



*Software for Condition Monitoring and Vibration Analysis*

# Vibrodesigner-Standard/RT User's Guide

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# Chapter 1 Introduction

Welcome to Vibrodesigner!

Vibrodesigner is an advanced condition monitoring system for industrial machinery. The system functionality encompasses a wide range of maintenance engineer tasks, from simple measurements and data acquisition to complete plant-wide maintenance. The Vibrodesigner solution has the power to enable monitoring and protecting machinery against high vibration and the potential damage associated with excessive vibration.

Condition-based machinery maintenance provides you with recording and trending vibration data to keep track of component performance. Permanent vibration analysis of machines for potential faults is the most effective technique in condition monitoring. Fault detection at early stages is based on spectral analysis of mechanical vibration of machinery components. With Vibrodesigner, you perform regular machinery inspections (diagnostic data acquisition), monitor condition and plan maintenance over the entire operating period for all machines. Shaft speed, temperature and other parameters are also used by Vibrodesigner for machinery monitoring.

Integrating offline and online monitoring is the optimal solution for condition-based maintenance. Data acquisition with portable STD-500/510/3300, stationary CTD-2060/2160/3168 monitors, or online ASTD-2 system helps you implement plant-wide maintenance.

Vibrodesigner automatically fulfills the following monitoring requirements:

- Preventing machinery from failures.
- Regular measurements for detecting possible machinery condition changes.
- Real-time machinery condition monitoring over any set of specified parameters.
- Long term storage of the collected data for statistics, further analysis and diagnostics.
- Pinpointing progressive defects and defining deadlines for repairs.
- Locating faulty components and determining a fault causes.

Vibrodesigner provides a large-scale functionality. It allows you to create the plant hierarchy that matches the structure of a real-world plant. Using Vibrodesigner, the maintenance engineer makes a plan of vibration inspections by creating machine models, machines, measurement points and inspection routes. An embedded interface for connecting to Technekon's portable analyzers enables loading inspection configuration (*routes*) into these devices. Inspection routes set all the parameters that a portable data collector will need for data acquisition. When vibration data are collected, you can load the collected data into the Vibrodesigner database on your computer. To detect various machine defects, you may compute any parameters from measured signals, bands or other calculated parameters. You may specify alarm/warning thresholds for these parameters and monitor calculated parameters as trends. You can also import the files

containing inspection data retrieved via the online ASTD-2 monitoring system. Besides, scheduled auto acquisition with remote data monitors can be applied.

A maintenance specialist may use the data stored in the database for:

- Creating and printing reports.
- Visual analysis of waveforms, orbits and spectra.
- Calculating and storing trends of frequency bands (absolute and relative).
- Trend visual analysis for frequency bands and different operational parameters. The analysis includes forecast and alarm levels.
- Viewing and analyzing orbits.
- Waveforms and spectra integration and differentiation, FFT, and so on.

You can create more than one database. Thus, the user may work with various databases, choosing the one of interest.

When installed on a plant local network, the program supports a multi-user access mode. Multiple users may logon to a common database that resides on one of the computers on the network<sup>1</sup>.

## Who Should Use This Book

This manual is intended for vibration analysis specialists in charge of monitoring a plant's machinery. It is assumed that the reader has acquired the following knowledge and skills:

- Knowledge of machinery vibration analysis
- Skills in using Windows 2000/XP

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<sup>1</sup> You need to specify special Windows security settings for accessing remote computers. For more information, see "Windows Security Settings for Remote Access".

# Chapter 2 Vibrodesigner Installation

This chapter describes how to install Vibrodesigner. It also contains Vibrodesigner system requirements.

It covers the following topics:

- Workstation Requirements
- Installing Vibrodesigner

## Workstation Requirements

Before you install, make sure that your workstation meets the following hardware requirements:

- Processor Intel Pentium™ 500 MHz or higher
- At least 128 MB of RAM (Windows 2000), 256 MB (Windows XP)
- At least 350 MB free hard disk space

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**Note** This disk space may vary depending on your database size. Up to 2.5 GB may be additionally required.

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- Video system supporting at least 1024x768 (High Color)

One of the following operating systems must be preinstalled on your computer:

- Microsoft Windows 2000 SP4
- Microsoft Windows XP SP1, SP2 or SP3

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**Note** To enable Vibrodesigner-Standard to work properly, the following program is to be preinstalled on your workstation: **Microsoft .NET Framework 2.0**.

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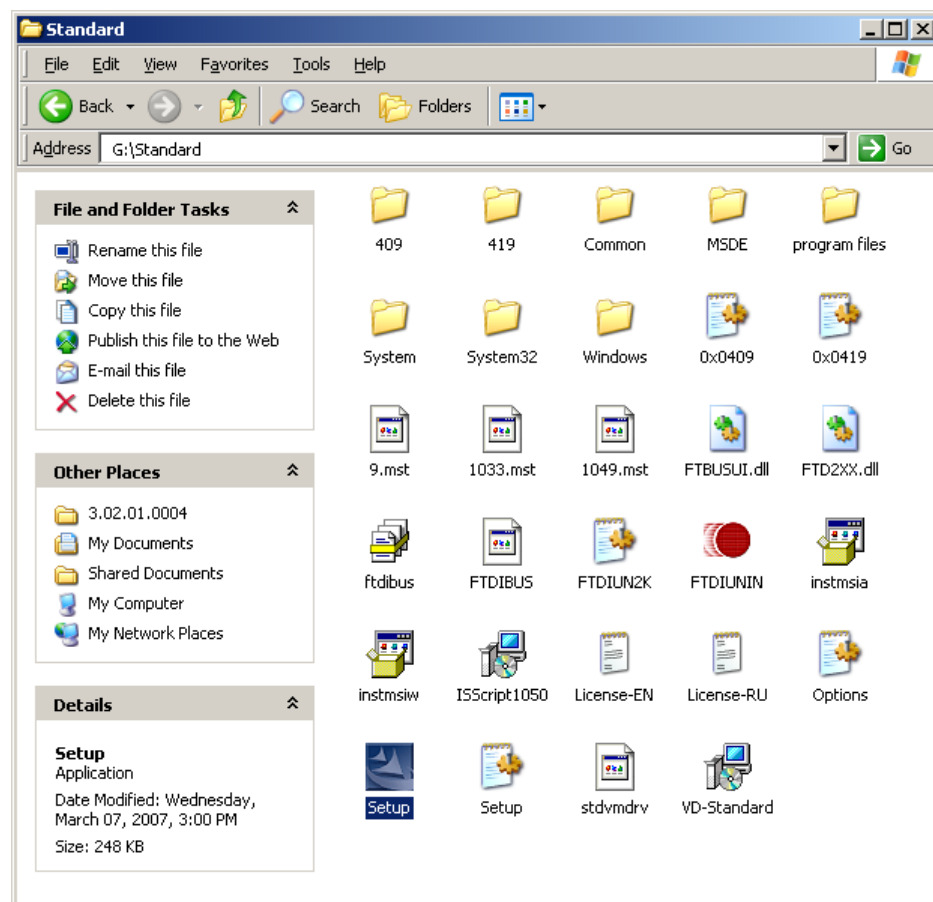
## Installing Vibrodesigner

To install Vibrodesigner-Standard properly, log on to the workstation as a local administrator. If necessary, contact your system administrator.

Before installing Vibrodesigner-Standard, make sure that the freeware Microsoft .NET Framework 2.0 software is installed on your computer and it works properly. If not, you have to install it. To do so, use the **dotnetfx.exe** file located in the folder NET\_FRAMEWORK2.0\ of the Vibrodesigner-Standard installation CD. Run **dotnetfx.exe** and follow the onscreen instructions. Make sure .NET Framework has been installed properly and no errors occurred. If another version of .NET Framework (different from 2.0) is installed, it do not affect Vibrodesigner performance. You have to install .NET Framework version 2.0.

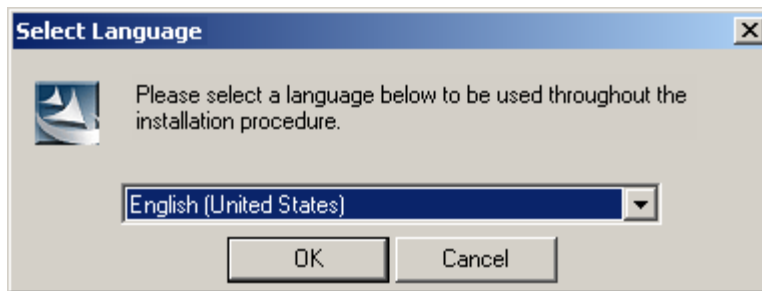
**Note** Close all running applications before installing Vibrodesigner.

- 1 Run the setup.exe file located on the Vibrodesigner installation CD. This file is selected in the picture below.



**Figure 1** Installation CD files

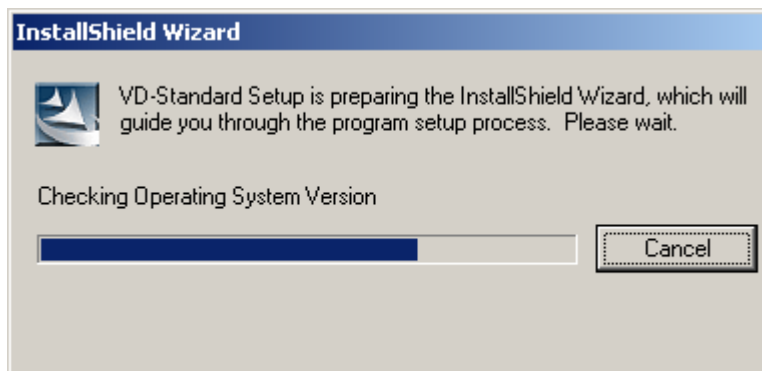
A dialog box appears, prompting you to select the installation and localization language.



**Figure 2 Choosing installation language**

- 2 Select **English** from the drop-down list and click **OK**.

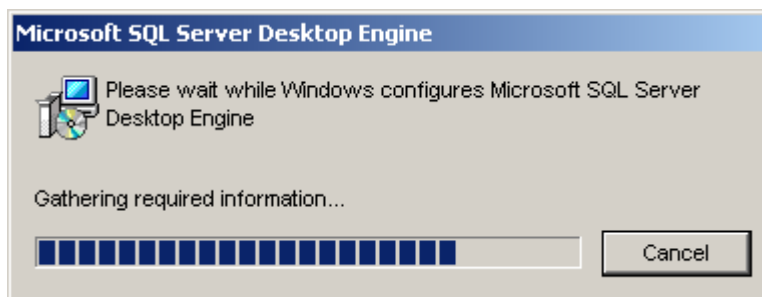
The setup wizard is started.



**Figure 3 Starting InstallShield Wizard**

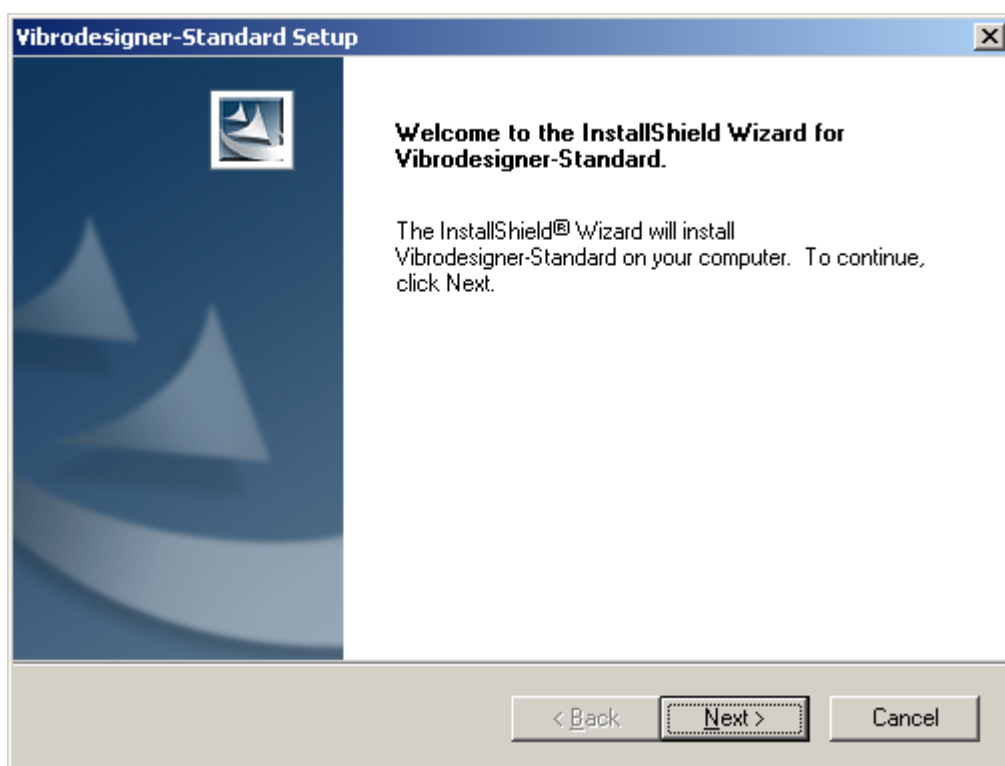
The installation of supplementary MSDE 2000 Release A program (the VD\_SQL\_SERVER instance) is performed to manage Vibrodesigner databases properly. This software will not affect your computer performance. Its installation may take several minutes, please wait until this operation is finished.

**Note:** The SQL server is not installed if you have previously installed Vibrodesigner 3.1 or higher on your computer.



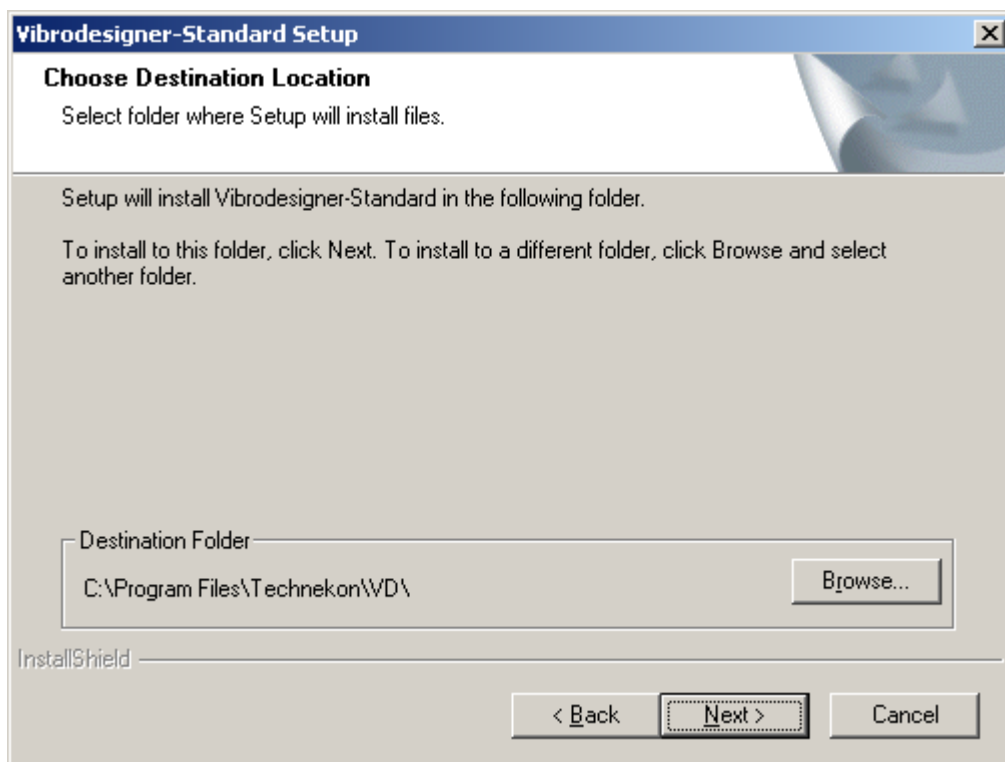
**Figure 4 MSDE Installation Process**

When finished, the Vibrodesigner program installation is started.



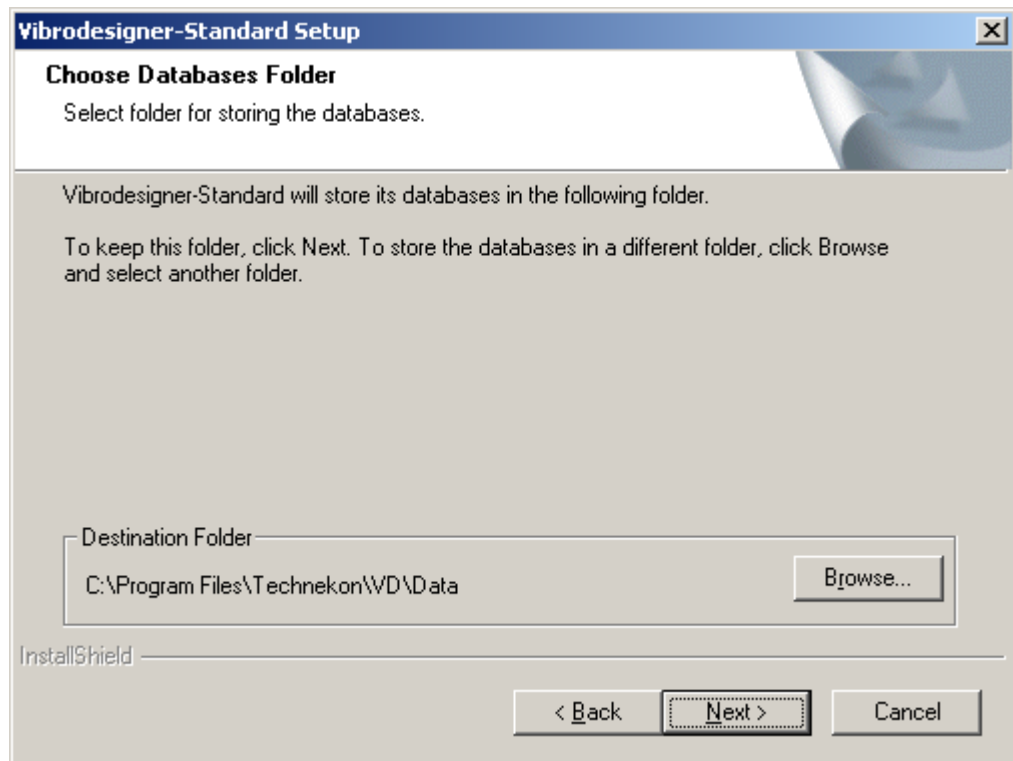
**Figure 5 Welcome Screen page**

3 Click **Next**.



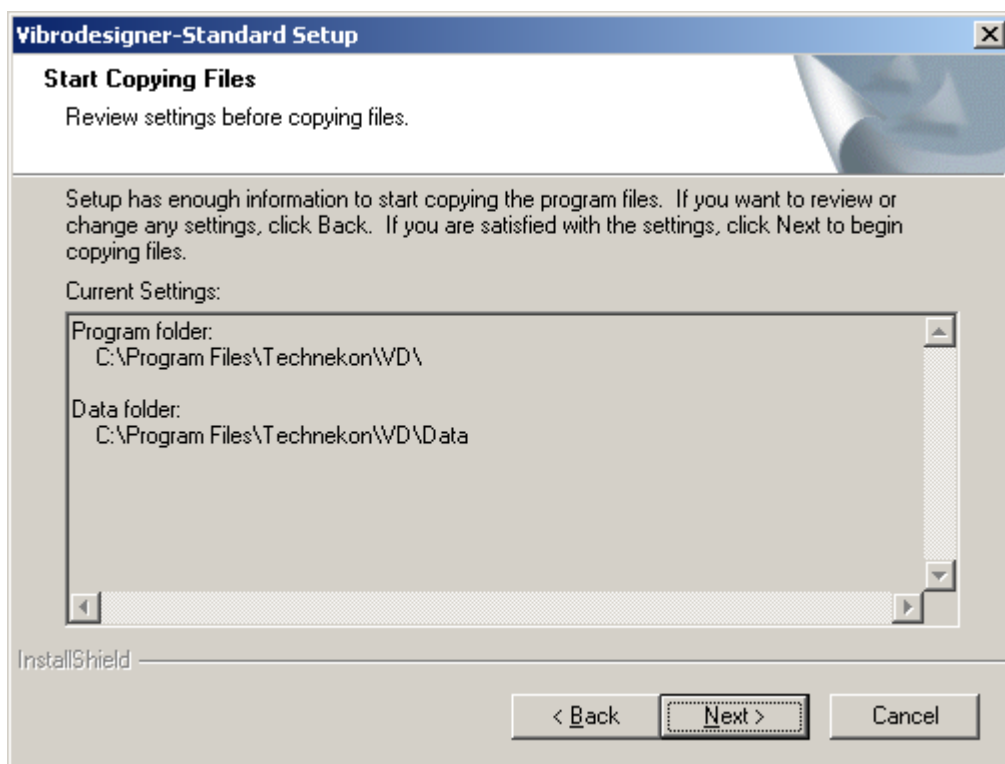
**Figure 6 Choose Destination Location page**

- 4 Either accept the default installation path or specify a different destination location by clicking **Browse**, and then click **Next**.



**Figure 7 Choose Databases Folder page**

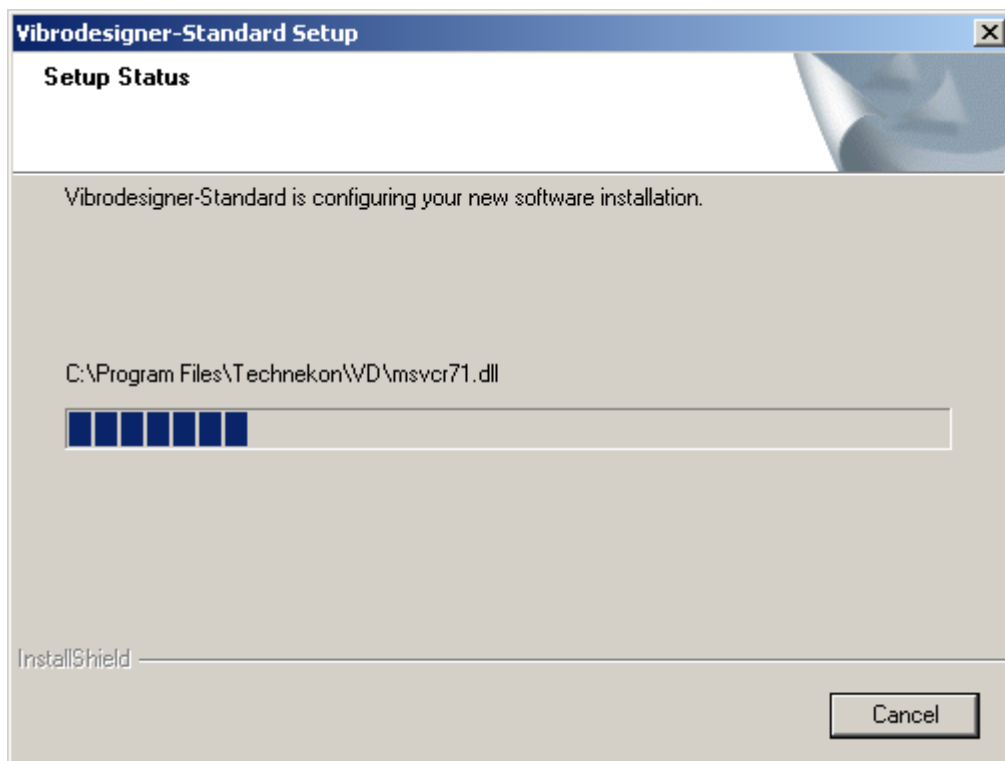
- 5 Either accept the default path to the stored databases or specify a different folder by clicking **Browse**, and then click **Next**.  
The selected settings are displayed.



**Figure 8 Start Copying Files page**

- 6 Click **Next**.

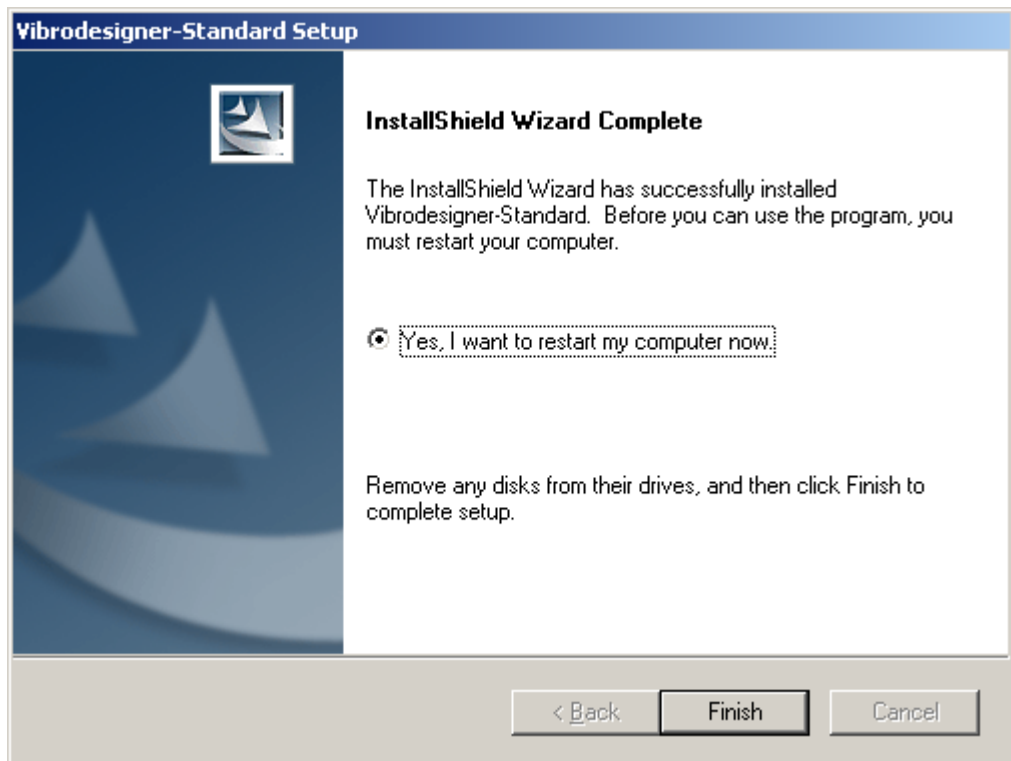
The Vibrodesigner installation is started.



**Figure 9 Starting Vibrodesigner installation**



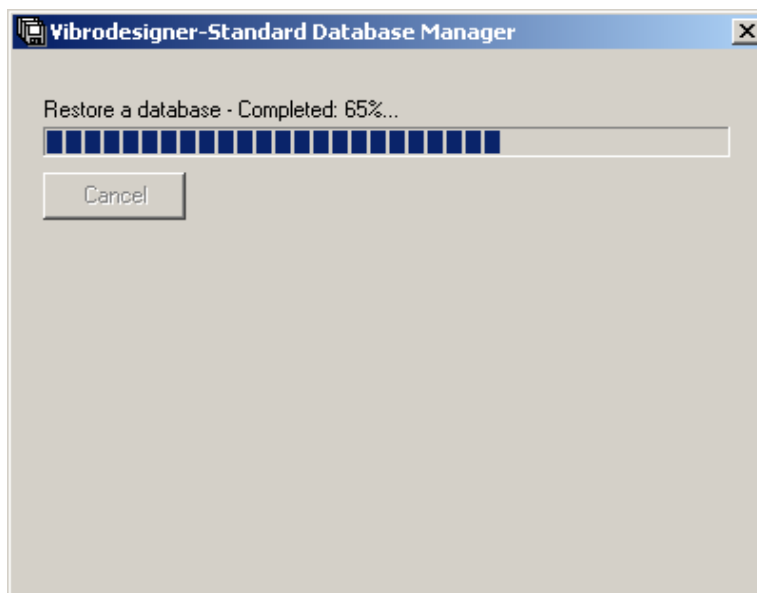
If you had installed MSDE 2000 just before installing Vibrodesigner, you are prompted to restart the computer. If not, you may start working with Vibrodesigner.



**Figure 10 InstallShield Wizard Complete Page**

7 Click **Finish**.

Having Windows restarted, a dialog box appears displaying how the demo database is being restored.



**Figure 11 Restoring demo database**

When finished, you may start working with Vibrodesigner.

## Chapter 3 Overview

This chapter contains a brief overview of Vibrodesigner.

It covers the following topics:

- Features of Vibrodesigner
- Starting Vibrodesigner
- Vibrodesigner Interface
- Vibrodesigner Working Modes
- Vibrodesigner Configuration Types

### Features of Vibrodesigner

Vibrodesigner is a robust system intended to accomplish various tasks of vibration condition monitoring. Main features of Vibrodesigner are the following:

- **Standard Interface**  
The Vibrodesigner provides a standard intuitive user interface that helps quickly master the software. Working with Vibrodesigner does not require special skills or knowledge of any programming language.
- **Versatility**  
The Vibrodesigner system enables you to work either with portable data collectors or stationary analyzers, as well as with the online ASTD-2 vibration diagnostics system. You can also import the data received by email from remote machine shops of your plant.
- **Multi-user access**  
The client-server architecture of the Vibrodesigner software allows you to work remotely with databases on the local plant network. You can create a unified repository of diagnostics data available to all interested specialists of your plant, as well as to outsourced specialists engaged in investigating the causes of the machinery condition changes.
- **Fast and easy configuration**  
The easy-to-use table editor allows you to quickly perform all necessary measurement settings. Modifying parameters of measurement points, frequency bands and warning/alarm levels becomes as easy as using a common office application.

- **Import/export of a plant hierarchy**

Vibrodesigner has a mechanism of import/export of the plant hierarchy, machine models and separate machine elements. It allows you to upload a ready-to-use configuration from a template and exchange configuration templates with fellow specialists.
- **Import/export of inspections**

Vibrodesigner allows exchanging data between various databases with identical logical structure and exporting collected data into MS Excel format.
- **Auto acquisition**

You can apply scheduled auto acquisition from remote data monitors.
- **Frequency bands**

Vibrodesigner enables you to create any absolute or relative bands, estimate trends for these bands using the collected data, automatically calculate RMS in bands in case of new data retrieval.
- **Alarms/warnings**

You can set alarms/warnings either for absolute level or for absolute/relative change of vibration levels in a band. When a level is exceeded, the corresponding element in the plant hierarchy is marked by an exclamation mark.
- **Reports**

You can easily create and print out a machinery condition report when an inspection is completed.
- **Graphical data representation**

Vibrodesigner provides you with a variety of features to display and analyze scalar and vector data. While displaying graphs, you use various settings (for example, color settings, line thickness and so on.)
- **Trends and prediction**

Flexible mechanisms of creating so-called trend sets of various technological parameters enables even an inexperienced specialist to reasonably estimate machinery functional reliability. Analyzing graphs, you can build prognoses and estimate machinery remaining time before failure. Prediction and warning levels can be displayed onscreen to help you in machinery condition analysis.
- **Waveforms and orbits**

Virtually infinite capabilities of waveform analysis. Integrating and differentiating vibration data, applying various filters to waveforms and shaft orbits, etc.—all these Vibrodesigner features greatly facilitate the work of maintenance engineers.
- **Spectra and spectrograms**

Any specialist will be delighted with our optimal solutions for extended spectrum analysis. Fourier transformation of vibration signals, cascade presentation of spectrum time dynamics, quick switch between spectrum measurement units, logarithmic scaling, harmonic cursors, automatic spectrum peak detection—all that is at your fingertips!

- Envelope spectra

By analyzing envelope spectra (frequencies and magnitudes of harmonics), you can define parameters of the vibration signal having amplitude modulation due to friction unit defects. Typically, this analysis is used for identifying inceptive bearing defects.

- Cepstra

Cepstral analysis allows getting spectra from original signal spectra logarithm and sometimes helps to detect implicit periodicity of original signal.

- Daily trends and coast-downs

Analyzing coast-down graphs may help you solve various vibration diagnostics issues, e.g., revealing rotor self-resonance frequencies. Viewing daily trends retrospective enables a maintenance engineer to perform effective analysis based on historical data.

- Monitoring real-time data

You can monitor real-time data captured from remote stationary devices or ASTD-2 systems on request. This significantly expand abilities of real-time machine diagnostics.

- Calculated parameters

You can monitor any machine parameters by automatic computing such parameters during inspection. Calculated parameters are computed with the specified formulas using measured or calculated parameters. You can specify alarm/warning levels for calculated parameters and thus automate defect development inspection.

- User support

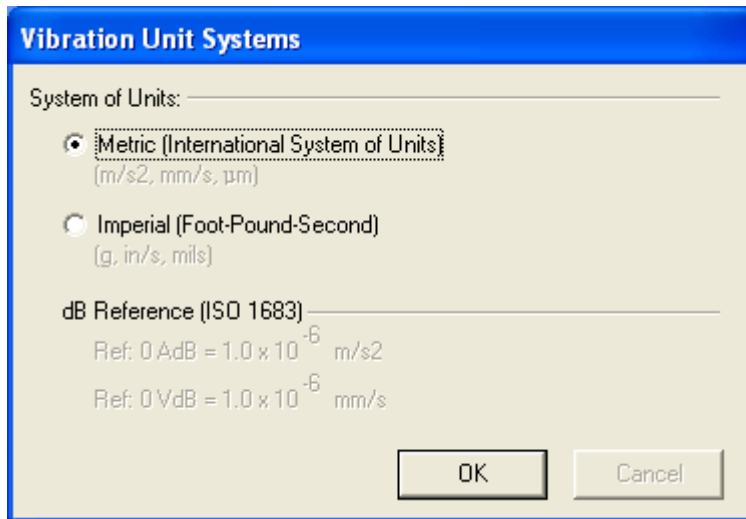
The program is accompanied by a set of documentation, including a user's manual. Registered users are provided with prompt technical consultations and new software versions.

## Starting Vibrodesigner

### To start Vibrodesigner:

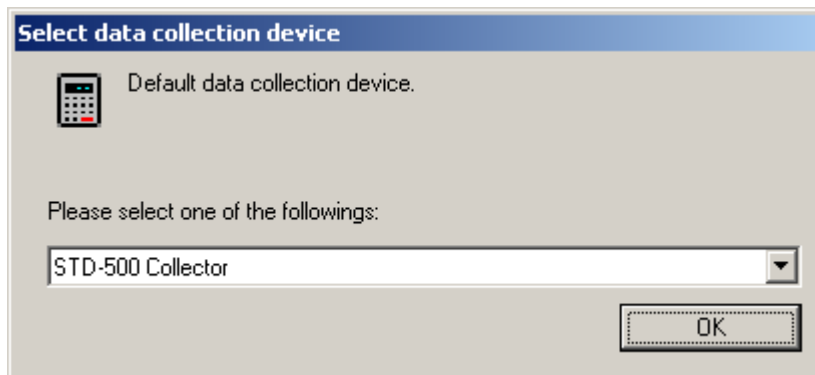
- 1 On the Windows **Start** menu, point to **Programs**, and then select **Vibrodesigner > Standard > Vibrodesigner-Standard**.

If you are starting Vibrodesigner for the first time, the **Vibration Unit Systems** dialog box appears.



**Figure 12 Vibration Unit Systems dialog box**

- 2 Select the system of units you are going to work with and click **OK**.
- 3 If you are starting Vibrodesigner for the first time, the **Select data collection device** dialog box appears.



**Figure 13 Select data collection device dialog box**

- 4 From the drop-down list, select the default data collector and click **OK**.

The Vibrodesigner main window appears. You can now work with Vibrodesigner. For convenience, you may adjust the program interface. For more information, see *Chapter 9, "Program Settings."*

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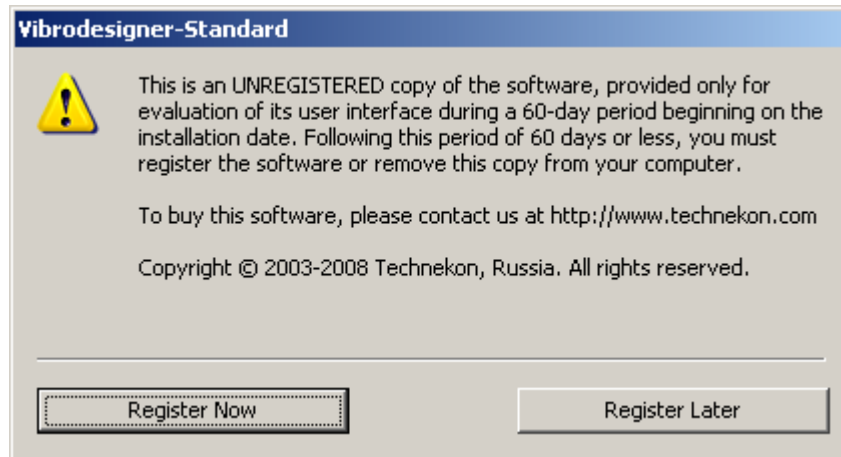
**Note:** The database you have previously been working is opened when Vibrodesigner starts. The software will start in the mode in which the database to be opened was closed.

---

You can also start Vibrodesigner from command prompt. In this case, you need to explicitly specify the server (/NETPATH:<server\_name>) where the program has been installed and the database name (/CONTAINER <db\_name>).

## Software Registration

When you start the program for the first time, you are informed that your version of software is not registered. If you don't register the program, this notification will be displayed each time you launch Vibrodesigner-Standard.



**Figure 14 Registration prompt**

A non-registered version of Vibrodesigner can be used as an evaluation demo less than 60 days starting from the installation date.

---

**Important!** A non-registered version of Vibrodesigner has a limited functionality: you can work with the preinstalled demo database only with Configuration mode prohibited.

---

Registered users are provided with prompt technical consultations and new software versions. To register the program, request a license key from Technekon.

---

**Note:** If you have not registered your version, the NOT REGISTERED text will be displayed at the top of the main program window and in the **About** dialog box.

---

### To request a license key:

1. Send an email to [sales@tehnekon.ru](mailto:sales@tehnekon.ru) with the following information:

- Your company's name
- A user's name
- Your email
- Software Copy ID

This ID is generated by the program and is displayed in **Registration of Vibrodesigner-Standard** dialog box only.

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**Important!** These data will be used to generate a license key. Save this information for further registration.

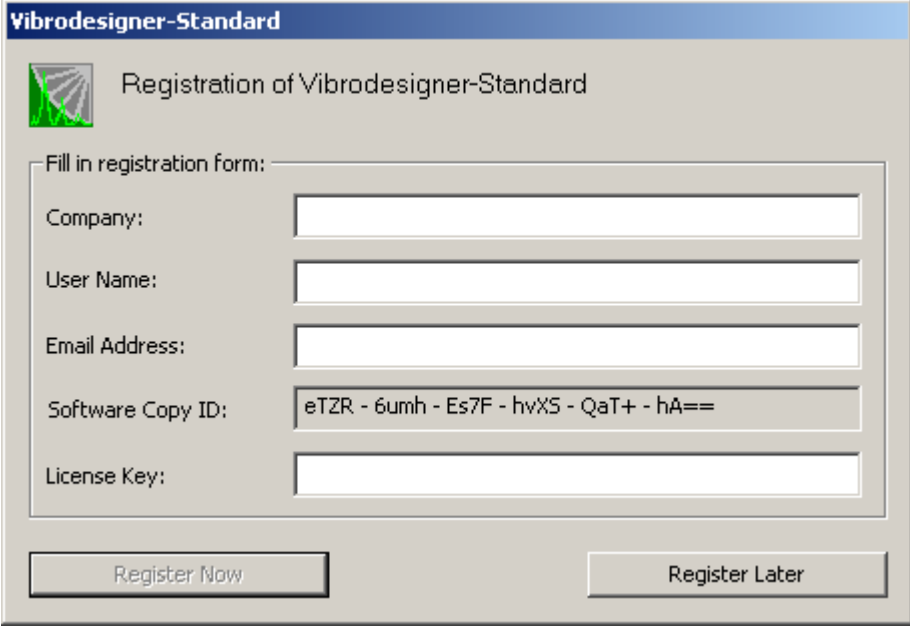
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2. After a while, check your email for a license key from Technekon.

**To register Vibrodesigner-Standard:**

1. Click the **Register Now** button.

The **Registration of Vibrodesigner-Standard** dialog box appears.

The image shows a Windows-style dialog box titled "Vibrodesigner-Standard". Inside the dialog, there is a small icon of a green waveform and the text "Registration of Vibrodesigner-Standard". Below this, there is a section labeled "Fill in registration form:" which contains five input fields. The first four fields are labeled "Company:", "User Name:", "Email Address:", and "Software Copy ID:". The "Software Copy ID" field contains the text "eTZR - 6umh - Es7F - hvXS - QaT+ - hA==". The fifth field is labeled "License Key:". At the bottom of the dialog, there are two buttons: "Register Now" on the left and "Register Later" on the right.

**Figure 15 Software registration dialog box**

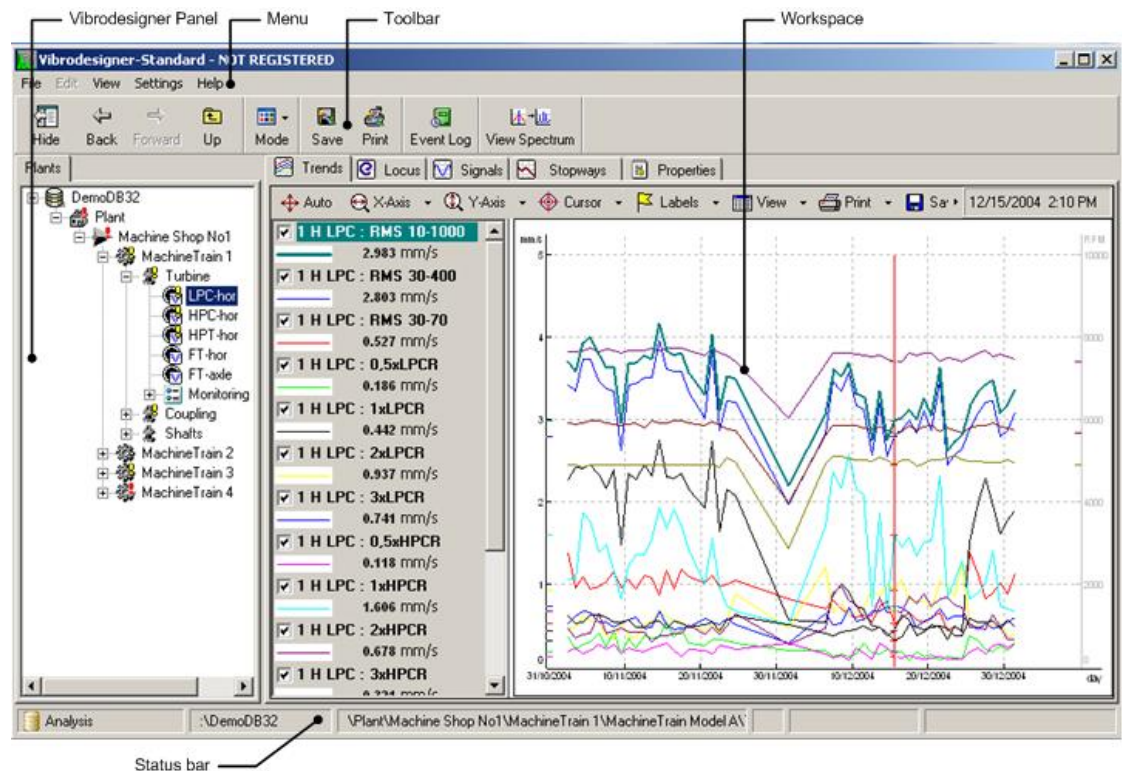
2. Enter the registration data you previously sent to generate the license key, and the license key.
  3. Click the **Register Now** button.
- The program is registered.

## Vibrodesigner Interface

This section describes the Vibrodesigner main window, main menu commands and the status bar.

## Vibrodesigner Main Window

The Vibrodesigner screen consists of the elements described below.



**Figure 16 Vibrodesigner main window**

### 1. Vibrodesigner panel

The Vibrodesigner view depends on the program working mode (see “Vibrodesigner Working Modes”). In the Analysis mode, the panel displays the plant hierarchy. Choosing the needed machine or a measurements point in the plant hierarchy allows you to view the corresponding graphs in the workspace. In the Configuration mode, the panel has three tabs. On the **Plants** tab, you can customize the plant hierarchy (see Chapter 5, “Plant Hierarchy”). On the **Machines** tab, you can create and customize machine models (see Chapter 5, “Machine Models”). On the **Elements** tab, you can create and customize machine element models (see Chapter 5, “Machine Element Models”).

### 2. Workspace

Depending on the working mode, the workspace is used either to view graphical data or edit object properties.

### 3. Menu

Provides access to Vibrodesigner commands.

### 4. Toolbar

Provides buttons for the common Vibrodesigner commands.

### 5. Status bar



Shows the current working mode, the current database, and the name of the object selected in the Vibrodesigner panel.

## Main Menu Overview

The **File** menu contains commands for:

- Working with databases
- Exporting/importing data
- Recalculating bands and calculated parameters
- Saving and printing graphical data
- Quitting Vibrodesigner

The **Edit** menu commands are available in the Configuration mode only and intended for working with the plant hierarchy objects.

Using the **View** menu commands, you can choose the working mode of interest, hide some interface elements and change the Vibrodesigner panel view.

Clicking **Settings** on the main menu displays the **Settings** dialog box used to customize the program interface and specify the default device.

The **Help** menu commands allow you to view the information about the current Vibrodesigner version

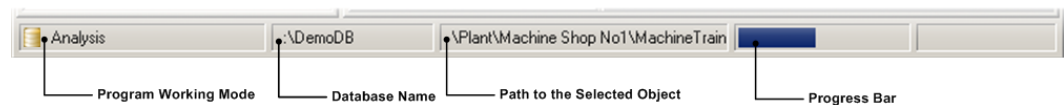
---

**Note:** For more information about main menu commands, refer to *Chapter 11, “Main Menu.”*

---

## Status Bar

The status bar is the area at the bottom of the Vibrodesigner main window. The picture below shows an example of the status bar view.



**Figure 17 Status bar**

The status bar provides you with the following information:

- The current working mode  
Vibrodesigner may work in one of the following modes: Analysis, Configuration, Comparison, and Real Time. For more information, refer to “Vibrodesigner Working Modes.”
- The name of the open database  
This element displays a name of the database which the user is currently working with.
- The path to a selected object

This element displays the path to the object selected in the plant hierarchy in the Vibrodesigner panel.

- The progress indicator

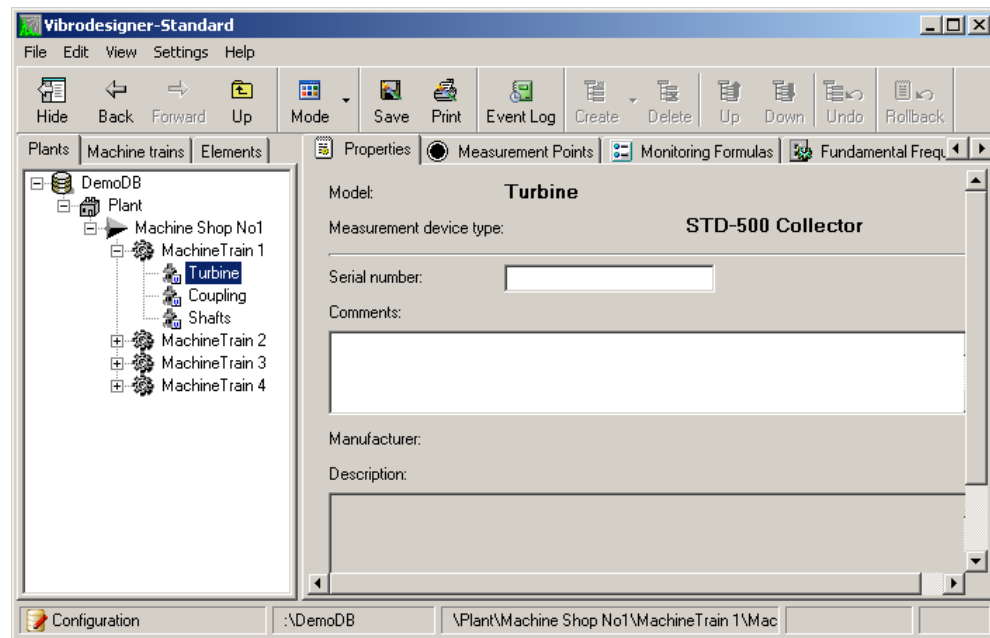
This element shows the percentage of a particular process that has been completed, such as inspection data import.

## Vibrodesigner Working Modes

Vibrodesigner may work in one of four modes:

- The Configuration mode
- The Analysis mode
- The Comparison mode
- The Real Time mode<sup>2</sup>

The Configuration mode is intended for creating a database structure, namely a plant hierarchy and a measurement model. Without a plant hierarchy and a monitored machinery structure, you cannot perform measurements neither save data in a database.



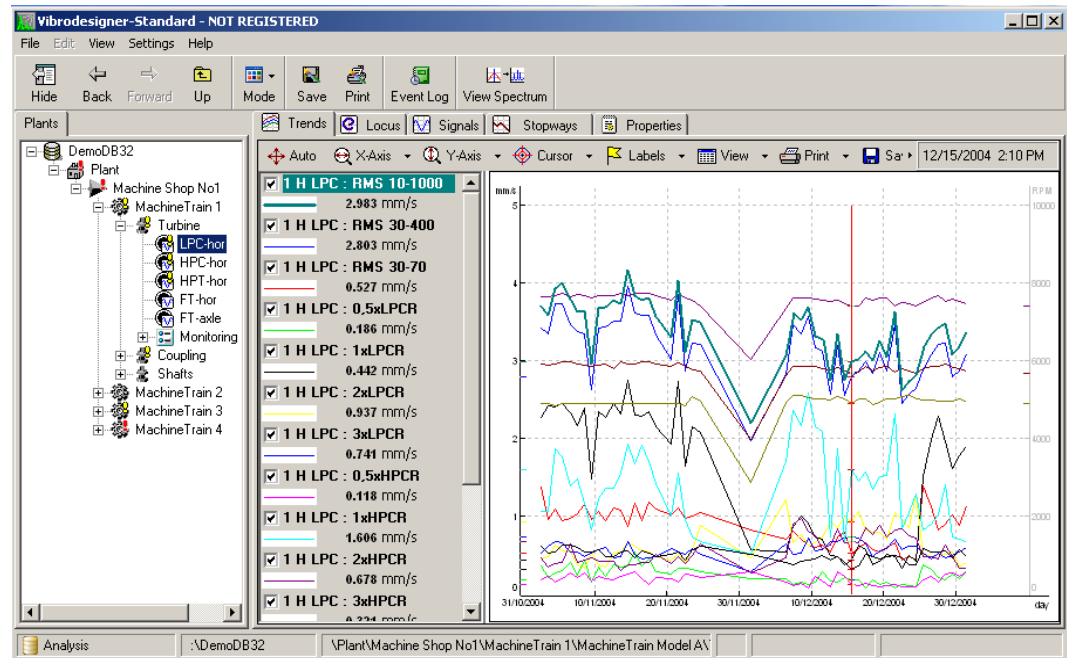
**Figure 18 Configuration mode**

The Analysis mode is intended for recording data from devices into a database and viewing/analyzing the collected data. In this mode, you cannot change the plant hierarchy. You are only allowed to add data by loading it from a vibration monitoring device.

---

<sup>2</sup> The Real-time mode is activated only after installing a special Vibrodesigner-RT package.

You can also switch to the Comparison mode whereby you may simultaneously view data from various machines belonged to different machine shops.



**Figure 19 Analysis mode**

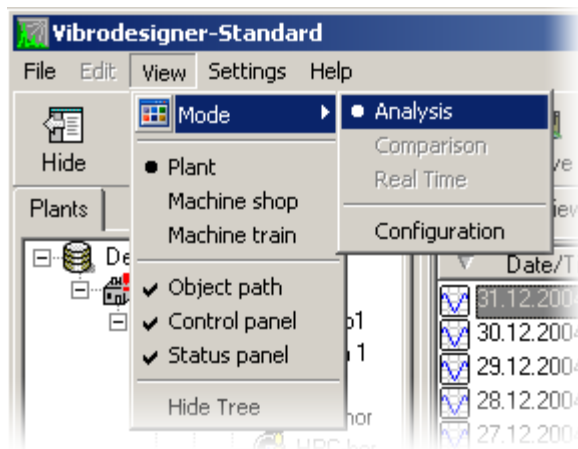
In the Real time mode, you can analyze real-time data captured directly from ASTD-2<sup>3</sup> systems or from connected CTD-2060/2160/3168 monitors on request. The program enables you to get and view current spectra, waveforms, orbits, and trend sets of machine parameters.

**Note:** Configuring the ASTD-2 system is carried out by Technekon's skilled technicians during the system deployment. This work involves synchronous setup and testing of machine shop servers and maintenance engineers' workstations (including configuring Vibrodesigner-Standard).

#### To select the working mode you need:

1. From the main menu, select **View**.  
The **View** context menu appears.

<sup>3</sup> To view current data, the maintenance engineer's workstation and ASTD-2 servers must reside on the same local network.



**Figure 20 Switching between modes**

2. Point to **Mode** and select the mode of interest—**Analysis**, **Comparison**, **Real Time**, and **Configuration**.

The selected mode is marked by a dot (•) in the menu. In the picture above, Analysis is the active mode.

---

**Note:** The active mode is also displayed on the status bar (in the left lower corner of the main program window.)

---

## Vibrodesigner Configuration Types

You may deploy one of the following Vibrodesigner configuration types:

- Local system
- Network system with local databases
- Network system with a unified repository of the plant diagnostics data
- Network System based on ASTD-2 machine shop server

### Local System

A local system is a typical and most frequently used type of configuration. In this case, a maintenance engineer performs all operations on his standalone computer and normally within one database. All the data are stored on the same computer. Access to the software and the databases is allowed only from the operator's workstation. If the workstation fails, vital diagnostics information may be lost. To prevent accidental loss of data, the maintenance engineer has to archive databases regularly. It is the most economical configuration.

### Network System with Local Databases

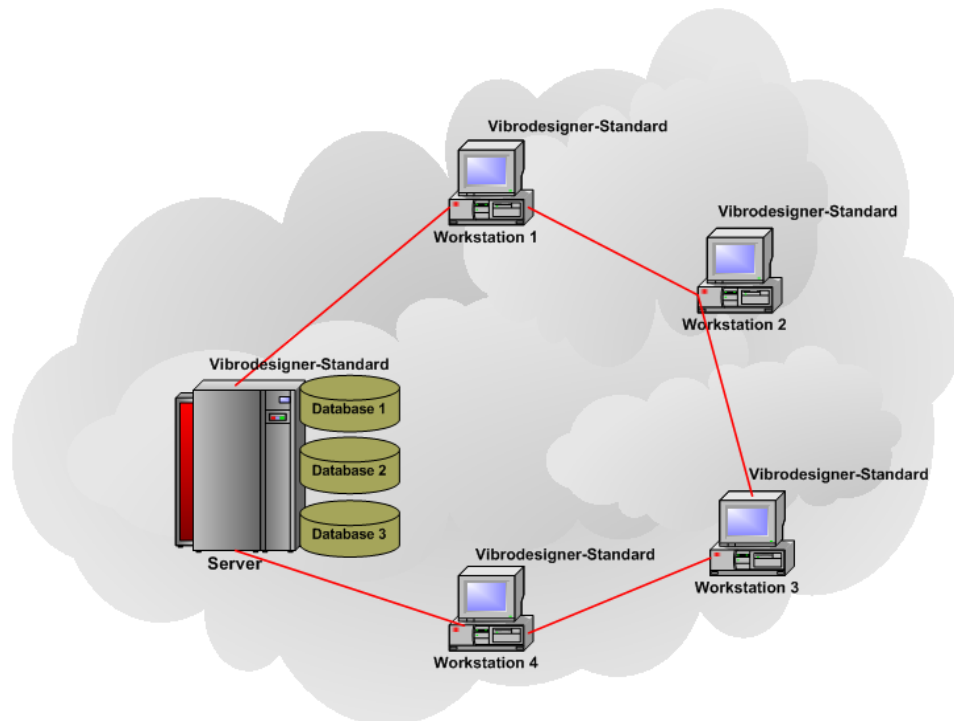
Additional capabilities become available if Vibrodesigner is installed on several workstations connected within the plant local area network (LAN). On each workstation, local databases available from other computers can be created. This is a multi-user

system. The data are distributed among multiple workstations so that data are available from remote computers only when the destination computers are switched on.

## Client-server Configuration

Vibrodesigner client server architecture is used to centralize control over the plant (or any plant division) databases. Typically, this configuration needs a dedicated computer (server) to store data. The server, which is powered via an UPS and is running round the clock, must be powerful and reliable. The server typically has special systems to improve data storage reliability, such as RAID-arrays. Vibrodesigner is installed on the server and a unified repository of the diagnostics data<sup>4</sup> is created, maintained, and regularly backed up. The Vibrodesigner applications are also installed on specialist' workstations, but local databases are not created on these computers. A maintenance specialist logs on and works with a database of interest stored on the server. This configuration provides a unified information environment on the plant to accomplish condition monitoring tasks. This is the most reliable and efficient solution.

The picture below shows an example of the Vibrodesigner client-server architecture.

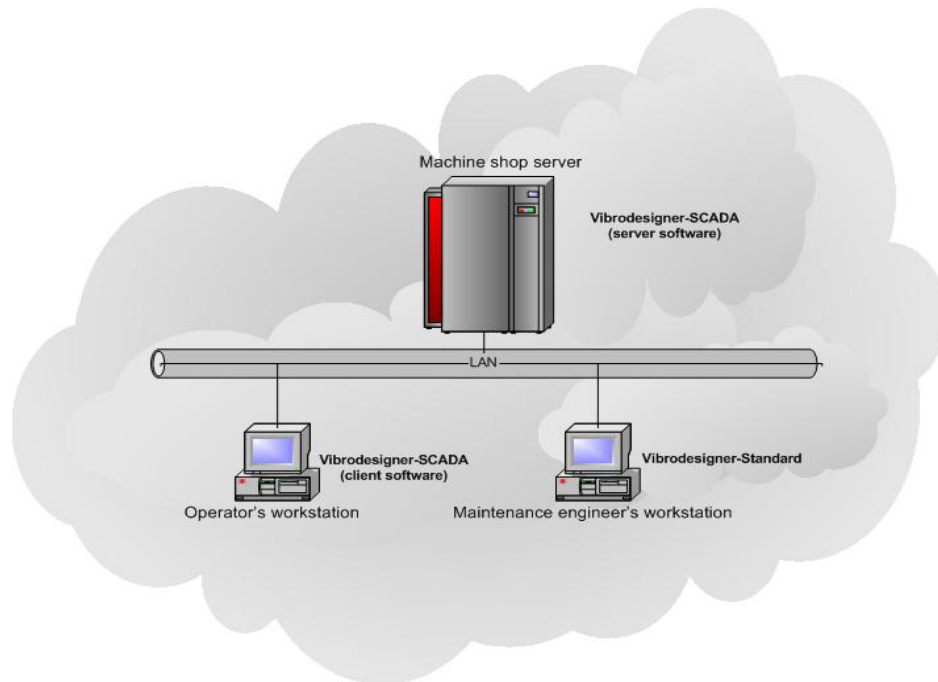


**Figure 21 Client-server architecture**

<sup>4</sup> The *unified repository of the diagnostics data* term does not assume that all the data are stored in a single Vibrodesigner database. This might affect the system performance in case of a large plant and large amounts of data. The number of databases to be created is not limited, it all depends on actual tasks and the plant scale. The *unified repository* means that all databases are stored and maintained centrally and available to all interested specialists.

## Network ASTD-2 System

The simplified network ASTD-2 architecture is shown in the picture below.



**Figure 22 Network ASTD-2 architecture**

The Vibrodesigner-Standard 3.2 application is an essential part of the automated ASTD-2 system. The ASTD-2 is installed on the local network and contains the following primary elements:

- ASTD-2 machine shop server
- Shift operator's workstation
- Maintenance engineer's workstation

*The machine shop server* is a powerful and reliable computer. This computer automatically performs the following operations:

- Collecting data from machines
- Generating daily trend
- Generating and storing shift reports and machine inspections
- Saving machine stops data
- Sending data files to maintenance engineer's workstation

*The shift operator's workstation* is intended for online monitoring of machine vibration condition. The Vibrodesigner-SCADA software is installed on this workstation.

*The maintenance engineer's workstation* is used for handling vibration diagnostics tasks. The Vibrodesigner-Standard software is installed on this computer and thus the entire system for condition monitoring and vibration analysis is created.

# Chapter 4 Quick Start

This chapter contains a small tutorial that helps you learn how to work with Vibrodesigner.

It covers the following topics:

- Introduction
- Creating New Databases
- Creating Machine Models
- Creating Plant Hierarchy
- Working with STD-500
- Analyzing Collected Data

## Introduction

This chapter allows you to acquire practical skills in using Vibrodesigner. If you have not worked with Vibrodesigner before, it is recommended to read this chapter carefully before studying all program features described in the following chapters. It will help you become familiar with basic concepts and work with the program professionally later on.

Here, we provide you with a brief step-by-step procedure of a simplified routine performed by a maintenance engineer. To successfully follow all steps of the procedure, you need to have an STD-500 monitor with accessories and any source of mechanical vibrations.

We will consider the following major actions:

1. Creating an empty database.
2. Creating a machine measurement model from machine element models.
3. Creating a plant hierarchy.
4. Working with STD-500.
5. Analyzing collected data.

## Creating New Databases

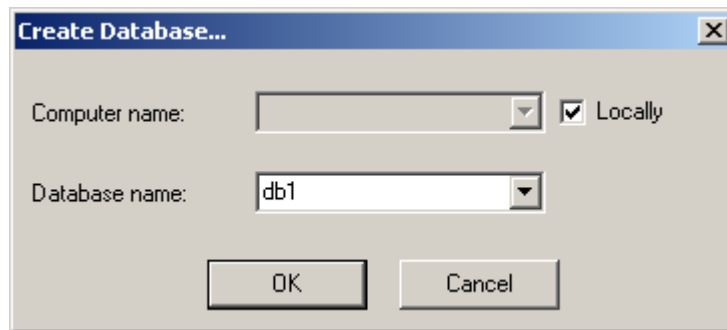
**To create a new database:**

1. Start Vibrodesigner.

The Vibrodesigner main window appears. In the Analysis mode, the left pane shows the object hierarchy, and the data associated with the selected object are displayed on the right. By default, the demonstration database is started.

2. Switch to the Configuration mode by selecting **Mode > Configuration** from the **View** menu.
3. On the **File** menu, click **Create database**.

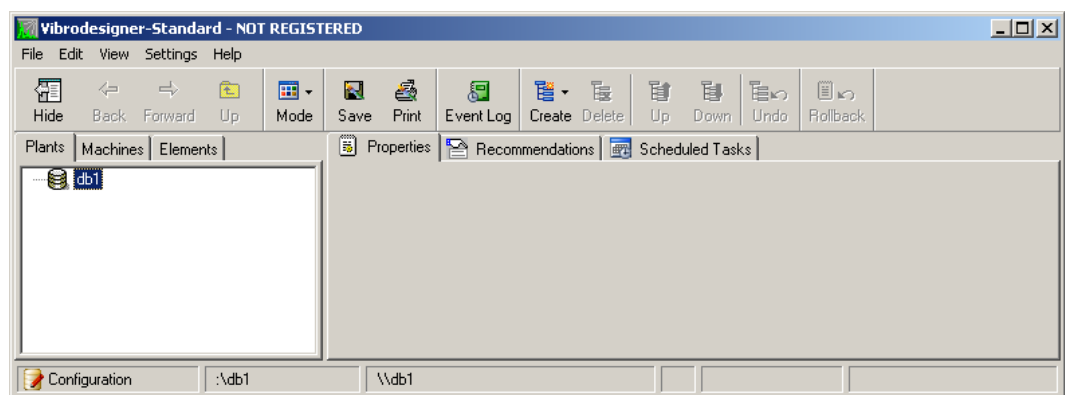
The **Create database** dialog box appears.



**Figure 23 Create Database dialog box**

4. In the **Database name** box, type a name of the database (for example, “db1”) and click **OK**.

The left Vibrodesigner panel displays the newly created database. The database object tree contains only the root element (*the database name*). The Vibrodesigner panel has three tabs. Firstly, on the **Elements** tab, machine elements are to be created. Secondly, on the **Machine** tab, the created elements are assembled into machines. Finally, on the **Plants** tab, the complete plant hierarchy is created. For now, your newly created database has no plants or machines.



**Figure 24 Empty database**

After creating a new empty database, you need to create models of machines to be inspected.

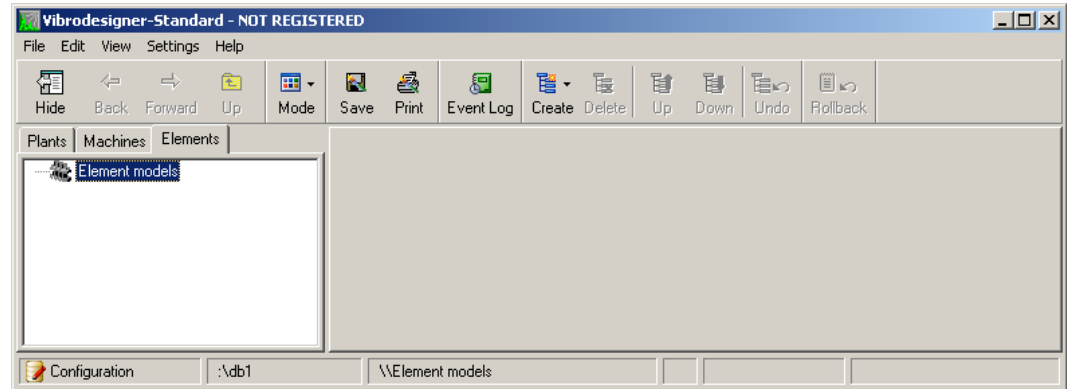


# Creating Machine Models

## Creating Machine Element Models

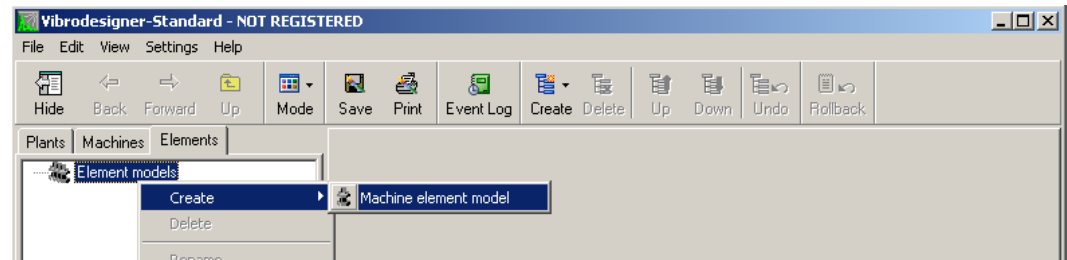
To create a machine measurement model, you need first to assemble such models from separate elements. On this step, you will create element models which can be used several times later on.

1. Click the **Elements** tab.



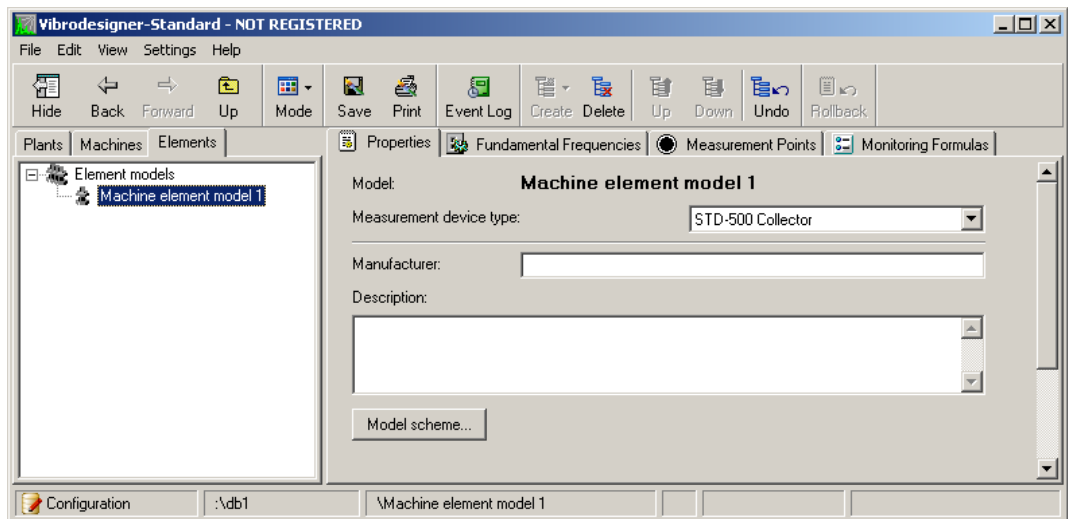
**Figure 25 Editing element models—the list is empty**

2. To create a machine element model, right-click the root element **Models of elements** and select **Create > Machine element model** from the menu.



**Figure 26 Creating new machine element model**

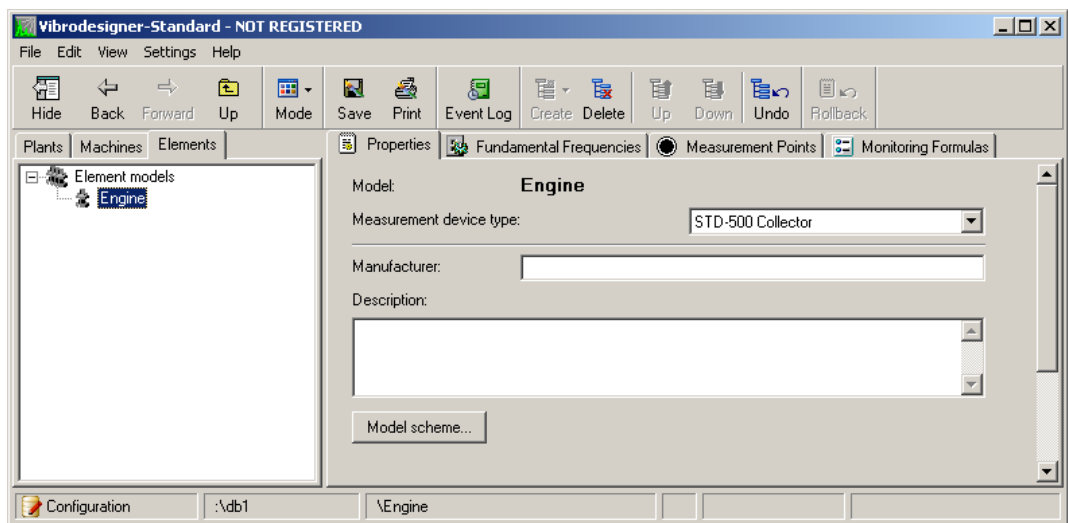
A new machine element model is now created. The tabs used to adjust element parameters are displayed in the workspace on the right.



**Figure 27 Newly created element model**

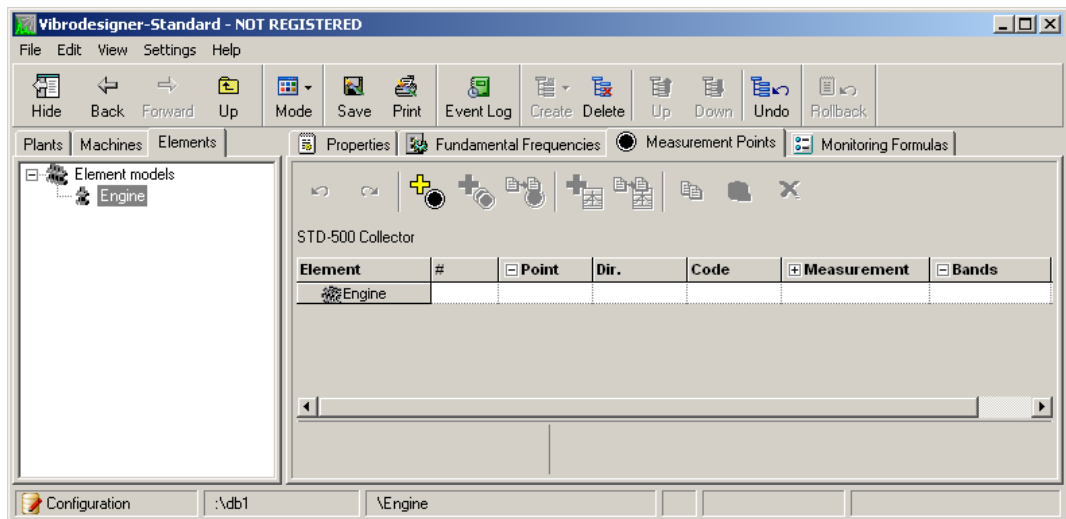
3. Rename the newly created model to **Engine**. To do so, right-click the newly created model displayed on the left, select **Rename** from the menu, and then type in **Engine**. You can rename any machine element in the same way.

The machine element model is renamed.



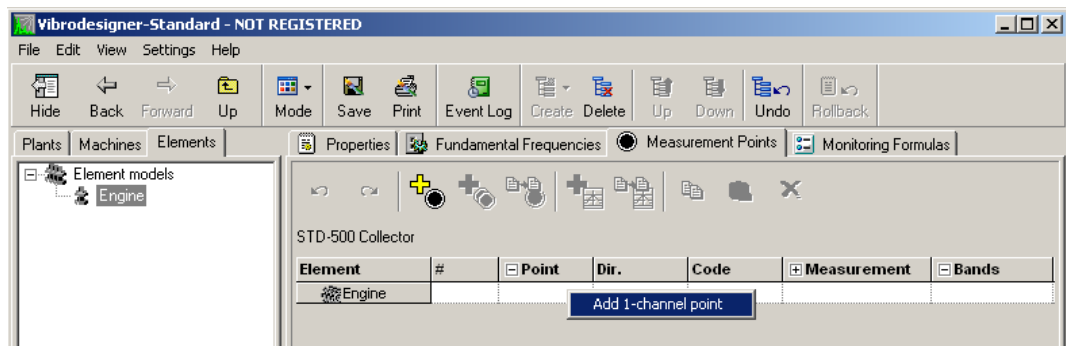
**Figure 28 Renaming model**

4. On the **Properties** tab to the right, specify the type of the measurement device (**STD-500 Collector**) which will be used to collect vibration data in the engine measurement points.
5. Click the **Measurement points** tab on the right. The table on this tab displays a list of measurement points of the selected element model. As we have not created any points so far, the table is empty.



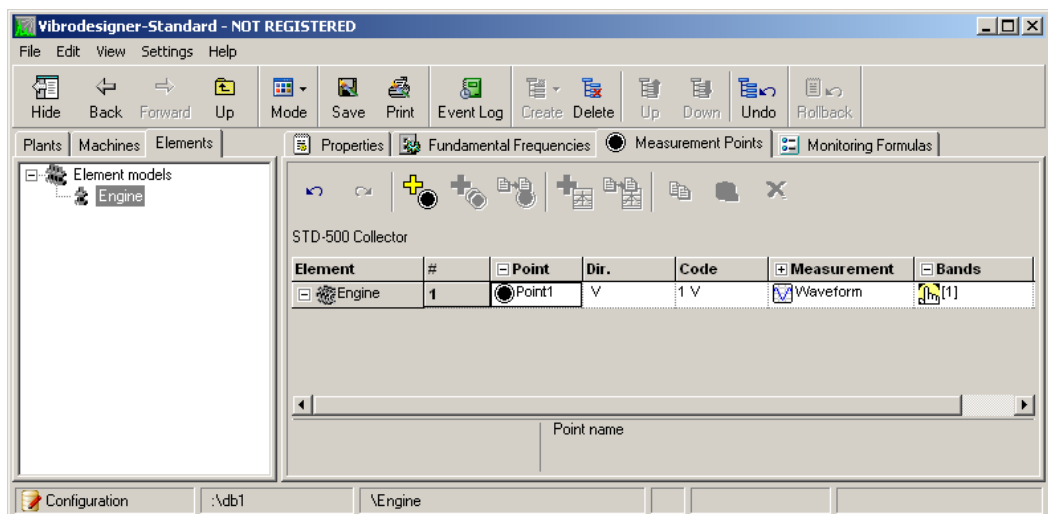
**Figure 29 Measurement Points tab**

6. Create a 1-channel measurement point on the **Engine** model. To do so, right-click in the measurement point table and select **Add 1-channel point** from the menu.



**Figure 30 Creating measurement point on the element**

A new measurement point is created and consequently a new record is displayed in the table. All point parameters are displayed in a row.

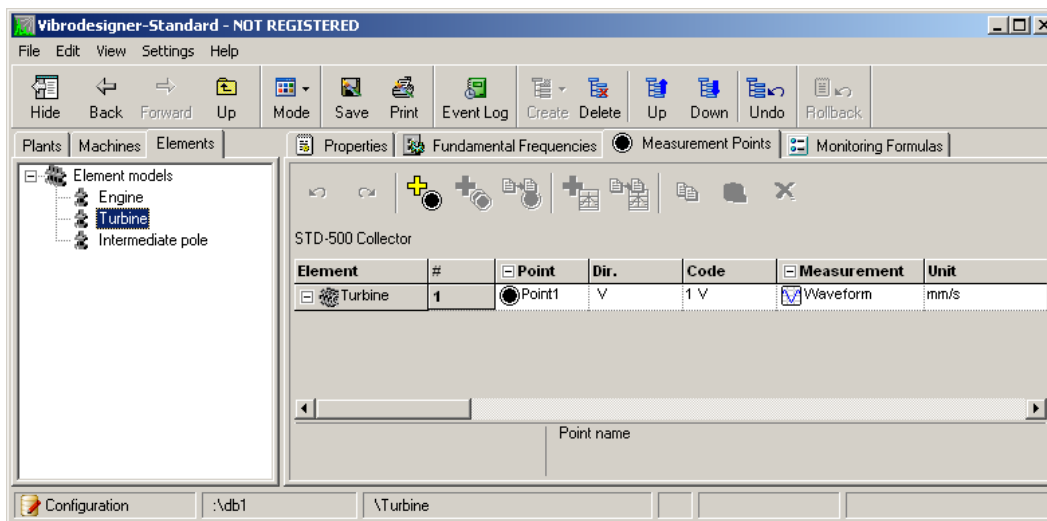


**Figure 31 Parameters of newly created point**


**Note:** The STD-500 data collector registers and measures signals as waveforms.

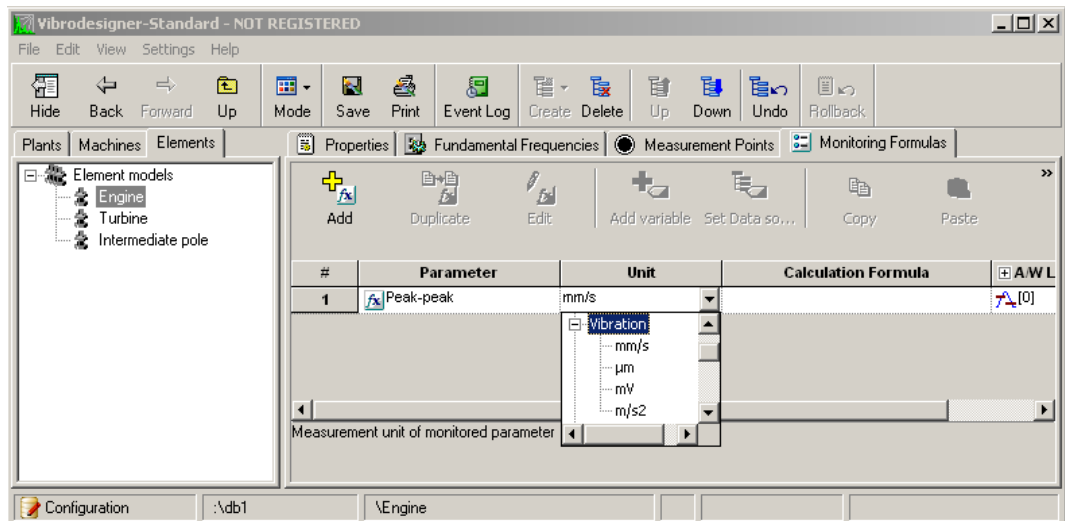
As a result, you have created an element model named **Engine**. On the engine, you specified one measurement point and set it to collect waves. The data acquisition is performed with a portable STD-500 data collector.

7. Repeat Steps 2-6 to create **Turbine** and **Intermediate Pole** elements. For this example, each *element* will contain one *measurement point* in which *waveform* type of data are to be measured. After creating a point, simply do not modify the default value in the **Measure** cell.




**Figure 32 Created point on the Turbine element**

8. Select **Engine** in the left panel and then click the **Monitoring formulas** on the right. This tab allows you to create machine monitoring parameters to be computed automatically with the specified formulas during recording inspection into the database.
9. Click  on the toolbar.  
A new row with default properties appears at the bottom of the table.
10. Click the **Parameter** cell and specify a name of the new calculated parameter (*Peak-peak*).
11. In the **Unit** cell, select the parameter measurement unit of interest from the drop-down list (*mm/s* in the **Vibration** section).



**Figure 33 Selecting measurement unit**

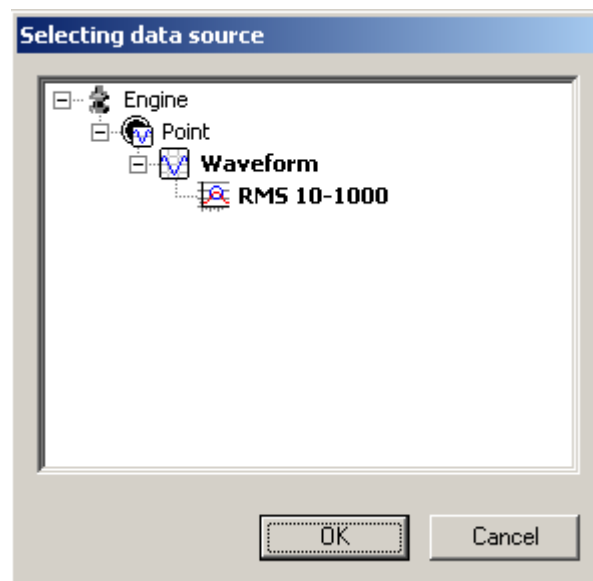
12. Right-click the **Name** cell and select **Add variable** from the menu.

A new variable with default properties appears in the table. The  icon in the **Name** cell means that you have not selected a data source for the variable.

13. In the **Name** cell, specify a name of the variable (*wave*).

14. Double-click the **Data source** cell.

The **Selecting data source** dialog box appears.



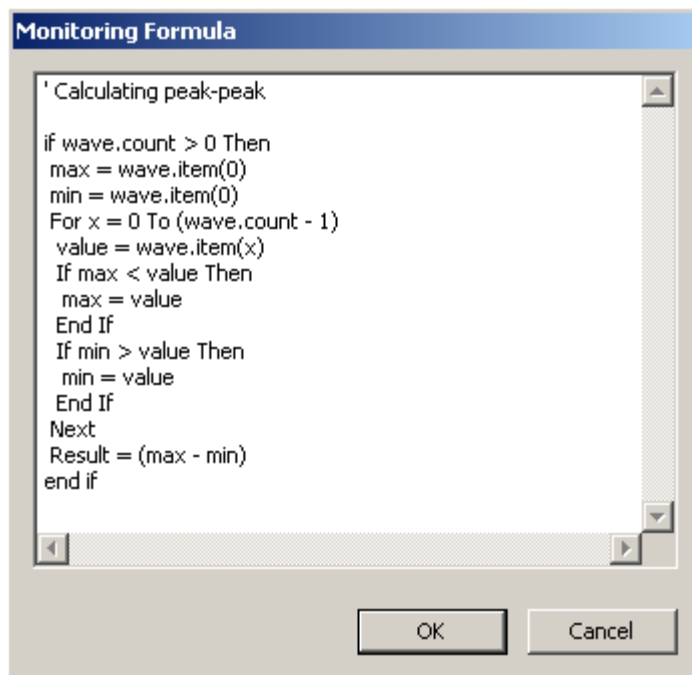
**Figure 34 Selecting data source**

15. Select the **Waveform** data source and click **OK**.

16. From the **Dimension** list, select *Array*.

17. Double-click the **Monitoring formula** cell.

The **Monitoring formula** dialog box appears.



**Figure 35 Monitoring formula dialog box**

18. Enter the following text into the **Monitoring formula** dialog box:

```
'Calculating peak-peak  
If wave.count > 0 Then  
max=wave.item(0)  
min=wave.item(0)  
For x = 0 To (wave.count - 1)  
    Value = wave.item(x)  
    If max < value Then  
        max = value  
    End If  
Next  
Result = (max - min)  
end if
```

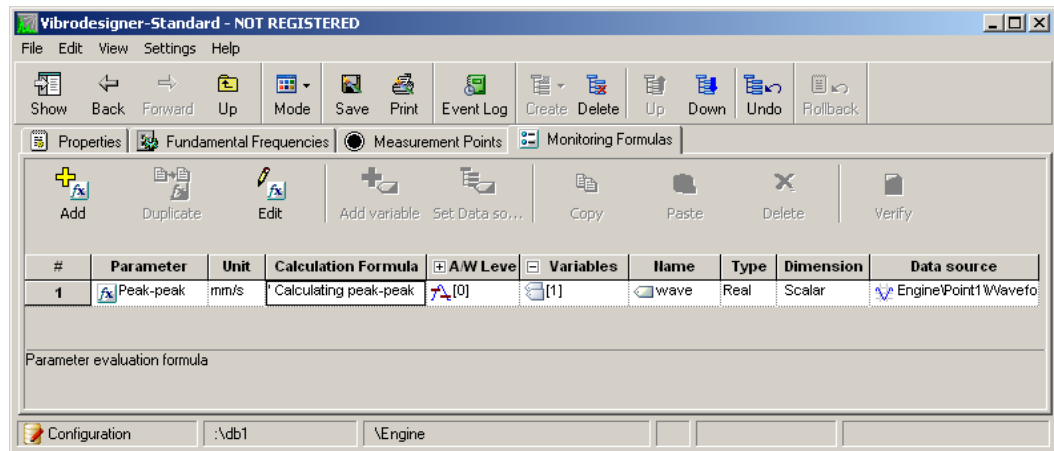
---

**Note:** You must assign the calculated value to the *Result* variable at the end of any monitoring formula. The program retrieves the resultant value from this reserved variable.

---

19. Click **OK**.

The first row of the specified formula is displayed in the **Monitoring formula** cell<sup>5</sup>. This formula will be used to automatically calculate a waveform peak-to-peak value when recording data into the database after inspection in the engine point.

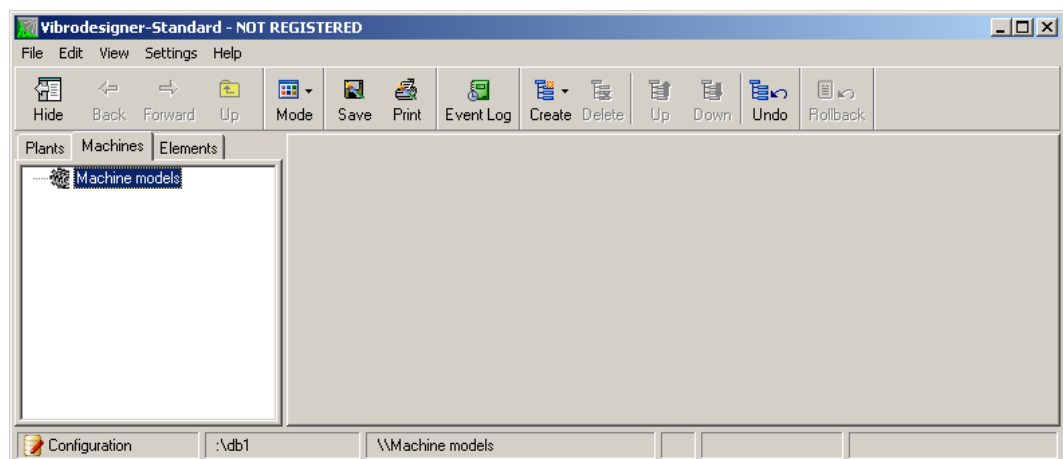


**Figure 36 Peak-peak monitoring formula**

## Assembling Machine Model

Generally, a machine measurement model consists of several standard elements, and multiple points are placed on each element. For simplicity, we have created only three elements (**Engine**, **Turbine** and **Intermediate pole**) with just one point on each element. Now let us build a Machine model with these three Elements.

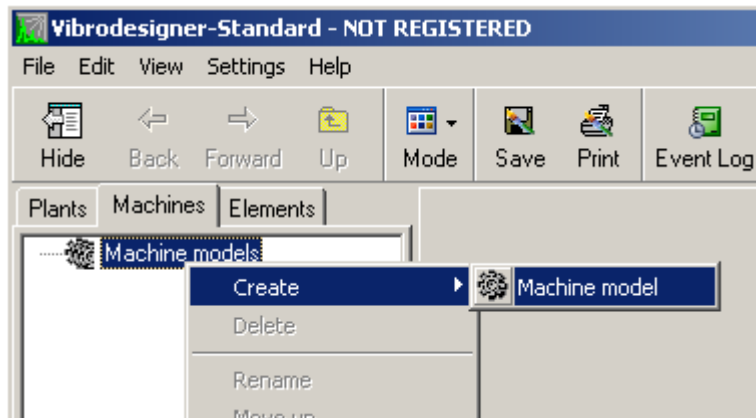
1. On the left panel, click the **Machines** tab.



