

CXM FFT Analyzer[®]



User guide

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Note:

Instrument Screens design can be changed in the future software version and can be changed without any notice.

The screen shots in the present Manual are for reference only.

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1. STANDARD FEATURES

- **Route Measurement**
 - **Spectra**
 - **Time Signal (in Route)**
 - **Envelope**
 - **Analysis**
 - **Frequency Response**
 - **Overall Level**
 - **Bearing Energy**
 - **Transducer Check**
 - **Data Logger**
-
- **Display** Colour Graphic TFT 320 x RGB x 240, 72.88 x 55.36 mm, White LED
 - **Battery Pack** 6 x 1.2 NiMH AA, Type rechargeable
 - **Battery charger**
 - **USB** communication with PC (Personal Computer).

2. STANDARD KIT

- Display Box
- 1 x Accelerometer
- 1 x Accelerometer Cable, 1 m
- Extension Tip
- Charger
- USB Communication Cable
- Manual
- Carry Bag
- USB Memory Stick with documents

3. WARRANTY DISCLAIMER

MaintTech warrants the product to be free from defects in material and workmanship under normal use and provides service within 2 years from the date of delivery.

The Accelerometers (CTC) have **Life Time Warranty**.

If the instrument malfunctions, do not attempt to repair the instrument yourself, as this will invalidate the warranty.

Warranty claimed products shall be returned prepaid to MaintTech for service.

We reserve the right to repair or to replace defect products.

Precautions

WARNING: Please read and understand this section before operating your instrument. Not heeding the warnings or recommendations could result in data loss, data inaccuracy, damage to the instrument, or injury to you.

WARNING: Ensure the cables and bootstrap cannot be entangled with any rotating or moving machinery.

WARNING: Do not operate the instrument in an explosive environment.

CAUTION: Mount the accelerometer properly before taking measurements or recordings (see: Accelerometer Setup Section). Otherwise, the data will be erroneous and/or inconsistent.

CAUTION: Do not use alcohol or any organic solvents to clean the instrument.

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

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4. INSTRUMENT KEYPAD

The keypad has an alternate function key, the ALT key (blue colour). ALT key may be used in combination with any other key to generate an alternate key code.

1. ON/OFF button. Used to start/stop the instrument. 
2. ENTER key. Used to confirm an action, also to start a new measurement. 
3. STORE key. Identically functions as ENTER key. (in the future releases can have special meaning) 
4. ESC key. Escape key. Used in combination with ALT key has a BACK meaning (return to previous screen) 
5. Arrow keys. Used to make an item selection or to move the cursor right/left.  
6. Number keys (0 to 9 and dot). Used to edit various parameters. In combination with ALT key can be used to generate SPACE and MINUS. Some number keys can be used to generate short-cuts (direct access to some most used functions, as follows:
 - ALT +1. Activate Balancing menu  
 - ALT +2. Activate Vibration Overall level menu 
 - ALT +3. Activate Instrument Settings menu 
 - ALT +4. Activate Instrument to PC communication menu (USB) 
 - ALT +5. Activate Route Measurements In some menus, the number keys can be used directly as short-cuts (to execute the numbered command from the list).
7. MAIN key– Used to activate Main menu, directly. 
8. MENU key – This key activates context setting menu. The context setting menu is not available in all screens. See details below. 

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9. F1, F2, F3 and F4 keys.  These keys have various meanings, depending on the on-screen menu. The meaning appears on the bottom part of the display.

BACKLIGHT key.  This key has two meanings:

- If this is used alone, re-adjust the backlight intensity to the default level. The default level can be established by the user in System-> Setting menu
- In conjunction with UP or DOWN arrow keys (LIGHT + UP or LIGHT + DOWN) can be used to adjust live the backlight intensity.

5. INSTRUMENT LED'S

CXM has three LED's, two are placed on the keypad and one is placed nearby the CHARGER-IN connector.

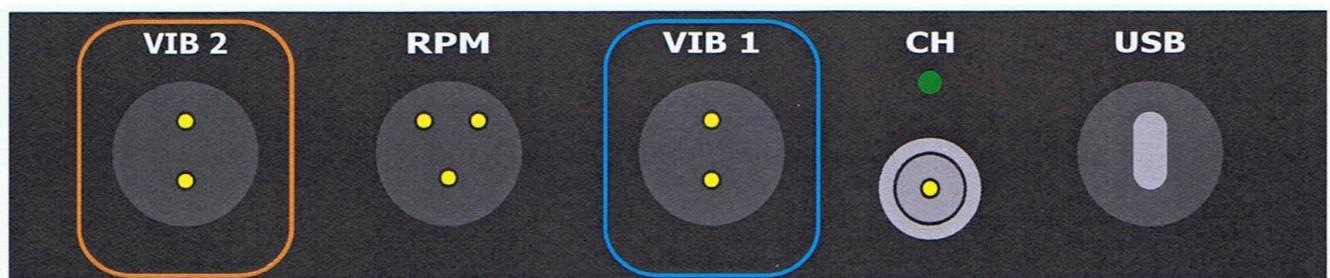
LED 1 (two colour) – This is the Instrument's status LED. When the instrument started, the LED will flash (green and red) for 1-2 seconds. If, after starting, the LED remains RED, this indicates a general Instrument failure. Normally, after starting-up, this LED will be off.

LED 2 – This LED is lit when any key is pressed, indicating that the keypad generate key codes. If one or more keys are damaged, when these keys are pressed, the LED will not be lit.

LED 3 (two colour). Charger status LED. If the charger is not attached, the LED will be off. Once when the battery charger is plugged-in, the LED will be lit in Green colour. If the charger detects a fault, the LED will be lit in Red. When the battery charging process is finished, both colours will be activated (Red/Green).

EXTERNAL CONNECTORS

External connectors are used to connect Vibration Transducers, RPM Transducer, external Charger and USB cable to the Instrument.



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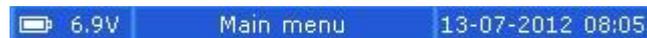
Instrument supports two types of vibration transducers:

- Accelerometers (Included as standard in the CXM FFT Analyzer kit)
- Velocity sensor (Can be delivered at order)

Depending on the selected measurement, only some of the transducers are required.

STATUS BAR

On the Display top side, in almost all screens, a status bar is shown as follows:



In the left side is shown as an icon, the power supply source, as follows:

- From the battery pack (a battery icon and the battery voltage)
- From the external charger (a charger icon and the battery voltage)
- From USB cable (a USB icon).

The battery icon can be coloured as follows:

- White. Battery OK.
- Yellow. Battery is more than 80% discharged.
- Red. The battery is almost discharged. The Instrument must be stopped immediately. The measurements done with the Battery icon in this status may be affected.

The charger icon can be coloured as follows:

- Green. The battery pack is in the charging process.
- Red. The charger detects a battery fault. The charging process is stopped.
- Yellow. The charging process is finished. The user can disconnect the external charger.

NOTE. When the Instrument is supplied through USB cable, the battery pack is NOT charged.

In the right side is shown the current date and time. The date and time can be adjusted in the System menu.

6. STARTING THE INSTRUMENT

When the Instrument is started-on, a logo will be visible for 1-2 seconds. Then the Instrument will show the latest menu selected when it was stopped.

NOTE. If the application software is damaged or corrupted, the Instrument Operating System will be unable to load and run the application.

The Operating System has only three commands are available, as follow:

1. Load application from SD Card
2. PC Communication
3. Run application

If the Instrument doesn't start normally, the third command will not work, because the Operating system has found that the application is missing or is corrupted.

First command can be used only if there is at least one application file in the PROGRAM directory. The application file is named CXBxxx.cxp, where xxx means the application version.

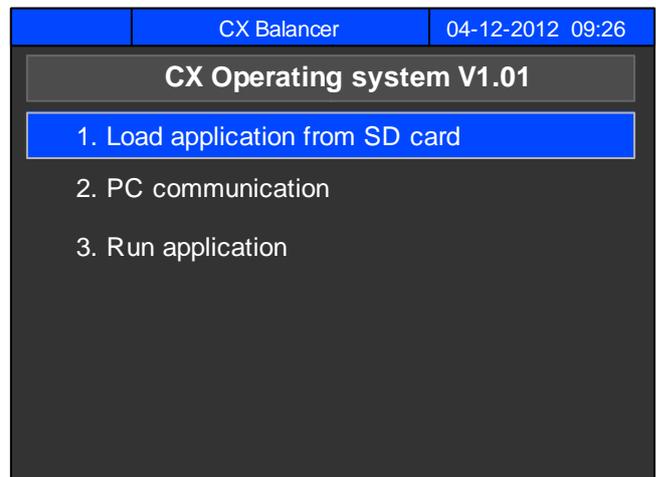
If more than one application files exist in PROGRAM directory, a browse list will appear on the screen. The user can select any of the application to be loaded into the RAM memory. After selection, the Operating System loads and runs the selected application.

Because the application is stored in the Instrument RAM memory, the application can run until the Instrument is stopped. To store the application in Flash memory (**permanent storage**); inside of application, just select **System-> Update program** command.

If in the SD Card doesn't exist any application file, the user must select the second command:

PC Communication - The USB cable must be connected to a computer.

The SD Card contents will be published in the File Browser, acting similarly with any USB Memory Stick. **No driver is required**; any computer will recognize automatically the card. Now, the user must copy an application file (CXBxxx.cxp), to the PROGRAM directory. Then the user must press ESC key to return to the Operating System window and using the **Load application from SD Card** command, he can load the application into the RAM memory.



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NOTE: The Operating System can be activated anytime if required, as follows:

- **Switch off the Instrument**
- **Press and keep ESC key pressed and start the Instrument**
- **The Operating System windows will be shown.**

STOPPING THE INSTRUMENT

The Instrument can be stopped any time, just pressing the ON/OFF button. On the next state, the last menu selected will be shown.

NOTE. *To save battery's life, just stop the Instrument if it isn't used. This action can also be done for short time interval. No damages occur, if the Instrument is started / stopped frequently.*

Also, to save battery's life, in the Settings menu can be set a time period for auto-stop.

When the keypad wasn't pressed for a longer time than indicate the settings, the Instrument will be automatically stopped. The user can cancel the stopping sequence, by pressing any key for 10 seconds, after the auto-stop event has occurred.

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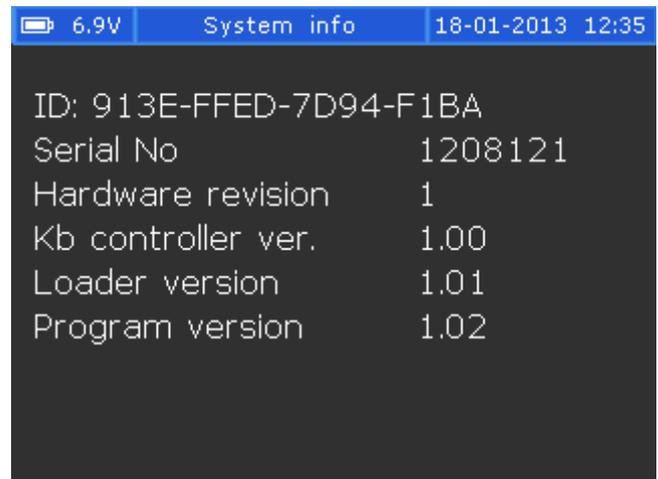
7. MAIN MENU

Main menu can be accessed anytime by pressing repeatedly the Esc key or directly, by pressing the MAIN key.



SYSTEM MENU

System menu can be accessed from the Main menu. Here you can Update the program, see the software version in the instrument, edit the transducers, check the transducers and change the Instrument settings.



8. ROUTE MEASUREMENTS

1.1 Route files

The following steps must be done in order to use the route transfer:

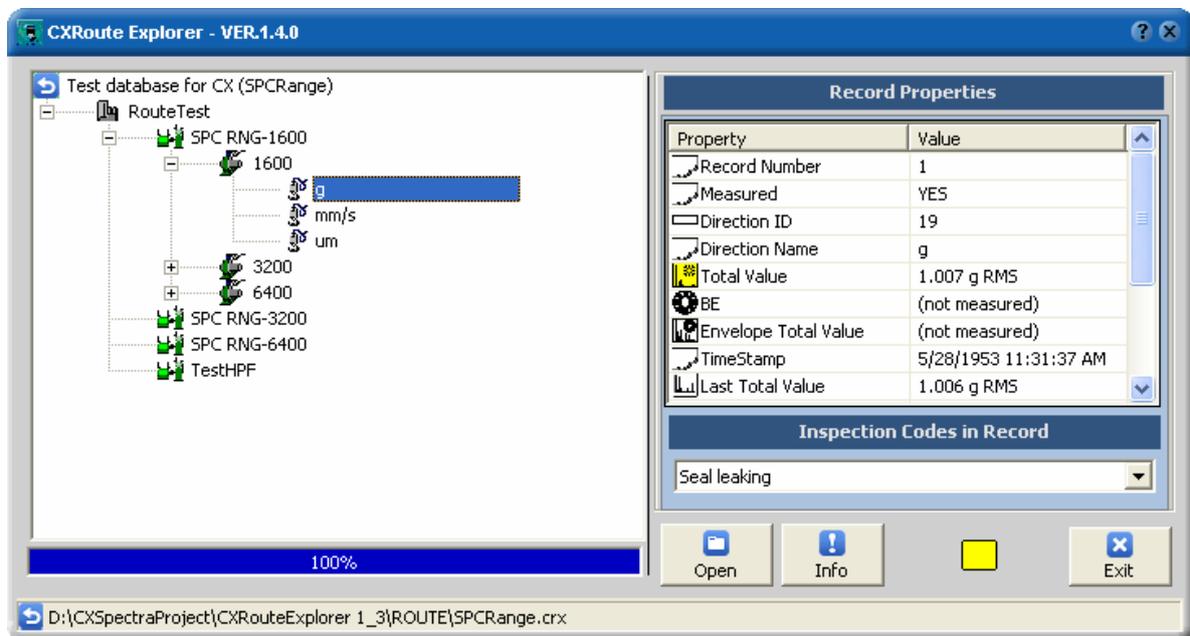
- Create a route in CXSpectra© application;
- Download the route definition into CXM FFT Analyzer®;
- Perform the measurements;
- Download the route measurements back in the Machine Database.

