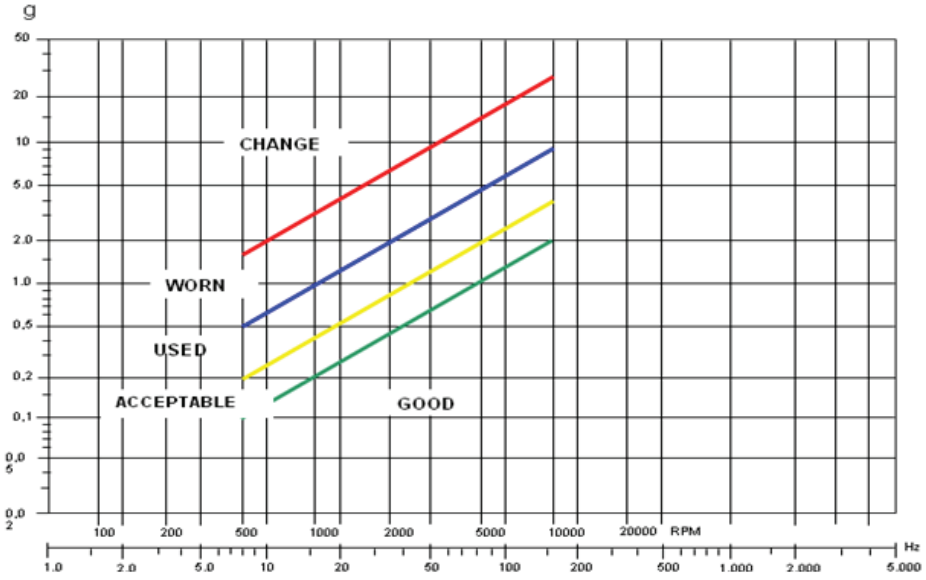
## Bearing Condition

The bearing condition value is a sum average value, the RMS value, of all high frequency vibrations in the set frequency interval. This value is an acceleration average with the unit “ g ”.

### Interpretation of the Bearing Condition Value

The bearing condition value is an indirect method of measuring the status of anti-friction bearings. A high value indicates that further frequency analysis needs to be performed.

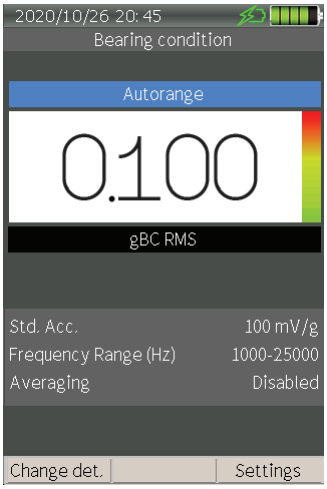
When the balls or rollers rotate inside a bearing, a wide band noise and vibration arise. The noise or vibrations are increased if the bearing is poorly lubricated, overloaded or has a damaged surface. Both listening and reading the BC value are good ways of analyzing the bearings.
Find the machine speed in the diagram, follow this line up to the judgment lines and read the value on the left axis.




The figure above is a guide to interpreting the bearing condition value. If vibrations from other causes (e.g. flow surge and sometimes gear mesh forces) have vibrations within the frequency range, this can indicate a high bearing condition value without the bearing being damaged. A high bearing condition value can also be acquired if the bearing is poorly lubricated or is overloaded due to a large misalignment or a large belt tension.
If the selected frequency band includes low frequencies, the bearing condition value would include vibrations
due to unbalance, misalignment etc., and not those purely from bearing vibrations, and would therefore be difficult to interpret. If the selected frequency band only includes very high frequency vibrations (above 20 kHz), a special vibration transducer would be needed that is very rigidly and closely mounted to the bearing because the machine structure works as a mechanical filter for high frequencies.
Normal machinery vibrations from unbalance, misalignment etc., have few vibrations above 3200 Hz.
**NOTE 1** A high bearing condition value should always be used to request further frequency analysis.
**NOTE 2** High bearing condition values can appear in gear boxes, grinding machines, converting machines with cutters and similar machines without any bearing faults. This is because these machines “naturally” produce high frequencies and the bearing condition value can be misinterpreted. Try to make measurements when the machine is unloaded.

**Measuring Bearing Condition**

The value of the BC measurement is shown at the top. A bar on the right of the value indicates the measurement stability.




On the lower part of the screen there are details regarding:

• Transducer used

• Frequency range

• Averaging type

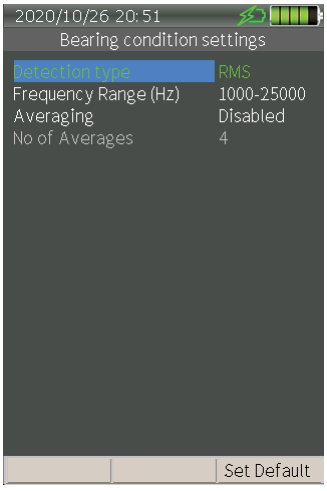
During live measurements you can press:

• **Change detection F1** Change detection type, RMS, Peak or Peak-Peak.

• **Settings F3** Enter the settings menu.

**Bearing Condition settings**

The following parameters can be set on bearing condition settings:




• **Detection** RMS, Peak or Peak-Peak

• **Frequency range Hz** 500-6400, 1000-25000, 2000-25000 or 3000-25000 Hz

• **Averaging** Disabled, Linear or smart

• **Number of Averages** 1, 2, 4, 8, 16, 32

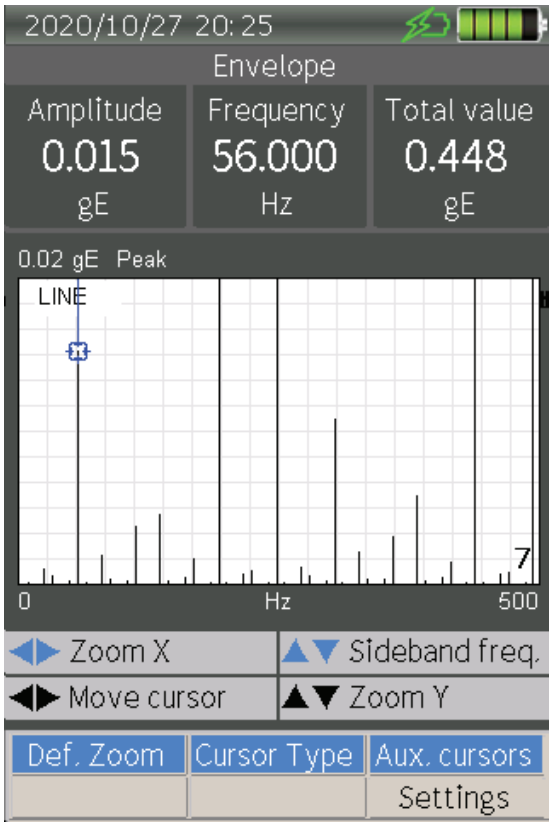
• **Set Default F3** Reset settings to default

## Envelope

Envelope is a spectrum measurement that enhances the energy in the high frequency signals and is used to find early signs of bearing faults. Envelope can also be used to detect cavitation in pumps. When you want to see the fluctuations of high frequencies it is better to use the unit “g” (acceleration) because the acceleration signal increases in signal level when the frequency increases.
Envelope signals have their own unit “gE” (Envelope acceler- ation). The level of an envelope signal depends more on how much fluctuation a certain fault can create in the original signal, and not on the seriousness of the fault itself. It is therefore difficult to compare two different measuring points, but it is possible to compare two Envelope spectra at the same measuring point.