**Figure 37 Machines tab**

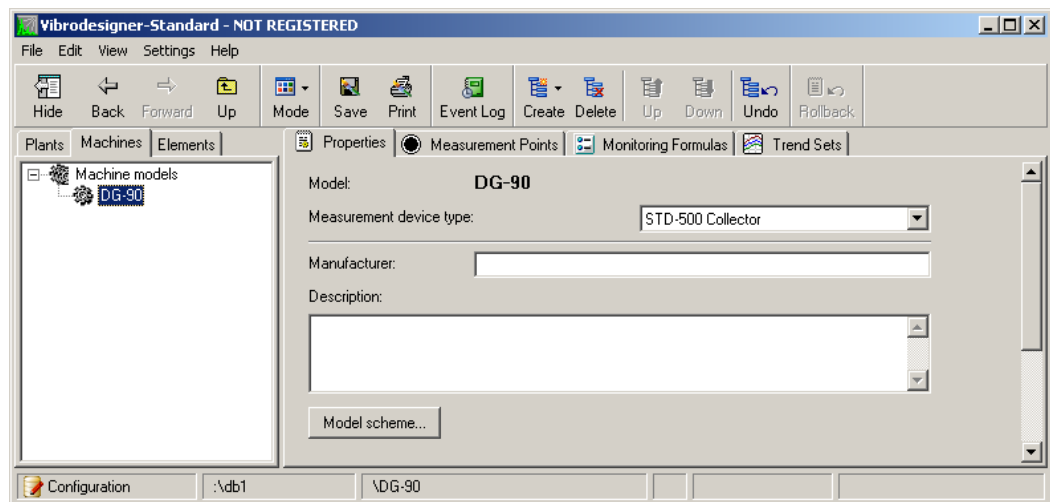
2. To create the first object in the machine models list, right-click the root element **Machine models** and select **Create > Machine model** from the menu.

<sup>5</sup> It is recommended to write comments for the multi-line formula in the first row.



**Figure 38 Creating new machine model**

3. Rename the newly created model to **DG-90** and specify the STD-500 monitor for measurements.

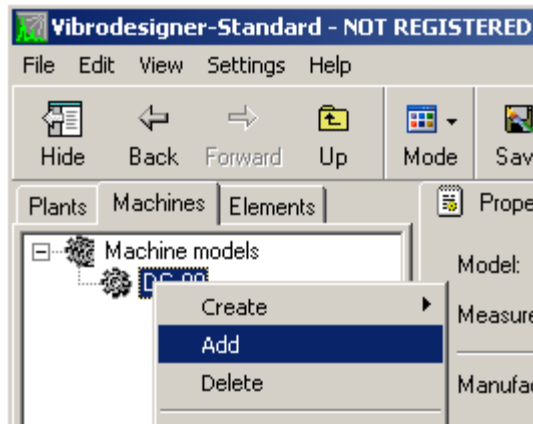


**Figure 39 Renaming machine model**

On this step, the model itself is created but it has no distinctive features, i.e. measurement points. Since all measurement points are created on machine elements, you need now to "fill" the model with previously created machine elements (**Engine** and **Turbine** in this example).

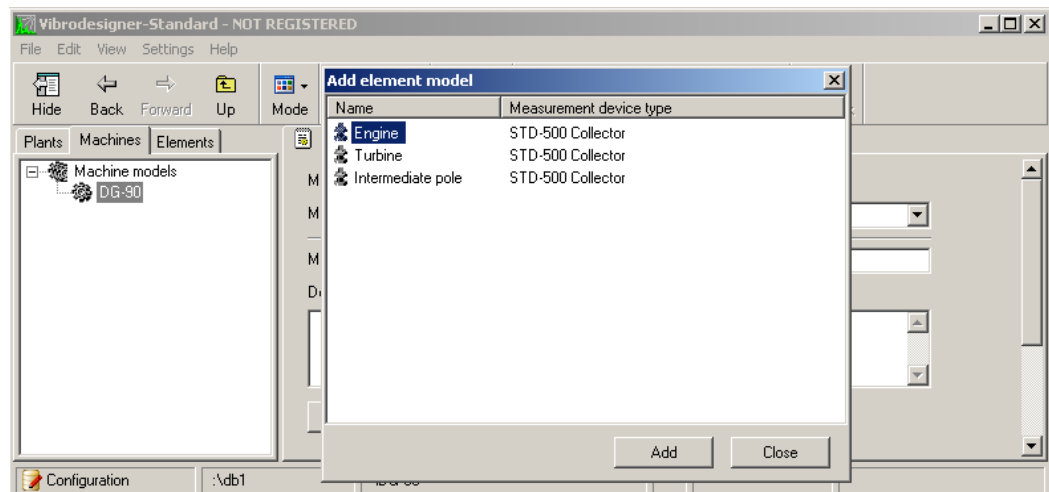
4. To add machine element models into the machine model, right-click the **DG-90** model and select **Add** from the menu.





**Figure 40 Adding machine element**

The **Add element model** dialog box appears.



**Figure 41 Assembling DG-90 model—adding Engine and Turbine elements**

- Click the **Engine** element and then click the **Add** button.

The **Engine** element containing its single measurement point appears in the **DG-90** model.

- Click the **Turbine** element and then click the **Add** button.

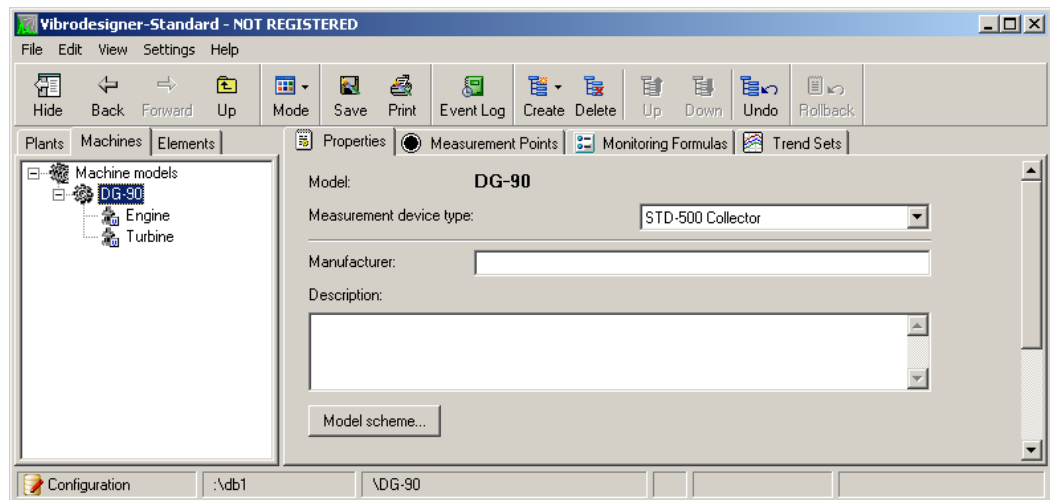
Now, the **Turbine** element containing a single measurement point also appears in the **DG-90** model.

- Close the **Add element model** dialog box.

---

**Note:** Modifying measurement point parameters on the **Machine** tab is prohibited. By clicking the **Measurement points** tab you may only view previously created points. You may modify their parameters on the **Elements** tab only; the point parameters will be updated at once in all machine models that contain such element models. It is useful since you do it once for all machines containing the element with this modified point.

---



**Figure 42 Assembled DG-90 model**

As a result, we have created a new machine model. It is assumed that our plant has only machines of "DG-90" type described by our DG-90 model. Otherwise, we would need to create more models corresponding to actual machines in use.

After creating the machine model, you need to create a plant hierarchy to store data.

## Creating Plant Hierarchy

Having created a measurement model of the machine, it is necessary to create the machine itself. Besides, you need to create a plant hierarchy that repeats the structure of the real-world plant. In this example, creating a plant hierarchy involves the following:

1. Creating a machine shop.
2. Creating a machine in the machine shop.
3. Specifying the machine properties, that is, defining its measurement model based on the created DG-90 model and specifying a serial number of the machine.
4. Creating the STD-500 data collector.

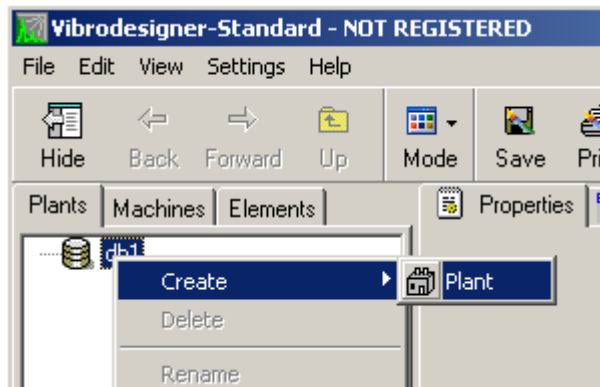
On this step, you build the database and create the structure that will be filled with machines. All machines have their measurement points that store collected data.

---

**Note:** All actions are performed in the Configuration mode.

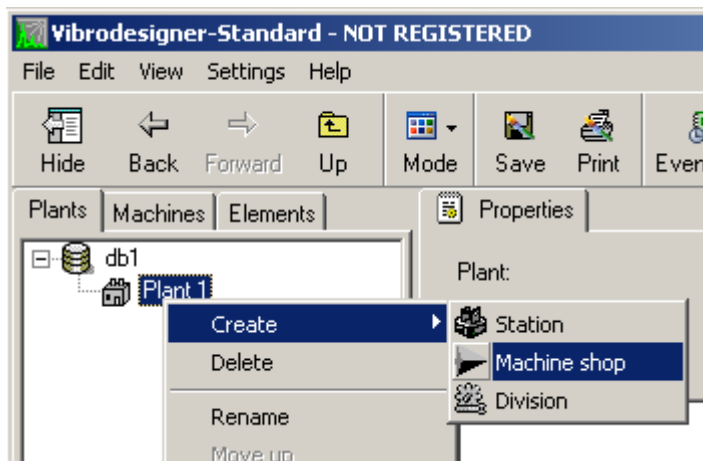
---

1. Click the **Plants** tab.
2. To create a new plant, right-click the root element **db1** and select **Create > Plant** from the menu.



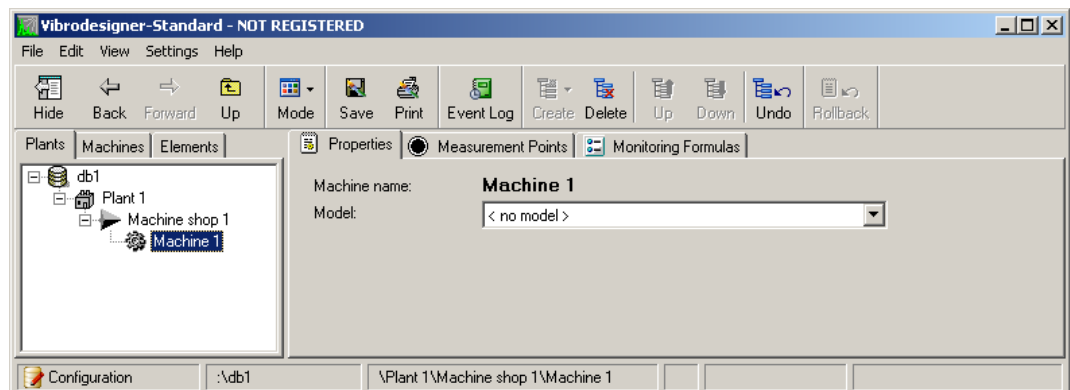
**Figure 43 Creating plant**

3. To add a new machine shop into the plant, right-click the created plant and select **Create > Machine shop** from the menu.



**Figure 44 Creating machine shop within plant**

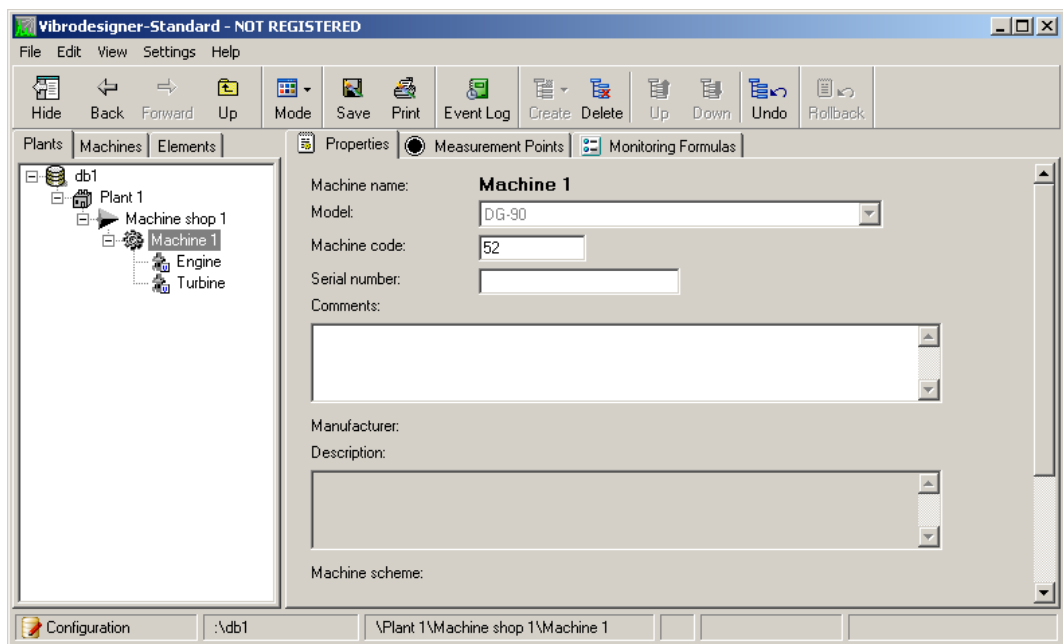
4. To create a machine within the Machine Shop 1, right-click the created machine shop and select **Create > Machine** from the menu.



**Figure 45 Newly created machine within machine shop**

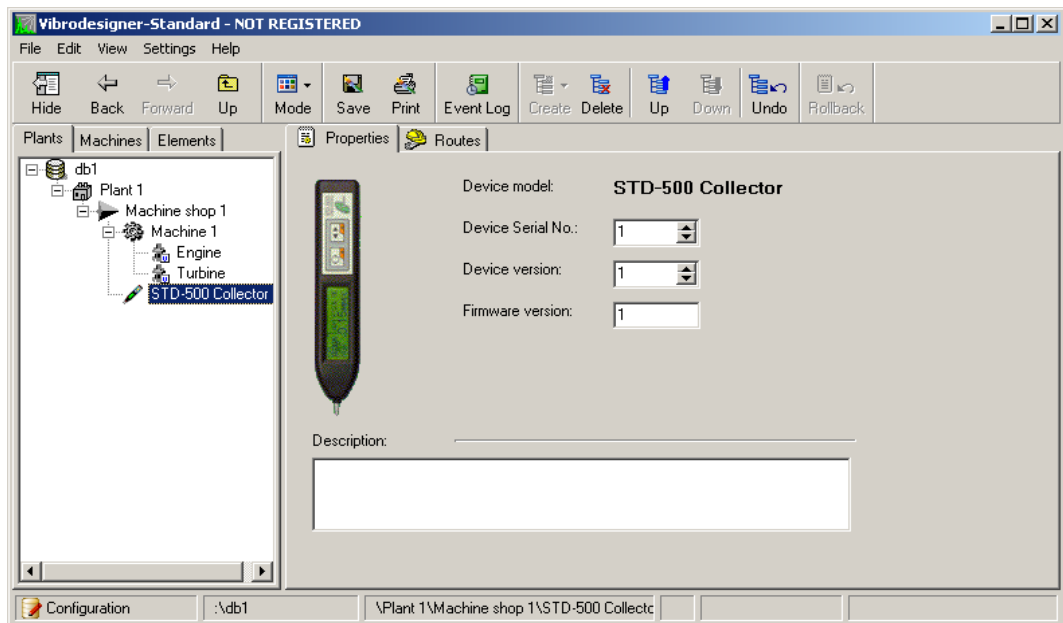
5. Specify the properties of the newly created machine. To do so, select **DG-90** from the **Model** drop-down list.

The Machine 1 now has child elements, the same as in the DG-90 model.




**Figure 46 Choosing machine model**

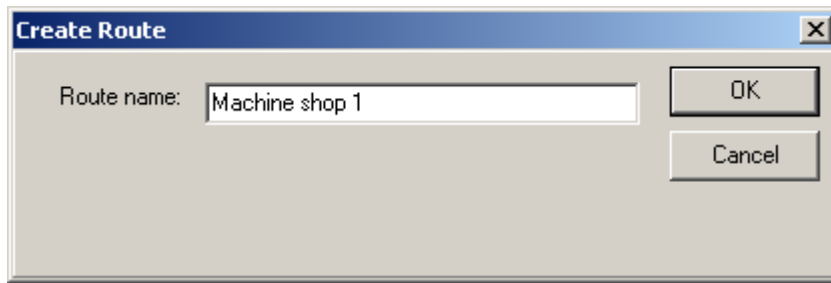
6. Create a STD-500 data collector for Machine shop 1. To do so, right-click **Machine shop 1** and select **Create > STD-500 Collector** from the menu.



**Figure 47 Newly created STD-500 collector for machine shop**

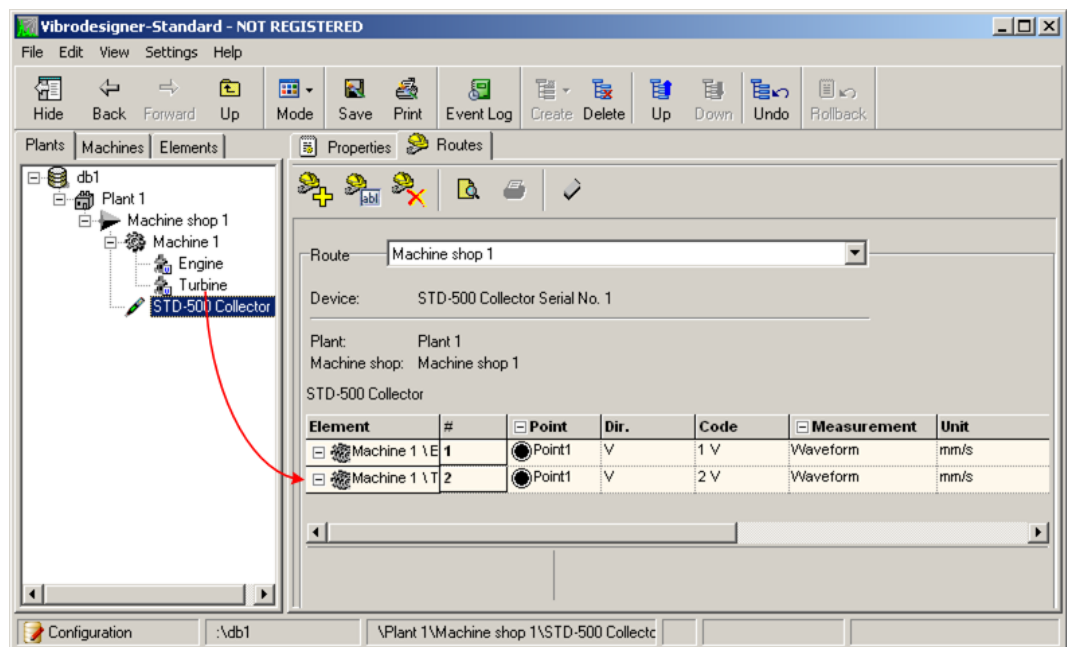
7. Click the **Routes** tab on the right.

8. To create a route for the STD-500 collector, click .  
The **Create Route** dialog box is displayed.



**Figure 48 Create Route dialog box**

9. Specify a name of the route (e.g. Machine shop 1) and click **OK**.
10. Drag the *Engine* element from the left panel into the right panel, and then drag the *Turbine* element, as shown in the picture below.



**Figure 49 Adding measurement points into route**

11. Click the **Properties** tab on the right.
12. Specify a version and a serial number of the device at hand, as well as the software version used by your STD-500.

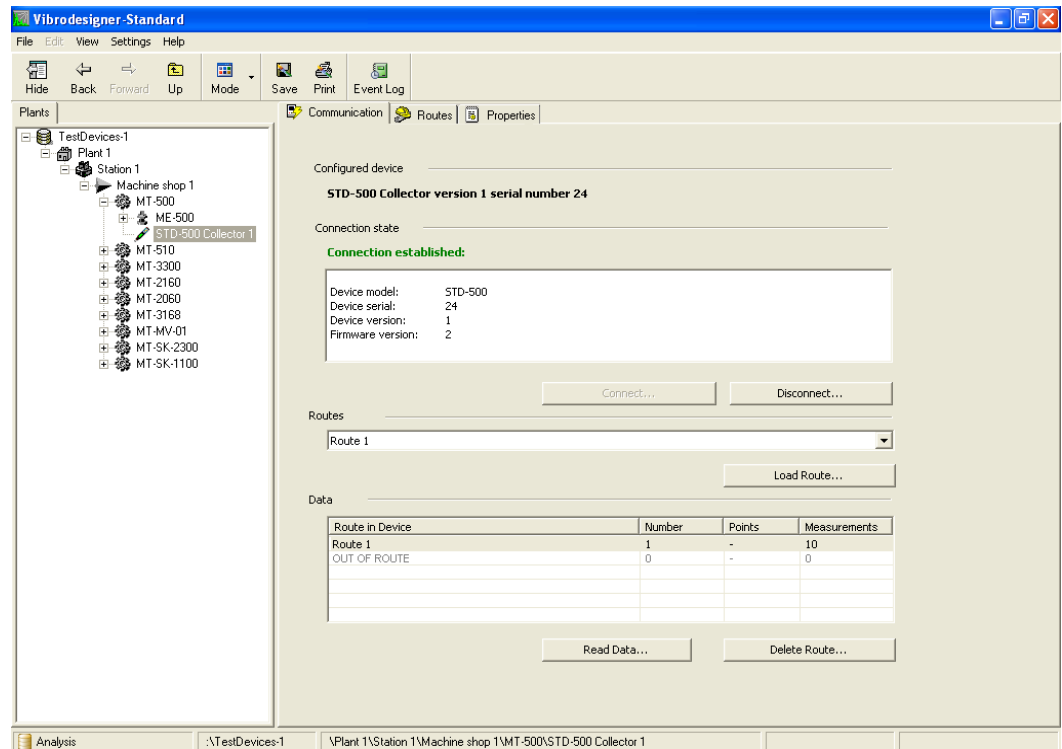
The plant hierarchy is configured (all necessary objects are created). You can now start working with the STD-500. In our example, operations in the Configuration mode are finished, and you will proceed with the Analysis mode.

## Working with STD-500

1. Install the STD-500 driver. For more information about the STD-500 driver installation, see “Installing STD-500/510 Driver.”

2. Connect your STD-500 to any USB port of your workstation. Use a special USB cable delivered with STD-500.
3. Switch to the Analysis mode and then select the device to be connected.

On the **Communication** tab on the right, the connection settings are displayed.



**Figure 50 Communication tab**

4. Click the **Connect** button.

The connection session is established.

---

**Important!** You will fail to establish a connection session if you have previously entered incorrect STD-500 version and serial number.

---

5. From the **Routes** list, select the Machine shop 1 route and click the **Load Route** button.
6. To close the connection session, click the **Disconnect** button.
7. Take your STD-500 and go through all route points.

For information on how to work with STD-500, refer to *STD-500 Operation Manual*.

8. Load measured data into the database. To do so, establish a connection session and click the **Read Data** button.

When loading, you can see the progress indicator.

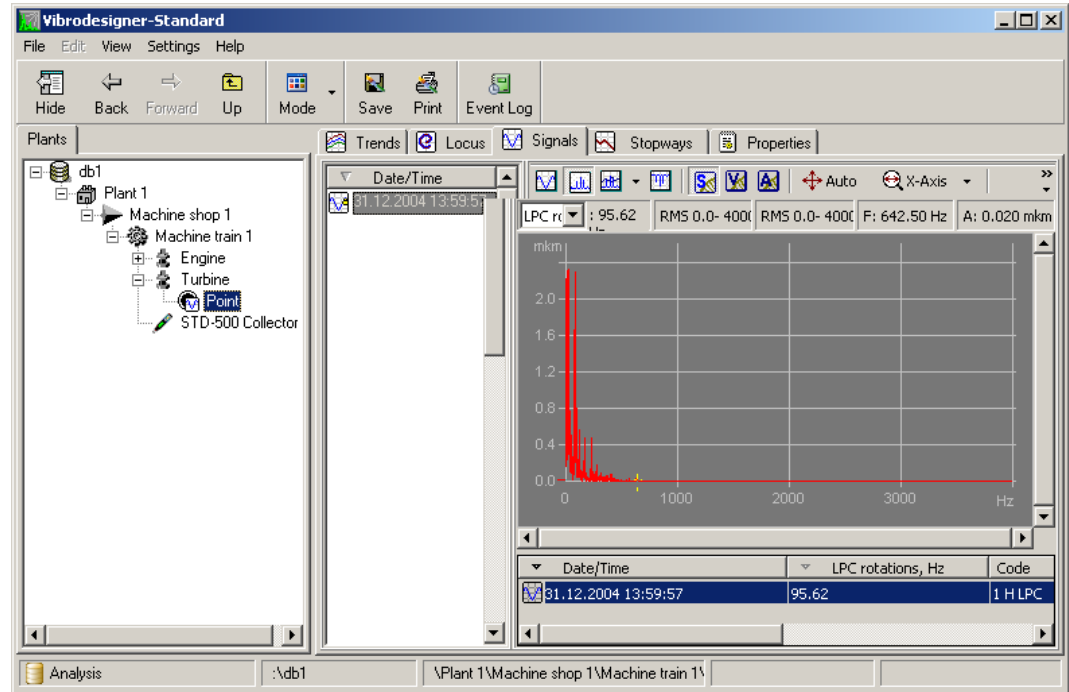
9. When done, click the **Disconnect** button.

The loaded data become available for analysis.

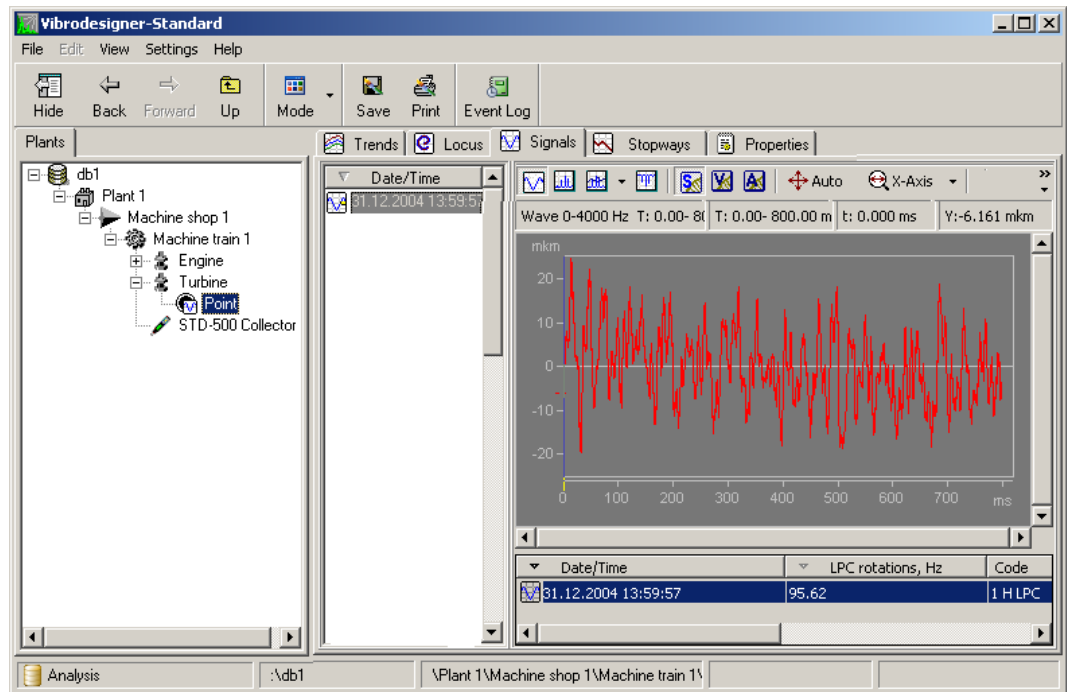
## Analyzing Collected Data

Having loaded the data, you may start to view and analyze it. To begin, select the machine measurement point with the measured spectrum or waveform, and click the **Signals** tab in the workspace on the right. You can also switch to the Comparison submode by selecting **Mode > Comparison** on the toolbar. In this mode, you can view and compare on one screen measurements from different measurement points and machines.

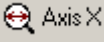

Let's briefly consider some aspects of spectrum and waveform analysis.






**Figure 51 Viewing spectrum**



**Figure 52 Viewing waveform**

Vibrodesigner provides you with features for detailed analysis of spectrum and waveform graphs. In particular, you can change the vertical and horizontal view range using the  **Axis X** and  **Axis Y** buttons on the toolbar or by dragging the mouse pointer in the workspace.

You can integrate and differentiate signals (the    buttons on the **Signals** tab) and transform waveforms into spectra and vice versa. You can set labels on the graphs. To do so, just double-click in the needed location, holding down the CTRL key. For more information, refer to *Chapter 6*, “Working with Graphical Data.”

We have finished the introductory section. In the following chapters, all Vibrodesigner features are described in details.



# Chapter 5 Configuration Mode

This chapter describes how to configure your measurement model.

It covers the following topics:

- Configuration Overview
- Machine Element Models
- Machine Models
- Plant Hierarchy
- Configuring Devices
- Configuring Auto Acquisition
- Database Structure Import and Export

## Configuration Overview

With Vibrodesigner, you can accomplish the following tasks:

- Machinery inspection
- Condition monitoring
- Visual data analysis
- Machinery diagnostics

Before going to any of these tasks, you need to build the plant hierarchy and to create the measurement model by specifying measurement points, measured signals on the points and alarm/warning levels. All these operations are done in the Configuration mode.

The first step in configuring your database is creating the plant hierarchy that matches the structure of your real-world plant and contains all the machine types operating in your plant. This database structure is used to store diagnostics information, display data as a hierarchy of machine locations, and specify measurement and control parameters. That's what we call a *measurement model of monitored machinery*.

Machine element models and machine models are used to build a measurement model. As any machine on the plant consists of standard elements, it is efficient to use element models. They are reusable parts that are added in different machines. Each element model describes all major element characteristics such as the number and types of measurement points; settings for signal and parameter measurements. It allows you to reuse once created models. From the condition monitoring point of view, machine models built with element models do fully define any machine. Thus, you need to create every point and measurement parameter only once. And it allows you to quickly modify

parameters in a model, since it will automatically spread to all elements and machines built from this model, no matter how many of them exist.

Typically, creating a plant hierarchy and a measurement model involves the following:

1. Creating an empty database.
2. Creating a plant hierarchy to the level of machines.

This step includes creating plants, stations, divisions, and machine shops.

3. Creating machine element models.

On this step, you create measurement points of machine elements, including 2-channel points. Then, for each point you specify transducer orientation, measured and computed signals, and alarm/warning levels.

---

**Note:** Before configuring a point of a machine element model, you need to correctly specify a type of the measurement device used to retrieve or collect data to be recorded into measurement points.

Vibrodesigner automatically checks whether the entered measurement parameters do match the capabilities of the specified device. It prevents from recording prohibited values into the database.

---

4. Creating machine models.

For each machine model, you specify the number and types of machine elements, define the sequence of elements connection, and specify the number of measurement points. If you have specified relative frequency bands in elements, you also need to match the fundamental frequency multipliers with the measurement points where these fundamental frequencies are measured.

5. Creating machines of a predefined type in the hierarchy.

You specify serial numbers of machines and other relevant information.

6. Creating inspection routes.

Inspection routes specify in which points, on which machines and in which order the measurements are to be performed. You may create multiple inspection routes but a single inspection route must include at least one inspection of one machine.

7. Specifying data collectors used for measurements.

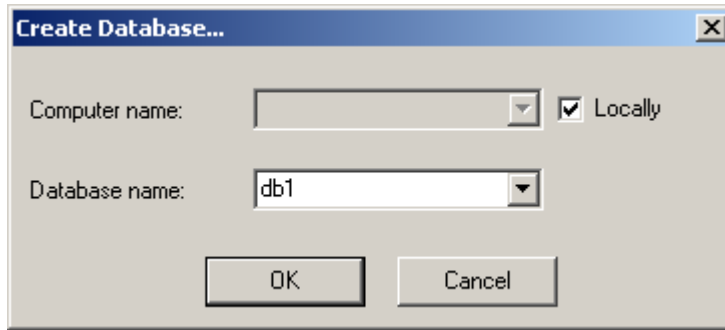
You may specify several devices. Measured signal parameters and inspection routes must match the capabilities of the devices in use.

## Creating Database

### To create a new database:

1. Switch to the Configuration mode by selecting **Mode > Configuration** from the **View** menu.
2. On the **File** menu, click **Create database**.

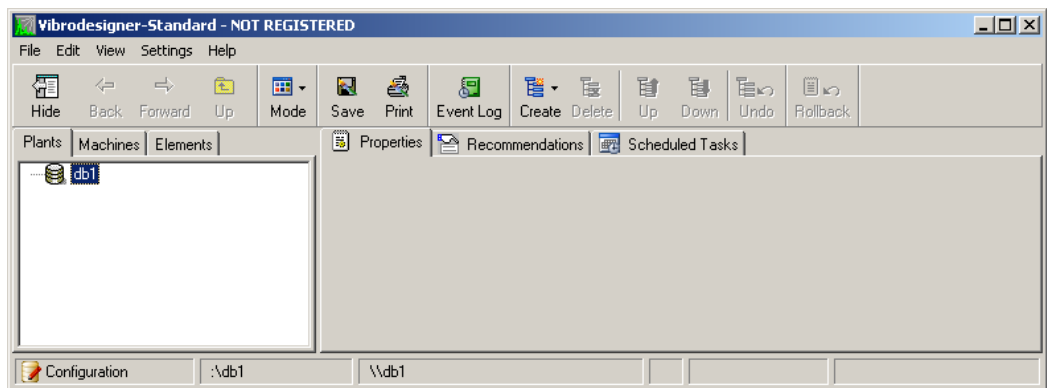
The **Create database** dialog box appears.



**Figure 53 Create Database dialog box**

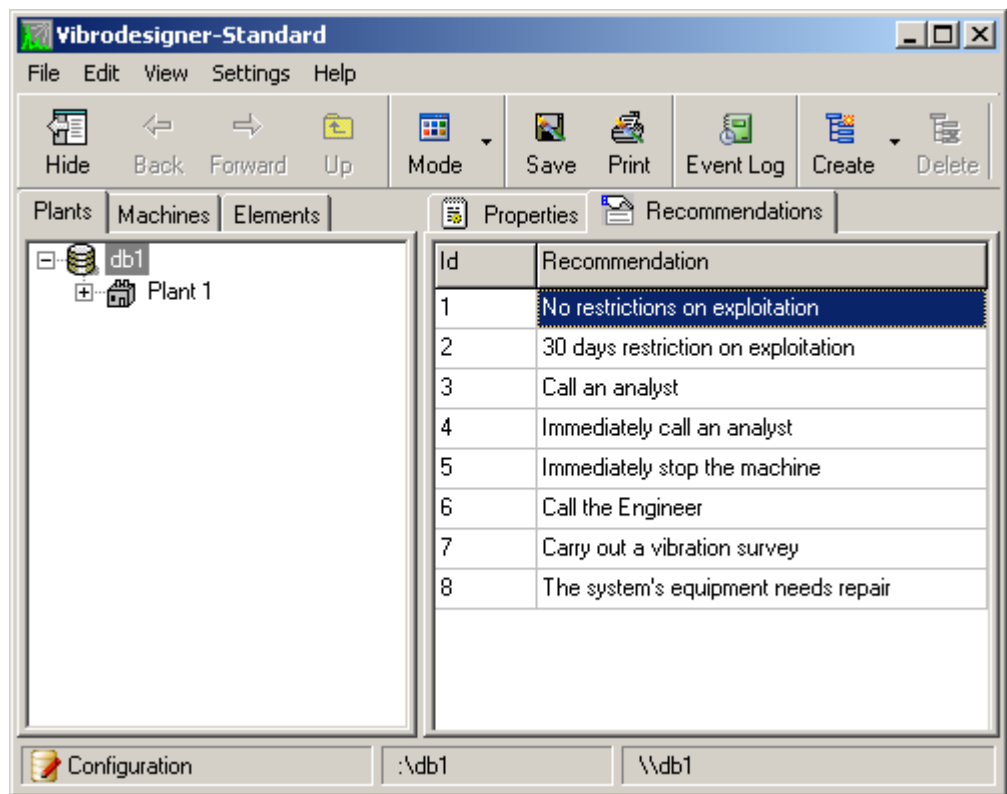
3. In the **Database name** box, type a name of the database (for example, “db1”) and click **OK**.

The left Vibrodesigner panel displays the newly created database. The database object tree contains only the root element (*the database name*). The Vibrodesigner panel has three tabs. Firstly, on the **Elements** tab, machine elements are to be created. Secondly, on the **Machines** tab, the created elements are assembled into machines. Finally, on the **Plants** tab, the complete plant hierarchy is created. For now, your newly created database has no plants or machines.



**Figure 54 Empty database**

4. To specify recommendation to be displayed in the inspection reports, click the **Recommendations** tab on the right.



**Figure 55 Recommendations tab**

- The **Recommendations** tab displays the preset recommendations by default. You can modify this list of recommendations. To add a new recommendation, click the **Add** button.

A new item appears on the recommendations list.

- Click the item and type the recommendation you need.

**Note:** The recommendation ID in Vibrodesigner must match the recommendation ID in the ASTD-2 system. Setting up this correspondence is performed when configuring the ASTD-2 system.

## Machine Element Models

### Introduction

A machine element is a part of a machine that can work separately. A machine element does not perform a particular technological task. Examples of machine elements are: engines, turbines and so on. As well as a complete machine, a machine element can be monitored. A machine element is completely described by the model of this machine element.

A machine element model is a *type* of machine element as those types are set in the manufacturer classification. A machine element model describes all element

characteristics essential for monitoring (number and names of measurement points and parameters, possible frequency bands, and alarms/warnings thresholds.)

---

**Note:** A machine element model cannot contain any other machine element models. A machine element model can be a part of more than one machine model. For information on machine models, refer to “Machine Models.”

---

## Using Machine Element Models

Machine element models do not exist in the real world. A machine element model is a *template* used to build inside a database records of multiple machines with their respective sets of predefined elements. In other words, the main purpose of a machine element model is to define all necessary settings for diagnostics tasks on any machine element of this model. Element models are typical units and you can work with them uniformly and repetitively. Modifying parameters of a machine element model changes characteristics of every corresponding element composing various machines.

A machine element model includes:

- Measurement points
- Measured signals (spectra and waveforms) and their characteristics
- Absolute or relative frequency bands and their characteristics
- Band alarm/warning levels
- Calculated parameters (monitoring formulas) of an element
- Calculated parameters alarms

---

**Note:** A machine element model cannot include any route or data collector.

---

## How to Create and Adjust Element Models

Generally, creating and adjusting a machine element model in Vibrodesigner is done as follows:

1. Creating a model and specifying its properties.

First, an empty model of a standard element is created and its common properties are specified.

2. Creating fundamental frequencies.

You specify fundamental frequencies (shafts) linked with the element model.

3. Creating measurement points on a machine element.

Main parameters of any measurement point are transducer orientation and measured signal type. You can create either 1-channel or 2-channel measurement points. You can specify waveform, spectrum, or envelope spectrum as a measured signal type (depending on the data collector in use.)

4. Adjusting measured signal properties in each measurement point.

For each signal type, you may customize different properties, for example, the number of samples for waveforms; the number of spectrum lines for spectra; upper frequency limit of a measurement, and so on.

5. If necessary, specifying a set of frequency bands used to monitor machinery condition.

You can customize as many absolute or relative frequency bands as needed (Vibrodesigner calculates RMS of spectrum magnitudes in the specified band.) If you plan to use relative (a.k.a. shaft speed tracking) bands, you need first to set fundamental frequencies (see “Adjusting Relative Bands” later in this chapter).

6. If necessary, specifying a set of calculated parameters (monitoring formulas) used to monitor a machine element condition.

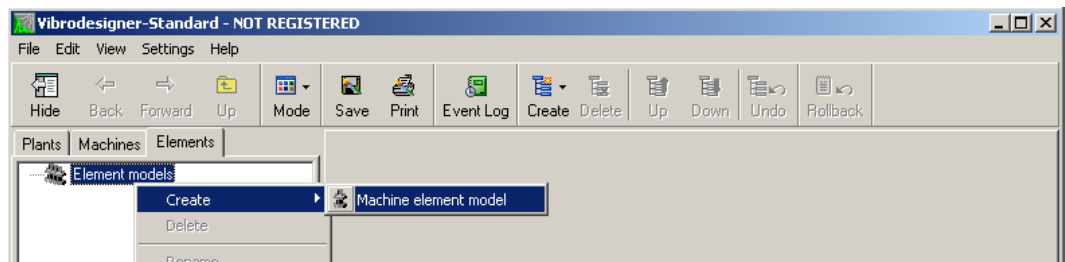
7. Specifying alarm/warning levels for each created band or calculated parameter. These levels are used to automatically monitor vibration by parameter value or by speed of parameter change.

You may specify any set of the following types of alarm level:

- Warning for absolute value of the monitored parameter
- Warning for absolute change of the monitored parameter
- Warning for relative change of the monitored parameter

## Creating Element Models and Specifying Model Parameters

Machine element models are created or modified on the **Elements** tab in the Configuration mode. Creating machine element models is done by a context menu of the hierarchy root element.

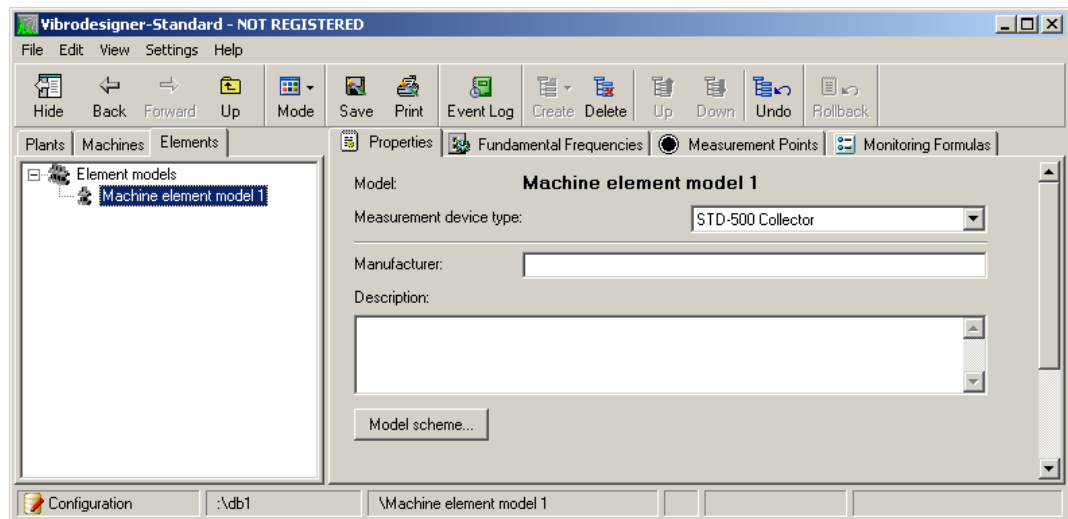


**Figure 56 Creating machine element model**

Each model has a set of the following properties:

- A type of the device intended for vibration measurement (mandatory parameter)
- Machine element manufacturer
- Short text description
- A scheme or a picture of the element model

An element model properties are specified on the **Properties** tab.

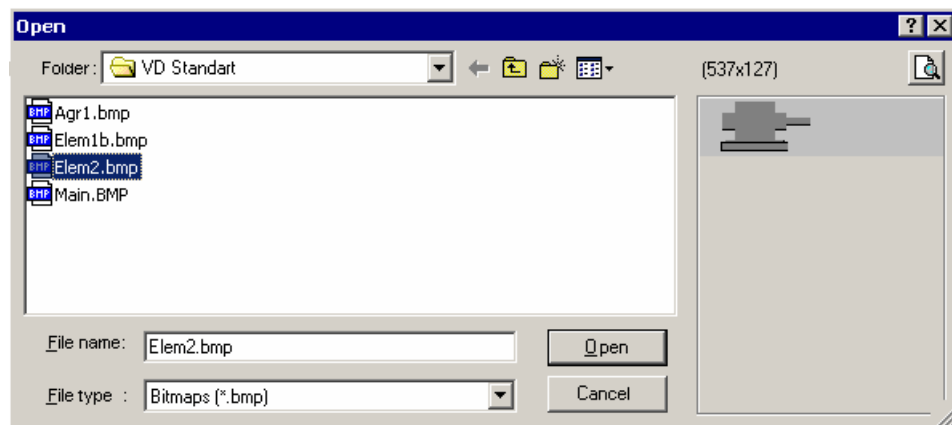


**Figure 57 Element model properties**

To select a picture for the machine model:

1. Click the **Model scheme** button.

The **Open** dialog box appears.



**Figure 58 Open dialog box**

2. Select the file you need and click the **Open** button.

The selected image is displayed on the **Properties** tab.

---

**Note:** You can select files in BMP format only.

---

The empty machine element—even with specified properties—has no functionality. After creating an empty element, you must specify measured and calculated vibration characteristics.

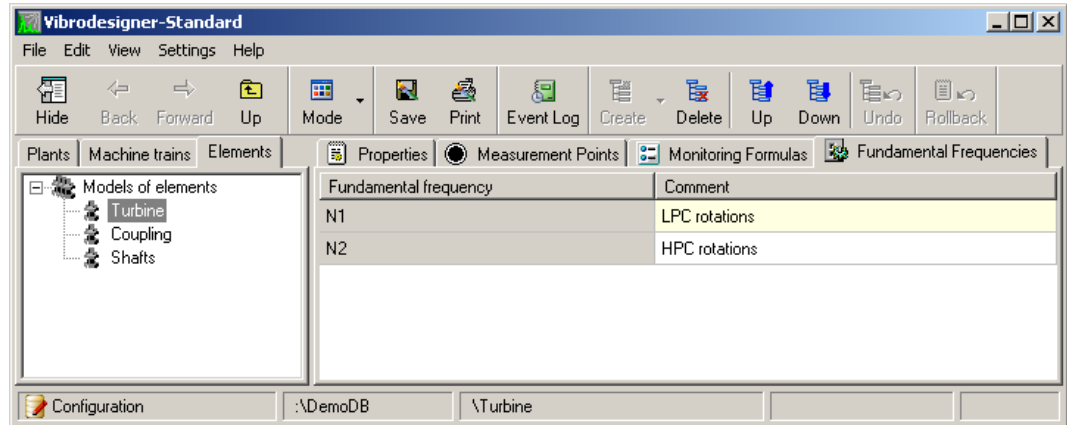
## Specifying Fundamental Frequencies

A fundamental frequency is a current rotation speed of a shaft. Fundamental frequencies are used to configure relative bands. For more information, see “.”

### To set fundamental frequencies for a machine element model:

1. On the **Elements** tab, select the machine element you need.
2. Select the **Fundamental frequencies** tab on the right.

A list of fundamental frequencies is displayed. By default, the list is empty. Fundamental frequency values are specified as logical names N1, N2 ... Since we do not have yet any point of rotation frequency measurement, these names are used for the algorithm of relative band calculation. Later in this manual (see “Linking Fundamental Frequencies to Measurement Points”) we will discuss how to link a fundamental frequency to a shaft frequency measurement point.



**Figure 59 Creating fundamental frequencies**

3. Right-click in the table of fundamental frequencies and select **Create** from the menu.

A new record appears in the list of fundamental frequencies. In the **Fundamental frequency** column, fundamental frequency values are displayed in N<frequency\_multiplier> format. You can add comments in the next column but you are not allowed to change fundamental frequency names.

4. Create all the fundamental frequencies you need.

If you need to delete a fundamental frequency, select the frequency to be deleted and use the **Delete** context menu command.

---

**Note:** When building a machine model, you must link its fundamental frequencies to the measurement points. For more information, see “Linking Fundamental Frequencies to Measurement Points” later in this chapter.

---

## Measurement Points Overview

Measurement points and their properties completely describe an element measurement model. There are two types of points:

- 1-channel measurement point

In the Vibrodesigner software and throughout this manual, a 1-channel measurement point is called a *measurement point*, or a *point*. A measurement point is characterized by a type of measured parameter. There are four types of a measured data parameter:



- Waveform
- Spectrum
- Envelope spectrum
- Parameter
- 2-channel measurement point

Measurements in a 2-channel point are done via two channels. The parameters in both channels are the same (see “Creating and Editing Measurement Points”), except for transducer orientation and transducer parameters. Each channel of a 2-channel point is characterized by one of the following measured type:

- Waveform
- Spectrum

These signals specify which values are measured by a data collector.

As a rule, knowing measured signals is not enough for analysis. If you measure a waveform (for example, with CTD-2060), you need the software to compute a spectrum from the waveform and calculate spectrum parameters (RMS in frequency bands). Although CTD-2060/2160 collect all initial data, spectrum parameters are not measured directly by these devices. Vibrodesigner computes all spectrum parameters. For this purpose, the software has an algorithm of computed frequency bands in points of both types (waveform and spectrum).

## Measurement Point Editor Overview

The *measurement point editor* is an electronic worksheet that allows you to create and modify points of a machine element. Working with the editor is similar to working with Microsoft Excel. An intuitive user interface allows you to easily create measurement points and modify their parameters. The editor controls the user input and does not allow the operator to enter inappropriate values.

In this editor, you can:

- Add a row (at the bottom of the table)
- Duplicate the selected row
- Copy a row
- Paste a row (below the selected row)
- Replace a row
- Move a row up and down
- Delete a row

You can perform the following actions with a **Bands** sub-row of the selected point:

- Add a sub-row (at the bottom of the **Bands** table)
- Paste a sub-row (below the selected sub-row)

- Replace a sub-row
- Move a sub-row up and down
- Delete a sub-row

As a monitored parameter, you can use an absolute band, relative band, peak, or peak-peak.

For each machine element, you can create all needed measurement point and specify its parameters. You may perform various actions with existing measurement points: duplicate points; copy and then paste or replace points; change the points order; delete points. You can also add comments for a table row, which will be displayed when resting the mouse pointer over the **Point** cell.

For more information on this editor, see *Appendixes*, “Measurement Point Editor.”

## Editing Measurement Parameters

Measurement signal parameters depend on the device in use. Using various Technekon’s online/offline devices, you can measure:

- Waveform
- Spectrum
- Envelope spectrum
- Vibration parameter

For more information on device parameters, refer to *Appendixes*, “Measurement Parameters for Different Devices.”

## Creating and Editing Bands

You can define frequency bands computed from measured signals in machine element points. Frequency bands can be calculated in the measurement points with Spectrum, Envelope spectrum and Waveform parameters. You can create bands with absolute frequency range or relative (tracking) bands. First, you need create the band itself, then select the band type (absolute or relative), and finally adjust band parameters.

---

**Note:** Before adjusting parameters of a relative band, you need to create fundamental frequencies (see “Specifying Fundamental Frequencies”). When creating a complete machine model, you must link these frequencies to measurement points of shaft rotation frequencies. For more information, see “Linking Fundamental Frequencies to Measurement Points” later in this chapter.

---

For detailed instructions on how to create and edit bands, refer to *Appendixes*, “How to Create and Edit Bands.”

## Adjusting Absolute Bands

For more information on how to adjust absolute bands, refer to Appendixes, “Adjusting Absolute Band.”

## Adjusting Relative Bands

Before adjusting a relative band, you need first to define fundamental frequencies for a machine element model. The actual range of a relative band depends on the fundamental frequency in use and is constantly changed over time. Hence, for calculating RMS in a relative band:

1. The center frequency is calculated.

This frequency is linked to the shaft rotation frequency. The fundamental frequency value is not defined explicitly as this value is measured at the moment of calculation and depends on the machine operating mode.

2. The band limits are calculated.

RMS in the band frequency range is calculated in accordance with the lower and upper frequencies of the band.

Having created fundamental frequencies, you may adjust your relative bands.

### To adjust relative bands for a machine element:

1. Click the **Measurement points** tab.
2. In the **Type** cell of the band you need, select a band type from the drop-down list.
3. Specify the center frequency.
4. Specify the lower frequency of the band.
5. Specify the upper frequency of the band.
6. If necessary, clear the **Calc.** check box.

The program can either automatically calculate RMS in the configured band, or retrieve RMS value from inspection data (if any).

## Monitoring Formulas for Element Models


You can create calculated parameters<sup>6</sup> and formulas for calculation for machine element models.

### To create a calculated parameter for an element model:

1. Select a target machine element on the **Elements** tab.
2. Select the **Monitoring formulas** tab on the right.

---

<sup>6</sup> Calculated parameters are scalar values computed from current measured or calculated machine parameters using specified formulas.

3. To add a new calculated parameter in the table, right-click in the table and select **Create parameter** from the menu. You can also click  on the toolbar.  
A new row with the default properties appears at the bottom of the table.
4. In the **Parameter** cell, type the name of the parameter.
5. In the **Unit** cell, select the parameter measurement unit of interest from the drop-down list.
6. In the **Variables** group cell, specify all the needed variables to be used in the monitoring formula.
7. Double-click the **Monitoring formula** cell.  
The **Monitoring formula** dialog box appears.
8. Specify the formula to be used for computing the parameter.
9. If necessary, specify alarms/warnings for the calculated parameter. To do so, click the «-» sign in the **A/W Levels** column and then enter the needed values in the cells.

---

**Note:** For more information on how to work with monitoring formulas editor, see *Appendixes*, “Configuring Calculated Parameters.”

---

## Exporting/Importing Element Models

You can export and import element models. Exporting data allows you to save into file the model structure. Importing allows you to upload the element models exported before. Thus, you can use standard element models and significantly save your time while creating a plant structure.

### To export element models:

1. On the **Elements** tab, right-click the name of the element model to be exported (or the root *Element models* node) and select **Export structure** from the menu.  
The **Export to file** dialog box appears.
2. Select the target folder, type the file name you need in the **File name** box, and then click the **Save** button.  
The export of the selected object structure is started. When finished, the successful message is displayed.
3. Click **OK**.

### To import a database structure:

1. Right-click the root *Element models* node where you need to import a structure and select **Import structure** from the menu.  
The **Import from file** dialog box appears.
2. Select the file for import and click the **Open** button.  
The import is started. When finished, the successful message is displayed.

3. Click **OK**.

## Machine Models

### Machine Models Overview

From the diagnostics point of view, a machine model does completely describe the machine. For each *machine model*, a configuration of machine *element models* is defined.

For each machine, its model defines:

- An assembly of elements into a machine
- General information about the machine model

---

**Important!** Each *machine model* requires one or more machine element models, as only machine element models contain information about measurement points.

---

### Using Machine Models

Machine models do not exist in the real world. These models are standard units inside your database and you can work with them uniformly and repetitively. In other words, a machine model is a *template* used for creating multiple machines with identical parameters. Modifying a machine model parameter makes all machines of this model change their characteristics accordingly and simultaneously. The main purpose of a machine model is to define once all the necessary settings for doing later all diagnostics tasks on all machines of this model.

A machine model consists of:

- Machine *element models*
- All objects composing the machine element models

---

**Note:** A machine model may not include an inspection route, but cannot include a data retrieval device.

---

### Relations between Element Models, Machine Models and Machines

Should be noted the following relations between the concepts of *machine element model*, *machine model* and the actual *machine*.

1. Modifying characteristics of machine *element models* results in changing the same characteristics of *all models of the machines* containing the changed *element model*.
2. A *new machine* in a plant hierarchy is build using one of the previously created *machine models*.
3. Modifying characteristics of a *machine model* results in changing the same characteristics of all *machines* created on the basis of the changed model. The only

exception is some parameters that describe a particular machine instance (for example, a serial number).

4. Modifying common parameters of a signal and alarms/warnings of an *element model* affects all signals and alarms/warnings belonging to the actual *elements* created on the basis of the changed models.
5. You can modify characteristics of a machine *element model* in the following cases:
  - All changes are enabled when no *machines* contain any data in any *element model* composing these *machine model*.
  - If at least one machine contains data under this machine *element model*, you are going to be prompted to delete such data. If confirmed, the data are removed and then all changes are enabled.
  - If at least one machine contains data under this machine *element model*, you can change the properties that do not affect data measurement and calculation.
  - In case of adding new elements. If a new frequency band is added, the data recalculation is required. For more information, see Chapter 6, “Recalculating Bands.”
6. You can modify characteristics of a *machine model* in the following cases:
  - All changes are enabled when no *machines* based on this *model* contain any data defined under this machine model.
  - If at least one machine contains data under this machine model, you are prompted to delete such data. If confirmed, the data are removed and then all changes are enabled.
  - If at least one machine contains data under this machine model, you can change the properties that do not affect data measurement and calculation.
  - In case of adding new machine *elements*.

## How to Create and Adjust Machine Models

In Vibrodesigner, *machine models* are made of *machine element models*. Assembling machine models is possible only after creating all necessary *element models*.

Creating a machine model involves the following steps:

1. Creating a model and adjusting its properties.

The empty model is created first and then the model properties are specified.
2. Assembling the machine model.

On this step, the contents of the model is specified, i.e. the previously created machine elements are added into the machine model.
3. If fundamental frequencies have been set for machine element, you need to link the fundamental frequencies to the measurement points within the machine model.
4. If necessary, specify a set of calculated parameters (monitoring formulas) used to monitor a machine condition.

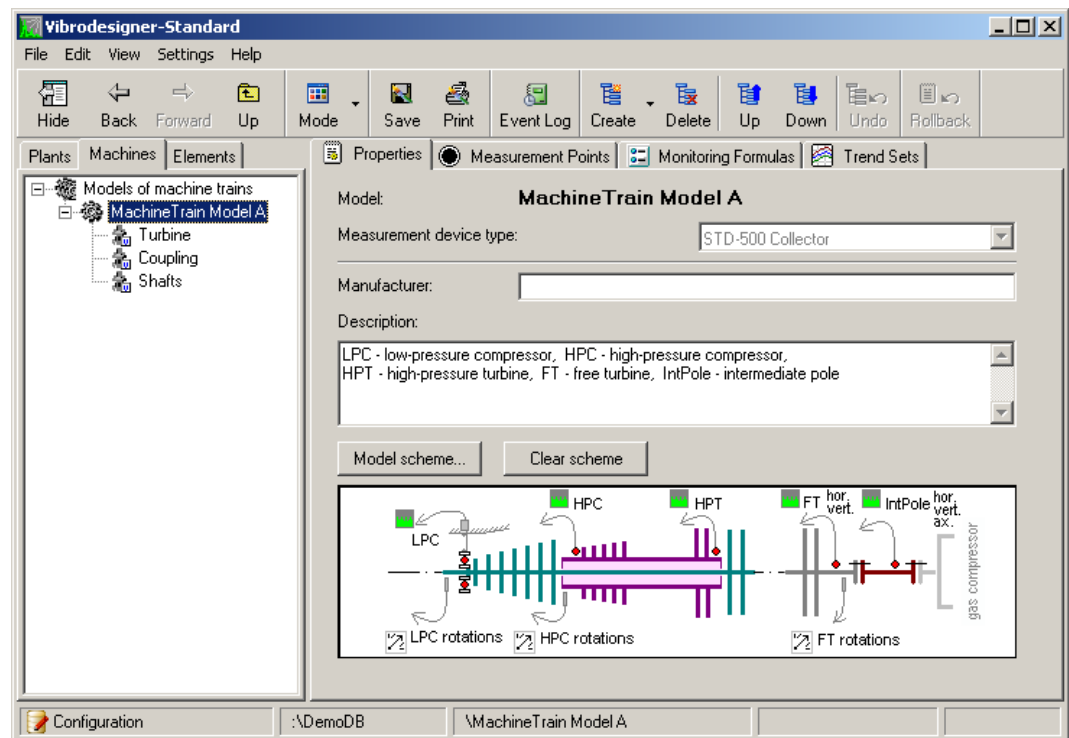
5. Typically, you need to set alarms to automatically monitor calculated parameters by value or change.
6. Configuring trend sets.

You can specify any trend sets, that is, sets of parameters which are to be displayed during analysis.

7. Configuring a stationary device for measurements.

If you plan to retrieve data for a certain machine model through a stationary device, you also need to configure such a device (see “Configuring Stationary Devices”).

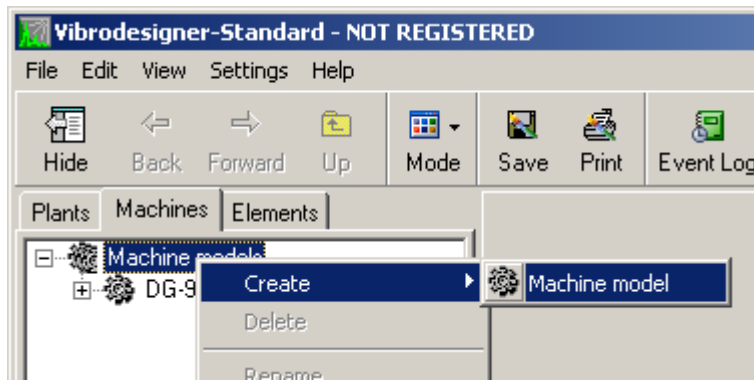
Creating and modifying machine models is performed on the **Machines** tab in the Configuration mode.



**Figure 60 Machine models**

## Creating Machine Models

To create a machine model, use a context menu of the hierarchy root element.

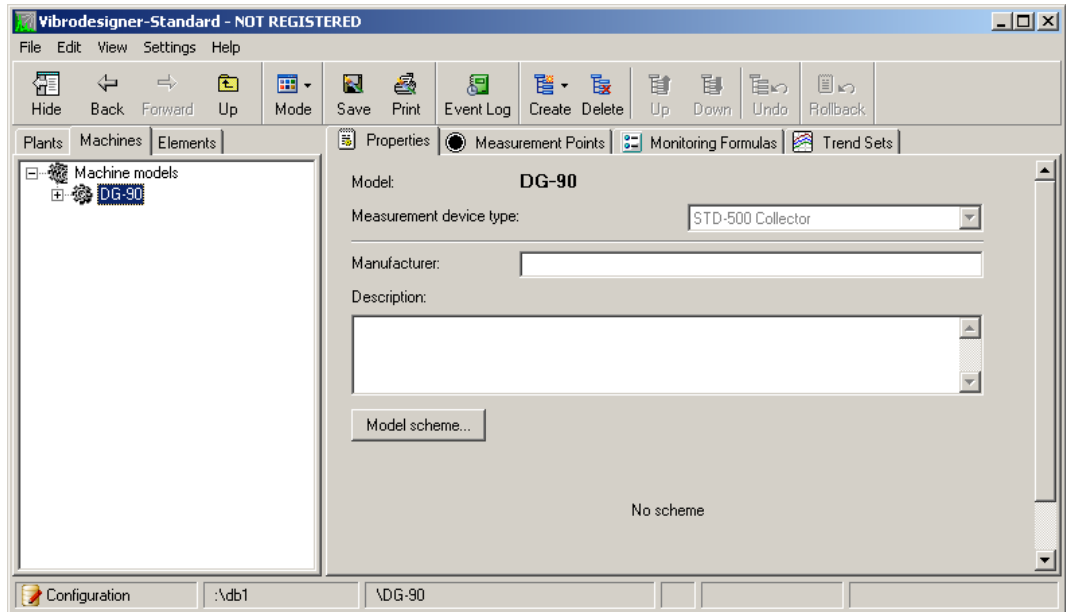


**Figure 61 Creating machine model**

Each model has a set of the following properties:

- A type of the data collector used for vibration measurement (mandatory parameter)  
This parameter is used to filter element models to be included in a machine model. The data collector specified for a machine model and for its nested element models must be the same.
- Machine manufacturer
- Graphical scheme of the model

A model properties are specified on the **Properties** tab.



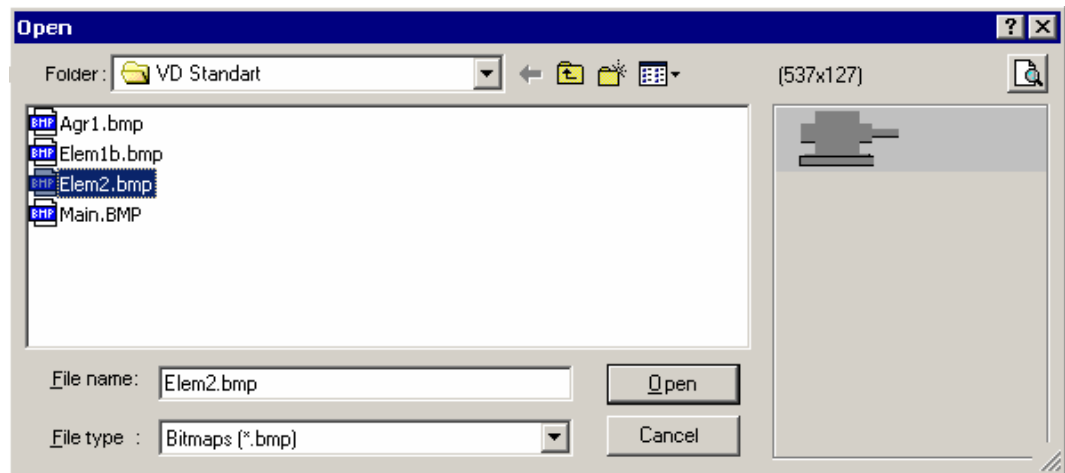
**Figure 62 Properties of machine model**

**To select a picture for the machine model:**

1. Click the **Model scheme** button.

The **Open** dialog box appears.





**Figure 63 Open dialog box**

2. Select the file you need and click the **Open** button.

The selected image is displayed on the **Properties** tab.

---

**Note:** You can select files in BMP format only.

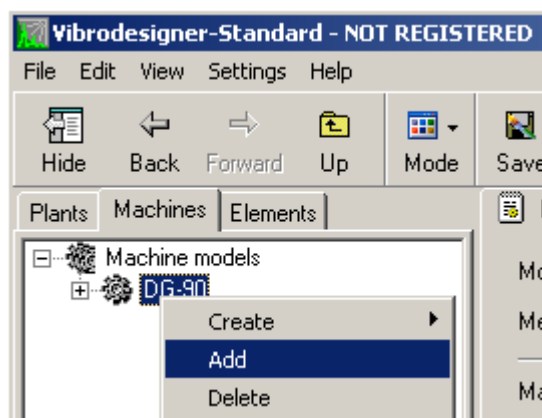
---

## Assembling Machine Models from Elements

The empty machine model—even with specified properties—has no functionality. After creating an empty model, you must assemble the model from previously created elements.

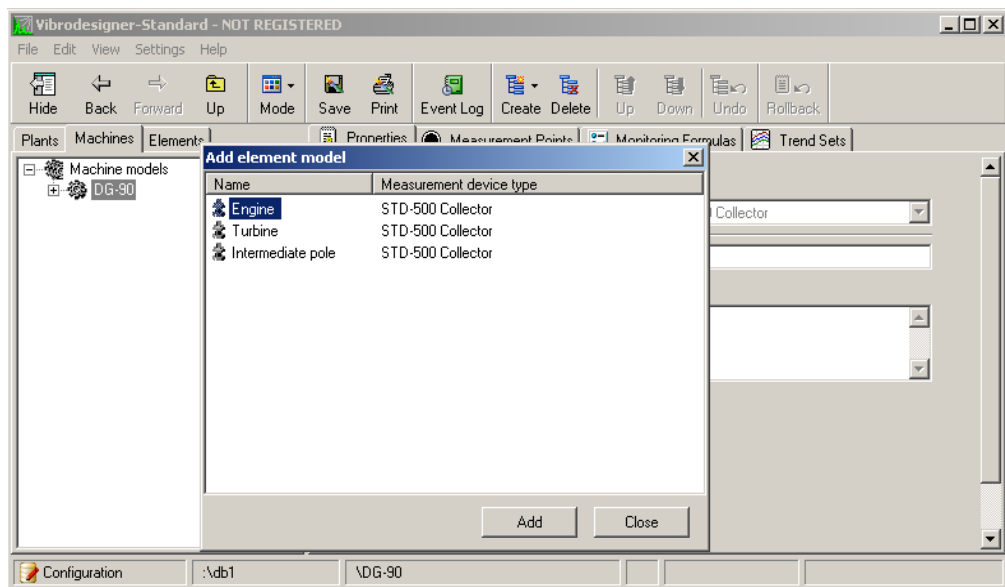
### To add machine element models into a machine model:

1. Right-click the machine model you need and select **Add** from the menu.



**Figure 64 Adding machine element**

The **Add element model** dialog box appears.

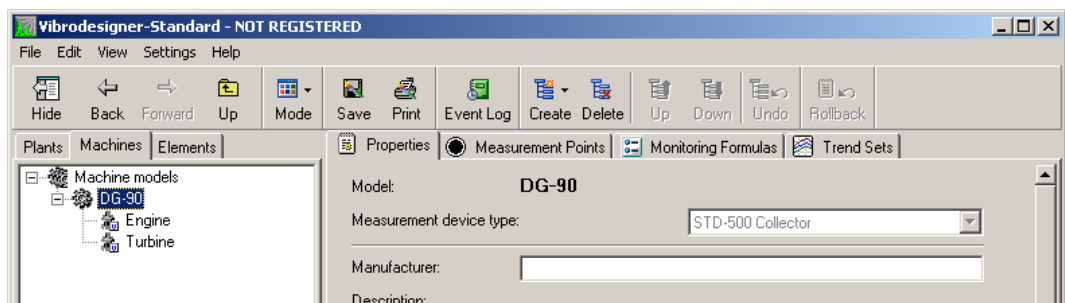


**Figure 65 Assembling machine model from elements**

2. Select the element model(s) you need and click the **Add** button.

**Note:** You can select more than one element at once if you hold down CTRL or SHIFT keys.

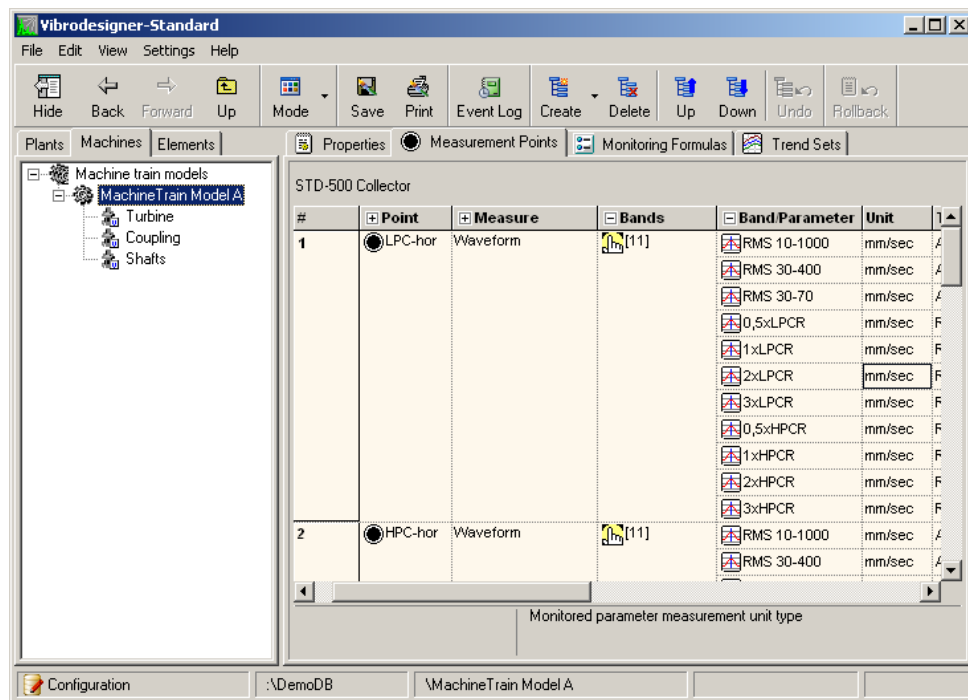
The selected elements appear in the machine model hierarchy.



**Figure 66 Assembled machine model**

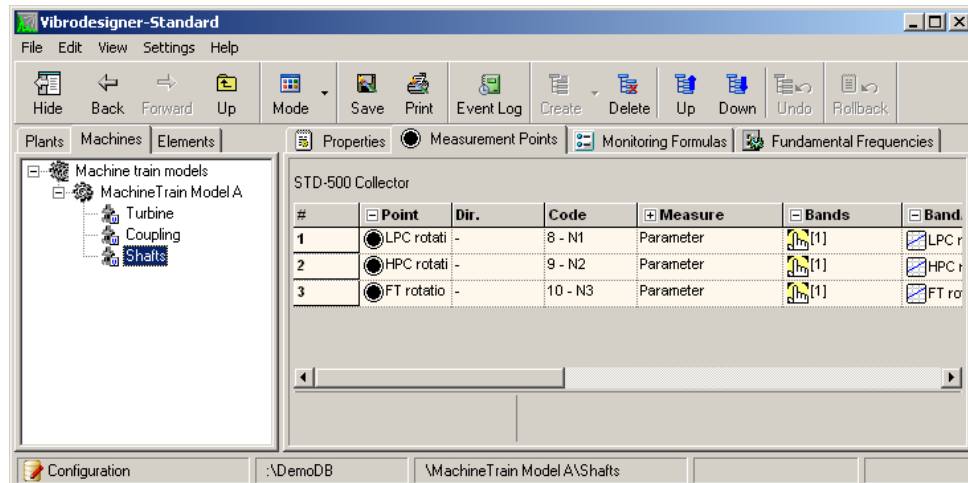
3. Close the **Add element model** dialog box.

Element models are not modified on the **Machines** tab. On this tab, you cannot add, delete, or rename the measurement points belonging to the machine element model. To modify point parameters, navigate to the **Elements** tab whereby you can change the needed element. The changes affect all machine models made of the modified machine element. On the **Machines** tab, you can only view measurement points by clicking either a name of the machine model or a name of the element model. The picture below shows how to display points by clicking a name of the machine model.



**Figure 67 Measurement point parameters on element model—the parameters are not modified in the machine tree**

You can also display measurement points of each machine element model by selecting it in the tree.



**Figure 68 Viewing point parameters on machine element**

## Linking Fundamental Frequencies to Measurement Points

To customize relative bands, you need to link created fundamental frequencies (see “Adjusting Relative Bands”) to the measurement points.

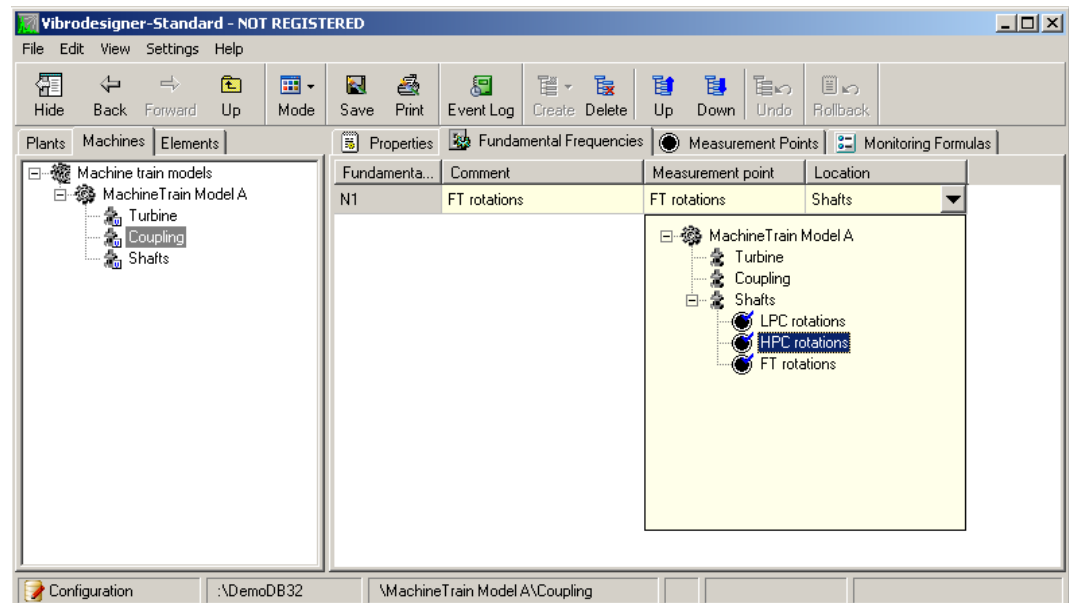
### To link fundamental frequencies to measurement points:

1. On the left Vibrodesigner panel, click the **Machines** tab.

2. Create a machine model.
3. Add the machine element models in the newly created machine model.

Once done, the machine model has the rotation frequency measurement points that is the data source for fundamental frequency values.

4. Click the **Fundamental Frequencies** tab on the right.
5. For each element model of the machine model, link the fundamental frequencies to the measurement points.




**Figure 69 Linking fundamental frequencies to measurement points—LPC rotations, HPC rotations, and FT rotations points can be linked**

**Note:** You cannot create new fundamental frequencies on the **Fundamental Frequencies** tab. Such frequencies are created for machine element models only.

## Monitoring Formulas for Machine Models

You can create calculated parameters<sup>7</sup> and formulas for calculation for machine models.

### To create a calculated parameter for an machine model:

1. Select a target machine model on the **Machines** tab.
2. Select the **Monitoring formulas** tab on the right.
3. To add a new calculated parameter in the table, right-click in the table and select **Create parameter** from the menu. You can also click  on the toolbar.

<sup>7</sup> Calculated parameters are scalar values computed from current measured or calculated machine parameters using specified formulas.

A new row with the default properties appears at the bottom of the table.

4. In the **Parameter** cell, type the name of the parameter.
5. In the **Unit** cell, select the parameter measurement unit of interest from the drop-down list.
6. In the **Variables** group cell, specify all the needed variables to be used in the monitoring formula.
7. Double-click the **Monitoring formula** cell.

The **Monitoring formula** dialog box appears.

8. Specify the formula to be used for computing the parameter.
9. If necessary, specify alarms/warnings for the calculated parameter. To do so, click the «-» sign in the **A/W Levels** column and then enter the needed values in the cells.

---

**Note:** For more information on how to work with monitoring formulas editor, see Appendixes, “Configuring Calculated Parameters.”

---

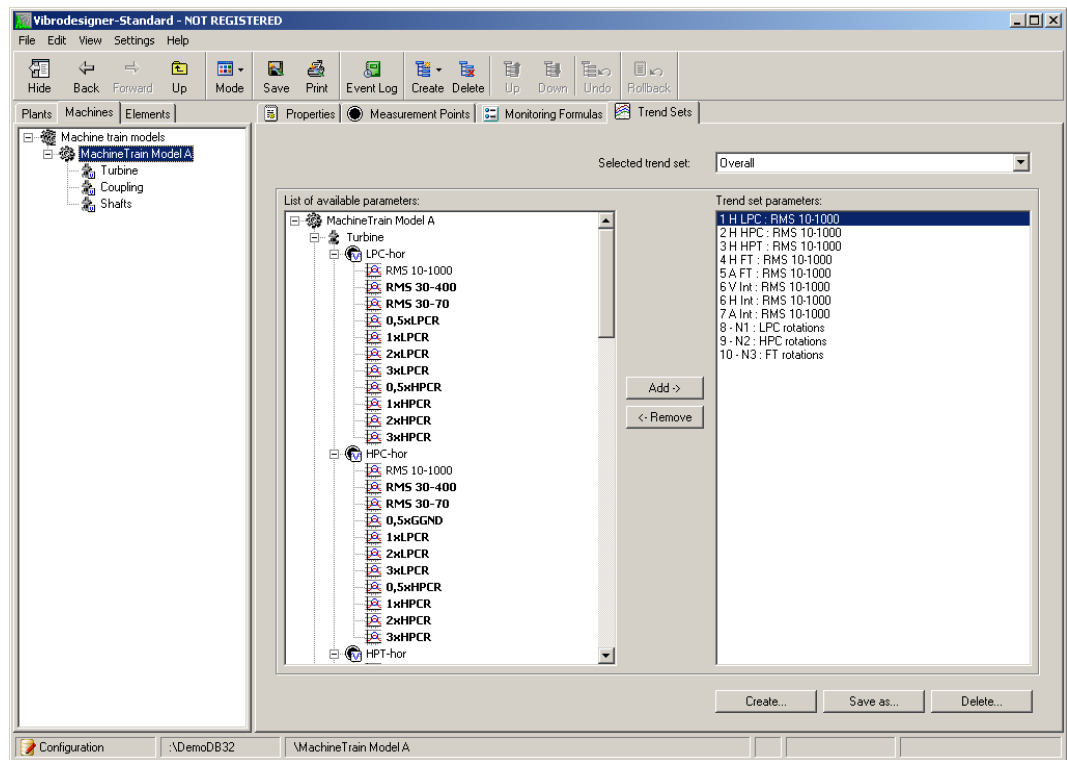
## Creating Trend Sets

You can create a number of parameter trend sets for each machine model to enable analyzing multiple parameters trends simultaneously. You may add the same parameter in various trend sets.

### To create a trend set for a machine model:

1. Select the **Machines** tab on the right and then select the machine model of interest.
2. Click the **Trend Sets** tab on the right.

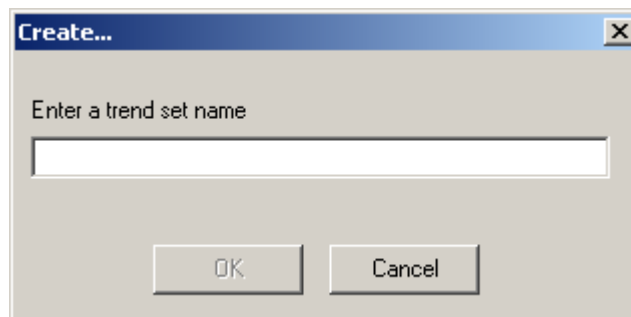
Two panels for configuring trend sets are displayed. In the left panel, you can see all available parameters. At the top of the right panel, you can see the drop-down list that contains existing trend sets. On selecting the trend set from this list, the trend set parameters are displayed below.



**Figure 70 Trend Sets tab**

3. Click the **Create** button.

The **Create** dialog box appears.



**Figure 71 Create dialog box**

4. Type a name of the new trend set and click **OK**.  
The created trend set is displayed in the drop-down list in the right panel.
5. In the left panel, select the parameters you need and click the **Add** button.  
The selected parameters are displayed in the right panel.

---

**Note:** You can also select more than one parameter at a time, holding CTRL or SHIFT down.

---

#### To modify a parameters list of the trend set:

1. From the drop-down list on the right, select the trend set of interest.

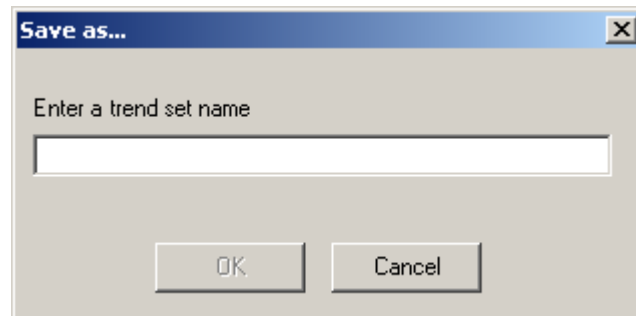
2. To add parameters into the trend set, select the parameters you need and click the **Add** button.
3. To remove parameters from the trend set, in the right panel select the parameters to be removed and click the **Remove** button.

You can save the selected trend set with another name. This will allow you to create a new trend set with pre-created parameters and thus save your time.

**To save a trend set with another name:**

1. From the drop-down list on the right, select the trend set to be saved with another name and click the **Save As** button.

The **Save As** dialog box appears.



**Figure 72 Save as dialog box**

2. Type a name of the new trend set and click **OK**.

The new trend set containing parameters of the selected trend set is created.

**To delete a trend set:**

1. From the drop-down list on the right, select the trend set to be deleted and click the **Delete** button.

You are prompted to confirm the operation.

2. Click **Yes**.

The selected trend set is deleted.

## Configuring Stationary Devices

If you plan to retrieve data from machine of a certain model via a stationary monitor, you have to add this monitor into the machine model. Then, you need to link monitor's channels to machine model measurement points. This will allow you to promptly replace the mounted monitor without any changes in the database structure. Besides, it allows creating standard machine models containing preconfigured monitors.

**To create a stationary monitor in the machine model:**

1. Right-click the machine model of interest and select a name of the device from the **Create** menu.

The monitor is created and displayed at the bottom of the element models list. In the workspace on the right, you can see a panel used to configure the device properties.

In the **Vibration channels** table, you need to match the monitor vibration channels and machine model points. In the **Tacho Channels** table, you need to match the monitor tachometric channels and rotation speed points of the machine model.

2. To match a monitor channel and a measurement point, right-click the channel number in the **Vibration channels** table and select the needed point from the menu.
3. Match all vibration channels and measurement point you need.
4. If necessary, match rotation speed channels and measurement points you need.

---

**Note:** For more information on configuring certain data monitors, see “Configuring Stationary Devices.”

---

## Exporting/Importing Machine Models

You can export and import machine models. Exporting data allows you to save into file the model structure. Importing allows you to upload the machine models exported before. Thus, you can use standard machine models and significantly save your time while creating a plant structure.

### To export machine models:

1. On the **Machines** tab, right-click the name of the model to be exported (or the root *Machine models* node) and select **Export structure** from the menu.

The **Export to file** dialog box appears.

2. Select the target folder, type the file name you need in the **File name** box, and then click the **Save** button.

The export of the selected object structure is started. When finished, the successful message is displayed.

3. Click **OK**.

### To import machine models:

1. Right-click the root *Machine models* node where you need to import a structure and select **Import structure** from the menu.

The **Import from file** dialog box appears.

2. Select the file for import and click the **Open** button.

The import is started. When finished, the successful message is displayed.

3. Click **OK**.

## Plant Hierarchy

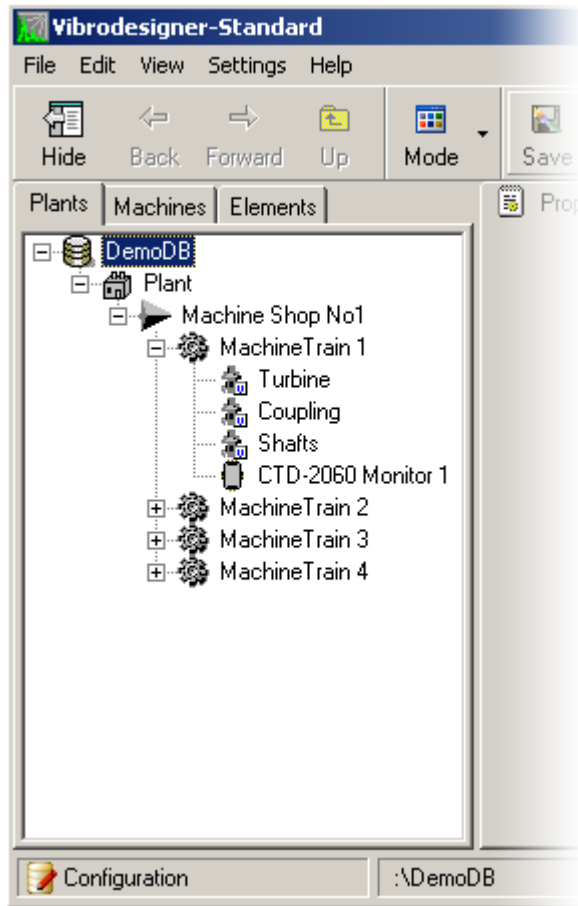
### Introduction

From the vibration diagnostics point of view, a plant hierarchy describes the structure of your real-world plant and contains all the machine types operating in your plant. First,



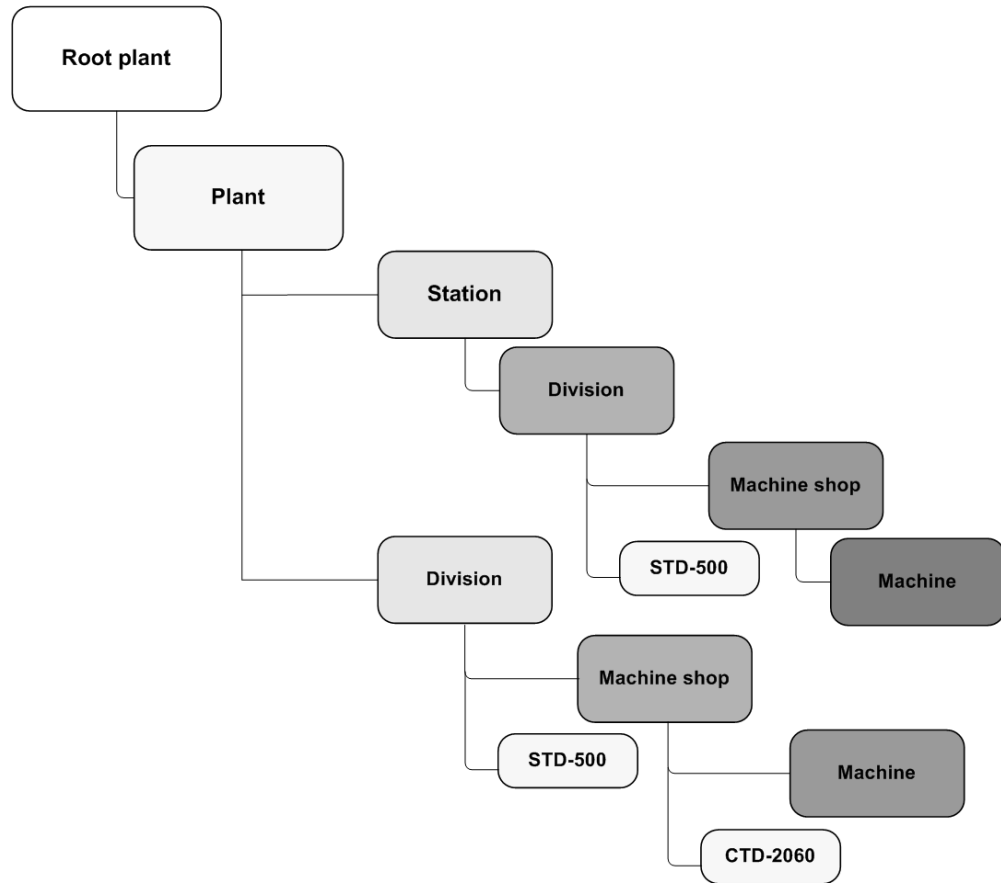
you create an empty database, then add information about existing divisions and machine shops, and finally specify monitored machinery, data collectors, and inspection routes.