Any Route file is a binary file having **.crx** extension. The Route files can be downloaded from the computer into the Instrument just using the CXSpectra© *Transfer* Menu commands or can be copied directly onto CXM FFT Analyzer® micro SD Card, in the Route folder.

To download a Route file with measurements, the next commands **Transfer -> To/From Instrument or Transfer To/From Files** must be used.

Before downloading a route in the Machine Database, the contents of the Route files can be previewed with the *CXRouteExplorer* application, found onto CXSpectra© Installation CD. This is a free application and can be used without any Protection Key.

See below a screen-shot presenting how to open a route with *CXRouteExplorer*:



1.2 Measuring in route

The route items are shown as below:

The screenshot shows a handheld device interface with a blue header bar. On the left, it displays '6.9V' with a battery icon. The center of the header says 'Route' and the right says '10-09-2013 08:38'. Below the header, the text 'Route: RUTA2' is visible. A list of items is shown: 'SECTIA1', 'Machine #2', 'Point #1', and 'Vertical' (which is highlighted with a blue bar). To the right of this list is a vertical stack of controls: a fraction '1/24' and a checked checkbox. Below this is a table with four columns: 'Meas. unit', 'Last', 'Current', and '%'. The rows are: 'mm/s RMS' (Last: 9.78, Current: 4.25, %: -57), 'gE RMS', 'gEn P' (Current: 10.76), and 'Date/time' (29/08/2013-09:19:04). At the bottom, there are four buttons: 'Change', 'Settings', 'Record info', and 'Insp. code'.

Meas. unit	Last	Current	%
mm/s RMS	9.78	4.25	-57
gE RMS			
gEn P		10.76	
Date/time	29/08/2013-09:19:04		

In the upper left corner is shown the hierarchy tree and in the upper right side appears the current record number (and the total records in the route). In the bottom of the screen is shown the measurement table. In the first column is shown, in each row, the measuring unit for:

- Total value (vibration overall value, speed or manual points)
- Bearing Energy (disable if is not settled in the route editor)
- Envelope spectrum unit (disabled if is not settled in the route editor)

The last row shows the measurement time-stamp (only if the Record is measured).

In the *Last* column are shown the latest measurements existing in the Machine database (the row is empty if there isn't any previous measurement). In the *Current* column is shown the result of the measurement (if it was done). The row is colored according with the alarm settings in the Machine database. In the last column (%) is indicated the change between the *Last* and *Current* measurement. A plus (+) sign indicates that the Current measurement is higher than the last one.

1.3 Moving in route

Depending on the blue cursor in the item hierarchy, the movement in the route list can vary. The movements between records can be done with the keypad LEFT and RIGHT arrow keys. If the cursor is placed onto the Department level, an advance in the route will be done from Department to Department. If the cursor is placed onto the Machine level, the movement will be done from Machine to Machine a.s.o.

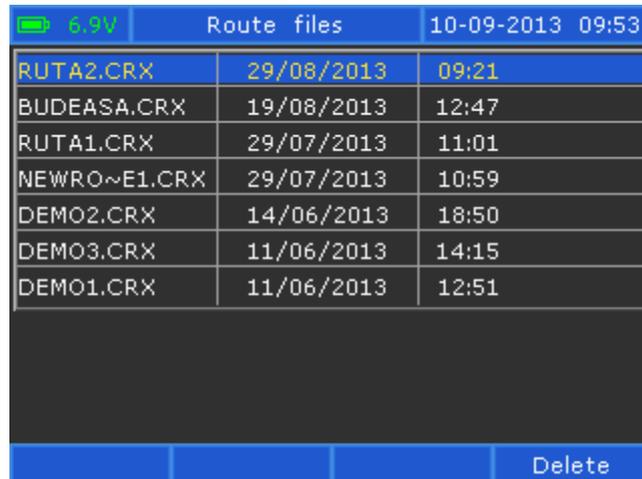
If the Instrument is shut off, at the next start, the record counter will remain in the last position.

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1.3.1 Route Menu line

Change Settings Record info Insp. code

F1 - Change. Allows the user to change to another existing route:

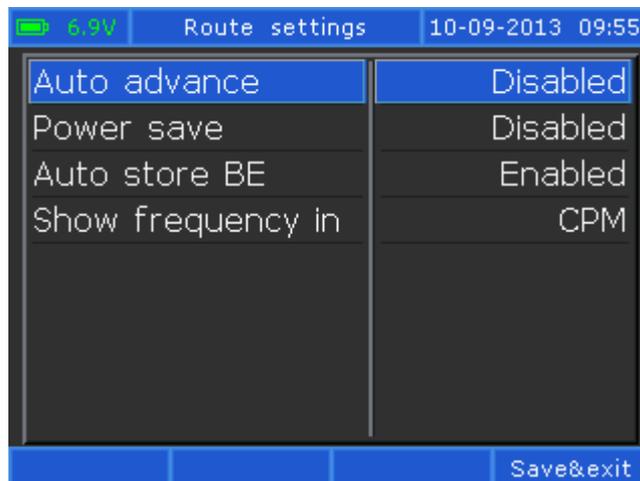


Route file	Date	Time
RUTA2.CRX	29/08/2013	09:21
BUDEASA.CRX	19/08/2013	12:47
RUTA1.CRX	29/07/2013	11:01
NEWRO~E1.CRX	29/07/2013	10:59
DEMO2.CRX	14/06/2013	18:50
DEMO3.CRX	11/06/2013	14:15
DEMO1.CRX	11/06/2013	12:51

Delete

Just select the new route (with UP or DOWN arrow keys) and press ENTER. Use F4 to delete a route from the Card. Press ESC to return without changing the active route.

F2 - Settings. General route settings can be done here:



Auto advance	Disabled
Power save	Disabled
Auto store BE	Enabled
Show frequency in	CPM

Save&exit

- **Auto Advance** (Enabled or Disabled). If it's Enabled, after the measurements were completed, the record pointer will automatically advance to the next record.
- **Power save** (Disabled or Enabled). If it's Disabled, the accelerometer power will remain ON between consecutive the measurements. This can speed up the acquisition time, but increases the power consumption.
- **Auto advance** (Enabled or Disabled). The first measurement in the route is Total value. Even if the measurement is stable, the measurement will never be automatically saved, but is waiting for the user to press the STORE button. For the remaining measurements (BE and Envelope), the Instrument can automatically save the measurements when stable, but only if *Auto advance* setting is *Enabled*. Otherwise, the user must save these measurements by pressing the STORE button.

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NOTE. After a setting was changed, the user must press F4 -Save&Exit to save the settings. If the user presses ESC, the settings won't be changed.

F3 - Show frequency in - (CPM or Hz) - The user can select the desired unit for the Speed measurement.

F4 - Inspection Code - For each Machine the user can add one or more Inspection Codes. The Inspection Code list is defined in the CXSpectra[®] Software and it will be transferred together with the route definition.

The Inspection Code items can be added in ANY Direction of the machine:



To add (or remove) an Inspection Code, just proceed as follows:

- Select the item with the cursor.
- Press the STORE key to add (or remove) the item.
- Press the ENTER key to save the selection or press ESC to keep everything unchanged.

NOTE: The Inspection Codes will be transferred into the Machine database, in the Machine Notepad.

1.3.2 Measuring in Route

For Vibration directions and Speed points:

- Select the Record.
- Place the transducer into a correct and stable position.
- Press the ENTER key to begin the measurement. Wait until the reading becomes stable and then press the STORE button.

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9. BEARING ENERGY

The Bearing Energy coefficient is a bearings condition estimator.

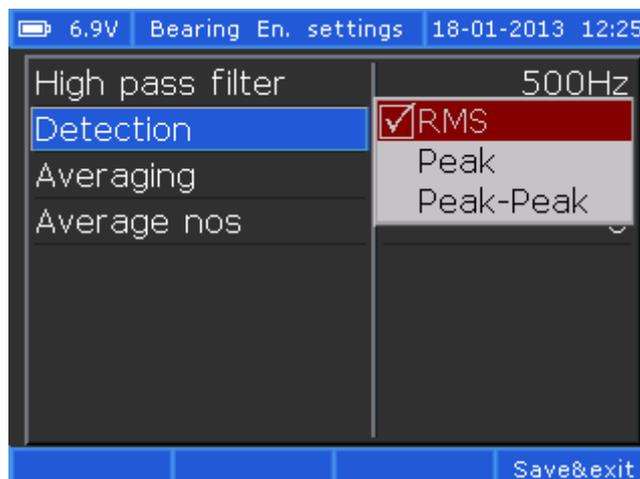
To measure the BE, from the Main Menu select Measurements and then *Bearing Energy*.



Bearing Energy is the Overall value of vibration in a high frequency range.



To change the show unit, press Settings (F2) and select RMS, Peak or Peak-Peak and press ENTER. Press Save&exit to activate the change.



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Press F2 - Settings to select the Filters:



After selecting the filter, press F4 to save the settings.

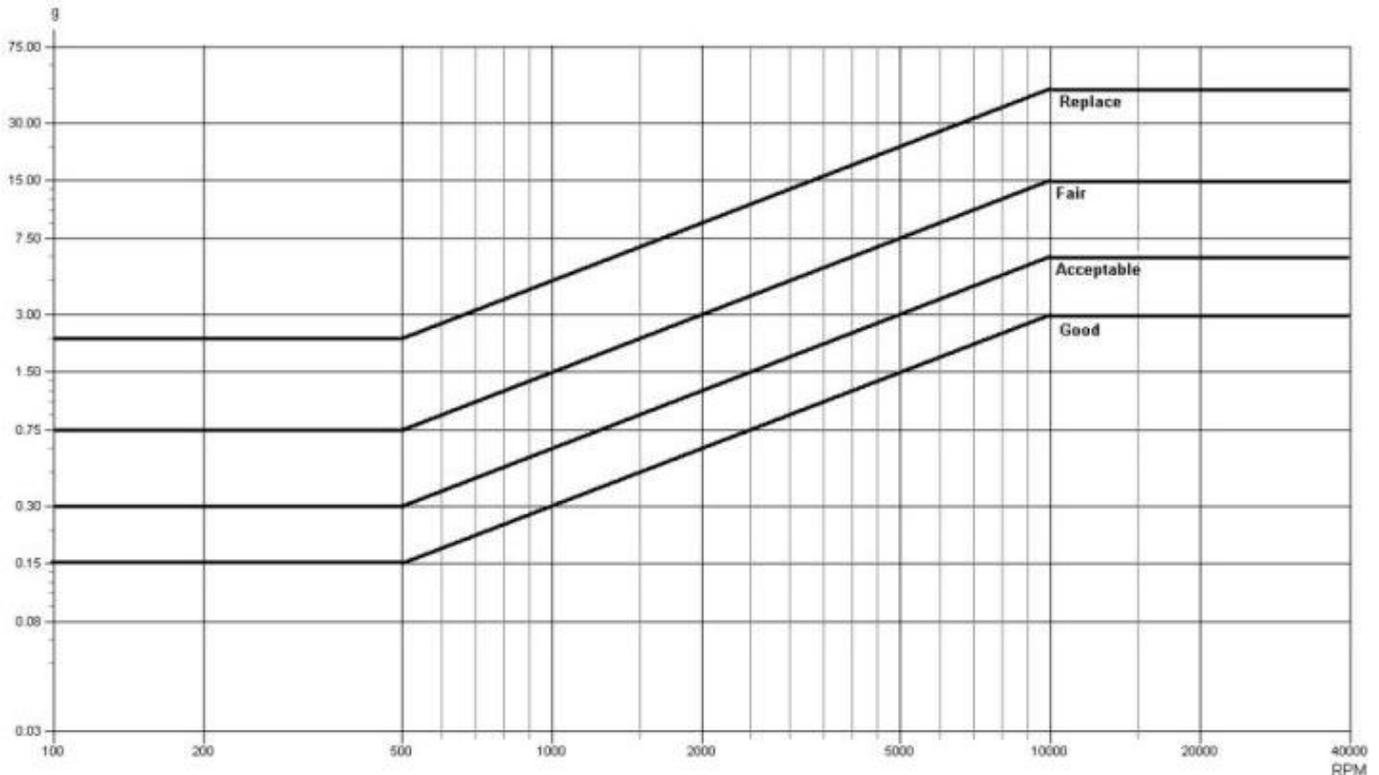
The list below shows the available frequency ranges.

Frequency range can be 500 Hz, 1000 Hz or 2000 Hz.

Use a low frequency range for low speed machines (below 600 RPM) and a high frequency range for high speed machines (above 6000 RPM).

Press F1 key to hold the measurement.

Press *Enter* key to continue measuring.



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The Bearing Energy value has the unit "g" Peak.

Find the machine speed. Follow this line up to the judgment lines and read the value onto the left axis.

The above diagram is just a guide to interpret the bearing condition value. If vibrations of other causes (e.g. flow surge, gear mesh) are within the selected frequency range, this can give a high bearing condition value, even if the bearing is not damaged.

A high bearing condition value can also be acquired if the bearing is poorly lubricated or is overloaded (e.g. by misalignment, or large belt forces).

Overall Level

Short Vibration Theory

The **Overall Vibration** is defined as the sum of a vibration energy produced across a filtered band-width or the sum of all vibration, measured within a specified frequency range.

Used as an initial "alarm" type survey, whereby if the overall indication is above a specified value, a more detailed survey is performed to identify the possible cause.

