ERBESSD INSTRUMENTS®

CONTENTS

About DigivibeMX ®

What is DigivibeMX®?

DigivibeMX® is a versatile, multi-functional software capable of analyzing machine vibration in real time, performing traditional route data collection and balancing single-plane or two-plane industrial rotors – in-situ or on soft bearing suspension machines. The *DigivibeMX*® model purchased determines which software capabilities are available for the user.

- *DigivibeMX*® M10 provides dynamic balancing capabilities
- *DigivibeMX*® M20 provides vibration data collection and analysis capabilities
- *DigivibeMX*® M30 combines the full balancing and vibration analysis capabilities of M10 and M20.

DigivibeMX® combines powerful machine health monitoring tools with easy-to-use functions and easy-to-interpret visual interfaces. The software provides immediate capabilities for inexperienced users, and more sophisticated tools for experienced users seeking a full range of analysis capabilities.

Functions include:

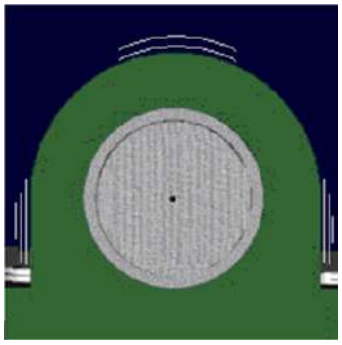
- Real-time vibration waveform and FFT spectrum analysis
- Dynamic rotor balancing with weight calculator for 1 or 2 planes
- Rolling Wizard without test weights
- Automatic RPM filtering
- Orbital Analysis
- Automatic generation of vibration analysis and balancing reports (compatible with Microsoft Word and Excel 2007)
- Powerful SQL database
- Accuracy up to +/- 0.1 RPM
- Up to 2 million lines of resolution
- ODS simulation features built into the software, compatible with imported .obj .xaml and .3ds modeling files
- ISO and enveloping alarms
- Trigger recording
- Sequential recording of 2 planes for dynamic balancing with the new I-600 interface

DigivibeMX® Is distributed with standard electronic accessories and optional computer equipment approved by **Erbessd Reliability Instruments®.**

Visit our page for more information on available equipment.
http://www.erbessdreliability.com

Basic concepts of machine vibration

What is vibration?



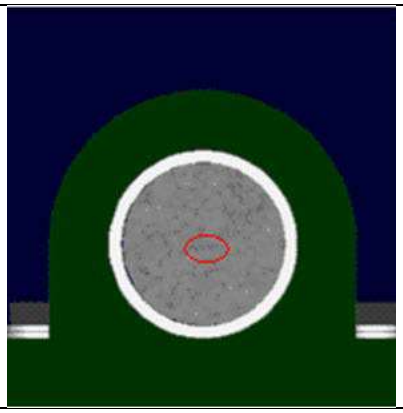
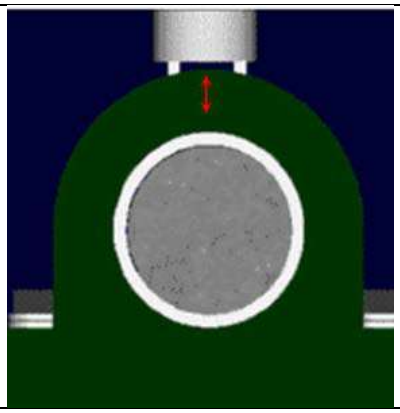
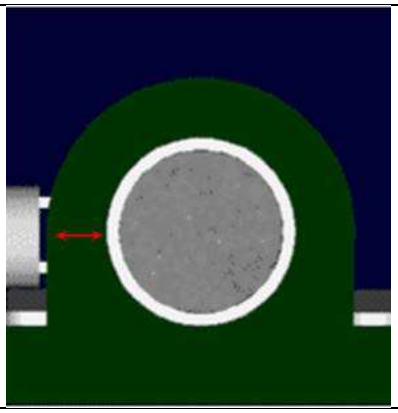
Vibration is reciprocating movement (forward and backward/upward and downward) of a structure or mechanical part. It is cyclical movement often associated with rotating equipment. It is commonly expressed in units of Cycles Per Minute (CPM) or Hertz (Hz).

Why do we measure the vibration?

1. Vibration Analysis allows us to evaluate the real-time condition of an operating machine and detect mechanical defects in their earliest stages – long before a catastrophic failure occurs. Early detection can prevent component failures that could potentially affect safety, quality, productivity, repair time and cost.

2. Diagnosing and correcting mechanical defects prolongs the life of bearings and other components that absorb vibration stresses and fatigue forces.

Sensor orientation to detect vibration

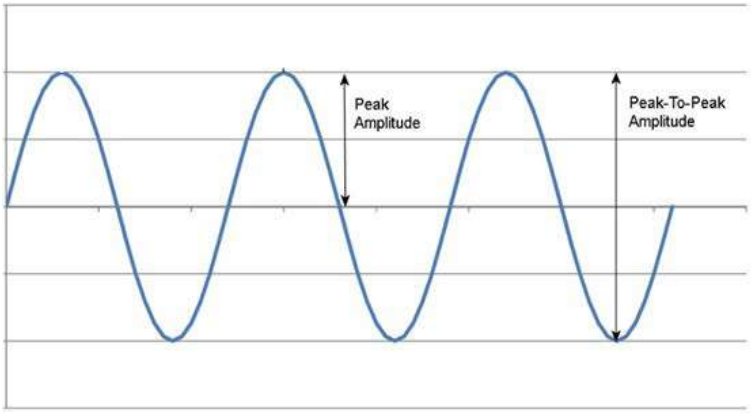
		
Actual bearing movement is elliptical	A vertically-positioned sensor will capture vertical vibration.	A horizontally-positioned sensor will capture horizontal vibration.

What characteristics of vibration do we measure?

AMPLITUDE.

A waveform's amplitude represents the physical displacement of a measured component, throughout its cycles of rotation. It expresses the Severity of Vibration a component is experiencing.

Amplitude is expressed in units of Displacement, Velocity, or Acceleration.



DISPLACEMENT

Displacement expresses the distance a component travels during one complete cycle, from Peak-to-Peak.

Units of Measure:
- **Micrometers** (µm or microns)
- **thousandths of an inch** (mils)

Conversion: 1 mil = 25.4 µm

Commonly used for:
- Balancing on Floating Bases
- Analysis using Proximeters
- Low Speed Rotors

VELOCITY

Velocity expresses the speed a component travels during one complete cycle, as the waveform crosses its zero axis.

Units of Measure:
- **mm/s**
- **in/s**

Conversion: 1 in/s = 25.4 mm/s

Commonly used for:
- Severity of Vibration ISO 10816
- Common balances
- Analysis of average frequencies
- Represents the destructive energy of the vibration

ACCELERATION

Acceleration expresses the rate of speed change during one complete cycle, after the waveform crosses its highest peak.

Units of Measure:
- **G's**
- **m/s^2, mm/s^2 ó in/s^2**

Conversion: 1 g = 9.8 m/s^2

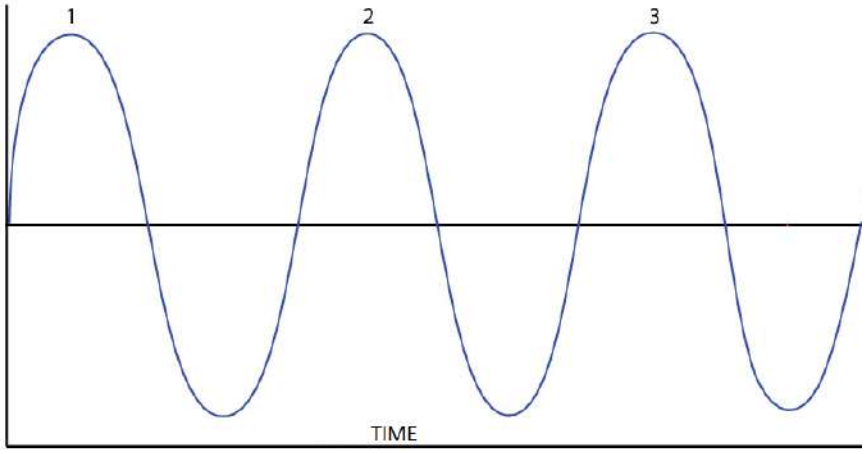
Commonly used for:
- Detecting bearing rolling element damage
- Monitoring high-frequency vibration
- Digital Stethoscope

FREQUENCY.

A waveform's Frequency represents how many cycles occur over a period of time.

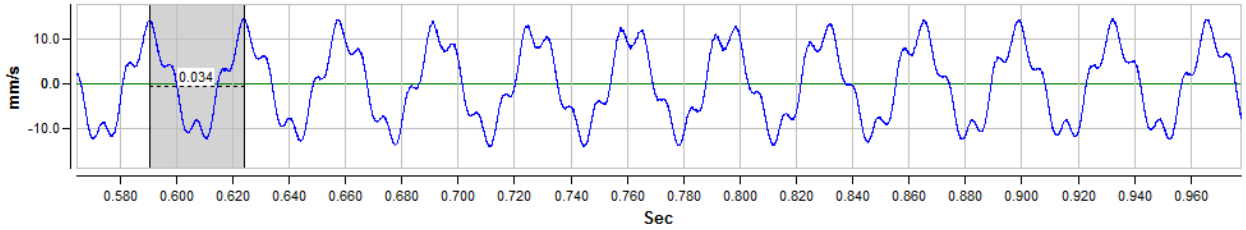
Units of Measure:

- **Hz** (Cycles per second) – commonly used in electrical engineering and higher-frequency applications.
- **CPM** (Cycles per minute) - commonly used in mechanical engineering and lower-frequency applications.



Graphical representation of vibration:

The Frequency graph above represents simple vibration in terms of amplitude (axis Y) over time (axis X). The clear sinusoidal waveform may represent the vibration of a single component. Such clear, simple waveforms are rarely seen in vibration data collected from complex machines with numerous components - all vibrating at different frequencies.

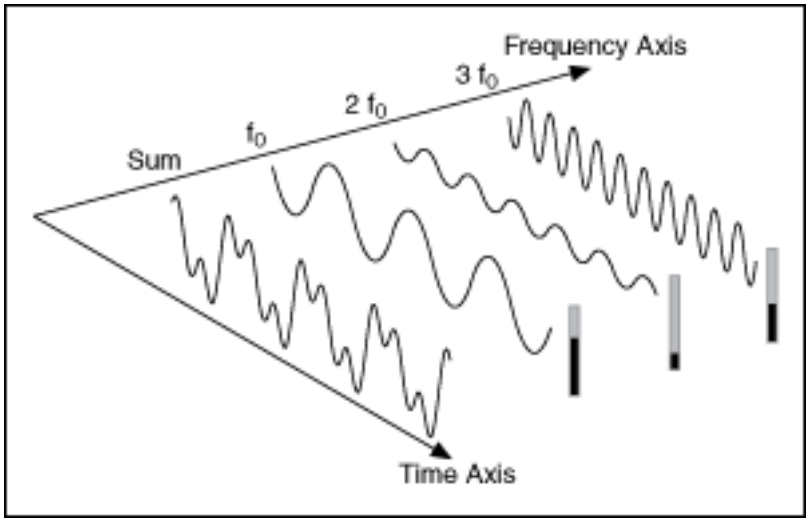


This is the vibration waveform of an electric motor. One could easily identify a repeating cycle of vibration and measure its Frequency from peak to peak:

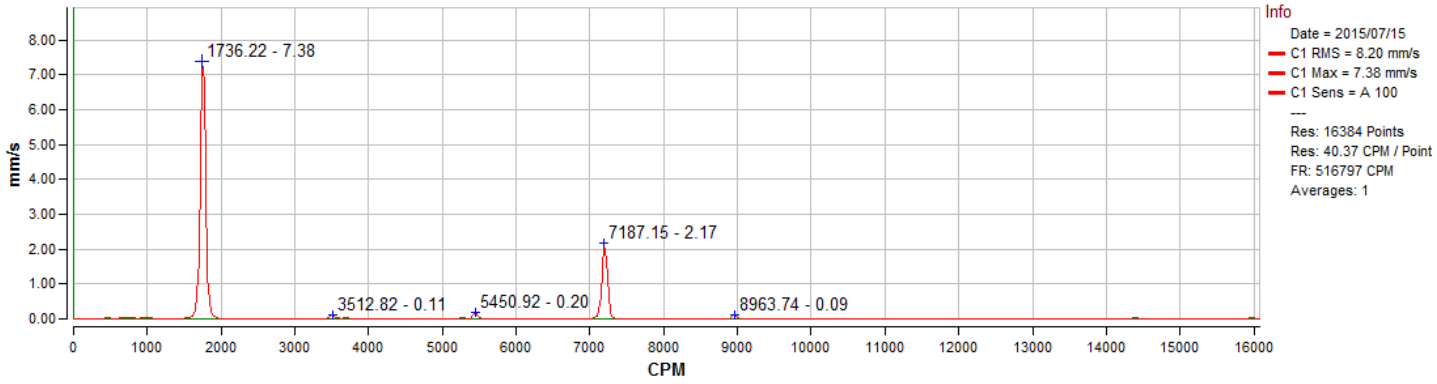
Time for one complete cycle: 0.034 seconds
Frequency in Hz: 1/0.034 = 29.4 Hz
CPM speed is 29.4 x 60 = 1764 CPM

But how would one discern the vibration of individual components within such complex waveforms?

Identifying the vibration of different individual components within complex waveforms would be very difficult for most people. One method of doing so is to perform a Fast Fourier Transform (FFT) on the complex waveform. FFT is an efficient algorithm that quickly calculates the Discrete Fourier transform (DFT) of a waveform, and its inverse. An FFT essentially extracts individual component waveforms and arranges them by their unique frequencies and amplitudes.



This is the FFT graph for our electric motor waveform.



The FFT identified unique waveforms at several frequencies, but there are only two significant peaks:

- at 1736.22 CPM (frequency) is a source of 7.38 mm/s (amplitude) vibration
- at 7187.15 CPM (frequency) is a source of 2.17 mm/s (amplitude) vibration

All that remains is to:

- identify the two sources of significant vibration
- determine whether their vibration levels warrant further maintenance actions.

For more details about the FFT algorithm:
(English) https://en.wikipedia.org/wiki/Fast_Fourier_transform
(Spanish) http://es.wikipedia.org/wiki/Transformada_r%C3%A1pida_de_Fourier

Types of sensors

DigivibeMX® systems use the following sensors:

Accelerometers:

Vibration sensors. Their output voltage is proportional to the acceleration of vibration.
Used for:

- Dynamic Balancing in 1 and 2 planes
- Vibration Analysis
- Route Data Collection
- Spot Analysis

Optical Laser Sensor:

Laser-emitting speed sensor:

- Measuring rotational speed (CPM or Hz)
- Dynamic Balancing (Phase)
- Capturing ODS modeling data

System requirements

Minimum requirements of a desktop, laptop or tablet computer* for *DigivibeMX®* software installation:
* Not compatible with Windows RT operating system

- Intel® Celeron® (1.60 GHz / 400MHz) or higher
- 2GB DDR2 or higher RAM
- Windows 10 (supports Windows 7, 8 and 8.1 *)
- SVGA or higher monitor (enhanced for touch screens)
- 500 MB of minimum disk space
- 1 USB 2.0 port
- Internet connection (for software installation and activation only)

Other Required Software:

- MySQL Connector Net 6.5.4 (Included with system purchase)
- SQL Compact server 3.5 SP2 (Included with system purchase)
- Microsoft Office 2007 or higher (for reporting features)
  Acrobat Reader 7.0 or higher (for opening help guide)

Software Installation

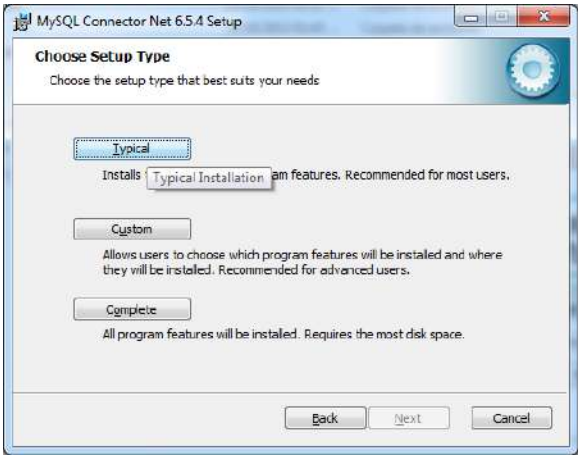
From CD: Insert the CD and wait for the Wizard window to appear.

From USB or Download: Open the setup folder location in Windows Explorer and Open Start.exe.

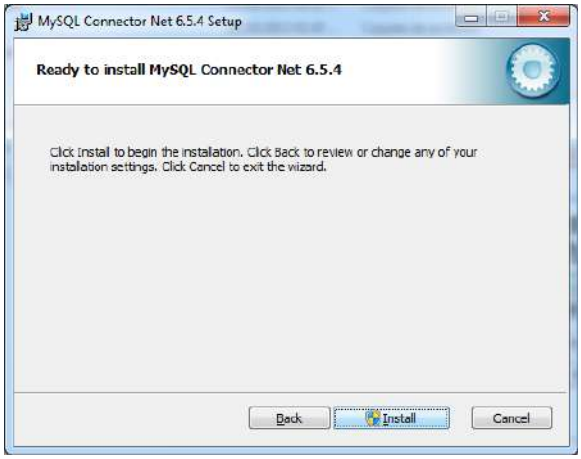
MySQL Connector Net

Click on: **"Install MySQL Server":**

Then select the installation **"Typical":**

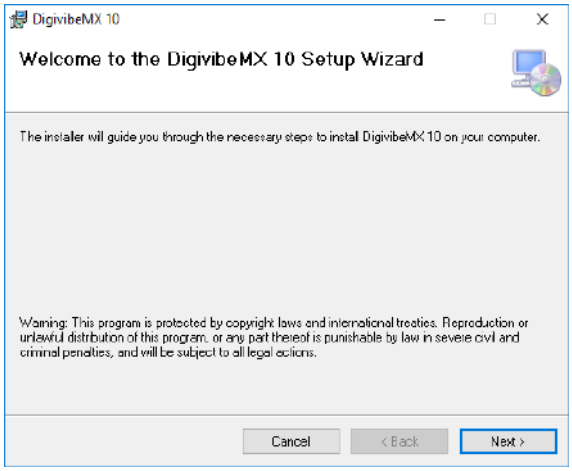


Then click on “Install”:

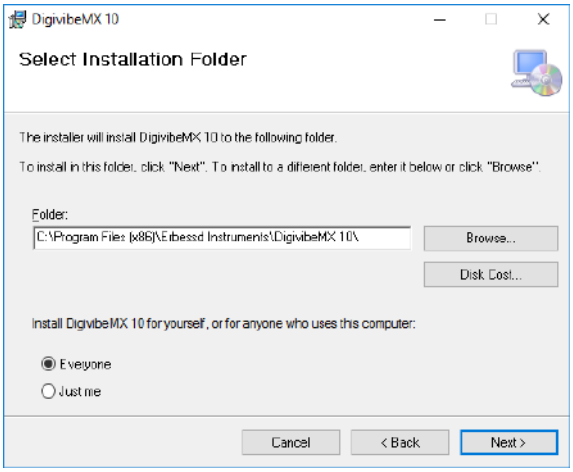


Return to the main window and click on **"Install DigivibeMX® Software".** DigivibeMX® Setup Wizard should launch.

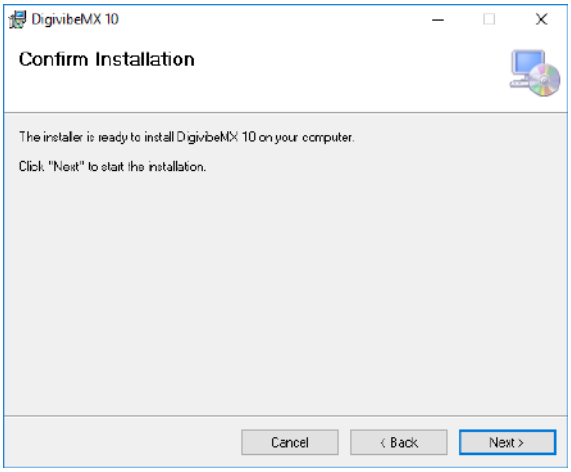
Click on **“Next”:**



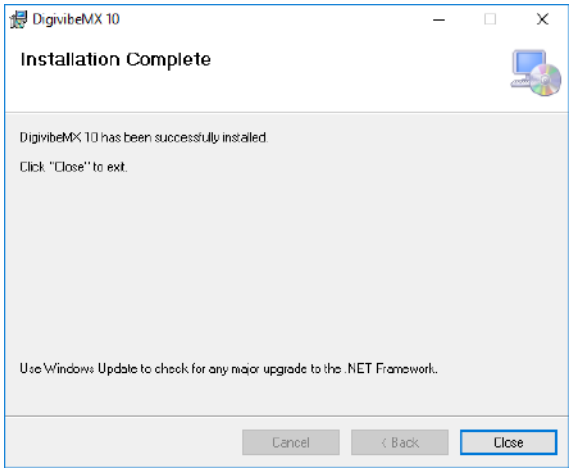
Select the location of the installation and "Next":



Click on **"Next"** to begin installation:



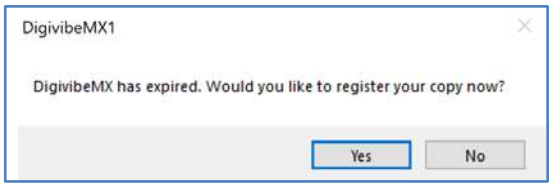
Installation complete!



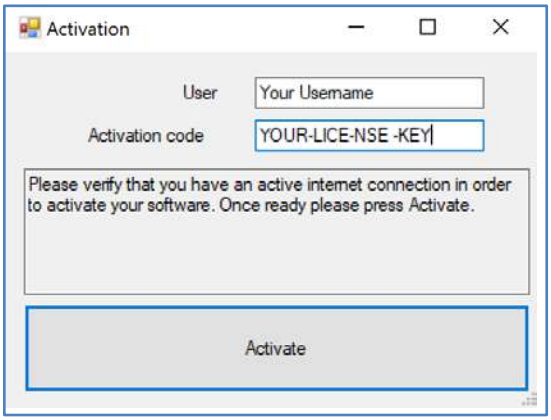
Product Activation

IMPORTANT: Activating *DigivibeMX*® software requires an Internet connection!

Upon first launch of *DigivibeMX*®, you will receive the following message. Click **"Yes"** to activate:



Enter your User name and Activation code in the following window:



Enter your username and activation code in the corresponding boxes.

The key consists of 16 characters, for example **WWWW-YYYY-WWWW-YYYY** (do not include dashes).

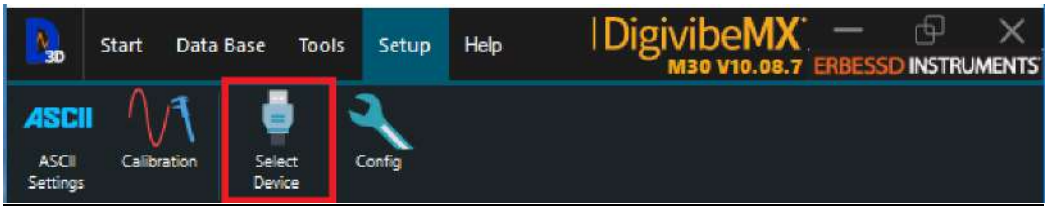
Important: Before clicking **"Activate"** verify that you have an active internet connection. Sometimes industrial, business or university networks prevent connection due to firewalls. If this occurs, you will receive an SQL error message. If necessary, you may consider activating the software from a different network (personal cellular network, for example).

Software Calibration

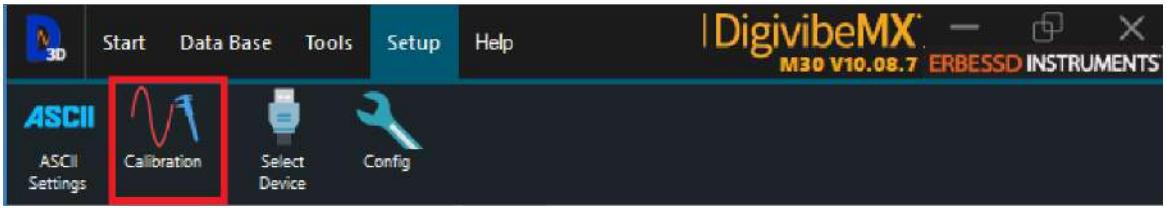
After the software is registered, you must calibrate the system before performing an analysis or balancing. This procedure is usually performed only once, during initial product activation. (It may be necessary to recalibrate if you ever modify the initial calibration with the comparison method, or if you reformat the computer.)

Step 1: Connect the 2 or 4 channel interface to the computer via USB. Connect the calibration device to the Op port using the 5-pin Tachometer cable, as shown. Ensure the computer recognizes that a new device has been installed.

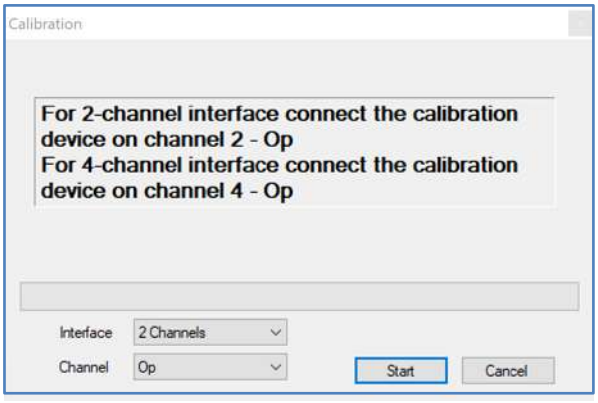
Go to "Setup" -> "Select Device" and verify that *DigivibeMX®* detects the connected interface. If no device is found, exit the software, check all connections, restart and recheck.



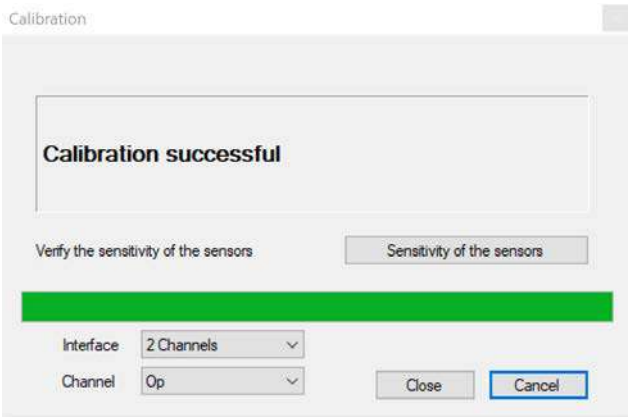
After the Input Device has been selected, proceed to "Setup" -> "Calibration".



The following window should open. Select your Interface and set Channel to Op, then click "**Start**".



The following screen confirms a successful calibration. DigivibeMX® software is now ready for use.

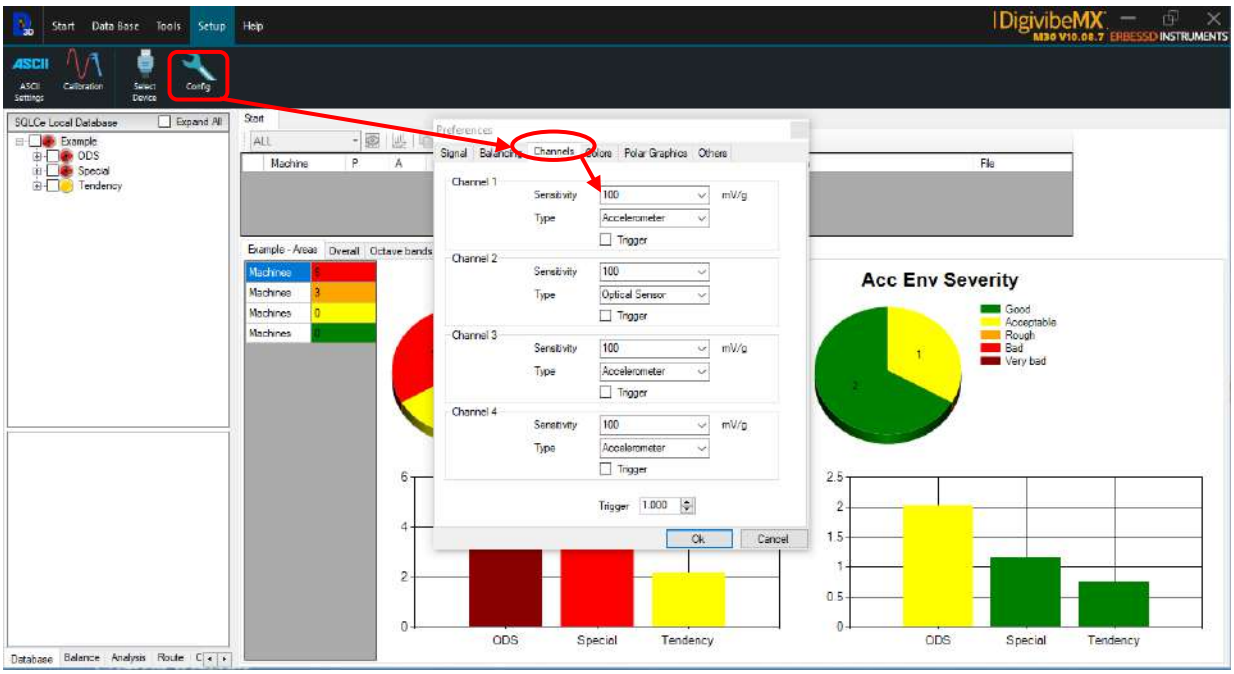


The default sensor sensitivity is preset to 100 mV / g. If you want to change it, click the "Sensitivity of the sensors" button.

For more information using DigivibeMX® software, please refer to the videos on the welcome screen of the installation disc, in the user manual (Help -> Contents) or on our YouTube account.

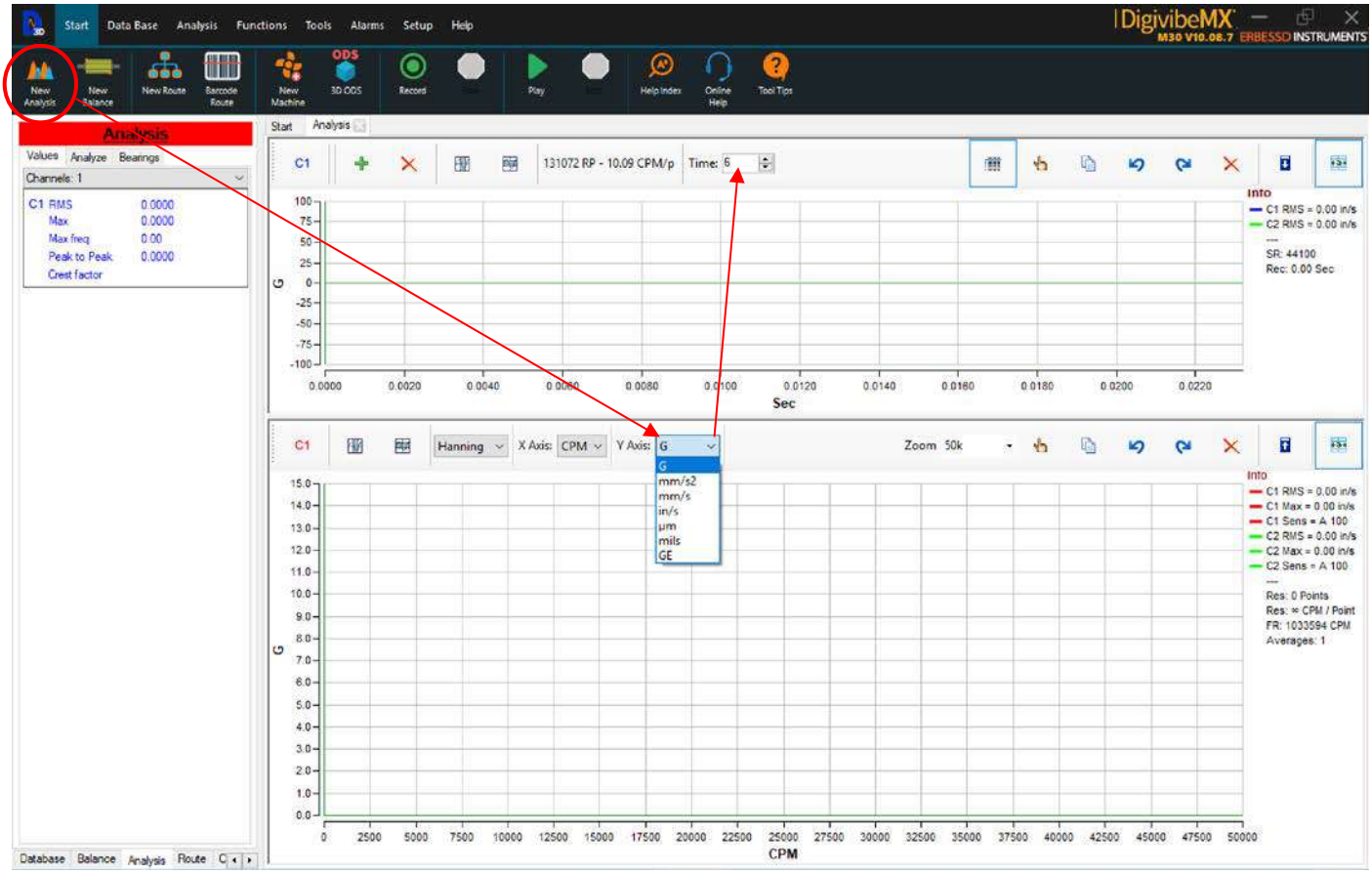
Calibrate DigivibeMX® manually or with External Reference

On the Setup Menu, select Config to open the Preferences context menu. On the "Channels" tab, set Channel 1 to 100mV/g for calibration purposes: (It does not have to be the actual sensitivity of the sensor used)

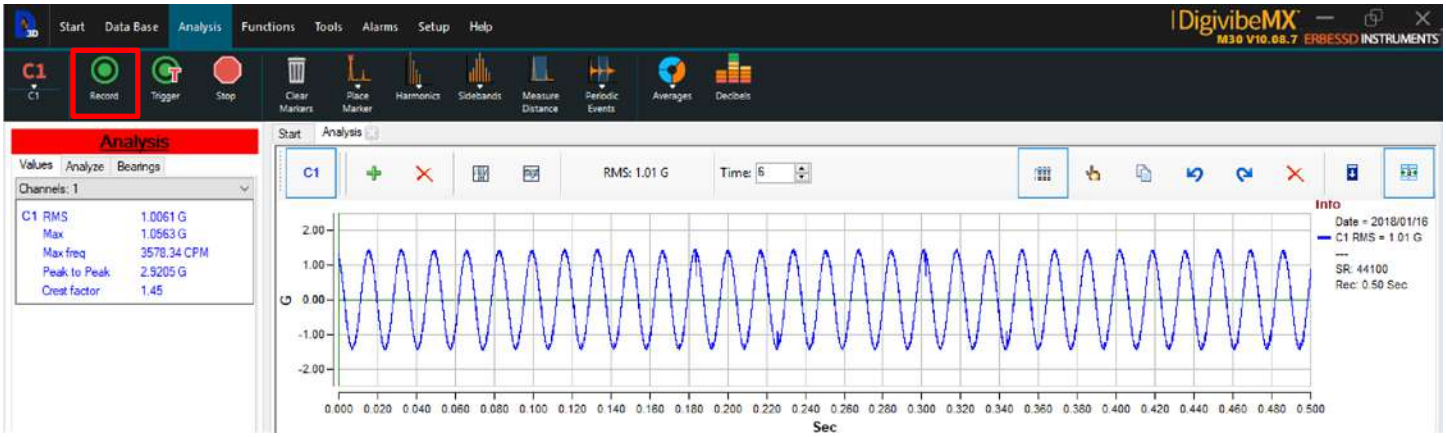


Connect the calibration device to the interface on port 1-A:

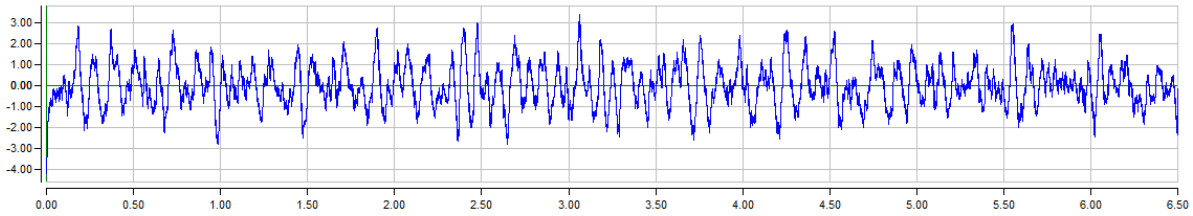
1) On the **Start** page, select **New Analysis**
2) Select acceleration **units G**
3) Select **6 seconds** of recording time



Record the signal:



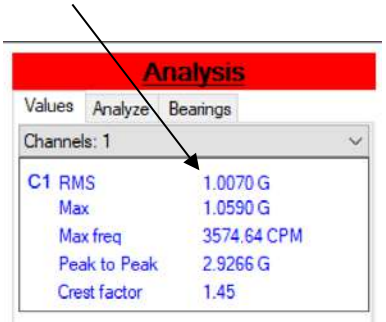
IMPORTANT: If the signal is **not sinusoidal**, as in the example below:



Confirm that:
- The correct interface and calibrator have been selected
- The Y-axis units are set to Gs and the sample time is 6 seconds.

If problems persists, you may have a damaged cord or calibration device.
Contact us: info@erbessd-instruments.com

When the system is properly calibrated, analysis value should be 1.00 G.



Navigating DigivibeMX® Software

User Interface

The User Interface is divided into 3 main sections:

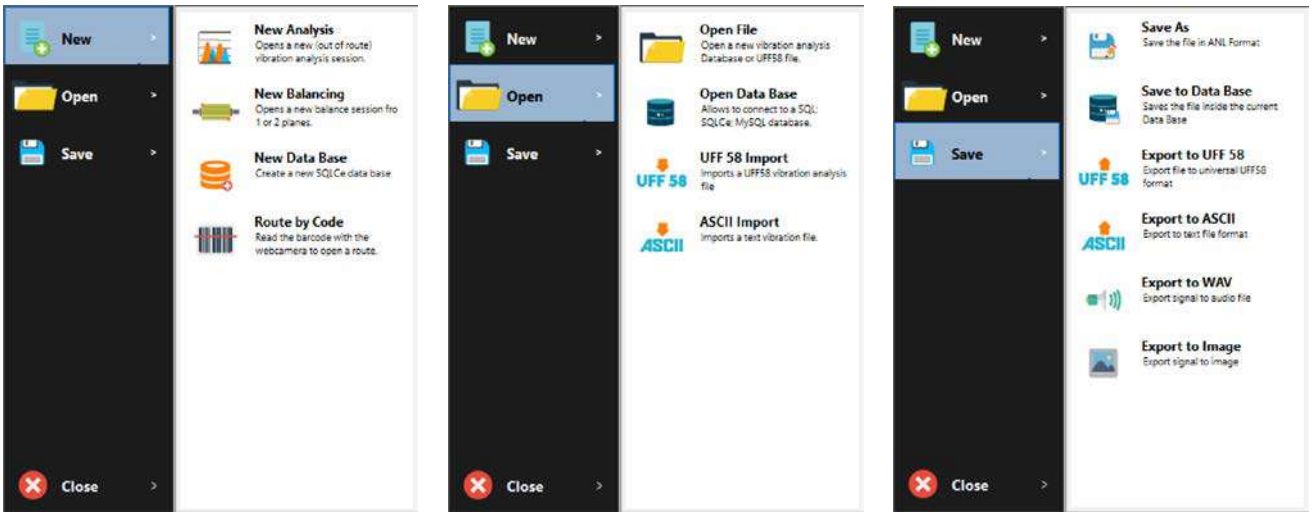
- Menus and Functions (Section 1)
- Toolbar and Shortcut Tabs (According to version) (Section 2)
- Analysis and Work Area (Section 3)

Main Menus

The graphic user interface of DigivibeMX® Version 10 has been completely redesigned, with more intuitive menu options, increased touchscreen compatibility and easier access to functions. The software is organized into 6 main functional menus.

- File menu
- Start menu
- Data Base menu
- Tools menu (According to DigivibeMX® version)
- Setup menu
- Help menu

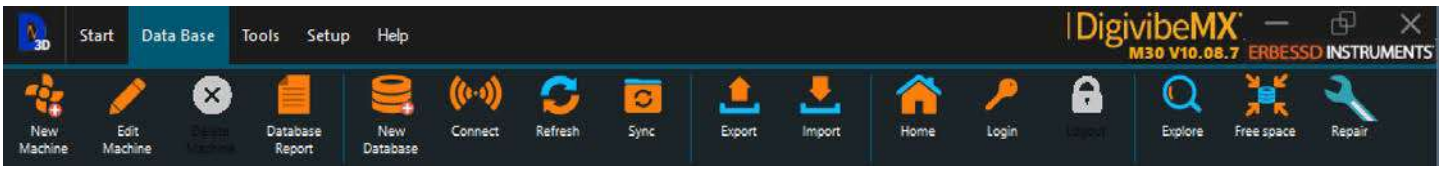
File Menu



Start Menu

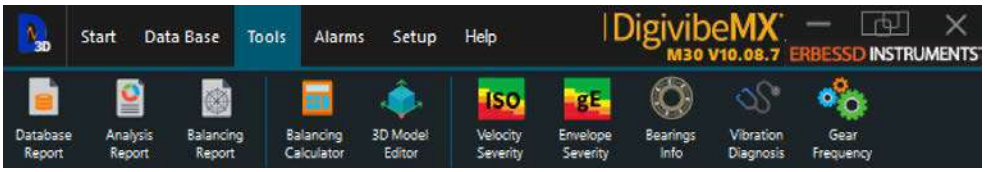
- **New Analysis**: Starts a new analysis session and opens the Analysis, Functions and Alarms menus
- **New Balance**: Starts a new balance session and opens the Balancing and Alarms menus
- **New Route**: Starts a new data collection Route by selecting from machines in the database
- **Barcode Route**: Starts a new data collection Route by scanning barcodes
- **New Machine**: Creates a new Site, Area or Machine in the database
- **3D ODS**: Starts a 3D ODS simulation session
- **Record**: Starts a vibration data collection
- **Stop**: Stops a vibration data collection
- **Play**: Playback of a recorded data collection as sound.
- **Stop**: Stops playback of a recorded data collection as sound.
- **Help Index**: Opens the software User Manual
- **Online Help**: Opens a web browser link with additional help, such as videos and manuals.
- **Tool Tips**: Activates tip balloons on various software items.

Data Base Menu



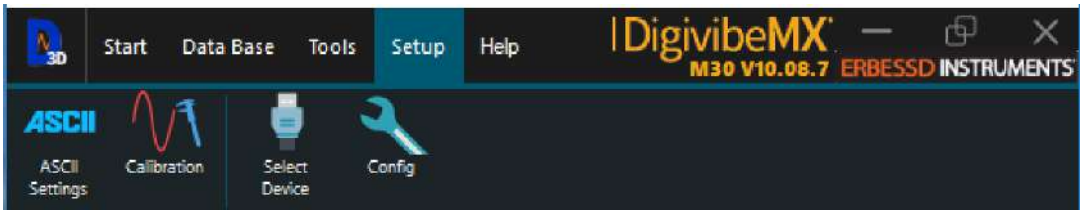
- **New Machine**: Creates a new Site, Area or Machine in the current database
- **Edit Machine**: Edits a selected machine in the database
- **Delete Machine**: Deletes selected (check marked) Sites, Areas or Machines from the database. Button is disabled until machines are selected.
- **Database Report**: Generates a report of the database
- **New Database**: Creates a new database
- **Connect**: Connects to a SQL, SQLCe or MySQL database
- **Refresh**: Updates the database with the latest changes made
- **Sync**: Synchronizes database locally or with **EI-Analytics** cloud service
- **Export**: Exports selected machines to a SQLCe database
- **Import**: Imports a SQLCe database
- **Home**: Updates the database tree and closes working database back to the Site level
- **Login**: Logs in to **EI-Analytics**
- **Logout**: Logs out of **EI-Analytics**
- **Explore**: Explores the tables in the database
- **Free space**: Cleans up the current database and create free space
- **Repair**: Repairs corrupted databases.

Tools Menu



- **Database Report**: Generates a report of machines check-marked in the database tree
- **Analysis Report**: Generates an analysis report from a signal in the work area
- **Balancing Report**: Generates a report for an in-process or completed balancing session
- **Balancing Calculator**: Opens the balancing calculator
- **3D Model Editor**: Opens a selected 3D ODS model for editing
- **Velocity Severity**: Opens an ISO 10816 machine vibration severity chart
- **Envelope Severity**: Opens a recommended enveloping machine vibration severity chart
- **Bearings**: Opens the bearing database
- **Vibration Diagnosis**: Accesses helpful vibration analysis diagnostic tools
- **Gear Frequency**: Opens the gear frequency calculator

Setup Menu



- **ASCII Settings**: Configures collected data to export as ASCII file type
- **Calibration**: Calibrates the software using the calibration device and 2/4 Channel interface
- **Select Device**: Selects a connected interface
- **Config**: Configures DigivibeMX® software and hardware for balancing and/or data collection

Help Menu

- **Help Index**: Opens the software user's manual
- **Help Content**: Opens the software PDF manual
- **Online Help**: Opens a web browser link to additional help, such as videos and manuals
- **Tool Tips**: Activates tip balloons on various software items
- **Erbessd Instruments**: Opens a web browser link to the company's official website
- **EI Analytic**: Opens a web browser link to the EI-Analytic homepage
- **Activation**: Opens the software activation window
- **About**: Displays software version and copyright information

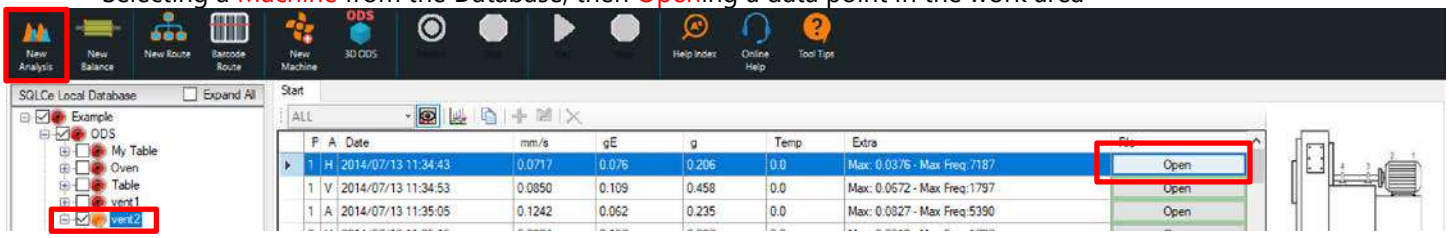
Conditional Menus

Conditional menus are not immediately visible when DigivibeMX® opens. They appear depending upon user-selected operations and software version (M10, M20 or M30). They provide additional functions for vibration analysis or balancing.

Analysis Menu (M20, M30)

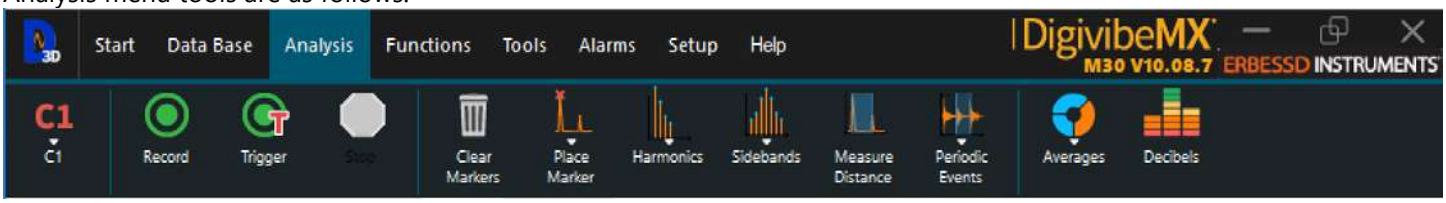
The Analysis menu in versions M20 and M30 is activated by:

- Selecting New Analysis on the Start menu for a new data collection, or…
- Selecting a Machine from the Database, then Opening a data point in the work area



Exit the Analysis menu by closing its tab in the work area

Analysis menu tools are as follows:



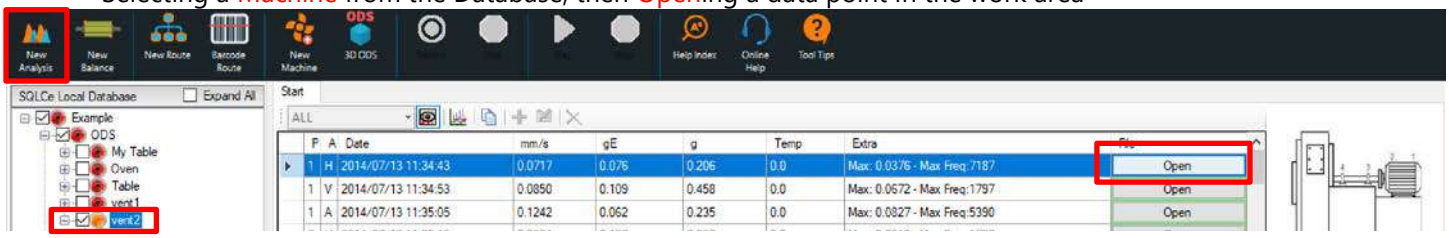
C1: Selects the number of channels to be used for data collection/analysis. Permits manual switching between channels.
Record: Starts a manual recording vibration data
Trigger: Initiates recording of vibration data when the machine's vibration level reaches a pre-defined level
Stop: Stops a vibration data recording
Clear Marker: Deletes markers placed on the FFT spectrum
Place Marker: Place a marker on the FFT spectrum
Harmonics: Set harmonics in the FFT, which range from 1 to 10
Sidebands: Place sidebands on the FFT, which range from 1 to 4
Measure Distance: Measures the distance on the horizontal axis between two points of the FFT

Periodic Events: Trace in the time graph from 5 to 20 cursors according to a frequency
Averages: Up to 10 times to eliminate random events
Decibels: Converts the vertical axis scale to dB

Functions Menu (M20, M30)

The Functions menu in versions M20 and M30 is activated by:

- Selecting New Analysis on the Start menu for a new data collection, or…
- Selecting a Machine from the Database, then Opening a data point in the work area



Exit the Routes menu by closing its tab in the work area

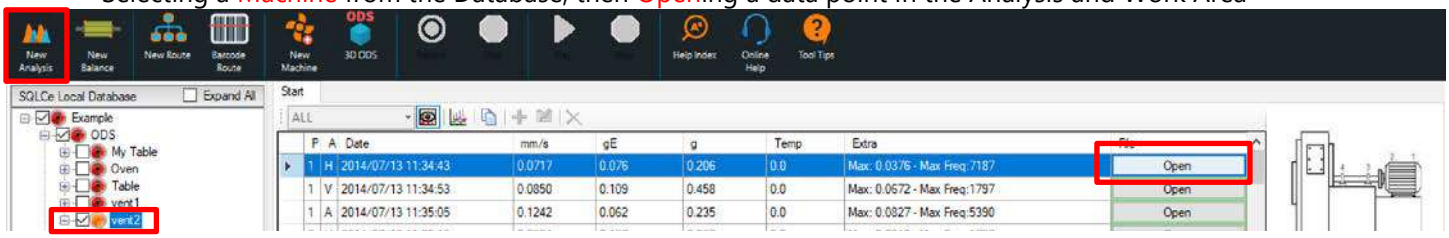
Functions menu tools are as follows:

- **3D FFT Waterfall**: Cascading 3D FFT representation of vibration data
- **Spectrograph**: Color representation of the amplitude of a signal
- **Cross-by-0 Frequency**: Frequency calculation based on the time elapsed between crossings of 0 axis
- **Crest Factor**: Calculation of the crest factor, while more sinusoidal, this value approaches 1.41
- **FFT**: Amplified frequency spectrum
- **Bode**: Bode chart for calculating resonant frequencies
- **Phase**: Graphic that represents the Phase in each frequency of the whole spectrum
- **Cross Power Spectrum**: 2 signal crossing function to weight matching frequencies
- **FRF** (Frequency Response Function): Measures the output spectrum of a system in response to a stimulus
- **Coherence**: Statistics to examine the relationship between 2 data collections
- **Orbit**: Dynamic 2D representation of rotor shaft displacement

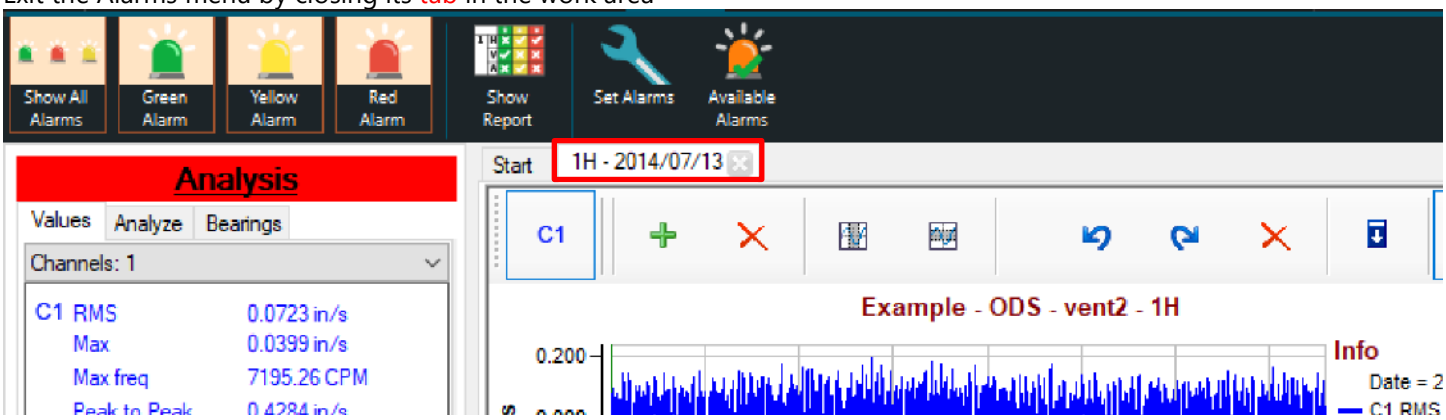
Alarms Menu (M20, M30)

The Alarms menu in versions M20 and M30 is activated by:

- Selecting New Analysis on the Start menu for a new data collection, or…
- Selecting a Machine from the Database, then Opening a data point in the Analysis and Work Area



Exit the Alarms menu by closing its tab in the work area



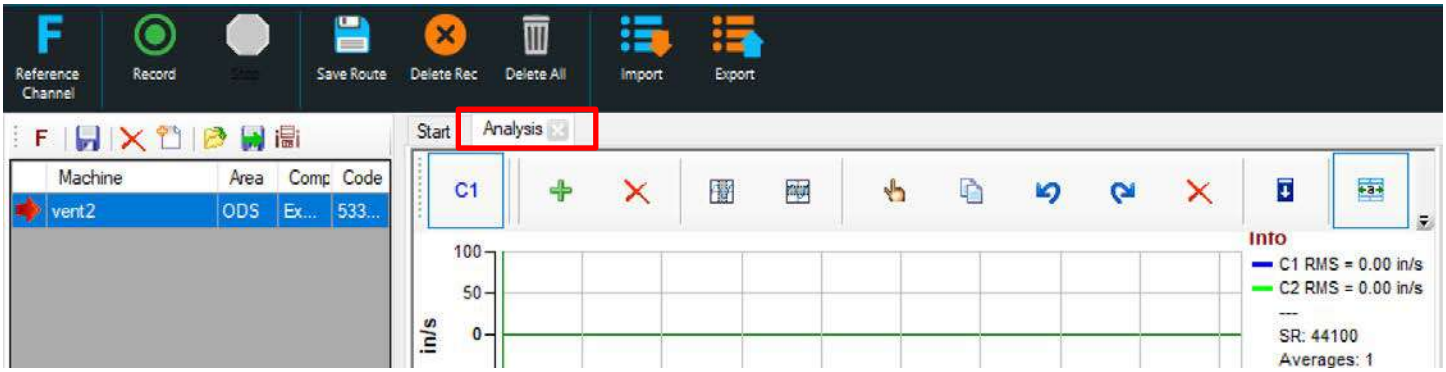
Alarms menu tools are as follows:

- **Show All Alarms**: Displays all alarm levels
- **Green Alarm**: Displays or hides alarms with a low impact level
- **Yellow Alarm**: Displays or hides alarms with an average impact level
- **Red Alarm**: Displays or hides alarms with a high impact level
- **Show Report**: Displays alarm levels of each axis per point of a machine across the 4 categories analyzed (Acceleration, Velocity, Displacement, Envelope)
- **Set Alarms**: Sets alarm parameters assigned to each machine monitoring point
- **Available Alarms**: Displays each machine monitoring point with at least one alarm assigned

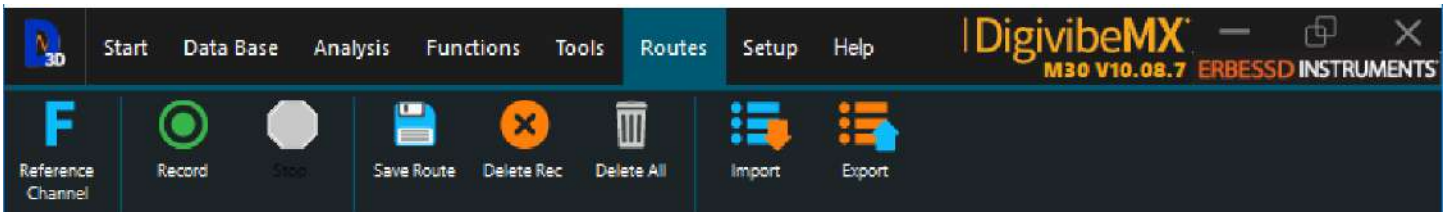
Routes Menu (M20, M30)

The Routes menu in versions M20 and M30 is activated by selecting New Route on the Start menu

Exit the Routes menu by closing its tab in the work area



Routes menu tools are as follows:



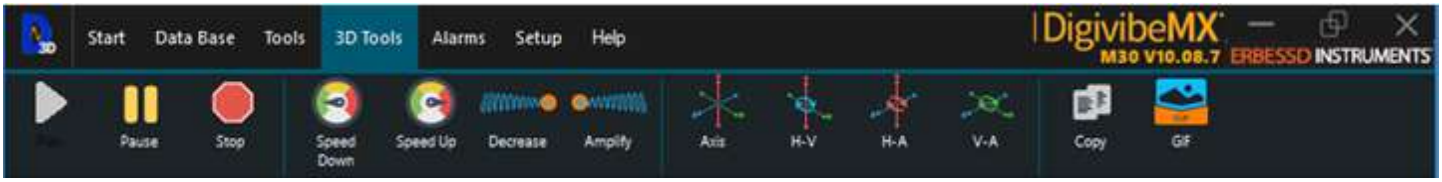
- **Reference Channel**: ODS data collections require assigning one channel to collect stationary reference data. Activate and assign a reference channel, if you want to create a route for ODS data collection
- **Record**: Start recording a vibration data collection
- **Stop**: Stop recording a vibration data collection
- **Save Route**: Saves the current route
- **Delete Rec**: Deletes the current or selected vibration data collection
- **Delete All**: Deletes the current or selected route
- **Import**: Loads a Route as a text file
- **Export**: Exports a Route as a text file

3D Tools Menu (M20, M30)

The 3D Tools menu in versions M20 and M30 is opened by selecting 3D ODS on the Start menu

Exit the 3D Tools menu by closing the 3D Sim tab in the work area

3D Tools menu tools are as follows:



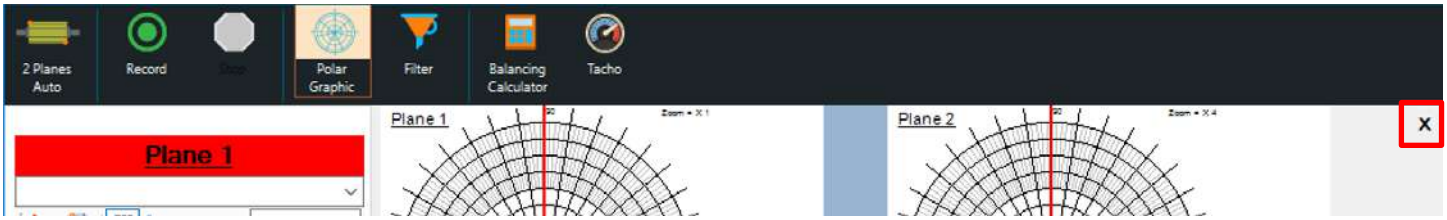
- **Start**: Start movement of the 3D ODS simulation
- **Pause**: Pause the simulation
- **Stop**: Stop the simulation
- **Speed Down**: Decrease simulation speed
- **Speed Up**: Increase simulation speed
- **Decrease**: Decrease amplitude of the simulation movement
- **Amplify**: Increase amplitude of the simulation movement
- **Axis**: Shows or hides axes
- **H-V**: Inverts Horizontal and Vertical axes
- **H-A**: Inverts Horizontal and Axial axes
- **V-A**: Inverts the Vertical and Axial axes
- **Copy**: Export the 3D ODS model as a still image file
- **GIF**: Export the simulation as a moving GIF file

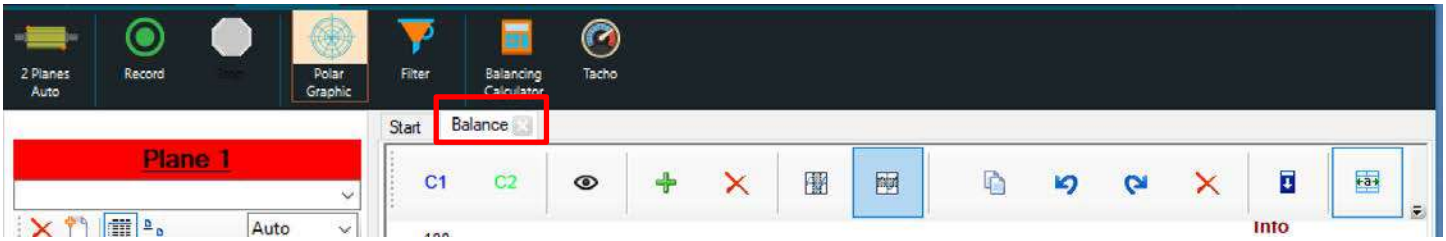
NOTE: For detailed instructions about using 3D ODS functions, please refer to Page 128.

Balancing Menu (M10, M30)

The Balancing menu in versions M10 and M30 is opened by selecting New Balance on the Start menu

Exit the Balancing menu by closing the balancing window, then closing its tab in the work area





Balancing menu tools are as follows:

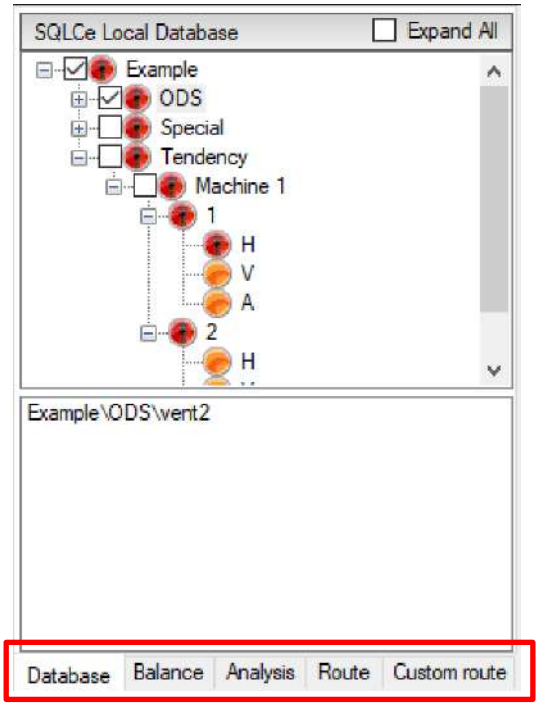
- **2 Planes Auto** (only applies to the I-600 Sequential interface. See Appendix 1 for details): Allows for automatic sequential recording of both planes, or independent recording of each plane
- **Record**: Starts vibration and phase data collection
- **Stop**: Stops vibration and phase data collection
- **Polar Graphic**: Shows or hides the polar graphs in a rolling session
- **Filter**: Defines a rotational speed frequency range to improve phase measurement accuracy
- **Balancing Calculator**: Assists with adjusting to conditions that could affect balancing accuracy
- **Tacho**: Displays the indicated rotor speed signal from the Tachometer

Using DigivibeMX® Software

DigivibeMX® is a powerful and versatile Condition Monitoring software. It empowers users with industry-leading vibration analysis and balancing capabilities. It also features different methods of navigation, in order to move quickly between different tasks.