### Measure Envelope

There are three windows at the top of the screen. The left window shows the amplitude of the cursor, the middle window shows the frequency of the cursor and the right window shows the total value.
The scale for the value is displayed above the spectrum chart and the range below the spectrum chart.




During measurements, the following actions can be performed:

• **Default zoom Ctrl + F1** Set the zoom back to default mode.

• **Cursor type Ctrl + F2** Change cursor type between LINE, PEAK and FREE.

• **Settings F3** Enter the settings menu.

• **Aux cursors Ctrl + F3** Add different types of cursors such as Harmonic or Sideband.

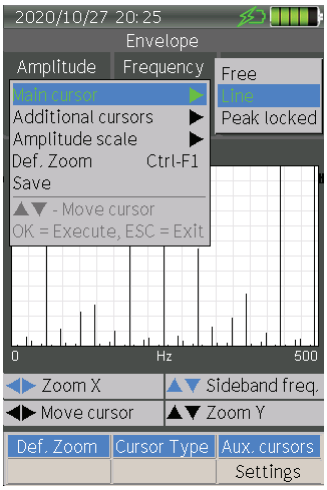
• Move the cursor using the Left and Right arrow keys. When pressing the key once the cursor will move one line at a time, when keeping the key pressed the cursor will move fast 10 lines at a time.

• Zoom in or out of the X Scale using the Ctrl + Right arrow or Ctrl + Left arrow keys. During zooming, the cursor remains visible on the spectra.

• Zoom in or out of the Y Scale using the Up or Down arrow keys. Notice that once the zoom occurs on the X or Y Axis, the plot will not be auto scaled. Instead, the manual settings are used. Press Ctrl + F1 (Default Zoom) to re-enable the auto-scaling mode.

**Aux** You can freeze (HOLD) the measurements by pressing the Aux key.

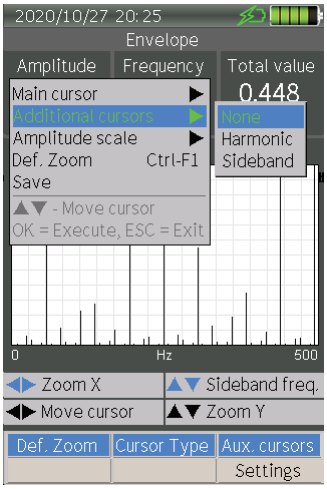
**Menu** In HOLD mode, you can access the (MENU) key menu where you can:




• **Change the Main cursor**
• **Free** The cursor is positioned over a line of the screen. If the screen area is less than the number of lines, the cursor moves pixel by pixel on the screen and displays the values for the highest line represented on the pixel. When you have zoomed enough, the cursor will move to the next line.

• **Line** This cursor is mainly used to see line values. The cursor will move to the position of the next spectrum line. This does not necessarily involve a change of X position on the screen but the Y position will change. This is the default cursor.

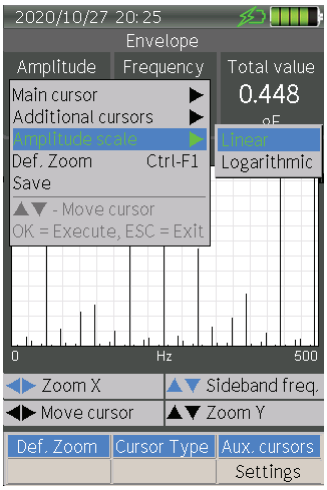
• **Peak locked** If the screen area is less than the number of lines, the cursor moves pixel by pixel on the screen and selects the highest line represented on a new pixel. It determines if that line is a peak and if so, calculates and displays peak values as cursor values. If it is not a peak, it will display the line value. The cursor shape is changed when a peak is found. The X position of the cursor is still the line position.




• **Additional cursors** This setting is the same as Ctrl + F3 during measurement.
• **Harmonic** Shows four harmonics of the cursor frequency.

• **Sideband** Shows four bands on each side of the cursor's frequency. You can change the frequency between each band by pressing the Ctrl + Up or Down arrows.

• **Amplitude scale** The two basic amplitude scaling types are linear and logarithmic.
• **Linear** Linear amplitude scaling makes the largest components in a spectrum very easy to see and to evaluate, but very small components may be overlooked completely. Linear scaling may be adequate in cases where the components are all about the same size.




• **Logaritmic** Logarithmic amplitude scaling shows the low level signals clearly in the presence of stronger signals.

• **Highest peak list** Shows a list containing the 20 highest peaks in spectrum measurement. All the settings in this menu are the same as in the spectra menu. See page 32.

• **Save** You can save a measured envelope file in the SD memory card in order to open it later in the file menu or transfer it to PC software for analysis.

**Envelope Measurement Settings**
When measuring envelope, you can enter the settings menu by clicking F3. The instrument will display the settings menu where the following parameters can be set:

• **Detection type** RMS, Peak or Peak-Peak

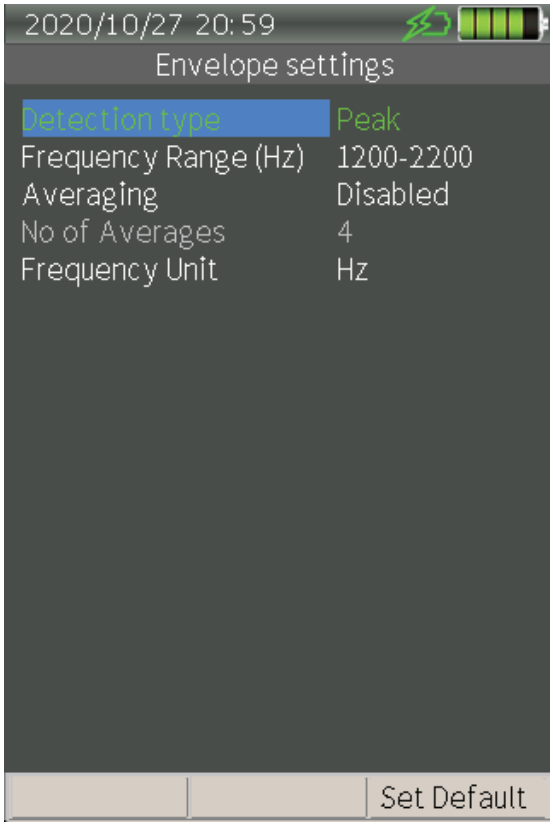
• **Frequency Range Hz** 600-1200, 1200-2200, 2200-3200, 3200-4200 and 3200-20000 Hz