The Overall vibration level "A" in a frequency range, as defined by the following equation, shall not exceed the Overall Amplitude Acceptance Limit specified for that frequency range (see also ISO-10816).

$$A = \sqrt{\frac{\sum_{i=1}^N A_i^2}{1.5}}$$

A = Overall vibration level in the frequency range

A_i = amplitude in the i^{th} line of resolution in the frequency range

($i=1$) = the first line of resolution in the frequency range

($i=N$) = the last line of resolution in the frequency range

N = the number of lines of resolution in the frequency range

The **fundamental frequency** - often referred to simply as the **fundamental** and abbreviated as $1 \times \text{RPM}$ - is the rotational speed of a rotor. The fundamental frequency is also called the **first harmonic**.

The **second harmonic**, abbreviated as $2 \times \text{RPM}$, is twice the fundamental frequency and the **third harmonic**, abbreviated as $3 \times \text{RPM}$, is three times of the fundamental frequency.

The harmonics can also be defined as frequency components at a frequency that is an integer multiple of the fundamental frequency ($1 \times \text{RPM}$).

The sum of the first three harmonic amplitudes can be calculated as root of squared value.

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Example: Assuming that:

1 × RPM Amplitude = 7 mm/sec

2 × RPM Amplitude = 5 mm/sec

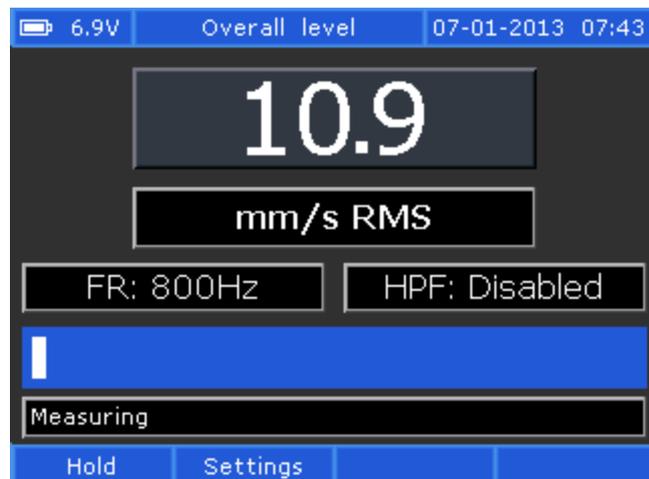
3 × RPM Amplitude = 2 mm/sec

The sum of the above amplitude can be calculated with the formula:

$$S = \sqrt{(1 \times RPM)^2 + (2 \times RPM)^2 + (3 \times RPM)^2} = \sqrt{49 + 25 + 4} = 8.83 \text{ mm/sec}$$

10. OVERALL LEVEL

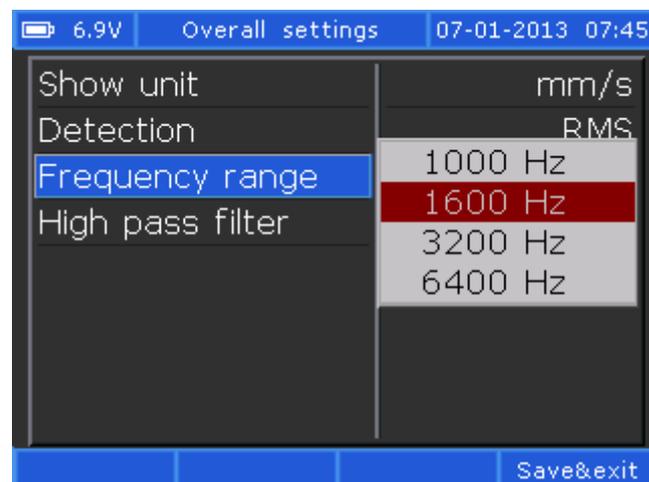
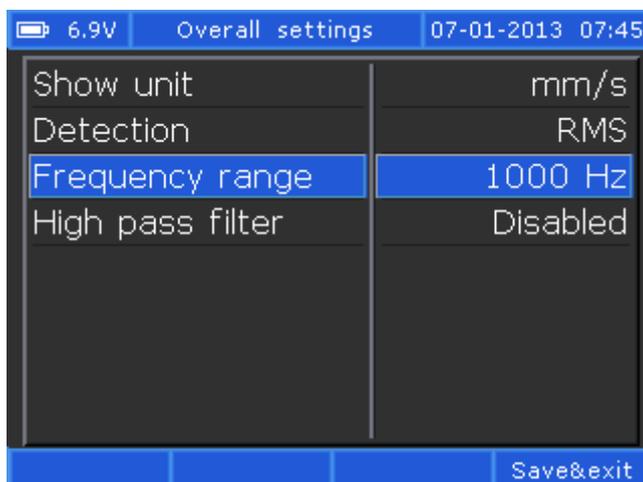
To measure the Overall level, select Measurements on the Main Menu and then Overall level.



Press F1 key to hold the measurement.

Press Enter key to continue the measurement.

Press F2 key for settings. Select *Show unit*, *Detection*, *Frequency range* or *High pass filter* and press ENTER.



Max. Frequency may be:

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- 1000 Hz
- 1600 Hz
- 3200 Hz
- 6400 Hz

A High Pass Filter can also be added, as follows:

- 4 Hz
- 8 Hz
- 10 Hz

Select the frequency range and press ENTER.

If you change some setting, just press F4 (Save&exit) to activate the change.

DIN ISO 10816-3 and -7

DIN ISO 10816-3 standard allows slightly higher limits when a foundation is considered flexible than when it is rigid. A conclusion from this is also that a resonant condition in principle is not allowed or at least should be avoided at operation speeds. In practice this also includes the double speed as well as any other natural excitation frequency such as blade passage etc.

Modern machines have high speeds, flexible bearing supports and foundations and can be considered as flexible even if it is not mounted on rubber or springs.

DIN ISO 10816-3	Group 1		Group 2	
Machine Type	Large machines 300kW < P < 50MW		Medium machines 15kW < P < 200kW	
	Motor H > 315mm		Motor 160mm < H < 315mm	
Foundation	flexibel	rigid	flexibel	rigid
Velocity v_{eff} mm/s rms	11,0	D		
	7,1	C		
	4,5			
	3,5	B		
	2,8			
	2,3			
	1,4	A		

A Newly commissioned machines
 B Unrestricted long term operation
 C Restricted long term operation
 D Vibration causing damage

DIN ISO 10816-7 plays a very important role for maintenance technicians in the evaluation of vibrations in centrifugal (rotodynamic) pumps.

The new ISO 10816-7 is valid since August 2009.

Original title of the standard:
 Mechanical vibration -
 Evaluation of machine
 vibration by measurements on
 non-rotating parts - Part 7:
 Rotodynamic pumps for
 industrial applications,
 including measurements on
 rotating shafts (ISO 10816-
 7:2009).

DIN ISO 10816-7	Category 1		Category 2			
Pump type	Rotodynamic pumps with high reliability, availability or security requirements.		Rotodynamic pumps for general or less critical applications.			r < 600 rpm
Power	< 200 kW	> 200 kW	< 200 kW	> 200 kW		0.5 rpm 1.0 rpm 2.0 rpm
Velocity v_{eff}	7,6	D	9,5	D		D
	6,5	C	8,5	C		
10 – 1000 Hz r > 600 rpm	5,0		6,1			
	4,0	B	5,1	B		
2 – 1000 Hz r < 600 rpm	3,5		4,2			
	2,5		3,2			
mm/s rms		A	mm/s rms	A	Displacement S_{PP}	
					130	C
					80	B
					50	
					µm	A

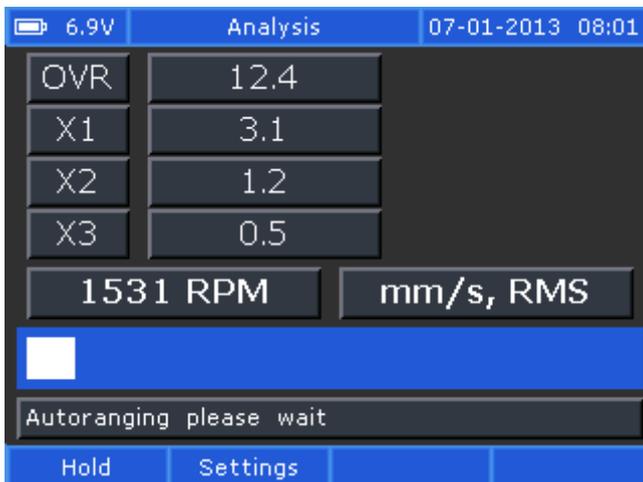
A Newly commissioned machines
 B Unrestricted long term operation
 C Restricted long term operation
 D Vibration causing damage

11. HARMONICS

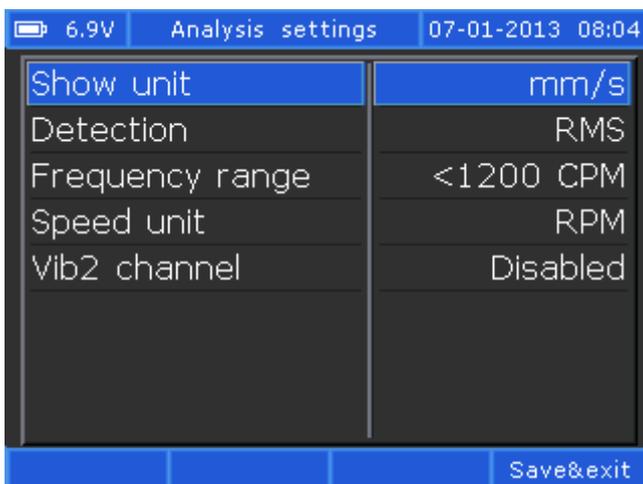
Select *Measurements* on the Main menu, press ENTER, then select 6. *Harmonics* and press ENTER.

The analysis screen shows the followings measurements:

- The overall vibration level
- The amplitude of the first three harmonics (1 × RPM, 2 × RPM and 3 × RPM)
- Rotor speed (a photocell must be attached).



The vibration transducers have to be placed on the bearings nearby the monitored rotor.



Press F1 key to hold the measurement.

Press *Enter* key to continue measuring.

Press F2 key for settings:

Use a low frequency range for low speed machines (below 1200 RPM) and a high frequency range for high speed machines (above 1200 RPM).

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The analysis of these values can be done as follows:

1. If the overall vibration is low (below the Overall Amplitude Acceptance Limit), it may be considered that the machine is running normally, on medium-term and even long-term. In this case, corrective measures are not necessary and the equipment can be kept running.
2. If the overall vibration exceeds the Overall Amplitude Acceptance Limit, the following harmonics have to be analyzed:
 - a. If the amplitude at $1 \times \text{RPM}$ exceeds 75% of the overall amplitude and the amplitude values for the second and the third harmonics $2 \times \text{RPM}$ and $3 \times \text{RPM}$ remains low, than the rotor is unbalanced. A successful balancing procedure will significantly reduce the overall vibration of the machine.
 - b. If the sum of the first three harmonics (calculated as above) is more than 75% of overall amplitude and the amplitude values at $2 \times \text{RPM}$ and $3 \times \text{RPM}$ are also important, then:
 - The machine is misaligned
 - Or
 - The rotor is unbalanced and the bearings have looseness.

An unbalanced rotor might be suspected if a high amplitude peak appears at $1 \times \text{RPM}$, a relatively low one at $2 \times \text{RPM}$ and a negligible one at $3 \times \text{RPM}$.

When the peak at $2 \times \text{RPM}$ exceeds $1/3$ of the fundamental amplitude, it may be misalignment. When the amplitude of the second harmonic ($2 \times \text{RPM}$) is more than $1/2$ of the fundamental, than most probably is misalignment.

Before balancing, just check the alignment first and then correct it, if necessary. Measure again to see the improvement.

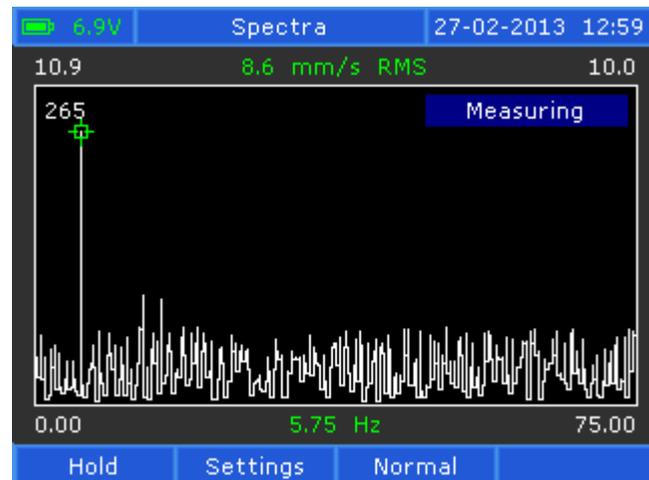
- c. If the sum of the first three harmonics is more than 75% of overall amplitude, then definitely the machine has also other mechanical faults, which might be seen at different frequencies than those already displayed. In this case, it is no use to balance the rotor, because you won't get an important decrease of the overall vibration. You should rather perform an investigation by spectrum analysis to identify the real sources of these large amounts of vibration.

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12. SPECTRA

To measure Spectrum with CXM go to the *Main Menu*, select *Measurements* and press *ENTER*.