Toolbar and Shortcut Tabs

The left-hand column (2nd section) of the screen acts as a toolbar. In addition to providing overview information about the current task, it features several shortcut tabs - allowing quick transition between key operations.



At the bottom of the toolbar are shortcut tabs for Database, Dynamic Balancing, Vibration Analysis, Route Data Collection and Custom Route functions. These functions are explained as follows:

Database Tab

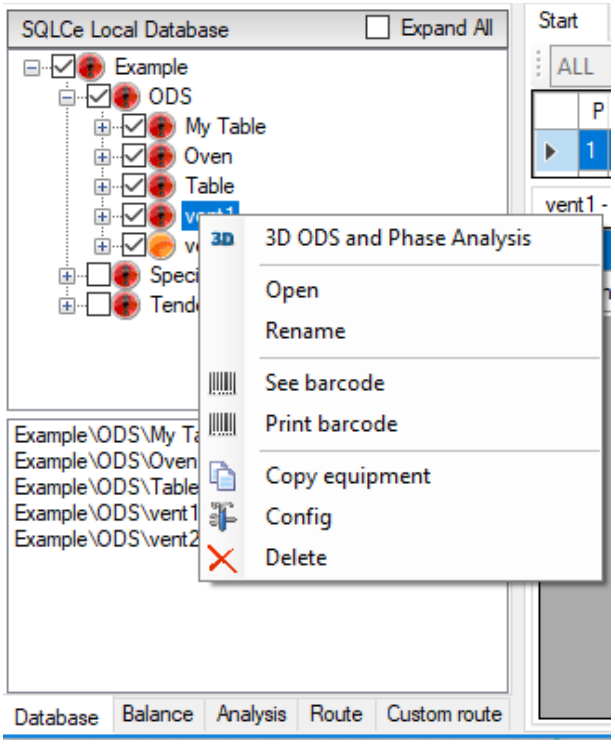
The Database Tab opens the database - a file and folder system where all collected vibration and balancing data is stored. The DigivibeMX® database system is compatible with SQL, MySQL, SQLCe. For specific Data Base Menu features and functions, please refer back to the "Data Base Menu" section of this manual.

The database view is divided into upper and lower panels. It features a File Explorer function similar to Windows, meaning that when a folder is check-marked in the upper panel, its subfolders are previewed in the lower panel.

Upper panel displays the database folders and files in tree format. A recommended database structure is as follows:

- **Top Level**: Company Name, Customer Name or Plant Location (for service providers or other users collecting data in multiple plant locations)
- **Second Level**: Plant Area or Process Area
- **Machine Level**: Machine ID
- **Measurement Point**: Motor Inboard, Point 1, etc.
- **Measurement Axis**: H, V, A or Reference (for ODS)
- **Collected Data Files**

If Machine Alarms are used, each level of the database will display the highest severity alarm for any collected data it contains.



Lower panel displays the scan path for selected files in the top panel. Data for selected items is previewed on the Start Tab in the main Work Area (Section 3).

NOTE: Right clicking on items in the Database opens a context menu. Several options are available, depending upon the item selected and functions available.

Balance Tab (M10, M30)

The Balance Tab opens a telemetry panel for dynamic balancing. The view is divided between **Plane 1** (upper) and **Plane 2** (lower).

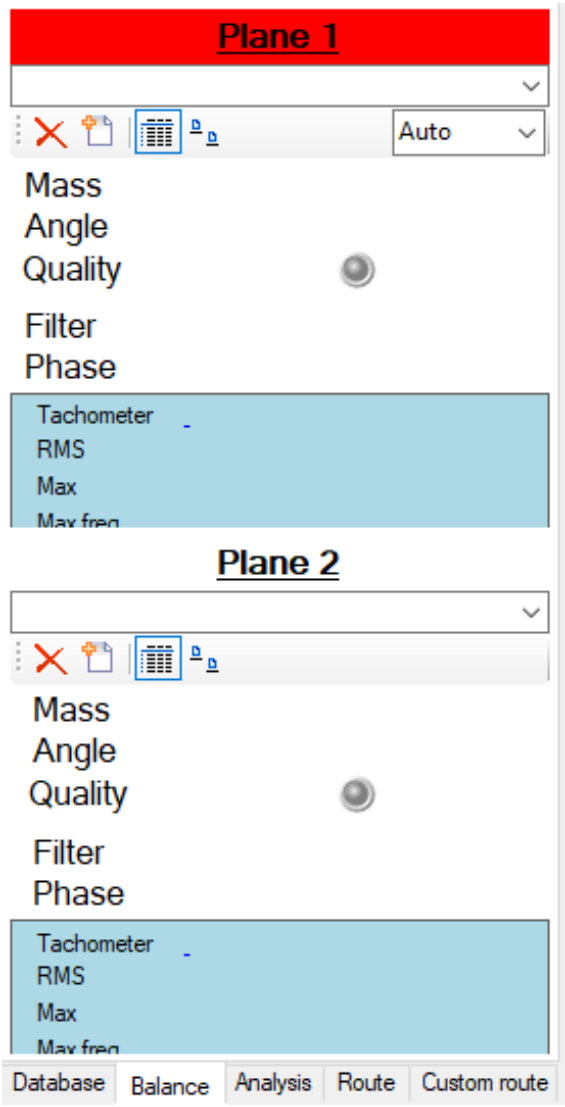
NOTE: For single plane balancing, only Plane 1 will be visible.

During the balancing process, each collected run is saved automatically for later review. The saved data from each run can be selected from the drop-down menus, under the **Plane 1** and **Plane 2** panel titles.

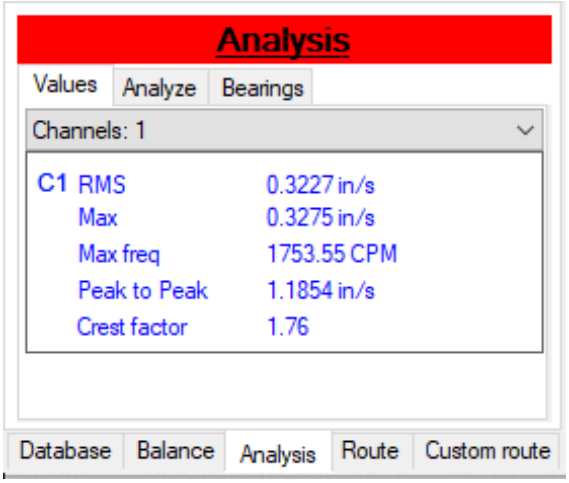
The following values are displayed for each Plane:
- **Mass:** Recommended mass to add or remove
- **Angle:** Recommended angle at which mass should be added or removed
- **Quality:** Balance quality grade

- **Filter:** Filtered Tachometer frequency range, if any
- **Phase:** Phase of the filtered value, if any

- **Tachometer speed, RMS, Max and Max Freq** are displayed in the lower (blue) section of each panel.



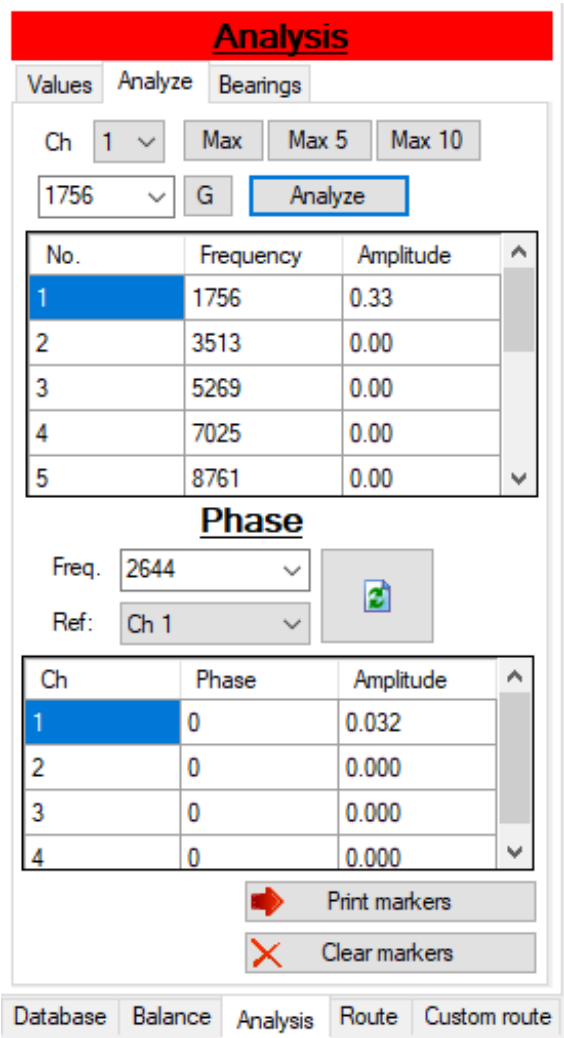
Analysis Tab (M20, M30)



The Analysis tab opens a telemetry panel for Vibration Analysis.

The **Analysis** panel has 3 top tabs: *Values, Analyze and Bearings*. The dropdown menu underneath the tabs allows selecting multiple channel data for comparison, if multiple channel data was recorded.

The *Values* tab displays significant overall values of a selected vibration data collection.
- **RMS:** Root Mean Square of overall vibration.
- **Max**: Maximum FFT peak value.
- **Max Freq:** Frequency of highest FFT vibration.
- **Peak to Peak:** Highest to lowest peak value of the waveform.
- **Crest Factor:** Expresses how close the waveform is to being a perfect sine wave.

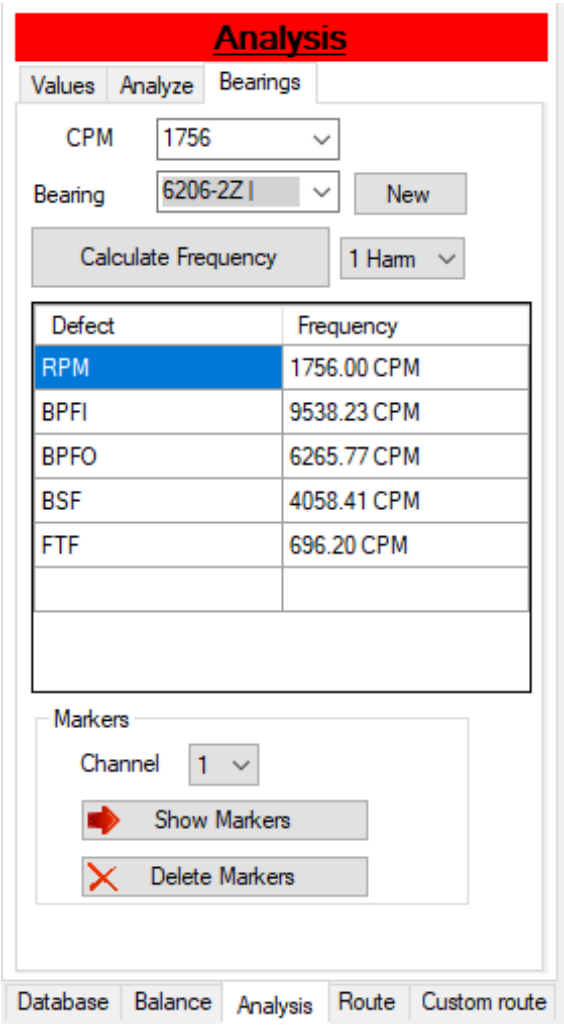


The *Analyze* tab provides a quick overview of peak values in the FFT. Specified values are also displayed on the FFT graph.
- **Max**: Maximum FFT peak value.
- **Max 5:** Five highest FFT peak values.
- **Max 10:** Ten highest FFT peak values.
- **Analyze:** Amplitudes at ten harmonic frequencies corresponding to speed of rotation.

Phase shows a comparison of up to 4 channels, where multiple-channel data has been collected.

Analysis Tab continued (M20, M30)

The *Bearings* tab provides analysis of potential bearing fault frequencies, according to the speed of rotation and the type of bearing installed.



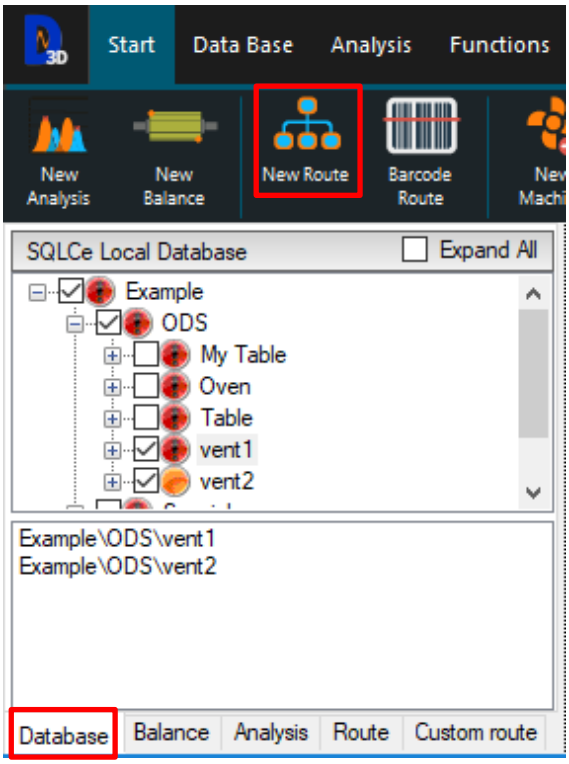
The *Bearings* tab has the following buttons and windows:

- **CPM:** Machine rotation speed.
- **Bearing:** Enter all or part of the installed bearing number and manufacturer.
- **Search:** Search for a desired bearing in the bearing database
- **Calculate Frequency:** Calculates and displays the bearing fault frequencies (BPFI, BPFO, BSF, FTF) and harmonics - according to the speed of rotation, characteristics of the selected bearing and desired harmonics.
- **1 Harm:** Select the number bearing fault frequency harmonics to be analyzed.

- **Channel:** Select the channel to be analyzed.
- **Show markers:** Display bearing fault frequency markers on the FFT graph.
- **Delete markers:** Delete bearing fault frequency markers from the FFT graph.

Route Tab (M20, M30)

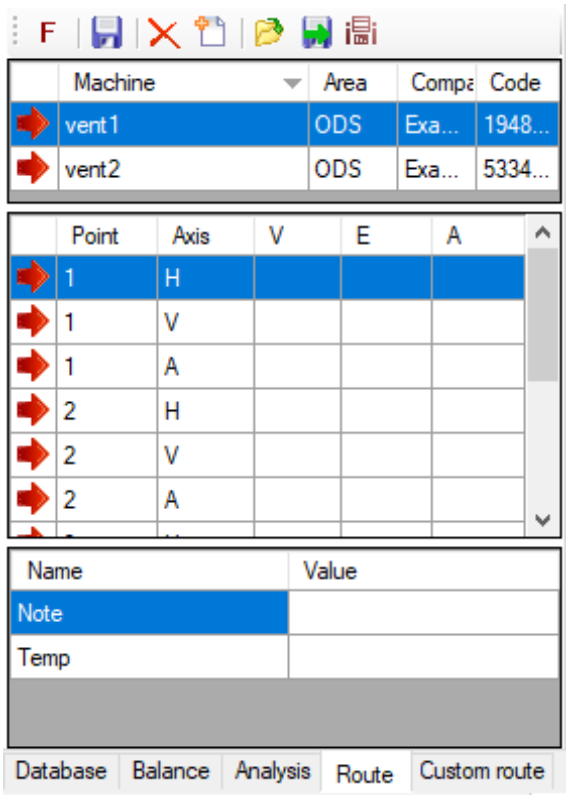
Machines in the database may not be listed in the order one would logically collect data from them. Creating a Route allows machines in the database to be organized into a logical order for efficient data collection. The *Route* tab opens automatically when New Route is selected on the Start Menu. If the tab is opened manually, no data will be present.



To begin the process of creating a route:
- Open the Start Menu
- Open the *Database* tab view
- Select all desired machines for the route
- Select New Route from the Start Menu (the *Route* tab will open automatically)

The *Route* tab view is divided into 3 sections:
1: list of the machines that are within the route.
2: the analysis points that were configured for the current machine.
3: section of comments additional to the route.

There is also a toolbar with the following elements:



F — Reference channel for ODS

Save route even if not all points have been recorded

Delete the machine from the list

Delete entire route

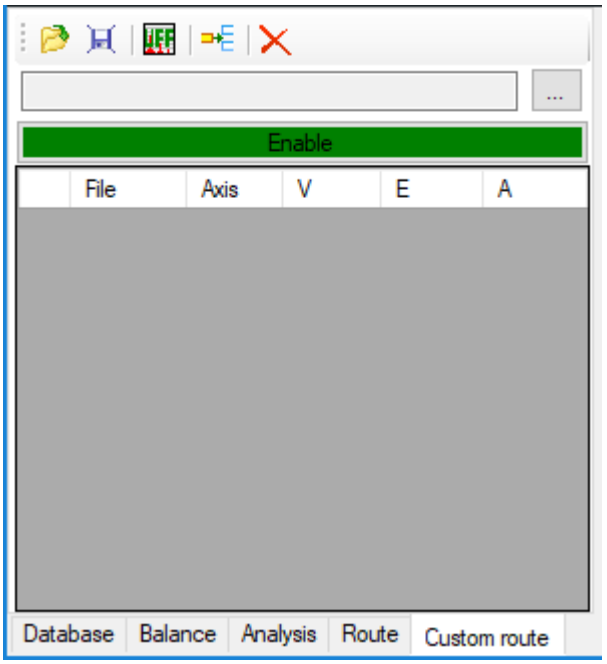
Import route list

Export route list.

Machine Image

Custom Route tab (M20, M30)

Create a Custom Route by modifying an existing route file or by adding new analysis points. This feature is mostly intended for off-route data collections that may or may not be added to the database. Major Route modifications are best accomplished by opening an existing Route in the *Route* tab.



-  Opens a Route file
-  Save as a new Route file
-  Export as a UFF58 file
-  Admin tool for adding rows
-  Delete item from Route

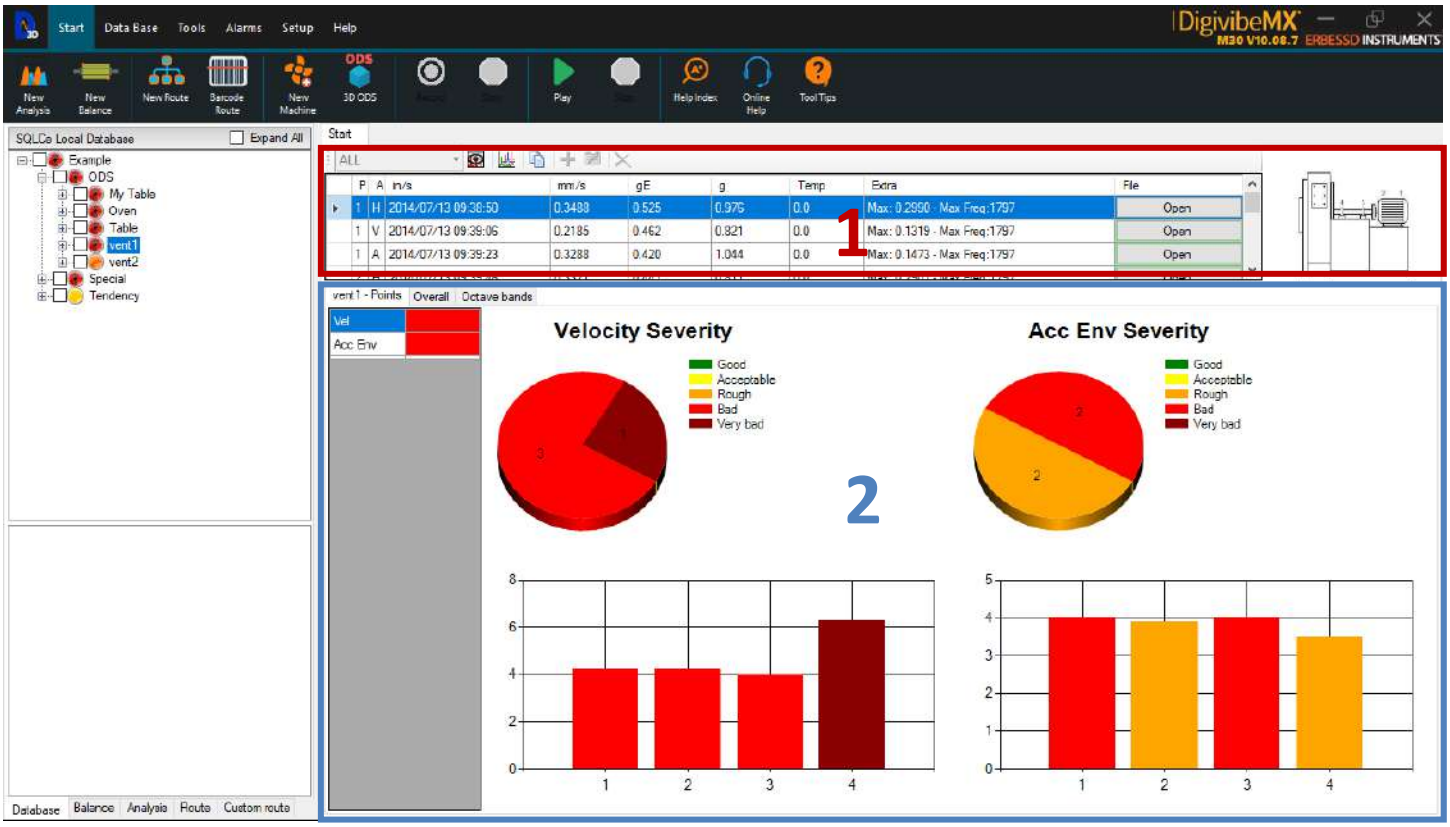
Analysis and Work Area

File Manager and Statistics Manager (M20, M30)

In the Start Menu view, the Analysis and Work Area consists of two distinct panels (outlined in the picture below):

Area 1: File Manager

Area 2: Statistics Manager



File Manager

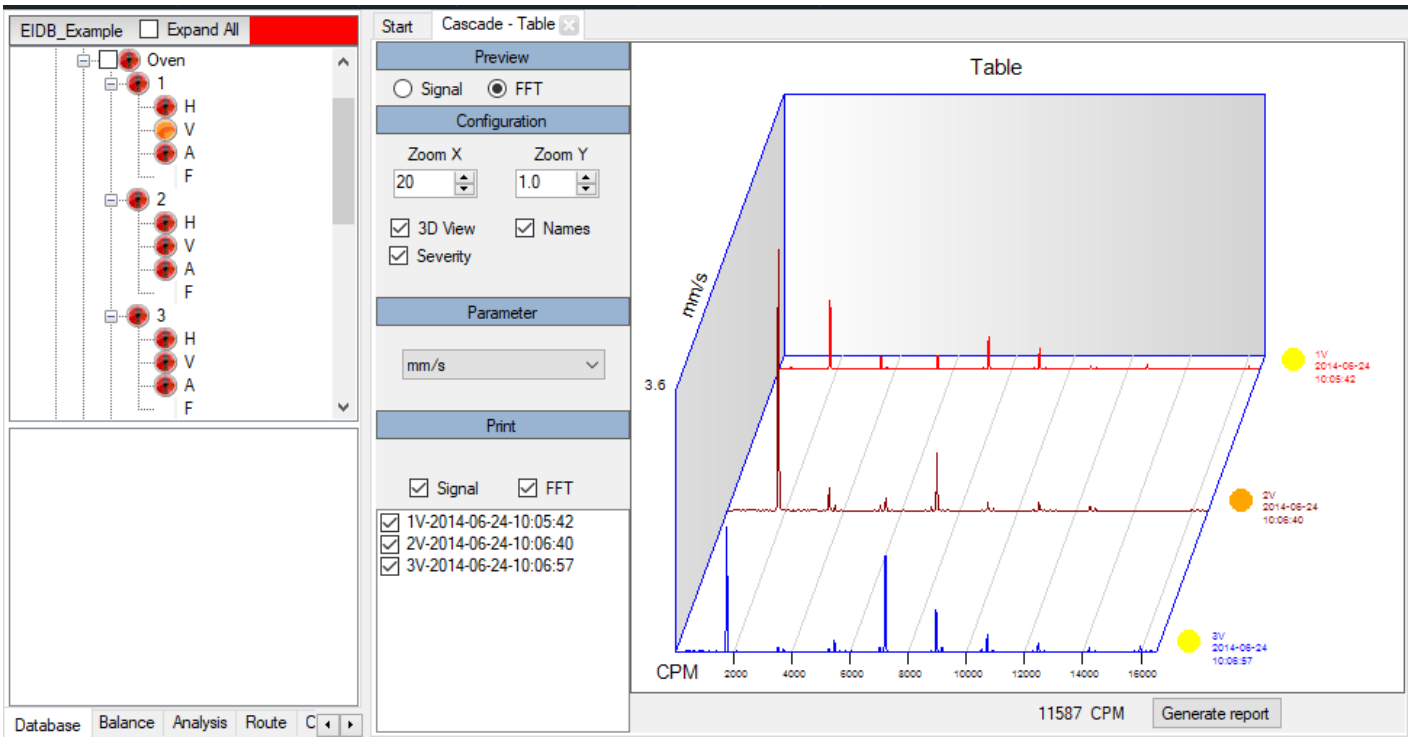
The File Manager panel previews the data contained a selected database item. Each row contains an overview of the most rimportant information. An "Open" button in the File column indicates that a measurement point has data, which can be opened for analysis. If the button says "No File", there is no data file for the measurement point. The measurements displayed in the Work and Analysis Area are determined by the level of item selected in the Database tree, as follows:

- **Plant Level:** Most recent values collected for all plant machines are displayed
- **Area Level:** Most recent values collected for all machines in the area are displayed
- **Machine:** Most recent values collected at each machine point are displayed
- **Point:** Most recent values collected at the selected point are displayed
- **Axis:** All values collected on the selected axis are displayed

The File Manager panel contains the following command buttons:


Filter the File Manager to only display measurement points containing data files


Open two or more selected data points in a cascade graph (as displayed below)




Copy selected row(s) to the clipboard

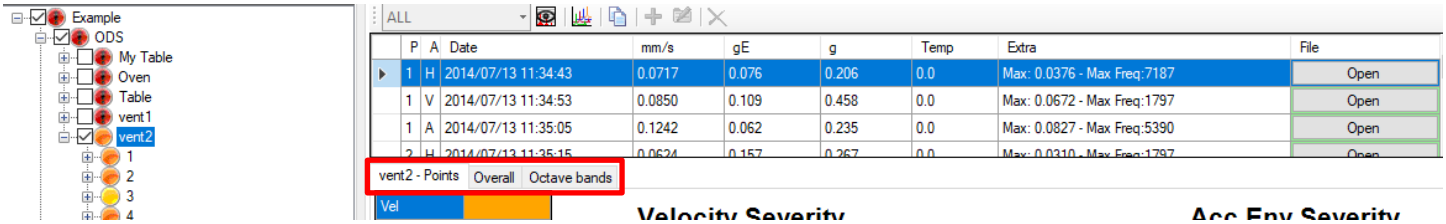

Add a measurement manually


Edit a measurement


Delete a measurement

Statistics Manager

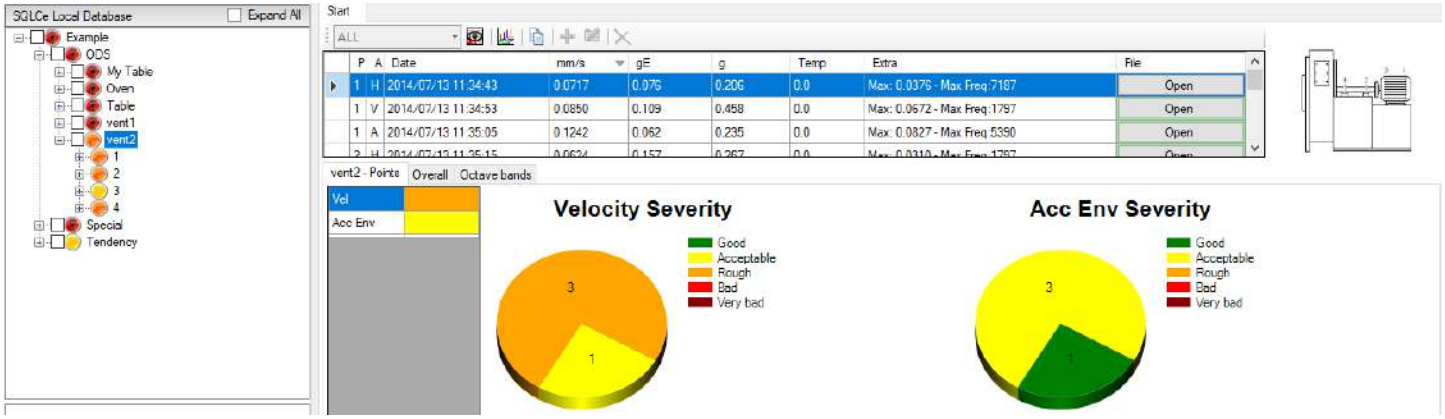
The lower section of the Statistics Manager panel contains 3 tabs: *Statistics* (name displayed on tab reflects the selected level and sublevel selected for Analysis from the Data Base), *Overall*, and *Octave Bands*.



Statistics Tab

Displays overall statistics for a selected level of Database - Company, Area, Machine or Point - in two key parameters:

- **Velocity Severity:** The most important parameter in overall machine vibration.
- **Acceleration Envelope Severity:** The most important parameter for measuring bearing and gearbox wear.



Statistical graphs are calculated using the Velocity and Acceleration Envelope values of each measurement, compared against the configuration and alarm values of each machine. Colors are displayed according to alarm severity settings.

For example, if you set the following alarm values:

- Good: 1.2 mm/s
- Satisfactory: 2.8 mm/s
- Unsatisfactory: 7 mm/s

The colors will appear like this in the graphs:

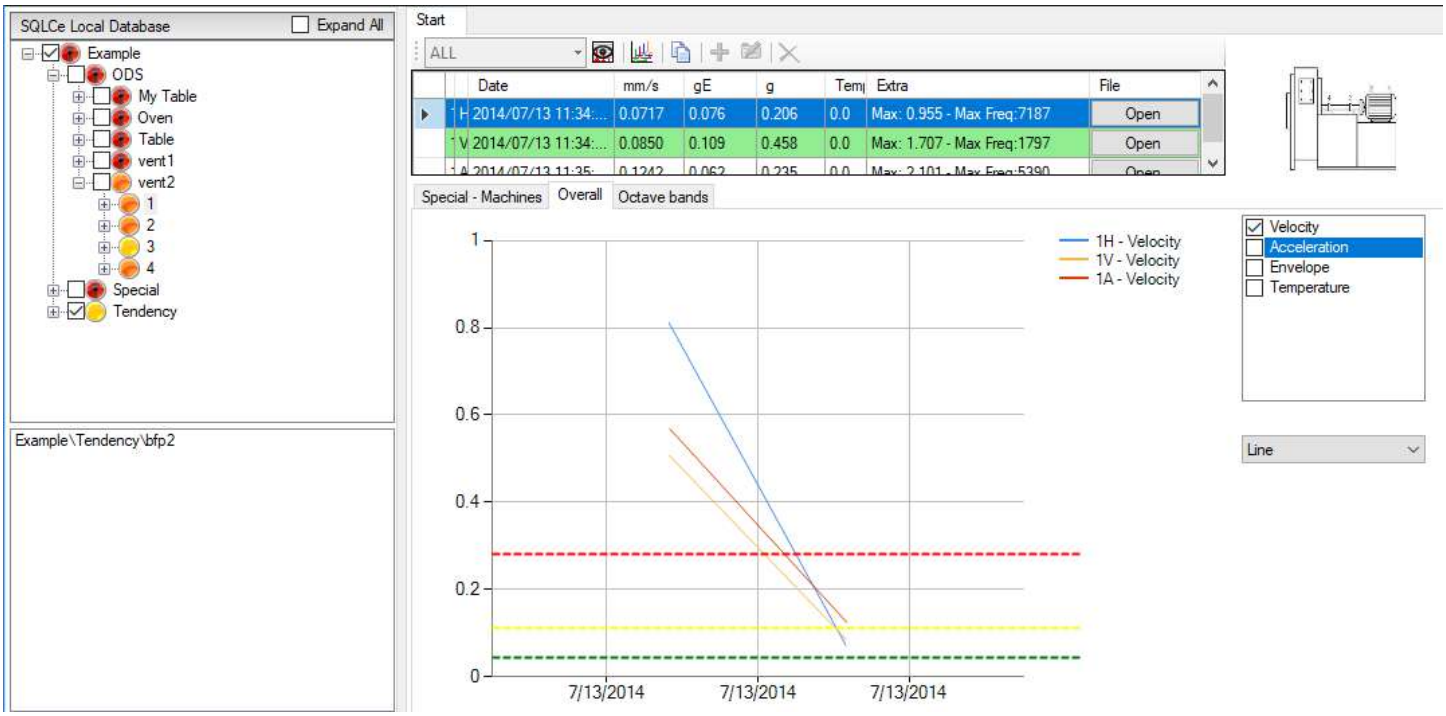
- 0.5 mm/s = Green
- 1.5 mm/s = Yellow
- 5 mm/s = Orange
- 8 mm/s = Red
- 15 mm/s = Dark Red

Color indication for each level of Database item:

- The color of a point will be the highest alarm value of any axis data collection.
- The color of a machine will be the highest alarm value of any point.
- The color of an area will be the averaged alarm value for all machines.
- The color of a plant will be the averaged alarm value for all areas.

Overall Tab

Displays a trend plot of the vibration at each point and axis over time. To view a trend plot, simply select a machine data collection point or axis in the database. If more than one data collection exists at that point or axis, they will be line plotted automatically. If only one data collection exists, the data plot will appear as a simple bar graph.

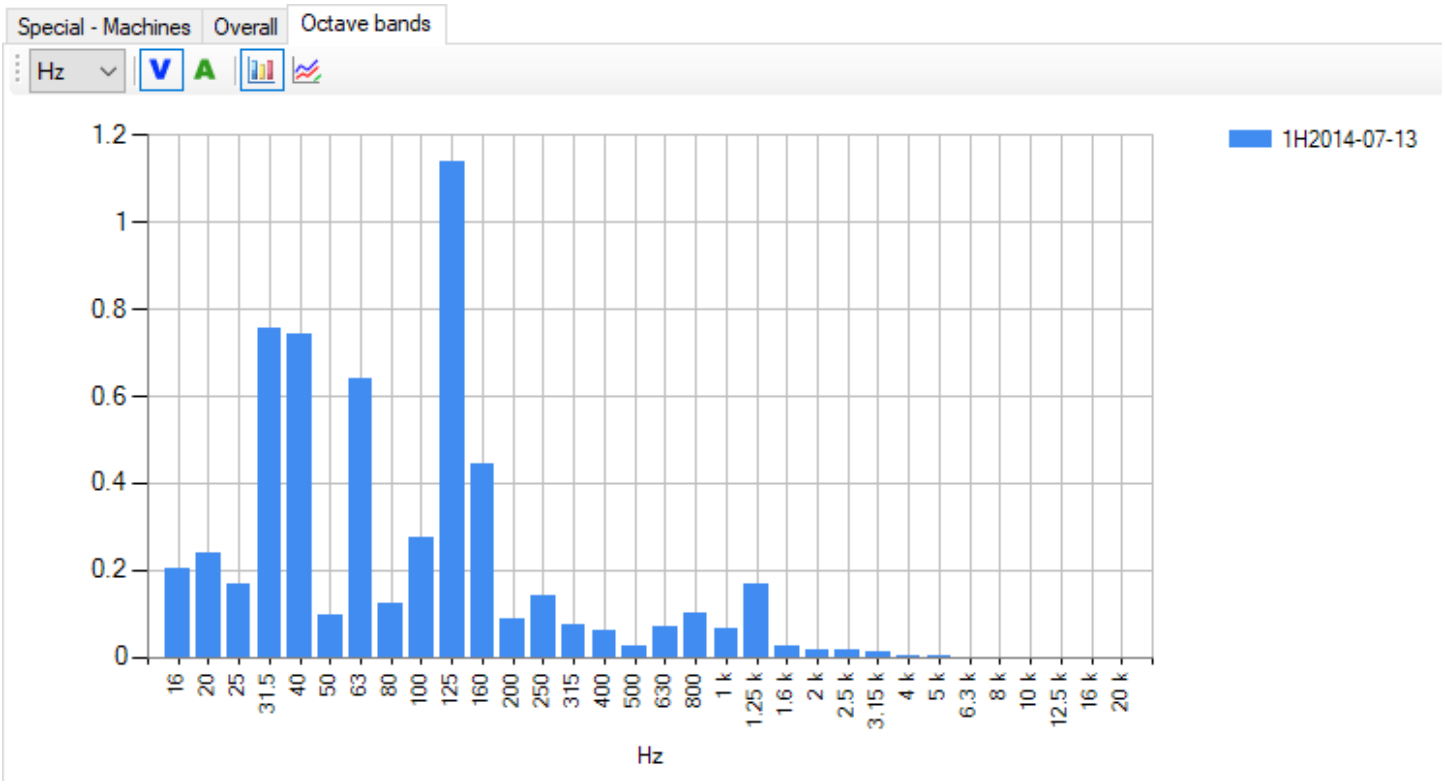


Trend curves can be displayed in any of the available displayed parameters: Velocity, Acceleration, Envelope or Temperature.

The trend is plotted only with the values of the files that appear in the file manager. If any data filters are applied to the File Manager (by date, file, etc.) the trend will be plotted according to the same filters.

Octave Bands Tab

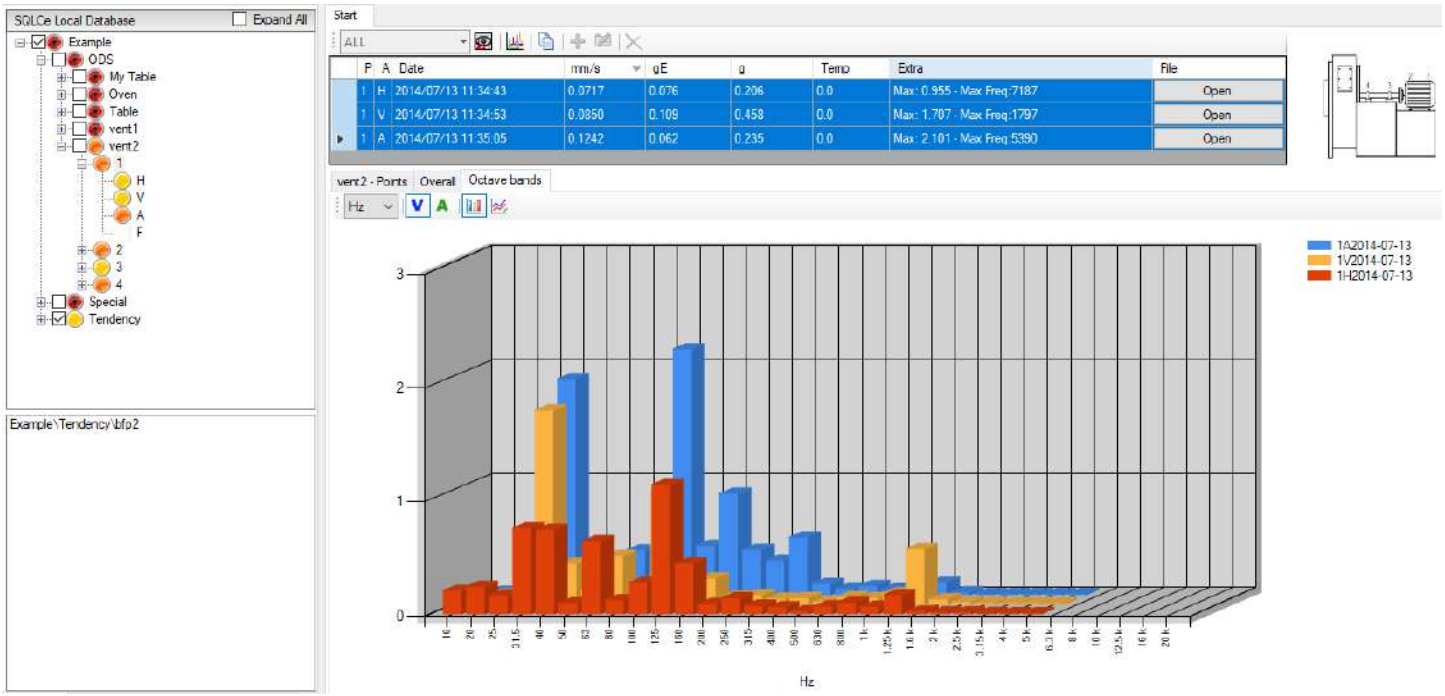
Displays the vibration spectrum on a 1/3 octave band chart. This method consists of dividing the entire frequency spectrum into 32 basic frequency bands distributed on a logarithmic scale - then grouping all nearby amplitudes into their corresponding frequency range bands.



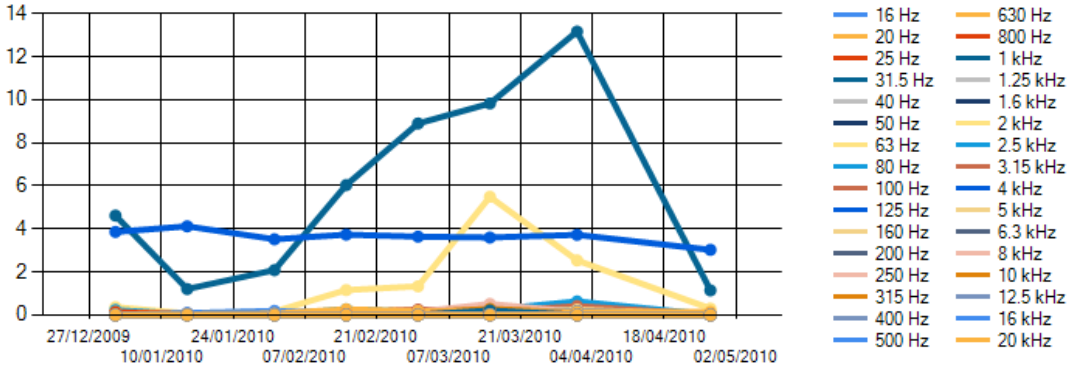
Octave Bands are intended to provide a view of overall vibration by frequency range - perhaps drawing attention to an increasing vibration trend in a particular frequency range. They are not intended to replace analysis of higher-resolution spectra for specific fault frequencies.

To see the octave bands of a single measurement, select it in the File Manager and its graph will be displayed.

If several measurements are selected, the Octave Bands graph will be 3D cascaded.

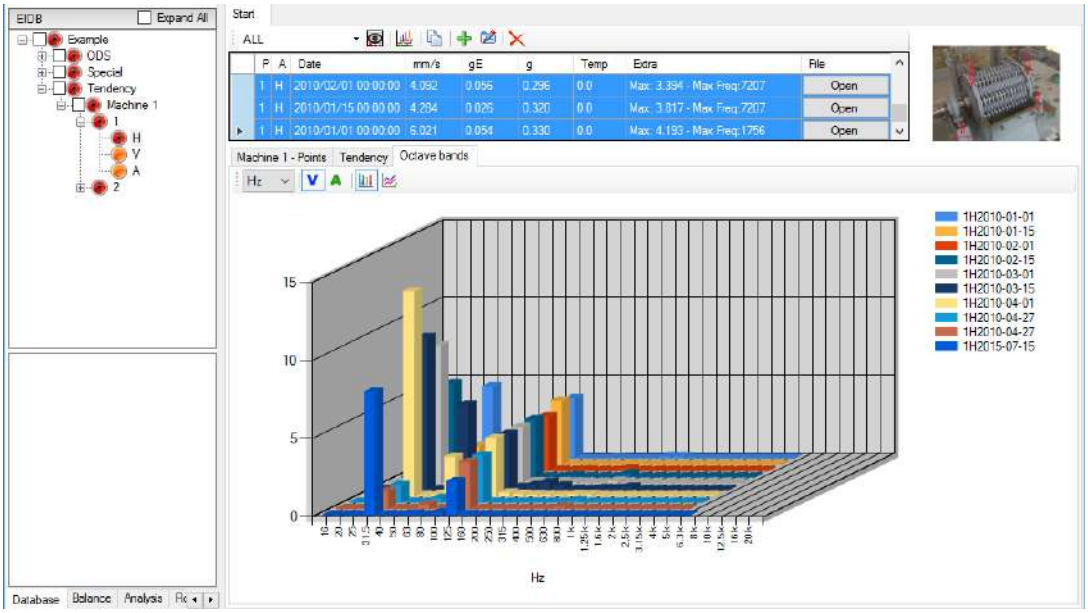


The  button displays the same values as a trend graph.

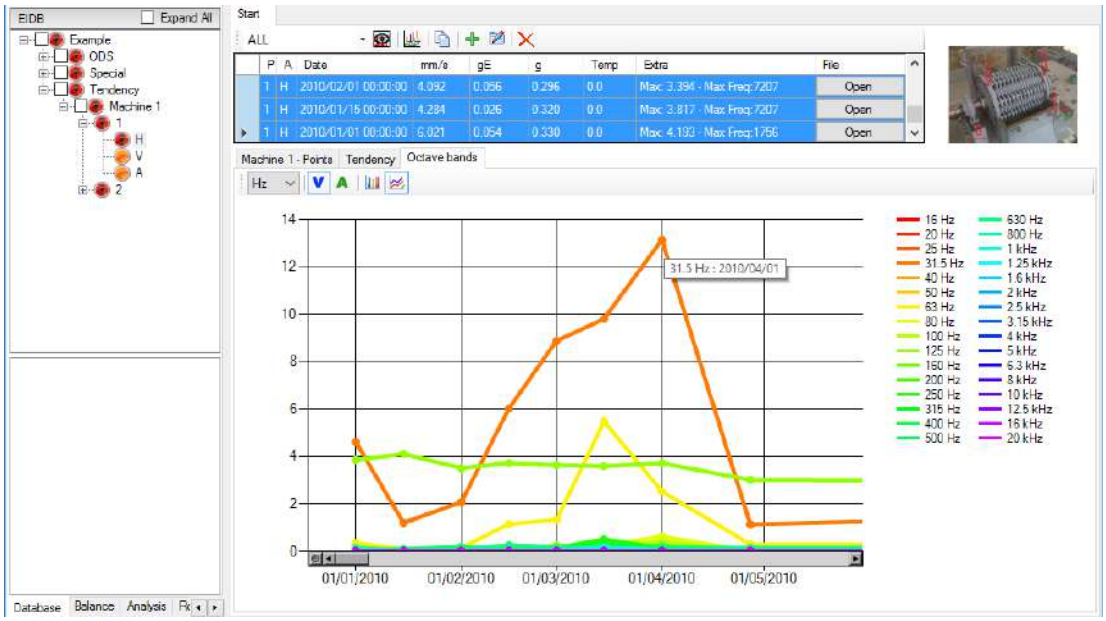


An example analysis of overall data using Octave Bands:

The cascade view shows a dramatic increase in vibration at 1H on 01/04/2010.



The same peak is visible in the trend view. The trend line indicates a period of gradually increasing vibration.



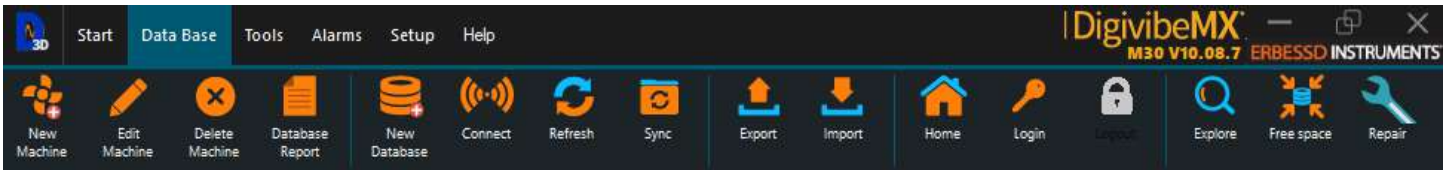
By positioning the mouse pointer over the rising frequency, a frequency of 31.5 Hz (1890 CPM) is displayed. Since the motor rotates at 1800 RPM, the peak is most likely the result of an unbalance. The data suggests the unbalance was corrected before the next data collection on 01/05/2010, as vibration levels had reduced significantly.

Using the Database Menu

The Database Menu features tools to manage the three database types compatible with DigivibeMX® - SQL, MySQL and SQLCe.

Options on the Database Menu include:

- Create, edit and delete machines
- Create, connect and update databases
- Export and import databases
- Explore and repair databases
- Free space in the database

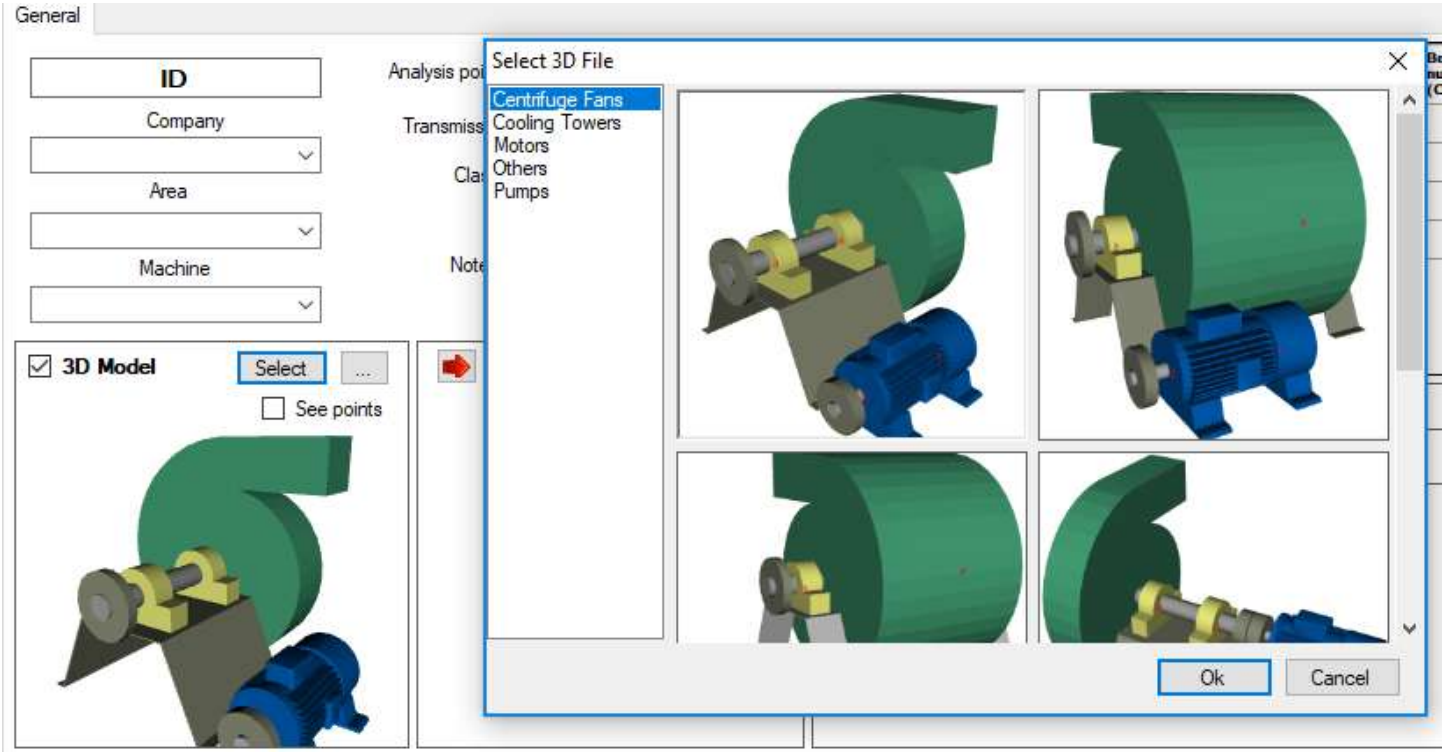


New Machine  **:** Adds new Companies, Areas or Machines to the existing database. Clicking opens a window for entering new machine locations, parameters and characteristics. The New Machine window is comprised of 3 panels:

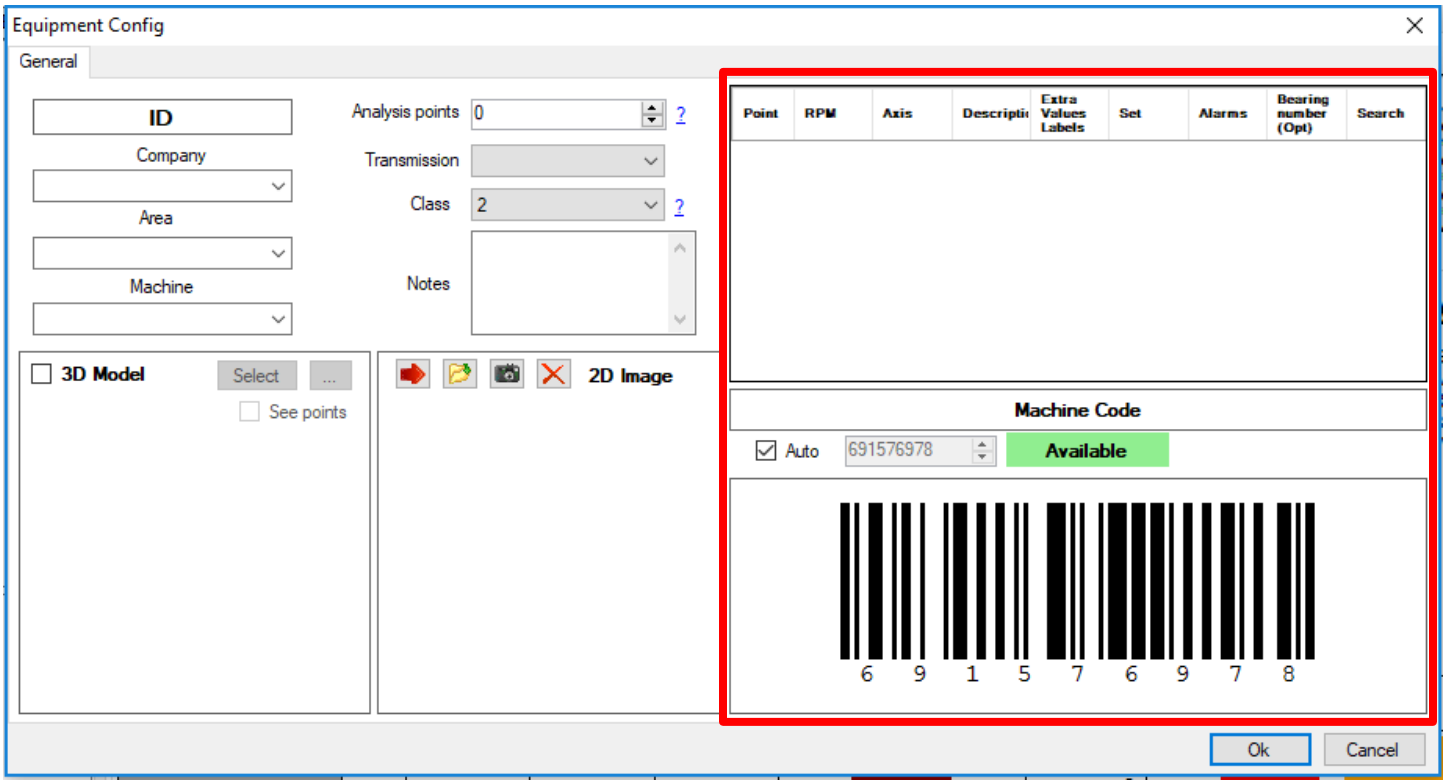
The first panel is for creating the New Machine identity and location (company name and area), as well as analysis points, type of transmission, class (according to ISO 10816) and additional notes (optional).

The second panel is for assigning a 3D ODS model or 2D image for the New Machine. 3D ODS models can be selected from the DigivibeMX® database, or imported from an external source in .3ds, .xaml, or .obj format. Standard 2D images can also be assigned to provide an on-route reference.

To add a **3D Model**: Check the **3D Model** box, click the "Select" button and choose a model file (as shown below).
To add a **2D Image**: The red arrow icon transfers a 3D model to a 2D image. Any .jpg image on the computer can be assigned by clicking on the file icon in the **2D Image** panel. There is also the option to take a photograph (provided DigivibeMX® is installed on a mobile computer or device with camera) by clicking on the Camera icon.



The third panel is used to assign data collection points, component speeds, collection axes and other specific machine characteristics. Detailed parameters enable faster identification of machine faults in Statistics Manager, which can help guide a more detailed analysis of machine data collections.



Point - Measurement Point identifier – MOB/MIB for Motor Outboard/Inboard or 1 of 4, 2 of 4, etc.
RPM - Expected RPM at each point. The program uses machine speed information to calculate acceleration envelopes.
Axis – Measurement axis that will be collected at a Point – Horizontal, Vertical, Axial.
Description – Machine notes may be added at each Point. They are useful for providing additional information or reminding technicians to collect and document other machine health data such as temperatures, oil levels, ect.
Extra Values Labels- In addition to vibration and temperature values, DigivibeMX® can graph up to 3 additional values for each point. These values may be identified with Extra Values Labels.

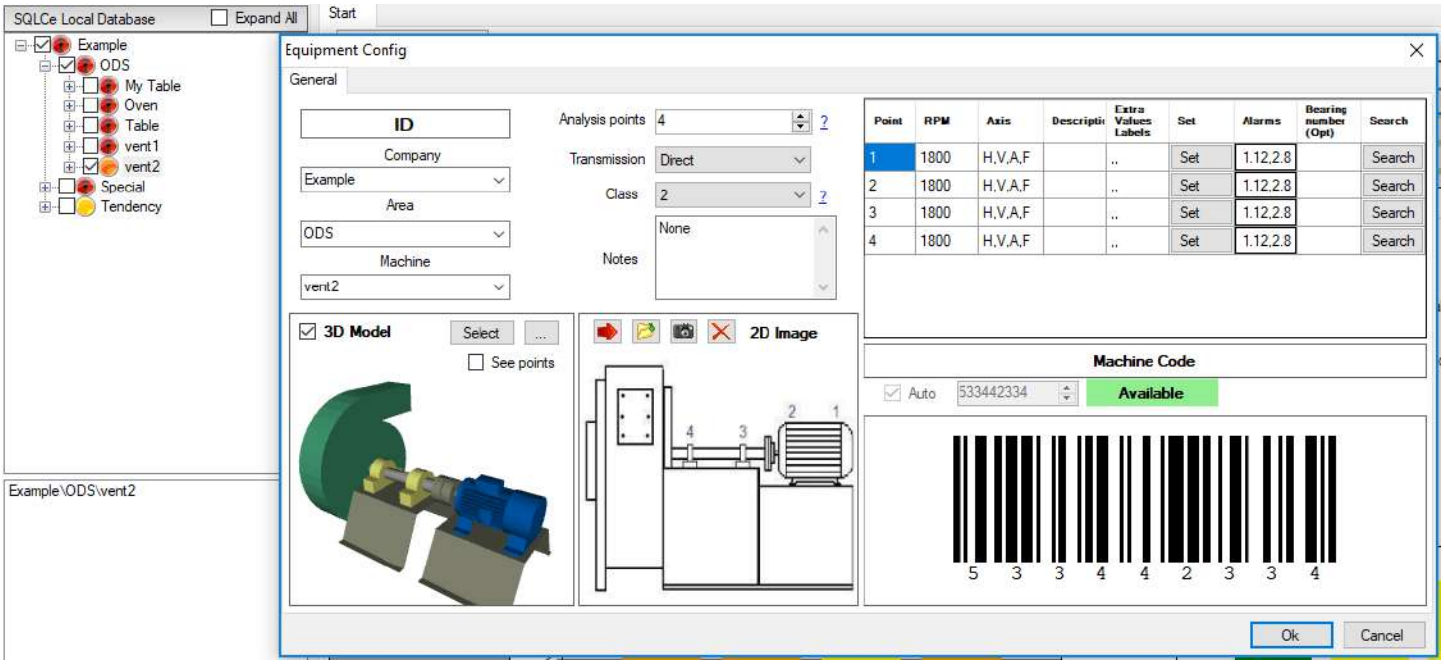
NOTE: The Set button opens a window for editing Description and Extra Values Labels

Bearing Number - This is an optional value. To register a bearing, enter the full or partial bearing number and click Search. The installed bearing may be selected from the Bearing Database.

DigvibeMX® automatically assigns each New Machine bar code. Bar codes can be assigned manually by unchecking the Auto box and using up/down buttons in the number box. Bar codes may be printed (right-click the desired machine in the Database tree and select "Print barcode') and affixed to machines. Machines barcodes can then be scanned during route data collection, to ensure that new data is assigned to the correct machine.

Edit Machine

Selecting any machine in the Data tree, then selecting Edit Machine will open the Equipment Config window for editing.

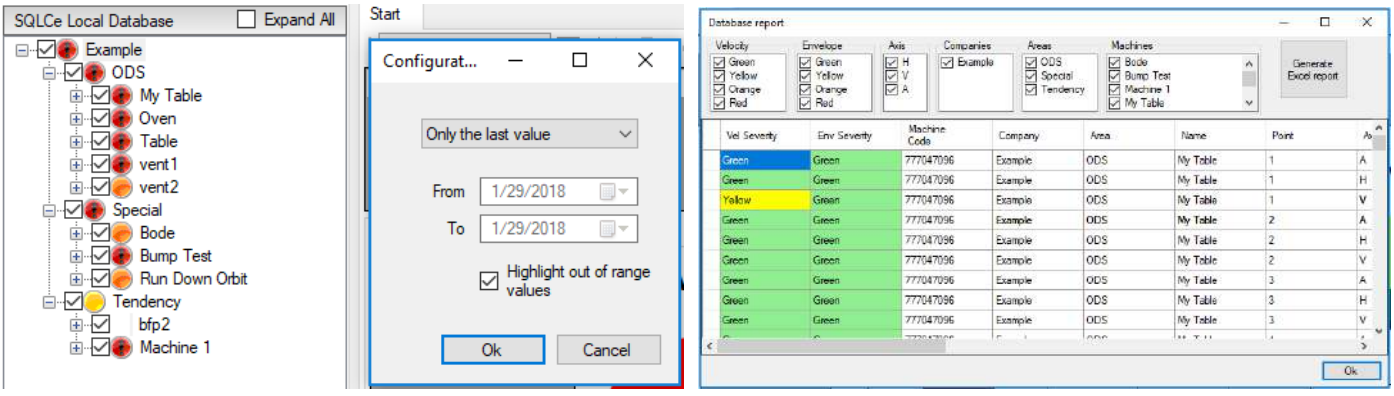


Delete Machine:

Selecting any machine in the Data tree, then selecting Delete Machine will remove the machine from the Database.