• **Averaging** Disabled, Linear, Exponential or Peak Hold

• **Number of averages** 1, 2, 4, 8, 16 or 32

• **Frequency unit** Hz or CPM

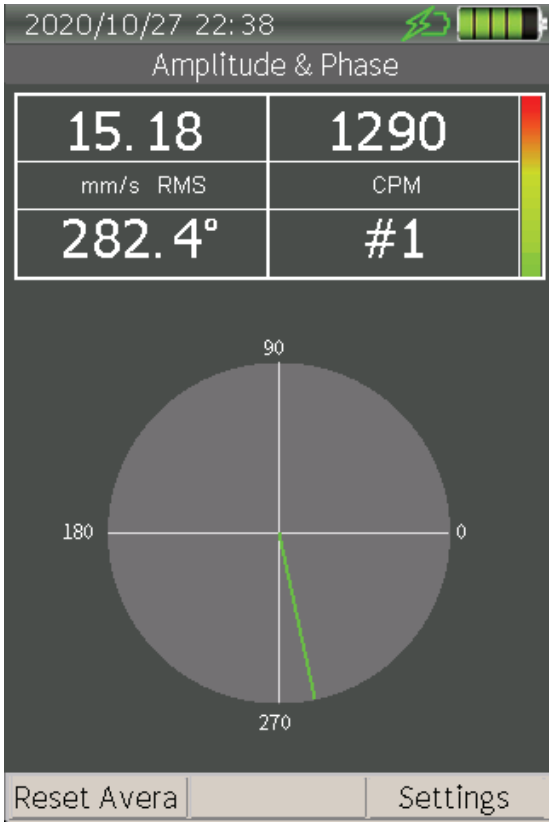
• **Set Default F3** Reset settings to default



## Phase

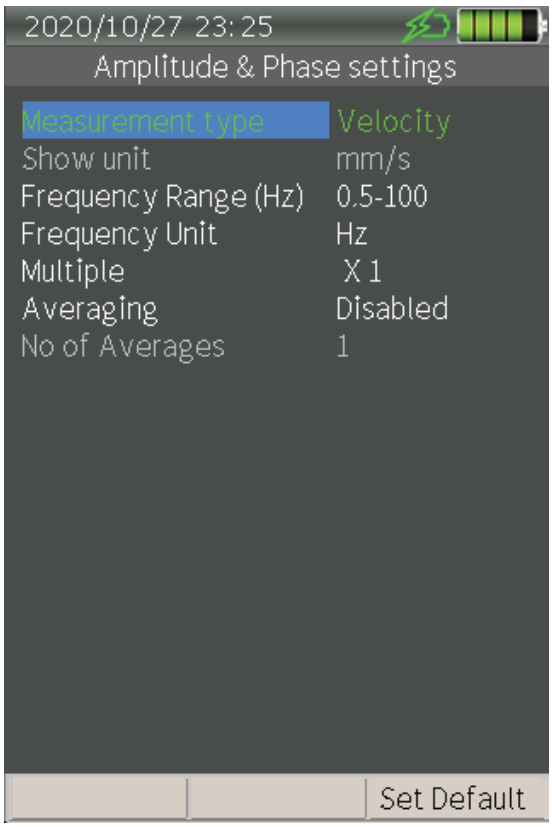
In the Phase menu you can measure Amplitude & Phase using a vibration sensor and a speed sensor.

The Phase application can help you diagnose machine faults such as, for example, resonance, misalignment, looseness and soft foot.
The Phase application can also help you separate faults that at first look like unbalance but in reality are caused by something else (for example misalignment). Knowledge of the phase relationships of various machine faults will help you to confirm the existence of a specific machine fault and help to prevent misdiagnosis.




**Measuring Amplitude & Phase**
Four values are shown in four windows at the top. Amplitude and phase are shown on the left and rotation frequency and multiple number are shown on the right. A bar to the right of these values indicates the measurement stability. A polar plot with current values of the vector is shown on the lower part of the screen.

During live measurements you can press:
• **F1** Reset averaging
• **F3** Enter the settings menu.




**Phase Measurement Settings**
The following parameters can be set for bearing condition settings:

• **Measurement type** Millivolt, Acceleration, Velocity or Displacement

• **Show Unit** Depending on the measurement type selected

• **Frequency Unit** Hz or CPM

• **Multiple** X1, X2, X3, X4 or X5 The frequency for amplitude/phase calculation. This may be the running speed (X1) or one of its multiples, up to X5

• **Averaging** Disabled, Linear or smart

• **Number of Averages** 1, 2, 4, 8, 16, 32

• **Set Default F3** Reset settings to default

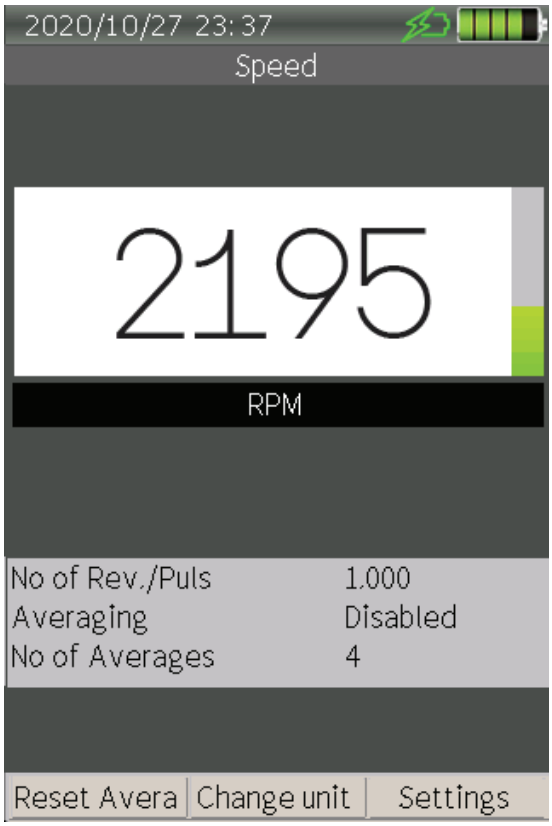
## Speed

The speed (machine revolution) can be measured with an External Tachometer. In the speed menu, all system resources are used only for speed measurement to get the best performance, this means that the accuracy and limits of the speed are extremely high.

**Measure Speed**

The value of speed measurement is shown at the top. A bar to the right of the value indicates the measurement stability.