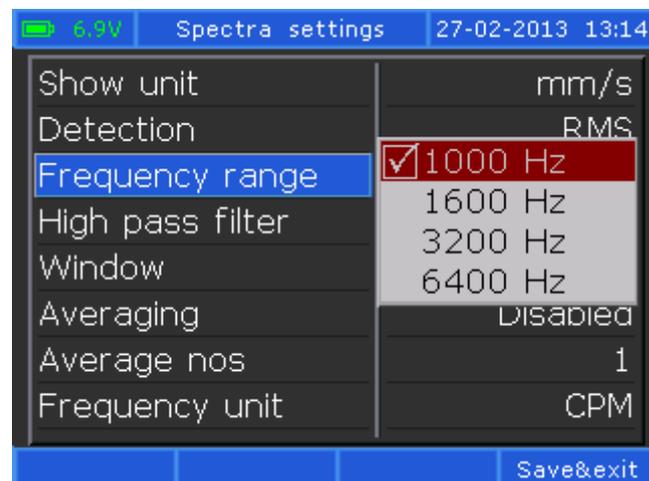
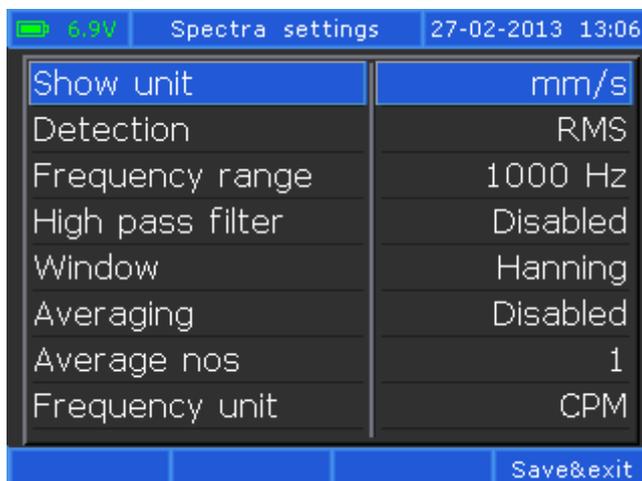
Go to 3. *Spectra* and press Enter.



Press *F2* or *Settings* button.

Here you can change the default settings.

To activate the new settings, press *Save&exit* button.



If the averaging is disabled, the spectrum is shown live on screen until the user presses *Hold*.

When the spectrum is measured (with or without averaging) the user can use the cursor and also the Zoom function.

This is important, because LIVE measurements can be done sometimes, but if the user does not have available cursors, he can see nothing.

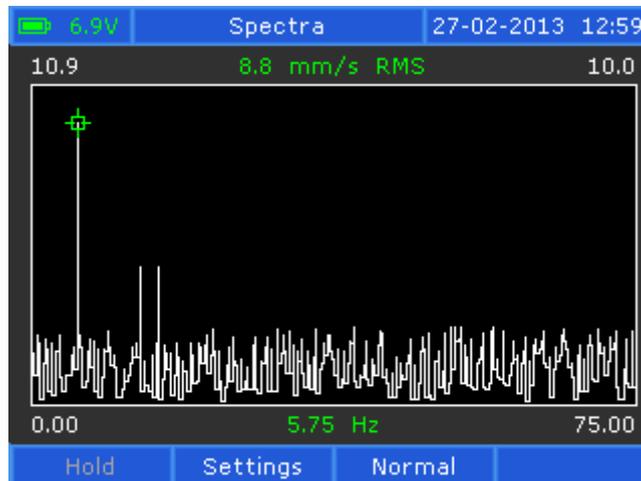
The Zoom function makes the zoom around the cursor position. The Zoom is a **true zoom**. This means that on the screen ALL the spectrum lines (300 lines= LCD Display resolution) are visible.

When a measurement begins the cursor is automatically placed on highest line in spectrum. If the user does not move the cursor (with arrow keys) manually, the cursor remains locked

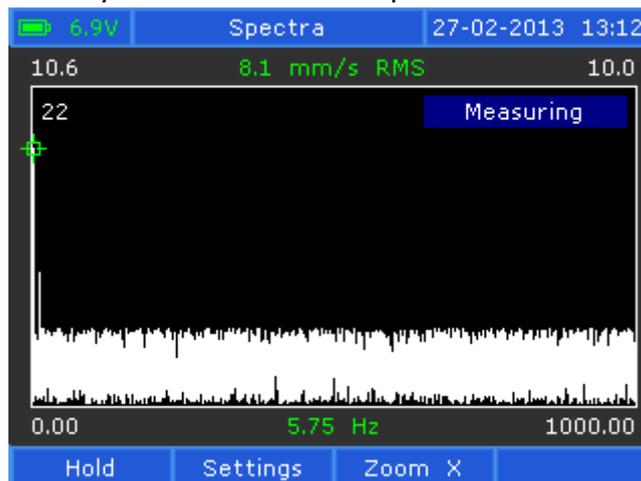
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on the highest line position. This is important, because if the machine speed is changed, the cursor will follow the highest speed.

Press *F1* or the *Hold* button to stop the measurement.

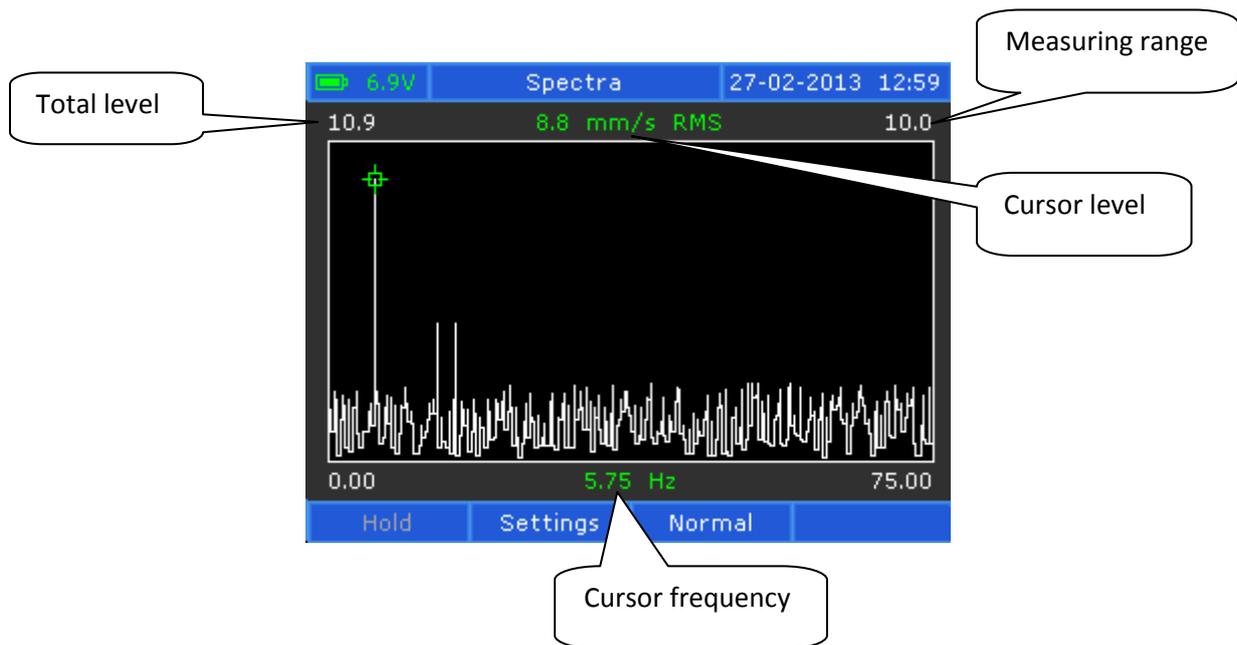


Press *F3* or *Normal* button and you zoom out the Spectrum.



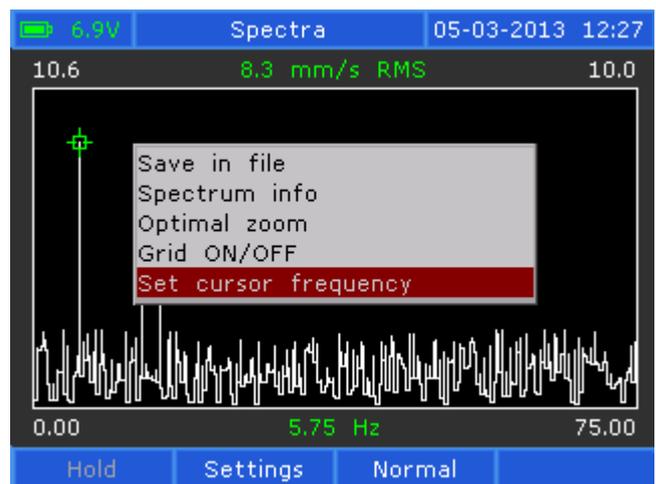
Press *F3* again and you zoom in Spectrum.

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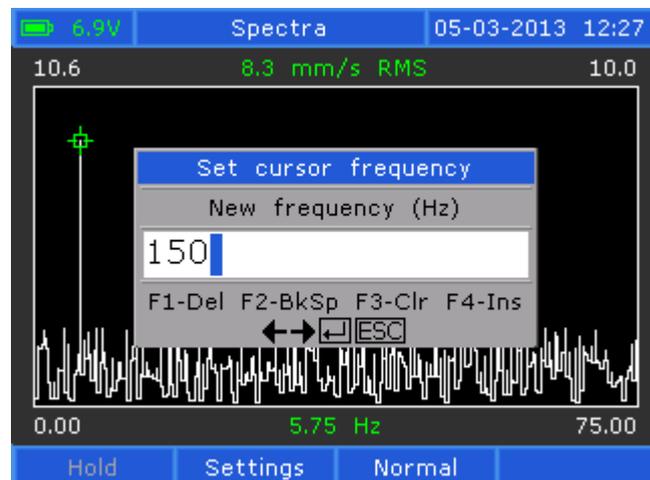
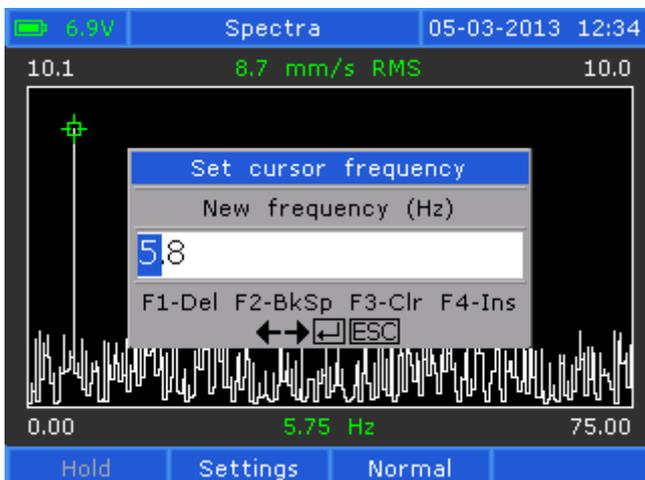


Move the cursor with  or  key.
 Decrease the measuring range with  key
 and increase it with  key.
 Stop the measurement by pressing *F1* or *Hold* button.

Press the MENU key  and select *Set cursor frequency* and press ENTER. Now you can place the cursor in the next window.

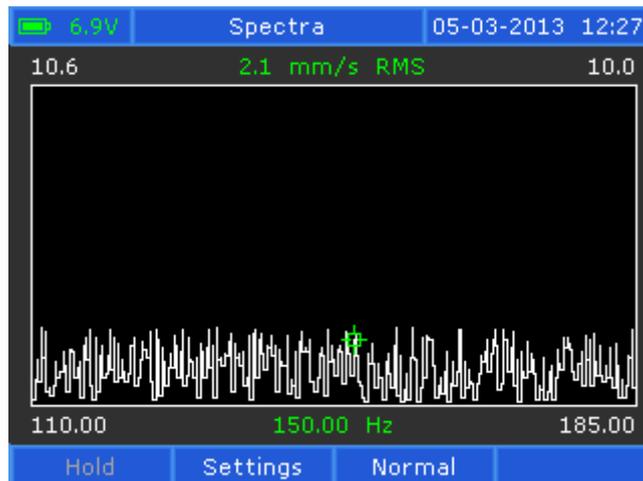


Enter the new frequency and press ENTER.



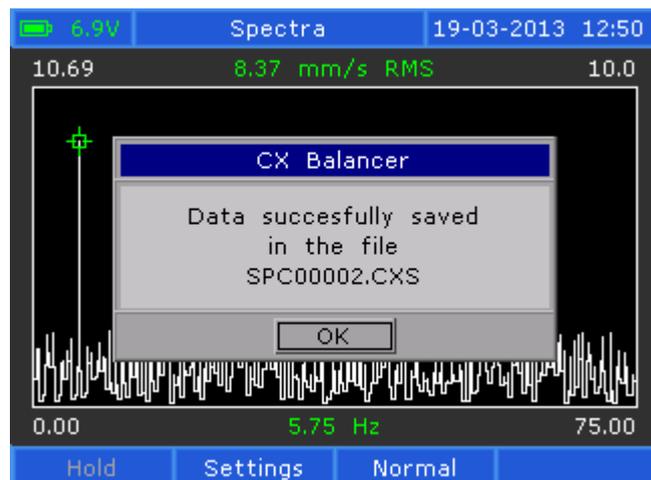
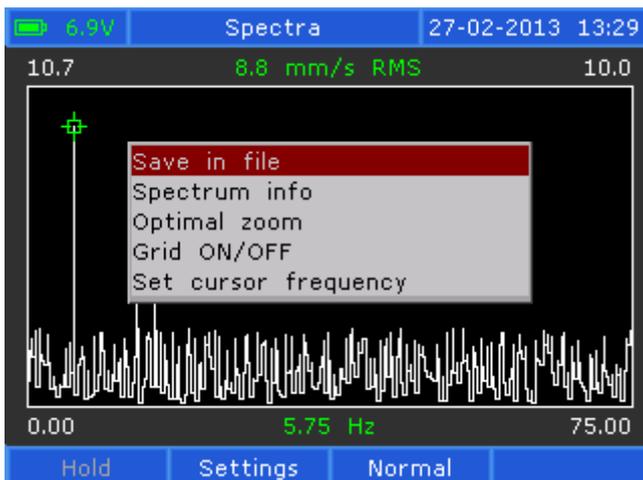
The cursor has been moved to 150 Hz.