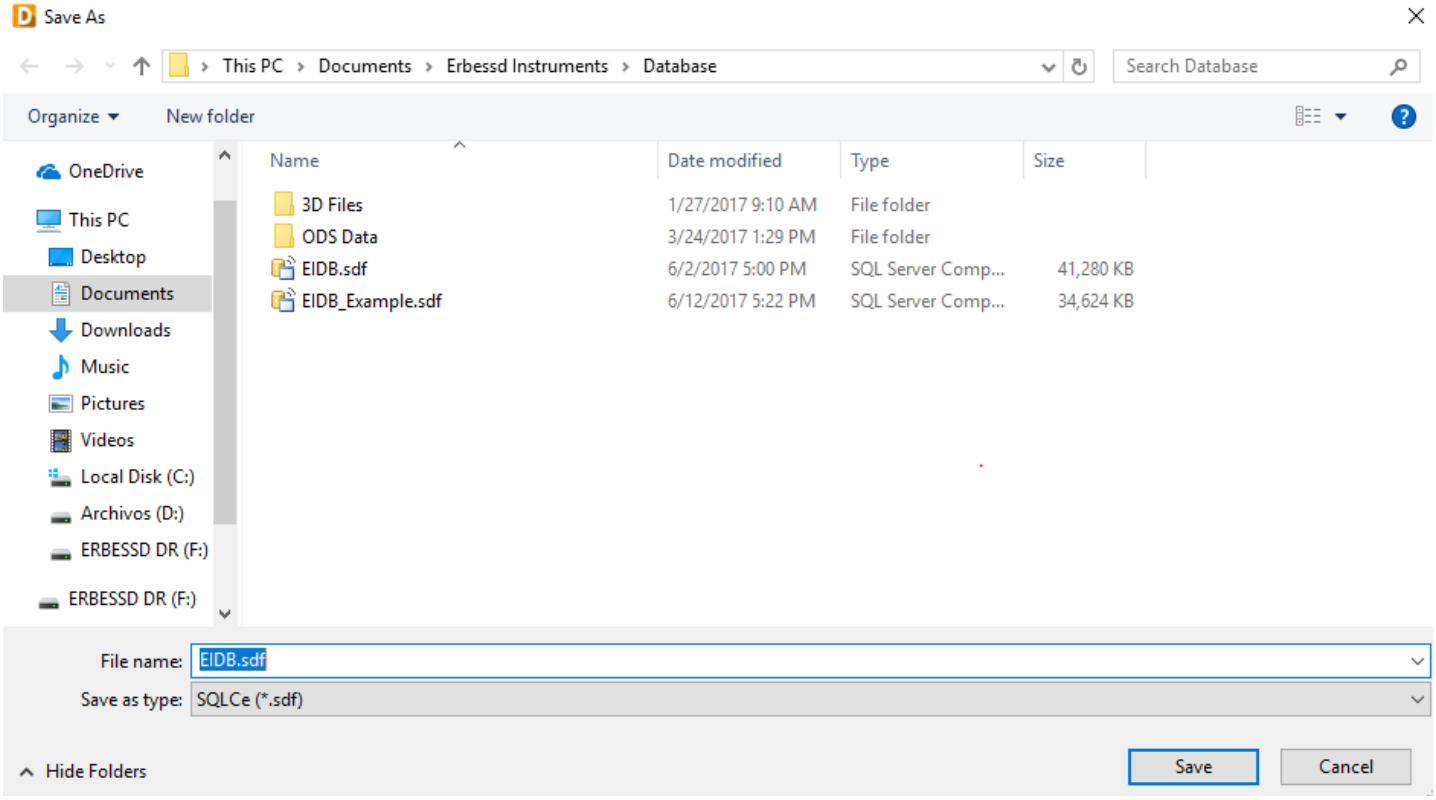
Database Report

Selecting any level of the Data tree, then selecting Database Report will generate a database report, which can be exported to Excel.



New Database

Selecting New Database allows a new separate database to be created. Database files can be created and saved in any location. It is recommended to keep all database files together in an easily-located common folder.



Connect

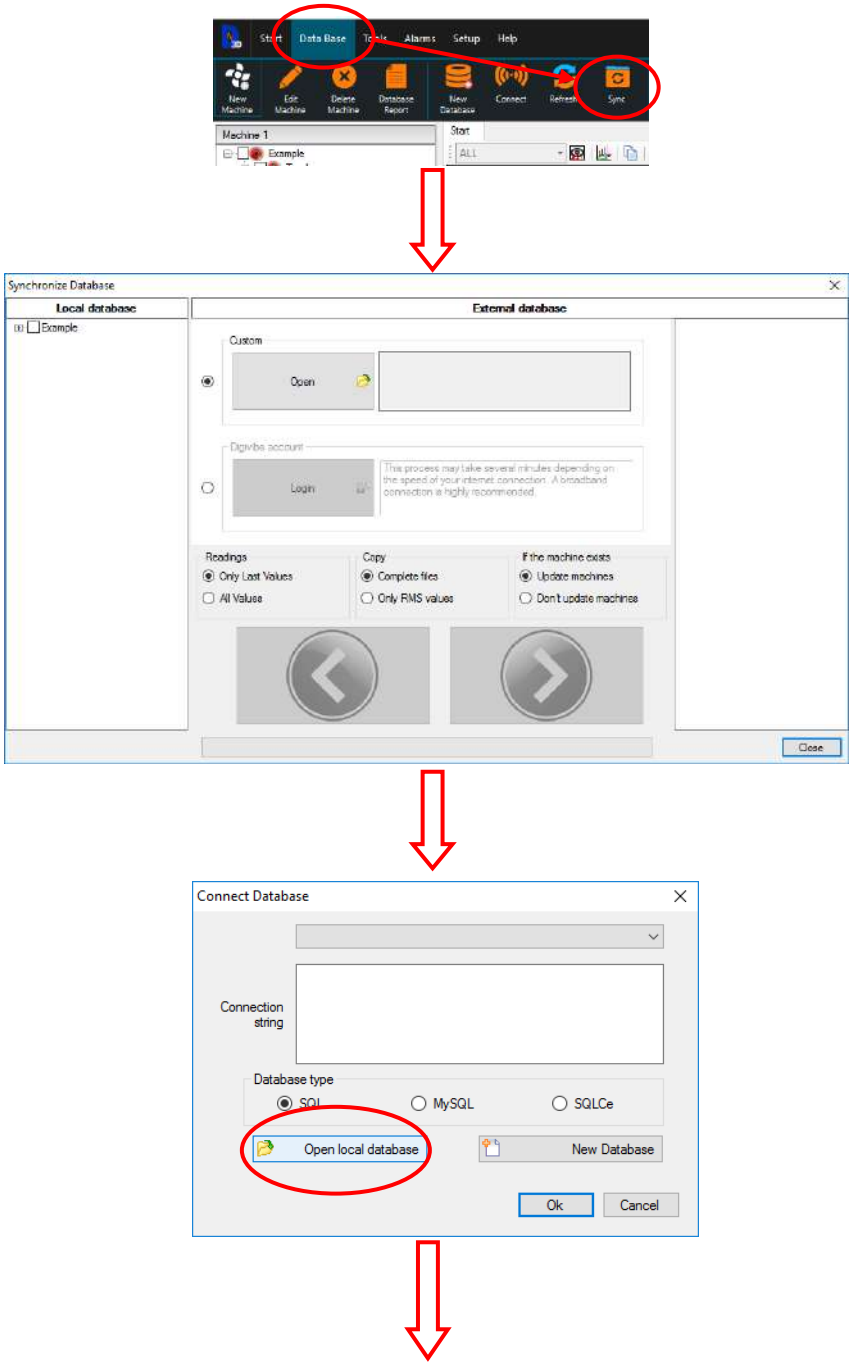
If database files are moved between devices or stored remotely, Connect to Database allows mapping their new location. .

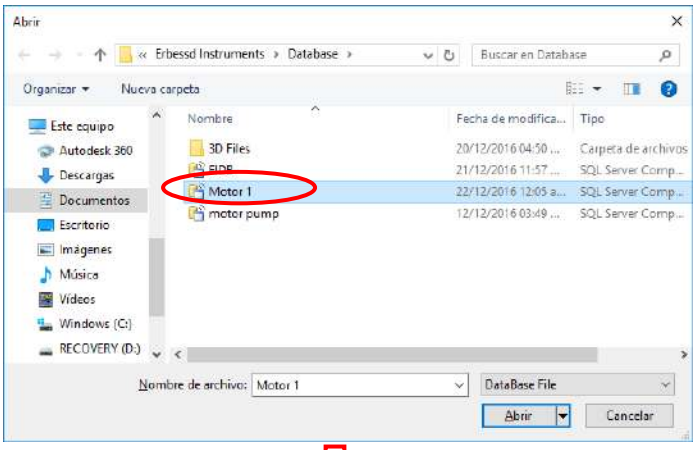
Refresh

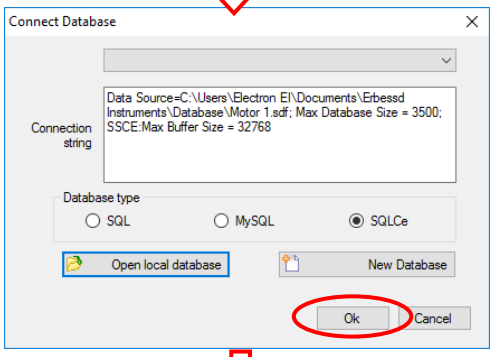
Updates database with any newly-collected data or equipment modifications.

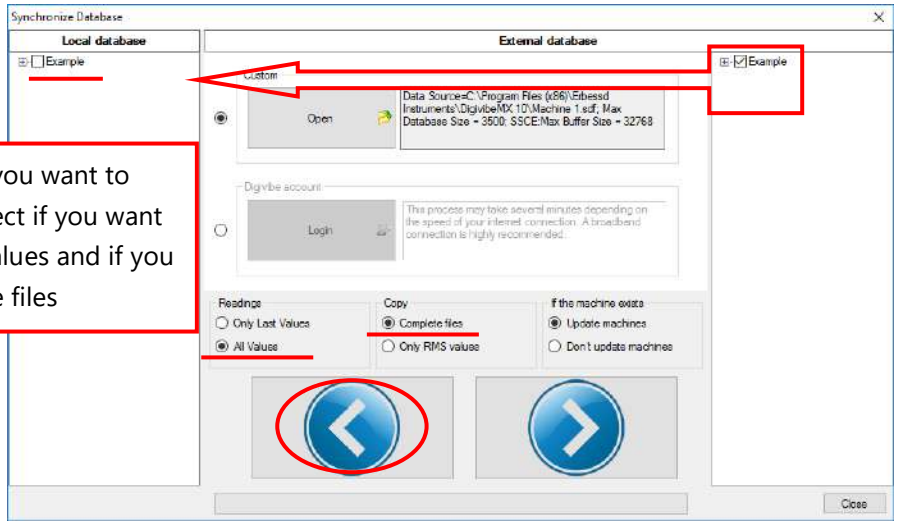
Sync

Synchronizes a secondary database with the main Database.



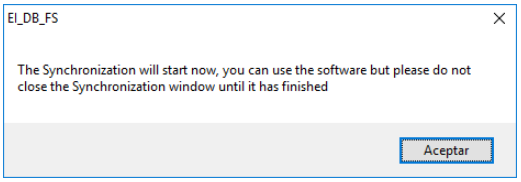




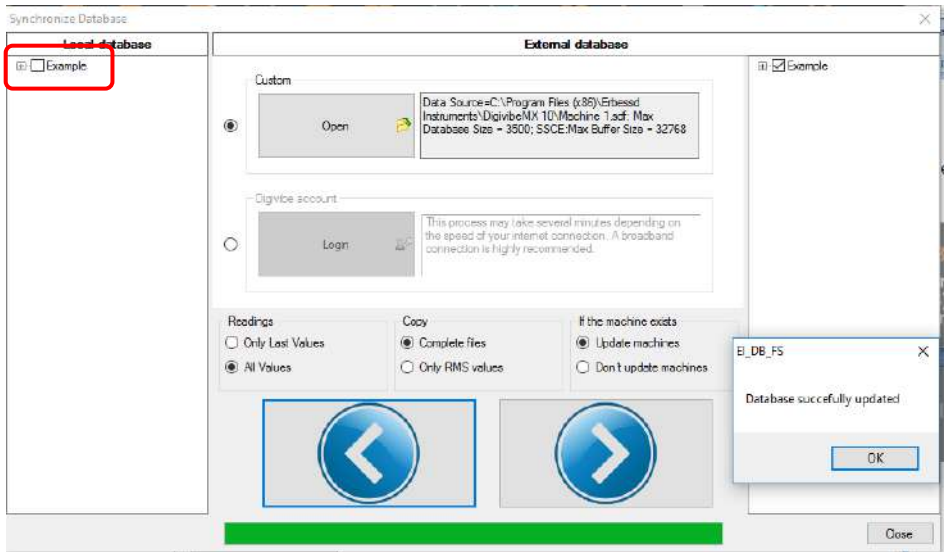


Select the base you want to synchronize, select if you want to pass all the values and if you want to copy the files

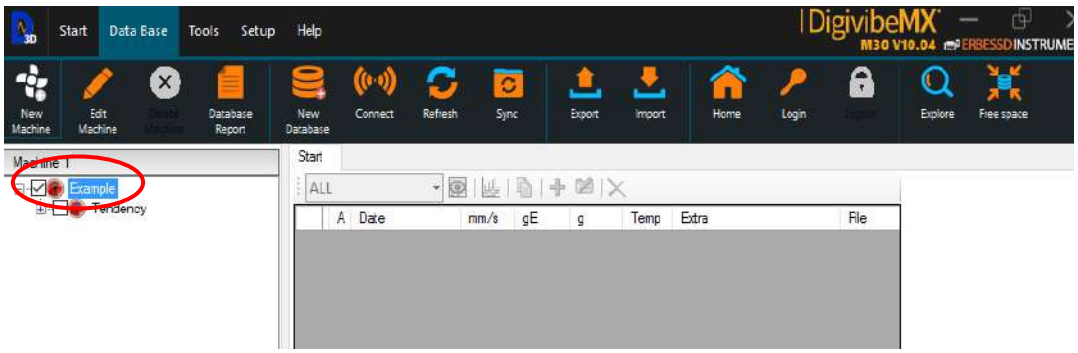
Synchronization will start, do not interrupt the process:



The synchronization ended successfully and the base is already integrated into the main:

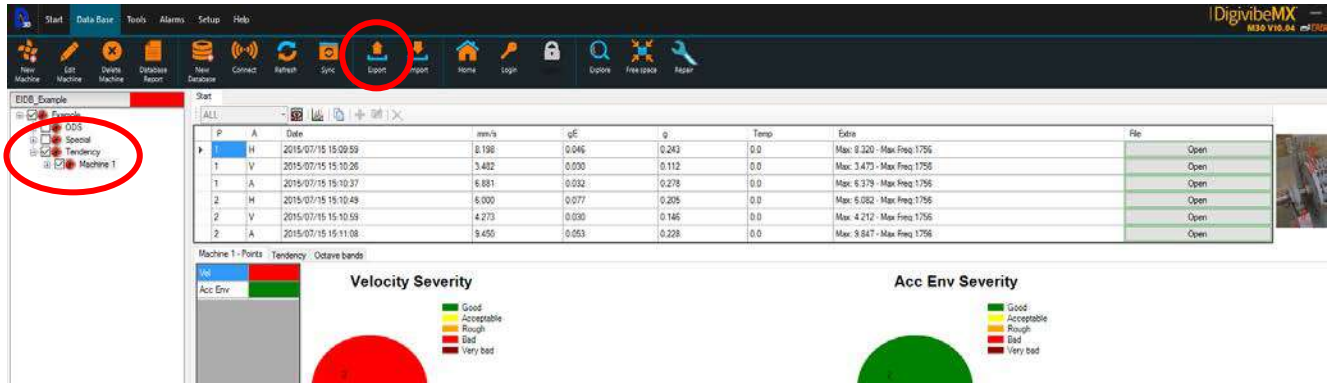


The main database has been updated and can now be used.

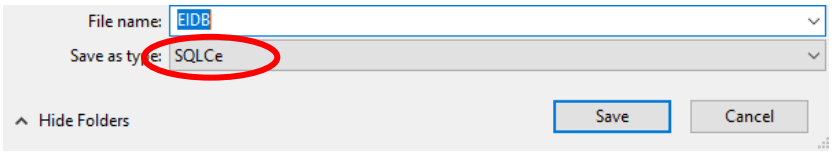


Export Database

Exports data from the current database to another computer. Select the desired levels of data to be Exported in the Data tree then select Export.



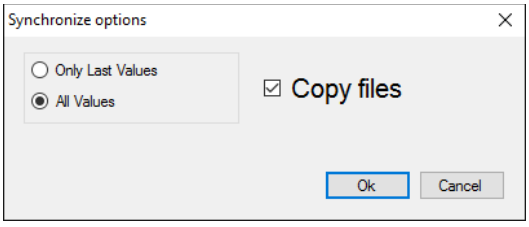
Save the exported database as an SQLCe file.



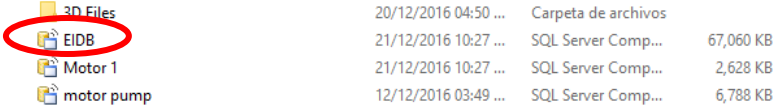
Select **All Values** and **Copy files** to include all collected data.

Select **Only Last Values** to transfer only the most recent collected data.

NOTE: Copying **All Values** can result in a very large database, which would be difficult to send via email.



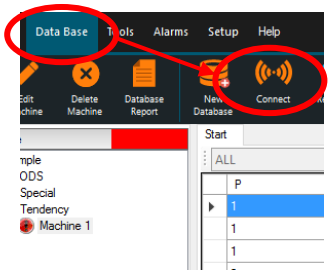
The exported database can now be shared via e-mail, placed in cloud storage, network drive, transferred via USB or imported to any other SQL-compatible software.



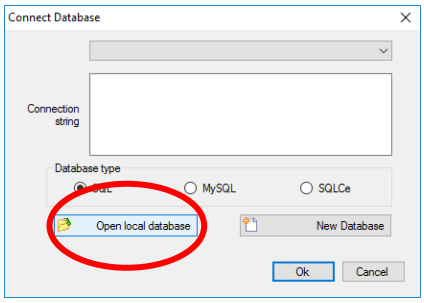
Import Database Whether you've exported a database for others to analyze or for backup, there are 2 ways to import it:

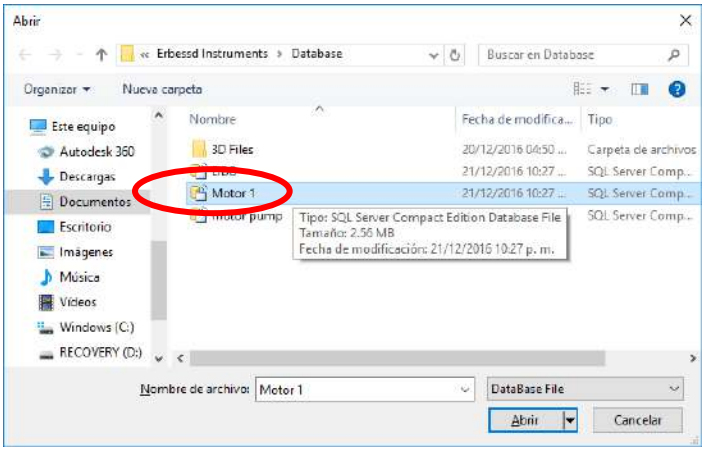
- Open only the exported base.
- Synchronize the exported database to a database that centralizes all the machines.

To open only one database, go to "Data Base", then "Connect" and click "Open local database" to select the exported database:

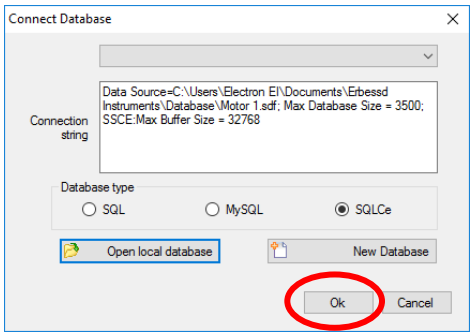


then

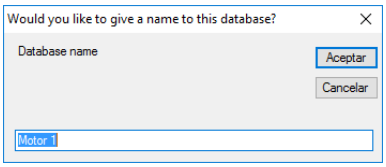




The command line with which that database can be accessed is displayed:



Select a name to identify it



You can now work with the newly imported database:

Home 

Immediately collapses the Data tree and returns navigation to the highest (Company) level.

Login  and 

Launches the EI-Analytic service, if activated. For more details about EI-Analytic, please contact sales or technical support.

Explore 

Allows manual exploration of the database.

Free space 

Utility for cleaning and compiling the database.

Repair 

Utility for repairing damaged or corrupted database files.

Using the Analysis and Functions Menus (M20, M30)

The Analysis and Functions Menus feature tools for collecting and analyzing machine vibration data.

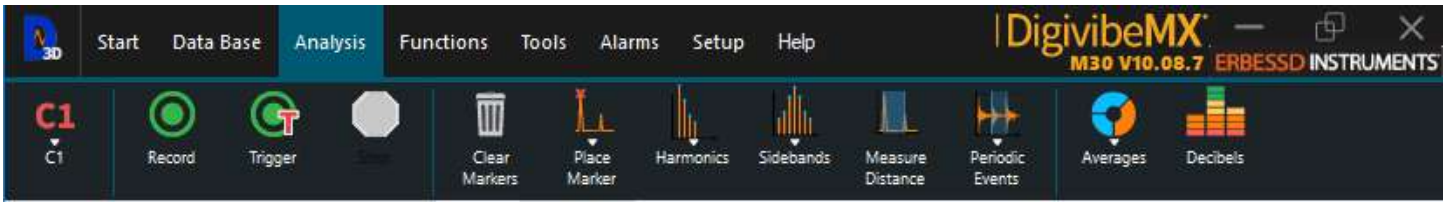
New analysis

There are two different methods for opening a new data collection and analysis session:

Method 1 – New General Analysis: This type of analysis does not associate to any machine in the database and will not be auto-saved to the Database. General analysis is recommended for spot-checking, troubleshooting or other situations when machine vibration data must be displayed, but not saved to the database.

Begin a general analysis using New Analysis on the Start Menu toolbar**.** This will open the Analysis Menu.

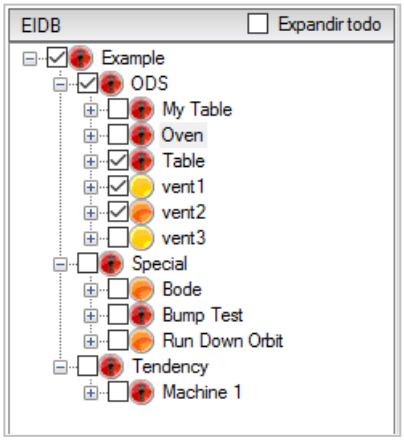
On the Analysis Menu, select the channels to be recorded (**C1**). Select **Record** to begin data collection and **Stop** to end.

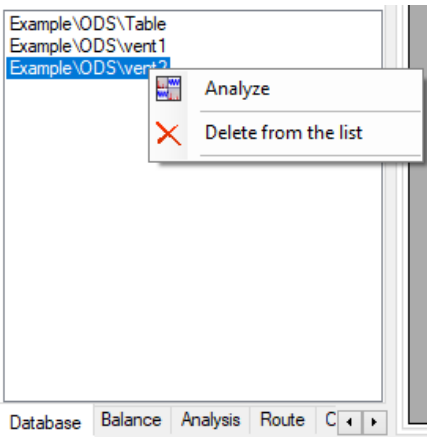


Method 2- New Route Analysis: This type of analysis is associated with machines in the Database. Data collections will be auto-saved. From the Start Menu/Database tab: select the machines to be collected from the Data tree.

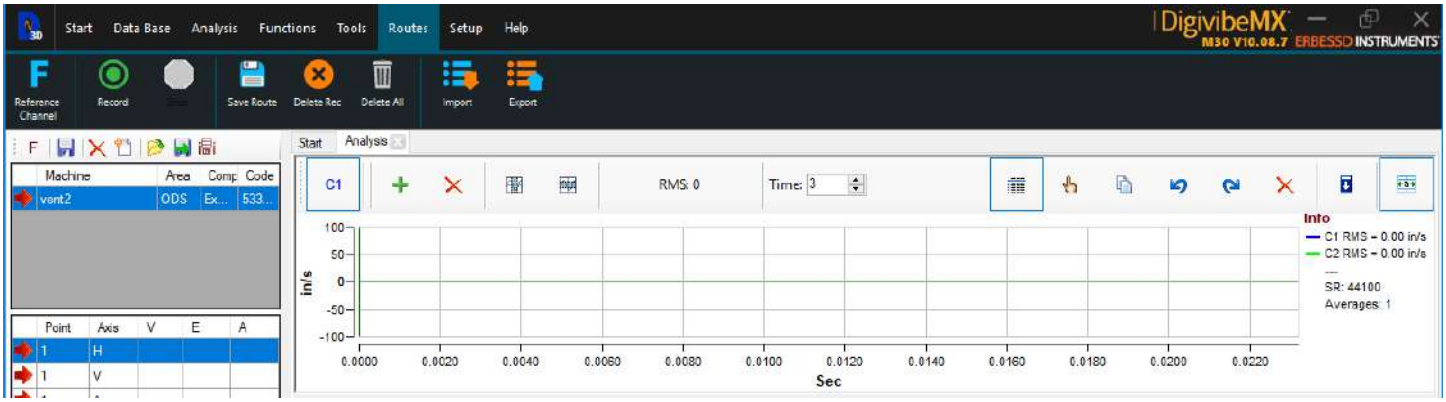
Select New Route to collect all selected machines.

-or-
Right-click the first machine to be collected in the lower left-hand panel, then select Analyze on the context menu.





The selected machine and collection points will open for data collection in the Routes Menu.



Select the Point(s) to be collected from the left-hand panel and Record.

Note: The option to analyze a route will automatically set the number of collection points, based on the configuration of each machine. To change the data points, press the "Configure" option of the contextual menu of the list.

Start/Stop Data Collection

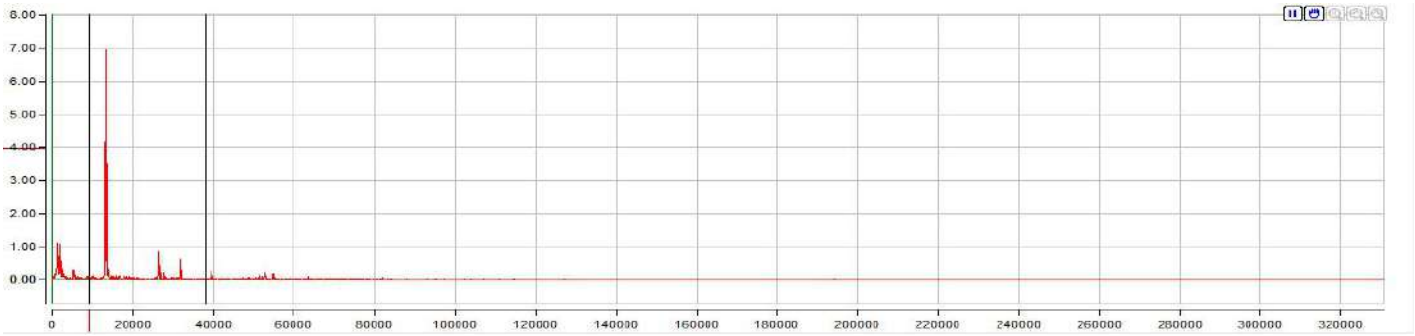
Data collection is started with  and stopped manually with  .

NOTE: Depending on the settings, data collection may stop automatically based on the specified collection time, or it may be stopped manually as desired. To change the automatic recording time configuration: select the Setup Menu, then open Config. Recording time is located the Signal tab.

NOTE: The  button is used to define start trigger settings for EIMU and other remote data collection methods.

Analysis of Vibration Data

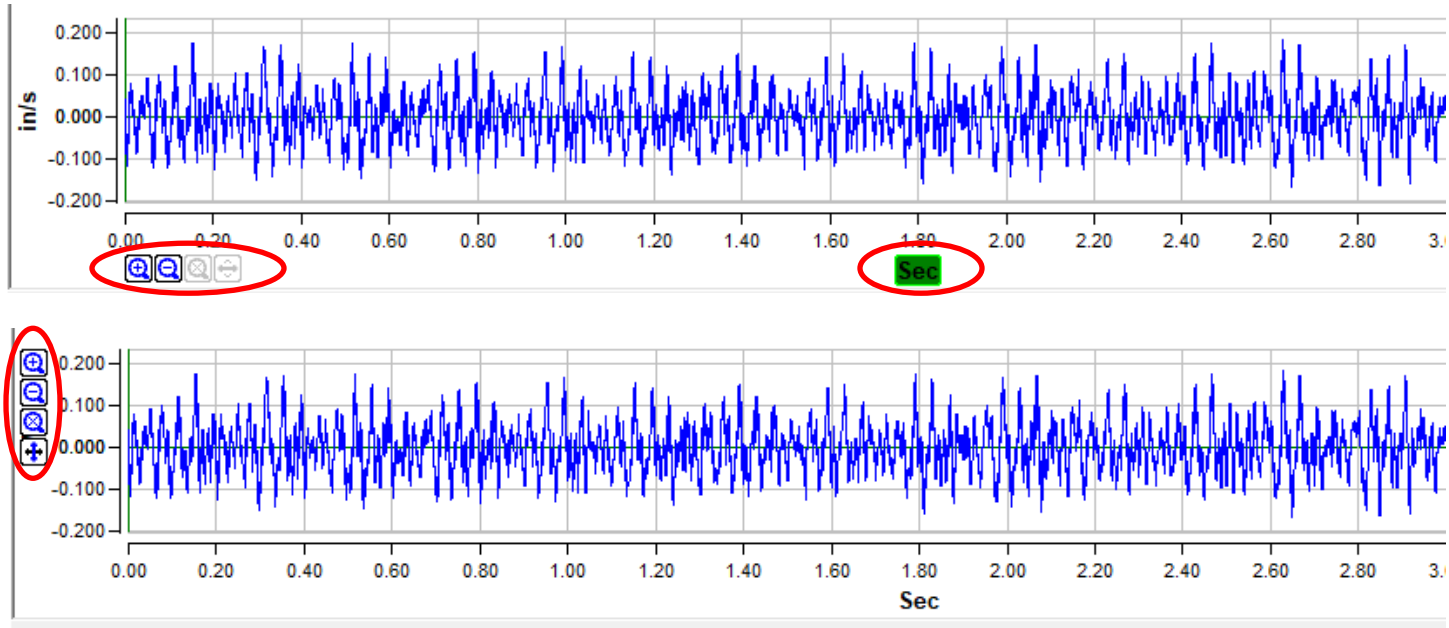
Selecting and Zooming: Magnifying a desired section of waveform or spectrum can be accomplished in a variety of ways. To select a section of the waveform or FFT for closer inspection, press the left mouse button and slide it along the graph. When the left mouse button is released, the selected section will be magnified.



-or-

Place the mouse pointer over the desired area and:
- **Scroll the mouse wheel**
- **Use the "Up" and "Down" arrows on the keyboard**

Floating zoom control buttons also appear automatically at each axis, when the mouse pointer is positioned over the units.

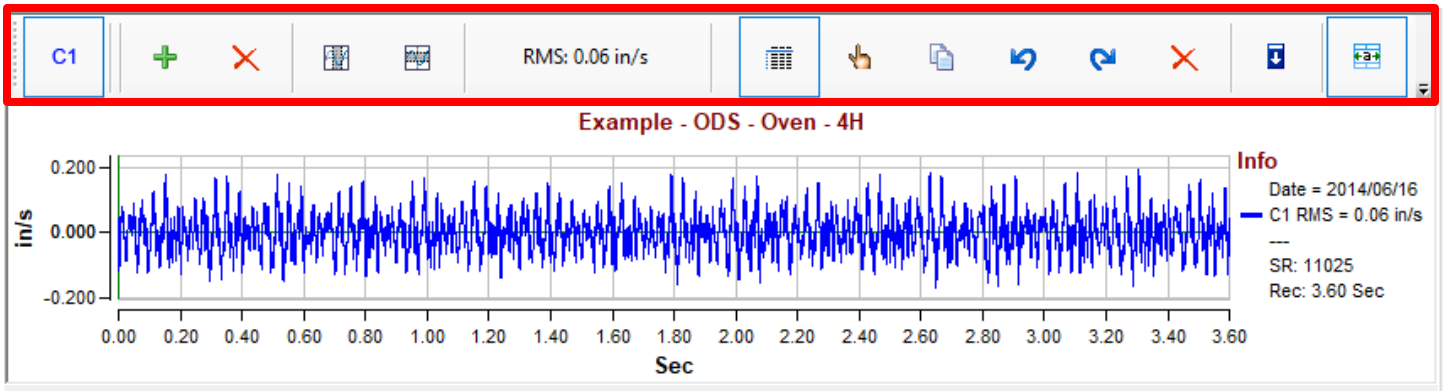


Floating button controls are as follows:

 **Zoom +:** Magnify the graph.
 **Zoom -:** De-magnify the graph.
 **Zoom off:** Resets to standard view.
 **Horizontal selection:** The selection + Zoom of the pointer will be horizontal.
 **Vertical selection:** The selection + Zoom of the pointer will be vertical.

Graph tools

A number of panel control buttons are located above each waveform/spectrum graph.



C1 View or hide channel 1

C2 View or hide channel 2

Add a channel to the view

Remove a channel from the view

Vertical Measuring Cursors

Horizontal measurement cursors

Show/Hide Labels

Hand tool to select between zoom and scroll with the mouse pointer

Copy Tool

Undo Zoom Tool

Zoom Reset Tool

Remove Zoom Tool

Collapse Panel 2, expand Panel 1

Collapse Panel 1, expand Panel 2

Enlarge icons for touch screen computers

Hanning Window selection

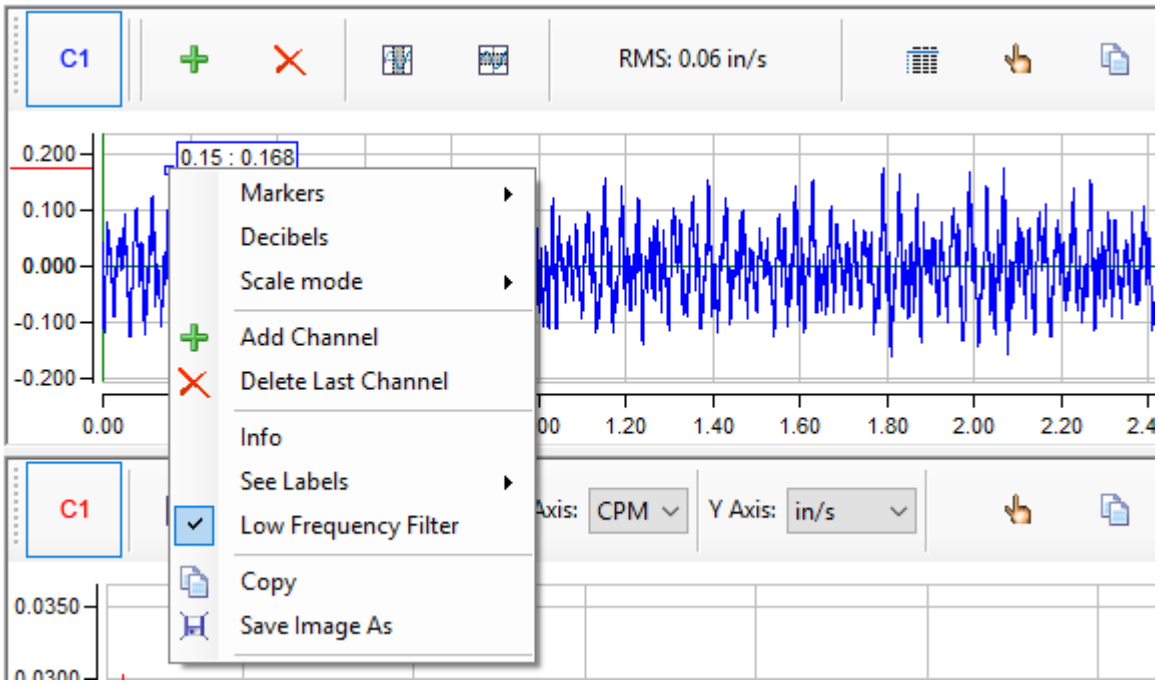
Eje X: CPM Parameter selection in X axis options: CPM, Hz Orders

Eje Y: mm/s Parameter selection in Y axis options:

- g – mm/s2
- mm/s – inch/s
- um – mils
- gE

Context Menu

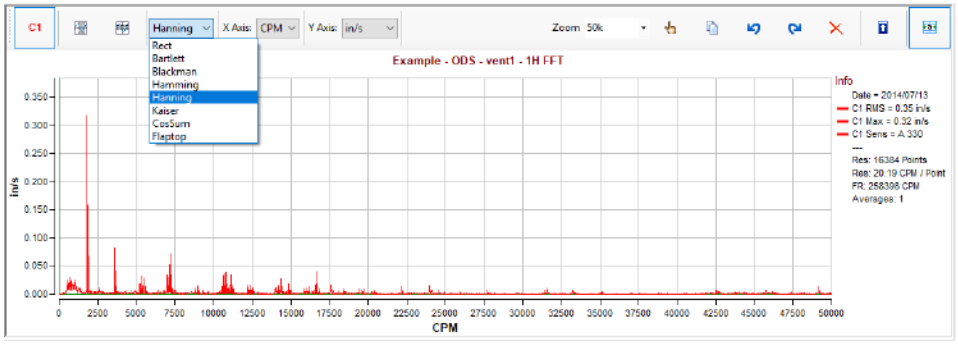
Right-clicking anywhere in the waveform or FFT spectrum opens a context menu with the following options:



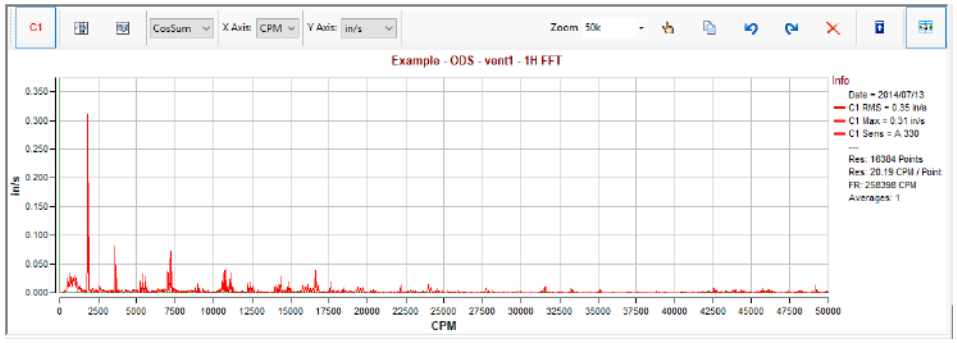
Markers: Select from several Marker options on a context submenu.
Decibels: Toggles the Decibels view of a selected point Off/On.
Scale Mode: Select between Linear or Logarithmic on a context submenu.
Add Channel: Adds a channel view.
Delete Last Channel: Deletes last added channel view.
Info: Opens a window with configuration information about the waveform/FFT data.
See Labels: Opens a submenu of label options.
Low Frequency Filter: Toggles Low Frequency Filter Off/On.
Copy: Copies a selected portion of the waveform/FFT to Clipboard.
Save Image As: Saves a selected waveform/FFT spectrum as a .jpg image file.

FFT Spectrum

The following FFT window options are available in DigivibeMX®: Rect, Bartlett, Blackman, Hamming, Hanning, Kaiser, CosSum, Flaptop.



When a different window is selected the spectrum will be automatically recalculated based on the saved waveform data.



Select from the following units on the Axis dropdown menus:
- **X Axis:** CPM, Hz, Orders
- **Y Axis:** G, mm/s2, mm/s, in/s, µm, mils, GE

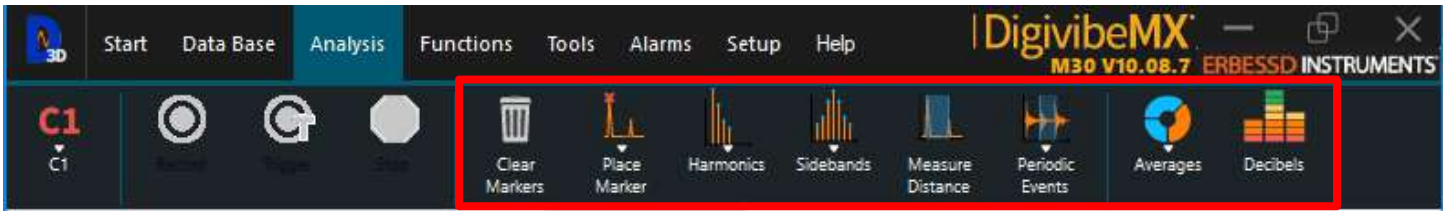
Other user-defined preferences for data collection are available from the Start Menu/Config, including:

Signal Tab
- **Sample Rate**: The number of samples DigivibeMX® will take per second.
- **Recording time**: The duration of each sample collection. At the end of this time, the FFT graph will be displayed.
- **Interval**: The rate at which the screen will be refreshed. In other words, the duration of each sample that appears on the screen during real-time analysis.

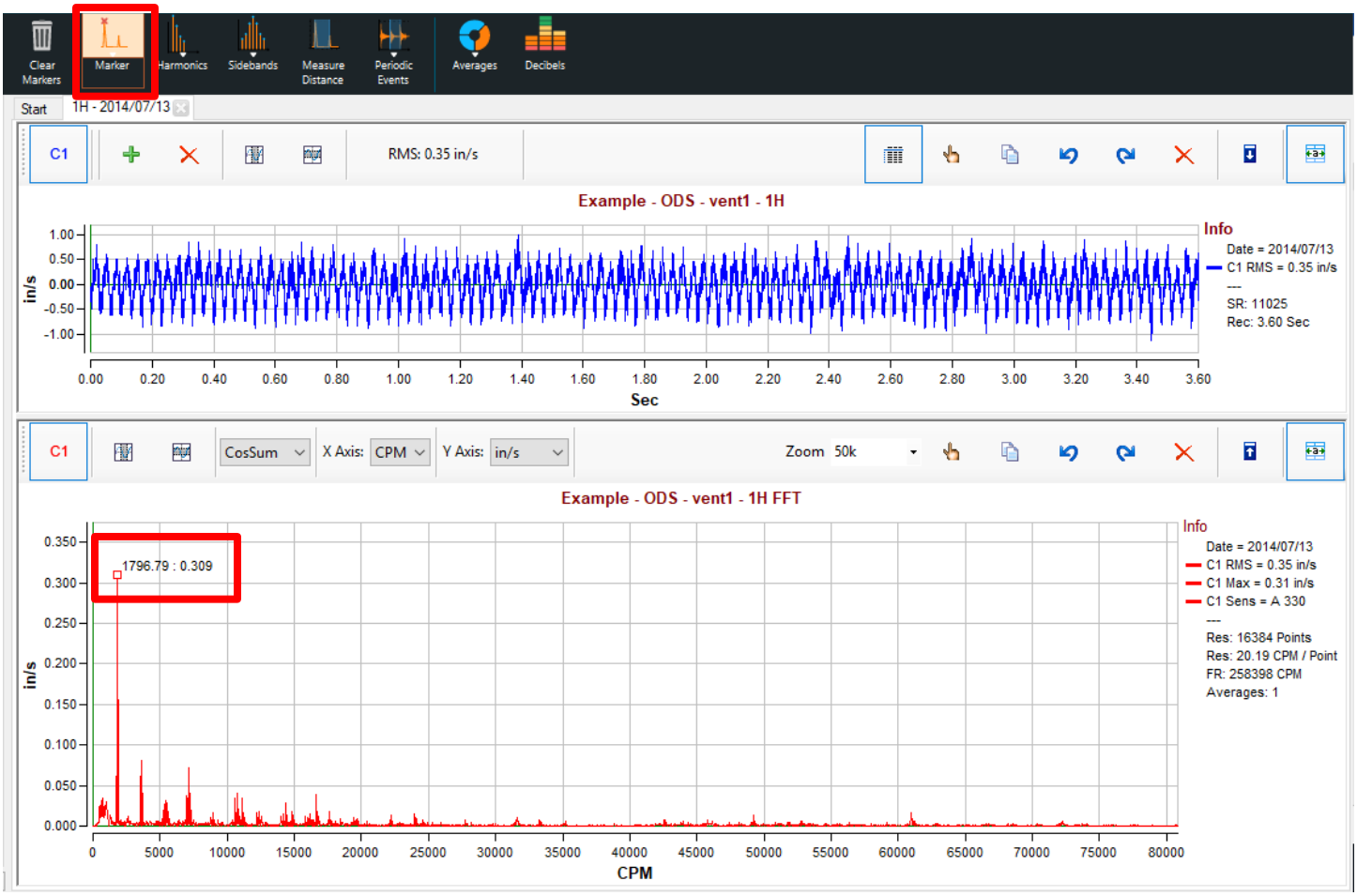
Channels Tab
- **Channels**: The number of channels that will be collected and processed simultaneously.

Analysis Menu Tools (M20, M30)

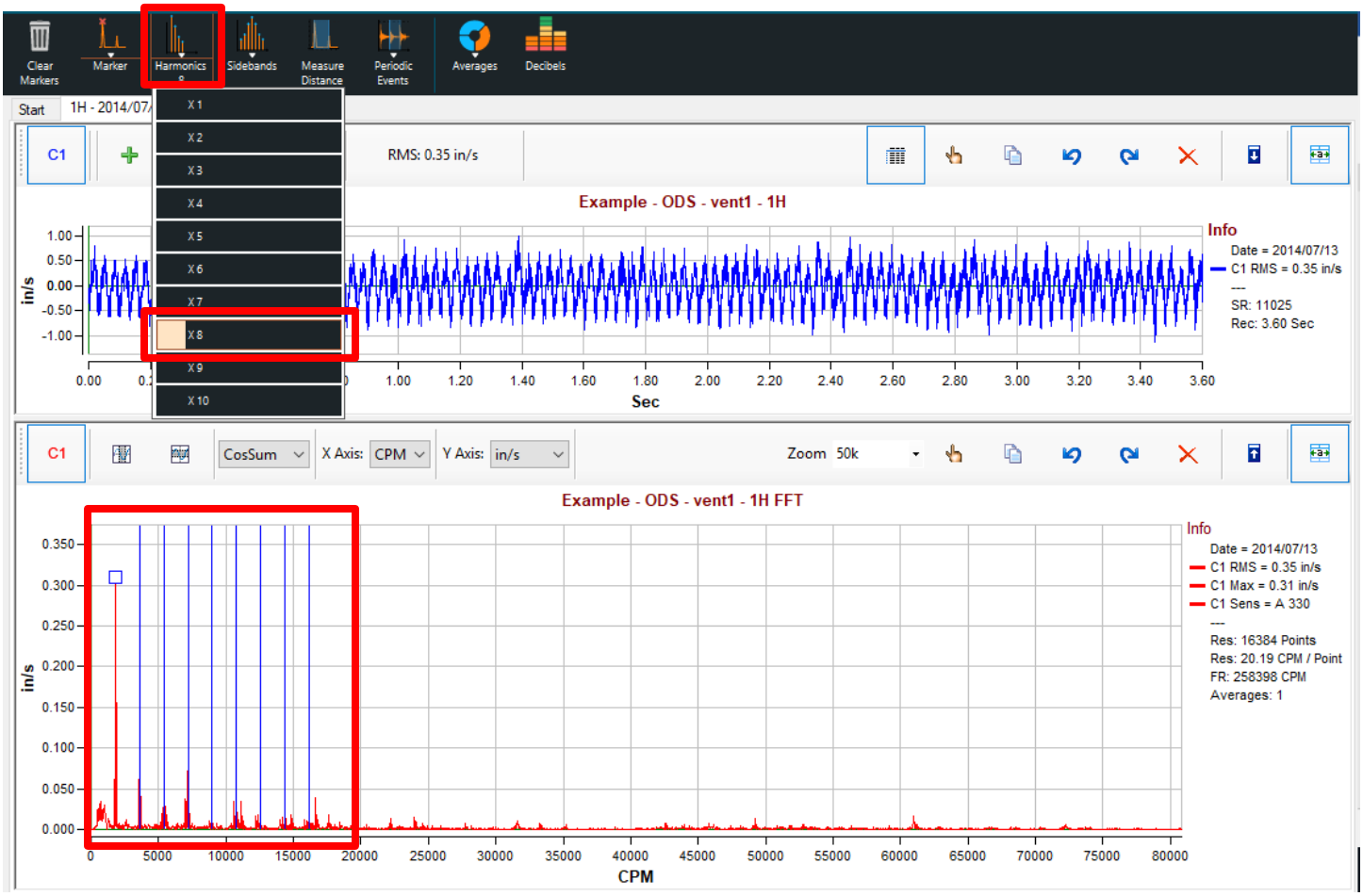
In addition to controls for Channel selection, Starting and Stopping a data recording, the Analysis Menu toolbar features a number of essential tools for analyzing collected vibration data:



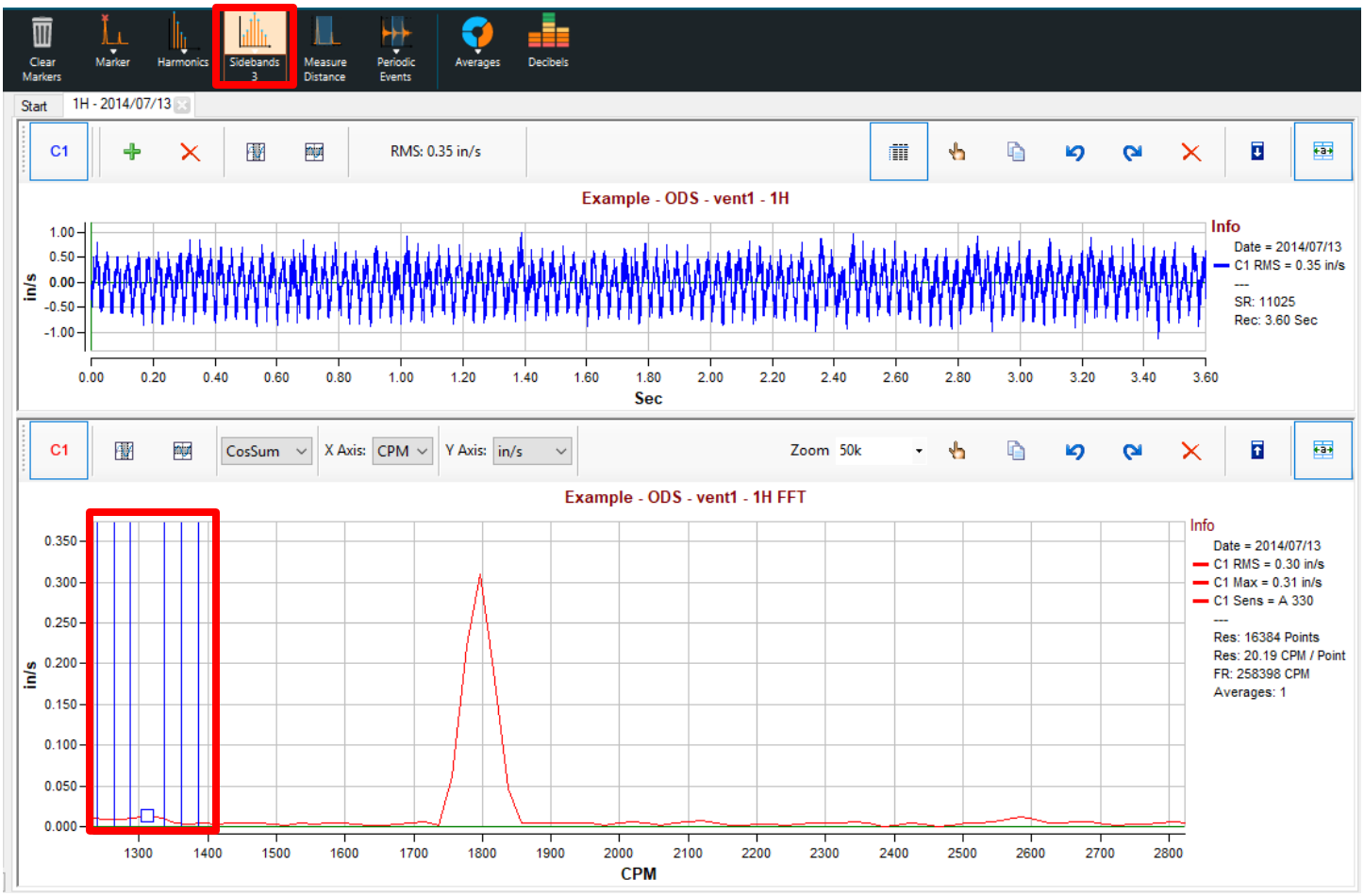
Place Marker: Select Place Marker and click on any desired point in the waveform/FFT to place a marker:



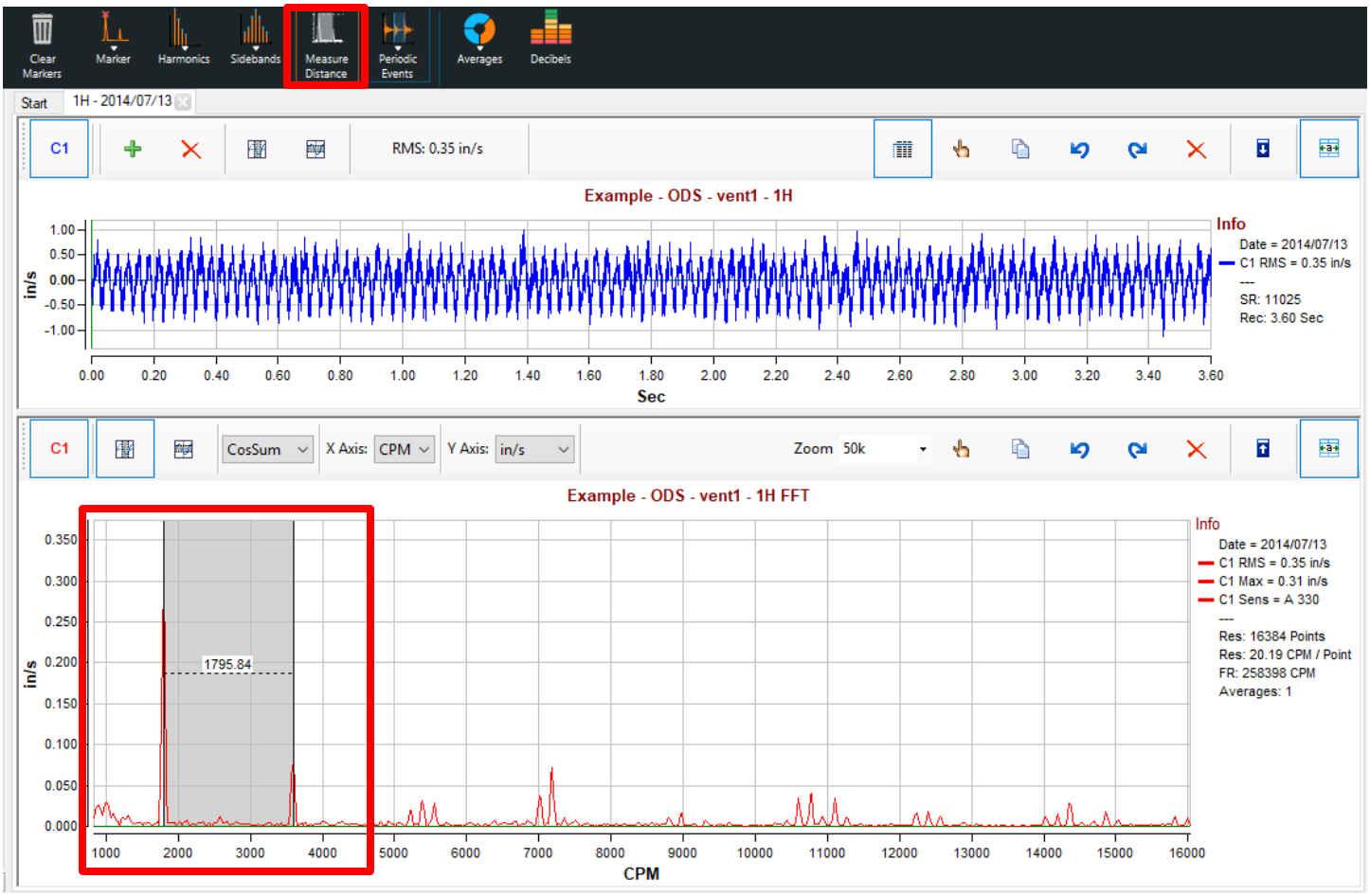
Harmonics: Specify the number of Harmonic marker lines desired (8 in this example), then select the vibration peak to be analyzed. A blue line for each specified harmonic of the selected peak appears on the graph.



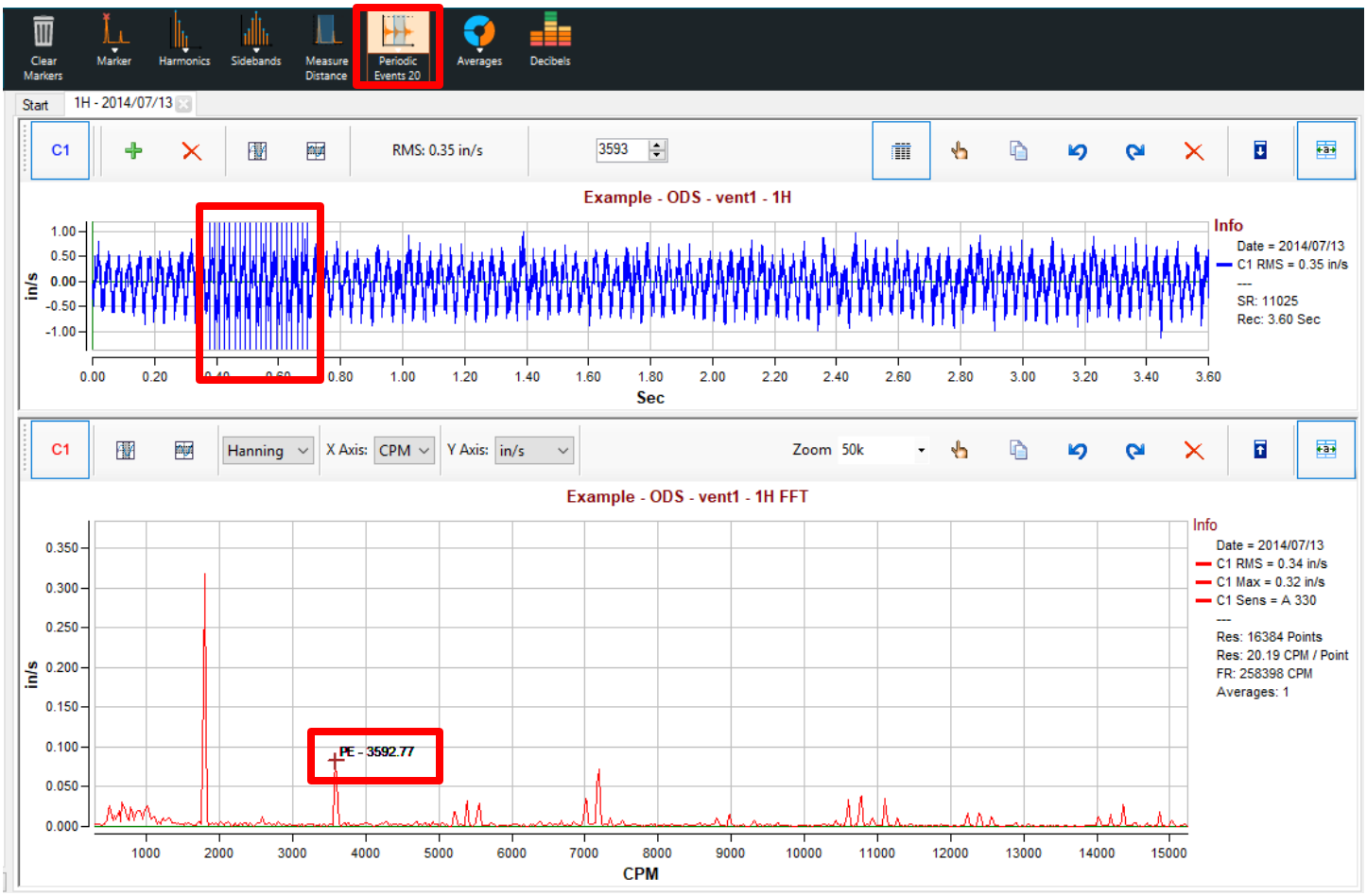
Sidebands: Specify the number of Sideband marker lines desired (3 in this example), then select the vibration peak to be analyzed for Sidebands. A blue line for each specified Sideband of the selected peak appears on the graph.



Measure Distance: Calculates and displays the distance between any two selected points on the graph.

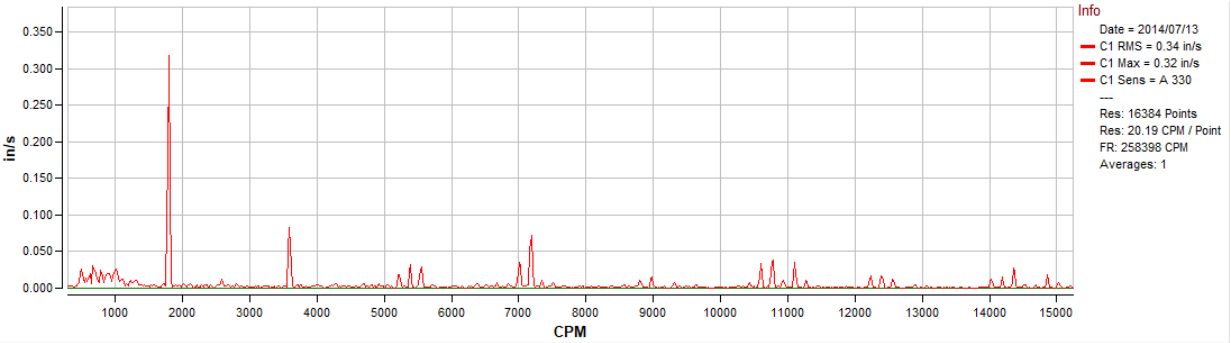


Periodic Events: Specify the number of Periodic Event marker lines desired (20 in this example), then select a vibration peak to be analyzed from the FFT. A blue line for each specified Periodic Event of the selected peak appears on the Waveform graph.

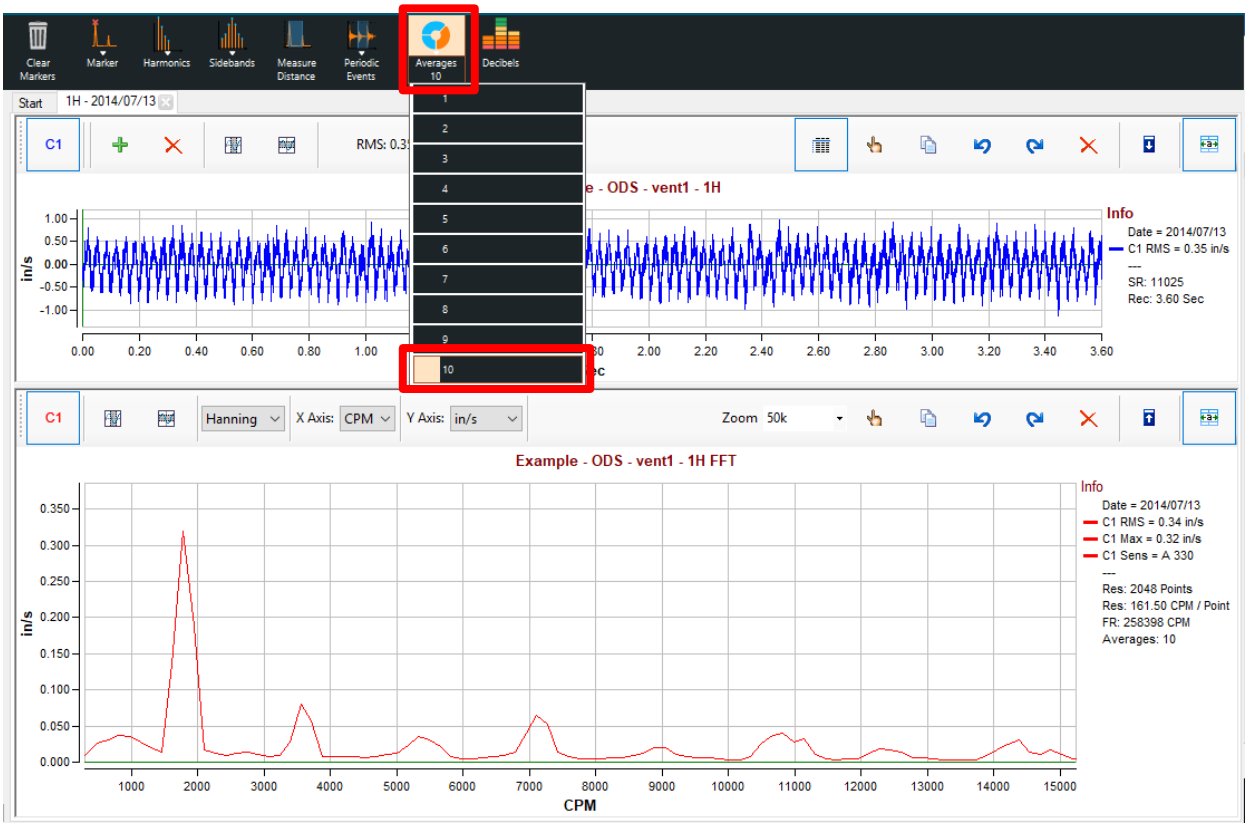


Averages: Specify the number of averages used to produce the FFT. The default FFT view is one average. Increasing the number of averages reduces the appearance of random outlying peaks and periodic occurrences, showing a truer representation of repeating events in the FFT. However, increasing the number of averages lowers FFT resolution.