On the lower part of the screen, details are shown regarding:




- Number of revolution per pulse
- Averaging
- Number of averages

During live measurements you can press:

- **F1** Reset averaging
- **F2** Change unit RPM or Hz
- **F3** Enter the settings menu

**Speed measurement settings**

When measuring envelope, you can enter the settings menu by clicking F3. The instrument will display the settings menu where the following parameters can be set:

- **Frequency unit** RPM or Hz
- **Number of revolutions per pulse**
- **Number of pulses per revolution**
- **Averaging** Disabled, Linear or smart
- **Number of Averages** 1, 2, 4, 8, 16, 32
- **Set Default F3** Reset settings to default

## Temperature

In the Temperature menu you can, for example, measure the bearing housing temperature (or any other surface temperature) with the built-in infrared temperature sensor.

### Emissivity

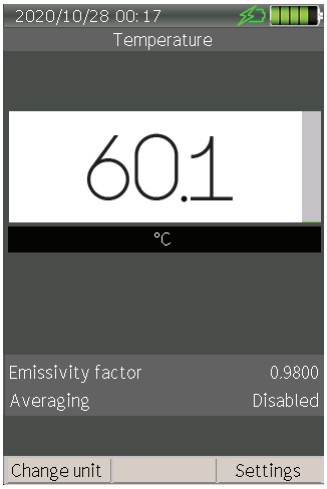
Set the coefficient for surface reflection factor (Emissivity factor) using a check via a contact probe (the table with emissivity factors is also included in the instrument's context sensitive help menu).
It is very difficult to get an accurate temperature reading on untreated metals. A coating such as paint, oil or emission adhesive tape applied to the object will considerably improve the accuracy of the measurement.

**NOTE** Incorrect setting of the emissivity factor can lead to considerable errors in themeasured temperature.

| Material | Emissivity factor |
|---|---|
| Heat sink, black anodized | 0.98 |
| Paper | 0.97 |
| Black paint, matt | 0.97 |
| Ice, smooth | 0.97 |
| Wood | 0.94 |
| Glass | 0.94 |
| Rubber, hard | 0.94 |
| Transformer paint | 0.94 |
| Concrete | 0.93 |
| Brick, mortar, plaster | 0.93 |
| Porcelain | 0.92 |
| Steel, oxidized | 0.79 |
| Cooper, oxidized | 0.76 |
| Steel, heat treated surface | 0.52 |
| Copper | 0.04 |
| Aluminium, bright | 0.04 |

### Measure Temperature

Direct the IR temperature transducer towards the surface you want to measure.
A red laser dot will guide you.
Keep a distance of approximately 200-500 mm (8-20 inches) between the instrument and the object. Reduce the distance between the object and the instrument in accordance with the surface size.

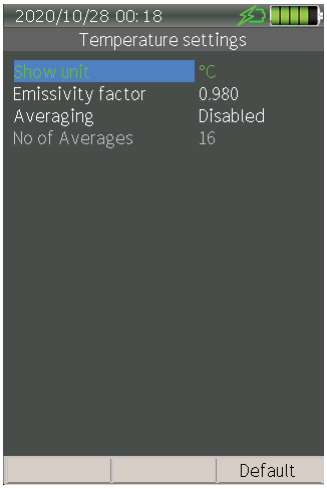



The value of the temperature measurement is shown at the top. A bar on the right of the value indicates the measurement stability.
On the lower part of the of the screen details are shown regarding:
• Emissivity factor
• Averaging

During live measurements you can press:
• **F1** Change units C or F
• **F3** Enter the settings menu

### Temperature Measurement Settings

When measuring temperature, you can enter the settings menu by clicking F3. The instrument will display the settings menu where the following parameters can be set:




• **Show unit** Celsius or Fahrenheit

• **Emissivity factor** see above

• **Averaging** Disabled, Linear or smart

• **Number of Averages** 1, 2, 4, 8, 16, 32

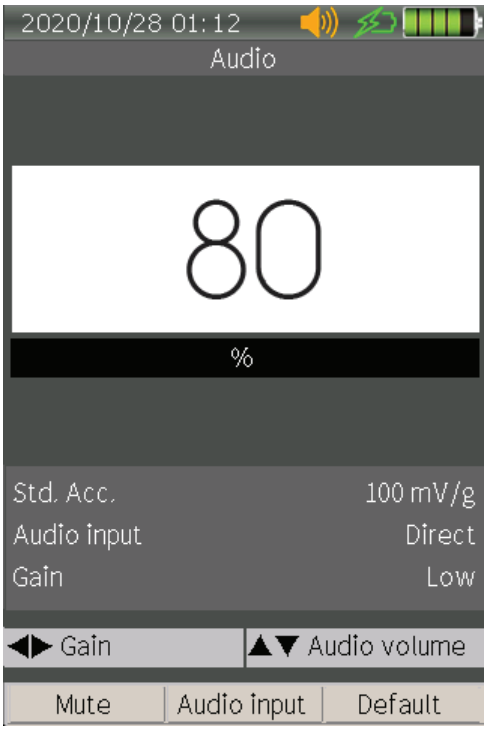
• **Set Default F3** Reset settings to default

**Audio**

Listening to bearing noise is an established, proven method. Sound analyses of low speed bearings and gears can sometimes be much faster and even more reliable than BC value. This is also a good technique for estimating lubrication volume.

**NOTE** The audio connector must be a 3.5mm stereo plug.

The value of the sound volume is shown at the top as a percentage.




On the lower part of the screen details are shown regarding:
- Transducer used
- Audio input
- Gain

During live listening you can press:

- **Gain** Using Left and Right arrows change the amplification from low to high when vibration level is low. To avoid damage to your hearing, the volume level reduces automatically to 20% when changing from low to high.

- **Audio volume** Using Up and Down arrows, increase and decrease the sound volume between 0 and 100% in ten steps. The level shows on the screen and on the speaker icon, one bar for up to 30%, two bars for up to 60% and three bars for up to 100%.

- **F1 Mute** This sets the sound level at zero and the speaker icon on the top of the screen turns red. If pressed twice, the volume will be reset to the previous level and the icon turns orange.

- **F2 Audio input** Direct or filtered. On filtered mode, a high pass filter at 500 Hz is used which removes all low frequency noises.

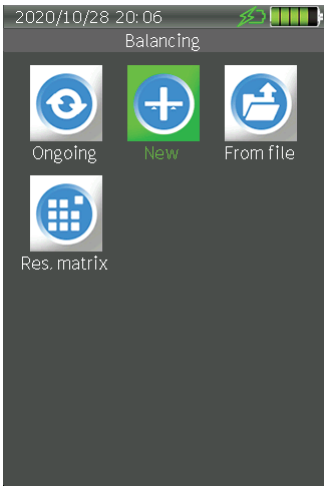
- **Set Default F3** Reset settings to default

**Aadvanced measurements**

This section contains features that are not included in the standard version of Viber X4™ and ones that require licenses. Contact one of VMI's authorized dealers close to your location to purchase licenses.