A plant structure is a hierarchical list (tree). This tree is formed in the Configuration mode on the **Plants** tab.



**Figure 73 Plant hierarchy**

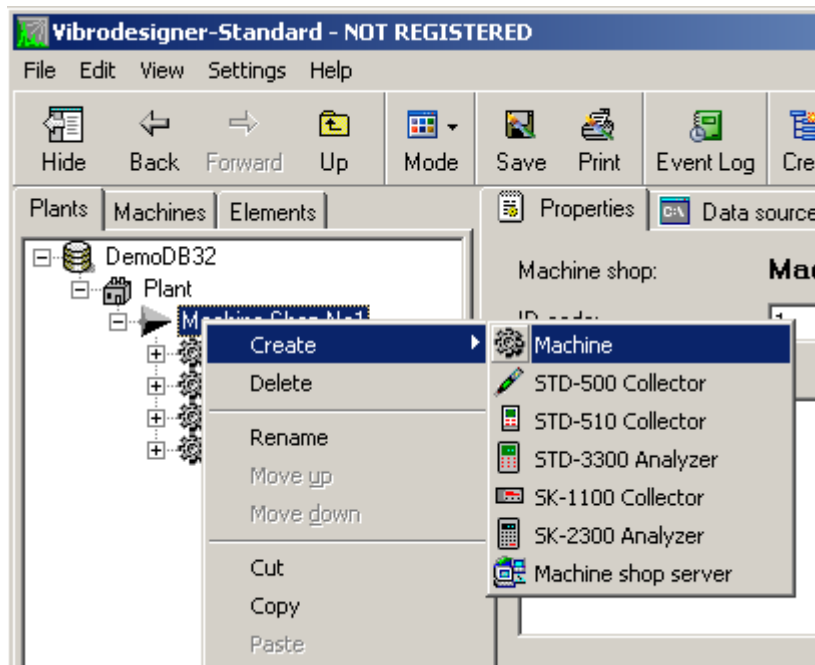
Your database may contain various plants which structures represent the structures of real-world plants. An example of the plant hierarchy is shown in the picture below.



**Figure 74 Plant hierarchy example**

The first element in the hierarchy is always the root plant that may include one or more child plants. Child plants may include stations, divisions and machine shops. A station may include divisions or machine shops. A division may include child divisions, stations and machine shops. Machines are placed in machine shops. Besides, every hierarchy level may contain routes and devices. For convenience, routes and devices may be grouped.

To create an object on a certain level of hierarchy (for example, to create a machine in the machine shop), use a context menu.



**Figure 75 Creating machine within machine shop—all hierarchy is created in the same way**

When you created an object, you are prompted to specify its properties in the right pane. Object properties are described in the following sections.

## Creating and Opening Databases

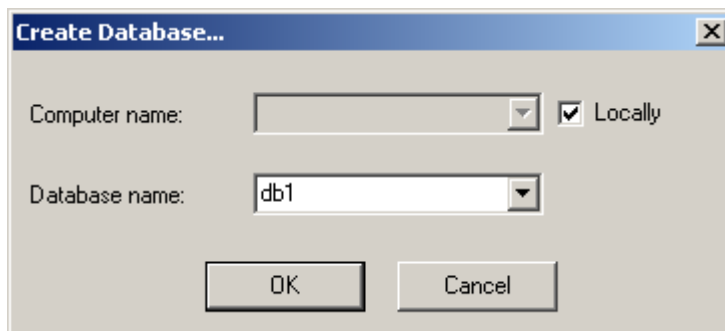
The complete plant hierarchy is stored in a database. The database created by a user on a local computer becomes available to all users on the local network<sup>8</sup>. All changes made by one user are displayed on workstations of other users. For more information about Vibrodesigner architecture, see *Chapter 3*, “Vibrodesigner Configuration Types.”

### To create a new database:

1. On the **File** menu, click **Create Database**.

The **Create Database** dialog box appears.

<sup>8</sup> You have to configure Windows security settings as described in “Windows Security Settings for Remote Access.”



**Figure 76 Create Database dialog box**

2. In the **Database name** box, type the database name you need.
3. Click **OK**.

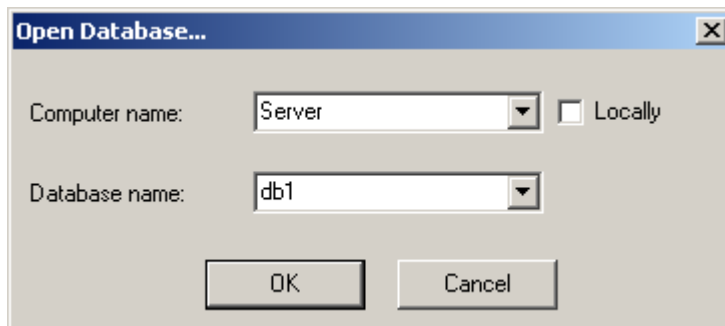
A new database is created. You can now start configure a plant hierarchy.

You may work with various databases. Thus, in addition to creating a new database from scratch, you can open an existing database and modify its structure.

**To open an existing database:**

1. On the **File** menu, select **Open database**.

The **Open Database** dialog box appears.



**Figure 77 Open Database dialog box**

2. If the database of interest is stored on a remote computer, clear the **Locally** check box and then select the needed database server from the **Computer name** list.

In the **Database name** box, a name of the database you opened for the last time on your computer is displayed. Clicking the arrow in this box shows the list of the databases stored on the specified computer.

3. From the **Database name** list, select the database you need.

---

**Note:** If the database you need is stored locally, select the **Locally** check box and select the needed local database from the **Database name** list.

---

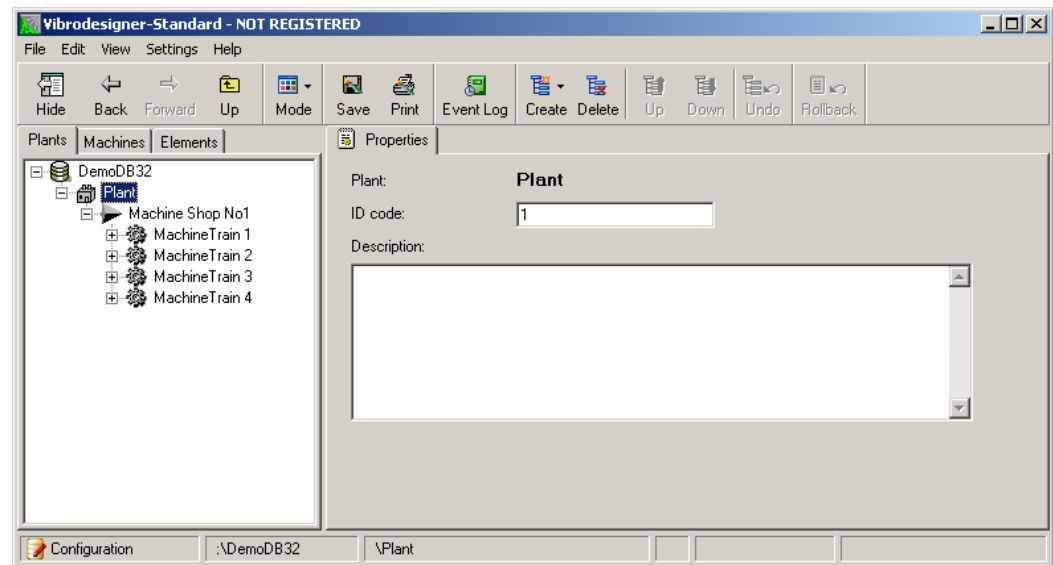
4. Click **OK**.

The selected database is opened.

## Plant

A *plant* is a root object in the plant hierarchy. All structure of the modeled plant is placed under the Plant object. Plant properties are the following:

- Plant name
- Plant identification code
- Short text description

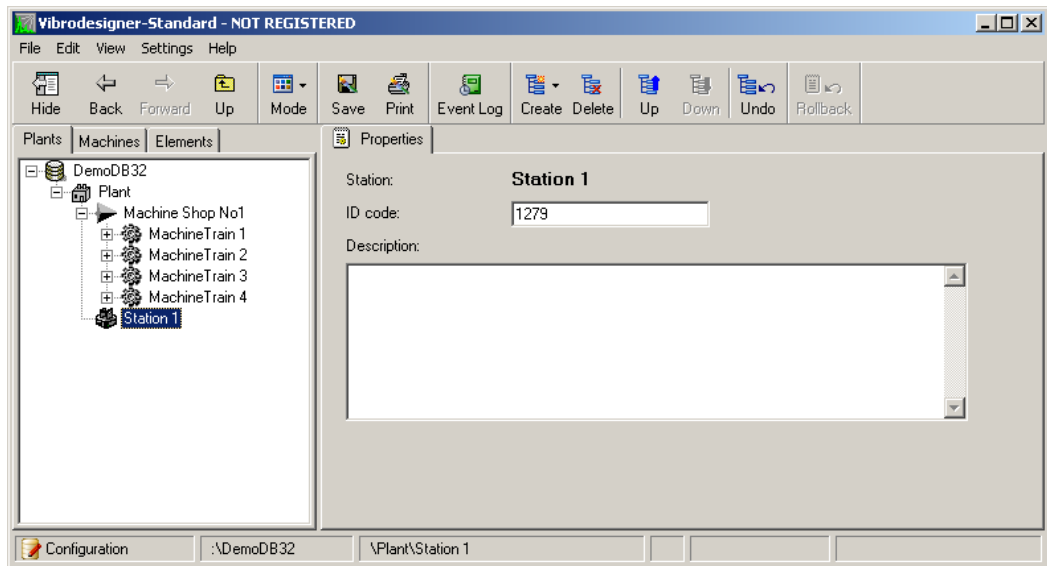


**Figure 78 Plant properties**

## Station

A *station* is the object of a plant hierarchy located under a plant or a division. A station may include divisions and machine shops. Station properties are the following:

- Station name
- Station identification code
- Short text description

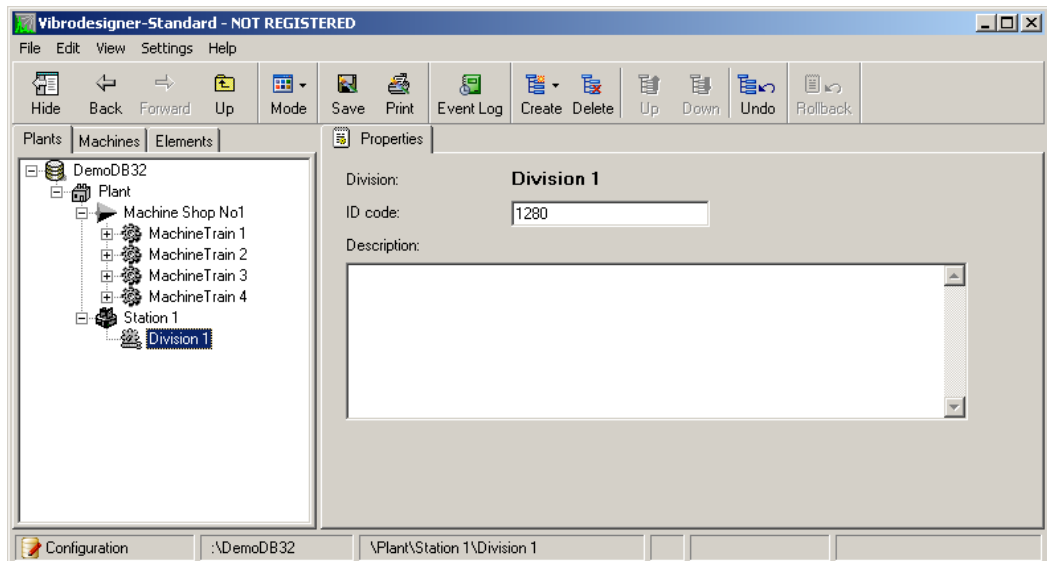


**Figure 79 Station properties**

## Division

A *division* is the object of a plant hierarchy located under a plant, a station or another division. A division may include stations, machine shops and other divisions. Division properties are the following:

- Division name
- Division identification code
- Short text description

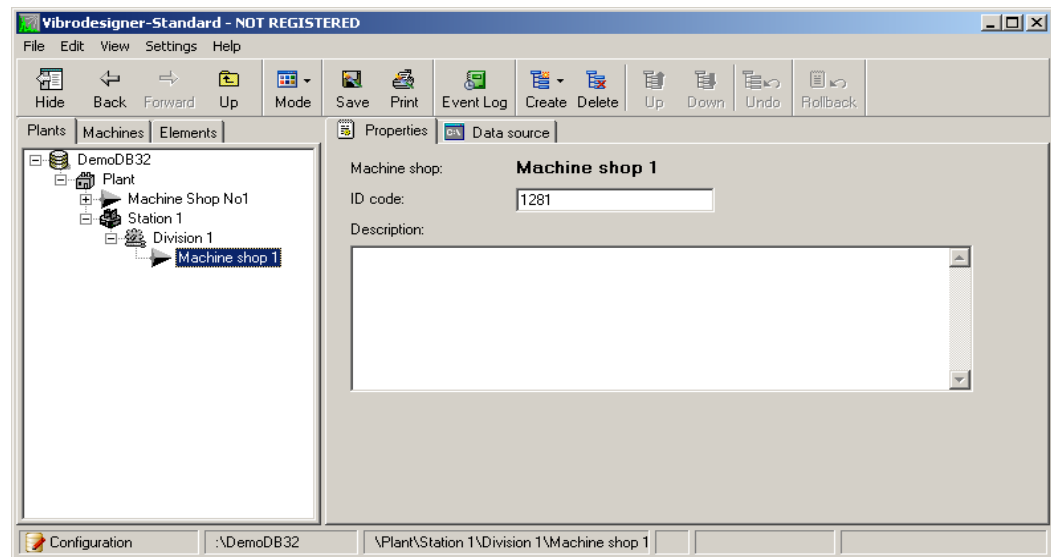


**Figure 80 Division properties**

## Machine Shop

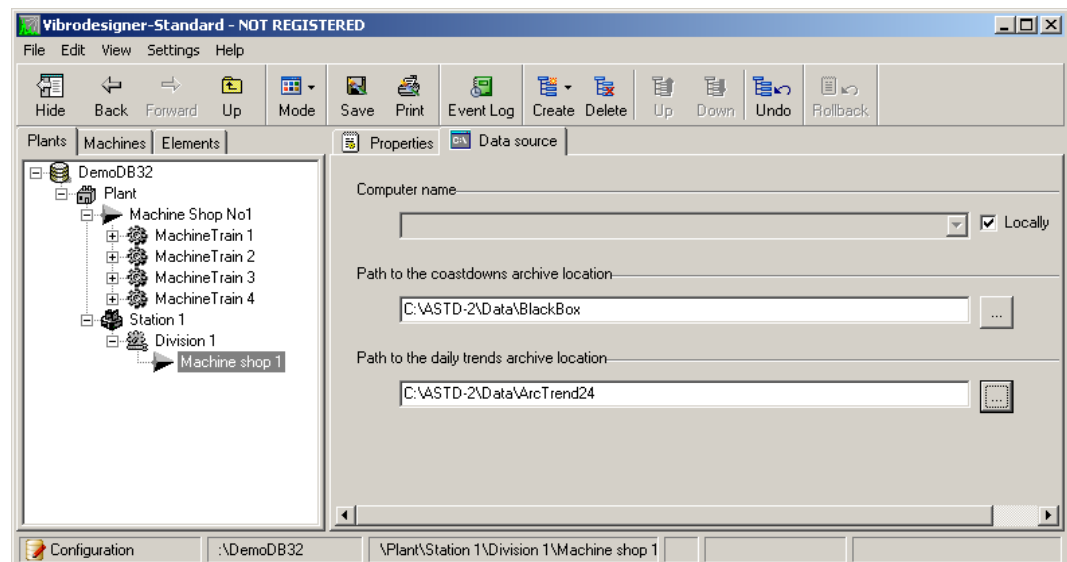
A *machine shop* is the object of a plant hierarchy located under a plant, a station or a division. A division contains machines. Machine shop properties include the following:

- Machine shop name
- Machine shop identification code
- Short text description



**Figure 81 Machine shop properties**

For each machine shop, you can specify on the **Data source** tab a computer name and the folders that contain coast-downs and daily trends archives. Coast-downs and daily trend files can be retrieved from the online machine shop systems. Coast-downs and daily trend retrospective can be then displayed in the Analysis mode.

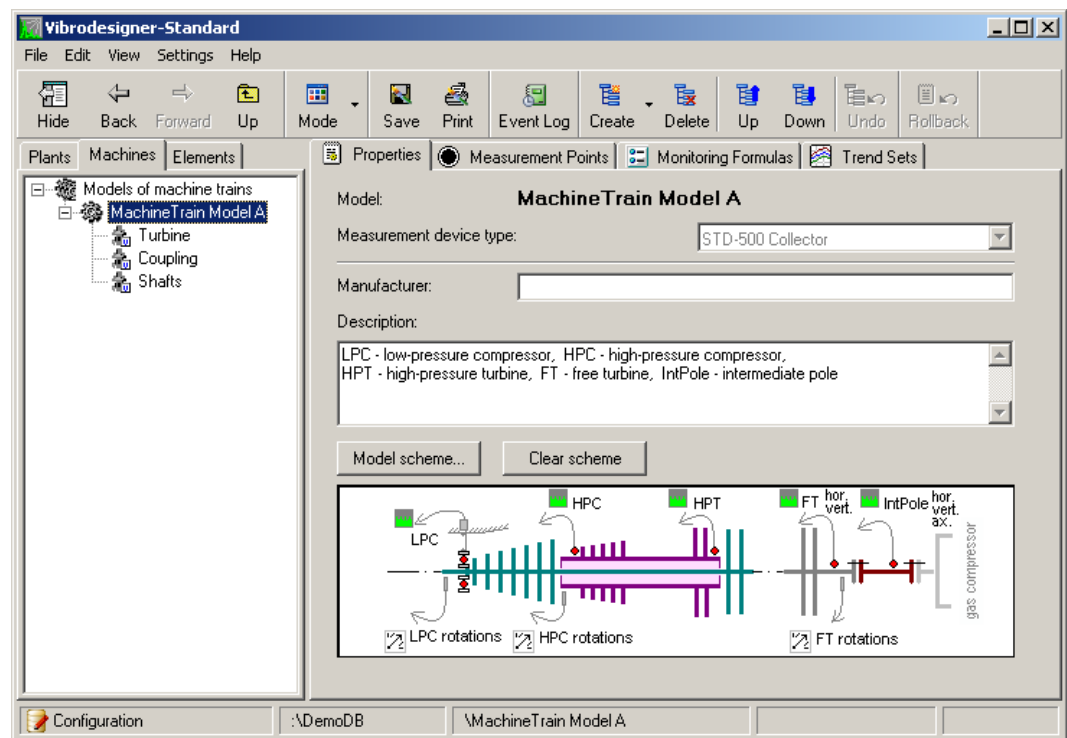


**Figure 82 Coast-downs and daily trends locations**

## Machine

From the vibration diagnostics point of view, a machine is the equipment for condition monitoring and hence a main object in the hierarchy. A *machine* is an electromechanical system designed to perform a particular technological task on the plant. Machines are located in machine shops. A machine consists of one or more machine elements, for example, engine, turbine and so on. Machine properties include the following:

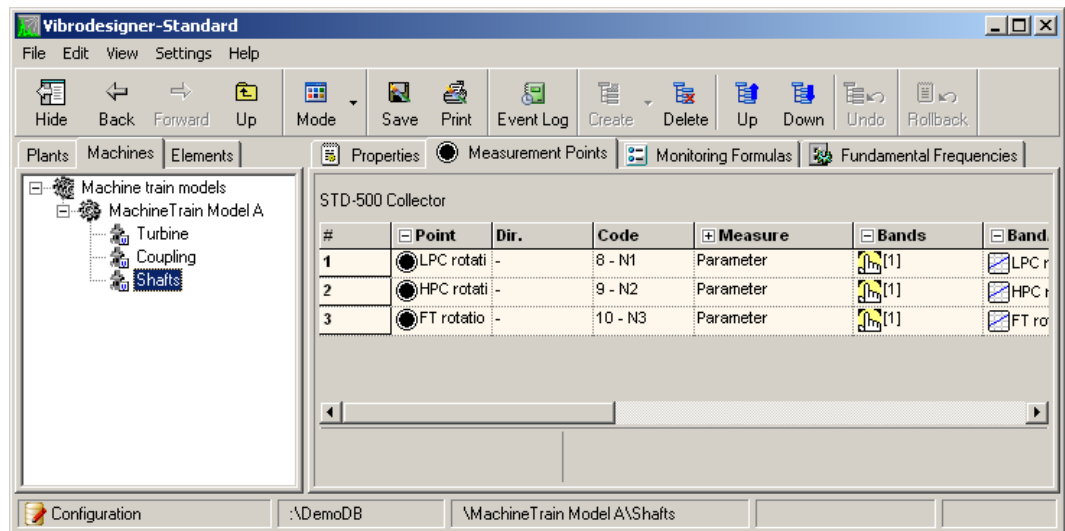
- Machine model  
The main property of a machine. A model is selected from the list of predefined machine models.
- Data collector type applied for the machine
- Machine manufacturer
- Short text description
- Model scheme



**Figure 83 Machine properties**

After adding element models, the machine will have the components with measurement points. You can view all measurement points by clicking either a name of the machine model or a name of the element model. Measurement points on machine level are not modified. For more information about machine models, see “Machine Models” earlier in this chapter.





**Figure 84** Viewing points of the element belonged to machine

## Machine Element

A *machine element* is a part of the machine that can operate separately. A machine element does not perform a particular technological task. The examples of machine elements are engine, turbine and so on. As well as a complete machine, a machine element can be monitored.

Machine elements appear in the hierarchy after selecting a machine model that set all major element characteristics, i.e. the number and names of measurement points, measurement parameters, possible diagnoses and messages (events), recommendations and so on. For more information about machine elements, see “Machine Element Models” earlier in this chapter.

## Devices

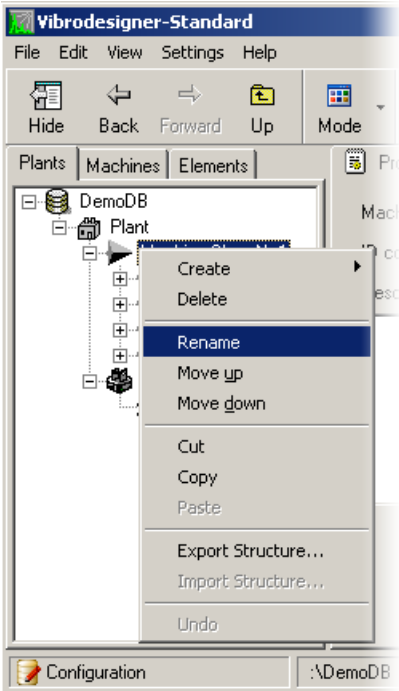
Devices are used to measure signals and save data in a database. It does not matter which plant hierarchy level devices occupy. Device properties include the following:

- Device name
- Device type
- Device version
- Device serial number
- Short text description
- Transducer information
  - Measurement unit that defines which parameter is measured by the transducer
  - Transducer sensitivity.

For more information about devices, see “Configuring Devices”.

# Editing Plant Hierarchy

To edit a plant hierarchy, you can use a context menu commands. All described below actions are applied both to a structure of machine models and a structure of machine element models. A context menu of hierarchy object is shown in the picture below.



**Figure 85 Context menu of hierarchy object**

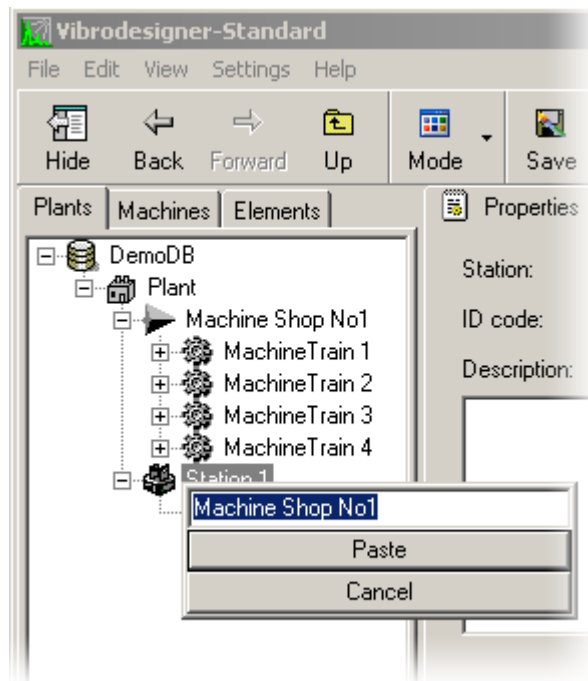
The table below describes the context menu commands.

**Context menu commands of a hierarchy object**

MENU COMMAND	DESCRIPTION
Delete	Delete the selected hierarchy object.
Rename	Rename the selected object of the plant hierarchy.
Move up	Move the selected object (or the measurement point) one level up in the hierarchy.
Move down	Move the selected object (or the measurement point) one level down in the hierarchy.
Cut	Cut the selected object to the Clipboard.
Copy	Copy the selected object to the Clipboard.
Paste	Paste the object from the Clipboard to the specified location.
Export structure	Export the selected data structure into a text file. For more information, see “Exporting Database Structure.”
Import structure	Import the data structure from a text file. For more information, see “Importing Database Structure.”

MENU COMMAND	DESCRIPTION
Undo	Cancel the last operation.

When pasting an object, a new window is displayed whereby you can rename the object and confirm/cancel the operation.



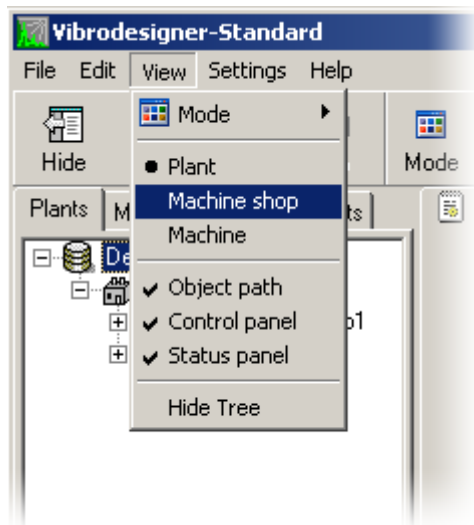
**Figure 86 Copying elements**

**Note:** You can modify:  
 a plant hierarchy down to machines level  
 a machine model structure down to elements level.

## Managing Hierarchy Viewing Modes

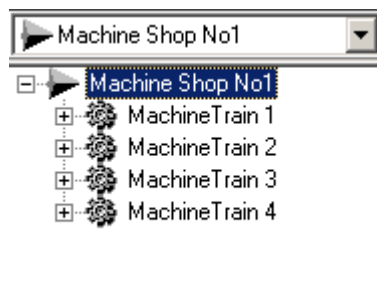
### Plant Hierarchy

While viewing a plant hierarchy, you can display each machine shop and machine separately. It is useful when a plant contains many machines and machine shops. For this purpose, use the **Machine** and **Machine shop** commands from the **View** menu.



**Figure 87** *Machine shop and Machine commands are used to view these objects in a convenient way*

Selecting the **Machine shop** command transforms the plant hierarchy on the left panel to provide easy navigation through machine shops.



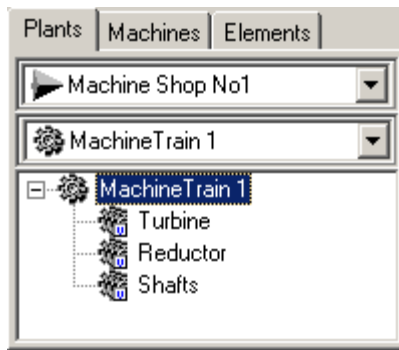
**Figure 88** *Plant hierarchy after selecting Machine shop command*

Switching between machine shops is performed by selecting the element of interest from the drop-down list. You can also create a new machine shop after selecting **<New machine shop>** from the drop-down list.



**Figure 89** *Creating new machine shop*

Selecting the **Machine** command transforms the plant hierarchy on the left panel to provide easy navigation through machine shops and machines.

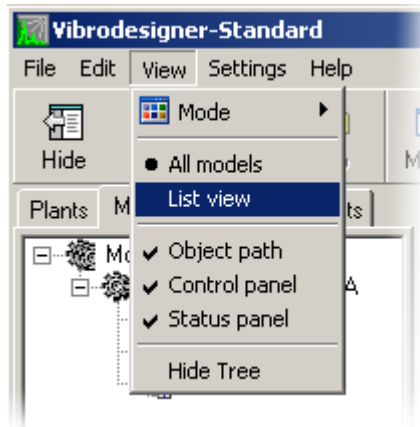


**Figure 90 Plant hierarchy after selecting Machine command**

To switch between machine shops, select the element of interest from the upper drop-down list. To switch between machines, select the element of interest from the lower drop-down list. You can create a new machine shop after selecting **<New machine shop>** from the upper drop-down list. You can also create a new machine after selecting **<New machine >** from the lower drop-down list.

## Machine Models and Elements

You can display machine models in drop-down lists on the **Machines** tab. To do so, select **List View** from the **View** menu.



**Figure 91 Viewing model list of machine elements**

You can also display machine element models in drop-down lists on the **Elements** tab. To do so, select **List View** from the **View** menu. Working with these lists is similar to working with machine and machine shop lists.

## Configuring Devices

This section describes how to create and adjust data collectors and analyzers in the Vibrodesigner-Standard application.

## Configuring Portable Devices

The new generation of Technekon's portable devices— STD-500, STD-510 and STD-3300—is designed to effectively perform inspections manually. An operator works with such devices in a similar way.

You can create portable devices at any level of plant hierarchy (plant, machine shop, station and so on).

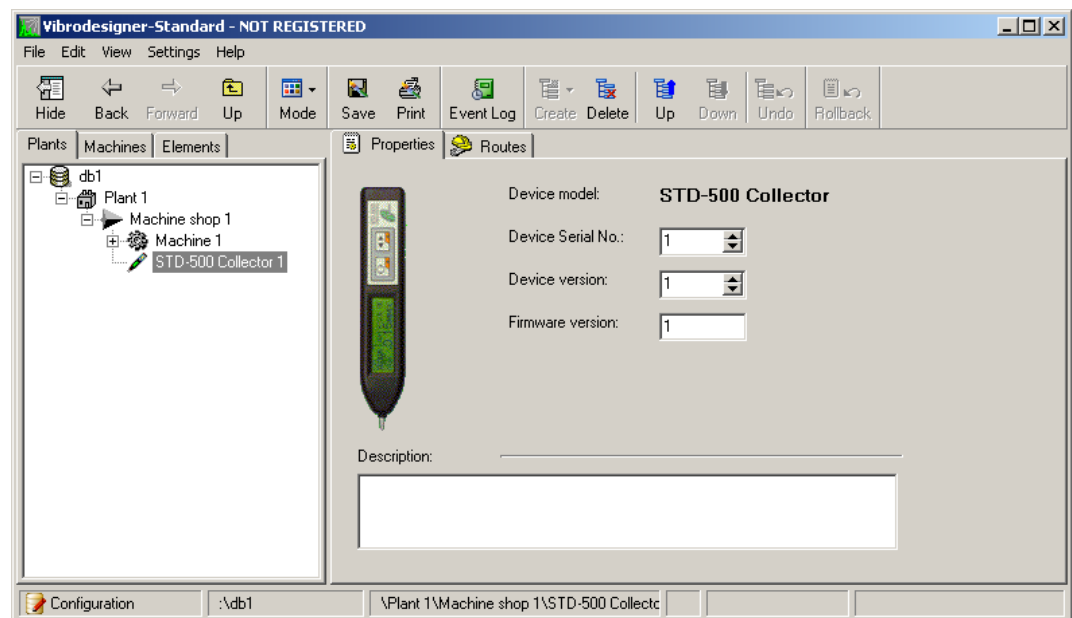
**Note:** Portable devices are created on the machine shop level only.

### STD-500 Data Collector

To add a STD-500 data collector into the plant hierarchy:

1. Right-click the hierarchy object of interest and select **Create > STD-500 Collector** from the menu.

The device appears in the plant hierarchy and at the same time the device properties are displayed on the right.



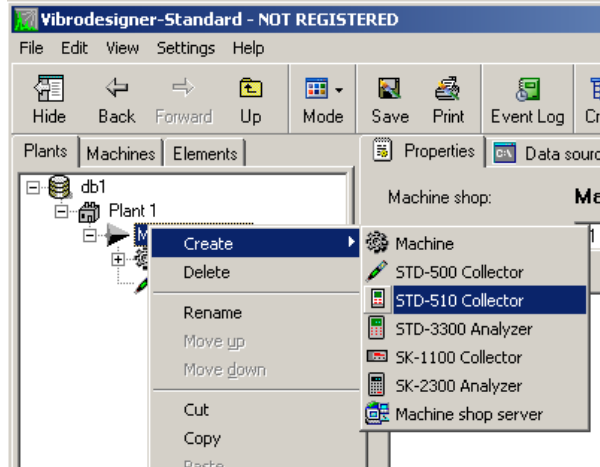
**Figure 92** STD-500 properties

2. Specify a version and a serial number of the device at hand, as well as the software version used by your STD-500.
3. Click the **Routes** tab and link the needed route to the created STD-500 instance. For more information on creating routes, see "Creating Routes for Portable Data Collectors".

## STD-510 Data Collector

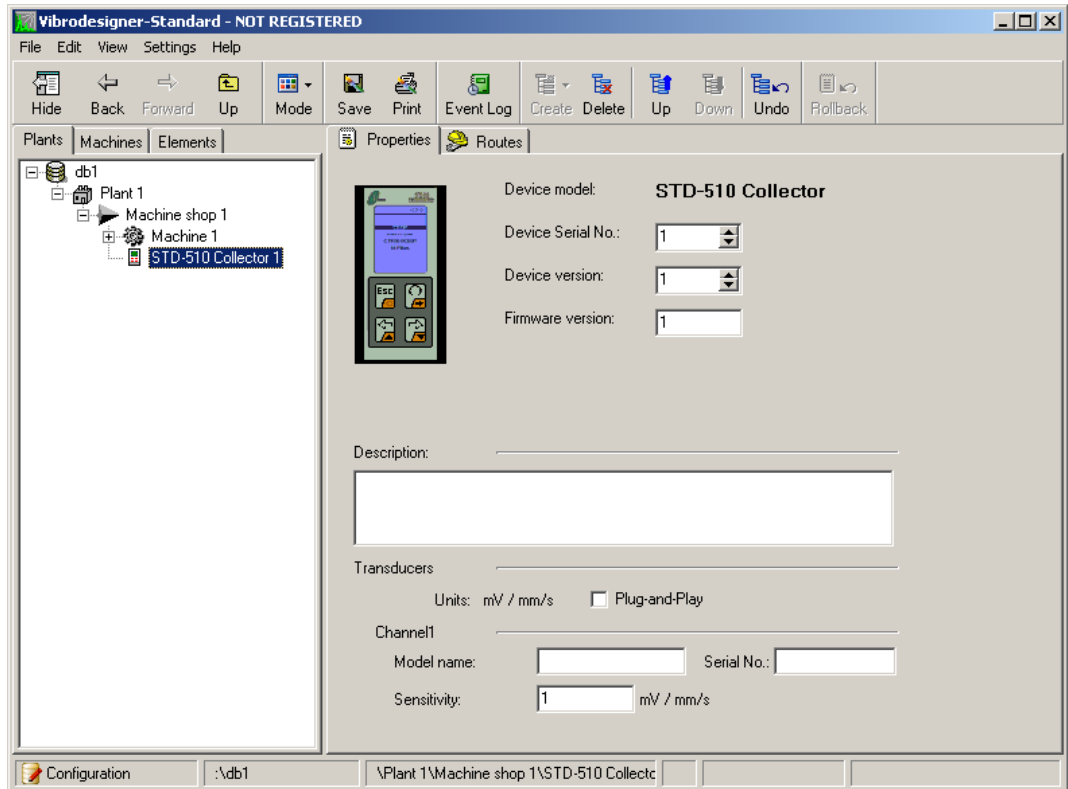
To add a STD-510 data collector into the plant hierarchy:

1. Right-click the hierarchy object of interest and select **Create > STD-510 Collector** from the menu.



**Figure 93 Creating STD-510 collector in plant hierarchy**

The device appears in the plant hierarchy and at the same time the device properties are displayed on the right.



**Figure 94 STD-510 properties**

4. Specify a version and a serial number of the device at hand, as well as the software version used by your STD-510.

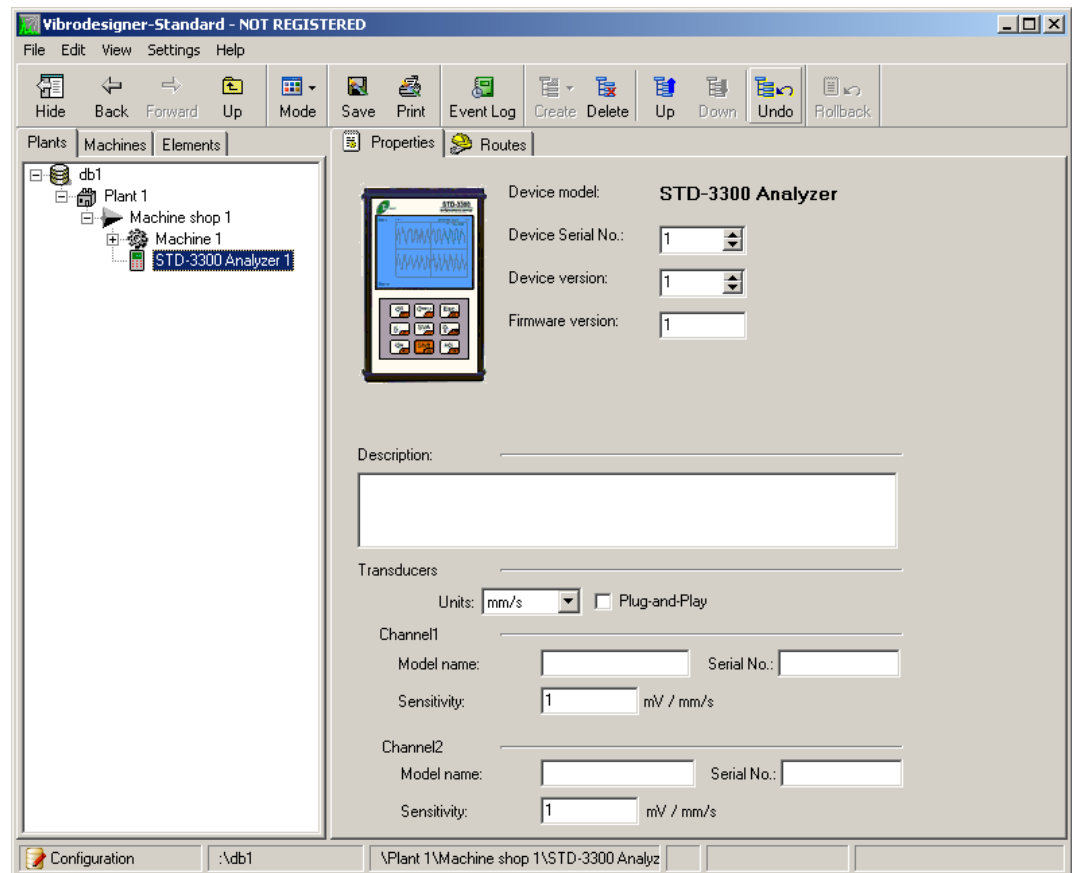
5. Specify properties of the collector's transducer. You can set the measurement unit, sensitivity, and the transducer's model and serial number. If the **Plug-and-Play** check box is selected, the regular transducer is to be used.
6. Click the **Routes** tab and link the needed route to the created STD-510 instance. For more information on creating routes, see "Creating Routes for Portable Data Collectors".

## STD-3300 Analyzer

### To add a STD-3300 analyzer into the plant hierarchy:

1. Right-click the hierarchy object of interest and select **Create > STD-3300 Analyzer** from the menu.

The device appears in the plant hierarchy and at the same time the device properties are displayed on the right.



**Figure 95 STD-3300 properties**

2. Specify a version and a serial number of the device at hand, as well as the software version used by your STD-3300.
3. Specify properties of the collector's transducers. You can set the measurement unit, sensitivity, and the transducer's model and serial number. If the **Plug-and-Play** check box is selected, the regular transducer is to be used.



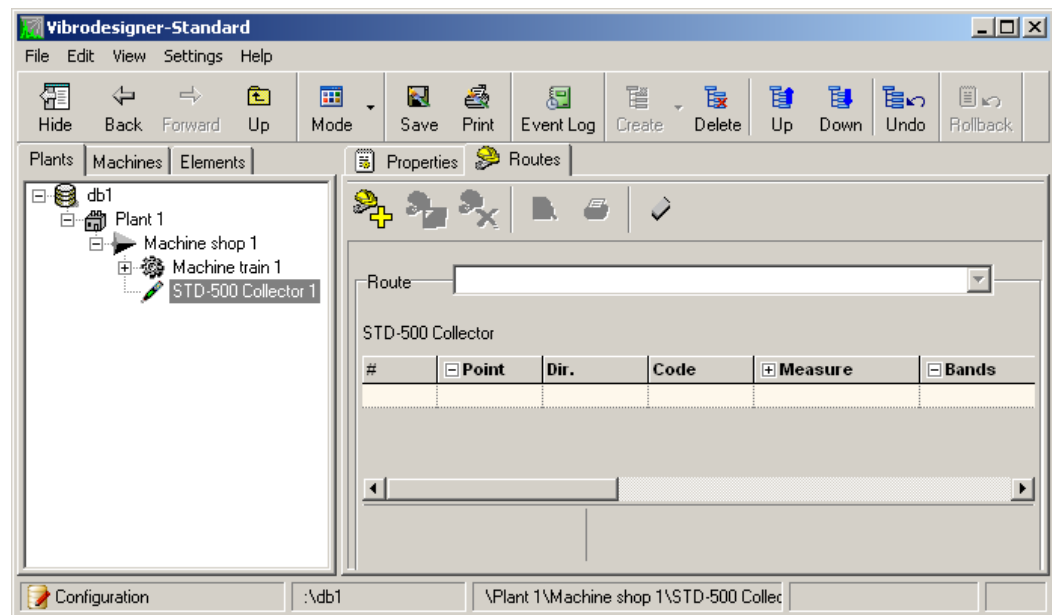
- Click the **Routes** tab and link the needed route to the created STD-3300 instance. For more information on creating routes, see “Creating Routes for Portable Data Collectors”.

## Creating Routes for Portable Data Collectors

A *route* is the order of measurements in points during inspection. Inspection routes specify in which points, on which machines and in which order the measurements are to be performed. Routes are created for portable devices and can be loaded only into assigned devices. You can include into the route only points of the element intended for using with particular device type. For a device instance, you may create as many routes as needed.

### To create a route for a portable device:

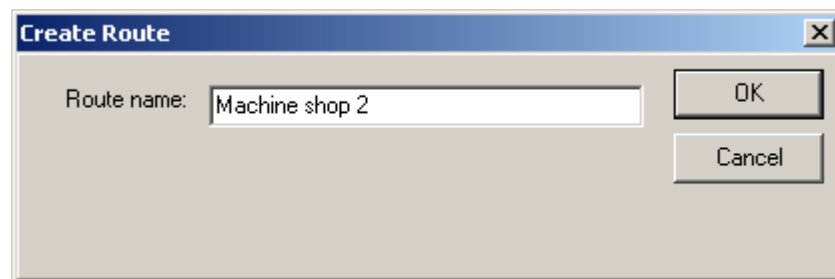
- Select the device of interest in the plant hierarchy.
- Click the **Routes** tab on the right.



**Figure 96 Routes tab**

- Click .

The **Create Route** dialog box is displayed.

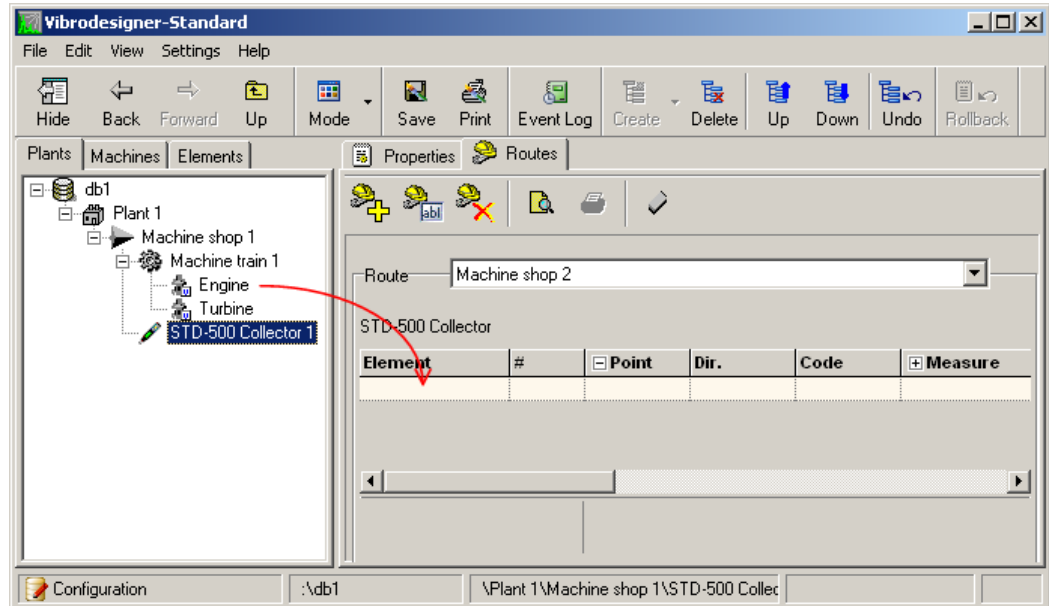


**Figure 97 Create Route dialog box**

4. Type a name of the new route and click **OK**.

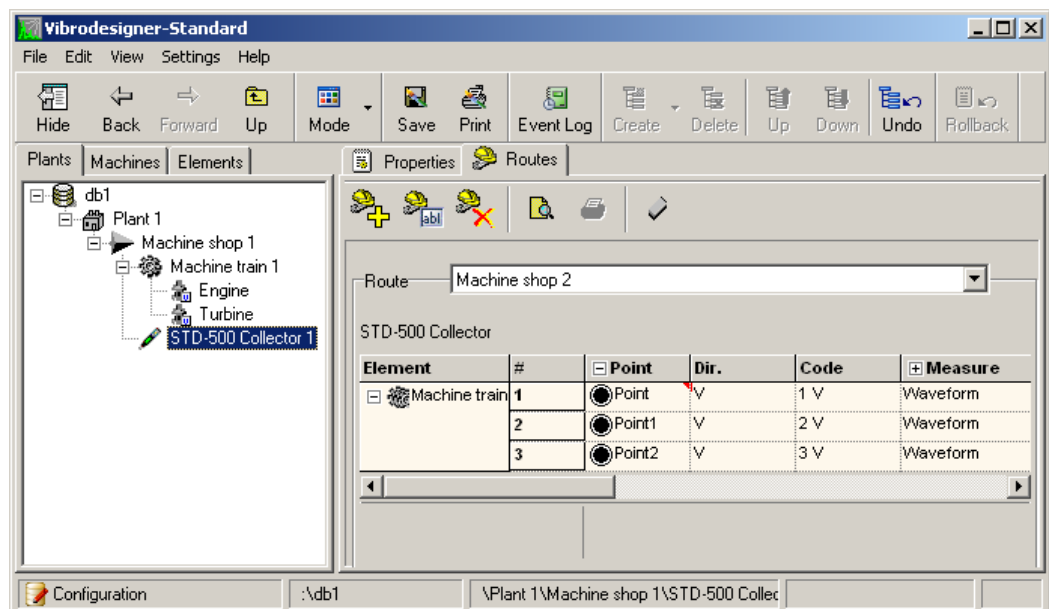
The new route is created. On creating, the route contains no measurement points.

5. To add points into the route, drag the machine element (e.g. *Engine* as shown below) from the left to right panel.



**Figure 98 Add measurement points to route**

The points located on the selected machine element are displayed in the table of route points.



**Figure 99 Route points**

6. Using the same technique, add all necessary points into the route.

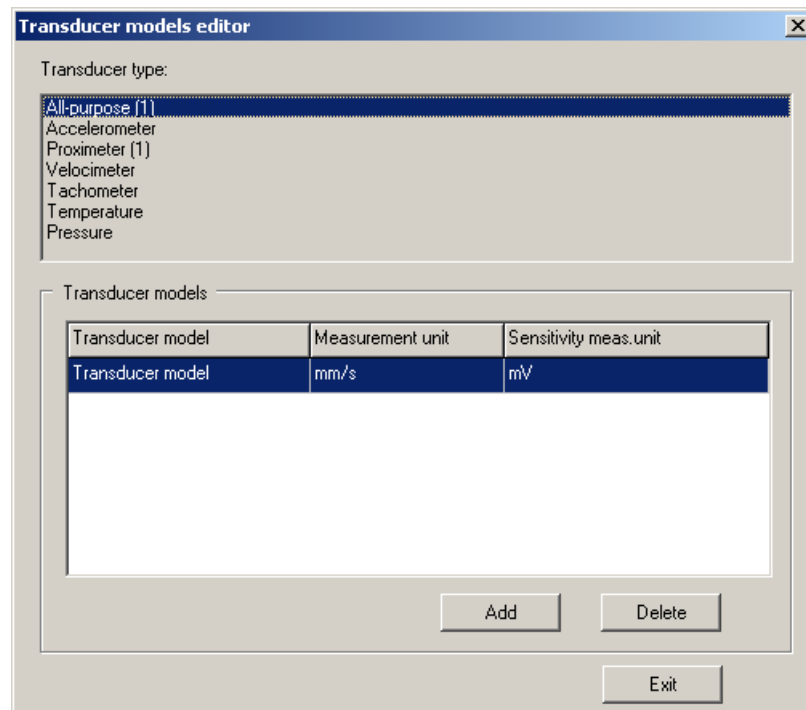
- If you plan to use a non-regular transducer for measurements, specify the name of the transducer in the **Transducer** cell. See below for more information on creating non-regular transducer models.

If you want to use non-regular transducers for portable devices, you need first to create models of such transducers.

### To create a transducer model:

- Click .

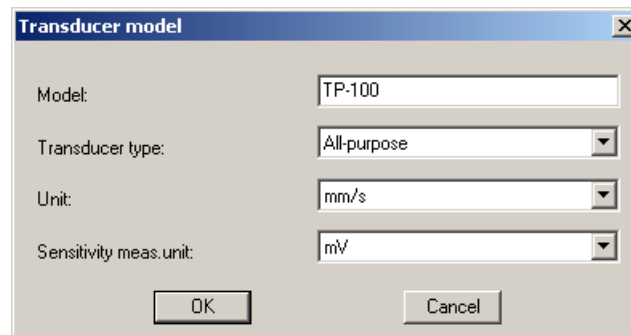
The **Transducer models editor** dialog box appears. To view a list of existing transducers, click a transducer type. As a result, transducers of the selected type are displayed below.



**Figure 100 Transducer model editor dialog box**

- Click the **Add** button.

The **Transducer model** dialog box appears.




**Figure 101 Transducer model dialog box**

3. In the **Model** box, type a name of the transducer model.
4. From the **Transducer type** list, select the type of interest.
5. From the **Measurement unit** list, select the measurement unit of interest.
6. From the **Sensitivity meas. unit** list, select the sensitivity measurement unit of interest.
7. Click **OK**.

The new transducer model is created.

**To change the route points order, do one of the following:**

- Right-click the selected point and select **Move up** or **Move down** from the menu.
- Click  in the **Point** cell and drag the point to the needed location.

The point position is changed.

**To remove a measurement point from the route:**

1. Select the route you need.
2. Select the point to be deleted.
3. Press DELETE.

The selected point is removed from the route.

**To rename a route:**

1. Select the route you need.

2. Click .

The **Rename Route** dialog box is displayed.




**Figure 102 Rename route dialog box**

3. Modify the route name and click **OK**.


The route name is changed.

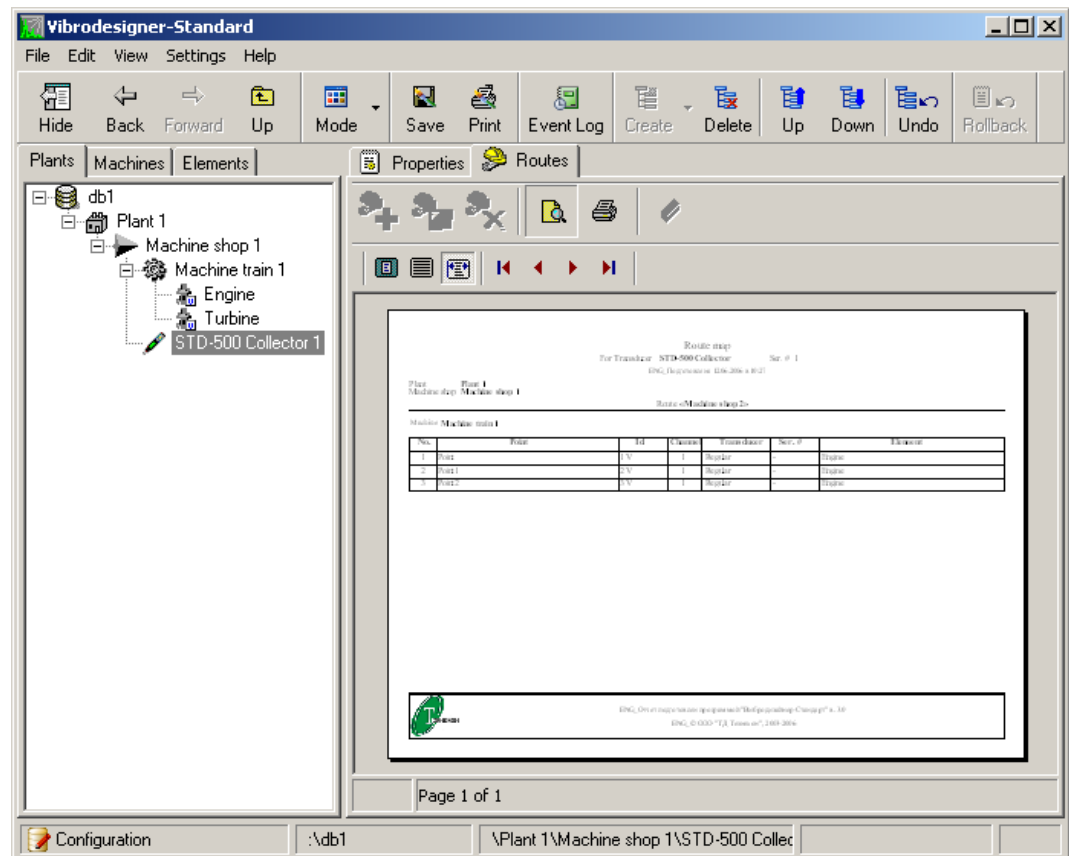
**To delete a route:**

1. Select the route you need.

- Click .
  - Click **Yes** to confirm the deletion.
- The route is deleted.


### To create a route map:

- From the **Route** list, select the route of interest and click .
- The route map is displayed in the workspace on the right.



**Figure 103 Viewing route map**

At the top of the route map, you can see a toolbar for zooming a route map and navigating through map's pages. This toolbar is described in "Inspection Reports".

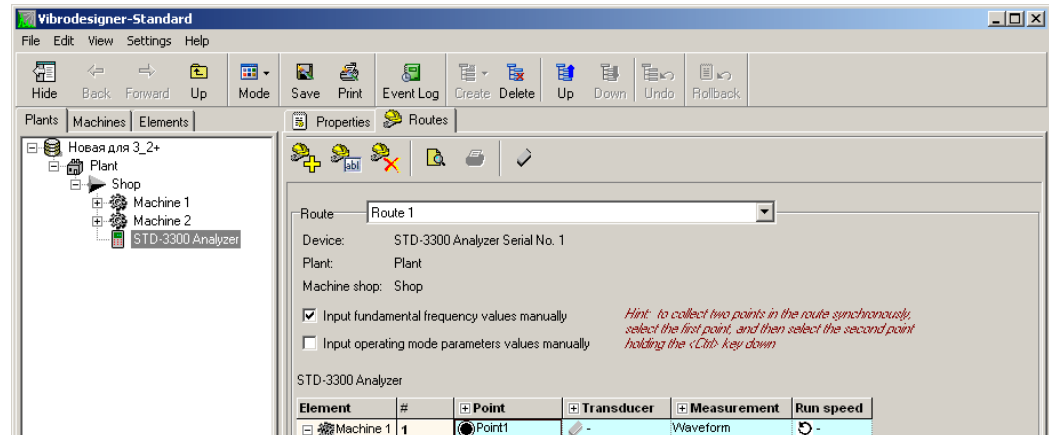
- To print out a route map, click  on the toolbar.
- The **Print** dialog box appears.
- Click **Yes** to confirm the operation.
- The route map is printed.

## Manual input of fundamental frequencies and mode parameters

Having loaded route data from the device, you can additionally enter fundamental frequencies and operating mode parameters values manually. Fundamental frequency values may also come to the device during inspection—when route data are loaded, you will be able to modify these values. For more information, see “Working with STD-500, STD-510 and STD-3300.”

### To activate manual input of fundamental frequencies in the Analysis mode:

- Select the **Input fundamental frequency values manually** check box.



**Figure 104 Activating manual input of fundamental frequencies**

### To activate manual input of mode parameters in the Analysis mode:

- Select the **Input operating mode parameters values manually** check box.

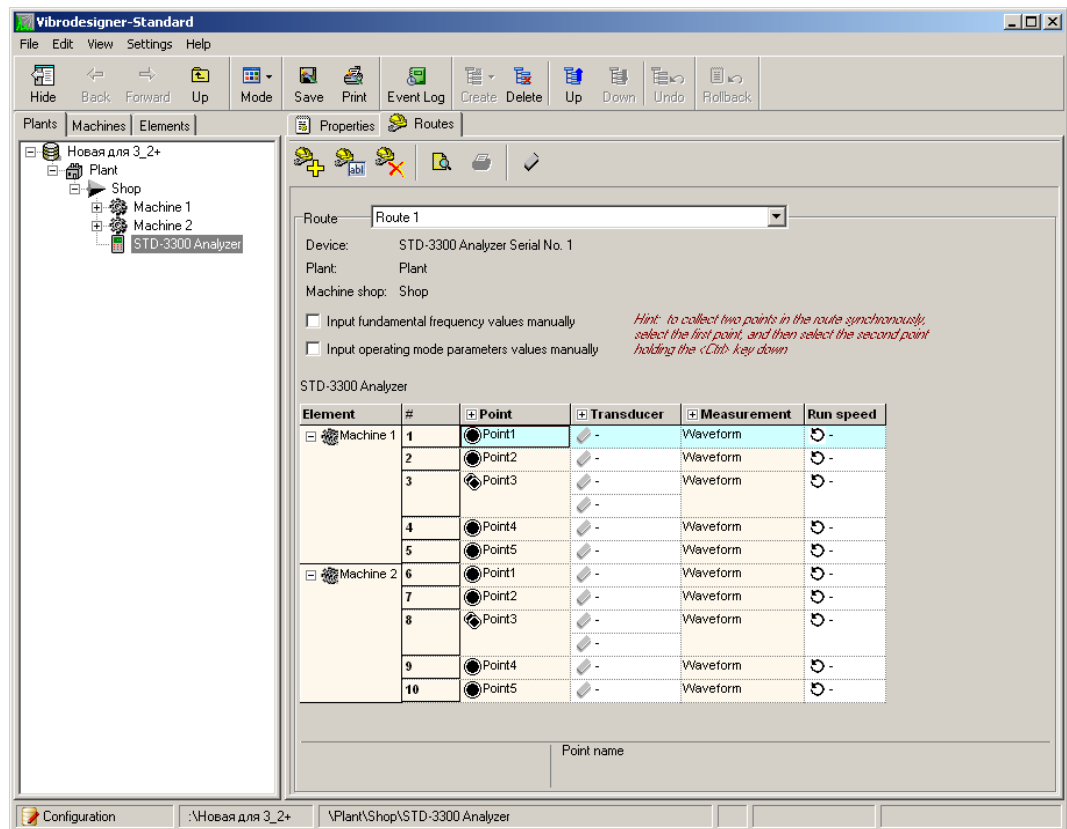
## Configuring synchronous data collection of single-channel points for STD-3300

If you need to collect data synchronously in two different point on the same machine, you can use STD-3300. The following conditions must be met:

- Point parameters are identical
- Points must belong to the same machine
- These points are single-channel

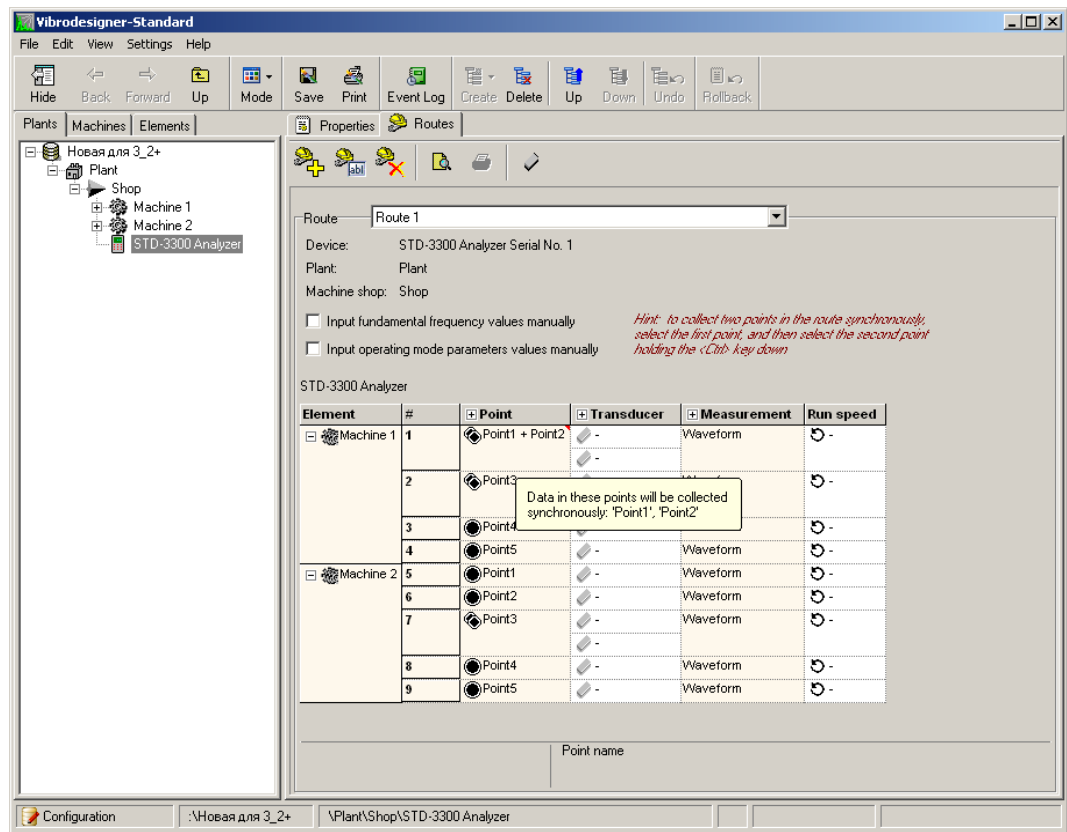
### To configure synchronous collection in two points:

1. Click the **Plants** tab.
2. In the plant hierarchy, select the device of interest.
3. Click the **Routes** tab on the right.
4. Click the first point for synchronous collection.



**Figure 105 Configuring synchronous collection in two points—step 1**

5. Holding CTRL down, click the second point for synchronous collection.  
When passing the route, data in these points will be collected synchronously.



**Figure 106 Configuring synchronous collection in two points—step 2**

**Note:** The transducer's type is defined automatically as to reference to the first point.

## Configuring Stationary Devices

The CTD-2160/2060 monitors allow you to make inspections of oil-transfer power equipments, pumps, compressors, pipelines and so on. These monitors are mounted permanently next to the inspected equipment and collect signals continuously via transducers. The major difference between the monitors is that CTD-2160 has 16 vibration channels and three tachometric channels, whereas CTD-2060 has six vibration channels and one tachometric channel.

Common procedure for configuring stationary monitors includes the following:

1. Creating a stationary monitor in the machine model.
2. Linking a monitor's channels to measurement points of the machine model.
3. Specifying parameters of a monitor's instance in the plant hierarchy.

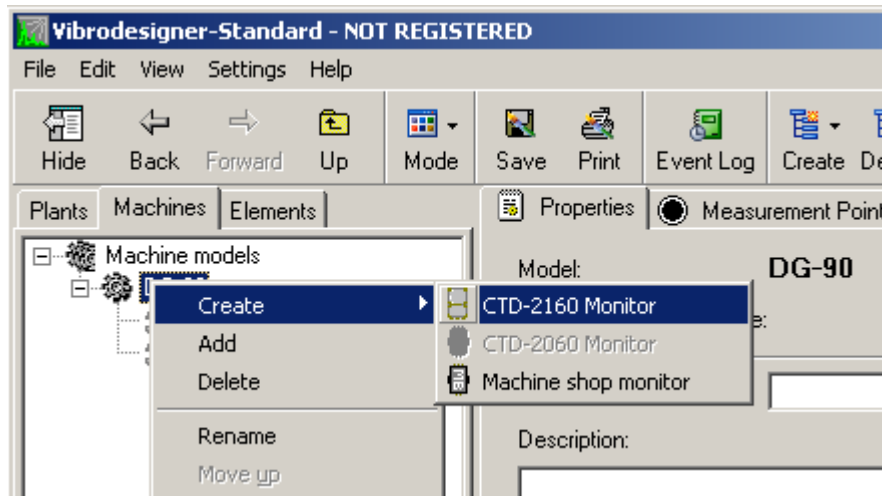
### CTD-2160 Monitor

The CTD-2160 monitor is designed for continuous protection of rotary equipment. This monitor registers and measures signals from vibration and rotary transducers. You can monitor up to 16 vibration channels and three tachometric channel simultaneously.



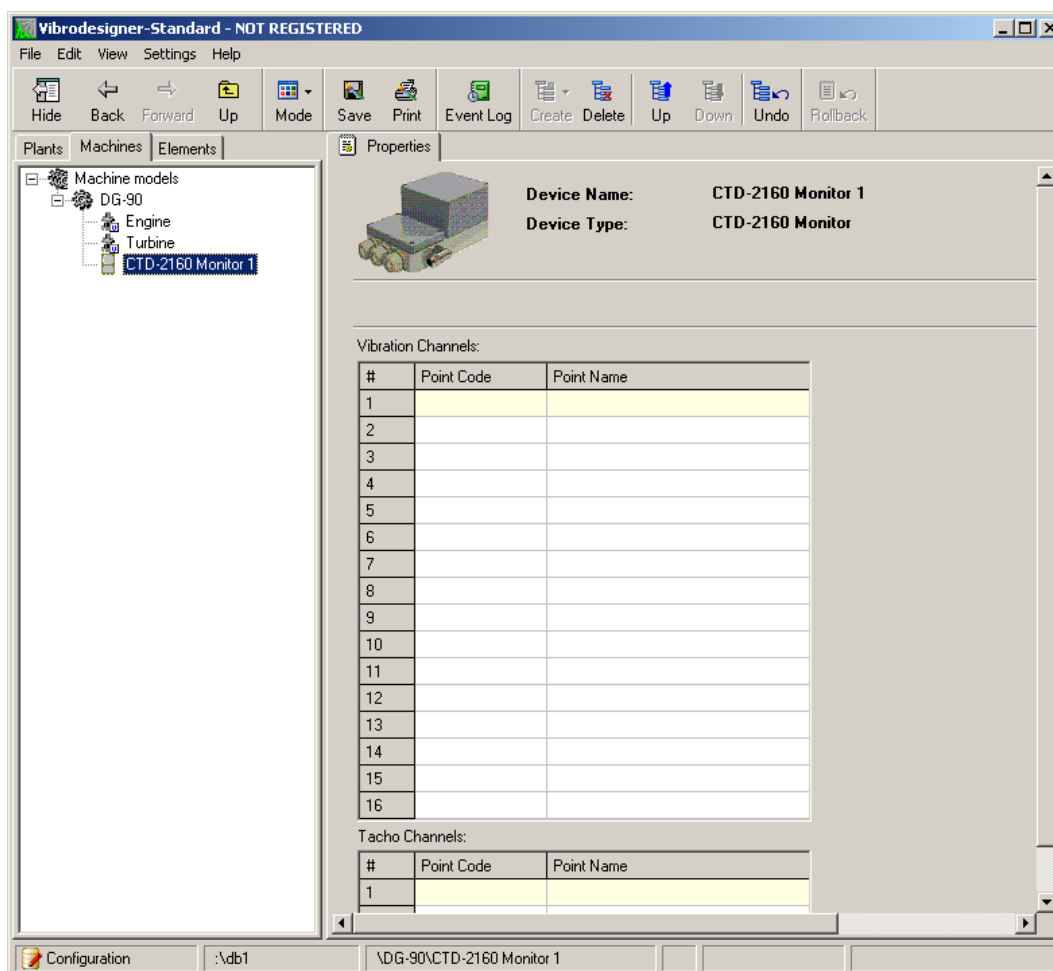
**To create and configure a CTD-2160 monitor in the machine model:**

1. Right-click the machine model of interest and select **Create > CTD-2160 Monitor**.



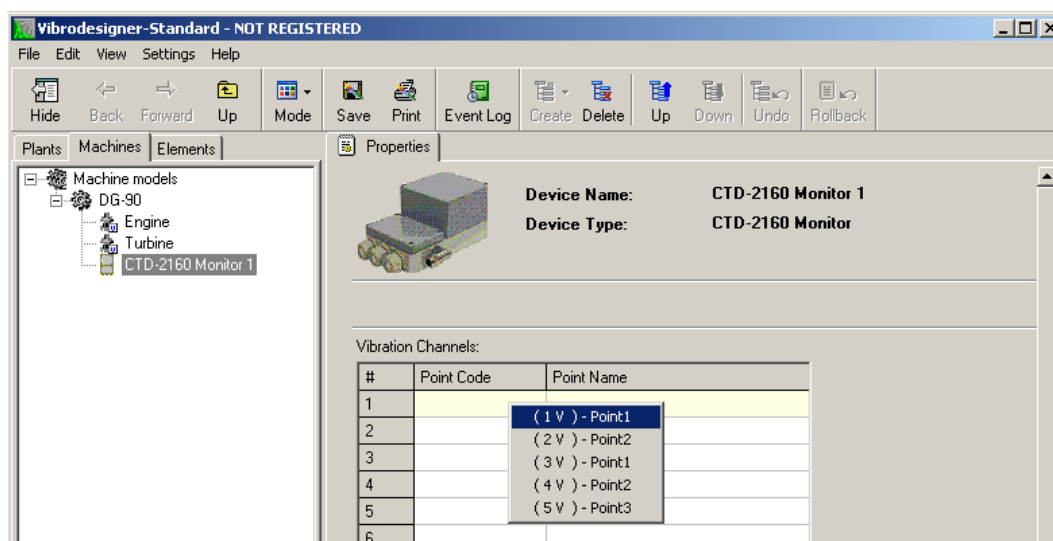
**Figure 107 Creating CTD-2160**

The monitor is created and displayed at the bottom of the element models list. In the workspace on the right, you need match the monitor channels (both vibration and tachometric) and machine points.



**Figure 108 CTD-2160 properties**

- To match a monitor channel and a measurement point, right-click the channel number in the **Vibration channels** table and select the needed point from the menu.



**Figure 109 Linking device channels to measurement points**

3. Match all vibration channels and measurement point you need.
4. If necessary, match rotation speed channels and measurement points you need.

---

**Note:** To remove a link between a channel and a measurement point, press DELETE.

---

Having created and configured the CTD-2160 at the machine models level, you need to specify the following information for each monitor's instance in the plant hierarchy:

- Serial number
- Profibus address
- COM port
- Baudrate

These settings will be used for identifying the monitor on the Profibus network. After specifying these settings, the user will not be able to change parameters of the monitor's channels.

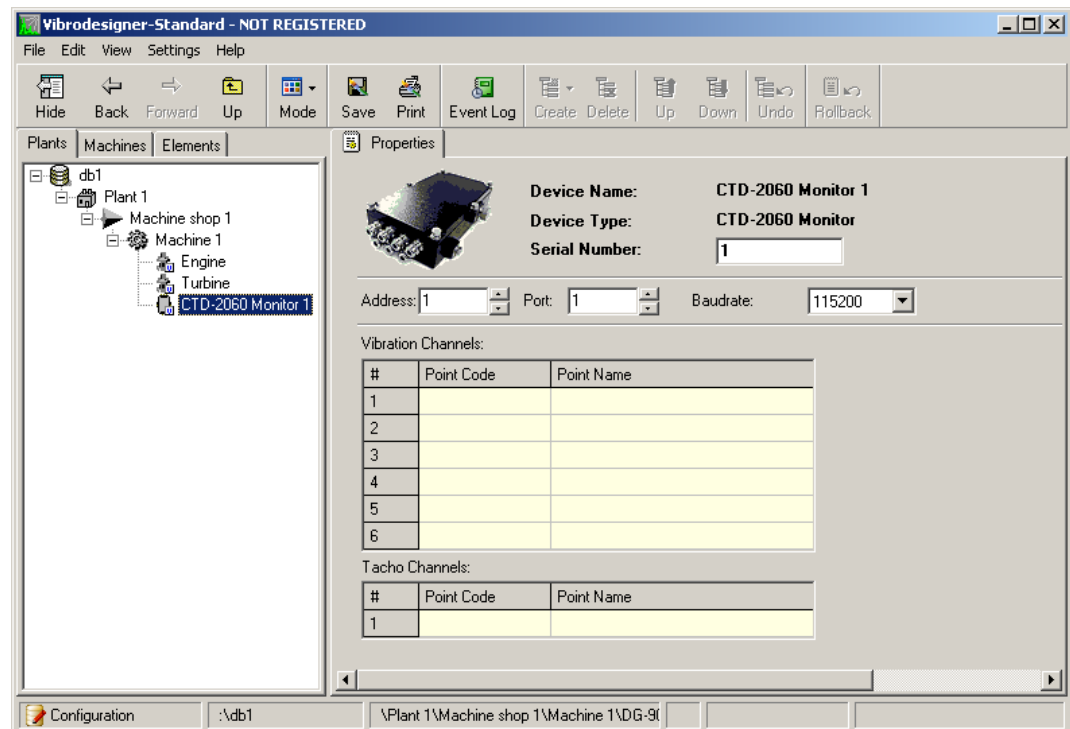
---

**Important!** These settings are required for proper operation in real-time mode.

---

#### To specify parameters of the CTD-2160 instance:

1. Click the **Plants** tab.
2. Locate the machine of interest and click **CTD-2160 Monitor**.



**Figure 110 Configuring CTD-2160 in plant hierarchy**

3. On the **Properties** tab on the right, specify the correct serial number of your monitor.

4. In the **Address** box, specify the monitor address on the Profibus network.

**Note:** The Profibus address is set with special jumpers located on the board inside. For more information, refer to *CTD-2160 Operation Manual*.

5. In the **Port** box, specify the number of the serial port your monitor is connected to.
6. In the **Baudrate** box, specify the connection speed with the monitor.

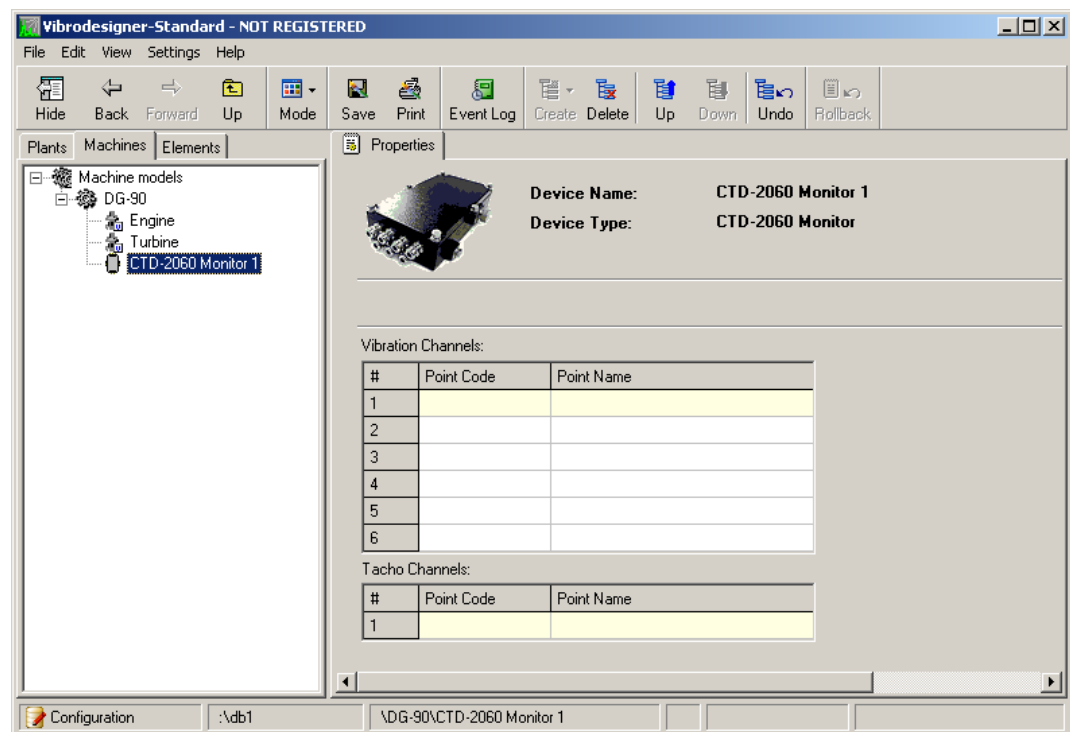
## CTD-2060 Monitor

The CTD-2060 monitor measures signals from vibration and rotary transducers. You can monitor up to six vibration channels simultaneously and one tachometric channel.

### To create and configure a CTD-2060 monitor in the machine model:

1. Right-click the machine model of interest and select **Create > CTD-2060 Monitor**.

The monitor is created and displayed at the bottom of the element models list. In the workspace on the right, you need match the monitor channels (both vibration and tachometric) and machine points.



**Figure 111 CTD-2060 properties**

2. To match a monitor channel and a measurement point, right-click the channel number in the **Vibration channels** table and select the needed point from the menu.
3. Match all vibration channels and measurement point you need.
4. If necessary, match the rotation speed channels and the measurement point you need.

**Note:** To remove a link between a channel and a measurement point, press DELETE.

Having created and configured the CTD-2060 at the machine models level, you need to specify the following information for each monitor's instance in the plant hierarchy:

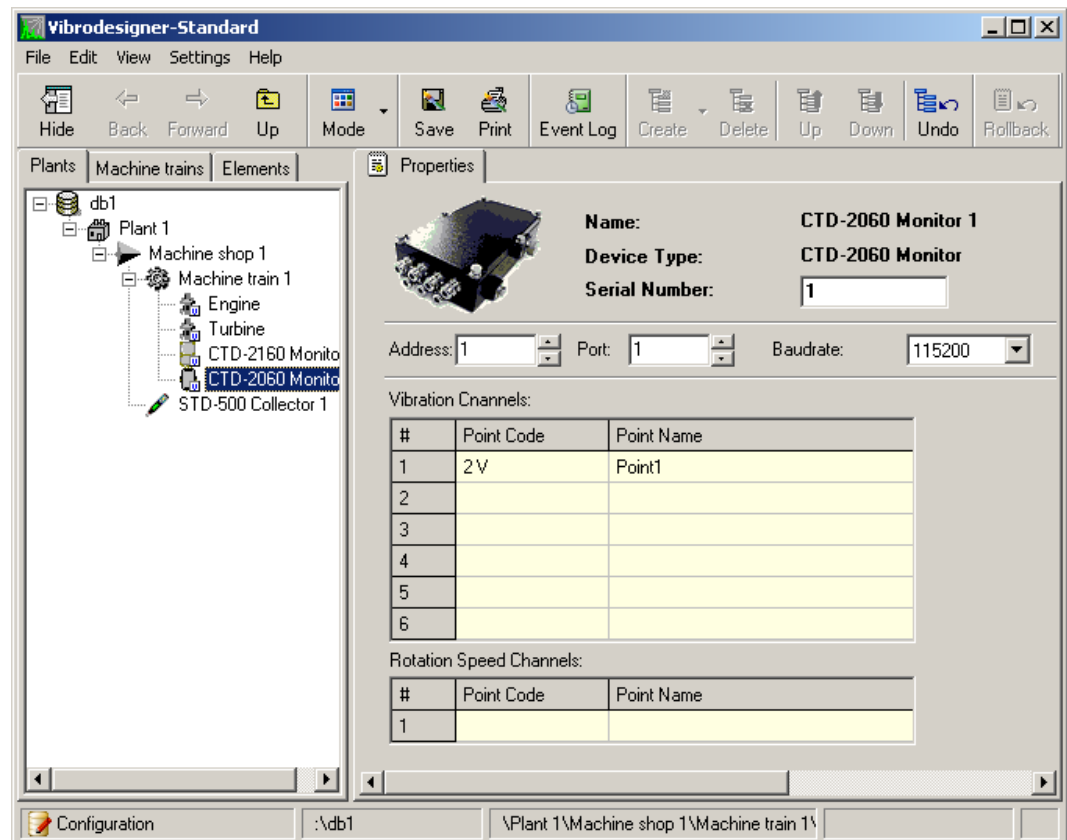
- Serial number
- Profibus address
- COM port
- Baudrate

These settings will be used for identifying the monitor on the Profibus network. After specifying these settings, the user will not be able to change parameters of the monitor's channels.

**Important!** These settings are required for proper operation in real-time mode.

### To specify parameters of the CTD-2060 instance:

1. Click the **Plants** tab.
2. Locate the machine of interest and click **CTD-2060 Monitor**.



**Figure 112 Configuring CTD-2060 in plant hierarchy**

3. On the **Properties** tab on the right, specify the correct serial number of your monitor.

4. In the **Address** box, specify the monitor address on the Profibus network.

**Note:** The Profibus address is set with special jumpers located on the board inside. For more information, refer to *CTD-2060 Operation Manual*.

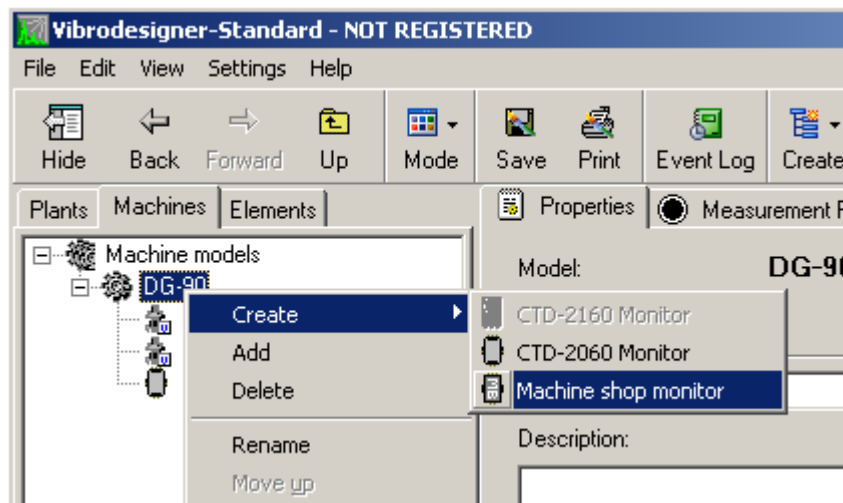
5. In the **Port** box, specify the number of the serial port your monitor is connected to.
6. In the **Baudrate** box, specify the connection speed with the monitor.

## Configuring ASTD-2 System Monitor

To view real-time data from remote ASTD-2 servers, you have to create and configure machine shop system monitors for all machines with inspected points. These monitors will be used for collecting vibration data.

**To create and configure a machine shop system monitor for the machine model:**

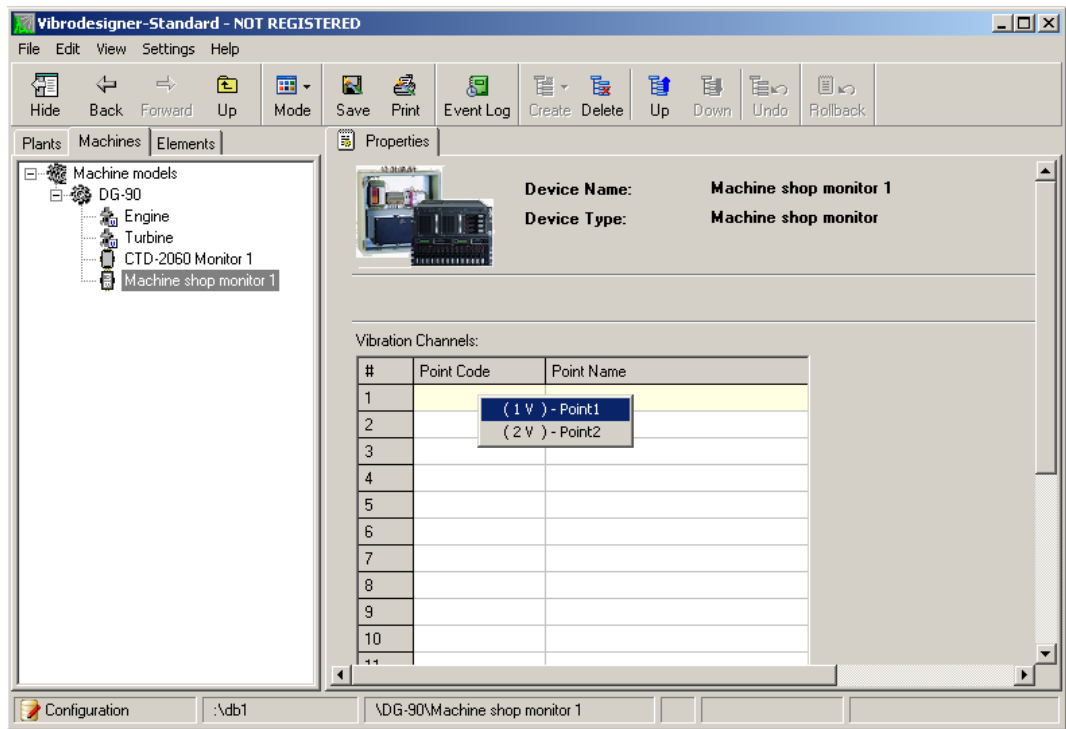
1. Right-click the machine model you need and then select **Create > Machine shop monitor** from the menu.



**Figure 113 Creating machine shop system device**

The monitor is created and displayed at the bottom of the element models list. In the workspace on the right, you need match the monitor channels and machine points.

2. To match a monitor channel and a measurement point, right-click the channel number in the **Vibration channels** table and select the needed point from the menu.



**Figure 114 Linking device channels to measurement points**

3. Match all vibration channels and measurement point you need.

---

**Note:** To remove a link between a channel and a measurement point, press DELETE.

---

Having created and configured the monitors at the machine models level, you need to specify monitor's serial numbers and IDs in the plant hierarchy. These settings will be used for identifying the monitor within the ASTD-2 system. After specifying the ID and the serial number of the monitor, the user will not be able to change parameters of the monitor's channels.