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Stop the measurement by pressing *F1* or *Hold* button.

Press the MENU key  and select *Save in file* to store the measured Spectrum.



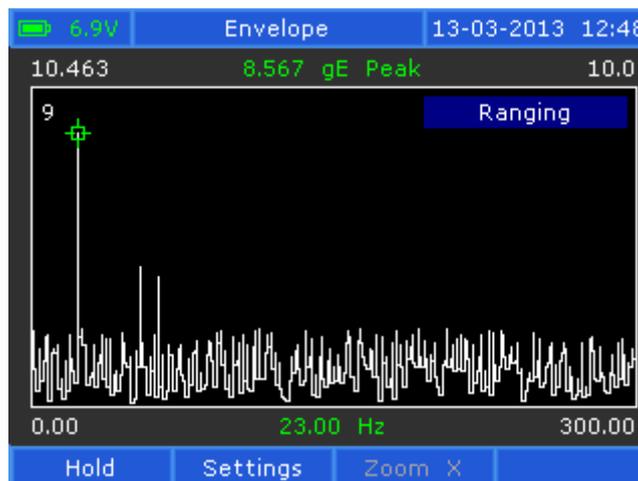
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13. ENVELOPE

To measure the Envelope with CXM you should go to the *Main Menu*, select *Measurements*, 4. *Envelope* and press *ENTER*.



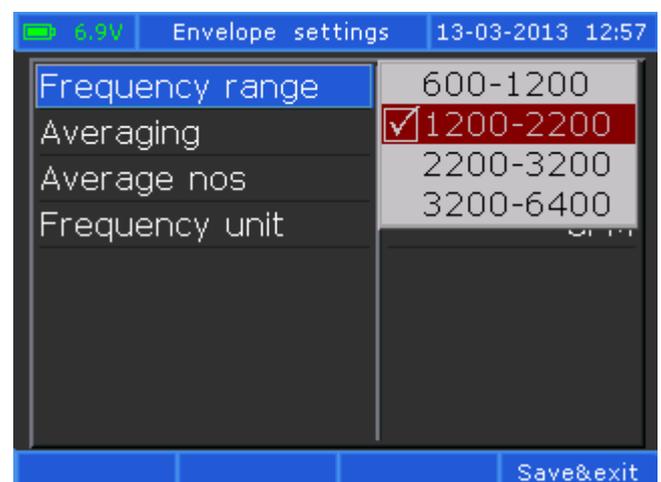
The selected frequency range is 600-1200 Hz.



Press *F1* or *Hold* button.

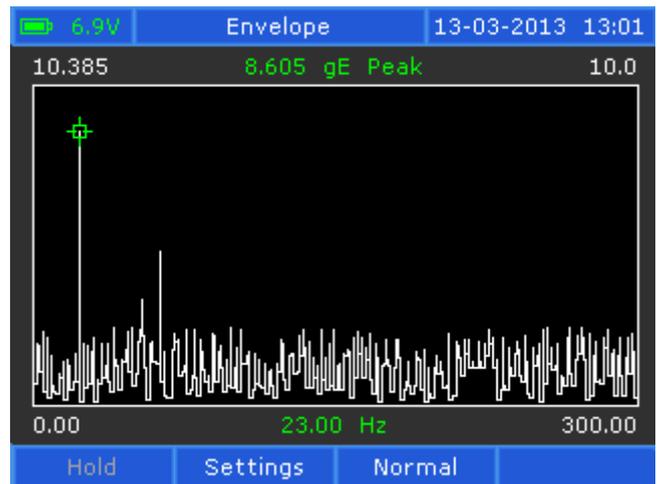
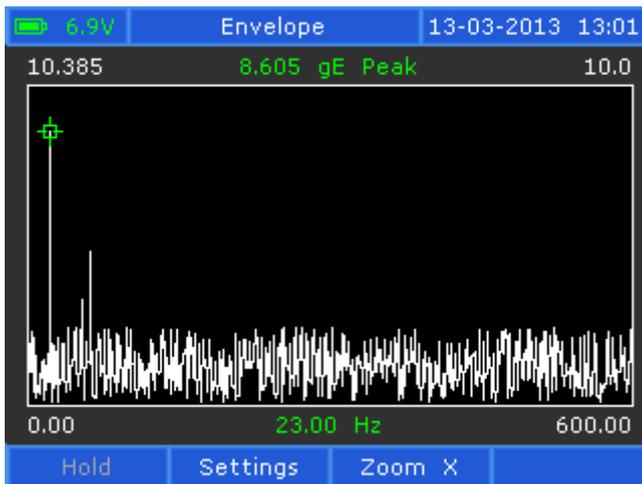
Press *F2* or *Settings* button.

Here you can change the default settings.
To activate the new settings, press *Save&exit* button.

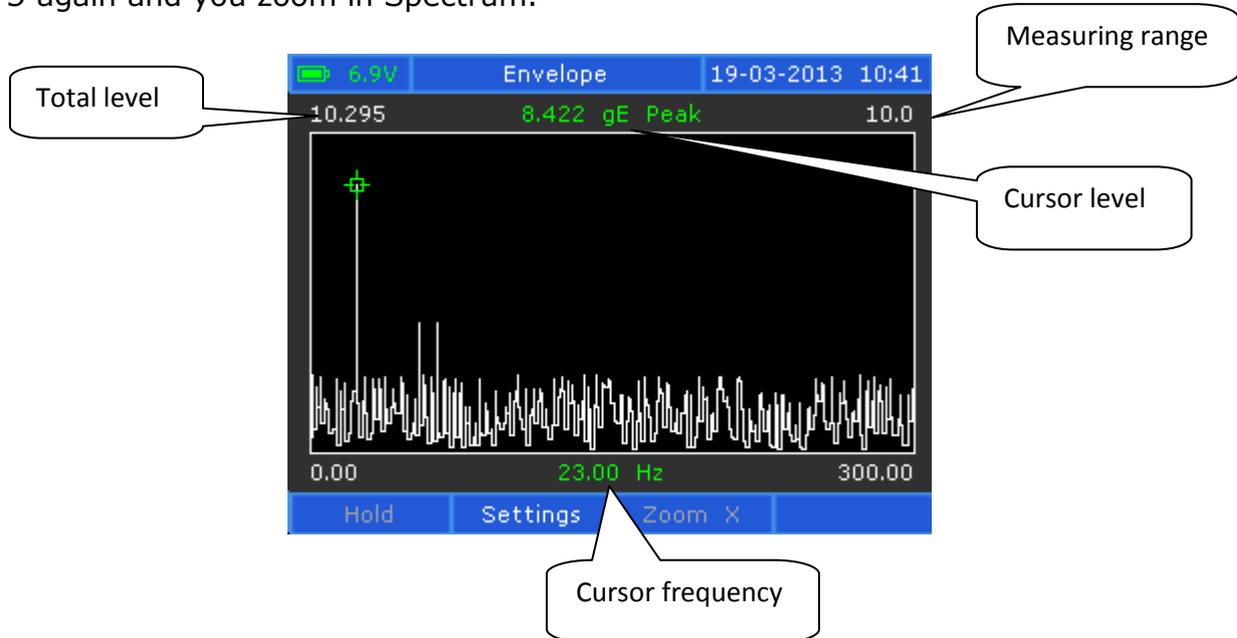


Press *F1* or *Hold* button to stop the measurement and press *F3* or *Zoom X*.

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Press *F3* again and you zoom in Spectrum.

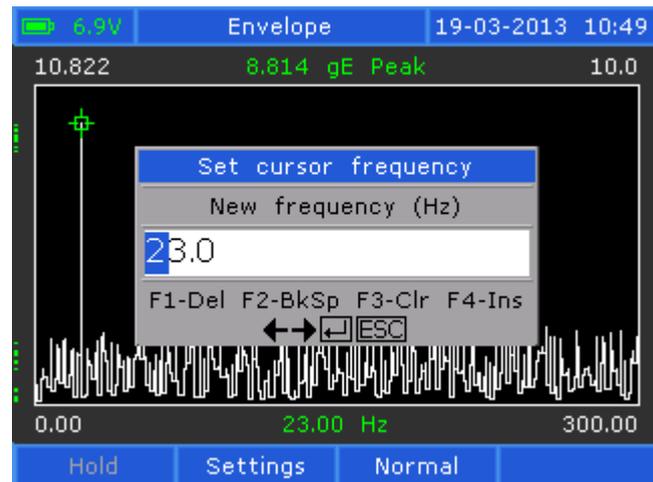
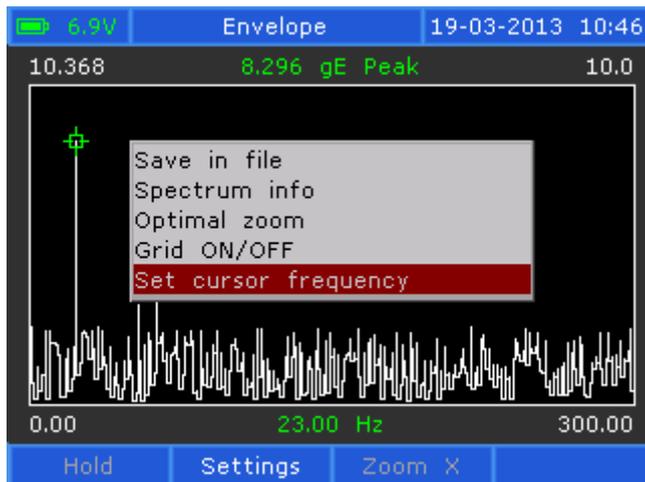


Move the cursor with  or  key.

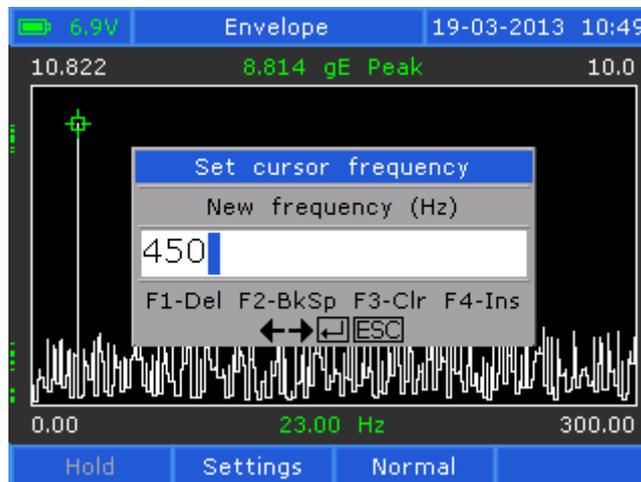
Decrease the measuring range with  key and increase it with  key.
Stop the measurement by pressing *F1* or *Hold* button.

Press MENU key  and select *Set cursor frequency* and press ENTER. Now you can place the cursor in the next window.

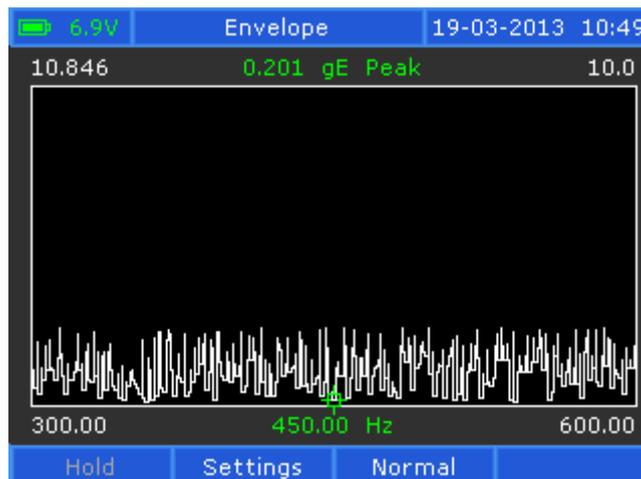
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Enter the new frequency and press ENTER.



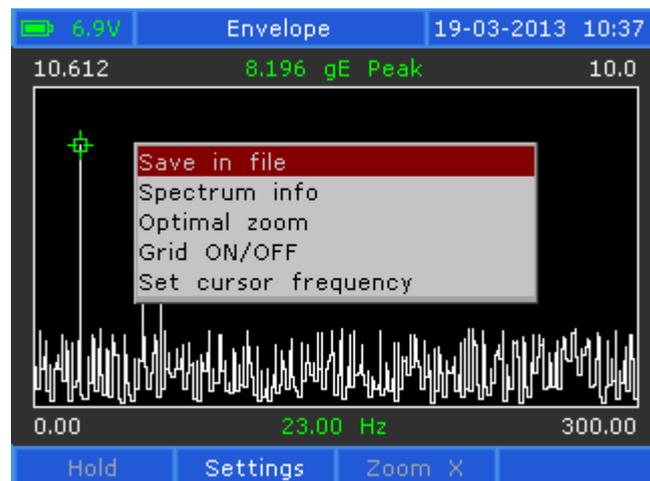
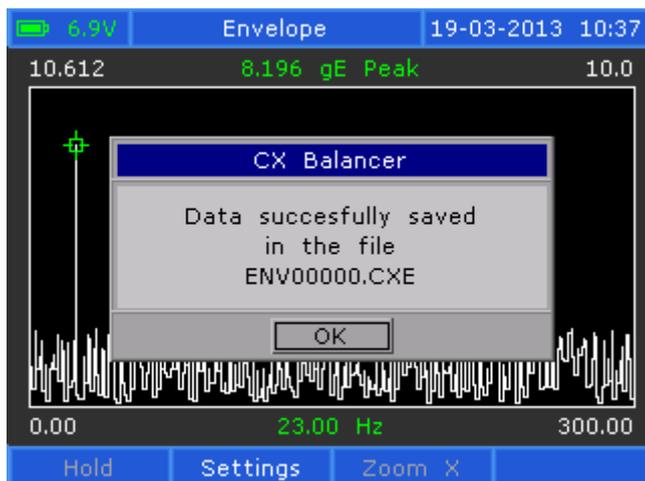
The cursor has been moved to 450 Hz.