This is the DigivibeMX® default FFT view, produced using 1 average:



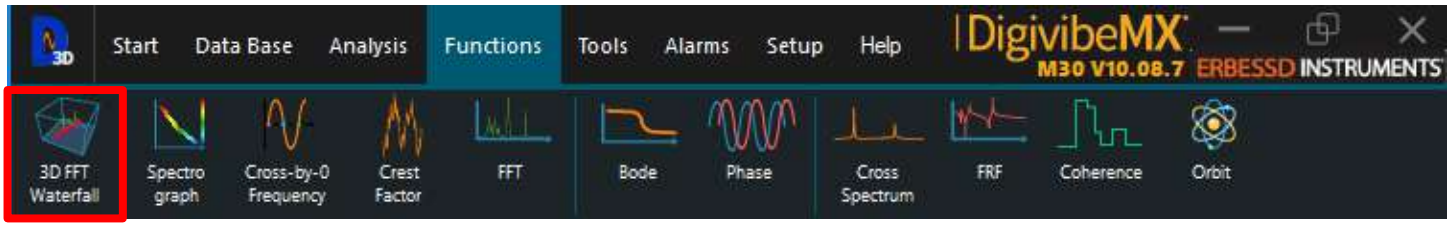
This FFT shows the same frequency range, but was averaged 10 times:



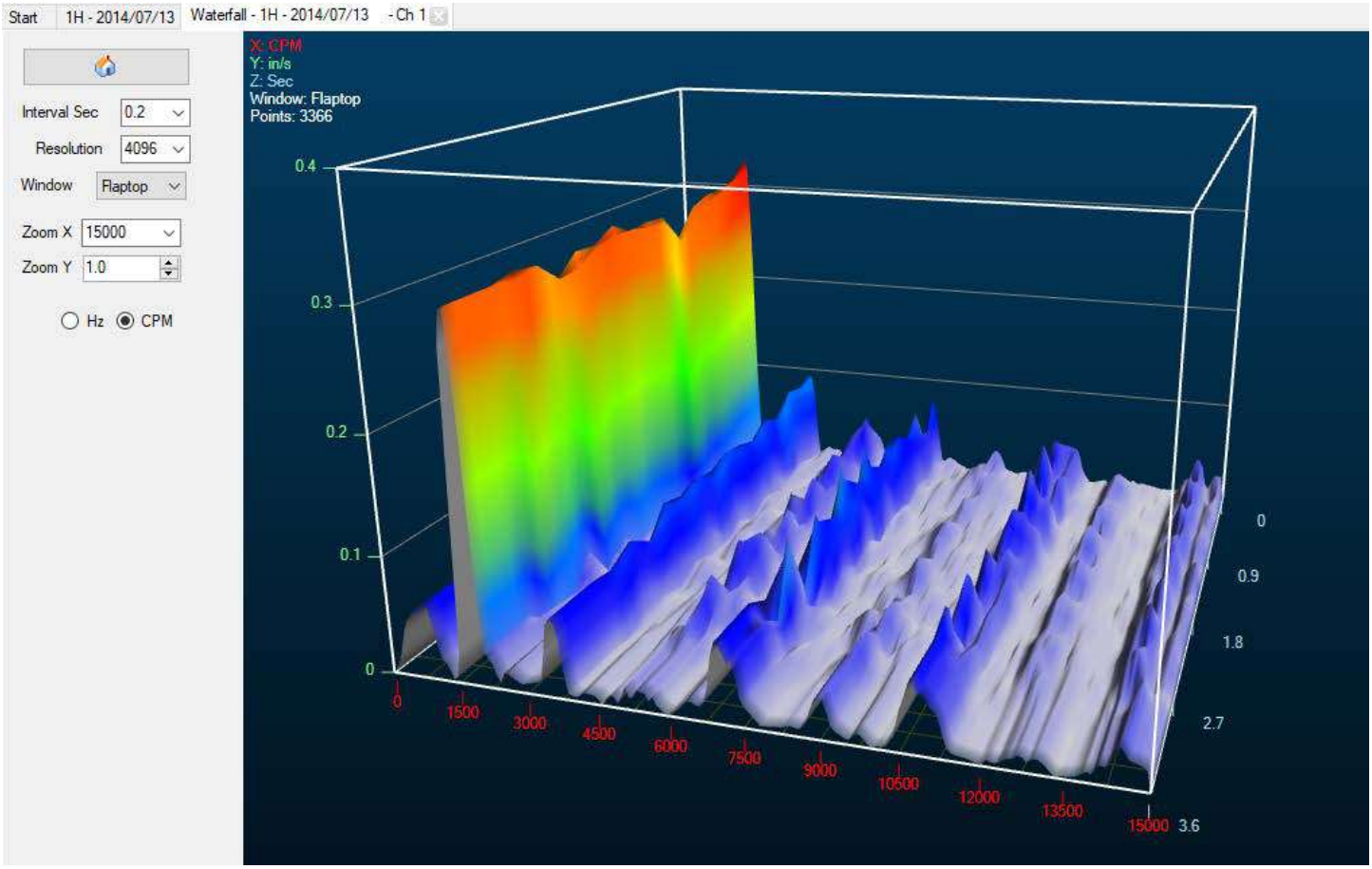
Decibels: Converts and displays the Waveform in Decibels.

Functions Menu Tools (M20, M30)

In addition to the Analysis Menu, the Functions Menu also features a number of essential tools for analyzing collected vibration data:

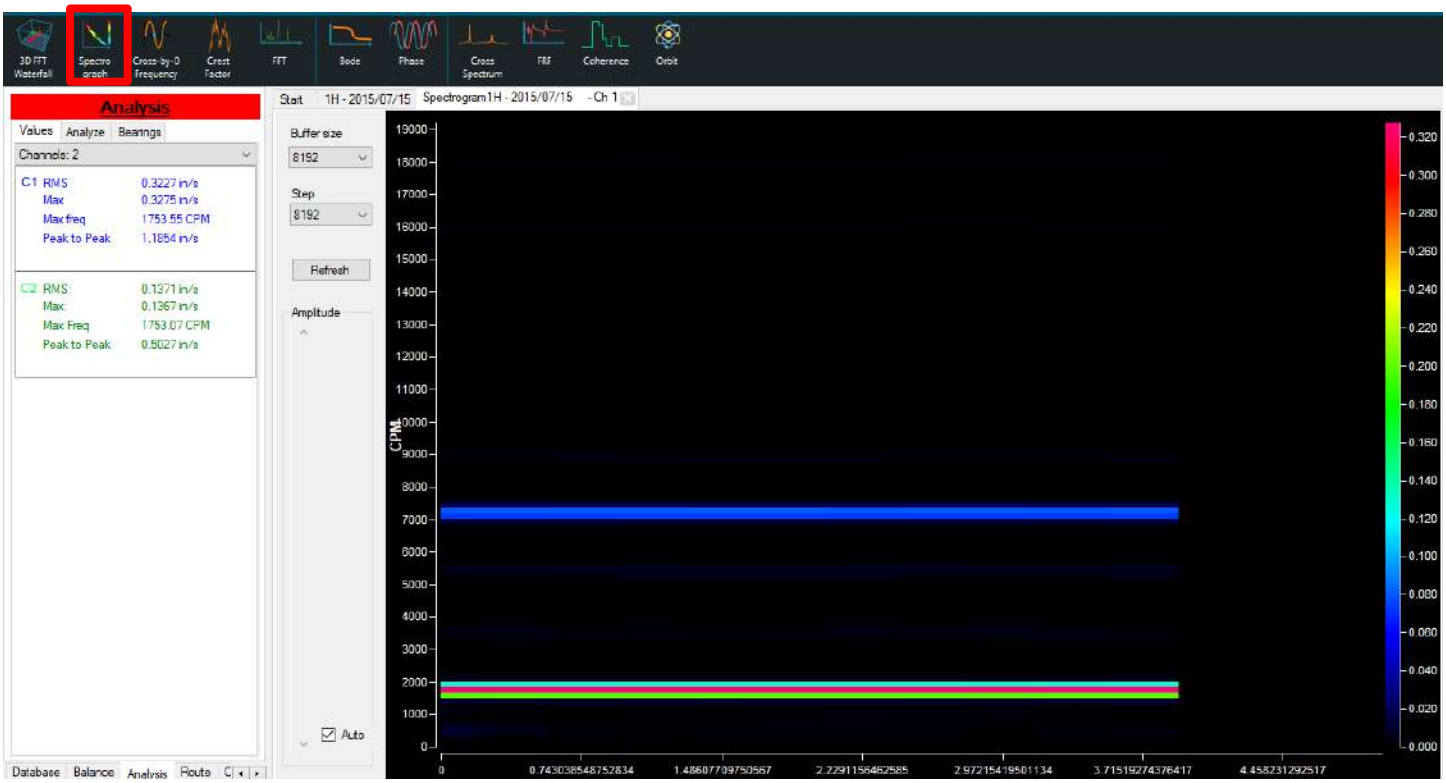


3D FFT Waterfall: Produces a color-coded 3D representation of the FFT spectrum, with time as the third axis. A 2D FFT spectrum displays peak vibration amplitudes by frequency. The 3D FFT Waterfall illustrates how vibration amplitudes at each frequency may fluctuate over time.

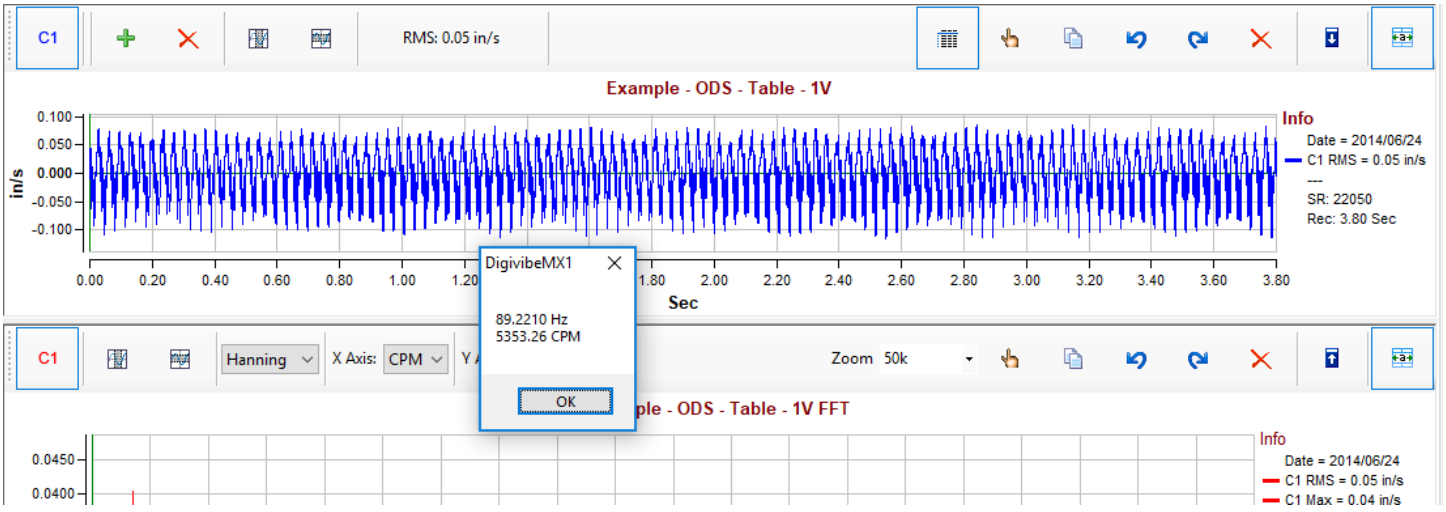


Spectrum Graph: Produces a color-coded bar graph representation of vibration severity by frequency range.

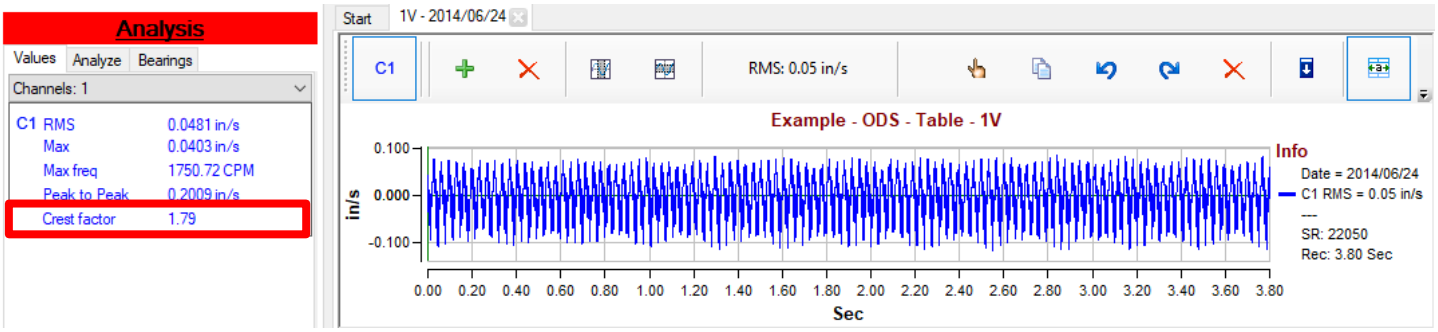
NOTE: Lines may initially appear very small. Zoom the view as necessary.



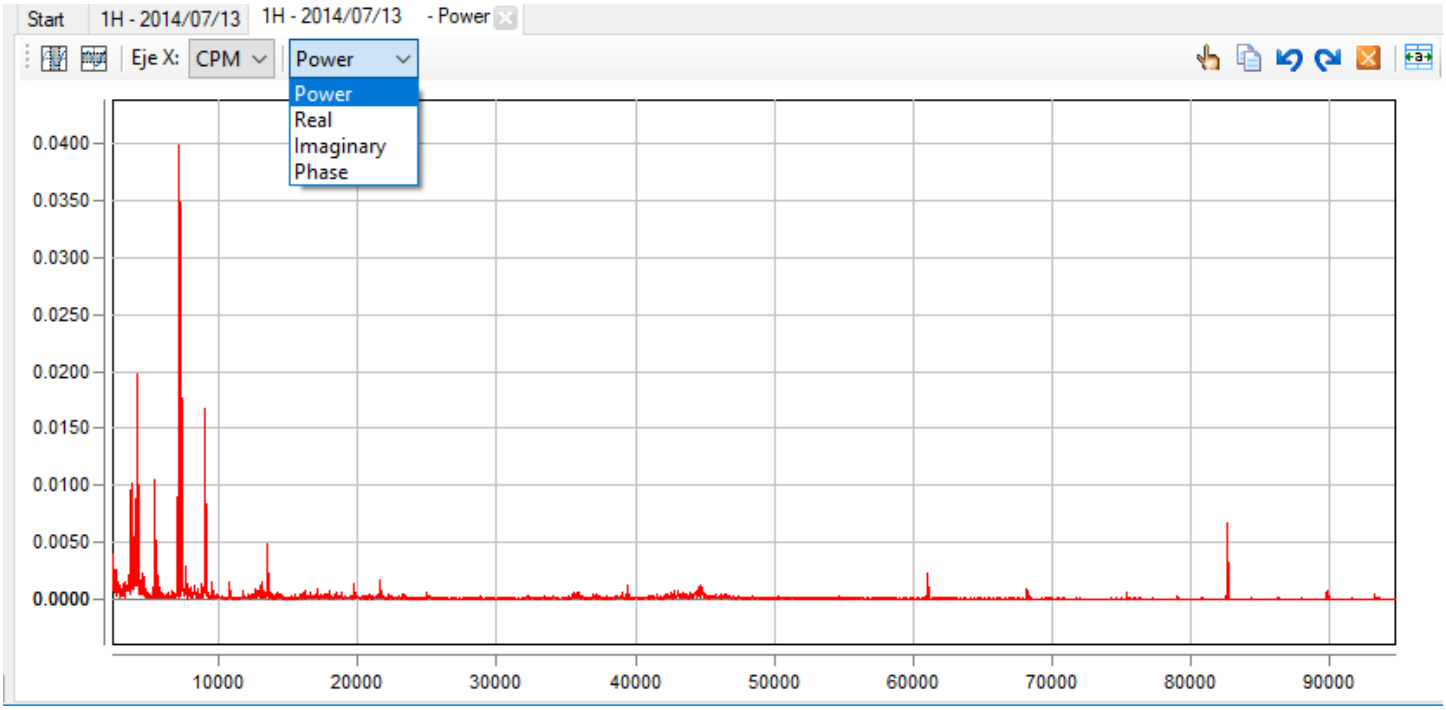
Cross-by-0 Frequency: Opens a window displaying the Cross-by-0 Frequency.



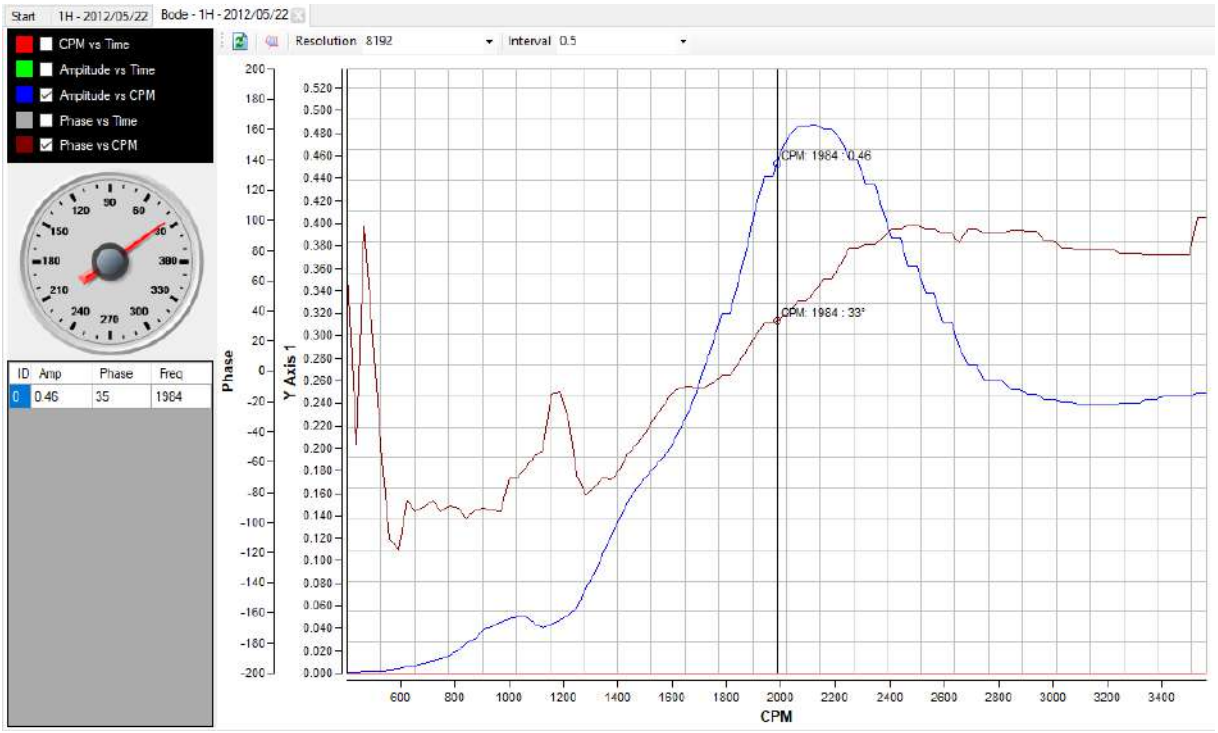
Crest Factor: Displays the waveform Crest Factor in the Analysis panel.



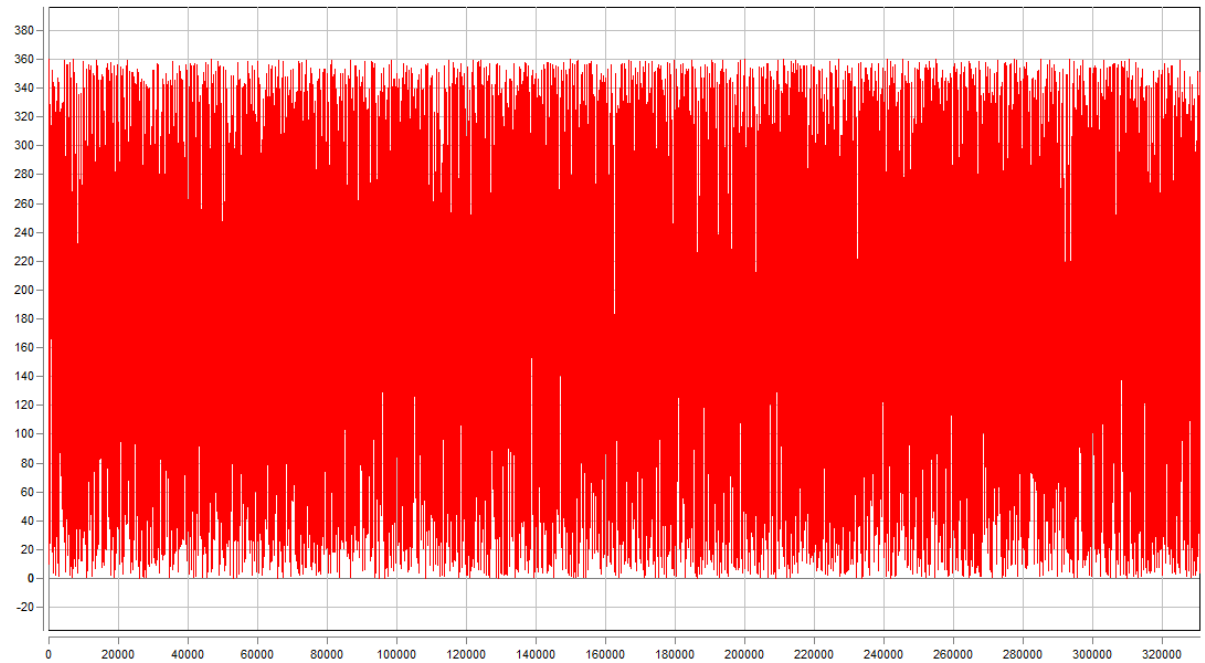
FFT: Displays the FFT with additional dropdown options to convert between Power, Real, Imaginary and Phase views.



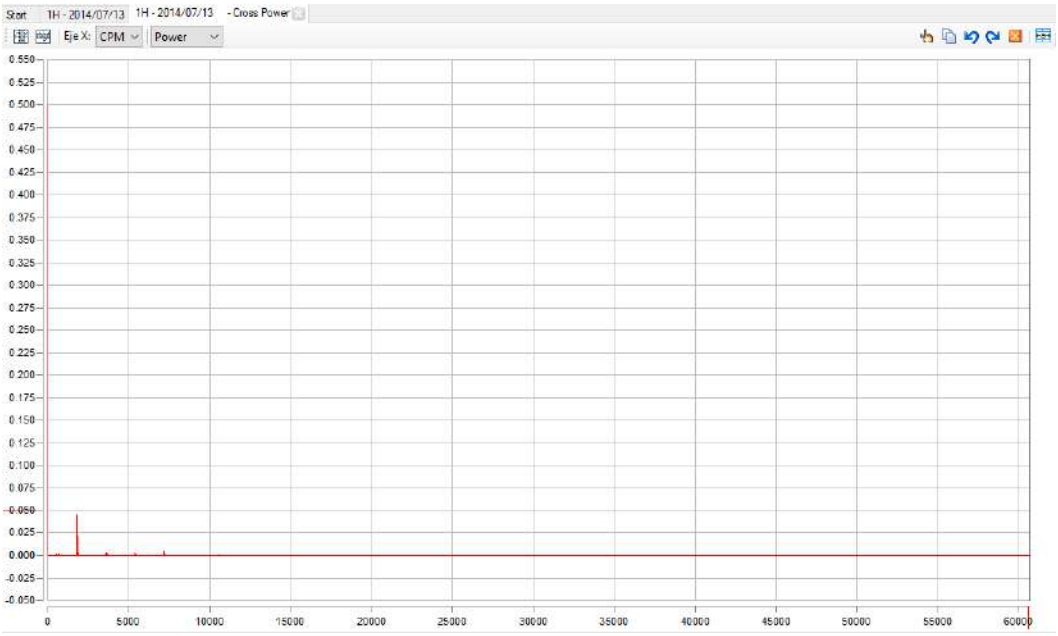
Bode: Displays machine start-up or run-down data collections in Bode Plot format.



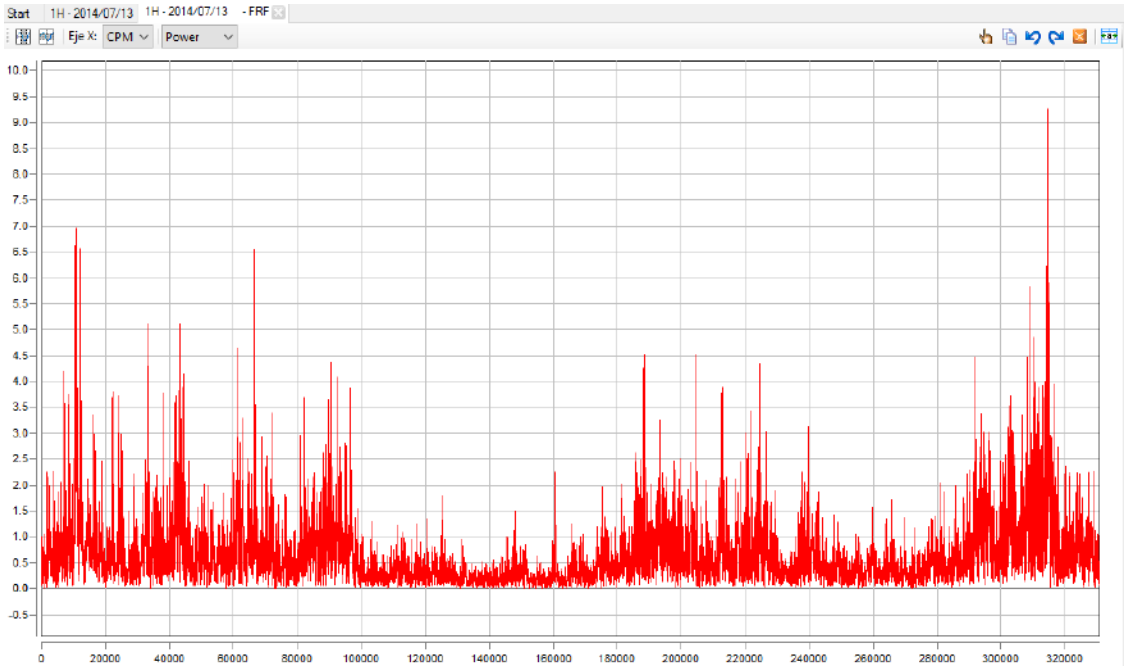
Phase: Displays the phase angle difference between a measured point and its reference point.



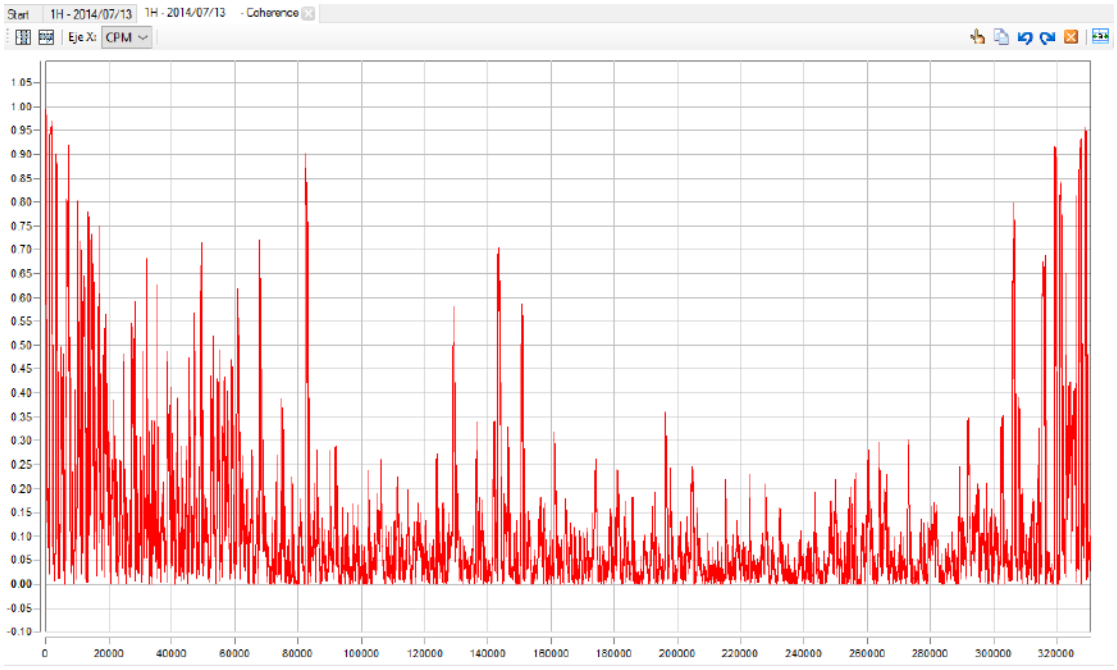
Cross Spectrum: Displays two channel data as a Cross Spectrum FFT graph.



FRF (Frequency Response Function): Displays a FFT-style graph measuring the output spectrum of a system, in response to a stimulus.



Coherence: Displays a spectral representation showing the relationship between two signals or data sets.



Orbit: Displays a static or dynamic graph representing the end travel of a rotating shaft.

NOTE: Orbit Analysis requires simultaneous data collection in the vertical and horizontal planes. In order to accomplish this, one would need triaxial, biaxial or two single-axis accelerometers. A single triaxial or biaxial accelerometer could be positioned vertically. With two single axis accelerometers, one must be positioned horizontally and the other vertically – each collected on its own channel. Start a new analysis and collect both channels simultaneously.

Create an orbit plot from the data by clicking on the Orbit button  located in the Functions Menu toolbar. If the collected data is identified as Horizontal and Vertical, Digivibe MX can determine which channel is vertical and which is horizontal.

In the orbit view, the duration of the drawing can be adjusted in milliseconds. The rendering speed of the graph can be adjusted by percentage. It is also possible to zoom in to fit an appropriate size. The image can be copied from DigivibeMX® with the right mouse button and pasted elsewhere as a still image.

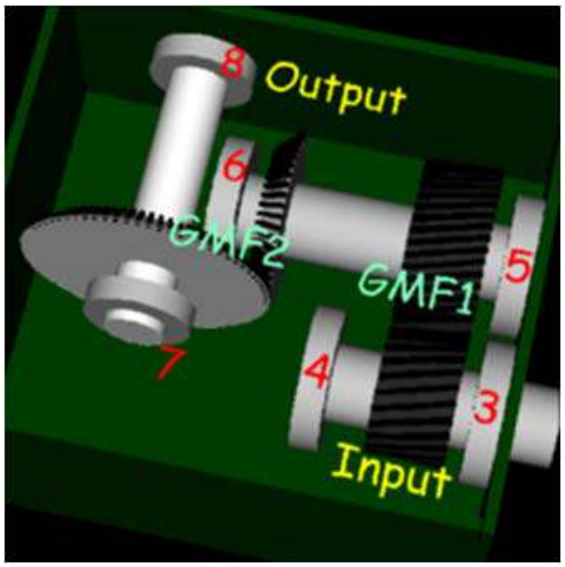
Observe the dynamic graph in video format by clicking the Start button. Playback can be paused and restarted at any point. A slider bar under the Pause and Stop buttons can be used to manually scroll through the entire Orbit plot.

Below the configuration settings on the right-hand side are Filter tools that can be used to filter Low Pass, Pass Band, Pass High and Block Band to improve the graphical interface.

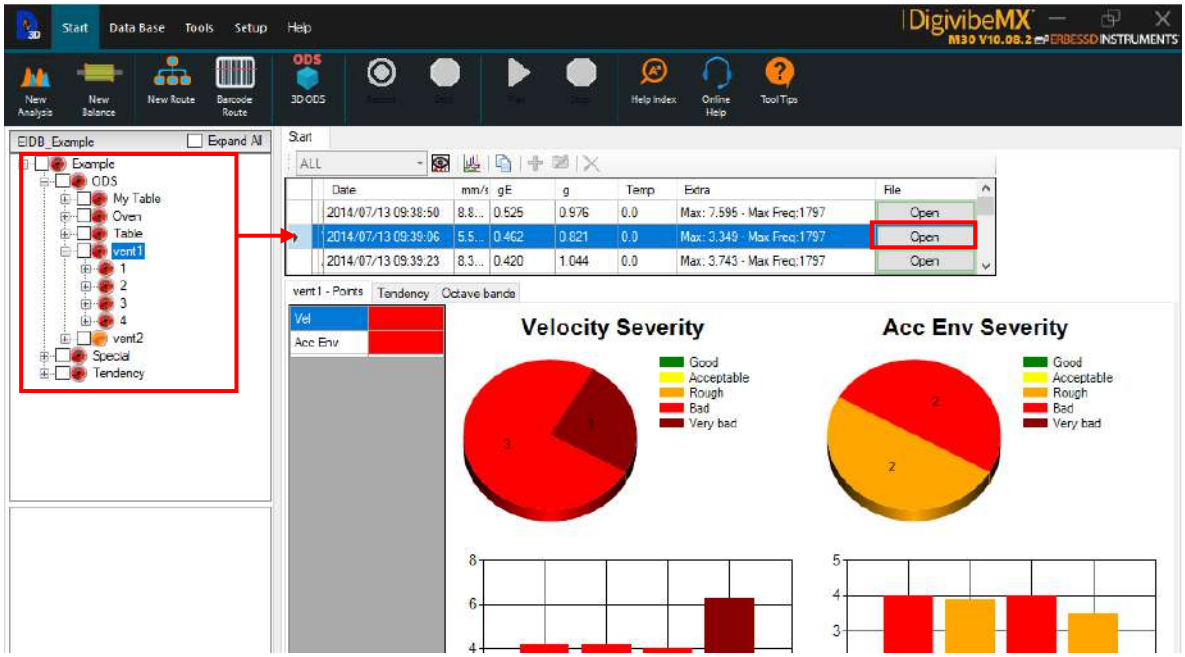
Gear Frequency Calculator

The Gear Calculator is located on the Tools Menu. It can be used to calculate gear mesh frequencies of a geared system, according to gear dimensions and number of teeth.

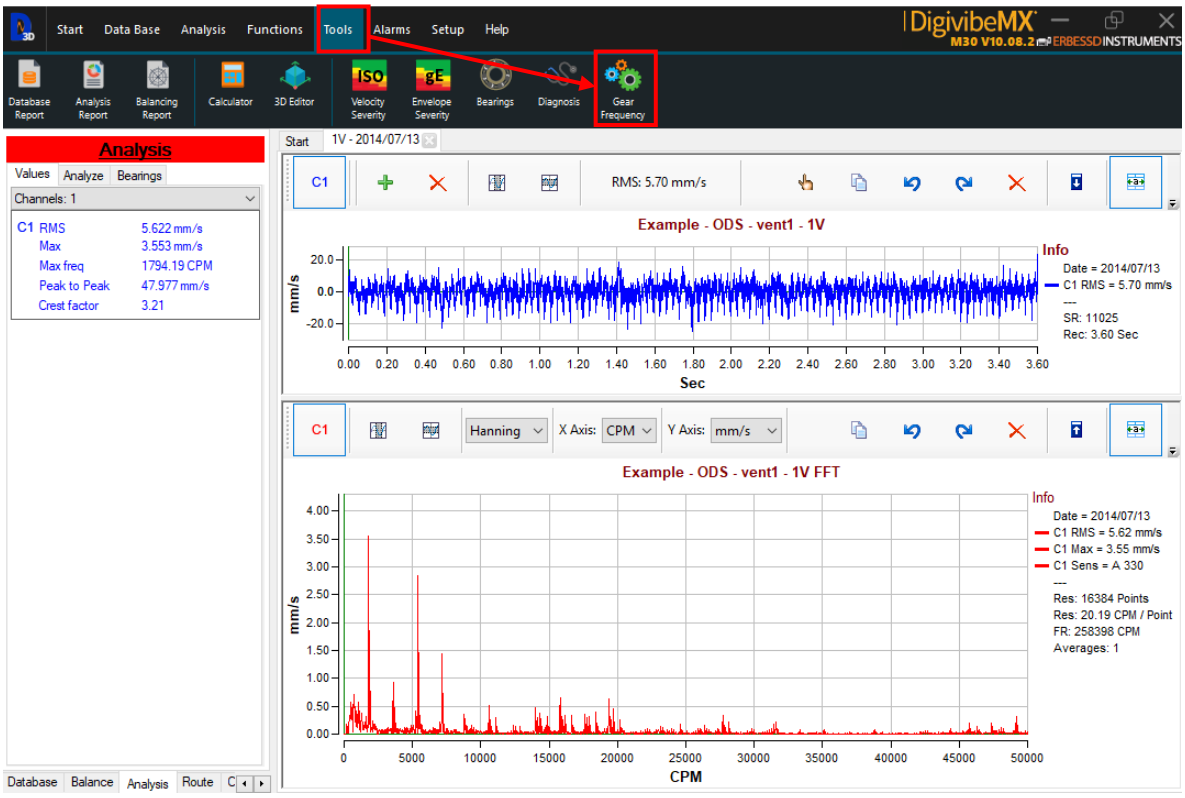
This example gear box will be used to illustrate the calculation of damage frequencies in gears:

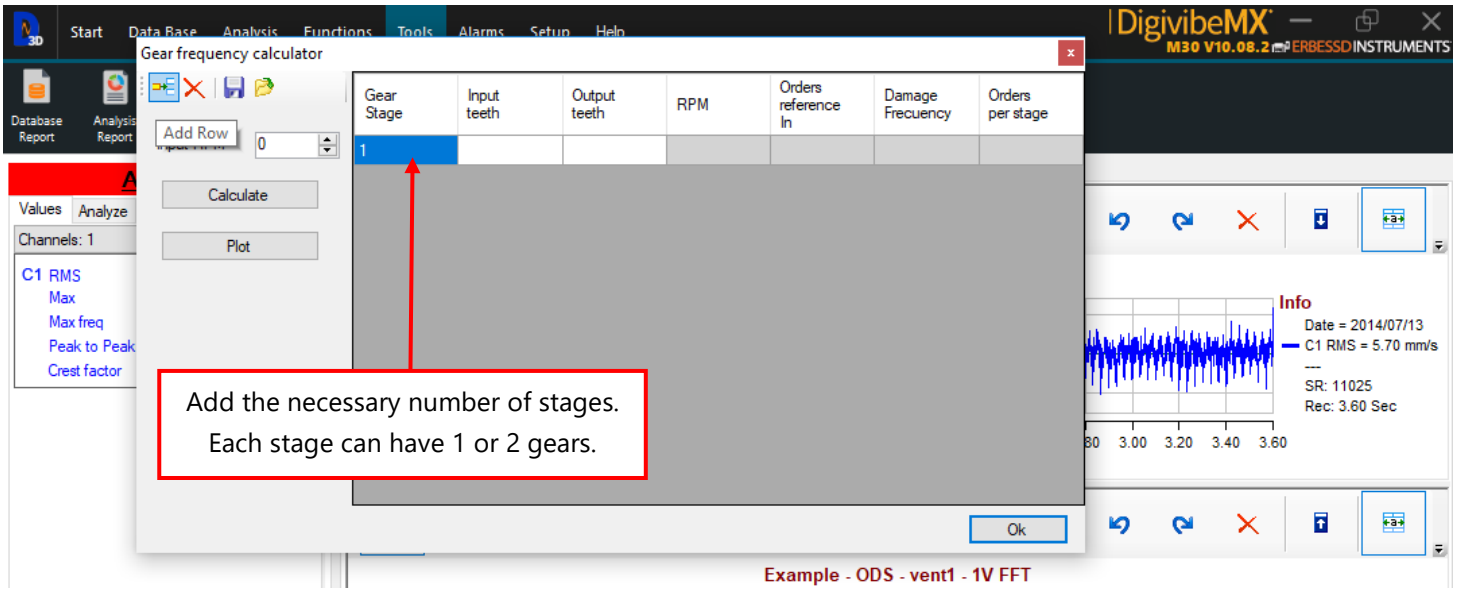


Select and open any data collection from a gearbox:



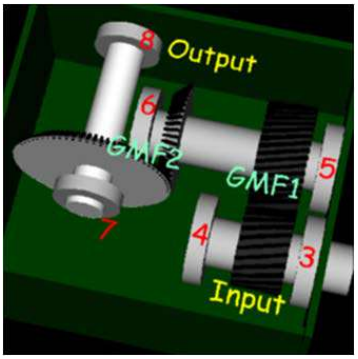
On the Tools Menu, select Gear Frequency

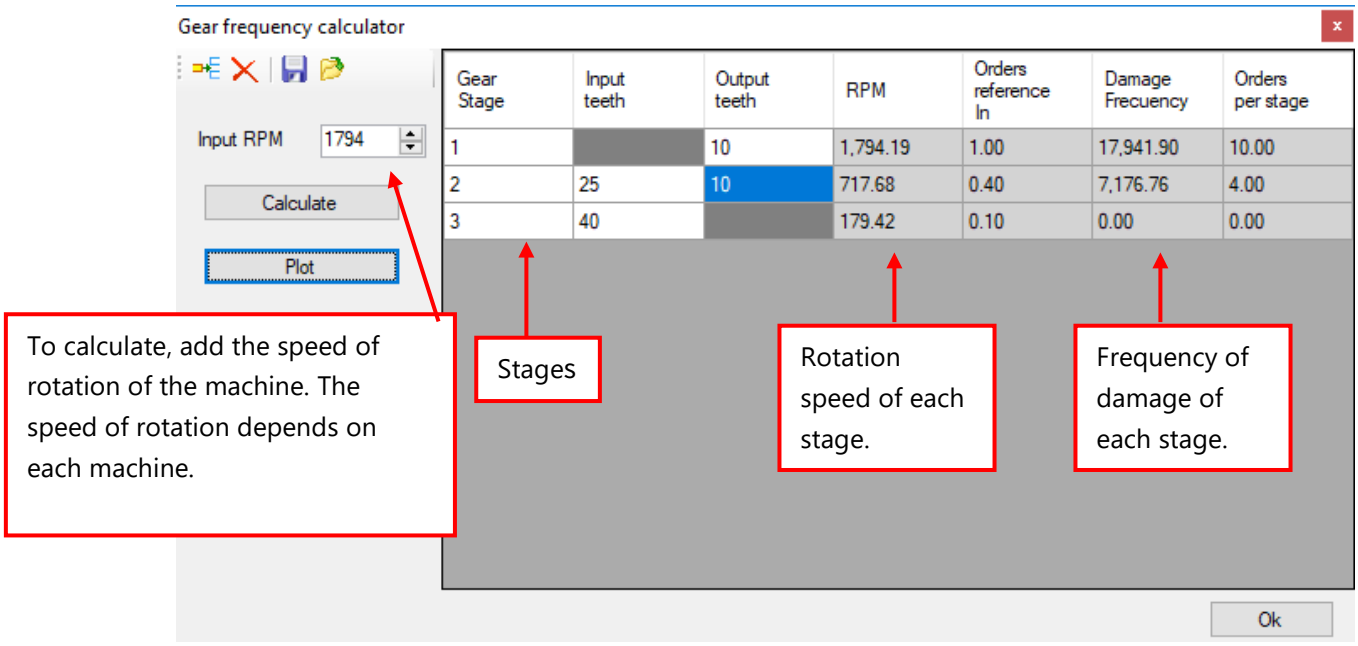




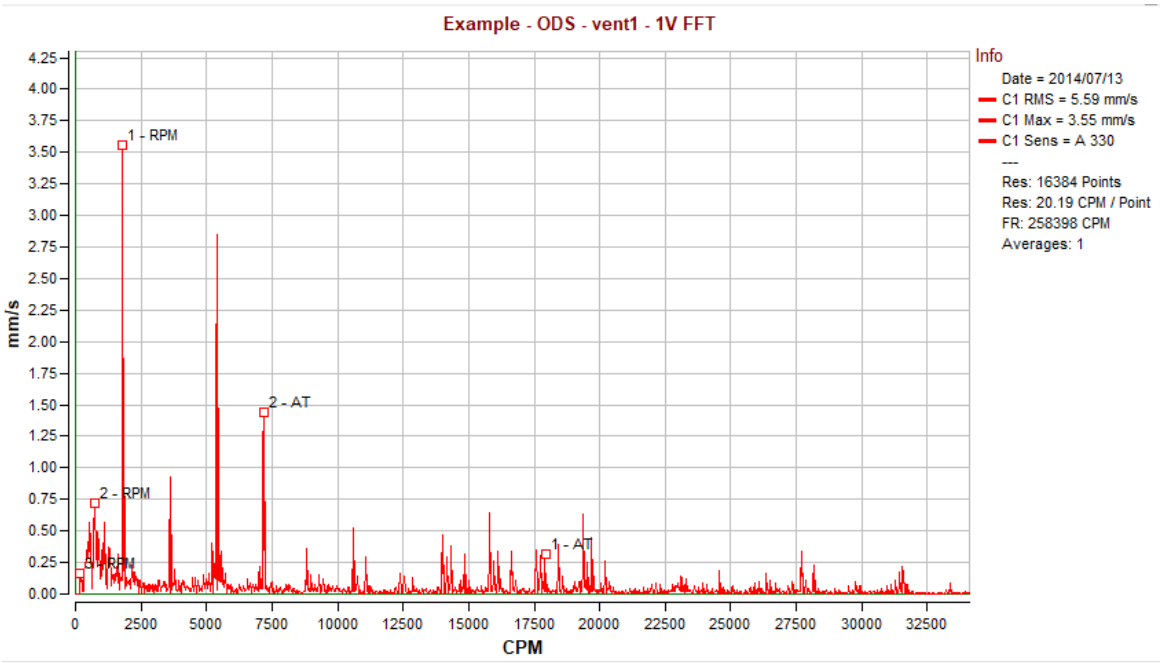
Specify the speed of rotation.

In the first stage of the gear (eg 3-4), indicate the number of teeth of the input gear that starts the movement. Subsequently in step 2 (step 5-6) there are 2 gears. Insert the number of teeth of each. Finally, step 3 (step 7-8) only has 1 gear, enter the number of teeth.

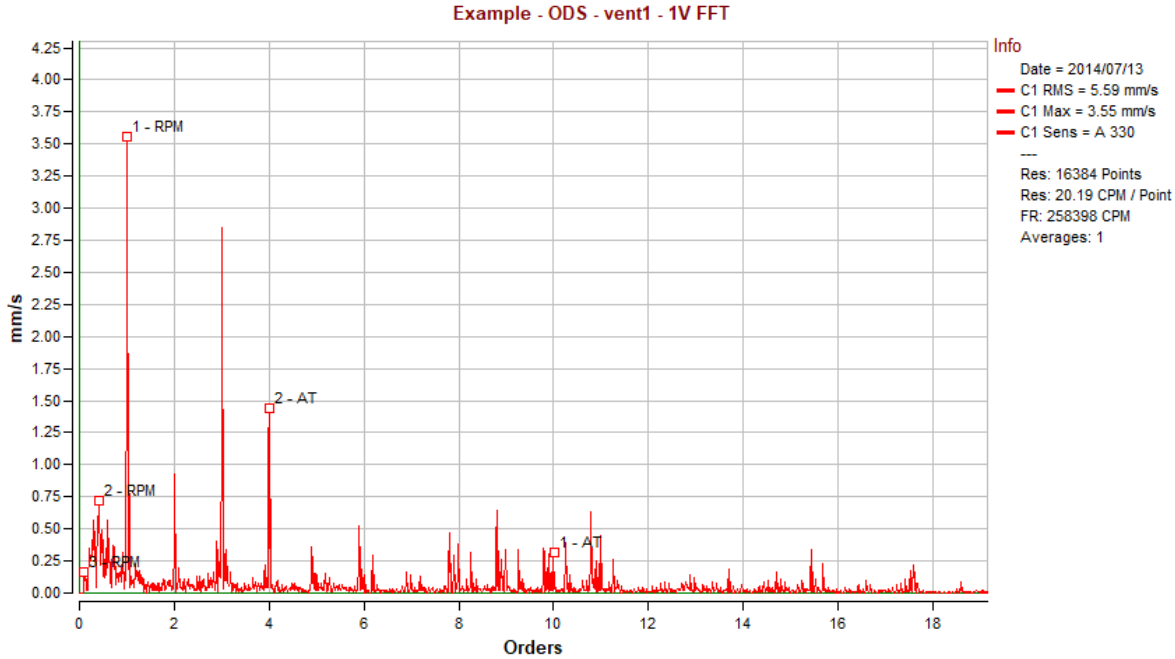




Press the "Calculate" and "Plot" button to position the markers on the FFT graphs and determine the intensity of the problem at the damage and rotation frequencies of each gear.



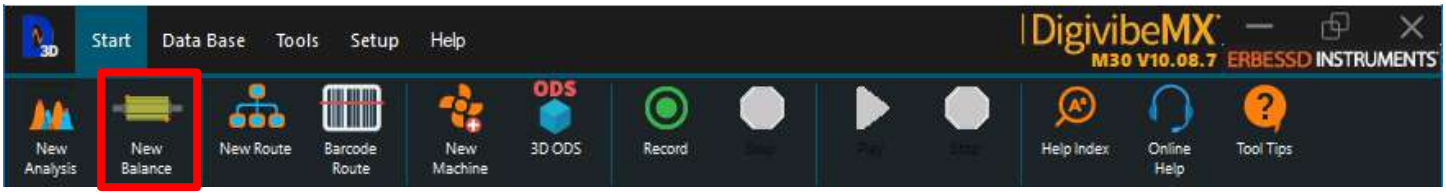
Markers in graph in CPM



Markers in graph in Orders.

Using the Balancing Menu (M10, M30)

To open the Balancing Menu, select New Balance on the Start Manu.



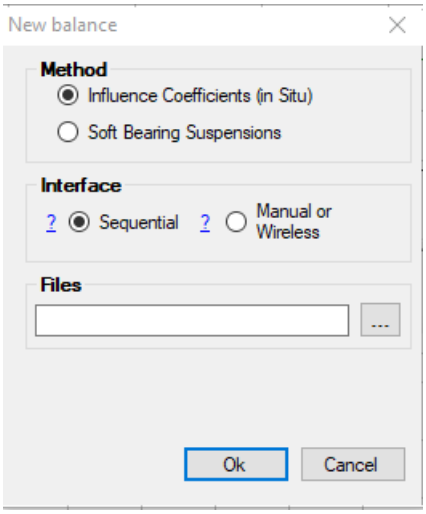
Specify which Balancing Method and Interface will be used.

Balancing Methods:

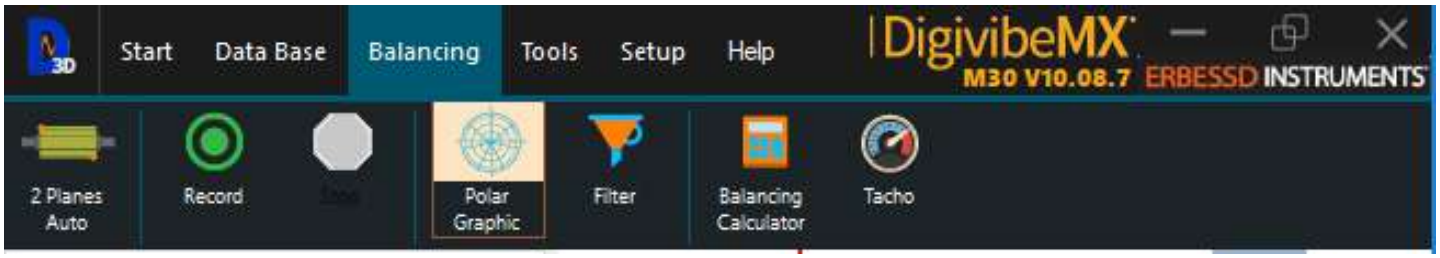
- Influence Coefficients (In Situ): for on-equipment balancing.
- Soft Bearing Suspensions: for off-equipment component balancing on Soft Bearing Suspensions.

Interface:

- Sequential: for standard automatic channel data collection.
- Manual or Wireless: for manual channel data collection or EI WiSer wireless accelerometers.



The Balancing Menu opens to begin a new Influence Coefficients or Soft Bearing Suspension balancing session.



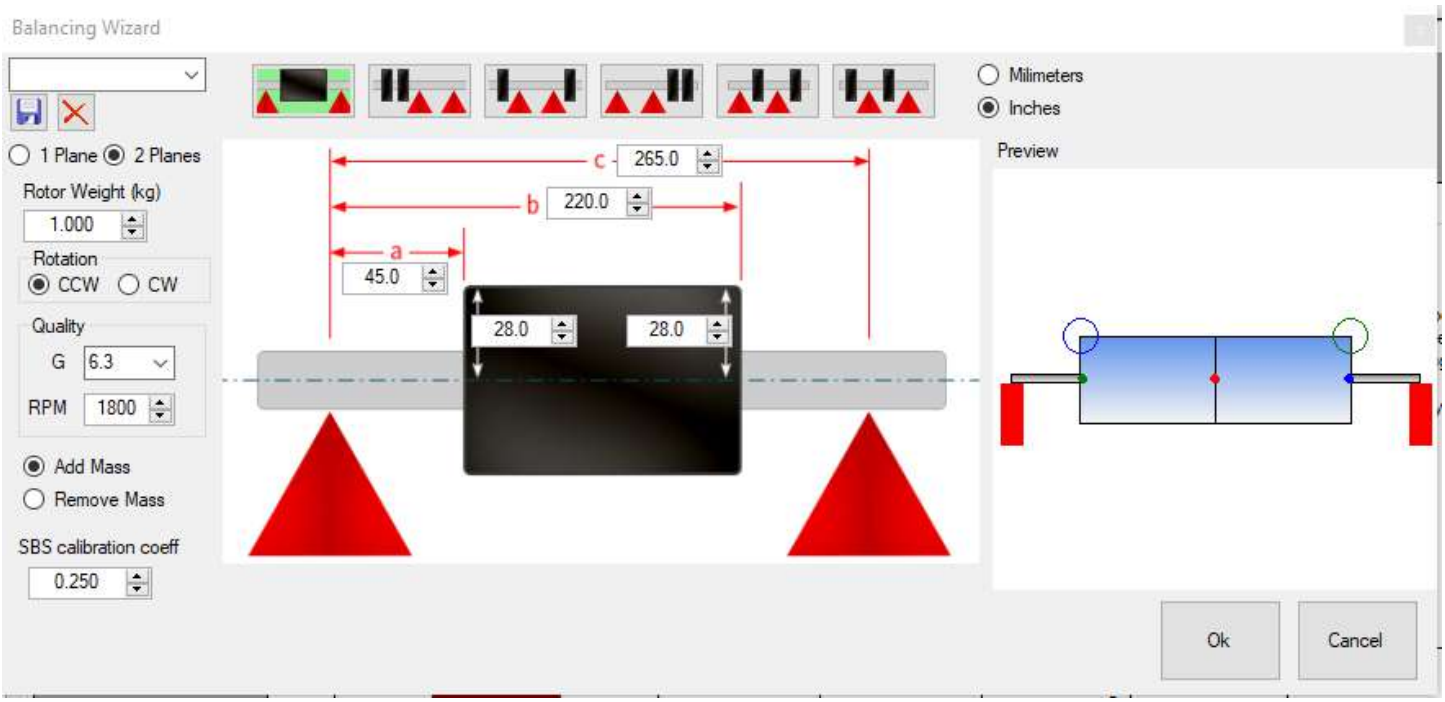
Dynamic Balancing with DivibeMX®

As previously mentioned, there are two distinctly different methods of balancing with DigivibeMX®

- **Influence Coefficients** for on-equipment machine balancing.
- **Soft Bearing Suspensions** for off-equipment component balancing on a Soft Bearing Suspension machine.

Soft Bearing Suspensions balancing

If the Soft Bearing Suspensions method is selected, a DigivibeMX® balancing session begins in the Balancing Wizard.



Component Orientation: Begin the balancing setup by selecting how the component is oriented on the Soft Bearing Suspension machine. Specify whether measurements are in Millimeters or Inches. Then fill in all specified measurement fields.

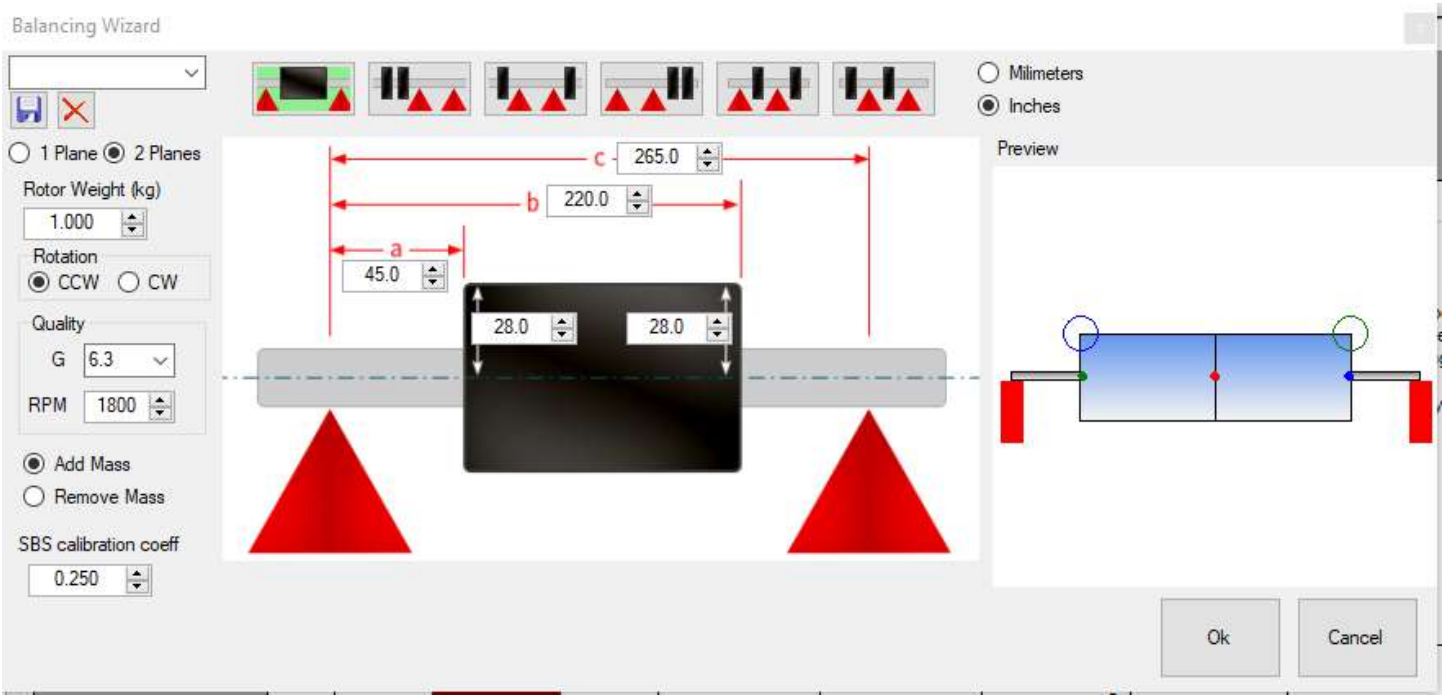
Planes: Select whether the balancing session will be in 1 Plane or 2 Plane.

Rotor Weight: Specify the component weight.

Rotation: Specify the direction of rotation, relative to the Plane 1 end of the rotor. (NOTE: if direction of rotation is incorrectly specified, all weight addition/removal locations will be off by 180 degrees. Weight adjustments will make the unbalance condition worse, instead of better.)

Quality: Balancing is based on the following table, and is calculated based on the actual working RPM:

Balance Quality Grade	Product of the Relationship $(e_{per} \times \omega)$ [1] [2] mm/s	Rotor Types - General Examples
G 4 000	4 000	Crankshaft/drives[3] of rigidly mounted slow marine diesel engines with uneven number of cylinders[3]
G 1 600	1 600	Crankshaft/drives of rigidly mounted large two-cycle engines
G 630	630	Crankshaft/drives of rigidly mounted large four-cycle engines Crankshaft/drives of elastically mounted marine diesel engines
G 250	250	Crankshaft/drives of rigidly mounted fast four-cylinder diesel engines[3]
G 100	100	Crankshaft/drives of fast diesel engines with six or more cylinders[3] Complete engines (gasoline or diesel) for cars, trucks and locomotives[3]
G 40	40	Car wheels, wheel rims, wheel sets, drive shafts Crankshaft/drives of elastically mounted fast four-cycle engines with six or more cylinders[3] Crankshaft/drives of engines of cars, trucks and locomotives
G 16	16	Drive shafts (propeller shafts, cardan shafts) with special requirements Parts of crushing machines Parts of agricultural machinery Individual components of engines (gasoline or diesel) for cars, trucks and locomotives Crankshaft/drives of engines with six or more cylinders under special requirements
G 6.3	6.3	Parts of process plant machines Marine main turbine gears (merchant service) Centrifuge drums Paper machinery rolls; print rolls Fans Assembled aircraft gas turbine rotors Flywheels Pump impellers Machine-tool and general machinery parts Medium and large electric armatures (of electric motors having at least 80 mm shaft height) without special requirements Small electric armatures, often mass produced, in vibration insensitive applications and/or with vibration-isolating mountings Individual components of engines under special requirements
G 2.5	2.5	Gas and steam turbines, including marine main turbines (merchant service) Rigid turbo-generator rotors Computer memory drums and discs Turbo-compressors Machine-tool drives Medium and large electric armatures with special requirements Small electric armatures not qualifying for one or both of the conditions specified for small electric armatures of balance quality grade G 6.3 Turbine-driven pumps
G 1	1	Tape recorder and phonograph (gramophone) drives Grinding-machine drives Small electric armatures with special requirements
G 0.4	0.4	Spindles, discs and armatures of precision grinders Gyroscopes



RPM: In this section you must set the actual working speed of the rotor, regardless of the speed of the balancer.

Add or remove mass: Select whether calculated correction weights are removing or adding mass.

Floating base mass: It is the mass of all parts of the floating element of the balancer on each side, ie only the floating mass of one of the pedestals. This is usually a constant and is saved in the program.