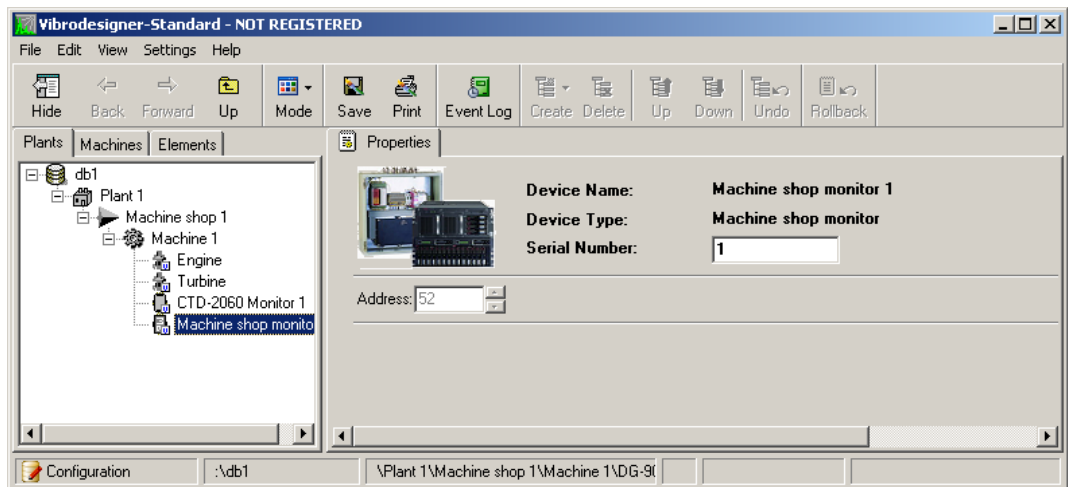
---

**Important!** These settings are required for proper operation in real-time mode.

---

#### To specify a serial number and ID of the machine shop monitor:

1. Click the **Plants** tab.
2. Locate the machine shop monitor of interest.
3. On the **Properties** tab on the right, specify the correct ID and serial number of your monitor.

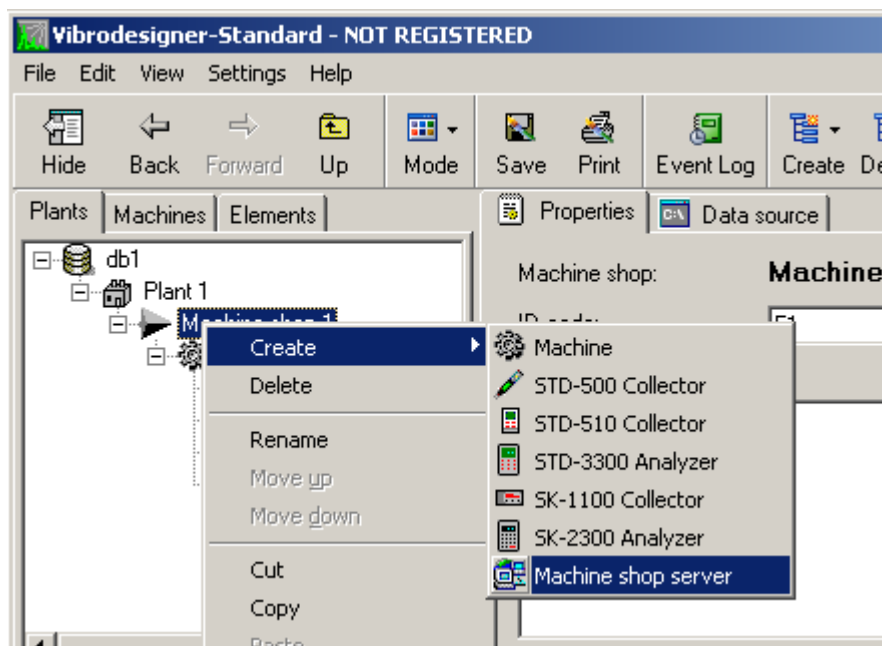


**Figure 115 Configuring machine shop system device in plant hierarchy**

The final step in configuring machine shop system monitors is creating a ASTD-2 server in the machine shop which machines are to be inspected real-time. The created ASTD-2 descriptions is used for identifying the computer on the network which serves as a data source.

#### To create a ASTD-2 server:

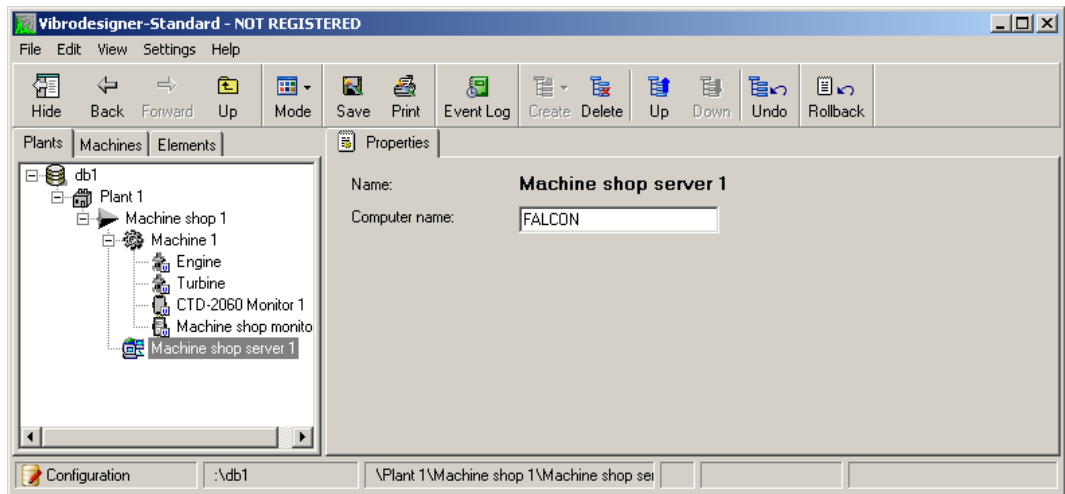
1. Right-click a name of the machine shop of interest and select **Create > Machine shop server** from the menu.



**Figure 116 Creating ASTD-2 server**

The machine shop server appears in the plant hierarchy.





**Figure 117 ASTD-2 server properties**

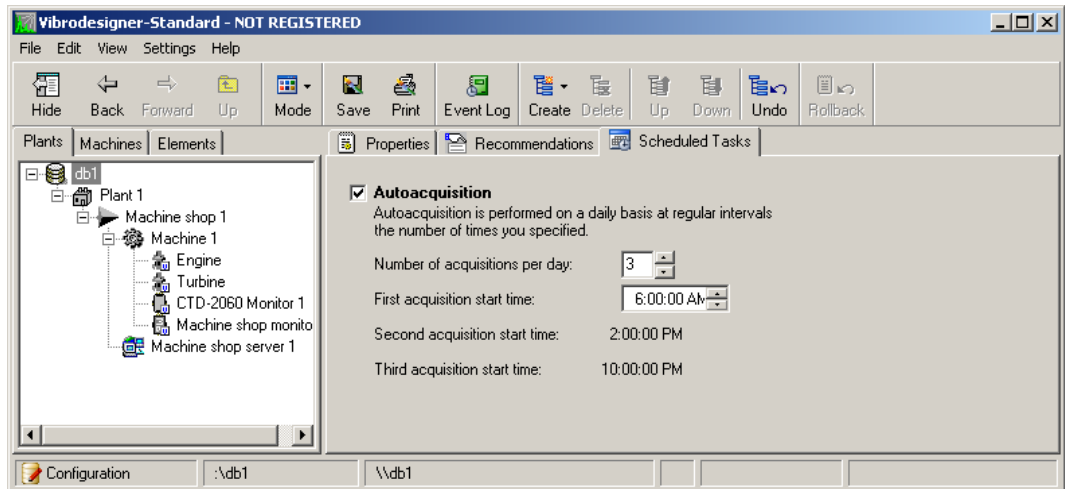
2. In the **Computer name** box, specify the DNS name of the machine shop server on the network or its IP address.

## Configuring Auto Acquisition

You can configure scheduled auto acquisition from remote monitors.

**To configure auto acquisition:**

1. In the left panel, select the **Plants** tab and then select the database of interest.
2. Click the **Scheduled Tasks** tab on the right.



**Figure 118 Configuring autoacquisition**

3. To perform daily auto acquisition from remote monitors, select the **Autoacquisition** check box.
4. In the **Number of autoacquisitions per day** box, specify how many times per day you have to collect data.

Data will be collected every day at regular intervals.

5. In the **First acquisition start time** box, specify the time of the first daily acquisition.  
At this time the auto acquisition will start automatically. For more information, see “Auto acquisitions.”

## Database Structure Import and Export

You can export and import a database structure. Exporting data allows you to save into file the configuration of one of the plant child elements (for example, a machine) or the complete plant. Importing allows you to upload the data exported before. Thus, you can use standard plant hierarchy elements and significantly save your time while creating a plant structure.

### Exporting Database Structure

A hierarchy export is performed into a text file. You can export the following elements:

- Root plant
- Child plant
- Station
- Machine shop
- Division
- Machine

When exporting a plant, the complete structure of the selected plant is recorded, including references to models of all transducers, elements and machines. When exporting a station, a machine shop, or a division, all upper hierarchy levels including the plant are recorded, as well as:

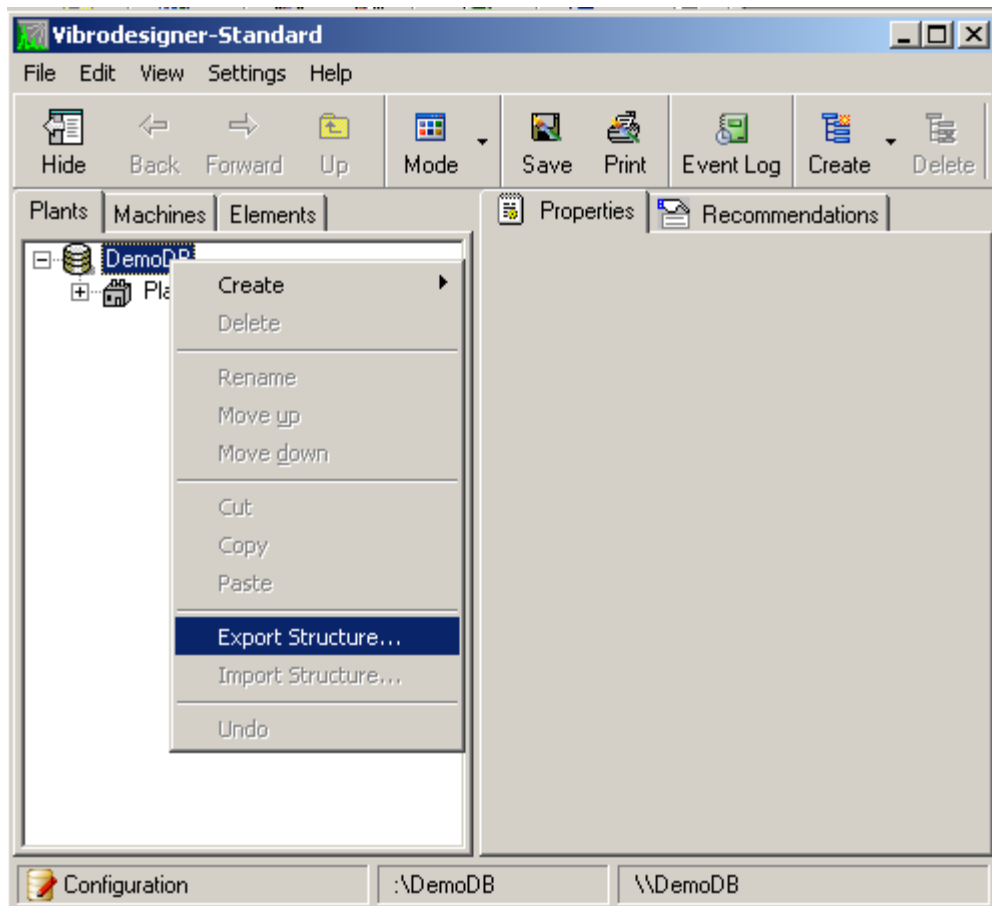
- Transducer models
- Element models
- Machine models

When exporting a machine, the following information is saved in a text file:

- Plant information
- Transducer models
- Element models
- Machine models

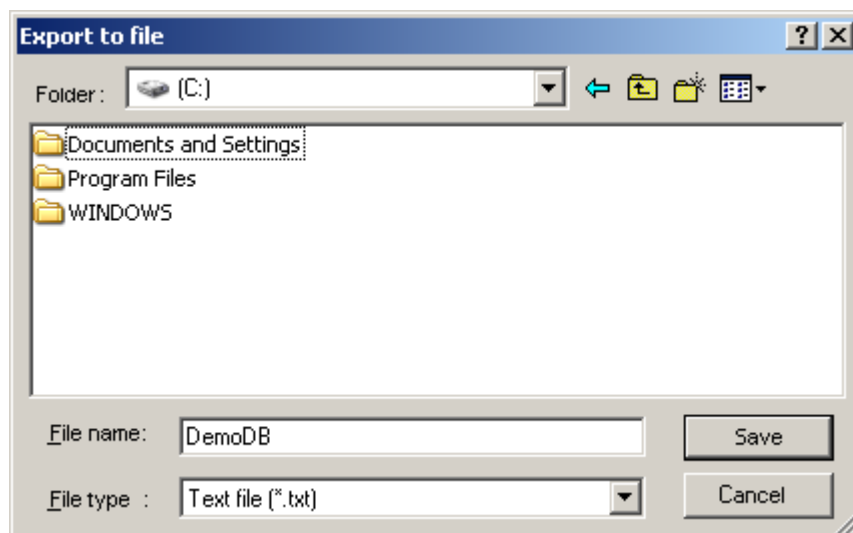
#### To export a database structure:

1. On the **Plants** tab, right-click the object to be exported and select **Export structure** from the menu.



**Figure 119 Exporting database structure**

The **Export to file** dialog box appears.



**Figure 120 Export to file dialog box**

2. Select the target folder, type the file name you need in the **File name** box, and then click the **Save** button.

The export of the selected object structure is started. When finished, the successful message is displayed.



**Figure 121 Export completed**

3. Click **OK**.

## Importing Database Structure

Importing a plant structure allows you to save time while creating a new database. Typically, this operation is performed in the following cases:

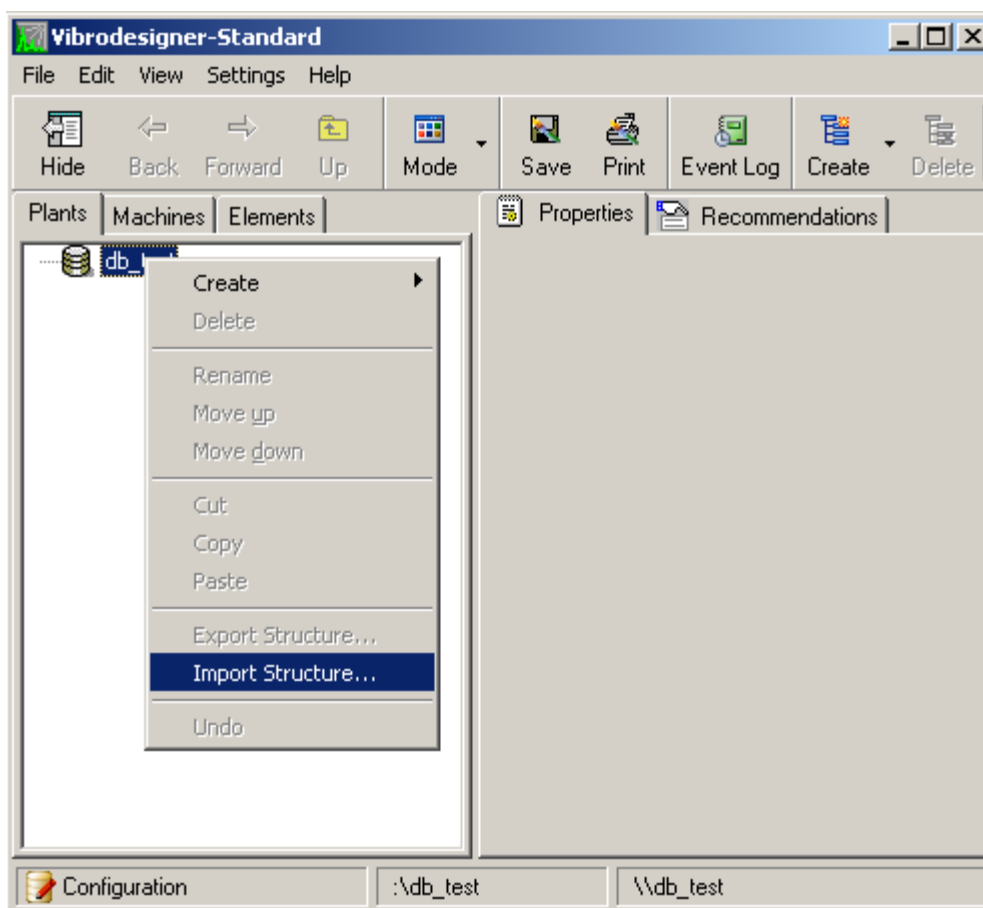
- To create a new database which structure repeats the existing one (for example, for subsequent import of inspection data from a remote computer).
- To use a standard set of elements and machine models.
- To add a structure of one element model or a machine model and all associated element models.

The import operation is applicable to the following objects *only*:

- The root element on the **Plants** tab (only if the newly created database contains no nodes, except for Plants).
- The root element on the **Machines** tab.
- The root element on the **Elements** tab.

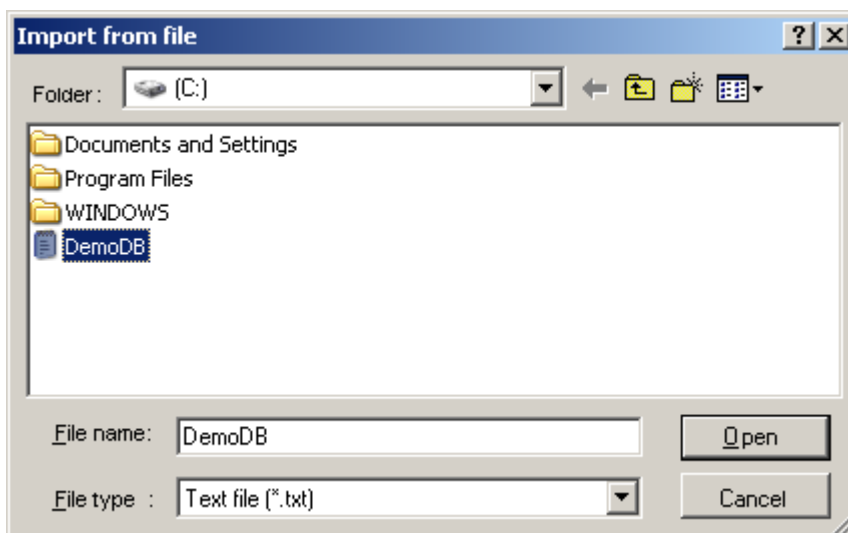
### To import a database structure:

1. Right-click the destination object where you need to import a structure and select **Import structure** from the menu.



**Figure 122 Importing database structure**

The **Import from file** dialog box appears.



**Figure 123 Import from file dialog box**

2. Select the file for import and click the **Open** button.

The import is started. When finished, the successful message is displayed.



**Figure 124 Import completed**

3. Click **OK**.

If the database structure contains all imported objects, the import procedure is interrupted and an error message is displayed.



**Figure 125 Error message**

The same message is displayed when you try import incorrect file. As a result, a new record appears in the event log (see *Chapter 8*). The event log greatly facilitates solving such problems.

# Chapter 6 Data Acquisition and Analysis

This chapter describes how to collect data during machinery inspections and analyze collected data.

It covers the following topics:

- Introduction
- Opening Database
- Machinery Inspection
- Recalculating Bands
- Data Analysis
- Working with Graphical Data
- Comparison Submode
- Real-time Monitoring
- Inspection Reports

## Introduction

Having configured a database structure, you may start inspection of machinery. The inspection purpose is estimating the current condition of machinery, detecting potential faults and making maintenance decisions. First, you collect data with either a portable or stationary device, then the collected data are loaded into a database and become available for analysis. Besides, inspection data can be retrieved from the remote online systems and imported into a database. When the inspection is completed, you have to generate an inspection report.

Data analysis includes:

1. Viewing the measurement points with active warnings/alarms.
2. Analyzing trends of vibration and measured signals (spectra, waveforms, and orbits).
3. Making a decision about places and causes of machinery faults.
4. Estimating a current machinery condition.
5. Making recommendations on machinery operation.

Thus, machinery inspection is a regular data acquisition for condition monitoring and machinery diagnostics. The inspection is not just a data acquisition, this procedure must meet the following requirements:

1. The data are collected in a certain order. The order is specified in the measurement device as a route, which determines the sequence of passing measurement points on the machine.
2. It is strongly recommended to collect all necessary data from a machine during a single inspection. It will guarantee completeness and accuracy of the data.
3. Data acquisition from a single machine must be completed during a short-time interval under exactly the same conditions. At least, rotation frequencies during data acquisition must remain unchanged.
4. To trace changes in machinery condition, all inspections must be performed under exactly the same conditions.

The typical machine inspection and subsequent analysis involve the following actions:

1. Measurements and uploading inspection data into a database.  
You can load inspection data either during a communication session or by importing data from file.
2. Analyzing active warnings/alarms.
3. Generating and analyzing an inspection report.
4. Analyzing trends of frequency bands with active warnings/alarms.
5. Analyzing trends of calculated parameters with active warnings/alarms.
6. If necessary, analyzing daily trends retrospect.
7. If necessary, analyzing spectra and waveforms.
8. If necessary, analyzing orbits in a measurement point.
9. If necessary, analyzing envelope spectra.
10. If necessary, analyzing cepstra.
11. If necessary, analyzing coast-downs.
12. Diagnostics (detecting places and causes of faults on the basis of collected data).
13. Preparing inspection results.

When machinery inspection and data analysis are completed, the maintenance specialist generates the «Statement of Machinery Condition» document (or similar) in accordance with the plant regulations. The document must include diagnoses, recommendations, reports and measurements. Additionally, the maintenance specialist can append to the document parameter values and trend/signal graphs which were used to make the decision on machinery condition.

## Opening Database

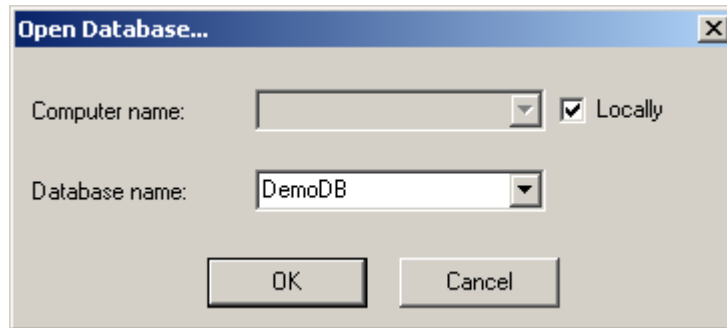
To start an inspection procedure or data analysis, you need to open the database of interest. You may work with various databases, either local or distributed.



**To open an existing database:**

1. On the **File** menu, click **Open database**.

The **Open database** dialog box appears.



**Figure 126** *Open Database dialog box*

2. If the database of interest is stored on a remote computer, clear the **Locally** check box and then select the needed database server from the **Computer name** list.

In the **Database name** box, a name of the database you opened for the last time on your computer is displayed. Clicking the arrow in this box shows the list of the databases stored on the specified computer.

3. From the **Database name** list, select the database of interest.

---

**Note:** If the database you need is stored locally, select the **Locally** check box and select the needed local database from the **Database name** list.

---

4. Click **OK**.

## Inspection Data Acquisition

### Overview

When using portable data collectors, the inspection data acquisition procedure involves the following steps:

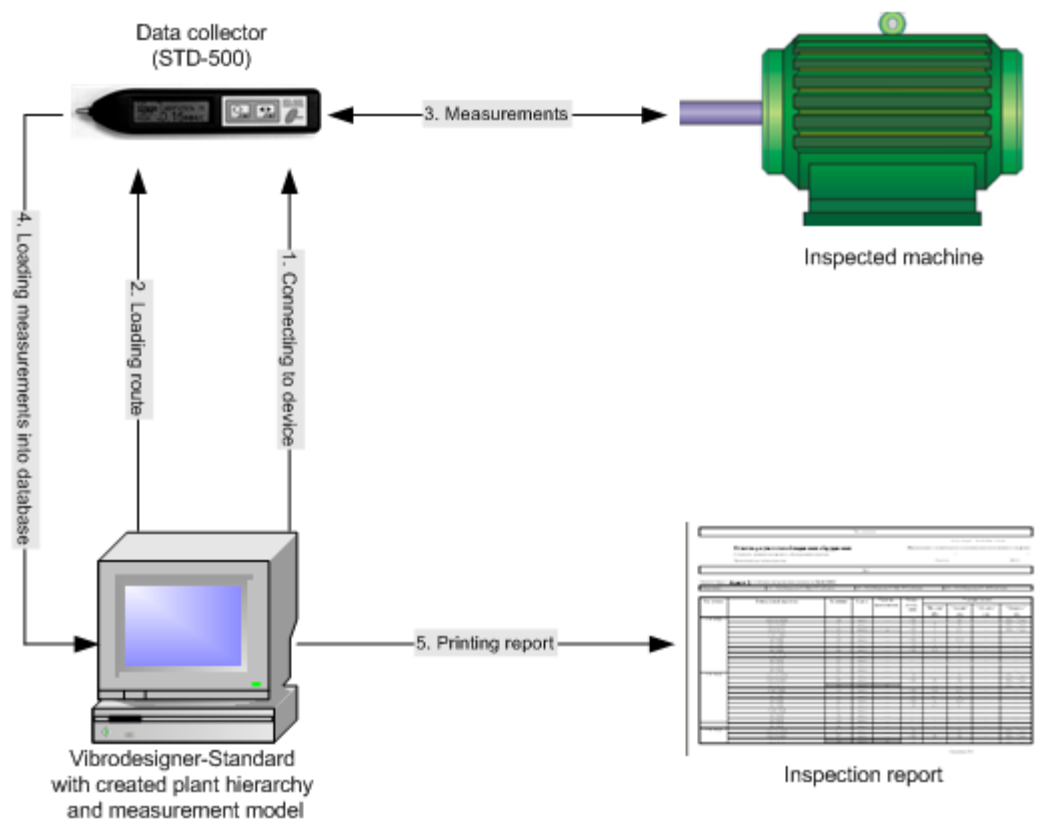
1. Connecting to the data collector.
2. Loading a measurement route into the data collector.
3. If necessary, printing a route map.
4. Collecting data in the route points.
5. Loading collected data into the database.

---

**Note:** You can load data either during the connection session or by importing data from files if inspection has been performed remotely.

---

6. Printing an inspection report.



**Figure 127 Inspection with portable device**

When working with stationary vibration monitors (CTD-2060/2160), the inspection procedure involves the following:

1. Connecting to the monitor.
2. Retrieving inspection data from the monitor and loading these data into the database.
3. Printing an inspection report.

---

**Note:** If the operator's computer is turned on, the scheduled auto acquisition from vibration monitors can be performed.

---

## Working with Portable (Offline) Devices

### Working with STD-500, STD-510 and STD-3300

Working with portable devices is shown with the STD-500 monitor. Use the same procedure for STD-510 and STD-3300.

---

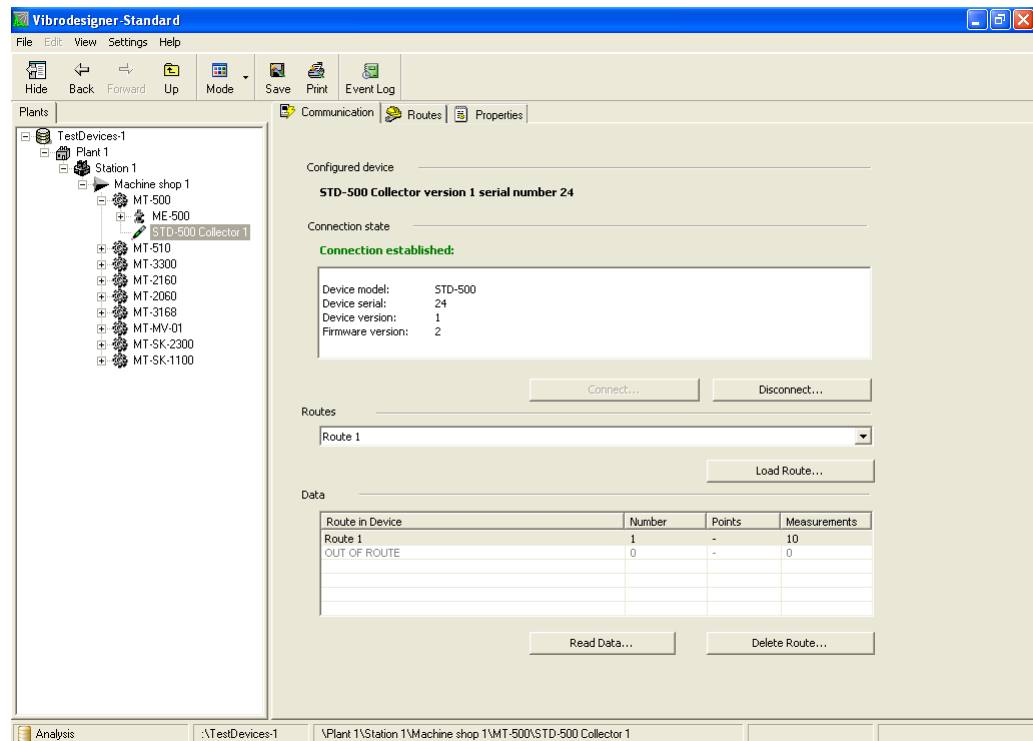
**Note:** If you want to work with STD-500/510/3300 monitors on your workstation, you need to install a special driver at the first connection. For more information, see "Installing STD-500/510 Driver."

---

**To collect data with STD-500:**

1. Connect your STD-500 to any USB port of your workstation. Use a special USB cable delivered with STD-500.
2. Switch to the Analysis mode.
3. In the plant hierarchy, select the device you want to connect to.

On the **Communication** tab on the right, you may see the parameters for establishing connection.



**Figure 128 Communication tab**

4. Click the **Connect** button.

The connection session is established.

**Important!** You will fail to establish a connection session if you have previously entered incorrect STD-500 version and serial number.

5. From the **Loading routes** list, select the Machine shop 1 route and click the **Load Route** button.

**Note:** To view a route map, click the Routes tab on the right, select the

route of interest and click



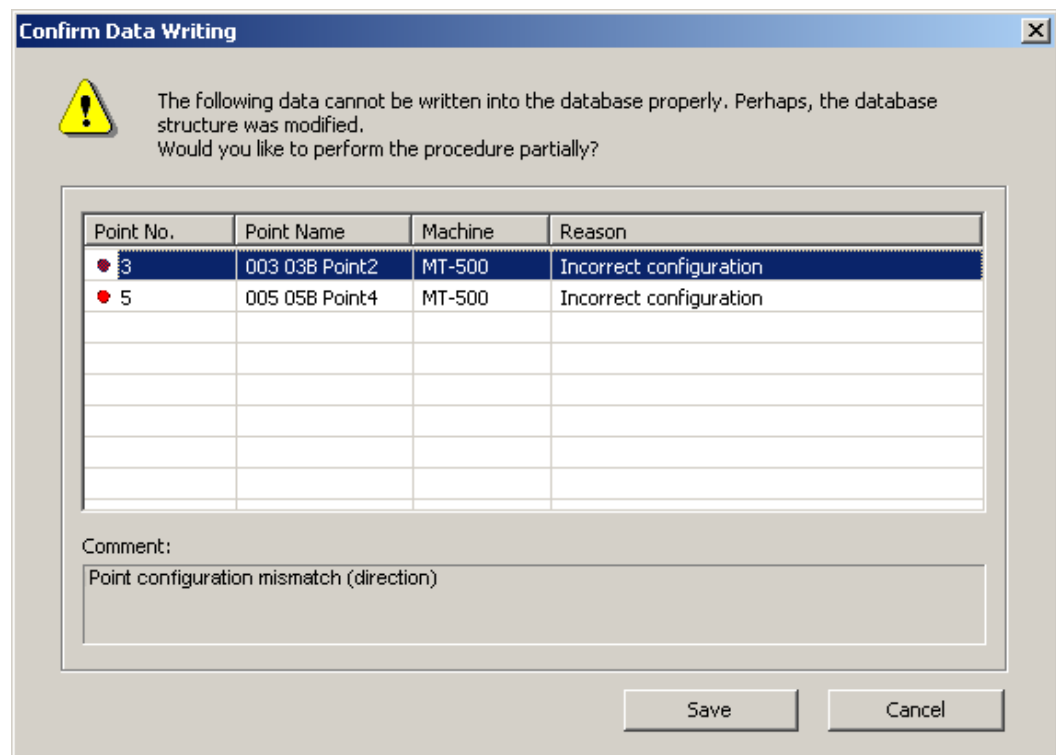
6. To close the connection session, click the **Disconnect** button.
7. Take your STD-500 and go through all route points.

For information on how to work with STD-500, refer to *STD-500 Operation Manual*.

8. Load measured data into the database. To do so, establish a connection session and click the **Read Data** button.

**Note:** If you try to load data of the route that is not presented in the database, you will see the warning message and the operation will be interrupted. A new error appears in the Event Log (see *Chapter 8*).

When loading, you can see the progress indicator. If the device configuration and the database configuration are the same, the inspection data are loaded into the database. If not, the **Confirm Data Writing** dialog box is displayed whereby you can see the detected discrepancies. You can click the **Save** button and thus record the data from channels which match the database configuration, or click the **Cancel** button to cancel the operation.

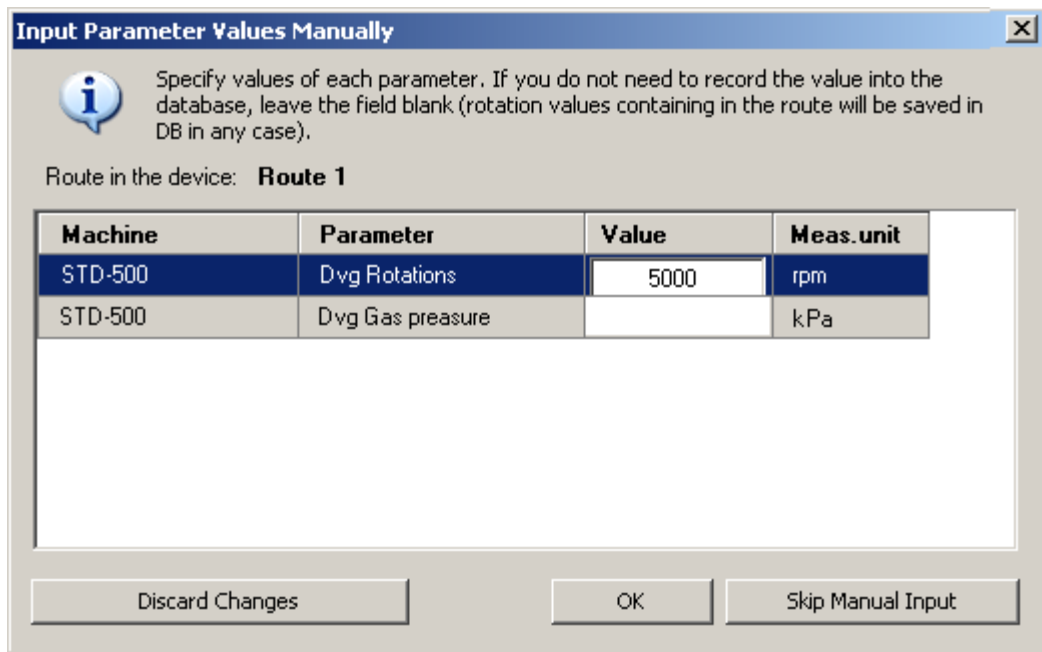


**Figure 129 Confirm Data Writing dialog box**

9. When done, click the **Disconnect** button.

The loaded data become available for analysis.

If you activated manual input of fundamental frequencies and/or operating mode parameters (see “Manual input of fundamental frequencies and mode parameters”), the **Input Parameter Values Manually** dialog box is displayed after loading the route data. In the fundamental frequency cells, average values are displayed. Enter values of each parameter and click **OK**.



**Input Parameter Values Manually**

Specify values of each parameter. If you do not need to record the value into the database, leave the field blank (rotation values containing in the route will be saved in DB in any case).

Route in the device: **Route 1**

Machine	Parameter	Value	Meas.unit
STD-500	Dvg Rotations	5000	rpm
STD-500	Dvg Gas pressure		kPa

Buttons: Discard Changes, OK, Skip Manual Input

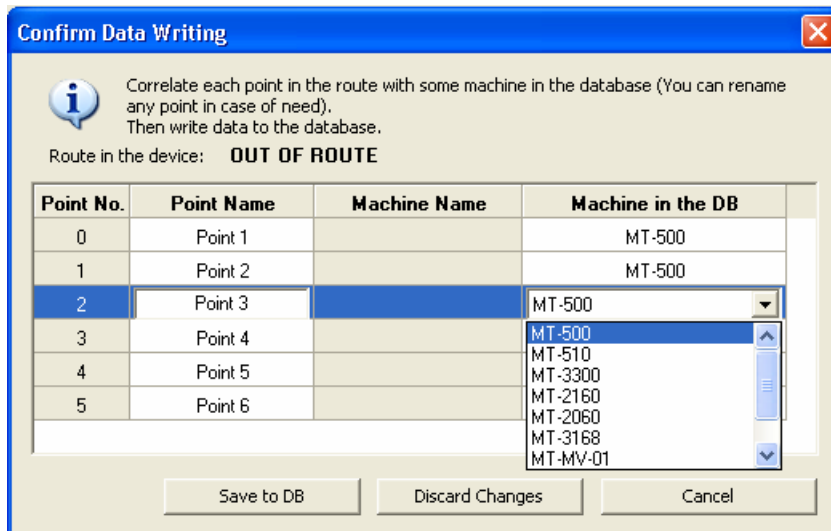
**Figure 130 Input Parameter Values Manually**

## Processing STD-500/STD-510/STD-3300 Out-of-route Points

### To load out-of-route points:

1. On the **Connecting Device** tab, click the **Read data** button.

When the data are loaded, the **Confirm Data Writing** dialog box appears.



**Confirm Data Writing**

Correlate each point in the route with some machine in the database (You can rename any point in case of need). Then write data to the database.

Route in the device: **OUT OF ROUTE**

Point No.	Point Name	Machine Name	Machine in the DB
0	Point 1		MT-500
1	Point 2		MT-500
2	Point 3		MT-500
3	Point 4		MT-500
4	Point 5		MT-510
5	Point 6		MT-3300

Buttons: Save to DB, Discard Changes, Cancel

**Figure 131 Confirm Data Writing dialog box**

In this dialog box, you must link each out-of-route point to a plant machine train.

2. To link a point to the machine, select the point of interest in the left pane, then select the machine the point is linked with.
3. Click **Save to DB** button.

The changes are saved in the database. In the Analysis mode, the out-of-route points are displayed as a folder at the machine elements level.

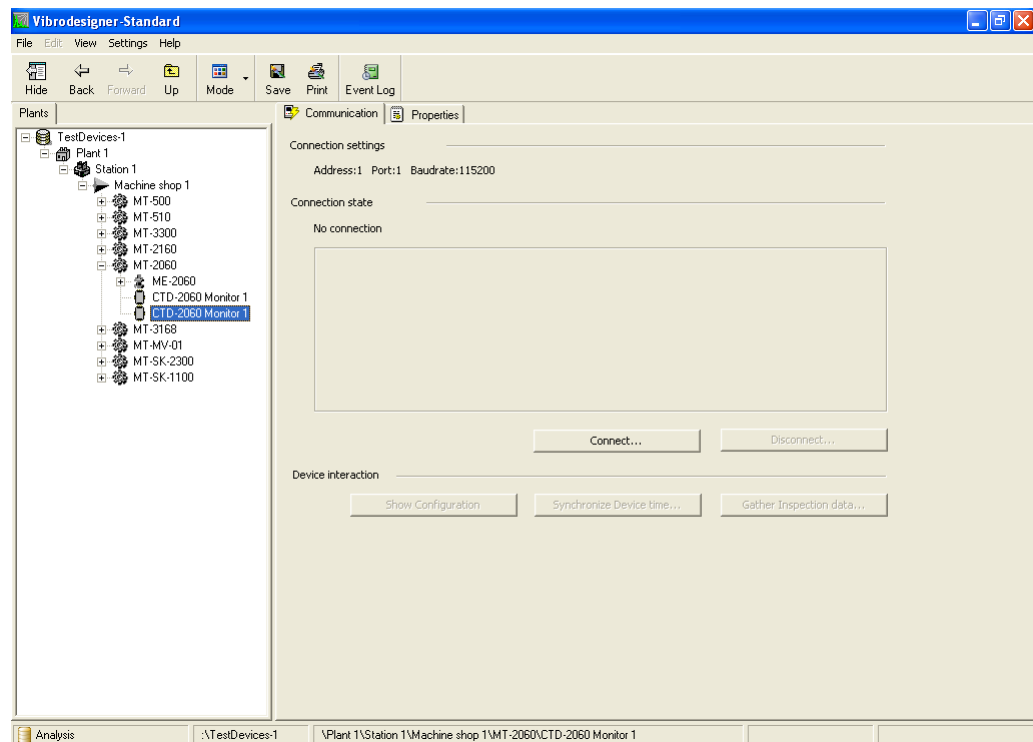
## Working with Stationary (Online) Devices

Working with stationary devices is shown with the CTD-2060 monitor. Use the same procedure for CTD-2160.

### To collect data with CTD-2060:

1. Connect your CTD-2060 to a serial port of your workstation.
2. Switch to the Analysis mode.
3. In the plant hierarchy, select the device you want to connect to.

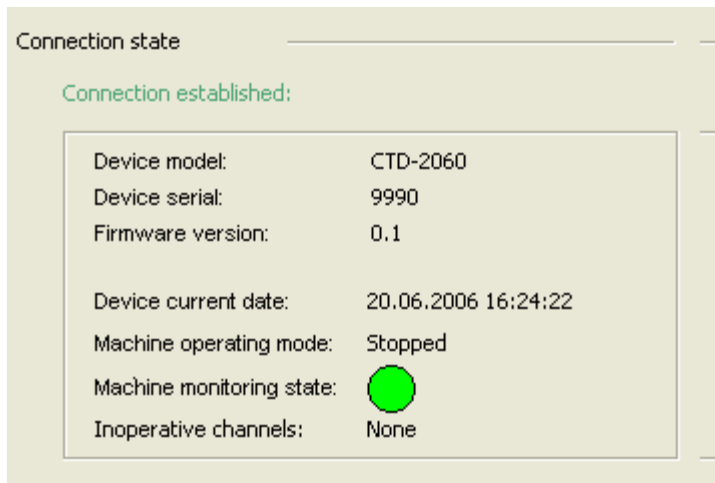
On the **Communication** tab on the right, you may see the parameters for establishing connection.



**Figure 132 Communication tab**

4. Select the COM port the device is connected to, and then specify the connection speed.
5. Click the **Connect** button.

The connection session is established. In the **Connection state** section, the current device settings are displayed.



**Figure 133 CTD-2060 Connection established**

---

**Important!** You will fail to establish a connection session if you have previously entered incorrect CTD-2060 version and serial number.

---

6. Click the **Read Inspection** button.

If the device configuration and the database configuration are the same, the inspection data are loaded into the database. If not, the warning message is displayed.

---

**Note:** To detect discrepancies between the device and database configurations, click the **Show Configuration** button. You will see the dialog box containing a table of configured point and links to the device channels. For more information about this dialog box, see “Comparing Stationary Device and Database Configurations.”

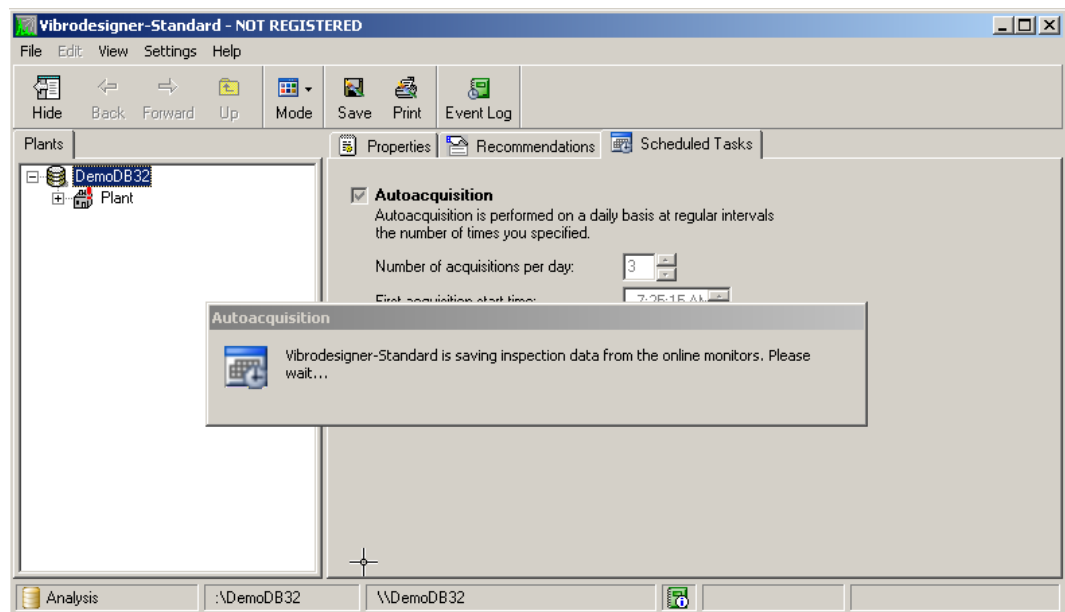
---

7. When done, click the **Disconnect** button.

The loaded data become available for analysis.

## Auto Acquisition

If you have configured scheduled auto acquisition from remote online monitors (see “Configuring Auto Acquisition”), saving inspection data will be started automatically when specified time comes. This operation will be started in case the operator’s computer is turned on. The following dialog box is displayed.



**Figure 134 Auto acquisition from online monitors**

---

**Important!** When the auto acquisition has been started, it is not recommended to work with Vibrodesigner-Standard or other applications. Please wait until this operation completed.

---

## Inspection Data Import and Export

Vibrodesigner enables you to exchange measured data between the databases with identical structure. For this purpose, inspection import/export mechanism is used. The inspection data is imported/exported in ZIP format.

### Importing Inspection Data

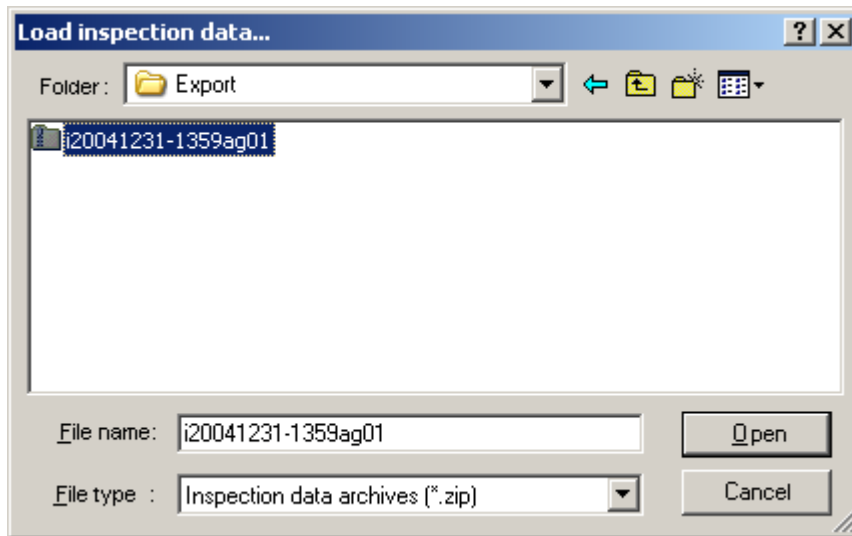
You can import inspections that have been previously exported from Vibrodesigner into ZIP files. Import operation allows you to load data received from a remote online data collector systems.

#### To import an inspection:

1. On the **File** menu, click **Import Inspections**.

The **Load inspection data** dialog box appears.



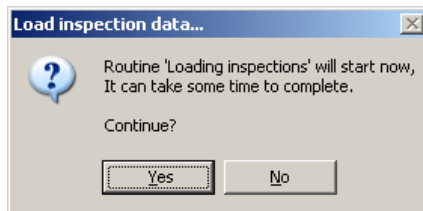


**Figure 135 Load inspection data dialog box**

2. Select the file to be imported into Vibrodesigner and click the **Open** button.

**Important!** The inspection file contents must match the structure of the database where the inspection is imported. The imported files must be obtained by exporting inspections from the database with the same logical structure.

You are prompted to confirm the operation.



**Figure 136 Inspection import confirmation**

3. Click **Yes**.

Loading inspection data is started. Depending on the file size, it may take from several seconds to several tens of minutes. The status bar displays the progress. When completed, the successful message is displayed.

4. Click **Yes**.

You can now start analyzing the imported inspection.

## Exporting Inspection Data

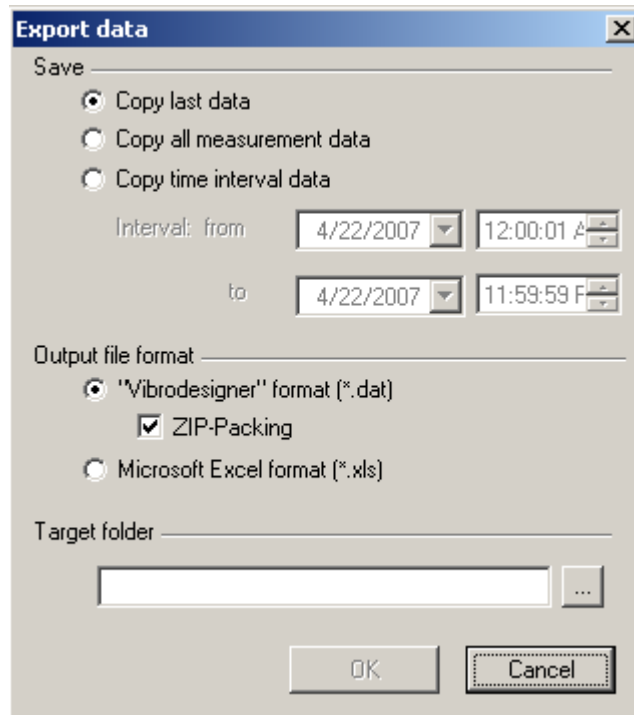
Exporting inspections into file is performed for the selected machine shop or a machine.

### To export an inspection:

1. In the plant hierarchy, select the machine shop or machine which inspections you need to export.

2. On the **File** menu, click **Export Inspections**.

The **Data Export** dialog box appears.




**Figure 137 Data Export dialog box**

3. Specify the data to be exported.

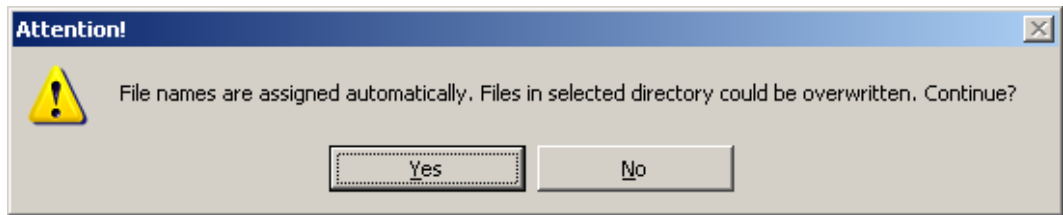
You can export:

- The last inspection (by selecting the **Copy last data** option).
  - All measured data of the selected object, which are stored in the database (by selecting the **Copy all measurement data** option).
  - Data in the specified interval (by selecting the **Copy time interval data** option and specifying the interval you need).
4. Select the output file format. You can select either the Vibrodesigner internal format (.dat) or Excel format. For more information about output Excel format, see “Excel File Format When Exporting Inspections.”
  5. In the **Target folder** box, specify a path to the folder where the inspection are to be exported.

You can also click the  button and select the target folder in the appeared dialog box.

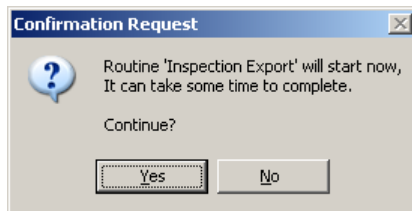
6. Click **OK**.

The following message is displayed.



**Figure 138 Export prompt**

7. Click **Yes**.



**Figure 139 Export confirmation**

8. Click **Yes**.

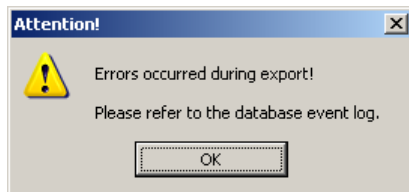
The export is started. When finished, a new ZIP file appears in the specified folder.

---

**Note:** It is recommended to rename the saved inspection file so that it has a meaningful name (for example, “inspection2006July”).

---

If an error occurred, the error message is displayed, as shown below.



**Figure 140 Export error**

To troubleshoot such problems, use the event log. For more information, see *Chapter 8*.

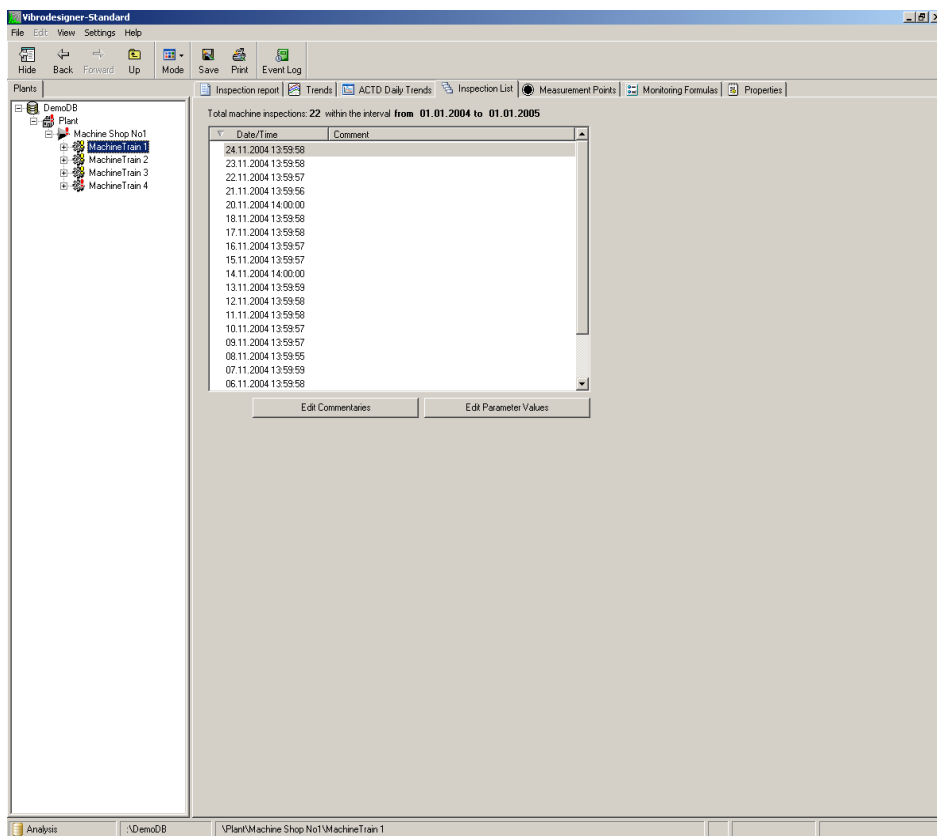
## Adjusting mode parameters values

You can view a list of existing inspections. When viewing the list, you can specify comments on the inspections and modify values of mode parameters and machine fundamental frequencies of selected inspections.

### To view the list of inspections:

1. In the plant hierarchy, select the machine of interest.
2. Select the **Inspection List** tab on the right.

The list of machine inspections is displayed.

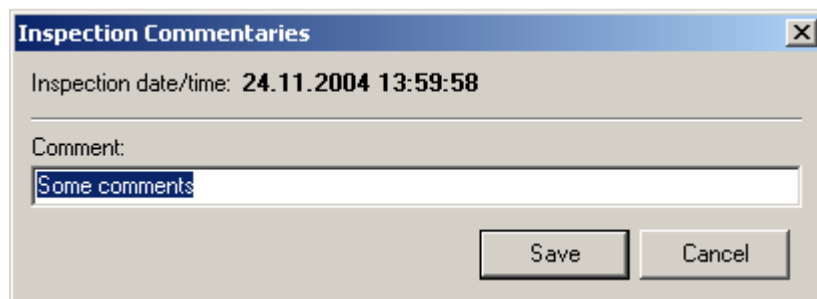


**Figure 141 Inspection list**

### To modify comments of an inspection:

1. Click the inspection of interest and click the **Edit Commentaries** button.

The **Inspection Commentaries** dialog box appears.



**Figure 142 Inspection commentaries dialog box**

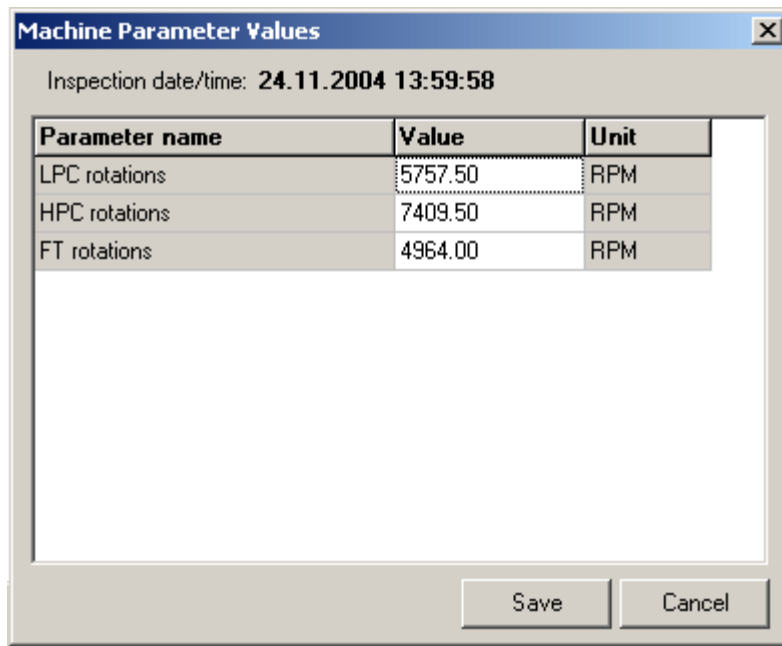
2. Enter any relevant comments and click the **Save** button.

The entered comments are displayed in the list of inspections.

### To modify values of mode parameters and fundamental frequencies:

1. Select the inspection of interest and click the **Edit Parameter Values** button.

The **Machine Parameter Values** dialog box appears.



The dialog box titled "Machine Parameter Values" displays the inspection date/time as 24.11.2004 13:59:58. It contains a table with three columns: Parameter name, Value, and Unit. The table lists three parameters: LPC rotations (5757.50 RPM), HPC rotations (7409.50 RPM), and FT rotations (4964.00 RPM). Below the table is a large empty text area. At the bottom right are "Save" and "Cancel" buttons.

Parameter name	Value	Unit
LPC rotations	5757.50	RPM
HPC rotations	7409.50	RPM
FT rotations	4964.00	RPM

**Figure 143** Machine parameters values dialog box

- Specify the values you need and click **Save**.

**Note** After saving new parameter values in the database, calculation of bands and parameters will be performed automatically.

## Recalculating Bands and Parameters

When recording the measured data from a data collector or importing data from an inspection file, the values of calculated absolute and relative bands and calculated parameters are computed automatically. If you have created new bands or calculated parameters, or modified properties of the existing ones, the old data of the bands and parameters will be deleted as they do not match the current parameters. When recording new inspection data, the values for such new or modified bands (parameters) will be automatically calculated and saved, but the values in these bands and parameters for all inspections made before are *not* saved. If you need to have these values, you may use the Calculate bands and parameters operation.

Recalculating bands and parameters may take much time, depending on

- The number of new or modified bands (parameters).
- The number of machines in the machine shops.
- The measured data size in the database.

You can select for which plant hierarchy elements to apply this operation. You can recalculate bands and parameters for:

- A complete plant (all measurement points of all machines are processed).
- A plant station (all measurement points of all machines of the selected station are processed).

- A plant division (all measurement points of all machines of the selected division are processed).
- A plant machine shop (all measurement points of all machines of the selected machine shop are processed).
- A machine (all measurement points of the selected machine are processed).
- A machine element (all measurement points of the selected machine element are processed).
- A measurement point of the machine element (a selected measurement point on the machine element is processed).

**To recalculate bands and parameters:**

1. In the plant hierarchy on the left, select the object you need.
2. On the **File** menu, click **Calculate bands**.  
You are prompted to confirm the operation.
3. Click **Yes**.  
Recalculating bands and parameters is started. The status bar displays the progress.

## Data Analysis

### Introduction

Analysis is the process of condition monitoring using visual data. The main purpose of analysis is detecting causes of machinery condition changes. The results of analysis are diagnoses, recommendations, reports, and collected measurement results. The analysis procedure is performed in the Analysis mode. In this mode, the left Vibrodesigner panel displays the **Plants** tab. You cannot modify the plant hierarchy in the Analysis mode.

During analysis, you can work with inspection reports and view measurement results. The standard analysis procedure comprises six primary steps:

1. Alarms/warnings analysis.  
Right after loading an inspection data, you need to verify whether new active warnings/alarms appear in the plant hierarchy. If appeared, you need to monitor machines where the warning/alarm levels have been exceeded.
2. Generating and analyzing an inspection report.  
You need to mark points with active alarms/warnings and pay attention to warnings for change, as well as analyze the vibration growth trend. Then you estimate remaining time before failure for the parameters.
3. Analyzing trends of frequency bands and operational parameters with active alarms/warnings.  
You need to visually estimate vibration change trends.

4. Analyzing trends of calculated parameters.

Analyzing trends of calculated parameters allows you to monitor data tendencies and predict subsequent data changes.

5. Analysis of original signals.

You may want to view spectra and waveforms in the measurement points for in-depth analysis of vibration change trend. If necessary, you can compare these spectra and waveforms with signals in other points or in the same points on other machines in the Comparison mode.

6. Orbit analysis (optional).

In case of suspecting certain defects, you need to analyze orbits in 2-channel measurement points.

7. Analyzing Nyquist diagram (optional).

Analyzing a Nyquist diagram allows monitoring how magnitude/phase of the selected signal harmonic is changing during period in case of permanent machine working mode.

8. Analyzing coast-downs and daily trend retrospect (if necessary and if such data are available).

Viewing daily trends retrospect and coast-downs enables a maintenance engineer to perform effective analysis based on historical data.

9. Diagnostics, i.e. locating places and causes of faults.

On the basis of acquired information, you need to locate the places and possible causes of faults (imbalance, bearing defects, gear defects and so on), estimate fault severities and the machinery remaining time before failure, and finally estimate a current machinery condition and make recommendations on machinery operation.

## Detecting Machinery Faults

When an inspection data are recorded, you may start to view and analyze the collected data. Typically, the first step is to determine the changes effected in the machinery condition. These changes may be located by warning indicators in the plant hierarchy and in inspection reports.

### Analysis of Active Alarms/Warnings

You can promptly trace exceeding the alarm/warning levels in measurement points. If the parameter exceeded the warning for absolute value or for change thresholds, a yellow exclamation mark is displayed for this object in the plant hierarchy.



LPC-hor

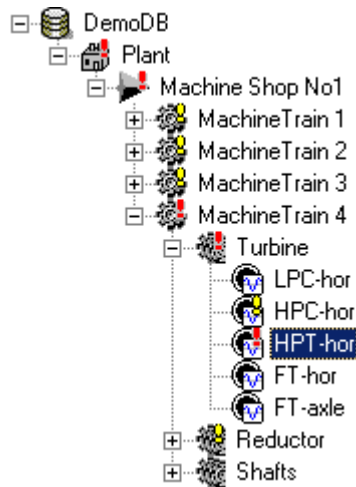
**Figure 144 Active warning**

If the parameter exceeded the failure threshold, a red exclamation mark is displayed in the plant hierarchy.



**Figure 145 Active failure**

Exclamation mark indication is shown for all measurement points with active alarms/warnings. The same indication is displayed on the upper hierarchy levels (machine element > machine > machine shop > division > station > plant) which the point with active alarm/warning is belonged to. By expanding the plant hierarchy tree, you can quickly locate the point with the active alarm/warning.



**Figure 146 Tracing warnings in hierarchy**

---

**Note:** If both failure and warning levels were exceeded, the red exclamation mark is displayed for all parent objects.

---

## Creating and Viewing Inspection Reports

You can generate a report for the following plant hierarchy levels:

- Plant
- Station
- Machine shop
- Machine

In the **Alarm levels** columns of the report, the maintenance engineer must note points with active alarms and pay attention to absolute and relative change levels, as well as analyze vibration tendency. Then, the machinery remaining time before failure estimations must be made. Keep in mind that these estimations are forecasting. A name of the point in the plant hierarchy is displayed in the **Point code** column of the report.

For more information about creating reports, see “Inspection Reports” later in this chapter. A report example is given in *Chapter 11*, “Inspection Report Example.”



## Viewing Measurements

When you found the machines, points and parameters with vibration changes, you may proceed with viewing data of these objects. To view data, you need first to select in the left Vibrodesigner panel the object that contains the data of interest. You can view measurement data on the following levels:

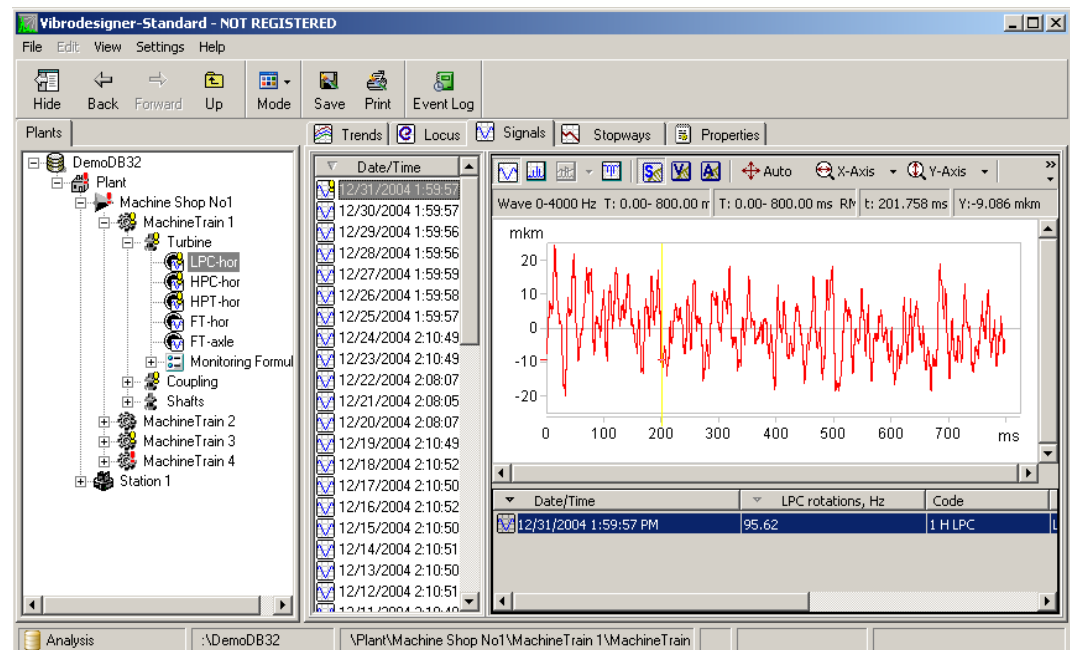
- Measurement point
- Machine

## Viewing Data in Measurement Points

**To view measured or calculated data in a machine point:**

1. In the Analysis mode, expand the plant hierarchy and select the measurement point you need.

The panel containing the inspection list and signal graphs is displayed in the workspace on the right.








**Figure 147 Properties of measurement point in Analysis mode—measured signal are displayed on the right**

If you selected a 1-channel point or a channel of the 2-channel point, you can see the following tabs: **Trends** (if calculating bands for the point has been configured), **Locus**, **Signals** and **Stopways**. If you selected a 2-channel point containing measured waveforms on its channels, the **Orbits** tab is displayed on the right. Thus, you can see only those tabs in the workspace that correspond to configured measured and calculated signals.

2. In the inspection list, select the inspection you need.
3. View the graphs on the tab you need.

On the **Trends** tab, spectral bands in the form of trends are at your disposal. On the **Locus** tab, the Nyquist diagram is displayed. On the **Signals** tab, you can view waveforms, spectra and envelope spectra. On the **Stopways** tab, the archive coastdowns may be displayed. On the **Orbits** tab, you can view signal orbits. If a waveform measurement is configured in a point, spectra in this point are calculated automatically. You can view in the workspace:

- A signal in the form of waveform (by clicking ).
- A signal in the form of spectrum (by clicking ).
- An envelope spectrum of the signal ().
- A signal cepstrum ().

Above graphs on the **Orbits** and **Signals** tabs, the  buttons are located that allow you to quickly switch measurement unit of waveforms and spectra, that is, integrate and differentiate signals (SVA transformation.) SVA transformation can also be done by using:

- The settings panel
- Y-Scale context menu
- Main menu commands

For more information about viewing graphical data, see “Working with Graphical Data” later in this chapter.

## Viewing Machine Data

When you select any machine in the plant hierarchy, the following tabs are displayed on the right:

- **Inspection report** tab

For information on inspection reports, refer to “Inspection Reports” later in this chapter. The report example generated by Vibrodesigner is shown in *Chapter 11*, “Inspection Report Example.”

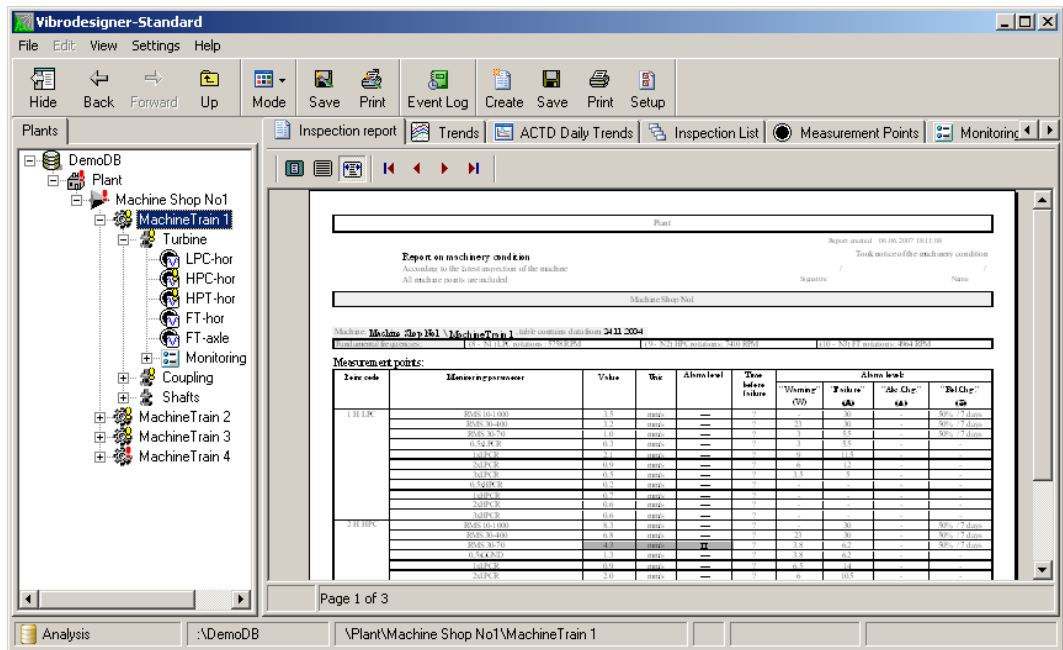


Figure 148 Viewing inspection report

- Trends tab

For information about trend analysis specifics, see “Viewing Trends” later in this chapter.

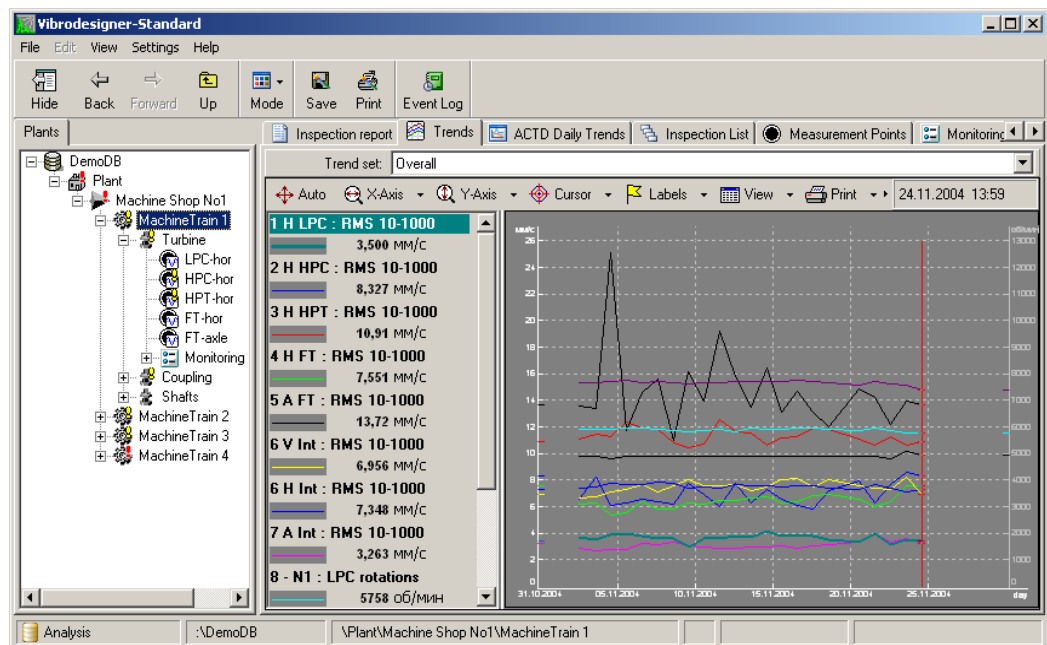
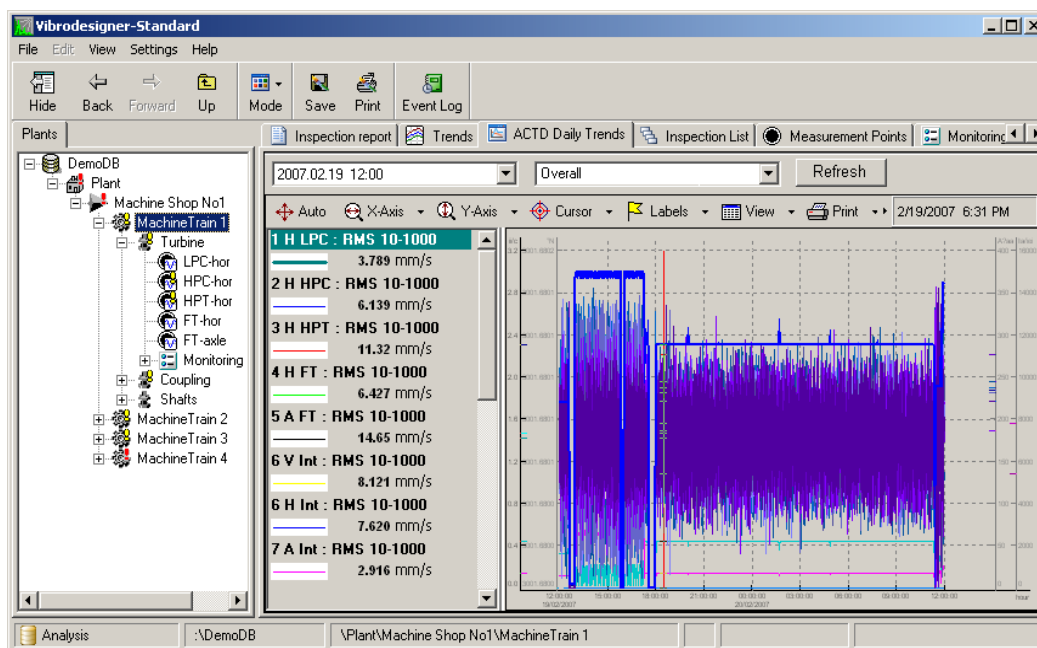


Figure 149 Viewing trends

- ACTD Daily Trends tab

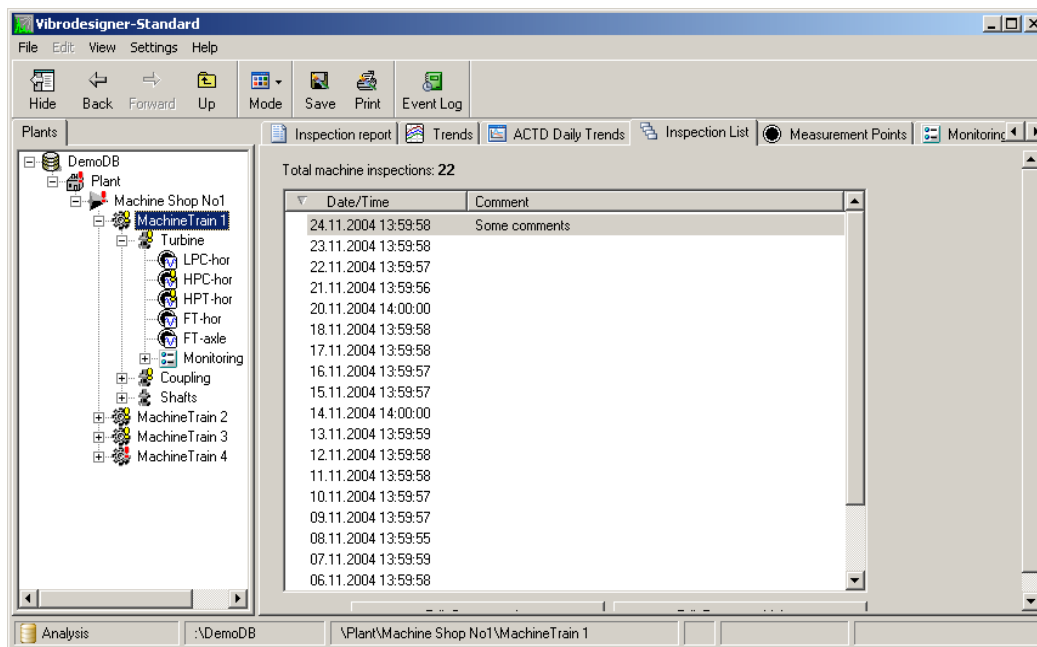
For information about daily trends, see “Viewing Daily Trends Retrospect”.



**Figure 150 Viewing ACTD daily trends**

- **Inspection List tab**

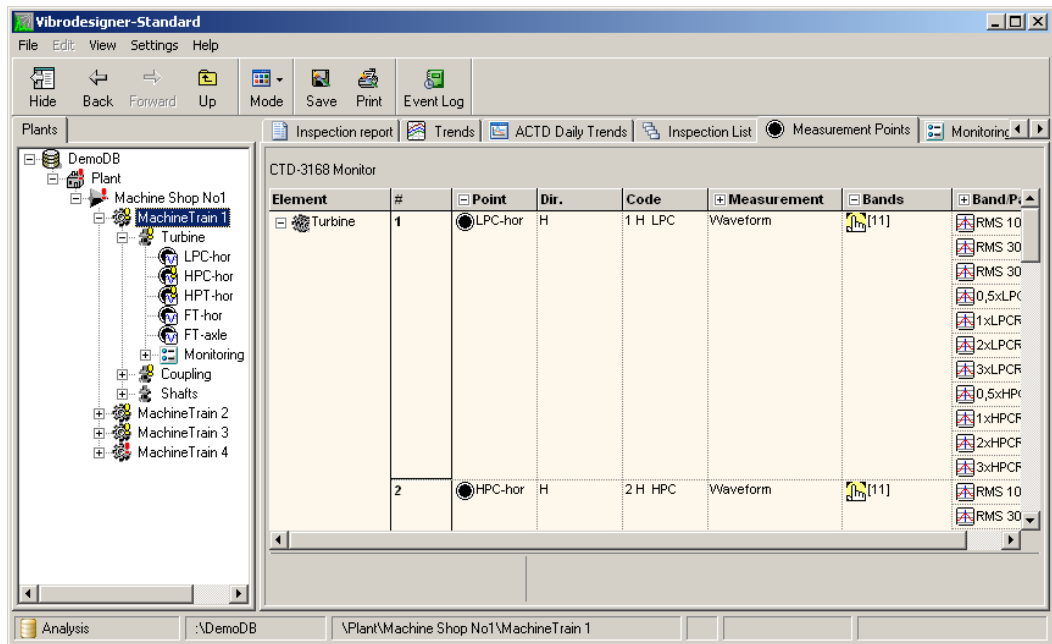
For more information, see “Adjusting mode parameters values”.



**Figure 151 Inspection list**

- **Measurement points tab**

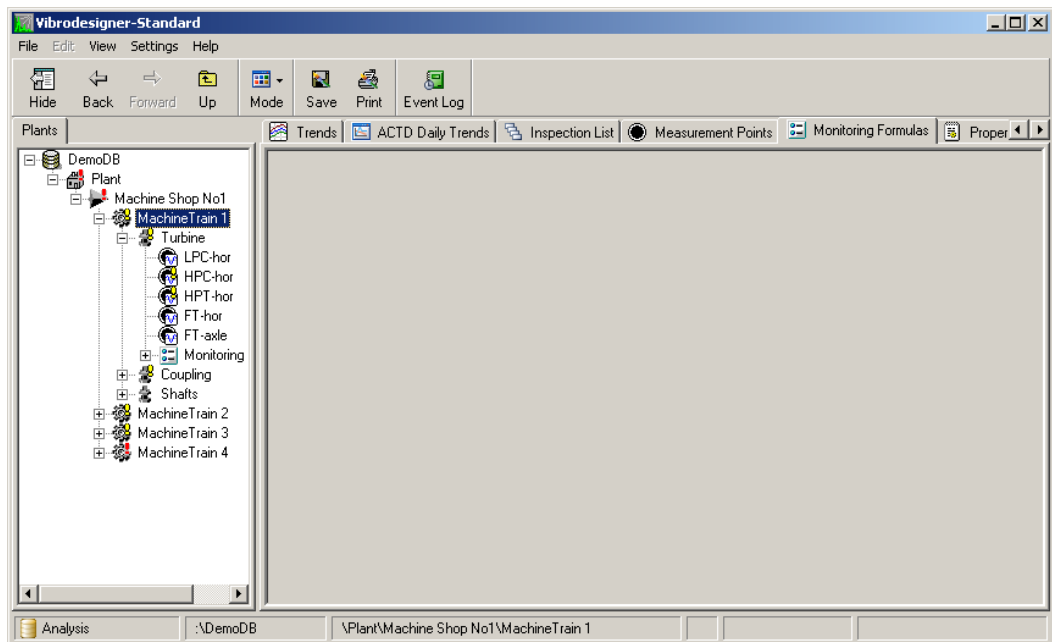
For more information, see “Measurement Point Editor”.



**Figure 152 Viewing measurement points**

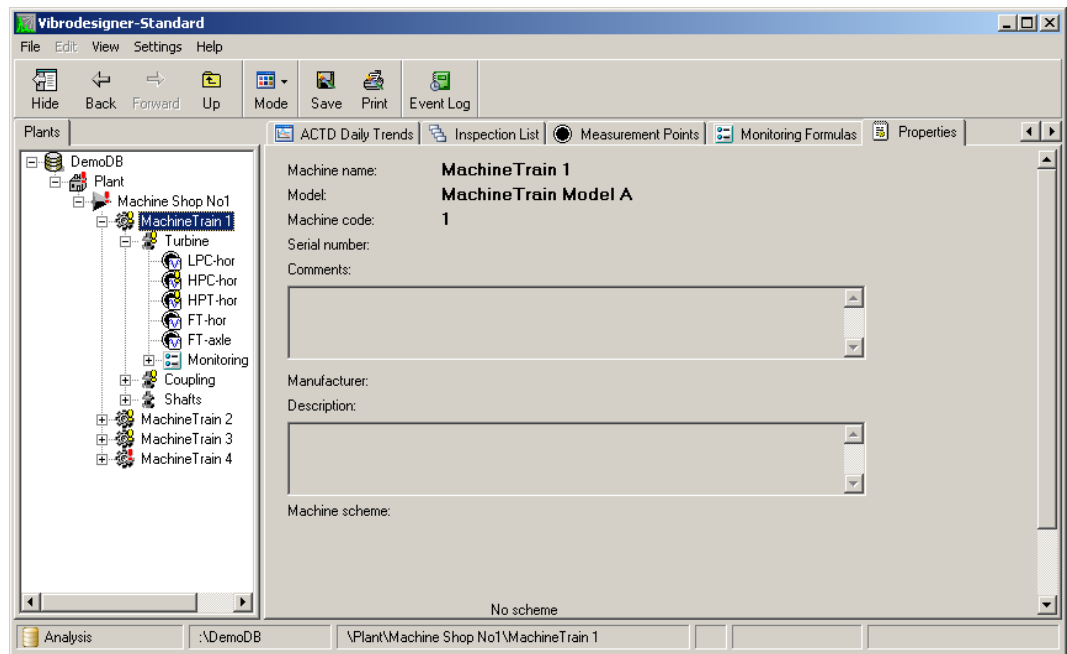
- **Monitoring Formulas tab**

For more information on how to work with monitoring formulas, see “Configuring Calculated Parameters”.



**Figure 153 Monitoring formulas tab**

- **Properties tab**



**Figure 154 Viewing machine properties**

You can also view the following parameters:

- Machine name
- Machine model
- Machine code
- Machine serial number
- Comments
- Machine manufacturer
- Machine description
- Machine scheme

These parameters cannot be modified in the Analysis mode; they are specified in the Configuration mode for a machine and a machine model.

## Inspection Reports

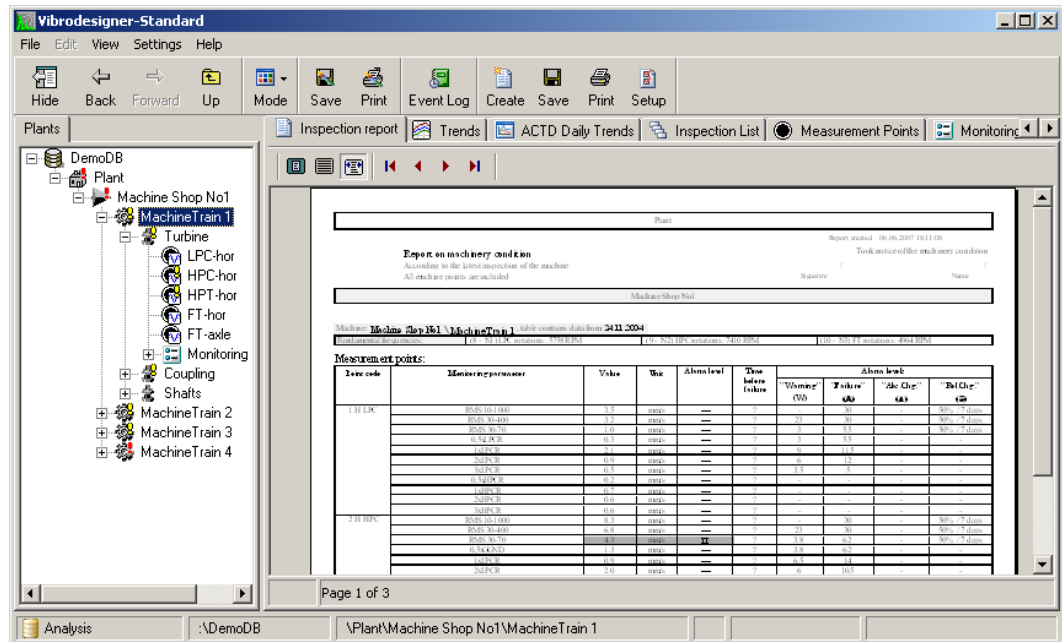
Vibrodesigner allows you to create inspection reports. Creating reports is the essential part of the entire condition monitoring procedure of a plant machinery. When inspection is finished, you can create the report containing data on current machinery condition. Reports allow you to analyze the measured data. The information about active warnings/alarms on the monitored machines are presented in every report. After analyzing, the report is turned over to the responsible department in accordance with the plant regulations.

### To generate an inspection report:

1. In the plant hierarchy, select one of the following objects:

- Plant
- Station
- Machine shop
- Machine







The **Inspection report** tab is displayed in the workspace.




**Figure 155 Inspection report tab**

On this tab, you can view the report saved for the last time. If the report has not been created yet, this tab displays the following text: “No report has been created yet.” At the top of the **Inspection report** tab, you can see the toolbar that provides buttons for zooming a report in the workspace and navigating through report pages. The table below describes toolbar buttons.

### Report toolbar

BUTTON	BUTTON NAME	DESCRIPTION
	Zoom to fit	Automatically adjust the zoom so that the image will fit to the workspace. Thus, the workspace displays the complete page of the report.
	100 %	Display the report page at its actual size.
	Zoom to width	Display the report page in the width of the workspace.
	First page	Scroll to the first report page.
	Previous page	Scroll to the previous report page, if any.
	Next page	Scroll to the next report page, if any.

BUTTON	BUTTON NAME	DESCRIPTION
	Last page	Scroll to the last report page.