Stop the measurement by pressing *F1* or *Hold* button.

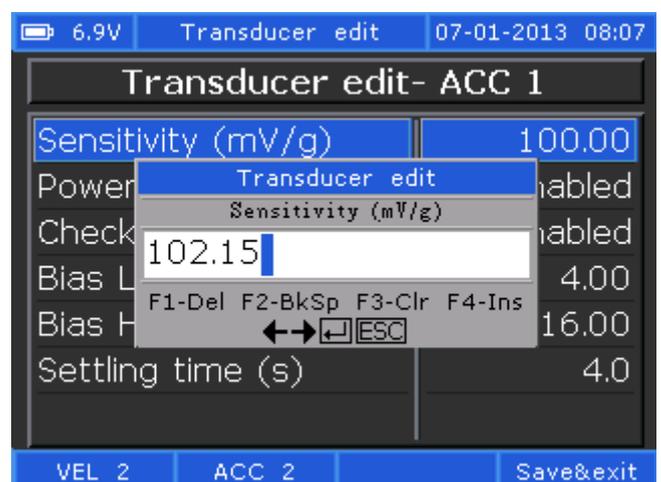
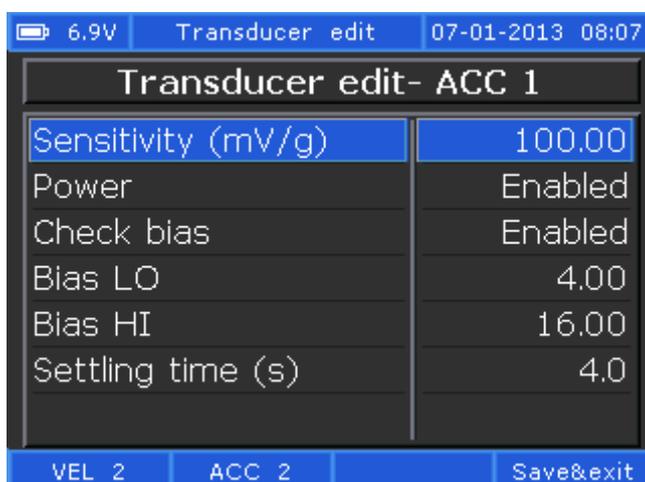
Press MENU key  and select *Save in file* to store the measured Spectrum.

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14. TRANSDUCER EDIT

To edit a transducer select System in the Main menu and press Enter key.
In the **System menu**, select **Transducer edit** and press **Enter** key.

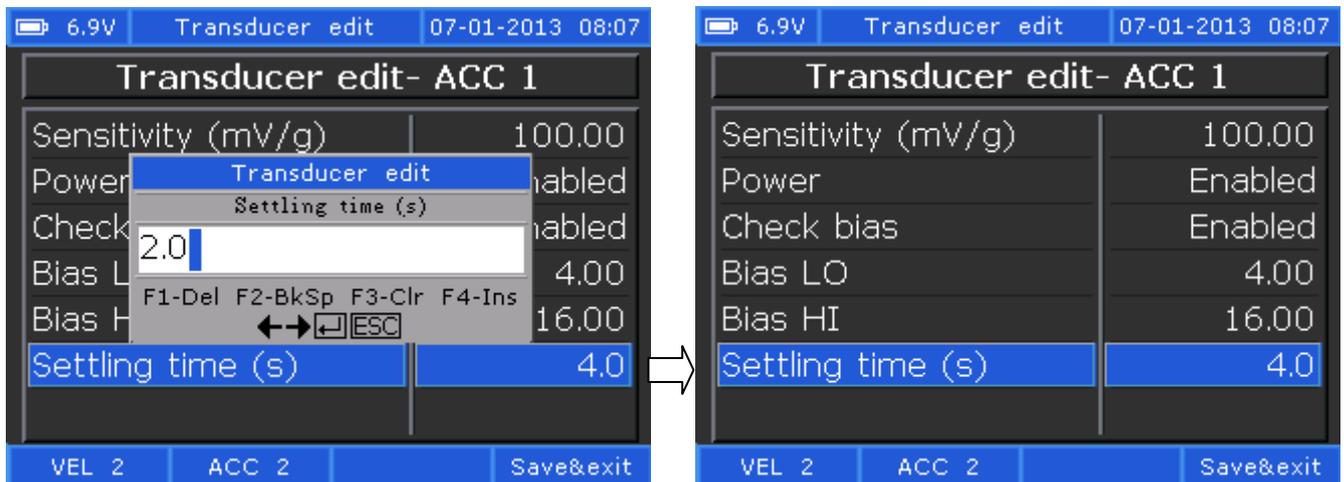


Here you must edit the sensitivity of the Transducer that you are going to use together with the CX Balancer.

The sensitivity is mentioned in the Calibration Certificate for each transducer.

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Power should be **Enabled** if you are using an accelerometer.



Here you can also edit the Settling time for the Accelerometer. It is the time that an Accelerometer needs for a stable measurement. This time is mentioned in the data sheet for any Accelerometer.

After finished editing, press F4 key to save the changes.

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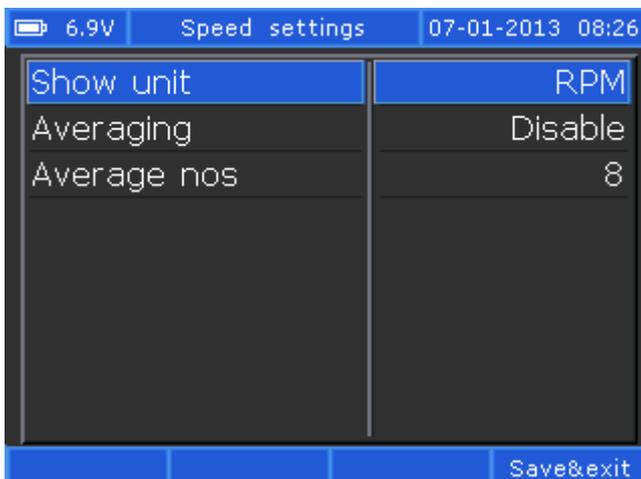
15. SPEED

To measure speed, you must connect an RPM transducer to the instrument.



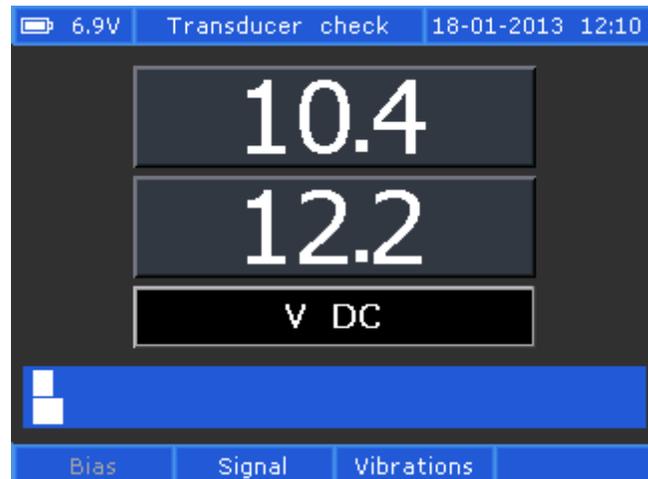
Press F1 key and the measurement will be stopped. Press Enter key and the measurement will continue.

Press F2 key, if you want to change the settings for Unit, Averaging or No of Averages. Then press F4 to save the new settings.



16. TRANSDUCER CHECK

Select 6. *System* in Main menu and then 4. *Transducer check*.



This function is very useful to test transducers and cables.

- *F1 - Bias* (default). Measures the DC component of the connected accelerometer. Normally the bias for a CTC accelerometer must be 12 ± 1 V DC. Without transducer, the power supply voltage is shown (>20 V DC). For the velocity transducers, the bias is close to zero.
- *F2 -Signal*. Measure the mV AC from the transducer or an external signal generator.
- *F3 -Vibration*. Measure the vibration in the transducer unit (g or mm/sec).

The measurement result depends on the transducer sensitivity.

This function measures the signal from both inputs. If there aren't any transducers connected, the signal must be lower than 3-5 mV AC. The frequency range is fixed to 4-3200 Hz.

Some simple tests:

1. Cable fault

The accelerometer is placed on the floor (no vibration). The bias must be near 12V. Keeping the transducer fixed, move the cable with the hand. The indication of Signal must remain less than 5mV. Otherwise the cable is defective.

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Shake the transducer. The Signal must increase. Otherwise the cable (or the transducer) is defective.

2. Instrument transducer power supply.

The internal transducer power supply must be 4 mA@ 20...24 V DC.

With no cable connected to the input, the bias must be over 20 V DC. If not, the instrument is defective.

Notice! The transducer must be set to be accelerometer.

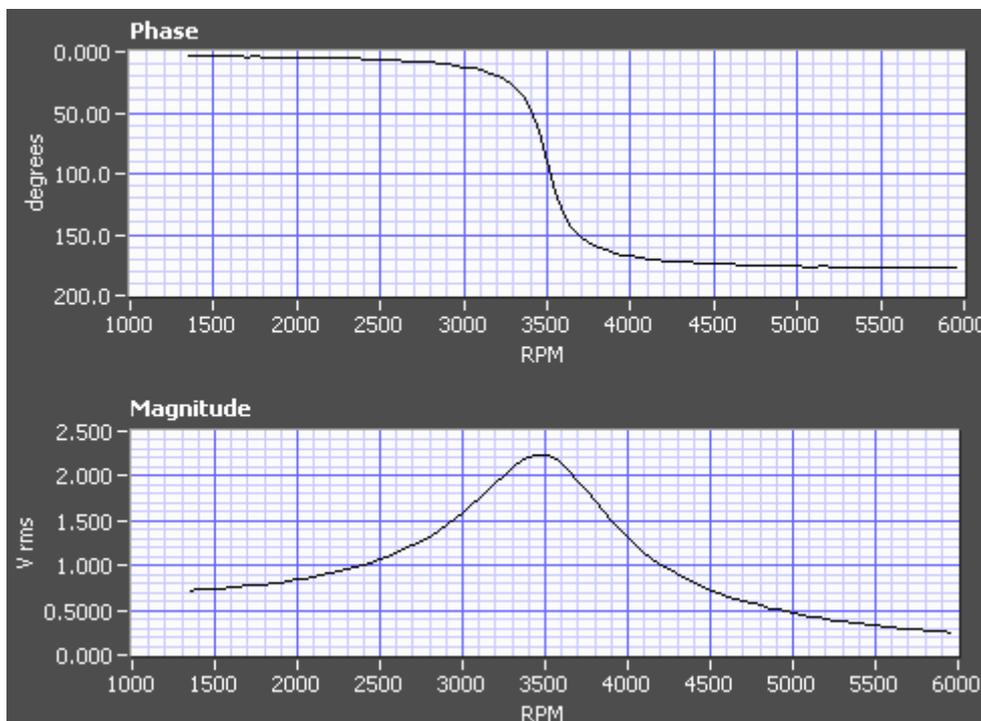
With cable and transducer connected, the bias must decrease to 12 ± 1 V DC.

3. Instrument accuracy

With the transducer set to be velocity, an external known signal must be connected (e.g. from a signal generator). In the Transducer check menu, the Signal or Vibrations must be selected.

17. FREQUENCY RESPONSE

The frequency response plots are a very useful way to represent the amplitude and phase of a system as function of frequency. This is referred to the frequency domain behavior of a system. The frequency response of a system is presented as two graphs: one showing amplitude and the other one showing phase, as below:



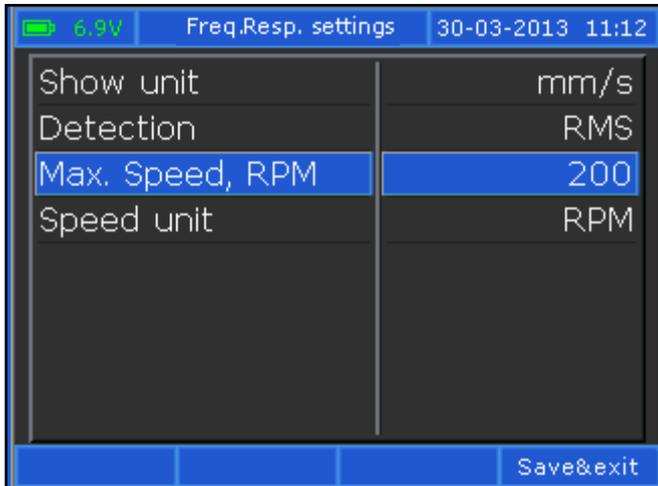
Ideal Frequency Response Plot - Resonance is indicated by peak amplitude and sharp, significant change of phase at the frequency of the peak.

With CXM you can create a *Frequency Response* plot, as follows:

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From the **Main Menu**, select **Measurements**.

Select **7. Frequency Response**

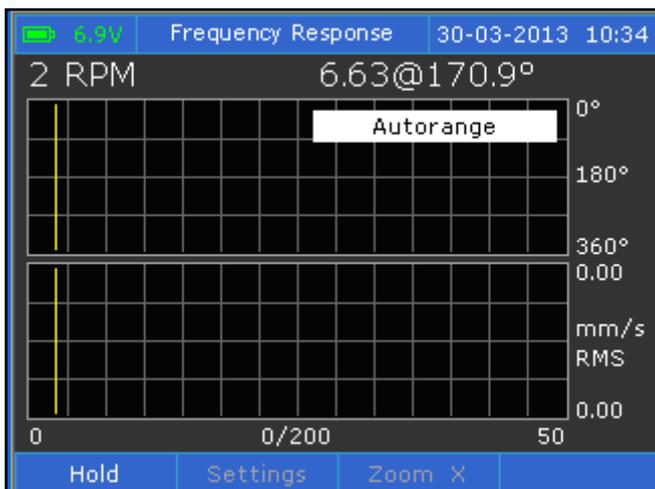


Press **F2 - Settings** and adjust the *Frequency Response* plot parameters.