On the right-hand side of the Balancing Wizard is a rotor image matching the selected SBS Component Orientation, with the following elements:

Large blue circle: Placement of the correction weight in plane 1

Large green circle: Placement of the correction weight on plane 2

Red small circle: Rotor center of gravity

Small blue dot: Plane 1 center of percussion* for correction weight placement site

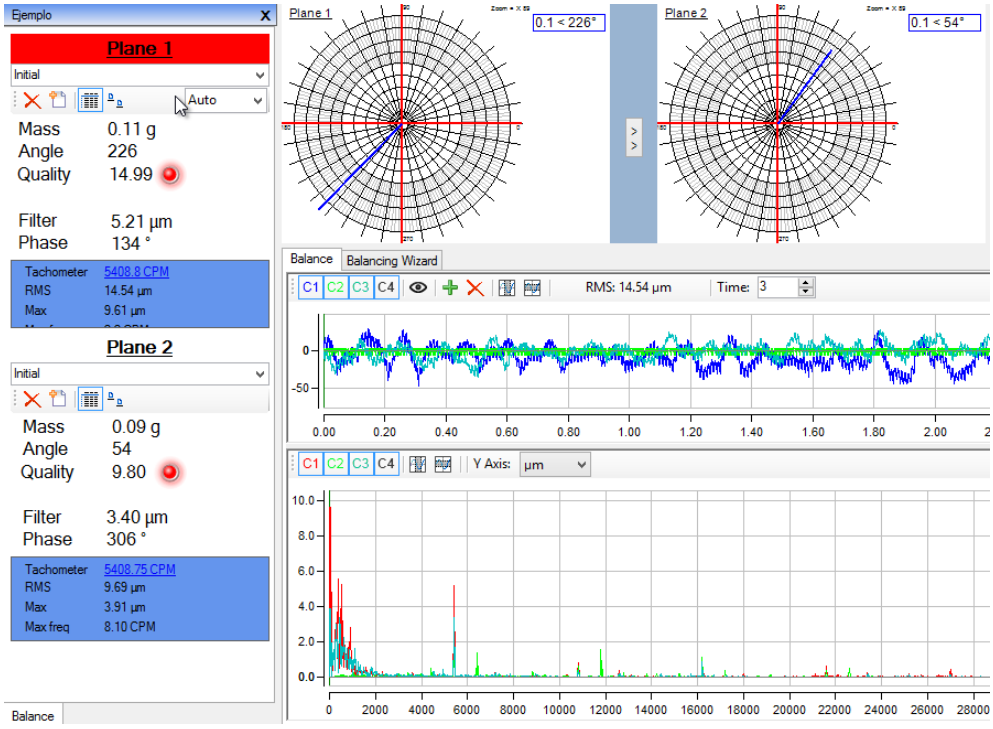
Small green dot: Plane 2 center of percussion* for correction weight placement site

Red rectangles: Points of bearing support.

* Centers of percussion are the centers of rotation, if the component is excited at its point of mass placement. These centers are the calculation axis for Soft Bearing Support influence coefficients.

When Balancing Wizard setup is complete, press Ok. DigivibeMX® Soft Bearing Suspensions method is ready to begin:

- Open to the Balancing Menu (if not already there).
- Start SBS machine
- Press the Record button when ready for the first balancing calculation.



In the toolbar on the left you will see the following information for both planes:

Mass: The mass correction required.

Angle: The angle mass correction should be placed. **Angle is always measured as seen from plane 1, CW or CCW as specified in the Balancing Wizard setup.**

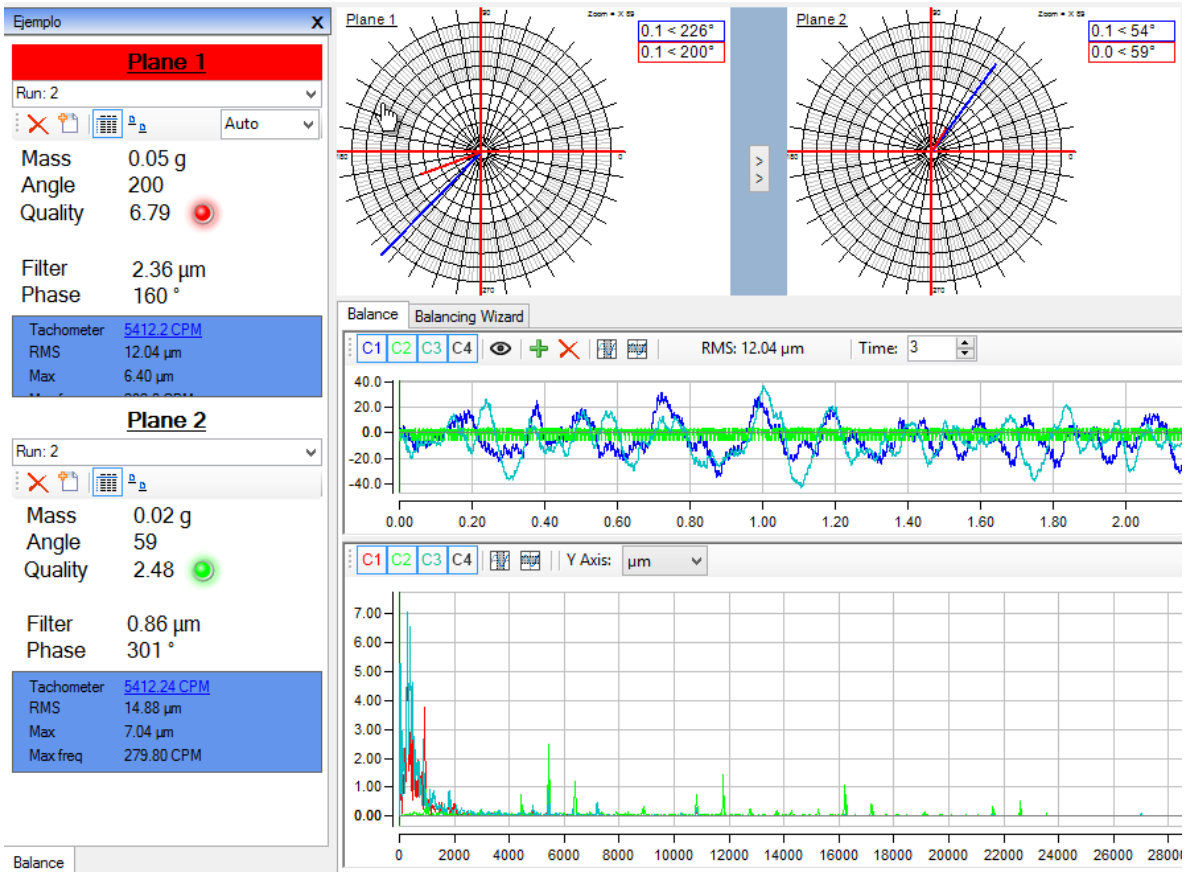
Quality: The quality corresponds to the degree of quality in which the piece is currently, relative to the quality grade selected in Balancing Wizard setup. A red indicator means the balance is not yet within the selected quality level. The indicator will appear green when the selected quality has been achieved.

Filter: The amount of vibration, measured in displacement units

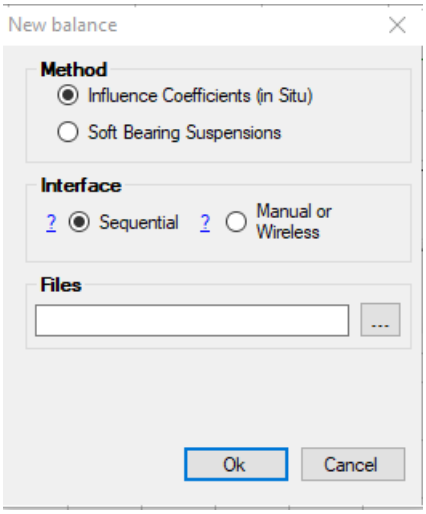
Phase: The phase of vibration, relative to the optical sensor.

Tachometer: The speed measured by the optical sensor

After placing mass corrections, it is necessary to take a new reading to verify the component's new condition. The vibration should lower and approach the desired degree of quality. This same procedure can be carried out as many times as necessary. A correct approximation would be 80% improvement on each run.

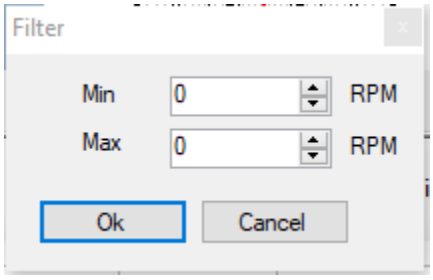


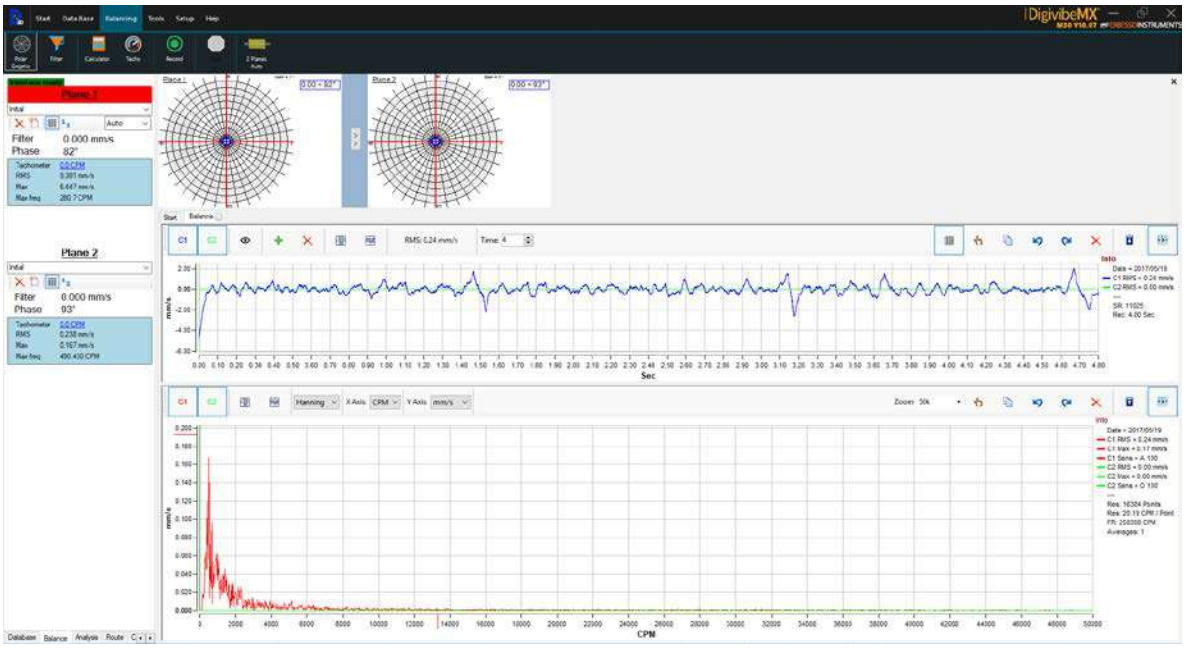
Influence Coefficients Balancing – Step by Step Plan (M10, M30)



When beginning a New Balance with Influence Coefficients, you will be asked the approximate speed at which you want to balance. The filter disregards any outlying readings from tachometer signal data.

It is important to understand that when choosing a range for the filter, we are actually telling the program between what frequencies and how often the speed of rotation must be found. If there is a slight change in speed, as with a VFD system, amplitude and phase data are not altered - as is often the case for low range filters. At any time during the balancing process, you can modify the filter with the  button on the toolbar.





On the left side you can see the balancing tools consisting of 2 panels, each corresponding to each balancing plane (when 2 planes are chosen). In the case of a rolling of 1 single plane, only the upper panel titled "Plane 1".

During the swing, each run is saved automatically for the purpose of reviewing it at any time. You can access each of the saved runs in the drop-down menu under the "Plane 1" panel title. When selecting a run, the Filter and Phase items will display the values obtained in those runs. The filtered value and the Phase are not the only data that are presented, but the most important ones for the roll. The other data can be accessed by positioning the mouse cursor over the Mas label, or by pressing the "View all measurements" button " to fix them on the screen.

Available Rolling Bar Buttons:

View All Measurements: Displays all data (RMS, Filtering, Phase, Tachometer, Maximum, Maximum Frequency)

View Filter and Phase only: Displays only important data for balancing (Filtering, Phase)

Delete: Deletes the selected sample

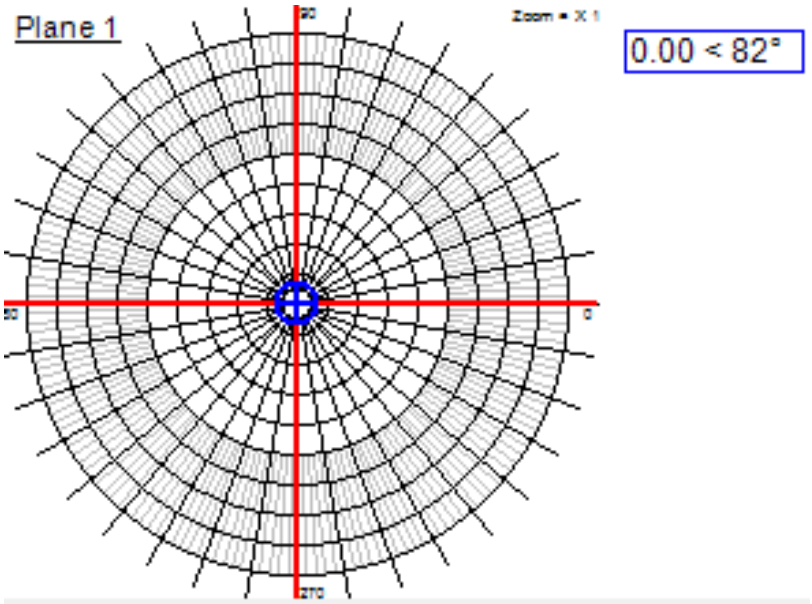
New: Deletes all selected samples

The balance data is processed by the same balancing calculator that can be found in the button , or in the menu View - Calculator.

Polar Graphs

The polar graphs are visible in the Analysis and Work Area, so they may be viewed in conjunction with data in with the balancing toolbar.

The polar graphs represent a Cartesian plane, in which the vectors of the balancing run are drawn. They also display the of values on which these vectors were based, repeating the data displayed in the Balancing toolbar.



Parts of the polar graph:

Title: Top left. Represents the name of the chart and is changeable through the context menu - preferences
Graphic: It is the Cartesian plane. In it will be drawn the vectors of the rolling.
Zoom: it is on the top right. Indicates the degree of Zoom in which it is. It can be modified through the context menu - zoom, or with the mouse wheel.
History: It is located in the whole right margin and if you want it within the same graph as shown in the previous figure.

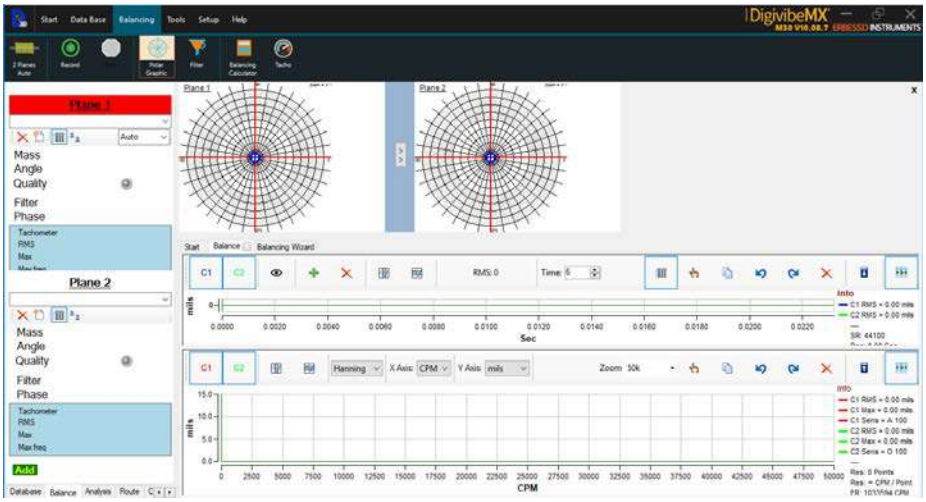
Context menu
The context menu (right click) of the polar graphs displays the following options:

Copy: Copy the graphic in image format
Save as: Save the polar plot in image format
Preferences: Opens the preferences box where you can configure the appearance and behavior of the polar graphs.
*The configuration of colors and appearance of polar graphs can be modified through the Context menu - Preferences

Vector method

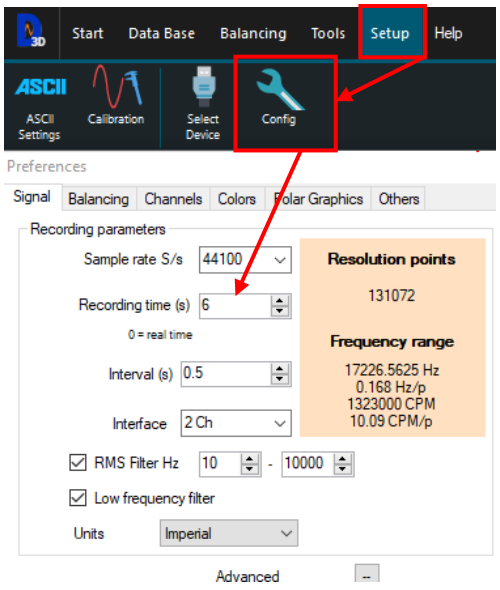
NOTE: It is recommended to familiarize with balancing in one plane, before attempting to balance in two planes.

DIGIVIBEMX® MX BALANCING SCREEN



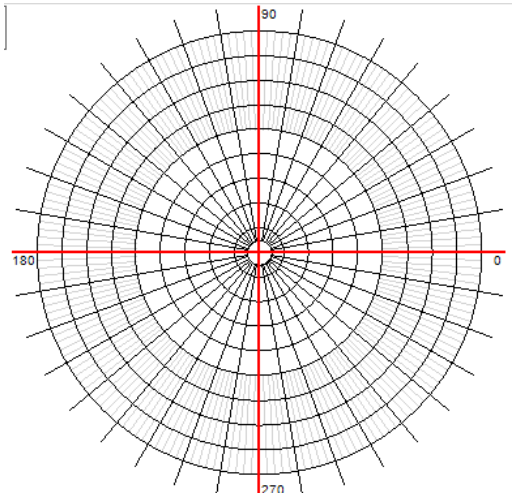
Preparations

a) Open DigivibeMX®
b) Select New Balance on the Start Menu.
c) Plane 1 selected (in red)
d) Recording time 6 seconds (Setup / Config / Signal tab: Recording time)



Method of the 3 test weights

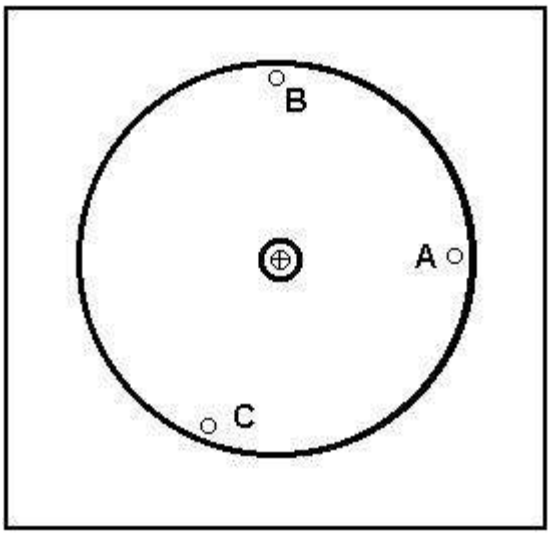
Sometimes it is not possible to use the Laser Tachometer due to unique circumstances. For example, in cooling tower fans, strong ambient light and large fan diameter can interfere with the Laser Tachometer's ability to read the reflective reference marker on the rotor. In other cases, the type of rotor, its speed, mechanical condition or other hazards in the vicinity make standard balancing very difficult.



In these cases, balancing can be performed using vibration measurements only. This method requires performing three test runs, then using a calculation to determine the position and magnitude of counterweights. The circular diagram will be used to perform the graphic calculation.

PROCESS

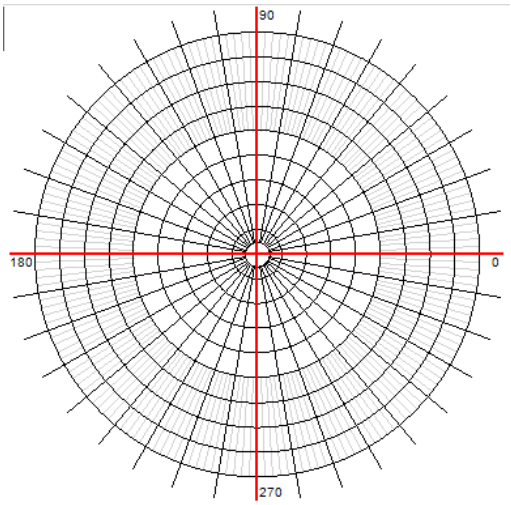
Determine three points on the rotor where counterweight will be placed for each of the three trial runs. The points should be located at the same radius and preferably 120 degrees apart from each other. The latter condition is not strictly necessary. In a fan with seven blades the counterweights can be placed at 0, 120 and 240, coinciding with the blades.



NOTE: DigivibeMX® has a three-point balancing calculator located on the 3-point tab of the balancing calculator  .

In our example, the three trial weight positions are located at 0, 90 and 250 (CCW rotation).

The original vibration is taken, which we will call V0. Using a suitable scale will draw a circle with its center in the center point of the graph. **V_0 = 2.3 mm/seg.**

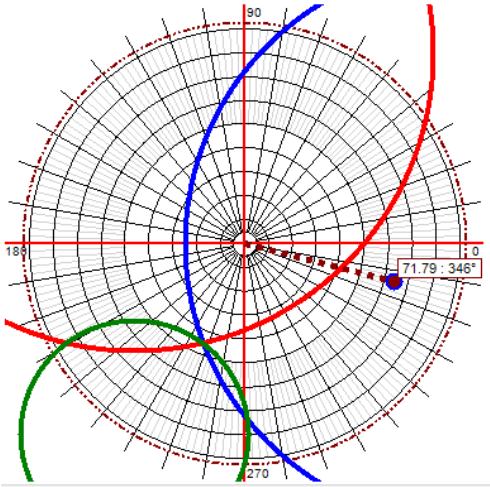


A test weight is placed at the point marked "A". The weight will be calculated using the same criteria described above.
The vibration measurement is performed. This value will be called V_A.

In our example, we will assume the following values obtained with a test weight of 90 grams. V_A=3.9, V_B=2.1 y V_c=3.6

The graphic calculation is performed, then the counterweight of the "A" point is removed and placed at the point marked "B". The value V_B is obtained and in the same way it is done with the point "C" to obtain the value Vc. Drawing a circle with center at point A and with radius equal to the value of vibration V_A using the same chosen scale. The same is done for points B and C.

Theoretically, the three circumferences must cross at the same point, but this does not happen with reliable accuracy. In general, the points of intersection of the circumferences, will define a small triangle. The center of the triangle is then taken and defined as the "D" point. This error is due to the lack of "linearity" mentioned above.



A vector is drawn from the center of the graph to the point "D", therefore VD = 2.2. At an angle of 138 degrees.

The correction weight is calculated according to the following formula:

$$P_c = P_P \times (V_0)/(V_D)$$

In our example

$$P_c = 90 \times 23/22 = 94 \text{ grams}$$

The location is given by the angle of 138 ° with respect to point A, which is always at an angle of 0 °.

The correction counter is placed permanently and a new measurement of the vibration is carried out which, if the method has been correctly followed, must have been lowered by at least 30% of the original value. If the state of the machine allows: the last vibration reading may be substituted as a new Vo, and this method repeated until desired vibration levels are achieved.

SENSOR CONNECTIONS FOR 2 CHANNEL INTERFACES:

Model 5V

- Accelerometer 1: Port 1-A
- Accelerometer 2: Port 1-B
- **Optical Sensor: Port Op**

Model 24V

- Accelerometer 1: Port 1-A
- Accelerometer 2: Port 1-B
- **Optical Sensor: Port Op**
- **ATTENTION: Port "2" is not used!**

Model 24V

- Accelerometer 1: Port 1-A
- Accelerometer 2: Port 1-B
- **Optical Sensor: Port Op**

SENSOR CONNECTIONS FOR 4 CHANNEL INTERFACES:

Model 5V

- Accelerometer 1: Port 1
- Accelerometer 2: Port 2
- **Optical Sensor: Port 4**
- **ATTENTION: Port "3" is not used!**

Model 24V

- Accelerometer 1: Port 1
- Accelerometer 2: Port 2
- **Optical Sensor: Port Op**
- **ATTENTION: Ports "3" and "4" are not used!**

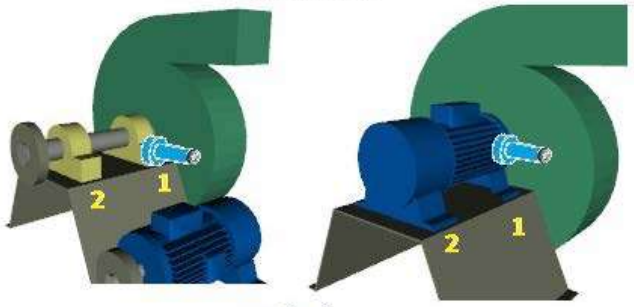
Field Balancing Guidance

STEP 1: POSITION THE SENSORS

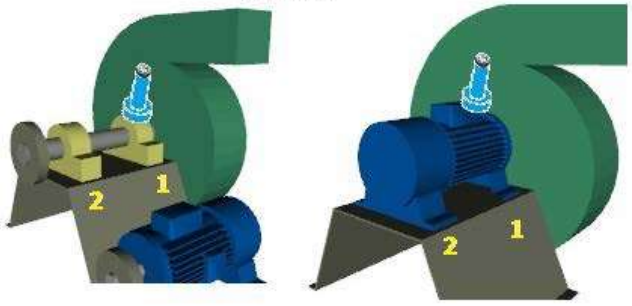
Position of vibration sensors for field balancing:

Balance in 1 plane:

- horizontal

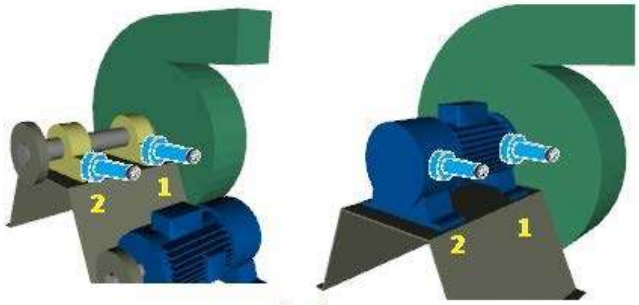


- vertical

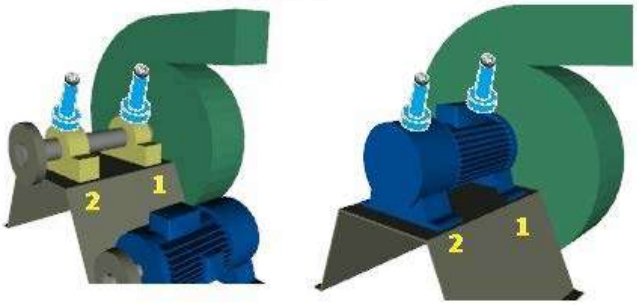


Balance in 2 planes:

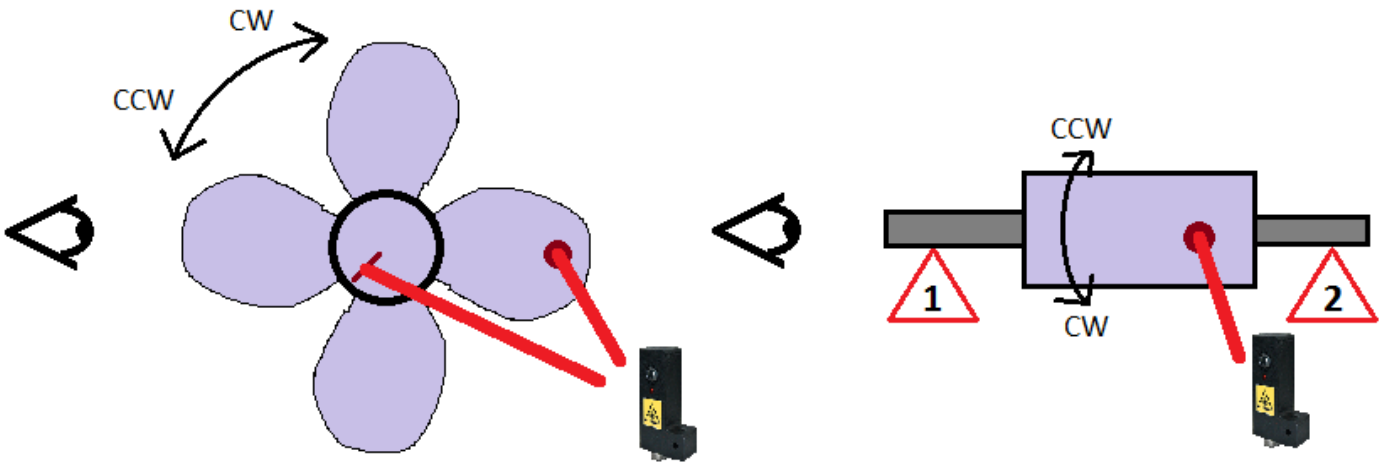
- horizontal



- vertical

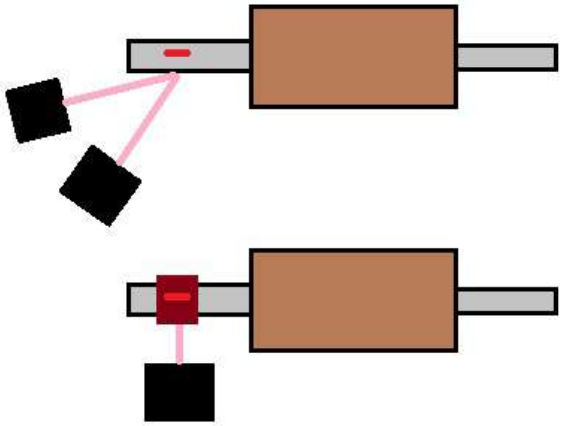


Place the optical sensor pointing to some part of the rotor that you want to balance and place a contrasting mark that passes through the sensor at each turn.



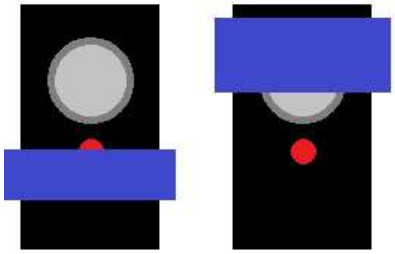
CW: Rotation RIGHT in the direction of the hands
CCW: LEFT turn counterclockwise

Recommended Position of Laser Speed Sensors



Recommended angle for the Laser for most of the situations, specially **very polished, bright and/or reflective** shafts.

If the shaft is too bright, put first a matte tape all around the shaft and then the piece of reflective tape.

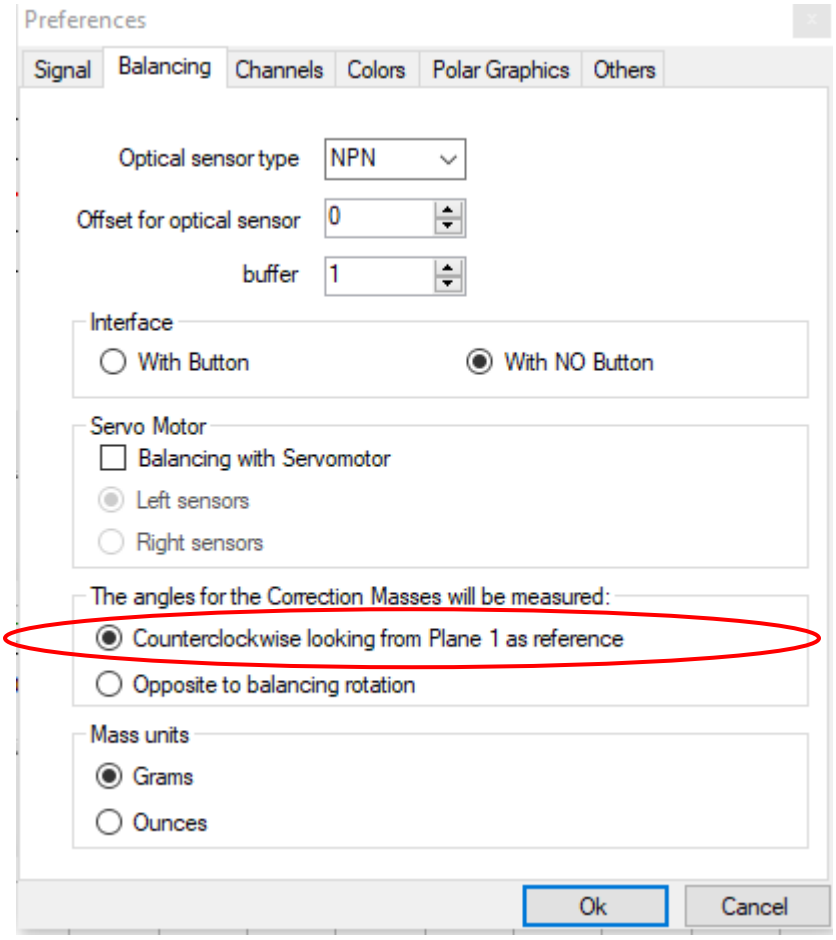


If the sensitivity is too high (blue led always ON), put some tape on the lens to reduce sensitivity, until the blue led twinkles only with the reflective tape.

It has 2 options for measuring angles:

- Always counterclockwise from plane 1. It is **required to indicate the direction of rotation of the rotor** (Right = CW or Left = CCW). This is the method that is defined by default.
- Always in the **opposite direction to rotor rotation**.

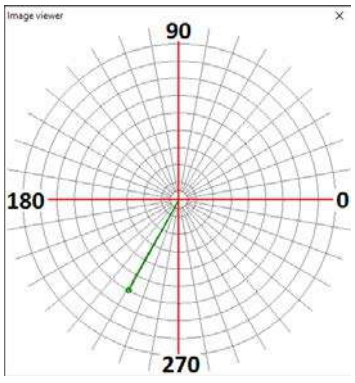
STEP 2: METHODS FOR MEASURING THE ANGLES OF CORRECTION WEIGHTS



If rotation is Izq

The angle of correction **240°**
Is measured in this sense:

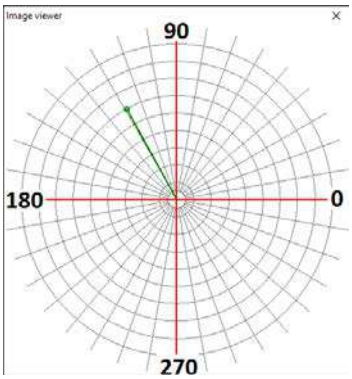
Izq

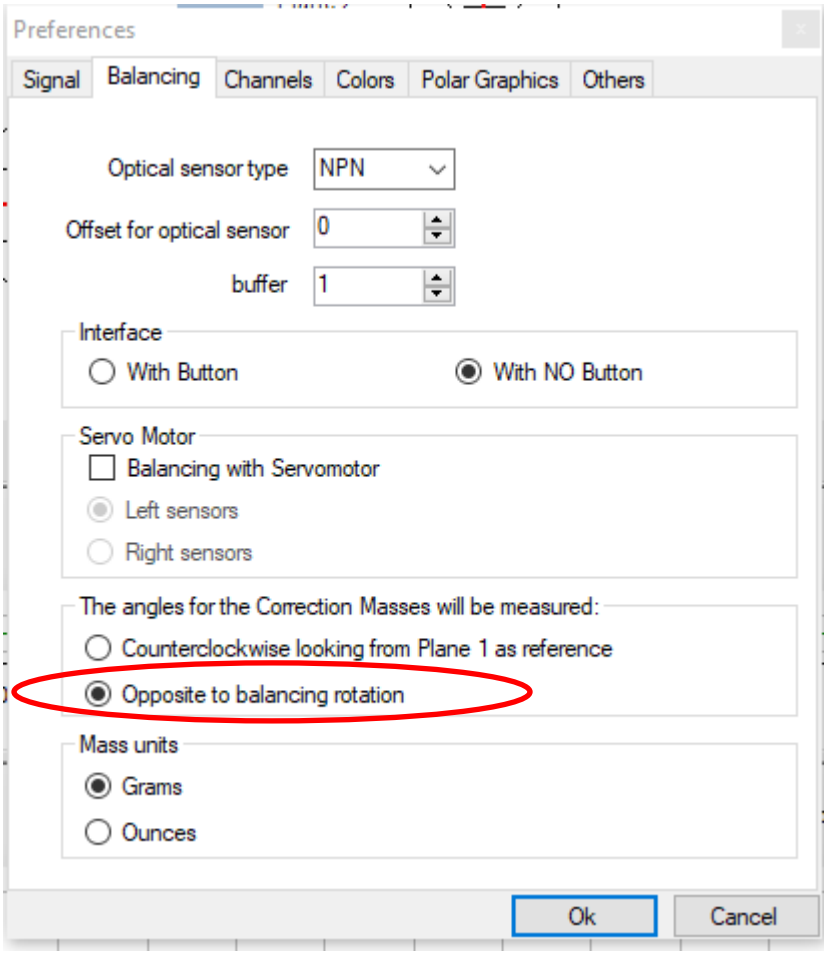


If rotation is Der

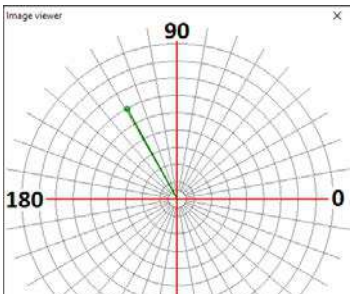
The angle of correction **120°**
Is measured in this sense:

Izq





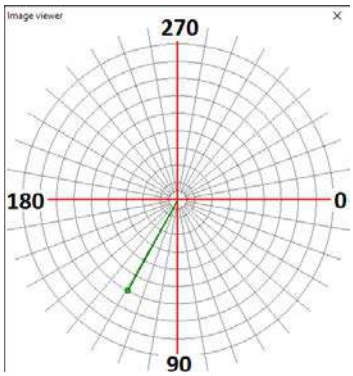
If rotation is Der



The angle of correction **120°**
Is measured in this sense: Izq

If rotation is Izq

The angle of correction **120°**
Is measured in this sense: Der

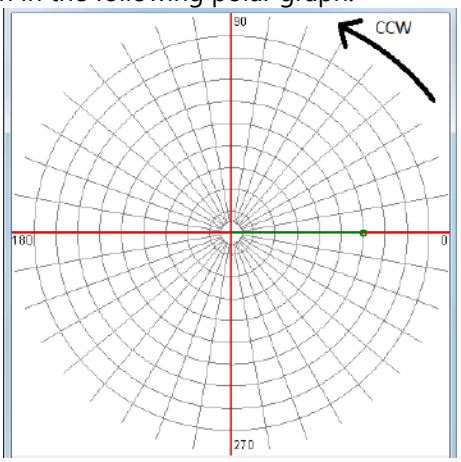


To have a good reference to measure the angles, always place the mark in the same position, for example upwards or to the right as the polar graphs.

Correction angles are measured with respect to the mark used by the optician representing the 0 °.

Correction angles are preferably measured **ALWAYS viewed from Plane 1**.

This mark will be our 0º like the one shown in the following polar graph:



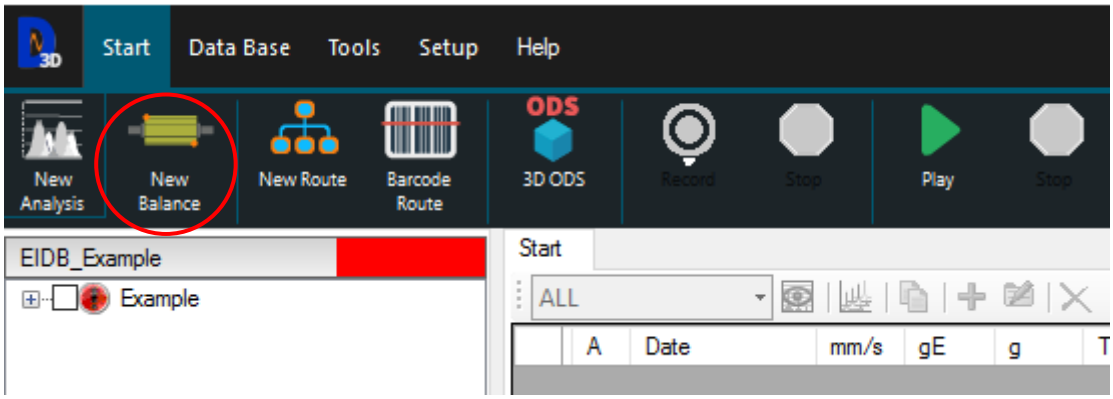
Position the accelerometer in the direction with the highest vibration level, Horizontal or Vertical.

ATTENTION: Never place the accelerometer in the axial direction, since although there may be a high vibration in that direction, the axial vibration is not due to unbalance, but to misalignment, twisted arrow among other factors.

IMPORTANT: The sensors, once installed, must not be moved during the rolling process..

STEP 3: USING DIGIVIBEMX SOFTWARE

Open the **DigivibeMX** or EI-Balance and select "NEW BALANCE"



The **New Balancing** window opens**:**

The filter is used when the tachometer fails to synchronize with the vibration signal or in case of using a sensor other than the supplied Laser, select the filter for the roll speed:
If the rotor rotates at 1200, write in **Min** «800» and in **Max** «1600».

To use it:
We select the range of the Filter, ie the **Speed Range** in which the rotor rotates.
If the rotor rotates approximately to 1750, we select the range:
"Between 1200 and 2000 RPM"

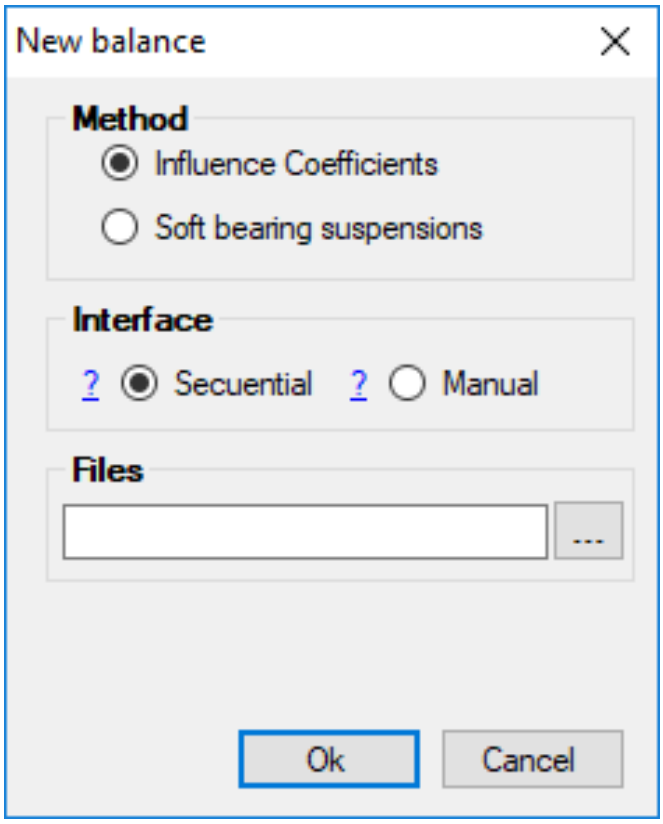
If the rotor rotates approximately to 1200, write in the box "Min 800" and in the box "Max 1600"

Interval:
It is the time with which the signal window is renewed in real time. A change here does not affect the rolling.

Recording:
If the speed of rotation is below 600 RPM, select:
12 seconds or more

If the speed of rotation is above 600 RPM, select:
6 seconds.

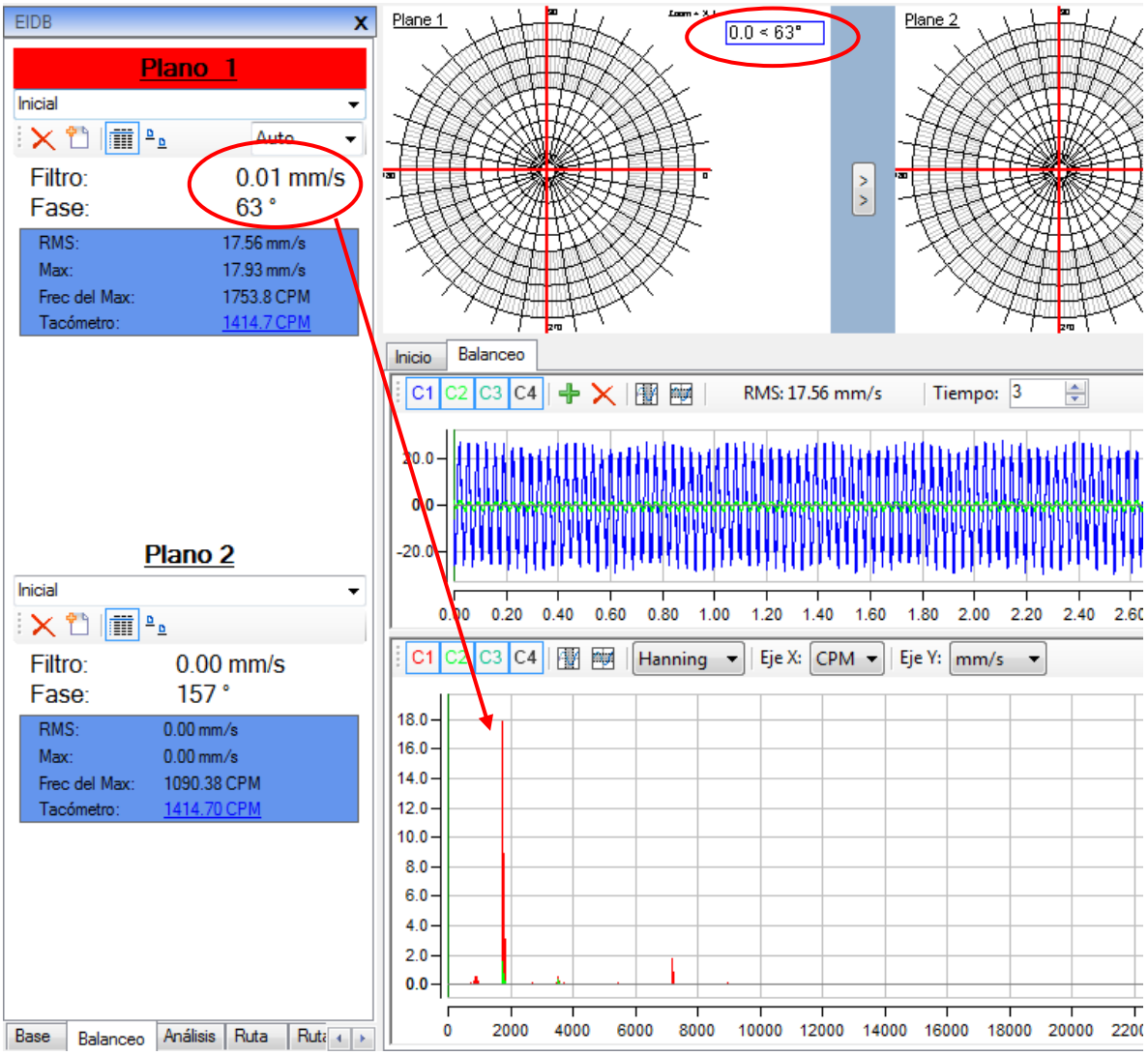
Select the "Influence Coefficients" method.
With this method it is necessary to place test weights.



USING THE BALANCING FILTER FEATURE

If the rotor we are going to balance rotates at 1750 RPM and the selected range is 600 to 1200 RPM, the vibration value will appear almost 0 and the balancing cannot be performed because the optical sensor and the unbalanced vibration will not be synchronized.

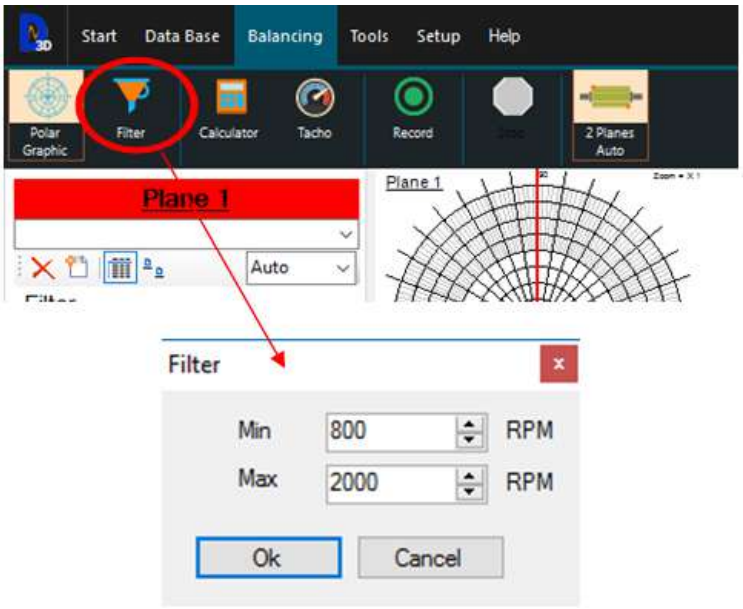
If we continue with that range the following will happen:



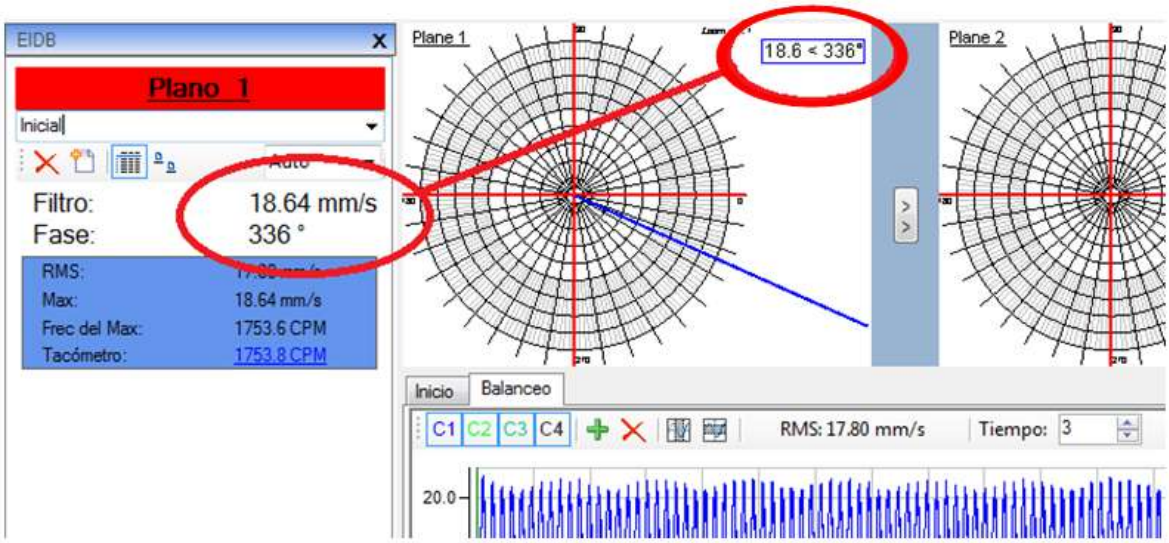
We will see a vibration of 0.01 mm / s when the RMS value is close to 18 mm / s. The **Maximum Frequency** is 1753.8 CPM, which indicates that there is a vibration peak at a higher frequency than the range we chose from 1200 to 1500 RPM.

Another fact to take into account is the graphic of the Spectrum in Frequency or FFT. It is the graph of "Red Peaks" that is below the blue graph (signal in time). We can see an important peak of 18 mm / s about 2000 CPM. This gives us an idea that that frequency can be the frequency of unbalance.
Therefore, if you are not sure of the rotor speed or if you get much lower than expected vibration values, it is best to take a wide range, such as 800 to 2000 RPM.

For that we click on Filter and we modify the value of the Min and Max:



Once the Filter is set, the filter value is now the value of the unbalance vibration:



Now, the values on the left correspond perfectly to those on the right.
This will be our initial run.

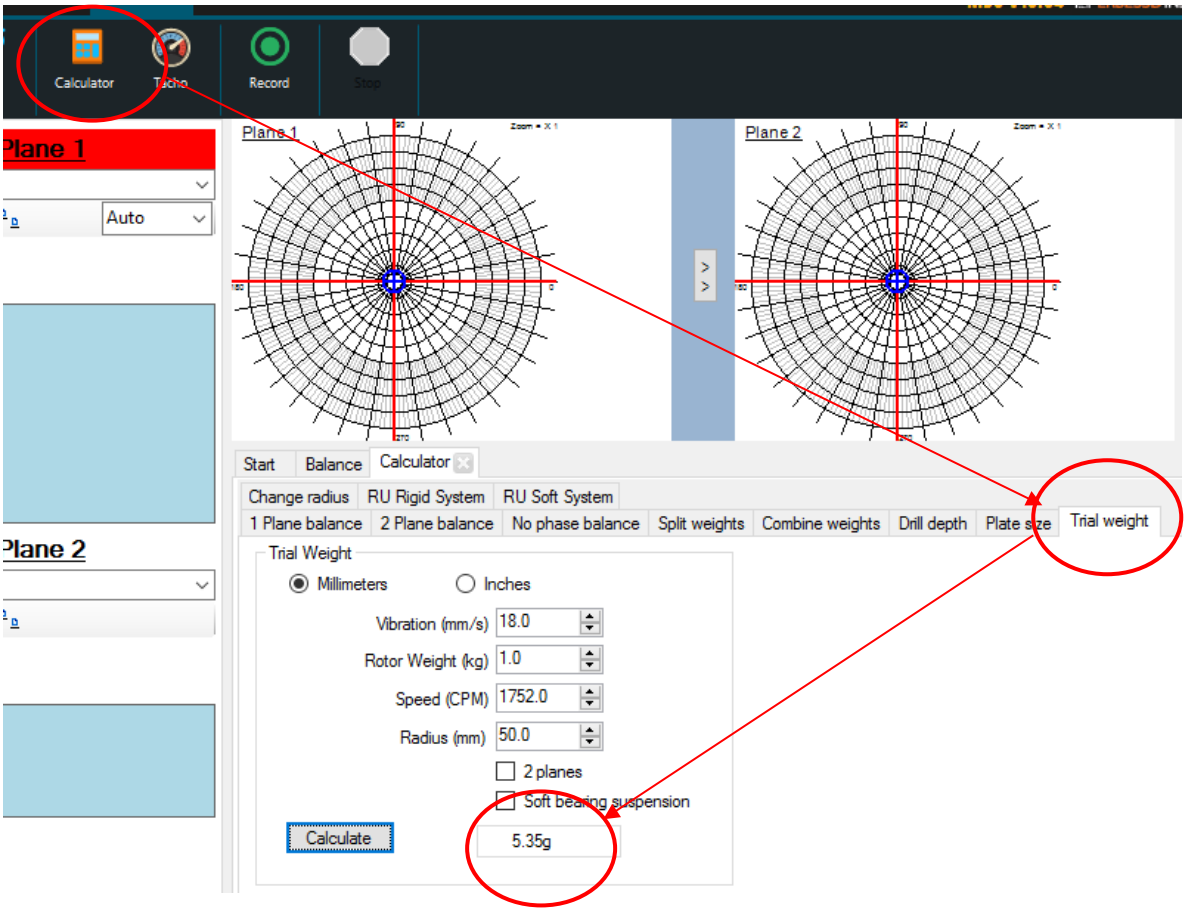
STEP 4: TEST WEIGHT

We put a test weight as the type of ear:

How to know which test weight to use?
We use the Balancing Calculator on the **"Test Weight"** tab**.**

This formula gives us a test weight value with which we will get a significant change in vibration and angle at the next test run so that we can calculate the proper position and weight to decrease vibration quickly.

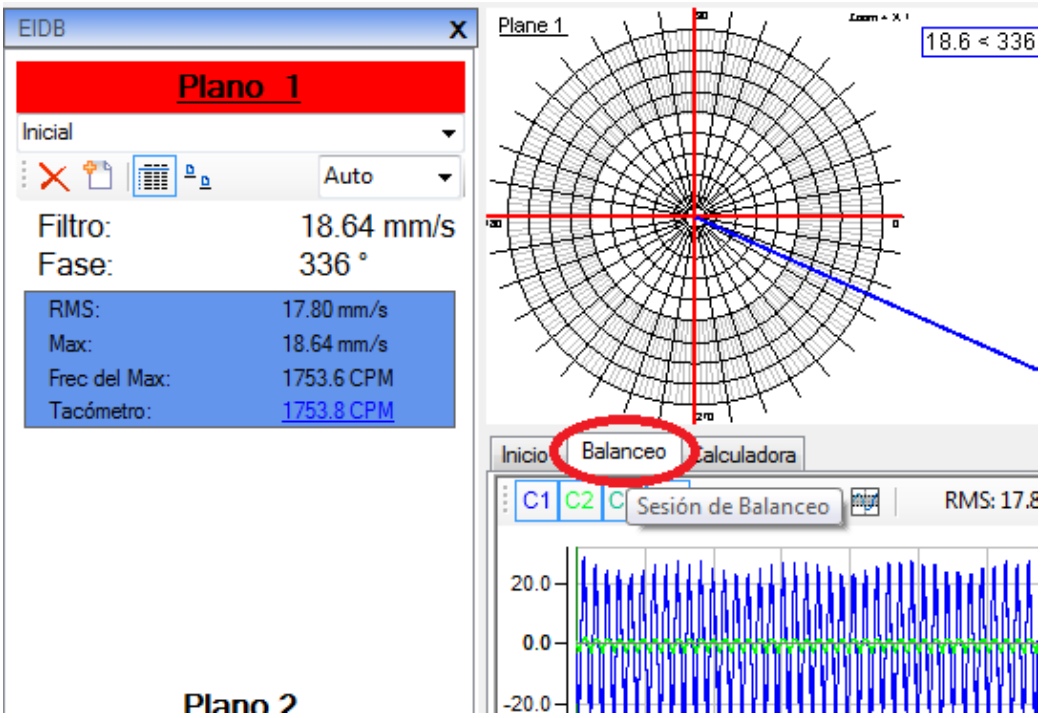
For this example, the balanced rotor is small, so the test weight is small: 5 grams.



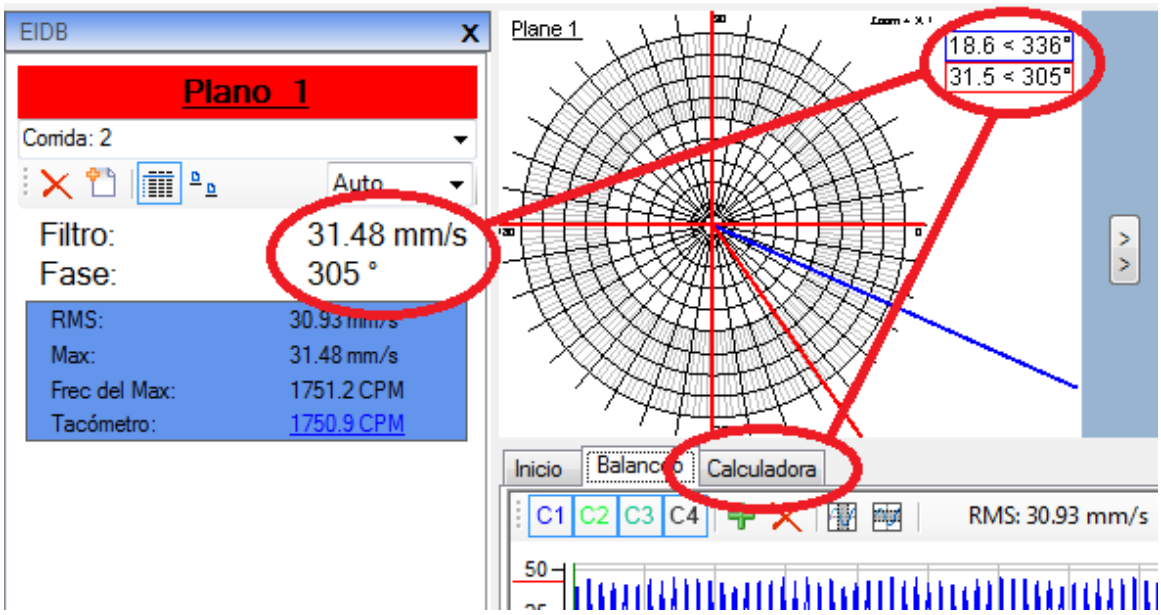
This weight is put anywhere. In this case at 90º of the mark that represents the 0º. But it can also be set to 0º. The practice will improve the technique.

IMPORTANT: According to the geometry of the rotor, the weights can be placed wherever or only in certain positions or angles that should be determined with some precision. For example if the rotor has 4 blades, we will only have 4 positions at 90º of separation, while if it has 12 blades, we will have 12 positions at 30º of separation between each blades.

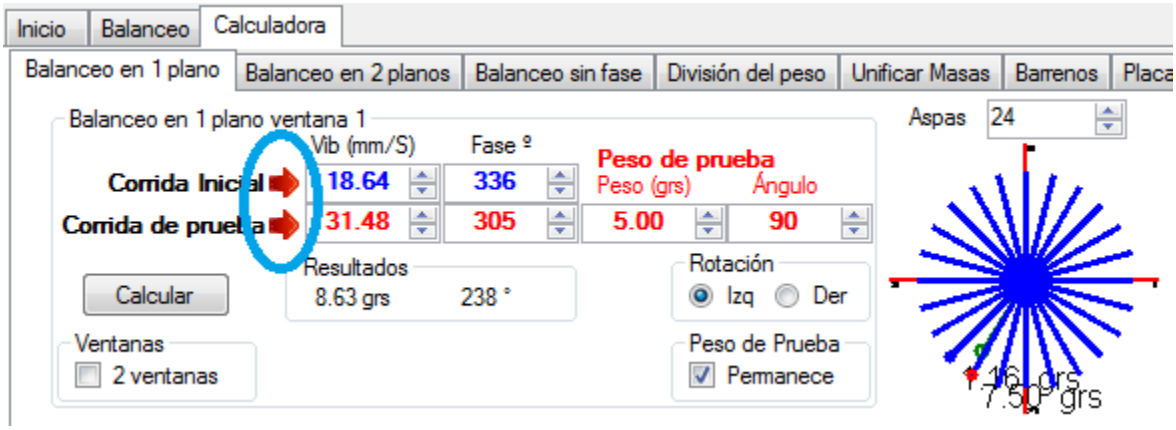
We returned to the **Balancing Session**, started the rotor again with the 1st test weight and recorded:



The resulting vibration increased and the angle changed. Sometimes the vibration will go down and the angle will change or not, but that will give us something to calculate the new position.

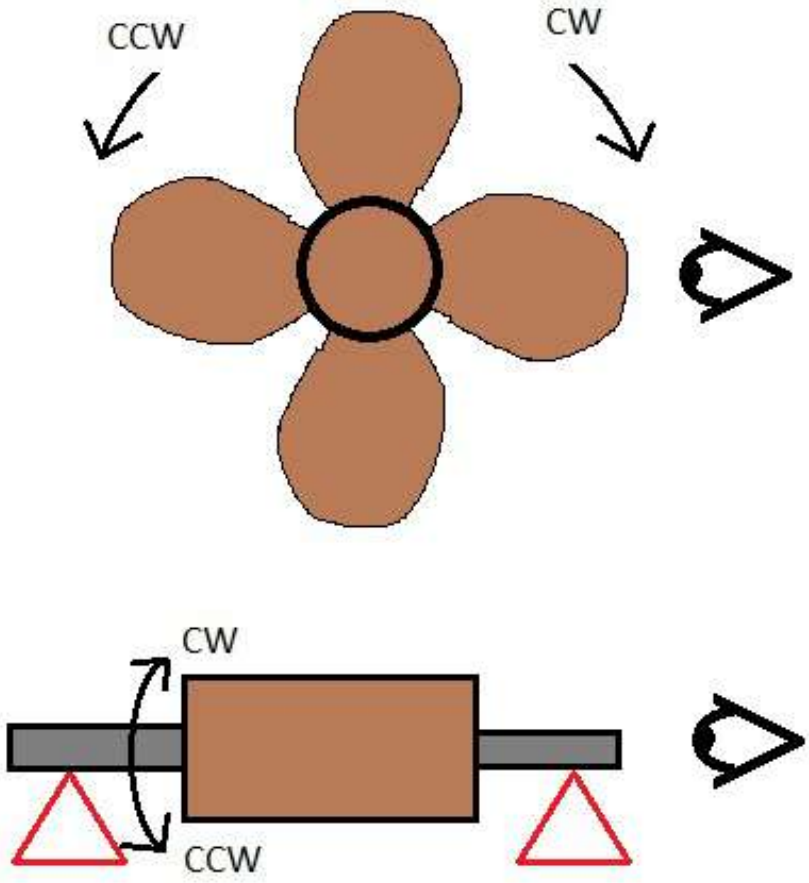


We go to the Balancing Calculator and select the "Balancing in 1 plane" tab.
In **First Run** we click on the red arrow and select the one that is our initial race.
In the **Test Run** we select the run with the test weight.