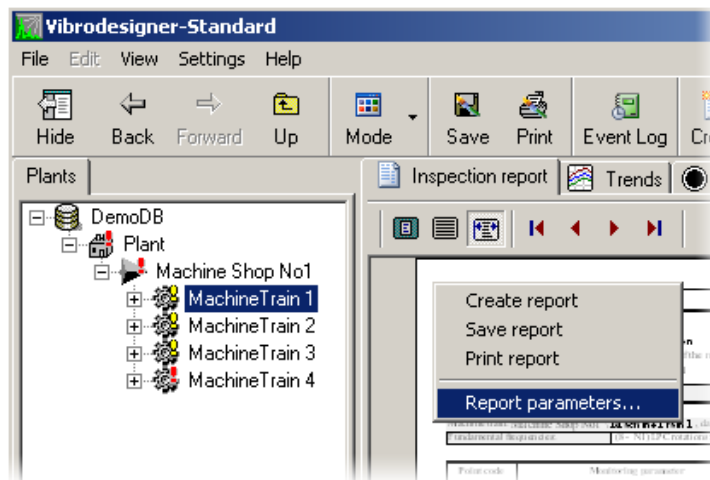
- Right-click in the workspace and select **Create report** from the menu, or use the **Create** button on the Vibrodesigner toolbar.

The report is being generated. The status bar displays the progress. When completed, the report is displayed in the workspace. You can view the report example in the *Chapter 11*, “Inspection Report Example.”

**Note:** A report is created with regard to report parameters and current plant configuration. For example, creating a report for a plant extracts station and machine shop data, whereas generating a report for a machine shop extracts machines of the selected machine.

### To set report parameters:

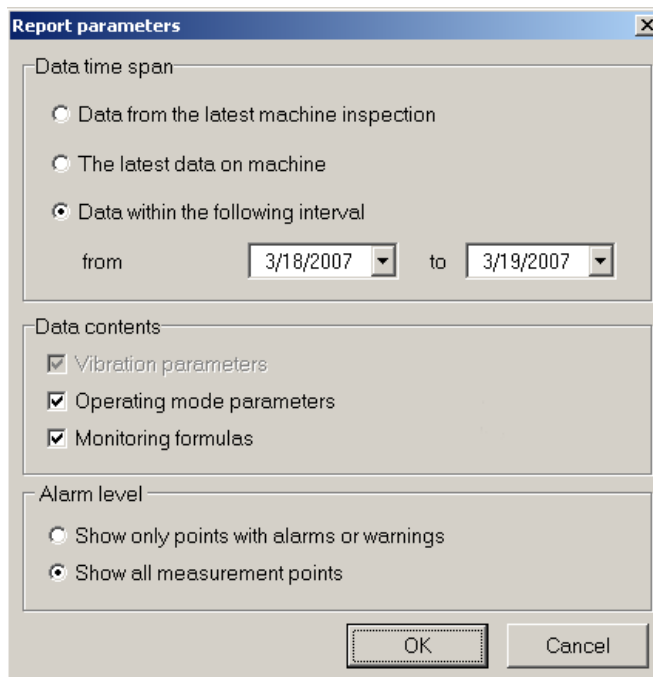
- Right-click in the workspace and select **Report parameters** from the menu.



**Figure 156** Modifying report parameters

The **Report parameters** dialog box appears.





The dialog box is titled "Report parameters" and contains three main sections:

- Data time span:**
  - ☐ Data from the latest machine inspection
  - ☐ The latest data on machine
  - ☒ Data within the following interval
 

from  to
- Data contents:**
  - ☒ Vibration parameters
  - ☒ Operating mode parameters
  - ☒ Monitoring formulas
- Alarm level:**
  - ☐ Show only points with alarms or warnings
  - ☒ Show all measurement points

At the bottom are "OK" and "Cancel" buttons.

**Figure 157 Report parameters dialog box**

2. If the **Data from the latest machine inspection** option is selected, only the data collected during the last machine inspection are included into your report. The report will not contain data from the measurement points that were skipped during the last inspection.
3. If the **The latest information on machine** option is selected, the latest data for each point on the machine are included into a report. If a point was skipped during the last inspection, the data from the previous inspection are included into your report, and so on.
4. If the **Data within the following interval** option is selected, the data collected in the interval specified in the **from** and **to** fields are included into your report.
5. If necessary, select the **Operating mode parameters** check box.  
If the check box is not selected, the machine report will include vibration measurement points only. If the check box is selected, in addition to vibration points, the measurement points with operating parameters (temperature, pressure, and so on) will be included as well.
6. If necessary, select the **Monitoring formulas** check box.  
In this case, the table with calculated parameters values will be added into a report.
7. If the **Show only points with alarms and warnings** option in the **Alarm level** section is selected, the report will include only active alarms/warnings in the specified data range.
8. If the **Show all measurement points** option in the **Alarm level** section is selected, the report will include the information about all machine points.
9. Click **OK**.

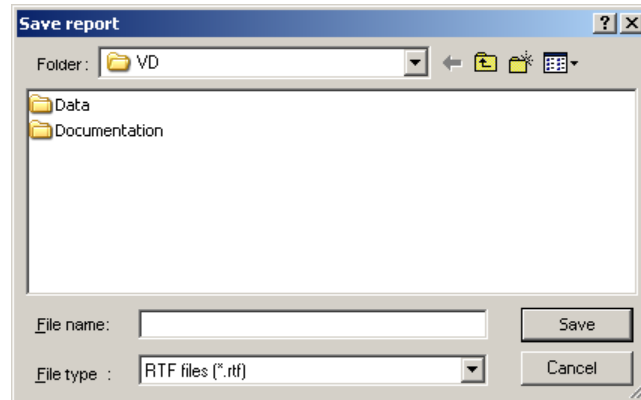
The report parameters are saved.

You can save your report in RTF format or print it out on the printer.

**To save a report:**

1. Right-click in the workspace and select **Save report** from the menu.

The **Save report** dialog box appears.



**Figure 158** *Save report dialog box*

2. Select the destination folder where you want to save your report, type the a report name in the **File name** box, and then click the **Save** button.

The report is saved in RTF format.

**To print out a report:**

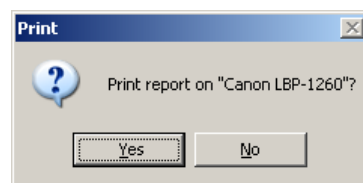
1. Right-click in the workspace and select **Print report** from the menu.

The **Print** dialog box appears, prompting you to confirm printing the report on the printer specified in the Vibrodesigner print settings.

---

**Note:** To specify a printer in Vibrodesigner settings, select **Print** from the **File** menu. In the **Print** dialog box, select the printer you need. If you have not specified a printer in Vibrodesigner, the report is printed on the Windows default printer.

---



**Figure 159** *Print dialog box*

2. Click **Yes**.

The report is printed out.

**To set a printer as default:**

1. On the Windows **Start** menu, click **Control Panel**, and then double-click **Printers and faxes**.

2. Right-click the printer you want to use as the default printer, and then click **Set as Default Printer**.

A check mark appears next to the printer icon in **Printers and Faxes**.

## Working with Graphical Data

### Introduction

Vibrodesigner is a comprehensive tool that provides many features for displaying and analyzing scalar and vector data. Graphical data are used in the following cases:

- When working with 1-channel points and with 2-channel point channels, you can view and analyze:
  - Waveforms
  - Envelopes
  - Spectra
  - Envelope spectra
  - Cepstra
  - Coast-downs
  - Nyquist diagram
  - Trends
- When working with 2-channel points, you can view orbits.
- When working with a machine, you can analyze trends in the points.
- When working in the Comparison submode, you can compare spectra, waveforms and trends in various machine points for different machines of a plant.

Thus, you can view waveforms, envelopes, spectra, envelope spectra, and trends of scalar and calculated parameters.

First of all, the standard techniques used while working with graphs are described. Then, specifics for each graph type are considered.

### Standard Techniques

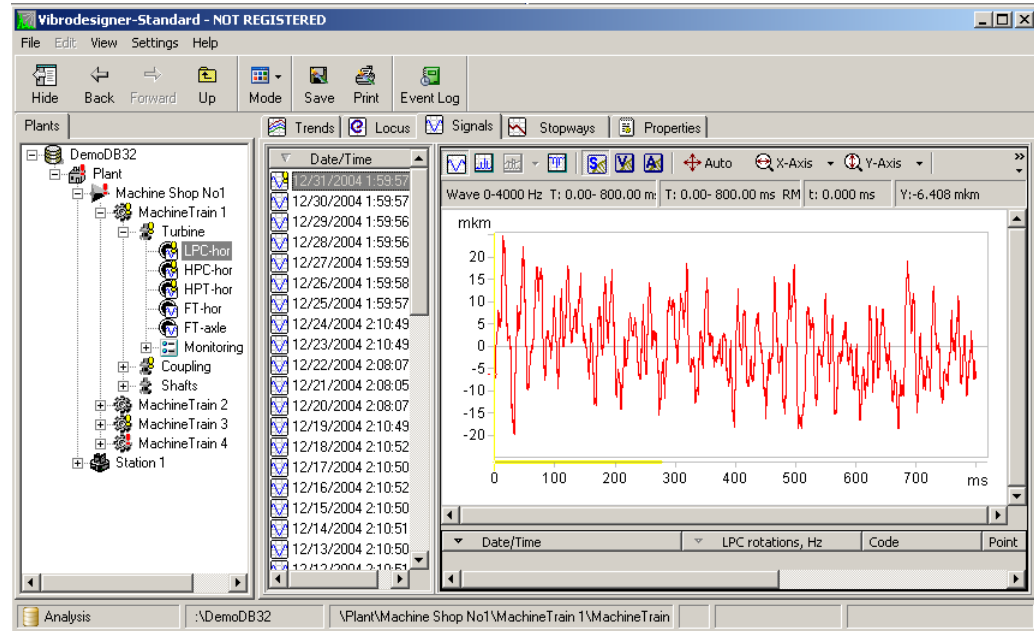
#### Zooming

You can view graphs at various levels of magnification to make it easier to see details or to get a broader view of the graph's contents. You can edit X-Scale and Y-Scale manually or using context menu commands. You can also autoscale graphs to set full value ranges for both X and Y axes.

**To scale the X axis manually:**

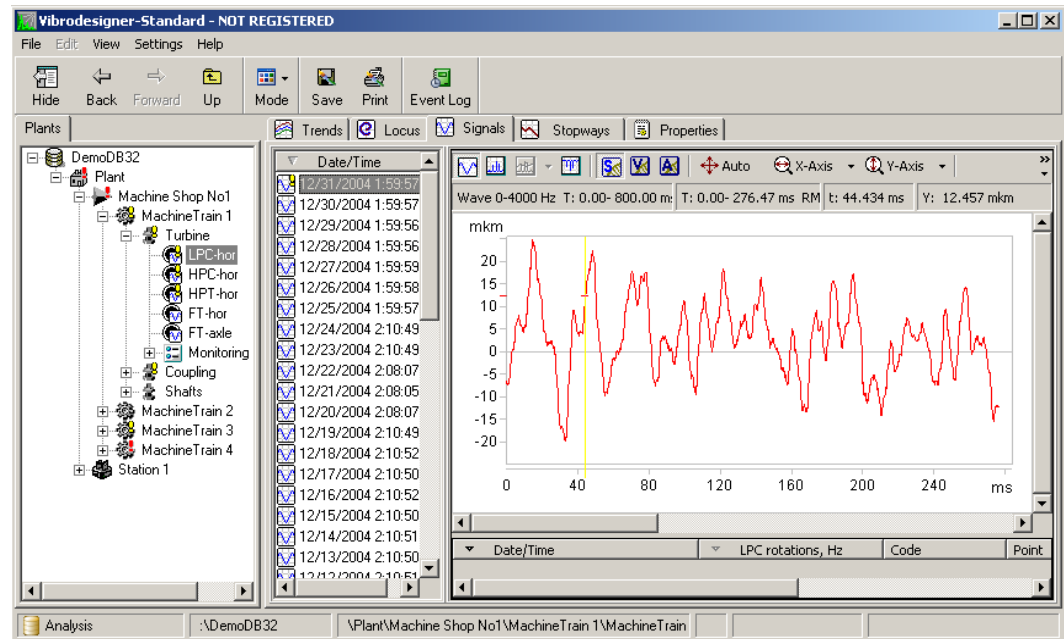
1. Place the cursor under the X axis.  
The mouse cursor mode is changed.
2. Holding down the left mouse button, drag to the right or left.

The selected part of the X scale is marked as yellow.



**Figure 160 X-axis is marked in yellow to zoom**

3. Release the left mouse button.  
The X axis is scaled by the specified interval.




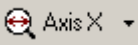
**Figure 161 Zooming by selected interval**

**To scale the Y axis manually:**


1. Place the cursor to the left of the Y axis.  
The mouse cursor mode is changed.
2. Holding down the left mouse button, drag up or down.  
The selected part of the Y scale is marked as yellow.
3. Release the left mouse button.  
The Y axis is scaled by the specified interval.

**To autoscale the axes, do one of the following:**


- Click  on the toolbar.
- Right-click in the workspace and select **Autoscale** from the menu.  
The axes are automatically autoscaled (extended to include all points of the graphs).

Use the X-Scale menu (  on the toolbar) to change the scale of the X axis.


**To display a full X-axis range:**

- Click  on the right of the **X-Scale** button on the toolbar, and select **Full size** from the menu.  
The X-scale is extended to a full range.

**To extend X-axis view range twice, do one of the following:**


- Click  on the right of the **X-Scale** button on the toolbar, and select **Expand** from the menu.
- Right-click under the X-Scale and select **Expand** from the menu.  
The X-axis value range is extended twice.

**To shrink X-axis view range twice, do one of the following:**


- Click  on the right of the **X-Scale** button on the toolbar, and select **Compress** from the menu.
- Right-click under the X-Scale and select **Compress** from the menu.  
The Y-axis value range is shrank twice.

**To set a particular X-axis view range:**

1. Right-click under the X-Scale and select **More** from the menu.  
The **X Axis** tab of the **Data parameters** dialog box is displayed. This tab view depends on the current signal representation (either waveform or spectrum).
2. In the **View range** section, specify the time interval you need, and click **OK**.  
The X-Scale view range is changed.


Use the Y-Scale menu ( Axis Y ▾ on the toolbar) to change the scale of the Y axis.

**To display a full Y-axis range:**

- Click  on the right of the **Y-Scale** button on the toolbar, and select **Full size** from the menu.


The Y-scale is extended to a full range.

**To fill graphs to fit to the workspace, do one of the following:**

- Click  on the right of the **Y-Scale** button on the toolbar, and select **Fit into** the menu.
- Right-click on the left of the Y-Scale and select **Fit into** from the menu.


The Y-Scale view range is set in accordance with data on the graphs. This operation is more recommended than autoscaling as only visible data are displayed.

**To extend Y-axis view range twice, do one of the following:**

- Click  on the right of the **Y-Scale** button on the toolbar, and select **Expand** from the menu.
- Right-click on the left of the Y-Scale and select **Expand** from the menu.

The Y-axis value range is extended twice.

**To shrink Y-axis view range twice, do one of the following:**

- Click  on the right of the **X-Scale** button on the toolbar, and select **Compress** from the menu.
- Right-click on the left of the Y-Scale and select **Compress** from the menu.

The Y-axis value range is shrank twice.

**To set a particular X-axis view range:**

1. Right-click on the left of the Y-Scale and select **Y-Scale Setup** from the menu.

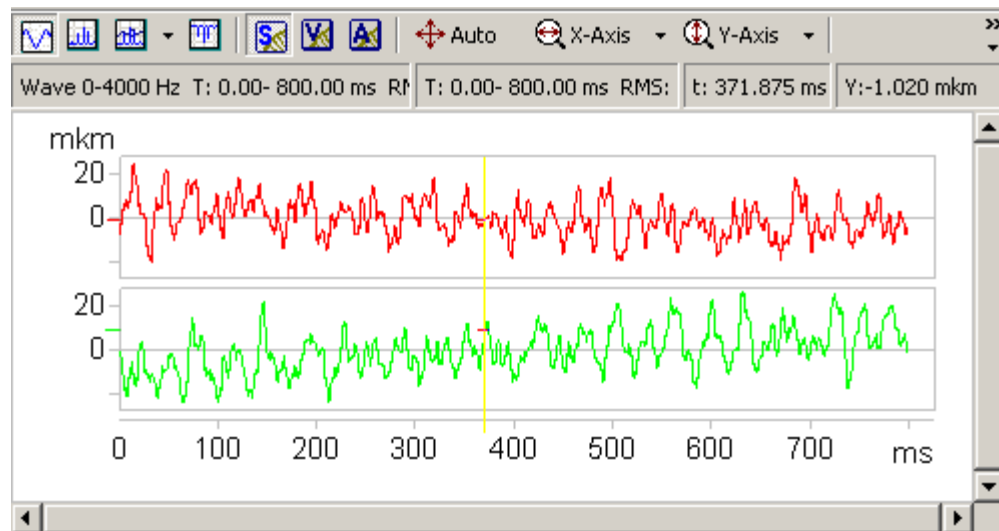
The **Y Axis** tab of the **Data parameters** dialog box is displayed. his tab view depends on the current signal representation (either waveform or spectrum).

3. In the **View range** section, specify the range you need, and click **OK**.

The Y-Scale view range is changed.

## Cursor

The cursor is the yellow vertical line in the workspace. It helps you trace X and Y values, which are displayed on the panel above the graphs.



**Figure 162 Cursor**

Using the cursor, you can:

- Monitor X and Y values of the graph.
- Zoom graphs.
- Set labels (see “Labels” later in this chapter).

Supplementary cursor features for a particular graph types are described later in this section.

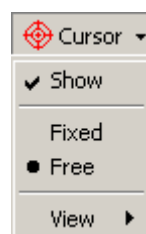
To move the cursor, apply one of the following techniques:

- Using the LEFT ARROW and RIGHT ARROW keys. Pressing the key shifts the cursor by one point along the X scale (either to the left or right.) While holding the key, the cursor moves along the X scale with acceleration.
- Using the HOME and END keys. Pressing HOME moves the cursor to the X scale zero point. Pressing END moves the cursor to the end of the X scale.
- Using the mouse.

#### To adjust cursor parameters:

- Click  Cursor on the toolbar.

The cursor menu is displayed.



**Figure 163 Cursor menu**

You can use one of the following cursor mode to move the cursor:

- Non-fixed cursor

In this mode, moving the mouse pointer above the X-scale moves the cursor in the workplace. The cursor follows the mouse pointer without stop. The non-fixed cursor is the default mode.

- Fixed cursor

In this mode, clicking the left mouse button above the X-scale moves the cursor in the workspace. The cursor is set in the nearest point of the active graph.

If necessary (for example, when you are printing screen), you can remove the cursor from the workspace. To do so, clear the **Show cursor** check box.

A cursor specifics for spectrum and waveform graphs is described in the following sections.

## Labels

You can set labels on the graphs in the workspace to facilitate data analysis. Labels can be set either manually or automatically. In the latter case, maximums and minimums of the active graph (or all graphs) are labeled.

### To add a label manually, do one of the following:

- Holding the CTRL key down, double-click the point in the workspace where you want to set a label.
- Place the cursor on the X scale where you want to set a label and press CTRL+INSERT (or select **Labels > Add label** from the context menu).


A new label is displayed in the workplace.

---

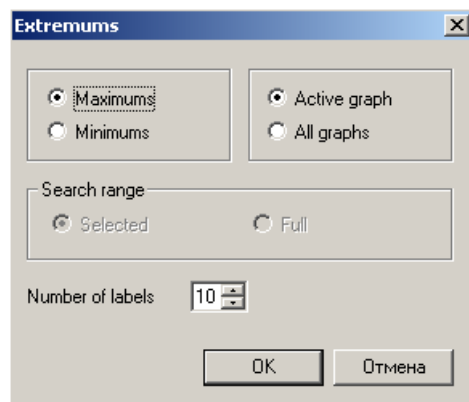
**Note:** To facilitate setting labels correctly, use the fixed cursor.

---

### To add labels automatically:

1. Click  on the right of the **Labels** button on the toolbar, and then select **Extremums** from the menu.

The **Extremums** dialog box appears.

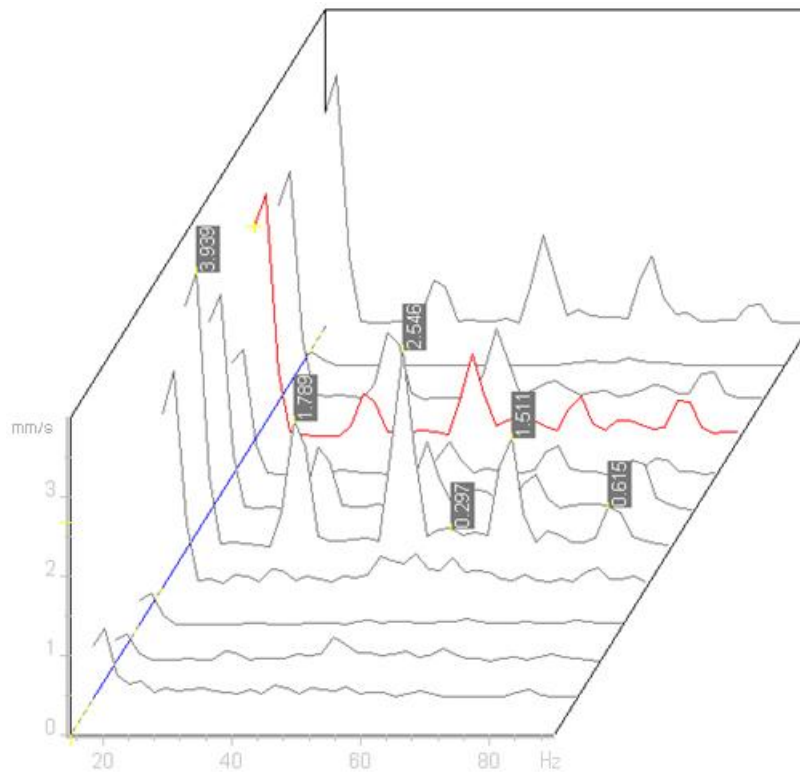


**Figure 164** *Extremums dialog box*



2. Select either **Maximums** or **Minimums** to display the extremum types to be labeled on the graph.
3. Select the graphs to be labeled. To display extremums of the active graph only, select **Active graph**. To display extremums of all graphs in the workspace, select **All graphs**.
4. To set labels in the entire graph interval, select **Full**. If you want to set labels for the displayed interval only, select **Selected**.
5. In the **Number of labels** box, specify the maximum number of labels displayed in the workspace at a time.
6. Click **OK**.

The labels with specified parameters are displayed in the workspace. The picture below shows spectrum graphs, one of which was autolabeled in first six maximums.




**Figure 165 Autolabels that corresponds to first six maximums of selected spectrum**

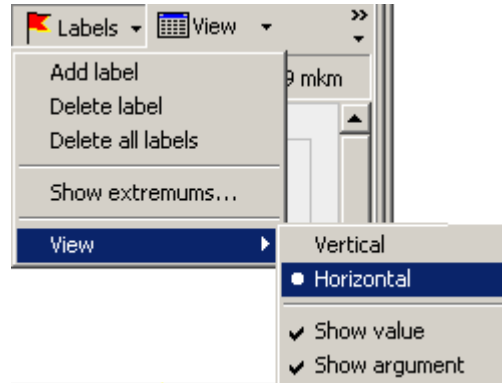
Besides, you can adjust the label appearance in the workspace. Labels can be displayed either vertically or horizontally about the X axis. A label can display:

- A function value
- An argument value
- Function and argument values

**To adjust label appearance:**

1. Click  on the right of the **Labels** button on the toolbar and select **View** from the menu.

The popup labels menu appears.



**Figure 166 Labels menu**


2. Select the label displaying orientation you need (either vertical or horizontal).
3. To display on the label the Y-scale value of the labeled point, select the **Show value** check box.
4. To display on the label the X-scale value of the labeled point, select the **Show argument** check box.

**To delete a label:**

1. Using the cursor, point to the label to be deleted.
2. Do one of the following:
  - Press CTRL+DEL.
  - Right-click the label and select **Delete label** from the **Labels** context menu.

The label is removed from the workspace.

**To delete all labels displayed in the workspace, do one of the following:**

- Press SHIFT+DEL.
- Click  on the right of the **Labels** button on the toolbar and select **Clear all labels** from the menu.
- Right-click in the workspace and select **Delete all labels** from the **Labels** context menu.


All labels are removed from the workspace.

## Screen View Options

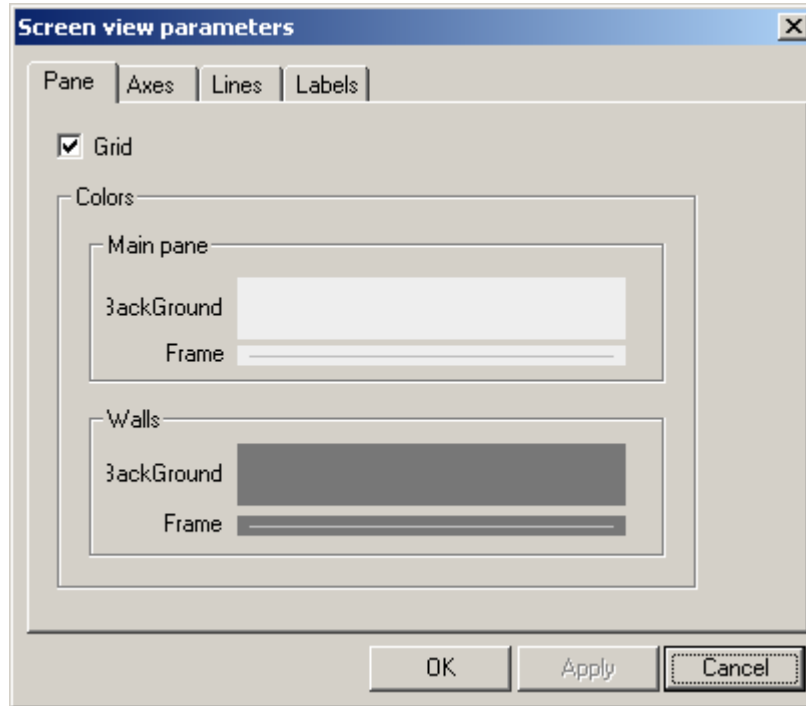
You can specify how lines, cursor and labels are displayed in the workspace separately for screen and printing. The procedure below describes how to specify screen view

option. Use the same procedure for printing view options (after selecting **View > Printer view options** on the toolbar).

**To specify screen view options:**

1. Click  on the right of the **View** button on the toolbar and select **Screen view options** from the menu.

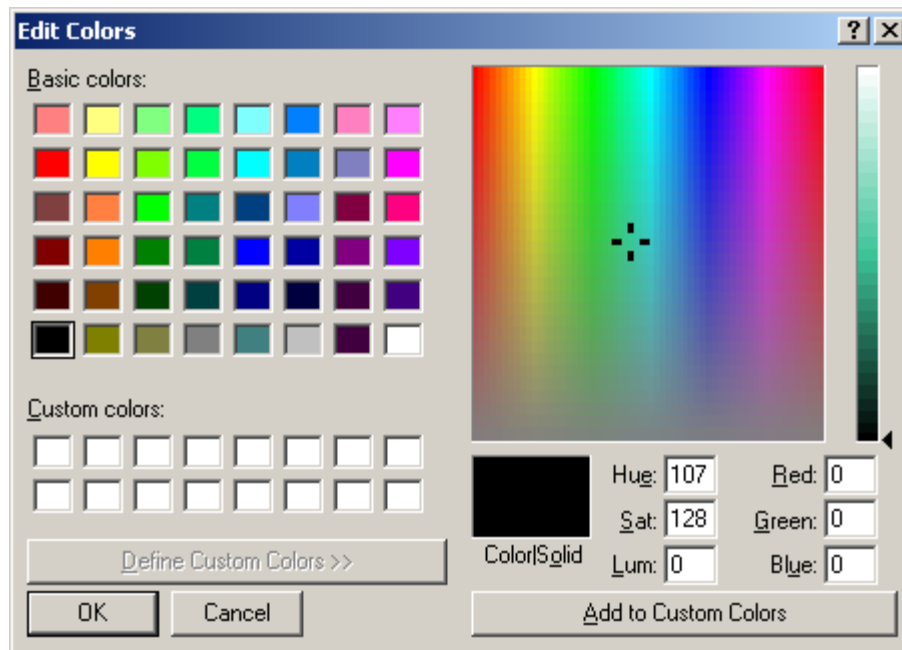
The **Screen view parameters** dialog box appears.



**Figure 167 Screen view parameters—Pane tab**

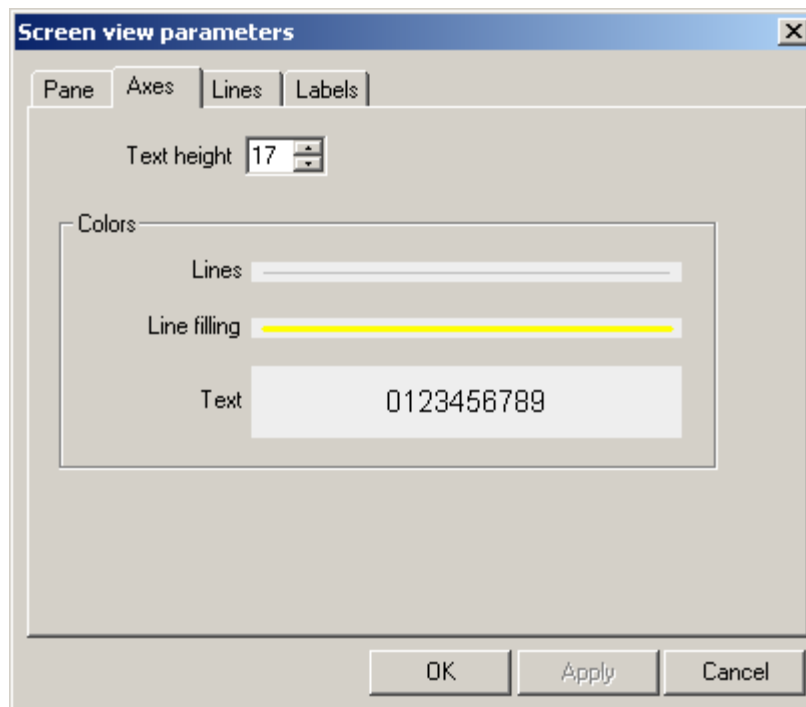
2. To display grid lines in the workspace, select the **Grid** check box.
3. You can specify colors of the workspace background and frames, as well as graph area colors. To set the color of interest, click the rectangle on the right of the parameter name.

The **Edit Colors** dialog box appears.



**Figure 168 Edit Colors dialog box**

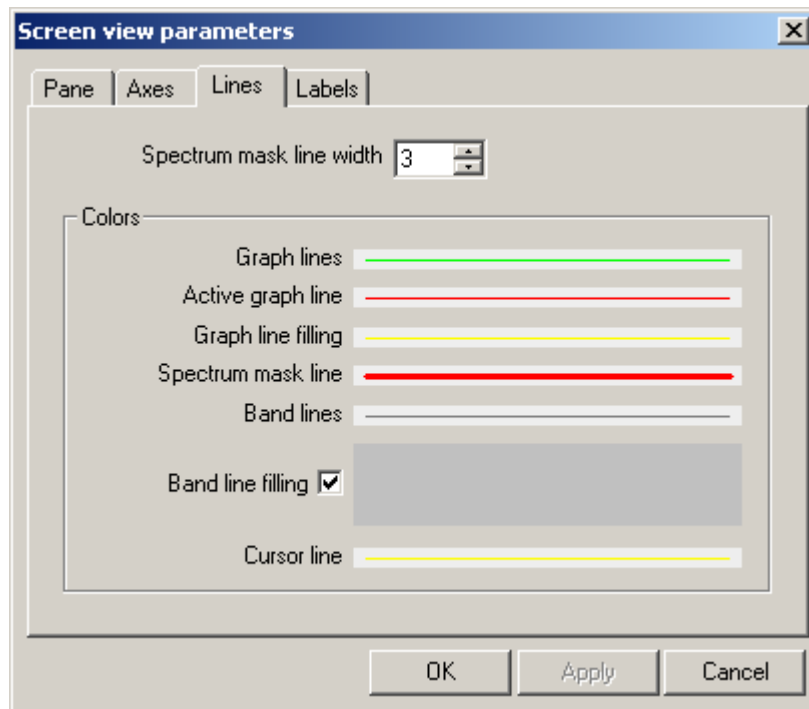
4. Select the color you need and click **OK**.  
The color of the rectangle is changed.
5. Click the **Apply** button and then click the **Axes** tab.



**Figure 169 Screen view parameters—Axes tab**

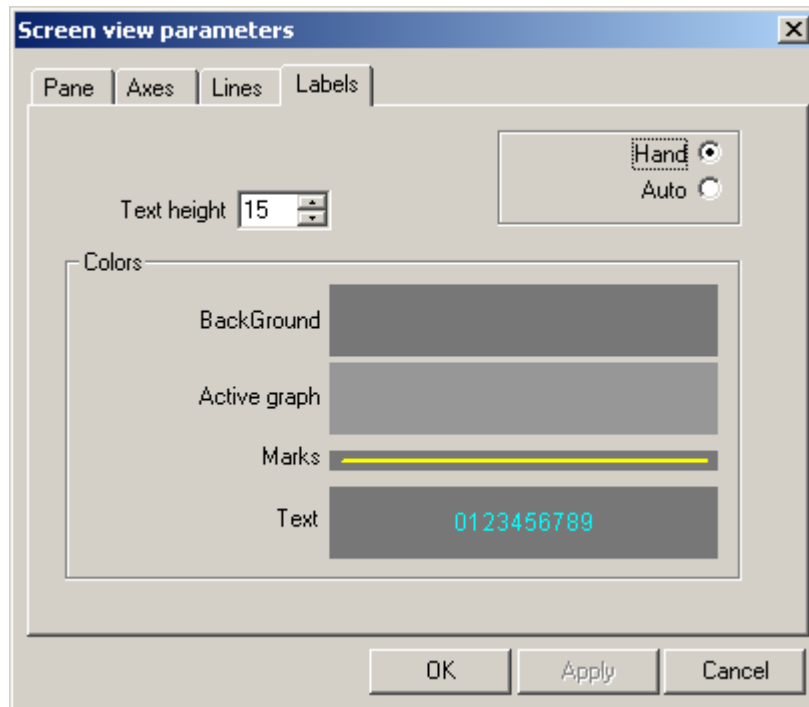
6. Specify the font size of the text displayed along the axes.  
The selected font size is applied to the digits in the **Text** rectangle.

7. In the **Colors** section, specify colors of axes lines, filling lines, the text displayed along the axes.
8. Click the **Apply** button and then click the **Lines** tab.



**Figure 170 Screen view parameters—Lines tab**

9. This tab is used to specify colors of various lines displayed in the workspace. To save the changes, click the **Apply** button and click the **Labels** tab.




**Figure 171 Screen view parameters—Labels tab**

10. To adjust parameters of manual labels, click **Hand**.
11. Specify the font size of the text displayed in labels.
12. In the **Colors** section, specify colors of label background, text and marks.
13. Click the **Auto** option and repeat Steps 11-12 to specify parameters of autolabels.
14. Click **OK** to save the changes.

## Printing Screen

You can print out the graphs displayed in the workspace. Before printing, you can set the page size and preview the output.


### To set the page size:

1. Click  on the right of the **Print** button on the toolbar and select **Page setup** from the menu.

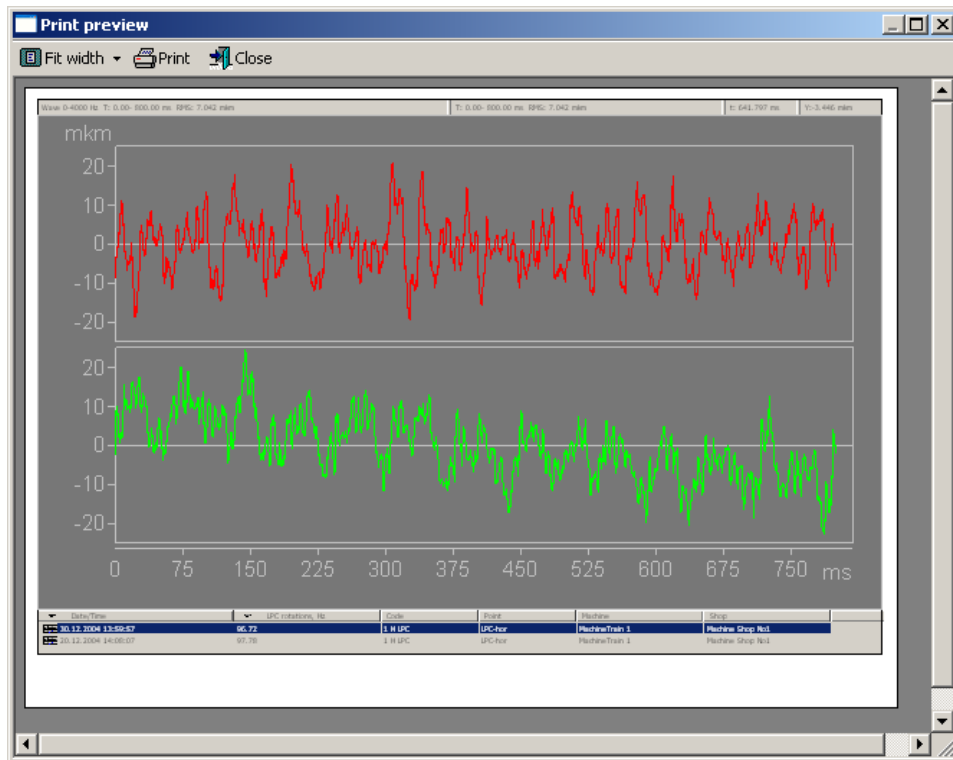
The **Page Setup** dialog box appears.

2. In the **Margins** boxes, specify the page margins you need.
3. From the **Printer** list, select the printer of interest.
4. Specify the paper size and orientation you need.
5. Click **OK** to save the page parameters.

### To preview the page:

1. Click  on the right of the **Print** button on the toolbar and select **Print preview** from the menu.

The **Print preview** dialog box appears.



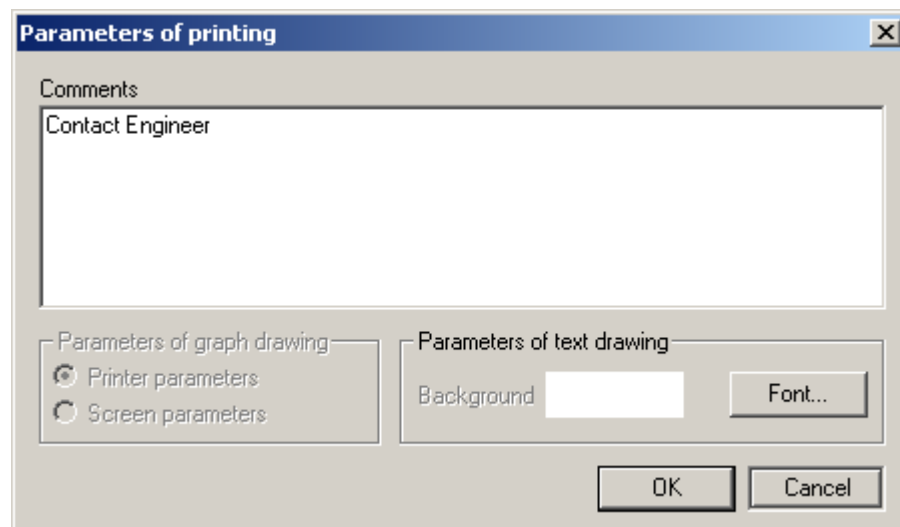
**Figure 172 Print preview**

2. On the toolbar, specify the page size.
3. To print out the page, click the **Print** button on the toolbar.

### To print graphs:

1. Click the **Print** button on the toolbar.

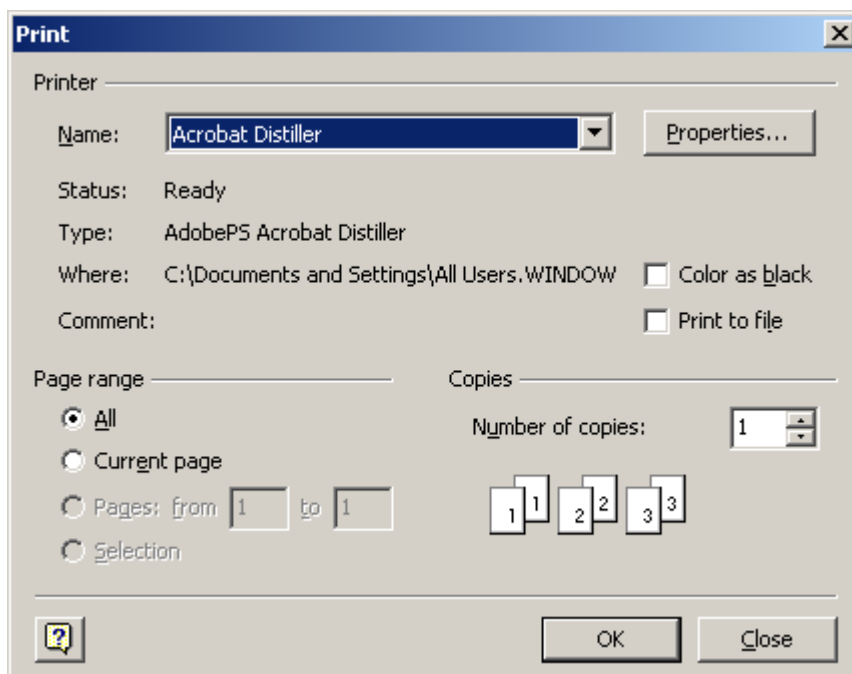
The **Parameters of printing** dialog box appears.



**Figure 173 Parameters of printing dialog box**

2. In the **Comments** box, type any pertinent comments to be printed along with the graphs and click **OK**.

The **Print** dialog box appears.



**Figure 174** *Print dialog box*

3. From the **Name** list, select the target printer and click **OK**.


The graphs displayed in the workspace are printed.

## Saving Pictures to File

You can save the data displayed in the workspace in one of the following formats:

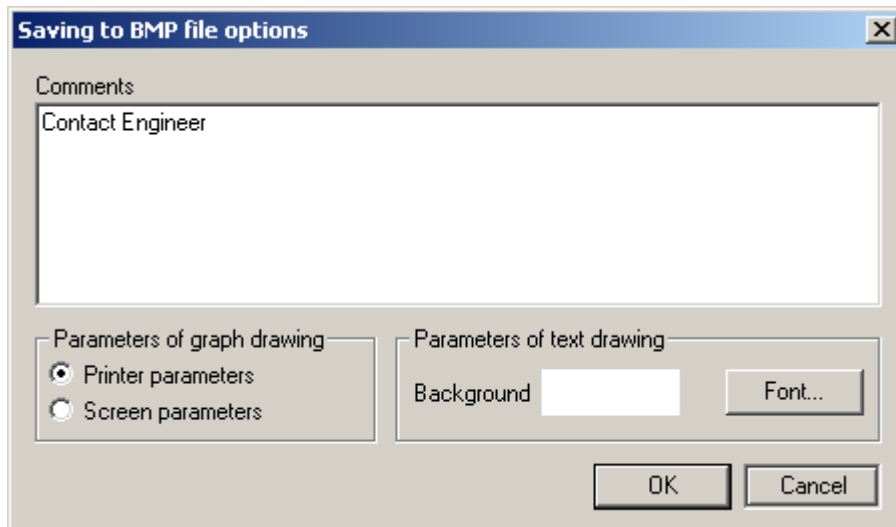
- BMP
- Excel
- CSV

### To save graphs in BMP format:

1. Click  on the right of the **Save** button on the toolbar and select **Save picture to BMP file** from the menu.

The **Parameters of saving to BMP file** dialog box is displayed.






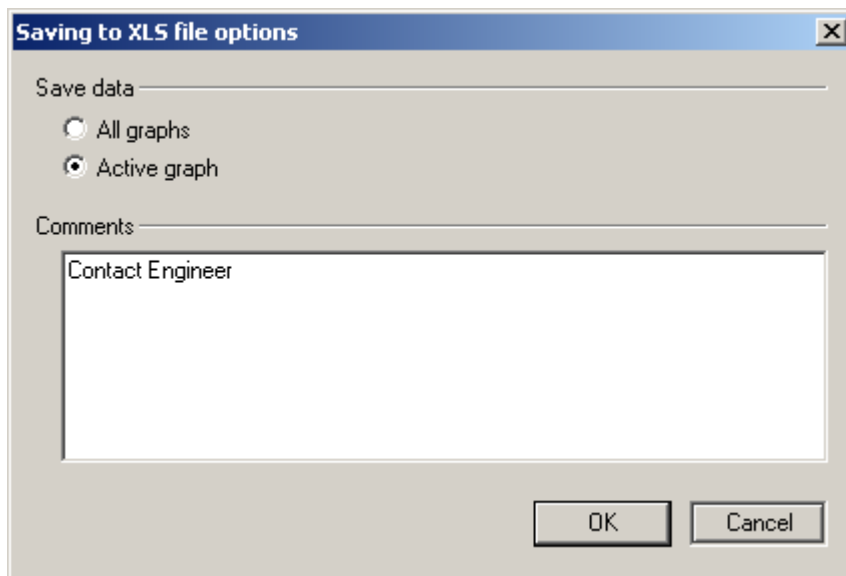
**Figure 175 Parameters of saving to .bmp file dialog box**

2. If necessary, type any relevant text in the **Comments** box and click **OK**.  
The **Save As** dialog box is displayed.
3. Specify a name of the file and click the **Save** button.  
The graphs displayed in the workspace are saved into the BMP file.

**To save data in Excel format:**

1. Click  on the right of the **Save** button on the toolbar and select **Save data to Excel file** from the menu.

The **Parameters of saving to .xls file** dialog box is displayed.



**Figure 176 Parameters of saving to .xls file dialog box**


2. Select either all graphs or an active graph to be saved.
3. If necessary, type any relevant text in the **Comments** box and click **OK**.

The **Save As** dialog box is displayed.

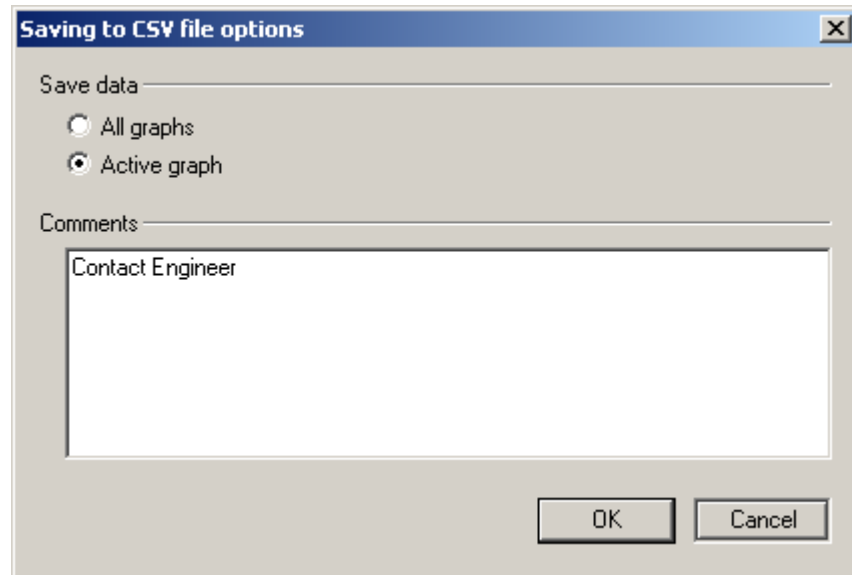
4. Specify a name of the file and click the **Save** button.

The graphs displayed in the workspace are saved into the Excel file.

#### To save data in CSV format:

1. Click  on the right of the **Save** button on the toolbar and select **Save data to CVS file** from the menu.

The **Parameters of saving to CSV file** dialog box is displayed.



**Figure 177 Parameters of saving to .csv file dialog box**

2. Select either all graphs or an active graph to be saved.
3. If necessary, type any relevant text in the **Comments** box and click **OK**.

The **Save As** dialog box is displayed.

4. Specify a name of the file and click the **Save** button.

The graphs displayed in the workspace are saved into the CSV (comma separated values) file.

## Viewing Trends

### Introduction

You can view trends for:

- A separate measurement point if measurement of bands and/or parameters have been configured in these points.
- A separate non-vibration measurement points
- Calculated parameters.

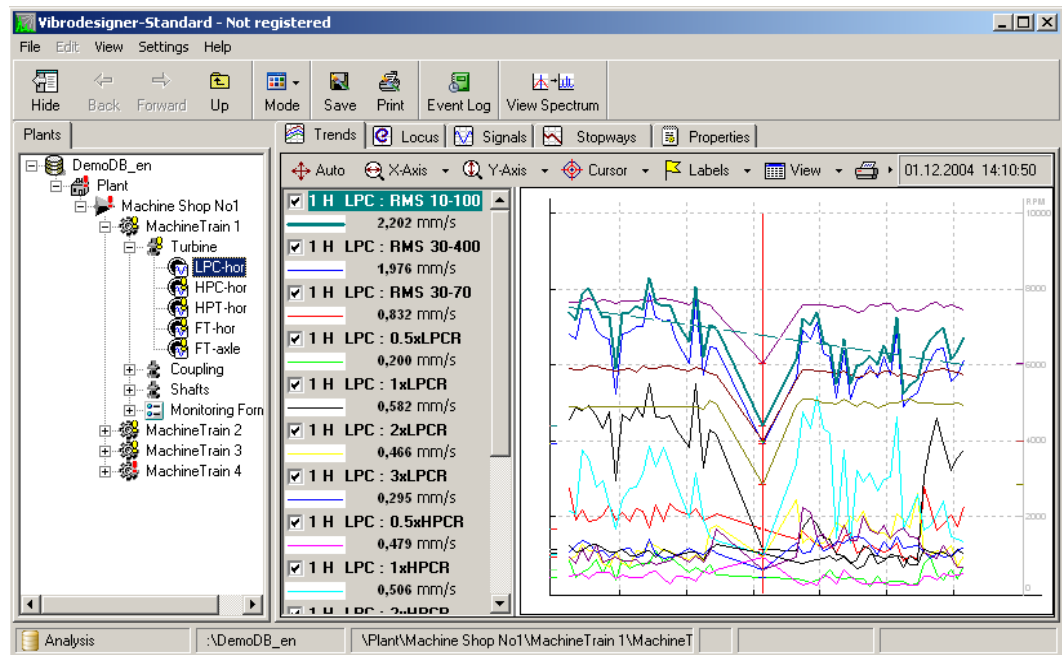
- Complete machines.

In this case, trends of spectrum characteristics in bands or parameter trends in machine points are displayed.

Thus, the **Trends** tab is displayed on the right panel if a machine or a point of any type is selected in the plant hierarchy on the left.

## Managing Trend View in Vibration Point

When selecting any measurement points in the plant hierarchy on the left, all the trends configured in the point are displayed on the **Trends** tab on the right.



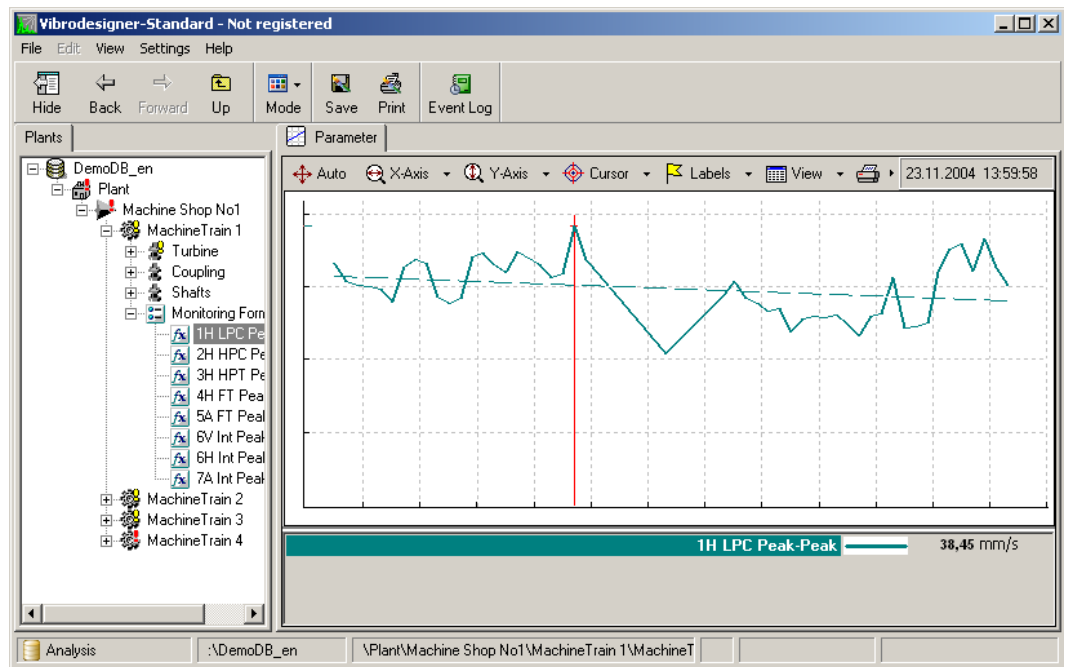
**Figure 178 Viewing trends in vibration point**

If necessary, you can clear the check box on the right of the trend in the list and consequently this trend will not be displayed in the workspace.

When viewing trends in vibration points, there is one additional button on the toolbar: **View Spectrum**. Clicking the **View Spectrum** button shows the **Signals** tab displaying the signal that corresponds to the selected trend point.

## Managing Trend View in Non-Vibration Point

When selecting a calculated parameter in the plant hierarchy on the left, all the trends configured for this parameter are displayed on the **Parameter** tab on the right.

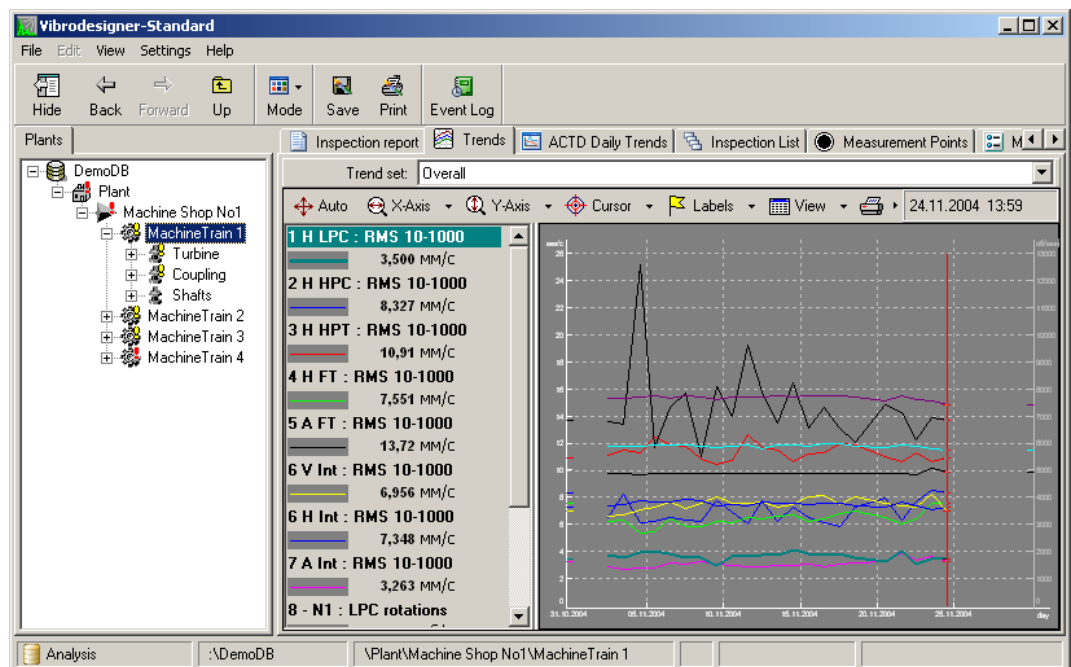


**Figure 179 Viewing trends of calculated parameter**

## Managing Machine Trend Views

When viewing trends, the workspace consists of two parts: names of the displayed trends with a color of the corresponding graph are displayed on the left; the graphs are shown on the right.

Vibrodesigner provides you with so called *trend sets*. The picture below shows the trend set which name is shown in the drop-down list above the graphs.




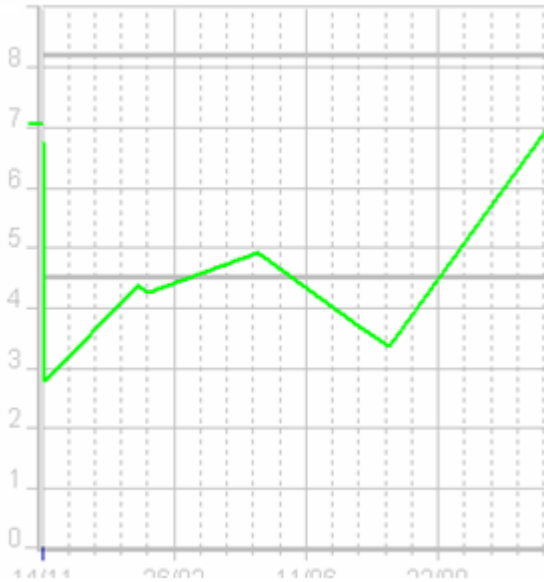
**Figure 180 Viewing machine trend**

To display one of the predefined trend sets, select the trend set of interest from the drop-down list.


## Viewing Trends Settings

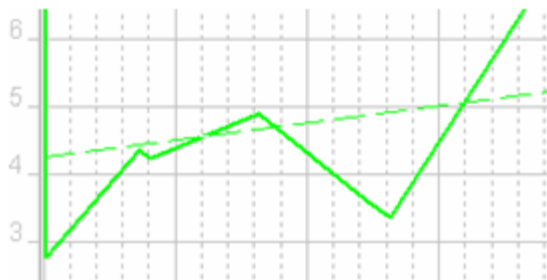
To adjust trend viewing parameters:

1. To show alarm/warning levels in the workspace, click  on the right of the **View** button on the toolbar and select **Level lines** from the menu. These levels are shown as horizontal lines.




**Figure 181 Warning and alarm levels on trend**

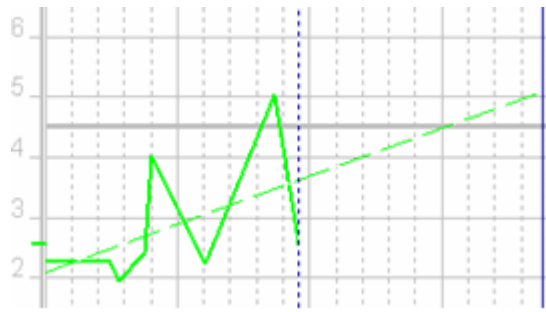
2. To show approximation line in the workspace, click  on the right of the **View** button on the toolbar and select **Approximation line** from the menu. As a result, the least squares linear approximation of the trend is displayed in the workspace. This approximation is displayed as a dot line.




**Figure 182 Linear trend approximation (dot line)**

3. To show prediction line in the workspace, click  on the right of the **View** button on the toolbar and select **Prognosis line** from the menu. As a result, a trend is extrapolated by least squares method. In this case, the approximating line is extended beyond the graph X-Scale range. It is recommended to view prediction along with

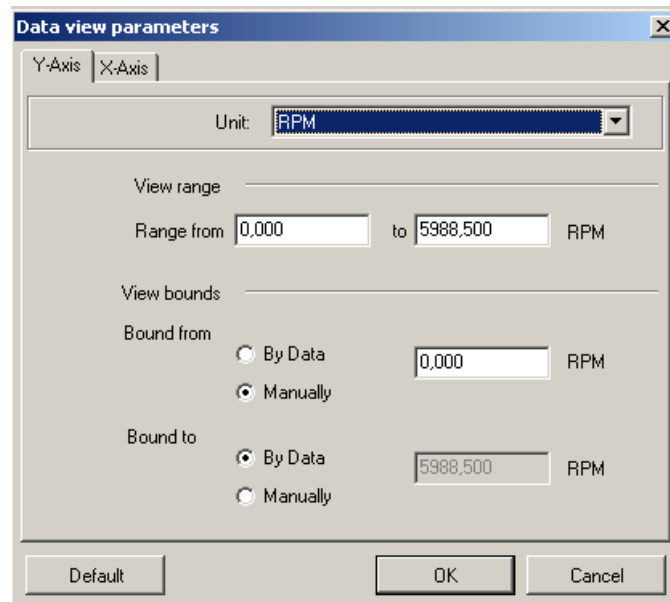
alarm and warning levels. You can estimate the machinery remaining time before failure at the crossing of prediction line and failure and warning levels.



**Figure 183 Linear trend prediction (dot line)—recommended to view along with A/W levels**

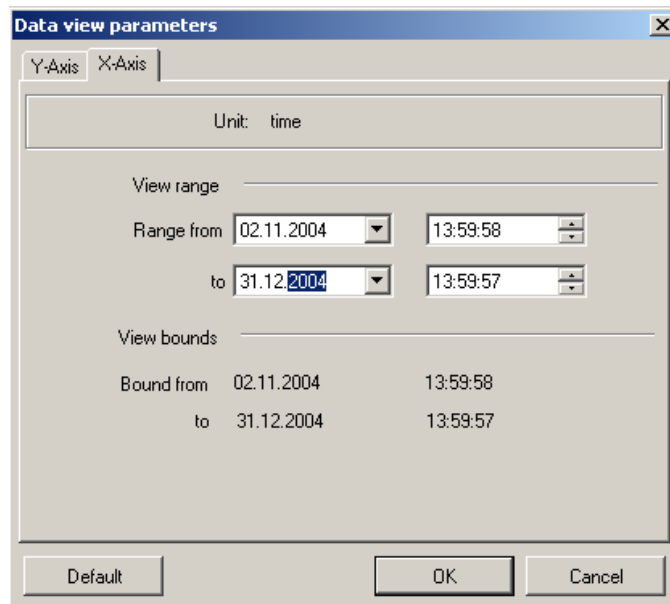
4. To adjust trend viewing parameters, click  on the right of the **View** button on the toolbar and select **Picture ranges** from the menu.

The **Data view parameters** dialog box appears.



**Figure 184 Data view parameters dialog box—Axis Y tab**

5. Select the measurement unit you need.
6. Specify the Y-Scale view range you need.
7. Click the **Axis X** tab.



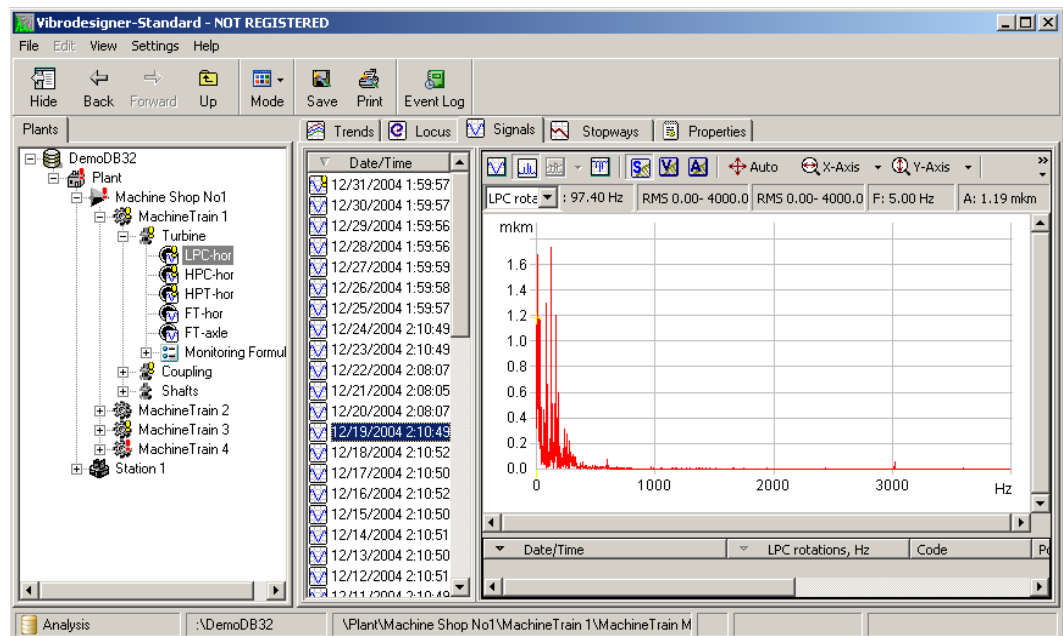
**Figure 185 Data view parameters dialog box—Axis X tab**

8. Specify the X-Scale view range you need.
9. Click **OK**.

## Viewing Spectra

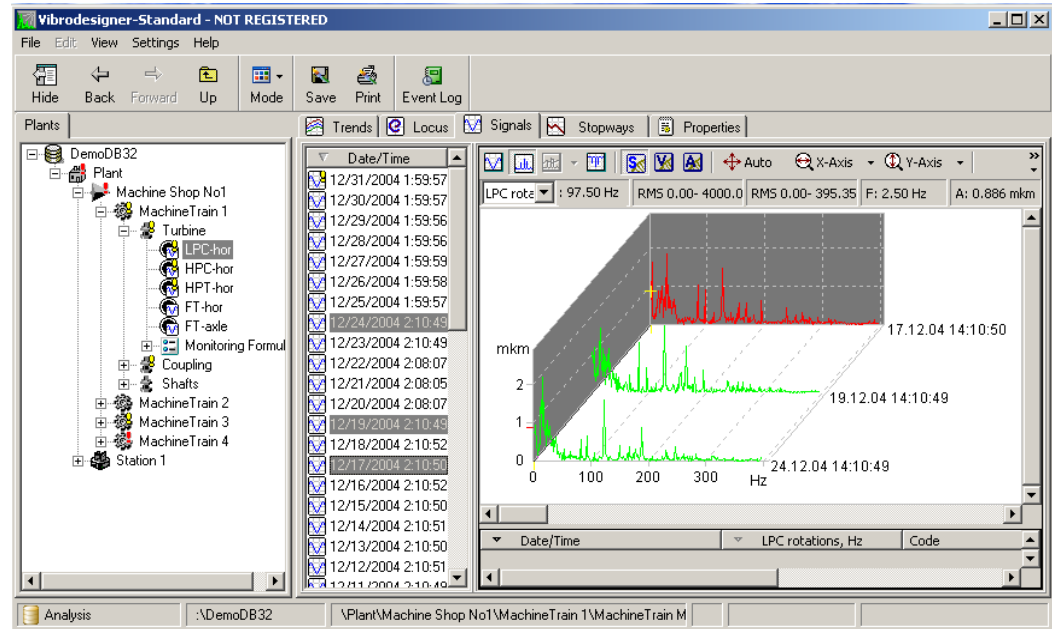
### Introduction

The picture below shows an example of displaying spectra. To display spectra, you select a spectrum from a certain inspection in the panel on the left of the graphs, and this spectrum is shown in the workspace on the right.



**Figure 186 Viewing spectra**

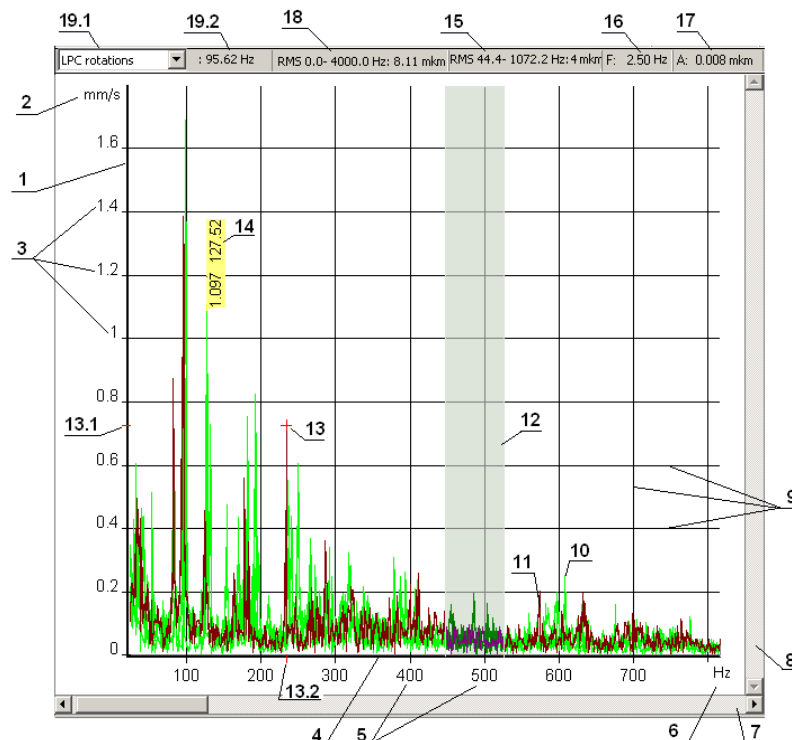
You can select multiple measurement points on the left of the graphs, holding down CTRL or SHIFT. As a result, multiple spectrum graphs will be displayed in the workspace.



**Figure 187 Viewing waterfall spectra**

## Spectrum Window Interface

The spectrum window interface is shown in the picture below.



**Figure 188 Spectrum window interface**



The spectrum window interface consists of the elements described below.

### **Waveform window interface**

ELEMENT	DESCRIPTION
1	Y axis.
2	Y axis measurement unit.
3	Y axis graduation marks.
4	X axis.
5	X axis graduation marks.
6	X axis measurement unit.
7	Horizontal scroll bar.
8	Vertical scroll bar.
9	Grid lines (can be disabled)
10	Spectrum graphs.
11	Active spectrum graph. The cursor [14] is moved along the active graph. The data in zones [15], [16] and [17] are displayed for the active graph.
12	One band of the active graph. Can be enabled/disabled.
13	Cursor. The cursor view and behavior are specified via the toolbar drop-down menu. The cursor is moved along the active graph. The current Y value under the cursor is marked with horizontal line on the Y axis [13.1]. The color of this mark matches the cursor color.
14	Label.
15	Active spectrum RMS within the current X.
16	Current X value under the cursor.
17	Current Y value under the cursor.
18	Active spectrum RMS within the specified range.
19	Selection list (19.1) and the value (19.2) of the fundamental frequency of the active graph.

## **Overview of Spectrum Window Features**

Besides the standard techniques applied to any graphs in Vibrodesigner-Standard (zooming, labeling, printing screen, saving data in BMP, CSV and Excel formats), you can perform the following operations with spectrum graphs:

- Display spectra in waterfall and 2D views
- Display spectrum profile in waterfall view
- Display absolute and relative bands in the workspace

- Adjust Fourier transformation settings
- Use linear and logarithm axes scale
- Modify X and Y measurement units
- Modify X and Y display ranges
- Display active spectrum RMS within the specified frequency range
- Display fundamental frequencies values
- Use harmonic cursor
- Set and change fundamental frequencies
- Set exact peak values


## Viewing Spectrum Settings

You can change the view of 3D spectrum graphs. To adjust waterfall spectra in 3D, use the mouse to move the cube diagonal.

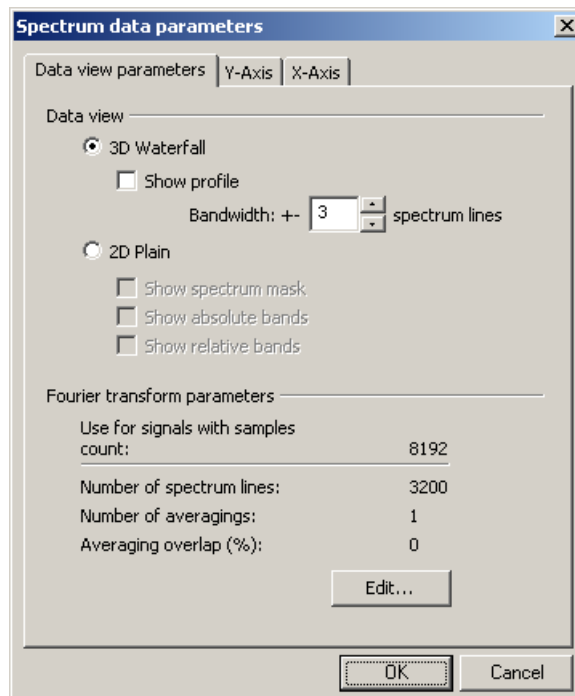


**Figure 189 Changing 3D spectra orientation**

### To adjust spectrum viewing parameters:

1. Click  on the right of the **View** button on the toolbar, and select **Data view options** from the menu.

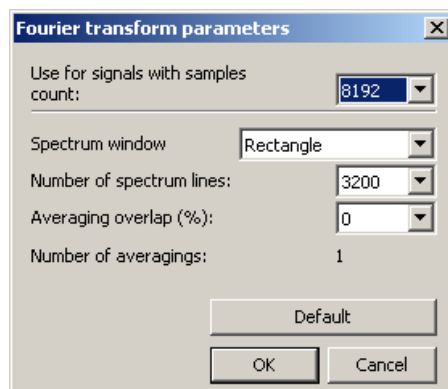
The **Spectrum data parameters** dialog box appears.



**Figure 190 Spectrum data parameters dialog box—Data view parameters tab**

2. To apply waterfall data view, select the **3D-Waterfall** option.
3. If you want to display spectrum profile, select the **Show profile** check box and specify the bandwidth for calculating RMS when displaying profile. For more information on spectrum profiles, see “Viewing Profiles.”
4. To apply 2D data view, select the **2D Plain** option.
5. To display absolute bands in the workspace, select the **Show absolute bands** check box.
6. To display relative bands in the workspace, select the **Show relative bands** check box.
7. To specify Fourier transformation parameters, click the **Edit** button.

The **Fourier transform parameters** dialog box appears.



**Figure 191 Fourier transform parameters dialog box**


8. From the list at the top of the dialog box, select the signal (containing a particular number of samples) which Fourier transformation are to be adjusted.
9. Specify the spectrum window of interest (rectangle or  $\cos^2$ ).
10. Specify the number of spectrum lines and overlapping percentage during averaging.
11. Click **OK** to save the changes.

---

**Note:** To specify the default Fourier conversion parameters, click the **Default** button..

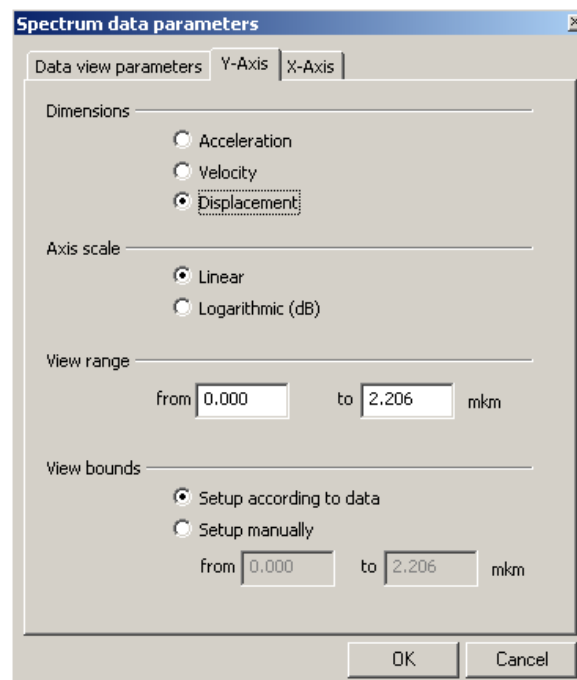
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### To specify Y axis parameters when viewing spectra:

1. Click  on the right of the **View** button on the toolbar, and select **Data view options** from the menu.

The **Spectrum data parameters** dialog box appears.

2. Click the **Y-Axis** tab.




**Figure 192 Spectrum data parameters dialog box—Axis Y tab**

3. Select the Y-Scale measurement unit you need.
4. Specify the Y-Scale type (*linear* or *logarithmic*) you need.
5. Specify the Y-Scale view range you need.
6. You can also specify the data viewing limits. If the **Setup according to data** option is selected, the maximum Y value will correspond to maximum value of actual data. If the **Setup manually** option is selected, you may set the limits that will exceed the specified view range.
7. Click **OK**.

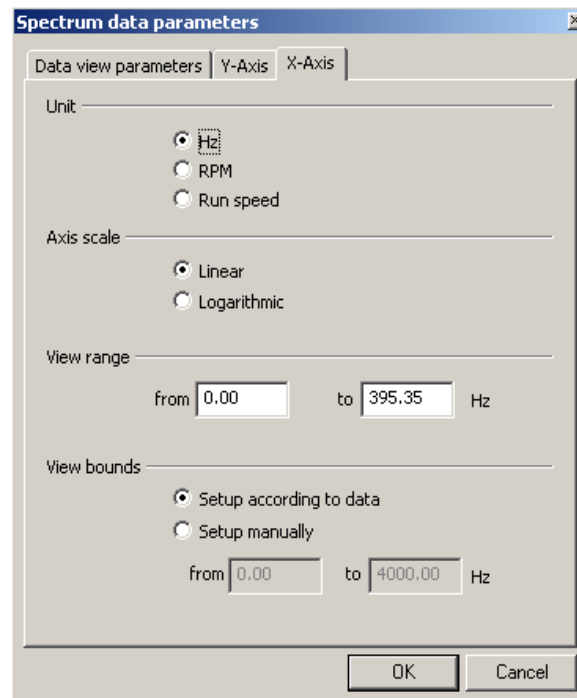
The changes are saved.

**To specify X axis parameters when viewing spectra:**

1. Click  on the right of the **View** button on the toolbar, and select **Data view options** from the menu.

The **Spectrum data parameters** dialog box appears.

2. Click the **X-Axis** tab.



**Figure 193 Spectrum data parameters dialog box—Axis Y tab**

3. Select the X-Scale measurement unit you need (Hz, RPM, or run speed).
4. Specify the X-Scale type (*linear* or *logarithmic*) you need.
5. Specify the X-Scale view range you need.
6. You can also specify the data viewing limits. If the **Setup according to data** option is selected, the maximum X value will correspond to maximum value of actual data. If the **Setup manually** option is selected, you may set the limits that will exceed the specified view range.
7. Click **OK**.

The changes are saved.

## Specifying Measurement Unit of Rotation Frequency

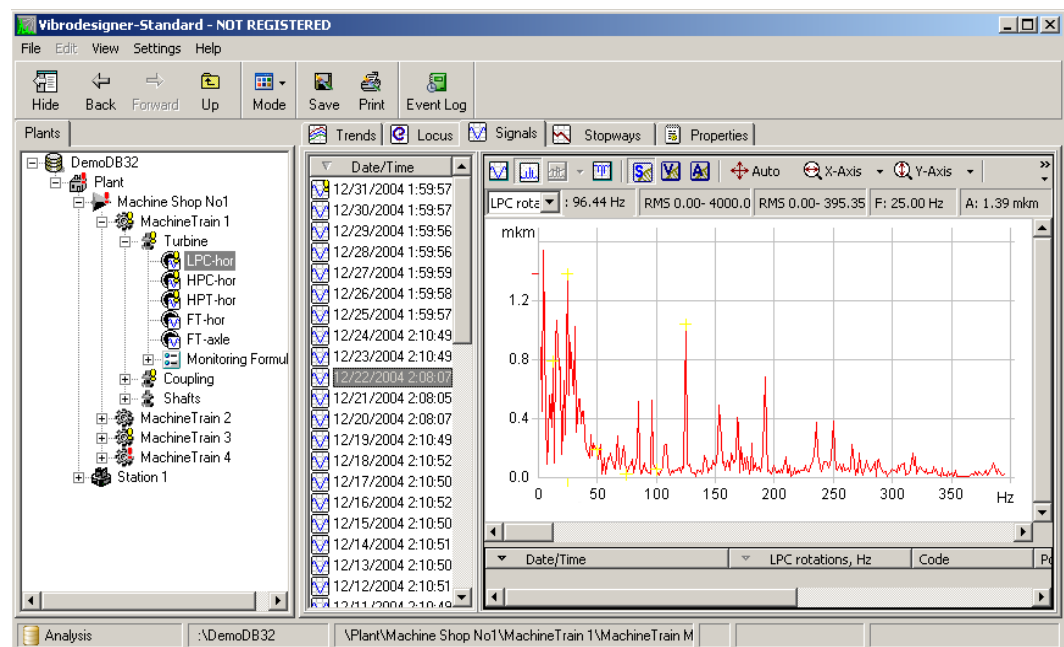
To specify measurement unit used to display fundamental frequency:

- Right-click in the workspace and select the measurement unit of interest (Hz or RPM) from the **Rotation frequency** menu.

The selected unit will be used when displaying fundamental frequencies in the list of parameters at the workspace bottom and on the upper panel.

## Cursor Settings

You can set a special cursor option named the *Harmonic cursor*. If this option is set, the cursor is multiplied, i.e. shows spectrum harmonics, half of the current frequency, as well as the current frequency.



**Figure 194** *Harmonic cursor displays multiple frequencies*

To set the harmonic cursor:

- Right-click in the workspace and select **Cursor > Harmonic** from the menu.

## Correcting Signal Peak

In some cases, you may encounter with a signal peak smearing when displaying spectra. Use the following procedure to define an actual peak value.

To correct a signal peak:

- Set the cursor on the peak of interest.

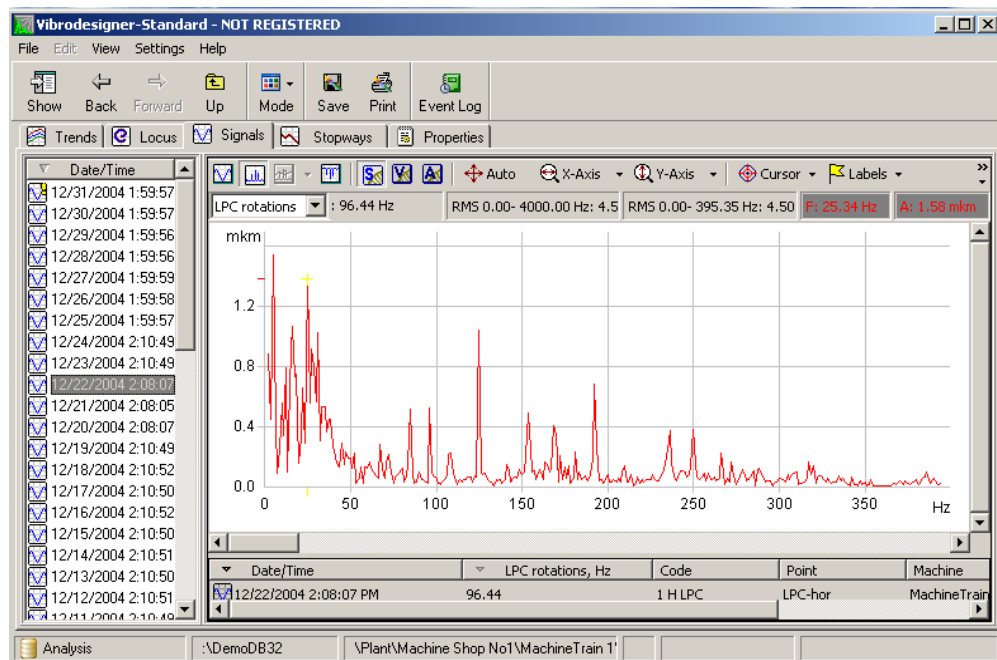
---

**Note:** Use the fixed cursor to set the cursor accurately.

---

- Press CTRL+A.

The magnitude and frequency of the signal are corrected. In the right upper corner of the window, you can see the corrected values in red.



**Figure 195 Correcting peak value**

## Assigning and Modifying Fundamental Frequencies

When displaying spectra, you can assign fundamental frequencies or modify values of existing fundamental frequencies.

### To assign a fundamental frequency:

1. Correct the peak value of the signal that correspond to the fundamental frequency.  
For more information, see “Correcting Signal Peak.”
2. Press CTRL+B.

The **Enter run speed value** dialog box appears.

The dialog box titled "Enter run speed value" contains the following fields and controls:

- Shaft:** FT rotations
- Inspection date / time:** 20.12.04 14:08
- Run speed value:** A text input field containing the value 126.25.
- Units:** Two radio buttons, **Hz** (selected) and **rpm**.
- Buttons:** OK and Cancel.

**Figure 196 Enter Run Speed Value dialog box**

3. Select the measurement unit of interest and type the fundamental frequency value.
4. Click **OK**.

The fundamental frequency value is saved.

### To modify a fundamental frequency value:

1. From the list above the spectrum graphs, select the fundamental frequency of interest.
2. Press CTRL+C.

The **Enter run speed value** dialog box appears.

3. Select the measurement unit of interest and type the new value of the fundamental frequency.
4. Click **OK**.

The fundamental frequency value is saved.

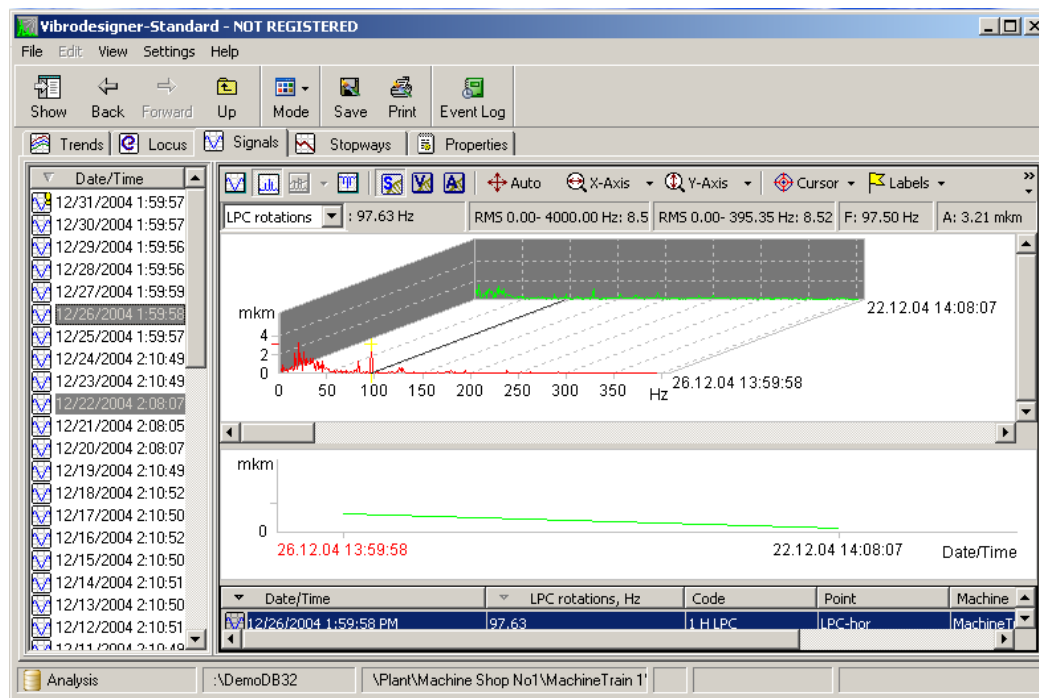
## Viewing Profiles

Vibrodesigner allows you to display so-called spectrum profiles. A profile represents the cross-section of 2D and 3D spectra. Each spectrum in waterfall view represents a time-extended vibration portrait of a certain measurement point. So, cross-section of waterfall spectra represents a trend which is similar to a trend in the frequency band.

### To show a profile of the selected spectrum:

- Right-click in the workspace, select Data view options from the menu and then select the **Show profile** check box.

A profile is displayed at the bottom of the workspace. It refers to the spectra section above which the cursor is placed.