**Balancing**

Balancing is a procedure by which the mass distribution of a rotor is adjusted to ensure that the vibration and/or forces on the bearings at a frequency corresponding to service speed are within specified limits.
Rotor unbalance can be caused by design, material, manufacturing or assembly. Every rotor has an individual unbalance distribution along its length, even in a series production.




**Balancing Application menu**

In the Balancing application menu you can choose:

• **Ongoing** to continue the last balancing session.

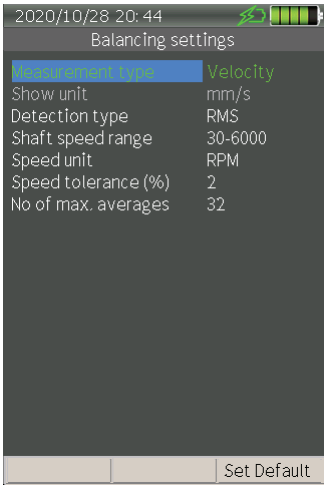
• **New** to perform a new one plane balancing.

• **From File** to choose a file from a previous balancing session.

• **Response matrix** to perform a balancing session with the unbalance sensitivity of an existing balancing file.

**Balancing Settings**

In Balancing Settings you can set the following:




• **Measurement type** Millivolt, Acceleration, Velocity or Displacement

• **Show Unit** Depending on the measurement type selected above

• **Detection type** RMS, Peak or Peak-Peak

• **Shaft speed range** 30-6000 or 120-60000 RPM

• **Speed unit** RPM or Hz

• **Speed tolerance (%)** 1, 2, 3, 4 or 5

• **Number of maximum averages** 1, 2, 4, 8, 16 or 32

• **Set Default F3** Reset settings to default

**Speed tolerance**
The tolerance of the current balancing speed is compared with the saved balancing speed to consider whether the measurement is suitable for the balancing procedure. When the measured speed is outside of this tolerance, the speed value will be shown in yellow. It is important to measure the vibrations at the same RPM during the whole balancing session.

**No of maximum averages**
This is the maximum number of measurements that can be used to save the data if the Auto save measurement is enabled. If the measurements are not stable enough (the speed is out of tolerance), the instrument will save the data when this number of measurements is reached.

**Rotor settings**
In this menu you enter:

- **Balancing Radius R1**

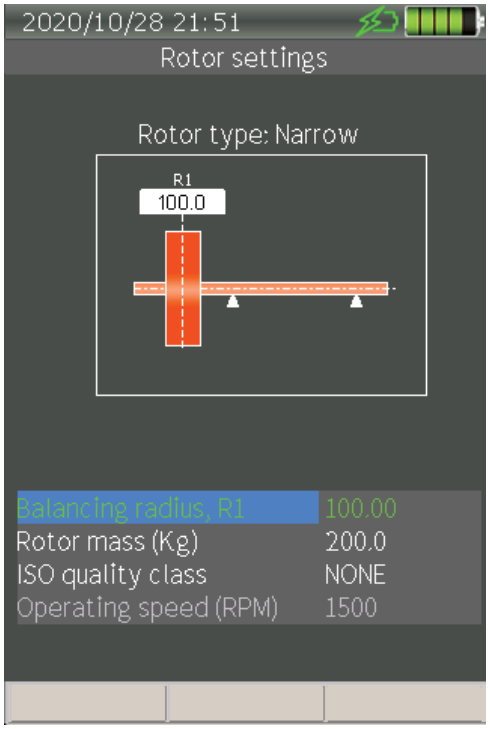
- **Rotor mass (Kg)**

- **ISO 1940-1 Balance quality**

If Enabled, you will enter the settings for ISO Quality before the measurement starts. Here you select the balancing quality grade. Enter the maximum rotor speed, weight and dimensions. The instrument then calculates maximum allowable residual unbalance and compares this value with the remaining unbalance in the rotor.

- **Operating speed (RPM)**

The operating speed is the maximum speed that the rotor will ever reach in normal operation, not the balancing speed you have currently selected.



**ISO 1940 Balance Quality Grades**
In ISO1940 machines are divided into different grades called Quality Grades

**NOTE** ISO 1940 Quality Grades is only an overview and not an extraction from the standard.

**G 0.4** Gyroscopes, Spindles, discs and armatures of precision grinders.

**G 1** Record players, Grinding-machine drives, Small electric armatures with special requirements.

**G 2.5** Turbo compressors, Rigid turbo-generator rotors, Gas and steam turbines, including marine main turbines (merchant service) computer hard disks, Machine-tool drives, Turbine-driven pumps, small electric armatures not qualifying for one or both of the conditions specified for small electric armatures of balance quality grade G 6.3, Medium and large electric armatures with special requirements.

**G 6.3** Normal process machinery, Parts of process plant machines, Marine main turbine gears (merchant service), Centrifuge drums, Paper machinery rolls, Print rolls, Fans, Assembled aircraft gas turbine rotors, Pump impellers, Flywheels, Machine-tool and general machinery parts, Medium and large electric armatures without special requirements, Small electric armatures, Individual components of engines under special requirements.

**G 16** Parts of agricultural machinery, Drive shafts (propeller shafts, Cardan shafts) with special requirements, Parts of crushing machines, Individual components of engines (gasoline or diesel) for cars, trucks and loco- motives, Crankshaft/drives of engines with six or more cylinders under special requirements.

**G 40** Car wheels, wheel rims, wheel sets, drive shafts, Crankshaft/drives of elastically mounted fast four-cycle engines with six or more cylinders, Crankshaft/drives of engines of cars, trucks and locomotives.

**G 100** Crankshaft/drives of fast diesel engines with six or more cylinders, Complete engines (gasoline ordiesel) for cars, trucks and locomotives.

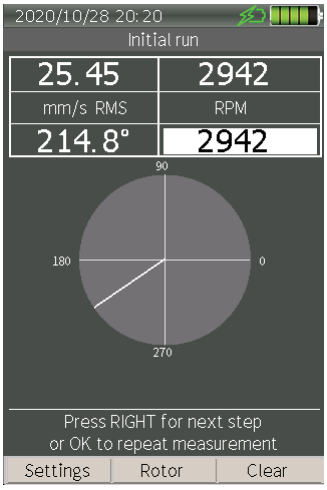
**G 250** Crankshaft/drives of rigidly mounted fast four-cylinder diesel engines.

**NOTE 1** It is impossible to balance to zero (0). There will always be some small remaining unbalance in the machine after the balancing procedure is finished. The ISO1940 standard provides help with regard to when you can stop the balancing procedure. If the remaining unbalance is less than the allowable unbalance according to the standard, then the machine is considered to be in good balance and the balancing procedure can be stopped.

**NOTE 2** Parts of a machine are normally balanced to one quality class lower than the whole machine. Example: A complete fan is normally balanced to Q6.3, but if you only balance the fan wheel you have to balance down to Q2.5.

**Balancing steps**
There are 3 basic steps to performing a new balancing session:

**1. Initial Run**
After you have made the settings for the balancing session, the rotor must be run at the balancing speed.