We select:

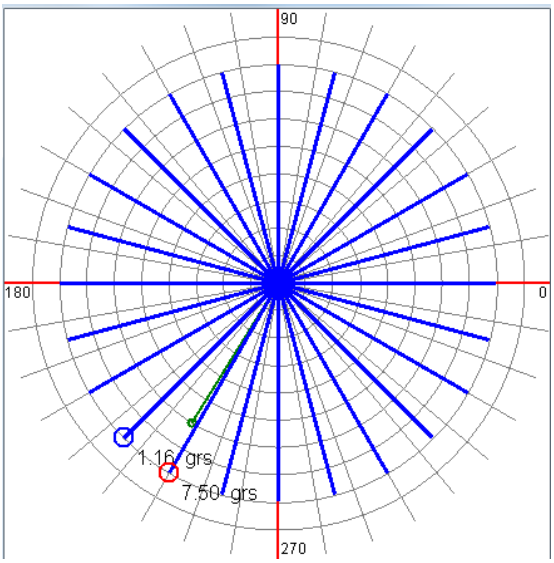
- Test weight (in this example it is 5 grams)
- Angle to which the test weight was placed with respect to the mark (in example 90 degrees)
- Rotate **Left (counterclockwise)** or Right (clockwise)
- - If the weight remains or not (in this example **SI** remains)
- - Number of blades (example 24)



Clicking on the diagram of the blades enlarges the graph to better visualize the position of the new correction weight:

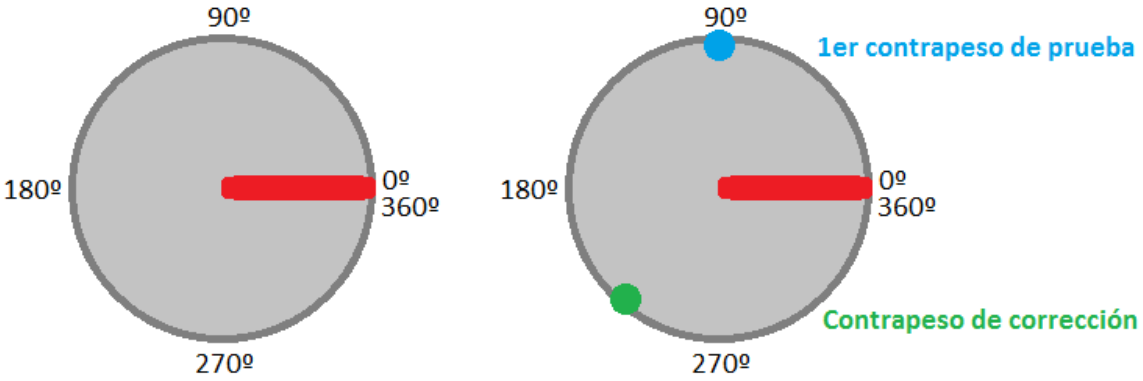
This diagram tells us that we require:
- 1.16 grams in a blade at 225º (15 blades in the opposite direction To the hands of the clock)
- 7.50 grams in which follows 240º (16 blades in direction Counterclockwise)

That is, 8.63 grams at 238 degrees
Mark that represents our 0º



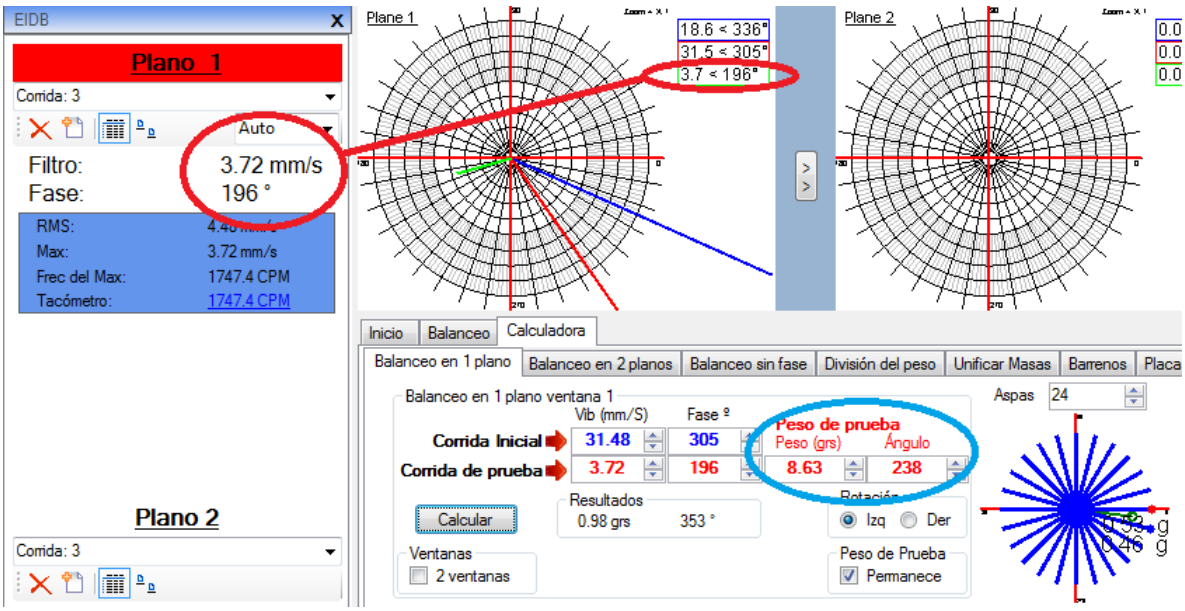
IMPORTANT: Correction angles indicated by the calculator should always be taken counterclockwise.

To facilitate the placement of the counterweights, we put the rotor with the mark of the optician in a horizontal position to the right:



IMPORTANT: In this example, the first test weight was placed at 90 °, but even if we had placed it at another angle (such as 0 ° or 300 °), the correction angle indicated by the calculator would be the same 238 °.

We put the new counterweight and start the engine again.

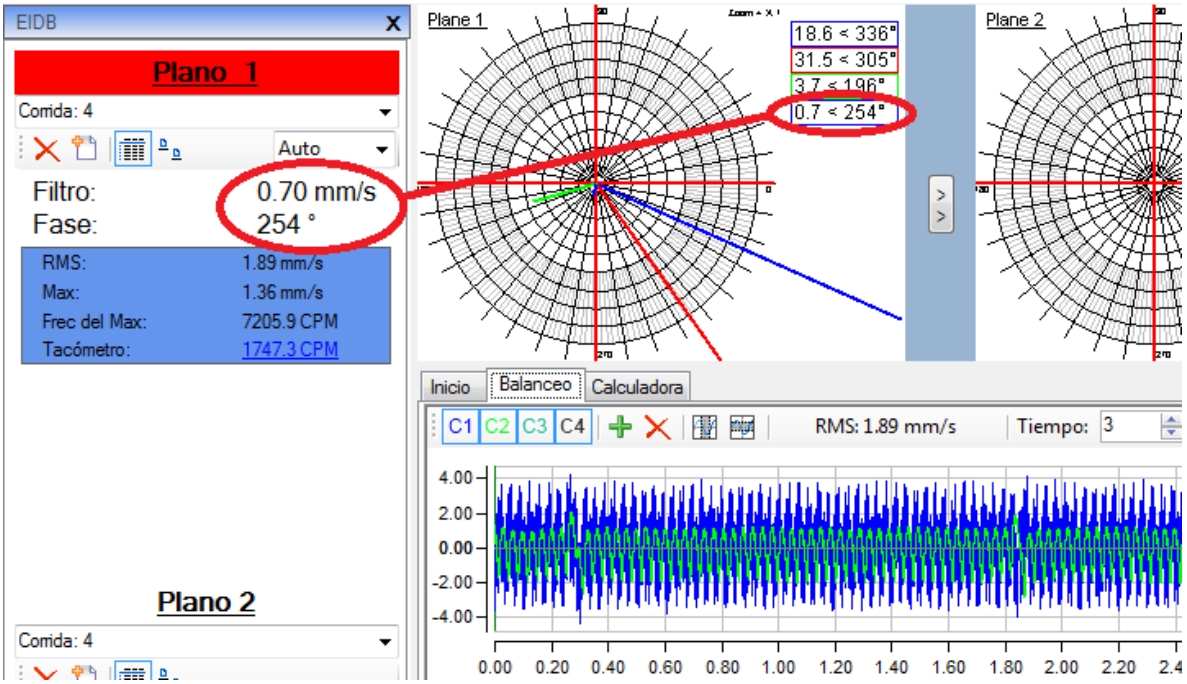


We get a significant decrease in vibration, which still requires a small tune to get better.

IMPORTANT: At the beginning when you are gaining experience in rolling, the vibration may not fall very significantly in the first correction due to the counterweight:
- It was not placed at the correct angle and / or
- It was placed on a different radio and / or
- It was not the exact weight.

- In the calculator we introduce the new values:
- The initial run will be the 2nd because we decided that the weight remained. If we had decided that the weight would NOT remain, the initial run would have been the first run.
- Now the test run is the 3rd we just completed.
- Now the test weight is the weight we place at the angle indicated in the previous calculation.

Now we place the new test weight (0.98 grams to 353º) that will remain and start the engine again to make a new measurement.

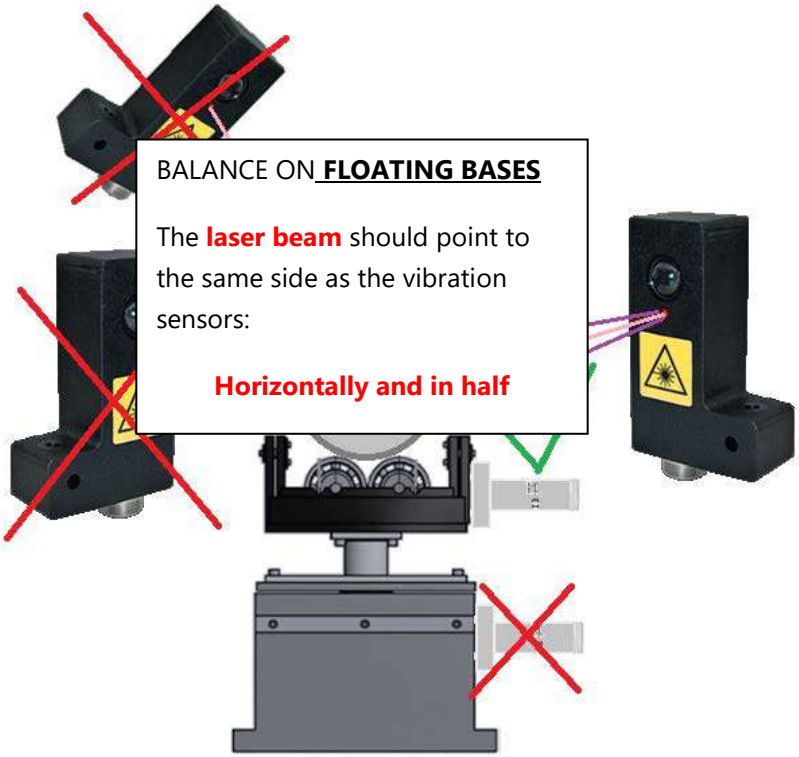


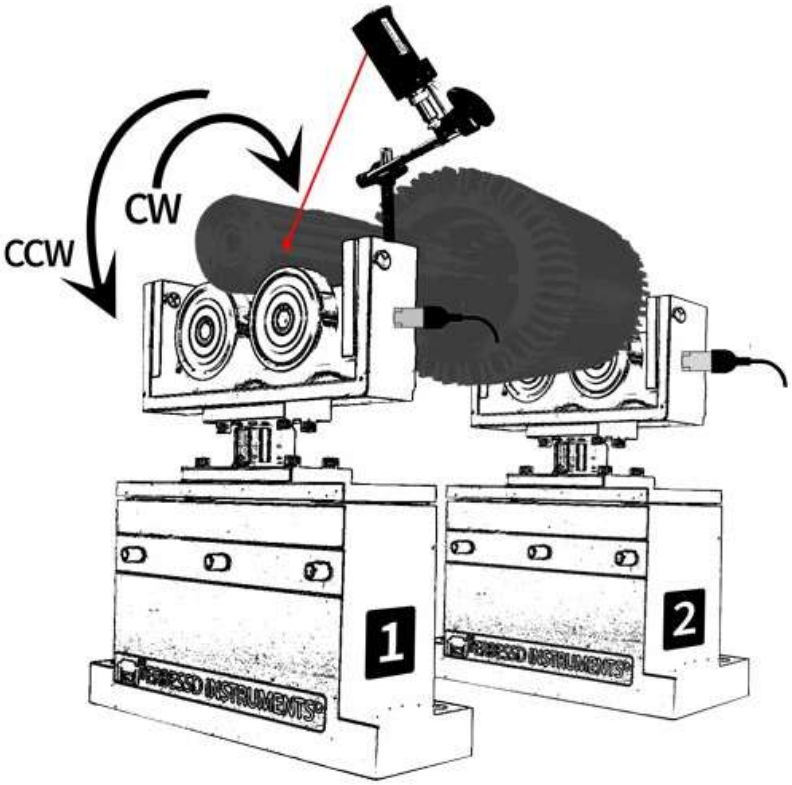
This new vibration value is very good, so we consider the finished balancing.
However, an acceptable final vibration value will depend on the rotor being balanced (fans, motors, compressors, crankshafts, etc.) as well as the initial value of the vibration. On the other hand, there are always vibrations that are added that are not due to imbalance, such as de-alignment, mechanical looseness, damaged bearings, loose bases, so it is always recommended to check these aspects before and / or after Balancing.
For the rolling in 2 planes in rigid systems, the same method is used, but adding a plane:

- 1st run to measure the vibration of the 2 planes
- 2nd run with a test weight ONLY on plane 1
- 3rd run with a test weight ONLY in plane 2 (weight had to be removed from plane 1)
- Use the balancing calculator with the function "Balancing in 2 planes"

Soft Bearing Suspension Balancing Guidance

STEP 1: POSITION THE SENSORS





IMPORTANTE:
Select the mode in which you will measure
The angles to place the counterweights.

Point the laser at any part of the axis or at
One side of the rotor on which the
Reflective mark.

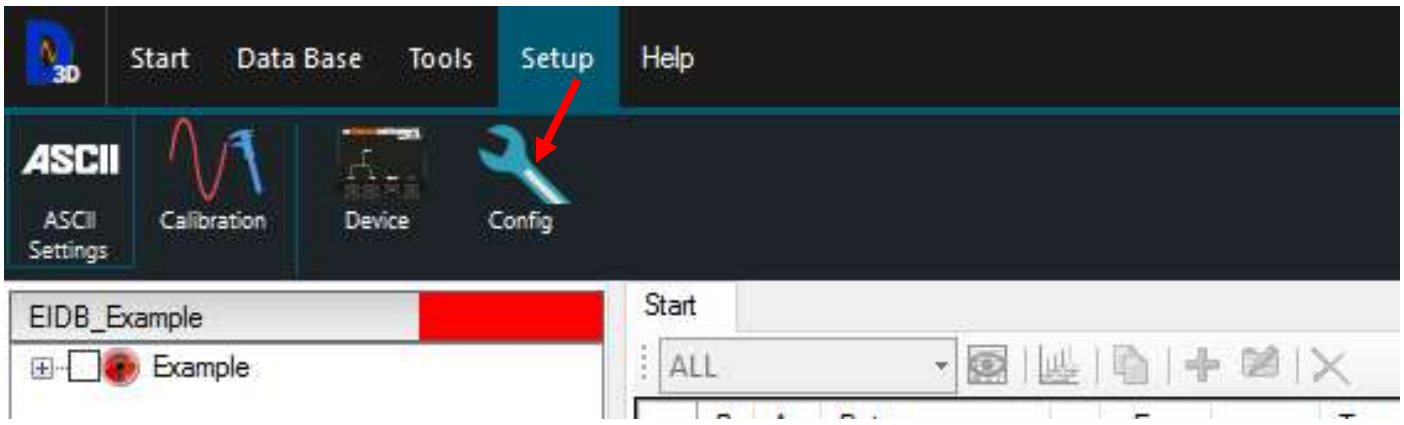
Sensors should not be moved
Until the roll is not finished.

Never place the sensors in the direction
axial.

In the models of balancers that already
Integrate the sensors, locate their position to
Correctly position the Laser sensor.

The **RED mark** represents 0 ° from which
The angles will be measured**.**

STEP 2: CONFIGURE DIGIVIBEMX

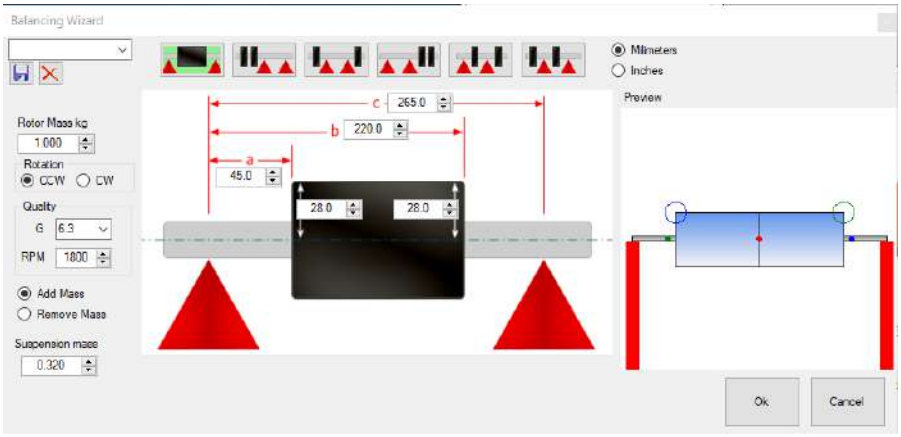


Open the **"Balancing Wizard"** window and:

- select the type of installation (centering, side, cantilever, etc.)
- select whether the measurements are in mm or inches (in)
- write the measures that are requested in the schematic drawing
- select whether to balance in 1 plane or 2
- write the mass of the rotor in kg
- select the rotation seen from plane 1
- select the degree of quality you want
- select the nominal working speed of the rotor
- select whether to add or remove correction mass for the roll
- write the weight of the floating bases according to the following table

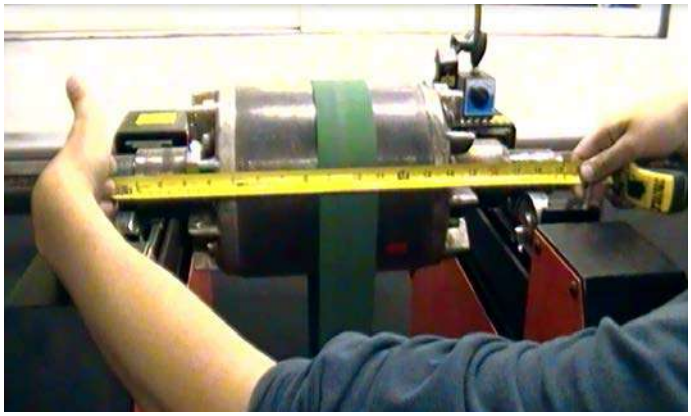
Tipo de SBS	EI-30	EI-300	EI-1000	EI-2000	EI-4500	EI-6000	EI-15T
Masa Unit.	0.25 kg	7 kg	15 kg	15kg	30 kg	60 kg	150 kg

Rotor Configuration Window



IMPORTANT:

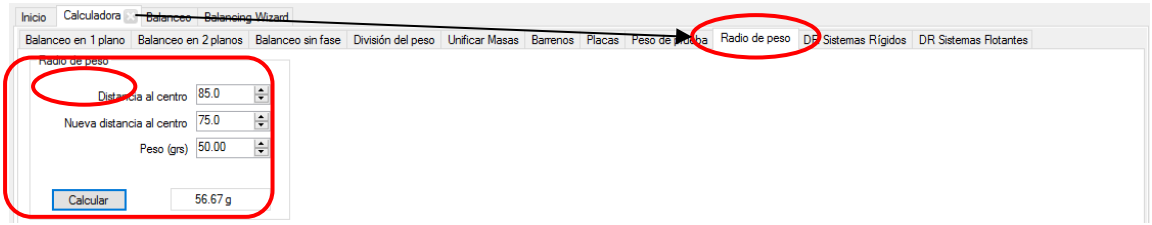
The distance to the faces of the rotor is the distance to which the correction weights will be placed.



IMPORTANT:

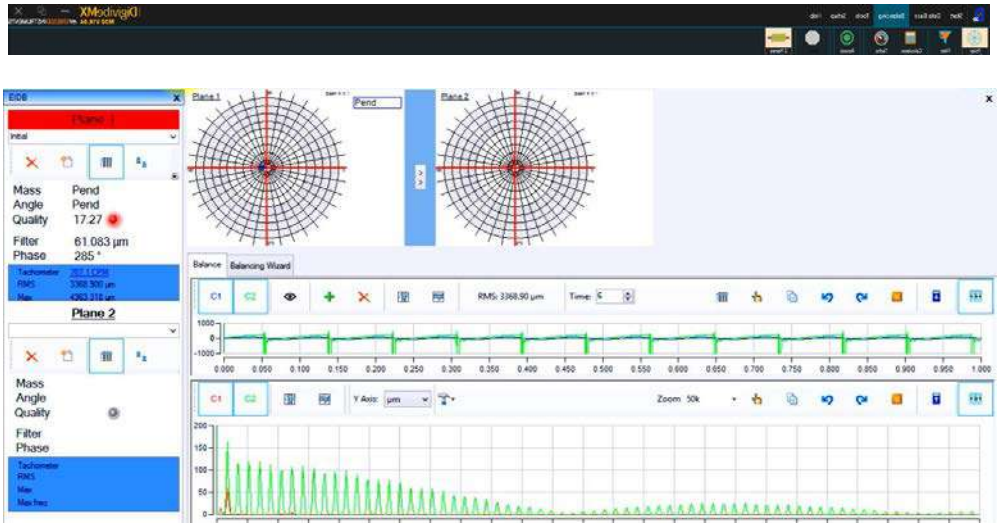
The radius of the rotor is the distance to the center from where the correction weights will be placed.

If at the end, the final counterweights have to change radius because they can not stay where the test weights were placed, then the calculated:



STEP 3: INITIAL RUN

Once the rotor is configured and there are no loose or trapped parts with the belt, start the engine and record the vibration of Plane 1 in red in the program by selecting Port 1-A on the interface (blue light on the side left). If you use the 4-channel interface, the 2 planes will be recorded simultaneously.



IMPORTANT: In balancing wizard, there must always be the same number of measurements in Plane 1 and Plane 2, since each measurement will be used to calculate the weights.

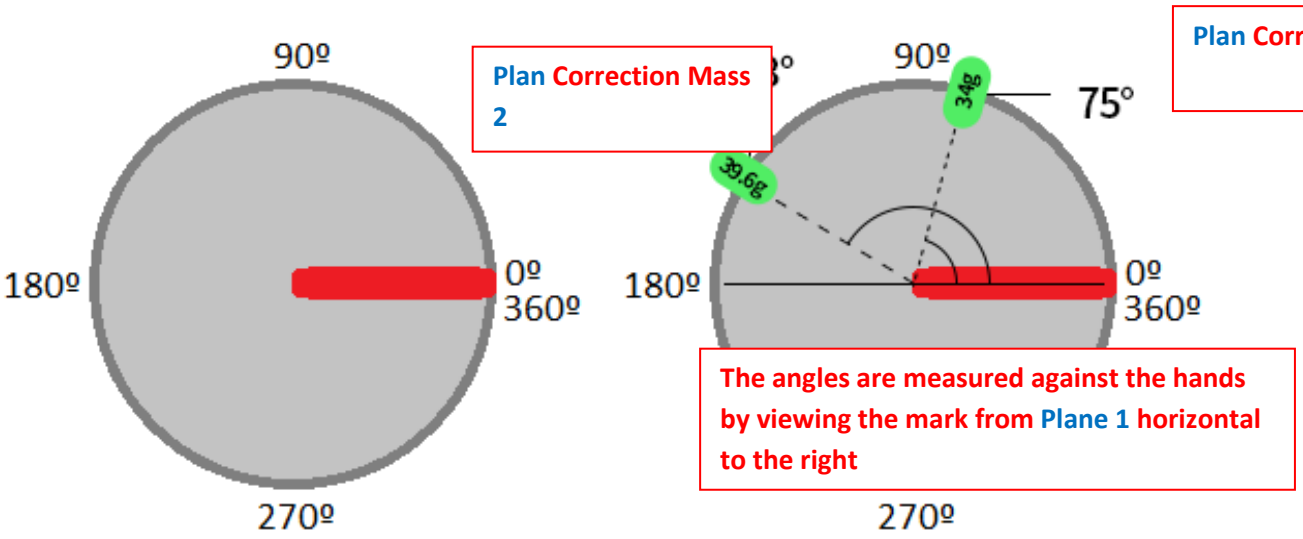
If any of the 2 measurements were forgotten or the 2 was not changed for the second measurement during the same run (for example 3 measurements in plane 1 and only one measurement in plane 2) then it is better to delete the measurements In order to have 1 measurement in each plane with the button .

Once the plane 1 has been recorded, select Plane 2 in the left column of the software and press the interface button to switch to Port 1-B (blue light on the right side):

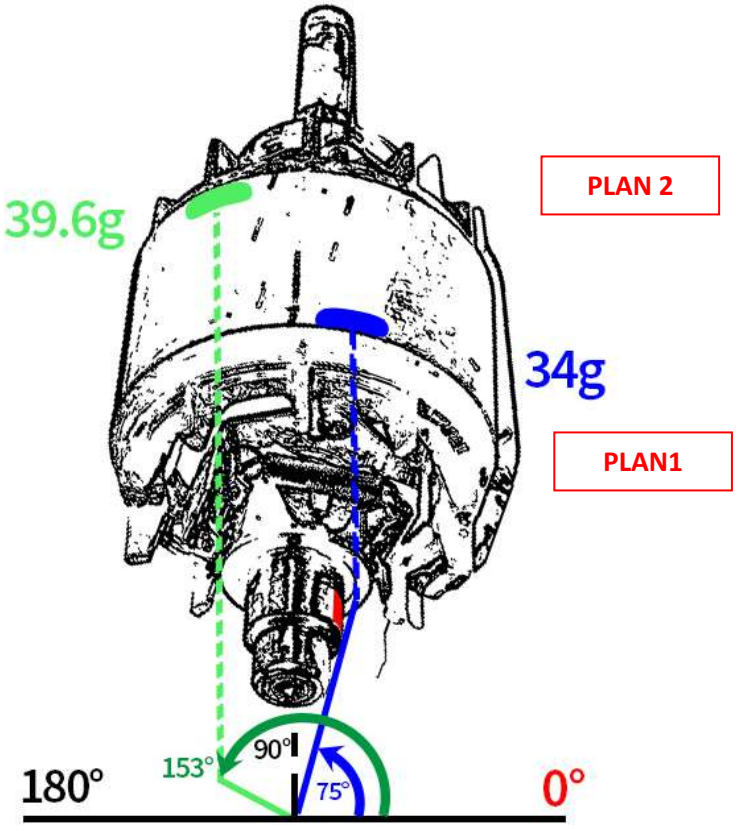
- In the left column (or to the right of each polar) you will see the data of the correction masses:
- in Plane 1 requires adding 34 gr to 75º
- in Plan 2 requires adding 39.6 gr to 153º

VERY IMPORTANT: The angles shown should ALWAYS be measured counterclockwise (CCW) viewed from PLAN 1 because we have defined it from the beginning.

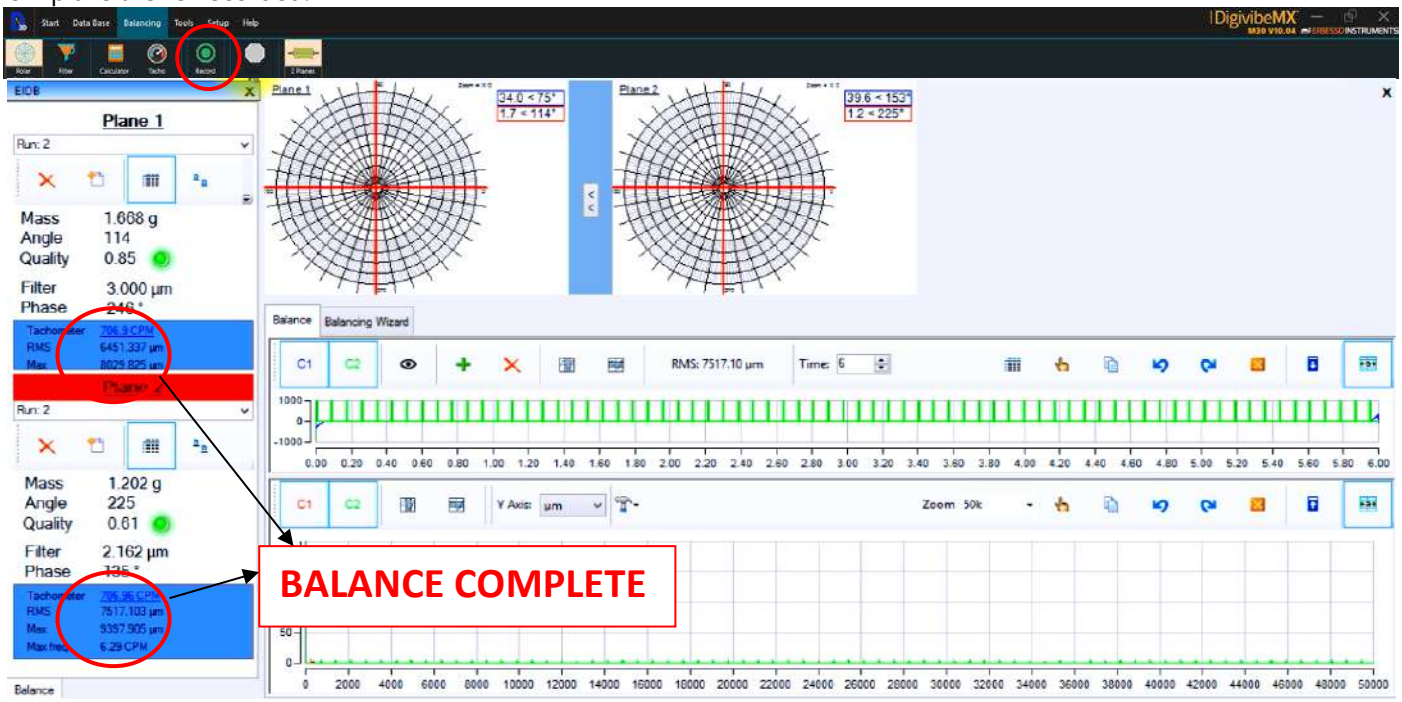
To facilitate positioning of the correction masses, place the optical mark horizontally to the right:



Final position of the correction masses:



Once the weights have been placed, the machine is started again and the vibration of the 2 planes is measured again. If the selected quality rating has already been reached (green dot), the rolling will be considered finished, otherwise new weights and angles will be proposed to further reduce the vibration.
The 2 plans are re-recorded:



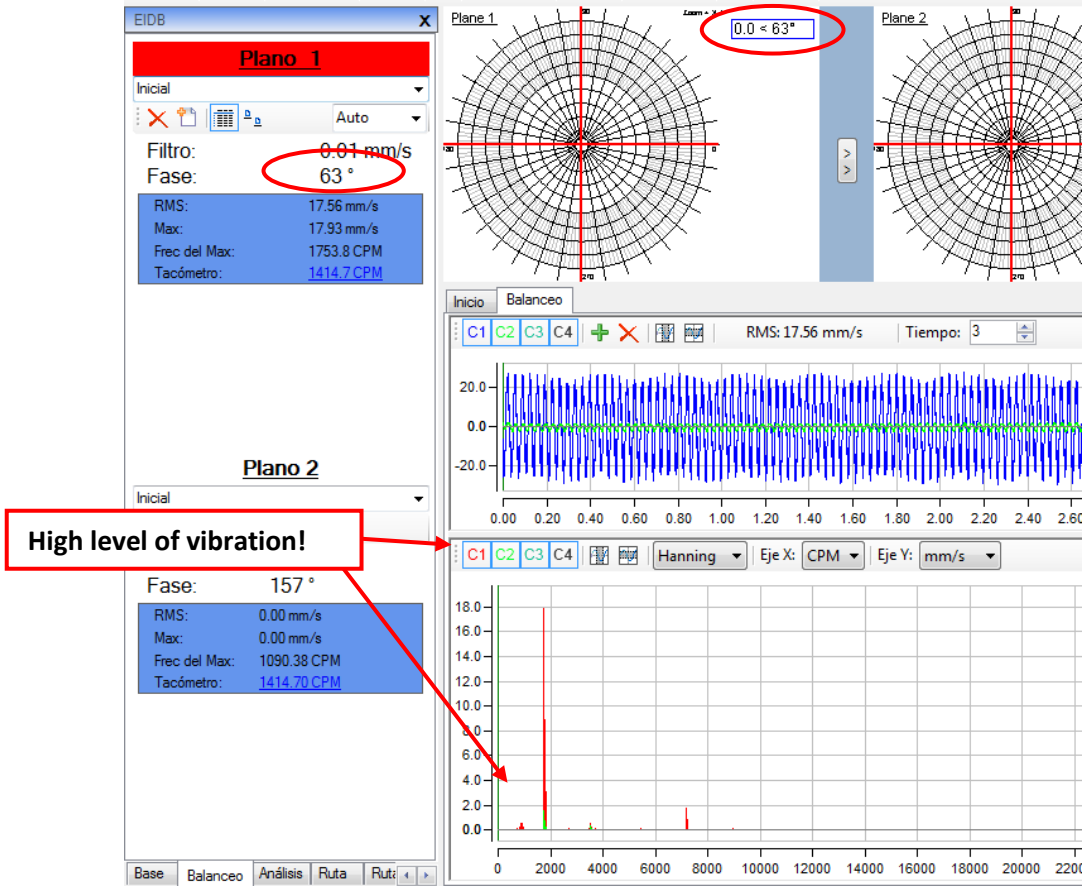
IMPORTANT: Especially with the first rollers, it is possible that the vibration does not decrease rapidly with the 1st correction weight. This is because the correction masses:
- were not placed at the appropriate angle and / or
- they were placed on a different radius and / or
- the correct weight was not placed.

An acceptable vibration value will always depend on the type of rotor to be balanced (fans, electric motor rotors, compressors, crankshafts, etc.) as well as the manufacturer's specifications.

It is common that once the rotors are balanced and reassembled again, these vibrate. In these cases, other causes of vibration have to be checked, such as de-alignment, play, electrical noise, damaged bearings, among others, which must be repaired in order to ensure optimal operation of the machine.

NOTE: USING THE BALANCING FILTER FEATURE

The machine is turned on.
If the selected filter is 600 to 1200 RPM and the rotation speed is out of range, for example 1750 RPM, the vibration value will be close to 0 because the accelerometer signal will not synchronize with the tachometer signal.

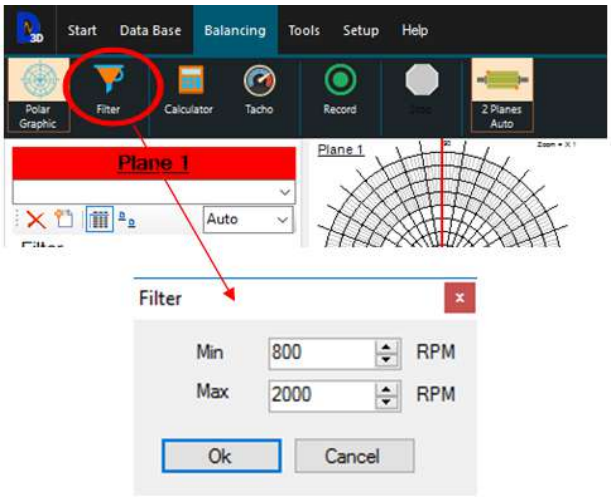


The vibration is 0.01 mm / s and the RMS value is 17.56 mm / s.
The **Max Freq** is 1753.8 CPM. This information indicates that there is a peak at a frequency greater than the filter range we initially selected from 600 to 1200 RPM.

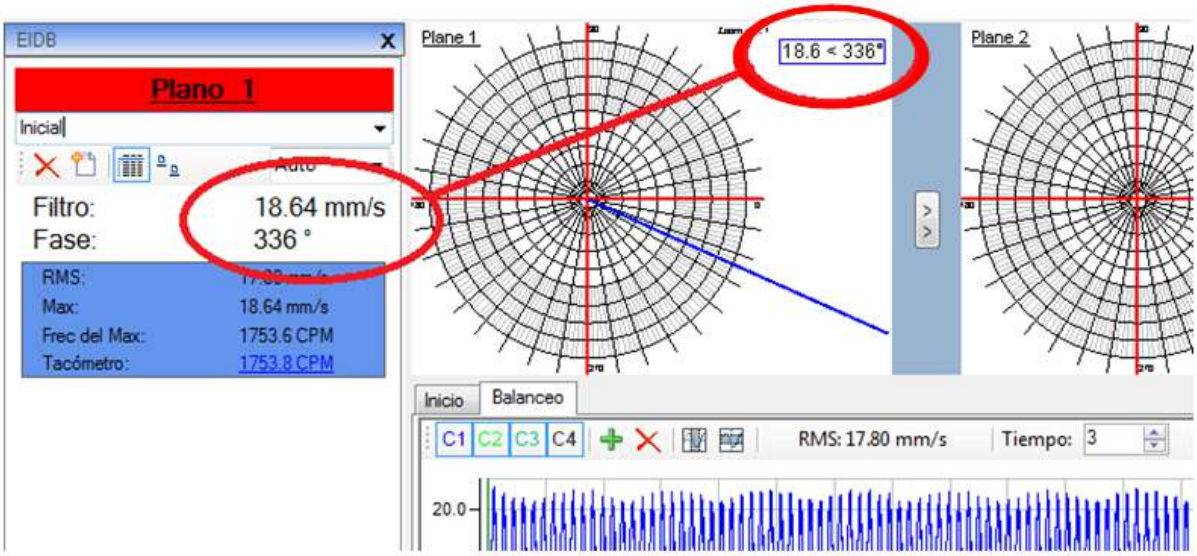
Another factor to take into account is the FFT frequency spectrum (bottom window) with the red peaks. There is a large amplitude peak 18 mm / s very close to 2000 CPM, which is with great certainty the speed of rotation.

If you are not sure of the rotation speed or if very low vibration levels appear when it is clear that you are unbalanced, then select a larger filter range, such as from 800 to 2000 RPM or select **"No filter"** by typing **Min = 0** And **Max = 0**.

Click on the Filter icon to change the values:



Without restarting the motor, you will see that the values are modified and the true values of vibration appear at that speed of rotation:



Now the values on the right correspond to those on the left!
Now you can continue the balance.

2-Plane Soft Bearing Suspension Balancing using Influence Coefficients

Fast guide

1. Open a new balance in Influence Coefficients.

2. With the sensors in place, increase the speed until the desired rocking speed is reached and record the vibration in Plane 1 and 2.

3. Place a test weight on Plane 1 at the 0 ° angle and record the vibration of the 2 planes.

4. Remove the counterweight from Plane 1 and place it on Plane 2 at 0 ° and record the 2 planes.

5. In the Calculator  use the formula "Balance in 2 planes", add with the red  arrows the corresponding runs, click on "Calculate" and place the indicated weights.

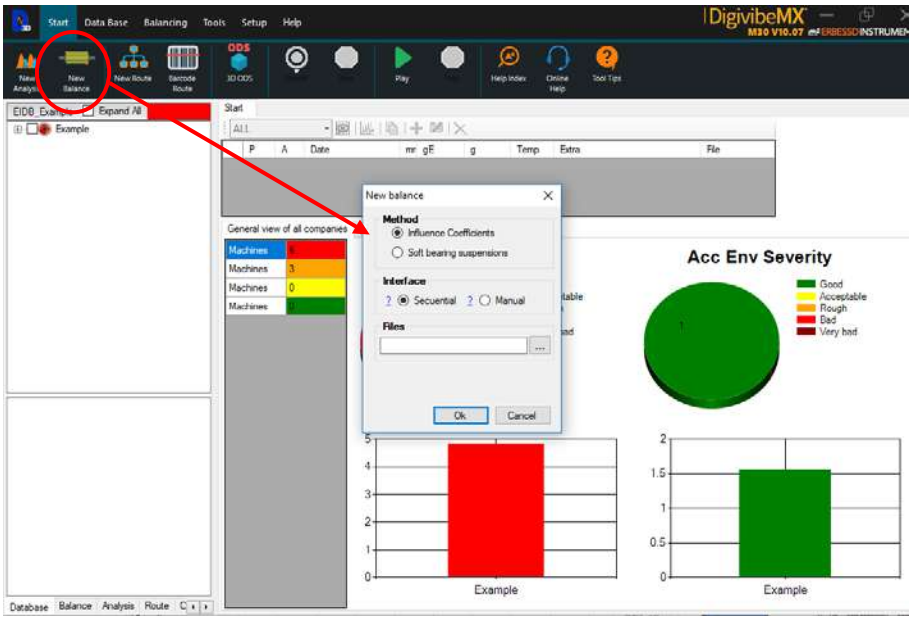
6. Record the 2 planes again.

7. To fine tune the balance, click on "Tuning" and select the last run to calculate the correction weights to be added in addition to the previous weights.

8. Record the vibration again on both planes and generate the swing report.

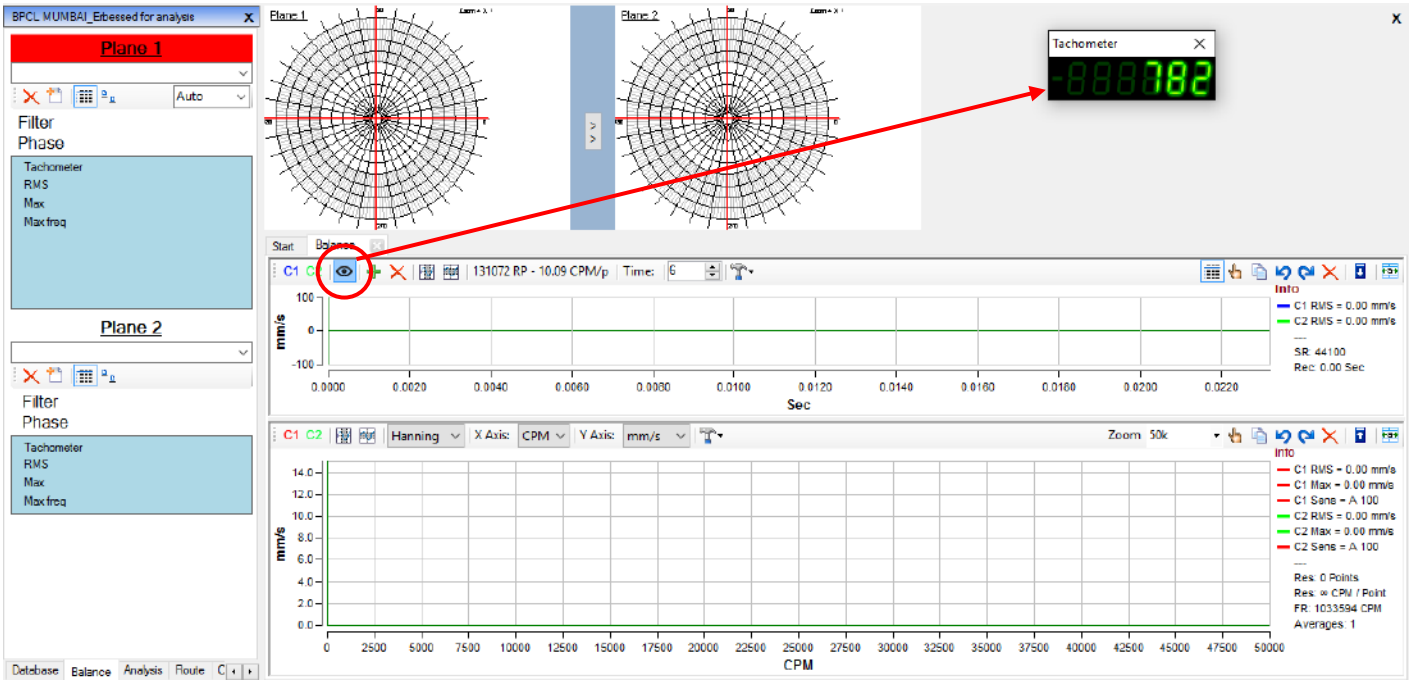
These steps are a reminder of the complete procedure for balancing 2 planes on floating bases using the Influence Coefficients (low rotation speed).

Open a new balancing with Influence Coefficients:



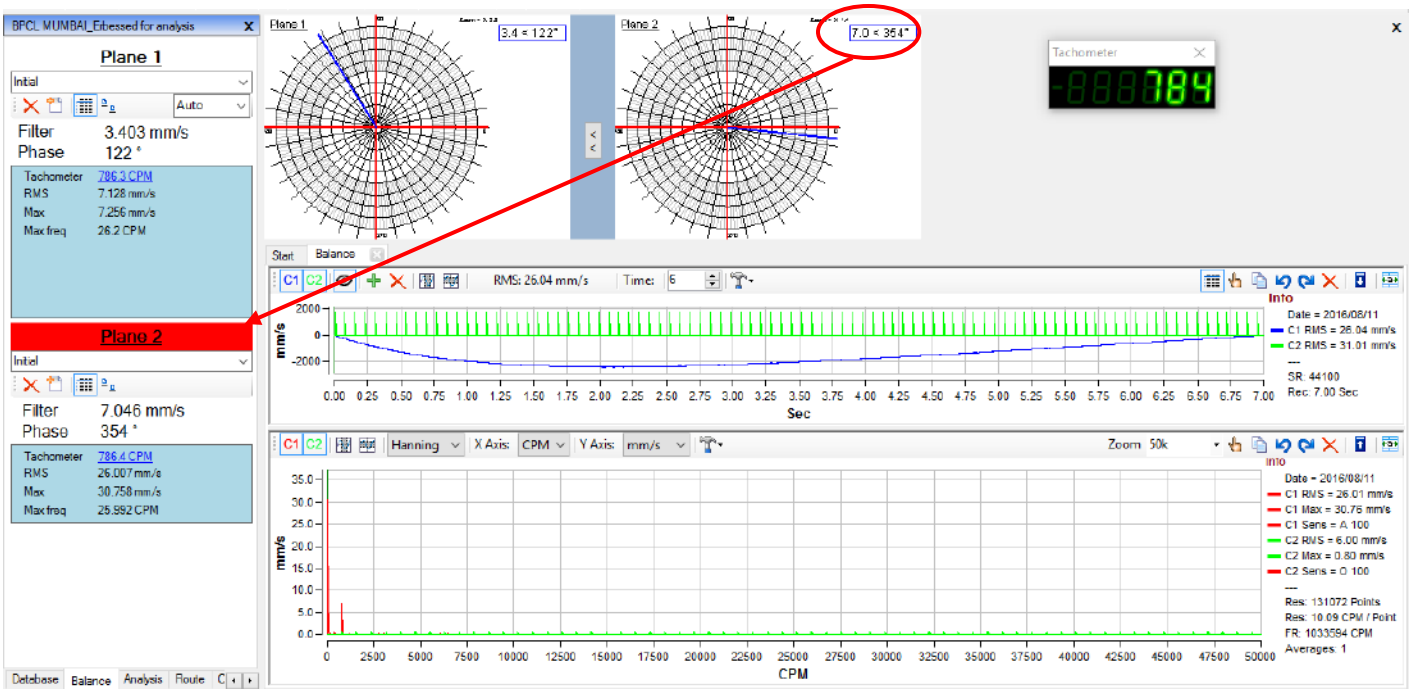
Use the tachometer to reach the desired speed.

IMPORTANT: The tachometer function with the "Eye" icon is only a reference that works best at speeds exceeding 300 RPM. If you want to know the exact speed, see tachometer value in the left column after recording a signal of at least 12 seconds.



Record the signal from Plane 1 (press the interface button to switch to plane 1-A):

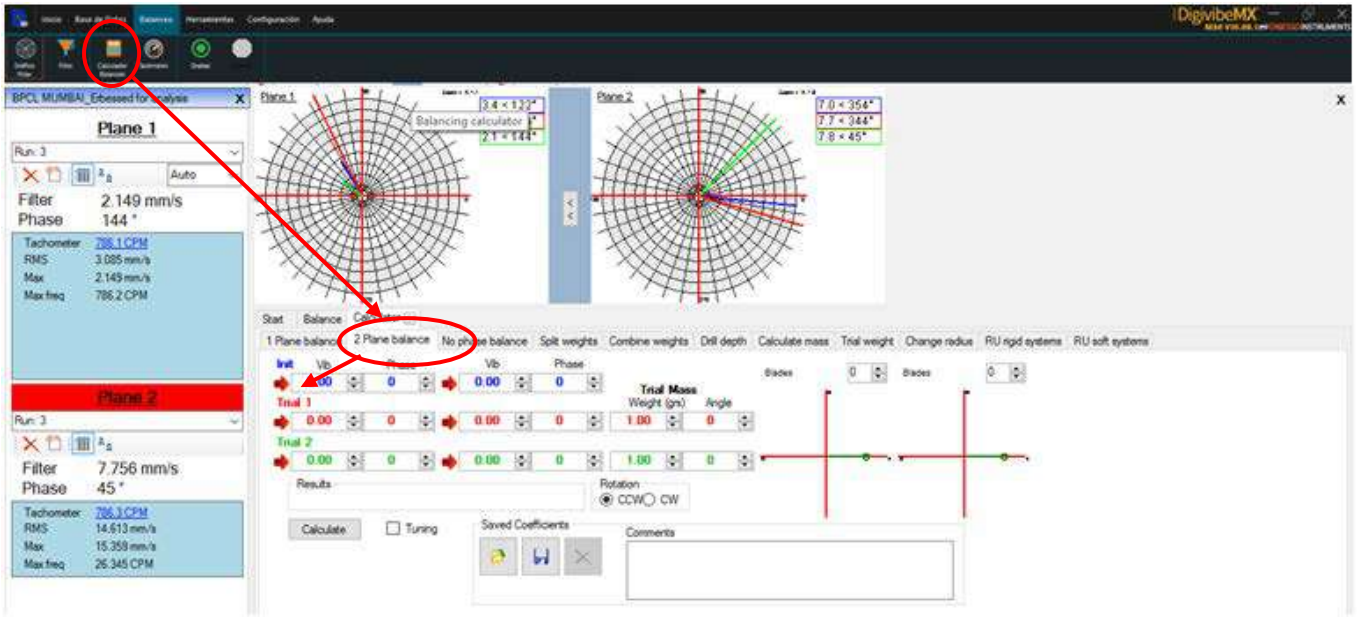
1st Run: Select the right graphic by clicking on it and record the signal from Plane 2 (press the interface button to switch to plane 1-B):



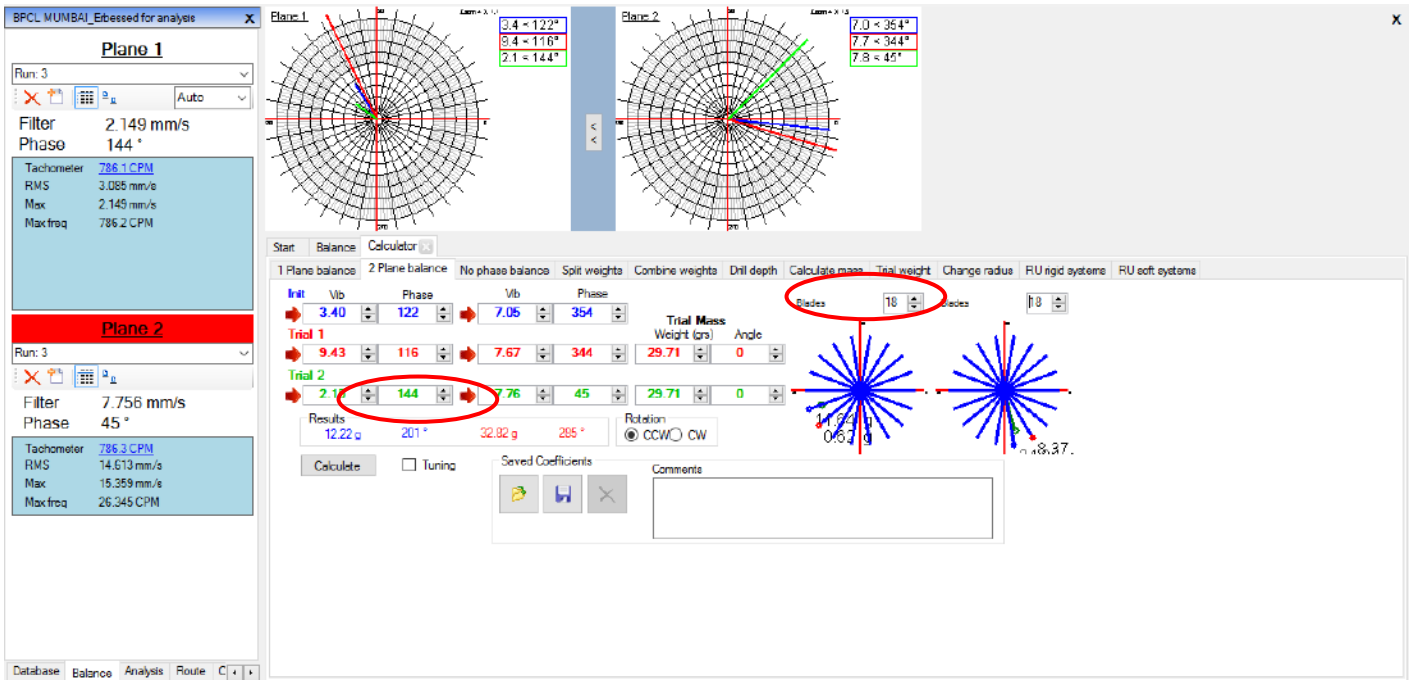
2nd Run: Place a counterweight on Plane 1 at 0 ° (if it can not be set at 0 °, then you have to point the angle with respect to plane 1 on the calculator) and record the vibration of the 2 planes:

3rd Run: Remove the counterweight from plane 1 and place it in plane 2 at 0 °. Record the vibration of the 2 planes:

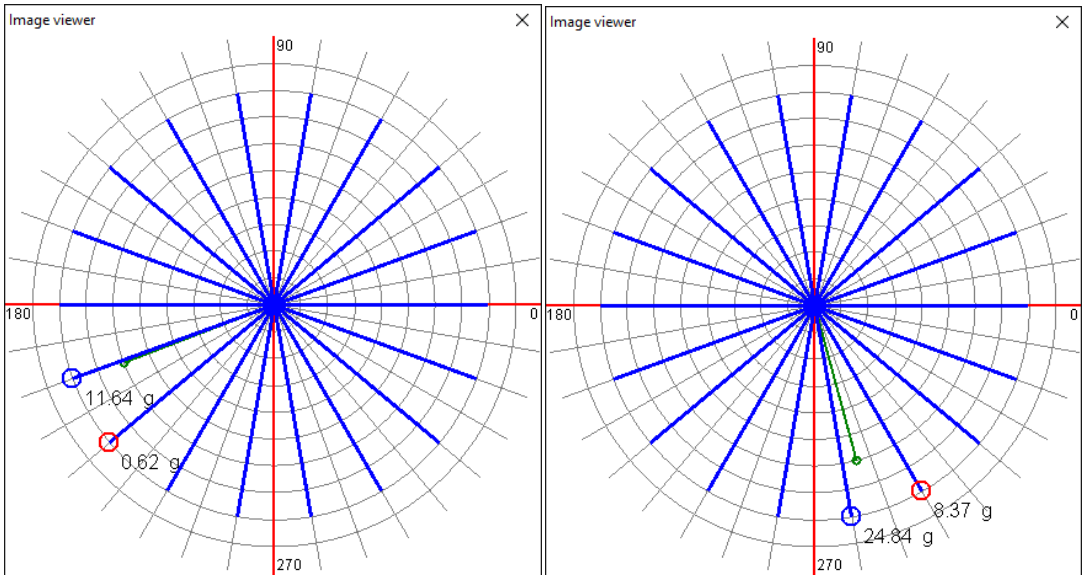
Open the Balance Calculator and select **"Balance in 2 planes"**. With the red arrows add the runs that correspond to the Initial, the 1st test and 2nd test:



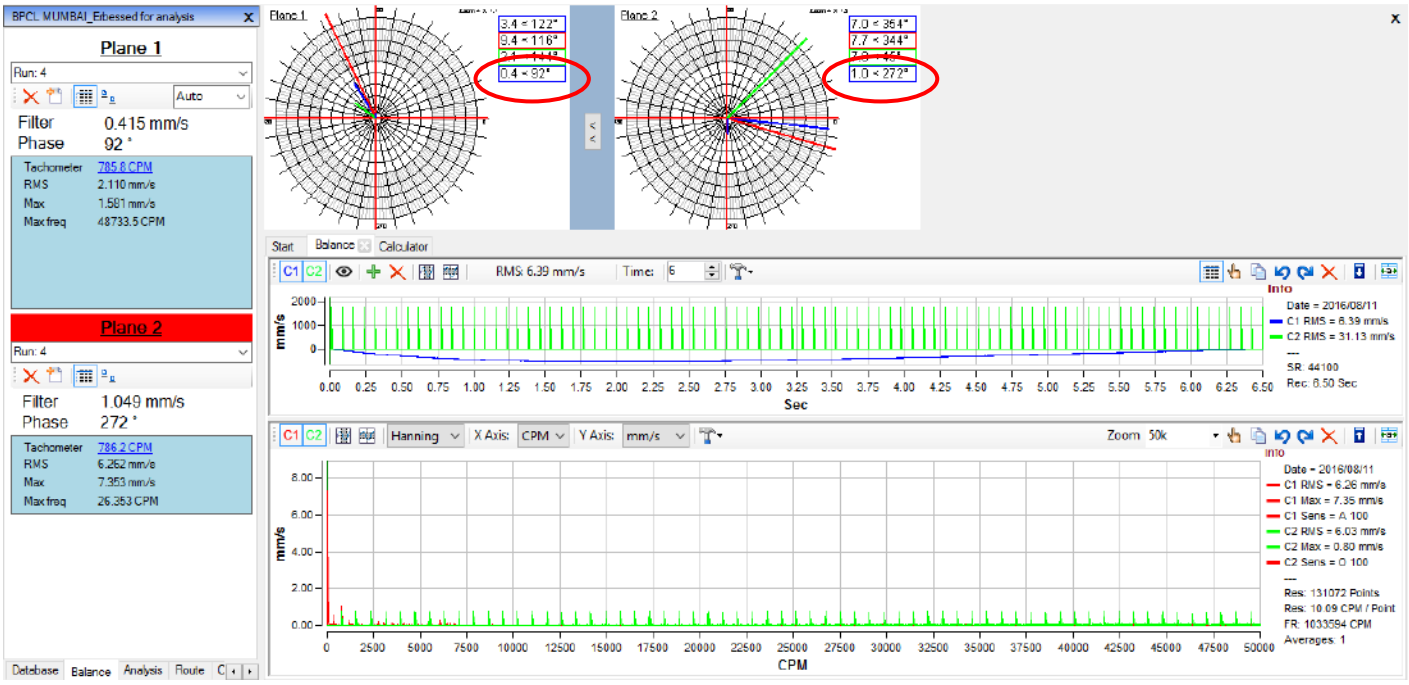
Click on "Calculate" and select the number of blades (these are the positions in which correction weights can be placed)



Click on the graphics of the blades to enlarge them and thus observe the distribution of the weights according to the final position of the weights by placing them on adjacent blades:

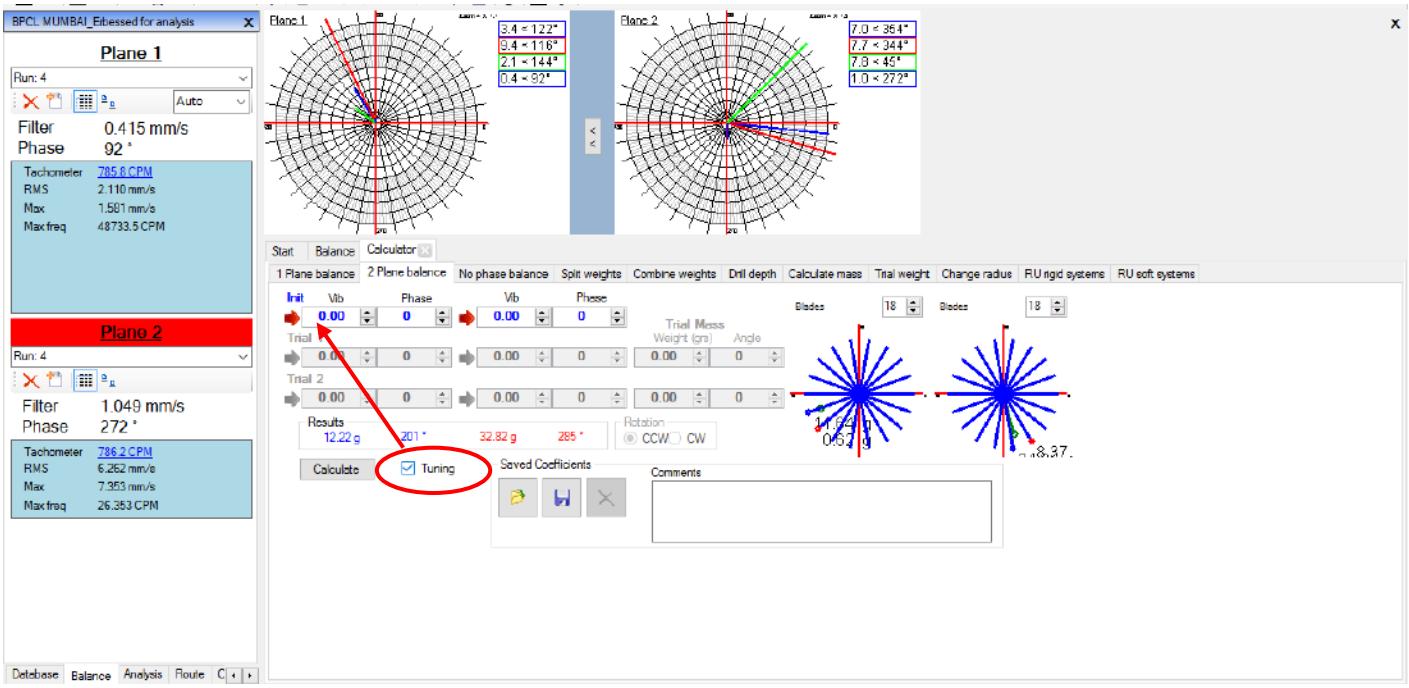


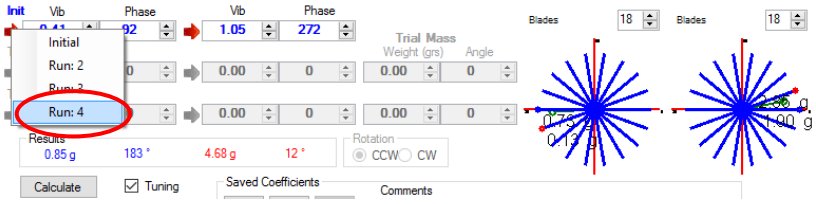
Record the 2 planes:



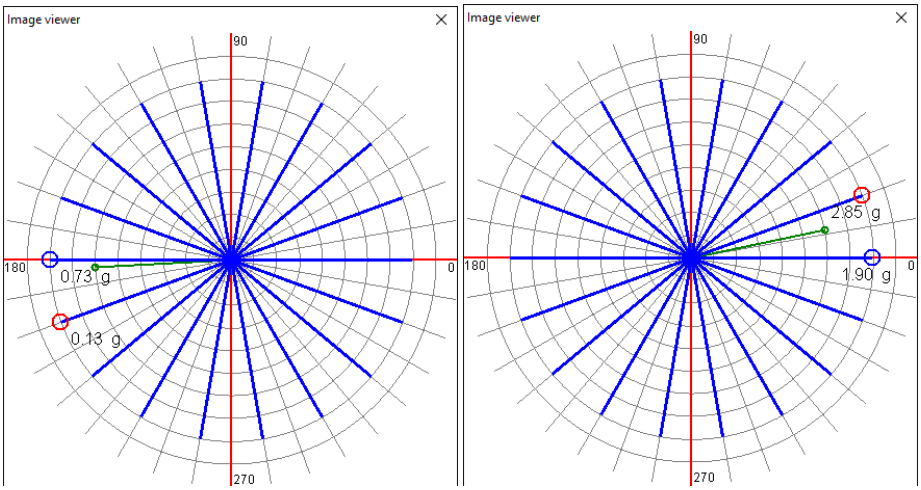
The vibration is reduced considerably but can be lowered even more simply with this last run. It is not necessary to repeat the process again.