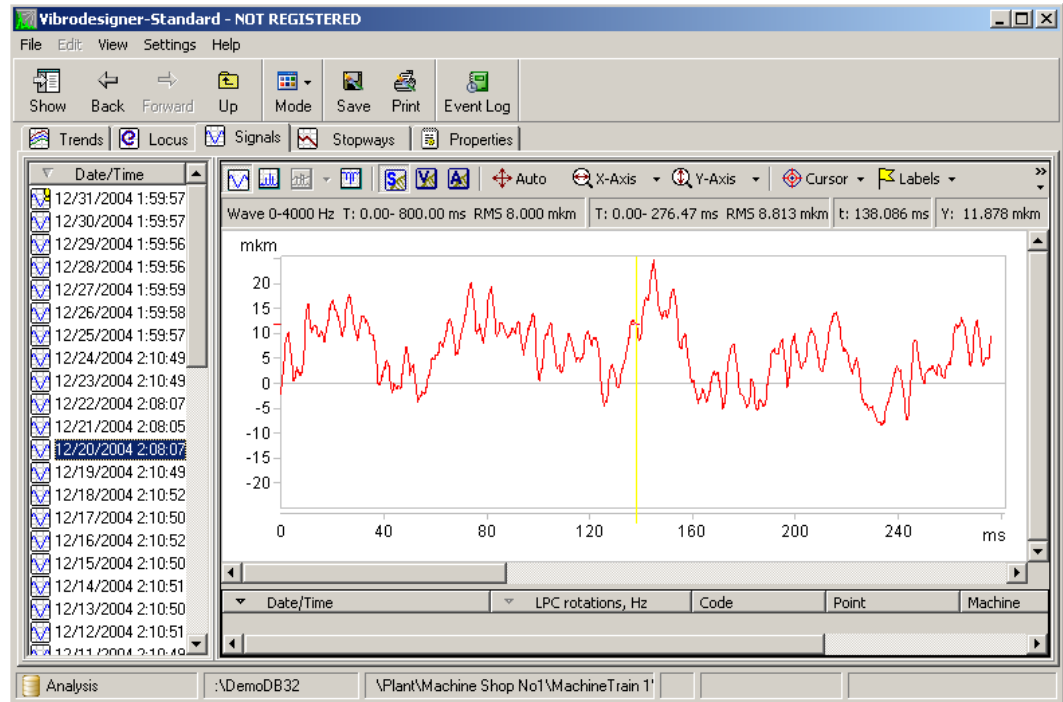
**Figure 197 Waterfall spectra profile**



## Viewing Waveform Graphs

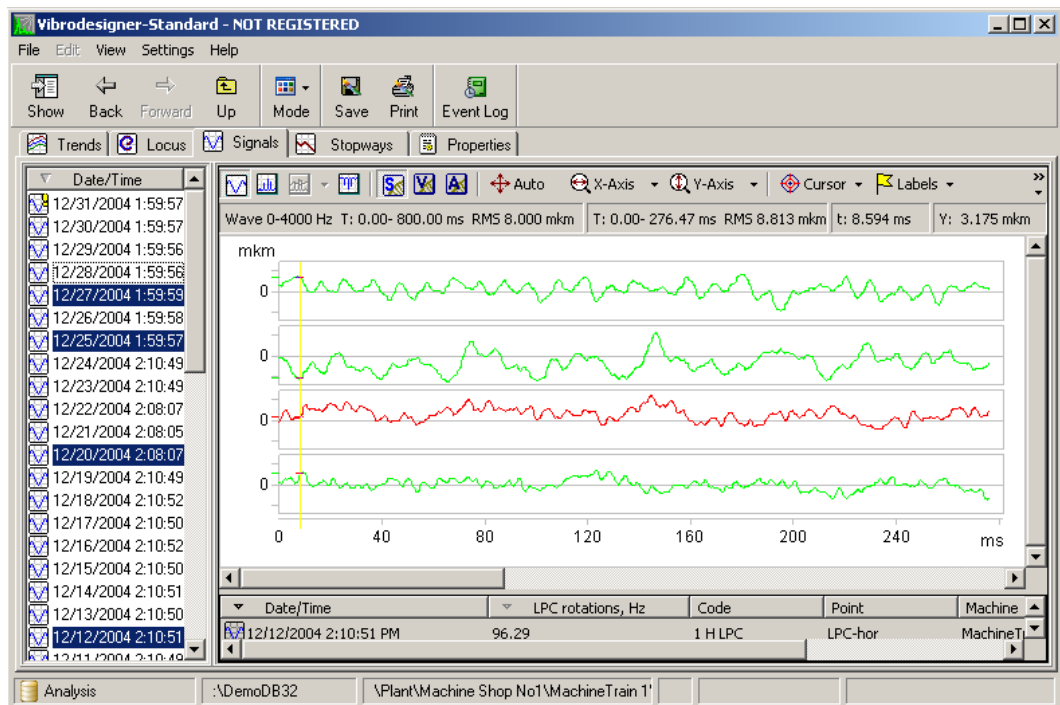
### Introduction

The picture below shows an example of displaying waveforms. To display waveforms, you select a waveform from a certain inspection in the panel on the left of the graphs, and this waveform is shown in the workspace on the right.



**Figure 198 Viewing waveform**

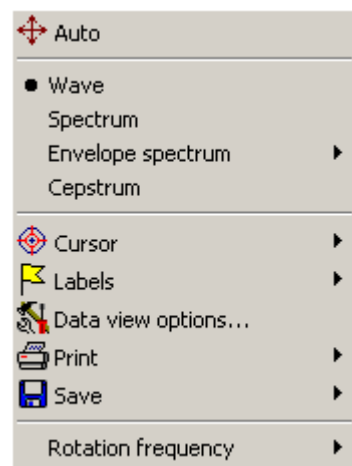
You can select multiple measurement points on the left of the graphs, holding down CTRL or SHIFT. As a result, multiple waveform graphs will be displayed in the workspace.



**Figure 199 Viewing four waveforms simultaneously**

Common commands to manage graphs are accessible:

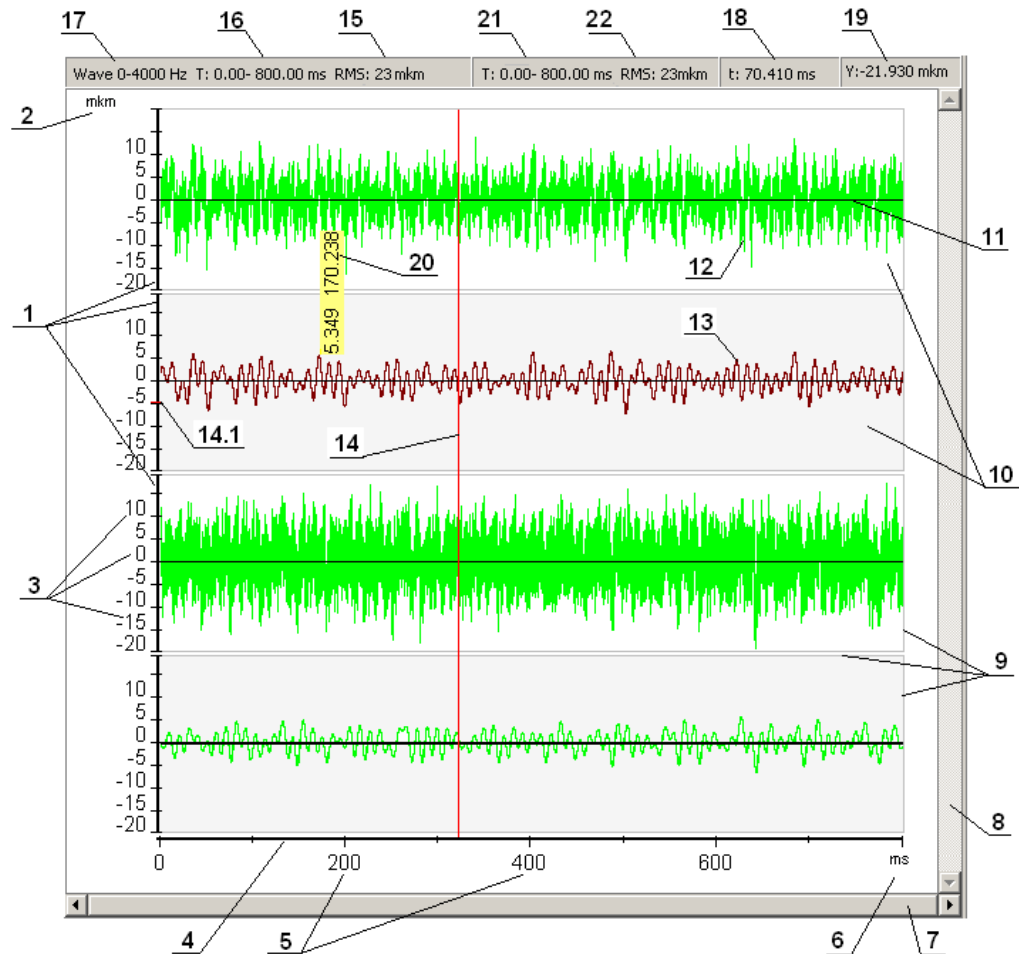
- From the context menu
- From the main menu
- On the toolbar



**Figure 200 Waveform context menu**

## Waveform Window Interface

The waveform window interface is shown in the picture below.



**Figure 201 Waveform window interface**

The waveform window interface consists of the elements described below.

### **Waveform window interface**

ELEMENT	DESCRIPTION
1	Y axes. The number of Y axes depends on the number of graphs in the workspace.
2	Y axis measurement unit (the same for all graphs).
3	Y axes graduation marks (the same for all graphs).
4	X axis.
5	X axis graduation marks
6	X axis measurement unit.
7	Horizontal scroll bar.
8	Vertical scroll bar.
9	Single graph frame.

10	Single graphs areas. The area is displayed as light-grey for filtered signals. The order of areas depends on specified signal sorting.
11	Zero-values axis displayed for each single graph area.
12	Single waveform graph.
13	Active waveform graph. The cursor [14] is moved along the active graph. The data in zones [15], [16], [17], [18] and [19] are displayed for the active graph.
14	Cursor. The cursor view and behavior are specified via the toolbar drop-down menu. The cursor is moved along the active graph. The current Y value under the cursor is marked with horizontal line on the Y axis [14.1]. The color of this mark matches the cursor color.
15	Active waveform or filtered signal RMS within the specified range [17] for the specified time period [16].
16	X axis limits of the active waveform.
17	Active waveform type (original or filtered) and the waveform frequency range.
18	Current X value under the cursor.
19	Current Y value under the cursor.
20	Label.
21	X axis viewing range of the active waveform.
22	Active waveform or filtered signal RMS within the specified range [17] for the specified time period [21].


## Overview of Waveform Window Features

Besides the standard techniques applied to any graphs in Vibrodesigner-Standard (zooming, labeling, printing screen, saving data in BMP, CSV and Excel formats), you can perform the following operations with waveform graphs:

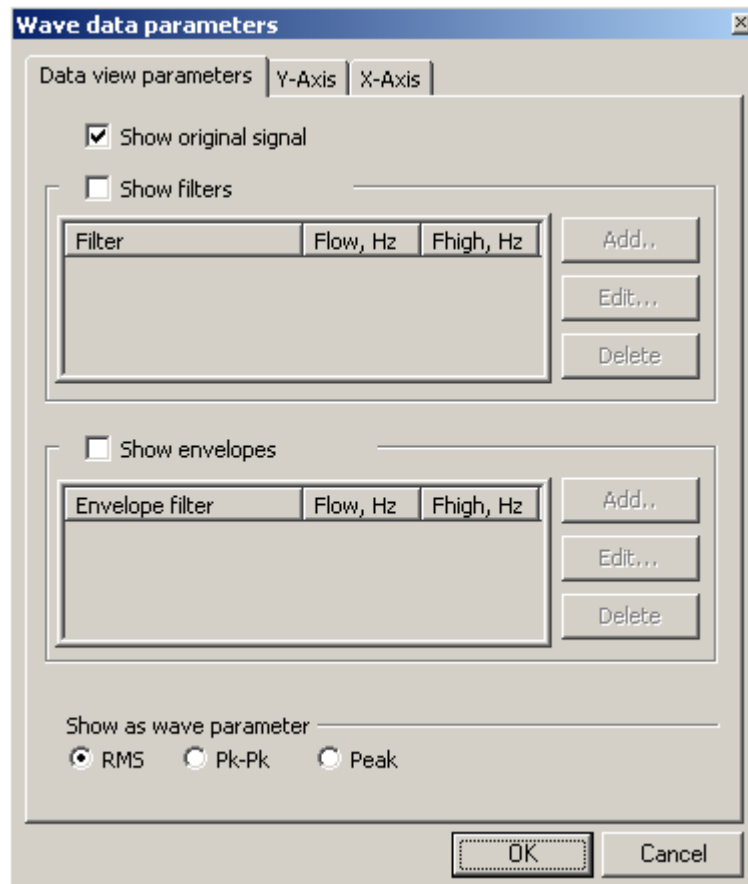
- Filter an original waveform with one or more than one filters so all the graphs are displayed in the workspace.
- View envelopes
- Modify Y axis measurement unit.
- Modify X and Y display ranges.
- Display active waveform or filtered signal RMS within the specified range for the specified time period.
- Specify measurement unit of fundamental frequency
- Use the locator cursor.

## Filters and Viewing Parameters

### To apply a filter:

1. Click  on the right of the **View** button on the toolbar and select **Data view options** from the menu.

The **Wave data parameters** dialog box appears.



**Figure 202 Wave data parameters dialog box**

2. Select the **Show filters** check box.
3. Select the check box on the left of the filter and click **OK**.

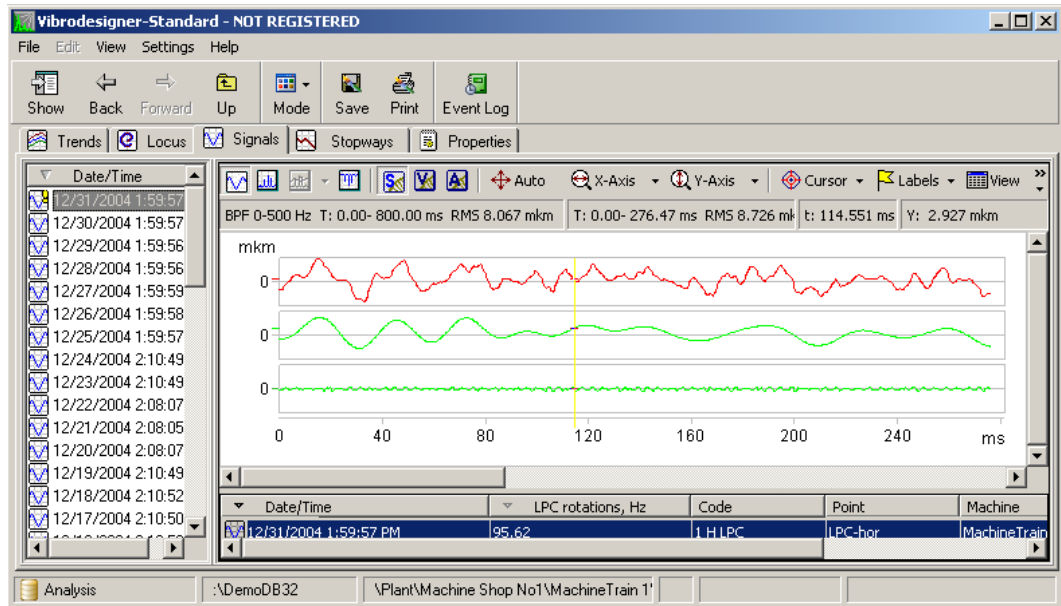
The filtered waveform is displayed in the workspace.

---

**Note:** If the **Show original signal** check box is selected, the original waveform is also displayed in the workspace.

---

Selecting multiple filters results in displaying multiple filtered waveforms. The picture below shows a waveform filtered by three different filters.



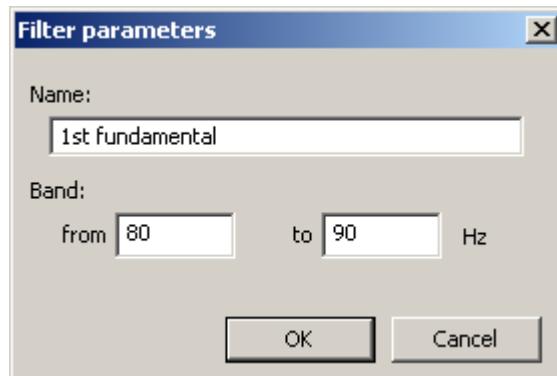
**Figure 203 Viewing three filtered waveforms**

As a result, you can compare the waveforms filtered by various filters.

**To add a new filter:**

1. On the **Data view parameters** tab, select the **Show filters** check box and click the **Add** button.

The **Filter parameters** dialog box appears.



**Figure 204 Filter parameters dialog box**

2. Type a name of the filter.
3. Specify the band range and click **OK**.

The created filter appears in the list of available filters.

**To modify filter parameters:**

1. In the **Filters** list, click the filter of interest and then click the **Edit** button.

The **Filter parameters** dialog box appears.

2. Modify the parameters you need and click **OK**.

**To delete a filter:**

1. In the **Filters** list, select the filter to be deleted and then click the **Edit** button.
2. Click **Yes** to confirm the deletion.

The selected filter is deleted.

**Viewing Envelopes****To view an envelope:**

1. On the **Data view parameters** tab, select the **Show envelopes** check box and click the **Add** button.

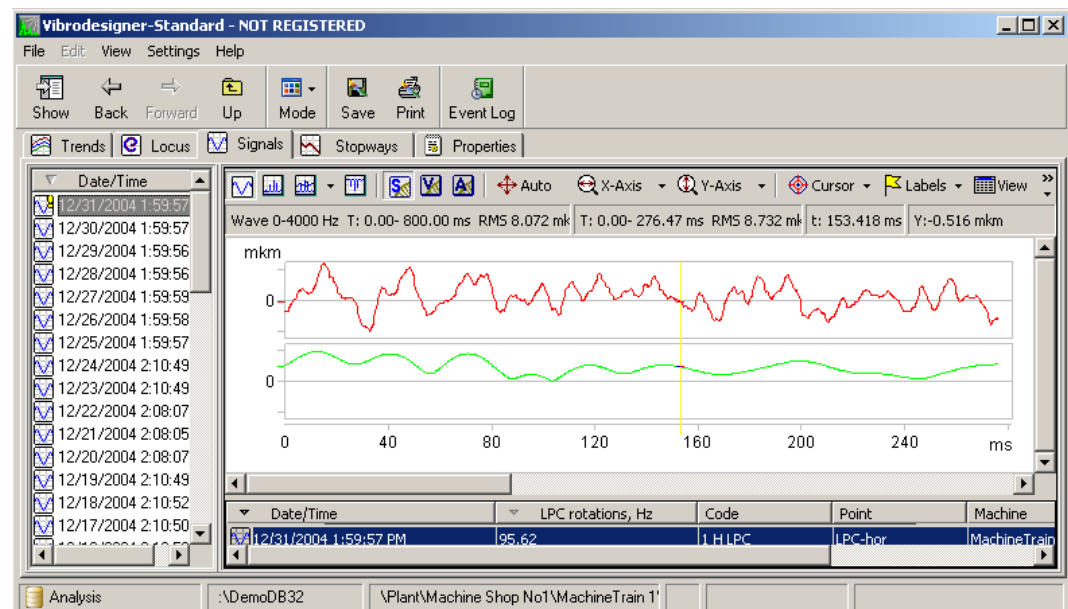
The **Filter parameters** dialog box appears.

4. Type a name of the filter.
5. Specify the band range of the envelope filter and click **OK**.

The created filter appears in the list of available envelope filters.


6. Select the check box on the left of the filter you need and click **OK**.

The envelope is displayed in the workspace as a separate graph.



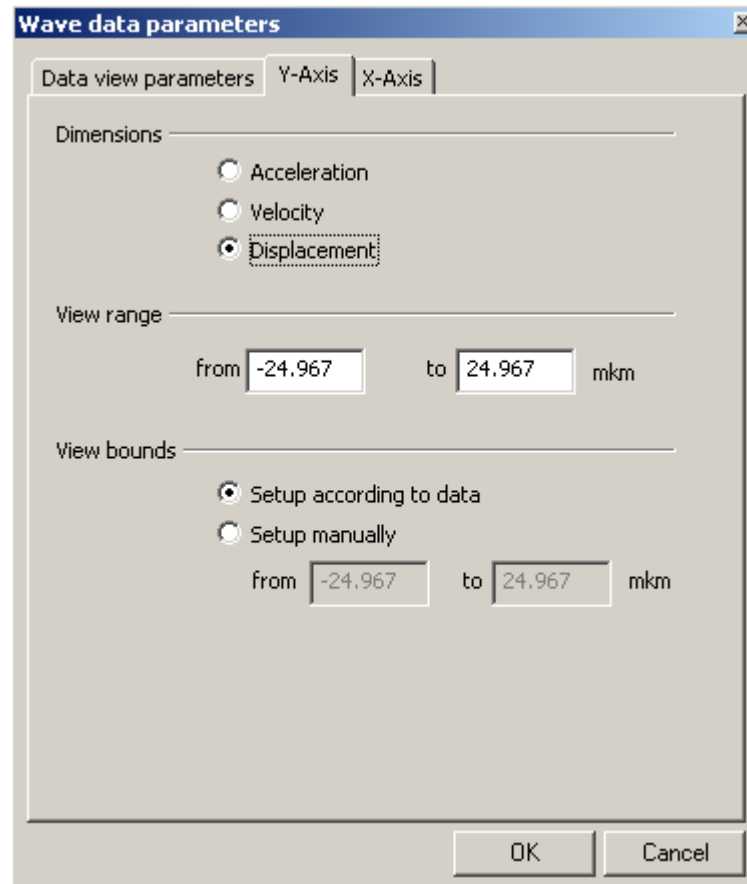
**Figure 205 Displaying envelope**

**Adjusting Waveform Parameters****To specify Y axis parameters when viewing waveforms:**

1. Click  on the right of the **View** button on the toolbar, and select **Data view options** from the menu.

The **Wave data parameters** dialog box appears.

2. Click the **Y- Axis** tab.




**Figure 206 Wave data parameters dialog box—Y-Axis tab**

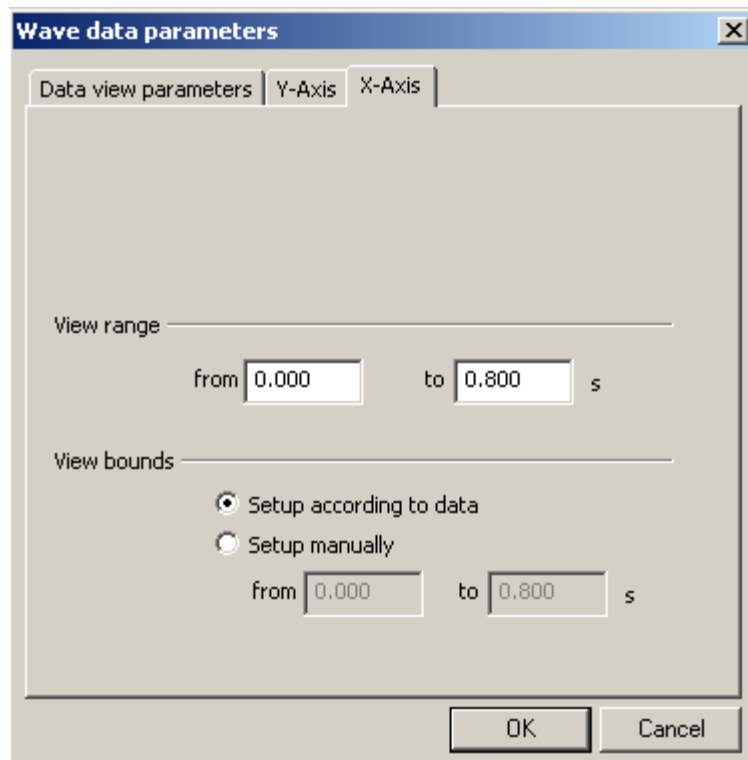
3. Select the Y-Scale measurement unit you need.
4. Specify the Y-Scale view range you need.
5. You can also specify the data viewing limits. If the **Setup according to data** option is selected, the maximum Y value will correspond to maximum value of actual data. If the **Setup manually** option is selected, you may set the limits that will exceed the specified view range.
6. Click **OK**.

The changes are saved.

#### **To specify X axis parameters when viewing spectra:**

1. Click  on the right of the **View** button on the toolbar, and select **Data view options** from the menu.  
The **Wave data parameters** dialog box appears.
2. Click the **X-Axis** tab.





**Figure 207 Wave data parameters dialog box—X-Axis tab**

3. Specify the X-Scale view range you need.
4. You can also specify the data viewing limits. If the **Setup according to data** option is selected, the maximum X value will correspond to maximum value of actual data. If the **Setup manually** option is selected, you may set the limits that will exceed the specified view range.
5. Click **OK**.

The changes are saved.

## Specifying Measurement Unit of Rotation Frequency

### To specify measurement unit used to display fundamental frequency:

- Right-click in the workspace and select the measurement unit of interest (Hz or RPM) from the **Rotation frequency** menu.

The selected unit will be used when displaying fundamental frequencies in the list of parameters at the workspace bottom and on the upper panel.

## Adjusting Cursor

You can set a special cursor option named *Locator*. If this option is set, the function value and argument (T) value will be displayed next to the cursor.



**Figure 208 Locator cursor**



**To apply the locator cursor:**

- Right-click in the workspace and select **Cursor > Locator** from the menu.

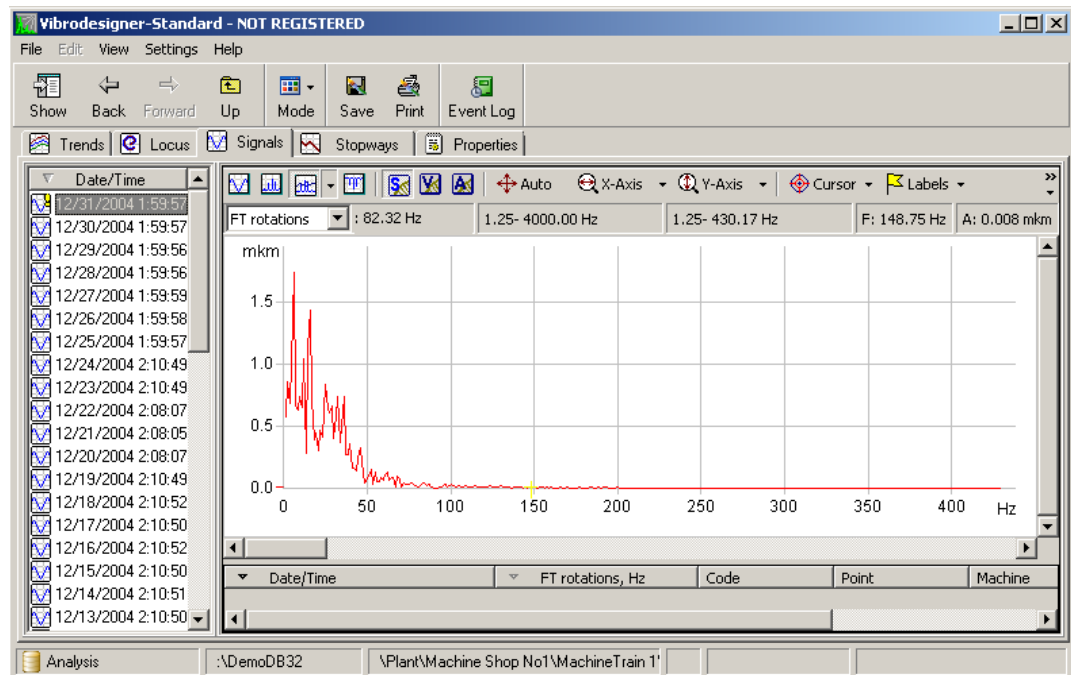
## Viewing Envelope Spectra

The picture below shows an example of displaying envelope spectra. To display envelope spectra, you select a signal from a certain inspection in the panel on the left of the graphs, and envelope spectrum of this signal is shown in the workspace on the right. Besides the standard techniques applied to any graphs in Vibrodesigner-Standard (zooming, labeling, printing screen, saving data in BMP, CSV and Excel formats), you can also perform operations specific for spectrum graphs (see “Overview of Spectrum Window Features”).

**To view envelope spectra:**

- Click  located on the right of the **Envelope Spectra** button () at the top of the workspace and select the envelope filter of interest (envelope filters have to be configured beforehand—for more information, see “Filters and Viewing Parameters.”)

The spectrum of the selected signal envelope is displayed in the workspace.



**Figure 209 Viewing envelope spectra**

## Viewing Orbit Graphs

### Introduction

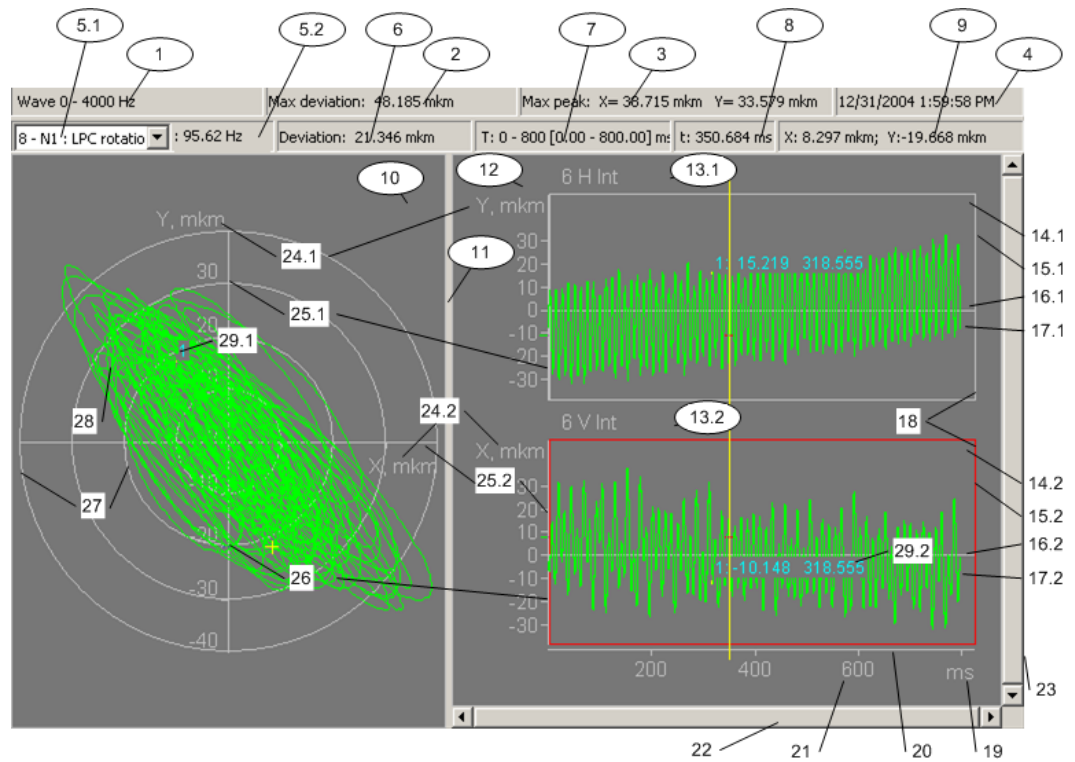
An *orbit* is a shaft's kinetic trajectory that represents quick in-bearing shaft's movements. A maintenance engineer can detect machine defects and their causes by analyzing orbit's shape, orbit's changes during operation time, maximum deviation and phase angle turn. Shaft cracks and changes of bearing and footing stiffness become apparent when analyzing changes of shaft's kinetic trajectory.

From the visual presentation viewpoint, an orbit is two waveforms recorded synchronously and displayed in a common coordinates—both coordinates of points are taken from waveform magnitudes (Y is taken from the first waveform; X is taken from the second waveform). Typically, an orbit measurement unit is mkm (vibration displacement). As a rule, an orbit is represented as two waveforms measured with two transducers in orthogonal directions in one machine point.

A phase label and a phase label trajectory (time-ordered phase labels connected with a line) are often shown on an orbit. A phase label is an orbit point that corresponds to the sync pulse from a tachometric transducer in case of shaft's complete rotation. Analyzing phase labels is an important part of orbit observation. A phase label trajectory allows you to assess misalignment relative to rotation axis.

### Orbit Window Interface

The orbit window interface is shown in the picture below.



**Figure 210 Orbit window interface**

The orbit window interface consists of the elements described below.

#### **Orbit window interface**

ELEMENT	DESCRIPTION
1	Orbit type (orbit of original or filtered signal).
2	Maximum orbit deviation. Defined by the time span specified by the user in display options.
3	Maximum magnitude of signals comprising the orbit. Defined by the time span specified by the user in display options.
4	Date and time when the orbit was captured.
5.1, 5.2	The rotation speed of selected machine shaft while measuring waveform.
6	Orbit deviation value for current orbit point.
7	Time span of displayed data.
8	Time label for current orbit point.
9	Signal peaks for current orbit point.
10	Orbit graph area (rectangular coordinate system).
11	Delimiter of zones 10 and 12.
12	Area of two waveforms comprising an orbit.
13.1, 13.2	Names of original signals.

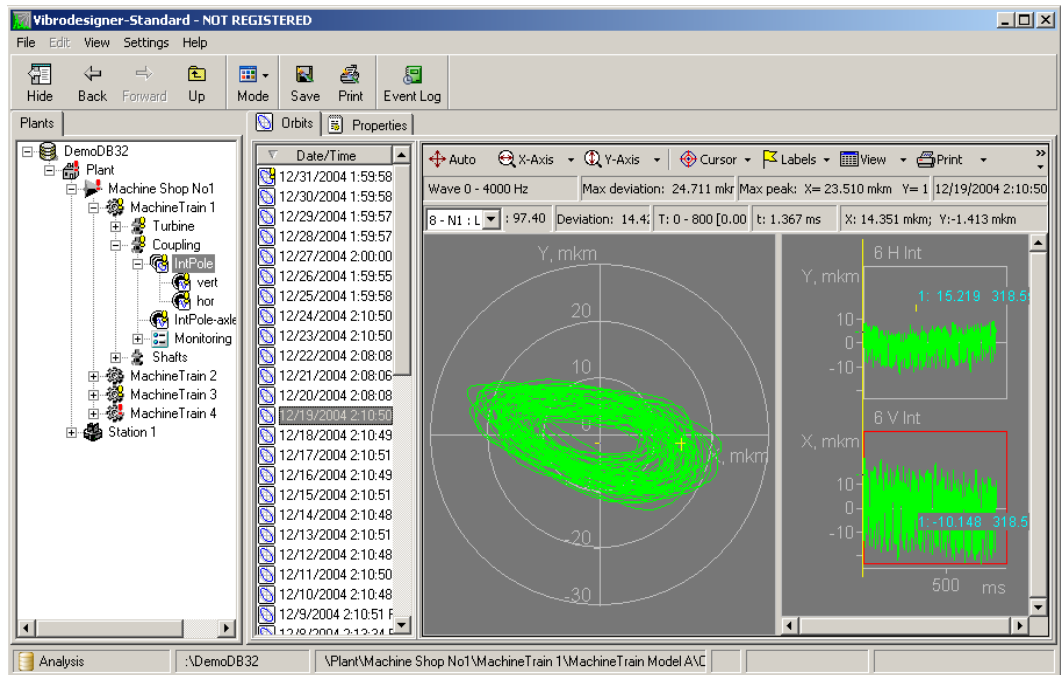
---

14.1, 14.2	Original signals areas.
15.1, 15.2	Original signal frames.
16.1, 16.2	Zero-values axis for original signal graphs.
17.1, 17.2	Original signal graphs.
18	Cursor.
19	Time axis.
20	Time axis graduation marks.
21	Time axis measurement unit (typically, ms or sec).
22	Horizontal scroll bar.
23	Vertical scroll bar.
24.1, 24.2	Measurement unit of orbit magnitude axis. Displayed on both signal and orbit graphs.
25	Magnitude axis for signals and orbit.
26	Y axes graduation marks. Displayed on both signal and orbit graphs.
27	Circular grid of an orbit graph (displays equal magnitude levels).
28	Orbit graph.
29.1, 29.2	Labels.

---

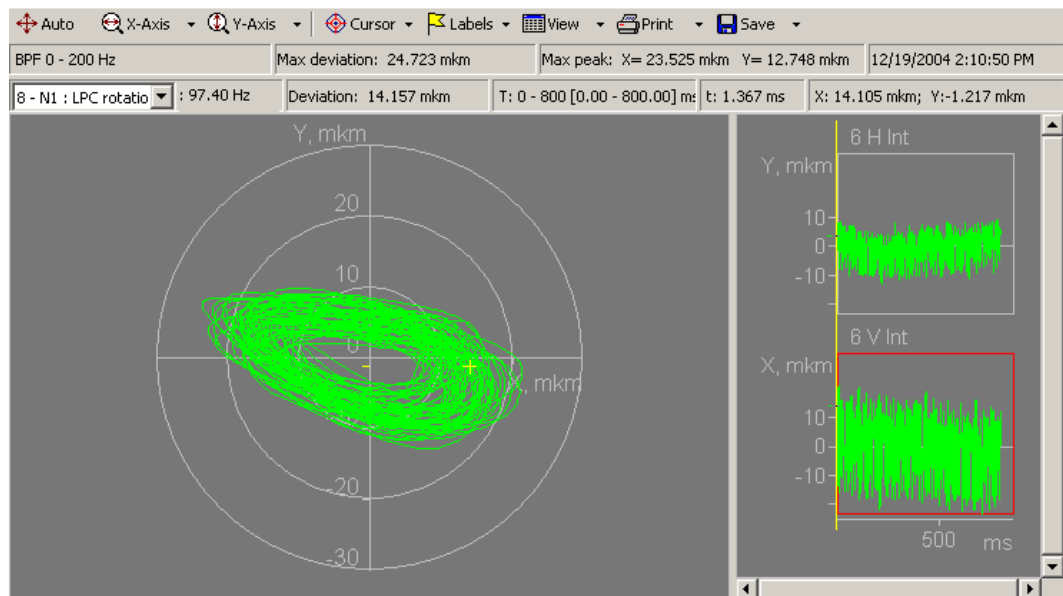
## Analyzing Orbits

Orbits in the 2-channel measurement points are displayed only if waveform type of signal has been specified for the channels in the Configuration mode. The picture below shows an example of the orbit displayed in the workspace.



**Figure 211 Viewing orbit**

You can work with the waveforms that form the orbit in the same way as with the normal waveforms, except for filtering. You can apply only one filter to the initial orbit. The picture below shows the filtered orbit and the waveforms that form the orbit. Above the graphs, which filter has been applied (in this case BPF 0-200 Hz).



**Figure 212 Filtered orbit**

The dialog box for adjusting filters can be called using:

- The context menu command (**Data view options**)
- The toolbar button (**View > Data view options**)

Only one orbit can be displayed in the workspace at a time. You are not allowed to select more than one element from the inspection list.

Besides, from the list above the orbit graph you can select fundamental frequency and thus view the value on the right of the list.


If synchronous waves are presented, the vertical lines are displayed on the original waveforms graph and phase labels and their trajectories are shown on the orbit graph. The vertical lines correspond to synchronous pulses used for retrieving phase labels.

## Viewing Cepstra

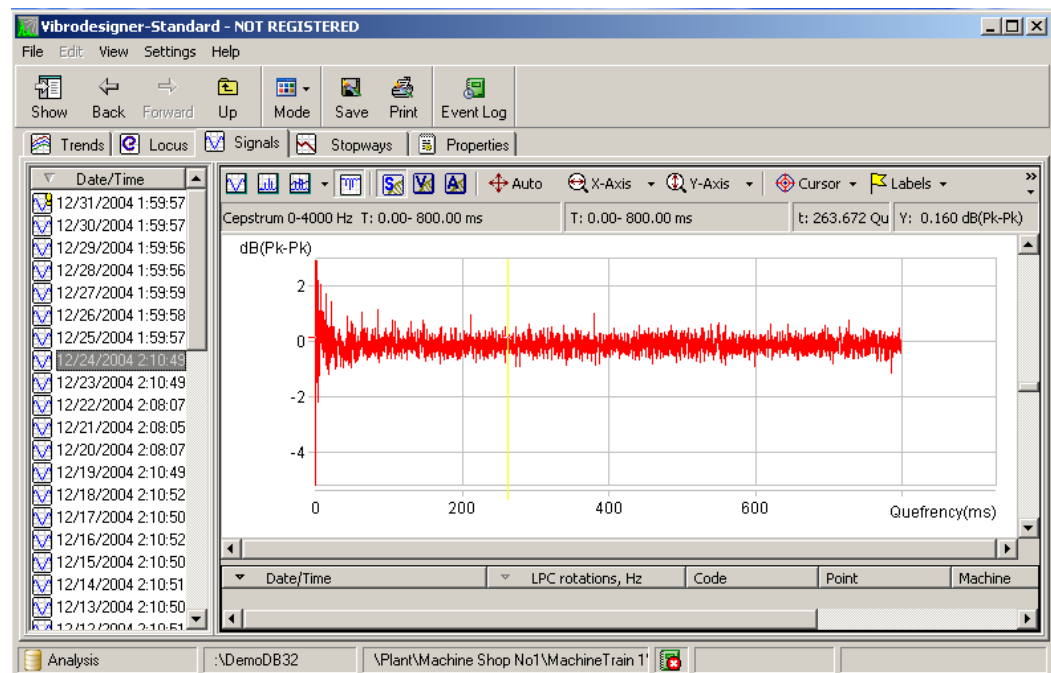
Cepstra is a spectrum of original signal spectrum logarithm. In some cases, analyzing cepstra helps locate not obvious sequences in original signal.

The picture below shows an example of displaying cepstra. To display cepstra, you select a signal from a certain inspection in the panel on the left of the graphs, and cepstra of this signal is shown in the workspace on the right. You can perform standard operations with cepstra graphs (zooming, labeling, printing screen, saving data in BMP, CSV and Excel formats).

### To view cepstra:

- Click  at the top of the workspace.


A signal cepstrum is displayed in the workspace.



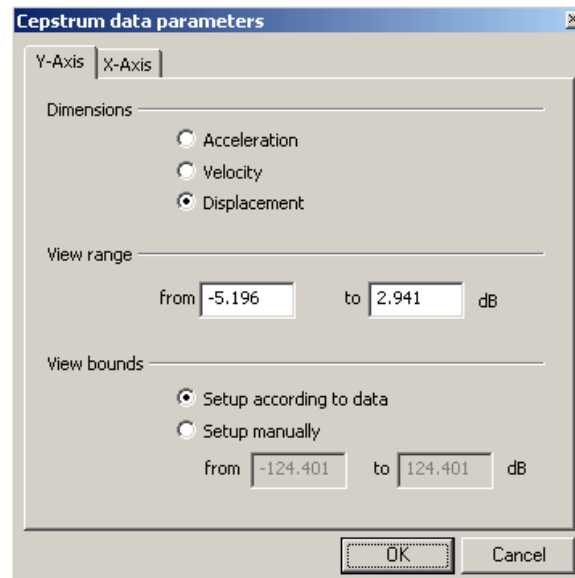
**Figure 213 Viewing cepstra**

## Viewing Cepstra Settings

### To specify Y axis parameters when viewing cepstra:

1. Click  on the right of the **View** button on the toolbar, and select **Data view options** from the menu.

The **Cepstrum data parameters** dialog box appears.




**Figure 214 Cepstrum data parameters dialog box—Axis Y tab**

2. Select the Y-Scale measurement unit you need.
3. Specify the Y-Scale view range you need.
4. You can also specify the data viewing limits. If the **Setup according to data** option is selected, the maximum Y value will correspond to maximum value of actual data. If the **Setup manually** option is selected, you may set the limits that will exceed the specified view range.
5. Click **OK**.

The changes are saved.

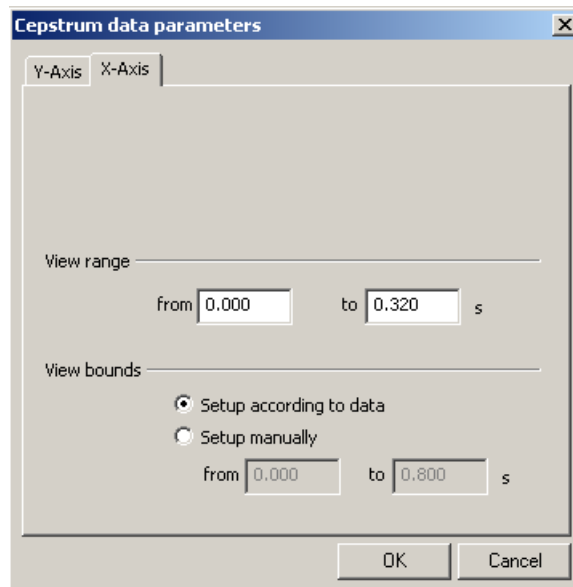
### To specify X axis parameters when viewing cepstra:

1. Click  on the right of the **View** button on the toolbar, and select **Data view options** from the menu.

The **Cepstrum data parameters** dialog box appears.

2. Click the **X-Axis** tab.





**Figure 215 Cepstrum data parameters dialog box—Axis Y tab**

3. Specify the X-Scale view range you need.
4. You can also specify the data viewing limits. If the **Setup according to data** option is selected, the maximum X value will correspond to maximum value of actual data. If the **Setup manually** option is selected, you may set the limits that will exceed the specified view range.
5. Click **OK**.

The changes are saved.

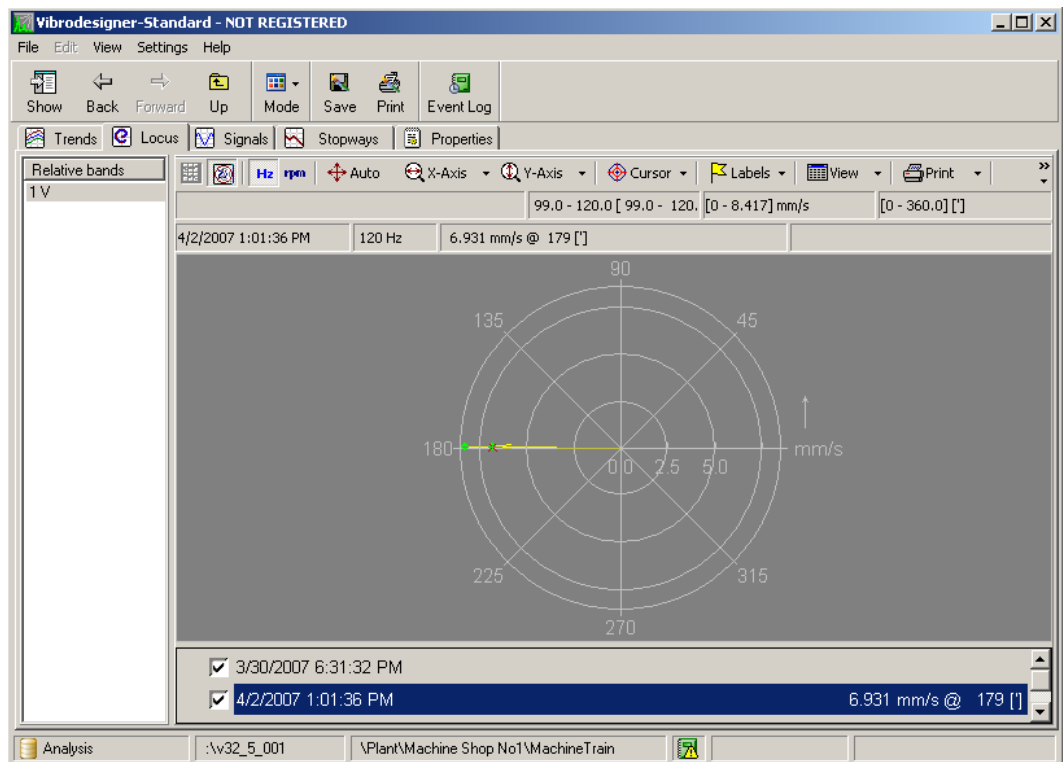
## Viewing Hodographs

The **Locus** tab contains a Nyquist diagram in a special stationary mode. In this mode, all data are captured on the same rotation frequency. Each curve (hodograph) on such a graph is degenerated and consists the only point.

The Nyquist diagram displays in polar coordinates a set of shaft vectors. Each point on the diagram corresponds to latest measure of the same signal harmonic performed during latest inspection. Data for Nyquist diagram are taken from archive database (all measurements are to be made in the same machine operating mode). Thus, the Nyquist diagram shows how amplitude/phase of the selected harmonic is changing in time when the operating mode is stable.

If starting from a certain instant the signal amplitude and phase significantly differ from previous measures (or from a reference measure that was made when the machine was working properly), it indicates some machinery changes and should attract your attention. Typically, to define allowable levels, the uncertainty zone (circle) is drawn for the reference measure. If all measurement are within this zone, there are no progressive defects at the moment.

The picture below shows an example of hodograph.



**Figure 216 Viewing hodographs**

The panel on the left displays the list of relative bands that contain phase data. Selecting one of the relative bands refreshes the diagram.

---

**Note:** For more information on Nyquist diagram, see “Working with Nyquist Diagram.”

---

## Comparison Submode

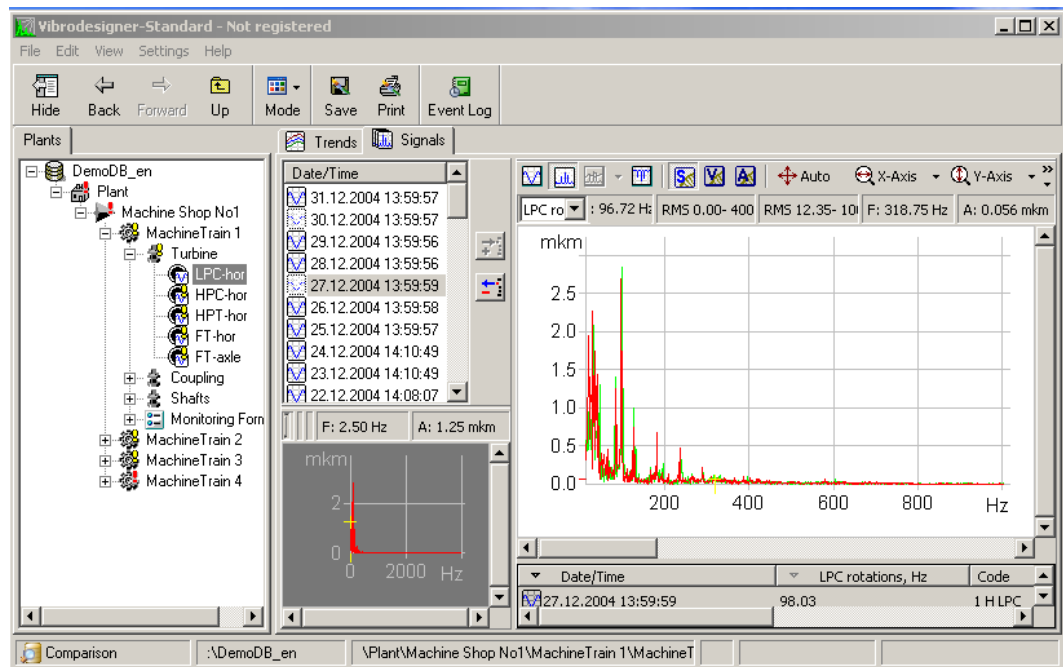
### Introduction

Vibrodesigner has a special Comparison mode designed to help you analyze graphical data. In the Comparison submode, all the features described above are at your disposal. The main difference from the normal mode is that you can simultaneously view spectra/waveforms from various machines that may belong to the different machine shops.

There are some limitations on viewing spectra in a machine measurement point. There is no use in viewing profiles due to a profile of the waterfall spectrum is useful only when all spectra were measured in the same point at different times. Generally, a waterfall spectrum in the Comparison submode may contain the spectra from different machine points and even different machines. Thus, you cannot view profile in the Comparison submode.

#### To switch to the Comparison mode:

- From the **View** main menu, select **Mode > Comparison**.



**Figure 217 Comparison submode**

In the Comparison submode, the **Signals** and **Trends** tabs are displayed in the workspace. These tabs allow you to view spectra, waveforms, and trends from various points of different machines. It facilitates the analysis and comparing vibration on different machines.

**Note:** In this mode, you can display less than 36 trends at the same time.

If the workspace displays spectra (waveforms/trends) in the normal mode, the same graphs are displayed after switching to the Comparison submode. On quitting the Comparison submode, the workspace displays the same data as before switching to the Comparison mode.


## Changing Structure of Waveforms, Spectrums and Trends

This section describes how to add waveforms into the view pane on the **Signals** tab. Unless specified otherwise, use the same procedures for spectra.

The Vibrodesigner screen in the Comparison submode consists of five panes:


- The plant hierarchy is displayed on the left. The machines and measurement points where at least one waveform has been measured are available.
- The middle upper pane contains the list of waveforms for the selected measurement point.
- The middle lower pane allows you to preview the waveform that can be added in the view pane.
- The right upper pane displays the selected waveform graphs (the **View** pane).
- The right lower pane shows the list of selected waveforms.

**To add a signal into the view pane:**

1. In the Comparison mode, click the **Signals** tab.
2. In the plant hierarchy on the left, select the measurement point you need.
3. In the middle upper pane, select one or more waveforms.
4. Drag the selected waveform(s) in the view pane (or use the  button.)
5. If necessary, select other measurement points of the same or different machine and add them in the view pane in the same way.

Trends on the **Trends** tab are added in the view pane in the same way as for signals.

**To delete the selected spectra, waveforms, and trends from the list:**

- Click  above the inspection list.

## Viewing Coast-downs

A *machine coast-down* is a non-steady operating mode when the shaft frequency is steady decreasing after engine has been switched off. Coast-downs are analyzed on the **Stopways** tab after selecting the point of interest. You can view data on three tabs:

- The **F (t)** tab displays how a certain parameter is changing during period.
- The **F (n)** tab displays how a certain parameter depends on a shaft rotation frequency.
- The **Response** tab displays amplitude-frequency response and phase-frequency response as Bode and Nyquist diagrams.

The main purpose of the **Stopways** window is displaying machinery vibration characteristics for analysis. The changes of selected harmonic or operating parameters are displayed in the workspace, and each graph displays characteristics of one parameter, but for different coast-downs.

---

**Note** It should be noticed that the workspace contains only those data that correspond to strictly decreasing rotation frequency, that is, to the coast-down event.

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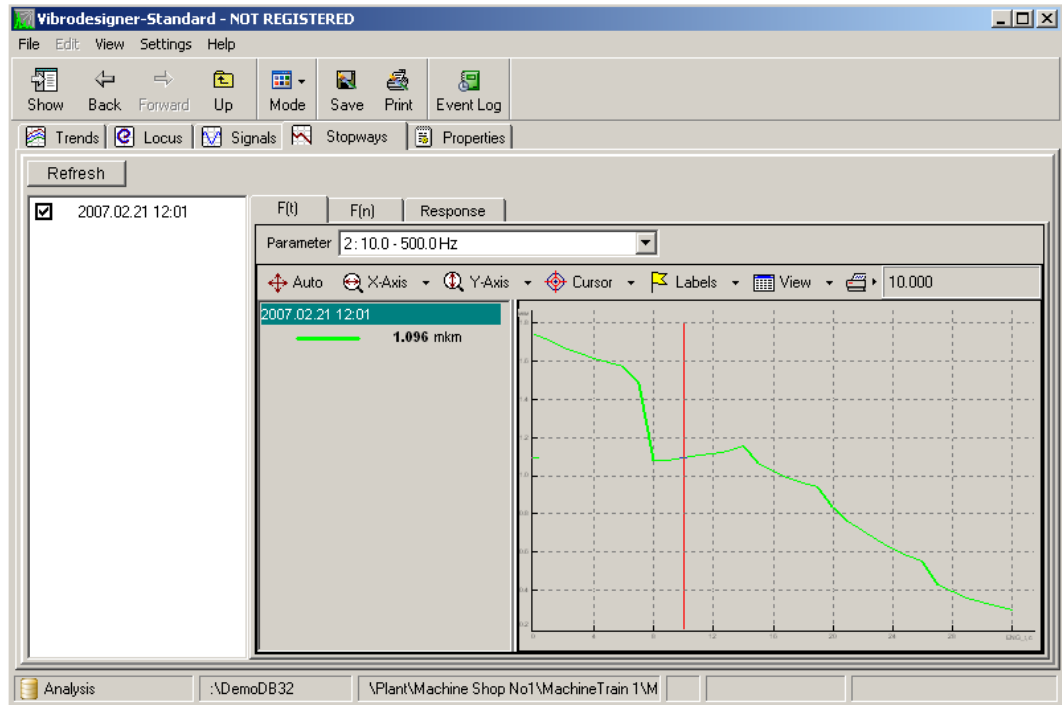
The coast-down analysis allows you to resolve various diagnostics issues, e.g., defining rotor self-resonance frequencies. The coast-down pattern help to define rotor bearing condition, gaps between rotatory and non-rotatory parts and so on. You can view on a single screen one or more graphs captured for different coast-downs.

**To start working with coast-downs:**

1. In the Analysis mode, select the machine point of interest.
2. Select the **Stopways** tab on the right.

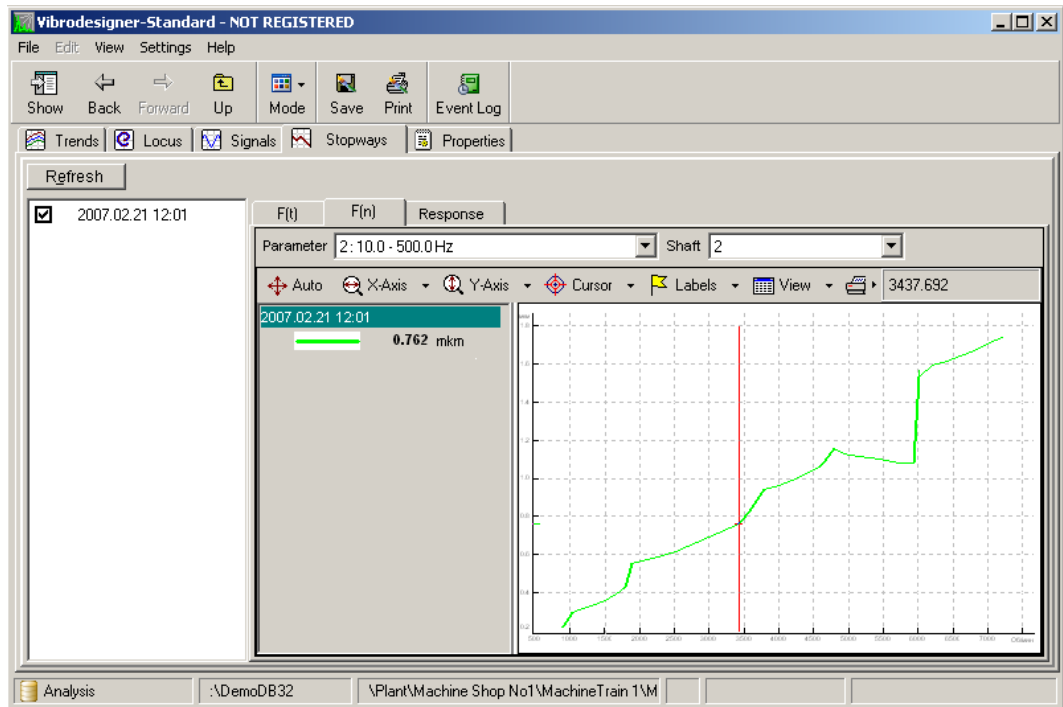
The workspace displays how a certain parameter is changing during period (the **F (t)** tab). You can perform standard operations applicable to every graph (zooming,

labeling, printing screen, saving data in BMP, CSV and Excel formats). For more information, see “Standard Techniques.”



**Figure 218 Viewing coast-downs— $F(t)$  tab**

3. Select the check box on the left of the latest coast-down on the list.
4. From the **Parameter** list, select the parameter of interest and click the **Refresh** button.  
The graph in the workspace refreshes.
5. To display how a certain parameter depends on rotation frequency, select the **F (n)** tab. You can perform standard operations applicable to every graph (zooming, labeling, printing screen, saving data in BMP, CSV and Excel formats). For more information, see, “Standard Techniques.”



**Figure 219 Viewing coast-downs—F(n) tab**

6. Select the check box on the left of the latest coast-down on the list.
7. From the **Parameter** list, select the parameter of interest.
8. In the **Shaft** list, select the machine shaft which frequency will be displayed on the X axis and click the **Refresh** button.

The graph in the workspace refreshes. You can view multiple coast-downs at the same time. If curves behavior has remarkable distinctions, you need to proceed with in-depth analysis.

9. To view Nyquist and Bode diagrams, click the **Response** tab. For more information on these diagrams, refer to next sections.

## Working with Nyquist Diagram


The Nyquist diagram displays vibration amplitude and phase as a vector in polar coordinates. Each diagram point is defined by length of vector (vibration amplitude) drawn from coordinates origin, and by counter wise phase. The line that connects diagram points in rotation frequency change sequence is a *hodograph*. The point order corresponds to a shaft rotation frequency.

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**Note:** The Nyquist diagram data are taken from files received from a ASTD-2 machine shop system.

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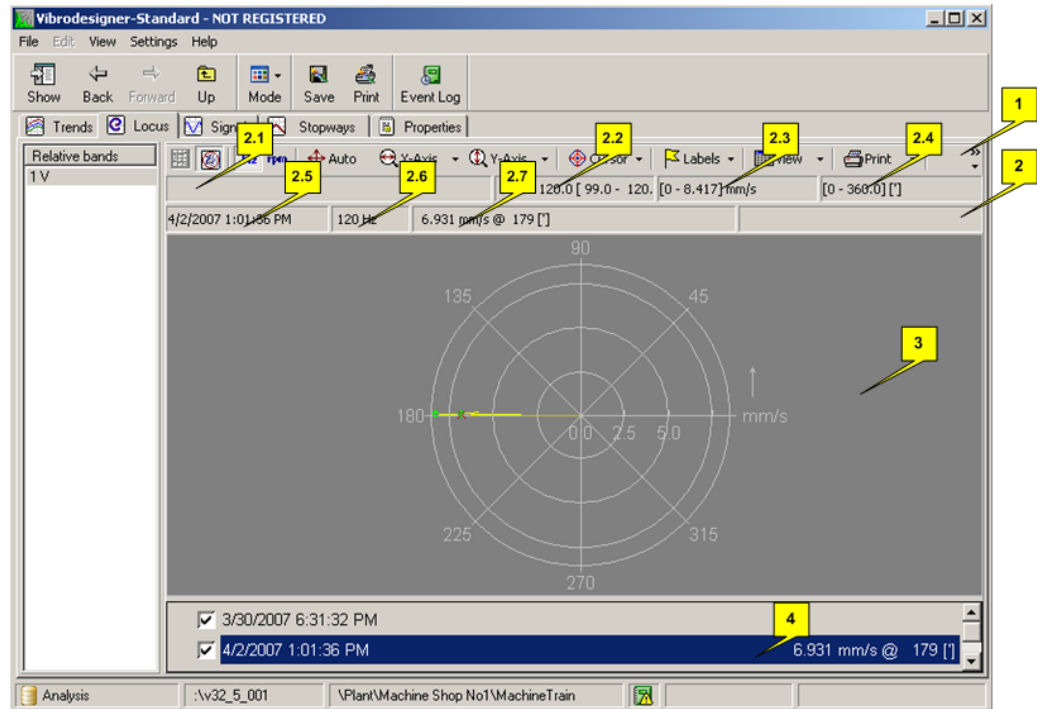
### To start viewing a Nyquist diagram:

- Click  on the **Response** tab.

**Note:** A special type of Nyquist diagram (stationary data mode) is displayed on the **Locus** tab. For more information, see “Viewing Hodographs.”

## Interface of Nyquist Diagram Window

The Nyquist diagram window interface is shown in the picture below.



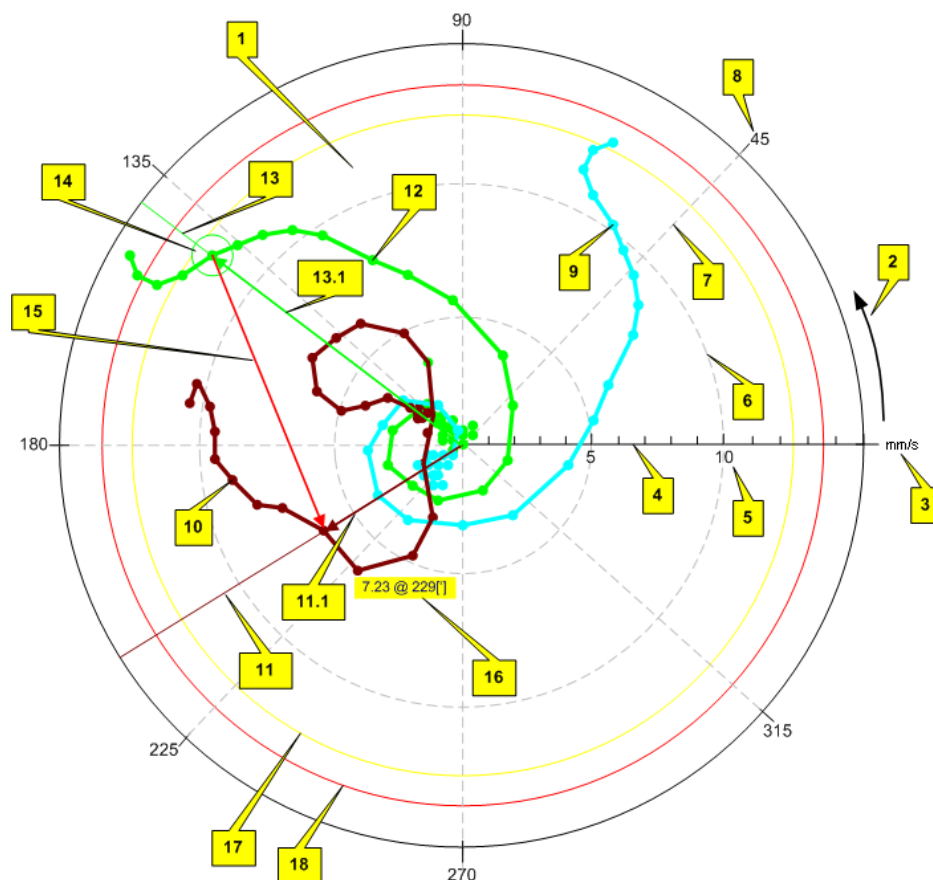
**Figure 220 Interface of Nyquist diagram window**

The Nyquist diagram window interface consists of the elements described below.

### Nyquist diagram window interface

ELEMENT	DESCRIPTION
1	Toolbar.
2	Information panel.
2.1	Name of displayed parameter.
2.2	Full and displayed data ranges (by rotation frequency).
2.3	Full and displayed data ranges (by amplitude).
2.4	Full and displayed data ranges (by phase).
2.5	Current date and time of current graph.
2.6	Current rotation frequency of current graph.
2.7	Current vibration vector value of active graph. In brackets—corresponding vibration vector value of reference graph.
3	Graphical window.

Main elements of a Nyquist diagram are shown in the picture below.



**Figure 221 Main elements of Nyquist diagram window**

#### **Main elements of Nyquist diagram window**

ELEMENT	DESCRIPTION
1	Circular area of Nyquist diagram.
2	Arrow indicating angle count direction.
3	Measurement unit of vibration vector amplitude.
4	Amplitude axis.
5	Amplitude axis graduation marks.
6	Circular grid (represents equal amplitude levels).
7	Radial grid (represents equal phase values).
8	Phase axis graduation marks (in degrees).
9	Non-active graph (can be more than one).
10	Active graph.



11	Cursor.
11.1	Current vibration vector.
12	Reference graph.
13	Reference graph cursor.
13.1	Reference vibration vector.
14	Uncertainty circle. Defines an allowable uncertainty zone of vibration vector for this rotation frequency.
15	Change vector (vector subtraction between current and base vibration vectors).
16	Label.
17, 18	Circles that correspond to alarm and warning amplitudes of vibration vector.

## Overview of Nyquist Diagram Window Features

Besides the standard techniques applied to any graphs in Vibrodesigner-Standard (zooming, labeling, printing screen, saving data in BMP, CSV and Excel formats), you can perform the following operations with Nyquist diagrams:

- Modify X axis measurement unit
- Modify contents of displayed data
- Specify/discard a reference measure

### To specify X axis measurement unit:

- On the toolbar, click the **Hz** button (Hertz will be displayed on the X axis) or the **rpm** button (rotations per minute will be displayed on the X axis).

### To change contents of displayed data:

- To remove original measurements from vibration vector, select check boxes on the left of the measurements.
- To add measurements into vibration vector, clear check boxes on the left of the measurements you need.

### To specify a reference measure:

1. Select the graph that will be displayed as referenced.
2. Right-click in the workspace and select **Assign reference graph** from the menu.

The selected graph will be displayed with green mark on the left in the parameters list.



**To discard a reference measure:**

- Select the graph of interest, right-click in the workspace and select **Assign reference graph** from the menu.

The green mark for the selected graph will be discarded.

## Viewing Nyquist Diagram Settings

1. Right-click in the workspace and select **Data view options** from the menu.


The **Data view options – Nyquist diagram** dialog box appears.

2. If you need to display labels, select the **Show labels** check box and select the label type of interest.
3. You can display current vibration vector, reference vector, uncertainty zone, change vectors and alarm vibration levels having selected the check box you need.

## Working with Bode Diagram

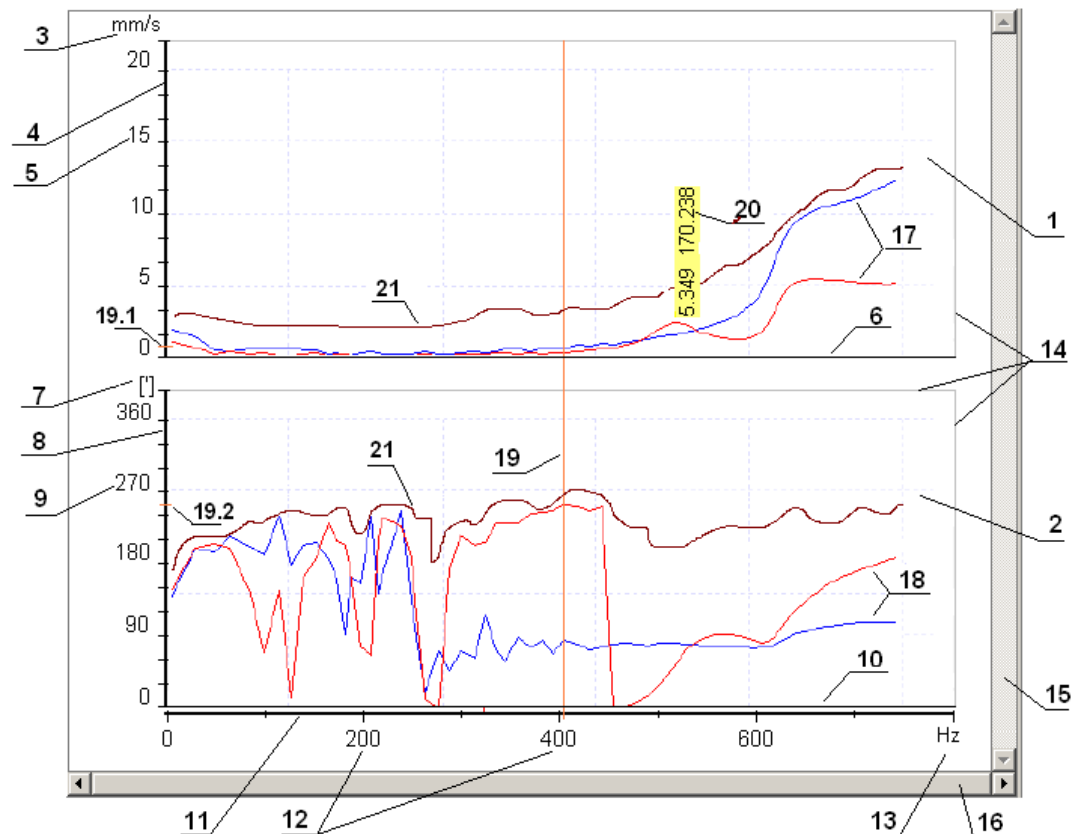
The Bode diagram shows how vibration harmonic amplitude and phase depends on shaft rotation frequency. The Bode diagram analysis allows you to resolve various diagnostics issues. Analyzing amplitude-frequency and phase-frequency curves obtained by measuring vibration parameters on engine bearings during rotor coast-down is the main criteria for locating transverse crack on the engine rotor shaft.

**To start viewing a Bode diagram:**

- Click  on the **Response** tab.

## Interface of Bode Diagram Window

The Bode diagram window interface is shown in the picture below.



**Figure 222 Main elements of Bode diagram window**

### Bode diagram window interface

ELEMENT	DESCRIPTION
1	Rectangular area for displaying amplitude-frequency response.
2	Rectangular area for displaying amplitude-phase response.
3	Measurement unit of amplitude-frequency response Y axis.
4	Amplitude-frequency response Y axis.
5	Graduation marks of amplitude-frequency response Y axis.
6	Amplitude-frequency response zero-values axis.
7	Measurement unit of amplitude-phase response Y axis.
8	Amplitude-phase response Y axis.
9	Graduation marks of amplitude-phase response Y axis.
10	Amplitude-phase response zero-values axis.
11	X axis.
12	X axis graduation marks.

13	Measurement unit of X axis.
14	Rectangular area frames.
15	Vertical scroll bar.
16	Horizontal scroll bar.
17	Amplitude-frequency response graphs.
18	Amplitude-phase response graphs.
19	Cursor.
20	Label.
21	Lines of reference Bode diagram. Used to compare two diagrams.

---

## Overview of Bode Diagram Window Features

Besides the standard techniques applied to any graphs in Vibrodesigner-Standard (zooming, labeling, printing screen, saving data in BMP, CSV and Excel formats), you can perform the following operations with Nyquist diagrams:

- Modify X axis measurement unit
- Modify contents of displayed data
- Specify/discard a reference measure
- Use the locator cursor

### To specify X axis measurement unit:

- On the toolbar, click the **Hz** button (Hertz will be displayed on the X axis) or the **rpm** button (rotations per minute will be displayed on the X axis).

### To change contents of displayed data:

- To remove original measurements from vibration vector, select check boxes on the left of the measurements.
- To add measurements into vibration vector, clear check boxes on the left of the measurements you need.

### To specify a reference measure:

1. Select the graph that will be displayed as referenced.
2. Right-click in the workspace and select **Assign reference graph** from the menu.  
The selected graph will be displayed with green mark on the left in the parameters list.



**To discard a reference measure:**

- Select the graph of interest, right-click in the workspace and select **Assign reference graph** from the menu.

The green mark for the selected graph will be discarded.

**To apply the locator cursor:**

- Right-click in the workspace and select **Cursor > Locator** from the menu.

## Viewing Daily Trends Retrospect

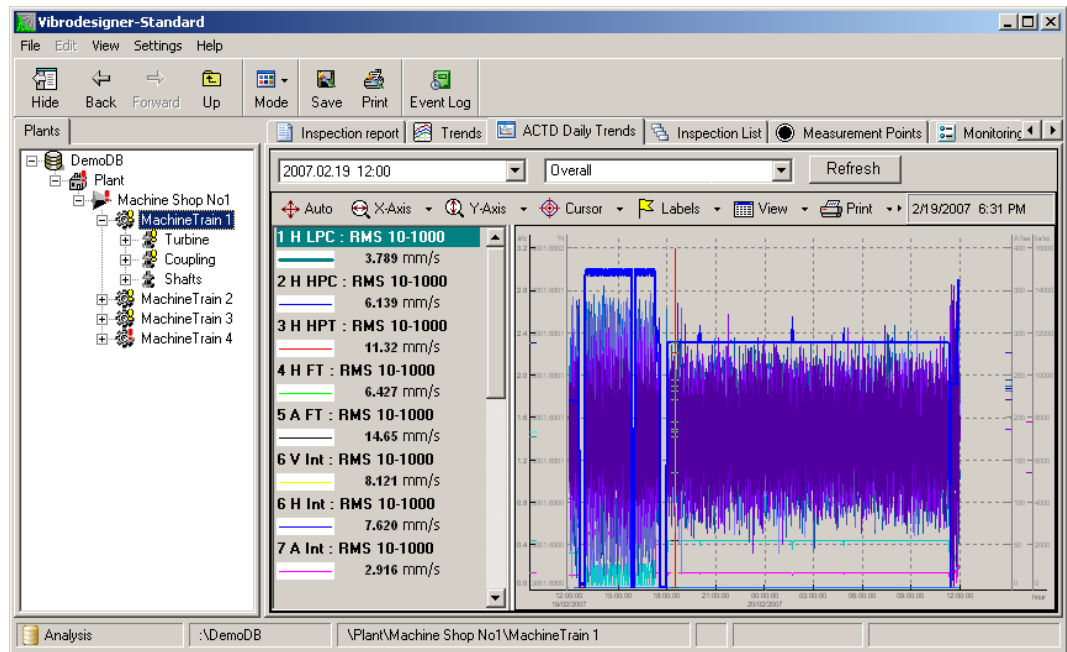
The ASTD-2 machine shop system enables you to save so called *machine daily trends*—slices of scalar vibration and monitoring parameters (band RMS, shaft amplitudes and phases, signal peak-peak values, rotations, operating parameters). Each slice is saved into a high-resolution (up to 1 sec) daily trend file. Typically, data for previous 1-3 months are stored. Retrospect of such daily trends allows locating fast-developing or accidental process on machines. This significantly helps a maintenance engineer to monitor machinery condition effectively. On the contrary, analyzing archive inspection data allows detecting steady-developing processes that usually affected by:

- Gradual machinery aging
- Operating conditions
- Steady minor defects affecting the entire machinery condition.

**To display daily trend retrospect:**

1. In the Analysis mode, select the machine of interest.
2. Click the **ACTD Daily Trends** tab on the right.

Archive daily trends are displayed in the workspace.



**Figure 223 Viewing daily trends retrospect**

3. Select the trend of interest in list above the workspace.  
This list contains date and time when the trend was archived.
4. Select the trend set of interest and click the **Refresh** button.

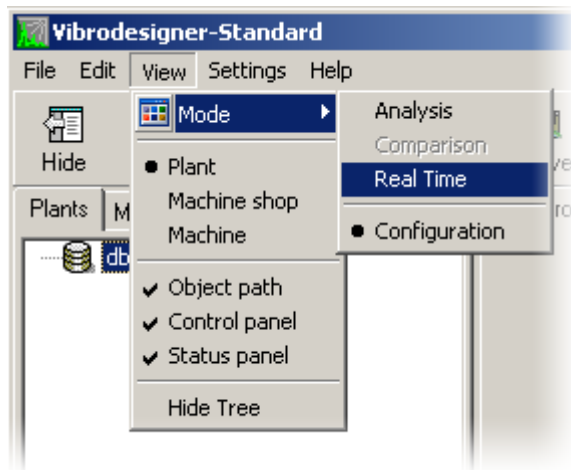
## Real-time Monitoring

### Introduction

Having installed the Vibrodesigner-RT patch, you can monitor real-time vibration data received from ASTD-2 machine shop systems or CTD-2060/2160/3168 monitors via LAN. This significantly expands abilities of real-time machine diagnostics. On request, the program enables you to view current spectra, waveforms, orbits, and trend sets of machine parameters. In Real Time mode, requests are directed to a ASTD-2 server or CTD-2060/2160/3168 monitors (but not to the Vibrodesigner database).

#### To switch to the Real Time mode:

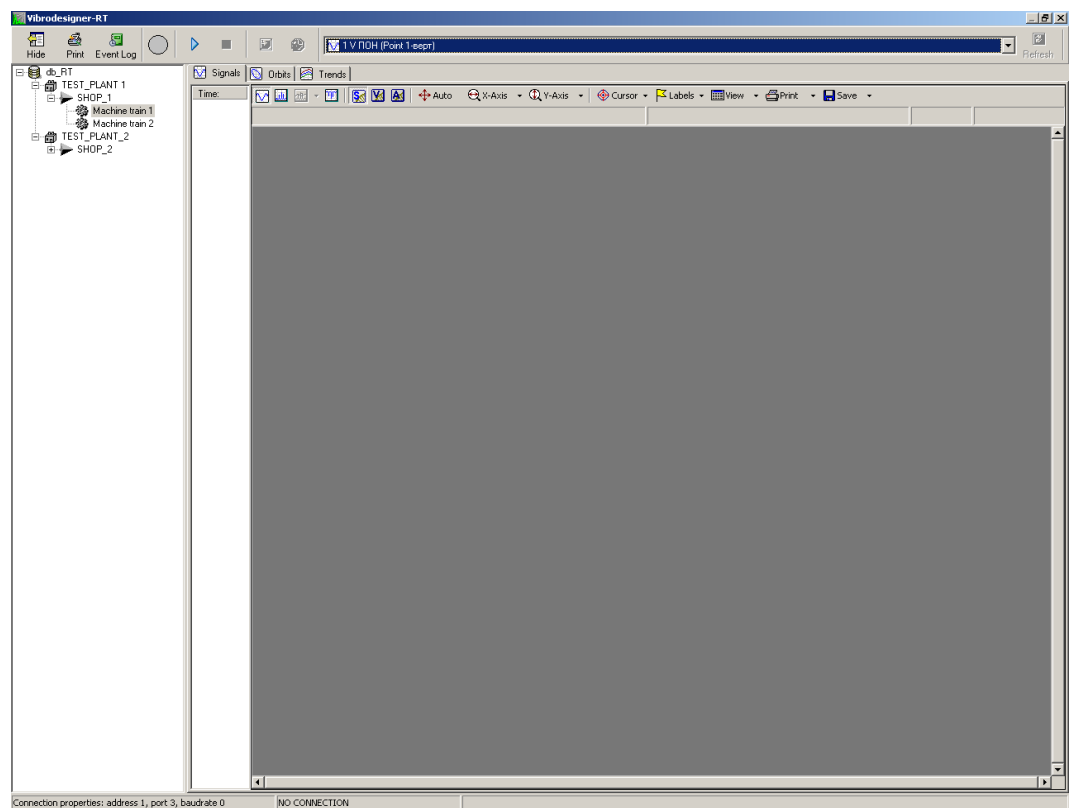
1. On the **View** menu, select **Mode > Real Time**.





**Figure 224 Switching to Real Time mode**

**Note:** When working with real-time data, the Comparison mode becomes disabled.

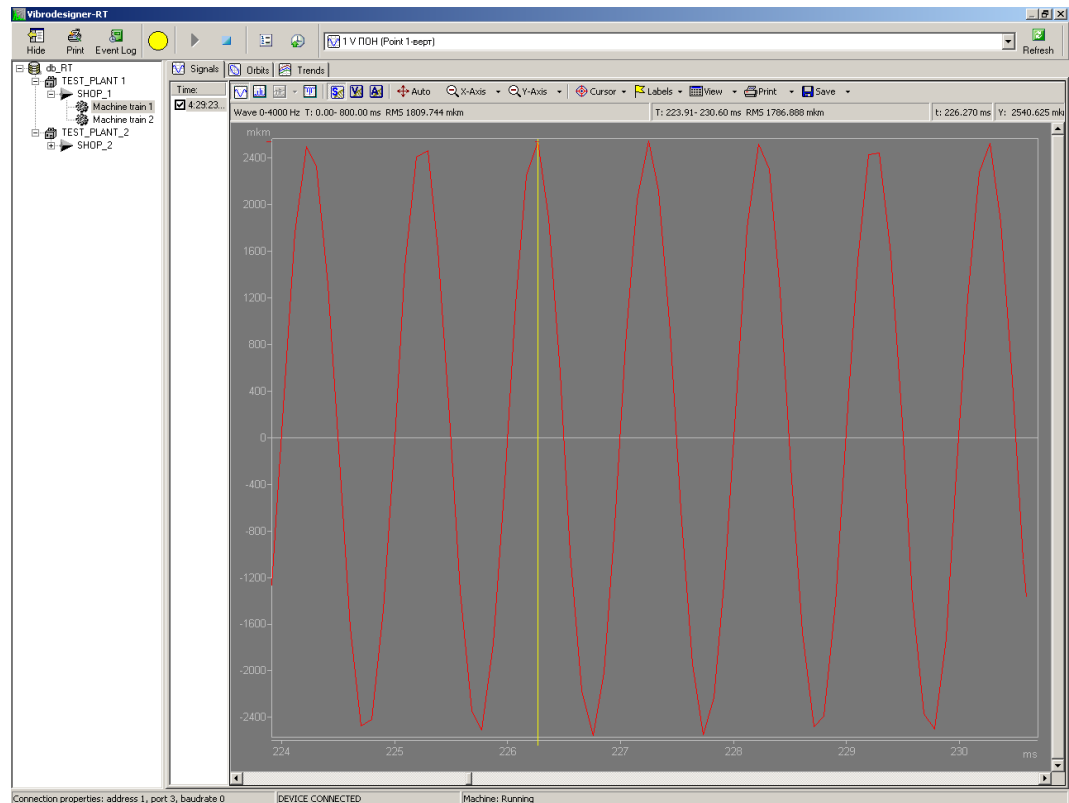
The **Vibrodesigner-RT** window appears.



**Figure 225 Vibrodesigner-RT window**

2. To establish connection, click  on the toolbar.
3. When done, select the machine point of interest from the drop-down list and click  **Refresh** to retrieve data from the monitor.

The current data are displayed in the workspace. The green indicator on the toolbar designates that connection is established.



**Figure 226 Viewing signals in real time**

#### To display device and database configurations:

- Click  on the toolbar.

The **Configuration Comparison** dialog box appears. For more information, refer to *Appendixes*, “Comparing Stationary Device and Database Configurations.”

#### To synchronize the computer and device time:

- Click  on the toolbar.

## Viewing 1-Channel Points

When viewing 1-channel measurement points, you can:

- Refresh the data displayed in the workspace
- Add the most recent ASTD-2 or vibration monitor data in the workspace for viewing multiple graphs simultaneously

#### To refresh data in the workspace:

- In the left panel, select the machine of interest and click the **Refresh** button on the toolbar.

The data in the workspace refreshes.



---

**Important!** When switching to another point, the data in the workspace are not saved.

---

As in the normal Analysis mode, you can add a new spectrum to existing ones in one of the following views:

- 2D (spectra are collided)
- 3D-Waterfall

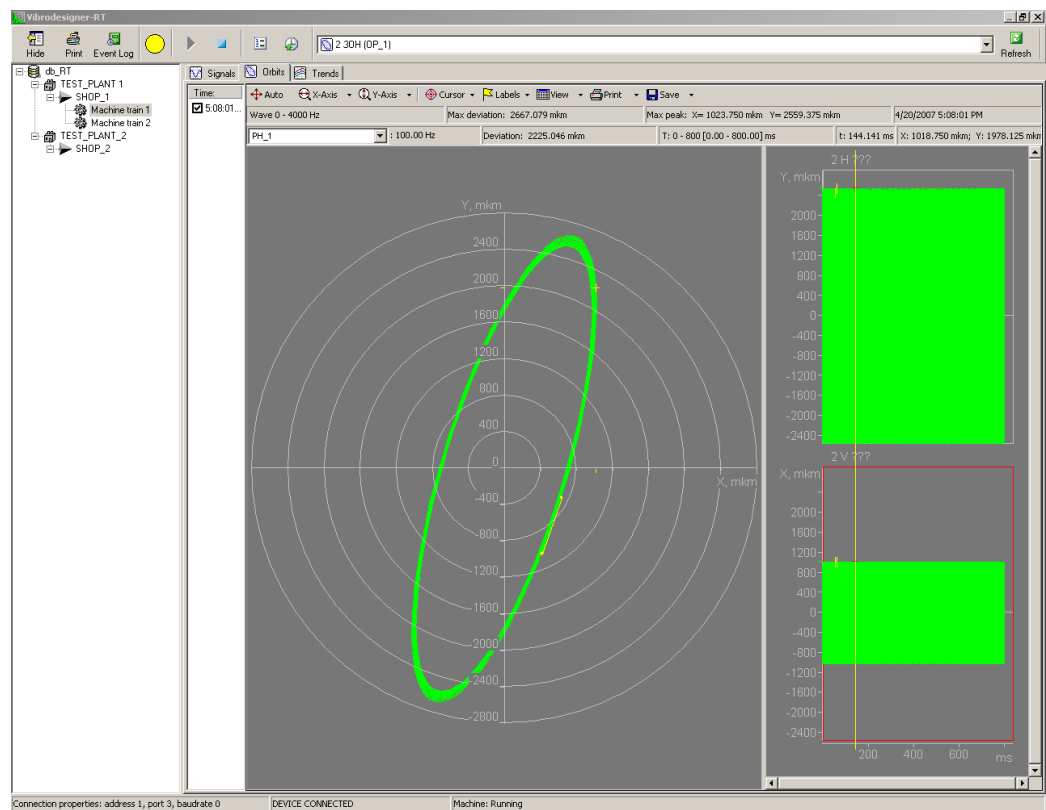
**To add data into the workspace:**

- Select the check box on the left of the measurement you need.

The ASTD-2 request is sent and the new signal is added into the workspace and displayed along with the previously collected data.

## Viewing Orbits

You can view 2-channel points as orbits. Displaying more than one orbit at a time is prohibited.



**Figure 227 Viewing orbit in Real Time mode**

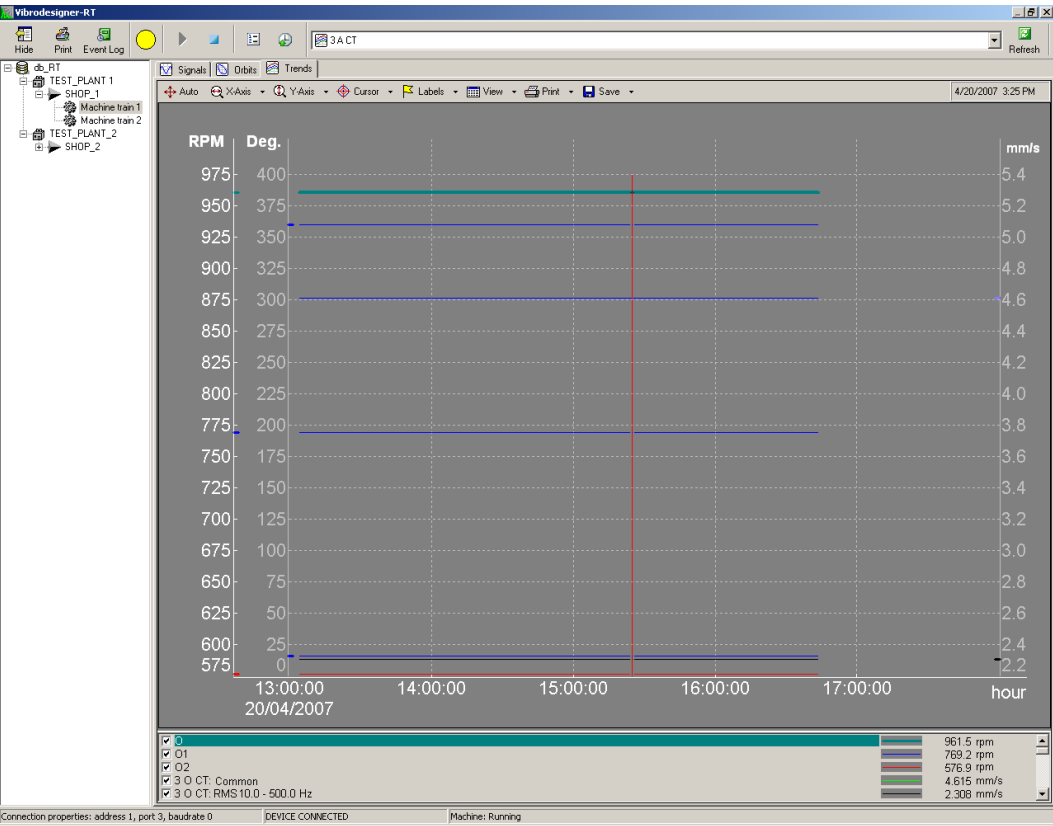
---

**Note:** If a point belongs to a 2-channel point, the second channel data also refreshes (but are not accumulated). An orbit is formed on receiving either the whole orbit data or one of the orbit's constituents.