When the speed is stabilized:

• Press the OK key to start the initial measurement. This is the step when the balancing speed is saved in the rotor data. After this step, the speed is compared with this value to calculate if it is within the set tolerance.

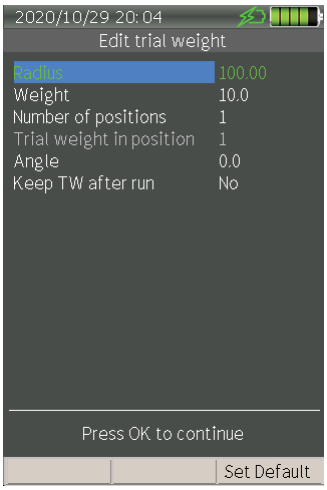
• Press the AUX key when the measurements are stable to save the value.
The saved rotation speed appears with a white background below the actual speed readings.

• Press the RIGHT arrow to go to the next step.

To clear previously measured data (and also the balancing speed), press the Clear key (F3). To repeat the measurement, press OK.

**2. Trial weight run**
Before starting the trial weight measurement, you need to edit the trial weight.

**Edit trial weight**
In this menu you enter:




• **Radius** Enter the radius of where you are placing the trial. If the value is already set in the Rotor settings, it will be displayed.

• **Weight** Mass of the trial weight.

• **Number of positions** With this function, the instrument distributes the balancing weight to evenly distributed positions. This eliminates the need for angle measurements in the rotor.
For example, if a fan has 6 blades then number the blades from 1 to 6 and write 6 in the setting for Number of positions. The instrument distributes the balaning weight to the blades nearest to each side of the correct angle. The vector sum of these two weights is equal to the calculated balancing weight.
The result is displayed in the form of two weights and two place numbers in the balancing menu.

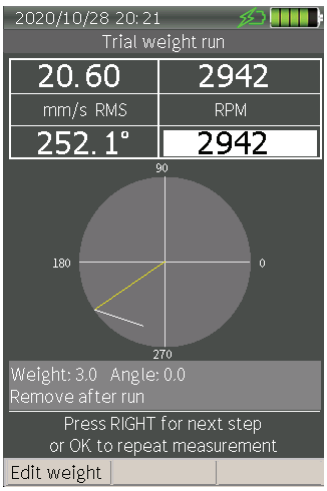
• **Trial weight in position** Here you enter the position where you have placed the trial weight.

• **Angle** This is the angle where the weight should be attached measured from the reference mark of the balancing plane against the direction of rotation of the shaft.

• **Keep trial weight after run** In this case the instrument will calculate a balancing weight that will balance both the trial weight and the original unbalance at the same time.
Why do I want to keep the trial weight in the machine?
• If the trial weight is impossible or very difficult to remove.
• If you have drilled or ground away material as a trial weight.
• If the trial weight substantially improved the balance status.
You can always step back and change this setting if the trial weight was unsuitable to keep. If you step back to change the resulting balancing, the weight will automatically be recalculated to not balance the trial weight.

• Attach the trial weight to the specified location and run the rotor to balancing speed.

• Press the OK key when the rotor speed has stabilized to start the trial weight measurement.



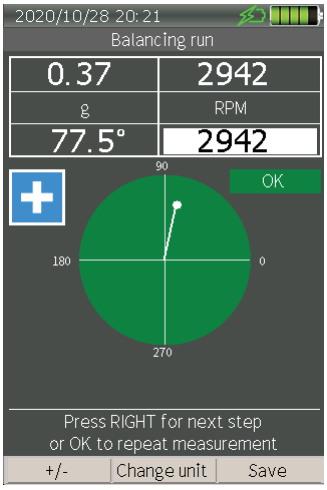

• Press the AUX key when measurements are stable to save the value.
If the speed is not within set limits, a warning message will appear when you try to save the measurement but you can still decide to continue (forcing the instrument to save).

• Press the RIGHT arrow to go to the next step. Press OK to repeat the measurement.

**3. Balancing run**
Using the data from the previous steps, the instrument calculates the weight to compensate residual unbalance and compares it with tolerances.

• Select a balancing weight according to the calculated value and enter it in the place shown on the display and run the rotor to balancing speed.

The position is counted from 0 against the direction of rotation. For example, if the rotor rotates clockwise, the position is counted from 0 counterclockwise.




• Press the OK key when the rotor speed has stabilized to start the balancing measurement.

• Press the AUX key when measurements are stable to save the value.

• Press the RIGHT arrow to go to the next step.

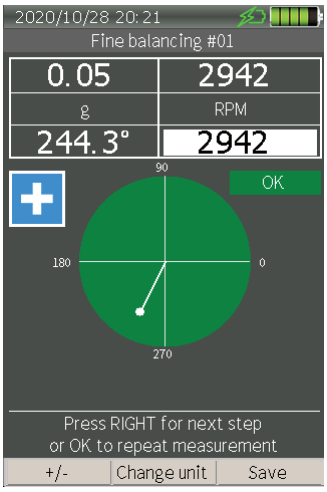
The options available are:
**Add/remove F1** To calculate the weight, switching between add + or remove - at the specified angle. A blue icon on the screen shows the current mode.

**Change unit F2** Switch the indication between weight and vibration units.

**Save F3** You can save the balancing file in the SD memory card to open it later in the menu or transfer it to PC software to make a balancing report.

**4. Fine Balancing**

Sometimes a small unbalance will remain when you have mounted the balancing weights. You can then select to continue with fine balancing and the instrument calculates new fine balancing weights in the same way as the instrument calculated the balancing weights. The number of Fine Balancing steps you can make is limited to 64.




• Repeat step 3 to perform fine balancing but with new suggested weight and place.

There are several reasons for having to add Fine Balancing weights:
• It is often difficult to place the balancing weight exactly at the angle that the instrument has calculated.
• It is often difficult to place the balancing weight on exactly the radius that you have written in the instrument.
• The stiffness of the bearing support is non-linear and depends on the vibration level.

Once the balancing weights are in place, you should start the machine and measure at least one more time to check the result. You may have made a mistake when you mounted the balancing weights or another fault may have arisen in the machine.

**Response matrix**

VIBER X4™ calculates and stores the unbalance sensitivity called Response Matrix while you are balancing. Next time you want to balance the same machine, you can use the Response Matrix and the instrument calculates the balancing weights directly after the first trial run, or if all the transducers are already mounted, even while the machine is still in production. No trial weights need to be mounted.

When you use the Response Matrix, all the transducers, including the RPM transducer, must be placed in the same directions and locations as when the Response Matrix was first calculated.

You cannot use balancing with the Response Matrix if the bearing stiffness has been changed. For example if:

• The machine has been moved from a stiff support to a support with springs or rubber feet.

• The machine has been moved from a support with springs or rubber feet to a stiff support.

• The weight of the machine has been changed by more than +/– 10%.