Return to the Calculator and select "Tuning" and with the red arrow select the last run (4):





Place the new 2 counterweights (without removing the previous 2 correction weights):



5th and last Run: Record the 2 planes.

5th and last Run: Record the 2 The current vibration is already very low, so the swing is considered finished. Now the Balance Sheet Report is made.

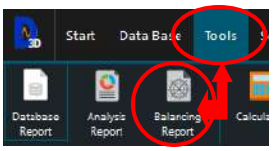
If the vibration is still high, repeat the entire procedure from the beginning and do not remove the counterweights that have already been placed, especially if a considerable vibration reduction has already been achieved.

It is common not to lower the vibration on the first attempt because:

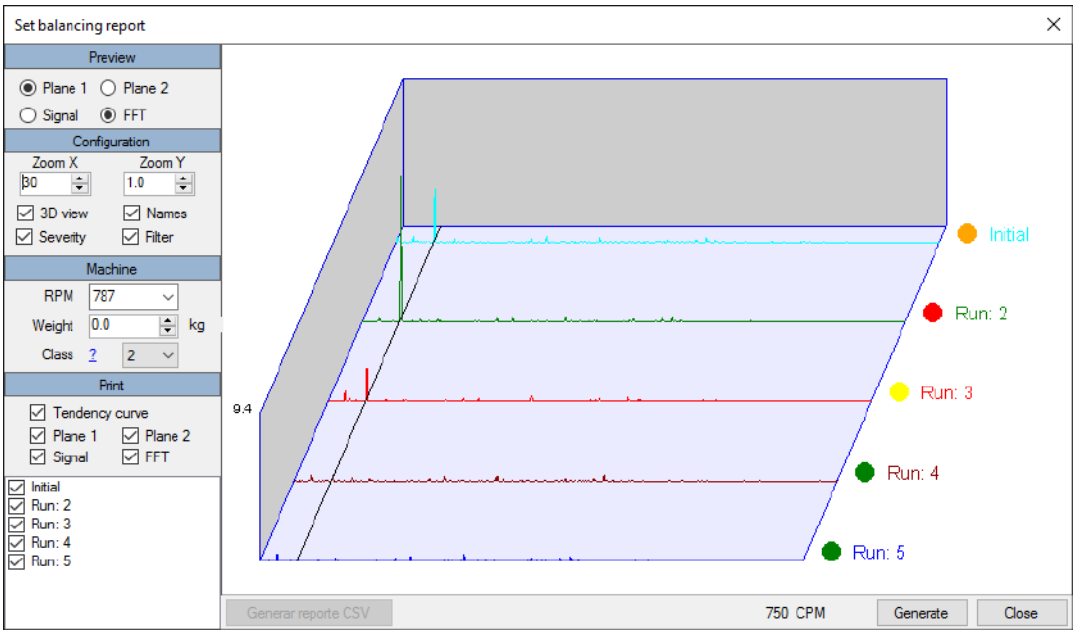
- adequate weights were not used
- placed on a different radio
- could not be placed at the right angle
- the angle was not measured correctly
- angles were measured from plane 2
- the inverted sensors were placed (the one of the plane 1 in the 2)
- the laser sensor was moved from position due to lack of tightening
- the laser turns on more than 1 time per turn (or does not turn on)
- the speed of rotation varied during the rolling (more than 20%)

Balance Report.

Select "Tools":



Select the graphs you want to report, as well as the signals and data. The graphs in time and spectrum can be enlarged or reduced. You can also add pictures and photos that you consider important with descriptive text (requires Microsoft Office Pro). Click on "Generate":



Saving and Uploading Data Files

In several functions, DigivibeMX® generates its own files by ordering them in the database, however in the options such as  Generic Analysis and Generic  Balancing this does not happen since it is not assigned to any equipment. This does not mean that the signals can not be saved. On the contrary, the difference is that you can do it if you want through the toolbar in the File menu - Save or Save As button, or from the context menu - File - Save.

DigivibeMX® handles several types of files depending on the function to which they correspond. They will be described below.

File Types

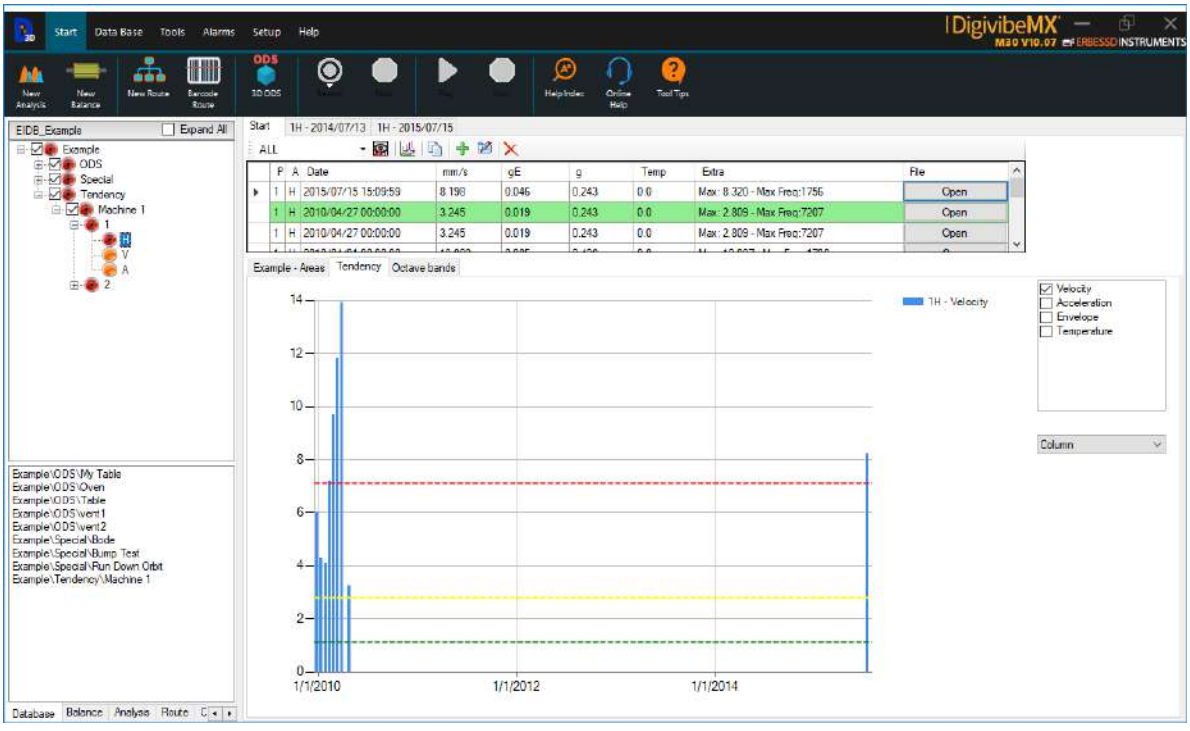
DigivibeMX® handles 8 different file types whose extensions are as follows:

Extension	Compatibility	Description
.anl	DigivibeMX®	Files of 1 single channel of vibration analysis.
.anl	DigivibeMX®	2-channel rolling files.
.asc	DigivibeMX®, Block de notas	Text file containing all data in Alpha-Numeric format.
.bal	DigivibeMX®	Balance Calculator session, retrieves all the information entered into the calculator.
.uff	Universal File Format	This file is used by many vibration analysis software and ODS programs.
.wav	Sound file	This file is compatible with any audio software.
.jpg	Pictures viewer	It is used in vibration graphics and polar graphs. It is elective between BMP and JPG
.bmp	Pictures viewer	It is used in vibration graphics and polar graphs. It is elective between BMP and JPG

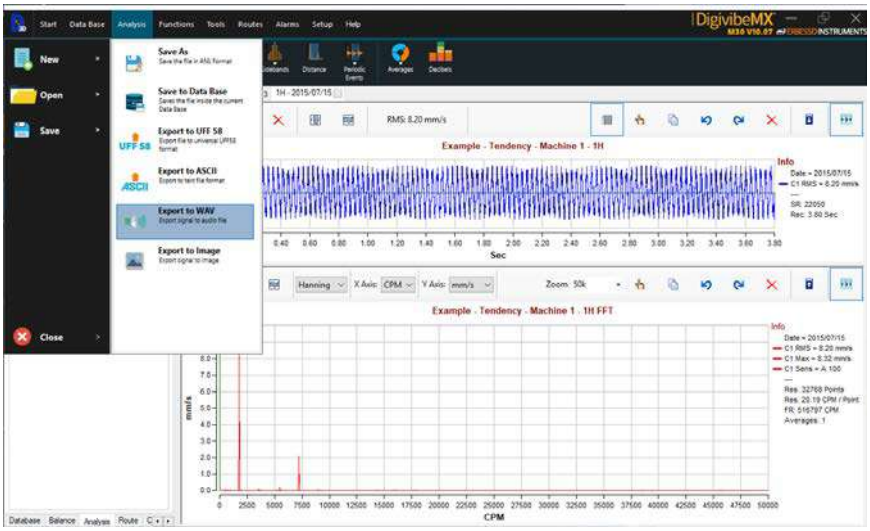
Saving Files

Save Options:

- **Button** Save the file corresponding to the visible session.
- **Button** Save as.
- **Button** File menu.
- **File menu - To export - As image**: Save the spectrum image.
- **File menu - To export – UFF58**: Export to universal format UFF58.
- **File menu - To export - WAV**: Export to audio format.
- To export a vibration signal to an audio file, you can start from the following sources:
- newly recorded signal (not stored in the computer)
- stored signal (from .anl file or database)



IMPORTANT: If the signal is not stored as an ".anl" file or in the database, you can export it as an audio file, but you can not re-import it as an audio file for later analysis.
Select **File**, **Export** and **WAV Audio**:



- **File menu - Export - ASCII**: Exports the visible vibration signal to an Alpha format

Opening Files

Options to open files:

- **Button** Opens a selected file
- **File menu - Open**: Opens a selected file
- **File menu - To import - ASCII**: Converts an Alpha-Numeric file to Binary of type .ANL to be read.
- **Contextual menu - To import – UFF58**: Open the UFF58 file in one or several new windows depending on the content.
- **Double-click the desired file from the database file window**: Open the selected database file in a new window.

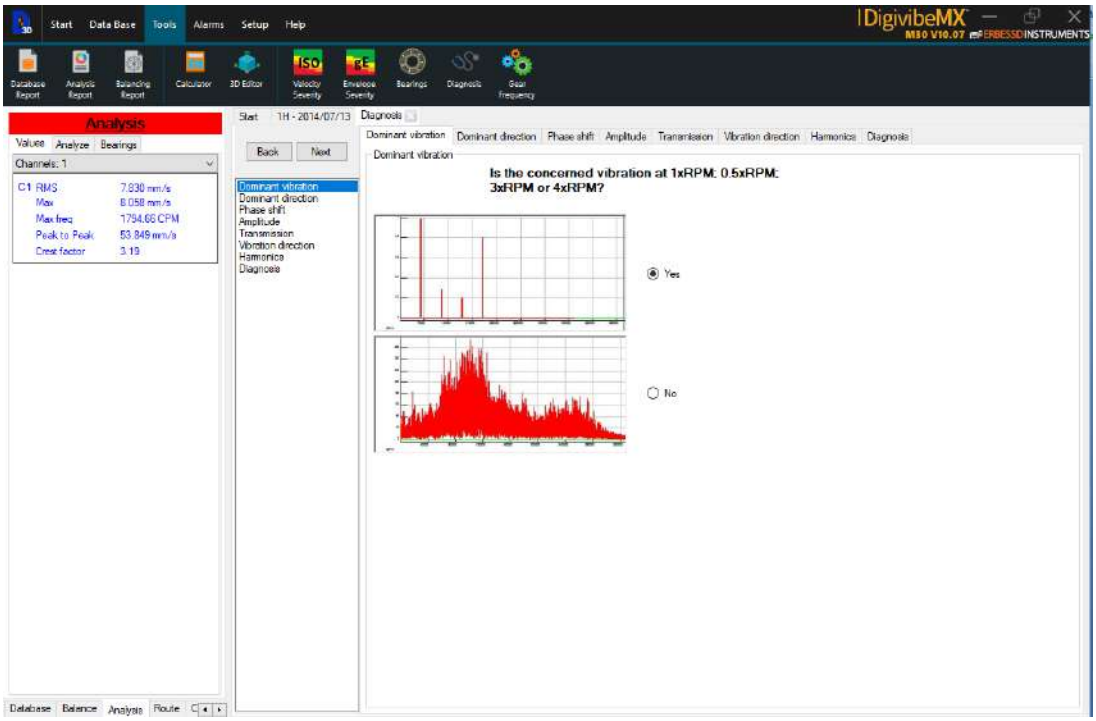
Exporting ASCII and UFF58 Files (M20, M30)

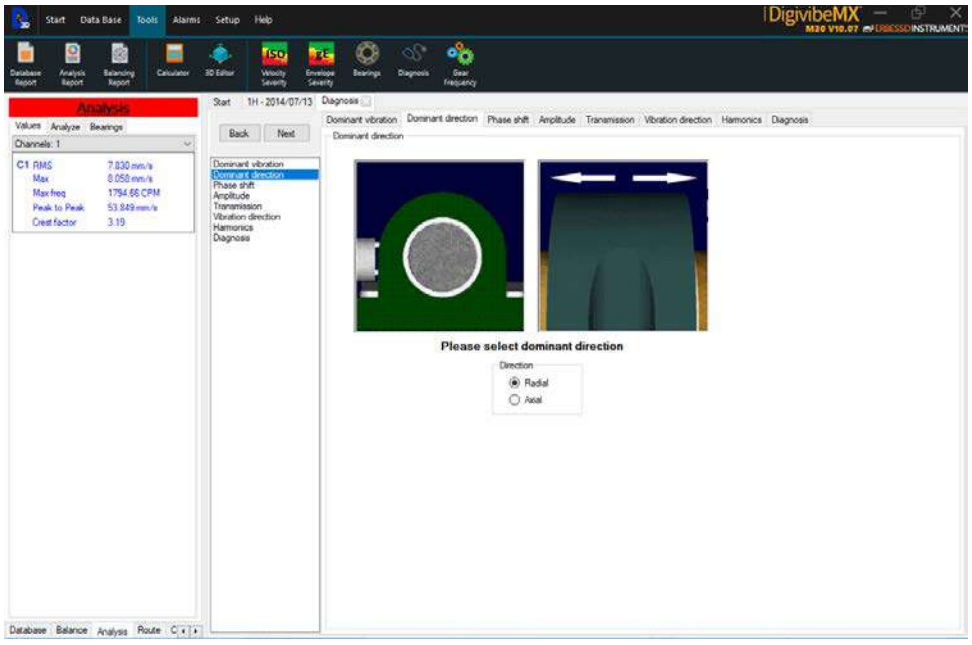
There are 2 file formats to which any signal can be exported. The ASCII format is a text format and the format UFF58 which is the format accepted by most vibration analysis equipment, mainly ODS. To do this, access the "File" menu - "Export".

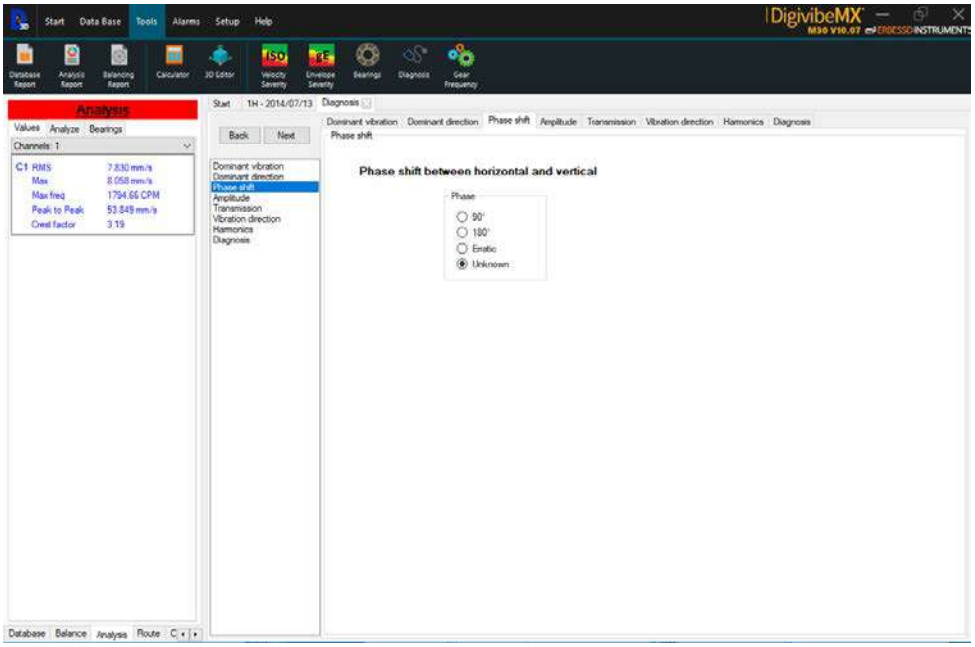
Interpretation and Diagnostic Tool (M20, M30)

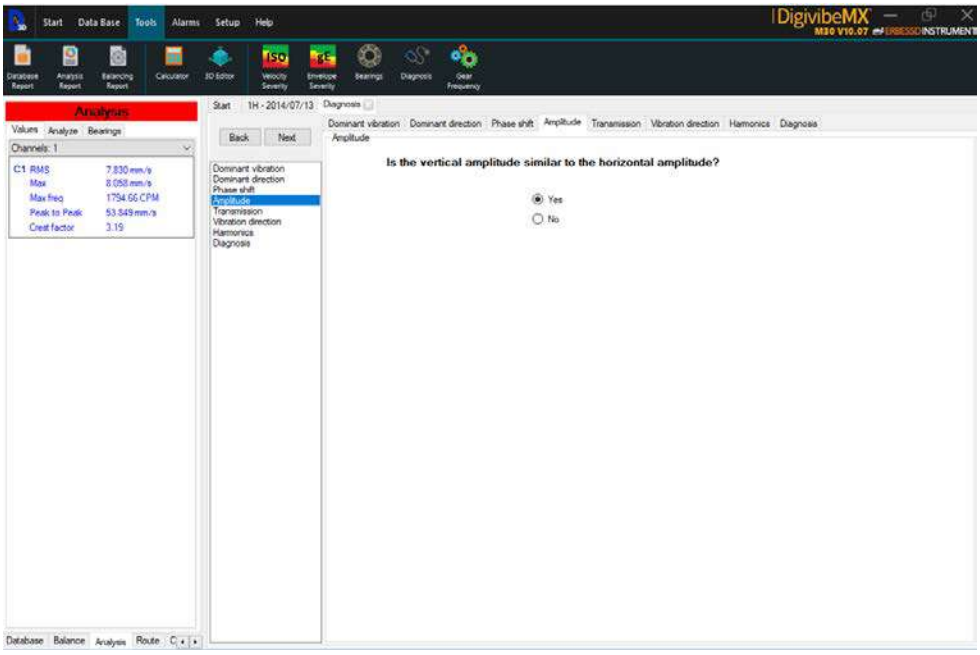
Another of the qualities of DigivibeMX® is the help it has for the interpretation of FFT graphics. You can find this help by pressing the **Diagnostic** button or from the View - Interpretation menu.

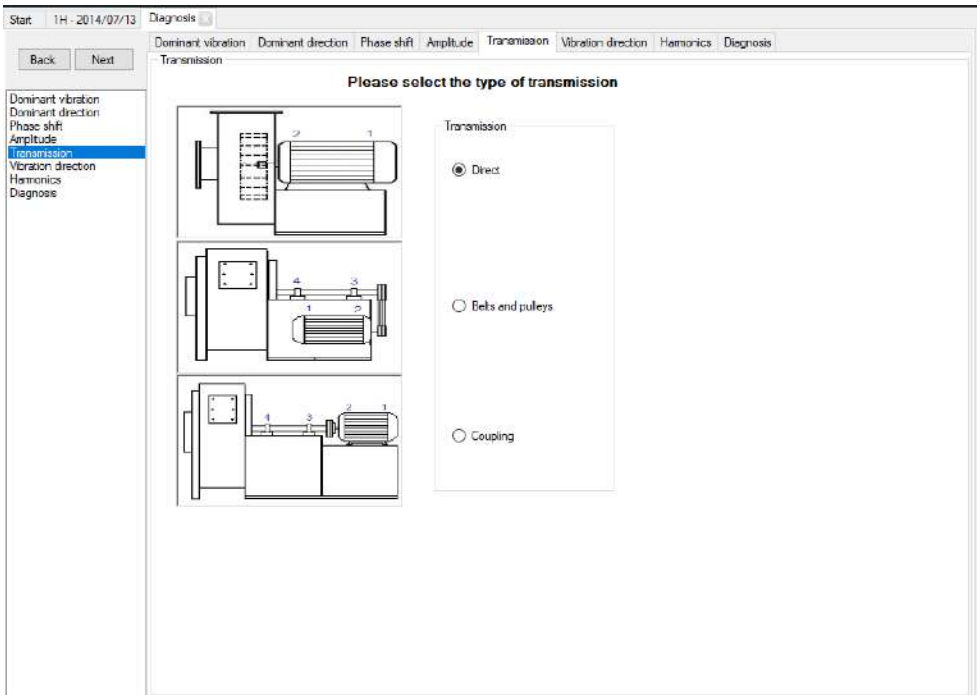
A new tab will appear with a series of questions that you will be answering. Each time you answer, press the "Next" button to go to the next question. At the end of the questions will be presented a diagnosis that can be copied and included in your report

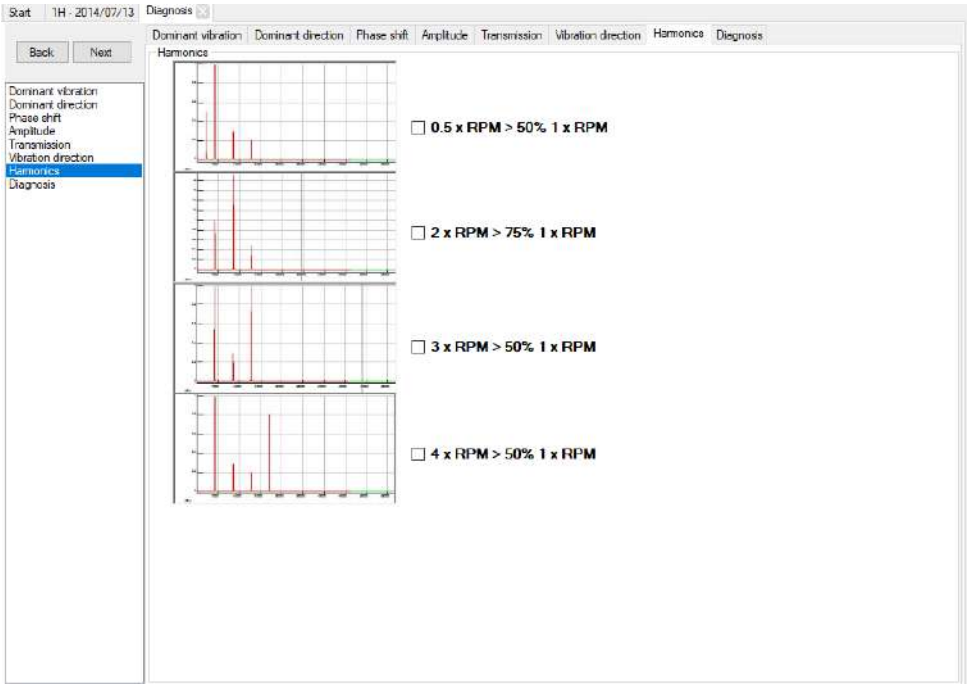




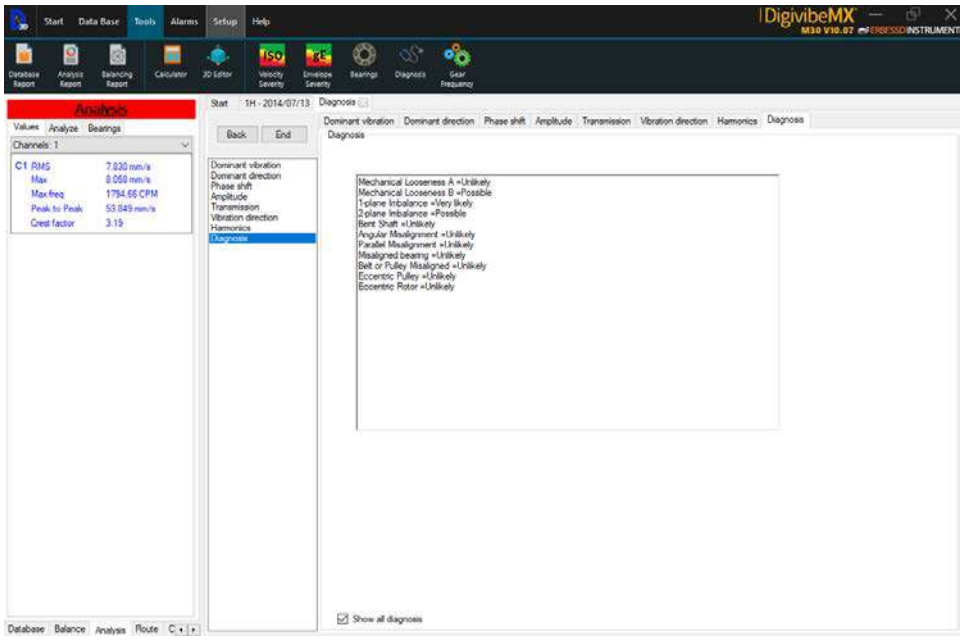

Start
Data Base
Tools
Alarms
Setup
Help
DigivibeMX
Analysis
Values
Analyze
Bearings
Channels: 1
C1 RMS 7.830 mm/s
Max 8.058 mm/s
Max freq 1754.66 CPM
Peak to Peak 53.849 mm/s
Crest factor 3.19
Back
Next
Dominant vibration
Dominant direction
Phase shift
Amplitude
Transmission
Vibration direction
Harmonics
Diagnosis
Phase shift between horizontal and vertical
Phase
90°
180°
Erratic
Unknown
Database
Balance
Analysis
Route


Start
Data Base
Tools
Alarms
Setup
Help
DigivibeMX
Analysis
Values
Analyze
Bearings
Channels: 1
C1 RMS 7.830 mm/s
Max 8.058 mm/s
Max freq 1754.66 CPM
Peak to Peak 53.849 mm/s
Crest factor 3.19
Back
Next
Dominant vibration
Dominant direction
Phase shift
Amplitude
Transmission
Vibration direction
Harmonics
Diagnosis
Is the vertical amplitude similar to the horizontal amplitude?
Yes
No
Database
Balance
Analysis
Route


Start
1H - 2014/07/13
Diagnosis
Back
Next
Dominant vibration
Dominant direction
Phase shift
Amplitude
Transmission
Vibration direction
Harmonics
Diagnosis
Please select the type of transmission
Direct
Belts and pulleys
Coupling


Start
1H - 2014/07/13
Diagnosis
Back
Next
Dominant vibration
Dominant direction
Phase shift
Amplitude
Transmission
Vibration direction
Harmonics
Diagnosis
0.5 x RPM > 50% 1 x RPM
2 x RPM > 75% 1 x RPM
3 x RPM > 50% 1 x RPM
4 x RPM > 50% 1 x RPM

ERBESSD INSTRUMENTS®



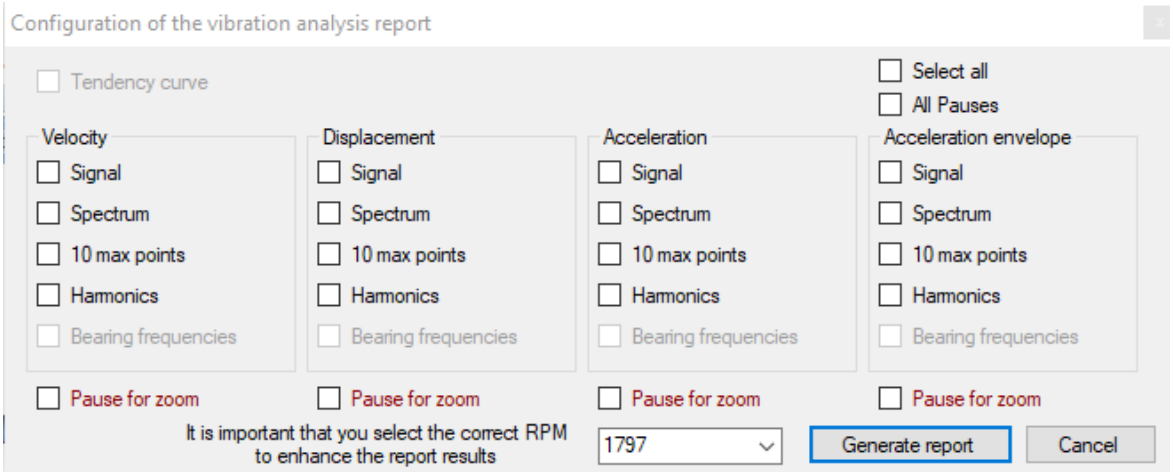
Automatic reporting (M30, M20, M10)

There are three types of automatic reports that can be performed with DigivibeMX®:

1- Vibration analysis report
2- Dynamic Balance Report
3- Comparative report

Vibration analysis report (M30, M20)

Quick way to generate reports of vibration analysis. By clicking on the button and choosing the analysis option, you can see a series of parameters that can be configured to make the report you want on the signal that has on the screen.

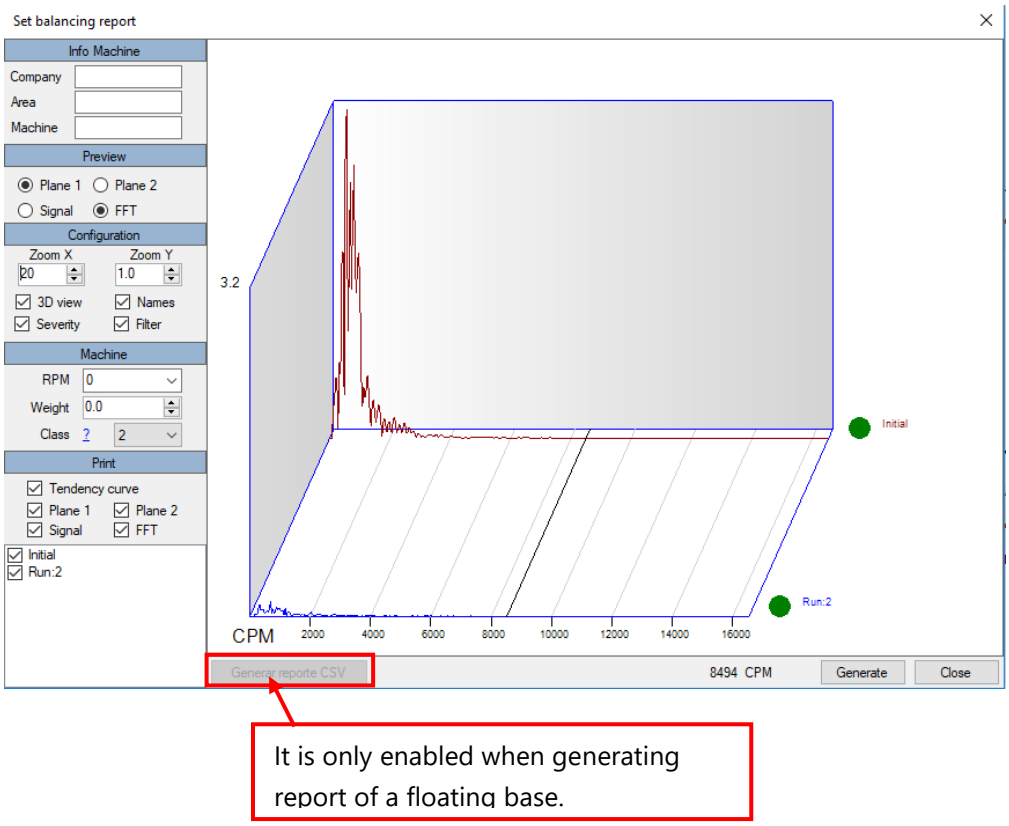


In each of these options the program will edit a chart and put the values in a table within the same document. The "Pause to zoom" option allows you to zoom in on each graph of the report, because sometimes the markers appear on top and can not be displayed properly. The Bearing Frequency option is only active if a bearing has been configured for the analysis in question.

The frequency of rotation is usually established by itself, however it is important to verify that it is suitable since otherwise the values in the acceleration envelope could be altered.

Dynamic Balance Report

The dynamic balance report is made at the end of a balance by clicking on the button and selecting the option "balance report".
Immediately afterwards a cascade report configuration box will appear, showing all the signals that were recorded during the roll.



It is only enabled when generating report of a floating base.

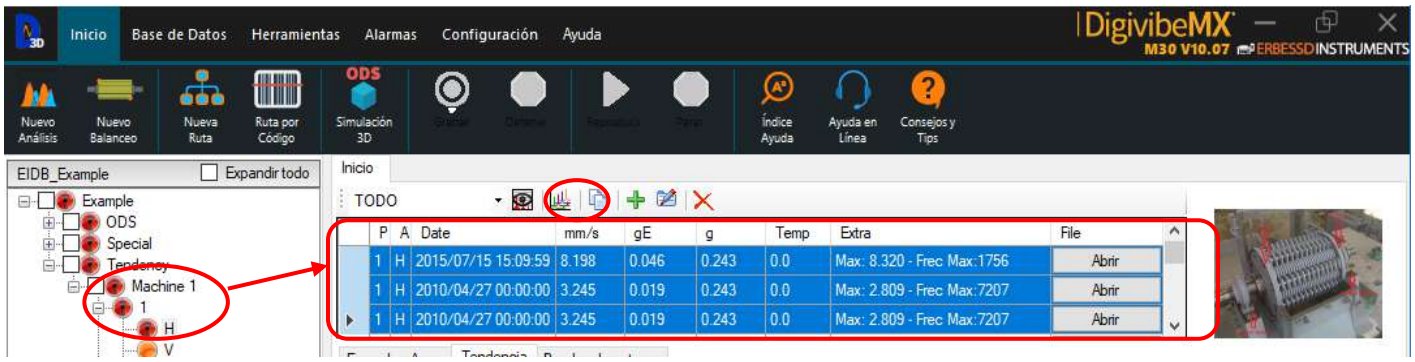
On the left is the configuration panel where you can select the desired plane and the cascaded graphs of both the signals in time and the spectra.

At the bottom are some options to configure your graph as the zoom and type of views. The severity option places a dot next to the race name in accordance with ISO 10816.
In the last box below you can choose which graphics should appear and which ones do not.

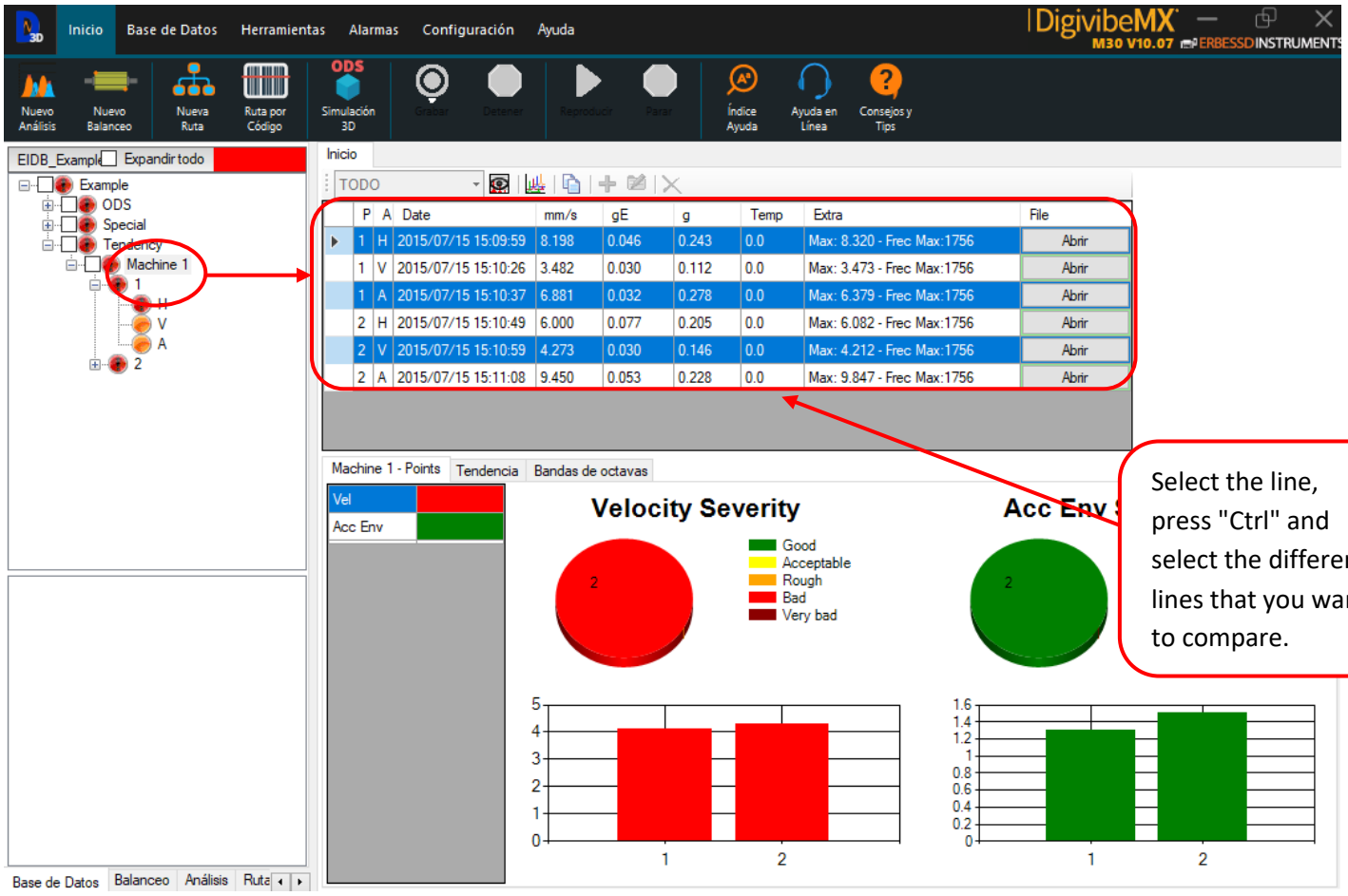
Note: The dynamic balancing report should always be done after some balancing. Can not Retrieve a Rolling Session After Restarting the Application.

Cascade Spectrum Report

To compare the signals click on the machine of interest registered in the database, select the point to compare and the signals of the same point, click on  :

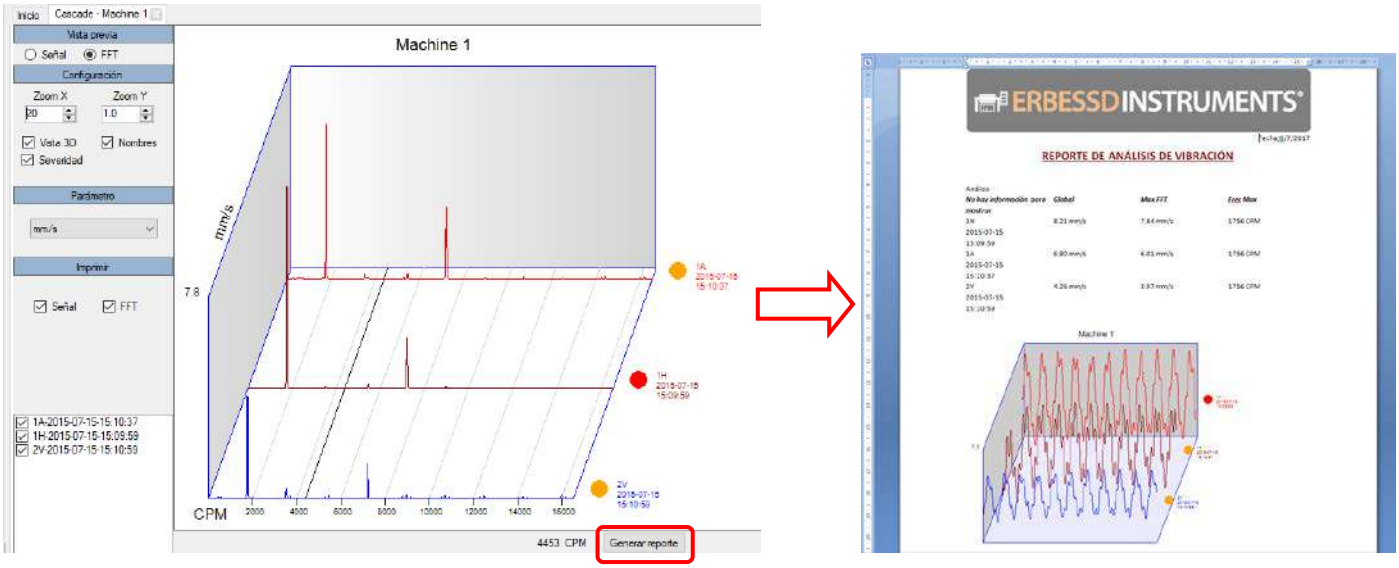


For the comparison of the last measurements of each point click on the desired machine and select the signals to compare, click on 



Select the line, press "Ctrl" and select the different lines that you want to compare.

To generate the report click on **Generate Report** at the bottom of the graph automatically generate the report.



3D Analysis (ODS)

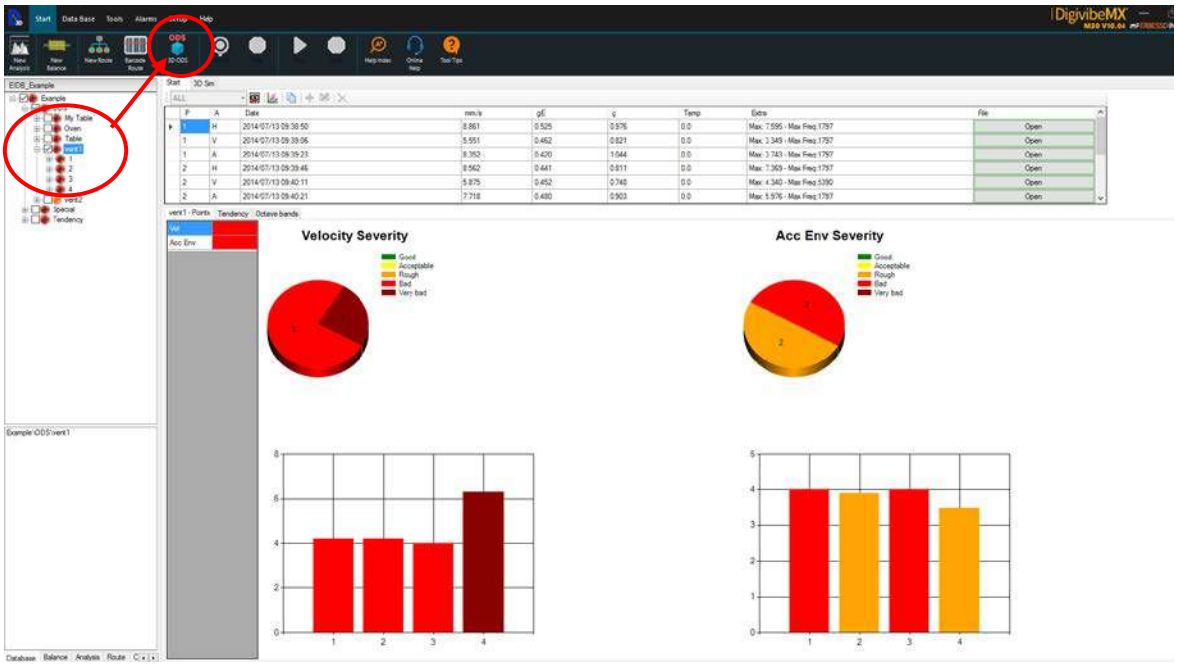
Operating deflection shape (ODS) Is a type of analysis capable of producing animations of the characteristics of the deformation of a mechanical system at any frequency. The ODS analysis provides information about the movement during the operation that can be converted into an animation. These animations can be very useful by defining areas of structural weakness and identifying areas of mechanical clearance. In resonance cases, the ODS analysis can provide an estimate of the mode of vibration of the excited natural frequency.

Reference channel

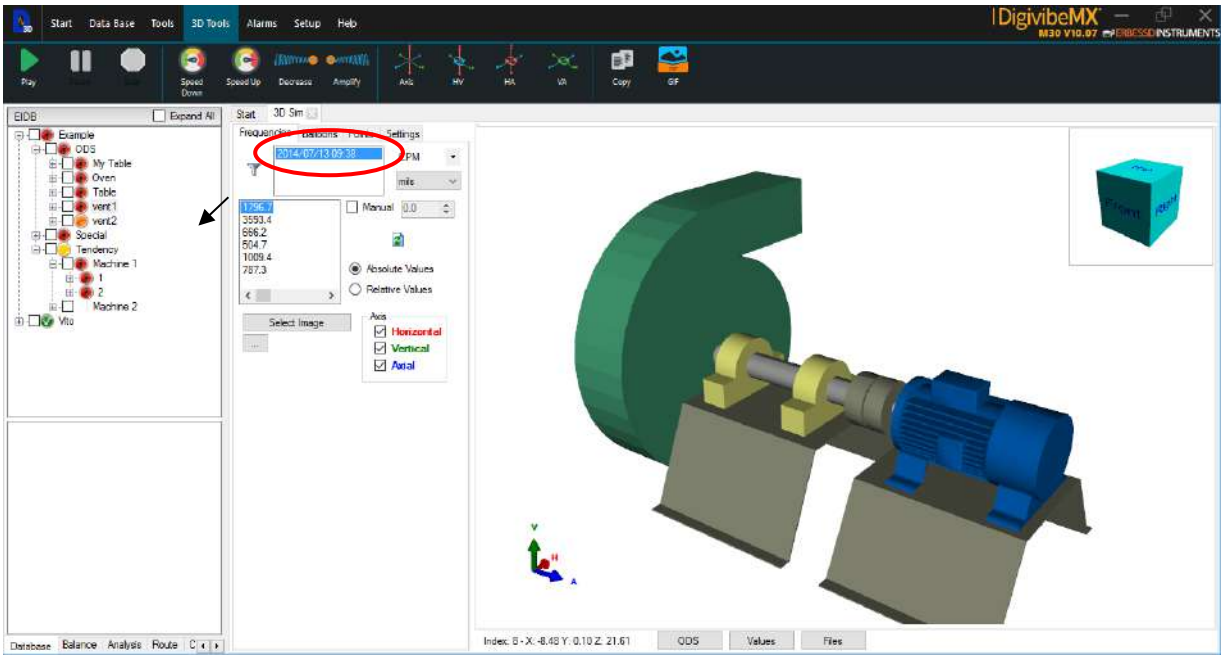
Erbessd Instruments is trying to include the ODS analysis in every possible route simply by adding a reference channel to each of them. The reference channel is nothing other than a second accelerometer placed anywhere on the machine near the vibration generating site and it will not move throughout the entire path of this machine. In this way each measured point can be compared with the reference point and therefore can be compared among themselves since the reference point acts as a constant. The reference channel is indicated in the software with the letter "F" (Fixed Channel). When you do a route analysis and want to include this option only select the option "F" during the route and the analyzer will do the analysis including this channel.

Phase Analyzer

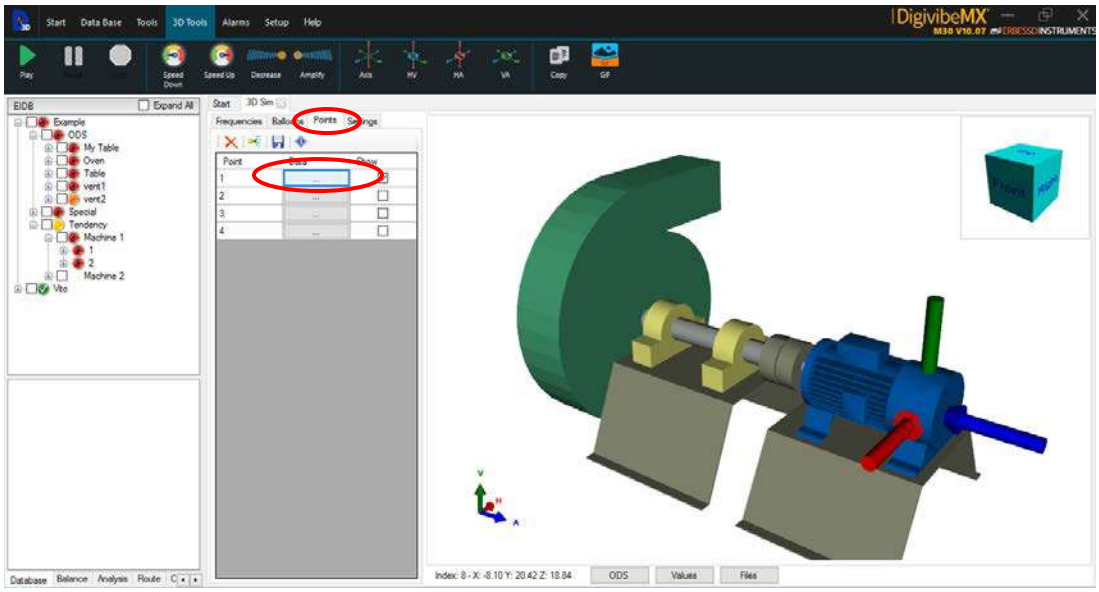
Select the machine you want to analyze and start the «ODS 3D» function:



Select route by date and RPM for phase analysis:



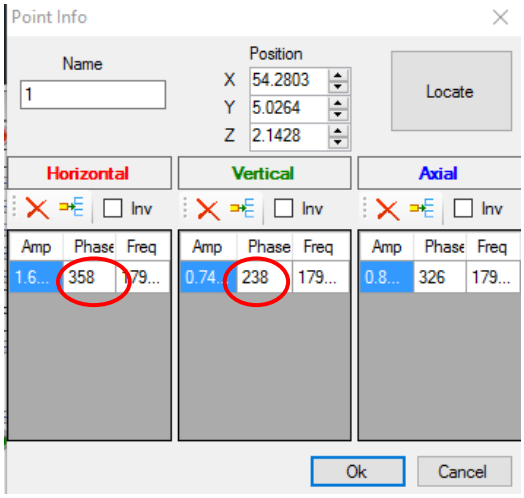
Select "Points" and click on the Data cell of the point you want to analyze:



- The phases are calculated between all points with respect to the Reference:
- Horizontal
- Vertical
- Axial

Subtract the phase of the point and direction that interests you with respect to the 2nd point of interest and thus obtain the phase between them (for example the Phase between 1H and 1V = 358 ° - 238 ° = 120 °).

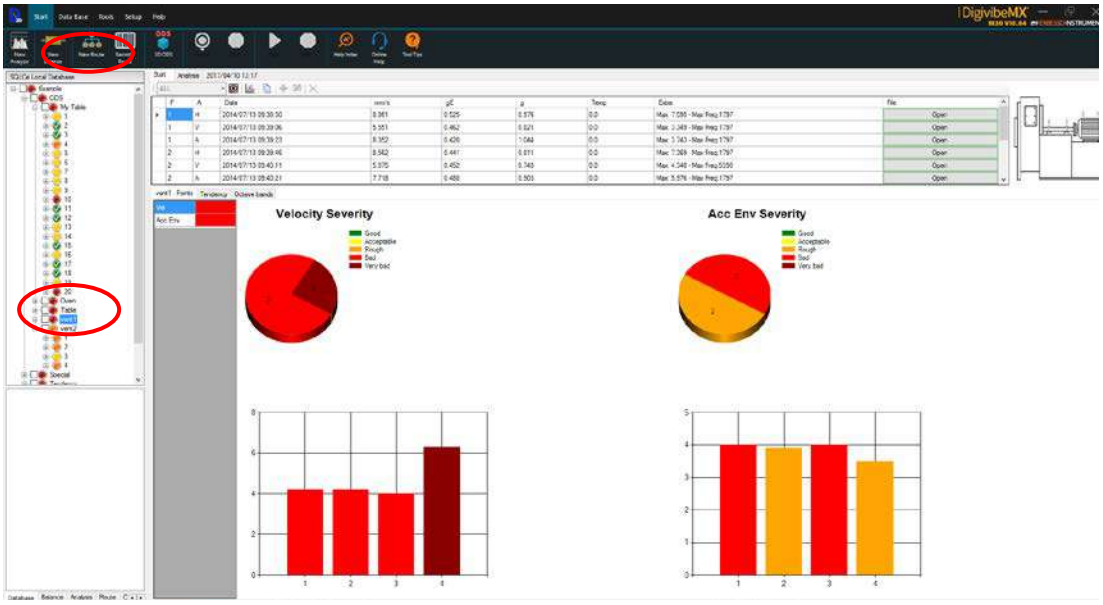
IMPORTANT: Make sure that the measurements were taken in the directions indicated in figure 3D, otherwise select the "Inv" box to reverse the direction at a given point (the arrow changes direction).



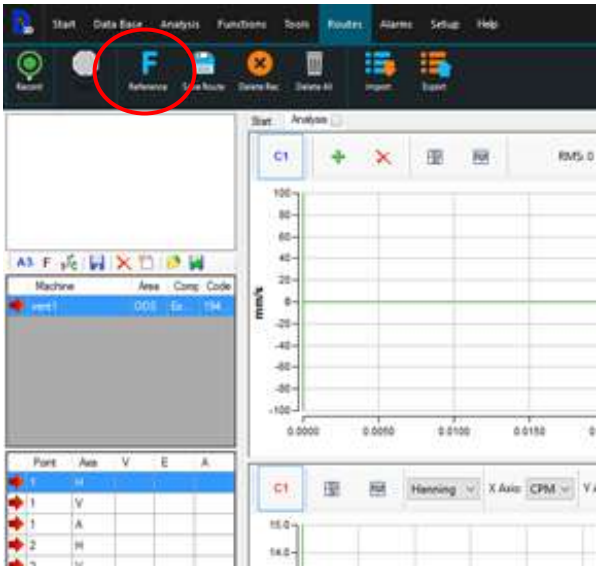
Collecting Data for 3D Simulations (ODS)

For 3D ODS Simulation, measurements need to be taken with 2 accelerometers on a route with F reference point. Sensor 1 collects data from all points and axes indicated by the route, while the 2nd sensor stays in the same reference location for all data collections. The reference location can be anywhere on the machine that vibration can be safely captured, without interfering with collecting route data points. **Do not** use route data collection points as reference points.

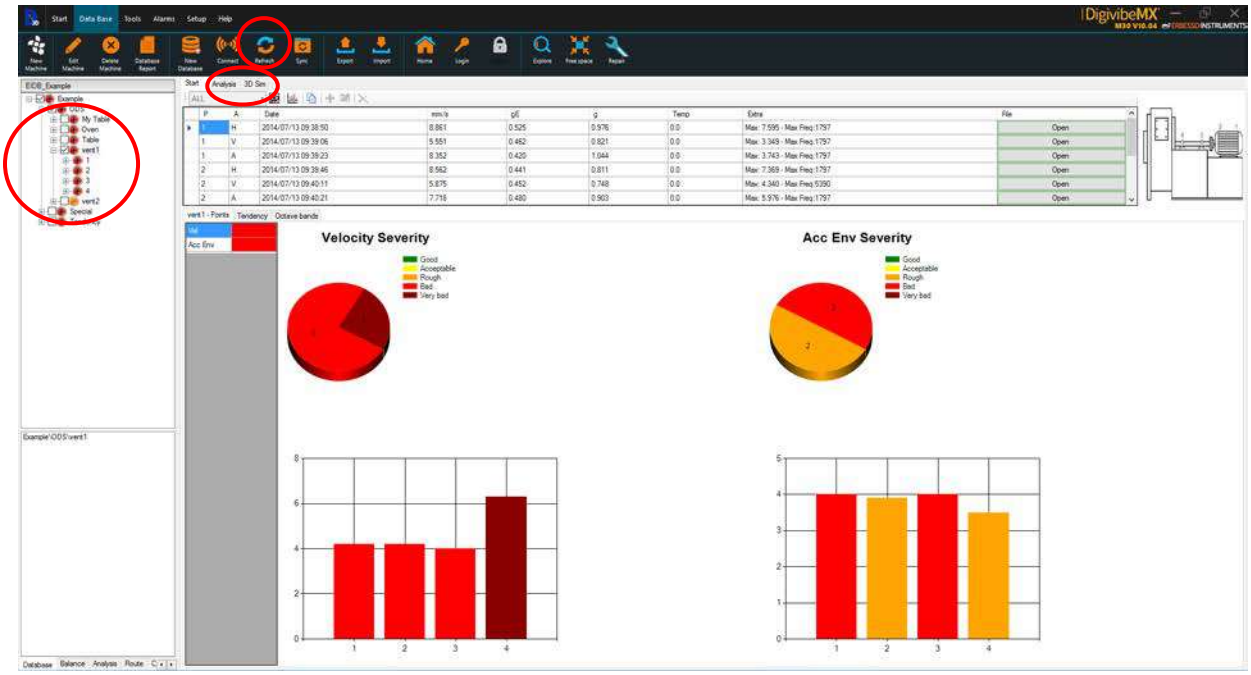
Select the machine and click on the «Routes» icon:



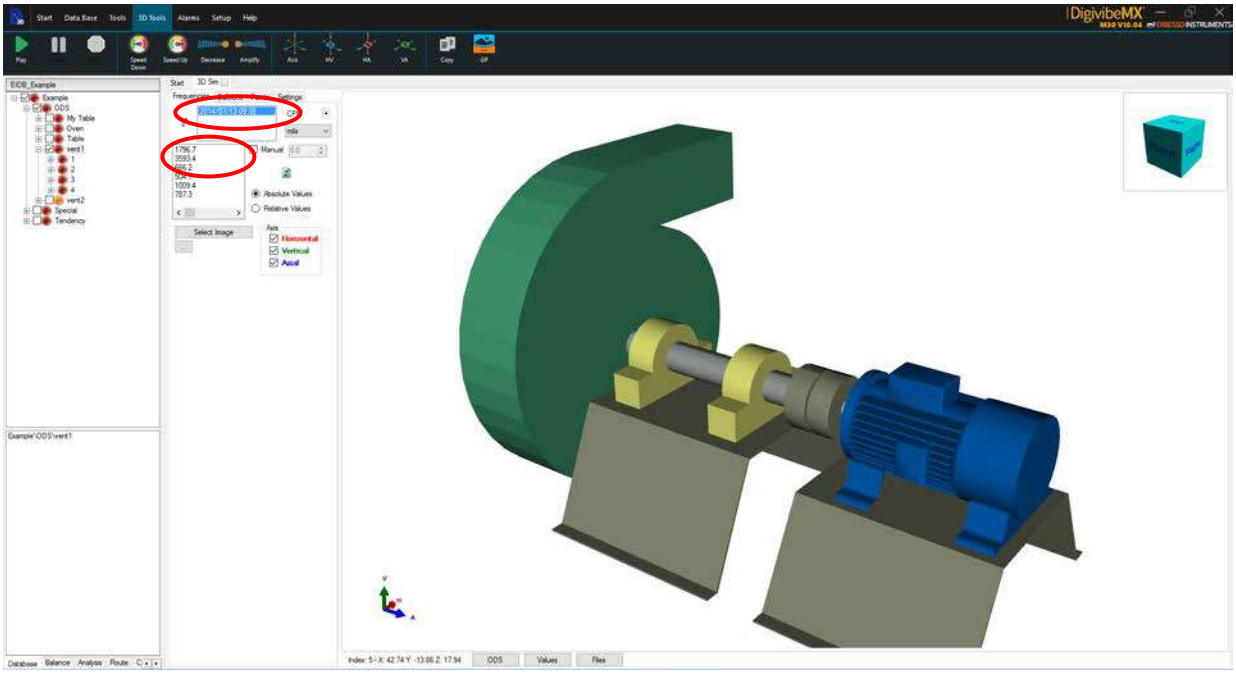
Click "F" to activate the reference point. "C2" appears next to "C1":



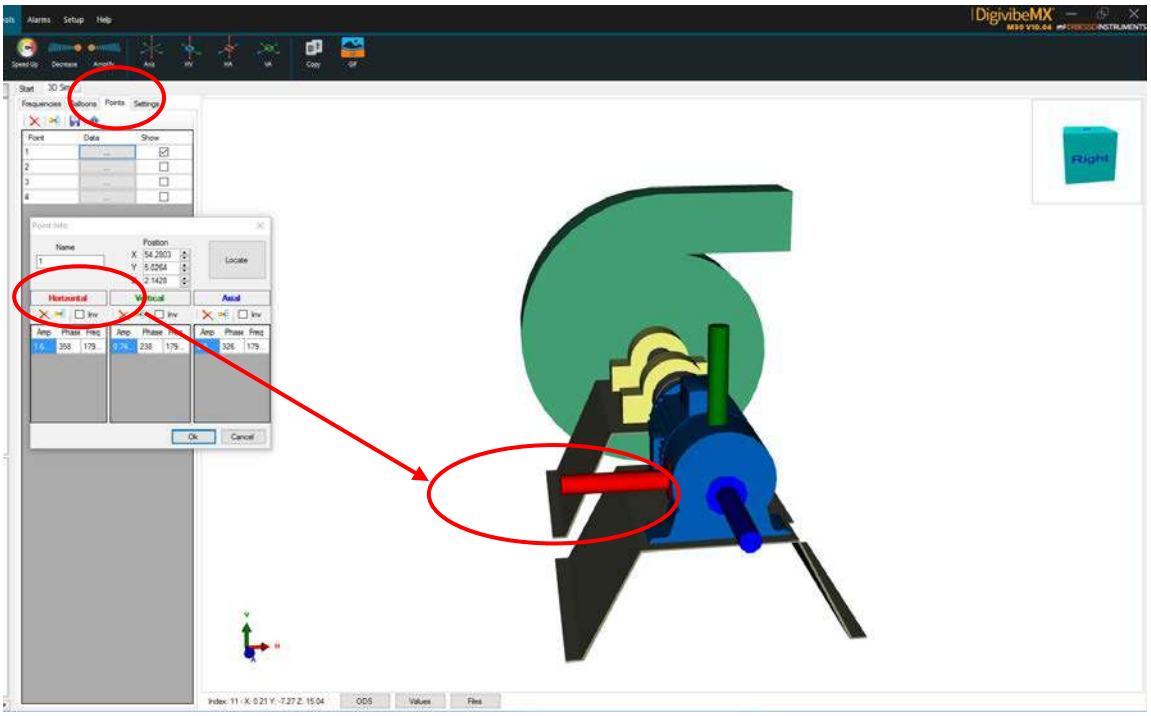
Once the route is finished, update the database and select the machine to which you just made the route again. Click on the 3D tab:

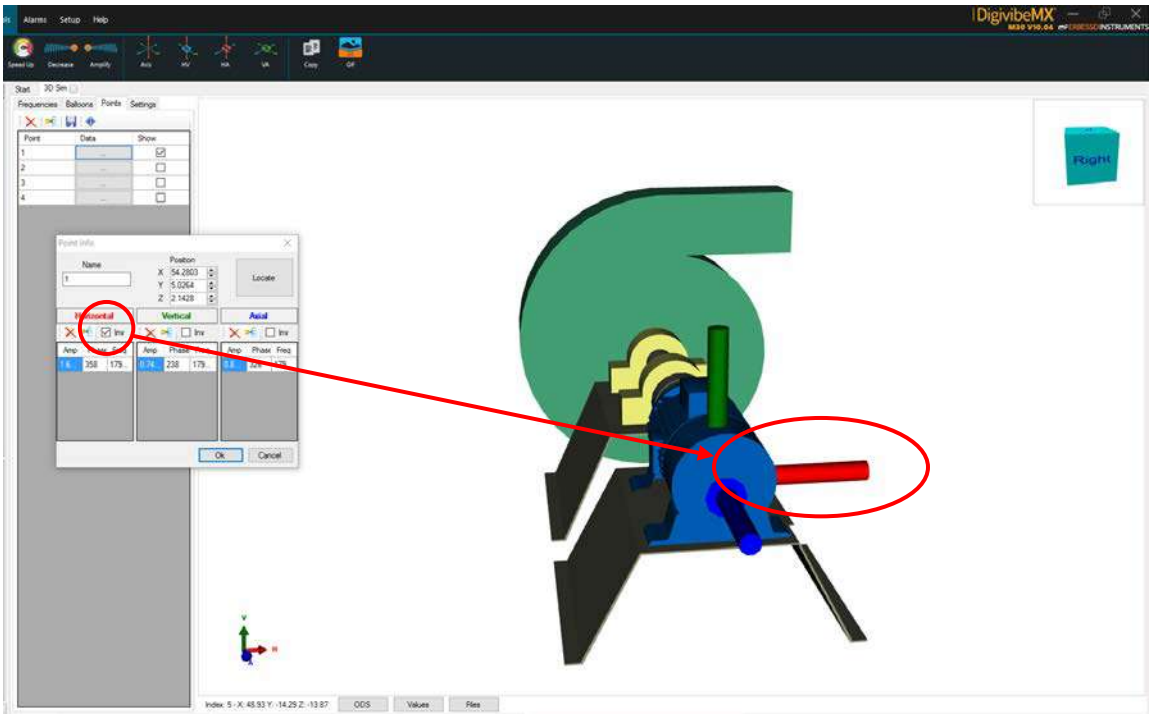


Select the file path and the RPM for the simulation:

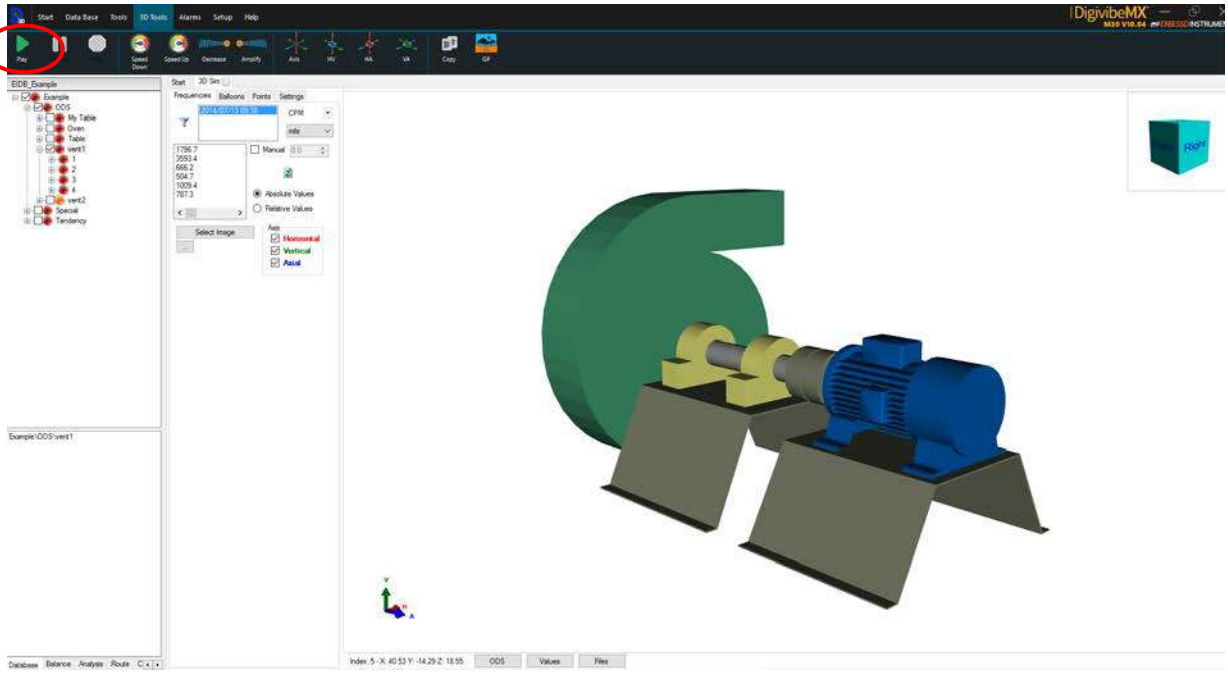


If for any reason, any of the data was NOT collected in the direction shown in the drawing, go to "Points" to reverse the direction of that point:

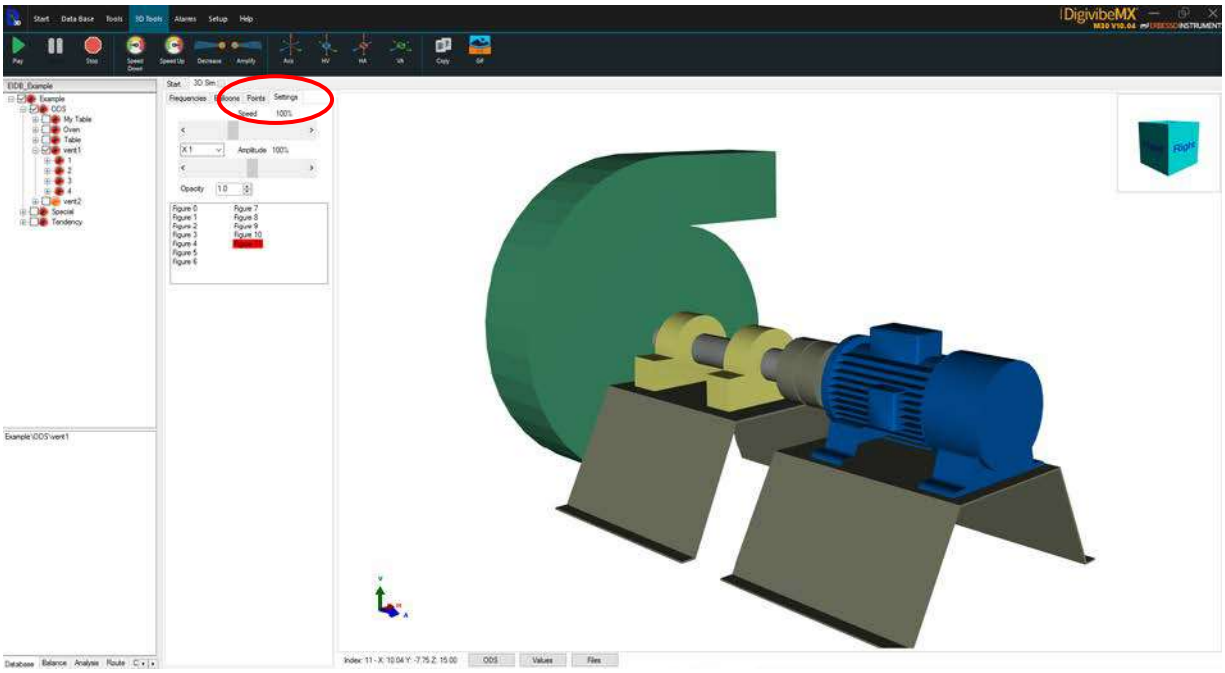




Press "Play" to start the simulation and analyze the deformation of the machine:



To change the speed and amplitude of the movement in the animation, go to "Settings":



Probably the most important of all 3D ODS components is the rotating hub. This cube allows rotation of the 3D model in any direction. Click on the cube and drag it in any desired direction to rotate the model view. Another way is to click on any face or edge of the cube. The figure will automatically rotate until it is in the selected position.