---

# Viewing Trends

In the Real Time mode, you can view trends on the measurement point level. The trend set with the point name is created for each point. This trend set contains all band/phase configurations of this points, as well as all existing rotation frequencies (tacho channels).



**Figure 228 Viewing trends in Real Time mode**

# Chapter 7 Database Management

This chapter describes how to manage Vibrodesigner databases.

It covers the following topics:

- Introduction
- Archiving Databases
- Restoring Databases
- Deleting Databases

## Introduction

The Vibrodesigner database management system is a single utility that enables you to:

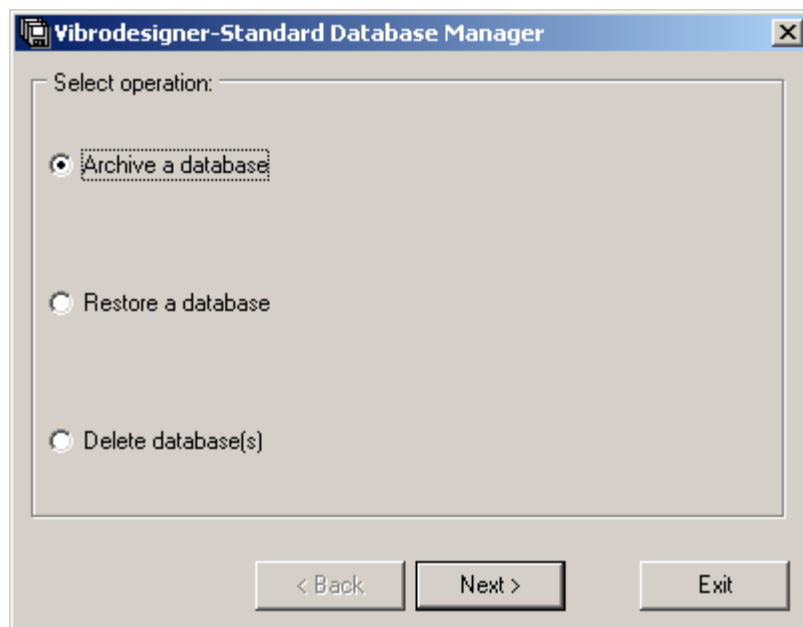
- Backup databases
- Restore databases from archives
- Delete Databases

A database archive is stored in ZIP format.

### To start working with databases:

- On the Windows **Start** menu, point to **Programs**, and select **Vibrodesigner > Standard > Manage Databases**.

The **Vibrodesigner-Standard Database Manager** dialog box appears.



**Figure 229 Vibrodesigner-Standard Database Manager dialog box**

You can now choose one of the following actions:

- Create a database archive
- Restore a database
- Delete a database.

To automatically perform needed actions, you can also use command prompt parameters when running the database management utility (BackupRestore.exe). The table below describes command prompt parameters.

#### **Command prompt parameters**

PARAMETER	DESCRIPTION
/OPERATION:A	Start a database backup.
/OPERATION:R	Start restoring a database.
/OPERATION:D	Start deleting a database.
/CONTAINER:<db_name>	The database for which you need to perform the operation.
/NETPATH:<server_name>	A name of the server where the database resides. If the parameter is not specified, the operation is carried out locally.
/ZIPFILE:<file_name>	A name of the file used either to store the archive or to restore the database.
/GUI:1	Display the progress bar only.
/GUI:2	Display the progress bar and errors.
/GUI:3	Display full graphical interface.

---

**Note:** To view information about all parameters, run  
`backuprestore.exe /?`.

---

## Archiving Databases

Database archiving is used to create backup copies to avoid failures and to transfer the database on a remote computer.

---

**Important!** Close the target Vibrodesigner database before archiving.

---

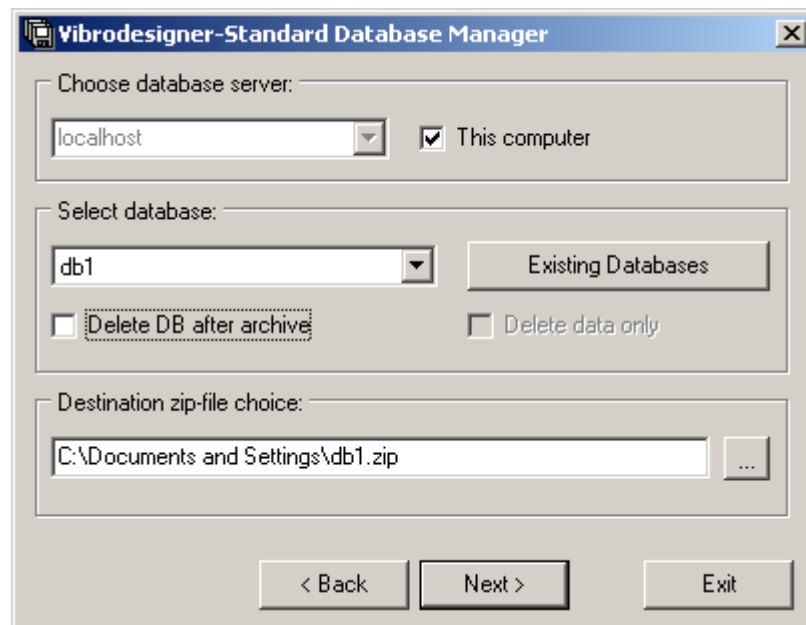
### To create a database archive:

1. On the Windows **Start** menu, point to **Programs**, and select **Vibrodesigner > Standard > Manage Databases**.

The **Vibrodesigner-Standard Database Manager** dialog box appears.

2. Click **Archive a database** and then click **Next**.

A dialog box appears, prompting you to select the database to be archived.



**Figure 230 Selecting database**

3. If the database resides on a remote computer, clear the **This computer** check box and select the database server of interest from the drop-down list.
4. Click the **Existing Databases** button.

In the **Select database** list, you can view the list of existing databases on the specified computer.

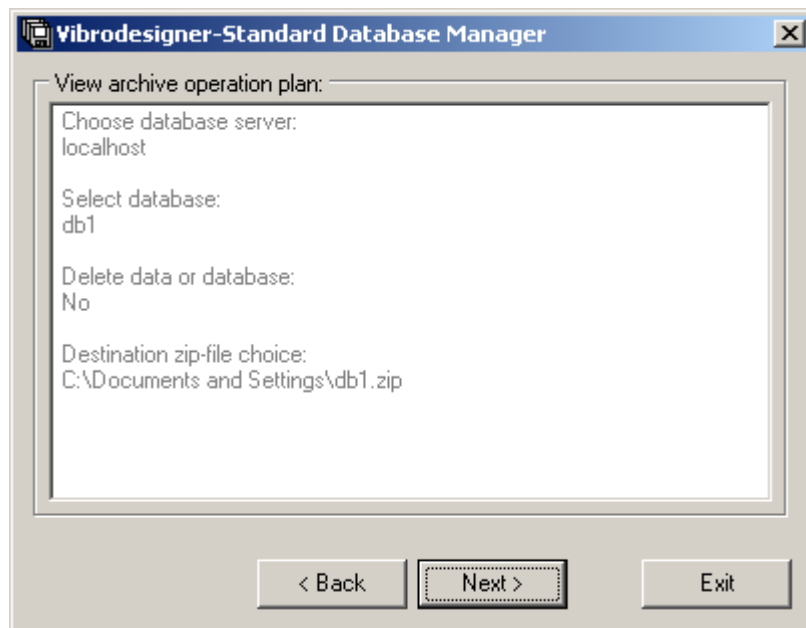
5. From the **Select database** drop-down list, select the database to be archived.

**Note:** To delete the database when the archiving procedure is complete, select the **Delete DB after archive** check box.

6. In the **Destination zip-file choice** box, specify a path to the file used to store the database archive.
7. Click **Next**.

**Note:** If a file with the same name exists at the specified location, you are prompted to either overwrite this file or cancel and then enter another file name.

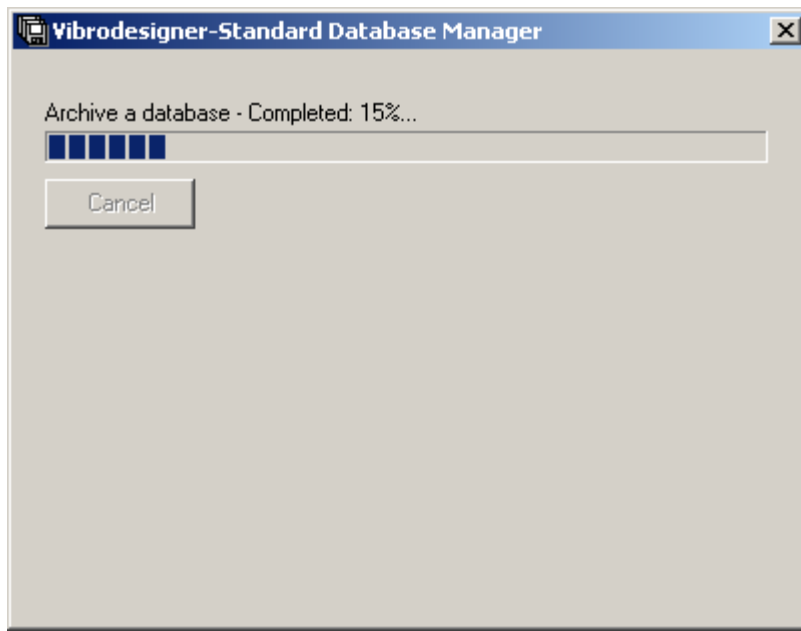
The selected backup parameters are displayed.



**Figure 231 Backup parameters**

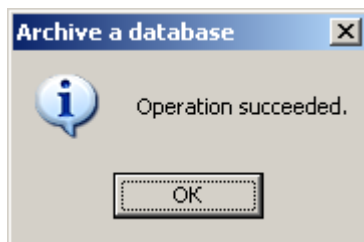
8. Click **Next**.

The archiving procedure is started.



**Figure 232 Archiving in progress**

When completed, the successful message is displayed.



**Figure 233 Archiving completed**

9. Click **OK**.

## Restoring Databases

You can restore a full database from the previously created archive.

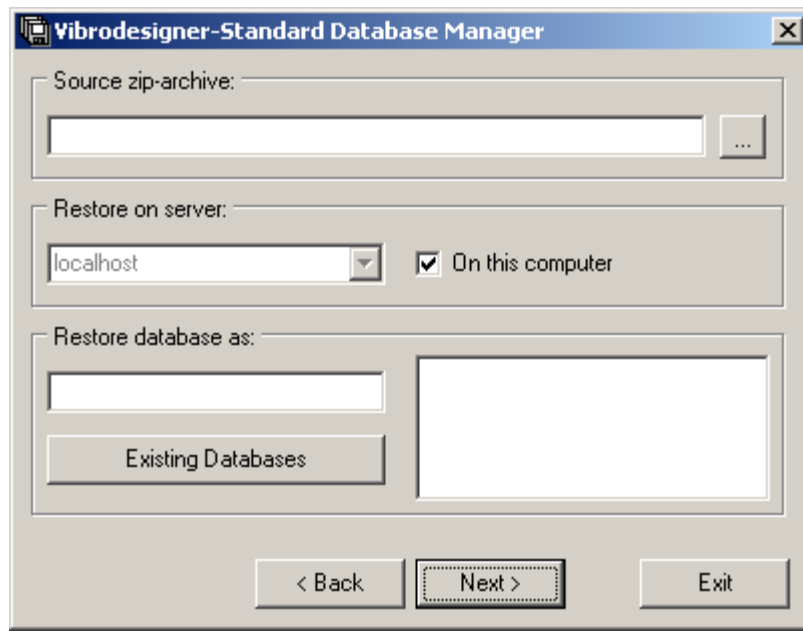
### To restore a database:

1. On the Windows **Start** menu, point to **Programs**, and select **Vibrodesigner > Standard > Manage Databases**.

The **Vibrodesigner-Standard Database Manager** dialog box appears.

2. Click **Restore a database** and then click **Next**.

A dialog box appears, prompting you to select the archive to be restored.

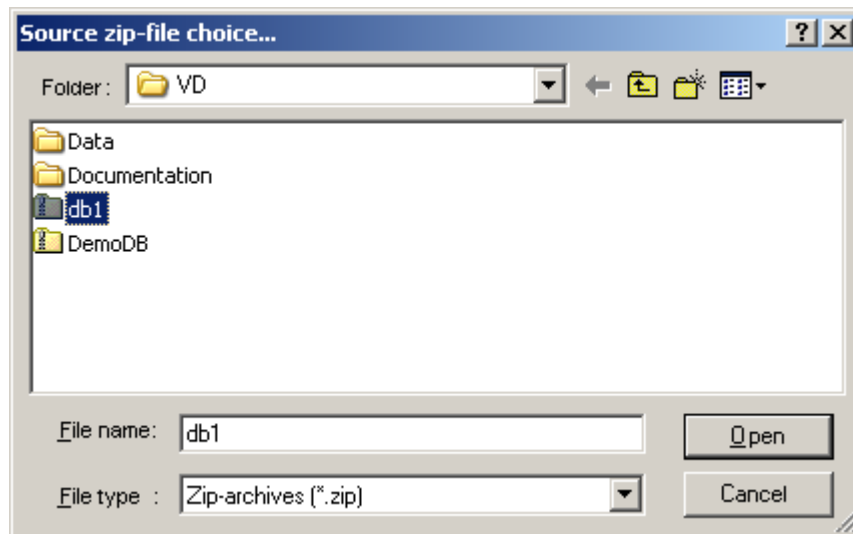


**Figure 234 Selecting archive**

3. If the database to be restored is located on a remote computer, clear the **This computer** check box and select the database server of interest from the drop-down list.

4. Click .

The **Source zip-file choice** dialog box appears.

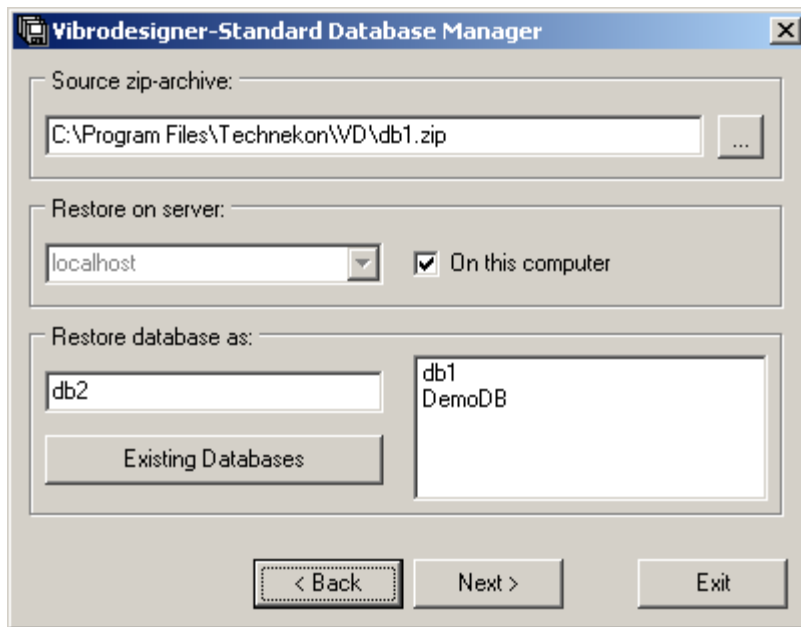


**Figure 235 Selecting archive file**

5. Select the archive file of interest and click **Open**.

A path to the selected archive file is displayed in the **Source zip-archive** box, and a file name appears in the **Restore database as:** box.



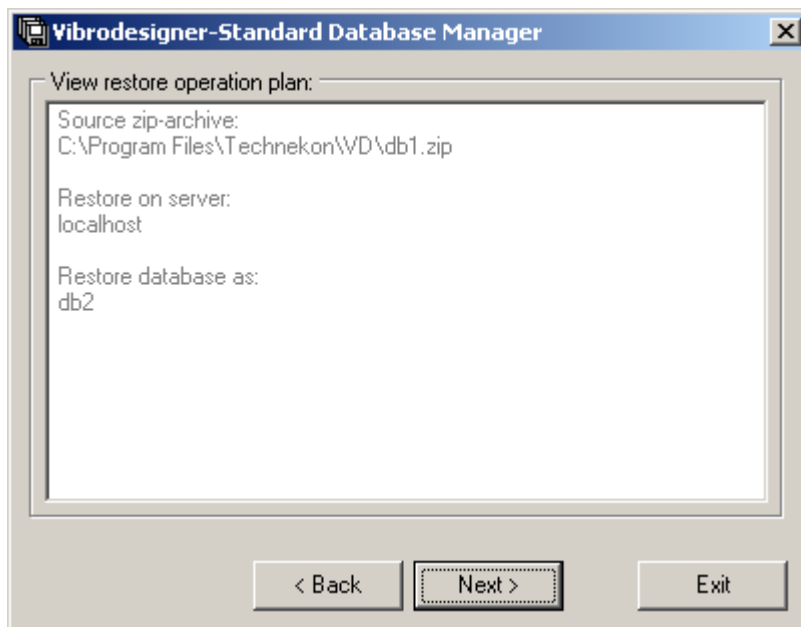


**Figure 236 Choosing database name**

By default, a database name is the same as the archive file name. You can also specify another name of the database to be restored in the **Restore database as:** box. To view a list of existing databases on the specified computer, click the **Existing Databases** button. Vibrodesigner does not allow restoring a database with the name of the existing database.

6. Click **Next**.

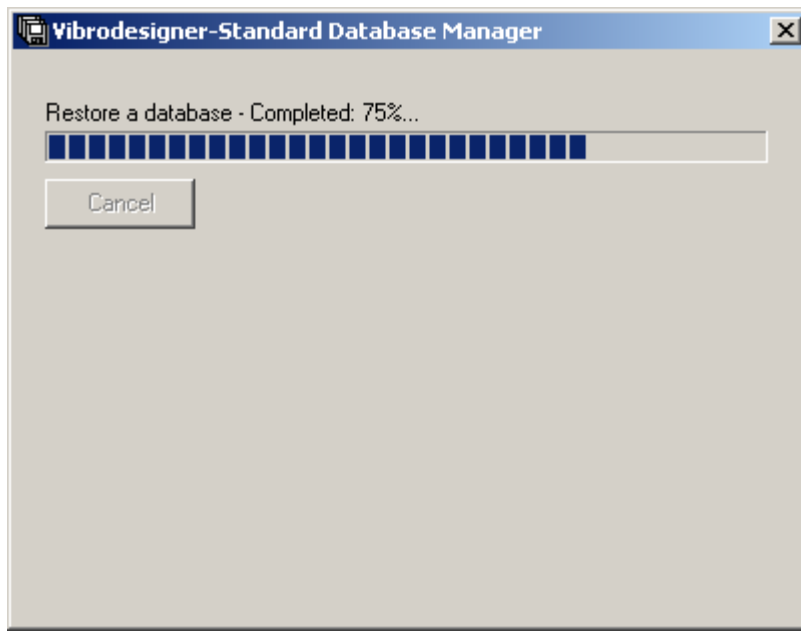
The selected restoring parameters are displayed.



**Figure 237 Restoring parameters**

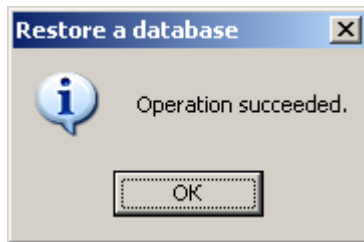
7. Click **Next**.

The restoring procedure is started.



**Figure 238 Restoring in progress**

When completed, the successful message is displayed.



**Figure 239 Restoring completed**

8. Click **OK**.

## Deleting Databases

If necessary, you may delete Vibrodesigner databases.

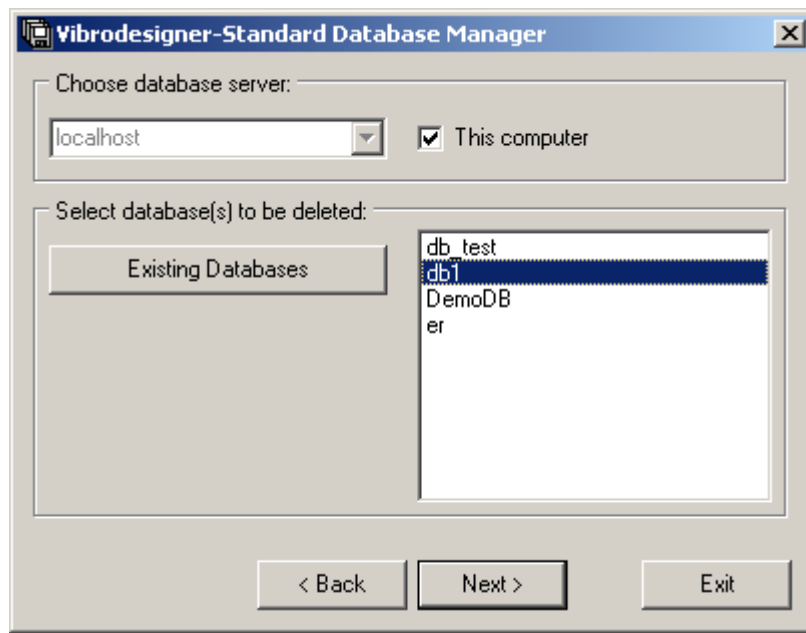
### To delete a database:

1. On the Windows **Start** menu, point to **Programs**, and select **Vibrodesigner > Standard > Manage Databases**.

The **Vibrodesigner-Standard Database Manager** dialog box appears.

2. Click **Delete database(s)** and then click **Next**.

A dialog box appears, prompting you to select the archive to be deleted.



**Figure 240 Selecting database**

3. If the database to be deleted is located on a remote computer, clear the **This computer** check box and select the database server from the drop-down list.

4. Click the **Existing Databases** button.

A list of existing databases is displayed on the right.

5. Click a name of the database you need.

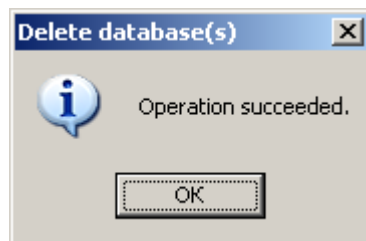
You can also select more than one database at a time, holding CTRL or SHIFT down.

6. Click **Next**.

You are prompted to confirm the deletion.

7. Click **Yes**.

The deletion procedure is started. When completed, the successful message is displayed.




**Figure 241 Deletion completed**

8. Click **OK**.

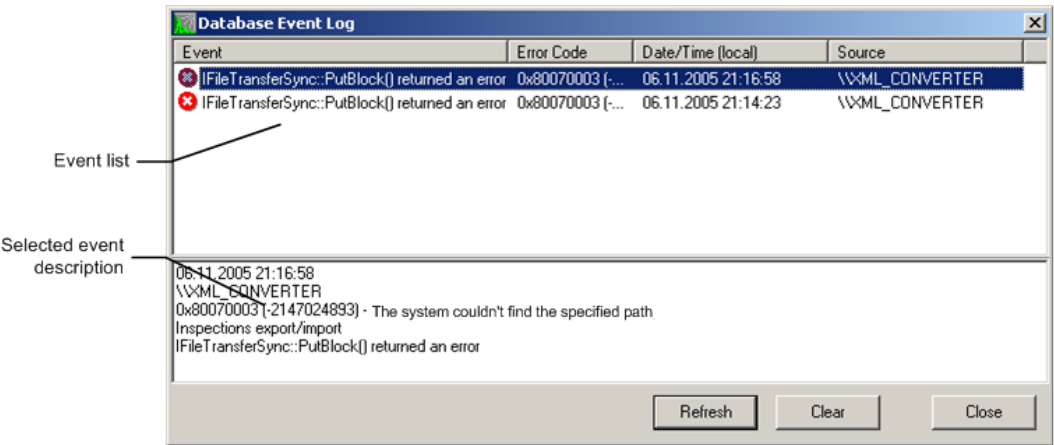
# Chapter 8 Event Log

The *event log* is the record of system events, which is used as a troubleshooting tool to fix Vibrodesigner problems. All the errors occurred while working with the system are registered in the event log. For example, if an error occurred while exporting inspections, the event log will help you easily locate a cause of the problem.

## To view the event log:

1. Select **View Database Event Log** from the **File** menu or click  on the toolbar.

The **Database Event log** dialog box appears.





**Figure 242 Database event log**


2. Click the **Refresh** button.

The last 256 event are displayed in the event list.

Vibrodesigner provides you with three event types. The event type is indicated as a special icon in the **Event** field.

## Event message types

ICON	NAME	DESCRIPTION
	Information message	This message informs you about events that do not affect the program operation. Not used in the current version.
	Warning	A configuration error. If such an error occurred, view the event description in the lower pane. If necessary, ask the system engineer to help you solve this problem.

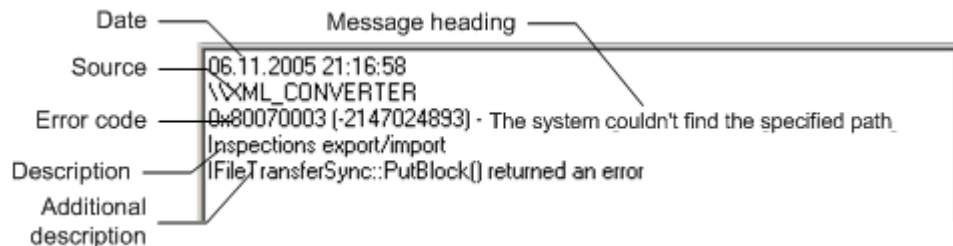
ICON	NAME	DESCRIPTION
	Error	A critical error. For example, such an error may occur when you try to modify a "Read Only" file.

The table below describes the fields displayed in the event list.

### **Description of event log fields**

FIELD	DESCRIPTION
Event	A brief description of the error.
Error code	A system error code in decimal and hexadecimal formats. This information may help the developer fix the problem.
Date/Time (local)	The local date and time on the operator's workstation, which depends on the current time zone. The time displayed in the event log for the event occurred simultaneously in Moscow and London is not the same.
Source	A path to the object caused an error. If the \\XML_CONVERTER value is displayed, the error occurred while importing/exporting inspections.

In the lower pane of the **Database Event Log dialog** box, the description of the selected event is displayed.



**Figure 243 Selected event description**

### **Selected event fields**

FIELD	DESCRIPTION
Date	Date and time on the operator's workstation at the moment of an error.
Source	A path to the object caused an error.
Error code	A system error code in decimal and hexadecimal formats.
Message heading	A Windows interpretation of the error, which depends on the system localization. This information may help the system engineer or the developer fix the problem.

FIELD	DESCRIPTION
Description	A brief description of the error, which depends on the program localization.
Additional description	An additional description may contain a name of the function which handling caused the bug. This information may help the developer fix the problem.

**To refresh the event list:**

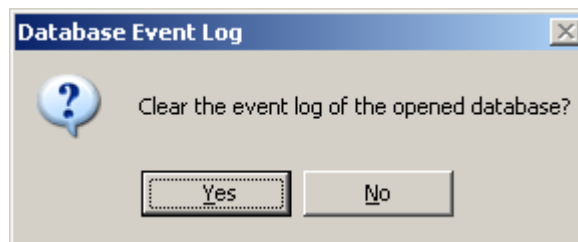
- Click the **Refresh** button.

The request to a database is performed, and the last 256 events are displayed.

**To remove all records of the event log:**

1. Click the **Clear** button.

You are prompted to confirm the operation.




**Figure 244 Confirmation of event log deletion**

2. Click **Yes**.

All the messages stored in the server database are deleted.

**To close the event log:**

- Click  in the upper right corner of the event log, or click any other window.

The event log is closed.

# Chapter 9 Program Settings

This chapter describes how to customize program settings.

It covers the following topics:

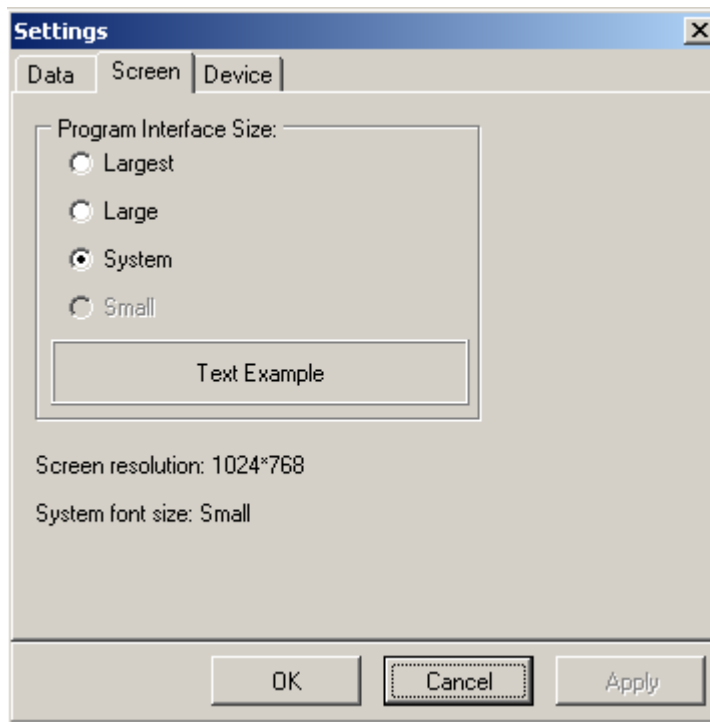
- Introduction
- Program Interface Size
- Display Ranges
- Default Device
- Graph Settings

## Introduction

In the current Vibrodesigner version, you can customize GUI element size, data display ranges, graph display settings, as well as select the default data collector and system of units.

**To start customizing the program settings:**

- On the main menu, click **Settings > Screen**.  
The **Settings** dialog box appears.



**Figure 245 Settings dialog box—Screen tab**

For detailed information on the program settings, see the following sections.

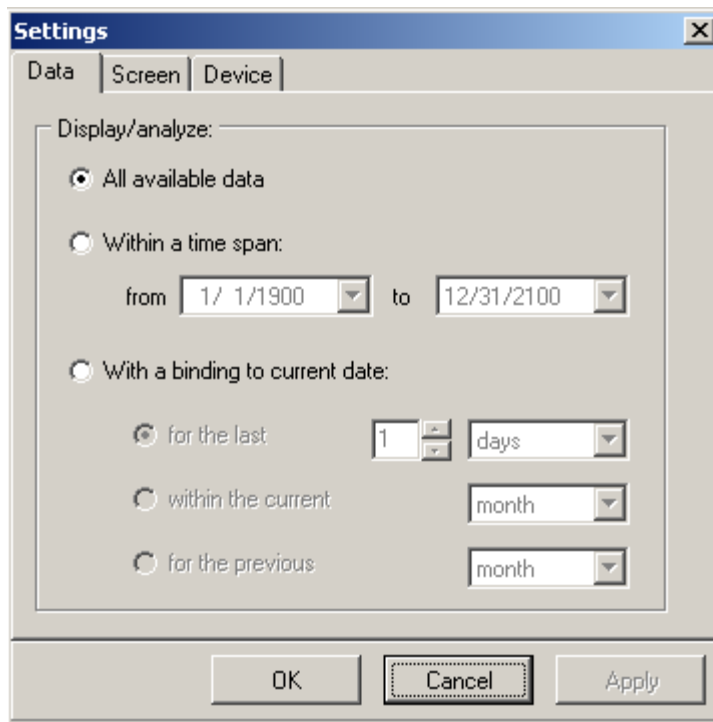
## Program Interface Size

On the **Screen** tab (see *Figure 245*), you can specify the size of the program interface elements. To do so, select the option you need in the **Program Interface Size** section. You may select the largest, large, or system (recommended) element size.

## Display Ranges

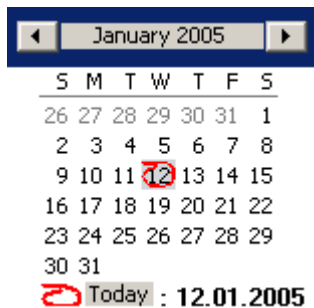
On the **Data** tab, you can customize the intervals used to display data in the workspace.





**Figure 246 Settings dialog box—Data tab**

To display all the data stored in the database, click **All available data**. You can also specify a particular time interval to display data. To do so, click **Within a time span**, and then select the needed date in the **from** and **to** fields. Selecting a date is performed in the standard calendar dialog box.



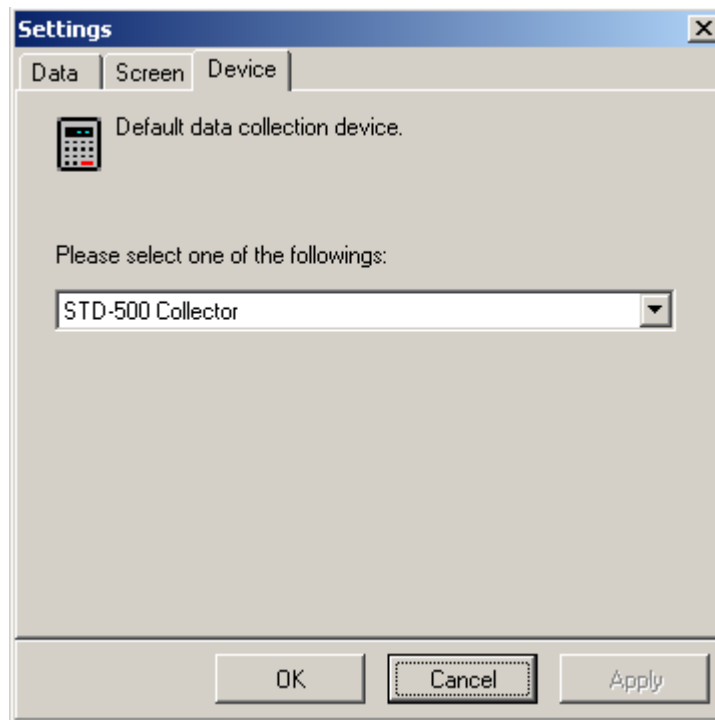
**Figure 247 Calendar**

If the **With a binding to current date** option is selected, you can specify the following intervals:

- For the last number of days/months/years
- Within the current month/year
- For the previous month/year.

## Default Device

On the **Device** tab, you can modify information about the default data collector in use. This information is used for correct operation in some Vibrodesigner modes.



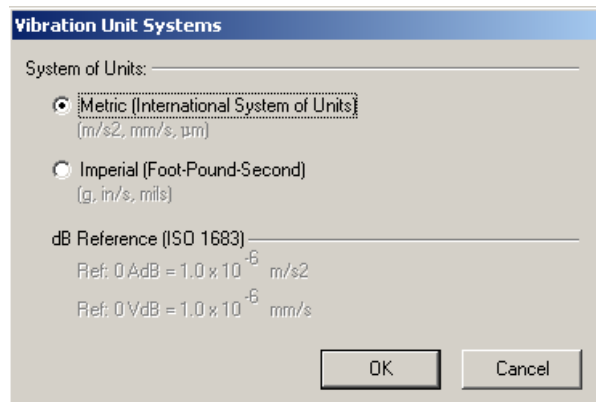
**Figure 248 Settings dialog box—Device tab**

## System of Units

To select the system of units to be used while working with Vibrodesigner-Standard, do as follows:

1. On the main menu, click **Settings > System of Units**.

The **Vibration Unit Systems** dialog box appears.



**Figure 249 Vibration Unit Systems**

2. Select either metric or imperial system of units.

The dB reference level is displayed at the bottom of the dialog box.

# Chapter 10 Troubleshooting

This chapter describes how to troubleshoot known problems in Vibrodesigner.

It covers the following topics:

- Loading Data Issues
- Printing Graph Issues


## Loading Data Issues

PROBLEM	POSSIBLE CAUSE	SOLUTION
It's impossible to load measured data from STD-500/510/3300	After the route loading, the STD-500 (or STD-510/3300) object has been changed in the plant hierarchy	<p>Unfortunately, modifying the database between the route loading and measurements may result in loading failure. Please avoid such a situation in future.</p> <p>If this situation did occur, you need to load the route once again (thus the measured data will be lost), perform measurements, and then load the newly measured data in the database.</p>

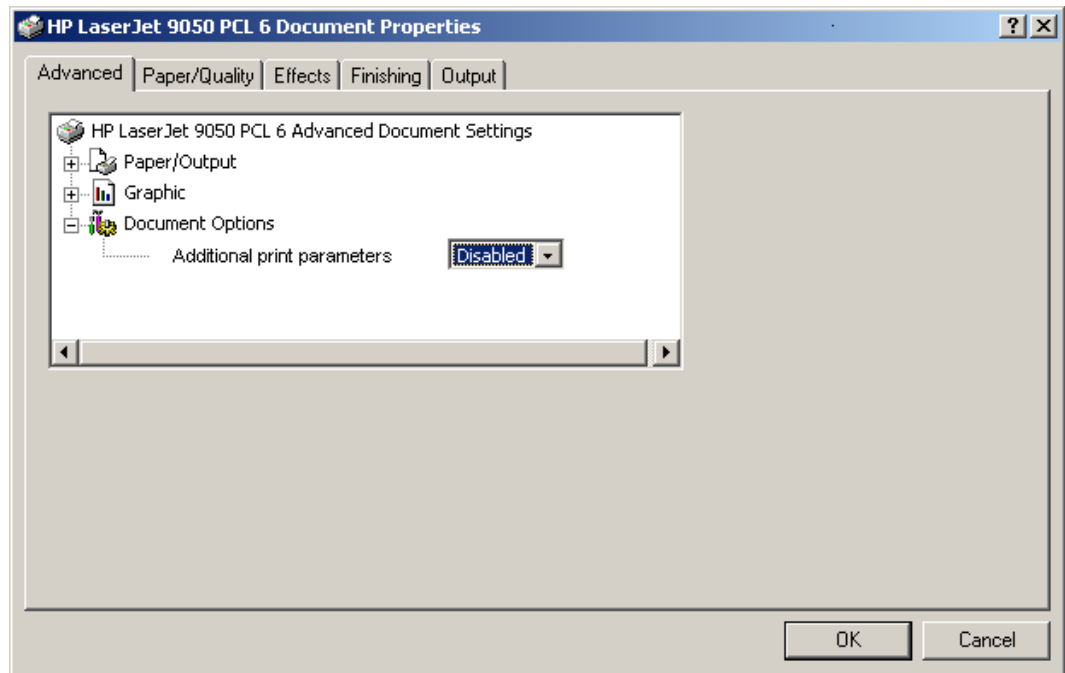
## Printing Graph Issues

In the current version, data are outputted through printing of a current window. So, printing out spectra, waveforms or trends on black-and-white printers may result in poor distinctiveness of color lines on the dark-gray background (default settings). If you use a black-and-white printer, you need to modify color settings (via the **Settings** menu in the main menu) to display them distinctly. Set the white color for background and graph frames; use dark colors for graph lines.

It is recommended to hide the left panel containing the plant hierarchy to have more

room for graphs. To do so, click  on the toolbar.

If graphs displayed on the **Signals**, **Trends**, **Orbits**, and **Locus** tabs cannot be printed, change your printer settings, as shown below.



**Figure 250 Additional print parameters**

## Local databases are not Accessible from Network Computers

If users from other computers on the local network cannot access databases on your workstation, check Windows security settings on your computer. For more information, see “Windows Security Settings for Remote Access”.

## Using Vibrodesigner with Antivirus Programs

Some antivirus programs running on your computer may seriously affect the Vibrodesigner performance. In this case, it is recommended to use another antivirus software or configure existing antivirus program as appropriate.

# Chapter 11 Appendixes

## Alarm/Warning Types

ALARM/WARNING NAME	BRIEF NAME
Warning for absolute value	AV
Warning for absolute change	AC
Warning for relative change	RC
Remaining time before failure warning	RR

## Measurement Directions

#	SYMBOL	BRIEF NAME	NAME
1	H	hor	Horizontal
2	V	vert	Vertical
3	A	axial	Axial
4	“ ”	“ ”	None
5	T	tang	Tangential
6	R	rad	Radial
7	X	radX	Radial (X)
8	Y	radY	Radial (Y)

## Inspection Report Example

4 3 6 8 7 5 1 9 10 2

Plant 1

Report on machinery condition  
Machine condition according to the latest data in the interval 3/18/2007 - 3/19/2007  
All machine points are included

Report created 4/22/2007 6:47:13 PM  
Took notice of the machinery condition

Signature \_\_\_\_\_ Name \_\_\_\_\_

Machine shop 1

11 Machine: Machine shop 1 \ Machine 1, table contains data from 3/19/2007

Fundamental frequencies:

Measurement points:

Pointcode	Monitoring parameter	Value	Unit	Alarmlevel	Time before failure	Alarm levels			
						"Warning" (W)	"Failure" (A)	"Abs. Chg" (Δ)	"Rel Chg." (δ)
1 V	RMS10-1000	17.7	mm/s	II	?	12	24	-	-
	RMS200-300	1.0	mm/s	—	?	12	-	-	-
2 V	RMS10-1000	10.7	mm/s	—	?	12	24	-	-
	RMS10-200	10.7	mm/s	—	?	12	-	-	-
3 V	RMS800-1000	0.2	mm/s	—	?	12	24	-	-
	RMS10-1000	22.0	mm/s	—	?	-	30	-	-

12 Monitoring formulas:

Element	Monitoring parameter	Value	Unit	Alarmlevel	Time before failure	Alarm levels			
						"Warning" (W)	"Failure" (A)	"Abs. Chg" (Δ)	"Rel Chg." (δ)
-	P 1	11.8	mm/s	—	?	-	-	-	-
EU 1	A 1	35.3	mm/s	A	?	5	8	-	-

**Report fields description**

FIELD	DESCRIPTION
1	A name of the root plant.
2	The local date and time on the operator's workstation in the following format: dd.mm.yyyy hh:mm:ss.
3	Depending on the operator's choice, this field shows: <i>"According to the latest inspection of the machine train"</i> <i>"According to the latest data from the machine train"</i> <i>"Machine train condition according to the latest data in the interval from dd.mm.yyyy to dd.mm.yyyy"</i> .
4	Depending on the operator's choice, this field shows: <i>"All machine train points are included"</i> <i>"Only point with alarms or warnings are included"</i> .
5	A path from the plant to the machine shop for which the report has been created.
6	A name of the machine. The machine shop where the machine is placed is also shown.
7	The date interval (in dd.mm.yyyy – dd.mm.yyyy format) when the data was collected.
8, 9, 10	Names of measurement points and shaft rotation frequency as follows: <i>"(&lt;point code&gt;) &lt;point name&gt;: &lt;value&gt; &lt;unit&gt;"</i> , where: <point code> — a code of the measurement point that is used to measure rotation frequency, <point name> — a name of the measurement point, <value> — a value of the shaft rotation frequency, <unit> — a measurement unit for the shaft rotation frequency.  Up to three fundamental frequencies can be displayed.
11	Text displayed above the table with vibration and operating mode parameters points
12	Text displayed above the table with calculated parameters.
Pont code	A measurement point code.
Monitoring parameter	A name of the monitored parameter/band.
Value	A value of the monitored parameter.
Unit	A measurement unit of the monitored parameter.
Alarm level	A code of alarm level active for a certain parameter. The following symbols can be shown: «A» — failure level; «П» — warning level; «Δ» — absolute change warning level; «δ» — relative change warning level; «-» — no warnings/alarms.

FIELD	DESCRIPTION
Time before failure	A number of days before exceeding the warning level. This is a forecasting value calculated with the least squares method for three previous months. Possible values: « <b>number of days</b> » — is the prognosis was calculated and its accuracy exceeds the permissible level. « <b>&gt;300</b> » — the predictable exceeding the failure level will occur later than in 300 days or there is no failure tendency. « <b>?</b> » — the prognosis calculation failed (for example, insufficient data) or the prognosis accuracy is lower than permissible level.
Warning	A warning level value. If two levels are set for this parameter (the upper and lower levels), two comma-separated numbers are displayed. The first number is the lower warning level; the second number is the upper warning level.
Failure	A failure level value. If two levels are set for this parameter (the upper and lower levels), two comma-separated numbers are displayed. The first number is the lower failure level; the second number is the upper failure level.
Abs.chg.	An absolute change level value. Displayed as follows:  “ <b>&lt;level&gt; / &lt;number_of_days&gt; days</b> ”, where <b>&lt;level&gt;</b> — a level value; <b>&lt;number_of_days&gt;</b> – the number of days used to take data for the reference value when calculating the level value.
Rel.chg.	A relative change level value. Displayed as follows:  “ <b>&lt;level&gt; / &lt;number_of_days&gt; days</b> ”, where <b>&lt;level&gt;</b> — a level value; <b>&lt;number_of_days&gt;</b> – the number of days used to take data for the reference value when calculating the level value.
Element	A name of the element within the machine the calculated parameter belongs to. If the calculated parameter belongs to a machine (not an element), the “-” sign is displayed.

## Main Menu

### *File menu*

MENU COMMAND	DESCRIPTION
Create Database	Open the <b>Create database</b> dialog box to create a new database.
Open Database	Open the <b>Open database</b> dialog box to open the database of interest.



MENU COMMAND	DESCRIPTION
Save	Save the changes in a database.
Export data	Open the <b>Export data</b> dialog box to export inspections.
Import data	Open the <b>Load inspection data</b> dialog box to import inspections.
Calculate bands and parameters	Compute the values of calculated frequency bands and calculated parameters. This operation is used 1) after changing band parameters and consequently deleting band values; 2) after modifying monitoring formulas.
Save picture	Open the <b>Save As</b> dialog box to save the graphs displayed in the workspace.
Print	Open the <b>Print</b> dialog box to print out the graphs displayed in the workspace.
Exit	Quit Vibrodesigner.

### ***Edit menu***

MENU COMMAND	DESCRIPTION
Delete	Remove the selected object of the plant hierarchy.
Rename	Rename the selected object of the plant hierarchy.
Move up	Move the selected object (or the measurement point) one level up in the hierarchy.
Move down	Move the selected object (or the measurement point) one level down in the hierarchy.
Cut	Cut the selected object to the Clipboard.
Copy	Copy the selected object to the Clipboard.
Paste	Paste the object from the Clipboard to the specified location.
Export structure	Export the selected data structure into a text file.
Import structure	Import the data structure from a text file.
Undo	Cancel the last operation.

### ***View menu***

MENU COMMAND	DESCRIPTION
Mode > Analysis	Switch to the Analysis mode
Mode Comparison	Switch to the Comparison submode of the Analysis mode.

MENU COMMAND	DESCRIPTION
Mode > Real Time	Switch to the Real Time mode.
Mode > Configuration	Switch to the Configuration mode.
Object path	Display/hide a path to the selected object.
Control panel	Display/hide the toolbar.
Status panel	Display/hide the status bar.
Plant	Display the entire plant hierarchy in the Vibrodesigner panel (available in the Configuration mode).
Machine shop	Display machine shops in the drop-down list (available in the Configuration mode).
Machine	Display machine shops and machines in the in the drop-down lists (available in the Configuration mode).

### *Settings menu*

MENU COMMAND	DESCRIPTION
Data	Open the <b>Data</b> tab of the <b>Settings</b> dialog box to specify display ranges.
Screen	Open the <b>Application View</b> tab of the <b>Settings</b> dialog box to specify program's interface.
Default Device	Open the <b>Device</b> tab of the <b>Settings</b> dialog box to specify the default device.

### *Help menu*

MENU COMMAND	DESCRIPTION
Vibrodesigner-Standard Help	Display the online help system.
About Vibrodesigner-Standard	Display the <b>About Vibrodesigner-Standard</b> dialog box.

## Keyboard Shortcuts

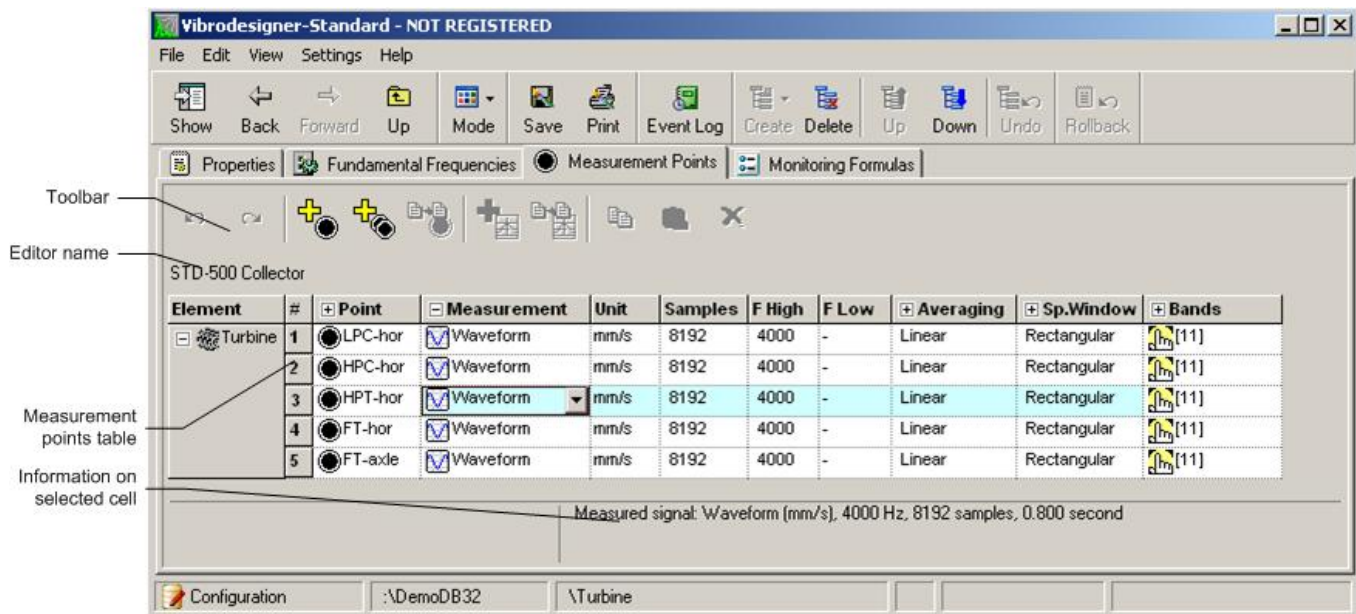
KEYBOARD COMMAND	ACTION	COMMENTS
GRAY+ (CTRL+GRAY+)	Zoom In	Extend the X-Scale (Y-Scale) twice.
GRAY- (CTRL+GRAY-)	Zoom Out	Shrink the X-Scale (Y-Scale) twice.

KEYBOARD COMMAND	ACTION	COMMENTS
GRAY* (CTRL+GRAY*)	Autoscale	Reset the initial X-Scale (Y-Scale) interval.
RIGHT ARROW, LEFT ARROW		Move the cursor along the X scale.
UP ARROW, DOWN ARROW		Select an active graph.
CTRL+INS	Add label	Add a new label at the cursor location.
CTRL+DEL>	Delete label	Delete the selected label.
SHIFT+DEL	Clear all labels	Remove all labels from the workspace.

## Measurement Point Editor

### Editor Interface

The measurement point editor screen consists of the elements described below.



**Figure 251 Measurement point editor interface**

#### 1. Toolbar

Provides buttons for common operations with measurement points. It also has the **Undo** button to cancel the last action and the **Redo** button to reverse the last Undo operation.

#### 2. Editor name

Displays information about the data collector used to measure signals in the specified points.

### 3. **Measurement points table**












Displays measurement points in a tabulated form. Here you can edit points of a machine element model. For more information, see “Measurement Points Table.”

### 4. **Information about selected cell**

Displays additional information about the selected cell.

## Measurement Points Table

You can view the measurement points table as a common table by using the scroll bar. Each table row represents information about a single measurement point of the machine element model.

Element	#	Point	Measurement	Unit	Samples	F High	F Low	Averaging	Sp.Window	Bands
 Turbine	1	LPC-hor	 Waveform	mm/s	8192	4000	-	Linear	Rectangular	 [11]
	2	HPC-hor	 Waveform	mm/s	8192	4000	-	Linear	Rectangular	 [11]
	3	HPT-hor	 Waveform	mm/s	8192	4000	-	Linear	Rectangular	 [11]
	4	FT-hor	 Waveform	mm/s	8192	4000	-	Linear	Rectangular	 [11]
	5	FT-axle	 Waveform	mm/s	8192	4000	-	Linear	Rectangular	 [11]

**Figure 252 Measurement points table**

Cell values in columns set measurement point properties. Point property names are displayed in column headings. All point properties are grouped and each point has three cell groups:

- The **Point** group

This group contains cells for editing a point name, a transducer direction, and a point abbreviation code name.

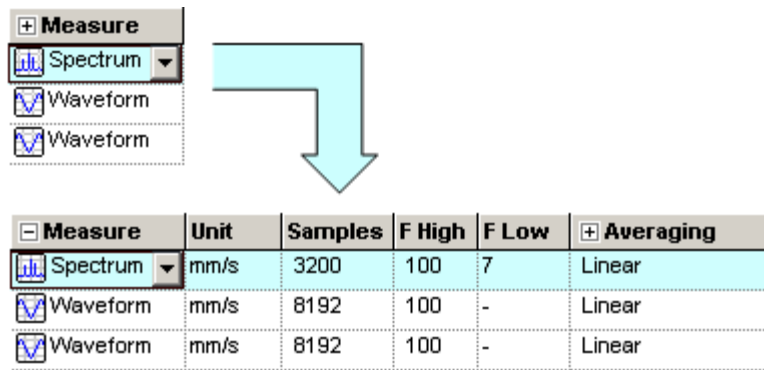
- The **Measurement** group

This group is used to specify measurement properties of the point. Contains the **Averaging** and **Spectral Window** subgroups.


- The **Bands** group

This group is used to edit frequency bands and alarms/warnings. Contains the **Band/Parameter** and **A/W Levels** subgroups.

To expand/collapse a cell group, click the “+” or “-” icon to the left of the group name.



**Figure 253 Expanding cell group**

**Note:** The group icon is displayed within the first cell of a cell group (for example,  for a cell group containing measurements of Waveform type). Clicking this icon selects the entire cell group.

Actions with rows and cells are done with the toolbar buttons and a context menu commands.

## Working with Rows

To perform any action with a row, you need first to select the row.

### To select a row (one measurement point):

- Click the cell containing the row number.

The row is selected.

You can perform the following actions with an entire row:

- Add a row (at the bottom of the table)
- Duplicate the selected row
- Copy a row
- Paste a row (below the selected row)
- Replace a row
- Move a row up and down
- Delete a row

You can paste or add:

- A 1-channel point with the default parameters
- A 2-channel point with the default parameters
- A point which parameters correspond to parameters of a selected point

You can perform the following actions with a **Bands** sub-row of the selected point:

- Add a sub-row (at the bottom of the **Bands** table)
- Paste a sub-row (below the selected sub-row)

- Replace a sub-row
- Move a sub-row up and down
- Delete a sub-row

You can paste or add:

- A band with the default parameters
- A band which parameters correspond to parameters of the selected band (of the same or any other measurement point)

## Working with Cells

Measurement point parameters are specified in its row cells. Depending on the cell type, you can change a cell value manually or select it from the drop-down list activated by clicking the cell. Each cell in the editor has its own format and permitted value range. Thus, Vibrodesigner prohibits entering inappropriate values of measurement point parameters. When attempting to enter a prohibited value, the system will not allow you to leave the cell before you correct the value.

To perform any action with a cell, you need first to select the cell.

### To select a cell:

- Click within the cell you need.

The cell is selected.


---

**Note:** To select a group cell (for example, the **Point** cell), click within the cell but not the group icon.

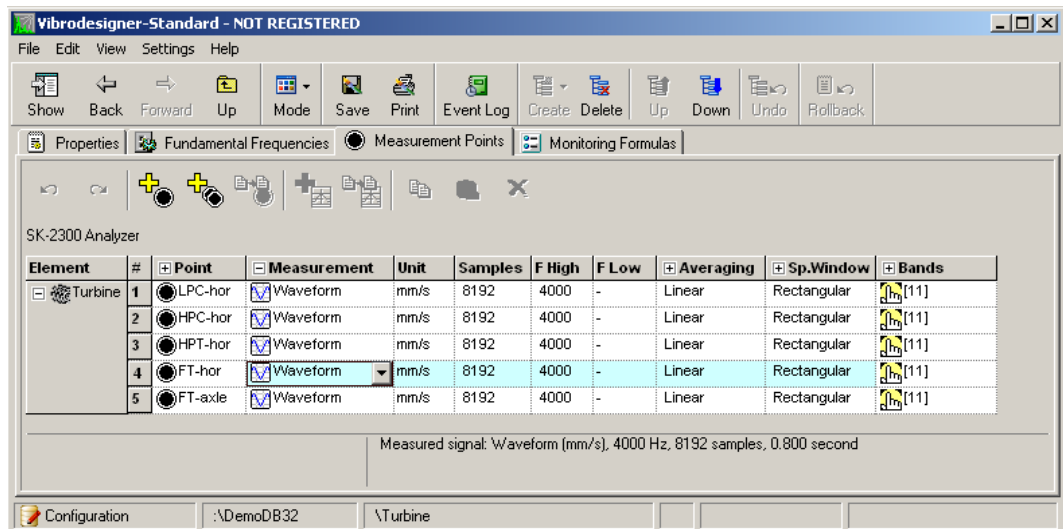
---

You can use the copy and paste operations for each cell. Pasting the values incompatible with the target cell format is prohibited. You can also copy and paste group values into a group of cells in a row (**Point**, **Measure**, **Bands**). To do so, you need first to select a cell group.

### To select a cell group:

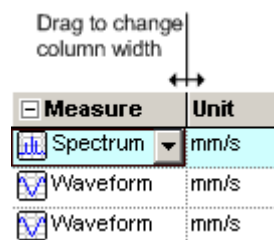
- Click a group icon in the cell you need (for example,  for the Waveform measurement group.)

The cell group is selected. If the cell group is collapsed, only the first cell is selected.



**Figure 254** Selecting cell group

You can change a column width to see all the text in the cell. To do so, drag the right border of the column heading to set the width you need.




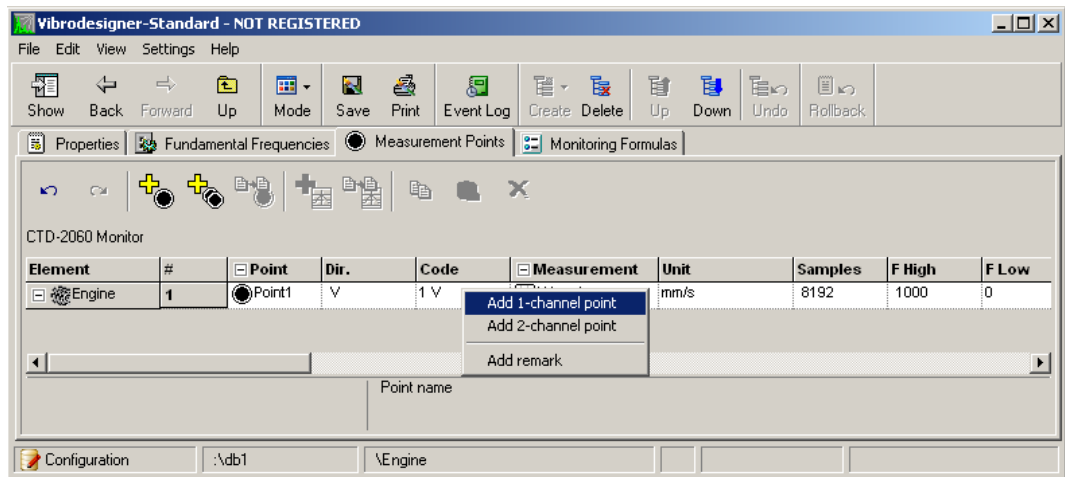
**Figure 255** Changing column width

## Creating and Editing Measurement Points

For each machine element, you can create all needed measurement points and specify their parameters. You may perform various actions with existing points: duplicate points; copy and then paste or replace points; change point locations; delete points. You can also add comments for a table row, which will be displayed when resting the mouse pointer over the **Point** cell.

### To create a 1-channel measurement point on the machine element:

1. On the **Elements** tab, select the machine element you need.
2. Select the **Measurement Points** tab on the right.
3. To add a new point in the table, right-click in the table and select **Add 1-channel point** from the menu. You can also click  on the toolbar or press CTRL+P.



**Figure 256 Creating measurement point on element**

A new 1-channel point with the default properties appears at the bottom of the table. For each 1-channel point, you can view and edit the following parameters:

- Point name
- Transducer direction

This value is selected from a limited list (radial, tangential and so on). When specified, the corresponding symbol is displayed in the **Code** cell.

- Point code

This parameter is used to identify a point on graphs or in reports. Consists of three elements:

- The point number on the machine
- An abbreviation for the transducer orientation
- An element abbreviation name that consists of up to 3 symbols. This abbreviation specifies the machine element where the point is placed (for example, HPC for "high pressure compressor", LPC for "low pressure compressor", and so on.)

The point number is set automatically and cannot be changed. The only way to change the point number is to move the point up/down within the element model. The transducer orientation code is selected in the **Dir.** cell. Thus, in the **Code** cell you may change the element abbreviation only. The other two point code elements are generated automatically.

- A measured signal

For 1-channel point, you can select one of the following values:

- Spectrum
- Envelope Spectrum
- Waveform
- Parameter



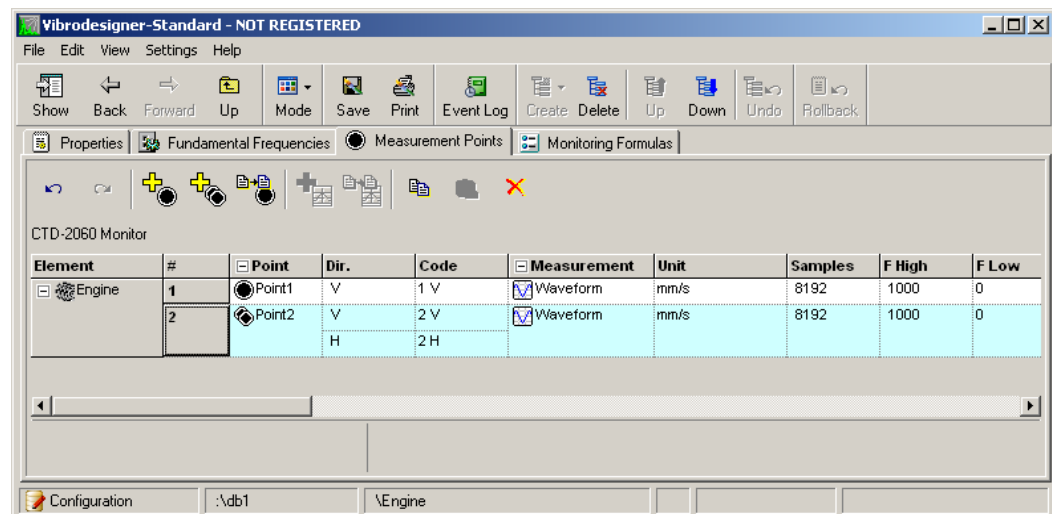
- Measurement parameters
- Averaging during data acquisition
- Band parameters
- Alarms/warnings for a band

### To create a 2-channel measurement point on the machine element:

1. On the **Elements** tab, select the machine element you need.
2. Select the **Measurement Points** tab on the right.
3. To add a new point in the table, right-click in the table and select **Add 2-channel**

**point** from the menu. You can also click  on the toolbar or press CTRL+O.

Once created, a new 2-channel point appears at the bottom of the table. The **Dir.** and **Code** cells contains two sub-rows for each measurement channel. Notice that characteristics of both channels are the same, except for the measurement direction.



**Figure 257 Creating 2-channel point**

For each 2-channel point, you can view and edit the following parameters:

- Point name
- Transducer orientation

This value is selected from a limited list (radial, tangential and so on). When specified, the corresponding symbol is displayed in the **Code** cell. Different directions must be specified for each channel.

- Point code

This parameter is used to identify a point on graphs or in reports. Consists of three elements:

- The point number on the machine (the same for each channel)
- An abbreviation for the transducer direction

- An element abbreviation name that consists of up to 3 symbols. This abbreviation specifies the machine element where the point is placed (for example, HPC for "high pressure compressor", LPC for "low pressure compressor", and so on.)

The point number is set automatically and cannot be changed. The only way to change the point number is to move the point up/down within the element model. The transducer orientation code is selected in the **Dir.** cell. Thus, in the **Code** cell you may change the element abbreviation only. The other two point code elements are generated automatically.

- A measured signal

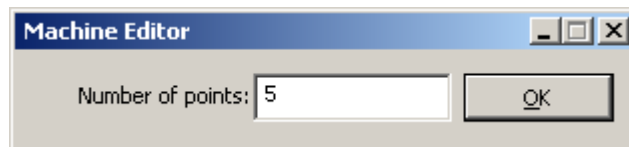
For 2-channel point, you can select one of the following values:

- Spectrum
- Waveform
- Measurement parameters
- Averaging during data acquisition
- Band parameters
- Alarms/warnings for a band

#### To make multiple copies of a measurement point:

1. Select the point you need.
2. Right-click the point and select the **Clone point** from the menu.

The **Machine Editor** dialog box appears.



**Figure 258 Machine Editor dialog box**



3. Type the number of points you want to create, and click **OK**.

The specified amount of points with the selected point parameters appear at the bottom of the table.

#### To duplicate a point:

1. Select the point you need.
2. Do one of the following:
  - Right-click the selected point and select **Duplicate point** from the menu.




- Click  on the toolbar.
- Holding the CTRL key down, click  in the **Point** cell and drag the point to the needed location (for example, at the bottom of the table).

A new point with the selected point parameters appears at the bottom of the table.

**To copy a point to the Clipboard:**

1. Select the point you need.
2. Do one of the following:
  - Right-click the selected point and select **Copy point** from the menu.




- Click  on the toolbar.
- Press CTRL+C.

The selected measurement point is copied to the Clipboard.

**To paste a point from the Clipboard:**

1. Select the point below which you want to add the previously copied point.
2. Do one of the following:
  - Right-click the selected point and select **Paste point** from the menu.



- Click  on the toolbar.
- Press CTRL+V or CTRL+INSERT.


The point from the Clipboard is inserted below the selected measurement point.

**To replace a point:**

1. Select the measurement point you want to replace with the previously copied point.
2. Right-click the selected point and select **Replace point** from the menu.

The selected point is replaced with the point from the Clipboard.

**To change the point order in the list:**


1. Select the point you need.
2. Do one of the following:
  - Right-click the selected point and select **Move up** or **Move down** from the menu.
  - Click  in the **Point** cell and drag the point to the needed location.

The point position is changed.

**To delete a measurement point:**

1. Select the point to be deleted.
2. Do one of the following:
  - Right-click the selected point and select **Delete point** from the menu.



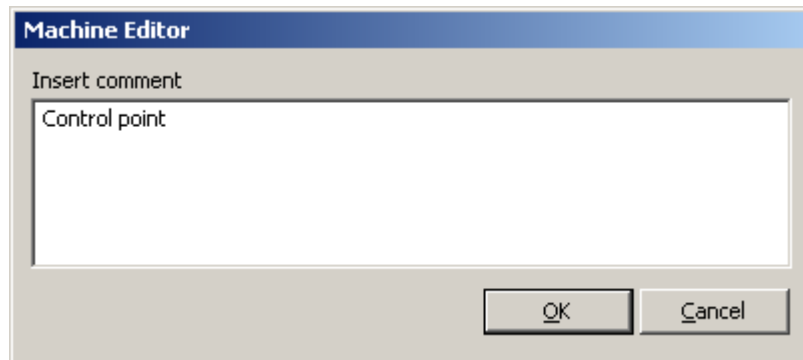
- Click  on the toolbar.
- Press CTRL+X or CTRL+DELETE.

The selected point is deleted.

### To create a comment for the measurement point:

1. Select the point of interest by clicking the row number.
2. Right-click the selected row and select **Insert comment** from the menu.

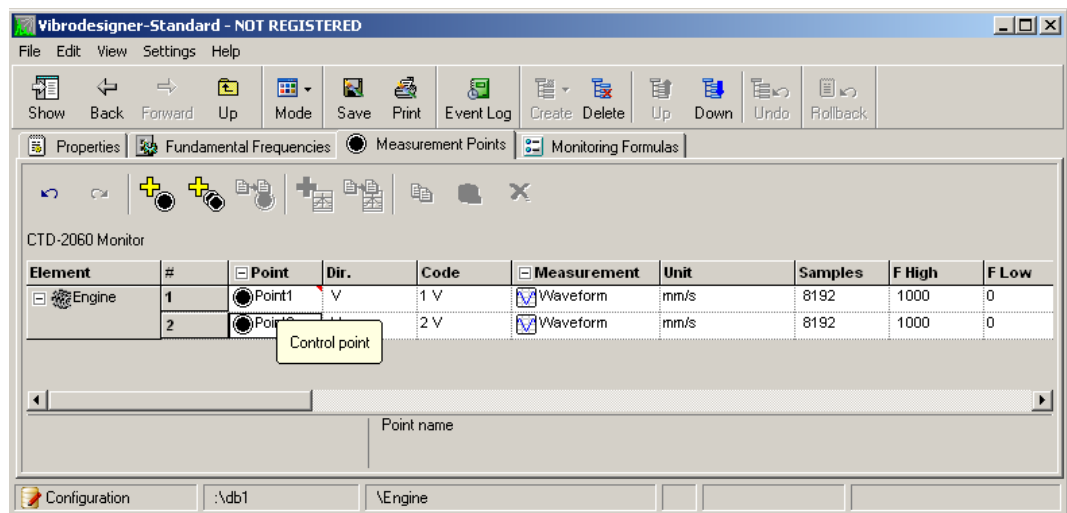
The **Machine editor** dialog box appears.



**Figure 259 Machine Editor dialog box**

3. Enter any necessary comments and click **OK**.

A small red icon appears in the upper right corner of the **Point** cell. When you rest the mouse pointer above this cell, the comment is shown in a popup window.



**Figure 260 Viewing point comment**

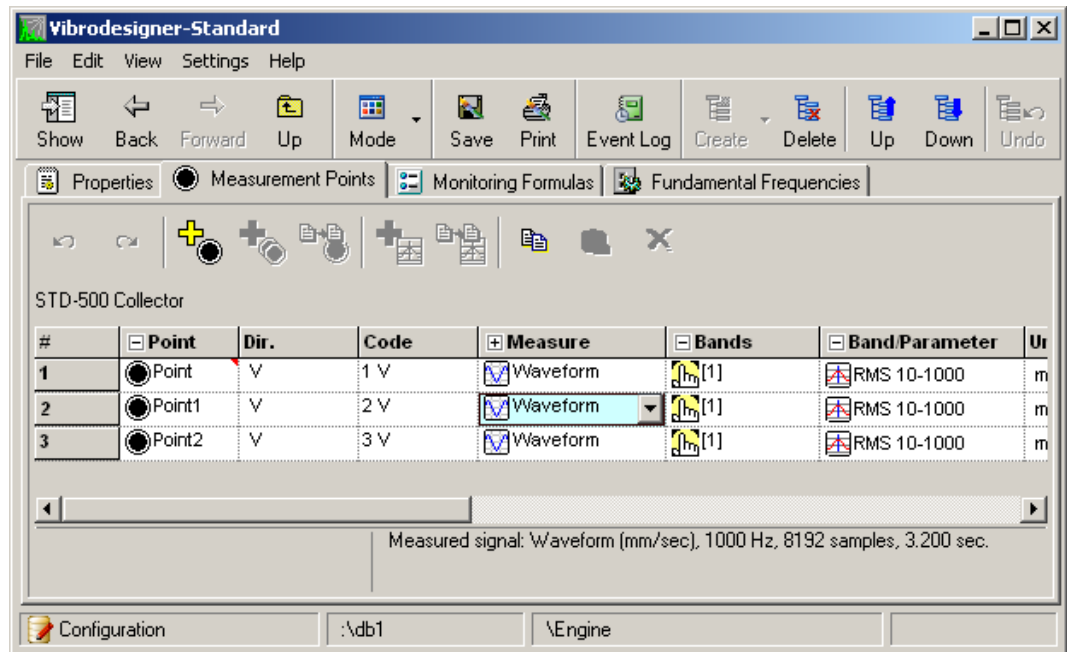
## Measurement Parameters for Different Devices

### STD-500 Signal Parameters

If a STD-500 data collector is selected for a machine, all parameters of this machine points will match STD-500 specifications.

**To adjust parameters of a measured waveform:**

1. In the **Measure** cell, select the type of measured signal (waveform).
2. Set the number of samples you need.

**Figure 261 Measurement properties for STD-500**

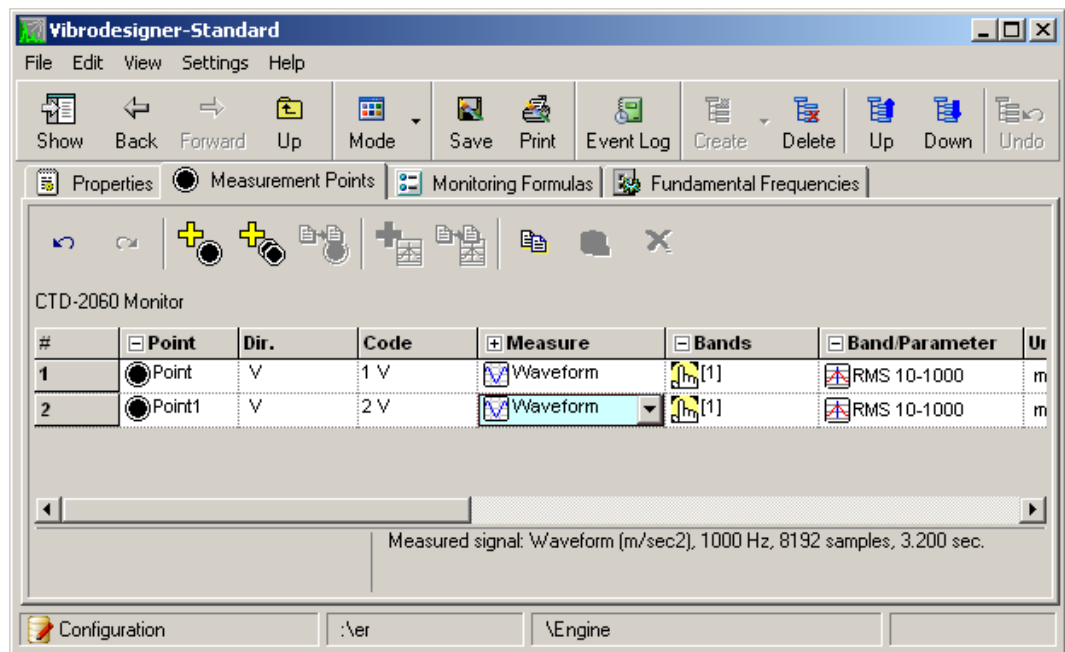
The rest of the device parameters are disabled and are calculated according to the number of samples and the STD-500 capabilities.

**CTD-2060 Signal Parameters**

If a CTD-2060 data collector is selected for a machine, all parameters of this machine points will match CTD-2060 specifications.

**To adjust parameters of a measured waveform:**

1. In the **Measure** cell, select the type of measured signal (waveform).
2. Set the number of samples you need.



**Figure 262 Measurement properties for CTD-2060**

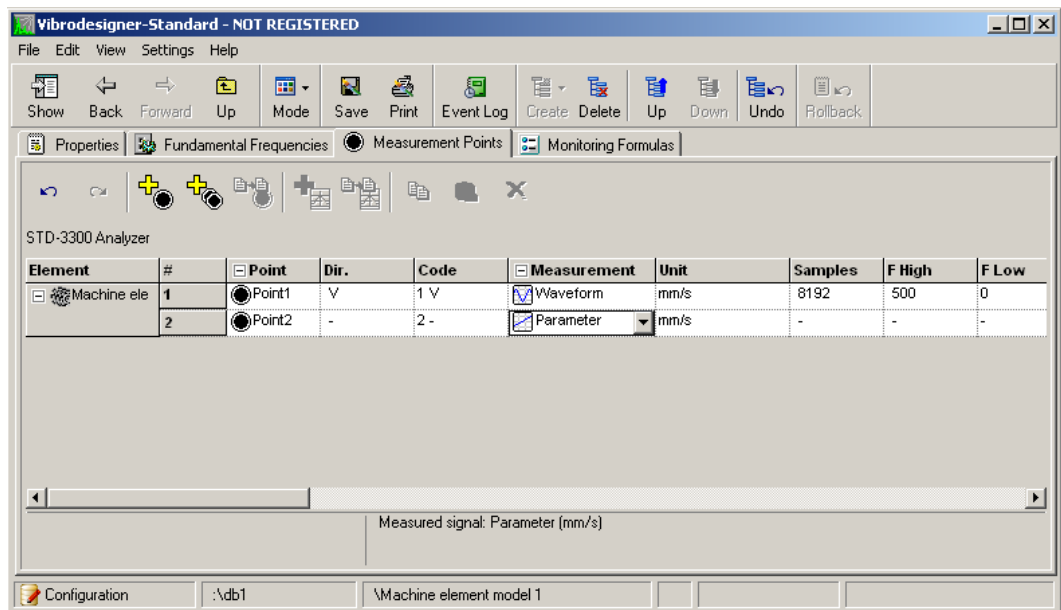
The rest of the device parameters are disabled and are calculated according to the number of samples and the CTD-2060 capabilities.

## STD-3300 Signal Parameters

If a STD-3300 analyzer is selected for a machine, all parameters of this machine points will match STD-3300 specifications. Using a STD-3300, you can measure either a waveform or vibration parameter.

### To adjust parameters of a measured signal:



1. In the **Measure** cell, select the type of measured signal (waveform or parameter).
2. In the row cells, select the measurement parameters of interest.



**Figure 263 Measurement properties for STD-3300**

## How to Create and Edit Bands

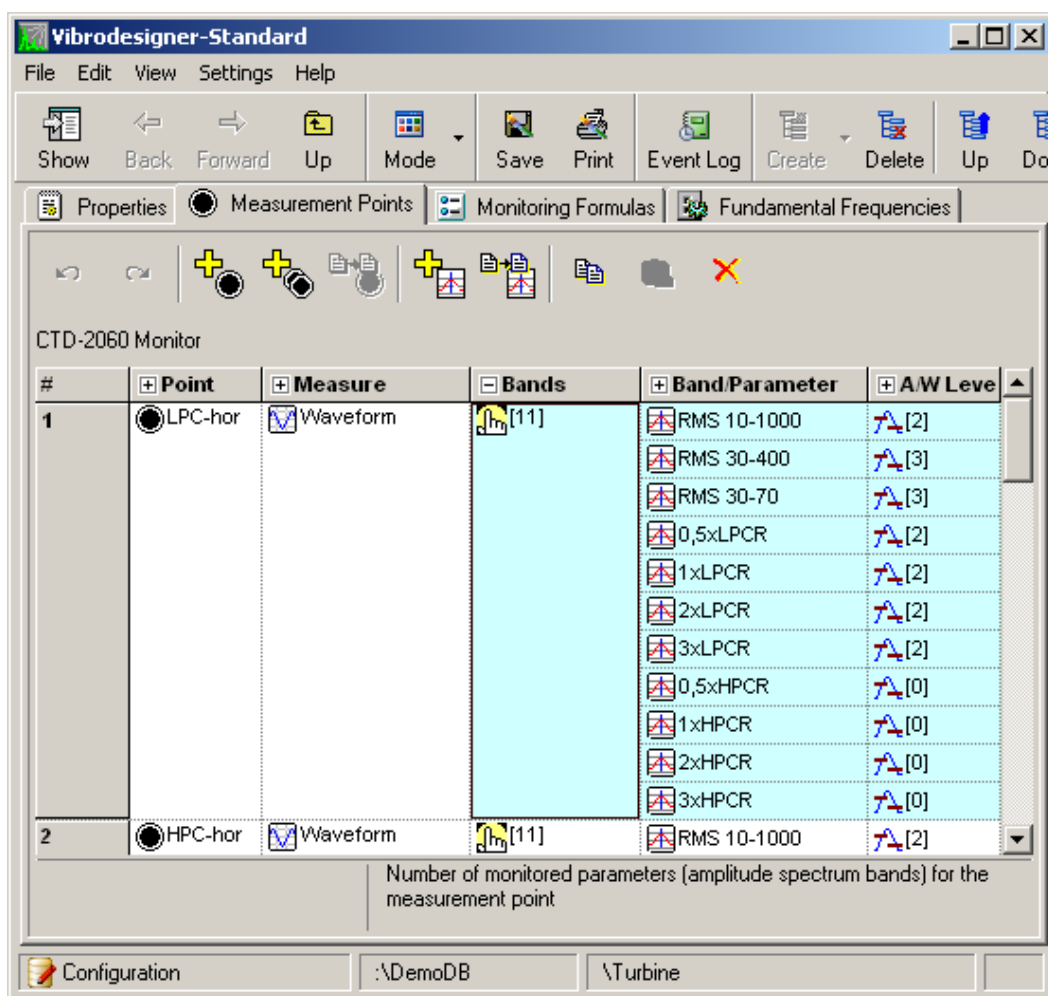
**To create a band in a measurement point:**

1. On the **Elements** tab, select the machine element you need.
2. Click the **Measurement points** tab on the right.  
The table displays a list of measurement points.
3. In the group cell **Bands** of the measurement point you need, click the  icon.  
The **Bands** group of the measurement point is selected.
4. Right-click in the table and select **Create band** from the menu. You can also use the  button or press CTRL+B.

At the bottom of the **Bands** sub-table of the selected measurement point, a new band appears.

5. In the **Band/Parameter** cell, type the band name you need.
6. Repeat Steps 4-5 to create all necessary bands for the measurement point.

The picture below shows 11 bands created at the selected measurement point.



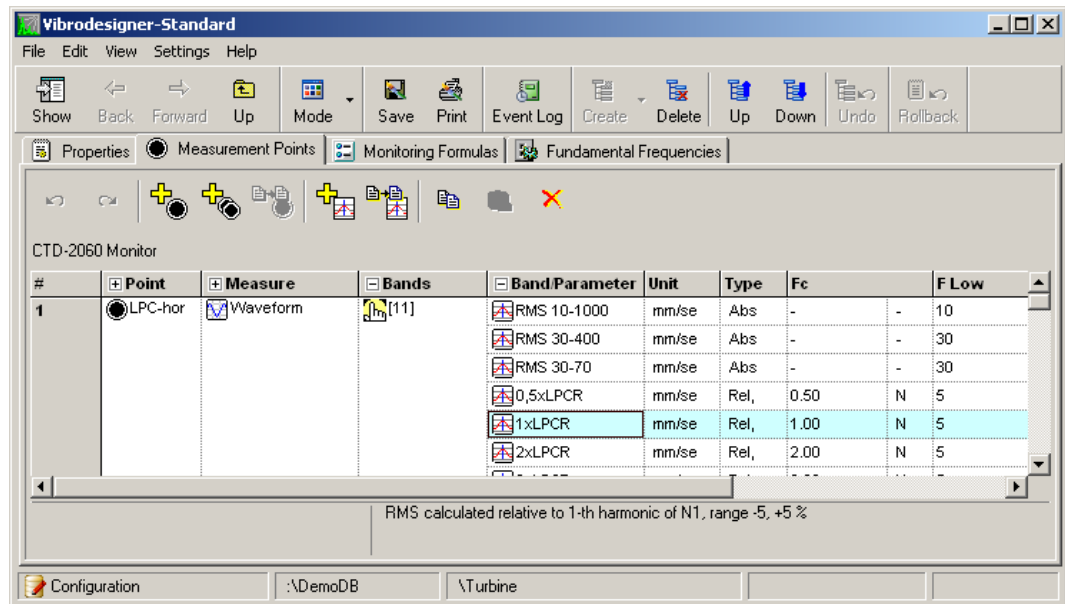
**Figure 264 Eleven bands**

To perform any action with a band, you need first to select the band.

**To select a band:**

- Click the group icon (📁) in the **Band/Parameter** cell.  
The band is selected.







**Figure 265 Selecting band**

#### To duplicate a band:

1. Select the band you need.
2. Do one of the following:
  - Right-click the selected band and select **Duplicate band** from the menu.



- Click  on the toolbar.
- Holding the CTRL key down, click  in the **Band/Parameter** cell and drag the band in the needed location (for example, at the bottom of the sub-table).

A new band with parameters identical to those of the selected band appears at the bottom of the **Bands** table.

#### To copy a band:

1. Select the band you need.
2. Do one of the following:
  - Right-click the selected band and select **Copy parameter** from the menu.




- Click  on the toolbar.
- Press CTRL+C.

The selected band is copied to the Clipboard.

#### To paste a band:

1. Select the band below which you want to add the previously copied band.
2. Do one of the following:

- Right-click the selected band and select **Paste parameter** from the menu.

- Click  on the toolbar.
- Press CTRL+V or CTRL+INSERT.


The band from the Clipboard is inserted below the selected band.

#### To replace a band:

1. Select the band you want to replace with the previously copied band.
2. Right-click the selected band and select **Replace parameter** from the menu.


The selected band is replaced with the band from the Clipboard.

#### To change the band order in the list:

1. Select the band you need.
2. Do one of the following:
  - Right-click the selected band and select **Move up** or **Move down** from the menu.
  - Click  in the **Band/Parameter** cell and drag the band in the needed location.

The band position is changed.

#### To delete a band:

1. Select the band to be deleted.
2. Do one of the following:
  - Right-click the selected band and select **Delete parameter** from the menu.
  - Click  on the toolbar.
  - Press CTRL+X or CTRL+DELETE.

The selected band is deleted.

## Adjusting Absolute Band

#### To adjust an absolute band:

- Enter into the table cells the necessary parameter values for the created bands:
  - Band name
  - Band measurement unit
  - Band type (*Abs*)
  - Lower frequency of a band ( $F_{low}$ )
  - Upper frequency of a band ( $F_{high}$ )
  - Warning+ level ( $W+$ )

- Alarm+ level (A+)
- Warning level for value change (D)
- Warning level for percentage change (s)

---

**Note:** (W-) and (A-) levels are not used for bands. They may be set for parameters only.

---

## Adjusting Relative Bands

Before adjusting a relative band, you need first to define fundamental frequencies for a machine element model. The actual range of a relative band depends on the fundamental frequency in use and is constantly changed over time. Hence, for calculating RMS in a relative band:

1. The center frequency is calculated.

This frequency is linked to the shaft rotation frequency. The fundamental frequency value is not defined explicitly as this value is measured at the moment of calculation and depends on the machine operating mode.

2. The band limits are calculated.

RMS in the band frequency range is calculated in accordance with the lower and upper frequencies of the band.

Having created fundamental frequencies, you may adjust your relative bands.

### To adjust relative bands for a machine element:

1. Click the **Measurement points** tab.
2. In the **Type** cell of the band you need, select a band type from the drop-down list. For a relative band, you can choose one of the following values:
  - *Rel, %* (a band boundaries are set as a fixed percentage of the center frequency).
  - *Rel, Hz* (a band boundaries are set as an offset in hertz from the center frequency).
3. Specify the center frequency. To do so, in the first **Fc** cell specify the multiplier, and then select the needed fundamental frequency in the second **Fc** cell (**Fc** means *center frequency*). Fundamental frequencies are added on the **Fundamental frequencies** tab (see above in this section)

The center frequency is calculated as  $F_c = k \cdot N$ , where  $k$  is a multiplier (typically, 0.5, 1, 2 or 3), and  $N$  is the fundamental frequency (it is equal to the shaft rotation frequency at the moment of band calculation). The multiplier specifies the harmonic number of the fundamental frequency for which the relative band is calculated. As a result, using the multiplier and the fundamental frequency, you may specify a certain logical frequency multiple to the shaft rotation frequency.

4. Specify the lower frequency of the band.

For the *Rel, %* band type, the lower boundary is set in percentage; the accuracy is one decimal place. For the *Rel, Hz* band type, the lower boundary is set in Hz; the accuracy is up to two decimal places. Only positive numbers are acceptable.

5. Specify the upper frequency of the band.


For the *Rel, %* band type, the upper boundary is set in percentage; the accuracy is one decimal place. For the *Rel, Hz* band type, the upper boundary is set in Hz; the accuracy is up to two decimal places. Only positive numbers are acceptable.

6. If necessary, clear the **Calc.** check box.

If this check box is selected, the band value is calculated from the measured (recorded) signal. If the check box is not selected, the band value is recorded to the database in the same way signal values are; the band value is not automatically calculated neither recorded to the database.