**Waveform**

The waveform is the shape of a time domain signal as seen on an oscilloscope screen. It is a visual representation or graph of the instantaneous value of the signal plotted against time. Inspection of the waveform can sometimes reveal information about the signal that the spectrum of the signal does not show. For instance, a sharp spike or impulse and a randomly varying continuous signal can have spectra that look almost identical, while their waveforms are completely different. In machine vibration, mechanical impacting usually causes spikes, while random noise can be caused by the advanced stages of bearing degradation.

**Waveform settings**

When you select Waveform, the instrument will display the setting menu where the following parameters can be set:

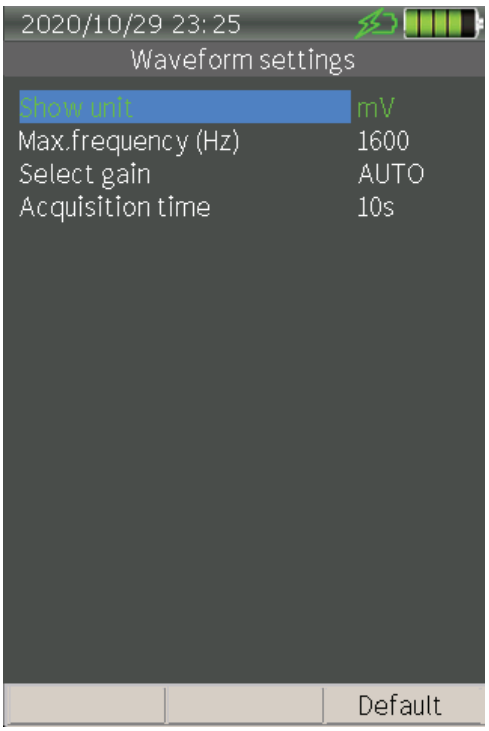
• **Show Unit** mV or g

• **Maximum frequency (Hz)** 1600, 3200 or 6400 Hz

• **Select gain** Auto, x1, x10 or x100.
Select Auto if vibration levels are stable. If the levels are variable, select a fixed gain to avoid auto-ranging while collecting waveform signal. The gain ratio depends on the vibration amplitude. The higher the vibration level, the lower the gain ratio.

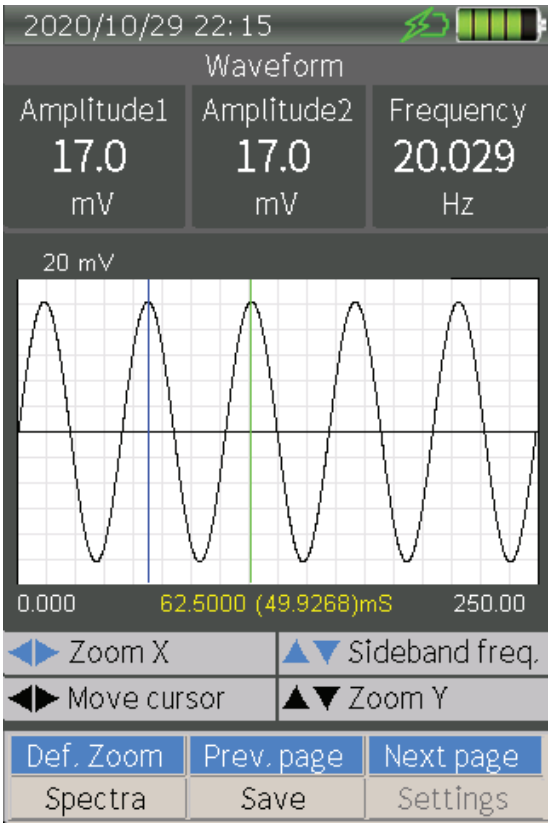
• **Acquisition time** From 10 seconds up to 20 minutes, depending on the maximum frequency selected above.

• **Set Default F3** Reset settings to default



**Waveform measurement**
When entering the waveform measurement, after the settings menu, a time domain signal window is shown in the middle of the display with some values shown above.

On the top left of the screen, the amplitude value of the blue cursor is shown, in the middle, the amplitude value of the green cursor is shown and on the right, the frequency calculated between these two cursors can be seen.




• **Zoom X, Ctrl + Left/Right arrows** Set X-Axis range in millisecond.

• **Zoom Y, Up/Down arrows** Set the Y-Axis range in mV or g, depending on the unit settings.

• **Move cursor, Left/Right arrows** Move both blue and green cursors to the left or right at same time.

• **Sideband frequency, Ctrl + Up/Down arrows** Moves blue and green cursors toward or away from each other to calculate the frequency between these two cursors. The Frequency value is displayed at the top right of the screen.

• **Spectra, F1** Shows the spectra instead of the waveform. All the settings in this menu are the same as in the spectra menu. See pages 30-31.

• **Default zoom, Ctrl + F1** Set the zoom back to default mode.

• **Save, F2** Save a measured waveform file in the SD memory card. It can be opened later in file menu or transferred to PC software to be analyzed.

• **Previous page, Ctrl + F2** Moves the contents of the time domain signal window one block backward. The length of each block can be changed by Zoom X.

• **Setting, F3** Enter the settings menu during measurement. This will be disabled when the measurement is completed.

• **Next page, Ctrl + F3** Moves the contents of the time domain signal window one block forward. The length of each block can be changed by Zoom X.

**Charging**

VIBER X4™ uses the latest battery charging technology called QC 3.0. We recommend using the VMI's original charger which is supplied with the VIBER X4™ on delivery. It is also possible to use an AC/DC adapter with 5V DC/2A output but this extends the charging time. When the charger is connected to VIBER X4™, the charging process starts automatically, regardless of whether the VIBER X4™ is switched on or off, and ends when the battery is fully charged.

A charge icon appears at the top of the screen when the charger is connected, regardless of which menu is selected. Different shapes and colors of the icon inform different modes, as described below.

 VMI's original quick charger is connected and charging is in progress with 2.048A charging current.

 Unknown adapter is connected and charging is in progress. Charging current varies between 0.5A and 1.5A.

 VMI's original quick charger is connected and the charging process is complete.

 Unknown adapter is connected and the charging process is complete.

 VMI's original quick charger is connected and the charging process has been suspended due to input overvoltage, high battery temperature or system overvoltage.

 Unknown adapter is connected and the charging process has been suspended due to input overvoltage, high battery temperature or system overvoltage.

 VMI's original quick charger is connected and the charging process has been stopped by the built-in timer. It is possible to resume the charging process by reconnecting the charger but the reason the timer has stopped charging should be checked.

 Unknown adapter is connected and the charging process has been stopped by the built-in timer. It is possible to resume the charging process by reconnecting the charger but the reason the timer has stopped charging should be checked.

**NOTE** The enclosure of VIBER X4™ may feel warmer than room temperature while using the quick charge. This is normal and is continuously checked by the charging processor. If the temperature rises too much, the charging process will stop immediately until the temperature drops to below the normal limits.