In the top menu you will find the following buttons:

Displays all 3 axes. If an axis direction does not match the direction data was collected, it can be inverted.

Invert the Horizontal and Vertical axes.

Invert Horizontal and Axial Axes

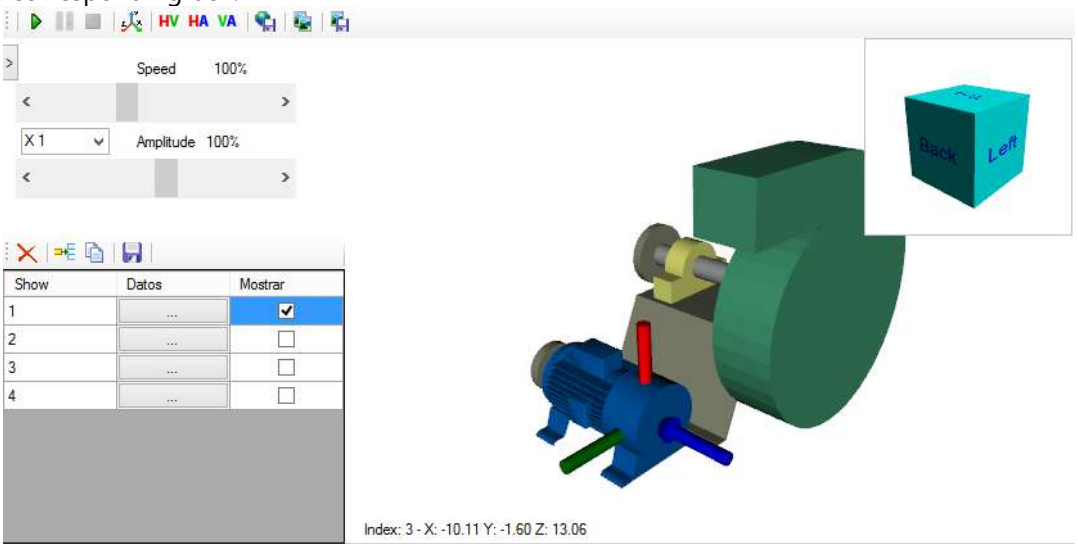
Invert the Vertical and Axial axes.

Export animation to AVI video format.

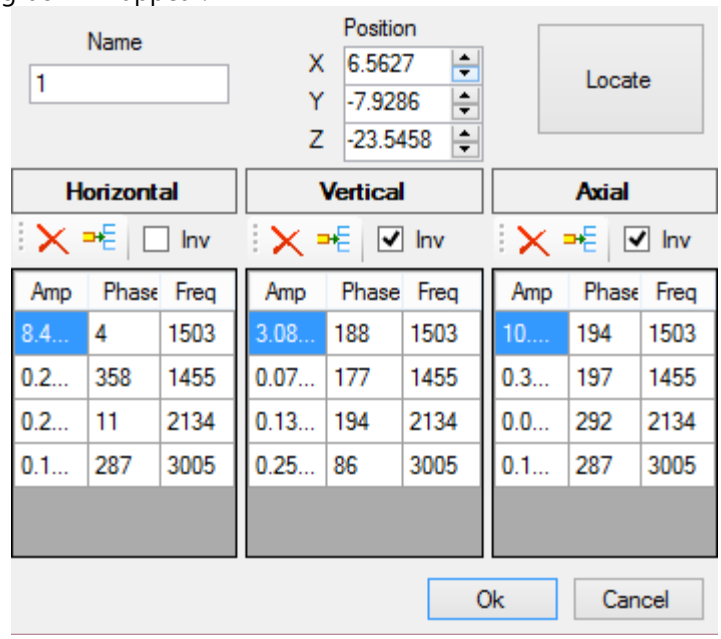
Export animation to GIF animated image format, this option greatly reduces file size.

Export picture in static image format jpg.

In the left panel you can control the speed of the simulation as well as the amplitude. In the lower panel you will see the number of vibration points assigned to this image, each row corresponds to a point. You can see the location of each point by selecting the corresponding box.



If you want to change the orientation of any of the axes of this point or the location of the point itself you can click the "..." button and the following dialog box will appear.

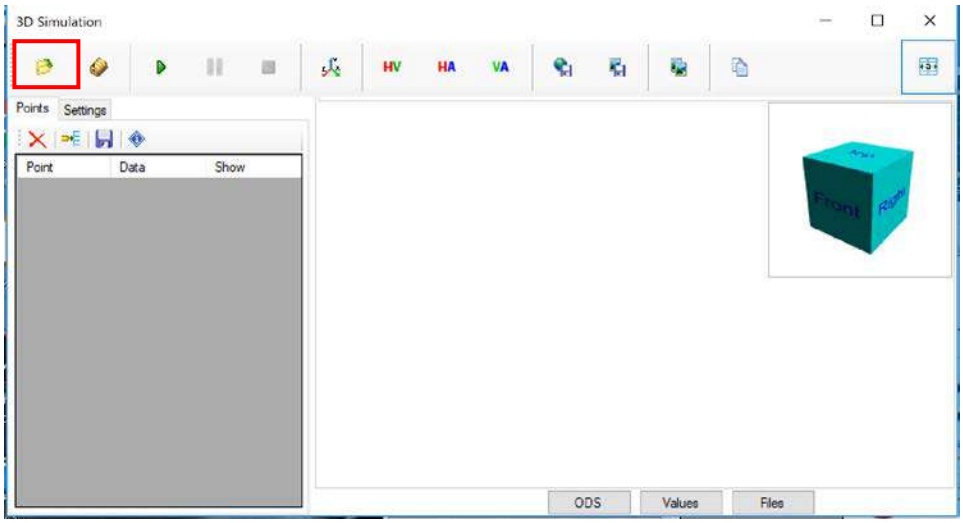


Here you can invert the axes of the point as well as change the location, add or delete information for each axis.
To establish the location of the point press the "Locate" button and it will begin to change color, at this moment select a point directly on the figure and the location will be in the boxes corresponding to X, Y and Z.

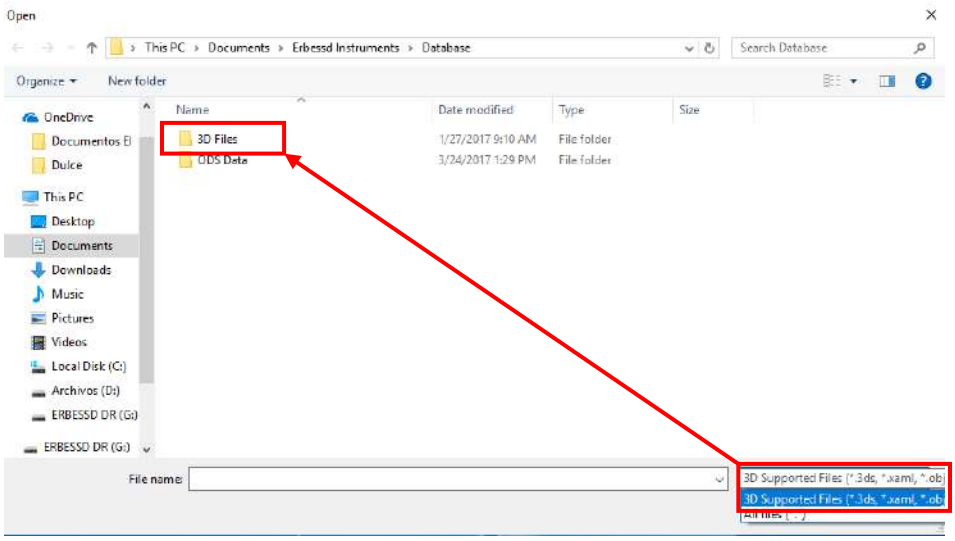
GUIDE TO CONFIGURING A 3D MODEL

To import a 3D model go to "Tools" and click on "3D Editor":

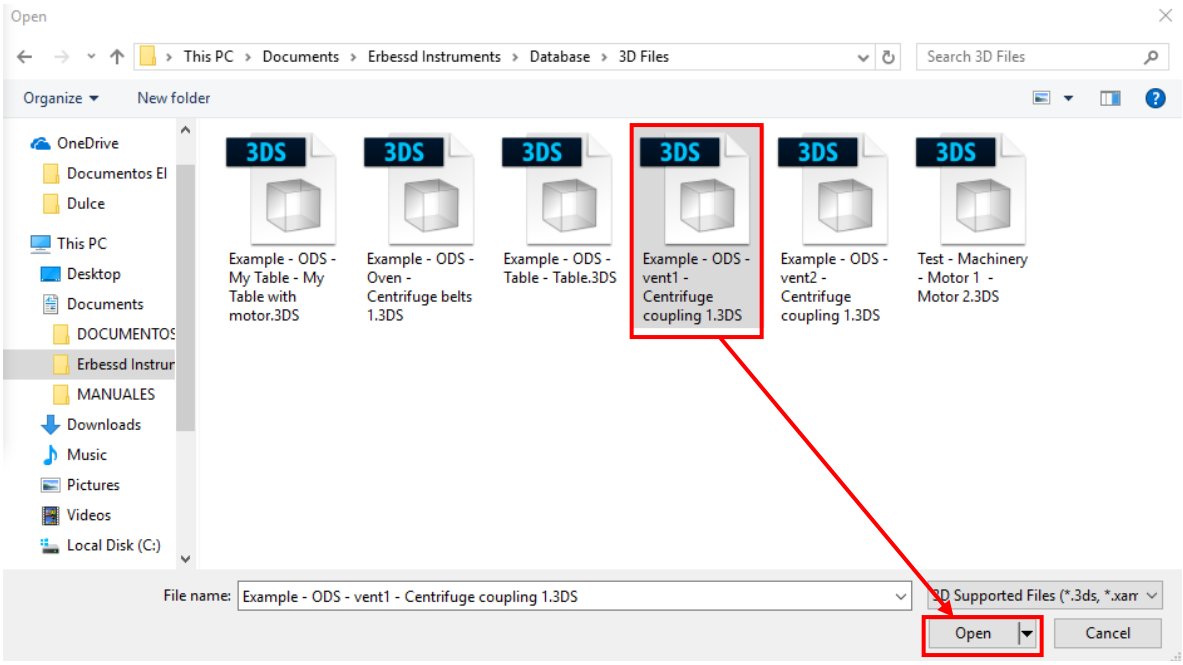
Open your "3D Editor", click "Open"



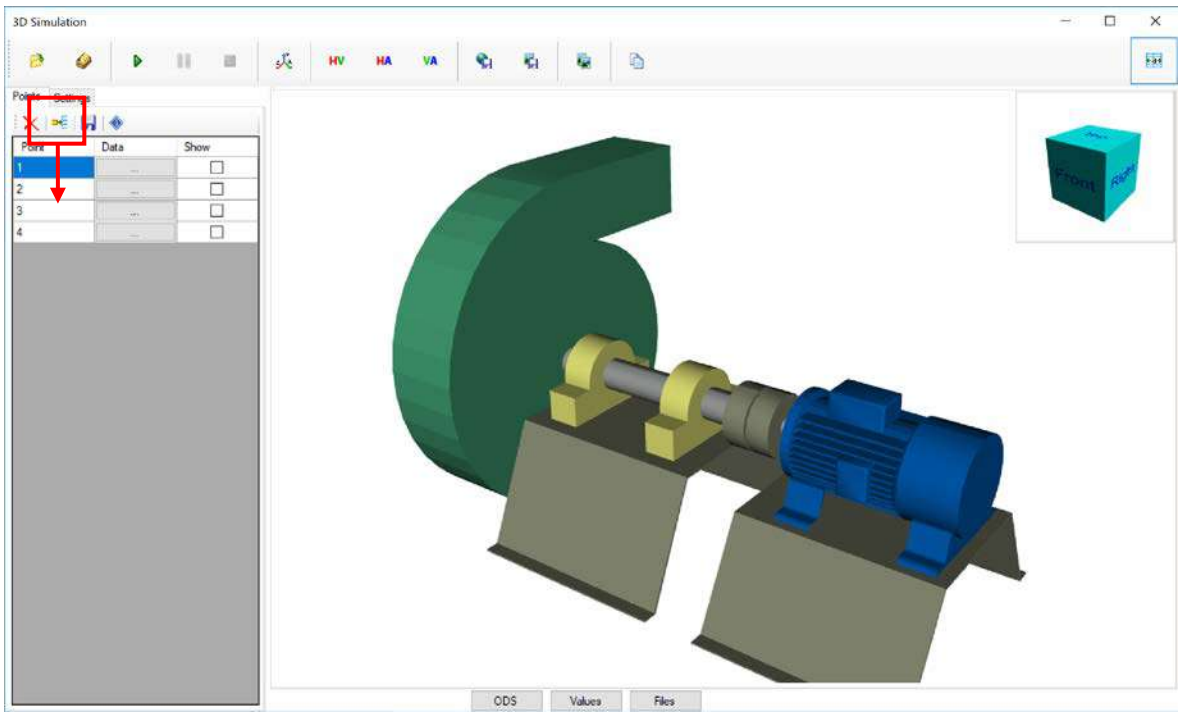
Supported formats are: .3ds, xaml, .obj, open the folder where the file was saved



Select the desired file and click "open "

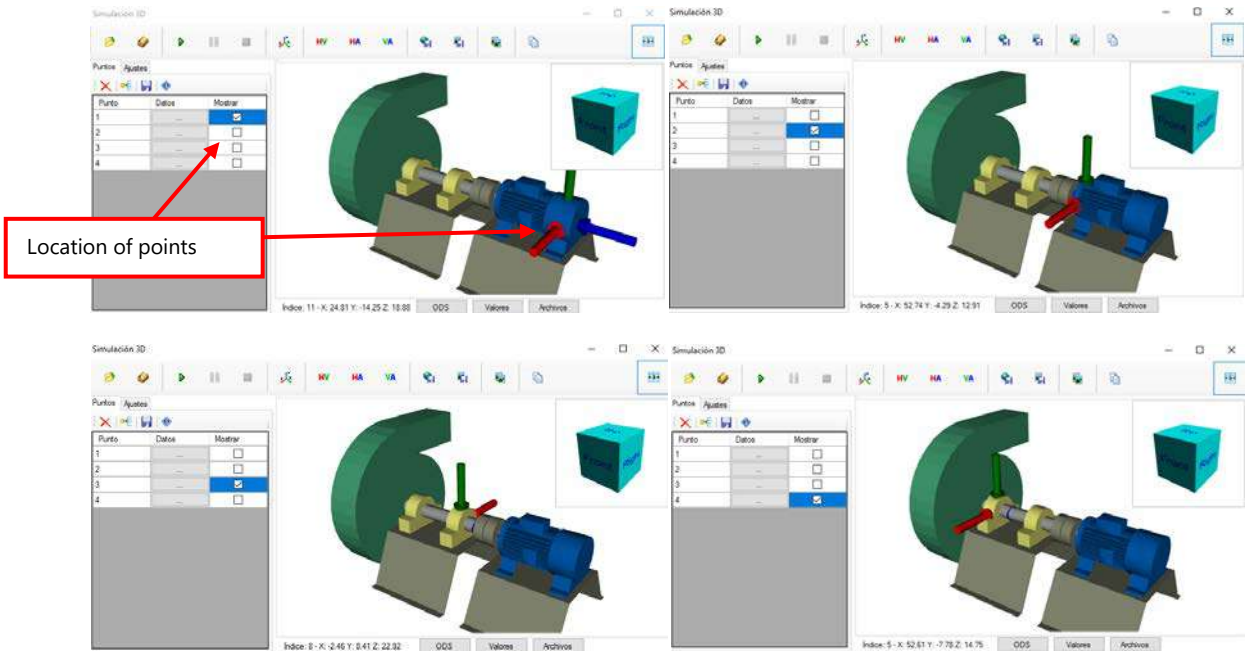


Add the number of waypoints you need (or delete the ones you do not need))

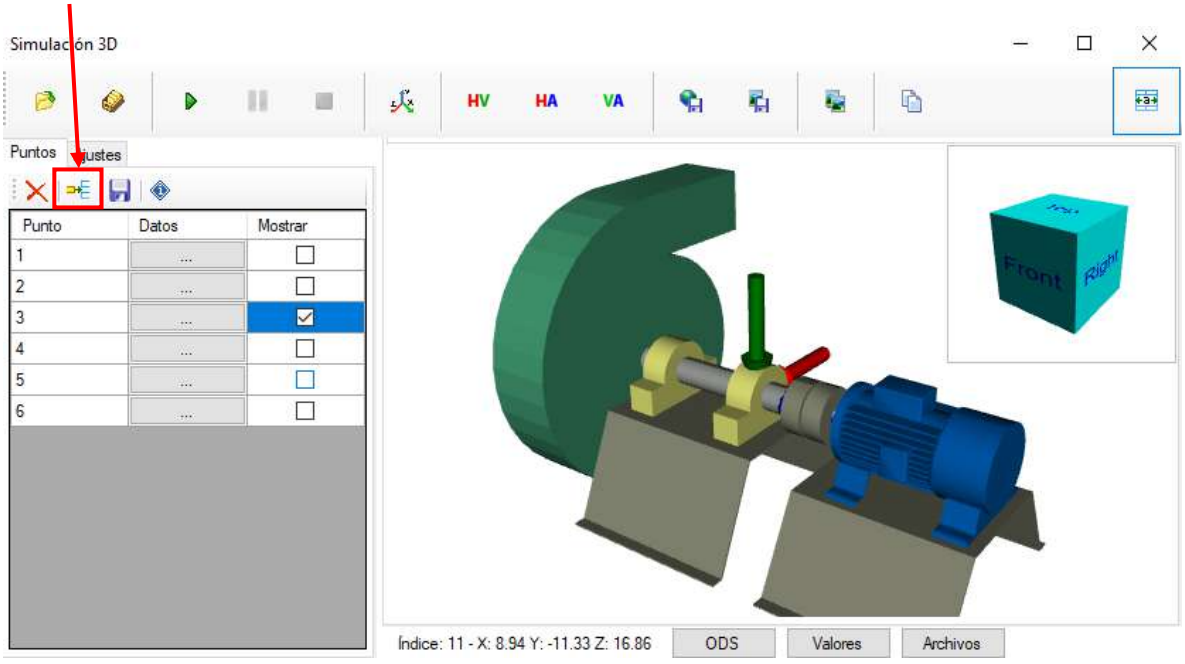


See where they are located and place them in the correct position by selecting the box of the point you want to locate.

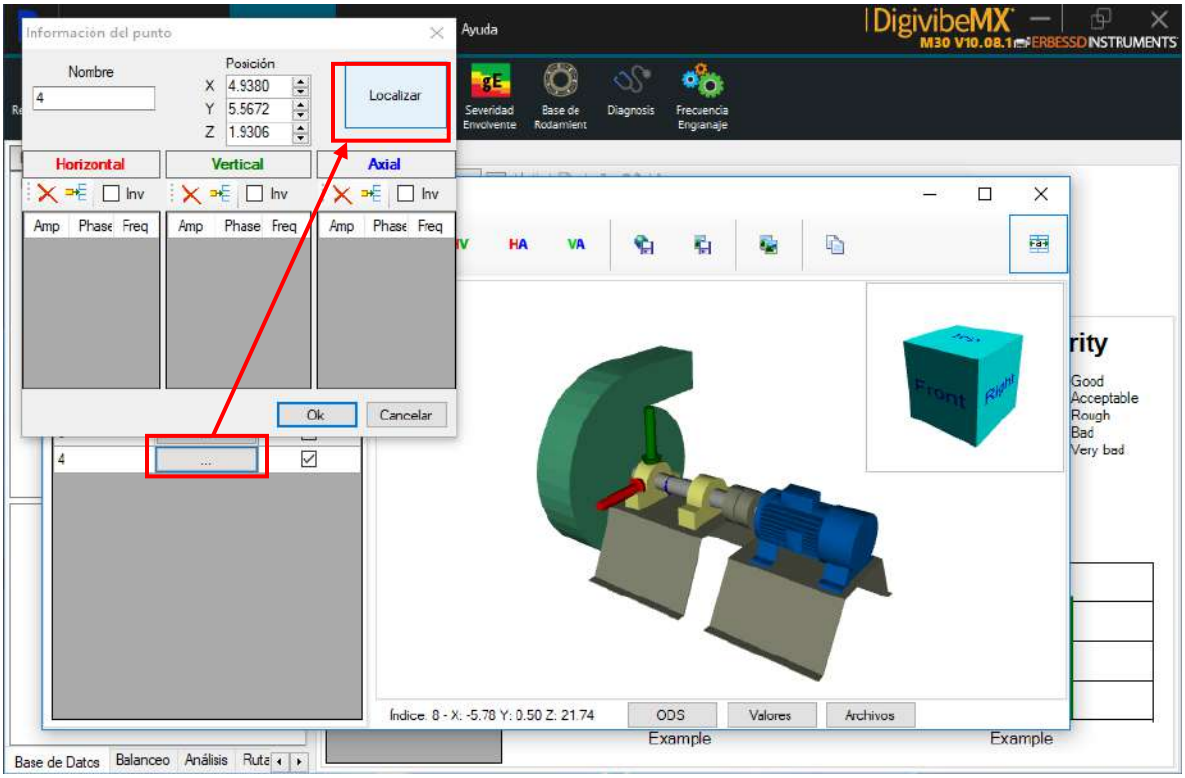
Example of the Position of each point:



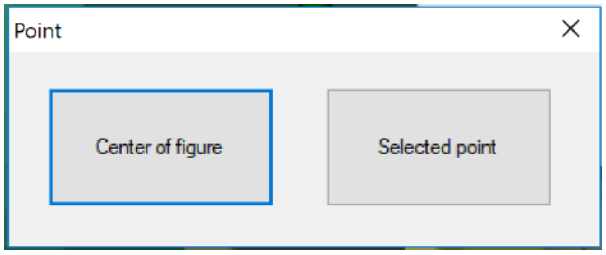
To add more points:



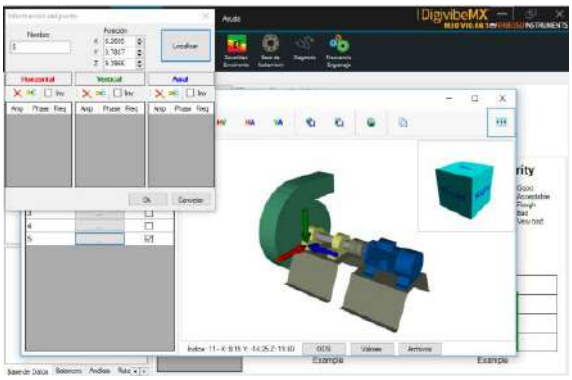
Go to "Data", click "FIND" to place the point in the correct place and click on the 3D model:

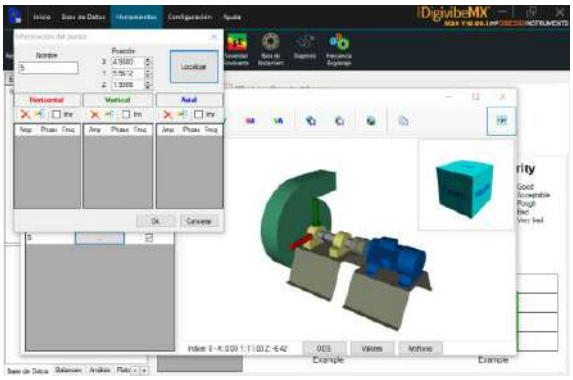


Click on LOCATE and click on the 3D model where you want to locate the point, then specify whether the point is in the center of the figure or at a selected point.

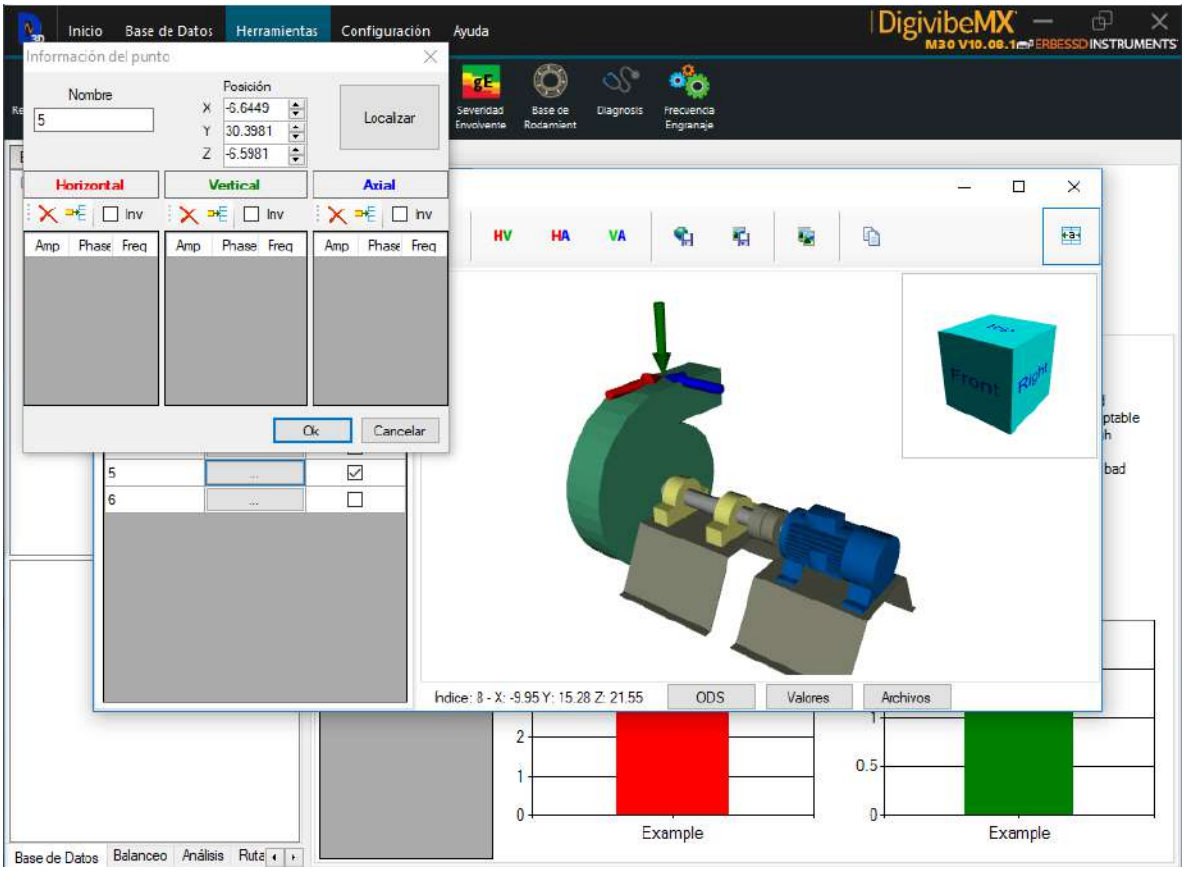


Example:

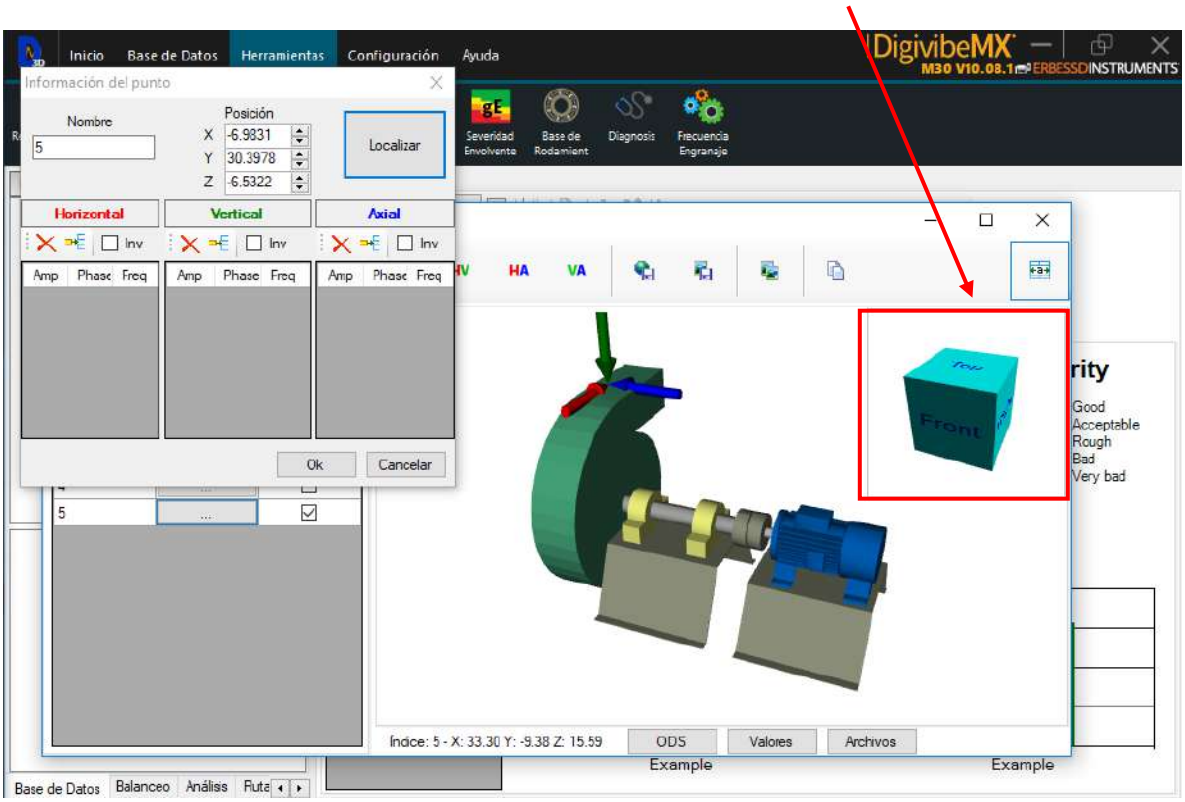




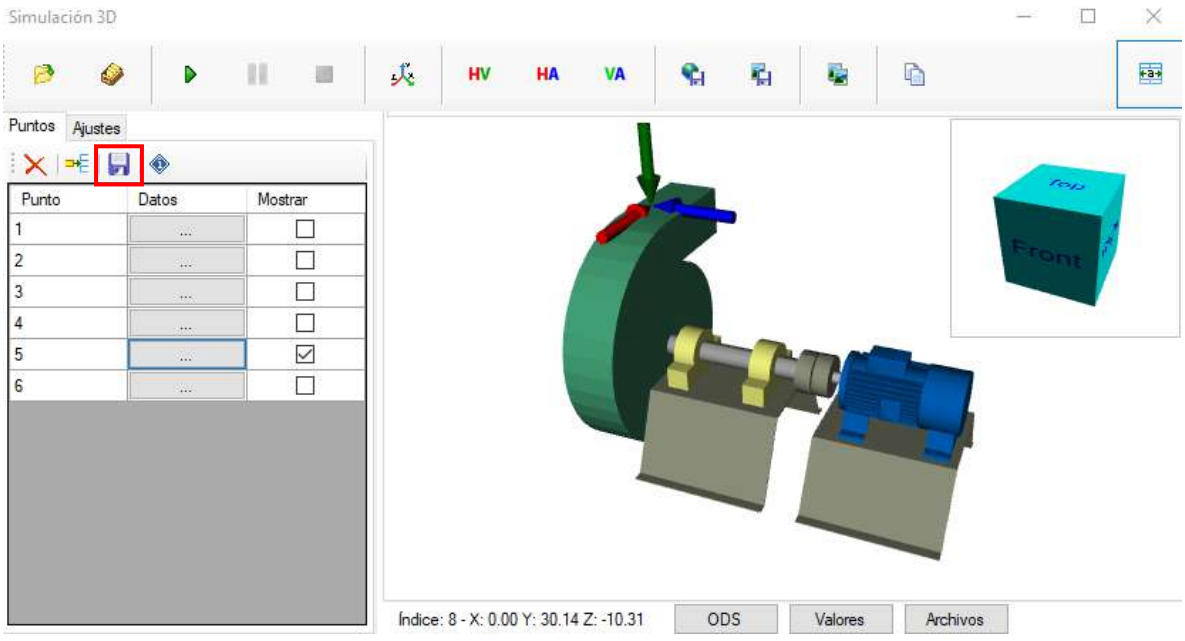
And so place the extra points:



To rotate the figure left-click without releasing the button and move the **3D cube** to improve the position

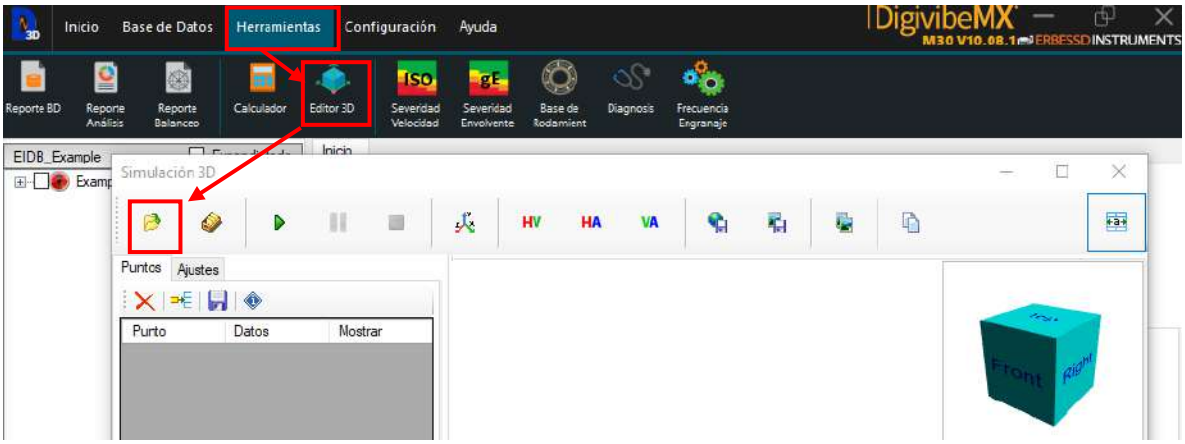


Save changes:

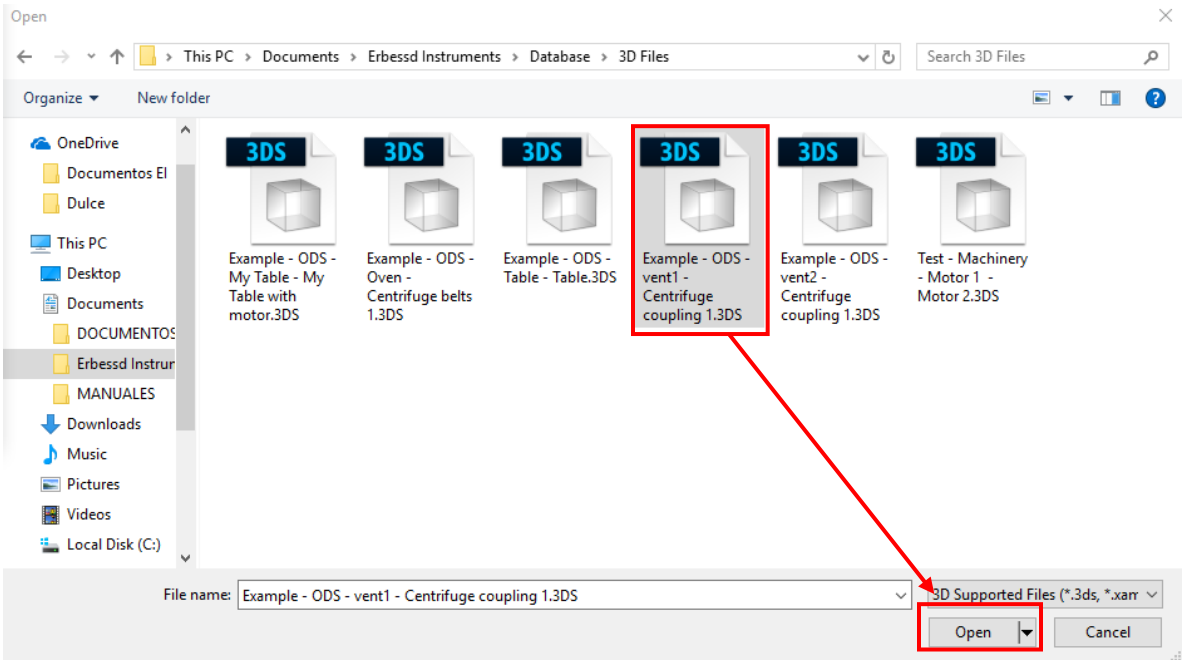


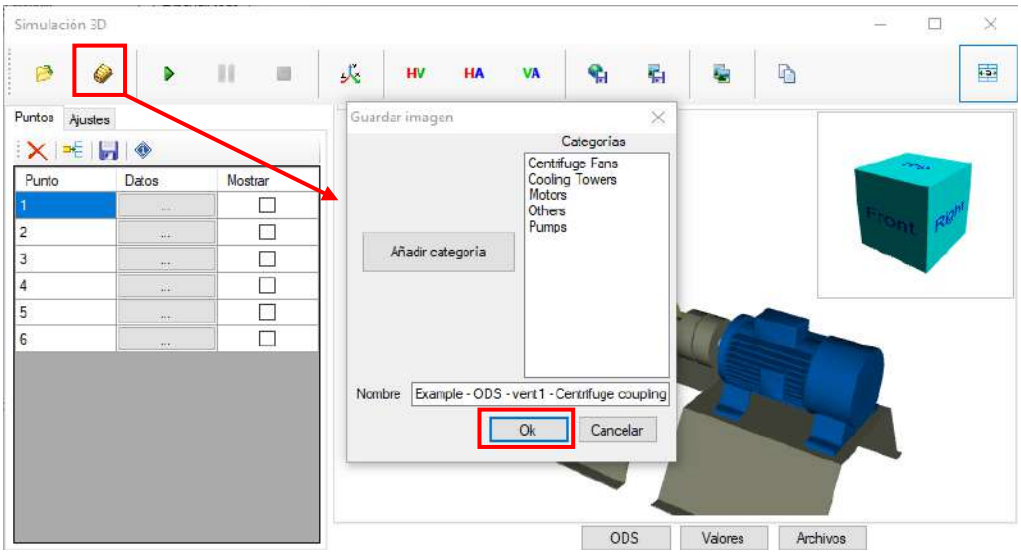
Save the 3D model to the clipboard for use on other machines.

You can add this custom machine to an existing category folder or a new one:



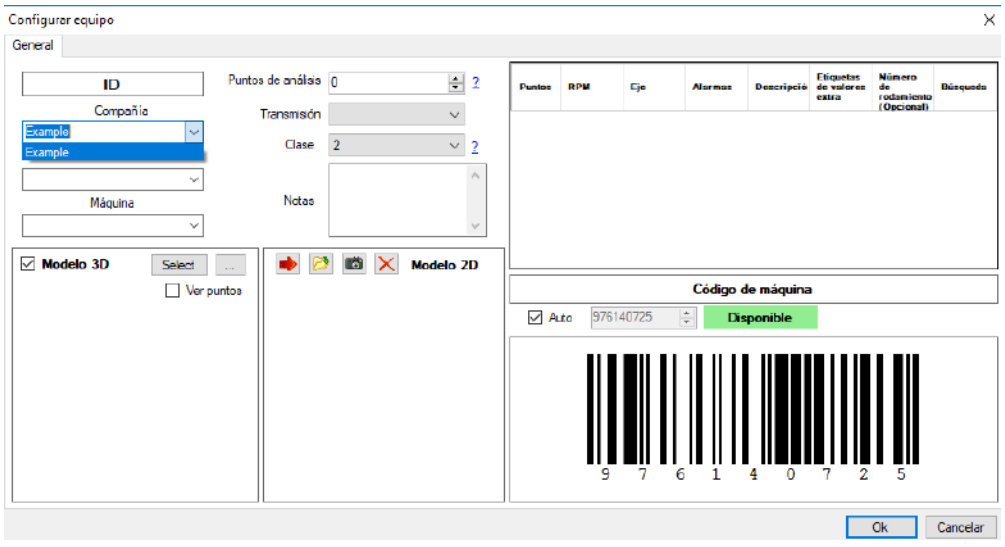
Select the desired file and Open.



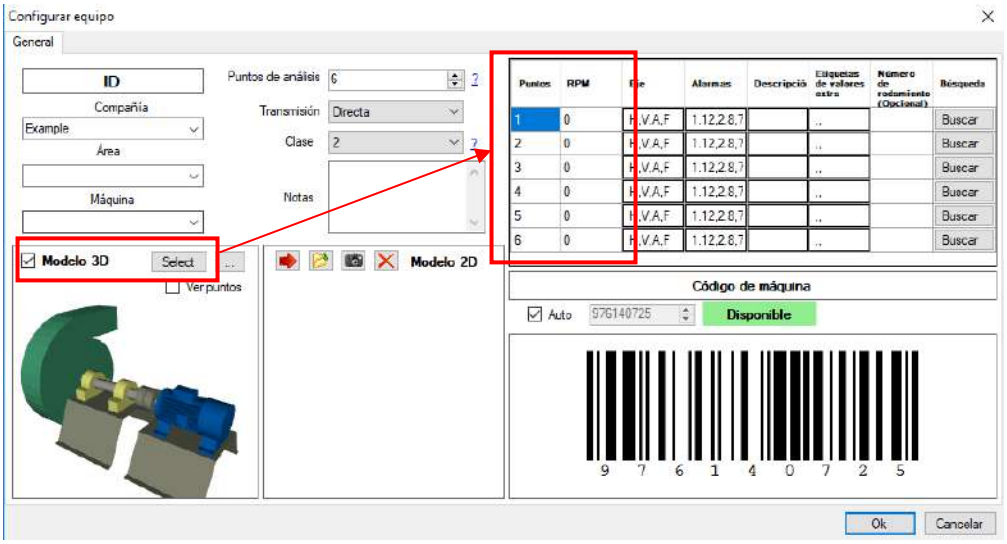


You can now use this 3D model on a Database machine.

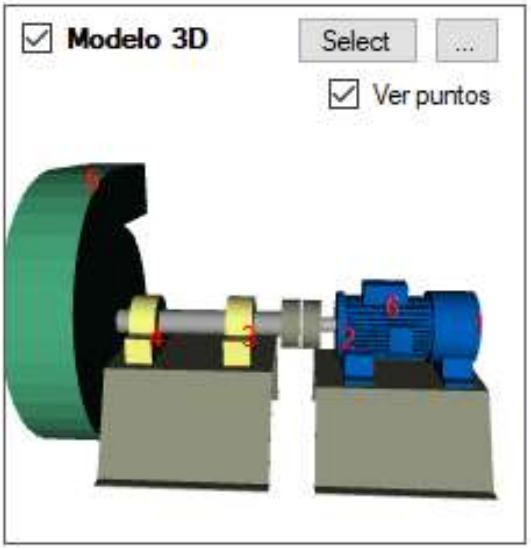
Go to the Database and select New Machine.



Select the newly configured 3D model and add the required points:



The new figure already has the 6 measurement points:

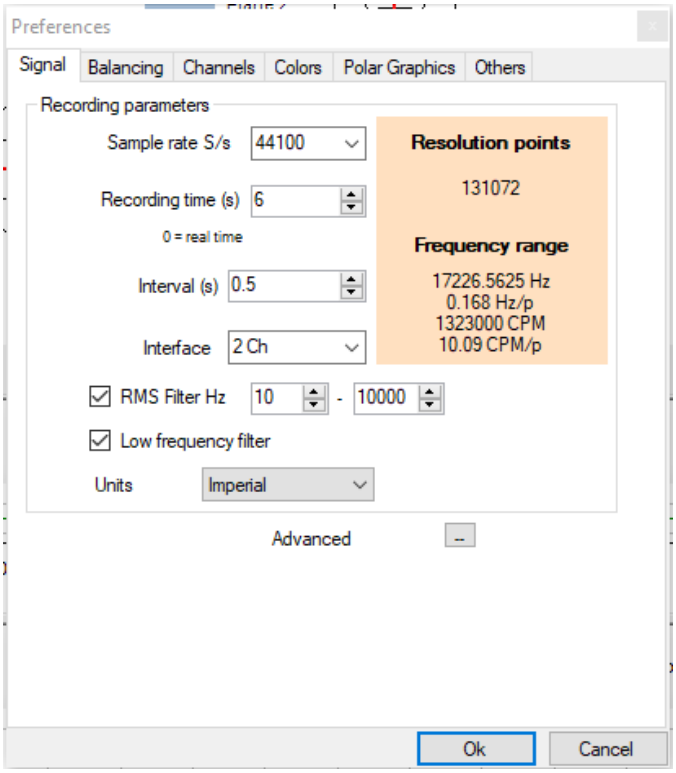


Digivibe MX Software Configuration

The preferences dialog box is opened from the Setup Menu / Config. It is used to configure the visual interface, as well as the input of the signal to the computer.

It contains the following 6 tabs:

Signal Tab



Within the "Signal" tab are the recording parameters that will help us configure our input signal.

- **Sampling Rate:** The number of samples that the equipment will take per second. If it is necessary to observe frequencies greater than 150,000 CPM, it is convenient to use a sampling greater than 11025.

- **Recording time:** It is the time during which the signal will be recorded. At the end of this time the capture will stop automatically showing all the recorded signal. To not record and capture does not stop automatically choose 0.

- **Interval:** It is the time in seconds that each new image will last in the screen. The longer the interval the accuracy of the real-time signal increases, but at the same time the length of time the screen is refreshed increases.

- **Interface:** Here you must select the type of interface you have, either 1 channel, 2 channels or 4 channels. This option is independent of the recording channels and is a configuration that should be done when configuring the system and not changed any more unless you change interface.

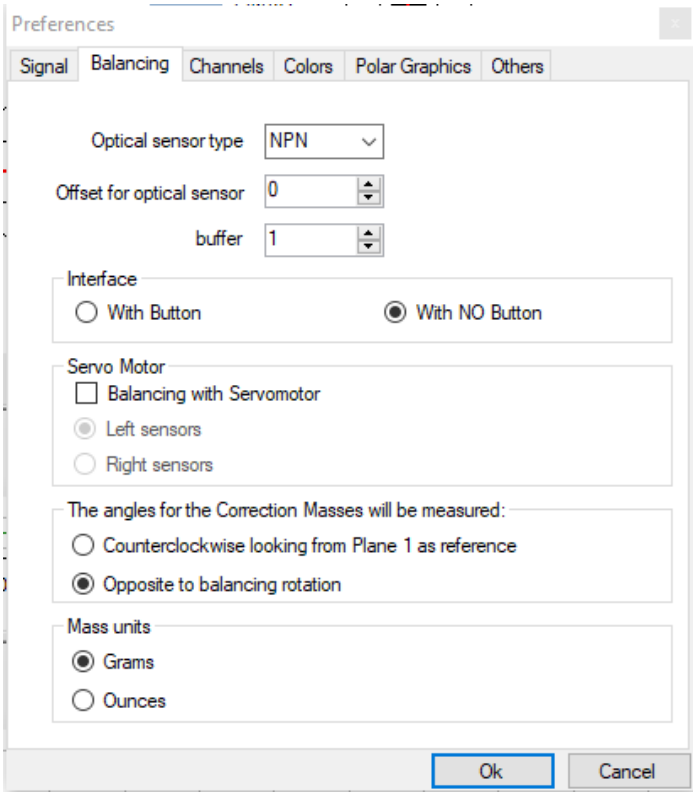
- **Low Frequency Filter:**

- **Units:** You can select between metric and imperial units

- **Damping:** The values of RMS and phase can be damped so as not to have sudden variations. It is used in equipment with very fluctuating vibrations to obtain data averaged in real time, is also very useful in balances whose phase is irregular due to mechanical problems. The minimum damping is 1 sample, and the maximum is 100.

- **Advanced options:** This option displays a dialog box to calibrate the computer. It is not recommended to enter this option as it could lose the calibration of your equipment, in which case the calibration will have to be performed by trained personnel.

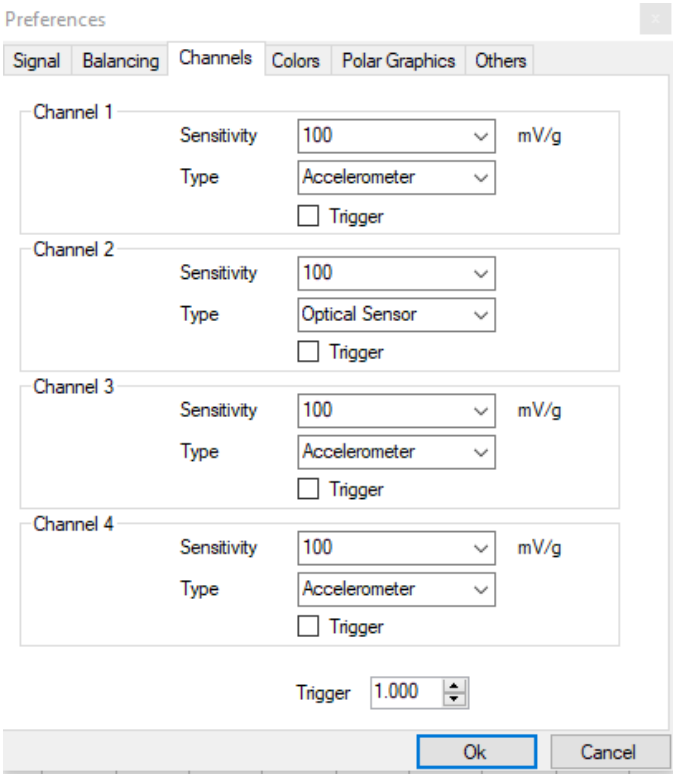
Balancing Tab



Within the "Balancing" tab you will find the following options to configure a swing session.

- **Optical sensor type:**
- **Ofsset for sensor:**
- **Buffer:**
- **Interface with external button:** When selecting this option the interface with external button (I-500) must be used otherwise the sequential interface (I-600) must be used. See Annex.
- Balncing with servo motor (Only can be used if the control module is available)
- Sensors on the left
- Sensors on the right
- **Angle for counterweight:**
- Counter-clockwise with plane 1 as reference
- Against the rotation of the engine.
- **Units of mass:** You can choose between grams and ounces, with which the DigivibeMX® will calculate the weights to placer

Channels Tab

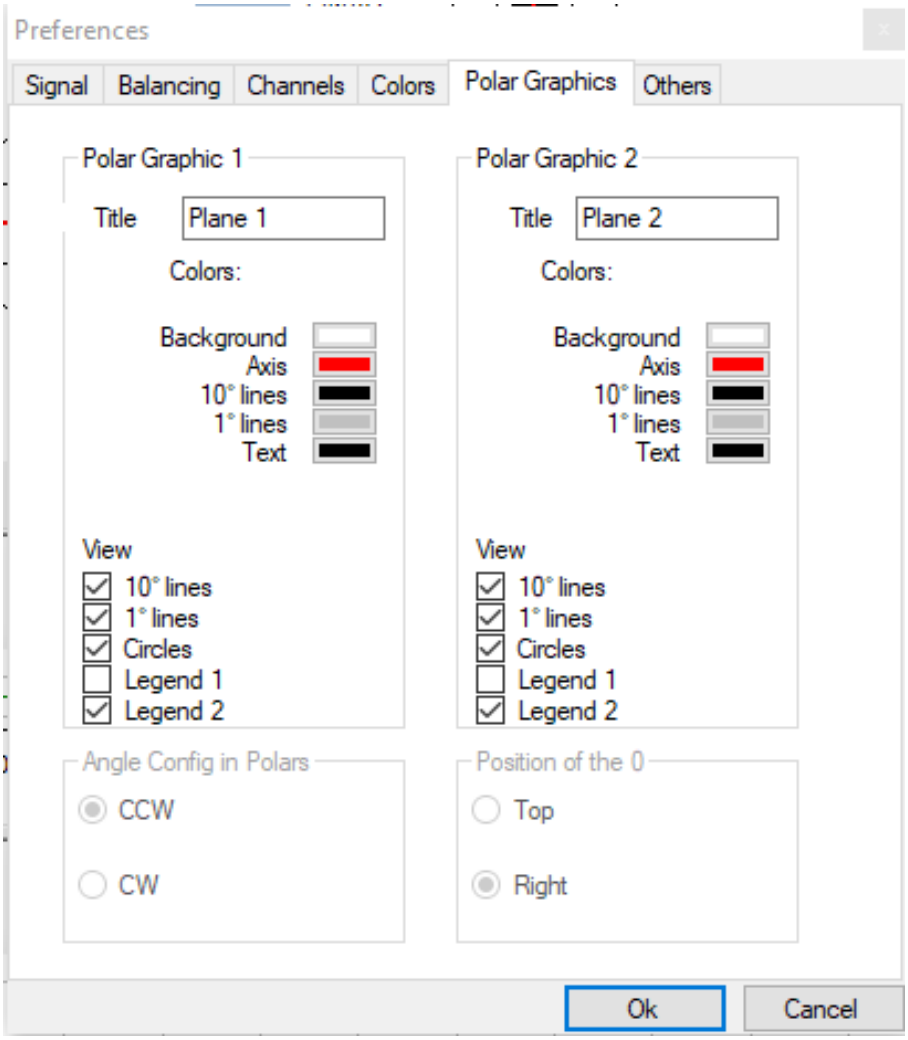


In this section you can select the type of sensor and the sensitivity that will be used in each of the channels.
In addition we have the option of Trigger, which allows us in an analysis session to begin recording at the moment the vibration is equal to or greater than the established (mm / s).

Colors Tab

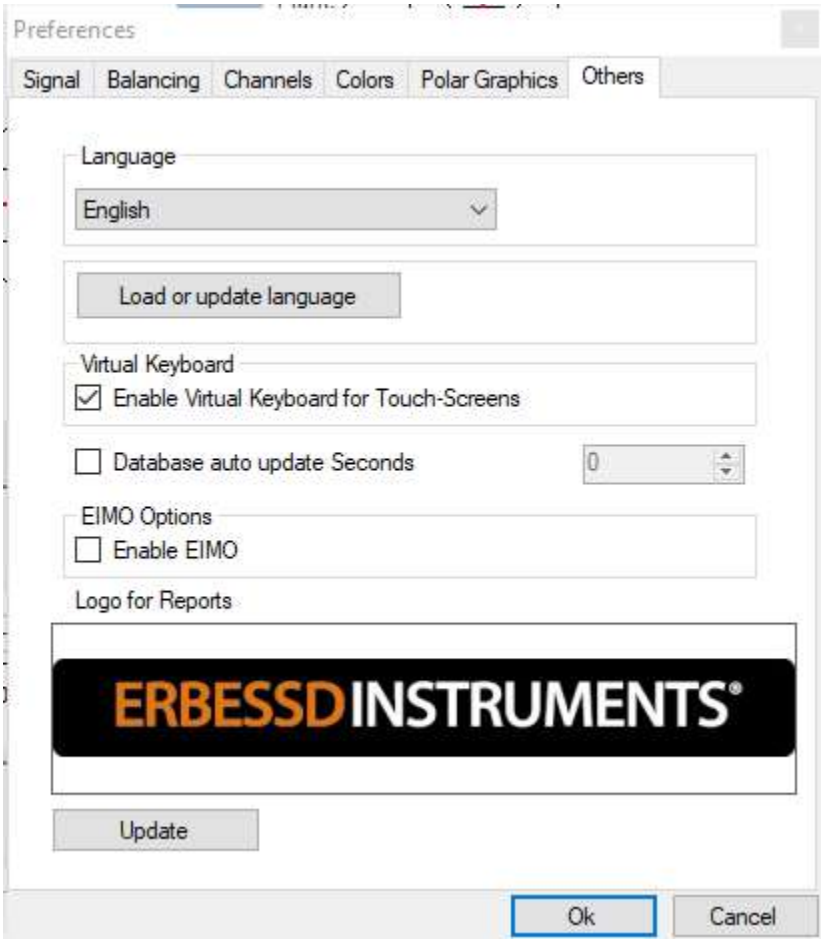
This option sets the colors that make up the signal graphics in time and FFT.

Polar Graphics Tab (M10, M30)



In the "Polar charts" tab you change the color settings, titles and other appearance options of the polar graphs.

Others Tab



In the "Others" tab you have the following options:

- **Language:** It allows us to change the language of the software, we currently have Spanish, English, French and Turkish.
- **- Load or update language:** Allows us to load a new language or update existing ones.
- **- Virtual keyboard:** Activates the numeric keypad when the balancing calculator or the balancing assistant is active in the work area.
- **- Database update:**
- **- Logo update:** Allows you to change the logo that will appear in the analysis and balance reports.

Product Registration

DigivibeMX® is a registered trademark and therefore requires an activation via the internet that can be made using the "Registry" option in the "Help" menu. It is essential to carry out this operation as otherwise the program could be suddenly deactivated.

Updates

DigivibeMX® is an application that is constantly updated. These updates are published on the Erbessd Instruments® page and are free to all users of Erbessd Instruments within the installed version.

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