## Measuring Peak or Peak/Peak in the Point

### To specify measurement of peak or peak/peak in a measurement point:

1. On the **Elements** tab, select the machine element you need.
2. Click the **Measurement points** tab on the right.  
The table displays a list of measurement points.
3. In the group cell **Bands** of the measurement point you need, click the  icon.  
The **Bands** group of the measurement point is selected.
4. Right-click in the table and select **Create band** from the menu. You can also use the button or press CTRL+B.  
At the bottom of the **Bands** sub-table of the selected measurement point, a new band appears.
5. In the **Band/Parameter** cell, type the band name you need and press ENTER.
6. To measure a signal amplitude in the point, select *Peak* in the **Type** cell.
7. To measure a peak-peak value in the point, select *Peak-peak* in the **Type** cell.
8. Select the **Calc.** check box if you need to calculate peak or peak-peak from the signal. If the check box is not selected, these values will be recorded from the inspection data.

## Configuring Calculated Parameters

### Use of Calculated Parameters

Calculated parameters is a powerful tool for machine diagnostics. In fact, calculated parameters are scalar values computed from current measured or calculated machine parameters using specified formulas. During each inspection, calculated parameters are

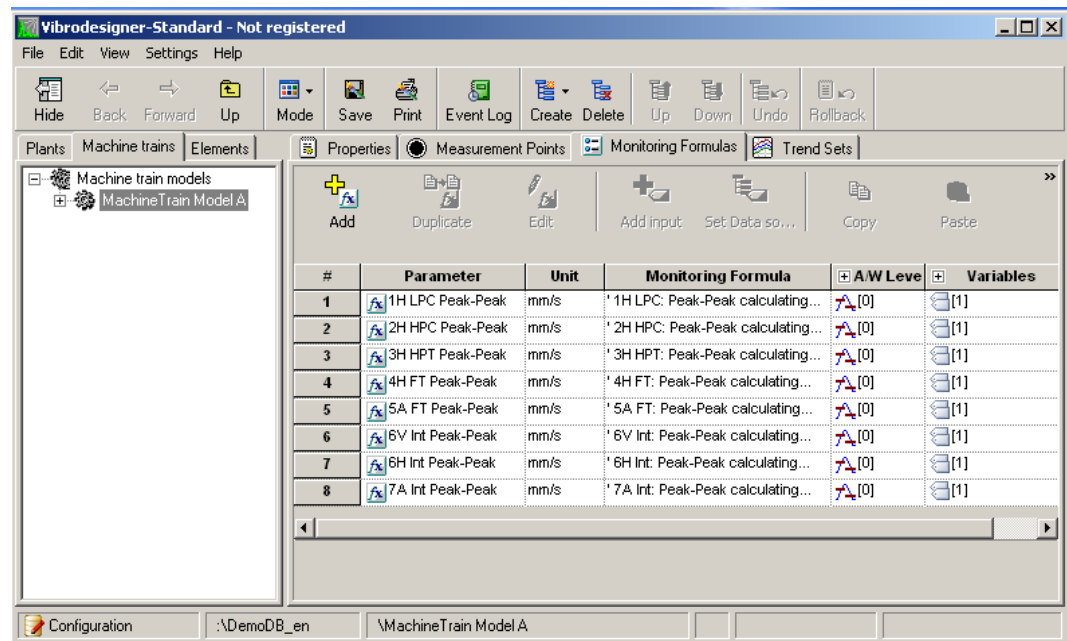
automatically computed and saved into the database. Thus, you can create and monitor calculated parameters trends. Such trends can be viewed and analyzed as any other parameter trends in Vibrodesigner, e.g. band trends, shaft trends and so on. Analyzing trends allows you to trace data tendencies and predict subsequent data changes. For more information on parameter trends analysis, see “Viewing Trends.”

You can specify alarm/warning levels for calculated parameters. If the parameter exceeded a threshold level, an exclamation mark is displayed in the plant hierarchy (see “Analysis of Active Alarms/Warnings”). Specifying monitoring formulas serves the needs of automating defect development inspection.

Calculated parameters are specified for element or machine models. They can be added into trend set for simultaneous monitoring along with other parameter trends.

## Monitoring Formulas Editor Interface

Specifying calculated parameters is performed on the **Monitoring formulas** tab of a particular machine model or element model.



**Figure 266 Monitoring formulas tab**

The calculated parameters editor consists of the following elements:

- Toolbar providing buttons for common operations.
- Table of parameters

#	Parameter	Unit	Monitoring Formula	A.W. Level	Variables	Wave	Type	Dimension	Data source
1	1H LPC Peak-Peak	mm/s	'1H LPC: Peak-Peak calculating...	[0]	[1]	wave	Real	Array	WMachine
2	2H HPC Peak-Peak	mm/s	'2H HPC: Peak-Peak calculating...	[0]	[1]	wave	Real	Array	WMachine
3	3H HPT Peak-Peak	mm/s	'3H HPT: Peak-Peak calculating...	[0]	[1]	wave	Real	Array	WMachine
4	4H FT Peak-Peak	mm/s	'4H FT: Peak-Peak calculating...	[0]	[1]	wave	Real	Array	WMachine
5	5A FT Peak-Peak	mm/s	'5A FT: Peak-Peak calculating...	[0]	[1]	wave	Real	Array	WMachine
6	6V Int Peak-Peak	mm/s	'6V Int: Peak-Peak calculating...	[0]	[1]	wave	Real	Array	WMachine
7	6H Int Peak-Peak	mm/s	'6H Int: Peak-Peak calculating...	[0]	[1]	wave	Real	Array	WMachine
8	7A Int Peak-Peak	mm/s	'7A Int: Peak-Peak calculating...	[0]	[1]	wave	Real	Array	WMachine

**Figure 267 Calculated parameters table**

Each table row represents information about a single calculated parameter. In a row cells, you can set the following:

- Calculated parameter name
- Calculated parameter measurement unit
- Formula used for computing the parameter
- Alarms/warning thresholds
- Monitoring formula variables

The **A/W Levels** and **Variables** columns contain cell groups. To expand/collapse a cell group, click the “+” or “-” icon to the left of the group name.

The **Variables** group cell may include multiple sub-rows each of which describes one input variable.

Variables	Name	Type	Dimensio	Data source
[3]	A	Real	Scalar	WModels of machine trains\Machine
	B	Real	Scalar	WModels of machine trains\Machine
	C	Real	Scalar	WModels of machine trains\Machine

**Figure 268 Variables group cell**

**Note:** The group icon is displayed within the first cell of a cell group (for example, for the **Variables** group). Clicking this icon selects the entire cell group.

Actions with rows and cells are done with the toolbar buttons and a context menu commands.

## Working with Rows

To perform any action with a row, you need first to select the row.

### To select a row (calculated parameter):

- Click the cell containing the row number.
- The row is selected.

You can perform the following actions with an entire row:

- Add a row (at the bottom of the table)
- Duplicate the selected row
- Copy a row
- Paste a row (below the selected row)
- Move a row up and down
- Delete a row

You can paste or add:

- Calculated parameter (row) with the default parameters

- Calculated parameter (row) which parameters correspond to parameters of a selected row

You can move up/down table's rows. You can copy a selected row. It is possible to delete a selected row.

You can perform the following actions with a **Variables** sub-row of the selected row:

- Add a sub-row (at the bottom of the **Variables** table)
- Paste a sub-row (below the selected sub-row)
- Copy a sub-row
- Delete a sub-row

In the **Variables** group, you can paste or add:

- A sub-row (variable) with the default parameters
- A sub-row (variable) with the parameters of selected sub-row

You can also copy the selected sub-row or delete one **Variables** sub-row.

## Working with Cells

To perform any action with a cell, you need first to select the cell.

### To select a cell:

- Click within the cell you need.

The cell is selected.


---

**Note:** To select a group cell (for example, the **Variables** cell), click within the cell but not the group icon.

---

You can use the copy and paste operations for each cell. Pasting the values incompatible with the target cell format is prohibited. You can also copy and paste group values into a group of cells in a row (**Regions**, **Variables**). To do so, you need first to select a cell group.

### To select a cell group:

- Click a group icon in the cell you need (for example,  for the **Variables** group.)

The cell group is selected. If the cell group is collapsed, only the first cell is selected.

You can edit any table's cell. Editing capabilities of a particular cell depend on cell data format and cell value restrictions.


You can change a column width to see all the text in the cell. To do so, drag the right border of the column heading to set the width you need.

## Creating and Editing Calculated Parameters

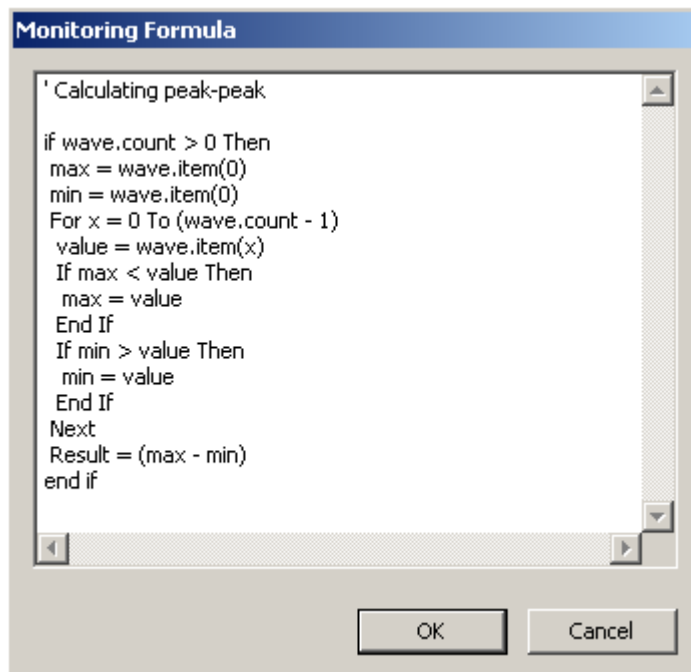
For each machine element or machine, you can create all needed calculated parameters and specify monitoring formulas. You may perform various actions with existing

calculated parameters: duplicate parameters; copy and then paste or replace parameters; change the parameters order; delete parameters. You can also add comments for a table row, which will be displayed when resting the mouse pointer over the **Parameter Name** cell.

**To create a calculated parameter:**

1. Select either a target machine element on the **Elements** tab or a target machine model on the **Elements** tab.
2. Select the **Monitoring formulas** tab on the right.
3. To add a new calculated parameter in the table, right-click in the table and select **Create parameter** from the menu. You can also click  on the toolbar.  
A new row with the default properties appears at the bottom of the table.
4. In the **Parameter** cell, type the name of the parameter.
5. In the **Unit** cell, select the parameter measurement unit of interest from the drop-down list.
6. In the **Variables** group cell, specify all the needed variables to be used in the monitoring formula. For more information about creating variables, see “Creating and editing monitoring formula variables”.
7. Double-click the **Monitoring formula** cell.

The **Monitoring formula** dialog box appears.



**Figure 269 Monitoring formula dialog box**



8. Specify the formula to be used for computing the parameter. You can use any VBScript statements as a formula. For more information about VBScript operators and functions, see “Monitoring Formulas and VB Script Overview”. You can also



use object-calculator features that enables you to utilize predefined methods, e.g. envelope spectrum for trends. For more information, refer to “Using Object-Calculator.”

**Note:** You must assign the calculated value to the *Result* variable at the end of any monitoring formula. The program retrieves the resultant value from this reserved variable.

- If necessary, specify alarms/warnings for the calculated parameter. To do so, click the «-» sign in the **A/W Levels** column and then enter the needed values in the cells. The table below briefly describes available alarms/warnings.


 <b>A/W Leve</b>	<b>W+</b>	<b>A+</b>	<b>W-</b>	<b>A-</b>	<b>D</b>	<b>s</b>	<b>Tmeas</b>
 [2]	-	30.000	-	-	-	50.000	7

**Figure 270 A/W Levels cell group**

#### **Calculated parameter alarms**

<b>CELL NAME</b>	<b>DESCRIPTION</b>
<b>W+</b>	Upper level of the warning
<b>A+</b>	Upper level of the alarm
<b>W-</b>	Lower level of the warning
<b>A-</b>	Lower level of the alarm
<b>D</b>	Warning for absolute change
<b>s</b>	Warning for relative change
<b>Tmeas</b>	The number of reference days for calculating warnings for changes.

#### **To edit a monitoring formula:**

- In the row of the calculated parameter of interest, select the **Monitoring formula** cell.
- Do one of the following:
  - Right-click the selected cell and then select **Edit** from the menu.
  - Click  on the toolbar.


The **Monitoring formula** dialog box is displayed.

- Modify the monitoring formula of the calculated parameter and click **OK**.  
The changed formula is saved.

#### **To duplicate a calculated parameter:**

- Select the parameter you need.

2. Do one of the following:

- Right-click the selected row and select **Duplicate parameter** from the menu.
- Click  on the toolbar.

A new row with the selected parameter properties appears at the bottom of the table.

#### **To change the calculated parameters order in the list:**

1. Select the parameter you need.

2. Do one of the following:

- Right-click the selected row and select **Move up** or **Move down** from the menu.
- Click the row number of interest and drag the row to the needed location.

The parameter position is changed.

#### **To delete a calculated parameter:**

1. Select the parameter to be deleted.

2. Do one of the following:

- Right-click the selected parameter and select **Delete parameter** from the menu.

- Click  on the toolbar.

- Press CTRL+X or CTRL+DELETE.

The selected parameter is deleted.

## **Creating and editing monitoring formula variables**

Before specifying a monitoring formula, you need to create an input variables array.  
Each variable is defined by :

- Name which must meet the VBScript naming conventions. A name of the variable:
  - Must start with a letter
  - Has no «period» symbols
  - Consists of less than 255 symbols
  - Must be unique within the formula
- Type (integer, float, bool)
- Size (scalar, vector)
- Reference to a data source

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
**Note:** A variable is a sub-row of the calculated parameter row.

---

#### **To create a variable:**

1. Select the **Variables** cell of the needed calculated parameters.

2. Do one of the following:

- Right-click the selected cell and then Add variable from the menu.
- Click  on the toolbar.

A new variable with the default properties appears at the bottom of the **Variables** table.

3. In the **Name** cell, specify a name of the variable.

4. In the **Type** cell, select the variable type.

5. In the **Size** cell, specify the variable size.


6. Double-click the **Data source** cell and select a data source for the variable. As a data source, you can select one of the following object types:

- Waveform
- Spectra
- Parameter
- Calculated spectra
- Band
- Calculated parameter
- Alarm/warning

**To delete a variable:**

3. Select the variable to be deleted.

4. Do one of the following:

- Right-click the selected band and select **Delete** from the menu.
- Click  on the toolbar.
- Press CTRL+X or CTRL+DELETE.

The selected variable is deleted.

## Excel File Format When Exporting Inspections

When exporting inspection data into Microsoft Excel, a file containing multiple lists is created. The sections below describe the format of each list.

### Machine List

The Machine list shows general information on a completed inspection. The data are displayed in three column. The first column shows inspection parameter names. The

second column contains values of the inspection parameters. The third column shows a brief description of inspection parameter values. The table below describes inspection parameters.

### ***Inspection parameters***

PARAMETER	VALUE	DESCRIPTION
CompanyID	Company system ID	Company name
PlantID	Plant system ID	Plant name
ShopID	Machine shop system ID	Machine shop name
MachineID	Machine system ID	Machine name
regime	System ID of machine working mode	Name of the machine working mode
InspectionStatusID	Inspection status system ID	Inspection status name
StartTimeLocal	Starting inspection local time	
StopTimeLocal	Finishing inspection local time	
bias	The difference between the workstation local time and UTC.	
ParametersNum	The number of inspected parameters	
VibroNum	The number of inspected measurement points	

## Parameters List

The Parameters list shows information on inspected machine parameters.

### ***Machine parameters***

FIELD	DESCRIPTION
PointNum	Number of measurement point
Dir	Brief name of transducer orientation
Abbrev	Code abbreviation of point
UnitType	Parameter measurement unit
DirCode	Measurement direction code
UnitTypeCode	Parameter measurement unit code
Time	Measurement period
Validity	Data validity flag
Value	Parameter value

## Wave List

The Wave list shows information about measured signals in the measurement points. Each point is displayed on a separate list. A name of the list includes the point number and measurement direction code, e.g. Waves1-10.

### *Measured signal parameters*

FIELD	DESCRIPTION
PointNum	Number of measurement point
Dir	Brief name of transducer orientation
Abbrev	Code abbreviation of point
UnitType	Parameter measurement unit
DirCode	Measurement direction code
UnitTypeCode	Parameter measurement unit code
Time	Measurement time
HighFreq	Upper frequency of the measurement band
Samples	Number of samples
AverageType	Averaging type
AverageNumber	Number of averages
AverageSyncType	Average synchronization type
MinValue	Minimum value of measured signal
MaxValue	Maximum value of measured signal
Validity	Data validity flag
Value	All values of the measured signal
SyncCount	Number of synchronized waveforms
SyncID	Synchronizad waveform ID

## Bands List

The Bands list shows information on measurement bands. Each point is displayed on a separate list. A name of the list includes the point number and measurement direction code, e.g. Bands1-10.

***Band parameters***

FIELD	DESCRIPTION
PointNum	Number of measurement point
Dir	Brief name of transducer orientation
Abbrev	Code abbreviation of point
UnitType	Parameter measurement unit
DirCode	Measurement direction code
UnitTypeCode	Parameter measurement unit code
Time	Measurement time
BandsCount	Number of band in the measurent point
BandID	Band ID
BandType	Band type
FreqType	Frequency type
ValueType	Value type
Fc	Center frequency
Flow	Lower frequency
Fhigh	Upper frequency
TachoPointNum	Number of tachoparameter
Validity	Data validity flag
Value	RMS value in the band
PhaseValue-Degree	Band phase value (for relative bands only)
CuttingRelBandsCount	Amount of cutting fundamental frequencies (for remainder band type)
CuttingRelBands	Cutting Fundamental frequencies references

**Sync List**

The Sync list shows information on synchronized waveforms (if any). Each point is displayed on a separate list. A name of the list includes the waveform number, e.g. Sync1.

***Synchronized waveforms parameters***

FIELD	DESCRIPTION
PointNum	Number of measurement point
Time	Measurement time

FIELD	DESCRIPTION
Resolution	Waveform collection resolution (Hz)
Numbers	Number of samples with synchrolabels

## Monitoring Formulas and VB Script Overview

This appendix describes main VBScript operators and statements, as well as embedded VBScript math functions.

### VBScript Operators

VBScript encompasses the full set of operators:

- Arithmetic operators
- Logical operators
- Comparison and concatenation operators

When several operations occur in an expression, each part is evaluated and resolved in a predetermined order called operator precedence. Parentheses can be used to override the order of precedence and force some parts of an expression to be evaluated before other parts. Operations within parentheses are always performed before those outside. Within parentheses, however, normal operator precedence is maintained. When expressions contain operators from more than one category, arithmetic operators are evaluated first, comparison operators are evaluated next, and logical operators are evaluated last. Comparison operators all have equal precedence; that is, they are evaluated in the left-to-right order in which they appear. Arithmetic and logical operators are evaluated in the following order of precedence:

#### ***VBScript operators***

ARITHMETIC	COMPARISON	LOGICAL
Negation (-)	Equality (=)	Not
Exponentiation (^)	Inequality (<>)	And
Multiplication and division (*, /)	Less than (<)	Or
Integer division (\)	Greater than (>)	Xor
Modulus arithmetic (Mod)	Less than or equal to (<=)	Eqv
Addition and subtraction (+, -)	Greater than or equal to (>=)	Imp
String concatenation (&)	Is	&

When multiplication and division occur together in an expression, each operation is evaluated as it occurs from left to right. Likewise, when addition and subtraction occur together in an expression, each operation is evaluated in order of appearance from left to right.

The string concatenation operator (&) is not an arithmetic operator, but in precedence it does fall after all arithmetic operators and before all comparison operators. The Is operator is an object reference comparison operator. It does not compare objects or their values; it checks only to determine if two object references refer to the same object.

## VBScript Conditional Statements

Very often when you write code, you want to perform different actions for different decisions. You can use conditional statements in your code to do this. In VBScript we have the following conditional statements:

- **if** statement – use this statement if you want to execute a set of code when a condition is true.
- **if...then...else** statement – use this statement if you want to select one of two sets of lines to execute.

You should use the If...Then...Else statement if you want to either execute some code if a condition is true or select one of two blocks of code to execute. If you want to execute more than one statement when a condition is true, you must put each statement on separate lines and end the statement with the keyword "End If". If you want to execute a statement if a condition is true and execute another statement if the condition is not true, you must add the "Else" keyword.

- **if...then...elseif** statement – use this statement if you want to select one of many sets of lines to execute

You can use the if...then...elseif statement if you want to select one of many blocks of code to execute.

- **select case** statement – use this statement if you want to select one of many sets of lines to execute

You can also use the SELECT statement if you want to select one of many blocks of code to execute.

## VBScript Looping Statements

Very often when you write code, you want to allow the same block of code to run a number of times. You can use looping statements in your code to do this. In VBScript there are four looping statements:

- **For...Next** statement – runs statements a specified number of times.

You can use a For...Next statement to run a block of code, when you know how many repetitions you want. You can use a counter variable that increases or decreases with each repetition of the loop. The For statement specifies the counter variable (i) and its start and end values. The Next statement increases the counter



variable (i) by one. Using the Step keyword, you can increase or decrease the counter variable by the value you specify.

- **For Each...Next** statement – runs statements for each item in a collection or each element of an array.

A For Each...Next loop repeats a block of code for each item in a collection, or for each element of an array.

- **Do...Loop** statement – loops while or until a condition is true.

You can use Do...Loop statements to run a block of code when you do not know how many repetitions you want. The block of code is repeated while a condition is true or until a condition becomes true.

- **While...Wend** statement – Do not use it - use the Do...Loop statement instead.

## VBScript Math Functions

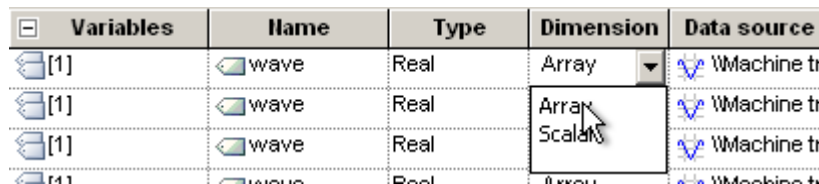
### *VBScript math functions*

FUNCTION	DESCRIPTION
Abs(number)	Returns the absolute value of a specified number
Atn(number)	Returns the arctangent of a number. The Atn function takes the ratio of two sides of a right triangle (number) and returns the corresponding angle in radians. The ratio is the length of the side opposite the angle divided by the length of the side adjacent to the angle. The range of the result is -pi /2 to pi/2 radians. To convert degrees to radians, multiply degrees by pi/180. To convert radians to degrees, multiply radians by 180/pi.
Cos(number)	Returns the cosine of an angle. The Cos function takes an angle and returns the ratio of two sides of a right triangle. The ratio is the length of the side adjacent to the angle divided by the length of the hypotenuse. The result lies in the range -1 to 1. To convert degrees to radians, multiply degrees by pi /180. To convert radians to degrees, multiply radians by 180/pi.
Exp(number)	Returns e (the base of natural logarithms) raised to a power.
Fix(value)	Returns the integer part of a specified number
Hex(value)	Returns a string representing the hexadecimal value of a number. If number is not already a whole number, it is rounded to the nearest whole number before being evaluated.
Int(value)	Returns the integer portion of a number. The number argument can be any valid numeric expression. If number contains Null, Null is returned.
Log(number)	Returns the natural logarithm of a number. The number argument can be any valid numeric expression greater than 0.  The natural logarithm is the logarithm to the base e. The constant e is approximately 2.718282. You can calculate base-n logarithms for any number x by dividing the natural logarithm of x by the natural logarithm of n as follows: $\text{Logn}(x) = \text{Log}(x) / \text{Log}(n)$

FUNCTION	DESCRIPTION
Rnd(number)	Returns a random number less than 1 but greater or equal to 0
Sgn(number)	Returns an integer indicating the sign of a number.
Sin(number)	Returns the sine of an angle. The Sin function takes an angle and returns the ratio of two sides of a right triangle. The ratio is the length of the side opposite the angle divided by the length of the hypotenuse. The result lies in the range -1 to 1. To convert degrees to radians, multiply degrees by pi /180. To convert radians to degrees, multiply radians by 180/pi.
Sqr(number)	Returns the square root of a number.
Tan(number)	Returns the tangent of an angle. Tan takes an angle and returns the ratio of two sides of a right triangle. The ratio is the length of the side opposite the angle divided by the length of the side adjacent to the angle. To convert degrees to radians, multiply degrees by pi /180. To convert radians to degrees, multiply radians by 180/pi.

## Working with Array Variables in Monitoring Formulas

To declare an array variable in the monitoring formulas editor, you have to choose **Array** in the **Dimension** cell, as shown in the picture below.



Variables	Name	Type	Dimension	Data source
[1]	wave	Real	Array	WMachine tr
[1]	wave	Real	Array	WMachine tr
[1]	wave	Real	Array	WMachine tr
[1]	wave	Real	Array	WMachine tr

**Figure 271 Creating array variable**

You can use the following methods when working with array variables: **Variable.Item(i)** and **Variable.Count**, where **Variable** – a name of the array variable created in the monitoring formulas editor by the user, **Item (i)** and **Count** – variable methods.

These methods are not VBScript properties—they are only used in the monitoring formulas editor for array handling.

The result of the **Variable.Item(i)** method is an *i* element of the array.

The result of the **Variable.Count** method is an array size (the number of array elements).

**Note:** You have to use the “.” (dot) delimiter between a variable name and variable method.

### Using array methods to calculate wave peak-to-peak value (example)

```

If wave.count > 0 Then
max=wave.item(0)
min=wave.item(0)

For x = 0 To (wave.count - 1)

```

```
Value = wave.item(x)

If max < value Then
max = value
End If

Next

Result = (max - min)

end if
```

## Using Object-Calculator

You can use in the monitoring formulas the object-calculator which is initialized by a wave and fundamental frequency values, and helps you to calculate some important wave characteristics not using bulk VBScript statements.

Examples of object-calculator and its methods usage are shown in the last section.

### Creating Object-Calculator

**To use the object-calculator in your formula, insert the following string at the beginning of the formula:**

```
Set vdePointData = CreateObject("VdeMath.VdePointData"),
```

where the vdePointData variable can have any name.

### Wave and fundamental frequency value initialization

**To initialize a wave, insert the following string in the formula:**

```
vdePointData.SetWave <Wave>, <Fhigh>,
```

where *Wave* – wave array variable; *Fhigh* – upper frequency of the wave.

**To initialize a fundamental frequency value, insert the following string in the formula:**

```
vdePointData.SetN <N>, <F>,
```

where *N* – fundamental frequency number; *F* – frequency value in Hertz.

### Using object-calculator to calculate data and to access data

This section contains description of object-calculator **data calculating** and **data accessing** methods.

**To receive array of wave samples, use the following variable**

```
vdePointData.Wave
```

where *Wave* – array of wave samples. When working with the *Wave* variable, you can use the same methods as for any array (Item(i) and Count (see “Working with Array Variables”)).

**To receive array of spectrum lines, use the following variable**

```
vdePointData.Spectrum
```

where *Spectrum* – spectrum lines array. The number of lines and step are calculated automatically using the upper frequency. When working with the *Spectrum* variable, you can use the same methods as for any array (Item(i) and Count (see “Working with Array Variables”)).

**To receive a fundamental frequency value, use the method**

```
vdePointData.N(<N>)
```

where *N* – the number of fundamental frequency (the same as was set in SetN – see above).

**To receive a filtered signal from the original wave, use the method**

```
vdePointData.Filter(<Flow>, <Fhigh>, <Type>)
```

where *Flow* – lower frequency of the filter in Hz, *Fhigh* – upper frequency of the filter in Hz, *Type* – a filter type (1 – the specified band is cut, 0 – the specified band is used). When working with the *Filter* variable, you can use the same methods as for any array.

**To receive an envelope spectrum, use the method**

```
vdePointData.EnvelopeSpectrum(<Flow>, <Fhigh>)
```

where *Flow* – the lower frequency of envelope filter in Hertz, *Fhigh* - the upper frequency of envelope filter in Hertz. When working with this variable, you can use the same methods as for any array.

**To receive RMS in the absolute band, use the method**

```
vdePointData.AbsRMS(<Flow>, <Fhigh>)
```

where *Flow* – the lower frequency of the band in Hertz, *Fhigh* - the upper frequency of the band in Hertz. The result is scalar.

**To receive RMS in the relative band (deviation from the center frequency is expressed in Hz), use the method**

```
vdePointData.RelHzRMS(<Left>, <Right>, <N>, <Coef>)
```

where *Left* - the width of the left band (from the center) in Hertz, *Right* - the width of the right band (from the center) in Hertz, *N* - the number of fundamental frequency for the center frequency, *Coef* – fundamental frequency multiplier. The result is scalar.

**To receive RMS in the relative band (deviation from the center frequency is expressed in %), use the method**

```
vdePointData.RelPercentRMS(<Left>, <Right>, <N>, <Coef>)
```

where *Left* – the width of the left band (from the center) in percentage of center frequency, *Right* - the width of the right band (from the center) in percentage of center frequency, *N* – the number of fundamental frequency for the center frequency, *Coef* – fundamental frequency multiplier. The result is scalar.

**To receive the average value of wave, use the method**

```
vdePointData.Average
```

**To receive the wave magnitude value within the period, use the method**

```
vdePointData.Peak(<Tlow>, <Thigh>)
```

where *Tlow* - start time of the range in seconds (0 – not used), *Thigh* – end time of the range in seconds (0 – not used).

**To receive the Peak-Peak value within the period, use the method**

```
vdePointData.PkPk(<Tlow>, <Thigh>)
```

where *Tlow* and *Thigh* the same as described above.

**To receive the Crest value within the period, use the method**

```
vdePointData.Crest(<Tlow>, <Thigh>)
```

**To receive the Kurtosis value within the period, use the method**

```
vdePointData.Kurtosis(<Tlow>, <Thigh>)
```

**To receive the Skewness value within the period, use the method**

```
vdePointData.Skewness(<Tlow>, <Thigh>)
```

## Using object-calculator to transform data

This section contains description of object-calculator **data transforming** methods.

These methods affect the return values of the data calculating and data getting methods described above.

**To differentiate wave, use the method**

```
vdePointData.ApplyDif
```

**To integrate wave, use the method**

```
vdePointData.ApplyInt
```

**To filter wave, use the method**

```
vdePointData.ApplyFilter <Flow>, <Fhigh>
```

where *Flow* – lower frequency, and *Fhigh* – upper frequency of the filter in Hz

**To reset the object data to the original wave, use the method**

```
vdePointData.Reset
```

## Using object-calculator in the Machine Element formulas (examples)

Let the upper frequency of the wave is 4000 Hz, and its measure unit is “mm/s”.

### Formula to calculate the Crest value

```
Set vdePointData = CreateObject("VdeMath.VdePointData")
vdePointData.SetWave wave, 4000.0
Result = vdePointData.Crest(0.0, 0.0)
```

### Formula to calculate Peak-Peak value of the integrated wave (i.e. in “mkm”) in the frequency band of 50-60 Hz

```
Set vdePointData = CreateObject("VdeMath.VdePointData")
vdePointData.SetWave wave, 4000.0
vdePointData.ApplyInt
vdePointData.ApplyFilter 50, 60
Result = vdePointData.PkPk(0.0, 0.0)
```

## Using object-calculator in the Machine formulas (example)

Let the machine model has one fundamental frequency, and its measure unit is “rpm”.

### Formula to calculate RMS value in the relative band “±5% from tripled fundamental frequency”

```
'Variable N1 is link to the fundamental frequency
Set vdePointData = CreateObject("VdeMath.VdePointData")
vdePointData.SetWave wave, 4000.0
vdePointData.SetN 1, N1/60.0
Result = vdePointData.RelPercentRMS(5.0, 5.0, 1, 3.0)
```

## Windows Security Settings for Remote Access

To enable remote access to the databases located on your workstation, you need to specify special Windows security settings. Choose one of the procedures below depending on the OS installed on your computer.

To connect to a ASTD-2 machine shop system or databases located on remote computers on the local network, you also need to properly configure security settings of the OS installed on your computer<sup>9</sup>.

---

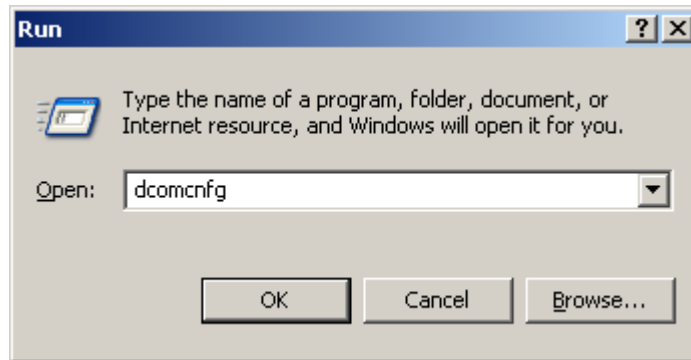
<sup>9</sup> If you have already configured necessary security settings for remote access to the databases located on your workstation, there is no need in these additional steps.

## Windows 2000 SP4

To enable access to the databases on your computer<sup>10</sup>:

1. On the Windows **Start** menu, select **Run**.

The **Run** dialog box is displayed.

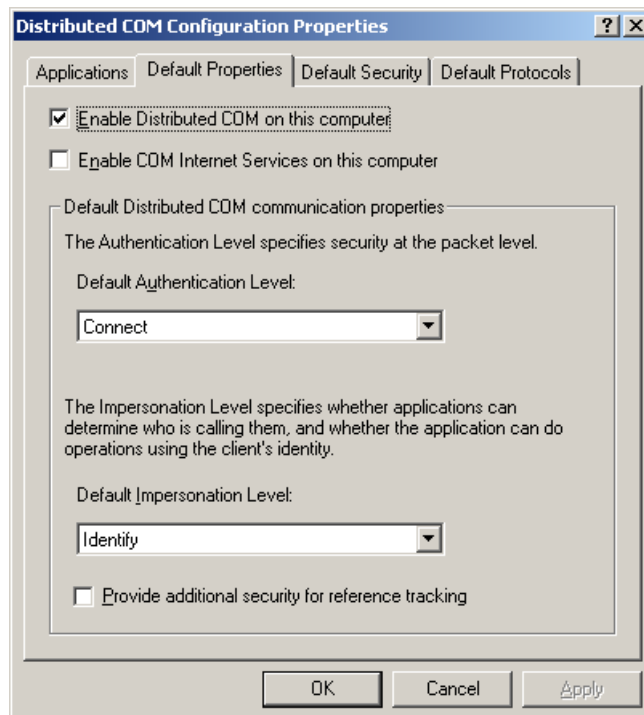


**Figure 272 Run dialog box**

2. In the **Open** box, type *dcomcnfg* and click **OK**.

The **Distributed COM Configuration Properties** dialog box appears.

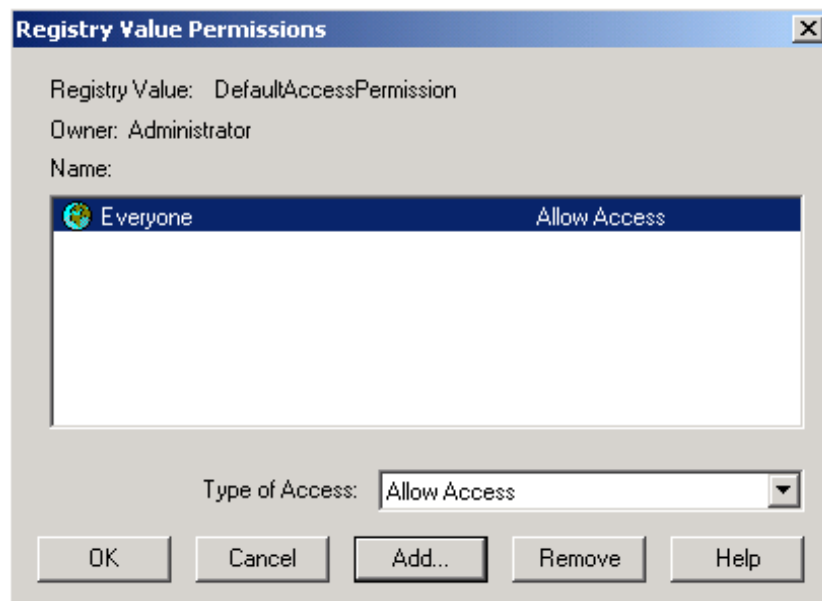
3. Click the **Default Properties** tab and specify the settings as in the picture below.



**Figure 273 Distributed COM Configuration Properties—Default Properties tab**

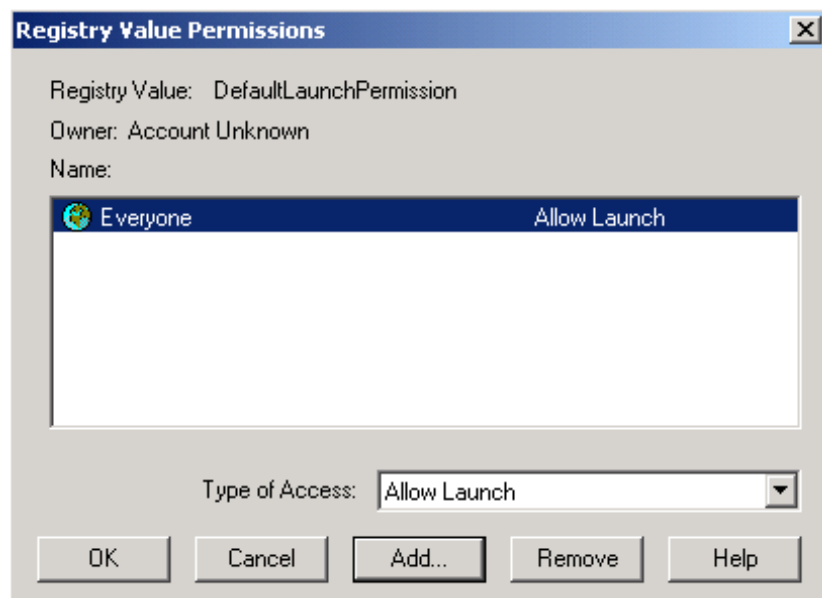
<sup>10</sup> To enable access to remote databases and ASTD-2 machine shop system, go through Steps 1-7 only.

4. Click the **Apply** button and then click the **Default Security** tab.
5. In the **Default Access Permissions** section, click the **Edit Permissions** button and specify the settings as in the picture below.



**Figure 274 Registry Value Permissions dialog box**

6. From the **Type of Access** list, select *Allow Access* and click **OK**.
7. In the **Default Launch Permissions** section, click the **Edit Permissions** button and specify the settings as in the picture below.



**Figure 275 Registry Value Permissions dialog box**

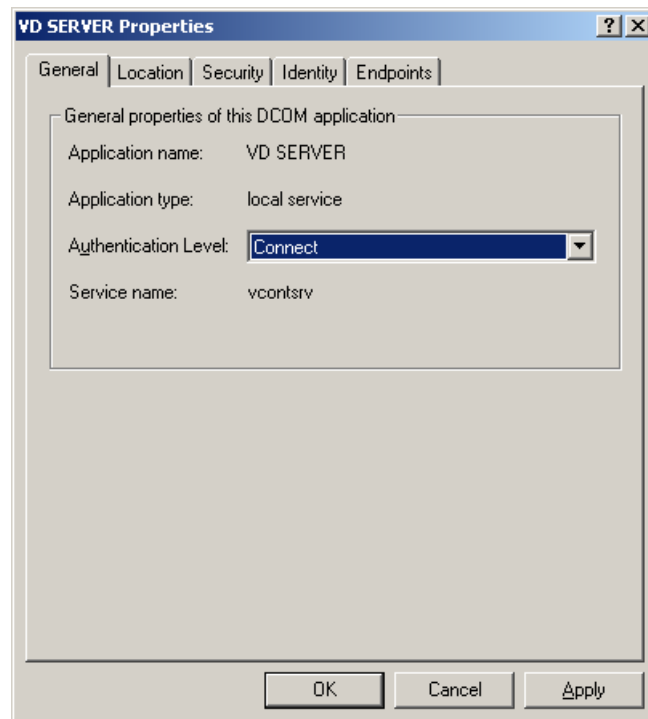
8. From the **Type of Access** list, select *Allow Launch* and click **OK**.
9. Click the **Apply** button and then click the **Applications** tab.



10. On the **Applications** tab, select VD SERVER from the list.

The **VD SERVER Properties** dialog box appears.

11. On the **General** tab, specify the settings as in the picture below.

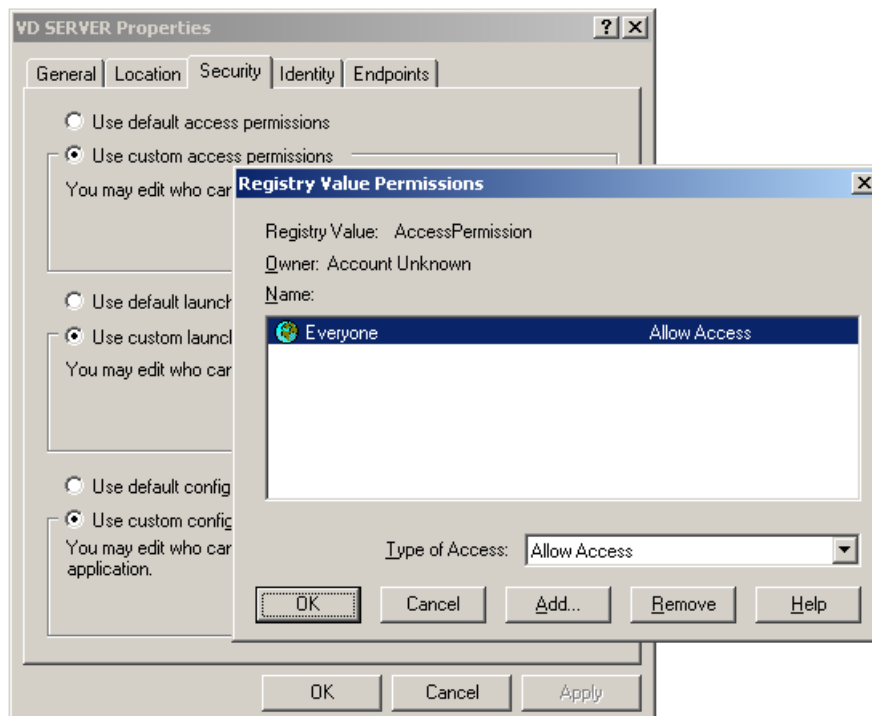


**Figure 276 VD SERVER Properties**

12. Click the **Security** tab.

13. Select **Use custom access permissions** and then click the **Edit** button.

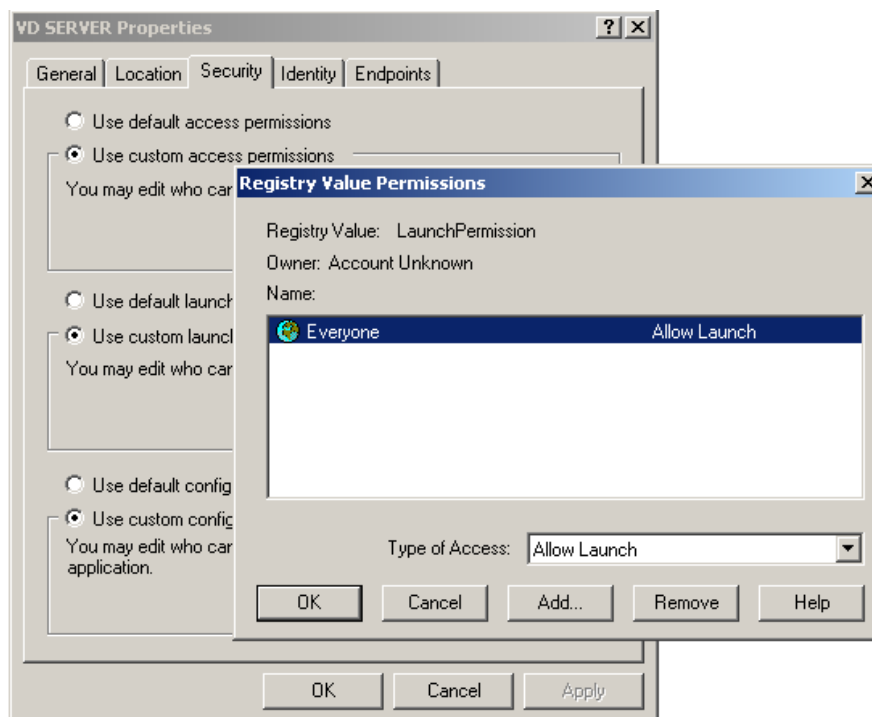
The **Registry Value Permissions** dialog box appears.



**Figure 277 Registry Value Permissions**

14. From the **Type of Access** list, select *Allow Access* and click **OK**.
15. Select **Use custom launch permissions** and then click the **Edit** button.

The **Registry Value Permissions** dialog box appears.



**Figure 278 Registry Value Permissions**

16. From the **Type of Access** list, select *Allow Launch* and click **OK**.

## Windows XP SP1

To enable access to the databases on your computer<sup>11</sup>:

1. On the Windows **Start** menu, select **Control Panel > Administrative Tools > Component Services**.

The **Component Services** dialog box appears.

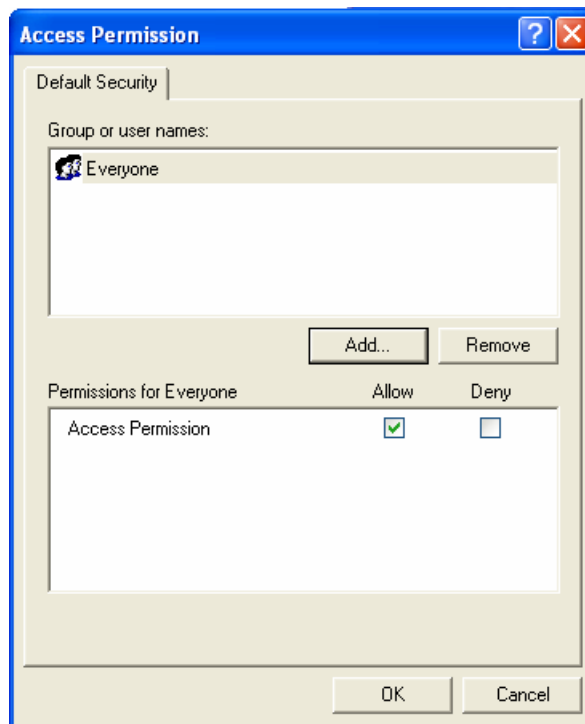
2. From the tree on the left, select **Component Services > Computers > My Computer**.

3. Right-click **My Computer** and select **Properties** from the menu.

The **My Computer Properties** dialog box appears.

4. Click the **COM Security** tab.

5. In the **Access Permissions** section, click the **Edit Default** button and specify the settings as in the picture below.

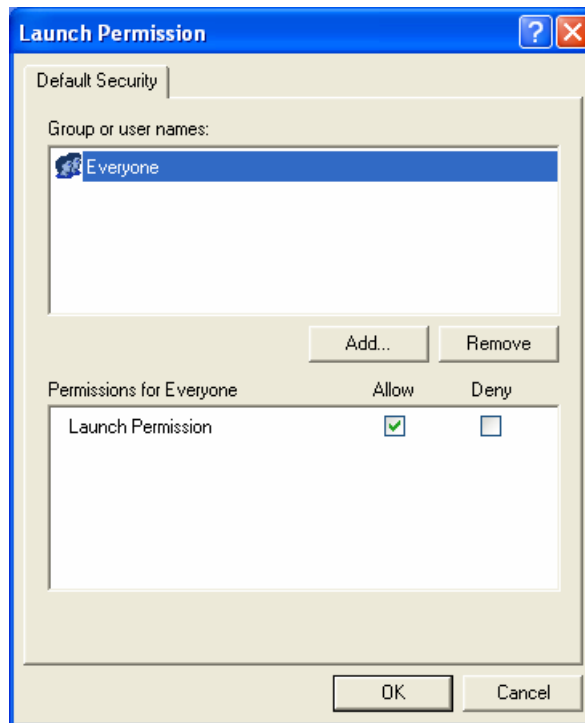


**Figure 279 Access Permission dialog box**

6. Click **OK**.

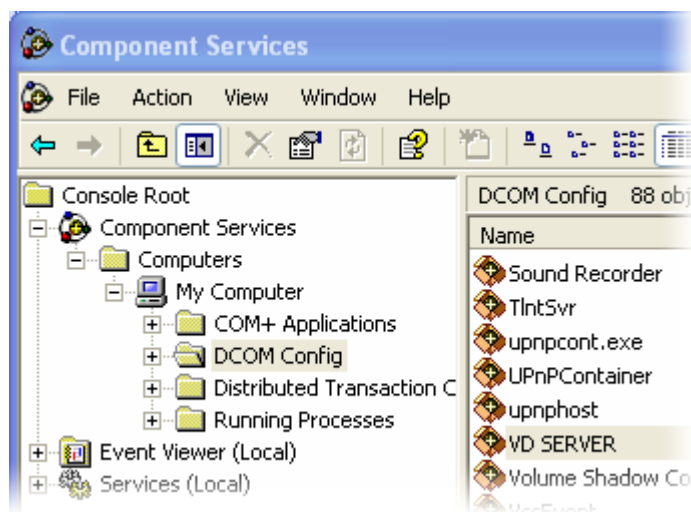
<sup>11</sup> To enable access to remote databases and ASTD-2 machine shop system, go through Steps 1-5 only.

7. In the **Launch Permissions** section, click the **Edit Defaults** button and specify the settings as in the picture below.



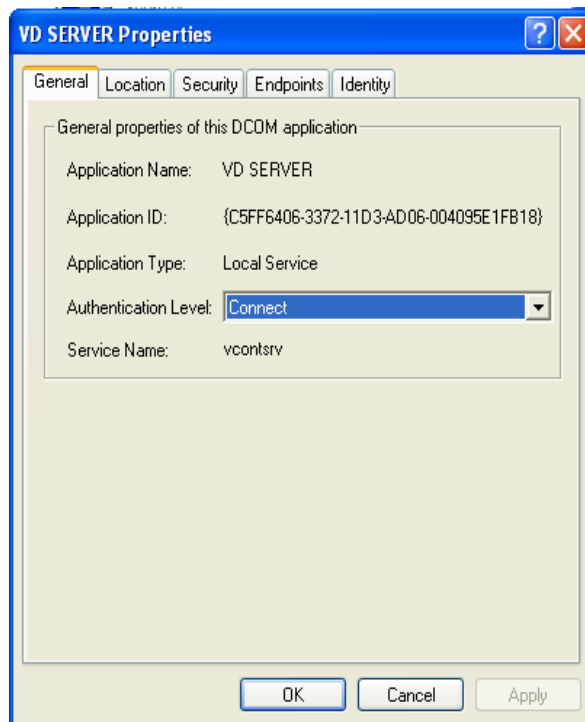
**Figure 280 Launch permission dialog box**

8. Click **OK**.
9. In the tree on the left, select **DCOM Settings** and then select **VD SERVER** on the right.



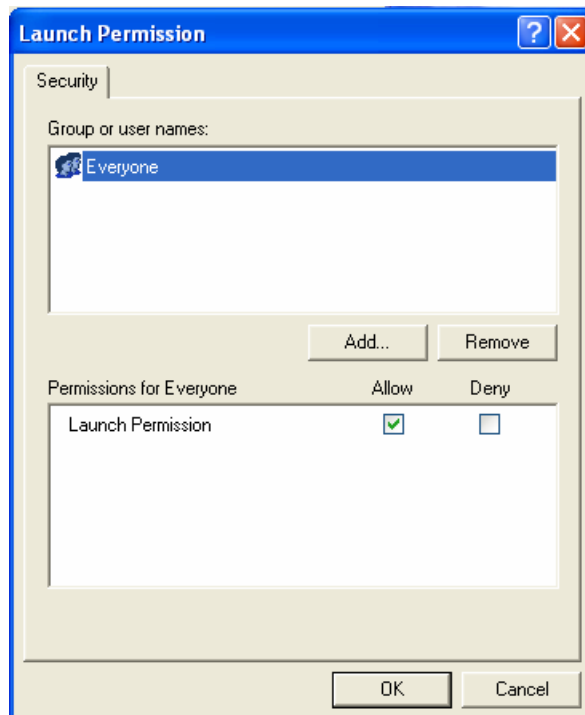
**Figure 281 Selecting VD SERVER in DCOM settings**

10. Right-click **VD SERVER** and select **Properties** from the menu.
11. On the **General** tab, specify the settings as in the picture below.



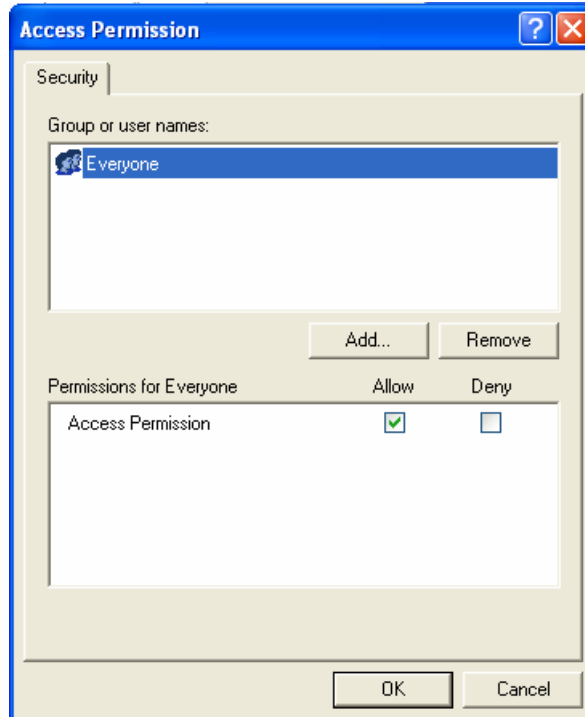
**Figure 282** *VD SERVER dialog box—General tab*

12. Click the **Security** tab.
13. Set the **Launch Permissions** option to **Customize** and click the **Edit** button.  
The **Launch Permissions** dialog box appears.
14. Specify the settings as in the picture below.



**Figure 283** *Launch permissions dialog box*

15. Click **OK**.
16. Set the **Access Permissions** option to **Customize** and click the **Edit** button.  
The **Access Permissions** dialog box appears.
17. Specify the settings as in the picture below.



**Figure 284 Access permissions dialog box**

18. Click **OK**.

## Windows XP SP2

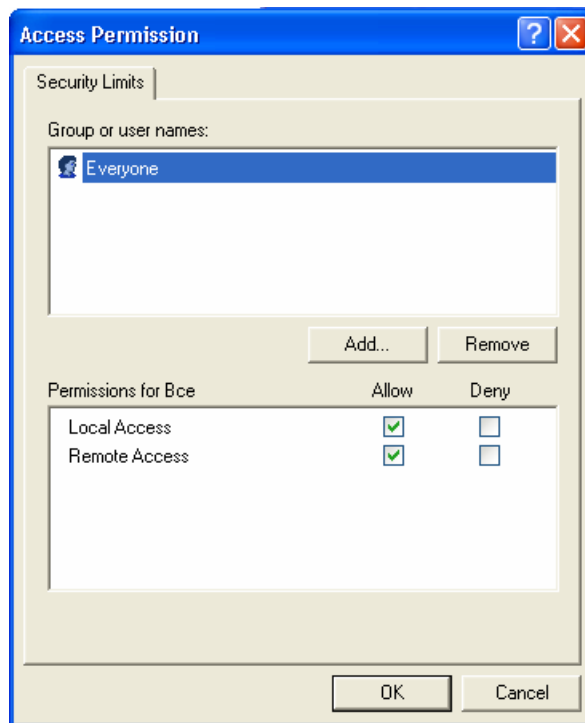
**To enable access to the databases on your computer<sup>12</sup>:**

1. On the Windows **Start** menu, select **Control Panel > Administrative Tools > Component Services**.  
The **Component Services** dialog box appears.
2. From the tree on the left, select **Component Services > Computers > My Computer**.
3. Right-click **My Computer** and select **Properties** from the menu.  
The **My Computer Properties** dialog box appears.
4. Click the **COM Security** tab.

---

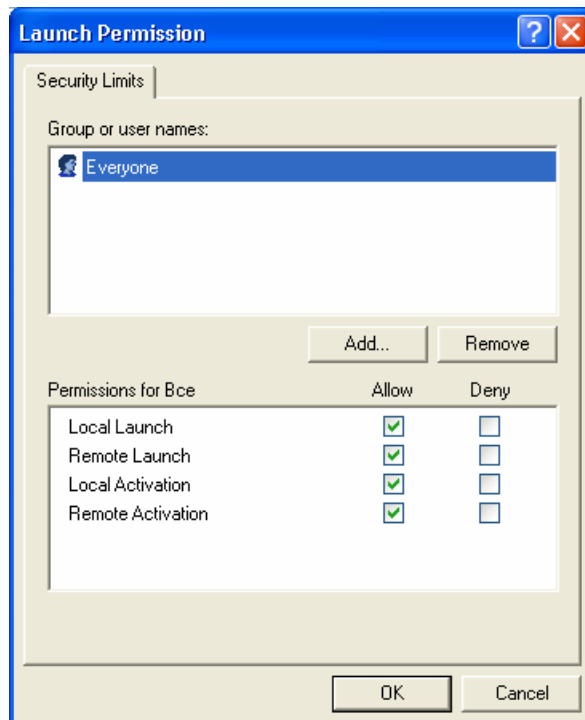
<sup>12</sup> To enable access to remote databases and ASTD-2 machine shop system, go through Steps 1-5 only.

5. In the **Access Permissions** section, click the **Edit Limits** button and specify the settings as in the picture below.



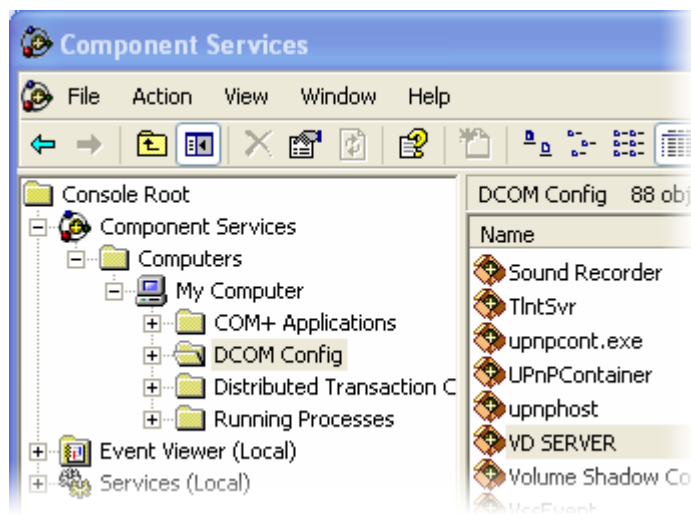
**Figure 285 Access permissions dialog box**

6. Click **OK**.
7. In the **Launch and Activation Permissions** section, click the **Edit Permissions** button and specify the settings as in the picture below.



**Figure 286 Launch permissions dialog box**

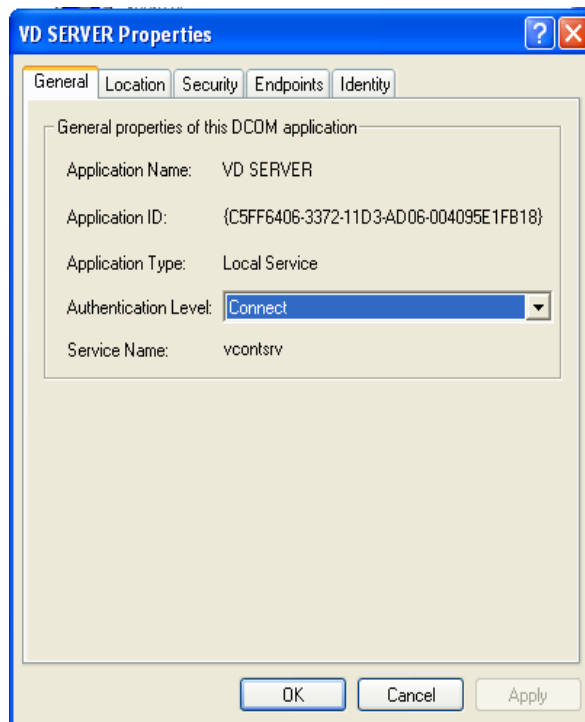
8. Click **OK**.
9. In the tree on the left, select **DCOM Settings** and then select **VD SERVER** on the right.



**Figure 287 Selecting VD SERVER in DCOM settings**

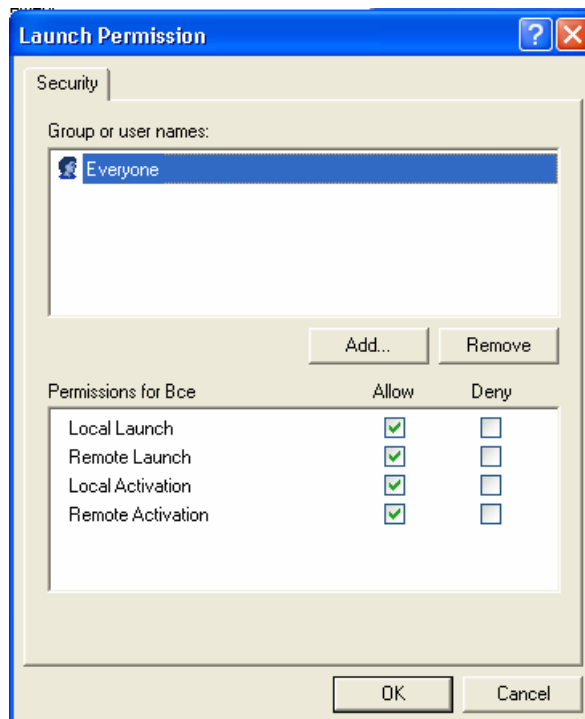
10. Right-click **VD SERVER** and select **Properties** from the menu.
11. On the **General** tab, specify the settings as in the picture below.





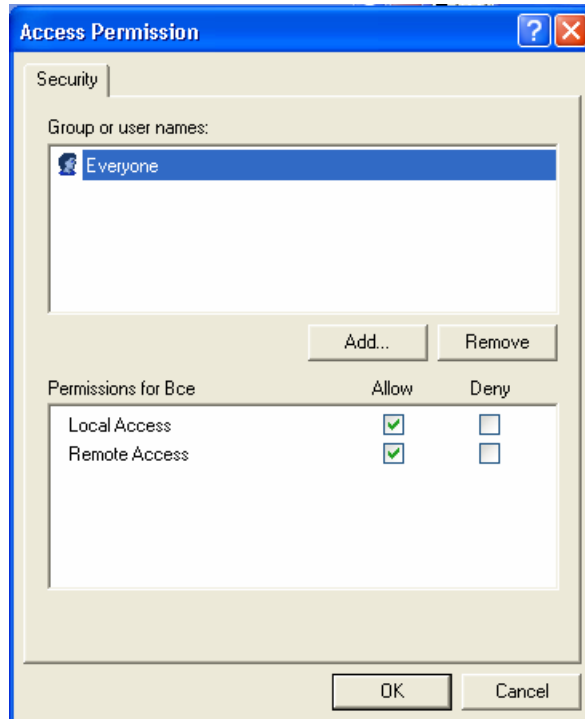
**Figure 288** *VD SERVER dialog box—General tab*

12. Click the **Security** tab.
13. Set the **Launch Permissions** option to **Edit** and click the **Edit** button.  
The **Launch Permissions** dialog box appears.
14. Specify the settings as in the picture below.



**Figure 289** *Launch permissions dialog box*

15. Click **OK**.
16. Set the **Access Permissions** option to **Edit** and click the **Edit** button.  
The **Access Permissions** dialog box appears.
17. Specify the settings as in the picture below.



**Figure 290 Access permissions dialog box**

18. Click **OK**.

## Installing STD-500/510 Driver

If you want to work with STD-500/510 monitors on your workstation, you need to install a special driver at the first connection. Installing the driver is shown with the STD-500 monitor. Use the same procedure for installing the STD-510 driver.

### To install the STD-500 driver:

1. Connect your STD-500 to any USB port of your workstation. Use a special USB cable delivered with STD-500.

The **Found New Hardware STD-500** message is displayed in the lower right corner of the Windows desktop.



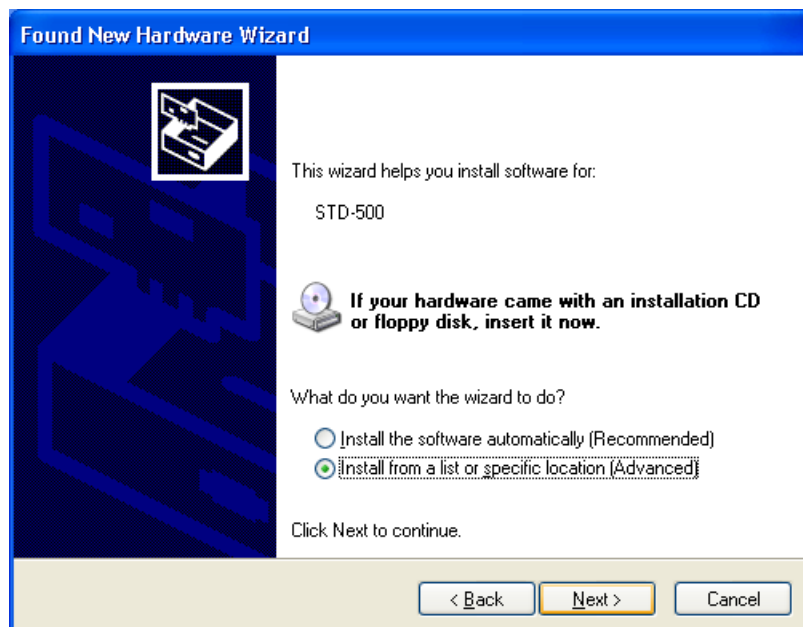
**Figure 291 Found New Hardware message**

After a while, the **Found New Hardware Wizard** appears.



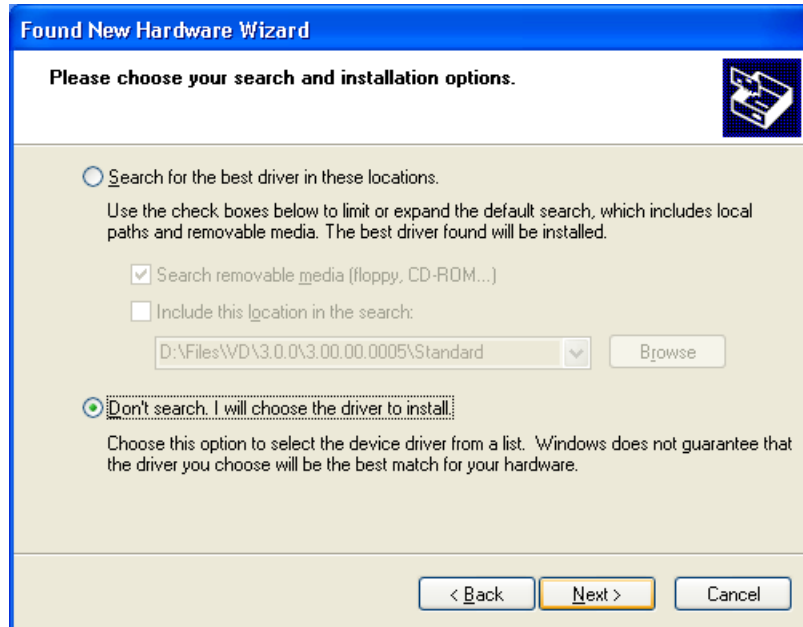
**Figure 292 Found New Hardware Wizard—first step**

2. Click **No, not this time** and then click **Next**.



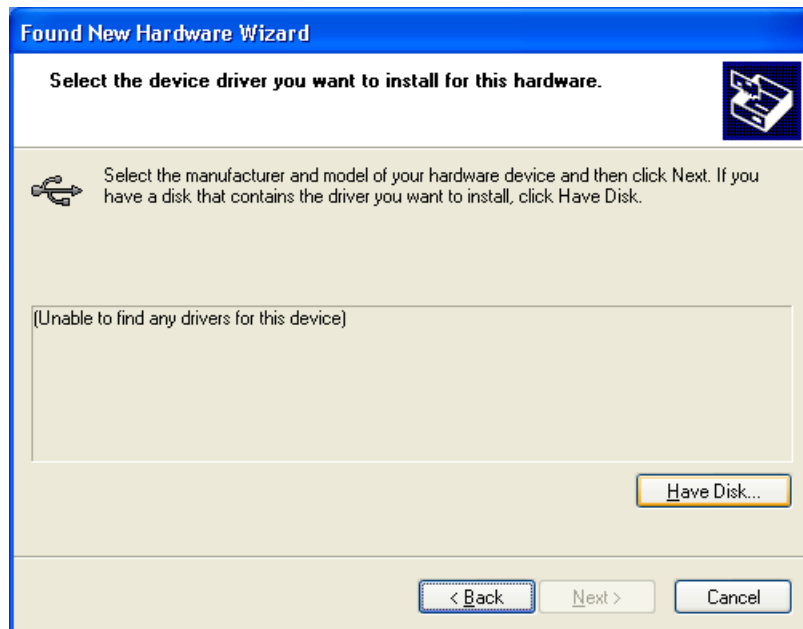
**Figure 293 Found New Hardware Wizard—second step**

3. Click **Install from a list or specific location** and then click **Next**.



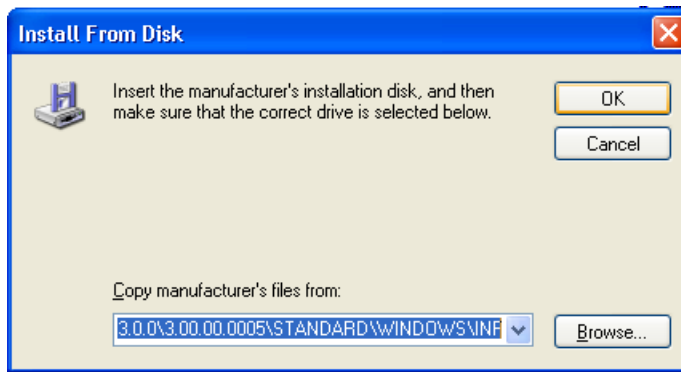
**Figure 294 Found New Hardware Wizard—third step**

4. Click **Don't search. I will choose the driver to install** and then click **Next**.



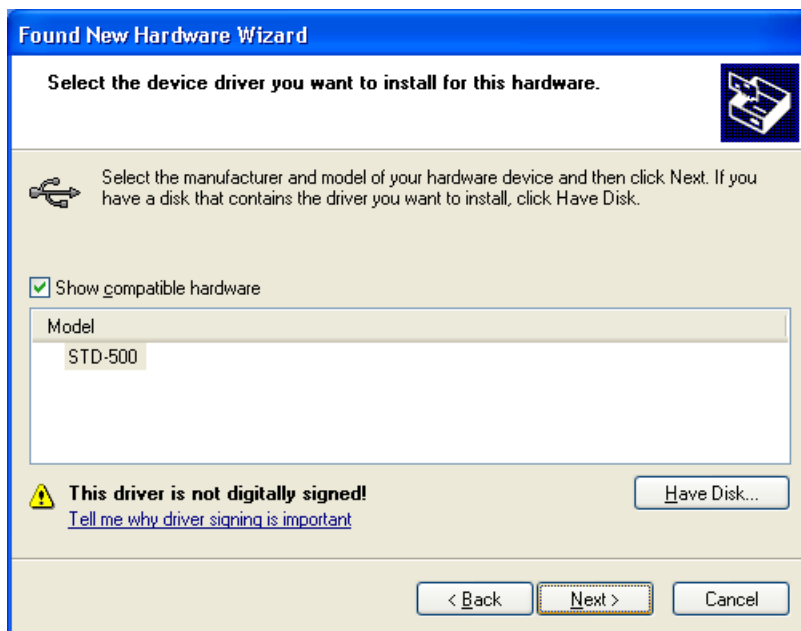
**Figure 295 Found New Hardware Wizard—fourth step**

5. Click the **Have Disk** button.



**Figure 296 Found New Hardware Wizard—fourth step**

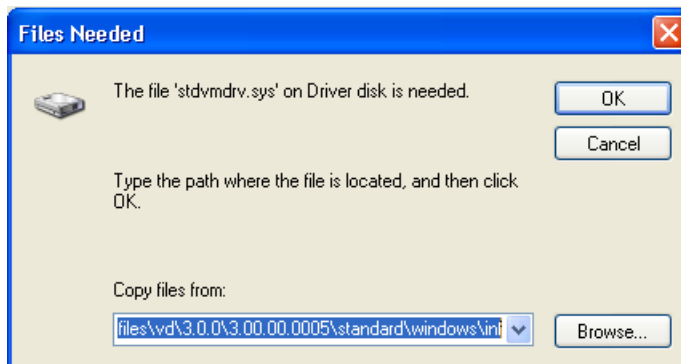
6. In the **Copy manufacturer's files from** box, specify <Vibrodesigner Installation CD>\Windows\INF\stdvmdrv.inf and then click **OK**.



**Figure 297 Found New Hardware Wizard—fifth step**

7. Click the **Next** button.

The **Files Needed** dialog box appears.



**Figure 298 Files Needed dialog box**

8. Click the **Browse** button, select the *stdvmdrv.sys* file located in the installation disk root folder, and then click **Open**.

The path to the selected file is shown in the **Copy files from** box.

9. Click **OK**.

The driver installation is started.

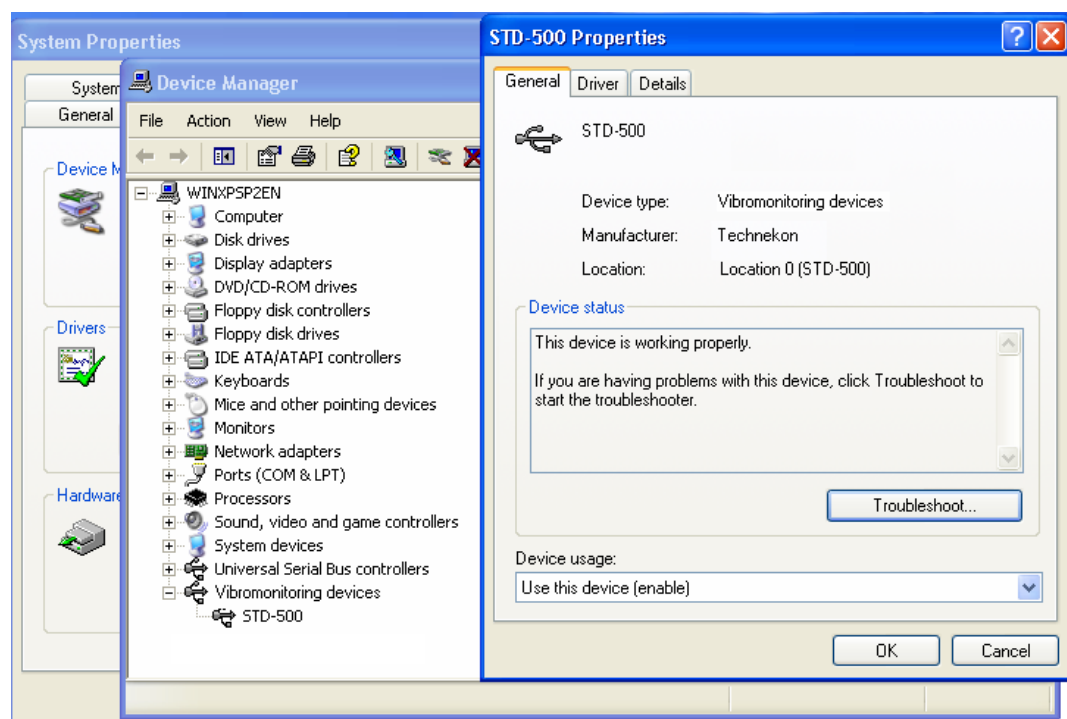
10. When finished, click the Finish button.

The **Your new hardware is installed and ready to use** message is displayed in the lower right corner of the Windows desktop.



**Figure 299** Your new hardware is installed and ready to use message

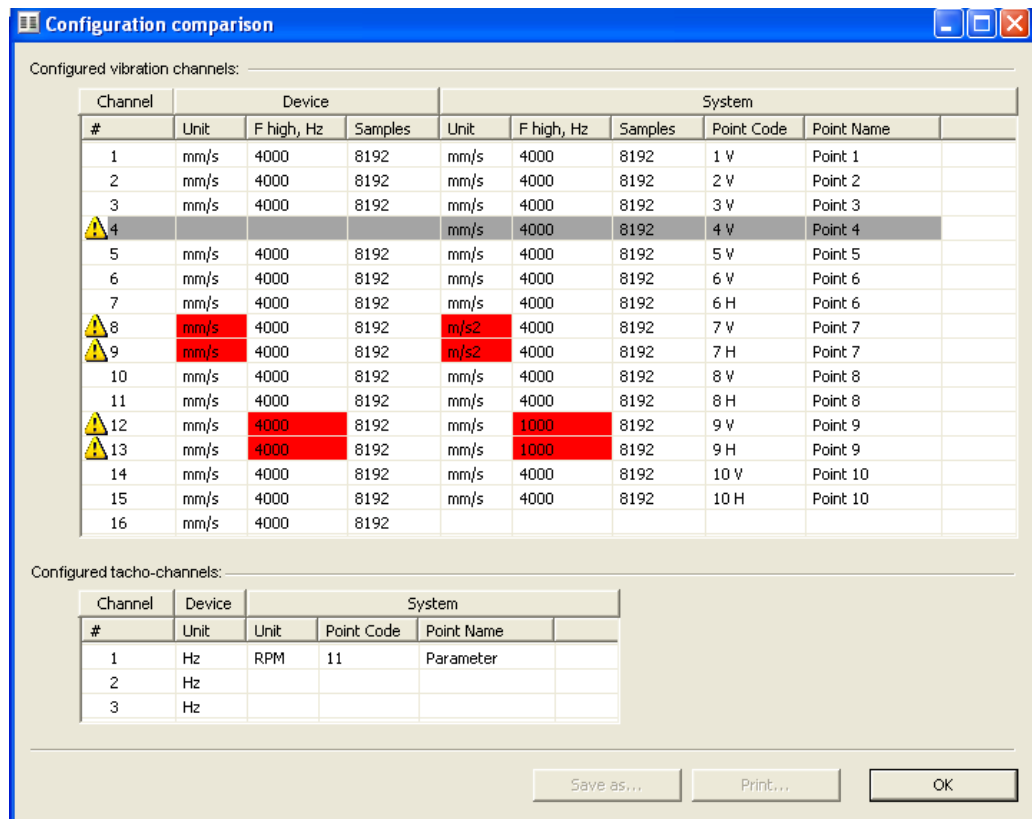
You can now view the information on the installed STD-500 in the **Vibromonitoring devices** section of the Windows **Device Manager**.



**Figure 300** STD-500 properties in Device Manager

## Comparing Stationary Device and Database Configurations

When working with stationary devices, the device configuration must match the configuration of machine measurement points defined in the program; otherwise, loading inspection data into the database will fail. To view both configurations and detect possible discrepancies, use the View configuration button on the **Communication** tab (see Figure 132). The **Configuration Comparison** dialog box appears.



**Figure 301 Comparing program and device configurations**

In this dialog box, you can see the channel configuration of the connected device (in the **Device** columns) as well as measurement points in the program bound to these channels (**System** columns). If a channel configuration does not match a measurement point configuration, you will see the exclamation mark (⚠) in the first column of this channel. You can see discrepancies for channels 4, 8, 9, 12 and 13 in the picture above. If a channel has been configured in the program but in the device this channel is blank, such a channel is shown as grey (see channel 4 in the above picture). Mismatching in configuration parameters is shown with red (see channels 8-9 and 12-13).

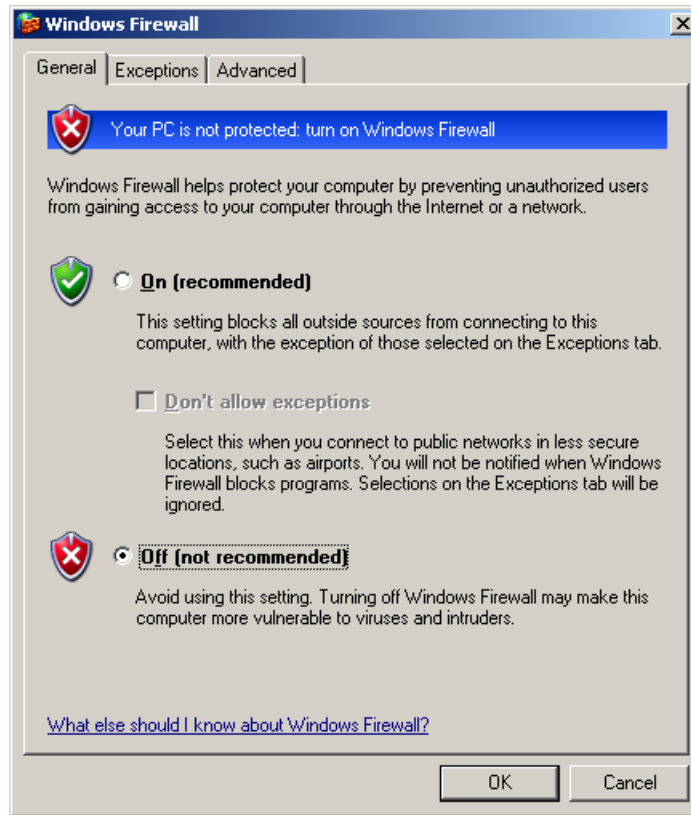
If the exclamation mark (⚠) is displayed for a certain channel, loading data from the device into the Vibrodesigner database is prohibited and thus the **Gather inspection data** button on the **Communication** tab is unavailable. You need to change configuration either in the device or in the program in order to load data into the database.

## Windows Firewall Settings

If you use Windows XP SP2 on your computer, the Vibrodesigner installer will automatically configure RPC ports and Windows firewall. Then, if a user has changed default firewall setting, the Vibrodesigner program may work incorrectly. If so, you have to either turn the Windows firewall off or configure it manually, as described below.

### To turn Windows firewall off:

1. Open the **Windows Firewall** window (**Start** menu > **Control panel** > **Windows Firewall**).
2. On the **General** tab, select **Off (not recommended)** and click **OK**.



**Figure 302 Windows firewall is turned off**

If you need to work with Windows firewall turned on, do as follows:

1. On your computer, restrict the dynamic RPC ports range. TO do so, by means of regedit.exe execute the RPCports.reg script, shown below.

Windows Registry Editor Version 5.00

```
[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Rpc\Internet]
```

```
"Ports"=hex(7):31,00,39,00,34,00,34,00,30,00,2d,00,31,00,39,00,35,00,33,00,39,\
```

```
00,00,00,00,00
```



---

```
"PortsInternetAvailable"="Y"
```

```
"UseInternetPorts"="Y"
```

2. In the Windows firewall, open the following ports:

- 135(TCPIP) – SCM
- 19440 – 19540(TCPIP) – dynamic range of RPC ports

3. Restart your computer.

You can also automatically configure Windows firewall on the client computer by executing the FirewallDCOM\_Client.vbs BB-script (see below) and restarting the firewall service.

```
'=====
'=====

' Firewall settings

'=====
'=====

' adding TCP port
Sub AddTCPPort(objProfile,Name, Number)
    set objPort = CreateObject( "HNetCfg.FWOpenPort" )
    objPort.Name = Name
    objPort.Protocol = 6 'NET_FW_IP_PROTOCOL_TCP
    objPort.Port = Number
    objPort.Scope = 1
    objPort.Enabled = TRUE
    objProfile.GloballyOpenPorts.Add( objPort )
end Sub

' adding UDP port
Sub AddUDPPort(objProfile,Name, Number)
    set objPort = CreateObject( "HNetCfg.FWOpenPort" )
    objPort.Name = Name
    objPort.Protocol = 17 'NET_FW_IP_PROTOCOL_UDP
    objPort.Port = Number
    objPort.Scope = 1
    objPort.Enabled = TRUE
```

```
        objProfile.GloballyOpenPorts.Add( objPort )
    end Sub

'Execution

    set objFwMgr = CreateObject("HNetCfg.FwMgr")
    set objProfile = objFwMgr.LocalPolicy.CurrentProfile

    set objServices = objProfile.Services

'SCM
AddTCPPEnd objProfile,"RPC" ,135

' DCOM dynamic range
For n = 0 to 99
    AddTCPPEnd objProfile,"DCOM" & (n+1) ,19440+n
next
```

# Chapter 12 Glossary

**Amplitude** – a calculated signal that is equal to maximum deviation from a certain harmonic signal. Amplitude is expressed in terms of peak-to-peak, zero-to-peak, or RMS. For pure sine waves only, these are related as follows:  $RMS = 0.707$  times zero-to-peak;  $peak-to-peak = 2$  times zero-to-peak.

**Band** – a specific range of frequencies. Each band has a defined upper and lower frequency limit.

**Band-Pass Filter** – a filter with a single transmission band extending from lower to upper cutoff frequencies. The width of the band is determined by the separation of frequencies at which amplitude is attenuated by 3 dB (0.707).

**Calculated signal** – a signal computed by Vibrodesigner using one or more measured or calculated signals in accordance with the specified measurement unit.

**Constant** – a pre-defined real number.

**Database archive** – a repository of structured data that based on the relational database model.

**Device** – a data collector each channel of which contains one transducer.

**Division** – a structure unit used to create a plant hierarchy. Divisions can belong to the root objects (database name). A machine shop division has all properties of the parent object.

**High-Pass Filter** – a filter with a transmission band starting at a lower cutoff frequency and extending to (theoretically) infinite frequency.

**Inspection** – the record of a set of measured signals from one or more elements of the machine. All the inspection data are collected under the same machine conditions and consequently can be used for vibration diagnostics. In the Vibrodesigner program, an inspection is the record of measured data into a database.

**Low-Pass Filter** – a filter whose transmission band extends from 0 to an upper cutoff frequency.

**Machine** – an electromechanical system designed to perform a particular technological task on the plant. A machine consists of one or more machine elements, for example, engine, turbine and so on. From the vibration diagnostics point of view, a machine is the equipment for vibration diagnostics measurements. Monitoring and prediction of the remaining time before failure and machine diagnostics can be performed either for the entire machine or for its elements.

**Machine element model** – a standard machine element with a predefined set of units and measurement points.

**Machine model** – a machine type with certain properties. A machine model consists of standard elements.

**Machine shop** – a plant hierarchy unit that can have child divisions and machines.

**Measured signal** – a signal taken from transducers and transformed into digital form in accordance with the specified measurement unit. In contrast to calculated signals, the measured signal is received from a data collector.

**Measurement event** – the record of current measured/calculated signal values into a measurement point.

**Measurement point** – a certain location on a machine element model where vibration measurements are to be performed. Each point is strictly linked to the element model. A point is characterized by its own parameters (point code, measurement direction, point number), measurement parameters and alarm/warning levels.

**Object** – a common name for any element of the plant hierarchy (machine shop, division, machine, route, device) or any element of the machine measurement model (element, point, measured or calculated signals).

**Orbit** – a way to display two synchronized waveforms measured in orthogonal directions when the measured values (typically, vibration displacement) are plotted along perpendicular X and Y axes. Time is the orbit parameter.

**Out-of-route points** – such points are belonged to a machine (machine element). The completed unarranged measurements are recorded in out-of-route points.

**Parameter** – a scalar measured or calculated signal. The examples are air temperature in a heating chamber or any vibration parameter.

**Peak-to-peak amplitude** – a vibration parameter that represents the doubled average value for the spectrum element in the entire frequency range or in the band.

**Phase angle** – a calculated signal that uniquely defines a harmonic signal at every instant.

**Plant** – a main hierarchy unit. A plant includes all downstream objects.

**RMS** – a vibration parameter that represents square root of the arithmetical average of a set of squared instantaneous spectrum elements within the band.

**Route** – the order of measurements in points during inspection. When creating a route from the measurement points, their measurement parameters are inherited from the points on the corresponding machines. A route stores references to particular measurement points, not points itself.

**Scalar value** – a real number.

**Spectrum** – a vector calculated signal. Calculated using discrete Fourier transformation of a waveform.

**Synchronized waveforms** – the waveforms time axes of which are matched with the time labels. Time labels correspond to the same condition of the vibration system. For

example, waveforms can be synchronized by phase labels that correspond to the same condition of the rotated shaft.

**Transducer** – a device for transforming the vibration magnitude into electric voltage that is passed into the measurement channel of the data collector. Using a transducer, a measurement is carried out. The transducer can be bound to the only point. A transducer has many parameters, including sensitivity.

**Vector**– an ordered sequence of real numbers which amount is fixed and defined.

**Vibration parameter** – a parameter that represents some integral characteristic of vibration, for example, band RMS.

**Warning level** – a level specified for measured and calculated parameters. This level is needed to trace exceeding predefined allowable values. The warning level is a set of a parameter name, a parameter value range, and the degree of alarm. The warning types are listed in *Chapter 11*, “Alarm/Warning Types.”

**Waveform** – a vector formed as a serial record of measured signal in the vector elements (strictly in time ascending order).

## Chapter 13 References

1. STD-500 Operation Manual.
2. CTD-2060 Operation Manual.
3. CTD-2160 Operation Manual.