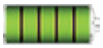
**VMI's original quick charger**

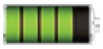
VMI's charger is a quick charger with QC 3.0 technology. Quick Charge 3.0 is engineered to refuel devices up to four times faster than conventional charging.
The charger is supplied with EU/US and UK Plugs and a USB-C cable.

The AC input range is 100V - 240V and DC output is 3.6V - 6.0V 3A, 6.0V - 9.0V 2A, 9.0V - 12V 1.5A. Total power on 18W.

**NOTE** The shape, color and size of this charger may be changed without further notice.

**Battery**
The battery pack's capacity is 23 Wh which can keep the instrument operational for more than 12 hours of continuous use. Try to keep the charge level as high as possible to keep the life of the battery pack as long as possible.
A battery icon appears at the top of the screen regardless of which menu has been selected. Different colors of the icon inform different modes, as described below:

 The battery pack is fully charged to 100% of the battery capacity.

 80% of the battery capacity remains.

 60% of the battery capacity remains.

 40% of the battery capacity remains. At this level you should fully charge the battery to keep the life of the battery pack as long as possible.

 20% of the battery capacity remains. Avoid using the instrument at this low battery level. The instrument will turn off automatically when the battery level approaches 0%.
A controlled shutdown will take place at this level to avoid losing measurement results.

**Supplied items**

**Standard VIBER X4™**

• 1 pc. VIBER X4™
• 1 pc. High performance accelerometer
• 1 pc. Transducer cable (1 m)
• 1 pc. Battery charger with EU/US and UK Plugs
• 1 pc. USB-C cable for transfer data to PC and charging
• 1 pc. In-ear stereo headphones
• 1 pc. Comfortable and adjustable shoulder strap with metal plate for attaching the transducer
• 1 pc. Robust, airtight, chemical resistant, dust- and waterproof, IP68, carrying case
• 1 pc. SpectraPro®, Route and analyzing software

**Optional accessories**

**Balancing kit**

• 1 pc. Balancing license
• 1 pc. Tachometer with holder
• 1 pc. 5m tacho cable
• 1 pc. 1m reflective tape
• 1 pc. Adjustable magnet holder for the tachometer
• 1 pc. Pocket scale

**Waveform**

• 1 pc. License for waveform measurement

**Demo unit**
These units may only be owned by VMI's authorized resellers and may not be resold to end users.
They are not included in VMI's standard service program and are not covered by any warranty repairs or calibrations.

These units can be recognized by:

• **Serial number** The serial number always starts with X4DEMO.

• **Sign** A "DEMO UNIT" sign is always displayed in the main menu.

**Important information**

Safety precautions

Vibration measurement and balancing involves measurement of rotating machines. Keep a safe distance from rotating parts and secure transducers and transducer cables away from rotating parts. Always follow internal, local and national security regulations! When working with weights on the rotor, always secure the start switch with a locking device and also use the emergency switch for double safety. This is especially important when the machine can be controlled remotely.

VMI takes no responsibility for any accidents to people and machines.

VMI and our authorized dealers will take no responsibility for any damage to machines and plants as a result of using the VIBER X4™ measurements.

Even though great efforts are made to ensure that the information in this manual is free from errors and to provide complete information for the end user, there may be items that have been missed due to the large amount of information. As a result, these items may be changed or corrected in later issues without further notice. Changes to the VIBER X4™ equipment may also be made which then affect the accuracy of the information.

## Technical data

| | | | |
|---|---|---|---|
| **Digital** | ADC | 24 bit, 128 kSPS | |
| | Dynamic range | 120 dB | |
| | Memory | 32 GB | |
| **Display** | Size & Resolution | 3.5 inch Amorphous TFT-LCD<br>320 x 480 pixels | |
| | Colors | 65536 | |
| **Signals in** | AC inputs | All standard ICP accelerometers (4mA/24V), velocimeters or general purpose AC transducers | |
| | Tacho input | 0.5 to 24 V Peak-Peak | |
| **Temp. sensor** | Temperature | -20 to 140 °C | Built-in infrared sensor |
| **Measurements** | Frequency range | Vibration: 0.5 to 12800 Hz<br>BC: 500 to 25000 Hz | |
| | Amplitude range | 0 to 80 g, peak | Depending on transducer |
| | Accuracy | 0.01 g ± 1 % for non integrated<br>0.1 mm/s ± 2 % for single integrated<br>2 µm ± 3 % for double integrated | |
| | FFT lines | Up to 12800 | |
| | Resolution | Up to 0.125 Hz/line | |
| | Windowing | Hanning, Hamming, Blackmann, Kaiser-Bessel | |
| **Power** | Battery | 3.7 V, 6.8 Ah Li-ion | Fuel gauge smart battery pack |
| | Operating time | 12 hours typical use | |
| | Charging | 2 hours up to 80% with fast charger | 4 hours fully charged |
| | Charger | Fast charger QC 3.0 compatible | |
| **Temp.** | Operating<br>Storage | -20 °C to +70 °C (-4 °F to 158 °F)<br>-30 °C to +80 °C (-22 °F to 176 °F) | |
| **Size** | Dimensions L x W x H<br>Weight | 190 x 100 x 60 mm<br>400 gr | |

**Declaration of Conformity**

VMI declares that the VIBER X4™ is manufactured in conformity with national and international regulations. The system complies with, and is tested according to, the following requirements:

EMC Directive: 2004/108/EC

Low Voltage Directive: 2006/95/EC

November 2020
Vibration Measurement Instrument International AB (VMI)

**Warranty disclaimer**

VMI warrants the products to be free from defects in material and workmanship under normal use and service within two years from the date of purchase. Warranty claimed products shall be returned prepaid to VMI for service. We reserve the right to repair or to replace defective products. Always try to explain the nature of any service problem by e-mail or telephone. First check all naturally occurring problems, such as discharged batteries, broken cables, etc. When returning the product, be sure to indicate that the purpose is to make repairs and indicate the original invoice number and date of shipment to you, if possible.

**Warranty exclusions**

Damage not resulting from a defect in material or workmanship or by other than normal use. Damage resulting from repairs performed other than by an authorized service center. The limited two year warranty and remedies contained herein are in lieu of all other warranties, expressed or implied, including any warranty of merchantability and any warranty of fitness for a particular purpose, and all other remedies, obligations or liabilities on our part. In addition, we hereby disclaim liability for consequential damages for breach of any expressed or implied warranty, including any implied warranty of merchantability and any implied warranty of fitness for a particular purpose. The duration of any implied warranty which might exist by operation of law shall be limited to one year from the date of original retail purchase.

**NOTE** Some countries do not allow the exclusion or limitation of consequential damages and some countries do not allow limitation on how long an implied warranty lasts, so the above exclusions or limitations may not apply to you. This warranty gives you specific legal rights and you may also have other rights that vary from country to country. If you have problems with your instrument during or after the warranty period, first contact the distributor you purchased the unit from.