Press **F4 - Save&Exit** to save these parameters and to return to the *Frequency Response* plot.

To begin the measurements, press **Enter**.

The actual machine RPM will be shown with a cursor, as shows the following picture:

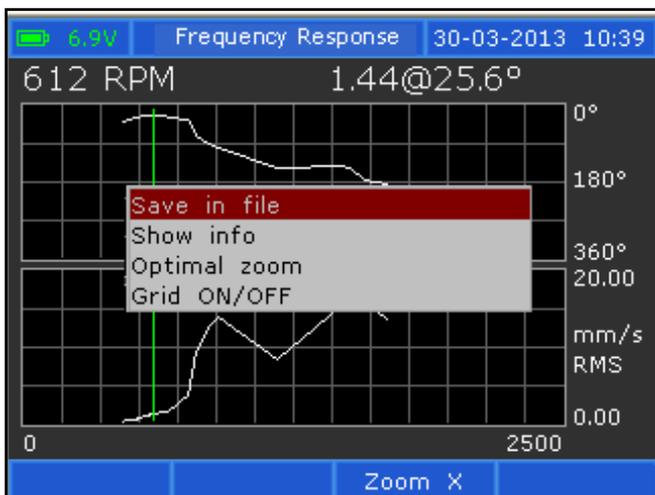


Adjust the machine RPM and wait until the amplitude and phase will be stable.

Press **Store** to take the first reading.

Change the RPM again and repeat the above step.

You can take up to 200 readings.



You may press **F1-Hold** to stop temporary the data acquisition and to visualize the readings.

In the Hold mode, the cursor can be moved with the left and right arrow keys.

Press again **Enter** key to resume.

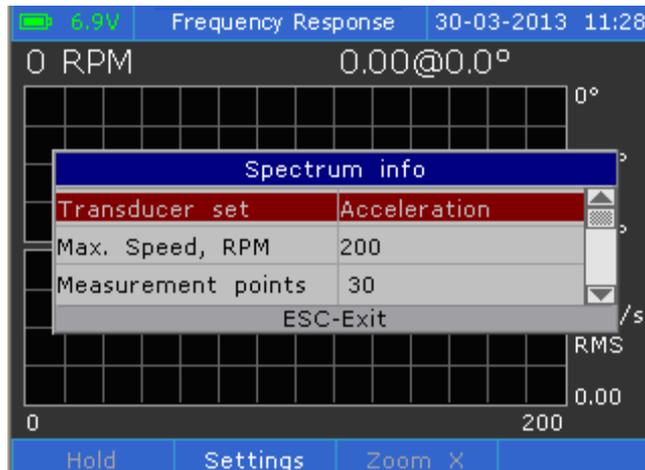
When the *Frequency Response* window is in Hold status, the **Menu** key is also active:

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This context menu allows you to do the following actions:

- Save the plot in a file
- Show acquisition details
- Zoom the Plot optimally
- Hide or Show the plot grid.

See below the *Show Info* window:



You may also use the **F3-Zoom X** key to enlarge a plot portion around the cursor position.

NOTE: When RPM is changed, the measurements won't be automatically saved. You must press the **Store** key, to save the measurements in the plot. This way, before storing the measurements, you can wait until the readings become stable. The *Frequency Response* plot will have a higher accuracy.

When all the points were collected, just save the *Frequency Response* plot into a file and exit the menu.

The file is saved onto the memory Card in the *RES* folder. Each *Frequency Response* file has the *.cxr* extension.

Once you exit, you cannot return to collect measurements from the saved file, but any saved file can be viewed:

Select **Analysis** menu and **5. View File**.

Press **F3** to select the list of pre-stored *Frequency Response* files:

Frequency Response files		
RES00005.CXR	26/03/2013	13:27
RES00004.CXR	26/03/2013	12:54
RES00003.CXR	26/03/2013	11:27
RES00002.CXR	22/03/2013	12:51
RES00001.CXR	22/03/2013	12:47
RES00000.CXR	22/03/2013	12:45

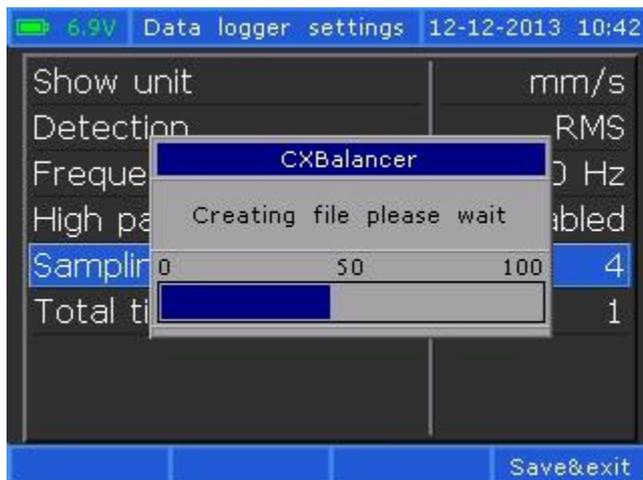
Select from the list any file and press **Enter** key.

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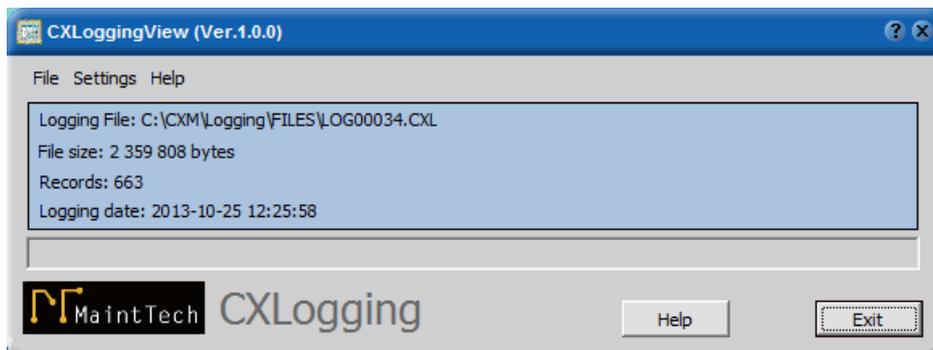
18. DATA LOGGER

The Data logging function can be used to collect the Total level values.

The Logging function can be very useful to check the running of a defective machine.



Copy the logging file from the CXM SD card to CXLoggingView software.



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LOGGING REPORT

Logging File : C:\CXM\Logging\FILES\LOG00034.CXL

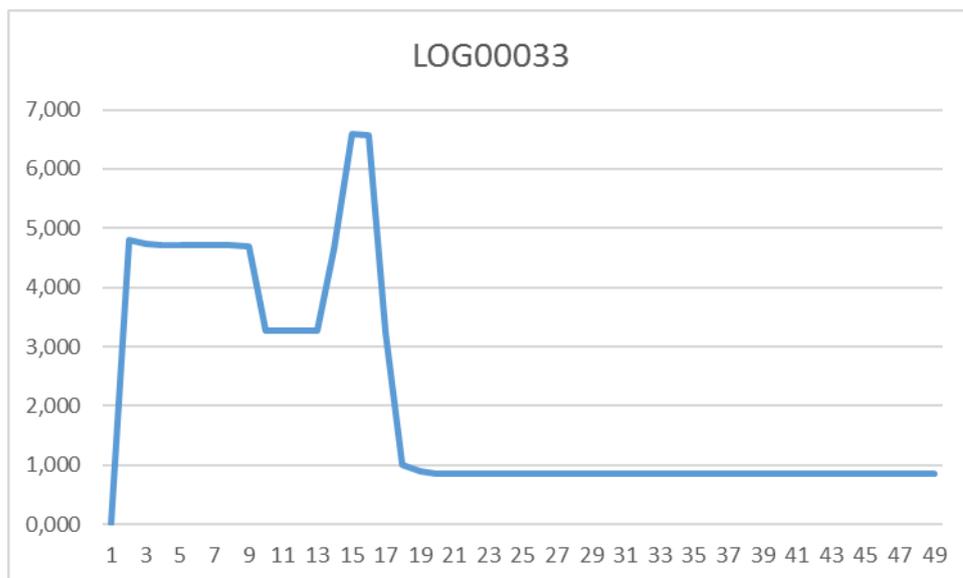
Begin recording: 25-10-13 12:26:06
End recording: 25-10-13 12:48:13

Frequency range: 6400 Hz
HP Filter: (none)

Number of recorded values: 663 (Bad Records: 0)

Record	TimeStamp	Total mV RMS	Record Status
1	25-10-13 12:26:06	0,0	
2	25-10-13 12:26:09	51,3	
3	25-10-13 12:26:11	50,6	
4	25-10-13 12:26:13	50,4	
5	25-10-13 12:26:15	50,4	
6	25-10-13 12:26:17	50,4	
7	25-10-13 12:26:19	50,4	
8	25-10-13 12:26:21	50,4	
9	25-10-13 12:26:23	50,4	
10	25-10-13 12:26:25	50,4	
11	25-10-13 12:26:27	50,4	

You can transfer the logging file to MS EXCEL and show the measurements in different type of diagrams.

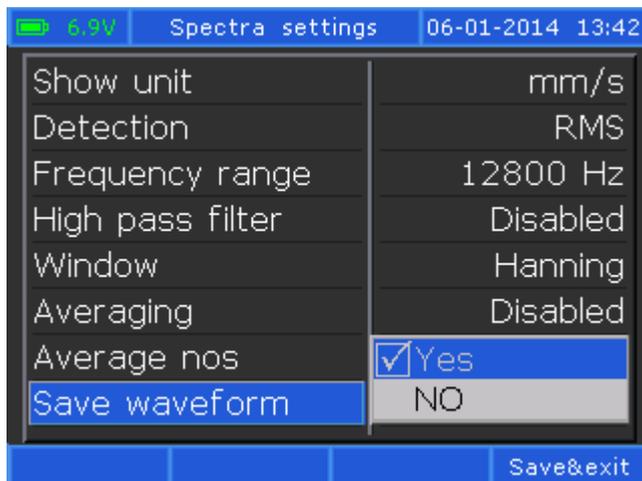


19. TIME SIGNAL

Introduction

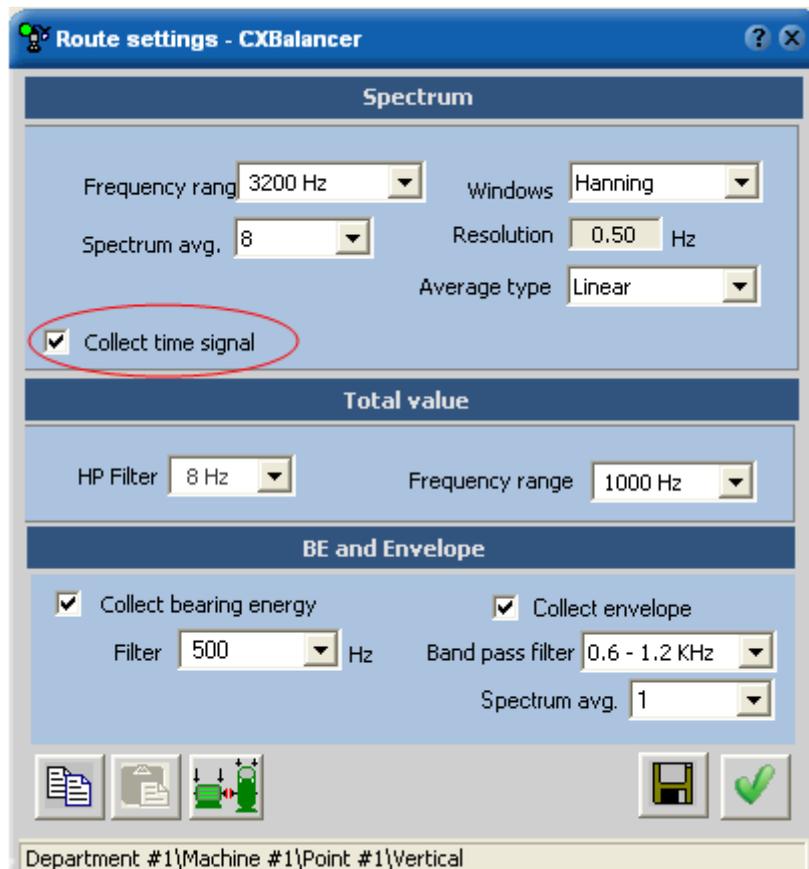
Time signal is the waveform as it is obtained from the attached vibration transducer. This means if the transducer is an accelerometer, the time-signal is shown in "g" unit; if the transducer is a velocity sensor, the time-signal is shown in mm/sec (or in/sec). The instrument won't proceed to any signal integration or derivation. This way, the user can use the time-signal to visualize HOW the machine is moving in the measured position.

Viewing time-signal



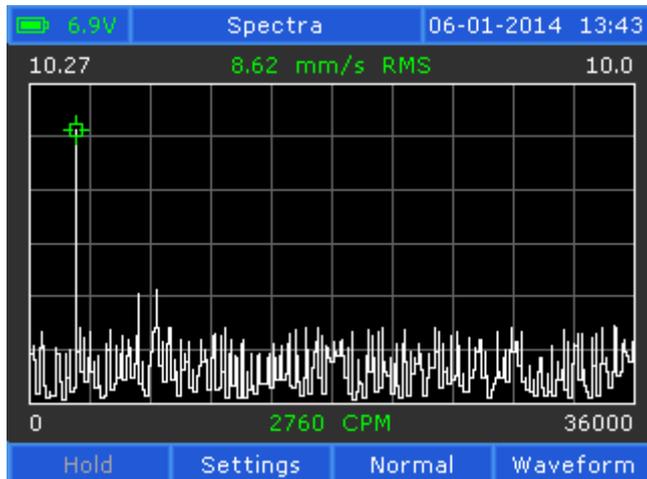
In CXM, the time-signal can be shown:

- In *Spectrum analysis*, but only if the spectrum is frozen (in *Hold* mode).
- In *View Files* menu, selecting any spectrum associated to a time-signal in the *Spectrum Setting* menu, as follows on the left screen.
- In *route*, to any record having spectrum (and if the time-signal collection is settled in CXSpectra, for that direction), as shown below:



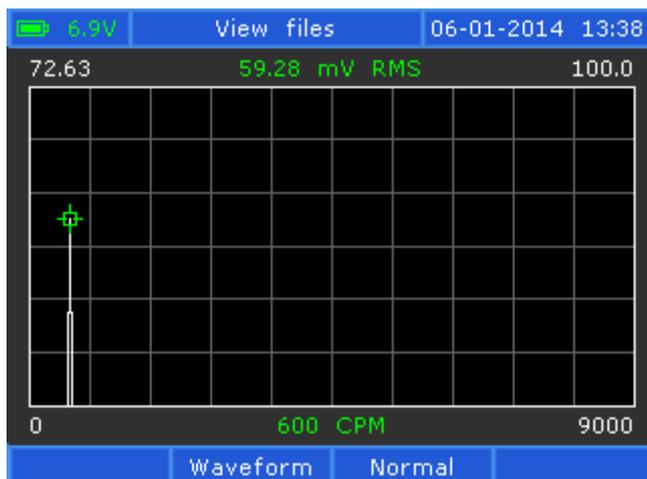
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Time-signal in spectrum analysis



When a spectrum is collected and if the *Save waveform* is set to YES, if the user freezes the spectrum plot by pressing **F1 – Hold** key, the time-signal can be show just pressing the **F4 – Waveform** key (otherwise this key is disabled).

Time-signal in View Files menu

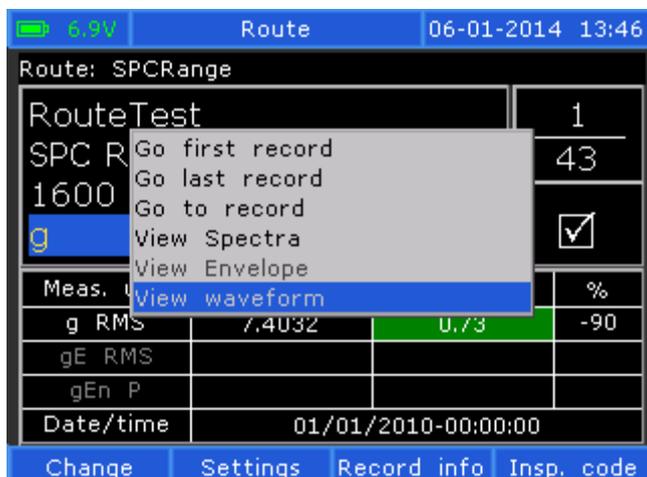


From the list, select any spectrum file having the time-signal stored.

The spectrum plot will be shown (as default).

Press **F2 - Waveform** key to show the time-signal.

Time-signal in Route



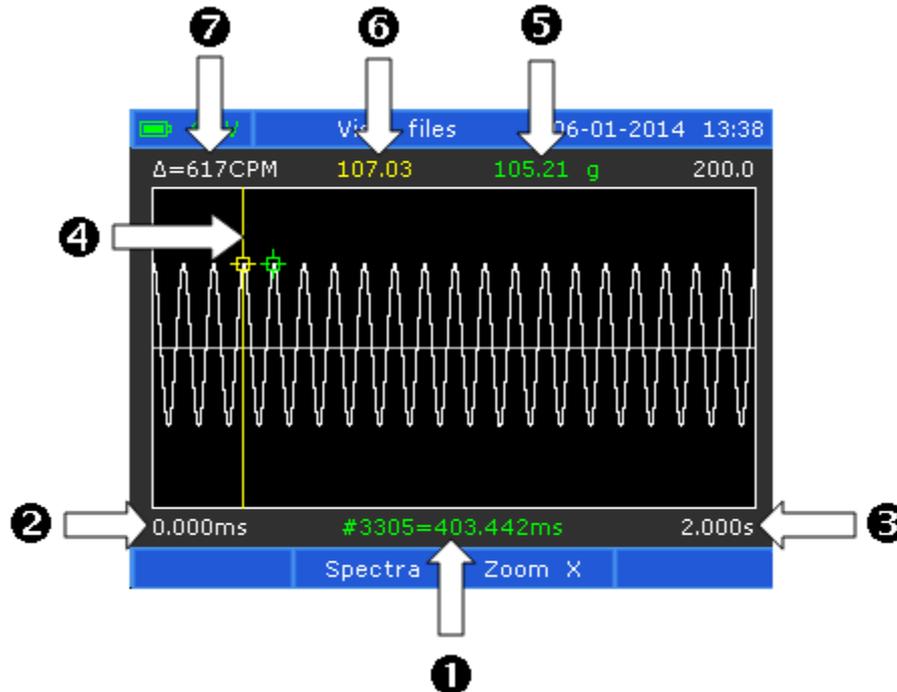
Browse to any vibration *direction* (or record).

Press the **Menu** key and select: **View waveform**.

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Time-signal plot

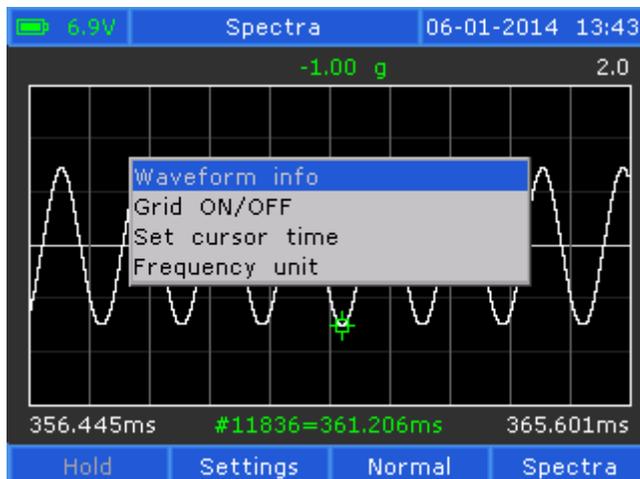
Time-signal plot is shown identically in all the above cases, only the context Menu is slightly changed.



Legend

1. Sample number/time at the cursor position (the cursor is green)
2. Start time (seconds). In the *Normal* mode, this value is always zero.
3. End time (seconds). In the *Normal* mode this value shows the time-signal total time.
4. Marker or reference line (yellow line). See below how to insert a marker)
5. Signal amplitude at cursor position
6. Signal amplitude at marker position
7. Difference between marker and cursor position (in CPM or Hz).

NOTE: Difference label appears only if between cursor and marker there are more than 4 samples.



The current actions in the time-signal plot are:

- **LEFT/RIGHT** arrow keys - The cursor (green) can be moved in the plot area.
- **UP/DOWN** arrow keys - Changes the amplitude scale.
- **F3 - Zoom X /Normal key**. In *Normal* mode, all the time-signal points are shown. In *Zoom* mode only a "window" is shown, around the cursor position. Each pixel contains a single sample.

- **ALT + LEFT, ALT + RIGHT** arrow keys. Scroll between "windows" - Is enabled only in *Zoom* mode.

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In the image above, the time-signal is zoomed. By pressing ALT + LEFT key, the cursor will be moved to the left "window" (347.289 to 56.445 msec. interval).

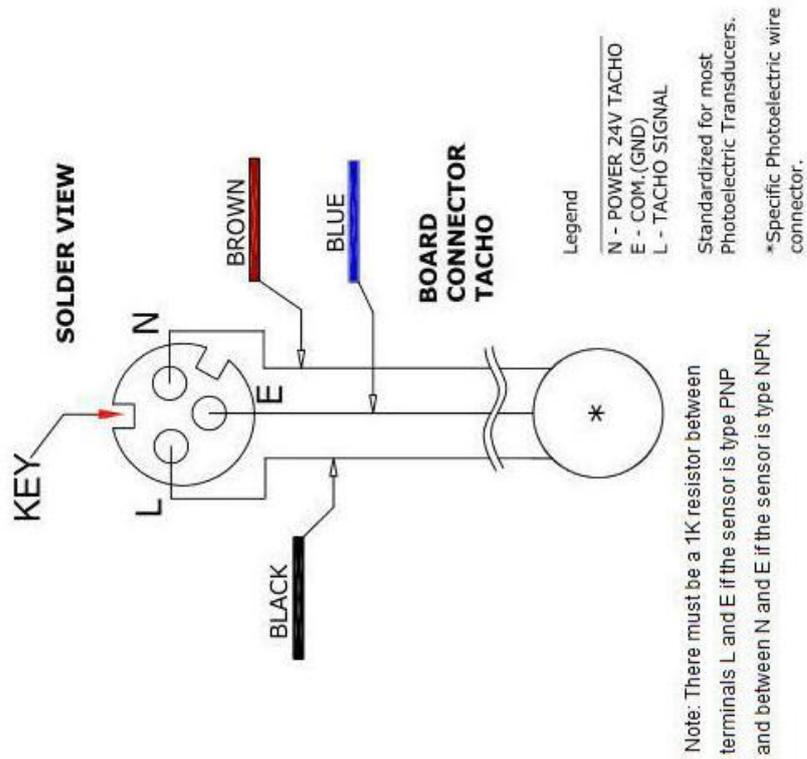
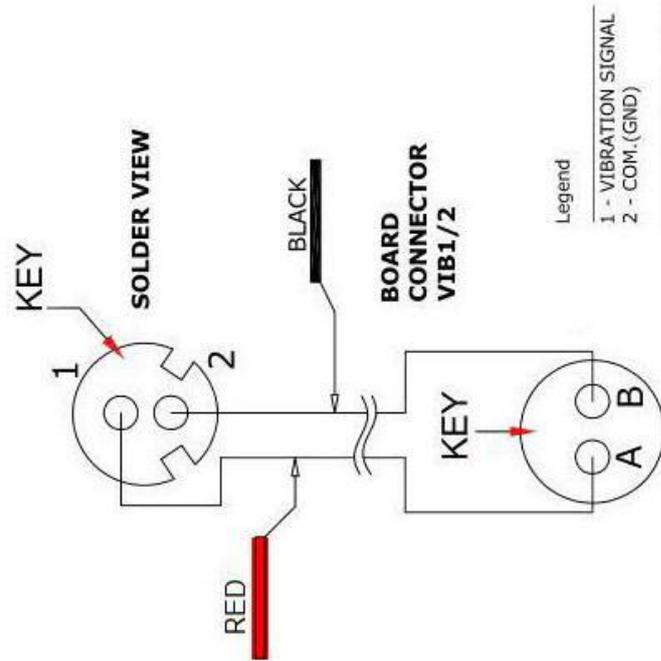
- **STORE** key - Place a yellow marker (or reference line) at cursor position. When the *STORE* key is pressed the marker always changes the position to the cursor position. The Marker line will be lost if the time-signal is zoomed or the cursor is moved outside the viewing area. The marker allows the user to determine the time-signal period (frequency).

- **MENU** key - The context menu will appear. The menu is almost the same, but depends on the context. The common menu lines are:

- **Grid ON/OFF.** Add or remove the grid line.
- **Set cursor time.** Allows the user to set the cursor to any specific time of the waveform (to any sample).
- **Frequency unit** - Changes the frequency unit from Hz to CPM or reverse.

Any others menu commands are self-explained.

20. CONNECTORS



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21. PRODUCT SPECIFICATION

Display Resolution Viewing Area Backlight	Color Graphic TFT 320 x RGB x 240 72.88 x 55.36 mm White LED	EMC	Radiated/conducted Emissions RF, ESD, fast transient immunity
Mechanical Size Weight Protection Class Sealed Connectors	Aluminum 180 x 190 x 55mm 950g IP54 with protection cap	Vibration Transducers Input Sensitivity Input Impedance Power Supply	Accelerometers 2 Channels 100 mV/g 50 kOhms 4.2 mA @ 24 V DC
Environment Operating Temp. Operating Humidity	-20°-80°C 80% RH 0-50C non-cond. 70% RH -20°-80°C non-cond.	Tachometer Input Measure Distance Range Accuracy	PNP or NPN standard Photocell TTL Pulse 0.1-2.0m 120-60000 RPM Max. ± 5 RPM
Battery Voltage Capacity Operation Time External Charger	6 x 1.2 NiMH AA Type rechargeable 7.2 V nominal 2.7 Ah 8 hours 12V @ 2A Supply 100-240 VAC @ 50-60 Hz	Vibration Indication Units/ max. level Accuracy Frequency Response Units Average	Acceleration -80 g, Velocity – 100 mm/s, Displacement – 10 mm ± 2% ± 0.2dB 0.5Hz-400Hz ± 0.2dB 10Hz-1kHz ± 0.5dB 2Hz-1.6kHz ± 0.5dB 4Hz-3.2kHz ± 0.5dB 8Hz-12.8kHz µm, mm/sec, g, in/sec, mils Peak, P-P, RMS
Communications	USB, Mass Storage Device 4 GB	Analysis	RPM, Total Level, x1, x2 and x3 RPM
Balancing (optional)	One or two plane 120-12000 RPM	Bearing Status	A coefficient indicating Bearing Faults
Route	Co-operating with CXSpectra		
Spectrum -Frequency Ranges Envelope -Frequency Ranges	1000, 1600, 3200, 6400 and 12800 Hz 600-1200 Hz 1200-2200 Hz 2200-3200 Hz 3200-6400 Hz 6400-12800 Hz	CXM set contains: - Display Box - 1 x Accelerometer with Magnet - 1 x 1 m Transducer Cable - Extension Tip - Charger - USB Communication Cable - Manual - Carrying Case (Aluminum)	